

**MOTOROLA SOLUTIONS**

CERTIFICATE 2518.05

DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2**Motorola Solutions, Inc.****EME Test Laboratory**

Motorola Solutions Malaysia Sdn Bhd (455657-H)
 Plot 2, Bayan Lepas Technoplex Industrial Park,
 Mukim 12 SWD 11900 Bayan Lepas Penang, Malaysia.

Date of Report: 11/13/2015**Report Revision: B**

Responsible Engineer: Chang Chi Chern (EME Engineer)
Report Author: Chang Chi Chern (EME Engineer)
Date/s Tested: 09/30/15 – 10/13/2015
Manufacturer/Location: Motorola Solutions, Inc, Penang
DUT Description: Handheld Portable – NKP 403-527 MHz 4 W GNSS BT WIFI GOB and FKP 403-527 MHz 4 W GNSS BT WIFI GOB
Test TX mode(s): CW (PTT), Bluetooth, and WLAN 802.11b/g/n
Max. Power output: 4.8 W (UHF band), 10.0 mW (Bluetooth), 22.4 mW (802.11b), 8.3 mW (802.11g), 12.6 mW (802.11n)
Nominal Power: 4.0 W (UHF band), 8.9 mW (Bluetooth), 16.6 mW (802.11b), 6.6 mW (802.11g), 10.0 mW (802.11n)
Tx Frequency Bands: LMR 403-527 MHz; Bluetooth 2.402-2.480 GHz; WLAN 2.412-2.462 GHz
Signaling type: FM, FHSS (Bluetooth), 802.11b/g/n (WLAN)
Model(s) Tested: PMUE3681B & PMUE3675B
Model(s) Certified: PMUE3681B & PMUE3675B
Serial Number(s): 807TRRC885, 807TRRC887, 871TRR8909, 871TRR8913
Classification: Occupational/Controlled
FCC ID: AZ489FT7065; LMR 406.125-512 MHz, Bluetooth 2.402-2.480 GHz, WLAN 2.412-2.462 GHz
 This report contains results that are immaterial for FCC equipment approval, which are clearly identified.
IC: 109U-89FT7065; This report contains results that are immaterial for IC equipment approval, which are clearly identified.

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 OET Bulletin 65. 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 4.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola Solutions Inc EME Laboratory. I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements. This reporting format is consistent with the suggested guidelines of the TIA TSB-150 December 2004. The results and statements contained in this report pertain only to the device(s) evaluated.

Deanna Zakharia
EMS EME Lab Senior Resource Manager,
Laboratory Director
Approval Date: 11/13/2015

Part 1 of 2

1.0	Introduction.....	4
2.0	FCC SAR Summary.....	4
3.0	Abbreviations / Definitions.....	4
4.0	Referenced Standards and Guidelines	5
5.0	SAR Limits	6
6.0	Description of Device Under Test (DUT)	6
7.0	Optional Accessories and Test Criteria.....	7
7.1	Antennas	7
7.2	Battery.....	8
7.3	Body worn Accessories.....	8
7.4	Audio Accessories	9
8.0	Description of Test System.....	10
8.1	Descriptions of Robotics/Probes/Readout Electronics	10
8.2	Description of Phantom(s).....	11
8.3	Description of Simulated Tissue.....	11
9.0	Additional Test Equipment.....	12
10.0	SAR Measurement System Validation and Verification	12
10.1	System Validation.....	12
10.2	System Verification	13
10.3	Equivalent Tissue Test Results	13
11.0	Environmental Test Conditions	16
12.0	DUT Test Setup and Methodology.....	16
12.1	Measurements	17
12.2	DUT Configuration(s).....	17
12.3	DUT Positioning Procedures	17
12.3.1	Body.....	17
12.3.2	Head.....	18
12.3.3	Face.....	18
12.4	DUT Test Channels	18
12.5	SAR Result Scaling Methodology.....	18
12.6	DUT Test Plan	19
13.0	DUT Test Data.....	19
13.1	LMR assessments at the Body for 406.125-512MHz band	19
13.2	WLAN assessment at the Body for 802.11 b/g/n.....	29
13.3	LMR assessments at the Face for 406.125-512 MHz band	30
13.4	WLAN assessment at the Face for 802.11 b/g/n.....	32
13.5	Assessment for Industry Canada.....	33
13.6	Assessment at the Bluetooth band	33
13.7	Assessment outside FCC Part 90	34
13.8	Shortened Scan Assessment.....	34
14.0	Simultaneous Transmission Exclusion for BT	35
15.0	Simultaneous Transmission between LMR, WLAN and BT	35

16.0 Results Summary	35
17.0 Variability Assessment	37
18.0 System Uncertainty	37

APPENDICES

A Measurement Uncertainty Budget	38
B Probe Calibration Certificates	43
C Dipole Calibration Certificates	75

Part 2 of 2**APPENDICES**

D System Verification Check Scans	2
E DUT Scans	26
F Shorten Scan of Highest SAR Configuration	40
G DUT Test Position Photos	42
H DUT, Body worn and audio accessories Photos	43

Report Revision History

Date	Revision	Comments
11/09/2015	A	Initial release
11/13/2015	B	Incorrect frequency for WLAN 802.11 b/g/n

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 handheld portable model number PMUE3681B and PMUE3675B. These devices are classified as Occupational/Controlled.

2.0 FCC SAR Summary

Table 1

Equipment Class	Frequency band (MHz)	Max Calc at Body (W/kg)		Max Calc at Face (W/kg)	
		1g-SAR	10g-SAR	1g-SAR	10g-SAR
TNF	406.125-512 MHz (LMR)	7.41	5.32	3.43	2.53
*DSS	2402-2480 MHz (Bluetooth)	NA	NA	NA	NA
DTS	2412-2462 MHz (WLAN 802.11 b/g/n)	0.0135	0.0046	0.0534	0.0324
**Simultaneous Results		7.42	5.32	3.48	2.56

*Results not required per KDB (refer to sections 13.6 and 14.0)

3.0 Abbreviations / Definitions

BT: Bluetooth
 CNR: Calibration Not Required
 CW: Continuous Wave
 DSS: Direct Spread Spectrum
 DTS: Digital Transmission System
 DUT: Device Under Test
 EME: Electromagnetic Energy
 FHSS: Frequency Hopping Spread Spectrum
 FKP: Full Keypad
 FM: Frequency Modulation
 Li-Ion: Lithium-Ion
 Li-Mn: Lithium Manganese
 LMR: Land Mobile Radio
 NA: Not Applicable
 NiMH: Nickel Metal Hydride
 NKP: No Keypad
 OFDM: Orthogonal Frequency Division Multiplexing
 PTT: Push to Talk
 RF: Radio Frequency
 RSM: Remote Speaker Microphone

SAR: Specific Absorption Rate

TNF: Licensed Non-Broadcast Transmitter Held to Face

WLAN: Wireless Local Area Network

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.

4.0 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)
- Federal Communications Commission, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”, OET Bulletin 65, FCC, Washington, D.C.: 1997.
- 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 (2015), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
- RSS-102 (Issue 5) – Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
- Australian Communications Authority Radio communications (Electromagnetic Radiation - Human Exposure) Standard (2014)
- 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).

- FCC KDB – 643646 D01 SAR Test for PTT Radios v01r01
- FCC KDB – 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- FCC KDB – 865664 D02 RF Exposure Reporting v01r01
- FCC KDB – 447498 D01 General RF Exposure Guidance v05r02
- FCC KDB – 248227 D01 802.11 Wi-Fi SAR v02

5.0 SAR Limits

Table 2

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

6.0 Description of Device Under Test (DUT)

These portable devices operate in the LMR bands using frequency modulation (FM). These devices also contain WLAN technology for data capabilities over 802.11b/g/n wireless networks and Bluetooth technology for short range wireless devices.

The LMR bands in these devices operate in a half duplex system. A half duplex system only allows the user to transmit or receive. These devices cannot transmit and receive simultaneously. The user must stop transmitting in order to receive a signal or listen for a response, regardless of PTT button or use of voice activated audio accessories. This type of operation, along with the RF safety booklet, which instructs the user to transmit no more than 50% of the time, justifies the use of 50% duty factor for this device.

These devices also incorporate a Bluetooth v4.0, which includes classis Bluetooth, Bluetooth high speed and Bluetooth low energy. It is Class 1 Bluetooth device with 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 derived from 5-slots packet type operation which consists of receiving on 1-slot and transmitting on 5-slots, and thus maximum duty cycle = 77%

WLAN 802.11 b/g/n operate using Direct Sequence Spread Spectrum (DSSS) and Orthogonal Frequency-Division Multiplexing (OFDM) accordance with the IEEE 802.11 b/g/n

The intended operating positions are “at the face” with the DUT at least 2.5cm 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 BT accessories.

Table 3 below summarizes the technologies, bands, maximum duty cycles and maximum output powers. Maximum output powers are defined as upper limit of the production line final test station.

Table 3

Radio Type	Band (MHz)	Transmission	Duty Cycle (%)	Max Power (W)
LMR	403-527	FM	*50	4.80
BT	2402-2480	FHSS	77	0.01
WLAN	2412-2462	802.11b	100	0.0224
WLAN	2412-2462	802.11g	100	0.0083
WLAN	2412-2462	802.11n	100	0.0126

Note - * includes 50% PTT operation

The intended operating positions are “at the face” with the DUT at least 2.5cm 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 BT accessories.

7.0 Optional Accessories and Test Criteria

These devices are 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 to assess compliance of the devices. 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 optional removable antennas and one internal BT/Wifi antenna offered for these products. The Table below lists their descriptions.

Table 4

Antenna Models	Description	Selected for test	Tested
PMAE4079A	UHF Slim Whip antenna, 403-527MHz, ¼ wave, 0dBd	Yes	Yes
PMAE4071A	UHF Stubby antenna, 470-527MHz, ¼ wave, -1dBd	Yes	Yes
PMAE4070A	UHF Stubby antenna, 440-490MHz, ¼ wave, -1dBd	Yes	Yes
PMAE4069A	UHF Stubby antenna, 403-450MHz, ¼ wave, -1dBd	Yes	Yes
0104039J80	IFA Bluetooth / Wifi antenna, 2400-2484MHz, ¼ wave, -4dBi	Yes	Yes; only for WLAN

7.2 Battery

There are optional batteries offered for these products. The Table below lists their descriptions.

Table 5

Battery Models	Description	Selected for test	Tested	Comments
PMNN4435AR	Li-Mn, 1400 mAh Low Temp -30C Battery Submersible (IP57)	Yes	Yes	
PMNN4463A	Li-Ion IP57 2000 mAh	Yes	Yes	
NNTN8129A	IMPRES Hi-Capacity Li-Ion FM Battery 2300 Min 2350 Typical	Yes	Yes	
PMNN4409BR	IMPRES Hi-Capacity Li-Ion Non-FM, 2150 mAh battery 2150 Min 2250 Typical	Yes	Yes	
PMNN4412A	Standard IP67 NiMH 1300 Min 1400 Typical	Yes	Yes	
PMNN4406BR	Core Slim Li-Ion, 1650 mAh Battery 1600 Min 1650 Typical	Yes	Yes	
PMNN4407BR	IMPRES Li-Ion, 1650 mAh Slim Battery 1600 Min 1650 Typical	Yes	Yes	
PMNN4448AR	IMPRES Standard IP67 Li-Ion 2700 Min 2800 Typical	Yes	Yes	
PMNN4493A	Belize Non-TIA High Capacity Low Voltage Li-Ion Battery 2950 Min 3000 Typical	Yes	Yes	Default battery for face testing
PMNN4489A	Belize TIA4950 IMPRES High Capacity Li-Ion Battery 2850 Min 2900 Typical	Yes	Yes	
PMNN4491A	Belize Slim Li-Ion Battery 2000 Min 2050 Typical	Yes	Yes	Default battery for body testing
PMNN4488A	Belize Ultra High Capacity Vibrator 2950 Min 3000 Typical	Yes	Yes	Only compatible with PMLN7296A
NNTN8560A	IMPRES Hi-Capacity Li-Ion 2500 mAh battery Submersible (IP57), Intrinsically safe (TIA4950) 2300 Min 2500 Typical	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 6

Body worn Models	Description	Selected for test	Tested	Comments
RLN4815A	Radio Pack Universal RADIOPAK & Utility Case	Yes	Yes	
HLN6602A	Chest Pack	Yes	Yes	
PMLN7296A	Vibrating Belt Clip	Yes	Yes	Only compatible with battery PMNN4488A
RLN4570A	Break-A-Way Chest Pack	Yes	Yes	
PMLN7008A	2.5 Inch Belt Clip	Yes	Yes	
PMLN4651A	Belt Clip 2 Inch	Yes	Yes	
4200865599	1.75-Inch Black Leather Belt	No	No	
4280384F89	RADIOPAK Lengthener	No	No	
RLN4295A	Small Clip Epaulet Strap	No	No	
HLN9985B	Waterproof Bag	No	No	

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 7

Audio Acc. Models	Description	Selected for test	Tested	Comments
PMMN4024A	Remote Speaker MIC	Yes	Yes	Default audio
PMLN5097A	Impres 3 Wire Surveillance -Black	Yes	Yes	
RMN5137A	MT Series Over-The Head Headset, Direct Radio Connect	Yes	Yes	
PMLN5275C	Heavy Duty Headset	Yes	Yes	
PMLN5973A	Ear Receive W/ Inline MIC/PTT Magone	Yes	Yes	
RMN5138A	MT Series Neckband Headset, Direct Radio Connect	No	No	By similarity to RMN5137A
RMN5139A	MT Series Hard Hat Attached Headset, Direct Radio Connect	No	No	By similarity to RMN5137A
PMLN6069A	Earbud W/ Inline MIC/PTT MAGONE	No	No	By similarity to PMLN5973A
PMLN5974A	LT WT HS W/ Boom MIC & PTT Magone	No	No	By similarity to PMLN5973A
PMLN5976A	Earset W/ Boom MIC Inline PTT Magone	No	No	By similarity to PMLN5973A
PMLN5106A	Impres 3 Wire Surveillance - Beige	No	No	By similarity to PMLN5097A
PMMN4025A	Impres Remote Speaker MIC	No	No	By similarity to PMMN4024A
BDN6719A	Earpiece w/3.5mm Threaded Plug	No	No	Receive only
BDN6781A	Earbud, Single Speaker	No	No	Receive only
BDN6726A	Receive Only Earpiece Black, 1-Wire	No	No	Receive only
BDN6727A	Receive Only Earpiece, Ext Loud, Black	No	No	Receive only
BDN6666A	Earpiece w/ Vol Control	No	No	Receive only
BDN6728A	Receive Only Earpiece w/ Vol, Black	No	No	Receive only
RLN5314A	Receive Only Surveillance Kit (Beige)/Noise	No	No	Receive only
RLN5313A	Receive Only Surveillance Kit (Black) /Noise	No	No	Receive only
BDN6664A	Receive Only Earpiece Beige 1-Wire	No	No	Receive only
BDN6665A	Receive Only Earpiece, Ext Loud, Beige	No	No	Receive only
RLN4941A	Receive Only Earpiece w/ Translucent Tube And Eartip - OTTO	No	No	Receive only
WADN4190B	Over The Ear Receiver For RSM	No	No	Receive only
PMLN4620B	D-Shell RX-Only Earpiece (3.5MM)	No	No	Receive only
AARLN4885B	Receive Only Earbud	No	No	Receive only
MDRLN4885B	Receive-Only Earbud	No	No	Receive only
MDRLN4941A	Receive-Only Earpiece	No	No	Receive only
RLN6284A	Earpiece with Acoustic Tube Assembly-Beige	No	No	Received only
RLN6285A	Earpiece with Acoustic Tube Assembly-Black	No	No	Received only
RLN6288A	Earpiece with High Noise Kit Assembly-Beige	No	No	Received only
RLN6289A	Earpiece with High Noise Kit Assembly-Black	No	No	Received only

8.0 Description of Test System



8.1 Descriptions of Robotics/Probes/Readout Electronics

Table 8

Dosimetric System type	System version	DAE type	Probe Type
Schmid & Partner Engineering AG SPEAG DASY 5	52.8.8.1222	DAE4	ES3DV3 EX3DV4 (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 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 9

Phantom Type	Phantom(s) Used	Material Parameters	Phantom Dimensions LxWxD (mm)	Material Thickness (mm)	Support Structure Material	Loss Tangent (wood)
Triple Flat	NA	200MHz -6GHz; Er = 3-5, Loss Tangent = ≤ 0.05	280x175x175	2mm +/- 0.2mm	Wood	< 0.05
SAM	NA	300MHz -6GHz; Er = < 5, Loss Tangent = ≤ 0.05	Human Model			
Oval Flat	√	300MHz -6GHz; Er = 4+/- 1, Loss Tangent = ≤ 0.05	600x400x190			

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 10. 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 (percent by mass)

Table 10

Ingredients	450 MHz		2450 MHz	
	Head	Body	Head	Body
Sugar	56.00	46.50	0	0
Diacetin	0	0	51.00	34.50
De ionized – Water	39.10	50.53	48.75	65.20
Salt	3.80	1.87	0.15	0.20
HEC	1.00	1.00	0	0
Bact.	0.10	0.10	0.10	0.10

9.0 Additional Test Equipment

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

Table 11

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Speag Probe	ES3DV3	3096	11/12/2014	11/12/2015
Speag Probe	EX3DV4	7364	6/23/2015	6/23/2016
Speag DAE	DEA4	1294	11/3/2014	11/3/2015
Speag DAE	DAE4	684	11/5/2014	11/5/2015
Signal Generator	E4438C	MY47272101	8/12/2014	8/12/2016
Power Meter	E4418B	MY45100911	5/29/2015	5/29/2017
Power Sensor	8481B	SG41090258	6/3/2015	6/3/2016
Power Meter	E4418B	MY45100532	10/21/2014	10/21/2015
Power Sensor	8481B	SG41090248	10/25/2014	10/25/2015
Power Meter	E4416A	MY50001037	2/16/2015	2/16/2016
Power Sensor	N8481B	MY51450002	2/23/2015	2/23/2016
Broadband Power Sensor	NRP-Z11	120907	2/11/2015	2/11/2016
Power Amplifier	5S1G4	312988	CNR	CNR
Power Amplifier	10W1000C	312859	CNR	CNR
Bi-directional Coupler	3020A	41935	8/27/2015	8/27/2016
Bi-directional Coupler	3022	81640	8/26/2015	8/26/2016
Dickson Temperature Recorder	TM320	12253047	11/11/2014	11/11/2015
Temperature Probe	80PK-22	8766	8/21/2015	8/21/2016
Thermometer	HH806AU	080307	11/12/2014	11/12/2015
Network Analyzer	E5071B	MY42403218	8/4/2015	8/4/2016
Dielectric Assessment Kit	DAK-12	1069	5/12/2015	5/12/2016
Speag Dipole	D450V3	1053	3/17/2015	3/17/2017
Speag Dipole	D2450V2	781	3/20/2015	3/20/2017

10.0 SAR Measurement System Validation and Verification

DASY output files of the probe/dipole calibration certificates and system verification test results are included in appendices B, C & D respectively.

10.1 System Validation

The SAR measurement system was validated according to procedures in KDB 865664. The validation status summary Table is below

Table 12

Dates	Probe Calibration Point		Probe SN	Measured Tissue Parameters		Validation		
				σ	ϵ_r	Sensitivity	Linearity	Isotropy
CW								
02/28/2015	Body	450	3096	0.92	54.7	Pass	Pass	Pass
03/14/2015	Head	450		0.88	43.1	Pass	Pass	Pass
WLAN								
7/15/2015	Body	2450	7364	1.86	48.9	Pass	Pass	Pass
7/15/2015	Head	2450		1.77	36.4	Pass	Pass	Pass

10.2 System Verification

System verification 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 13

Probe Serial #	Tissue Type	Dipole Kit / Serial #	Ref SAR @ 1W (W/kg)	System Check Results Measured (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
3096	FCC Body	SPEAG D450V3 / 1053	4.41 +/- 10%	1.21	4.80	9/30/2015
				1.08	4.32	10/1/2015
				1.12	4.48	10/2/2015
				1.15	4.60	10/3/2015
				1.07	4.28	10/4/2015
				1.17	4.68	10/5/2015
				1.19	4.76	10/6/2015
				1.13	4.52	10/7/2015
				1.14	4.56	10/8/2015
				1.16	4.64	10/9/2015
				1.15	4.60	10/11/2015
				1.12	4.48	10/12/2015
				1.15	4.60	10/13/2015
	IEEE/IEC Head		4.45 +/- 10%	1.10	4.40	10/9/2015
				1.18	4.72	10/10/2015
1.20		4.80		10/11/2015		
7364	FCC Body	SPEAG D2450V2 / 781	51.9 +/- 10%	12.7	50.80	10/5/2015
				12.3	49.20	10/7/2015
				12.8	51.20	10/8/2015
				12.9	51.60	10/9/2015
	IEEE/IEC Head	52.3 +/- 10%	13.5	54.00	10/11/2015	
			13.1	52.40	10/12/2015	
			13.1	52.40	10/13/2015	

10.3 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 14

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
403	FCC Body	0.93 (0.89-0.98)	57.2 (54.3-60.0)	0.89	56.0	10/9/2015
403	IEEE/ IEC Head	0.87 (0.83-0.91)	44.1 (41.9-46.3)	0.84	45.9	10/10/2015
406	FCC Body	0.93 (0.89-0.98)	57.1 (54.3-60.0)	0.89	55.7	9/30/2015
				0.89	55.5	10/04/2015
				0.89	55.6	10/06/2015
				0.89	55.5	10/07/2015
				0.89	55.8	10/08/2015
				0.89	55.6	10/11/2015
406	IEEE/ IEC Head	0.87 (0.83-0.91)	44.0 (41.8-46.2)	0.83	44.5	10/09/2015
440	FCC Body	0.94 (0.89-0.99)	56.8 (54.0-59.6)	0.92	55.7	10/01/2015
				0.92	55.2	10/02/2015
				0.92	55.0	10/03/2015
				0.92	55.0	10/04/2015
				0.92	55.0	10/07/2015
				0.92	55.2	10/08/2015*
450	FCC Body	0.94 (0.89-0.99)	56.7 (53.9-59.5)	0.93	55.0	09/30/2015
				0.93	55.5	10/01/2015
				0.93	55.0	10/02/2015
				0.93	54.8	10/03/2015
				0.93	54.8	10/04/2015
				0.93	55.1	10/05/2015
				0.93	54.9	10/06/2015
				0.93	55.1	10/08/2015
				0.93	55.2	10/09/2015
				0.92	54.9	10/11/2015
				0.92	55.4	10/12/2015
				0.92	55.1	10/13/2015
450	IEEE/ IEC Head	0.87 (0.83-0.91)	43.5 (41.3-45.7)	0.87	43.5	10/9/2015
				0.88	44.9	10/10/2015
				0.85	44.2	10/11/2015
459	FCC Body	0.94 (0.89-0.99)	56.7 (53.8-59.5)	0.93	54.7	10/04/2015
				0.93	54.9	10/05/2015*

Table 14 continued

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
465	FCC Body	0.94 (0.89-0.99)	56.6 (53.8-59.5)	0.94	54.8	09/30/2015
				0.94	55.3	10/01/2015
				0.94	54.8	10/02/2015
				0.94	54.6	10/03/2015
				0.94	54.6	10/04/2015
				0.94	54.7	10/06/2015
				0.94	54.6	10/07/2015
				0.94	54.8	10/08/2015*
470	FCC Body	0.94 (0.89-0.99)	56.6 (53.8-59.5)	0.94	54.7	09/30/2015
				0.94	55.2	10/01/2015
				0.94	54.6	10/04/2015
				0.94	54.8	10/05/2015
				0.94	54.6	10/06/2015
				0.94	54.5	10/07/2015
				0.94	54.8	10/08/2015*
470	IEEE/ IEC Head	0.87 (0.83-0.91)	43.4 (41.2-45.6)	0.90	44.5	10/10/2015
481	FCC Body	0.94 (0.90-0.99)	56.6 (53.8-59.4)	0.95	55.1	10/01/2015
				0.96	54.6	10/02/2015
				0.95	54.4	10/03/2015
				0.95	54.4	10/04/2015
				0.95	54.4	10/07/2015
490	FCC Body	0.94 (0.90-0.99)	56.5 (53.7-59.4)	0.96	55.0	10/01/2015
				0.96	54.3	10/04/2015
				0.96	54.5	10/08/2015
				0.96	54.6	10/09/2015
502	FCC Body	0.94 (0.90-0.99)	56.5 (53.7-59.3)	0.97	54.8	10/01/2015
				0.97	54.1	10/04/2015
				0.97	54.1	10/07/2015
512	FCC Body	0.94 (0.90-0.99)	56.5 (53.6-59.3)	0.98	54.7	10/01/2015
				0.98	54.0	10/04/2015
520	FCC Body	0.95 (0.90-0.99)	56.4 (53.6-59.2)	0.99	54.2	10/09/2015
520	IEEE/ IEC Head	0.87 (0.83-0.92)	43.1 (41.0-45.3)	0.90	42.8	10/11/2015
527	FCC Body	0.95 (0.90-0.99)	56.4 (53.6-59.2)	0.98	53.8	10/09/2015
				0.99	54.3	10/12/2015
527	IEEE/ IEC Head	0.88 (0.83-0.92)	43.1 (40.9-45.2)	0.91	42.7	10/11/2015

Table 14 continued

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
2412	FCC Body	1.91 (1.82-2.01)	52.8 (47.5-58.0)	1.99	47.9	10/05/2015
				1.95	47.7	10/07/2015
				1.99	48.1	10/08/2015
				1.97	48.0	10/09/2015
2412	IEEE/ IEC Head	1.77 (1.68-1.86)	39.3 (35.3-43.2)	1.85	37.3	10/11/2015
				1.83	37.2	10/12/2015
				1.82	37.0	10/13/2015
2450	FCC Body	1.95 (1.85-2.05)	52.7 (47.4-58.0)	2.04	47.8	10/5/2015
				1.99	47.6	10/7/2015
				2.04	48.0	10/8/2015
				2.02	47.9	10/9/2015
2450	IEEE/ IEC Head	1.80 (1.71-1.89)	39.2 (35.3-43.1)	1.89	37.2	10/11/2015
				1.87	37.1	10/12/2015
				1.86	36.8	10/13/2015

Note: * This tissue date covered for next test day (within 24 hours)

11.0 Environmental Test Conditions

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

Table 15

	Target	Measured
Ambient Temperature	18 – 25 °C	Range: 20.4 – 24.1°C Avg. 22.5 °C
Tissue Temperature	NA	Range: 19.3-21.6°C Avg. 20.1°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 Setup and Methodology

12.1 Measurements

SAR measurements were performed using the DASY system described in section 8.0 using zoom scans. Oval flat phantoms filled with applicable simulated tissue were used for body and face testing.

The Table below includes the step sizes and resolution of area and zoom scans per KDB 865664 requirements

Table 16

Description		≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location		$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area}		≤ 2 GHz: ≤ 15 mm $2 - 3$ GHz: ≤ 12 mm	$3 - 4$ GHz: ≤ 12 mm $4 - 6$ GHz: ≤ 10 mm
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom} , Δy_{Zoom}		≤ 2 GHz: ≤ 8 mm $2 - 3$ GHz: ≤ 5 mm*	$3 - 4$ GHz: ≤ 5 mm* $4 - 6$ GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	≤ 5 mm	$3 - 4$ GHz: ≤ 4 mm $4 - 5$ GHz: ≤ 3 mm $5 - 6$ GHz: ≤ 2 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.			

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.

12.3 DUT Positioning Procedures

The positioning of the device for each body location is described below and illustrated in Appendix G.

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 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.

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

Where

N_c = Number of channels

F_{high} = Upper channel

F_{low} = Lower channel

F_c = Center channel

12.5 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 drift. Appendix F includes a shortened scan to justify SAR scaling for drift. For this device the “Max Calc. 1g-SAR” and “Max Calc.10g-SAR” are scaled using the following formula:

$$\text{Max_Calc} = \text{SAR_meas} \cdot 10^{\frac{-\text{Drift}}{10}} \cdot \frac{P_{\text{max}}}{P_{\text{int}}} \cdot \text{DC}$$

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 $P_{\text{int}} > P_{\text{max}}$, then $P_{\text{max}}/P_{\text{int}} = 1$.

Drift = 1 for positive drift

Additional SAR scaling was applied using the methodologies outlined in FCC KDB 865664 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.

12.6 DUT Test Plan

The guidelines and requirements outlined in section 4.0 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.

LMR tests were performed in CW mode and 50% duty cycle was applied to PTT configurations in the final results.

WLAN tests were performed in 802.11b mode using a duty cycle of 99.88% with results scaled to 100% as per guidelines of KDB 248227.

Standalone and simultaneous BT testing were assessed in sections 13.6 and 14.0 per the guidelines of KDB 447498.

13.0 DUT Test Data

13.1 LMR assessments at the Body for 406.125-512MHz band

Battery PMNN4491A was selected as the default battery for assessments at the Body because it is the thinnest battery (refer to Exhibit 7B for battery illustration). The default battery was used during conducted power measurements for all test channels within FCC allocated frequency range (406.125-512MHz) which are listed in Table 17. The channel with the highest conducted power will be identified as the default channel per KDB 643646 (SAR Test for PTT Radios). SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 17

Test Freq (MHz)	Power (W)
406.1250	4.77
417.1000	4.77
428.1000	4.74
440.0000	4.70
450.0000	4.74
459.1000	4.77
465.0000	4.78
470.0000	4.77
480.5000	4.72
490.0000	4.68
501.5000	4.70
512.0000	4.70

Assessments at the Body with Body worn RLN4570A

DUT assessment with offered antennas, default battery and, default body worn accessory per KDB 643646. Optional batteries were tested per the requirements of

KDB 643646. Refer to Table 17 for highest output power channel. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 18

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#	
PMAE4069A	PMNN4491A	RLN4570A	PMMN4024A	406.125	4.75	-0.57	5.920	4.180	3.41	2.41	AZ-AB-151011-14	
				417.100								
				428.100								
				440.000								
				450.000								
PMAE4079A	PMNN4491A	RLN4570A	PMMN4024A	406.125	4.74	-0.20	6.080	4.290	3.22	2.27	FIE-AB-150930-07	
				428.100								
				440.000								
				459.100								
				470.000								
				490.000								
				512.000								
PMAE4070A	PMNN4491A	RLN4570A	PMMN4024A	440.000	4.70	-0.50	7.090	4.920	4.06	2.82	TLC-AB-151001-02	
				450.000	4.77	-0.53	10.600	7.500	6.03	4.26	FIE-AB-150930-10	
				465.000	4.78	-0.46	10.200	7.120	5.69	3.97	FIE-AB-150930-09	
				470.000	4.75	-0.51	8.930	6.320	5.07	3.59	FIE-AB-150930-11	
				490.000	4.68	-0.59	6.090	4.170	3.58	2.45	TLC-AB-151001-03	
PMAE4071A	PMNN4491A	RLN4570A	PMMN4024A	470.000	4.77	-0.47	8.510	5.950	4.77	3.34	TLC-AB-151001-04	
				480.500	4.71	-0.49	8.640	6.080	4.93	3.47	TLC-AB-151001-05	
				490.000	4.68	-0.51	7.840	5.430	4.52	3.13	TLC-AB-151001-07	
				501.500	4.70	-0.50	7.110	4.940	4.07	2.83	TLC-AB-151001-06	
				512.000	4.78	-0.48	8.130	5.720	4.56	3.21	TLC-AB-151001-08	
Assessment of Additional Batteries												
PMAE4070A	NNTN8129AR	RLN4570A	PMMN4024A	440.000	4.56	-0.33	5.200	3.740	2.95	2.12	TLC-AB-151001-10	
450.000				4.59	-0.41	7.630	5.500	4.38	3.16	TLC-AB-151001-09		
465.000				4.71	-0.47	7.230	5.190	4.11	2.95	FIE-AB-151001-11		
PMAE4071A				480.500	4.62	-0.43	6.810	4.910	3.91	2.82	FIE-AB-151001-12	
PMAE4070A	PMNN4409BR	RLN4570A	PMMN4024A	440.000	4.69	-0.36	5.600	4.040	3.11	2.25	FIE-AB-151001-14	
450.000				4.73	-0.47	8.460	6.090	4.78	3.44	FIE-AB-151001-13		
465.000				4.79	-0.49	7.790	5.590	4.37	3.14	FIE-AB-151001-15		
PMAE4071A				480.500	4.72	-0.52	7.990	5.740	4.58	3.29	FIE-AB-151001-16	
PMAE4070A	PMNN4412A	RLN4570A	PMMN4024A	440.000	4.71	-0.41	6.280	4.480	3.52	2.51	FIE-AB-151001-18	
450.000				4.79	-0.73	8.710	6.230	5.16	3.69	FIE-AB-151001-17		
465.000				4.69	-1.02	7.170	5.150	4.64	3.33	FIE-AB-151001-19		
PMAE4071A				480.500	4.79	-0.83	7.680	5.570	4.66	3.38	FIE-AB-151001-20	

Table 18 continued

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
Assessment of Additional Batteries											
PMAE4070A	PMNN4406BR	RLN4570A	PMMN4024A	440.000	4.68	-0.52	6.450	4.480	3.73	2.59	TLC-AB-151002-03
				450.000	4.78	-0.57	8.620	6.000	4.94	3.44	TLC-AB-151002-02
				465.000	4.79	-0.53	7.830	5.470	4.43	3.10	TLC-AB-151002-04
PMAE4071A				480.500	4.79	-0.60	7.880	5.500	4.53	3.16	TLC-AB-151002-05
PMAE4070A	PMNN4407BR	RLN4570A	PMMN4024A	440.000	4.68	-0.35	7.780	5.470	4.32	3.04	MO-AB-151002-07
				450.000	4.76	-0.49	10.800	7.540	6.10	4.26	TLC-AB-151002-06
				465.000	4.75	-0.55	8.220	5.800	4.71	3.33	MO-AB-151002-08
PMAE4071A				480.500	4.71	-0.60	9.250	6.540	5.41	3.83	TLC-AB-151003-02
PMAE4070A	PMNN4448AR	RLN4570A	PMMN4024A	440.000	4.69	-0.39	5.690	4.070	3.19	2.28	TLC-AB-151003-04
				450.000	4.76	-0.52	8.390	6.010	4.77	3.42	TLC-AB-151003-03
				465.000	4.74	-0.38	7.700	5.530	4.26	3.06	TLC-AB-151003-05
PMAE4071A				480.500	4.69	-0.37	7.520	5.400	4.19	3.01	TLC-AB-151003-06
PMAE4070A	PMNN4493A	RLN4570A	PMMN4024A	440.000	4.71	-0.41	5.960	4.260	3.34	2.39	TLC-AB-151003-08
				450.000	4.76	-0.49	7.960	5.710	4.49	3.22	TLC-AB-151003-07
				465.000	4.74	-0.36	7.700	5.550	4.24	3.05	TLC-AB-151003-09
PMAE4071A				480.500	4.68	-0.49	7.380	5.320	4.24	3.05	TLC-AB-151003-10
PMAE4070A	PMNN4489A	RLN4570A	PMMN4024A	440.000	4.58	-0.34	5.640	4.030	3.20	2.28	TLC-AB-151003-12
				450.000	4.68	-0.38	8.190	5.850	4.58	3.27	TLC-AB-151003-11
				465.000	4.60	-0.42	8.070	5.750	4.64	3.30	TLC-AB-151003-13
PMAE4071A				480.500	4.60	-0.44	7.790	5.530	4.50	3.19	TLC-AB-151003-14
PMAE4070A	NNTN8560A	RLN4570A	PMMN4024A	440.000	4.57	-0.33	5.070	3.630	2.87	2.06	AZ-AB-151003-16
				450.000	4.60	-0.37	7.610	5.440	4.32	3.09	AZ-AB-151003-15
				465.000	4.63	-0.38	7.300	5.250	4.13	2.97	AZ-AB-151003-17
PMAE4071A				480.500	4.58	-0.40	7.700	5.490	4.42	3.15	AZ-AB-151003-18
PMAE4070A	PMNN4435AR	RLN4570A	PMMN4024A	440.000	4.75	-0.38	4.940	3.550	2.72	1.96	AZ-AB-151003-20
				450.000	4.80	-0.47	7.270	5.220	4.05	2.91	AZ-AB-151003-19
				465.000	4.80	-0.61	7.350	5.280	4.23	3.04	AZ-AB-151003-21
PMAE4071A				480.500	4.76	-0.62	7.020	5.090	4.08	2.96	AZ-AB-151003-22
PMAE4070A	PMNN4463A	RLN4570A	PMMN4024A	440.000	4.73	-0.37	4.820	3.470	2.66	1.92	AZ-AB-151003-24
				450.000	4.78	-0.57	7.210	5.170	4.13	2.96	AZ-AB-151003-23
				465.000	4.79	-0.63	6.850	4.940	3.97	2.86	TLC-AB-151004-02
PMAE4071A				480.500	4.71	-0.64	6.480	4.660	3.83	2.75	TLC-AB-151004-03

Assessments at the Body with Body worn HLN6602A

DUT assessment with offered antennas, default battery and, optional body worn accessory per KDB 643646. Optional batteries were tested per the requirements of KDB 643646. Refer to Table 17 for highest output power channel. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 19

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
PMAE4069A	PMNN4491A	HLN6602A	PMMN4024A	406.125	4.76	-0.50	5.060	3.580	2.86	2.03	TLC-AB-151004-04
				417.100							
				428.100							
				440.000							
				450.000							
PMAE4079A	PMNN4491A	HLN6602A	PMMN4024A	406.125	4.75	-0.49	6.370	4.550	3.60	2.57	TLC-AB-151004-05
				428.100							
				440.000	4.68	-0.44	6.670	4.730	3.79	2.68	TLC-AB-151004-07
				459.100	4.75	-0.52	7.900	5.610	4.50	3.20	TLC-AB-151004-06
				470.000	4.70	-0.46	7.220	5.100	4.10	2.90	TLC-AB-151004-08
				490.000							
				512.000	4.68	-0.42	6.680	4.690	3.77	2.65	TLC-AB-151004-09
PMAE4070A	PMNN4491A	HLN6602A	PMMN4024A	440.000	4.64	-0.36	6.450	4.570	3.62	2.57	AZ-AB-151004-13
				450.000	4.68	-0.50	9.030	6.400	5.20	3.68	TLC-AB-151004-11
				465.000	4.70	-0.45	8.150	5.790	4.62	3.28	TLC-AB-151004-10
				470.000	4.73	-0.49	7.810	5.510	4.44	3.13	AZ-AB-151004-12
				490.000	4.70	-0.55	5.430	3.800	3.15	2.20	AZ-AB-151004-14
PMAE4071A	PMNN4491A	HLN6602A	PMMN4024A	470.000	4.73	-0.50	9.260	6.560	5.27	3.73	AZ-AB-151004-15
				480.500	4.70	-0.46	8.270	5.870	4.69	3.33	AZ-AB-151004-16
				490.000							
				501.500	4.71	-0.52	6.530	4.580	3.75	2.63	AZ-AB-151004-17
				512.000							
Assessment of Additional Batteries											
PMAE4079A	NNTN8129AR	HLN6602A	PMMN4024A	459.100	4.67	-0.51	6.020	4.360	3.48	2.52	AZ-AB-151004-18
PMAE4070A				450.000	4.65	-0.42	7.020	5.070	3.99	2.88	AZ-AB-151004-19
PMAE4071A				470.000	4.63	-0.51	7.050	5.090	4.11	2.97	AZ-AB-151004-20
PMAE4079A	PMNN4409BR	HLN6602A	PMMN4024A	459.100	4.74	-0.53	6.260	4.540	3.58	2.60	AZ-AB-151004-21
PMAE4070A				450.000	4.76	-0.65	7.430	5.380	4.35	3.15	FIE-AB-151005-02
PMAE4071A				470.000	4.71	-0.62	7.450	5.400	4.38	3.17	FIE-AB-151005-03
PMAE4079A	PMNN4412A	HLN6602A	PMMN4024A	459.100	4.58	-0.68	5.940	4.260	3.64	2.61	AZ-AB-151005-04
PMAE4070A				450.000	4.60	-0.62	7.770	5.590	4.68	3.36	AZ-AB-151005-05
PMAE4071A				470.000	4.70	-0.76	7.560	5.470	4.60	3.33	AZ-AB-151005-07
PMAE4079A	PMNN4406BR	HLN6602A	PMMN4024A	459.100	4.77	-0.52	6.310	4.480	3.58	2.54	AZ-AB-151005-08
PMAE4070A				450.000	4.78	-0.54	7.750	5.460	4.41	3.10	AZ-AB-151005-09
PMAE4071A				470.000	4.76	-0.52	7.370	5.260	4.19	2.99	AZ-AB-151005-10

Table 19 continued

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
Assessment of Additional Batteries											
PMAE4079A	PMNN4407BR	HLN6602A	PMMN4024A	459.100	4.76	-0.55	8.230	5.850	4.71	3.35	AZ-AB-151005-11
PMAE4070A				450.000	4.72	-0.57	9.750	6.910	5.65	4.01	AZ-AB-151005-12
PMAE4071A				470.000	4.72	-0.59	9.420	6.710	5.49	3.91	AZ-AB-151005-13
PMAE4079A	PMNN4448AR	HLN6602A	PMMN4024A	459.100	4.60	-0.42	5.980	4.340	3.44	2.49	AZ-AB-151005-14
PMAE4070A				450.000	4.60	-0.50	7.600	5.510	4.45	3.23	AZ-AB-151005-15
PMAE4071A				470.000	4.72	-0.54	7.480	5.430	4.31	3.13	MO-AB-151005-16
PMAE4079A	PMNN4493A	HLN6602A	PMMN4024A	459.100	4.78	-0.45	6.450	4.670	3.59	2.60	MO-AB-151005-17
PMAE4070A				450.000	4.76	-0.51	7.460	5.380	4.23	3.05	MO-AB-151005-18
PMAE4071A				470.000	4.79	-0.57	7.720	5.610	4.41	3.21	MO-AB-151005-19
PMAE4079A	PMNN4489A	HLN6602A	PMMN4024A	459.100	4.57	-0.46	6.290	4.540	3.67	2.65	MO-AB-151005-20
PMAE4070A				450.000	4.57	-0.43	7.120	5.130	4.13	2.97	MO-AB-151006-01
PMAE4071A				470.000	4.58	-0.46	7.680	5.580	4.47	3.25	MO-AB-151006-02
PMAE4079A	NNTN8560A	HLN6602A	PMMN4024A	459.100	4.56	-0.45	6.580	4.740	3.84	2.77	MO-AB-151006-03
PMAE4070A				450.000	4.58	-0.41	7.350	5.300	4.23	3.05	MO-AB-151006-04
PMAE4071A				470.000	4.61	-0.48	8.010	5.800	4.66	3.37	MO-AB-151006-05
PMAE4079A	PMNN4435AR	HLN6602A	PMMN4024A	459.100	4.78	-0.67	5.710	4.140	3.35	2.43	MO-AB-151006-06
PMAE4070A				450.000	4.80	-0.55	6.730	4.870	3.82	2.76	MO-AB-151006-07
PMAE4071A				470.000	4.80	-0.72	7.180	5.210	4.24	3.07	MO-AB-151006-08
PMAE4079A	PMNN4463A	HLN6602A	PMMN4024A	459.100	4.80	-0.78	6.080	4.360	3.64	2.61	MO-AB-151006-09
PMAE4070A				450.000	4.80	-0.58	6.790	4.880	3.88	2.79	MO-AB-151006-10
PMAE4071A				470.000	4.80	-0.60	5.810	4.200	3.34	2.41	AZ-AB-151006-12

Assessments at the Body with Body worn RLN4815A

DUT assessment with offered antennas, default battery and, optional body worn accessory per KDB 643646. Optional batteries were tested per the requirements of KDB 643646. Refer to Table 17 for highest output power channel. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 20

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
PMAE4069A	PMNN4491A	RLN4815A	PMMN4024A	406.125	4.72	-0.40	3.070	2.260	1.71	1.26	AZ-AB-151006-13
				417.100							
				428.100							
				440.000							
				450.000							

Table 20 continued

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
PMAE4079A	PMNN4491A	RLN4815A	PMMN4024A	406.125	4.74	-0.52	3.600	2.650	2.05	1.51	AZ-AB-151006-14
				428.100							
				440.000							
				459.100							
				470.000							
				490.000							
				512.000							
PMAE4070A	PMNN4491A	RLN4815A	PMMN4024A	440.000							
				450.000							
				465.000	4.77	-0.47	5.090	3.730	2.85	2.09	AZ-AB-151006-15
				470.000							
				490.000							
PMAE4071A	PMNN4491A	RLN4815A	PMMN4024A	470.000	4.71	-0.58	5.040	3.690	2.94	2.15	AZ-AB-151006-16
				480.500							
				490.000							
				501.500							
				512.000							
Assessment of Additional Batteries											
PMAE4071A	NNTN8129AR	RLN4815A	PMMN4024A	470.000	4.69	-0.57	4.280	3.140	2.50	1.83	AZ-AB-151006-17
	PMNN4409BR			470.000	4.74	-0.59	4.440	3.270	2.58	1.90	AZ-AB-151006-18
	PMNN4412A			470.000	4.60	-0.77	4.530	3.310	2.82	2.06	AZ-AB-151006-19
	PMNN4406BR			470.000	4.60	-0.58	4.900	3.580	2.92	2.13	AZ-AB-151006-20
	PMNN4407BR			470.000	4.76	-0.66	5.620	4.110	3.30	2.41	AZ-AB-151006-21
	PMNN4448AR			470.000	4.77	-0.55	4.420	3.250	2.52	1.86	AZ-AB-151006-22
	PMNN4493A			470.000	4.80	-0.52	4.580	3.360	2.58	1.89	AZ-AB-151006-23
	PMNN4489A			470.000	4.62	-0.52	4.700	3.440	2.75	2.01	AZ-AB-151006-24
	NNTN8560A			470.000	4.63	-0.51	4.830	3.530	2.82	2.06	MO-AB-151006-25
	PMNN4435A			470.000	4.80	-0.78	4.380	3.210	2.62	1.92	MO-AB-151006-26
	PMNN4463A			470.000	4.73	-0.75	4.090	3.010	2.47	1.82	MO-AB-151006-27

Assessments at the Body with Body worn PMLN7008A

DUT assessment with offered antennas, default battery and, optional body worn accessory per KDB 643646. Optional batteries were tested per the requirements of KDB 643646. Refer to Table 17 for highest output power channel. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 21

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
PMAE4069A	PMNN4491A	PMLN7008A	PMMN4024A	406.125	4.73	-0.48	3.880	2.770	2.20	1.57	MO-AB-151006-29
				417.100							
				428.100							
				440.000							
				450.000							
PMAE4079A	PMNN4491A	PMLN7008A	PMMN4024A	406.125	4.73	-0.48	4.570	3.270	2.59	1.85	MO-AB-151007-01
				428.100							
				440.000							
				459.100							
				470.000							
				490.000							
PMAE4070A	PMNN4491A	PMLN7008A	PMMN4024A	440.000	4.57	-0.35	3.970	2.810	2.26	1.60	MO-AB-151007-03
				450.000							
				465.000	4.77	-0.48	6.530	4.590	3.67	2.58	MO-AB-151007-02
				470.000							
				490.000							
PMAE4071A	PMNN4491A	PMLN7008A	PMMN4024A	470.000	4.65	-0.59	6.950	4.900	4.11	2.90	MO-AB-151007-04
				480.500	4.63	-0.46	6.160	4.340	3.55	2.50	MO-AB-151007-05
				490.000							
				501.500	4.77	-0.52	4.970	3.470	2.82	1.97	MO-AB-151007-06
				512.000							
Assessment of Additional Batteries											
PMAE4071A	NNTN8129AR	PMLN7008A	PMMN4024A	470.000	4.65	-0.59	5.540	3.930	3.28	2.32	MO-AB-151007-07
	PMNN4409BR			470.000	4.74	-0.59	5.870	4.170	3.40	2.42	MO-AB-151007-08
	PMNN4412A			470.000	4.80	-0.86	6.240	4.390	3.80	2.68	MO-AB-151007-10
	PMNN4406BR			470.000	4.77	-0.55	5.520	4.010	3.15	2.29	AZ-AB-151007-12
	PMNN4407BR			470.000	4.75	-0.59	7.380	5.170	4.27	2.99	AZ-AB-151007-13
	PMNN4448AR			470.000	4.76	-0.47	5.790	4.100	3.25	2.30	AZ-AB-151007-14
	PMNN4493A			470.000	4.78	-0.49	5.590	4.030	3.14	2.27	AZ-AB-151007-15
	PMNN4489A			470.000	4.60	-0.51	6.430	4.530	3.77	2.66	AZ-AB-151007-16
	NNTN8560A			470.000	4.62	-0.51	6.440	4.530	3.76	2.65	AZ-AB-151007-17
	PMNN4435AR			470.000	4.80	-0.70	5.980	4.290	3.51	2.52	AZ-AB-151007-18
	PMNN4463A			470.000	4.80	-0.68	5.490	3.980	3.21	2.33	AZ-AB-151007-19

Assessments at the Body with Body worn PMLN4651A

DUT assessment with offered antennas, default battery and, optional body worn accessory per KDB 643646. Optional batteries were tested per the requirements of KDB 643646. Refer to Table 17 for highest output power channel. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 22

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
PMAE4069A	PMNN4491A	PMLN4651A	PMMN4024A	406.125	4.77	-0.41	4.140	2.990	2.29	1.65	AZ-AB-151007-20
				417.100							
				428.100							
				440.000							
				450.000							
PMAE4079A	PMNN4491A	PMLN4651A	PMMN4024A	406.125	4.75	-0.41	4.770	3.470	2.65	1.93	AZ-AB-151007-21
				428.100							
				440.000							
				459.100							
				470.000							
				490.000							
PMAE4070A	PMNN4491A	PMLN4651A	PMMN4024A	440.000	4.64	-0.37	4.380	3.120	2.47	1.76	AZ-AB-151007-23
				450.000							
				465.000	4.80	-0.50	7.090	5.020	3.98	2.82	AZ-AB-151007-22
				470.000							
				490.000							
PMAE4071A	PMNN4491A	PMLN4651A	PMMN4024A	470.000	4.65	-0.58	7.490	5.290	4.42	3.12	AZ-AB-151007-24
				480.500	4.68	-0.47	6.810	4.820	3.89	2.75	AZ-AB-151007-25
				490.000							
				501.500	4.68	-0.47	5.340	3.750	3.05	2.14	AZ-AB-151007-26
				512.000							
Assessment of Additional Batteries											
PMAE4071A	NNTN8129AR	PMLN4651A	PMMN4024A	470.000	4.57	-0.70	5.820	4.130	3.59	2.55	MO-AB-151007-27
	PMNN4409BR			470.000	4.67	-0.61	6.170	4.390	3.65	2.60	MO-AB-151007-28
	PMNN4412A			470.000	4.80	-0.77	6.760	4.780	4.04	2.85	MO-AB-151007-29
	PMNN4406BR			470.000	4.70	-0.54	5.690	4.150	3.29	2.40	MO-AB-151007-30
	PMNN4407BR			470.000	4.70	-0.61	7.550	5.320	4.44	3.13	MO-AB-151008-01
	PMNN4448AR			470.000	4.70	-0.53	6.100	4.330	3.52	2.50	MO-AB-151008-02
	PMNN4493A			470.000	4.75	-0.61	5.800	4.170	3.37	2.42	MO-AB-151008-03
	PMNN4489A			470.000	4.58	-0.52	6.490	4.590	3.83	2.71	MO-AB-151008-04
	NNTN8560A			470.000	4.63	-0.50	6.680	4.720	3.89	2.75	MO-AB-151008-05
	PMNN4435AR			470.000	4.80	-0.74	6.000	4.300	3.56	2.55	MO-AB-151008-06
	PMNN4463A			470.000	4.79	-0.71	5.680	4.100	3.35	2.42	MO-AB-151008-07

Assessments at the Body with Body worn PMLN7296A

DUT assessment with offered antennas, battery with vibrator PMNN4488A and optional body worn accessory per KDB 643646. Body worn PMLN7296A is not compatible with other optional batteries. Refer to Table 17 for highest output power channel. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 23

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
PMAE4069A	PMNN4488A	PMLN7296A	PMMN4024A	406.125	4.80	-0.52	3.530	2.420	1.99	1.36	MO-AB-151008-09
				417.100							
				428.100							
				440.000							
				450.000							
PMAE4079A	PMNN4488A	PMLN7296A	PMMN4024A	406.125	4.80	-0.49	4.270	2.940	2.39	1.65	MO-AB-151008-10
				428.100							
				440.000							
				459.100							
				470.000							
				490.000							
PMAE4070A	PMNN4488A	PMLN7296A	PMMN4024A	440.000							
				450.000							
				465.000	4.79	-0.41	5.180	3.660	2.85	2.02	AZ-AB-151008-11
				470.000							
				490.000							
PMAE4071A	PMNN4488A	PMLN7296A	PMMN4024A	470.000	4.80	-0.44	5.620	3.960	3.11	2.19	AZ-AB-151008-12
				480.500							
				490.000							
				501.500							
				512.000							

Assessment at the Body with other audio accessories

Assessment for additional audio accessories as per "KDB 643646 Body SAR Test Consideration for Audio Accessories without Built-in Antenna; Sec 1,A". SAR plots of the highest result per Table (bolded) are presented in Appendix E.

Table 24

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
PMAE4070A	PMNN4407BR	RLN4570A	PMLN5973A	440.000	4.70	-0.47	8.520	5.990	4.85	3.41	AZ-AB-151008-13
				450.000	4.68	-0.57	10.500	7.490	6.14	4.38	AZ-AB-151008-14
				465.000	4.73	-0.52	7.810	5.490	4.47	3.14	AZ-AB-151008-15
				470.000	4.73	-0.59	8.460	5.990	4.92	3.48	AZ-AB-151008-16
				490.000	4.75	-0.63	5.990	4.270	3.50	2.49	AZ-AB-151008-17
			PMLN5097A	440.000	4.75	-0.42	7.780	5.430	4.33	3.02	AZ-AB-151008-18
				450.000	4.71	-0.56	10.800	7.590	6.26	4.40	AZ-AB-151008-19
				465.000	4.80	-0.55	8.370	5.920	4.75	3.36	AZ-AB-151008-20
				470.000	4.75	-0.52	8.820	6.110	5.02	3.48	AZ-AB-151008-21
				490.000	4.71	-0.59	6.140	4.240	3.58	2.47	AZ-AB-151008-22
			PMLN5275C	440.000	4.67	-0.50	7.500	5.340	4.32	3.08	AZ-AB-151008-23
				450.000	4.79	-0.66	10.100	7.210	5.89	4.21	MO-AB-151008-24
				465.000	4.77	-0.52	8.740	6.240	4.96	3.54	MO-AB-151008-25
				470.000	4.75	-0.58	8.340	5.910	4.82	3.41	MO-AB-151008-26
				490.000	4.70	-0.62	6.640	4.650	3.91	2.74	MO-AB-151008-27
			RMN5137A	440.000	4.70	-0.51	8.380	5.900	4.81	3.39	MO-AB-151009-01
				450.000	4.75	-0.62	11.300	7.910	6.59	4.61	MO-AB-151009-02
				465.000	4.75	-0.57	9.000	6.310	5.19	3.64	MO-AB-151009-03
				470.000	4.71	-0.56	8.610	6.030	4.99	3.50	MO-AB-151009-04
				490.000	4.71	-0.65	6.150	4.280	3.64	2.53	MO-AB-151009-05

Assessment of wireless BT configuration

Assessment using the overall highest SAR configuration at the body from above without an audio accessory attached. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 25

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
PMAE4070A	PMNN4407BR	RLN4570A	NONE	440.000	4.66	-0.44	9.510	6.750	5.42	3.85	MO-AB-151009-06
				450.000	4.80	-0.81	12.300	8.830	7.41	5.32	AZ-AB-151011-12
				465.000	4.78	-0.58	10.600	7.590	6.08	4.36	MO-AB-151009-08
				470.000	4.69	-0.54	9.820	7.020	5.69	4.07	MO-AB-151009-09
				490.000	4.74	-0.60	7.200	5.120	4.19	2.98	MO-AB-151009-11

13.2 WLAN assessment at the Body for 802.11 b/g/n

The tables below represent the output power measurements for WLAN 2.4 GHz 802.11b/g/n for assessments at the Body using battery PMNN4491A because it is the thinnest battery (refer to Exhibit 7B for battery illustration). These power measurements were used to determine the necessary modes for SAR testing according to KDB 248227 D01 SAR Measurement Procedures for 802.11a/b/g/Transmitters.

The battery was used during conducted power measurements for all test channels within FCC allocated frequency range (2.412-2.462 GHz) which are listed in Table 26. The channel with the highest conducted power will be identified as the default channel per KDB 643646 (SAR Test for PTT Radios). SAR plots of the highest results per Table (bolded) are presented in Appendix E.

SAR is not required for 802.11 g/n when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is $\leq 1.2\text{W/kg}$.

Table 26

Mode	Channel #	Channel Frequency	Modulation	Battery: PMNN4491A	Antenna Max Power [mW]
				Antenna port[mW]	
802.11b (1Mbps)	1	2412	DSSS	19.49	22.4
	6	2437		17.06	
	11	2462		16.37	
802.11g (6Mbps)	1	2412	OFDM	7.51	8.3
	6	2437		6.70	
	11	2462		6.37	
802.11n (MCS0)	1	2412	OFDM	11.75	12.6
	6	2437		10.44	
	11	2462		9.94	

802.11b was chosen over 802.11 g & n for testing because it has the highest max power

Assessments at the Body with all offered Body worn

DUT assessment with WLAN internal antenna, all offered batteries without any cable accessory attachment against phantom with all offered body worn. Refer to Table 26 for highest output power channel. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 27

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
0104039J80 WiFi Ant	PMNN4491A	RLN4570A	None	2412.000	0.0195	-0.72	0.00723	0.00296	0.0098	0.0040	FIE-AB-151005-02
		HLN6602A		2412.000	0.0195	-0.85	0.00591	0.00295	0.0083	0.0041	FIE-AB-151005-03
		RLN4815A		2412.000	0.0195	3.13	0.000839	0.000141	0.0010	0.0002	TLC-AB-151007-10
		PMLN7008A		2412.000	0.0195	-2.72	0.00326	0.00109	0.0070	0.0023	TLC-AB-151007-11
		PMLN4651A		2412.000	0.0195	-0.20	0.00792	0.00372	0.0096	0.0045	FIE-AB-151008-02
0104039J80 WiFi Ant	PMNN4488A	PMLN7296A	None	2412.000	0.0195	-0.01	0.0023	0.00036	0.0027	0.0004	TLC-AB-151008-05
Assessment of Additional Batteries											
0104039J80 WiFi Ant	NNTN8129AR	RLN4570A	None	2412.000	0.0196	-1.34	0.00131	0.000131	0.0020	0.0002	TLC-AB-151008-06
	PMNN4409BR			2412.000	0.0190	1.35	0.00332	0.0011	0.0039	0.0013	TLC-AB-151008-07
	PMNN4412A			2412.000	0.0197	-2.26	0.00186	0.000651	0.0036	0.0012	TLC-AB-151008-08
	PMNN4406BR			2412.000	0.0193	0.18	0.00737	0.00217	0.0086	0.0025	TLC-AB-151008-09
	PMNN4407BR			2412.000	0.0191	0.41	0.00415	0.00127	0.0049	0.0015	FIE-AB-151009-03
	PMNN4448AR			2412.000	0.0190	0.36	0.011	0.00452	0.0130	0.0053	FIE-AB-151009-04
	PMNN4493A			2412.000	0.0192	0.92	0.00546	0.00102	0.0064	0.0012	FIE-AB-151009-05
	PMNN4489A			2412.000	0.0190	-3.03	0.00147	0.000274	0.0035	0.0006	FIE-AB-151009-06
	NNTN8560A			2412.000	0.0191	-1.64	0.00786	0.00267	0.0135	0.0046	TLC-AB-151009-07
	PMNN4435AR			2412.000	0.0190	-1.01	0.00489	0.0019	0.0073	0.0028	TLC-AB-151009-09
	PMNN4463A			2412.000	0.0191	0.21	0.00283	0.000945	0.0033	0.0011	TLC-AB-151009-10

Random drifts are due to low SAR values near or below the system noise threshold.

13.3 LMR assessments at the Face for 406.125-512 MHz band

Battery PMNN4493A was selected as the default battery for assessments at the Face because it has the highest capacity (refer to Exhibit 7B for battery illustration). The default battery was used during conducted power measurements for all test channels within FCC allocated frequency range (406.125 – 512 MHz) which are listed in Table 28. The channel with the highest conducted power will be identified as the default channel per KDB 643646 (SAR Test for PTT Radios). SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 28

Test Freq (MHz)	Power (W)
406.1250	4.800
417.1000	4.800
428.1000	4.790
440.0000	4.770
450.0000	4.800
459.1000	4.800
465.0000	4.800
470.0000	4.800
480.5000	4.800
490.0000	4.790
501.5000	4.770
512.0000	4.760

DUT assessment with offered antennas, default battery with front of DUT positioned 2.5cm facing phantom per KDB 643646. Optional batteries were tested per the requirements of KDB 643646. Refer to Table 28 for highest output power channel. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 29

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
PMAE4069A	PMNN4493A	NONE	NONE	406.125	4.78	-0.66	3.690	2.750	2.16	1.61	MO-FACE-151009-19
				417.100							
				428.100							
				440.000							
				450.000							
PMAE4079A	PMNN4493A	NONE	NONE	406.125	4.78	-0.59	4.110	3.060	2.36	1.76	MO-FACE-151009-20
				428.100							
				440.000							
				459.100							
				470.000							
				490.000							
				512.000							
PMAE4070A	PMNN4493A	NONE	NONE	440.000							
				450.000	4.80	-0.35	5.360	3.980	2.90	2.16	FIE-FACE-151010-04
				465.000							
				470.000							
				490.000							
PMAE4071A	PMNN4493A	NONE	NONE	470.000	4.78	-0.44	5.480	4.060	3.04	2.26	FIE-FACE-151010-05
				480.500							
				490.000							
				501.500							
				512.000							
Assessment of Additional Batteries											
PMAE4071A	PMNN4491A	NONE	NONE	470.000	4.76	-0.53	5.580	4.120	3.18	2.35	FIE-FACE-151010-06
	NNTN8129AR			470.000	4.65	-0.32	5.220	3.870	2.90	2.15	FIE-FACE-151010-07
	PMNN4409BR			470.000	4.75	-0.49	5.530	4.090	3.13	2.31	FIE-FACE-151010-08
	PMNN4412A			470.000	4.60	-0.57	5.100	3.770	3.03	2.24	FIE-FACE-151010-09
	PMNN4406BR			470.000	4.75	-0.58	5.260	3.890	3.04	2.25	FIE-FACE-151010-10
	PMNN4407BR			470.000	4.76	-0.54	5.450	4.030	3.11	2.30	FIE-FACE-151010-11
	PMNN4448AR			470.000	4.76	-0.46	5.770	4.280	3.23	2.40	TLC-FACE-151010-12
	PMNN4489A			470.000	4.70	-0.54	5.930	4.380	3.43	2.53	TLC-FACE-151010-14
	PMNN4488A			470.000	4.79	-0.59	5.910	4.380	3.39	2.51	TLC-FACE-151010-15
	NNTN8560A			470.000	4.69	-0.40	5.640	4.180	3.16	2.35	TLC-FACE-151010-16
	PMNN4435AR			470.000	4.79	-0.67	5.820	4.300	3.40	2.51	TLC-FACE-151010-17
	PMNN4463A			470.000	4.75	-0.66	5.790	4.280	3.41	2.52	TLC-FACE-151010-18

13.4 WLAN assessment at the Face for 802.11 b/g/n

The tables below represent the output power measurements for WLAN 2.4 GHz 802.11b/g/n for assessments at the Face using battery PMNN4493A because it has the highest capacity (refer to Exhibit 7B for battery illustration). These power measurements were used to determine the necessary modes for SAR testing according to KDB 248227 D01 SAR Measurement Procedures for 802.11a/b/g/Transmitters.

The battery was used during conducted power measurements for all test channels within FCC allocated frequency range (2.412-2.462GHz) which are listed in Table 30. The channel with the highest conducted power will be identified as the default channel per KDB 643646 (SAR Test for PTT Radios). SAR plots of the highest results per Table (bolded) are presented in Appendix E.

SAR is not required for 802.11 g/n when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is $\leq 1.2\text{W/kg}$.

Table 30

Mode	Channel #	Channel Frequency	Modulation	Battery: PMNN4493A	Antenna Max Power [mW]
				Antenna port[mW]	
802.11b (1Mbps)	1	2412	DSSS	19.94	22.4
	6	2437		17.34	
	11	2462		16.69	
802.11g (6Mbps)	1	2412	OFDM	7.41	8.3
	6	2437		6.45	
	11	2462		6.38	
802.11n (MCS0)	1	2412	OFDM	12.30	12.6
	6	2437		11.04	
	11	2462		9.68	

802.11b was chosen over 802.11 g & n for testing because it has the highest max power

DUT assessment with WLAN internal antenna using all offered batteries with front of the DUT 2.5 cm from phantom. Refer to Table 30 for highest output power channel. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 31

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
0104039J80 WiFi Ant	PMNN4493A	None	None	2412.000	0.0199	-0.72	0.017	0.00832	0.0226	0.0111	KKL-FACE-151011-05
Assessment of Additional Batteries											
0104039J80 WiFi Ant	NNTN8129A	None	None	2412.000	0.0196	-0.39	0.017	0.00814	0.0213	0.0102	TLC-FACE-151011-08
	PMNN4409BR			2412.000	0.0190	-0.01	0.016	0.00808	0.0189	0.0096	TLC-FACE-151011-09
	PMNN4412A			2412.000	0.0197	-0.11	0.019	0.00958	0.0222	0.0112	TLC-FACE-151011-10
	PMNN4406BR			2412.000	0.0193	-0.02	0.019	0.00989	0.0222	0.0115	TLC-FACE-151012-10
	PMNN4407BR			2412.000	0.0191	-0.04	0.016	0.00794	0.0190	0.0094	TLC-FACE-151012-11
	PMNN4448A			2412.000	0.0190	0.27	0.017	0.00885	0.0201	0.0104	TLC-FACE-151012-14
	PMNN4491A			2412.000	0.0192	0.56	0.018	0.0089	0.0210	0.0104	TLC-FACE-151012-15
	PMNN4489A			2412.000	0.0190	-0.12	0.017	0.0076	0.0206	0.0092	TLC-FACE-151012-16
	NNTN8560A			2412.000	0.0191	0.15	0.018	0.00861	0.0211	0.0101	TLC-FACE-151012-17
	PMNN4435AR			2412.000	0.0190	-1.37	0.033	0.020	0.0534	0.0324	TLC-FACE-151013-09
	PMNN4463A			2412.000	0.0191	-0.72	0.016	0.00751	0.0222	0.0104	FIE-FACE-151013-03
	PMNN4488A			2412.000	0.0195	-0.02	0.016	0.00794	0.0185	0.0092	FIE-FACE-151013-04

13.5 Assessment for Industry Canada

Based on the assessment results for body and face per KDB643646 D01, additional tests were not required for the Industry Canada frequency range (406.125-430MHz) and (450-470MHz) as the testing performed is in compliance with Industry Canada frequency range.

13.6 Assessment at the Bluetooth band

Per guidelines in KDB 447498, the following formula was used to determine the test exclusion for standalone Bluetooth transmitter;

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{F_{(\text{GHz})}}] = 2.43, \text{ which is } \leq 3 \text{ for 1-g SAR}$$

Where:

Max. power = 7.7mW (10mW*77% duty cycle)

Min. test separation distance = 5mm for actual test separation < 5mm

F(GHz) = 2.48 GHz

Per the result from the calculation above, the standalone SAR assessment was not required for Bluetooth band. Therefore, SAR results for Bluetooth are not reported herein.

13.7 Assessment outside FCC Part 90

Assessment of outside FCC Part 90 using the highest SAR configuration for each band from above. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

TABLE 32

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g- SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g- SAR (W/kg)	Run#
Body											
PMAE4069A	PMNN4407BR	RLN4570A	NONE	403.000	4.64	-0.49	7.760	5.440	4.49	3.15	AZ-AB-151009-12
PMAE4079A	PMNN4407BR	RLN4570A	NONE	403.000	4.63	-0.45	8.710	6.140	5.01	3.53	AZ-AB-151009-13
				519.500	4.63	-0.63	9.020	6.540	5.41	3.92	AZ-AB-151009-14
				527.000	4.80	-0.75	8.750	6.090	5.20	3.62	AZ-AB-151009-16
PMAE4071A	PMNN4407BR	RLN4570A	NONE	519.500	4.63	-0.49	11.600	8.310	6.73	4.82	AZ-AB-151009-15
				527.000	4.80	-0.71	12.70	9.20	7.48	5.42	AZ-AB-151012-12
Face											
PMAE4069A	PMNN4489A	NONE	NONE	403.000	4.60	-0.43	3.950	2.930	2.28	1.69	TLC-FACE-151010-19
PMAE4079A	PMNN4489A	NONE	NONE	403.000	4.59	-0.57	4.150	3.080	2.47	1.84	TLC-FACE-151010-20
				519.500	4.58	-0.50	4.310	3.200	2.53	1.88	FIE-FACE-151011-02
				527.000	4.63	-0.30	4.110	3.060	2.28	1.70	FIE-FACE-151011-03
PMAE4071A	PMNN4489A	NONE	NONE	519.500	4.59	-0.31	4.830	3.580	2.71	2.01	FIE-FACE-151011-04
				527.000	4.63	-0.47	6.57	4.90	3.79	2.83	AZ-FACE-151011-09

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 D 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 F.

Table 33

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
PMAE4070A	PMNN4407BR	RLN4570A	NONE	450.000	4.80	-0.45	13.000	9.200	7.21	5.10	MO-AB-151012-04

14.0 Simultaneous Transmission Exclusion for BT

Per guidelines in KDB 447498, the following formula was used to determine the test exclusion to an antenna that transmits simultaneously with other antennas for test distances $\leq 50\text{mm}$:

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] * [\sqrt{F(\text{GHz})/X}] = 0.32 \text{ W/kg, which is } \leq 0.4 \text{ W/kg (1g)}$$

Where:

X = 7.5 for 1g-SAR; 18.75 for 10g

Max. power = 7.7 mW (10mW*77% duty cycle)

Min. test separation distance = 5mm for actual test separation < 5mm

F(GHz) = 2.48 GHz

Per the result from the calculation above, simultaneous exclusion is applied and therefore SAR results are not reported herein.

15.0 Simultaneous Transmission between LMR, WLAN and BT

This device uses a single transmitter module and antenna for both WLAN and BT. WLAN and BT cannot transmit simultaneously. Simultaneous transmission for BT had been excluded as mentioned in section 14.0. The maximum sourced-based time-averaged output power for tested 802.11b is 22.4 mW while the BT is 7.7 mW. Therefore the measured SAR from 802.11b is used in conjunction with LMR for simultaneous results.

The Table below summarizes the simultaneous transmissions between LMR and WLAN bands.

Table 34

		LMR Bands
		UHF (406.125-512 MHz)
WLAN Band	2412 - 2462	√

16.0 Results Summary

Based on the test guidelines from section 4.0 and satisfying frequencies within FCC bands and Industry Canada Frequency bands, the highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing:

Table 35

Technologies	Frequency band (MHz)	Max Calc at Body (W/kg)		Max Calc at Face (W/kg)	
		1g-SAR	10g-SAR	1g-SAR	10g-SAR
FCC					
LMR	406.125 -512	7.41	5.32	3.43	2.53
WLAN	2412-2462	0.0135	0.0046	0.0534	0.0324
Industry Canada					
LMR	406.125-430	3.60	2.57	2.36	1.76
LMR	450-470	7.41	5.32	3.43	2.53
WLAN	2412-2462	0.0135	0.0046	0.0534	0.0324
Overall					
LMR	403-527	7.48	5.42	3.79	2.83
WLAN	2412-2462	0.0135	0.0046	0.0534	0.0324

All results are scaled to the maximum output power.

The highest combined 1g-SAR results for simultaneous is indicated in the following Table:

Table 36

Designator	Frequency bands	Combined 1g-SAR (W/kg)	Combined 10g-SAR (W/kg)
Body			
FCC	LMR (406.125-512 MHz) and WLAN band	7.42	5.32
Industry Canada	LMR (406.125-430 MHz) and WLAN band	3.61	2.57
	LMR (450-470 MHz) and WLAN band	7.42	5.32
Overall	LMR (403-527 MHz) and WLAN band	7.49	5.42
Face			
FCC	LMR (406.125-512 MHz) and WLAN band	3.48	2.56
Industry Canada	LMR (406.125-430 MHz) and WLAN band	2.41	1.79
	LMR (450-470 MHz) and WLAN band	3.48	2.56
Overall	LMR (403-527 MHz) and WLAN band	3.84	2.86

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 OET Bulletin 65. The 10 grams result is not applicable to FCC filing.

17.0 Variability Assessment

Per the guidelines in KDB 865664 SAR variability assessment is required because SAR results are above 4.0W/kg (Occupational). The Table below includes test results of the original measurement(s), the repeated measurement(s), and the ratio (SAR_{high}/SAR_{low}) for the applicable test configuration(s).

Table 37

Run#	Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq. (MHz)	Adj Calc. 1g-SAR (W/kg)	Ratio	Comments
AZ-AB-151011-12	PMAE4070A	PMNN4407BR	RLN4570A	NONE	450.000	7.41	1.03	No additional repeated scans is required due to the Ratio (SAR_{high}/SAR_{low}) < 1.20 and not greater than 7.50 W/kg
MO-AB-151012-04						7.21		
MO-AB-151013-03						7.26		

18.0 System Uncertainty

A system uncertainty analysis is not required for this report per KDB 865664 because the highest report SAR value Occupational exposure is less than 7.5W/kg.

Per the guidelines of ISO 17025 a reported system uncertainty is required and therefore measurement uncertainty budget is included in Appendix A.

Appendix A

Measurement Uncertainty Budget

Table A.1: Uncertainty Budget for Device Under Test, for 450 MHz

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i> = <i>f</i> (<i>d</i> , <i>k</i>)	<i>f</i>	<i>g</i>	<i>h</i> = <i>c</i> x <i>f</i> / <i>e</i>	<i>i</i> = <i>c</i> x <i>g</i> / <i>e</i>	<i>k</i>
Uncertainty Component	IEEE 1528 section	Tol. (± %)	Prob Dist	Div.	<i>c_i</i> (1 g)	<i>c_i</i> (10 g)	1 g <i>u_i</i> (±%)	10 g <i>u_i</i> (±%)	<i>v_i</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	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				11	11	477
Expanded Uncertainty (95% CONFIDENCE LEVEL)			<i>k</i> =2				23	22	

Notes for uncertainty budget Tables:

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

b) Tol. - tolerance in influence quantity.

c) Prob. Dist. – Probability distribution

d) N, R - normal, rectangular probability distributions

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

f) *c_i* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.

g) *u_i* – SAR uncertainty

h) *v_i* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

Table A.2: Uncertainty Budget for Device Under Test, for 2450 MHz

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e = f(d,k)</i>	<i>f</i>	<i>g</i>	<i>h = c x f / e</i>	<i>i = c x g / e</i>	<i>k</i>
Uncertainty Component	IEEE 1528 section	Tol. (± %)	Prob Dist	Div.	ci (1 g)	ci (10 g)	1 g u _i (±%)	10 g u _i (±%)	v _i
Measurement System									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
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				11	11	419
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				22	22	

Notes for uncertainty budget Tables:

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

b) Tol. - tolerance in influence quantity.

c) Prob. Dist. – Probability distribution

d) N, R - normal, rectangular probability distributions

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

f) *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

Table A.3: Uncertainty Budget for System Validation (dipole & flat phantom) for 450 MHz

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i> = <i>f</i> (<i>d</i> , <i>k</i>)	<i>f</i>	<i>g</i>	<i>h</i> = <i>c</i> x <i>f</i> / <i>e</i>	<i>i</i> = <i>c</i> x <i>g</i> / <i>e</i>	<i>k</i>
Uncertainty Component	IEEE 1528 section	Tol. (± %)	Prob Dist	Div.	<i>c_i</i> (1 g)	<i>c_i</i> (10 g)	1 g <i>U_i</i> (±%)	10 g <i>U_i</i> (±%)	<i>v_i</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	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				10	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			<i>k</i> =2				19	18	

Notes for uncertainty budget Tables:

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

Table A.4: Uncertainty Budget for System Validation (dipole & flat phantom) for 2450 MHz

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e = f(d,k)</i>	<i>f</i>	<i>g</i>	<i>h = c x f / e</i>	<i>i = c x g / e</i>	<i>k</i>
Uncertainty Component	IEEE 1528 section	Tol. (± %)	Prob Dist	Div.	<i>c_i</i> (1 g)	<i>c_i</i> (10 g)	1 g <i>U_i</i> (±%)	10 g <i>U_i</i> (±%)	<i>v_i</i>
Measurement System									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
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				9	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			<i>k</i> =2				18	17	

Notes for uncertainty budget Tables:

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

Appendix B

Probe Calibration Certificates

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



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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **Motorola Solutions MY**

Certificate No: **ES3-3096_Nov14**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3096**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-12.v9, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes**

Calibration date: **November 12, 2014**

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642UD1700	4-Aug-09 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390586	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by:	Name Jeton Kasthali	Function Laboratory Technician	Signature 
Approved by:	Name Kaja Pokovic	Technical Manager	

Issued: November 12, 2014

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

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



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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Glossary:

TSL	tissue simulating liquid
NORM _{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, D	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., $\theta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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 $\theta = 0$ ($f \leq 900$ 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}; D_{x,y,z}; VR_{x,y,z}; A, B, C, D** 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.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

ES3DV3 – SN:3096

November 12, 2014

Probe ES3DV3

SN:3096

Manufactured: July 12, 2005
Calibrated: November 12, 2014

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

ES3DV3- SN:3096

November 12, 2014

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3096

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V/m})^2$) ^A	1.27	1.02	1.19	$\pm 10.1\%$
DCP (mV) ^B	102.9	103.8	102.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^C (k=2)
0	CW	X	0.0	0.0	1.0	0.00	213.0	$\pm 3.3\%$
		Y	0.0	0.0	1.0		216.6	
		Z	0.0	0.0	1.0		205.6	
10012- CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.95	68.5	18.5	1.87	149.6	$\pm 0.7\%$
		Y	3.44	71.3	19.8		147.0	
		Z	2.99	68.9	18.7		144.4	
10013- CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.41	71.1	23.6	9.46	125.3	$\pm 3.3\%$
		Y	11.06	69.9	22.6		124.5	
		Z	11.75	72.2	24.2		145.8	
10059- CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	X	3.69	71.8	20.0	2.12	149.3	$\pm 0.5\%$
		Y	4.13	73.7	20.8		149.8	
		Z	3.71	72.1	20.1		144.1	
10060- CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	X	13.67	96.2	28.4	2.83	136.2	$\pm 0.5\%$
		Y	17.13	99.6	29.2		135.5	
		Z	13.31	96.5	28.7		130.3	
10061- CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	X	10.55	87.5	25.9	3.60	139.8	$\pm 0.7\%$
		Y	16.59	94.9	26.1		141.7	
		Z	10.32	87.8	26.1		133.2	
10071- CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	X	11.69	71.6	24.2	9.83	123.2	$\pm 3.3\%$
		Y	11.23	70.1	23.0		121.8	
		Z	12.03	72.7	24.8		142.4	
10072- CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	X	11.35	71.6	24.0	9.62	121.1	$\pm 4.9\%$
		Y	11.83	72.5	24.2		149.6	
		Z	11.77	72.9	24.8		139.9	
10073- CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	X	12.56	74.8	26.1	9.94	148.3	$\pm 5.2\%$
		Y	12.18	73.4	25.0		149.9	
		Z	11.99	73.6	25.5		137.5	
10074- CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	X	12.92	75.6	26.9	10.30	147.1	$\pm 5.7\%$
		Y	12.40	73.9	25.5		146.6	
		Z	12.27	74.3	26.1		135.2	
10075- CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	X	13.32	76.8	27.8	10.77	143.7	$\pm 6.0\%$
		Y	12.83	74.9	26.4		145.7	
		Z	12.52	74.9	26.9		131.6	
10076- CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	X	13.55	77.2	28.3	10.94	143.3	$\pm 6.3\%$
		Y	12.99	75.3	26.8		144.4	
		Z	12.67	75.3	27.2		130.5	

Certificate No: ES3-3096 Nov14

Page 4 of 13

ES3DV3- SN:3096

November 12, 2014

10077-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	X	13.59	77.4	28.5	11.00	142.7	±6.3 %
		Y	13.01	75.4	26.9		143.4	
		Z	12.65	75.3	27.3		129.6	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.34	69.2	21.6	8.10	129.8	±2.2 %
		Y	10.11	68.6	21.0		129.9	
		Z	10.21	69.0	21.4		123.3	
10115-CAA	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	X	10.92	69.9	22.1	8.46	132.8	±2.5 %
		Y	10.64	69.0	21.4		134.1	
		Z	10.77	69.6	21.9		127.1	
10116-CAA	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	X	10.36	69.3	21.6	8.15	129.4	±2.2 %
		Y	10.16	68.7	21.1		130.3	
		Z	10.27	69.1	21.5		124.1	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.31	69.2	21.5	8.07	129.8	±2.2 %
		Y	10.10	68.5	21.0		131.1	
		Z	10.18	68.9	21.4		124.4	
10118-CAA	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	X	11.06	70.0	22.3	8.59	133.3	±2.5 %
		Y	10.80	69.3	21.6		135.2	
		Z	10.94	69.8	22.2		128.5	
10119-CAA	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	X	10.33	69.2	21.6	8.13	128.2	±2.2 %
		Y	10.15	68.6	21.1		130.4	
		Z	10.25	69.1	21.5		123.2	
10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	9.97	68.6	21.4	8.09	124.1	±2.2 %
		Y	9.81	68.2	20.9		126.0	
		Z	10.23	69.7	22.0		145.2	
10194-CAA	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	X	9.99	68.9	21.5	8.12	123.7	±2.2 %
		Y	9.87	68.4	21.0		126.6	
		Z	10.30	69.6	22.0		146.0	
10195-CAA	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	X	10.16	69.1	21.6	8.21	125.4	±2.2 %
		Y	10.00	68.5	21.1		126.2	
		Z	10.44	70.0	22.2		146.0	
10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.99	68.9	21.5	8.10	124.0	±2.2 %
		Y	9.75	68.1	20.9		124.5	
		Z	10.23	69.7	22.0		144.4	
10197-CAA	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	X	10.05	69.0	21.5	8.13	125.1	±2.2 %
		Y	9.84	68.3	20.9		124.9	
		Z	10.30	69.8	22.0		145.0	
10198-CAA	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	X	10.19	69.1	21.7	8.27	125.0	±2.2 %
		Y	10.00	68.4	21.1		125.2	
		Z	10.48	70.0	22.2		145.3	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.86	68.8	21.4	8.03	123.8	±1.9 %
		Y	9.63	68.0	20.8		122.4	
		Z	10.11	69.6	21.9		143.2	
10220-CAA	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	X	10.05	69.0	21.5	8.13	125.5	±2.2 %
		Y	9.83	68.2	20.9		124.2	
		Z	10.30	69.8	22.0		145.2	

Certificate No: ES3-3096_Nov14

Page 5 of 13

ES3DV3- SN:3096

November 12, 2014

10221-CAA	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	X	10.20	69.1	21.6	8.27	126.0	±2.2 %
		Y	10.02	68.4	21.1		125.1	
		Z	10.49	70.0	22.2		146.6	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.29	69.2	21.5	8.06	129.4	±2.2 %
		Y	10.03	68.4	20.9		128.2	
		Z	10.17	68.9	21.4		123.3	
10223-CAA	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	X	10.96	70.0	22.2	8.48	134.3	±2.7 %
		Y	10.64	69.0	21.5		132.8	
		Z	10.80	69.6	22.0		127.6	
10224-CAA	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	X	10.31	69.3	21.6	8.08	129.7	±2.2 %
		Y	10.07	68.5	21.0		129.5	
		Z	10.18	69.0	21.4		123.4	
10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	2.76	68.2	18.5	1.71	127.5	±0.5 %
		Y	3.24	71.1	19.9		129.0	
		Z	2.87	69.0	19.0		144.9	
10316-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	10.22	69.2	21.8	8.36	124.8	±2.2 %
		Y	10.01	68.5	21.2		124.4	
		Z	10.49	70.0	22.3		144.7	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.55	67.7	18.4	1.54	128.2	±0.7 %
		Y	2.69	69.8	19.4		129.0	
		Z	2.64	68.4	18.8		145.3	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.04	68.8	21.6	8.23	123.9	±2.2 %
		Y	9.83	68.2	21.0		124.4	
		Z	10.30	69.7	22.1		144.1	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preamble)	X	9.94	68.9	21.5	8.14	124.2	±2.2 %
		Y	9.73	68.2	20.9		124.5	
		Z	10.17	69.7	22.0		143.2	
10419-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preamble)	X	10.01	68.9	21.6	8.19	124.8	±2.2 %
		Y	9.84	68.3	21.0		125.6	
		Z	10.30	69.8	22.1		143.9	

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 Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 7 and 8).

^B Numerical linearization parameter, uncertainty not required.

^C 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:3096

November 12, 2014

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3096

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^e	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha ^g	Depth ^h (mm)	Unct. (k=2)
150	52.3	0.76	6.87	6.87	6.87	0.05	1.20	± 13.3 %
300	45.3	0.87	6.98	6.98	6.98	0.12	2.80	± 13.3 %
450	43.5	0.87	6.61	6.61	6.61	0.22	2.00	± 13.3 %
750	41.9	0.89	6.40	6.40	6.40	0.38	1.62	± 12.0 %
900	41.5	0.97	6.05	6.05	6.05	0.42	1.48	± 12.0 %
2450	39.2	1.80	4.48	4.48	4.48	0.79	1.41	± 12.0 %

^c Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 60 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^e 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.

^g Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

ES3DV3- SN:3096

November 12, 2014

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3096

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 ^g	Depth ^g (mm)	Unct. (k=2)
150	61.9	0.80	6.80	6.80	6.80	0.05	1.20	± 13.3 %
300	58.2	0.92	6.77	6.77	6.77	0.10	1.25	± 13.3 %
450	56.7	0.94	6.73	6.73	6.73	0.12	1.25	± 13.3 %
750	55.5	0.96	5.99	5.99	5.99	0.70	1.21	± 12.0 %
900	55.0	1.05	5.82	5.82	5.82	0.35	1.71	± 12.0 %
2450	52.7	1.95	4.38	4.38	4.38	0.82	1.25	± 12.0 %

^c Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

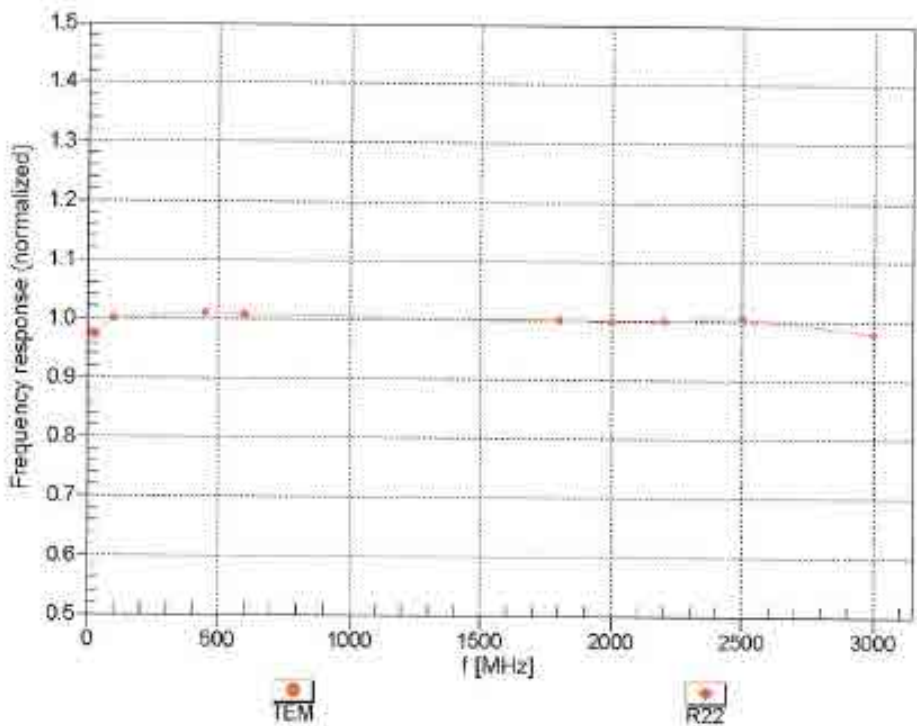
^f At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^g Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

ES3DV3-SN:3096

November 12, 2014

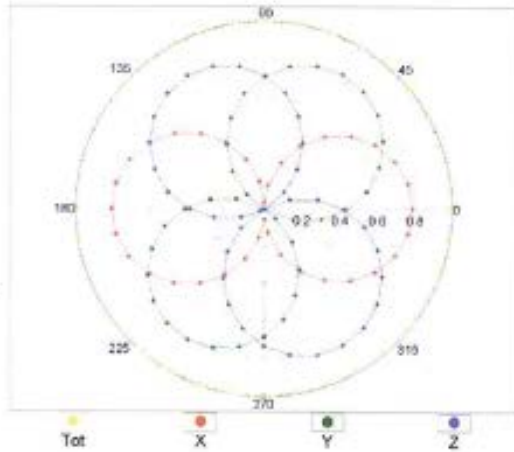
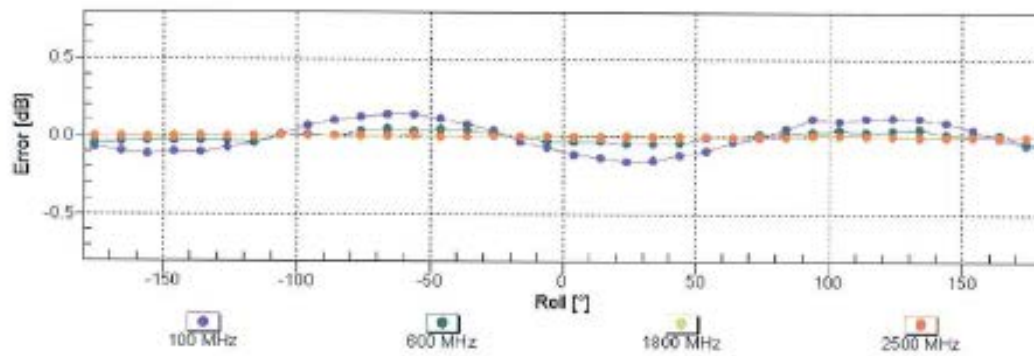
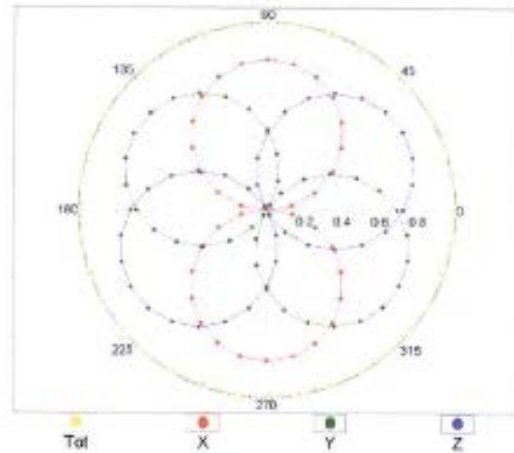
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

ES3DV3- SN:3096

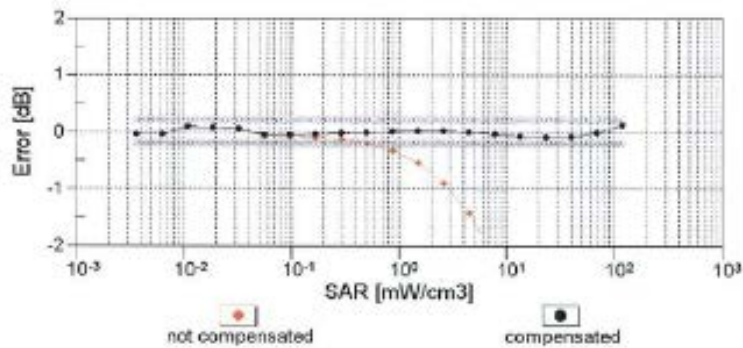
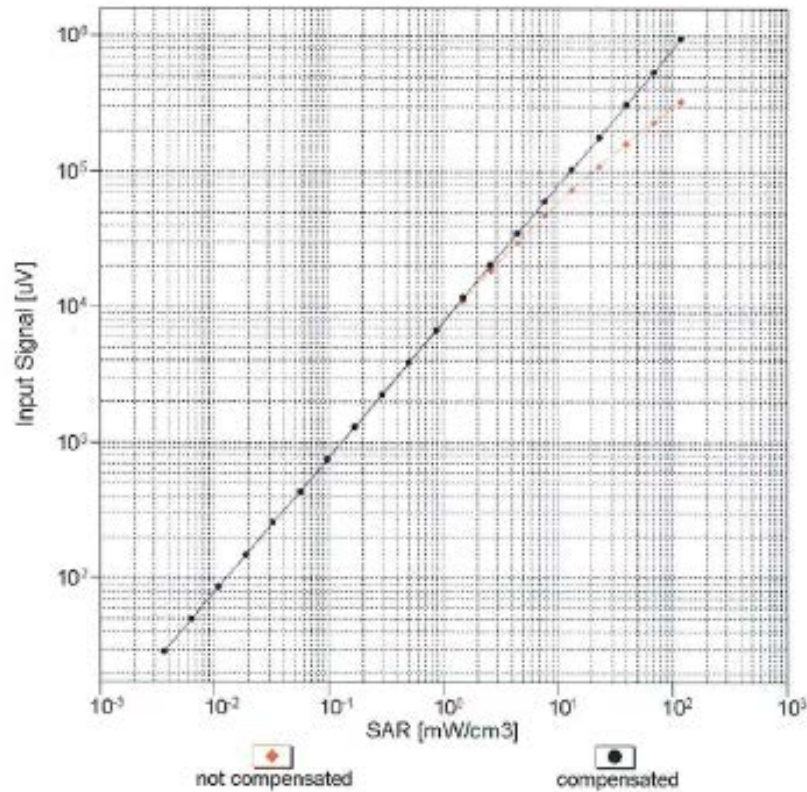
November 12, 2014

Receiving Pattern (ϕ), $\theta = 0^\circ$ **f=600 MHz,TEM****f=1800 MHz,R22****Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)**

ES3DV3- SN:3096

November 12, 2014

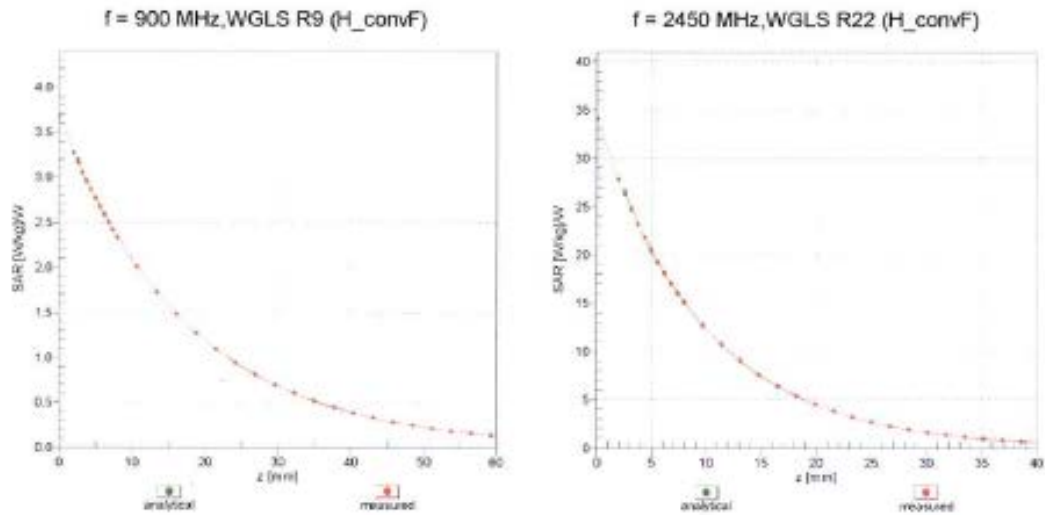
Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f_{\text{eval}} = 1900 \text{ MHz}$)

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

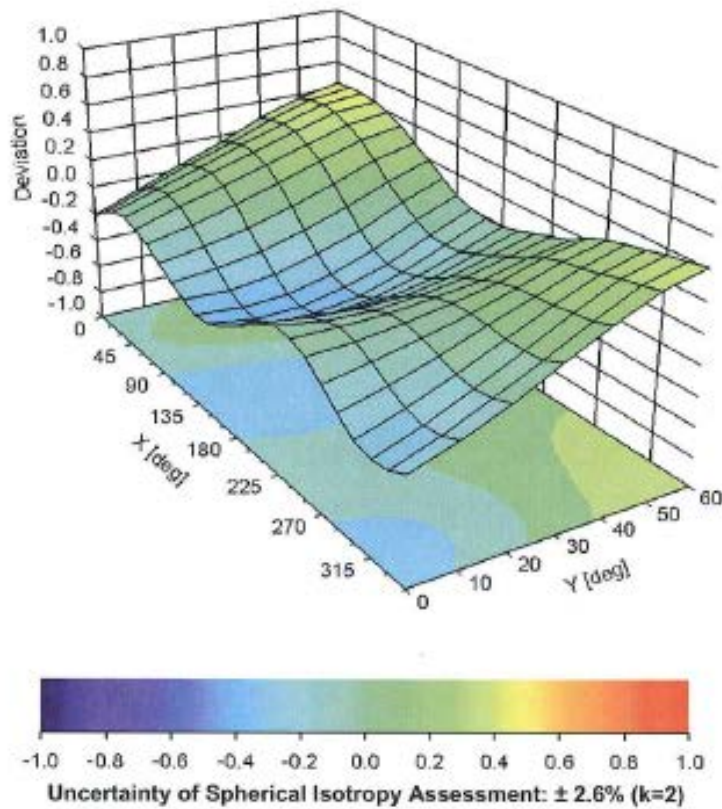
ES3DV3- SN:3096

November 12, 2014

Conversion Factor Assessment



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



ES3DV3- SN:3096

November 12, 2014

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3096**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	~136.1
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

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



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

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

Accreditation No.: **SCS 0108**

Client **Motorola Solutions MY**

Certificate No: **EX3-7364_Jun15**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7364**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-12.v9, QA CAL-14 v4, QA CAL-23.v5,
QA CAL-25.v6
Calibration procedure for dosimetric E-field probes**

Calibration date: **June 23, 2015**

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	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3e)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013, Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by:	Name Claudio Lauber	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Issued: June 24, 2015

Certificate No: **EX3-7364_Jun15**

Page 1 of 18

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)

Accreditation No.: **SCS 0108**

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

Glossary:

TSL	tissue simulating liquid
NORM _{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, D	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., $\theta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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 $\theta = 0$ ($f \leq 900$ 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}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D 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.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

EX3DV4 – SN:7364

June 23, 2015

Probe EX3DV4

SN:7364

Manufactured: February 5, 2015
Calibrated: June 23, 2015

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

EX3DV4- SN:7364

June 23, 2015

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7364**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.48	0.46	0.59	$\pm 10.1 \%$
DGP (mV) ^B	97.7	96.3	97.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^C (k=2)
0.	CW	X	0.0	0.0	1.0	0.00	115.0	$\pm 3.5 \%$
		Y	0.0	0.0	1.0		110.5	
		Z	0.0	0.0	1.0		124.6	
10011-CAB	UMTS-FDD (WCDMA)	X	3.42	67.2	18.6	2.91	122.6	$\pm 0.5 \%$
		Y	3.14	64.8	18.9		117.5	
		Z	3.48	67.3	18.5		135.3	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.86	68.1	18.5	1.87	122.4	$\pm 0.5 \%$
		Y	2.39	63.9	15.8		117.3	
		Z	3.01	69.0	18.8		135.0	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	10.47	68.7	22.2	9.46	115.4	$\pm 2.7 \%$
		Y	10.30	68.1	21.6		107.3	
		Z	10.58	69.3	22.6		126.2	
10059-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	X	3.03	69.0	19.0	2.12	120.5	$\pm 0.5 \%$
		Y	2.58	65.1	16.6		115.0	
		Z	2.93	68.2	18.4		133.3	
10060-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	X	3.74	77.3	22.8	2.83	148.9	$\pm 0.5 \%$
		Y	2.75	70.3	19.2		141.7	
		Z	3.40	75.1	21.8		118.0	
10061-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	X	3.83	73.4	21.4	3.60	145.6	$\pm 0.7 \%$
		Y	3.06	68.2	18.5		139.1	
		Z	3.96	74.0	21.7		117.9	
10062-CAB	IEEE 802.11a/b WiFi 5 GHz (OFDM, 6 Mbps)	X	10.17	68.5	21.5	8.68	116.8	$\pm 2.5 \%$
		Y	9.91	67.6	20.8		107.4	
		Z	10.39	69.3	22.0		132.5	
10063-CAB	IEEE 802.11a/b WiFi 5 GHz (OFDM, 9 Mbps)	X	10.01	68.4	21.4	8.63	116.3	$\pm 2.5 \%$
		Y	9.85	67.7	20.9		108.8	
		Z	10.24	69.2	22.0		131.7	
10064-CAB	IEEE 802.11a/b WiFi 5 GHz (OFDM, 12 Mbps)	X	10.46	68.7	21.9	9.09	117.4	$\pm 2.7 \%$
		Y	10.34	68.2	21.3		110.7	
		Z	10.69	69.6	22.5		132.1	
10065-CAB	IEEE 802.11a/b WiFi 5 GHz (OFDM, 18 Mbps)	X	10.10	68.4	21.7	9.00	113.5	$\pm 2.5 \%$
		Y	10.01	68.0	21.2		107.5	
		Z	10.29	69.2	22.2		127.6	
10066-CAB	IEEE 802.11a/b WiFi 5 GHz (OFDM, 24 Mbps)	X	10.32	68.7	22.1	9.38	113.2	$\pm 2.5 \%$
		Y	10.20	68.1	21.6		106.0	
		Z	10.49	69.4	22.6		125.8	

Certificate No: EX3-7364_Jun15

Page 4 of 18

EX3DV4- SN:7364

June 23, 2015

10067-CAB	IEEE 802.11a/n WiFi 5 GHz (OFDM, 36 Mbps)	X	10.83	69.1	22.8	10.12	111.9	±3.0 %
		Y	10.70	68.6	22.3		105.5	
		Z	11.04	70.0	23.5		125.5	
10068-CAB	IEEE 802.11a/n WiFi 5 GHz (OFDM, 48 Mbps)	X	10.64	69.0	22.9	10.24	108.5	±3.3 %
		Y	11.07	70.0	23.2		145.3	
		Z	10.83	69.9	23.5		121.7	
10069-CAB	IEEE 802.11a/n WiFi 5 GHz (OFDM, 54 Mbps)	X	10.95	69.2	23.2	10.58	109.6	±3.5 %
		Y	11.38	70.3	23.6		148.1	
		Z	11.13	70.1	23.8		122.0	
10071-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	X	10.46	68.7	22.4	9.83	110.6	±2.5 %
		Y	10.38	68.2	21.9		105.8	
		Z	10.71	69.6	23.1		124.2	
10072-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	X	10.01	68.4	22.2	9.62	106.7	±3.0 %
		Y	10.38	69.2	22.4		144.1	
		Z	10.18	69.1	22.7		119.4	
10073-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	X	10.78	70.9	23.9	9.94	149.7	±3.0 %
		Y	10.27	69.1	22.6		139.1	
		Z	10.17	69.3	23.1		115.9	
10074-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	X	10.82	71.0	24.2	10.30	144.0	±3.3 %
		Y	10.30	69.2	22.9		133.6	
		Z	10.22	69.5	23.4		111.8	
10075-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	X	10.91	71.3	24.8	10.77	138.9	±3.3 %
		Y	10.34	69.2	23.3		129.4	
		Z	10.31	69.7	23.9		108.0	
10076-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	X	10.84	71.1	24.9	10.94	134.9	±3.3 %
		Y	10.25	69.0	23.3		125.9	
		Z	10.28	69.7	24.1		106.3	
10077-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	X	10.61	71.1	24.9	11.00	133.2	±3.5 %
		Y	10.23	69.1	23.4		124.7	
		Z	11.06	72.3	25.6		148.3	
10097-CAB	UMTS-FDD (HSDPA)	X	4.64	66.4	18.3	3.98	129.4	±0.7 %
		Y	4.47	65.1	17.4		126.4	
		Z	4.82	67.2	18.8		144.7	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.66	66.5	18.4	3.98	130.1	±0.7 %
		Y	4.50	65.3	17.5		126.7	
		Z	4.78	67.0	18.7		145.5	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.59	67.6	19.7	5.67	136.1	±1.4 %
		Y	6.37	66.4	18.8		131.7	
		Z	6.14	66.0	18.9		107.5	
10101-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	7.68	67.9	20.1	6.42	146.1	±1.7 %
		Y	7.50	67.0	19.4		140.3	
		Z	7.24	66.6	19.5		115.2	
10102-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	8.00	68.2	20.4	6.60	148.5	±1.7 %
		Y	7.78	67.2	19.6		141.8	
		Z	7.54	66.9	19.7		117.4	

Certificate No: EX3-7364_Jun15

Page 5 of 18

EX3DV4- SN:7364

June 23, 2015

10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	8.41	67.0	19.5	5.80	133.0	±1.2 %
		Y	6.24	66.1	18.8		128.4	
		Z	6.04	65.7	18.9		106.2	
10109-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	7.40	67.6	20.0	6.43	141.0	±1.7 %
		Y	7.23	66.7	19.3		135.5	
		Z	6.98	66.3	19.4		111.0	
10110-CAC	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.05	66.5	19.2	5.75	129.1	±1.4 %
		Y	5.89	65.5	18.5		124.3	
		Z	6.26	67.4	19.8		145.9	
10111-CAC	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	7.12	67.4	20.0	6.44	136.5	±1.4 %
		Y	6.94	66.5	19.2		130.8	
		Z	6.69	66.0	19.3		107.3	
10112-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	7.64	67.8	20.2	6.69	142.4	±1.7 %
		Y	7.46	66.9	19.5		136.7	
		Z	7.21	66.5	19.6		111.3	
10113-CAC	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	7.32	67.5	20.1	6.62	137.7	±1.7 %
		Y	7.15	66.6	19.4		131.4	
		Z	6.92	66.2	19.4		108.9	
10114-CAB	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.23	68.5	21.0	8.10	124.2	±2.5 %
		Y	10.04	67.9	20.5		117.0	
		Z	10.56	69.5	21.7		142.7	
10115-CAB	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	X	10.80	69.1	21.5	8.46	128.6	±2.5 %
		Y	10.61	68.5	21.0		120.9	
		Z	11.08	70.0	22.1		145.6	
10116-CAB	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	X	10.31	68.7	21.1	8.15	125.0	±2.5 %
		Y	10.13	68.1	20.6		118.2	
		Z	10.59	69.6	21.7		142.4	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.27	68.6	21.1	8.07	125.9	±2.5 %
		Y	10.08	68.0	20.5		119.0	
		Z	10.52	69.4	21.6		142.8	
10118-CAB	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	X	10.91	69.2	21.7	8.59	128.3	±2.5 %
		Y	10.70	68.6	21.1		121.2	
		Z	11.21	70.2	22.3		146.3	
10119-CAB	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	X	10.27	68.6	21.1	8.13	125.1	±2.5 %
		Y	10.10	68.0	20.6		118.1	
		Z	10.57	69.6	21.7		142.8	
10140-CAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	7.93	68.3	20.4	6.49	147.7	±1.7 %
		Y	7.73	67.4	19.6		142.8	
		Z	7.42	66.8	19.6		116.6	
10141-CAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	8.04	68.2	20.3	6.53	149.1	±1.7 %
		Y	7.84	67.4	19.6		143.2	
		Z	7.58	66.9	19.7		117.6	
10142-CAC	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	5.83	66.2	19.1	5.73	125.7	±1.2 %
		Y	5.68	65.2	18.4		121.2	
		Z	6.04	67.0	19.6		142.9	

Certificate No: EX3-7364_Jun15

Page 6 of 18

EX3DV4- SN:7364

June 23, 2015

10143-CAC	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	6.82	67.3	19.9	6.35	131.4	±1.4 %
		Y	6.65	66.3	19.1		126.5	
		Z	7.04	68.1	20.4		148.1	
10144-CAC	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	7.15	67.5	20.1	6.65	132.6	±1.4 %
		Y	6.96	66.6	19.4		127.2	
		Z	7.36	68.4	20.7		149.1	
10145-CAC	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	5.54	65.9	19.0	5.76	120.5	±1.2 %
		Y	5.42	65.1	18.3		116.1	
		Z	5.76	66.9	19.6		135.7	
10146-CAC	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	6.48	67.3	19.9	6.41	124.0	±1.4 %
		Y	6.28	66.2	19.1		119.2	
		Z	6.70	68.1	20.4		140.0	
10147-CAC	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	6.74	67.4	20.1	6.72	124.3	±1.7 %
		Y	6.55	66.4	19.4		119.3	
		Z	6.97	68.3	20.7		140.2	
10149-CAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	7.35	67.4	19.9	6.42	138.2	±1.4 %
		Y	7.17	66.5	19.2		133.3	
		Z	6.97	66.3	19.4		109.6	
10150-CAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	7.61	67.7	20.1	6.60	140.5	±1.4 %
		Y	7.45	66.9	19.5		135.0	
		Z	7.22	66.5	19.6		112.4	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.03	66.4	19.2	5.75	127.0	±1.4 %
		Y	5.85	65.3	18.4		122.3	
		Z	6.24	67.3	19.8		145.2	
10155-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	7.06	67.2	19.8	6.43	134.1	±1.4 %
		Y	6.91	66.4	19.2		128.7	
		Z	6.69	66.1	19.3		107.1	
10156-CAC	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	5.76	66.0	19.1	5.79	123.3	±1.2 %
		Y	5.63	65.1	18.3		118.7	
		Z	5.97	67.0	19.7		139.3	
10157-CAC	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	6.80	67.2	19.9	6.49	128.7	±1.4 %
		Y	6.62	66.3	19.2		123.2	
		Z	6.99	68.0	20.4		144.9	
10158-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	7.30	67.4	20.0	6.62	134.5	±1.4 %
		Y	7.12	66.5	19.3		129.0	
		Z	6.91	66.3	19.5		107.5	
10159-CAC	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	6.91	67.4	20.0	6.56	129.3	±1.4 %
		Y	6.69	66.3	19.2		123.1	
		Z	7.12	68.2	20.5		145.9	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.54	67.1	19.6	5.82	132.9	±1.4 %
		Y	6.29	65.9	18.7		126.6	
		Z	6.71	67.9	20.0		149.3	
10161-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	7.41	67.6	20.0	6.43	139.7	±1.7 %
		Y	7.22	66.6	19.3		133.2	
		Z	6.97	66.2	19.3		110.0	

EX3DV4- SN:7364

June 23, 2015

10162-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	7.66	67.9	20.2	6.58	141.5	±1.7 %
		Y	7.48	67.0	19.5		134.6	
		Z	7.18	66.4	19.5		112.1	
10166-CAC	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	4.96	65.8	18.8	5.46	115.4	±0.9 %
		Y	4.76	64.5	17.9		110.2	
		Z	5.13	66.5	19.3		130.4	
10167-CAC	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	5.82	66.9	19.6	6.21	117.4	±1.2 %
		Y	5.60	65.7	18.8		109.9	
		Z	6.07	67.9	20.3		132.7	
10168-CAC	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	6.28	67.1	20.0	6.79	117.2	±1.4 %
		Y	6.06	66.0	19.2		111.0	
		Z	6.49	67.9	20.6		132.0	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.78	65.8	19.1	5.73	109.6	±1.2 %
		Y	4.92	66.1	19.0		145.3	
		Z	4.94	66.5	19.6		123.2	
10170-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	5.36	66.3	19.7	6.52	107.4	±1.4 %
		Y	5.59	67.0	19.8		142.7	
		Z	5.61	67.4	20.4		121.7	
10171-AAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	5.36	66.5	19.7	6.49	107.3	±1.4 %
		Y	5.59	67.1	19.8		144.6	
		Z	5.64	67.6	20.4		121.5	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.71	65.4	18.8	5.72	107.7	±1.2 %
		Y	4.91	66.0	18.9		144.8	
		Z	4.91	66.3	19.4		122.3	
10176-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	5.78	68.1	20.6	6.52	149.6	±1.4 %
		Y	5.57	66.9	19.7		142.9	
		Z	5.65	67.6	20.5		121.7	
10177-CAB	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	5.05	67.1	19.7	5.73	150.0	±1.2 %
		Y	4.91	66.0	18.9		144.6	
		Z	4.93	66.5	19.5		122.4	
10178-CAC	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	5.80	68.2	20.7	6.52	149.3	±1.4 %
		Y	5.59	67.0	19.8		142.5	
		Z	5.63	67.5	20.4		121.7	
10179-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	5.80	68.3	20.7	6.50	149.2	±1.4 %
		Y	5.62	67.2	19.9		144.8	
		Z	5.61	67.5	20.4		121.4	
10180-CAC	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	5.80	68.3	20.7	6.50	148.6	±1.4 %
		Y	5.60	67.1	19.8		144.4	
		Z	5.63	67.5	20.4		121.6	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.04	67.0	19.7	5.72	149.4	±1.2 %
		Y	4.94	66.2	19.1		145.5	
		Z	4.92	66.4	19.5		122.1	
10182-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	5.79	68.2	20.7	6.52	148.9	±1.4 %
		Y	5.57	66.9	19.7		142.2	
		Z	5.63	67.5	20.5		121.0	

Certificate No: EX3-7364_Jun15

Page 8 of 18

EX3DV4- SN:7364

June 23, 2015

10183-AAA	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	5.81	68.4	20.8	6.50	148.4	±1.4 %
		Y	5.62	67.2	19.9		144.3	
		Z	5.62	67.5	20.4		121.1	
10184-CAC	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	5.06	67.1	19.8	5.73	149.2	±1.2 %
		Y	4.91	66.0	18.9		144.9	
		Z	4.94	66.5	19.5		122.0	
10185-CAC	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	5.77	68.1	20.6	6.51	148.4	±1.4 %
		Y	5.57	66.9	19.8		142.5	
		Z	5.62	67.5	20.4		121.5	
10186-AAC	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	5.81	68.4	20.8	6.50	148.0	±1.7 %
		Y	5.63	67.3	19.9		144.7	
		Z	5.60	67.5	20.3		121.0	
10187-CAC	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	5.07	67.1	19.8	5.73	149.3	±1.2 %
		Y	4.94	66.2	19.0		145.6	
		Z	4.91	66.3	19.4		122.3	
10188-CAC	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	5.79	68.2	20.7	6.52	148.1	±1.7 %
		Y	5.57	66.9	19.7		142.5	
		Z	5.61	67.4	20.4		121.2	
10189-AAC	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	5.83	68.5	20.8	6.50	148.1	±1.4 %
		Y	5.60	67.1	19.8		144.5	
		Z	5.64	67.6	20.4		121.5	
10193-CAB	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	9.64	67.7	20.6	8.09	112.5	±2.2 %
		Y	9.63	67.5	20.3		109.6	
		Z	10.04	68.9	21.4		132.4	
10194-CAB	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	X	9.78	68.0	20.9	8.12	116.1	±2.2 %
		Y	9.67	67.5	20.4		110.9	
		Z	10.06	68.9	21.5		131.8	
10195-CAB	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	X	9.93	68.3	21.0	8.21	117.1	±2.5 %
		Y	9.81	67.7	20.5		112.3	
		Z	10.19	69.1	21.5		134.2	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.73	68.0	20.8	8.10	116.3	±2.2 %
		Y	9.62	67.5	20.3		111.7	
		Z	10.01	68.9	21.4		132.6	
10197-CAB	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	X	9.77	68.0	20.8	8.13	116.4	±2.2 %
		Y	9.75	67.7	20.5		111.4	
		Z	10.10	69.0	21.5		132.9	
10198-CAB	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	X	9.96	68.2	21.0	8.27	117.4	±2.5 %
		Y	9.88	67.8	20.6		112.8	
		Z	10.29	69.3	21.7		135.1	
10219-CAB	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.62	67.9	20.8	8.03	116.5	±2.2 %
		Y	9.53	67.4	20.3		111.0	
		Z	9.94	68.9	21.4		132.9	
10220-CAB	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	X	9.81	68.1	20.9	8.13	117.2	±2.2 %
		Y	9.70	67.6	20.4		111.6	
		Z	10.10	69.0	21.5		134.0	

Certificate No: EX3-7364_Jun15

Page 9 of 18

EX3DV4- SN:7364

June 23, 2015

10221-CAB	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	X	9.97	68.2	21.0	8.27	118.3	±2.5 %
		Y	9.89	67.8	20.6		112.7	
		Z	10.29	69.2	21.7		135.4	
10222-CAB	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.14	68.4	20.9	8.06	122.8	±2.5 %
		Y	10.02	67.9	20.5		116.9	
		Z	10.48	69.4	21.6		140.6	
10223-CAB	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	X	10.72	69.0	21.4	8.48	126.2	±2.5 %
		Y	10.54	68.3	20.9		119.3	
		Z	11.04	69.9	22.1		143.9	
10224-CAB	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	X	10.13	68.4	20.9	8.08	123.4	±2.5 %
		Y	10.01	68.0	20.5		115.7	
		Z	10.44	69.3	21.5		140.3	
10225-CAB	UMTS-FDD (HSPA+)	X	7.19	67.5	19.6	5.97	143.8	±1.4 %
		Y	7.05	66.7	19.0		138.4	
		Z	6.78	66.2	19.0		112.5	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	6.03	66.9	18.8	4.87	136.9	±1.2 %
		Y	5.89	66.1	18.1		131.5	
		Z	5.76	66.1	18.5		109.1	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.32	65.7	18.0	3.96	119.3	±0.9 %
		Y	4.16	64.5	17.1		112.7	
		Z	4.57	66.9	18.7		136.2	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.29	66.6	19.2	5.81	126.9	±1.4 %
		Y	6.12	65.6	18.5		120.7	
		Z	6.52	67.5	19.8		142.9	
10298-AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	5.62	66.1	19.1	5.72	120.8	±1.2 %
		Y	5.44	65.0	18.3		115.1	
		Z	5.80	66.9	19.6		136.0	
10299-AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	6.55	67.1	19.8	6.39	125.4	±1.4 %
		Y	6.35	66.1	19.0		119.2	
		Z	6.82	68.2	20.5		140.5	
10300-AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	6.73	67.3	20.0	6.60	125.1	±1.4 %
		Y	6.53	66.3	19.2		118.8	
		Z	6.99	68.2	20.6		140.9	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.94	67.4	19.7	6.06	135.3	±1.4 %
		Y	6.75	66.4	19.0		129.1	
		Z	6.55	66.2	19.2		106.3	
10315-AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	2.71	67.3	17.7	1.71	120.4	±0.5 %
		Y	2.36	64.0	15.7		114.8	
		Z	2.97	68.9	18.7		133.5	
10316-AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	9.89	68.1	21.1	8.36	116.2	±2.5 %
		Y	9.75	67.5	20.5		108.9	
		Z	10.15	69.0	21.6		131.4	
10317-AAB	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	X	9.89	68.1	21.1	8.36	116.7	±2.5 %
		Y	9.76	67.6	20.6		110.0	
		Z	10.16	69.0	21.7		132.3	

Certificate No: EX3-7364_Jun15

Page 10 of 18

EX3DV4- SN:7364

June 23, 2015

10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.58	66.6	17.4	1.54	122.6	±0.5 %
		Y	2.36	64.2	15.8		117.2	
		Z	2.79	68.0	18.2		136.1	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.83	68.1	21.0	8.23	117.6	±2.2 %
		Y	9.72	67.6	20.5		110.8	
		Z	10.12	69.0	21.6		132.8	
10417-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	9.82	68.1	20.9	8.23	117.7	±2.2 %
		Y	9.76	67.7	20.5		111.5	
		Z	10.11	69.0	21.6		133.6	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preamble)	X	9.69	68.0	20.9	8.14	116.8	±2.2 %
		Y	9.59	67.5	20.4		110.3	
		Z	9.95	68.8	21.4		131.4	
10419-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preamble)	X	9.76	68.1	20.9	8.19	117.3	±2.2 %
		Y	9.70	67.6	20.5		111.1	
		Z	10.04	68.9	21.5		132.4	
10422-AAA	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	X	10.03	68.4	21.1	8.32	119.6	±2.5 %
		Y	9.90	67.7	20.6		112.8	
		Z	10.29	69.2	21.7		133.6	
10423-AAA	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	X	10.19	68.5	21.3	8.47	120.0	±2.5 %
		Y	10.08	68.0	20.8		112.9	
		Z	10.43	69.3	21.8		134.2	
10424-AAA	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	X	10.08	68.4	21.2	8.40	119.6	±2.5 %
		Y	9.96	67.8	20.7		112.6	
		Z	10.33	69.2	21.8		133.7	
10425-AAA	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	X	10.62	68.9	21.4	8.41	126.1	±2.7 %
		Y	10.42	68.2	20.8		117.7	
		Z	10.92	69.8	22.0		142.2	
10426-AAA	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	X	10.66	69.0	21.5	8.45	126.5	±2.7 %
		Y	10.43	68.2	20.8		118.2	
		Z	10.95	69.8	22.0		142.5	
10427-AAA	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	X	10.65	69.0	21.4	8.41	126.9	±2.7 %
		Y	10.40	68.2	20.8		118.2	
		Z	10.92	69.8	22.0		142.7	
10434-AAA	W-CDMA (BS Test Model 1, 64 DPCH)	X	9.04	67.7	21.1	8.60	103.3	±2.7 %
		Y	9.68	69.3	21.7		143.5	
		Z	9.37	68.8	21.8		116.7	

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 Norm(X,Y,Z) do not affect the E^2 -field uncertainty inside TSL (see Pages 12 and 13).

^b Numerical linearization parameter: uncertainty not required.

^c Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

EX3DV4- SN:7364

June 23, 2015

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7364

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^e	Conductivity (S/m) ^e	ConvF X	ConvF Y	ConvF Z	Alpha ^d	Depth ^d (mm)	Unct. (k=2)
150	52.3	0.76	12.95	12.95	12.95	0.00	1.00	± 13.3 %
300	45.3	0.87	11.95	11.95	11.95	0.10	1.10	± 13.3 %
450	43.5	0.87	10.72	10.72	10.72	0.15	1.10	± 13.3 %
750	41.9	0.89	10.01	10.01	10.01	0.29	1.08	± 12.0 %
900	41.5	0.97	9.26	9.26	9.26	0.24	1.23	± 12.0 %
1810	40.0	1.40	7.93	7.93	7.93	0.33	0.80	± 12.0 %
1900	40.0	1.40	7.93	7.93	7.93	0.35	0.80	± 12.0 %
2450	39.2	1.80	7.18	7.18	7.18	0.27	0.98	± 12.0 %
2600	39.0	1.96	6.93	6.93	6.93	0.34	0.93	± 12.0 %
5200	36.0	4.66	5.22	5.22	5.22	0.35	1.80	± 13.1 %
5300	35.9	4.76	5.00	5.00	5.00	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.75	4.75	4.75	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.64	4.64	4.64	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.52	4.52	4.52	0.40	1.80	± 13.1 %

^c Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^e 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.

^d Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4--SN:7364

June 23, 2015

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7364

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^d	Conductivity (S/m) ^e	ConvF X	ConvF Y	ConvF Z	Alpha ^g	Depth ^h (mm)	Unct. (k=2)
150	61.8	0.80	12.28	12.28	12.28	0.00	1.00	± 13.3 %
300	58.2	0.92	11.24	11.24	11.24	0.08	1.10	± 13.3 %
450	56.7	0.94	11.02	11.02	11.02	0.09	1.10	± 13.3 %
750	55.5	0.96	9.42	9.42	9.42	0.27	1.06	± 12.0 %
900	55.0	1.05	9.20	9.20	9.20	0.27	1.22	± 12.0 %
1810	53.3	1.52	7.75	7.75	7.75	0.43	0.85	± 12.0 %
1900	53.3	1.52	7.57	7.57	7.57	0.47	0.80	± 12.0 %
2450	52.7	1.95	7.33	7.33	7.33	0.35	0.90	± 12.0 %
2600	52.5	2.16	7.17	7.17	7.17	0.31	0.95	± 12.0 %
5200	49.0	5.30	4.52	4.52	4.52	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.29	4.29	4.29	0.45	1.90	± 13.1 %
5500	48.6	5.65	3.92	3.92	3.92	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.74	3.74	3.74	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.06	4.06	4.06	0.50	1.90	± 13.1 %

^c Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

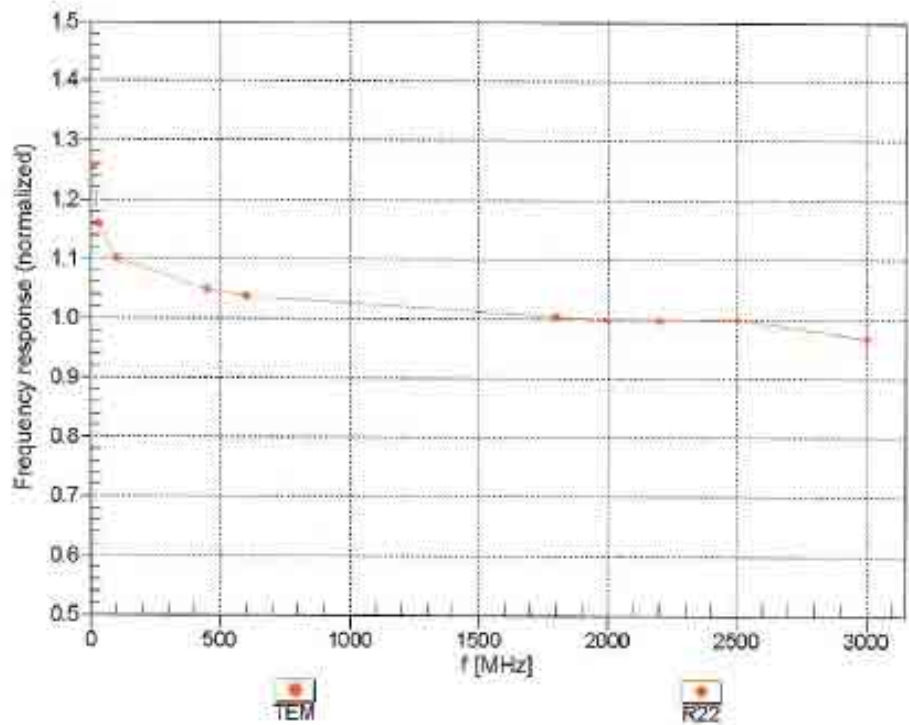
^d At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^g Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4-SN:7364

June 23, 2015

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

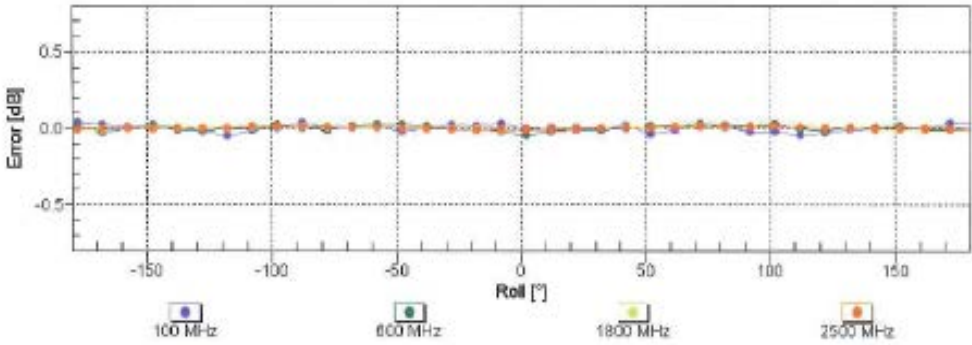
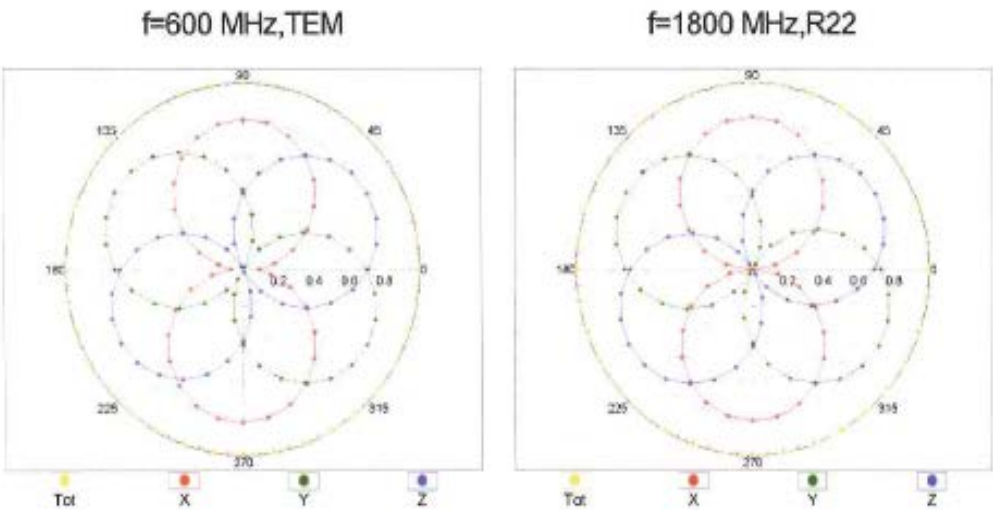


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

EX3DV4-SN:7364

June 23, 2015

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

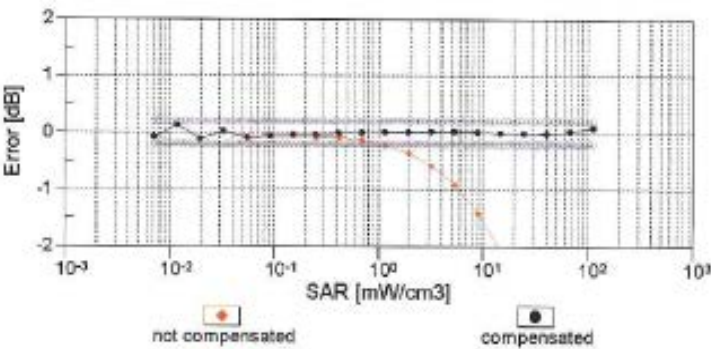
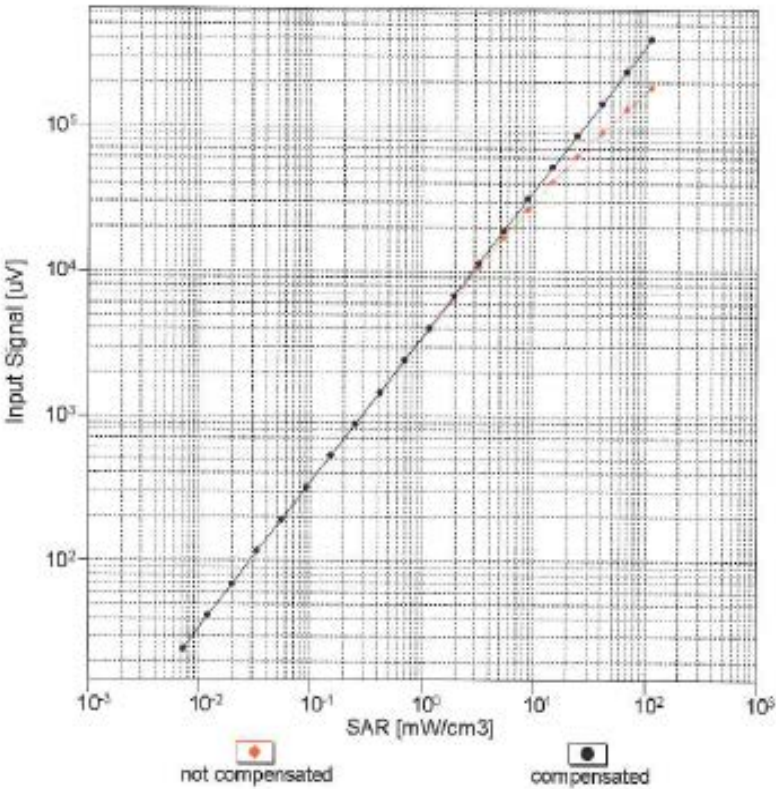


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

EX3DV4-- SN:7364

June 23, 2015

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)

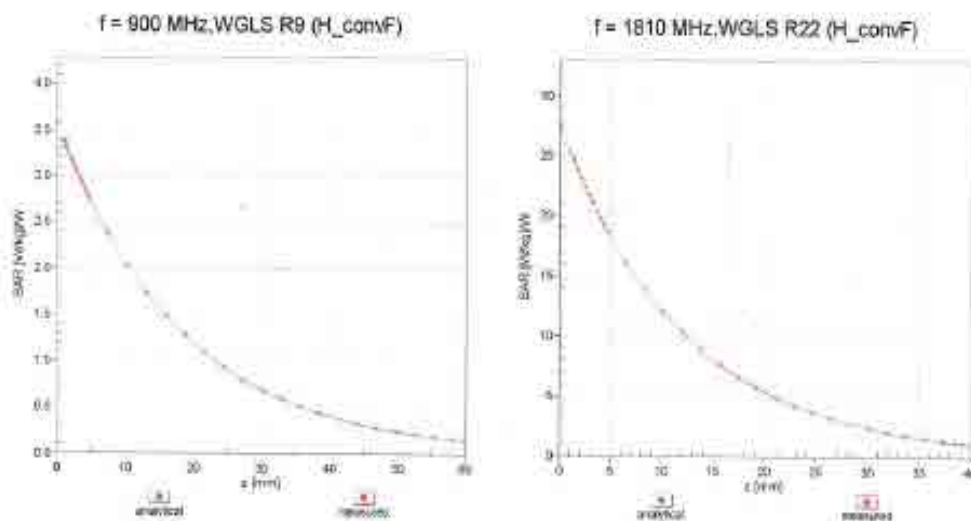


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

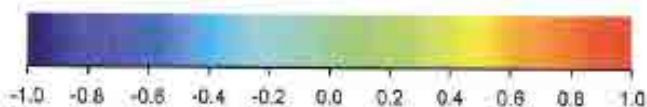
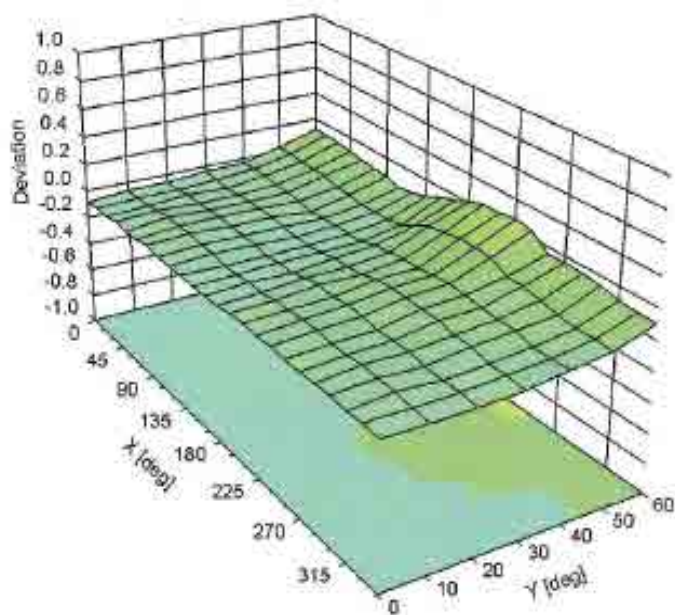
EX3DV4- SN:7364

June 23, 2015

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHzUncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ (k=2)

EX3DV4- SN:7364

June 23, 2015

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7364**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	132.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Appendix C

Dipole Calibration Certificates

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



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

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

Accreditation No.: **SCS 0108**

Client **Motorola Solutions MY**

Certificate No: **D450V3-1053_Mar15**

CALIBRATION CERTIFICATE

Object **D450V3 - SN:1053**

Calibration procedure(s) **QA CAL-15.v8**
Calibration procedure for dipole validation kits below 700 MHz

Calibration date: **March 17, 2015**

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 ($22 \pm 3^\circ\text{C}$ and humidity $< 70\%$).

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498067	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ET3DV6	SN: 1507	30-Dec-14 (No. ET3-1507_Dec14)	Dec-15
DAE4	SN: 654	30-Jun-14 (No. DAE4-654_Jun14)	Jun-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	04-Aug-99 (in house check Apr-13)	in house check: Apr-16
Network Analyzer HP 8753E	US37390505 S4206	18-Oct-01 (in house check Oct-14)	in house check: Oct-16

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

Issued: March 17, 2015

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

Certificate No: **D450V3-1053_Mar15**

Page 1 of 8

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



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

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	V52.8.8
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 ± 0.2) °C	$43.9 \pm 6 \%$	$0.88 \text{ mho/m} \pm 6 \%$
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	250 W input power	1.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.45 W/kg $\pm$ 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 W input power	0.747 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	2.97 W/kg $\pm$ 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 ± 0.2) °C	$56.7 \pm 6 \%$	$0.97 \text{ mho/m} \pm 6 \%$
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	250 W input power	1.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	4.41 W/kg $\pm$ 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 W input power	0.746 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	2.92 W/kg $\pm$ 17.6 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	57.2 Ω - 2.2 j Ω
Return Loss	- 23.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	55.2 Ω - 5.3 j Ω
Return Loss	- 23.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1,350 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 16, 2005

DASY5 Validation Report for Head TSL

Date: 17.03.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1053

Communication System: UID 0 - CW; Frequency: 450 MHz

Medium parameters used: $f = 450$ MHz; $\sigma = 0.88$ S/m; $\epsilon_r = 43.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.58, 6.58, 6.58); Calibrated: 30.12.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 30.06.2014
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

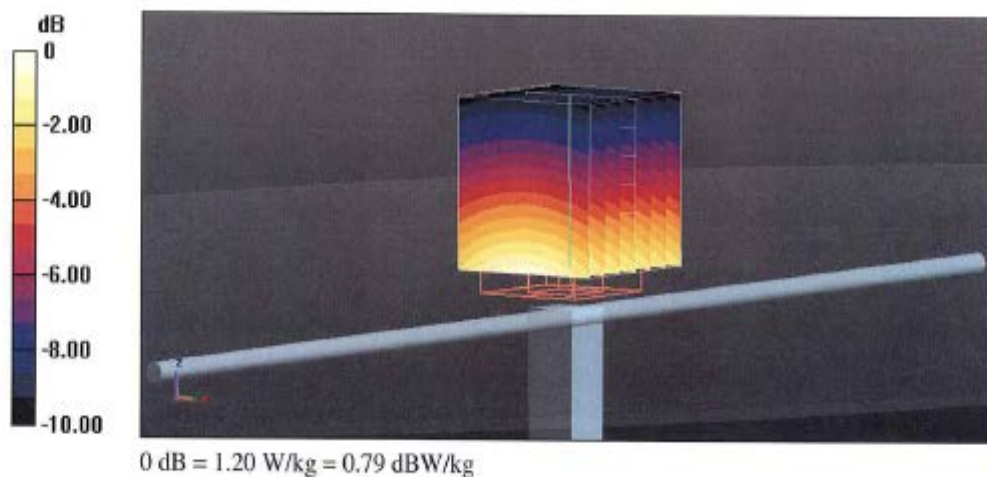
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 38.88 V/m; Power Drift = 0.03 dB

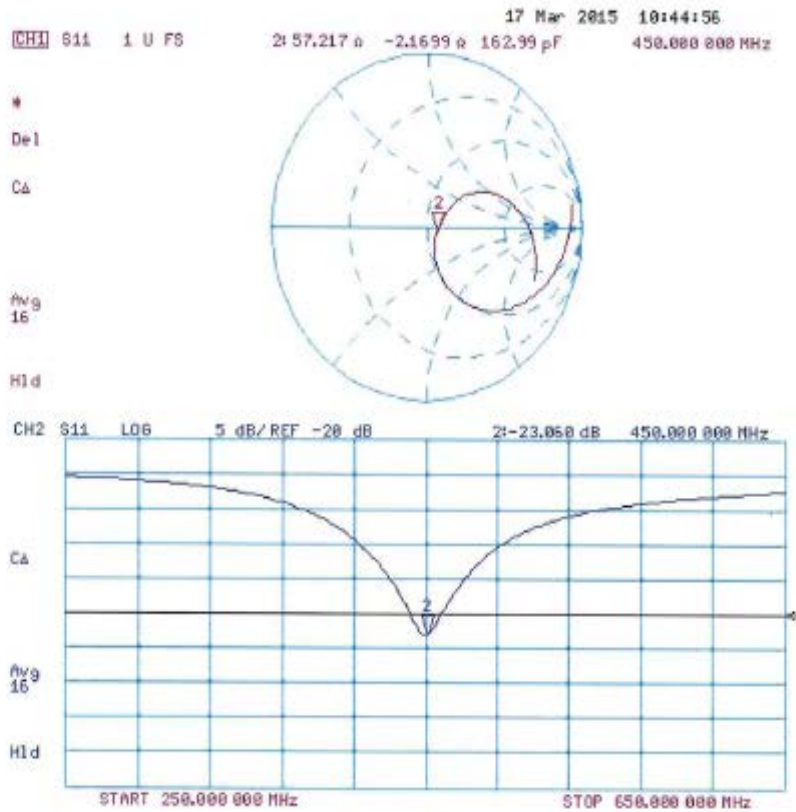
Peak SAR (extrapolated) = 1.61 W/kg

SAR(1 g) = 1.12 W/kg; SAR(10 g) = 0.747 W/kg

Maximum value of SAR (measured) = 1.20 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.03.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1053

Communication System: UID 0 - CW; Frequency: 450 MHz

Medium parameters used: $f = 450 \text{ MHz}$; $\sigma = 0.97 \text{ S/m}$; $\epsilon_r = 56.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(7.05, 7.05, 7.05); Calibrated: 30.12.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 30.06.2014
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

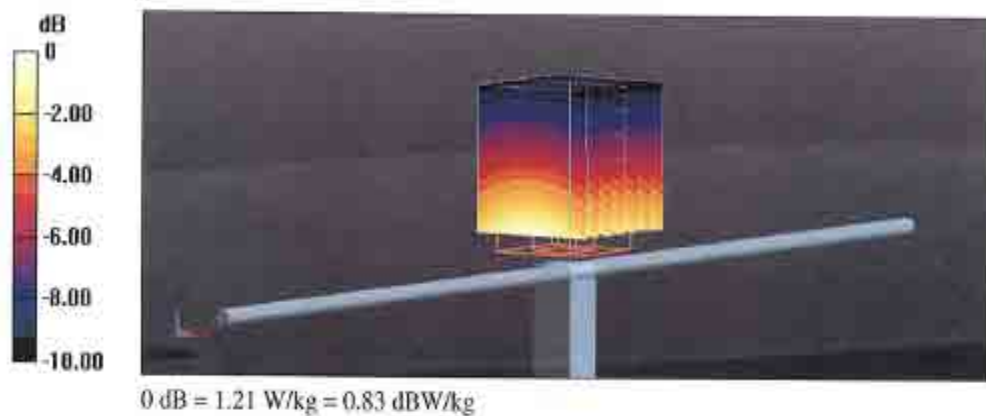
Dipole Calibration for Body Tissue/ $d=15\text{mm}$, $P_{in}=250\text{mW}$ /Zoom Scan (7x7x7)/Cube 0:Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 36.35 V/m; Power Drift = -0.01 dB

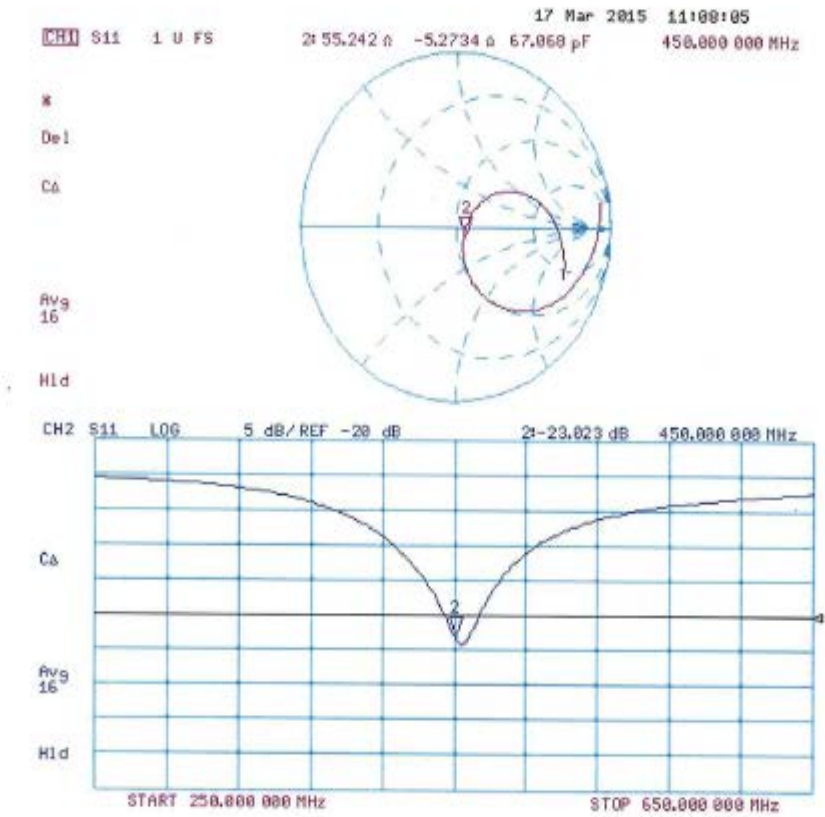
Peak SAR (extrapolated) = 1.81 W/kg

SAR(1 g) = 1.13 W/kg; SAR(10 g) = 0.746 W/kg

Maximum value of SAR (measured) = 1.21 W/kg



Impedance Measurement Plot for Body TSL



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



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

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

Client **Motorola Solutions MY**

Certificate No: **D2450V2-781_Mar15**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN:781**

Calibration procedure(s) **QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **March 20, 2015**

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SM1-05	100005	04-Aug-09 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

Calibrated by:	Name Israël Elneoug	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 20, 2015

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

Certificate No: D2450V2-781_Mar15

Page 1 of 8

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



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

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.8 $\pm$ 6 %	1.83 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	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.3 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.4 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied:

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.8 $\pm$ 6 %	2.02 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	250 mW input power	13.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.9 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.2 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	$53.9 \Omega + 1.2 j\Omega$
Return Loss	-29.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$49.9 \Omega + 3.2 j\Omega$
Return Loss	-30.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.155 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	May 06, 2005

DASY5 Validation Report for Head TSL

Date: 20.03.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:781

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.83$ S/m; $\epsilon_r = 37.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

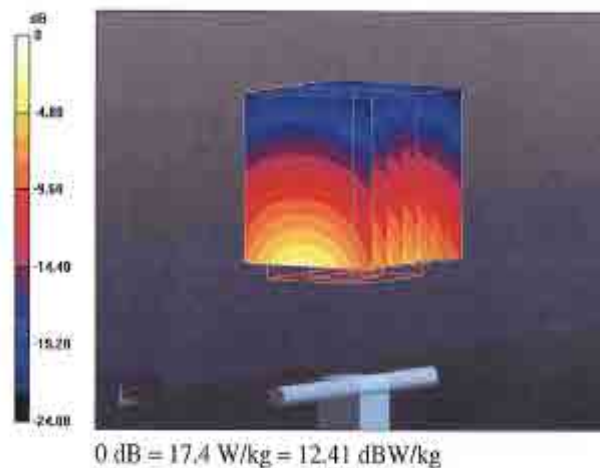
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.2 V/m; Power Drift = 0.01 dB

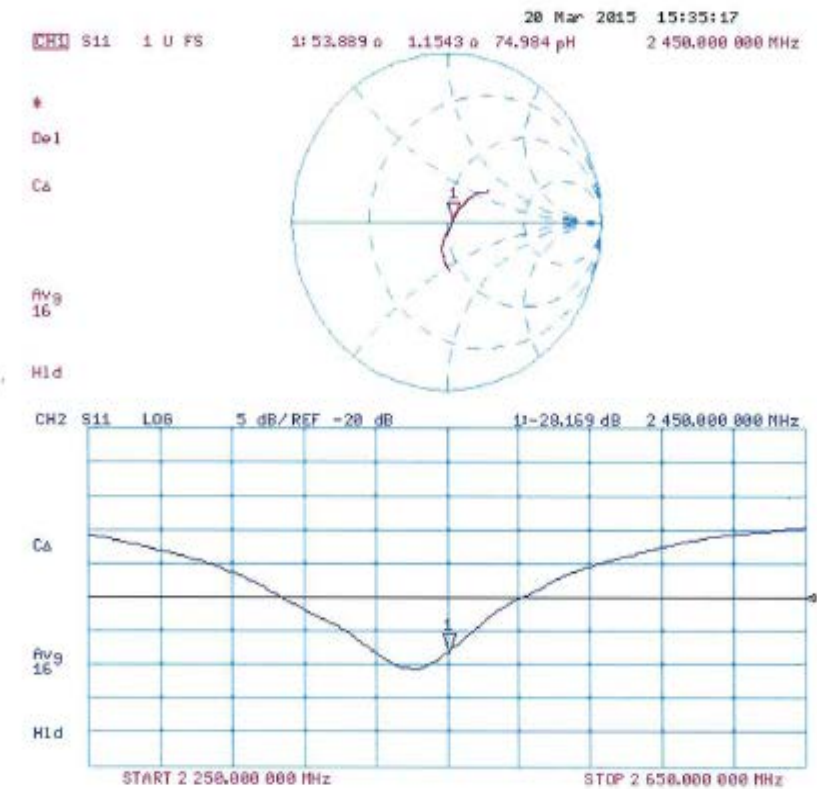
Peak SAR (extrapolated) = 27.9 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.16 W/kg

Maximum value of SAR (measured) = 17.4 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.03.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:781

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ S/m; $\epsilon_r = 50.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

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

Reference Value = 95.66 V/m; Power Drift = 0.03 dB

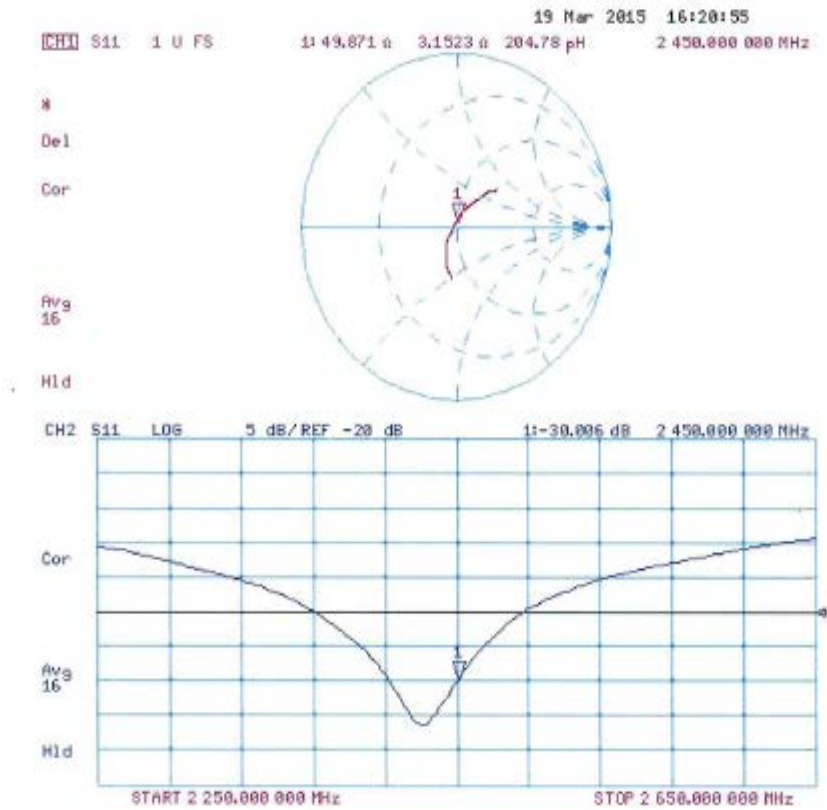
Peak SAR (extrapolated) = 28.0 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.15 W/kg

Maximum value of SAR (measured) = 17.4 W/kg



Impedance Measurement Plot for Body TSL



Dipole Data

As stated in KDB 865664, only dipoles used for longer calibration intervals required to provide supporting information and measurement to qualify for extended calibration interval.

Dipole D450V3 (serial number 1053) and D2450V2 (serial number 781) not exceed annual calibration date, hence no further justification required.