TESTING CERT # 2518.05

DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2

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Date of Report: 06/22/2017
Report Revision: B

Responsible Engineer:	Veeramani Veerapan
Report Author:	Veeramani Veerapan
Date/s Tested:	5/19/2017 – 6/5/2017; 6/19/2017-6/20/2017
Manufacturer:	Motorola Solutions Inc.
DUT Description:	Handheld Portable – 136-174MHz, 3W, Limited Keypad, BT/ WiFi
Test TX mode(s):	CW (PTT) , Bluetooth, WLAN 802.11 b/g/n
Max. Power output:	2.4 W (LMR CW 136-174MHz band), 3.3 W (LMR TDMA 136-174MHz band), 9.2 mW (Bluetooth), 9.2 mW (Bluetooth LE), 25.1 mW (WLAN 802.11 b), 9.2 mW (WLAN 802.11g), 9.2 mW (WLAN 802.11n)
Nominal Power:	2.0 W (LMR CW 136-174MHz band), 3.0 W (LMR TDMA 136-174MHz band), 6.3 mW (Bluetooth), 6.3 mW (Bluetooth LE), 17.8 mW (WLAN 802.11 b), 6.3 mW (WLAN 802.11g), 6.3 mW (WLAN 802.11n)
Tx Frequency Bands:	LMR 136-174MHz; Bluetooth 2.402-2.480 GHz; WLAN 802.11 b/g/n 2.412-2.462 GHz
Signaling type:	FM (LMR), FHSS (Bluetooth), 802.11 b/g/n (WLAN)
Model(s) Tested:	PMUD3422A (AAH88JCD9SA2AN)
Model(s) Certified:	PMUD3422A (AAH88JCD9SA2AN)
Serial Number(s):	130TTK0285, 130TTK0272
Classification:	Occupational/Controlled
FCC ID:	AZ489FT7107; LMR 150.8-173.4 MHz, Bluetooth 2.402-2.480 GHz, WLAN 802.11 b/g/n 2.412-2.462 GHz This report contains results that are immaterial for FCC equipment approval, which are clearly identified.
IC:	109U-89FT7107; This report contains results that are immaterial for IC equipment approval, which are clearly identified.
ISED Test Site Registration:	109AK

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.

Tiong Nguk Ing

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Approval Date: 6/22/2017

Part 1 of 2

APPENDICES

Part 2 of 2

APPENDICES

Report Revision History

Date	Revision	Comments
06/20/2017	A	Initial release
06/22/2017	B	Include sales model number

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 PMUD3422A.This device is 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	150.8 -173.4MHz (LMR)	0.83	0.60	0.71	0.50
*DSS	2402-2480 MHz (Bluetooth)	NA	NA	NA	NA
DTS	2412-2462 MHz (WLAN 802.11 b/g/n)	0.058	0.033	0.013	0.007
Simultaneous Results		0.89	0.63	0.72	0.51

*Results not required per KDB 447498 (refer to sections 13.6 and 14.0)

3.0 Abbreviations / Definitions

BT: Bluetooth
CNR: Calibration Not Required
CW: Continuous Wave
DSSS: Direct Sequence Spread Spectrum
DTS: Digital Transmission System
DUT: Device Under Test
EME: Electromagnetic Energy
FHSS: Frequency Hopping Spread Spectrum
4FSK: 4 Level Frequency Shift Keying
Li-ion: Lithium-Ion
LMR: Land Mobile Radio
NA: Not Applicable
OFDM: Orthogonal Frequency Division Multiplexing
TDMA: Time Division Multiple Access
DSP: Digital Signal Processor
PTT: Push to Talk
RF: Radio Frequency
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 (2013), 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 Radio communication 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 v01r03
- FCC KDB – 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB – 865664 D02 RF Exposure Reporting v01r02
- FCC KDB – 447498 D01 General RF Exposure Guidance v06
- FCC KDB – 248227 D01 802.11 Wi-Fi SAR v02r02

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 Devices Under Test (DUT)

This portable device operates in the LMR band using frequency modulation (FM) and TDMA signaling incorporating traditional simplex two-way radio transmission protocol. This device also contain WLAN technology for data capabilities over 802.11 b/g/n wireless networks and Bluetooth technology for short range wireless devices.

The LMR band in this device operate in a half duplex system. A half duplex system only allows the user to transmit or receive. This device 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.

This device also incorporate Class 1 Bluetooth Low energy (LE) device which is a Frequency Hopping Spread Spectrum (FHSS) technology and LE intended to reduce power consumption. The Bluetooth radio modem is used to wireless link audio accessories.
The maximum actual transmission duty cycle is imposing by Bluetooth standard. Packet types varying duty cycles: 1-slot, 3-slots and 5-slots packets. A 5-slot packet type receives on 1-slot and transmits 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. With WiFi access, the radio can receive new code plug, firmware and software feature while allow users keep talking without interruption.

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

Technologies	Band (MHz)	Transmission	Duty Cycle (%)	Max Power (W)
LMR	150.8-173.4	FM	*50	2.4
LMR	150.8-173.4	TDMA	*25	3.3
BT	2402-2480	FHSS	77	0.0092
BT LE	2402-2480	FHSS	77	0.0092
WLAN	2412-2462	802.11b	100	0.0251
WLAN	2412-2462	802.11g	100	0.0092
WLAN	2412-2462	802.11n	100	0.0092

Note - * includes 50% PTT operation

The intended operating positions are "at the face" with the DUT at least 2.5 cm 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

This device is offered with optional accessories. All accessories were individually evaluated during the test plan creation to determine if testing was required per the guidelines outlined in "SAR Test Reduction Considerations for Occupational PTT Radios" FCC KDB 643646 to assess compliance of the device. 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/WLAN antenna offered for this product. The Table below lists their descriptions.

Table 4

Antenna Models	Description	Selected for test	Tested
PMAD4144B	Stubby antenna, 136-144 MHz, ¼ wave, -12.15 dBd gain	Yes	Yes*
PMAD4145B	Stubby antenna, 144-156 MHz, ¼ wave, -11.15 dBd gain	Yes	Yes
PMAD4146B	Stubby antenna, 156-174 MHz, ¼ wave, -9.15 dBd gain	Yes	Yes
PMAD4154A	Whip antenna, 136-144 MHz, ¼ wave, -9.94 dBd gain	Yes	Yes*

Note: * Antennas not cover FCC Frequency range.

Table 5 Continued

Antenna Models	Description	Selected for test	Tested
PMAD4155A	Whip antenna, 144-156 MHz, ¼ wave, 7.75 dBd gain	Yes	Yes
PMAD4156A	Whip antenna, 156-174 MHz, ¼ wave, -6.65 dBd gain	Yes	Yes
PMLN7569A	BT/WIFI Module Patch Ant, 2.402-2.480GHz, ¼ wave, -1.91 dBd	Yes	Yes; for WLAN only

7.2 Battery

There is only one battery offered for this product. The Table below lists its description.

Table 6

Battery Model	Description	Selected for test	Tested	Comments
PMNN4468A	Battery, Li-Ion capacity, 2300mAh	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 7

Body worn Models	Description	Selected for test	Tested	Comments
PMLN6074A	Wrist Strap	No	No	Test not required
PMLN7076A	Flexible Hand Strap	No	No	Test not required
PMLN7128A	Belt Clip	Yes	Yes	
PMLN7190A	Swivel Carry Holster	Yes	Yes	

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 accessory.

Table 8

Audio Acc. Models	Description	Selected for test	Tested	Comments
PMLN7156A	MagOne Earbud with in-line Mic & PTT	Yes	Yes	
PMLN7157A	2-Wire surveillance kit with Translucent, Black	Yes	No	Intended for test. Per KDB provisions test not required.
PMLN7158A	1-Wire surveillance kit with in-line Mic & PTT, Black	Yes	No	Intended for test. Per KDB provisions test not required.
PMLN7159A	Adjustable - Style earpiece with in-line Mic & PTT, Black	Yes	No	Intended for test. Per KDB provisions test not required.
PMLN7181A	Flexiable- Fit swivel earpiece with Boom Mic	Yes	No	Intended for test. Per KDB provisions test not required.
PMLN7189A	Swivel earpiece in-line Mic & PTT	Yes	No	Intended for test. Per KDB provisions test not required.
PMLN7203A	Flexiable- Fit swivel earpiece with Boom Mic, Multipack	No	No	By similarity to PMLN7181A

8.0 Description of Test System

8.1 Descriptions of Robotics/Probes/Readout Electronics

Table 9

Dosimetric System type	System version	DAE type	Probe Type
Schmid & Partner Engineering AG SPEAG DASY 5	52.8.8.1222	DAE4	ES3DV4 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 10

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

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 11

Ingredients	150 MHz		2450 MHz	
	Head	Body	Head	Body
Sugar	55.4	49.7	0	0
Diacetin	0	0	51.00	34.50
De ionized –Water	38.35	46.2	48.75	65.20
Salt	5.15	3.0	0.15	0.20
HEC	1.0	1.0	0	0
Bact.	0.1	0.1	0.10	0.10

9.0 Additional Test Equipment

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

Table 12

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Speag Probe	EX3DV4	3735	3/10/2017	3/10/2018
Speag DAE	DAE4	729	10/12/2016	10/12/2017
Speag Probe	ES3DV3	3196	5/17/2017	5/17/2018
Speag DAE	DAE4	684	5/17/2017	5/17/2018
*Signal Generator	E4438C	MY44270302	6/18/2015	6/18/2017
Signal Generator	E4438C	MY42081753	4/8/2017	4/8/2018
Power Sensor	E9301B	MY55210003	7/27/2016	7/27/2017
*Power Sensor	N8481B	MY51450002	6/7/2016	6/7/2017
Power Meter	E4419B	MY50000505	9/2/2015	9/2/2017
Power Meter	E4418B	MY45100532	11/4/2015	11/4/2017
Power Sensor	E93018	MY55210003	7/27/2017	7/27/2018
Power Sensor	E4412A	US37183007	5/19/2017	5/19/2018
Power Meter	E4419B	MY45103725	5/22/2017	5/22/2019
Power Meter	E418B	MY45101917	5/22/2017	5/22/2019
Broadband Power Sensor	NRP-Z11	121252	2/6/2017	2/6/2019
Power Amplifier	10WD1000	28782	CNR	CNR
Bi-directional Coupler	3020A	41931	7/15/2016	7/15/2017
Bi-directional Coupler	3020A	41935	9/2/2016	9/2/2017
Dickson Temperature Recorder	TM320	06153216	8/2/2016	8/2/2017
Dickson Temperature Recorder	TM320	12253047	10/20/2016	10/20/2017
Temperature Probe	JHSS-18U-RSC-6	AGIL700129	12/2/2016	12/2/2017
Thermometer	HH202A	35881	12/2/2016	12/2/2017
Network Analyzer	E5071B	MY42403218	8/15/2016	8/15/2017
Dielectric Assessment Kit	DAK-12	1069	10/11/2016	10/11/2017
Dielectric Assessment Kit	DAK-3.5	1156	10/11/2016	10/11/2017
Speag Dipole	CLA-150	4005	7/8/2015	7/8/2017
Speag Dipole	D2450V2	782	2/15/2017	2/15/2019

Note: * Equipments used for test date prior to calibration due date.

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 13

Dates	Probe Calibration Point		Probe SN	Measured Tissue Parameters		Validation		
				σ	ϵ_r	Sensitivity	Linearity	Isotropy
CW								
05/31/2017	Body	150	3196	0.83	59.3	Pass	Pass	Pass
05/30/2017	Head	150		0.74	51.7	Pass	Pass	Pass
04/06/2017	Body	150	3735	0.82	60.0	Pass	Pass	Pass
04/05/2017	Head	150		0.73	50.3	Pass	Pass	Pass
04/23/2017	Body	2450	3735	2.03	53.1	Pass	Pass	Pass
03/22/2017	Head	2450		1.86	36.2	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 14

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
3735	FCC Body	SPEAG CLA-150 / 4005	3.88 +/- 10%	4.03	4.03	5/20/2017
				4.09	4.09	5/21/2017
				4.16	4.16	5/25/2017
	IEEE/IEC Head		3.83 +/- 10%	4.06	4.06	5/21/2017
				4.11	4.11	5/22/2017
3196	FCC Body		3.88 +/- 10%	4.04	4.04	6/19/2017
	IEEE/IEC Head		3.83 +/- 10%	3.96	3.96	6/19/2017
3735	FCC Body	SPEAG D2450V2 / 782	50.50 +/- 10%	11.50	46.00	6/05/2017
	IEEE/IEC Head		53.30 +/- 10%	12.80	51.20	6/05/2017

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 15

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
136	FCC Body	0.79 (0.75-0.83)	62.3 (59.1-65.4)	0.78	59.7	5/20/2017
	IEEE/ IEC Head	0.75 (0.71-0.79)	53.0 (50.3-55.6)	0.72	51.7	5/22/2017
140	FCC Body	0.79 (0.75-0.83)	62.1 (59.0-65.2)	0.78	59.6	5/20/2017
	IEEE/ IEC Head	0.75 (0.72-0.79)	52.7 (50.1-55.4)	0.72	51.6	5/22/2017
144	FCC Body	0.80 (0.76-0.84)	62.1 (58.9-65.2)	0.78	59.5	5/20/2017
	IEEE/ IEC Head	0.76 (0.72-0.79)	52.6 (49.9-55.2)	0.73	51.4	5/22/2017
147	FCC Body	0.80 (0.76-0.84)	62.0 (58.9-65.1)	0.79	59.4	5/20/2017
	IEEE/ IEC Head	0.76 (0.72-0.80)	52.4 (49.8-55.1)	0.73	51.3	5/22/2017
150	FCC Body	0.80 (0.76-0.84)	61.9 (58.8-65.0)	0.79	59.3	5/20/2017
				0.77	59.7	5/21/2017
				0.84	58.9	5/25/2017
				0.78	59.0	6/19/2017
	IEEE/ IEC Head	0.76 (0.72-0.80)	52.3 (49.7-54.9)	0.73	51.6	5/21/2017
				0.73	51.2	5/22/2017
				0.73	51.3	6/19/2017
151	FCC Body	0.80 (0.76-0.84)	61.9 (58.8-65.0)	0.79	59.3	5/20/2017
				0.78	59.0	6/19/2017
	IEEE/ IEC Head	0.76 (0.72-0.80)	52.3 (49.7-54.9)	0.73	51.5	5/21/2017
				0.73	51.3	6/19/2017
156	FCC Body	0.80 (0.76-0.85)	61.8 (58.7-64.8)	0.84	58.7	5/25/2017
162	FCC Body	0.81 (0.77-0.85)	61.6 (58.5-64.7)	0.84	58.6	5/25/2017
173	FCC Body	0.82 (0.78-0.86)	61.3 (58.3-64.4)	0.80	58.8	5/20/2017
				0.78	58.9	5/21/2017
	IEEE/ IEC Head	0.78 (0.74-0.82)	51.2 (48.7-53.8)	0.75	50.5	5/21/2017
2412	FCC Body	1.91 (1.82-2.01)	52.8 (47.5-58.0)	1.99	50.1	6/05/2017
	IEEE/ IEC Head	1.77 (1.68-1.86)	39.3 (35.3-43.2)	1.76	36.7	6/05/2017
2450	FCC Body	1.95 (1.85-2.05)	52.7 (47.4-58.0)	2.03	50.1	6/05/2017
	IEEE/ IEC Head	1.80 (1.71-1.89)	39.2 (35.3-43.1)	1.79	36.7	6/05/2017

11.0 Environmental Test Conditions

The EME Laboratory's ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. Simulated tissue temperature is measured prior to each scan to insure it is within +/ - 2^{o}C of the temperature at which the dielectric properties were determined. The liquid depth within the phantom used for measurements was at least 15cm. Additional precautions are routinely taken to ensure the stability of the simulated tissue such as covering the phantoms when scans are not

actively in process in order to minimize evaporation. The lab environment is continuously monitored. The Table below presents the range and average environmental conditions during the SAR tests reported herein:

Table 16

	Target	Measured
Ambient Temperature	18 – 25 ˚C	Range: 19.8 – 23.2˚C Avg. 21.7 ˚C
Tissue Temperature	NA	Range: 19.5 – 21.9˚C Avg. 20.7˚C

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 and Triple 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 17

<table>
<tr><th colspan="2">Description</th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="2">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="2">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="2" rowspan="2">Maximum area scan spatial resolution: ΔxArea, ΔyArea</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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 ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="2">Maximum zoom scan spatial resolution: ΔxZoom, ΔyZoom</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td>Maximum zoom scan spatial resolution, normal to phantom surface</td><td>uniform grid: ΔzZoom(n)</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td colspan="4">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.</td></tr>
</table>

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 side separated 2.5cm from the phantom.

12.4 DUT Test Channels

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

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

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

12.5 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:

$$Max\_Calc = SAR\_meas \cdot 10^{\frac{-Drift}{10}} \cdot \frac{P\_\max}{P\_\text{int}} \cdot DC$$

P_max = Maximum Power (W)
P_int = Initial Power (W)
Drift = DASY drift results (dB)
SAR_meas = Measured 1-g or 10-g Avg. SAR (W/kg)
DC = Transmission mode duty cycle in % where applicable
50% duty cycle is applied for PTT operation

Note: for conservative results, the following are applied:
If P_int > P_max, then P_max/P_int = 1.
Drift = 1 for positive drift

Additional SAR scaling was applied using the methodologies outlined in FCC 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. All tests were performed in CW and 50% duty cycle was applied to PTT configurations in the final results.

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

WLAN tests were performed in 802.11b mode using a duty cycle of 99.87% with results scaled to 100% as per guidelines of KDB 248227.

13.0 DUT Test Data

13.1 LMR assessments at the Body for 150.8 – 173.4 MHz band

The battery PMNN4468A was used for assessments at the Body because it is the only offered battery (refer to Exhibit 7B for battery illustration). The conducted power measurements for all test channels within FCC allocated frequency range (150.8-173.4 MHz) which is listed in Table 18. The channel with the highest conducted power will be identified as the default channel per KDB 643646 (SAR Test for PTT Radios).

Table 18

Test Freq (MHz)	Power (W)
150.8000	2.30
156.0000	2.30
162.0000	2.29
167.6000	2.28
173.4000	2.32

Assessments at the Body with Body worn PMLN7128A

DUT assessment with offered antennas, battery and, default body worn accessory per KDB 643646. Refer to Table 18 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#
PMAD4145B	PMNN4468A	PMLN7128A	PMLN7156A	150.80	2.40	0.04	0.476	0.300	**0.24**	**0.15**	FD(AM)-AB-170619-08
				156.00							
PMAD4146B	PMNN4468A	PMLN7128A	PMLN7156A	156.00							
				162.00							
				167.60							
				173.40	2.31	-0.09	0.249	0.174	0.13	0.09	FD-AB-170520-02
PMAD4155A	PMNN4468A	PMLN7128A	PMLN7156A	150.80	2.36	0.37	0.154	0.111	0.08	0.06	FD-AB-170520-03
				156.00							
PMAD4156A	PMNN4468A	PMLN7128A	PMLN7156A	156.00							
				162.00							
				167.60							
				173.40	2.33	-0.30	0.349	0.224	0.19	0.12	FD-AB-170520-04

Assessments at the Body with Body worn PMLN7190A

DUT assessment with offered antennas, battery and, default body worn accessory per 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#
PMAD4145B	PMNN4468A	PMLN7190A	PMLN7156A	150.80	2.31	0.25	0.197	0.132	0.10	0.07	FD-AB-170520-05
				156.00							
PMAD4146B	PMNN4468A	PMLN7190A	PMLN7156A	156.00							
				162.00							
				167.60							
				173.40	2.33	-0.51	0.407	0.282	0.24	0.16	FD-AB-170520-06
PMAD4155A	PMNN4468A	PMLN7190A	PMLN7156A	150.80	2.30	0.47	0.081	0.059	0.04	0.03	FD-AB-170520-07
				156.00							
PMAD4156A	PMNN4468A	PMLN7190A	PMLN7156A	156.00							
				162.00							
				167.60							
				173.40	2.30	-0.21	0.933	0.664	**0.51**	**0.36**	FD-AB-170520-08

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

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 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#
PMAD4156A	PMNN4468A	PMLN7190A	None	156.00							
				162.00							
				167.60							
				173.40	2.29	0.30	1.580	1.150	**0.83**	**0.60**	FD-AB-170520-09

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 PMNN4468A (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 22. 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 ≤ 1.2W/kg.

Table 22

Mode	Channel #	Channel Frequency	Modulation	Battery: PMNN4468A	Antenna Max Power [mW]
				Antenna port[mW]	
802.11b (1Mbps)	1	2412	DSSS	22.0	25.1
	6	2437		20.7	
	11	2462		20.5	
802.11g (6Mbps)	1	2412	OFDM	8.6	9.2
	6	2437		7.5	
	11	2462		7.8	
802.11n (MCS0)	1	2412	OFDM	8.7	9.2
	6	2437		8.0	
	11	2462		7.5	

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, offered battery without any cable accessory attachment against phantom with all offered body worn. Refer to Table 22 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#
PMLN7569A WiFi Ant	PMNN4468A	PMLN7128A	None	2412.000	0.0220	0.19	0.031	0.018	0.035	0.021	FD-AB-170605-04
		PMLN7190A			0.0220	0.02	0.051	0.029	**0.058**	**0.033**	FD-AB-170605-05

13.3 LMR assessments at the Face for 150.8-173.4 MHz band

The battery PMNN4468A was used for assessments at the Face because it is the only offered battery (refer to Exhibit 7B for battery illustration). The conducted power measurements for all test channels within FCC allocated frequency range (150.8-173.4 MHz) which is listed in Table 23. The channel with the highest conducted power will be identified as the default channel per KDB 643646 (SAR Test for PTT Radios).

Table 24

Test Freq (MHz)	Power (W)
150.8000	2.30
156.0000	2.30
162.0000	2.29
167.6000	2.28
173.4000	2.32

Assessments with front of radio facing the Face

DUT assessment with offered antennas, battery with front of DUT positioned 2.5cm facing phantom per KDB 643646. Refer to Table 24 for highest output power channel. 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#
PMAD4145B	PMNN4468A	2.5cm @ Front	NONE	150.80	2.40	-0.38	1.24	0.80	0.68	0.44	TLC(FAZ)-FACE-170619-14
				156.00							
PMAD4146B	PMNN4468A	2.5cm @ Front	NONE	156.00							
				162.00							
				167.60							
				173.40	2.33	-0.48	1.24	0.87	**0.71**	**0.50**	ZR-FACE-170521-13
PMAD4155A	PMNN4468A	2.5cm @ Front	NONE	150.80	2.40	-0.63	1.03	0.78	0.60	0.45	ZR-FACE-170521-14
				156.00							
PMAD4156A	PMNN4468A	2.5cm @ Front	NONE	156.00							
				162.00							
				167.60							
				173.40	2.38	0.16	1.19	0.90	0.60	0.45	ZR-FACE-170521-15

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 PMNN4468A (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 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 ≤ 1.2W/kg.

Table 26

Mode	Channel #	Channel Frequency	Modulation	Battery: PMNN4468A Antenna port[mW]	Antenna Max Power [mW]
802.11b (1Mbps)	1	2412	DSSS	22.0	25.1
	6	2437		20.7	
	11	2462		20.5	
802.11g (6Mbps)	1	2412	OFDM	8.6	9.2
	6	2437		7.5	
	11	2462		7.8	
802.11n (MCS0)	1	2412	OFDM	8.7	9.2
	6	2437		8.0	
	11	2462		7.5	

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

DUT assessment with WLAN internal antenna with front of the DUT
2.5 cm from phantom with all offered battery. 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#
PMLN7569A WiFi Ant	PMNN4468A	2.5cm @ Front	None	2412.000	0.0220	0.24	0.011	0.00586	**0.013**	**0.007**	FD-FACE-170605-02

13.5 Assessment for ISED Canada

Based on the assessment results for body and face per KDB643646, additional tests were required for ISED Canada frequency range (138-174 MHz). The overall highest test configuration from 150.8-173.4 MHz was repeated with the test frequencies – 140 MHz, 144 MHz and 147 MHz.

Table 28

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											
PMAD4144B	PMNN4468A	PMLN7190A	BT(None)	140.000	2.39	-0.07	0.71	0.50	0.36	0.25	ZR-AB-170520-12
				144.000	2.40	-0.07	0.22	0.15	0.11	0.08	ZR-AB-170520-13
PMAD4145B	PMNN4468A	PMLN7190A	BT(None)	144.000	2.40	0.03	0.36	0.26	0.18	0.13	ZR-AB-170520-14
				147.400	2.30	-0.41	0.78	0.55	0.45	0.32	ZR-AB-170520-15
PMAD4154A	PMNN4468A	PMLN7190A	BT(None)	140.000	2.39	-0.84	1.22	0.84	**0.743**	**0.51**	ZR-AB-170520-17
				144.000	2.34	0.09	0.19	0.12	0.10	0.06	ZR-AB-170520-18
PMAD4155A	PMNN4468A	PMLN7190A	BT(None)	144.000	2.34	-0.77	1.15	0.82	0.70	0.50	ZR-AB-170520-19
				147.400	2.31	-0.23	0.76	0.53	0.42	0.29	ZR-AB-170520-20
Face											
PMAD4144B	PMNN4468A	None	None	140.000	2.36	0.28	0.74	0.49	0.38	0.25	FD-FACE-170522-04
				144.000	2.37	-0.05	0.36	0.24	0.18	0.12	FD-FACE-170522-05
PMAD4145B	PMNN4468A	None	None	144.000	2.40	0.50	0.39	0.27	0.20	0.13	FD-FACE-170522-06
				147.400	2.40	-0.11	0.90	0.61	0.46	0.31	FD-FACE-170522-07
PMAD4154A	PMNN4468A	None	None	140.000	2.34	-0.98	1.32	0.96	**0.85**	**0.62**	FD-FACE-170522-09
				144.000	2.33	-0.01	0.22	0.16	0.11	0.08	FD-FACE-170522-10
PMAD4155A	PMNN4468A	None	None	144.000	2.31	-0.59	1.00	0.75	0.60	0.44	FD-FACE-170522-11
				147.400	2.40	-0.64	0.87	0.65	0.50	0.38	FD-FACE-170522-12

As per ISED Notice 2016-DRS001, additional tests were required for the low, mid and high frequency channels for the configuration with the highest SAR value.

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#
Body											
PMAD4156A	PMNN4468A	PMLN7190A	BT(None)	156.00	2.40	-0.75	0.891	0.643	0.53	0.38	FD-AB-170525-08
				162.00	2.40	-0.34	0.958	0.698	0.52	0.38	FD-AB-170525-09
				173.40	2.29	0.30	1.580	1.150	**0.83**	**0.60**	FD-AB-170520-09
Face											
PMAD4154A	PMNN4468A	2.5cm @ Front	None	136.00	2.30	-0.32	1.14	0.83	0.64	0.47	FD-FACE-170522-08
				140.00	2.34	-0.98	1.32	0.96	**0.85**	**0.62**	FD-FACE-170522-09
				144.00	2.33	-0.01	0.22	0.16	0.11	0.08	FD-FACE-170522-10

13.6 Assessment at the Bluetooth band

13.6.1 FCC Requirement

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

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] *[$\sqrt{F_{(GHz)}}$] = 2.2 W/kg, which is ≤ 3 W/kg (1g)

Where:

Max. Power = 7.08mW (9.2mW*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.

13.6.2 ISED Canada Requirement

Based on RSS-102 Issue 5, exemption limits for SAR evaluation for controlled devices at Bluetooth frequency band with separation distance ≤ 5mm was 20 mW.

Standalone Bluetooth transmitter operates at

Maximum conducted power:
= 9.2 mW * 77 %
= 7.08 mW or 8.50 dBm

Equivalent isotropically radiated power (EIRP):
= Maximum conducted power, dBm + Antenna gain, dBi
= 8.50 dBm + 0.24 dBi
= 8.74 dBm or 7.48 mW

Higher output power level, Equivalent isotropically radiated power (EIRP) 7.48 mW was below the threshold power level 20 mW. Hence SAR test was not required for Bluetooth band.

13.7 Assessment outside FCC Part 90

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

Table 30

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											
PMAD4144B	PMNN4468A	PMLN7190A	BT(None)	136.000	2.39	0.14	0.32	0.23	0.16	0.11	ZR-AB-170520-11
PMAD4154A	PMNN4468A	PMLN7190A	BT(None)	136.000	2.39	-0.94	1.18	0.82	0.736	0.51	ZR-AB-170520-16
Face											
PMAD4144B	PMNN4468A	None	None	136.000	2.33	0.27	0.32	0.21	0.16	0.11	FD-FACE-170522-03
PMAD4154A	PMNN4468A	None	None	136.000	2.30	-0.32	1.14	0.83	0.64	0.47	FD-FACE-170522-08

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 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#
PMAD4156A	PMNN4468A	PMLN7190A	BT(None)	173.400	2.31	-0.11	1.250	0.921	0.67	0.49	FD-AB-170521-11

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 ≤ 50mm:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] *[√F(GHz)/X] = 0.30 W/kg, which is ≤ 0.4 W/kg (1g)

Where:

X = 7.5 for 1g-SAR; 18.75 for 10g
Max. Power = 7.08mW (9.2mW*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

These devices use 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 802.11 b is 25.1mW while BT is 7.08mW. 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 32

		LMR Band
	Freq. (MHz)	VHF (150.8-173.4 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 ISED Canada Frequency bands, the highest Operational Maximum Calculated 1-gram and 10-gram average SAR values found for this filing:

Table 33

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	150.8-173.4	0.83	0.60	0.71	0.50
WLAN	2412-2462	0.058	0.033	0.013	0.007
ISED Canada					
LMR	138-174	0.83	0.60	0.85	0.62
WLAN	2412-2462	0.058	0.033	0.013	0.007
Overall					
LMR	136-174	0.83	0.60	0.85	0.62
WLAN	2412-2484	0.058	0.033	0.013	0.007

All results are scaled to the maximum output power.

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

Table 33

Designator	Frequency bands	Combined 1g-SAR (W/kg)	Combined 10g-SAR (W/kg)
Body			
FCC	LMR (150.8-173.4MHz) and WLAN band	0.89	0.63
ISED Canada	LMR (138-174 MHz) and WLAN band	0.89	0.63
Overall	LMR (136-174MHz) and WLAN band	0.89	0.63
Face			
FCC	LMR (150.8-173.4MHz) and WLAN band	0.72	0.51
ISED Canada	LMR (138-174 MHz) and WLAN band	0.86	0.63
Overall	LMR (136-174MHz) and WLAN band	0.86	0.63

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 not required because SAR results are below 4.0W/kg (Occupational).

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 150 MHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	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	∞
Liquid Conductivity (Temperature Uncertainty)	E3.4	2.7	R	1.73	0.78	0.71	1.2	1.1	∞
Liquid Permittivity (Temperature Uncertainty)	E3.4	0.4	R	1.73	0.26	0.10	0.1	0.1	∞
Combined Standard Uncertainty			RSS				12	11	498
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				23	23	

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

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**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	∞
Liquid Conductivity (Temperature Uncertainty)	E3.4	2.7	R	1.73	0.78	0.71	1.2	1.1	∞
Liquid Permittivity (Temperature Uncertainty)	E3.4	0.4	R	1.73	0.26	0.10	0.1	0.1	∞
Combined Standard Uncertainty			RSS				11	11	434
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 150 MHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g U_i (±%)**	**10 g U_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	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	∞
Liquid Conductivity (Temperature Uncertainty)	E3.4	2.7	R	1.73	0.78	0.71	1.2	1.1	∞
Liquid Permittivity (Temperature Uncertainty)	E3.4	0.4	R	1.73	0.26	0.10	0.1	0.1	∞
Combined Standard Uncertainty			RSS				10	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				19	19	

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

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g U_i (±%)**	**10 g U_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	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	∞
Liquid Conductivity (Temperature Uncertainty)	E3.4	2.7	R	1.73	0.78	0.71	1.2	1.1	∞
Liquid Permittivity (Temperature Uncertainty)	E3.4	0.4	R	1.73	0.26	0.10	0.1	0.1	∞
Combined Standard Uncertainty			RSS				9	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				18	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) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

Appendix B
Probe Calibration Certificates

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

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

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

Accreditation No.: **SCS 0108**

Client **Motorola Solutions MY**

Certificate No: **EX3-3735_Mar17**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3735

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: March 10, 2017

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 NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-16 (No. ES3-3013_Dec16)	Dec-17
DAE4	SN: 660	7-Dec-16 (No. DAE4-660_Dec16)	Dec-17
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

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

Issued: March 14, 2017

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

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

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

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, 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., ϑ = 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:

a) 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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "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)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3735

Manufactured: February 15, 2010
Calibrated: March 10, 2017

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3735

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.37	0.39	0.46	± 10.1 %
DCP (mV)[B]	105.5	101.6	100.2	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	141.9	±3.0 %
		Y	0.0	0.0	1.0		141.6	
		Z	0.0	0.0	1.0		149.0	

Note: For details on UID parameters see Appendix.

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 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3735

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	52.3	0.76	11.79	11.79	11.79	0.00	1.00	± 13.3 %
300	45.3	0.87	11.08	11.08	11.08	0.08	1.30	± 13.3 %
450	43.5	0.87	10.37	10.37	10.37	0.16	1.30	± 13.3 %
750	41.9	0.89	9.82	9.82	9.82	0.45	0.86	± 12.0 %
835	41.5	0.90	9.44	9.44	9.44	0.50	0.80	± 12.0 %
900	41.5	0.97	9.28	9.28	9.28	0.36	1.00	± 12.0 %
1450	40.5	1.20	8.46	8.46	8.46	0.36	0.80	± 12.0 %
1810	40.0	1.40	7.97	7.97	7.97	0.27	1.01	± 12.0 %
1900	40.0	1.40	7.89	7.89	7.89	0.33	0.85	± 12.0 %
2100	39.8	1.49	7.83	7.83	7.83	0.27	0.80	± 12.0 %
2300	39.5	1.67	7.37	7.37	7.37	0.29	0.88	± 12.0 %
2450	39.2	1.80	7.08	7.08	7.08	0.38	0.86	± 12.0 %
2600	39.0	1.96	6.78	6.78	6.78	0.34	0.89	± 12.0 %
4950	36.3	4.40	5.49	5.49	5.49	0.40	1.80	± 13.1 %
5250	35.9	4.71	4.88	4.88	4.88	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.57	4.57	4.57	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.40	4.40	4.40	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.56	4.56	4.56	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.

[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.

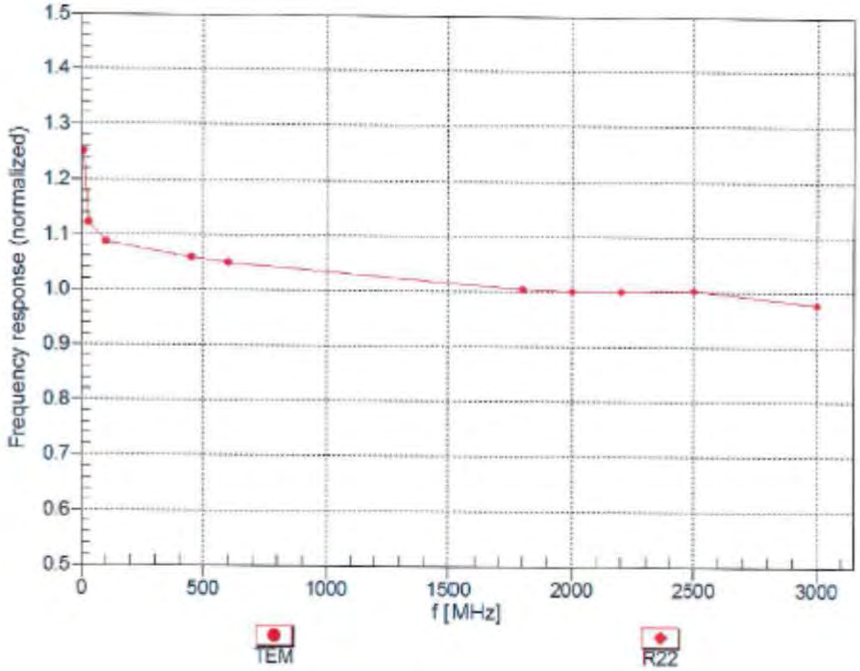
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3735

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)	Unc (k=2)
150	61.9	0.80	11.23	11.23	11.23	0.00	1.00	± 13.3 %
300	58.2	0.92	10.61	10.61	10.61	0.05	1.20	± 13.3 %
450	56.7	0.94	10.56	10.56	10.56	0.07	1.20	± 13.3 %
750	55.5	0.96	9.52	9.52	9.52	0.30	1.00	± 12.0 %
835	55.2	0.97	9.28	9.28	9.28	0.42	0.87	± 12.0 %
900	55.0	1.05	9.19	9.19	9.19	0.44	0.80	± 12.0 %
1450	54.0	1.30	8.07	8.07	8.07	0.34	0.80	± 12.0 %
1810	53.3	1.52	7.88	7.88	7.88	0.36	0.85	± 12.0 %
1900	53.3	1.52	7.76	7.76	7.76	0.30	0.90	± 12.0 %
2100	53.2	1.62	7.73	7.73	7.73	0.40	0.80	± 12.0 %
2300	52.9	1.81	7.32	7.32	7.32	0.42	0.80	± 12.0 %
2450	52.7	1.95	7.24	7.24	7.24	0.41	0.86	± 12.0 %
2600	52.5	2.16	6.90	6.90	6.90	0.36	0.89	± 12.0 %
4950	49.4	5.01	4.51	4.51	4.51	0.40	1.90	± 13.1 %
5250	48.9	5.36	4.35	4.35	4.35	0.40	1.90	± 13.1 %
5500	48.6	5.65	4.00	4.00	4.00	0.40	1.90	± 13.1 %
5600	48.5	5.77	3.75	3.75	3.75	0.50	1.90	± 13.1 %
5750	48.3	5.94	3.83	3.83	3.83	0.50	1.90	± 13.1 %

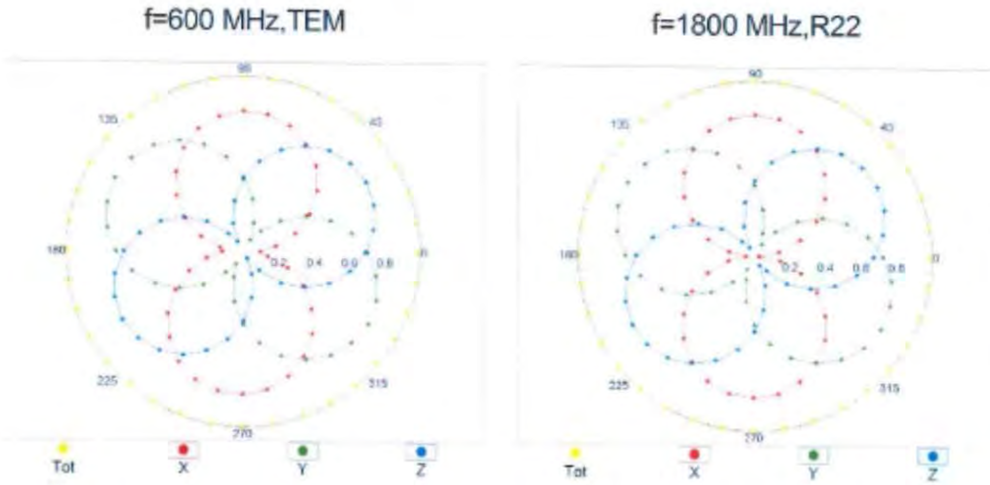
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz 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.
[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.

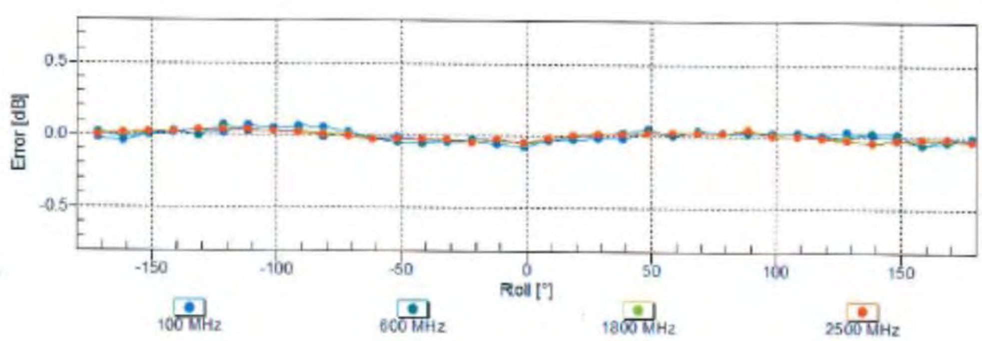
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

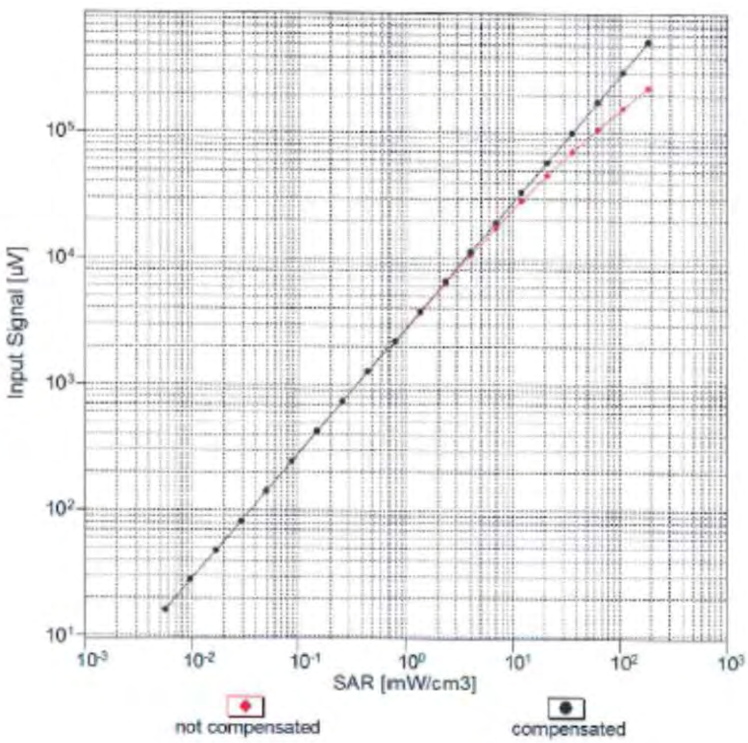
Receiving Pattern (ϕ), ϑ = 0°

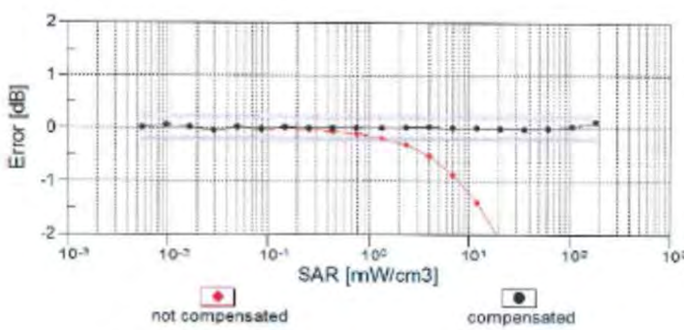




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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



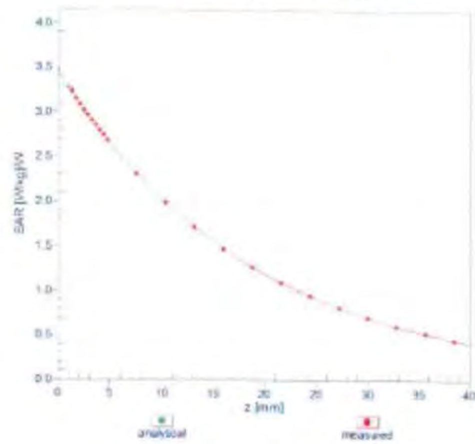


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

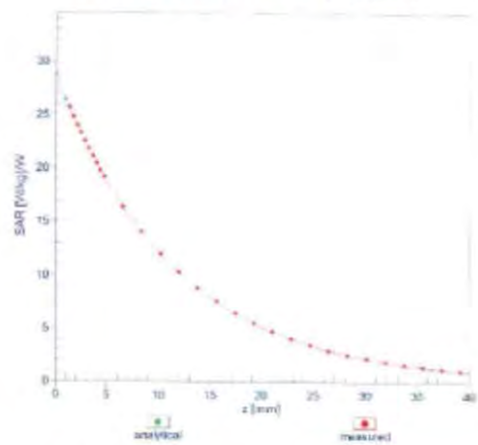
EX3DV4– SN:3735 March 10, 2017

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

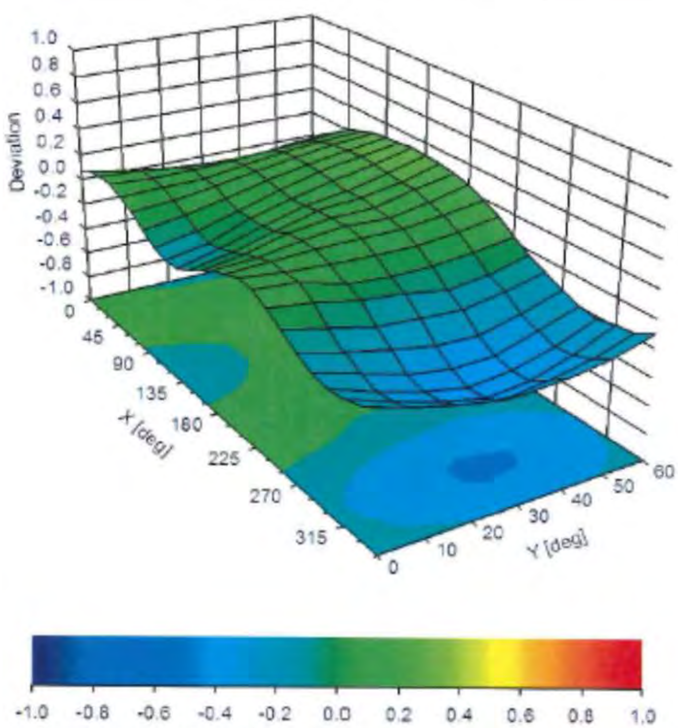


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3735

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-1.5
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: Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	141.9	±3.0 %
		Y	0.0	0.0	1.0		141.6	
		Z	0.0	0.0	1.0		149.0	
10021-DAC	GSM-FDD (TDMA, GMSK)	X	3.44	68.2	14.9	9.39	118.0	±2.2 %
		Y	3.22	69.4	16.8		85.0	
		Z	12.08	88.1	24.1		147.1	
10023-DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	4.06	71.2	16.7	9.57	114.5	±2.7 %
		Y	3.01	68.0	16.2		83.3	
		Z	11.22	87.4	24.1		141.6	
10024-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	5.62	76.3	17.1	6.56	149.2	±2.2 %
		Y	6.09	79.3	19.0		142.0	
		Z	16.49	90.1	22.6		125.8	
10025-DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	6.61	75.2	26.4	12.62	77.0	±2.2 %
		Y	5.33	69.5	23.9		56.8	
		Z	7.84	79.0	28.9		89.4	
10026-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	7.48	79.8	26.6	9.55	147.0	±2.5 %
		Y	5.75	73.4	23.8		120.4	
		Z	9.68	84.4	28.7		127.8	
10027-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	40.65	99.8	23.0	4.80	145.4	±1.7 %
		Y	23.67	96.2	22.9		147.6	
		Z	47.87	100.0	23.5		143.2	
10028-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	43.00	100.0	22.3	3.55	130.4	±1.7 %
		Y	36.95	99.6	22.6		133.5	
		Z	60.81	99.8	22.1		126.2	
10029-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	7.59	81.3	26.3	7.78	145.1	±2.7 %
		Y	5.99	75.7	23.9		143.3	
		Z	9.66	84.1	27.1		146.1	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	5.02	67.8	19.4	4.57	149.2	±0.9 %
		Y	4.68	66.2	18.6		129.2	
		Z	4.84	66.4	18.5		138.5	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	6.17	75.3	25.9	11.01	118.9	±3.0 %
		Y	4.85	69.1	23.0		86.4	
		Z	9.59	85.3	30.7		147.5	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	6.02	76.9	23.7	6.52	133.6	±2.2 %
		Y	5.32	73.9	22.4		136.6	
		Z	7.69	79.7	24.5		131.6	
10081-CAB	CDMA2000 (1xRTT, RC3)	X	4.24	67.6	19.3	3.97	142.4	±0.7 %
		Y	3.96	66.1	18.4		145.9	
		Z	3.98	65.7	18.0		133.7	

10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	5.59	77.4	18.0	6.56	143.9	±2.5 %
		Y	5.36	77.0	18.0		139.4	
		Z	14.11	87.2	21.4		126.1	
10099-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	7.91	81.7	27.6	9.55	141.4	±2.2 %
		Y	6.07	75.0	24.6		116.8	
		Z	9.76	84.6	28.7		126.1	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.99	68.2	20.8	8.07	124.1	±2.7 %
		Y	10.02	68.1	20.7		128.3	
		Z	10.36	68.9	21.1		144.0	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.14	69.3	21.5	8.10	147.6	±3.0 %
		Y	9.68	67.9	20.6		124.3	
		Z	10.02	68.7	21.1		140.2	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	4.76	69.1	19.8	3.91	148.6	±0.7 %
		Y	4.37	67.2	18.8		127.1	
		Z	4.48	67.1	18.5		141.7	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	4.23	69.8	20.2	3.46	141.9	±0.7 %
		Y	3.74	67.0	18.7		144.4	
		Z	3.66	66.0	17.9		134.6	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	4.06	69.2	19.8	3.39	141.8	±0.7 %
		Y	3.68	67.1	18.7		143.8	
		Z	3.63	66.3	18.0		133.7	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	4.15	69.1	19.8	3.50	140.6	±0.7 %
		Y	3.76	67.0	18.7		142.9	
		Z	3.72	66.3	18.2		133.4	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	7.03	71.7	25.9	12.49	95.3	±2.7 %
		Y	5.88	66.3	22.9		68.8	
		Z	9.34	78.7	29.6		118.5	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	6.00	72.8	20.9	3.76	128.4	±0.7 %
		Y	4.95	68.7	18.9		133.1	
		Z	4.96	68.0	18.5		142.1	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	5.91	72.8	20.9	3.77	127.8	±0.7 %
		Y	4.93	68.9	19.0		130.8	
		Z	4.87	68.0	18.5		141.9	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	6.96	71.2	20.9	5.22	134.2	±0.9 %
		Y	6.38	69.1	19.8		136.9	
		Z	6.47	68.7	19.5		125.4	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	4.22	76.7	22.6	1.54	149.3	±1.2 %
		Y	3.68	73.6	20.9		128.1	
		Z	2.82	68.3	18.2		138.3	
10417-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	10.18	69.2	21.6	8.23	145.8	±3.0 %
		Y	10.09	68.8	21.2		148.6	
		Z	10.04	68.6	21.1		136.8	

EX3DV4– SN:3735 March 10, 2017

10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	10.12	69.4	21.6	8.14	146.6	±2.7 %
		Y	9.97	68.7	21.2		147.5	
		Z	9.96	68.6	21.1		137.7	
10419-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preambule)	X	10.24	69.5	21.7	8.19	148.0	±3.0 %
		Y	10.04	68.8	21.2		149.3	
		Z	10.07	68.7	21.2		140.0	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	8.54	69.2	20.7	6.55	135.8	±1.9 %
		Y	8.28	68.3	20.1		137.1	
		Z	8.19	67.6	19.7		129.9	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	10.88	69.8	21.8	8.25	136.2	±3.0 %
		Y	10.86	69.4	21.5		138.8	
		Z	10.71	68.6	21.1		133.1	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	5.92	82.8	24.9	1.58	128.2	±0.7 %
		Y	3.52	73.0	20.8		130.5	
		Z	2.89	68.7	18.4		143.9	
10518-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	10.26	69.5	21.7	8.23	145.6	±3.0 %
		Y	10.10	68.8	21.2		147.6	
		Z	10.16	68.9	21.3		140.0	
10525-AAA	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	10.03	68.5	21.2	8.36	122.7	±3.0 %
		Y	10.00	68.2	21.0		124.0	
		Z	10.40	69.1	21.5		142.7	
10526-AAA	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	10.10	68.5	21.3	8.42	123.6	±2.7 %
		Y	10.05	68.2	21.0		123.9	
		Z	10.48	69.2	21.5		143.3	
10534-AAA	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	10.58	69.0	21.4	8.45	129.5	±2.7 %
		Y	10.49	68.6	21.2		129.9	
		Z	10.47	68.5	21.1		123.7	
10535-AAA	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	10.58	69.0	21.4	8.45	129.7	±2.7 %
		Y	10.52	68.7	21.2		132.0	
		Z	10.49	68.5	21.1		124.1	
10544-AAA	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	11.04	69.5	21.5	8.47	134.3	±2.7 %
		Y	10.75	68.7	21.0		133.9	
		Z	10.88	69.0	21.1		127.7	
10545-AAA	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	11.10	69.6	21.5	8.55	134.0	±2.7 %
		Y	10.82	68.8	21.1		134.4	
		Z	10.97	69.0	21.2		127.9	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	9.90	68.5	21.2	8.25	122.7	±3.0 %
		Y	9.89	68.3	21.0		124.9	
		Z	10.26	69.1	21.4		142.4	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	6.11	82.4	24.9	1.99	129.0	±0.7 %
		Y	3.46	71.4	20.1		149.7	
		Z	3.49	70.6	19.3		141.5	

Certificate No: EX3-3735_Mar17 Page 14 of 16

10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	6.14	82.6	25.0	1.99	127.7	±0.9 %
		Y	3.59	72.3	20.6		148.0	
		Z	3.56	71.0	19.5		140.0	
10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	10.06	68.6	21.5	8.59	122.5	±3.0 %
		Y	10.34	69.1	21.6		147.4	
		Z	10.50	69.3	21.8		139.6	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	10.61	70.0	22.2	8.60	149.8	±2.7 %
		Y	10.38	69.2	21.7		148.3	
		Z	10.55	69.4	21.8		140.8	
10583-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	10.11	68.7	21.5	8.59	124.6	±2.7 %
		Y	10.35	69.1	21.6		148.8	
		Z	10.51	69.4	21.8		140.5	
10584-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	10.11	68.7	21.5	8.60	123.0	±3.0 %
		Y	10.07	68.4	21.2		123.3	
		Z	10.56	69.5	21.8		141.6	
10591-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	10.23	68.8	21.6	8.63	125.2	±3.0 %
		Y	10.15	68.4	21.2		124.7	
		Z	10.65	69.4	21.8		142.5	
10592-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	10.40	69.0	21.8	8.79	125.2	±2.7 %
		Y	10.34	68.5	21.4		126.6	
		Z	10.85	69.7	22.1		144.2	
10599-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	10.88	69.4	21.8	8.79	132.6	±3.0 %
		Y	10.78	69.0	21.5		132.8	
		Z	10.78	68.8	21.5		124.2	
10600-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	10.94	69.4	21.9	8.88	131.7	±3.0 %
		Y	10.84	69.0	21.6		132.9	
		Z	10.86	68.9	21.6		124.4	
10607-AAA	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	10.26	68.8	21.6	8.64	125.4	±3.0 %
		Y	10.24	68.5	21.3		126.7	
		Z	10.71	69.6	21.9		144.0	
10608-AAA	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	10.40	69.0	21.7	8.77	125.8	±3.3 %
		Y	10.36	68.6	21.4		127.2	
		Z	10.87	69.8	22.1		145.4	
10616-AAA	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	10.90	69.4	21.9	8.82	131.8	±3.0 %
		Y	10.79	68.9	21.5		132.7	
		Z	10.83	68.9	21.5		123.8	
10617-AAA	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	10.91	69.4	21.9	8.81	132.1	±3.0 %
		Y	10.78	69.0	21.5		133.1	
		Z	10.83	68.9	21.5		124.0	
10626-AAA	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	11.37	69.9	21.9	8.83	136.7	±3.0 %
		Y	11.05	69.1	21.4		134.9	
		Z	11.27	69.5	21.6		128.1	

10627-AAA	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	11.44	70.0	22.0	8.88	137.5	±3.0 %
		Y	11.10	69.1	21.5		135.1	
		Z	11.35	69.5	21.7		128.9	
10648-AAA	CDMA2000 (1x Advanced)	X	4.39	70.8	20.9	3.45	148.1	±0.9 %
		Y	3.84	67.8	19.3		148.6	
		Z	3.78	66.9	18.5		139.2	

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

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Accreditation No.: **SCS 0108**

Client **Motorola MY** Certificate No: **ES3-3196_May17**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3196

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: May 17, 2017

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 NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02525)	Apr-18
Reference 20 dB Attenuator	SN: S5277 (20x)	07-Apr-17 (No. 217-02528)	Apr-18
Reference Probe ES3DV2	SN: 3013	31-Dec-16 (No. ES3-3013_Dec16)	Dec-17
DAE4	SN: 660	7-Dec-16 (No. DAE4-660_Dec16)	Dec-17
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

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

Issued: May 18, 2017

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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, 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., ϑ = 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:

a) 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
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "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)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3196

Manufactured: June 16, 2008
Calibrated: May 17, 2017

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3196

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.25	1.26	1.30	± 10.1 %
DCP (mV)[B]	101.5	100.5	99.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	191.9	±3.5 %
		Y	0.0	0.0	1.0		203.8	
		Z	0.0	0.0	1.0		204.9	

Note: For details on UID parameters see Appendix.

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 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3196

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	52.3	0.76	7.46	7.46	7.46	0.08	1.25	± 13.3 %
300	45.3	0.87	7.36	7.36	7.36	0.12	1.60	± 13.3 %
450	43.5	0.87	7.11	7.11	7.11	0.20	1.60	± 13.3 %
750	41.9	0.89	6.82	6.82	6.82	0.71	1.27	± 12.0 %
835	41.5	0.90	6.63	6.63	6.63	0.53	1.40	± 12.0 %
900	41.5	0.97	6.45	6.45	6.45	0.74	1.20	± 12.0 %
1450	40.5	1.20	5.78	5.78	5.78	0.74	1.15	± 12.0 %
1810	40.0	1.40	5.58	5.58	5.58	0.42	1.62	± 12.0 %
1900	40.0	1.40	5.42	5.42	5.42	0.71	1.26	± 12.0 %
2100	39.8	1.49	5.44	5.44	5.44	0.78	1.22	± 12.0 %
2300	39.5	1.67	5.00	5.00	5.00	0.74	1.27	± 12.0 %
2450	39.2	1.80	4.74	4.74	4.74	0.65	1.38	± 12.0 %
2600	39.0	1.96	4.60	4.60	4.60	0.75	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.

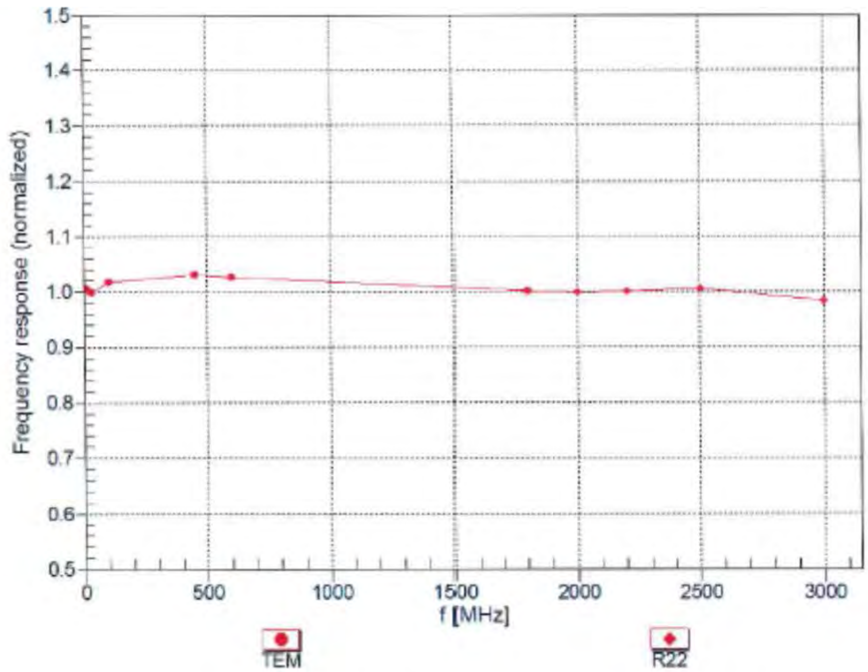
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3196

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)	Unc (k=2)
150	61.9	0.80	7.06	7.06	7.06	0.09	1.25	± 13.3 %
300	58.2	0.92	6.92	6.92	6.92	0.10	1.60	± 13.3 %
450	56.7	0.94	7.00	7.00	7.00	0.13	1.60	± 13.3 %
750	55.5	0.96	6.44	6.44	6.44	0.80	1.13	± 12.0 %
835	55.2	0.97	6.31	6.31	6.31	0.50	1.47	± 12.0 %
900	55.0	1.05	6.27	6.27	6.27	0.52	1.47	± 12.0 %
1450	54.0	1.30	5.40	5.40	5.40	0.71	1.19	± 12.0 %
1810	53.3	1.52	5.11	5.11	5.11	0.40	1.83	± 12.0 %
1900	53.3	1.52	4.91	4.91	4.91	0.60	1.47	± 12.0 %
2100	53.2	1.62	5.24	5.24	5.24	0.60	1.49	± 12.0 %
2300	52.9	1.81	4.72	4.72	4.72	0.80	1.27	± 12.0 %
2450	52.7	1.95	4.58	4.58	4.58	0.80	1.13	± 12.0 %
2600	52.5	2.16	4.40	4.40	4.40	0.80	1.20	± 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.

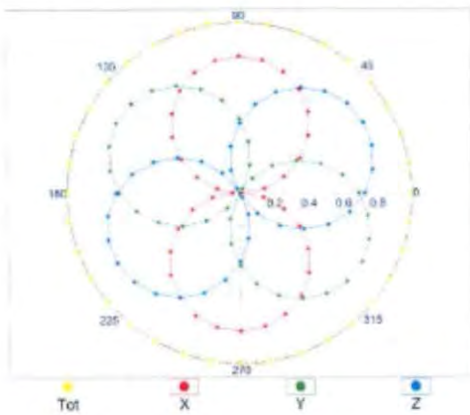
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



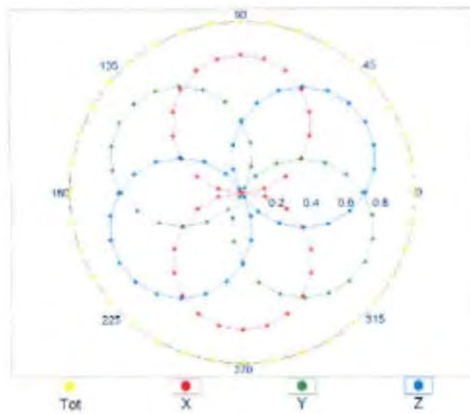
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

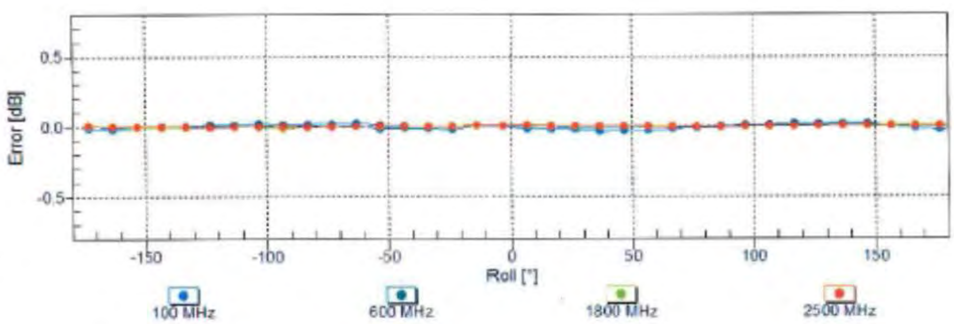
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



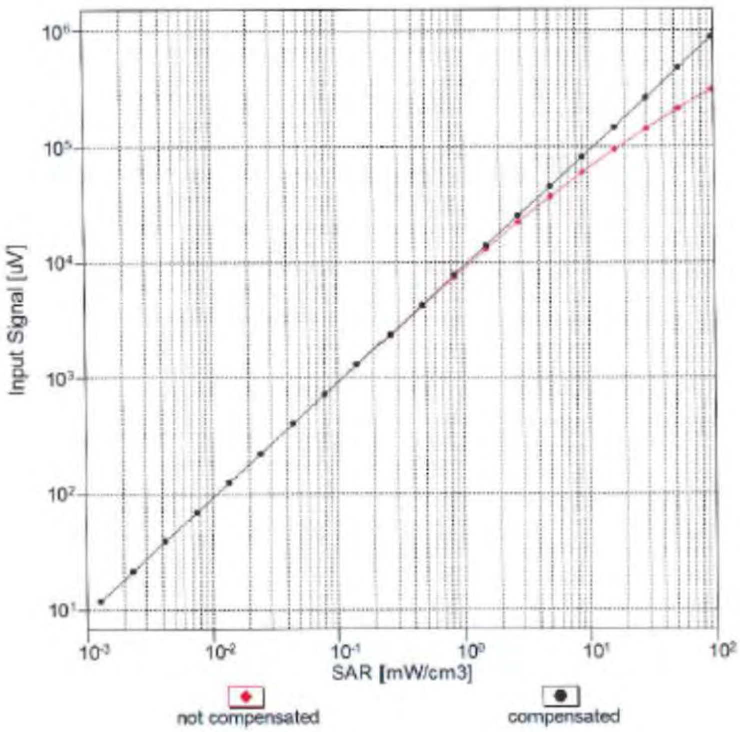
f=1800 MHz,R22

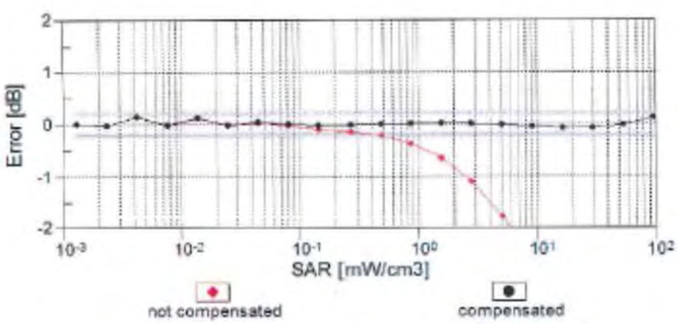




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

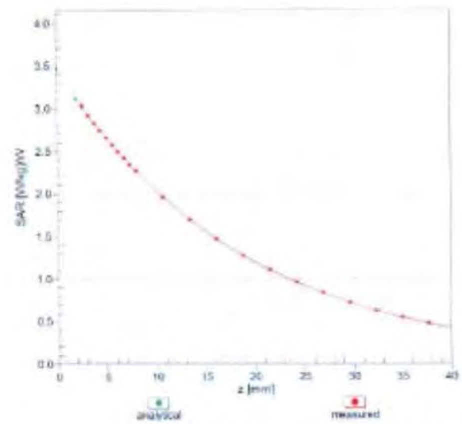




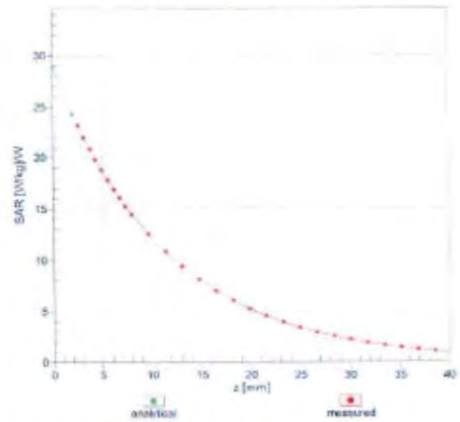
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

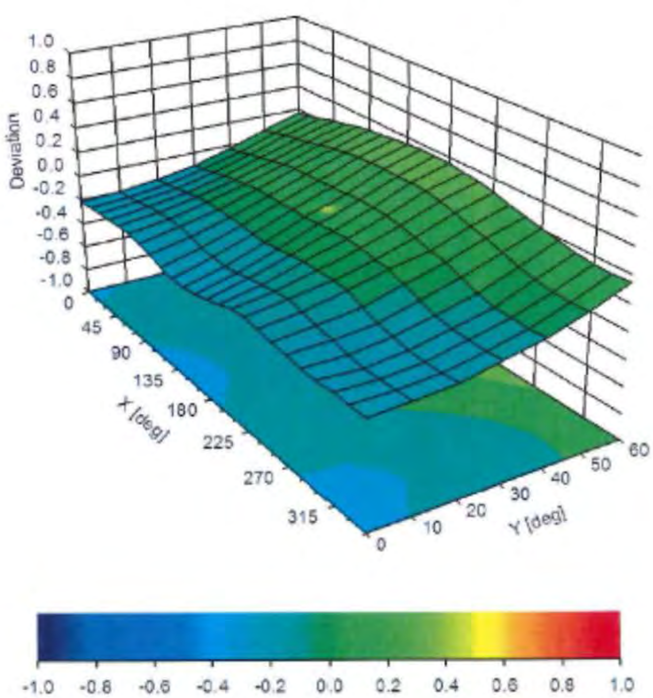


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3196

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	6.7
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

Appendix: Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	191.9	±3.5 %
		Y	0.0	0.0	1.0		203.8	
		Z	0.0	0.0	1.0		204.9	
10011-CAB	UMTS-FDD (WCDMA)	X	3.15	66.2	18.1	2.91	131.3	±0.7 %
		Y	3.25	66.4	17.9		143.9	
		Z	3.34	67.3	18.9		144.4	
10097-CAB	UMTS-FDD (HSDPA)	X	4.57	66.5	18.5	3.98	141.0	±0.9 %
		Y	4.44	65.6	17.9		129.2	
		Z	4.57	66.5	18.7		131.2	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.63	66.8	18.7	3.98	141.2	±0.9 %
		Y	4.48	65.8	18.0		129.6	
		Z	4.56	66.4	18.7		130.5	
10100-CAC	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.64	68.4	20.3	5.67	148.8	±1.4 %
		Y	6.31	66.9	19.3		134.7	
		Z	6.47	67.7	20.0		137.4	
10101-CAC	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	7.41	67.5	20.1	6.42	132.2	±1.9 %
		Y	7.45	67.4	19.8		144.4	
		Z	7.62	68.2	20.6		147.4	
10108-CAD	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.50	67.9	20.2	5.80	144.9	±1.4 %
		Y	6.20	66.5	19.1		132.7	
		Z	6.38	67.4	20.0		134.5	
10109-CAD	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	7.19	67.3	20.0	6.43	128.8	±1.7 %
		Y	7.22	67.1	19.7		141.7	
		Z	7.36	67.8	20.5		143.1	
10110-CAD	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.14	67.1	19.8	5.75	140.8	±1.4 %
		Y	5.93	66.1	19.0		128.6	
		Z	6.05	66.8	19.7		131.2	
10111-CAD	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	7.21	68.0	20.5	6.44	148.8	±1.7 %
		Y	6.96	66.8	19.6		137.4	
		Z	7.09	67.5	20.3		138.9	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.47	69.6	21.8	8.07	135.7	±2.7 %
		Y	10.30	69.0	21.3		145.6	
		Z	10.27	69.1	21.6		124.4	
10140-CAC	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	7.66	67.8	20.3	6.49	133.4	±1.7 %
		Y	7.64	67.6	20.0		145.3	
		Z	7.83	68.4	20.7		148.8	
10142-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	5.97	67.0	19.8	5.73	137.4	±1.7 %
		Y	5.99	66.8	19.4		149.4	
		Z	5.87	66.5	19.6		128.3	
10143-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	6.96	67.8	20.4	6.35	145.0	±1.4 %
		Y	6.67	66.5	19.4		130.6	
		Z	6.87	67.4	20.3		135.1	

10145-CAD	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	5.66	66.4	19.5	5.76	132.2	±1.4 %
		Y	5.72	66.4	19.3		145.5	
		Z	5.83	67.1	20.0		146.9	
10146-CAD	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	6.59	67.3	20.2	6.41	134.3	±1.7 %
		Y	6.70	67.5	20.1		148.7	
		Z	6.57	67.3	20.2		128.0	
10149-CAC	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	7.42	68.1	20.5	6.42	148.9	±1.7 %
		Y	7.16	66.9	19.7		137.3	
		Z	7.32	67.6	20.4		139.9	
10154-CAD	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.08	66.9	19.7	5.75	135.0	±1.4 %
		Y	5.91	66.0	19.0		128.3	
		Z	6.02	66.6	19.7		129.1	
10155-CAD	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	7.10	67.6	20.3	6.43	144.0	±1.7 %
		Y	6.93	66.7	19.6		135.0	
		Z	7.06	67.4	20.3		136.1	
10156-CAD	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	5.86	66.6	19.6	5.79	132.5	±1.4 %
		Y	5.94	66.6	19.4		148.0	
		Z	6.04	67.3	20.1		149.4	
10157-CAD	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	6.88	67.5	20.3	6.49	139.1	±1.4 %
		Y	6.70	66.6	19.6		130.0	
		Z	6.83	67.3	20.3		131.8	
10160-CAC	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.52	67.4	19.9	5.82	139.8	±1.4 %
		Y	6.31	66.4	19.2		131.6	
		Z	6.47	67.2	19.9		134.3	
10161-CAC	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	7.46	68.0	20.5	6.43	147.9	±1.7 %
		Y	7.28	67.2	19.8		139.9	
		Z	7.40	67.8	20.4		141.3	
10166-CAD	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	5.26	67.0	19.8	5.46	146.2	±1.2 %
		Y	5.10	65.9	18.9		137.5	
		Z	5.20	66.6	19.7		140.5	
10167-CAD	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	6.21	68.0	20.5	6.21	147.9	±1.4 %
		Y	6.11	67.3	19.9		141.5	
		Z	6.20	67.9	20.6		145.1	
10169-CAC	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.11	67.1	20.0	5.73	137.1	±1.2 %
		Y	4.97	66.1	19.2		128.7	
		Z	5.09	66.9	20.1		134.8	
10170-CAC	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	6.01	68.6	21.2	6.52	140.6	±1.7 %
		Y	5.76	67.1	20.0		128.6	
		Z	5.90	68.0	21.0		135.3	
10175-CAD	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.08	67.0	19.9	5.72	138.1	±1.7 %
		Y	5.19	67.1	19.8		149.2	
		Z	5.09	66.9	20.1		135.6	
10176-CAD	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	5.98	68.5	21.1	6.52	139.5	±1.7 %
		Y	5.72	67.0	20.0		127.8	
		Z	5.92	68.1	21.0		136.1	

ES3DV3– SN:3196 May 17, 2017

10177-CAF	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	5.09	67.0	20.0	5.73	137.8	±1.7 %
		Y	5.15	66.9	19.7		149.7	
		Z	5.09	66.9	20.1		135.5	
10178-CAD	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	5.96	68.4	21.0	6.52	139.4	±1.4 %
		Y	5.74	67.0	20.0		128.0	
		Z	5.93	68.2	21.1		135.7	
10181-CAC	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.08	67.0	20.0	5.72	137.3	±1.4 %
		Y	5.15	66.9	19.7		149.8	
		Z	5.08	66.9	20.0		136.0	
10182-CAC	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	5.99	68.5	21.1	6.52	140.2	±1.4 %
		Y	5.75	67.1	20.1		128.3	
		Z	5.92	68.1	21.0		136.0	
10184-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	5.08	67.0	20.0	5.73	137.5	±1.4 %
		Y	5.13	66.8	19.6		149.7	
		Z	5.08	66.8	20.0		135.5	
10185-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	5.99	68.5	21.1	6.51	140.4	±1.4 %
		Y	5.77	67.2	20.1		128.7	
		Z	5.95	68.3	21.1		135.9	
10187-CAD	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	5.10	67.0	20.0	5.73	137.7	±1.2 %
		Y	4.94	65.9	19.1		127.3	
		Z	5.11	66.9	20.1		135.0	
10188-CAD	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	5.99	68.5	21.1	6.52	141.3	±1.7 %
		Y	5.75	67.1	20.1		129.1	
		Z	5.94	68.2	21.0		136.0	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.32	69.9	22.1	8.10	149.3	±2.5 %
		Y	9.93	68.6	21.2		136.9	
		Z	10.25	69.7	22.1		144.6	
10225-CAB	UMTS-FDD (HSPA+)	X	6.96	66.8	19.5	5.97	126.9	±1.4 %
		Y	7.05	67.0	19.4		142.8	
		Z	7.10	67.3	19.9		144.5	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	6.05	67.2	19.2	4.87	146.9	±1.2 %
		Y	5.88	66.4	18.5		136.3	
		Z	6.02	67.0	19.2		140.4	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.38	66.5	18.7	3.96	128.6	±0.9 %
		Y	4.48	66.7	18.6		141.5	
		Z	4.53	67.1	19.2		146.6	
10297-AAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.39	67.4	20.0	5.81	134.6	±1.4 %
		Y	6.16	66.3	19.1		126.6	
		Z	6.34	67.1	19.9		130.2	
10298-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	5.70	66.4	19.5	5.72	128.8	±1.4 %
		Y	5.79	66.5	19.4		144.2	
		Z	5.89	67.2	20.1		146.6	
10299-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	6.71	67.5	20.2	6.39	135.5	±1.4 %
		Y	6.54	66.6	19.5		127.4	
		Z	6.64	67.2	20.2		129.0	

Certificate No: ES3-3196_May17 Page 14 of 18

10311-AAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	7.01	68.2	20.4	6.06	141.6	±1.7 %
		Y	6.76	67.1	19.6		133.7	
		Z	6.92	67.8	20.3		135.3	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.59	67.8	18.6	1.54	148.4	±0.7 %
		Y	2.50	66.6	17.5		141.3	
		Z	2.62	68.0	19.0		142.7	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	10.26	69.8	22.1	8.14	147.2	±2.5 %
		Y	9.97	68.8	21.4		139.1	
		Z	10.18	69.6	22.1		141.7	
10430-AAA	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	X	9.52	69.2	22.0	8.28	133.2	±1.9 %
		Y	9.19	68.0	21.1		124.7	
		Z	9.46	69.0	22.0		127.4	
10431-AAA	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	X	10.13	69.7	22.3	8.38	141.6	±2.5 %
		Y	9.84	68.7	21.5		133.3	
		Z	10.08	69.6	22.3		136.1	
10432-AAA	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	X	10.35	69.9	22.3	8.34	145.3	±2.5 %
		Y	10.06	68.8	21.5		137.2	
		Z	10.28	69.7	22.3		139.8	
10433-AAA	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	X	10.59	70.1	22.4	8.34	149.7	±2.5 %
		Y	10.26	69.0	21.5		139.9	
		Z	10.53	69.9	22.4		144.9	
10434-AAA	W-CDMA (BS Test Model 1, 64 DPCH)	X	9.81	69.7	22.5	8.60	132.3	±2.2 %
		Y	9.51	68.5	21.6		125.0	
		Z	9.78	69.6	22.5		129.2	
10435-AAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.19	72.9	24.2	7.82	127.6	±2.2 %
		Y	7.59	73.8	24.4		147.3	
		Z	7.07	72.3	24.1		124.7	
10457-AAA	UMTS-FDD (DC-HSDPA)	X	8.35	67.3	20.1	6.62	139.7	±1.4 %
		Y	8.12	66.5	19.4		128.3	
		Z	8.32	67.2	20.1		135.4	
10460-AAA	UMTS-FDD (WCDMA, AMR)	X	2.90	68.0	19.1	2.39	143.8	±0.9 %
		Y	2.85	67.4	18.5		132.5	
		Z	2.99	68.8	19.7		138.4	
10461-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.38	73.6	24.6	7.82	132.5	±3.0 %
		Y	7.55	73.6	24.3		145.4	
		Z	7.23	72.9	24.4		126.5	
10462-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.72	73.8	24.9	8.30	126.2	±2.7 %
		Y	8.15	74.7	25.1		140.6	
		Z	8.45	76.2	26.4		149.1	
10464-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.27	73.2	24.4	7.82	127.9	±2.5 %
		Y	7.46	73.4	24.2		140.3	
		Z	7.79	75.0	25.6		148.8	

10465-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.64	73.4	24.7	8.32	124.5	±3.0 %
		Y	8.16	74.7	25.1		140.5	
		Z	8.38	75.9	26.3		147.0	
10467-AAB	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.11	72.6	24.1	7.82	125.3	±2.5 %
		Y	7.44	73.3	24.2		139.5	
		Z	7.82	75.2	25.6		149.0	
10468-AAB	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.57	76.6	26.4	8.32	149.6	±3.0 %
		Y	8.14	74.6	25.1		140.9	
		Z	8.46	76.3	26.4		149.0	
10470-AAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.89	75.4	25.6	7.82	148.3	±2.7 %
		Y	7.51	73.6	24.3		140.6	
		Z	7.81	75.1	25.6		148.1	
10471-AAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.51	76.4	26.3	8.32	149.0	±3.0 %
		Y	8.14	74.6	25.1		141.1	
		Z	8.44	76.2	26.4		148.4	
10473-AAB	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.86	75.3	25.5	7.82	148.1	±2.7 %
		Y	7.48	73.5	24.3		141.1	
		Z	7.76	74.9	25.5		147.8	
10474-AAB	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.51	76.4	26.3	8.32	149.1	±3.0 %
		Y	8.13	74.6	25.1		141.7	
		Z	8.40	76.0	26.3		147.9	
10477-AAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.57	76.7	26.5	8.32	148.4	±3.0 %
		Y	8.17	74.7	25.2		142.2	
		Z	8.39	76.0	26.3		148.1	
10479-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.41	72.1	23.7	7.74	130.6	±2.7 %
		Y	7.11	70.5	22.6		126.0	
		Z	7.44	72.1	23.9		130.3	
10480-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.20	73.1	24.4	8.18	136.4	±3.0 %
		Y	7.90	71.6	23.3		130.3	
		Z	8.19	73.0	24.5		134.3	
10482-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.16	73.0	24.1	7.71	142.7	±3.3 %
		Y	7.79	71.3	22.9		136.9	
		Z	8.07	72.6	24.1		140.2	
10483-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.56	71.7	23.7	8.39	127.2	±2.7 %
		Y	9.01	72.7	24.0		148.0	
		Z	9.13	73.5	24.9		148.2	
10485-AAB	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.29	73.3	24.2	7.59	148.2	±2.5 %
		Y	7.91	71.7	23.0		140.3	
		Z	8.08	72.6	24.0		141.9	
10486-AAB	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.80	71.9	23.9	8.38	130.9	±2.7 %
		Y	9.04	72.2	23.7		149.2	
		Z	8.62	71.3	23.6		125.3	
10488-AAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.12	71.6	23.3	7.70	128.9	±2.7 %
		Y	8.42	72.1	23.3		147.2	
		Z	8.65	73.3	24.4		147.8	

10489-AAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.11	72.0	23.9	8.31	137.4	±2.7 %
		Y	8.58	70.0	22.4		127.9	
		Z	8.95	71.5	23.6		130.3	
10491-AAB	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.67	72.3	23.5	7.74	135.2	±2.5 %
		Y	8.08	70.0	22.1		125.2	
		Z	8.48	71.6	23.3		128.7	
10492-AAB	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.70	72.6	24.1	8.41	144.0	±2.7 %
		Y	9.18	70.6	22.8		135.3	
		Z	9.54	72.0	23.9		138.6	
10494-AAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.68	72.5	23.7	7.74	133.9	±2.5 %
		Y	8.08	70.2	22.2		124.5	
		Z	8.51	71.9	23.5		127.7	
10495-AAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.60	72.5	24.1	8.37	142.9	±2.7 %
		Y	9.17	70.8	22.9		135.6	
		Z	9.48	72.1	23.9		137.9	
10497-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.00	72.9	24.1	7.67	144.0	±3.0 %
		Y	7.60	71.0	22.7		136.2	
		Z	7.89	72.4	24.0		139.2	
10498-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.34	71.4	23.6	8.40	124.4	±3.0 %
		Y	8.78	72.3	23.8		144.6	
		Z	8.94	73.3	24.8		145.4	
10500-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.79	71.1	23.1	7.67	125.5	±2.5 %
		Y	8.03	71.5	23.0		140.7	
		Z	8.44	73.3	24.4		146.1	
10501-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.98	72.0	24.0	8.44	133.9	±2.7 %
		Y	8.50	70.0	22.6		125.3	
		Z	8.84	71.5	23.8		128.5	
10503-AAB	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.11	71.6	23.3	7.72	128.9	±2.5 %
		Y	8.46	72.3	23.4		147.4	
		Z	8.77	73.7	24.6		149.9	
10504-AAB	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.12	72.1	23.9	8.31	137.9	±3.0 %
		Y	8.56	69.9	22.4		127.3	
		Z	8.98	71.6	23.7		132.5	
10506-AAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.66	72.5	23.7	7.74	133.6	±2.2 %
		Y	8.00	70.0	22.1		122.6	
		Z	8.54	72.0	23.6		129.3	
10507-AAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.56	72.4	24.0	8.36	142.4	±3.0 %
		Y	9.00	70.3	22.6		132.3	
		Z	9.54	72.3	24.1		139.8	
10509-AAB	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	9.43	73.2	24.1	7.99	139.9	±2.7 %
		Y	8.75	70.8	22.6		128.7	
		Z	9.34	72.9	24.1		135.9	

ES3DV3– SN:3196 May 17, 2017

10510-AAB	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.51	71.0	23.2	8.49	122.3	±2.7 %
		Y	9.71	71.2	23.1		140.2	
		Z	10.19	72.9	24.4		147.3	
10512-AAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	9.02	72.8	23.7	7.74	135.0	±2.5 %
		Y	8.41	70.7	22.3		126.5	
		Z	9.01	72.8	23.8		133.0	
10513-AAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	10.08	73.0	24.3	8.42	147.1	±2.7 %
		Y	9.44	70.8	22.8		136.6	
		Z	10.02	72.8	24.3		144.2	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	2.69	68.5	18.9	1.58	145.5	±0.7 %
		Y	2.62	67.5	18.1		139.0	
		Z	2.73	68.7	19.3		143.9	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	10.41	69.9	22.3	8.25	146.6	±2.2 %
		Y	10.14	68.9	21.5		138.8	
		Z	10.38	69.8	22.3		142.6	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	3.47	71.3	20.1	1.99	145.7	±0.7 %
		Y	3.22	69.4	19.0		137.8	
		Z	3.47	71.3	20.4		142.7	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	3.56	71.9	20.4	1.99	144.9	±0.7 %
		Y	3.39	70.5	19.4		138.7	
		Z	3.52	71.7	20.6		142.1	
10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	10.83	70.6	22.9	8.59	146.0	±2.7 %
		Y	10.51	69.5	22.0		140.4	
		Z	10.78	70.4	22.9		142.4	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	10.88	70.7	22.9	8.60	147.2	±2.7 %
		Y	10.55	69.6	22.1		139.9	
		Z	10.79	70.5	22.9		141.6	
10591-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	10.96	70.7	22.9	8.63	148.2	±2.7 %
		Y	10.64	69.6	22.0		142.7	
		Z	10.91	70.5	22.9		144.1	
10592-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	11.14	70.9	23.1	8.79	147.7	±2.7 %
		Y	10.84	69.8	22.3		143.1	
		Z	11.11	70.8	23.1		144.3	
10599-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	11.15	70.1	22.5	8.79	126.8	±2.5 %
		Y	10.76	69.0	21.7		121.8	
		Z	11.13	70.1	22.6		124.8	
10600-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	11.22	70.2	22.6	8.88	126.7	±2.2 %
		Y	10.85	69.1	21.8		122.4	
		Z	11.24	70.2	22.7		124.7	

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

Certificate No: ES3-3196_May17 Page 18 of 18