MOTOROLA SOLUTIONS

MS ISO/IEC 17025
TESTING
SAMM No.0826

DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2

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Date of Report: 10/24/2018
Report Revision: C

Responsible Engineer:	Veeramani Veerapan
Report Author:	Veeramani Veerapan
Date/s Tested:	08/28/2018-09/17/2018
Manufacturer:	Motorola Solutions Inc.
DUT Description:	Handheld Portable – DTR700, 1 Watt, 900 MHz, 50CH
Test TX mode(s):	CW (PTT)
Max. Power output:	1.0 W
Nominal Power:	1.0 W
Tx Frequency Bands:	902-928 MHz
Signaling type:	FSK
Model(s) Tested:	DTS150NBDLAA (PMUF1955A)
Model(s) Certified:	DTS150NBDLAA (PMUF1955A), DTS130NBDLAA (PMUF1953A)
Serial Number(s):	379TUR0031 and 379TUR0009
Classification:	Occupational / Controlled
FCC ID:	AZ489FT5874; 902-928MHz
IC:	109U-89FT5874; 902-928MHz
ISED Test Site registration:	109AK
FCC Test Firm Registration Number:	823256

The test results clearly demonstrate compliance with FCC General Population/Uncontrolled RF Exposure limits of 1.6 W/kg averaged over 1 gram per the requirements of FCC 47 CFR § 2.1093 and ISED RSS-102 (Issue 5).

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
Digitally signed by Tiong Nguk Ing
Date: 2018.10.24 23:17:49 +08'00'

Tiong Nguk Ing
Deputy Technical Manager (Approved Signatory)
Approval Date: 10/24/2018

Part 1 of 2

APPENDICES

Part 2 of 2

APPENDICES

Report Revision History

Date	Revision	Comments
09/17/2018	A	Initial release
10/05/2018	B	Battery part number changed from PMNN4468B to PMNN4578A
10/24/2018	C	FCC and IC ID not correct in cover page of Part 2 of 2.

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 DTS150NBDLAA (PMUF1955A). This device is classified as Occupational/Controlled. This device operate in ISM unlicensed operations band, thus need comply with General Population/Uncontrolled exposure limit.

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	1g-SAR
DSS	902-928	0.30	0.79

3.0 Abbreviations / Definitions

CNR: Calibration Not Required
CW: Continuous Wave
8FSK: 8 Level, Frequency Shift Keying
DUT: Device Under Test
EME: Electromagnetic Energy
NA: Not Applicable
ISM: Industrial, Scientific and Medical
PTT: Push to Talk
RSM: Remote Speaker Microphone
SAR: Specific Absorption Rate
DSS: Direct Spread Spectrum

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 – 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 - 648474 D04 Handset SAR v01r03
- FCC KDB – 643646 D01 SAR Test for PTT Radios V01r03

5.0 SAR Limits

Table 2

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average - ANSI - (averaged over the whole body)	0.08	0.4
Spatial Peak - ANSI - (averaged over any 1-g of tissue)	1.6	8.0
Spatial Peak – ICNIRP/ANSI - (hands/wrists/feet/ankles averaged over 10-g)	4.0	20.0
Spatial Peak - ICNIRP - (Head and Trunk 10-g)	2.0	10.0

6.0 Description of Device Under Test (DUT)

This portable device operates digital two-way communication architecture. Moto talk operates in the 900 MHz Industrial, Scientific and Medical (ISM) band. It is a spread spectrum protocol utilizing 2, 4, and 8FSK (Frequency Shift Keying). Radio protocol duty cycle is 95%. User transmit duty cycle is 50% (50%Talk and 50% listen).

The model represented under this filing transmitting in the 902-928 MHz band. The nominal output power is 1.0 W with maximum output power of 1.0 W as defined by upper limit of the production line final test station.

The intended operating positions are “at the face” with the DUT at least 2.5cm from the mouth, and “at the body” by means of the offered body worn accessories. Body worn audio and PTT operation is accomplished by means of optional remote accessories that are connected to the radio.

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 section 4.0 to assess compliance of this device. The following sections identify the test criteria and details for each accessory category. Refer to Exhibit 7B for antenna separation distances.

7.1 Antenna

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

Table 3

Antenna No.	Antenna Model	Description	Selected for test	Tested
1	PMAF4024A	Whip antenna, 902-928 MHz, 1/2 wave, 2.15 dBi gain	Yes	Yes

7.2 Battery

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

Table 4

Battery No.	Battery Model	Description	Selected for test	Tested	Comments
1	PMNN4578A	Battery Pack, 2500 mAh, Li-Ion	Yes	Yes	

7.3 Body worn Accessory

There is only one body worn accessory offered for this product. The Table below lists its description.

Table 5

Body worn No.	Body worn Model	Description	Selected for test	Tested	Comments
1	PMLN7939A	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 accessories.

Table 6

Audio No.	Audio Acc. Models	Description	Selected for test	Tested	Comments
1	HKLN4606A	RSM with PTT, Slim Plug	Yes	Yes	Default Audio
2	HKLN4599B	Earpiece with PTT, MIC, Slim Plug	Yes	*No	
3	HKLN4601A	Surveillance Earpiece with PTT, Slim Plug	Yes	*No	
4	HKLN4604B	Swivel Earpiece with PTT, MIC, Slim Plug	Yes	*No	
5	HKLN4605A	Earbud with PTT, MIC, Slim Plug	Yes	*No	
6	HKLN4606A	RSM with PTT, Slim Plug	Yes	*No	

Note: * Intended for test. Per KDB provisions tests not required.

8.0 Description of Test System

8.1 Descriptions of Robotics/Probes/Readout Electronics

Table 7

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

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

8.2 Description of Phantom(s)

Table 8

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

8.3 Description of Simulated Tissue

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

The simulated tissue mixture was mixed based on the Simulated Tissue Composition indicated in Table 9. 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 9

	900MHz	
Ingredients	Head	Body
Sugar	56.5	44.9
Diacetin	0	0
De ionized – Water	40.95	53.06
Salt	1.45	0.94
HEC	1.0	1.0
Bact.	0.1	0.1

9.0 Additional Test Equipment

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

Table 10

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Speag Probe	ES3DV3	3122	04/18/18	04/18/19
Speag Probe	EX3DV4	7486	03/20/18	03/20/19
Speag Probe	EX3DV4	7364	01/17/18	01/17/19
Speag DAE	DAE4	850	03/07/18	03/07/19
Speag DAE	DAE4	1488	03/09/18	03/09/19
Speag DAE	DAE4	1483	01/04/18	01/04/19
Power Meter	E9301B	MY55210003	09/29/17	09/29/18
Power Meter	E4418B	MY45100532	11/01/17	11/01/18
Power Meter	E4418B	MY45107917	05/22/17	05/22/19
Power Meter	E4419B	MY45103725	05/22/17	05/22/19
Power Meter	E4418B	MY45100911	07/14/17	07/14/19
Power Sensor	E4416A	MY50001037	05/22/17	05/22/19
Power Sensor	E9301B	MY55210006	11/12/17	11/12/18
Power Sensor	8481B	MY41091170	04/23/18	04/23/19
Power Sensor	E9301B	MY50290001	04/24/18	04/24/19
Power Sensor	E9301B	MY41495733	04/17/18	04/17/19
Signal Generator	E4438C	MY45091270	08/13/18	08/13/20
Signal Generator	E4438C	MY42081753	03/27/18	03/27/19
BI-direction Coupler	3020A	41931	07/04/18	07/04/19
BI-direction Coupler	3020A	40295	09/04/18	09/04/19
Amplifier	10W1000C	312859	CNR	CNR
Amplifier	50W1000A	14715	CNR	CNR
Amplifier	10WD1000	28782	CNR	CNR
Thermometer	HH806AU	080307	11/30/17	11/30/18
Thermometer	HH202A	35881	12/13/17	12/13/18
Temperature Probe	80PK-22	06032017	03/07/18	03/07/19
Temperature Probe	80PK-22	05032017	03/07/18	03/07/19
Temperature & Humidity Logger	TM320	12253047	10/26/17	10/26/18
Dielectric Assessment Kit	DAK-3.5	1156	01/09/18	01/09/19
Network Analyzer	E5071B	MY42403147	11/15/17	11/15/18
Speag Dipole	D900V2	1d026	01/18/17	01/18/19

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 11

Dates	Probe Calibration Point		Probe SN	Measured Tissue Parameters		Validation		
				σ	ϵ_r	Sensitivity	Linearity	Isotropy
CW								
4/28/2018	Body	900	3122	0.92	54.6	Pass	Pass	Pass
4/27/2018	Head	900		1.00	40.1	Pass	Pass	Pass
4/19/2018	Body	900	7486	1.08	53.2	Pass	Pass	Pass
4/19/2018	Head	900		1.01	40.3	Pass	Pass	Pass
2/22/2018	Body	900	7364	1.08	54.1	Pass	Pass	Pass
2/23/2018	Head	900		0.96	40.4	Pass	Pass	Pass

10.2 System Verification

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

Table 12

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
3122	FCC Body	SPEAG D900V2 / 1d026	11.00 +/- 10%	2.58	10.32	8/28/2018
				2.65	10.60	8/29/2018
	IEEE/IEC Head		10.90 +/- 10%	2.51	10.04	8/29/2018#
7486	FCC Body		11.00 +/- 10%	2.86	11.44	9/12/2018
	IEEE/IEC Head		10.90 +/- 10%	2.62	10.48	9/12/2018
7364				2.68	10.72	9/17/2018

Note: # System verification cover next testing day (within 24 hrs)

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 13

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
900	FCC Body	1.05 (1.00-1.10)	55.0 (52.3-57.8)	1.09	52.7	8/28/2018
				1.08	52.7	8/29/2018
				1.08	52.7	9/12/2018
	IEEE/ IEC Head	0.97 (0.92-1.02)	41.5 (39.4-43.6)	1.00	40.0	8/29/2018#
				1.01	39.8	9/12/2018
				1.01	39.5	9/17/2018
902	FCC Body	1.05 (1.00-1.10)	55.0 (52.3-57.8)	1.08	52.7	9/12/2018#
	IEEE/ IEC Head	0.97 (0.92-1.02)	41.5 (39.4-43.6)	1.01	39.8	9/12/2018
				1.01	39.5	9/17/2018
915	FCC Body	1.06 (1.01-1.11)	55.0 (52.3-57.8)	1.10	52.5	8/28/2018
				1.09	52.5	8/29/2018
	IEEE/ IEC Head	0.98 (0.93-1.03)	41.5 (39.4-43.6)	1.01	39.8	8/29/2018#
928	FCC Body	1.07 (1.01-1.12)	55.0 (52.2-57.7)	1.11	52.5	9/12/2018#
	IEEE/ IEC Head	0.99 (0.94-1.03)	41.5 (39.4-43.5)	1.03	39.5	9/12/2018#

Note: # Tissue sheet date cover next testing day (within 24 hrs)

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 14

	Target	Measured
Ambient Temperature	18 – 25 ˚C	Range: 19.3 – 24.2˚C Avg. 22.8 ˚C
Tissue Temperature	18 – 25 ˚C	Range: 21.0 – 22.0˚C Avg. 21.5˚C

Relative humidity target range is a recommended target

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

12.0 DUT Test Setup and Methodology

12.1 Measurements

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

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

Table 15

Description		≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location		30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: ΔxArea, ΔyArea		≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: ΔxZoom, ΔyZoom		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: ΔzZoom(n)	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.			

12.2 DUT Configuration(s)

The DUT is a portable device operational at the body and face as described in section 6.0 while using the applicable accessories listed in section 7.0.

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 the offered audio accessories as applicable.

12.3.2 Head

Not applicable.

12.3.3 Face

The DUT was positioned with its' front sides 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" 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" is scale 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.

13.0 DUT Test Data

13.1 Assessments at the Body for 902-928MHz band

Battery PMNN4578A was used during conducted power measurements for all test channels within FCC allocated frequency range (902-928MHz) which are listed in Table 16.

Table 16

Test Freq (MHz)	Power (W)
902.000	0.972
915.000	0.986
928.000	0.975

Assessments at the Body
Assessment of antenna with battery, body worn accessory and audio accessory were performed. SAR plot of the highest result per Table (bolded) are presented in Appendix E.

Table 17

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
PMAF4024A	PMNN4578A	PMLN7939A	HKLN4606A	915.000	0.936	-0.30	0.482	**0.28**	ZZ-AB-180828-02

Assessments at the Body with other audio accessories
By adapting SAR thresholds to general population limits per “KDB 643646 Body SAR Test Consideration for Audio Accessories without Built-In Antenna”, SAR testing with other audio accessories was deemed not necessary as SAR < 0.8 W/kg.

13.2 Assessments at the Face for 902-928MHz band

Assessment of the offered antenna with battery with front of the DUT positioned 2.5 cm facing phantom.

Table 18

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
PMAF4024A	PMNN4578A	None, Radio Front	None	915.000	1.00	-0.36	1.26	**0.68**	ZZ-FACE-180830-01#

13.3 Assessment for ISED, Canada

As per ISED Notice 2016-DRS001, additional tests were required for the low, mid and high frequency channels for the configuration with highest SAR value. 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)	Max Calc. 1g-SAR (W/kg)	Run#
Body									
PMAF4024A	PMNN4578A	PMLN7939A	HKLN4606A	902.000	0.946	-0.46	0.518	**0.30**	FD-AB-180913-02#
				915.000	0.936	-0.30	0.482	0.28	ZZ-AB-180828-02
				928.000	0.970	-0.43	0.393	0.22	FD-AB-180913-03#
Face									
PMAF4024A	PMNN4578A	None, Radio Front	None	902.000	1.00	-0.44	1.43	**0.79**	FD-FACE-180912-07
				915.000	1.00	-0.36	1.26	0.68	ZZ-FACE-180830-01#
				928.000	1.00	-0.48	1.22	0.68	ZZ-FACE-180913-01#

13.4 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 20

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
PMAF4024A	PMNN4578A	None, Radio Front	None	902.000	1.00	-0.14	1.52	0.78	LOH-FACE-180917-06

14.0 Results Summary

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

Table 21

Designator	Frequency band (MHz)	Max Calc at Body (W/kg)	Max Calc at Face (W/kg)
		1g-SAR	1g-SAR
FCC, US	902-928	0.30	0.79
ISED, Canada	902-928	0.30	0.79

All results are scaled to the maximum output power.

The test results clearly demonstrate compliance with FCC General Population/Uncontrolled RF Exposure limits of 1.6 W/kg averaged over 1 gram per the requirements of FCC 47 CFR § 2.1093 and ISED RSS-102 (Issue 5).

15.0 Variability Assessment

Per the guidelines in KDB 865664 SAR variability assessment is not required because SAR results are below 0.8W/kg (General Population).

16.0 System Uncertainty

A system uncertainty analysis is not required for this report per KDB 865664 because the highest report SAR value general population exposure is less than 1.5W/kg.

Per the guidelines of ISO/IEC 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 900 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	6.0	6.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				11	11	419
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				22	22	

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

Table A.2: Uncertainty Budget for System Validation (dipole & flat phantom) for 900 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	∞
Combined Standard Uncertainty			RSS				9	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				18	17	

Notes for uncertainty budget Tables:
a) Column headings *a*-*k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *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: ES3-3122_Apr18

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3122
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:	April 18, 2018

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-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
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-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 19, 2018

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, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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:3122

Manufactured: July 11, 2006
Calibrated: April 18, 2018

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3122

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.30	1.19	1.39	± 10.1 %
DCP (mV)[B]	101.7	102.8	102.3	

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	212.2	±3.5 %
		Y	0.0	0.0	1.0		209.0	
		Z	0.0	0.0	1.0		170.3	

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:3122

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	7.20	7.20	7.20	0.08	1.20	± 13.3 %
300	45.3	0.87	7.01	7.01	7.01	0.13	1.20	± 13.3 %
450	43.5	0.87	6.80	6.80	6.80	0.23	1.30	± 13.3 %
750	41.9	0.89	6.61	6.61	6.61	0.80	1.17	± 12.0 %
835	41.5	0.90	6.31	6.31	6.31	0.61	1.31	± 12.0 %
900	41.5	0.97	6.18	6.18	6.18	0.66	1.28	± 12.0 %
1450	40.5	1.20	5.64	5.64	5.64	0.80	1.12	± 12.0 %
1810	40.0	1.40	5.24	5.24	5.24	0.39	1.66	± 12.0 %
1900	40.0	1.40	5.21	5.21	5.21	0.44	1.51	± 12.0 %
2100	39.8	1.49	5.28	5.28	5.28	0.80	1.20	± 12.0 %
2300	39.5	1.67	4.86	4.86	4.86	0.80	1.21	± 12.0 %
2450	39.2	1.80	4.64	4.64	4.64	0.69	1.32	± 12.0 %
2600	39.0	1.96	4.46	4.46	4.46	0.80	1.33	± 12.0 %
3500	37.9	2.91	4.38	4.38	4.38	0.80	1.25	± 13.1 %
3700	37.7	3.12	4.08	4.08	4.08	0.70	1.25	± 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: ES3DV3 - SN:3122

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	6.82	6.82	6.82	0.08	1.20	± 13.3 %
300	58.2	0.92	6.79	6.79	6.79	0.10	1.20	± 13.3 %
450	56.7	0.94	6.95	6.95	6.95	0.10	1.30	± 13.3 %
750	55.5	0.96	6.39	6.39	6.39	0.54	1.37	± 12.0 %
835	55.2	0.97	6.28	6.28	6.28	0.80	1.14	± 12.0 %
900	55.0	1.05	6.22	6.22	6.22	0.58	1.33	± 12.0 %
1450	54.0	1.30	5.39	5.39	5.39	0.80	1.12	± 12.0 %
1810	53.3	1.52	5.02	5.02	5.02	0.51	1.53	± 12.0 %
1900	53.3	1.52	4.81	4.81	4.81	0.67	1.36	± 12.0 %
2100	53.2	1.62	5.09	5.09	5.09	0.57	1.53	± 12.0 %
2300	52.9	1.81	4.58	4.58	4.58	0.80	1.24	± 12.0 %
2450	52.7	1.95	4.52	4.52	4.52	0.80	1.18	± 12.0 %
2600	52.5	2.16	4.26	4.26	4.26	0.79	1.20	± 12.0 %
3500	51.3	3.31	3.86	3.86	3.86	0.70	1.30	± 13.1 %
3700	51.0	3.55	3.85	3.85	3.85	0.70	1.30	± 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.

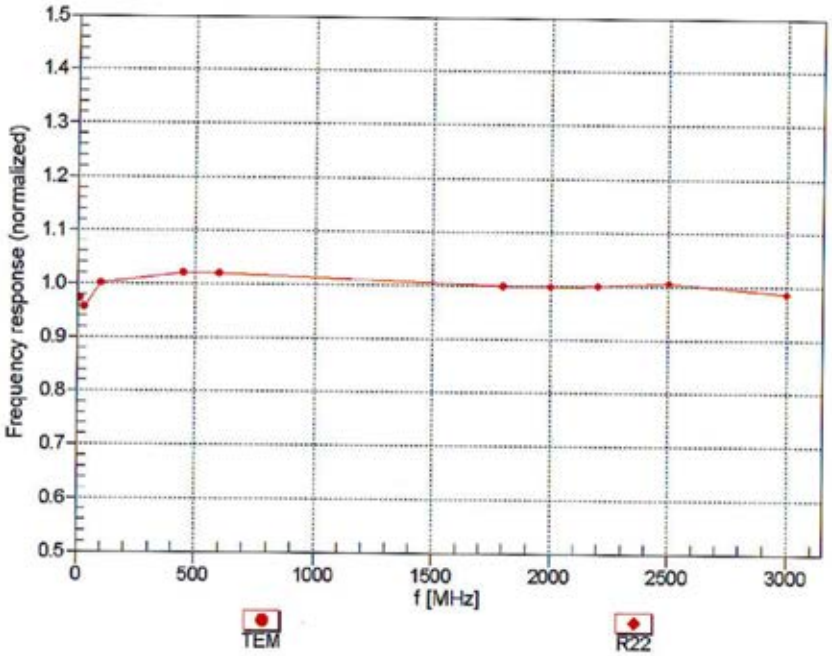
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF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

ES3DV3– SN:3122

April 18, 2018

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



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

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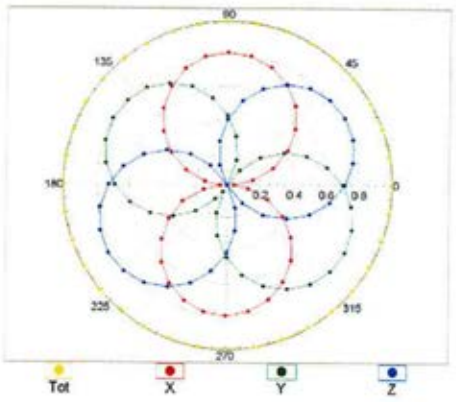
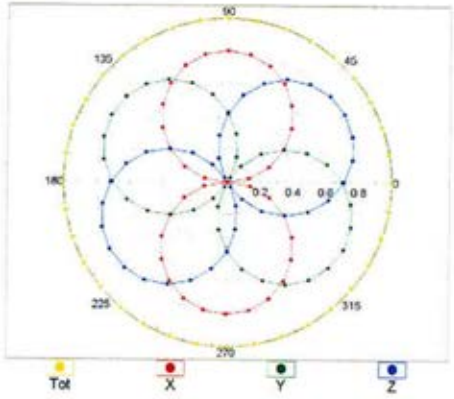
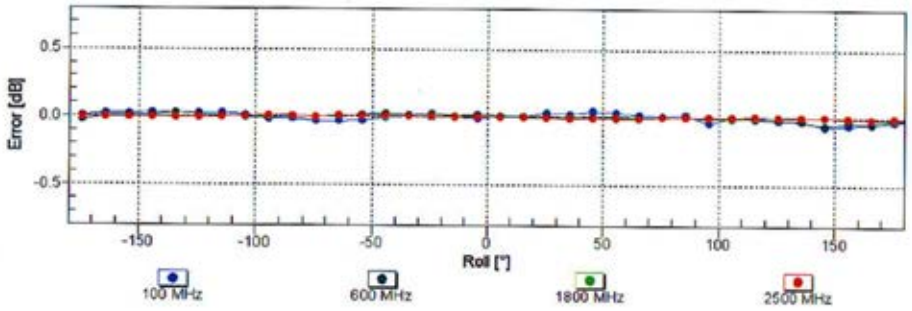
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22





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

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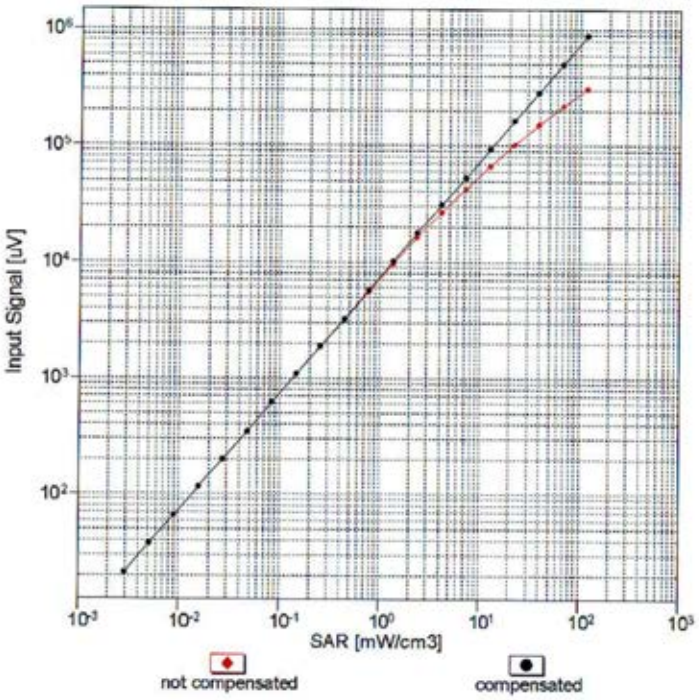
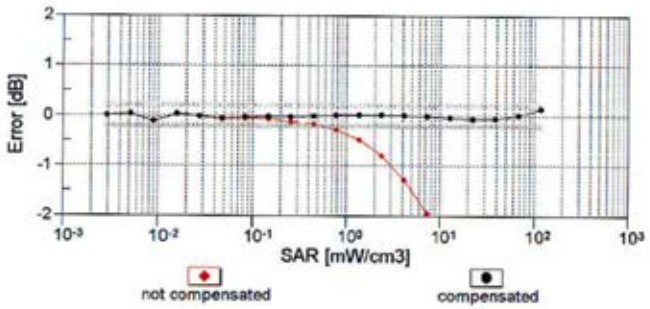
Dynamic Range f(SAR$_{head}$)
(TEM cell , f_{eval}= 1900 MHz)





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

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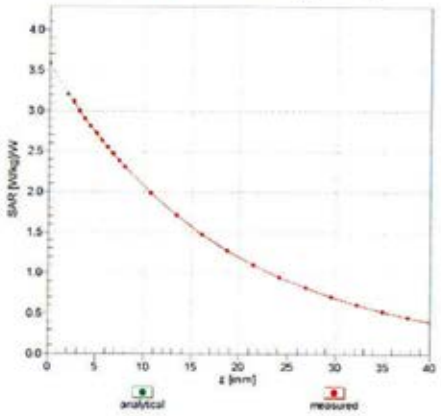
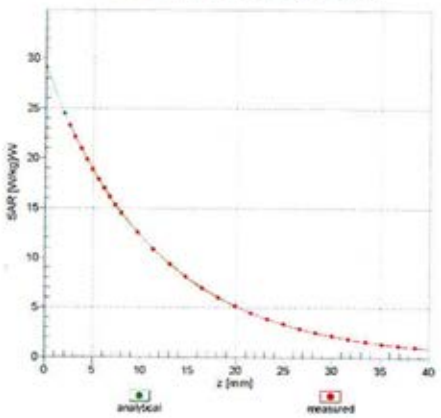
Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

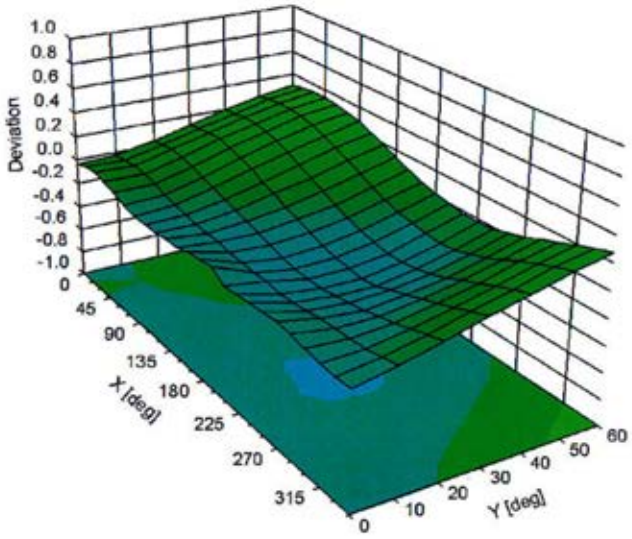


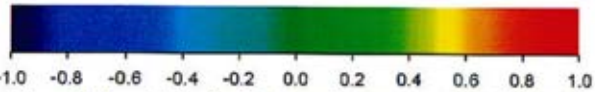
f = 1900 MHz,WGLS R22 (H_convF)



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:3122

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	25.7
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	212.2	±3.5 %
		Y	0.0	0.0	1.0		209.0	
		Z	0.0	0.0	1.0		170.3	
10011-CAB	UMTS-FDD (WCDMA)	X	2.98	64.8	17.0	2.91	126.1	±0.7 %
		Y	3.13	65.9	17.9		124.0	
		Z	3.15	66.2	18.0		136.1	
10097-CAB	UMTS-FDD (HSDPA)	X	4.38	65.4	17.7	3.98	134.3	±0.7 %
		Y	4.50	66.1	18.2		132.7	
		Z	4.48	66.2	18.3		145.2	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.34	65.2	17.5	3.98	134.1	±0.7 %
		Y	4.49	66.0	18.2		132.3	
		Z	4.50	66.3	18.3		145.2	
10100-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.27	67.0	19.3	5.67	140.9	±1.2 %
		Y	6.41	67.6	19.8		139.9	
		Z	5.90	65.7	18.8		108.7	
10101-CAD	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	6.87	65.7	18.9	6.42	106.2	±1.4 %
		Y	7.57	68.1	20.4		149.7	
		Z	7.03	66.4	19.4		115.6	
10108-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.22	66.8	19.4	5.80	138.9	±1.2 %
		Y	6.37	67.5	19.9		137.7	
		Z	5.89	65.6	18.8		107.6	
10109-CAE	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	7.24	67.4	19.9	6.43	148.0	±1.4 %
		Y	7.38	68.0	20.4		146.2	
		Z	6.83	66.2	19.3		113.4	
10110-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	5.97	66.4	19.2	5.75	136.1	±1.2 %
		Y	6.07	66.9	19.6		135.0	
		Z	6.07	67.0	19.7		147.6	
10111-CAE	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	7.04	67.2	19.8	6.44	145.2	±1.2 %
		Y	7.15	67.8	20.3		143.0	
		Z	6.63	66.0	19.3		110.9	
10117-CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.95	68.4	21.0	8.07	128.7	±1.9 %
		Y	10.18	69.0	21.5		127.3	
		Z	10.18	69.1	21.5		141.1	
10140-CAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	7.06	65.9	19.1	6.49	107.8	±1.2 %
		Y	7.20	66.4	19.5		105.6	
		Z	7.24	66.6	19.5		117.5	
10142-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	5.88	66.4	19.2	5.73	134.9	±1.2 %
		Y	5.92	66.7	19.5		132.9	
		Z	5.90	66.8	19.6		145.1	
10143-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	6.86	67.2	19.8	6.35	142.8	±1.2 %
		Y	6.92	67.6	20.2		140.2	
		Z	6.39	65.8	19.2		108.6	

10145-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	5.65	66.0	19.0	5.76	131.7	±0.9 %
		Y	5.68	66.4	19.4		129.3	
		Z	5.69	66.7	19.5		140.8	
10146-CAE	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	6.63	67.1	19.8	6.41	137.8	±1.2 %
		Y	6.68	67.6	20.2		134.4	
		Z	6.66	67.7	20.3		146.5	
10149-CAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	7.25	67.4	20.0	6.42	147.7	±1.4 %
		Y	7.35	67.9	20.4		145.9	
		Z	6.83	66.2	19.3		113.4	
10154-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.99	66.5	19.3	5.75	136.2	±1.2 %
		Y	6.07	66.9	19.6		134.5	
		Z	6.07	67.0	19.7		147.4	
10155-CAE	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	7.06	67.3	19.9	6.43	145.5	±1.4 %
		Y	7.14	67.7	20.3		142.7	
		Z	6.59	65.9	19.2		110.4	
10156-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	5.81	66.1	19.1	5.79	133.7	±1.2 %
		Y	5.87	66.5	19.5		131.2	
		Z	5.86	66.7	19.6		143.6	
10157-CAE	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	6.87	67.2	19.9	6.49	140.8	±1.2 %
		Y	6.94	67.7	20.4		138.5	
		Z	6.41	65.9	19.3		107.2	
10160-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.37	66.8	19.4	5.82	141.1	±1.2 %
		Y	6.51	67.4	19.9		139.7	
		Z	6.01	65.7	18.9		108.6	
10161-CAD	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	7.33	67.5	20.0	6.43	149.2	±1.4 %
		Y	7.44	68.0	20.4		147.2	
		Z	6.88	66.2	19.3		114.2	
10166-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	5.07	65.6	18.8	5.46	126.4	±0.9 %
		Y	5.09	66.0	19.1		124.0	
		Z	5.12	66.3	19.3		136.0	
10167-CAE	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	6.07	66.9	19.6	6.21	130.6	±1.2 %
		Y	6.12	67.4	20.1		127.4	
		Z	6.13	67.7	20.2		139.8	
10169-CAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.95	65.8	19.0	5.73	120.9	±0.9 %
		Y	5.02	66.5	19.6		118.9	
		Z	5.03	66.6	19.6		130.3	
10170-CAD	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	5.79	67.1	20.0	6.52	121.6	±1.2 %
		Y	5.87	67.7	20.5		118.9	
		Z	5.88	67.9	20.5		130.8	
10175-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.94	65.8	18.9	5.72	121.0	±0.9 %
		Y	5.03	66.5	19.5		118.8	
		Z	5.04	66.7	19.6		130.1	
10176-CAE	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	5.81	67.2	20.0	6.52	121.6	±1.2 %
		Y	5.88	67.8	20.6		118.6	
		Z	5.90	68.0	20.6		130.7	

10177-CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	4.97	65.9	19.0	5.73	121.3	±0.9 %
		Y	5.02	66.4	19.5		118.7	
		Z	5.04	66.7	19.6		130.4	
10178-CAE	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	5.82	67.2	20.0	6.52	121.9	±1.2 %
		Y	5.84	67.6	20.4		118.9	
		Z	5.91	68.0	20.6		131.0	
10181-CAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.94	65.7	18.9	5.72	121.0	±0.9 %
		Y	5.02	66.4	19.5		118.7	
		Z	5.06	66.8	19.7		130.4	
10182-CAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	5.80	67.1	19.9	6.52	121.6	±1.2 %
		Y	5.86	67.7	20.5		118.8	
		Z	5.91	68.0	20.6		130.8	
10184-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	4.96	65.9	19.0	5.73	121.0	±0.9 %
		Y	5.03	66.5	19.6		118.7	
		Z	5.03	66.6	19.6		130.0	
10185-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	5.80	67.1	20.0	6.51	121.5	±1.2 %
		Y	5.88	67.8	20.5		118.7	
		Z	5.92	68.1	20.7		130.9	
10187-CAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	4.95	65.8	18.9	5.73	120.9	±0.9 %
		Y	5.03	66.4	19.5		119.0	
		Z	5.02	66.5	19.5		130.1	
10188-CAE	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	5.81	67.1	20.0	6.52	121.6	±1.2 %
		Y	5.87	67.7	20.5		118.9	
		Z	5.91	68.0	20.6		131.0	
10196-CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.69	68.1	20.9	8.10	124.2	±1.9 %
		Y	9.87	68.7	21.5		122.8	
		Z	9.88	68.9	21.5		136.4	
10225-CAB	UMTS-FDD (HSPA+)	X	6.58	65.3	18.5	5.97	107.4	±1.2 %
		Y	6.57	65.5	18.7		104.1	
		Z	6.70	66.1	19.0		116.2	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	5.90	66.4	18.6	4.87	146.3	±0.9 %
		Y	6.00	66.9	19.0		144.2	
		Z	5.62	65.8	18.3		112.0	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.25	65.6	18.0	3.96	130.0	±0.7 %
		Y	4.34	66.2	18.5		128.8	
		Z	4.37	66.5	18.6		140.4	
10297-AAC	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.29	67.1	19.6	5.81	138.4	±1.2 %
		Y	6.38	67.4	19.9		137.2	
		Z	5.90	65.7	18.9		106.8	
10298-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	5.72	66.2	19.1	5.72	132.5	±1.2 %
		Y	5.78	66.7	19.6		130.4	
		Z	5.74	66.7	19.6		142.0	
10299-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	6.73	67.1	19.8	6.39	139.4	±1.2 %
		Y	6.79	67.7	20.3		136.6	
		Z	6.79	67.9	20.4		149.1	

10311-AAC	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.77	67.4	19.8	6.06	143.5	±1.2 %
		Y	6.94	68.0	20.3		142.6	
		Z	6.39	66.2	19.2		110.2	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.33	65.6	17.0	1.54	129.1	±0.5 %
		Y	2.47	66.6	17.8		127.4	
		Z	2.44	66.8	17.9		139.9	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.79	68.3	21.2	8.23	125.1	±1.9 %
		Y	10.02	69.0	21.7		122.7	
		Z	9.95	68.9	21.6		136.4	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	9.68	68.3	21.1	8.14	124.1	±1.7 %
		Y	9.88	68.9	21.6		121.6	
		Z	9.84	68.9	21.5		135.2	
10430-AAB	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	X	9.17	67.9	21.0	8.28	114.8	±1.7 %
		Y	9.27	68.5	21.6		111.7	
		Z	9.24	68.6	21.6		123.3	
10431-AAB	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	X	9.64	68.2	21.2	8.38	120.8	±1.9 %
		Y	9.80	68.8	21.7		118.2	
		Z	9.78	68.9	21.7		131.0	
10432-AAB	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	X	9.81	68.3	21.2	8.34	123.7	±1.9 %
		Y	10.05	69.1	21.9		121.5	
		Z	9.98	69.0	21.7		135.3	
10433-AAB	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	X	9.99	68.5	21.3	8.34	126.5	±1.9 %
		Y	10.26	69.3	21.9		124.6	
		Z	10.17	69.2	21.8		137.9	
10435-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.10	71.6	23.1	7.82	112.9	±1.9 %
		Y	7.32	72.6	23.9		111.3	
		Z	7.64	73.9	24.5		123.1	
10457-AAA	UMTS-FDD (DC-HSDPA)	X	7.93	66.1	19.2	6.62	119.3	±1.4 %
		Y	8.08	66.6	19.6		118.1	
		Z	8.09	66.7	19.6		130.5	
10460-AAA	UMTS-FDD (WCDMA, AMR)	X	2.62	65.9	17.6	2.39	123.9	±0.5 %
		Y	2.76	66.9	18.4		122.0	
		Z	2.79	67.5	18.7		134.0	
10461-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.13	71.6	23.1	7.82	113.1	±1.9 %
		Y	7.43	73.0	24.1		111.8	
		Z	7.64	73.8	24.4		122.7	
10462-AAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.65	72.3	23.7	8.30	112.2	±2.2 %
		Y	7.95	73.7	24.7		111.2	
		Z	8.26	74.9	25.2		122.1	
10464-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.11	71.6	23.1	7.82	112.9	±1.9 %
		Y	7.35	72.7	23.9		111.4	
		Z	7.58	73.6	24.3		122.6	

10465-AAA	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.68	72.4	23.8	8.32	111.9	±1.9 %
		Y	7.92	73.6	24.6		111.2	
		Z	8.26	74.8	25.1		122.0	
10467-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.15	71.7	23.2	7.82	112.9	±1.9 %
		Y	7.43	73.0	24.1		111.0	
		Z	7.66	73.9	24.5		122.9	
10468-AAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.68	72.4	23.8	8.32	112.4	±1.9 %
		Y	7.93	73.6	24.7		110.9	
		Z	8.22	74.7	25.1		121.8	
10470-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.09	71.5	23.1	7.82	112.7	±1.9 %
		Y	7.34	72.7	23.9		111.2	
		Z	7.62	73.7	24.4		122.5	
10471-AAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.67	72.4	23.8	8.32	112.3	±2.2 %
		Y	7.88	73.4	24.5		110.9	
		Z	8.24	74.7	25.1		122.2	
10473-AAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.12	71.6	23.2	7.82	112.9	±1.9 %
		Y	7.37	72.8	24.0		111.2	
		Z	7.60	73.7	24.4		122.6	
10474-AAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.73	72.6	23.9	8.32	112.4	±1.9 %
		Y	7.87	73.4	24.6		111.0	
		Z	8.21	74.6	25.0		121.8	
10477-AAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	7.64	72.3	23.7	8.32	111.8	±2.2 %
		Y	7.90	73.5	24.6		111.1	
		Z	8.18	74.6	25.0		121.9	
10479-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.45	71.3	22.9	7.74	120.3	±2.2 %
		Y	7.66	72.3	23.7		118.0	
		Z	7.88	73.2	24.1		129.9	
10480-AAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.25	72.2	23.6	8.18	123.2	±2.2 %
		Y	8.45	73.3	24.4		120.5	
		Z	8.67	74.1	24.7		133.0	
10482-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.03	71.7	23.1	7.71	127.5	±2.2 %
		Y	8.19	72.5	23.7		125.5	
		Z	8.42	73.5	24.2		138.2	
10483-AAA	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.13	72.6	23.9	8.39	134.8	±2.7 %
		Y	9.37	73.7	24.7		132.1	
		Z	9.59	74.6	25.1		146.2	
10485-AAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.00	71.7	22.9	7.59	129.1	±2.2 %
		Y	8.29	72.8	23.8		127.4	
		Z	8.44	73.5	24.1		140.5	
10486-AAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.23	72.6	23.9	8.38	137.5	±2.7 %
		Y	9.54	73.8	24.8		135.8	
		Z	9.69	74.4	25.0		149.2	
10488-AAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.43	72.1	23.2	7.70	133.5	±2.5 %
		Y	8.75	73.3	24.1		131.7	
		Z	8.90	73.8	24.3		146.1	

10489-AAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.50	72.7	23.9	8.31	143.4	±2.7 %
		Y	9.76	73.6	24.6		141.5	
		Z	8.33	69.4	22.2		106.1	
10491-AAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.89	72.5	23.4	7.74	138.5	±2.5 %
		Y	9.25	73.7	24.2		138.1	
		Z	7.77	69.3	21.8		103.9	
10492-AAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.48	68.5	21.6	8.41	101.7	±2.2 %
		Y	10.41	74.3	25.0		148.8	
		Z	8.85	69.9	22.5		111.1	
10494-AAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.83	72.6	23.4	7.74	137.3	±2.5 %
		Y	9.23	73.8	24.3		136.5	
		Z	7.73	69.3	21.8		102.7	
10495-AAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.90	73.0	24.1	8.37	148.8	±3.0 %
		Y	10.25	74.1	24.9		147.7	
		Z	8.73	69.8	22.4		110.1	
10497-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	7.88	71.5	22.9	7.67	126.6	±2.2 %
		Y	8.14	72.7	23.8		124.7	
		Z	8.32	73.5	24.1		137.7	
10498-AAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.98	72.6	23.9	8.40	132.5	±2.7 %
		Y	9.18	73.5	24.6		129.8	
		Z	9.41	74.4	25.0		143.5	
10500-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.22	71.9	23.1	7.67	131.3	±2.2 %
		Y	8.51	73.0	24.0		129.2	
		Z	8.66	73.7	24.2		142.6	
10501-AAA	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.44	72.7	24.0	8.44	140.1	±2.7 %
		Y	9.70	73.7	24.8		137.6	
		Z	8.19	69.2	22.2		103.6	
10503-AAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.41	72.0	23.2	7.72	133.4	±2.5 %
		Y	8.78	73.3	24.1		132.4	
		Z	8.93	73.9	24.3		146.1	
10504-AAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.47	72.6	23.8	8.31	143.3	±2.7 %
		Y	9.78	73.7	24.7		141.4	
		Z	8.34	69.4	22.2		106.3	
10506-AAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	8.81	72.5	23.4	7.74	137.6	±2.2 %
		Y	9.27	74.0	24.4		136.6	
		Z	7.75	69.4	21.9		102.8	
10507-AAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	9.84	72.8	24.0	8.36	148.2	±2.7 %
		Y	10.25	74.1	24.9		147.3	
		Z	8.73	69.7	22.3		110.1	
10509-AAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	9.51	73.2	23.8	7.99	144.0	±2.5 %
		Y	10.02	74.6	24.8		143.6	
		Z	8.39	69.9	22.2		107.5	

10510-AAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.90	69.0	21.8	8.49	104.8	±1.9 %
		Y	9.29	70.1	22.6		104.4	
		Z	9.32	70.3	22.7		115.7	
10512-AAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	X	9.20	73.1	23.6	7.74	141.4	±2.2 %
		Y	9.71	74.6	24.5		140.9	
		Z	8.12	70.0	22.1		105.9	
10513-AAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	X	8.75	68.9	21.8	8.42	103.2	±1.9 %
		Y	9.18	70.2	22.7		102.7	
		Z	9.18	70.3	22.7		114.3	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	2.40	66.0	17.2	1.58	129.3	±0.5 %
		Y	2.48	66.6	17.8		128.1	
		Z	2.48	67.0	18.0		140.0	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	9.86	68.4	21.2	8.25	124.9	±1.9 %
		Y	10.07	69.1	21.7		122.7	
		Z	10.05	69.1	21.7		136.5	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	3.14	68.9	18.5	1.99	129.3	±0.7 %
		Y	3.26	69.5	19.1		127.8	
		Z	3.46	71.1	19.7		140.3	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	3.02	68.2	18.2	1.99	128.8	±0.5 %
		Y	3.29	69.8	19.2		127.7	
		Z	3.48	71.2	19.7		139.7	
10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	10.24	69.0	21.7	8.59	125.8	±2.2 %
		Y	10.50	69.8	22.3		123.8	
		Z	10.46	69.7	22.3		137.2	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	10.24	69.0	21.7	8.60	125.5	±2.2 %
		Y	10.55	69.9	22.4		123.8	
		Z	10.47	69.8	22.3		136.8	
10591-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	10.36	69.0	21.8	8.63	127.3	±3.0 %
		Y	10.67	69.9	22.5		125.9	
		Z	10.57	69.8	22.3		138.9	
10592-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	10.54	69.3	22.0	8.79	127.5	±3.3 %
		Y	10.87	70.2	22.7		126.3	
		Z	10.80	70.1	22.6		140.1	
10599-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	10.88	69.6	22.1	8.79	132.3	±2.2 %
		Y	11.27	70.6	22.8		131.4	
		Z	11.17	70.4	22.7		145.6	
10600-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	10.98	69.7	22.2	8.88	132.5	±3.5 %
		Y	11.36	70.7	22.9		131.7	
		Z	11.27	70.6	22.8		146.1	

[6] 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 Solutions MY** Certificate No: **EX3-7486_Mar18/2**

CALIBRATION CERTIFICATE (Replacement of No:EX3-7486_Mar18)

Object EX3DV4 - SN:7486

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 20, 2018

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	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
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-17)	In house check: Oct-18

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

Issued: April 13, 2018

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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, *, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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 E²-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:7486

Manufactured: March 20, 2017
Calibrated: March 20, 2018

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7486

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)²)[A]	0.37	0.47	0.49	± 10.1 %
DCP (mV)[B]	101.3	90.6	100.1	

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	134.1	±3.0 %
		Y	0.0	0.0	1.0		129.8	
		Z	0.0	0.0	1.0		135.9	

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 E²-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7486

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	13.66	13.66	13.66	0.00	1.00	± 13.3 %
300	45.3	0.87	12.30	12.30	12.30	0.08	1.20	± 13.3 %
450	43.5	0.87	11.43	11.43	11.43	0.14	1.30	± 13.3 %
750	41.9	0.89	10.72	10.72	10.72	0.34	0.99	± 12.0 %
835	41.5	0.90	10.29	10.29	10.29	0.44	0.80	± 12.0 %
900	41.5	0.97	10.11	10.11	10.11	0.24	1.21	± 12.0 %
1450	40.5	1.20	9.06	9.06	9.06	0.36	0.80	± 12.0 %
1810	40.0	1.40	8.66	8.66	8.66	0.40	0.80	± 12.0 %
1900	40.0	1.40	8.32	8.32	8.32	0.28	0.85	± 12.0 %
2100	39.8	1.49	8.67	8.67	8.67	0.33	0.85	± 12.0 %
2300	39.5	1.67	8.06	8.06	8.06	0.30	0.80	± 12.0 %
2450	39.2	1.80	7.72	7.72	7.72	0.36	0.87	± 12.0 %
2600	39.0	1.96	7.42	7.42	7.42	0.36	0.84	± 12.0 %
4950	36.3	4.40	5.98	5.98	5.98	0.35	1.80	± 13.1 %
5250	35.9	4.71	5.61	5.61	5.61	0.40	1.80	± 13.1 %
5500	35.6	4.96	5.15	5.15	5.15	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.93	4.93	4.93	0.40	1.80	± 13.1 %
5750	35.4	5.22	5.13	5.13	5.13	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:7486

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	13.10	13.10	13.10	0.00	1.00	± 13.3 %
300	58.2	0.92	12.07	12.07	12.07	0.05	1.20	± 13.3 %
450	56.7	0.94	11.68	11.68	11.68	0.09	1.30	± 13.3 %
750	55.5	0.96	10.35	10.35	10.35	0.55	0.80	± 12.0 %
835	55.2	0.97	9.98	9.98	9.98	0.59	0.80	± 12.0 %
900	55.0	1.05	9.94	9.94	9.94	0.41	0.91	± 12.0 %
1450	54.0	1.30	8.98	8.98	8.98	0.34	0.80	± 12.0 %
1810	53.3	1.52	8.42	8.42	8.42	0.39	0.80	± 12.0 %
1900	53.3	1.52	8.30	8.30	8.30	0.38	0.85	± 12.0 %
2100	53.2	1.62	8.60	8.60	8.60	0.34	0.89	± 12.0 %
2300	52.9	1.81	7.85	7.85	7.85	0.41	0.80	± 12.0 %
2450	52.7	1.95	7.77	7.77	7.77	0.38	0.80	± 12.0 %
2600	52.5	2.16	7.49	7.49	7.49	0.36	0.80	± 12.0 %
4950	49.4	5.01	5.16	5.16	5.16	0.45	1.90	± 13.1 %
5250	48.9	5.36	4.77	4.77	4.77	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.27	4.27	4.27	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.11	4.11	4.11	0.50	1.90	± 13.1 %
5750	48.3	5.94	4.27	4.27	4.27	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.

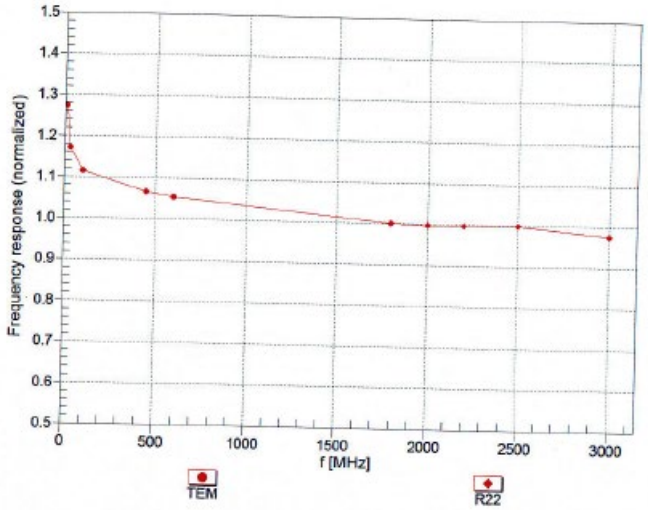
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF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

EX3DV4- SN:7486

March 20, 2018

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



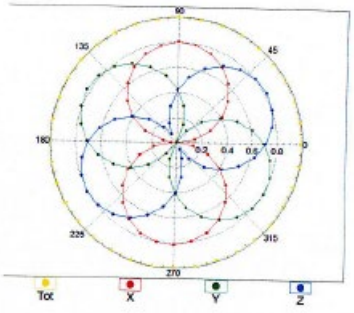
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

EX3DV4– SN:7486

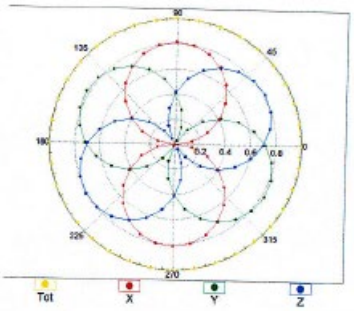
March 20, 2018

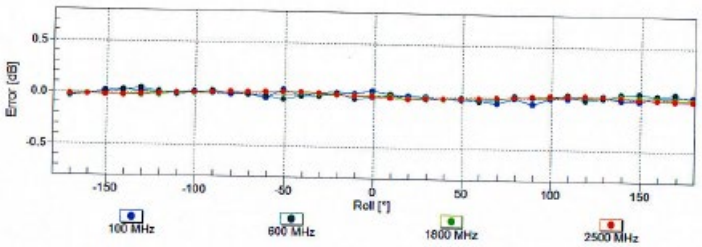
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22





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

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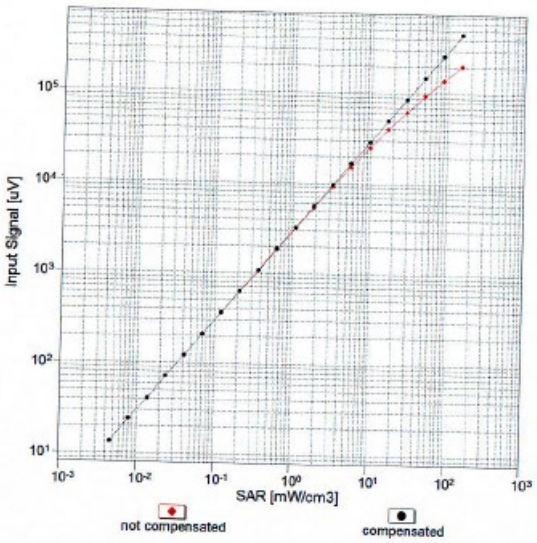
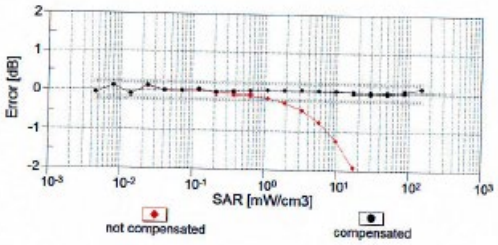
Dynamic Range f(SAR$_{head}$)

(TEM cell , f_{eval}= 1900 MHz)





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

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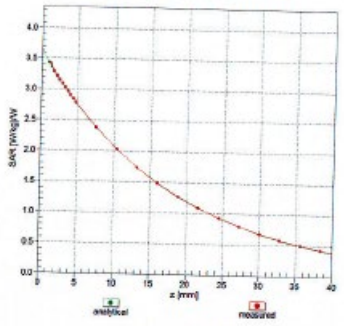
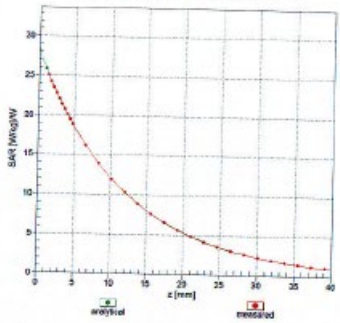
Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

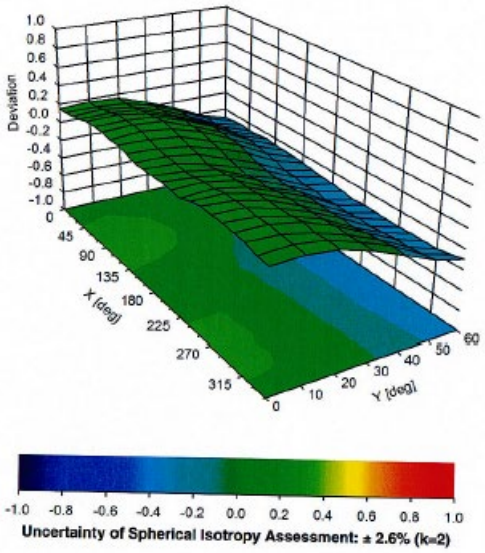


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:7486

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	19.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Appendix: 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	134.1	±3.0 %
		Y	0.0	0.0	1.0		129.8	
		Z	0.0	0.0	1.0		135.9	
10021-DAC	GSM-FDD (TDMA, GMSK)	X	1.23	59.7	9.5	9.39	79.8	±1.9 %
		Y	1.64	64.6	12.9		66.6	
		Z	1.58	63.0	11.5		93.7	
10023-DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	1.31	60.4	9.9	9.57	77.2	±1.9 %
		Y	1.71	65.2	13.1		64.2	
		Z	1.56	62.3	11.3		90.7	
10024-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	1.32	63.4	10.1	6.56	147.2	±2.2 %
		Y	3.32	76.5	16.6		132.6	
		Z	1.43	64.4	11.2		144.8	
10025-DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	4.76	70.7	24.3	12.62	56.7	±1.7 %
		Y	4.37	68.2	23.8		47.2	
		Z	5.41	74.8	27.1		66.8	
10026-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	4.29	70.7	22.6	9.55	116.8	±1.7 %
		Y	3.95	68.2	21.8		96.1	
		Z	4.86	73.8	24.5		138.6	
10027-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	0.96	62.2	8.9	4.80	135.3	±1.9 %
		Y	1.12	65.3	11.3		141.0	
		Z	1.05	62.3	8.7		139.1	
10028-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	0.53	58.4	6.0	3.55	131.7	±1.7 %
		Y	0.86	63.5	9.5		144.8	
		Z	38.88	97.7	19.9		135.9	
10029-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	4.31	72.6	22.6	7.78	146.7	±1.7 %
		Y	4.25	72.0	23.1		136.1	
		Z	4.88	75.6	24.5		136.8	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.48	66.3	18.5	4.57	141.8	±0.9 %
		Y	4.50	65.6	18.5		138.4	
		Z	4.67	67.2	19.2		145.8	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	3.77	67.7	22.6	11.01	82.1	±1.4 %
		Y	3.60	66.5	22.7		68.6	
		Z	4.07	69.7	24.1		97.1	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	4.28	73.6	22.5	6.52	149.5	±1.7 %
		Y	3.96	71.2	21.9		142.7	
		Z	4.54	74.9	23.5		134.9	
10061-CAB	CDMA2000 (1xRTT, RC3)	X	3.87	66.3	18.4	3.97	138.9	±0.7 %
		Y	3.84	65.5	18.4		135.4	
		Z	3.99	67.0	19.0		142.5	
10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	1.19	61.8	8.9	6.56	145.6	±1.9 %
		Y	1.75	67.1	11.8		131.7	
		Z	1.37	63.4	10.2		149.5	

CAC	BPSK)	X	9.44	68.1	20.8	8.10	137.7	±3.0 %
		Y	9.52	67.8	21.0		135.6	
		Z	9.63	68.5	21.3		142.3	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	4.09	66.9	18.5	3.91	142.6	±0.7 %
		Y	4.05	66.1	18.5		139.2	
		Z	4.31	68.0	19.3		145.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.58	67.0	18.5	3.48	138.6	±0.7 %
		Y	3.52	66.1	18.5		135.6	
		Z	3.76	68.0	19.3		142.5	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.55	67.1	18.5	3.39	138.8	±0.7 %
		Y	3.45	66.0	18.3		135.3	
		Z	3.72	68.2	19.3		142.1	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	3.59	66.8	18.4	3.50	139.1	±0.7 %
		Y	3.53	65.9	18.3		135.3	
		Z	3.75	67.9	19.2		142.1	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	4.79	64.7	22.2	12.49	67.0	±0.9 %
		Y	4.55	62.7	21.6		55.7	
		Z	5.09	66.2	23.5		79.2	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.94	70.5	19.4	3.76	143.1	±0.5 %
		Y	4.58	67.9	18.5		142.3	
		Z	5.28	71.7	20.3		147.5	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.99	71.0	19.7	3.77	142.4	±0.7 %
		Y	4.85	68.7	19.0		140.8	
		Z	5.22	71.9	20.4		146.7	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	6.06	70.3	20.2	5.22	144.0	±0.9 %
		Y	6.09	69.1	20.0		144.9	
		Z	6.35	71.1	20.9		126.5	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.84	68.7	18.4	1.54	147.1	±0.7 %
		Y	2.69	67.9	18.5		142.7	
		Z	3.42	72.6	20.5		127.9	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.55	68.1	21.0	8.23	138.3	±3.0 %
		Y	9.63	67.9	21.1		135.2	
		Z	9.74	68.6	21.4		143.3	
10417-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	9.55	68.1	21.0	8.23	138.6	±3.0 %
		Y	9.57	67.7	21.0		135.1	
		Z	9.75	68.7	21.5		142.9	

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10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	9.42	68.1	20.9	8.14	137.4	±2.7 %
		Y	9.48	67.8	21.1		133.4	
		Z	9.60	68.6	21.4		142.1	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	8.00	69.1	20.4	6.55	146.0	±1.4 %
		Y	8.03	68.3	20.3		145.6	
		Z	7.90	68.7	20.4		126.9	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	10.44	70.1	21.8	8.25	142.9	±3.0 %
		Y	10.66	69.7	21.9		145.3	
		Z	10.16	69.1	21.5		125.4	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	2.80	68.5	18.3	1.58	146.7	±0.7 %
		Y	2.68	67.7	18.4		142.1	
		Z	3.39	72.6	20.6		127.7	
10518-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	9.54	68.2	21.0	8.23	137.2	±2.7 %
		Y	9.60	67.9	21.1		134.4	
		Z	9.73	68.7	21.4		142.6	
10525-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	9.75	68.3	21.1	8.36	139.0	±3.0 %
		Y	9.84	68.1	21.3		136.8	
		Z	9.97	68.9	21.6		144.9	
10526-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	9.83	68.4	21.2	8.42	139.8	±3.0 %
		Y	9.87	68.1	21.3		136.8	
		Z	10.02	68.9	21.7		145.1	
10534-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	10.28	68.7	21.3	8.45	147.5	±3.3 %
		Y	10.29	68.4	21.4		142.9	
		Z	10.10	68.2	21.2		126.2	
10535-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	10.28	68.7	21.3	8.45	147.1	±3.3 %
		Y	10.31	68.5	21.5		143.9	
		Z	10.06	68.1	21.1		126.4	
10544-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	10.17	67.8	20.6	8.47	126.6	±3.0 %
		Y	10.49	68.4	21.3		147.4	
		Z	10.41	68.4	21.2		131.6	
10545-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	10.26	68.0	20.8	8.55	126.9	±3.0 %
		Y	10.58	68.5	21.4		147.6	
		Z	10.47	68.5	21.2		131.4	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	9.59	68.3	21.1	8.25	138.4	±3.0 %
		Y	9.65	68.0	21.2		135.3	
		Z	9.77	68.7	21.5		143.3	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	2.92	68.6	18.8	1.99	142.6	±0.9 %
		Y	2.91	68.8	19.2		138.5	
		Z	3.22	71.0	20.0		146.2	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	2.98	69.3	18.9	1.99	142.2	±0.7 %
		Y	2.73	67.6	18.5		137.3	
		Z	3.32	71.8	20.4		146.3	

10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	9.66	68.2	21.3	8.59	135.0	±3.0 %
		Y	9.71	67.9	21.3		131.3	
		Z	9.86	68.7	21.7		140.0	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	9.65	68.2	21.3	8.60	134.6	±3.0 %
		Y	9.72	68.0	21.4		130.7	
		Z	9.86	68.7	21.7		140.0	
10583-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	9.65	68.2	21.2	8.59	135.2	±3.0 %
		Y	9.73	68.0	21.4		131.7	
		Z	9.86	68.8	21.8		140.4	
10584-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	9.68	68.3	21.3	8.60	134.7	±3.0 %
		Y	9.70	67.9	21.4		131.0	
		Z	9.87	68.8	21.8		139.9	
10591-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	9.78	68.2	21.3	8.63	136.5	±3.3 %
		Y	9.77	67.8	21.3		132.6	
		Z	9.96	68.8	21.7		141.9	
10592-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	9.93	68.4	21.5	8.79	137.0	±3.3 %
		Y	9.95	68.0	21.5		132.6	
		Z	10.14	68.9	21.9		142.4	
10599-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	10.39	68.7	21.6	8.79	144.8	±3.3 %
		Y	10.30	68.2	21.6		138.5	
		Z	10.20	68.2	21.4		124.8	
10600-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	10.45	68.8	21.6	8.66	144.7	±3.5 %
		Y	10.43	68.4	21.7		139.6	
		Z	10.26	68.3	21.5		124.7	
10607-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	9.79	68.2	21.3	8.64	136.8	±3.0 %
		Y	9.85	67.9	21.4		133.4	
		Z	10.02	68.9	21.8		142.3	
10608-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	9.93	68.4	21.5	8.77	136.9	±3.3 %
		Y	9.99	68.1	21.6		132.2	
		Z	10.15	69.0	22.0		142.6	
10616-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	10.42	68.8	21.6	8.82	144.9	±3.3 %
		Y	10.38	68.3	21.6		139.5	
		Z	10.24	68.3	21.5		124.8	
10617-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	10.39	68.7	21.5	8.81	144.8	±3.5 %
		Y	10.40	68.4	21.7		139.7	
		Z	10.20	68.2	21.4		124.6	
10626-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	10.30	67.8	20.9	8.83	124.0	±3.0 %
		Y	10.61	68.4	21.5		143.7	
		Z	10.54	68.5	21.4		129.7	
10627-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	10.35	67.9	21.0	8.88	124.1	±3.0 %
		Y	10.68	68.6	21.7		144.0	
		Z	10.58	68.5	21.5		129.5	

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10648-AAA	CDMA2000 (1x Advanced)	X	3.62	67.2	18.6	3.45	139.5	±0.7 %
		Y	3.49	66.1	18.5		135.6	
		Z	3.75	68.1	19.4		143.0	

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

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

S Schweizerischer Kalibrierdienst
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Swiss Calibration Service

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

Accreditation No.: SCS 0108

Client **Motorola Solutions MY** Certificate No: **EX3-7364_Jan18**

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:7364

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

Calibration date: January 17, 2018 * 1 yr cal

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	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
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-17)	In house check: Oct-18

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

Issued: January 17, 2018

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

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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, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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:7364

Manufactured: February 5, 2015
Calibrated: January 17, 2018

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.42	0.45	0.57	± 10.1 %
DCP (mV)[B]	100.4	100.7	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	193.4	±3.3 %
		Y	0.0	0.0	1.0		181.2	
		Z	0.0	0.0	1.0		175.4	

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:7364

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	13.60	13.60	13.60	0.00	1.00	± 13.3 %
300	45.3	0.87	12.21	12.21	12.21	0.08	1.20	± 13.3 %
450	43.5	0.87	11.17	11.17	11.17	0.13	1.20	± 13.3 %
750	41.9	0.89	10.73	10.73	10.73	0.40	0.88	± 12.0 %
835	41.5	0.90	10.42	10.42	10.42	0.52	0.80	± 12.0 %
900	41.5	0.97	10.16	10.16	10.16	0.52	0.80	± 12.0 %
1450	40.5	1.20	9.19	9.19	9.19	0.34	0.80	± 12.0 %
1810	40.0	1.40	8.74	8.74	8.74	0.41	0.80	± 12.0 %
1900	40.0	1.40	8.57	8.57	8.57	0.34	0.80	± 12.0 %
2100	39.8	1.49	8.72	8.72	8.72	0.35	0.80	± 12.0 %
2300	39.5	1.67	8.06	8.06	8.06	0.32	0.82	± 12.0 %
2450	39.2	1.80	7.71	7.71	7.71	0.41	0.80	± 12.0 %
2600	39.0	1.96	7.48	7.48	7.48	0.45	0.80	± 12.0 %
4950	36.3	4.40	5.72	5.72	5.72	0.35	1.80	± 13.1 %
5250	35.9	4.71	5.50	5.50	5.50	0.35	1.80	± 13.1 %
5500	35.6	4.96	5.09	5.09	5.09	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.84	4.84	4.84	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.95	4.95	4.95	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:7364

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	13.02	13.02	13.02	0.00	1.00	± 13.3 %
300	58.2	0.92	12.20	12.20	12.20	0.04	1.10	± 13.3 %
450	56.7	0.94	11.51	11.51	11.51	0.06	1.10	± 13.3 %
750	55.5	0.96	10.91	10.91	10.91	0.10	0.80	± 12.0 %
835	55.2	0.97	10.16	10.16	10.16	0.42	0.80	± 12.0 %
900	55.0	1.05	10.04	10.04	10.04	0.51	0.80	± 12.0 %
1450	54.0	1.30	8.89	8.89	8.89	0.34	0.80	± 12.0 %
1810	53.3	1.52	8.06	8.06	8.06	0.45	0.80	± 12.0 %
1900	53.3	1.52	8.08	8.08	8.08	0.37	0.80	± 12.0 %
2100	53.2	1.62	8.60	8.60	8.60	0.36	0.93	± 12.0 %
2300	52.9	1.81	7.93	7.93	7.93	0.41	0.80	± 12.0 %
2450	52.7	1.95	7.71	7.71	7.71	0.33	0.80	± 12.0 %
2600	52.5	2.16	7.51	7.51	7.51	0.28	0.80	± 12.0 %
4950	49.4	5.01	5.05	5.05	5.05	0.40	1.90	± 13.1 %
5250	48.9	5.36	4.94	4.94	4.94	0.35	1.90	± 13.1 %
5500	48.6	5.65	4.42	4.42	4.42	0.40	1.90	± 13.1 %
5600	48.5	5.77	4.22	4.22	4.22	0.40	1.90	± 13.1 %
5750	48.3	5.94	4.54	4.54	4.54	0.40	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.

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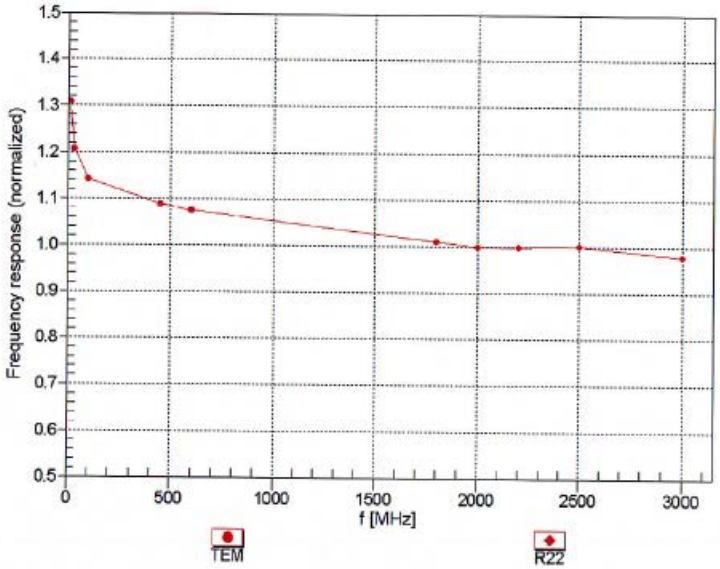
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

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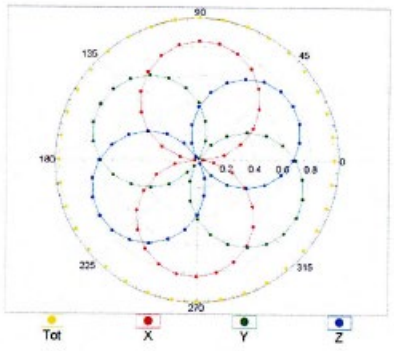
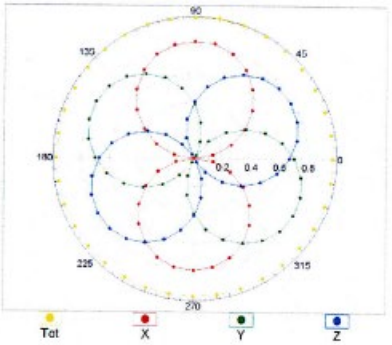
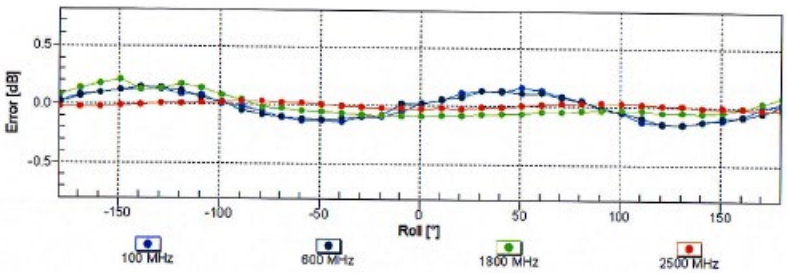
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22





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

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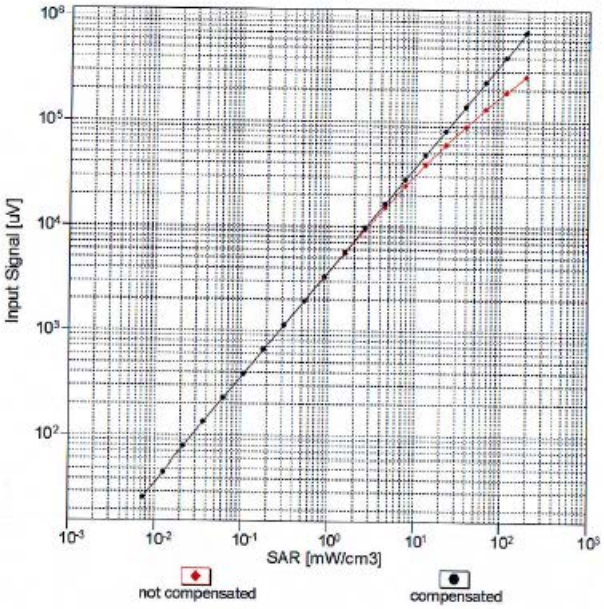
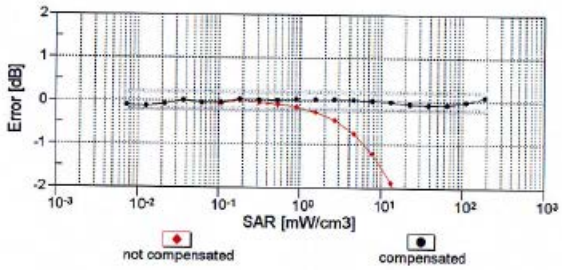
Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)





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

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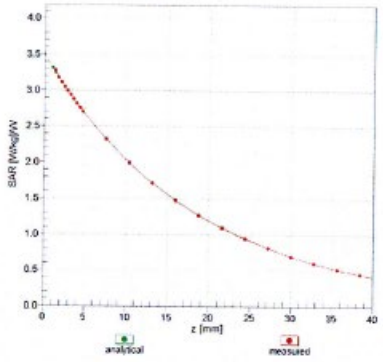
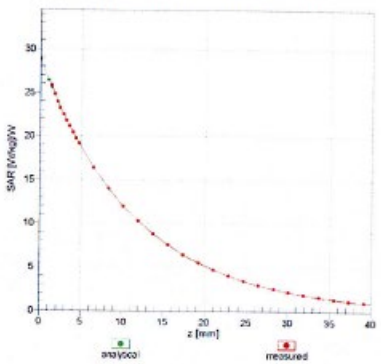
Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

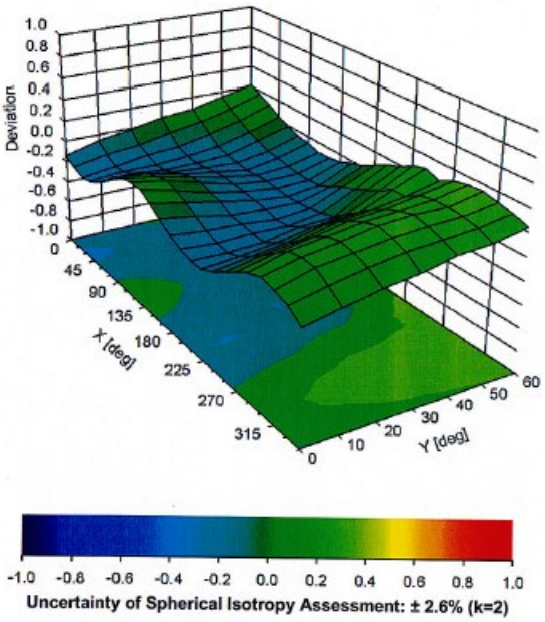


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	130.8
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

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	193.4	±3.3 %
		Y	0.0	0.0	1.0		181.2	
		Z	0.0	0.0	1.0		175.4	
10021-DAC	GSM-FDD (TDMA, GMSK)	X	1.77	63.4	11.3	9.39	100.1	±1.4 %
		Y	1.68	63.9	11.8		69.8	
		Z	2.22	66.1	13.5		108.1	
10023-DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	1.76	63.2	11.5	9.57	97.3	±1.9 %
		Y	1.75	64.0	11.9		68.1	
		Z	2.18	65.9	13.5		104.1	
10024-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	1.73	65.2	10.9	6.56	139.4	±1.9 %
		Y	3.79	77.3	16.6		140.0	
		Z	2.21	67.8	12.6		149.9	
10025-DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	5.16	72.6	26.0	12.62	71.3	±2.5 %
		Y	4.79	70.1	24.4		49.8	
		Z	5.91	75.8	27.7		76.4	
10026-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	4.81	72.7	23.8	9.55	145.5	±2.2 %
		Y	4.23	69.9	22.7		101.8	
		Z	5.53	75.9	25.6		144.0	
10027-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	1.20	65.8	10.8	4.80	141.1	±2.2 %
		Y	2.42	73.2	14.2		149.7	
		Z	1.66	66.5	11.4		138.4	
10028-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	1.19	67.6	11.3	3.55	131.1	±2.2 %
		Y	27.05	99.7	21.5		131.6	
		Z	50.28	96.5	19.0		133.1	
10029-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	2.94	64.5	14.5	7.78	132.6	±1.7 %
		Y	4.27	71.7	22.7		142.8	
		Z	5.94	79.1	26.2		138.5	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	3.38	61.4	13.3	4.57	142.1	±2.5 %
		Y	4.62	66.5	19.0		144.1	
		Z	4.88	67.7	19.6		142.0	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	2.94	63.3	16.2	11.01	93.6	±1.7 %
		Y	3.67	66.9	22.7		72.1	
		Z	4.70	72.2	25.4		111.8	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	2.54	62.9	12.7	6.52	131.8	±2.7 %
		Y	4.06	71.8	22.2		149.7	
		Z	5.22	76.8	24.3		133.3	
10081-CAB	CDMA2000 (1xRTT, RC3)	X	2.60	60.0	11.8	3.97	138.0	±2.7 %
		Y	3.86	66.1	18.7		140.8	
		Z	4.08	67.3	19.3		138.0	
10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	0.90	62.3	10.4	6.56	139.1	±2.7 %
		Y	2.39	70.7	13.5		138.9	
		Z	2.09	66.7	11.9		149.1	

10099-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	3.72	68.1	18.2	9.55	134.0	±2.5 %
		Y	4.76	73.4	24.6		100.9	
		Z	6.17	79.5	27.7		143.7	
10117-CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.20	66.8	19.1	8.07	149.3	±3.0 %
		Y	9.86	68.2	20.9		147.0	
		Z	10.11	68.8	21.4		145.8	
10196-CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	8.83	66.4	19.0	8.10	143.8	±3.0 %
		Y	9.57	68.0	21.0		141.5	
		Z	9.77	68.6	21.4		140.5	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	3.00	61.6	13.4	3.91	143.4	±2.5 %
		Y	4.24	67.2	19.1		145.0	
		Z	4.55	68.6	19.8		142.3	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	2.31	59.8	11.4	3.46	139.0	±2.7 %
		Y	3.61	67.1	19.0		140.0	
		Z	3.96	68.9	19.9		137.7	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	2.31	60.1	11.6	3.39	139.4	±2.2 %
		Y	3.62	67.5	19.3		140.4	
		Z	3.92	69.1	20.0		137.4	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	2.20	59.0	10.9	3.50	117.7	±1.7 %
		Y	3.50	65.9	18.2		119.5	
		Z	3.73	66.6	18.4		135.7	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	4.65	64.5	22.7	12.49	80.2	±2.2 %
		Y	4.63	62.8	21.6		58.7	
		Z	5.66	68.1	24.7		91.9	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	3.38	62.6	14.0	3.76	127.5	±1.4 %
		Y	4.82	69.1	19.3		148.9	
		Z	5.32	70.9	20.2		145.2	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	3.45	63.3	14.5	3.77	127.4	±1.4 %
		Y	4.93	70.0	19.8		147.6	
		Z	5.43	71.7	20.6		144.8	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	5.00	64.9	16.3	5.22	132.4	±1.7 %
		Y	6.30	69.7	20.3		128.8	
		Z	6.46	70.0	20.5		127.6	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	1.54	60.1	11.1	1.54	149.5	±1.4 %
		Y	2.92	70.6	20.2		147.0	
		Z	3.62	74.5	21.7		143.7	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.23	67.2	19.8	8.23	147.0	±3.0 %
		Y	9.66	68.1	21.1		141.3	
		Z	9.89	68.7	21.6		140.4	

10417-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	9.38	67.5	20.1	8.23	149.1	±2.7 %
		Y	9.64	68.0	21.0		141.3	
		Z	9.87	68.7	21.5		140.0	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	9.24	67.4	20.1	8.14	147.9	±2.7 %
		Y	9.53	68.0	21.0		140.0	
		Z	9.76	68.7	21.5		139.0	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	7.39	66.3	18.5	6.55	135.6	±2.5 %
		Y	8.01	67.9	20.1		129.0	
		Z	8.04	68.0	20.2		128.3	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	10.01	67.8	20.4	8.25	137.7	±3.0 %
		Y	10.38	68.5	21.2		126.7	
		Z	10.45	68.7	21.5		128.0	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	1.69	61.0	12.7	1.58	129.8	±0.9 %
		Y	3.13	72.1	20.9		146.4	
		Z	3.85	75.8	22.3		144.0	
10518-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	9.46	67.8	20.4	8.23	149.7	±2.7 %
		Y	9.65	68.1	21.1		140.4	
		Z	9.89	68.7	21.6		139.4	
10525-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	9.29	66.9	20.0	8.36	125.6	±3.0 %
		Y	9.85	68.2	21.2		142.2	
		Z	10.11	68.9	21.7		141.4	
10526-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	9.38	67.0	20.1	8.42	126.0	±3.0 %
		Y	9.93	68.3	21.3		143.4	
		Z	10.19	69.0	21.8		141.8	
10534-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	9.79	67.4	20.2	8.45	131.8	±3.0 %
		Y	10.28	68.5	21.3		148.9	
		Z	10.60	69.3	21.9		148.4	
10535-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	9.81	67.4	20.2	8.45	132.9	±3.3 %
		Y	10.29	68.5	21.3		148.8	
		Z	10.61	69.4	21.9		148.7	
10544-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	10.18	67.8	20.3	8.47	137.6	±3.3 %
		Y	10.16	67.8	20.8		126.4	
		Z	10.52	68.6	21.4		126.2	
10545-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	10.23	67.9	20.5	8.55	137.0	±3.0 %
		Y	10.26	67.9	20.9		126.2	
		Z	10.59	68.7	21.4		126.4	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	9.18	66.9	20.0	8.25	125.4	±2.7 %
		Y	9.70	68.1	21.1		141.2	
		Z	9.92	68.8	21.6		139.9	

10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	2.02	62.8	14.1	1.99	149.5	±0.9 %
		Y	3.16	71.3	20.7		142.8	
		Z	4.03	75.9	22.5		140.7	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	1.80	61.3	12.5	1.99	147.0	±0.7 %
		Y	3.13	71.4	20.7		141.9	
		Z	4.17	76.8	22.9		140.5	
10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	9.52	67.7	20.5	8.59	145.8	±3.0 %
		Y	9.75	68.0	21.3		136.9	
		Z	10.03	68.8	21.9		137.7	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	9.51	67.7	20.5	8.60	144.9	±2.7 %
		Y	9.77	68.1	21.3		137.2	
		Z	10.06	68.9	21.9		137.4	
10583-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	9.45	67.5	20.4	8.59	145.2	±3.3 %
		Y	9.75	68.0	21.3		137.4	
		Z	10.04	68.9	21.9		137.6	
10584-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	9.47	67.6	20.3	8.60	144.5	±3.3 %
		Y	9.77	68.1	21.3		137.3	
		Z	10.06	68.9	21.9		137.3	
10591-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	9.53	67.5	20.2	8.63	146.3	±3.0 %
		Y	9.87	68.1	21.3		139.3	
		Z	10.17	68.9	21.9		139.4	
10592-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	9.88	68.2	20.9	8.79	148.1	±3.3 %
		Y	10.04	68.3	21.5		139.5	
		Z	10.33	69.1	22.1		139.5	
10599-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	9.84	67.3	20.3	8.79	128.8	±3.3 %
		Y	10.37	68.5	21.5		144.3	
		Z	10.76	69.5	22.2		146.7	
10600-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	9.93	67.4	20.4	8.88	129.6	±3.3 %
		Y	10.47	68.6	21.7		145.3	
		Z	10.84	69.6	22.3		146.5	
10607-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	9.63	67.8	20.5	8.64	147.1	±3.3 %
		Y	9.90	68.1	21.4		139.1	
		Z	10.20	69.0	22.0		139.8	
10608-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	9.79	67.9	20.6	8.77	147.6	±3.3 %
		Y	10.02	68.2	21.5		139.7	
		Z	10.35	69.2	22.1		139.8	
10616-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	9.89	67.3	20.3	8.82	129.8	±3.3 %
		Y	10.41	68.5	21.6		145.4	
		Z	10.77	69.5	22.2		146.5	
10617-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	9.82	67.2	20.1	8.81	129.4	±3.3 %
		Y	10.40	68.5	21.6		145.4	
		Z	10.78	69.5	22.2		146.8	

10626-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	10.24	67.7	20.5	8.83	134.6	±3.3 %
		Y	10.58	68.6	21.5		148.1	
		Z	10.66	68.7	21.6		124.6	
10627-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	10.19	67.6	20.4	8.88	134.0	±3.3 %
		Y	10.65	68.7	21.5		149.0	
		Z	10.73	68.8	21.7		124.8	
10648-AAA	CDMA2000 (1x Advanced)	X	2.98	63.3	15.2	3.45	146.8	±1.4 %
		Y	3.65	67.4	19.3		141.0	
		Z	4.05	69.6	20.4		137.8	

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