MOTOROLA SOLUTIONS

MS ISO/IEC 17025 TESTING

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SAMM No.0826 **CERTIFICATE 2518.05**

DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2

Motorola Solutions Inc.
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Date of Report: **10/1/2019**
Report Revision: **B**

Responsible Engineer:	Ch'ng Jian Sheng (EME Engineer)
Report Author:	Ch'ng Jian Sheng (EME Engineer)
Date/s Tested:	07/26/2019-07/30/2019
Manufacturer:	Motorola Solutions Inc.
DUT Description:	Handheld Portable – BC300D 403-470MHz
Test TX mode(s):	CW (PTT)
Max. Power output:	4.8 W
Nominal Power:	4.0 W
Tx Frequency Bands:	LMR 403-470MHz
Signaling type:	FM
Model(s) Tested:	BC300D (PMUE5508A)
Model(s) Certified:	BC300D (PMUE5508A)
Serial Number(s):	0275VM4526
Classification:	Occupational/Controlled
FCC ID:	AZ489FT4955; LMR 406.125-470 MHz This report contains results that are immaterial for FCC equipment approval, which are clearly identified.
IC:	109U-89FT4955; LMR 406.1-430MHz & 450-470MHz This report contains results that are immaterial for ISED equipment approval, which are clearly identified.
ISED Test Site registration:	109AK
FCC Test Firm Registration Number:	823256

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of FCC 47 CFR § 2.1093 and 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 (no deviation from standard methods). 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: 2019.10.01 14:08:36 +08'00'

Tiong Nguk Ing
Deputy Technical Manager (Approved Signatory)
Approval Date: 10/01/2019

Part 1 of 2

APPENDICES

Part 2 of 2

APPENDICES

Report Revision History

Date	Revision	Comments
08/02/2019	A	Initial release
10/01/2019	B	Amendment on the Face configuration at Table 19

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 BC300D (PMUE5508A). This device is classified as Occupational/Controlled.

2.0 FCC SAR Summary

Table 1

Equipment Class	Frequency band (MHz)	Max Calc at Body (W/kg)	Max Calc at Face (W/kg)
		1g-SAR	1g-SAR
TNF	406.125-470	1.96	2.50

3.0 Abbreviations / Definitions

BT: Bluetooth
CNR: Calibration Not Required
CW: Continuous Wave
DUT: Device Under Test
EME: Electromagnetic Energy
FM: Frequency Modulation
LMR: Land Mobile Radio
NA: Not Applicable
PTT: Push to Talk
RSM: Remote Speaker Microphone
SAR: Specific Absorption Rate
TNF: Licensed Non-Broadcast Transmitter Held to Face

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 (2016) 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 Radiocommunication Apparatus (All Frequency Bands)
- Australian Communications Authority Radio communications (Electromagnetic Radiation - Human Exposure) Standard (2014)
- ANATEL, Brazil Regulatory Authority, Resolution No. 303 of July 2, 2002 "Regulation of the limitation of exposure to electrical, magnetic, and electromagnetic fields in the radio frequency range between 9 kHz and 300 GHz." and "Attachment to resolution # 303 from July 2, 2002"
- IEC62209-2 Edition 1.0 2010-03, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz).
- FCC KDB – 643646 D01 SAR Test for PTT Radios v01r03
- FCC KDB – 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB – 865664 D02 RF Exposure Reporting v01r02
- FCC KDB – 447498 D01 General RF Exposure Guidance v06

5.0 SAR Limits

Table 2

EXPOSURE LIMITS	SAR (W/kg) (General Population / Uncontrolled Exposure Environment)	SAR (W/kg) (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 in the LMR band using frequency modulation (FM) in a half duplex system. A half duplex system only allows the user to transmit or receive. This device cannot transmit and receive simultaneously. The user must stop transmitting in order to receive a signal or listen for a response, regardless of PTT button or use of voice activated audio accessories. This type of operation, along with the RF safety booklet, which instructs the user to transmit no more than 50% of the time, justifies the use of 50% duty factor for this device.

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

Table 3

Technology	Band (MHz)	Transmission	Duty Cycle (%)	Max Power (W)
LMR	403-470	FM	*50	4.8

Note - * includes 50% PTT operation

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

7.0 Optional Accessories and Test Criteria

This device is offered with optional accessories. All accessories were individually evaluated during the test plan creation to determine if testing was required per the guidelines outlined in "SAR Test Reduction Considerations for Occupational PTT Radios" FCC KDB 643646 to assess compliance of 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 Antennas

There are optional removable antennas offered for this product. The Table below lists their descriptions.

Table 4

Antenna No.	Antenna Models	Description	Selected for test	Tested
1	PMAE4020A	Removable Stubby Antenna 450-470 MHz, ¼ wave, -3dBi gain	Yes	Yes
2	PMAE4104A	Removable Whip Antenna 403-470 MHz, ¼ wave, -2dBi gain	Yes	Yes

7.2 Battery

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

Table 5

Battery No.	Battery Models	Description	Selected for test	Tested	Comments
1	PMNN4075A	MagOne Li-Ion battery 1700 mAh	Yes	Yes	

7.3 Body worn Accessory

There is one body worn accessory offered for this product. The Table below lists the body worn accessories, and body worn accessory descriptions.

Table 6

Body worn No.	Body worn Models	Description	Selected for test	Tested	Comments
1	RLN5644A	2" Belt Clip	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 7

Audio No.	Audio Acc. Models	Description	Selected for test	Tested	Comments
1	PMLN6531A	MagOne Earpiece with in-line Mic/PTT/VOX	Yes	Yes	Default Audio
2	PMLN6534A	MagOne Earbud with in-line MIC/PTT/VOX	No	No	By similarity to PMLN6531A
3	PMLN6542A	MagOne Breeze Headset with boom mic & PTT	Yes	No	Per KDB provisions test not required
4	PMMN4092A	MagOne RSM	Yes	No	Per KDB provisions test not required

8.0 Description of Test System

8.1 Descriptions of Robotics/Probes/Readout Electronics

Table 8

Dosimetric System type	System version	DAE type	Probe Type
Schmid & Partner Engineering AG SPEAG DASY 5	52.10.2.1495	DAE4	EX3DV4 (E-Field)

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

8.2 Description of Phantom(s)

Table 9

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

8.3 Description of Simulated Tissue

The sugar based simulate tissue is produced by placing the correct measured amount of De-ionized water into a large container. Each of the dried ingredients are weighed and added to the water carefully to avoid clumping. If the solution has a high sugar concentration the water is pre-heated to aid in dissolving the ingredients. The solution is mixed thoroughly, covered, and allowed to sit overnight prior to use.

The simulated tissue mixture was mixed based on the Simulated Tissue Composition indicated in Table 10. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters at each of the tested frequencies to verify that the Di-electric parameters were within the tolerance of the tissue specifications.

Simulated Tissue Composition (% by mass)

Table 10

Ingredients	450MHz	
	Head	Body
Sugar	56.0	46.5
De ionized –Water	39.1	50.53
Salt	3.8	1.87
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 11

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Speag Probe	EX3DV4	7364	01/23/2019	01/23/2020
Speag DAE	DAE4	1483	01/10/2019	01/10/2020
Amplifier	10W1000C	312859	CNR	CNR
Bi-directional Coupler	3020A	41935	09/15/2018	09/15/2019
Power Meter	E4418B	GB40206480	09/16/2018	09/16/2019
Power Sensor	E9301B	MY55210003	04/26/2019	04/26/2020
Power Meter	E4419B	MY45103725	06/10/2019	06/10/2021
Power Sensor	E9301B	MY55210006	12/19/2018	12/19/2019
Power Meter	E4419B	MY40330364	09/16/2017	09/16/2019
Power Sensor	E9301B	MY41495594	08/15/2018	08/15/2019
Vector Signal Generator	E4438C	MY44270302	03/09/2019	03/09/2020
Temperature & Humidity Logger	TM320	12253047	10/30/2018	10/30/2019
Thermometer	HH806AU	080307	12/05/2018	12/05/2019
Temperature Probe	80PK-22	06032017	12/05/2018	12/05/2019
Thermometer	HH202A	35881	12/26/2018	12/26/2019
Temperature Probe	80PK-22	05032017	12/26/2018	12/26/2019
Network Analyzer	E5071B	MY42403218	09/06/2018	09/06/2019
Dielectric Assessment Kit	DAK-3.5	1156	01/08/2019	01/08/2020
SPEAG Dipole	D450V3	1053	10/19/2018	10/19/2020

10.0 SAR Measurement System Validation and Verification

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

10.1 System Validation

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

Table 12

Dates	Probe Calibration Point		Probe SN	Measured Tissue Parameters		Validation		
				σ	ϵ_r	Sensitivity	Linearity	Isotropy
CW								
03/15/2019	Body	450	7364	0.92	55.0	Pass	Pass	Pass
03/15/2019	Head	450		0.85	42.6	Pass	Pass	Pass

10.2 System Verification

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

Table 13

Probe Serial #	Tissue Type	Dipole Kit / Serial #	Ref SAR @ 1W (W/kg)	System Check Results Measured (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
7364	FCC Body	SPEAG D450V3 / 1053	4.53 +/- 10%	1.12	4.48	07/25/2019#
				1.15	4.60	07/30/2019
	IEEE/IEC Head		4.57 +/- 10%	1.18	4.72	07/26/2019#
				1.22	4.88	07/28/2019
				1.18	4.72	07/29/2019

Note: # System verification check date covered for next test day (Within 24 hours)

10.3 Equivalent Tissue Test Results

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

Table 14

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
403	FCC Body	0.93 (0.89-0.98)	57.2 (54.3-60.0)	0.90	55.5	07/25/2019#
	IEEE/ IEC Head	0.87 (0.83-0.91)	44.1 (41.9-46.3)	0.83	45.3	07/28/2019
406	FCC Body	0.93 (0.89-0.98)	57.1 (54.3-60.0)	0.90	55.4	07/25/2019#
	IEEE/ IEC Head	0.87 (0.83-0.91)	44.0 (41.8-46.2)	0.84	44.7	07/26/2019#
422	FCC Body	0.94 (0.89-0.98)	57.0 (54.1-59.8)	0.94	55.3	07/30/2019
	IEEE/ IEC Head	0.87 (0.83-0.91)	43.8 (41.6-46.0)	0.86	44.6	07/29/2019
450	FCC Body	0.94 (0.89-0.99)	56.7 (53.9-59.5)	0.94	54.7	07/25/2019#
				0.97	54.8	07/30/2019
	IEEE/ IEC Head	0.87 (0.83-0.91)	43.5 (41.3-45.7)	0.89	43.9	07/26/2019#
				0.88	44.4	07/28/2019
				0.88	44.1	07/29/2019
470	FCC Body	0.94 (0.89-0.99)	56.6 (53.8-59.5)	0.96	54.4	07/25/2019#
	IEEE/ IEC Head	0.87 (0.83-0.91)	43.4 (41.2-45.6)	0.90	43.5	07/26/2019#

`

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 15

	Target	Measured
Ambient Temperature	18 – 25 ˚C	Range: 19.9 - 24.2 ˚C Avg. 22.2 ˚C
Tissue Temperature	18 – 25 ˚C	Range: 20.5 – 21.5 ˚C Avg. 20.7 ˚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 disturbances that could possibly affect the test results. If such unwanted signals are discovered the SAR scans are repeated.

12.0 DUT Test Setup and Methodology

12.1 Measurements

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

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

Table 16

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

12.2 DUT Configuration(s)

The DUT is a portable device operational at the body and face as described in section 6.0 while using the applicable accessories listed in section 7.0. All accessories listed in section 7.0 of this report were considered when implementing the guidelines specified in KDB 643646.

12.3 DUT Positioning Procedures

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

12.3.1 Body

The DUT was positioned in normal use configuration against the phantom with the offered body worn accessory as well as with the offered audio accessories as applicable.

12.3.2 Head

Not applicable.

12.3.3 Face

The DUT was positioned with its’ front side separated 2.5cm from the phantom.

12.4 DUT Test Channels

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

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

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

12.5 SAR Result Scaling Methodology

The calculated 1-gram 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" are scaled using the following formula:

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

P_max = Maximum Power (W)
P_int = Initial Power (W)
Drift = DASY drift results (dB)
SAR_meas = Measured 1-g 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 LMR assessments at the Body for 406.125-470MHz band

Battery PMNN4075A was selected as the default battery for assessments at the Body since it is the only offered battery (refer to Exhibit 7B for battery illustration). The default battery was used during conducted power measurements for all test channels within FCC allocated frequency range (406.125-470MHz) which are listed in Table 17. The channel with the highest conducted power will be identified as the default channel per KDB 643646 (SAR Test for PTT Radios).

Table 17

Test Freq (MHz)	Power (W)
406.1250	4.72
422.1000	4.68
438.1000	4.63
450.0000	4.66
454.0000	4.71
460.0000	4.69
470.0000	4.71

Assessments at the Body with Body worn RLN5644A

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

Table 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#
PMAE4104A	PMNN4075A	RLN5644A	PMLN6531A	406.1250	4.71	-0.69	3.28	**1.96**	LOH-AB-190726-05#
				422.1000					
				438.1000					
				454.0000					
				470.0000					
PMAE4020A				450.0000					
				460.0000					
				470.0000	4.76	-0.28	3.11	1.67	LOH-AB-190726-06#

Assessment at the Body with other audio accessories

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

13.2 LMR assessments at the Face for 406.125-470MHz band

Battery PMNN4075A was selected as the default battery for assessments at the Face since it is the only offered battery (refer to Exhibit 7B for battery illustration). The default battery was used during conducted power measurements for all test channels within FCC allocated frequency range (406.125-470MHz) which are listed in Table 17. The channel with the highest conducted power will be identified as the default channel per KDB 643646 (SAR Test for PTT Radios). SAR plots of the highest results per Table (bolded) are presented in Appendix E.

DUT assessment with offered antennas and default battery with front of DUT positioned 2.5cm facing phantom per KDB 643646. Refer to Table 17 for highest output power channel. SAR plots of the highest results per Table (bolded) are presented in Appendix E.

Table 19

<table>
<tr><th>Antenna</th><th>Battery</th><th>Carry Accessory</th><th>Cable Accessory</th><th>Test Freq (MHz)</th><th>Init Pwr (W)</th><th>SAR Drift (dB)</th><th>Meas. 1g-SAR (W/kg)</th><th>Max Calc. 1g-SAR (W/kg)</th><th>Run#</th></tr>
<tr><td rowspan="5">PMAE4104A</td><td rowspan="8">PMNN4075A</td><td rowspan="8">None</td><td rowspan="8">None</td><td>406.1250</td><td>4.80</td><td>-0.45</td><td>4.40</td><td>2.44</td><td>LOH-FACE-190726-16</td></tr>
<tr><td>422.1000</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>438.1000</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>454.0000</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>470.0000</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">PMAE4020A</td><td>450.0000</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>460.0000</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>470.0000</td><td>4.75</td><td>-0.31</td><td>4.45</td><td>2.41</td><td>LOH-FACE-190726-17</td></tr>
</table>

13.3 Assessment for ISED, Canada

Based on the assessment results for body and face per KDB643646, additional tests were not required for ISED, Canada frequency range (406.1-430MHz & 450-470MHz) as testing performed is in compliance with ISED Canada frequency range.

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

Table 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#
Body									
PMAE4104A	PMNN4075A	RLN5644A	PMLN6531A	406.1250	4.71	-0.69	3.28	1.96	LOH-AB-190726-05#
				422.1000	4.73	-0.56	3.02	1.74	ZZ-AB-190730-02
				470.0000	4.80	-0.26	3.10	1.65	ZZ-AB-190726-08#
Face									
PMAE4104A	PMNN4075A	None	None	406.1250	4.80	-0.45	4.40	2.44	LOH-FACE-190726-16
				422.1000	4.75	-0.43	4.21	2.35	ZZ-FACE-190729-02
				470.0000	4.78	-0.32	3.69	1.99	LOH-FACE-190727-01#

13.4 Assessment for Outside FCC and ISED frequency range

Assessment of outside FCC and ISED frequency range using highest SAR configuration from above. SAR plots of the highest results per Table (bolded) are presented in the Appendix.

Table 21

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									
PMAE4104A	PMNN4075A	RLN5644A	PMLN6531A	403.0000	4.70	-0.45	3.16	1.79	ZZ-AB-190726-13#
Face									
PMAE4104A	PMNN4075A	None	None	403.0000	4.77	-0.47	4.26	**2.39**	LOH-FACE-190728-02

13.5 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 22

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#
PMAE4104A	PMNN4075A	None	None	406.1250	4.78	-0.17	4.78	**2.50**	LOH-FACE-190727-02#

14.0 Results Summary

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

Table 23

Designator	Frequency band (MHz)	Max Calc at Body (W/kg)	Max Calc at Face (W/kg)
		1g-SAR	1g-SAR
FCC			
LMR	406.125-470	1.96	2.50
ISED			
LMR	406.1-470	1.96	2.50
Overall			
LMR	403-470	1.96	2.50

All results are scaled to the maximum output power.

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of FCC 47 CFR § 2.1093 and 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 4.0W/kg (Occupational).

16.0 System Uncertainty

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

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

Appendix A
Measurement Uncertainty Budget

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

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	c_i **(1 g)**	c_i **(10 g)**	**1 g** u_i **(±%)**	**10 g** u_i **(±%)**	v_i
Measurement System									
Probe Calibration	E.2.1	6.7	N	1.00	1	1	6.7	6.7	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				11	11	477
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				23	22	

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

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

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.7	N	1.00	1	1	6.7	6.7	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	R	1.73	0.64	0.43	1.2	0.8	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	R	1.73	0.6	0.49	0.6	0.5	∞
Combined Standard Uncertainty			RSS				10	19	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				19	18	

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

Appendix B
Probe Calibration Certificates

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

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

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

Accreditation No.: **SCS 0108**

Client **Motorola Solutions MY**

Certificate No: **EX3-7364_Jan19**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:7364
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7 Calibration procedure for dosimetric E-field probes
Calibration date:	January 23, 2019

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
DAE4	SN: 660	19-Dec-18 (No. DAE4-660_Dec18)	Dec-19
Reference Probe ES3DV2	SN: 3013	31-Dec-18 (No. ES3-3013_Dec18)	Dec-19
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

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

Issued: January 26, 2019

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

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

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

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

Accreditation No.: **SCS 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).

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)^2)[A]	0.46	0.46	0.57	± 10.1 %
DCP (mV)[B]	99.7	97.6	99.3	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max dev.	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	114.6	+ 2.7 %	± 4.7 %
		Y	0.0	0.0	1.0		112.4		
		Y	0.0	0.0	1.0		127.7		

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

Sensor Model Parameters

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	129.9
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

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	12.97	12.97	12.97	0.00	1.00	± 13.3 %
300	45.3	0.87	12.05	12.05	12.05	0.09	1.20	± 13.3 %
450	43.5	0.87	10.75	10.75	10.75	0.13	1.30	± 13.3 %
750	41.9	0.89	10.42	10.42	10.42	0.56	0.80	± 12.0 %
835	41.5	0.90	10.23	10.23	10.23	0.30	1.09	± 12.0 %
900	41.5	0.97	9.78	9.78	9.78	0.31	1.08	± 12.0 %
1810	40.0	1.40	8.25	8.25	8.25	0.35	0.87	± 12.0 %
1900	40.0	1.40	8.19	8.19	8.19	0.37	0.85	± 12.0 %
2100	39.8	1.49	8.15	8.15	8.15	0.25	1.09	± 12.0 %
2450	39.2	1.80	7.38	7.38	7.38	0.40	0.85	± 12.0 %
5250	35.9	4.71	5.08	5.08	5.08	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.86	4.86	4.86	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.68	4.68	4.68	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.72	4.72	4.72	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. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. 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

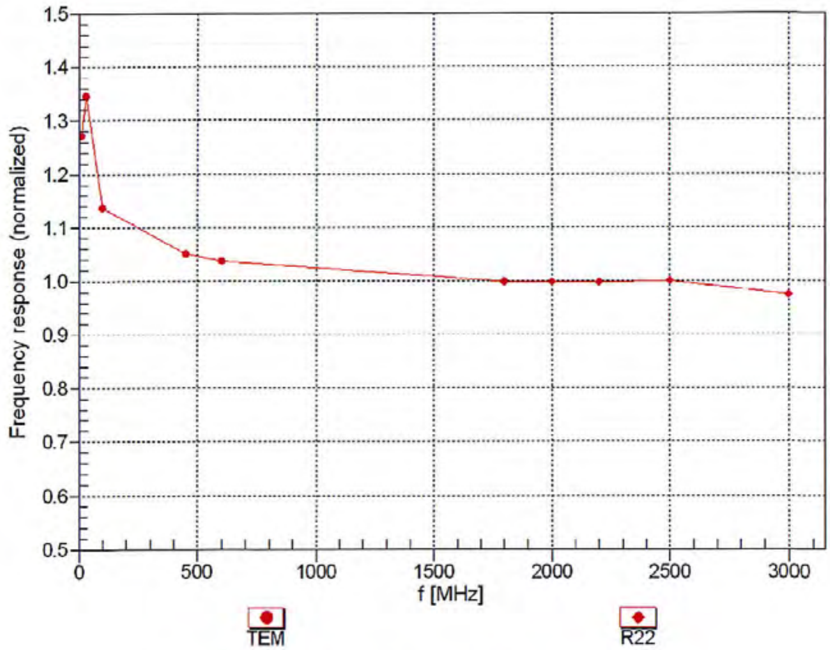
Calibration Parameter Determined in Body Tissue Simulating Media

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	12.37	12.37	12.37	0.00	1.00	± 13.3 %
300	58.2	0.92	11.79	11.79	11.79	0.05	1.20	± 13.3 %
450	56.7	0.94	11.17	11.17	11.17	0.14	1.30	± 13.3 %
750	55.5	0.96	10.24	10.24	10.24	0.50	0.83	± 12.0 %
835	55.2	0.97	9.94	9.94	9.94	0.41	0.90	± 12.0 %
900	55.0	1.05	9.93	9.93	9.93	0.35	0.96	± 12.0 %
1810	53.3	1.52	7.97	7.97	7.97	0.44	0.85	± 12.0 %
1900	53.3	1.52	7.89	7.89	7.89	0.46	0.85	± 12.0 %
2100	53.2	1.62	7.96	7.96	7.96	0.46	0.90	± 12.0 %
2450	52.7	1.95	7.48	7.48	7.48	0.34	0.98	± 12.0 %
5250	48.9	5.36	4.47	4.47	4.47	0.45	1.90	± 13.1 %
5500	48.6	5.65	4.07	4.07	4.07	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.89	3.89	3.89	0.45	1.90	± 13.1 %
5750	48.3	5.94	4.19	4.19	4.19	0.45	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. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

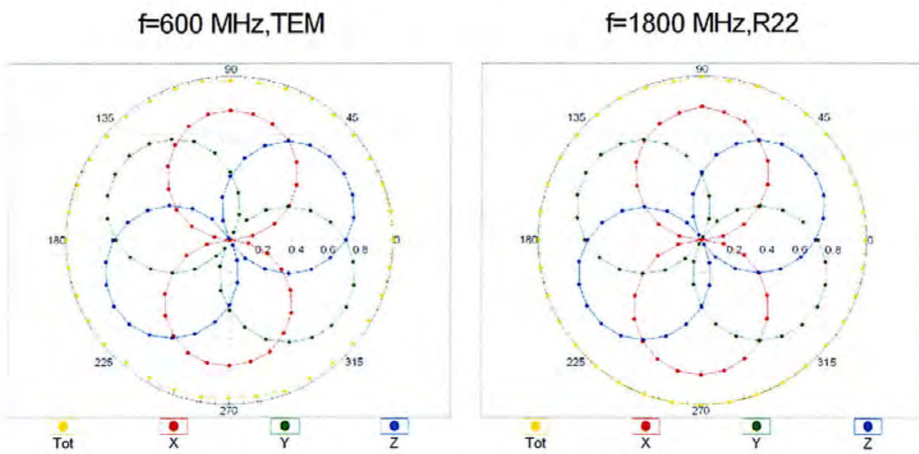
Frequency Response of E-Field

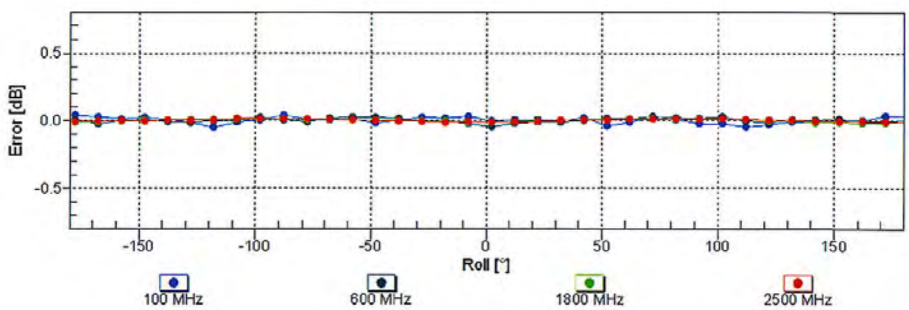
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

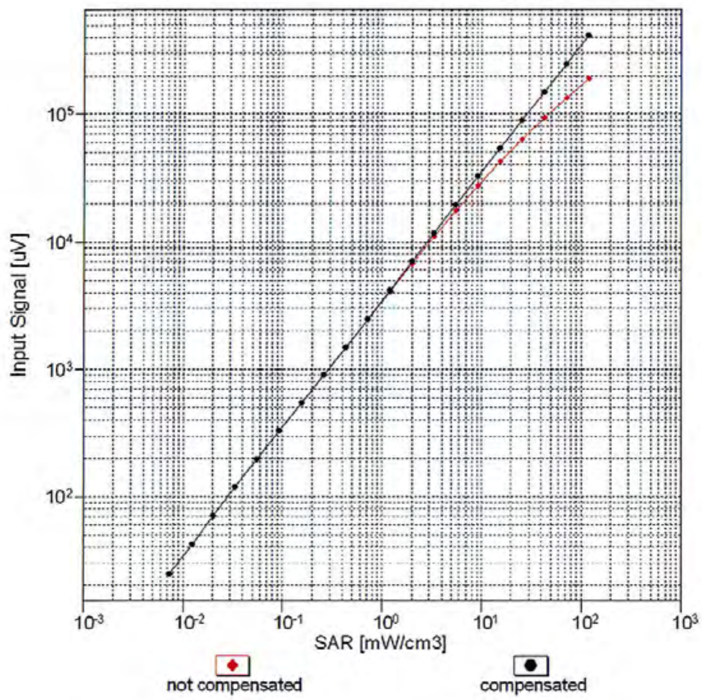
Receiving Pattern (ϕ), $\vartheta = 0°$

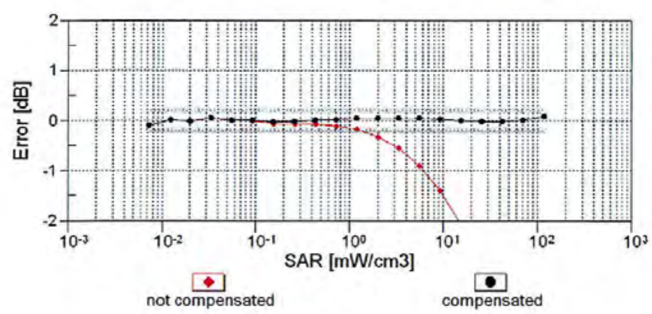




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

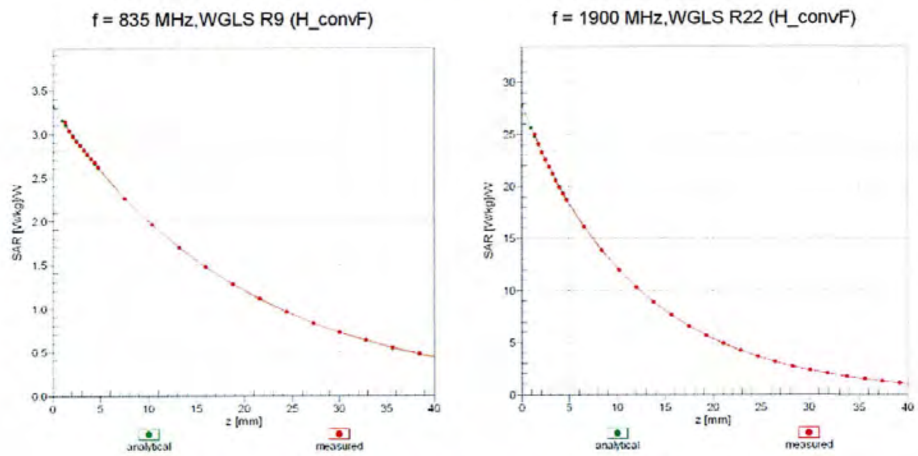
Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)





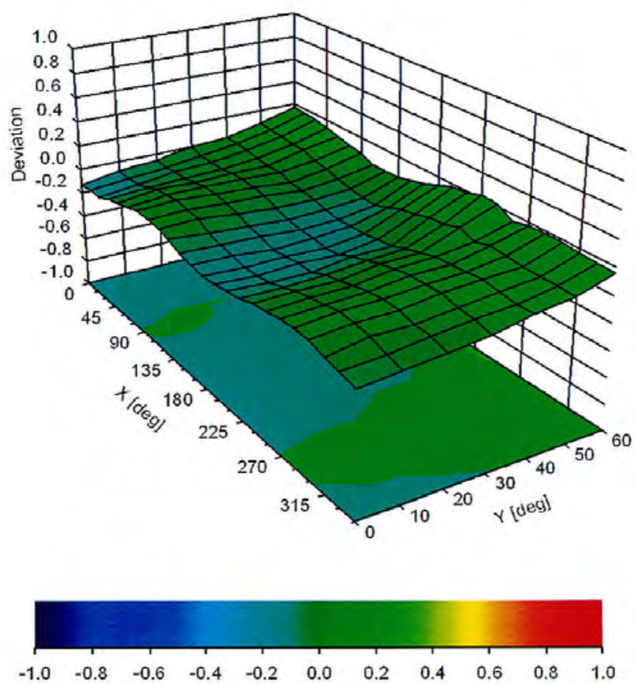
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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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	114.6	±2.7 %
		Y	0.0	0.0	1.0		112.4	
		Z	0.0	0.0	1.0		127.7	
10021-DAC	GSM-FDD (TDMA, GMSK)	X	1.72	63.0	12.0	9.39	94.6	±1.9 %
		Y	1.71	65.4	13.2		68.7	
		Z	2.22	65.7	13.5		108.0	
10023-DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	1.75	63.4	12.3	9.57	91.5	±1.7 %
		Y	1.83	65.6	13.2		67.1	
		Z	2.26	65.5	13.3		104.9	
10024-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	1.71	64.7	10.9	6.56	147.1	±1.2 %
		Y	4.98	81.5	18.4		127.8	
		Z	2.35	69.4	14.0		131.0	
10025-DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	5.28	72.4	25.7	12.62	61.2	±1.2 %
		Y	4.38	68.1	23.6		44.2	
		Z	5.84	75.3	27.6		69.5	
10026-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	5.13	74.3	24.8	9.55	140.7	±1.9 %
		Y	4.43	71.4	23.6		100.8	
		Z	5.35	74.8	25.1		128.7	
10027-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	1.22	62.4	8.8	4.80	140.5	±1.7 %
		Y	29.58	100.0	21.9		130.1	
		Z	34.45	99.7	22.2		118.2	
10028-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	54.30	99.7	20.4	3.55	116.7	±1.9 %
		Y	0.97	66.1	10.9		148.2	
		Z	43.93	99.7	21.0		131.0	
10029-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	4.59	72.8	23.2	7.78	137.7	±1.4 %
		Y	3.83	68.9	21.1		125.2	
		Z	5.87	78.6	26.0		118.8	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.72	66.7	19.1	4.57	123.7	±0.9 %
		Y	4.44	65.3	18.2		121.2	
		Z	4.88	67.4	19.4		140.2	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	4.17	68.9	23.5	11.01	89.7	±1.4 %
		Y	3.52	65.8	22.2		64.7	
		Z	4.64	71.3	24.8		101.7	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	4.77	75.3	23.9	6.52	116.4	±1.4 %
		Y	4.03	71.6	22.1		147.1	
		Z	5.32	76.9	24.4		133.3	
10081-CAB	CDMA2000 (1xRTT, RC3)	X	4.00	66.6	18.9	3.97	120.2	±0.5 %
		Y	3.78	65.2	18.0		118.1	
		Z	4.11	67.0	19.1		136.1	

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10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	1.59	64.6	11.2	6.56	144.9	±1.9 %
		Y	1.86	68.3	12.9		126.4	
		Z	2.87	71.7	14.8		131.1	
10099-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	5.33	75.9	25.9	9.55	139.0	±2.2 %
		Y	4.36	71.0	23.4		99.7	
		Z	5.59	76.5	26.3		126.6	
10117-CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.95	68.2	21.0	8.07	124.6	±2.2 %
		Y	9.62	67.4	20.5		119.2	
		Z	10.30	69.2	21.6		143.9	
10196-CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.61	68.0	21.0	8.10	119.9	±1.9 %
		Y	9.28	67.1	20.4		114.4	
		Z	9.94	69.0	21.6		137.6	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	4.41	67.8	19.3	3.91	123.6	±0.7 %
		Y	4.02	65.7	18.1		120.5	
		Z	4.58	68.5	19.6		139.9	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.79	67.8	19.3	3.46	120.1	±0.5 %
		Y	3.37	65.1	17.7		117.4	
		Z	3.91	68.2	19.5		135.9	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.75	67.9	19.4	3.39	120.3	±0.5 %
		Y	3.35	65.3	17.8		117.1	
		Z	3.86	68.3	19.5		135.5	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	3.86	68.0	19.4	3.50	120.3	±0.5 %
		Y	3.44	65.4	17.9		117.0	
		Z	3.91	68.0	19.4		135.8	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	5.27	66.0	23.4	12.49	74.0	±1.4 %
		Y	4.56	62.5	21.4		53.0	
		Z	5.70	68.1	24.8		84.1	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	5.20	70.4	19.9	3.76	126.4	±0.5 %
		Y	4.56	67.7	18.4		123.3	
		Z	5.28	70.5	19.9		143.5	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	5.38	71.6	20.6	3.77	124.9	±0.7 %
		Y	4.42	67.3	18.2		121.9	
		Z	5.02	69.8	19.6		142.4	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	6.70	71.0	20.9	5.22	129.5	±0.7 %
		Y	5.85	67.9	19.2		125.2	
		Z	6.66	70.6	20.7		148.5	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	3.44	72.9	21.1	1.54	126.4	±0.5 %
		Y	2.56	67.0	17.9		123.5	
		Z	3.20	71.3	20.2		142.2	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.70	68.1	21.2	8.23	119.3	±1.9 %
		Y	9.38	67.2	20.5		114.1	
		Z	10.02	69.0	21.7		137.1	

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10417-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	9.70	68.1	21.2	8.23	119.3	±1.9 %
		Y	9.42	67.3	20.6		114.1	
		Z	10.03	69.0	21.7		137.4	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	9.58	68.0	21.1	8.14	118.4	±1.9 %
		Y	9.30	67.2	20.5		113.4	
		Z	9.87	68.9	21.6		136.2	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	7.83	67.4	19.9	6.55	108.2	±1.2 %
		Y	7.69	67.0	19.4		104.5	
		Z	8.11	68.2	20.3		124.3	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	10.63	69.2	21.7	8.25	130.7	±2.2 %
		Y	10.48	68.9	21.4		123.4	
		Z	10.07	67.8	20.9		101.8	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	3.51	73.4	21.3	1.58	125.8	±0.5 %
		Y	2.68	68.0	18.5		122.8	
		Z	3.41	72.6	20.8		142.5	
10518-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	9.68	68.0	21.1	8.23	118.9	±1.9 %
		Y	9.42	67.3	20.6		114.1	
		Z	10.04	69.1	21.7		137.4	
10525-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	9.92	68.2	21.3	8.36	120.5	±1.9 %
		Y	9.66	67.6	20.8		116.3	
		Z	10.24	69.2	21.9		139.1	
10526-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	10.00	68.3	21.4	8.42	120.7	±1.9 %
		Y	9.69	67.5	20.8		116.2	
		Z	10.32	69.3	22.0		139.3	
10534-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	10.41	68.7	21.5	8.45	125.5	±2.2 %
		Y	10.06	67.8	20.9		120.8	
		Z	10.78	69.7	22.1		145.9	
10535-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	10.43	68.7	21.5	8.45	126.5	±2.2 %
		Y	10.08	67.9	20.9		121.2	
		Z	10.78	69.7	22.1		146.0	
10544-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	10.74	69.0	21.5	8.47	130.5	±2.2 %
		Y	10.26	67.9	20.8		123.8	
		Z	10.20	67.7	20.8		101.3	
10545-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	10.83	69.1	21.6	8.55	130.8	±2.2 %
		Y	10.36	68.1	21.0		124.5	
		Z	10.28	67.8	20.9		101.7	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	9.76	68.2	21.2	8.25	119.0	±1.9 %
		Y	9.46	67.4	20.7		114.6	
		Z	10.08	69.1	21.8		137.5	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	3.65	73.3	21.4	1.99	123.5	±0.5 %
		Y	2.71	67.4	18.4		120.2	
		Z	3.53	72.6	21.0		138.6	

10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	3.80	74.3	21.8	1.99	122.7	±0.5 %
		Y	2.83	68.4	18.9		120.1	
		Z	3.60	73.2	21.2		138.7	
10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	9.84	68.2	21.5	8.59	117.1	±1.9 %
		Y	9.55	67.4	20.9		112.7	
		Z	10.17	69.1	22.0		134.4	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	9.84	68.2	21.5	8.60	116.5	±1.9 %
		Y	9.55	67.4	20.9		112.4	
		Z	10.18	69.2	22.1		134.2	
10583-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	9.87	68.3	21.5	8.59	117.1	±1.9 %
		Y	9.55	67.4	20.9		112.6	
		Z	10.18	69.2	22.1		134.3	
10584-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	9.87	68.3	21.5	8.60	116.6	±1.9 %
		Y	9.54	67.4	20.9		112.3	
		Z	10.17	69.2	22.1		134.1	
10591-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	9.98	68.3	21.5	8.63	118.4	±1.9 %
		Y	9.66	67.4	20.9		113.7	
		Z	10.29	69.2	22.1		136.0	
10592-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	10.14	68.4	21.7	8.79	118.6	±2.2 %
		Y	9.83	67.6	21.1		113.8	
		Z	10.49	69.5	22.3		136.9	
10599-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	10.57	68.8	21.8	8.79	124.4	±2.2 %
		Y	10.16	67.8	21.1		118.7	
		Z	10.89	69.7	22.4		143.5	
10600-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	10.65	68.9	21.9	8.88	123.9	±2.2 %
		Y	10.24	67.9	21.2		118.8	
		Z	10.98	69.9	22.5		143.9	
10607-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	9.99	68.3	21.5	8.64	118.6	±2.2 %
		Y	9.67	67.4	20.9		113.5	
		Z	10.33	69.3	22.1		136.4	
10608-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	10.13	68.4	21.7	8.77	118.9	±1.9 %
		Y	9.80	67.6	21.1		113.5	
		Z	10.48	69.5	22.3		137.0	
10616-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	10.58	68.8	21.8	8.82	124.5	±2.2 %
		Y	10.21	67.9	21.2		118.8	
		Z	10.94	69.8	22.4		143.9	
10617-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	10.59	68.8	21.8	8.81	124.8	±2.2 %
		Y	10.21	67.9	21.2		118.9	
		Z	10.93	69.8	22.4		144.1	
10626-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	10.89	69.1	21.8	8.83	128.8	±2.2 %
		Y	10.39	68.0	21.1		121.6	
		Z	11.24	70.1	22.4		149.4	

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10627-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	10.94	69.1	21.9	8.88	129.3	±2.2 %
		Y	10.43	68.0	21.1		121.2	
		Z	11.32	70.2	22.5		149.9	
10648-AAA	CDMA2000 (1x Advanced)	X	3.77	67.8	19.4	3.45	120.1	±0.7 %
		Y	3.51	66.0	18.3		117.6	
		Z	3.94	68.6	19.8		136.8	

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

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Appendix C
Dipole Calibration Certificates

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

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

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

Accreditation No.: **SCS 0108**

Client **Motorola Solutions MY**

Certificate No: **D450V3-1053_Oct18**

CALIBRATION CERTIFICATE

Object	D450V3 - SN:1053
Calibration procedure(s)	QA CAL-15.v8 Calibration procedure for dipole validation kits below 700 MHz
Calibration date:	October 19, 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: 5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 3877	30-Dec-17 (No. EX3-3877_Dec17)	Dec-18
DAE4	SN: 654	05-Jul-18 (No. DAE4-654_Jul18)	Jul-19

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	12-Jun-18 (No. 217-02285/02284)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	12-Jun-18 (No. 217-02285)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	12-Jun-18 (No. 217-02284)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

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

Issued: October 19, 2018

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

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

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

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	44.1 ± 6 %	0.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**4.57 W/kg ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	0.762 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**3.05 W/kg ± 17.6 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.5 ± 6 %	0.92 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**4.53 W/kg ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	0.753 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**3.05 W/kg ± 17.6 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	57.6 Ω - 4.4 jΩ
Return Loss	- 21.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	55.1 Ω - 7.0 jΩ
Return Loss	- 21.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.351 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 16, 2005

DASY5 Validation Report for Head TSL

Date: 19.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

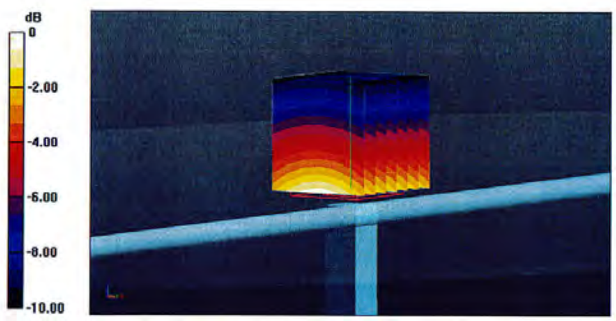
DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1053

Communication System: UID 0 - CW; Frequency: 450 MHz
Medium parameters used: f = 450 MHz; $\sigma = 0.87$ S/m; $\varepsilon_r = 44.1$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.5, 10.5, 10.5) @ 450 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 05.07.2018
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Head Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 38.89 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 1.74 W/kg
SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.762 W/kg
Maximum value of SAR (measured) = 1.52 W/kg



0 dB = 1.52 W/kg = 1.82 dBW/kg

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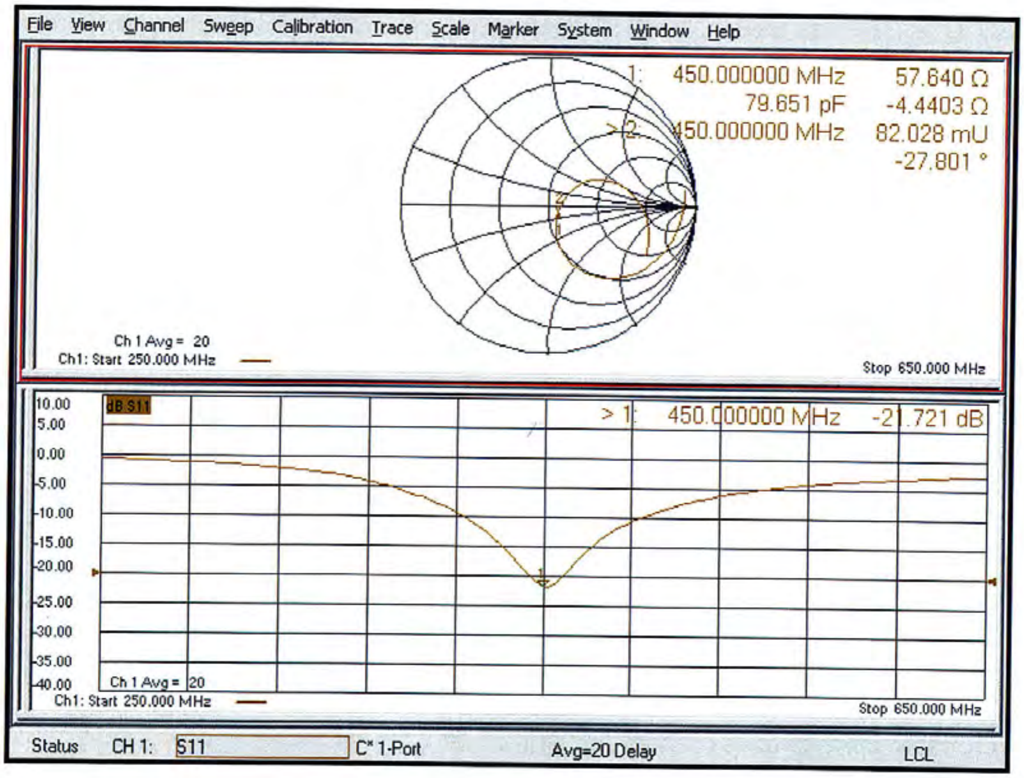
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 19.10.2018

Test Laboratory: SPEAG, Zurich, Switzerland

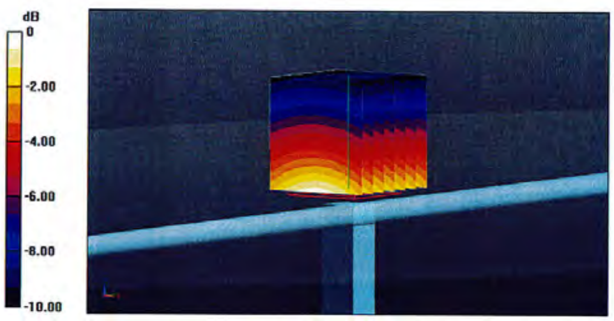
DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1053

Communication System: UID 0 - CW; Frequency: 450 MHz
Medium parameters used: f = 450 MHz; $\sigma = 0.92$ S/m; $\varepsilon_r = 55.5$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.8, 10.8, 10.8) @ 450 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 05.07.2018
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Body Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 41.78 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.72 W/kg
SAR(1 g) = 1.12 W/kg; SAR(10 g) = 0.753 W/kg
Maximum value of SAR (measured) = 1.50 W/kg



0 dB = 1.50 W/kg = 1.76 dBW/kg

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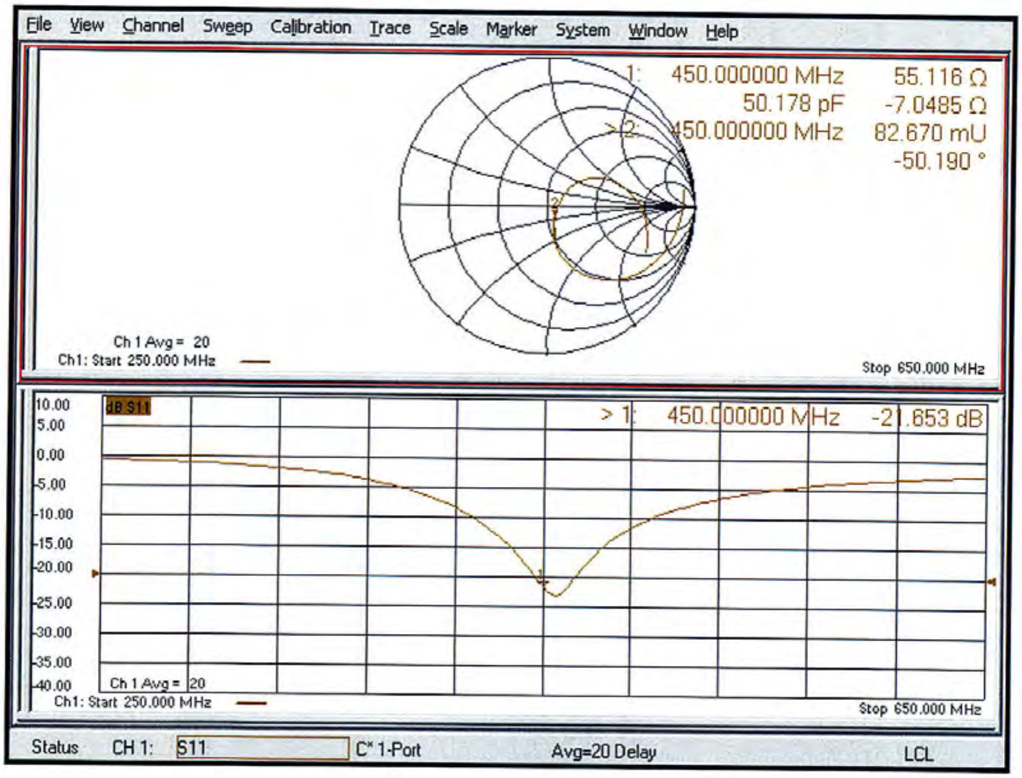
Impedance Measurement Plot for Body TSL



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