

 MOTOROLA SOLUTIONS	 TESTING CERT # 2518.05		
DECLARATION OF COMPLIANCE SAR ASSESSMENT PCII Report			
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<table border="0"> <tr> <td style="vertical-align: top;"> Responsible Engineer: Report Author: Date/s Tested: Manufacturer: DUT Description: Test TX mode(s): Max. Power output: Nominal Power: Tx Frequency Bands: Signaling type: Model(s) Tested: Model(s) Certified: Serial Number(s): Classification: FCC ID: IC ISED Test Site registration: </td> <td style="vertical-align: top;"> Veeramani (Sr. EME Engineer) Veeramani (Sr. EME Engineer) 03/28/2017- 03/29/2017; 04/04/2017 Motorola Solutions Inc. T503 Rechargeable 2-Way Radio, FRS 0.5W, GMRS 1.5W CW (PTT) 2.0W (GMRS), 0.5W (FRS) 1.5W (GMRS), 0.4W (FRS) FRS 467.5625 – 467.7125 MHz FRS 462.5625 – 462.7125 MHz GMRS 462.5500 – 462.7250 MHz FM T503 (PMUE5289A) T503 (PMUE5289A) 1754TES806 General Population/Uncontrolled AZ489FT4927; FRS 467.5625 – 467.7125 MHz, FRS 462.5625 – 462.7125 MHz, GMRS 462.5500 – 462.7250 MHz This report contains results that are immaterial for FCC equipment approval, which are clearly identified. 109U-89FT4927; This report contains results that are immaterial for ISED equipment approval, which are clearly identified. 109AK </td> </tr> </table> 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 OET Bulletin 65. The 10 grams result is not applicable to FCC filing. The test results clearly demonstrate compliance with ICNIRP (1998) Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz), Health Physics 74, 494-522 RF Exposure limits of 2 W/kg averaged over 10grams of contiguous tissue.		Responsible Engineer: Report Author: Date/s Tested: Manufacturer: DUT Description: Test TX mode(s): Max. Power output: Nominal Power: Tx Frequency Bands: Signaling type: Model(s) Tested: Model(s) Certified: Serial Number(s): Classification: FCC ID: IC ISED Test Site registration:	Veeramani (Sr. EME Engineer) Veeramani (Sr. EME Engineer) 03/28/2017- 03/29/2017; 04/04/2017 Motorola Solutions Inc. T503 Rechargeable 2-Way Radio, FRS 0.5W, GMRS 1.5W CW (PTT) 2.0W (GMRS), 0.5W (FRS) 1.5W (GMRS), 0.4W (FRS) FRS 467.5625 – 467.7125 MHz FRS 462.5625 – 462.7125 MHz GMRS 462.5500 – 462.7250 MHz FM T503 (PMUE5289A) T503 (PMUE5289A) 1754TES806 General Population/Uncontrolled AZ489FT4927; FRS 467.5625 – 467.7125 MHz, FRS 462.5625 – 462.7125 MHz, GMRS 462.5500 – 462.7250 MHz This report contains results that are immaterial for FCC equipment approval, which are clearly identified. 109U-89FT4927; This report contains results that are immaterial for ISED equipment approval, which are clearly identified. 109AK
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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 Deputy Technical Manager Approval Date: 4/6/2017	 Certification Date: 4/6/2017 Certification No.: L1170401		

1.0	Introduction.....	4
2.0	FCC SAR Summary.....	4
3.0	Abbreviations / Definitions.....	4
4.0	Referenced Standards and Guidelines	5
5.0	SAR Limits	6
6.0	Description of Devices under Test (DUT).....	6
7.0	Optional Accessories and Test Criteria.....	7
7.1	Antenna.....	7
7.2	Batteries	7
7.3	Body worn Accessory	7
7.4	Audio Accessory.....	8
8.0	Description of Test System.....	8
8.1	Descriptions of Robotics/Probes/Readout Electronics	8
8.2	Description of Phantom(s).....	9
8.3	Description of Simulated Tissue.....	9
9.0	Additional Test Equipment.....	10
10.0	SAR Measurement System Validation and Verification	11
10.1	System Validation.....	11
10.2	System Verification	11
10.3	Equivalent Tissue Test Results	12
11.0	Environmental Test Conditions	13
12.0	DUT Test Setup and Methodology.....	13
12.1	Measurements	13
12.2	DUT Configuration(s).....	14
12.3	DUT Positioning Procedures	14
12.3.1	Body.....	14
12.3.2	Head.....	14
12.3.3	Face.....	14
12.4	DUT Test Channels	15
12.5	SAR Result Scaling Methodology	15
12.6	DUT Test Plan	15
13.0	DUT Test Data.....	16
13.1	Assessments at the Body for FRS and GMRS band.....	16
13.2	Assessments at the Face for FRS and GMRS band.....	16
13.3	Assessment for ISED Canada	17
13.4	Shortened Scan Assessment.....	17
14.0	Simultaneous Transmission Exclusion for BT	17
15.0	Results Summary	17
16.0	Variability Assessment	18
17.0	System Uncertainty.....	18

APPENDICES

A Measurement Uncertainty Budget 19

B Probe Calibration Certificates 22

C Dipole Calibration Certificates 37

D System Verification Check Scans 47

E DUT Scans - (Shortened Scan and Highest SAR Configurations) 52

F DUT Test Position Photos 56

Report Revision History

Date	Revision	Comments
04/05/2017	A	Release of PCII results with new hardware.

1.0 Introduction

This report details the utilization, test setups, test equipments, and test results of the Specific Absorption Rate (SAR) measurements performed at the Motorola Solutions Inc. EME Test Laboratory for handheld portable model number T503 (PMUE5289A). This device is classified as General Population/Uncontrolled. T503 (PMUE5289A) do not involve layout and mechanical changes, only removes light reflector, light button, water sensor and vibrator. The information herein is to show evidence of Class II Permissive Change compliance base on the SAR evaluation of the DUT.

2.0 FCC SAR Summary

Table 1

Equipment Class	Frequency band (MHz)	Max Calc at Body (W/kg)		Max Calc at Face (W/kg)	
		1g-SAR	10g-SAR	1g-SAR	10g-SAR
FRF	462.5625 – 462.7125 (FRS)	*0.90	0.67	*0.78	0.57
	462.5500 – 462.7250 (GMRS)				
	467.5625 - 467.7125 (FRS)	0.61	0.45	0.47	0.35
Simultaneous Results		NA	NA	NA	NA

*The previously reported result at the body 0.65 W/kg and face 0.51 W/kg are hereby replaced with the result presented herein.

3.0 Abbreviations / Definitions

CNR: Calibration Not Required
 CW: Continuous Wave
 DUT: Device under Test
 EME: Electromagnetic Energy
 FM: Frequency Modulation
 NA: Not Applicable
 NiMH: Nickel Metal Hydride
 PTT: Push to Talk
 SAR: Specific Absorption Rate
 FRF: Part 95 Family Radio Face Held Transmitter
 FRS: Family Radio Service
 GMRS: General Mobile Radio Service

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

6.0 Description of Devices under Test (DUT)

This portable device operates with analog Frequency Modulation (FM) incorporating traditional simplex two-way radio transmission protocol. This model's intended use is 5-5-90 (5% Transmit, 5% Receive and 90 % Standby); with a maximum transmit duty cycle of 50%.

The model represented under this filing with a fixed antenna and cover both GMRS and FRS band.

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

Table 3

Band (MHz)	Duty Cycle (%)	Max Power (W)
462.5625 – 462.7125 (FRS)	*50	0.5
467.5625 – 467.7125 (FRS)		
462.5500 – 462.7250 (GMRS)	*50	2.0

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 section 4.0 to assess compliance of this device. The following sections identify the test criteria and details for each accessory category.

7.1 Antenna

There is only one fixed antenna applicable for this PCII filling. The Table below lists its description.

Table 4

Antenna Model	Description	Selected for test	Tested
EAN.144F.823RA1	Fixed antenna, 100-500 MHz , ¼ Wave, 0 dBd	Yes	Yes

7.2 Batteries

There are optional batteries applicable for this PCII filling. The Table below lists their descriptions.

Table 5

Battery Models	Description	Selected for test	Tested	Comments
KEBT-1300	3xAA NiMH Rechargeable Battery Pack 1300 mAh	Yes	Yes	
AA Alkaline	3xAA Alkaline individual batteries	Yes	Yes	

7.3 Body worn Accessory

There is only one body worn applicable for this PCII filling. The table below lists its description.

Table 6

Body worn Models	Description	Selected for test	Tested	Comments
PMLN7240A	T400 series Whistle belt clip	Yes	Yes	

7.4 Audio Accessory

There is only one audio accessory applicable for this PCII filling. The table below lists its description.

Table 7

Audio Acc. Models	Description	Selected for test	Tested	Comments
53724B	Remote Speaker Microphone	Yes	Yes	

8.0 Description of Test System



8.1 Descriptions of Robotics/Probes/Readout Electronics

Table 8

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

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

8.2 Description of Phantom(s)

Table 9

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

8.3 Description of Simulated Tissue

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

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

Simulated Tissue Composition (percent by mass)**Table 10**

Ingredients	450 MHz	
	Head	Body
Sugar	56.00	46.50
Diacetin	0	0
De ionized –Water	39.10	50.53
Salt	3.80	1.87
HEC	1.00	1.00
Bact.	0.10	0.10

9.0 Additional Test Equipment

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

Table 11

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Speag Probe	ES3DV3	3096	29-Apr-16	29-Apr-17
Speag DAE	DAE4	1384	27-Sep-16	27-Sep-17
Signal Generator	E4438C	MY45091270	26-Jul-16	26-Jul-18
Power Meter	E4418B	MY45101014	4-Nov-15	4-Nov-17
Power Meter	E4419B	MY40330364	29-May-15	29-May-17
Power Sensor	8482B	MY41090719	15-Jun-16	15-Jun-17
Power Sensor	8482B	2703A04641	15-Jun-16	15-Jun-17
Bi-directional Coupler	3022	81640	2-Sep-16	2-Sep-17
Amplifier	10WD1000	28782	CNR	CNR
Dickson Temperature Recorder	TM320	06153216	2-Aug-16	2-Aug-17
Temperature Probe	JHSS-18U-RSC-6	AGIL700129	2-Dec-16	2-Dec-17
Thermometer	HH202A	35881	2-Dec-16	2-Dec-17
Dielectric Assessment Kit	DAK-3.5	1156	11-Oct-16	11-Oct-17
Network Analyzer	E5071B	MY42403218	15-Aug-16	15-Aug-17
Speag Dipole	D450V3	1077	25-Nov-15	25-Nov-17

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								
05/30/2016	Body	450	3096	0.95	56.4	Pass	Pass	Pass
05/30/2016	Head	450		0.87	43.3	Pass	Pass	Pass

10.2 System Verification

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

Table 13

Probe Serial #	Tissue Type	Dipole Kit / Serial #	Ref SAR @ 1W (W/kg)	System Check Results Measured (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
3096	FCC Body	SPEAG D450V3 / 1077	4.52 +/- 10%	1.06	4.24	3/28/2017
	1.06			4.24	4/4/2017	
	IEEE/IEC Head		4.57 +/- 10%	1.13	4.52	3/29/2017
				1.07	4.28	4/4/2017

10.3 Equivalent Tissue Test Results

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

Table 14

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
450	FCC Body	0.94 (0.89-0.99)	56.7 (53.9-59.5)	0.95	57.8	3/28/2017
				0.95	55.4	4/4/2017
	IEEE/IEC Head	0.87 (0.83-0.91)	43.5 (41.3-45.7)	0.89	45.2	3/29/2017
				0.86	43.6	4/4/2017
463	FCC Body	0.94 (0.89-0.99)	56.6 (53.8-59.5)	0.96	57.6	3/28/2017
				0.96	55.3	4/4/2017
	IEEE/IEC Head	0.87 (0.83-0.91)	43.4 (41.3-45.6)	0.90	45.0	3/29/2017
468	FCC Body	0.94 (0.89-0.99)	56.6 (53.8-59.5)	0.97	57.6	3/28/2017
	IEEE/IEC Head	0.87 (0.83-0.91)	43.4 (41.2-45.6)	0.88	43.2	4/4/2017

11.0 Environmental Test Conditions

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

Table 15

	Target	Measured
Ambient Temperature	18 – 25 °C	Range: 19.9 – 23.6°C Avg. 21.8 °C
Tissue Temperature	NA	Range: 19.8 -22.0°C Avg. 20.8°C

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

12.0 DUT Test Setup and Methodology

12.1 Measurements

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

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

Table 16

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

12.2 DUT Configuration(s)

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

12.3 DUT Positioning Procedures

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

12.3.1 Body

The DUT was positioned in normal use configuration against the phantom with the offered body worn accessory.

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.

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

Where

N_c = Number of channels

F_{high} = Upper channel

F_{low} = Lower channel

F_c = Center channel

12.5 SAR Result Scaling Methodology

The calculated 1-gram and 10-gram averaged SAR results indicated as “Max Calc. 1g-SAR” and “Max Calc.10g-SAR” in the data Tables is determined by scaling the measured SAR to account for power leveling variations and drift. Appendix F includes a shortened scan to justify SAR scaling for drift. For this device the “Max Calc. 1g-SAR” and “Max Calc.10g-SAR” are scaled using the following formula:

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

P_{max} = Maximum Power (W)

P_{int} = Initial Power (W)

Drift = DASY drift results (dB)

SAR_meas = Measured 1-g or 10-g Avg. SAR (W/kg)

DC = Transmission mode duty cycle in % where applicable

50% duty cycle is applied for PTT operation

Note: for conservative results, the following are applied:

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

Drift = 1 for positive drift

Additional SAR scaling was applied using the methodologies outlined in FCC KDB 865664 using tissue sensitivity values. SAR was scaled for conditions where the tissue permittivity was measured above the nominal target and for tissue conductivity that was measured below the nominal target. Negative or reduced SAR scaling is not permitted.

12.6 DUT Test Plan

The guidelines and requirements outlined in section 4.0 were used to assess compliance of this device. All modes of operation identified in section 6.0 were considered during the development of the test plan. 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 FRS and GMRS band

Assessments at the Body were done with offered antenna, default batteries and, default body worn accessories indicated in section 7.0 which represent the highest applicable configurations at the body found during the initial compliance assessment on file with the FCC. SAR plot of the highest result per Table 17 (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)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
FRS band (467.5625 -467.7125 MHz)											
Fixed	3XAA Alkaline	PMLN7240A	53724B	467.6375	0.40	-0.78	0.81	0.60	0.61	0.45	TLC-AB-170328-06
GMRS band (462.5500 – 462.7250 MHz) and FRS band (467.5625 -467.7125 MHz)											
Fixed	3XAA Alkaline	PMLN7240A	53724B	462.6375	1.63	-0.99	1.17	0.86	0.90	0.67	TLC-AB-170328-02

13.2 Assessments at the Face for FRS and GMRS band

Assessment at the Face were done with offered antenna, default batteries and, default body worn accessories indicated in section 7.0 which represent the highest applicable configurations at the body found during the initial compliance assessment on file with the FCC. SAR plot of the highest result per Table 18 (bolded) are presented in Appendix E.

Table 18

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
FRS band (467.5625 -467.7125 MHz)											
Fixed	KEBT-1300	None	None	467.6375	0.39	-0.45	0.66	0.48	0.47	0.35	FIE-FACE-170404-06
GMRS band (462.5500 – 462.7250 MHz) and FRS band (467.5625 -467.7125 MHz)											
Fixed	KEBT-1300	None	None	462.6375	1.57	-0.57	1.08	0.79	0.78	0.57	FIE-FACE-170329-02

13.3 Assessment for ISED Canada

Additional tests were not required for ISED Canada frequency range as testing performed is in compliance with ISED Canada frequency range.

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 E.

Table 19

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Meas. 10g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Max Calc. 10g-SAR (W/kg)	Run#
Fixed	3XAA Alkaline	PMLN7240A	53724B	462.6375	1.63	-0.49	1.28	0.95	0.88	0.65	FIE-AB-170404-04

14.0 Simultaneous Transmission Exclusion for BT

Not applicable.

15.0 Results Summary

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

Table 17

Designator	Frequency band (MHz)	Max Calc at Body (W/kg)		Max Calc at Face (W/kg)	
		1g-SAR	10g-SAR	1g-SAR	10g-SAR
FCC/ ISED	462.5625 – 462.7125 (FRS)	*0.90	0.67	*0.78	0.57
	462.5500 – 462.7250 (GMRS)				
	467.5625 - 467.7125 (FRS)	0.61	0.45	0.47	0.35

*The previously reported result at the body 0.65 W/kg and face 0.51 W/kg are hereby replaced with the result presented herein.

The test results clearly demonstrate compliance with General Population / Uncontrolled RF Exposure limits of 1.6 W/kg averaged over 1 gram per the requirements of OET Bulletin 65. The 10 grams result is not applicable to FCC filing.

16.0 Variability Assessment

Per the guidelines in KDB 865664 SAR variability assessment is required because SAR results are above 0.8W/kg (General population).

The Table below includes test results of the original measurement(s), the repeated measurement(s), and the ratio (SAR_{high}/SAR_{low}) for the applicable test configuration(s).

Table 21

Run#	Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq. (MHz)	Adj Calc. 1g-SAR (W/kg)	Ratio	Comments
TLC-AB-170328-02	Fixed Antenna	3XAA Alkaline	PMLN7240A	53724B	462.6375	0.73	1.01	No additional repeated scans is required due to the Ratio (SAR_{high}/SAR_{low}) < 1.20
FIE-AB-170404-04						0.72		

17.0 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 17025 a reported system uncertainty is required and therefore measurement uncertainty budget is included in Appendix A.

Appendix A

Measurement Uncertainty Budget

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

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

Notes for uncertainty budget Tables:

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

b) Tol. - tolerance in influence quantity.

c) Prob. Dist. – Probability distribution

d) N, R - normal, rectangular probability distributions

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

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

g) *u_i* – SAR uncertainty

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

Table A.2: Uncertainty Budget for System Validation (dipole & flat phantom) for 450 MHz

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e = f(d,k)</i>	<i>f</i>	<i>g</i>	<i>h = c x f / e</i>	<i>i = c x g / e</i>	<i>k</i>
Uncertainty Component	IEEE 1528 section	Tol. (± %)	Prob Dist	Div.	<i>c_i</i> (1 g)	<i>c_i</i> (10 g)	1 g <i>U_i</i> (±%)	10 g <i>U_i</i> (±%)	<i>v_i</i>
Measurement System									
Probe Calibration	E.2.1	6.7	N	1.00	1	1	6.7	6.7	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	R	1.73	0.64	0.43	1.2	0.8	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	R	1.73	0.6	0.49	0.6	0.5	∞
Combined Standard Uncertainty			RSS				10	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			<i>k</i> =2				19	18	

Notes for uncertainty budget Tables:

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

b) Tol. - tolerance in influence quantity.

c) Prob. Dist. – Probability distribution

d) N, R - normal, rectangular probability distributions

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

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

g) *u_i* – SAR uncertainty

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

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: **ES3-3096_Apr16**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3096**

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 29, 2016**

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

All calibrations have been conducted in the closed laboratory facility; environment temperature ($22 \pm 3^\circ\text{C}$) and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02288)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (No. 217-02285/02284)	In house check: Jun-16
Power sensor E4412A	SN: MY41498087	06-Apr-16 (No. 217-02285)	In house check: Jun-16
Power sensor E4412A	SN: 000110210	06-Apr-16 (No. 217-02284)	In house check: Jun-16
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Apr-13)	In house check: Jun-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: April 29, 2016

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

Certificate No: **ES3-3096_Apr16**

Page 1 of 14

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



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

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

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

ES3DV3 – SN:3096

April 29, 2016

Probe ES3DV3

SN:3096

Manufactured: July 12, 2005
Repaired: April 26, 2016
Calibrated: April 29, 2016

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

Certificate No: ES3-3096_Apr16

Page 3 of 14

ES3DV3- SN:3096

April 29, 2016

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

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$) ^A	0.96	0.89	0.90	$\pm 10.1\%$
DCP (mV) ^B	105.7	104.3	104.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu V}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	185.2	$\pm 3.8\%$
		Y	0.0	0.0	1.0		173.8	
		Z	0.0	0.0	1.0		198.7	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.57	67.8	19.7	5.67	138.2	$\pm 1.7\%$
		Y	6.44	67.4	19.5		131.7	
		Z	6.59	67.8	19.5		149.1	
10101-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	7.34	67.0	19.5	6.42	125.4	$\pm 1.7\%$
		Y	7.61	67.9	20.1		143.6	
		Z	7.40	67.3	19.5		133.1	
10102-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	X	7.61	67.1	19.7	6.60	127.1	$\pm 1.7\%$
		Y	7.91	68.2	20.3		145.4	
		Z	7.60	67.1	19.4		135.3	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.50	67.5	19.6	5.80	137.0	$\pm 1.7\%$
		Y	6.39	67.1	19.5		130.5	
		Z	6.44	67.2	19.3		146.5	
10109-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	7.49	67.8	20.0	6.43	146.2	$\pm 1.7\%$
		Y	7.37	67.5	19.9		139.9	
		Z	7.05	66.5	19.1		127.8	
10110-CAC	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.19	66.9	19.4	5.75	132.5	$\pm 1.7\%$
		Y	6.08	66.6	19.3		127.5	
		Z	6.13	66.7	19.1		142.4	
10111-CAC	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	7.22	67.4	19.8	6.44	141.3	$\pm 2.2\%$
		Y	7.13	67.2	19.9		135.8	
		Z	7.13	67.4	19.6		148.8	
10112-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	X	7.72	67.9	20.1	6.59	146.0	$\pm 1.9\%$
		Y	7.63	67.7	20.1		140.7	
		Z	7.28	66.7	19.3		129.0	
10113-CAC	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	X	7.49	67.6	20.1	6.62	143.6	$\pm 1.9\%$
		Y	7.36	67.3	20.0		137.2	
		Z	7.09	66.6	19.4		127.0	
10140-CAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	7.90	68.2	20.2	6.49	148.7	$\pm 1.9\%$
		Y	7.81	68.0	20.2		143.9	
		Z	7.56	67.2	19.5		134.1	
10141-CAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	X	7.70	67.3	19.7	6.53	127.2	$\pm 1.9\%$
		Y	7.97	68.2	20.3		146.1	
		Z	7.60	67.0	19.4		135.4	

Certificate No: ES3-3096_Apr16

Page 4 of 14

ES3DV3- SN:3096

April 29, 2016

10142-CAC	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	6.04	66.7	19.3	5.73	130.8	±1.7 %
		Y	6.19	67.4	19.7		149.8	
		Z	5.97	66.6	19.1		140.2	
10143-CAC	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	7.02	67.3	19.8	6.35	138.0	±1.9 %
		Y	6.90	67.1	19.7		132.9	
		Z	6.94	67.3	19.5		147.4	
10144-CAC	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	X	7.38	67.6	20.1	6.65	140.2	±1.9 %
		Y	7.28	67.5	20.1		135.4	
		Z	7.27	67.8	20.0		148.2	
10146-CAC	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	5.78	66.2	19.1	5.76	126.9	±1.4 %
		Y	5.95	67.1	19.6		146.3	
		Z	5.63	65.9	18.6		133.9	
10146-CAC	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	6.76	67.2	19.7	6.41	133.2	±1.9 %
		Y	6.66	67.0	19.7		128.2	
		Z	6.59	67.1	19.5		140.7	
10147-CAC	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	X	7.06	67.4	20.0	6.72	134.5	±2.2 %
		Y	6.96	67.2	20.0		129.8	
		Z	6.95	67.6	20.0		141.4	
10149-CAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	7.47	67.8	20.0	6.42	144.6	±1.9 %
		Y	7.41	67.7	20.1		140.2	
		Z	7.13	66.8	19.4		129.1	
10150-CAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	X	7.74	67.9	20.2	6.60	146.5	±1.9 %
		Y	7.67	67.9	20.2		142.5	
		Z	7.35	66.9	19.4		130.7	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.17	66.8	19.3	5.75	132.7	±1.4 %
		Y	6.12	66.7	19.4		128.1	
		Z	6.16	66.9	19.2		142.4	
10155-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	7.21	67.4	19.8	6.43	141.3	±1.9 %
		Y	7.16	67.4	20.0		136.7	
		Z	6.79	66.1	19.0		125.3	
10156-CAC	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	5.99	66.5	19.2	5.79	129.8	±1.7 %
		Y	6.16	67.3	19.8		149.3	
		Z	5.90	66.4	18.9		137.3	
10157-CAC	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	7.01	67.2	19.8	6.49	136.9	±1.9 %
		Y	6.93	67.2	19.9		131.7	
		Z	6.88	67.2	19.6		143.5	
10158-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	X	7.49	67.6	20.1	6.62	142.3	±1.9 %
		Y	7.42	67.6	20.1		137.4	
		Z	7.13	66.7	19.4		125.9	
10159-CAC	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	X	7.12	67.3	19.9	6.56	137.4	±2.2 %
		Y	7.08	67.4	20.0		132.4	
		Z	7.02	67.5	19.8		145.3	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.61	67.3	19.5	5.82	135.9	±1.7 %
		Y	6.51	67.1	19.5		132.3	
		Z	6.62	67.4	19.5		146.9	

Certificate No: ES3-3096_Apr16

Page 5 of 14

ES3DV3- SN:3096

April 29, 2016

10181-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	7.52	67.7	20.0	6.43	144.3	±1.9 %
		Y	7.44	67.6	20.0		140.0	
		Z	7.11	66.6	19.2		127.8	
10182-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	X	7.75	67.9	20.1	6.58	146.0	±1.9 %
		Y	7.67	67.8	20.1		141.6	
		Z	7.35	66.8	19.4		130.4	
10186-CAC	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	5.41	66.8	19.4	5.46	143.9	±1.2 %
		Y	5.36	66.8	19.4		138.5	
		Z	5.14	66.1	18.8		129.3	
10187-CAC	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	6.46	67.9	20.1	6.21	149.0	±1.7 %
		Y	6.36	67.8	20.1		143.6	
		Z	5.99	66.7	19.2		131.7	
10188-CAC	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	X	6.66	67.1	20.0	6.79	125.6	±1.9 %
		Y	6.88	68.2	20.7		144.3	
		Z	6.54	67.4	20.0		133.1	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.24	66.8	19.5	5.73	135.2	±1.4 %
		Y	5.23	66.9	19.6		133.1	
		Z	5.10	66.7	19.1		145.3	
10170-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	6.17	68.2	20.5	6.52	137.9	±1.7 %
		Y	6.12	68.1	20.5		134.4	
		Z	5.93	68.0	20.2		145.0	
10171-AAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	X	6.20	68.4	20.5	6.49	138.1	±1.7 %
		Y	6.14	68.2	20.6		134.7	
		Z	5.91	67.8	20.0		144.8	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.24	66.9	19.6	5.72	136.0	±1.4 %
		Y	5.21	66.8	19.6		133.5	
		Z	5.07	66.5	19.0		143.3	
10176-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	6.20	68.3	20.5	6.52	138.9	±1.7 %
		Y	6.14	68.2	20.6		135.4	
		Z	5.91	67.8	20.1		145.0	
10177-CAE	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	5.26	67.0	19.6	5.73	136.2	±1.2 %
		Y	5.23	66.9	19.7		133.8	
		Z	5.07	66.5	19.0		143.4	
10178-CAC	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	6.19	68.2	20.5	6.52	136.8	±1.7 %
		Y	6.16	68.2	20.6		135.8	
		Z	5.89	67.7	20.0		144.1	
10179-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	X	6.21	68.4	20.5	6.50	138.1	±1.7 %
		Y	6.12	68.2	20.5		133.9	
		Z	5.92	68.0	20.1		143.5	
10180-CAC	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	X	6.18	68.2	20.5	6.50	138.1	±1.7 %
		Y	6.15	68.3	20.6		134.8	
		Z	5.90	67.9	20.1		143.9	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.24	66.9	19.5	5.72	135.5	±1.4 %
		Y	5.25	67.0	19.7		133.1	
		Z	5.10	66.7	19.2		142.5	

Certificate No: ES3-3096_Apr16

Page 6 of 14

ES3DV3- SN:3096

April 29, 2016

10182-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	6.17	68.2	20.5	6.52	138.0	±1.7 %
		Y	6.10	68.0	20.5		133.2	
		Z	5.89	67.7	20.0		142.5	
10183-AAA	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	X	6.17	68.2	20.5	6.50	137.2	±1.7 %
		Y	6.12	68.2	20.6		133.6	
		Z	5.93	68.1	20.2		142.5	
10184-CAC	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	5.22	66.8	19.5	5.73	134.5	±1.2 %
		Y	5.21	66.8	19.6		132.5	
		Z	5.15	66.9	19.3		141.2	
10185-CAC	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	6.18	68.2	20.5	6.51	137.2	±1.9 %
		Y	6.10	68.0	20.5		132.7	
		Z	5.93	67.9	20.1		143.9	
10186-AAC	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	X	6.20	68.3	20.5	6.50	136.8	±1.7 %
		Y	6.11	68.1	20.5		133.6	
		Z	6.02	68.5	20.5		142.7	
10187-CAC	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	5.25	66.9	19.5	5.73	134.3	±1.2 %
		Y	5.22	66.9	19.6		132.1	
		Z	5.10	66.7	19.2		141.6	
10188-CAC	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	6.18	68.2	20.5	6.52	136.7	±1.9 %
		Y	6.12	68.1	20.6		132.9	
		Z	5.87	67.7	20.0		143.8	
10189-AAC	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	X	6.20	68.3	20.5	6.50	137.0	±1.7 %
		Y	6.11	68.1	20.5		132.3	
		Z	5.97	68.2	20.2		143.8	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.45	67.2	19.5	5.81	131.4	±1.7 %
		Y	6.37	67.1	19.5		128.0	
		Z	6.29	66.6	18.9		134.7	
10298-AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	5.82	66.2	19.1	5.72	127.0	±1.4 %
		Y	6.03	67.2	19.7		146.8	
		Z	5.71	66.1	18.8		129.6	
10299-AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	6.84	67.2	19.7	6.39	132.9	±1.7 %
		Y	6.74	67.0	19.7		129.6	
		Z	6.66	67.1	19.5		135.2	
10300-AAB	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	X	7.08	67.4	20.0	6.60	134.1	±1.9 %
		Y	7.00	67.3	20.0		130.9	
		Z	6.91	67.4	19.8		141.9	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	7.01	67.8	19.9	6.06	136.2	±1.7 %
		Y	6.99	67.8	20.0		135.2	
		Z	6.74	66.9	19.3		125.0	

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 8 and 9).

^b Numerical linearization parameter: uncertainty not required.

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

ES3DV3- SN:3096

April 29, 2016

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3096**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	7.16	7.16	7.16	0.08	1.20	± 13.3 %
300	45.3	0.87	7.14	7.14	7.14	0.14	1.60	± 13.3 %
450	43.5	0.87	6.70	6.70	6.70	0.22	1.70	± 13.3 %
750	41.9	0.89	6.55	6.55	6.55	0.80	1.17	± 12.0 %
900	41.5	0.97	6.19	6.19	6.19	0.73	1.22	± 12.0 %
1810	40.0	1.40	5.09	5.09	5.09	0.43	1.61	± 12.0 %
1900	40.0	1.40	5.05	5.05	5.05	0.56	1.39	± 12.0 %
2300	39.5	1.67	4.75	4.75	4.75	0.59	1.41	± 12.0 %
2450	39.2	1.80	4.52	4.52	4.52	0.73	1.32	± 12.0 %
2600	39.0	1.96	4.33	4.33	4.33	0.80	1.27	± 12.0 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

ES3DV3- SN:3096

April 29, 2016

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3096**Calibration Parameter Determined in Body Tissue Simulating Media**

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
150	61.9	0.80	6.97	6.97	6.97	0.08	1.50	± 13.3 %
300	58.2	0.92	6.76	6.76	6.76	0.12	1.30	± 13.3 %
450	56.7	0.94	6.82	6.82	6.82	0.15	1.30	± 13.3 %
750	55.5	0.96	6.11	6.11	6.11	0.61	1.37	± 12.0 %
900	55.0	1.05	5.97	5.97	5.97	0.62	1.32	± 12.0 %
1810	53.3	1.52	4.91	4.91	4.91	0.63	1.34	± 12.0 %
1900	53.3	1.52	4.74	4.74	4.74	0.56	1.45	± 12.0 %
2300	52.9	1.81	4.46	4.46	4.46	0.80	1.20	± 12.0 %
2450	52.7	1.95	4.31	4.31	4.31	0.80	1.18	± 12.0 %
2600	52.5	2.16	4.15	4.15	4.15	0.80	1.15	± 12.0 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

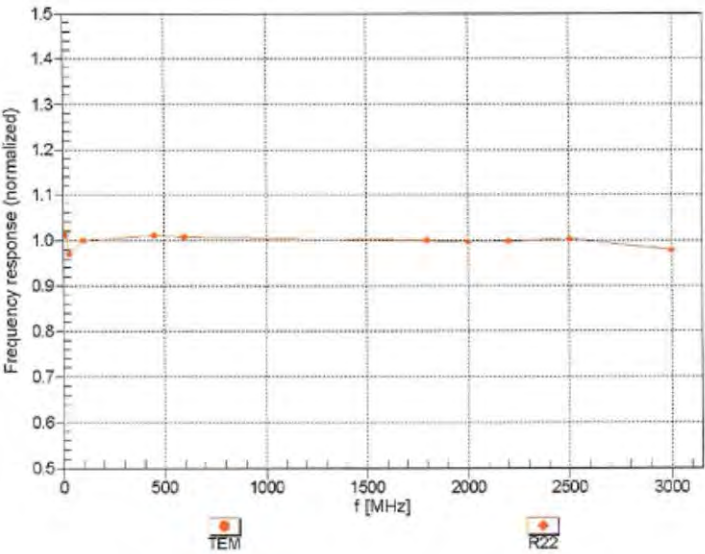
^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty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

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

ES3DV3- SN:3096

April 29, 2016

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

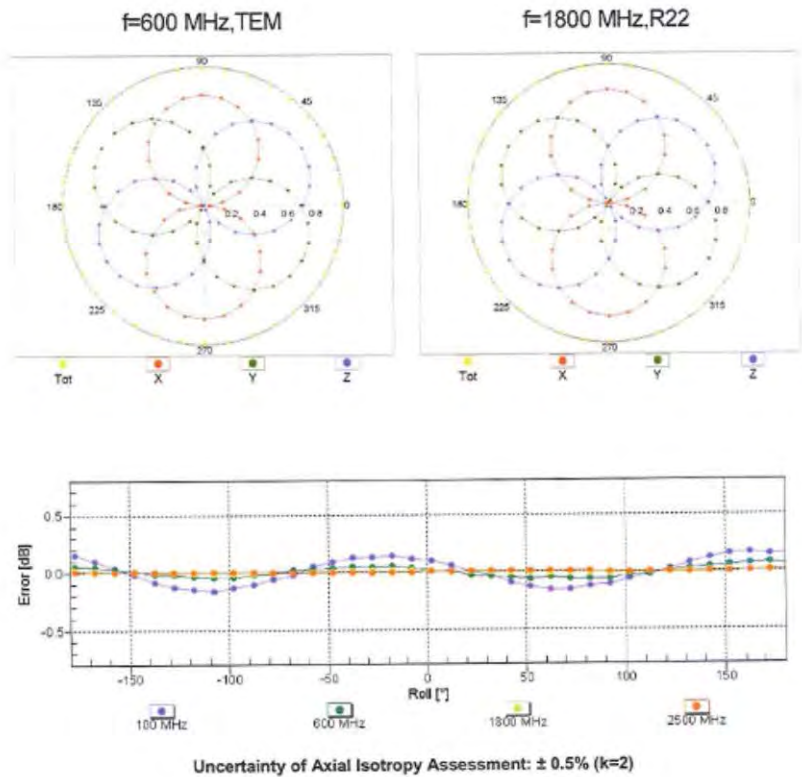


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

ES3DV3- SN:3096

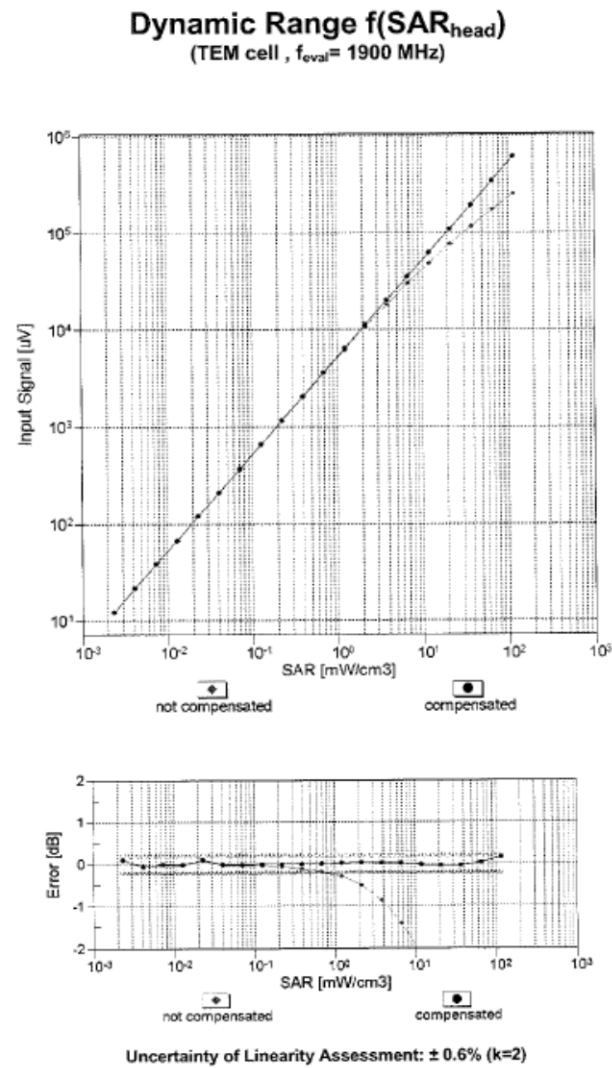
April 29, 2016

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



ES3DV3- SN:3096

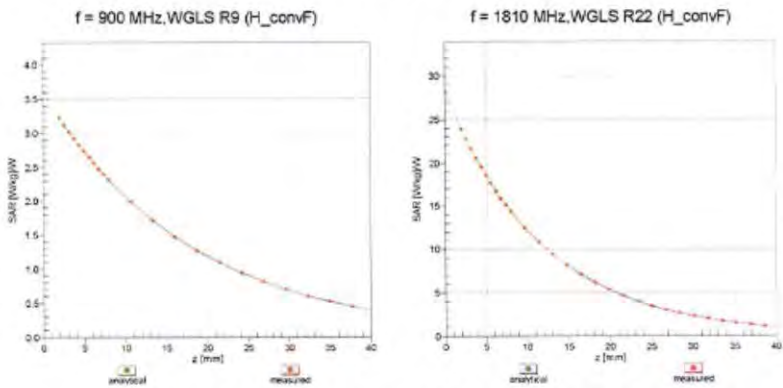
April 29, 2016



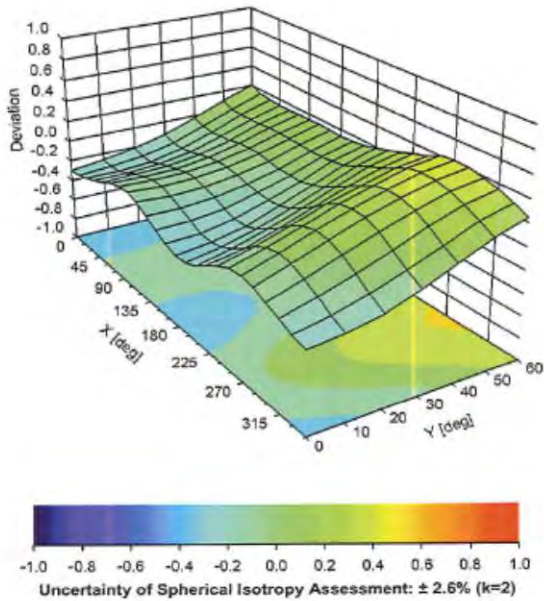
ES3DV3- SN:3096

April 29, 2016

Conversion Factor Assessment



Deviation from Isotropy in Liquid
Error (ϕ, θ), $f = 900 \text{ MHz}$



ES3DV3- SN:3096

April 29, 2016

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

Sensor Arrangement	Triangular
Connector Angle (°)	2.3
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 C

Dipole Calibration Certificates

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



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

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

Accreditation No.: **SCS 0108**

Client **Motorola EME**

Certificate No: **D450V3-1077_Nov15**

CALIBRATION CERTIFICATE

Object **D450V3 - SN: 1077**

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

Calibration date: **November 25, 2015**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ET3DV6	SN: 1507	30-Dec-14 (No. ET3-1507_Dec14)	Dec-15
DAE4	SN: 654	08-Jul-15 (No. DAE4-654_Jul15)	Jul-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	04-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by:	Name Leif Klysner	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	

Issued: November 25, 2015

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

Certificate No: **D450V3-1077_Nov15**

Page 1 of 8

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



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

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.6.8
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	44.0 $\pm$ 6 %	0.89 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.57 W/kg $\pm$ 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	0.777 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	3.07 W/kg $\pm$ 17.6 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	56.3 $\pm$ 6 %	0.95 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	4.52 W/kg $\pm$ 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	0.749 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	2.97 W/kg $\pm$ 17.6 % (k=2)

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

Impedance, transformed to feed point	58.1 Ω - 2.3 j Ω
Return Loss	- 22.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	55.0 Ω - 6.8 j Ω
Return Loss	- 21.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.349 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	June 24, 2010

DASY5 Validation Report for Head TSL

Date: 25.11.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium parameters used: $f = 450$ MHz; $\sigma = 0.89$ S/m; $\epsilon_r = 44$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.58, 6.58, 6.58); Calibrated: 30.12.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 08.07.2015
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

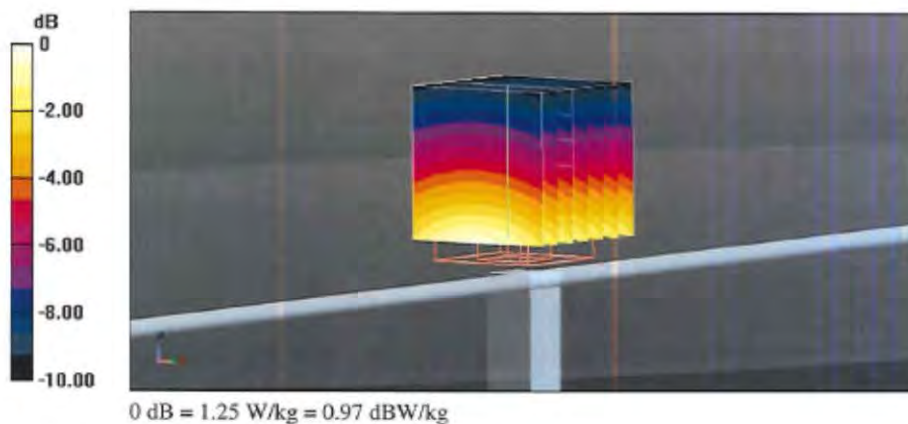
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 39.43 V/m; Power Drift = -0.04 dB

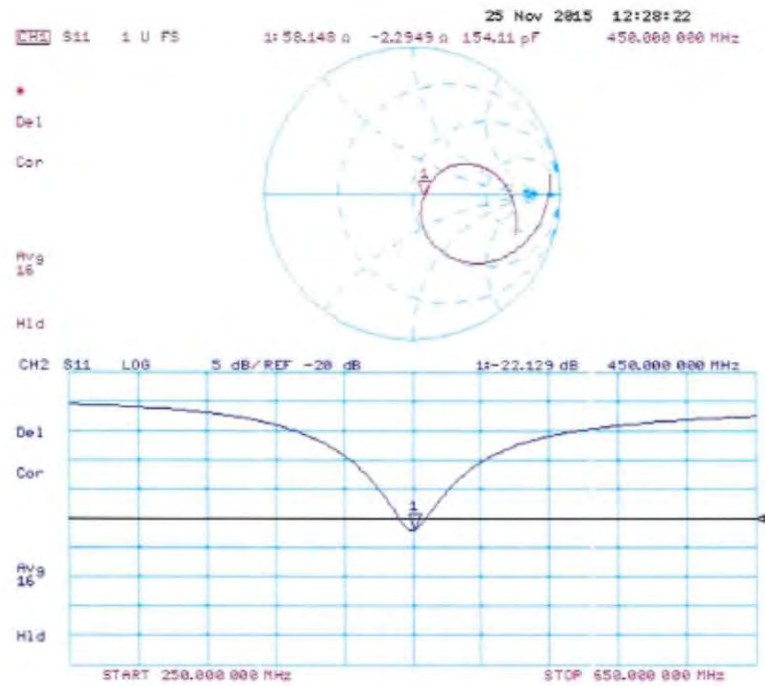
Peak SAR (extrapolated) = 1.67 W/kg

SAR(1 g) = 1.16 W/kg; SAR(10 g) = 0.777 W/kg

Maximum value of SAR (measured) = 1.25 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 25.11.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium parameters used: $f = 450$ MHz; $\sigma = 0.95$ S/m; $\epsilon_r = 56.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(7.05, 7.05, 7.05); Calibrated: 30.12.2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 08.07.2015
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

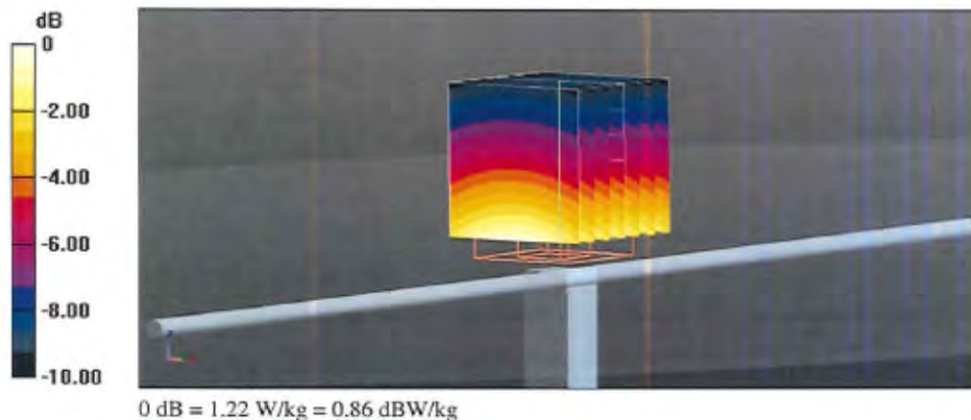
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 36.74 V/m; Power Drift = -0.04 dB

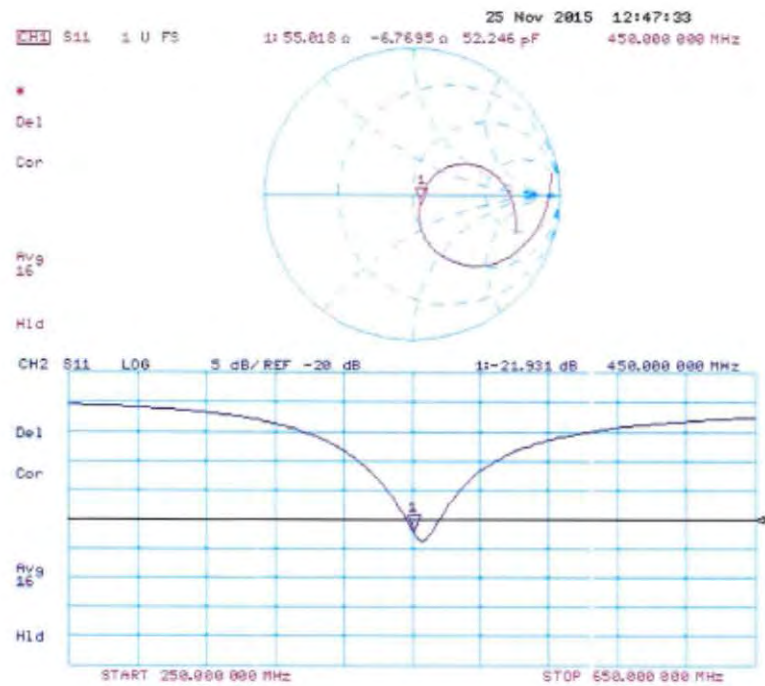
Peak SAR (extrapolated) = 1.80 W/kg

SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.749 W/kg

Maximum value of SAR (measured) = 1.22 W/kg



Impedance Measurement Plot for Body TSL



Dipole Data

As stated in KDB 865664, for dipole D450V3 (serial number 1077) exceed annual calibration, the test laboratory must ensure that the required supporting information and documentation are included in report to qualify for extended calibration interval.

The table below includes dipole impedance and return loss measurement data measured by Motorola Solutions' EME lab. The results meet requirements stated in KDB 865664.

Dipole D450V3 (SN 1077)	Head			Body		
	Impedance		Return Loss	Impedance		Return Loss
Date Measured	real Ω	imag $j\Omega$	dB	real Ω	imag $j\Omega$	dB
06/28/2016	58.87	-2.93	-22.48	50.59	-6.61	-22.25
12/01/2016	59.08	-2.93	-22.65	51.05	-7.45	-22.63

APPENDIX D

System Verification Check Scans

Motorola Solutions, Inc. EME Laboratory

Date/Time: 3/28/2017 2:07:52 PM

Robot#: DASY5-PG-2 | Run#: FIE-SYSP-450B-170328-01
 Dipole Model#: D450V3
 Phantom#: EL14 1040
 Tissue Temp: 20.5 (C)
 Serial#: 1077
 Test Freq: 450.0000 (MHz)
 Start Power: 250 (mW)
 Rotation (1D): 0.12 dB
 Adjusted SAR (1W): 4.24 mW/g (1g)

Comments:

Duty Cycle: 1:1, Medium parameters used: $f = 450$ MHz; $\sigma = 0.95$ S/m; $\epsilon_r = 57.8$; $\rho = 1000$ kg/m³
 Probe: ES3DV3 - SN3096, Frequency: 450 MHz, ConvF(6.82, 6.82, 6.82); Calibrated: 4/29/2016
 Electronics: DAE4 Sn1483, Calibrated: 9/27/2016

Below 2 GHz-Rev.2/System Performance Check/Dipole Area Scan 2 (41x201x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 36.93 V/m; Power Drift = -0.12 dB

Fast SAR: SAR(1 g) = 1.09 W/kg; SAR(10 g) = 0.754 W/kg (SAR corrected for target medium)

Maximum value of SAR (interpolated) = 1.24 W/kg

Below 2 GHz-Rev.2/System Performance Check/0-Degree Cube (5x5x7)/Cube 0:

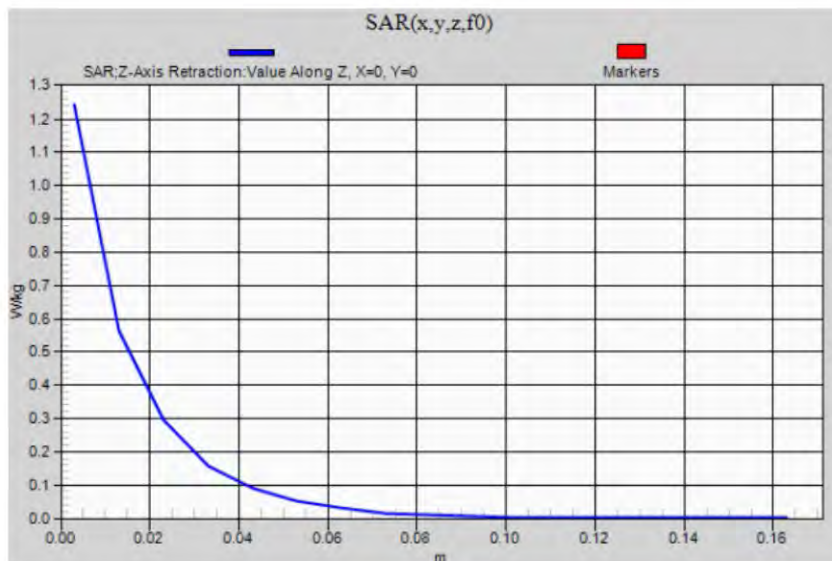
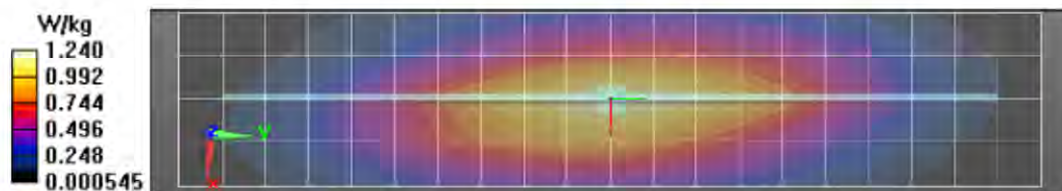
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 36.93 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 1.68 W/kg

SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.703 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 1.24 W/kg

Below 2 GHz-Rev.2/System Performance Check/Z-Axis Retraction (1x1x17): Measurement grid: dx=20mm, dy=20mm, dz=10mm

Motorola Solutions, Inc. EME Laboratory

Date/Time: 3/29/2017 7:53:57 AM

Robot#: DASY5-PG-2 | Run#: FIE-SYSP-450H-170329-01
 Dipole Model#: D450V3
 Phantom#: ELI4 1109
 Tissue Temp: 21.3 (C)
 Serial#: 1077
 Test Freq: 450.0000 (MHz)
 Start Power: 250 (mW)
 Rotation (1D): 0.071 dB
 Adjusted SAR (1W): 4.52 mW/g (1g)

Comments

Duty Cycle: 1:1, Medium parameters used: $f = 450$ MHz; $\sigma = 0.89$ S/m; $\epsilon_r = 45.2$; $\rho = 1000$ kg/m³
 Probe: ES3DV3 - SN3096, Frequency: 450 MHz, ConvF(6.7, 6.7, 6.7); Calibrated: 4/29/2016
 Electronics DAE4 Srt483, Calibrated: 9/27/2016

Below 2 GHz-Rev.2/System Performance Check/Dipole Area Scan 2 (41x201x1):

Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Reference Value = 39.52 V/m; Power Drift = -0.03 dB

Fast SAR: SAR(1 g) = 1.17 W/kg; SAR(10 g) = 0.808 W/kg (SAR corrected for target medium)

Maximum value of SAR (interpolated) = 1.34 W/kg

Below 2 GHz-Rev.2/System Performance Check/0-Degree Cube (5x5x7)/Cube 0:

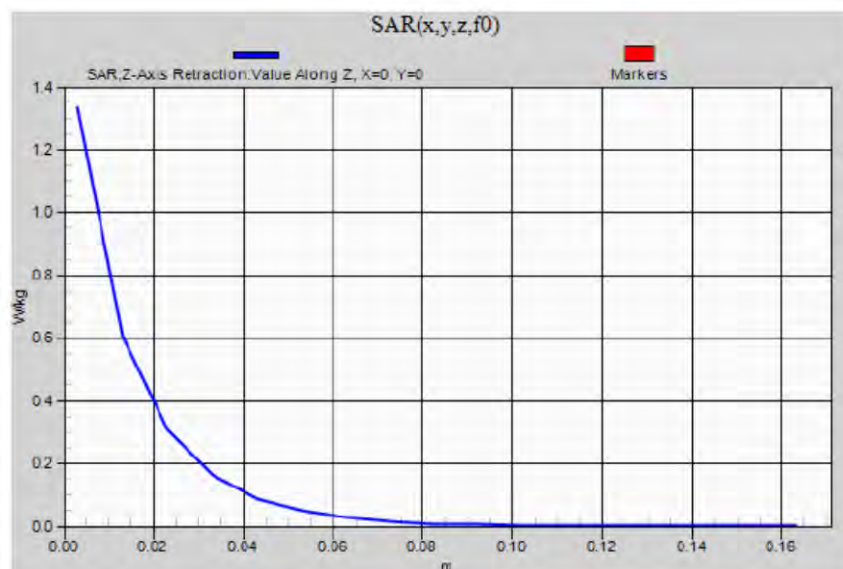
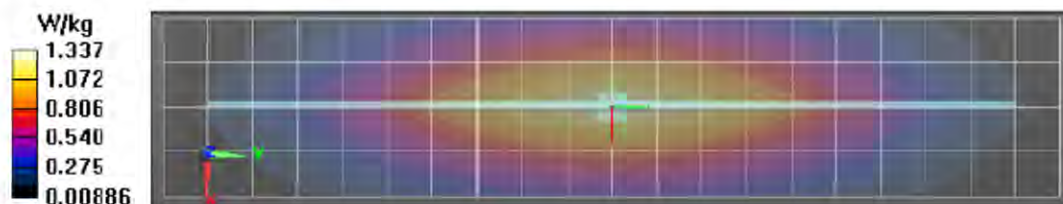
Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 39.52 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.76 W/kg

SAR(1 g) = 1.13 W/kg; SAR(10 g) = 0.752 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 1.33 W/kg

Below 2 GHz-Rev.2/System Performance Check/Z-Axis Retraction (1x1x17): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=10$ mm

Motorola Solutions, Inc. EME Laboratory
Date/Time: 4/4/2017 2:10:03 PM

Robot#: DASY5-PG-2 | Run#: TLC-SYSP-450B-170404-03
Dipole Model# D450V3
Phantom# EL14 1077
Tissue Temp: 20.4 (C)
Serial#: 1077
Test Freq: 450.0000 (MHz)
Start Power: 250 (mW)
Rotation (1D): 0.083 dB
Adjusted SAR (1W): 4.24 mW/g (1g)

Comments:

Duty Cycle: 1:1, Medium parameters used: $f = 450 \text{ MHz}$; $\sigma = 0.95 \text{ S/m}$; $\epsilon_r = 55.4$; $\rho = 1000 \text{ kg/m}^3$
Probe: ES3DV3 - SN3096, , Frequency: 450 MHz, ConvF(6.82, 6.82, 6.82); Calibrated: 4/29/2016
Electronics: DAE4 Sn1483, Calibrated: 9/27/2016

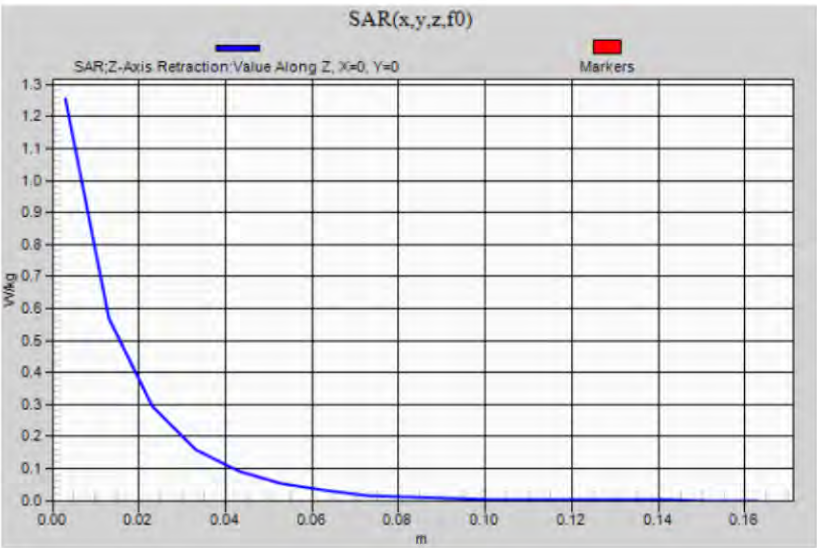
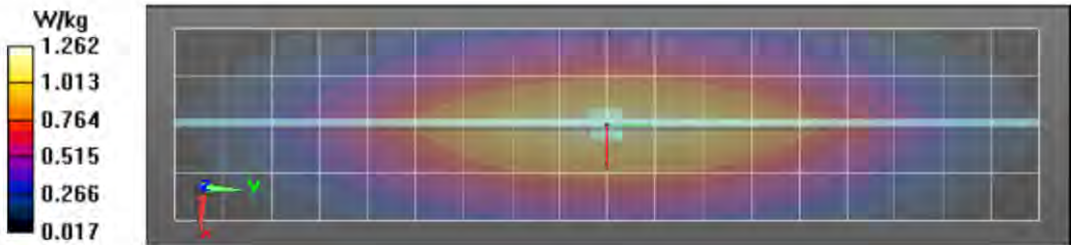
Below 2 GHz-Rev.2/System Performance Check/Dipole Area Scan 2 (41x181x1):

Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$
Reference Value = 37.03 V/m, Power Drift = -0.12 dB
Fast SAR: SAR(1 g) = 1.1 W/kg; SAR(10 g) = 0.762 W/kg (SAR corrected for target medium)
Maximum value of SAR (interpolated) = 1.26 W/kg

Below 2 GHz-Rev.2/System Performance Check/0-Degree Cube (5x5x7)/Cube 0:

Measurement grid: $dx=7.5 \text{ mm}$, $dy=7.5 \text{ mm}$, $dz=5 \text{ mm}$
Reference Value = 37.03 V/m, Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.70 W/kg
SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.708 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 1.25 W/kg

Below 2 GHz-Rev.2/System Performance Check/Z-Axis Retraction (1x1x17): Measurement grid: $dx=20 \text{ mm}$, $dy=20 \text{ mm}$, $dz=10 \text{ mm}$



Motorola Solutions, Inc. EME Laboratory
Date/Time: 4/4/2017 6:05:16 PM

Robot#: DASY5-PG-2 | Run#: FIE-SYSP-450H-170404-05
Dipole Model#: D450V3
Phantom#: EL14 1077
Tissue Temp: 20.5 (C)
Serial#: 1077
Test Freq: 450.0000 (MHz)
Start Power: 250 (mW)
Rotation (1D): 0.087 dB
Adjusted SAR (1W): 4.28 mW/g (1g)

Comments:
Duty Cycle: 1:1, Medium parameters used: $f = 450 \text{ MHz}$; $\sigma = 0.86 \text{ S/m}$; $\epsilon_r = 43.6$; $\rho = 1000 \text{ kg/m}^3$
Probe: ES3DV3 - SN3096, Frequency: 450 MHz, ConvF(6.7, 6.7, 6.7); Calibrated: 4/29/2016
Electronics: DAE4 Sn1483, Calibrated: 9/27/2016

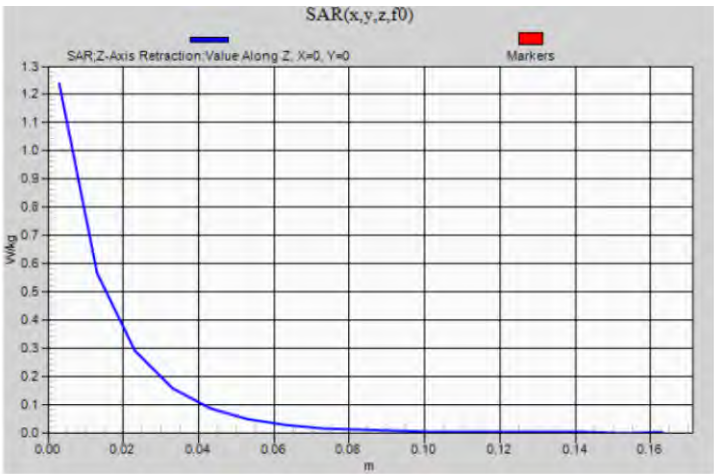
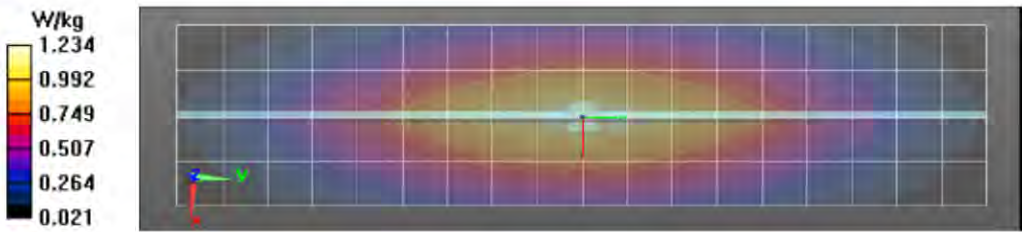
Below 2 GHz-Rev.2/System Performance Check/Dipole Area Scan 2 (41x181x1):

Interpolated grid: $dx = 1.500 \text{ mm}$, $dy = 1.500 \text{ mm}$
Reference Value = 38.52 V/m; Power Drift = -0.01 dB
Fast SAR: SAR(1 g) = 1.09 W/kg; SAR(10 g) = 0.756 W/kg (SAR corrected for target medium)
Maximum value of SAR (interpolated) = 1.23 W/kg

Below 2 GHz-Rev.2/System Performance Check/0-Degree Cube (5x5x7)/Cube 0:

Measurement grid: $dx = 7.5 \text{ mm}$, $dy = 7.5 \text{ mm}$, $dz = 5 \text{ mm}$
Reference Value = 38.52 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.64 W/kg
SAR(1 g) = 1.07 W/kg; SAR(10 g) = 0.713 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 1.24 W/kg

Below 2 GHz-Rev.2/System Performance Check/Z-Axis Retraction (1x1x17): Measurement grid: $dx = 20 \text{ mm}$, $dy = 20 \text{ mm}$, $dz = 10 \text{ mm}$



APPENDIX E

DUT Scans - (Shortened Scan and Highest SAR configurations)

Shortened Scan of Highest SAR configuration

Motorola Solutions, Inc. EME Laboratory

Date/Time: 4/4/2017 2:56:52 PM

Robot#: DASY5-PG-2 | Run#: FIE-AB-17404-04
 Model#: PMUE5289A
 Phantom#: ELI4 1040
 Tissue Temp: 20.8 (°C)
 Serial#: 1754TES806
 Antenna: Fixed
 Test Freq: 462.6375 (MHz)
 Battery: 3XAA Alkaline
 Carry Acc: PMLN7240A
 Audio Acc: 53724B
 Start Power: 1.63 (W)

Comments

Duty Cycle: 1:1, Medium parameters used: $f = 463$ MHz; $\sigma = 0.96$ S/m; $\epsilon_r = 55.3$; $\rho = 1000$ kg/m³
 Probe: ES3DV3 - SN3096, Frequency: 462.637 MHz, ConvF(6.82, 6.82, 6.82); Calibrated: 4/29/2016
 Electronics: DAE4 Sni483, Calibrated: 9/27/2016

Below 2 GHz-Rev.2/Ab Scan/1-Area Scan (71x171x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Reference Value = 38.94 V/m; Power Drift = -0.67 dB

Fast SAR: SAR(1 g) = 1.26 W/kg; SAR(10 g) = 0.919 W/kg (SAR corrected for target medium)

Maximum value of SAR (interpolated) = 1.41 W/kg

Below 2 GHz-Rev.2/Ab Scan/2-Volume 2D Scan (41x41x1): Interpolated grid: $dx=0.7500$ mm, $dy=0.7500$ mm, $dz=1.000$ mm

Reference Value = 38.94 V/m; Power Drift = -0.76 dB

Fast SAR: SAR(1 g) = 1.21 W/kg; SAR(10 g) = 0.887 W/kg (SAR corrected for target medium)

Maximum value of SAR (interpolated) = 1.34 W/kg

Below 2 GHz-Rev.2/Ab Scan/4-Z-Axis Scan (1x1x17): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=10$ mm

Maximum value of SAR (measured) = 1.32 W/kg

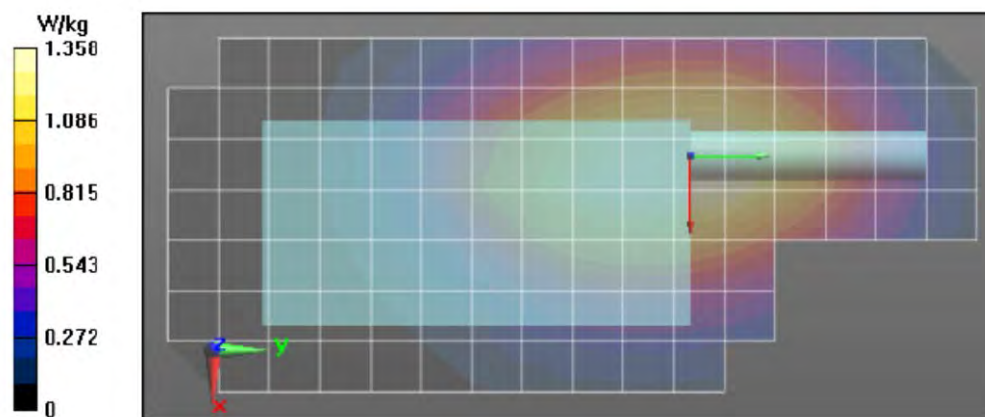
Below 2 GHz-Rev.2/Ab Scan/3-Zoom Scan (6x6x7)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 39.76 V/m; Power Drift = -0.49 dB

Peak SAR (extrapolated) = 1.80 W/kg

SAR(1 g) = 1.28 W/kg; SAR(10 g) = 0.949 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 1.43 W/kg



Shortened scan reflects highest SAR producing configuration and is compared to the full scan.

Scan Description	Referenced Table	Test Time (min.)	SAR 1g (W/kg)	SAR 10g (W/kg)
Shorten scan (zoom)	19	7	0.88	0.65
Full scan (area & zoom)	17	25	0.90	0.67

Highest Body SAR Configuration Results

Motorola Solutions, Inc. EME Laboratory

Date/Time: 3/28/2017 3:19:55 PM

Robot#: DASY5-PG-2 | Run#: TLC-AB-170328-02
 Model#: PMUE5289A
 Phantom#: ELI4 1040
 Tissue Temp: 20.8 (C)
 Serial#: 1754TES806
 Antenna: Fixed
 Test Freq: 462.6375 (MHz)
 Battery: 3XAA Alkaline
 Carry Acc: PMLN7240A
 Audio Acc: 53724B
 Start Power: 1.63 (W)

Comments:

Duty Cycle: 1:1, Medium parameters used: $f = 463$ MHz; $\sigma = 0.96$ S/m; $\epsilon_r = 57.6$; $\rho = 1000$ kg/m³
 Probe: ES3DV3 - SN3096, , Frequency: 462.637 MHz, ConvF(6.82, 6.82, 6.82); Calibrated: 4/29/2016
 Electronics: DAE4 Sn1483, Calibrated: 9/27/2016

Below 2 GHz-Rev.2/Ab Scan/1-Area Scan (71x171x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 39.53 V/m; Power Drift = -0.84 dB

Fast SAR: SAR(1 g) = 1.27 W/kg; SAR(10 g) = 0.922 W/kg (SAR corrected for target medium)

Maximum value of SAR (interpolated) = 1.42 W/kg

Below 2 GHz-Rev.2/Ab Scan/3-Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 39.53 V/m; Power Drift = -0.99 dB

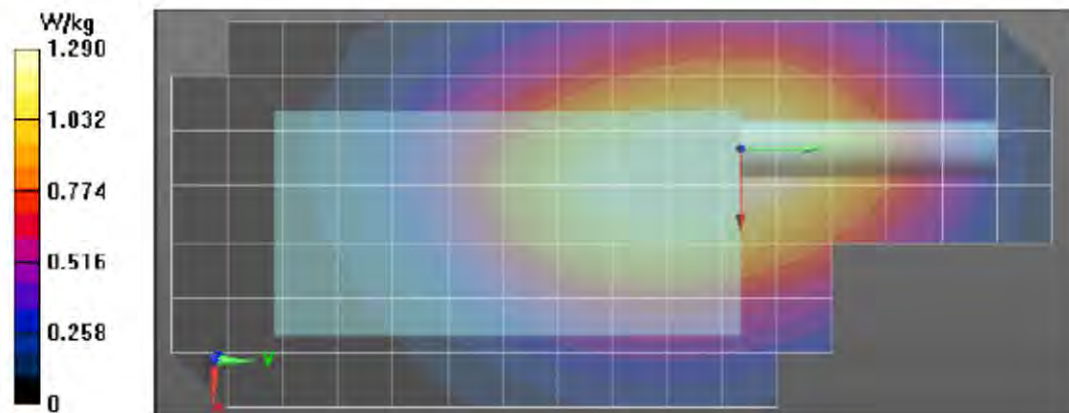
Peak SAR (extrapolated) = 1.63 W/kg

SAR(1 g) = 1.17 W/kg; SAR(10 g) = 0.863 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 1.31 W/kg

Below 2 GHz-Rev.2/Ab Scan/4-Z-Axis Scan (1x1x17): Measurement grid: dx=20mm, dy=20mm, dz=10mm

Maximum value of SAR (measured) = 1.29 W/kg



Highest Face SAR Configuration Results

Motorola Solutions, Inc. EME Laboratory

Date/Time: 3/29/2017 10:03:22 AM

Robot#: DASY5-PG-2 | Run#: FIE-FACE-170329-02

Model#: PMUE5289A

Phantom#: ELI4 1109

Tissue Temp: 21.1 (C)

Serial#: 1754TES806

Antenna: Fixed

Test Freq: 462.6375 (MHz)

Battery: KEBT-1300

Carry Acc: None

Audio Acc: None

Start Power: 1.57 (W)

Comments:

Duty Cycle: 1:1, Medium parameters used: $f = 463$ MHz; $\sigma = 0.9$ S/m; $\epsilon_r = 45$; $\rho = 1000$ kg/m³

Probe: ES3DV3 - SN3096, Frequency: 462.637 MHz, ConvF(6.7, 6.7, 6.7); Calibrated: 4/29/2016

Electronics: DAE4 Sn1483, Calibrated: 9/27/2016

Below 2 GHz-Rev.2/Face Scan/1-Area Scan (61x151x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 35.14 V/m; Power Drift = -0.42 dB

Fast SAR: SAR(1 g) = 1.15 W/kg; SAR(10 g) = 0.834 W/kg (SAR corrected for target medium)

Maximum value of SAR (interpolated) = 1.28 W/kg

Below 2 GHz-Rev.2/Face Scan/3-Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 35.14 V/m; Power Drift = -0.57 dB

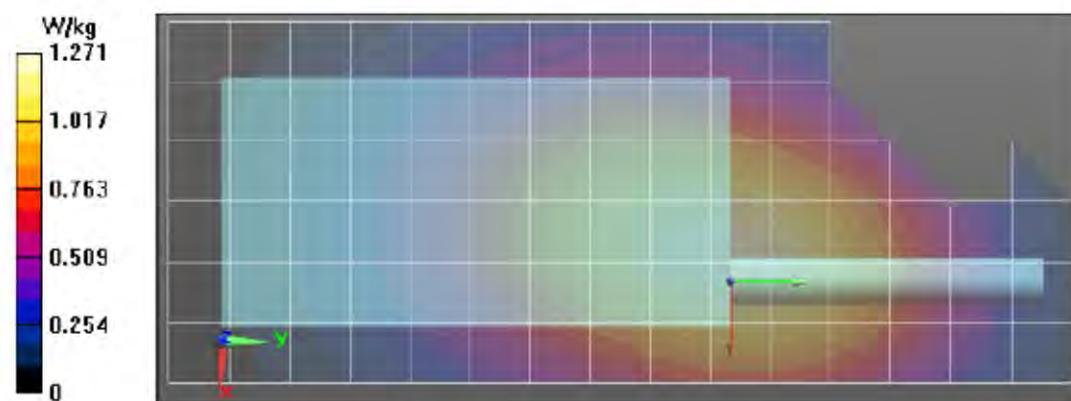
Peak SAR (extrapolated) = 1.49 W/kg

SAR(1 g) = 1.08 W/kg; SAR(10 g) = 0.791 W/kg (SAR corrected for target medium)

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

Below 2 GHz-Rev.2/Face Scan/4-Z-Axis Scan (1x1x17): Measurement grid: dx=20mm, dy=20mm, dz=10mm

Maximum value of SAR (measured) = 1.19 W/kg



APPENDIX F

DUT Test Position Photos

1.0 Highest SAR Test Position per body location

- 1.1 Body
- DUT with fixed antenna, offered battery 3xAA Alkaline and body worn kit PMLN7240A against the phantom with an audio accessory 53724B attached.



Antenna kit #	Separation Distances (mm)		
	@ bottom surface of the DUT	@ antenna's base	@ antenna's tip
Fixed Antenna	13	25	30

- 1.2 Face
- Front of DUT with fixed antenna and offered battery KEBT-1300 separated 2.5cm from the phantom without an audio accessory attached.



Antenna kit #	Separation Distances (mm)		
	@ bottom surface of the DUT	@ antenna's base	@ antenna's tip
Fixed Antenna	28	35	35