



**MOTOROLA SOLUTIONS**



**MS ISO/IEC 17025  
TESTING  
SMM No. 0826**

**DECLARATION OF COMPLIANCE SAR ASSESSMENT PCII Report Part 1 of 2**

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**Date of Report: 10/23/2017**  
**Report Revision: A**

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**Date/s Tested:** 07/13/2017- 08/11/2017  
**Manufacturer:** Motorola Solutions Inc.  
**DUT Description:** Handheld Portable - Frequency bands; LMR 136-174 MHz, 380-520 MHz, 764-776 MHz, 794-824 MHz & 851-869 MHz; Bluetooth 2.402-2.480 GHz; WLAN 2.400-2.483.5 GHz  
**Test TX mode(s):** CW (PTT), Bluetooth, and WLAN 802.11b/g/n  
**Max. Power output:** 6.6 W (VHF), 5.7 W (UHF), 2.99 W (700 MHz band), 3.6 W (800 MHz band), 10 mW (Bluetooth), 63.1 mW (802.11b), 25.1 mW (802.11g/n)  
**Nominal Power:** 6.0 W (VHF), 5.0 W (UHF), 2.5 W (700 MHz band), 3.0 W (800 MHz band), 10 mW (Bluetooth), 47.1 mW (802.11b), 19.95 mW (802.11g), 19.63 mW (802.11n)  
**Tx Frequency Bands:** LMR 136-174 MHz, 380-520 MHz, 764-805 MHz, 806-870 MHz; Bluetooth 2402-2480 MHz; WLAN 2400-2483.5 MHz  
**Signaling type:** FM, TDMA, FHSS (Bluetooth), 802.11b/g/n (WLAN)  
**Model(s) Tested:** H91TGD9PW5AN (PNUW1012C), H91TGD9PW7AN (PNUW1014C)  
**Model(s) Certified:** H91TGD9PW5AN (PNUW1012C), H91TGD9PW7AN (PNUW1014C)  
**Serial Number(s):** 579TTME968, 579TTME969, 579TTME980  
**Classification:** Occupational/Controlled  
**FCC ID:** AZ489FT7061; 150.8-173.4 MHz, 406.1-512 MHz, 764-775 MHz, 794-824 MHz, 851-869 MHz  
 This report contains results that are immaterial for FCC equipment approval, which are clearly identified.  
**IC** 109U-89FT7061; 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.

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*  
**Tiong Nguk Ing**  
**Deputy Technical Manager**  
**Approval Date: 10/23/2017**

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**Report Revision History**

Date	Revision	Comments
10/23/2017	A	Release of PCII results.

### 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. Test Laboratory for handheld portables model number H91TGD9PW5AN (PNUW1012C) and H91TGD9PW7AN (PNUW1014C). These devices are classified as Occupational /Controlled. The information herein is to show evidence of Class II Permissive Change compliance base on the SAR evaluation of a design change on power amplifier 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	1g-SAR
TNF	150.8-173.4 MHz (LMR)	3.57	0.77
	406.1-470 MHz (LMR)	7.93	4.65
	450-512 MHz (LMR)	6.74	3.56
	7/800 (LMR)	6.99	3.62
DSS	2402-2480 MHz	NA	NA
*DTS	2400-2483.5 MHz	0.0348	0.1597
Simultaneous Results		7.96	4.81

**Note:** New highest reported SAR value for head, body-worn accessory, and Simultaneous transmission exposure conditions are 4.65 W/kg, 7.93 W/kg, and 7.96 W/kg.

The initial filed results 4.27 W/kg, 7.91 W/kg and 7.94 W/kg are hereby replaced with the results presented herein.

### 3.0 Abbreviations / Definitions

- BT: Bluetooth
- CNR: Calibration Not Required
- CW: Continuous Wave
- DSP: Digital Signal Processor
- DSS: Direct Spread Spectrum
- DSSS: Direct Sequence Spread Spectrum
- DTS: Digital Transmission System

DUT: Device Under Test  
EME: Electromagnetic Energy  
FHSS: Frequency Hopping Spread Spectrum  
FM: Frequency Modulation  
GPS: Global Positioning System  
Li-Ion: Lithium Ion  
LMR: Land Mobile Radio  
MIC: Microphone  
NA: Not Applicable  
NiMH: Nickel Metal Hydrate  
PTT: Push to Talk  
SAR: Specific Absorption Rate  
STD: Standard  
RF: Radio Frequency  
RSM: Remote Speaker Microphone  
TDMA: Time Division Multiple Access  
TNF: Licensed Non-Broadcast Transmitter Held to Face  
WLAN: Wireless Local Area Network

Audio accessories: These accessories allow communication while the DUT is worn on the body.

Body worn accessories: These accessories allow the DUT to be worn on the body of the user.

Maximum Power: Defined as the upper limit of the production line final test station.

#### 4.0 Referenced Standards and Guidelines

This product is designed to comply with the following applicable national and international standards and guidelines.

- IEC62209-1 (2005) Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)
- Federal Communications Commission, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”, OET Bulletin 65, FCC, Washington, D.C.: 1997.
- IEEE 1528 (2013), Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronics Engineers (IEEE) C95.1-2005
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6 (2015), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz

- RSS-102 (Issue 5) – Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)
- Australian Communications Authority Radio communications (Electromagnetic Radiation - Human Exposure) Standard (2014)
- ANATEL, Brazil Regulatory Authority, Resolution No. 303 of July 2, 2002 "Regulation of the limitation of exposure to electrical, magnetic, and electromagnetic fields in the radio frequency range between 9 kHz and 300 GHz." and “Attachment to resolution # 303 from July 2, 2002”
- IEC62209-2 Edition 1.0 2010-03, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz).
- FCC KDB – 643646 D01 SAR Test for PTT Radios v01r03
- FCC KDB – 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB – 865664 D02 RF Exposure Reporting v01r02
- FCC KDB – 447498 D01 General RF Exposure Guidance v06
- FCC KDB – 248227 D01 802.11 Wi-Fi SAR v02r02

**5.0 SAR Limits**

**Table 2**

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

**6.0 Description of Devices under Test (DUT)**

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

Time Division Multiple Access (TDMA) is used to allocate portions of the RF signal by dividing time into two slots. Time allocation enables each unit to transmit its voice information without interference from other transmitting units. Transmission from a unit or base station is accommodated during two time-slot lengths of 15 milliseconds with frame length of 60 milliseconds. The TDMA technique requires sophisticated algorithms and a digital signal processor (DSP) to perform voice compressions/decompressions and RF modulation/demodulation. The maximum duty cycle for TDMA 1:2 is 50%.

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

These devices also incorporate a Class 1 Bluetooth device which is a Frequency Hopping Spread Spectrum (FHSS) technology. The Bluetooth radio modem is used to wireless link audio accessories. The maximum actual transmission duty cycle is imposed by the Bluetooth standard. The maximum duty cycle for BT is 76.1%. Refer to section 14.0 Simultaneous Transmission Exclusion.

WLAN 802.11b/g/n operates using Direct Sequence Spread Spectrum (DSSS). These devices work in accordance with the IEEE 802.11b/g/n standard.

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**

Radio Type	Band (MHz)	Transmission	Duty Cycle (%)	Max Power (W)
LMR	136-174	FM or TDMA	*50 / *25	6.60
LMR	380-520	FM or TDMA	*50 / *25	5.70
LMR	764-805	FM or TDMA	*50 / *25	2.99
LMR	806-870	FM or TDMA	*50 / *25	3.60
BT	2400	FHSS	76	0.01
WLAN	2400 - 2483.5	802.11b	100	0.0631
WLAN	2400 - 2483.5	802.11g	100	0.0251
WLAN	2400 - 2483.5	802.11n	100	0.0251

Note - \* includes 50% PTT operation

The intended operating positions are “at the face” with the DUT at least 2.5cm from the mouth, and “at the body” by means of the offered body worn accessories. Body worn audio and PTT operation is accomplished by means of optional remote accessories that are connected to the radio. Operation at the body without an audio accessory attached is possible by means of BT accessories.

## 7.0 Optional Accessories and Test Criteria

These devices are offered with optional accessories. All accessories were individually evaluated during the test plan creation to determine if testing was required per the guidelines outlined in section 4.0 to assess compliance of this device. The following sections identify the test criteria and details for each accessory category applicable for this PCII filing only. Detail listing of all approved offered accessories available in original filing report.

### 7.1 Antennas

There are four antennas applicable for this PCII filling. The Table below lists the antennas and their descriptions.

**Table 4**

Antenna Models	Description	Selected for Test	Tested
FAF5259A	U1/GPS Stubby antenna; 380-470 MHz, 1575 MHz; ¼ wave ; -2 dBd gain	Yes	Yes
FAF5260A	U2/GPS Stubby antenna; 450-520 MHz, 1575 MHz; ¼ wave ; -2 dBd gain	Yes	Yes
NAR6594A	VHF/7-800/GPS antenna; 136-174 MHz, 764-870 MHz, 1575 MHz; ¼ wave ; -2 dBd gain	Yes	Yes
NAR6595A	7-800 Stubby antenna; 764-870 MHz; ¼ wave ; -2 dBd gain	Yes	Yes
PMAT4001A	VHF/U1/U2/GPS antenna; 136-175 MHz, 380-470 MHz, 450-520 MHz, 1575 MHz; ¼ wave ; -2 dBd gain	Yes	Yes

### 7.2 Batteries

There are four batteries applicable for this PCII filling. The Table below lists the batteries and their descriptions.

**Table 5**

Battery Models	Description	Tested	Selected for Test	Comments
NNTN7038B	Battery IMPRES STD IP67 Li-Ion 2900Min 3100Typical	Yes	Yes	
NNTN7573A	IMPRES NiMH 2100 mAh Submersible (Delta T) Battery - Ruggedized	Yes	Yes	
NNTN8092A	Battery IMPRES FM R Li-Ion 2300Min 2350Typical Black	Yes	Yes	
PMNN4403B	Battery STD IP67 Li-Ion 2050Min Black	Yes	Yes	

### 7.3 Body worn Accessories

There are two body worn accessories applicable for this PCII filling. The table below lists the body worns and their descriptions.

**Table 6**

Body worn Models	Description	Selected for test	Tested	Comments
NTN8266B	2.5 Inch Belt Clip	Yes	Yes	
HLN6875A	3.0 Inch Belt Clip	Yes	Yes	

### 7.4 Audio Accessories

There are two audio accessories applicable for this PCII filling. The table below lists the audio accessories and their descriptions.

**Table 7**

Audio Acc. Models	Description	Selected for test	Tested	Comments
NMN6274A	IMPRES XP RSM W/ Dual MIC Noise Suppression, 3.5 mm Threaded Jack	Yes	Yes	
NNTN8575A	Audio Accessory-Remote Speaker MIC	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**

% of Listed Ingredients	150 MHz		450MHz		750MHz		900MHz	
	Head	Body	Head	Body	Head	Body	Head	Body
Sugar	55.4	49.7	56.0	46.5	57.0	46	56.5	44.9
Diacetin	0	0	0	0	0	0	0	0
De ionized -Water	38.35	46.2	39.1	50.53	40.12	51.8	40.95	53.06
Salt	5.15	3.00	3.8	1.87	1.78	1.1	1.45	0.94
HEC	1	1	1	1	1	1	1	1
Bact.	0.1	0.1	0.1	0.1	0.1	0.1	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	ES3DV3	3122	10-Mar-17	10-Mar-18
Speag DAE	DAE4	850	28-Feb-17	28-Feb-18
Signal Generator	E4438C	MY45091270	26-Jul-16	26-Jul-18
Power Sensor	8481B	SG41090258	27-Jun-17	27-Jun-18
Power Sensor	8481B	MY41091170	21-May-17	21-May-18
Power Meter	E4419B	MY50000505	2-Sep-15	2-Sep-17*
Power Meter	E4418B	MY45100911	14-Jul-17	14-Jul-19
Power Sensor	E9301B	MY41495594	20-Jul-17	20-Jul-18
Power Meter	E4418B	MY45100532	4-Nov-15	4-Nov-17
Bi-directional Coupler	3020A	41935	2-Sep-16	2-Sep-17*
Bi-directional Coupler	3020A	41931	21-Jul-17	21-Jul-18
Amplifier	10WD1000	28782	CNR	CNR
Dickson Temperature Recorder	TM320	12253047	20-Oct-16	20-Oct-17
Temperature Probe	80PK-22	6032017	24-Mar-17	24-Mar-18
Temperature Probe	80PK-22	5032017	24-Mar-17	24-Mar-18
Thermometer	HH202A	35881	2-Dec-16	2-Dec-17
Thermometer	HH202A	18801	25-Jan-17	25-Jan-18
Dielectric Assessment Kit	DAK-3.5	1156	11-Oct-16	11-Oct-17
Dielectric Assessment Kit	DAK-12	1069	11-Oct-16	11-Oct-17
Network Analyzer	E5071B	MY42403147	15-Nov-16	15-Nov-17
Speag Dipole	CLA150	4010	8-Nov-16	8-Nov-18
Speag Dipole	D450V3	1077	25-Nov-15	25-Nov-17
Speag Dipole	D750V3	1098	24-Nov-15	24-Nov-17
Speag Dipole	D900V2	1d026	18-Jan-17	18-Jan-19

\*Out for calibration; replaced with MY45100911 and 41931 for continued testing.

## 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		
				$\sigma$	$\epsilon_r$	Sensitivity	Linearity	Isotropy
CW								
04/19/2017	Body	150	3122	0.83	59.2	Pass	Pass	Pass
04/19/2017	Head	150		0.76	51.2	Pass	Pass	Pass
04/18/2017	Body	450		0.97	54.8	Pass	Pass	Pass
04/19/2017	Head	450		0.83	43.9	Pass	Pass	Pass
04/16/2017	Body	750		0.94	55.6	Pass	Pass	Pass
04/12/2017	Head	750		0.88	42.9	Pass	Pass	Pass
04/16/2017	Body	900		1.01	55.2	Pass	Pass	Pass
04/12/2017	Head	900		0.93	42.5	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
3122	FCC Body	SPEAG CLA150 / 4010	3.78 +/- 10%	3.96	3.96	07/17/2017
	IEEE/IEC Head				3.64	08/03/2017
	FCC Body	SPEAG D450V3 / 1077	4.52 +/- 10%	1.16	4.64	07/15/2017
	IEEE/IEC Head				4.68	08/07/2017
	FCC Body	SPEAG D750V3 / 1098	8.86 +/- 10%	2.18	8.76	07/12/2017*
	IEEE/IEC Head				8.40	07/18/2017*
	IEEE/IEC Head	SPEAG D900V2 / 1d026	10.90 +/- 10%	2.59	10.36	08/10/2017*

Note: \* System performance check cover next testing 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
150	FCC Body	0.80 (0.76-0.84)	61.90 (58.80-65.00)	0.77	59.3	07/17/2017
	IEEE/IEC Head	0.76 (0.72-0.80)	52.30 (49.70-54.90)	0.74	52.5	08/03/2017
140	FCC Body	0.79 (0.75-0.83)	62.2 (59.0-65.3)	0.76	59.5	07/17/2017
143	IEEE/IEC Head	0.76 (0.72-0.79)	52.6 (50.0-55.3)	0.74	52.8	08/03/2017
156	FCC Body	0.80 (0.76-0.85)	61.80 (58.70-64.80)	0.77	59.2	07/17/2017
173	IEEE/IEC Head	0.78 (0.74-0.82)	51.20 (48.70-53.80)	0.76	51.5	08/03/2017
406	FCC Body	0.93 (0.89-0.98)	57.1 (54.3-60.0)	0.89	56.7	08/07/2017
	IEEE/IEC Head	0.87 (0.83-0.91)	44.0 (41.8-46.2)	0.84	44.6	08/03/2017
450	FCC Body	0.94 (0.89-0.99)	56.7 (53.9-59.5)	0.95 0.93	56.3 56.1	07/15/2017 08/07/2017
	IEEE/IEC Head	0.87 (0.83-0.91)	43.5 (41.3-45.7)	0.88	43.7	08/03/2017
481	IEEE/IEC Head	0.87 (0.83-0.92)	43.3 (41.2-45.5)	0.90	43.0	08/03/2017
750	FCC Body	0.96 (0.92-1.01)	55.5 (52.8-58.3)	0.92	56.2	07/12/2017*
	IEEE/IEC Head	0.89 (0.85-0.93)	41.9 (39.8-44.0)	0.85	43.2	07/18/2017*
809	FCC Body	0.97 (0.92-1.02)	55.3 (52.5-58.1)	0.98	55.7	07/12/2017*
	IEEE/IEC Head	0.90 (0.85-0.94)	41.6 (39.5-43.7)	0.91 0.90	42.3 42.0	07/18/2017* 08/10/2017*
900	IEEE/IEC Head	0.97 (0.92-1.02)	41.5 (39.4-43.6)	0.99	40.8	08/10/2017*

Note: \* Tissue date covered for next test day (within 24 hours).

### 11.0 Environmental Test Conditions

The EME Laboratory’s ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. Simulated tissue temperature is measured prior to each scan to insure it is within +/- 2°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: 18.0 – 22.7°C Avg. 20.4 °C
Tissue Temperature	NA	Range: 19.8 -22.0°C Avg. 20.9°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	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location		30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: ΔxArea, ΔyArea		≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: ΔxZoom, ΔyZoom		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: ΔzZoom(n)	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.			

**12.2 DUT Configuration(s)**

The DUT is a portable device operational at the body and face as described in section 6.0 while using the applicable accessories listed in section 7.0. 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 as well as with and without the offered audio accessories as applicable.

**12.3.2 Head**

Not applicable.

**12.3.3 Face**

The DUT was positioned with 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

$F_{\text{high}}$  = Upper channel

$F_{\text{low}}$  = 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 E includes a shortened scan to justify SAR scaling for drift. For this device the “Max Calc. 1g-SAR” is scaled using the following formula:

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

$P_{\text{max}}$  = Maximum Power (W)

$P_{\text{int}}$  = 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 LMR assessments at the Body**

Assessments at the Body were done with offered antennas, 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)	Max Calc. 1g-SAR (W/kg)	Run#
<b>VHF</b>									
PMAT4001A	NNTN7573A	HLN6875A	None	139.700	6.52	-0.45	12.30	<b>6.91</b>	ZR-AB-170717-15
NAR6594A	NNTN7573A	HLN6875A	None	156.450	6.53	-0.36	6.50	<b>3.57</b>	ZR-AB-170717-14
<b>UHF1</b>									
FAF5259A	NNTN7038B	NTN8266B	NNTN8575A	406.125	5.70	-0.33	14.70	<b>7.93</b>	TLC(HR)-AB-170807-07
<b>UHF2</b>									
FAF5260A	PMNN4403B	NTN8266B	None	450.000	5.70	-0.29	12.60	<b>6.74</b>	ZR-AB-170715-11
<b>7/800 MHz</b>									
NAR6595A	PMNN4403B	NTN8266B	NMN6274A	808.5000	3.60	-1.08	10.90	<b>6.99</b>	FD-AB-170713-01#

### 13.2 LMR assessments at the Face

Assessments at the Face were done with offered antennas, 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)	Max Calc. 1g-SAR (W/kg)	Run#
<b>VHF</b>									
PMAT4001A	NNTN8092A	None; Radio at back	None	143.400	6.60	-0.16	2.45	<b>1.27</b>	FD(HR)-FACE-170803-11
NAR6594A	NNTN8092A	None; Radio at back	None	173.400	6.60	-0.30	1.44	<b>0.77</b>	TLC(AN)-FACE-170803-12
<b>UHF1</b>									
FAF5259A	NNTN7038B	None; Radio at back	None	406.125	5.67	-0.23	8.77	<b>4.65</b>	FD(HR)-FACE-170803-09
<b>UHF2</b>									
FAF5260A	NNTN7038B	None; Radio at back	None	481.000	5.66	-0.22	6.72	<b>3.56</b>	FD(HR)-FACE-170803-08
<b>7/800 MHz</b>									
NAR6595A	NNTN7038B	None; Radio at back	None	808.5000	3.60	-0.43	6.19	<b>3.42</b>	ZR-FACE-170719-01#

### 13.3 Shortened Scan Assessment

A “shortened” scan using the SAR degraded 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)	Max Calc. 1g-SAR (W/kg)	Run#
NAR6595A	NNTN7038B	None; Radio at back	None	808.500	3.60	-0.12	7.05	3.62	ZR(AN)-FACE-170811-01#

**14.0 Simultaneous Transmission between LMR, WLAN and BT**

These devices use a single transmitter module and antenna for both WLAN and BT. WLAN and BT cannot transmit simultaneously. Simultaneous transmission for BT had been excluded as derived in initial filing. WLAN 802.11b measured SAR during initial compliance assessment is used in conjunction with LMR for simultaneous results.

**15.0 Results Summary**

The highest Operational Maximum Calculated 1-gram average SAR values found for this filing:

**Table 20**

Technologies	Frequency band (MHz)	Max Calc at Body (W/kg)	Max Calc at Face (W/kg)
		1g-SAR	1g-SAR
<b>FCC</b>			
LMR VHF	150.8-173.4	3.57	0.77
LMR UHF1	406.1-470	<b>7.93</b>	<b>4.65</b>
LMR UHF2	450-512	6.74	3.56
LMR 7/800	7/800	6.99	*3.62
WLAN	2400 - 2483.5	0.0348	0.1597
<b>ISED Canada</b>			
LMR VHF	138-174	6.91	1.27
LMR UHF1	406.1-430	<b>7.93</b>	<b>4.65</b>
LMR UHF2	450-470	6.74	3.56
LMR 7/800	7/800	6.99	*3.62
WLAN	2400 - 2483.5	0.0348	0.1597
<b>Overall</b>			
LMR VHF	136-174	6.91	1.27
LMR UHF1	380-470	<b>7.93</b>	<b>4.65</b>
LMR UHF2	450-520	6.74	3.56
LMR 7/800	7/800	6.99	*3.62
WLAN	2400 - 2483.5	0.0348	0.1597

All results are scaled to the maximum output power

**Notes:**

\* - SAR degraded more than one system uncertainty.

**Bold** – Highest SAR values.

The SAR results for simultaneous is indicated in the following Table:

**Table 21**

Designator	Frequency band	1-g SAR (W/kg)	
		Body	Face
FCC	LMR (VHF) and WLAN bands	3.60	0.93
	LMR (UHF1) and WLAN bands	<b>7.96</b>	<b>4.81</b>
	LMR (UHF2) and WLAN bands	6.77	3.72
	LMR (7/800) and WLAN bands	7.02	3.78
ISED Canada	LMR (VHF) and WLAN bands	6.94	1.43
	LMR (UHF1) and WLAN bands	<b>7.96</b>	<b>4.81</b>
	LMR (UHF2) and WLAN bands	6.77	3.72
	LMR (7/800) and WLAN bands	7.02	3.78
Overall	LMR (VHF) and WLAN bands	6.94	1.43
	LMR (UHF1) and WLAN bands	<b>7.96</b>	<b>4.81</b>
	LMR (UHF2) and WLAN bands	6.77	3.72
	LMR (7/800) and WLAN bands	7.02	3.78

Note: New highest reported SAR value for head, body-worn accessory, and Simultaneous transmission exposure conditions are 4.65 W/kg, 7.93 W/kg, and 7.96 W/kg.

The initial filed results 4.27 W/kg, 7.91 W/kg and 7.94 W/kg are hereby replaced with the results presented herein.

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.

**16.0 System Uncertainty**

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 100 MHz to 800 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>
<b>Uncertainty Component</b>	IEEE 1528 section	Tol. (± %)	Prob Dist	Div.	<i>c<sub>i</sub></i> (1 g)	<i>c<sub>i</sub></i> (10 g)	1 g <i>u<sub>i</sub></i> (±%)	10 g <i>u<sub>i</sub></i> (±%)	<i>v<sub>i</sub></i>
<b>Measurement System</b>									
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	∞
<b>Test sample Related</b>									
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	∞
<b>Phantom and Tissue Parameters</b>									
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	∞
<b>Combined Standard Uncertainty</b>			RSS				12	11	482
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>			<i>k</i> =2				23	23	

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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<sub>i</sub>* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
- g) *u<sub>i</sub>* – SAR uncertainty
- h) *v<sub>i</sub>* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

**TABLE A.2: Uncertainty Budget for Device Under Test, for 800 MHz to 3 GHz**

<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>
<b>Uncertainty Component</b>	<b>IEEE 1528 section</b>	<b>Tol. (± %)</b>	<b>Prob Dist</b>	<b>Div.</b>	<i>c<sub>i</sub></i> (1 g)	<i>c<sub>i</sub></i> (10 g)	1 g <i>u<sub>i</sub></i> (±%)	10 g <i>u<sub>i</sub></i> (±%)	<i>v<sub>i</sub></i>
<b>Measurement System</b>									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Modulation Response	E.2.5	1.9	R	1.73	1	1	1.1	1.1	∞
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	∞
<b>Test sample Related</b>									
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	∞
<b>Phantom and Tissue Parameters</b>									
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	∞
<b>Combined Standard Uncertainty</b>			RSS				11	11	419
<b>Expanded Uncertainty</b> (95% CONFIDENCE LEVEL)			<i>k</i> =2				22	22	

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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<sub>i</sub>* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
- g) *u<sub>i</sub>* – SAR uncertainty
- h) *v<sub>i</sub>* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

**TABLE A.3: Uncertainty Budget for System Validation (dipole & flat phantom) for 100 MHz to 800 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>
<b>Uncertainty Component</b>	<b>IEEE 1528 section</b>	<b>Tol. (± %)</b>	<b>Prob Dist</b>	<b>Div.</b>	<i>c<sub>i</sub></i> (1 g)	<i>c<sub>i</sub></i> (10 g)	<b>1 g U<sub>i</sub> (±%)</b>	<b>10 g U<sub>i</sub> (±%)</b>	<i>v<sub>i</sub></i>
<b>Measurement System</b>									
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	∞
<b>Dipole</b>									
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	∞
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	R	1.73	0.64	0.43	1.2	0.8	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	R	1.73	0.6	0.49	0.6	0.5	∞
Liquid Conductivity (Temperature Uncertainty)	E3.4	2.7	R	1.73	0.78	0.71	1.2	1.1	∞
Liquid Permittivity (Temperature Uncertainty)	E3.4	0.4	R	1.73	0.26	0.10	0.1	0.1	∞
<b>Combined Standard Uncertainty</b>			RSS				10	9	99999
<b>Expanded Uncertainty</b> (95% CONFIDENCE LEVEL)			<i>k</i> =2				19	19	

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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<sub>i</sub>* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
- g) *u<sub>i</sub>* – SAR uncertainty
- h) *v<sub>i</sub>* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

**TABLE A.4: Uncertainty Budget for System Validation (dipole & flat phantom) for 800 MHz to 3 GHz**

<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>
<b>Uncertainty Component</b>	<b>IEEE 1528 section</b>	<b>Tol. (± %)</b>	<b>Prob Dist</b>	<b>Div.</b>	<i>c<sub>i</sub></i> (1 g)	<i>c<sub>i</sub></i> (10 g)	<b>1 g U<sub>i</sub> (±%)</b>	<b>10 g U<sub>i</sub> (±%)</b>	<i>v<sub>i</sub></i>
<b>Measurement System</b>									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Modulation Response	E.2.5	1.9	R	1.73	1	1	1.1	1.1	∞
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	∞
<b>Dipole</b>									
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	∞
<b>Phantom and Tissue Parameters</b>									
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	∞
<b>Combined Standard Uncertainty</b>			RSS				9	9	99999
<b>Expanded Uncertainty</b> (95% CONFIDENCE LEVEL)			<i>k=2</i>				18	17	

**FCD-0558 Uncertainty Budget Rev.8**

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<sub>i</sub>* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
- g) *u<sub>i</sub>* – SAR uncertainty
- h) *v<sub>i</sub>* - 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  
**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: **ES3-3122\_Mar17**

**CALIBRATION CERTIFICATE**

Object **ES3DV3 - SN:3122**

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

Calibration date: **March 10, 2017**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: March 14, 2017

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  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

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

**Glossary:**

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

**Calibration is Performed According to the Following Standards:**

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Methods Applied and Interpretation of Parameters:**

- *NORM<sub>x,y,z</sub>*: Assessed for E-field polarization θ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)<sub>x,y,z</sub>* = *NORM<sub>x,y,z</sub>* \* *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<sub>x,y,z</sub>*: 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<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>*: 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 *NORM<sub>x,y,z</sub>* \* *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<sub>x</sub>* (no uncertainty required).

ES3DV3 – SN:3122

March 10, 2017

# Probe ES3DV3

## SN:3122

Manufactured: July 11, 2006  
Calibrated: March 10, 2017

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

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

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	1.29	1.18	1.38	$\pm 10.1\%$
DCP (mV) <sup>B</sup>	100.7	101.2	102.2	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	187.6	$\pm 3.3\%$
		Y	0.0	0.0	1.0		204.9	
		Z	0.0	0.0	1.0		187.3	

Note: For details on UID parameters see Appendix.

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

<sup>A</sup> The uncertainties of Norm X,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> 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:3122

March 10, 2017

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

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc (k=2)
150	52.3	0.76	7.36	7.36	7.36	0.05	1.20	± 13.3 %
300	45.3	0.87	7.24	7.24	7.24	0.12	1.20	± 13.3 %
450	43.5	0.87	7.00	7.00	7.00	0.18	1.30	± 13.3 %
750	41.9	0.89	6.62	6.62	6.62	0.80	1.09	± 12.0 %
835	41.5	0.90	6.39	6.39	6.39	0.51	1.36	± 12.0 %
900	41.5	0.97	6.36	6.36	6.36	0.80	1.11	± 12.0 %
1450	40.5	1.20	5.81	5.81	5.81	0.76	1.12	± 12.0 %
1810	40.0	1.40	5.37	5.37	5.37	0.51	1.46	± 12.0 %
1900	40.0	1.40	5.28	5.28	5.28	0.61	1.30	± 12.0 %
2100	39.8	1.49	5.40	5.40	5.40	0.57	1.32	± 12.0 %
2300	39.5	1.67	4.91	4.91	4.91	0.63	1.29	± 12.0 %
2450	39.2	1.80	4.68	4.68	4.68	0.78	1.26	± 12.0 %
2600	39.0	1.96	4.48	4.48	4.48	0.80	1.27	± 12.0 %

<sup>C</sup> 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.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) 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 ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

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March 10, 2017

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

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>c</sup>	Relative Permittivity <sup>f</sup>	Conductivity (S/m) <sup>f</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>g</sup>	Depth <sup>d</sup> (mm)	Unc (k=2)
150	61.9	0.80	6.91	6.91	6.91	0.05	1.20	± 13.3 %
300	58.2	0.92	6.90	6.90	6.90	0.08	1.30	± 13.3 %
450	56.7	0.94	7.10	7.10	7.10	0.12	1.30	± 13.3 %
750	55.5	0.96	6.34	6.34	6.34	0.46	1.50	± 12.0 %
835	55.2	0.97	6.26	6.26	6.26	0.35	1.71	± 12.0 %
900	55.0	1.05	6.20	6.20	6.20	0.50	1.40	± 12.0 %
1450	54.0	1.30	5.24	5.24	5.24	0.69	1.21	± 12.0 %
1810	53.3	1.52	5.09	5.09	5.09	0.47	1.52	± 12.0 %
1900	53.3	1.52	4.94	4.94	4.94	0.37	1.88	± 12.0 %
2100	53.2	1.62	5.20	5.20	5.20	0.59	1.50	± 12.0 %
2300	52.9	1.81	4.68	4.68	4.68	0.76	1.28	± 12.0 %
2450	52.7	1.95	4.56	4.56	4.56	0.71	1.19	± 12.0 %
2600	52.5	2.16	4.34	4.34	4.34	0.80	1.14	± 12.0 %

<sup>c</sup> 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.

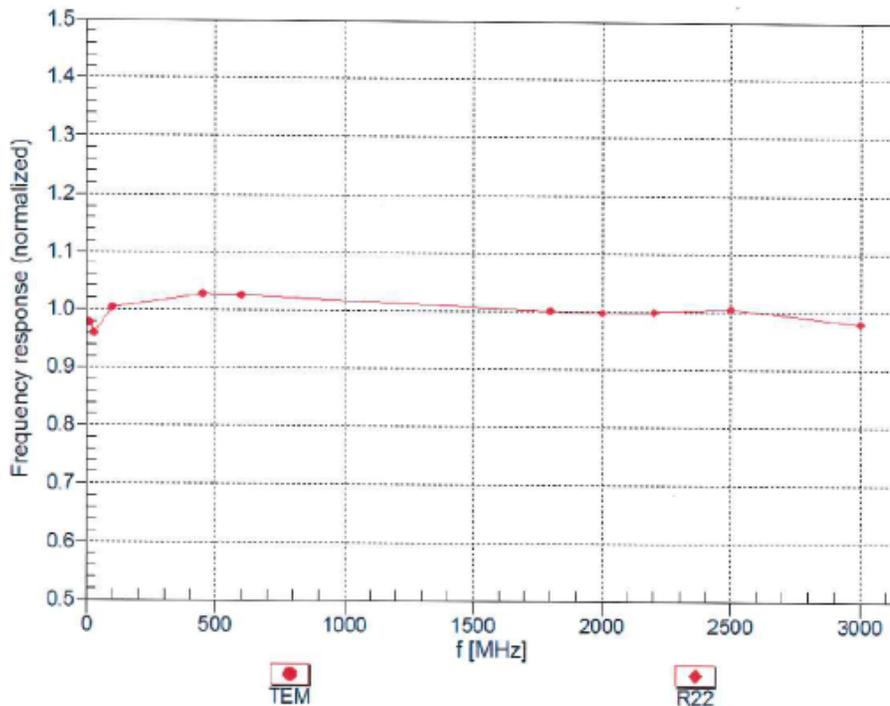
<sup>f</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

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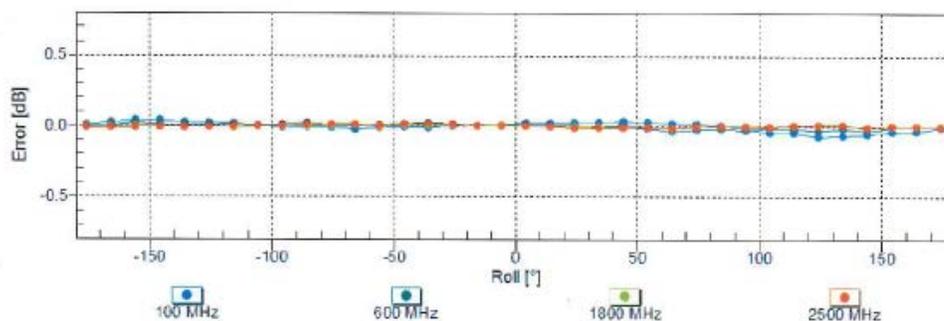
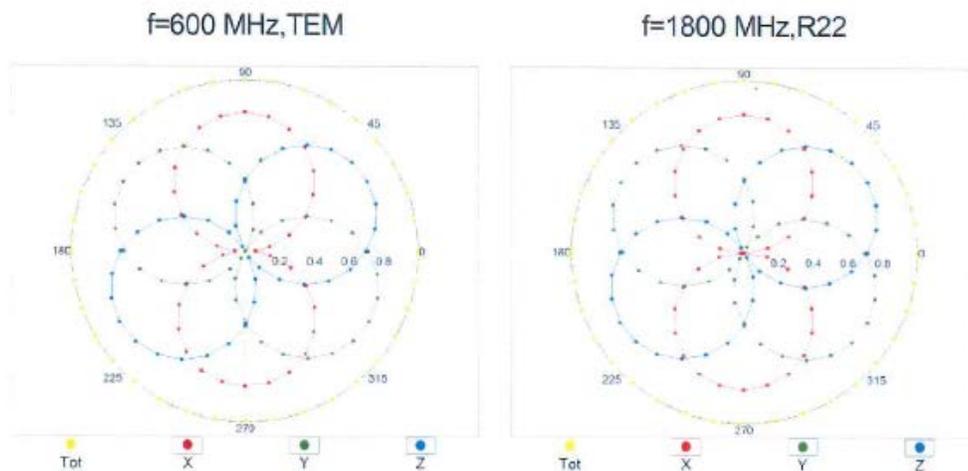
March 10, 2017

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



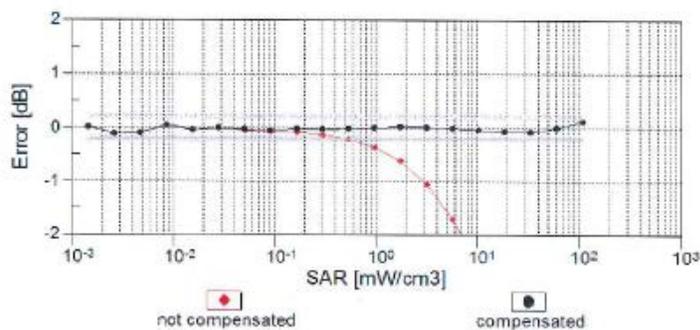
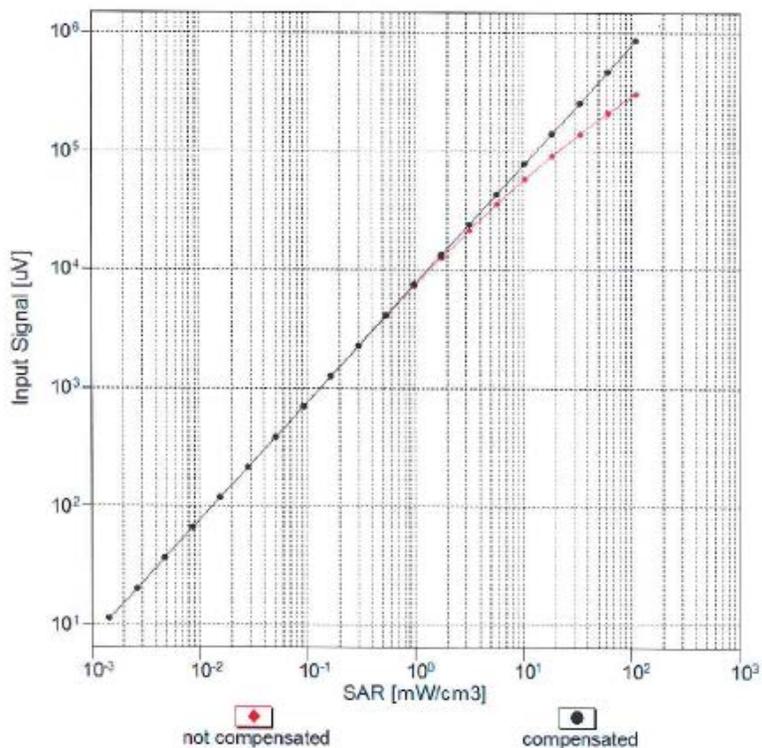
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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



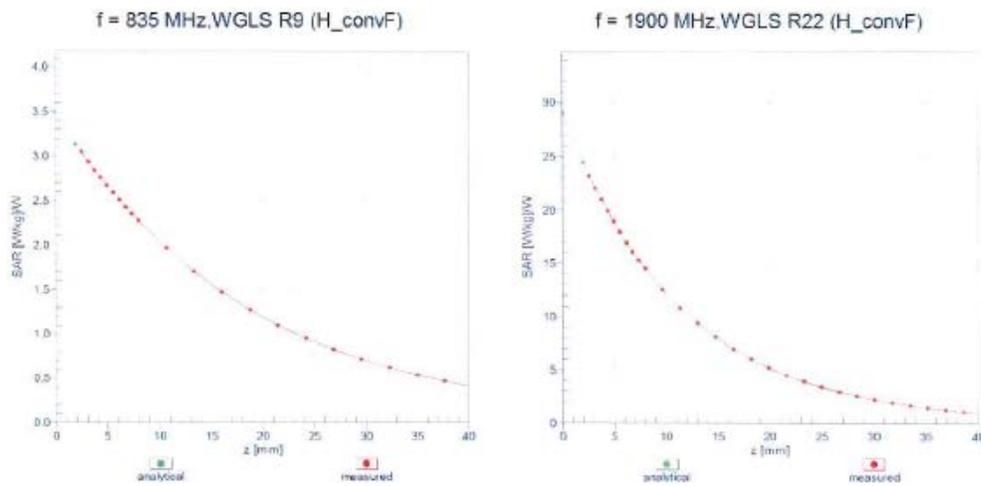
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

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

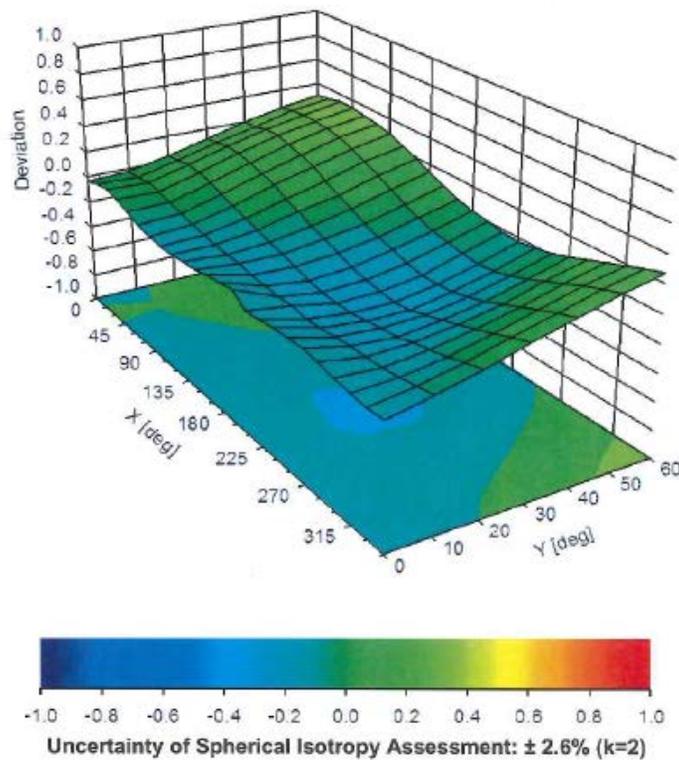


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

### Conversion Factor Assessment



### Deviation from Isotropy in Liquid Error ( $\phi$ , $\theta$ ), f = 900 MHz



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

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	24.2
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

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March 10, 2017

**Appendix: Modulation Calibration Parameters**

UID	Communication System Name		A dB	B dB $\sqrt{\mu V}$	C	D dB	VR mV	Unc <sup>L</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	187.6	$\pm 3.3\%$
		Y	0.0	0.0	1.0		204.9	
		Z	0.0	0.0	1.0		187.3	
10011-CAB	UMTS-FDD (WCDMA)	X	3.44	67.4	18.8	2.91	147.2	$\pm 0.7\%$
		Y	3.30	66.9	18.5		142.5	
		Z	3.17	66.4	18.1		128.3	
10097-CAB	UMTS-FDD (HSDPA)	X	4.67	66.4	18.5	3.98	136.0	$\pm 0.9\%$
		Y	4.52	66.1	18.3		129.7	
		Z	4.55	66.4	18.4		137.8	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.71	66.6	18.6	3.98	135.9	$\pm 0.7\%$
		Y	4.50	65.9	18.1		130.5	
		Z	4.54	66.3	18.4		138.1	
10100-CAC	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.59	67.8	20.0	5.67	141.1	$\pm 1.4\%$
		Y	6.44	67.5	19.7		136.3	
		Z	6.46	67.7	19.8		144.4	
10101-CAC	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	7.40	67.1	19.8	6.42	126.7	$\pm 1.4\%$
		Y	7.65	68.2	20.4		147.7	
		Z	7.30	67.1	19.7		130.2	
10103-CAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	11.85	77.0	26.3	9.29	121.3	$\pm 3.3\%$
		Y	13.00	80.2	28.0		143.1	
		Z	11.33	76.3	25.9		121.1	
10104-CAC	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	X	12.14	75.0	25.7	9.97	132.9	$\pm 3.8\%$
		Y	11.70	74.4	25.6		125.1	
		Z	11.81	74.7	25.6		134.5	
10108-CAD	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.53	67.5	19.9	5.80	139.8	$\pm 1.4\%$
		Y	6.40	67.3	19.8		134.6	
		Z	6.39	67.4	19.7		142.6	
10109-CAD	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	7.52	67.9	20.3	6.43	148.8	$\pm 1.7\%$
		Y	7.39	67.8	20.3		143.1	
		Z	7.06	66.7	19.6		125.5	
10110-CAD	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.25	67.0	19.7	5.75	136.0	$\pm 1.4\%$
		Y	6.06	66.6	19.4		131.0	
		Z	6.03	66.6	19.4		137.9	
10111-CAD	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	7.30	67.6	20.2	6.44	146.0	$\pm 1.7\%$
		Y	7.14	67.5	20.1		139.7	
		Z	7.08	67.4	20.0		146.7	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.26	68.8	21.3	8.07	130.1	$\pm 1.9\%$
		Y	10.26	69.0	21.4		124.6	
		Z	10.11	68.6	21.1		130.8	
10140-CAC	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	7.66	67.5	20.0	6.49	129.1	$\pm 1.4\%$
		Y	7.87	68.4	20.5		149.2	
		Z	7.45	67.1	19.7		131.2	

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10142-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	6.10	66.8	19.6	5.73	134.9	±1.4 %
		Y	5.92	66.5	19.4		129.5	
		Z	5.90	66.6	19.4		136.9	
10143-CAD	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	7.09	67.5	20.1	6.35	141.9	±1.7 %
		Y	6.89	67.2	20.0		135.9	
		Z	6.86	67.3	19.9		143.1	
10145-CAD	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	5.84	66.3	19.3	5.76	130.9	±1.4 %
		Y	5.88	67.0	19.7		148.4	
		Z	5.64	66.2	19.2		132.2	
10146-CAD	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	6.85	67.3	20.1	6.41	137.3	±1.4 %
		Y	6.64	67.1	19.9		130.3	
		Z	6.62	67.3	20.0		137.3	
10149-CAC	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	7.54	68.0	20.4	6.42	147.8	±1.7 %
		Y	7.37	67.7	20.3		141.9	
		Z	7.06	66.8	19.6		125.9	
10151-CAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	12.64	79.4	27.6	9.28	144.0	±3.3 %
		Y	12.04	78.8	27.6		134.6	
		Z	12.32	79.4	27.6		144.6	
10152-CAC	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	X	11.94	75.7	26.4	9.92	125.2	±3.3 %
		Y	13.16	79.4	28.5		148.7	
		Z	11.57	75.4	26.2		126.1	
10154-CAD	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.25	67.0	19.7	5.75	135.1	±1.4 %
		Y	6.06	66.6	19.5		130.7	
		Z	6.06	66.8	19.5		138.4	
10155-CAD	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	7.28	67.6	20.2	6.43	143.3	±1.7 %
		Y	7.11	67.3	20.0		138.5	
		Z	7.09	67.4	20.0		146.0	
10156-CAD	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	6.04	66.6	19.5	5.79	131.3	±1.4 %
		Y	5.87	66.3	19.4		127.7	
		Z	5.85	66.4	19.4		134.1	
10157-CAD	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	7.08	67.4	20.2	6.49	138.7	±1.7 %
		Y	6.90	67.2	20.1		133.9	
		Z	6.84	67.2	20.0		140.4	
10160-CAC	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.66	67.5	19.9	5.82	139.5	±1.4 %
		Y	6.51	67.2	19.7		135.4	
		Z	6.46	67.2	19.6		142.1	
10161-CAC	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	7.59	67.9	20.3	6.43	147.1	±1.7 %
		Y	7.42	67.7	20.2		143.8	
		Z	7.10	66.7	19.6		125.3	
10166-CAD	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	5.45	66.8	19.6	5.40	144.3	±1.4 %
		Y	5.28	66.6	19.5		142.3	
		Z	5.25	66.7	19.4		147.9	
10167-CAD	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	6.25	67.0	19.9	6.21	126.2	±1.2 %
		Y	6.32	67.8	20.3		147.3	
		Z	6.06	67.0	19.8		129.1	

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10169-CAC	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.30	66.9	19.8	5.73	136.5	±1.2 %
		Y	5.14	66.7	19.6		135.5	
		Z	5.13	66.8	19.6		140.0	
10170-CAC	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	6.21	68.1	20.7	6.52	140.1	±1.7 %
		Y	6.08	68.2	20.8		137.5	
		Z	6.07	68.4	20.8		142.6	
10172-CAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	11.10	81.4	28.7	9.21	131.0	±3.0 %
		Y	11.41	83.1	29.8		127.4	
		Z	11.00	81.9	28.9		133.0	
10173-CAC	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	X	11.79	82.6	29.4	9.48	130.7	±3.5 %
		Y	12.09	84.3	30.4		127.2	
		Z	11.73	83.3	29.5		132.0	
10175-CAD	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.29	66.8	19.8	5.72	136.1	±1.2 %
		Y	5.17	66.9	19.8		136.5	
		Z	5.14	66.9	19.7		140.8	
10176-CAD	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	6.24	68.2	20.8	6.52	138.9	±1.7 %
		Y	6.08	68.2	20.8		137.4	
		Z	6.02	68.1	20.6		142.1	
10177-CAF	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	5.28	66.8	19.8	5.73	135.9	±1.2 %
		Y	5.19	66.9	19.8		136.5	
		Z	5.12	66.8	19.6		140.5	
10178-CAD	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	6.23	68.2	20.8	6.52	139.3	±1.7 %
		Y	6.10	68.3	20.8		138.1	
		Z	6.07	68.3	20.8		143.2	
10181-CAC	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.29	66.8	19.8	5.72	136.3	±1.2 %
		Y	5.17	66.9	19.8		136.0	
		Z	5.14	66.9	19.7		141.5	
10182-CAC	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	6.21	68.1	20.7	6.52	139.1	±1.7 %
		Y	6.10	68.3	20.8		137.8	
		Z	6.06	68.3	20.7		143.9	
10184-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	5.30	66.9	19.8	5.73	136.1	±1.2 %
		Y	5.16	66.7	19.7		135.0	
		Z	5.17	67.0	19.7		141.4	
10185-CAD	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	6.24	68.3	20.8	6.51	138.8	±1.7 %
		Y	6.07	68.2	20.8		136.3	
		Z	6.05	68.2	20.7		143.5	
10187-CAD	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	5.30	66.9	19.8	5.73	135.6	±1.2 %
		Y	5.15	66.7	19.7		134.9	
		Z	5.15	66.9	19.7		141.2	
10188-CAD	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	6.23	68.2	20.8	6.52	138.0	±1.7 %
		Y	6.07	68.1	20.7		136.1	
		Z	6.05	68.2	20.7		142.6	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.32	69.3	21.7	8.10	146.1	±2.5 %
		Y	10.28	69.6	21.9		144.7	
		Z	9.78	68.3	21.0		125.3	

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10225-CAB	UMTS-FDD (HSPA+)	X	7.34	67.5	19.8	5.97	149.3	±1.7 %
		Y	7.13	67.2	19.6		144.5	
		Z	6.91	66.6	19.2		129.1	
10226-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	X	11.61	82.2	29.1	9.49	130.0	±3.3 %
		Y	11.90	83.8	30.2		126.8	
		Z	11.74	83.3	29.6		133.5	
10228-CAA	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	X	10.88	80.8	28.5	9.22	129.1	±3.0 %
		Y	11.40	83.1	29.7		126.9	
		Z	11.12	82.2	29.0		133.9	
10229-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	X	11.47	81.9	29.0	9.48	128.1	±3.0 %
		Y	12.26	84.7	30.5		127.6	
		Z	11.57	82.9	29.4		132.2	
10231-CAB	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	X	10.84	80.8	28.4	9.19	129.0	±3.0 %
		Y	11.42	83.2	29.8		126.4	
		Z	11.17	82.4	29.1		133.9	
10232-CAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	X	11.41	81.7	28.9	9.48	128.3	±3.3 %
		Y	12.12	84.4	30.4		127.6	
		Z	11.62	83.0	29.4		132.0	
10234-CAC	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	X	10.91	81.0	28.5	9.21	129.5	±3.0 %
		Y	11.59	83.6	30.0		127.8	
		Z	11.13	82.2	29.0		133.9	
10235-CAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	X	11.50	81.9	29.0	9.48	129.9	±3.0 %
		Y	12.13	84.5	30.5		127.5	
		Z	11.62	83.0	29.5		132.4	
10237-CAC	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	10.99	81.2	28.7	9.21	129.9	±3.0 %
		Y	11.52	83.5	29.9		126.9	
		Z	11.33	82.8	29.3		134.9	
10238-CAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	X	11.58	82.2	29.2	9.48	128.5	±3.3 %
		Y	12.00	84.2	30.3		127.1	
		Z	11.84	83.6	29.7		133.1	
10240-CAC	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	10.94	81.1	28.6	9.21	129.9	±3.0 %
		Y	11.53	83.5	30.0		126.9	
		Z	11.30	82.7	29.3		134.7	
10241-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	X	12.91	82.8	30.1	9.82	145.7	±3.5 %
		Y	13.75	86.0	32.0		142.6	
		Z	11.06	79.3	28.4		120.4	
10243-CAA	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	X	11.67	80.6	28.8	9.46	142.9	±3.5 %
		Y	12.05	82.6	30.0		139.1	
		Z	11.65	81.5	29.1		145.0	
10244-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	x	12.36	79.1	28.5	10.06	133.5	±3.3 %
		Y	12.16	79.7	29.1		127.6	
		Z	12.17	79.6	28.7		134.5	
10246-CAB	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	10.85	77.3	26.9	9.30	125.6	±3.5 %
		Y	12.74	82.9	29.9		149.8	
		Z	10.58	77.5	27.0		126.9	

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10247-CAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	X	12.67	79.5	28.6	9.91	138.3	±3.3 %
		Y	12.28	79.6	28.9		131.0	
		Z	12.44	79.9	28.8		139.2	
10249-CAC	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	X	11.09	77.6	27.0	9.29	127.7	±3.3 %
		Y	10.81	77.7	27.3		123.1	
		Z	10.81	77.7	27.1		129.0	
10250-CAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	X	12.92	79.3	28.4	9.81	144.5	±3.5 %
		Y	12.76	79.9	28.9		138.7	
		Z	12.74	79.7	28.6		146.1	
10252-CAC	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	11.52	77.9	27.0	9.24	132.6	±3.5 %
		Y	11.32	78.1	27.4		128.5	
		Z	11.98	78.3	27.2		136.2	
10253-CAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	X	11.71	75.2	26.1	9.90	122.5	±3.5 %
		Y	13.10	79.2	28.4		148.6	
		Z	11.49	75.3	26.2		124.4	
10255-CAC	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	12.23	78.7	27.3	9.20	141.6	±3.5 %
		Y	11.94	78.6	27.5		136.0	
		Z	12.06	78.9	27.4		143.7	
10256-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	X	11.56	77.5	27.5	9.96	129.6	±3.5 %
		Y	11.40	78.0	28.0		126.2	
		Z	11.27	77.8	27.6		130.2	
10258-CAA	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	X	10.46	76.5	26.6	9.34	121.6	±3.5 %
		Y	12.72	83.1	30.0		148.9	
		Z	10.31	77.0	26.8		123.0	
10259-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	X	12.64	79.1	28.4	9.98	138.0	±3.5 %
		Y	12.56	79.8	29.1		134.4	
		Z	12.39	79.4	28.6		139.7	
10261-CAB	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	X	11.07	77.2	26.8	9.24	128.1	±3.5 %
		Y	10.94	77.8	27.3		125.4	
		Z	10.87	77.6	26.9		129.7	
10262-CAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	X	12.36	77.8	27.5	9.83	142.5	±3.8 %
		Y	12.35	78.6	28.2		139.4	
		Z	12.28	78.4	27.8		145.0	
10264-CAC	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	11.48	77.8	27.0	9.23	132.2	±3.5 %
		Y	11.44	78.5	27.6		129.3	
		Z	11.25	78.0	27.1		133.3	
10265-CAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	X	11.49	74.7	25.9	9.92	119.5	±3.5 %
		Y	13.12	79.3	28.5		148.1	
		Z	11.36	75.0	26.0		121.9	
10267-CAC	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	12.15	78.5	27.2	9.30	137.8	±3.5 %
		Y	12.27	79.4	27.9		136.8	
		Z	12.06	78.8	27.4		141.0	
10268-CAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	X	12.40	75.8	26.5	10.06	128.6	±3.5 %
		Y	12.47	76.5	27.1		126.3	
		Z	12.27	75.9	26.5		132.1	

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10270-CAC	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	13.14	79.3	27.8	9.58	148.5	±3.5 %
		Y	13.12	80.0	28.3		145.1	
		Z	11.30	75.6	25.9		120.3	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	6.17	67.1	19.1	4.87	142.2	±1.2 %
		Y	6.02	66.9	19.0		140.2	
		Z	6.01	67.0	18.9		146.6	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.66	67.3	19.1	3.96	144.7	±0.9 %
		Y	4.51	66.9	18.8		145.3	
		Z	4.34	66.3	18.5		127.5	
10297-AAB	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.43	67.2	19.8	5.81	129.0	±1.2 %
		Y	6.35	67.1	19.7		130.3	
		Z	6.31	67.1	19.7		133.9	
10298-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	X	6.12	67.3	19.9	5.72	149.3	±1.4 %
		Y	5.97	67.2	19.9		149.0	
		Z	5.68	66.2	19.2		130.1	
10299-AAC	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	X	6.89	67.2	20.0	6.39	132.2	±1.4 %
		Y	6.74	67.2	20.0		131.2	
		Z	6.68	67.2	19.9		135.2	
10311-AAB	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.97	67.7	20.1	6.06	136.1	±1.4 %
		Y	6.96	67.9	20.2		137.6	
		Z	6.92	67.8	20.0		143.1	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.88	69.5	19.6	1.54	142.2	±0.7 %
		Y	2.59	67.4	18.2		144.6	
		Z	2.63	68.2	18.6		148.4	
10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preamble)	X	10.23	69.2	21.7	8.14	141.9	±2.5 %
		Y	10.23	69.6	21.9		142.9	
		Z	10.14	69.3	21.7		147.5	
10419-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preamble)	X	10.35	69.4	21.8	8.19	143.8	±2.5 %
		Y	10.33	69.7	22.0		144.4	
		Z	10.24	69.4	21.8		149.4	
10430-AAA	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	X	9.65	68.7	21.6	8.28	132.1	±2.2 %
		Y	9.69	69.4	22.0		132.6	
		Z	9.48	68.8	21.6		136.1	
10431-AAA	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	X	10.22	69.3	21.9	8.38	140.1	±2.5 %
		Y	10.20	69.6	22.2		139.2	
		Z	10.08	69.4	21.9		144.7	
10432-AAA	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	X	10.44	69.5	22.0	8.34	144.2	±2.5 %
		Y	10.43	69.9	22.2		143.3	
		Z	10.30	69.5	21.9		149.4	
10433-AAA	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	X	10.64	69.7	22.0	8.34	147.8	±2.5 %
		Y	10.65	70.1	22.3		147.6	
		Z	10.10	68.6	21.3		125.9	

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10457-AAA	UMTS-FDD (DC-HSDPA)	X	8.36	67.0	19.8	6.62	137.0	±1.7 %
		Y	8.36	67.3	20.0		137.5	
		Z	8.29	67.1	19.8		143.7	
10460-AAA	UMTS-FDD (WCDMA, AMR)	X	3.15	69.4	19.9	2.39	137.0	±0.5 %
		Y	2.81	67.3	18.6		137.3	
		Z	2.94	68.4	19.1		142.9	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	2.93	69.7	19.7	1.58	142.8	±0.5 %
		Y	2.57	67.2	18.1		143.8	
		Z	2.77	69.1	19.0		149.8	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	10.47	69.5	21.9	8.25	145.7	±2.5 %
		Y	10.48	69.9	22.2		143.8	
		Z	9.94	68.4	21.2		124.0	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	4.04	73.3	21.0	1.99	144.1	±0.7 %
		Y	3.73	71.9	20.2		145.8	
		Z	3.82	72.5	20.3		127.7	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	4.21	74.2	21.4	1.99	143.0	±0.7 %
		Y	3.82	72.2	20.2		144.4	
		Z	3.83	72.7	20.4		148.4	
10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	10.96	70.2	22.5	8.59	148.0	±2.7 %
		Y	11.01	70.8	22.9		146.5	
		Z	10.38	69.1	21.8		125.0	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	11.04	70.5	22.6	8.60	149.6	±2.7 %
		Y	11.05	70.8	22.9		147.7	
		Z	10.44	69.3	21.9		126.2	
10591-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	10.65	69.2	21.9	8.63	123.9	±2.2 %
		Y	10.70	69.7	22.3		122.3	
		Z	10.53	69.2	21.8		128.0	
10592-AAA	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	10.87	69.5	22.1	8.79	124.7	±2.5 %
		Y	10.88	69.8	22.4		122.8	
		Z	10.75	69.5	22.1		128.6	
10599-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	11.22	69.9	22.3	8.79	128.9	±2.5 %
		Y	11.33	70.4	22.6		127.9	
		Z	11.11	69.9	22.2		133.4	
10600-AAA	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	11.30	69.9	22.3	8.88	128.7	±2.5 %
		Y	11.46	70.6	22.8		128.6	
		Z	11.22	70.0	22.3		133.5	

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.