MOTOROLA SOLUTIONS

MS ISO/IEC 17025
TESTING
SAMM No. 0826

DECLARATION OF COMPLIANCE SAR ASSESSMENT PCII Report Part 1 of 2

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Date of Report: 12/03/2018
Report Revision: B

Responsible Engineer:	Saw Sun Hock (EME Engineer)
Report Author:	Saw Sun Hock (EME Engineer)
Date/s Tested:	11/2/2018, 11/7/2018, 11/9/2018
Manufacturer:	Motorola Solutions Inc.
DUT Description:	Video RSM Si500 (Fusion), display, BT, 5GHz WiFi
Test TX mode(s):	WLAN 802.11b/g/n (2.4 GHz), WLAN 802.11 ac/n (5 GHz), Bluetooth, Bluetooth LE
Max. Power output:	Refer to Part 1. Table 3
Nominal Power:	Refer to Part 1. Table 3
Tx Frequency Bands:	WLAN 2.4 GHz 802.11 b/g/n, WLAN 5 GHz 802.11 ac/n, Bluetooth, Bluetooth LE
Signaling type:	DSSS, OFDM & FHSS (Bluetooth)
Model(s) Tested:	N7001A
Model(s) Certified:	N7001A
Serial Number(s):	372TTX0098
Classification:	Occupational / Controlled (comply with General Population / Uncontrolled limit)
FCC ID:	AZ489FT7105; WLAN 2.4 GHz 802.11 b/g/n, WLAN 5 GHz 802.11 ac/n, Bluetooth, Bluetooth LE. This report contains results that are immaterial for FCC equipment approval, which are clearly identified.
IC	109U-89FT7105; This report contains results that are immaterial for IC 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 General Population/Uncontrolled RF Exposure limits of 1.6 W/kg averaged over 1 gram per the requirements of FCC 47 CFR § 2.1093 and ISED RSS-102 (Issue 5).

Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 4.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola Solutions Inc EME Laboratory.
I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements. This reporting format is consistent with the suggested guidelines of the TIA TSB-150 December 2004. The results and statements contained in this report pertain only to the device(s) evaluated.

Tiong

Tiong Digitally signed by Tiong Date: 2018.12.03 22:40:41 +08'00'

Tiong Nguk Ing
Deputy Technical Manager (Approved Signatory)
Approval Date: 12/3/2018

Part 1 of 2

APPENDICES

Part 2 of 2

APPENDICES

Report Revision History

Date	Revision	Comments
11/12/2018	A	Release of PCII results
12/03/2018	B	Update the SPEAG Probe model number

1.0 Introduction

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (SAR) measurements performed at the Motorola Solutions Inc. EME Test Laboratory for model number N7001A. This device is classified as Occupational/Controlled but comply with General Population/Uncontrolled SAR limit as operate in unlicensed frequency bands. The information herein is to show evidence of Class II Permissive Change compliance base on the SAR evaluation of new body worn PMLN7960A introduce to this device.

2.0 FCC SAR Summary

Table 1

Equipment Class	Frequency band (MHz)	Max Calc at Body (W/kg)
		1g-SAR
DTS	2.4GHz WLAN (WLAN 802.11b/g/n)	0.37
NII	5GHz WLAN (WLAN 802.11 ac/n)	0.42

Note:
New highest reported SAR value for body-worn accessory exposure conditions are 0.37 W/kg (2.4GHz) and 0.42 W/kg (5GHz).

3.0 Abbreviations / Definitions

BT: Bluetooth
CNR: Calibration Not Required
CW: Continuous Wave
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
RF: Radio Frequency
NA: Not Applicable
NII: National Information Infrastructure
OFDM: Orthogonal Frequency Division Multiplexing
SAR: Specific Absorption Rate
U-NII: Unlicensed National Information Infrastructure
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 – 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
- FCC KDB – 648474 D04 Handset SAR v01r03

5.0 SAR Limits

Table 1

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 device operates in the WLAN technology for data capabilities over 802.11 b/g/n (2.4GHz), 802.11ac/n (5GHz) wireless network and Bluetooth technology for short range wireless device.

This device also incorporates a Bluetooth v4.0, which include classis Bluetooth, and Bluetooth low energy. It is Class 1 Bluetooth device with 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 derived from 5-slots packet type operation which consists of receiving on 1-slot and transmitting on 5-slots, and thus maximum duty cycle=78%

WLAN 2.4GHz 802.11 b/g/n operate using Direct Sequence Spread Spectrum (DSSS) and Orthogonal Frequency-Division Multiplexing (OFDM) with channel bandwidth of 20 MHz
WLAN 5GHz 802.11 ac/n operate using Orthogonal Frequency-Division Multiplexing (OFDM) with channel bandwidth of 20MHz, 40MHz, 80MHz.

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

Technologies	Band (MHz)	Transmission	Duty Cycle (%)	Nominal Power (mW)	Max Power (mW)
2.4 GHz WLAN-802.11b	2412-2462	DSSS	99.97%	63	79.4
2.4 GHz WLAN-802.11g	2412-2462	OFDM	99.82%	47.9	60.3
2.4 GHz WLAN-802.11n (20 MHz)	2412-2462	OFDM	99.80%	38.0	47.9
2.4 GHz WLAN-802.11n (40 MHz)	2412-2462	OFDM	99.60%	38.9	49.0
5 GHz WLAN-802.11n (20 MHz)	5150-5850	OFDM	99.80%	32.4	40.7
5 GHz WLAN-802.11n (40 MHz)	5150-5850	OFDM	99.60%	35.5	44.7
5 GHz WLAN-802.11ac (20 MHz)	5150-5850	OFDM	98.99%	34.7	43.7
5 GHz WLAN-802.11ac (40 MHz)	5150-5850	OFDM	98.00%	37.2	46.8
5 GHz WLAN-802.11ac (80 MHz)	5150-5850	OFDM	96.15%	35.5	44.7
Bluetooth	2402-2480	FHSS	78%	10.0	11.2
Bluetooth LE	2402-2480	DSSS	50%	10.0	11.2

The intended operating position is “at the body” with the DUT facing front against the phantom. The positions “at the body” by mean of the offered body worn accessories.

7.0 Optional Accessories and Test Criteria

The following sections describe the antennas, batteries, and body-worn accessories.

7.1 Antennas

Only one antenna applicable for this PCII filling. The Table below lists the antenna and it description.

Table 4

Antenna Models	Description	Selected for test	Tested
AN000183A05	Internal WLAN antenna, 2400-2484MHz, 5150-5850 MHz, λ/2 wave, Low -2.56 dBd, Mid -0.59 dBd, High 0.7 dBd Internal BT antenna, 2400-2484 MHz, λ/4 wave, Low -2.57 dBd, Mid -2.41 dBd, High -2.02 dBd	Yes	Yes

7.2 Batteries

Only one battery applicable for this PCII filling. The Table below lists it description.

Table 5

Battery Models	Description	Selected for test	Tested	Comments
PMNN4549A	High Capacity IMPRES Battery 2925 mAh	Yes	Yes	

7.3 Body worn Accessories

New body worn introduced for this PCII filling. The Table below lists it description.

Table 6

Body worn Models	Description	Selected for test	Tested	Comments
PMLN7960A	Mounting Kit, SI Magnetic Mount Carry Holster	Yes	Yes	

7.4 Audio Accessory

There is no audio accessory applicable for this PCII filling.

8.0 Description of Test System

8.1 Descriptions of Robotics/Probes/Readout Electronics

Table 7

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

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

8.2 Description of Phantom(s)

Table 8

Phantom Type	Phantom(s) Used	Material Parameters	Phantom Dimensions LxWxD (mm)	Material Thickness (mm)	Support Structure Material	Loss Tangent (wood)
Triple Flat	√	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	NA	300MHz -6GHz; Er = 4+/- 1, Loss Tangent = ≤0.05	600x400x190			

8.3 Description of Simulated Tissue

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

The simulated tissue mixture was mixed based on the Simulated Tissue Composition indicated in Table 9. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters at each of the tested frequencies to verify that the Di-electric parameters were within the tolerance of the tissue specifications.

Simulated Tissue Composition (percent by mass)
Table 9

Ingredients	2450 MHz Body	*5 GHz Body
Sugar	NA	NA
Diacetin	34.5	NA
De ionized – Water	65.20	NA
Salt	0.20	NA
HEC	NA	NA
Bact.	0.1	NA

Note: * SPEAG provides Motorola proprietary stimulant ingredients for the 5 GHz band

9.0 Additional Test Equipment

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

Table 10

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
Speag Probe	EX3DV4	7486	3/20/2018	3/20/2019
Speag DAE	DAE4	1488	3/9/2018	3/9/2019
Signal Generator	E4438C	MY42081753	3/27/2018	3/27/2019
Power Sensor	E9301B	MY55210006	11/12/2017	11/12/2018
Power Meter	E4418B	GB40206480	9/16/2017	9/16/2019
Power Sensor	8481B	MY41091170	4/23/2018	4/23/2019
Power Meter	E4418B	MY45107917	5/22/2017	5/22/2019
Bi-directional Coupler	3022	81640	9/15/2018	9/15/2019
Bi-directional Coupler	3024	61177	8/16/2018	8/16/2019
Amplifier	5S1G4	312988	CNR	CNR
Amplifier	5S4G11	312664	CNR	CNR
Dickson Temperature Recorder	TM320	10271109	4/13/2018	4/13/2019
Temperature Probe	80PK-22	06032017	3/7/2018	3/7/2019
Temperature Probe	80PK-22	05032017	3/7/2018	3/7/2019
Thermometer	HH806AU	080307	11/30/2017	11/30/2018
Thermometer	HH202A	35881	12/13/2017	12/13/2018
Dielectric Assessment Kit	DAK-3.5	1156	1/9/2018	1/9/2019
Network Analyzer	E5071B	MY42403218	9/6/2018	9/6/2019
Speag Dipole	D2450V2	782	2/15/2017	2/15/2019
Speag Dipole	D5GHzV2	1022	2/13/2018	2/13/2020

10.0 SAR Measurement System Validation and Verification

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

10.1 System Validation

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

Table 11

Dates	Probe Calibration Point		Probe SN	Measured Tissue Parameters		Validation		
				σ	ϵ_r	Sensitivity	Linearity	Isotropy
CW								
4/24/2018	Body	2450	7486	2.01	47.9	Pass	Pass	Pass
4/22/2018	Head	2450		1.82	36.3	Pass	Pass	Pass
4/24/2018	Body	5750		6.05	44.0	Pass	Pass	Pass
4/22/2018	Head	5750		4.89	31.9	Pass	Pass	Pass

10.2 System Verification

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

Table 12

Probe Serial #	Tissue Type	Dipole Kit / Serial #	Ref SAR @ 1W (W/kg)	System Check Results Measured (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
7486	FCC Body	SPEAG D2450V2 / 782	50.50 +/- 10%	13.2	52.80	11/2/2018
				12.9	51.60	11/7/2018
		SPEAG D5GHzV2 / 1022	76.70 +/- 10%	7.20	72.00	11/2/2018
				7.40	74.00	11/9/2018

10.3 Equivalent Tissue Test Results

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

Table 13

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
2412	FCC Body	1.91 (1.82-2.01)	52.8 (47.5-58.0)	1.91	48.1	11/2/2018
2437		1.94 (1.84-2.03)	52.7 (47.4-58.0)	1.95	47.8	11/7/2018
2450		1.95 (1.85-2.05)	52.7 (47.4-58.0)	1.96	48.0	11/2/2018
				1.96	47.8	11/7/2018
2462		1.97 (1.87-2.07)	52.7 (47.4-58.0)	1.98	47.7	11/7/2018
5710	FCC Body	5.89 (5.31-6.48)	48.3 (43.5-53.2)	5.84	44.3	11/2/2018
5670		5.85 (5.26-6.43)	48.4 (43.5-53.2)	5.99	44.2	11/9/2018
5750		5.94 (5.35-6.54)	48.3 (43.4-53.1)	5.90	44.3	11/2/2018
				6.09	44.1	11/9/2018
5795		5.99 (5.39-6.59)	48.2 (43.4-53.0)	6.15	44.0	11/9/2018

11.0 Environmental Test Conditions

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

Table 14

	Target	Measured
Ambient Temperature	18 – 25 ˚C	Range: 19.8 – 23.5˚C Avg. 21.4 ˚C
Tissue Temperature	18 – 25 ˚C	Range: 20.8 -22.3˚C Avg. 21.4˚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. Triple flat phantoms filled with applicable simulated tissue were used for body testing.

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

Table 15

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

12.2 DUT Configuration(s)

The DUT is a device operational at the body as described in section 6.0 while using the applicable accessories listed in section 7.0. All accessories listed in section 7.0 of this report were considered when implementing the standards and guidelines specified in section 4.0.

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 with its front against the phantom with the offered body worn accessories.

12.3.2 Head

Not applicable.

12.3.3 Face

Not applicable.

12.4 DUT Test Channels

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

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

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

12.5 SAR Result Scaling Methodology

The calculated 1-gram averaged SAR results indicated as “Max Calc. 1g-SAR” in the data Tables is determined by scaling the measured SAR to account for power leveling variations and drift. Appendix 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:

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

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

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

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

12.6 DUT Test Plan

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

Standalone BT testing was assessed in sections 13.3 per the guidelines of KDB 447498.

WLAN 2.4GHz tests were performed in 802.11b mode using a duty cycle of 99.97%. WLAN 5GHz tests were performed in 802.11 ac mode using a duty cycle of 98.00% with results scaled to 100% as per guidelines of KDB 248227.

13.0 DUT Test Data

13.1 WLAN assessment at the Body

Assessments at the Body with offered Body worn

Assessment for the new introduced body worn accessory at the body were done with antenna and battery indicate in section 7.0 which represent the highest applicable configurations at the body found during the initial compliance assessment on filed with the FCC/ISED.

Table 16

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#
2.4 GHz (802.11 b)									
AN000183A05	PMNN4549A	PMLN7960A @ front of DUT	None	2412	0.058	0.16	0.27	0.37	FD-AB-181102-08
5 GHz (802.11 ac, 40 MHz)									
AN000183A05	PMNN4549A	PMLN7960A @ front of DUT	None	5710	0.034	-0.18	0.21	0.31	ZZ-AB-181102-06

13.2 Assessment for ISED, Canada

As per ISED Notice 2016-DRS001, additional tests were required for the low, mid and high frequency channels for the configuration with the highest SAR value. The SAR results are in Tables below. SAR plot of the highest results 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#
2.4 GHz (802.11 b)									
AN000183A05	PMNN4549A	PMLN7960A @ front of DUT	None	2412	0.058	0.16	0.27	**0.37**	FD-AB-181102-08
				2437	0.059	0.47	0.22	0.30	FD-AB-181107-02
				2462	0.060	0.30	0.20	0.27	FD-AB-181107-03
5 GHz (802.11 ac, 40 MHz)									
AN000183A05	PMNN4549A	PMLN7960A @ front of DUT	None	5670	0.035	-0.93	0.16	0.26	FD-AB-181109-06
				5710	0.034	-0.18	0.21	0.31	ZZ-AB-181102-06
				5795	0.032	-0.11	0.27	**0.42**	ZZ-AB-181109-09

13.3 Assessment at the Bluetooth band

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

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] *[$\sqrt{F_{(GHz)}}$] = 2.75, which is ≤ 3 for 1-g SAR or 7.5 for 10-g extremity

Where:

Max. power = 8.74 mW (11.2 mW*78% duty cycle)
Min. test separation distance = 5mm for actual test separation < 5mm
F(GHz) = 2.48 GHz

Per the result from the calculation above, the standalone SAR assessment was not required for Bluetooth band. Therefore, SAR results for Bluetooth are not reported herein.

14.0 Simultaneous Transmission

WLAN 2.4GHz, 5GHz and BT share the same chipset, transmission path and antenna. The transmissions of these technologies are controlled by switching which only allows one technology to transmit at a single time and therefore do not support simultaneous transmission.

15.0 Results Summary

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

Table 18

Designator	Frequency band (MHz)	Max Calc at Body (W/kg)
		1g-SAR
FCC / ISED Canada	2.4 GHz (WLAN 802.11 b/g/n)	0.37
	5 GHz (WLAN 802.11 ac/n)	0.42

The test results clearly demonstrate compliance with FCC General Population/Uncontrolled RF Exposure limits of 1.6 W/kg averaged over 1 gram per the requirements of FCC 47 CFR § 2.1093.

14.0 Variability Assessment

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

15.0 System Uncertainty

A system uncertainty analysis is not required for this report per KDB 865664 because the highest report SAR value General Population / Uncontrolled 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

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

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**ci (1 g)**	**ci (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	R	1.73	0.64	0.43	1.2	0.8	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	R	1.73	0.6	0.49	0.6	0.5	∞
Combined Standard Uncertainty			RSS				9	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				18	17	

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

Uncertainty Budget for Device Under Test, for 2450 MHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**ci (1 g)**	**ci (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				11	11	419
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				22	22	

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

Uncertainty Budget for System Verification (dipole & flat phantom) for 5.1 to 6 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	IEEE 1528 section	**Tol. (± %)**	**Prob. Dist.**	**Div.**	c_i **(1 g)**	c_i **(10 g)**	**1 g** u_i **(±%)**	**10 g** u_i **(±%)**	v_i
Measurement System									
Probe Calibration	E.2.1	6.6	N	1.00	1	1	6.6	6.6	∞
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	2.0	R	1.73	1	1	1.2	1.2	∞
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	1.0	R	1.73	1	1	0.6	0.6	∞
Probe Positioning w.r.t. Phantom	E.6.3	4.0	R	1.73	1	1	2.3	2.3	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	2.1	R	1.73	1	1	1.2	1.2	∞
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	∞
Dielectric Parameter Correction	--	1.4	N	1.00	1	0.79	1.4	1.1	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	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				10	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				19	19	

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

Uncertainty Budget for Device Under Test for 5.1 to 6 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	IEEE 1528 section	**Tol. (± %)**	**Prob Dist**	**Div.**	c_i **(1 g)**	c_i **(10 g)**	**1 g** u_i **(±%)**	**10 g** u_i **(±%)**	v_i
Measurement System									
Probe Calibration	E.2.1	6.6	N	1.00	1	1	6.6	6.6	∞
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	2.0	R	1.73	1	1	1.2	1.2	∞
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	1.0	R	1.73	1	1	0.6	0.6	∞
Probe Positioning w.r.t Phantom	E.6.3	4.0	R	1.73	1	1	2.3	2.3	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	2.1	R	1.73	1	1	1.2	1.2	∞
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	∞
Dielectric Parameter Correction	--	1.4	N	1.00	1	0.79	1.4	1.1	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	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	465
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				23	23	

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

Appendix B
Probe Calibration Certificates

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

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

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

Accreditation No.: SCS 0108

Client Motorola Solutions MY

Certificate No: EX3-7486_Mar18/2

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

Object: EX3DV4 - SN:7486

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

Calibration date: March 20, 2018

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02525)	Apr-18
Reference 20 dB Attenuator	SN: S5277 (20x)	07-Apr-17 (No. 217-02528)	Apr-18
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

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

Issued: April 13, 2018

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

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

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

Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:7486

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

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)²)[A]	0.37	0.47	0.49	± 10.1 %
DCP (mV)[B]	101.3	90.8	100.1	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	134.1	±3.0 %
		Y	0.0	0.0	1.0		129.8	
		Z	0.0	0.0	1.0		135.9	

Note: For details on UID parameters see Appendix.

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

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	52.3	0.76	13.66	13.66	13.66	0.00	1.00	± 13.3 %
300	45.3	0.87	12.30	12.30	12.30	0.08	1.20	± 13.3 %
450	43.5	0.87	11.43	11.43	11.43	0.14	1.30	± 13.3 %
750	41.9	0.89	10.72	10.72	10.72	0.34	0.99	± 12.0 %
835	41.5	0.90	10.29	10.29	10.29	0.44	0.80	± 12.0 %
900	41.5	0.97	10.11	10.11	10.11	0.24	1.21	± 12.0 %
1450	40.5	1.20	9.06	9.06	9.06	0.36	0.80	± 12.0 %
1810	40.0	1.40	8.66	8.66	8.66	0.40	0.80	± 12.0 %
1900	40.0	1.40	8.32	8.32	8.32	0.28	0.85	± 12.0 %
2100	39.8	1.49	8.67	8.67	8.67	0.33	0.85	± 12.0 %
2300	39.5	1.67	8.06	8.06	8.06	0.30	0.80	± 12.0 %
2450	39.2	1.80	7.72	7.72	7.72	0.36	0.87	± 12.0 %
2600	39.0	1.96	7.42	7.42	7.42	0.36	0.84	± 12.0 %
4950	36.3	4.40	5.98	5.98	5.98	0.35	1.80	± 13.1 %
5250	35.9	4.71	5.61	5.61	5.61	0.40	1.80	± 13.1 %
5500	35.6	4.96	5.15	5.15	5.15	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.93	4.93	4.93	0.40	1.80	± 13.1 %
5750	35.4	5.22	5.13	5.13	5.13	0.40	1.80	± 13.1 %

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

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

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	61.9	0.80	13.10	13.10	13.10	0.00	1.00	± 13.3 %
300	58.2	0.92	12.07	12.07	12.07	0.05	1.20	± 13.3 %
450	56.7	0.94	11.68	11.68	11.68	0.09	1.30	± 13.3 %
750	55.5	0.96	10.35	10.35	10.35	0.55	0.80	± 12.0 %
835	55.2	0.97	9.98	9.98	9.98	0.59	0.80	± 12.0 %
900	55.0	1.05	9.94	9.94	9.94	0.41	0.91	± 12.0 %
1450	54.0	1.30	8.98	8.98	8.98	0.34	0.80	± 12.0 %
1810	53.3	1.52	8.42	8.42	8.42	0.39	0.80	± 12.0 %
1900	53.3	1.52	8.30	8.30	8.30	0.38	0.85	± 12.0 %
2100	53.2	1.62	8.60	8.60	8.60	0.34	0.89	± 12.0 %
2300	52.9	1.81	7.85	7.85	7.85	0.41	0.80	± 12.0 %
2450	52.7	1.95	7.77	7.77	7.77	0.38	0.80	± 12.0 %
2600	52.5	2.16	7.49	7.49	7.49	0.36	0.80	± 12.0 %
4950	49.4	5.01	5.16	5.16	5.16	0.45	1.90	± 13.1 %
5250	48.9	5.36	4.77	4.77	4.77	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.27	4.27	4.27	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.11	4.11	4.11	0.50	1.90	± 13.1 %
5750	48.3	5.94	4.27	4.27	4.27	0.50	1.90	± 13.1 %

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

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

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

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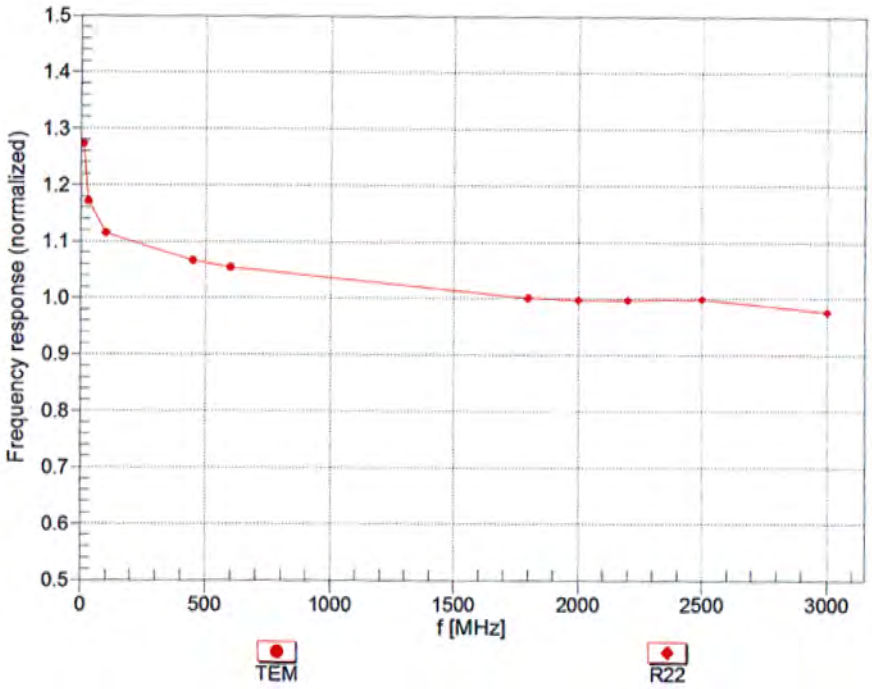
Frequency Response of E-Field

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



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

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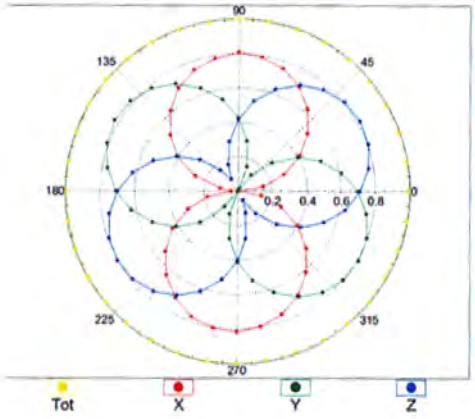
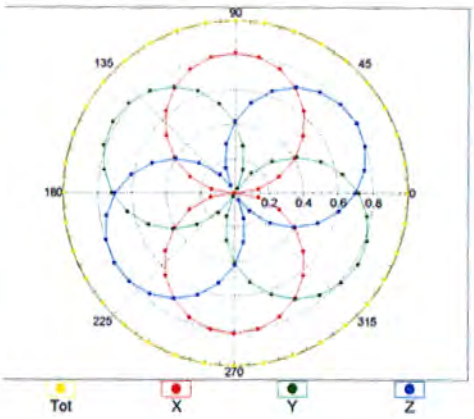
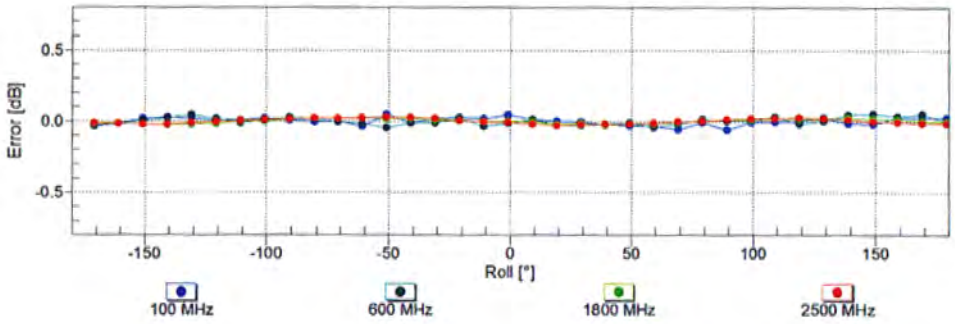
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



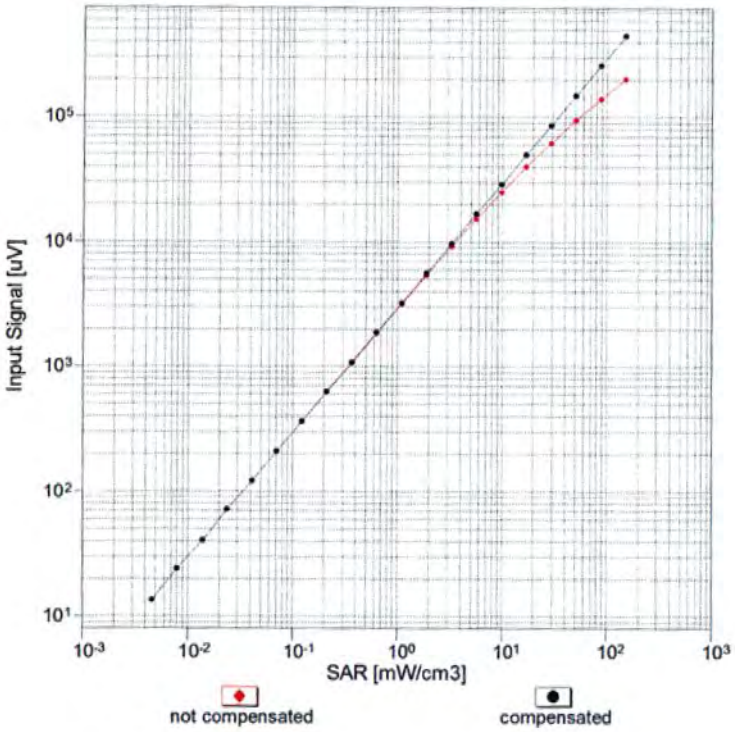
f=1800 MHz,R22

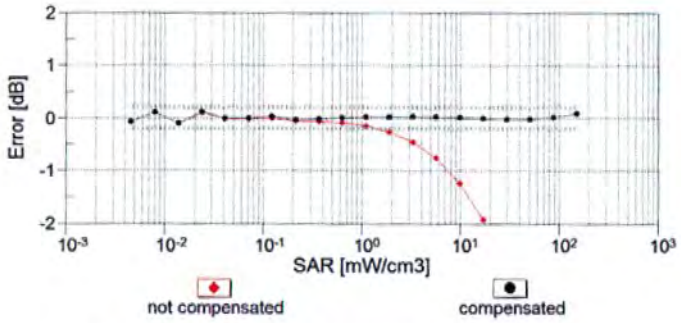




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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





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

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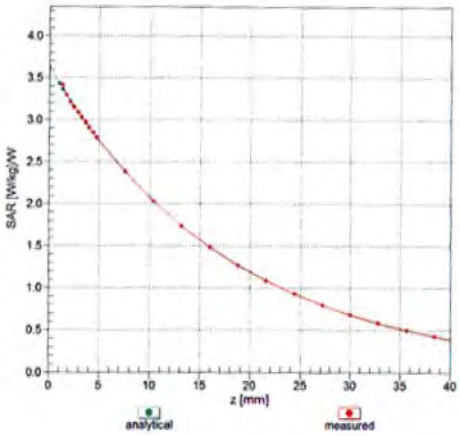
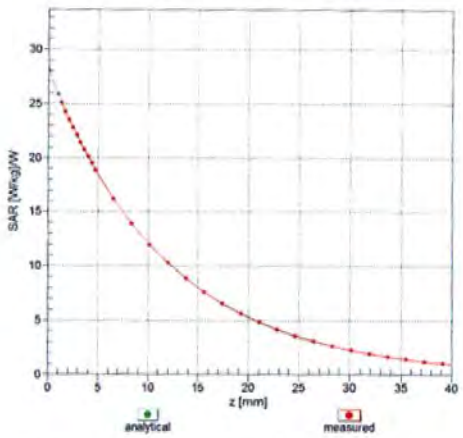
Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

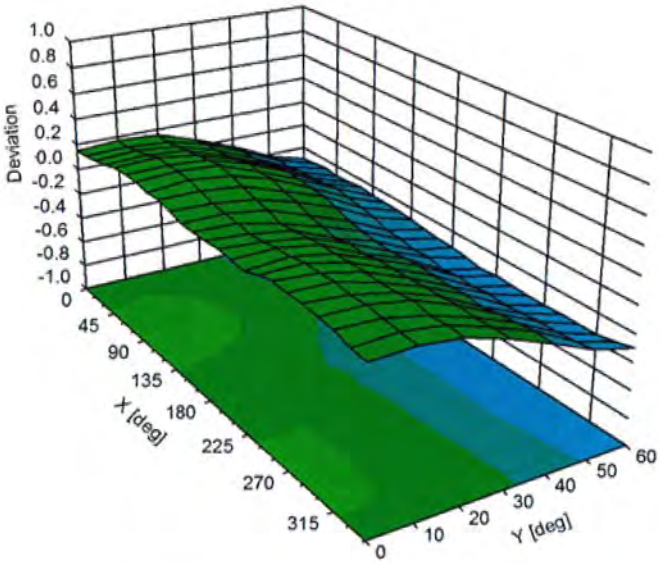


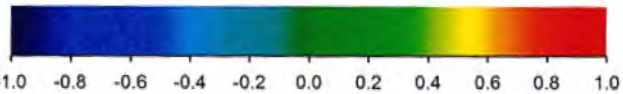
f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

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

Other Probe Parameters

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

Appendix: Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	134.1	±3.0 %
		Y	0.0	0.0	1.0		129.8	
		Z	0.0	0.0	1.0		135.9	
10021-DAC	GSM-FDD (TDMA, GMSK)	X	1.23	59.7	9.5	9.39	79.8	±1.9 %
		Y	1.64	64.6	12.9		66.6	
		Z	1.58	63.0	11.5		93.7	
10023-DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	1.31	60.4	9.9	9.57	77.2	±1.9 %
		Y	1.71	65.2	13.1		64.2	
		Z	1.56	62.3	11.3		90.7	
10024-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	1.32	63.4	10.1	6.56	147.2	±2.2 %
		Y	3.32	76.5	16.6		132.6	
		Z	1.43	64.4	11.2		144.8	
10025-DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	4.76	70.7	24.3	12.62	56.7	±1.7 %
		Y	4.37	68.2	23.8		47.2	
		Z	5.41	74.8	27.1		66.8	
10026-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	4.29	70.7	22.6	9.55	116.8	±1.7 %
		Y	3.95	68.2	21.8		96.1	
		Z	4.86	73.8	24.5		138.6	
10027-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	0.96	62.2	8.9	4.80	135.3	±1.9 %
		Y	1.12	65.3	11.3		141.0	
		Z	1.05	62.3	8.7		139.1	
10028-DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	0.53	58.4	6.0	3.55	131.7	±1.7 %
		Y	0.86	63.5	9.5		144.8	
		Z	38.88	97.7	19.9		135.9	
10029-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	4.31	72.6	22.6	7.78	146.7	±1.7 %
		Y	4.25	72.0	23.1		136.1	
		Z	4.88	75.6	24.5		136.8	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.48	66.3	18.5	4.57	141.8	±0.9 %
		Y	4.50	65.6	18.5		138.4	
		Z	4.67	67.2	19.2		145.8	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	3.77	67.7	22.6	11.01	82.1	±1.4 %
		Y	3.60	66.5	22.7		68.6	
		Z	4.07	69.7	24.1		97.1	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	4.28	73.6	22.5	6.52	149.5	±1.7 %
		Y	3.98	71.2	21.9		142.7	
		Z	4.54	74.9	23.5		134.9	
10081-CAB	CDMA2000 (1xRTT, RC3)	X	3.87	66.3	18.4	3.97	138.9	±0.7 %
		Y	3.84	65.5	18.4		135.4	
		Z	3.99	67.0	19.0		142.5	
10090-DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	X	1.19	61.8	8.9	6.56	145.6	±1.9 %
		Y	1.75	67.1	11.8		131.7	
		Z	1.37	63.4	10.2		143.5	

10099-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	X	4.71	73.7	24.3	9.55	114.9	±2.7 %
		Y	4.59	72.7	24.5		96.4	
		Z	5.27	76.6	26.1		136.9	
10117-CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.85	68.2	20.8	8.07	145.6	±3.0 %
		Y	9.82	67.8	20.9		141.9	
		Z	9.64	67.7	20.7		124.8	
10196-CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.44	68.1	20.8	8.10	137.7	±3.0 %
		Y	9.52	67.8	21.0		135.6	
		Z	9.63	68.5	21.3		142.3	
10290-AAB	CDMA2000, RC1, SO55, Full Rate	X	4.09	66.9	18.5	3.91	142.6	±0.7 %
		Y	4.05	66.1	18.5		139.2	
		Z	4.31	68.0	19.3		145.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.58	67.0	18.5	3.46	138.6	±0.7 %
		Y	3.52	66.1	18.5		135.6	
		Z	3.76	68.0	19.3		142.5	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.55	67.1	18.5	3.39	138.8	±0.7 %
		Y	3.45	66.0	18.3		135.3	
		Z	3.72	68.2	19.3		142.1	
10293-AAB	CDMA2000, RC3, SO3, Full Rate	X	3.59	66.8	18.4	3.50	139.1	±0.7 %
		Y	3.53	65.9	18.3		135.3	
		Z	3.75	67.9	19.2		142.1	
10295-AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	X	4.79	64.7	22.2	12.49	67.0	±0.9 %
		Y	4.55	62.7	21.6		55.7	
		Z	5.09	66.2	23.5		79.2	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.94	70.5	19.4	3.76	143.1	±0.5 %
		Y	4.58	67.9	18.5		142.3	
		Z	5.28	71.7	20.3		147.5	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.98	71.0	19.7	3.77	142.4	±0.7 %
		Y	4.65	68.7	19.0		140.8	
		Z	5.22	71.9	20.4		146.7	
10406-AAB	CDMA2000, RC3, SO32, SCH0, Full Rate	X	6.06	70.3	20.2	5.22	144.0	±0.9 %
		Y	6.09	69.1	20.0		144.9	
		Z	6.35	71.1	20.9		126.5	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.84	68.7	18.4	1.54	147.1	±0.7 %
		Y	2.69	67.9	18.5		142.7	
		Z	3.42	72.6	20.5		127.9	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.55	68.1	21.0	8.23	138.3	±3.0 %
		Y	9.63	67.9	21.1		135.2	
		Z	9.74	68.6	21.4		143.3	
10417-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	9.55	68.1	21.0	8.23	138.6	±3.0 %
		Y	9.57	67.7	21.0		135.1	
		Z	9.75	68.7	21.5		142.9	

10418-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preambule)	X	9.42	68.1	20.9	8.14	137.4	±2.7 %
		Y	9.48	67.8	21.1		133.4	
		Z	9.60	68.6	21.4		142.1	
10458-AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	X	8.00	69.1	20.4	6.55	146.0	±1.4 %
		Y	8.03	68.3	20.3		145.6	
		Z	7.90	68.7	20.4		126.9	
10459-AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	X	10.44	70.1	21.8	8.25	142.9	±3.0 %
		Y	10.66	69.7	21.9		145.3	
		Z	10.16	69.1	21.5		125.4	
10515-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	X	2.80	68.5	18.3	1.58	146.7	±0.7 %
		Y	2.68	67.7	18.4		142.1	
		Z	3.39	72.6	20.6		127.7	
10518-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	X	9.54	68.2	21.0	8.23	137.2	±2.7 %
		Y	9.60	67.9	21.1		134.4	
		Z	9.73	68.7	21.4		142.6	
10525-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	X	9.75	68.3	21.1	8.36	139.0	±3.0 %
		Y	9.84	68.1	21.3		136.8	
		Z	9.97	68.9	21.6		144.9	
10526-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	X	9.83	68.4	21.2	8.42	139.8	±3.0 %
		Y	9.87	68.1	21.3		136.8	
		Z	10.02	68.9	21.7		145.1	
10534-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	X	10.28	68.7	21.3	8.45	147.5	±3.3 %
		Y	10.29	68.4	21.4		142.9	
		Z	10.10	68.2	21.2		126.2	
10535-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	X	10.28	68.7	21.3	8.45	147.1	±3.3 %
		Y	10.31	68.5	21.5		143.9	
		Z	10.06	68.1	21.1		126.4	
10544-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	X	10.17	67.8	20.6	8.47	126.6	±3.0 %
		Y	10.49	68.4	21.3		147.4	
		Z	10.41	68.4	21.2		131.6	
10545-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	X	10.26	68.0	20.8	8.55	126.9	±3.0 %
		Y	10.58	68.5	21.4		147.6	
		Z	10.47	68.5	21.2		131.4	
10564-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	X	9.59	68.3	21.1	8.25	138.4	±3.0 %
		Y	9.65	68.0	21.2		135.3	
		Z	9.77	68.7	21.5		143.3	
10571-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	X	2.92	68.6	18.6	1.99	142.6	±0.9 %
		Y	2.91	68.8	19.2		138.5	
		Z	3.22	71.0	20.0		146.2	
10572-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	X	2.98	69.3	18.9	1.99	142.2	±0.7 %
		Y	2.73	67.6	18.5		137.3	
		Z	3.32	71.8	20.4		146.3	

10575-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	X	9.66	68.2	21.3	8.59	135.0	±3.0 %
		Y	9.71	67.9	21.3		131.3	
		Z	9.86	68.7	21.7		140.0	
10576-AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	X	9.65	68.2	21.3	8.60	134.6	±3.0 %
		Y	9.72	68.0	21.4		130.7	
		Z	9.86	68.7	21.7		140.0	
10583-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	X	9.65	68.2	21.2	8.59	135.2	±3.0 %
		Y	9.73	68.0	21.4		131.7	
		Z	9.86	68.8	21.8		140.4	
10584-AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	X	9.68	68.3	21.3	8.60	134.7	±3.0 %
		Y	9.70	67.9	21.4		131.0	
		Z	9.87	68.8	21.8		139.9	
10591-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	X	9.78	68.2	21.3	8.63	136.5	±3.3 %
		Y	9.77	67.8	21.3		132.6	
		Z	9.98	68.8	21.7		141.9	
10592-AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	X	9.93	68.4	21.5	8.79	137.0	±3.3 %
		Y	9.95	68.0	21.5		132.6	
		Z	10.14	68.9	21.9		142.4	
10599-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	X	10.39	68.7	21.6	8.79	144.8	±3.3 %
		Y	10.30	68.2	21.6		138.5	
		Z	10.20	68.2	21.4		124.8	
10600-AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	X	10.45	68.8	21.6	8.88	144.7	±3.5 %
		Y	10.43	68.4	21.7		139.6	
		Z	10.26	68.3	21.5		124.7	
10607-AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	X	9.79	68.2	21.3	8.64	136.8	±3.0 %
		Y	9.85	67.9	21.4		133.4	
		Z	10.02	68.9	21.8		142.3	
10608-AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	X	9.93	68.4	21.5	8.77	136.9	±3.3 %
		Y	9.99	68.1	21.6		132.2	
		Z	10.15	69.0	22.0		142.6	
10616-AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	X	10.42	68.8	21.6	8.82	144.9	±3.3 %
		Y	10.38	68.3	21.6		139.5	
		Z	10.24	68.3	21.5		124.8	
10617-AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	X	10.39	68.7	21.5	8.81	144.8	±3.5 %
		Y	10.40	68.4	21.7		139.7	
		Z	10.20	68.2	21.4		124.6	
10626-AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	X	10.30	67.8	20.9	8.83	124.0	±3.0 %
		Y	10.61	68.4	21.5		143.7	
		Z	10.54	68.5	21.4		129.7	
10627-AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	X	10.35	67.9	21.0	8.88	124.1	±3.0 %
		Y	10.68	68.6	21.7		144.0	
		Z	10.58	68.5	21.5		129.5	

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

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