



SAR TEST REPORT

Test Report No. : 13365324H-B

Applicant : Murata Manufacturing Co., Ltd.

Type of EUT : Communication Module

Model Number of EUT : 1MW

FCC ID : VPYLB1MW

**Test regulation : FCC47CFR 2.1093
*For Permissive Change**

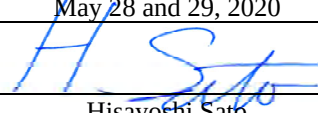
Test Result : Complied (Refer to SECTION 4)

**Reported SAR(1g) Value : The highest reported SAR(1g)
Body : 1.17 W/kg**

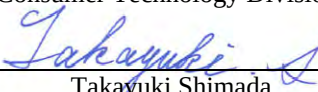
1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.
8. The information provided from the customer for this report is identified in Section 1.

Date of test: May 28 and 29, 2020

**Representative
test engineer:**


Hisayoshi Sato
Engineer
Consumer Technology Division

Approved by :


Takayuki Shimada
Leader
Consumer Technology Division



This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
http://japan.ul.com/resources/emc_accredited/

- ☐ This report contains data that are not covered by the NVLAP accreditation.
- ☒ There is no testing item of "Non-accreditation".

REVISION HISTORY

Original Test Report No.: 13365324H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13365324H-B	June 16, 2020	-	-

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	NSA	Normalized Site Attenuation
AC	Alternating Current	NVLAP	National Voluntary Laboratory Accreditation Program
AFH	Adaptive Frequency Hopping	OBW	Occupied Band Width
AM	Amplitude Modulation	OFDM	Orthogonal Frequency Division Multiplexing
Amp, AMP	Amplifier	P/M	Power meter
ANSI	American National Standards Institute	PCB	Printed Circuit Board
Ant, ANT	Antenna	PER	Packet Error Rate
AP	Access Point	PHY	Physical Layer
Atten., ATT	Attenuator	PK	Peak
AV	Average	PN	Pseudo random Noise
BPSK	Binary Phase-Shift Keying	PRBS	Pseudo-Random Bit Sequence
BR	Bluetooth Basic Rate	PSD	Power Spectral Density
BT	Bluetooth	QAM	Quadrature Amplitude Modulation
BT LE	Bluetooth Low Energy	QP	Quasi-Peak
BW	BandWidth	QPSK	Quadri-Phase Shift Keying
Cal Int	Calibration Interval	RBW	Resolution Band Width
CCK	Complementary Code Keying	RDS	Radio Data System
Ch., CH	Channel	RE	Radio Equipment
CISPR	Comite International Special des Perturbations Radioelectriques	RF	Radio Frequency
CW	Continuous Wave	RMS	Root Mean Square
DBPSK	Differential BPSK	Rx	Receiving
DC	Direct Current	SA, S/A	Spectrum Analyzer
DFS	Dynamic Frequency Selection	SG	Signal Generator
DQPSK	Differential QPSK	SVSWR	Site-Voltage Standing Wave Ratio
DSSS	Direct Sequence Spread Spectrum	TR	Test Receiver
EDR	Enhanced Data Rate	Tx	Transmitting
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	VBW	Video BandWidth
EMC	ElectroMagnetic Compatibility	Vert.	Vertical
EMI	ElectroMagnetic Interference	WLAN	Wireless LAN
EN	European Norm		
ERP, e.r.p.	Effective Radiated Power		
EU	European Union		
EUT	Equipment Under Test		
Fac.	Factor		
FCC	Federal Communications Commission		
FHSS	Frequency Hopping Spread Spectrum		
FM	Frequency Modulation		
Freq.	Frequency		
GFSK	Gaussian Frequency-Shift Keying		
GNSS	Global Navigation Satellite System		
GPS	Global Positioning System		
Hori.	Horizontal		
IEC	International Electrotechnical Commission		
IEEE	Institute of Electrical and Electronics Engineers		
IF	Intermediate Frequency		
ILAC	International Laboratory Accreditation Conference		
ISED	Innovation, Science and Economic Development Canada		
ISO	International Organization for Standardization		
JAB	Japan Accreditation Board		
LAN	Local Area Network		
LIMS	Laboratory Information Management System		
MCS	Modulation and Coding Scheme		
MRA	Mutual Recognition Arrangement		
NIST	National Institute of Standards and Technology		
NS	No signal detect.		

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

CONTENTS	PAGE
SECTION1: Customer information.....	5
SECTION2: Equipment under test (EUT).....	5
2.1 Identification of EUT.....	5
2.2 Product description	6
SECTION3: Test standard information.....	7
3.1 Test Specification	7
3.2 Procedure.....	7
3.3 Additions or deviations to standard	7
3.4 Exposure limit.....	8
3.5 SAR	8
3.6 Test Location	8
SECTION4: Test result.....	9
4.1 Result.....	9
4.2 Stand-alone SAR result.....	9
4.3 Simultaneous transmission SAR result.....	9
SECTION5: Tune-up tolerance information and software information.....	10
SECTION6: RF Exposure Conditions (Test Configurations)	12
6.1 Summary of the distance between antenna and surface of EUT	12
6.2 SAR test exclusion considerations according to KDB447498 D01	13
6.3 SAR test exclusion considerations according to KDB UMPC	16
SECTION7: Description of the Body setup	17
7.1 Procedure for SAR test position determination	17
7.2 Test position for Body setup	17
SECTION8: Description of the operating mode.....	18
8.1 Output Power and SAR test required.....	18
SECTION9: Test surrounding	22
9.1 Measurement uncertainty	22
SECTION10: Parameter Check.....	23
10.1 For SAR system check.....	23
10.2 For SAR measurement.....	24
SECTION11: System Check confirmation.....	25
SECTION12: Measured and Reported (Scaled) SAR Results	26
12.1 Result of Body SAR of WLAN 2.4GHz Band	28
12.2 Result of Body SAR of Bluetooth	29
12.3 Result of Body SAR of WLAN 5.3GHz Band	30
12.4 Result of Body SAR of WLAN 5.5GHz Band	31
12.5 Result of Body SAR of WLAN 5.8GHz Band	31
12.6 Repeated measurement	32
SECTION13: Test instruments	33
APPENDIX 1 : System Check.....	34
APPENDIX 2 : SAR Measurement data	42
APPENDIX 3 : System specifications.....	48
APPENDIX 4 : Photographs of test setup.....	99

SECTION1: Customer information

Company Name	:	Murata Manufacturing Co., Ltd.
Address	:	1-10-1 Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan
Contact Person	:	Motoo Hayashi
Telephone Number	:	+81-75-955-6736
Facsimile Number	:	+81-75-955-6634

The information provided from the customer is as follows;

- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
 - Operating/Test Mode(s) (Mode(s)) on all the relevant pages
 - SECTION 1: Customer information
 - SECTION 2: Equipment under test (EUT), other than Receipt Date
 - SECTION 5: Tune-up tolerance information and software information
- * The laboratory is exempted from liability of any test results affected from the above information in SECTION 2.

SECTION2: Equipment under test (EUT)

2.1 Identification of EUT

<Information of the EUT>

Type	:	Communication Module
Model No	:	1MW
Serial No	:	29
Rating	:	VBAT: Min. 3.35 V / Typ. 3.6 V / Max. 4.2 V VIO: 1.8 V / 3.3 V
Receipt Date of Sample	:	January 14, 2020
Country of Mass-production	:	China, Japan
Condition	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab

2.2 Product description

Model: 1MW (referred to as the EUT in this report) is a Communication Module.

Radio Specification

Radio Type : Transceiver

Specification of Wireless LAN (IEEE802.11b/g/a/n-20/11ac-20/11ac-40/11ac-80)

Type of radio	IEEE802.11b	IEEE802.11g/n (20 M band)	IEEE802.11a/n/ac (20 M band)	IEEE802.11n/ac (40 M band)	IEEE802.11ac (80 M band)
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5580 MHz 5660 MHz - 5700 MHz 5745 MHz - 5825 MHz	5190 MHz - 5230 MHz 5270 MHz - 5310 MHz 5510 MHz, 5550 MHz, 5670 MHz 5755 MHz - 5795 MHz	5210 MHz 5290 MHz 5530 MHz 5775 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM(IEEE802.11ac only))		
Channel spacing	5 MHz		20 MHz	40 MHz	80 MHz
Antenna type	Monopole pattern antenna				
Antenna Gain	[RF Cable 30 mm] 2.4 GHz: 0 dBi 5 GHz: 1.5dBi [RF Cable 300 mm] 2.4 GHz: -1.3 dBi 5 GHz: -1.8 dBi				

Specification of Bluetooth (Ver. 4.2 with EDR function)

	Bluetooth Ver.4.2 with EDR function
Frequency of operation	2402 MHz - 2480 MHz
Type of modulation	BT: FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK) LE: GFSK
Channel spacing	BT: 1 MHz LE: 2 MHz
Antenna type	Monopole pattern antenna
Antenna Gain	[RF Cable 30 mm] 2.4 GHz: 0 dBi [RF Cable 300 mm] 2.4 GHz: -1.3 dBi

* WLAN and Bluetooth do not transmit simultaneously.

SECTION3: Test standard information

3.1 Test Specification

Title : **FCC47CFR 2.1093**

Radiofrequency radiation exposure evaluation: portable devices.

: **IEEE Std 1528-2013:**

IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

: **Published RF exposure KDB procedures**

- | | |
|---|---|
| ☒ KDB447498D01(v06) | RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices |
| ☐ KDB447498D02(v02r01) | SAR Measurement Procedures for USB Dongle Transmitters |
| ☐ KDB648474D04(v01r03) | SAR Evaluation Considerations for Wireless Handsets |
| ☐ KDB941225D01(v03r01) | 3G SAR Measurement Procedures |
| ☐ KDB941225D05(v02r05) | SAR Evaluation Considerations for LTE Devices |
| ☐ KDB941225D06(v02r01) | SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities (Hot Spot SAR) |
| ☒ KDB941225D07(v01r02) | SAR Evaluation Procedures for UMPC Mini-Tablet Devices |
| ☐ KDB616217D04(v01r02) | SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers |
| ☒ KDB865664D01(v01r04) | SAR Measurement Requirements for 100MHz to 6 GHz |
| ☒ KDB248227D01(v02r02) | SAR Guidance for 802.11(Wi-Fi) Transmitters |

Reference

- [1]SPEAG uncertainty document (AN 15-7/AN19-17) for DASY 5 System from SPEAG (Schmid & Partner Engineering AG).
 [2]IEC62209-2:2010+AMD1:2019 CSV

3.2 Procedure

Transmitter	WLAN and Bluetooth
Test Procedure	Published RF exposure KDB procedures
Category	SAR
Note: UL Japan, Inc. 's SAR Work Procedures 13-EM-W0429 and 13-EM-W0430	

This EUT operates only with the specified Digital Camera.

Therefore the test was performed with the Digital Camera (Host) in which the distance to the exterior surface is shortest.

3.3 Additions or deviations to standard

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Exposure limit

(A) Limits for Occupational/Controlled Exposure (W/kg)

Spatial Average (averaged over the whole body)	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.4	8.0	20.0

(B) Limits for General population/Uncontrolled Exposure (W/kg)

Spatial Average (averaged over the whole body)	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.08	1.6	4.0

Occupational/Controlled Environments: are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

General Population/Uncontrolled Environments: are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

**NOTE:GENERAL POPULATION/UNCONTROLLED EXPOSURE
SPATIAL PEAK(averaged over any 1g of tissue) LIMIT
1.6 W/kg**

3.5 SAR

Specific Absorption Rate (SAR): The time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ), as shown in the following equation:

$$SAR = \frac{d}{dt} \left(\frac{dW}{dm} \right) = \frac{d}{dt} \left(\frac{dW}{\rho dV} \right)$$

SAR is expressed in units of watts per kilogram (W/kg) or equivalently milliwatts per gram (mW/g).

SAR is related to the E-field at a point by the following equation:

$$SAR = \frac{\sigma |E|^2}{\rho}$$

where

σ = conductivity of the tissue (S/m)

ρ = mass density of the tissue (kg/m³)

E = rms E-field strength (V/m)

3.6 Test Location

UL Japan, Inc. Ise EMC Lab.

Shielded room for SAR testings

NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED SAR Lab Company Number: 2973C

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

SECTION4: Test result

4.1 Result

Complied

Highest values at each band are listed next section.

4.2 Stand-alone SAR result

Reported SAR

Measured SAR is scaled to the maximum tune-up tolerance limit by the following formulas.

Reported SAR= Measured SAR [W/kg] * Scaled factor

Maximum tune-up tolerance limit is by the specification from a customer.

* Scaled factor = Maximum tune-up tolerance limit [mW] / Measured power [mW]

Body SAR

Mode	Freq. (MHz)	Power (dBm)		Scaled factor	1-g SAR (W/kg)	
		Tune-up upper Power	Measured average Power		Meas.	Reported
WLAN11n-40	5310	12.00	10.08	1.556	0.749	1.165
Bluetooth DH5	2402	7.50	6.77	1.183	0.082	0.097

Note(s):

The sample used by the SAR test is not more than 2 dB lower than the maximum tune-up tolerance limit. That is, measured power is included the tune-up tolerance range.

*Details are shown at section 12.

4.3 Simultaneous transmission SAR result

Wireless LAN and Bluetooth(incl. BT LE) do not transmit simultaneously.

SECTION5: Tune-up tolerance information and software information

Maximum tune-up tolerance limit

Mode	Maximum frequency in each band	Maximum tune-up tolerance limit [dBm]	Maximum tune-up tolerance limit [mW]
WLAN 11b	2462	13.00	19.95
WLAN 11g	2462	13.00	19.95
WLAN 11n	2462	13.00	19.95
BT	2480	7.50	5.62
BT LE	2480	6.00	3.98
WLAN 11a	5320	12.00	15.85
WLAN 11a	5700	9.00	7.94
WLAN 11a	5825	9.00	7.94
WLAN 11n-20	5320	12.00	15.85
WLAN 11n-20	5700	9.00	7.94
WLAN 11n-20	5825	9.00	7.94
WLAN 11n-40	5310	12.00	15.85
WLAN 11n-40	5670	9.00	7.94
WLAN 11n-40	5795	9.00	7.94
WLAN 11ac-20	5320	12.00	15.85
WLAN 11ac-20	5700	9.00	7.94
WLAN 11ac-20	5825	9.00	7.94
WLAN 11ac-40	5310	12.00	15.85
WLAN 11ac-40	5670	9.00	7.94
WLAN 11ac-40	5795	9.00	7.94
WLAN 11ac-80	5290	11.00	12.59
WLAN 11ac-80	5530	9.00	7.94
WLAN 11ac-80	5775	9.00	7.94

For WLAN Maximum tune-up tolerance limit is defined by a customer as duty100%.

Software setting

*The power value of the EUT was set for testing as follows (setting value might be different from product specification value);

[WLAN2.4GHz / 5GHz]

Power settings: WLAN: Refer to the following Power Setting table

Software: T0.40.01

[BT / BT LE]

Power settings: config:0218

Software: T0.40.01

*This setting of software is the worst case.

The test was performed with condition that obtained the maximum average power in pre-check.

Any conditions under the normal use do not exceed the condition of setting.

In addition, end users cannot change the settings of the output power of the product.

[Power setting]

Mode	Frequency	Power Setting
11b(2.4GHz)	2412 MHz	51
11b(2.4GHz)	2437 MHz and 2462 MHz	52
11n-40(5.3GHz)	5270 MHz and 5310 MHz	48
11ac-80(5.5GHz)	5530 MHz	36
11ac-80(5.8GHz)	5775 MHz	36

UL Japan, Inc.

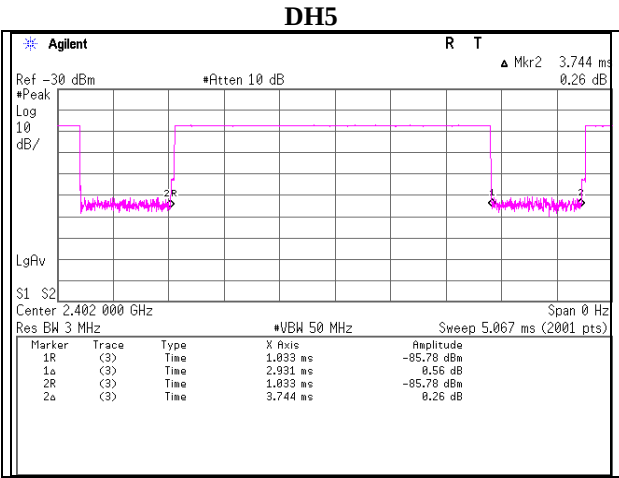
Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

Duty Confirmation for Bluetooth



SECTION6: RF Exposure Conditions (Test Configurations)

6.1 Summary of the distance between antenna and surface of EUT

Test position	Distance
Front	11.7 mm
Rear	24.4 mm
Left	2.2 mm
Right	130.1 mm
Top	55.9 mm
Bottom	5.1 mm

*Details are shown in appendix 4

6.2 SAR test exclusion considerations according to KDB447498 D01

The following is based on KDB447498D01.

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$$

for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

1. The upper frequency of the frequency band was used in order to calculate standalone SAR test exclusion considerations.
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison
4. The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. When the separation of antenna to EUT's surfaces and edges are ≤ 50 mm, the separation distance used for the SAR exclusion calculations is 5 mm.
5. "N/A" displayed on below exclusion calculation means not applicable this formula since distance between antenna and surface is > 50 mm.

When the calculated threshold value by a numerical formula above-mentioned in the following table is 3.0 or less, SAR test is excluded.

SAR exclusion calculations for antenna <50mm from the user

Antenna	Tx Interface	Frequency (MHz)	Output Power		Calculated Threshold Value					
			dBm	mW	Front	Rear	Left	Right	Top	Bottom
Main	11b	2462	13.00	20	6.3	6.3	6.3	N/A	N/A	6.3
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	11g	2462	13.00	20	6.3	6.3	6.3	N/A	N/A	6.3
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	11n-20	2462	13.00	20	6.3	6.3	6.3	N/A	N/A	6.3
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	Bluetooth	2480	7.50	6	1.8	1.8	1.8	N/A	N/A	1.8
					-EXEMPT-	-EXEMPT-	-EXEMPT-			-EXEMPT-
Main	BTLE	2480	6.00	4	1.3	1.3	1.3	N/A	N/A	1.3
					-EXEMPT-	-EXEMPT-	-EXEMPT-			-EXEMPT-

SAR exclusion calculations for antenna <50mm from the user

Antenna	Tx Interface	Frequency (MHz)	Output Power		Calculated Threshold Value					
			dBm	mW	Front	Rear	Left	Right	Top	Bottom
Main	WLAN 11a	5320	12.00	16	7.3	7.3	7.3	N/A	N/A	7.3
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11a	5700	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11a	5825	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11n-20	5320	12.00	16	7.3	7.3	7.3	N/A	N/A	7.3
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11n-20	5700	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11n-20	5825	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11n-40	5310	12.00	16	7.3	7.3	7.3	N/A	N/A	7.3
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11n-40	5670	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11n-40	5795	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-

SAR exclusion calculations for antenna <50mm from the user

Antenna	Tx Interface	Frequency (MHz)	Output Power		Calculated Threshold Value					
			dBm	mW	Front	Rear	Left	Right	Top	Bottom
Main	WLAN 11ac-20	5320	12.00	16	7.3	7.3	7.3	N/A	N/A	7.3
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11ac-20	5700	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11ac-20	5825	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11ac-40	5310	12.00	16	7.3	7.3	7.3	N/A	N/A	7.3
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11ac-40	5670	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11ac-40	5795	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11ac-80	5290	11.00	13	5.8	5.8	5.8	N/A	N/A	5.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11ac-80	5530	9.00	8	3.7	3.7	3.7	N/A	N/A	3.7
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-
Main	WLAN 11ac-80	5775	9.00	8	3.8	3.8	3.8	N/A	N/A	3.8
					-MEASURE-	-MEASURE-	-MEASURE-			-MEASURE-

2) At 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following.

a) $[(3 \cdot 50) / (\sqrt{f(\text{GHz})})] + (\text{test separation distance} - 50 \text{ mm}) \cdot (f(\text{MHz}) / 150) \text{ mW}$ at > 100 MHz and ≤ 1500 MHz

b) $[(3 \cdot 50) / (\sqrt{f(\text{GHz})})] + (\text{test separation distance} - 50 \text{ mm}) \cdot 10 \text{ mW}$ at > 1500 MHz and ≤ 6 GHz

1. The upper frequency of the frequency band was used in order to calculate standalone SAR test exclusion considerations.
2. Power and distance are rounded to the nearest mW and mm before calculation
3. “N/A” displayed on below exclusion calculation means not applicable this formula since distance between antenna and surface is < 50 mm.

When output power is less than the calculated threshold value by a numerical formula above-mentioned in the following table, SAR test is excluded.

SAR exclusion calculations for antenna >50mm from the user

Antenna	Tx Interface	Frequency (MHz)	Output Power		Calculated Threshold Value					
			dBm	mW	Front	Rear	Left	Right	Top	Bottom
Main	11b	2462	13.00	20	N/A	N/A	N/A	896.6 mW -EXEMPT-	154.6 mW -EXEMPT-	N/A
Main	11g	2462	13.00	20	N/A	N/A	N/A	896.6 mW -EXEMPT-	154.6 mW -EXEMPT-	N/A
Main	11n-20	2462	13.00	20	N/A	N/A	N/A	896.6 mW -EXEMPT-	154.6 mW -EXEMPT-	N/A
Main	Bluetooth	2480	7.50	6	N/A	N/A	N/A	896.3 mW -EXEMPT-	154.3 mW -EXEMPT-	N/A
Main	BTLE	2480	6.00	4	N/A	N/A	N/A	896.3 mW -EXEMPT-	154.3 mW -EXEMPT-	N/A

SAR exclusion calculations for antenna >50mm from the user

Antenna	Tx Interface	Frequency (MHz)	Output Power		Calculated Threshold Value					
			dBm	mW	Front	Rear	Left	Right	Top	Bottom
Main	WLAN 11a	5320	12.00	16	N/A	N/A	N/A	866 mW -EXEMPT-	124 mW -EXEMPT-	N/A
Main	WLAN 11a	5700	9.00	8	N/A	N/A	N/A	863.8 mW -EXEMPT-	121.8 mW -EXEMPT-	N/A
Main	WLAN 11a	5825	9.00	8	N/A	N/A	N/A	863.2 mW -EXEMPT-	121.2 mW -EXEMPT-	N/A
Main	WLAN 11n-20	5320	12.00	16	N/A	N/A	N/A	866 mW -EXEMPT-	124 mW -EXEMPT-	N/A
Main	WLAN 11n-20	5700	9.00	8	N/A	N/A	N/A	863.8 mW -EXEMPT-	121.8 mW -EXEMPT-	N/A
Main	WLAN 11n-20	5825	9.00	8	N/A	N/A	N/A	863.2 mW -EXEMPT-	121.2 mW -EXEMPT-	N/A
Main	WLAN 11n-40	5310	12.00	16	N/A	N/A	N/A	866.1 mW -EXEMPT-	124.1 mW -EXEMPT-	N/A
Main	WLAN 11n-40	5670	9.00	8	N/A	N/A	N/A	864 mW -EXEMPT-	122 mW -EXEMPT-	N/A
Main	WLAN 11n-40	5795	9.00	8	N/A	N/A	N/A	863.3 mW -EXEMPT-	121.3 mW -EXEMPT-	N/A

SAR exclusion calculations for antenna >50mm from the user

Antenna	Tx Interface	Frequency (MHz)	Output Power		Calculated Threshold Value					
			dBm	mW	Front	Rear	Left	Right	Top	Bottom
Main	WLAN 11ac-20	5320	12.00	16	N/A	N/A	N/A	866 mW -EXEMPT-	124 mW -EXEMPT-	N/A
Main	WLAN 11ac-20	5700	9.00	8	N/A	N/A	N/A	863.8 mW -EXEMPT-	121.8 mW -EXEMPT-	N/A
Main	WLAN 11ac-20	5825	9.00	8	N/A	N/A	N/A	863.2 mW -EXEMPT-	121.2 mW -EXEMPT-	N/A
Main	WLAN 11ac-40	5310	12.00	16	N/A	N/A	N/A	866.1 mW -EXEMPT-	124.1 mW -EXEMPT-	N/A
Main	WLAN 11ac-40	5670	9.00	8	N/A	N/A	N/A	864 mW -EXEMPT-	122 mW -EXEMPT-	N/A
Main	WLAN 11ac-40	5795	9.00	8	N/A	N/A	N/A	863.3 mW -EXEMPT-	121.3 mW -EXEMPT-	N/A
Main	WLAN 11ac-80	5290	11.00	13	N/A	N/A	N/A	866.2 mW -EXEMPT-	124.2 mW -EXEMPT-	N/A
Main	WLAN 11ac-80	5530	9.00	8	N/A	N/A	N/A	864.8 mW -EXEMPT-	122.8 mW -EXEMPT-	N/A
Main	WLAN 11ac-80	5775	9.00	8	N/A	N/A	N/A	863.4 mW -EXEMPT-	121.4 mW -EXEMPT-	N/A

6.3 SAR test exclusion considerations according to KDB UMPC

Based on KDB941225D07, UMPC mini-tablet devices must be tested for 1-g SAR on all surfaces and side edges with a transmitting antenna location at ≤ 25 mm from that surface or edges, at 5 mm separation from a flat phantom, for the data modes, wireless technologies and frequency bands by the devices to determine SAR compliance.

KDB 941225 UMPC

SAR test required					
Front	Rear	Left	Right	Top	Bottom
MEASURE	MEASURE	MEASURE	EXEMPT	EXEMPT	MEASURE

SECTION7: Description of the Body setup

7.1 Procedure for SAR test position determination

-The tested procedure was performed according to the KDB 447498 D01 (Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies) and the KDB 941225 D07 (SAR Evaluation Procedures for UMPC Mini-Tablet Devices).

7.2 Test position for Body setup

No.	Position	Test distance	WLAN	Bluetooth
			Tested	Tested
1	Front	0mm	☒	☒
2	Rear	0mm	☒	☒
3	Left	0mm	☒	☒
4	Right	0mm	☐	☐
5	Top	0mm	☐	☐
6	Bottom	0mm	☒	☒

*The test was conservatively performed with test distance 0mm.

SECTION8: Description of the operating mode

8.1 Output Power and SAR test required

According to KDB248227D01, The initial test configuration for 2.4 GHz and 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. SAR for the initial test configuration is measured using the highest maximum output power channel determined by the default power measurement procedures. When multiple configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined according to the following steps applied sequentially.

1. The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.
2. If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
3. If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.
4. When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n.

WLAN 2.4GHz (DTS Band)

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Tune-up upper Power (dBm)	Measured average Power (dBm)	Initial test configuration	Note(s)
2.4	11b	1 Mbps	1	2412	13.00	12.89		2
			6	2437	13.00	12.89		
			11	2462	13.00	12.95	Yes	
	11g	6 Mbps	1	2412	13.00	-		1
			6	2437	13.00	-		
			11	2462	13.00	-		
	11n-20	6.5 Mbps	1	2412	13.00	-		1
			6	2437	13.00	-		
			11	2462	13.00	-		

Note(s):

1. When the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.
2. Initial SAR test channel was chosen. (shaded blue frame)

Bluetooth

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Tune-up upper Power (dBm) (Burst)	Measured average Power (dBm) (Burst)	Initial test configuration	Note(s)
2.4	Bluetooth	DH5	1	2402	7.50	6.77	Yes	2
			39	2441	7.50	6.63		
			79	2480	7.50	5.87		
	Bluetooth	LE	37	2402	6.00	-		1
			17	2440	6.00	-		
			39	2480	6.00	-		

Note(s):

1. According to KDB865664, SAR measurement is not required for EDR and LE when the specified tune-up tolerances for EDR and LE are lower than BDR.
2. SAR test channel was chosen. (shaded blue frame)

WLAN 5GHz (U-NII-1 and U-NII-2A Bands)

Band	Mode	Data Rate	Ch #	Freq. (MHz)	Tune-up upper Power (dBm) (Burst)	Measured average Power (dBm) (Burst)	Initial test configuration	Note(s)
U-NII-1	11a	6 Mbps	36	5180	12.00	-		2
			44	5220	12.00	-		
			48	5240	12.00	-		
U-NII-2A	11a	6 Mbps	52	5260	12.00	-		
			60	5300	12.00	-		
			64	5320	12.00	-		
U-NII-1	11n-20	MCS0	36	5180	12.00	-		2
			44	5220	12.00	-		
			48	5240	12.00	-		
U-NII-2A	11n-20	MCS0	52	5260	12.00	-		
			60	5300	12.00	-		
			64	5320	12.00	-		
U-NII-1	11ac-20	MCS0	36	5180	12.00	-		2
			44	5220	12.00	-		
			48	5240	12.00	-		
U-NII-2A	11ac-20	MCS0	52	5260	12.00	-		
			60	5300	12.00	-		
			64	5320	12.00	-		
U-NII-1	11n-40	MCS0	38	5190	12.00	-		2
			46	5230	12.00	-		
U-NII-2A	11n-40	MCS0	54	5270	12.00	10.01		
			62	5310	12.00	10.08	Yes	1, 3
U-NII-1	11ac-40	MCS0	38	5190	12.00	-		2
			46	5230	12.00	-		
U-NII-2A	11ac-40	MCS0	54	5270	12.00	-		
			62	5310	12.00	-		
U-NII-1	11ac-80	MCS0	42	5210	11.00	-		2
U-NII-2A	11ac-80	MCS0	68	5290	11.00	-		

Note(s):

- When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel with the largest bandwidth and lowest data rate is selected (i.e. 11n-40).
- When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is
 - ≤ 1.2 W/kg, SAR is not required for UNII band I
 - > 1.2 W/kg, both bands should be tested independently for SAR.
- Initial SAR test channel was chosen. (shaded blue frame)

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

WLAN 5GHz (U-NII-2C Band and U-NII-3 Band)

Band	Mode	Data Rate	Ch #	Freq. (MHz)	Tune-up upper Power (dBm) (Burst)	Measured average Power (dBm) (Burst)	Initial test configuration	Note(s)
U-NII-2C	11a	6 Mbps	100	5500	9.00	-		
			116	5580	9.00	-		
			140	5700	9.00	-		
U-NII-2C	11n-20	MCS0	100	5500	9.00	-		
			116	5580	9.00	-		
			140	5700	9.00	-		
U-NII-2C	11ac-20	MCS0	100	5500	9.00	-		
			116	5580	9.00	-		
			140	5700	9.00	-		
U-NII-2C	11n-40	MCS0	102	5510	9.00	-		
			110	5550	9.00	-		
			134	5670	9.00	-		
U-NII-2C	11ac-40	MCS0	102	5510	9.00	-		
			110	5550	9.00	-		
			134	5670	9.00	-		
U-NII-2C	11ac-80	MCS0	106	5530	9.00	7.72	Yes	1, 2

U-NII-3	11a	6 Mbps	149	5745	9.00	-		
			157	5785	9.00	-		
			165	5825	9.00	-		
U-NII-3	11n-20	MCS0	149	5745	9.00	-		
			157	5785	9.00	-		
			165	5825	9.00	-		
U-NII-3	11ac-20	MCS0	149	5745	9.00	-		
			157	5785	9.00	-		
			165	5825	9.00	-		
U-NII-3	11n-40	MCS0	151	5755	9.00	-		
			159	5795	9.00	-		
U-NII-3	11ac-40	MCS0	151	5755	9.00	-		
			159	5795	9.00	-		
U-NII-3	11ac-80	MCS0	155	5775	9.00	8.59	Yes	1, 2

Note(s):

- When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel with the largest bandwidth and lowest data rate is selected (i.e. 11ac-80).
- Initial SAR test channel was chosen. (shaded blue frame)

SECTION9: Test surrounding

9.1 Measurement uncertainty

This measurement uncertainty budget is suggested by IEEE Std 1528(2013) and IEC62209-2:2010+AMD1:2019 CSV, and determined by Schmid & Partner Engineering AG (DASY5/6 Uncertainty Budget). Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz Section 2.8.1., when the highest measured SAR(1g) within a frequency band is < 1.5W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std.1528 (2013) is not required in SAR reports submitted for equipment approval.

<Body>

Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std.Unc. (10g)
Measurement System							
Probe Calibration	± 6.55 %	N	1	1	1	±6.55%	±6.55%
Axial Isotropy	± 4.7 %	R	√3	0.7	0.7	±1.9%	±1.9%
Hemispherical Isotropy	± 9.6 %	R	√3	0.7	0.7	±3.9%	±3.9%
Linearity	± 4.7 %	R	√3	1	1	±2.7%	±2.7%
Modulation Response	± 2.4 %	R	√3	1	1	±1.4%	±1.4%
System Detection Limits	± 1.0 %	R	√3	1	1	±0.6%	±0.6%
Boundary Effects	± 2.0 %	R	√3	1	1	±1.2%	±1.2%
Readout Electronics	± 0.3 %	N	1	1	1	±0.3%	±0.3%
Response Time	± 0.8 %	R	√3	1	1	±0.5%	±0.5%
Integration Time	± 2.6 %	R	√3	1	1	±1.5%	±1.5%
RF Ambient Noise	± 3.0 %	R	√3	1	1	±1.7%	±1.7%
RF Ambient Reflections	± 3.0 %	R	√3	1	1	±1.7%	±1.7%
Probe Positioner	± 0.04 %	R	√3	1	1	±0.0%	±0.0%
Probe Positioning	± 0.8 %	R	√3	1	1	±0.5%	±0.5%
Post-processing	± 4.0 %	R	√3	1	1	±2.3%	±2.3%
Test Sample Related							
Device Holder	± 3.6 %	N	1	1	1	±3.6%	±3.6%
Test sample Positioning	± 2.9 %	N	1	1	1	±2.9%	±2.9%
Power Scaling	± 0.0 %	R	√3	1	1	±0.0%	±0.0%
Power Drift	± 5.0 %	R	√3	1	1	±2.9%	±2.9%
Phantom and Setup							
Phantom Uncertainty	± 7.6 %	R	√3	1	1	±4.4%	±4.4%
SAR correction	± 1.9 %	N	1	1	0.84	±1.9%	±1.6%
Liquid Conductivity (mea.)	+ 4.9 %	N	1	0.78	0.71	±3.9%	±3.5%
Liquid Permittivity (mea.)	- 4.4 %	N	1	0.23	0.26	±1.0%	±1.2%
Temp. unc. - Conductivity	± 3.4 %	R	√3	0.78	0.71	±1.5%	±1.4%
Temp. unc. - Permittivity	± 0.4 %	R	√3	0.23	0.26	±0.1%	±0.1%
Combined Std. Uncertainty						±12.6%	±12.4%
Expanded STD Uncertainty (κ =2)						±25.1%	±24.8%

Note: This uncertainty budget for validation is worst-case.
Table of uncertainties are listed for ISO/IEC 17025.

SECTION10: Parameter Check

The dielectric parameters were checked prior to assessment using the DAK dielectric probe kit.
The dielectric parameters measurement is reported in each correspondent section.

According to KDB865664 D01, +/- 5% tolerances are required for ϵ_r and σ and then below table which is the target value of the simulated tissue liquid is quoted from KDB865664 D01.

Target Frequency	Head		Body	
(MHz)	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ϵ_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m³)

The dielectric parameters are linearly interpolated between the closest pair of target frequencies to determine the applicable dielectric parameters corresponding to the device test frequency.

10.1 For SAR system check

DIELECTRIC PARAMETERS MEASUREMENT RESULTS													
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Target [σ]	Target [ϵ_r]	Measure [σ]	Measure [ϵ_r]	Deviation σ [%]	Deviation ϵ_r [%]	Limit [%]	Remark
2020/05/28	24.0	45	MBBL600-6000	23.5	5250.0	5.358	48.946	5.196	47.015	-3.018	-3.946	+/- 5	
2020/05/28	24.0	45	MBBL600-6000	23.5	5600.0	5.766	48.471	5.652	46.253	-1.984	-4.577	+/- 5	
2020/05/29	24.0	45	MBBL600-6000	23.5	5800.0	6.000	48.200	5.973	46.371	-0.450	-3.795	+/- 5	
2020/05/29	24.0	45	MBBL600-6000	23.5	2450.0	1.950	52.700	2.047	51.949	4.974	-1.425	+/- 5	

σ : Conductivity / ϵ_r : Relative Permittivity

Correlation confirmation with measured TSL parameters of the calibration certificate of system check dipoles (Refer to Appendix 3)

+/- 6% limit for deviation provided by manufacture tolerances are required for ϵ_r and σ and then below table which is the target value of the simulated tissue liquid is quoted from data measured TSL parameters of dipole calibration.

Freq [MHz]	Model,S/N	Body	
		σ	ϵ
2450	D2450,713	2.04	50.7
5250	D5GHV2,1020	5.51	47.0
5600	D5GHV2,1020	5.99	46.4
5800	D5GHV2,1020	6.26	46.0

DIELECTRIC PARAMETERS MEASUREMENT RESULTS													
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Target σ	Target ϵ_r	Measure σ	Measure ϵ_r	Deviation σ [%]	Deviation ϵ_r [%]	Limit [%]	Remark
2020/5/28	24.0	45	MBBL600-6000	23.5	5250.0	5.510	47.000	5.196	47.015	-5.699	0.032	+/- 6	
2020/5/28	24.0	45	MBBL600-6000	23.5	5600.0	5.990	46.400	5.652	46.253	-5.643	-0.317	+/- 6	
2020/5/29	24.0	45	MBBL600-6000	23.5	5800.0	6.260	46.000	5.973	46.371	-4.585	0.807	+/- 6	
2020/5/29	24.0	45	MBBL600-6000	23.5	2450.0	2.040	50.700	2.047	51.949	0.343	2.464	+/- 6	

ϵ_r : Relative Permittivity / σ : Conductivity

10.2 For SAR measurement

DIELECTRIC PARAMETERS MEASUREMENT RESULTS													
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Target σ	Target ϵ_r	Measure σ	Measure ϵ_r	Deviation σ [%]	Deviation ϵ_r [%]	Limit [%]	Remark
2020/5/29	24.0	45	MBBL600-6000	23.5	2412.0	1.914	52.751	2.007	52.130	4.876	-1.177	+/- 5	
2020/5/29	24.0	45	MBBL600-6000	23.5	2437.0	1.938	52.717	2.032	52.008	4.873	-1.346	+/- 5	
2020/5/29	24.0	45	MBBL600-6000	23.5	2462.0	1.967	52.685	2.060	51.892	4.727	-1.505	+/- 5	
2020/5/29	24.0	45	MBBL600-6000	23.5	2402.0	1.904	52.764	1.997	52.182	4.877	-1.103	+/- 5	
2020/5/29	24.0	45	MBBL600-6000	23.5	2441.0	1.941	52.712	2.037	51.990	4.924	-1.370	+/- 5	
2020/5/29	24.0	45	MBBL600-6000	23.5	2480.0	1.993	52.662	2.080	51.813	4.389	-1.612	+/- 5	
2020/5/28	24.0	45	MBBL600-6000	23.5	5270.0	5.381	48.919	5.192	47.006	-3.513	-3.911	+/- 5	
2020/5/28	24.0	45	MBBL600-6000	23.5	5310.0	5.428	48.865	5.238	46.986	-3.496	-3.845	+/- 5	
2020/5/28	24.0	45	MBBL600-6000	23.5	5530.0	5.685	48.566	5.502	46.434	-3.214	-4.391	+/- 5	
2020/5/29	24.0	45	MBBL600-6000	23.5	5775.0	5.971	48.234	5.967	46.289	-0.064	-4.032	+/- 5	

σ : Conductivity / ϵ_r : Relative Permittivity

SECTION11: System Check confirmation

The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ± 0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.

The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm ± 0.5 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm ± 0.5 cm for measurements > 3 GHz.

The DASY system with an E-Field Probe was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom).

The standard measuring distance was 10 mm (above 1GHz to 6GHz) and 15 mm (below 1GHz) from dipole center to the simulating liquid surface.

The coarse grid with a grid spacing of 12 mm (1GHz to 3GHz) and 15 mm (below 1GHz) was aligned with the dipole.

For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.

Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.

Distance between probe sensors and phantom surface was set to 3 mm.

For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm

The dipole input power (forward power) was 100 mW(For 5GHz band) or 250 mW(For other band).

The results are normalized to 1 W input power.

Target Value

Freq [MHz]	Model,S/N	Body	
		(SPEAG) 1g [W/kg]	(SPEAG) 10g[W/kg]
2450	D2450,713	53.20	24.72
5250	D5GHV2,1020	76.70	21.40
5600	D5GHV2,1020	80.90	22.40
5800	D5GHV2,1020	76.50	21.10

The target(reference) SAR values can be obtained from the calibration certificate of system validation dipoles(Refer to Appendix 2). The target SAR values are SAR measured value in the calibration certificate scaled to 1W.

Date Tested	Test Freq	Model,S/N	T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ± 10 %
					Zoom Scan	Normalize to 1 W		
2020/5/28	5250	D5GHV2,1020	Body	1g	6.99	69.9	76.70	-8.9
				10g	2.00	20.00	21.40	-6.5
2020/5/28	5600	D5GHV2,1020	Body	1g	7.44	74.40	80.90	-8.0
				10g	2.11	21.10	22.40	-5.8
2020/5/29	5800	D5GHV2,1020	Body	1g	6.94	69.40	76.50	-9.3
				10g	1.98	19.80	21.10	-6.2
2020/5/29	2450	D2450,713	Body	1g	13.80	55.2	53.20	3.8
				10g	6.42	25.7	24.72	3.9

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

SECTION12: Measured and Reported (Scaled) SAR Results

WLAN SAR Test Reduction criteria are as follows

● **KDB 248227 D01 (SAR Guidance for 802.11(Wi-Fi) Transmitters):**

SAR test reduction for 802.11 WLAN transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the initial test position(s) by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The initial test position(s) is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the reported SAR for the initial test position is:

- ✧ ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- ✧ > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.
 - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
 - When it is unclear, all equivalent conditions must be tested.
- ✧ For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required test channels are considered.
 - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- ✧ When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- ✧ When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the initial test position, Area Scans were performed to determine the position with the *Maximum Value of SAR (measured)*. The position that produced the highest *Maximum Value of SAR* is considered the worst case position; thus used as the initial test position.

SAR Test Reduction criteria(excluding WLAN) are as follows

KDB 447498 D01 (General RF Exposure Guidance):

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ◇ ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
 - ◇ ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
 - ◇ ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
1. According to Notice 2016-DRS001 based on the IEEE1528 and IEC 62209 requirements, the low, mid and high frequency channels for the configuration with the highest SAR value must be tested regardless of the SAR value measured.
 2. When reported SAR value is exceed 1.2W/kg(if any), device holder perturbation verification is required; however, since distance between device holder and antenna of EUT is enough, it was not conducted.
 3. Reported SAR= Measured SAR [W/kg] · Scaled factor
 - * Scaled factor = Maximum tune-up tolerance limit [mW] / Measured power [mW]
- Maximum tune-up tolerance limit is by the specification from a customer.

Note: Measured value is rounded round off to three decimal places

12.1 Result of Body SAR of WLAN 2.4GHz Band

Test Position	Dist. (mm)	Mode	Ch #.	Freq. (MHz)	Power (dBm)		Scaled factor	1-g SAR (W/kg)		Plot No.
					Tune-up upper Power	Measured average Power		Meas.	Reported	
Front	0	11b	1	2412	13.00	12.89	1.03			
			6	2437	13.00	12.89	1.03			
			11	2462	13.00	12.95	1.01	0.010	0.010	
Rear	0	11b	1	2412	13.00	12.89	1.03			
			6	2437	13.00	12.89	1.03			
			11	2462	13.00	12.95	1.01	0.008	0.008	
Left	0	11b	1	2412	13.00	12.89	1.03	0.352	0.361	1
			6	2437	13.00	12.89	1.03	0.272	0.279	
			11	2462	13.00	12.95	1.01	0.257	0.260	
Bottom	0	11b	1	2412	13.00	12.89	1.03			
			6	2437	13.00	12.89	1.03			
			11	2462	13.00	12.95	1.01	0.037	0.037	

OFDM was excluded from the following table according to KDB248227D01.

SAR is not required for the following 2.4 GHz OFDM conditions according to KDB248227D01.

- 1) When KDB447498D01 SAR test exclusion applies to the OFDM configuration.
- 2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Maximum tune-up tolerance limit		Maximum tune-up tolerance limit		OFDM scaled factor	Position	DSSS Reported SAR value [W/kg]	OFDM Estimated SAR value [W/kg]	Exclusion limit [W/kg]	Standalone SAR request
DSSS		OFDM							
[dBm]	[mW]	[dBm]	[mW]						
13.00	19.95	13.00	19.95	1.000	Left	0.361	0.361	< 1.2	No

Note(s):

1. OFDM scaled factor = Maximum tune-up tolerance limit of OFDM [mW] / Maximum tune-up tolerance limit of DSSS [mW]
2. Estimated SAR of OFDM = Reported SAR of DSSS [W/kg] · OFDM scaled factor

12.2 Result of Body SAR of Bluetooth

Test Position	Dist. (mm)	Mode	Ch #.	Freq. (MHz)	Power (dBm)		Scaled factor	1-g SAR (W/kg)		Plot No.
					Tune-up upper Power	Measured average Power		Meas.	Reported	
Front	0	DH5	0	2402	7.50	6.77	1.18	Not detect	-	
			39	2441	7.50	6.63	1.22			
			78	2480	7.50	5.87	1.46			
Rear	0	DH5	0	2402	7.50	6.77	1.18	Not detect	-	
			39	2441	7.50	6.63	1.22			
			78	2480	7.50	5.87	1.46			
Left	0	DH5	0	2402	7.50	6.77	1.18	0.082	0.097	2
			39	2441	7.50	6.63	1.22	0.063	0.077	
			78	2480	7.50	5.87	1.46	0.046	0.067	
Bottom	0	DH5	0	2402	7.50	6.77	1.18	0.009	0.011	
			39	2441	7.50	6.63	1.22			
			78	2480	7.50	5.87	1.46			

Not detect is no SAR peak.

12.3 Result of Body SAR of WLAN 5.3GHz Band

5.3GHz Band

Test Position	Dist. (mm)	Mode	Ch #.	Freq. (MHz)	Power (dBm)		Scaled factor	1-g SAR (W/kg)		Plot No.
					Tune-up upper Power	Measured average Power		Meas.	Reported	
Front	0	11n-40	54	5270	12.00	10.01	1.581			
			62	5310	12.00	10.08	1.556	0.102	0.159	
Rear	0	11n-40	54	5270	12.00	10.01	1.581			
			62	5310	12.00	10.08	1.556	0.005	0.008	
Left	0	11n-40	54	5270	12.00	10.01	1.581	0.591	0.935	
			62	5310	12.00	10.08	1.556	0.749	1.165	3
Bottom	0	11n-40	54	5270	12.00	10.01	1.581			
			62	5310	12.00	10.08	1.556	0.131	0.204	

U-NII-1 band(WLAN 5.2GHz Band) test configuration was excluded from the following according to KDB248227D01.

When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band(WLAN 5.3GHz Band) by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.

Maximum tune-up tolerance limit		Maximum tune-up tolerance limit		Scaled factor	Position	5.3GHz Reported SAR value [W/kg]	5.2GHz Estimated SAR value [W/kg]	Exclusion limit [W/kg]	Standalone SAR request
5.3GHz		5.2GHz							
[dBm]	[mW]	[dBm]	[mW]						
12.00	15.85	12.00	15.85	1.000	Left	1.165	1.165	< 1.2	No

Notes:

1. Scaled factor = Maximum tune-up tolerance limit of 5.2GHz [mW] / Maximum tune-up tolerance limit of 5.3GHz [mW]
2. Estimated SAR of subsequent test configuration = Reported SAR of initial test configuration [W/kg] · scaled factor

12.4 Result of Body SAR of WLAN 5.5GHz Band

Test Position	Dist. (mm)	Mode	Ch #.	Freq. (MHz)	Power (dBm)		Scaled factor	1-g SAR (W/kg)		Plot No.
					Tune-up upper Power	Measured average Power		Meas.	Reported	
Front	0	11ac-80	106	5530	9.00	7.72	1.343	0.046	0.062	
Rear	0	11ac-80	106	5530	9.00	7.72	1.343	Not detect	-	
Left	0	11ac-80	106	5530	9.00	7.72	1.343	0.488	0.655	4
Bottom	0	11ac-80	106	5530	9.00	7.72	1.343	0.049	0.066	

Not detect is no SAR peak.

12.5 Result of Body SAR of WLAN 5.8GHz Band

Test Position	Dist. (mm)	Mode	Ch #.	Freq. (MHz)	Power (dBm)		Scaled factor	1-g SAR (W/kg)		Plot No.
					Tune-up upper Power	Measured average Power		Meas.	Reported	
Front	0	11ac-80	155	5775	9.00	8.59	1.099	0.062	0.068	
Rear	0	11ac-80	155	5775	9.00	8.59	1.099	0.010	0.011	
Left	0	11ac-80	155	5775	9.00	8.59	1.099	0.515	0.566	5
Bottom	0	11ac-80	155	5775	9.00	8.59	1.099	0.023	0.025	

12.6 Repeated measurement

According to KDB865664 D1.

- 1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg ($\sim 10\%$ from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

Wireless Technologies	Test Configuration			Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio
	Exposure	Position	Dist. (mm)				Original	Repeated	
WLAN 2.4 GHz	Body	Left	0	11b	1	2412	0.352	N/A	N/A
Bluetooth	Body	Left	0	DH5	0	2402	0.082	N/A	N/A
WLAN 5.3 GHz	Body	Left	0	11n-40	62	5310	0.749	N/A	N/A
WLAN 5.5 GHz	Body	Left	0	11ac-80	106	5530	0.488	N/A	N/A
WLAN 5.8 GHz	Body	Left	0	11ac-80	155	5775	0.515	N/A	N/A

Note(s):

N/A: Repeated Measurement is not required since the original highest measured SAR for all band is < 0.80 W/kg.

SECTION13: Test instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MDA-07	Dipole Antenna	Schmid&Partner Engineering AG	D2450V2	713	SAR(D2450)	2019/09/09 * 12
MDA-08	Dipole Antenna	Schmid&Partner Engineering AG	D5GHzV2	1020	SAR(D5G)	2019/11/19 * 12
MMBBL600-6000	Body Simulating Liquid	Schmid&Partner Engineering AG	SL AAB U16 BC	-	SAR	Pre Check
MNA-03	Vector Reflectometer	Copper Mountain Technologies	PLANAR R140	0030913	SAR	2020/04/22 * 12
MDPK-03	Dielectric assessment kit	Schmid&Partner Engineering AG	DAK-3.5	0008	SAR	2020/04/28 * 12
MOS-37	Digital thermometer	LKM electronic	DTM3000	-	SAR	2019/07/3 * 12
COTS-MSAR-04	Dielectric assessment software	Schmid&Partner Engineering AG	DAK	-	SAR	-
MDAE-03	Data Acquisition Electronics	Schmid&Partner Engineering AG	DAE4	1372	SAR	2019/06/14 * 12
MPB-09	Dosimetric E- Field Probe	Schmid&Partner Engineering AG	EX3DV4	3922	SAR	2019/11/20 * 12
MPF-04	2mm Oval Flat Phantom	Schmid&Partner Engineering AG	QDOVA001BB	1207	SAR	2020/05/21 * 12
MDH-03	Device holder	Schmid&Partner Engineering AG	Mounting device for transmitter	-	SAR	Pre Check
MOS-31	Thermo- Hygrometer	CUSTOM	CTH-201	3101	SAR	2019/07/03 * 12
MRBT-04	SAR robot	Schmid&Partner Engineering AG	TX60 Lspeag	F13/5PPLA1/A/01	SAR	2020/04/26 * 12
MPM-11	Dual Power Meter	Agilent	E4419B	MY45102060	SAR	2019/08/02 * 12
MPSE-20	Power sensor	Agilent	N8482H	MY53050001	SAR	2019/06/05 * 12
MRFA-24	Pre Amplifier	R&K	R&K CGA020M602- 2633R	B30550	SAR	2019/06/17 * 12
MSG-10	Signal Generator	Agilent	N5181A	MY47421098	SAR	2019/11/25 * 12
MAT-78	Attenuator	Telegartner	J01156A0011	0042294119	SAR	Pre Check
MPSE-24	Power sensor	Anritsu Limited	MA24106A	1026164	SAR	2019/08/02 * 12
MPSE-25	Power sensor	Anritsu Limited	MA24106A	1031504	SAR	2019/08/02 * 12
COTS-MPSE-02	Software for MA24106A	Anritsu Limited	Anritsu PowerXpert	-	SAR	-
MHDC-12	Dual Directional Coupler	Hewlett Packard	772D	2839A0016	SAR(2- 18GHz)	Pre Check

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

SAR room is checked before every testing and ambient noise is <0.012W/kg

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

APPENDIX 1 : System Check

5.25GHz

Communication System: UID 0, CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); ; Duty Cycle: 1:1
Medium parameters used: $f = 5250$ MHz; $\sigma = 5.196$ S/m; $\epsilon_r = 47.015$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.78, 4.78, 4.78) @ 5250 MHz;

Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface)

Electronics: DAE4 Sn1372;

Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA001BB;Serial: TP:1207

Measurement SW: DASY52, Version 52.10 (3);SEMCAD X Version 14.6.13 (7474)

Pin/100mW 5250MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 16.9 W/kg

Pin/100mW 5250MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.85 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 25.5 W/kg

SAR(1 g) = 6.99 W/kg; SAR(10 g) = 2 W/kg

Smallest distance from peaks to all points 3 dB below = 7.4 mm

Ratio of SAR at M2 to SAR at M1 = 68.3%

Maximum value of SAR (measured) = 16.0 W/kg

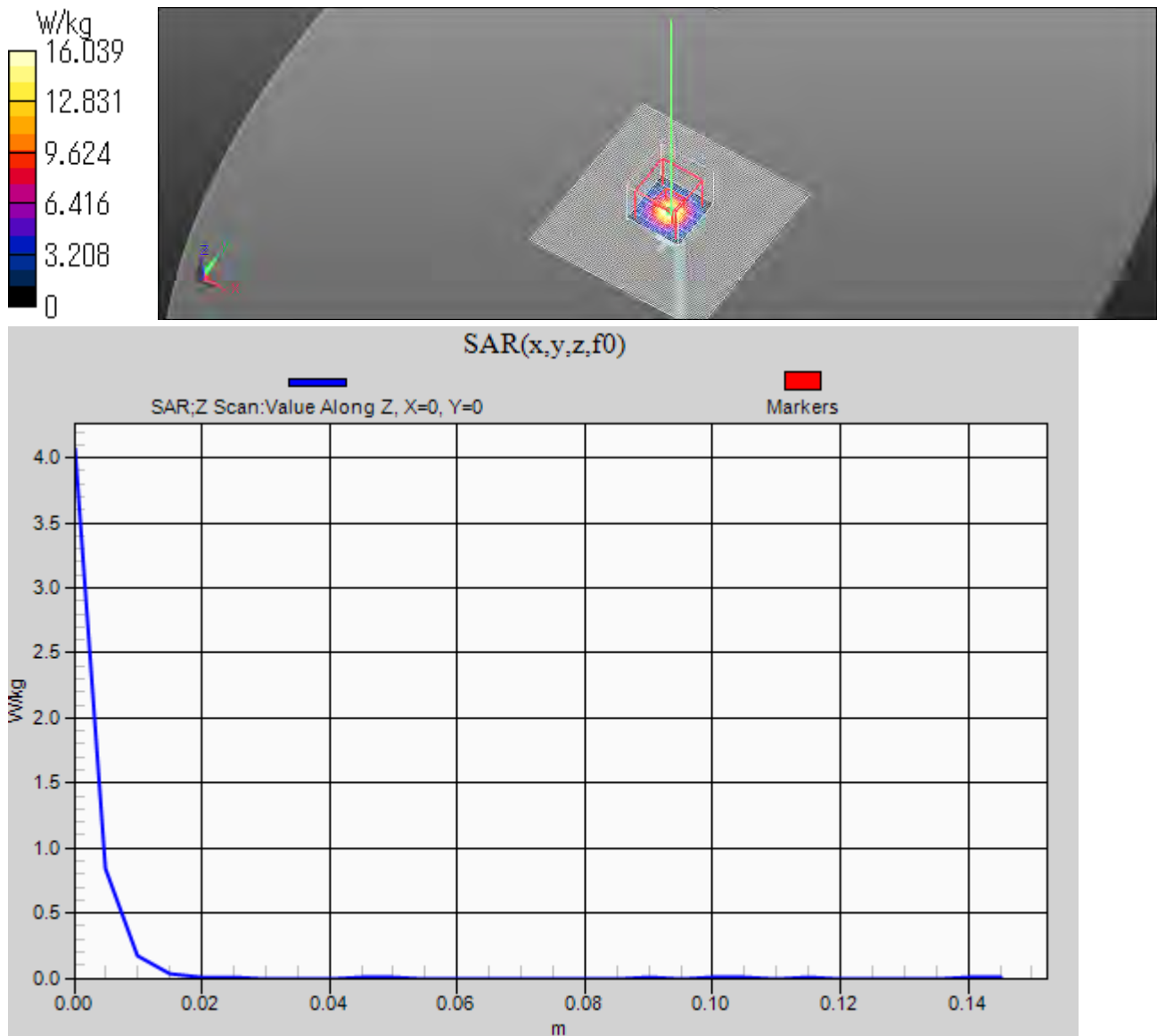
Pin/100mW 5250MHz/Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 4.07 W/kg

Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.

Liquid temp. is kept within the 2 degree.C. during the test.

Date: 2020/05/28



5.6GHz

Communication System: UID 0, _CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); ; Duty Cycle: 1:1

Medium parameters used: $f = 5600$ MHz; $\sigma = 5.652$ S/m; $\epsilon_r = 46.253$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.08, 4.08, 4.08) @ 5600 MHz;

Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface)

Electronics: DAE4 Sn1372;

Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1207

Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Pin/100mW 5600MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 16.5 W/kg

Pin/100mW 5600MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 68.03 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 31.9 W/kg

SAR(1 g) = 7.44 W/kg; SAR(10 g) = 2.11 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 63%

Maximum value of SAR (measured) = 18.3 W/kg

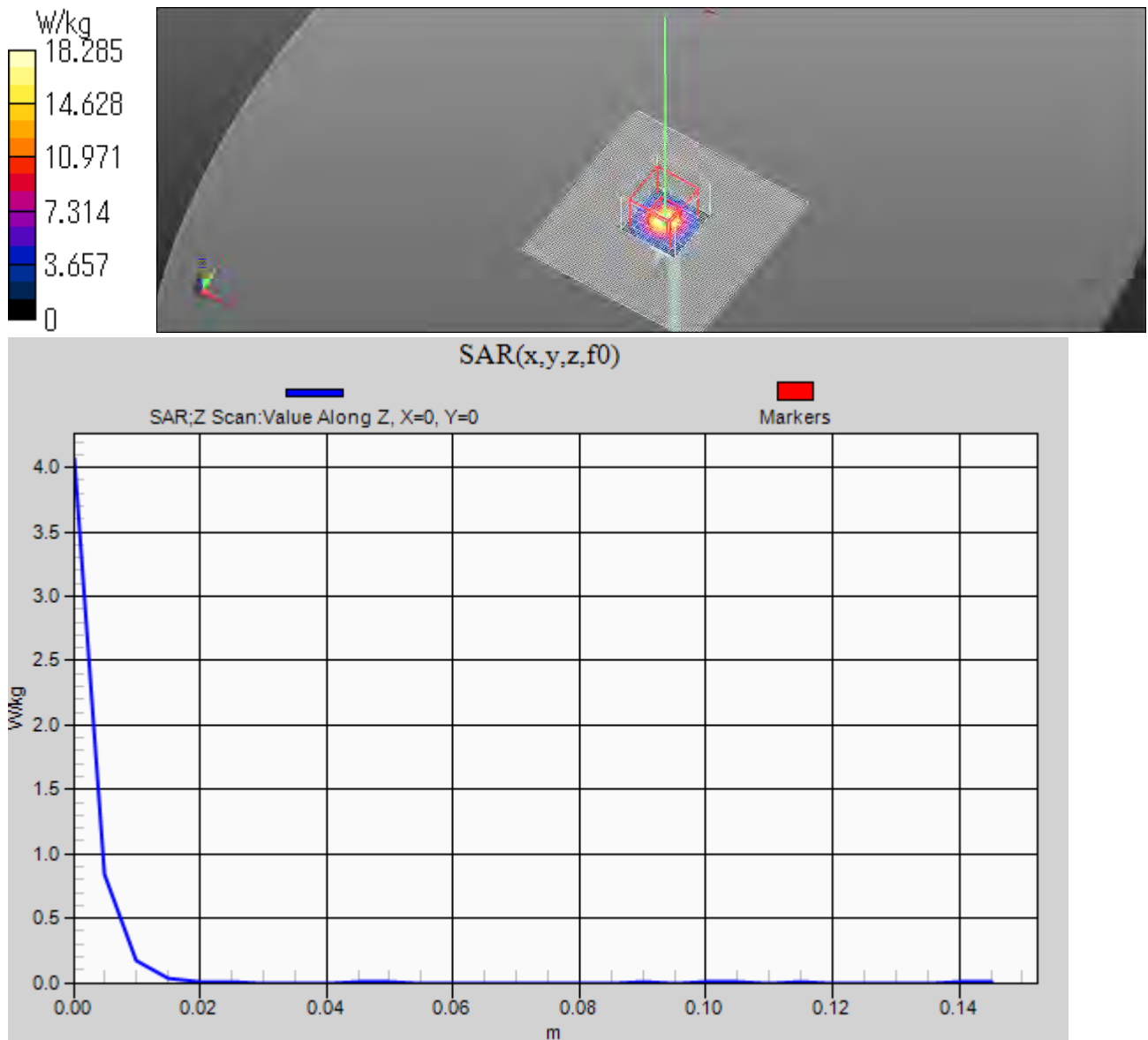
Pin/100mW 5600MHz/Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 3.87 W/kg

Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.

Liquid temp. is kept within the 2 degree.C. during the test.

Date: 2020/05/28



5.8GHz

Communication System: UID 0, _CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); ; Duty Cycle: 1:1

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.973$ S/m; $\epsilon_r = 46.371$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.23, 4.23, 4.23) @ 5800 MHz;

Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface)

Electronics: DAE4 Sn1372;

Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA001BB;Serial: TP:1207

Measurement SW: DASY52, Version 52.10 (3);SEMCAD X Version 14.6.13 (7474)

Pin/100mW 5800MHz 2 2/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 15.3 W/kg

Pin/100mW 5800MHz 2 2/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.30 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 31.2 W/kg

SAR(1 g) = 6.94 W/kg; SAR(10 g) = 1.98 W/kg

Smallest distance from peaks to all points 3 dB below = 7.5 mm

Ratio of SAR at M2 to SAR at M1 = 61.3%

Maximum value of SAR (measured) = 16.9 W/kg

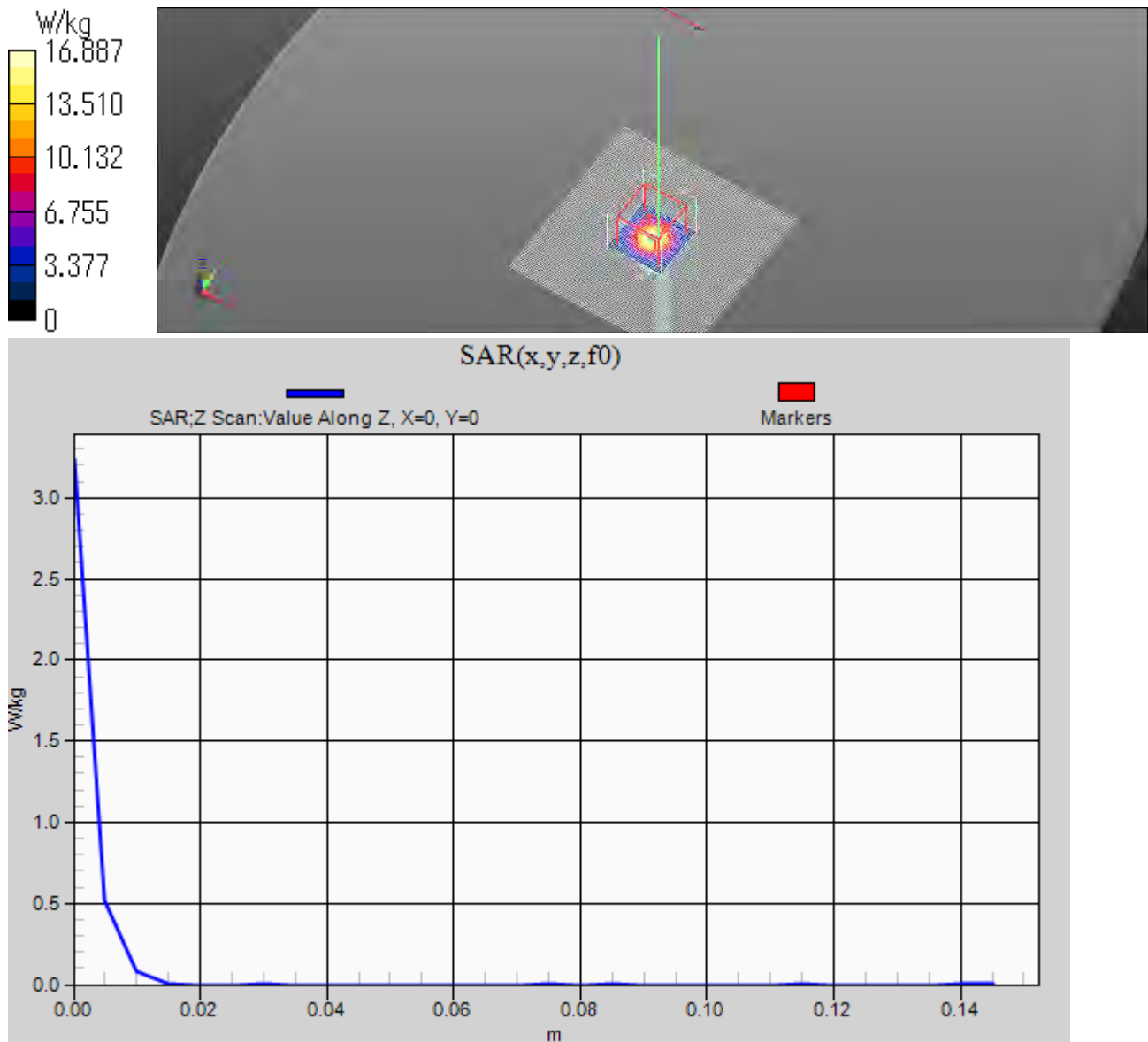
Pin/100mW 5800MHz 2 2/Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 3.23 W/kg

Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.

Liquid temp. is kept within the 2 degree.C. during the test.

Date: 2020/05/29



2450MHz

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); ; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.047$ S/m; $\epsilon_r = 51.949$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(7.49, 7.49, 7.49) @ 2450 MHz;

Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface)

Electronics: DAE4 Sn1372;

Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA001BB;Serial: TP:1207

Measurement SW: DASY52, Version 52.10 (3);SEMCAD X Version 14.6.13 (7474)

Pin/250mW/Area Scan (81x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 23.0 W/kg

Pin/250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 110.5 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 28.6 W/kg

SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.42 W/kg

Smallest distance from peaks to all points 3 dB below = 8.9 mm

Ratio of SAR at M2 to SAR at M1 = 49.3%

Maximum value of SAR (measured) = 23.2 W/kg

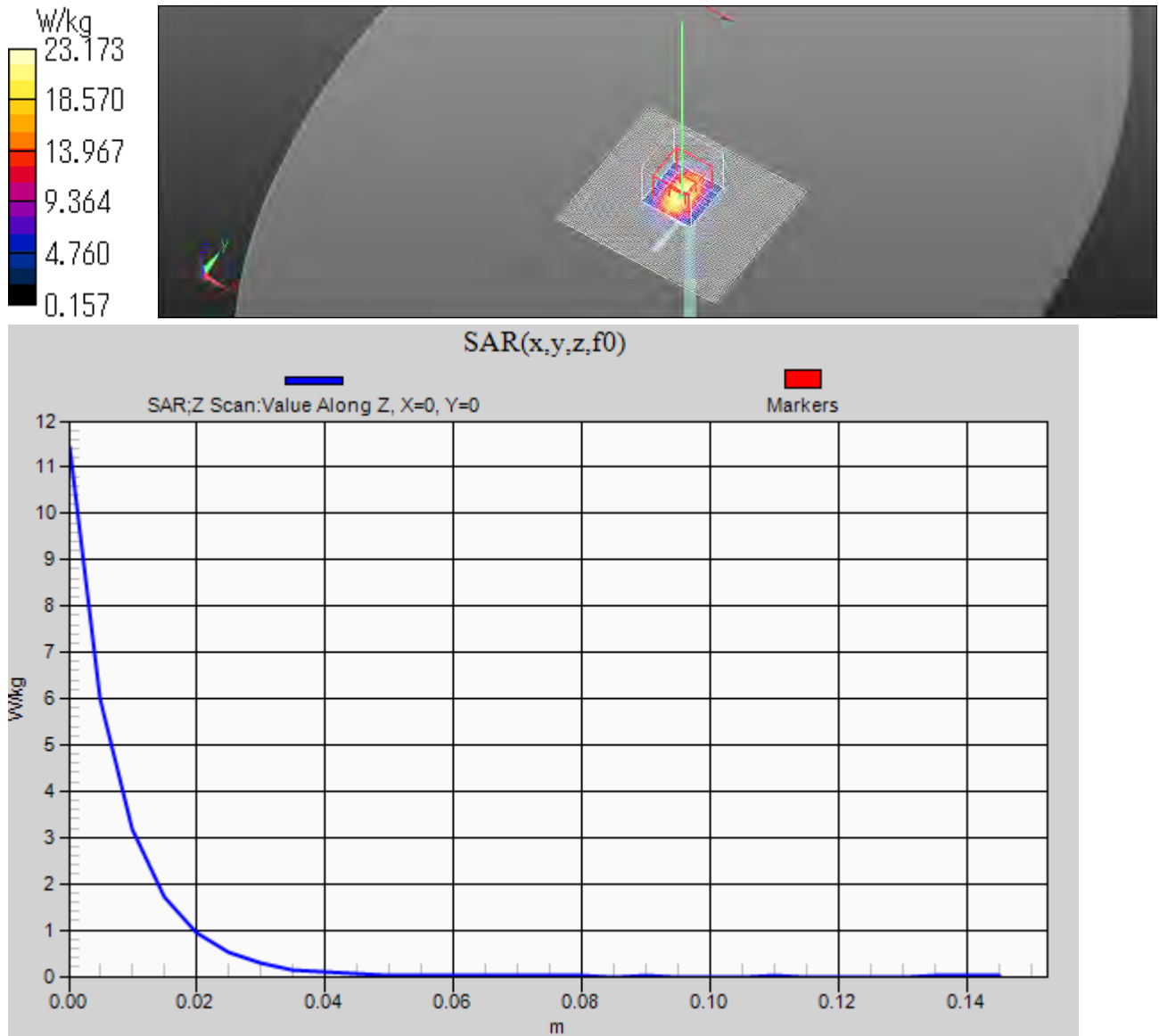
Pin/250mW/Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 11.4 W/kg

Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.

Liquid temp. is kept within the 2 degree.C. during the test.

Date: 2020/05/29



APPENDIX 2 : SAR Measurement data

Evaluation procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the E-field at a fixed location above the ear point or central position of flat phantom was used as a reference value for assessing the power drop.

Step 2: The SAR distribution at the exposed side of head or body position was measured at a distance of each device from the inner surface of the shell. The area covered the entire dimension of the antenna of EUT and the horizontal grid spacing was 15 mm x 15 mm, 12 mm x 12 mm or 10mm x 10mm. Based on these data, the area of the maximum absorption was determined by spline interpolation.

Step 3: Around this point found in the Step 2 (area scan), a volume of 30mm x 30mm x 30mm or more was assessed by measuring 7 x 7 x 7 points at least for below 3GHz and a volume of 28 mm x 28mm x 22.5mm or more was assessed by measuring 8 x 8 x 6(ratio step method (*1)) points at least for 5GHz band.

And for any secondary peaks found in the Step2 which are within 2dB of maximum peak and not with this Step3 (Zoom scan) is repeated. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

(1). The data at the surface were extrapolated, since the center of the dipoles is 1mm(EX3DV4) away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm [4]. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

(2). The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the "Not a knot"-condition (in x, y and z-directions) [4], [5]. The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.

(3). All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

***1. Ratio step method parameters used;**

The first measurement point: 2mm from the phantom surface, the initial grid separation: 2mm, subsequent graded grid ratio: 1.5

These parameters comply with the requirement of the KDB 865664D01.

Step 4: Re-measurement of the E-field at the same location as in Step 1.

Confirmation after SAR testing

It was checked that the power drift [W] is within +/-5%.The verification of power drift during the SAR test is that DASY5 system calculates the power drift by measuring the e-field at the same location at beginning and the end of the scan measurement for each test position.

DASY5 system calculation Power drift value[dB] = $20\log(E_a)/(E_b)$

Before SAR testing : $E_b[V/m]$

After SAR testing : $E_a[V/m]$

Limit of power drift[W] = +/-5%

$X[dB]=10\log[P]=10\log(1.05/1)=10\log(1.05)-10\log(1)=0.212dB$

from E-field relations with power.

$p=E^2/\eta=E^2/$

Therefore, The correlation of power and the E-field

$XdB=10\log(P)=10\log(E)^2=20\log(E)$

Therefore,

The calculated power drift of DASY5 System must be the less than +/-0.212dB.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

Measurement data

Plot No. 1

WLAN 2.4GHz Left 0mm 11b 2412MHz

Communication System: UID 0, #WLAN 11a/b/g/n (0); Communication System Band: 11b/g/n (2.4G); ; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2412 \text{ MHz}$; $\sigma = 2.007 \text{ S/m}$; $\epsilon_r = 52.13$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(7.49, 7.49, 7.49) @ 2412 MHz;

Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1372;

Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA001BB;Serial: TP:1207

Measurement SW: DASY52, Version 52.10 (3);SEMCAD X Version 14.6.13 (7474)

WLAN 11b 1Mbps/Left 0mm 2412MHz/Area Scan (71x61x1): Interpolated grid: $dx=1.200 \text{ mm}$, $dy=1.200 \text{ mm}$

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.660 W/kg

WLAN 11b 1Mbps/Left 0mm 2412MHz/Zoom Scan finer (11x11x7)/Cube 0: Measurement grid: $dx=3\text{mm}$, $dy=3\text{mm}$, $dz=5\text{mm}$

Reference Value = 20.02 V/m ; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 1.11 W/kg

SAR(1 g) = 0.352 W/kg ; SAR(10 g) = 0.108 W/kg

Smallest distance from peaks to all points 3 dB below = 4.4 mm

Ratio of SAR at M2 to SAR at M1 = 35.5%

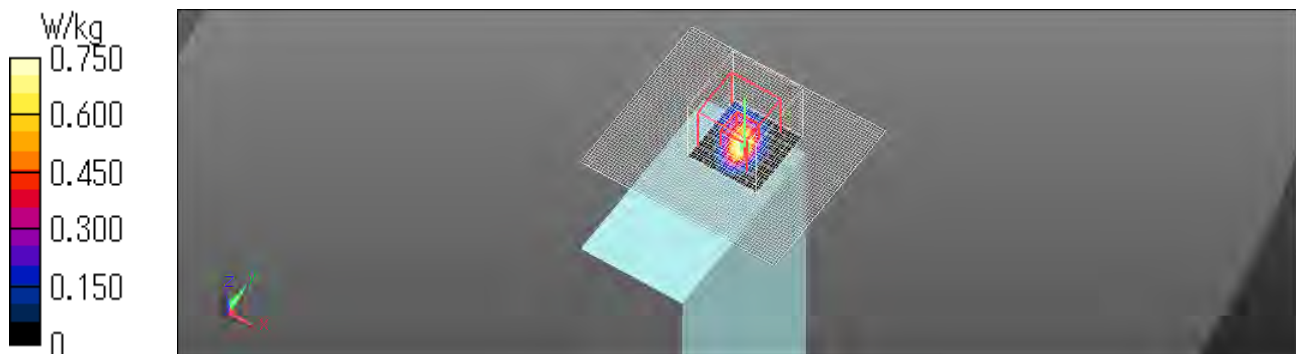
Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.750 W/kg

Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.

Liquid temp. is kept within the 2 degree.C. during the test.

Date: 2020/05/29



Plot No. 2

Bluetooth Left 0mm DH5 2402MHz

Communication System: UID 0, #Bluetooth (0); Communication System Band: Bluetooth; ; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2402$ MHz; $\sigma = 1.997$ S/m; $\epsilon_r = 52.182$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(7.49, 7.49, 7.49) @ 2402 MHz;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1372;

Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA001BB;Serial: TP:1207

Measurement SW: DASY52, Version 52.10 (3);SEMCAD X Version 14.6.13 (7474)

Bluetooth DH5/Left 0mm 2402MHz/Area Scan (71x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.181 W/kg

Bluetooth DH5/Left 0mm 2402MHz/Zoom Scan finer (11x11x7)/Cube 0: Measurement grid: dx=3mm, dy=3mm, dz=5mm

Reference Value = 10.01 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.261 W/kg

SAR(1 g) = 0.082 W/kg; SAR(10 g) = 0.024 W/kg

Smallest distance from peaks to all points 3 dB below = 4.8 mm

Ratio of SAR at M2 to SAR at M1 = 37.1%

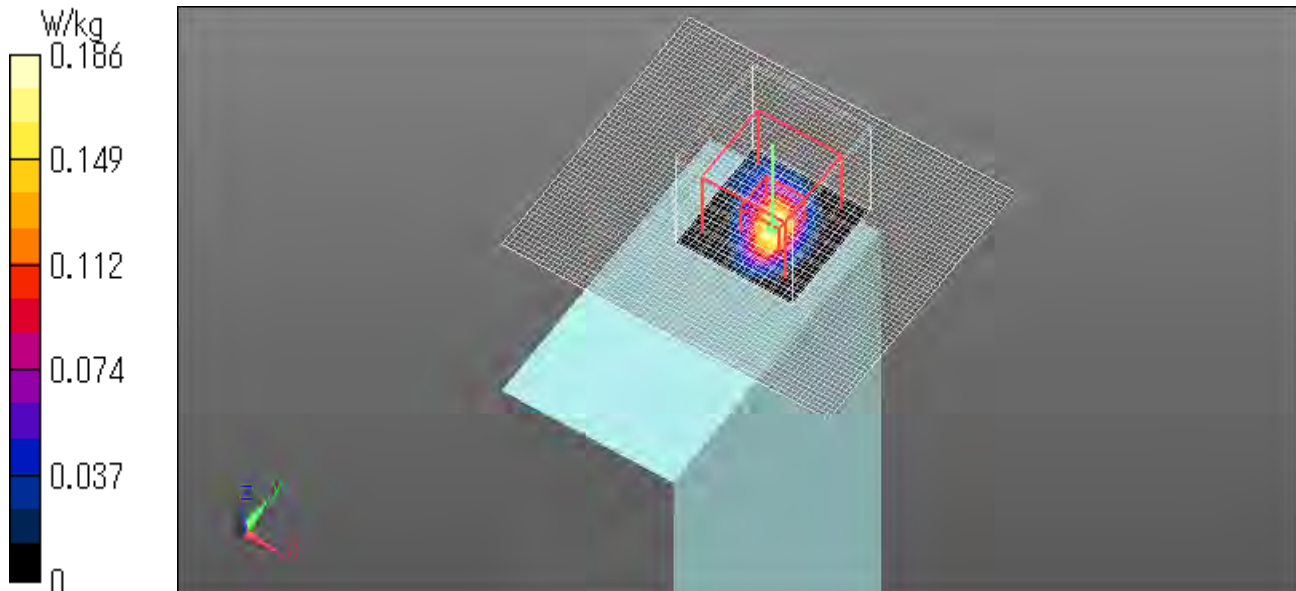
Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.186 W/kg

Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.

Liquid temp. is kept within the 2 degree.C. during the test.

Date: 2020/05/29



UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

Plot No. 3

WLAN 5.3GHz Left 0mm 11n-40 5310MHz

Communication System: UID 0, _WLAN (0); Communication System Band: 11n40/ac40; ; Duty Cycle: 1:1

Medium parameters used: $f = 5310$ MHz; $\sigma = 5.238$ S/m; $\epsilon_r = 46.986$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.78, 4.78, 4.78) @ 5310 MHz;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1372;

Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA001BB;Serial: TP:1207

Measurement SW: DASY52, Version 52.10 (3);SEMCAD X Version 14.6.13 (7474)

WLAN5.3GHz Body/Left 0mm 5310MHz/Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.05 W/kg

WLAN5.3GHz Body/Left 0mm 5310MHz/Zoom Scan finer (10x10x7)/Cube 0: Measurement grid: dx=3mm, dy=3mm, dz=1.4mm

Reference Value = 22.62 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 3.74 W/kg

SAR(1 g) = 0.749 W/kg; SAR(10 g) = 0.152 W/kg

Smallest distance from peaks to all points 3 dB below = 4.2 mm

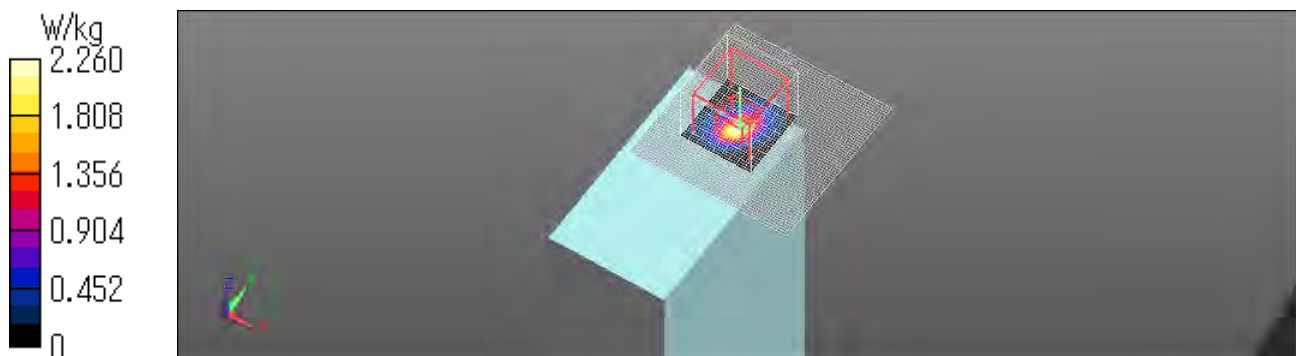
Ratio of SAR at M2 to SAR at M1 = 65.4%

Maximum value of SAR (measured) = 2.26 W/kg

Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.

Liquid temp. is kept within the 2 degree.C. during the test.

Date: 2020/05/28



UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

Plot No. 4

WLAN 5.5GHz Left 0mm 11ac-80 5530MHz

Communication System: UID 0, _WLAN (0); Communication System Band: 11ac80; ; Duty Cycle: 1:1

Medium parameters used: $f = 5530$ MHz; $\sigma = 5.502$ S/m; $\epsilon_r = 46.434$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.08, 4.08, 4.08) @ 5530 MHz;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1372;

Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA001BB;Serial: TP:1207

Measurement SW: DASY52, Version 52.10 (3);SEMCAD X Version 14.6.13 (7474)

WLAN5.5GHz Body/Left 0mm 5530MHz/Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.52 W/kg

WLAN5.5GHz Body/Left 0mm 5530MHz/Zoom Scan finer (11x11x7)/Cube 0: Measurement grid: dx=3mm, dy=3mm, dz=1.4mm

Reference Value = 18.67 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 2.65 W/kg

SAR(1 g) = 0.488 W/kg; SAR(10 g) = 0.092 W/kg

Smallest distance from peaks to all points 3 dB below = 4.2 mm

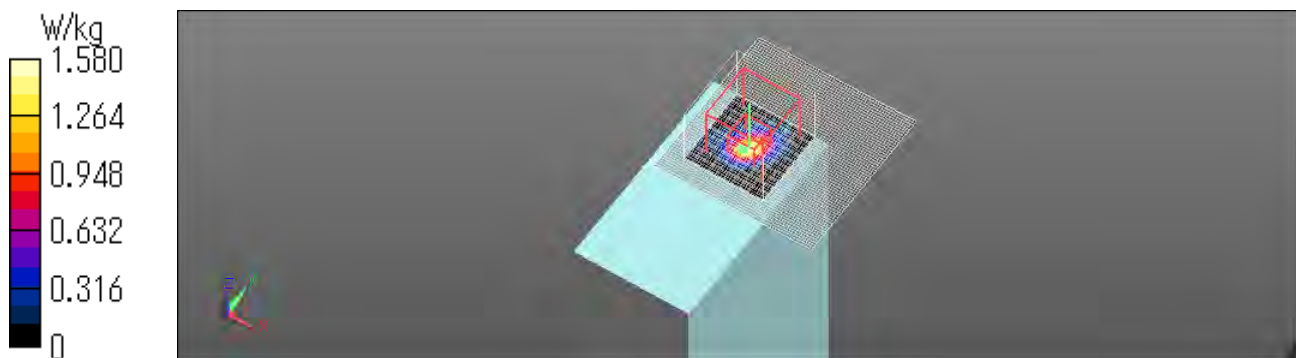
Ratio of SAR at M2 to SAR at M1 = 61.9%

Maximum value of SAR (measured) = 1.58 W/kg

Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.

Liquid temp. is kept within the 2 degree.C. during the test.

Date: 2020/05/28



Plot No. 5

WLAN 5.8GHz Left 0mm 11ac-80 5775MHz

Communication System: UID 0, _WLAN (0); Communication System Band: 11ac80; ; Duty Cycle: 1:1

Medium parameters used: $f = 5775$ MHz; $\sigma = 5.967$ S/m; $\epsilon_r = 46.289$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.23, 4.23, 4.23) @ 5775 MHz;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1372;

Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA001BB;Serial: TP:1207

Measurement SW: DASY52, Version 52.10 (3);SEMCAD X Version 14.6.13 (7474)

WLAN5.8GHz Body/Left 0mm 5775MHz/Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.30 W/kg

WLAN5.8GHz Body/Left 0mm 5775MHz/Zoom Scan finer (11x11x7)/Cube 0: Measurement grid: dx=3mm, dy=3mm, dz=1.4mm

Reference Value = 17.18 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 3.01 W/kg

SAR(1 g) = 0.515 W/kg; SAR(10 g) = 0.097 W/kg

Smallest distance from peaks to all points 3 dB below = 4 mm

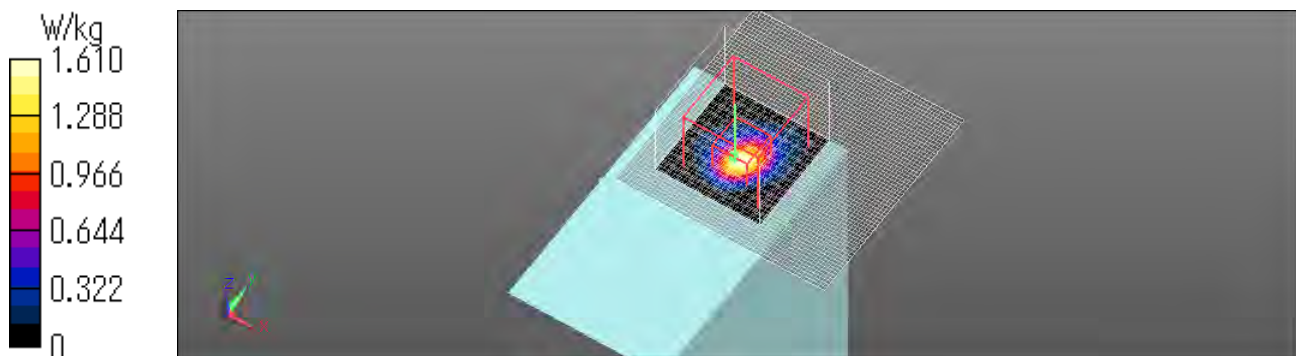
Ratio of SAR at M2 to SAR at M1 = 61%

Maximum value of SAR (measured) = 1.61 W/kg

Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.

Liquid temp. is kept within the 2 degree.C. during the test.

Date: 2020/05/29



UL Japan, Inc.

Ise EMC Lab.

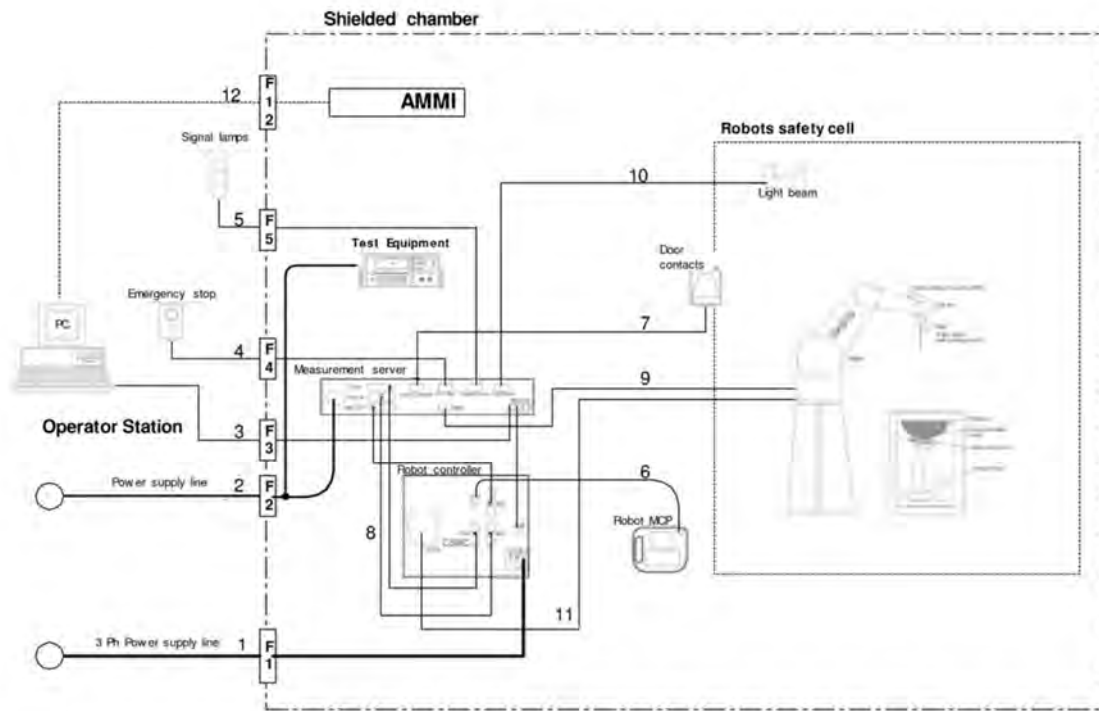
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

APPENDIX 3 : System specifications

Configuration and peripherals



The DASYS5 system for performing compliance tests consist of the following items:
Our system is DASYS6; however, it behaves as DASYS5.

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronic (DAE), which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection.
The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Windows 10 or 7 and the DASYS5/6 software.
- Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

Specifications

a)Robot TX60L

Number of Axes	:	6
Nominal Load	:	2 kg
Maximum Load	:	5kg
Reach	:	920mm
Repeatability	:	+/-0.03mm
Control Unit	:	CS8c
Programming Language	:	VAL3
Weight	:	52.2kg
Manufacture	:	Stäubli Robotics

b)E-Field Probe

Model	:	EX3DV4
Construction	:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycol ether)
Frequency	:	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	:	+/-0.3 dB in HSL (rotation around probe axis) +/-0.5 dB in tissue material (rotation normal probe axis)
Dynamic Range	:	10uW/g to > 100 mW/g;Linearity +/-0.2 dB(noise: typically < 1uW/g)
Dimensions	:	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	:	Highprecision dosimetric measurement in any exposure scenario (e.g., very strong gradient fields).Only probe which enables compliance testing for frequencies up to 6GHz with precision of better 30%.
Manufacture	:	Schmid & Partner Engineering AG



EX3DV4 E-field Probe

c)Data Acquisition Electronic (DAE4)

Features	:	Signal amplifier, multiplexer, A/D converter and control logic Serial optical link for communication with DASY5 embedded system (fully remote controlled) Two step probe touch detector for mechanical surface detection and emergency robot stop
Measurement Range	:	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset voltage	:	< 5 μ V (with auto zero)
Input Resistance	:	200 M Ω
Input Bias Current	:	< 50 fA
Battery Power	:	> 10 h of operation (with two 9.6 V NiMH accus)
Dimension	:	60 x 60 x 68 mm
Manufacture	:	Schmid & Partner Engineering AG

d)Electro-Optic Converter (EOC)

Version	:	EOC 61
Description	:	for TX60 robot arm, including proximity sensor
Manufacture	:	Schmid & Partner Engineering AG

e)DASY5 Measurement server

Features	:	Intel ULV Celeron 400MHz 128MB chip disk and 128MB RAM 16 Bit A/D converter for surface detection system Vacuum Fluorescent Display Robot Interface Serial link to DAE (with watchdog supervision) Door contact port (Possibility to connect a light curtain) Emergency stop port (to connect the remote control) Signal lamps port Light beam port Three Ethernet connection ports Two USB 2.0 Ports Two serial links Expansion port for future applications
Dimensions (L x W x H)	:	440 x 241 x 89 mm
Manufacture	:	Schmid & Partner Engineering AG

f) Light Beam Switches

Version	:	LB5
Dimensions (L x H)	:	110 x 80 mm
Thickness	:	12 mm
Beam-length	:	80 mm
Manufacture	:	Schmid & Partner Engineering AG

g)Software

Item	:	Dosimetric Assessment System DASY5
Type No.	:	SD 000 401A, SD 000 402A
Software version No.	:	DASY52, Version 52.6 (1)
Manufacture / Origin	:	Schmid & Partner Engineering AG

h)Robot Control Unit

Weight	:	70 Kg
AC Input Voltage	:	selectable
Manufacturer	:	Stäubli Robotics

i)Phantom and Device Holder

Phantom

Type	:	SAM Twin Phantom V4.0
Description	:	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.
Material	:	Vinylester, glass fiber reinforced (VE-GF)
Shell Material	:	Fiberglass
Thickness	:	2.0 +/-0.2 mm
Dimensions	:	Length: 1000 mm Width: 500 mm Height: adjustable feet
Volume	:	Approx. 25 liters
Manufacture	:	Schmid & Partner Engineering AG

Type	:	2mm Flat phantom ELI4.0 or 5
Description	:	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY4.5 and higher and is compatible with all SPEAG dosimetric probes and dipoles.
Material	:	Vinylester, glass fiber reinforced (VE-GF)
Shell Thickness	:	2.0 ± 0.2 mm (sagging: <1%)
Filling Volume	:	approx. 30 liters
Dimensions	:	Major ellipse axis: 600 mm Minor axis: 400 mm
Manufacture	:	Schmid & Partner Engineering AG

Device Holder

In combination with the Twin SAM Phantom V4.0/V4.0c or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).

Material	:	POM
----------	---	-----

Laptop Extensions kit

Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM, ELI4 Phantoms.

Material	:	POM, Acrylic glass, Foam
----------	---	--------------------------

Urethane

For this measurement, the urethane foam was used as device holder.

j) Simulated Tissues (Liquid)

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Product identifier

Trade name	Broad Band Tissue Simulation Liquid HBBL600-10000V6, MBBL600-6000V6, HU16B, MU16B
Manufacturer/Supplier	Schmid & Partner Engineering AG

Declarable components:

CAS: 107-21-1 EINECS: 203-473-3 Reg.nr.: 01-2119456816-28-0000	Ethenediol STOT RE 2, H373; Acute Tox. 4, H302	< 5.2%
CAS: 68608-26-4 EINECS: 271-781-5 Reg.nr.: 01-2119527859-22-0000	Sodium petroleum sulfonate Eye Irrit. 2, H319	< 2.9%
CAS: 107-41-5 EINECS: 203-489-0 Reg.nr.: 01-2119539582-35-0000	Hexylene Glycol / 2-Methyl-pentane-2,4-diol Skin Irrit. 2, H315; Eye Irrit. 2, H319	< 2.9%
CAS: 68920-66-1 NLP: 500-236-9 Reg.nr.: 01-2119489407-26-0000	Alkoxylated alcohol, > C ₁₆ Aquatic Chronic 2, H411; Skin Irrit. 2, H315; Eye Irrit. 2, H319	< 2.0%

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

Dosimetric E-Field Probe Calibration Certificate (EX3DV4, S/N: 3922)

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 **UL Japan (KYCOM)**

Certificate No: **EX3-3922_Nov19**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3922**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7**
Calibration procedure for dosimetric E-field probes

Calibration date: **November 20, 2019**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-19 (No. 217-02894)	Apr-20
DAE4	SN: 660	07-Oct-19 (No. DAE4-660_Oct19)	Oct-20
Reference Probe ES3DV2	SN: 3013	31-Dec-18 (No. ES3-3013_Dec18)	Dec-19
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Issued: November 20, 2019

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

EX3DV4 – SN:3922

November 20, 2019

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3922

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$) ^A	0.65	0.56	0.59	± 10.1 %
DCP (mV) ^B	99.7	104.7	103.0	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB μV	C	D dB	VR mV	Max dev.	Max Unc ^E (k=2)
0	CW	X	0.00	0.00	1.00	0.00	161.5	± 2.7 %	± 4.7 %
		Y	0.00	0.00	1.00		157.8		
		Z	0.00	0.00	1.00		155.8		
10352- AAA	Pulse Waveform (200Hz, 10%)	X	15.00	89.43	21.27	10.00	60.0	± 3.8 %	± 9.6 %
		Y	15.00	88.86	20.08		60.0		
		Z	15.00	88.29	20.48		60.0		
10353- AAA	Pulse Waveform (200Hz, 20%)	X	15.00	90.02	20.39	6.99	80.0	± 2.5 %	± 9.6 %
		Y	15.00	92.87	21.10		80.0		
		Z	15.00	88.98	19.56		80.0		
10354- AAA	Pulse Waveform (200Hz, 40%)	X	15.00	93.10	20.41	3.98	95.0	± 1.2 %	± 9.6 %
		Y	15.00	101.67	24.10		95.0		
		Z	15.00	89.60	18.25		95.0		
10355- AAA	Pulse Waveform (200Hz, 60%)	X	15.00	94.68	19.67	2.22	120.0	± 1.1 %	± 9.6 %
		Y	15.00	116.86	29.78		120.0		
		Z	15.00	88.21	16.09		120.0		
10387- AAA	QPSK Waveform, 1 MHz	X	0.58	60.00	7.68	0.00	150.0	± 3.1 %	± 9.6 %
		Y	0.49	60.30	6.75		150.0		
		Z	0.56	60.06	7.20		150.0		
10388- AAA	QPSK Waveform, 10 MHz	X	2.01	66.50	14.81	0.00	150.0	± 1.2 %	± 9.6 %
		Y	2.41	70.77	17.33		150.0		
		Z	2.08	67.29	15.11		150.0		
10396- AAA	64-QAM Waveform, 100 kHz	X	2.62	67.94	17.64	3.01	150.0	± 1.1 %	± 9.6 %
		Y	2.86	71.65	19.64		150.0		
		Z	2.87	69.39	18.26		150.0		
10399- AAA	64-QAM Waveform, 40 MHz	X	3.37	66.42	15.33	0.00	150.0	± 2.0 %	± 9.6 %
		Y	3.47	67.71	16.24		150.0		
		Z	3.44	66.93	15.57		150.0		
10414- AAA	WLAN CCDF, 64-QAM, 40MHz	X	4.74	65.25	15.29	0.00	150.0	± 4.1 %	± 9.6 %
		Y	4.67	65.86	15.74		150.0		
		Z	4.84	65.72	15.55		150.0		

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.

EX3DV4- SN:3922

November 20, 2019

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3922

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $ms.V^{-2}$	T2 $ms.V^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	43.7	331.00	36.27	18.28	0.53	5.10	0.00	0.48	1.01
Y	33.1	242.24	34.43	12.46	0.04	5.10	0.89	0.21	1.01
Z	42.9	326.93	36.74	15.90	0.56	5.10	0.00	0.55	1.01

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	107.5
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

EX3DV4- SN:3922

November 20, 2019

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3922

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)
900	41.5	0.97	10.30	10.30	10.30	0.46	0.89	± 12.0 %
2450	39.2	1.80	7.89	7.89	7.89	0.44	0.80	± 12.0 %
5250	35.9	4.71	5.40	5.40	5.40	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.61	4.61	4.61	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.84	4.84	4.84	0.40	1.80	± 13.1 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

EX3DV4- SN:3922

November 20, 2019

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3922

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)
835	55.2	0.97	9.92	9.92	9.92	0.29	1.09	± 12.0 %
900	55.0	1.05	9.79	9.79	9.79	0.30	1.01	± 12.0 %
1900	53.3	1.52	7.95	7.95	7.95	0.37	0.86	± 12.0 %
2450	52.7	1.95	7.49	7.49	7.49	0.30	0.95	± 12.0 %
5250	48.9	5.36	4.78	4.78	4.78	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.08	4.08	4.08	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.23	4.23	4.23	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. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

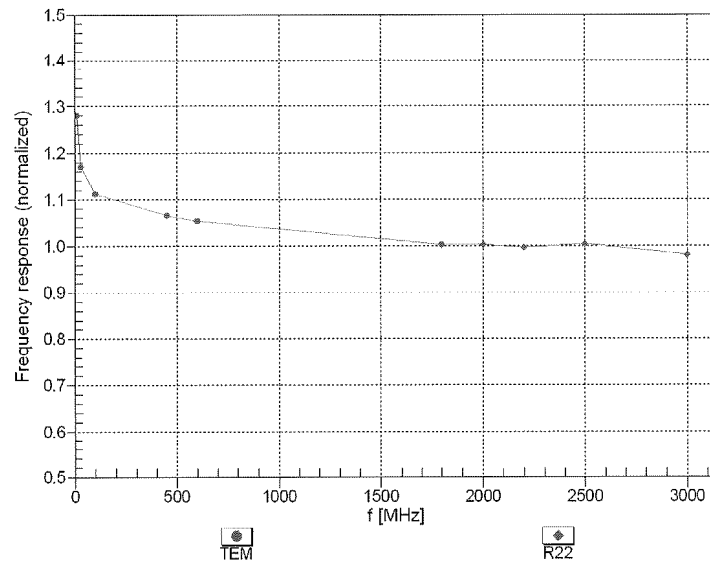
^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty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

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

EX3DV4- SN:3922

November 20, 2019

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

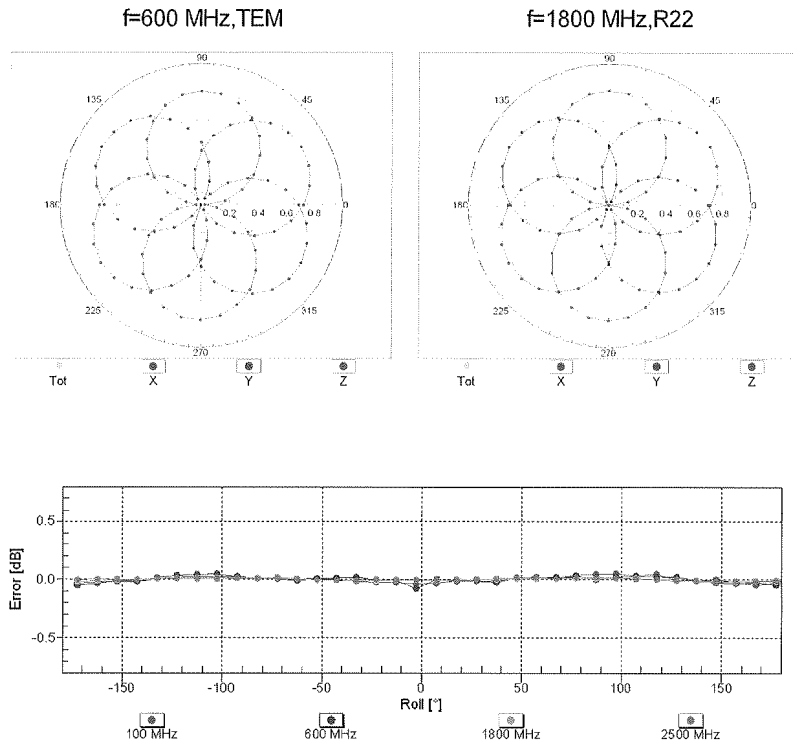


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

EX3DV4- SN:3922

November 20, 2019

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

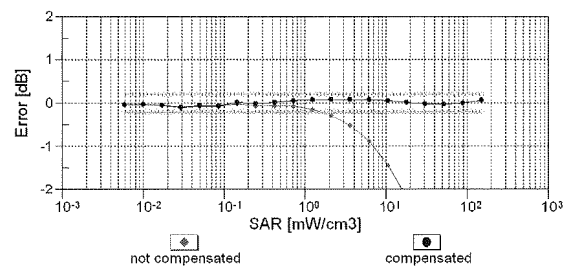
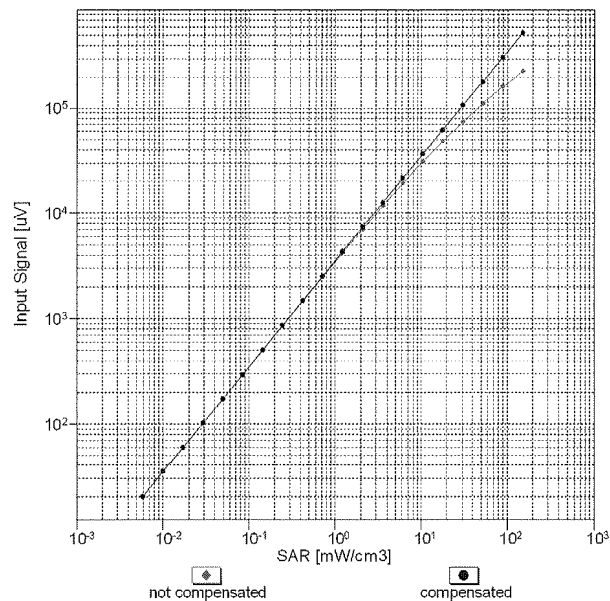


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

EX3DV4- SN:3922

November 20, 2019

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

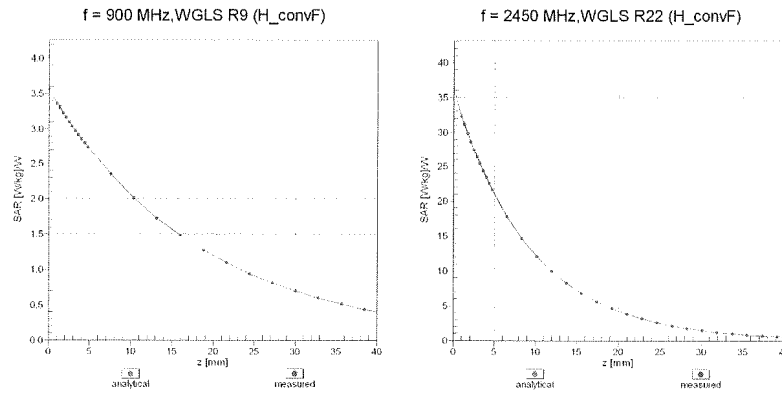


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

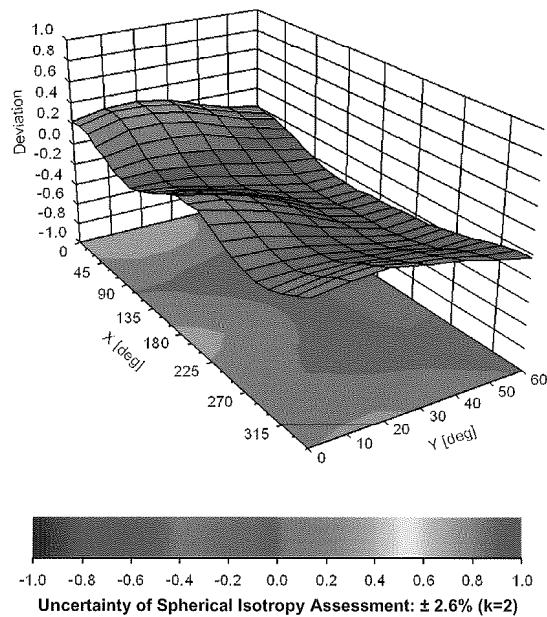
EX3DV4- SN:3922

November 20, 2019

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ , θ), f = 900 MHz



EX3DV4- SN:3922

November 20, 2019

Appendix: Modulation Calibration Parameters

UID	Rev	Communication System Name	Group	PAR (dB)	Unc ^E (k=2)
0		CW	CW	0.00	± 4.7 %
10010	CAA	SAR Validation (Square, 100ms, 10ms)	Test	10.00	± 9.6 %
10011	CAB	UMTS-FDD (WCDMA)	WCDMA	2.91	± 9.6 %
10012	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	WLAN	1.87	± 9.6 %
10013	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	WLAN	9.46	± 9.6 %
10021	DAC	GSM-FDD (TDMA, GMSK)	GSM	9.39	± 9.6 %
10023	DAC	GPRS-FDD (TDMA, GMSK, TN 0)	GSM	9.57	± 9.6 %
10024	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	GSM	6.56	± 9.6 %
10025	DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	GSM	12.62	± 9.6 %
10026	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	GSM	9.55	± 9.6 %
10027	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	GSM	4.80	± 9.6 %
10028	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	GSM	3.55	± 9.6 %
10029	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	GSM	7.78	± 9.6 %
10030	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	Bluetooth	5.30	± 9.6 %
10031	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	Bluetooth	1.87	± 9.6 %
10032	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	Bluetooth	1.16	± 9.6 %
10033	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	Bluetooth	7.74	± 9.6 %
10034	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	Bluetooth	4.53	± 9.6 %
10035	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	Bluetooth	3.83	± 9.6 %
10036	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	Bluetooth	8.01	± 9.6 %
10037	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	Bluetooth	4.77	± 9.6 %
10038	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	Bluetooth	4.10	± 9.6 %
10039	CAB	CDMA2000 (1xRTT, RC1)	CDMA2000	4.57	± 9.6 %
10042	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	AMPS	7.78	± 9.6 %
10044	CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	AMPS	0.00	± 9.6 %
10048	CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	DECT	13.80	± 9.6 %
10049	CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	DECT	10.79	± 9.6 %
10056	CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	TD-SCDMA	11.01	± 9.6 %
10058	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	GSM	6.52	± 9.6 %
10059	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	WLAN	2.12	± 9.6 %
10060	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	WLAN	2.83	± 9.6 %
10061	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	WLAN	3.60	± 9.6 %
10062	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	WLAN	8.68	± 9.6 %
10063	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	WLAN	8.63	± 9.6 %
10064	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	WLAN	9.09	± 9.6 %
10065	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	WLAN	9.00	± 9.6 %
10066	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	WLAN	9.38	± 9.6 %
10067	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	WLAN	10.12	± 9.6 %
10068	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	WLAN	10.24	± 9.6 %
10069	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	WLAN	10.56	± 9.6 %
10071	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	WLAN	9.83	± 9.6 %
10072	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	WLAN	9.62	± 9.6 %
10073	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	WLAN	9.94	± 9.6 %
10074	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	WLAN	10.30	± 9.6 %
10075	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	WLAN	10.77	± 9.6 %
10076	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	WLAN	10.94	± 9.6 %
10077	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	WLAN	11.00	± 9.6 %
10081	CAB	CDMA2000 (1xRTT, RC3)	CDMA2000	3.97	± 9.6 %
10082	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	AMPS	4.77	± 9.6 %
10090	DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	GSM	6.56	± 9.6 %
10097	CAB	UMTS-FDD (HSDPA)	WCDMA	3.98	± 9.6 %
10098	CAB	UMTS-FDD (HSUPA, Subtest 2)	WCDMA	3.98	± 9.6 %
10099	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	GSM	9.55	± 9.6 %
10100	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-FDD	5.67	± 9.6 %
10101	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	± 9.6 %
10102	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10103	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10104	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-TDD	9.97	± 9.6 %
10105	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-TDD	10.01	± 9.6 %
10108	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-FDD	5.80	± 9.6 %

Certificate No: EX3-3922_Nov19

Page 11 of 23

EX3DV4-SN:3922

November 20, 2019

10109	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10110	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-FDD	5.75	± 9.6 %
10111	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-FDD	6.44	± 9.6 %
10112	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-FDD	6.59	± 9.6 %
10113	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-FDD	6.62	± 9.6 %
10114	CAC	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	WLAN	8.10	± 9.6 %
10115	CAC	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	WLAN	8.46	± 9.6 %
10116	CAC	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	WLAN	8.15	± 9.6 %
10117	CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	WLAN	8.07	± 9.6 %
10118	CAC	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	WLAN	8.59	± 9.6 %
10119	CAC	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	WLAN	8.13	± 9.6 %
10140	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-FDD	6.49	± 9.6 %
10141	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-FDD	6.53	± 9.6 %
10142	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10143	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-FDD	6.35	± 9.6 %
10144	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-FDD	6.65	± 9.6 %
10145	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-FDD	5.76	± 9.6 %
10146	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.41	± 9.6 %
10147	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.72	± 9.6 %
10149	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	± 9.6 %
10150	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10151	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-TDD	9.28	± 9.6 %
10152	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-TDD	9.92	± 9.6 %
10153	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-TDD	10.05	± 9.6 %
10154	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-FDD	5.75	± 9.6 %
10155	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10156	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-FDD	5.79	± 9.6 %
10157	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-FDD	6.49	± 9.6 %
10158	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-FDD	6.62	± 9.6 %
10159	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-FDD	6.56	± 9.6 %
10160	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-FDD	5.82	± 9.6 %
10161	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-FDD	6.43	± 9.6 %
10162	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-FDD	6.58	± 9.6 %
10166	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-FDD	5.46	± 9.6 %
10167	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.21	± 9.6 %
10168	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.79	± 9.6 %
10169	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10170	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10171	AAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-FDD	6.49	± 9.6 %
10172	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10173	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10174	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10175	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10176	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10177	CAI	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10178	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10179	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10180	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10181	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10182	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10183	AAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10184	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10185	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-FDD	6.51	± 9.6 %
10186	AAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10187	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-FDD	5.73	± 9.6 %
10188	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.52	± 9.6 %
10189	AAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.50	± 9.6 %
10193	CAC	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	WLAN	8.09	± 9.6 %
10194	CAC	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	WLAN	8.12	± 9.6 %
10195	CAC	IEEE 802.11n (HT Greenfield, 65 Mbps, 64-QAM)	WLAN	8.21	± 9.6 %
10196	CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	WLAN	8.10	± 9.6 %
10197	CAC	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	WLAN	8.13	± 9.6 %
10198	CAC	IEEE 802.11n (HT Mixed, 65 Mbps, 64-QAM)	WLAN	8.27	± 9.6 %
10219	CAC	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	WLAN	8.03	± 9.6 %

EX3DV4- SN:3922

November 20, 2019

10220	CAC	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	WLAN	8.13	± 9.6 %
10221	CAC	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	WLAN	8.27	± 9.6 %
10222	CAC	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	WLAN	8.06	± 9.6 %
10223	CAC	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	WLAN	8.48	± 9.6 %
10224	CAC	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	WLAN	8.08	± 9.6 %
10225	CAB	UMTS-FDD (HSPA+)	WCDMA	5.97	± 9.6 %
10226	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.49	± 9.6 %
10227	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.26	± 9.6 %
10228	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-TDD	9.22	± 9.6 %
10229	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10230	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10231	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-TDD	9.19	± 9.6 %
10232	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10233	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10234	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10235	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10236	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10237	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10238	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-TDD	9.48	± 9.6 %
10239	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-TDD	10.25	± 9.6 %
10240	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-TDD	9.21	± 9.6 %
10241	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.82	± 9.6 %
10242	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-TDD	9.86	± 9.6 %
10243	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-TDD	9.46	± 9.6 %
10244	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10245	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-TDD	10.06	± 9.6 %
10246	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-TDD	9.30	± 9.6 %
10247	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-TDD	9.91	± 9.6 %
10248	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-TDD	10.09	± 9.6 %
10249	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10250	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-TDD	9.81	± 9.6 %
10251	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-TDD	10.17	± 9.6 %
10252	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10253	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-TDD	9.90	± 9.6 %
10254	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-TDD	10.14	± 9.6 %
10255	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-TDD	9.20	± 9.6 %
10256	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.96	± 9.6 %
10257	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.08	± 9.6 %
10258	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-TDD	9.34	± 9.6 %
10259	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-TDD	9.98	± 9.6 %
10260	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-TDD	9.97	± 9.6 %
10261	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-TDD	9.24	± 9.6 %
10262	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-TDD	9.83	± 9.6 %
10263	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-TDD	10.16	± 9.6 %
10264	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-TDD	9.23	± 9.6 %
10265	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-TDD	9.92	± 9.6 %
10266	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-TDD	10.07	± 9.6 %
10267	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-TDD	9.30	± 9.6 %
10268	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-TDD	10.06	± 9.6 %
10269	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-TDD	10.13	± 9.6 %
10270	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-TDD	9.58	± 9.6 %
10274	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	WCDMA	4.87	± 9.6 %
10275	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	WCDMA	3.96	± 9.6 %
10277	CAA	PHS (QPSK)	PHS	11.81	± 9.6 %
10278	CAA	PHS (QPSK, BW 884MHz, Roll-off 0.5)	PHS	11.81	± 9.6 %
10279	CAA	PHS (QPSK, BW 884MHz, Roll-off 0.38)	PHS	12.18	± 9.6 %
10290	AAB	CDMA2000, RC1, SO55, Full Rate	CDMA2000	3.91	± 9.6 %
10291	AAB	CDMA2000, RC3, SO55, Full Rate	CDMA2000	3.46	± 9.6 %
10292	AAB	CDMA2000, RC3, SO32, Full Rate	CDMA2000	3.39	± 9.6 %
10293	AAB	CDMA2000, RC3, SO3, Full Rate	CDMA2000	3.50	± 9.6 %
10295	AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	CDMA2000	12.49	± 9.6 %
10297	AAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-FDD	5.81	± 9.6 %
10298	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-FDD	5.72	± 9.6 %
10299	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-FDD	6.39	± 9.6 %

Certificate No: EX3-3922_Nov19

Page 13 of 23

EX3DV4- SN:3922

November 20, 2019

10300	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10301	AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC)	WiMAX	12.03	± 9.6 %
10302	AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3 CTRL symbols)	WiMAX	12.57	± 9.6 %
10303	AAA	IEEE 802.16e WiMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)	WiMAX	12.52	± 9.6 %
10304	AAA	IEEE 802.16e WiMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)	WiMAX	11.86	± 9.6 %
10305	AAA	IEEE 802.16e WiMAX (31:15, 10ms, 10MHz, 64QAM, PUSC, 15 symbols)	WiMAX	15.24	± 9.6 %
10306	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 64QAM, PUSC, 18 symbols)	WiMAX	14.67	± 9.6 %
10307	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, PUSC, 18 symbols)	WiMAX	14.49	± 9.6 %
10308	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)	WiMAX	14.46	± 9.6 %
10309	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, 16QAM, AMC 2x3, 18 symbols)	WiMAX	14.58	± 9.6 %
10310	AAA	IEEE 802.16e WiMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3, 18 symbols)	WiMAX	14.57	± 9.6 %
10311	AAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-FDD	6.06	± 9.6 %
10313	AAA	IDEN 1:3	IDEN	10.51	± 9.6 %
10314	AAA	IDEN 1:6	IDEN	13.48	± 9.6 %
10315	AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	WLAN	1.71	± 9.6 %
10316	AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	WLAN	8.36	± 9.6 %
10317	AAC	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	WLAN	8.36	± 9.6 %
10352	AAA	Pulse Waveform (200Hz, 10%)	Generic	10.00	± 9.6 %
10353	AAA	Pulse Waveform (200Hz, 20%)	Generic	6.99	± 9.6 %
10354	AAA	Pulse Waveform (200Hz, 40%)	Generic	3.98	± 9.6 %
10355	AAA	Pulse Waveform (200Hz, 60%)	Generic	2.22	± 9.6 %
10356	AAA	Pulse Waveform (200Hz, 80%)	Generic	0.97	± 9.6 %
10387	AAA	QPSK Waveform, 1 MHz	Generic	5.10	± 9.6 %
10388	AAA	QPSK Waveform, 10 MHz	Generic	5.22	± 9.6 %
10396	AAA	64-QAM Waveform, 100 kHz	Generic	6.27	± 9.6 %
10399	AAA	64-QAM Waveform, 40 MHz	Generic	6.27	± 9.6 %
10400	AAD	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	WLAN	8.37	± 9.6 %
10401	AAD	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	WLAN	8.60	± 9.6 %
10402	AAD	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	WLAN	8.53	± 9.6 %
10403	AAB	CDMA2000 (1xEV-DO, Rev. 0)	CDMA2000	3.76	± 9.6 %
10404	AAB	CDMA2000 (1xEV-DO, Rev. A)	CDMA2000	3.77	± 9.6 %
10406	AAB	CDMA2000, RC3, S032, SCH0, Full Rate	CDMA2000	5.22	± 9.6 %
10410	AAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9, Subframe Conf=4)	LTE-TDD	7.82	± 9.6 %
10414	AAA	WLAN CCDF, 64-QAM, 40MHz	Generic	8.54	± 9.6 %
10415	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	WLAN	1.54	± 9.6 %
10416	AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	WLAN	8.23	± 9.6 %
10417	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	WLAN	8.23	± 9.6 %
10418	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Long preamble)	WLAN	8.14	± 9.6 %
10419	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc duty cycle, Short preamble)	WLAN	8.19	± 9.6 %
10422	AAB	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	WLAN	8.32	± 9.6 %
10423	AAB	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	WLAN	8.47	± 9.6 %
10424	AAB	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	WLAN	8.40	± 9.6 %
10425	AAB	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	WLAN	8.41	± 9.6 %
10426	AAB	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	WLAN	8.45	± 9.6 %
10427	AAB	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	WLAN	8.41	± 9.6 %
10430	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	LTE-FDD	8.28	± 9.6 %
10431	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	LTE-FDD	8.38	± 9.6 %
10432	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10433	AAC	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10434	AAA	W-CDMA (BS Test Model 1, 64 DPCH)	WCDMA	8.60	± 9.6 %
10435	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10447	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.56	± 9.6 %
10448	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.53	± 9.6 %
10449	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.51	± 9.6 %
10450	AAC	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.48	± 9.6 %

Certificate No: EX3-3922_Nov19

Page 14 of 23

EX3DV4-- SN:3922

November 20, 2019

10451	AAA	W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%)	WCDMA	7.59	± 9.6 %
10456	AAB	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc duty cycle)	WLAN	8.63	± 9.6 %
10457	AAA	UMTS-FDD (DC-HSDPA)	WCDMA	6.62	± 9.6 %
10458	AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	CDMA2000	6.55	± 9.6 %
10459	AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	CDMA2000	8.25	± 9.6 %
10460	AAA	UMTS-FDD (WCDMA, AMR)	WCDMA	2.39	± 9.6 %
10461	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10462	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.30	± 9.6 %
10463	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.56	± 9.6 %
10464	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10465	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	± 9.6 %
10466	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	± 9.6 %
10467	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10468	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	± 9.6 %
10469	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.56	± 9.6 %
10470	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10471	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	± 9.6 %
10472	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	± 9.6 %
10473	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10474	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	± 9.6 %
10475	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	± 9.6 %
10477	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.32	± 9.6 %
10478	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.57	± 9.6 %
10479	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	± 9.6 %
10480	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.18	± 9.6 %
10481	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.45	± 9.6 %
10482	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.71	± 9.6 %
10483	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.39	± 9.6 %
10484	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.47	± 9.6 %
10485	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.59	± 9.6 %
10486	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.38	± 9.6 %
10487	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.60	± 9.6 %
10488	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.70	± 9.6 %
10489	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.31	± 9.6 %
10490	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.54	± 9.6 %
10491	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	± 9.6 %

Certificate No: EX3-3922_Nov19

Page 15 of 23

EX3DV4- SN:3922

November 20, 2019

10492	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.41	± 9.6 %
10493	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.55	± 9.6 %
10494	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	± 9.6 %
10495	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.37	± 9.6 %
10496	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.54	± 9.6 %
10497	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.67	± 9.6 %
10498	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.40	± 9.6 %
10499	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.68	± 9.6 %
10500	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.67	± 9.6 %
10501	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.44	± 9.6 %
10502	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.52	± 9.6 %
10503	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.72	± 9.6 %
10504	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.31	± 9.6 %
10505	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.54	± 9.6 %
10506	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	± 9.6 %
10507	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.36	± 9.6 %
10508	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.55	± 9.6 %
10509	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.99	± 9.6 %
10510	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.49	± 9.6 %
10511	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.51	± 9.6 %
10512	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Subframe=2,3,4,7,8,9)	LTE-TDD	7.74	± 9.6 %
10513	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.42	± 9.6 %
10514	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Subframe=2,3,4,7,8,9)	LTE-TDD	8.45	± 9.6 %
10515	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc duty cycle)	WLAN	1.58	± 9.6 %
10516	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc duty cycle)	WLAN	1.57	± 9.6 %
10517	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc duty cycle)	WLAN	1.58	± 9.6 %
10518	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc duty cycle)	WLAN	8.23	± 9.6 %
10519	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc duty cycle)	WLAN	8.39	± 9.6 %
10520	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc duty cycle)	WLAN	8.12	± 9.6 %
10521	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc duty cycle)	WLAN	7.97	± 9.6 %
10522	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10523	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc duty cycle)	WLAN	8.08	± 9.6 %
10524	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc duty cycle)	WLAN	8.27	± 9.6 %
10525	AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc duty cycle)	WLAN	8.36	± 9.6 %
10526	AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc duty cycle)	WLAN	8.42	± 9.6 %
10527	AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 99pc duty cycle)	WLAN	8.21	± 9.6 %
10528	AAB	IEEE 802.11ac WiFi (20MHz, MCS3, 99pc duty cycle)	WLAN	8.36	± 9.6 %
10529	AAB	IEEE 802.11ac WiFi (20MHz, MCS4, 99pc duty cycle)	WLAN	8.36	± 9.6 %
10531	AAB	IEEE 802.11ac WiFi (20MHz, MCS6, 99pc duty cycle)	WLAN	8.43	± 9.6 %
10532	AAB	IEEE 802.11ac WiFi (20MHz, MCS7, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10533	AAB	IEEE 802.11ac WiFi (20MHz, MCS8, 99pc duty cycle)	WLAN	8.38	± 9.6 %
10534	AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc duty cycle)	WLAN	8.45	± 9.6 %

EX3DV4- SN:3922

November 20, 2019

10535	AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10536	AAB	IEEE 802.11ac WiFi (40MHz, MCS2, 99pc duty cycle)	WLAN	8.32	± 9.6 %
10537	AAB	IEEE 802.11ac WiFi (40MHz, MCS3, 99pc duty cycle)	WLAN	8.44	± 9.6 %
10538	AAB	IEEE 802.11ac WiFi (40MHz, MCS4, 99pc duty cycle)	WLAN	8.54	± 9.6 %
10540	AAB	IEEE 802.11ac WiFi (40MHz, MCS6, 99pc duty cycle)	WLAN	8.39	± 9.6 %
10541	AAB	IEEE 802.11ac WiFi (40MHz, MCS7, 99pc duty cycle)	WLAN	8.46	± 9.6 %
10542	AAB	IEEE 802.11ac WiFi (40MHz, MCS8, 99pc duty cycle)	WLAN	8.65	± 9.6 %
10543	AAB	IEEE 802.11ac WiFi (40MHz, MCS9, 99pc duty cycle)	WLAN	8.65	± 9.6 %
10544	AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc duty cycle)	WLAN	8.47	± 9.6 %
10545	AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc duty cycle)	WLAN	8.55	± 9.6 %
10546	AAB	IEEE 802.11ac WiFi (80MHz, MCS2, 99pc duty cycle)	WLAN	8.35	± 9.6 %
10547	AAB	IEEE 802.11ac WiFi (80MHz, MCS3, 99pc duty cycle)	WLAN	8.49	± 9.6 %
10548	AAB	IEEE 802.11ac WiFi (80MHz, MCS4, 99pc duty cycle)	WLAN	8.37	± 9.6 %
10550	AAB	IEEE 802.11ac WiFi (80MHz, MCS6, 99pc duty cycle)	WLAN	8.38	± 9.6 %
10551	AAB	IEEE 802.11ac WiFi (80MHz, MCS7, 99pc duty cycle)	WLAN	8.50	± 9.6 %
10552	AAB	IEEE 802.11ac WiFi (80MHz, MCS8, 99pc duty cycle)	WLAN	8.42	± 9.6 %
10553	AAB	IEEE 802.11ac WiFi (80MHz, MCS9, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10554	AAC	IEEE 802.11ac WiFi (160MHz, MCS0, 99pc duty cycle)	WLAN	8.48	± 9.6 %
10555	AAC	IEEE 802.11ac WiFi (160MHz, MCS1, 99pc duty cycle)	WLAN	8.47	± 9.6 %
10556	AAC	IEEE 802.11ac WiFi (160MHz, MCS2, 99pc duty cycle)	WLAN	8.50	± 9.6 %
10557	AAC	IEEE 802.11ac WiFi (160MHz, MCS3, 99pc duty cycle)	WLAN	8.52	± 9.6 %
10558	AAC	IEEE 802.11ac WiFi (160MHz, MCS4, 99pc duty cycle)	WLAN	8.61	± 9.6 %
10560	AAC	IEEE 802.11ac WiFi (160MHz, MCS6, 99pc duty cycle)	WLAN	8.73	± 9.6 %
10561	AAC	IEEE 802.11ac WiFi (160MHz, MCS7, 99pc duty cycle)	WLAN	8.56	± 9.6 %
10562	AAC	IEEE 802.11ac WiFi (160MHz, MCS8, 99pc duty cycle)	WLAN	8.69	± 9.6 %
10563	AAC	IEEE 802.11ac WiFi (160MHz, MCS9, 99pc duty cycle)	WLAN	8.77	± 9.6 %
10564	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc duty cycle)	WLAN	8.25	± 9.6 %
10565	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10566	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc duty cycle)	WLAN	8.13	± 9.6 %
10567	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc duty cycle)	WLAN	8.00	± 9.6 %
10568	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc duty cycle)	WLAN	8.37	± 9.6 %
10569	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc duty cycle)	WLAN	8.10	± 9.6 %
10570	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc duty cycle)	WLAN	8.30	± 9.6 %
10571	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc duty cycle)	WLAN	1.99	± 9.6 %
10572	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc duty cycle)	WLAN	1.99	± 9.6 %
10573	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc duty cycle)	WLAN	1.98	± 9.6 %
10574	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc duty cycle)	WLAN	1.98	± 9.6 %
10575	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc duty cycle)	WLAN	8.59	± 9.6 %
10576	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc duty cycle)	WLAN	8.60	± 9.6 %
10577	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc duty cycle)	WLAN	8.70	± 9.6 %
10578	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc duty cycle)	WLAN	8.49	± 9.6 %
10579	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc duty cycle)	WLAN	8.36	± 9.6 %
10580	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc duty cycle)	WLAN	8.76	± 9.6 %
10581	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc duty cycle)	WLAN	8.35	± 9.6 %
10582	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc duty cycle)	WLAN	8.67	± 9.6 %
10583	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc duty cycle)	WLAN	8.59	± 9.6 %
10584	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc duty cycle)	WLAN	8.60	± 9.6 %
10585	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc duty cycle)	WLAN	8.70	± 9.6 %
10586	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc duty cycle)	WLAN	8.49	± 9.6 %
10587	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc duty cycle)	WLAN	8.36	± 9.6 %

Certificate No: EX3-3922_Nov19

Page 17 of 23

EX3DV4-SN:3922

November 20, 2019

10588	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc duty cycle)	WLAN	8.76	± 9.6 %
10589	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc duty cycle)	WLAN	8.35	± 9.6 %
10590	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc duty cycle)	WLAN	8.67	± 9.6 %
10591	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	WLAN	8.63	± 9.6 %
10592	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc duty cycle)	WLAN	8.79	± 9.6 %
10593	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS2, 90pc duty cycle)	WLAN	8.64	± 9.6 %
10594	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS3, 90pc duty cycle)	WLAN	8.74	± 9.6 %
10595	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc duty cycle)	WLAN	8.74	± 9.6 %
10596	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc duty cycle)	WLAN	8.71	± 9.6 %
10597	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc duty cycle)	WLAN	8.72	± 9.6 %
10598	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc duty cycle)	WLAN	8.50	± 9.6 %
10599	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	WLAN	8.79	± 9.6 %
10600	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc duty cycle)	WLAN	8.88	± 9.6 %
10601	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10602	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc duty cycle)	WLAN	8.94	± 9.6 %
10603	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc duty cycle)	WLAN	9.03	± 9.6 %
10604	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc duty cycle)	WLAN	8.76	± 9.6 %
10605	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc duty cycle)	WLAN	8.97	± 9.6 %
10606	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10607	AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	WLAN	8.64	± 9.6 %
10608	AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc duty cycle)	WLAN	8.77	± 9.6 %
10609	AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 90pc duty cycle)	WLAN	8.57	± 9.6 %
10610	AAB	IEEE 802.11ac WiFi (20MHz, MCS3, 90pc duty cycle)	WLAN	8.78	± 9.6 %
10611	AAB	IEEE 802.11ac WiFi (20MHz, MCS4, 90pc duty cycle)	WLAN	8.70	± 9.6 %
10612	AAB	IEEE 802.11ac WiFi (20MHz, MCS5, 90pc duty cycle)	WLAN	8.77	± 9.6 %
10613	AAB	IEEE 802.11ac WiFi (20MHz, MCS6, 90pc duty cycle)	WLAN	8.94	± 9.6 %
10614	AAB	IEEE 802.11ac WiFi (20MHz, MCS7, 90pc duty cycle)	WLAN	8.59	± 9.6 %
10615	AAB	IEEE 802.11ac WiFi (20MHz, MCS8, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10616	AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10617	AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc duty cycle)	WLAN	8.81	± 9.6 %
10618	AAB	IEEE 802.11ac WiFi (40MHz, MCS2, 90pc duty cycle)	WLAN	8.58	± 9.6 %
10619	AAB	IEEE 802.11ac WiFi (40MHz, MCS3, 90pc duty cycle)	WLAN	8.86	± 9.6 %
10620	AAB	IEEE 802.11ac WiFi (40MHz, MCS4, 90pc duty cycle)	WLAN	8.87	± 9.6 %
10621	AAB	IEEE 802.11ac WiFi (40MHz, MCS5, 90pc duty cycle)	WLAN	8.77	± 9.6 %
10622	AAB	IEEE 802.11ac WiFi (40MHz, MCS6, 90pc duty cycle)	WLAN	8.68	± 9.6 %
10623	AAB	IEEE 802.11ac WiFi (40MHz, MCS7, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10624	AAB	IEEE 802.11ac WiFi (40MHz, MCS8, 90pc duty cycle)	WLAN	8.96	± 9.6 %
10625	AAB	IEEE 802.11ac WiFi (40MHz, MCS9, 90pc duty cycle)	WLAN	8.96	± 9.6 %
10626	AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	WLAN	8.83	± 9.6 %
10627	AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc duty cycle)	WLAN	8.88	± 9.6 %
10628	AAB	IEEE 802.11ac WiFi (80MHz, MCS2, 90pc duty cycle)	WLAN	8.71	± 9.6 %
10629	AAB	IEEE 802.11ac WiFi (80MHz, MCS3, 90pc duty cycle)	WLAN	8.85	± 9.6 %
10630	AAB	IEEE 802.11ac WiFi (80MHz, MCS4, 90pc duty cycle)	WLAN	8.72	± 9.6 %
10631	AAB	IEEE 802.11ac WiFi (80MHz, MCS5, 90pc duty cycle)	WLAN	8.81	± 9.6 %
10632	AAB	IEEE 802.11ac WiFi (80MHz, MCS6, 90pc duty cycle)	WLAN	8.74	± 9.6 %
10633	AAB	IEEE 802.11ac WiFi (80MHz, MCS7, 90pc duty cycle)	WLAN	8.83	± 9.6 %
10634	AAB	IEEE 802.11ac WiFi (80MHz, MCS8, 90pc duty cycle)	WLAN	8.80	± 9.6 %
10635	AAB	IEEE 802.11ac WiFi (80MHz, MCS9, 90pc duty cycle)	WLAN	8.81	± 9.6 %
10636	AAC	IEEE 802.11ac WiFi (160MHz, MCS0, 90pc duty cycle)	WLAN	8.83	± 9.6 %
10637	AAC	IEEE 802.11ac WiFi (160MHz, MCS1, 90pc duty cycle)	WLAN	8.79	± 9.6 %
10638	AAC	IEEE 802.11ac WiFi (160MHz, MCS2, 90pc duty cycle)	WLAN	8.86	± 9.6 %
10639	AAC	IEEE 802.11ac WiFi (160MHz, MCS3, 90pc duty cycle)	WLAN	8.85	± 9.6 %
10640	AAC	IEEE 802.11ac WiFi (160MHz, MCS4, 90pc duty cycle)	WLAN	8.98	± 9.6 %
10641	AAC	IEEE 802.11ac WiFi (160MHz, MCS5, 90pc duty cycle)	WLAN	9.06	± 9.6 %
10642	AAC	IEEE 802.11ac WiFi (160MHz, MCS6, 90pc duty cycle)	WLAN	9.06	± 9.6 %
10643	AAC	IEEE 802.11ac WiFi (160MHz, MCS7, 90pc duty cycle)	WLAN	8.89	± 9.6 %
10644	AAC	IEEE 802.11ac WiFi (160MHz, MCS8, 90pc duty cycle)	WLAN	9.05	± 9.6 %
10645	AAC	IEEE 802.11ac WiFi (160MHz, MCS9, 90pc duty cycle)	WLAN	9.11	± 9.6 %
10646	AAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Subframe=2,7)	LTE-TDD	11.96	± 9.6 %
10647	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Subframe=2,7)	LTE-TDD	11.96	± 9.6 %
10648	AAA	CDMA2000 (1x Advanced)	CDMA2000	3.45	± 9.6 %
10652	AAE	LTE-TDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.91	± 9.6 %
10653	AAE	LTE-TDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.42	± 9.6 %
10654	AAD	LTE-TDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.96	± 9.6 %

EX3DV4- SN:3922

November 20, 2019

10655	AAE	LTE-TDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.21	± 9.6 %
10658	AAA	Pulse Waveform (200Hz, 10%)	Test	10.00	± 9.6 %
10659	AAA	Pulse Waveform (200Hz, 20%)	Test	6.99	± 9.6 %
10660	AAA	Pulse Waveform (200Hz, 40%)	Test	3.98	± 9.6 %
10661	AAA	Pulse Waveform (200Hz, 60%)	Test	2.22	± 9.6 %
10662	AAA	Pulse Waveform (200Hz, 80%)	Test	0.97	± 9.6 %
10670	AAA	Bluetooth Low Energy	Bluetooth	2.19	± 9.6 %
10671	AAA	IEEE 802.11ax (20MHz, MCS0, 90pc duty cycle)	WLAN	9.09	± 9.6 %
10672	AAA	IEEE 802.11ax (20MHz, MCS1, 90pc duty cycle)	WLAN	8.57	± 9.6 %
10673	AAA	IEEE 802.11ax (20MHz, MCS2, 90pc duty cycle)	WLAN	8.78	± 9.6 %
10674	AAA	IEEE 802.11ax (20MHz, MCS3, 90pc duty cycle)	WLAN	8.74	± 9.6 %
10675	AAA	IEEE 802.11ax (20MHz, MCS4, 90pc duty cycle)	WLAN	8.90	± 9.6 %
10676	AAA	IEEE 802.11ax (20MHz, MCS5, 90pc duty cycle)	WLAN	8.77	± 9.6 %
10677	AAA	IEEE 802.11ax (20MHz, MCS6, 90pc duty cycle)	WLAN	8.73	± 9.6 %
10678	AAA	IEEE 802.11ax (20MHz, MCS7, 90pc duty cycle)	WLAN	8.78	± 9.6 %
10679	AAA	IEEE 802.11ax (20MHz, MCS8, 90pc duty cycle)	WLAN	8.89	± 9.6 %
10680	AAA	IEEE 802.11ax (20MHz, MCS9, 90pc duty cycle)	WLAN	8.80	± 9.6 %
10681	AAA	IEEE 802.11ax (20MHz, MCS10, 90pc duty cycle)	WLAN	8.62	± 9.6 %
10682	AAA	IEEE 802.11ax (20MHz, MCS11, 90pc duty cycle)	WLAN	8.83	± 9.6 %
10683	AAA	IEEE 802.11ax (20MHz, MCS0, 99pc duty cycle)	WLAN	8.42	± 9.6 %
10684	AAA	IEEE 802.11ax (20MHz, MCS1, 99pc duty cycle)	WLAN	8.26	± 9.6 %
10685	AAA	IEEE 802.11ax (20MHz, MCS2, 99pc duty cycle)	WLAN	8.33	± 9.6 %
10686	AAA	IEEE 802.11ax (20MHz, MCS3, 99pc duty cycle)	WLAN	8.28	± 9.6 %
10687	AAA	IEEE 802.11ax (20MHz, MCS4, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10688	AAA	IEEE 802.11ax (20MHz, MCS5, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10689	AAA	IEEE 802.11ax (20MHz, MCS6, 99pc duty cycle)	WLAN	8.55	± 9.6 %
10690	AAA	IEEE 802.11ax (20MHz, MCS7, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10691	AAA	IEEE 802.11ax (20MHz, MCS8, 99pc duty cycle)	WLAN	8.25	± 9.6 %
10692	AAA	IEEE 802.11ax (20MHz, MCS9, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10693	AAA	IEEE 802.11ax (20MHz, MCS10, 99pc duty cycle)	WLAN	8.25	± 9.6 %
10694	AAA	IEEE 802.11ax (20MHz, MCS11, 99pc duty cycle)	WLAN	8.57	± 9.6 %
10695	AAA	IEEE 802.11ax (40MHz, MCS0, 90pc duty cycle)	WLAN	8.78	± 9.6 %
10696	AAA	IEEE 802.11ax (40MHz, MCS1, 90pc duty cycle)	WLAN	8.91	± 9.6 %
10697	AAA	IEEE 802.11ax (40MHz, MCS2, 90pc duty cycle)	WLAN	8.61	± 9.6 %
10698	AAA	IEEE 802.11ax (40MHz, MCS3, 90pc duty cycle)	WLAN	8.89	± 9.6 %
10699	AAA	IEEE 802.11ax (40MHz, MCS4, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10700	AAA	IEEE 802.11ax (40MHz, MCS5, 90pc duty cycle)	WLAN	8.73	± 9.6 %
10701	AAA	IEEE 802.11ax (40MHz, MCS6, 90pc duty cycle)	WLAN	8.86	± 9.6 %
10702	AAA	IEEE 802.11ax (40MHz, MCS7, 90pc duty cycle)	WLAN	8.70	± 9.6 %
10703	AAA	IEEE 802.11ax (40MHz, MCS8, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10704	AAA	IEEE 802.11ax (40MHz, MCS9, 90pc duty cycle)	WLAN	8.56	± 9.6 %
10705	AAA	IEEE 802.11ax (40MHz, MCS10, 90pc duty cycle)	WLAN	8.69	± 9.6 %
10706	AAA	IEEE 802.11ax (40MHz, MCS11, 90pc duty cycle)	WLAN	8.66	± 9.6 %
10707	AAA	IEEE 802.11ax (40MHz, MCS0, 99pc duty cycle)	WLAN	8.32	± 9.6 %
10708	AAA	IEEE 802.11ax (40MHz, MCS1, 99pc duty cycle)	WLAN	8.55	± 9.6 %
10709	AAA	IEEE 802.11ax (40MHz, MCS2, 99pc duty cycle)	WLAN	8.33	± 9.6 %
10710	AAA	IEEE 802.11ax (40MHz, MCS3, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10711	AAA	IEEE 802.11ax (40MHz, MCS4, 99pc duty cycle)	WLAN	8.39	± 9.6 %
10712	AAA	IEEE 802.11ax (40MHz, MCS5, 99pc duty cycle)	WLAN	8.67	± 9.6 %
10713	AAA	IEEE 802.11ax (40MHz, MCS6, 99pc duty cycle)	WLAN	8.33	± 9.6 %
10714	AAA	IEEE 802.11ax (40MHz, MCS7, 99pc duty cycle)	WLAN	8.26	± 9.6 %
10715	AAA	IEEE 802.11ax (40MHz, MCS8, 99pc duty cycle)	WLAN	8.45	± 9.6 %
10716	AAA	IEEE 802.11ax (40MHz, MCS9, 99pc duty cycle)	WLAN	8.30	± 9.6 %
10717	AAA	IEEE 802.11ax (40MHz, MCS10, 99pc duty cycle)	WLAN	8.48	± 9.6 %
10718	AAA	IEEE 802.11ax (40MHz, MCS11, 99pc duty cycle)	WLAN	8.24	± 9.6 %
10719	AAA	IEEE 802.11ax (80MHz, MCS0, 90pc duty cycle)	WLAN	8.81	± 9.6 %
10720	AAA	IEEE 802.11ax (80MHz, MCS1, 90pc duty cycle)	WLAN	8.87	± 9.6 %
10721	AAA	IEEE 802.11ax (80MHz, MCS2, 90pc duty cycle)	WLAN	8.76	± 9.6 %
10722	AAA	IEEE 802.11ax (80MHz, MCS3, 90pc duty cycle)	WLAN	8.55	± 9.6 %
10723	AAA	IEEE 802.11ax (80MHz, MCS4, 90pc duty cycle)	WLAN	8.70	± 9.6 %
10724	AAA	IEEE 802.11ax (80MHz, MCS5, 90pc duty cycle)	WLAN	8.90	± 9.6 %
10725	AAA	IEEE 802.11ax (80MHz, MCS6, 90pc duty cycle)	WLAN	8.74	± 9.6 %
10726	AAA	IEEE 802.11ax (80MHz, MCS7, 90pc duty cycle)	WLAN	8.72	± 9.6 %
10727	AAA	IEEE 802.11ax (80MHz, MCS8, 90pc duty cycle)	WLAN	8.66	± 9.6 %

Certificate No: EX3-3922_Nov19

Page 19 of 23

EX3DV4- SN:3922

November 20, 2019

10728	AAA	IEEE 802.11ax (80MHz, MCS9, 90pc duty cycle)	WLAN	8.65	± 9.6 %
10729	AAA	IEEE 802.11ax (80MHz, MCS10, 90pc duty cycle)	WLAN	8.64	± 9.6 %
10730	AAA	IEEE 802.11ax (80MHz, MCS11, 90pc duty cycle)	WLAN	8.67	± 9.6 %
10731	AAA	IEEE 802.11ax (80MHz, MCS0, 99pc duty cycle)	WLAN	8.42	± 9.6 %
10732	AAA	IEEE 802.11ax (80MHz, MCS1, 99pc duty cycle)	WLAN	8.46	± 9.6 %
10733	AAA	IEEE 802.11ax (80MHz, MCS2, 99pc duty cycle)	WLAN	8.40	± 9.6 %
10734	AAA	IEEE 802.11ax (80MHz, MCS3, 99pc duty cycle)	WLAN	8.25	± 9.6 %
10735	AAA	IEEE 802.11ax (80MHz, MCS4, 99pc duty cycle)	WLAN	8.33	± 9.6 %
10736	AAA	IEEE 802.11ax (80MHz, MCS5, 99pc duty cycle)	WLAN	8.27	± 9.6 %
10737	AAA	IEEE 802.11ax (80MHz, MCS6, 99pc duty cycle)	WLAN	8.36	± 9.6 %
10738	AAA	IEEE 802.11ax (80MHz, MCS7, 99pc duty cycle)	WLAN	8.42	± 9.6 %
10739	AAA	IEEE 802.11ax (80MHz, MCS8, 99pc duty cycle)	WLAN	8.29	± 9.6 %
10740	AAA	IEEE 802.11ax (80MHz, MCS9, 99pc duty cycle)	WLAN	8.48	± 9.6 %
10741	AAA	IEEE 802.11ax (80MHz, MCS10, 99pc duty cycle)	WLAN	8.40	± 9.6 %
10742	AAA	IEEE 802.11ax (80MHz, MCS11, 99pc duty cycle)	WLAN	8.43	± 9.6 %
10743	AAA	IEEE 802.11ax (160MHz, MCS0, 90pc duty cycle)	WLAN	8.94	± 9.6 %
10744	AAA	IEEE 802.11ax (160MHz, MCS1, 90pc duty cycle)	WLAN	9.16	± 9.6 %
10745	AAA	IEEE 802.11ax (160MHz, MCS2, 90pc duty cycle)	WLAN	8.93	± 9.6 %
10746	AAA	IEEE 802.11ax (160MHz, MCS3, 90pc duty cycle)	WLAN	9.11	± 9.6 %
10747	AAA	IEEE 802.11ax (160MHz, MCS4, 90pc duty cycle)	WLAN	9.04	± 9.6 %
10748	AAA	IEEE 802.11ax (160MHz, MCS5, 90pc duty cycle)	WLAN	8.93	± 9.6 %
10749	AAA	IEEE 802.11ax (160MHz, MCS6, 90pc duty cycle)	WLAN	8.90	± 9.6 %
10750	AAA	IEEE 802.11ax (160MHz, MCS7, 90pc duty cycle)	WLAN	8.79	± 9.6 %
10751	AAA	IEEE 802.11ax (160MHz, MCS8, 90pc duty cycle)	WLAN	8.82	± 9.6 %
10752	AAA	IEEE 802.11ax (160MHz, MCS9, 90pc duty cycle)	WLAN	8.81	± 9.6 %
10753	AAA	IEEE 802.11ax (160MHz, MCS10, 90pc duty cycle)	WLAN	9.00	± 9.6 %
10754	AAA	IEEE 802.11ax (160MHz, MCS11, 90pc duty cycle)	WLAN	8.94	± 9.6 %
10755	AAA	IEEE 802.11ax (160MHz, MCS0, 99pc duty cycle)	WLAN	8.64	± 9.6 %
10756	AAA	IEEE 802.11ax (160MHz, MCS1, 99pc duty cycle)	WLAN	8.77	± 9.6 %
10757	AAA	IEEE 802.11ax (160MHz, MCS2, 99pc duty cycle)	WLAN	8.77	± 9.6 %
10758	AAA	IEEE 802.11ax (160MHz, MCS3, 99pc duty cycle)	WLAN	8.69	± 9.6 %
10759	AAA	IEEE 802.11ax (160MHz, MCS4, 99pc duty cycle)	WLAN	8.58	± 9.6 %
10760	AAA	IEEE 802.11ax (160MHz, MCS5, 99pc duty cycle)	WLAN	8.49	± 9.6 %
10761	AAA	IEEE 802.11ax (160MHz, MCS6, 99pc duty cycle)	WLAN	8.58	± 9.6 %
10762	AAA	IEEE 802.11ax (160MHz, MCS7, 99pc duty cycle)	WLAN	8.49	± 9.6 %
10763	AAA	IEEE 802.11ax (160MHz, MCS8, 99pc duty cycle)	WLAN	8.53	± 9.6 %
10764	AAA	IEEE 802.11ax (160MHz, MCS9, 99pc duty cycle)	WLAN	8.54	± 9.6 %
10765	AAA	IEEE 802.11ax (160MHz, MCS10, 99pc duty cycle)	WLAN	8.54	± 9.6 %
10766	AAA	IEEE 802.11ax (160MHz, MCS11, 99pc duty cycle)	WLAN	8.51	± 9.6 %
10767	AAA	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	7.99	± 9.6 %
10768	AAA	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.01	± 9.6 %
10769	AAA	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.01	± 9.6 %
10770	AAA	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	± 9.6 %
10771	AAA	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	± 9.6 %
10772	AAA	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.23	± 9.6 %
10773	AAA	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.03	± 9.6 %
10774	AAA	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	± 9.6 %
10776	AAA	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.30	± 9.6 %
10778	AAA	5G NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10780	AAA	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.38	± 9.6 %
10781	AAA	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.38	± 9.6 %
10782	AAA	5G NR (CP-OFDM, 50% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.43	± 9.6 %

Certificate No: EX3-3922_Nov19

Page 20 of 23

EX3DV4- SN:3922

November 20, 2019

10783	AAA	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.31	± 9.6 %
10784	AAA	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.29	± 9.6 %
10785	AAA	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.40	± 9.6 %
10786	AAA	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10787	AAA	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.44	± 9.6 %
10788	AAA	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10789	AAA	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10790	AAA	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10791	AAA	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.83	± 9.6 %
10792	AAA	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.92	± 9.6 %
10793	AAA	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.95	± 9.6 %
10794	AAA	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	± 9.6 %
10795	AAA	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.84	± 9.6 %
10796	AAA	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	± 9.6 %
10797	AAA	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.01	± 9.6 %
10798	AAA	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.89	± 9.6 %
10799	AAA	5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.93	± 9.6 %
10801	AAA	5G NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.89	± 9.6 %
10802	AAA	5G NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.87	± 9.6 %
10803	AAA	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.93	± 9.6 %
10805	AAA	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10806	AAA	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10809	AAA	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10810	AAA	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10812	AAA	5G NR (CP-OFDM, 50% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10817	AAA	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10818	AAA	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10819	AAA	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.33	± 9.6 %
10820	AAA	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.30	± 9.6 %
10821	AAA	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10822	AAA	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10823	AAA	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.36	± 9.6 %
10824	AAA	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.39	± 9.6 %

Certificate No: EX3-3922_Nov19

Page 21 of 23

EX3DV4-SN:3922

November 20, 2019

10825	AAA	5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10827	AAA	5G NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.42	± 9.6 %
10828	AAA	5G NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.43	± 9.6 %
10829	AAA	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.44	± 9.6 %
10830	AAA	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.63	± 9.6 %
10831	AAA	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.73	± 9.6 %
10832	AAA	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.74	± 9.6 %
10833	AAA	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.75	± 9.6 %
10834	AAA	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.75	± 9.6 %
10835	AAA	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.70	± 9.6 %
10836	AAA	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.66	± 9.6 %
10837	AAA	5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.68	± 9.6 %
10839	AAA	5G NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.70	± 9.6 %
10840	AAA	5G NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.67	± 9.6 %
10841	AAA	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.71	± 9.6 %
10842	AAA	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.48	± 9.6 %
10844	AAA	5G NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10846	AAA	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10854	AAA	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10855	AAA	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.36	± 9.6 %
10856	AAA	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10857	AAA	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10858	AAA	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.36	± 9.6 %
10859	AAA	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10860	AAA	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10861	AAA	5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.40	± 9.6 %
10863	AAA	5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10864	AAA	5G NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10865	AAA	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10866	AAA	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.89	± 9.6 %
10868	AAA	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.89	± 9.6 %
10869	AAA	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	5.75	± 9.6 %
10870	AAA	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	5.86	± 9.6 %

Certificate No: EX3-3922_Nov19

Page 22 of 23

EX3DV4-- SN:3922

November 20, 2019

10871	AAA	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	5.75	± 9.6 %
10872	AAA	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	6.52	± 9.6 %
10873	AAA	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.61	± 9.6 %
10874	AAA	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.65	± 9.6 %
10875	AAA	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	7.78	± 9.6 %
10876	AAA	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	8.39	± 9.6 %
10877	AAA	5G NR (CP-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	7.95	± 9.6 %
10878	AAA	5G NR (CP-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	8.41	± 9.6 %
10879	AAA	5G NR (CP-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.12	± 9.6 %
10880	AAA	5G NR (CP-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.38	± 9.6 %
10881	AAA	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	5.75	± 9.6 %
10882	AAA	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	5.96	± 9.6 %
10883	AAA	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	6.57	± 9.6 %
10884	AAA	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	6.53	± 9.6 %
10885	AAA	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.61	± 9.6 %
10886	AAA	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.65	± 9.6 %
10887	AAA	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	7.78	± 9.6 %
10888	AAA	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	8.35	± 9.6 %
10889	AAA	5G NR (CP-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	8.02	± 9.6 %
10890	AAA	5G NR (CP-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	8.40	± 9.6 %
10891	AAA	5G NR (CP-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.13	± 9.6 %
10892	AAA	5G NR (CP-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.41	± 9.6 %

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

System Check Dipole SAR Calibration Certificate -Dipole 2450MHz (D2450V2 S/N: 713)

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

Client **UL Japan (KYCOM)**

Certificate No: **D2450V2-713_Sep19**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN:713**

Calibration procedure(s) **QA CAL-05.v11**
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: **September 09, 2019**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

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

Issued: September 13, 2019

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

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



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

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.9 $\pm$ 6 %	1.86 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.5 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.1 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.7 $\pm$ 6 %	2.04 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.3 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.5 Ω + 1.6 j Ω
Return Loss	- 28.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6 Ω + 4.0 j Ω
Return Loss	- 27.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.159 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 09.09.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:713

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.86$ S/m; $\epsilon_r = 37.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.9, 7.9, 7.9) @ 2450 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

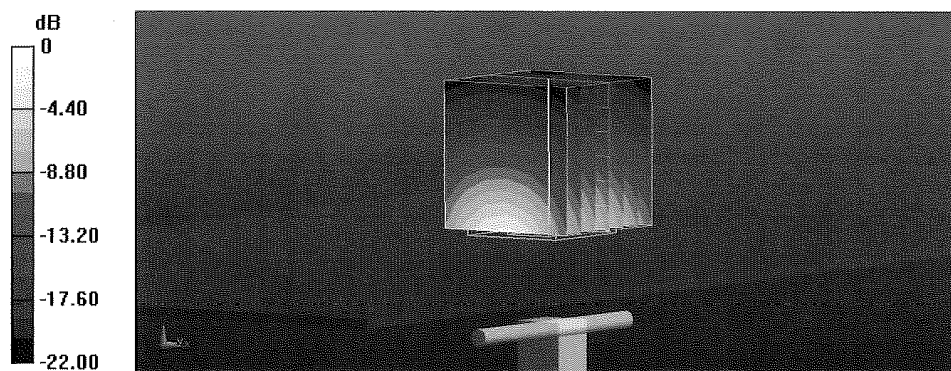
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 118.4 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 27.2 W/kg

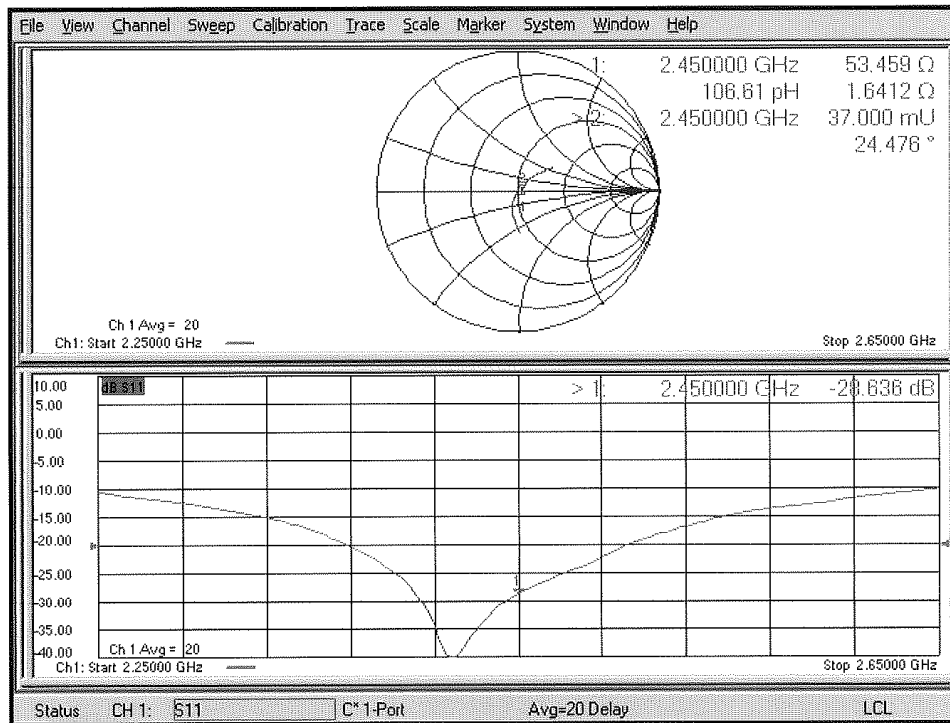
SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.35 W/kg

Maximum value of SAR (measured) = 22.5 W/kg



0 dB = 22.5 W/kg = 13.52 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 09.09.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:713

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.04$ S/m; $\epsilon_r = 50.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.94, 7.94, 7.94) @ 2450 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

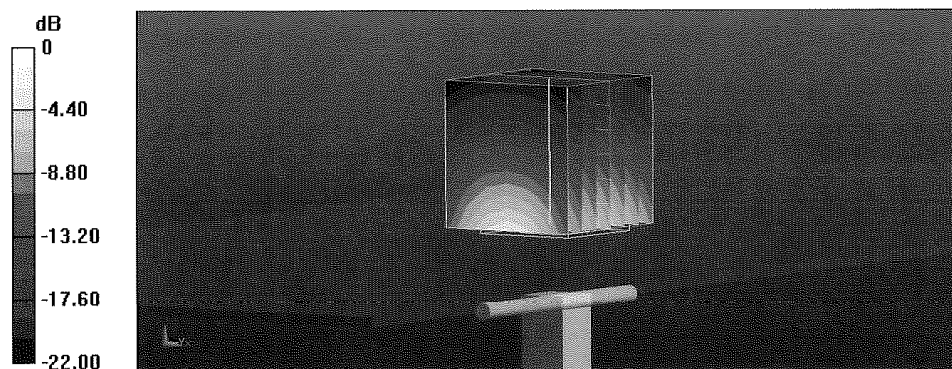
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 109.7 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 26.6 W/kg

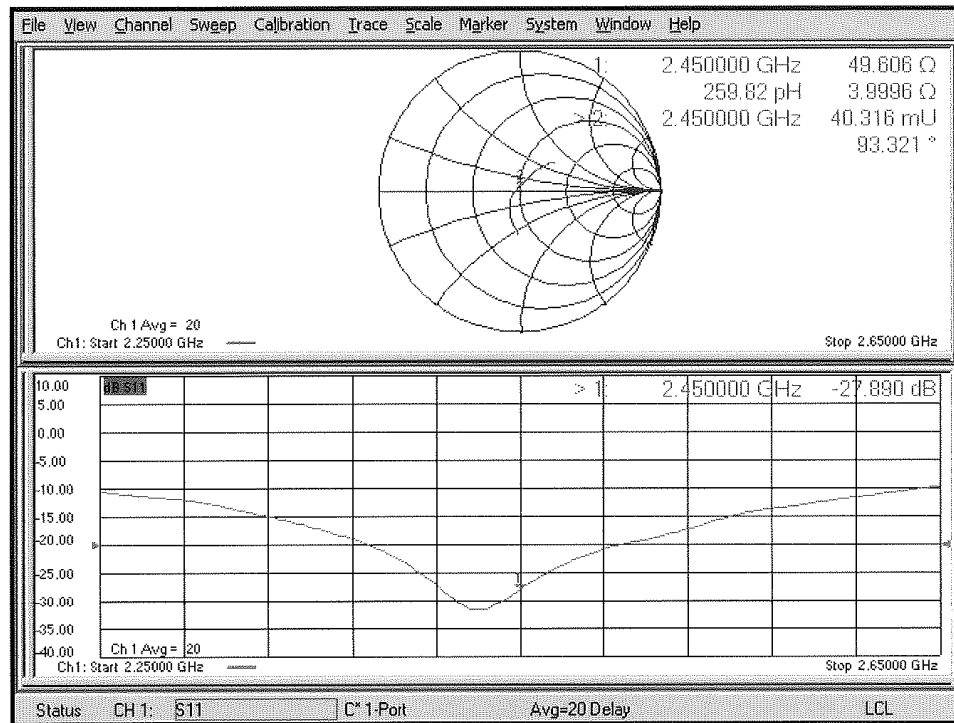
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.18 W/kg

Maximum value of SAR (measured) = 21.9 W/kg



0 dB = 21.9 W/kg = 13.40 dBW/kg

Impedance Measurement Plot for Body TSL



System Check Dipole SAR Calibration Certificate -DipoleD5GHz (D5GHzV2 S/N: 1020)

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 **UL Japan (KYCOM)**

Certificate No: **D5GHzV2-1020_Nov19**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1020**

Calibration procedure(s) **QA CAL-22.v4**
Calibration Procedure for SAR Validation Sources between 3-6 GHz

Calibration date: **November 19, 2019**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 3503	25-Mar-19 (No. EX3-3503_Mar19)	Mar-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

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

Issued: November 20, 2019

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

Certificate No: D5GHzV2-1020_Nov19

Page 1 of 13

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



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

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	4.49 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.3 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.3 ± 6 %	4.84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.9 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.0 ± 6 %	5.05 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.7 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.7 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.0 ± 6 %	5.51 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.67 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	76.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.2 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.4 ± 6 %	5.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	80.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.2 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.0 ± 6 %	6.26 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.65 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.9 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	50.9 Ω - 8.1 j Ω
Return Loss	- 21.9 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.7 Ω - 3.0 j Ω
Return Loss	- 25.5 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	57.2 Ω + 1.4 j Ω
Return Loss	- 23.3 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	51.0 Ω - 6.1 j Ω
Return Loss	- 24.3 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	54.8 Ω - 2.4 j Ω
Return Loss	- 25.9 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	57.7 Ω + 2.0 j Ω
Return Loss	- 22.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------

DASY5 Validation Report for Head TSL

Date: 18.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1020

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: $f = 5250$ MHz; $\sigma = 4.49$ S/m; $\epsilon_r = 34.8$; $\rho = 1000$ kg/m³,
Medium parameters used: $f = 5600$ MHz; $\sigma = 4.84$ S/m; $\epsilon_r = 34.3$; $\rho = 1000$ kg/m³,
Medium parameters used: $f = 5800$ MHz; $\sigma = 5.05$ S/m; $\epsilon_r = 34$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.4, 5.4, 5.4) @ 5250 MHz, ConvF(4.95, 4.95, 4.95) @ 5600 MHz, ConvF(4.96, 4.96, 4.96) @ 5800 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 77.97 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 28.4 W/kg

SAR(1 g) = 8.22 W/kg; SAR(10 g) = 2.35 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 70.3%

Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 77.98 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 31.8 W/kg

SAR(1 g) = 8.50 W/kg; SAR(10 g) = 2.42 W/kg

Smallest distance from peaks to all points 3 dB below = 7.4 mm

Ratio of SAR at M2 to SAR at M1 = 67.6%

Maximum value of SAR (measured) = 20.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 74.30 V/m; Power Drift = -0.03 dB

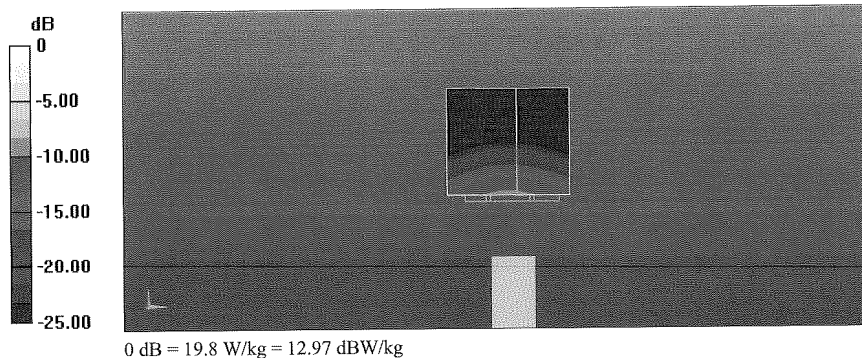
Peak SAR (extrapolated) = 32.6 W/kg

SAR(1 g) = 8.15 W/kg; SAR(10 g) = 2.3 W/kg

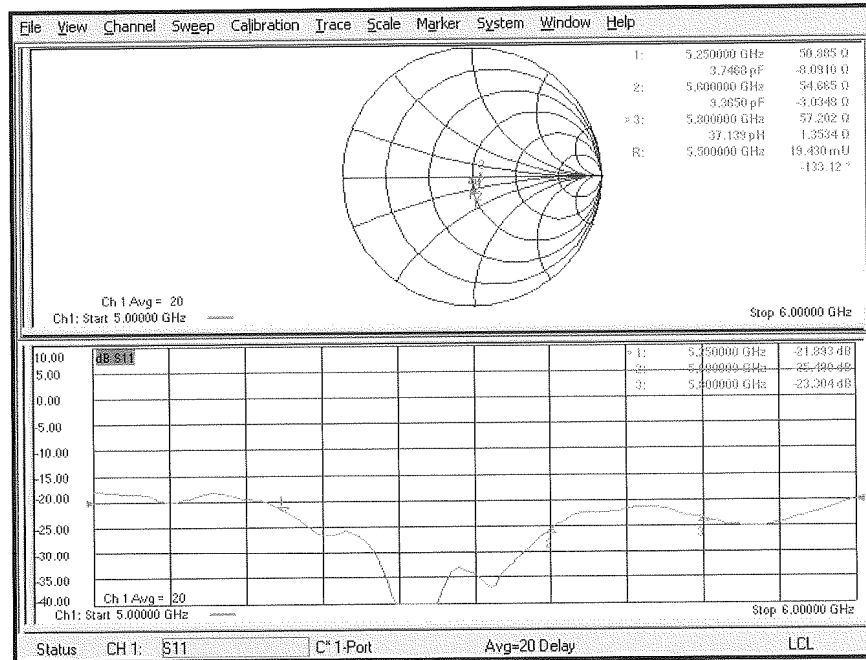
Smallest distance from peaks to all points 3 dB below = 7.4 mm

Ratio of SAR at M2 to SAR at M1 = 65.3%

Maximum value of SAR (measured) = 19.8 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1020

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: $f = 5250$ MHz; $\sigma = 5.51$ S/m; $\epsilon_r = 47$; $\rho = 1000$ kg/m³,
Medium parameters used: $f = 5600$ MHz; $\sigma = 5.99$ S/m; $\epsilon_r = 46.4$; $\rho = 1000$ kg/m³,
Medium parameters used: $f = 5800$ MHz; $\sigma = 6.26$ S/m; $\epsilon_r = 46$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.26, 5.26, 5.26) @ 5250 MHz, ConvF(4.74, 4.74, 4.74) @ 5600 MHz, ConvF(4.62, 4.62, 4.62) @ 5800 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:

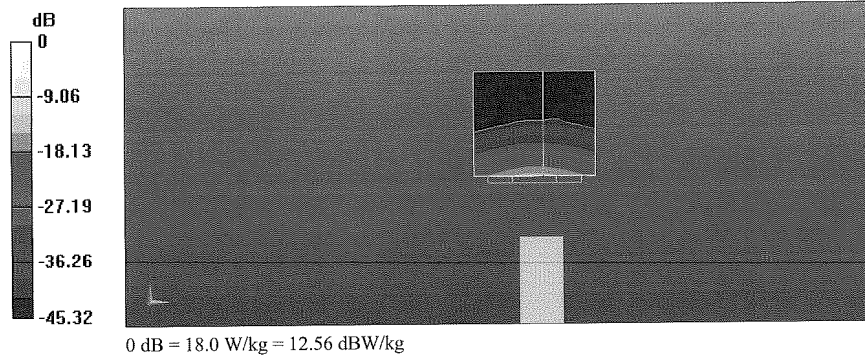
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm
Reference Value = 68.82 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 29.7 W/kg
SAR(1 g) = 7.67 W/kg; SAR(10 g) = 2.14 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 66.8%
Maximum value of SAR (measured) = 18.0 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:

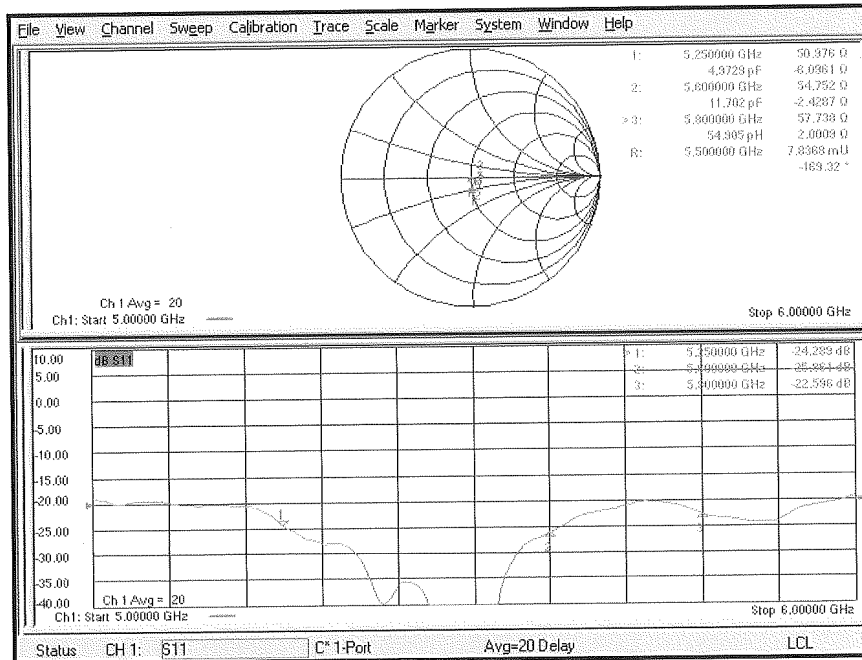
Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm
Reference Value = 68.78 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 34.8 W/kg
SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.24 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 63.5%
Maximum value of SAR (measured) = 19.8 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:

Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=1.4$ mm
Reference Value = 66.62 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 33.7 W/kg
SAR(1 g) = 7.65 W/kg; SAR(10 g) = 2.11 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 62.9%
Maximum value of SAR (measured) = 19.0 W/kg



Impedance Measurement Plot for Body TSL



System check uncertainty

The uncertainty budget has been determined for the DASY5 measurement system according to the SPEAG documents and is given in the following Table.

Repeatability Budget for System Check

<0.3 – 3GHz range Body>

Error Description	Uncertainty value $\pm$ %	Probability distribution	divisor	(ci) 1g	Standard (1g)	vi or veff
Measurement System						
Probe calibration	$\pm$ 1.8	Normal	1	1	$\pm$ 1.8	∞
Axial isotropy of the probe	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
Spherical isotropy of the probe	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
Boundary effects	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
Probe linearity	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
Detection limit	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
Modulation response	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
Readout electronics	$\pm$ 0.0	Normal	1	1	$\pm$ 0.0	∞
Response time	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
Integration time	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
RF ambient Noise	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
RF ambient Reflections	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
Probe Positioner	$\pm$ 0.4	Rectangular	$\sqrt{3}$	1	$\pm$ 0.2	∞
Probe positioning	$\pm$ 2.9	Rectangular	$\sqrt{3}$	1	$\pm$ 1.7	∞
Max.SAR Eval.	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
Test Sample Related						
Deviation of wxp.dipole	$\pm$ 0.0	Rectangular	$\sqrt{3}$	1	$\pm$ 0.0	∞
Dipole Axis to Liquid Distance	$\pm$ 2.0	Rectangular	$\sqrt{3}$	1	$\pm$ 1.2	∞
Input power and SAR drift meas.	$\pm$ 3.4	Rectangular	$\sqrt{3}$	1	$\pm$ 2.0	∞
Phantom and Setup						
Phantom uncertainty	$\pm$ 4.0	Rectangular	$\sqrt{3}$	1	$\pm$ 2.3	∞
Algorithm for correcting SAR for deviations in permittivity and conductivity	$\pm$ 1.9	Rectangular	$\sqrt{3}$	1	$\pm$ 1.1	∞
Liquid conductivity (meas.)	$\pm$ 5.0	Normal	1	0.78	+ 3.9	∞
Liquid permittivity (meas.)	$\pm$ 5.0	Normal	1	0.26	- 1.3	∞
Liquid conductivity - temp.unc (below 2deg.C.)	$\pm$ 1.7	Rectangular	$\sqrt{3}$	0.78	$\pm$ 0.8	∞
Liquid permittivity - temp.unc (below 2deg.C.)	$\pm$ 0.3	Rectangular	$\sqrt{3}$	0.23	$\pm$ 0.0	∞
Combined Standard Uncertainty						
					$\pm$ 5.945	
Expanded Uncertainty (k=2)						
					$\pm$ 11.9	

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999

Facsimile: +81 596 24 8124

<3 – 6GHz range Body>

Error Description	Uncertainty value $\pm$ %	Probability distribution	divisor	(ci) 1g	Standard (1g)	vi or veff
Measurement System						
Probe calibration	± 1.8	Normal	1	1	± 1.8	∞
Axial isotropy of the probe	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
Spherical isotropy of the probe	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
Boundary effects	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
Probe linearity	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
Detection limit	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
Modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
Readout electronics	± 0.0	Normal	1	1	± 0.0	∞
Response time	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
Integration time	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
RF ambient Noise	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
RF ambient Reflections	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	± 0.5	∞
Probe positioning	± 6.7	Rectangular	$\sqrt{3}$	1	± 3.9	∞
Max.SAR Eval.	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
Test Sample Related						
Deviation of wxp.dipole	± 0.0	Rectangular	$\sqrt{3}$	1	± 0.0	∞
Dipole Axis to Liquid Distance	± 2.0	Rectangular	$\sqrt{3}$	1	± 1.2	∞
Input power and SAR drift meas.	± 3.4	Rectangular	$\sqrt{3}$	1	± 2.0	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	$\sqrt{3}$	1	± 2.3	∞
Algorithm for correcting SAR for deviations in permittivity and conductivity	± 1.9	Rectangular	$\sqrt{3}$	1	± 1.1	∞
Liquid conductivity (meas.)	± 5.0	Normal	1	0.78	+ 3.9	∞
Liquid permittivity (meas.)	± 5.0	Normal	1	0.26	- 1.3	∞
Liquid conductivity - temp.unc (below 2deg.C.)	± 1.7	Rectangular	$\sqrt{3}$	0.78	± 0.8	∞
Liquid permittivity - temp.unc (below 2deg.C.)	± 0.3	Rectangular	$\sqrt{3}$	0.23	± 0.0	∞
Combined Standard Uncertainty						
					± 6.906	
Expanded Uncertainty (k=2)						
					± 13.8	