

FCC SAR Test Report

(Class II Permissive Change)

Product Name : 802.11a/b/g/n/ac RTL8822CE Combo module

Model No. : RTL8822CE

Applicant : Realtek Semiconductor Corp.

Address : No. 2, Innovation Road II, Hsinchu Science Park, Hsinchu 300, Taiwan

Date of Receipt : 2020/08/25

Issued Date : 2020/09/16

Report No. : 2080794R-E3082130002

Report Version : V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

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Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Test Report

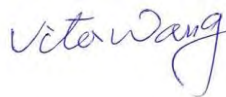
Issued Date: 2020/09/16

Report No.: 2080794R-E3082130002



Product Name : 802.11a/b/g/n/ac RTL8822CE Combo module
Applicant : Realtek Semiconductor Corp.
Address : No. 2, Innovation Road II, Hsinchu Science Park, Hsinchu 300,
Taiwan
Manufacturer : Realtek Semiconductor Corp.
Model No. : RTL8822CE
Trade Name : Realtek
FCC ID : TX2-RTL8822CE
Applicable Standard : IEEE 1528-2013
KDB 447498 D01 v06
KDB 865664 D01 V01r04
Measurement : 47CFR § 2.1093
procedures : KDB 248227 D01 v02r02
KDB 616217 D04 V01r02
Test Result : Max. SAR Measurement (1g)
2.4GHz: **1.108** W/kg
5 GHz: **1.083** W/kg
Application Type : Certification

The above equipment has been tested by DEKRA, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report.

Documented By : 
(Adm. Specialist / Vita Wang)

Tested By : 
(Senior Engineer / Vorana Chen)

Approved By : 
(Director / Vincent Lin)

TABLE OF CONTENTS

Description	Page
1. General Information	5
1.1 EUT Description	5
1.2 Antenna List	6
1.3 SAR Test Exclusion Calculation	7
1.4 Test Environment.....	13
2. SAR Measurement System	15
2.1 DASY5 System Description	15
2.1.1 Applications	16
2.1.2 Area Scans	16
2.1.3 Zoom Scan (Cube Scan Averaging)	16
2.1.4 Uncertainty of Inter-/Extrapolation and Averaging	16
2.2 DASY5 E-Field Probe	17
2.2.1 Isotropic E-Field Probe Specification	17
2.3 Boundary Detection Unit and Probe Mounting Device	18
2.4 DATA Acquisition Electronics (DAE) and Measurement Server	18
2.5 Robot.....	19
2.6 Light Beam Unit.....	19
2.7 Device Holder	20
2.8 SAM Twin Phantom.....	20
3. Tissue Simulating Liquid	21
3.1 The composition of the tissue simulating liquid.....	21
3.2 Tissue Calibration Result	21
3.3 Tissue Dielectric Parameters for Head and Body Phantoms	23
4. SAR Measurement Procedure	24
4.1 SAR System Check	24
4.1.1 Dipoles	24
4.1.2 System Check Result	24
4.2 SAR Measurement Procedure.....	26
5. SAR Exposure Limits	27
6. Test Equipment List	28
7. Measurement Uncertainty	29
8. Conducted Power Measurement (Including tolerance allowed for production unit).....	31
9. Test Results	36
9.1 SAR Test Results Summary	36
9.2 Simultaneous Transmission.....	39
9.2.1 Simultaneous transmission of MIMO in 802.11 test exclusion considerations	39
9.2.2 Simultaneous transmission of Wi-Fi and other wireless technologies	40
10. SAR measurement variability	41
Appendix	42
Appendix A. SAR System Check Data	
Appendix B. SAR measurement Data	
Appendix C. Test Setup Photographs & EUT Photographs	
Appendix D. Probe Calibration Data	
Appendix E. Dipole Calibration Data	

Revision History

Report No.	Version	Description	Issued Date
2080794R-E3082130002	V1.0	Initial issue of report.	2020-09-16

1. General Information

1.1 EUT Description

Product Name	802.11a/b/g/n/ac RTL8822CE Combo module				
Trade Name	Realtek				
Model No.	RTL8822CE				
FCC ID	TX2-RTL8822CE				
Frequency Range	802.11b/g/n/ac-20MHz: 2412-2472MHz 802.11n/ac-40MHz: 2422-2462MHz 802.11a/n/ac-20MHz: 5180-5320MHz, 5500-5720MHz, 5745-5825MHz 802.11n/ac-40/MHz: 5190-5310MHz, 5510-5710MHz, 5755-5795MHz 802.11ac-80MHz: 5210-5290MHz, 5530-5690MHz, 5775MHz BT: 1MHz, BLE: 2MHz				
Number of Channels	802.11b/g/n-20: 13, n-40MHz: 9 802.11a/n/ac-20: 25; 802.11n/ac-40: 12; 802.11ac-80MHz: 6 BT: 79 , BLE: 40				
Data Rate	802.11b: 1-11Mbps, 802.11a/g: 6-54Mbps, 802.11n: up to 300Mbps 802.11ac-80MHz: up to 866.7Mbps BT: 3Mbps, BLE: 1Mbps				
Channel Separation	802.11b/g/n/ac-20MHz: 5 MHz, 802.11a/n-20/ac-20MHz: 20MHz 802.11n-40/ac-40MHz: 40MHz, 802.11ac-80MHz: 80MHz BT : 1MHz , BLE : 2MHz				
Type of Modulation	802.11b: DSSS, DBPSK, DQPSK, CCK 802.11a/g/n/ac: OFDM, BPSK, QPSK, 16QAM, 64QAM, 256QAM FHSS: GFSK(1Mbps) / π /4DQPSK(2Mbps) / 8DPSK(3Mbps)				
Device Category	Portable				
RF Exposure Environment	Uncontrolled				
Summary of test result –Reported 1g SAR (W/Kg)					
Test configuration	DTS (Main)	DTS (Aux)	U-NII (Main)	U-NII (Aux)	DSS (BT)
Body-Standalone	0.867	1.108	1.054	1.083	0.132
Body-Simultaneous	DTS (Main + Aux)		U-NII (Main + Aux)		UNII Main + BT
	1.627 (SPLSR=0.013)		2.137(SPLSR=0.019)		1.186
When BT and WIFI transmitter does simultaneously transmitter, WIFI will transmit on Main and BT will transmit on Aux.					

Note: (1) This is to request a Class II permissive change for FCC ID: TX2-RTL8822CE, originally granted on 11/02/2018

The major change filed under this application is:

Change

#1: Additional Chassis added, ASUSTeK, model number: TP470E, J470E, R460E, SF470E.

Brand	Model No.	Difference
ASUS	TP470E	All models are electrically identical, different model names are for marketing purpose.
	J470E	
	R460E	
	SF470E	

The representative test sample is TP470E.

#2 Reduce Main and Aux Wi-Fi Output Power through the Gravity Sensor(G-sensor) and BIOS respectively , and SAR were evaluated accordingly (Bluetooth Output Power don't be changed).

#3 Add two antennas (INPAQ, AWAN) to WLAN module which have the same antenna's type (PIFA) with original grant, and each antenna gain is lower.

#4 Add 2 to 1 switch circuit to connect with Main port of WLAN Module for Aux 0 and Aux 1 antennas only one of the two antennas can be selected at the same time.

1.2 Antenna List

No.	Manufacturer	Part No.	ASUS Part No.	Antenna Type	Peak Gain
1	INPAQ (For:NB)	WA-F-LB-02-224(Main) WA-F-LB-01-088(Aux0) WA-F-LB-03-153(Aux1)	14008-04110000(Main) 14008-04110200(Aux0) 14008-04110100(Aux1)	PIFA	0.21dBi for 2.4GHz 1.15dBi for 5.15~5.25GHz 1.24dBi for 5.25~5.35GHz 1.44dBi for 5.47~5.725GHz 1.47dBi for 5.725~5.850GHz
2	INPAQ (For:PAD)	WA-F-LB-02-224(Main) WA-F-LB-01-088(Aux0) WA-F-LB-03-153(Aux1)	14008-04110000(Main) 14008-04110200(Aux0) 14008-04110100(Aux1)	PIFA	-1.18dBi for 2.4GHz 2.20dBi for 5.15~5.25GHz 1.45dBi for 5.25~5.35GHz 2.77dBi for 5.47~5.725GHz 2.91dBi for 5.725~5.850GHz
3	AWAN (For:NB)	AYF6Y-100023(Main) AYF6Y-100024(Aux0) AYF6Y-100126(Aux1)	14008-04110400(Main) 14008-04110500(Aux0) 14008-04110300(Aux1)	PIFA	-0.10dBi for 2.4GHz -1.11dBi for 5.15~5.25GHz -1.11dBi for 5.25~5.35GHz 1.29dBi for 5.47~5.725GHz 0.61dBi for 5.725~5.850GHz
4	AWAN (For:PAD)	AYF6Y-100023(Main) AYF6Y-100024(Aux0) AYF6Y-100126(Aux1)	14008-04110400(Main) 14008-04110500(Aux0) 14008-04110300(Aux1)	PIFA	-1.95dBi for 2.4GHz 0.80dBi for 5.15~5.25GHz 0.80dBi for 5.25~5.35GHz 1.53dBi for 5.47~5.725GHz 2.77dBi for 5.725~5.850GHz

Note:

(1) INPAQ antenna was tested and recorded in this report since it represents worst case gain.

(2) There are the same antenna only difference in Manufacturer.

(3) INPAQ (P/N: WA-F-LB-02-224) and ASUS (P/N: 14008-04110000) both antennas are identical.

INPAQ (P/N: WA-F-LB-01-088) and ASUS (P/N: 14008-04110200) both antennas are identical.

INPAQ (P/N: WA-F-LB-03-153) and ASUS (P/N: 14008-04110100) both antennas are identical.

AWAN (P/N: AYF6Y-100023) and ASUS (P/N: 14008-04110400) both antennas are identical.

AWAN (P/N: AYF6Y-100024) and ASUS (P/N: 14008-04110500) both antennas are identical.

AWAN (P/N: AYF6Y-100026) and ASUS (P/N: 14008-04110300) both antennas are identical.

1.3 SAR Test Exclusion Calculation

According to KDB Publication 447498 D01, section 4.3.1, per the calculations of item 1 ($\text{Power(mW)}/\text{separation (mm)} \times \sqrt{f(\text{GHz})} \leq 3.0$), SAR is required as shown in the table below where calculated values are greater than 3.0 :

According to KDB Publication 616217 D04, section 4.2.b), When between the antenna and user is more than 5mm, edge SAR is not required for NB mode.

NB Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna < 50mm from the user :

Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (≤ 3.0 SAR is not required)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Main	WiFi	2462	20	100	214	248	43	208	12	4	>50mm	>50mm	3.6	>50mm	13.1	31.4
Main	WiFi	5240	18	63	214	248	43	208	12	4	>50mm	>50mm	3.4	>50mm	12.0	28.9
Main	WiFi	5320	18	63	214	248	43	208	12	4	>50mm	>50mm	3.4	>50mm	12.1	29.1
Main	WiFi	5700	18	63	214	248	43	208	12	4	>50mm	>50mm	3.5	>50mm	12.6	30.1
Main	WiFi	5825	18	63	214	248	43	208	12	4	>50mm	>50mm	3.5	>50mm	12.7	30.5

NB Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna > 50mm from the user :

Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (SAR test exclusion power,mW)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Main	WiFi	2462	20	100	214	248	43	208	12	4	1735.6	2075.6	<50mm	1675.6	<50mm	<50mm
Main	WiFi	5240	18	63	214	248	43	208	12	4	1705.5	2045.5	<50mm	1645.5	<50mm	<50mm
Main	WiFi	5320	18	63	214	248	43	208	12	4	1705.0	2045.0	<50mm	1645.0	<50mm	<50mm
Main	WiFi	5700	18	63	214	248	43	208	12	4	1702.8	2042.8	<50mm	1642.8	<50mm	<50mm
Main	WiFi	5825	18	63	214	248	43	208	12	4	1702.2	2042.2	<50mm	1642.2	<50mm	<50mm

NB Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna < 50mm from the user :

Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (≤ 3.0 SAR is not required)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Aux0	WiFi	2462	20	100	214	49	242	208	12	4	>50mm	3.2	>50mm	>50mm	13.1	31.4
Aux0	WiFi	5240	18	63	214	49	242	208	12	4	>50mm	2.9	>50mm	>50mm	12.0	28.9
Aux0	WiFi	5320	18	63	214	49	242	208	12	4	>50mm	3.0	>50mm	>50mm	12.1	29.1
Aux0	WiFi	5700	18	63	214	49	242	208	12	4	>50mm	3.1	>50mm	>50mm	12.6	30.1
Aux0	WiFi	5825	18	63	214	49	242	208	12	4	>50mm	3.1	>50mm	>50mm	12.7	30.5
Aux0	BT	2480	6	4	214	49	242	208	12	4	>50mm	0.1	>50mm	>50mm	0.5	1.3

NB Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna > 50mm from the user :

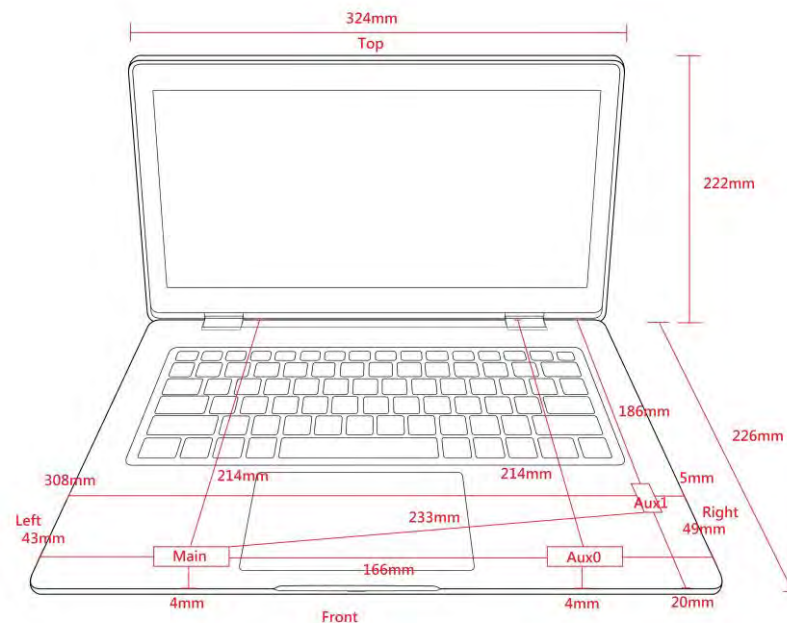
Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (SAR test exclusion power,mW)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Aux0	WiFi	2462	20	100	214	49	242	208	12	4	1735.6	<50mm	2015.6	1675.6	<50mm	<50mm
Aux0	WiFi	5240	18	63	214	49	242	208	12	4	1705.5	<50mm	1985.5	1645.5	<50mm	<50mm
Aux0	WiFi	5320	18	63	214	49	242	208	12	4	1705.0	<50mm	1985.0	1645.0	<50mm	<50mm
Aux0	WiFi	5700	18	63	214	49	242	208	12	4	1702.8	<50mm	1982.8	1642.8	<50mm	<50mm
Aux0	WiFi	5825	18	63	214	49	242	208	12	4	1702.2	<50mm	1982.2	1642.2	<50mm	<50mm
Aux0	BT	2480	6	4	214	49	242	208	12	4	1735.3	<50mm	2015.3	1675.3	<50mm	<50mm

NB Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna < 50mm from the user :

Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (≤ 3.0 SAR is not required)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Aux1	WiFi	2462	20	100	186	5	308	207	12	20	>50mm	31.4	>50mm	>50mm	13.1	7.8
Aux1	WiFi	5240	18	63	186	5	308	207	12	20	>50mm	28.9	>50mm	>50mm	12.0	7.2
Aux1	WiFi	5320	18	63	186	5	308	207	12	20	>50mm	29.1	>50mm	>50mm	12.1	7.3
Aux1	WiFi	5700	18	63	186	5	308	207	12	20	>50mm	30.1	>50mm	>50mm	12.6	7.5
Aux1	WiFi	5825	18	63	186	5	308	207	12	20	>50mm	30.5	>50mm	>50mm	12.7	7.6
Aux1	BT	2480	6	4	186	5	308	207	12	20	>50mm	1.3	>50mm	>50mm	0.5	0.3

NB Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna > 50mm from the user :

Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (SAR test exclusion power, mW)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Aux1	WiFi	2462	20	100	186	5	308	207	12	20	1455.6	<50mm	2675.6	1665.6	<50mm	<50mm
Aux1	WiFi	5240	18	63	186	5	308	207	12	20	1425.5	<50mm	2645.5	1635.5	<50mm	<50mm
Aux1	WiFi	5320	18	63	186	5	308	207	12	20	1425.0	<50mm	2645.0	1635.0	<50mm	<50mm
Aux1	WiFi	5700	18	63	186	5	308	207	12	20	1422.8	<50mm	2642.8	1632.8	<50mm	<50mm
Aux1	WiFi	5825	18	63	186	5	308	207	12	20	1422.2	<50mm	2642.2	1632.2	<50mm	<50mm
Aux1	BT	2480	6	4	186	5	308	207	12	20	1455.3	<50mm	2675.3	1665.3	<50mm	<50mm



PAD Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna < 50mm from the user :

Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (≤ 3.0 SAR is not required)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Main	WiFi	2462	14.5	28	2	248	43	4	207	12	8.8	>50mm	1.0	8.8	>50mm	3.7
Main	WiFi	5240	9.5	9	2	248	43	4	207	12	4.1	>50mm	0.5	4.1	>50mm	1.7
Main	WiFi	5320	9.5	9	2	248	43	4	207	12	4.1	>50mm	0.5	4.1	>50mm	1.7
Main	WiFi	5700	9.5	9	2	248	43	4	207	12	4.3	>50mm	0.5	4.3	>50mm	1.8
Main	WiFi	5825	9.5	9	2	248	43	4	207	12	4.3	>50mm	0.5	4.3	>50mm	1.8

PAD Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna > 50mm from the user :

Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (SAR test exclusion power,mW)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Main	WiFi	2462	14.5	28	2	248	43	4	207	12	<50mm	2075.6	<50mm	<50mm	1665.6	<50mm
Main	WiFi	5240	9.5	9	2	248	43	4	207	12	<50mm	2045.5	<50mm	<50mm	1635.5	<50mm
Main	WiFi	5320	9.5	9	2	248	43	4	207	12	<50mm	2045.0	<50mm	<50mm	1635.0	<50mm
Main	WiFi	5700	9.5	9	2	248	43	4	207	12	<50mm	2042.8	<50mm	<50mm	1632.8	<50mm
Main	WiFi	5825	9.5	9	2	248	43	4	207	12	<50mm	2042.2	<50mm	<50mm	1632.2	<50mm

PAD Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna < 50mm from the user :

Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (≤ 3.0 SAR is not required)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Aux0	WiFi	2462	14.5	28	2	49	242	4	207	12	8.8	0.9	>50mm	8.8	>50mm	3.7
Aux0	WiFi	5240	9.5	9	2	49	242	4	207	12	4.1	0.4	>50mm	4.1	>50mm	1.7
Aux0	WiFi	5320	9.5	9	2	49	242	4	207	12	4.1	0.4	>50mm	4.1	>50mm	1.7
Aux0	WiFi	5700	9.5	9	2	49	242	4	207	12	4.3	0.4	>50mm	4.3	>50mm	1.8
Aux0	WiFi	5825	9.5	9	2	49	242	4	207	12	4.3	0.4	>50mm	4.3	>50mm	1.8
Aux0	BT	2480	6	4	2	49	242	4	207	12	1.3	0.1	>50mm	1.3	>50mm	0.5

PAD Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna > 50mm from the user :

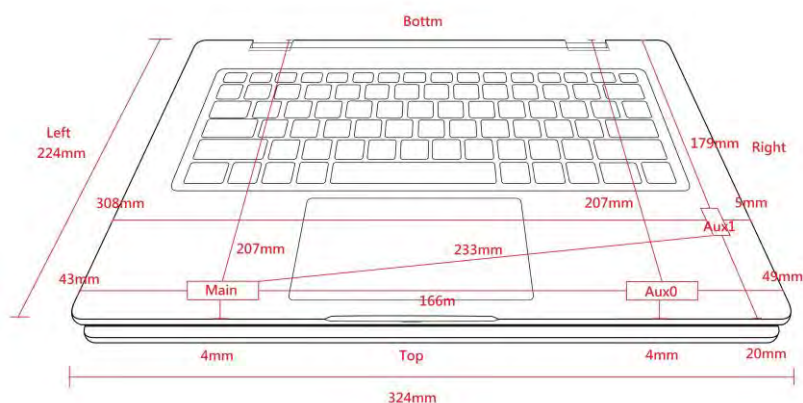
Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (SAR test exclusion power,mW)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Aux0	WiFi	2462	14.5	28	2	49	242	4	207	12	<50mm	<50mm	2015.6	<50mm	1665.6	<50mm
Aux0	WiFi	5240	9.5	9	2	49	242	4	207	12	<50mm	<50mm	1985.5	<50mm	1635.5	<50mm
Aux0	WiFi	5320	9.5	9	2	49	242	4	207	12	<50mm	<50mm	1985.0	<50mm	1635.0	<50mm
Aux0	WiFi	5700	9.5	9	2	49	242	4	207	12	<50mm	<50mm	1982.8	<50mm	1632.8	<50mm
Aux0	WiFi	5825	9.5	9	2	49	242	4	207	12	<50mm	<50mm	1982.2	<50mm	1632.2	<50mm
Aux0	BT	2480	6	4	2	49	242	4	207	12	<50mm	<50mm	2015.3	<50mm	1665.3	<50mm

PAD Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna < 50mm from the user :

Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (≤ 3.0 SAR is not required)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Aux1	WiFi	2462	14.5	28	2	5	308	20	179	17	8.8	8.8	>50mm	2.2	>50mm	2.6
Aux1	WiFi	5240	9.5	9	2	5	308	20	179	17	4.1	4.1	>50mm	1.0	>50mm	1.2
Aux1	WiFi	5320	9.5	9	2	5	308	20	179	17	4.1	4.1	>50mm	1.0	>50mm	1.2
Aux1	WiFi	5700	9.5	9	2	5	308	20	179	17	4.3	4.3	>50mm	1.1	>50mm	1.3
Aux1	WiFi	5825	9.5	9	2	5	308	20	179	17	4.3	4.3	>50mm	1.1	>50mm	1.3
Aux1	BT	2480	6	4	2	5	308	20	179	17	1.3	1.3	>50mm	0.3	>50mm	0.4

PAD Mode SAR exclusion calculations for WiFi-SISO and Bluetooth for antenna > 50mm from the user :

Antenna	Tx	Frequency (MHz)	Output Power		Separation distances (mm)						Calculated Threshold Value (SAR test exclusion power,mW)					
			dBm	mW	Back	Right	Left	Top	Bottom	Front	Back	Right	Left	Top	Bottom	Front
Aux1	WiFi	2462	14.5	28	2	5	308	20	179	17	<50mm	<50mm	2675.6	<50mm	1385.6	<50mm
Aux1	WiFi	5240	9.5	9	2	5	308	20	179	17	<50mm	<50mm	2645.5	<50mm	1355.5	<50mm
Aux1	WiFi	5320	9.5	9	2	5	308	20	179	17	<50mm	<50mm	2645.0	<50mm	1355.0	<50mm
Aux1	WiFi	5700	9.5	9	2	5	308	20	179	17	<50mm	<50mm	2642.8	<50mm	1352.8	<50mm
Aux1	WiFi	5825	9.5	9	2	5	308	20	179	17	<50mm	<50mm	2642.2	<50mm	1352.2	<50mm
Aux1	BT	2480	6	4	2	5	308	20	179	17	<50mm	<50mm	2675.3	<50mm	1385.3	<50mm



1.4 Test Environment

Ambient conditions in the laboratory:

Test Date: Sep. 03, 2020

Items	Required	Actual
Temperature (°C)	18-25	22.9 ± 2
Humidity (%RH)	30-70	51

Test Date: Sep. 05, 2020

Items	Required	Actual
Temperature (°C)	18-25	22.9 ± 2
Humidity (%RH)	30-70	52

USA : FCC Registration Number: TW3023
Canada : IC Registration Number: 4075A

Site Description : Accredited by TAF
Accredited Number: 3023

Test Laboratory : DEKRA Testing and Certification Co., Ltd
Address : No.5-22, Ruishukeng, Linkou Dist.,
New Taipei City 24451, Taiwan, R.O.C.
Phone number : 886-2-8601-3788
Fax number : 886-2-8601-3789
Email address : info.tw@dekra.com
Website : <http://www.dekra.com.tw>

1.5 Hall Effect and Gravity Sensor Evaluation Procedure

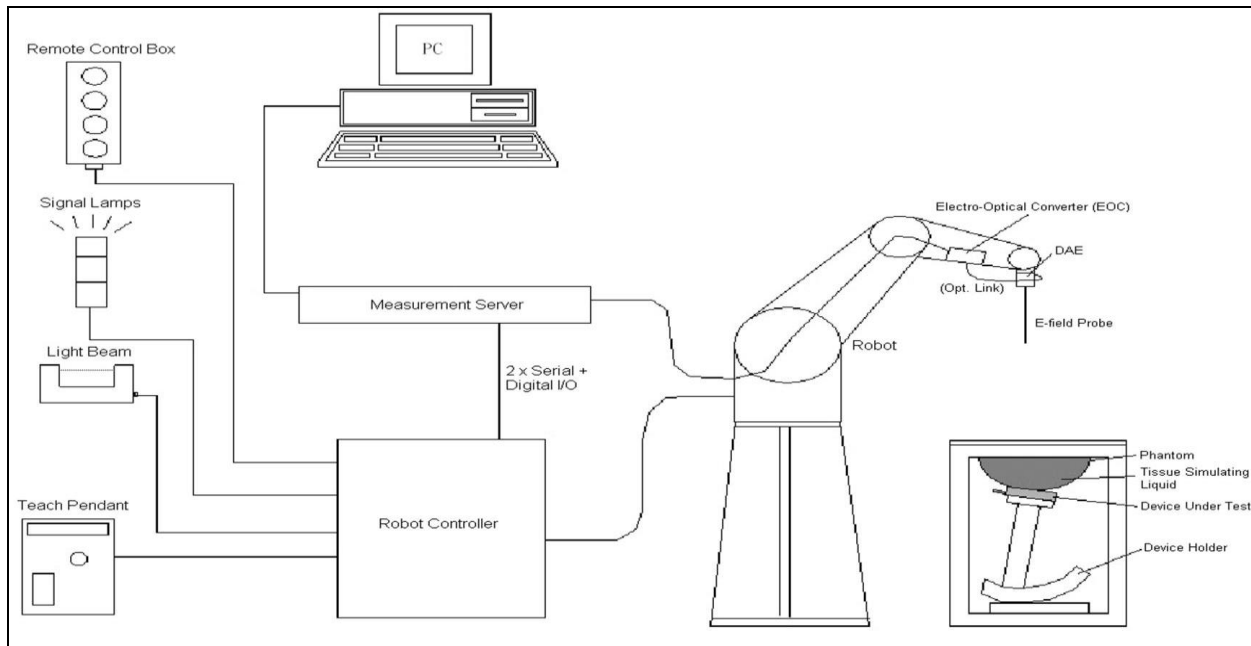
The test procedure is according to the document (2019-11-13-4.1 RF_Exposure JN) that presented on November 2019 TCBC workshop.

The following guidance should be applied to laptops/tablets that use Hall Effect or gravity sensors to detect lid angle for the purpose of power reduction:

1. With the lid is in closed mode (0 degrees), open the screen in 10 degree steps until laptop mode is obtained
2. Lower the screen 5 degrees. Closed mode should be re-obtained. If not, keep lowering in 5 degree steps.
3. Open the screen in 1 degree steps until laptop mode is re-obtained
4. Continue opening the screen in 1 degree steps until at least 5 degrees past where laptop mode was obtained
5. Then continue opening the screen in 10 degree steps until tablet mode is obtained
6. Power measurements should be taken at each step
7. Reverse this procedure going from tablet mode back down to closed mode
8. Related verification results please refer to OPDes file.

2. SAR Measurement System

2.1 DASY5 System Description



The DASY5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A data acquisition electronics (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 from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

2.1.1 Applications

Predefined procedures and evaluations for automated compliance testing with all worldwide standards, e.g., IEEE 1528, OET 65, IEC 62209-1, IEC 62209-2, EN 50360, EN 50383 and others.

2.1.2 Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 10mm² step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2013, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan).

2.1.3 Zoom Scan (Cube Scan Averaging)

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. A density of 1000 kg/m³ is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1 g cube is 10mm, with the side length of the 10 g cube 21,5mm.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications (including FCC) utilize a physical step of 5x5x7 (8mmx8mmx5mm) providing a volume of 32mm in the X & Y axis, and 30mm in the Z axis.

2.1.4 Uncertainty of Inter-/Extrapolation and Averaging

In order to evaluate the uncertainty of the interpolation, extrapolation and averaged SAR calculation algorithms of the Postprocessor, DASY5 allows the generation of measurement grids which are artificially predefined by analytically based test functions. Therefore, the grids of area scans and zoom scans can be filled with uncertainty test data, according to the SAR benchmark functions of IEEE 1528. The three analytical functions shown in equations as below are used to describe the possible range of the expected SAR distributions for the tested

handsets. The field gradients are covered by the spatially flat distribution f1, the spatially steep distribution f3 and f2 accounts for H-field cancellation on the phantom/tissue surface.

$$f_1(x, y, z) = Ae^{-\frac{z}{a}} \cos^2 \left(\frac{\pi}{2} \frac{\sqrt{x'^2 + y'^2}}{5a} \right)$$

$$f_2(x, y, z) = Ae^{-\frac{z}{a}} \frac{a^2}{a^2 + x'^2} \left(3 - e^{-\frac{2z}{a}} \right) \cos^2 \left(\frac{\pi}{2} \frac{y'}{3a} \right)$$

$$f_3(x, y, z) = A \frac{a^2}{\frac{a^2}{4} + x'^2 + y'^2} \left(e^{-\frac{2z}{a}} + \frac{a^2}{2(a + 2z)^2} \right)$$

2.2 DASY5 E-Field Probe

The SAR measurement is conducted with the dosimetric probe manufactured by SPEAG. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN 62209-1, IEC 62209, etc.) under ISO 17025. The calibration data are in Appendix D.

2.2.1 Isotropic E-Field Probe Specification

Model	Ex3DV4	
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
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 to probe axis)	
Dynamic Range	10 μ W/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μ W/g)	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

2.3 Boundary Detection Unit and Probe Mounting Device

The DASY probes use a precise connector and an additional holder for the probe, consisting of a plastic tube and a flexible silicon ring to center the probe. The connector at the DAE is flexibly mounted and held in the default position with magnets and springs. Two switching systems in the connector mount detect frontal and lateral probe collisions and trigger the necessary software response.



2.4 DATA Acquisition Electronics (DAE) and Measurement Server

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The input impedance of the DAE4 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.



The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chipdisk and 128MB RAM. The necessary circuits for communication with the DAE electronics box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY5 I/O board, which is directly connected to the PC/104 bus of the CPU board.



2.5 Robot

The DASY5 system uses the high precision robots TX90 XL type out of the newer series from Stäubli SA (France). For the 6-axis controller DASY5 system, the CS8C robot controller version from Stäubli is used.

The XL robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller



2.6 Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.

The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.



2.7 Device Holder

The DASY5 device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR).

Thus the device needs no repositioning when changing the angles.

The DASY5 device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon_r = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.



2.8 SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:

- Left head
- Right head
- Flat phantom



The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

3. Tissue Simulating Liquid

3.1 The composition of the tissue simulating liquid

INGREDIENT (% Weight)	2450MHz Head	5200MHz Head	5800MHz Head
Water	46.7	67.63	68.29
Salt	0.00	0.00	0.00
Sugar	0.00	0.00	0.00
HEC	0.00	0.00	0.00
Preventol	0.00	0.00	0.00
DGBE	53.3	3.38	2.44
Triton X-100	0.00	28.99	29.27

3.2 Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using APREL Dielectric Probe Kit and Agilent E5071C Vector Network Analyzer.

Head Tissue Simulate Measurement				
Frequency [MHz]	Description	Dielectric Parameters		Tissue Temp. [°C]
		ϵ_r	σ [s/m]	
2450 MHz	Reference result ± 5% window	39.2 37.24 to 41.16	1.8 1.71 to 1.89	N/A
	05-Sep-20	39.86	1.84	21.8
2412 MHz	Low channel	39.97	1.79	21.8
2437 MHz	Mid channel	39.90	1.82	21.8
2480 MHz	High channel	39.76	1.88	21.8

Head Tissue Simulate Measurement				
Frequency [MHz]	Description	Dielectric Parameters		Tissue Temp. [°C]
		ϵ_r	σ [s/m]	
5250MHz	Reference result ± 5% window	35.95 34.15 to 37.75	4.71 4.47 to 4.95	N/A
	03-Sep-20	35.76	4.71	21.9
5230 MHz	Low channel	35.82	4.69	21.9
5270 MHz	Mid channel	35.71	4.74	21.9
5290 MHz	High channel	35.65	4.77	21.9

Head Tissue Simulate Measurement				
Frequency [MHz]	Description	Dielectric Parameters		Tissue Temp. [°C]
		ϵ_r	σ [s/m]	
5600MHz	Reference result $\pm 5\%$ window	35.5 33.73 to 37.28	5.07 4.82 to 5.32	N/A
	03-Sep-20	34.80	5.19	21.9
5530 MHz	Low channel	34.99	5.10	21.9
5610 MHz	Mid channel	34.77	5.20	21.9
5690 MHz	High channel	34.56	5.31	21.9

Head Tissue Simulate Measurement				
Frequency [MHz]	Description	Dielectric Parameters		Tissue Temp. [°C]
		ϵ_r	σ [s/m]	
5800MHz	Reference result $\pm 5\%$ window	35.3 33.54 to 37.07	5.27 5.01 to 5.53	N/A
	03-Sep-20	34.25	5.45	21.9
5755 MHz	Channel 151	34.37	5.39	21.9
5775 MHz	Channel 155	34.32	5.41	21.9

3.3 Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEC 62209-1 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head tissue parameters that have not been specified are interpolated according to the head parameters specified in IEC 62209-1

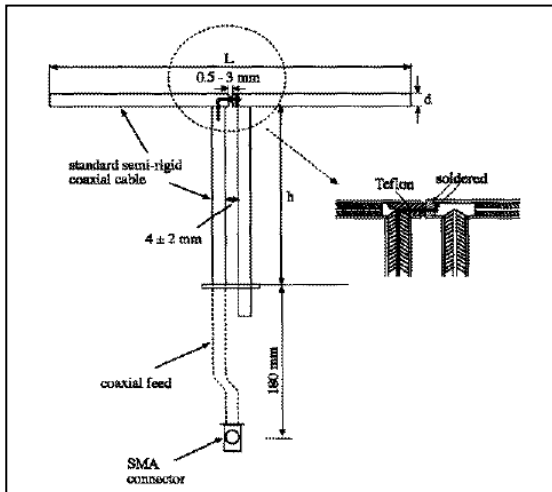
Target Frequency	Head	
(MHz)	ϵ_r	σ (S/m)
300	45.3	0.87
450	43.5	0.87
750	41.9	0.89
835	41.5	0.90
900	41.5	0.97
1450	40.5	1.20
1640	40.2	1.31
1750	40.1	1.37
1800 – 2000	40.0	1.40
2450	39.2	1.80
3000	38.5	2.40
5000	36.2	4.45
5200	36.0	4.66
5400	35.8	4.86
5600	35.3	5.27
5800	35.3	5.27
6000	35.1	5.48

(ϵ_r = relative permittivity, σ = conductivity and $\rho = 1000 \text{ kg/m}^3$)

4. SAR Measurement Procedure

4.1 SAR System Check

4.1.1 Dipoles



The dipoles used is based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of both IEEE and FCC Supplement C. the table below provides details for the mechanical and electrical specifications for the dipoles.

Frequency	L (mm)	h (mm)	d (mm)
2450MHz	51.5	30.4	3.6
5200M~5800MHz	20.6	40.3	3.6

4.1.2 System Check Result

System Performance Check at 2450MHz Dipole Kit: D2450V2				
Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
2450 MHz	Reference result ± 10% window	53.1 47.79 to 58.41	24.6 22.14 to 27.06	N/A
	05-Sep-20	51.6	23.8	21.8
Note: (1) The power level is used 250mW (2) All SAR values are normalized to 1W forward power. (3) The reference result is from Appendix E.				

System Performance Check at 5250MHz**Dipole Kit: D5GHzV2**

Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
5250 MHz	Reference result ± 10% window	81.6 73.44 to 89.76	23.2 20.88 to 25.52	N/A
	03-Sep-20	77.5	22.1	21.9

Note: (1) The power level is used 100mW
 (2) All SAR values are normalized to 1W forward power.
 (3) The reference result is from Appendix E.

System Performance Check at 5600MHz**Dipole Kit: D5GHzV2**

Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
5600 MHz	Reference result ± 10% window	85.9 77.31 to 94.49	24.2 21.78 to 26.62	N/A
	03-Sep-20	84.3	23.7	21.9

Note: (1) The power level is used 100mW
 (2) All SAR values are normalized to 1W forward power.
 (3) The reference result is from Appendix E.

System Performance Check at 5800MHz**Dipole Kit: D5GHzV2**

Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
5800 MHz	Reference result ± 10% window	82.0 73.80 to 90.20	22.8 20.52 to 25.08	N/A
	03-Sep-20	82.1	22.4	21.9

Note: (1) The power level is used 100mW
 (2) All SAR values are normalized to 1W forward power.
 (3) The reference result is from Appendix E.

4.2 SAR Measurement Procedure

The Dasy5 calculates SAR using the following equation,

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

σ : represents the simulated tissue conductivity

ρ : represents the tissue density

The EUT is set to transmit at the required power in line with product specification, at each frequency relating to the LOW, MID, and HIGH channel settings.

Pre-scans are made on the device to establish the location for the transmitting antenna, using a large area scan in either air or tissue simulation fluid.

The EUT is placed against the Universal Phantom where the maximum area scan dimensions are larger than the physical size of the resonating antenna. When the scan size is not large enough to cover the peak SAR distribution, it is modified by either extending the area scan size in both the X and Y directions, or the device is shifted within the predefined area.

The area scan is then run to establish the peak SAR location (interpolated resolution set at 1mm^2) which is then used to orient the center of the zoom scan. The zoom scan is then executed and the 1g and 10g averages are derived from the zoom scan volume (interpolated resolution set at 1mm^3).

5. SAR Exposure Limits

SAR assessments have been made in line with the requirements of IEEE-1528, FCC Supplement C, and comply with ANSI/IEEE C95.1-1992 “Uncontrolled Environments” limits. These limits apply to a location which is deemed as “Uncontrolled Environment” which can be described as a situation where the general public may be exposed to an RF source with no prior knowledge or control over their exposure.

Limits for General Population/Uncontrolled Exposure (W/kg)

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (1g cube tissue for brain or body)	1.60 W/kg
Spatial Average SAR (whole body)	0.08 W/kg
Spatial Peak SAR (10g for hands, feet, ankles and wrist)	4.00 W/kg

6. Test Equipment List

Instrument	Manufacturer	Model No.	Serial No.	Last Calibration	Next Calibration
Stäubli Robot TX60L	Stäubli	TX60L	F09/5BL1A1/A06	2009/05/18	only once
Controller	Speag	CS8c	N/A	2009/05/18	only once
Reference Dipole 2450MHz	Speag	D2450V2	930	2019/11/21	2022/11/20
Reference Dipole 5GHz	Speag	D5GHzV2	1041	2020/05/25	2023/05/24
SAM Twin Phantom	Speag	QD000 P40 CA	Tp 1515	N/A	N/A
Device Holder	Speag	N/A	N/A	N/A	N/A
Data Acquisition Electronic	Speag	DAE4	1207	2019/11/14	2020/11/13
E-Field Probe	Speag	EX3DV4	3698	2019/11/22	2020/11/21
SAR Software	Speag	DASY52	V52.10.0.1446	N/A	N/A
Apriel Dipole Spaccer	Apriel	ALS-DS-U	QTK-295	N/A	N/A
Power Amplifier	Mini-Circuit	ZHL-42	D051404-20	N/A	N/A
Directional Coupler	Agilent	87300C	MY44300353	N/A	N/A ¹
Attenuator	Woken	WATT-218FS-10	N/A	N/A	N/A ¹
Attenuator	Mini-Circuit	BW-S20W2+	N/A	N/A	N/A ¹
Vector Network	Agilent	E5071C	MY46106342	2019/09/09	2020/09/08
Signal Generator	Anritsu	N5182B	MY53050685	2020/06/28	2021/06/27
Power Meter	Anritsu	ML2487A	6K00001447	2019/10/24	2020/10/23
Wide Bandwidth Sensor	Anritsu	MA2411B	1339194	2019/10/24	2020/10/23

Note: System Check, the path loss measured by the network analyzer, includes the signal generator, amplifier, cable, attenuator and directional coupler.

7. Measurement Uncertainty

DASY5 Uncertainty (According to IEEE 1528-2013) Measurement uncertainty for 30 MHz to 3 GHz								
Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(vi) V _{eff}
Measurement System								
Probe Calibration	±6%	N	1	1	1	±6.0%	±6.0%	∞
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Modulation Response	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max. SAR Eval.	±4.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Power Scaling	±0%	R	$\sqrt{3}$	1	1	±0.0%	±0.0%	
Phantom and Setup								
Phantom Uncertainty	±6.1%	R	$\sqrt{3}$	1	1	±3.5%	±3.5%	∞
SAR correction	±1.9%	R	$\sqrt{3}$	1	0.84	±1.1%	±0.9%	∞
Liquid Conductivity (meas.)	±2.5%	R	$\sqrt{3}$	0.78	0.71	±1.1%	±1.0%	∞
Liquid Permittivity (meas.)	±2.5%	R	$\sqrt{3}$	0.26	0.26	±0.3%	±0.4%	∞
Temp. unc. - Conductivity	±3.4%	R	$\sqrt{3}$	0.78	0.71	±1.5%	±1.4%	∞
Temp. unc. - Permittivity	±0.4%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%	∞
Combined Std. Uncertainty						±11.2%	±11.1%	361
Expanded STD Uncertainty						±22.3%	±22.2%	

DASY5 Uncertainty (According to IEEE 1528-2013) Measurement uncertainty for 3GHz to 6 GHz								
Error Description	Uncert. value	Prob. Dist.	Div.	(c _i) 1g	(c _i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v _i) V _{eff}
Measurement System								
Probe Calibration	±6.55%	N	1	1	1	±6.55%	±6.55%	∞
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Modulation Response	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Probe Positioning	±6.7%	R	$\sqrt{3}$	1	1	±3.9%	±3.9%	∞
Post-processing	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Power Scaling	±0%	R	$\sqrt{3}$	1	1	±0.0%	±0.0%	
Phantom and Setup								
Phantom Uncertainty	±6.6%	R	$\sqrt{3}$	1	1	±3.8%	±3.8%	∞
SAR correction	±1.9%	R	$\sqrt{3}$	1	1	±1.1%	±0.9%	∞
Liquid Conductivity (meas.)	±2.5%	R	$\sqrt{3}$	1	0.84	±1.1%	±1.0%	∞
Liquid Permittivity (meas.)	±2.5%	R	$\sqrt{3}$	0.26	0.26	±0.3%	±0.4%	∞
Temp. unc. - Conductivity	±3.4%	R	$\sqrt{3}$	0.78	0.71	±1.5%	±1.4%	∞
Temp. unc. - Permittivity	±0.4%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%	∞
Combined Std. Uncertainty						±12.3%	±12.2%	748
Expanded STD Uncertainty						±24.6%	±24.5%	

8. Conducted Power Measurement (Including tolerance allowed for production unit)

WLAN 2.4G 2TX SISO (NB)

	Frequency	Mode	BW	SISO-Main(TX1)				SISO-Aux(TX2)			
				CH	PK Power	AV Power	AV Target	CH	PK Power	AV Power	AV Target
DSSS/OFDM mode specified maximum output power at an antenna port	WLAN 2.4GHz	b	20	1	20.80	18.76	19	1	20.86	18.91	19
				2	20.75	18.72	19	2	20.71	18.77	19
				3	22.02	19.98	20	3	21.91	19.89	20
				6	21.95	19.99	20	6	22.03	19.99	20
				9	21.86	19.86	20	9	21.77	19.79	20
				10	20.68	18.77	19	10	20.63	18.72	19
				11	20.92	18.91	19	11	20.84	18.88	19
				12	16.00	13.96	14	12	16.00	13.98	14
				13	12.57	10.49	10.5	13	12.66	10.49	10.5
		g	20	1	24.00	13.86	14	1	24.32	13.94	14
				6	28.27	19.90	20	6	27.33	19.85	20
				11	23.86	13.89	14	11	24.30	13.97	14
				12	20.86	10.70	11	12	21.22	10.80	11
				13	18.04	7.99	8	13	18.42	7.81	8
		n(HT)	20	1	23.11	13.81	14	1	23.25	13.88	14
				6	28.08	19.92	20	6	27.28	19.90	20
				11	23.06	13.95	14	11	23.37	13.85	14
				12	20.08	10.87	11	12	20.26	10.89	11
				13	17.03	7.95	8	13	17.18	7.75	8
			40	3	22.83	13.33	13.5	3	23.00	13.37	13.5
				6	26.04	16.97	17	6	26.27	16.98	17
				9	23.25	13.88	14	9	23.46	13.99	14
				10	20.27	10.87	11	10	20.58	10.85	11
				11	17.13	7.93	8	11	17.78	7.98	8

WLAN 5G 2TX SISO (NB)

OFDM mode specified maximum output power at an antenna port	Frequency	Mode	BW	SISO-Main(TX1)			SISO-Aux(TX2)			Frequency	Mode	BW	SISO-Main(TX1)			SISO-Aux(TX2)			
				CH	AV Power	AV Target	CH	AV Power	AV Target				CH	AV Power	AV Target	CH	AV Power	AV Target	
U-NII-1 (5150~5250MHz)	a	20	36	17.83	18	36	17.90	18	U-NII-2A (5250~5350MHz)	a	20	52	17.92	18	52	17.93	18		
			40	17.89	18	40	17.81	18				56	17.75	18	56	17.89	18		
			44	17.91	18	44	17.91	18				60	17.93	18	60	17.90	18		
			48	17.93	18	48	17.85	18				64	17.72	18	64	17.91	18		
	n(HT)	20	36	17.85	18	36	17.81	18		n(HT)	20	52	17.93	18	52	17.91	18		
			40	17.83	18	40	17.87	18				56	17.91	18	56	17.92	18		
			44	17.86	18	44	17.88	18				60	17.90	18	60	17.82	18		
			48	17.92	18	48	17.89	18				64	17.89	18	64	17.86	18		
		40	38	16.84	17	38	16.81	17			40	54	17.96	18	54	17.95	18		
			46	17.93	18	46	17.94	18				62	16.33	16.5	62	16.30	16.5		
	ac	80	42	15.43	15.5	42	15.40	15.5		ac	80	58	14.98	15	58	14.96	15		
	U-NII-1 + U-NII-2A																		
	U-NII-2C (5470~5650MHz)	a	20	100	17.86	18	100	17.93	18	5.65 GHz & U-NII-3 (5725~5850MHz)	a	20	132	17.91	18	132	17.87	18	
				112	17.87	18	112	17.89	18				149	17.85	18	149	17.91	18	
116				17.83	18	116	17.85	18	165				17.84	18	165	17.90	18		
128				17.88	18	128	17.93	18	132				17.93	18	132	17.91	18		
n(HT)		20	100	17.92	18	100	17.92	18	n(HT)		20	149	17.80	18	149	17.90	18		
			112	17.81	18	112	17.93	18				165	17.83	18	165	17.90	18		
			116	17.90	18	116	17.85	18				134	17.87	18	134	17.86	18		
			128	17.91	18	128	17.84	18				151	17.95	18	151	17.85	18		
		40	102	15.43	15.5	102	15.39	15.5			40	159	17.77	18	159	17.80	18		
			110	17.77	18	110	17.90	18				20	144	16.96	17	144	17.35	17.5	
			118	17.87	18	118	17.86	18				40	142	17.91	18	142	17.88	18	
			126	17.83	18	126	17.92	18				80	138	17.90	18	138	17.75	18	
ac		80	106	14.31	14.5	106	14.49	14.5	ac	80	155	17.40	17.5	155	17.25	17.5			
			122	17.92	18	122	17.83	18											

WLAN 2.4G 2TX SISO (PAD)

	Frequency	Mode	BW	SISO-Main(TX1)				SISO-Aux(TX2)			
				CH	PK Power	AV Power	AV Target	CH	PK Power	AV Power	AV Target
DSSS/OFDM mode specified maximum output power at an antenna port	WLAN 2.4GHz	b	20	1	16.45	14.41	14.5	1	16.51	14.47	14.5
				6	16.54	14.49	14.5	6	16.57	14.49	14.5
				11	16.34	14.35	14.5	11	16.50	14.48	14.5
				12	16.00	13.96	14	12	16.00	13.98	14
				13	12.57	10.49	10.5	13	12.66	10.49	10.5
		g	20	1	24.00	13.86	14	1	24.32	13.94	14
				6	24.43	14.42	14.5	6	25.02	14.45	14.5
				11	23.86	13.89	14	11	24.30	13.97	14
				12	20.86	10.70	11	12	21.22	10.80	11
				13	18.04	7.99	8	13	18.42	7.81	8
		n(HT)	20	1	23.11	13.81	14	1	23.25	13.88	14
				6	23.50	14.31	14.5	6	23.77	14.43	14.5
				11	23.06	13.95	14	11	23.37	13.85	14
				12	20.08	10.87	11	12	20.26	10.89	11
				13	17.03	7.95	8	13	17.18	7.75	8
			40	3	22.83	13.33	13.5	3	23.00	13.37	13.5
				6	23.81	14.41	14.5	6	23.93	14.34	14.5
				9	23.25	13.88	14	9	23.46	13.99	14
				10	20.27	10.87	11	10	20.58	10.85	11
				11	17.13	7.93	8	11	17.78	7.98	8

WLAN 5G 2TX SISO (PAD)

OFDM mode specified maximum output power at an antenna port	Frequency	Mode	BW	SISO-Main(TX1)			SISO-Aux(TX2)			Frequency	Mode	BW	SISO-Main(TX1)			SISO-Aux(TX2)		
				CH	AV	AV	CH	AV	AV				CH	AV	AV			
					Power	Target		Power	Target					Power	Target	Power	Target	
U-NII-1 (5150~5250MHz)	a	20	36	9.42	9.5	36	9.35	9.5	U-NII-2A (5250~5350MHz)	a	20	52	9.29	9.5	52	9.35	9.5	
			40	9.29	9.5	40	9.42	9.5				56	9.33	9.5	56	9.23	9.5	
			44	9.36	9.5	44	9.45	9.5				60	9.38	9.5	60	9.44	9.5	
			48	9.31	9.5	48	9.33	9.5				64	9.31	9.5	64	9.34	9.5	
	n(HT)	20	36	9.43	9.5	36	9.31	9.5		n(HT)	20	52	9.40	9.5	52	9.36	9.5	
			40	9.39	9.5	40	9.35	9.5				56	9.37	9.5	56	9.37	9.5	
			44	9.32	9.5	44	9.41	9.5				60	9.35	9.5	60	9.28	9.5	
			48	9.38	9.5	48	9.40	9.5				64	9.33	9.5	64	9.38	9.5	
		40	38	9.44	9.5	38	9.41	9.5			40	54	9.43	9.5	54	9.40	9.5	
			46	9.38	9.5	46	9.45	9.5				62	9.45	9.5	62	9.30	9.5	
	ac	80	42	9.47	9.5	42	9.32	9.5		ac	80	58	9.48	9.5	58	9.49	9.5	
	U-NII-1 + U-NII-2A																	
	U-NII-2C (5470~5650MHz)	a	20	100	9.25	9.5	100	9.27	9.5	5.65 GHz & U-NII-3 (5725~5850MHz)	a	20	132	9.40	9.5	132	9.32	9.5
				112	9.36	9.5	112	9.45	9.5				149	9.42	9.5	149	9.34	9.5
				116	9.21	9.5	116	9.43	9.5				165	9.39	9.5	165	9.45	9.5
				128	9.41	9.5	128	9.35	9.5				132	9.40	9.5	132	9.23	9.5
n(HT)		20	100	9.26	9.5	100	9.37	9.5	n(HT)		20	149	9.42	9.5	149	9.45	9.5	
			112	9.38	9.5	112	9.34	9.5				165	9.44	9.5	165	9.27	9.5	
			116	9.31	9.5	116	9.25	9.5				134	9.34	9.5	134	9.43	9.5	
			128	9.36	9.5	128	9.32	9.5				151	9.42	9.5	151	9.34	9.5	
		40	102	9.37	9.5	102	9.37	9.5			40	159	9.36	9.5	159	9.36	9.5	
			110	9.40	9.5	110	9.28	9.5				20	144	9.35	9.5	144	9.27	9.5
			118	9.42	9.5	118	9.27	9.5				40	142	9.41	9.5	142	9.36	9.5
			126	9.28	9.5	126	9.35	9.5				80	138	9.26	9.5	138	9.13	9.5
ac		80	106	9.49	9.5	106	9.36	9.5	ac		80	155	9.36	9.5	155	8.99	9.5	
			122	9.25	9.5	122	9.24	9.5										

BT Only Support Aux (NB/PAD)

Bluetooth mode maximum output power	Frequency	Mode	Modulation	SISO-Main(TX1)				SISO-Aux(TX2)			
				CH	PK Power	AV Power	AV Target	CH	PK Power	AV Power	AV Target
Bluetooth mode maximum output power	BT 2.4GHz	BR	GFSK	0	N/A	N/A	N/A	0	4.76	3.19	6.00
				39	N/A	N/A	N/A	39	4.57	3.01	6.00
				78	N/A	N/A	N/A	78	5.03	3.78	6.00
		EDR	8DPSK	0	N/A	N/A	N/A	0	6.89	2.91	6.00
				39	N/A	N/A	N/A	39	6.27	2.37	6.00
				78	N/A	N/A	N/A	78	6.98	3.22	6.00
		BLE	GFSK	0	N/A	N/A	N/A	0	4.87	2.89	6.00
				19	N/A	N/A	N/A	19	4.41	2.32	6.00
				39	N/A	N/A	N/A	39	5.11	3.06	6.00

9. Test Results

9.1 SAR Test Results Summary

SAR MEASUREMENT									
Liquid Temperature (°C) : 22.1 ±2					Relative Humidity (%): 52				
Ambient Temperature (°C) : 22.9 ±2					Depth of Liquid (cm):>15				
Test Position Body	Antenna Position	Dist (mm)	Frequency		Conducted Power (dBm)		SAR 1g (W/kg)		Limit (W/kg)
			Channel	MHz	Measurement	Tune-up Limit	Measurement	Tune-up Scaled	
Test Mode: 802.11b – INPAQ Main Antenna									
Bottom(NB)	Fixed	0	3	2422	19.98	20	0.575	0.578	1.6
Bottom(NB)	Fixed	0	6	2437	19.99	20	0.865	0.867	1.6
Bottom(NB)	Fixed	0	9	2452	19.86	20	0.719	0.743	1.6
Back(PAD)	Fixed	0	6	2437	14.49	14.5	0.516	0.517	1.6
Top(PAD)	Fixed	0	6	2437	14.49	14.5	0.332	0.333	1.6
Test Mode: 802.11b – INPAQ Aux0 Antenna									
Bottom(NB)	Fixed	0	6	2437	19.99	20	0.758	0.760	1.6
Back(PAD)	Fixed	0	1	2412	14.47	14.5	1.100	1.108	1.6
Back(PAD)	Fixed	0	6	2437	14.49	14.5	1.040	1.042	1.6
Back(PAD)	Fixed	0	11	2462	14.48	14.5	0.989	0.994	1.6
Top(PAD)	Fixed	0	6	2437	14.49	14.5	0.163	0.163	1.6
Test Mode: 802.11b – INPAQ Aux1 Antenna									
Bottom(NB)	Fixed	0	6	2437	19.99	20	0.095	0.095	1.6
Back(PAD)	Fixed	0	6	2437	14.49	14.5	0.426	0.427	1.6
Right-Side(PAD)	Fixed	0	6	2437	14.49	14.5	0.032	0.032	1.6
Test Mode: 802.11b - AWAN Main Antenna									
Bottom(NB)	Fixed	0	6	2437	19.91	20	0.521	0.532	1.6
Test Mode: 802.11b - AWAN Aux0 Antenna									
Back(PAD)	Fixed	0	1	2412	14.41	14.5	0.947	0.967	1.6
Test Mode: BT - 1M - INPAQ Aux0 Antenna									
Back(PAD)	Fixed	0	78	2480	3.78	6	0.079	0.132	1.6
Note : 1. 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, SAR is not required. 2. When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.									

SAR MEASUREMENT									
Liquid Temperature (°C) : 21.9 ±2					Relative Humidity (%): 51				
Ambient Temperature (°C) : 22.9 ±2					Depth of Liquid (cm):>15				
Test Position Body	Antenna Position	Dist (mm)	Frequency		Conducted Power (dBm)		SAR 1g (W/kg)		Limit (W/kg)
			Channel	MHz	Measurement	Tune-up Limit	Measurement	Tune-up Scaled	
Test Mode: 802.11n40M – INPAQ Main Antenna									
Bottom(NB)	Fixed	0	46	5230	17.93	18	1.030	1.047	1.6
Bottom(NB)	Fixed	0	54	5270	17.96	18	0.809	0.816	1.6
Bottom(NB)	Fixed	0	151	5755	17.95	18	0.790	0.799	1.6
Test Mode: 802.11ac80M – INPAQ Main Antenna									
Bottom(NB)	Fixed	0	122	5610	17.92	18	0.621	0.633	1.6
Back(PAD)	Fixed	0	58	5290	9.48	9.5	0.687	0.690	1.6
Back(PAD)	Fixed	0	106	5530	9.49	9.5	0.837	0.839	1.6
Back(PAD)	Fixed	0	122	5610	9.25	9.5	0.702	0.744	1.6
Back(PAD)	Fixed	0	138	5690	9.26	9.5	0.997	1.054	1.6
Back(PAD)	Fixed	0	155	5775	9.36	9.5	0.884	0.913	1.6
Top(PAD)	Fixed	0	58	5290	9.48	9.5	0.170	0.171	1.6
Top(PAD)	Fixed	0	106	5530	9.49	9.5	0.275	0.276	1.6
Top(PAD)	Fixed	0	155	5775	9.36	9.5	0.298	0.308	1.6
Test Mode: 802.11n40M – INPAQ Aux0 Antenna									
Bottom(NB)	Fixed	0	54	5270	17.95	18	0.691	0.699	1.6
Bottom(NB)	Fixed	0	151	5755	17.85	18	0.600	0.621	1.6
Test Mode: 802.11ac80M – INPAQ Aux0 Antenna									
Bottom(NB)	Fixed	0	122	5610	17.83	18	0.448	0.466	1.6
Back(PAD)	Fixed	0	58	5290	9.49	9.5	0.633	0.634	1.6
Back(PAD)	Fixed	0	106	5530	9.36	9.5	0.795	0.821	1.6
Back(PAD)	Fixed	0	122	5610	9.24	9.5	0.715	0.759	1.6
Back(PAD)	Fixed	0	138	5690	9.13	9.5	0.995	1.083	1.6
Back(PAD)	Fixed	0	155	5775	8.99	9.5	0.759	0.854	1.6
Top(PAD)	Fixed	0	58	5290	9.49	9.5	0.258	0.259	1.6
Top(PAD)	Fixed	0	106	5530	9.36	9.5	0.239	0.247	1.6
Top(PAD)	Fixed	0	155	5775	8.99	9.5	0.188	0.211	1.6

Test Mode: 802.11n40M – INPAQ Aux1 Antenna									
Bottom(NB)	Fixed	0	54	5270	17.95	18	0.287	0.290	1.6
Bottom(NB)	Fixed	0	151	5755	17.85	18	0.273	0.283	1.6
Test Mode: 802.11ac80M – INPAQ Aux1 Antenna									
Bottom(NB)	Fixed	0	122	5530	17.83	18	0.263	0.273	1.6
Back(PAD)	Fixed	0	58	5290	9.49	9.5	0.418	0.419	1.6
Back(PAD)	Fixed	0	106	5530	9.36	9.5	0.532	0.549	1.6
Back(PAD)	Fixed	0	155	5775	8.99	9.5	0.392	0.441	1.6
Right-Side(PAD)	Fixed	0	58	5290	9.49	9.5	0.057	0.057	1.6
Right-Side(PAD)	Fixed	0	106	5530	9.36	9.5	0.058	0.060	1.6
Right-Side(PAD)	Fixed	0	155	5775	8.99	9.5	0.054	0.061	1.6
Test Mode: 802.11ac80M – AWAN Main Antenna									
Back(PAD)	Fixed	0	138	5690	9.49	9.5	0.776	0.778	1.6
Test Mode: 802.11ac80M – AWAN Aux0 Antenna									
Back(PAD)	Fixed	0	138	5690	9.45	9.5	0.785	0.794	1.6
Note : 1. When multiple transmission modes (802.11 n) 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 2. When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required in that exposure configuration. 3. When the reported SAR of the highest measured maximum U-NII-2A for the exposure configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.									

9.2 Simultaneous Transmission

Simultaneous Transmission Configurations	
1	WLAN 2.4GHz Main + WLAN 2.4GHz Aux
2	WLAN 2.4GHz Main + BT Aux
3	WLAN 5GHz Main + BT Aux
4	WLAN 5GHz Main + WLAN 5GHz Aux

9.2.1 Simultaneous transmission of MIMO in 802.11 test exclusion considerations

Frequency (GHz)	Test Position (Body)	WLAN Main SAR (W/Kg)	WLAN Aux0 SAR W/Kg)	Simultaneous Transmission (W/Kg)	Antenna pair in mm	Peak location separation ratio
2.4	Bottom(NB)	0.867	0.760	1.627	166	0.013
2.4	Back(PAD)	0.517	1.108	1.625	166	0.012
2.4	Top(PAD)	0.333	0.163	0.496	N/A	N/A
5	Bottom(NB)	1.047	0.699	1.746	166	0.014
5	Back(PAD)	1.054	1.083	2.137	166	0.019
5	Top(PAD)	0.308	0.259	0.567	N/A	N/A

Frequency (GHz)	Test Position (Body)	WLAN Main SAR (W/Kg)	WLAN Aux1 SAR W/Kg)	Simultaneous Transmission (W/Kg)	Antenna pair in mm	Peak location separation ratio
2.4	Bottom(NB)	0.867	0.095	0.962	N/A	N/A
2.4	Back(PAD)	0.517	0.427	0.944	N/A	N/A
2.4	Top(PAD)	0.333	0.032	0.365	N/A	N/A
5	Bottom(NB)	1.047	0.290	1.337	N/A	N/A
5	Back(PAD)	1.054	0.549	1.603	233	0.009
5	Top(PAD)	0.308	0.061	0.369	N/A	N/A

Note : The sum of value is less than 1.6W/Kg or the ratio is determined by $(SAR1 + SAR2)^{1.5}/R_i$, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for SAR test exclusion.

9.2.2 Simultaneous transmission of Wi-Fi and other wireless technologies

When the sum of SAR is larger than the limit, The ratio is determined by $(SAR1 + SAR2)^{1.5/R_i}$, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion. The estimation result as below:

For DTS Band:

Mode	WLAN Main SAR (W/Kg)	BT SAR (W/Kg)	Simultaneous Transmission (W/Kg)	Antenna pair in mm	Peak location separation ratio
Bottom(NB)	0.867	0.132	0.999	N/A	N/A
Back(PAD)	0.517	0.132	0.649	N/A	N/A

The sum of value is less than 1.6W/Kg, thus simultaneous SAR testing is not needed.

For U-NII Band:

Mode	WLAN Main SAR (W/Kg)	BT SAR (W/Kg)	Simultaneous Transmission (W/Kg)	Antenna pair in mm	Peak location separation ratio
Bottom(NB)	1.047	0.132	1.179	N/A	N/A
Back(PAD)	1.054	0.132	1.186	N/A	N/A

The sum of value is less than 1.6W/Kg, thus simultaneous SAR testing is not needed.

10. SAR measurement variability

- 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 .

Frequency		SAR 1g (W/kg)						
Channel	MHz	Original	First Repeated		Second Repeated		Third Repeated	
			Value	Ratio	Value	Ratio	Value	Ratio
1	2412	1.100	1.080	1.019	N/A	N/A	N/A	N/A
138	5690	0.997	0.946	1.054	N/A	N/A	N/A	N/A

Appendix

Appendix A. SAR System Check Data

Appendix B. SAR measurement Data

Appendix C. Test Setup Photographs & EUT Photographs

Appendix D. Probe Calibration Data

Appendix E. Dipole Calibration Data

Appendix A. SAR System Check Data

Test Laboratory: DEKRA

Date/Time: 2020/09/05

System Performance Check_2450MHz-Head

DUT: Dipole 2450 MHz; Type: D2450V2

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

Communication System PAR: 0 dB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.84$ S/m; $\epsilon_r = 39.86$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASYS2, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Configuration/2450MHz_Body/Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 15.7 W/kg

Configuration/2450MHz_Body/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

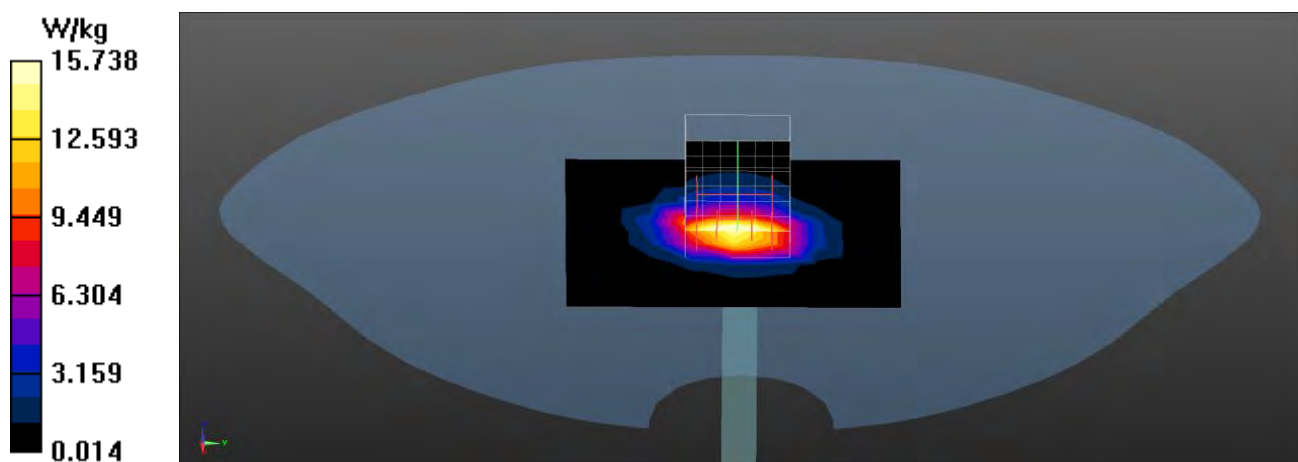
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.4 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 25.4 W/kg

SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.95 W/kg

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



Test Laboratory: DEKRA

Date/Time: 2020/09/03

System Performance Check_5250MHz-Head**DUT: Dipole 5GHz; Type: D5GHzV2**

Communication System: UID 0, CW; Frequency: 5250 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.71$ S/m; $\epsilon_r = 35.76$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 21.9

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(4.73, 4.73, 4.73); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with right table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Configuration/5250MHz_Body/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 15.1 W/kg

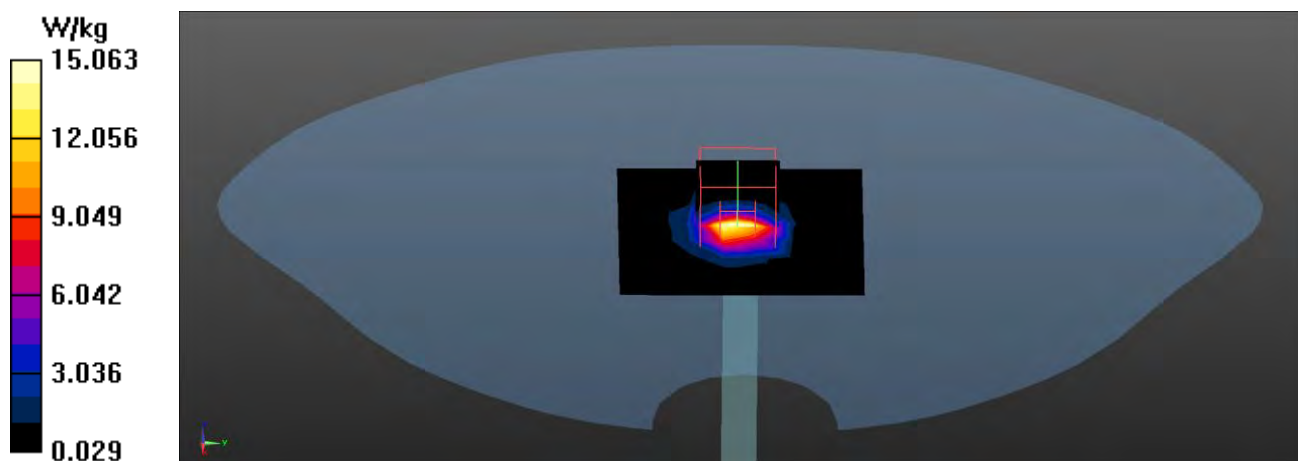
Configuration/5250MHz_Body/Zoom Scan (7x7x12), dist=1.4mm**(7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 68.70 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 26.3 W/kg

SAR(1 g) = 7.75 W/kg; SAR(10 g) = 2.21 W/kg

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



Test Laboratory: DEKRA

Date/Time: 2020/09/03

System Performance Check_5600MHz-Head**DUT: Dipole 5GHz; Type: D5GHzV2**

Communication System: UID 0, CW; Frequency: 5600 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 5600$ MHz; $\sigma = 5.19$ S/m; $\epsilon_r = 34.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 21.9

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(4.43, 4.43, 4.43); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with right table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Configuration/5600MHz_Body/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 13.2 W/kg

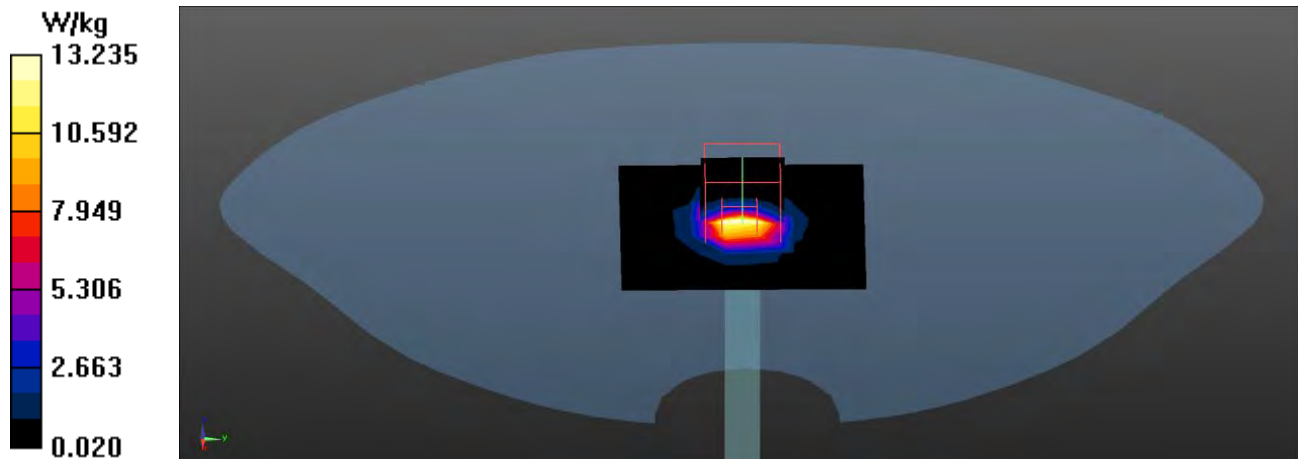
Configuration/5600MHz_Body/Zoom Scan (7x7x12), dist=1.4mm (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 69.61 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 31.1 W/kg

SAR(1 g) = 8.43 W/kg; SAR(10 g) = 2.37 W/kg

Maximum value of SAR (measured) = 19.7 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/03

System Performance Check_5800MHz-Head**DUT: Dipole 5GHz; Type: D5GHzV2**

Communication System: UID 0, CW; Frequency: 5800 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.45$ S/m; $\epsilon_r = 34.25$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 21.9

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(4.6, 4.6, 4.6); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with right table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Configuration/5800MHz_Body/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 12.4 W/kg

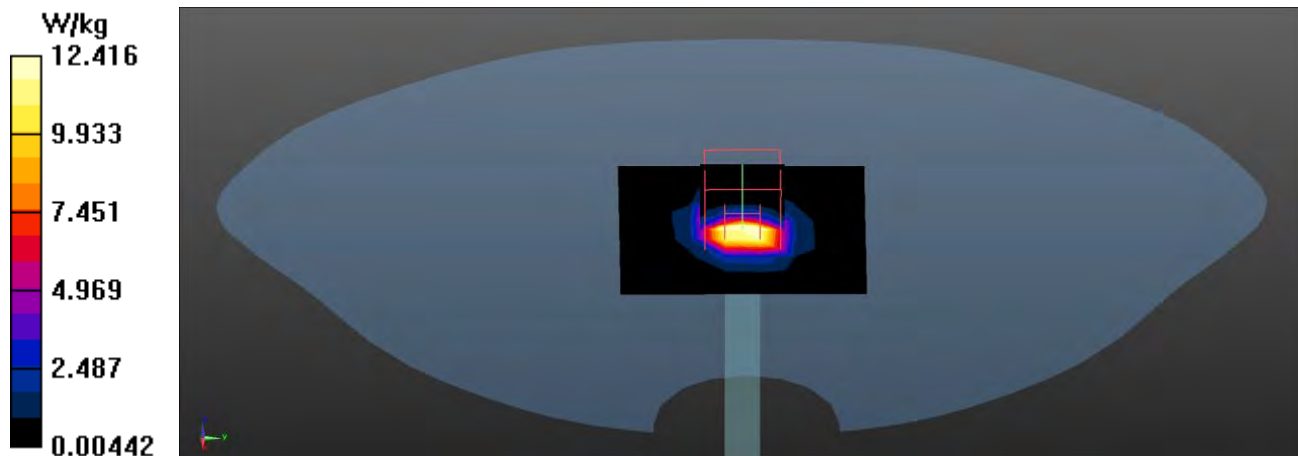
Configuration/5800MHz_Body/Zoom Scan (7x7x12), dist=1.4mm (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 71.39 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 33.9 W/kg

SAR(1 g) = 8.21 W/kg; SAR(10 g) = 2.24 W/kg

Maximum value of SAR (measured) = 20.9 W/kg



Appendix B. SAR measurement Data

Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_3-Bottom(NB) Main-INPAQ

DUT: VivoBook/ ASUS Laptop; Type: TP470E

Communication System: UID 0, WLAN 2.4G; Frequency: 2422 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2422$ MHz; $\sigma = 1.8$ S/m; $\epsilon_r = 39.94$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASYS2, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Configuration/Body/Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.882 W/kg

Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid:

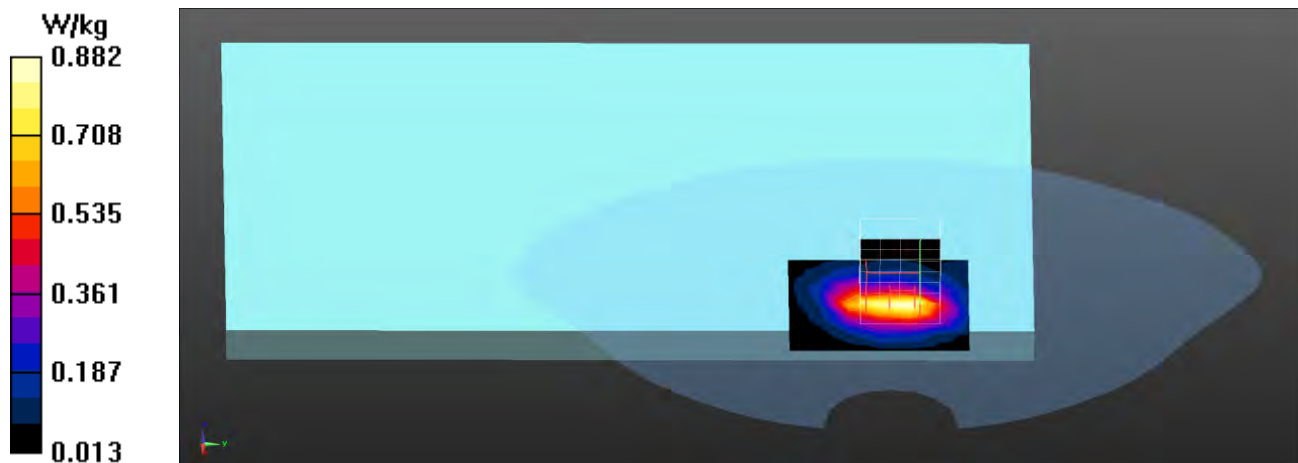
dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.06 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.13 W/kg

SAR(1 g) = 0.575 W/kg; SAR(10 g) = 0.312 W/kg

Maximum value of SAR (measured) = 0.879 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_6-Bottom(NB) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2437 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

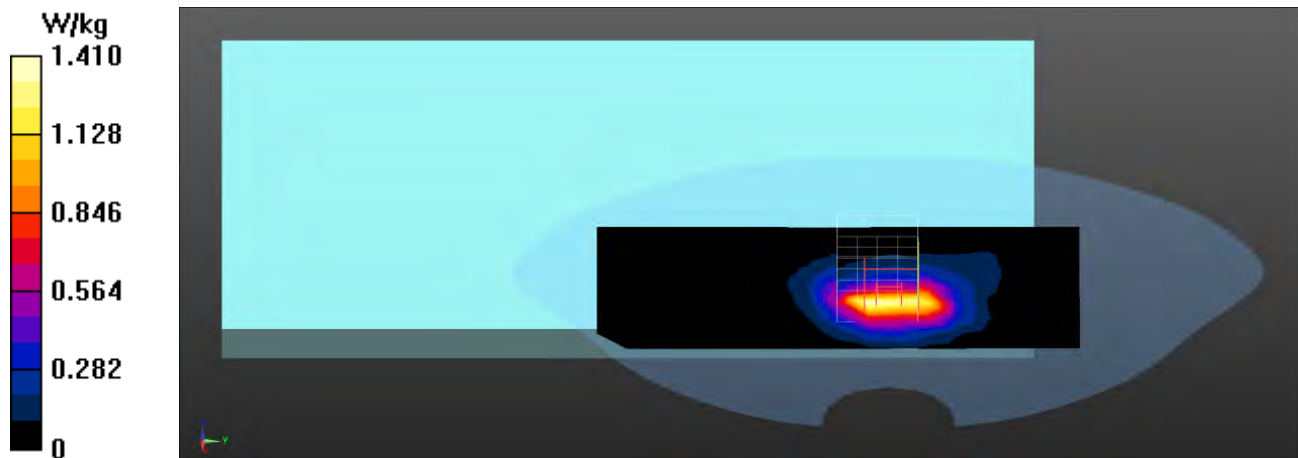
Configuration/Body/Area Scan (9x17x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 1.41 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 25.01 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 1.70 W/kg

SAR(1 g) = 0.865 W/kg; SAR(10 g) = 0.473 W/kg

Maximum value of SAR (measured) = 1.37 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_9-Bottom(NB) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2452 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2452$ MHz; $\sigma = 1.85$ S/m; $\epsilon_r = 39.85$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

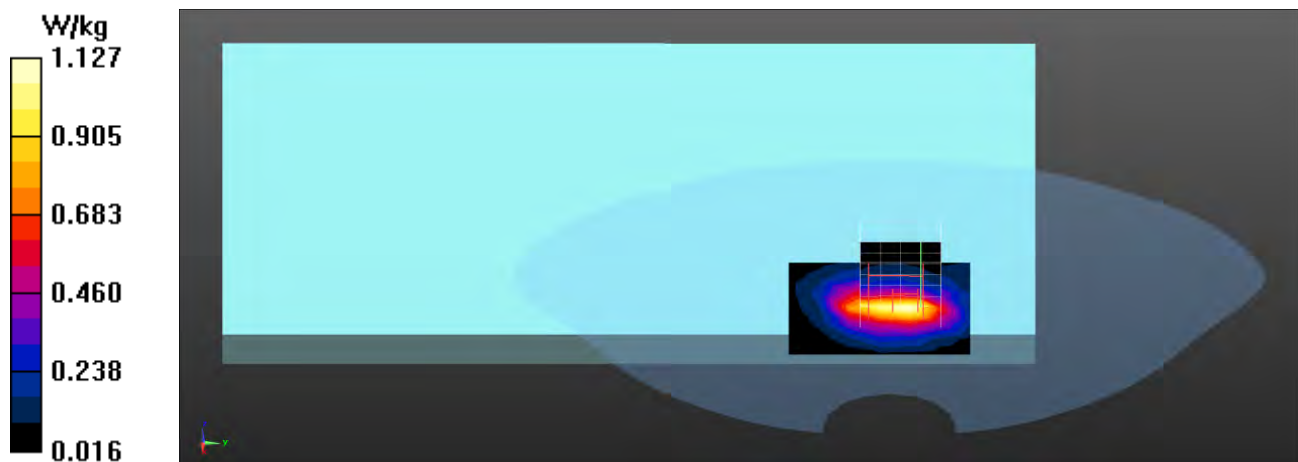
Configuration/Body/Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 1.13 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 20.89 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 1.48 W/kg

SAR(1 g) = 0.719 W/kg; SAR(10 g) = 0.385 W/kg

Maximum value of SAR (measured) = 1.14 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_6-Back(PAD) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2437 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

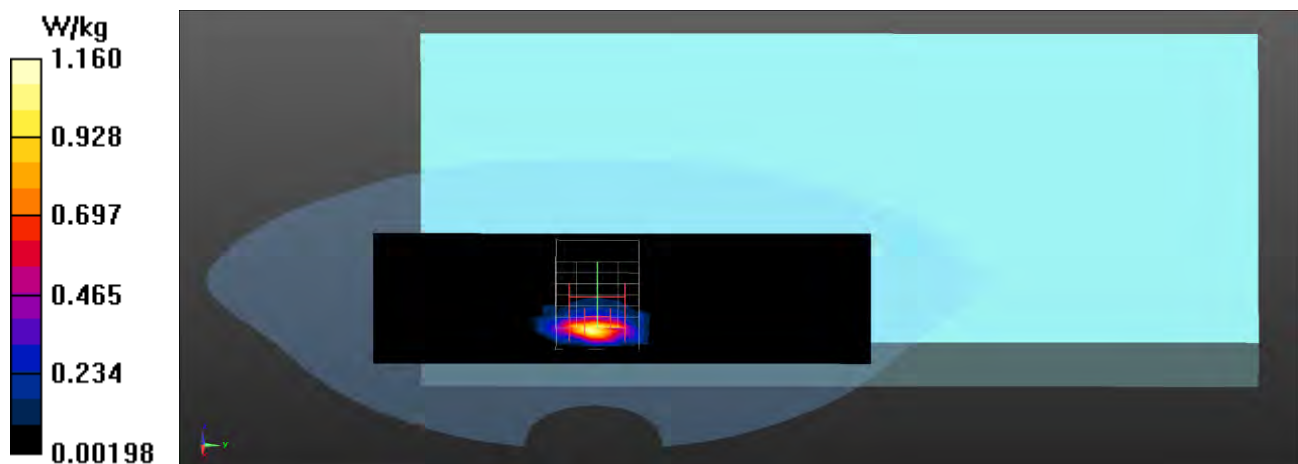
Configuration/Body/Area Scan (9x17x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 1.16 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 7.111 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 1.47 W/kg

SAR(1 g) = 0.516 W/kg; SAR(10 g) = 0.194 W/kg

Maximum value of SAR (measured) = 1.09 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_6-Top(PAD) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2437 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

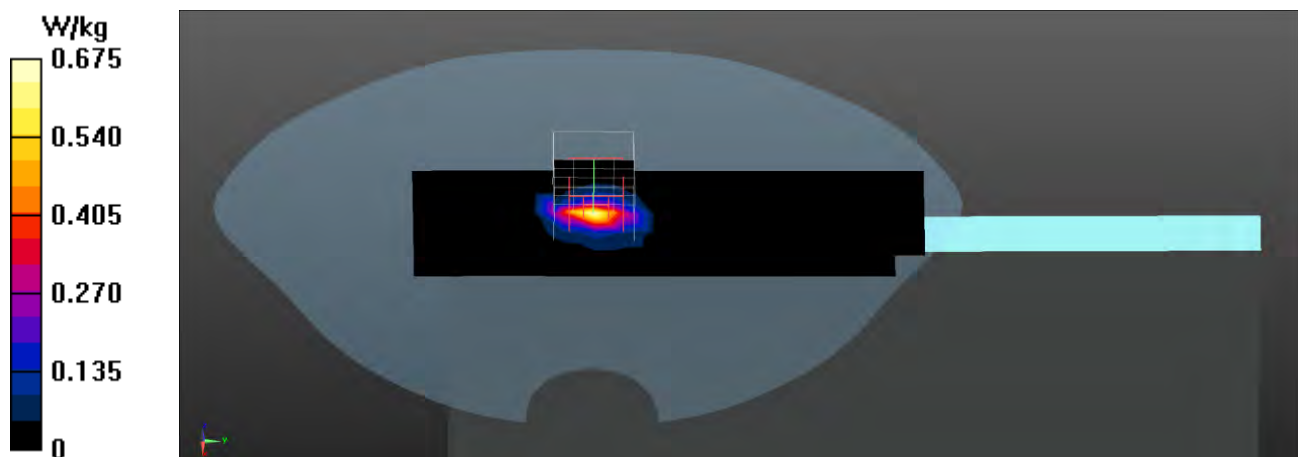
Configuration/Body/Area Scan (6x18x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.675 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.549 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 0.864 W/kg

SAR(1 g) = 0.332 W/kg; SAR(10 g) = 0.128 W/kg

Maximum value of SAR (measured) = 0.669 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_6-Bottom(NB) Aux0-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2437 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

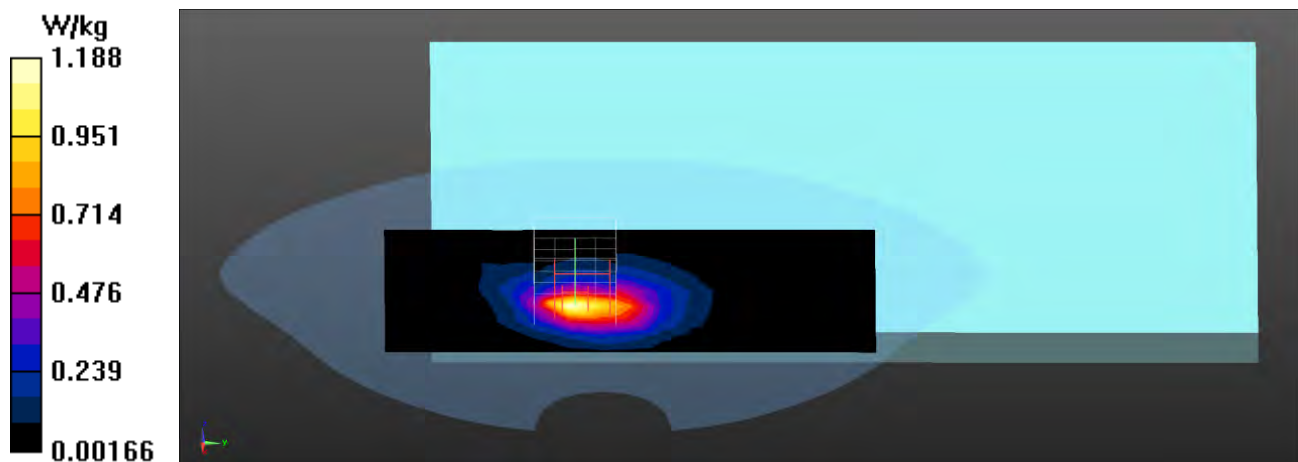
Configuration/Body/Area Scan (9x17x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 1.19 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.96 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 1.45 W/kg

SAR(1 g) = 0.758 W/kg; SAR(10 g) = 0.388 W/kg

Maximum value of SAR (measured) = 1.20 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_1-Back(PAD) Aux0-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2412 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.79$ S/m; $\epsilon_r = 39.97$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

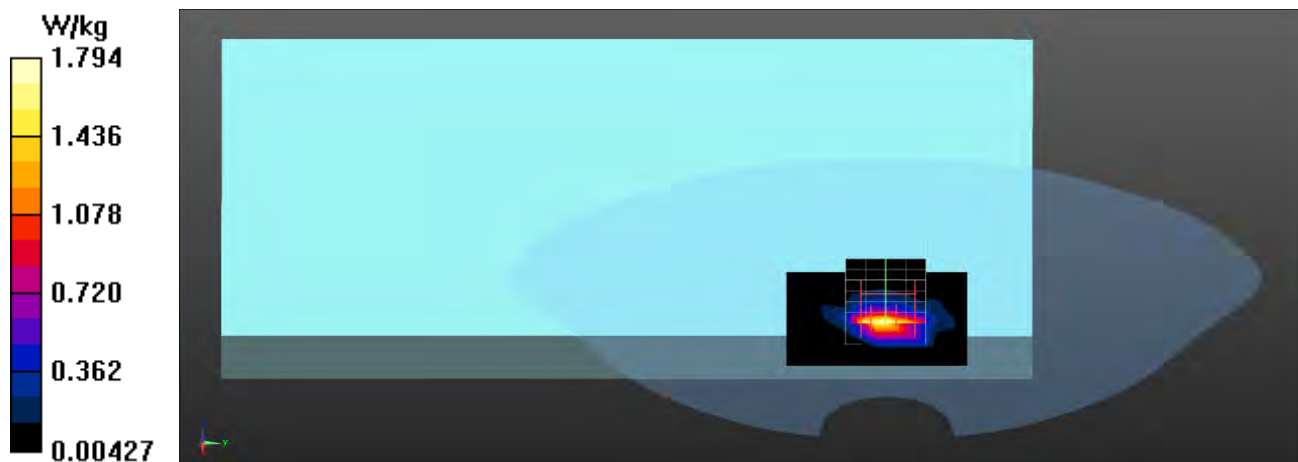
Configuration/Body/Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 1.79 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.098 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 2.69 W/kg

SAR(1 g) = 1.1 W/kg; SAR(10 g) = 0.424 W/kg

Maximum value of SAR (measured) = 1.96 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_6-Back(PAD) Aux0-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2437 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

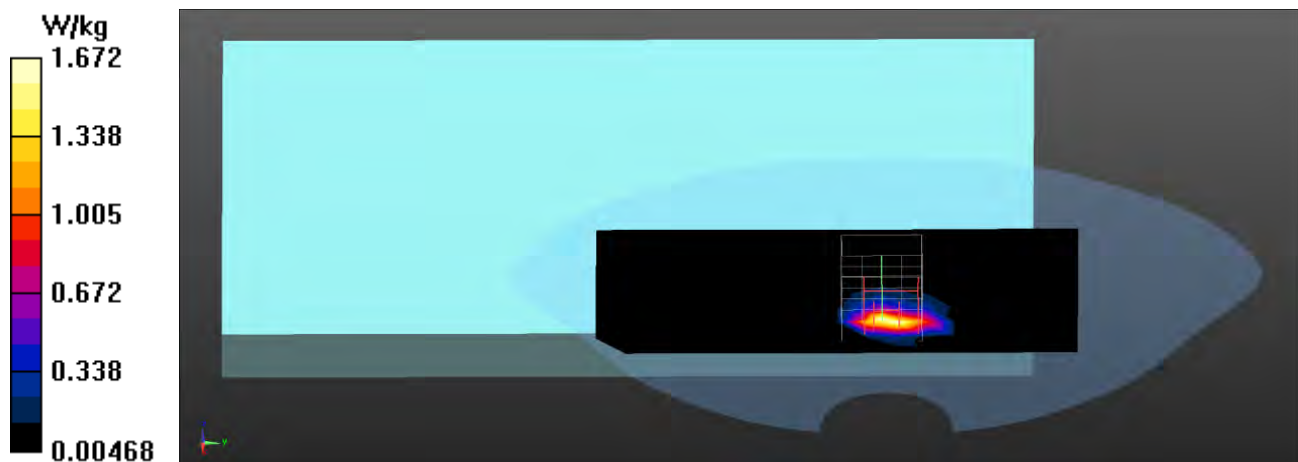
Configuration/Body/Area Scan (9x17x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 1.67 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.463 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 2.59 W/kg

SAR(1 g) = 1.04 W/kg; SAR(10 g) = 0.401 W/kg

Maximum value of SAR (measured) = 1.88 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b 11-Back(PAD) Aux0-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2462 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2462$ MHz; $\sigma = 1.86$ S/m; $\epsilon_r = 39.82$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

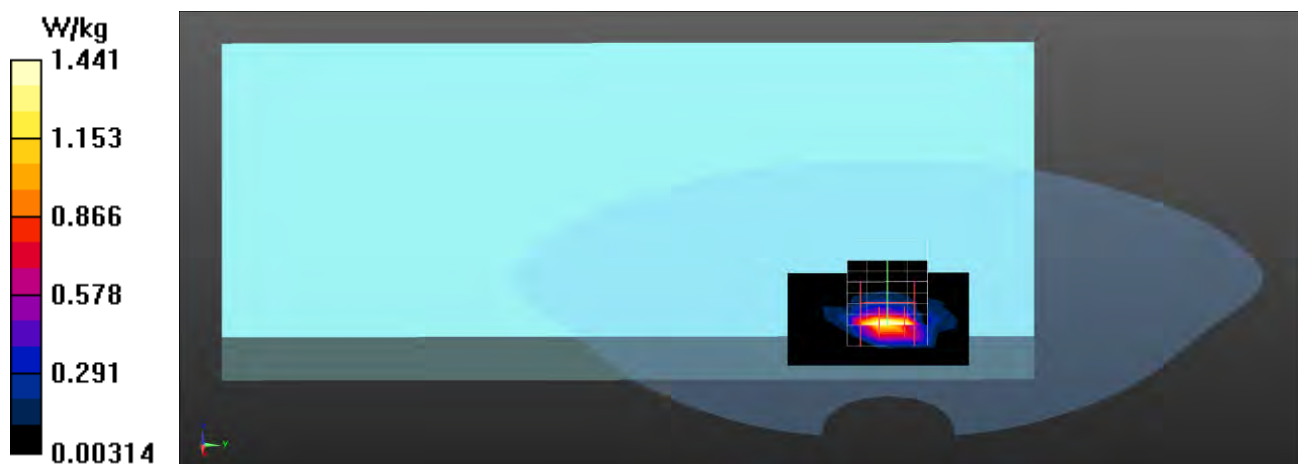
Configuration/Body/Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 1.44 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 7.959 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.71 W/kg

SAR(1 g) = 0.989 W/kg; SAR(10 g) = 0.261 W/kg

Maximum value of SAR (measured) = 1.82 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_6-Top(PAD) Aux0-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2437 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

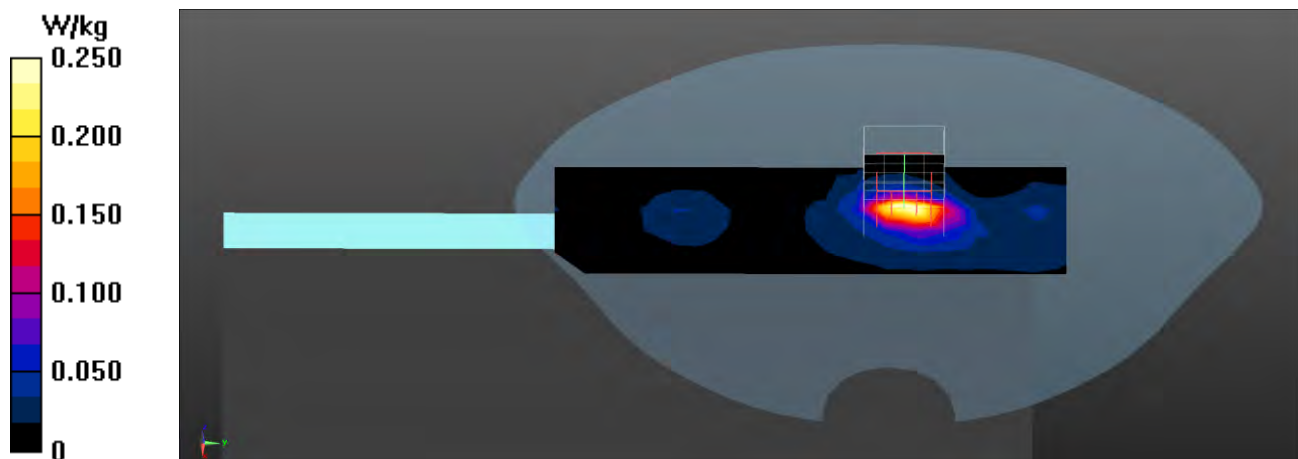
Configuration/Body/Area Scan (6x18x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.250 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.376 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.402 W/kg

SAR(1 g) = 0.163 W/kg; SAR(10 g) = 0.068 W/kg

Maximum value of SAR (measured) = 0.312 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_6-Bottom(NB) Aux1-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2437 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

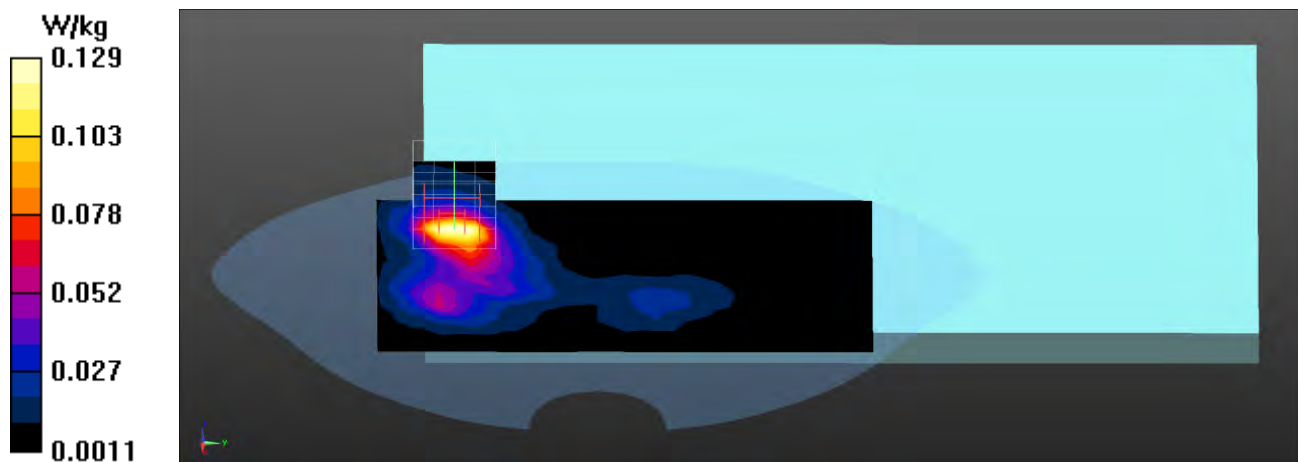
Configuration/Body/Area Scan (11x17x1): Measurement grid: dx=12mm,dy=12mm
Maximum value of SAR (measured) = 0.129 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.035 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.212 W/kg

SAR(1 g) = 0.095 W/kg; SAR(10 g) = 0.047 W/kg

Maximum value of SAR (measured) = 0.139 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_6-Back(PAD) Aux1-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2437 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

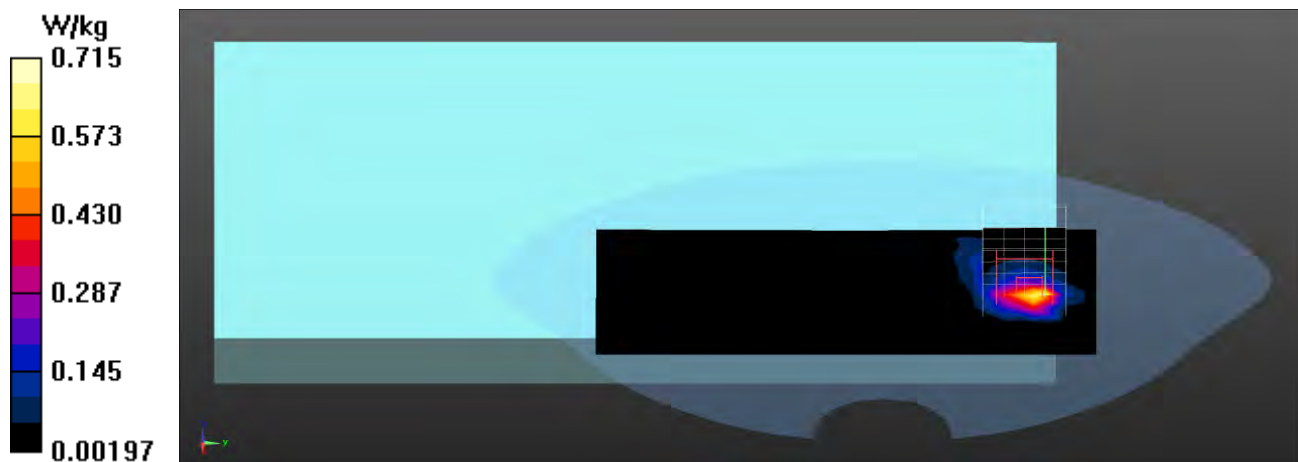
Configuration/Body/Area Scan (9x17x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.715 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.713 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 1.14 W/kg

SAR(1 g) = 0.426 W/kg; SAR(10 g) = 0.180 W/kg

Maximum value of SAR (measured) = 0.691 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_6-Right-Side(PAD) Aux1-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2437 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

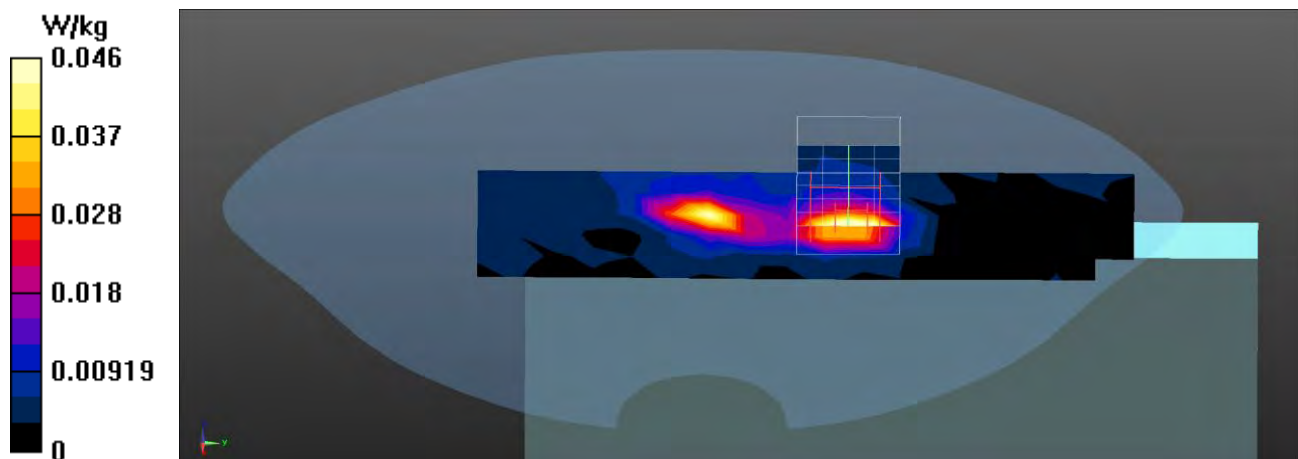
Configuration/Body/Area Scan (6x18x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.0460 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.580 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.0710 W/kg

SAR(1 g) = 0.032 W/kg; SAR(10 g) = 0.016 W/kg

Maximum value of SAR (measured) = 0.0551 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_6-Bottom(NB) Main-AWAN**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2437 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.82$ S/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

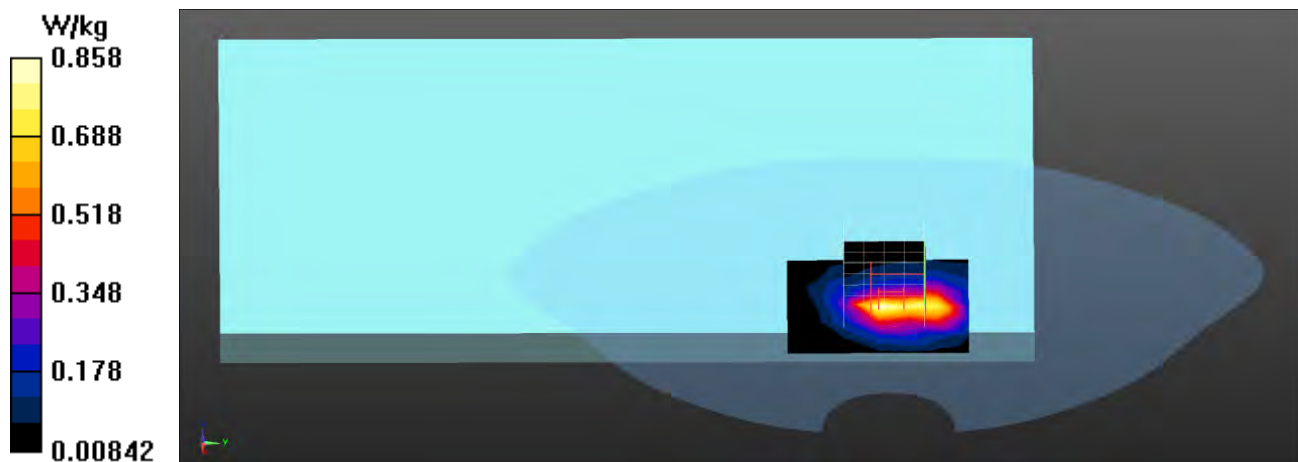
Configuration/Body/Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.858 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.41 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.02 W/kg

SAR(1 g) = 0.521 W/kg; SAR(10 g) = 0.281 W/kg

Maximum value of SAR (measured) = 0.838 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

802.11b_1-Back(PAD) Aux0-AWAN**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 2.4G; Frequency: 2412 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.79$ S/m; $\epsilon_r = 39.97$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

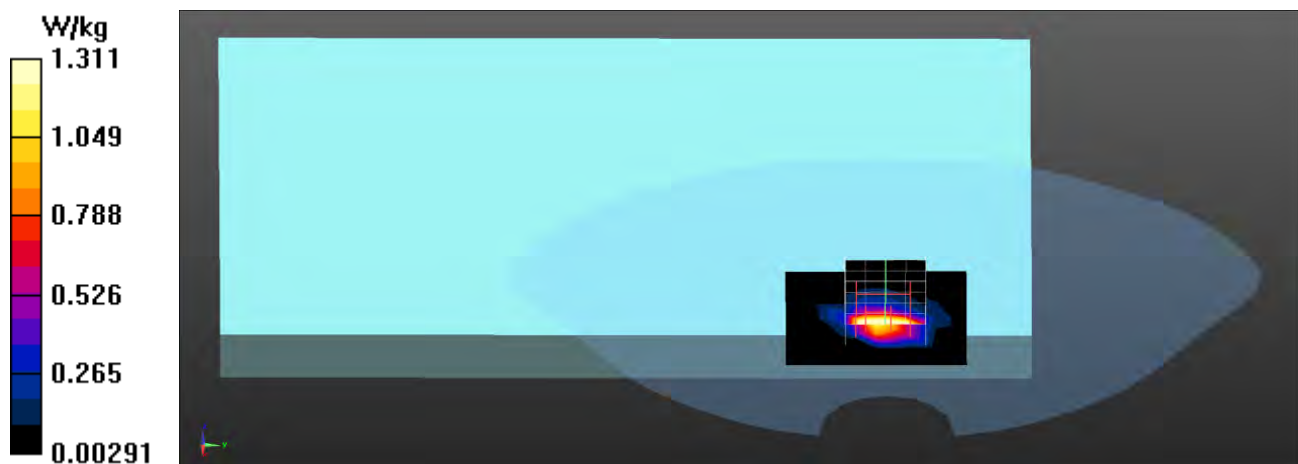
Configuration/Body/Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 1.31 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.132 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 2.62 W/kg

SAR(1 g) = 0.947 W/kg; SAR(10 g) = 0.360 W/kg

Maximum value of SAR (measured) = 1.75 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/05

BT-1M_78-Back(PAD) Aux0-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, BT 1M&3M&BLE; Frequency: 2480 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 2480$ MHz; $\sigma = 1.88$ S/m; $\epsilon_r = 39.76$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 22.1

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(7.06, 7.06, 7.06); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with left table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

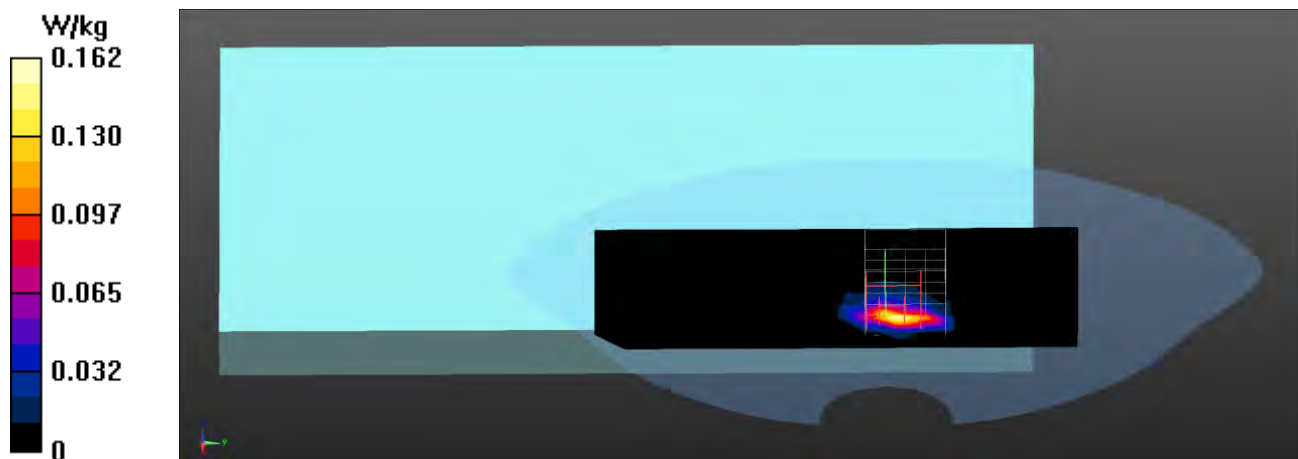
Configuration/Body/Area Scan (9x17x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.162 W/kg**Configuration/Body/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid:
dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.159 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 0.217 W/kg

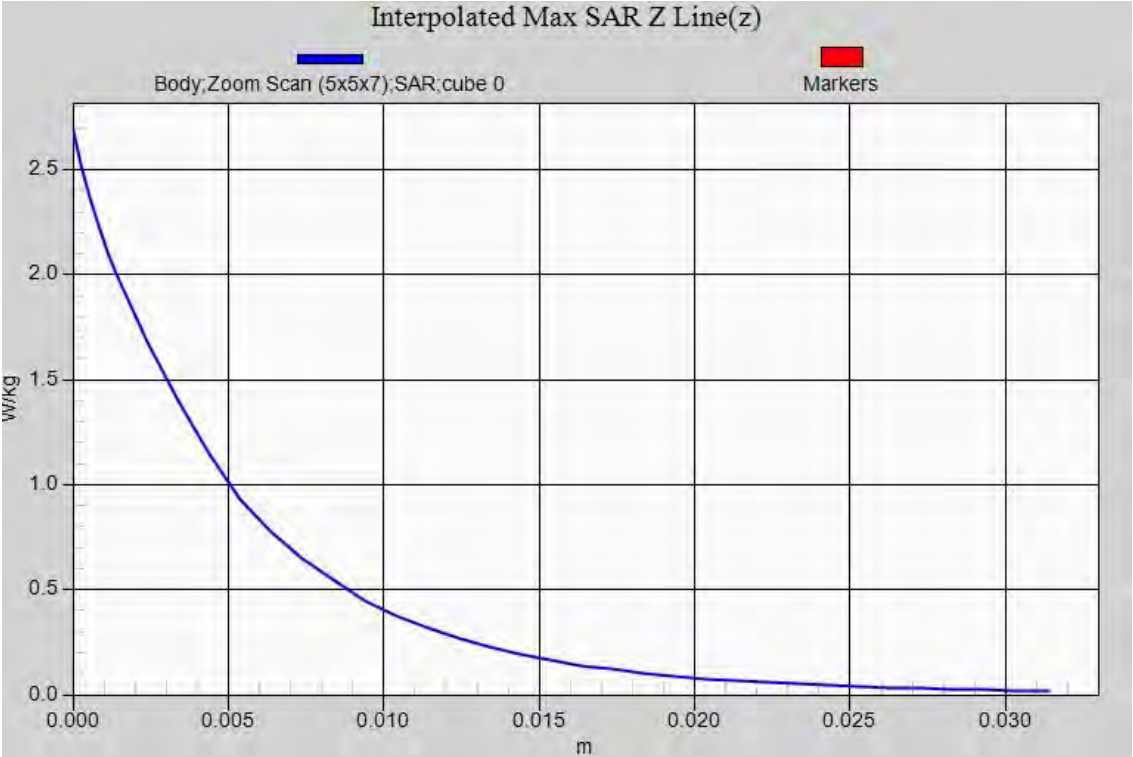
SAR(1 g) = 0.079 W/kg; SAR(10 g) = 0.031 W/kg

Maximum value of SAR (measured) = 0.143 W/kg



802.11b EUT Back (PAD) - (INPAQ Aux0 Antenna) Z-Axis plot

Channel: 1



Test Laboratory: DEKRA

Date/Time: 2020/09/03

802.11n40M_46-Bottom(NB) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 5G; Frequency: 5230 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 5230$ MHz; $\sigma = 4.69$ S/m; $\epsilon_r = 35.82$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 21.9

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(4.73, 4.73, 4.73); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with right table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Configuration/Body/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 2.50 W/kg

Configuration/Body/Zoom Scan (7x7x12) (7x7x12)/Cube 0: Measurement grid:

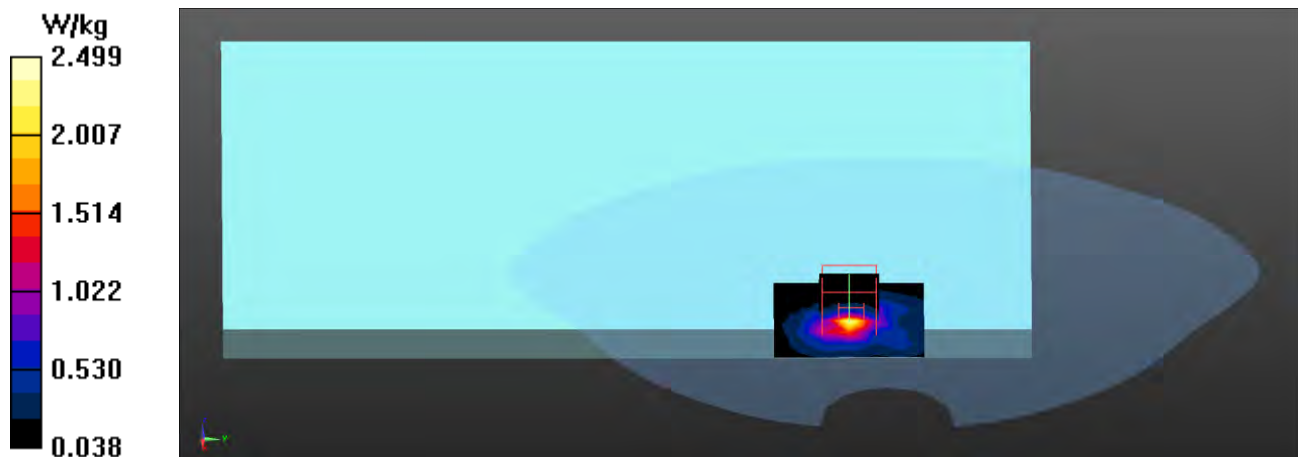
dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.941 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 4.41 W/kg

SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.351 W/kg

Maximum value of SAR (measured) = 2.47 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/03

802.11n40M_54-Bottom(NB) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 5G; Frequency: 5270 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 5270$ MHz; $\sigma = 4.74$ S/m; $\epsilon_r = 35.71$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 21.9

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(4.73, 4.73, 4.73); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with right table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

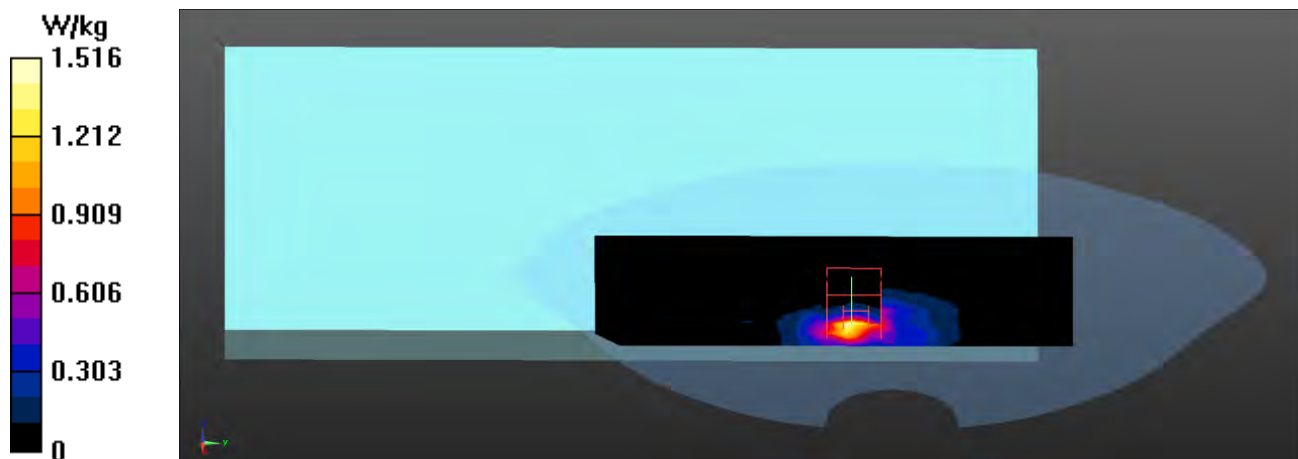
Configuration/Body/Area Scan (10x20x1): Measurement grid: dx=10mm,dy=10mm
Maximum value of SAR (measured) = 1.52 W/kg**Configuration/Body/Zoom Scan (7x7x12) (7x7x12)/Cube 0:** Measurement grid:
dx=4mm, dy=4mm, dz=2mm

Reference Value = 5.798 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.01 W/kg

SAR(1 g) = 0.809 W/kg; SAR(10 g) = 0.254 W/kg

Maximum value of SAR (measured) = 1.73 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/03

802.11n40M_151-Bottom(NB) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 5G; Frequency: 5755 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 5755$ MHz; $\sigma = 5.39$ S/m; $\epsilon_r = 34.37$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 21.9

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(4.6, 4.6, 4.6); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with right table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

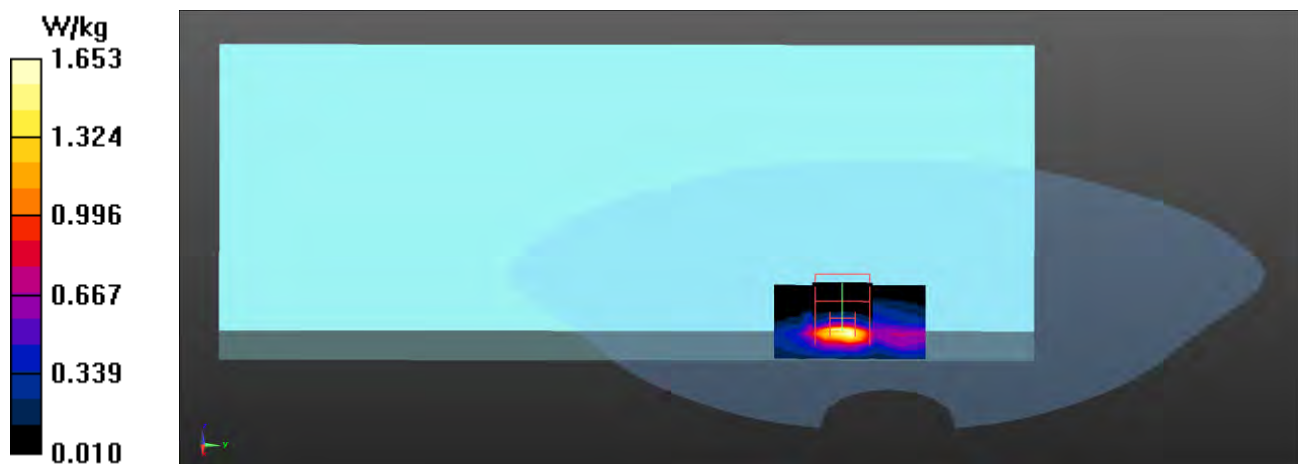
Configuration/Body/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.65 W/kg**Configuration/Body/Zoom Scan (7x7x12) (7x7x12)/Cube 0:** Measurement grid:
dx=4mm, dy=4mm, dz=2mm

Reference Value = 4.348 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 3.42 W/kg

SAR(1 g) = 0.790 W/kg; SAR(10 g) = 0.275 W/kg

Maximum value of SAR (measured) = 1.90 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/03

802.11ac80M_122-Bottom(NB) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 5G; Frequency: 5610 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 5610 \text{ MHz}$; $\sigma = 5.2 \text{ S/m}$; $\epsilon_r = 34.77$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Ambient Temperature ($^{\circ}\text{C}$) : 22.9, Liquid Temperature ($^{\circ}\text{C}$) : 21.9

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(4.43, 4.43, 4.43); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with right table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

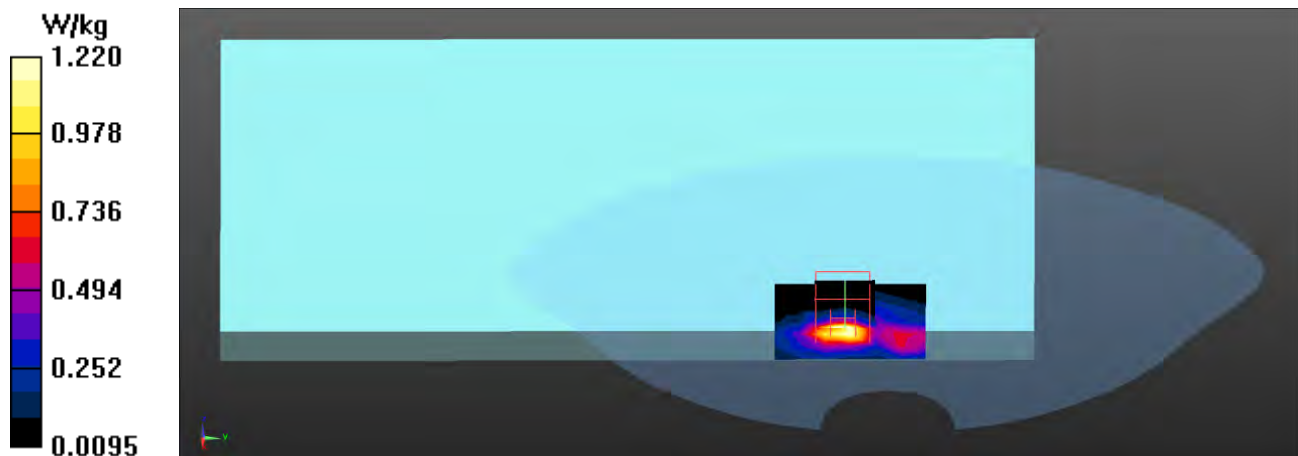
Configuration/Body/Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$
Maximum value of SAR (measured) = 1.22 W/kg**Configuration/Body/Zoom Scan (7x7x12) (7x7x12)/Cube 0:** Measurement grid:
 $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Reference Value = 4.391 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 2.64 W/kg

SAR(1 g) = 0.621 W/kg; SAR(10 g) = 0.217 W/kg

Maximum value of SAR (measured) = 1.46 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/03

802.11ac80M_58-Back(PAD) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 5G; Frequency: 5290 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 5290$ MHz; $\sigma = 4.77$ S/m; $\epsilon_r = 35.65$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 21.9

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(4.73, 4.73, 4.73); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with right table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

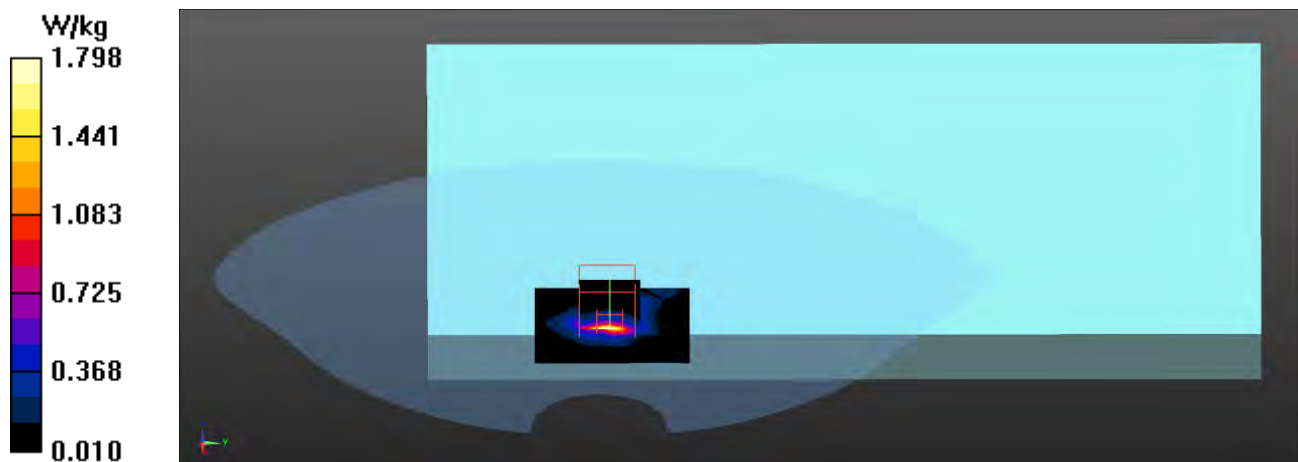
Configuration/Body/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.80 W/kg**Configuration/Body/Zoom Scan (7x7x12) (7x7x12)/Cube 0:** Measurement grid:
dx=4mm, dy=4mm, dz=2mm

Reference Value = 2.557 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 4.02 W/kg

SAR(1 g) = 0.687 W/kg; SAR(10 g) = 0.200 W/kg

Maximum value of SAR (measured) = 2.08 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/03

802.11ac80M_106-Back(PAD) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 5G; Frequency: 5530 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 5530$ MHz; $\sigma = 5.1$ S/m; $\epsilon_r = 34.99$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 21.9

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(4.43, 4.43, 4.43); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with right table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Configuration/Body/Area Scan (10x21x1): Measurement grid: dx=10mm, dy=10mm

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

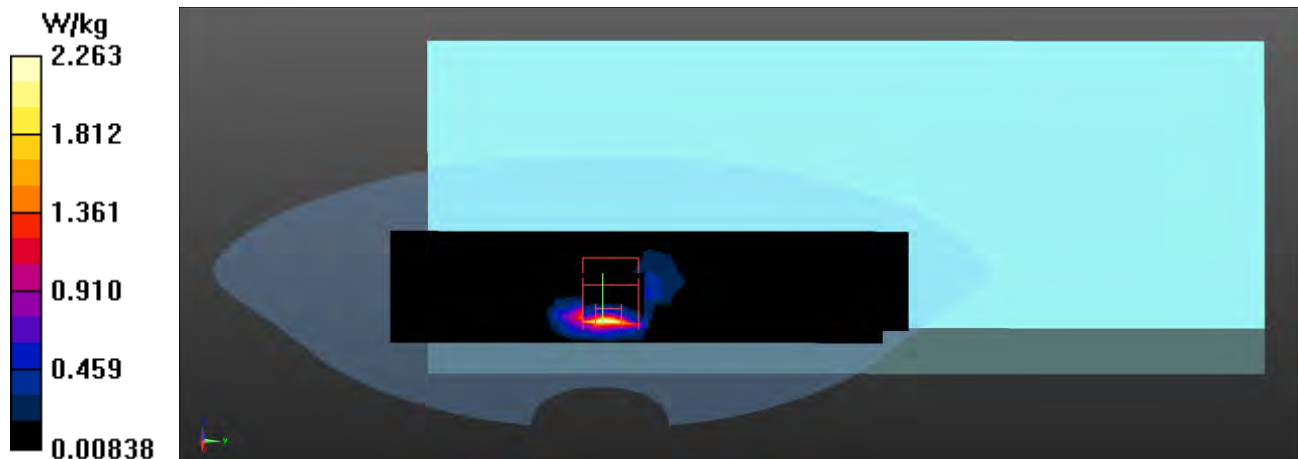
Configuration/Body/Zoom Scan (7x7x12) (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 2.668 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 5.40 W/kg

SAR(1 g) = 0.837 W/kg; SAR(10 g) = 0.229 W/kg

Maximum value of SAR (measured) = 2.62 W/kg



Test Laboratory: DEKRA

Date/Time: 2020/09/03

802.11ac80M_122-Back(PAD) Main-INPAQ**DUT: VivoBook/ ASUS Laptop; Type: TP470E**

Communication System: UID 0, WLAN 5G; Frequency: 5610 MHz;

Communication System PAR: 0 dB

Medium parameters used: $f = 5610$ MHz; $\sigma = 5.2$ S/m; $\epsilon_r = 34.77$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature (°C) : 22.9, Liquid Temperature (°C) : 21.9

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3698; ConvF(4.43, 4.43, 4.43); Calibrated: 2019/11/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1207; Calibrated: 2019/11/14
- Phantom: SAM with right table; Type: SAM;
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Configuration/Body/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.98 W/kg**Configuration/Body/Zoom Scan (7x7x12) (7x7x12)/Cube 0:** Measurement grid:
dx=4mm, dy=4mm, dz=2mm

Reference Value = 2.562 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 4.64 W/kg

SAR(1 g) = 0.702 W/kg; SAR(10 g) = 0.194 W/kg

Maximum value of SAR (measured) = 2.14 W/kg

