SAR Evaluation Report

Applicant	:	**ASUSTeK COMPUTER INC.**
Applicant Address	:	**1F., No. 15, Lide Rd., Beitou Dist., Taipei City 112, Taiwan**
Product Name	:	**Intel® Wi-Fi 6E AX211**
Trade Name	:	**Intel**
Model Number	:	**AX211NGW**
Applicable Standard	:	**47 CFR §2.1093**
Received Date		**Oct. 17, 2023**
Test Period	:	**Nov. 04 ~ Dec. 27, 2023**
Issued Date	:	**Dec. 29, 2023**

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Taiwan Accreditation Foundation accreditation number: 1330
Test Firm MRA designation number: TW0010

Note:
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Approved By：

Ted. Hsieh

Testing Laboratory
1330

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Revision History

Rev.	Issued Date	Description	Revised by
00	Dec. 07, 2023	Initial Issue	Rowan Hsieh
01	Dec. 29, 2023	Add Front edge SAR	Rowan Hsieh

1. General Information

1.1 Reference Testing Standards

Standard	Description	Version
47 CFR §2.1093	Radiofrequency radiation exposure evaluation: portable devices	-
IEC/IEEE 62209-1528	Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)	2020
IEEE 1528	Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques	2013
IEEE C95.1	IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz	1992
KDB 248227 D01	SAR guidance for IEEE 802.11 (Wi-Fi) transmitters	v02r02
KDB 447498 D04	RF exposure procedures and equipment authorization policies for mobile and portable devices	v01
KDB 616217 D04	SAR evaluation considerations for laptop, notebook and tablet computers	v01r02
KDB 865664 D01	SAR measurement requirement for 100 MHz to 6 GHz	v01r04
KDB 865664 D02	RF exposure compliance reporting and documentation considerations	v01r02

1.2 Testing Location

Test Facilities

Company Name: Eurofins E&E Wireless Taiwan Co., Ltd.
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Test Site Location

■ No. 140-1, Changan Street, Bade District, Taoyuan City 334025, Taiwan
☐ No. 2, Wuquan 5th Rd. Wugu Dist., New Taipei City, Taiwan

Laboratory Accreditation

Location	TAF	FCC	ISED
No. 140-1, Changan Street, Bade District, Taoyuan City 334025, Taiwan	Accreditation No.: 1330	Designation No.: TW0010	Company No.: 7381A CAB ID: TW1330
No. 2, Wuquan 5th Rd. Wugu Dist., New Taipei City, Taiwan	Accreditation No.: 1330	Designation No.: TW0034	Company No.: 28922 CAB ID: TW1330

2. Description of Device Under Test (DUT)

Applicant	ASUSTeK COMPUTER INC. 1F., No. 15, Lide Rd., Beitou Dist., Taipei City 112, Taiwan
Product Name	Intel® Wi-Fi 6E AX211
Trade Name	Intel
Model Number	AX211NGW
SN No.	R8NTLP00062935B
FCC ID	MSQAX211NG
Host Information	Product Name: Notebook PC Trade Name: ASUS Model Name: BR1204FG, BR1204CG, BR1104FG, BR1104CG All models are electrically identical, different model names are for marketing purpose.
Frequency Range	WLAN 2.4 GHz Band：2412 - 2472 MHz WLAN 5.2 GHz Band：5180 - 5240 MHz WLAN 5.3 GHz Band：5260 - 5320 MHz WLAN 5.6 GHz Band：5500 - 5720 MHz WLAN 5.8 GHz Band：5745 - 5825 MHz WLAN 5.9 GHz Band：5845 - 5885 MHz WLAN 6.2 GHz Band：5955 - 6415 MHz WLAN 6.5 GHz Band：6435 - 6515 MHz WLAN 6.7 GHz Band：6535 - 6855 MHz WLAN 7.0 GHz Band：6875 - 7115 MHz Bluetooth：2402 - 2480 MHz
Supported Modulations	WLAN 2.4 GHz : 802.11b / g / n / ac / ax HT20 / HT40 / VHT20 / VHT40 / HE20 / HE40
	WLAN 5 GHz : 802.11a/n/ac/ax HT20 / HT40 / VHT20 / VHT40 / VHT80 / VHT160 / HE20 / HE40 / HE80 / HE160
	WLAN 6 GHz : 802.11a / n / ac / ax HT20 / HT40 / VHT20 / VHT40 / VHT80 / VHT160 / HE20 / HE40 / HE80 / HE160
	Bluetooth : BR / EDR / LE
Device Category	Portable
Module Name	Intel, AX211NGW

Note:

1. The above information of DUT was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Antenna list:

Antenna Source	ANT	Manufacturer	Part No. (Vendor)	Type	Frequency (MHz)	Max. Gain (dBi)	
						NB	PAD
1	Chain A (Ant-0)	INPAQ	WA-F-LE-01-009 (HQ26003000240)	PIFA Antenna	2402 – 2480	1.51	1.41
					5150 – 5250	2.60	1.46
					5250 – 5350	2.60	1.72
					5470 – 5725	2.23	1.91
					5725 – 5850	2.74	1.77
					5850 - 5895	2.74	1.98
					5925 - 6425	3.35	2.24
					6425 - 6525	2.4	2.3
					6525 - 6875	2.4	1.97
					6875 - 7125	2.37	2.59
	Chain B (Ant-1)	INPAQ	WA-F-LE-03-002 (HQ26003000230)	PIFA Antenna	2402 – 2480	2.94	2.66
					5150 – 5250	3.20	3.20
					5250 – 5350	3.20	2.98
					5470 – 5725	3.98	2.54
					5725 – 5850	3.85	3.78
					5850 - 5895	3.64	3.98
					5925 - 6425	3.91	3.84
					6425 - 6525	3.72	3.77
					6525 - 6875	3.35	3.4
					6875 - 7125	3.35	3.92
2	Chain A (Ant-0)	INNOWAVE	F001C8711590001	PIFA Antenna	2402 – 2480	1.46	1.13
					5150 – 5250	1.33	1.25
					5250 – 5350	1.24	1.47
					5470 – 5725	1.59	1.82
					5725 – 5850	1.61	1.51
					5850 - 5895	1.35	1.86
					5925 - 6425	1.48	2.04
					6425 - 6525	1.93	2.17
					6525 - 6875	1.55	1.69
					6875 - 7125	1.81	2.23
	Chain B (Ant-1)	INNOWAVE	F001C8712190002	PIFA Antenna	2402 – 2480	2.72	2.46
					5150 – 5250	2.56	3.09
					5250 – 5350	2.85	2.72
					5470 – 5725	2.60	2.35
					5725 – 5850	2.78	3.36
					5850 - 5895	3.04	3.18
					5925 - 6425	3.13	3.67
					6425 - 6525	3.47	3.7
					6525 - 6875	3.76	3.34
					6875 - 7125	2.93	3.89

Note：
1. Antenna Source 1 (INPAQ antenna) and Antenna Source 2 (INNOWAVE antenna) are the same type of antenna, only different in manufacturer.
2. The Chain A is connected to AUX port / Chain B is connected to Main port of module.

3. Summary of Maximum Value

Equipment Class	Mode	Highest Reported SAR		Highest Reported SAR	
		Body standalone SAR_{1g} (W/kg)	Simultaneous Transmission SAR (W/kg)	Body standalone SAR_{1g} (W/kg)	Simultaneous Transmission SAR (W/kg)
DTS	WLAN 2.4 GHz	1.14	1.14	1.09	1.09
NII	WLAN 5 GHz	1.03	1.03	0.87	1.01
6XD	WLAN 6 GHz	0.39	0.39	0.45	0.45
DSS / DTS	Bluetooth	0.04	1.14	0.01	1.09

Equipment Class	Mode	Highest Standalone Transmission	Highest Simultaneous Transmission
		Averaging Area [4 cm²] Total PD (mW/cm²)	Total Exposure Ratio
6XD	WLAN 6 GHz	0.75	0.75

Note:

1.The SAR limit for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992.

2.The test procedures, as described in American National Standards, Institute ANSI/IEEE C95.1 were employed and they specify the maximum exposure limit of tissue for portable devices being used within 20 cm between user and EUT in the uncontrolled environment. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment used are included within this test report.

1.The SAR limit for general population / uncontrolled exposure is specified in Health Canada’s Safety Code 6.

2.The test procedures, as described in American National Standards, Institute ANSI/IEEE C95.3 were employed and they specify the maximum exposure limit of tissue for portable devices being used within 20 cm between user and EUT in the uncontrolled environment. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment used are included within this test report.

4. The evaluation requirements, as described in 47 CFR Part §1.310 were employed and they specify the maximum exposure limit for general population / uncontrolled exposure is 1.0 mW/cm2 (equal to 10 W/m2) for 1.5 GHz to 100 GHz.

5. According to the TCB Worshop Oct. 2018Notes, the average power density results are presented using averaging areas of 4 cm2.

6. Total exposure ratio (TER) calculated by taking ratio of reported SAR divided by SAR limit and adding it to measured power density divided by power density limit. Numerical sum of the two ratios should be less than 1.

4. Introduction

4.1 SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dw) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\text{SAR} = \frac{d}{dt}\left(\frac{dw}{dm}\right) = \frac{d}{dt}\left(\frac{dw}{\rho dv}\right)$$

SAR measurement can be related to the electrical field in the tissue by

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

Where：

σ = conductivity of the tissue (S/m)

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

E = RMS electric field strength (V/m)

SAR is expressed in units of Watts per kilogram (W/kg).

4.2 Power Density Definition

Power density (PD) is defined as the rates of energy transfer per area for an electromagnetic filed.
According to the IEC TR 63170, the following formula is used to determine the local power density:

$$\mathbf{S} = \frac{1}{2}\Re(\mathbf{E} \times \mathbf{H}) \cdot \hat{\boldsymbol{n}}$$

And the spatial-average power denity distribution on the evaluate surface is determined as the following equation:

$$\mathbf{S}_{\mathbf{av}} = \frac{1}{2A}\Re \cdot \left(\int \mathbf{E} \times \mathbf{H} \cdot \hat{\mathbf{n}}\, \mathbf{dA}\right)$$

Where:
E is the complex electric field peak phasor and H is the complex conjugate magnetic field peak phasor, respectively. *A* is the spatial averae area spefied by the applicable exposure or regulatory requirement.
Power density is expressed in unit of watt per square meter (W/m2).

4.3 RF Exposure Limits

Table 1 Safety Limits for Controlled / Uncontrolled Environment Exposure

SAR Exposure Limit		
	General Population / Uncontrolled Exposure 1 (W/kg)	***Occupational / Controlled Exposure 2 (W/kg)***
Spatial Peak SAR 3 (head or Body)	**1.60**	**8.00**
Spatial Peak SAR 4 (Whole Body)	**0.08**	**0.40**
Spatial Peak SAR 5 (Hands / Feet / Ankle / Wrist)	**4.00**	**20.00**
Power Density Exposure Limit (1,500 - 100,000 MHz)		
	General Population / Uncontrolled Exposure (mW/cm2) 6	***Occupational / Controlled Exposure (mW/cm2)***
Power Density (S)	**1.0**	**5.0**

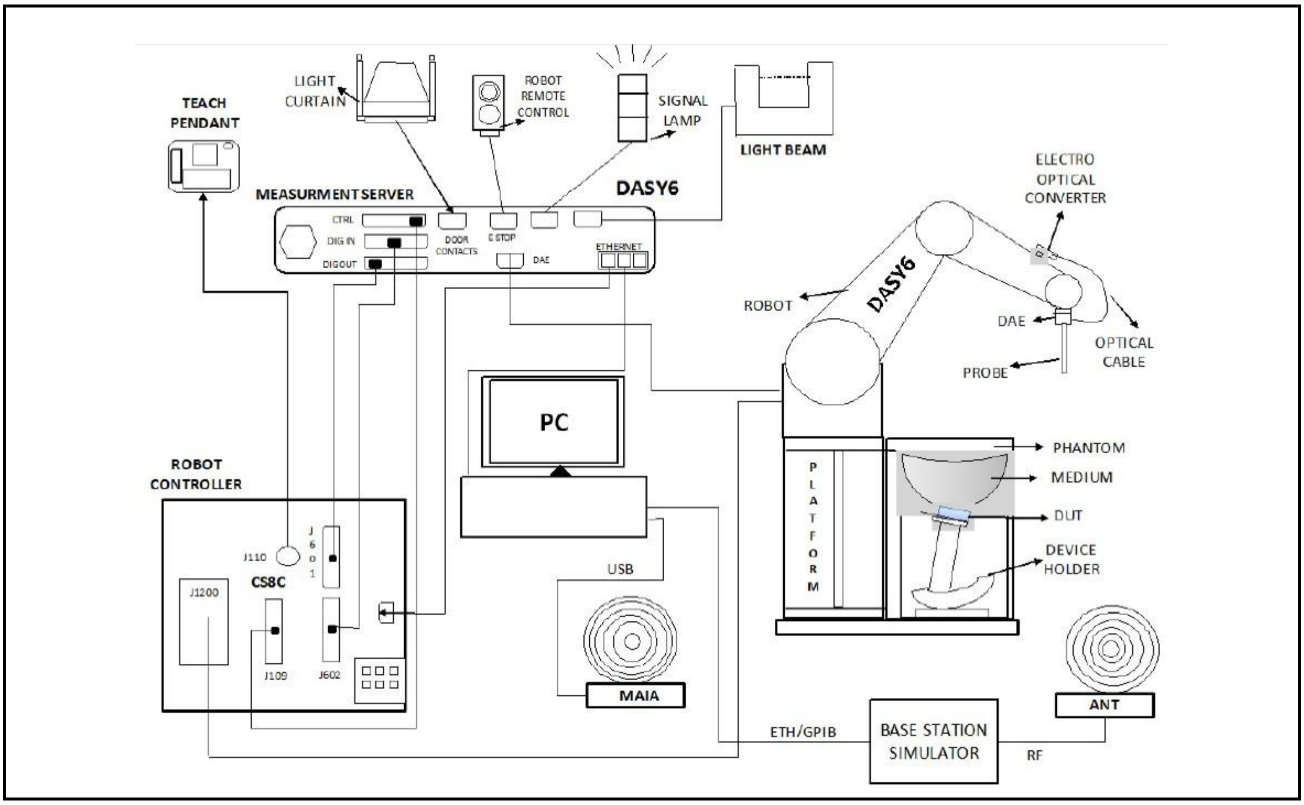
Notes：

1. **General Population / Uncontrolled Environments** are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.
2. **Occupational / Controlled Environments** are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).
3. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
4. The Spatial Average value of the SAR averaged over the whole body.
5. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
6. 1 mW/cm2 = 10 W/m2.

5. System Describtion

5.1 SAR Measurement System

The DASY system in SAR Configuration is shown below:



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

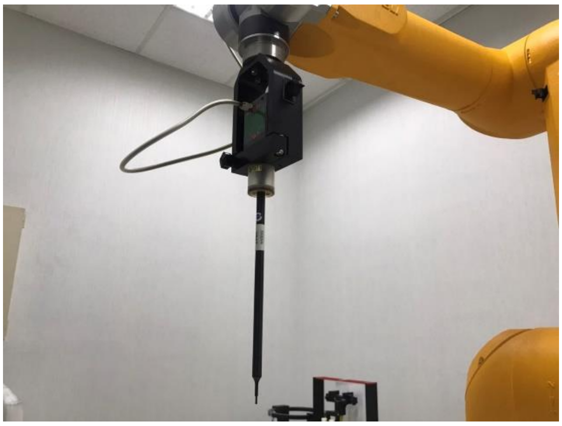
1. A standard high precision 6-axis robot (Stäubli TX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. An isotropic field probe optimized and calibrated for the targeted measurements.
3. A data acquisition electronics (DAE) 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.
4. 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.
5. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
6. The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
7. A computer running Win7/Win8/Win10 professional operating system and DASY software.
8. Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
9. The phantom, the device holder and other accessories according to the targeted measurement.
10. Tissue simulating liquid mixed according to the given recipes.
11. The validation dipole has been calibrated within and the system performance check has been successful.

<DASY E-Field Probe System>

The SAR measurements were conducted with the dosimetric probe (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probes is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	4 MHz to 10 GHz Linearity: ± 0.2 dB (30 MHz to 10 GHz)
Directivity	±0.1 dB in TSL (rotation around probe axis) ±0.3 dB in TSL (rotation normal to probe axis)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Calibration	ISO/IEC 17025 calibration service available

EX3DV4 E-Field Probe



Probe setup on robot

<Data Acquisition Electronic (DAE) System>

Model	DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4 mV, 400 mV)
Input Offset Voltage	< 5 μV (with auto zero)
Input Bias Current	< 50 fA
Dimensions	60 x 60 x 68 mm

<Robot>

Positioner	Stäubli Unimation Corp.
Robot Model	TX90XL
Number of Axes	6
Nominal Load	5 kg
Reach	1450 mm
Repeatability	± 0.035 mm

<Device Holder>

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ=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.

Device Holder 1

Device Holder 2

<Oval Flat Phantom – ELI>

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (Oval Flat) phantom defined in IEEE 1528, IEC 62209-2 and IEC/IEEE 62209-1528. It enables the dosimetric evaluation of wireless portable device usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness	2 ±0.2 mm
Filling Volume	Approx. 30 liters
Dimensions	190×600×400 mm (H × L × W)

<SAM Phantom>

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528, IEC 62209-1 and IEC/IEEE 62209-1528. It enables the dosimetric evaluation of left and right hand phone usage as well as body-mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.

Shell Thickness	2 ±0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet

5.2 Tissue Simulating Liquids (TSL)

<Tissue Dielectric Parameters in IEEE 1528-2013 and IEC/IEEE 62209-1528>

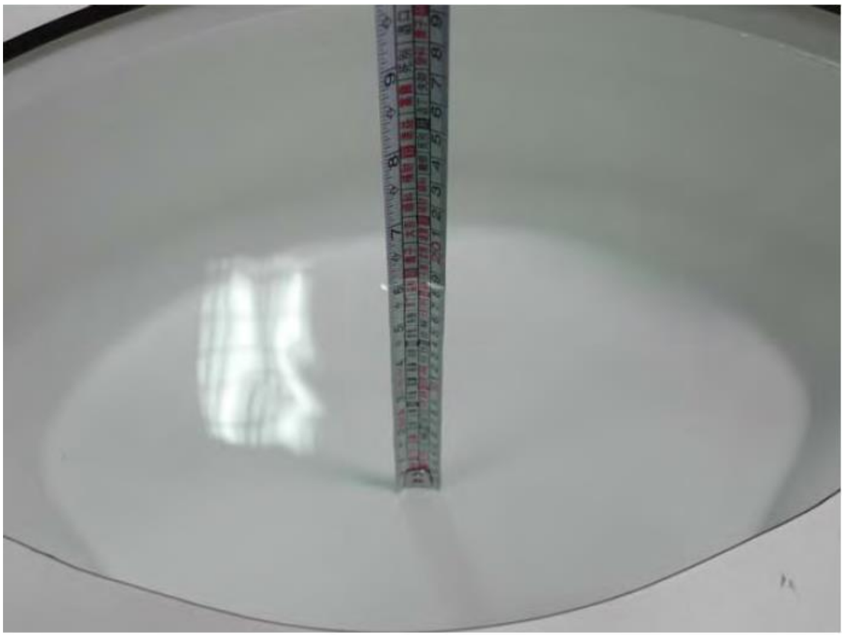
The following table incorporates the tissue dielectric parameters of head recommended by IEEE 1528-2013 and IEC/IEEE 62209-1528. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in human head. Other head and body tissue parameters that have not been specified are derived from the tissue dielectric parameters which computed by the 4-Cole-Cole equation according to the above-mentioned standards.

Table 2 Dielectric properties of the tissue-equivalent liquid material

Frequency (MHz)	Relative Permittivity (εr)	Conductivity (σ)
30	55.0	0.75
150	52.3	0.76
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
1800	40.0	1.40
1900	40.0	1.40
1950	40.0	1.40
2000	40.0	1.40
2100	39.8	1.49
2450	39.2	1.80
2600	39.0	1.96
3000	38.5	2.40
3500	37.9	2.91
4000	37.4	3.43
4500	36.8	3.94
5000	36.2	4.45
5200	36.0	4.66
5400	35.8	4.86
5600	35.5	5.07
5800	35.3	5.27
6000	35.1	5.48
6500	34.5	6.07
7000	33.9	6.65
7500	33.3	7.24
8000	32.7	7.84
8500	32.1	8.46
9000	31.6	9.08
9500	31.0	9.71
10000	30.4	10.4

<Liquid Depth>

The depth of tissue-equivalent liquid in a phantom must be ≧ 15.0 cm to ensure that the probe is immersed sufficiently in the tissue medium.



Tissue-equivalent Liquid Height

<Test Site Environment>

Item	Requirement	Actual
Temperature (°C)	18 - 25	21 - 23

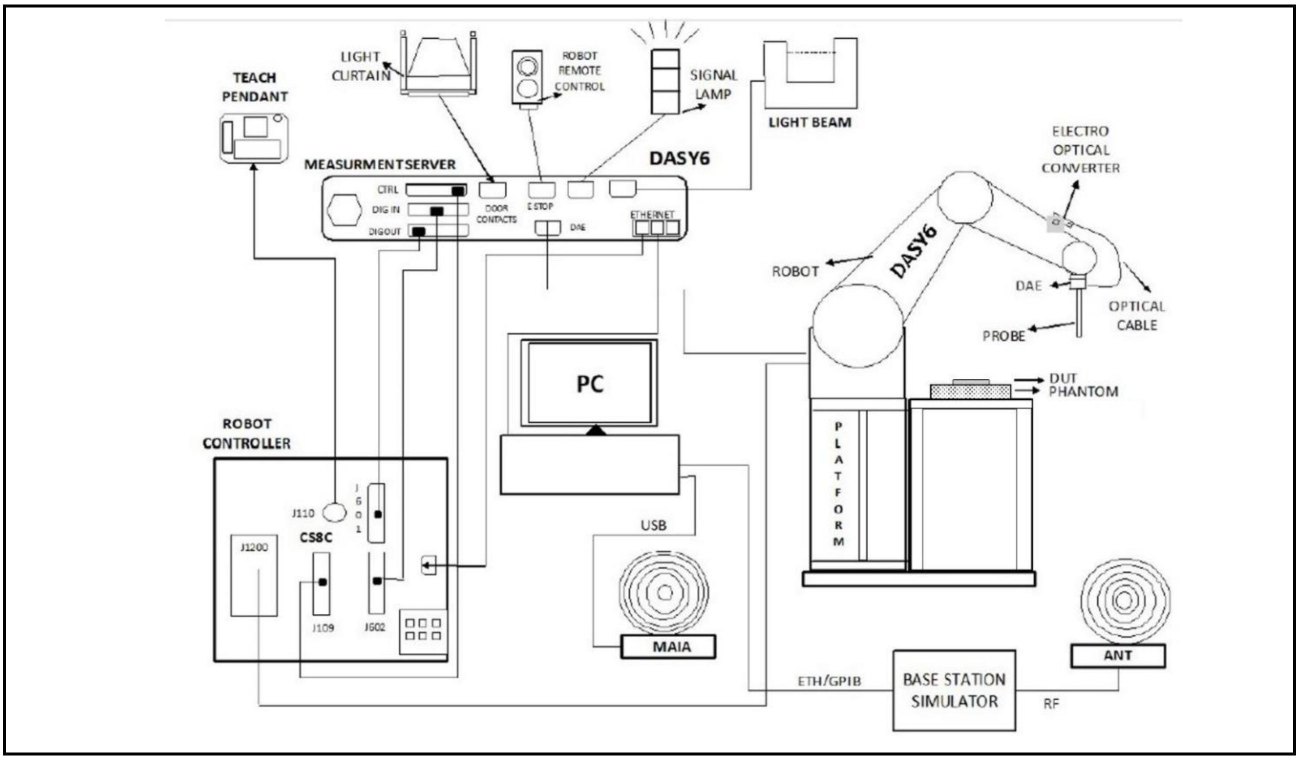
<Liquid Check>

1. The dielectric parameters of the liquids were verified prior to the SAR evaluation using a DAKS 3.5 Probe Kit.
2. The SAR testing with IEC tissue parameters as an alternative option to Head and body parameters. The head TSL were applied to body SAR tests with restrictions below:

Frequency (MHz)	Ambient Temp. (℃)	Tissue Temp. (℃)	Permittivity (εr)	Conductivity (σ)	Targeted Permittivity (εr)	Targeted Conductivity (σ)	Deviation Permittivity (εr) (%)	Deviation Conductivity (σ) (%)	Date
2450	23.3	22.2	37.890	1.785	39.2	1.8	-3.34	-0.83	Nov. 04, 2023
2450	22.8	22.2	40.048	1.823	39.2	1.8	2.16	1.28	Dec. 27, 2023
5250	23.1	22.2	34.611	4.531	35.9	4.71	-3.59	-3.80	Nov. 05, 2023
5250	23.2	22.1	33.955	4.441	35.9	4.71	-5.42	-5.71	Nov. 06, 2023
5250	22.8	22	35.406	4.581	35.9	4.71	-1.38	-2.74	Dec. 27, 2023
5600	22.9	22	34.083	4.986	35.5	5.07	-3.99	-1.66	Nov. 13, 2023
5600	22.8	22.2	34.969	4.916	35.5	5.07	-1.50	-3.04	Dec. 27, 2023
5750	22.9	22	33.680	5.228	35.4	5.22	-4.86	0.15	Nov. 14, 2023
5800	23.2	22.1	33.794	5.176	35.3	5.27	-4.27	-1.78	Nov. 15, 2023
5800	22.8	22.2	34.610	5.144	35.3	5.27	-1.95	-2.39	Dec. 27, 2023
6500	23.2	22.2	32.200	5.650	34.5	6.07	-6.67	-6.92	Nov. 21, 2023
6500	22.8	22.2	33.400	6.000	34.5	6.07	-3.19	-1.15	Dec. 27, 2023

5.3 *Power Density Measurement System*

The DASY system in Configuration is shown below:



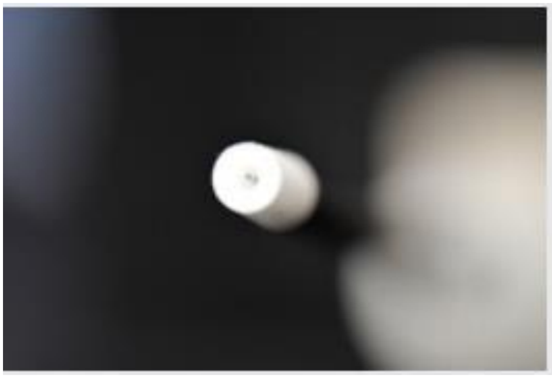
The DASY system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli TX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated. The probe is equipped with an optical surface detector system.
3. 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.
4. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
5. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
6. A computer running Win7/Win8/Win10 professional operating system and DASY software.
7. Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
8. The mmWave phantom.
9. Validation dipole kits allowing validating the proper functioning of the system.

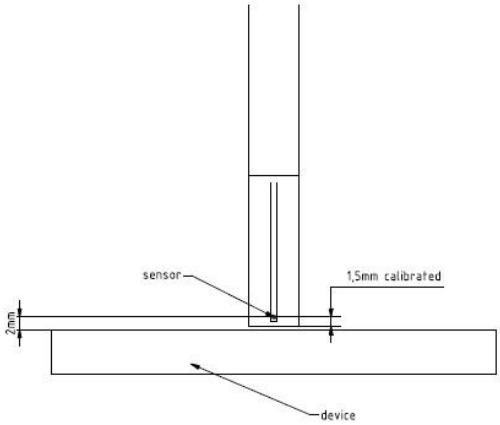
<DASY E-Field Probe System>

The EUmmWV3 probe is based on the pseudo-vector probe design, which not only measures the field magnitude but also derives its polarization ellipse. This probe concept also has the advantage that the sensor angle errors or distortions of the field by the substrate can be largely nullified by calibration.This is particularly important as, at these very high frequencies, field distortions by the substrate are dependent on the wavelength. It has two dipoles optimally arranged to obtain pseudo-vector information. It has minimum 3 measurements/point, 120º rotated around probe axis. Sensors (0.8 mm length) printed on glass substrate protected by high density foam. Low perturbation of the measured field. Requires positioner which can do accurate probe rotation.

Frequency Range	750 MHz - 110 GHz
Dynamic Range	< 20 V/m - 10'000 V/m with PRE-10 (min < 50 V/m - 3000 V/m)
Position Precision	< 0.2 mm
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: encapsulation 8 mm (internal sensor < 1mm) Distance from probe tip to dipole centers: < 2 mm Sensor displacement to probe's calibration point: < 0.3 mm
Applications	Electric field measurements of 5G devices and other mm-wave transmitters operating above 10 GHz in <2 mm distance from device (free-space) Power density, magnetic field, and far-field analysis using total field reconstruction (cDASY6 5G or ICEy-mmW module required)
compatibility	cDASY6 + 5G-Module SW1.0 and higher



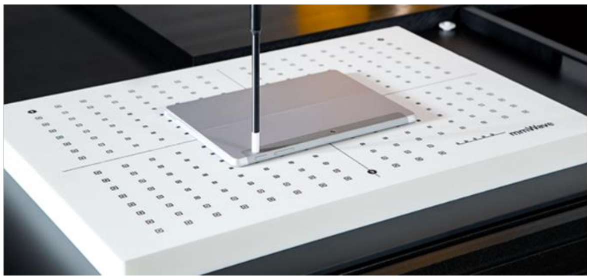
E-Field mm-Wave Probe



Sensor to DUT Surface

<mmWave phantom>

The mmWave phantom approximates free-space conditions, allowing to evaluate not only the antenna side of the device but also the front (screen) or any opposite-radiating side of wireless devices operating above 10 GHz without distorting the radiofrequency (RF) field. It consists of a 40 mm thick Rohacell plate used as a test bed which has a loss tangent (tan δ) ≤0.05 and a relative permittivity (εr) ≤1.2. The high-performance RF absorbers are placed below the foam.



<Data Acquisition Electronic (DAE)>

The data acquisition electronics (DAE) consist of a highly sensitive electrometer-grade preampli er with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter, and a command decoder with a 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 DAE box is 200MOhm; the inputs are symmetric and oating. Common mode rejection is above 80 dB.

Model	DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4 mV, 400 mV)
Input Offset Voltage	< 5 µV (with auto zero)
Input Bias Current	< 50 fA
Dimensions	60 x 60 x 68 mm

<Robot>

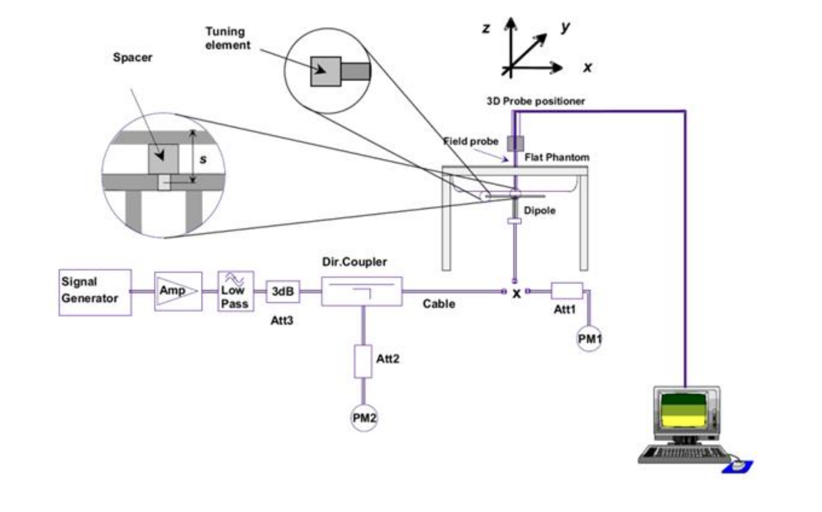
Positioner	Stäubli Unimation Corp.
Robot Model	TX90XL
Number of Axes	6
Nominal Load	5 kg
Reach	1450 mm
Repeatability	± 0.035 mm

6. *System Verification*

6.1 *SAR System Verification*

<Symmetric Dipoles for SAR System Verification>

Construction	Symmetrical dipole with λ/4 balun enables measurement of feed point impedance with NWA matched for use near flat phantoms filled with head simulating solutions Includes distance holder and tripod adaptor Calibration Calibrated SAR value for specified position and input power at the flat phantom in head simulating solutions.
Return Loss	> 20 dB at specified verification position.
Options	Dipoles for other frequencies or solutions and other calibration conditions are available upon request.



System Verification Setup Diagram

Validation Kit

6.1.1 *SAR Verification Summary*

The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touched the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. Before the system check testing, the Powersource1 will be adjusted for the desired forward power of 17 dBm (50 mW) or the signal generator will be adjusted for desired forward power of 20 dBm (100 mW) at the dipole connector and the RF output power would be turned on. After system check testing, the SAR result will be normalized to 1 W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

Date	Frequency (MHz)	Targeted 1g SAR (W/kg)	Measured 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)	Targeted 8g SAR (W/kg)	Measured 8g SAR (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Nov. 04, 2023	2450	51.7	2.58	51.48	-0.43	-	-	-	712	7674	1253
Dec. 27, 2023	2450	51.7	2.59	51.68	-0.04	-	-	-	712	3847	541
Nov. 05, 2023	5250	79.6	3.79	75.62	-5.00	-	-	-	1021	7674	1253
Nov. 06, 2023	5250	79.6	3.72	74.22	-6.75	-	-	-	1021	7674	1253
Dec. 27, 2023	5250	79.7	4.01	80.01	0.39	-	-	-	1358	3847	541
Nov. 13, 2023	5600	81.3	4.23	84.40	3.81	-	-	-	1021	7674	1253
Dec. 27, 2023	5600	81.8	4.39	87.59	7.08	-	-	-	1358	3847	541
Nov. 14, 2023	5750	79.5	3.95	78.81	-0.86	-	-	-	1021	7674	1253
Nov. 15, 2023	5800	78.7	3.83	76.42	-2.90	-	-	-	1021	7674	1253
Dec. 27, 2023	5800	81.5	3.93	78.41	-3.79	-	-	-	1358	3847	541
Nov. 21, 2023	6500	294	28.4	284.00	-3.40	66.1	6.16	-6.81	1016	7674	1253
Dec. 27, 2023	6500	294	27.3	273.00	-7.14	66.1	6.22	-5.90	1016	3847	541

6.2 *Power Density System Verification*

The system performance check verifies that the system operates within its specifications.

The system check is successful if the difference between the normalized measured local power density and the numerically validated target value is within the reported expanded uncertainty of the measurement system.

The recommended settings for measurement of verification sources are listed in the following:

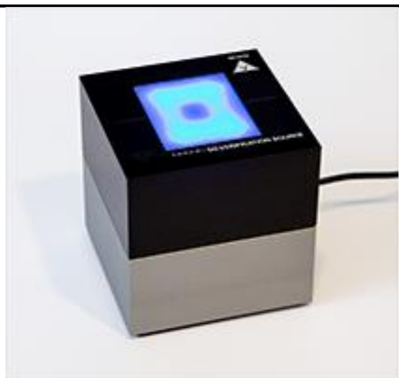
Settings for Measurement of Verification Sources			
Frequency[GHz]	***Grid step***	***Grid extent X/Y [mm]***	***Measurement points***
10	0.125 (λ/8)	60 / 60	18 × 18
30	0.25 (λ/4)	60 / 60	26 × 26
45	0.25 (λ/4)	42 / 42	28 × 28
60	0.25 (λ/4)	32.5 / 32.5	28 × 28
90	0.25 (λ/4)	30 / 30	38 × 38

<System Varification Souce>

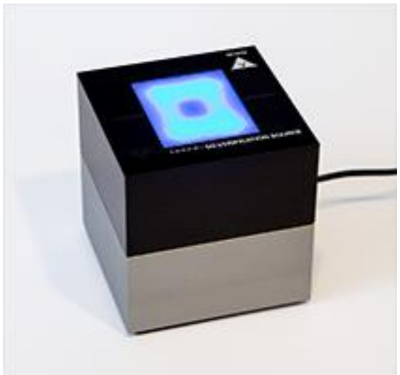
The verification sources apply to system check or verification at specific mmWave frequencies. The sources comprise horn-antennas and very stable signal generators.

Frequency accuracy	10 GHz at 10 mm from the antenna
E-field polarization	Linear
Input Power	Max. 20 W
Conector	SMA
Weight	700 g
Operation	requires a stable source with known forward power to perform system performance check or validation

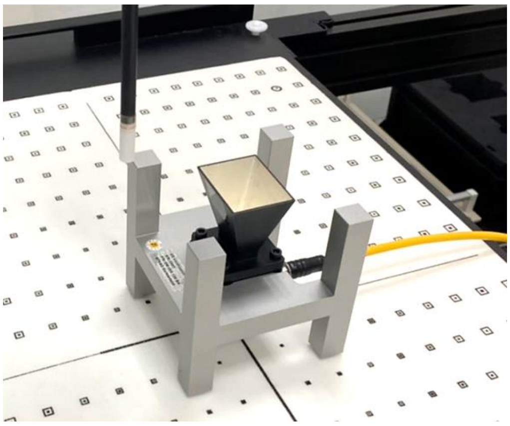
Calibrated Frequency	30 GHz at 10mm from the antenna (5.55 mm from the case surface)
Frequency accuracy	± 100 MHz
E-field polarization	Linear
Harmonics	-20 dBc
Total radiated power	14 dBm
Power stability	0.05 dB
Power consumption	5 W
Size	100 × 100 × 100 mm
Weight	1 kg

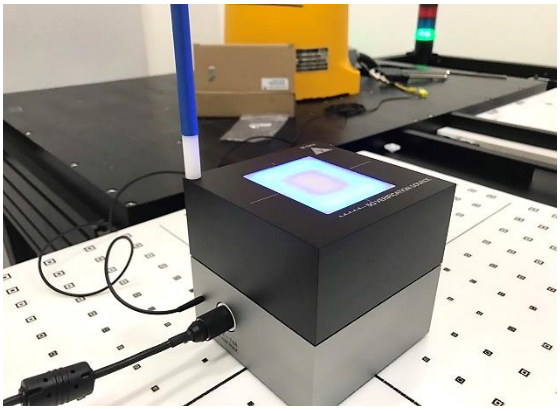


Calibrated Frequency	60 GHz at 10mm from the antenna (5.55 mm from the case surface)
Frequency accuracy	± 100 MHz
E-field polarization	± 100 MHz
Harmonics	Linear
Total radiated power	-20 dBc
Harmonics	14 dBm
Power stability	0.1 dB
Power consumption	5 W
Size	100 × 100 × 100 mm
Weight	1 kg



6.3 *Power Density Verification Summary*





System Verification Setup photo

Prior to the assessment, the validation data compared to the original value provided by SPEAG should be within its specifications of ± 0.66 dB. The ± 0.66 dB deviation threshold represents the expanded uncertainty for system performance checks using SPEAG’s mmWave verification sources. The power density distribution was verified through visual inspection as per Nov. 2017 TCBC Workshop Notes, both spatially (shape) and numerically (level) have no noticeable differences. The following result indicates the system check can meet the variation criterion and plots can be referred to Appendix B of this report.

Date	***Frequency (MHz)***	***Targeted Avg PD 4 cm2 (W/m^2)***	***psPDn+ 4 cm2 (W/m^2)***	***psPDtot+ 4 cm2 (W/m^2)***	***psPDmod+ 4 cm2 (W/m^2)***	***Measured Avg PD 4 cm2 (W/m^2)***	***Deviation (%)***	***Dipole S/N***	***Probe S/N***	***DAE S/N***
Nov. 22, 2023	10G	171	155	158	162	158.33	-7.41	2003	9639	1253
Dec. 27, 2023	10G	56.7	52.2	54.3	54.9	53.80	-5.11	1060	9639	541

Note:

The measured total PD was the average of psPDn+, psPDtot+ and psPDmod+, which refers to the demonstration from calibration certificate.

7. Test Equipment List

7.1 SAR Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Cal. Date	Cal.Period
SPEAG	2450 MHz System Validation Kit	D2450V2	712	Jul. 11, 2023	1 year
SPEAG	5 GHz System Validation Kit	D5GHzV2	1021	Jul. 18, 2023	1 year
SPEAG	5 GHz System Validation Kit	D5GHzV2	1358	Aug. 22, 2023	1 year
SPEAG	6.5 GHz System Validation Kit	D6.5GHzV2	1016	Aug. 16, 2023	1 year
SPEAG	5G Verification Source	10 GHz	2003	Feb. 15, 2023	1 year
SPEAG	5G Verification Source	10 GHz	1060	Aug. 21, 2023	1 year
SPEAG	Dosimetric E-Field Probe	EUmmWV4	9639	Aug. 18, 2023	1 year
SPEAG	Dosimetric E-Field Probe	EX3DV4	7647	Apr. 26, 2023	1 year
SPEAG	Dosimetric E-Field Probe	EX3DV4	3847	Mar. 23, 2023	1 year
SPEAG	Data Acquisition Electronics	DAE4	1253	Dec. 16, 2022	1 year
SPEAG	Data Acquisition Electronics	DAE4	541	Mar. 22, 2023	1 year
Keysight	Network Analyzer	E5080B	MY59202161	Feb. 18, 2023	1 year
SPEAG	Dielectric Probe Kit	DAK-3.5	1219	Jan. 19, 2023	1 year
SPEAG	Dielectric Probe Kit	DAKS_VNA R140	0010318	May. 22, 2023	1 year
SPEAG	Dielectric Probe Kit	DAKS-3.5	1101	May. 23, 2023	1 year
SPEAG	POWERSOURCE1	SE UMS 160 CA	4283	Aug. 16, 2023	1 year
HILA	Digital Thermometer	TM-905A	2202672	Aug. 02, 2023	1 year
Keysight	Spectrum Analyzer	N9010B	MY59071418	Mar. 20, 2023	1 year
Agilent	Power Sensor	8481H	3318A20779	May. 25, 2023	1 year
Agilent	Power Meter	EDM Series E4418B	GB40206143	May. 25, 2023	1 year
Agilent	Signal Generator	E8257D	MY44320425	Feb. 17, 2023	1 year
Testo	Thermometer	608-H1	45018321	May. 12, 2023	1 year

Testing Engineer: Gary Chao

8. Measurement Procedure

8.1 SAR Measurement Procedure

The measurement procedures are as follows:

1. The DUT is installed engineering testing software that provides continuous transmitting signal.
2. Measure output power through RF cable and power meter
3. Set scan area, grid size and other setting on the DASY software
4. Find out the largest SAR result on these testing positions of each band
5. Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

1. Power reference measurement
2. Area scan
3. Zoom scan
4. Power drift measurement

8.1.1 *Area & Zoom Scan Procedures*

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures points and step size follow as below. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution.

The measure settings are referred to KDB 865664 D01v01r04 :

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 mm ± 1 mm</td><td>½·δ·ln(2) mm ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: ΔxArea, ΔyArea</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: ΔxArea, ΔyArea</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: ΔzZoom(n)</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">Graded grid</td><td>ΔzZoom(1): between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>ΔzZoom(n>1): between subsequent points</td><td colspan="2">≤ 1.5·ΔzZoom(n-1) mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.
* When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

8.1.2 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1 g aggregate SAR, the DUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

8.1.3 Power Drift Monitoring

All SAR testing is under the DUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of DUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5 %, the SAR will be retested.

8.1.4 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1 g and 10 g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1 g and 10 g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. Extraction of the measured data (grid and values) from the Zoom Scan
2. Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. Generation of a high-resolution mesh within the measured volume
4. Interpolation of all measured values form the measurement grid to the high-resolution grid
5. Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. Calculation of the averaged SAR within masses of 1 g and 10 g

8.2 *Power Density Measurement Procedure*

8.2.1 *Power Density Assessment Based on E-field*

According to the IEEE/IEC 63195-1, within a short distance from the transmitting source, power density is determined based on both electric and magnetic fields. Generally, the magnitude and phase of two components of either the E-field or H-field are needed on a sufficiently large surface to fully characterize the total E-field and H-field distributions. The measurement points are chosen according to the requirements of the methodology used. The following procedure was used:

(1) Measure the E-field on the measurement surface at a reference location where the field is well above the noise level. This reference level will be used at the end of this procedure to assess output power drift of the DUT during the measurement.

(2) Scan the electric field on the measurement surface. The requirements of measurement surface dimensions and spatial resolution are dependent on the measurement system and assessment methodology applied. Measurements are therefore conducted according to the instructions provided by SPEAG user's mannual.

(3) Measurement spatial resolution can depend on the measured field characteristic and measurement methodology used by the system. Planar scanners typically require a step size of less than λ /2.

(4) Calculated H-field from measured field by using reconstruction algorithm since only E-field is directly measured on the evaluation surface. Reconstruction algorithms can also be used to obtain field information from the measured data. In substance, reconstruction algorithms are the set of algorithms, mathematical techniques and procedures that are applied to the measured field on the measurement surface to determine E- and H-field (amplitude and phase) on the evaluation surface.

(5) Determine the spatial-average power density distribution on the evaluation surface by the following formula. The spatial averaging area, A, is specified by the applicable exposure limits or regulatory requirements. The average area was specified according to regulatory requirements.

$$\mathbf{S}_{\mathbf{av}} = \frac{\mathbf{1}}{\mathbf{2}A} \Re \cdot \left(\int \mathbf{E} \times \mathbf{H} \cdot \hat{\mathbf{n}}\, \mathbf{dA} \right)$$

(6) The maximum spatial-average and/or local power density on the evaluation surface is the final quantity to determine compliance against applicable limits. The spatial averaging area, 4cm2, is specified by the Oct. 2018 TCB Workshop notes requirements.

(7) Measure the E-field on the measurement surface position at the reference location chosen in step A). The power drift of the DUT is estimated as the difference between the squared amplitude of the field values taken in steps a) and g). When the drift is smaller than ± 5 %, this term should be considered in the uncertainty budget. Drifts larger than 5 % due to the design and operating characteristics of the device should be accounted for or addressed according to regulatory requirements to determine compliance.

8.2.2 *Total Field and Power Density Reconstruction*

Computation of the power density in general requires knowledge of the electric (E-) and magnetic (H-) field amplitudes and phases in the plane of incidence. Reconstruction of these quantities from pseudo-vector E-field measurements is feasible, as they are constrained by Maxwell's equations. The manufacturer SPEAG have developed a reconstruction approach based on the Gerchberg-Saxton algorithm, which benefits from the availability of the E-field polarization ellipse information obtained with the EUmmWV3 probe. This reconstruction algorithm, together with the ability of the probe to measure extremely close to the source without perturbing the field, permits reconstruction of the E- and H-fields, as well as of the power density, on measurement planes located as near as λ/5 away.

9. Measurement Uncertainty

9.1 SAR Measurement Uncertainty

Measurement Uncertainty (0.3-6 GHz)								
Uncertainty Component	**Tol.**	**Prob. Dist.**	**Div.**	**Ci - 1g**	**Ci - 10g**	**ui - 1g (%)**	**ui - 10g (%)**	**vi**
Measurement System								
Probe calibration	12.0	N	2	1	1	6.0	6.0	∞
Probe Calibration Drift	1.7	R	1.732	1	1	1.0	1.0	∞
Other Probe+Electronic	0.7	N	1	1	1	0.7	0.7	∞
Probe Linearity	4.7	R	1.732	1	1	2.7	2.7	∞
Broadband Signal	3.0	R	1.732	1	1	1.7	1.7	∞
Probe Isotropy	7.6	R	1.732	1	1	4.4	4.4	∞
RF Ambient	1.8	N	1	1	1	1.8	1.8	∞
Probe Positioning	0.006 mm	N	1	0.14	0.14	0.1	0.1	∞
Data Processing	1.2	N	1	1	1	1.2	1.2	∞
Phantom and Device Errors								
Conductivity (meas.)DAK	2.5	N	1	0.78	0.71	2.0	1.8	∞
Conductivity (temp.)	3.3	R	1.732	0.78	0.71	1.5	1.4	∞
Phantom Shell Permittivity	14	R	1.732	0	0	0.0	0.0	∞
Distance DUT - TSL	2	N	1	2	2	4.0	4.0	∞
Device Positioning	1	N	1	1	1	1.0	1.0	∞
Device Holder	3.6	N	1	1	1	3.6	3.6	∞
DUT Modulation	2.4	R	1.732	1	1	1.4	1.4	∞
Time-average SAR	1.7	R	1.732	1	1	1.0	1.0	∞
DUT Drift	2.5	N	1	1	1	2.5	2.5	∞
Correction to the SAR Results								
Deviation to Target	1.9	N	1	1	0.84	1.9	1.6	∞
SAR scaling	0.0	R	1.732	1	1	0.0	0.0	∞
Combined Standard Uncertainty					RSS	11.0	10.9	
Expanded Uncertainty (95% confidence interval)					k =2	21.9	21.7	

Measurement Uncertainty (3-6 GHz)								
Uncertainty Component	***Tol.***	***Prob. Dist.***	***Div.***	***Ci - 1g***	***Ci - 10g***	***ui - 1g (%)***	***ui - 10g (%)***	***vi***
Measurement System								
Probe Calibration	13.1	N	2	1	1	6.55	6.55	∞
Probe Calibration Drift	1.7	R	1.732	1	1	1.0	1.0	∞
Other Probe+Electronic	1.2	N	1	1	1	1.2	1.2	∞
Probe Linearity	4.7	R	1.732	1	1	2.7	2.7	∞
Broadband Signal	2.6	R	1.732	1	1	1.5	1.5	∞
Probe Isotropy	7.6	R	1.732	1	1	4.4	4.4	∞
RF Ambient	1.8	N	1	1	1	1.8	1.8	∞
Probe Positioning	0.005 mm	N	1	0.29	0.29	0.15	0.15	∞
Data Processing	2.3	N	1	1	1	2.3	2.3	∞
Phantom and Device Errors								
Conductivity (meas.)DAK	2.5	N	1	0.78	0.71	2.0	1.8	∞
Conductivity (temp.)	3.4	R	1.732	0.78	0.71	1.5	1.4	∞
Phantom Shell Permittivity	14	R	1.732	0.25	0.25	2.0	2.0	∞
Distance DUT - TSL	2	N	1	2	2	4.0	4.0	∞
Device Positioning	1	N	1	1	1	1.0	1.0	∞
Device Holder	3.6	N	1	1	1	3.6	3.6	∞
DUT Modulation	2.4	R	1.732	1	1	1.4	1.4	∞
Time-average SAR	1.7	R	1.732	1	1	1.0	1.0	∞
DUT Drift	2.5	N	1	1	1	2.5	2.5	∞
Correction to the SAR Results								
Deviation to Target	1.9	N	1	1	0.84	1.9	1.6	∞
SAR scaling	0.0	R	1.732	1	1	0.0	0.0	∞
Combined Standard Uncertainty					RSS	11.6	11.6	
Expanded Uncertainty (95% confidence interval)					k =2	23.2	23.0	

Measurement Uncertainty (6-10 GHz)								
Uncertainty Component	**Tol.**	**Prob. Dist.**	**Div.**	**Ci - 1g**	**Ci - 10g**	**ui - 1g (%)**	**ui - 10g (%)**	**vi**
Measurement System								
Probe calibration	18.6	N	2	1	1	9.3	9.3	∞
Probe Calibration Drift	1.7	R	1.732	1	1	1.0	1.0	∞
Other Probe+Electronic	2.4	N	1	1	1	2.4	2.4	∞
Probe Linearity	4.7	R	1.732	1	1	2.7	2.7	∞
Broadband Signal	2.8	R	1.732	1	1	1.6	1.6	∞
Probe Isotropy	7.6	R	1.732	1	1	4.4	4.4	∞
RF Ambient Condition	1.8	N	1	1	1	1.8	1.8	∞
Probe Positioning	0.005mm	N	1	0.50	0.50	0.25	0.25	∞
Data Processing	3.5	N	1	1	1	3.5	3.5	∞
Phantom and Device Errors								
Conductivity (meas.)DAK	2.5	N	1	0.78	0.71	2.0	1.8	∞
Conductivity (temp.)	2.4	R	1.732	0.78	0.71	1.1	1.0	∞
Phantom Shell Permittivity	14.0	R	1.732	0.5	0.5	4.0	4.0	∞
Distance DUT - TSL	2	N	1	2	2	4.0	4.0	∞
Device Positioning	1	N	1	1	1	1.0	1.0	∞
Device Holder	3.6	N	1	1	1	3.6	3.6	∞
DUT Modulation	2.4	R	1.732	1	1	1.4	1.4	∞
Time-average SAR	1.7	R	1.732	1	1	1.0	1.0	∞
DUT Drift	2.5	N	1	1	1	2.5	2.5	∞
Correction to the SAR Results								
Deviation to Target	1.9	N	1	1	0.84	1.9	1.6	∞
SAR scaling	0.0	R	1.732	1	1	0.0	0.0	∞
Combined Standard Uncertainty					RSS	14.2	14.1	
Expanded Uncertainty (95% confidence interval)					k =2	28.4	28.3	

9.2 Power Density Measurement Uncertainty

Measurement Uncertainty for PD						
Error Description	***Uncertainty Value (± dB)***	***Prob Dist.***	***Div.***	***(Ci)***	***Standard Uncertainty (± dB)***	***Vif***
Measurement System						
Probe calibration	0.49	N	1	1	0.49	∞
Isotropy	0.50	R	1.732	1	0.29	∞
System Linearity	0.20	R	1.732	1	0.12	∞
System Detectection Limit	0.04	R	1.732	1	0.02	∞
Amplitude and phase noise	0.04	R	1.732	1	0.02	∞
Data Acquisition	0.03	N	1	1	0.03	∞
Probe Positioning Repeatability	0.04	R	1.732	1	0.02	∞
Probe Positioning Offset	0.30	R	1.732	1	0.17	∞
Field Reconstruction	0.60	R	1.732	1	0.35	∞
Test Sample Related						
Power Drift of Measurement	0.21	R	1.732	1	0.12	∞
Modulation Response	0.40	R	1.732	1	0.23	∞
Integration Time	0	R	1.732	1	0	∞
Response Time	0	R	1.732	1	0	∞
RF Ambient Noise	0.04	R	1.732	1	0.02	∞
RF Ambient Reflection	0.04	R	1.732	1	0.02	∞
Combined Std. Uncertainty					0.76	
Expanded Std. Uncertainty (K=2)					1.52	

10. Measurement Evaluation

10.1 Positioning of the DUT in Relation to the Phantom

The following measurement procedure shall be according to RSS-102 Supplementary procedures (SPR-001):

Unless the side(s)/edge(s) of the laptop type computer (laptop mode/tablet mode) containing the built-in antenna(s) was already tested against the flat phantom.

Industry Canada requires SAR measurements to be performed with the side(s)/edge(s) of the display screen containing the built-in antenna(s) pointing towards the flat phantom.

1. If the integrated antenna(s) are located in the back side of the display screen, the back side shall be facing towards the flat phantom at a distance not exceeding 25 mm.
2. If the integrated antenna(s) are installed along the edge(s) of the display screen, the edge(s) shall be facing towards the flat phantom at a distance not exceeding 25 mm.

According to KDB 616217 D04:

1. When antennas are incorporated in the keyboard section of a laptop computer, SAR is required for the bottom surface of the keyboard. Provided tablet use conditions are not supported by the laptop computer, SAR tests for bystander exposure from the edges of the keyboard.
2. Some 2-in-1 tablets may operate with the display folded on top of the keyboard. Most recent tablets are designed with an interactive display that may not require a physical keyboard. Both configurations are used in similar manners and require SAR evaluation for the back surface and edges of the tablet. For keyboards that can be unfolded like a laptop, the procedures for laptop platform should also be applied.

According to KDB 616217 D04:

1. SAR evaluation is required for back (bottom) surface and side edges of the devices.
2. Some 2-in-1 tablets may operate with the display folded on top of the keyboard. Most recent tablets are designed with an interactive display that may not require a physical keyboard. Both configurations are used in similar manners and require SAR evaluation for the back surface and edges of the tablet. For keyboards that can be unfolded like a laptop, SAR evaluation is required for the bottom surface of the keyboard.
3. SAR evaluation for the front surface of tablet display screens are generally not necessary, except for tablets that are designed to require continuous operations with the hand(s) next to the antenna.
4. When voice mode is supported on a tablet and it is limited to speaker mode or headset operations only, additional SAR testing for this type of voice use is not required.

10.2 SAR Testing Consideration

10.2.1 SAR Testing with WLAN

A Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement. The test frequencies established using test mode must correspond to the actualchannel frequencies.
For WLAN SAR testing, the DUT has installed WLAN engineering testing software which can provide continuous transmitting RF signal. And the RF signal utilized in SAR measurement has almost 100 % duty cycle and crest factor is 1.

- The cards was operated utilizing proprietary software (DRTU) and each channel was measured using a broadband power meter to determine the maximum average power.

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

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

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.

※ For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
※ When it is unclear, all equivalent conditions must be tested.

- For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required test channels are considered.

※ The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.

- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.

- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

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

- After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following:
  (1) The channel closest to mid-band frequency is selected for SAR measurement.
  (2) For channels with equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.
  These channel selection procedures apply to both the initial test configuration and subsequent test configuration(s) selection.

< U-NII 6-7 GHz SAR Testing Consideration>

WIFI6E SAR and Power Density measurements were implemented according to the U-NII 6-7 GHz Interim Procedures described in Oct. 2020 TCB workshop.

- A minimum of 5 test channels across full 5925 to 7125 MHz band were used.
- The SAR evaluations using 6-7 GHz parameters were perfomed per IEC/IEEE 62209-1528, and the Absorbed Power Density (APD) were reported based on SAR measurements.
  According to DASY Application Note, the APD is evaluated numerically using the FDTD method of Sim4Life V5.2. For comparison with the basic restrictions, the APD is averaged over square surface areas of 1 cm2 and 4 cm2 in the lowermost voxel layer of a flat phantom at a frequency of 6.5 GHz. The phantom consists of a dielectric shell of 2 mm thickness and a relative permittivity εr = 3.7. It is filled with a tissue-simulating liquid with εr = 34.5 and σ = 6.07 S/m.

10.3 *Gravity Sensor (G-sensor) Consideration*

This device has built-in G-sensor which triggers power reduction in specified modes. The mechanism operation was verificated according to the guidance in TCB workshop Oct.2021. The results shows as follows.

<WLAN 2.4G>

Orientation 1	<A> From the lid in closed mode (0 degrees), open the screen in 10 degree steps until laptop mode is obtained																																					
Laptop mode	Degree	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360
	Power	19.58	19.9	19.62	19.82	19.53	19.81	19.65	19.51	19.92	19.74	19.58	19.72	19.57	19.52	19.83	19.73	19.55	19.65	19.83	19.75	18.08																
Range of trigger angle	<B> Lower the screen by 5 degrees increments to verify that the “closed mode” is triggered.																																					
190	Degree	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	....						265	270	275	280	285	290	295	300	305	310	315	320	325	330
	Power									19.75	18.13																											
	<C> Open the screen in 1 degree steps until laptop mode is reobtained and continue opening the screen in 1 degree steps at least 5 degrees.																																					
	Degree	0	1	2	3	.....							190	191	192	193	194	195	....																			360
	Power												19.72	18.09	18.04	18.1	18.1	18.13																				
	<D> Then continue opening the screen in 10 degree steps until tablet mode is obtained.																																					
	Degree	0	10	20	35	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360
	Power																				19.76	18.03	18.09	18.11	18.12	18.21	18.16	18.25	18.27	18.18	18.15	18.02	18.04	18.29	18.18	18.13	18.22	18.25
Orientation 2	<A> From Tablet mode 0 degrees, open the screen in 10 degree step until laptop mode is obtained.																																					
Tablet mode	Degree	360	350	340	330	320	310	300	290	280	270	260	250	240	230	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0
	Power	18.21	18.09	18.08	18.29	18.11	18.22	18.24	18.1	18.29	18.3	18.02	18.17	18.19	18.07	18.22	18.05	18.12	19.84																			
Range of trigger angle	<B> Move back by 5 degree, until Tablet mode is reobtained.																																					
190	Degree	360	355	350	345	340	335	330	325	320	315	310	305	300							195	190			....										15	10	5	0
	Power																				18.22	19.87																
	<C> Open the screen in 1 degree steps until laptop mode is reobtained and continue opening the screen in 1 degree steps at least 5 degrees.																																					
	Degree	360	359	358	357	356	355	354	353	352	351	350	349	348	....									197	196	195	194	193	192	191	190	189	188	187	186	185	184	183
	Power																									18.3	18.23	18.3	18.21	18.17	19.95							
	<D> Then continue opening the screen in 10 degree steps until Close mode is obtained.																																					
	Degree	360	350	340	330	320	310	300	290	280	270	260	250	236	230	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0
	Power	18	18.06	18.05	18.12	18.26	18.3	18.26	18.3	18.1	18.19	18.06	18.1	18.11	18.05	18.13	18.29	18.21	19.91																			

<WLAN 5G>

Orientation 1	<A> From the lid in closed mode (0 degrees), open the screen in 10 degree steps until laptop mode is obtained																																					
Laptop mode	Degree	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360
	Power	18.22	18.22	18.04	18.17	18.12	18.01	18	18.06	18.1	18.25	18.13	18.22	18.24	18.14	18.04	18.09	18.07	18.27	18.25	18.09	9.2																
Range of trigger angle	<B> Lower the screen by 5 degrees increments to verify that the “closed mode” is triggered.																																					
190	Degree	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	....						265	270	275	280	285	290	295	300	305	310	315	320	325	330
	Power									18.09	9.01																											
	<C> Open the screen in 1 degree steps until laptop mode is reobtained and continue opening the screen in 1 degree steps at least 5 degrees.																																					
	Degree	0	1	2	3	.....							190	191	192	193	194	195	....																			360
	Power												18.09	9.18	9.07	9.08	9.04	9.13																				
	<D> Then continue opening the screen in 10 degree steps until tablet mode is obtained.																																					
	Degree	0	10	20	35	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360
	Power																				18.09	9.2	9.01	9.02	9.19	9.13	9.01	9.11	9.09	9.06	9.04	9.17	9.09	9.04	9.17	9.04	9.08	9.08
Orientation 2	<A> From Tablet mode 0 degrees, open the screen in 10 degree step until laptop mode is obtained.																																					
Tablet mode	Degree	360	350	340	330	320	310	300	290	280	270	260	250	240	230	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0
	Power	9.13	9.07	9.02	9.06	9.19	9.15	9.02	9.1	9.02	9.01	9.17	9.2	9.18	9.09	9.02	9.08	9.19	18.09																			
Range of trigger angle	<B> Move back by 5 degree, until Tablet mode is reobtained.																																					
190	Degree	360	355	350	345	340	335	330	325	320	315	310	305	300							195	190			....										15	10	5	0
	Power																				9.16	18.09																
	<C> Open the screen in 1 degree steps until laptop mode is reobtained and continue opening the screen in 1 degree steps at least 5 degrees.																																					
	Degree	360	359	358	357	356	355	354	353	352	351	350	349	348	....									197	196	195	194	193	192	191	190	189	188	187	186	185	184	183
	Power																									9.06	9.13	9.18	9.08	9.18	18.09							
	<D> Then continue opening the screen in 10 degree steps until Close mode is obtained.																																					
	Degree	360	350	340	330	320	310	300	290	280	270	260	250	236	230	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0
	Power	9.02	9.04	9.16	9.02	9.08	9.1	9.17	9.06	9.2	9.08	9.03	9.02	9.02	9.05	9.1	9.01	9.02	18.09	18.06	18.06	18.05	18.19	18.06	18.09	18.18	18.14	18.12	18.09	18.08	18.18	18.18	18.04	18.14	18.17	18.2	18.18	18.03

<WLAN 6G>

Orientation 1	<A> From the lid in closed mode (0 degrees), open the screen in 10 degree steps until laptop mode is obtained																																					
Laptop mode	Degree	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360
	Power	17.25	17.39	17.36	17.35	17.23	17.25	17.46	17.2	17.4	17.44	17.29	17.26	17.39	17.26	17.44	17.25	17.4	17.27	17.34	17.41	14.12																
Range of trigger angle	<B> Lower the screen by 5 degrees increments to verify that the “closed mode” is triggered.																																					
190	Degree	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	....						265	270	275	280	285	290	295	300	305	310	315	320	325	330
	Power									17.41	14.48																											
	<C> Open the screen in 1 degree steps until laptop mode is reobtained and continue opening the screen in 1 degree steps at least 5 degrees.																																					
	Degree	0	1	2	3	.....							190	191	192	193	194	195	....																			360
	Power												17.41	14.16	14.22	14.14	14.39	14.48																				
	<D> Then continue opening the screen in 10 degree steps until tablet mode is obtained.																																					
	Degree	0	10	20	35	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360
	Power																				17.41	14.3	14.13	14.41	14.11	14.38	14.13	14.39	14.35	14.46	14.15	14.37	14.24	14.3	14.22	14.43	14.24	14.19
Orientation 2	<A> From Tablet mode 0 degrees, open the screen in 10 degree step until laptop mode is obtained.																																					
Tablet mode	Degree	360	350	340	330	320	310	300	290	280	270	260	250	240	230	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0
	Power	14.21	14.19	14.25	14.17	14.11	14.49	14.48	14.27	14.49	14.17	14.34	14.48	14.17	14.46	14.22	14.45	14.12	17.41																			
Range of trigger angle	<B> Move back by 5 degree, until Tablet mode is reobtained.																																					
190	Degree	360	355	350	345	340	335	330	325	320	315	310	305	300							195	190			....										15	10	5	0
	Power																				14.48	17.41																
	<C> Open the screen in 1 degree steps until laptop mode is reobtained and continue opening the screen in 1 degree steps at least 5 degrees.																																					
	Degree	360	359	358	357	356	355	354	353	352	351	350	349	348	....									197	196	195	194	193	192	191	190	189	188	187	186	185	184	183
	Power																									14.48	14.23	14.21	14.26	14.14	17.41							
	<D> Then continue opening the screen in 10 degree steps until Close mode is obtained.																																					
	Degree	360	350	340	330	320	310	300	290	280	270	260	250	236	230	220	210	200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0
	Power	14.15	14.26	14.18	14.43	14.32	14.29	14.15	14.12	14.18	14.44	14.21	14.15	14.28	14.37	14.48	14.44	14.12	17.41	17.22	17.35	17.38	17.35	17.26	17.25	17.34	17.27	17.37	17.4	17.46	17.43	17.45	17.2	17.4	17.33	17.22	17.3	17.23

10.4 *Conducted Power Measurements*

Refer to Appendix A

10.5 *Antenna location*

Refer to Appendix E.

10.6 Test Results

10.6.1 SAR Test Result

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Antenna	Sample	Antenna Manufacturer	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
	WLAN 2.4 GHz	802.11b	Rear Face	0	1	2412	ANT 0	1	INPAQ	18.42	18.5	99.84	0.073	0.07
	WLAN 2.4 GHz	802.11b	Left Side	0	1	2412	ANT 0	1	INPAQ	18.42	18.5	99.84	1.07	1.09
	WLAN 2.4 GHz	802.11b	Right Side	0	1	2412	ANT 0	1	INPAQ	18.42	18.5	99.84	0.001	0.00
	WLAN 2.4 GHz	802.11b	Top Side	0	1	2412	ANT 0	1	INPAQ	18.42	18.5	99.84	0.024	0.02
	WLAN 2.4 GHz	802.11b	Bottom Side	0	1	2412	ANT 0	1	INPAQ	18.42	18.5	99.84	0.001	0.00
7	WLAN 2.4 GHz	802.11b	Bottom of laptop	0	1	2412	ANT 1	1	INPAQ	20.08	20.25	99.78	1.09	1.14
	WLAN 2.4 GHz	802.11b	Front Side of laptop	0	1	2412	ANT 1	1	INPAQ	20.08	20.25	99.78	0.723	0.75
	WLAN 2.4 GHz	802.11b	Rear Face	0	1	2412	ANT 1	1	INPAQ	18.46	18.5	99.78	0.519	0.52
	WLAN 2.4 GHz	802.11b	Left Side	0	1	2412	ANT 1	1	INPAQ	18.46	18.5	99.78	0.001	0.00
	WLAN 2.4 GHz	802.11b	Right Side	0	1	2412	ANT 1	1	INPAQ	18.46	18.5	99.78	0.25	0.25
	WLAN 2.4 GHz	802.11b	Top Side	0	1	2412	ANT 1	1	INPAQ	18.46	18.5	99.78	0.341	0.34
	WLAN 2.4 GHz	802.11b	Bottom Side	0	1	2412	ANT 1	1	INPAQ	18.46	18.5	99.78	0.001	0.00
	WLAN 2.4 GHz	802.11n HT20	Bottom of laptop	0	6	2437	ANT 0+1	1	INPAQ	22.51	23.25	99.56	0.807	0.96
	WLAN 2.4 GHz	802.11n HT20	Front Side of laptop	0	6	2437	ANT 0+1	1	INPAQ	22.51	23.25	99.56	0.629	0.75
	WLAN 2.4 GHz	802.11n HT20	Rear Face	0	6	2437	ANT 0+1	1	INPAQ	21.36	21.5	99.56	0.53	0.55
	WLAN 2.4 GHz	802.11n HT20	Left Side	0	6	2437	ANT 0+1	1	INPAQ	21.36	21.5	99.56	0.998	1.03
	WLAN 2.4 GHz	802.11n HT20	Right Side	0	6	2437	ANT 0+1	1	INPAQ	21.36	21.5	99.56	0.197	0.20
	WLAN 2.4 GHz	802.11n HT20	Top Side	0	6	2437	ANT 0+1	1	INPAQ	21.36	21.5	99.56	0.423	0.44
	WLAN 2.4 GHz	802.11n HT20	Bottom Side	0	6	2437	ANT 0+1	1	INPAQ	21.36	21.5	99.56	0.001	0.00
	WLAN 2.4 GHz	802.11b	Left Side	0	6	2437	ANT 0	1	INPAQ	18.39	18.5	99.78	0.922	0.95
	WLAN 2.4 GHz	802.11b	Left Side	0	11	2462	ANT 0	1	INPAQ	18.41	18.5	99.78	0.956	0.98
	WLAN 2.4 GHz	802.11b	Left Side	0	12	2467	ANT 0	1	INPAQ	18.38	18.5	99.78	0.842	0.87
	WLAN 2.4 GHz	802.11b	Left Side	0	13	2472	ANT 0	1	INPAQ	16.36	16.5	99.78	0.541	0.56
	WLAN 2.4 GHz	802.11b	Bottom of laptop	0	6	2437	ANT 1	1	INPAQ	20.07	20.25	99.78	0.997	1.04
	WLAN 2.4 GHz	802.11b	Bottom of laptop	0	11	2462	ANT 1	1	INPAQ	20.06	20.25	99.78	1.02	1.07
	WLAN 2.4 GHz	802.11b	Bottom of laptop	0	12	2467	ANT 1	1	INPAQ	18.65	18.75	99.78	0.761	0.78
	WLAN 2.4 GHz	802.11b	Bottom of laptop	0	13	2472	ANT 1	1	INPAQ	16.15	16.25	99.78	0.443	0.45
	WLAN 2.4 GHz	802.11n HT20	Bottom of laptop	0	6	2437	ANT 0+1	1	INPAQ	22.51	23.25	99.78	0.739	0.88
	WLAN 2.4 GHz	802.11n HT20	Bottom of laptop	0	11	2462	ANT 0+1	1	INPAQ	18.92	19.5	99.78	0.761	0.87
	WLAN 2.4 GHz	802.11n HT20	Bottom of laptop	0	12	2467	ANT 0+1	1	INPAQ	14.21	14.5	99.78	0.563	0.60
	WLAN 2.4 GHz	802.11n HT20	Bottom of laptop	0	13	2472	ANT 0+1	1	INPAQ	12.11	12.25	99.78	0.328	0.34
	WLAN 2.4 GHz	802.11n HT20	Left Side	0	6	2437	ANT 0+1	1	INPAQ	21.36	21.5	99.78	0.913	0.94
	WLAN 2.4 GHz	802.11n HT20	Left Side	0	11	2462	ANT 0+1	1	INPAQ	18.92	19.5	99.78	0.941	1.08
	WLAN 2.4 GHz	802.11n HT20	Left Side	0	12	2467	ANT 0+1	1	INPAQ	14.21	14.5	99.78	0.697	0.75
	WLAN 2.4 GHz	802.11n HT20	Left Side	0	13	2472	ANT 0+1	1	INPAQ	12.11	12.25	99.78	0.405	0.42
	WLAN 2.4 GHz	802.11b	Bottom of laptop	0	1	2412	ANT 1	1	INNOWAVE	20.08	20.25	99.78	1.05	1.09
	WLAN 2.4 GHz	802.11b	Bottom of laptop	0	1	2412	ANT 1	2	INPAQ	20.08	20.25	99.78	0.958	1.00
	WLAN 2.4 GHz	802.11b	Bottom of laptop	0	1	2412	ANT 1	2	INNOWAVE	20.08	20.25	99.78	0.938	0.98
40	Bluetooth	GFSK	Bottom of laptop	0	78	2480	ANT 1	1	INPAQ	10.33	10.5	77.50	0.031	0.04
	Bluetooth	GFSK	Front Side of laptop	0	78	2480	ANT 1	1	INPAQ	10.33	10.5	77.50	0.028	0.04
	Bluetooth	GFSK	Rear Face	0	78	2480	ANT 1	1	INPAQ	10.33	10.5	77.50	0.00689	0.01
	Bluetooth	GFSK	Left Side	0	78	2480	ANT 1	1	INPAQ	10.33	10.5	77.50	0.001	0.00
	Bluetooth	GFSK	Right Side	0	78	2480	ANT 1	1	INPAQ	10.33	10.5	77.50	0.00736	0.01
	Bluetooth	GFSK	Top Side	0	78	2480	ANT 1	1	INPAQ	10.33	10.5	77.50	0.00752	0.01
	Bluetooth	GFSK	Bottom Side	0	78	2480	ANT 1	1	INPAQ	10.33	10.5	77.50	0.001	0.00
	Bluetooth	GFSK	Bottom of laptop	0	0	2402	ANT 1	1	INPAQ	9.95	10.5	77.50	0.023	0.03
	Bluetooth	GFSK	Bottom of laptop	0	39	2441	ANT 1	1	INPAQ	10.11	10.5	77.50	0.013	0.02
	Bluetooth	GFSK	Bottom of laptop	0	78	2480	ANT 1	1	INNOWAVE	10.33	10.5	77.50	0.022	0.03
	Bluetooth	GFSK	Bottom of laptop	0	78	2480	ANT 1	2	INPAQ	10.33	10.5	77.50	0.024	0.03
	Bluetooth	GFSK	Bottom of laptop	0	78	2480	ANT 1	2	INNOWAVE	10.33	10.5	77.50	0.021	0.03

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Antenna	Sample	Antenna Manufacturer	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
	WLAN 5 GHz	802.11ac VHT80	Rear Face	0	42	5210	ANT 0	1	INPAQ	10.87	11	99.12	0.057	0.06
	WLAN 5 GHz	802.11ac VHT80	Left Side	0	42	5210	ANT 0	1	INPAQ	10.87	11	99.12	0.465	0.48
	WLAN 5 GHz	802.11ac VHT80	Right Side	0	42	5210	ANT 0	1	INPAQ	10.87	11	99.12	0.001	0.00
	WLAN 5 GHz	802.11ac VHT80	Top Side	0	42	5210	ANT 0	1	INPAQ	10.87	11	99.12	0.028	0.03
	WLAN 5 GHz	802.11ac VHT80	Bottom Side	0	42	5210	ANT 0	1	INPAQ	10.87	11	99.12	0.001	0.00
	WLAN 5 GHz	802.11ac VHT80	Bottom of laptop	0	42	5210	ANT 1	1	INPAQ	14.17	14.5	99.12	0.377	0.41
500	WLAN 5 GHz	802.11ac VHT80	Front Side of laptop	0	42	5210	ANT 1	1	INPAQ	14.17	14.5	99.12	0.911	0.99
	WLAN 5 GHz	802.11ac VHT80	Rear Face	0	42	5210	ANT 1	1	INPAQ	10.89	11	99.12	0.223	0.23
	WLAN 5 GHz	802.11ac VHT80	Left Side	0	42	5210	ANT 1	1	INPAQ	10.89	11	99.12	0.001	0.00
	WLAN 5 GHz	802.11ac VHT80	Right Side	0	42	5210	ANT 1	1	INPAQ	10.89	11	99.12	0.05	0.05
	WLAN 5 GHz	802.11ac VHT80	Top Side	0	42	5210	ANT 1	1	INPAQ	10.89	11	99.12	0.305	0.32
	WLAN 5 GHz	802.11ac VHT80	Bottom Side	0	42	5210	ANT 1	1	INPAQ	10.89	11	99.12	0.001	0.00
	WLAN 5 GHz	802.11ac VHT80	Bottom of laptop	0	42	5210	ANT 0+1	1	INPAQ	17.11	17.5	99.12	0.381	0.42
	WLAN 5 GHz	802.11ac VHT80	Front Side of laptop	0	42	5210	ANT 0+1	1	INPAQ	17.11	17.5	99.12	0.868	0.96
	WLAN 5 GHz	802.11ac VHT80	Rear Face	0	42	5210	ANT 0+1	1	INPAQ	13.85	14	99.12	0.224	0.23
	WLAN 5 GHz	802.11ac VHT80	Left Side	0	42	5210	ANT 0+1	1	INPAQ	13.85	14	99.12	0.49	0.51
	WLAN 5 GHz	802.11ac VHT80	Right Side	0	42	5210	ANT 0+1	1	INPAQ	13.85	14	99.12	0.031	0.03
	WLAN 5 GHz	802.11ac VHT80	Top Side	0	42	5210	ANT 0+1	1	INPAQ	13.85	14	99.12	0.286	0.30
	WLAN 5 GHz	802.11ac VHT80	Bottom Side	0	42	5210	ANT 0+1	1	INPAQ	13.85	14	99.12	0.001	0.00
	WLAN 5 GHz	802.11ac VHT80	Front Side of laptop	0	42	5210	ANT 1	1	INNOWAVE	14.17	14.5	99.12	0.884	0.96
	WLAN 5 GHz	802.11ac VHT80	Front Side of laptop	0	42	5210	ANT 1	2	INPAQ	14.17	14.5	99.12	0.856	0.93
	WLAN 5 GHz	802.11ac VHT80	Front Side of laptop	0	42	5210	ANT 1	2	INNOWAVE	14.17	14.5	99.12	0.812	0.88
	WLAN 5 GHz	802.11ac VHT160	Rear Face	0	50	5250	ANT 0	1	INPAQ	10.94	11	99.03	0.068	0.07
	WLAN 5 GHz	802.11ac VHT160	Left Side	0	50	5250	ANT 0	1	INPAQ	10.94	11	99.03	0.525	0.54
	WLAN 5 GHz	802.11ac VHT160	Right Side	0	50	5250	ANT 0	1	INPAQ	10.94	11	99.03	0.001	0.00
	WLAN 5 GHz	802.11ac VHT160	Top Side	0	50	5250	ANT 0	1	INPAQ	10.94	11	99.03	0.034	0.03
	WLAN 5 GHz	802.11ac VHT160	Bottom Side	0	50	5250	ANT 0	1	INPAQ	10.94	11	99.03	0.001	0.00
	WLAN 5 GHz	802.11ac VHT160	Bottom of laptop	0	50	5250	ANT 1	1	INPAQ	14.41	14.5	99.03	0.387	0.40
501	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	50	5250	ANT 1	1	INPAQ	14.41	14.5	99.03	0.912	0.94
	WLAN 5 GHz	802.11ac VHT160	Rear Face	0	50	5250	ANT 1	1	INPAQ	10.91	11	99.03	0.235	0.24
	WLAN 5 GHz	802.11ac VHT160	Left Side	0	50	5250	ANT 1	1	INPAQ	10.91	11	99.03	0.001	0.00
	WLAN 5 GHz	802.11ac VHT160	Right Side	0	50	5250	ANT 1	1	INPAQ	10.91	11	99.03	0.049	0.05
	WLAN 5 GHz	802.11ac VHT160	Top Side	0	50	5250	ANT 1	1	INPAQ	10.91	11	99.03	0.314	0.32
	WLAN 5 GHz	802.11ac VHT160	Bottom Side	0	50	5250	ANT 1	1	INPAQ	10.91	11	99.03	0.001	0.00
	WLAN 5 GHz	802.11n HT40	Bottom of laptop	0	54	5270	ANT 0+1	1	INPAQ	17.2	17.5	97.65	0.342	0.38
	WLAN 5 GHz	802.11n HT40	Front Side of laptop	0	54	5270	ANT 0+1	1	INPAQ	17.2	17.5	97.65	0.842	0.92
	WLAN 5 GHz	802.11ac VHT160	Rear Face	0	50	5250	ANT 0+1	1	INPAQ	13.91	14	99.03	0.237	0.24
	WLAN 5 GHz	802.11ac VHT160	Left Side	0	50	5250	ANT 0+1	1	INPAQ	13.91	14	99.03	0.566	0.58
	WLAN 5 GHz	802.11ac VHT160	Right Side	0	50	5250	ANT 0+1	1	INPAQ	13.91	14	99.03	0.032	0.03
	WLAN 5 GHz	802.11ac VHT160	Top Side	0	50	5250	ANT 0+1	1	INPAQ	13.91	14	99.03	0.29	0.30
	WLAN 5 GHz	802.11ac VHT160	Bottom Side	0	50	5250	ANT 0+1	1	INPAQ	13.91	14	99.03	0.001	0.00
	WLAN 5 GHz	802.11n HT40	Front Side of laptop	0	62	5310	ANT 0+1	1	INPAQ	17.21	17.5	97.65	0.842	0.92
	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	50	5250	ANT 1	1	INNOWAVE	14.41	14.5	99.03	0.876	0.90
	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	50	5250	ANT 1	1	INPAQ	14.41	14.5	99.03	0.845	0.87
	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	50	5250	ANT 1	2	INNOWAVE	14.41	14.5	99.03	0.833	0.86

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Antenna	Sample	Antenna Manufacturer	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
	WLAN 5 GHz	802.11ac VHT160	Rear Face	0	114	5570	ANT 0	1	INPAQ	10.44	10.5	99.03	0.071	0.07
	WLAN 5 GHz	802.11ac VHT160	Left Side	0	114	5570	ANT 0	1	INPAQ	10.44	10.5	99.03	0.444	0.45
	WLAN 5 GHz	802.11ac VHT160	Right Side	0	114	5570	ANT 0	1	INPAQ	10.44	10.5	99.03	0.001	0.00
	WLAN 5 GHz	802.11ac VHT160	Top Side	0	114	5570	ANT 0	1	INPAQ	10.44	10.5	99.03	0.034	0.03
	WLAN 5 GHz	802.11ac VHT160	Bottom Side	0	114	5570	ANT 0	1	INPAQ	10.44	10.5	99.03	0.001	0.00
	WLAN 5 GHz	802.11ac VHT160	Bottom of laptop	0	114	5570	ANT 1	1	INPAQ	14.29	14.5	99.03	0.511	0.54
502	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	114	5570	ANT 1	1	INPAQ	14.29	14.5	99.03	0.872	0.92
	WLAN 5 GHz	802.11ac VHT160	Rear Face	0	114	5570	ANT 1	1	INPAQ	10.45	10.5	99.03	0.117	0.12
	WLAN 5 GHz	802.11ac VHT160	Left Side	0	114	5570	ANT 1	1	INPAQ	10.45	10.5	99.03	0.001	0.00
	WLAN 5 GHz	802.11ac VHT160	Right Side	0	114	5570	ANT 1	1	INPAQ	10.45	10.5	99.03	0.041	0.04
	WLAN 5 GHz	802.11ac VHT160	Top Side	0	114	5570	ANT 1	1	INPAQ	10.45	10.5	99.03	0.235	0.24
	WLAN 5 GHz	802.11ac VHT160	Bottom Side	0	114	5570	ANT 1	1	INPAQ	10.45	10.5	99.03	0.001	0.00
	WLAN 5 GHz	802.11ac VHT80	Bottom of laptop	0	138	5690	ANT 0+1	1	INPAQ	17.25	17.5	97.65	0.327	0.35
	WLAN 5 GHz	802.11ac VHT80	Front Side of laptop	0	138	5690	ANT 0+1	1	INPAQ	17.25	17.5	97.65	0.842	0.91
	WLAN 5 GHz	802.11ac VHT160	Rear Face	0	114	5570	ANT 0+1	1	INPAQ	13.45	13.5	99.03	0.119	0.12
	WLAN 5 GHz	802.11ac VHT160	Left Side	0	114	5570	ANT 0+1	1	INPAQ	13.45	13.5	99.03	0.462	0.47
	WLAN 5 GHz	802.11ac VHT160	Right Side	0	114	5570	ANT 0+1	1	INPAQ	13.45	13.5	99.03	0.03	0.03
	WLAN 5 GHz	802.11ac VHT160	Top Side	0	114	5570	ANT 0+1	1	INPAQ	13.45	13.5	99.03	0.222	0.23
	WLAN 5 GHz	802.11ac VHT160	Bottom Side	0	114	5570	ANT 0+1	1	INPAQ	13.45	13.5	99.03	0.001	0.00
	WLAN 5 GHz	802.11ac VHT80	Front Side of laptop	0	106	5530	ANT 0+1	1	INPAQ	17.35	17.5	97.65	0.828	0.88
	WLAN 5 GHz	802.11ac VHT80	Front Side of laptop	0	122	5610	ANT 0+1	1	INPAQ	17.12	17.5	97.65	0.811	0.91
	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	114	5570	ANT 1	1	INNOWAVE	14.29	14.5	99.03	0.844	0.89
	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	114	5570	ANT 1	2	INPAQ	14.29	14.5	99.03	0.812	0.86
	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	114	5570	ANT 1	2	INNOWAVE	14.29	14.5	99.03	0.801	0.85
	WLAN 5 GHz	802.11ax HE160	Rear Face	0	163	5815	ANT 0	1	INPAQ	10.98	11	98.54	0.107	0.11
	WLAN 5 GHz	802.11ax HE160	Left Side	0	163	5815	ANT 0	1	INPAQ	10.98	11	98.54	0.853	0.87
	WLAN 5 GHz	802.11ax HE160	Right Side	0	163	5815	ANT 0	1	INPAQ	10.98	11	98.54	0.001	0.00
	WLAN 5 GHz	802.11ax HE160	Top Side	0	163	5815	ANT 0	1	INPAQ	10.98	11	98.54	0.024	0.02
	WLAN 5 GHz	802.11ax HE160	Bottom Side	0	163	5815	ANT 0	1	INPAQ	10.98	11	98.54	0.001	0.00
	WLAN 5 GHz	802.11ac VHT160	Bottom of laptop	0	163	5815	ANT 1	1	INPAQ	14.82	15	99.03	0.342	0.36
504	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	163	5815	ANT 1	1	INPAQ	14.82	15	99.03	0.978	1.03
	WLAN 5 GHz	802.11ax HE160	Rear Face	0	163	5815	ANT 1	1	INPAQ	10.83	11	98.54	0.163	0.17
	WLAN 5 GHz	802.11ax HE160	Left Side	0	163	5815	ANT 1	1	INPAQ	10.83	11	98.54	0.001	0.00
	WLAN 5 GHz	802.11ax HE160	Right Side	0	163	5815	ANT 1	1	INPAQ	10.83	11	98.54	0.066	0.07
	WLAN 5 GHz	802.11ax HE160	Top Side	0	163	5815	ANT 1	1	INPAQ	10.83	11	98.54	0.294	0.31
	WLAN 5 GHz	802.11ax HE160	Bottom Side	0	163	5815	ANT 1	1	INPAQ	10.83	11	98.54	0.001	0.00
	WLAN 5 GHz	802.11ac VHT160	Bottom of laptop	0	163	5815	ANT 0+1	1	INPAQ	17.84	18	99.03	0.333	0.35
	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	163	5815	ANT 0+1	1	INPAQ	17.84	18	99.03	0.924	0.97
	WLAN 5 GHz	802.11ax HE160	Rear Face	0	163	5815	ANT 0+1	1	INPAQ	13.49	14	98.54	0.157	0.18
	WLAN 5 GHz	802.11ax HE160	Left Side	0	163	5815	ANT 0+1	1	INPAQ	13.49	14	98.54	0.755	0.86
	WLAN 5 GHz	802.11ax HE160	Right Side	0	163	5815	ANT 0+1	1	INPAQ	13.49	14	98.54	0.048	0.05
	WLAN 5 GHz	802.11ax HE160	Top Side	0	163	5815	ANT 0+1	1	INPAQ	13.49	14	98.54	0.279	0.32
	WLAN 5 GHz	802.11ax HE160	Bottom Side	0	163	5815	ANT 0+1	1	INPAQ	13.49	14	98.54	0.001	0.00
	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	163	5815	ANT 1	1	INNOWAVE	14.82	15	99.03	0.949	1.00
	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	163	5815	ANT 1	2	INPAQ	14.82	15	99.03	0.726	0.76
	WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	163	5815	ANT 1	2	INNOWAVE	14.82	15	99.03	0.662	0.70

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Antenna	Sample	Antenna Manufacturer	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
	WLAN 6 GHz	802.11ax HE160	Rear Face	0	111	6505	ANT 0	1	INPAQ	10.49	10.5	98.71	0.064	0.06
194	WLAN 6 GHz	802.11ax HE160	Left Side	0	111	6505	ANT 0	1	INPAQ	10.49	10.5	98.71	0.445	0.45
	WLAN 6 GHz	802.11ax HE160	Right Side	0	111	6505	ANT 0	1	INPAQ	10.49	10.5	98.71	0.001	0.00
	WLAN 6 GHz	802.11ax HE160	Top Side	0	111	6505	ANT 0	1	INPAQ	10.49	10.5	98.71	0.018	0.02
	WLAN 6 GHz	802.11ax HE160	Bottom Side	0	111	6505	ANT 0	1	INPAQ	10.49	10.5	98.71	0.001	0.00
	WLAN 6 GHz	802.11ax HE160	Bottom of laptop	0	111	6505	ANT 1	1	INPAQ	13.49	13.5	98.71	0.14	0.14
	WLAN 6 GHz	802.11ax HE160	Front Side of laptop	0	111	6505	ANT 1	1	INPAQ	13.49	13.5	98.71	0.389	0.39
	WLAN 6 GHz	802.11ax HE160	Rear Face	0	111	6505	ANT 1	1	INPAQ	10.45	10.5	98.71	0.135	0.14
	WLAN 6 GHz	802.11ax HE160	Left Side	0	111	6505	ANT 1	1	INPAQ	10.45	10.5	98.71	0.001	0.00
	WLAN 6 GHz	802.11ax HE160	Right Side	0	111	6505	ANT 1	1	INPAQ	10.45	10.5	98.71	0.063	0.06
	WLAN 6 GHz	802.11ax HE160	Top Side	0	111	6505	ANT 1	1	INPAQ	10.45	10.5	98.71	0.149	0.15
	WLAN 6 GHz	802.11ax HE160	Bottom Side	0	111	6505	ANT 1	1	INPAQ	10.45	10.5	98.71	0.001	0.00
	WLAN 6 GHz	802.11ax HE160	Bottom of laptop	0	111	6505	ANT 0+1	1	INPAQ	13.47	13.5	98.71	0.047	0.05
	WLAN 6 GHz	802.11ax HE160	Front Side of laptop	0	111	6505	ANT 0+1	1	INPAQ	13.47	13.5	98.71	0.345	0.35
	WLAN 6 GHz	802.11ax HE160	Rear Face	0	111	6505	ANT 0+1	1	INPAQ	13.47	13.5	98.71	0.071	0.07
	WLAN 6 GHz	802.11ax HE160	Left Side	0	111	6505	ANT 0+1	1	INPAQ	13.47	13.5	98.71	0.223	0.23
	WLAN 6 GHz	802.11ax HE160	Right Side	0	111	6505	ANT 0+1	1	INPAQ	13.47	13.5	98.71	0.025	0.03
	WLAN 6 GHz	802.11ax HE160	Top Side	0	111	6505	ANT 0+1	1	INPAQ	13.47	13.5	98.71	0.073	0.07
	WLAN 6 GHz	802.11ax HE160	Bottom Side	0	111	6505	ANT 0+1	1	INPAQ	13.47	13.5	98.71	0.001	0.00
	WLAN 6 GHz	802.11ax HE160	Left Side	0	15	6025	ANT 0	1	INPAQ	10.28	10.5	98.71	0.311	0.33
	WLAN 6 GHz	802.11ax HE160	Left Side	0	143	6665	ANT 0	1	INPAQ	10.28	10.5	98.71	0.358	0.38
	WLAN 6 GHz	802.11ax HE160	Left Side	0	175	6825	ANT 0	1	INPAQ	10.25	10.5	98.71	0.319	0.34
	WLAN 6 GHz	802.11ax HE160	Left Side	0	207	6985	ANT 0	1	INPAQ	10.26	10.5	98.71	0.289	0.31
	WLAN 6 GHz	802.11ax HE160	Left Side	0	111	6505	ANT 0	1	INNOWAVE	10.49	10.5	98.71	0.415	0.42
	WLAN 6 GHz	802.11ax HE160	Left Side	0	111	6505	ANT 0	2	INPAQ	10.49	10.5	98.71	0.404	0.41
	WLAN 6 GHz	802.11ax HE160	Left Side	0	111	6505	ANT 0	2	INNOWAVE	10.49	10.5	98.71	0.397	0.40

10.6.2 Power Density Test Result

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Antenna	Sample	Antenna Manufacturer	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	Scaling Factor for Measurement Uncertainty	sPDn 4 cm^2 (W/m^2)	Scaling sPDn 4 cm^2 (W/m^2)	sPDtot 4 cm^2 (W/m^2)	Scaling sPDtot 4 cm^2 (W/m^2)
	WLAN 6 GHz	802.11ax HE160	Rear Face	2	111	ANT 0	1	INPAQ	10.49	10.5	98.71	1.119	0.637	0.65	1.21	1.23
302	WLAN 6 GHz	802.11ax HE160	Left Side	2	111	ANT 0	1	INPAQ	10.49	10.5	98.71	1.119	3.87	3.93	7.39	7.50
	WLAN 6 GHz	802.11ax HE160	Right Side	2	111	ANT 0	1	INPAQ	10.49	10.5	98.71	1.119	0	0.00	0	0.00
	WLAN 6 GHz	802.11ax HE160	Top Side	2	111	ANT 0	1	INPAQ	10.49	10.5	98.71	1.119	0.179	0.18	0.343	0.35
	WLAN 6 GHz	802.11ax HE160	Bottom Side	2	111	ANT 0	1	INPAQ	10.49	10.5	98.71	1.119	0	0.00	0	0.00
	WLAN 6 GHz	802.11ax HE160	Bottom of laptop	2	111	ANT 1	1	INPAQ	13.49	13.5	98.71	1.119	1.01	1.03	1.92	1.95
	WLAN 6 GHz	802.11ax HE160	Front Side of laptop	2	111	ANT 1	1	INPAQ	13.49	13.5	98.71	1.119	3.12	3.17	6.11	6.20
	WLAN 6 GHz	802.11ax HE160	Rear Face	2	111	ANT 1	1	INPAQ	10.45	10.5	98.71	1.119	1.2	1.23	2.29	2.35
	WLAN 6 GHz	802.11ax HE160	Left Side	2	111	ANT 1	1	INPAQ	10.45	10.5	98.71	1.119	0	0.00	0	0.00
	WLAN 6 GHz	802.11ax HE160	Right Side	2	111	ANT 1	1	INPAQ	10.45	10.5	98.71	1.119	0.606	0.62	1.15	1.18
	WLAN 6 GHz	802.11ax HE160	Top Side	2	111	ANT 1	1	INPAQ	10.45	10.5	98.71	1.119	1.54	1.58	2.94	3.01
	WLAN 6 GHz	802.11ax HE160	Bottom Side	2	111	ANT 1	1	INPAQ	10.45	10.5	98.71	1.119	0	0.00	0	0.00
	WLAN 6 GHz	802.11ax HE160	Bottom of laptop	2	111	ANT 0+1	1	INPAQ	13.47	13.5	98.71	1.119	0.449	0.46	0.858	0.88
	WLAN 6 GHz	802.11ax HE160	Front Side of laptop	2	111	ANT 0+1	1	INPAQ	13.47	13.5	98.71	1.119	2.98	3.04	5.71	5.82
	WLAN 6 GHz	802.11ax HE160	Rear Face	2	111	ANT 0+1	1	INPAQ	13.47	13.5	98.71	1.119	0.543	0.55	1.03	1.05
	WLAN 6 GHz	802.11ax HE160	Left Side	2	111	ANT 0+1	1	INPAQ	13.47	13.5	98.71	1.119	1.83	1.87	3.51	3.58
	WLAN 6 GHz	802.11ax HE160	Right Side	2	111	ANT 0+1	1	INPAQ	13.47	13.5	98.71	1.119	0.25	0.26	0.478	0.49
	WLAN 6 GHz	802.11ax HE160	Top Side	2	111	ANT 0+1	1	INPAQ	13.47	13.5	98.71	1.119	0.761	0.78	1.45	1.48
	WLAN 6 GHz	802.11ax HE160	Bottom Side	2	111	ANT 0+1	1	INPAQ	13.47	13.5	98.71	1.119	0	0.00	0	0.00
	WLAN 6 GHz	802.11ax HE160	Left Side	2	15	ANT 0	1	INPAQ	10.28	10.5	98.71	1.119	2.58	2.75	4.93	5.25
	WLAN 6 GHz	802.11ax HE160	Left Side	2	143	ANT 0	1	INPAQ	10.28	10.5	98.71	1.119	3.12	3.32	5.97	6.36
	WLAN 6 GHz	802.11ax HE160	Left Side	2	175	ANT 0	1	INPAQ	10.25	10.5	98.71	1.119	2.71	2.91	5.18	5.56
	WLAN 6 GHz	802.11ax HE160	Left Side	2	207	ANT 0	1	INPAQ	10.26	10.5	98.71	1.119	2.49	2.67	4.75	5.09
	WLAN 6 GHz	802.11ax HE160	Left Side	2	111	ANT 0	1	INNOWAVE	10.49	10.5	98.71	1.119	3.68	3.74	7.03	7.14
	WLAN 6 GHz	802.11ax HE160	Left Side	2	111	ANT 0	2	INPAQ	10.49	10.5	98.71	1.119	3.99	4.05	6.21	6.31
	WLAN 6 GHz	802.11ax HE160	Left Side	2	111	ANT 0	2	INNOWAVE	10.49	10.5	98.71	1.119	3.81	3.87	6.13	6.22

Note:

1. The test spacing is the distance between probe sensor and DUT surface.
2. The test duty cycle was approached 100 % to facilitate test measurements only. It was confirmed by the manufacturer that the device was not over driven at this test duty cycle, to facilitate linear scaling in the test report.
3. 1.0 W/m2 = 0.1 mW/cm2.

10.7 Measurement Variability

According to KDB 865664 D01v01r04, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

The following procedures are applied to determine if repeated measurements are required:

1. The original highest measured Reported SAR 1-g is ≧ 0.80 W/kg, repeated that measurement once.
2. Perform a second repeated measurement the ratio of the largest to the smallest SAR for the original and first repeated measurements is <1.2 W/kg, or when the original or repeated measurement is ≧ 1.45 W/kg (~10% from the 1-g SAR limit).

Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Note	Original SAR_{1g} (W/kg)	First SAR_{1g} (W/kg)	First Ratio SAR_{1g}	Original SAR_{10g} (W/kg)	First SAR_{10g} (W/kg)	First Ratio SAR_{10g}
WLAN 2.4 GHz	802.11b	Bottom of laptop	0	1	2412	Index. #7_once	1.09	1.06	2.75%	0.452	0.441	2.43%
WLAN 5 GHz	802.11ac VHT80	Front Side of laptop	0	42	5210	Index. #500_once	0.911	0.882	3.18%	0.266	0.257	3.38%
WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	50	5250	Index. #501_once	0.912	0.897	1.64%	0.288	0.284	1.39%
WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	114	5570	Index. #502_once	0.872	0.829	4.93%	0.276	0.264	4.35%
WLAN 5 GHz	802.11ac VHT160	Front Side of laptop	0	163	5815	Index. #504_once	0.978	0.942	3.68%	0.312	0.304	2.56%

10.8 *Simultaneous Transmission Evaluation*

10.8.1 *Simultaneous Transmission Configurations*

Simultaneous Tx Combination	*Capable Transmit Configuration*
1	WLAN 2.4 GHz ANT 0 + Bluetooth ANT 1
2	WLAN 5 GHz ANT 0 + Bluetooth ANT 1
3	WLAN 5 GHz ANT 0+1 + Bluetooth ANT 1
4	WLAN 6 GHz ANT 0 + Bluetooth ANT 1
5	WLAN 6 GHz ANT 0+1 + Bluetooth ANT 1

<Total Exposure Ratio (TER)>

According to IEC TR 63170 and TCBC workshop, total Exposure Ratio (TER) is calculated by taking ratio of reported SAR divided by SAR limit and adding it to measured power density divided by power density limit.

$$\text{TER} = \sum_{n=1}^{N} \frac{SAR_n}{SAR_n\,,\ limit} + \sum_{m=1}^{M} \frac{S_{m,avg}}{S_{lim}\,,\ limit} < 1$$

Numerical sum of the two ratios should be less than 1.

The worst-case power density results for each test configuration among all antenna arrays were considered for Total Exposure Ratio (TER) analysis. The sum of TER were listed in the following subclause.

10.8.2 Simultaneous Transmission Result

When the sum of SAR1g of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.
The sum of SAR1g results is shown as below.

<Sum of SAR1g Results>

Exposure Position	1	2	3	4	5	6	7	8	9	10	1 + 10	4 + 10	6 + 10	7 + 10	9 + 10
	WLAN 2.4 GHz ANT 0	WLAN 2.4 GHz ANT 1	WLAN 2.4 GHz ANT 0+1	WLAN 5 GHz ANT 0	WLAN 5 GHz ANT 1	WLAN 5 GHz ANT 0+1	WLAN 6 GHz ANT 0	WLAN 6 GHz ANT 1	WLAN 6 GHz ANT 0+1	Bluetooth ANT 1	$\sum SAR_{1g}$ (W/kg)	$\sum SAR_{1g}$ (W/kg)	$\sum SAR_{1g}$ (W/kg)	$\sum SAR_{1g}$ (W/kg)	$\sum SAR_{1g}$ (W/kg)
	SAR_{1g} (W/kg)	SAR_{1g} (W/kg)	SAR_{1g} (W/kg)	SAR_{1g} (W/kg)	SAR_{1g} (W/kg)	SAR_{1g} (W/kg)	SAR_{1g} (W/kg)	SAR_{1g} (W/kg)	SAR_{1g} (W/kg)	SAR_{1g} (W/kg)					
Bottom of Laptop at 0 mm	0.00	1.14	0.96	0.00	0.54	0.42	0.00	0.14	0.05	0.04	0.04	0.04	0.46	0.04	0.09
Front Side of Laptop at 0 mm	0.00	0.75	0.75	0.00	1.03	0.97	0.00	0.39	0.35	0.04	0.04	0.04	1.01	0.04	0.39
Rear Face at 0 mm	0.07	0.52	0.55	0.11	0.24	0.24	0.06	0.14	0.07	0.01	0.08	0.12	0.25	0.07	0.08
Left Side at 0 mm	1.09	0.00	1.08	0.87	0.00	0.86	0.45	0.00	0.23	0.00	1.09	0.87	0.86	0.45	0.23
Right Side at 0 mm	0.00	0.25	0.20	0.00	0.07	0.05	0.00	0.06	0.03	0.01	0.01	0.01	0.06	0.01	0.04
Top Side at 0 mm	0.02	0.34	0.44	0.03	0.32	0.32	0.02	0.15	0.07	0.01	0.03	0.04	0.33	0.03	0.08
Bottom Side at 0 mm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

<Total Exposure Ratio (TER) Results>

	8	9	10	11	8+11	10+11
Exposure Position	WLAN 6 GHz ANT 0	WLAN 6 GHz ANT 1	WLAN 6 GHz ANT 0+1	Bluetooth ANT 1	Total Exposure Ratio	Total Exposure Ratio
Test Postion	Total PD (W/m²)	Total PD (W/m²)	Total PD (W/m²)	SAR1 g (W/kg)		
Bottom of laptop	0	1.95	0.88	0.04	0.03	0.11
Front Side of Laptop	0	6.2	5.82	0.04	0.03	0.61
Rear Face	1.23	2.35	1.05	0.01	0.13	0.11
Left Side	7.5	0	3.58	0	0.75	0.36
Right Side	0	1.18	0.49	0.01	0.01	0.06
Top Side	0.35	3.01	1.48	0.01	0.04	0.15
Bottom Side	0	0	0	0	0.00	0.00

Note: 1.0 W/m2 = 0.1 mW/cm2.

10.8.3 SAR to peak location separation (SPLSR)

According to KDB 447498, when the sum of SAR is greater than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio (SPLSR), and the simultaneously transmitting antennas must be considered one pair at a time. The ratio is determined by **(SAR1+SAR2)1.5 / (separation distance between the peak SAR locations for the antenna pair, mm)**, round 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 SPLSR hotspot combination procedure in TCB workshop Nov. 2019 was applied when simultaneous transmission SAR is > 1.6 W/kg and antenna pair is co-located.

SPLSR analysis is not required in this report since the sum of SAR is under the SAR limit.

10.9 Requirements on the Uncertainty Evaluation

10.9.1 SAR Uncertainty Evaluation

Decision Rule

■ Uncertainty is not included.

☐ Uncertainty is included.

The highest measured 1-g SAR is less than 1.5 W/kg and the highest measured 10-g SAR is less than 3.75 W/kg. Therefore, per KDB Publication 865664 D01, the extended measurement uncertainty analysis described in IEEE 1528-2013 and IEC/IEEE 62209-1528 is not required.

10.9.2 Power Density Uncertainty Evaluation

Decision Rule

■ Uncertainty is not included.

☐ Uncertainty is included.

According to IEC/IEEE 63195, if the total uncertainty exceeds 2 dB, the measurement results must be adjusted according to IEC 62479. The total measurement uncertainty for DASY system is 1.51 dB. Therefore, the adjustment is not required.

11. Conclusion

The SAR test values and PD test values found for the device are separately below the maximum limit of 1.6 W/kg and 1.0 mW/cm2.

************************************ End of Report ************************************