



Test report No.: 2470803R-SAUSV01S-A

SAR Test Report

Product Name	WiFi USB Adapter
Trademark	msi
Model and /or type reference	GUBE65
Applicant's name / address	Micro-Star Int'l Co.,Ltd. No.69, Lide St., Zhonghe Dist., New Taipei City 235, Taiwan
Manufacturer's name	Micro-Star Int'l Co.,Ltd.
FCC ID	I4L-GUBE65
Applicable Standard	IEEE 1528-2013 KDB 447498 D01 v06 KDB 865664 D01 v01r04
Test Result	Max. SAR Measurement (1g) 2.4 GHz: 1.120 W/kg 5 GHz: 1.177 W/kg 6 GHz: 0.733 W/kg Max. psPD Measurement (4cm ²) 6 GHz: 9.162 W/m ²
Verdict Summary	IN COMPLIANCE
Documented By (Senior Project Specialist / Genie Chang)	<i>Genie Chang</i>
Tested By (Senior Engineer / Luke Cheng)	<i>Luke Cheng</i>
Approved By (Assistant Manager / San Lin)	<i>San Lin</i>
Date of Receipt	2024/07/26
Date of Issue	2024/12/26
Report Version	V1.0

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

Revision History

Report No.	Version	Description	Issued Date
2470803R-SAUSV01S-A	V1.0	Initial issue of report.	2024/12/26

1. General Information

1.1 EUT Description

Product Name	WiFi USB Adapter
Trademark	msi
Model and /or type reference	GUBE65
FCC ID	I4L-GUBE65
Frequency Range	WLAN 2.4GHz: 2412-2472MHz WLAN 5GHz: 5180-5240MHz, 5260-5320MHz, 5500-5720MHz, 5745-5825MHz, 5845-5885MHz WLAN 6GHz: 5955-7115MHz
Type of Modulation	802.11b: DSSS 802.11a/g/n/ac/ax/be: OFDM, OFDMA
Antenna Type	PCB
Device Category	Portable
RF Exposure Environment	Uncontrolled

Summary of test result – Reported 1g SAR (W/kg)			
Test configuration	DTS	NII	6XD
Standalone	1.120	1.177	0.733
Summary of test result – Power Density			
Test configuration	6XD		
APD (W/m ²)	4.400		
Reported PD (W/m ²)	9.162		

1.2 Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	WHA YU	C059-510503-A (Main)	PCB	1.78 dBi for 2400 MHz 2.70 dBi for 5150~5250 MHz 2.52 dBi for 5250~5350 MHz 2.67 dBi for 5470~5725 MHz 2.62 dBi for 5725~5850 MHz 2.61 dBi for 5850~5895MHz 2.80 dBi for 5925~6425MHz 2.69 dBi for 6425~6525MHz 2.69 dBi for 6525~6875MHz 2.64 dBi for 6875~7125MHz
		C059-510504-A (Aux)		1.62 dBi for 2400 MHz 2.67 dBi for 5150~5250 MHz 2.67 dBi for 5250~5350 MHz 2.66 dBi for 5470~5725 MHz 2.66 dBi for 5725~5850 MHz 2.36 dBi for 5850~5895MHz 2.76 dBi for 5925~6425MHz 2.45 dBi for 6425~6525MHz 2.45 dBi for 6525~6875MHz 1.84 dBi for 6875~7125MHz

Note: The above EUT information by manufacturer.

1.3 Test Environment

Ambient conditions in the laboratory:

Test Date: 2024/10/23 - 2024/11/25

Items	Required	Actual
Temperature (°C)	18-25	23 ± 2
Humidity (%RH)	30-70	50 ± 20

USA	FCC Designation Number: TW0033
Canada	CAB Identifier Number: TW3023 / Company Number: 26930

Site Description	Accredited by TAF
	Accredited Number: 3023

Test Laboratory	DEKRA Testing and Certification Co., Ltd.
	Linkou Laboratory
Address	No.5-22, Ruishukeng Linkou District, New Taipei City, 24451, Taiwan, R.O.C
Performed Location	No. 26, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan, R.O.C.
Phone Number	+886-3-275-7255
Fax Number	+886-3-327-8031

1.4 Measurement procedures

IEEE 1528-2013

47CFR § 2.1093

KDB 248227 D01 v02r02

KDB 447498 D01 v06

KDB 447498 D02 v02r01

KDB 865664 D01 v01r04

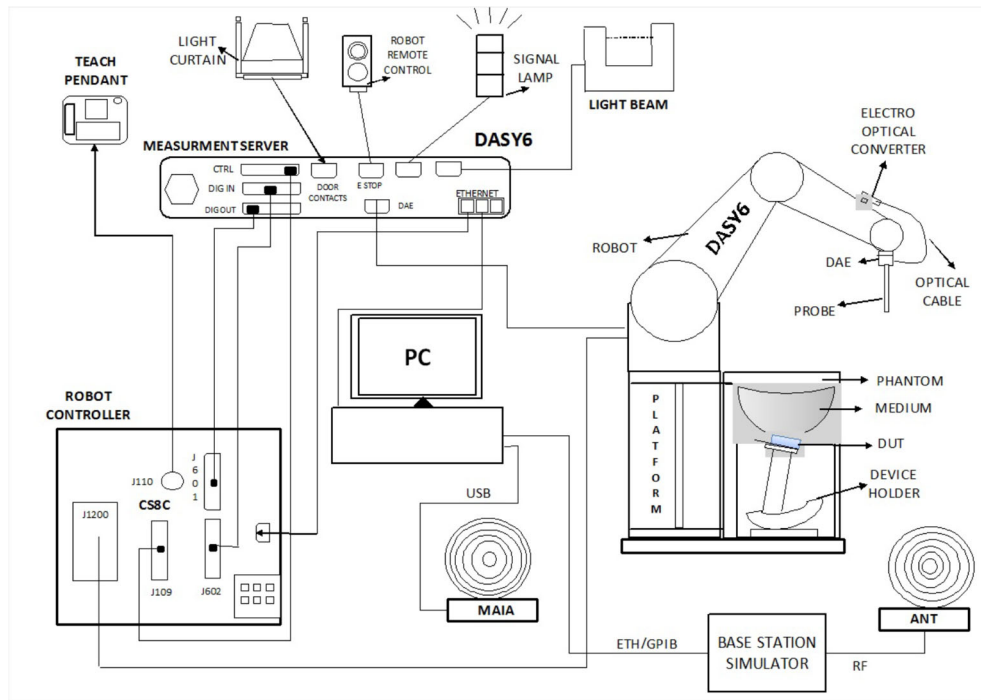
IEC TR 63170:2018

IEC/IEEE 62209-1528:2020

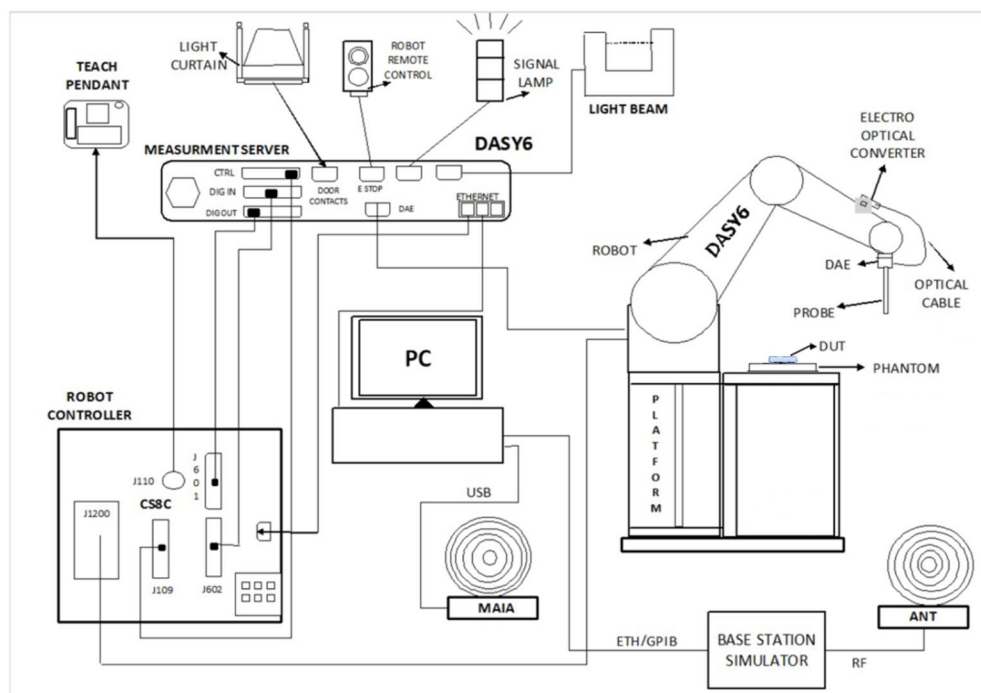
2. SAR Measurement System

2.1 DASY System Description

SAR Configurations is shown below:



Power Density Configurations is shown below:



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

- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7/8/10 and the DASY software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

2.2 Area Scans

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

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing.

2.2.1 Zoom Scan (Cube Scan Averaging)

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

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

2.2.2 SAR measurement drifts

Before an area scan and after the zoom scan, single point SAR measurements are performed at defined locations to estimate the SAR measurement drift due to device output power variations. If a device is known to drift randomly, additional single point drift reference measurements should be performed at regular intervals throughout the area and zoom scan test durations. The SAR drift shall be kept within $\pm 5\%$, whether there are substantial drifts or not. The field difference will be calculated in dB units in the DASY software.

2.2.3 Uncertainty of Inter-/Extrapolation and Averaging

In order to evaluate the uncertainty of the interpolation, extrapolation and averaged SAR calculation algorithms of the Postprocessor, DASY allows the generation of measurement grids which are artificially predefined by analytically based test functions. Therefore, the grids of area scans and zoom scans can be filled with uncertainty test data, according to the SAR benchmark functions.

2.3 DASY E-Field Probe

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

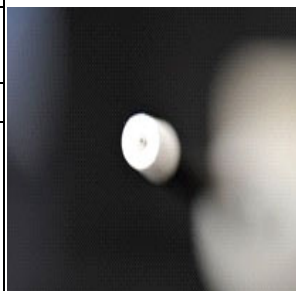
SPEAG conducts the probe calibration in compliance with international and national standards under ISO 17025.

The calibration data are in Appendix D.

Isotropic E-Field Probe Specification

Model	Ex3DV4	
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	4 MHz – 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)	
Dynamic Range	10 μ W/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μ W/g)	
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	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

E-Field mm-Wave Probe Specification

Model	EUmmWVx	
Construction	Two dipoles optimally arranged to obtain pseudo-vector information Minimum three measurements/point, 120° rotated around probe axis Sensors (0.8 mm length) printed on glass substrate protected by high density foam	
Frequency	750 MHz to 110 GHz	
Dynamic Range	< 20 V/m to 10000 V/m with PRE-10 (min < 20 V/m to 2000 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	
Application	E-field measurements of 5G devices and other mm-wave transmitters operating above 10GHz in < 2 mm distance from device (free-space) Power density, H-field, and far-field analysis using total field reconstruction	

2.4 DATA Acquisition Electronics (DAE) and Measurement Server

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit.

Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE4 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.



2.5 Robot

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

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

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

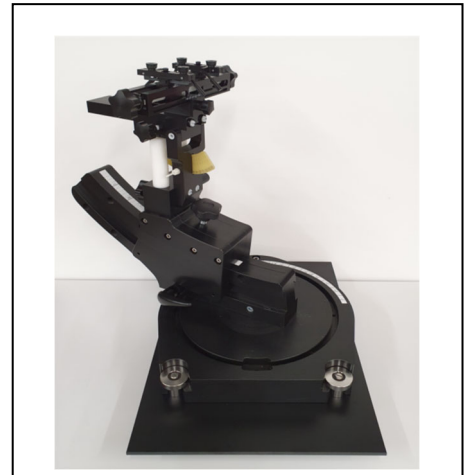


2.6 Device Holder

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

Thus the device needs no repositioning when changing the angles.

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



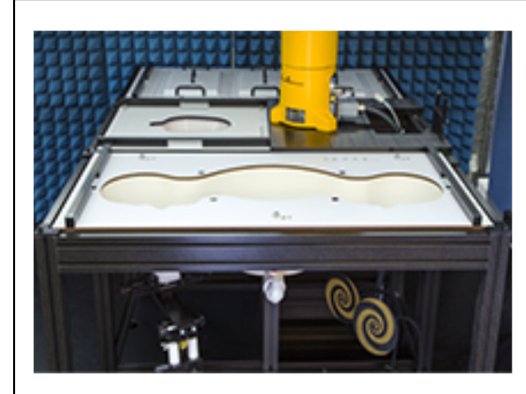
2.7 Phantom

2.7.1 SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm).

It has three measurement areas:

- Left head
- Right head
- Flat phantom



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

2.7.2 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) side or any opposite-radiating side of wireless devices operating above 10 GHz without distorting the RF field. It consists of a 40 mm thick Rohacell plate used as a test bed, which has a loss tangent ($\tan \delta$) ≤ 0.05 and a relative permittivity (ϵ_r) ≤ 1.2 . High-performance RF absorbers are placed below the foam.



3. Tissue Simulating Liquid

3.1 The composition of the tissue simulating liquid

Description: Aqueous solution with surfactants and inhibitors

Declarable, or hazardous components:

CAS: 107-21-1 EINECS: 203-473-3 Reg.nr.: 01-2119456816-28-0000	Ethanediol STOT RE 2, H373; Acute Tox. 4, H302	< 5.2%
CAS: 68608-26-4 EINECS: 271-781-5 Reg.nr.: 01-2119527859-22-0000	Sodium petroleum sulfonate Eye Irrit. 2, H319	< 2.9%
CAS: 107-41-5 EINECS: 203-489-0 Reg.nr.: 01-2119539582-35-0000	Hexylene Glycol / 2-Methyl-pentane-2,4-diol Skin Irrit. 2, H315; Eye Irrit. 2, H319	< 2.9%
CAS: 68920-66-1 NLP: 500-236-9 Reg.nr.: 01-2119489407-26-0000	Alkoxylated alcohol, > C₁₆ Aquatic Chronic 2, H411; Skin Irrit. 2, H315; Eye Irrit. 2, H319	< 2.0%

3.2 Tissue Calibration Result

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

Date	Tissue Type	Frequency (MHz)	Relative Permittivity (ε _r)			Conductivity (σ)			Tissue Temp. (°C)
			Measured	Target	Delta (%)	Measured	Target	Delta (%)	
2024/10/23	Head	2450	40.16	39.20	2.45	1.79	1.80	-0.56	22.2
		2412	40.30	39.28	2.60	1.74	1.77	-1.69	
		2437	40.21	39.23	2.50	1.77	1.79	-1.12	
		2462	40.11	39.18	2.37	1.80	1.81	-0.55	
2024/10/29	Head	5250	36.43	35.95	1.34	4.71	4.71	0.00	22.1
		5290	36.32	35.91	1.14	4.77	4.75	0.42	
2024/10/31	Head	5600	35.46	35.50	-0.11	5.19	5.07	2.37	22.3
		5530	35.65	35.61	0.11	5.09	5.00	1.80	
		5570	35.54	35.55	-0.03	5.15	5.04	2.18	
		5610	35.44	35.49	-0.14	5.20	5.08	2.36	
		5690	35.22	35.41	-0.54	5.30	5.16	2.71	
		5800	34.91	35.30	-1.10	5.45	5.27	3.42	
		5775	34.98	35.33	-0.99	5.41	5.25	3.05	
		5815	34.89	35.29	-1.13	5.45	5.29	3.02	
		5855	34.77	35.25	-1.36	5.52	5.33	3.56	

Date	Tissue Type	Frequency (MHz)	Relative Permittivity (ϵ_r)			Conductivity (σ)			Tissue Temp. (°C)
			Measured	Target	Delta (%)	Measured	Target	Delta (%)	
2024/11/25	Head	6500	35.60	34.50	3.19	5.95	6.07	-1.98	22.1
		6025	36.40	35.07	3.79	5.39	5.51	-2.18	
		6185	36.10	34.88	3.50	5.58	5.70	-2.11	
		6345	35.80	34.69	3.21	5.77	5.89	-2.04	
		6505	35.50	34.49	2.92	5.96	6.08	-1.97	
		6825	35.00	34.11	2.61	6.35	6.45	-1.55	
		6985	34.70	33.92	2.31	6.53	6.63	-1.51	

3.3 Tissue Dielectric Parameters for Phantoms

The head tissue dielectric parameters recommended by the IEC/IEEE 62209-1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head tissue parameters that have not been specified are interpolated according to the head parameters specified in IEC/IEEE 62209-1528.

Target Frequency (MHz)	Head	
	ϵ_r	σ (S/m)
450	43.5	0.87
750	41.9	0.89
835	41.5	0.90
900	41.5	0.97
1450	40.5	1.20
1640	40.2	1.31
1750	40.1	1.37
1800 – 2000	40.0	1.40
2450	39.2	1.80
3000	38.5	2.40
5000	36.2	4.45
5200	36.0	4.66
5400	35.8	4.86
5600	35.5	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

4. Measurement Procedure

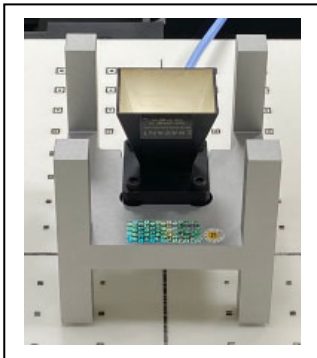
4.1 SAR System Check

4.1.1 Dipoles



The SAR dipoles are optimized symmetrical dipole with $\lambda/4$ balun matched to a Flat phantom section filled with tissue simulating liquids. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC signals. They are available for the variety of frequencies between 300MHz and 10 GHz. The provided tripod is used to hold the dipole below the phantom. As the distance between the dipole center and the TSL is critical, a spacer is placed between the dipole and the phantom. The spacing distance is frequency dependent.

4.1.2 Verification Source



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

4.1.3 SAR System Check Result

1. Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %.
2. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Input Power (mW)	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Delta 1g (%)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Delta 10g (%)	Tissue Temp. (°C)
2024/10/23	2450	250	13.40	52.50	53.6	2.10	6.13	24.70	24.52	-0.73	22.2
2024/10/29	5250	100	7.68	78.10	76.8	-1.66	2.19	22.40	21.9	-2.23	22.1
2024/10/31	5600	100	7.91	82.30	79.1	-3.89	2.22	23.50	22.2	-5.53	22.3
	5800	100	7.53	80.20	75.3	-6.11	2.13	22.80	21.3	-6.58	
2024/11/25	6500	100	29.40	294.00	294	0.00	5.62	53.90	56.2	4.27	22.1

4.1.4 Power Density System Check Result

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:

Frequency (GHz)	Grid step	Grid extent X/Y (mm)	Measurement points
10	0.125 ($\lambda/8$)	60 / 60	18 x 18

According to the DASY specification in the user's manual and SPEAG's recommendation, the deviation threshold of ± 0.66 dB represents the expanded standard uncertainty for system performance check. The system check is successful if the measured results are within ± 0.66 dB tolerances to the target value shown in the calibration certificate of the verification source.

Date	Frequency (GHz)	Distance (mm)	Input Power (mW)	Measured Avg 4 cm ² (W/m ²)	Targeted Avg 4 cm ² (W/m ²)	Deviation (dB)
2024/11/5	10	10	138	192.7	187.00	0.13

Note: The Measured Avg PD was the average of psPDn+, psPDtot+ and psPDmod+, which refers to the demonstration from calibration certificate.

4.2 SAR Measurement Procedure

The Dasy calculates SAR using the following equation,

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

Where :

σ : represents the simulated tissue conductivity

ρ : represents the tissue density

E :RMS electric field strength (V/m)

The SAR / APD measurements for the EUT should be performed on the channel that produces the highest rated output power of each transmitting antenna.

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

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

The area scan is then run to establish the peak SAR / APD location (interpolated resolution set at 1mm²) which is then used to orient the center of the zoom scan. The zoom scan is then executed and the 1g and 10g averages are derived from the zoom scan volume (interpolated resolution set at 1mm³).

5. RF Exposure Limits

SAR assessments have been made in line with the requirements of IEEE-1528, RSS-102 Issue 6, and comply with ANSI/IEEE C95.1-1992 “Uncontrolled Environments” limits. These limits apply to a location which is deemed as “Uncontrolled Environment” which can be described as a situation where the general public may be exposed to an RF source with no prior knowledge or control over their exposure.

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

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (1g cube tissue for brain or body)	1.60 W/kg
Spatial Average SAR (whole body)	0.08 W/kg
Spatial Peak SAR (10g for hands, feet, ankles and wrist)	4.00 W/kg
Power density ¹	1 mW/cm²

Note: 1 mW/cm² = 10 W/m²

6. Test Equipment List

Instrument	Manufacturer	Model No.	Serial No.	Last Calibration	Next Calibration
Reference Dipole 2450MHz	Speag	D2450V2	1053	2024/02/19	2027/02/18
Reference Dipole 5GHz	Speag	D5GHzV2	1321	2024/03/12	2027/03/11
Reference Dipole 6.5GHz	Speag	D6.5GHzV2	1021	2024/02/12	2027/02/11
Verification Source Antenna 10GHz	Speag	5G Verification Source 10GHz	2006	2024/04/18	2025/04/17
Device Holder	Speag	N/A	N/A	N/A	N/A
Data Acquisition Electronic	Speag	DAE4	1207	2023/11/22	2024/11/21
Data Acquisition Electronic	Speag	DAE4	1791	2024/04/22	2025/04/21
Data Acquisition Electronic	Speag	DAE4	1651	2024/02/15	2025/02/14
E-Field Probe	Speag	EX3DV4	3698	2023/11/21	2024/11/20
E-Field Probe	Speag	EX3DV4	7784	2024/04/22	2025/04/21
mmWave E-field Probe	Speag	EUmmWV4	9546	2024/04/18	2025/04/17
SAR Software	Speag	DASY52	V52.10.4.1535	N/A	N/A
SAR Software	Speag	DASY8	V16.4.0.5005	N/A	N/A
Power Amplifier	Mini-Circuit	ZVE-8G+	447202211	N/A	N/A
Power Amplifier	Mini-Circuit	ZVA-02303HP+	20211217-1	N/A	N/A
Directional Coupler	Agilent	87300C	MY44300353	N/A	N/A ¹
Attenuator	Woken	WATT-218FS-10	N/A	N/A	N/A ¹
Attenuator	Mini-Circuit	BW-S20W2+	N/A	N/A	N/A ¹
Vector Network Analyzer	Agilent	E5071C	MY46108013	2024/03/19	2025/03/18
Signal Generator	Anritsu	MG3694A	041902	2024/08/20	2025/08/19
Power Meter	Anritsu	ML2487A	6K00001447	2024/10/19	2025/10/18
Power Sensor	Anritsu	MA2411B	1339194	2024/10/19	2025/10/18

Note: 1. System Check, the path loss measured by the network analyzer, includes the signal generator, amplifier, cable, attenuator and directional coupler.

7. Measurement Uncertainty

Measurement uncertainty for 300 MHz to 3 GHz							
Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)
Measurement System Errors							
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%
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%
Other Probe+Electronic	±0.8%	N	1	1	1	±0.8%	±0.8%
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.)	±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 Permittivity	±14.0%	R	1.732	0	0	±0.0%	±0.0%
Distance DUT - TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
Device Positioning	±1.0%	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%
Val Antenna Unc.	±0.0%	N	1	1	1	±0.0%	±0.0%
Unc. Input Power	±0.0%	N	1	1	1	±0.0%	±0.0%
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 Uncertainty						±11.0%	±10.9%
Expanded Uncertainty						±21.9%	±21.7%

Measurement uncertainty for 3 GHz to 6 GHz

Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)
Measurement System Errors							
Probe Calibration	±14.0%	N	2	1	1	±7.0%	±7.0%
Probe Calibration Drift	±1.7%	R	1.732	1	1	±1.0%	±1.0%
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%
Other Probe+Electronic	±1.2%	N	1	1	1	±1.2%	±1.2%
RF Ambient	±1.8%	N	1	1	1	±1.8%	±1.8%
Probe Positioning	±0.005 mm	N	1	0.29	0.29	±0.2%	±0.2%
Data Processing	±2.3%	N	1	1	1	±2.3%	±2.3%
Phantom and Device Errors							
Conductivity (meas.)	±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 Permittivity	±14.0%	R	1.732	0.25	0.25	±2.0%	±2.0%
Distance DUT - TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
Device Positioning	±1.0%	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%
Val Antenna Unc.	±0.0%	N	1	1	1	±0.0%	±0.0%
Unc. Input Power	±0.0%	N	1	1	1	±0.0%	±0.0%
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 Uncertainty						±11.9%	±11.8%
Expanded Uncertainty						±23.8%	±23.6%

Measurement uncertainty for 6 GHz to 10 GHz

Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)
Measurement System Errors							
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%
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%
Other Probe+Electronic	±2.4%	N	1	1	1	±2.4%	±2.4%
RF Ambient	±1.8%	N	1	1	1	±1.8%	±1.8%
Probe Positioning	±0.005 mm	N	1	0.5	0.5	±0.3%	±0.3%
Data Processing	±3.5%	N	1	1	1	±3.5%	±3.5%
Phantom and Device Errors							
Conductivity (meas.)	±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 Permittivity	±14.0%	R	1.732	0.5	0.5	±4.0%	±4.0%
Distance DUT - TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
Device Positioning	±1.0%	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%
Val Antenna Unc.	±0.0%	N	1	1	1	±0.0%	±0.0%
Unc. Input Power	±0.0%	N	1	1	1	±0.0%	±0.0%
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 Uncertainty						±14.2%	±14.1%
Expanded Uncertainty						±28.4%	±28.3%

Measurement uncertainty for Power Density						
Error Description	Uncert. Value ($\pm$ dB)	Prob. Dist.	Div.	(ci)	Std. Unc. ($\pm$ dB)	(vi) veff
Uncertainty terms dependent on the measurement system						
Calibration	0.49	N	1	1	0.49	∞
Probe correction	0	R	1.732	1	0	∞
Frequency response ($BW \leq 1$ GHz)	0.20	R	1.732	1	0.12	∞
Sensor cross coupling	0	R	1.732	1	0	∞
Isotropy	0.50	R	1.732	1	0.29	∞
Linearity	0.20	R	1.732	1	0.12	∞
Probe scattering	0	R	1.732	1	0	∞
Probe positioning offset	0.30	R	1.732	1	0.17	∞
Probe positioning repeatability	0.04	R	1.732	1	0.02	∞
Sensor mechanical offset	0	R	1.732	1	0	∞
Probe spatial resolution	0	R	1.732	1	0	∞
Field impedance dependance	0	R	1.732	1	0	∞
Measurement drift	0.05	R	1.732	1	0.03	∞
Amplitude and phase noise	0.04	R	1.732	1	0.02	∞
Measurement area truncation	0	R	1.732	1	0	∞
Data acquisition	0.03	N	1	1	0.03	∞
Sampling	0	R	1.732	1	0	∞
Field reconstruction	0.60	R	1.732	1	0.35	∞
Signal-to-Noise Ratio	0	R	1.732	1	0	∞
FTE/MEO	0	R	1.732	1	0	∞
Power density scaling	-	R	1.732	1	-	∞
Spatial averaging	0.10	R	1.732	1	0.06	∞
Uncertainty terms dependent on the DUT and environmental factors						
Probe coupling with DUT	0	R	1.732	1	0	∞
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	∞
Device holder influence	0.10	R	1.732	1	0.06	∞
DUT alignment	0	R	1.732	1	0	∞
RF ambient conditions	0.04	R	1.732	1	0.02	∞
Laboratory Temperature	0.05	R	1.732	1	0.03	∞
Laboratory Reflections	0.04	R	1.732	1	0.02	∞
Immunity / secondary reception	0	R	1.732	1	0	∞
Drift of the DUT	0.21	R	1.732	1	0.12	∞
Combined Standard Uncertainty					0.76	∞
Expanded Standard Uncertainty (95%)					1.53	

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

WLAN 2.4G 2TX MIMO												
	Frequency	Mode	BW	Ant 1			Ant 2			MIMO Ant 1 + Ant 2		
				CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power
DSSS/OFDM mode specified maximum output power at an antenna port	WLAN 2.4GHz	b	20	1	12.15	12.25	1	12.22	12.25	1	15.20	15.25
				6	12.23	12.25	6	12.17	12.25	6	15.21	15.25
				11	12.16	12.25	11	12.20	12.25	11	15.19	15.25
				12	12.05	12.25	12	12.06	12.25	12	15.07	15.25
				13	12.08	12.25	13	12.09	12.25	13	15.10	15.25
		g	20	1	12.05	12.25	1	11.95	12.25	1	15.01	15.25
				6	12.02	12.25	6	11.96	12.25	6	15.00	15.25
				11	12.03	12.25	11	11.99	12.25	11	15.02	15.25
				12	12.01	12.25	12	12.02	12.25	12	15.03	15.25
				13	12.06	12.25	13	12.04	12.25	13	15.06	15.25
		n (HT)	20	1	12.05	12.25	1	12.01	12.25	1	15.04	15.25
				6	12.22	12.25	6	11.84	12.25	6	15.04	15.25
				11	12.19	12.25	11	11.83	12.25	11	15.02	15.25
				12	12.08	12.25	12	12.00	12.25	12	15.05	15.25
				13	12.02	12.25	13	12.03	12.25	13	15.04	15.25
			40	3	11.73	12.25	3	12.23	12.25	3	15.00	15.25
				6	11.97	12.25	6	12.02	12.25	6	15.01	15.25
				9	11.80	12.25	9	12.17	12.25	9	15.00	15.25
				10	11.81	12.25	10	12.21	12.25	10	15.02	15.25
				11	11.94	12.25	11	12.13	12.25	11	15.05	15.25
		ax (HE)	20	1	12.01	12.25	1	12.03	12.25	1	15.03	15.25
				6	11.83	12.25	6	12.15	12.25	6	15.00	15.25
				11	12.17	12.25	11	11.82	12.25	11	15.01	15.25
				12	11.84	12.25	12	12.20	12.25	12	15.03	15.25
				13	11.78	12.25	13	12.23	12.25	13	15.02	15.25
			40	3	11.87	12.25	3	12.17	12.25	3	15.03	15.25
				6	11.93	12.25	6	12.09	12.25	6	15.02	15.25
				9	11.82	12.25	9	12.15	12.25	9	15.00	15.25
				10	12.08	12.25	10	12.02	12.25	10	15.06	15.25
				11	12.00	12.25	11	12.08	12.25	11	15.05	15.25
		be (EHT)	20	1	11.95	12.25	1	12.03	12.25	1	15.00	15.25
				6	11.94	12.25	6	12.10	12.25	6	15.03	15.25
				11	12.04	12.25	11	12.05	12.25	11	15.06	15.25
				12	11.87	12.25	12	12.11	12.25	12	15.00	15.25
				13	11.84	12.25	13	12.14	12.25	13	15.00	15.25
			40	3	11.78	12.25	3	12.23	12.25	3	15.02	15.25
				6	12.03	12.25	6	12.05	12.25	6	15.05	15.25
				9	12.01	12.25	9	12.08	12.25	9	15.06	15.25
				10	11.94	12.25	10	12.03	12.25	10	15.00	15.25
				11	12.07	12.25	11	11.96	12.25	11	15.03	15.25

WLAN 5G 2TX MIMO												
	Frequency	Mode	BW	Ant 1			Ant 2			MIMO Ant 1 + Ant 2		
				CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power
OFDM mode specified maximum output power at an antenna port	U-NII-1 (5150~5250MHz)	a	20	36	12.24	13	36	12.28	13	36	15.27	16.0
				40	12.25	13	40	12.39	13	40	15.33	16.0
				44	12.19	13	44	12.21	13	44	15.21	16.0
				48	12.13	13	48	12.49	13	48	15.32	16.0
		n (HT)	20	36	12.41	13	36	12.27	13	36	15.35	16.0
				40	12.30	13	40	12.21	13	40	15.27	16.0
				44	12.13	13	44	12.00	13	44	15.08	16.0
				48	12.27	13	48	12.08	13	48	15.19	16.0
			40	38	12.15	13	38	12.21	13	38	15.19	16.0
				46	12.21	13	46	12.18	13	46	15.21	16.0
		ac(VHT)	80	42	12.61	13	42	12.42	13	42	15.53	16.0
		ax (HE)	20	36	12.12	13	36	12.17	13	36	15.16	16.0
				40	12.14	13	40	12.08	13	40	15.12	16.0
				44	12.16	13	44	12.19	13	44	15.19	16.0
				48	12.18	13	48	12.21	13	48	15.21	16.0
			40	38	12.16	13	38	12.14	13	38	15.16	16.0
				46	12.18	13	46	12.21	13	46	15.21	16.0
				42	12.22	13	42	12.16	13	42	15.20	16.0
				42	12.22	13	42	12.16	13	42	15.20	16.0
		be (EHT)	20	36	12.26	13	36	12.30	13	36	15.29	16.0
				40	12.22	13	40	12.15	13	40	15.20	16.0
				44	12.54	13	44	12.23	13	44	15.40	16.0
				48	12.25	13	48	12.11	13	48	15.19	16.0
			40	38	12.21	13	38	12.19	13	38	15.21	16.0
				46	12.29	13	46	12.16	13	46	15.24	16.0
				42	12.26	13	42	12.21	13	42	15.25	16.0
				42	12.26	13	42	12.21	13	42	15.25	16.0
	U-NII-2A (5250~5350MHz)	a	20	52	12.15	13	52	12.51	13	52	15.34	16.0
				56	12.26	13	56	12.35	13	56	15.32	16.0
				60	12.38	13	60	12.08	13	60	15.24	16.0
				64	12.18	13	64	12.02	13	64	15.11	16.0
		n (HT)	20	52	12.24	13	52	12.06	13	52	15.16	16.0
				56	12.16	13	56	12.09	13	56	15.14	16.0
				60	12.19	13	60	12.10	13	60	15.16	16.0
				64	12.22	13	64	12.13	13	64	15.19	16.0
			40	54	12.18	13	54	12.22	13	54	15.21	16.0
				62	12.24	13	62	12.16	13	62	15.21	16.0
		ac (VHT)	80	58	12.84	13	58	12.57	13	58	15.72	16.0
			160	50	12.75	13	50	12.55	13	50	15.66	16.0
		ax (HE)	20	52	12.13	13	52	12.11	13	52	15.13	16.0
				56	12.15	13	56	12.13	13	56	15.15	16.0
				60	12.20	13	60	12.14	13	60	15.18	16.0
				64	12.19	13	64	12.20	13	64	15.21	16.0
			40	54	12.23	13	54	12.16	13	54	15.21	16.0
				62	12.19	13	62	12.10	13	62	15.16	16.0
			80	58	12.27	13	58	12.11	13	58	15.20	16.0
			160	50	12.21	13	50	12.11	13	50	15.17	16.0
		be (EHT)	20	52	12.27	13	52	12.15	13	52	15.22	16.0
				56	12.17	13	56	12.11	13	56	15.15	16.0
				60	12.23	13	60	12.16	13	60	15.21	16.0
				64	12.18	13	64	12.20	13	64	15.20	16.0
			40	54	12.13	13	54	12.25	13	54	15.20	16.0
				62	12.12	13	62	12.15	13	62	15.14	16.0
			80	58	12.21	13	58	12.19	13	58	15.21	16.0
			160	50	12.18	13	50	12.14	13	50	15.17	16.0

WLAN 5G 2TX MIMO												
	Frequency	Mode	BW	Ant 1			Ant 2			MIMO Ant 1 + Ant 2		
				CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power
OFDM mode specified maximum output power at an antenna port	U-NII-2C (5470~5725MHz)	a	20	100	12.17	13	100	12.28	13	100	15.24	16.0
				116	12.14	13	116	12.23	13	116	15.20	16.0
				124	12.27	13	124	12.15	13	124	15.22	16.0
				132	12.16	13	132	12.33	13	132	15.26	16.0
		n (HT)	20	100	12.15	13	100	12.19	13	100	15.18	16.0
				116	12.17	13	116	12.15	13	116	15.17	16.0
				124	12.19	13	124	12.18	13	124	15.20	16.0
				132	12.16	13	132	12.21	13	132	15.20	16.0
			40	102	12.21	13	102	12.24	13	102	15.24	16.0
				110	12.30	13	110	12.28	13	110	15.30	16.0
				126	12.26	13	126	12.25	13	126	15.27	16.0
				134	12.18	13	134	12.20	13	134	15.20	16.0
		ac (VHT)	20	144	12.15	13	144	12.16	13	144	15.17	16.0
			40	142	12.22	13	142	12.25	13	142	15.25	16.0
			80	106	12.75	13	106	12.70	13	106	15.74	16.0
				122	12.71	13	122	12.57	13	122	15.65	16.0
				138	12.67	13	138	12.48	13	138	15.59	16.0
			160	114	12.82	13	114	12.71	13	114	15.78	16.0
		ax (HE)	20	100	12.14	13	100	12.17	13	100	15.17	16.0
				116	12.16	13	116	12.13	13	116	15.16	16.0
				124	12.20	13	124	12.11	13	124	15.17	16.0
				132	12.18	13	132	12.21	13	132	15.21	16.0
			40	102	12.21	13	102	12.18	13	102	15.21	16.0
				110	12.28	13	110	12.16	13	110	15.23	16.0
				126	12.26	13	126	12.14	13	126	15.21	16.0
				134	12.27	13	134	12.19	13	134	15.24	16.0
			20	144	12.15	13	144	12.16	13	144	15.17	16.0
			40	142	12.22	13	142	12.26	13	142	15.25	16.0
			80	106	12.21	13	106	12.17	13	106	15.20	16.0
				122	12.26	13	122	12.19	13	122	15.24	16.0
				138	12.29	13	138	12.23	13	138	15.27	16.0
			160	114	12.18	13	114	12.24	13	114	15.22	16.0
		be (EHT)	20	100	12.12	13	100	12.23	13	100	15.19	16.0
				112	12.25	13	112	12.15	13	112	15.21	16.0
				116	12.26	13	116	12.16	13	116	15.22	16.0
				128	12.75	13	128	12.11	13	128	15.45	16.0
				132	12.20	13	132	12.25	13	132	15.24	16.0
			40	102	12.21	13	102	12.00	13	102	15.12	16.0
				110	12.18	13	110	12.22	13	110	15.21	16.0
				118	12.26	13	118	12.11	13	118	15.20	16.0
				126	12.24	13	126	12.26	13	126	15.26	16.0
				134	12.22	13	134	12.19	13	134	15.22	16.0
			20	144	12.20	13	144	12.25	13	144	15.24	16.0
			40	142	12.15	13	142	12.13	13	142	15.15	16.0
			80	106	12.17	13	106	12.38	13	106	15.29	16.0
				122	12.22	13	122	12.25	13	122	15.25	16.0
				138	12.24	13	138	12.15	13	138	15.21	16.0
			160	114	12.15	13	114	12.20	13	114	15.19	16.0

WLAN 5G 2TX MIMO

	Frequency	Mode	BW	Ant 1			Ant 2			MIMO Ant 1 + Ant 2		
				CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power
OFDM mode specified maximum output power at an antenna port	U-NII-3 (5725~5850MHz)	a	20	149	12.12	13	149	12.24	13	149	15.19	16.0
				157	12.17	13	157	12.29	13	157	15.24	16.0
				165	12.15	13	165	12.23	13	165	15.20	16.0
		n (HT)	20	149	12.14	13	149	12.01	13	149	15.09	16.0
				157	12.12	13	157	12.03	13	157	15.09	16.0
				165	12.20	13	165	12.06	13	165	15.14	16.0
			40	151	12.19	13	151	12.21	13	151	15.21	16.0
				159	12.24	13	159	12.11	13	159	15.19	16.0
				155	12.73	13	155	12.38	13	155	15.57	16.0
		ac(VHT)	20	149	12.28	13	149	12.19	13	149	15.25	16.0
				157	12.32	13	157	12.11	13	157	15.23	16.0
				165	12.16	13	165	12.18	13	165	15.18	16.0
			40	151	12.21	13	151	12.22	13	151	15.23	16.0
				159	12.26	13	159	12.25	13	159	15.27	16.0
				155	12.20	13	155	12.18	13	155	15.20	16.0
		be (EHT)	20	149	12.21	13	149	12.16	13	149	15.20	16.0
				157	12.24	13	157	12.20	13	157	15.23	16.0
				165	12.29	13	165	12.11	13	165	15.21	16.0
			40	151	12.12	13	151	12.11	13	151	15.13	16.0
				159	12.36	13	159	12.14	13	159	15.26	16.0
				155	12.18	13	155	12.26	13	155	15.23	16.0
	U-NII-4 (5850~5925MHz)	a	20	169	12.26	13	149	12.24	13	149	15.26	16.0
				173	12.31	13	157	12.12	13	157	15.23	16.0
				177	12.34	13	165	12.18	13	165	15.27	16.0
		n (HT)	20	169	12.16	13	169	12.09	13	169	15.14	16.0
				173	12.17	13	173	12.05	13	173	15.12	16.0
				177	12.18	13	177	12.08	13	177	15.14	16.0
			40	167	12.16	13	167	12.20	13	167	15.19	16.0
				175	12.17	13	175	12.14	13	175	15.17	16.0
				171	12.82	13	171	12.83	13	171	15.84	16.0
		ac (VHT)	80	163	12.80	13	163	12.43	13	163	15.63	16.0
				169	12.28	13	169	12.16	13	169	15.23	16.0
				173	12.19	13	173	12.14	13	173	15.18	16.0
		ax (HE)	20	177	12.21	13	177	12.17	13	177	15.20	16.0
				167	12.24	13	167	12.18	13	167	15.22	16.0
				175	12.17	13	175	12.20	13	175	15.20	16.0
			40	171	12.16	13	171	12.21	13	171	15.20	16.0
				163	12.26	13	163	12.17	13	163	15.23	16.0
				169	12.26	13	169	12.21	13	169	15.25	16.0
		be (EHT)	20	173	12.24	13	173	12.26	13	173	15.26	16.0
				177	12.19	13	177	12.18	13	177	15.20	16.0
				167	12.27	13	167	12.09	13	167	15.19	16.0
			40	175	12.25	13	175	12.18	13	175	15.23	16.0
				171	12.28	13	171	12.14	13	171	15.22	16.0
				163	12.23	13	163	12.25	13	163	15.25	16.0

WLAN 6G 2TX MIMO

	Frequency	Mode	BW	Ant 1			Ant 2			MIMO Ant 1 + Ant 2		
				CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power
OFDM mode specified maximum output power at an antenna port	U-NII-5 (5925~6425MHz)	ax (HE)	20	1	8.92	9	1	8.33	9	1	11.65	12.0
				45	7.97	8	45	7.82	8	45	10.91	11.0
				93	8.03	8.5	93	7.93	8.5	93	10.99	11.5
			40	3	11.26	12	3	11.24	12	3	14.26	15.0
				43	10.18	10.5	43	10.03	10.5	43	13.12	13.5
				91	10.53	11	91	10.36	11	91	13.46	14.0
			80	7	11.22	12	7	11.29	12	7	14.27	15.0
				39	11.31	12	39	11.26	12	39	14.30	15.0
				87	11.28	12	87	11.24	12	87	14.27	15.0
			160	15	11.94	12	15	11.85	12	15	14.91	15.0
				47	11.82	12	47	11.71	12	47	14.78	15.0
				79	11.65	12	79	11.34	12	79	14.51	15.0
		be (EHT)	20	1	8.96	9	1	8.84	9	1	11.91	12.0
				49	7.89	8	49	7.92	8	49	10.92	11.0
				93	8.32	8.5	93	8.21	8.5	93	11.28	11.5
			40	3	11.64	12	3	11.32	12	3	14.49	15.0
				43	10.09	10.5	43	10.06	10.5	43	13.09	13.5
				91	10.86	11	91	11.11	11.5	91	14.00	14.5
			80	7	11.12	12	7	11.19	12	7	14.17	15.0
				39	11.21	12	39	11.23	12	39	14.23	15.0
				87	11.18	12	87	11.14	12	87	14.17	15.0
			160	15	11.23	12	15	11.17	12	15	14.21	15.0
				47	11.18	12	47	11.21	12	47	14.21	15.0
				79	11.21	12	79	11.13	12	79	14.18	15.0
	U-NII-6 (6425~6525MHz)	ax (HE)	20	97	7.84	8.5	97	7.68	8	97	10.77	11.5
				105	7.66	8.5	105	7.07	7.5	105	10.39	11.0
				113	7.81	8	113	7.55	8	113	10.69	11.0
			40	99	11.23	12	99	11.17	12	99	14.21	15.0
				107	11.07	11.5	107	11.02	11.5	107	14.06	14.5
				103	11.33	12	103	11.32	12	103	14.34	15.0
		be (EHT)	20	111	11.95	12	111	11.92	12	111	14.95	15.0
				97	8.12	8.5	97	7.90	8	97	11.02	11.5
				105	7.57	8	105	7.41	7.5	105	10.50	11.0
			40	113	7.88	8	113	7.73	8	113	10.82	11.0
				99	11.56	12	99	11.29	12	99	14.44	15.0
				107	11.14	11.5	107	11.28	11.5	107	14.22	14.5
			80	103	11.20	12	103	11.15	12	103	14.19	15.0
				111	11.24	12	111	11.29	12	111	14.28	15.0

WLAN 6G 2TX MIMO

	Frequency	Mode	BW	Ant 1			Ant 2			MIMO Ant 1 + Ant 2		
				CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power	CH	Avg. Power	Tune-Up Power
OFDM mode specified maximum output power at an antenna port	U-NII-7 (6525~6875MHz)	ax (HE)	20	117	8.47	9	117	8.39	9	117	11.44	12.0
				149	8.53	9	149	8.41	9	149	11.48	12.0
				181	8.62	9	181	8.43	9	181	11.54	12.0
			40	115	10.64	11	115	10.49	11	115	13.58	14.0
				147	10.66	11	147	10.53	11.5	147	13.61	14.5
				179	11.24	12	179	11.32	12	179	14.29	15.0
			80	119	11.24	12	119	11.28	12	119	14.27	15.0
				135	11.26	12	135	11.25	12	135	14.27	15.0
				151	11.18	12	151	11.30	12	151	14.25	15.0
				167	11.29	12	167	11.23	12	167	14.27	15.0
			160	183	11.31	12	183	11.27	12	183	14.30	15.0
				143	11.42	12	143	11.51	12	143	14.48	15.0
				175	11.69	12	175	11.83	12	175	14.77	15.0
				117	8.71	9	117	8.93	9	117	11.83	12.0
		be (EHT)	20	149	8.89	9	149	8.83	9	149	11.87	12.0
				181	8.76	9	181	8.72	9	181	11.75	12.0
				115	10.81	11	115	10.92	11	115	13.88	14.0
			40	147	10.86	11	147	11.13	11.5	147	14.01	14.3
				179	11.62	12	179	11.36	12	179	14.50	15.0
				119	11.14	12	119	11.18	12	119	14.17	15.0
			80	135	11.16	12	135	11.24	12	135	14.21	15.0
				151	11.09	12	151	11.13	12	151	14.12	15.0
				167	11.18	12	167	11.12	12	167	14.16	15.0
				183	11.21	12	183	11.16	12	183	14.20	15.0
			160	143	11.19	12	143	11.26	12	143	14.24	15.0
				175	11.16	12	175	11.25	12	175	14.22	15.0
	U-NII-8 (6875~7125MHz)	ax (HE)	20	185	8.72	9	185	8.48	9	185	11.61	12.0
				209	9.61	10	209	9.68	10	209	12.66	13.0
				233	10.13	10.5	233	10.11	10.5	233	13.13	13.5
			40	187	11.30	13	187	11.25	13	187	14.29	16.0
				227	11.27	13	227	11.21	13	227	14.25	16.0
				199	11.16	13	199	11.16	13	199	14.17	16.0
			80	215	11.18	13	215	11.15	13	215	14.18	16.0
				207	11.83	13	207	11.64	13	207	14.75	16.0
				185	8.85	9	185	8.97	9	185	11.92	12.0
		be (EHT)	20	209	9.91	10	209	9.68	10	209	12.81	13.0
				233	10.26	10.5	233	10.12	10.5	233	13.20	13.5
				187	11.33	13	187	11.53	13	187	14.44	16.0
			40	227	11.28	13	227	11.15	13	227	14.23	16.0
				199	11.26	13	199	11.26	13	199	14.27	16.0
				215	11.28	13	215	11.13	13	215	14.22	16.0
			80	207	11.20	13	207	11.28	13	207	14.25	16.0
				185	8.85	9	185	8.97	9	185	11.92	12.0
				209	9.91	10	209	9.68	10	209	12.81	13.0
				233	10.26	10.5	233	10.12	10.5	233	13.20	13.5
				187	11.33	13	187	11.53	13	187	14.44	16.0
				227	11.28	13	227	11.15	13	227	14.23	16.0

9. Test Results

9.1 Test Results Summary

SAR MEASUREMENT								
Ambient Temperature (°C): 23.2±2					Relative Humidity (%):52 %			
Liquid Temperature (°C): 22.2±2					Depth of Liquid (cm): >15			
Test Position	Dist. (mm)	Frequency		Conducted Power (dBm)		SAR (W/kg)		Plot No.
		Ch.	MHz	Meas.	Tune-Up Limit	Meas-1g	Scaled-1g	
Test Mode: WLAN2.4GHz_802.11b-1M_MIMO								
Front-180 Degree	5	6	2437	15.21	15.25	1.040	1.050	
Back-180 Degree	5	1	2412	15.20	15.25	1.060	1.072	
Back-180 Degree	5	6	2437	15.21	15.25	1.110	1.120	1
Back-180 Degree	5	11	2462	15.19	15.25	1.060	1.075	
Left-side-180 Degree	5	6	2437	15.21	15.25	0.236	0.238	
Right-side-180 Degree	5	6	2437	15.21	15.25	0.043	0.043	
Tip-180 Degree	5	6	2437	15.21	15.25	0.721	0.728	
Bottom-90 Degree	5	6	2437	15.21	15.25	0.019	0.019	
Front-0 Degree	5	6	2437	15.21	15.25	0.892	0.900	
Back-0 Degree	5	6	2437	15.21	15.25	0.088	0.089	
Left-side-0 Degree	5	6	2437	15.21	15.25	0.259	0.261	
Right-side-0 Degree	5	6	2437	15.21	15.25	0.061	0.062	
Tip-0 Degree	5	6	2437	15.21	15.25	0.011	0.011	

Note:

- When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required.
- When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required in that exposure configuration.

SAR MEASUREMENT								
Ambient Temperature (°C): 23.1 ±2					Relative Humidity (%):51 %			
Liquid Temperature (°C): 22.1±2					Depth of Liquid (cm): >15			
Test Position	Dist. (mm)	Frequency		Conducted Power (dBm)		SAR (W/kg)		Plot No.
		Ch.	MHz	Meas.	Tune-Up Limit	Meas-1g	Scaled-1g	
Test Mode: WLAN5GHz_802.11ac80-VHT0_MIMO								
Front-180 Degree	5	58	5290	15.72	16	0.817	0.898	
Back-180 Degree	5	58	5290	15.72	16	0.731	0.804	
Left-side-180 Degree	5	58	5290	15.72	16	0.168	0.185	
Right-side-180 Degree	5	58	5290	15.72	16	0.140	0.154	
Tip-180 Degree	5	58	5290	15.72	16	0.530	0.583	
Bottom-90 Degree	5	58	5290	15.72	16	0.079	0.087	
Front-0 Degree	5	58	5290	15.72	16	0.880	0.968	19
Back-0 Degree	5	58	5290	15.72	16	0.123	0.135	
Left-side-0 Degree	5	58	5290	15.72	16	0.188	0.207	
Right-side-0 Degree	5	58	5290	15.72	16	0.090	0.099	
Tip-0 Degree	5	58	5290	15.72	16	0.071	0.078	
Test Mode: WLAN5GHz_802.11ac160-VHT0_MIMO								
Front-0 Degree	5	50	5250	15.66	16	0.786	0.876	

Note:

- When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required in that exposure configuration.
- When multiple transmission modes have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected.
- When the reported SAR of the highest measured maximum U-NII-2A for the exposure configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.

SAR MEASUREMENT								
Ambient Temperature (°C): 23.3 ±2					Relative Humidity (%):53 %			
Liquid Temperature (°C): 22.3±2					Depth of Liquid (cm): >15			
Test Position	Dist. (mm)	Frequency		Conducted Power (dBm)		SAR (W/kg)		Plot No.
		Ch.	MHz	Meas.	Tune-Up Limit	Meas-1g	Scaled-1g	
Test Mode: WLAN5GHz_802.11ac80-VHT0_MIMO								
Front-180 Degree	5	106	5530	15.74	16	0.659	0.721	
Back-180 Degree	5	106	5530	15.74	16	0.827	0.905	
Back-180 Degree	5	122	5610	15.65	16	0.667	0.745	
Back-180 Degree	5	138	5690	15.59	16	0.644	0.730	
Left-side-180 Degree	5	106	5530	15.74	16	0.260	0.285	
Right-side-180 Degree	5	106	5530	15.74	16	0.129	0.141	
Tip-180 Degree	5	106	5530	15.74	16	0.553	0.605	
Bottom-90 Degree	5	106	5530	15.74	16	0.082	0.090	
Front-0 Degree	5	106	5530	15.74	16	1.000	1.095	15
Front-0 Degree	5	122	5610	15.65	16	0.906	1.012	
Front-0 Degree	5	138	5690	15.59	16	0.939	1.064	
Back-0 Degree	5	106	5530	15.74	16	0.175	0.192	
Left-side-0 Degree	5	106	5530	15.74	16	0.253	0.277	
Right-side-0 Degree	5	106	5530	15.74	16	0.137	0.150	
Tip-0 Degree	5	106	5530	15.74	16	0.089	0.097	
Test Mode: WLAN5GHz_802.11ac160-VHT0_MIMO								
Front-0 Degree	5	114	5570	15.78	16	0.999	1.083	

Note:

- When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required in that exposure configuration.
- When multiple transmission modes have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected.

SAR MEASUREMENT								
Ambient Temperature (°C): 23.3 ±2					Relative Humidity (%):53 %			
Liquid Temperature (°C): 22.3±2					Depth of Liquid (cm): >15			
Test Position	Dist. (mm)	Frequency		Conducted Power (dBm)		SAR (W/kg)		Plot No.
		Ch.	MHz	Meas.	Tune-Up Limit	Meas-1g	Scaled-1g	
Test Mode: WLAN5GHz_802.11ac80-VHT0_MIMO								
Front-180 Degree	5	155	5775	15.57	16	0.851	0.969	
Back-180 Degree	5	155	5775	15.57	16	0.649	0.739	
Left-side-180 Degree	5	155	5775	15.57	16	0.539	0.614	
Right-side-180 Degree	5	155	5775	15.57	16	0.129	0.147	
Tip-180 Degree	5	155	5775	15.57	16	0.525	0.598	
Bottom-90 Degree	5	155	5775	15.57	16	0.093	0.106	
Front-0 Degree	5	155	5775	15.57	16	0.964	1.097	
Back-0 Degree	5	155	5775	15.57	16	0.147	0.167	
Left-side-0 Degree	5	155	5775	15.57	16	0.315	0.359	
Right-side-0 Degree	5	155	5775	15.57	16	0.128	0.146	
Tip-0 Degree	5	155	5775	15.57	16	0.147	0.167	
Front-180 Degree	5	171	5855	15.84	16	0.940	1.006	
Back-180 Degree	5	171	5855	15.84	16	0.784	0.839	
Left-side-180 Degree	5	171	5855	15.84	16	0.449	0.480	
Right-side-180 Degree	5	171	5855	15.84	16	0.186	0.199	
Tip-180 Degree	5	171	5855	15.84	16	0.643	0.688	
Bottom-90 Degree	5	171	5855	15.84	16	0.057	0.061	
Front-0 Degree	5	171	5855	15.84	16	1.100	1.177	16
Back-0 Degree	5	171	5855	15.84	16	0.074	0.079	
Left-side-0 Degree	5	171	5855	15.84	16	0.341	0.365	
Right-side-0 Degree	5	171	5855	15.84	16	0.219	0.234	
Tip-0 Degree	5	171	5855	15.84	16	0.049	0.052	
Test Mode: WLAN5GHz_802.11ac160-VHT0_MIMO								
Front-0 Degree	5	163	5815	15.63	16	0.977	1.097	

Note:

- When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required in that exposure configuration.
- When multiple transmission modes have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected.

SAR MEASUREMENT									
Ambient Temperature (°C): 23.1 ±2					Relative Humidity (%): 51%				
Liquid Temperature (°C):22.1 ±2					Depth of Liquid (cm): >15				
Test Position	Dist. (mm)	Frequency		Conducted Power (dBm)		SAR (W/kg)		APD (W/m²)	Plot No.
		Ch.	MHz	Meas.	Tune-Up Limit	Meas-1g	Scaled-1g	Meas-4cm²	
Test Mode: WLAN6GHz_802.11ax160-HE0_MIMO									
Front-180 Degree	5	207	6985	14.75	16	0.376	0.517	3.150	
Back-180 Degree	5	207	6985	14.75	16	0.532	0.731	3.600	
Left-side-180 Degree	5	207	6985	14.75	16	0.159	0.219	1.160	
Right-side-180 Degree	5	207	6985	14.75	16	0.109	0.150	0.793	
Tip-180 Degree	5	207	6985	14.75	16	0.448	0.616	3.480	
Bottom-90 Degree	5	207	6985	14.75	16	0.069	0.095	0.414	
Front-0 Degree	5	15	6025	14.91	15	0.573	0.603	4.100	
Front-0 Degree	5	47	6185	14.78	15	0.604	0.655	4.400	
Front-0 Degree	5	111	6505	14.95	15	0.595	0.621	3.680	
Front-0 Degree	5	175	6825	14.77	15	0.621	0.675	4.180	
Front-0 Degree	5	207	6985	14.75	16	0.533	0.733	3.620	83
Back-0 Degree	5	207	6985	14.75	16	0.165	0.227	1.260	
Left-side-0 Degree	5	207	6985	14.75	16	0.190	0.261	1.610	
Right-side-0 Degree	5	207	6985	14.75	16	0.169	0.232	1.450	
Tip-0 Degree	5	207	6985	14.75	16	0.083	0.114	0.667	

Note:

- When multiple transmission modes have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected.

PD MEASUREMENT											
Ambient Temperature (°C): 23.2 ±2						Relative Humidity (%): 53%					
Test Position	Dist. (mm)	Frequency		Conducted Power (dBm)		psPDn+ (W/m²)		psPDtot+ (W/m²)		Uncertainty	Plot No.
		Ch.	MHz	Meas.	Tune-Up Limit	Meas-4cm²	Scaled- 4cm²	Meas-4cm²	Scaled- 4cm²	Uncertainty Scaling Factor	
Test Mode: WLAN6GHz_802.11ax160-HE0_MIMO											
Front-0 Degree	5	15	6025	14.91	15	6.930	8.184	7.600	8.976	1.122	
Front-0 Degree	5	47	6185	14.78	15	6.100	7.423	6.930	8.433	1.122	
Front-0 Degree	5	111	6505	14.95	15	5.080	5.944	7.830	9.162	1.122	4
Front-0 Degree	5	175	6825	14.77	15	6.230	7.599	7.360	8.977	1.122	
Front-0 Degree	5	207	6985	14.75	16	4.030	6.217	5.560	8.577	1.122	

Note:

1. Per WLAN 6 GHz interim test procedure in Oct. 2020 TCBs Workshop notes. At least 5 channels for BW 160MHz should be tested.

9.2 Simultaneous Transmission

Simultaneous Transmission Configurations	
1	WLAN 2.4 GHz ANT Main + WLAN 2.4 GHz ANT Aux
2	WLAN 5 GHz ANT Main + WLAN 5 GHz ANT Aux
3	WLAN 6 GHz ANT Main + WLAN 6 GHz ANT Aux

9.2.1 Simultaneous transmission test exclusion considerations

Exposure Position	1	2	3
	WLAN2.4GHz MIMO Ant 1 + Ant 2	WLAN5GHz MIMO Ant 1 + Ant 2	WLAN6GHz MIMO Ant 1 + Ant 2
	SAR 1g (W/kg)	SAR 1g (W/kg)	SAR 1g (W/kg)
Front-180 Degree at 5 mm	1.050	1.006	0.517
Back-180 Degree at 5 mm	1.120	0.905	0.731
Left-side-180 Degree at 5 mm	0.238	0.614	0.219
Right-side-180 Degree at 5 mm	0.043	0.199	0.150
Tip-180 Degree at 5 mm	0.728	0.688	0.616
Bottom-90 Degree at 5 mm	0.019	0.106	0.095
Front-0 Degree at 5 mm	0.900	1.177	0.733
Back-0 Degree at 5 mm	0.089	0.192	0.227
Left-side-0 Degree at 5 mm	0.261	0.365	0.261
Right-side-0 Degree at 5 mm	0.062	0.234	0.232
Tip-0 Degree at 5 mm	0.011	0.167	0.114

10. SAR measurement variability

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

Frequency		SAR 1g (W/kg)		
Channel	MHz	Original	First Repeated	
			Value	Ratio
6	2437	1.11	1.08	1.028
171	5855	1.10	1.08	1.019

Appendix

Appendix A. System Check Data

Appendix B. Highest measurement Data

Appendix C. Test Setup Photographs

Appendix D. Probe Calibration Data

Appendix E. Dipole Calibration Data

Appendix F. Product Photos-Please refer to the file: 2470803R-Product Photos