

Test Report

Applicant : MediaTek Inc.
 Applicant Address : No. 1, Dusing 1st Rd., Hsinchu Science Park, Hsinchu City, 30078 Taiwan
 Product Name : 2TX 11ax (WiFi6) + BLE Combo Card
 Trade Name : MediaTek
 Model Number : MT7921
 Applicable Standard : 47 CFR §2.1093
 Received Date : Aug. 14, 2023
 Test Period : Aug. 25 ~ Aug. 28, 2023
 Issued Date : Sep. 22, 2023

Issued by

Approved By : _____

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Taiwan Accreditation Foundation accreditation number: 1330

Test Firm MRA designation number: TW0010

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Revision History

Rev.	Issue Date	Revisions	Revised By
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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

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

Site Address: No. 140-1, Changan Street, Bade District, Taoyuan City 334025, Taiwan (R.O.C.)

Site Address: No. 2, Wuquan 5th Rd. Wugu Dist., New Taipei City, Taiwan (R.O.C.)

2. Description of Device Under Test (DUT)

Applicant	MediaTek Inc. No. 1, Dusing 1st Rd., Hsinchu Science Park, Hsinchu City, 30078 Taiwan
Product Name	2TX 11ax (WiFi6) + BLE Combo Card
Trade Name	MediaTek
Model Number	MT7921
SN No.	R7NTLP000124277
FCC ID	RAS-MT7921
Host Information	Product Name: Chromebook Trade Name: ASUS Model Name: CM3001DM2A, CL3001DM2A, CM3001DM2, CL3001DM2, CM3001D, CL3001D 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 Bluetooth : 2402 - 2480 MHz
Supported Modulations	WLAN 2.4 GHz : 802.11 b / g / n / ac / ax HT20 / HT40 / VHT20 / VHT40 / HE20 / HE40
	WLAN 5 GHz : 802.11 a / n / ac / ax HT20 / HT40 / VHT20 / VHT40 / VHT80 / HE20 / HE40 / HE80
	Bluetooth : BR / EDR / LE
Device Category	Portable Device
Module Name	MediaTek, MT7921

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	Max. Gain (dBi)	
						NB	PAD
1	Chain 0	INNOWAVE	F001C4213190001	PIFA Antenna	2402 - 2480	2.28	2.28
					5150 - 5250	1.35	1.35
					5250 - 5350	1.25	1.25
					5470 - 5725	1.87	1.87
					5725 - 5850	2.15	2.15
	Chain 1	INNOWAVE	F001C4213190002	PIFA Antenna	2402 - 2480	1.61	1.61
					5150 - 5250	1.48	1.48
					5250 - 5350	1.06	1.06
					5470 - 5725	1.26	1.26
					5725 - 5850	1.32	1.32
2	Chain 0	INPAQ	WA-P-LE-02-211	PIFA Antenna	2402 - 2480	2.11	2.11
					5150 - 5250	0.18	0.18
					5250 - 5350	1.22	1.22
					5470 - 5725	1.41	1.41
					5725 - 5850	2.13	2.13
	Chain 1	INPAQ	WA-P-LE-03-030	PIFA Antenna	2402 - 2480	1.21	1.21
					5150 - 5250	0.53	0.53
					5250 - 5350	0.53	0.53
					5470 - 5725	1.14	1.14
					5725 - 5850	1.26	1.26

Note :

1. Antenna Source 1 (INNOWAVE antenna) and Antenna Source 2 (INPAQ antenna) are the same type of antenna, only different in manufacturer.
2. The Chain 0 is connected to Main port / Chain 1 is connected to AUX port of module.

3. Summary of Maximum Value

Equipment Class	Mode	Highest Reported SAR	
		Body standalone SAR _{1g} (W/kg)	Simultaneous Transmission SAR (W/kg)
DTS	WLAN 2.4 GHz	0.93	1.13
NII	WLAN 5 GHz	1.19	1.39
DSS / DTS	Bluetooth	0.20	1.39

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.

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 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

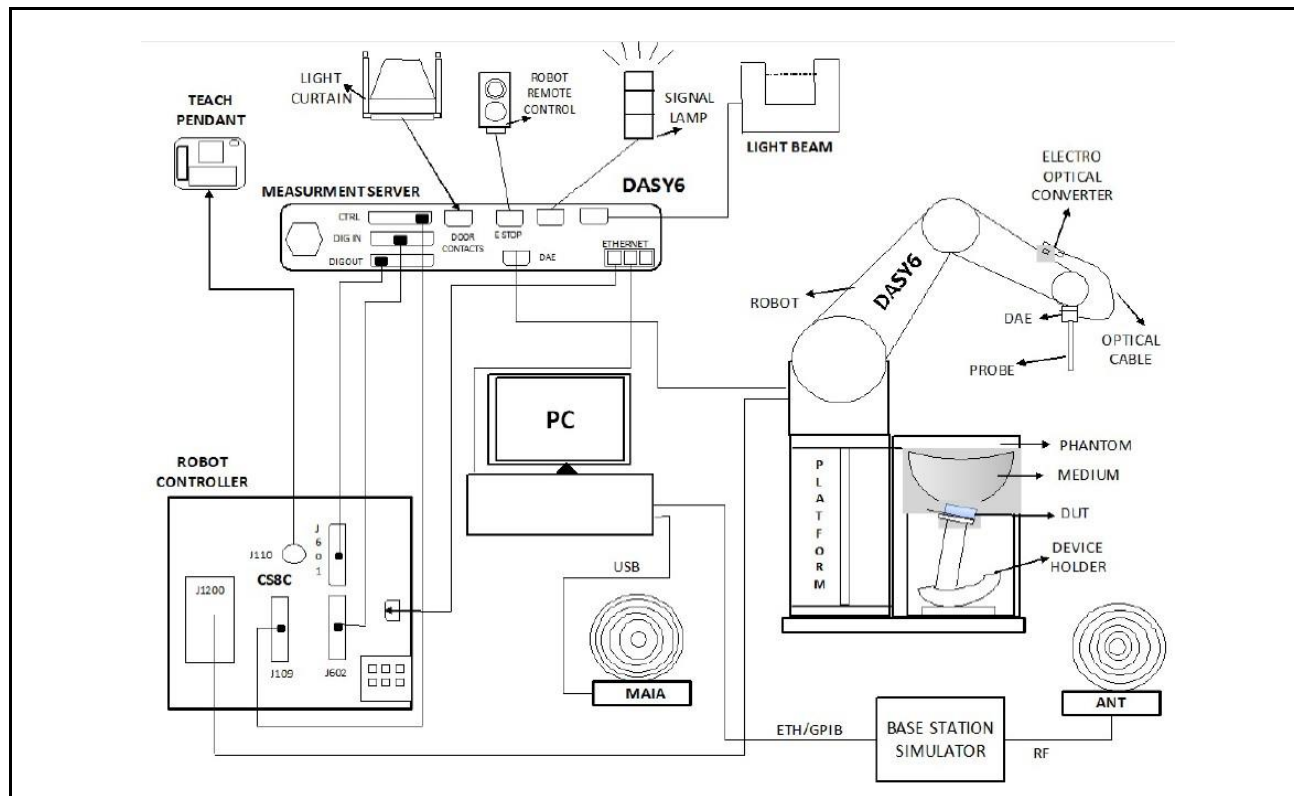
Notes :

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.

5. System Description

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 μ V (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	\pm 0.035 mm	


<Device Holder>

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon=3$ 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.

	
Device Holder 1	Device Holder 2

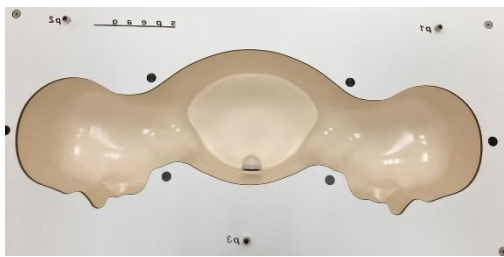
<Oval Flat Phantom – ELI>

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>

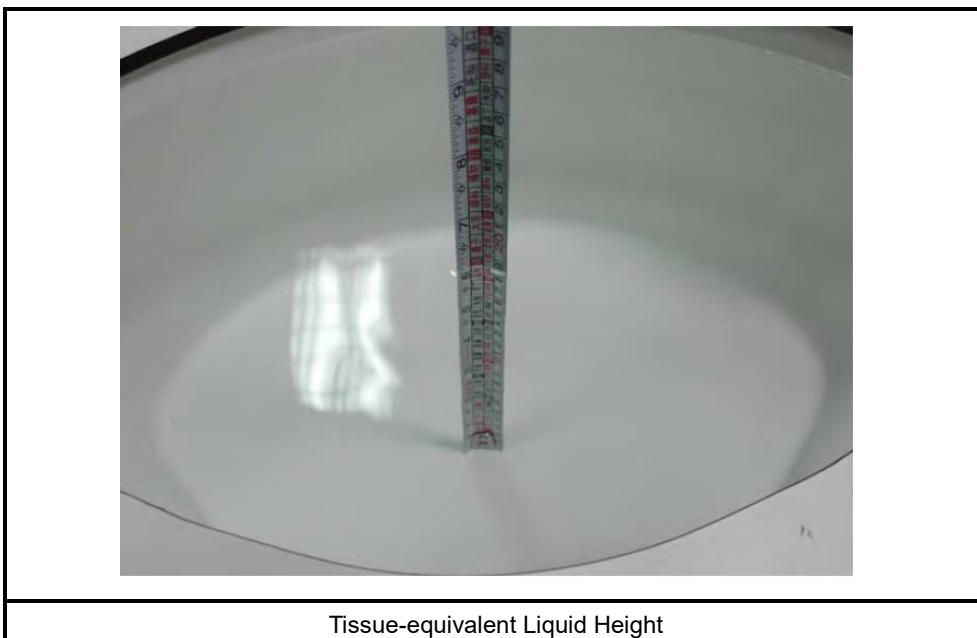
The following table incorporates the tissue dielectric parameters of head recommended by IEEE 1528-2013 and IEC/IEEE 62209-1528. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in human head. 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 (ϵ_r)	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.



<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. (°C)	Liquid Temp. (°C)	Permittivity (ϵ_r)	Conductivity (σ)	Targeted Permittivity (ϵ_r)	Targeted Conductivity (σ)	Deviation Permittivity (ϵ_r)	Deviation Conductivity (σ)	Date
2450	22.5	22.3	38.7	1.8	39.2	1.8	-1.28	0.00	Aug. 25, 2023
5250	22.6	22.4	34.7	4.54	35.9	4.71	-3.34	-3.61	Aug. 28, 2023
5600	22.6	22.3	34.1	4.92	35.5	5.07	-3.94	-2.96	Aug. 28, 2023
5750	22.6	22.2	33.8	5.09	35.4	5.22	-4.52	-2.49	Aug. 28, 2023

7. 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	Dosimetric E-Field Probe	EX3DV4	7737	Jun. 05, 2023	1 year
SPEAG	Data Acquisition Electronics	DAE4	1669	May. 23, 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	Dielectric Probe Kit	DAKS_VNA R140B	22420002	Dec. 08, 2022	1 year
SPEAG	Dielectric Probe Kit	DAKS-3.5	1158	Dec. 14, 2022	1 year
SPEAG	POWERSOURCE1	SE UMS 160 CA	4244	May. 16, 2023	1 year
HILA	Digital Thermometer	TM-906A	1500033	Nov. 03, 2022	1 year
HILA	Digital Thermometer	TM-905A	2202672	Aug. 02, 2023	1 year
HILA	Digital Thermometer	TM-905A	2202674	Aug. 09, 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
R&S	Power Sensor	NRP8S	111511	Nov. 29, 2022	1 year
R&S	Power Sensor	NRP8S	111512	Nov. 29, 2022	1 year
R&S	Power Sensor	NRP50S	101511	Nov. 29, 2022	1 year
Testo	Thermometer	608-H1	83563350	Jun. 17, 2023	1 year
Testo	Thermometer	608-H1	83288312	Jun. 02, 2023	1 year

Testing Engineer: Mars Chang

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 :

		≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5 mm ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location		30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: $\Delta x_{Area}, \Delta y_{Area}$		≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: $\Delta x_{Area}, \Delta y_{Area}$		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	Graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm 3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5 · $\Delta z_{Zoom}(n-1)$ mm
Minimum zoom scan volume	x, y, z	≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
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.			

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 DASYS 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 DASYS 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 from 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

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	

10. Measurement Evaluation

10.1 Positioning of the DUT in Relation to the Phantom

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.

10.2 SAR Testing with RF Transmitter

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 actual channel 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 card was operated utilizing proprietary software (QATool Dbg) 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.

10.5 Test Results

10.5.1 SAR Test Result

Note. The covers have a stand function. The device needs the Cover attached to support it be used at Laptop Mode with 90 degrees. We have evaluated Tablet + Cover 1 and Tablet + Cover 2 in each frequency band. Therefore, the bystander SAR test were only evaluated with Cover which is the worse case in accordance with the condition above.

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Antenna	Sample	Cover	Keyboard	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	WLAN 2.4 GHz	802.11b	Back of Display Screen	25	6	2437	ANT 0	1	w/Cover1	w/	18.44	18.5	99.00	0.064	0.07
	WLAN 2.4 GHz	802.11b	Top Side of Display Screen	25	6	2437	ANT 0	1	w/Cover1	w/	18.44	18.5	99.00	0.102	0.10
	WLAN 2.4 GHz	802.11b	Rear Face	0	6	2437	ANT 0	1	w/o	w/o	12.91	13	99.00	0.251	0.26
	WLAN 2.4 GHz	802.11b	Left Side	0	6	2437	ANT 0	1	w/o	w/o	12.91	13	99.00	0.001	0.00
	WLAN 2.4 GHz	802.11b	Right Side	0	6	2437	ANT 0	1	w/o	w/o	12.91	13	99.00	0.313	0.32
	WLAN 2.4 GHz	802.11b	Top Side	0	6	2437	ANT 0	1	w/o	w/o	12.91	13	99.00	0.33	0.34
	WLAN 2.4 GHz	802.11b	Bottom Side	0	6	2437	ANT 0	1	w/o	w/o	12.91	13	99.00	0.001	0.00
	WLAN 2.4 GHz	802.11b	Back of Display Screen	25	6	2437	ANT 1	1	w/Cover1	w/	18.26	18.5	99.00	0.001	0.00
	WLAN 2.4 GHz	802.11b	Top Side of Display Screen	25	6	2437	ANT 1	1	w/Cover1	w/	18.26	18.5	99.00	0.001	0.00
	WLAN 2.4 GHz	802.11b	Left Side of Display Screen	25	6	2437	ANT 1	1	w/Cover1	w/	18.26	18.5	99.00	0.001	0.00
	WLAN 2.4 GHz	802.11b	Rear Face	0	6	2437	ANT 1	1	w/o	w/o	12.97	13	99.00	0.6	0.61
	WLAN 2.4 GHz	802.11b	Left Side	0	6	2437	ANT 1	1	w/o	w/o	12.97	13	99.00	0.223	0.23
	WLAN 2.4 GHz	802.11b	Right Side	0	6	2437	ANT 1	1	w/o	w/o	12.97	13	99.00	0.001	0.00
	WLAN 2.4 GHz	802.11b	Top Side	0	6	2437	ANT 1	1	w/o	w/o	12.97	13	99.00	0.202	0.21
	WLAN 2.4 GHz	802.11b	Bottom Side	0	6	2437	ANT 1	1	w/o	w/o	12.97	13	99.00	0.001	0.00
	WLAN 2.4 GHz	802.11b	Back of Display Screen	25	6	2437	ANT 0+1	1	w/Cover1	w/	21.16	21.5	87.30	0.001	0.00
	WLAN 2.4 GHz	802.11b	Top Side of Display Screen	25	6	2437	ANT 0+1	1	w/Cover1	w/	21.16	21.5	87.30	0.001	0.00
	WLAN 2.4 GHz	802.11b	Left Side of Display Screen	25	6	2437	ANT 0+1	1	w/Cover1	w/	21.16	21.5	87.30	0.001	0.00
	WLAN 2.4 GHz	802.11n HT40	Rear Face	0	6	2437	ANT 0+1	1	w/o	w/o	15.95	16	87.30	0.651	0.75
	WLAN 2.4 GHz	802.11n HT40	Left Side	0	6	2437	ANT 0+1	1	w/o	w/o	15.95	16	87.30	0.189	0.22
	WLAN 2.4 GHz	802.11n HT40	Right Side	0	6	2437	ANT 0+1	1	w/o	w/o	15.95	16	87.30	0.047	0.05
	WLAN 2.4 GHz	802.11n HT40	Top Side	0	6	2437	ANT 0+1	1	w/o	w/o	15.95	16	87.30	0.18	0.21
	WLAN 2.4 GHz	802.11n HT40	Bottom Side	0	6	2437	ANT 0+1	1	w/o	w/o	15.95	16	87.30	0.001	0.00
	WLAN 2.4 GHz	802.11n HT40	Rear Face	0	3	2422	ANT 0+1	1	w/o	w/o	15.87	16	87.30	0.47	0.55
1	WLAN 2.4 GHz	802.11n HT40	Rear Face	0	9	2452	ANT 0+1	1	w/o	w/o	15.81	16	87.30	0.78	0.93
	WLAN 2.4 GHz	802.11n HT40	Rear Face	0	10	2457	ANT 0+1	1	w/o	w/o	11.44	11.5	87.30	0.131	0.15
	WLAN 2.4 GHz	802.11n HT40	Rear Face	0	11	2462	ANT 0+1	1	w/o	w/o	9.43	9.5	87.30	0.087	0.10
	WLAN 2.4 GHz	802.11n HT40	Rear Face	0	9	2437	ANT 0+1	2	w/o	w/o	15.81	16	87.30	0.611	0.73
	WLAN 2.4 GHz	802.11n HT40	Rear Face	0	9	2452	ANT 0+1	1	w/Cover1	w/o	15.81	16	87.30	0.133	0.16
	WLAN 2.4 GHz	802.11n HT40	Rear Face	0	9	2452	ANT 0+1	1	w/Cover2	w/o	15.81	16	87.30	0.094	0.11
	WLAN 2.4 GHz	802.11n HT40	Rear Face	0	9	2452	ANT 0+1	1	w/o	w/	15.81	16	87.30	0.203	0.24

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Antenna	Sample	Cover	Keyboard	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	Bluetooth	GFSK	Back of Display Screen	25	39	2441	ANT 1	1	w/Cover1	w/	11.32	11.5	74.60	0.001	0.00
	Bluetooth	GFSK	Top Side of Display Screen	25	39	2441	ANT 1	1	w/Cover1	w/	11.32	11.5	74.60	0.001	0.00
	Bluetooth	GFSK	Left Side of Display Screen	25	39	2441	ANT 1	1	w/Cover1	w/	11.32	11.5	74.60	0.001	0.00
5	Bluetooth	GFSK	Rear Face	0	39	2441	ANT 1	1	w/o	w/o	11.32	11.5	74.60	0.145	0.20
	Bluetooth	GFSK	Left Side	0	39	2441	ANT 1	1	w/o	w/o	11.32	11.5	74.60	0.093	0.13
	Bluetooth	GFSK	Right Side	0	39	2441	ANT 1	1	w/o	w/o	11.32	11.5	74.60	0.001	0.00
	Bluetooth	GFSK	Top Side	0	39	2441	ANT 1	1	w/o	w/o	11.32	11.5	74.60	0.113	0.16
	Bluetooth	GFSK	Bottom Side	0	39	2441	ANT 1	1	w/o	w/o	11.32	11.5	74.60	0.001	0.00
	Bluetooth	GFSK	Rear Face	0	0	2402	ANT 1	1	w/o	w/o	11.25	11.5	74.60	0.128	0.18
	Bluetooth	GFSK	Rear Face	0	78	2480	ANT 1	1	w/o	w/o	11.24	11.5	74.60	0.09	0.13
	Bluetooth	GFSK	Rear Face	0	39	2441	ANT 1	2	w/o	w/o	11.32	11.5	74.60	0.128	0.18
	Bluetooth	GFSK	Rear Face	0	39	2441	ANT 1	1	w/Cover1	w/o	11.32	11.5	74.60	0.00164	0.00
	Bluetooth	GFSK	Rear Face	0	39	2441	ANT 1	1	w/Cover2	w/o	11.32	11.5	74.60	0.001	0.00
	Bluetooth	GFSK	Rear Face	0	39	2441	ANT 1	1	w/o	w/	11.32	11.5	74.60	0.077	0.11
	WLAN 5 GHz	802.11n HT40	Back of Display Screen	25	54	5270	ANT 0	1	w/Cover1	w/	14.84	15	86.21	0.012	0.01
	WLAN 5 GHz	802.11n HT40	Top Side of Display Screen	25	54	5270	ANT 0	1	w/Cover1	w/	14.84	15	86.21	0.025	0.03
	WLAN 5 GHz	802.11a	Rear Face	0	56	5280	ANT 0	1	w/o	w/o	7.98	8	96.00	0.866	0.91
	WLAN 5 GHz	802.11a	Left Side	0	56	5280	ANT 0	1	w/o	w/o	7.98	8	96.00	0.001	0.00
	WLAN 5 GHz	802.11a	Right Side	0	56	5280	ANT 0	1	w/o	w/o	7.98	8	96.00	0.119	0.12
2	WLAN 5 GHz	802.11a	Top Side	0	56	5280	ANT 0	1	w/o	w/o	7.98	8	96.00	1.13	1.18
	WLAN 5 GHz	802.11a	Bottom Side	0	56	5280	ANT 0	1	w/o	w/o	7.98	8	96.00	0.001	0.00
	WLAN 5 GHz	802.11n HT40	Back of Display Screen	25	54	5280	ANT 1	1	w/Cover1	w/	14.88	15	95.14	0.02	0.02
	WLAN 5 GHz	802.11n HT40	Top Side of Display Screen	25	54	5280	ANT 1	1	w/Cover1	w/	14.88	15	95.14	0.029	0.03
	WLAN 5 GHz	802.11n HT40	Left Side of Display Screen	25	54	5280	ANT 1	1	w/Cover1	w/	14.88	15	95.14	0.011	0.01
	WLAN 5 GHz	802.11a	Rear Face	0	56	5280	ANT 1	1	w/o	w/o	7.11	8	95.14	0.476	0.61
	WLAN 5 GHz	802.11a	Left Side	0	56	5280	ANT 1	1	w/o	w/o	7.11	8	95.14	0.053	0.07
	WLAN 5 GHz	802.11a	Right Side	0	56	5280	ANT 1	1	w/o	w/o	7.11	8	95.14	0.001	0.00
	WLAN 5 GHz	802.11a	Top Side	0	56	5280	ANT 1	1	w/o	w/o	7.11	8	95.14	0.468	0.60
	WLAN 5 GHz	802.11a	Bottom Side	0	56	5280	ANT 1	1	w/o	w/o	7.11	8	95.14	0.001	0.00
	WLAN 5 GHz	802.11n HT40	Back of Display Screen	25	54	5280	ANT 0+1	1	w/Cover1	w/	17.97	18	96.00	0.018	0.02
	WLAN 5 GHz	802.11n HT40	Top Side of Display Screen	25	54	5280	ANT 0+1	1	w/Cover1	w/	17.97	18	96.00	0.042	0.04
	WLAN 5 GHz	802.11n HT40	Left Side of Display Screen	25	54	5280	ANT 0+1	1	w/Cover1	w/	17.97	18	96.00	0.00988	0.01

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Antenna	Sample	Cover	Keyboard	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	WLAN 5 GHz	802.11a	Rear Face	0	56	5280	ANT 0+1	1	w/o	w/o	10.62	11	96.00	0.731	0.83
	WLAN 5 GHz	802.11a	Left Side	0	56	5280	ANT 0+1	1	w/o	w/o	10.62	11	96.00	0.103	0.12
	WLAN 5 GHz	802.11a	Right Side	0	56	5280	ANT 0+1	1	w/o	w/o	10.62	11	96.00	0.058	0.07
	WLAN 5 GHz	802.11a	Top Side	0	56	5280	ANT 0+1	1	w/o	w/o	10.62	11	96.00	0.628	0.71
	WLAN 5 GHz	802.11a	Bottom Side	0	56	5280	ANT 0+1	1	w/o	w/o	10.62	11	96.00	0.001	0.00
	WLAN 5 GHz	802.11a	Rear Face	0	52	5260	ANT 0	1	w/o	w/o	7.92	8	96.00	0.854	0.91
	WLAN 5 GHz	802.11a	Rear Face	0	60	5300	ANT 0	1	w/o	w/o	7.91	8	96.00	0.839	0.89
	WLAN 5 GHz	802.11a	Rear Face	0	64	5320	ANT 0	1	w/o	w/o	7.59	8	96.00	0.766	0.88
	WLAN 5 GHz	802.11a	Top Side	0	52	5260	ANT 0	1	w/o	w/o	7.92	8	96.00	1.1	1.17
	WLAN 5 GHz	802.11a	Top Side	0	60	5300	ANT 0	1	w/o	w/o	7.91	8	96.00	0.952	1.01
	WLAN 5 GHz	802.11a	Top Side	0	64	5320	ANT 0	1	w/o	w/o	7.59	8	96.00	0.847	0.97
	WLAN 5 GHz	802.11a	Rear Face	0	52	5260	ANT 0+1	1	w/o	w/o	10.58	11	96.00	0.614	0.70
	WLAN 5 GHz	802.11a	Rear Face	0	60	5300	ANT 0+1	1	w/o	w/o	10.56	11	96.00	0.752	0.87
	WLAN 5 GHz	802.11a	Rear Face	0	64	5320	ANT 0+1	1	w/o	w/o	10.59	11	96.00	0.71	0.81
	WLAN 5 GHz	802.11a	Top Side	0	56	5280	ANT 0	2	w/o	w/o	7.98	8	96.00	0.752	0.79
	WLAN 5 GHz	802.11a	Top Side	0	56	5280	ANT 0	1	w/Cover1	w/o	7.98	8	96.00	0.742	0.78
	WLAN 5 GHz	802.11a	Top Side	0	56	5280	ANT 0	1	w/Cover2	w/o	7.98	8	96.00	0.732	0.77
	WLAN 5 GHz	802.11a	Top Side	0	56	5280	ANT 0	1	w/o	w/	7.98	8	96.00	0.759	0.79
	WLAN 5 GHz	802.11a	Top Side	0	56	5280	ANT 0	1	w/o	w/o	7.98	8	96.00	1.11	1.16
	WLAN 5 GHz	802.11a	Back of Display Screen	25	132	5660	ANT 0	1	w/Cover1	w/	17.48	17.5	96.00	0.041	0.04
	WLAN 5 GHz	802.11a	Top Side of Display Screen	25	132	5660	ANT 0	1	w/Cover1	w/	17.48	17.5	96.00	0.102	0.11
3	WLAN 5 GHz	802.11a	Rear Face	0	132	5660	ANT 0	1	w/o	w/o	10.86	11	96.00	1.11	1.19
	WLAN 5 GHz	802.11a	Left Side	0	132	5660	ANT 0	1	w/o	w/o	10.86	11	96.00	0.001	0.00
	WLAN 5 GHz	802.11a	Right Side	0	132	5660	ANT 0	1	w/o	w/o	10.86	11	96.00	0.053	0.06
	WLAN 5 GHz	802.11a	Top Side	0	132	5660	ANT 0	1	w/o	w/o	10.86	11	96.00	1	1.08
	WLAN 5 GHz	802.11a	Bottom Side	0	132	5660	ANT 0	1	w/o	w/o	10.86	11	96.00	0.001	0.00
	WLAN 5 GHz	802.11a	Back of Display Screen	25	132	5660	ANT 1	1	w/Cover1	w/	17.49	17.5	95.14	0.025	0.03
	WLAN 5 GHz	802.11a	Top Side of Display Screen	25	132	5660	ANT 1	1	w/Cover1	w/	17.49	17.5	95.14	0.036	0.04
	WLAN 5 GHz	802.11a	Left Side of Display Screen	25	132	5660	ANT 1	1	w/Cover1	w/	17.49	17.5	95.14	0.031	0.03
	WLAN 5 GHz	802.11a	Rear Face	0	132	5660	ANT 1	1	w/o	w/o	10.74	11	95.14	0.632	0.71
	WLAN 5 GHz	802.11a	Left Side	0	132	5660	ANT 1	1	w/o	w/o	10.74	11	95.14	0.159	0.18
	WLAN 5 GHz	802.11a	Right Side	0	132	5660	ANT 1	1	w/o	w/o	10.74	11	95.14	0.001	0.00

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Antenna	Sample	Cover	Keyboard	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	WLAN 5 GHz	802.11a	Top Side	0	132	5660	ANT 1	1	w/o	w/o	10.74	11	95.14	0.309	0.34
	WLAN 5 GHz	802.11a	Bottom Side	0	132	5660	ANT 1	1	w/o	w/o	10.74	11	95.14	0.001	0.00
	WLAN 5 GHz	802.11a	Back of Display Screen	25	132	5660	ANT 0+1	1	w/Cover1	w/	20.43	20.5	96.00	0.052	0.06
	WLAN 5 GHz	802.11a	Top Side of Display Screen	25	132	5660	ANT 0+1	1	w/Cover1	w/	20.43	20.5	96.00	0.066	0.07
	WLAN 5 GHz	802.11a	Left Side of Display Screen	25	132	5660	ANT 0+1	1	w/Cover1	w/	20.43	20.5	96.00	0.029	0.03
	WLAN 5 GHz	802.11a	Rear Face	0	132	5660	ANT 0+1	1	w/o	w/o	13.9	14	96.00	0.635	0.68
	WLAN 5 GHz	802.11a	Left Side	0	132	5660	ANT 0+1	1	w/o	w/o	13.9	14	96.00	0.224	0.24
	WLAN 5 GHz	802.11a	Right Side	0	132	5660	ANT 0+1	1	w/o	w/o	13.9	14	96.00	0.05	0.05
	WLAN 5 GHz	802.11a	Top Side	0	132	5660	ANT 0+1	1	w/o	w/o	13.9	14	96.00	0.901	0.96
	WLAN 5 GHz	802.11a	Bottom Side	0	132	5660	ANT 0+1	1	w/o	w/o	13.9	14	96.00	0.001	0.00
	WLAN 5 GHz	802.11a	Rear Face	0	100	5500	ANT 0	1	w/o	w/o	10.65	11	96.00	0.674	0.76
	WLAN 5 GHz	802.11a	Rear Face	0	116	5580	ANT 0	1	w/o	w/o	10.77	11	96.00	0.955	1.05
	WLAN 5 GHz	802.11a	Rear Face	0	124	5620	ANT 0	1	w/o	w/o	10.82	11	96.00	1.04	1.13
	WLAN 5 GHz	802.11a	Rear Face	0	140	5700	ANT 0	1	w/o	w/o	10.54	11	96.00	0.976	1.13
	WLAN 5 GHz	802.11a	Rear Face	0	144	5720	ANT 0	1	w/o	w/o	10.74	11	96.00	1.06	1.17
	WLAN 5 GHz	802.11a	Top Side	0	100	5500	ANT 0	1	w/o	w/o	10.65	11	96.00	0.785	0.89
	WLAN 5 GHz	802.11a	Top Side	0	116	5580	ANT 0	1	w/o	w/o	10.77	11	96.00	0.952	1.05
	WLAN 5 GHz	802.11a	Top Side	0	124	5620	ANT 0	1	w/o	w/o	10.82	11	96.00	0.942	1.02
	WLAN 5 GHz	802.11a	Top Side	0	140	5700	ANT 0	1	w/o	w/o	10.54	11	96.00	0.852	0.99
	WLAN 5 GHz	802.11a	Top Side	0	144	5720	ANT 0	1	w/o	w/o	10.74	11	96.00	0.943	1.04
	WLAN 5 GHz	802.11a	Top Side	0	100	5500	ANT 0+1	1	w/o	w/o	13.6	14	96.00	0.805	0.92
	WLAN 5 GHz	802.11a	Top Side	0	116	5580	ANT 0+1	1	w/o	w/o	13.8	14	96.00	0.874	0.95
	WLAN 5 GHz	802.11a	Top Side	0	124	5620	ANT 0+1	1	w/o	w/o	13.77	14	96.00	0.862	0.95
	WLAN 5 GHz	802.11a	Top Side	0	140	5700	ANT 0+1	1	w/o	w/o	13.62	14	96.00	0.754	0.86
	WLAN 5 GHz	802.11a	Top Side	0	144	5720	ANT 0+1	1	w/o	w/o	13.72	14	96.00	0.852	0.95
	WLAN 5 GHz	802.11a	Rear Face	0	132	5660	ANT 0	2	w/o	w/o	10.86	11	96.00	0.865	0.93
	WLAN 5 GHz	802.11a	Rear Face	0	100	5500	ANT 0	2	w/o	w/o	10.65	11	96.00	0.529	0.60
	WLAN 5 GHz	802.11a	Rear Face	0	116	5580	ANT 0	2	w/o	w/o	10.77	11	96.00	0.744	0.82
	WLAN 5 GHz	802.11a	Rear Face	0	124	5620	ANT 0	2	w/o	w/o	10.82	11	96.00	0.807	0.88
	WLAN 5 GHz	802.11a	Rear Face	0	140	5700	ANT 0	2	w/o	w/o	10.54	11	96.00	0.743	0.86
	WLAN 5 GHz	802.11a	Rear Face	0	144	5720	ANT 0	2	w/o	w/o	10.74	11	96.00	0.826	0.91
	WLAN 5 GHz	802.11a	Rear Face	0	132	5660	ANT 0	1	w/Cover1	w/o	10.86	11	96.00	0.291	0.31
	WLAN 5 GHz	802.11a	Rear Face	0	132	5660	ANT 0	1	w/Cover2	w/o	10.86	11	96.00	0.209	0.22

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Antenna	Sample	Cover	Keyboard	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	WLAN 5 GHz	802.11a	Rear Face	0	132	5660	ANT 0	1	w/o	w/	10.86	11	96.00	0.352	0.38
	WLAN 5 GHz	802.11a	Rear Face	0	132	5660	ANT 0	1	w/o	w/o	10.86	11	96.00	1.09	1.17
	WLAN 5 GHz	802.11a	Back of Display Screen	25	157	5785	ANT 0	1	w/Cover1	w/	19.91	20	96.00	0.026	0.03
	WLAN 5 GHz	802.11a	Top Side of Display Screen	25	157	5785	ANT 0	1	w/Cover1	w/	19.91	20	96.00	0.078	0.08
	WLAN 5 GHz	802.11a	Rear Face	0	157	5785	ANT 0	1	w/o	w/o	11.93	12	96.00	0.805	0.85
	WLAN 5 GHz	802.11a	Left Side	0	157	5785	ANT 0	1	w/o	w/o	11.93	12	96.00	0.001	0.00
	WLAN 5 GHz	802.11a	Right Side	0	157	5785	ANT 0	1	w/o	w/o	11.93	12	96.00	0.036	0.04
4	WLAN 5 GHz	802.11a	Top Side	0	157	5785	ANT 0	1	w/o	w/o	11.93	12	96.00	1.1	1.16
	WLAN 5 GHz	802.11a	Bottom Side	0	157	5785	ANT 0	1	w/o	w/o	11.93	12	96.00	0.001	0.00
	WLAN 5 GHz	802.11a	Back of Display Screen	25	157	5785	ANT 1	1	w/Cover1	w/	19.65	20	95.14	0.019	0.02
	WLAN 5 GHz	802.11a	Top Side of Display Screen	25	157	5785	ANT 1	1	w/Cover1	w/	19.65	20	95.14	0.035	0.04
	WLAN 5 GHz	802.11a	Left Side of Display Screen	25	157	5785	ANT 1	1	w/Cover1	w/	19.65	20	95.14	0.018	0.02
	WLAN 5 GHz	802.11a	Rear Face	0	157	5785	ANT 1	1	w/o	w/o	11.94	12	95.14	0.597	0.64
	WLAN 5 GHz	802.11a	Left Side	0	157	5785	ANT 1	1	w/o	w/o	11.94	12	95.14	0.136	0.14
	WLAN 5 GHz	802.11a	Right Side	0	157	5785	ANT 1	1	w/o	w/o	11.94	12	95.14	0.001	0.00
	WLAN 5 GHz	802.11a	Top Side	0	157	5785	ANT 1	1	w/o	w/o	11.94	12	95.14	0.284	0.30
	WLAN 5 GHz	802.11a	Bottom Side	0	157	5785	ANT 1	1	w/o	w/o	11.94	12	95.14	0.001	0.00
	WLAN 5 GHz	802.11a	Back of Display Screen	25	157	5785	ANT 0+1	1	w/Cover1	w/	22.45	23	96.00	0.036	0.04
	WLAN 5 GHz	802.11a	Top Side of Display Screen	25	157	5785	ANT 0+1	1	w/Cover1	w/	22.45	23	96.00	0.103	0.12
	WLAN 5 GHz	802.11a	Left Side of Display Screen	25	157	5785	ANT 0+1	1	w/Cover1	w/	22.45	23	96.00	0.017	0.02
	WLAN 5 GHz	802.11a	Rear Face	0	157	5785	ANT 0+1	1	w/o	w/o	14.95	15	96.00	0.771	0.81
	WLAN 5 GHz	802.11a	Left Side	0	157	5785	ANT 0+1	1	w/o	w/o	14.95	15	96.00	0.131	0.14
	WLAN 5 GHz	802.11a	Right Side	0	157	5785	ANT 0+1	1	w/o	w/o	14.95	15	96.00	0.047	0.05
	WLAN 5 GHz	802.11a	Top Side	0	157	5785	ANT 0+1	1	w/o	w/o	14.95	15	96.00	1.01	1.06
	WLAN 5 GHz	802.11a	Bottom Side	0	157	5785	ANT 0+1	1	w/o	w/o	14.95	15	96.00	0.001	0.00
	WLAN 5 GHz	802.11a	Rear Face	0	149	5745	ANT 0	1	w/o	w/o	11.9	12	96.00	0.805	0.86
	WLAN 5 GHz	802.11a	Rear Face	0	165	5825	ANT 0	1	w/o	w/o	11.82	12	96.00	0.805	0.87
	WLAN 5 GHz	802.11a	Top Side	0	149	5745	ANT 0	1	w/o	w/o	11.9	12	96.00	1.05	1.12
	WLAN 5 GHz	802.11a	Top Side	0	165	5825	ANT 0	1	w/o	w/o	11.82	12	96.00	0.934	1.01
	WLAN 5 GHz	802.11a	Rear Face	0	149	5745	ANT 0+1	1	w/o	w/o	14.86	15	96.00	0.752	0.81
	WLAN 5 GHz	802.11a	Rear Face	0	165	5825	ANT 0+1	1	w/o	w/o	14.87	15	96.00	0.748	0.80
	WLAN 5 GHz	802.11a	Top Side	0	149	5745	ANT 0+1	1	w/o	w/o	14.86	15	96.00	0.995	1.07

Index.	Band	Modulation	Test Position	Spacing (mm)	Channel	Frequency (MHz)	Antenna	Sample	Cover	Keyboard	Meas. Conducted Power (dBm)	Tune-up (dBm)	Duty Cycle (%)	SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	WLAN 5 GHz	802.11a	Top Side	0	165	5825	ANT 0+1	1	w/o	w/o	14.87	15	96.00	0.983	1.06
	WLAN 5 GHz	802.11a	Top Side	0	157	5785	ANT 0	2	w/o	w/o	11.93	12	96.00	1.09	1.15
	WLAN 5 GHz	802.11a	Top Side	0	149	5785	ANT 0	2	w/o	w/o	11.9	12	96.00	1.06	1.13
	WLAN 5 GHz	802.11a	Top Side	0	165	5785	ANT 0	2	w/o	w/o	11.82	12	96.00	1.01	1.10
	WLAN 5 GHz	802.11a	Top Side	0	157	5785	ANT 0	1	w/Cover1	w/o	11.93	12	96.00	0.708	0.75
	WLAN 5 GHz	802.11a	Top Side	0	157	5785	ANT 0	1	w/Cover2	w/o	11.93	12	96.00	0.639	0.68
	WLAN 5 GHz	802.11a	Top Side	0	157	5785	ANT 0	1	w/o	w/	11.93	12	96.00	0.748	0.79
	WLAN 5 GHz	802.11a	Top Side	0	157	5785	ANT 0	1	w/o	w/o	11.93	12	96.00	1.05	1.11

10.6 SAR 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	Cover	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 5 GHz	802.11a	Top Side	0	56	w/o	Index. #2_once	1.13	1.11	1.77%	0.298	0.295	1.01%
WLAN 5 GHz	802.11a	Rear Face	0	132	w/o	Index. #3_once	1.11	1.09	1.80%	0.302	0.298	1.32%
WLAN 5 GHz	802.11a	Top Side	0	157	w/o	Index. #4_once	1.1	1.05	4.55%	0.261	0.255	2.30%

10.7 Simultaneous Transmission Evaluation

10.7.1 Simultaneous Transmission Configurations

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

10.7.2 Simultaneous Transmission Result

When the sum of SAR_{1g} 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 SAR_{1g} results and TER results are shown as below.

<Sum of SAR_{1g} Results>

Exposure Position	1	2	3	4	5	6	7	1 + 7	2 + 7	3 + 7	4 + 7	5 + 7	6 + 7
	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	Bluetooth ANT 1	Σ SAR _{1g} (W/kg)	Σ SAR _{1g} (W/kg)	Σ SAR _{1g} (W/kg)	Σ SAR _{1g} (W/kg)	Σ SAR _{1g} (W/kg)	Σ 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)						
Back of display screen w/Cover1 at 25 mm	0.07	0.00	0.00	0.04	0.03	0.06	0.00	0.07	0.00	0.00	0.04	0.03	0.06
Top Side of Display Screen w/Cover1 at 25 mm	0.10	0.00	0.00	0.11	0.04	0.12	0.00	0.10	0.00	0.00	0.11	0.04	0.12
Left Side of Display Screen w/Cover1 at 25 mm	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.03
Rear Face w/o at 0 mm	0.26	0.61	0.93	1.19	0.71	0.87	0.20	0.46	0.81	1.13	1.39	0.91	1.07
Left Side w/o at 0 mm	0.00	0.23	0.22	0.00	0.18	0.24	0.13	0.13	0.36	0.35	0.13	0.31	0.37
Right Side w/o at 0 mm	0.32	0.00	0.05	0.12	0.00	0.07	0.00	0.32	0.00	0.05	0.12	0.00	0.07
Top Side w/o at 0 mm	0.34	0.21	0.21	1.18	0.60	1.07	0.16	0.50	0.37	0.37	1.34	0.76	1.23
Bottom Side w/o 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
Rear Face w/Cover1 at 0 mm	0.00	0.00	0.16	0.31	0.00	0.00	0.00	0.00	0.00	0.16	0.31	0.00	0.00
Rear Face w/Cover2 at 0 mm	0.00	0.00	0.11	0.22	0.00	0.00	0.00	0.00	0.00	0.11	0.22	0.00	0.00
Top Side w/Cover1 at 0 mm	0.00	0.00	0.00	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.00
Top Side w/Cover2 at 0 mm	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.00

10.7.3 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 $(SAR1+SAR2)^{1.5} / (\text{separation distance between the peak SAR locations for the antenna pair, mm})$, 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 Hybrid SPLSR procedure in Nov. 2019 TCB workshop and the guidance in Apr. 2022 TCB workshop were applied to the circumstance that 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.

10.8 Requirements on the Uncertainty Evaluation

10.8.1 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.

11. Conclusion

The SAR test values found for the device are separately below the maximum limit of 1.6 W/kg.

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