

# FCC SAR TEST REPORT

**Applicant** : Lenovo(Shanghai) Electronics Technology Co., Ltd.  
**Equipment** : Portable Tablet Computer  
**Brand Name** : Lenovo  
**Model Name** : TB520FU  
**FCC ID** : O57TB520FU  
**Standard** : FCC 47 CFR Part 2 (2.1093)

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.



Approved by: Si Zhang

**Sporton International Inc. (Kunshan)**

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People's Republic of China**



Table of Contents

1. Statement of Compliance ..... 4
2. Administration Data ..... 5
3. Guidance Applied..... 6
4. Equipment Under Test (EUT) Information ..... 7
4.1 General Information ..... 7
5. Proximity Sensor Triggering Test..... 8
6. RF Exposure Limits.....11
6.1 Uncontrolled Environment.....11
6.2 Controlled Environment.....11
6.3 RF Exposure limit for below 6GHz .....11
6.4 RF Exposure limit for above 6GHz.....12
7. Specific Absorption Rate (SAR).....13
7.1 Introduction .....13
7.2 SAR Definition.....13
8. System Description and Setup .....14
8.1 E-Field Probe .....15
8.2 Data Acquisition Electronics (DAE) .....15
8.3 Phantom.....16
8.4 Device Holder.....17
9. Measurement Procedures .....18
9.1 Spatial Peak SAR Evaluation.....18
9.2 Power Reference Measurement.....19
9.3 Area Scan .....19
9.4 Zoom Scan.....20
9.5 Volume Scan Procedures.....20
9.6 Power Drift Monitoring.....20
10. Test Equipment List.....21
11. SAR System Verification .....22
11.1 Tissue Simulating Liquids .....22
11.2 SAR Tissue Verification .....23
11.3 SAR System Performance Check Results.....24
11.4 PD System Verification Results .....25
12. RF Exposure Positions .....26
12.1 SAR Testing for Tablet.....26
12.2 Miscellaneous Testing Considerations .....26
13. Conducted RF Output Power (Unit: dBm).....27
14. Antenna Location .....30
15. SAR Test Results .....31
15.1 Body SAR Test Result .....32
15.2 Repeated SAR Measurement .....35
15.3 PD Test Result .....36
16. Simultaneous Transmission Analysis .....37
16.1 Body Exposure Conditions .....38
16.2 SPLSR Evaluation and Analysis.....39
17. Uncertainty Assessment .....48
18. References.....51
Appendix A. Plots of System Performance Check
Appendix B. Plots of High SAR and PD Measurement
Appendix C. DASy Calibration Certificate
Appendix D. Test Setup Photos
Appendix E. Conducted RF Output Power Table
Appendix F. Power reduction mechanism verification



### History of this test report

Report No.	Version	Description	Issued Date
FA480207	01	Initial issue of report	Sep. 20, 2024



### 1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Lenovo(Shanghai) Electronics Technology Co., Ltd., Portable Tablet Computer, TB520FU**, are as follows.

Equipment Class	Frequency Band	Reported SAR	Highest Simultaneous Transmission 1g SAR (W/kg)	Measured APD	Scaled PD
		Body (Separation 0mm) (1g SAR W/kg)		Body (W/m^2)	psPD (W/m^2)
DTS	2.4GHz WLAN	1.19	1.58		
NII	5GHz WLAN	1.18	1.58		
6XD	6GHz WLAN	1.10	1.58	4.76	7.13
DSS	Bluetooth	0.34	1.58		
Date of Testing:		2024/8/19 ~ 2024/9/5			

<b>Declaration of Conformity:</b>
The test results with all measurement uncertainty excluded is presented in accordance with the regulation limits or requirements declared by manufacturers.
<b>Comments and Explanations:</b>
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR) and Power density exposure limits (1 mW/cm^2 = 10 W/m^2) specified in FCC 47 CFR part 2 (2.1093), ANSI/IEEE C95.1-1992 and FCC 47 CFR Part1.1310, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

## **2. Administration Data**

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

<b>Testing Laboratory</b>			
<b>Test Firm</b>	Sporton International Inc. (Kunshan)		
<b>Test Site Location</b>	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
<b>Test Site No.</b>	<b>Sporton Site No.</b>	<b>FCC Designation No.</b>	<b>FCC Test Firm Registration No.</b>
	SAR06-KS SAR04-KS	CN1257	314309

<b>Applicant</b>	
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<b>Address</b>	Section 304-305, Building No. 4, # 222, Meiyue Road, China (Shanghai) Pilot Free Trade Zone

<b>Manufacturer</b>	
<b>Company Name</b>	Lenovo PC HK Limited
<b>Address</b>	23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong, China



### **3. Guidance Applied**

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards.

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- IEC/IEEE 62209-1528:2020
- IEC TR 63170:2018
- IEC 62479:2010
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 616217 D04 SAR for laptop and tablets v01r02
- SPEAG DASY6 System Handbook
- SPEAG DASY6 Application Note (Interim Procedure for Device Operation at 6GHz-10GHz)

## 4. Equipment Under Test (EUT) Information

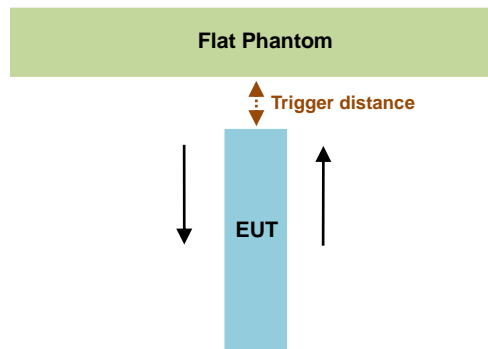
### 4.1 General Information

Product Feature & Specification	
Equipment Name	Portable Tablet Computer
Brand Name	Lenovo
Model Name	TB520FU
FCC ID	O57TB520FU
S/N	Sample 1: HA21JL07 Sample 2: HA21MSR6 Sample 3: HA21MSFN
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz WLAN 6GHz U-NII-5: 5925 MHz ~ 6425 MHz WLAN 6GHz U-NII-6: 6425 MHz ~ 6525 MHz WLAN 6GHz U-NII-7: 6525 MHz ~ 6875 MHz WLAN 6GHz U-NII-8: 6875 MHz ~ 7125 MHz Bluetooth: 2402 MHz ~ 2480 MHz WPT: 111 KHz ~ 145 KHz
Mode	WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 2.4GHz 802.11be EHT20/EHT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac/ax VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160 WLAN 5GHz 802.11be EHT20/EHT40/EHT80/EHT160 WLAN 6GHz 802.11ax HE20/HE40/HE80/HE160 WLAN 6GHz 802.11be EHT20/EHT40/EHT80/EHT160/EHT320 Bluetooth BR/EDR/LE WPT: ASK
HW Version	TB520FU
SW Version	TB520FU_RF01_240903
EUT Stage	Identical Prototype
<b>Remark:</b> 1. The EUT has no voice function. 2. The 2.4GHz/5GHz/6GHz WLAN can transmit in SISO/MIMO antenna mode. 3. The device does not support UNII-8 CH233 (BW=20M, Center Frequency = 7115MHz). 4. For Ant1, the device employs proximity sensors that detect the presence of the user's body also a finger or hand at the bottom faces of the device. When bottom face of body is detected, WLAN2.4GHz&5GHz&6GHz bands reduced power will be active. (P-sensor can't work at detecting presence of the user's body at other edges of the device.) 5. This device will be equipped with keyboard, and its working modes are laptop and tablet, for the tablet mode test is more conservatively, so no need to evaluate laptop mode separately. 6. The device support DBS (Dual Band Simultaneous) function, when the device 2.4GHz and 5GHz or 6GHz transmit at the same time the device will limit different output power for simultaneous transmission compliance. 7. The device support HBS (High Band Simultaneous) function, when the device WLAN 5GHz low Band (5150~5350MHz) and WLAN 5GHz high band (5470~5850MHz) or WLAN 6GHz transmit at the same time the device will limit different output power for simultaneous transmission compliance. 8. There are four samples. The difference between them could be referred to the TB520FU_Operational Description of Product Equality Declaration which is exhibited separately. According to the differences, sample 1 was chosen to perform full test, and the sample 2/3 verified the difference with the sample 1. For sample 4, the differences do not affect the test, so sample 4 are not tested. 9. RF exposure report for WPC (Wireless power charging) will be separately submitted.	

## 5. Proximity Sensor Triggering Test

### <Proximity Sensor Triggering Distance (KDB 616217 D04 section 6.2)>:

1. Proximity sensor triggering distance testing was performed according to the procedures outlined in KDB 616217 D04 section 6.2, and EUT moving further away from the flat phantom and EUT moving toward the flat phantom were both assessed and the tissue-equivalent medium for highest frequency 7125MHz and lowest 2412MHz frequency was used for proximity sensor triggering testing.
2. Capacitive proximity sensor placed coincident with antenna elements at the Bottom Face of the device are utilized to determine when the device comes in proximity of the user's body at the Bottom Face side of the device. There is no need to do sensor coverage testing for the proximity sensor is designed to support sufficient detection range and sensitivity to cover regions of the sensors in all applicable directions since the proximity sensor entirely covers the antenna.
3. When the sensor is active, WLAN 2.4GHz / WLAN 5.2GHz / WLAN 5.3GHz / WLAN 5.5GHz / WLAN 5.8GHz / WLAN 6GHz reduced power will be active.
4. The sensors used to detect the proximity of the user's body at the Bottom Face side of the device use a detection threshold distance. The data shown in the sections below shows the distance(s).



Proximity Sensor Triggering Distance (mm)		
Position	Bottom Face	
	Moving away	Moving towards
Minimum	17	16

### <Proximity Sensor Triggering Coverage (KDB 616217 D04 section 6.3)>:

If a sensor is spatially offset from the antenna(s), it is necessary to verify sensor triggering for conditions where the antenna is next to the user but the sensor is laterally further away to ensure sensor coverage is sufficient for reducing the power to maintain compliance. For p-sensor coverage testing, the device is moved and “along the direction of maximum antenna and sensor offset”.

Illustrated in the internal photo exhibit, although the sensor is spatially offset, there is no trigger condition where the antenna is next to the user but the sensor is laterally further away, therefore proximity sensor coverage testing is not required.

This procedure is not required because antenna and sensor are collocated and the peak SAR location is overlapping with the sensor.



**Proximity sensor power reduction**

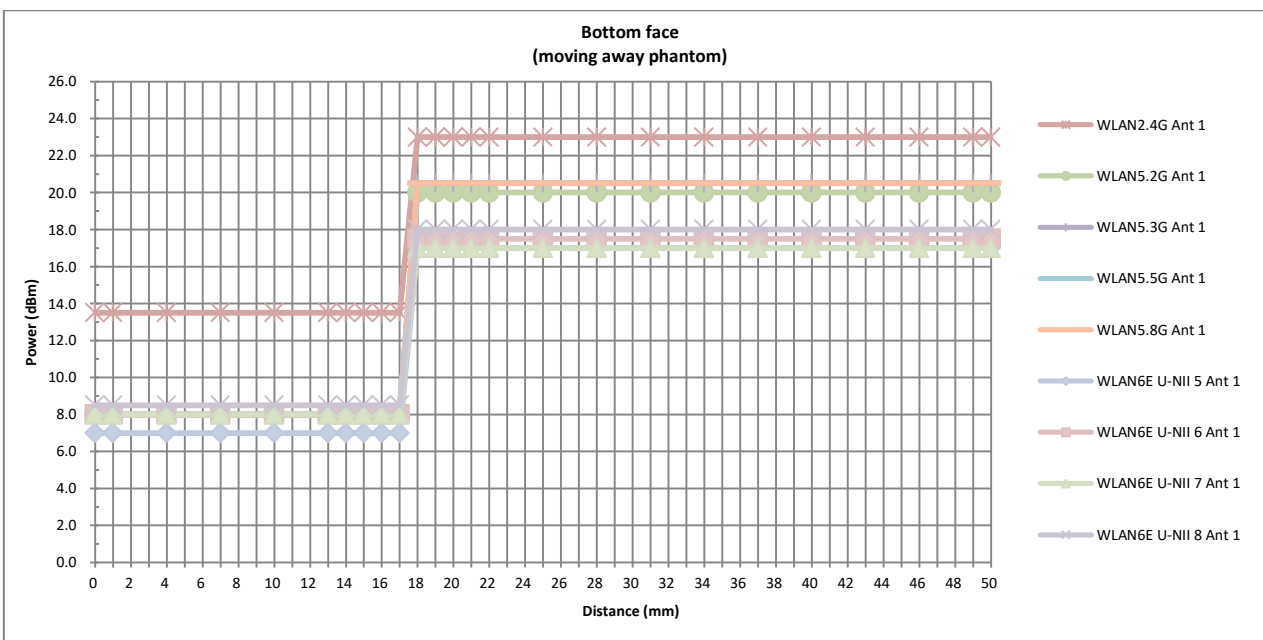
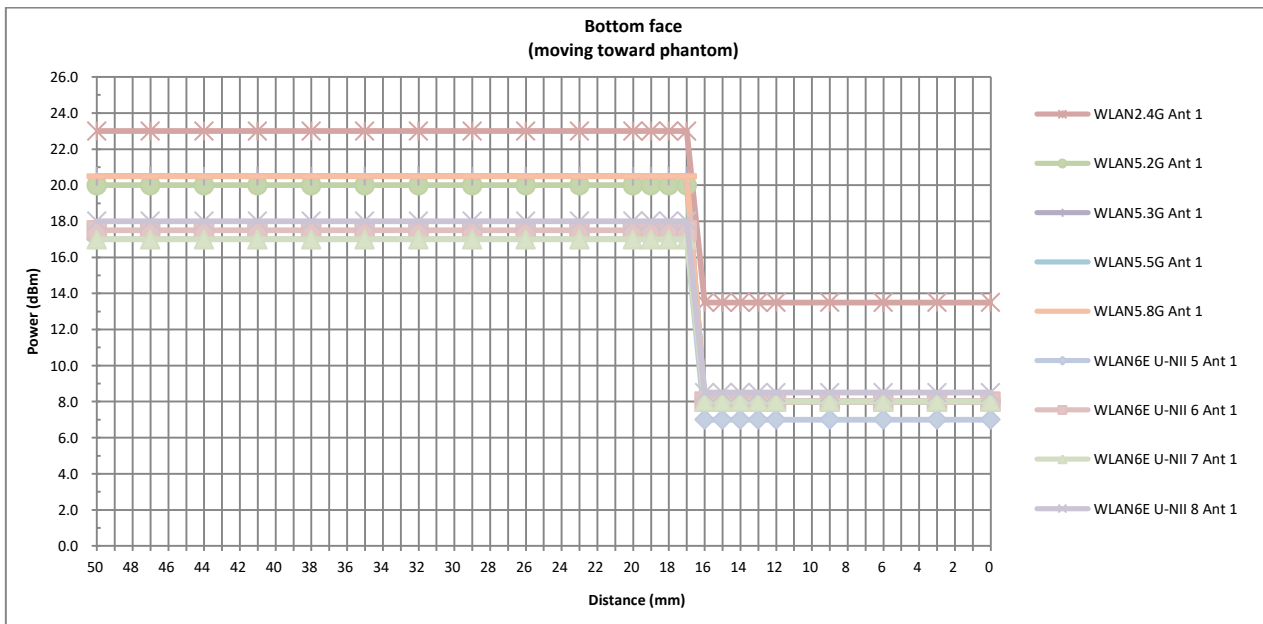
Exposure Position / wireless mode	Bottom Face <sup>(1)</sup>	Edge 1	Edge 2	Edge 3	Edge 4
WLAN 2.4GHz Ant1	9.50 dB	0dB	0dB	0dB	0dB
WLAN 5.2GHz Ant1	12.00 dB	0dB	0dB	0dB	0dB
WLAN 5.3GHz Ant1	12.50 dB	0dB	0dB	0dB	0dB
WLAN 5.5GHz Ant1	12.50 dB	0dB	0dB	0dB	0dB
WLAN 5.8GHz Ant1	12.50 dB	0dB	0dB	0dB	0dB
WLAN 6GHz Band5 Ant1	10.00 dB	0dB	0dB	0dB	0dB
WLAN 6GHz Band6 Ant1	9.50 dB	0dB	0dB	0dB	0dB
WLAN 6GHz Band7 Ant1	9.00 dB	0dB	0dB	0dB	0dB
WLAN 6GHz Band8 Ant1	9.50 dB	0dB	0dB	0dB	0dB

**Remark:**

1. <sup>(1)</sup>: Reduced maximum limit applied by activation of proximity sensor.
2. Tests were performed in accordance with KDB 616217 D04 section 6.1, 6.2, 6.3 and 6.5 and compliant results are shown and described in exhibit "P-Sensor operational description"
3. For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at a conservative trigger distance was performed:
  - Bottom Face: 15 mm

Power Measurement during Sensor Trigger distance testing

Band/Mode	Measured power reduction (dBm)		Reduction Levels (dB)
	w/o power back-off	w/ power back-off	
WLAN 2.4GHz Ant1	23.00	13.50	9.50
WLAN 5.2GHz Ant1	20.00	8.00	12.00
WLAN 5.3GHz Ant1	20.50	8.00	12.50
WLAN 5.5GHz Ant1	20.50	8.00	12.50
WLAN 5.8GHz Ant1	20.50	8.00	12.50
WLAN 6GHz Band5 Ant1	17.00	7.00	10.00
WLAN 6GHz Band6 Ant1	17.50	8.00	9.50
WLAN 6GHz Band7 Ant1	17.00	8.00	9.00
WLAN 6GHz Band8 Ant1	18.00	8.50	9.50



## 6. RF Exposure Limits

### 6.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

### 6.2 Controlled Environment

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). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

### 6.3 RF Exposure limit for below 6GHz

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

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

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

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

1. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

**6.4 RF Exposure limit for above 6GHz**

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310. The unit of power density evaluation is W/m<sup>2</sup> or mW/cm<sup>2</sup>.

Peak Spatially Averaged Power Density was evaluated over a square area of 4cm<sup>2</sup> per interim FCC Guidance for near-field power density evaluations per October 2018 TCB Workshop notes

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

Note: 1.0 mW/cm<sup>2</sup> is 10 W/m<sup>2</sup>

## **7. Specific Absorption Rate (SAR)**

### **7.1 Introduction**

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

### **7.2 SAR Definition**

The SAR definition is 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 ( $\rho$ ). The equation description is as below:

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

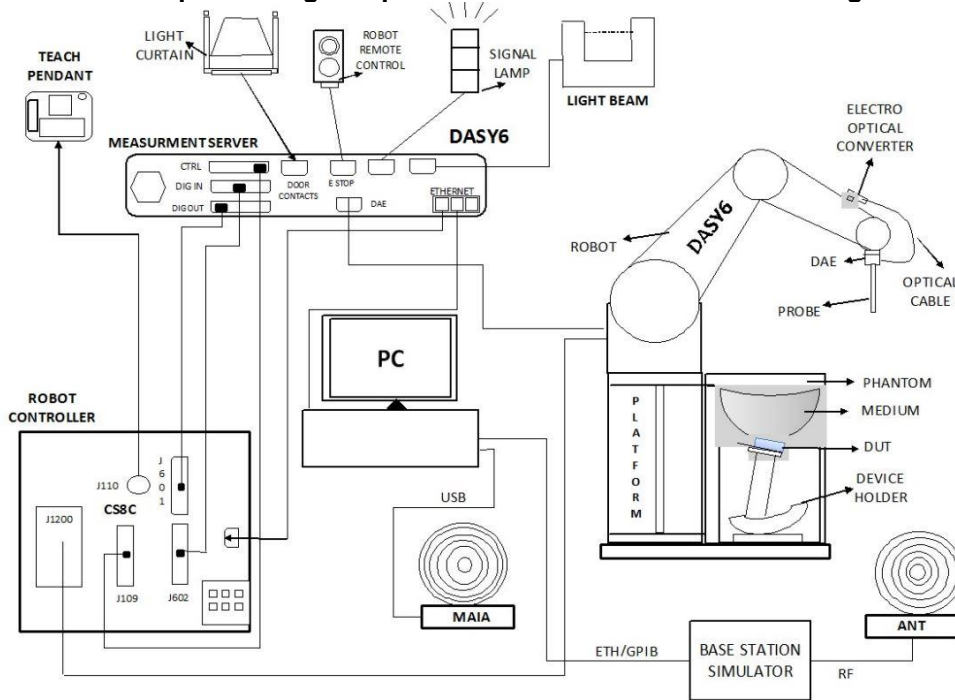
SAR is expressed in units of Watts per kilogram (W/kg)

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

Where:  $\sigma$  is the conductivity of the tissue,  $\rho$  is the mass density of the tissue and E is the RMS electrical field strength.

## 8. System Description and Setup

The DASY system used 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).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- 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 function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 or Win10 and the DASY5 or DASY6<sup>(1)</sup> 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.

Note: 1. DASY6 software used: DASY6 mmWave V3.0.0.841 and older generations and used the developed Plane-to-Plane Phase Reconstruction (PTP-PR) Algorithm which was used in PD measurement.

**8.1 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. This probe has a built in optical surface detection system to prevent from collision with phantom.

**<EX3DV4 Probe>**

<b>Construction</b>	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
<b>Frequency</b>	4 MHz – >10 GHz Linearity: ±0.2 dB (30 MHz – 10 GHz)	
<b>Directivity</b>	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)	
<b>Dynamic Range</b>	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)	
<b>Dimensions</b>	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	

**8.2 Data Acquisition Electronics (DAE)**

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 DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.



**Photo of DAE**


**8.3 Phantom**

**<SAM Twin Phantom>**

<b>Shell Thickness</b>	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
<b>Filling Volume</b>	Approx. 25 liters	
<b>Dimensions</b>	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
<b>Measurement Areas</b>	Left Hand, Right Hand, Flat Phantom	

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

**<ELI Phantom>**

<b>Shell Thickness</b>	2 ± 0.2 mm (sagging: <1%)	
<b>Filling Volume</b>	Approx. 30 liters	
<b>Dimensions</b>	Major ellipse axis: 600 mm Minor axis: 400 mm	

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices or for evaluating transmitters operating at low frequencies. ELI is fully compatible with standard and all known tissue simulating liquids.



## 8.4 Device Holder

### <Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.



Mounting Device for Hand-Held Transmitters



Mounting Device Adaptor for Wide-Phones

### <Mounting Device for Laptops and other Body-Worn Transmitters>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.



Mounting Device for Laptops

## 9. Measurement Procedures

The measurement procedures are as follows:

### <Conducted power measurement>

- (a) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
- (b) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

### <SAR measurement>

- (a) Use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix D demonstrates.
- (c) Set scan area, grid size and other setting on the DASY software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band
- (f) Measure SAR results for other channels in worst SAR testing position if the reported 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:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

### 9.1 Spatial Peak SAR Evaluation

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

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g 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 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

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

**9.2 Power Reference Measurement**

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

**9.3 Area Scan**

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ 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.	

### 9.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

		≤ 3 GHz	> 3 GHz	
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$		$\leq 2$ GHz: $\leq 8$ mm 2 – 3 GHz: $\leq 5$ mm*	3 – 4 GHz: $\leq 5$ mm* 4 – 6 GHz: $\leq 4$ mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	$\leq 5$ mm	3 – 4 GHz: $\leq 4$ mm 4 – 5 GHz: $\leq 3$ mm 5 – 6 GHz: $\leq 2$ mm	
	graded grid	$\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	$\leq 4$ mm	3 – 4 GHz: $\leq 3$ mm 4 – 5 GHz: $\leq 2.5$ mm 5 – 6 GHz: $\leq 2$ mm
		$\Delta z_{Zoom}(n>1)$ : between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z	$\geq 30$ mm	3 – 4 GHz: $\geq 28$ mm 4 – 5 GHz: $\geq 25$ mm 5 – 6 GHz: $\geq 22$ mm	
Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ 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.				

### 9.5 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 1g aggregate SAR, the EUT 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.

### 9.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASy measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT 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.



10. Test Equipment List

Table with 6 columns: Manufacturer, Name of Equipment, Type/Model, Serial Number, Last Cal., Due Date. Rows include various test equipment like System Validation Kits, Hygrometers, Signal Generators, etc.

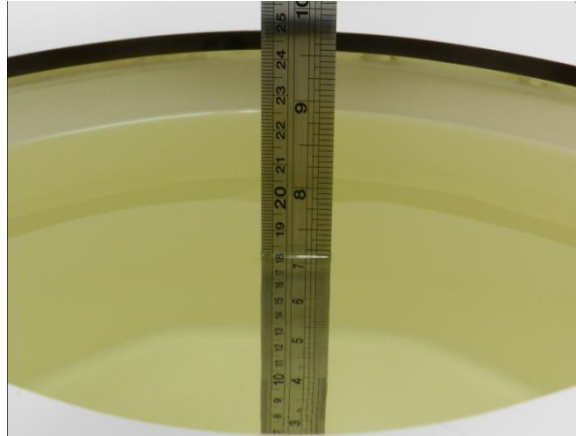
General Note:

- 1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter...
2. The dipole calibration interval can be extended to 3 years with justification according to KDB 865664 D01.

## **11. SAR System Verification**

### **11.1 Tissue Simulating Liquids**

For the measurement of the field distribution inside the SAM phantom with DASYS, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 11.1.



**Fig 11.1 Photo of Liquid Height for Body SAR**

**11.2 SAR Tissue Verification**

The tissue dielectric parameters of tissue-equivalent media used for SAR measurements must be characterized within a temperature range of 18°C to 25°C, measured with calibrated instruments and apparatuses, such as network analyzers and temperature probes. The temperature of the tissue-equivalent medium during SAR measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized. The tissue dielectric measurement system must be calibrated before use. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements.

The liquid tissue depth was at least 15cm in the phantom for all SAR testing

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ε <sub>r</sub> )
For Head								
2450	55.0	0	0	0	0	45.0	1.80	39.2

**Simulating Liquid for 5GHz, Manufactured by SPEAG**

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

**<Tissue Dielectric Parameter Check Results>**

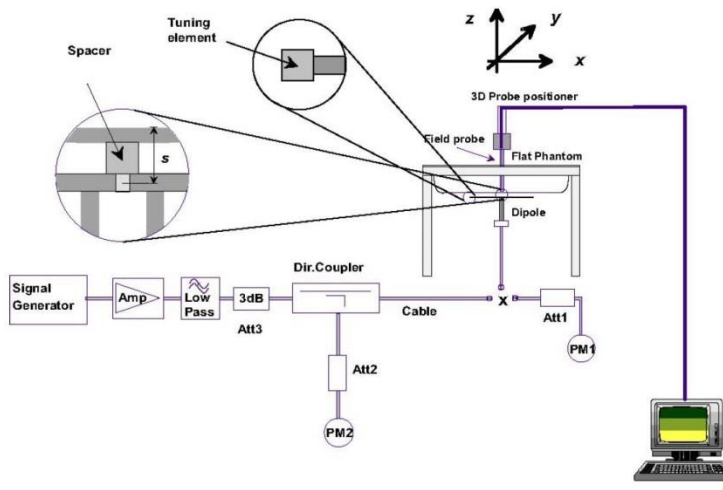
Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (ε <sub>r</sub> )	Conductivity Target (σ)	Permittivity Target (ε <sub>r</sub> )	Delta (σ) (%)	Delta (ε <sub>r</sub> ) (%)	Limit (%)	Date
2450	Head	22.7	1.810	38.600	1.80	39.20	0.56	-1.53	±5	2024/8/19
5250	Head	22.6	4.550	36.200	4.71	35.90	-3.40	0.84	±5	2024/8/20
5600	Head	22.9	4.930	35.700	5.07	35.50	-2.76	0.56	±5	2024/8/21
5750	Head	22.8	5.100	35.500	5.22	35.40	-2.30	0.28	±5	2024/8/22
6500	Head	22.7	6.180	33.700	6.07	34.50	1.81	-2.32	±5	2024/8/23

**11.3 SAR System Performance Check Results**

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. 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.

**<1g SAR>**

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2024/8/19	2450	Head	50	1095	7774	1691	2.660	52.60	53.2	1.14
2024/8/20	5250	Head	50	1113	7774	1691	4.110	81.50	82.2	0.86
2024/8/21	5600	Head	50	1113	7774	1691	4.360	82.60	87.2	5.57
2024/8/22	5750	Head	50	1113	7774	1691	4.180	80.80	83.6	3.47
2024/8/23	6500	Head	50	1031	7764	1691	14.600	297.00	292	-1.68



**System Performance Check Setup**



**Setup Photo**

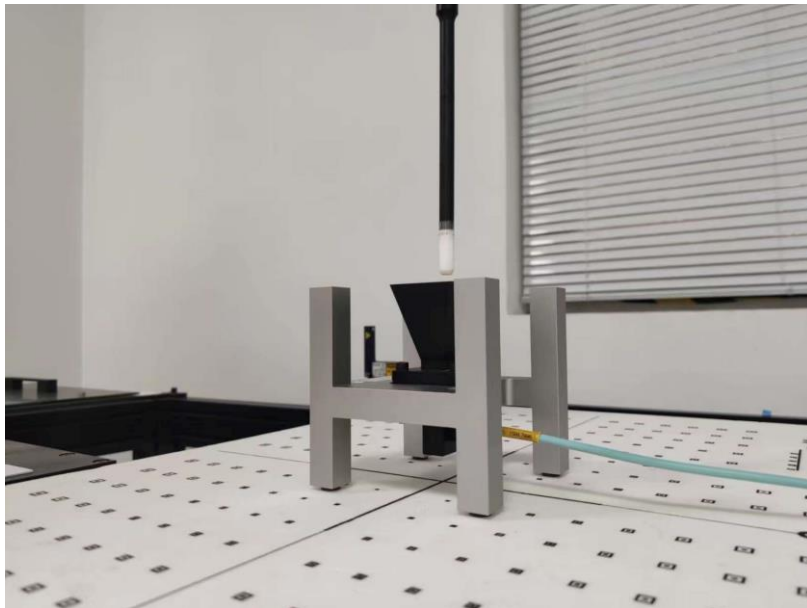


**11.4 PD System Verification Results**

The system was verified to be within  $\pm 0.66$  dB of the power density targets on the calibration certificate according to the test system specification in the user’s manual and calibration facility recommendation. The 0.66 dB deviation threshold represents the expanded uncertainty for system performance checks using SPEAG’s mmWave verification sources. The same spatial resolution and measurement region used in the source calibration was applied during the system check. The measured power density distribution of verification source was also confirmed through visual inspection to have no noticeable differences, both spatially (shape) and numerically (level) from the distribution provided by the manufacturer, per November 2017 TCBC Workshop Notes.

Frequency (GHz)	5G Verification Source	Probe S/N	DAE S/N	Distance (mm)	Input Power (mW)	Measured 4 cm <sup>2</sup> (W/m <sup>2</sup> )	Normalized <sup>(1)</sup> 4 cm <sup>2</sup> (W/m <sup>2</sup> )	Targeted 4 cm <sup>2</sup> (W/m <sup>2</sup> )	Deviation (dB)	Date
10	10GHz_2005	9553	1358	10	100	98.2	155.6	161	-0.15	2024/9/1

Note: (1) means the measured PD was normalized to Prad power which can be referred to DASYS Calibration Certificate in appendix C.



System Verification Setup Photo



## **12. RF Exposure Positions**

### **12.1 SAR Testing for Tablet**

This device can be used also in full sized tablet exposure conditions, due to its size. Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR exclusion threshold in KDB 447498 D01v06 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

#### **<EUT Setup Photos>**

Please refer to Appendix D for the test setup photos.

### **12.2 Miscellaneous Testing Considerations**

- Evaluate SAR using 6-7 GHz parameters per IEC/IEEE 62209-1528:2020.
- Per procedures of KDB Pubs. 447498 and 248227, and applicable product-specific procedures among KDB Pubs. 648474 (handsets/phablets).
- Where supported by the test system, also report estimated absorbed (epithelial) power density (for reference purposes only, not specifically for compliance) and estimated incident PD, derived from measured SAR.
- In addition, for the highest SAR test configurations evaluate incident PD using the mmw near-field probe and total-field/power-density reconstruction method (2 mm closest meas. plane)
  - Adjust measured results per amount that measurement uncertainty exceeds 30 % (see e.g. IEC 62479:2010)



### **13. Conducted RF Output Power (Unit: dBm)**

#### **<WLAN Conducted Power>**

##### **General Note:**

1. For each antenna, transmit power in SISO operation is larger than (or equal to) the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode. So WLAN SAR testing was performed on SISO antenna, MIMO SAR base on standalone SAR summed together as MIMO SAR.
2. For each frequency band or when MIMO mode was not performed, due to for each antenna, transmit power in SISO operation is larger than (or equal to) the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode.
3. Per KDB 248227 D01v02r02, the simultaneous SAR provisions in KDB publication 447498 should be applied to determine simultaneous transmission SAR test exclusion for WiFi MIMO. If the sum of 1g single transmission chain SAR measurements is  $< 1.6\text{W/kg}$  and SAR peak to location ratio  $\leq 0.04$ , no additional SAR measurements for MIMO.
4. The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures. For "Not required", SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band or when MIMO mode was not performed, due to for each antenna, transmit power in SISO operation is larger than (or equal to) the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode. Additional output power measurements were not necessary.
5. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
6. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
7. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
8. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
  - a. When the reported SAR of the initial test position is  $\leq 0.4\text{ W/kg}$ , further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
  - b. When the reported SAR of the test position is  $> 0.4\text{ W/kg}$ , SAR is repeated for the 802.11 transmission mode 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 report SAR is  $\leq 0.8\text{ W/kg}$  or all required test position are tested.

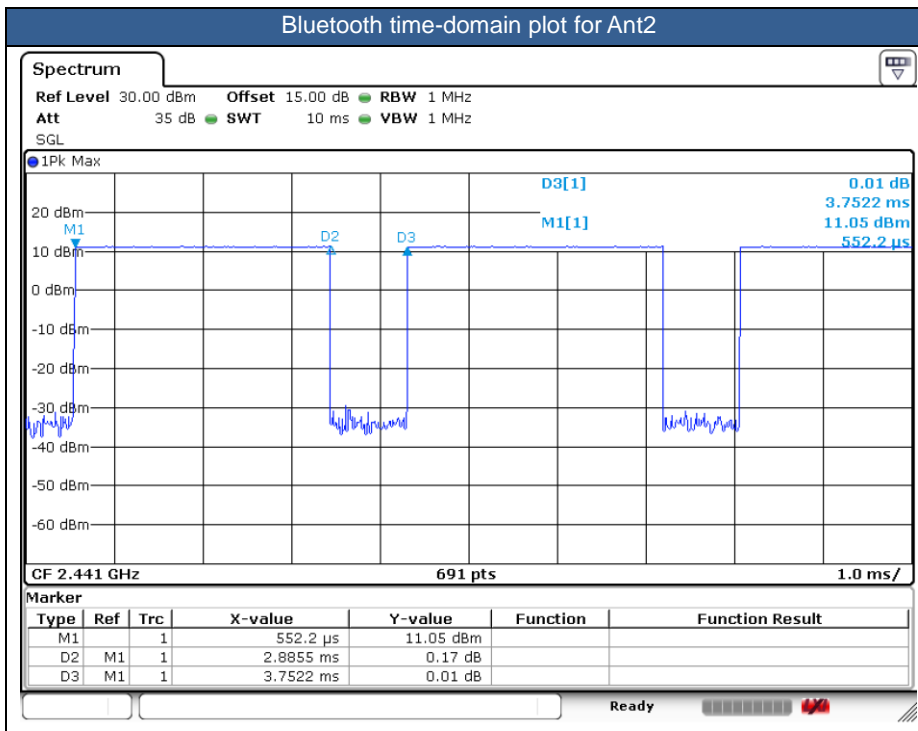
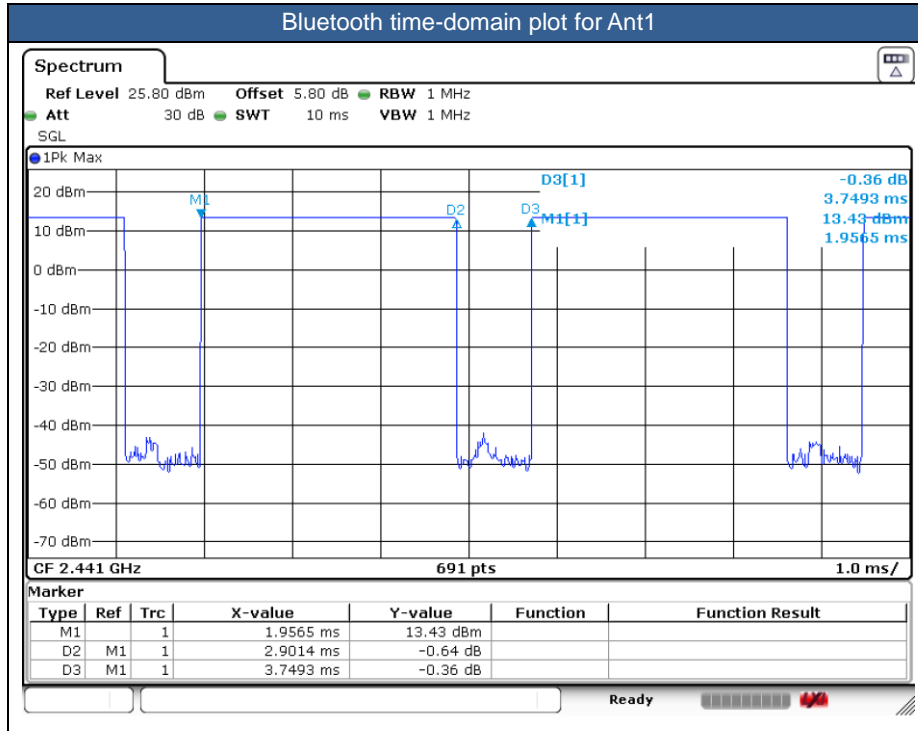


- c. For all positions/configurations, when the reported SAR is  $> 0.8$  W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is  $\leq 1.2$  W/kg or all required channels are tested.
- 9. 802.11 ax/be supports both full tone size mode and partial tone size mode, after verification on partial tone size mode that partial size tone mode power will not be higher than full tone size mode, therefore, full tone mode power was chosen to be measured in this report.
- 10. In applying the test guidance, the IEEE 802.11 mode with the maximum output power (out of all modes) should be considered for testing
- 11. For modes with the same maximum output power, the guidance from section 5.3.2 a) of FCC KDB Publication 248227 D01 should be applied, with 802.11ax being considered as the highest 802.11 mode for the appropriate frequency bands
- 12. When SAR testing for 802.11ax is required
  - a. If the maximum output power is highest for OFDMA scenarios, choose the tone size with the maximum number of tones and the highest maximum output power
  - b. Otherwise, consider the fully allocated channel for SAR testing
  - c. When SAR testing is required on RU sizes less than the fully allocated channel, use the RU number closest to the middle of the channel, choosing the higher RU number when two RUs are equidistant to the middle of the channel
- 13. For the conducted power measurement is MIMO chains transmitting simultaneously and measured the separately conducted power for both chains and then based on the conducted power of two antennas respectively to calculate sum of the power for MIMO mode.

<2.4GHz Bluetooth>

General Note:

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The Bluetooth duty cycle is 77.39% for Ant1, 76.90% for Ant2, as following figure, Bluetooth SAR scaling need further consideration and the theoretical duty cycle is 83.3%, therefore the actual duty cycle will be scaled up to the theoretical value of Bluetooth reported SAR calculation.



## 14. Antenna Location

The detailed antenna location information can refer to SAR Test Setup Photos.

**<SAR test exclusion table>**

**General Note:**

1. The below table, when the distance is < 50 mm exclusion threshold is "Ratio", when the distance is > 50 mm exclusion threshold is "mW"
2. Maximum power is the source-based time-average power and represents the maximum RF output power among production units
3. Per KDB 447498 D01v06, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
4. Per KDB 447498 D01v06, standalone SAR test exclusion threshold is applied; If the test separation distance is < 5mm, 5mm is used to determine SAR exclusion threshold.
5. Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
  - $[(max. \text{ power of channel, including tune-up tolerance, mW}) / (min. \text{ test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
  - f(GHz) is the RF channel transmit frequency in GHz
  - Power and distance are rounded to the nearest mW and mm before calculation
  - The result is rounded to one decimal place for comparison
6. Per KDB 447498 D01v06, at 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following
  - a) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm) · ( f(MHz)/150)] mW, at 100 MHz to 1500 MHz
  - b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm) · 10] mW at > 1500 MHz and ≤ 6 GHz

Exposure Position	Wireless Interface	BT ANT 1	BT ANT 2	2.4GHz WLAN ANT 1	2.4GHz WLAN ANT 2	5GHz WLAN ANT 1	5GHz WLAN ANT 2	6GHz WLAN ANT 1	6GHz WLAN ANT 2
	Calculated Frequency (MHz)	2441	2441	2462	2462	5825	5825	5985	5985
	Maximum power (dBm)	11.0	8.0	23.0	23.0	20.5	19.0	18.0	17.5
	Maximum rated power(mW)	12.59	6.31	199.53	199.53	112.20	79.43	63.10	56.23
Bottom Face	Separation distance(mm)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	exclusion threshold	3.9	2.0	62.6	62.6	54.2	38.3	54.9	38.9
	Testing required?	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Edge 1	Separation distance(mm)	12.9	5.0	12.9	5.0	12.9	5.0	12.9	5.0
	exclusion threshold	1.5	2.0	24.3	62.6	21.0	38.3	21.3	38.9
	Testing required?	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Edge 2	Separation distance(mm)	234.3	32.8	234.3	32.8	234.3	32.8	234.3	32.8
	exclusion threshold	1939.0	0.3	1939.0	9.6	1905.0	5.9	1904.0	5.9
	Testing required?	No	No	No	Yes	No	Yes	No	Yes
Edge 3	Separation distance(mm)	151.5	164.4	151.5	164.4	151.5	164.4	151.5	164.4
	exclusion threshold	1111.0	1240.0	1111.0	1240.0	1077.0	1206.0	1077.0	1205.0
	Testing required?	No	No	No	No	No	No	No	No
Edge 4	Separation distance(mm)	24.3	216.8	24.3	216.8	24.3	216.8	24.3	216.8
	exclusion threshold	0.8	1764.0	12.9	1763.0	11.2	1730.0	11.3	1729.0
	Testing required?	No	No	Yes	No	Yes	No	Yes	No



## **15. SAR Test Results**

### **General Note:**

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
  - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
  - b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
  - c. For SAR testing of Bluetooth signal with 83.3% theoretical duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle) \*83.3%".
  - d. For WLAN/BT: Reported SAR(W/kg)= Measured SAR(W/kg)\* Duty Cycle scaling factor \* Tune-up scaling factor
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
  - $\leq 0.8$  W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz
  - $\leq 0.6$  W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
  - $\leq 0.4$  W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8$ W/kg.
4. For WLAN 6GHz doesn't support wireless router capability.
5. Per FCC guidance, SAR was performed using 6.5 GHz SAR probe calibration factors.
6. Per October 2020 TCB Workshop Interim procedures, start instead with a minimum of 5 test channels across the full band, then adapt and apply conducted power and SAR test reduction procedures of KDB Pub. 248227 v02r02
7. Absorbed power density (APD) using a 4cm<sup>2</sup> averaging area is reported based on SAR measurements.

### **WLAN SAR Note:**

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required 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  $\leq 1.2$  W/kg.
2. Per KDB 248227 D01v02r02, U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is  $\leq 1.2$  W/kg, SAR is not required for U-NII-1 band.
3. Per KDB 248227 D01v02r02, when SAR measurement is required for at least one of the two U-NII bands and the highest reported SAR adjusted by the ratio of specified maximum output power of aggregated to standalone band is  $< 1.2$  W/kg, SAR is not required for the 160 MHz channel.
4. When the reported SAR of the test position is  $> 0.4$  W/kg, SAR is repeated for the 802.11 transmission mode 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 report SAR is  $\leq 0.8$  W/kg or all required test position are tested.
5. For all positions / configurations, when the reported SAR is  $> 0.8$  W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is  $\leq 1.2$  W/kg or all required channels are tested.
6. The 2.4GHz/5GHz/6GHz WLAN can transmit in SISO/MIMO antenna mode.
7. For each antenna, transmit power in SISO operation is larger than or equal to the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode. So WLAN SAR testing was performed on SISO antenna, MIMO SAR base on standalone SAR summed together as MIMO SAR.
8. During SAR testing the WLAN 6GHz transmission was verified using a spectrum analyzer.
9. When SAR testing for 802.11ax is required
  - d. If the maximum output power is highest for OFDMA scenarios, choose the tone size with the maximum number of tones and the highest maximum output power
  - e. Otherwise, consider the fully allocated channel for SAR testing
  - f. When SAR testing is required on RU sizes less than the fully allocated channel, use the RU number closest to the middle of the channel, choosing the higher RU number when two RUs are equidistant to the middle of the channel.



15.1 Body SAR Test Result

Table with columns: Plot No., Band, Mode, Test Position, Gap (mm), Antenna, Power State, Ch., Freq. (MHz), Sample, Average Power (dBm), Tune-Up Limit (dBm), Tune-up Scaling Factor, Duty Cycle %, Duty Cycle Scaling Factor, Power Drift (dB), Measured 1g SAR (W/kg), Reported 1g SAR (W/kg). Rows include 2450MHz, 5000MHz, and 2450MHz sections with various test configurations.





	WLAN5.5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Non DBS	138	5690	1	6.62	8.00	1.374	100	1.000	0.07	0.806	1.107
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	DBS	122	5610	1	4.85	6.00	1.303	100	1.000	0.09	0.541	0.705
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	HBS	122	5610	1	3.28	5.00	1.486	100	1.000	0.13	0.369	0.548
	WLAN5.5GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full power	132	5660	1	18.92	20.50	1.439	99.32	1.007	0.08	0.759	1.100
	WLAN5.5GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full power	100	5500	1	18.54	20.00	1.400	99.32	1.007	0.08	0.737	1.039
	WLAN5.5GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full power	116	5580	1	18.66	20.00	1.361	99.32	1.007	0.01	0.751	1.030
	WLAN5.5GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full power	124	5620	1	18.88	20.50	1.452	99.32	1.007	0.03	0.762	1.114
	WLAN5.5GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full power	140	5700	1	18.75	20.50	1.496	99.32	1.007	-0.08	0.734	1.106
	WLAN5.5GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full power	144	5720	1	18.70	20.00	1.349	99.32	1.007	-0.08	0.746	1.013
	WLAN5.5GHz	802.11n-HT40 MCS0	Bottom Face	0mm	Ant 2	Full power	134	5670	1	17.37	19.00	1.455	100	1.000	0	0.073	0.106
	WLAN5.5GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	134	5670	1	17.37	19.00	1.455	100	1.000	-0.04	0.765	1.113
	WLAN5.5GHz	802.11n-HT40 MCS0	Edge 2	0mm	Ant 2	Full power	134	5670	1	17.37	19.00	1.455	100	1.000	-0.15	0.124	0.180
	WLAN5.5GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	102	5510	1	17.03	18.50	1.403	100	1.000	0.11	0.753	1.056
	WLAN5.5GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	110	5550	1	17.20	18.50	1.349	100	1.000	0.04	0.782	1.055
	WLAN5.5GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	126	5630	1	17.31	19.00	1.476	100	1.000	0.07	0.761	1.123
	WLAN5.5GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	126	5630	2	17.31	19.00	1.476	100	1.000	-0.17	0.732	1.080
	WLAN5.5GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	126	5630	3	17.31	19.00	1.476	100	1.000	-0.03	0.710	1.048
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 2	DBS	106	5530	1	14.47	16.00	1.422	100	1.000	0.02	0.513	0.730
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 2	HBS	106	5530	1	13.37	15.00	1.455	100	1.000	-0.03	0.397	0.578
	WLAN5.5GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	142	5710	1	16.97	18.50	1.422	100	1.000	0.1	0.778	1.107
05	WLAN5.8GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Non DBS	155	5775	1	6.74	8.00	1.337	100	1.000	0.07	0.848	1.133
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Non DBS	155	5775	2	6.74	8.00	1.337	100	1.000	0.14	0.812	1.085
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Non DBS	155	5775	3	6.74	8.00	1.337	100	1.000	0.11	0.789	1.055
	WLAN5.8GHz	802.11a 6Mbps	Edge 1	0mm	Ant 1	Full power	149	5745	1	19.02	20.50	1.406	99.32	1.007	0.08	0.271	0.384
	WLAN5.8GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	Full power	149	5745	1	19.02	20.50	1.406	99.32	1.007	-0.17	0.205	0.290
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	DBS	155	5775	1	4.32	6.00	1.472	100	1.000	-0.11	0.492	0.724
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	HBS	155	5775	1	2.48	4.00	1.419	100	1.000	-0.16	0.391	0.555
	WLAN5.8GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full power	149	5745	1	19.02	20.50	1.406	99.32	1.007	-0.09	0.768	1.087
	WLAN5.8GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full power	157	5785	1	18.96	20.50	1.426	99.32	1.007	0.01	0.755	1.084
	WLAN5.8GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full power	165	5825	1	18.92	20.50	1.439	99.32	1.007	0.04	0.743	1.077
	WLAN5.8GHz	802.11n-HT40 MCS0	Bottom Face	0mm	Ant 2	Full power	159	5795	1	17.06	18.50	1.393	100	1.000	0.11	0.075	0.104
	WLAN5.8GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	159	5795	1	17.06	18.50	1.393	100	1.000	0.07	0.802	1.117
	WLAN5.8GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	159	5795	2	17.06	18.50	1.393	100	1.000	-0.05	0.776	1.081
	WLAN5.8GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	159	5795	3	17.06	18.50	1.393	100	1.000	0.18	0.753	1.049
	WLAN5.8GHz	802.11n-HT40 MCS0	Edge 2	0mm	Ant 2	Full power	159	5795	1	17.06	18.50	1.393	100	1.000	0.18	0.102	0.142
	WLAN5.8GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	151	5755	1	17.01	18.50	1.409	100	1.000	0.07	0.785	1.106
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 2	DBS	155	5775	1	14.46	16.00	1.426	100	1.000	0.06	0.520	0.741
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 2	HBS	155	5775	1	13.49	15.00	1.416	100	1.000	0.02	0.400	0.566



Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Measured APD (W/m <sup>2</sup> )
<b>6000MHz</b>																		
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	Non DBS	207	6985	1	6.99	8.50	1.416	100	1.000	0.03	0.770	1.090	4.06
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	DBS	207	6985	1	5.61	7.00	1.377	100	1.000	-0.19	0.531	0.731	2.9
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	HBS	207	6985	1	3.83	5.50	1.469	100	1.000	0.01	0.385	0.566	2.09
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	0mm	Ant 1	Full power	207	6985	1	16.68	18.00	1.355	100	1.000	0.07	0.132	0.179	0.698
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 4	0mm	Ant 1	Full power	207	6985	1	16.68	18.00	1.355	100	1.000	0.09	0.057	0.077	0.302
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	Non DBS	15	6025	1	6.03	7.00	1.250	100	1.000	-0.01	0.808	1.010	4.62
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	Non DBS	47	6185	1	6.09	7.00	1.233	100	1.000	-0.05	0.787	0.970	4.01
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	Non DBS	111	6505	1	6.75	8.00	1.334	100	1.000	0.06	0.765	1.020	3.89
06	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	Non DBS	143	6665	1	7.01	8.00	1.256	100	1.000	-0.05	0.879	<b>1.104</b>	4.65
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	Non DBS	143	6665	2	7.01	8.00	1.256	100	1.000	0.14	0.811	1.019	3.91
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	Non DBS	143	6665	3	7.01	8.00	1.256	100	1.000	-0.17	0.819	1.029	4.05
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	15mm	Ant 1	Full power	207	6985	1	16.68	18.00	1.355	100	1.000	0.08	0.689	0.934	3.49
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	15mm	Ant 1	Full power	15	6025	1	15.35	17.00	1.462	100	1.000	0.06	0.714	1.044	3.78
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	15mm	Ant 1	Full power	47	6185	1	15.50	17.00	1.413	100	1.000	0.03	0.703	0.993	3.78
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	15mm	Ant 1	Full power	111	6505	1	16.04	17.50	1.400	100	1.000	0.01	0.676	0.946	3.18
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	15mm	Ant 1	Full power	143	6665	1	15.48	17.00	1.419	100	1.000	0.03	0.707	1.003	3.8
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 2	Full power	207	6985	1	15.73	17.50	1.503	100	1.000	0.18	0.077	0.116	0.444
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	0mm	Ant 2	Full power	207	6985	1	15.73	17.50	1.503	100	1.000	-0.17	0.707	1.063	4.25
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	0mm	Ant 2	DBS	207	6985	1	14.83	16.50	1.469	100	1.000	-0.04	0.522	0.767	2.96
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	0mm	Ant 2	HBS	207	6985	1	13.97	15.50	1.422	100	1.000	-0.05	0.416	0.592	2.2
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 2	0mm	Ant 2	Full power	207	6985	1	15.73	17.50	1.503	100	1.000	0.09	0.292	0.439	1.98
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 2	0mm	Ant 2	Full power	15	6025	1	15.40	17.00	1.445	100	1.000	0.09	0.247	0.357	1.78
07	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	0mm	Ant 2	Full power	15	6025	1	15.40	17.00	1.445	100	1.000	-0.02	0.751	1.086	<b>4.76</b>
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	0mm	Ant 2	Full power	15	6025	2	15.40	17.00	1.445	100	1.000	0.17	0.714	1.032	4.11
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	0mm	Ant 2	Full power	15	6025	3	15.40	17.00	1.445	100	1.000	-0.05	0.722	1.044	4.23
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	0mm	Ant 2	Full power	47	6185	1	14.96	16.50	1.426	100	1.000	-0.13	0.703	1.002	3.85
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	0mm	Ant 2	Full power	111	6505	1	15.53	17.00	1.403	100	1.000	-0.01	0.612	0.859	3.38
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	0mm	Ant 2	Full power	143	6665	1	15.09	16.50	1.384	100	1.000	0.02	0.522	0.722	2.76

**15.2 Repeated SAR Measurement**

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 1	Non DBS	1	2412	12.22	13.50	1.343	97.03	1.031	0.03	0.860	1	1.191
2nd	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 1	Non DBS	1	2412	12.22	13.50	1.343	97.03	1.031	0.04	0.811	1.060	1.123
1st	WLAN5GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	62	5310	17.15	18.50	1.365	100	1.000	0.05	0.865	1	1.180
2nd	WLAN5GHz	802.11n-HT40 MCS0	Edge 1	0mm	Ant 2	Full power	62	5310	17.15	18.50	1.365	100	1.000	0.03	0.803	1.077	1.096
1st	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Non DBS	122	5610	6.81	8.00	1.315	100	1.000	0.08	0.857	1	1.127
2nd	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Non DBS	122	5610	6.81	8.00	1.315	100	1.000	0.07	0.815	1.052	1.072
1st	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Non DBS	155	5775	6.74	8.00	1.337	100	1.000	0.07	0.848	1	1.133
2nd	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Non DBS	155	5775	6.74	8.00	1.337	100	1.000	-0.03	0.786	1.079	1.051
1st	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	Non DBS	143	6665	7.01	8.00	1.256	100	1.000	-0.05	0.879	1	1.104
2nd	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	0mm	Ant 1	Non DBS	143	6665	7.01	8.00	1.256	100	1.000	0.07	0.823	1.068	1.034

**General Note:**

- Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8W/kg$ .
- Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is  $\leq 1.2$  and the measured SAR  $< 1.45W/kg$ , only one repeated measurement is required.
- The ratio is the difference in percentage between original and repeated *measured SAR*.
- All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

**15.3 PD Test Result**

**Power Density General Notes:**

1. The manufacturer has confirmed that the devices tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
2. Batteries are fully charged at the beginning of the measurements.
3. Absorbed power density (APD) using a 4cm<sup>2</sup> averaging area is reported based on SAR measurements.
4. Power density was calculated by repeated E-field measurements on two measurement planes separated by λ/4.
5. The device was 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.
6. Per FCC guidance and equipment manufacturer guidance, power density results were scaled according to IEC 62479:2010 for the portion of the measurement uncertainty > 30%. Total expanded uncertainty of 2.68 dB (85.4%) was used to determine the psPD measurement scaling factor.
7. Per April 2021 TCB Workshop, For the highest SAR test configurations also measure incident PD (total) using power-density reconstruction method in 2 mm closest measurement plane.
8. Per October 2020 TCB Workshop, PTP-PR algorithm was used during psPD measurement and calculations.
9. The measurement procedure consists of measuring the PD<sub>inc</sub> at two different distances: 2 mm (compliance distance) and λ/5. The grid extents should be large enough to fully capture the transmitted energy. The grid step should be fine enough to demonstrate that the integrated Power Density iPD<sub>n</sub> fulfill the criterion described below. Since iPD ratio between the two distances is iPD ≥ -1dB, the grid step (0.0625) was sufficient for determining compliance at d=2mm.

$$10 \cdot \log_{10} \frac{iPD_n(2mm)}{iPD_n(\lambda/5)} \geq -1$$

**<WLAN PD>**

Band	Mode	Test Position	Gap (mm)	Antenna	Sample	Ch.	Freq. (MHz)	Power State	Average Power (dBm)	Grid Step (λ)	iPD <sub>n</sub>	iPD ratio (≥ -1)	Normal psPD (W/m <sup>2</sup> )	Total psPD (W/m <sup>2</sup> )
WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	2mm	Ant 1	1	15	6025	Non DBS	6.03	0.0625	1.33	0.27	2.24	2.59
WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	8.59mm	Ant 1	1	15	6025	Non DBS	6.03	0.15	1.25		1.95	2.31
WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	2mm	Ant 1	1	207	6985	Non DBS	6.99	0.0625	1.82	0.93	2.27	2.61
WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	10mm	Ant 1	1	207	6985	Non DBS	6.99	0.15	1.47		2.04	2.45

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Sample	Ch.	Freq. (MHz)	Power State	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Grid Step (λ)	Scaling Factor for measurement uncertainty	Power Drift (dB)	Normal psPD (W/m <sup>2</sup> )	Scaled Normal psPD (W/m <sup>2</sup> )	Total psPD (W/m <sup>2</sup> )	Scaled Total psPD (W/m <sup>2</sup> )
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	2mm	Ant 1	1	15	6025	Non DBS	6.03	7.00	1.250	100	1.000	0.0625	1.5535	-0.03	2.240	4.35	2.590	5.03
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	2mm	Ant 1	1	47	6185	Non DBS	6.09	7.00	1.233	100	1.000	0.0625	1.5535	0.01	1.610	3.08	1.900	3.64
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	2mm	Ant 1	1	111	6505	Non DBS	6.75	8.00	1.334	100	1.000	0.0625	1.5535	-0.03	3.230	6.69	3.420	7.08
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	2mm	Ant 1	1	143	6665	Non DBS	7.01	8.00	1.256	100	1.000	0.0625	1.5535	0.02	1.840	3.59	2.130	4.16
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	2mm	Ant 1	1	207	6985	Non DBS	6.99	8.50	1.416	100	1.000	0.0625	1.5535	0.05	2.270	4.99	2.610	5.74
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	2mm	Ant 1	1	207	6985	Full power	16.68	18.00	1.355	100	1.000	0.0625	1.5535	0.08	1.993	4.20	2.330	4.91
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 4	2mm	Ant 1	1	207	6985	Full power	16.68	18.00	1.355	100	1.000	0.0625	1.5535	0.01	2.250	4.74	2.450	5.16
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	15mm	Ant 1	1	207	6985	Full power	16.68	18.00	1.355	100	1.000	0.0625	1.5535	0.03	1.880	3.96	1.970	4.15
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	2mm	Ant 2	1	15	6025	Full power	15.40	17.00	1.445	100	1.000	0.0625	1.5535	-0.08	2.420	5.43	2.970	6.67
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	2mm	Ant 2	1	47	6185	Full power	14.96	16.50	1.426	100	1.000	0.0625	1.5535	-0.08	1.790	3.96	2.610	5.78
01	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	2mm	Ant 2	1	111	6505	Full power	15.53	17.00	1.403	100	1.000	0.0625	1.5535	0.1	2.570	5.60	3.270	7.13
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	2mm	Ant 2	2	111	6505	Full power	15.53	17.00	1.403	100	1.000	0.0625	1.5535	-0.03	2.110	4.60	2.890	6.30
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	2mm	Ant 2	3	111	6505	Full power	15.53	17.00	1.403	100	1.000	0.0625	1.5535	0.01	2.350	5.12	3.110	6.78
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	2mm	Ant 2	1	143	6665	Full power	15.09	16.50	1.384	100	1.000	0.0625	1.5535	-0.18	1.560	3.35	2.120	4.56
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 1	2mm	Ant 2	1	207	6985	Full power	15.73	17.50	1.503	100	1.000	0.0625	1.5535	0.1	0.993	2.32	1.990	4.65
	WLAN6GHz	802.11ax-HE160 MCS0	Bottom Face	2mm	Ant 2	1	207	6985	Full power	15.73	17.50	1.503	100	1.000	0.0625	1.5535	0.12	0.025	0.06	0.062	0.14
	WLAN6GHz	802.11ax-HE160 MCS0	Edge 2	2mm	Ant 2	1	207	6985	Full power	15.73	17.50	1.503	100	1.000	0.0625	1.5535	0.08	0.011	0.03	0.036	0.08

## 16. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Portable Tablet Computer
		Body
1.	Bluetooth + WLAN2.4GHz	Yes
2.	Bluetooth + WLAN5GHz/WLAN6GHz	Yes
3.	WLAN2.4GHz + WLAN5GHz/6GHz	Yes
4.	WLAN2.4GHz + WLAN5GHz/6GHz + Bluetooth	Yes
5.	WLAN5GHz high Band + WLAN5GHz low band + Bluetooth	Yes
6.	WLAN6GHz + WLAN5GHz low band + Bluetooth	Yes

**Note:**

1. The 2.4GHz/5GHz/6GHz WLAN can transmit in MIMO and SISO antenna mode and MIMO SAR base on standalone SAR summed together as MIMO SAR.
2. According to the EUT characteristic, when WLAN 2.4GHz and Bluetooth share the same antenna path and cannot transmit simultaneously; when WLAN2.4GHz and Bluetooth are located on different antennas, they can transmit simultaneously.
3. According to the EUT characteristic, WLAN 5GHz/6GHz and Bluetooth can transmit simultaneously.
4. According to the EUT characteristic, WLAN 5GHz/6GHz and WLAN 2.4GHz can transmit simultaneously.
5. According to the EUT characteristic, WLAN 5GHz low band and WLAN 6GHz can transmit simultaneously.
6. According to the EUT characteristic, two Bluetooth antennas can transmit simultaneously.
7. The worst case 5 GHz WLAN SAR for each configuration was used for SAR summation.
8. The maximum SAR summation is calculated based on the same configuration and test position.
9. For simultaneously analysis, since the SAR summation of 3 transmitters can cover others combination of 2 transmitters, therefore in this section did not additional to evaluate 2TX combination of simultaneously transmission.
10. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
  - i) 1g Scalar SAR summation < 1.6W/kg.
  - ii)  $SPLSR = (SAR1 + SAR2)^{1.5} / (\text{min. separation distance, mm})$ , and the peak separation distance is determined from the square root of  $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$ , where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
  - iii) If  $SPLSR \leq 0.04$  for 1g SAR, simultaneously transmission SAR measurement is not necessary.
  - iv) Simultaneously transmission SAR measurement, and the reported multi-band 1g SAR < 1.6W/kg.
  - v) The SPLSR calculated results please refer to section 16.2.
11. The WLAN6GHz Sim-Tx analysis guidance with other transmitters was based on SAR test results. The simultaneous transmission and test exemption analysis were compliant with KDB 447498 D01. For the device does not support FR2 or other MPE field measurement, therefore section 16 in the SAR report has no TER analysis according to KDB 987594 requirement.

### 16.1 Body Exposure Conditions

#### For Non DBS

Exposure Position	1	2	3	4	5	6	7	8	2+7	1+8	3+4+7+8	5+6+7+8	1+2	SPLSR
	WLAN2.4GHz Ant 1 1g SAR (W/kg)	WLAN2.4GHz Ant 2 1g SAR (W/kg)	WLAN5GHz Ant 1 1g SAR (W/kg)	WLAN5GHz Ant 2 1g SAR (W/kg)	WLAN6GHz Ant 1 1g SAR (W/kg)	WLAN6GHz Ant 2 1g SAR (W/kg)	Bluetooth Ant 1 1g SAR (W/kg)	Bluetooth Ant 2 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Summed 1g SAR (W/kg)	
Bottom Face	1.191	0.122	1.133	0.106	1.104	0.116	0.344	0.015	0.47	1.21	1.60	1.58	1.31	1
Edge 1	0.096	0.792	0.384	1.180	0.179	1.086	0.004	0.014	0.80	0.11	1.58	1.28	0.89	
Edge 2		0.094		0.180		0.439			0.09	0.00	0.18	0.44	0.09	
Edge 4	0.001		0.394		0.077		0.008		0.01	0.00	0.40	0.09	0.00	

#### For DBS

Exposure Position	1	2	3	4	5	6	7	8	1+2+3+4	2+3+4+7	1+3+4+8	1+2+5+6	2+5+6+7	1+5+6+8	SPLSR
	WLAN2.4GHz Ant 1 1g SAR (W/kg)	WLAN2.4GHz Ant 2 1g SAR (W/kg)	WLAN5GHz Ant 1 1g SAR (W/kg)	WLAN5GHz Ant 2 1g SAR (W/kg)	WLAN6GHz Ant 1 1g SAR (W/kg)	WLAN6GHz Ant 2 1g SAR (W/kg)	Bluetooth Ant 1 1g SAR (W/kg)	Bluetooth Ant 2 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Summed 1g SAR (W/kg)	
Bottom Face	0.719	0.122	0.735	0.106	0.731	0.116	0.344	0.015	1.68	1.31	1.58	1.69	1.31	1.58	1,2
Edge 1	0.096	0.751	0.384	0.760	0.179	0.776	0.004	0.014	1.99	1.90	1.25	1.80	1.71	1.07	3,4,5,6
Edge 2		0.094		0.180		0.439			0.27	0.27	0.18	0.53	0.53	0.44	
Edge 4	0.001		0.394		0.077		0.008		0.40	0.40	0.40	0.08	0.09	0.08	

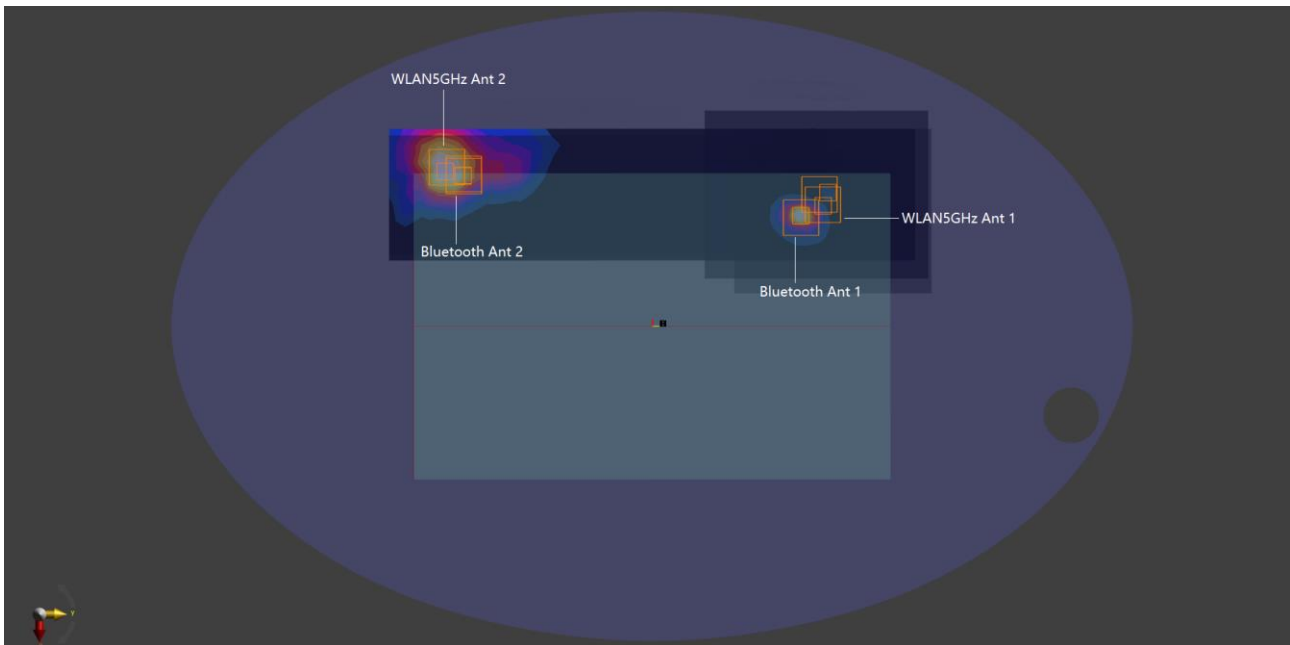
#### For HBS

Exposure Position	1	2	3	4	5	6	7	8	1+2+3+4+7+8	3+4+5+6+7+8	SPLSR
	WLAN5GHz High Ant 1 1g SAR (W/kg)	WLAN5GHz High Ant 2 1g SAR (W/kg)	WLAN5GHz Low Ant 1 1g SAR (W/kg)	WLAN5GHz Low Ant 2 1g SAR (W/kg)	WLAN6GHz Ant 1 1g SAR (W/kg)	WLAN6GHz Ant 2 1g SAR (W/kg)	Bluetooth Ant 1 1g SAR (W/kg)	Bluetooth Ant 2 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Summed 1g SAR (W/kg)	
Bottom Face	0.555	0.106	0.547	0.105	0.566	0.116	0.344	0.015	1.67	1.69	1&2
Edge 1	0.384	0.578	0.132	0.550	0.179	0.592	0.004	0.014	1.66	1.47	3
Edge 2		0.180		0.072		0.439			0.25	0.51	
Edge 4	0.290		0.394		0.077		0.008		0.69	0.48	

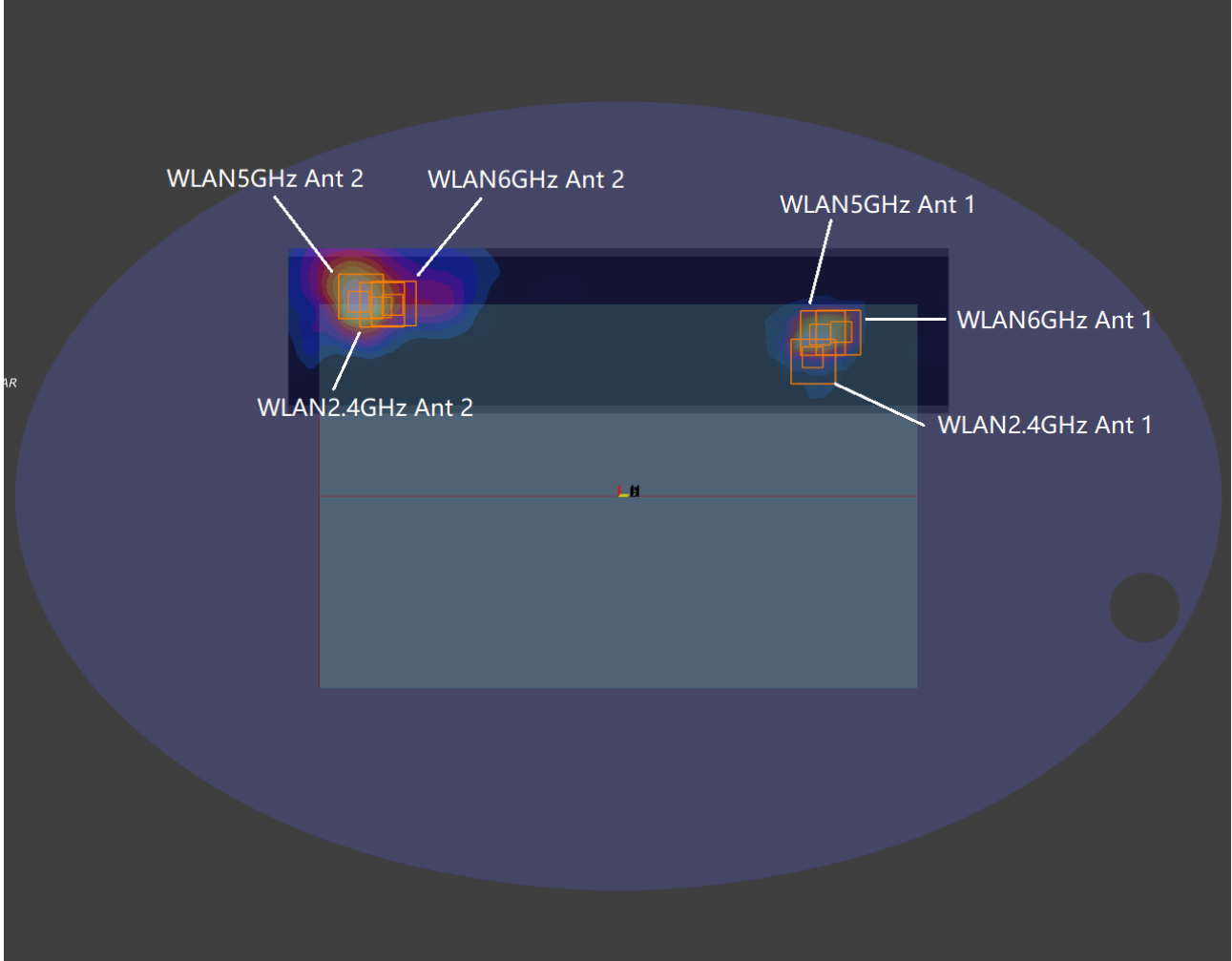
## 16.2 SPLSR Evaluation and Analysis

### General Note:

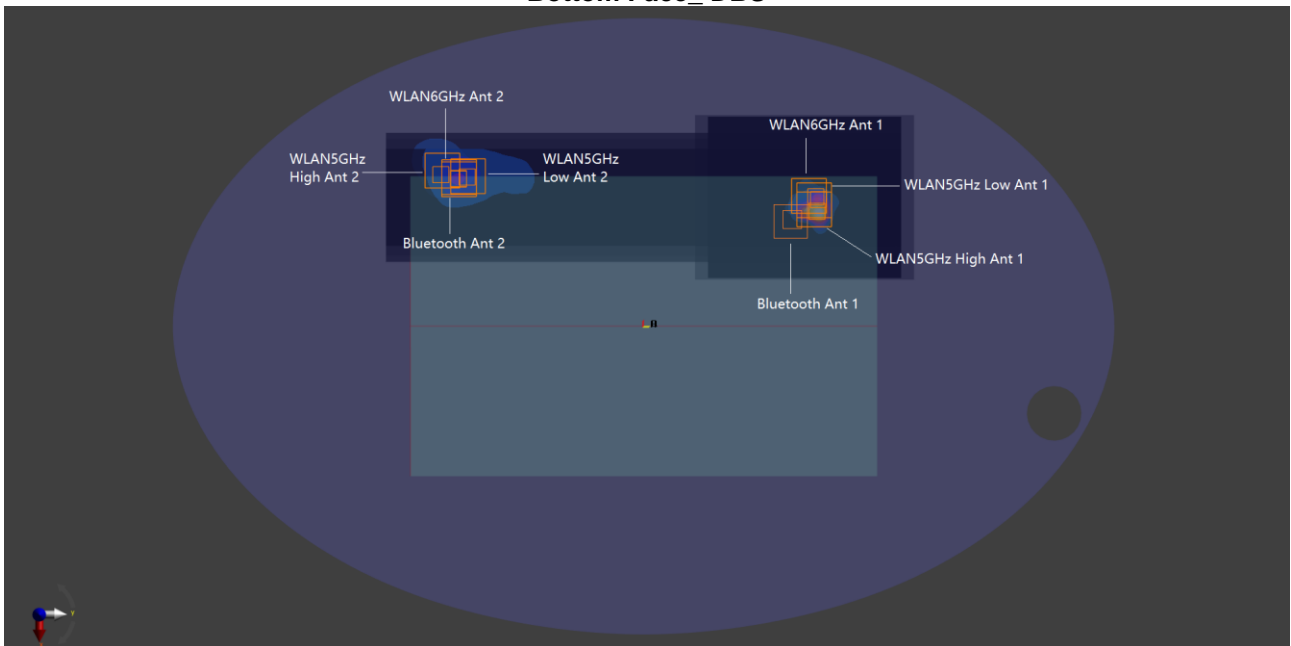
1. When standalone SAR is measured for both antennas in the pair, the peak location separation distance is computed by the square root of  $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$ , where  $(x_1, y_1, z_1)$  and  $(x_2, y_2, z_2)$  are the coordinates in the area scans or extrapolated peak SAR locations in the zoom scans, as appropriate.
2.  $SPLSR = (SAR_1 + SAR_2)1.5 / (\text{min. separation distance, mm})$ . If  $SPLSR \leq 0.04$  for 1g SAR, simultaneously transmission SAR measurement is not necessary.
3. Per April 2022 TCB Workshop Notes, WIFI 5GHz ant1 was summed algebraically with the WIFI 2.4GHz/BT Antenna 1 for the purposes of hybrid SPLSR combination and they share the same antenna; WIFI 5GHz ant2 was summed algebraically with the WIFI 2.4GHz/BT Antenna 2 for the purposes of hybrid SPLSR combination and they share the same antenna.
4. Per April 2022 TCB Workshop, instead of doing a small volume scan over a co-located antenna pair, used summing the SAR values of the co-located pair and using that value in SPLSR calculation. In the calculation used the minimum distance between the spatially separated antenna and the closest antenna of the co-located antenna pair to be conservative.



Bottom Face\_ Non DBS

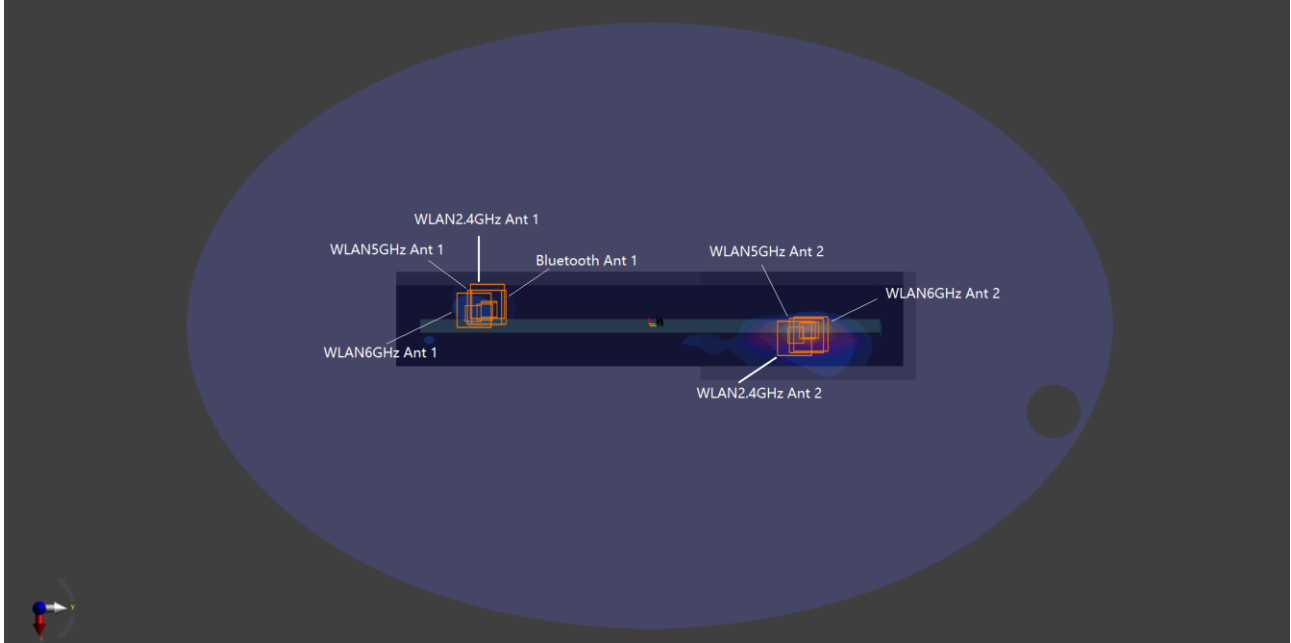


Bottom Face\_DB S

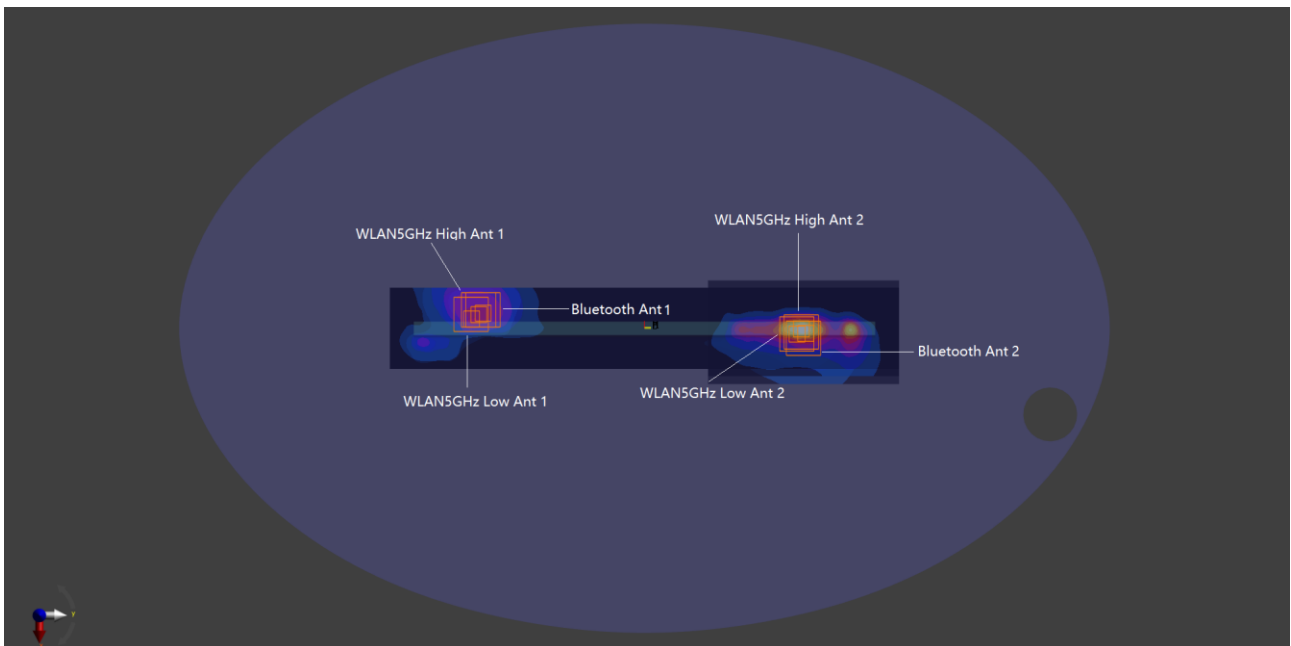


Bottom Face\_HBS





Edge 1\_ DB S



Edge 1\_ HBS

**For Non DBS**

	Band	Position	SAR 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
						X	Y	Z				
Case 1	WLAN5GHz Ant 1	Bottom Face	1.133	1.477	0mm	-75.5	105.6	-177	230.0	1.60	0.01	Not required
	Bluetooth Ant 1		0.344		0mm							
	WLAN5GHz Ant 2		0.106	0.121	0mm	-91.3	-123.9	-177				
	Bluetooth Ant 2		0.015		0mm							
	WLAN5GHz Ant 1	Bottom Face	1.133	1.477	0mm	-75.5	105.6	-177	221.2	1.60	0.01	Not required
	Bluetooth Ant 1		0.344		0mm							
	WLAN5GHz Ant 2		0.106	0.121	0mm							
	Bluetooth Ant 2		0.015		0mm	-90.8	-115	-174				
	WLAN5GHz Ant 1	Bottom Face	1.133	1.477	0mm				219.2	1.60	0.01	Not required
	Bluetooth Ant 1		0.344		0mm	-63.5	93.5	-177				
	WLAN5GHz Ant 2		0.106	0.121	0mm	-91.3	-123.9	-177				
	Bluetooth Ant 2		0.015		0mm							
	WLAN5GHz Ant 1	Bottom Face	1.133	1.477	0mm				210.3	1.60	0.01	Not required
	Bluetooth Ant 1		0.344		0mm	-63.5	93.5	-177				
	WLAN5GHz Ant 2		0.106	0.121	0mm							
	Bluetooth Ant 2		0.015		0mm	-90.8	-115	-174				

**For DBS**

	Band	Position	SAR 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
						X	Y	Z				
Case 1	WLAN2.4GHz Ant 1	Bottom Face	0.719	1.454	0mm	-63.1	96.3	-177	209.8	1.68	0.01	Not required
	WLAN5GHz Ant 1		0.735		0mm							
	WLAN2.4GHz Ant 2		0.122	0.228	0mm	-91.7	-111.5	-177				
	WLAN5GHz Ant 2		0.106		0mm							
	WLAN2.4GHz Ant 1	Bottom Face	0.719	1.454	0mm	-63.1	96.3	-177	222.0	1.68	0.01	Not required
	WLAN5GHz Ant 1		0.735		0mm							
	WLAN2.4GHz Ant 2		0.122	0.228	0mm							
	WLAN5GHz Ant 2		0.106		0mm	-91.3	-123.9	-177				
	WLAN2.4GHz Ant 1	Bottom Face	0.719	1.454	0mm				216.6	1.68	0.01	Not required
	WLAN5GHz Ant 1		0.735		0mm	-79.5	104.8	-177				
	WLAN2.4GHz Ant 2		0.122	0.228	0mm	-91.7	-111.5	-177				
	WLAN5GHz Ant 2		0.106		0mm							
	WLAN2.4GHz Ant 1	Bottom Face	0.719	1.454	0mm				229.0	1.68	0.01	Not required
	WLAN5GHz Ant 1		0.735		0mm	-79.5	104.8	-177				
	WLAN2.4GHz Ant 2		0.122	0.228	0mm							
	WLAN5GHz Ant 2		0.106		0mm	-91.3	-123.9	-177				
Case 2	WLAN2.4GHz Ant 1	Bottom Face	0.719	1.450	0mm	-63.1	96.3	-177	209.8	1.69	0.01	Not required
	WLAN6GHz Ant 1		0.731		0mm							
	WLAN2.4GHz Ant 2		0.122	0.238	0mm	-91.7	-111.5	-177				
	WLAN6GHz Ant 2		0.116		0mm							
	WLAN2.4GHz Ant 1	Bottom Face	0.719	1.450	0mm	-63.1	96.3	-177	214.1	1.69	0.01	Not required
	WLAN6GHz Ant 1		0.731		0mm							
	WLAN2.4GHz Ant 2		0.122	0.238	0mm							
	WLAN6GHz Ant 2		0.116		0mm	-91	-116	-174				
	WLAN2.4GHz Ant 1	Bottom Face	0.719	1.450	0mm				219.9	1.69	0.01	Not required
	WLAN6GHz Ant 1		0.731		0mm	-77	107.9	-177				
	WLAN2.4GHz Ant 2		0.122	0.238	0mm	-91.7	-111.5	-177				
	WLAN6GHz Ant 2		0.116		0mm							
	WLAN2.4GHz Ant 1	Bottom Face	0.719	1.450	0mm				224.4	1.69	0.01	Not required
	WLAN6GHz Ant 1		0.731		0mm	-77	107.9	-177				
	WLAN2.4GHz Ant 2		0.122	0.238	0mm							
	WLAN6GHz Ant 2		0.116		0mm							

	Band	Position	SAR 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
						X	Y	Z				
	WLAN6GHz Ant 2		0.116		0mm	-91	-116	-174				
Case 3	WLAN2.4GHz Ant 1	Edge 1	0.096	0.480	0mm	-16.2	-105	-177	198.4	1.99	0.01	Not required
	WLAN5GHz Ant 1		0.384		0mm							
	WLAN2.4GHz Ant 2		0.751	1.511	0mm	3.1	92.5	-177				
	WLAN5GHz Ant 2		0.76		0mm							
	WLAN2.4GHz Ant 1	Edge 1	0.096	0.480	0mm	-16.2	-105	-177	206.6	1.99	0.01	Not required
	WLAN5GHz Ant 1		0.384		0mm							
	WLAN2.4GHz Ant 2		0.751	1.511	0mm							
	WLAN5GHz Ant 2		0.76		0mm	2.3	100.8	-177				
	WLAN2.4GHz Ant 1	Edge 1	0.096	0.480	0mm				197.7	1.99	0.01	Not required
	WLAN5GHz Ant 1		0.384		0mm	-6.2	-105	-177				
	WLAN2.4GHz Ant 2		0.751	1.511	0mm	3.1	92.5	-177				
	WLAN5GHz Ant 2		0.76		0mm							
	WLAN2.4GHz Ant 1	Edge 1	0.096	0.480	0mm				206.0	1.99	0.01	Not required
	WLAN5GHz Ant 1		0.384		0mm	-6.2	-105	-177				
	WLAN2.4GHz Ant 2		0.751	1.511	0mm							
	WLAN5GHz Ant 2		0.76		0mm	2.3	100.8	-177				
Case 4	WLAN5GHz Ant 1	Edge 1	0.384	0.388	0mm	-6.2	-105	-177	197.7	1.90	0.01	Not required
	Bluetooth Ant 1		0.004		0mm							
	WLAN2.4GHz Ant 2		0.751	1.511	0mm	3.1	92.5	-177				
	WLAN5GHz Ant 2		0.76		0mm							
	WLAN5GHz Ant 1	Edge 1	0.384	0.388	0mm	-6.2	-105	-177	206.0	1.90	0.01	Not required
	Bluetooth Ant 1		0.004		0mm							
	WLAN2.4GHz Ant 2		0.751	1.511	0mm							
	WLAN5GHz Ant 2		0.76		0mm	2.3	100.8	-177				
	WLAN5GHz Ant 1	Edge 1	0.384	0.388	0mm				197.4	1.90	0.01	Not required
	Bluetooth Ant 1		0.004		0mm	-9.2	-104.5	-177				
	WLAN2.4GHz Ant 2		0.751	1.511	0mm	3.1	92.5	-177				
	WLAN5GHz Ant 2		0.76		0mm							
	WLAN5GHz Ant 1	Edge 1	0.384	0.388	0mm				205.6	1.90	0.01	Not required
	Bluetooth Ant 1		0.004		0mm	-9.2	-104.5	-177				
	WLAN2.4GHz Ant 2		0.751	1.511	0mm							
	WLAN5GHz Ant 2		0.76		0mm	2.3	100.8	-177				
Case 5	WLAN2.4GHz Ant 1	Edge 1	0.096	0.275	0mm	-16.2	-105	-177	198.4	1.80	0.01	Not required
	WLAN6GHz Ant 1		0.179		0mm							
	WLAN2.4GHz Ant 2		0.751	1.527	0mm	3.1	92.5	-177				
	WLAN6GHz Ant 2		0.776		0mm							
	WLAN2.4GHz Ant 1	Edge 1	0.096	0.275	0mm	-16.2	-105	-177	206.7	1.80	0.01	Not required
	WLAN6GHz Ant 1		0.179		0mm							
	WLAN2.4GHz Ant 2		0.751	1.527	0mm							
	WLAN6GHz Ant 2		0.776		0mm	1.7	100.9	-174				
	WLAN2.4GHz Ant 1	Edge 1	0.096	0.275	0mm				201.7	1.80	0.01	Not required
	WLAN6GHz Ant 1		0.179		0mm	-4.2	-109	-174				
	WLAN2.4GHz Ant 2		0.751	1.527	0mm	3.1	92.5	-177				
	WLAN6GHz Ant 2		0.776		0mm							
	WLAN2.4GHz Ant 1	Edge 1	0.096	0.275	0mm				210.0	1.80	0.01	Not required
	WLAN6GHz Ant 1		0.179		0mm	-4.2	-109	-174				
	WLAN2.4GHz Ant 2		0.751	1.527	0mm							
	WLAN6GHz Ant 2		0.776		0mm	1.7	100.9	-174				



Case 6	Band	Position	SAR 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z					
	WLAN6GHz Ant 1	Edge 1	0.179	0.183	0mm	-4.2	-109	-174	201.7	1.71	0.01	Not required
	Bluetooth Ant 1		0.004		0mm							
	WLAN2.4GHz Ant 2		0.751	1.527	0mm	3.1	92.5	-177				
	WLAN6GHz Ant 2		0.776		0mm							
	WLAN5GHz Ant 1	Edge 1	0.179	0.183	0mm	-6.2	-105	-177	206.0	1.71	0.01	Not required
	Bluetooth Ant 1		0.004		0mm							
	WLAN2.4GHz Ant 2		0.751	1.527	0mm							
	WLAN5GHz Ant 2		0.776		0mm	2.3	100.8	-177				
	WLAN5GHz Ant 1	Edge 1	0.179	0.183	0mm				197.4	1.71	0.01	Not required
	Bluetooth Ant 1		0.004		0mm	-9.2	-104.5	-177				
	WLAN2.4GHz Ant 2		0.751	1.527	0mm	3.1	92.5	-177				
	WLAN5GHz Ant 2		0.776		0mm							
	WLAN5GHz Ant 1	Edge 1	0.179	0.183	0mm				205.6	1.71	0.01	Not required
	Bluetooth Ant 1		0.004		0mm	-9.2	-104.5	-177				
	WLAN2.4GHz Ant 2		0.751	1.527	0mm							
	WLAN5GHz Ant 2		0.776		0mm	2.3	100.8	-177				

For HBS

Case 1	Band	Position	SAR 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR					
					X	Y	Z										
	WLAN5GHz High Ant 1	Bottom Face	0.555	1.446	0mm	-77.4	106.6	-177	230.9	1.67	0.01	Not required					
	WLAN5GHz Low Ant 1		0.547		0mm												
	Bluetooth Ant 1		0.344		0mm												
	WLAN5GHz High Ant 2		0.106	0.226	0mm	-91.3	-123.9	-177									
	WLAN5GHz Low Ant 2		0.105		0mm												
	Bluetooth Ant 2		0.015		0mm												
		WLAN5GHz High Ant 1	Bottom Face	0.555	1.446	0mm	-77.4	106.6					-177	217.2	1.67	0.01	Not required
		WLAN5GHz Low Ant 1		0.547		0mm											
		Bluetooth Ant 1		0.344		0mm											
		WLAN5GHz High Ant 2		0.106	0.226	0mm	-93.2	-110					-174				
		WLAN5GHz Low Ant 2		0.105		0mm											
		Bluetooth Ant 2		0.015		0mm											
	WLAN5GHz High Ant 1	Bottom Face	0.555	1.446	0mm	-77.4	106.6	-177	222.0	1.67	0.01	Not required					
	WLAN5GHz Low Ant 1		0.547		0mm												
	Bluetooth Ant 1		0.344		0mm												
	WLAN5GHz High Ant 2		0.106	0.226	0mm	-90.8	-115	-174									
	WLAN5GHz Low Ant 2		0.105		0mm												
	Bluetooth Ant 2		0.015		0mm												
	WLAN5GHz High Ant 1	Bottom Face	0.555	1.446	0mm				234.9	1.67	0.01	Not required					
	WLAN5GHz Low Ant 1		0.547		0mm	-77.8	110.6	-177									
	Bluetooth Ant 1		0.344		0mm												
	WLAN5GHz High Ant 2		0.106	0.226	0mm	-91.3	-123.9	-177									
	WLAN5GHz Low Ant 2		0.105		0mm												
	Bluetooth Ant 2		0.015		0mm												
	WLAN5GHz High Ant 1	Bottom Face	0.555	1.446	0mm				221.2	1.67	0.01	Not required					
	WLAN5GHz Low Ant 1		0.547		0mm	-77.8	110.6	-177									
	Bluetooth Ant 1		0.344		0mm												
	WLAN5GHz High Ant 2		0.106	0.226	0mm	-93.2	-110	-174									
	WLAN5GHz Low Ant 2		0.105		0mm												
	Bluetooth Ant 2		0.015		0mm												
	WLAN5GHz High Ant 1	Bottom Face	0.555	1.446	0mm				226.0	1.67	0.01	Not required					
	WLAN5GHz Low Ant 1		0.547		0mm	-77.8	110.6	-177									
	Bluetooth Ant 1		0.344	0.226	0mm												
	WLAN5GHz High Ant 2		0.106		0mm												



	WLAN5GHz Low Ant 2		0.105		0mm				219.2	1.67	0.01	Not required	
	Bluetooth Ant 2		0.015		0mm	-90.8	-115	-174					
	WLAN5GHz High Ant 1		0.555		0mm								
	WLAN5GHz Low Ant 1	Bottom Face	1.446	0.547	0mm				219.2	1.67	0.01	Not required	
	Bluetooth Ant 1			0.344		0mm	-63.5	93.5					-177
	WLAN5GHz High Ant 2			0.106		0mm	-91.3	-123.9					-177
	WLAN5GHz Low Ant 2		0.226	0.105	0mm				219.2	1.67	0.01	Not required	
	Bluetooth Ant 2			0.015		0mm							
	WLAN5GHz High Ant 1			0.555		0mm							
	WLAN5GHz Low Ant 1	Bottom Face	1.446	0.547	0mm				205.7	1.67	0.01	Not required	
	Bluetooth Ant 1			0.344		0mm	-63.5	93.5					-177
	WLAN5GHz High Ant 2			0.106		0mm							
	WLAN5GHz Low Ant 2		0.226	0.105	0mm				205.7	1.67	0.01	Not required	
	Bluetooth Ant 2			0.015		0mm							
	WLAN5GHz High Ant 1			0.555		0mm							
WLAN5GHz Low Ant 1	Bottom Face	1.446	0.547	0mm				210.3	1.67	0.01	Not required		
Bluetooth Ant 1			0.344		0mm	-63.5	93.5					-177	
WLAN5GHz High Ant 2			0.106		0mm								
WLAN5GHz Low Ant 2		0.226	0.105	0mm				210.3	1.67	0.01	Not required		
Bluetooth Ant 2			0.015		0mm	-90.8	-115					-174	
WLAN5GHz High Ant 1			0.555		0mm								
Case 2	<b>Band</b>	<b>Position</b>	<b>SAR 1g SAR (W/kg)</b>	<b>Summed 1g SAR (W/kg)</b>	<b>Gap (mm)</b>	<b>SAR peak location (mm)</b>			<b>3D distance (mm)</b>	<b>Summed SAR (W/kg)</b>	<b>SPLSR Results</b>	<b>Simultaneous SAR</b>	
	WLAN5GHz Low Ant 1	Bottom Face	0.547	1.457	0mm	-77.8	110.6	-177	221.2	1.69	0.01	Not required	
	WLAN6GHz Ant 1		0.566		0mm								
	Bluetooth Ant 1		0.344		0mm								
	WLAN5GHz Low Ant 2	Bottom Face	0.236	0.105	0mm				221.2	1.69	0.01	Not required	
	WLAN6GHz Ant 2			0.116		0mm	-93.2	-110					-174
	Bluetooth Ant 2			0.015		0mm							
	WLAN5GHz Low Ant 1	Bottom Face	1.457	0.547	0mm				227.0	1.69	0.01	Not required	
	WLAN6GHz Ant 1			0.566		0mm							
	Bluetooth Ant 1			0.344		0mm							
	WLAN5GHz Low Ant 2	Bottom Face	0.236	0.105	0mm				227.0	1.69	0.01	Not required	
	WLAN6GHz Ant 2			0.116		0mm	-91	-116					-174
	Bluetooth Ant 2			0.015		0mm							
	WLAN5GHz Low Ant 1	Bottom Face	1.457	0.547	0mm				226.0	1.69	0.01	Not required	
	WLAN6GHz Ant 1			0.566		0mm							
	Bluetooth Ant 1			0.344		0mm							
	WLAN5GHz Low Ant 2	Bottom Face	0.236	0.105	0mm				226.0	1.69	0.01	Not required	
	WLAN6GHz Ant 2			0.116		0mm							
	Bluetooth Ant 2			0.015		0mm	-90.8	-115					-174
	WLAN5GHz Low Ant 1	Bottom Face	1.457	0.547	0mm				215.8	1.69	0.01	Not required	
	WLAN6GHz Ant 1			0.566		0mm	-78.2	105.3					-177
	Bluetooth Ant 1			0.344		0mm							
	WLAN5GHz Low Ant 2	Bottom Face	0.236	0.105	0mm				215.8	1.69	0.01	Not required	
	WLAN6GHz Ant 2			0.116		0mm	-93.2	-110					-174
	Bluetooth Ant 2			0.015		0mm							
	WLAN5GHz Low Ant 1	Bottom Face	1.457	0.547	0mm				221.7	1.69	0.01	Not required	
	WLAN6GHz Ant 1			0.566		0mm	-78.2	105.3					-177
	Bluetooth Ant 1			0.344		0mm							
	WLAN5GHz Low Ant 2	Bottom Face	0.236	0.105	0mm				221.7	1.69	0.01	Not required	
	WLAN6GHz Ant 2			0.116		0mm	-91	-116					-174
Bluetooth Ant 2	0.015			0mm									
WLAN5GHz Low Ant 1	Bottom Face	1.457	0.547	0mm				220.7	1.69	0.01	Not required		
WLAN6GHz Ant 1			0.566		0mm	-78.2	105.3					-177	
Bluetooth Ant 1			0.344		0mm								
WLAN5GHz Low Ant 2	Bottom Face	0.236	0.105	0mm				220.7	1.69	0.01	Not required		
WLAN6GHz Ant 2			0.116		0mm								
Bluetooth Ant 2			0.015		0mm								



Case 3	Band	Position	SAR 1g SAR (W/kg)	Summed 1g SAR (W/kg)	Gap (mm)	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
						X	Y	Z				
						WLAN6GHz Ant 2	0.116					
Bluetooth Ant 2	0.015		0mm	-90.8	-115	-174						
WLAN5GHz Low Ant 1	0.547	Bottom Face	1.457	0mm				205.7	1.69	0.01	Not required	
WLAN6GHz Ant 1	0.566			0mm								
Bluetooth Ant 1	0.344			0mm	-63.5	93.5	-177					
WLAN5GHz Low Ant 2	0.105		0.236	0mm	-93.2	-110	-174					
WLAN6GHz Ant 2	0.116			0mm								
Bluetooth Ant 2	0.015			0mm								
WLAN5GHz Low Ant 1	0.547	Bottom Face	1.457	0mm			211.3	1.69	0.01	Not required		
WLAN6GHz Ant 1	0.566			0mm								
Bluetooth Ant 1	0.344			0mm	-63.5	93.5					-177	
WLAN5GHz Low Ant 2	0.105		0.236	0mm								
WLAN6GHz Ant 2	0.116			0mm	-91	-116					-174	
Bluetooth Ant 2	0.015			0mm								
WLAN5GHz Low Ant 1	0.547	Bottom Face	1.457	0mm			210.3	1.69	0.01	Not required		
WLAN6GHz Ant 1	0.566			0mm								
Bluetooth Ant 1	0.344			0mm	-63.5	93.5					-177	
WLAN5GHz Low Ant 2	0.105		0.236	0mm								
WLAN6GHz Ant 2	0.116			0mm								
Bluetooth Ant 2	0.015			0mm	-90.8	-115					-174	
WLAN5GHz High Ant 1	0.384	Edge 1	0.520	0mm	-6.2	-105	-177	204.5	1.66	0.01	Not required	
WLAN5GHz Low Ant 1	0.132			0mm								
Bluetooth Ant 1	0.004			0mm								
WLAN5GHz High Ant 2	0.578		1.142	0mm	-1.7	99.5	-177					
WLAN5GHz Low Ant 2	0.55			0mm								
Bluetooth Ant 2	0.014			0mm								
WLAN5GHz High Ant 1	0.384	Edge 1	0.520	0mm	-6.2	-105	-177	197.4	1.66	0.01	Not required	
WLAN5GHz Low Ant 1	0.132			0mm								
Bluetooth Ant 1	0.004			0mm								
WLAN5GHz High Ant 2	0.578		1.142	0mm	1.3	92.3	-177					
WLAN5GHz Low Ant 2	0.55			0mm								
Bluetooth Ant 2	0.014			0mm								
WLAN5GHz High Ant 1	0.384	Edge 1	0.520	0mm	-6.2	-105	-177	206.2	1.66	0.01	Not required	
WLAN5GHz Low Ant 1	0.132			0mm								
Bluetooth Ant 1	0.004			0mm								
WLAN5GHz High Ant 2	0.578		1.142	0mm	2.6	101	-174					
WLAN5GHz Low Ant 2	0.55			0mm								
Bluetooth Ant 2	0.014			0mm								
WLAN5GHz High Ant 1	0.384	Edge 1	0.520	0mm	-3.4	-108	-174	207.5	1.66	0.01	Not required	
WLAN5GHz Low Ant 1	0.132			0mm								
Bluetooth Ant 1	0.004			0mm								
WLAN5GHz High Ant 2	0.578		1.142	0mm	-1.7	99.5	-177					
WLAN5GHz Low Ant 2	0.55			0mm								
Bluetooth Ant 2	0.014			0mm								
WLAN5GHz High Ant 1	0.384	Edge 1	0.520	0mm	-3.4	-108	-174	200.4	1.66	0.01	Not required	
WLAN5GHz Low Ant 1	0.132			0mm								
Bluetooth Ant 1	0.004			0mm								
WLAN5GHz High Ant 2	0.578		1.142	0mm	1.3	92.3	-177					
WLAN5GHz Low Ant 2	0.55			0mm								
Bluetooth Ant 2	0.014			0mm								
WLAN5GHz High Ant 1	0.384	Edge 1	0.520	0mm			209.1	1.66	0.01	Not required		
WLAN5GHz Low Ant 1	0.132			0mm	-3.4	-108					-174	
Bluetooth Ant 1	0.004		1.142	0mm								
WLAN5GHz High Ant 2	0.578			0mm								
WLAN5GHz Low Ant 2	0.55		0mm									
Bluetooth Ant 2	0.014		0mm									
WLAN5GHz High Ant 1	0.384	Edge 1	0.520	0mm			209.1	1.66	0.01	Not required		
WLAN5GHz Low Ant 1	0.132			0mm	-3.4	-108					-174	
Bluetooth Ant 1	0.004		1.142	0mm								
WLAN5GHz High Ant 2	0.578			0mm								
WLAN5GHz Low Ant 2	0.55		0mm									
Bluetooth Ant 2	0.014		0mm									



WLAN5GHz Low Ant 2		0.55		0mm								
Bluetooth Ant 2		0.014		0mm	2.6	101	-174					
WLAN5GHz High Ant 1	Edge 1	0.384	0.520	0mm				204.1	1.66	0.01	Not required	
WLAN5GHz Low Ant 1		0.132		0mm								
Bluetooth Ant 1		0.004		0mm	-9.2	-104.5	-177					
WLAN5GHz High Ant 2		0.578	1.142	0mm	-1.7	99.5	-177					
WLAN5GHz Low Ant 2		0.55		0mm								
Bluetooth Ant 2		0.014		0mm								
WLAN5GHz High Ant 1	Edge 1	0.384	0.520	0mm				197.1	1.66	0.01	Not required	
WLAN5GHz Low Ant 1		0.132		0mm								
Bluetooth Ant 1		0.004		0mm	-9.2	-104.5	-177					
WLAN5GHz High Ant 2		0.578	1.142	0mm								
WLAN5GHz Low Ant 2		0.55		0mm	1.3	92.3	-177					
Bluetooth Ant 2		0.014		0mm								
WLAN5GHz High Ant 1	Edge 1	0.384	0.520	0mm				205.9	1.66	0.01	Not required	
WLAN5GHz Low Ant 1		0.132		0mm								
Bluetooth Ant 1		0.004		0mm	-9.2	-104.5	-177					
WLAN5GHz High Ant 2		0.578	1.142	0mm								
WLAN5GHz Low Ant 2		0.55		0mm								
Bluetooth Ant 2		0.014		0mm	2.6	101	-174					

Test Engineer : Martin Li, Varus Wang, Light Wang, Ricky Gu

## **17. Uncertainty Assessment**

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg. Therefore, the measurement uncertainty table is not required in this report.

**Declaration of Conformity:**

The test results with all measurement uncertainty excluded is presented in accordance with the regulation limits or requirements declared by manufacturers.

**Comments and Explanations:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture’s specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in table below.

<b>Uncertainty Distributions</b>	<b>Normal</b>	<b>Rectangular</b>	<b>Triangular</b>	<b>U-Shape</b>
Multi-plying Factor <sup>(a)</sup>	1/k <sup>(b)</sup>	1/√3	1/√6	1/√2

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

### **Standard Uncertainty for Assumed Distribution**

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual “root-sum-squares” (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

The judgment of conformity in the report is based on the measurement results excluding the measurement uncertainty.



Uncertainty Budget According to IEC/IEEE 62209-1528 (Frequency band: 4 MHz - 10 GHz range)							
Error Description	Uncert. Value (±%)	Prob. Dist.	Div.	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
<b>Measurement System errors</b>							
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 and detection Limit	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 and data acquisition errors	2.4	N	1	1	1	2.4	2.4
RF ambient and noise	1.8	N	1	1	1	1.8	1.8
Probe positioning errors	0.006	N	1	0.5	0.5	0.0	0.0
Data processing errors	4.0	N	1	1	1	4.0	4.0
<b>Phantom and Device Errors</b>							
Measurement of phantom conductivity ( $\sigma$ )	2.5	N	1	0.78	0.71	2.0	1.8
Temperature effects (medium)	5.4	R	1.732	0.78	0.71	2.4	2.2
Shell permittivity	14.0	R	1.732	0.5	0.5	4.0	4.0
Distance between the radiating element of the DUT and the phantom medium	2.0	N	1	2	2	4.0	4.0
Repeatability of positioning the DUT or source against the phantom	1.0	N	1	1	1	1.0	1.0
Device holder effects	3.6	N	1	1	1	3.6	3.6
Effect of operating mode on probe sensitivity	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
Variation in SAR due to drift in output of DUT	2.5	N	1	1	1	2.5	2.5
Validation antenna uncertainty (validation measurement only)	0.0	N	1	1	1	0.0	0.0
Uncertainty in accepted power (validation measurement only)	0.0	N	1	1	1	0.0	0.0
<b>Correction to the SAR results</b>							
Phantom deviation from target ( $\epsilon', \sigma$ )	1.9	N	1	1	0.84	1.9	1.6
SAR scaling	0.0	R	1.732	1	1	0.0	0.0
<b>Combined Std. Uncertainty</b>						<b>14.5%</b>	<b>14.4%</b>
<b>Coverage Factor for 95 %</b>						<b>K=2</b>	<b>K=2</b>
<b>Expanded STD Uncertainty</b>						<b>29.0%</b>	<b>28.8%</b>

**SAR Uncertainty Budget for frequency range 4MHz to 10GHz**

cDASY6 Module mmWave Uncertainty Budget Evaluation Distances to the Antennas > $\lambda/2\pi$ In Compliance with IEC TR 63170					
Error Description	Uncertainty Value ( $\pm$ dB)	Probability	Divisor	(Ci)	Standard Uncertainty ( $\pm$ dB)
<b>Uncertainty terms dependent on the measurement system</b>					
Probe Calibration	0.49	N	1	1	0.49
Probe correction	0.00	R	1.732	1	0.00
Frequency response	0.20	R	1.732	1	0.12
Sensor cross coupling	0.00	R	1.732	1	0.00
Isotropy	0.50	R	1.732	1	0.29
Linearity	0.20	R	1.732	1	0.12
Probe scattering	0.00	R	1.732	1	0.00
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	0.00	R	1.732	1	0.00
Probe spatial resolution	0.00	R	1.732	1	0.00
Field impedance dependence	0.00	R	1.732	1	0.00
Amplitude and phase drift	0.00	R	1.732	1	0.00
Amplitude and phase noise	0.04	R	1.732	1	0.02
Measurement area truncation	0.00	R	1.732	1	0.00
Data acquisition	0.03	N	1	1	0.03
Sampling	0.00	R	1.732	1	0.00
Field reconstruction	2.00	R	1.732	1	1.15
Forward transformation	0.00	R	1.732	1	0.00
Power density scaling	0.00	R	1.732	1	0.00
Spatial averaging	0.10	R	1.732	1	0.06
System detection limit	0.04	R	1.732	1	0.02
<b>Uncertainty terms dependent on the DUT and environmental factors</b>					
Probe coupling with DUT	0.00	R	1.732	1	0.0
Modulation response	0.40	R	1.732	1	0.2
Integration time	0.00	R	1.732	1	0.0
Response time	0.00	R	1.732	1	0.0
Device holder influence	0.10	R	1.732	1	0.1
DUT alignment	0.00	R	1.732	1	0.0
RF ambient conditions	0.04	R	1.732	1	0.0
Ambient reflections	0.04	R	1.732	1	0.0
Immunity / secondary reception	0.00	R	1.732	1	0.0
Drift of the DUT		R	1.732	1	
<b>Combined Std. Uncertainty</b>					<b>1.34</b>
<b>Expanded STD Uncertainty (95%)</b>					<b>2.68</b>

**PD Uncertainty Budget**

## 18. References

- [1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”
- [2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992
- [3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013
- [4] SPEAG DASY System Handbook
- [5] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.
- [6] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015
- [7] FCC KDB 865664 D01 v01r04, “SAR Measurement Requirements for 100 MHz to 6 GHz”, Aug 2015.
- [8] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.
- [9] IEC/IEEE 62209-1528:2020, “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)”, Oct. 2020
- [10] IEC 62479:2010 Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)
- [11] IEC TR 63170: 2018 Measurement procedure for the evaluation of power density related to human exposure to radio frequency fields from wireless communication devices operating between 6 GHz and 100 GHz
- [12] FCC KDB 616217 D04 v01r02, “SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers”, Oct 2015
- [13] SPEAG DASY6 System Handbook
- [14] SPEAG DASY6 Application Note (Interim Procedures for Devices Operating at 6-10 GHz)

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