

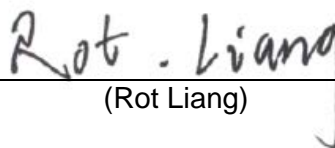
# FCC SAR Test Report

## FCC ID: QISBAH2-W19A

**Project No.** : 1904C015  
**Equipment** : Tablet  
**Model Name** : BAH2-W19  
**Applicant** : Huawei Technologies Co., Ltd.  
**Address** : Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, China

**Date of Receipt** : Apr. 03, 2019  
**Date of Test** : Apr. 04, 2019 ~ Apr. 15, 2019  
**Issued Date** : Apr. 24, 2019  
**Tested by** : BTL Inc.

**PREPARED BY** :

  
(Rot Liang)

**APPROVED BY** :

  
(Herbert Liu)

# **B T L I N C .**

No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan,  
Guangdong, China.

TEL: +86-769-8318-3000 FAX: +86-769-8319-6000



Certificate #5123.02

## Declaration

**BTL** represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

**BTL's** reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, A2LA, or any agency of the U.S. Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

**BTL's** laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

**BTL** is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

## Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

<b>Table of Contents</b>	<b>Page</b>
<b>1 . GENERAL SUMMARY</b>	<b>6</b>
<b>2 . RF EMISSIONS MEASUREMENT</b>	<b>7</b>
2.1 TEST FACILITY	7
2.2 MEASUREMENT UNCERTAINTY	7
<b>3 . GENERAL INFORMATION</b>	<b>8</b>
3.1 STATEMENT OF COMPLIANCE	8
3.2 GENERAL DESCRIPTION OF EUT	9
3.3 LABORATORY ENVIRONMENT	10
3.4 MAIN TEST INSTRUMENTS	10
<b>4 . SAR MEASUREMENTS SYSTEM CONFIGURATION</b>	<b>11</b>
4.1 SAR MEASUREMENT SET-UP	11
4.1.1 TEST SETUP LAYOUT	11
4.2 DASY5 E-FIELD PROBE SYSTEM	12
4.2.1 EX3DV4 PROBE SPECIFICATION	12
4.2.2 E-FIELD PROBE CALIBRATION	13
4.2.3 OTHER TEST EQUIPMENT	14
4.2.4 SCANNING PROCEDURE	15
4.2.5 SPATIAL PEAK SAR EVALUATION	16
4.2.6 DATA STORAGE AND EVALUATION	17
4.2.7 DATA EVALUATION BY SEMCAD	18
<b>5 . SYSTEM VERIFICATION PROCEDURE</b>	<b>20</b>
5.1 TISSUE VERIFICATION	20
5.2 SYSTEM CHECK	21
5.3 SYSTEM CHECK PROCEDURE	21
<b>6 . SAR MEASUREMENT VARIABILITY AND UNCERTAINTY</b>	<b>22</b>
6.1 SAR MEASUREMENT VARIABILITY	22
<b>7 . OPERATIONAL CONDITIONS DURING TEST</b>	<b>23</b>
7.1 SAR TEST CONFIGURATION	23
7.1.1 WIFI TEST CONFIGURATION	23
7.2 TEST POSITION	26
7.2.1 BODY	26
7.3 PROXIMITY SENSOR POWER REDUCTION INFORMATION	27
7.3.1 GENERAL PROXIMITY SENSOR IMPLEMENTATION DESCRIPTION	27
7.3.2 PROXIMITY SENSOR COVERAGE, DISTANCE AND ANGLE	27
7.4 SAR POWER REDUCTION USING COUNTRY CODE DETECTION	33
7.4.1 GENERAL DESCRIPTION	33
7.4.2 SUMMARY SAR TEST PLAN	34

<b>Table of Contents</b>	<b>Page</b>
<b>8 . TEST RESULT</b>	<b>35</b>
<b>8.1 CONDUCTED POWER RESULTS</b>	<b>35</b>
8.1.1 CONDUCTED POWER MEASUREMENTS OF WIFI 2.4G	35
8.1.2 CONDUCTED POWER MEASUREMENTS OF WIFI 5G	36
8.1.3 CONDUCTED POWER MEASUREMENTS OF BT	44
<b>8.2 SAR TEST RESULTS</b>	<b>45</b>
8.2.1 SAR MEASUREMENT RESULT	46
<b>9 . MULTIPLE TRANSMITTER EVALUATION</b>	<b>47</b>
9.1 SIMULTANEOUS TRANSMISSION CONDITIONS	47
<b>APPENDIX</b>	<b>48</b>
<b>1. TEST LAYOUT</b>	<b>48</b>
Appendix A. SAR Plots of System Verification	
Appendix B. SAR Plots of SAR Measurement	
Appendix C. Calibration Certificate	
Appendix D. Photographs of the Test Set-Up	
Appendix E. Antenna location and standalone SAR test exclusion	

## REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue	Apr. 18, 2019
R01	1. Add country code. 2. Add 5600-5650 power data.	Apr. 24, 2019

## 1. GENERAL SUMMARY

Equipment	Tablet
Brand Name	HUAWEI
Model Name	BAH2-W19
Manufacturer	Huawei Technologies Co., Ltd.
Address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, China
Standard(s)	<p><b>ANSI Std C95.1-1992</b> Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz - 300 GHz.(IEEE Std C95.1-1991)</p> <p><b>IEEE Std 1528-2013</b> Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques</p> <p><b>KDB447498 D01</b> General RF Exposure Guidance v06  <b>KDB248227 D01</b> 802.11 Wi-Fi SAR v02r02  <b>KDB865664 D01</b> SAR measurement 100 MHz to 6 GHz v01r04  <b>KDB865664 D02</b> SAR Reporting v01r02  <b>KDB690783 D01</b> SAR Listings on Grants v01r03  <b>KDB616217 D04</b> SAR for laptop and tablets v01r02</p>

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCC SAR-1-1904C015) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of A2LA according to the ISO/IEC 17025 quality assessment standard and technical standard(s).

## 2. RF EMISSIONS MEASUREMENT

### 2.1 TEST FACILITY

The test facilities used to collect the test data in this report is **SAR room** at the location of No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China.

### 2.2 MEASUREMENT UNCERTAINTY

Note: Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is  $< 1.5$  W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

### 3. GENERAL INFORMATION

#### 3.1 STATEMENT OF COMPLIANCE

Mode	Highest Body SAR-1g (W/kg)
2.4G WLAN	0.48
5.3G WLAN	0.68
5.6G WLAN	0.51
5.8G WLAN	0.75
Bluetooth	0.35
Note: The highest reported SAR for body is 0.75W/kg.	

Note: The device is in compliance with Specific Absorption Rate (SAR) for general population uncontrolled exposure limits according to the FCC rule §2.1093, the ANSI C95.1:1992/IEEE C95.1:1991, the NCRP Report Number 86 for uncontrolled environment and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013.



### 3.2 GENERAL DESCRIPTION OF EUT

Equipment	Tablet				
Model Name	BAH2-W19				
Storage capacity	EMCP	3GB+32GB			
	LPDDR3+eMMC	4GB+64GB			
Test Sample	LPDDR3+eMMC	Sample 1	Engineering Sample No.: D190403405		
		Sample 2	Engineering Sample No.: D190403406		
		Sample 3	Engineering Sample No.: D190403494		
	EMCP	Sample 1	Engineering Sample No.: D190403404		
		Sample 2	Engineering Sample No.: D190403401		
		Sample 3	Engineering Sample No.: D190403493		
S/N	LPDDR3+eMMC	Sample 1	J5JNU19326100038		
		Sample 2	2DKNU19325100061		
		Sample 3	NU1163193R100158		
	EMCP	Sample 1	J5JNU19326100059		
		Sample 2	2DKNU19325100055		
		Sample 3	NU1161193M100085		
HW Version	SH0BAH2LM				
SW Version	BAH2-W19 8.0.0.135(C605)				
Modulation	WiFi(DSSS/OFDM),BT(GFSK/π/4-DQPSK/8-DPSK)				
Operation Frequency Range(s)	Bluetooth	2402~2480			
	WIFI	2412~2462			
		5150~5250			
		5250~5350			
		5470~5725			
		5725~5850			
Test Channels (low-mid-high)	0-39-78 (BT)				
	0-19-39 (BLE)				
	1-6-11 (2.4G WIFI 802.11b/g/n HT20)				
	3-6-9 (2.4G WIFI 802.11n HT40)				
	Band	5.2G	5.3G	5.6G	5.8G
	802.11a/n HT20/ ac VHT20	36-40-44-48	52-56-60-64	100-104-108- 112-116-120- 124-128-132- 136-140	149-153-157- 161-165
	802.11n HT40/ ac VHT40	38-46	54-62	102-110-118- 126-134	151-159
	802.11ac VHT80	42	58	106-122	155
Other Information					
Battery	Battery Model	HB2994I8ECW			
	Rated capacity	7350 mAh			
	Nominal Voltage	+3.82V			
	Charging Voltage	+4.4V			
	Manufacture	1# SCUD (Fujian) Electronics Co., Ltd. 2# SUNWODA Electronic Co., Ltd 3# Huizhou Desay Battery Co., Ltd			
With Earphone(Yes/No)	No				

### 3.3 LABORATORY ENVIRONMENT

Temperature	Min. = 18°C, Max. = 25°C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5Ω
Ambient noise is checked and found very low and in compliance with requirement of standards.	
Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

### 3.4 MAIN TEST INSTRUMENTS

Item	Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Interval
1	Data Acquisition Electronics	Speag	DAE4	1390	May 11, 2018	1 Year
2	E-field Probe	Speag	EX3DV4	7396	May 29, 2018	1 Year
3	System Validation Dipole	Speag	D2450V2	919	Jun. 11, 2018	3 Years
4	System Validation Dipole	Speag	D5GHzV2	1160	Jun. 20, 2018	3 Years
5	ELI4 Phantom	Speag	ELI4 Phantom V5.0	1222	N/A	N/A
6	Bluetooth Test Set	Anritsu	Mt8852B-042	1132009	Aug. 11, 2018	1 Year
7	Power Amplifier	Mini-Circuits	ZHL-42W+	QA1333003	Feb. 25, 2019	1 Year
8	Power Amplifier	Mini-Circuits	ZVE-8G+	520701341	Feb. 25, 2019	1 Year
9	DC Source	Iteck	OT6154	M00157	Oct. 12, 2018	1 Year
10	ENA Network Analyzer	Agilent	E5071C	MY46102965	Mar. 10, 2019	1 Year
11	MXG Analog Signal Generator	Agilent	N5181A	MY49060710	Aug. 11, 2018	1 Year
12	Signal Generator	Agilent	E4438C	MY4907131	Mar. 10, 2019	1 Year
13	P-series power meter	Agilent	N1911A	MY45100473	Aug. 11, 2018	1 Year
14	Wideband power sensor	Agilent	N1921A	MY51100041	Aug. 11, 2018	1 Year
15	Peak Power Analyzer	Keysight	8990B	MY51000506	Nov. 26, 2018	1 Year
16	Wideband Power Sensor	Keysight	N1923A	MY58310004	Nov. 26, 2018	1 Year
17	Dielectric Assessment Kit	Speag	DAK-3.5	1226	N/A	N/A
18	Dual directional coupler	Woken	TS-PCC0M-05	107090019	Mar. 10, 2019	1 Year
19	Coupler	Woken	0110A05601O-10	COM5BNW1A2	Mar. 10, 2019	1 Year
20	Digital Thermometer	LKM	DTM3000	3519	Jul. 19, 2018	1 Year
21	Thermohygrometer	Parkoo	JR609	N/A	Aug. 23, 2018	1 Year

Remark:

1. "N/A" denotes no model name, serial No. or calibration specified.
2. \* These test equipment have been recalibrated between the test periods. All these test equipment were within the valid period when the tests were performed.
3. 1) Per KDB865664 D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.
  - a) There is no physical damage on the dipole;
  - b) System check with specific dipole is within 10% of calibrated value;
  - c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement;
  - d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.
- 2) Network analyzer probe calibration against air, distilled water and a short block performed before measuring liquid parameters.

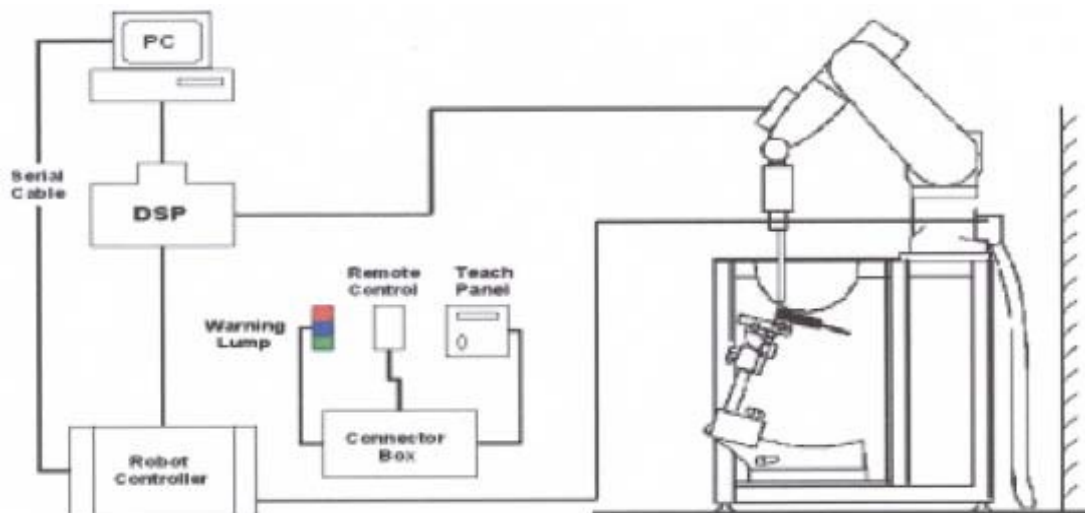
## 4. SAR MEASUREMENTS SYSTEM CONFIGURATION

### 4.1 SAR MEASUREMENT SET-UP

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

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
6. The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows.
7. DASY5 software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

#### 4.1.1 TEST SETUP LAYOUT



## 4.2 DASY5 E-FIELD PROBE SYSTEM

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

### 4.2.1 EX3DV4 PROBE SPECIFICATION

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to 6 GHz Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)
Directivity	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 $\mu$ W/g to > 100 mW/g Linearity: $\pm 0.2$ dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm



**EX3DV4 E-field Probe**

#### 4.2.2 E-FIELD PROBE CALIBRATION

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm 10\%$ . The spherical isotropy was evaluated and found to be better than  $\pm 0.25\text{dB}$ . The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$\text{SAR} = C \frac{\Delta T}{\Delta t}$$

Where:  $\Delta t$  = Exposure time (30 seconds),

$C$  = Heat capacity of tissue (brain or muscle),

$\Delta T$  = Temperature increase due to RF exposure.

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

Where:  $\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density ( $\text{kg/m}^3$ ).


## 4.2.3 OTHER TEST EQUIPMENT

### 4.2.3.1 Device Holder for Transmitters

**Construction:** Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices (e.g., laptops, cameras, etc.) It is light weight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.

**Material:** POM, Acrylic glass, Foam

### 4.2.3.2 Phantom

Model	ELI4 Phantom	
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
Shell Thickness	2±0.1 mm	
Filling Volume	Approx. 30 liters	
Dimensions	Length: 600 mm ; Width: 190mm Height: adjustable feet	
Available	Special	

#### 4.2.4 SCANNING PROCEDURE

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max.  $\pm 5\%$ .

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above  $\pm 0.1\text{mm}$ ). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within  $\pm 30^\circ$ .)

- Area Scan

The “area scan” measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The standard scan uses large grid spacing for faster measurement. Standard grid spacing for head measurements is 15 mm in x- and y- dimension ( $\leq 2\text{GHz}$ ), 12 mm in x- and y- dimension (2-4 GHz) and 10mm in x- and y- dimension (4-6GHz). If a finer resolution is needed, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation.

- Zoom Scan

A “zoom scan” measures the field in a volume around the 2D peak SAR value acquired in the previous “coarse” scan. This is a fine grid with maximum scan spatial resolution:  $\Delta x_{\text{zoom}}, \Delta y_{\text{zoom}} \leq 2\text{GHz} - \leq 8\text{mm}$ , 2-4GHz -  $\leq 5\text{ mm}$  and 4-6 GHz -  $\leq 4\text{mm}$ ;  $\Delta z_{\text{zoom}} \leq 3\text{GHz} - \leq 5\text{ mm}$ , 3-4 GHz -  $\leq 4\text{mm}$  and 4-6GHz -  $\leq 2\text{mm}$  where the robot additionally moves the probe along the z-axis away from the bottom of the Phantom. DASY is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in Appendix B. Test results relevant for the specified standard (see chapter 1.4.) are shown in table form in chapter 7.2.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 2 mm steps. This measurement shows the continuity of the liquid and can - depending in the field strength – also show the liquid depth.



The following table summarizes the area scan and zoom scan resolutions per FCC KDB 865664D01:

Frequency	Maximun Area Scan resolution ( $\Delta x_{area}, \Delta y_{area}$ )	Maximun Zoom Scan spatial resolution ( $\Delta x_{Zoom}, \Delta y_{Zoom}$ )	Maximun Zoom Scan spatial resolution			Minimum zoom scan volume (x,y,z)
			Uniform Grid	Graded Grad		
			$\Delta z_{Zoom}(n)$	$\Delta z_{Zoom}(1)^*$	$\Delta z_{Zoom}(n>1)^*$	
$\leq 2\text{GHz}$	$\leq 15\text{mm}$	$\leq 8\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 1.5^* \Delta z_{Zoom}(n-1)$	$\geq 30\text{mm}$
2-3GHz	$\leq 12\text{mm}$	$\leq 5\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 1.5^* \Delta z_{Zoom}(n-1)$	$\geq 30\text{mm}$
3-4GHz	$\leq 12\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 3\text{mm}$	$\leq 1.5^* \Delta z_{Zoom}(n-1)$	$\geq 28\text{mm}$
4-5GHz	$\leq 10\text{mm}$	$\leq 4\text{mm}$	$\leq 3\text{mm}$	$\leq 2.5\text{mm}$	$\leq 1.5^* \Delta z_{Zoom}(n-1)$	$\geq 25\text{mm}$
5-6GHz	$\leq 10\text{mm}$	$\leq 4\text{mm}$	$\leq 2\text{mm}$	$\leq 2\text{mm}$	$\leq 1.5^* \Delta z_{Zoom}(n-1)$	$\geq 22\text{mm}$

#### 4.2.5 SPATIAL PEAK SAR EVALUATION

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of 5 x 5 x 7 points( with 8mm horizontal resolution) or 7 x 7 x 7 points( with 5mm horizontal resolution) or 8 x 8 x 7 points( with 4mm horizontal resolution). The algorithm that finds the maximal averaged volume is separated into three different stages.

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting "Graph Evaluated".
- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.
- All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

#### Extrapolation

The extrapolation is based on a least square algorithm [W. Gander, Computer mathematic, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

#### Interpolation

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computer mathematic, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff ].

#### Volume Averaging

At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.

#### Advanced Extrapolation

DASY5 uses the advanced extrapolation option which is able to compensate boundary effects on E-field probes.



## 4.2.6 DATA STORAGE AND EVALUATION

### 4.2.6.1 Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “DAE”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm<sup>2</sup>], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

#### 4.2.7 DATA EVALUATION BY SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	Sensitivity	Normi, $a_{i0}$ , $a_{i1}$ , $a_{i2}$
	Conversion factor	ConvF <sub>i</sub>
	Diode compression point	Dcp <sub>i</sub>
Device parameters:	Frequency	f
	Crest factor	cf
Media parameters:	Conductivity	
	Density	

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multi meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

With	$V_i$ = compensated signal of channel i	(i = x, y, z)
	$U_i$ = input signal of channel i	(i = x, y, z)
	cf = crest factor of exciting field	(DASY parameter)
	dcp <sub>i</sub> = diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E-field probes: } E_i = (V_i / \text{Norm}_i \cdot \text{ConvF})^{1/2}$$

$$\text{H-field probes: } H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$$

With  $V_i$  = compensated signal of channel  $i$  ( $i = x, y, z$ )

$\text{Norm}_i$  = sensor sensitivity of channel  $i$  ( $i = x, y, z$ )  
[mV/(V/m)<sup>2</sup>] for E-field Probes

$\text{ConvF}$  = sensitivity enhancement in solution

$a_{ij}$  = sensor sensitivity factors for H-field probes

$f$  = carrier frequency [GHz]

$E_i$  = electric field strength of channel  $i$  in V/m

$H_i$  = magnetic field strength of channel  $i$  in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{\text{tot}} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

The primary field data are used to calculate the derived field units.

$$\text{SAR} = (E_{\text{tot}})^2 \cdot \sigma / (\rho \cdot 1000)$$

With  $\text{SAR}$  = local specific absorption rate in mW/g

$E_{\text{tot}}$  = total field strength in V/m  
= conductivity in [mho/m] or [Siemens/m]  
= equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{\text{pwe}} = E_{\text{tot}}^2 / 3770 \text{ or } P_{\text{pwe}} = H_{\text{tot}}^2 \cdot 37.7$$

With  $P_{\text{pwe}}$  = equivalent power density of a plane wave in mW/cm<sup>2</sup>

$E_{\text{tot}}$  = total field strength in V/m

$H_{\text{tot}}$  = total magnetic field strength in A/m

## 5. SYSTEM VERIFICATION PROCEDURE

### 5.1 TISSUE VERIFICATION

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within  $\pm 5\%$  of the target values.

The following materials are used for producing the tissue-equivalent materials.

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
Body 2450	-	31.4	-	0.1	-	-	68.5	-
Body 5G	-	-	-	-	-	10.7	78.6	10.7

Salt: 99+% Pure Sodium Chloride; Sugar: 98+% Pure Sucrose; Water: De-ionized, 16M + resistivity  
 HEC: Hydroxyethyl Cellulose; DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]  
 Triton X-100(ultra pure): Polyethylene glycol mono [4-(1,1,3,3-tetramethylbutyl)phenyl]ether

Tissue Verification									
Tissue Type	Frequency (MHz)	Liquid Temp. (°C)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	Targeted Conductivity ( $\sigma$ )	Targeted Permittivity ( $\epsilon_r$ )	Deviation Conductivity ( $\sigma$ ) (%)	Deviation Permittivity ( $\epsilon_r$ ) (%)	Date
Body	2450	22.6	1.983	51.387	1.95	52.7	1.69	-2.49	Apr. 04, 2019
Body	2450	22.5	1.999	51.714	1.95	52.7	2.51	-1.87	Apr. 08, 2019
Body	5300	22.2	5.495	47.444	5.42	48.9	1.38	-2.98	Apr. 06, 2019
Body	5300	22.3	5.471	47.292	5.42	48.9	0.94	-3.29	Apr. 15, 2019
Body	5500	22.2	5.768	47.015	5.65	48.6	2.09	-3.26	Apr. 06, 2019
Body	5500	22.3	5.741	46.869	5.65	48.6	1.61	-3.56	Apr. 15, 2019
Body	5600	22.2	5.900	46.819	5.77	48.5	2.25	-3.47	Apr. 06, 2019
Body	5600	22.3	5.872	46.679	5.77	48.5	1.77	-3.75	Apr. 15, 2019
Body	5800	22.2	6.178	46.487	6.00	48.2	2.97	-3.55	Apr. 06, 2019
Body	5800	22.3	6.149	46.351	6.00	48.2	2.48	-3.84	Apr. 15, 2019

Note:

- 1) The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.
- 2) KDB 865664 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.
- 3) The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies. The SAR test plots may slightly differ from the table above since the DASY rounds to three significant digits.

## 5.2 SYSTEM CHECK

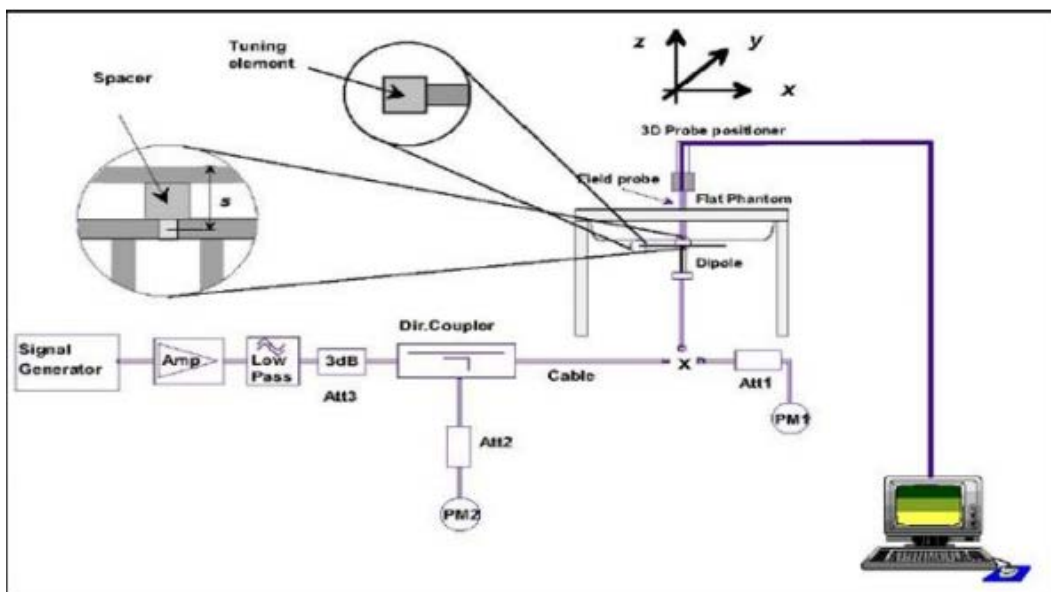
The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands and tissue liquids used during the tests.

System Check	Date	Frequency (MHz)	Targeted SAR-1g (W/kg)	Measured SAR-1g (W/kg)	normalized SAR-1g (W/kg)	Deviation (%)	Dipole S/N
Body	Apr. 04, 2019	2450	50.80	12.30	49.20	-3.15	919
Body	Apr. 08, 2019	2450	50.80	12.40	49.60	-2.36	919
Body	Apr. 06, 2019	5300	72.30	6.90	69.00	-4.56	1160
Body	Apr. 15, 2019	5300	72.30	6.87	68.70	-4.98	1160
Body	Apr. 06, 2019	5500	76.20	7.30	73.00	-4.20	1160
Body	Apr. 15, 2019	5500	76.20	7.27	72.70	-4.59	1160
Body	Apr. 06, 2019	5600	77.70	8.06	80.60	3.73	1160
Body	Apr. 15, 2019	5600	77.70	8.03	80.30	3.35	1160
Body	Apr. 06, 2019	5800	76.60	7.50	75.00	-2.09	1160
Body	Apr. 15, 2019	5800	76.60	7.46	74.60	-2.61	1160

## 5.3 SYSTEM CHECK PROCEDURE

The system check is performed by using a system check dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a plexiglass spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 250 mW(below 3GHz) or 100mW(3-6GHz). To adjust this power a power meter is used. The power sensor is connected to the cable before the system check to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the system check to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test.

System check results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system ( $\pm 10\%$ ).



## 6. SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

### 6.1 SAR MEASUREMENT VARIABILITY

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

The detailed repeated measurement results are shown in Section 8.2.

## 7. OPERATIONAL CONDITIONS DURING TEST

### 7.1 SAR TEST CONFIGURATION

#### 7.1.1 WIFI TEST CONFIGURATION

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal.

##### 2.4G

Mode	802.11b	802.11g	802.11n HT20	802.11n HT40
Duty cycle	100%			
Crest factor	1			

##### 5G

Mode	802.11a	802.11n HT20	802.11n HT40	802.11ac HT20	802.11ac HT40	802.11ac VH80
Duty cycle	100%					
Crest factor	1					

For WiFi SAR testing, a communication link is set up with the test mode software for WiFi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The RF signal utilized in SAR measurement has 100% duty cycle and its crest factor is 1. The test procedures in KDB 248227 D01 are applied.

#### 7.1.1.1 2.4G SAR Test Requirements

##### 802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

- 1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is  $\leq 0.8$  W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 2) When the reported SAR is  $> 0.8$  W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is  $> 1.2$  W/kg, SAR is required for the third channel; i.e., all channels require testing.

##### 2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied. SAR is not required for the following 2.4 GHz OFDM conditions.

- 1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- 2) 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.

##### SAR Test Requirements for OFDM configurations

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, each standalone And frequency aggregated band is considered separately for SAR test reduction. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

### 7.1.1.2 5G SAR Test Requirements

#### ✧ U-NII-1 and U-NII-2A Band

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is  $\leq 1.2$  W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, both bands are tested independently for SAR. When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is  $\leq 1.2$  W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, both bands are tested independently for SAR.

#### ✧ U-NII-2C, U-NII-3 Bands

The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification.

Unless band gap channels are permanently disabled, they must be considered for SAR testing. To maintain SAR measurement accuracy and to facilitate test reduction, the channels in U-NII-2C band above 5.65 GHz may be grouped with the 5.8 GHz channels in U-NII-3 or §15.247 band to enable two SAR probe calibration frequency points to cover the bands, including the band gap channels.<sup>11</sup> When band gap channels are supported and the bands are not aggregated for SAR testing, band gap channels must be considered independently in each band according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

### 7.1.1.3 OFDM transmission mode and SAR test channel selection

For the 2.4GHz and 5GHz bands, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations (for example 802.11a, 802.11n and 802.11ac, or 802.11g and 802.11n, with the same channel bandwidth, modulation, and data rate, etc.), the lower order 802.11 mode (i.e. 802.11a then 802.11n and 802.11ac, or 802.11g then 802.11n) is used for SAR measurement. When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.



#### 7.1.1.4 Initial test configuration procedure

For OFDM, in both 2.4G and 5GHz bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, and lowest data rate. If the average RF output powers of the highest identical transmission modes are within 0.25 dB of each other, mid channel of the transmission mode with highest average RF output powers is the initial test channel. Otherwise, the channel of the transmission mode with the highest average RF output power will be the initial test configuration.

When the reported SAR is  $\leq 0.8$  W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is  $\leq 1.2$  W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurement.

## 7.2 TEST POSITION

### 7.2.1 BODY

The overall diagonal dimension of the display section of a tablet is 21.1cm>20cm, per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the Tablet touching the phantom. SAR evaluation for the front surface of tablet display screens is generally not necessary. The SAR Exclusion Threshold in KDB 447498 D01 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 adjacent the phantom and the edge containing the antenna positioned perpendicular to the phantom.

#### SAR test reduction and exclusion guidance

(1)The SAR exclusion threshold for distances<50mm is defined by the following equation:

$$\frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} \sqrt{\text{Frequency (GHz)}} \leq 3.0$$

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

(2)The SAR exclusion threshold for distances>50mm is defined by the following equation, as illustrated in KDB 447498 D01 Appendix B:

a) at 100 MHz to1500 MHz

$$[\text{Power allowed at numeric Threshold at 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot (f_{\text{(MHz)}}/150)] \text{ mW}$$

b) at >1500MHz and ≤6GHz

$$[\text{Power allowed at numeric Threshold at 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot 10] \text{ mW}$$

The location of the antenna inside EUT and standalone SAR test exclusion, please refer to Appendix E.

### 7.3 PROXIMITY SENSOR POWER REDUCTION INFORMATION

In this section, the following list is used to prepare an inquiry seeking SAR test guidance for proximity sensor power reduction. The procedure in KDB 616217 is applied for SAR testing.

#### 7.3.1 GENERAL PROXIMITY SENSOR IMPLEMENTATION DESCRIPTION

This device uses a proximity sensor that share the same metallic electrode as the transmitting antenna to facilitate triggering in typical user interactivity with the device.

Due to the operating configurations and exposure conditions required by the device, the proximity sensor is used to indicate when the tablet is held close to a user's body exposure condition. It utilizes the proximity sensor to reduce the output power in specific wireless and operating modes to ensure SAR compliance for the following scenarios: To reduce the output power of wifi antennas during body operating configurations.

#### 7.3.2 PROXIMITY SENSOR COVERAGE, DISTANCE AND ANGLE

##### 7.3.2.1 Procedures for determining proximity sensor triggering distances

The device was tested by the test lab to determine the proximity sensor triggering distances for the Rear face(back side) and top side of the device. To ensure all production units are compliant, the smallest separation distance determined by the sensor triggering minus 1 mm, must be used as the test separation distance for SAR testing.

The proximity sensor triggering distance measurement method is as below:



Picture proximity sensor triggering distance assessment top side



Picture proximity sensor triggering distance assessment Front side and back side

**Table 1: Summary of Trigger Distances**

Band	Trigger distance –Rear Face		Trigger distance –Top Side	
	Moving toward phantom	Moving from phantom	Moving toward phantom	Moving toward phantom
Sensor pad	14mm	14mm	15mm	15mm

Note:

- 1) For Rear Face, based on the most conservative measured triggering distance of N mm, additional SAR test is required at (N-1) mm.
- 2) For Top Side, based on the most conservative measured triggering distance of N mm, additional SAR test is required at (N-1) mm.

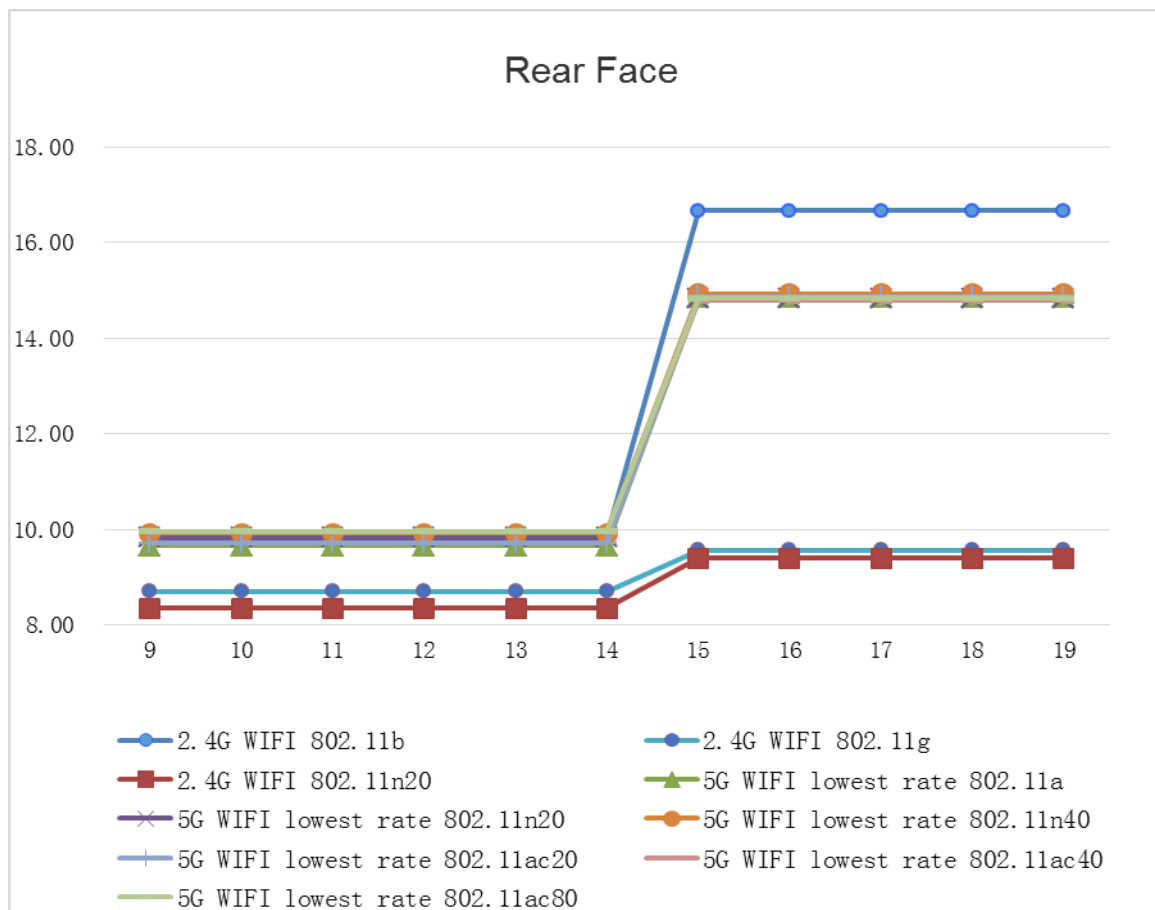
The proximity sensor is not triggered, when approaching from other sides. Therefore, the proximity sensor coverage is not evaluated on these orientations.

### 7.3.2.2 Procedures for determining antenna and proximity sensor coverage

The proximity sensor and main antenna use same metallic electrode, so there is no spatial offset.

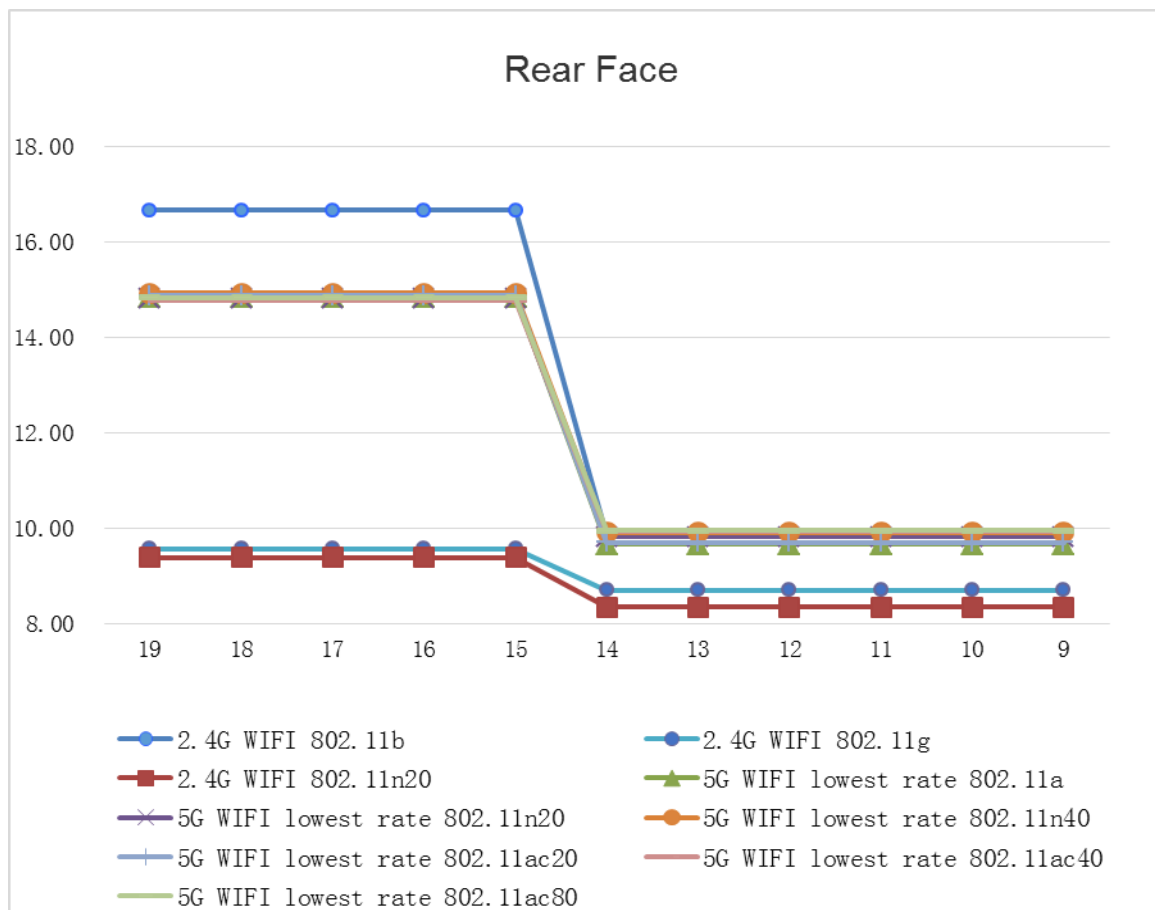
#### 1) Rear Face(moving away from the phantom)

mode		distance(mm)										
		Rear Face										
		Sensor on						Sensor off				
		9	10	11	12	13	14	15	16	17	18	19
2.4G WIFI	802.11b	9.85	9.85	9.85	9.85	9.85	9.85	16.67	16.67	16.67	16.67	16.67
	802.11g	8.70	8.70	8.70	8.70	8.70	8.70	9.57	9.57	9.57	9.57	9.57
	802.11n20	8.35	8.35	8.35	8.35	8.35	8.35	9.39	9.39	9.39	9.39	9.39
5G WIFI lowest rate	802.11a	9.66	9.66	9.66	9.66	9.66	9.66	14.85	14.85	14.85	14.85	14.85
	802.11n20	9.83	9.83	9.83	9.83	9.83	9.83	14.83	14.83	14.83	14.83	14.83
	802.11n40	9.92	9.92	9.92	9.92	9.92	9.92	14.93	14.93	14.93	14.93	14.93
	802.11ac20	9.71	9.71	9.71	9.71	9.71	9.71	14.88	14.88	14.88	14.88	14.88
	802.11ac40	9.94	9.94	9.94	9.94	9.94	9.94	14.78	14.78	14.78	14.78	14.78
	802.11ac80	9.96	9.96	9.96	9.96	9.96	9.96	14.84	14.84	14.84	14.84	14.84



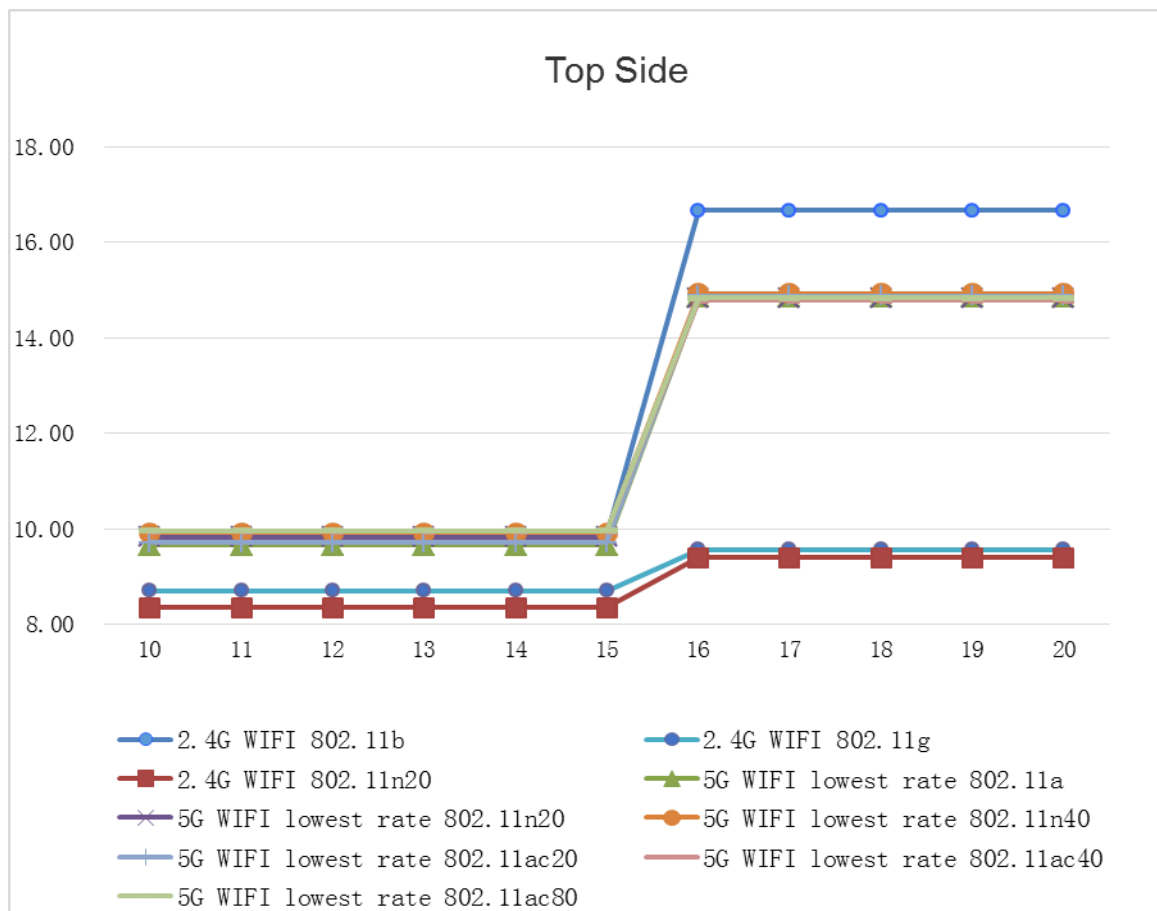
## 2) Rear Face(moving toward the phantom)

mode		distance(mm)											
		Rear Face											
		Sensor off					Sensor on						
		19	18	17	16	15	14	13	12	11	10	9	
2.4G WIFI	802.11b	16.67	16.67	16.67	16.67	16.67	9.85	9.85	9.85	9.85	9.85	9.85	
	802.11g	9.57	9.57	9.57	9.57	9.57	8.70	8.70	8.70	8.70	8.70	8.70	
	802.11n20	9.39	9.39	9.39	9.39	9.39	8.35	8.35	8.35	8.35	8.35	8.35	
5G WIFI lowest rate	802.11a	14.85	14.85	14.85	14.85	14.85	9.66	9.66	9.66	9.66	9.66	9.66	
	802.11n20	14.83	14.83	14.83	14.83	14.83	9.83	9.83	9.83	9.83	9.83	9.83	
	802.11n40	14.93	14.93	14.93	14.93	14.93	9.92	9.92	9.92	9.92	9.92	9.92	
	802.11ac20	14.88	14.88	14.88	14.88	14.88	9.71	9.71	9.71	9.71	9.71	9.71	
	802.11ac40	14.78	14.78	14.78	14.78	14.78	9.94	9.94	9.94	9.94	9.94	9.94	
	802.11ac80	14.84	14.84	14.84	14.84	14.84	9.96	9.96	9.96	9.96	9.96	9.96	



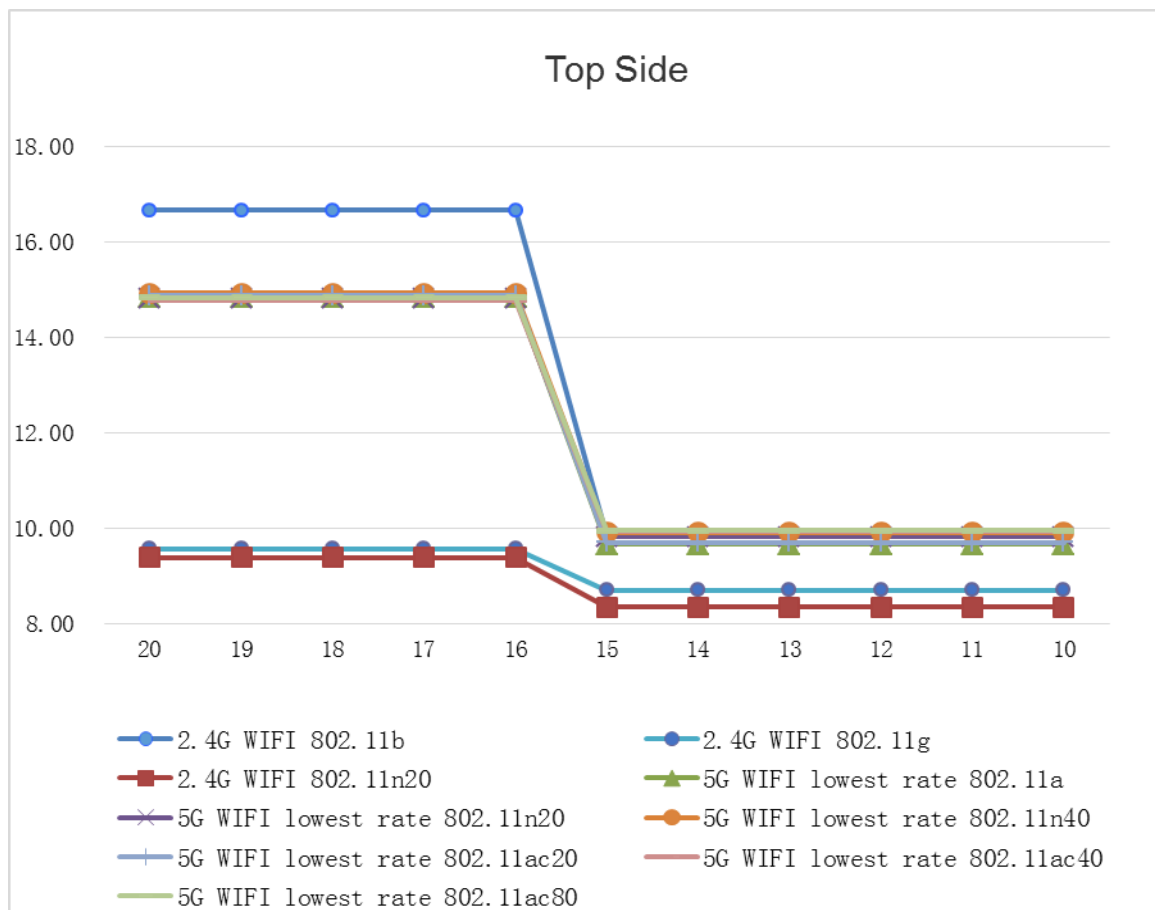
### 3) Top Side(moving away from the phantom)

mode		distance(mm)										
		Top Side										
		Sensor on						Sensor off				
		10	11	12	13	14	15	16	17	18	19	20
2.4G WIFI	802.11b	9.85	9.85	9.85	9.85	9.85	9.85	16.67	16.67	16.67	16.67	16.67
	802.11g	8.70	8.70	8.70	8.70	8.70	8.70	9.57	9.57	9.57	9.57	9.57
	802.11n20	8.35	8.35	8.35	8.35	8.35	8.35	9.39	9.39	9.39	9.39	9.39
5G WIFI lowest rate	802.11a	9.66	9.66	9.66	9.66	9.66	9.66	14.85	14.85	14.85	14.85	14.85
	802.11n20	9.83	9.83	9.83	9.83	9.83	9.83	14.83	14.83	14.83	14.83	14.83
	802.11n40	9.92	9.92	9.92	9.92	9.92	9.92	14.93	14.93	14.93	14.93	14.93
	802.11ac20	9.71	9.71	9.71	9.71	9.71	9.71	14.88	14.88	14.88	14.88	14.88
	802.11ac40	9.94	9.94	9.94	9.94	9.94	9.94	14.78	14.78	14.78	14.78	14.78
	802.11ac80	9.96	9.96	9.96	9.96	9.96	9.96	14.84	14.84	14.84	14.84	14.84



#### 4) Top Side(moving toward the phantom)

mode		distance(mm)											
		Top Side											
		Sensor off						Sensor on					
		20	19	18	17	16	15	14	13	12	11	10	
2.4G WIFI	802.11b	16.67	16.67	16.67	16.67	16.67	9.85	9.85	9.85	9.85	9.85	9.85	
	802.11g	9.57	9.57	9.57	9.57	9.57	8.70	8.70	8.70	8.70	8.70	8.70	
	802.11n20	9.39	9.39	9.39	9.39	9.39	8.35	8.35	8.35	8.35	8.35	8.35	
5G WIFI lowest rate	802.11a	14.85	14.85	14.85	14.85	14.85	9.66	9.66	9.66	9.66	9.66	9.66	
	802.11n20	14.83	14.83	14.83	14.83	14.83	9.83	9.83	9.83	9.83	9.83	9.83	
	802.11n40	14.93	14.93	14.93	14.93	14.93	9.92	9.92	9.92	9.92	9.92	9.92	
	802.11ac20	14.88	14.88	14.88	14.88	14.88	9.71	9.71	9.71	9.71	9.71	9.71	
	802.11ac40	14.78	14.78	14.78	14.78	14.78	9.94	9.94	9.94	9.94	9.94	9.94	
	802.11ac80	14.84	14.84	14.84	14.84	14.84	9.96	9.96	9.96	9.96	9.96	9.96	

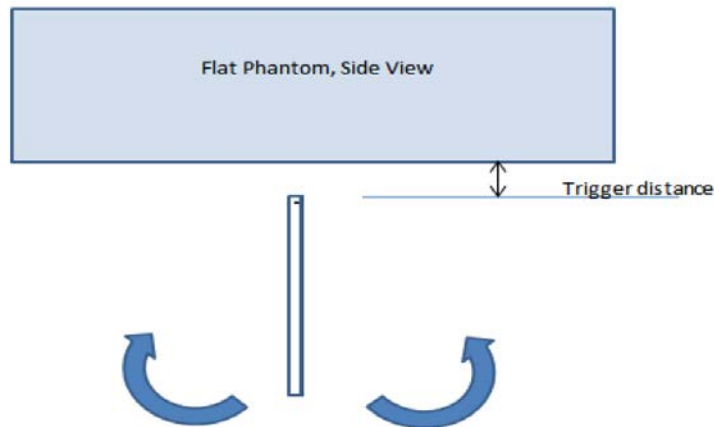


### 7.3.2.3 Procedures for determining device tilt angle influences to proximity sensor triggering

The DUT was positioned directly below the flat phantom at the minimum measured trigger distance with Bottom side parallel to the base of the flat phantom for each band.

The EUT was rotated about Top side for angles up to  $\pm 45^\circ$ . If the output power increased during the rotation the DUT was moved 1mm toward the phantom and the rotation repeated. This procedure was repeated until the power remained reduced for all angles up to  $\pm 45^\circ$ .

The proximity sensor triggering tilt angle measurement method is as below:



Picture: Proximity sensor tilts angle assessment

**Table 2: Summary of EUT Tilt Angle Influence to Proximity Sensor Triggering (Top side)**

Band(MHz)	Minimum trigger distance at which power reduction was maintained over $\pm 45^\circ$	Power Reduction Status										
		-45°	-35°	-25°	-15°	-5°	0°	5°	15°	25°	35°	45°
WIFI 2.4G	15mm	on	on	on	on	on	on	on	on	on	on	on
WIFI 5G	15mm	on	on	on	on	on	on	on	on	on	on	on

**Conclusion:** It can be ensured that the proximity sensor can be valid triggered for the DUT tilt coverage exposure condition (WIFI Antenna).

### 7.3.2.4 Summary SAR test Plan for Proximity sensor power reduction

The proximity sensor is used to indicate when the device is held close to a user's body exposure condition.

- 1) SAR tests with proximity sensor power reduction are required for top side, rear face of WIFI Antenna. To ensure all production units are compliant, the smallest separation distance determined by the sensor triggering minus 1 mm, must be used as the test separation distance for additional SAR testing at the maximum power level with sensor off.
- 2) For the other sides or of the device, SAR is still tested at the maximum power level with sensor off.



## 7.4 SAR POWER REDUCTION USING COUNTRY CODE DETECTION

### 7.4.1 GENERAL DESCRIPTION

The product supports supporting the countries detection mechanism. The main purpose is to distinguish CE countries and FCC/IC countries and apply the relevant power levels accordingly. The main purpose is to provide enhanced user experience while meeting the SAR compliance for different countries.

This device uses the mobile country code (MCC) to indicate whether the users in CE countries or FCC/IC countries. The selection between CE countries and FCC/IC countries power levels is based on the country code detection mechanism. It can determine the countries where users are and set the relevant power level for WiFi antennas accordingly.

**Table 3: Summary of country code detection mechanism**

Antenna	MCC OF CE COUNTRY (CE standard)	MCC OF FCC/IC COUNTRY (FCC/IC standard)
WiFi 5G Ant	Power Level A1	Power Level B1

**Table 4: The device model and frequency Bands**

Model	BAH2-W19
SIM Card	single
CE bands	WiFi 2.4G/5G/BT
FCC/IC bands	WiFi 2.4G/5G/BT
Bands supporting country code detection mechanism	WIFI 5G

The software of the device has information of CE and FCC/IC countries so that to detect where the users are. If the users are in CE countries, the power level A is applied. If the users are in FCC/IC countries, the power level B is applied.

Note:

- 1) The device distinguishes different countries by MCC information. If we are close to a country border and the phone switches to a neighboring network the power reduction will follow the newest registered MCC information.
- 2) The default status when the device doesn't know the MCC information will be set to the Lower Power Level between A and B.
- 3) Other countries that don't exist in the MCC list of this attachment will be executed the same max power level of CE standard countries.
- 4) For WIFI bands, the router also has MCC information so the device can distinguish different countries.

#### 7.4.2 SUMMARY SAR TEST PLAN

Based on the summary table of countries detection mechanism above, we plan to perform the SAR test as below:

- 1) Some AT commands or test scripts are supplied to fix the country code so that the relevant power level can be chosen and tested at a time.
- 2) For conducted power test, both the detailed full power and reduced tune-up specifications and conducted power measurement results will be tested and provided in the final SAR report.
- 3) For SAR test, the device will be tested at relevant power level applicable to the country code and certification type according to the real usage scenario.

**For conducted power test,** both the full power level and reduced power level will be tested by setting different MCC to validate that the country code detection mechanism works.

**For FCC SAR test,**

Standalone FCC SAR of Wifi 5G ant evaluated at power level B1 (FCC mobile country code)

## 8. TEST RESULT

### 8.1 CONDUCTED POWER RESULTS

The Average conducted power of WiFi/BT is measured with RMS detector. The tested channel results are marks in bold.

#### 8.1.1 CONDUCTED POWER MEASUREMENTS OF WIFI 2.4G

##### 1. Conducted power measurement results of WiFi 2.4G (Sensor off)

Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune up	Average Power(dBm)
802.11b	1	2412	1	17.50	<b>16.67</b>
	6	2437		17.50	15.75
	11	2462		17.50	16.32
802.11g	1	2412	6	11.00	9.57
	6	2437		11.00	9.15
	11	2462		11.00	9.80
802.11n HT20	1	2412	HT0	11.00	9.39
	6	2437		11.00	9.06
	11	2462		11.00	9.51
802.11n HT40	3	2422	HT0	8.00	Not Required
	6	2437		8.00	Not Required
	9	2452		8.00	Not Required

##### 2. Conducted power measurement results of WiFi 2.4G (Sensor on)

Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune up	Average Power(dBm)
802.11b	1	2412	1	10.00	<b>9.85</b>
	6	2437		10.00	<b>9.55</b>
	11	2462		10.00	<b>9.68</b>
802.11g	1	2412	6	10.00	8.70
	6	2437		10.00	8.32
	11	2462		10.00	8.85
802.11n HT20	1	2412	HT0	10.00	8.35
	6	2437		10.00	8.05
	11	2462		10.00	8.52
802.11n HT40	3	2422	HT0	8.00	Not Required
	6	2437		8.00	Not Required
	9	2452		8.00	Not Required

Note: Per KDB248227 D01, for WiFi 2.4GHz, the highest measured maximum output power Channel for DSSS modes(802.11b)was selected for SAR measurement. SAR for OFDM modes(2.4GHz 802.11g/n) was not required When the highest reported SAR for DSSS is adjusted by the ratio of OFDM modes(802.11g/n)to DSSS modes(802.11b)specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg.

## 8.1.2 CONDUCTED POWER MEASUREMENTS OF WIFI 5G

### 1. Conducted power measurement results of WiFi 5G (FCC standard Sensor off)

Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.2G	802.11a	36	5180	6	15.00	14.85
		40	5200		15.00	14.89
		44	5220		15.00	14.91
		48	5240		15.00	14.95
	802.11n HT20	36	5180	HT0	15.00	14.83
		40	5200		15.00	14.53
		44	5220		15.00	14.62
		48	5240		15.00	14.67
	802.11n HT40	38	5190	HT0	15.00	14.82
		46	5230		15.00	14.93
	802.11ac VHT20	36	5180	MCS0	15.00	14.88
		40	5200		15.00	14.55
		44	5220		15.00	14.59
		48	5240		15.00	14.62
	802.11ac VHT40	38	5190	MCS0	15.00	14.78
		46	5230		15.00	14.86
	802.11ac VHT80	42	5210	MCS0	15.00	14.84

Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.3G	802.11a	52	5260	6	15.00	14.57
		56	5280		15.00	14.61
		60	5300		15.00	14.63
		64	5320		15.00	14.74
	802.11n HT20	52	5260	HT0	15.00	14.73
		56	5280		15.00	14.88
		60	5300		15.00	14.96
		64	5320		15.00	14.73
	802.11n HT40	54	5270	HT0	15.00	14.52
		62	5310		15.00	14.78
	802.11ac VHT20	52	5260	MCS0	15.00	14.73
		56	5280		15.00	14.83
		60	5300		15.00	14.94
		64	5320		15.00	14.74
	802.11ac VHT40	54	5270	MCS0	15.00	14.67
		62	5310		15.00	14.65
	802.11ac VHT80	58	5290	MCS0	15.00	<b>14.73</b>

Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.6G	802.11a	100	5500	6	15.00	14.74
		104	5520		15.00	14.71
		108	5540		15.00	14.67
		112	5560		15.00	14.65
		116	5580		15.00	14.75
		120	5600		15.00	14.63
		124	5620		15.00	14.59
		128	5640		15.00	14.66
		132	5660		15.00	14.59
		136	5680		15.00	14.54
		140	5700		15.00	14.62
	802.11n HT20	100	5500	HT0	15.00	14.77
		104	5520		15.00	14.72
		108	5540		15.00	14.65
		112	5560		15.00	14.63
		116	5580		15.00	14.72
		120	5600		15.00	14.61
		124	5620		15.00	14.58
		128	5640		15.00	14.55
		132	5660		15.00	14.55
		136	5680		15.00	14.58
		140	5700		15.00	14.84
	802.11n HT40	102	5510	HT0	15.00	14.97
		110	5550		15.00	14.96
		118	5590		15.00	14.91
		126	5630		15.00	14.84
		134	5670		15.00	14.53
	802.11ac VHT20	100	5500	MCS0	15.00	14.84
		104	5520		15.00	14.76
		108	5540		15.00	14.73
		112	5560		15.00	14.64
		116	5580		15.00	14.68
		120	5600		15.00	14.62
		124	5620		15.00	14.58
		128	5640		15.00	14.55
		132	5660		15.00	14.59
		136	5680		15.00	14.61
		140	5700		15.00	14.91
	802.11ac VHT40	102	5510	MCS0	15.00	14.94
		110	5550		15.00	14.78
		118	5590		15.00	14.75
		126	5630		15.00	14.71
		134	5670		15.00	14.55
	802.11ac VHT80	106	5530	MCS0	15.00	<b>14.82</b>
		122	5610		15.00	14.82

Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.8G	802.11a	149	5745	6	15.00	14.57
		153	5765		15.00	14.53
		157	5785		15.00	14.72
		161	5805		15.00	14.68
		165	5825		15.00	14.74
	802.11n HT20	149	5745	HT0	15.00	14.73
		153	5765		15.00	14.65
		157	5785		15.00	14.94
		161	5805		15.00	14.87
		165	5825		15.00	14.77
	802.11n HT40	151	5755	HT0	15.00	14.48
		159	5795		15.00	14.63
	802.11ac VHT20	149	5745	MCS0	15.00	14.78
		153	5765		15.00	14.72
		157	5785		15.00	14.75
		161	5805		15.00	14.66
		165	5825		15.00	14.81
	802.11ac VHT40	151	5755	MCS0	15.00	14.56
		159	5795		15.00	14.58
	802.11ac VHT80	155	5775	MCS0	15.00	<b>14.76</b>

## 2. Conducted power measurement results of WiFi 5G (FCC standard Sensor on)

Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.2G	802.11a	36	5180	6	10.00	9.66
		40	5200		10.00	9.74
		44	5220		10.00	9.69
		48	5240		10.00	9.75
	802.11n HT20	36	5180	HT0	10.00	9.83
		40	5200		10.00	9.86
		44	5220		10.00	9.84
		48	5240		10.00	9.89
	802.11n HT40	38	5190	HT0	10.00	9.93
		46	5230		10.00	9.92
	802.11ac VHT20	36	5180	MCS0	10.00	9.71
		40	5200		10.00	9.76
		44	5220		10.00	9.82
		48	5240		10.00	9.86
	802.11ac VHT40	38	5190	MCS0	10.00	9.94
		46	5230		10.00	9.91
	802.11ac VHT80	42	5210	MCS0	10.00	9.96

Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.3G	802.11a	52	5260	6	10.00	9.08
		56	5280		10.00	9.30
		60	5300		10.00	9.41
		64	5320		10.00	9.62
	802.11n HT20	52	5260	HT0	10.00	9.27
		56	5280		10.00	9.43
		60	5300		10.00	9.64
		64	5320		10.00	9.86
	802.11n HT40	54	5270	HT0	10.00	9.55
		62	5310		10.00	9.97
	802.11ac VHT20	52	5260	MCS0	10.00	9.26
		56	5280		10.00	9.46
		60	5300		10.00	9.66
		64	5320		10.00	9.92
	802.11ac VHT40	54	5270	MCS0	10.00	9.51
		62	5310		10.00	9.95
	802.11ac VHT80	58	5290	MCS0	10.00	<b>9.45</b>

Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.6G	802.11a	100	5500	6	10.00	9.37
		104	5520		10.00	9.39
		108	5540		10.00	9.41
		112	5560		10.00	9.38
		116	5580		10.00	9.35
		120	5600		10.00	9.36
		124	5620		10.00	9.29
		128	5640		10.00	9.33
		132	5660		10.00	9.40
		136	5680		10.00	9.36
		140	5700		10.00	9.32
	802.11n HT20	100	5500	HT0	10.00	9.59
		104	5520		10.00	9.54
		108	5540		10.00	9.60
		112	5560		10.00	9.58
		116	5580		10.00	9.55
		120	5600		10.00	9.62
		124	5620		10.00	9.51
		128	5640		10.00	9.48
		132	5660		10.00	9.62
		136	5680		10.00	9.57
		140	5700		10.00	9.61
	802.11n HT40	102	5510	HT0	10.00	9.82
		110	5550		10.00	9.86
		118	5590		10.00	9.84
		126	5630		10.00	9.11
		134	5670		10.00	9.98
	802.11ac VHT20	100	5500	MCS0	10.00	9.55
		104	5520		10.00	9.58
		108	5540		10.00	9.54
		112	5560		10.00	9.57
		116	5580		10.00	9.59
		120	5600		10.00	9.51
		124	5620		10.00	9.53
		128	5640		10.00	9.54
		132	5660		10.00	9.61
		136	5680		10.00	9.57
		140	5700		10.00	9.58
	802.11ac VHT40	102	5510	MCS0	10.00	9.88
		110	5550		10.00	9.86
		118	5590		10.00	9.82
		126	5630		10.00	9.83
		134	5670		10.00	9.83
	802.11ac VHT80	106	5530	MCS0	10.00	9.64
		122	5610		10.00	9.63



Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.8G	802.11a	149	5745	6	10.00	9.24
		153	5765		10.00	9.38
		157	5785		10.00	9.53
		161	5805		10.00	9.73
		165	5825		10.00	9.82
	802.11n HT20	149	5745	HT0	10.00	9.45
		153	5765		10.00	9.57
		157	5785		10.00	9.74
		161	5805		10.00	9.91
		165	5825		10.00	9.85
	802.11n HT40	151	5755	HT0	10.00	9.74
		159	5795		10.00	9.96
	802.11ac VHT20	149	5745	MCS0	10.00	9.44
		153	5765		10.00	9.55
		157	5785		10.00	9.74
		161	5805		10.00	9.86
		165	5825		10.00	9.82
	802.11ac VHT40	151	5755	MCS0	10.00	9.71
		159	5795		10.00	9.92
	802.11ac VHT80	155	5775	MCS0	10.00	9.41

### 3. Conducted power measurement results of WiFi 5G (CE standard)

Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.2G& 5.3G	802.11a	36	5180	6	19.00	18.84
		52	5260		19.00	18.77
		64	5320		19.00	18.81
	802.11n HT20	36	5180	HT0	19.00	18.76
		52	5260		19.00	18.82
		64	5320		19.00	18.78
	802.11n HT40	38	5190	HT0	19.00	18.75
		54	5270		19.00	18.73
		62	5310		19.00	18.69
	802.11ac VHT20	36	5180	MCS0	19.00	18.81
		52	5260		19.00	18.79
		64	5320		19.00	18.72
	802.11ac VHT40	38	5190	MCS0	19.00	18.73
		54	5270		19.00	18.76
		62	5310		19.00	18.64
	802.11ac VHT80	42	5210	MCS0	19.00	18.51
		58	5290		19.00	18.62

Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.6G	802.11a	100	5500	6	19.00	18.82
		120	5600		19.00	18.79
		140	5700		19.00	18.85
	802.11n HT20	100	5500	HT0	19.00	18.84
		120	5600		19.00	18.74
		140	5700		19.00	18.77
	802.11n HT40	102	5510	HT0	19.00	18.75
		118	5590		19.00	18.72
		134	5670		19.00	18.65
	802.11ac VHT20	100	5500	MCS0	19.00	18.79
		120	5600		19.00	18.81
		140	5700		19.00	18.74
	802.11ac VHT40	102	5510	MCS0	19.00	18.76
		118	5590		19.00	18.77
		134	5670		19.00	18.72
	802.11ac VHT80	106	5530	MCS0	19.00	18.64
		122	5610		19.00	18.62

Band	Mode	Channel	Frequency (MHz)	Data Rate(Mbps)	Max. Tune-up	Average Power(dBm)
5.8G	802.11a	149	5745	6	19.00	18.77
		157	5785		19.00	18.74
		165	5825		19.00	18.72
	802.11n HT20	149	5745	HT0	19.00	18.65
		157	5785		19.00	18.75
		165	5825		19.00	18.69
	802.11n HT40	151	5755	HT0	19.00	18.59
		159	5795		19.00	18.64
	802.11ac VHT20	149	5745	MCS0	19.00	18.72
		157	5785		19.00	18.71
		165	5825		19.00	18.68
	802.11ac VHT40	151	5755	MCS0	19.00	18.65
		159	5795		19.00	18.66
	802.11ac VHT80	155	5775	MCS0	19.00	18.54

#### Stand-alone SAR

According to the output power measurement result we can draw the conclusion that:

Based upon description of Low-power exclusion level ( $P_{max}$ ) in EN 62479:2010:

Stand-alone SAR are required for 5G WiFi, because the output power of 5G WiFi transmitter is  $\leq$  ( $P_{max}=13\text{dBm}$ ).

### 8.1.3 CONDUCTED POWER MEASUREMENTS OF BT

BT	Average Conducted Power(dBm)			
	Max.	CH0	CH39	CH78
	Tune up	2402MHz	2441MHz	2480MHz
DH5	10.00	8.17	8.27	8.25
2DH5	10.00	6.55	6.38	5.82
3DH5	10.00	6.58	6.36	5.83

BT	Average Conducted Power(dBm)			
	Max.	CH0	CH19	CH39
	Tune up	2402MHz	2441MHz	2480MHz
BLE(1M)	10.00	7.48	7.32	6.81

## 8.2 SAR TEST RESULTS

### General Notes:

- 1) Per KDB447498 D01, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demonstrate compliant.
- 2) Per KDB447498 D01, 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. When the maximum output power variation across the required test channels is  $> \frac{1}{2}$  dB, instead of the middle channel, the highest output power channel must be used.
- 3) Per KDB865664 D01, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8$  W/kg; if the deviation among the repeated measurement is  $\leq 20\%$ , and the measured SAR  $< 1.45$  W/kg, only one repeated measurement is required.
- 4) Per KDB865664 D02, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is  $> 1.5$  W/kg, or  $> 7.0$  W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing.

### WLAN Notes:

1. For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When the reported SAR of the initial test position is  $\leq 0.4$  W/kg, further SAR measurement is not required for the other (remaining) test positions. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is  $\leq 0.8$  W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 for 2.4GHz WIFI single transmission chain operations, the highest measured maximum output power Channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 7.1.4 for more information.
3. Justification for test configurations for WLAN per KDB Publication 248227 for 5GHz WIFI single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed power. Other transmission mode were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2W/kg. See Section 7.1.4 for more information.

## 8.2.1 SAR MEASUREMENT RESULT

Test No.	Band	Channel	Test Position	Separation Distance (cm)	Storage Scenarios	Battery	Sensor	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift (dB)	SAR 1g (W/kg)	SAR 10g (W/kg)	Reported 1g SAR
T01	802.11b	1	Rear Face	1.3	LPDDR3+eMMC	1	off	17.5	16.67	0.01	0.094	0.052	0.113
T02	802.11b	1	Top Side	1.4	LPDDR3+eMMC	1	off	17.5	16.67	-0.09	0.094	0.051	0.114
T03	802.11b	1	Rear Face	0	LPDDR3+eMMC	1	on	10	9.85	0	<b>0.462</b>	<b>0.179</b>	<b>0.478</b>
T04	802.11b	1	Top Side	0	LPDDR3+eMMC	1	on	10	9.85	0.06	0.188	0.078	0.195
T05	802.11b	6	Rear Face	0	LPDDR3+eMMC	1	on	10	9.55	0.11	0.424	0.165	0.470
T06	802.11b	11	Rear Face	0	LPDDR3+eMMC	1	on	10	9.68	0.02	0.318	0.124	0.342
T07	802.11b	1	Rear Face	0	LPDDR3+eMMC	2	on	10	9.85	-0.07	0.445	0.177	0.461
T08	802.11b	1	Rear Face	0	LPDDR3+eMMC	3	on	10	9.85	-0.02	0.352	0.122	0.364
T09	802.11b	1	Rear Face	0	EMCP	1	on	10	9.85	0	0.436	0.175	0.451
T10	802.11b	1	Rear Face	0	EMCP	2	on	10	9.85	-0.03	0.441	0.187	0.456
T11	802.11b	1	Rear Face	0	EMCP	3	on	10	9.85	0.11	0.448	0.184	0.464
T12	BT DH5	39	Rear Face	0	LPDDR3+eMMC	1	-	10	8.27	-0.01	0.189	0.079	0.281
T13	BT DH5	39	Top Side	0	LPDDR3+eMMC	1	-	10	8.27	0.06	0.092	0.035	0.137
T14	BT DH5	0	Rear Face	0	LPDDR3+eMMC	1	-	10	8.17	0	<b>0.232</b>	<b>0.088</b>	<b>0.354</b>
T15	BT DH5	78	Rear Face	0	LPDDR3+eMMC	1	-	10	8.25	0.13	0.227	0.082	0.340
T16	BT DH5	0	Rear Face	0	LPDDR3+eMMC	2	-	10	8.17	0.02	0.195	0.077	0.297
T17	BT DH5	0	Rear Face	0	LPDDR3+eMMC	3	-	10	8.17	0.06	0.168	0.062	0.256
T18	BT DH5	0	Rear Face	0	EMCP	1	-	10	8.17	-0.09	0.204	0.067	0.311
T19	BT DH5	0	Rear Face	0	EMCP	2	-	10	8.17	0.01	0.171	0.058	0.261
T20	BT DH5	0	Rear Face	0	EMCP	3	-	10	8.17	0.02	0.131	0.051	0.200
T13	802.11ac80	58	Rear Face	1.3	LPDDR3+eMMC	1	off	15	14.73	0	0.131	0.036	0.139
T14	802.11ac80	58	Top Side	1.4	LPDDR3+eMMC	1	off	15	14.73	0.02	0.373	0.152	0.397
T15	802.11ac80	58	Rear Face	0	LPDDR3+eMMC	1	on	10	9.45	0.06	0.371	0.103	0.421
T16	802.11ac80	58	Top Side	0	LPDDR3+eMMC	1	on	10	9.45	-0.01	<b>0.596</b>	<b>0.140</b>	<b>0.676</b>
T17	802.11ac80	58	Top Side	0	LPDDR3+eMMC	2	on	10	9.45	0	0.473	0.138	0.537
T18	802.11ac80	58	Top Side	0	LPDDR3+eMMC	3	on	10	9.45	0.07	0.554	0.143	0.629
T19	802.11ac80	58	Top Side	0	EMCP	1	on	10	9.45	0	0.260	0.070	0.295
T20	802.11ac80	58	Top Side	0	EMCP	2	on	10	9.45	-0.02	0.231	0.068	0.262
T21	802.11ac80	58	Top Side	0	EMCP	3	on	10	9.45	0.09	0.201	0.061	0.228
T22	802.11ac80	106	Rear Face	1.3	LPDDR3+eMMC	1	off	15	14.82	0	0.169	0.061	0.176
T23	802.11ac80	106	Top Side	1.4	LPDDR3+eMMC	1	off	15	14.82	0	0.406	0.161	0.423
T24	802.11ac80	106	Rear Face	0	LPDDR3+eMMC	1	on	10	9.64	0.04	0.236	0.064	0.256
T25	802.11ac80	106	Top Side	0	LPDDR3+eMMC	1	on	10	9.64	0	<b>0.471</b>	<b>0.108</b>	<b>0.512</b>
T26	802.11ac80	122	Top Side	0	LPDDR3+eMMC	1	on	10	9.63	-0.02	0.294	0.077	0.320
T27	802.11ac80	106	Top Side	0	LPDDR3+eMMC	2	on	10	9.64	0.07	0.334	0.104	0.363
T28	802.11ac80	106	Top Side	0	LPDDR3+eMMC	3	on	10	9.64	0.14	0.417	0.116	0.453
T29	802.11ac80	106	Top Side	0	EMCP	1	on	10	9.64	0	0.174	0.046	0.189
T30	802.11ac80	106	Top Side	0	EMCP	2	on	10	9.64	-0.01	0.177	0.054	0.192
T31	802.11ac80	106	Top Side	0	EMCP	3	on	10	9.64	0.05	0.135	0.037	0.147
T32	802.11ac80	155	Rear Face	1.3	LPDDR3+eMMC	1	off	15	14.76	0	0.190	0.072	0.201
T33	802.11ac80	155	Top Side	1.4	LPDDR3+eMMC	1	off	15	14.76	0.12	0.310	0.126	0.328
T34	802.11ac80	155	Rear Face	0	LPDDR3+eMMC	1	on	10	9.41	-0.07	0.506	0.122	0.580
T35	802.11ac80	155	Top Side	0	LPDDR3+eMMC	1	on	10	9.41	0	<b>0.654</b>	<b>0.149</b>	<b>0.749</b>
T36	802.11ac80	155	Top Side	0	LPDDR3+eMMC	2	on	10	9.41	0.18	0.642	0.164	0.735
T37	802.11ac80	155	Top Side	0	LPDDR3+eMMC	3	on	10	9.41	-0.02	0.621	0.183	0.711
T38	802.11ac80	155	Top Side	0	EMCP	1	on	10	9.41	0	0.293	0.071	0.336
T39	802.11ac80	155	Top Side	0	EMCP	2	on	10	9.41	0.03	0.286	0.068	0.328
T40	802.11ac80	155	Top Side	0	EMCP	3	on	10	9.41	0.01	0.284	0.076	0.325

Note: The value with boldface is the maximum SAR Value of each test band.

## 9. MULTIPLE TRANSMITTER EVALUATION

The following tables list information which is relevant for the decision if a simultaneous transmit evaluation is necessary according to FCC KDB 447498D01 General RF Exposure Guidance v06.

The location of the antenna inside EUT and standalone SAR test exclusion, please refer to Appendix E.

### 9.1 SIMULTANEOUS TRANSMISSION CONDITIONS

WiFi antenna and BT antenna cannot transmit simultaneously.

## APPENDIX

### 1. Test Layout

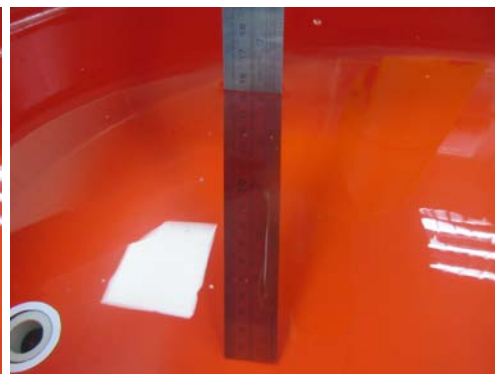
#### Specific Absorption Rate Test Layout



#### Liquid depth in the flat Phantom ( $\geq 15\text{cm}$ depth)

MSL\_2450MHz\_15.1cm

MSL\_5GHz\_15.5cm





## **Appendix A. SAR Plots of System Verification**

(Pls See BTL-FCC SAR-1-1904C015\_Appendix A.)

## **Appendix B. SAR Plots of SAR Measurement**

(Pls See BTL-FCC SAR-1-1904C015\_Appendix B.)

## **Appendix C. Calibration Certificate**

(Pls See BTL-FCC SAR-1-1904C015\_Appendix C.)

## **Appendix D. Photographs of the Test Set-Up**

(Pls See BTL-FCC SAR-1-1904C015\_Appendix D.)

## **Appendix E. Antenna location and standalone SAR test exclusion**

(Pls See BTL-FCC SAR-1-1904C015\_Appendix E.)

**End of Test Report**