FCC SAR Compliance Test Report

Product Name:	HUAWEI MediaPad M3 Lite
Model:	CPN-W09
Report No.:	SYBH(Z-SAR)016042017-2
FCC ID:	QISCPN-W09

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DATE	2017-06-28	2017-06-28

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REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2017-06-28	Deng Zhao

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1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for CPN-W09 is as below Table 1.

Band	Max Reported 1-g SAR (W/kg)
	Body(0mm)
WiFi 2.4G	**1.07**
BT	**/**
The highest reported SAR is 1.07W/kg per KDB690783 D01.	

Table 1:Summary of test result
Note: BT SAR test is not required per KDB447498D01.

The device is in compliance with Specific Absorption Rate(SAR)for general population/uncontraolled exposure limits according to the FCC rule §2.1093, the ANSI/IEEE C95.1:1992, the NCRP Report Number 86 for uncontrolled environment, according to the Industry Canada Radio Standards Specification RSS-102 for General Population/Uncontrolled exposure, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013

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1.2 RF exposure limits

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain/Body/Arms/Legs)	**1.60 W/kg**	8.00 W/kg
Spatial Average SAR** (Whole Body)	0.08 W/kg	0.40 W/kg
Spatial Peak SAR*** (Hands/Feet/Ankle/Wrist)	4.00 W/kg	20.00 W/kg

Table 2: RF exposure limits

The limit applied in this test report is shown in **bold** letters

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

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.

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1.3 EUT Description

Device Information:			
Product Name:	HUAWEI MediaPad M3 Lite		
Model:	CPN-W09		
FCC ID :	QISCPN-W09		
SN:	1#:KVPBBEB730600147 2#:KVPBBEB730600150 3#:MWUBB17417200045		
Device Type :	Portable device		
Device Phase:	Identical Prototype		
Exposure Category:	Uncontrolled environment / general population		
Hardware Version :	A088e		
Software Version :	CPN-W09C331B005SP01		
Antenna Type :	Internal antenna		
Device Operating Configurations:			
Supporting Mode(s)	WiFi 2.4G , BT		
Test Modulation	WiFi(DSSS/OFDM),BT(GFSK/π/4-DQPSK/8DPSK)		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	BT	2402-2480	
	WiFi 2.4G	2412-2462	
Test Channels :	802.11b/g/n 20M:1-2-3-4-5-6-7-8-9-10-11		

Table 3:Device information and operating configuration

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1.3.1 General Description

The HUAWEI MediaPad M3 Lite (M3 Lite for short) is an 8-inch tablet with a Qualcomm MSM8940 octa-core processor. The M3 Lite comes with an IPS screen with a resolution of 1920 x 1200 pixels.The M3 Lite runs Huawei's latest EMUI 5.1 OS, which is developed based on Google Android N (7.0).

Battery information:

Name	Manufacture	Serials number	Description
Li-ion	SCUD (FUJIAN) Electronics Co., Ltd	/	Battery Model: HB3080G1EBW Rated capacity: 4650 mAh Nominal Voltage: ⎓ +3.8V Charging Voltage: ⎓ +4.35V
	Harbin Coslight Power Co., Ltd	/	Battery Model: HB3080G1EBC Rated capacity: 4650 mAh Nominal Voltage: ⎓ +3.8V Charging Voltage: ⎓ +4.35V

1.3.2 Power reduction specification

This device uses a proximity sensor that shares the same metallic electrode as the main 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 device 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 of WIFI antenna to ensure SAR compliance. The test procedures in KDB 616217 is applied to determine proximity sensor triggering distances, and sensor coverage for normal and tilt positions. The detailed test configuration description are provided in Section 6 of this report.
The following tables summerize the key power reduction information.The detailed full power and reduced tune-up specifications and conducted power measurement results are provided in Section 7 of this report.

Band	WiFi antenna Power Reduction Amount (dB)	
	Sensor on	Sensor off
WiFi 2.4G (2 to 10CH)	5	0
WiFi 2.4G (1CH and 11CH)	3	

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1.4 Test specification(s)

ANSI C95.1:1992	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991)
IEEE Std 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
KDB447498 D01	General RF Exposure Guidance v06
KDB616217 D04	SAR for laptop and tablets v01r02
KDB248227 D01	SAR Guidance for IEEE 802 11 Wi-Fi SAR v02r02
KDB865664 D01	SAR measurement 100 MHz to 6 GHz v01r04
KDB865664 D02	SAR Reporting v01r02
KDB690783 D01	SAR Listings on Grants v01r03

1.5 Testing laboratory

Test Site	The Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Section G1,Huawei Base Bantian, Longgang District, Shenzhen 518129, P.R. China
Telephone	+86 755 28780808
Fax	+86 755 89652518
State of accreditation	The Test laboratory (area of testing) is accredited according to ISO/IEC 17025. CNAS Registration number: L0310 A2LA TESTING CERT #2174.01 & 2174.02 & 2174.03

1.6 Applicant and Manufacturer

Company Name	HUAWEI TECHNOLOGIES CO., LTD
Address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

1.7 Application details

Start Date of test	2017-06-23
End Date of test	2017-06-23

1.8 Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

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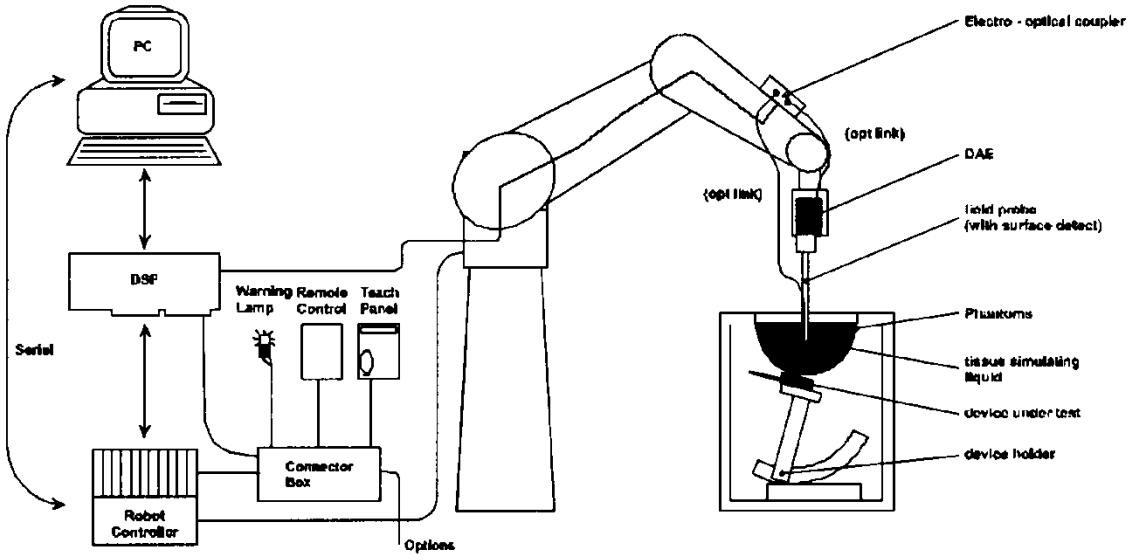
2 SAR Measurement System

2.1 SAR Measurement Set-up



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

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).

- 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.

- 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.
- A unit to operate the optical surface detector which is connected to the EOC.
- 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.
- 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.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System check dipoles allowing to validate the proper functioning of the system.

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2.2 Test environment

The DASY5 measurement system is placed at the head end of a room with dimensions:
5 x 2.5 x 3 m³, the SAM phantom is placed in a distance of 75 cm from the side walls and 1.1m from the rear wall. Above the test system a 1.5 x 1.5 m² array of pyramid absorbers is installed to reduce reflections from the ceiling.
Picture 1 of the photo documentation shows a complete view of the test environment.
The system allows the measurement of SAR values larger than 0.005 mW/g.

2.3 Data Acquisition Electronics description

The data acquisition electronics (DAE) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converte and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

DAE4

Input Impedance	200MOhm	
The Inputs	symmetrical and floating	
Common mode rejection	above 80 dB	

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2.4 Probe description

These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor (±2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.

Isotropic E-Field Probe ES3DV3 for Dosimetric Measurements

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 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)	
Dynamic range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones	

Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

Construction	Symmetrical design with triangular core 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: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic range	10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB(noise:typically<1µW/g)	
Dimensions	Overall length: 337 mm (Tip:20 mm) Tip diameter:2.5 mm (Body:12 mm) Typical distance from probe tip to dipole centers: 1mm	
Application	High precision dosimetric measurements in any exposure scenario(e.g.,very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%	

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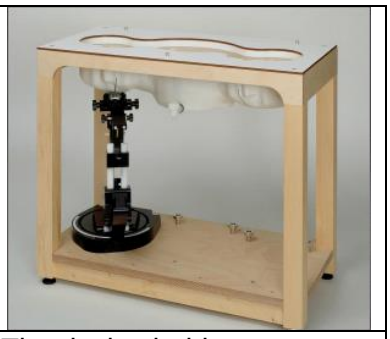
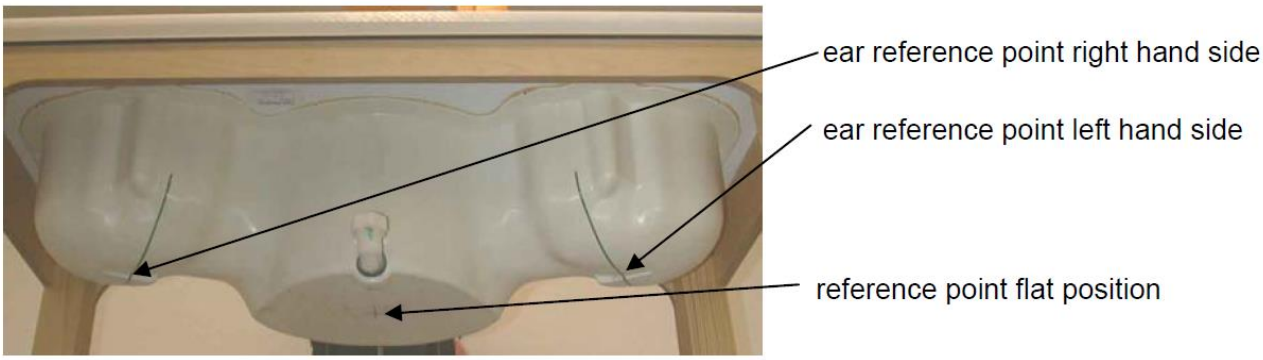
2.5 Phantom description

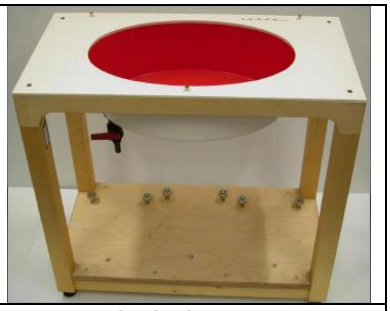
SAM Twin Phantom

Shell Thickness	2mm±0.2mm;The ear region:6.0±0.2mm	
Filling Volume	Approximately 25 liters	
Dimensions	Length:1000mm; Width:500mm; Height: adjustable feet	
Measurement Areas	Left hand Right hand Flat phantom	
The bottom plate contains three pairs 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 cover the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on top of this phantom cover are possible. Three reference marks are provided on the phantom counter. These reference marks are used to teach the absolute phantom position relative to the robot.		

The following figure shows the definition of reference point:



ELI4 Phantom

Shell Thickness	2mm±0.2mm	
Filling Volume	Approximately 30 liters	
Dimensions	Major axis:600mm; Minor axis:400mm;	
Measurement Areas	Flat phantom	
The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209-2 and all known tissue simulating liquids.		

The phantom shell material is resistant to all ingredients used in the tissue-equivalent liquid recipes. The shell of the phantom including ear spacers is constructed from low permittivity and low loss material, with a relative permittivity 2≤εr≤5 at ≤3 GHz,3≤ εr≤4 at >3 GHz and and a loss tangent ⩽0.05.

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2.6 Device holder description

The DASY5 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. 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. This device holder is used for standard mobile phones or PDA's only. If necessary an additional support of polystyrene material is used.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε =3 and loss tangent σ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.
The device holder permits the device to be positioned with a tolerance of ±1° in the tilt angle.

Larger DUT's (e.g. notebooks) cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values.
Therefore those devices are normally only tested at the flat part of the SAM.

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2.7 Test Equipment List

This table gives a complete overview of the SAR measurement equipment.
Devices used during the test described are marked ☒

	Manufacturer	Device	Type	Serial number	Date of last calibration*	Valid period
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	3736	2017-04-27	One year
☒	SPEAG	2450MHz Dipole	D2450V2	860	2016-11-23	Three years
☒	SPEAG	Data acquisition electronics	DAE4	852	2017-04-27	One year
☒	SPEAG	Software	DASY 5	N/A	NCR	NCR
☐	SPEAG	Twin Phantom	SAM1	TP-1475	NCR	NCR
☐	SPEAG	Twin Phantom	SAM2	TP-1474	NCR	NCR
☐	SPEAG	Twin Phantom	SAM3	TP-1597	NCR	NCR
☐	SPEAG	Twin Phantom	SAM4	TP-1620	NCR	NCR
☒	SPEAG	Flat Phantom	ELI 4.0	TP-1038	NCR	NCR
☐	SPEAG	Flat Phantom	ELI 5.0	TP-1111	NCR	NCR
☒	Agilent	Wireless Connectivity Test Set	N4010A	MY49081592	2016-08-05	One year
☒	R&S	Signal Analyser	FSV30	101195	2016-08-31	One year
☒	Agilent	Network Analyser	E5071C	MY46213349	2016-12-30	One year
☒	Agilent	Dielectric Probe Kit	85070E	2484	NCR	NCR
☒	Agilent	Signal Generator	E8257D	MY51500314	2017-04-25	One year
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA1402001	NCR	NCR
☒	AR	Directional Coupler	DC7144M1	31190	2017-05-26	One year
☒	R & S	Power Meter	NRP	100740	2016-07-20	One year
☒	R & S	Power Meter Sensor	NRP-Z11	106288	2016-07-07	One year
☒	Agilent	Power Meter	E4417A	MY45101339	2016-12-30	One year
☒	Agilent	Power Meter Sensor	E9321A	MY44420359	2016-12-30	One year

Note:

1) Per KDB865664D01 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 shorting block performed before measuring liquid parameters.

3) *All the equipments are within the valid period when the tests are performed.

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3 SAR Measurement Procedure

3.1 Scanning procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and system check. 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. +/- 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 ± 0.1mm). 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 ± 30°.)

- 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(⩽2GHz)，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.
  Results of this coarse scan are shown in Appendix B.

- 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: Δx_{zoom}, Δy_{zoom}⩽ 2GHz - ⩽8mm, 2-4GHz - ⩽5 mm and 4-6 GHz-⩽4mm; Δz_{zoom} ⩽3GHz - ⩽5 mm, 3-4 GHz- ⩽4mm and 4-6GHz-⩽2mm 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 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. A z-axis scan of the measurement with maximum SAR value is shown in Appendix B.

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

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

3.2 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, Computermathematik, 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, Computermathematik, 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 compansate boundary effects on E-field probes.

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3.3 Data Storage and Evaluation

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 "DAE4". 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/cm²], [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.

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	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

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 multimeter 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_i	= diode compression point	(DASY parameter)

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

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evaluated:

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

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)

$Norm_i$ = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)^2] for E-field Probes

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):

$$E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}$$

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

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

with SAR = local specific absorption rate in mW/g

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

σ = conductivity in [mho/m] or [Siemens/m]

ρ = equivalent tissue density in g/cm^3

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.

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

with P_{pwe} = equivalent power density of a plane wave in mW/cm^2

E_{tot} = total electric field strength in V/m

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

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4 System Verification Procedure

4.1 Tissue Verification

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectic parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ± 5% of the target values.

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

Ingredients (% of weight)	**Head Tissue**						
Frequency Band (MHz)	750	835	1750	1900	2300	2450	2600
Water	39.2	41.45	52.64	55.242	62.82	62.7	55.242
Salt (NaCl)	2.7	1.45	0.36	0.306	0.51	0.5	0.306
Sugar	57.0	56.0	0.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	47.0	44.542	36.67	36.8	44.452
Ingredients (% of weight)	**Body Tissue**						
Frequency Band (MHz)	750	835	1750	1900	2300	2450	2600
Water	50.3	52.4	69.91	69.91	73.32	73.2	64.493
Salt (NaCl)	1.60	1.40	0.13	0.13	0.06	0.04	0.024
Sugar	47.0	45.0	0.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	29.96	29.96	26.62	26.7	32.252

Table 4: Tissue Dielectric Properties

Salt: 99+% Pure Sodium Chloride; Sugar: 98+% Pure Sucrose; Water: De-ionized, 16MΩ+ 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

☐**Simulating Head Liquid (HBBL600-6000MHz), Manufactured by SPEAG:**

Ingredients	(% by weight)
Water	50-65%
Mineral oil	10-30%
Emulsifiers	8-25%
Sodium salt	0-1.5%

☒**Simulating Body Liquid (MBBL600-6000MHz),Manufactured by SPEAG:**

Ingredients	(% by weight)
Water	60-80%
Esters,Emulsifiers,Inhibitors	20-40%
Sodium salt	0-1.5%

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Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Deviation (Within +/-5%)		Liquid Temp.	Test Date
		εr	σ (S/m)	εr	σ (S/m)	$\Delta\varepsilon_r$	Δσ		
Body	2410	52.80	1.91	51.51	1.967	-2.44%	2.98%	21.4°C	2017/06/23
	2435	52.70	1.94	51.50	1.995	-2.28%	2.84%		
	2450	52.70	1.95	51.51	2.011	-2.28%	3.13%		
	2460	52.70	1.96	51.49	2.019	-2.30%	3.01%		

Table 5:Measured Tissue Parameter

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.

4.2 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(Graphic Plot(s) see Appendix A).

System Check	**Target SAR (1W)**		**Measured SAR (Normalized to 1W)**		**Deviation (Within +/-10%)**		**Liquid Temp.**	**Test Date**
	1-g (W/kg)	**10-g (W/kg)**	**1-g (W/kg)**	**10-g (W/kg)**	**Δ1-g**	**Δ10-g**		
2450MHz Body	50.60	23.80	53.60	24.60	5.93%	3.36%	21.4°C	2017/06/23

Table 6:System Check Results

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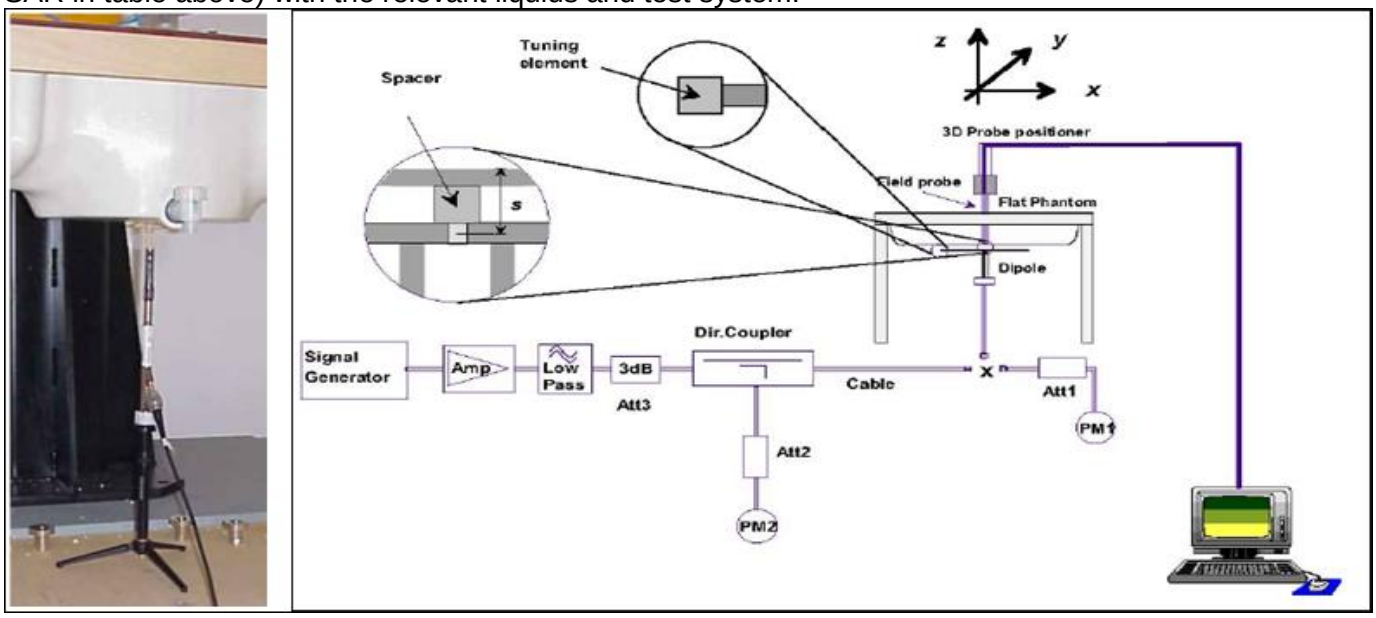
4.3 System check Procedure

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 (result on plot).

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.



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5 SAR measurement variability and uncertainty

5.1 SAR measurement variability

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04, 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 ⩾ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ⩾ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ⩾ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

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 7.2.

5.2 SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04,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.

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6 SAR Test Configuration

6.1 Test Positions Configuration

The overall diagonal dimension of the tablet is > 20 cm. Per FCC KDB616217D04, the back side and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR Exclusion Threshold in FCC KDB 447498D01 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.

The device does not have telephone receiver. Next to the ear operation is not supported. Voice mode is limited to speaker mode and headset operations only, so additional Head SAR testing for this type of voice use is not required per KDB616217D04.

6.2 WiFi Test Configuration

For WiFi SAR testing, a communication link is set up with the testing software for WiFi mode test. During the test,at the each test frequency channel, the EUT is operated at the RF continuous emission mode. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. The test procedures in KDB 248227D01 are applied.

6.2.1 Initial Test Position Procedure

For exposure condition with multiple test position, such as handsets operating next to the ear, devices with hotspot mode or UMPC mini-tablet , 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 position in an exposure condition. The test position with the highest extrapolated(peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, 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 ≤ 1.2 W/kg or all required channels are tested.

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6.2.2 Initial Test Configuration Procedure

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required (see section 5.3.2 of KDB 248227D01). SAR test reduction of subsequent highest output test channels is based on the *reported* SAR of the initial test configuration.

For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode. For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration.

When the *reported* SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the *reported* SAR is ≤ 1.2 W/kg or all required channels are tested.

6.2.3 Sub Test Configuration Procedure

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units.

When the highest reported SAR for the initial test configuration, according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ⩽ 1.2 W/kg, SAR is not required for that subsequent test configuration.

6.2.4 WiFi 2.4G SAR Test Procedures

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions.

A) 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 (section 3.1 of of KDB 248227D01v02) for the exposure configuration is ≤ 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.

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B) 2.4GHz 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 (section 5.3 of of KDB 248227D01v02r02). 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 ≤ 1.2 W/kg.

C) SAR Test Requirements for OFDM configurations

When SAR measurement is required for 802.11 g/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

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6.3 Proximity sensor power reduction Configurations

Per KDB616217, this device uses a proximity sensor that shares the same metallic electrode as the main 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 device 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 of WIFi antenna to ensure SAR compliance.

In order to validate the power change before and after sensor power reduction in WiFi non signaling mode, a specific external test software and chipset based internal test modes are used in sensor triggering power measurement validation tests. It can be ensured that the unmodified settings in production units, including maximum output power, amplifier gain and other RF performance or tuning parameters, are used for SAR measurement per KDB248227.

The following tables summerize the key power reduction information for proximity sensor. The test procedures in KDB 616217 should be applied to determine proximity sensor triggering distances, and sensor coverage for normal and tilt positions. To ensure all production units are compliant, it is generally necessary to reduce the triggering distance determined from the triggering tests by 1 mm, or more if it is necessary, and use the smallest distance for movements to and from the phantom, minus 1 mm, as the sensor triggering distance for determining the SAR measurement distance.

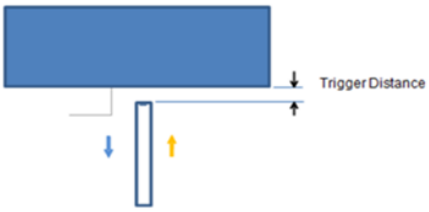
WiFi antenna				
Band	Sensor Trigger Distance	Full power level (dBm)	Reduced power level (dBm)	Power reduction amount (dB)
WiFi 2.4G (2~10CH)	Back side:9mm Top side:11mm Right side 5mm	16.5	11.5	5
WIFi 2.4G (1CH and 11CH)	Back side:9mm Top side:11mm Right side 5mm	14.5	11.5	3

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 front side, back side and bottom 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 are as below:

Picture:Proximity sensor trigging distances assesment for the back side



Picture:Proximity sensor trigging distances assesment for the Top side

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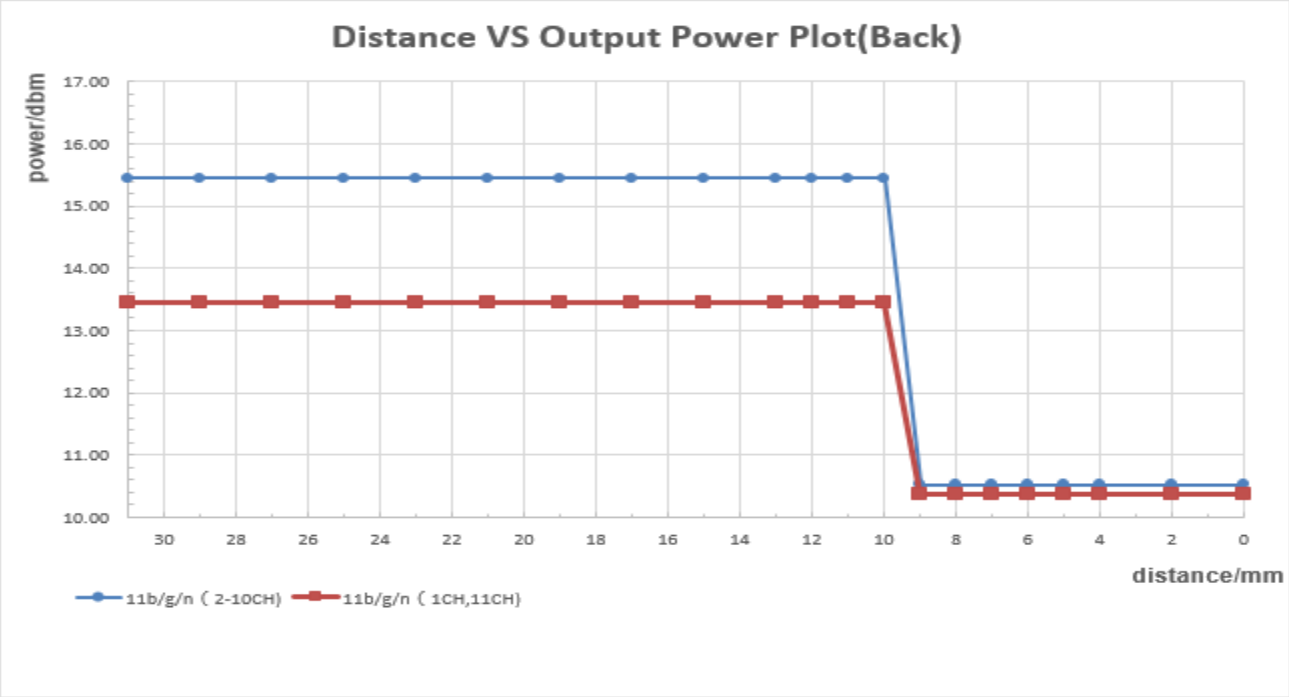
Table: Summary of Trigger Distances

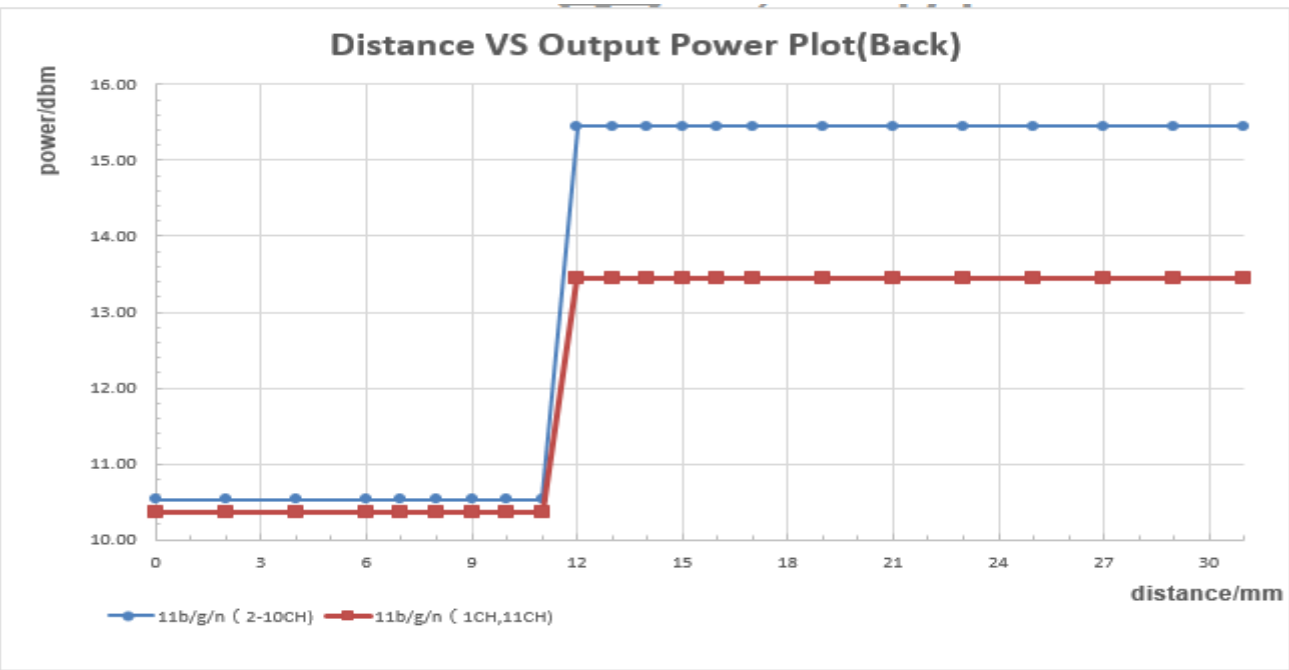
Band(MHz)	Trigger distance-Back Side		Trigger distance-Top Side		Trigger distance-Right Side	
	Moving toward phantom	Moving away from phantom	Moving toward phantom	Moving away from phantom	Moving toward phantom	Moving away from phantom
WiFi 2.4G 11b	9mm	9mm	11mm	11mm	5mm	5mm

The detailed conducted power measurement data to determine the triggering distances is as below:

The DUT(Back side of WiFi 2.4G) is moved towards the flat phantom:



The DUT(Back side of WiFi 2.4G) is moved away from the flat phantom:



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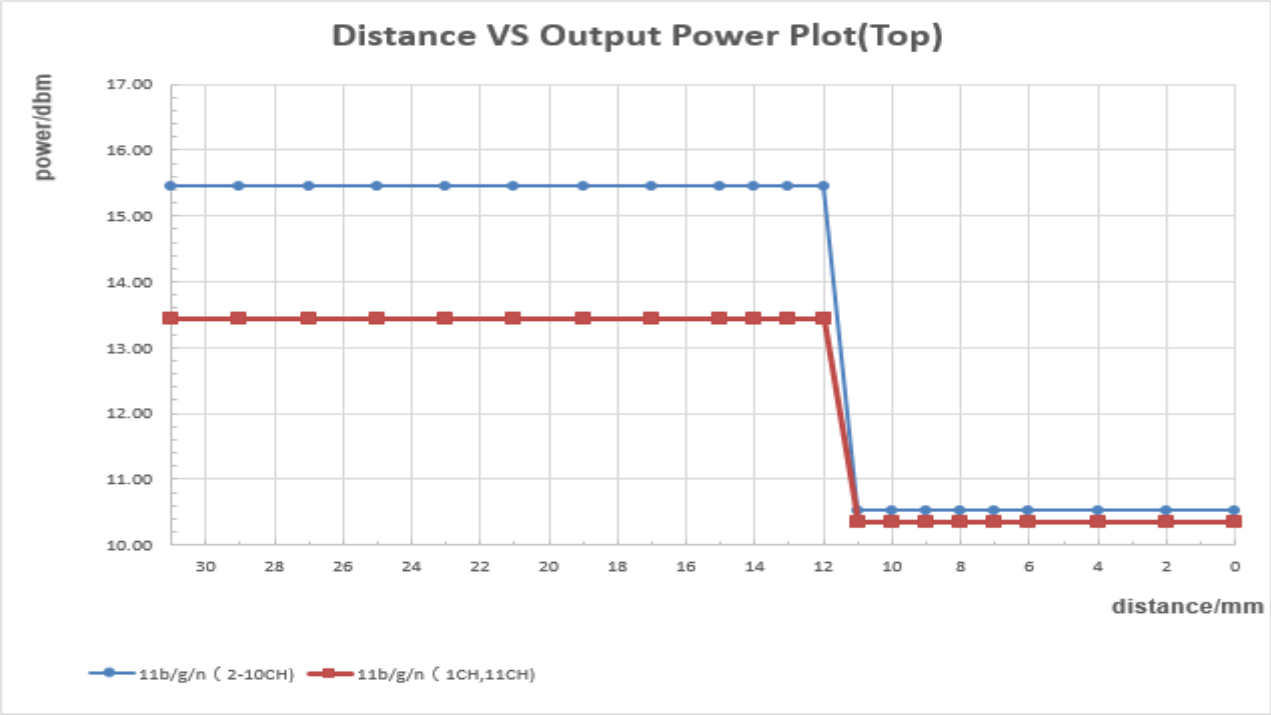
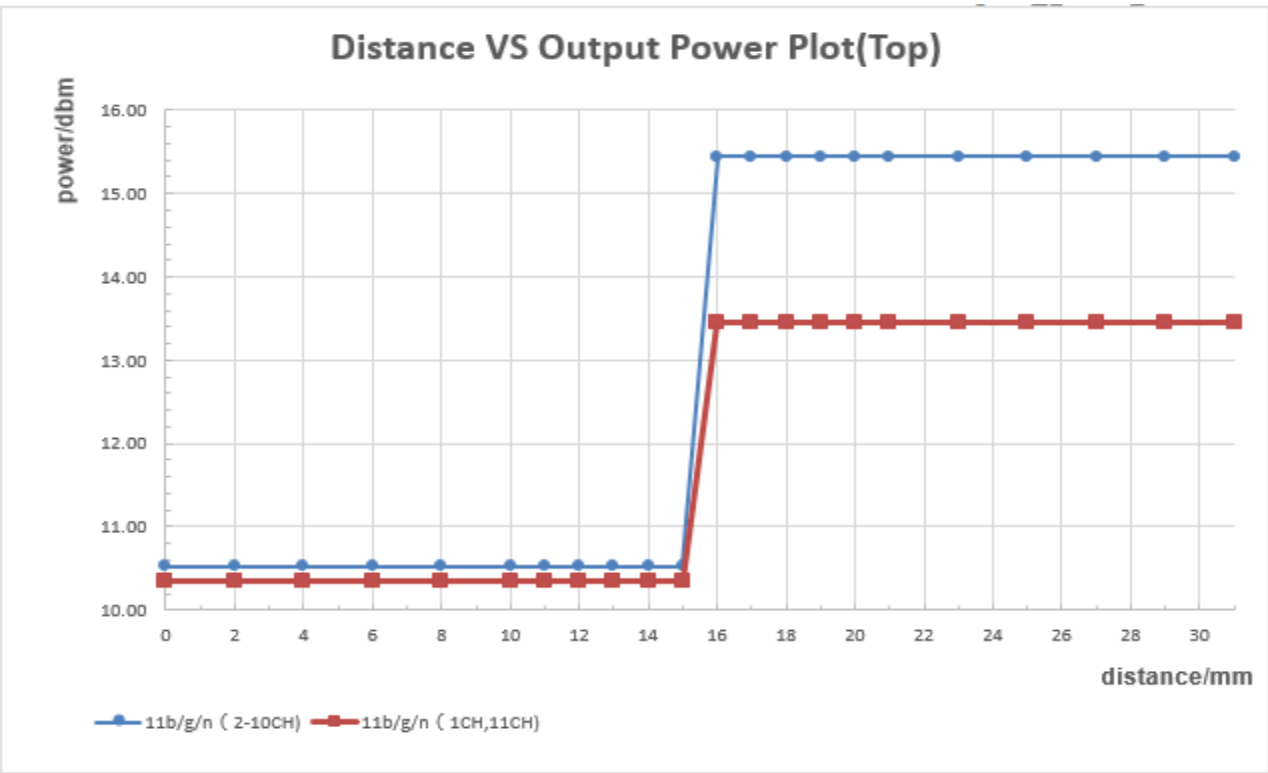
The DUT(Top side of WiFi 2.4G) is moved towards the flat phantom:



The DUT(Top side of WiFi 2.4G) is moved away from the flat phantom:



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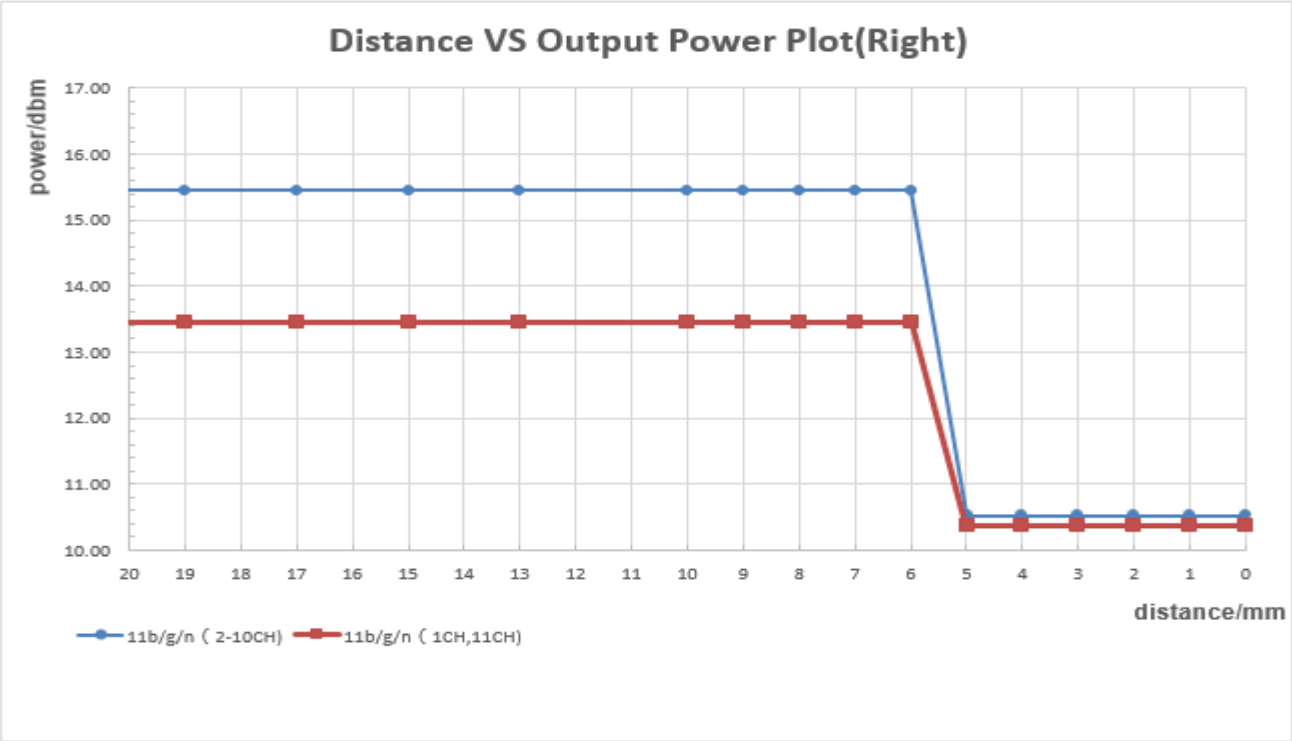
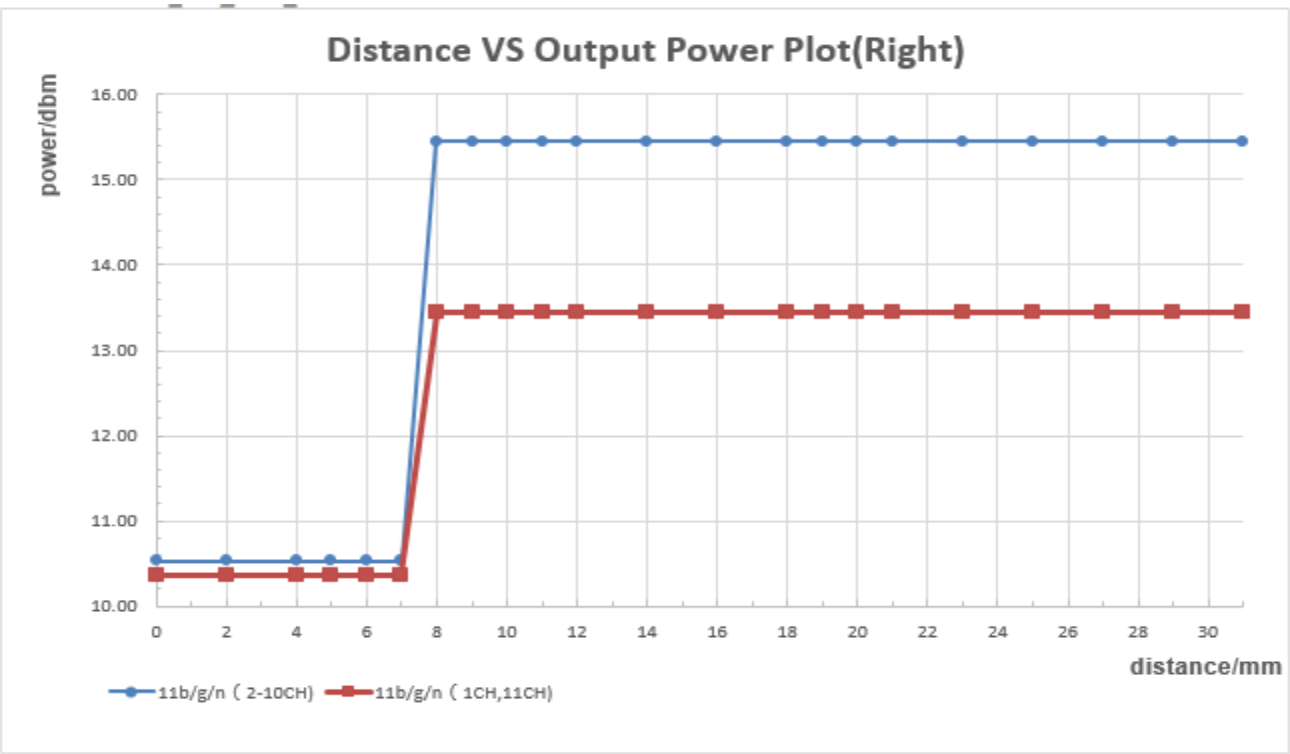
The DUT(Right side of WiFi 2.4G) is moved towards the flat phantom:



The DUT(Right side of WiFi 2.4G) is moved away from the flat phantom:



Conclusion: It can be ensured that the proximity sensor can be valid triggered for the body exposure condition(WiFi 2.4G).

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2) Procedures for determining antenna and proximity sensor coverage

There is no spatial offset between the Main antenna and the proximity sensor element, so procedures for determining the proximity sensor coverage does not need to be assessed.

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 top side and right side parallel to the base of the flat phantom for each band.

The EUT was rotated about top side and right side for angles up to +/- 45°. 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 +/- 45°.

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

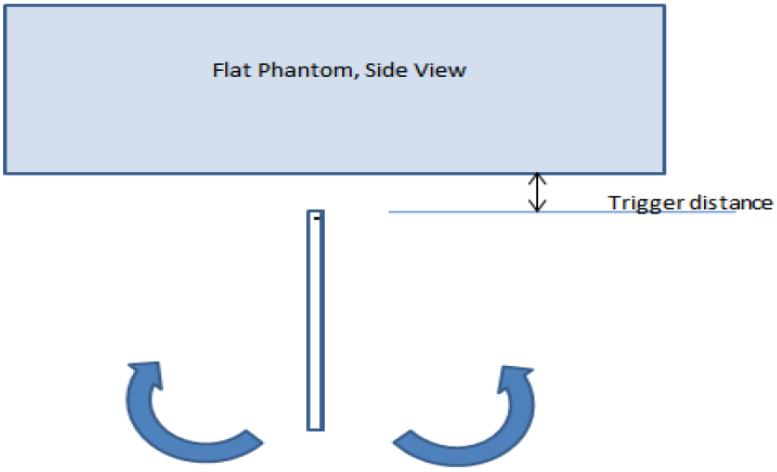

Table: Summary of Tablet Tilt Angle Influence to Proximity Sensor Triggering(Top side)

Band(MHz)	Minimum trigger distance at which power reduction was maintained over ±45°	Power Reduction Status										
		-45°	-35°	-25°	-15°	-5°	0°	5°	15°	25°	35°	45°
WiFi 2.4G	11mm	on	on	on	on	on	on	on	on	on	on	on

Table: Summary of Tablet Tilt Angle Influence to Proximity Sensor Triggering(Right side)

Band(MHz)	Minimum trigger distance at which power reduction was maintained over ±45°	Power Reduction Status										
		-45°	-35°	-25°	-15°	-5°	0°	5°	15°	25°	35°	45°
WiFi 2.4G	5mm	on	on	on	on	on	on	on	on	on	on	on

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Conclusion: It can be ensured that the proximity sensor can be valid triggered for the DUT tilt coverage exposure condition (WiFi 2.4G bands of WiFi Antenna).

SAR test Plan:

1) Since the capacitive proximity sensor triggering distance for the Back side is 9 mm , a conservative distance of 8 mm was requried for addtional SAR test at maximum power level with sensor off per KDB 616217.

2) Since the capacitive proximity sensor triggering distance for the Top side is 11 mm , a conservative distance of 10 mm was requried for addtional SAR test at maximum power level with sensor off per KDB 616217.

3) Since the capacitive proximity sensor triggering distance for the Right side is 5 mm , a conservative distance of 4 mm was requried for addtional SAR test at maximum power level with sensor off per KDB 616217.

4) SAR tests with proximity sensor power reduction are only required for the sides of frequency bands in the table above. For the other sides or other frequency bands of the device, SAR is still tested at the maximum power level with sensor off.

6.4 BT Test Configuration

For BT testing, the EUT's BT test mode is open and the EUT is connected with N4010A which provides continuous transmitting RF signal with maximum output power.

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7 SAR Measurement Results

7.1.1 Conducted power measurements of WiFi 2.4G

Mode	Channel	Frequency (MHz)	Tune up	Average Power (dBm)	SAR Test (Yes/No)
802.11b	1	2412	14.5	13.45	No
	2	2417	16.5	15.10	No
	3	2422	16.5	15.21	No
	4	2427	16.5	15.45	No
	5	2432	16.5	15.23	No
	6	2437	16.5	15.37	No
	7	2442	16.5	15.26	No
	8	2447	16.5	**15.45**	Yes
	9	2452	16.5	15.14	No
	10	2457	16.5	15.41	No
	11	2462	14.5	13.80	No
802.11g	1	2412	14.5	12.91	No
	2	2417	16.5	14.70	No
	3	2422	16.5	14.72	No
	4	2427	16.5	15.00	No
	5	2432	16.5	15.17	No
	6	2437	16.5	15.12	No
	7	2442	16.5	15.03	No
	8	2447	16.5	15.07	No
	9	2452	16.5	14.79	No
	10	2457	16.5	15.15	No
	11	2462	14.5	13.42	No
802.11n 20M	1	2412	14.5	13.16	No
	2	2417	16.5	14.91	No
	3	2422	16.5	14.84	No
	4	2427	16.5	15.09	No
	5	2432	16.5	14.93	No
	6	2437	16.5	15.00	No
	7	2442	16.5	14.98	No
	8	2447	16.5	15.05	No
	9	2452	16.5	15.07	No
	10	2457	16.5	14.84	No
	11	2462	14.5	13.24	No

Table 7: Conducted power measurement results of WiFi 2.4G(Full power)

Note : For this device, different maximum output power is specified across the channels in a Wi-Fi transmission mode, the maximum specified output power of WiFi 2.4G ch1 and 11 is reduced.So the additional conducted power measurement for the adjacent channel 2 to 10 is performed. The general WiFi SAR test or test reduction procedures in KDB 248227 is applied and considered for all required channels.

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Mode	Channel	Frequency (MHz)	Tune up	Average Power (dBm)	SAR Test (Yes/No)
802.11b	1	2412	11.5	10.36	No
	2	2417	11.5	10.20	No
	3	2422	11.5	10.40	No
	4	2427	11.5	10.40	No
	5	2432	11.5	9.95	No
	6	2437	11.5	9.85	No
	7	2442	11.5	10.51	No
	8	2447	11.5	**10.53**	Yes
	9	2452	11.5	**10.62**	Yes
	10	2457	11.5	10.51	No
	11	2462	11.5	10.52	No
802.11g	1	2412	11.5	10.19	No
	2	2417	11.5	10.13	No
	3	2422	11.5	9.68	No
	4	2427	11.5	10.01	No
	5	2432	11.5	10.59	No
	6	2437	11.5	10.26	No
	7	2442	11.5	11.00	No
	8	2447	11.5	10.57	No
	9	2452	11.5	9.99	No
	10	2457	11.5	10.42	No
	11	2462	11.5	10.49	No
802.11n 20M	1	2412	11.5	10.06	No
	2	2417	11.5	9.62	No
	3	2422	11.5	10.35	No
	4	2427	11.5	10.48	No
	5	2432	11.5	9.80	No
	6	2437	11.5	9.86	No
	7	2442	11.5	10.85	No
	8	2447	11.5	10.48	No
	9	2452	11.5	10.75	No
	10	2457	11.5	9.84	No
	11	2462	11.5	10.43	No

Table 8: Conducted power measurement results of WiFi 2.4G(Sensor on)

Note: 1) The Average conducted power of WiFi is measured with RMS detector.

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7.1.2 Conducted power measurements of BT

The output power of BT antenna is as following:

BT 2450	Tune-up	Average Conducted Power (dBm)		
		0CH	39CH	78CH
DH5	9.50	6.33	7.12	6.25
2DH5	9.50	4.30	4.45	3.81
3DH5	9.50	4.16	5.08	4.17

BT 2450	Tune-up	Average Conducted Power (dBm)		
		0CH	19CH	39CH
BT BLE	9.50	6.58	6.50	6.48

Table 9: Conducted power measurement results of BT.

Note: The conducted power of BT is measured with RMS detector.

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7.2 SAR measurement Results

General Notes:

1) Per KDB447498 D01v06, all SAR measurement results are scaled to the maximum tune-up tolerance limit to demonstrate SAR compliance.

2) Per KDB447498 D01v06, 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:

● ≤ 0.8W/kg for 1-g or 2.0W/kg for 10-g respectively, when the transmission band is ≤ 100MHz.

● ≤ 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.

● ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz.

When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.

3) Per KDB865664 D01v01r04,for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%, and the measured SAR <1.45W/Kg, only one repeated measurement is required.

4) Per KDB865664 D02v01r01, 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(Refer to the blue SAR test results in the tables of Section 7.3 and appendix B for detailed SAR plots).

WiFi Notes:

Per KDB248227D01:

1) When reported SAR for the initial test position is ≤ 0.4W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, 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 ≤ 1.2 W/kg or all required channels are tested.

2) The highest SAR measured for the initial test position or initial test configuration should be used to determine SAR test exclusion according to the sum of 1-g SAR and SAR peak to location ratio provisions in KDB 447498D01. In addition, a test lab may also choose to perform standalone SAR measurements for test positions and 802.11 configurations that are not required by the initial test position or initial test configuration procedures and apply the results to determine simultaneous transmission SAR test exclusion, according to sum of 1-g and SAR peak to location ratio requirements to reduce the number of simultaneous transmission SAR measurements.

3) For WiFi 2.4G , SAR is measured for 2.4 GHz 802.11b DSSS using the initial test position procedure. SAR is not required for the 2.4 GHz 802.11g/n OFDM conditions when KDB Publication 447498 SAR test exclusion applies to the OFDM configuration or when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

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7.2.1 SAR measurement Result of WiFi 2.4G

Test Position of Body	Dist.	Test channel /Freq. (MHz)	Test Mode	Area Scan 1-g SAR（W/kg）	SAR Value (W/kg)		Power Drift (dB)	Actual duty factor	Scaled SAR1-g (W/kg)	Conducted Power (dBm)	Tune-up Power (dBm)	Reported SAR1-g (W/kg)	Accessory Information	SAR Plot.
					1-g	10-g								
Back Side	0mm	9/2452	802.11b	0.808	0.776	0.312	0.00	98.00%	0.792	10.62	11.50	0.970	Battery 1#	/
Right Side	0mm	9/2452	802.11b	0.55	0.496	0.19	0.11	98.00%	0.506	10.62	11.50	0.620	Battery 1#	/
Top Side	0mm	9/2452	802.11b	0.483	0.545	0.199	-0.11	98.00%	0.556	10.62	11.50	0.681	Battery 1#	/
Back Side	0mm	8/2447	802.11b	0.821	**0.837**	0.337	0.00	98.00%	**0.854**	10.53	11.50	**1.068**	Battery 1#	Yes
Back Side-Repeated	0mm	8/2447	802.11b	0.843	0.720	0.295	0.00	98.00%	0.735	10.53	11.50	0.919	Battery 1#	/
Back Side	0mm	8/2447	802.11b	0.797	0.678	0.279	0.00	98.00%	0.692	10.53	11.50	0.865	Battery 2#	/
Additional SAR test with sensor off per KDB616217														
Back Side	8mm	8/2447	802.11b	0.403	0.369	0.192	-0.05	98.00%	0.377	15.45	16.50	0.480	Battery 1#	/
Right Side	4mm	8/2447	802.11b	0.765	0.704	0.322	0.12	98.00%	0.718	15.45	16.50	0.915	Battery 1#	/
Top Side	10mm	8/2447	802.11b	0.196	0.194	0.084	0.10	98.00%	0.198	15.45	16.50	0.252	Battery 1#	/

Table 10: Body SAR test results of WiFi 2.4G

Note: SAR is not required for the 2.4 GHz 802.11g/n OFDM conditions since the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is < 1.2 W/kg.

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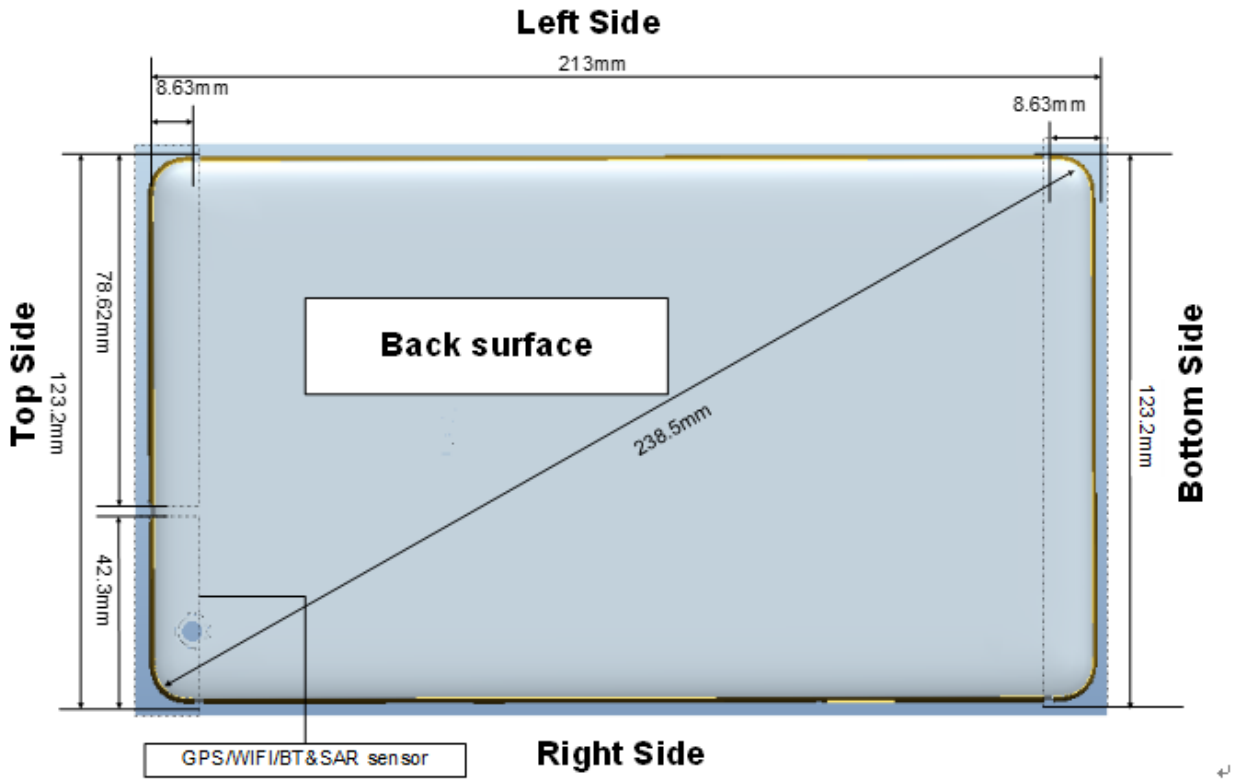
7.3 Multiple Transmitter Evaluation

The following tables list information which is relevant for the decision if a simultaneous transmit evaluation is necessary according to FCC KDB 447498 D01 General RF Exposure Guidance v06.
The location of the antennas inside the device is shown as below picture:



Note:
1) Per KDB 616217, because the diagonal Length is ＞200mm, it is considered a “ tablet” device and need to test 0mm 1g Body SAR.
2) WiFi 2.4G and BT can’t transmit simultaneously.

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7.3.1 Standalone SAR exclusion calculation

Per FCC KDB 447498D01v06:

1) The 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

2) 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) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz

b) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm) • 10] mW at > 1500 MHz and ≤ 6 GHz

(Antenna to adjacent sides<50mm)

Band	Exposure Condition	f(GHz)	Pmax	Pmax	Seperation Distance(mm)					Calculated Value					SAR Test(yes or no)				
			(dBm)*	(mW)	Back side	Left side	Right side	Top side	Bottom side	Back side	Left side	Right side	Top side	Bottom side	Back side	Left side	Right side	Top side	Bottom side
WiFi 2.4G	Body 0mm	2.450	16.50	44.67	5.0	78.6	5.0	5.0	204.4	13.983	>50mm	13.983	13.983	>50mm	Yes	>50mm	Yes	Yes	>50mm
BT	Body 0mm	2.450	9.50	8.91	5.0	78.6	5.0	5.0	204.4	2.790	>50mm	2.790	2.790	>50mm	No	>50mm	No	No	>50mm

(Antenna to adjacent sides >50mm)

Band	Exposure Condition	f(GHz)	Pmax	Pmax	Seperation Distance(mm)					Calculated Threshold Value					SAR Test(yes or no)				
			(dBm)*	(mW)	Back side	Left side	Right side	Top side	Bottom side	Back side	Left side	Right side	Top side	Bottom side	Back side	Left side	Right side	Top side	Bottom side
WiFi 2.4G	Body 0mm	2.450	16.50	44.67	5.0	78.6	5.0	5.0	204.4	<50mm	382.30	<50mm	<50mm	1640.20	<50mm	No	<50mm	<50mm	No
BT	Body 0mm	2.450	9.50	8.91	5.0	78.6	5.0	5.0	204.4	<50mm	382.30	<50mm	<50mm	1640.20	<50mm	No	<50mm	<50mm	No

Note :According to the table above,

1) WiFi 2.4G SAR test is only required for Top side , Back side, Right side per KDB447498.

2) BT SAR test is not required for all sides.

7.3.2 Simultaneous Transmission Conlcusion

The device only has one WiFi/BT Tx antenna. WiFi 2.4G and BT can't transmit simultaneously therefore simultaneous transmission SAR is not required per KDB 447498 D01.

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Appendix A. System Check Plots

(Pls See Appendix No.: SYBH(Z-SAR)016042017-2A, total: 4 pages)

Appendix B. SAR Measurement Plots

(Pls See Appendix No.: SYBH(Z-SAR)016042017-2B, total: 2 pages)

Appendix C. Calibration Certificate

(Pls See Appendix No.: SYBH(Z-SAR)016042017-2C, total: 26 pages)

Appendix D. Photo documentation

(Pls See Appendix No.: SYBH(Z-SAR)016042017-2D, total: 5 pages)

End

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