HUAWEI

TESTING No. L0310

ACCREDITED TESTING CERT #2174.01

FCC SAR Compliance Test Report

Product Name: HUAWEI MediaPad T1 10

Model: T1-A21w

Report No.: SYBH(Z-SAR)024012015-2

FCC ID: QIST1-A21W

	APPROVED (Lab Manager)	PREPARED (Test Engineer)
BY	Wei Huanbin	Pan Man
DATE	2015-02-14	2015-02-14

Reliability Laboratory of Huawei Technologies Co., Ltd.

Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

Tel: +86 755 28780808 Fax: +86 755 89652518

Table of Contents

※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2015-02-14	Pan Man

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for T1-A21w is as below Table 1.

Band	MAX Reported SAR_{1g} (W/kg)
	Body 0mm
WiFi 2.4G	1.413
WiFi 5G	1.410

Table 1:Summary of test result

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 1528-2003 & IEEE Std 1528a-2005.

1.2 RF exposure limits

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

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.

1.3 EUT Description

Device Information:			
Product Name:	HUAWEI MediaPad T1 10		
Models:	T1-A21w		
FCC ID :	QIST1-A21W		
SN No.:	66Y0115120000117		
Device Type :	Portable device		
Device Phase:	Identical Prototype		
Exposure Category:	Uncontrolled environment / general population		
Hardware Version :	SH1T1A21LM		
Software Version :	T1-A21w V100R001C001		
Antenna Type :	Internal antenna		
Device Operating Configurations:			
Supporting Mode(s)	WiFi 2.4G/ WiFi 5G(Tested); BT(Untested)		
Test Modulation	WiFi(DSSS/OFDM)		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WiFi 2.4G	2412-2462	
	WiFi 5G	5150-5250	
		5250-5350	
		5470-5725	
		5725-5850	
	BT	2402-2480	
	1-6-11 (WiFi 2.4G)		
	802.11a/11n 20M:36-40-44-48-52-56-60-64-100-104-108-112-116-132-136-140-149-153-157-161-165(WiFi 5G)		
	802.11n 40M:38-46-54-62-102-110-134-151-159(WiFi 5G)		
	0-19-39-78(BT)		

Table 3:Device information and operating configuration
Note : *5600MHz-5650MHz is notched.

1.3.1 General Description

错误！未知的文档属性名称 错误！未提供属性名称 MediaPad T1 10 (MediaPad T1 10 for short) is a 9.6-inch tablet that incorporates a Qualcomm MSM8916 chip, and a 28 nm A53 quad-core at 1.2 GHz. With support Wi-Fi data connections, MediaPad T1 10 provides users with unprecedented access to high-speed Internet services.

Battery information:

Name	Manufacture	Serials number	Description
Li-ion Battery	Huawei Technologies Co.,Ltd.	NA	Battery Model: HB3080G1EBC Rated capacity: 4800 mAh Nominal Voltage: ⎓ +3.8V Charging Voltage: ⎓ +4.35V

1.4 Test specification(s)

ANSI Std 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 1528-2003	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
IEEE Std 1528a-2005	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques Amendment 1: CAD File for Human Head Model (SAM Phantom)
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 4 of March 2010)
KDB447498 D01	General RF Exposure Guidance v05r02
KDB248227 D01	SAR meas for 802.11 a/b/g v01r02
KDB616217 D04	SAR for laptop and tablets v01r01
KDB865664 D01	SAR measurement 100 MHz to 6 GHz v01r03
KDB865664 D02	SAR Reporting v01r01
KDB690783 D01	SAR Listings on Grants v01r03

1.5 Testing laboratory

Test Site	The Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Zone K3,Huawei Industrial Base, Bantian Industry Area, Longgang District, Shenzhen, Guangdong, 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

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

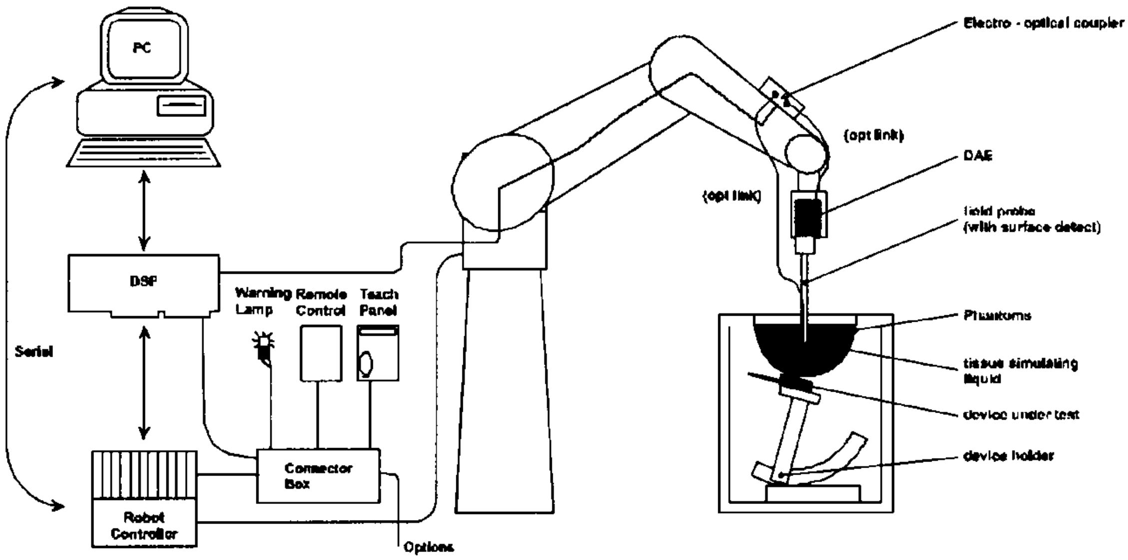
Start Date of test	2015-02-04
End Date of test	2015-02-08

1.8 Ambient Condition

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

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.

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	

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

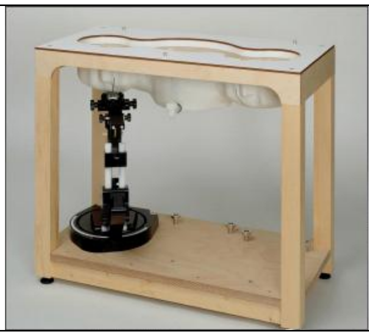
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 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

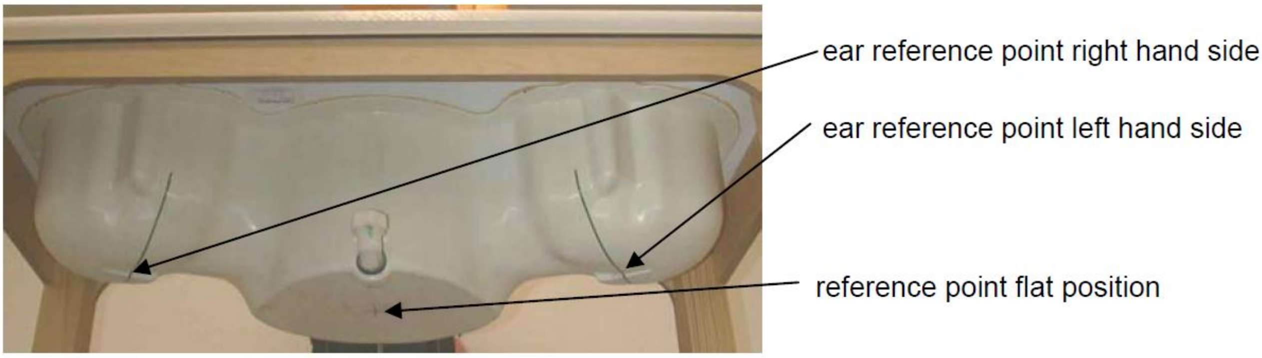
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to >6 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity	± 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%	

2.5 Phantom description

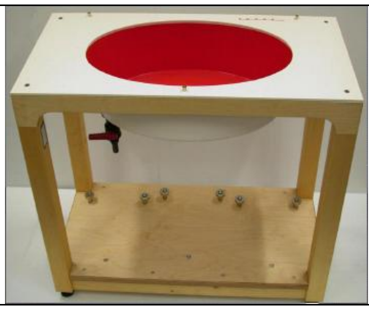
SAM Twin Phantom

Shell Thickness	2mm +/- 0.2 mm; The ear region: 6mm	
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 +/- 0.2 mm	
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 $2 \le \varepsilon_r \le 5$ at ≤3 GHz,$3 \le \varepsilon_r \le 4$ at >3 GHz and and a loss tangent $\leqslant 0.05$.

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.

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	2014-04-24	One year
☒	SPEAG	Dosimetric E-Field Probe	ES3DV3	3168	2014-09-24	One year
☐	SPEAG	835 MHz Dipole	D835V2	4d059	2013-05-02	Three years
☐	SPEAG	1750 MHz Dipole	D1750V2	1123	2014-07-08	Three years
☐	SPEAG	1900 MHz Dipole	D1900V2	5d143	2014-09-23	Three years
☒	SPEAG	2450 MHz Dipole	D2450V2	860	2014-11-19	Three years
☐	SPEAG	2600 MHz Dipole	D2600V2	1021	2014-07-16	Three years
☒	SPEAG	5GHz Dipole	D5GHzV2	1155	2014-04-21	Three years
☒	SPEAG	Data acquisition electronics	DAE4	852	2014-04-30	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
☐	R & S	Universal Radio Communication Tester	CMU 200	111379	2014-07-11	One year
☐	R & S	Universal Radio Communication Tester	CMW 500	126855	2014-07-11	One year
☒	Agilent	Network Analyser	E5071C	MY46213349	2014-02-25	One year
☒	Agilent	Dielectric Probe Kit	85070E	2484	NCR	NCR
☒	Agilent	Signal Generator	N5181A	MY47420989	2015-01-07	One year
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA1402001	NCR	NCR
☒	MINI-CIRCUITS	Amplifier	ZVE-8G+	129601322	NCR	NCR
☒	AR	Directional Coupler	DC7144M1	0423264	2014-04-02	One year
☒	R & S	Power Meter	NRP	100740	2014-07-11	One year
☒	R & S	Power Meter Sensor	NRP-Z11	106288	2014-07-11	One year
☒	Agilent	Power Meter	E4417A	MY45101339	2015-01-07	One year
☒	Agilent	Power Meter Sensor	E9321A	MY44420359	2015-01-07	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 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}, $\Delta y_{zoom} \leq$ 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.

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*Δz_{Zoom}(n-1)	≥30mm
2-3GHz	≤12mm	≤5mm	≤5mm	≤4mm	≤1.5*Δz_{Zoom}(n-1)	≥30mm
3-4GHz	≤12mm	≤5mm	≤4mm	≤3mm	≤1.5*Δz_{Zoom}(n-1)	≥28mm
4-5GHz	≤10mm	≤4mm	≤3mm	≤2.5mm	≤1.5*Δz_{Zoom}(n-1)	≥25mm
5-6GHz	≤10mm	≤4mm	≤2mm	≤2mm	≤1.5*Δz_{Zoom}(n-1)	≥22mm

3.2 Spatial Peak SAR Evaluations

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.

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 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.

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

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

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)	Body Tissue					
Frequency Band (MHz)	750	835	1750	1900	**2450**	2600
Water	50.3	52.4	69.91	69.91	73.2	64.493
Salt (NaCl)	1.60	1.40	0.13	0.13	0.04	0.024
Sugar	47.0	45.0	0.0	0.0	0.0	0.0
HEC	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	29.96	29.96	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 Body Liquid for 5G (MBBL3500-5800MHz),Manufactured by SPEAG:

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

Tissue Type	Measured Frequency （MHz）	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		εr (+/-5%)	σ (S/m) (+/-5%)	εr	σ (S/m)		
2450 Body	2410	52.80 (50.16~55.44)	1.91 (1.81~2.00)	50.87	1.95	21.4°C	2015-02-04
	2435	52.70 (50.07~55.34)	1.94 (1.84~2.04)	50.77	1.98		
	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	50.74	2.00		
	2460	52.70 (50.07~55.34)	1.96 (1.86~2.06)	50.74	2.01		
5G Body	5200	49.0 (46.55~51.45)	5.30 (5.03~5.56)	50.98	5.19	21.2°C	2015-02-05
	5300	49.0 (46.55~51.45)	5.30 (5.03~5.56)	49.89	5.37	21.2°C	2015-02-05
	5600	48.5 (46.08~50.93)	5.77 (5.48~6.06)	49.16	5.62	21.4°C	2015-02-06
	5800	48.20 (45.79~50.61)	6.00 (5.70~6.30)	48.03	5.98	21.4°C	2015-02-07
ε_r= Relative permittivity, σ= Conductivity							

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).

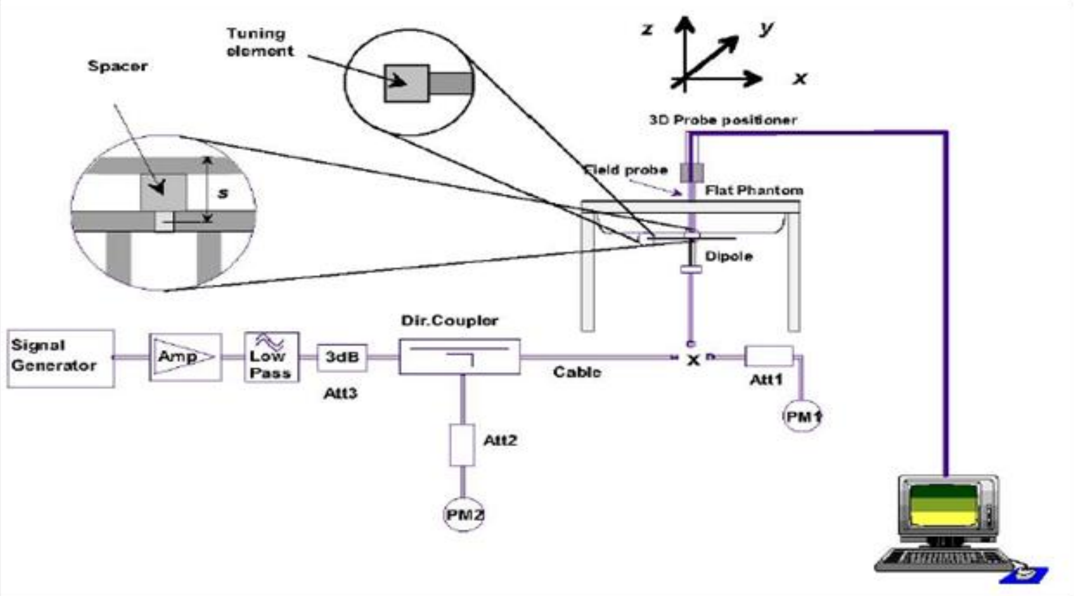
System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
2450MHz Body	51.4 (46.26~56.54)	23.9 (21.51~26.29)	56.00	25.76	21.4°C	2015-02-04
5200MHz Body	77.6 (69.84~85.36)	21.6 (19.44~23.76)	80.20	22.40	21.2°C	2015-02-05
5300MHz Body	78.5 (70.65~86.35)	22.0 (19.80~24.20)	82.50	22.80	21.2°C	2015-02-05
5600MHz Body	83.1 (74.79~91.41)	22.9 (20.61~25.19)	84.60	23.40	21.4°C	2015-02-06
5800MHz Body	76.7 (69.03~84.37)	21.2 (19.08~23.32)	74.70	20.60	21.4°C	2015-02-07

Table 6:System Check Results

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 5GHz) or 100mW(above 5GHz). 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.


Tuning
element
Spacer
s
z
y
x
3D Probe positioner
Field probe
Flat Phantom
Dipole
Signal
Generator
Amp
Low
Pass
3dB
Att3
Dir.Coupler
Cable
Att1
PM1
Att2
PM2

5 SAR measurement variability and uncertainty

5.1 SAR measurement variability

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r03, 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 v01r03,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 1528-2003 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.

6 SAR Test Configuration

6.1 WiFi 2.4G Test Configuration

For the 802.11b/g SAR tests, a communication link is set up with the test mode software for WiFi mode test. The Absolute Radio Frequency Channel Number(ARFCN) is allocated to 1 ,6 and 11 respectively in the case of 2450 MHz.During the test,at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate.

802.11b/g operating modes are tested independently according to the service requirements in each frquency band. 802.11b/g modes are tested on channel 1, 6, 11; however,if output power reduction is necessary for channels 1 and/or 11 to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2.412	1#	√	△
		2.437	6	√	△
		2.462	11#	√	△

Notes:
√ = "default test channels"
△= possible 802.11g channels with maximum average output ¼ dB the "default test channels"
= when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

802.11 Test Channels per FCC KDB 248227

6.2 WiFi 5G Test Configuration

For the 802.11a SAR tests, a communication link is set up with the test mode software for WiFi mode test. 802.11a operating modes are tested independently according to the service requirements in each 5G WiFi frquency band. During the test,at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate.

Per KDB248227,for each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate. When 802.11n-HT20 and 11n-HT40 output power is less than 0.25dB higher than 802.11a, the SAR can be excluded.

7 SAR Measurement Results

7.1.1 Conducted power measurements of WiFi 2.4G

Wi-Fi 2450MHz	Channel	Tune-up	Average Power (dBm) for Data Rates (Mbps)							
			1	2	5.5	11	/	/	/	/
802.11b	1	12.00	**10.46**	10.39	10.45	9.92	/	/	/	/
	6	12.00	**10.67**	10.64	10.59	10.15	/	/	/	/
	11	12.00	**10.58**	10.47	10.42	9.92	/	/	/	/
Wi-Fi 2450MHz	Channel	Tune-up	6	9	12	18	24	36	48	54
802.11g	1	12.00	10.08	9.97	9.75	9.13	8.85	8.21	7.45	7.34
	6	12.00	10.27	10.20	10.05	9.41	9.09	8.43	7.71	7.62
	11	12.00	10.11	9.96	9.70	9.05	8.72	8.03	7.33	7.23
Wi-Fi 2450MHz	Channel	Tune-up	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n 20M	1	11.50	10.00	9.61	9.24	8.91	8.42	7.75	7.45	7.32
	6	11.50	10.19	9.76	9.34	8.98	8.46	7.78	7.48	7.32
	11	11.50	10.05	9.67	9.34	9.05	8.51	7.83	7.56	7.48
802.11n 40M	3	11.50	8.89	7.80	7.38	6.6	6.08	5.35	5.01	4.88
	6	11.50	9.05	7.91	7.42	6.59	6.06	5.37	5.07	4.92
	9	11.50	8.92	7.79	7.38	6.58	6.02	5.26	4.89	4.77

Table 7: Conducted power measurement results of WiFi 2.4G.

Note:

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

2) The bolded mode was selected for SAR testing.

3) Per KDB248227, for WiFi 2.4GHz, highest average RF output power channel for the lowest data rate of 802.11b mode was selected for SAR evalutation. SAR test at higher data rates and higher order modulations (including 802.11g/n) were not required since the maximum average output power for each of these configurations is not more than 1/4dB higher than the tested channel for the lowest data rate of 802.11b mode.

7.1.2 Conducted power measurements of WiFi 5G

Mode	Channel	Frequency (MHz)	Average Power (dBm)								
			Tune-up	Data Rate (bps)							
				6M	9M	12M	18M	24M	36M	48M	54M
802.11a	CH 36	5180	10.50	**9.68**	9.52	9.44	8.82	8.37	7.84	7.08	6.82
	CH 40	5200	10.50	**9.45**	9.25	9.16	8.55	8.22	7.68	6.92	6.71
	CH 44	5220	10.50	**8.99**	8.77	8.60	7.97	7.55	6.96	6.30	6.04
	CH 48	5240	10.50	**8.95**	8.68	8.51	7.78	7.46	6.91	6.21	5.96
	CH 52	5260	10.00	**8.95**	8.84	8.77	8.14	7.78	7.15	6.37	6.13
	CH 56	5280	10.00	**9.03**	8.87	8.87	8.28	7.87	7.11	6.32	6.13
	CH 60	5300	10.00	**8.76**	8.56	8.56	7.89	7.47	6.79	5.99	5.87
	CH 64	5320	10.00	**9.06**	8.88	8.77	8.19	7.83	7.10	6.31	6.12
	CH 100	5500	10.50	**9.28**	9.10	9.04	8.49	8.05	7.36	6.51	6.28
	CH 104	5520	10.50	**9.01**	8.85	8.79	8.18	7.79	7.15	6.41	6.18
	CH 108	5540	10.50	**9.14**	8.94	8.94	8.36	7.99	7.35	6.53	6.40
	CH 112	5560	10.50	**9.07**	8.90	8.84	8.28	7.87	7.21	6.35	6.16
	CH 116	5580	10.50	**8.89**	8.73	8.67	8.03	7.71	7.09	6.26	6.12
	CH 132	5660	10.50	**9.16**	8.92	8.84	8.19	7.76	7.09	6.32	6.11
	CH 136	5680	10.50	**9.26**	9.06	8.99	8.36	8.04	7.31	6.49	6.38
	CH 140	5700	10.50	**9.60**	9.31	9.26	8.72	8.33	7.67	6.80	6.69
	CH 149	5745	10.50	**9.85**	9.70	9.72	9.18	8.82	8.16	7.33	7.20
	CH 153	5765	10.50	**9.70**	9.54	9.50	8.93	8.57	7.82	7.02	6.86
	CH 157	5785	10.50	**9.79**	9.59	9.51	8.92	8.48	7.85	7.12	6.96
	CH 161	5805	10.50	**9.93**	9.73	9.70	9.16	8.82	8.18	7.45	7.32
	CH 165	5825	10.50	**9.65**	9.47	9.38	8.83	8.47	7.82	7.08	6.89

Mode	Channel	Frequency (MHz)	Average Power (dBm)								
			Tune-up	Data Rate (bps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n 20M	CH 36	5180	10.50	9.38	9.11	8.62	8.27	7.66	6.87	6.53	6.5
	CH 40	5200	10.50	9.22	8.99	8.52	8.25	7.71	6.86	6.5	6.38
	CH 44	5220	10.50	8.96	8.74	8.28	7.95	7.40	6.58	6.23	6.18
	CH 48	5240	10.50	8.78	8.51	7.98	7.66	7.12	6.3	6.05	5.98
	CH 52	5260	10.00	8.66	8.44	7.87	7.60	7.04	6.15	5.88	5.83
	CH 56	5280	10.00	8.87	8.64	8.14	7.78	7.28	6.44	6.21	6.1
	CH 60	5300	10.00	8.59	8.41	7.82	7.55	7.04	6.21	5.96	5.92
	CH 64	5320	10.00	9.09	8.84	8.27	8.00	7.47	6.66	6.41	6.37
	CH 100	5500	10.50	9.24	9.02	8.46	8.23	7.60	6.69	6.37	6.25
	CH 104	5520	10.50	9.04	8.74	8.26	8.00	7.37	6.60	6.28	6.26
	CH 108	5540	10.50	9.01	8.72	8.17	7.95	7.38	6.47	6.16	6.02
	CH 112	5560	10.50	8.85	8.60	8.01	7.78	7.20	6.31	6.08	5.92
	CH 116	5580	10.50	8.62	8.38	7.88	7.64	7.09	6.31	6.02	5.96
	CH 132	5660	10.50	9.06	8.80	8.22	7.98	7.48	6.61	6.32	6.21
	CH 136	5680	10.50	9.11	8.89	8.4	8.17	7.60	6.74	6.39	6.30
	CH 140	5700	10.50	9.35	9.13	8.58	8.22	7.71	6.89	6.61	6.50
	CH 149	5745	10.50	9.71	9.42	8.89	8.66	8.14	7.37	7.06	7.00
	CH 153	5765	10.50	9.63	9.40	8.85	8.58	8.04	7.27	6.90	6.74
	CH 157	5785	10.50	9.81	9.63	9.04	8.71	8.10	7.21	6.93	6.79
	CH 161	5805	10.50	9.77	9.55	9.04	8.75	8.20	7.37	7.04	7.01
	CH 165	5825	10.50	9.42	9.16	8.68	8.39	7.81	7.01	6.65	6.56
Mode	Channel	Frequency (MHz)	Average Power (dBm)								
			Tune-up	Data Rate (bps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n 40M	CH 38	5190	10.50	8.00	7.87	7.71	7.31	6.98	6.48	5.92	5.76
	CH 46	5230	10.50	7.70	7.51	7.38	7.02	6.65	6.13	5.65	5.56
	CH 54	5270	10.00	7.38	7.21	7.06	6.73	6.27	5.87	5.28	5.18
	CH 62	5310	10.00	7.47	7.22	7.18	6.76	6.34	5.92	5.38	5.17
	CH 102	5510	10.50	7.55	7.39	7.25	6.79	6.36	5.85	5.29	5.15
	CH 110	5550	10.50	7.61	7.38	7.35	6.92	6.58	6.09	5.57	5.47
	CH 134	5670	10.50	7.47	7.29	7.20	6.85	6.43	5.91	5.29	5.08
	CH 151	5755	10.50	7.57	7.32	7.23	6.82	6.39	6.00	5.43	5.30
	CH 159	5795	10.50	7.95	7.73	7.62	7.21	6.76	6.25	5.67	5.57

Table 8: Conducted power measurement results of WiFi 5G.

Note:

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

2) The bolded mode was selected for SAR testing.

3) Per KDB248227D01v01r02 and October 2012/April 2013 FCC/TCB workshop meeting notes:for WiFi 5GHz, highest average RF output power channel for the lowest data rate of 802.11a mode was selected for SAR evalutation. SAR test at higher data rates and higher order modulations (including 802.11n 20MHz and 40MHz) were not required since the maximum average output power for each of these configurations is not more than 1/4dB higher than the tested channel for the lowest data rate of 802.11a mode..

7.1.3 Conducted power measurements of BT

The output power of BT antenna is as following:

BT 2450	Average Conducted Power (dBm)			
	Tune-up	0CH	39CH	78CH
DH5	4.00	2.66	1.69	3.20
2DH5	4.00	2.57	1.46	3.13
3DH5	4.00	2.64	1.71	3.16

BT 2450	Average Conducted Power (dBm)			
	Tune-up	0CH	19CH	39CH
BT(4.0)	4.00	-2.01	-0.34	-0.09

Table 9: Conducted power measurement results of BT.

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

7.2 SAR measurement Results

General Notes:

1) The maximum reported SAR of each test band is shown in **bold** letters.

2) Per KDB447498 D01v05r02, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demostrate compliant.

3) Per KDB447498 D01v05r02, 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: ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 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.

4) Per KDB 865664 D01v01,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.

5) 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 appendix B for details).

WLAN Notes:

Per KDB248227D01v01r02 and October 2012/April 2013 FCC/TCB workshop meeting notes:

1) For WiFi 2.4GHz, highest average RF output power channel for the lowest data rate of 802.11b mode was selected for SAR evalutation. SAR test at higher data rates and higher order modulations (including 802.11g/n) were not required since the maximum average output power for each of these configurations is not more than 1/4dB higher than the tested channel for the lowest data rate of 802.11b mode.

2) For WiFi 5GHz, highest average RF output power channel for the lowest data rate of 802.11a mode was selected for SAR evalutation. SAR test at higher data rates and higher order modulations (including 802.11n 20MHz and 40MHz) were not required since the maximum average output power for each of these configurations is not more than 1/4dB higher than the tested channel for the lowest data rate of 802.11a mode.

7.2.1 SAR measurement Result of WiFi 2.4G

Test Position of Body with 0mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Back Side	6/2437	802.11 b	0.986	0.343	0.000	10.67	12.00	1.339	21.4°C
Back Side-Repeated	6/2437	802.11 b	1.040	0.377	0.000	10.67	12.00	1.413	21.4°C
Back Side	1/2412	802.11 b	0.936	0.330	0.000	10.69	12.00	1.266	21.4°C
Back Side	11/2462	802.11 b	0.895	0.322	0.000	10.58	12.00	1.241	21.4°C
Right Side	6/2437	802.11 b	0.169	0.071	0.150	10.67	12.00	0.230	21.4°C
Bottom Side	6/2437	802.11 b	0.160	0.064	-0.170	10.67	12.00	0.217	21.4°C

Table 10: Body SAR test results of WiFi 2.4G

Note: * - repeated at the highest SAR measurement according to the FCC KDB 865664.

7.2.2 SAR measurement Result of WiFi 5G

Test Position of Body with 0mm	Test channel /Freq.	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data of 5.2GHz band									
Back Side	36/5180	11a	0.941	0.199	0.000	9.68	10.50	1.137	21.2°C
Back Side	40/5200	11a	0.957	0.202	0.000	9.45	10.50	1.219	21.2°C
Back Side	44/5220	11a	0.867	0.185	0.000	8.99	10.50	1.227	21.2°C
Back Side	48/5240	11a	0.899	0.189	-0.040	8.95	10.50	1.285	21.2°C
Right Side	36/5180	11a	0.397	0.121	-0.150	9.68	10.50	0.480	21.2°C
Bottom Side	36/5180	11a	0.504	0.128	0.110	9.68	10.50	0.609	21.2°C
Test data of 5.3GHz band									
Back Side	64/5320	11a	0.913	0.192	0.000	9.06	10.00	1.134	21.2°C
Back Side	52/5260	11a	**1.100**	0.216	0.000	8.95	10.00	1.401	21.2°C
Back Side-Repeated	52/5260	11a	1.030	0.209	0.000	8.95	10.00	1.312	21.2°C
Back Side	56/5280	11a	0.970	0.202	0.000	9.03	10.00	1.213	21.2°C
Back Side	60/5300	11a	0.992	0.202	0.000	8.76	10.00	1.320	21.2°C
Right Side	64/5320	11a	0.362	0.114	-0.100	9.06	10.00	0.449	21.2°C
Bottom Side	64/5320	11a	0.619	0.149	0.020	9.06	10.00	0.769	21.2°C
Test data of 5.5GHz band									
Back Side	140/5700	11a	0.874	0.166	0.000	9.60	10.50	1.075	21.4°C
Back Side	100/5500	11a	0.849	0.166	0.000	9.28	10.50	1.124	21.4°C
Back Side	104/5520	11a	0.847	0.165	0.000	9.01	10.50	1.194	21.4°C
Back Side	108/5540	11a	0.872	0.169	0.000	9.14	10.50	1.193	21.4°C
Back Side	112/5560	11a	0.899	0.171	0.000	9.07	10.50	1.250	21.4°C
Back Side	116/5580	11a	0.918	0.175	0.000	8.89	10.50	1.330	21.4°C
Back Side	132/5660	11a	0.948	0.179	0.000	9.16	10.50	1.291	21.4°C
Back Side	136/5680	11a	1.060	0.201	0.000	9.26	10.50	1.410	21.4°C
Right Side	140/5700	11a	0.298	0.097	-0.070	9.60	10.50	0.367	21.4°C
Bottom Side	140/5700	11a	0.648	0.163	-0.060	9.60	10.50	0.797	21.4°C
Test data of 5.8GHz band									
Back Side	161/5805	11a	0.880	0.171	0.000	9.93	10.50	1.003	21.4°C
Back Side	149/5745	11a	0.969	0.183	0.000	9.85	10.50	1.125	21.4°C
Back Side	153/5765	11a	0.991	0.188	0.000	9.70	10.50	1.191	21.4°C
Back Side	157/5785	11a	0.985	0.190	0.000	9.79	10.50	1.160	21.4°C
Back Side	165/5825	11a	0.898	0.173	0.000	9.65	10.50	1.092	21.4°C
Right Side	161/5805	11a	0.241	0.076	0.020	9.93	10.50	0.275	21.4°C
Bottom Side	161/5805	11a	0.700	0.164	-0.040	9.93	10.50	0.798	21.4°C

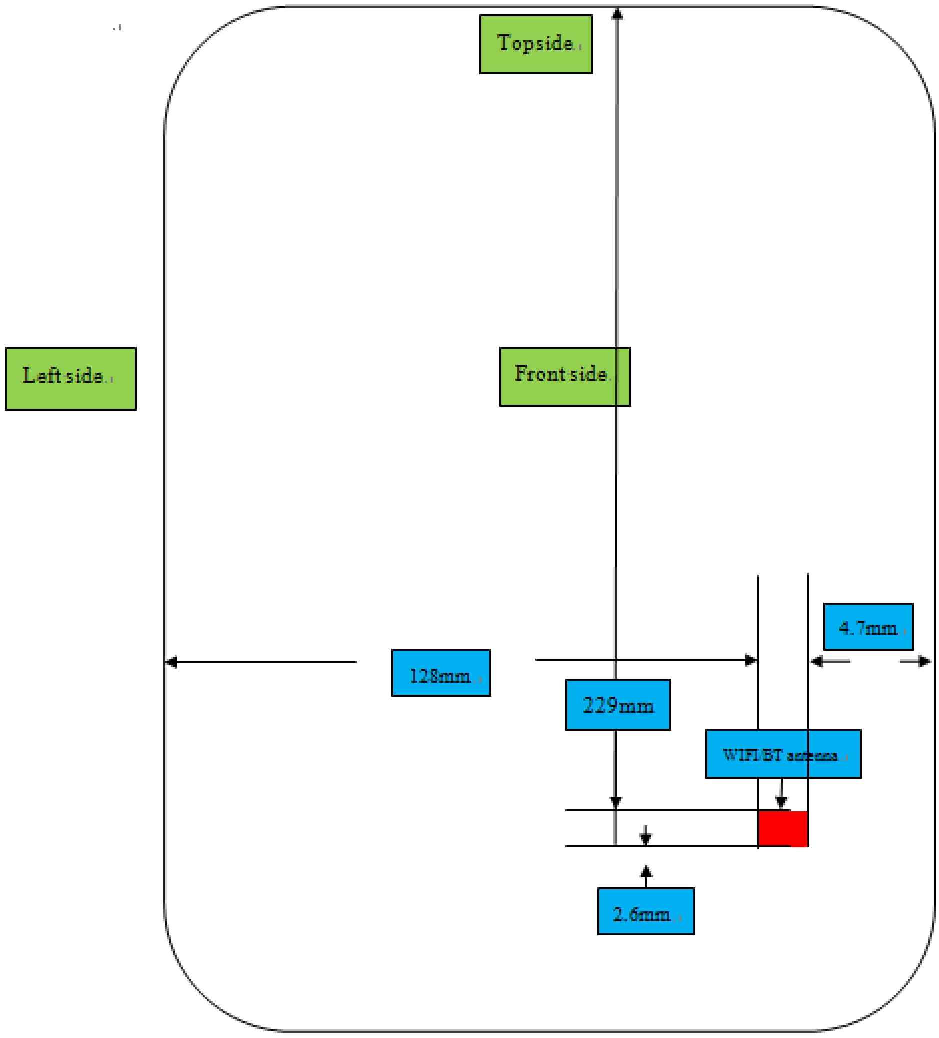
Table 11: Body SAR test results of WiFi 5G

Note: * - repeated at the highest SAR measurement according to the FCC KDB 865664.

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 447498D01 General RF Exposure Guidance v05r02.

The location of the antennas inside the device is shown as below picture:



Note:Diversity antenna is used to improve the acceptance of performance of the main antenna. It does not have the transmitter function.

The Body SAR measurement sides and edges of each band are as below:

Antenna	Back Side	Left Side	Right Side	Top Side	Bottom Side
WiFi 2.4G/5G/BT	Yes	NO	Yes	NO	Yes

Table 12: SAR measurement positions

Note:Per FCC KDB 616217,the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom.The SAR Exclusion Threshold in KDB 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.

7.3.1 Stand-alone SAR Test Exclusion

Per FCC KDB 447498 D01, 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 result is rounded to one decimal place for comparison

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

Body position

Mode	Position	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	SAR test exclusion
BT	Body	4.00	2.512	5	2.480	0.791	3.00	Yes

Table 13: Standalone SAR test exclusion for BT

Note:

1)* - maximum possible output power(including tune-up tolerance) declared by manufacturer.

7.3.2 Simultaneous Transmission Possibilities

The device does not support simultaneous BT and WiFi, because they share the same antenna, use the technique of Time Division Multiplexer and cannot transmit simultaneously. Additional simultaneous transmission SAR evaluation is not required.

Appendix A. System Check Plots

(Pls See Appendix A.)

Appendix B. SAR Measurement Plots

(Pls See Appendix B.)

Appendix C. Calibration Certificate

(Pls See Appendix C.)

Appendix D. Photo documentation

(Pls See Appendix D.)

End