FCC SAR Compliance Test Report

Project Name: M310

Model : MediaQ M310

FCC ID : QIS-MEDIAQM310

Report No. : SYBH(Z-SAR)005062013-2

	APPROVED (Manager)	CHECKED	PREPARED
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DATE	2013-06-12	2013-06-12	2013-06-12

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※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	2013-06-09	Sun Shaobin
Rev.1.1	Revised Test Report	2013-06-12	Sun Shaobin

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for MediaQ M310 are as below Table 1.

Band	Position	MAX Reported 1-g SAR (W/kg)
WiFi 2.4G	Body 5mm	0.362
WiFi 5G	Body 5mm	0.180

Table 1:Summary of test result

The device is in compliance with Specific Absorption Rate（SAR）for general population/uncontraolled exposure limits of 1.6 W/Kg as averaged over any 1 g tissue 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 and FCC OET Bulletin 65 Supplement C Edition 01-01.

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

<table>
<tr><td colspan="4">Device Information:</td></tr>
<tr><td>DUT Name:</td><td colspan="3">M310</td></tr>
<tr><td>Type Identification:</td><td colspan="3">MediaQ M310</td></tr>
<tr><td>FCC ID:</td><td colspan="3">QIS-MEDIAQM310</td></tr>
<tr><td>Device Type :</td><td colspan="3">Peripheral transmitter</td></tr>
<tr><td>Device Phase:</td><td colspan="3">Identical Prototype</td></tr>
<tr><td>Exposure Category:</td><td colspan="3">uncontrolled environment / general population</td></tr>
<tr><td>Hardware Version :</td><td colspan="3">MS1M310M Ver.A</td></tr>
<tr><td>Software Version :</td><td colspan="3">Singlebox M310 V100R001C01B0XX</td></tr>
<tr><td>Antenna Type :</td><td colspan="3">internal antenna</td></tr>
<tr><td colspan="4">Device Operating Configurations:</td></tr>
<tr><td>Supporting Mode(s)</td><td colspan="3">WiFi 2.4G, WiFi 5G(tested), Bluetooth 2.1 EDR/3.0/4.0 BLE</td></tr>
<tr><td>Test Modulation</td><td colspan="3">WiFi: DBPSK,DQPSK, BPSK,QPSK, 16QAM, 64QAM
BT:GFSK,π/4-DPSK,8DPSK</td></tr>
<tr><td rowspan="7">Operating Frequency Range(s)</td><td>Band</td><td>Tx (MHz)</td><td>Rx (MHz)</td></tr>
<tr><td>WiFi 2.4GHz</td><td>2412-2462</td><td>2412-2462</td></tr>
<tr><td>WiFi 5.2GHz</td><td>5180-5240</td><td>5180-5240</td></tr>
<tr><td>WiFi 5.3GHz</td><td>5260-5320</td><td>5260-5320</td></tr>
<tr><td>WiFI 5.5GHz</td><td>5500-5700</td><td>5500-5700</td></tr>
<tr><td>WiFi 5.8GHz</td><td>5745-5825</td><td>5745-5825</td></tr>
<tr><td>BT</td><td>2400-2480</td><td>2400-2480</td></tr>
</table>

Table 3:Device information and operating configuration

Note:

1) 5600MHz-5650MHz is notched.

2) In the MIMO module, the device only supports WiFi 2.4G band 802.11n-HT20.

1.3.1 General Description

MediaQ M310 (short for M310), Huawei's new home device, is powered by HiSilicon Quad-core processor. It incorporates OTT TV, Huawei AirSharing, Massive games, Media Management and so on. M310 brings extraordinary social entertainment experience to you.

The advanced NCVM technology brings an exquisite and fashionable appearance to M310, which is light and compact with a thickness of only 0.55 inches (14 mm).

Built-in YouTube, Google Play and Browser. YouTube provides massive videos of the most popular and stylish. Google Play brings abundant Apps such as videos, music, games and so on. Via browser, you can grab the latest trend information, be in front of the fashion easily.

Huawei AirSharing makes it easy to share information. Contents on smart phone/Pad can be pushed or mirrored to large TV screen easily via M310.

Preload massive games Ducati Challenge, Samurai II: Vengeance, and more from Google Play. Quad-core CPU and 16-core GPU bring extraordinary experience.

Media management aggregates and orderly arranges all the multimedia files on home devices, such as PC, portable hard disk, NAS and so on.

Abundant accessories for selection: Bluetooth 4.0 remote controller can control M310 360-degree easily. And the Smartphone Remote can also be used to control M310.Y cable extends an extra USB interface, which can connect data storage devices such as USB flash drive and portable hard disk.

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 1528-2003	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)
OET Bulletin No. 65, Supplement C Edition 01-01– 2001	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields---Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 4 of March 2010)
KDB447498 D02	SAR Procedures for Dongle Xmtr v02
KDB248227 D01	SAR meas for 802.11 a/b/g v01r02
KDB447498 D01	General RF Exposure Guidance v05r01
KDB865664 D01	SAR measurement 100 MHz to 6 GHz v01r01
KDB865664 D02	SAR Reporting v01r01

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

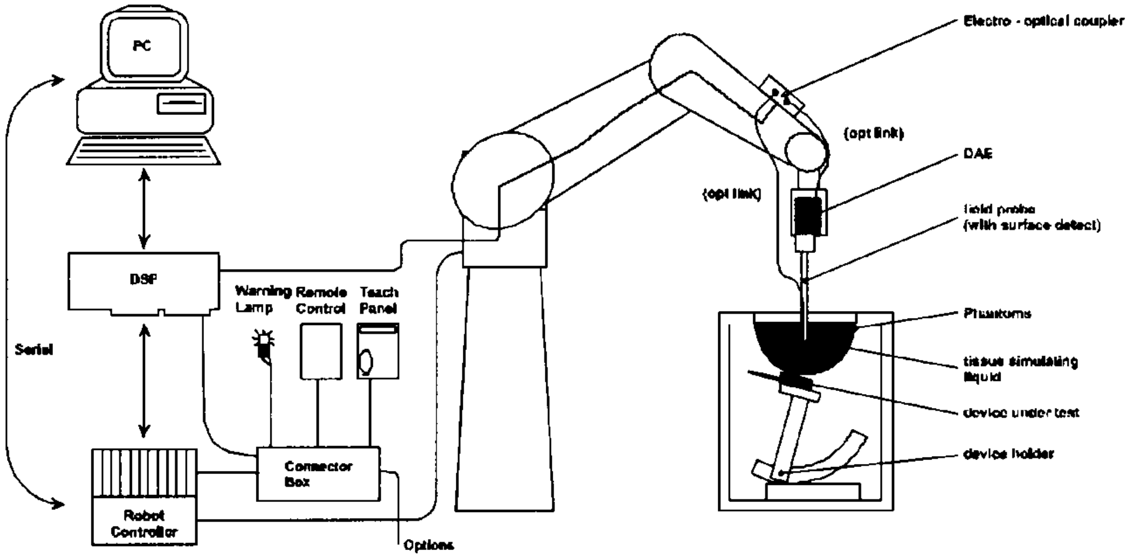
Start Date of test	2013/06/07
End Date of test	2013/06/09

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 XP.
- 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 DASY4 measurement system is placed at the head end of a room with dimensions: $5 \times 2.5 \times 3$ 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 1.5×1.5 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.

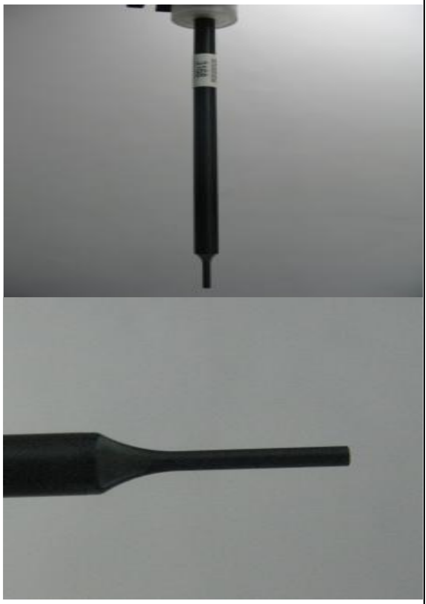
DAE4

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

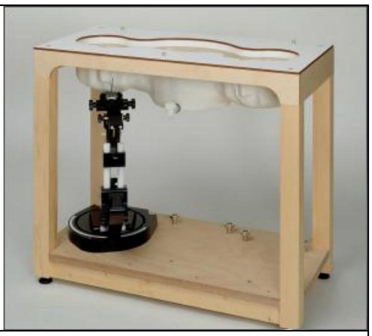
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4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

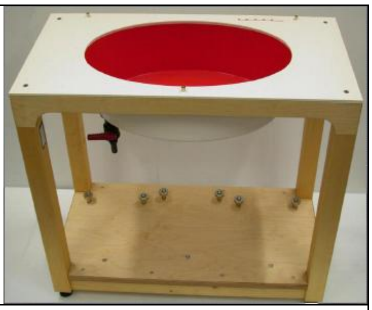
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to >6 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity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

ELI4 Phantom

Shell Thickness	2mm +/- 0.2 mm	
Filling Volume	Approximately 30 liters	
Dimensions	Length:1000mm; Width:500mm; Height: adjustable feet	
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.		

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.

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	3744	2012-07-27	One year
☐	SPEAG	Dosimetric E-Field Probe	ES3DV3	3168	2012-10-02	One year
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	3898	2013-01-14	One year
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	3736	2013-05-10	One year
☐	SPEAG	835 MHz Dipole	D835V2	4d126	2011-11-07	Three years
☐	SPEAG	1800 MHz Dipole	D1800V2	2d184	2011-03-08	Three years
☐	SPEAG	1900 MHz Dipole	D1900V2	5d143	2011-09-26	Three years
☐	SPEAG	2000 MHz Dipole	D2000V2	1052	2011-03-10	Three years
☐	SPEAG	2300 MHz Dipole	D2300V2	1016	2011-11-22	Three years
☒	SPEAG	2450 MHz Dipole	D2450V2	860	2011-03-08	Three years
☐	SPEAG	2600 MHz Dipole	D2600V2	1021	2011-11-22	Three years
☒	SPEAG	5GHz Dipole	D5GHzV2	1040	2012-06-19	Three years
☐	SPEAG	Data acquisition electronics	DAE4	852	2012-11-22	One year
☐	SPEAG	Data acquisition electronics	DAE4	851	2012-07-25	One year
☒	SPEAG	Data acquisition electronics	DAE4	1236	2012-11-23	One year
☒	SPEAG	Software	DASY 5	N/A	N/A	N/A
☐	SPEAG	Twin Phantom	SAM1	TP-1475	N/A	N/A
☐	SPEAG	Twin Phantom	SAM2	TP-1474	N/A	N/A
☒	SPEAG	Twin Phantom	SAM3	TP-1597	N/A	N/A
☒	SPEAG	Twin Phantom	SAM4	TP-1620	N/A	N/A
☐	SPEAG	Flat Phantom	ELI 5.0	TP-1038	N/A	N/A
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1111	N/A	N/A
☐	R & S	Universal Radio Communication Tester	CMU 200	113989	2012-06-07	One year
☒	Agilent)*	Network Analyser	E5071B	MY42404956	2013-02-27	One year
☒	Agilent	Dielectric Probe Kit	85070E	2484	N/A	N/A
☒	Agilent	Signal Generator	N5181A	MY47420989	2013-02-27	One year
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA0746001	N/A	N/A
☒	MINI-CIRCUITS	Amplifier	ZVE-8G+	523101139	N/A	N/A
☒	Agilent	Power Meter	E4417A	MY45101339	2013-02-26	One year
☒	Agilent	Power Meter Sensor	E9321A	MY44420359	2013-02-26	One year

Note: All the test equipments are calibrated once a year, except the dipoles, which are calibrated every three years. Moreover, we have self-calibration every year to the dipoles.

1) Per KDB 450824 D02 requirements for dipole calibration, Huawei SAR lab has adopted three years calibration interval. But 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) Return-loss is within 10% of calibrated measurement;
d) Impedance 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(2-4GHz) 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}, $\Delta y_{zoom} \leq$ 4GHz - ≤ 5 mm and 4-6 GHz-≤ 4 mm; $\Delta z_{zoom} \leq$ 3GHz - ≤ 5 mm, 3-4 GHz- ≤ 4 mm 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.

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 7 x 7 x 7 points. 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)	450	835	900	1800	1900	**2450**
Water	51.16	52.4	56.0	69.91	69.91	73.2
Salt (NaCl)	1.49	1.40	0.76	0.13	0.13	0.04
Sugar	46.78	45.0	41.76	0.0	0.0	0.0
HEC	0.52	1.0	1.21	0.0	0.0	0.0
Bactericide	0.05	0.1	0.27	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	0.0	29.96	29.96	26.7

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,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)		
2450B	2410	52.80 (50.16~55.44)	1.91 (1.81~2.00)	51.39	1.903	21.4°C	2013-06-07
	2435	52.70 (50.07~55.34)	1.94 (1.84~2.04)	51.31	1.929		
	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	51.24	1.962		
	2460	52.70 (50.07~55.34)	1.96 (1.86~2.06)	51.26	1.964		
5200B ~ 5800B	5200	49.00 (44.10~53.90)	5.30 (4.77~5.83)	48.61	5.263	21.4°C	2013-06-08
	5500	48.60 (43.74~53.46)	5.65 (5.08~6.21)	47.22	5.610	21.4°C	2013-06-08
	5800	48.20 (43.38~53.02)	6.00 (5.4~6.6)	47.26	6.052	21.4°C	2013-06-08
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 450824 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).

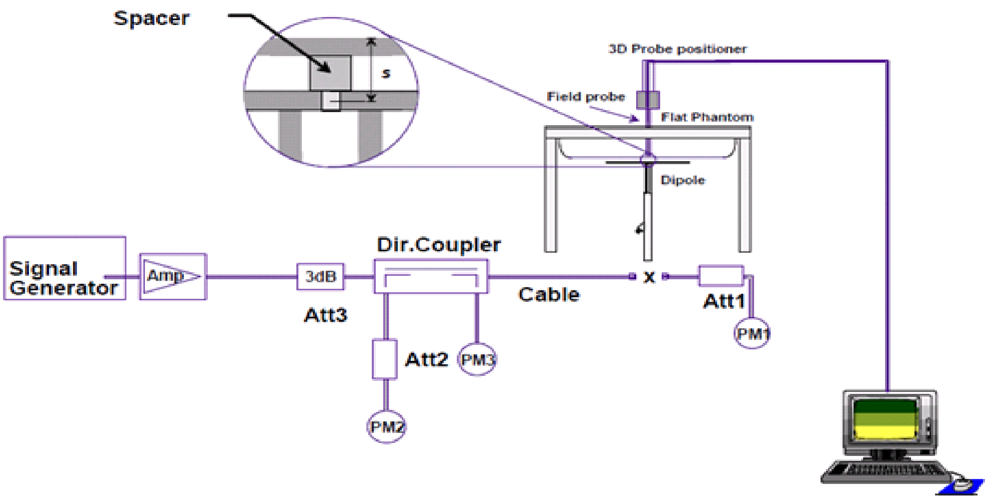
System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
D2450V2 Body	52.80 (47.52~58.08)	24.50 (22.05~26.95)	51.60	23.84	21.4°C	2013/6/7
D5200V2 Body	73.1 (65.79~80.41)	20.5 (18.45~22.55)	75.30	21.30	21.4°C	2013/6/8
D5500V2 Body	78.1 (70.29~85.91)	21.7 (19.53~23.87)	75.80	21.20	21.4°C	2013/6/8
D5800V2 Body	73.8 (66.42~81.18)	20.4 (18.36~22.44)	72.40	20.40	21.4°C	2013/6/8

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 for frequencies below 5 GHz or 100 mW for frequencies above 5 GHz.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.



5 Measurement Uncertainty Evaluation

The measured SAR was<1.5 W/kg for all frequency bands.Therefore, per KDB Publication 865664D01v01,the SAR measurement uncertainty analysis per IEEE 1528-2003 was not required.

6 SAR Test Configuration

6.1 WiFi 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 Requirements

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 Conducted power measurements

The output power was measured using an integrated RF connector and attached RF cable.

7.1.1 Conducted power measurements BT

BT 2450MHz	Average Conducted Power (dBm)		
	0CH	39CH	78CH
	3.6	3.6	3.6

Table 7: Test results conducted power measurement BT 2450 MHz

7.1.2 Conducted power measurements WiFi 2.4G

Wi-Fi 2450	Channel	Average Power (dBm) for Data Rates (Mbps)							
		1	2	5.5	11	/	/	/	/
802.11b	1	13.53	13.64	13.94	13.95	/	/	/	/
	6	13.59	14.10	14.18	**14.31**	/	/	/	/
	11	13.58	13.74	13.84	13.99	/	/	/	/
802.11g	Channel	6	9	12	18	24	36	48	54
	1	10.26	10.39	10.47	10.53	10.2	10.33	10.25	10.33
	6	10.72	10.71	10.77	10.93	10.65	10.59	10.74	10.65
	11	10.48	10.65	10.74	10.76	10.61	10.54	10.59	10.71
802.11n HT20	Channel	6.5	13	19.5	26	39	52	58.5	65
	antenna 1								
	1	10.50	10.60	10.60	10.70	10.60	10.50	10.50	10.50
	6	**10.72**	10.60	10.70	10.70	10.60	10.60	10.60	10.60
	11	10.40	10.50	10.60	10.60	10.50	10.50	10.50	10.50
	antenna 0								
	1	9.50	9.50	9.60	9.70	9.60	9.50	9.50	9.60
	6	**9.70**	9.80	9.90	**9.80**	9.70	9.50	9.60	9.70
	11	9.40	9.50	9.60	9.60	9.50	9.50	9.40	9.40
802.11n HT40	Channel	7.2	14.4	21.6	28.8	43.3	57.7	65	72.2
	3	10.30	10.40	10.30	10.40	10.40	10.40	10.40	10.40
	6	**10.50**	10.70	10.70	10.70	10.60	10.60	10.60	10.60
	9	10.30	10.30	10.50	10.50	10.40	10.30	10.40	10.40

Table 8: Test results conducted power measurement WiFi 2.4G

Note:

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

2) 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.

7.1.3 Conducted power measurements WiFi 5G

Mode	Channel	Frequency (MHz)	Average Power (dBm)							
			Data Rate (bps)							
			6M	9M	12M	18M	24M	36M	48M	54M
802.11a	CH 36	5180	9.19	9.11	9.43	9.41	9.16	9.18	9.22	9.26
	CH 40	5200	**9.42**	9.38	9.38	9.37	9.41	9.34	9.29	9.31
	CH 44	5220	9.19	9.18	9.21	9.22	9.19	9.18	9.17	9.20
	CH 48	5240	9.33	9.29	9.31	9.36	9.31	9.34	9.24	9.27
	CH 52	5260	**9.86**	9.69	9.76	9.66	9.63	9.57	9.61	9.55
	CH 56	5280	9.48	9.46	9.45	9.46	9.38	9.38	9.37	9.39
	CH 60	5300	9.44	9.42	9.38	9.39	9.39	9.41	9.34	9.32
	CH 64	5320	9.38	9.54	9.59	9.48	9.45	9.48	9.42	9.23
	CH 100	5500	9.24	9.31	9.48	9.37	9.26	9.33	9.35	9.34
	CH 104	5520	9.27	9.25	9.27	9.25	9.25	9.24	9.23	9.26
	CH 108	5540	9.48	9.44	9.45	9.48	9.47	9.48	9.39	9.54
	CH 112	5560	**9.74**	9.52	9.61	9.60	9.67	9.70	9.58	9.57
	CH 116	5580	9.55	9.48	9.52	9.50	9.49	9.47	9.48	9.47
	CH 132	5660	9.71	9.68	9.71	9.69	9.68	9.67	9.61	9.70
	CH 136	5680	9.51	9.51	9.48	9.48	9.47	9.42	9.44	9.42
	CH 140	5700	9.52	9.64	9.55	9.61	9.62	9.66	9.68	9.59
	CH 149	5745	**9.72**	9.42	9.65	9.64	9.53	9.47	9.41	9.50
	CH 153	5765	9.28	9.28	9.29	9.31	9.30	9.29	9.30	9.33
	CH 157	5785	9.22	9.25	9.21	9.47	9.28	9.21	9.31	9.25
	CH 161	5805	9.61	9.63	9.62	9.58	9.64	9.55	9.59	9.58
	CH 165	5825	9.15	9.36	9.44	9.46	9.23	9.47	9.35	9.35

Mode	Channel	Frequency (MHz)	Average Power (dBm)							
			Data Rate (bps)							
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n-HT20 (5GHz)	CH 36	5180	9.4	9.5	9.4	9.3	9.3	9.3	9.3	9.3
	CH 40	5200	9.6	9.7	9.8	9.7	9.7	9.6	9.6	9.5
	CH 44	5220	9.7	9.6	9.6	9.6	9.7	9.6	9.6	9.6
	CH 48	5240	9.4	9.5	9.4	9.4	9.5	9.5	9.5	9.4
	CH 52	5260	9.5	9.5	9.4	9.4	9.5	9.4	9.4	9.4
	CH 56	5280	9.5	9.5	9.5	9.5	9.4	9.4	9.4	9.4
	CH 60	5300	9.6	9.6	9.6	9.6	9.6	9.5	9.5	9.5
	CH 64	5320	9.4	9.3	9.3	9.3	9.4	9.3	9.3	9.3
	CH 100	5500	9.5	9.5	9.5	9.6	9.5	9.5	9.5	9.5
	CH 104	5520	9.5	9.5	9.4	9.4	9.4	9.5	9.3	9.2
	CH 108	5540	9.4	9.5	9.5	9.4	9.4	9.4	9.4	9.4
	CH 112	5560	9.4	9.5	9.5	9.5	9.5	9.4	9.4	9.4
	CH 116	5580	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3
	CH 132	5660	9.6	9.6	9.5	9.5	9.5	9.5	9.4	9.4
	CH 136	5680	9.2	9.3	9.3	9.3	9.3	9.3	9.3	9.3
	CH 140	5700	**9.8**	9.8	9.8	9.8	9.8	9.8	9.8	9.5

	CH 149	5745	9.7	9.8	9.8	9.8	9.7	9.6	9.7	9.6
	CH 153	5765	9.6	9.6	9.6	9.6	9.6	9.6	9.5	9.5
	CH 157	5785	9.3	9.6	9.6	9.7	9.5	9.5	9.4	9.4
	CH 161	5805	9.3	9.3	9.3	9.4	9.3	9.3	9.3	9.2
	CH 165	5825	9.4	9.6	9.7	9.8	9.6	9.4	9.6	9.5

Mode	**Channel**	**Frequency (MHz)**	**Average Power (dBm)**							
			Data Rate (bps)							
			MCS0	**MCS1**	**MCS2**	**MCS3**	**MCS4**	**MCS5**	**MCS6**	**MCS7**
802.11n-HT40 (5GHz)	CH 38	5190	9.5	9.4	9.4	9.4	9.4	9.4	9.4	9.4
	CH 46	5230	**9.6**	9.5	9.5	9.5	9.6	9.5	9.6	9.6
	CH 54	5270	9.2	9.2	9.2	9.3	9.3	9.2	9.2	9.2
	CH 62	5310	9.4	9.4	9.4	9.5	9.4	9.4	9.4	9.4
	CH 102	5510	9.3	9.3	9.3	9.3	9.2	9.3	9.3	9.3
	CH 110	5550	9.4	9.3	9.3	9.4	9.3	9.3	9.3	9.3
	CH 134	5670	9.3	9.3	9.3	9.2	9.2	9.2	9.3	9.3
	CH 151	5755	9.4	9.5	9.6	9.6	9.5	9.4	9.5	9.5
	CH 159	5795	9.2	9.2	9.3	9.3	9.3	9.3	9.3	9.3

Table 9: Test results conducted power measurement WiFi 5G

Note:

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

2) 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.5G Hz WiFi SAR was tested on 802.11a . As 802.11n-HT20 and 11n-HT40 output power is less than 0.25dB higher than 802.11a,thus the SAR can be excluded.

7.2 SAR measurement Result

1) Per KDB447498 D01v05,testing of other required channels within the operating mode of a frequency band is not required when the reported(Scaled) SAR for the middle channel or highest output power channels is ≤ 0.8W/kg. 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.
2) Per KDB865664 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.
3). 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.
4) All measurement SAR result is scaled-up to account for tune-up tolerance is compliant.

7.2.1 SAR measurement Result of WiFi 2.4G

Test Position of Body with 5mm	Test channel /Frequency	Mode	SAR (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data of 802.11b(Ant1)									
Front Side	6/2437	802.11 b	0.206	0.108	0.010	13.59	15.00	0.285	21.4°C
Rear Side	6/2437	802.11 b	0.262	0.139	0.050	13.59	15.00	**0.362**	21.4°C
Left Side	6/2437	802.11 b	0.006	0.003	-0.080	13.59	15.00	0.008	21.4°C
Right Side	6/2437	802.11 b	0.244	0.117	-0.140	13.59	15.00	0.338	21.4°C
Bottom Side	6/2437	802.11 b	0.082	0.039	-0.050	13.59	15.00	0.113	21.4°C
Rear Side-2Mbps	6/2437	802.11 b	**0.290**	0.154	-0.120	14.10	15.00	0.357	21.4°C
Rear Side-5.5Mbps	6/2437	802.11 b	0.249	0.132	0.170	14.18	15.00	0.301	21.4°C
Rear Side-11Mbps	6/2437	802.11 b	0.197	0.104	0.190	14.31	15.00	0.231	21.4°C
Test data of 802.11n 20M(Ant1)									
Front Side	6/2437	802.11 n	0.108	0.056	0.040	10.72	12.00	0.145	21.4°C
Rear Side	6/2437	802.11 n	0.128	0.068	-0.190	10.72	12.00	0.172	21.4°C
Left Side	6/2437	802.11 n	0.002	0.001	0.170	10.72	12.00	0.002	21.4°C
Right Side	6/2437	802.11 n	0.121	0.058	-0.030	10.72	12.00	0.162	21.4°C
Bottom Side	6/2437	802.11 n	0.037	0.018	0.070	10.72	12.00	0.050	21.4°C
Test data of 802.11n 20M(Ant0)									
Front Side	6/2437	802.11 n	0.038	0.021	0.170	9.70	11.00	0.052	21.4°C
Rear Side	6/2437	802.11 n	0.070	0.031	-0.170	9.70	11.00	0.094	21.4°C
Left Side	6/2437	802.11 n	0.052	0.026	0.160	9.70	11.00	0.070	21.4°C
Right Side	6/2437	802.11 n	0.001	0.000	0.010	9.70	11.00	0.002	21.4°C
Bottom Side	6/2437	802.11 n	0.013	0.063	0.010	9.70	11.00	0.018	21.4°C
Test data of 802.11n 40M(Ant1)									
Front Side	6/2437	802.11 n	0.026	0.014	-0.090	10.50	12.00	0.037	21.4°C
Rear Side	6/2437	802.11 n	0.027	0.014	0.130	10.50	12.00	0.038	21.4°C

Left Side	6/2437	802.11 n	NA	NA	-0.050	10.50	12.00	NA	21.4°C
Right Side	6/2437	802.11 n	0.030	0.014	0.010	10.50	12.00	0.042	21.4°C
Bottom Side	6/2437	802.11 n	0.009	0.004	-0.100	10.50	12.00	0.012	21.4°C

Table 10: Test results body SAR WiFi 2450MHz

Note:

1) In the MIMO module, the M310 only supports WiFi 2.4G band 802.11n-HT20.

2) Per KDB248227, the test mode software does not support simultaneous transmission,so each antenna is tested independently. When the sum of 1-g SAR or SAR to peak location separation is below limit, PBA is also not required.(See section 7.3)

7.2.2 SAR measurement Result of WiFi 5G

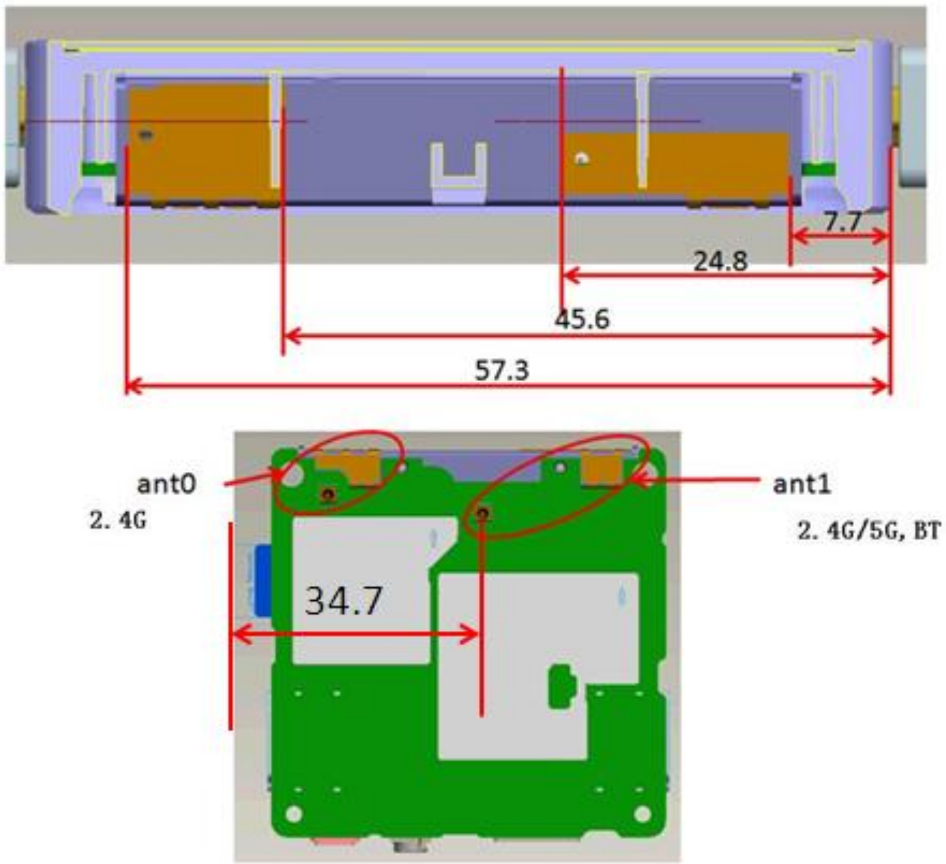
Test Position of Body with 5mm	Test channel /Frequency	Mode	SAR (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up Limit (dBm)	Scaled SAR_{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Test data of 5.2GHz band									
Front Side	40/5200	802.11 a	0.069	0.021	-0.190	9.42	11.00	0.099	21.4°C
Rear Side	40/5200	802.11 a	0.101	0.031	-0.130	9.42	11.00	0.145	21.4°C
Left Side	40/5200	802.11 a	0.009	0.003	0.030	9.42	11.00	0.013	21.4°C
Right Side	40/5200	802.11 a	0.125	0.045	0.130	9.42	11.00	0.180	21.4°C
Bottom Side	40/5200	802.11 a	0.036	0.013	0.100	9.42	11.00	0.051	21.4°C
Test data of 5.3GHz band									
Front Side	52/5260	802.11 a	0.099	0.029	-0.040	9.86	11.00	0.129	21.4°C
Rear Side	52/5260	802.11 a	0.118	0.040	0.040	9.86	11.00	0.153	21.4°C
Left Side	52/5260	802.11 a	NA	NA	-0.100	9.86	11.00	NA	21.4°C
Right Side	52/5260	802.11 a	**0.135**	0.049	0.120	9.86	11.00	0.176	21.4°C
Bottom Side	52/5260	802.11 a	0.066	0.021	0.170	9.86	11.00	0.086	21.4°C
Test data of 5.5GHz band									
Front Side	112/5560	802.11 a	0.093	0.028	0.150	9.74	11.00	0.125	21.4°C
Rear Side	112/5560	802.11 a	0.094	0.029	0.080	9.74	11.00	0.126	21.4°C
Left Side	112/5560	802.11 a	NA	NA	-0.130	9.74	11.00	NA	21.4°C
Right Side	112/5560	802.11 a	**0.135**	0.046	-0.160	9.74	11.00	**0.180**	21.4°C
Bottom Side	112/5560	802.11 a	0.081	0.026	-0.050	9.74	11.00	0.108	21.4°C
Test data of 5.8GHz band									
Front Side	149/5745	802.11 a	0.077	0.025	0.160	9.72	11.00	0.103	21.4°C
Rear Side	149/5745	802.11 a	0.068	0.022	-0.110	9.72	11.00	0.091	21.4°C
Left Side	149/5745	802.11 a	NA	NA	-0.190	9.72	11.00	NA	21.4°C
Right Side	149/5745	802.11 a	0.082	0.029	0.190	9.72	11.00	0.111	21.4°C
Bottom Side	149/5745	802.11 a	0.093	0.030	0.120	9.72	11.00	0.125	21.4°C

Table 11: Test results Body SAR WiFi 5MHz

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 v05.

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



The SAR measurement positions of each band are as below:

Mode	Front Side	Rear Side	Left Side	Right Side	Top Side	Bottom Side
WiFi 2.4G	Yes	Yes	Yes	Yes	NA*	Yes
WiFi 5G	Yes	Yes	Yes	Yes	NA*	Yes

Table 12: SAR measurement positions

Note: *Testing of the sides with the power cable and HDMI out protruding will be omitted.

7.3.1 Stand-alone SAR test exclusion

The 1-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, 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	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	Exclusion threshold	SAR test exclusion
BT	5.0	3.16	5	2.450	0.99	3.00	Yes

Table 13: Standalone SAR test exclusion in body position

Note: * - maximum possible output power declared by manufacturer

7.3.2 Simultaneous SAR evaluation

The Simultaneous Transmission Possibilities are as below:

Mode	Configuration	Body
MIMO (802.11n-HT20)	WiFi 2.4G Ant 0+ WiFi 2.4G Ant 1	Yes

Note:

1) In the MIMO module, the M310 only supports WiFi 2.4G band 802.11n-HT20.

2) BT , WiFi 2.4G and WiFi 5G can't transmit simultaneously.

7.3.3 SAR Summation Scenario

Test Position		Scaled SAR_{Max}		Σ1-g SAR	SPLSR
		WiFi 2.4G Ant0 (802.11n 20M)	WiFi 2.4G Ant1 (802.11n 20M)		
Body	Front Side	0.052	0.145	0.197	N/A
	Rear Side	0.094	0.172	**0.266**	N/A
	Left Side	0.070	0.002	0.072	N/A
	Right Side	0.002	0.162	0.164	N/A
	Bottom Side	0.018	0.050	0.068	N/A

The above numeral summed SAR results is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore simultaneous transmission SAR with Volume Scans is not required per KDB 447498 D01v05r01

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