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TEST REPORT

Report No. ..... :	**CHTEW19070115**	Report verificaiton:
Project No. ..... :	**SHT1907049301EW**	
FCC ID ..... :	**2AR45-MIFI**	
Applicant's name ..... :	**Shanghai Notion Information Technology CO. LTD**	
Address.....:	Floor 5,Building 5,NO 289,BishengRd,Pudongdistrict, Shanghai,China	
Manufacturer.....:	Shanghai Notion Information Technology CO. LTD	
Address.....:	Floor 5,Building 5,NO 289,Bisheng Rd,Pudongdistrict, Shanghai,China	
Test item description ..... :	**LTE MiFi**	
Trade Mark .....:	-	
Model/Type reference.....:	M022	
Listed Model(s) .....:	M022T, M028, M028B, M028AT, M028A, M023, L02C, L02I, L02H, L02B	
Standard ..... :	**FCC 47 CFR Part2.1093** **IEEE Std C95.1, 1999 Edition** **IEEE 1528: 2013**	
Date of receipt of test sample…….:	Jul. 16, 2019	
Date of testing……...:	Jul. 17, 2019- Jul. 19, 2019	
Date of issue……:	Jul. 22, 2019	
Result..... ……...:	**PASS**	

Compiled by (position+printedname+signature)...:	File administrators:Xiaodong Zhao	Xiaodong Zhao
Supervised by (position+printedname+signature)...:	Test Engineer: Xiaodong Zhao	Xiaodong Zhao
Approved by (position+printedname+signature)...:	Manager: Hans Hu	Hans Hu

Testing Laboratory Name ..... :	**Shenzhen Huatongwei International Inspection Co., Ltd**
Address.....:	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

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1 . Test Standards and Report version

1.1. Test Standards

The tests were performed according to following standards:

FCC 47 Part 2.1093: Radiofrequency radiation exposure evaluation: portable devices.
IEEE Std C95.1, 1999 Edition: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
IEEE Std 1528™-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

FCC published RF exposure KDB procedures:
865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz
865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations
447498 D01 General RF Exposure Guidance v06: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
248227 D01 802 11 Wi-Fi SAR v02r02: SAR Measurement Proceduresfor802.11 a/b/g Transmitters
941225 D05 SAR for LTE Devices v02r05: SAR Evaluation Considerations for LTE Devices
941225 D06 Hotspot Mode v02r01: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

TCB workshop April, 2019; Page 19, Tissue Simulating Liquids (TSL)

1.2. Report version

Revision No.	Date of issue	Description
N/A	2019-07-22	Original

2. Summary

2.1. Client Information

Applicant:	Shanghai Notion Information Technology CO. LTD
Address:	Floor 5,Building 5,NO 289,Bisheng Rd,Pudongdistrict,Shanghai,China
Manufacturer:	Shanghai Notion Information Technology CO. LTD
Address:	Floor 5,Building 5,NO 289,Bisheng Rd,Pudongdistrict,Shanghai,China

2.2. Product Description

Name of EUT:	LTE MiFi			
Trade Mark:	-			
Model No.:	M022			
Listed Model(s):	M022T, M028, M028B, M028AT, M028A, M023, L02C, L02I, L02H, L02B			
Power supply:	DC 3.7V			
Device Category:	Portable			
Product stage:	Production unit			
RF Exposure Environment:	General Population/Uncontrolled			
IMEI:	352717100213480			
Hardware version:	L02I_1_10			
Software version:	L02IAVANTEL1_M022T_LCD_V003_8801_2.174.000_tx_develop_20190719_1800			
Device Dimension:	Overall (Length x Width x Thickness):100 x 64 x 15mm			
Maximum SAR Value				
Separation Distance:	Hotspot:	10mm		
Max Report SAR Value(1g):	Test location:	PCT	DTS	Simultaneous Tx
	Hotspot:	1.438 W/kg	0.091 W/kg	1.529 W/kg
LTE				
Operation Band:	FDD Band 4			
Power Class:	Class 3			
Operating Mode:	QPSK 16QAM			
Antenna Type:	Integral			
WiFi 2.4G				
Operating Mode:	802.11b 802.11g 802.11n(HT20)			
Antenna Type:	Integral			
Remark: *1. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power.*				

3. Test Environment

3.1. Test laboratory

Laboratory:Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

3.2. Test Facility

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 762235

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 762235.

IC-Registration No.: 5377A

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377A.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Ambient temperature	18 °C to 25 °C
Ambient humidity	30%RH to 70%RH
Air Pressure	950-1050mbar

4. Equipments Used during the Test

Used	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. date (YY-MM-DD)	Due date (YY-MM-DD)
●	Data Acquisition Electronics DAEx	SPEAG	DAE4	1549	2019/03/19	2020/03/18
●	E-field Probe	SPEAG	EX3DV4	7494	2019/03/25	2020/03/24
●	Universal Radio Communication Tester	R&S	CMW500	137681	2019/06/27	2020/06/26
● Tissue-equivalent liquids Validation						
●	Dielectric Assessment Kit	SPEAG	DAK-3.5	1267	N/A	N/A
○	Dielectric Assessment Kit	SPEAG	DAK-12	1130	N/A	N/A
●	Network analyzer	Keysight	E5071C	MY46733048	2018/09/19	2019/09/18
● System Validation						
○	System Validation Antenna	SPEAG	CLA-150	4024	2018/02/21	2021/02/20
○	System Validation Dipole	SPEAG	D450V3	1102	2018/02/23	2021/02/22
●	System Validation Dipole	SPEAG	D750V3	1180	2018/02/07	2021/02/06
●	System Validation Dipole	SPEAG	D835V2	4d238	2018/02/19	2021/02/18
●	System Validation Dipole	SPEAG	D1750V2	1164	2018/02/06	2021/02/05
●	System Validation Dipole	SPEAG	D1900V2	5d226	2018/02/22	2021/02/21
●	System Validation Dipole	SPEAG	D2450V2	1009	2018/02/05	2021/02/04
●	System Validation Dipole	SPEAG	D2600V2	1150	2018/02/05	2021/02/04
○	System Validation Dipole	SPEAG	D5GHzV2	1273	2018/02/21	2021/02/20
●	Signal Generator	R&S	SMB100A	114360	2018/08/21	2019/08/20
●	Power Viewer for Windows	R&S	N/A	N/A	N/A	N/A
●	Power sensor	R&S	NRP18A	101010	2018/08/21	2019/08/20
●	Power sensor	R&S	NRP18A	101011	2018/08/21	2019/08/20
●	Power Amplifier	BONN	BLWA 0160-2M	1811887	2018/11/15	2019/11/14
●	Dual Directional Coupler	Mini-Circuits	ZHDC-10-62-S+	F975001814	2018/11/15	2019/11/14
●	Attenuator	Mini-Circuits	VAT-3W2+	1819	2018/11/15	2019/11/14
●	Attenuator	Mini-Circuits	VAT-10W2+	1741	2018/11/15	2019/11/14

Note:

1. *The Probe,Dipole and DAE calibration reference to the Appendix B and C.*
2. *Referring to KDB865664 D01, the dipole calibration interval can be extended to 3 years with justifcatio. The dipole are also not physically damaged or repaired during the interval.*

5. Measurement Uncertainty

Measurement uncertainty evaluation for DUT SAR test									
No.	Error Description	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System									
1	Probe calibration	6.65%	N	1	1	1	6.65%	6.65%	∞
2	Axial isotropy	0.60%	R	$\sqrt{3}$	0.7	0.7	0.24%	0.24%	∞
3	Hemispherical isotropy	1.60%	R	$\sqrt{3}$	0.7	0.7	0.65%	0.65%	∞
4	Boundary Effects	2.00%	R	$\sqrt{3}$	1	1	1.15%	1.15%	∞
5	Probe Linearity	0.45%	R	$\sqrt{3}$	1	1	0.26%	0.26%	∞
6	System Detection Limits	1.00%	R	$\sqrt{3}$	1	1	0.58%	0.58%	∞
7	Modulation response	2.40%	R	$\sqrt{3}$	1	1	1.39%	1.39%	∞
8	Readout electronics	0.30%	N	1	1	1	0.30%	0.30%	∞
9	Response time	0.80%	R	$\sqrt{3}$	1	1	0.46%	0.46%	∞
10	Integration time	2.60%	R	$\sqrt{3}$	1	1	1.50%	1.50%	∞
11	RF Ambient Noise	3.00%	R	$\sqrt{3}$	1	1	1.73%	1.73%	∞
12	RF Ambient Reections	3.00%	R	$\sqrt{3}$	1	1	1.73%	1.73%	∞
13	Probe Positioner	0.04%	R	$\sqrt{3}$	1	1	0.02%	0.02%	∞
14	Probe Positioning	0.80%	R	$\sqrt{3}$	1	1	0.46%	0.46%	∞
15	Max. SAR Eval.	4.00%	R	$\sqrt{3}$	1	1	2.31%	2.31%	∞
Test Sample Related									
16	Test sample positioning	2.90%	N	1	1	1	2.90%	2.90%	145
17	Device holder uncertainty	3.60%	N	1	1	1	3.60%	3.60%	5
18	Power Drift	5.00%	R	$\sqrt{3}$	1	1	2.89%	2.89%	∞
19	Power Scaling	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
Phantom and Setup									
20	Phantom uncertainty	6.60%	R	$\sqrt{3}$	1	1	3.81%	3.81%	∞
21	SAR correction	0.00%	N	1	1	0.84	0.00%	0.00%	∞
22	Liquid conductivity (meas.)	2.50%	N	1	0.78	0.71	1.95%	1.78%	∞
23	Liquid permittivity (meas.)	2.50%	N	1	0.23	0.26	0.58%	0.65%	∞
24	Temp. unc. - Conductivity	3.60%	R	$\sqrt{3}$	0.78	0.71	1.62%	1.48%	∞
25	Temp. unc. - Permittivity	0.50%	R	$\sqrt{3}$	0.23	0.26	0.07%	0.08%	∞
Combined standard uncertainty			**RSS**				**11.06%**	**11.00%**	
Expanded uncertainty (confidence interval of 95%)			**K=2**				**22.12%**	**21.99%**	

Measurement uncertainty evaluation for System Check									
No.	Error Description	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System									
1	Probe calibration	6.65%	N	1	1	1	6.65%	6.65%	∞
2	Axial isotropy	0.00%	R	$\sqrt{3}$	0.7	0.7	0.00%	0.00%	∞
3	Hemispherical isotropy	0.00%	R	$\sqrt{3}$	0.7	0.7	0.00%	0.00%	∞
4	Boundary Effects	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
5	Probe Linearity	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
6	System Detection Limits	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
7	Modulation response	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
8	Readout electronics	0.00%	N	1	1	1	0.00%	0.00%	∞
9	Response time	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
10	Integration time	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
11	RF Ambient Noise	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
12	RF Ambient Reections	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
13	Probe Positioner	0.04%	R	$\sqrt{3}$	1	1	0.02%	0.02%	∞
14	Probe Positioning	0.80%	R	$\sqrt{3}$	1	1	0.46%	0.46%	∞
15	Max. SAR Eval.	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
System check source (dipole)									
16	Dev. of experimental dipole	0.00%	N	1	1	1	0.00%	0.00%	∞
17	Dipole Axis to Liquid Dist.	2.00%	R	$\sqrt{3}$	1	1	1.15%	1.15%	∞
18	Input power & SAR drift	5.00%	R	$\sqrt{3}$	1	1	2.89%	2.89%	∞
Phantom and Setup									
19	Phantom uncertainty	7.60%	R	$\sqrt{3}$	1	1	4.39%	4.39%	∞
20	SAR correction	0.00%	N	1	1	0.84	0.00%	0.00%	∞
21	Liquid conductivity (meas.)	2.50%	N	1	0.78	0.71	1.95%	1.78%	∞
22	Liquid permittivity (meas.)	2.50%	N	1	0.23	0.26	0.58%	0.65%	∞
23	Temp. unc. - Conductivity	3.60%	R	$\sqrt{3}$	0.78	0.71	1.62%	1.48%	∞
24	Temp. unc. - Permittivity	0.50%	R	$\sqrt{3}$	0.23	0.26	0.07%	0.08%	∞
Combined standard uncertainty			**RSS**				**9.25%**	**9.18%**	
Expanded uncertainty (confidence interval of 95%)			**K=2**				**18.51%**	**18.36%**	

6. SAR Measurements System Configuration

6.1. 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 2003.

DASY5 software and SEMCAD data evaluation software.

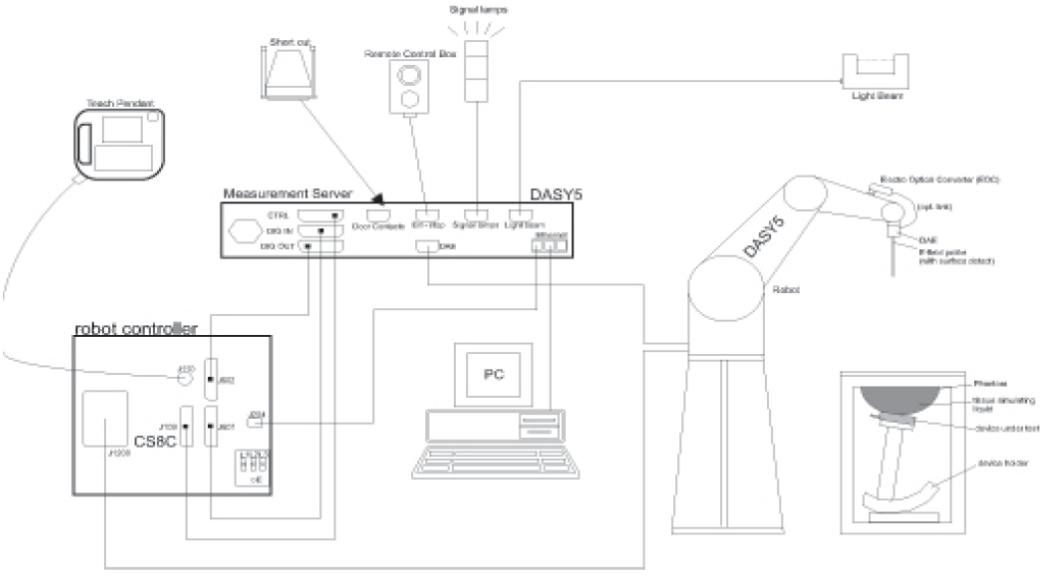
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

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 validation dipoles allowing to validate the proper functioning of the system.



6.2. DASY5 E-field Probe System

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

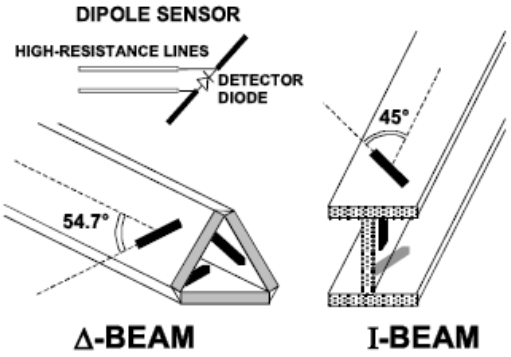
- **Probe Specification**

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	4 MHz to 10 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 W/kg; Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm
Application	General dosimetry up to 6 GHz Dosimetry in strong gradient fields Compliance tests of Mobile Phones
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

- **Isotropic E-Field Probe**

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



6.3. Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI isfully compatible with standard and all known tissuesimulating liquids. ELI has been optimized regarding its performance and can beintegrated into our standard phantom tables. A cover prevents evaporation ofthe liquid. Reference markings on the phantom allow installation of thecomplete setup, including all predefined phantom positions and measurementgrids, by teaching three points. The phantom is compatible with all SPEAGdosimetric probes and dipoles.

SAM-Twin Phantom

ELI Phantom

6.4. Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

Device holder supplied by SPEAG

7. SAR Test Procedure

7.1. Scanning Procedure

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

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

Area Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot.Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

Zoom Scan
After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

Spatial Peak Detection
The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses.The DASY5 system allows evaluations that combine measured data and robot positions, such as:
• maximum search
• extrapolation
• boundary correction
• peak search for averaged SAR
During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard’s method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.
Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space.
They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard’s method for extrapolation.

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 5mm steps.

Table 1: Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v04

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 mm ± 1 mm	½·δ·ln(2) mm ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

7.2. 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),s 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 ".DA4". 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], [W/kg], [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

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

Probe parameters:	Sensitivity:	Normi, ai0, ai1, ai2
	Conversion factor:	ConvFi
	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:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

Vi: compensated signal of channel (i = x, y, z)
Ui: input signal of channel (i = x, y, z)
cf: crest factor of exciting field (DASY parameter)
dcpi: diode compression point (DASY parameter)

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

$$\mathrm{E-fieldprobes}: \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\mathrm{H-fieldprobes}: \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

Vi: compensated signal of channel (i = x, y, z)
Normi: sensor sensitivity of channel (i = x, y, z), [mV/(V/m)2] for E-field Probes
ConvF: sensitivity enhancement in solution
aij: sensor sensitivity factors for H-field probes
f: carrier frequency [GHz]
Ei: electric field strength of channel i in V/m
Hi: magnetic field strength of channel i in A/m

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

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

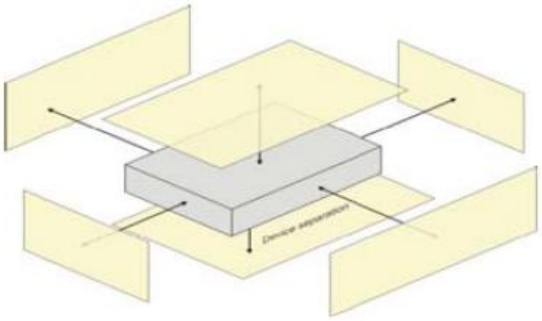
SAR: local specific absorption rate in W/kg
Etot: total field strength in V/m
σ: conductivity in [mho/m] or [Siemens/m]
ρ: equivalent tissue density in g/cm3

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.

8. Position of the wireless device in relation to the phantom

8.1. Hotspot Mode Exposure conditions

The hotspot mode and body-worn accessory SAR test configurations may overlap for handsets. When the same wireless mode transmission configurations for voice and data are required for SAR measurements, the more conservative configuration with a smaller separation distance should be tested for the overlapping SAR configurations. This typically applies to the back and front surfaces of a handset when SAR is required for both hotspot mode and body-worn accessory exposure conditions. Depending on the form factor and dimensions of a device, the test separation distance used for hotspot mode SAR measurement is either 10 mm or that used in the body-worn accessory configuration, whichever is less for devices with dimension > 9 cm x 5 cm. For smaller devices with dimensions ≤ 9 cm x 5 cm because of a greater potential for next to body use a test separation of ≤ 5 mm must be used.



Picture 5 Test positions for Hotspot Mode

9. Dielectric Property Measurements & System Check

9.1. Tissue Dielectric Parameters

The temperature of the tissue-equivalent medium used during measurement must also be within 18℃ to 25℃ and within ± 2℃ of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3-4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

The dielectric constant (ε_r) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within ± 5% of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for ε_r and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Tissue dielectric parameters for Head and Body				
Target Frequency (MHz)	Head		Body	
	ε_r	σ(S/m)	ε_r	σ(S/m)
750	41.9	0.89	55.5	0.96
835	41.5	0.90	55.2	0.97
1750	40.1	1.37	53.4	1.49
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
2600	39.0	1.96	52.5	2.16

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

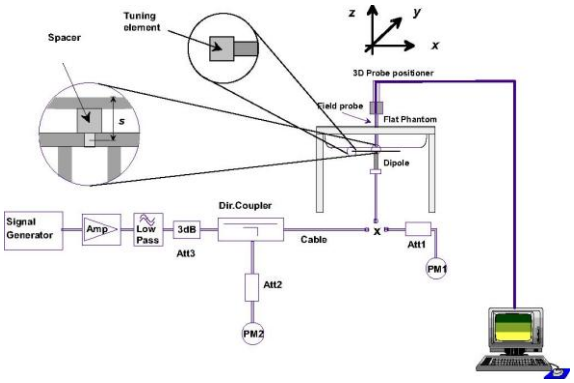
Dielectric performance of Head tissue simulating liquid									
Frequency (MHz)	ε_r		σ(S/m)		Delta (ε_r)	Delta (σ)	Limit	Temp (℃)	Date
	Target	Measured	Target	Measured					
1750	40.10	41.93	1.37	1.38	4.56%	0.36%	±5%	22.5	2019-07-18
2450	39.20	40.96	1.80	1.84	4.48%	2.11%	±5%	22.5	2019-07-19

9.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- The results are normalized to 1 W input power.



System Performance Check Setup

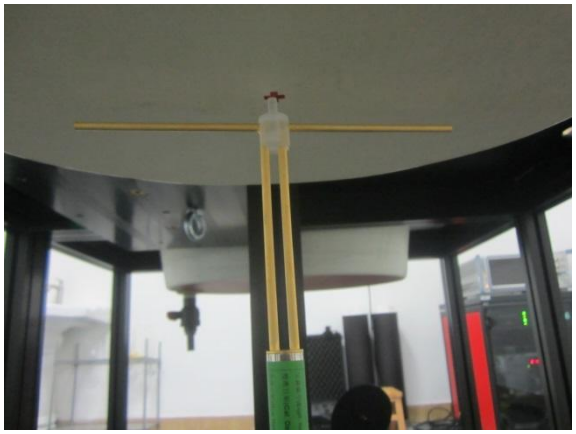


Photo of Dipole Setup

System Check Result:
The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within ±10% of the manufacturer calibrated dipole SAR target.

Head											
Frequency (MHz)	1g SAR			10g SAR			Delta (1g)	Delta (10g)	Limit	Temp (℃)	Date
	Target 1W	Normalize to 1W	Measured 250mW	Target 1W	Normalize to 1W	Measured 250mW					
1750	36.60	36.24	9.06	19.40	19.44	4.86	-0.98%	0.21%	±10%	22.5	2019-07-18
2450	51.50	50.40	12.60	24.10	23.44	5.86	-2.14%	-2.74%	±10%	22.5	2019-07-19

Plots of System Performance Check

System Performance Check-Head 1750MHz

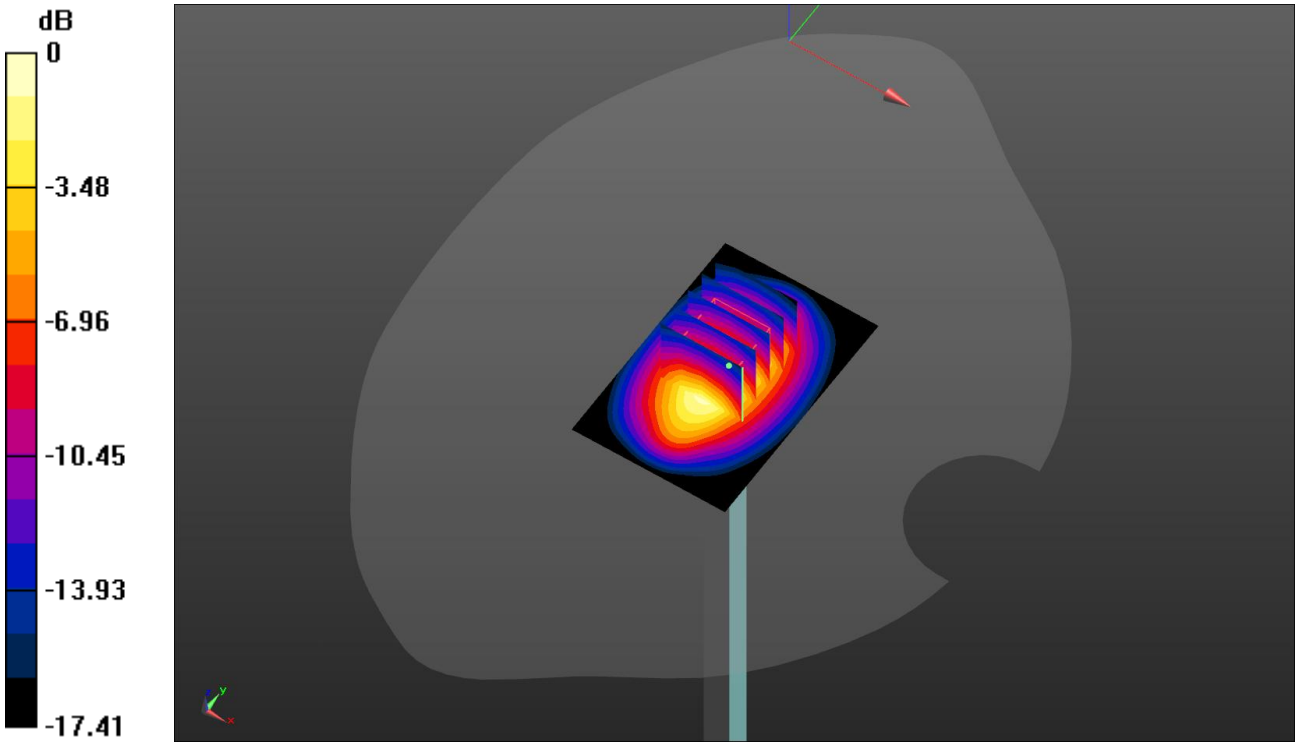
DUT: D1750V2; Type: D1750V2; Serial: 1164
Date: 2019-07-18
Communication System: UID 0, CW (0); Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.375 S/m; ε_r = 41.933; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(8.91, 8.91, 8.91); Calibrated: 3/25/2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1549; Calibrated: 3/19/2018
- Phantom: Twin-SAM V8.0; Type: QD 000 P41 AA; Serial: 1947
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Head/d=10mm,Pin=250mW/Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.1 W/kg

Head/d=10mm,Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 103.5 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 16.5 W/kg
SAR(1 g) = 9.06 W/kg; SAR(10 g) = 4.86 W/kg
Maximum value of SAR (measured) = 13.8 W/kg



SystemPerformanceCheck-Head 2450MHz

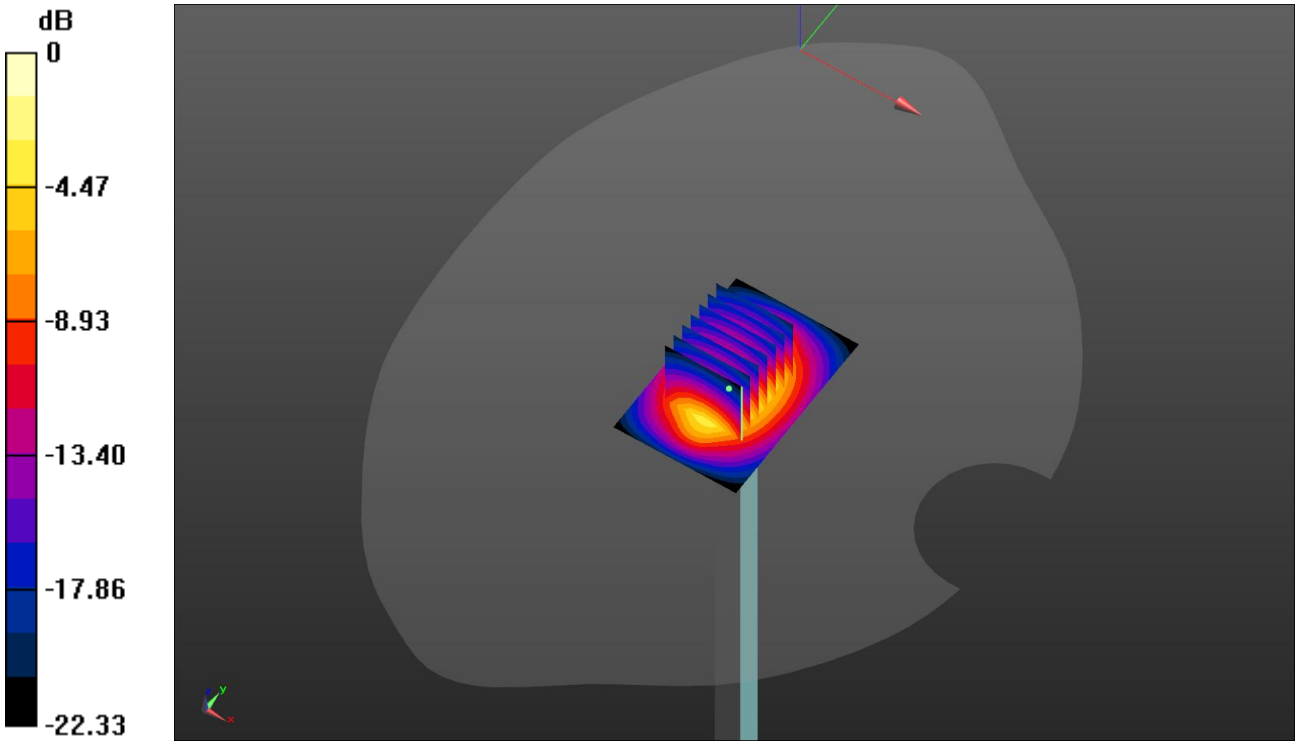
DUT: D2450V2; Type: D2450V2; Serial: 1009
Date:2019-07-19
Communication System: UID 0, CW (0); Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.838 S/m; ε_r = 40.956; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7494; ConvF(7.90, 7.90, 7.90); Calibrated: 3/25/2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1549; Calibrated: 3/19/2018
- Phantom: Twin-SAM V8.0; Type: QD 000 P41 AA; Serial: 1947
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Head/d=10mm,Pin=250mW/Area Scan (41x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 21.1 W/kg

Head/d=10mm,Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 110.0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 26.2 W/kg
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.86 W/kg
Maximum value of SAR (measured) = 20.8 W/kg



10. SAR Exposure Limits

SAR assessments have been made in line with the requirements of FCC 47 CFR § 2.1093.

Type Exposure	Limit (W/kg)	
	General Population/ Uncontrolled Exposure Environment	Occupational/ Controlled Exposure Environment
Spatial Average SAR (whole body)	0.08	0.4
Spatial Peak SAR (1g cube tissue for head and trunk)	1.6	8.0
Spatial Peak SAR (10g for limb)	4.0	20.0

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

Occupational/Controlled Environments: are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

11. Conducted Power Measurement Results

11.1. LTE

General Note:

1. CMW500 base station simulator was used to setup the connection with EUT; the frequency band, channel,bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUTtransmitting at maximum power and at different configurations which are requested to be reported to FCC, forconducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r03, when a properly configured base station simulator is used for the SAR and powermeasurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RBallocation, using the RB offset and required test channel combination with the highest maximum output power for RBoffsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r03, for QPSK with 100% RB allocation, SAR is not required when the highest maximumoutput power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations andthe highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highestoutput power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also betested.
6. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is > not ½ dB higher than thesame configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225D05v02r03, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r03, smaller bandwidth output power for each RB allocation configuration is > not ½ dBhigher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supportedbandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.

LTE-FDD Band 4				Conducted Power(dBm)		
Band-width	Modulation	RB allocation	RB offset	19957	20175	20393
				1710.7MHz	1732.5MHz	1754.3MHz
1.4MHz	QPSK	1	0	22.57	22.23	23.57
			2	23.75	23.02	22.17
			5	22.10	22.88	23.88
		3	0	22.70	23.59	23.18
			1	22.18	22.26	23.31
			3	22.34	23.67	23.27
		6	0	22.90	22.62	22.21
	16QAM	1	0	23.46	22.84	23.24
			2	22.29	22.62	22.44
			5	22.71	22.01	22.36
		3	0	23.83	23.06	22.56
			1	22.63	23.66	23.19
			3	22.88	22.30	22.19
		6	0	23.92	22.25	22.77
Band-width	Modulation	RB allocation	RB offset	19965	20175	20385
				1711.5MHz	1732.5MHz	1753.5MHz
3MHz	QPSK	1	0	22.20	22.57	23.18
			8	23.63	23.32	23.68
			14	23.15	23.25	23.53
		8	0	22.54	22.57	23.24
			4	23.17	23.30	22.86
			7	22.44	23.70	23.58
		15	0	22.36	22.18	23.13
	16QAM	1	0	23.20	22.85	22.95
			8	23.94	22.99	23.69
			14	23.76	22.83	22.63
		8	0	22.84	22.07	23.18
			4	22.80	22.20	22.26
			7	23.20	23.04	23.88
		15	0	23.37	22.57	23.87

LTE-FDD Band 4				Conducted Power(dBm)		
Band-width	Modulation	RB allocation	RB offset	19975	20175	20375
				1712.5MHz	1732.5MHz	1752.5MHz
5MHz	QPSK	1	0	22.64	23.94	22.88
			12	22.65	22.36	23.49
			24	23.75	22.15	23.78
		12	0	22.97	23.62	23.80
			7	23.67	23.46	23.87
			13	22.31	22.27	22.81
		25	0	23.55	22.73	22.49
	16QAM	1	0	23.41	22.55	23.20
			12	23.94	23.38	23.44
			24	22.30	22.93	23.03
		12	0	22.74	22.19	23.66
			7	22.13	22.19	23.67
			13	22.23	23.44	23.95
		25	0	22.35	23.74	23.44
Band-width	Modulation	RB allocation	RB offset	20000	20175	20350
				1715MHz	1732.5MHz	1750MHz
10MHz	QPSK	1	0	23.52	23.06	22.32
			24	23.55	22.98	23.46
			49	23.41	22.23	23.43
		25	0	22.66	23.07	23.03
			24	22.66	22.07	22.25
			49	22.12	23.41	22.82
		50	0	22.96	23.19	22.32
	16QAM	1	0	22.22	22.56	22.63
			24	23.52	22.99	22.04
			49	22.15	23.23	23.77
		25	0	22.94	23.41	23.69
			24	22.01	22.82	23.02
			49	23.17	22.37	22.80
		50	0	22.26	22.99	22.70

LTE-FDD Band 4				Conducted Power(dBm)		
Band-width	Modulation	RB allocation	RB offset	20025	20175	20325
				1717.5MHz	1732.5MHz	1747.5MHz
15MHz	QPSK	1	0	23.37	23.06	22.31
			38	23.28	23.55	22.67
			74	23.34	23.88	23.93
		38	0	22.38	23.11	22.36
			18	23.95	22.57	23.94
			37	23.96	22.02	22.81
		75	0	22.82	22.23	22.72
	16QAM	1	0	23.52	22.60	23.83
			38	22.64	23.95	23.28
			74	23.98	22.98	22.94
		38	0	23.09	22.78	23.61
			18	23.63	22.77	22.49
			37	22.49	22.50	22.22
		75	0	23.81	22.17	23.74
Band-width	Modulation	RB allocation	RB offset	20050	20175	20300
				1720MHz	1732.5MHz	1745MHz
20MHz	QPSK	1	0	22.48	22.70	22.86
			49	22.28	23.53	22.81
			99	23.37	22.92	22.43
		50	0	23.45	23.51	23.75
			25	23.63	23.68	23.77
			50	23.01	22.71	22.81
		100	0	22.33	23.56	22.51
	16QAM	1	0	23.78	22.62	22.31
			49	23.12	23.64	22.33
			99	22.47	23.46	23.67
		50	0	23.82	23.59	22.01
			25	23.16	22.72	22.64
			50	23.22	23.21	22.30
		100	0	22.31	22.41	22.74

11.2. WiFi

For 2.4GHz WiFi SAR testing, highest average RF output power channel for the lowest data rate for 802.11b were for SAR evaluation.

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

SAR testing is not required for OFDM mode(s) when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

WiFi 2.4G			
Mode	Channel	Frequency (MHz)	Conducted Average Power (dBm)
802.11b	1	2412	15.47
	6	2437	15.33
	11	2462	15.29
802.11g	1	2412	13.54
	6	2437	13.63
	11	2462	13.41
802.11n (HT20)	1	2412	13.29
	6	2437	13.38
	11	2462	13.57

12. Maximum Tune-up Limit

LTE				
Fequency Band	Band-width(MHz)	Modulation	RB allocation	Maximum Tune-up (dBm)
FDD Band 4	1.4	QPSK	1	24.00
			3	24.00
			6	24.00
		16QAM	1	24.00
			3	24.00
			6	24.00
	3	QPSK	1	24.00
			8	24.00
			15	24.00
		16QAM	1	24.00
			8	24.00
			15	24.00
	5	QPSK	1	24.00
			12	24.00
			25	24.00
		16QAM	1	24.00
			12	24.00
			25	24.00
	10	QPSK	1	24.00
			25	24.00
			50	24.00
		16QAM	1	24.00
			25	24.00
			50	24.00
	15	QPSK	1	24.00
			38	24.00
			75	24.00
		16QAM	1	24.00
			38	24.00
			75	24.00
	20	QPSK	1	24.00
			50	24.00
			100	24.00
		16QAM	1	24.00
			50	24.00
			100	24.00

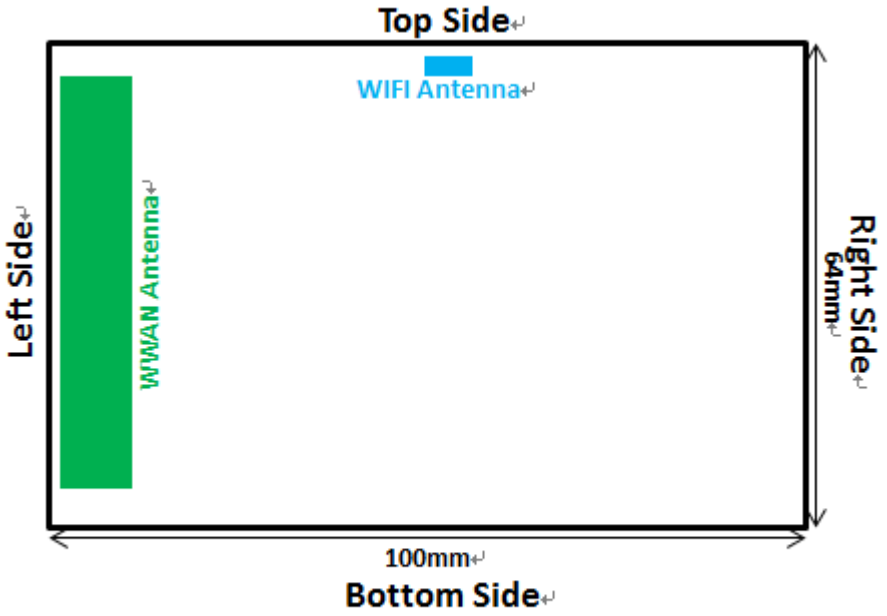
The allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2-1due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
256 QAM	≥ 1						≤ 5

WiFi 2.4G	
Mode	Maximum Tune-up (dBm) Conducted Average Power
802.11b	16.00
802.11g	14.00
802.11n(HT20)	14.00

13. Antenna Location



Front View

Distance of the Antenna to the EUT surface/edge(mm)						
Antenna	Rear	Front	Top side	Bottom side	Right side	Left side
WWAN	2	5	10	10	90	3
WiFi	8	5	5	58	44	49

Positions for SAR tests; Hotspot mode						
Antenna	Rear	Front	Top side	Bottom side	Right side	Left side
WWAN	Yes	Yes	Yes	Yes	No	Yes
WiFi	Yes	Yes	Yes	No	No	No

General note:
Referring to KDB941225 D06, when the overall device length and width are >9cm*5cm, the test distance is 10mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.

14. Measured and Reported SAR Results

SAR Test Reduction criteria are as follows:

- Reported SAR(W/kg) for WWAN = Measured SAR *Tune-up Scaling Factor
- Reported SAR(W/kg) for Wi-Fi and Bluetooth = Measured SAR * Tune-up scaling factor * Duty Cycle scaling factor
- Duty Cycle scaling factor = 1 / Duty cycle (%)

KDB 447498 D01 General RF Exposure Guidance:

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
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 941225 D05 SAR for LTE Devices:

SAR test reduction is applied using the following criteria:

- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel.
- When the reported SAR is > 0.8 W/kg, testing for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
- Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
- Testing for 16-QAM and 64-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
- Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

KDB 248227 D01 SAR meas for 802.11:

When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the initial test position(s) by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The initial test position(s) is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the reported SAR for the initial test position is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.

- For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
- When it is unclear, all equivalent conditions must be tested.

- For all positions/configurations tested using the initial test position and subsequent test positions,when the reported SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required test channels are considered.
  - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the initial test position, Area Scans were performed to determine the position with the Maximum Value of SAR (measured). The position that produced the highest Maximum Value of SAR is considered the worst case position; thus used as the initial test position.

14.1. Hotspot SAR

LTE Band 4										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Plot No.
		CH	MHz							
20M QPSK 1RB	Front	20050	1720	22.28	24.00	1.49	-0.14	0.968	1.438	-
		20175	1732.5	23.53	24.00	1.11	0.00	0.831	0.926	-
		20300	1745	22.81	24.00	1.32	-0.18	1.030	1.355	-
	Rear	20050	1720	22.28	24.00	1.49	-0.17	0.998	1.483	1
		20175	1732.5	23.53	24.00	1.11	0.19	1.220	1.359	-
		20300	1745	22.81	24.00	1.32	-0.05	1.050	1.381	-
	Left	20175	1732.5	23.53	24.00	1.11	-0.04	0.536	0.597	-
	Right	20175	1732.5	23.53	24.00	1.11	-	-	-	-
	Top	20175	1732.5	23.53	24.00	1.11	0.00	0.407	0.454	-
	Bottom	20175	1732.5	23.53	24.00	1.11	0.01	0.351	0.391	-
20M QPSK 50RB	Front	20050	1720	23.63	24.00	1.09	-0.08	0.709	0.772	-
		20175	1732.5	23.68	24.00	1.08	0.18	0.803	0.864	-
		20300	1745	23.77	24.00	1.05	-0.10	0.826	0.871	-
	Rear	20050	1720	23.63	24.00	1.09	-0.10	0.731	0.796	-
		20175	1732.5	23.68	24.00	1.08	0.11	1.179	1.269	-
		20300	1745	23.77	24.00	1.05	-0.03	0.842	0.888	-
	Left	20175	1732.5	23.68	24.00	1.08	-0.02	0.518	0.557	-
	Right	20175	1732.5	23.68	24.00	1.08	-	-	-	-
	Top	20175	1732.5	23.68	24.00	1.08	0.11	0.393	0.423	-
	Bottom	20175	1732.5	23.68	24.00	1.08	0.01	0.339	0.365	-
20M QPSK 100RB	Front	20050	1720	22.33	24.00	1.47	0.17	0.782	1.149	-
		20175	1732.5	23.56	24.00	1.11	-0.06	0.845	0.935	-
		20300	1745	22.51	24.00	1.41	0.03	0.815	1.149	-
	Rear	20050	1720	22.33	24.00	1.47	-0.11	0.792	1.163	-
		20175	1732.5	23.56	24.00	1.11	0.05	0.915	1.013	-
		20300	1745	22.51	24.00	1.41	0.18	0.873	1.230	-

WiFi 2.4G												
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune-up limit (dBm)	Tune-up scaling factor	Duty Cycle	Duty Cycle Scaling Factor	Power Drift (dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Plot No.
		CH	MHz									
802.11b	Front	1	2412	15.47	16.00	1.13	100.00%	1.00	-0.13	0.081	0.091	-
		6	2437	15.33	16.00	1.17	100.00%	1.00	-	-	-	-
		11	2462	15.29	16.00	1.18	100.00%	1.00	-	-	-	-
	Rear	1	2412	15.47	16.00	1.13	100.00%	1.00	-0.14	0.028	0.031	-
		6	2437	15.33	16.00	1.17	100.00%	1.00	-	-	-	-
		11	2462	15.29	16.00	1.18	100.00%	1.00	-	-	-	-
	Left	1	2412	15.47	16.00	1.13	100.00%	1.00	-	-	-	-
	Right	1	2412	15.47	16.00	1.13	100.00%	1.00	-	-	-	-
	Top	1	2412	15.47	16.00	1.13	100.00%	1.00	-0.14	0.091	0.103	2
	Bottom	1	2412	15.47	16.00	1.13	100.00%	1.00	-	-	-	-

SAR Test Data Plots to the Appendix A.

15. SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. These 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 <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), 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 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).

4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Band	Test Position	Frequency		Highest Measured SAR (W/kg)	First Repeated		Second Repeated	
		CH	MHz		Measured SAR(W/kg)	Largest to Smallest SAR Ratio	Measured SAR(W/kg)	Largest to Smallest SAR Ratio
LTE Band 4 20M_QPSK_1RB	Rear	20175	1732.5	1.22	1.16	1.05	N/A	N/A

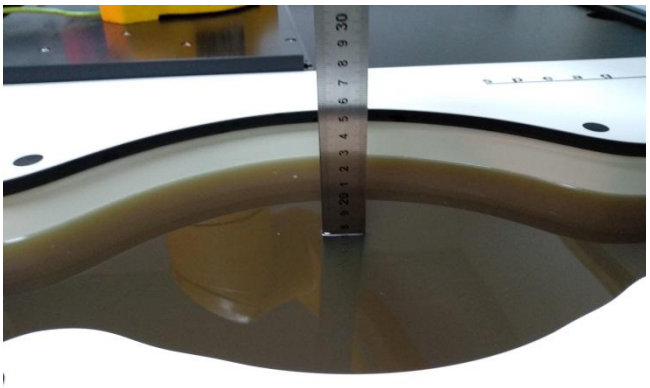
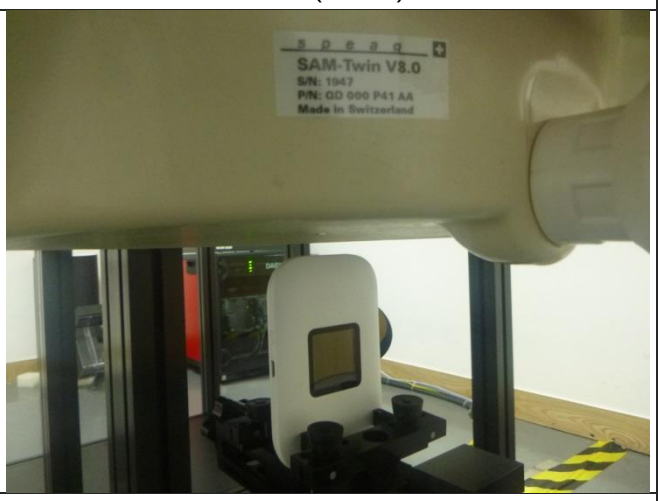
16. Simultaneous Transmission analysis

No.	Simultaneous Transmission Configurations	Hotspot	Note
1	LTE + WIFI (data)	Yes	

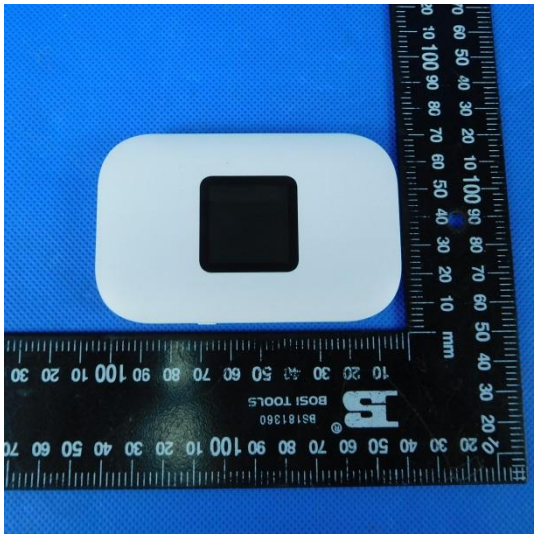
16.1. Hotspot

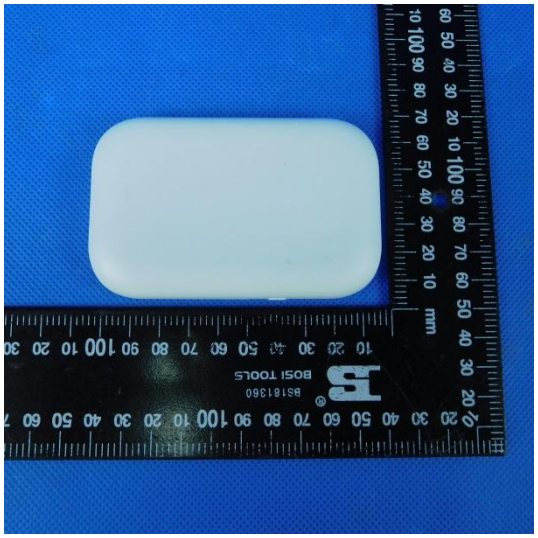
PCT + DTS					
WWAN Band		Exposure Position	Max SAR (W/kg)		Summed SAR
			PCT	DTS	(W/kg)
LTE	B4 1RB	Front	1.438	0.091	**1.529**
		Rear	1.483	0.031	1.514
		Left side	0.597	-	0.597
		Right side	-	-	-
		Top side	0.454	0.103	0.556
		Bottom side	0.391	-	0.391
	B4 50RB	Front	0.871	0.091	0.962
		Rear	1.269	0.031	1.300
		Left side	0.557	-	0.557
		Right side	-	-	-
		Top side	0.423	0.103	0.526
		Bottom side	0.365	-	0.365
	B4 100RB	Front	1.149	0.091	1.240
		Rear	1.230	0.031	1.262

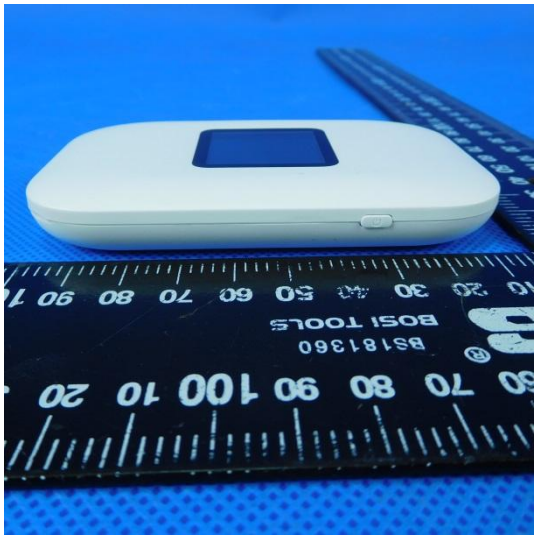
17. TestSetup Photos

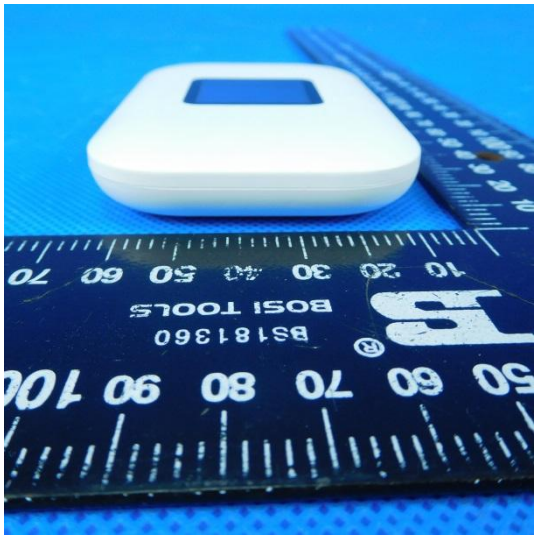
	
Liquid depth in the Body phantom	Front (10mm)
	
Rear (10mm)	Left Side (10mm)
	
Top Side (10mm)	Bottom Side (10mm)

18. External Photos of the EUT









---------End of Report----------