STS LAB

FCC SAR TEST REPORT

Report No: STS1803208H01

Issued for

Shenzhen EDUP Electronics Technology Co.,Ltd.

6 Floor, #6 Building, No.48, Kangzheng Road Liantang Industrial Area, Buji Town Shenzhen, China

Product Name:	11AC 1200M Wireless USB Adapter
Brand Name:	EDUP
Model Name:	EP-AC1601
Series Model:	EP-AC1602,EP-AC1617,EP-AC1618
FCC ID:	2AHRDEP-AC1601
Test Standard:	ANSI/IEEE Std. C95.1
	FCC 47 CFR Part 2 (2.1093)
	IEEE 1528: 2013
Max. Report SAR (1g):	Body: 1.106 W/kg

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STS APPROVAL

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Test Report Certification

Applicant's name	:	Shenzhen EDUP Electronics Technology Co.,Ltd.
Address	:	6 Floor, #6 Building, No.48, Kangzheng Road Liantang Industrial Area, Buji Town Shenzhen, China
Manufacture's Name	:	Shenzhen EDUP Electronics Technology Co.,Ltd.
Address	:	6 Floor, #6 Building, No.48, Kangzheng Road Liantang Industrial Area, Buji Town Shenzhen, China

Product description

Product name	:	11AC 1200M Wireless USB Adapter
Brand name	:	EDUP
Model name	:	EP-AC1601
Series Model	:	EP-AC1602,EP-AC1617,EP-AC1618
Standards	:	ANSI/IEEE Std. C95.1-1992 FCC 47 CFR Part 2 (2.1093) IEEE 1528: 2013

The device was tested by Shenzhen STS Test Services Co., Ltd. in accordance with the measurement methods and procedures specified in KDB 865664 The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of Test	:	
Date (s) of performance of tests	:	20 Apr. 2018
Date of Issue	:	21 Apr. 2018
Test Result	:	**Pass**

Testing Engineer : Aaron Bu

(Aaron Bu)

Technical Manager : John Zou

(John Zou)

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Authorized Signatory : Vita Li

(Vita Li)

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1.General Information

Environmental evaluation measurements of specific absorption rate (SAR) distributions in emulated human head and body tissues exposed to radio frequency (RF) radiation from wireless portable devices for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC).

1.1 EUT Description

Product Name	11AC 1200M Wireless USB Adapter		
Brand Name	EDUP		
Model Name	EP-AC1601		
Series Model	EP-AC1602,EP-AC1617,EP-AC1618		
FCC ID	2AHRDEP-AC1601		
Model Difference	Different model naming		
Device Category	Portable		
RF Exposure Environment	General Population / Uncontrolled		
Hardware Version	YHMB8812AUO-EPNO		
Software Version	RTLWlanU_WindowsDriver_1030.22.0405.2017_Drv_3.00.0018.L		
Frequency Range	WLAN 802.11b/g/n(HT20/40):2412~2462MHz WLAN 802.11a/n/ac(HT20/40/80): 5150~5250 MHz; WLAN 802.11a/n/ac(HT20/40/80): 5725~5875 MHz;		
Max. Reported SAR(1g): (Limit:1.6W/kg)	Band	Mode	Body
	DTS	2.4G WLAN ANT A	0.836
	DTS	2.4G WLAN ANT B	0.879
	DTS	2.4G WLAN ANT A+B	1.106
FCC Equipment Class	Digital Transmission System (DTS)		
Operating Mode:	WLAN: 802.11 b/g/n(HT20/40) /a/ac20/ac40/ac80		
Antenna Specification:	WLAN: PCB Antenna		
Hotspot Mode:	Support		
DTM Mode:	Not Support		

1.2 Test Environment

Ambient conditions in the SAR laboratory:

Items	Required
Temperature (℃)	18-25
Humidity (%RH)	30-70

1.3 Test Factory

Shenzhen STS Test Services Co., Ltd.
Add. : 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road,
Fuyong Street, Bao’an District, Shenzhen, Guangdong, China
CNAS Registration No.: L7649
FCC Registration No.: 625569
IC Registration No.: 12108A
A2LA Certificate No.: 4338.01

2.Test Standards And Limits

No.	Identity	Document Title
1	47 CFR Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
2	ANSI/IEEE Std. C95.1-1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
3	IEEE Std. 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
4	FCC KDB 447498 D01 v06	RF Exposure Procedures and Equipment Authorization Policies for mobile and portable devices
5	FCC KDB 447498 D02 v01	SAR measurement procedure for USB dongle transmitter.
6	FCC KDB 865664 D01 v01r04	SAR Measurement 100 MHz to 6 GHz
7	FCC KDB 865664 D02 v01r02	RF Exposure Reporting
8	FCC KDB 941225 D06 v02r01	Hotspot Mode SAR
9	FCC KDB 248227 D01 Wi-Fi SAR v02r02	SAR Considerations for 802.11 Devices

(A). Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

(B). Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

NOTE: Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Population/Uncontrolled Environments:

are defined as locations where there is the exposure of individuals 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).

NOTE

GENERAL POPULATION/UNCONTROLLED EXPOSURE

PARTIAL BODY LIMIT

1.6 W/kg

3. SAR Measurement System

3.1 Definition Of Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathrm{SAR} = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right)$$

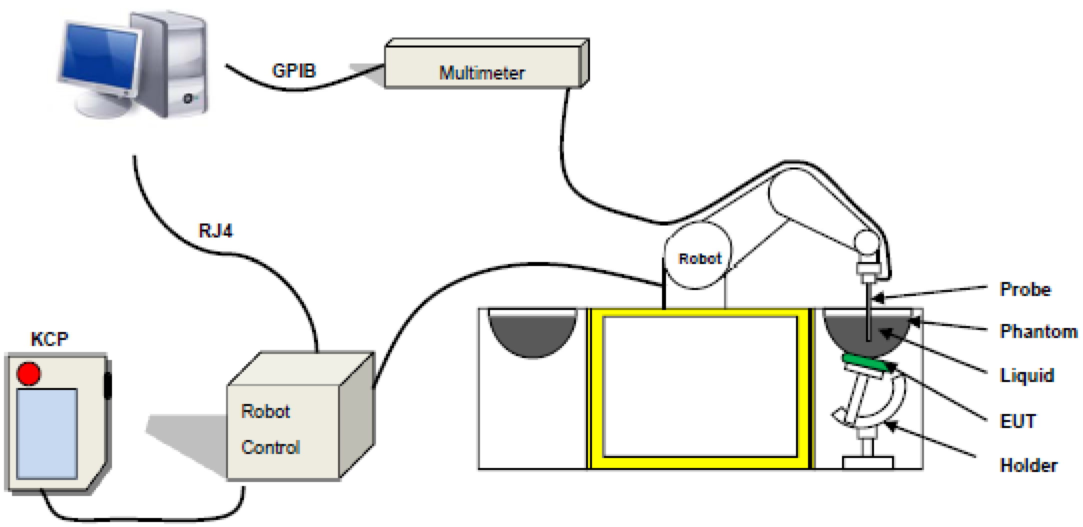
SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

$$\mathrm{SAR} = \frac{\sigma E^2}{\rho}$$

Where: σ is the conductivity of the tissue,
ρ is the mass density of the tissue and E is the RMS electrical field strength.

3.2 SAR System

MVG SAR System Diagram:



Comosar is a system that is able to determine the SAR distribution inside a phantom of human being according to different standards. The Comosar system consists of the following items:

- Main computer to control all the system
- 6 axis robot
- Data acquisition system
- Miniature E-field probe
- Phone holder
- Head simulating tissue

The following figure shows the system.

The EUT under test operating at the maximum power level is placed in the phone holder, under the phantom, which is filled with head simulating liquid. The E-Field probe measures the electric field inside the phantom. The OpenSAR software computes the results to give a SAR value in a 1g or 10g mass.

3.2.1 Probe

For the measurements the Specific Dosimetric E-Field Probe SN 14/16 EP309 with following specifications is used

- Dynamic range: 0.01-100 W/kg
- Tip Diameter: 5 mm
- Length of Individual Dipoles: 4.5 mm
- Maximum external diameter: 8 mm
- Distance between dipole/probe extremity: 8 mm (repeatability better than +/- 2.7mm)
- Probe linearity: 0±2.27%(±0.10dB)
- Axial Isotropy: < 0.10 dB
- Spherical Isotropy: < 0.10 dB
- Calibration range: 400 MHz to 3 GHz for head & body simulating liquid.
- Angle between probe axis (evaluation axis) and surface normal line: less than 30°

Figure 1-MVG COMOSAR Dosimetric E field Dipole

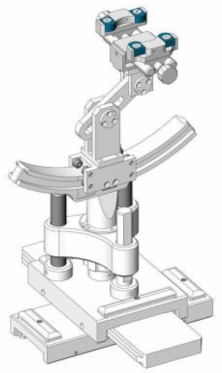
3.2.2 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.

Figure-SN 32/14 SAM115

Figure-SN 32/14 SAM116

3.2.3 Device Holder



The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

4. Tissue Simulating Liquids

4.1 Simulating Liquids Parameter Check

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Frequency (MHz)	Bactericide	DGBE	HEC	NaCl	Sucrose	1,2-Propanediol	X100	Water	Conductivity	Permittivity
	%	%	%	%	%	%	%	%	σ	εr
750	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
835	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
900	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
1800	/	13.84	/	0.35	/	/	30.45	55.36	1.38	41.0
1900	/	13.84	/	0.35	/	/	30.45	55.36	1.38	41.0
2000	/	7.99	/	0.16	/	/	19.97	71.88	1.55	41.1
2450	/	7.99	/	0.16	/	/	19.97	71.88	1.88	40.3
2600	/	7.99	/	0.16	/	/	19.97	71.88	1.88	40.3

Tissue dielectric parameters for head and body phantoms				
Frequency	ε_r		σ S/m	
	Head	Body	Head	Body
300	45.3	58.2	0.87	0.92
450	43.5	56.7	0.87	0.94
900	41.5	55.0	0.97	1.05
1450	40.5	54.0	1.20	1.30
1800	40.0	53.3	1.40	1.52
2450	39.2	52.7	1.80	1.95
3000	38.5	52.0	2.40	2.73
5800	35.3	48.2	5.27	6.00

LIQUID MEASUREMENT RESULTS

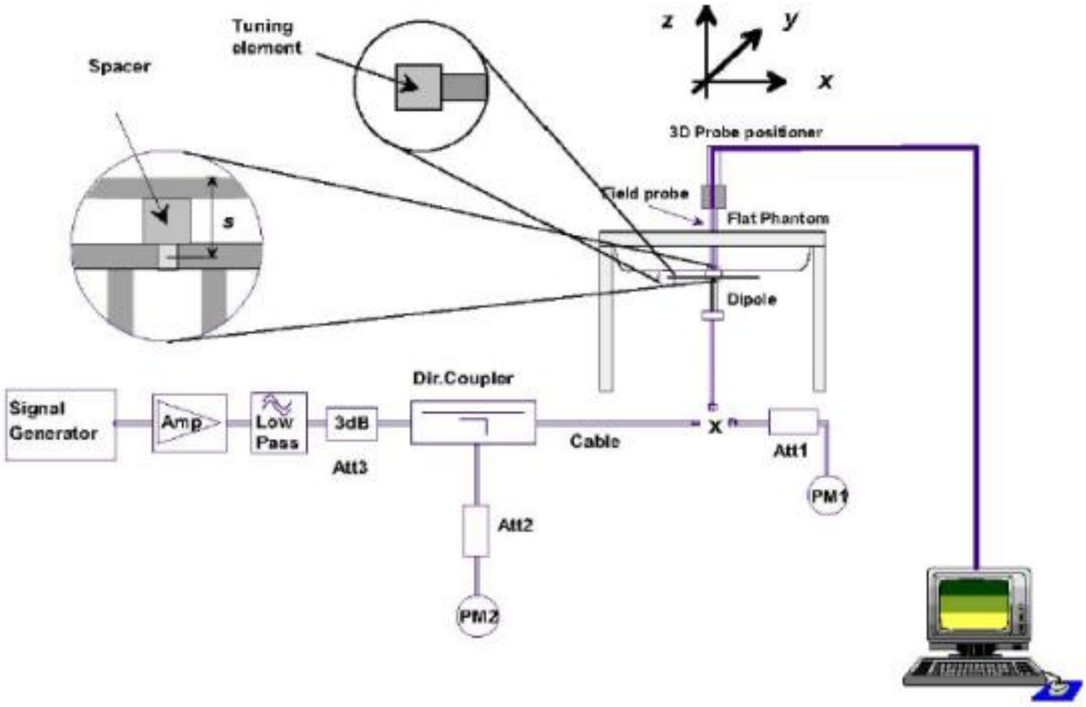
Date	Ambient condition		Body Simulating Liquid		Parameters	Target	Measured	Deviation [%]	Limited [%]
	Temp. [°C]	Humidity [%]	Frequency	Temp. [°C]					
2018-04-20	22.5	44	2450 MHz	22.1	Permittivity:	52.70	51.36	-2.54	± 5
					Conductivity	1.95	1.98	1.54	± 5

5. SAR System Validation

5.1 Validation System

Each MVG system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the MVG software, enable the user to conduct the system performance check and system validation. System kit includes a dipole, and dipole device holder.

The system check verifies that the system operates within its specifications. It's performed daily or before every SAR measurement. The system check uses normal SAR measurement in the flat section of the phantom with a matched dipole at a specified distance. The system validation setup is shown as below.



5.2 Validation Result

Comparing to the original SAR value provided by MVG, the validation data should be within its specification of 10 %.

Freq.(MHz)	Power(mW)	Tested Value (W/Kg)	Normalized SAR (W/kg)	Target(W/Kg)	Tolerance(%)	Date
2450 Body	100	5.527	52.27	52.4	-0.25	2018-04-20

Note: The tolerance limit of System validation ±10%.

6. SAR Evaluation Procedures

The procedure for assessing the average SAR value consists of the following steps:
The following steps are used for each test position
- Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface
- Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
- Measurement of the SAR distribution with a grid of 8 to 16mm * 8 to16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.
- Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

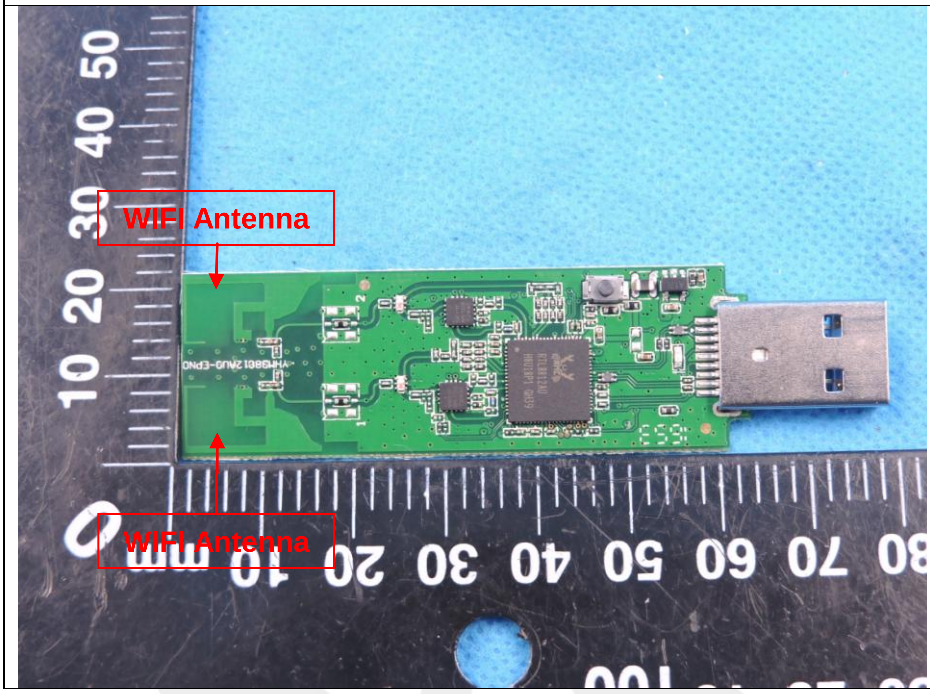
Area Scan& Zoom Scan:

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR -distribution over 10 g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r01 quoted below.

When the 1-g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

7. EUT Antenna Location Sketch

It is a 11AC 1200M Wireless USB Adapter, support WIFI mode.

Photo 3


7.1 SAR test exclusion consider table

According with FCC KDB 447498 D01, appendix A, <SAR test exclusion thresholds for 100MHz ~ 6GHz and≤50mm＞table, this device SAR test configurations consider as following:

Band	Test position configurations			
	Vertical- Front	Vertical- Back	Horizontal- Up	Horizontal- Down
WLAN	＜5mm	＜5mm	＜5mm	＜5mm
	Yes	Yes	Yes	Yes

Note：

1. maximum power is the source-based time-average power and represents the maximum RF output power among production units.
2. per KDB 447498 D01, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
3. per KDB 447498 D01, standalone SAR test exclusion threshold is applied; if the distance of the antenna to the user is <5mm, 5mm is user to determine SAR exclusion threshold
4. per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distance ≤50mm are determined by:

   [(max.power of channel, including tune-up tolerance, Mw)/(min. test separation distance, mm)]*[√f(GHZ）)≤3.0 for 1-g SAR and≤7.5 for10-g extremity SAR ,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 For <50mm distance, we just calculate mW of the exclusion threshold value(3.0)to do compare
5. per KDB 447498 D01, at 100 MHz to 6GHz and for test separation distances >50mm, the SAR test exclusion threshold is determined according to the following

   a)[threshold at 50mm in step 1]+(test separation distance -50mm)*(f (MHz)/150)]Mw, at 100 MHz to 1500 MHz

   b) [threshold at 50mm in step1]+(test separation distance -50mm) *10]mW at＞1500MHz and≤6GHz
6. Per KDB 447498 D02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/ HSUPA/DC-HSDPA output power is<0.25db higher than RMC 12.2Kbps,or reported SAR with RMC 12.2kbps setting is ≤1.2W/Kg, HSDPA/HSUPA/DC-HSDPA SAR evaluation can be excluded.
7. Per KDB 248227 D01, choose the highest output power channel to test SAR and determine further SAR exclusion 8.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 each of these configurations is less than 1/4db higher than those measured at the lower data rate than 11b mode ,thus the SAR can be excluded.

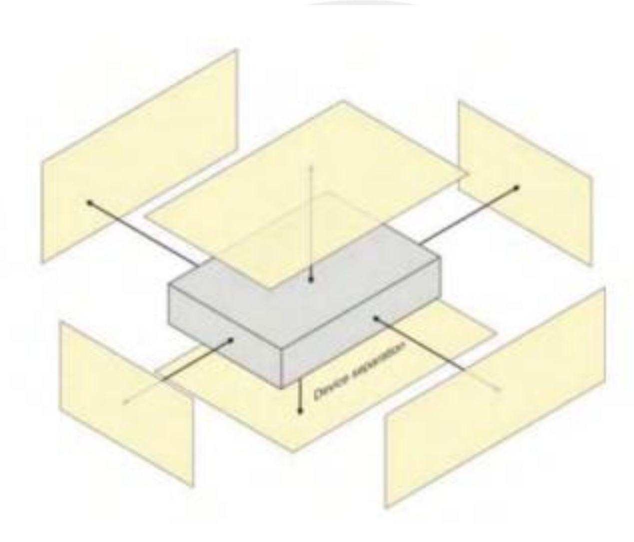
8. EUT Test Position

According to KDB 447498 D02, USB connector orientations on laptop computers, which is tested for SAR compliance in body-worn accessory and other use configurations described in the following subsections.

8.1 Hotspot mode exposure position condition

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing function,   the relevant hand and body exposure condition are tested according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surface and edges with a transmitting antenna located within 25 mm form that surface or edge.

When form factor of a handset is smaller than 9cm x 5cm, a test separation distance of 5mm (instead of 10mm)is required for testing hotspot mode. When the separate distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration(surface).



8.2 USB connector Orientations Implemented on Laptop Computers

Note: These are USB connector orientations on laptop computers; USB dongles have the reverse configuration for plugging into the corresponding laptop computers.

8.3 Simple Dongle Test Procedures

Test all USB orientations [see figure below: (A) Horizontal-Up, (B) Horizontal-Down, (C) Vertical-Front, and (D) Vertical-Back] with a device-to-phantom separation distance of 5 mm or less, according to KDB Publication 447498 D01 requirements. These test orientations are intended for the exposure conditions found in typical laptop/notebook/netbook or tablet computers with either horizontal or vertical USB connector configurations at various locations in the keyboard section of the computer. Current generation portable host computers should be used to establish the required SAR measure-ement separation distance. The same test separation distance must be used to test all frequency bands and modes in each USB orientation. The typical Horizontal-Up USB connection (A), found in the majority of host computers, must be tested using an appropriate host computer. A host computer with either Vertical-Front (C) or Vertical-Back (D) USB connection should be used to test one of the vertical USB orientations. If a suitable host computer is not available for testing the Horizontal-Down (B) or the remaining Vertical USB orientation, a high quality USB cable, 12 inches or less, may be used for testing these other orientations. It must be documented that the USB cable does not influence the radiating characteristics and output power of the transmitter.

8.4 Dongles with Swicel or Rotating Connectors

A swivel or rotating USB connector may enable the dongle to connect in different orientations to host computers. When the antenna is built-in within the housing of a dongle, a swivel or rotating connector may allow the antenna to assume different positions. The combination of these possible configurations must be considered to determine the SAR test requirements. When the antenna is located near the tip of a dongle, it may operate at closer proximity to users in certain connector orientations where dongle tip testing may be required.

The 5 mm test separation distance used for testing simple dongles has been established based on the overall host platform (laptop/notebook/netbook) and device variations, and varying user operating configurations and exposure conditions expected for a peripheral device. The same test distance should generally apply to dongles with swivel or rotating connectors. The procedures described for simple dongles should be used to position the four surfaces of the dongle at 5 mm from the phantom to evaluate SAR. At least one of the horizontal and one of the vertical positions should be tested using an applicable host computer. If the antenna is within 1 cm from the tip of the dongle (the end without the USB connector), the tip of the dongle should also be tested at 5 mm perpendicular to the phantom. For antennas located within 2.5 cm from the USB connector and if the dongle can be positioned at 45º to 90º from the horizontal position [(A) or (B)], testing in one or more of these configurations may need to be considered. A KDB inquiry should be submitted to determine the applicable test configurations.

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9. Uncertainty

9.1 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in IEEE 1528: 2013.This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

NO	Source	Tol(%)	Prob. Dist.	Div. k	ci (1g)	ci (10g)	1gUi	10gUi	Veff
Measurement System									
1	Probe calibration	5.8	N	1	1	1	5.8	5.8	∞
2	Axial isotropy	3.5	R	√3	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.43	1.43	∞
3	Hemispherical isotropy	5.9	R	√3	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
4	Boundary effect	1.0	R	√3	1	1	0.58	0.58	∞
5	Linearity	4.7	R	√3	1	1	2.71	2.71	∞
6	System Detection limits	1.0	R	√3	1	1	0.58	0.58	∞
7	Readout electronics	0.5	N	1	1	1	0.50	0.50	∞
8	Response time	0	R	√3	1	1	0	0	∞
9	Integration time	1.4	R	√3	1	1	0.81	0.81	∞
10	Ambient noise	3.0	R	√3	1	1	1.73	1.73	∞
11	Ambient reflections	3.0	R	√3	1	1	1.73	1.73	∞
12	Probe positioner mech. restrictions	1.4	R	√3	1	1	0.81	0.81	∞
13	Probe positioning with respect to phantom shell	1.4	R	√3	1	1	0.81	0.81	∞
14	Max.SAR evaluation	1.0	R	√3	1	1	0.6	0.6	∞
Test sample related									
15	Device positioning	2.6	N	1	1	1	2.6	2.6	11

16	Device holder	3	N	1	1	1	3.0	3.0	7
17	Drift of output power	5.0	R	√3	1	1	2.89	2.89	∞
Phantom and set-up									
18	Phantom uncertainty	4.0	R	√3	1	1	2.31	2.31	∞
19	Liquid conductivity (target)	2.5	N	1	0.78	0.71	1.95	1.78	5
20	Liquid conductivity (meas)	4	N	1	0.23	0.26	0.92	1.04	5
21	Liquid Permittivity (target)	2.5	N	1	0.78	0.71	1.95	1.78	∞
22	Liquid Permittivity (meas)	5.0	N	1	0.23	0.26	1.15	1.30	∞
Combined standard			RSS	$U_c = \sqrt{\sum_{i=1}^{n} C_i^2 U_i^2}$			10.63%	10.54%	
Expanded uncertainty (P=95%)		$U = k\,U_c$,k=2					21.26%	21.08%	

9.2 System validation Uncertainty

NO	Source	Tol(%)	Prob. Dist.	Div. k	ci (1g)	ci (10g)	1gUi	10gUi	Veff
Measurement System									
1	Probe calibration	5.8	N	1	1	1	5.8	5.8	∞
2	Axial isotropy	3.5	R	√3	$(1\text{-cp})^{1/2}$	$(1\text{-cp})^{1/2}$	1.43	1.43	∞
3	Hemispherical isotropy	5.9	R	√3	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
4	Boundary effect	1.0	R	√3	1	1	0.58	0.58	∞
5	Linearity	4.7	R	√3	1	1	2.71	2.71	∞
6	System Detection limits	1.0	R	√3	1	1	0.58	0.58	∞
7	Modulation response	0	N	1	1	1	0	0	∞
8	Readout electronics	0.5	N	1	1	1	0.50	0.50	∞
9	Response time	0	R	√3	1	1	0	0	∞
10	Integration time	1.4	R	√3	1	1	0.81	0.81	∞
11	Ambient noise	3.0	R	√3	1	1	1.73	1.73	∞
12	Ambient reflections	3.0	R	√3	1	1	1.73	1.73	∞
13	Probe positioner mech. restrictions	1.4	R	√3	1	1	0.81	0.81	∞
14	Probe positioning with respect to phantom shell	1.4	R	√3	1	1	0.81	0.81	∞
15	Max.SAR evaluation	1.0	R	√3	1	1	0.6	0.6	∞
Dipole									
16	Deviation of experimental source from	4	N	1	1	1	4.00	4.00	∞

17	Input power and SAR drit measurement	5	R	√3	1	1	2.89	2.89	∞
18	Dipole Axis to liquid Distance	2	R	√3	1	1			∞
Phantom and set-up									
19	Phantom uncertainty	4.0	R	√3	1	1	2.31	2.31	∞
20	Uncertainty in SAR correction for deviation(in	2.0	N	1	1	0.84	2	1.68	∞
21	Liquid conductivity (target)	2	N	1	1	0.84	2.00	1.68	∞
22	Liquid conductivity (temperature uncertainty)	2.5	N	1	0.78	0.71	1.95	1.78	5
23	Liquid conductivity (meas)	4	N	1	0.23	0.26	0.92	1.04	5
24	Liquid Permittivity (target)	2.5	N	1	0.78	0.71	1.95	1.78	∞
25	Liquid Permittivity (temperature uncertainty)	2.5	N	1	0.78	0.71	1.95	1.78	5
26	Liquid Permittivity (meas)	5.0	N	1	0.23	0.26	1.15	1.30	∞
Combined standard			RSS	$U_c = \sqrt{\sum_{i=1}^{n} C_i^2 U_i^2}$			10.15%	10.05%	
Expanded uncertainty (P=95%)		$U = k\ U_c$,k=2					20.29%	20.10%	

10. Conducted Power Measurement

10.1 Test Result

WLAN

Mode	Channel Number	Frequency (MHz)	Average EIRP Power (dBm)		
			Antenna A	Antenna B	Antenna A+B
802.11b	1	2412	14.02	16.42	N/A
	6	2437	13.22	17.54	N/A
	11	2462	13.11	17.32	N/A
802.11g	1	2412	12.55	15.72	N/A
	6	2437	11.88	15.65	N/A
	11	2462	11.78	15.90	N/A
802.11n(HT 20)	1	2412	12.53	14.42	16.59
	6	2437	11.56	15.38	16.89
	11	2462	11.57	15.89	17.26
802.11n(HT 40)	3	2422	12.87	14.02	16.49
	6	2437	11.67	15.02	16.67
	9	2452	11.43	15.23	16.74

WLAN (5.2Gband)

Mode	Channel Number	Frequency (MHz)	Average EIRP Power (dBm)		
			Antenna A	Antenna B	Antenna A+B
802.11a	36	5180	2.06	-0.11	N/A
	40	5200	2.48	0.20	N/A
	48	5240	2.50	0.46	N/A
802.11 n-HT20	36	5180	0.96	-1.01	3.10
	40	5200	1.19	-0.40	3.48
	48	5240	0.98	-0.65	3.25
802.11 n-HT40	38	5190	0.17	-2.67	1.99
	46	5230	-0.09	-2.43	1.91
802.11ac(HT20)	36	5180	1.21	-0.83	3.32
	40	5200	0.78	-0.45	3.32
	48	5240	0.78	-0.22	3.32
802.11ac(HT40)	38	5190	-0.48	-2.31	1.71
	46	5230	0.19	-1.99	2.25
802.11ac(HT80)	42	5210	-1.40	-2.75	0.99

WLAN (5.8Gband)

Mode	Channel Number	Frequency (MHz)	Average EIRP Power (dBm)		
			Antenna A	Antenna B	Antenna A+B
802.11a	149	5745	0.20	-3.33	N/A
	157	5785	-0.72	-3.53	N/A
	165	5825	0.03	-3.53	N/A
802.11 n-HT20	149	5745	-0.62	-5.10	0.70
	157	5785	-0.80	-4.64	0.70
	165	5825	-1.31	-4.59	0.36
802.11 n-HT40	151	5755	-2.24	-6.56	-0.87
	159	5795	-2.17	-6.07	-0.69
802.11ac(HT20)	149	5745	-0.83	-4.94	0.59
	157	5785	-1.60	-5.07	0.01
	165	5825	-1.61	-4.10	0.33
802.11ac(HT40)	151	5755	-3.17	-6.84	-1.62
	159	5795	-3.29	-6.54	-1.61
802.11ac(HT80)	155	5775	-3.44	-7.33	-1.95

10.2 Tune-up Power

Mode	WLAN(AVG)		
	Antenna A	Antenna B	Antenna A+B
IEEE 802.11b	14±1dBm	17±1dBm	N/A
IEEE 802.11g	12±1dBm	15±1dBm	N/A
IEEE 802.11n(HT 20)	12±1dBm	15±1dBm	17±1dBm
IEEE 802.11n(HT 40)	12±1dBm	15±1dBm	16±1dBm

	Mode	WLAN(AVG)		
		Antenna A	Antenna B	Antenna A+B
5200 MHz	802.11a	2±1dBm	0±1dBm	N/A
	802.11 n-HT20	-1±1dBm	-1±1dBm	3±1dBm
	802.11 n-HT40	0±1dBm	-2±1dBm	1±1dBm
	802.11ac(HT20)	1±1dBm	0±1dBm	3±1dBm
	802.11ac(HT40)	0±1dBm	-2±1dBm	2±1dBm
	802.11ac(HT80)	-1±1dBm	-2±1dBm	0±1dBm

	Mode	WLAN(AVG)		
		Antenna A	Antenna B	Antenna A+B
5800 MHz	802.11a	0±1dBm	-3±1dBm	N/A
	802.11 n-HT20	-1±1dBm	-5±1dBm	0±1dBm
	802.11 n-HT40	-2±1dBm	-6±1dBm	0±1dBm
	802.11ac(HT20)	-1±1dBm	-5±1dBm	0±1dBm
	802.11ac(HT40)	-3±1dBm	-6±1dBm	-1±1dBm
	802.11ac(HT80)	-3±1dBm	-7±1dBm	-1±1dBm

10.3 SAR Test Exclusions Applied

Per FCC KDB 447498D01, the 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHZ)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

- f(GHZ) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

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

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 3.0$$

Based on the maximum conducted power of **2.4 GHz WLAN ANT A Body** (rounded to the nearest mW) and the antenna to user separation distance,

2.4 GHz WLAN SAR was required; [(31.623/5)* √2.462] = **9.92** > 3.0.

Based on the maximum conducted power of **2.4 GHz WLAN ANT B Body** (rounded to the nearest mW) and the antenna to user separation distance,

2.4 GHz WLAN SAR was required; [(63.096/5)* √2.462] = **19.80** >3.0.

Based on the maximum conducted power of **2.4 GHz WLAN ANT A+B Body** (rounded to the nearest mW) and the antenna to user separation distance,

2.4 GHz WLAN SAR was required; [(63.096/5)* √2.462] = **19.80** >3.0.

Based on the maximum conducted power of **5.2 GHz WLAN ANT A Body** (rounded to the nearest mW) and the antenna to user separation distance,

5.2 GHz WLAN ANT A SAR was required; [1.995/5)* √5200] = **0.91** ＜3.0.

Based on the maximum conducted power of **5.2 GHz WLAN ANT B Body** (rounded to the nearest mW) and the antenna to user separation distance,

5.2 GHz WLAN ANT B SAR was required; [1.259/5)* √5200] = **0.57** ＜3.0.

Based on the maximum conducted power of **5.2 GHz WLAN ANT A+B Body** (rounded to the nearest mW) and the antenna to user separation distance,

5.2 GHz WLAN ANT A+B SAR was required; [2.512/5)* √5200] = **1.15** ＜3.0.

Based on the maximum conducted power of **5.8 GHz WLAN ANT A Body** (rounded to the nearest mW) and the antenna to user separation distance,

5.8 GHz WLAN ANT A SAR was required; [(1.259/5)* √5800] =**0.61** < 3.0

Based on the maximum conducted power of **5.8 GHz WLAN ANT B Body** (rounded to the nearest mW) and the antenna to user separation distance,

5.8 GHz WLAN ANT B SAR was required; [(0.631/5)* √5800] = **0.30** < 3.0

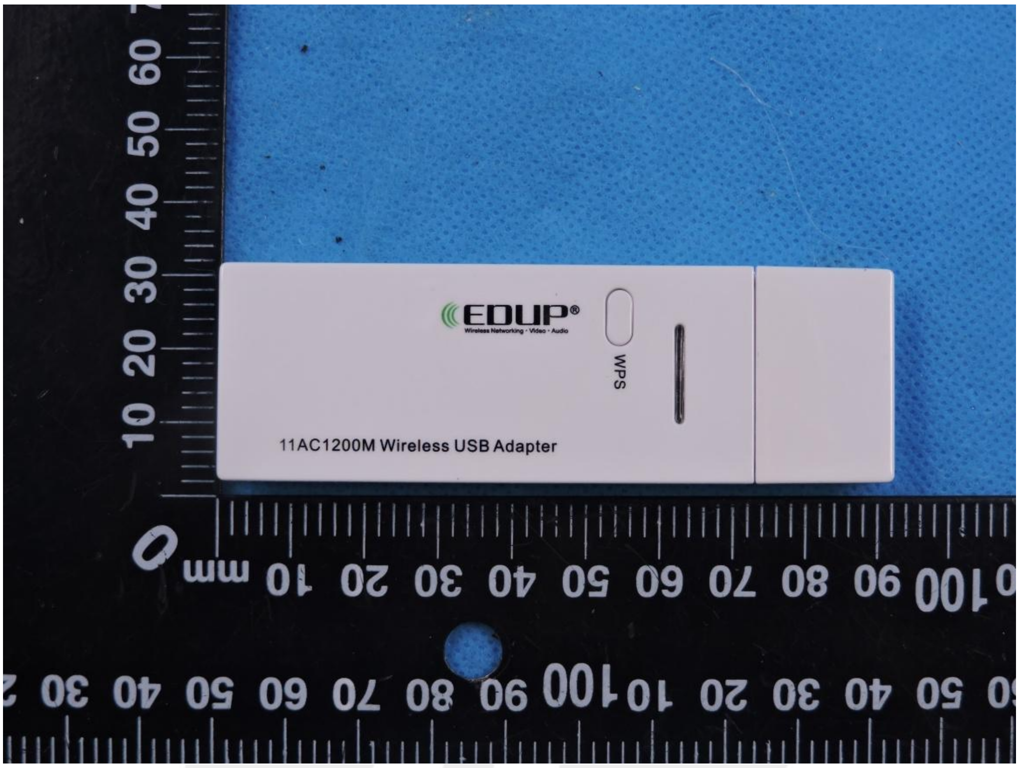
Based on the maximum conducted power of **5.8 GHz WLAN ANT A+B Body** (rounded to the nearest mW) and the antenna to user separation distance,

5.8 GHz WLAN ANT A+B SAR was required; [(1.259/5)* √5800] = **0.61** < 3.0

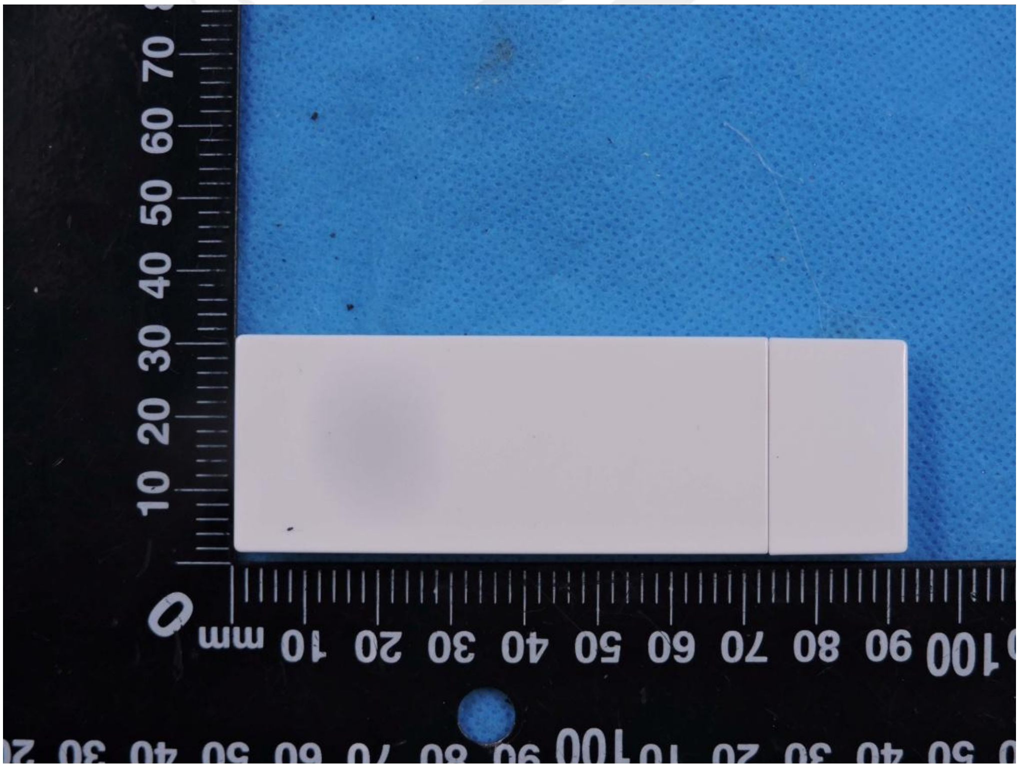
11. EUT And Test Setup Photo

11.1 EUT Photo

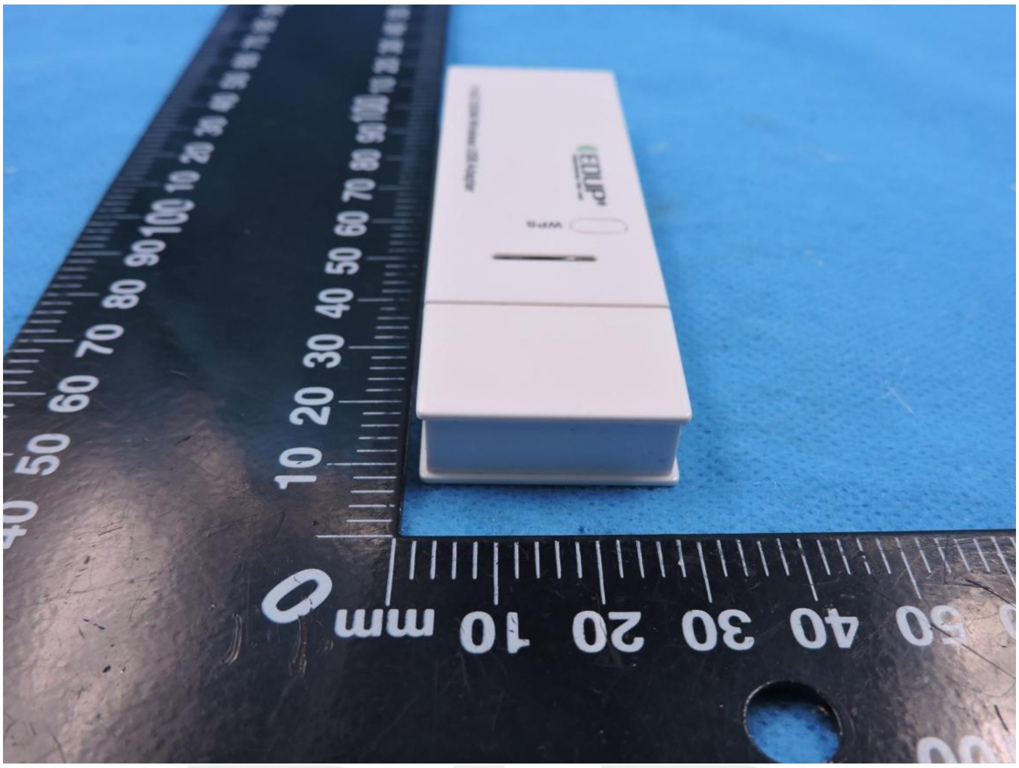
Front side



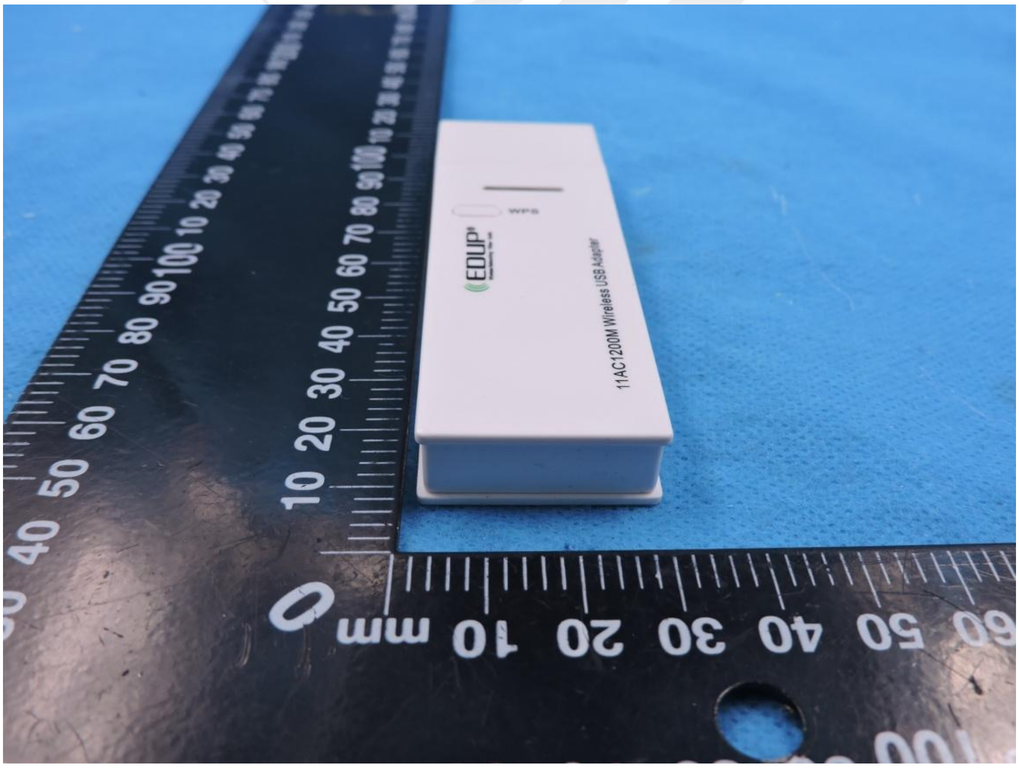
Back side



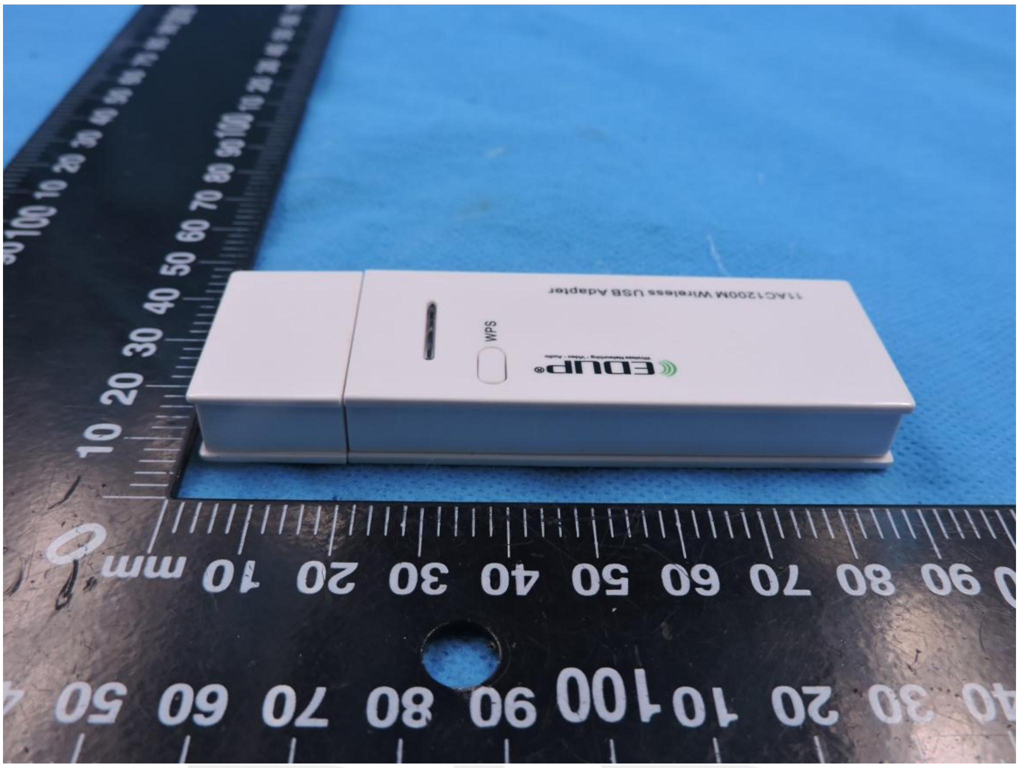
Top side



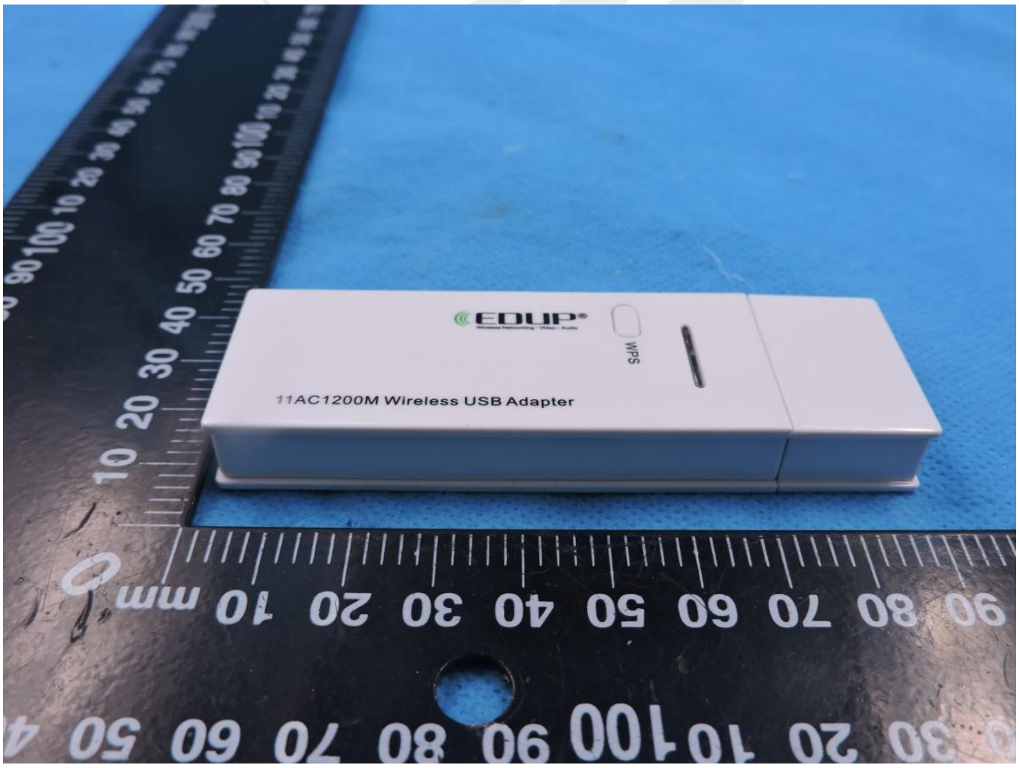
Bottom side



Left side

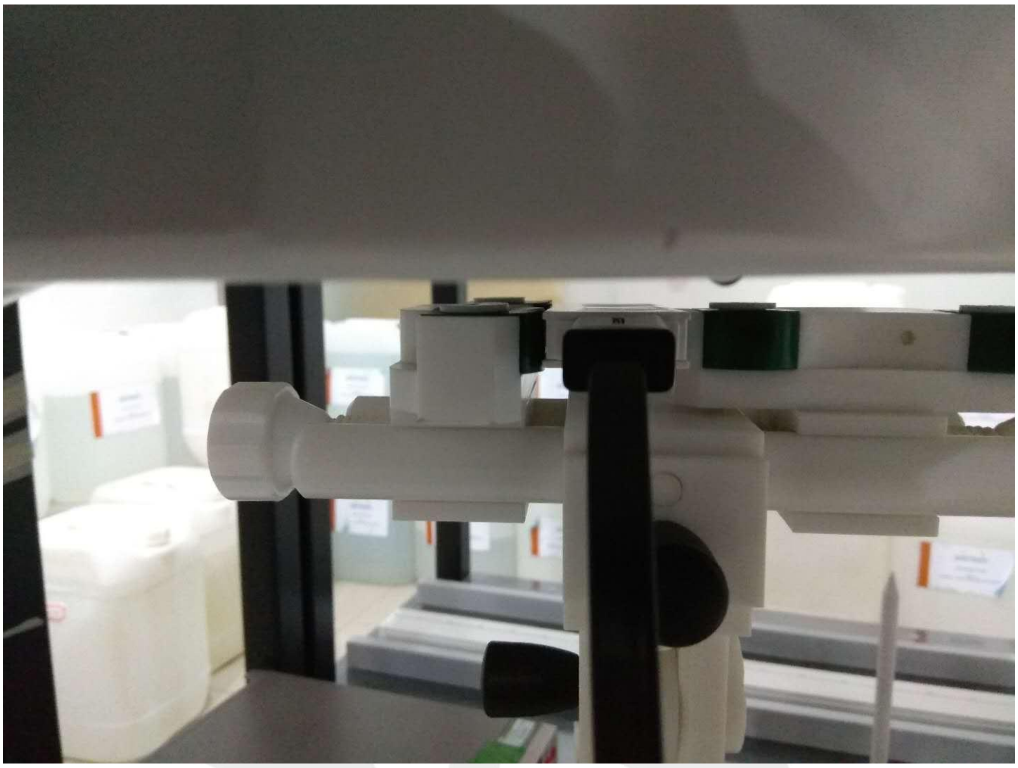


Right side

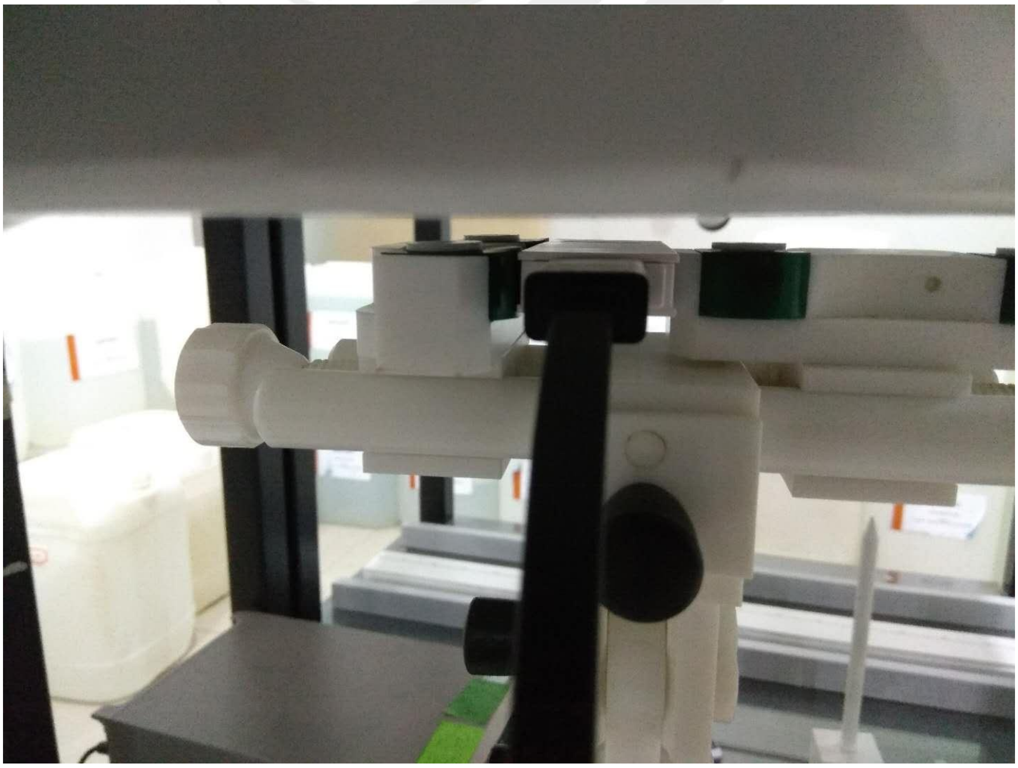


11.2 Setup Photo

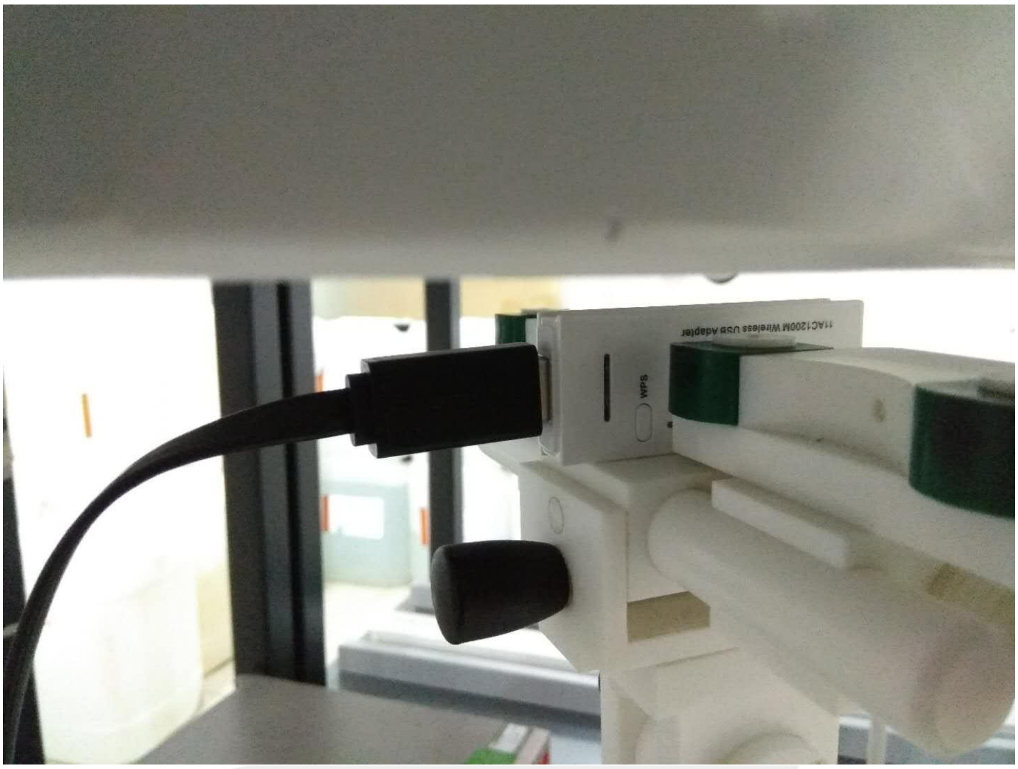
.Horizontal- Up side (separation distance is 5mm)



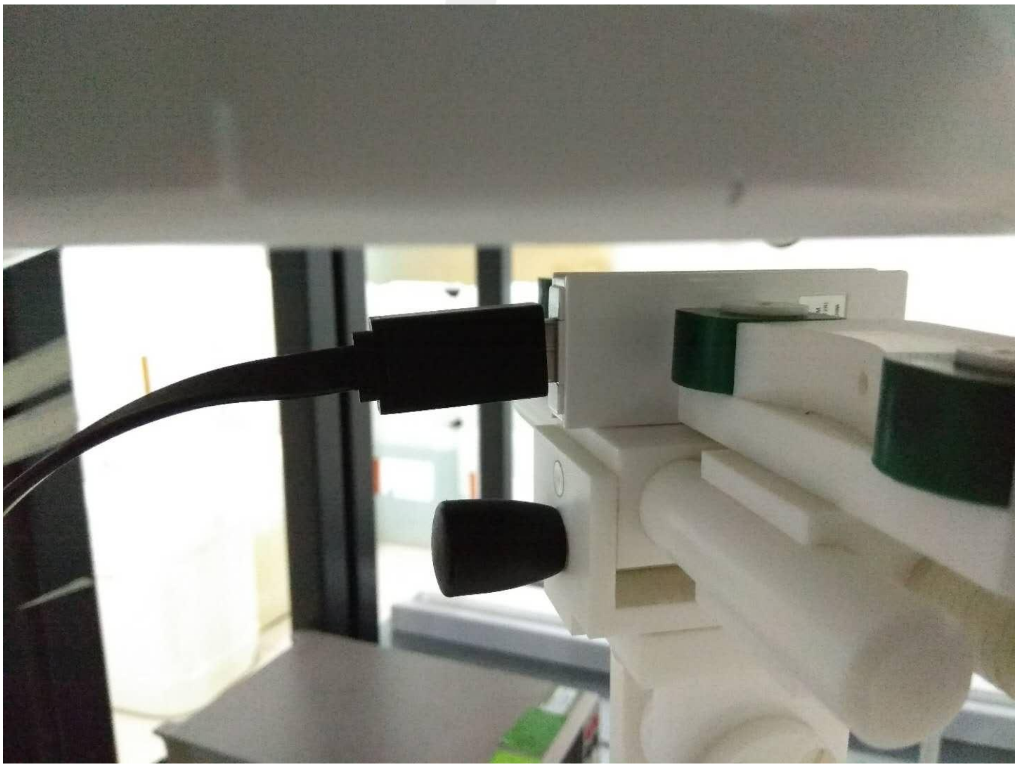
.Horizontal- Down side (separation distance is 5mm)



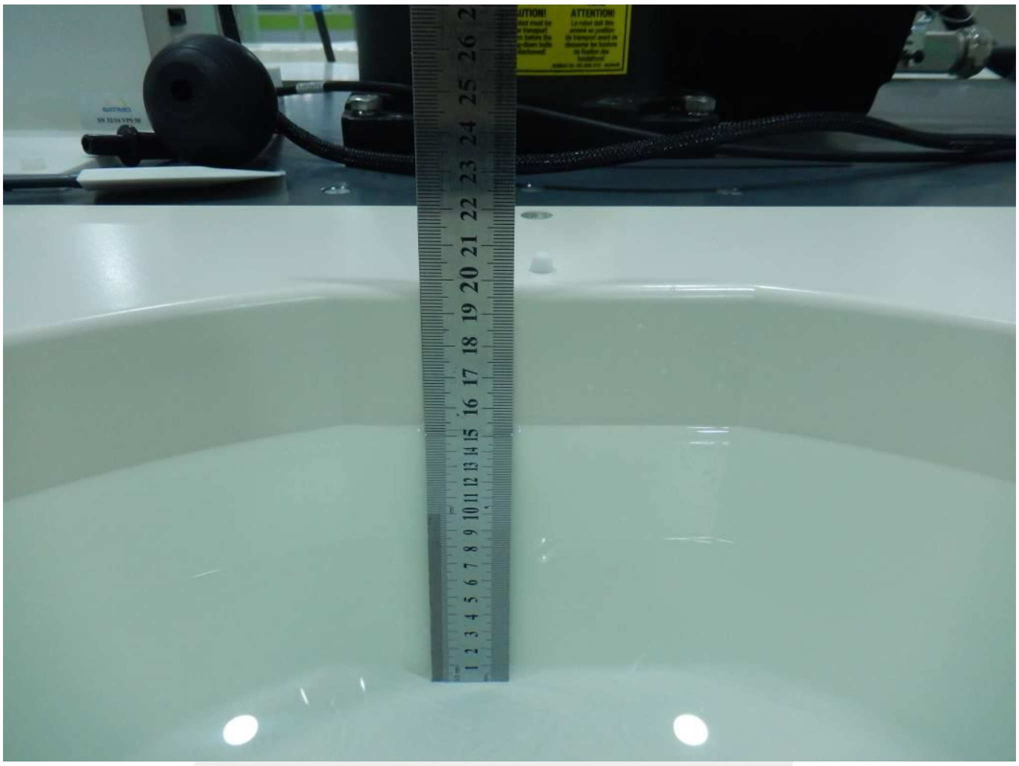
Vertical- Front (separation distance is 5mm)



Vertical- Down (separation distance is 5mm)



Liquid depth (15 cm)



12. SAR Result Summary

12.1 Body-worn and Hotspot SAR

802.11b（Antenna A）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 2.4G	802.11b	Vertical-Front	1	0.553	1.58	15	14.02	100	0.693	/
		Vertical-Back	1	0.537	-2.59	15	14.02	100	0.673	/
		Horizontal-Up	1	0.524	-3.80	15	14.02	100	0.657	/
		Horizontal-Down	1	0.667	-1.64	15	14.02	100	**0.836**	1
			6	0.521	3.55	15	13.22	100	0.785	/
			11	0.509	1.07	15	13.11	100	0.787	/

802.11b（Antenna B）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 2.4G	802.11b	Vertical-Front	6	0.634	-2.87	18	17.54	100	0.705	/
		Vertical-Back	6	0.598	-2.74	18	17.54	100	0.665	/
		Horizontal-Up	6	0.673	-1.51	18	17.54	100	0.748	/
		Horizontal-Down	1	0.671	-1.88	18	16.42	100	0.873	/
			6	0.791	-2.06	18	17.54	100	**0.879**	2
			11	0.653	-1.69	18	17.32	100	0.764	/

802.11n（Antenna A）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 2.4G	802.11n	Vertical-Front	11	0.352	-1.98	18	17.26	100	0.417	/
		Vertical-Back	11	0.314	-2.82	18	17.26	100	0.372	/
		Horizontal-Up	11	0.376	-0.78	18	17.26	100	0.446	/
		Horizontal-Down	11	0.421	2.14	18	17.26	100	**0.499**	3

802.11n（Antenna B）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 2.4G	802.11n	Vertical-Front	11	0.434	3.20	18	17.26	100	0.515	/
		Vertical-Back	11	0.423	-3.14	18	17.26	100	0.502	/
		Horizontal-Up	11	0.470	3.06	18	17.26	100	0.557	/
		Horizontal-Down	11	0.512	1.32	18	17.26	100	**0.607**	4

Band	Mode	Scaled SAR (W/Kg)		A+B
WLAN 2.4G	802.11n	Antenna A	0.499	**1.106**
	802.11n	Antenna B	0.607	

Note:

1. The test separation of all above table is 5mm.
2. Per KDB 447498 D01v05r01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For WWAN: Scaled SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
3. Per KDB 248227- 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. (The highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power was **1.282** W/Kg for Body)
4. 3. When the user enables the personal Wireless router functions for the handsets, actual operations include simultaneous transmission of both the Wi-Fi transmitting frequency and thus cannot be evaluated for SAR under actual use conditions. The “Portable Hotspot” feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.

Repeated SAR

Band	Mode	Test Position	Channel	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Scaled SAR (W/Kg)	Meas. No.
WLAN 2.4G	802.11b	Horizontal-Down	1	0.649	-1.69	15	14.02	0.813	/
WLAN 2.4G	802.11b	Horizontal-Down	6	0.782	-1.93	18	17.54	0.869	

11.3 repeated SAR measurement

Band	Mode	Test Position	Channel	Original Measured SAR 1g(mW/g)	1 st Repeated SAR 1g	Ratio	Original Measured SAR 1g(mW/g)	2nd Repeated SAR 1g	Ratio
WLAN 2.4G	802.11b	Horizontal-Down	1	0.836	0.813	0.97	/	/	/
WLAN 2.4G	802.11b	Horizontal-Down	6	0.879	0.869	0.99	/	/	/

Note:

1. Per KDB 865664 D01,for each frequency band ,repeated SAR measurement is required only when the measured SAR is≥0.8W/Kg.
2. Per KDB 865664 D01,if the ratio of largest to smallest SAR for the original and first repeated measurement is≤1.2and the measured SAR＜1.45W/Kg, only one repeated measurement is required.
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 ≥ 1.45W/Kg
4. The ratio is the difference in percentage between original and repeated measured SAR.

13. Equipment List

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
2450MHzDipole	MVG	SID2450	SN 30/14 DIP2G450-335	2017.08.15	2020.08.14
E-Field Probe	MVG	SSE5	SN 14/16 EP309	2017.12.15	2018.12.14
Dielectric Probe Kit	MVG	SCLMP	SN 32/14 OCPG67	2017.12.03	2018.12.02
Antenna	MVG	ANTA3	SN 07/13 ZNTA52	N/A	N/A
Phantom1	MVG	SAM	SN 32/14 SAM115	2014.09.01	N/A
Phantom2	MVG	SAM	SN 32/14 SAM116	2014.09.01	N/A
Phone holder	MVG	N/A	SN 32/14 MSH97	2014.09.01	N/A
Laptop holder	MVG	N/A	SN 32/14 LSH29	2014.09.01	N/A
Network Analyzer	Agilent	8753ES	US38432810	2018.03.08	2019.03.07
Multi Meter	Keithley	Multi Meter 2000	4050073	2017.10.15	2018.10.14
Signal Generator	Agilent	N5182A	MY50140530	2017.10.15	2018.10.14
Wireless Communication Test Set	Agilent	8960-E5515C	MY48360751	2017.10.15	2018.10.14
Wireless Communication Test Set	R&S	CMW500	117239	2017.10.15	2018.10.14
Power Amplifier	DESAY	ZHL-42W	9638	2017.10.15	2018.10.14
Power Meter	R&S	NRP	100510	2017.10.15	2018.10.14
Power Meter	Agilent	E4418B	GB43312526	2017.10.15	2018.10.14
Power Sensor	R&S	NRP-Z11	101919	2017.10.15	2018.10.14
Power Sensor	Agilent	E9301A	MY41497725	2017.10.15	2018.10.14
9dB Attenuator	Agilent	99899	DC-18GHz	2017.05.10	2018.05.09
11dB Attenuator	Agilent	8494B	DC-18GHz	2017.05.10	2018.05.09
110dB Attenuator	Agilent	8494B	DC-18GHz	2017.05.10	2018.05.09
Directional coupler	Narda	4226-20	3305	2017.10.15	2018.10.14
hygrothermograph	MiEO	HH660	N/A	2017.10.18	2018.10.17
Thermograph	Elitech	RC-4	S/N EF7176501537	2017.11.10	2018.11.09

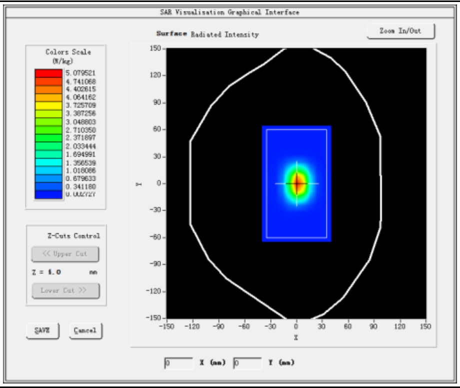
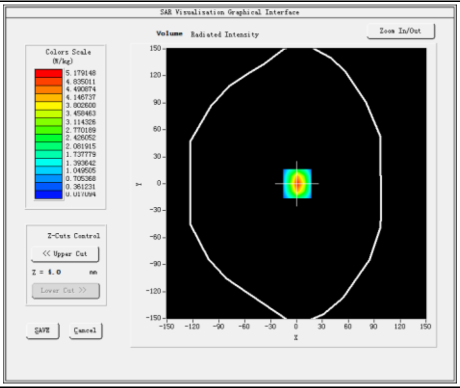
Appendix A. System Validation Plots

System Performance Check Data (2450MHz Body)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2018-04-20
Measurement duration: 14 minutes 23 seconds

Experimental conditions.

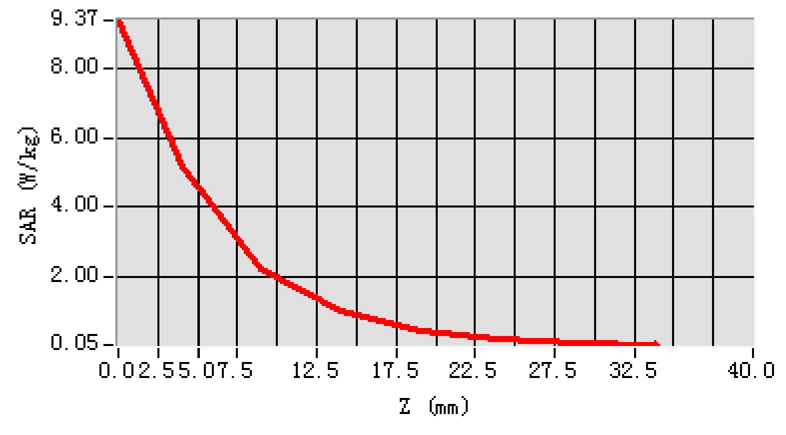
Device Position	Validation plane
Band	2450 MHz
Channels	-
Signal	CW
Frequency (MHz)	2450
Relative permittivity	51.36
Conductivity (S/m)	1.98
Power drift (%)	-0.07
Probe	SN 14/16 EP309
ConvF	5.24
Crest factor:	1:1

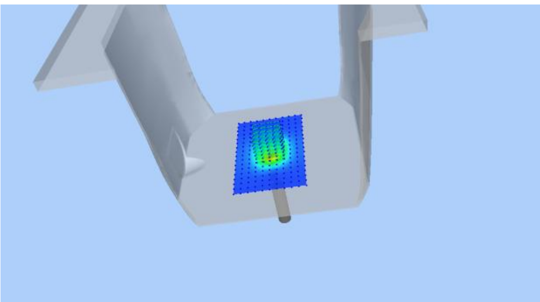
SURFACE SAR	VOLUME SAR
	

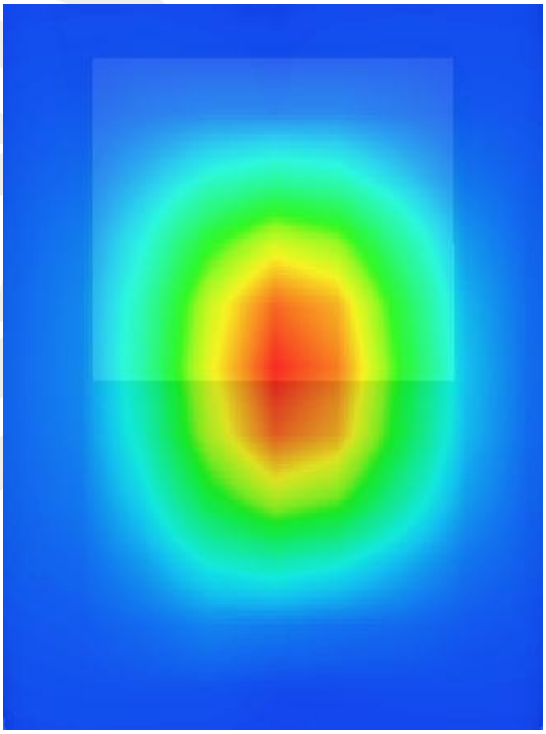
Maximum location: X=1.00, Y=0.00

SAR 10g (W/Kg)	2.274723
SAR 1g (W/Kg)	5.527211

Z Axis Scan


9.37
8.00
6.00
4.00
2.00
0.05
SAR (W/kg)
0.0 2.5 5.0 7.5 12.5 17.5 22.5 27.5 32.5 40.0
Z (mm)





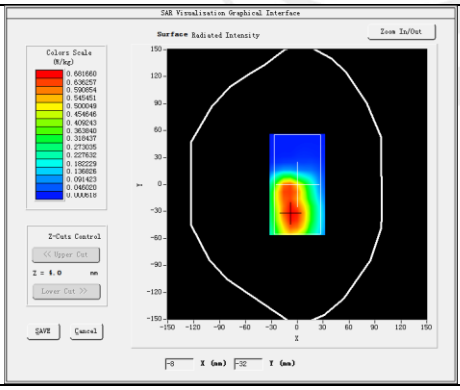
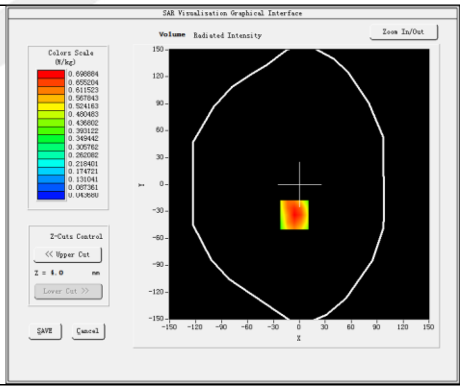
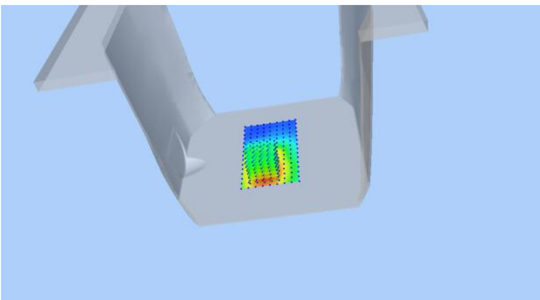
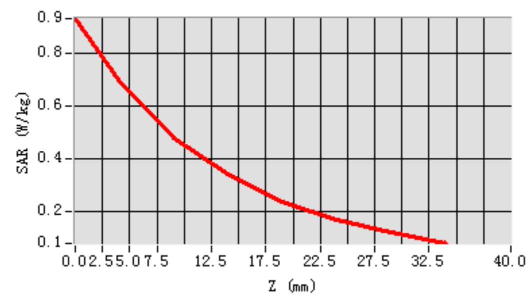
Appendix B. SAR Test Plots

Plot 1: DUT: 11AC 1200M Wireless USB Adapter; EUT Model: EP-AC1601

Test Date	2018-04-20
Probe	SN 14/16 EP309
ConvF	5.24
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Horizontal- Down
Antenna	A
Band	IEEE 802.11b ISM
Channels	Low
Signal	IEEE802.b (Crest factor: 1.0)
Frequency (MHz)	2412
Relative permittivity (real part)	52.70
Conductivity (S/m)	1.95
Variation (%)	-1.64

Maximum location: X=-6.00, Y=-34.00
SAR Peak: 0.94 W/kg

SAR 10g (W/Kg)	0.436173
SAR 1g (W/Kg)	0.666903

SURFACE SAR	VOLUME SAR
	
3D	**Z Axis Scan**
	

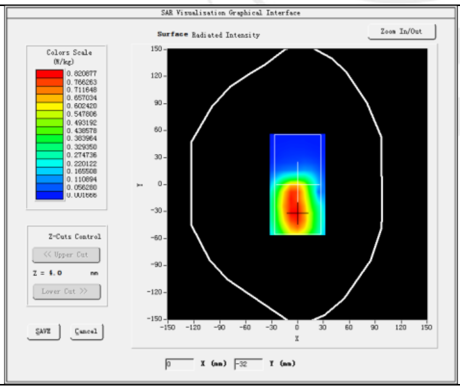
Plot 2: DUT: 11AC 1200M Wireless USB Adapter; EUT Model: EP-AC1601

Test Date	2018-04-20
Probe	SN 14/16 EP309
ConvF	5.24
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Horizontal- Down
Antenna	B
Band	IEEE 802.11b ISM
Channels	Middle
Signal	IEEE802.b (Crest factor: 1.0)
Frequency (MHz)	2437
Relative permittivity (real part)	52.70
Conductivity (S/m)	1.95
Variation (%)	-2.06

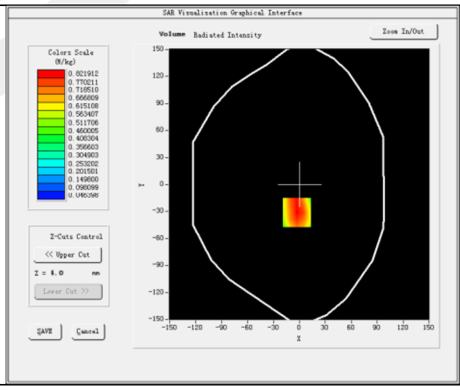
Maximum location: X=-3.00, Y=-31.00
SAR Peak: 1.14 W/kg

SAR 10g (W/Kg)	0.518800
SAR 1g (W/Kg)	0.790737

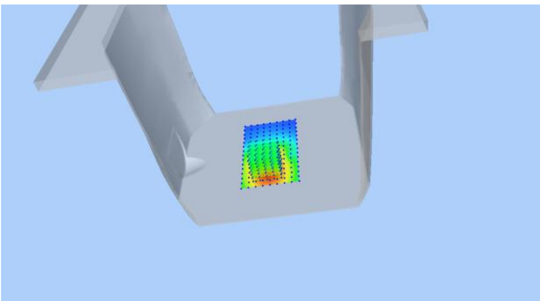
SURFACE SAR



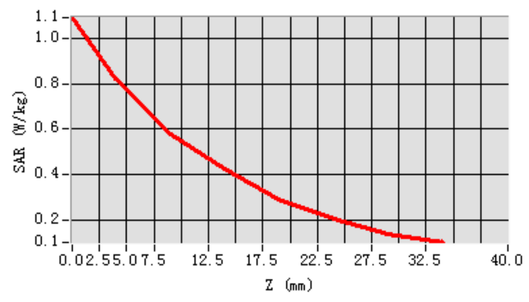
VOLUME SAR



3D



Z Axis Scan



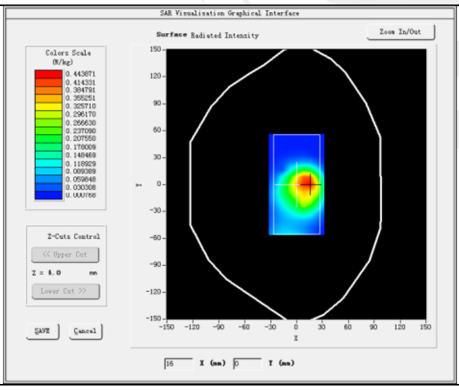
Plot 3: DUT: 11AC 1200M Wireless USB Adapter; EUT Model: EP-AC1601

Test Date	2018-04-20
Probe	SN 14/16 EP309
ConvF	5.24
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Horizontal- Down
Antenna	A
Band	IEEE 802.11n ISM
Channels	High
Signal	IEEE802.n (Crest factor: 1.0)
Frequency (MHz)	2462
Relative permittivity (real part)	52.70
Conductivity (S/m)	1.95
Variation (%)	2.14

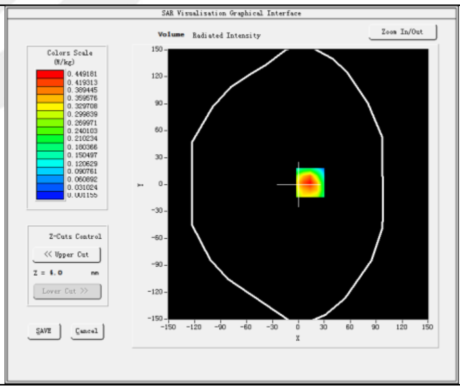
Maximum location: X=14.00, Y=2.00
SAR Peak: 0.73 W/kg

SAR 10g (W/Kg)	0.213053
SAR 1g (W/Kg)	0.421075

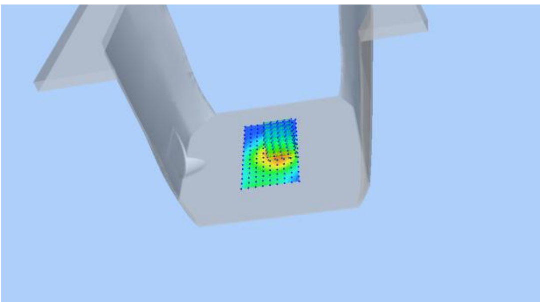
SURFACE SAR



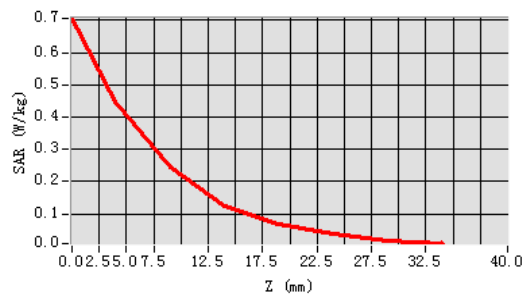
VOLUME SAR



3D



Z Axis Scan



Plot 4: DUT: 11AC 1200M Wireless USB Adapter; EUT Model: EP-AC1601

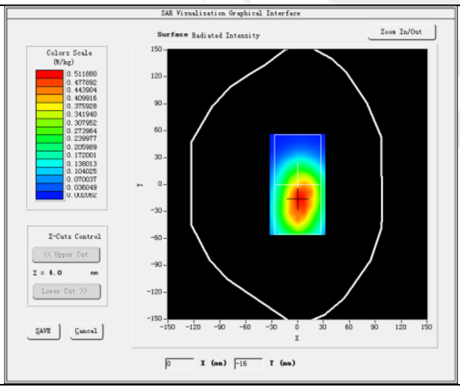
Test Date	2018-04-20
Probe	SN 14/16 EP309
ConvF	5.24
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Horizontal- Down
Antenna	B
Band	IEEE 802.11n ISM
Channels	High
Signal	IEEE802.n (Crest factor: 1.0)
Frequency (MHz)	2462
Relative permittivity (real part)	52.70
Conductivity (S/m)	1.95
Variation (%)	1.32

Maximum location: X=2.00, Y=-16.00

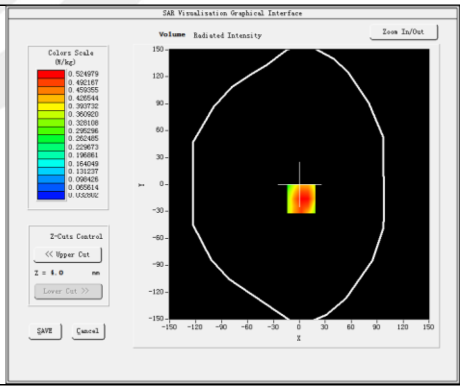
SAR Peak: 0.76 W/kg

SAR 10g (W/Kg)	0.334812
SAR 1g (W/Kg)	0.512044

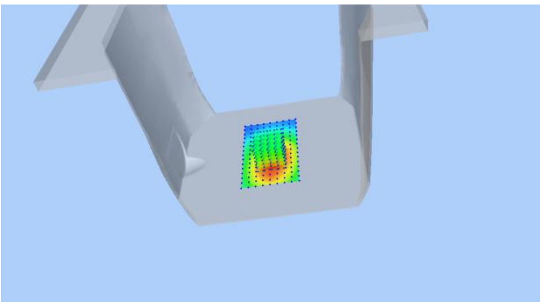
SURFACE SAR



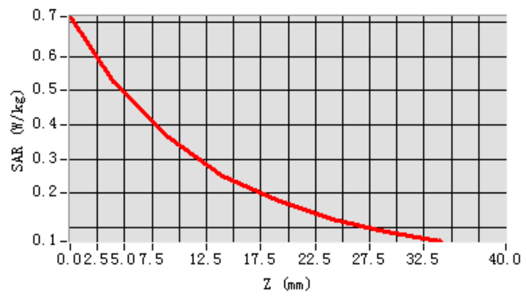
VOLUME SAR



3D



Z Axis Scan



Appendix C. Probe Calibration And Dipole Calibration Report

Refer the appendix Calibration Report.

※※※※※END OF THE REPORT※※※※※