S T S L A B

FCC SAR TEST REPORT

Report No.: STS2305315H02

Issued for

JAEWONCNC Co.,Ltd

A-501~510,517, H-Businesspark, 25, Beobwon-ro 11-gil, Songpa-gu, Seoul, Republic of Korea

Product Name:	Wireless USB Adapter
Brand:	IROAD
Model Number:	WD-4512BT
Series Model(s):	N/A
FCC ID:	2BA5E-WD4512BT
Test Standard:	ANSI/IEEE Std. C95.1
	FCC 47 CFR Part 2 (2.1093)
	IEC/IEEE 62209-1528
Max. Report SAR (1g):	Body: 0.982 W/kg

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Test Report Certification

Applicant's name ..... : JAEWONCNC Co.,Ltd

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Manufacturer's Name ..... : JAEWONCNC Co.,Ltd

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Product description

Product name ..... : Wireless USB Adapter

Brand name ..... : IROAD

Model name ..... : WD-4512BT

Series Model..... : N/A

Standards ..... : ANSI/IEEE Std. C95.1-1992
FCC 47 CFR Part 2 (2.1093)
IEC/IEEE 62209-1528

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 .....: 24 May 2023 ~ 25 May 2023

Date of Issue.....: 29 May 2023

Test Result.....: **Pass**

Testing Engineer : Shi fan. long

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Revision History

Rev.	Issue Date	Report No.	Effect Page	Contents
00	29 May 2023	STS2305315H02	ALL	Initial Issue

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	Wireless USB Adapter		
Brand Name	IROAD		
Model Name	WD-4512BT		
Series Model	N/A		
Model Difference	N/A		
Device Category	Portable		
Product stage	Production unit		
RF Exposure Environment	General Population / Uncontrolled		
Hardware Version	V1.0		
Software Version	V1.0		
Frequency Range	WLAN802.11b/g/n (HT20): 2412 ~ 2472MHz WLAN 802.11n(HT40): 2422 ~ 2462MHz WLAN 802.11a/n20/n40/ac20/ac40/ac80: 5725 to 5850 MHz Bluetooth: 2402 MHz to 2480 MHz		
Max. Reported SAR(1g): (Limit:1.6W/kg)	Band	Mode	Body Worn (W/kg)
	DTS	2.4GHz WLAN	0.419
	NII	5.8GHz WLAN	0.982
	DTS	BLE Note	0.499
1-g Sum SAR			1.481
FCC Equipment Class	Digital Transmission System (DTS) Unlicensed National Information Infrastructure TX(NII)		
Operating Mode:	2.4G WLAN : 802.11b(DSSS):CCK,DQPSK,DBPSK 802.11g(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11n(OFDM):BPSK,QPSK,16-QAM,64-QAM 5G WLAN: 802.11a(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11n(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11ac(OFDM):BPSK,QPSK,16-QAM,64-QAM,256-QAM Bluetooth: GFSK +π/4DQPSK+8DPSK BLE: GFSK		
Antenna Specification:	Bluetooth/WLAN: Chip antenna		
DTM Mode	Not Support		

Support units

Ltem	Equipment	Mfr/Brand	Mode/Type NO	Serial No	Note
01	ASUS BOOK PC	ASUS NOTEBOOK PC	P1450CE	N/A	N/A
02	USB Extension Cable	LENOVO	N/A	N/A	20CM

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.

A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm 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	IEC/IEEE 62209-1528	Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)
4	FCC KDB 447498 D02 v02r01	SAR Procedures for Dongle
5	FCC KDB 447498 D04 v01	RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices
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 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:

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

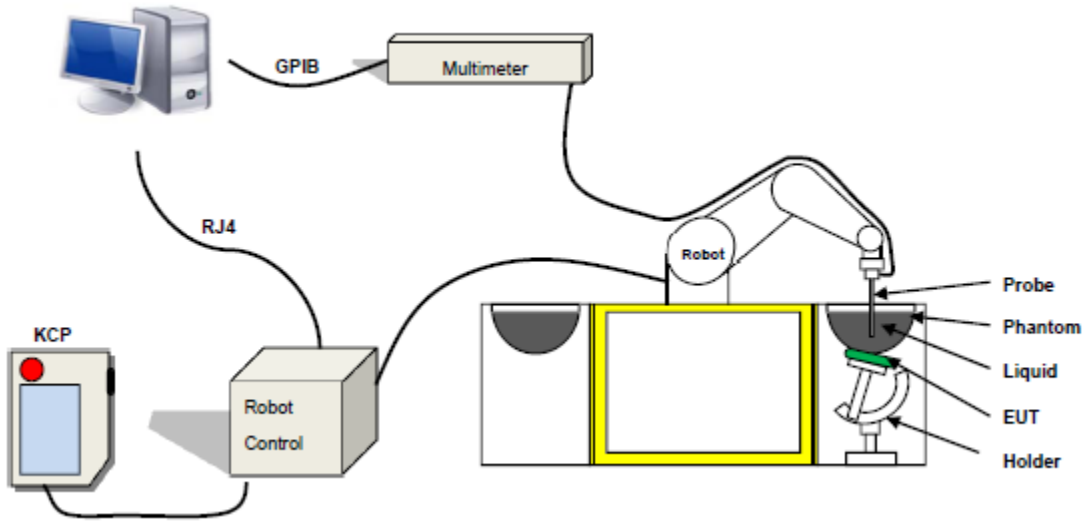
SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

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

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 Open SAR 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 07/21 EPGO352 with following specifications is used

- Probe Length: 330 mm
- Length of Individual Dipoles: 2 mm
- Maximum external diameter: 8 mm
- Probe Tip External Diameter: 2.5 mm
- Distance between dipole/probe extremity: 1 mm
- Dynamic range: 0.01-100 W/kg
- Probe linearity: 3%
- Axial Isotropy: < 0.10 dB
- Spherical Isotropy: < 0.10 dB
- Calibration range:150 MHz to 6 GHz for head & body simulating liquid.
- Angle between probe axis (evaluation axis) and surface normal line: less than 30°

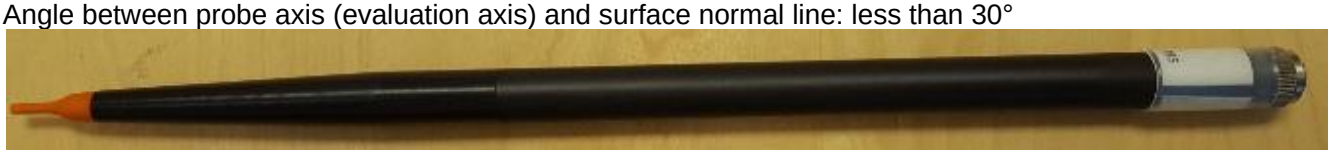


Figure 1-MVG COMOSAR Dosimetric E field Dipole

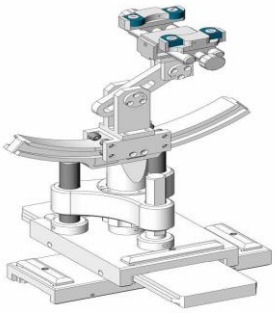
3.2.2 Phantom

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.

SN 32/14 SAM115

Figure-SN 21/21 ELLI48

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. 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.

Head Tissue

Frequency (MHz)	cellulose	DGBE	HEC	NaCl	Preventol	Sugar	X100	Water	Conductivity	Permittivity
	%	%	%	%	%	%	%	%	σ	εr
750	0.2	/	/	1.4	0.2	57.0	/	41.1	0.89	41.9
835	0.2	/	/	1.4	0.2	57.9	/	40.3	0.90	41.5
900	0.2	/	/	1.4	0.2	57.9	/	40.3	0.97	41.5
1800	/	44.5	/	0.3	/	/	30.45	55.2	1.4	40.0
1900	/	44.5	/	0.3	/	/	30.45	55.2	1.4	40.0
2000	/	44.5	/	0.3	/	/	/	55.2	1.4	40.0
2450	/	44.9	/	0.1	/	/	/	55.0	1.80	39.2
2600	/	45.0	/	0.1	/	/	/	54.9	1.96	39.0

Body Tissue

Frequency (MHz)	cellulose	DGBE	HEC	NaCl	Preventol	Sugar	X100	Water	Conductivity	Permittivity
	%	%	%	%	%	%	%	%	σ	εr
750	0.2	/	/	0.9	0.1	47.2	/	51.7	0.96	55.5
835	0.2	/	/	0.9	0.1	48.2	/	50.8	0.97	55.2
900	0.2	/	/	0.9	0.1	48.2	/	50.8	1.05	55.0
1800	/	29.4	/	0.4	/	/	30.45	70.2	1.52	53.3
1900	/	29.4	/	0.4	/	/	30.45	70.2	1.52	53.3
2000	/	29.4	/	0.4	/	/	/	70.2	1.52	53.3
2450	/	31.3	/	0.1	/	/	/	68.6	1.95	52.7
2600	/	31.7	/	0.1	/	/	/	68.2	2.16	52.3

Tissue dielectric parameters for head and body phantoms				
Frequency	εr		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

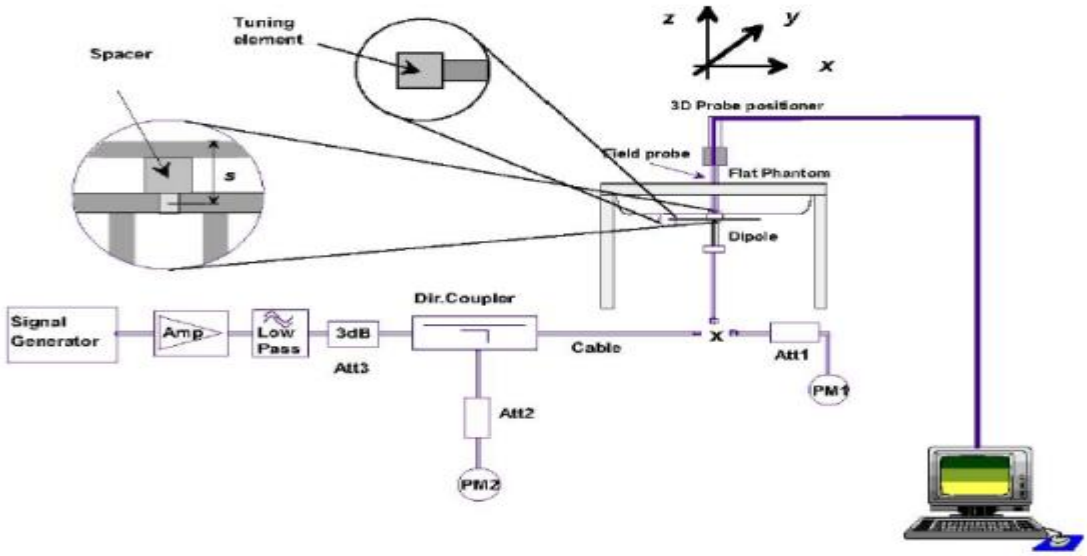
Date	Ambient		Simulating Liquid		Parameters	Target	Measured	Deviation %	Limited %
	Temp. [°C]	Humidity %	Frequency (MHz)	Temp. [°C]					
2023-05-24	22.9	49	2437	22.6	Permittivity	39.22	40.56	3.41	±5
					Conductivity	1.79	1.74	-2.71	±5
2023-05-24	23.0	49	2450	22.8	Permittivity	39.20	39.86	1.68	±5
					Conductivity	1.80	1.85	2.78	±5
2023-05-25	23.6	58	5755	23.3	Permittivity	35.35	36.19	2.39	±5
					Conductivity	5.22	5.25	0.52	±5
2023-05-25	23.1	49	5795	22.8	Permittivity	35.31	35.29	-0.04	±5
					Conductivity	5.26	5.24	-0.47	±5
2023-05-25	23.6	58	5800	23.3	Permittivity	35.30	36.41	3.14	±5
					Conductivity	5.27	5.32	0.95	±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 %.

Date	Freq.	Power	Tested Value	Normalized SAR	Target SAR	Tolerance	Limit
	(MHz)	(mW)	(W/Kg)	(W/kg)	1g(W/kg)	(%)	(%)
2023-05-24	2450	100	5.556	55.56	54.70	1.57	10
2023-05-25	5800	100	19.187	191.87	183.06	4.81	10

Note:

1. The tolerance limit of System validation ±10%.
2. The dipole input power (forward power) was 100 mW.
3. The results are normalized to 1 W input power.

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.

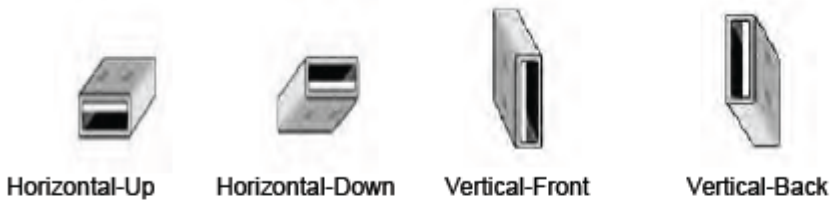
➢ Area Scan& Zoom Scan

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 D01 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 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.

7.1 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.

7.2 SAR Test Exclusions Applied

Standalone SAR test exclusion applies 447498 D04 Interim General Radio Frequency Exposure Guidelines v01. The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold Pth (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^x & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

Function	Fre. (GHz)	Separation distance (cm)	Max Turn up power (dBm)	Max Turn up power (mW)	Pth (mW)
BLE	2.402	0.5	-0.6	0.87	2.79

Note: The Maximum power is less than the Pth, complies with the exemption requirements.

8. Uncertainty

8.1 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.

Symbol	Uncertainty Component	Prob. Dist.	Unc. $a(x_i)$	Div. q_i	$u(x_i) = a(x_i)/q_i$	C_i	$u(y) = C_i * u(x_i)$	v_i
Measurement system errors								
CF	Probe calibration	N (k = 2)	5.72	2	2.86	1	2.86	∞
CF_{drift}	Probe calibration drift	R	0.15	√3	0.09	1	0.09	∞
LIN	Probe linearity and detection limit	R	1.27	√3	0.73	1	0.73	∞
BBS	Broadband signal	R	0.12	√3	0.07	1	0.07	∞
ISO	Probe isotropy	R	0.16	√3	0.09	1	0.09	∞
DAE	Other probe and data acquisition errors	N	2.4	1	2.40	1	2.40	∞
AMB	RF ambient and noise	N	3.51	1	3.51	1	3.51	∞
Δ_{xyz}	Probe positioning errors	N	1.2	1	1.20	2/δ	1.20	
DAT	Data processing errors	N	2.1	1	2.10	1	2.10	∞
Phantom and device (DUT or validation antenna) errors								
LIQ(σ)	Measurement of phantom conductivity(σ)	N	4.1	1	4.1	c_ε, c_σ	4.10	∞
LIQ(T_c)	Temperature effects (medium)	R	2.7	√3	1.56	c_ε, c_σ	1.56	∞
EPS	Shell permittivity	R	2.1	√3	1.21	See 8.4.2.3	0.30	∞
DIS	Distance between the radiating element of the DUT and the phantom medium	N	0.7	1	0.7	2	1.40	∞
D_{xyz}	Repeatability of positioning the DUT or source against the phantom	N	1.2	1	1.2	1	1.20	5
H	Device holder effects	N	3.8	1	3.8	1	3.80	
MOD	Effect of operating mode on probe sensitivity	R	3.42	√3	1.97	1	1.97	∞
TAS	Time-average SAR	R	1.8	√3	1.04	1	1.04	∞
RF_{drift}	Variation in SAR due to drift in output of DUT	N	4.5	1	4.5	1	4.50	
VAL	Validation antenna uncertainty (validation measurement only)	N	1.4	1	1.4	1	1.40	
P_{in}	Uncertainty in accepted power (validation measurement only)	N	2.4	1	2.4	1	2.40	
Corrections to the SAR result (if applied)								
C(ε′,σ)	Phantom deviation from target (ε′,σ))	N	3.7	1	3.7	1	3.70	
C(R)	SAR scaling	R	1.8	√3	1.04	1	1.04	
u(ΔSAR)	Combined uncertainty						10.84	
U	Expanded uncertainty and effective degrees of freedom					U =	21.68	

9. Conducted Power Measurement

9.1 Test Result

2.4GWIFI				
Mode	Channel Number	Frequency (MHz)	Average Power (dBm)	Output Power (mW)
802.11b	1	2412	14.39	27.48
	7	2437	14.51	28.25
	11	2462	14.4	27.54
802.11g	1	2412	12.13	16.33
	7	2437	11.45	13.96
	11	2462	11.97	15.74
802.11 n-HT20	1	2412	11.79	15.10
	7	2437	11.52	14.19
	11	2462	11.59	14.42
802.11 n-HT40	3	2422	11.96	15.70
	6	2437	11.9	15.49
	9	2452	11.36	13.68

5.8G WLAN				
Mode	Channel Number	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
802.11a20	149	5745	14.24	26.55
	157	5785	14.12	25.82
	165	5825	13.59	22.86
802.11 n-HT20	149	5745	13.57	22.75
	157	5785	13.5	22.39
	165	5825	13.01	20.00
802.11 n-HT40	151	5755	14.48	28.05
	159	5795	14.28	26.79
802.11ac-VHT20	149	5745	13.79	23.93
	157	5785	13.5	22.39
	165	5825	11.92	15.56
802.11ac-VHT40	151	5755	13.36	21.68
	159	5795	13.17	20.75
802.11ac-VHT80	155	5775	13.57	22.75

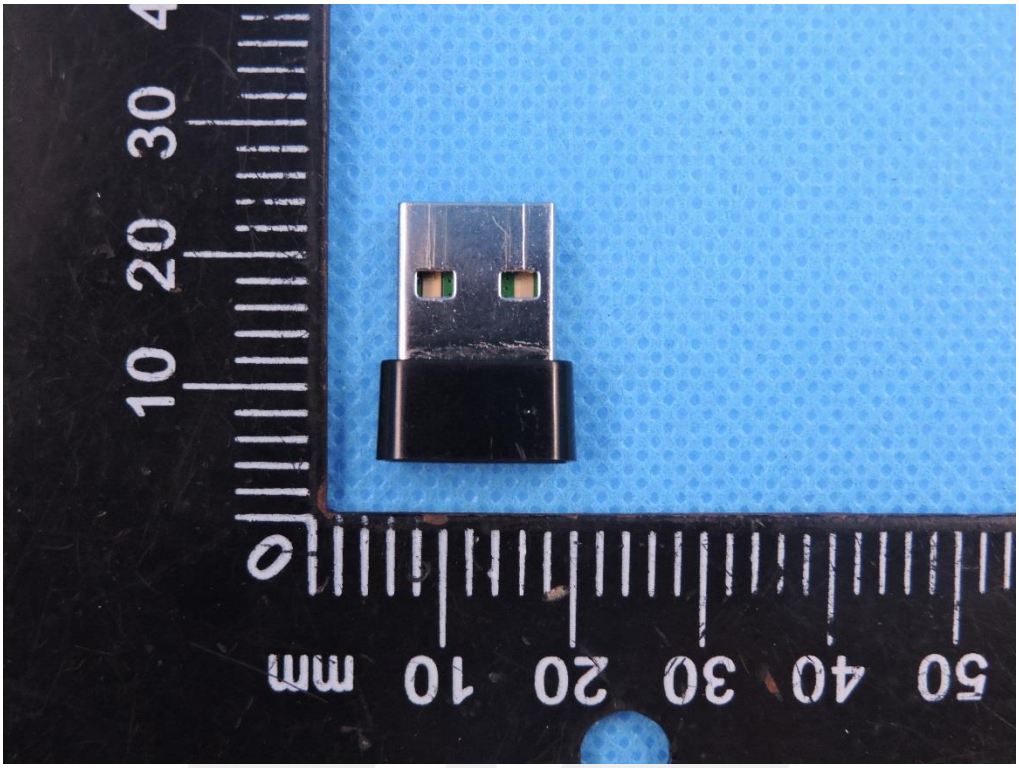
BT				
Mode	Channel Number	Frequency (MHz)	Average Power (dBm)	Output Power (mW)
GFSK(1Mbps)	0	2402	-4.11	0.39
	39	2441	-4.48	0.36
	78	2480	-5.07	0.31
π/4-QPSK(2Mbps)	0	2402	-2.41	0.57
	39	2441	-2.68	0.54
	78	2480	-3.07	0.49
8DPSK(3Mbps)	0	2402	-2.1	0.62
	39	2441	-2.31	0.59
	78	2480	-2.64	0.54

BLE				
Mode	Channel Number	Frequency (MHz)	Average Power (dBm)	Output Power (mW)
GFSK(1Mbps)	0	2402	-1.65	0.68
	19	2440	-2.03	0.63
	39	2480	-2.53	0.56

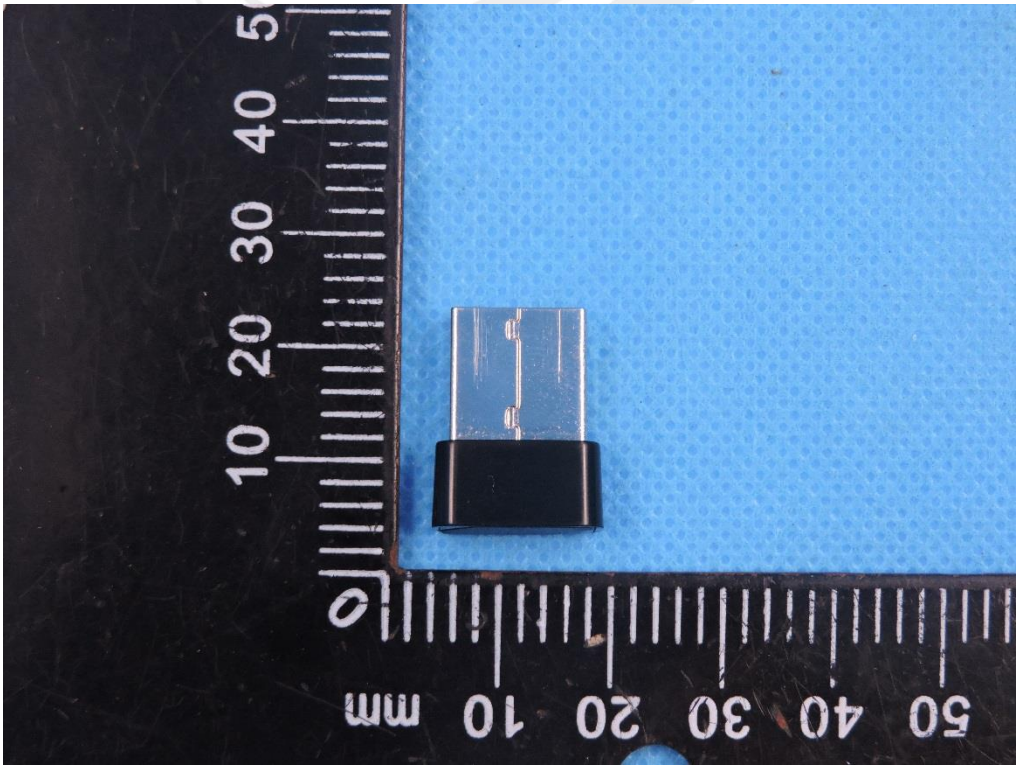
10. EUT and Test Setup Photo

10.1 EUT Photo

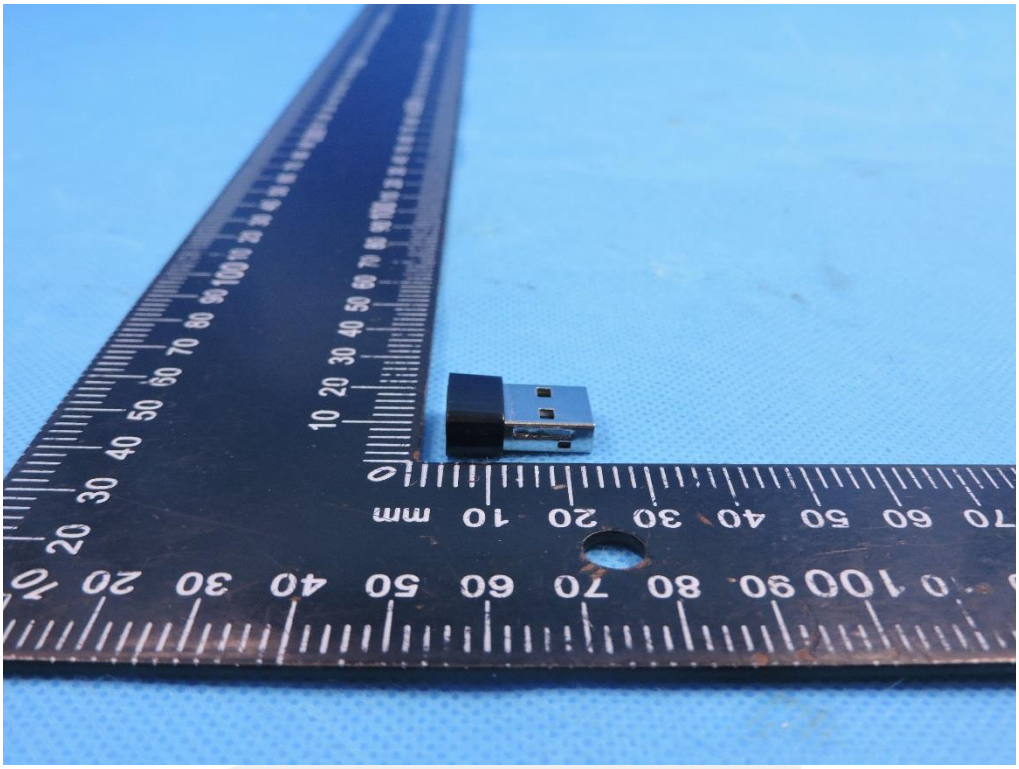
Front side



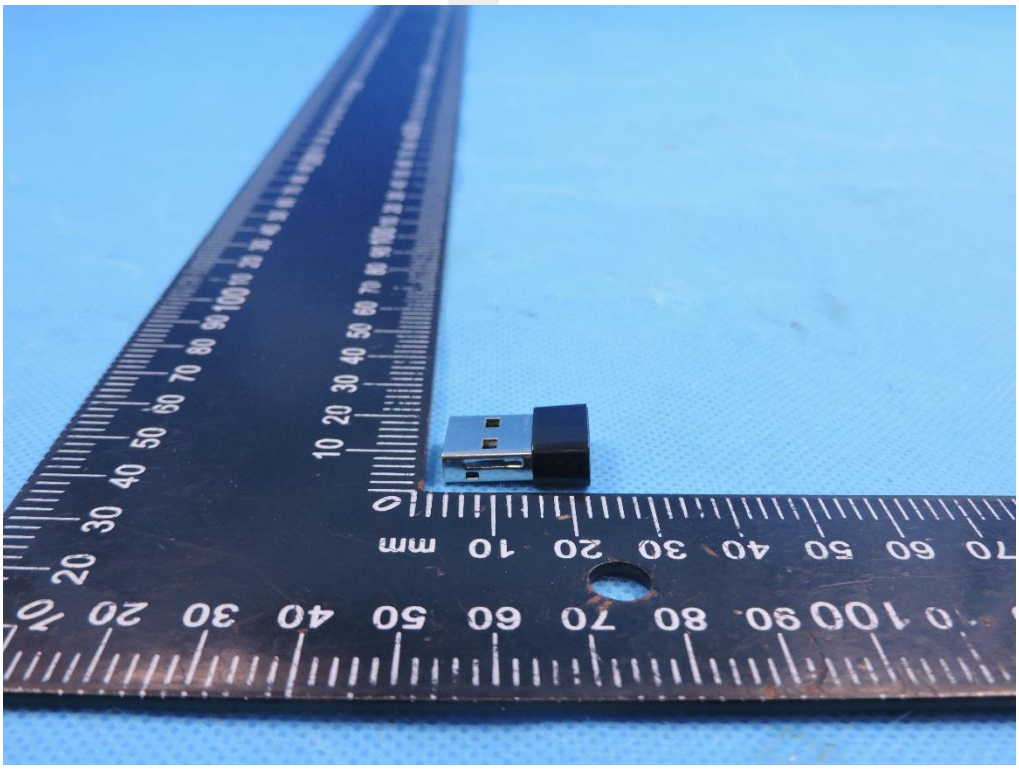
Back side



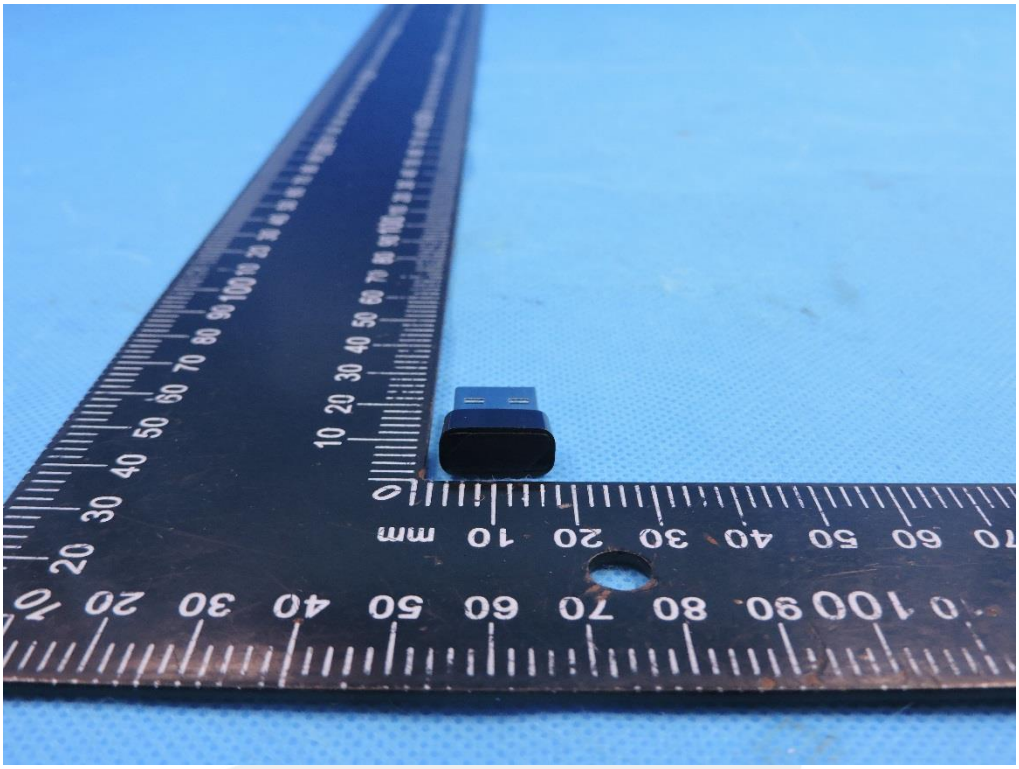
Left Edge



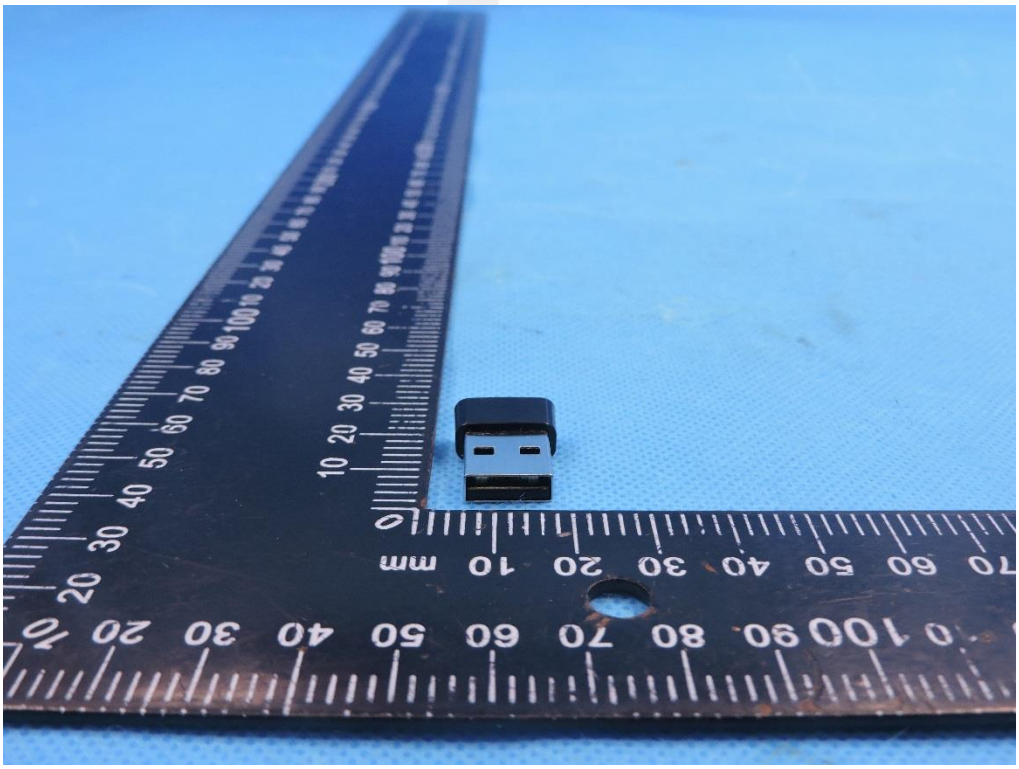
Right Edge



Top Edge

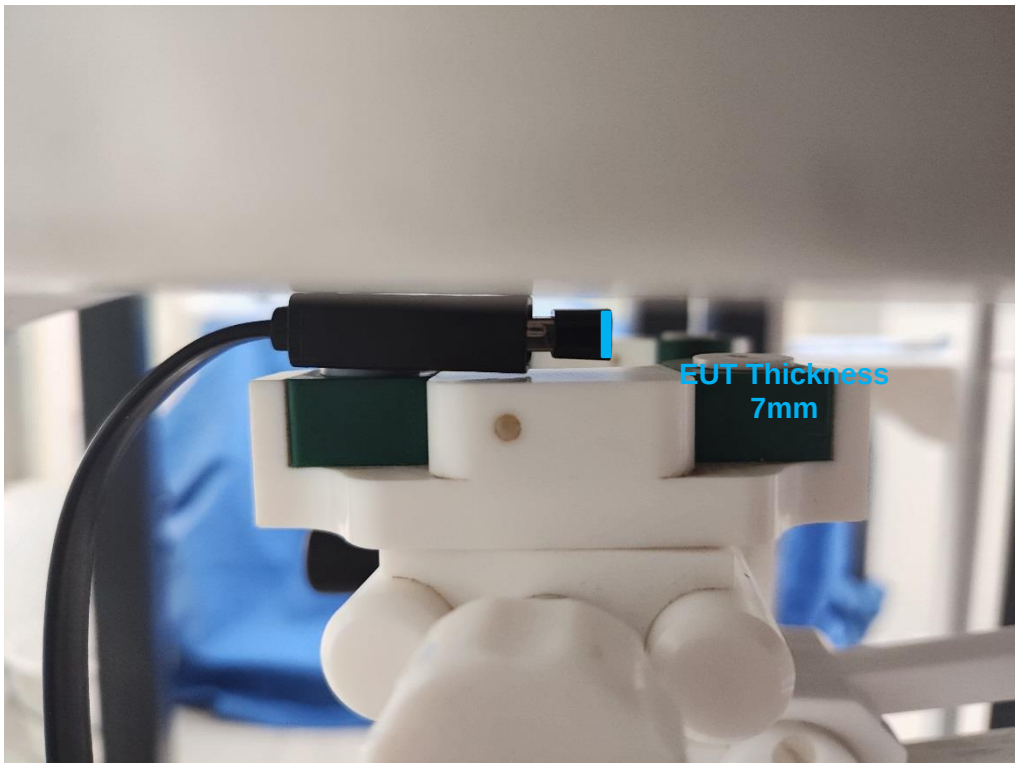


Bottom Edge

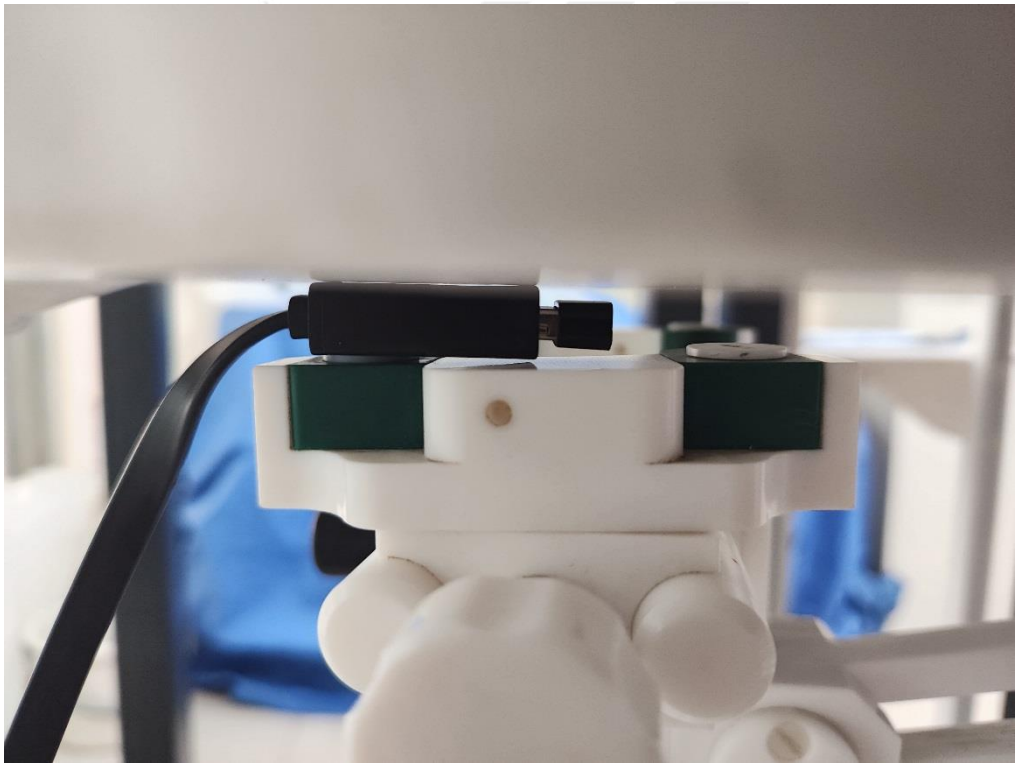


11.2 Setup Photos

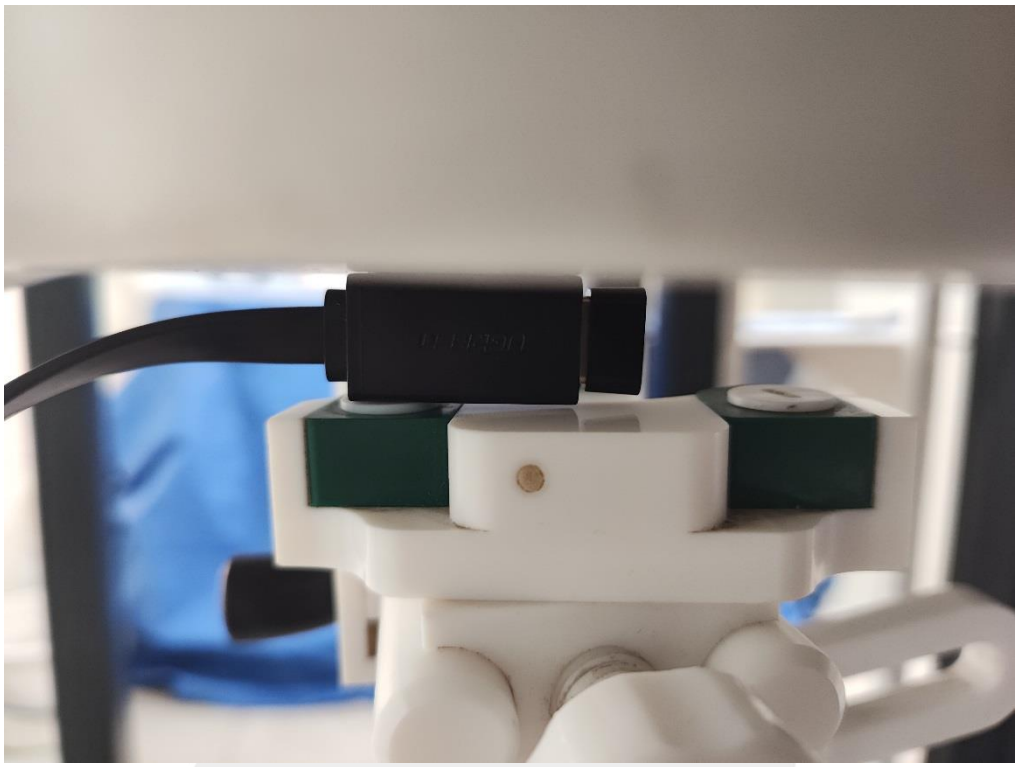
.Horizontal- Up side (separation distance is 0mm)



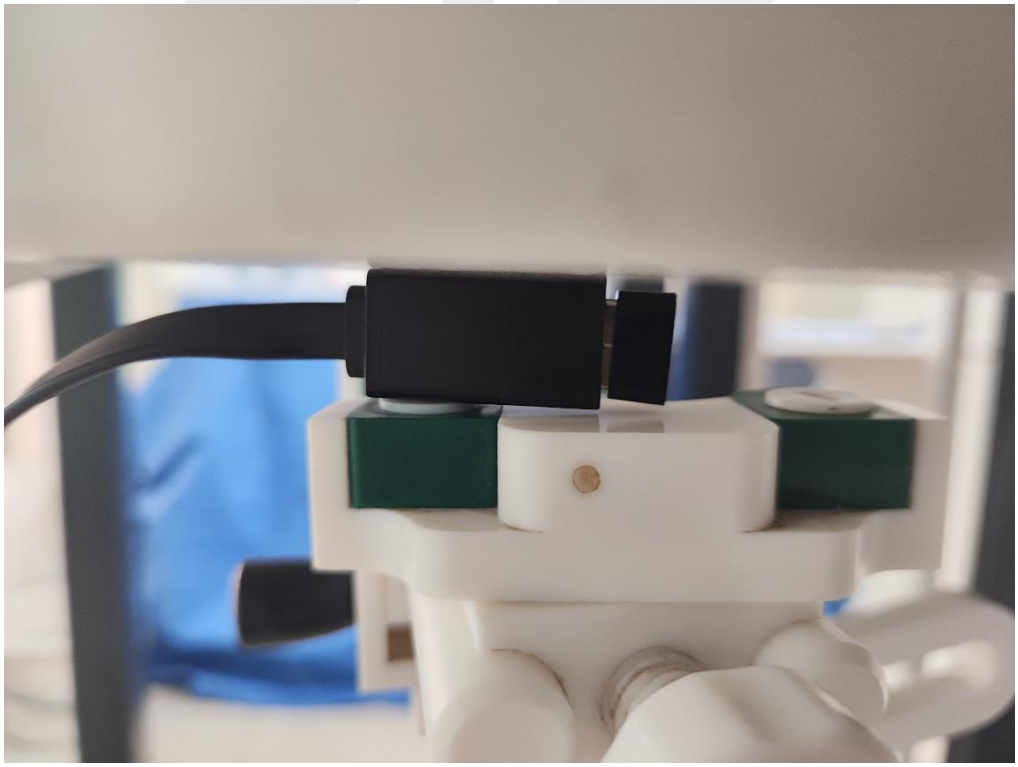
.Horizontal- Down side (separation distance is 0mm)



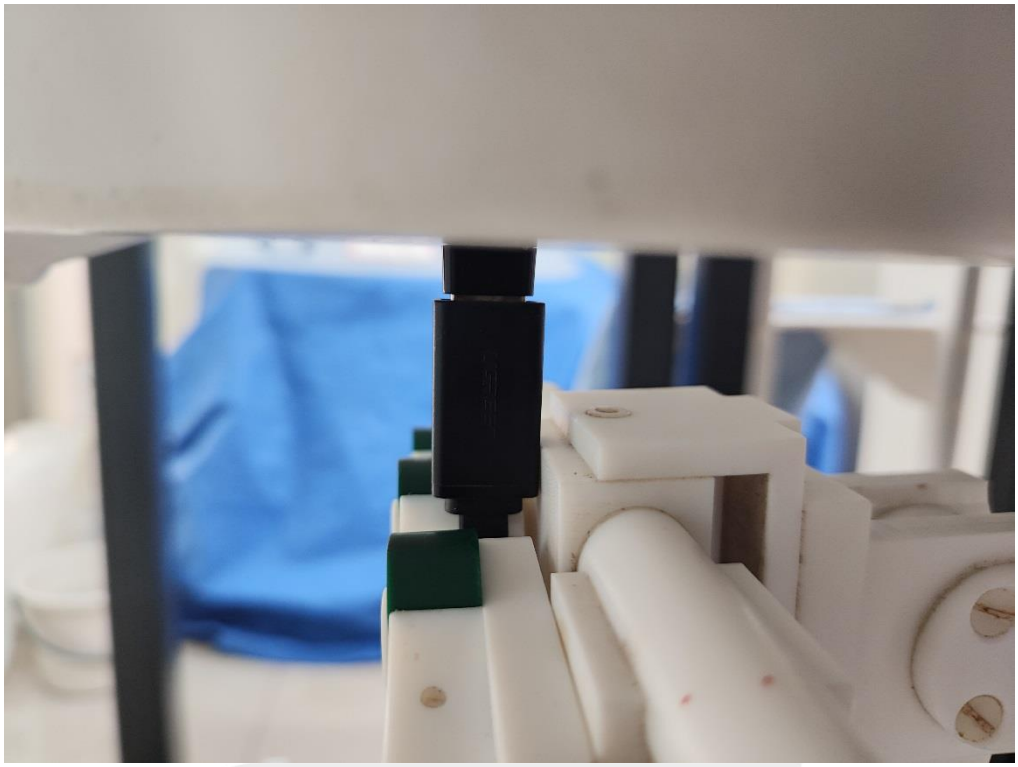
Vertical- Front (separation distance is 0mm)



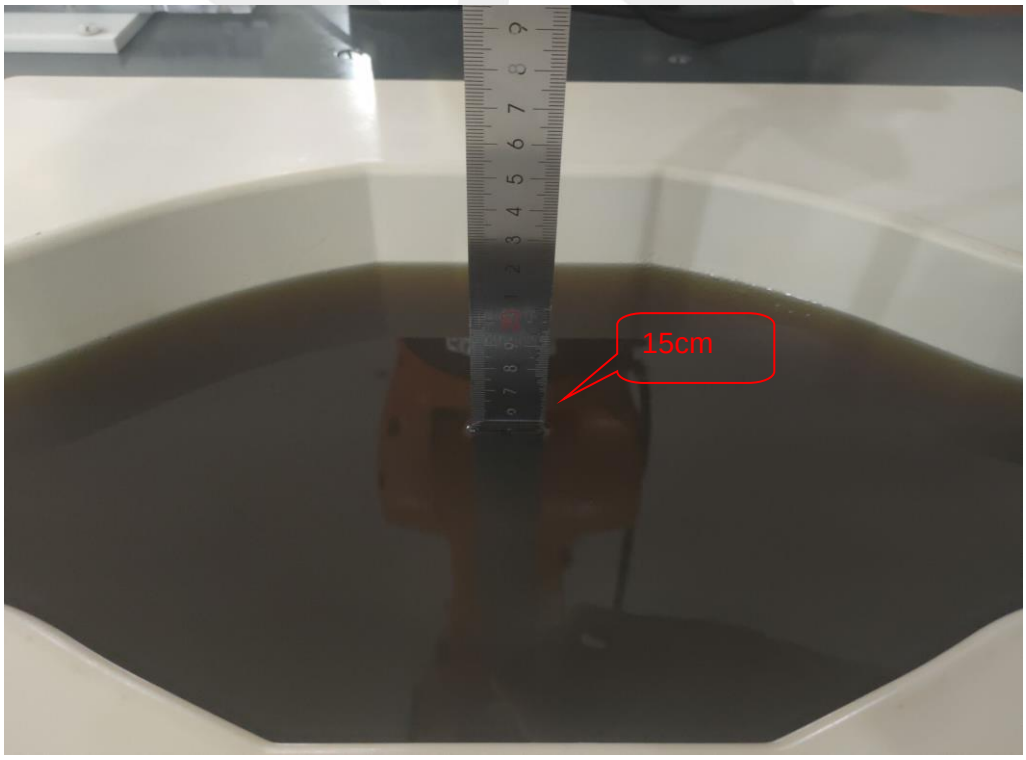
Vertical- Back (separation distance is 0mm)



Top edge (separation distance is 0mm)



Liquid depth (15 cm)



12. SAR Result Summary

12.1 Body-worn SAR

Band	Model	Test Position	Freq.	SAR (1g) (W/kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Scaled SAR (W/Kg)	Meas.No.
2.4GHz WLAN	802.11b	Horizontal- Up	2437	0.374	-2.53	15.00	14.51	**0.419**	**1**
		Horizontal- Down	2437	0.256	0.47	15.00	14.51	0.287	/
		Vertical- Front	2437	0.153	3.47	15.00	14.51	0.171	/
		Vertical- Back	2437	0.017	2.42	15.00	14.51	0.019	/
		Top edge	2437	0.105	-0.60	15.00	14.51	0.118	/
5.8GHz WLAN	802.11 n-HT40	Horizontal- Up	5755	0.977	-0.12	14.50	14.48	**0.982**	**2**
		Horizontal- Up	5795	0.852	-1.61	14.50	14.28	0.896	/
		Horizontal- Down	5755	0.666	-2.75	14.50	14.48	0.669	/
		Vertical- Front	5755	0.645	-1.53	14.50	14.48	0.648	/
		Vertical- Back	5755	0.490	-1.90	14.50	14.48	0.492	/
		Top edge	5755	0.193	-2.78	14.50	14.48	0.194	/

Note:

1. The test separation of all above table is 0mm.
2. Per KDB 447498 D04, 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. Scaled SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor

Repeated SAR

Band	Mode	Test Position	Freq.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Scaled SAR(W/Kg)	Meas. No.
5.8GHz WLAN	802.11 n-HT40	Front Side	5755	0.955	3.29	14.50	14.48	0.959	-
		Front Side	5795	0.838	-0.47	14.50	14.28	0.882	-

Repeated SAR measurement

Band	Mode	Test Position	Freq.	Original Measured SAR 1g(W/kg)	1 st Repeated SAR 1g	Ratio	Original Measured SAR 1g(W/kg)	2nd Repeated SAR 1g	Ratio
5.8GHz WLAN	802.11 n-HT40	Front Side	5755	0.977	0.955	1.023	-	-	-
		Front Side	5795	0.852	0.838	1.017	-	-	-

Simultaneous Multi-band Transmission Evaluation:

Application Simultaneous Transmission information:

Position	Simultaneous State
Body	1. 2.4G/5G WIFI + BLE

NOTE:

1. If the test separation distance is <5mm, 5mm is used for excluded SAR calculation.
2. The reported SAR summation is calculated based on the same configuration and test position.
3. KDB 447498 Appendix E, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
   SAR_{est} =1.6 · Pant / Pth [W/kg].
   P_{ant} is maximum time-averaged power or effective radiated power (ERP), whichever is greater, and P_{th} is defined in Formula KDB 447498 (B.2).

Estimated SAR		Antenna to user(cm)	Pant	Pth	Stand Alone SAR(1g) [W/kg]
BLE	Body	≤0.5	0.87	2.79	0.499

Simultaneous Mode	Position	Mode	Max. 1-g SAR (W/kg)	1-g Sum SAR (W/kg)
BLE + 2.4G WLAN	Body	2.4G WLAN	0.419	0.918
		BLE	0.499	
BLE + Bluetooth	Body	5G WLAN	0.982	1.481
		BLE	0.499	

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna.

When the sum of SAR 1g of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit (SAR-1g 1.6 W/kg), the simultaneous transmission SAR is not required. When the sum of SAR 1g is greater than the SAR limit (SAR-1g 1.6 W/kg), SAR test exclusion is determined by the SPLSR.

13. Equipment List

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
2450MHzDipole	MVG	SID2450	SN 30/14 DIP2G450-335	2020.07.14	2023.07.13
Waveguide	MVG	SWG5500	SN 13/14 WGA32	2020.07.14	2023.07.13
E-Field Probe	MVG	SSE2	SN 07/21 EPGO352	2023.02.24	2024.02.23
Dielectric Probe Kit	MVG	SCLMP	SN 32/14 OCPG67	2022.11.15	2023.11.14
Antenna	MVG	ANTA3	SN 07/13 ZNTA52	N/A	N/A
Phantom1	MVG	SAM	SN 32/14 SAM115	N/A	N/A
Phantom3	MVG	SAM	SN 21/21 ELLI48	N/A	N/A
Phone holder	MVG	N/A	SN 32/14 MSH97	N/A	N/A
Laptop holder	MVG	N/A	SN 32/14 LSH29	N/A	N/A
Attenuator	Agilent	99899	DC-18GHz	N/A	N/A
Directional coupler	Narda	4226-20	3305	N/A	N/A
Network Analyzer	Agilent	8753ES	US38432810	2022.09.28	2023.09.27
Multi Meter	Keithley	Multi Meter 2000	4050073	2022.09.29	2023.09.28
Signal Generator	Agilent	N5182A	MY50140530	2022.09.28	2023.09.27
Wireless Communication Test Set	Agilent	8960-E5515C	MY48360751	2022.09.28	2023.09.27
Wireless Communication Test Set	R&S	CMW500	156324	2022.09.29	2023.09.28
Power Amplifier	DESAY	ZHL-42W	9638	2022.10.08	2023.10.07
Power Meter	R&S	NRP	100510	2022.09.28	2023.09.27
Power Sensor	R&S	NRP-Z11	101919	2022.09.28	2023.09.27
Power Sensor	Keysight	U2021XA	MY56280002	2022.09.29	2023.09.28
Temperature hygrometer	SuWei	SW-108	N/A	2022.09.30	2023.09.29
Thermograph	Elitech	RC-4	S/N EF7176501537	2022.09.30	2023.09.29

Note:
Per KDB 865664 D01, Dipole SAR Validation Verification, STS LAB has adopted 3 years calibration intervals.
On annual basis, every measurement dipole has been evaluated and is in compliance with the following criteria:
1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value Return-loss in within 20% of calibrated measurement

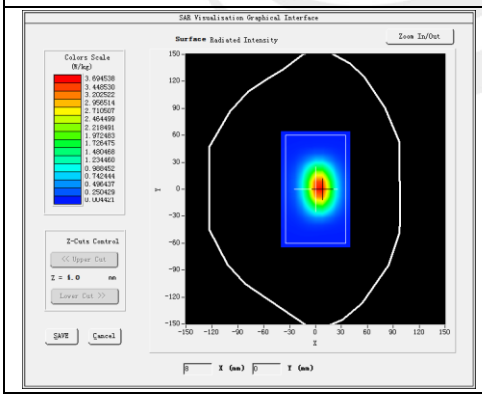
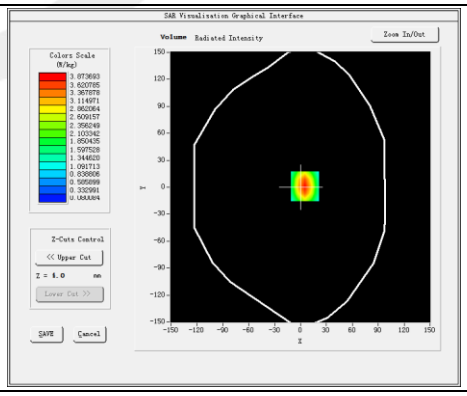
Appendix A. System Validation Plots

System Performance Check Data (2450MHz)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm, dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2023-05-24

Experimental conditions.

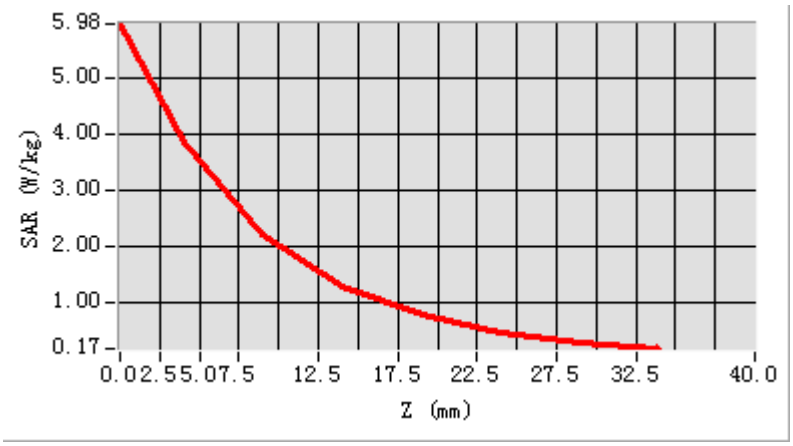
Phantom	Validation plane
Device Position	-
Band	2450MHz
Channels	-
Signal	CW
Frequency (MHz)	2450MHz
Relative permittivity	39.86
Conductivity (S/m)	1.85
Probe	SN 07/21 EPGO352
ConvF	1.75
Crest factor:	1:1

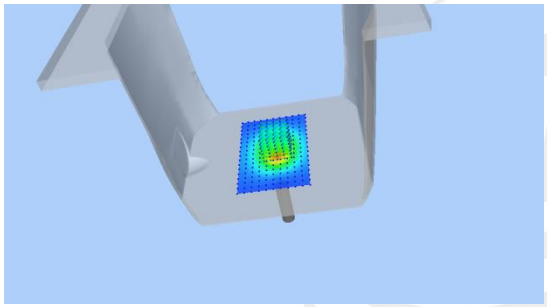
SURFACE SAR	VOLUME SAR
	

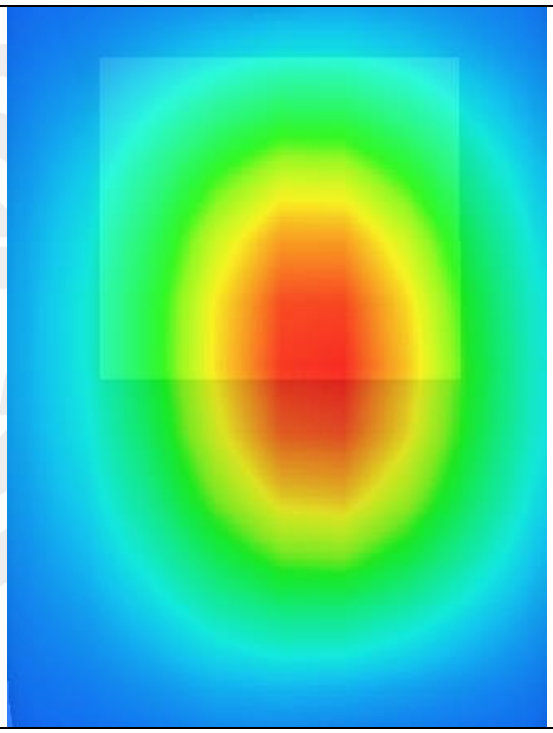
Maximum location: X=5.00, Y=1.00

SAR 10g (W/Kg)	2.481343
SAR 1g (W/Kg)	5.556464

Z Axis Scan


5.98
5.00
4.00
3.00
2.00
1.00
0.17
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)



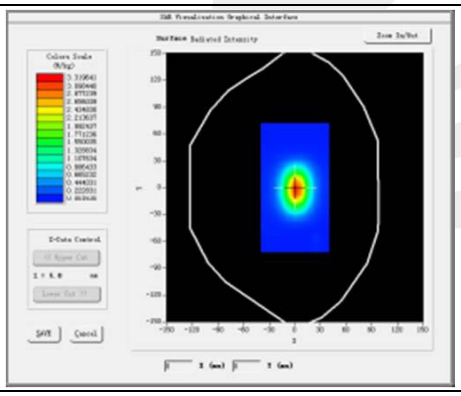
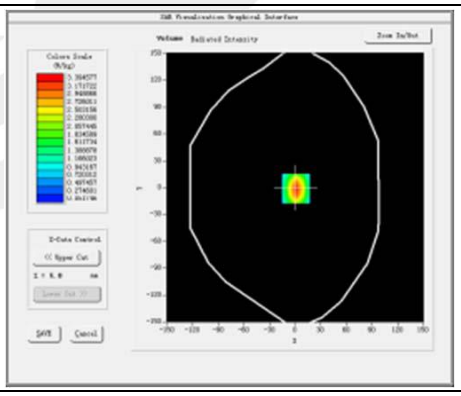


System Performance Check Data (5800MHz)

Type: Dipole measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2023-05-25

Experimental conditions.

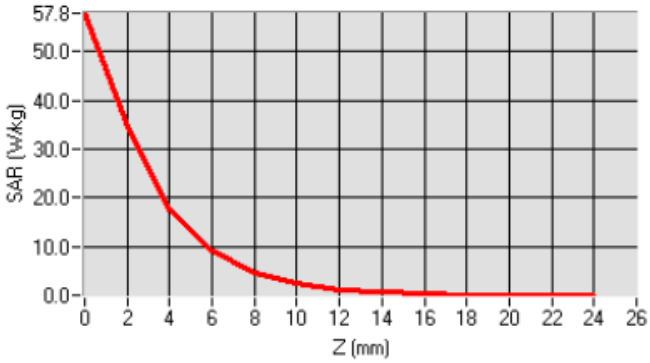
Device Position	Validation plane
Band	5800 MHz
Channels	-
Signal	CW
Frequency (MHz)	5800
Relative permittivity	36.41
Conductivity (S/m)	5.32
Probe	SN 07/21 EPGO352
ConvF	1.64
Crest factor:	1:1

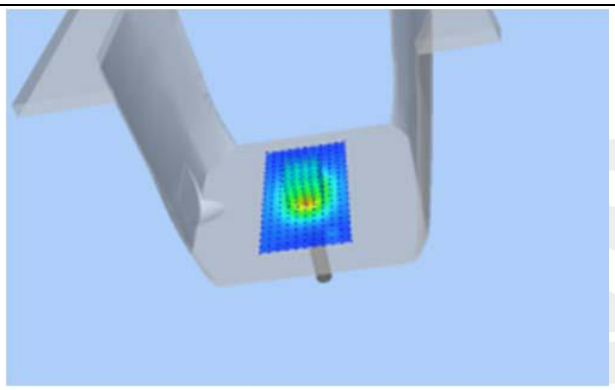
SURFACE SAR	VOLUME SAR
	

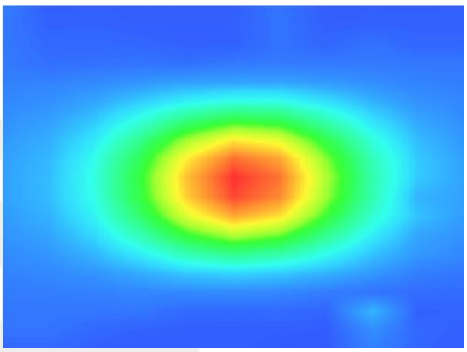
Maximum location: X=7.00, Y=2.00

SAR 10g (W/Kg)	6.128489
SAR 1g (W/Kg)	19.186727

Z Axis Scan


57.8
50.0
40.0
30.0
20.0
10.0
0.0
SAR (W/kg)
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Z (mm)





Appendix B. SAR Test Plots

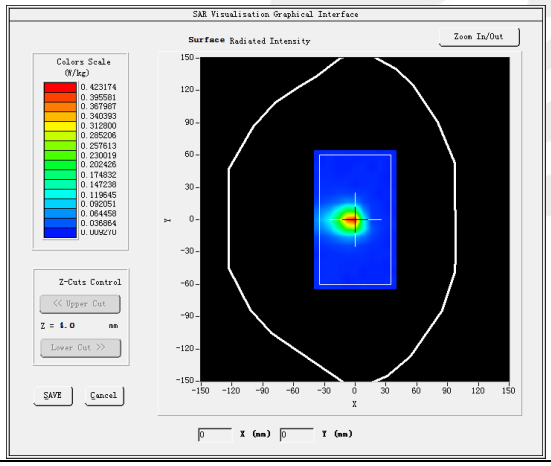
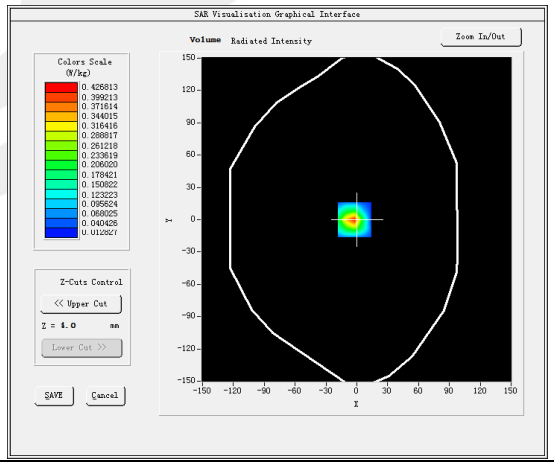
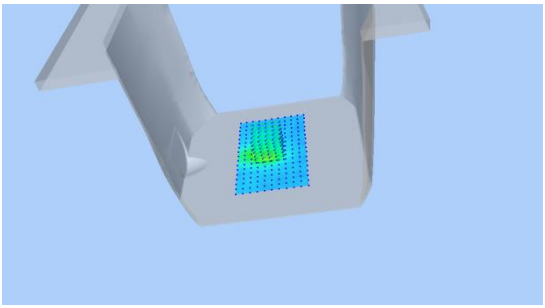
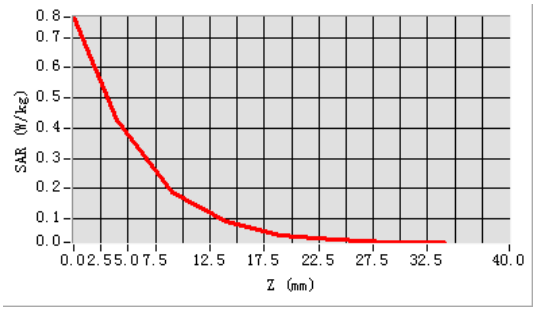
Plot 1: DUT: Wireless USB Adapter; EUT Model: WD-4512BT

Test Date	2023-05-24
Probe	SN 07/21 EPGO352
Area Scan	dx=8mm, dy=8mm, h= 5.00 mm
Zoom Scan	5x5x7, dx=8mm, dy=8mm, dz=5mm, Complete/ndx=8mm, dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Horizontal- Up
Band	2.4GHz WLAN
Signal	802.11b (Crest factor: 1.0)
Frequency (MHz)	2437
Relative permittivity (real part)	40.56
Conductivity (S/m)	1.74

Maximum location: X=-2.00, Y=0.00

SAR Peak: 0.76 W/kg

SAR 10g (W/Kg)	0.150896
SAR 1g (W/Kg)	0.373979

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

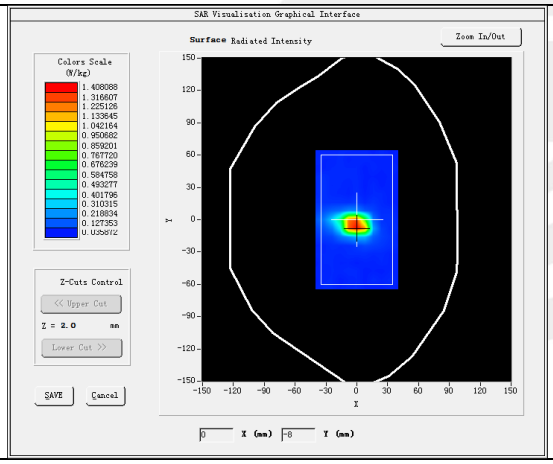
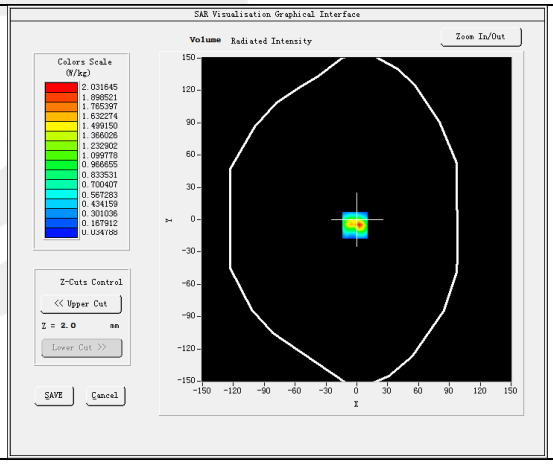
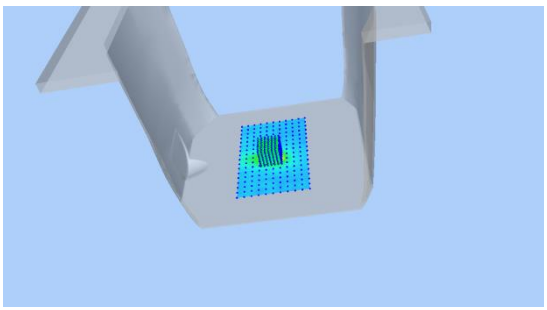
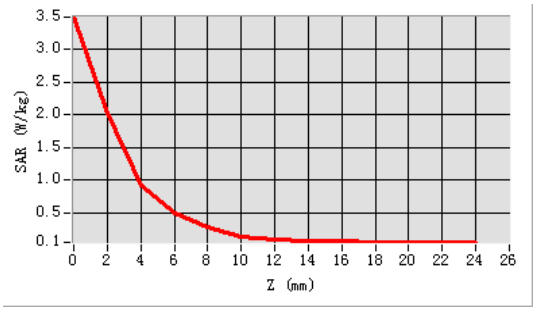
Plot 2: DUT: Wireless USB Adapter; EUT Model: WD-4512BT

Test Date	2023-05-25
Probe	SN 07/21 EPGO352
Area Scan	dx=8mm, dy=8mm, h= 5.00 mm
Zoom Scan	7x7x12, dx=4mm, dy=4mm, dz=2mm, Complete/ndx=8mm, dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Horizontal- Up
Band	5.8GHz WLAN
Signal	802.11 n-HT40 (Crest factor: 1.0)
Frequency (MHz)	5755
Relative permittivity (real part)	36.19
Conductivity (S/m)	5.25

Maximum location: X=-2.00, Y=-5.00

SAR Peak: 3.71 W/kg

SAR 10g (W/Kg)	0.333595
SAR 1g (W/Kg)	0.976695

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※※※※※