SAR Test Report

Report No.: AGC11447201002FH01

FCC ID	:	QOS-TCMICROTX
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	MICRO TX
BRAND NAME	:	TBS TRACER
MODEL NAME	:	MICRO TX
APPLICANT	:	TBS Avionics Limited
DATE OF ISSUE	:	Jan. 29,2021
STANDARD(S)	:	IEEE Std. 1528:2013 FCC 47 CFR Part 2§2.1093:2013 IEEE Std C95.1 ™-2005 IEC 62209-1: 2016
REPORT VERSION	:	V1.0

Attestation of Global Compliance(Shenzhen) Co., Ltd.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 29,2021	Valid	Initial Release

Test Report Certification

Applicant Name	TBS Avionics Limited
Applicant Address	9/F, Tungtex Building 203 Wai Yip Street, Kwun Tong, Hong Kong, China
Manufacturer Name	TBS Avionics Limited
Manufacturer Address	9/F, Tungtex Building 203 Wai Yip Street, Kwun Tong, Hong Kong, China
Factory Name	TBS Avionics Limited
Factory Address	9/F, Tungtex Building 203 Wai Yip Street, Kwun Tong, Hong Kong, China
Product Designation	MICRO TX
Brand Name	TBS TRACER
Model Name	MICRO TX
Power Supply	Rating: DC 3.5V to 13V, 2W Max.
Applicable Standard	IEEE Std. 1528:2013 FCC 47 CFR Part 2§2.1093:2013 IEEE Std C95.1 ™-2005 IEC 62209-1: 2016
Test Date	Dec. 03,2020 to Jan. 28,2021
Report Template	AGCRT-US-2.4G/SAR (2018-01-01)

Note: The results of testing in this report apply to the product/system which was tested only.

Prepared By — Thea Huang (Project Engineer) — Jan. 28,2021

Reviewed By — Angela Li (Reviewer) — Jan. 29,2021

Approved By — Forrest Lei (Authorized Officer) — Jan. 29,2021

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1. SUMMARY OF MAXIMUM SAR VALUE

The maximum results of Specific Absorption Rate (SAR) found during testing for EUT are as follows:

Frequency Band	Highest Reported 10g-Extremity SAR(W/Kg)	Highest Reported 1g-SAR(W/Kg)	SAR Test Result
2.4GHz TX	1.372	1.557	PASS
Simultaneous Reported SAR	1.389	1.579	
SAR Test Limit (W/Kg)	4.0	1.6	

This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6W/Kg) specified in IEEE Std. 1528:2013; FCC 47CFR § 2.1093; IEEE/ANSI C95.1:2005 and the following specific FCC Test Procedures:

- KDB 447498 D01 General RF Exposure Guidance v06
- KDB 865664 D01 SAR Measurement 100MHz to 6GHz v01r04
- KDB 248227 D01 802 11 Wi-Fi SAR v02r02
- KDB 941225 D07 UMPC Mini Tablet v01r02

2. GENERAL INFORMATION

2.1. EUT Description

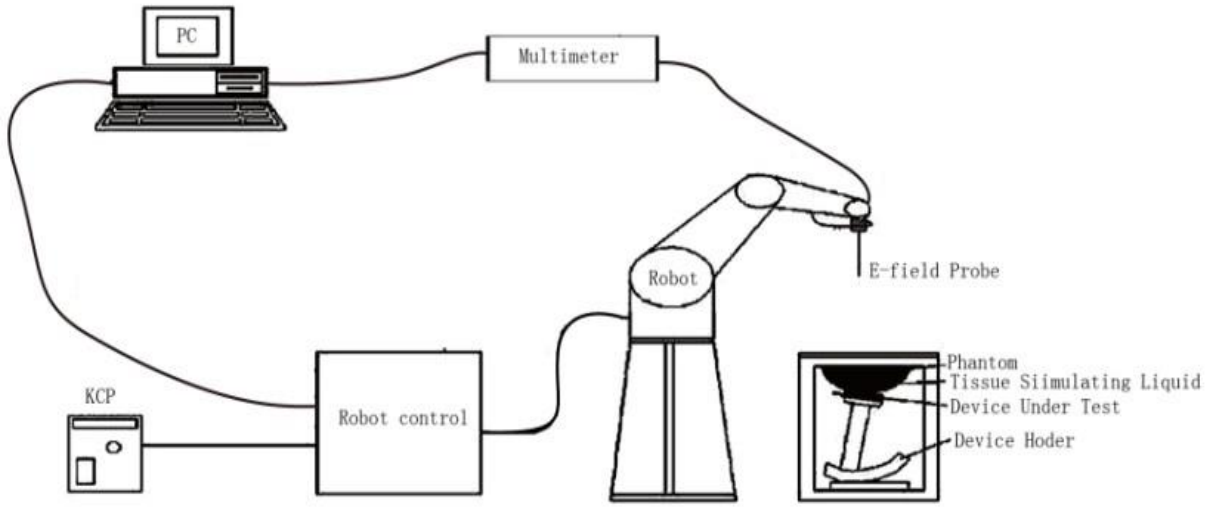
General Information	
Product Designation	MICRO TX
Test Model	MICRO TX
Hardware Version	V1.01
Software Version	v4.39
Sample ID	201028094
Device Category	Portable
RF Exposure Environment	Uncontrolled
Antenna Type	Internal
2.4GHz band TX	
Operation Frequency	2403~2470.2MHz
Type of Modulation	GFSK
Conducted Peak Output Power(dBm)	29.114dBm
Antenna Gain	2dBi
2.4GHz WIFI	
WIFI Specification	☐802.11a ☒802.11b ☒802.11g ☒802.11n(20) ☐802.11n(40)
Operation Frequency	2412~2462MHz
Average Power (dBm)	11b: 0.21dBm,11g: -0.80dBm,11n(20): -0.59dBm.
Antenna Gain	3dBi

Note: 1.The sample used for testing is end product.
2. The test sample has no any deviation to the test method of standard mentioned in page 1.

Product	Type
	☒ Production unit ☐ Identical Prototype

3. SAR MEASUREMENT SYSTEM

3.1. The SATIMO system used for performing compliance tests consists of following items



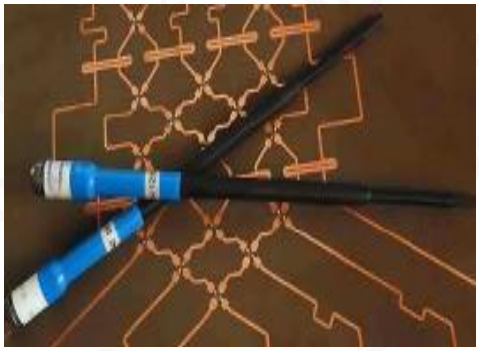
The COMOSAR system for performing compliance tests consists of the following items:

- The PC. It controls most of the bench devices and stores measurement data.A computer running WinXP and the Opensar software.
- The E-Field probe. The probe is a 3-axis system made of 3 distinct dipoles. Each dipole returns a voltage in function of the ambient electric field.
- The Keithley multimeter measures each probe dipole voltages.
- The SAM phantom simulates a human head. The measurement of the electric field is made inside the phantom.
- The liquids simulate the dielectric properties of the human head tissues.
- The network emulator controls the mobile phone under test.
- The validation dipoles are used to measure a reference SAR. They are used to periodically check the bench to make sure that there is no drift of the system characteristics over time.
- The phantom, the device holder and other accessories according to the targeted measurement.

3.2. COMOSAR E-Field Probe

The SAR measurement is conducted with the dosimetric probe manufactured by SATIMO. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. SATIMO conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528 and relevant KDB files.) The calibration data are in Appendix D.

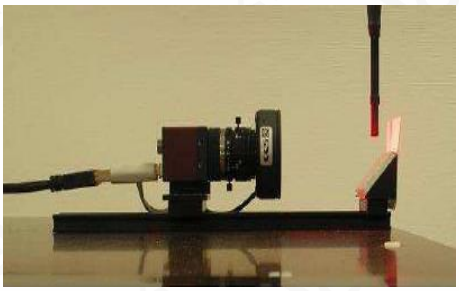
Isotropic E-Field Probe Specification

Model	SSE5	
Manufacture	MVG	
Identification No.	SN 24/20 EP336	
Frequency	0.7GHz-3GHz Linearity:±0.08dB(0.7GHz-3GHz)	
Dynamic Range	0.01W/Kg-100W/Kg Linearity:±0.08dB	
Dimensions	Overall length:330mm Length of individual dipoles:4.5mm Maximum external diameter:8mm Probe Tip external diameter:5mm Distance between dipoles/ probe extremity:2.7mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 3 GHz with precisin of better 30%.	

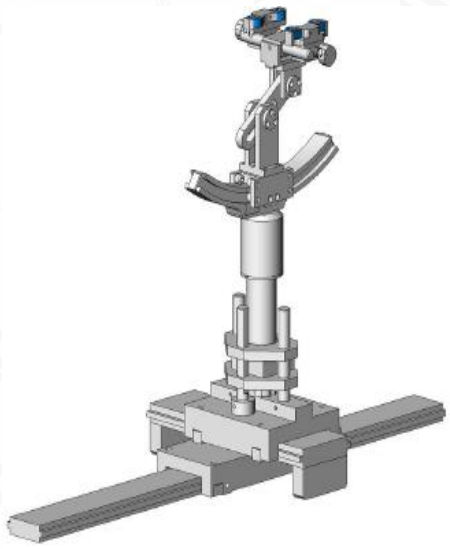
3.3. Robot

The COMOSAR system uses the KUKA robot from SATIMO SA (France).For the 6-axis controller COMOSAR system, the KUKA robot controller version from SATIMO is used. The XL robot series have many features that are important for our application: □ High precision (repeatability 0.02 mm) □ High reliability (industrial design) □ Jerk-free straight movements □ Low ELF interference (the closed metallic construction shields against motor control fields) □ 6-axis controller	

3.4. Video Positioning System

The video positioning system is used in OpenSAR to check the probe. Which is composed of a camera, LED, mirror and mechanical parts.The camera is piloted by the main computer with firewire link. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.	

3.5. Device Holder

The COMOSAR device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR). Thus the device needs no repositioning when changing the angles. The COMOSAR device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity εr =3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.	

3.6. SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas: □ Left head □ Right head □ Flat phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

ELLI39 Phantom

The Flat phantom is a fiberglass shell phantom with 2mm+/- 0.2 mm shell thickness. It has only one measurement area for Flat phantom	

4. SAR MEASUREMENT PROCEDURE

4.1. Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in 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 occupational/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 given mass density (ρ). The equation description is as below:

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

SAR is expressed in units of Watts per kilogram (W/Kg)
SAR can be obtained using either of the following equations:

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

$$SAR = c_h \frac{dT}{dt}\Big|_{t=0}$$

Where

SAR	is the specific absorption rate in watts per kilogram;
E	is the r.m.s. value of the electric field strength in the tissue in volts per meter;
σ	is the conductivity of the tissue in siemens per metre;
ρ	is the density of the tissue in kilograms per cubic metre;
c_h	is the heat capacity of the tissue in joules per kilogram and Kelvin;
$\frac{dT}{dt} \mid t = 0$	is the initial time derivative of temperature in the tissue in kelvins per second

4.2. SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface is 2.7mm This distance cannot be smaller than the distance os sensor calibration points to probe tip as `defined in the probe properties,

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in SATIMO software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in db) is specified in the standards for compliance testing. For example, a 2db range is required in IEEE Standard 1528, whereby 3db is a requirement when compliance is assessed in accordance with the ARIB standard (Japan) If one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximum are detected, the number of Zoom Scan has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100MHz to 6GHz

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 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.	

Step 3: Zoom Scan

Zoom Scan are used to assess the peak spatial SAR value within a cubic average volume containing 1g abd 10g of simulated tissue. The Zoom Scan measures points(refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1g and 10g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB865664 d01 SAR Measurement 100MHz to 6GHz

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·$\Delta z_{Zoom}(n-1)$	
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 draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 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.

Step 4: Power Drift Measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the same settings. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

4.3. RF Exposure Conditions

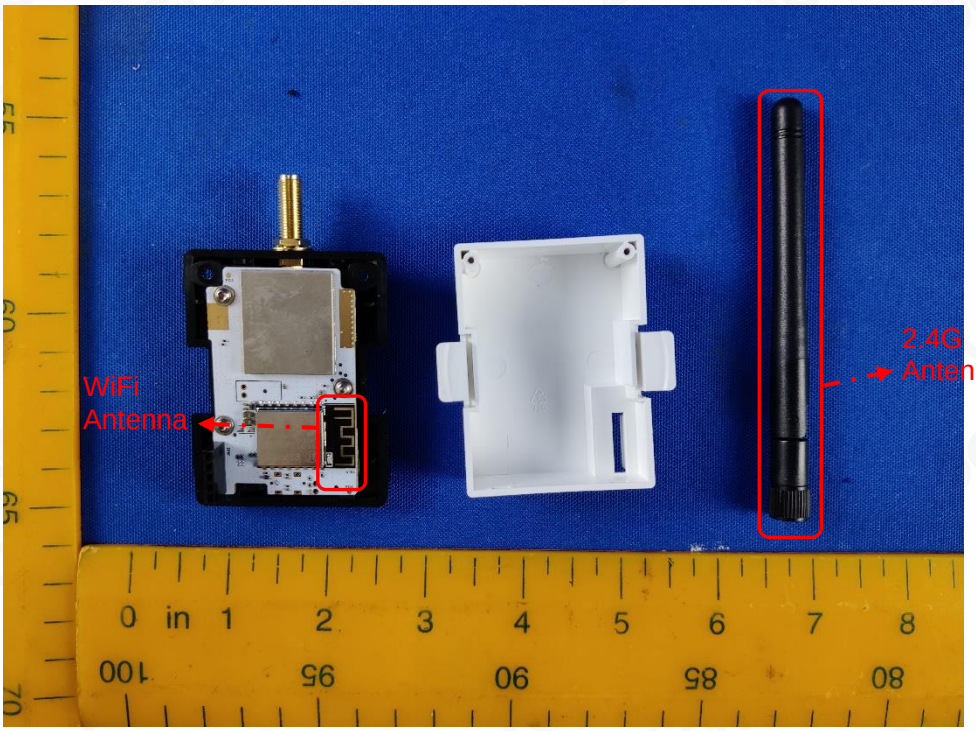
Test Configuration and setting:

The EUT is a MICRO TX. The device has 2.4GHz Tx and 2.4GHz WIFI.

The TRACER MICRO TX has a standard JR-form factor, the module fits perfectly on the back of the TBS TANGO FPV remote. It clips easily in place and can use the telemetry compatible CRSF-format between the module and radio.

2.4GHz Tx were controlled by software during test.

Antenna Location:



5. TISSUE SIMULATING LIQUID

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15cm. For head SAR testing the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15cm For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm.The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 10% are listed in 6.2

5.1. The composition of the tissue simulating liquid

Ingredient (% Weight) / Frequency (MHz)	Water	Nacl	Polysorbate 20	DGBE	1,2 Propanediol	Triton X-100
2450 Head	71.88	0.16	0.0	7.99	0.0	19.97

5.2. Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEC 62209-1 have been incorporated in the following table. The body tissue dielectric parameters recommended by the IEC 62209-2 have been incorporated in the following table.

Target Frequency (MHz)	head		body	
	εr	σ (S/m)	εr	σ (S/m)
300	45.3	0.87	45.3	0.87
450	43.5	0.87	43.5	0.87
835	41.5	0.90	41.5	0.90
900	41.5	0.97	41.5	0.97
915	41.5	1.01	41.5	1.01
1450	40.5	1.20	40.5	1.20
1610	40.3	1.29	40.3	1.29
1800 – 2000	40.0	1.40	40.0	1.40
2450	**39.2**	**1.80**	**39.2**	**1.80**
3000	38.5	2.40	38.5	2.40

(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)

5.3. Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using SATIMO Dielectric Probe Kit and R&S Network Analyzer ZVL6.

Tissue Stimulant Measurement for 2450MHz					
	Fr. (MHz)	Dielectric Parameters (±10%)		Tissue Temp [°C]	Test time
		εr39.2(35.28-43.12)	δ[s/m]1.80(1.62-1.98)		
Head	2403.4	40.32	1.72	20.1	Jan. 28,2021
	2436.2	39.06	1.76		
	2450	38.27	1.78		
	2469.8	37.51	1.83		

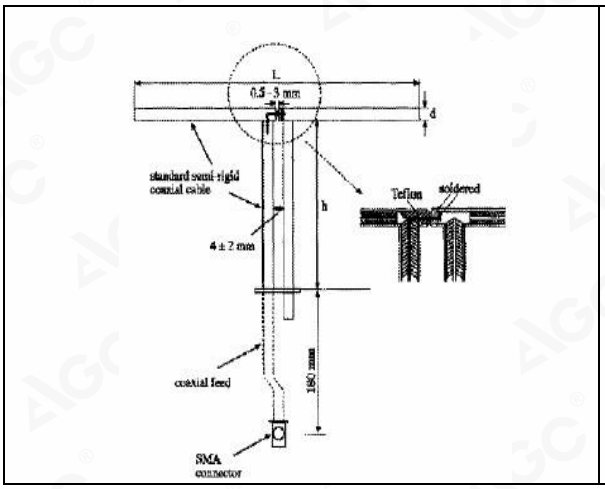
6. SAR SYSTEM CHECK PROCEDURE

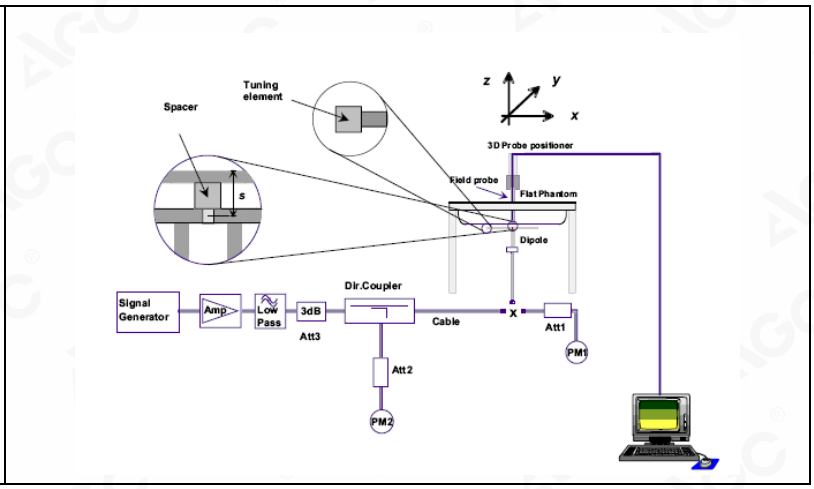
6.1. SAR System Check Procedures

SAR system check 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 remeasured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

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

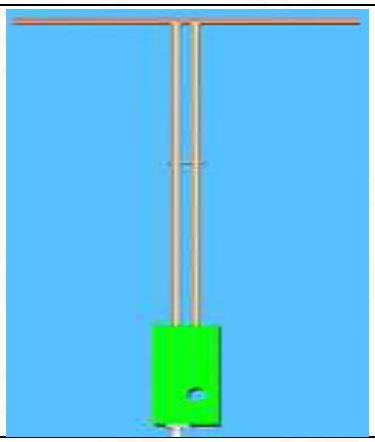
The system check verifies that the system operates within its specifications. It's performed daily or before every SAR measurement. The system check uses normal SAR measurement in the flat section of the phantom with a matched dipole at a specified distance. The system check setup is shown as below.





6.2. SAR System Check

6.2.1. Dipoles



The dipoles used is based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of IEEE. the table below provides details for the mechanical and electrical
Specifications for the dipoles.

Frequency	L (mm)	h (mm)	d (mm)
2450MHz	51.5	30.4	3.6

6.2.2. System Check Result

System Performance Check at 2450MHz for Head								
Validation Kit: SN 46/11DIP 2G450-189								
Frequency [MHz]	Target Value(W/Kg)		Reference Result (± 10%)		Tested Value(W/Kg)		Tissue Temp. [°C]	Test time
	1g	10g	1g	10g	1g	10g		
2450	53.97	24.01	48.573-59.367	21.609-26.411	55.28	24.80	20.1	Jan. 28,2021

Note:
(1) We use a CW signal of 18dBm for system check, and then all SAR values are normalized to 1W forward power. The result must be within ±10% of target value.

7. EUT TEST POSITION

This EUT was tested in **Back, Front and Edge2.**

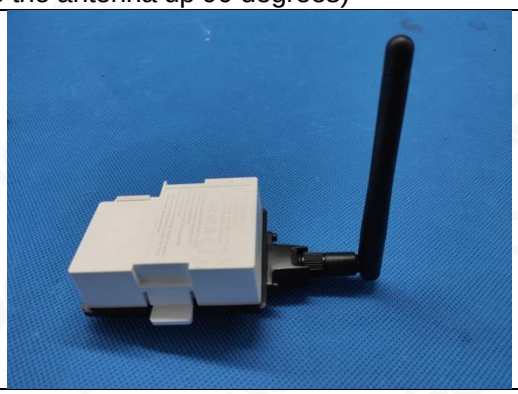
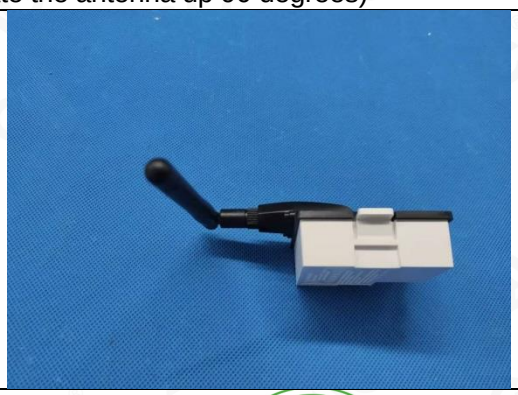
7.1. Test Position

(1) To position the EUT parallel to the phantom surface.

(2) To adjust the EUT parallel to the flat phantom.

(3) To adjust the distance between the EUT surface and the flat phantom to **10mm** for body and **0mm** for hand.

Antenna position relative to EUT

Back	
(Rotate the antenna 0 degrees)	(Rotate the antenna 90 degrees to the left)
	
(Rotate the antenna 90 degrees to the right)	(Rotate the antenna down 90 degrees)
	
Front	**Edge2**
(Rotate the antenna up 90 degrees)	(Rotate the antenna up 90 degrees)
	

8. SAR EXPOSURE LIMITS

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

Type Exposure	Uncontrolled Environment Limit (W/kg)
Spatial Peak SAR (1g cube tissue for brain or body)	1.60
Spatial Average SAR (Whole body)	0.08
Spatial Peak SAR (Limbs)	4.0

9. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

10. TEST EQUIPMENT LIST

Equipment description	Manufacturer/ Model	Identification No.	Current calibration date	Next calibration date
SAR Probe	MVG	SN 24/20 EP336	Jun. 24,2020	Jun. 23,2021
Phantom	SATIMO	SN_2316_ELLI39	Validated. No cal required.	Validated. No cal required.
Liquid	SATIMO	-	Validated. No cal required.	Validated. No cal required.
Multimeter	Keithley 2000	4114939	Sep. 07,2020	Sep. 06,2021
Dipole	SATIMO SID2450	SN 46/11 DIP 2G450-189	Apr. 26,2019	Apr. 25,2022
Signal Generator	Agilent-E4438C	US41461365	Aug. 21,2020	Aug. 20,2021
Vector Analyzer	Agilent / E4440A	US41421290	Sep. 06,2020	Sep. 05,2021
Network Analyzer	Rhode & Schwarz ZVL6	SN101443	Oct. 16,2020	Oct. 15,2021
Attenuator	Warison /WATT-6SR1211	S/N:WRJ34AYM2F1	June 10,2020	June 09,2021
Attenuator	Mini-circuits / VAT-10+	31405	June 10,2020	June 09,2021
Amplifier	AS0104-55_55	1004793	June 11,2020	June 10,2021
Directional Couple	Werlatone/ C5571-10	SN99463	May 15,2020	May 14,2022
Directional Couple	Werlatone/ C6026-10	SN99482	May 15,2020	May 14,2022
Power Sensor	NRP-Z21	1137.6000.02	Sep. 08,2020	Sep. 07,2021
Power Sensor	NRP-Z23	100323	Feb. 18,2020	Feb. 17,2021
Power Viewer	R&S	V2.3.1.0	N/A	N/A

Note: Per KDB 865664 Dipole SAR Validation, AGC 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;
3. Return-loss is within 20% of calibrated measurement;
4. Impedance is within 5Ω of calibrated measurement.

11. MEASUREMENT UNCERTAINTY

SATIMO Uncertainty- SN 24/20 EP336 Measurement uncertainty for DUT averaged over 1 gram / 10 gram.									
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	vi
Measurement System									
Probe calibration	E.2.1	7.000	N	1	1	1	7.000	7.000	∞
Axial Isotropy	E.2.2	0.105	R	$\sqrt{3}$	√0.5	√0.5	0.043	0.043	∞
Hemispherical Isotropy	E.2.2	0.105	R	$\sqrt{3}$	√0.5	√0.5	0.043	0.043	∞
Boundary effect	E.2.3	1.000	R	$\sqrt{3}$	1	1	0.577	0.577	∞
Linearity	E.2.4	0.870	R	$\sqrt{3}$	1	1	0.502	0.502	∞
System detection limits	E.2.4	1.000	R	$\sqrt{3}$	1	1	0.577	0.577	∞
Modulation response	E2.5	3.000	R	$\sqrt{3}$	1	1	1.732	1.732	∞
Readout Electronics	E.2.6	0.021	N	1	1	1	0.021	0.021	∞
Response Time	E.2.7	0.000	R	$\sqrt{3}$	1	1	0.000	0.000	∞
Integration Time	E.2.8	1.400	R	$\sqrt{3}$	1	1	0.808	0.808	∞
RF ambient conditions-Noise	E.6.1	3.000	R	$\sqrt{3}$	1	1	1.732	1.732	∞
RF ambient conditions-reflections	E.6.1	3.000	R	$\sqrt{3}$	1	1	1.732	1.732	∞
Probe positioner mechanical tolerance	E.6.2	1.400	R	$\sqrt{3}$	1	1	0.808	0.808	∞
Probe positioning with respect to phantom shell	E.6.3	1.400	R	$\sqrt{3}$	1	1	0.808	0.808	∞
Extrapolation, interpolation, and integrations algorithms for max. SAR evaluation	E.5	2.300	R	$\sqrt{3}$	1	1	1.328	1.328	∞
Test sample Related									
Test sample positioning	E.4.2	2.6	N	1	1	1	2.600	2.600	∞
Device holder uncertainty	E.4.1	3	N	1	1	1	3.000	3.000	∞
Output power variation—SAR drift measurement	E.2.9	5	R	$\sqrt{3}$	1	1	2.887	2.887	∞
SAR scaling	E.6.5	5	R	$\sqrt{3}$	1	1	2.887	2.887	∞
Phantom and tissue parameters									
Phantom shell uncertainty—shape, thickness, and permittivity	E.3.1	4	R	$\sqrt{3}$	1	1	2.309	2.309	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E.3.2	1.9	N	1	1	0.84	1.900	1.596	∞
Liquid conductivity measurement	E.3.3	2.5	R	$\sqrt{3}$	0.78	0.71	1.126	1.025	∞
Liquid permittivity measurement	E.3.3	4	N	1	0.78	0.71	3.120	2.840	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.23	0.26	0.332	0.375	∞
Liquid permittivity—temperature uncertainty	E.3.4	5	N	1	0.23	0.26	1.150	1.300	M
Combined Standard Uncertainty			RSS				10.525	10.341	
Expanded Uncertainty (95% Confidence interval)			K=2				21.051	20.681	

SATIMO Uncertainty- SN 24/20 EP336 System Validation uncertainty for DUT averaged over 1 gram / 10 gram.									
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	vi
Measurement System									
Probe calibration	E.2.1	7	N	1	1	1	7.000	7.000	∞
Axial Isotropy	E.2.2	0.105	R	$\sqrt{3}$	1	1	0.061	0.061	∞
Hemispherical Isotropy	E.2.2	0.105	R	$\sqrt{3}$	0	0	0.000	0.000	∞
Boundary effect	E.2.3	1	R	$\sqrt{3}$	1	1	0.577	0.577	∞
Linearity	E.2.4	0.870	R	$\sqrt{3}$	1	1	0.502	0.502	∞
System detection limits	E.2.4	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	E2.5	3.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Readout Electronics	E.2.6	0.021	N	1	1	1	0.021	0.021	∞
Response Time	E.2.7	0.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Integration Time	E.2.8	1.4	R	$\sqrt{3}$	0	0	0.00	0.00	∞
RF ambient conditions-Noise	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient conditions-reflections	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner mechanical tolerance	E.6.2	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	E.6.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation, and integrations algorithms for max. SAR evaluation	E.5	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
System validation source									
Deviation of experimental dipole from numerical dipole	E.6.4	5.0	N	1	1	1	5.00	5.00	∞
Input power and SAR drift measurement	8,6.6.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole axis to liquid distance	8,E.6.6	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and set-up									
Phantom shell uncertainty—shape, thickness, and permittivity	E.3.1	4.0	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E.3.2	1.9	N	1	1	0.84	1.90	1.60	∞
Liquid conductivity（temperature uncertainty）	E.3.3	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid conductivity（measured）	E.3.3	4	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity（temperature uncertainty）	E.3.4	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Liquid permittivity（measured）	E.3.4	5	N	1	0.23	0.26	1.15	1.30	M
Combined Standard Uncertainty			RSS				10.458	10.272	
Expanded Uncertainty (95% Confidence interval)			K=2				20.916	20.544	

SATIMO Uncertainty- SN 24/20 EP336 System Check uncertainty for DUT averaged over 1 gram / 10 gram.									
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	vi
Measurement System									
Probe calibration drift	E.2.1.3	0.5	N	1	1	1	0.50	0.50	∞
Axial Isotropy	E.2.2	0.105	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Hemispherical Isotropy	E.2.2	0.105	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Boundary effect	E.2.3	1	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Linearity	E.2.4	0.870	R	$\sqrt{3}$	0	0	0.00	0.00	∞
System detection limits	E.2.4	1.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Modulation response	E2.5	3.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Readout Electronics	E.2.6	0.021	N	1	0	0	0.00	0.00	∞
Response Time	E.2.7	0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Integration Time	E.2.8	1.4	R	$\sqrt{3}$	0	0	0.00	0.00	∞
RF ambient conditions-Noise	E.6.1	3.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
RF ambient conditions-reflections	E.6.1	3.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Probe positioner mechanical tolerance	E.6.2	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	E.6.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation, and integrations algorithms for max. SAR evaluation	E.5	2.3	R	$\sqrt{3}$	0	0	0.00	0.00	∞
System check source (dipole)									
Deviation of experimental dipoles	E.6.4	2.0	N	1	1	1	2.00	2.00	∞
Input power and SAR drift measurement	8,6.6.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole axis to liquid distance	8,E.6.6	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and tissue parameters									
Phantom shell uncertainty—shape, thickness, and permittivity	E.3.1	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E.3.2	1.9	N	1	1	0.84	1.90	1.60	∞
Liquid conductivity measurement	E.3.3	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid permittivity measurement	E.3.3	4	N	1	0.78	0.71	3.12	2.84	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Liquid permittivity—temperature uncertainty	E.3.4	5	N	1	0.23	0.26	1.15	1.30	M
Combined Standard Uncertainty			RSS				5.562	5.203	
Expanded Uncertainty (95% Confidence interval)			K=2				11.124	10.406	

12. CONDUCTED POWER MEASUREMENT

2.4GHz TX

Mode	Channel	Frequency(MHz)	Conducted Peak Output Power(dBm)
GFSK	01	2403.4	**29.144**
	42	2436.2	29.002
	84	2469.8	28.549

Note: The power is tested by selecting the maximum power of 1000mW.

2.4GHz WIFI

Mode	Data Rate (Mbps)	Channel	Frequency(MHz)	Average Power (dBm)
802.11b	1	01	2412	-0.18
		06	2437	**0.21**
		11	2462	0.14
802.11g	6	01	2412	-0.80
		06	2437	-1.08
		11	2462	-0.88
802.11n(20)	6.5	01	2412	-1.15
		06	2437	-0.59
		11	2462	-0.60

According to 447498 D01 General RF Exposure Guidance v06
The 1-g 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

P_t= 0.21dBm=1.05mW

The value of the Maximum Average Power P_t is referred to the test report of the CFR47 §15.247.

The result for RF exposure evaluation SAR=(1.05mW/5mm) .[√2.437GHz)]=0.328≤ 7.5 for 10-g extremity SAR.
The result for RF exposure evaluation SAR=(1.05mW/10mm) .[√2.437GHz)]=0.164<3.0 for 1-g SAR.

CONCLUSION
The SAR evaluation for WIFI is not required.

13. TEST RESULTS

13.1. SAR Test Results Summary

13.1.1. Test position and configuration

1. The EUT is a MICRO TX;
2. Based on FCC (Tracking Number 170678) guidance, use a non-standard setting for SAR testing. The operating instructions contain additional information: Apply the UMPC procedures in KDB 941225 D07 for SAR testing
3. Test configuration:
   (1). The antenna should be placed directly against the flatphantom in such a way that the controller does not interfere with the antenna placement.
   (2). After the initial measurement, the controller should be rotated 180 degrees and the antenna should be retested making sure that the controller does not interfere with antenna placement. This is to test the symmetry in the dipole antenna pattern.
   (3). The third, and final, measurement should be with the antenna bent at 90 degrees and pointed down away from the flat phantom.
4. Using a separation distance of 0mm for 10g-Extremity SAR and 10mm for 1g-SAR test;
4. For SAR testing, the device was controlled by software to test at reference fixed frequency points.

13.1.2. Operation Mode

1. Per KDB 447498 D01 v06 ,for each exposure position, if the highest 1-g SAR is ≤ 0.8 W/kg, testing for low and high channel is optional.
2. Per KDB 865664 D01 v01r04,for each frequency band, if the measured SAR is ≥0.8W/Kg, testing for repeated SAR measurement is required , that the highest measured SAR is only to be tested. When the SAR results are near the limit, the following procedures are required for each device to verify these types of SAR measurement related variation concerns by repeating the highest measured SAR configuration in each frequency band.
   (1) When the original highest measured SAR is ≥0.8W/Kg, repeat that measurement once.
   (2) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is >1.20 or when the original or repeated measurement is ≥1.45 W/Kg.
   (3) Perform a third repeated measurement only if the original, first and second repeated measurement is ≥1.5 W/Kg and ratio of largest to smallest SAR for the original, first and second measurement is ≥ 1.20.
3. Maximum Scaling SAR in order to calculate the Maximum SAR values to test under the standard Peak Power, Calculation method is as follows:
   Maximum Scaling SAR =tested SAR (Max.) ×[maximum turn-up power (mw)/ maximum measurement output power(mw)]
4. Per KDB 941225 D07 v01r02, UMPC mini-tablet devices must be tested for 1-g SAR on all surfaces and side edges with a transmitting antenna located at ≤ 25 mm from that surface or edge. Depending on the device form factor, antenna locations, operating configurations and exposure conditions, a test separation distance up to 10 mm may be considered for some devices; for example, certain game controllers and dual display smart phones. Under such circumstances, 10-g extremity SAR must also be measured at zero test separation for all measured 1-g (10 mm) SAR configurations to address hand exposure.

5. Per KDB 248227 D01 v02r02 Chapter 5.3.4, SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units. The initial test position procedure is applied to next to the ear, UMPC mini-tablet and hotspot mode configurations. When the same maximum output power is specified for multiple transmission modes, the procedures in 5.3.2 are applied to determine the test configuration. Additional power measurements may be required to determine if SAR measurements are required for subsequent highest output power channels in a subsequent test configuration. The subsequent test configuration and SAR measurement procedures are described in the following.

   (1) When SAR test exclusion provisions of KDB Publication 447498 D01 are applicable and SAR measurement is not required for the initial test configuration, SAR is also not required for the next highest maximum output power transmission mode subsequent test configuration(s) in that frequency band or aggregated band and exposure configuration.

   (2) When the highest reported SAR for the initial test configuration (when applicable, include subsequent highest output channels), according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

13.1.3. Test Result

SAR MEASUREMENT									
Depth of Liquid (cm):>15									
Product: MICRO TX									
Test separation distance: **0mm**									
Position	**Mode**	**Ch.**	**Fr. (MHz)**	**Power Drift (<±5%)**	**10g-Extremity SAR (W/kg)**	**Max. Tune-up Power (dBm)**	**Meas. output Power (dBm)**	**Scaled SAR (W/Kg)**	**Limit W/kg**
2.4GHz TX									
Back									
Rotate the antenna 0 degrees	GFSK	42	2436.2	-0.12	**1.311**	29.20	29.002	**1.372**	4.0
Rotate the antenna 90 degrees to the left	GFSK	42	2436.2	0.05	1.008	29.20	29.002	1.055	4.0
Rotate the antenna 90 degrees to the right	GFSK	42	2436.2	-0.32	1.176	29.20	29.002	1.231	4.0
Rotate the antenna down 90 degrees	GFSK	42	2436.2	0.04	0.338	29.20	29.002	0.354	4.0
Front									
Rotate the antenna up 90 degrees	GFSK	42	2436.2	0.18	0.034	29.20	29.14	0.034	4.0
Edge2									
Rotate the antenna up 90 degrees	GFSK	42	2436.2	0.11	0.019	29.20	29.14	0.019	4.0

Note:
(1)When the 10g-Extremity Reported SAR is ≤ 2.0 W/kg, testing for low and high channel is optional. Refer to KDB 447498.

SAR MEASUREMENT									
Depth of Liquid (cm):>15									
Product: MICRO TX									
Test separation distance: **10mm**									
Position	**Mode**	**Ch.**	**Fr. (MHz)**	**Power Drift (<±5%)**	**SAR (1g) (W/kg)**	**Max. Tune-up Power (dBm)**	**Meas. output Power (dBm)**	**Scaled SAR (W/Kg)**	**Limit W/kg**
2.4GHz TX									
Back									
Rotate the antenna 0 degrees	GFSK	01	2403.4	-0.19	**1.537**	29.20	29.144	**1.557**	1.6
Rotate the antenna 0 degrees	GFSK	42	2436.2	0.20	1.362	29.20	29.002	1.426	1.6
Rotate the antenna 0 degrees	GFSK	84	2469.8	-0.24	1.257	29.20	28.549	1.460	1.6
Rotate the antenna 90 degrees to the left	GFSK	42	2436.2	-0.17	0.649	29.20	29.002	0.679	1.6
Rotate the antenna 90 degrees to the right	GFSK	42	2436.2	-0.32	0.724	29.20	29.002	0.758	1.6
Rotate the antenna down 90 degrees	GFSK	42	2436.2	0.06	0.412	29.20	29.002	0.431	1.6
Front									
Rotate the antenna up 90 degrees	GFSK	42	2436.2	0.13	0.035	29.20	29.002	0.037	1.6
Edge2									
Rotate the antenna up 90 degrees	GFSK	42	2436.2	0.08	0.027	29.20	29.002	0.028	1.6

Note:
(1) When the 1-g Reported SAR is ≤ 0.8 W/kg, testing for low and high channel is optional. Refer to KDB 447498.

Repeated SAR										
Product: MICRO TX										
Test separation distance: **10mm**										
Position	**Mode**	**Ch.**	**Fr. (MHz)**	**Power Drift (<±5%)**	**Once SAR (1g) (W/kg)**	**Power Drift (<±5%)**	**Twice SAR (1g) (W/kg)**	**Power Drift (<±5%)**	**Third SAR (1g) (W/kg)**	**Limit (W/kg)**
Back										
Rotate the antenna 0 degrees	GFSK	01	2403.4	-0.13	1.529	-0.11	1.517	-0.08	1.498	1.6

Simultaneous Multi-band Transmission Evaluation:

Application Simultaneous Transmission information:

NO	Simultaneous state	Portable Handset
		Body-worn
1	2.4G TX+ WLAN 2.4GHz (data)	Yes

NOTE:

1. 2.4G TX and WIFI with different antenna.
2. KDB 447498 D01, WIFI SAR is excluded as below table.
3. Based upon KDB 447498 D01,for handsets the test separation distance is determined by the smallest distance between the outer surface of the device and the user; which is 0mm for body-worn SAR.
4. According to KDB 447498 D01 4.3.1, Standalone SAR test exclusion is as follow:
   For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:
   [(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[30], where
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation[31]
   - The result is rounded to one decimal place for comparison
   - The values 3.0 and 7.5 are referred to as numeric thresholds in step b) below

   The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.
5. If the test separation distance is <5mm, 5mm is used for excluded SAR calculation.
6. According to KDB 447498 D01 4.3.2, simultaneous transmission SAR test exclusion is as follow:
   (1) 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.
   (2) Any transmitters and antennas should be considered when calculating simultaneous mode.
   (3) For mobile phone and PC, it's the sum of all transmitters and antennas at the same mode with same position in each applicable exposure condition
   (4)When the standalone SAR test exclusion of section 4.3.2 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to det
   (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;
   where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.

7. When the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The simultaneous transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SAR to peak location separation ratio to qualify for test exclusion. The ratio is determined by (SAR1 + SAR2)1.5/Ri, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

Estimated SAR		Max Power including Tune-up Tolerance		Separation Distance (mm)	Estimated SAR (W/kg)
		dBm	mW		
2.4GHz WIFI-1-g SAR	Body	0.21	1.05	10	0.022
2.4GHz WIFI-10g-Extremity SAR				0	0.017

Sum of the SAR for 2.4GHz TX &Wi-Fi:

RF Exposure Conditions	Test Position	Simultaneous Transmission Scenario		Σ10g-Extremity SAR (W/kg)	SPLSR (Yes/No)
		2.4GHz TX	Wi-Fi		
Body-worn	**Back**				
	Rotate the antenna 0 degrees	1.372	0.017	**1.389**	**No**
	Rotate the antenna 90 degrees to the left	1.055	0.017	1.072	**No**
	Rotate the antenna 90 degrees to the right	1.231	0.017	1.248	**No**
	Rotate the antenna down 90 degrees	0.354	0.017	0.371	**No**
	Front				
	Rotate the antenna up 90 degrees	0.034	0.017	0.051	**No**
	Edge2				
	Rotate the antenna up 90 degrees	0.019	0.017	0.036	**No**

Note:

·According to KDB 447498 D01 General RF Exposure Guidance, when the simultaneous transmission SAR is less than 4.0 W/Kg, SPLSR assessment is not required.

·SPLSR mean is “The SAR to Peak Location Separation Ratio “

Sum of the SAR for 2.4GHz TX &Wi-Fi:

RF Exposure Conditions	Test Position	Simultaneous Transmission Scenario		Σ1-g SAR (W/Kg)	SPLSR (Yes/No)
		2.4GHz TX	Wi-Fi		
Body-worn	**Back**				
	Rotate the antenna 0 degrees	1.557	0.022	**1.579**	**No**
	Rotate the antenna 90 degrees to the left	0.679	0.022	0.701	**No**
	Rotate the antenna 90 degrees to the right	0.758	0.022	0.780	**No**
	Rotate the antenna down 90 degrees	0.431	0.022	0.453	**No**
	Front				
	Rotate the antenna up 90 degrees	0.037	0.022	0.059	**No**
	Edge2				
	Rotate the antenna up 90 degrees	0.028	0.022	0.050	**No**

Note:

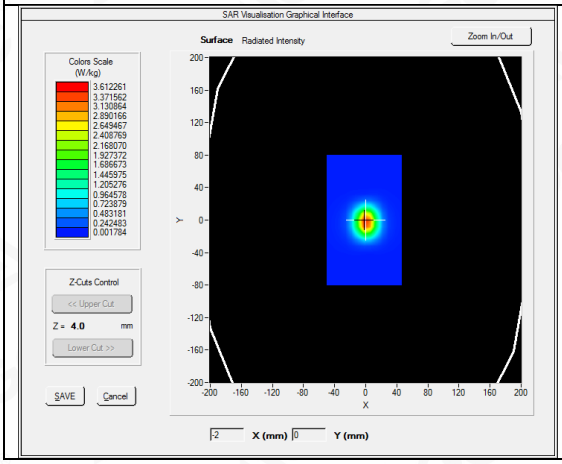
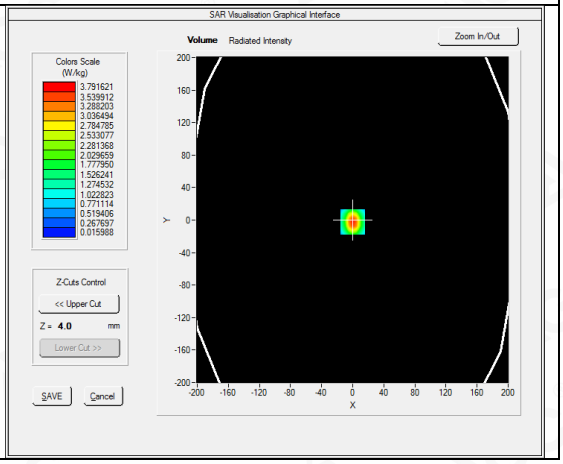
·According to KDB 447498 D01 General RF Exposure Guidance, when the simultaneous transmission SAR is less than1.6 W/Kg, SPLSR assessment is not required.
·SPLSR mean is “The SAR to Peak Location Separation Ratio “

APPENDIX A. SAR SYSTEM CHECK DATA

Test Laboratory: AGC Lab **Date: Jan. 28,2021**
System Check Head 2450 MHz
DUT: Dipole 2450 MHz Type: SID 2450
Communication System CW; Communication System Band: D2450 (2450.0 MHz); Duty Cycle: 1:1; Conv.F=4.23
Frequency: 2450 MHz; Medium parameters used: f = 2450 MHz; σ=1.78 mho/m; εr =38.27; ρ= 1000 kg/m³ ;
Phantom section: Flat Section; Input Power=18dBm
Ambient temperature (℃):21.2, Liquid temperature (℃): 20.1, Relative Humidity (%): 44.8

SATIMO Configuration
- Probe: SSE5; Calibrated: Jun. 24,2020; Serial No.: SN 24/20 EP336
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: ELLI39 Phantom
- Measurement SW: OpenSAR V4_02_32

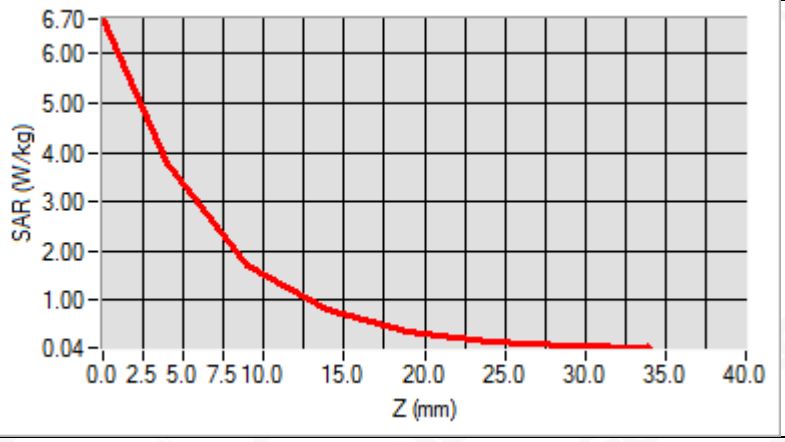
Configuration/System Check 2450MHz Head/Area Scan: Measurement grid: dx=8mm, dy=8mm
Configuration/System Check 2450MHz Head/Zoom Scan: Measurement grid: dx=5mm,dy=5mm, dz=5mm

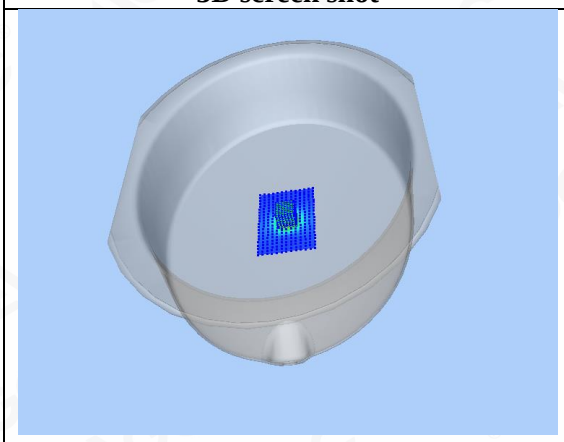
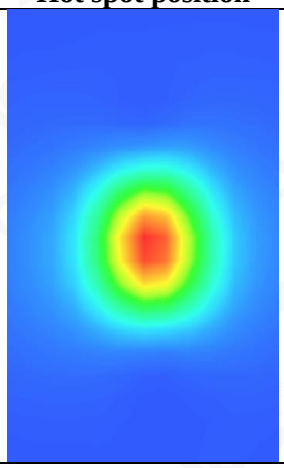
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=-2.00
SAR Peak: 6.60 W/kg

SAR 10g (W/Kg)	1.564784
SAR 1g (W/Kg)	3.488090

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	6.7004	3.7916	1.7201	0.8031	0.3801	0.1811	0.0875



3D screen shot	Hot spot position
	

APPENDIX B. SAR MEASUREMENT DATA

Test separation distance: 0mm

2.4GHz TX

Test Laboratory: AGC Lab **Date: Jan. 28,2021**

2.4GHz TX Mid-Hands - Back (Rotate the antenna 0 degrees)

DUT: MICRO TX; Type: MICRO TX

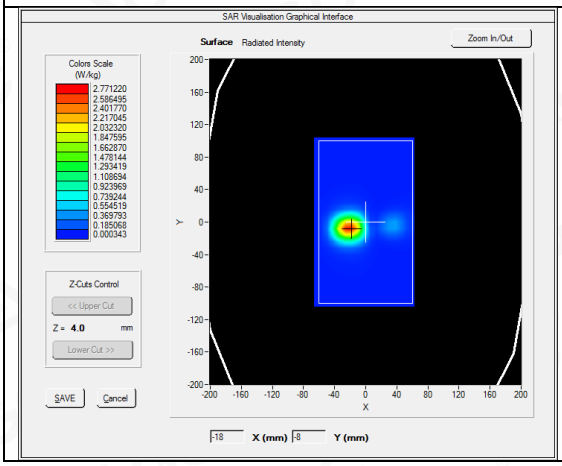
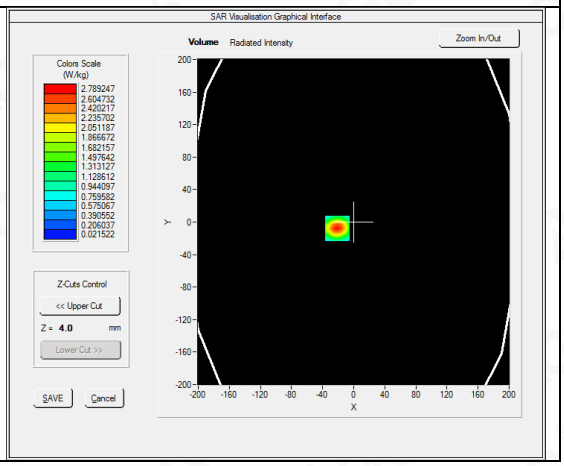
Communication System: 2.4GHz TX; Communication System Band: 2.4GHz TX; Duty Cycle: 18%; Conv.F=4.23; Frequency: 2436.2 MHz; Medium parameters used: f = 2450 MHz; σ =1.76 mho/m; εr =39.06; ρ= 1000 kg/m³ ; Phantom section: Flat Section
Ambient temperature (℃): 21.2, Liquid temperature (℃): 20.1

SATIMO Configuration:

- Probe: SSE5; Calibrated: Jun. 24,2020; Serial No.: SN 24/20 EP336
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: ELLI39 Phantom
- Measurement SW: OpenSAR V4_02_32

Configuration/2.4GHz TX Mid- Hands - Back /Area Scan: Measurement grid: dx=8mm, dy=8mm
Configuration/2.4GHz TX Mid- Hands - Back /Zoom Scan: Measurement grid: dx=5mm,dy=5mm, dz=5mm;

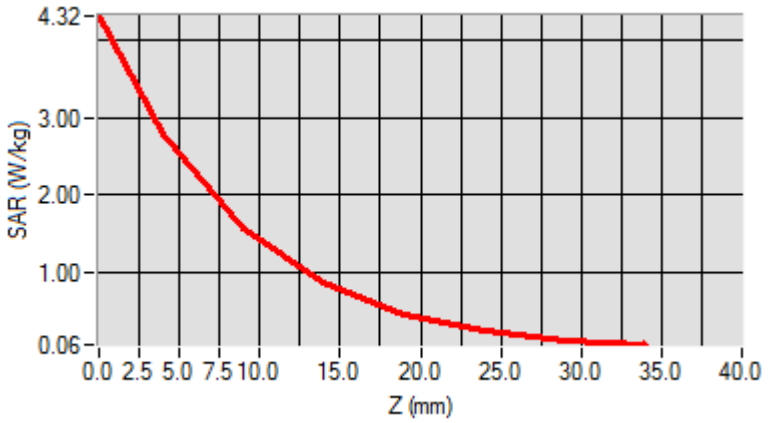
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	ELLI
Device Position	Hands Back
Band	2450MHz
Channels	Middle
Signal	Crest factor: 5.6

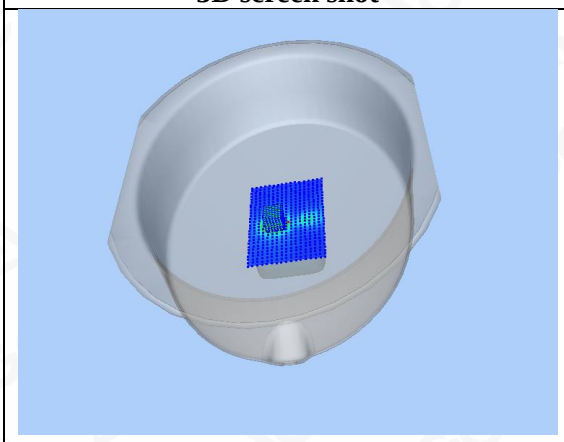
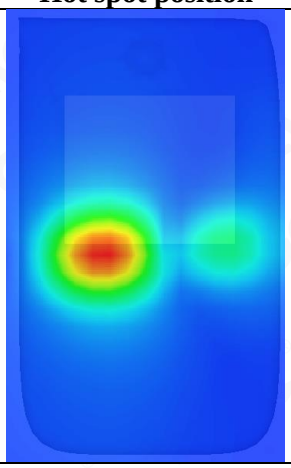
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-21.00, Y=-8.00
SAR Peak: 4.30 W/kg

SAR 10g (W/Kg)	1.310942
SAR 1g (W/Kg)	2.563375

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	4.3195	2.7892	1.5569	0.8664	0.4652	0.2464	0.1271



3D screen shot	Hot spot position
	

Test separation distance: 10mm

2.4GHz TX
Test Laboratory: AGC Lab **Date: Jan. 28,2021**
2.4GHz TX Low-Body - Back (Rotate the antenna 0 degrees)
DUT: MICRO TX; Type: MICRO TX

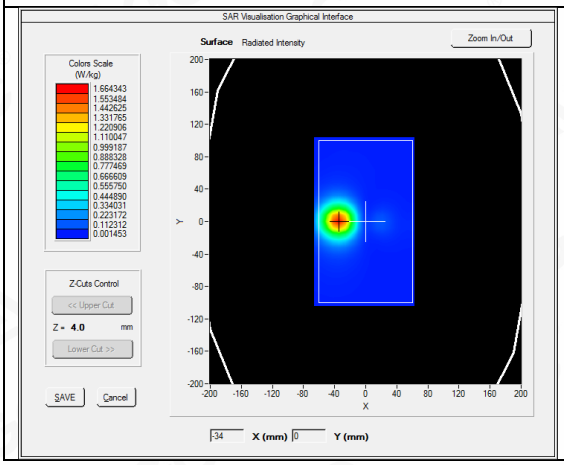
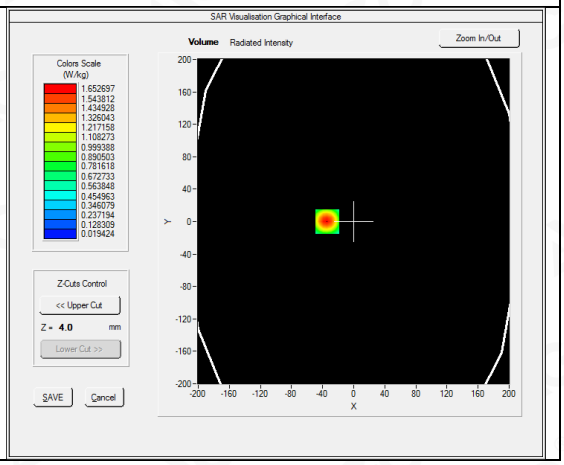
Communication System: 2.4GHz TX; Communication System Band: 2.4GHz TX; Duty Cycle: 18%; Conv.F=4.23; Frequency: 2403.4 MHz; Medium parameters used: f = 2450 MHz; σ =1.72 mho/m; εr =40.32; ρ= 1000 kg/m^3 ;
Phantom section: Flat Section
Ambient temperature (℃): 21.2, Liquid temperature (℃): 20.1

SATIMO Configuration:

- Probe: SSE5; Calibrated: Jun. 24,2020; Serial No.: SN 24/20 EP336
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: ELLI39 Phantom
- Measurement SW: OpenSAR V4_02_32

Configuration/2.4GHz TX Low- Body - Back /Area Scan: Measurement grid: dx=8mm, dy=8mm
Configuration/2.4GHz TX Low- Body - Back /Zoom Scan: Measurement grid: dx=5mm,dy=5mm, dz=5mm;

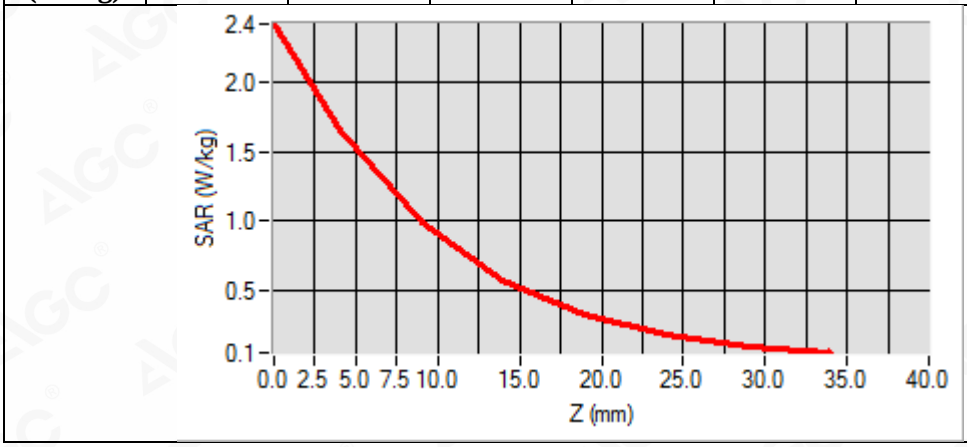
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	ELLI
Device Position	Body Back
Band	2450MHz
Channels	Low
Signal	Crest factor: 5.6

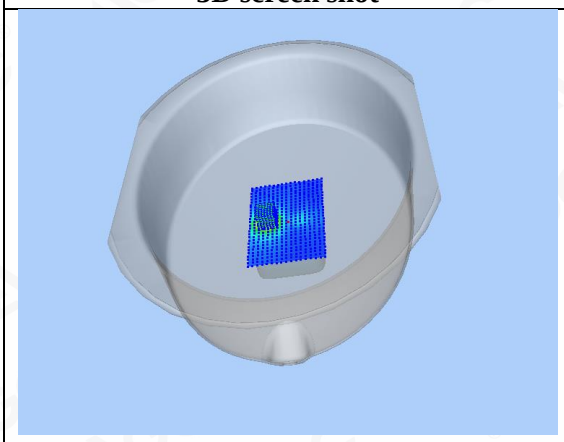
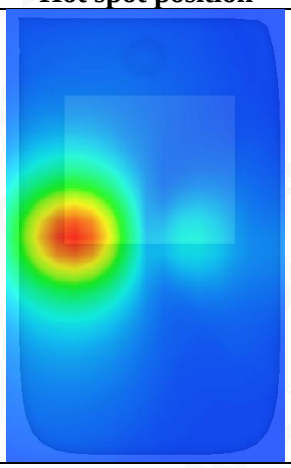
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-34.00, Y=0.00
SAR Peak: 2.43 W/kg

SAR 10g (W/Kg)	0.851077
SAR 1g (W/Kg)	1.536784

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	2.4203	1.6527	0.9910	0.5781	0.3235	0.1776	0.0952



3D screen shot	Hot spot position
	

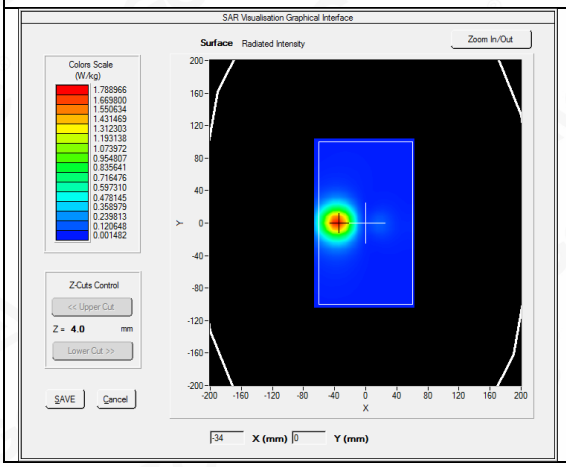
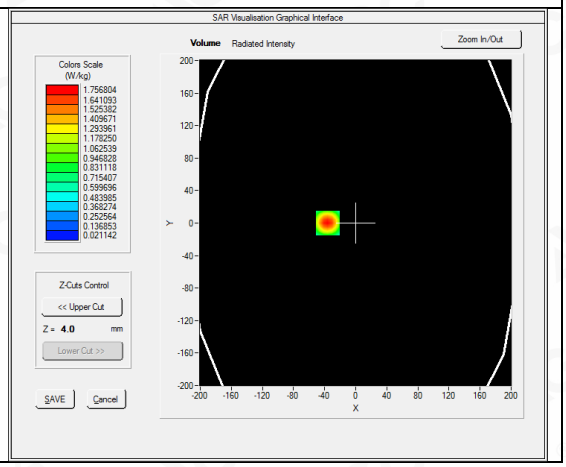
Once Repeated SAR
2.4GHz TX
Test Laboratory: AGC Lab **Date: Jan. 28,2021**
2.4GHz TX Low-Body - Back (Rotate the antenna 0 degrees)
DUT: MICRO TX; Type: MICRO TX

Communication System: 2.4GHz TX; Communication System Band: 2.4GHz TX; Duty Cycle: 18%; Conv.F=4.23; Frequency: 2403.4 MHz; Medium parameters used: f = 2450 MHz; σ =1.72 mho/m; εr =40.32; ρ= 1000 kg/m^3 ; Phantom section: Flat Section
Ambient temperature (℃): 21.2, Liquid temperature (℃): 20.1

SATIMO Configuration:
- Probe: SSE5; Calibrated: Jun. 24,2020; Serial No.: SN 24/20 EP336
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: ELLI39 Phantom
- Measurement SW: OpenSAR V4_02_32

Configuration/2.4GHz TX Low- Body - Back /Area Scan: Measurement grid: dx=8mm, dy=8mm
Configuration/2.4GHz TX Low- Body - Back /Zoom Scan: Measurement grid: dx=5mm,dy=5mm, dz=5mm;

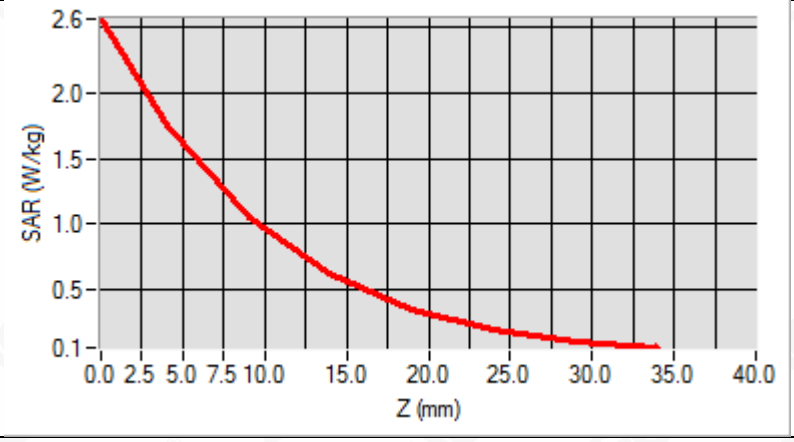
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	ELLI
Device Position	Body Back
Band	2450MHz
Channels	Low
Signal	Crest factor: 5.6

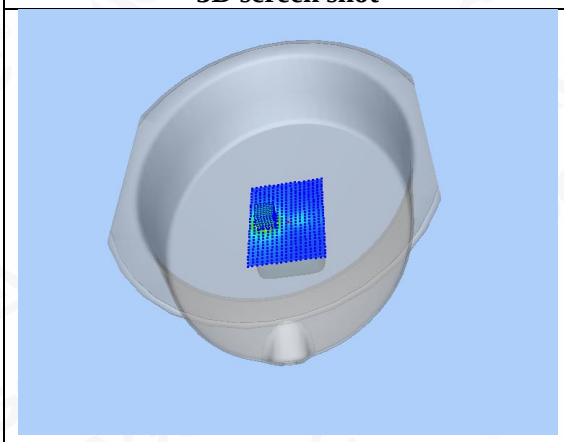
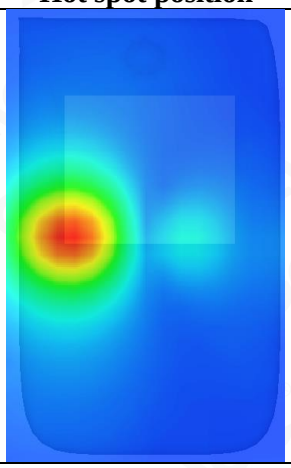
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-36.00, Y=0.00
SAR Peak: 2.57 W/kg

SAR 10g (W/Kg)	0.841250
SAR 1g (W/Kg)	1.529416

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	2.5668	1.7568	1.0552	0.6134	0.3425	0.1877	0.1007



3D screen shot	Hot spot position
	

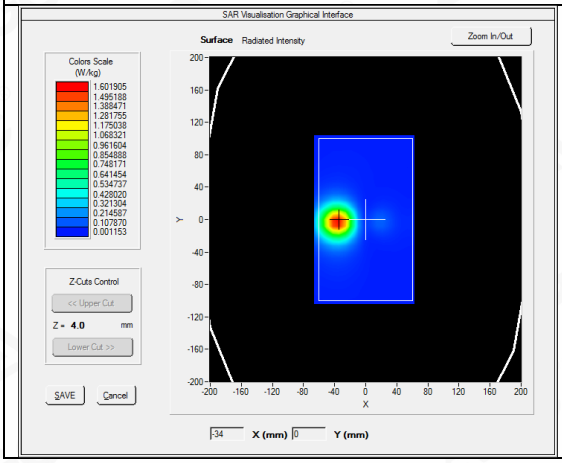
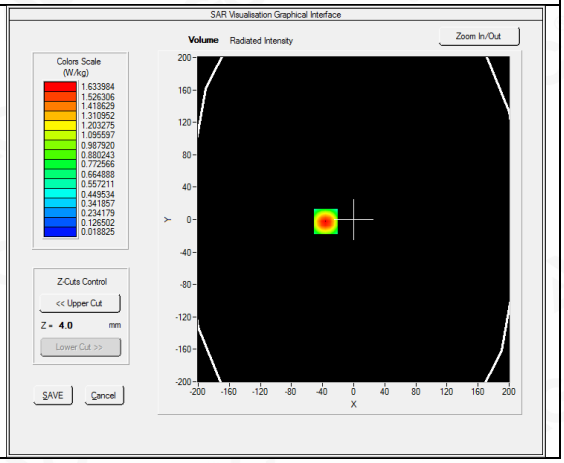
Twice Repeated SAR
Test Laboratory: AGC Lab **Date: Jan. 28,2021**
2.4GHz TX Low-Body - Back (Rotate the antenna 0 degrees)
DUT: MICRO TX; Type: MICRO TX

Communication System: 2.4GHz TX; Communication System Band: 2.4GHz TX; Duty Cycle: 18%; Conv.F=4.23; Frequency: 2403.4 MHz; Medium parameters used: f = 2450 MHz; σ =1.72 mho/m; εr =40.32; ρ= 1000 kg/m^3 ; Phantom section: Flat Section
Ambient temperature (℃): 21.2, Liquid temperature (℃): 20.1

SATIMO Configuration:
- Probe: SSE5; Calibrated: Jun. 24,2020; Serial No.: SN 24/20 EP336
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: ELLI39 Phantom
- Measurement SW: OpenSAR V4_02_32

Configuration/2.4GHz TX Low- Body - Back /Area Scan: Measurement grid: dx=8mm, dy=8mm
Configuration/2.4GHz TX Low- Body - Back /Zoom Scan: Measurement grid: dx=5mm,dy=5mm, dz=5mm;

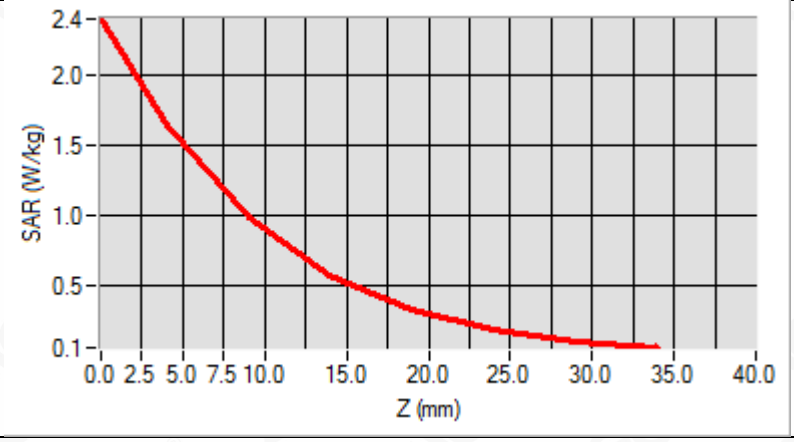
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	ELLI
Device Position	Body Back
Band	2450MHz
Channels	Low
Signal	Crest factor: 5.6

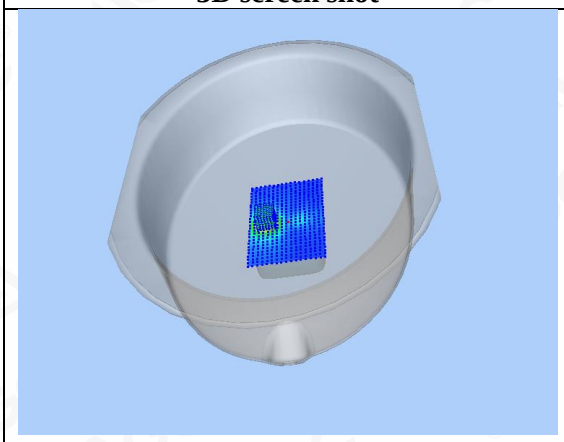
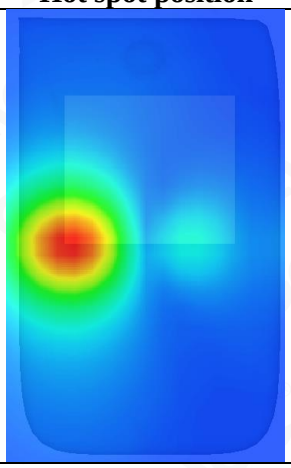
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-36.00, Y=-2.00
SAR Peak: 2.39 W/kg

SAR 10g (W/Kg)	0.842557
SAR 1g (W/Kg)	1.517485

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	2.3943	1.6340	0.9796	0.5703	0.3194	0.1750	0.0935



3D screen shot	Hot spot position
	

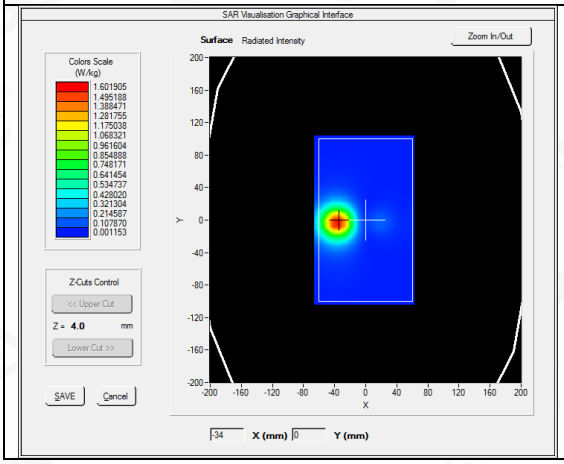
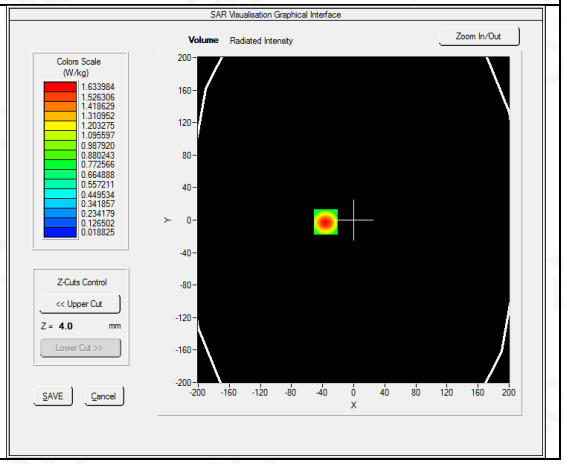
Third Repeated SAR
Test Laboratory: AGC Lab **Date: Jan. 28,2021**
2.4GHz TX Low-Body - Back (Rotate the antenna 0 degrees)
DUT: MICRO TX; Type: MICRO TX

Communication System: 2.4GHz TX; Communication System Band: 2.4GHz TX; Duty Cycle: 18%; Conv.F=4.23; Frequency: 2403.4 MHz; Medium parameters used: f = 2450 MHz; σ =1.72 mho/m; εr =40.32; ρ= 1000 kg/m^3 ; Phantom section: Flat Section
Ambient temperature (℃): 21.2, Liquid temperature (℃): 20.1

SATIMO Configuration:
- Probe: SSE5; Calibrated: Jun. 24,2020; Serial No.: SN 24/20 EP336
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: ELLI39 Phantom
- Measurement SW: OpenSAR V4_02_32

Configuration/2.4GHz TX Low- Body - Back /Area Scan: Measurement grid: dx=8mm, dy=8mm
Configuration/2.4GHz TX Low- Body - Back /Zoom Scan: Measurement grid: dx=5mm,dy=5mm, dz=5mm;

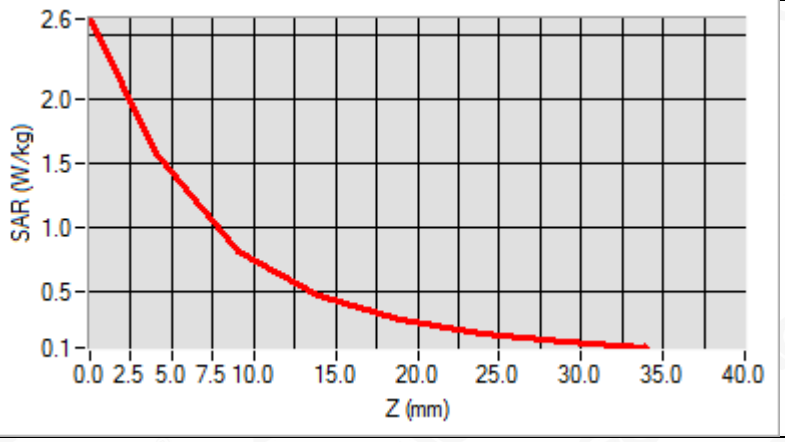
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	ELLI
Device Position	Body Back
Band	2450MHz
Channels	Low
Signal	Crest factor: 5.6

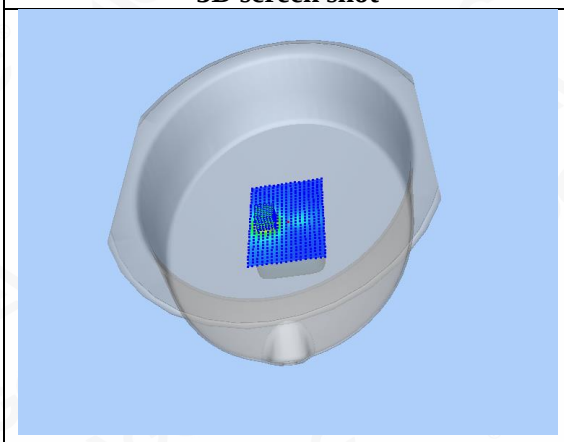
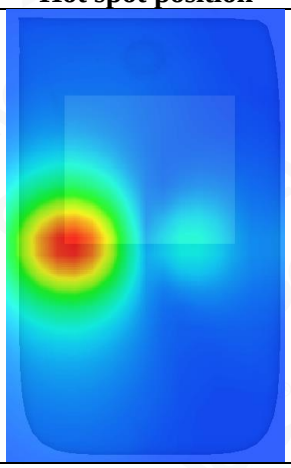
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-36.00, Y=-2.00
SAR Peak: 2.61 W/kg

SAR 10g (W/Kg)	0.806615
SAR 1g (W/Kg)	1.498179

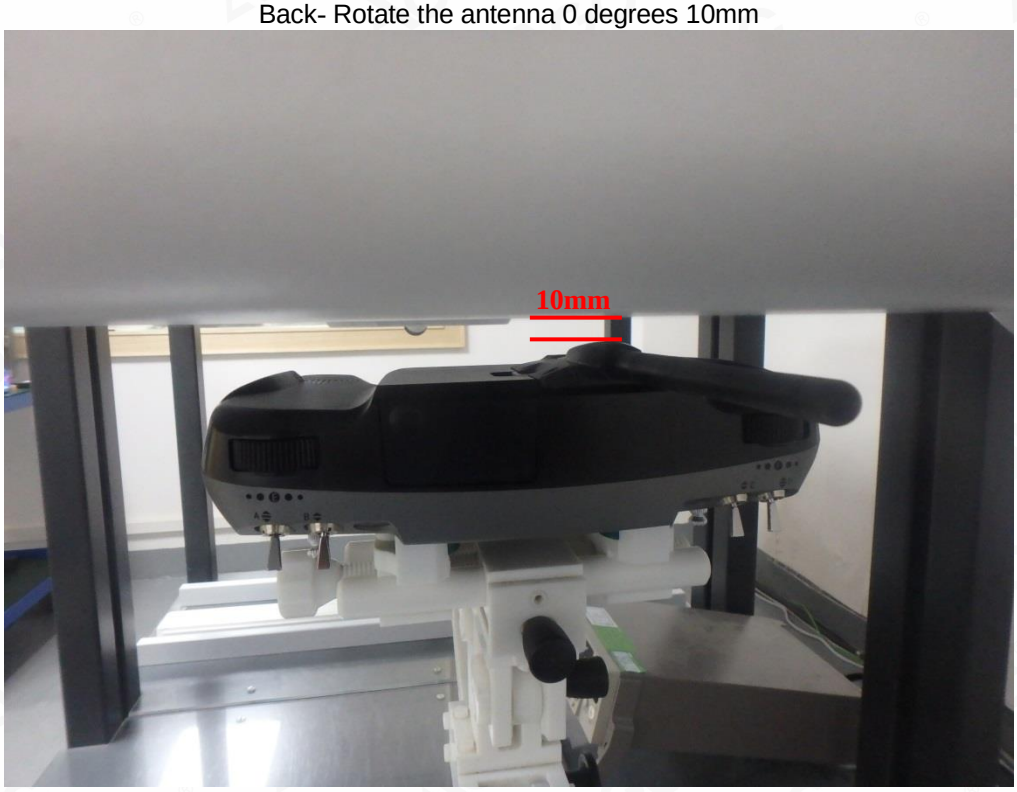
Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	2.6290	1.5773	0.8183	0.4671	0.2854	0.1735	0.1094



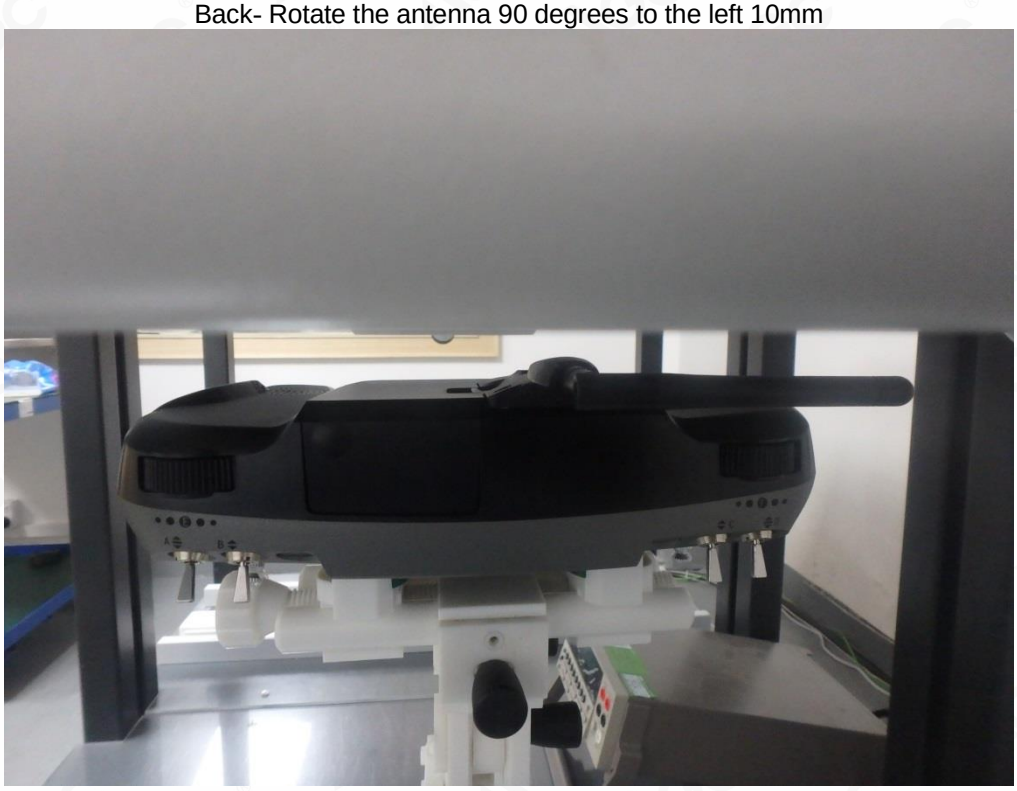
3D screen shot	Hot spot position
	

APPENDIX C. TEST SETUP PHOTOGRAPHS

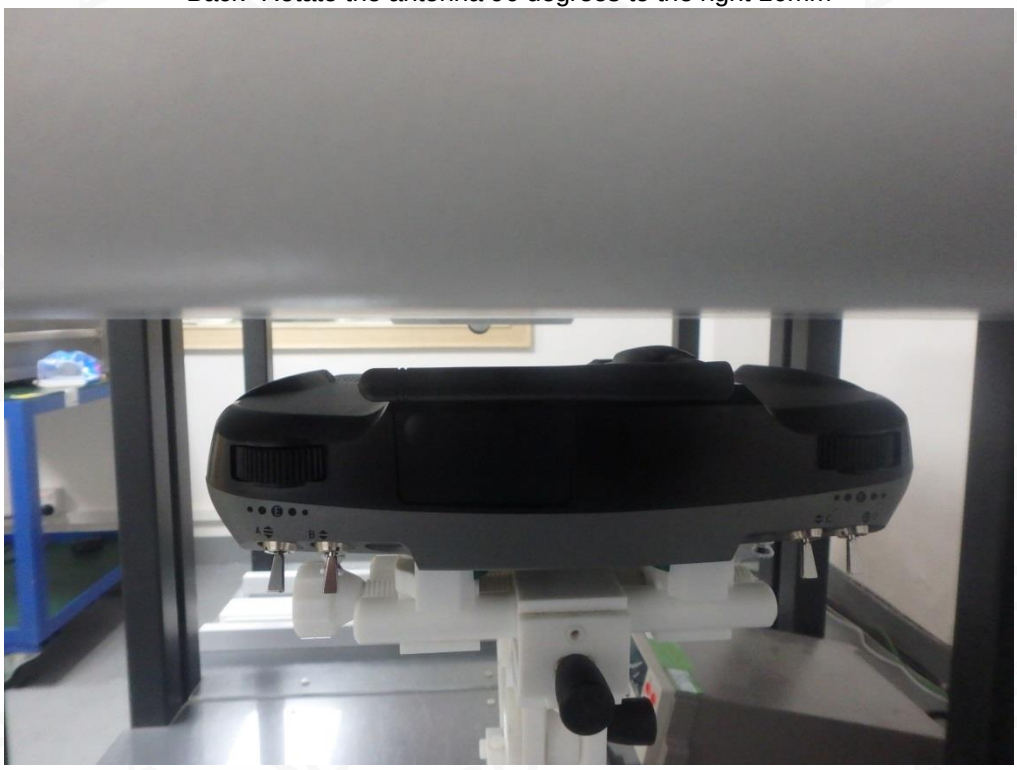
Back- Rotate the antenna 0 degrees 10mm



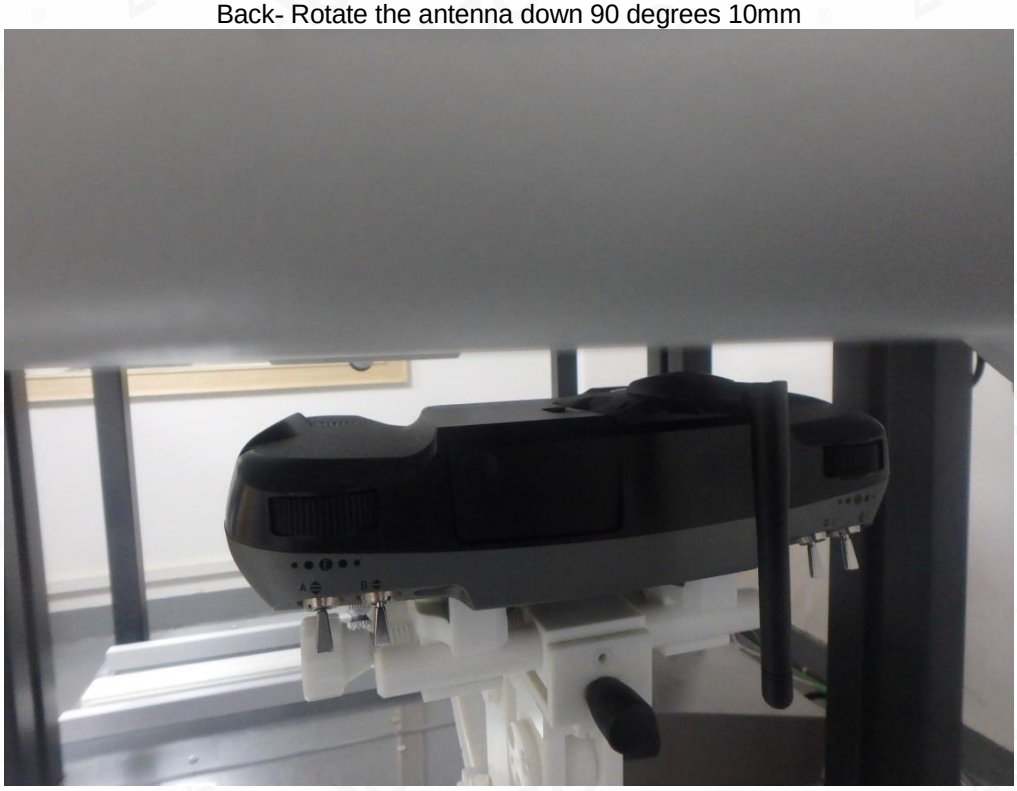
Back- Rotate the antenna 90 degrees to the left 10mm



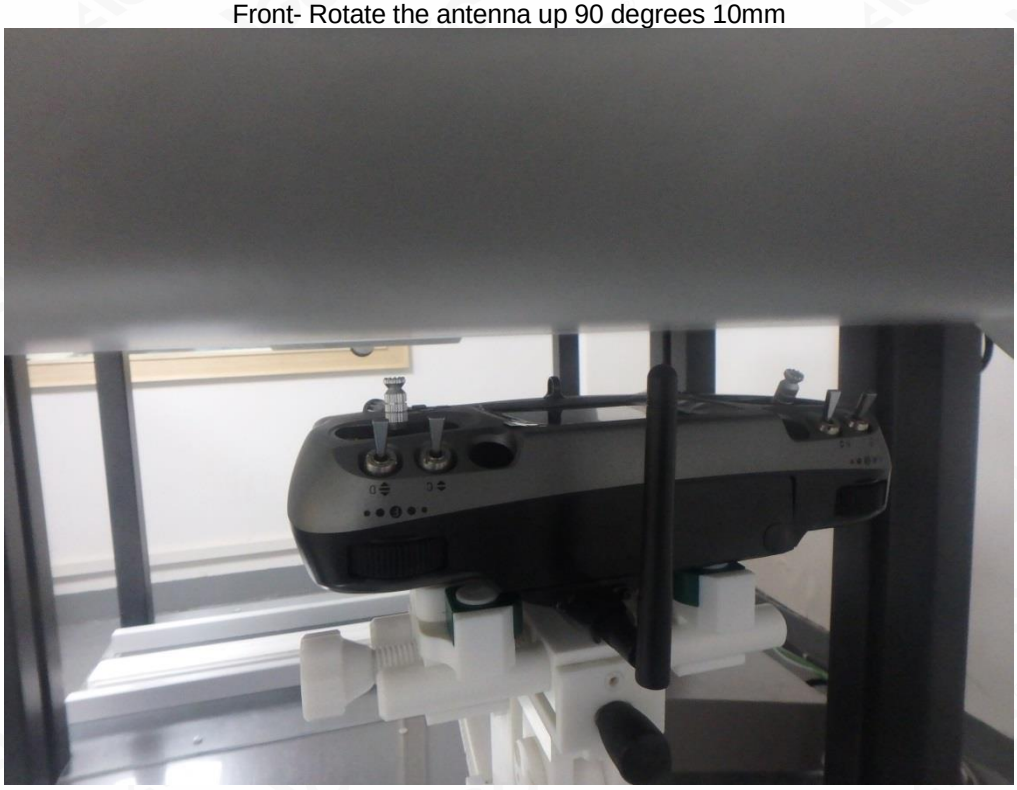
Back- Rotate the antenna 90 degrees to the right 10mm



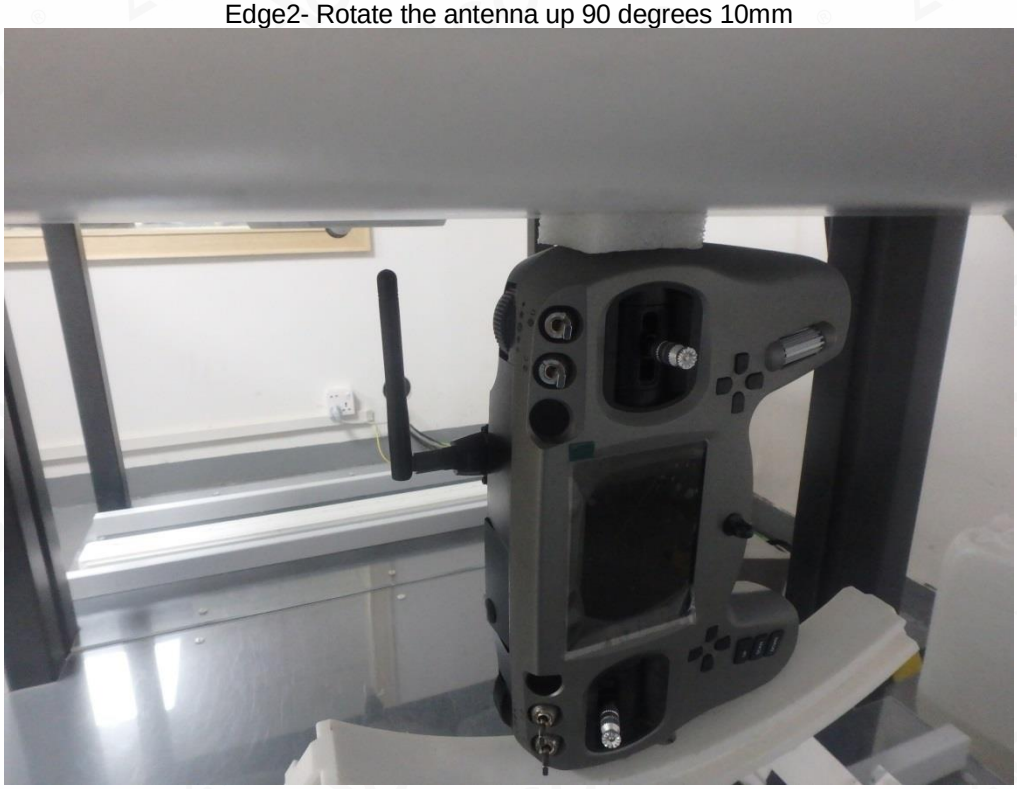
Back- Rotate the antenna down 90 degrees 10mm



Front- Rotate the antenna up 90 degrees 10mm

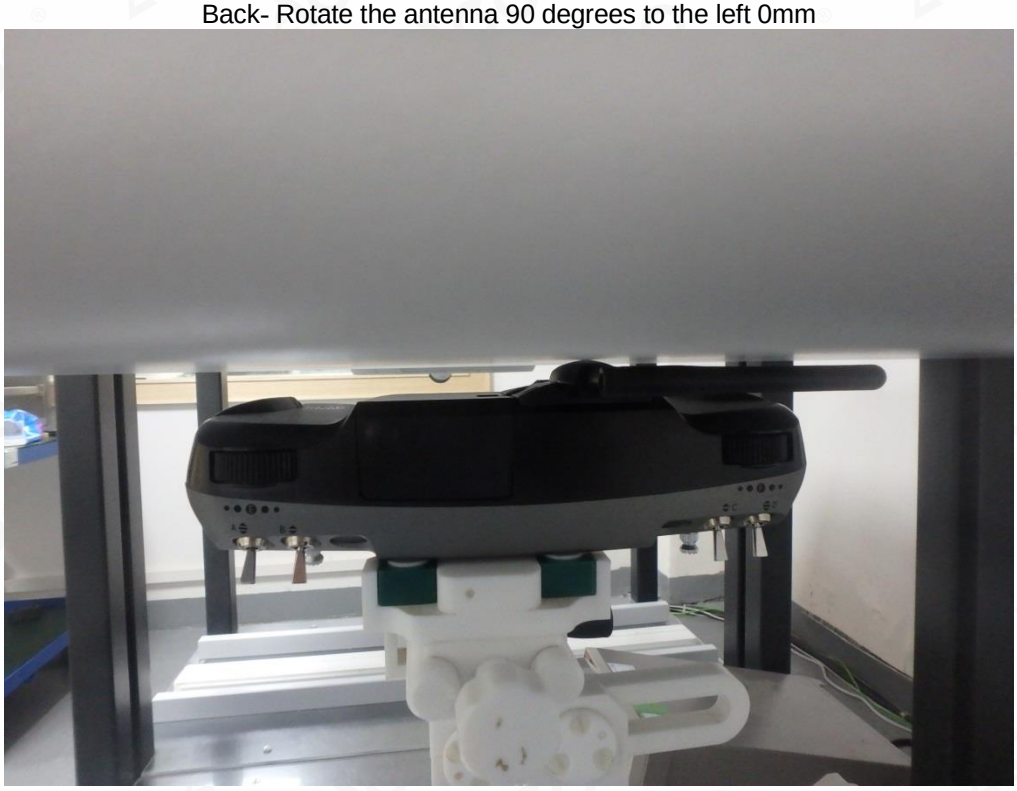


Edge2- Rotate the antenna up 90 degrees 10mm

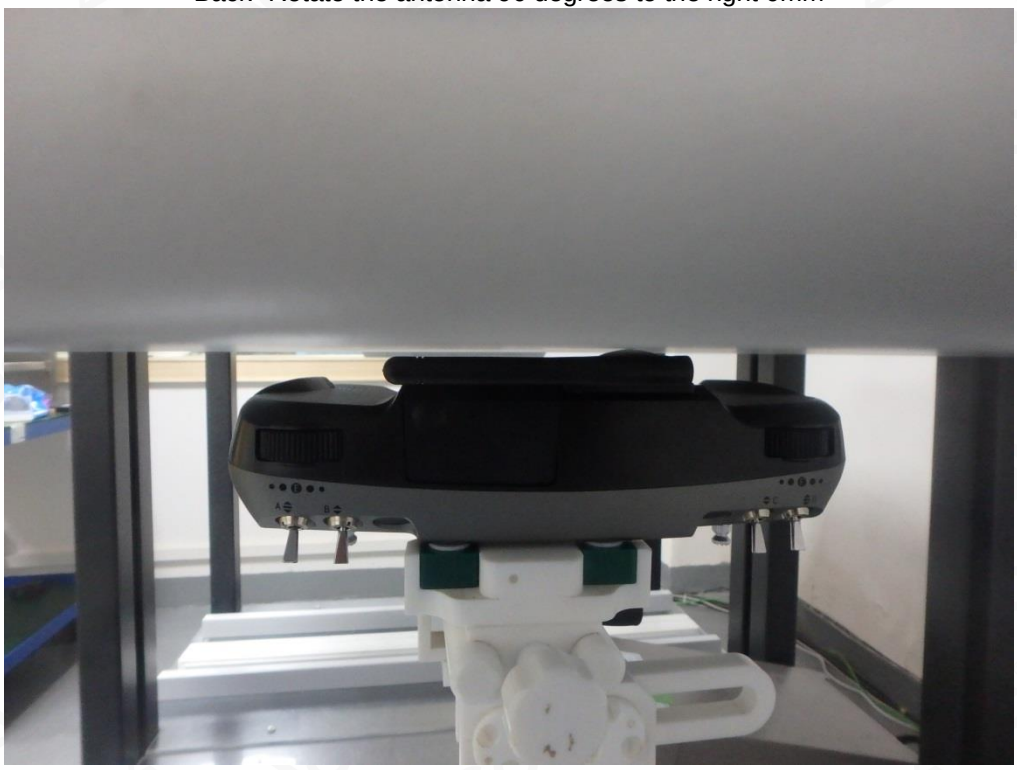


Back- Rotate the antenna 0 degrees 0mm

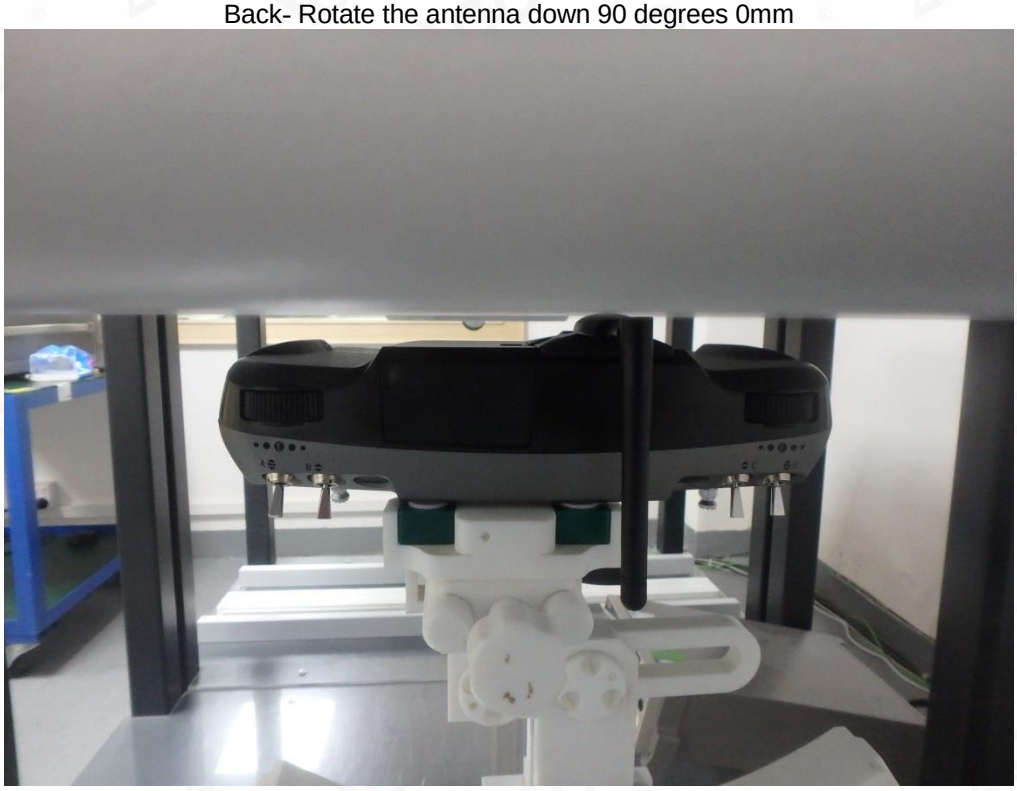
Back- Rotate the antenna 90 degrees to the left 0mm



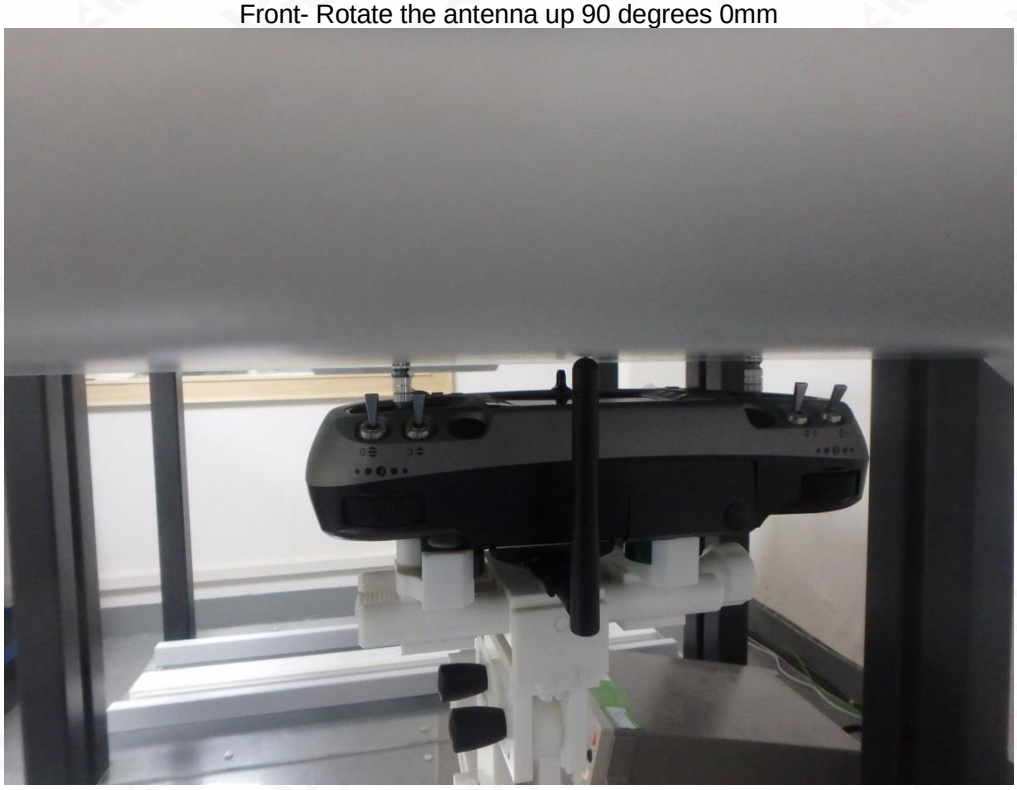
Back- Rotate the antenna 90 degrees to the right 0mm



Back- Rotate the antenna down 90 degrees 0mm



Front- Rotate the antenna up 90 degrees 0mm

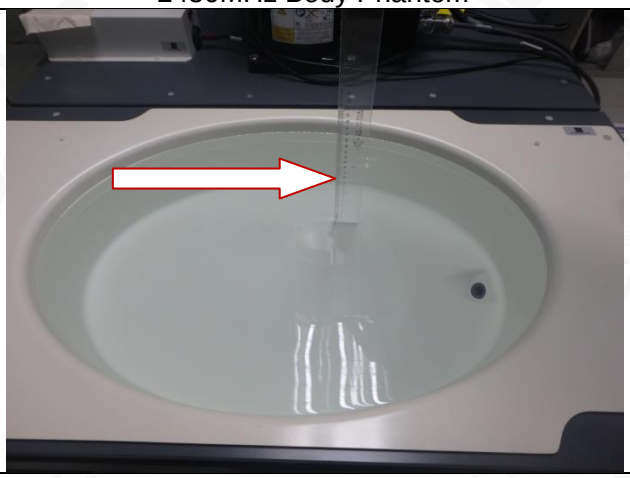


Edge2- Rotate the antenna up 90 degrees 0mm

DEPTH OF THE LIQUID IN THE PHANTOM—ZOOM IN

Note：The position used in the measurement were according to IEEE 1528-2013

2450MHz Body Phantom



APPENDIX D. CALIBRATION DATA

Refer to Attached files.