

# SAR Test Report

Report No.: AGC00793190201FH01

**FCC ID** : 2AQN2-V6PLUST20S

**APPLICATION PURPOSE** : Original Equipment

**PRODUCT DESIGNATION** : Bluetooth Headset

**BRAND NAME** : N/A

**MODEL NAME** : V6 PLUS\_T20S

**CLIENT** : Shenzhen Winnerelec Industrial CO., LTD

**DATE OF ISSUE** : Apr. 09,2019

**STANDARD(S)** : IEEE Std. 1528:2013  
FCC 47 CFR Part 2§2.1093:2013  
IEEE C95.1TM:2005

**REPORT VERSION** : V1.2

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

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### Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Mar. 14,2019	Invalid	Initial Release
V1.1	1 <sup>st</sup>	Apr. 08,2019	Invalid	Retestd the 1g-SAR values
V1.2	2 <sup>nd</sup>	Apr. 09,2019	Valid	Modify SAR values on page 5.

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## Test Report

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Manufacturer Name	Shenzhen Winnerelec Industrial CO., LTD
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Factory Name	Shenzhen Winnerelec Industrial CO., LTD
Factory Address	411-416 Room Social security building, Honghua Bei Road Gongming Street Guangming New District, Shenzhen, China
Product Designation	Bluetooth Headset
Brand Name	N/A
Model Name	V6 PLUS_T20S
EUT Voltage	DC3.7V by battery
Applicable Standard	IEEE Std. 1528:2013 FCC 47 CFR Part 2§2.1093:2013 IEEE C95.1TM:2005
Test Date	Mar. 07,2019 to Apr. 04,2019
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.

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## TABLE OF CONTENTS

<b>1. SUMMARY OF MAXIMUM SAR VALUE</b>	<b>5</b>
<b>2. GENERAL INFORMATION</b>	<b>6</b>
2.1. EUT DESCRIPTION	6
<b>3. SAR MEASUREMENT SYSTEM</b>	<b>7</b>
3.1. THE SATIMO SYSTEM USED FOR PERFORMING COMPLIANCE TESTS CONSISTS OF FOLLOWING ITEMS	7
3.2. COMOSAR E-FIELD PROBE	8
3.3. ROBOT	8
3.4. VIDEO POSITIONING SYSTEM	9
3.5. DEVICE HOLDER	9
3.6. SAM TWIN PHANTOM	10
<b>4. SAR MEASUREMENT PROCEDURE</b>	<b>11</b>
4.1. SPECIFIC ABSORPTION RATE (SAR)	11
4.2. SAR MEASUREMENT PROCEDURE	12
4.3. RF EXPOSURE CONDITIONS	14
<b>5. TISSUE SIMULATING LIQUID</b>	<b>15</b>
5.1. THE COMPOSITION OF THE TISSUE SIMULATING LIQUID	15
5.2. TISSUE DIELECTRIC PARAMETERS FOR HEAD AND BODY PHANTOMS	15
5.3. TISSUE CALIBRATION RESULT	16
<b>6. SAR SYSTEM CHECK PROCEDURE</b>	<b>17</b>
6.1. SAR SYSTEM CHECK PROCEDURES	17
6.2. SAR SYSTEM CHECK	18
<b>7. EUT TEST POSITION</b>	<b>20</b>
7.1. BODY WORN POSITION	20
<b>8. SAR EXPOSURE LIMITS</b>	<b>21</b>
<b>9. TEST FACILITY</b>	<b>22</b>
<b>10. TEST EQUIPMENT LIST</b>	<b>23</b>
<b>11. MEASUREMENT UNCERTAINTY</b>	<b>24</b>
<b>12. CONDUCTED POWER MEASUREMENT</b>	<b>27</b>
<b>13. TEST RESULTS</b>	<b>28</b>
13.1. SAR TEST RESULTS SUMMARY	28
<b>APPENDIX A. SAR SYSTEM CHECK DATA</b>	<b>30</b>
<b>APPENDIX B. SAR MEASUREMENT DATA</b>	<b>34</b>
<b>APPENDIX C. TEST SETUP PHOTOGRAPHS</b>	<b>40</b>
<b>APPENDIX D. CALIBRATION DATA</b>	<b>44</b>

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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 1g-SAR(W/Kg)	Highest Reported 10g-Extremity SAR(W/Kg)	SAR Test Result
BT 2.4G	1.342	0.573	PASS
SAR Test Limit (W/Kg)	1.6	4.0	

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

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## 2. GENERAL INFORMATION

### 2.1. EUT Description

General Information	
Product Designation	Bluetooth Headset
Test Model	V6 PLUS_T20S
Hardware Version	V6 PLUS_T20S_V3
Software Version	V6 PLUS_T20S_REV:02
Device Category	Portable
RF Exposure Environment	Uncontrolled
Antenna Type	Internal
Bluetooth	
Operation Frequency	2402~2480MHz
Antenna Gain	0dBi
Bluetooth Version	BR/EDR
Type of modulation	<b>BR/EDR:</b> GFSK, $\Pi/4$ -DQPSK, 8-DPSK;
Maximum Peak Power	<b>BR/EDR:</b> 16.142dBm;
Power Supply	DC 3.7V, 650 mAh (by battery)

Note: The sample used for testing is end product.

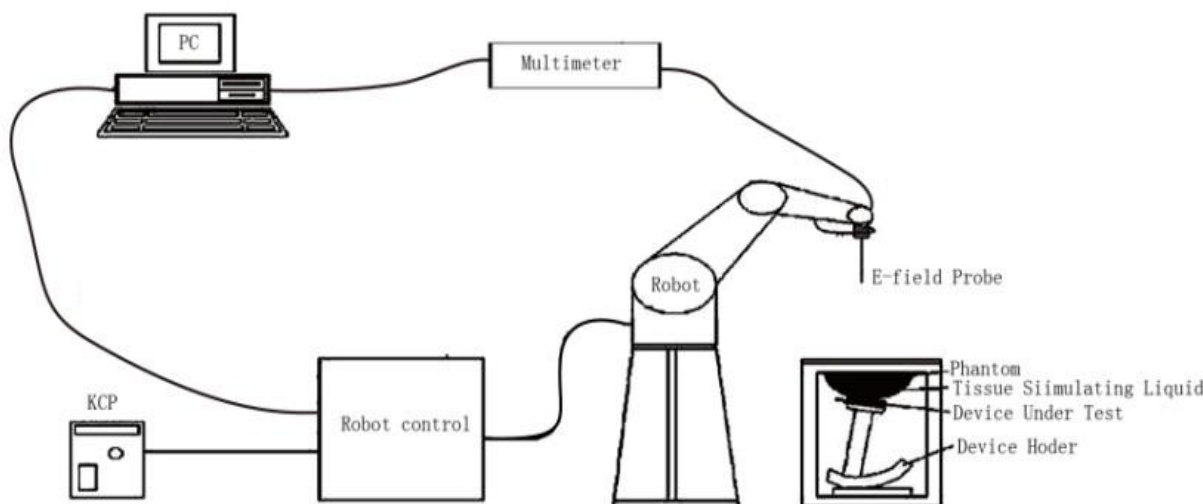
Product	Type
	<input checked="" type="checkbox"/> Production unit <input type="checkbox"/> Identical Prototype

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### 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.

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### 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. IEEE1528 etc.) Under ISO17025. The calibration data are in Appendix D.

#### Isotropic E-Field Probe Specification

<b>Model</b>	SSE5	
<b>Manufacture</b>	MVG	
<b>Identification No.</b>	SN 22/12 EP159	
<b>Frequency</b>	0.45GHz-3GHz Linearity: $\pm 0.11$ dB (0.45GHz-3GHz)	
<b>Dynamic Range</b>	0.01W/Kg-100W/Kg Linearity: $\pm 0.11$ dB	
<b>Dimensions</b>	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	
<b>Application</b>	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 precision 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:

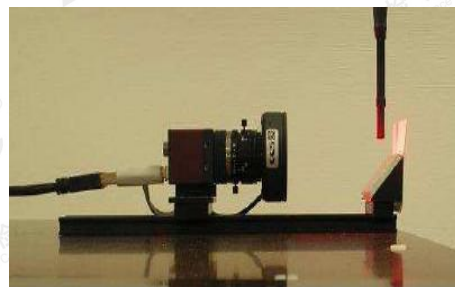
- ☐ High precision (repeatability 0.02 mm)
- ☐ High reliability (industrial design)
- ☐ Jerk-free straight movements
- ☐ Low ELF interference (the closed metallic construction shields against motor control fields)
- ☐ 6-axis controller





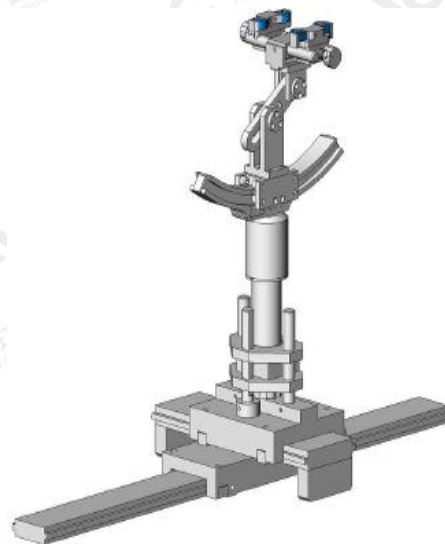
### 3.4. Video Positioning System

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  $\epsilon_r = 3$  and loss tangent  $\delta = 0.02$ . 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.

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## 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:

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

$$SAR = c_h \left. \frac{dT}{dt} \right|_{t=0}$$

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 <sub>h</sub>	is the heat capacity of the tissue in joules per kilogram and Kelvin;
$\left. \frac{dT}{dt} \right _{t=0}$	is the initial time derivative of temperature in the tissue in kelvins per second

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## 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 of 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

	$\leq 3 \text{ GHz}$	$> 3 \text{ GHz}$
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	$5 \pm 1 \text{ mm}$	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5 \text{ mm}$
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$	$\leq 2 \text{ GHz}: \leq 15 \text{ mm}$ $2 - 3 \text{ GHz}: \leq 12 \text{ mm}$	$3 - 4 \text{ GHz}: \leq 12 \text{ mm}$ $4 - 6 \text{ GHz}: \leq 10 \text{ mm}$
	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 $\leq$ 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 and 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.

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

Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			$\leq 2 \text{ GHz}: \leq 8 \text{ mm}$ $2 - 3 \text{ GHz}: \leq 5 \text{ mm}^*$	$3 - 4 \text{ GHz}: \leq 5 \text{ mm}^*$ $4 - 6 \text{ GHz}: \leq 4 \text{ mm}^*$
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{\text{Zoom}}(n)$		$\leq 5 \text{ mm}$	$3 - 4 \text{ GHz}: \leq 4 \text{ mm}$ $4 - 5 \text{ GHz}: \leq 3 \text{ mm}$ $5 - 6 \text{ GHz}: \leq 2 \text{ mm}$
	graded grid	$\Delta z_{\text{Zoom}}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	$\leq 4 \text{ mm}$	$3 - 4 \text{ GHz}: \leq 3 \text{ mm}$ $4 - 5 \text{ GHz}: \leq 2.5 \text{ mm}$ $5 - 6 \text{ GHz}: \leq 2 \text{ mm}$
		$\Delta z_{\text{Zoom}}(n>1)$ : between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$	
Minimum zoom scan volume	x, y, z		$\geq 30 \text{ mm}$	$3 - 4 \text{ GHz}: \geq 28 \text{ mm}$ $4 - 5 \text{ GHz}: \geq 25 \text{ mm}$ $5 - 6 \text{ GHz}: \geq 22 \text{ mm}$
Note: $\delta$ 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 <u>reported</u> SAR from the <u>area scan based 1-g SAR estimation</u> procedures of KDB 447498 is $\leq 1.4 \text{ W/kg}$ , $\leq 8 \text{ mm}$ , $\leq 7 \text{ mm}$ and $\leq 5 \text{ mm}$ 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.

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### 4.3. RF Exposure Conditions

Test Configuration and setting:

The device is a bluetooth headset, and supports Bluetooth wireless technology.

For SAR testing, the device was controlled by software to test at reference fixed frequency points.

#### Antenna Location:



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## 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 5% are listed in 5.2

### 5.1. The composition of the tissue simulating liquid

Ingredient (% Weight) Frequency (MHz)	Water	NaCl	Polysorbate 20	DGBE	1,2- Propanediol	Triton X-100	Diethylen glycol monohex ylether
2450 Head	71.88	0.16	0.0	7.99	0.0	19.97	0.0
2450 Body	70	1	0.0	9	0.0	20	0.0

### 5.2. Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE 1528 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 IEEE 1528 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 IEEE 1528.

Target Frequency (MHz)	head		body	
	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (S/m)
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	1.01	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800–2000	40.0	1.40	53.3	1.52
<b>2450</b>	<b>39.2</b>	<b>1.80</b>	<b>52.7</b>	<b>1.95</b>
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

( $\epsilon_r$  = relative permittivity,  $\sigma$  = conductivity and  $\rho$  = 1000 kg/m<sup>3</sup>)

### 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 ( $\pm 5\%$ )		Tissue Temp [°C]	Test time
		$\epsilon_r$	$\delta[s/m]$		
Head		39.2(37.24-41.16)	1.80(1.71-1.89)	22.6	Apr. 04,2019
	2402	39.06	1.75		
	2441	38.82	1.77		
	2450	38.65	1.83		
	2480	37.75	1.85		
Body		52.7(50.065-55.335)	1.95(1.8525-2.0475)	20.0	Mar. 07,2019
	2402	54.12	1.88		
	2441	53.68	1.89		
	2450	52.45	1.91		
	2480	52.03	1.93		

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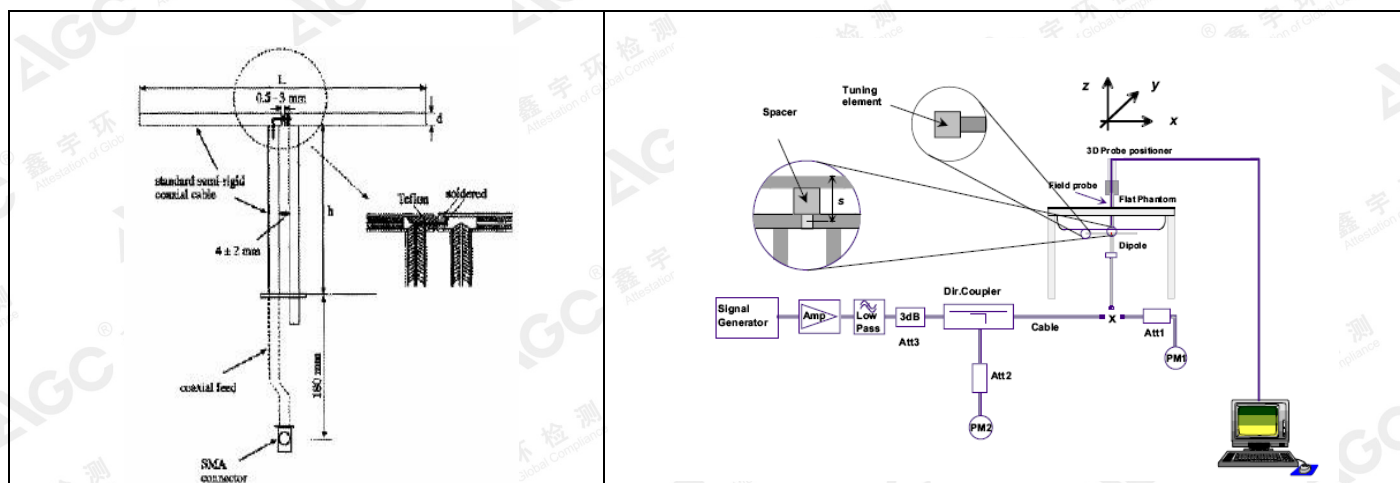
## 6. SAR SYSTEM CHECK PROCEDURE

### 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.

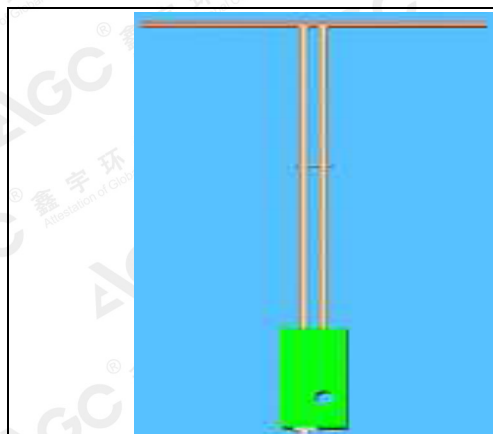
The system check verifies that the system operates within its specifications. It's performed daily or before every SAR measurement. The system check uses normal SAR measurement in the flat section of the phantom with a matched dipole at a specified distance. The system check setup is shown as below.



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## 6.2. SAR System Check

### 6.2.1. Dipoles



The dipole 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 dipole.

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

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### 6.2.2. System Check Result

System Performance Check at 2450MHz for Head								
Validation Kit:SN29/15 DIP 2G450-393								
Frequency [MHz]	Target Value(W/Kg)		Reference Result ( $\pm 10\%$ )		Normalized to 1W(W/Kg)		Tissue Temp. [°C]	Test time
	1g	10g	1g	10g	1g	10g		
2450	54.53	24.30	49.077-59.983	21.87-26.73	51.78	24.06	22.6	Apr. 04,2019
System Performance Check at 2450MHz for Body								
Frequency [MHz]	Target Value(W/Kg)		Reference Result ( $\pm 10\%$ )		Normalized to 1W(W/Kg)		Tissue Temp. [°C]	Test time
	1g	10g	1g	10g	1g	10g		
2450	49.92	23.16	44.928-54.912	20.844-25.476	51.06	23.70	20.0	Mar. 07,2019

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  $\pm 10\%$  of target value.

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## 7. EUT TEST POSITION

This EUT was tested in **Body back, Body front and 4 edges.**

### 7.1. Body Worn 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 **0mm.**

The SAR test procedure has been defined by FCC via KDB.

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## 8. SAR EXPOSURE LIMITS

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

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

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## 9. TEST FACILITY

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

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## 10. TEST EQUIPMENT LIST

Equipment description	Manufacturer/ Model	Identification No.	Current calibration date	Next calibration date
SAR Probe	MVG	SN 22/12 EP159	Aug. 08,2018	Aug. 07,2019
Phantom	SATIMO	SN_4511_SAM90	Validated. No cal required.	Validated. No cal required.
Liquid	SATIMO	-	Validated. No cal required.	Validated. No cal required.
Multimeter	Keithley 2000	4114939	Sep. 20,2018	Sep. 19,2019
Dipole	SATIMO SID2450	SN29/15 DIP 2G450-393	Jul. 05,2016	Jul. 04,2019
Signal Generator	Agilent-E4438C	US41461365	Feb. 27,2019	Feb. 26,2020
Vector Analyzer	Agilent / E4440A	US41421290	Feb. 27,2019	Feb. 26,2020
Network Analyzer	Rhode & Schwarz ZVL6	SN100132	Feb. 27,2019	Feb. 26,2020
Attenuator	Warison /WATT-6SR1211	N/A	N/A	N/A
Attenuator	Mini-circuits / VAT-10+	N/A	N/A	N/A
Amplifier	EM30180	SN060552	Feb. 27,2019	Feb. 26,2020
Directional Couple	Werlatone/ C5571-10	SN99463	Jun. 12,2018	Jun. 11,2019
Directional Couple	Werlatone/ C6026-10	SN99482	Jun. 12,2018	Jun. 11,2019
Power Sensor	NRP-Z21	1137.6000.02	Sep. 20,2018	Sep. 19,2019
Power Sensor	NRP-Z23	US38261498	Feb. 27,2019	Feb. 26,2020
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.

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## 11. MEASUREMENT UNCERTAINTY

Measurement uncertainty for Dipole averaged over 1 gram / 10 gram.									
a	b	c	d	e f(d,k)	f	g	h cx <sub>f</sub> /e	i cx <sub>g</sub> /e	k
Uncertainty Component	Sec.	Tol (± %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g U <sub>i</sub> (±%)	10g U <sub>i</sub> (±%)	vi
<b>Measurement System</b>									
Probe calibration	E.2.1	5.831	N	1	1	1	5.83	5.83	∞
Axial Isotropy	E.2.2	0.695	R	√3	√0.5	√0.5	0.28	0.28	∞
Hemispherical Isotropy	E.2.2	1.045	R	√3	√0.5	√0.5	0.43	0.43	∞
Boundary effect	E.2.3	1.0	R	√3	1	1	0.58	0.58	∞
Linearity	E.2.4	0.685	R	√3	1	1	0.40	0.40	∞
System detection limits	E.2.4	1.0	R	√3	1	1	0.58	0.58	∞
Modulation response	E.2.5	3.0	R	√3	1	1	1.73	1.73	∞
Readout Electronics	E.2.6	0.021	N	1	1	1	0.021	0.021	∞
Response Time	E.2.7	0	R	√3	1	1	0	0	∞
Integration Time	E.2.8	1.4	R	√3	1	1	0.81	0.81	∞
RF ambient conditions-Noise	E.6.1	3.0	R	√3	1	1	1.73	1.73	∞
RF ambient conditions-reflections	E.6.1	3.0	R	√3	1	1	1.73	1.73	∞
Probe positioner mechanical tolerance	E.6.2	1.4	R	√3	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	E.6.3	1.4	R	√3	1	1	0.81	0.81	∞
Extrapolation, interpolation, and integrations algorithms for max. SAR evaluation	E.5	2.3	R	√3	1	1	1.33	1.33	∞
<b>Test sample Related</b>									
Test sample positioning	E.4.2	2.6	N	1	1	1	2.6	2.6	∞
Device holder uncertainty	E.4.1	3	N	1	1	1	3	3	∞
Output power variation—SAR drift measurement	E.2.9	5	R	√3	1	1	2.89	2.89	∞
SAR scaling	E.6.5	5	R	√3	1	1	2.89	2.89	∞
<b>Phantom and tissue parameters</b>									
Phantom shell uncertainty—shape, thickness, and permittivity	E.3.1	4	R	√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	4	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity measurement	E.3.3	5	N	1	0.23	0.26	1.15	1.30	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	√3	0.78	0.71	1.13	1.02	∞
Liquid permittivity—temperature uncertainty	E.3.4	2.5	R	√3	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty			RSS				9.79	9.59	
Expanded Uncertainty (95% Confidence interval)			K=2				19.58	19.18	

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System check uncertainty for Dipole averaged over 1 gram / 10 gram.									
a	b	c	d	<sup>e</sup> f(d,k)	f	g	<sup>h</sup> cx <sub>f</sub> /e	<sup>i</sup> cx <sub>g</sub> /e	k
Uncertainty Component	Sec.	Tol (± %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g U <sub>i</sub> (±%)	10g U <sub>i</sub> (±%)	v <sub>i</sub>
<b>Measurement System</b>									
Probe calibration drift	E.2.1.3	0.5	N	1	1	1	0.50	0.50	∞
Axial Isotropy	E.2.2	0.695	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Hemispherical Isotropy	E.2.2	1.045	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Linearity	E.2.4	0.685	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	E.2.5	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	∞
<b>System check source (dipole)</b>									
Deviation of experimental dipoles	E.6.4	2	N	1	1	1	2	2	∞
Input power and SAR drift measurement	8,6.6.4	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole axis to liquid distance	8,E.6.6	2	R	$\sqrt{3}$	1	1	1.15	1.15	∞
<b>Phantom and tissue parameters</b>									
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	4	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity measurement	E.3.3	5	N	1	0.23	0.26	1.15	1.30	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid permittivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty			RSS				5.564	5.205	
Expanded Uncertainty (95% Confidence interval)			K=2				11.128	10.410	

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System Validation uncertainty for Dipole averaged over 1 gram / 10 gram.									
a	b	c	d	e f(d,k)	f	g	h cx/f/e	i cx/g/e	k
Uncertainty Component	Sec.	Tol (±%)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (±%)	10g Ui (±%)	vi
<b>Measurement System</b>									
Probe calibration	E.2.1	5.831	N	1	1	1	5.83	5.83	∞
Axial Isotropy	E.2.2	0.695	R	$\sqrt{3}$	1	1	0.40	0.40	∞
Hemispherical Isotropy	E.2.2	1.045	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	E.2.4	0.685	R	$\sqrt{3}$	1	1	0.40	0.40	∞
System detection limits	E.2.4	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	E.2.5	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	∞
<b>System check source (dipole)</b>									
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	∞
<b>Phantom and tissue parameters</b>									
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 measurement	E.3.3	4.0	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity measurement	E.3.3	5.0	N	1	0.23	0.26	1.15	1.30	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid permittivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty			RSS				9.718	9.517	
Expanded Uncertainty (95% Confidence interval)			K=2				19.437	19.035	

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## 12. CONDUCTED POWER MEASUREMENT

### Bluetooth\_BR/EDR

Modulation	Channel	Frequency(MHz)	Maximum Peak Power (dBm)
GFSK	0	2402	14.460
	39	2441	15.628
	78	2480	<b>16.142</b>
$\pi/4$ -DQPSK	0	2402	14.403
	39	2441	15.355
	78	2480	15.801
8-DPSK	0	2402	14.381
	39	2441	15.299
	78	2480	15.812

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## 13. TEST RESULTS

### 13.1. SAR Test Results Summary

#### 13.1.1. Test position and configuration

1. The EUT is a model of Bluetooth headset. According to user manual, the EUT is installed in the helmet, when remove it out of the helmet, the EUT can also normally work.
2. Based on FCC guidance, use a non-standard setting for SAR testing. The operating instructions contain additional information:

According to KDB 447498 D01 General RF Exposure Guide v06, due to maximum peak power for bluetooth is more than just a test exclusion threshold, which must be tested.

3. Test procedure:
  - (1) For the side that at taches to the helmet test 1-g SAR at a test separation distance of 0mm from the flat phantom filled with head tissue simulating Liquid.
  - (2) For the other 5 sides, test 10-g extremity SAR at a test separation distance of 0mm from the flat phantom filled with body tissue simulating Liquid.
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  $\leq 0.8$  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  $\geq 0.8$ W/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  $\geq 0.8$ W/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  $\geq 1.45$  W/Kg.
  - (3) Perform a third repeated measurement only if the original, first and second repeated measurement is  $\geq 1.5$  W/Kg and ratio of largest to smallest SAR for the original, first and second measurement is  $\geq 1.20$ .
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.)  $\times$  [maximum turn-up power (mw)/ maximum measurement output power(mw) ]

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### 13.1.3. SAR Test Results Summary

SAR MEASUREMENT									
Depth of Liquid (cm):>15					Relative Humidity (%): 52.4				
Product: Bluetooth Headset									
Test Mode: Bluetooth for head liquid									
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
Body back	1DH5	0	2402	-0.35	0.899	16.20	14.460	1.342	1.6
Body back	1DH5	39	2441	0.26	1.093	16.20	15.628	1.247	1.6
Body back	1DH5	78	2480	-0.18	1.076	16.20	16.142	1.090	1.6
Body back	2DH5	39	2441	-0.42	0.923	16.20	15.355	1.121	1.6
Body back	3DH5	39	2441	0.11	0.895	16.20	15.299	1.101	1.6

Note:

- When the 1-g SAR is  $\leq 0.8\text{W/kg}$ , testing for low and high channel is optional.
- The test separation of all above table is 0mm.

SAR MEASUREMENT									
Depth of Liquid (cm):>15					Relative Humidity (%): 50.7				
Product: Bluetooth Headset									
Test Mode: Bluetooth for body liquid									
Position	Mode	Ch.	Fr. (MHz)	Power Drift (<±5%)	10g-Extr emity SAR (W/kg)	Max. Tune-up Power (dBm)	Meas. output Power (dBm)	Scaled SAR (W/Kg)	Limit W/kg
Body front	1DH5	39	2441	-0.22	0.447	16.20	15.628	0.510	4.0
Edge 1 (Top)	1DH5	39	2441	-0.27	0.390	16.20	15.628	0.445	4.0
Edge 2 (Right)	1DH5	39	2441	0.16	0.236	16.20	15.628	0.269	4.0
Edge 3 (Bottom)	1DH5	39	2441	-0.35	0.295	16.20	15.628	0.337	4.0
Edge 4 (Left)	1DH5	39	2441	0.27	<b>0.502</b>	16.20	15.628	<b>0.573</b>	4.0

Note:

- When the 1-g SAR is  $\leq 0.8\text{W/kg}$ , testing for low and high channel is optional.
- The test separation of all above table is 0mm.

Repeated SAR										
Product: Bluetooth Headset										
Test Mode: Bluetooth for head liquid										
Position	Mode	Ch.	Fr. (MHz)	Power Drift ( $\leq \pm 5\%$ )	Once SAR (1g) (W/kg)	Power Drift ( $\leq \pm 5\%$ )	Twice SAR (1g) (W/kg)	Power Drift ( $\leq \pm 5\%$ )	Third SAR (1g) (W/kg)	Limit (W/kg)
Body back	1DH5	39	2441	0.23	1.051	--	--	--	--	1.6

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## APPENDIX A. SAR SYSTEM CHECK DATA

Test Laboratory: AGC Lab

Date: Apr. 04, 2019

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=4.90

Frequency: 2450 MHz; Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.83$  mho/m;  $\epsilon_r = 38.65$ ;  $\rho = 1000$  kg/m<sup>3</sup> ;

Phantom section: Flat Section; Input Power=18dBm

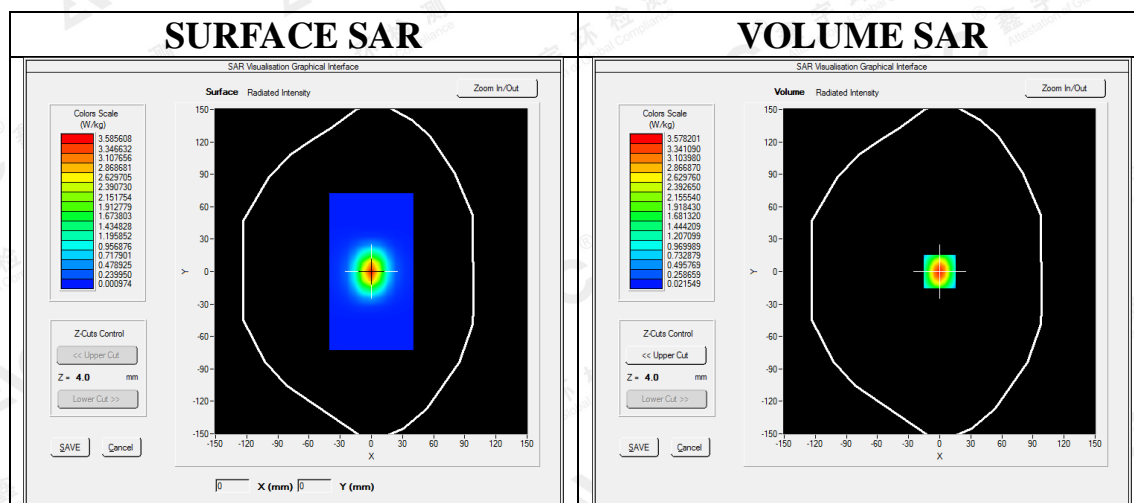
Ambient temperature (°C): 23.1, Liquid temperature (°C): 22.6

SATIMO Configuration:

- Probe: SSE5; Calibrated: Aug. 08, 2018; Serial No.: SN 22/12 EP159
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4\_02\_35

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

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



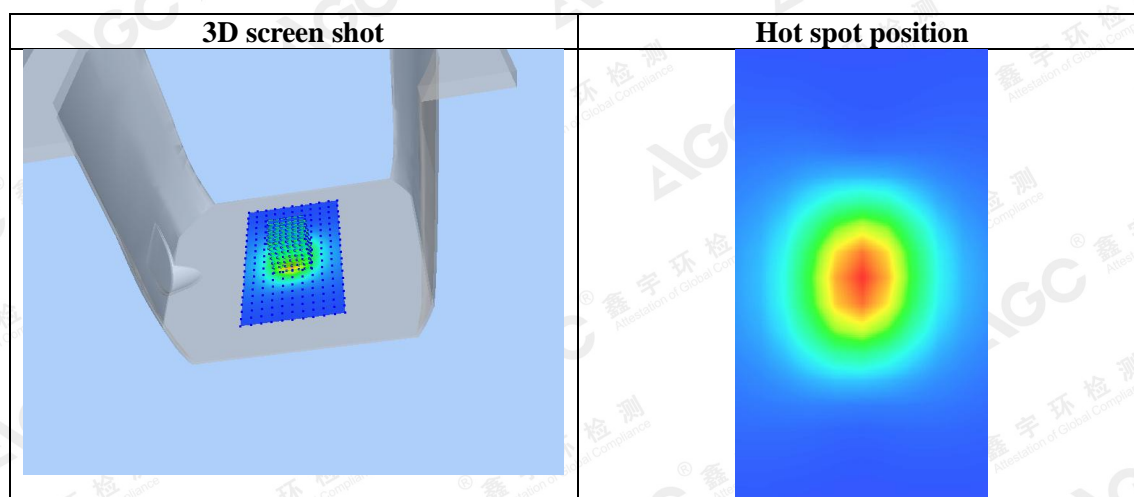
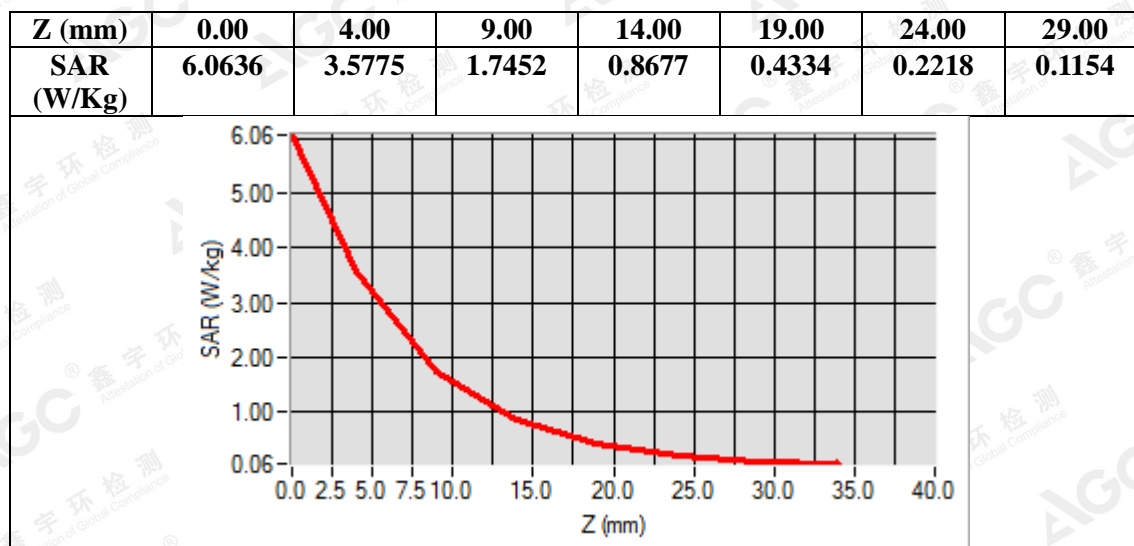
Maximum location: X=0.00, Y=0.00

SAR Peak: 5.99 W/kg

<b>SAR 10g (W/Kg)</b>	1.518375
<b>SAR 1g (W/Kg)</b>	3.266971

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**Test Laboratory: AGC Lab**

**Date: Mar. 07,2019**

**System Check Body 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=4.84

Frequency: 2450 MHz; Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.91$  mho/m;  $\epsilon_r = 52.45$ ;  $\rho = 1000$  kg/m<sup>3</sup> ;

Phantom section: Flat Section; Input Power=18dBm

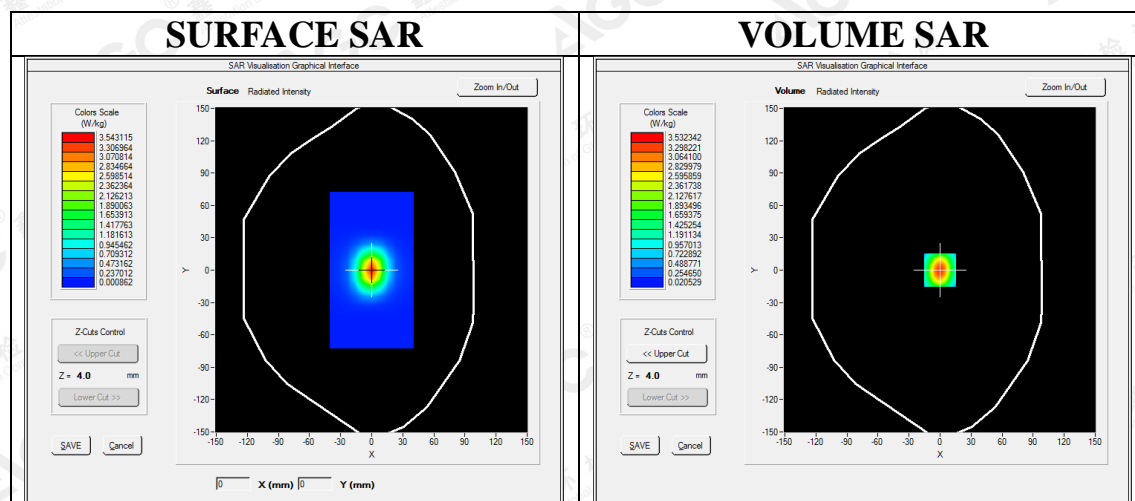
Ambient temperature (°C):20.2, Liquid temperature (°C): 20.0

**SATIMO Configuration**

- Probe: SSE5; Calibrated: Aug. 08,2018; Serial No.: SN 22/12 EP159
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4\_02\_35

**Configuration/System Check 2450MHz Body/Area Scan:** Measurement grid: dx=8mm, dy=8mm

**Configuration/System Check 2450MHz Body/Zoom Scan:** Measurement grid: dx=5mm dy=5mm dz=5mm



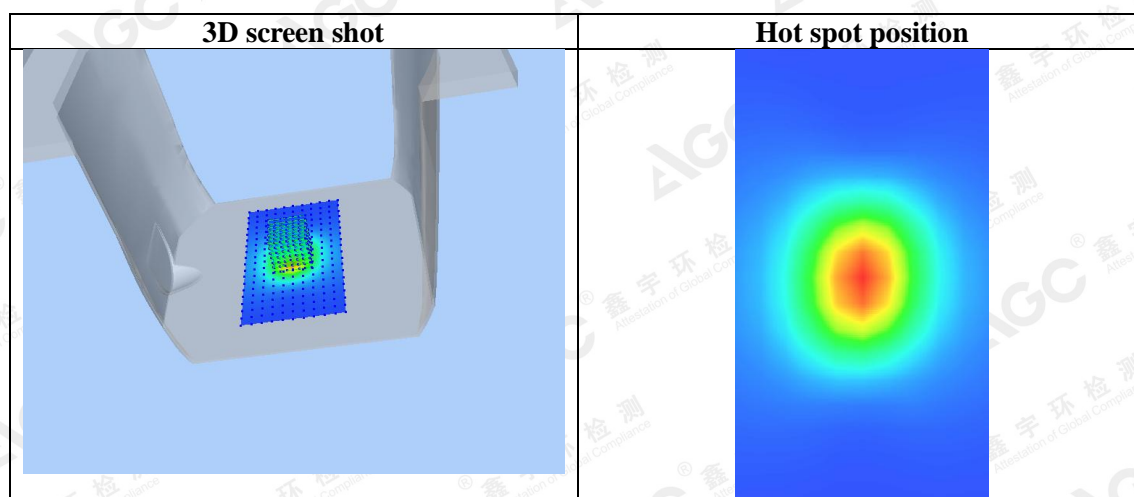
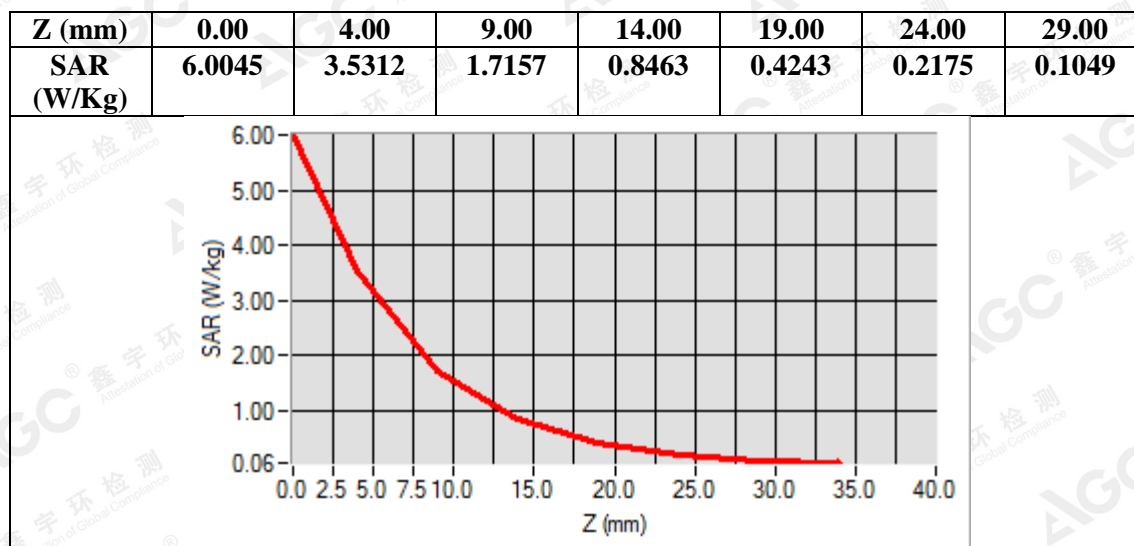
**Maximum location: X=0.00, Y=0.00**

**SAR Peak: 5.93 W/kg**

<b>SAR 10g (W/Kg)</b>	1.495425
<b>SAR 1g (W/Kg)</b>	3.221748

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## APPENDIX B. SAR MEASUREMENT DATA

Bluetooth for head liquid

Test Laboratory: AGC Lab

Date: Apr. 04, 2019

Bluetooth Mid- Body back(1DH5)

DUT: Bluetooth Headset; Type: V6 PLUS\_T20S

Communication System: Wi-Fi; Communication System Band: Bluetooth; Duty Cycle: 1:1.28; Conv.F=4.90;  
Frequency: 2441 MHz; Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.77$  mho/m;  $\epsilon_r = 38.82$ ;  $\rho = 1000$  kg/m<sup>3</sup> ;  
Phantom section: Flat Section  
Ambient temperature (°C): 23.1, Liquid temperature (°C): 22.6

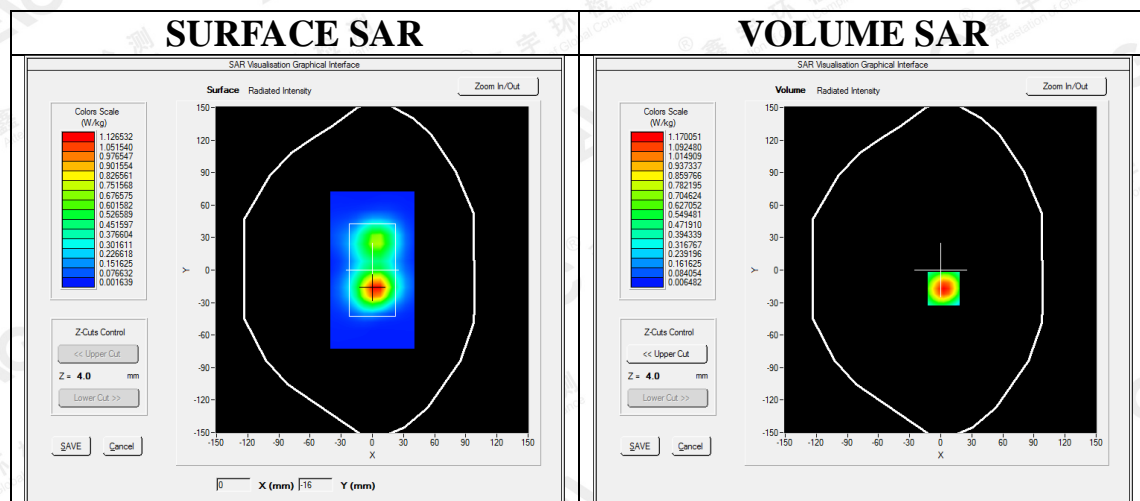
SATIMO Configuration:

- Probe: SSE5; Calibrated: Aug. 08, 2018; Serial No.: SN 22/12 EP159
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4\_02\_35

Configuration/Bluetooth Mid- Body back /Area Scan: Measurement grid: dx=8mm, dy=8mm

Configuration/Bluetooth Mid- Body back /Zoom Scan: Measurement grid: dx=5mm dy=5mm dz=5mm;

Area Scan	sam_direct_droit2_surf8mm.txt
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	SAM twin phantom
Device Position	Body back
Band	Bluetooth
Channels	Middle
Signal	Crest factor: 1.28

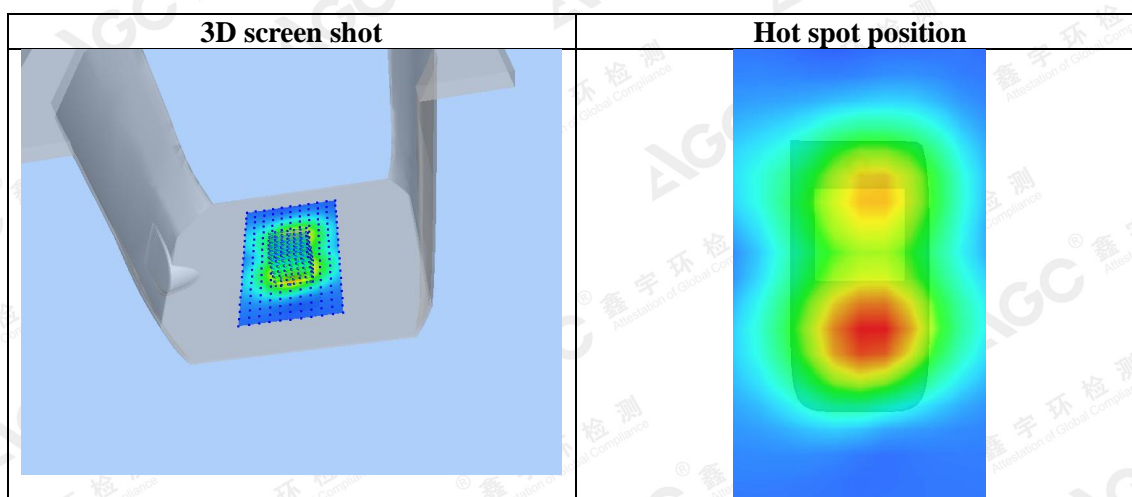
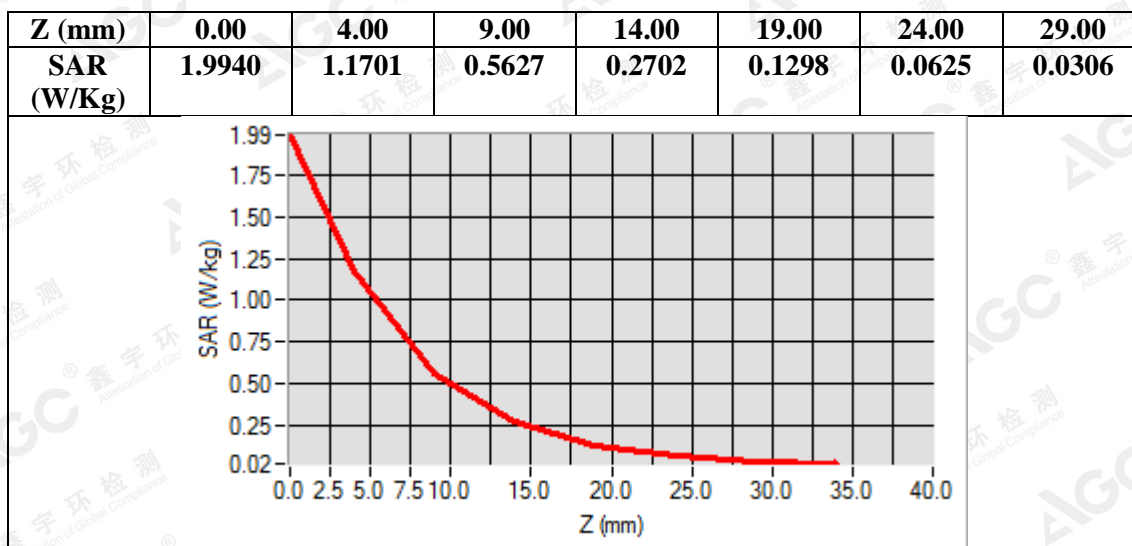


Maximum location: X=3.00, Y=-17.00  
SAR Peak: 1.97 W/kg

SAR 10g (W/Kg)	0.524865
SAR 1g (W/Kg)	1.093217

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# Bluetooth for body liquid

Test Laboratory: AGC Lab

Bluetooth Mid- Edge4 (1DH5)

DUT: Bluetooth Headset; Type: V6 PLUS\_T20S

Date: Mar. 07,2019

Communication System: Wi-Fi; Communication System Band: Bluetooth; Duty Cycle: 1:1.28; Conv.F=4.84;  
Frequency: 2441 MHz; Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.89$  mho/m;  $\epsilon_r = 53.68$ ;  $\rho = 1000$  kg/m<sup>3</sup> ;  
Phantom section: Flat Section  
Ambient temperature (°C):20.2, Liquid temperature (°C): 20.0

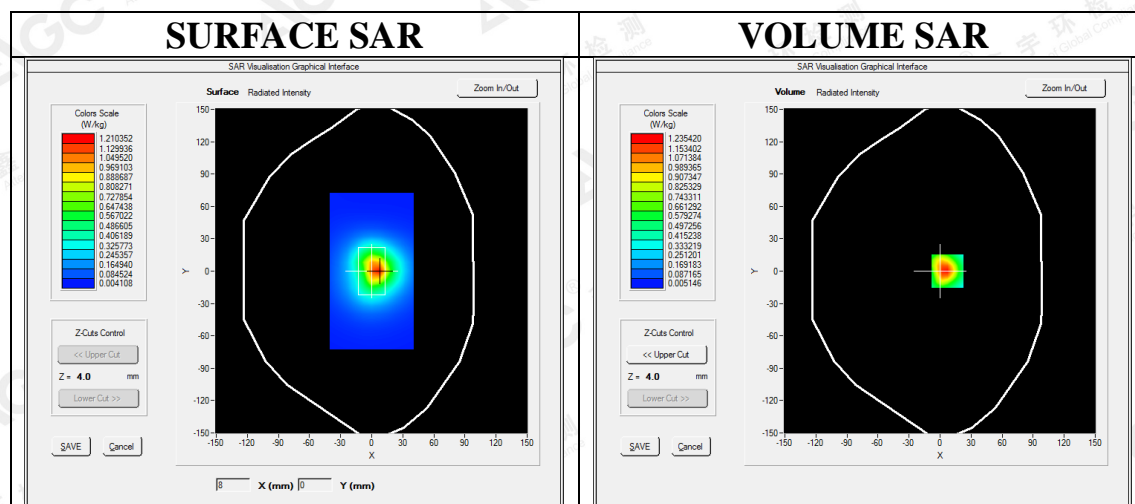
## SATIMO Configuration:

- Probe: SSE5; Calibrated: Aug. 08,2018; Serial No.: SN 22/12 EP159
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4\_02\_35

Configuration/Bluetooth Mid- Edge4 /Area Scan: Measurement grid: dx=8mm, dy=8mm

Configuration/Bluetooth Mid- Edge4 /Zoom Scan: Measurement grid: dx=5mm dy=5mm dz=5mm;

Area Scan	sam_direct_droit2_surf8mm.txt
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	SAM twin phantom
Device Position	Edge4
Band	Bluetooth
Channels	Middle
Signal	Crest factor: 1.28



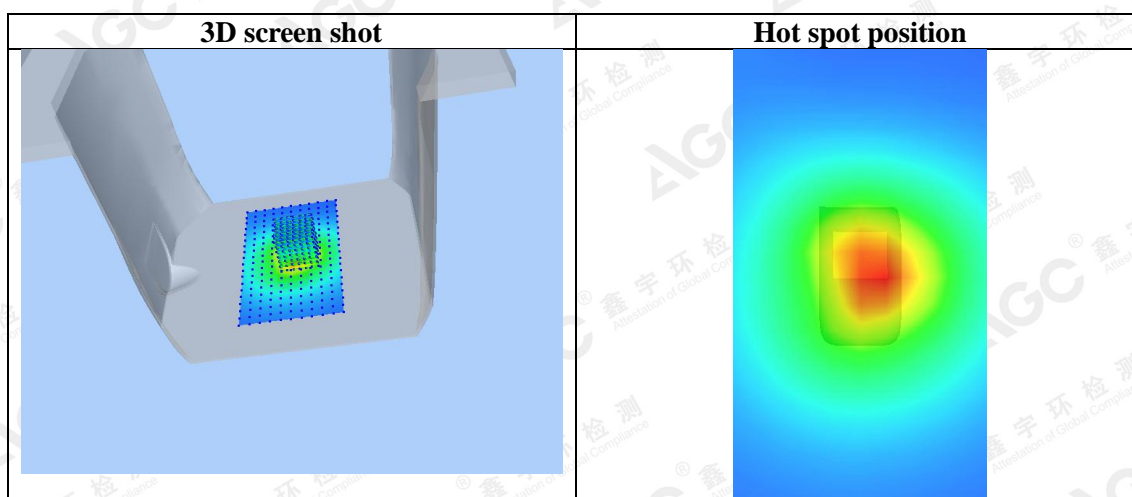
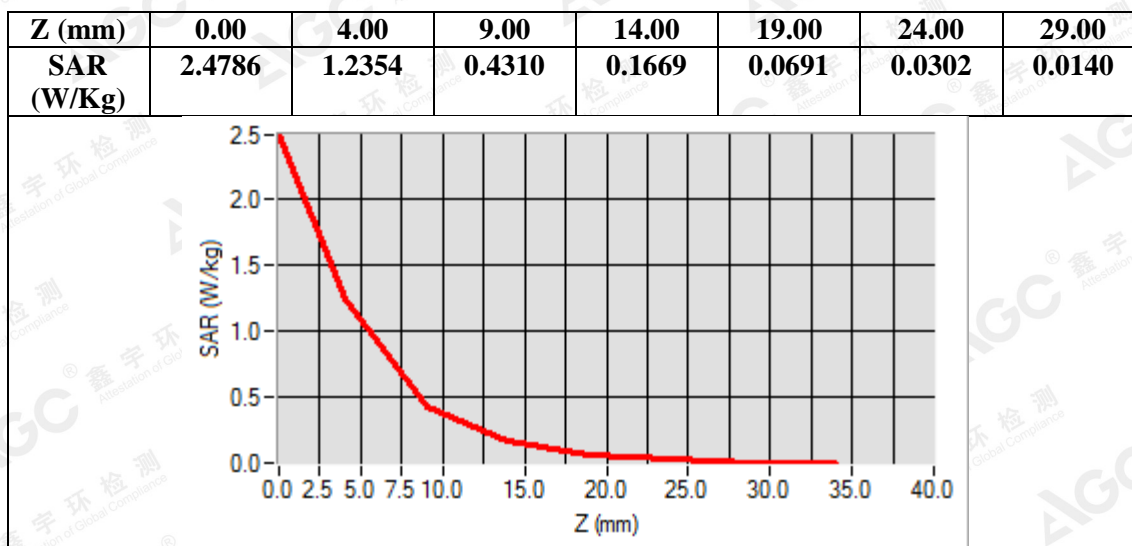
Maximum location: X=7.00, Y=0.00

SAR Peak: 2.50 W/kg

SAR 10g (W/Kg)	0.502421
SAR 1g (W/Kg)	1.178866

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**Repeated SAR**

**Test Laboratory:** AGC Lab

**Bluetooth Mid- Body back(1DH5)**

**DUT: Bluetooth Headset; Type: V6 PLUS\_T20S**

**Date: Apr. 04,2019**

Communication System: Wi-Fi; Communication System Band: Bluetooth; Duty Cycle: 1:1.28; Conv.F=4.90;  
Frequency: 2441 MHz; Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.77$  mho/m;  $\epsilon_r = 38.82$ ;  $\rho = 1000$  kg/m<sup>3</sup> ;  
Phantom section: Flat Section  
Ambient temperature (°C):23.1, Liquid temperature (°C): 22.6

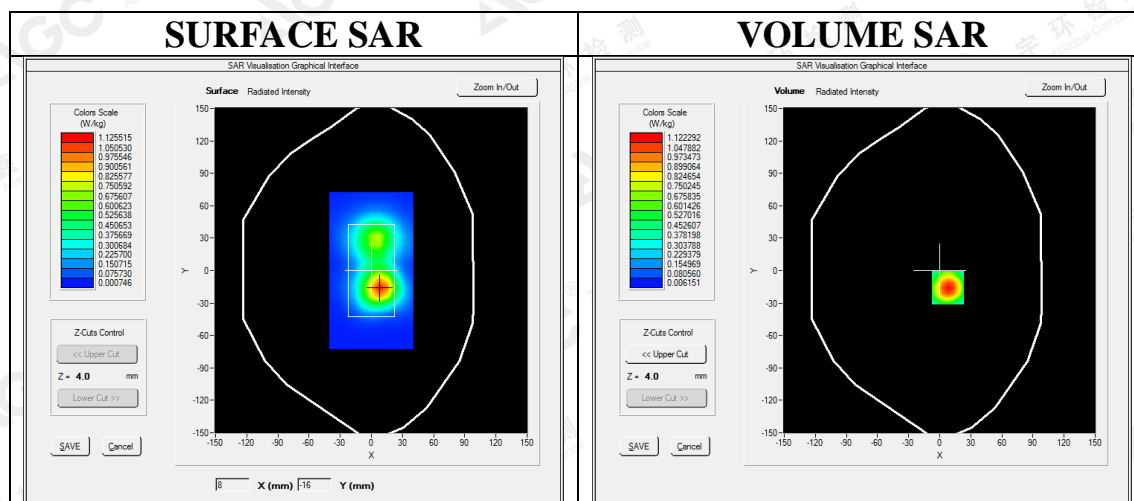
**SATIMO Configuration:**

- Probe: SSE5; Calibrated: Aug. 08,2018; Serial No.: SN 22/12 EP159
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4\_02\_35

**Configuration/Bluetooth Mid- Body back /Area Scan:** Measurement grid: dx=8mm, dy=8mm

**Configuration/Bluetooth Mid- Body back /Zoom Scan:** Measurement grid: dx=5mm dy=5mm dz=5mm;

<b>Area Scan</b>	sam_direct_droit2_surf8mm.txt
<b>ZoomScan</b>	7x7x7,dx=5mm dy=5mm dz=5mm
<b>Phantom</b>	SAM twin phantom
<b>Device Position</b>	Body back
<b>Band</b>	Bluetooth
<b>Channels</b>	Middle
<b>Signal</b>	Crest factor: 1.28



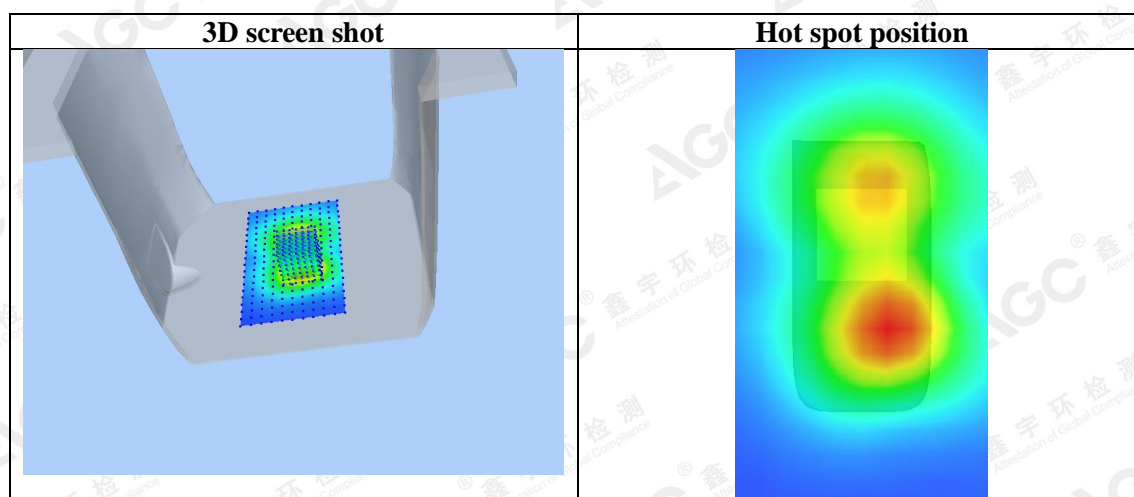
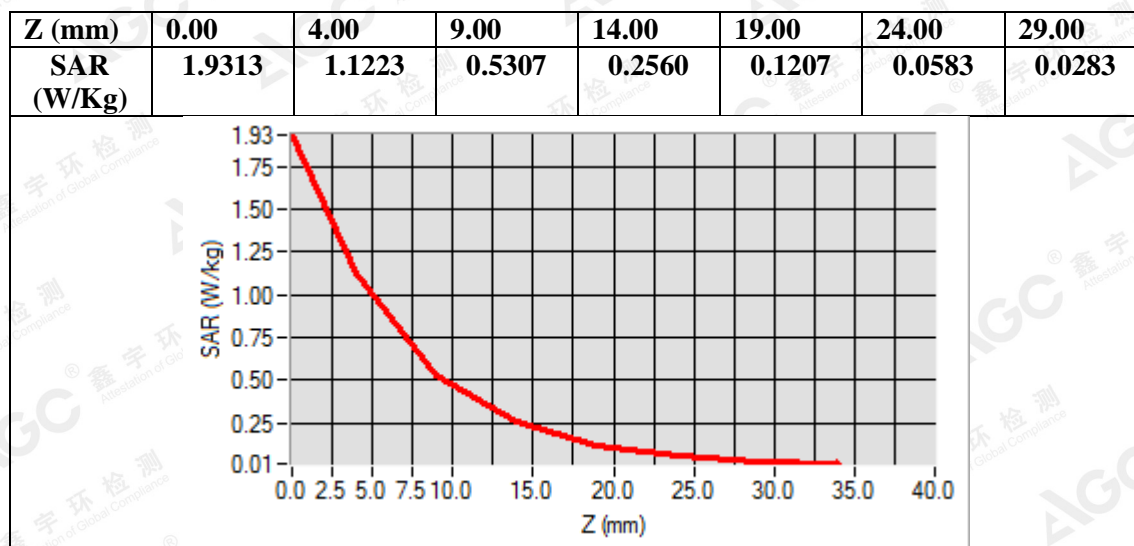
**Maximum location: X=8.00, Y=-16.00**

**SAR Peak: 1.91 W/kg**

<b>SAR 10g (W/Kg)</b>	0.503185
<b>SAR 1g (W/Kg)</b>	1.051492

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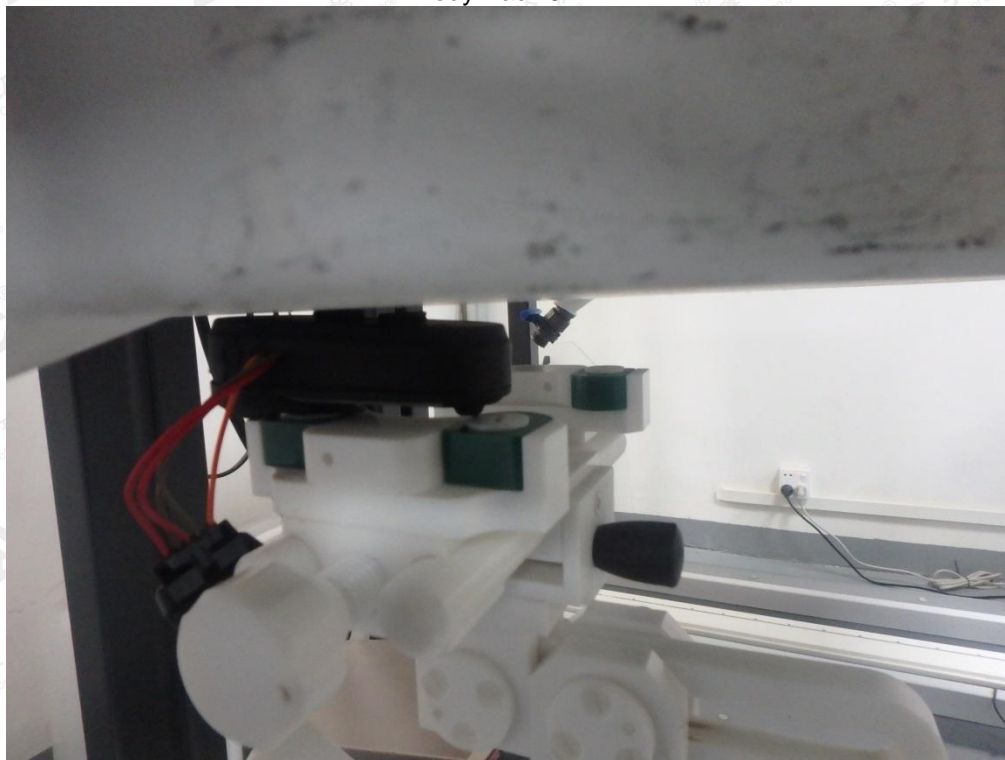




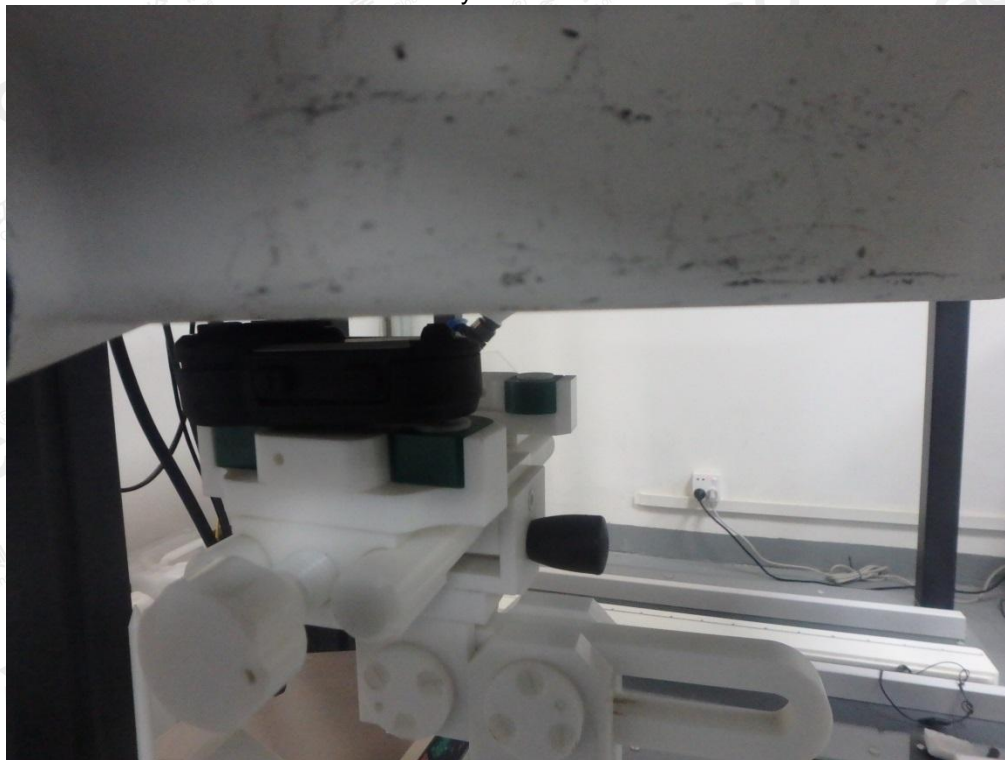
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## APPENDIX C. TEST SETUP PHOTOGRAPHS

Body Back 0mm



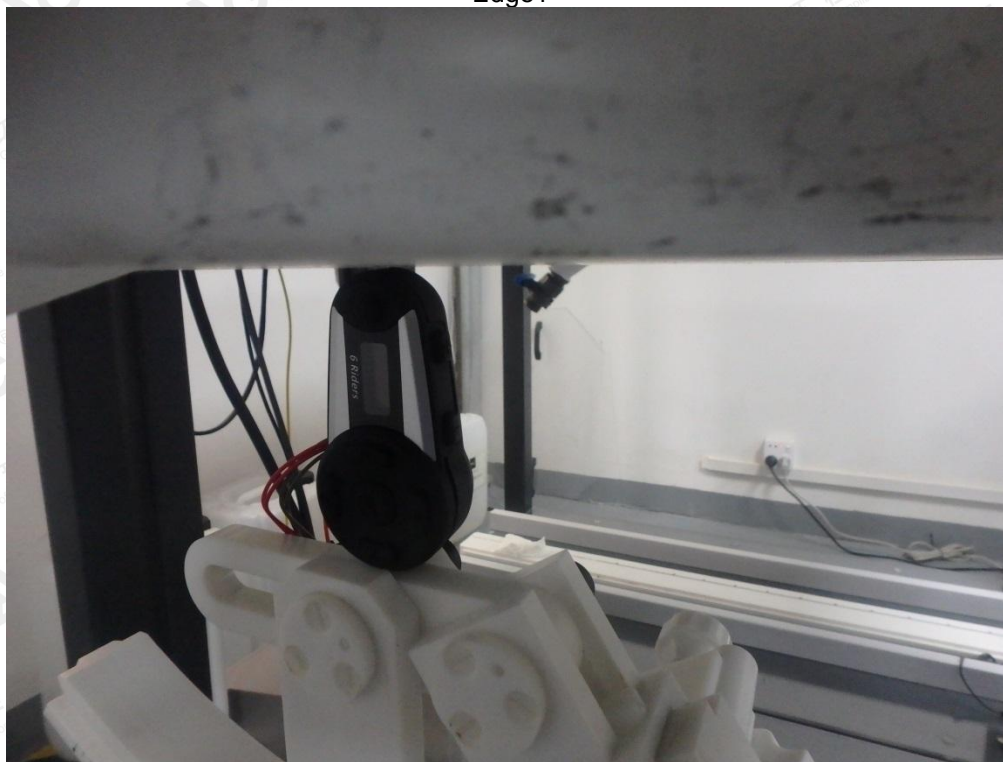
Body Front 0mm



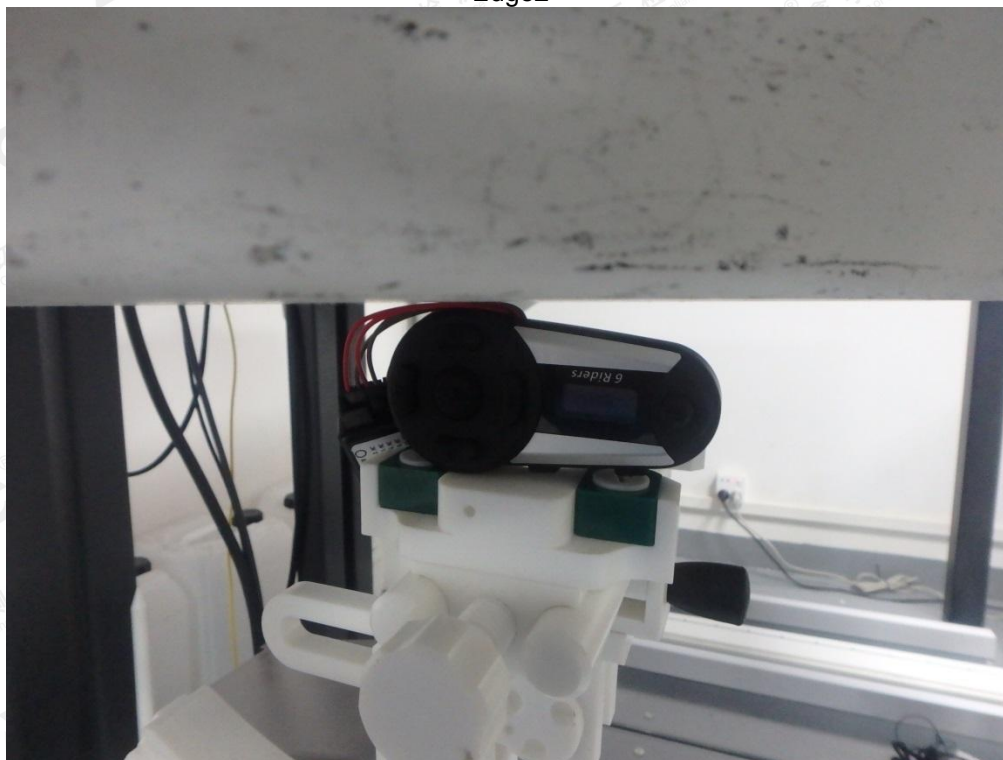
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Edge1

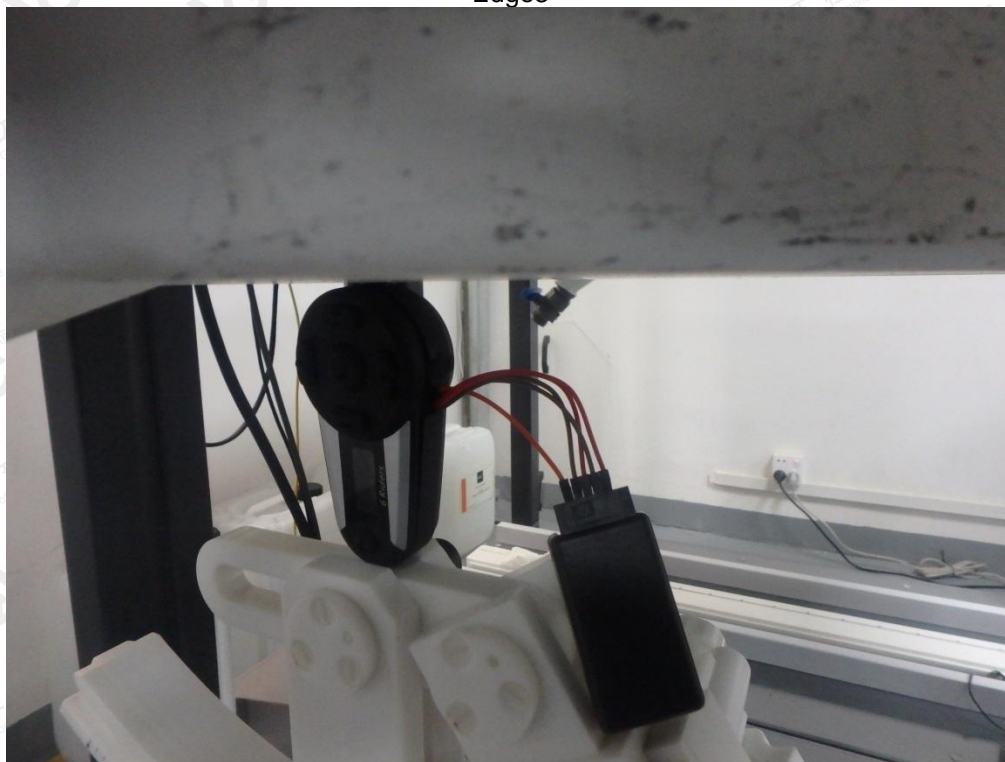


Edge2

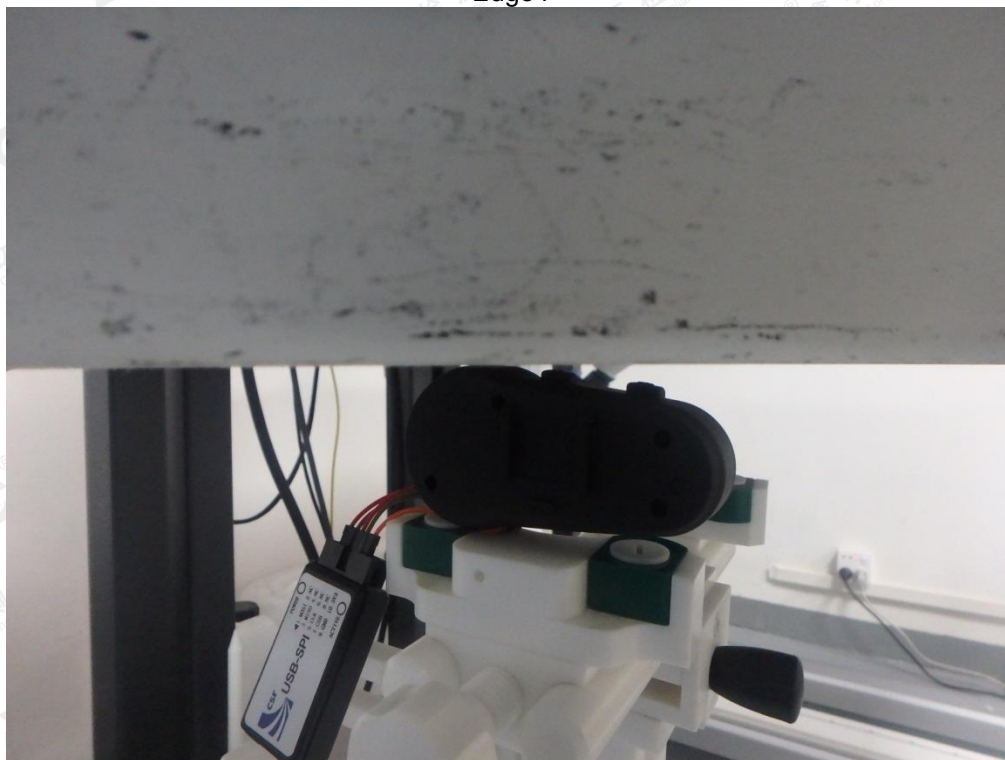


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Edge3



Edge4



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### DEPTH OF THE LIQUID IN THE PHANTOM—ZOOM IN

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



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## APPENDIX D. CALIBRATION DATA

Refer to Attached files.

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