FCC SAR TEST REPORT

Report No.: STS1808183H01

Issued for

Shadow Creator Information Technology Co., Ltd.

3 Floor, Building 12, 399 lane, Chuan Qiao Road, Pudong New Area, Shanghai, China

Product Name:	Mixed Reality HDM
Brand Name:	Shadow Creator
Model Name:	Action One A01
Series Model:	N/A
FCC ID:	2AQYUACTIONONE-A1
Test Standard:	ANSI/IEEE Std. C95.1
	FCC 47 CFR Part 2 (2.1093)
	IEEE 1528: 2013
Max. Report SAR (1g):	Head: 0.306 W/kg

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Test Report Certification

Applicant's name ..... :	Shadow Creator Information Technology Co., Ltd.
Address ..... :	3 Floor, Building 12, 399 lane, Chuan Qiao Road, Pudong New Area, Shanghai, China
Manufacture's Name ..... :	Shadow Creator Information Technology Co., Ltd.
Address ..... :	3 Floor, Building 12, 399 lane, Chuan Qiao Road, Pudong New Area, Shanghai, China

Product description

Product name ..... :	Mixed Reality HDM
Brand name ..... :	Shadow Creator
Model name ..... :	Action One A01
Series Model ..... :	N/A
Standards ..... :	ANSI/IEEE Std. C95.1-1992 FCC 47 CFR Part 2 (2.1093) IEEE 1528: 2013

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

Date of Test ..... :	
Date (s) of performance of tests ..... :	12 Oct. 2018~13 Oct. 2018
Date of Issue ..... :	15 Oct. 2018
Test Result ..... :	**Pass**

Testing Engineer **:** Aaron Bu

(Aaron Bu)

Technical Manager **:** Jason Lu

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Authorized Signatory **:** Vita Li

(Vita Li)

Table of Contents

1.General Information **4**

1.1 EUT Description 4

1.2 Test Environment 5

1.3 Test Factory 5

2.Test Standards And Limits **6**

3. SAR Measurement System **7**

3.1 Definition Of Specific Absorption Rate (SAR) 7

3.2 SAR System 7

4. Tissue Simulating Liquids **10**

4.1 Simulating Liquids Parameter Check 10

5. SAR System Validation **12**

5.1 Validation System 12

5.2 Validation Result 12

6. SAR Evaluation Procedures **13**

7. EUT Antenna Location Sketch **14**

8. EUT Test Position **15**

8.1 Define Two Imaginary Lines On The Handset 15

8.2 Hotspot mode exposure position condition 16

9. Uncertainty **17**

9.1 Measurement Uncertainty 17

9.2 System validation Uncertainty 19

10. Conducted Power Measurement **21**

10.1 Tune-up Power 23

11. EUT And Test Setup Photo **24**

11.1 EUT Photo 24

11.2 Setup Photo 27

12. SAR Result Summary **28**

12.1 Head Liquid SAR 28

13. Equipment List **31**

Appendix A. System Validation Plots **32**

Appendix B. SAR Test Plots **36**

Appendix C. Probe Calibration And Dipole Calibration Report **44**

1.General Information

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

1.1 EUT Description

Product Name	Mixed Reality HDM		
Brand Name	Shadow Creator		
Model Name.	Action One A01		
Series Model	N/A		
FCC ID	2AQYUACTIONONE-A1		
Model Difference	N/A		
Adapter	Input: AC 100-240V, 450mA, 50-60 Hz Output: DC 5.2V, 2000mA		
Battery	Rated Voltage: 3.8V; Charge Limit: 4.35V; Capacity: 2000mAh		
Device Category	Portable		
Product stage	Production unit		
RF Exposure Environment	General Population / Uncontrolled		
Hardware Version	A01-MB-V2.0		
Software Version	SW_A01_YC_A_V1.12.5_180810		
Frequency Range	WLAN 802.11b/g/n(HT20):2412~2462MHz WLAN 802.11a/n/ac(HT20/40/80): 5725~5875 MHz; Bluetooth:2402~ 2480MHz		
Max. Reported SAR(1g): (Limit:1.6W/kg)	Band	Mode	Head(W/kg)
	DTS	2.4G WLAN ANT A	0.049
	DTS	2.4G WLAN ANT B	0.024
	DTS	2.4G WLAN (MIMO)	0.099
	NII	5.8G WLAN ANT A	0.239
	NII	5.8G WLAN ANT B	0.196
	NII	5.8G WLAN ANT (MIMO)	0.306
	DTS	Bluetooth Note	0.084
FCC Equipment Class	Digital Transmission System (DTS)		
Operating Mode:	WLAN: 802.11 b/g/n(HT20) /a/ac20/ac40/ac80 Bluetooth: V5.0 + EDR (GFSK, π/4DQPSK, 8DPSK) ; BLE: GFSK		
Antenna Specification:	BT,WLAN: PIFA Antenna		
Hotspot Mode:	Not Support		
DTM Mode:	Not Support		

Note:
1. Bluetooth SAR was estimated
2. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power

1.2 Test Environment

Ambient conditions in the SAR laboratory:

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

1.3 Test Factory

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

2.Test Standards And Limits

No.	Identity	Document Title
1	47 CFR Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
2	ANSI/IEEE Std. C95.1-1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
3	IEEE Std. 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
4	FCC KDB 447498 D01 v06	Mixed Reality HDM and Portable Device RF Exposure Procedures and Equipment Authorization Policies
5	FCC KDB 865664 D01 v01r04	SAR Measurement 100 MHz to 6 GHz
6	FCC KDB 616217 D04	SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers
7	FCC KDB 248227 D01 Wi-Fi SAR v02r02	SAR Considerations for 802.11 Devices

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

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

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

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

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

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

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

NOTE

GENERAL POPULATION/UNCONTROLLED EXPOSURE

PARTIAL BODY LIMIT

1.6 W/kg

3. SAR Measurement System

3.1 Definition Of Specific Absorption Rate (SAR)

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

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

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

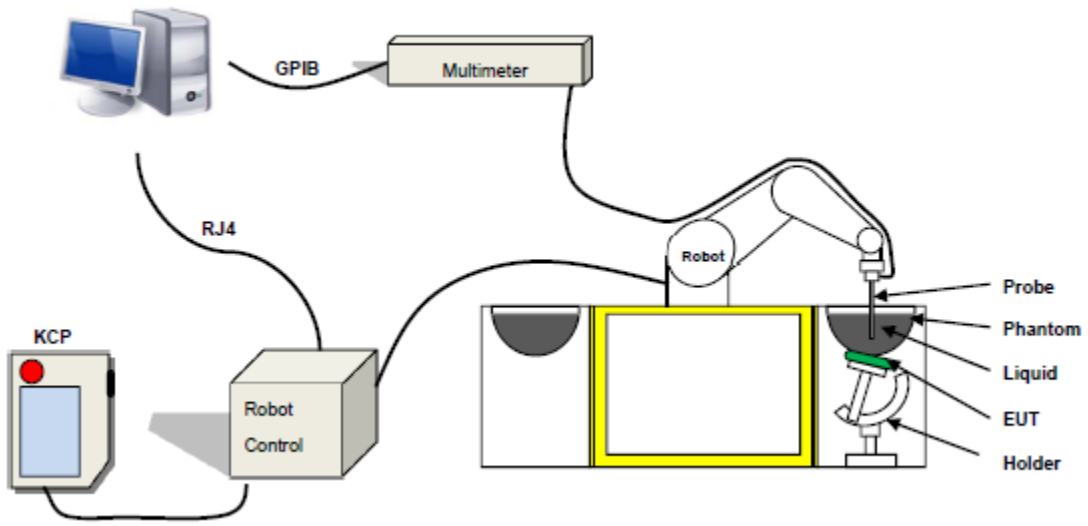
SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

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

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

3.2 SAR System

SATIMO SAR System Diagram:



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

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

The following figure shows the system.

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

3.2.1 Probe

For the measurements the Specific Dosimetric E-Field Probe SN 45/15 EPGO281 with following specifications is used

- Dynamic range: 0.01-100 W/kg
- Tip Diameter: 2.5 mm
- Length of Individual Dipoles: 2 mm
- Maximum external diameter: 8 mm
- Distance between dipole/probe extremity: 8 mm (repeatability better than +/- 1mm)
- Probe linearity: 0±2.60%(0.11dB)
- Axial Isotropy: ＜0.25 dB
- Spherical Isotropy: ＜0.25 dB
- Calibration range: 450 MHz to 6 GHz for head & body simulating liquid.
- Angle between probe axis (evaluation axis) and surface normal line: less than 30°

Figure-MVG COMOSAR Dosimetric E field Dipole

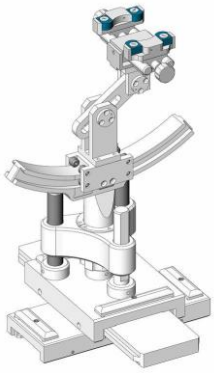
3.2.2 Phantom

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

Figure-SN 32/14 SAM115

Figure-SN 32/14 SAM116

3.2.3 Device Holder



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

4. Tissue Simulating Liquids

4.1 Simulating Liquids Parameter Check

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

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

Tissue dielectric parameters for head and body phantoms				
Frequency	ε_r		σ S/m	
	Head	Body	Head	Body
300	45.3	58.2	0.87	0.92
450	43.5	58.7	0.87	0.94
900	41.5	55.0	0.97	1.05
1450	40.5	54.0	1.20	1.30
1800	40.0	53.3	1.40	1.52
2450	39.2	52.7	1.80	1.95
3000	38.5	52.0	2.40	2.73
5800	35.3	48.2	5.27	6.00

LIQUID MEASUREMENT RESULTS

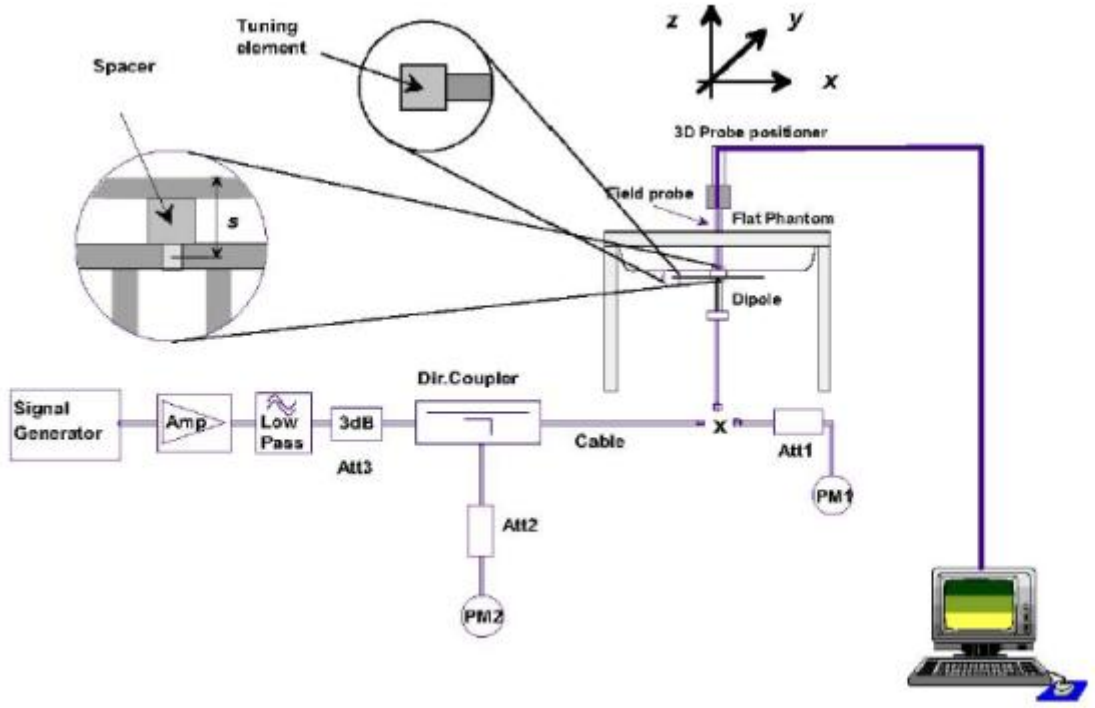
Date	Ambient condition		Head Simulating Liquid		Parameters	Target	Measured	Deviation [%]	Limited [%]
	Temp. [°C]	Humidity [%]	Frequency	Temp. [°C]					
2018-10-12	23.2	49	2450 MHz	22.8	Permittivity:	39.2	38.96	-0.60	±5
					Conductivity:	1.8	1.75	-2.82	±5
2018-10-13	23.1	48	5800 MHz	22.8	Permittivity:	35.3	35.45	0.42	±5
					Conductivity:	5.27	5.30	0.57	±5

5. SAR System Validation

5.1 Validation System

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

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



5.2 Validation Result

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

Freq.(MHz)	Power(mW)	Tested Value (W/Kg)	Normalized SAR (W/kg)	Target(W/Kg)	Tolerance(%)	Date
2450 Head	100	5.267	52.67	52.4	-0.51	2018-10-12
5800 Head	100	17.85	178.5	181.2	1.51	2018-10-13

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

6. SAR Evaluation Procedures

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

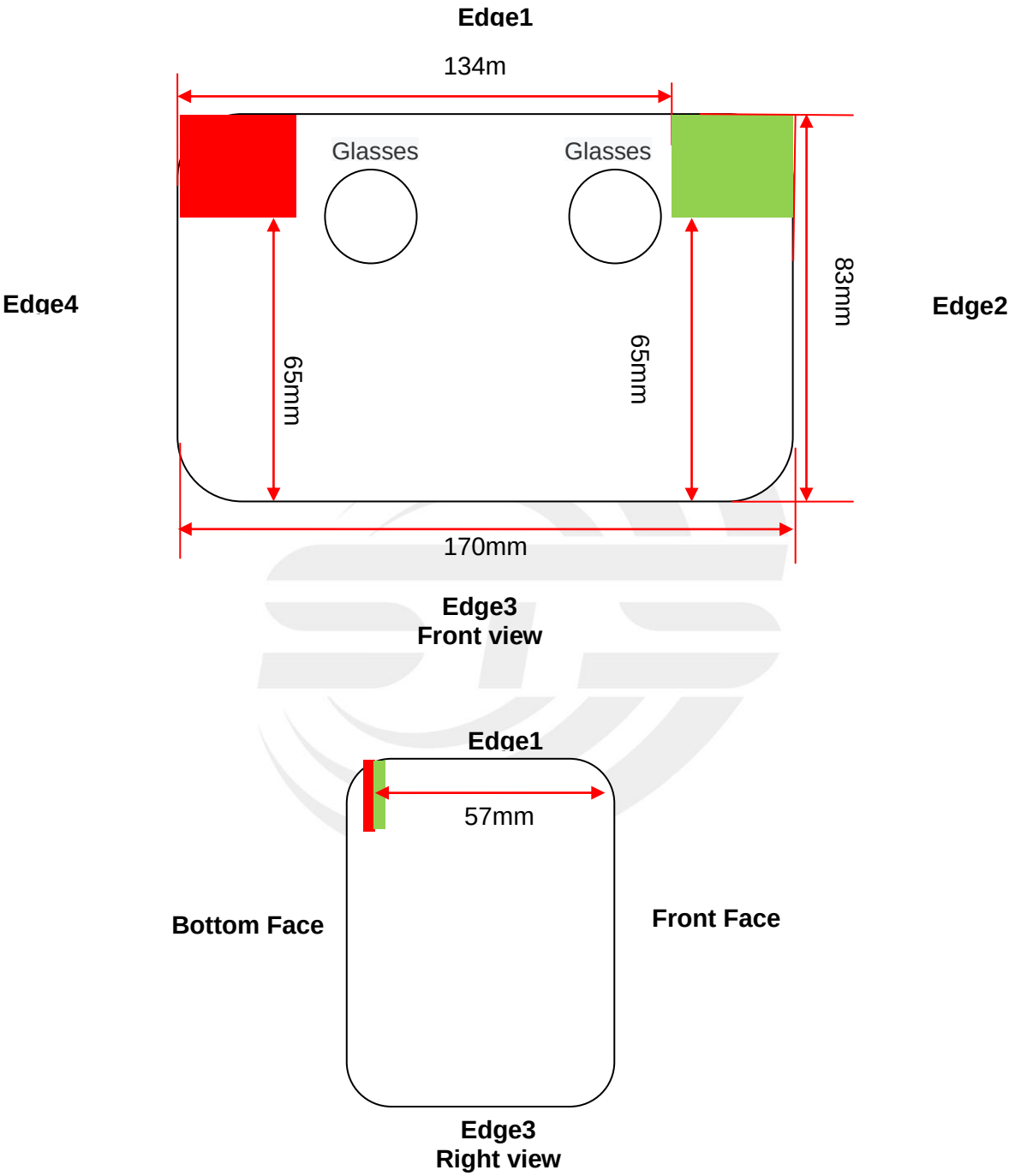
Area Scan& Zoom Scan:

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

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

7. EUT Antenna Location Sketch

It is a Mixed Reality HDM, support WLAN/BT mode.

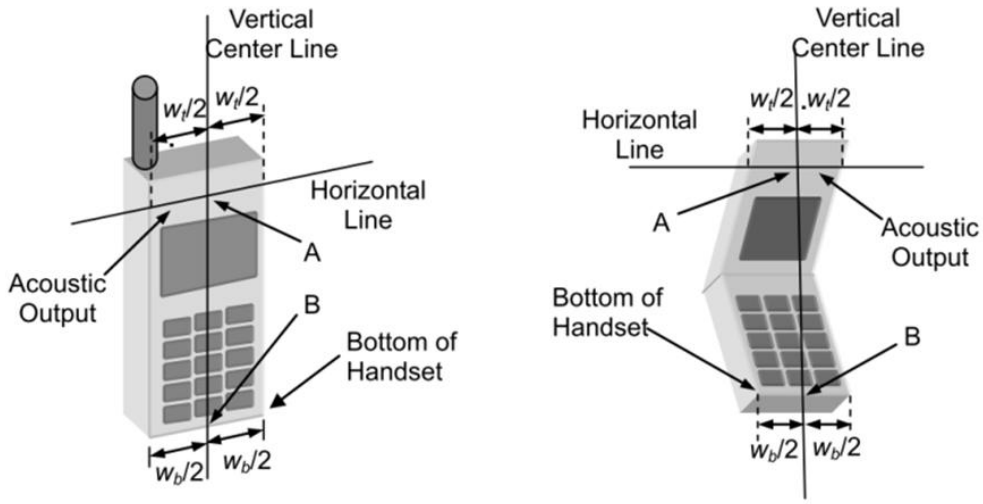


8. EUT Test Position

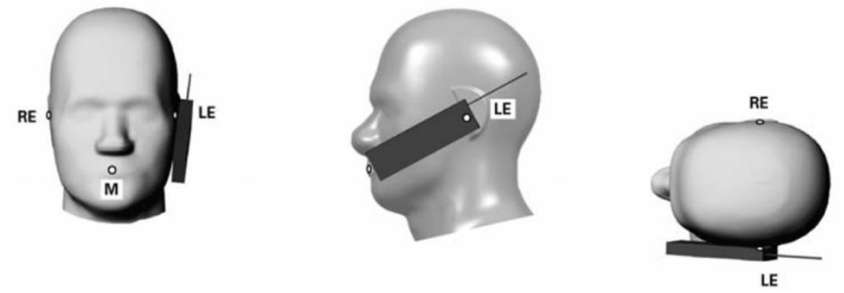
This EUT was tested in Right Cheek, Right Titled, Left Cheek, Left Titled, Front Face and Rear Face.

8.1 Define Two Imaginary Lines On The Handset

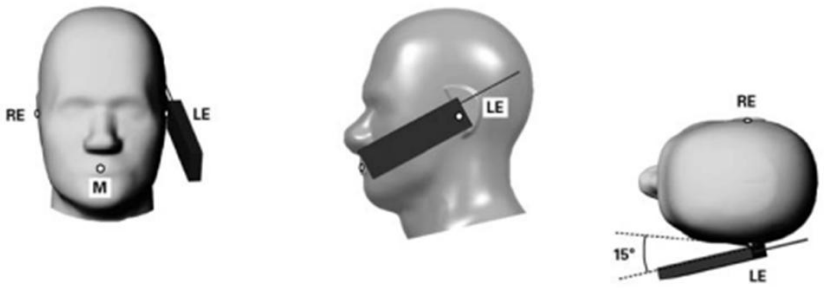
(1)The vertical centerline passes through two points on the front side of the handset the midpoint of the width wt of the handset at the level of the acoustic output, and the midpoint of the width wb of the handset.
(2)The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.
(3)The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.



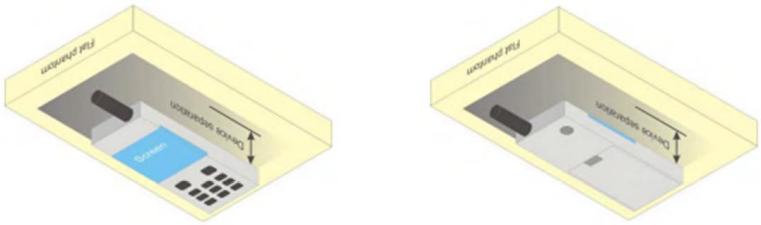
Cheek Position
1)To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.
2)To move the device towards the phantom with the ear piece aligned with the the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost



Title Position
(1)To position the device in the “cheek” position described above.
(2) While maintaining the device in the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until with the ear is lost.

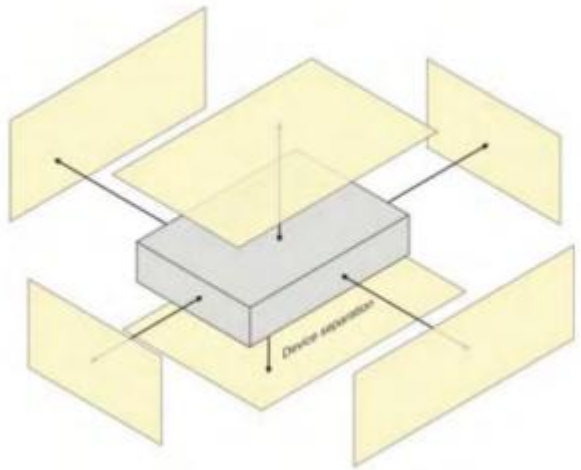


Body-worn Position Conditions:
Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB Publication 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. When the same wireless transmission configuration is used for testing body-worn accessory and hotspot mode SAR, respectively, in voice and data mode, SAR results for the most conservative *test separation distance* configuration may be used to support both SAR conditions. When the *reported* SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest *reported* SAR configuration for that wireless mode and frequency band should be repeated for the body-worn accessory with a headset attached to the handset.



8.2 Hotspot mode exposure position condition

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing function, the relevant hand and body exposure condition are tested according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surface and edges with a transmitting antenna located within 25 mm form that surface or edge. When form factor of a handset is smaller than 9cm x 5cm, a test separation distance of 5mm (instead of 10mm)is required for testing hotspot mode. When the separate distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration(surface).



9. Uncertainty

9.1 Measurement Uncertainty

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

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

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

9.2 System validation Uncertainty

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

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

10. Conducted Power Measurement

WLAN (2.4Gband)

Mode	Channel Number	Frequency (MHz)	Average Power (dBm)		
			Antenna A	Antenna B	Antenna A+B
802.11b	1	2412	21.12	20.21	N/A
	6	2437	21.30	20.17	N/A
	11	2462	21.74	20.34	N/A
802.11g	1	2412	20.51	19.25	N/A
	6	2437	20.73	19.51	N/A
	11	2462	20.84	19.36	N/A
802.11n(HT 20)	1	2412	19.61	18.42	22.07
	6	2437	19.42	18.31	21.91
	11	2462	19.90	18.62	22.32

WLAN (5.8band)

Mode	Channel Number	Frequency (MHz)	Average EIRP Power (dBm)		
			Antenna A	Antenna B	Antenna A+B
802.11a	149	5745	15.43	14.25	N/A
	157	5785	15.84	14.09	N/A
	165	5825	15.32	14.87	N/A
802.11 n-HT20	149	5745	16.07	14.75	18.470
	157	5785	15.29	14.65	17.992
	165	5825	14.90	14.21	17.579
802.11 n-HT40	151	5755	14.67	13.58	17.169
	159	5795	14.26	13.37	16.848
802.11ac(HT20)	149	5745	15.06	14.80	17.942
	157	5785	15.65	14.15	17.975
	165	5825	15.01	14.35	17.703
802.11ac(HT40)	151	5755	14.53	12.65	16.701
	159	5795	13.86	12.89	16.412
802.11ac(HT80)	155	5775	12.37	10.97	14.736

Bluetooth

Mode	Channel Number	Frequency (MHz)	Average Power (dBm)
GFSK(1Mbps)	0	2402	2.46
	39	2441	1.83
	78	2480	2.69
π/4-DQPSK(2Mbps)	0	2402	2.57
	39	2441	0.26
	78	2480	1.37
8DPSK(3Mbps)	0	2402	1.67
	39	2441	1.08
	78	2480	1.43

BLE

Mode	Channel Number	Frequency (MHz)	Average Power (dBm)
GFSK(1Mbps)	0	2402	-3.57
	19	2440	-4.35
	39	2480	-3.68
GFSK(2Mbps)	0	2402	-3.67
	19	2440	-4.59
	39	2480	-3.82

10.1 Tune-up Power

Mode	WLAN(AVG)		
	Antenna A	Antenna B	Antenna A+B
IEEE 802.11b	21±1dBm	20±1dBm	N/A
IEEE 802.11g	20±1dBm	19±1dBm	N/A
IEEE 802.11n(HT 20)	19±1dBm	18±1dBm	22±1dBm

	Mode	WLAN(AVG)		
		Antenna A	Antenna B	Antenna A+B
5800 MHz	802.11a	15±1dBm	14±1dBm	N/A
	802.11 n-HT20	15.1±1dBm	14±1dBm	18±1dBm
	802.11 n-HT40	14±1dBm	13±1dBm	17±1dBm
	802.11ac(HT20)	15±1dBm	14±1dBm	17±1dBm
	802.11ac(HT40)	14±1dBm	12±1dBm	16±1dBm
	802.11ac(HT80)	12±1dBm	10±1dBm	14±1dBm

Mode	BT(AVG)	
GFSK	2±1dBm	
π/4-DQPSK	Low	2±1dBm
	Middle	0±1dBm
	High	1±1dBm
8DPSK	1±1dBm	

Mode	BLE(AVG)
GFSK(1Mbps)	-4±1dBm
GFSK(2Mbps)	-4±1dBm

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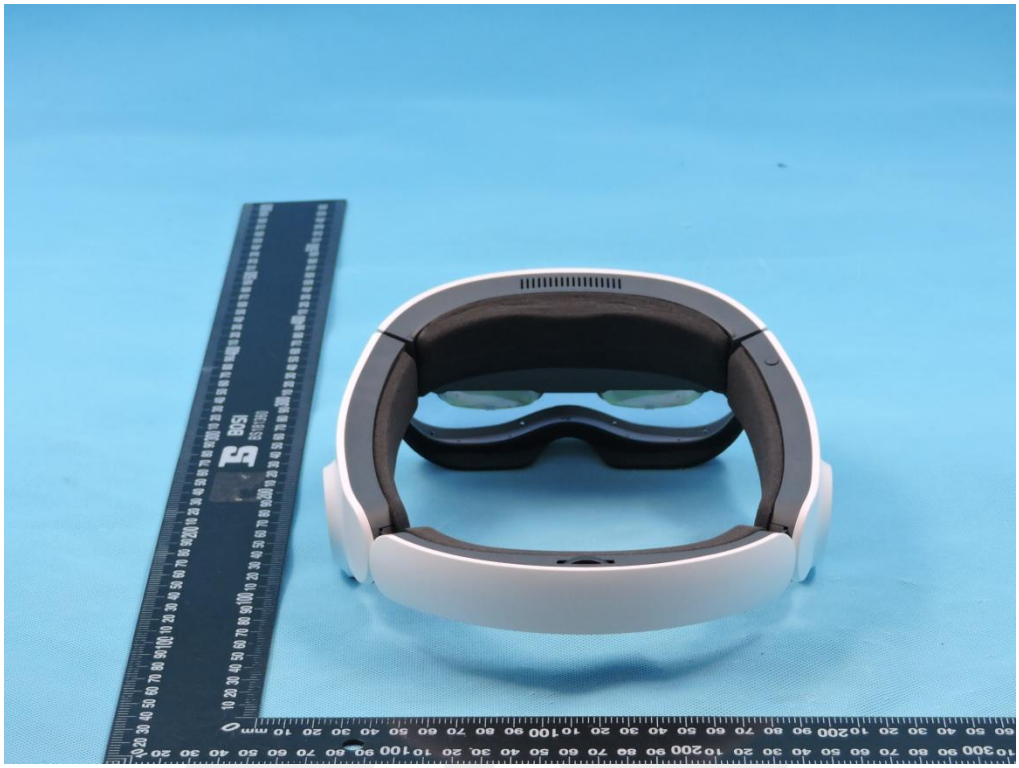
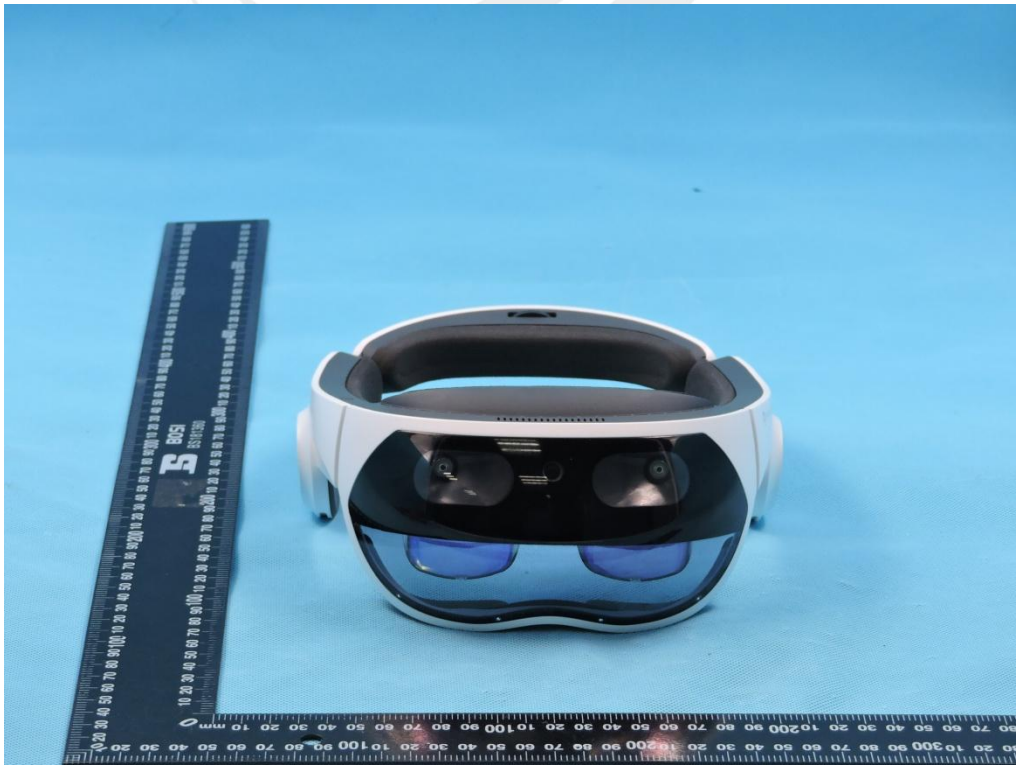
11. EUT And Test Setup Photo

11.1 EUT Photo

Front side



Back side



Edge1

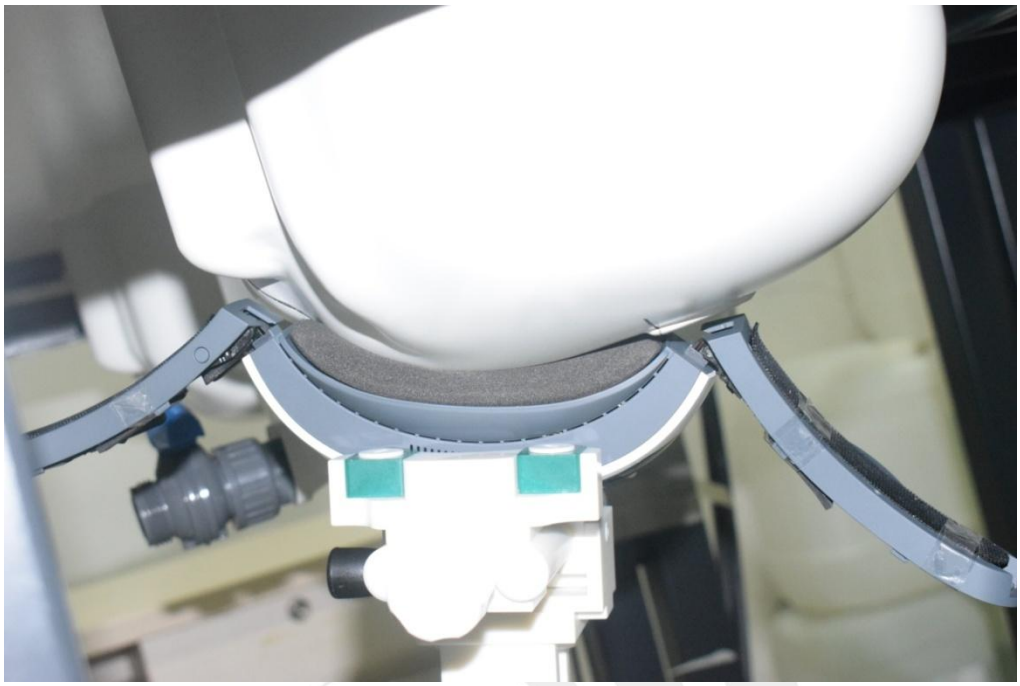
Edge2

Edge3

Edge4

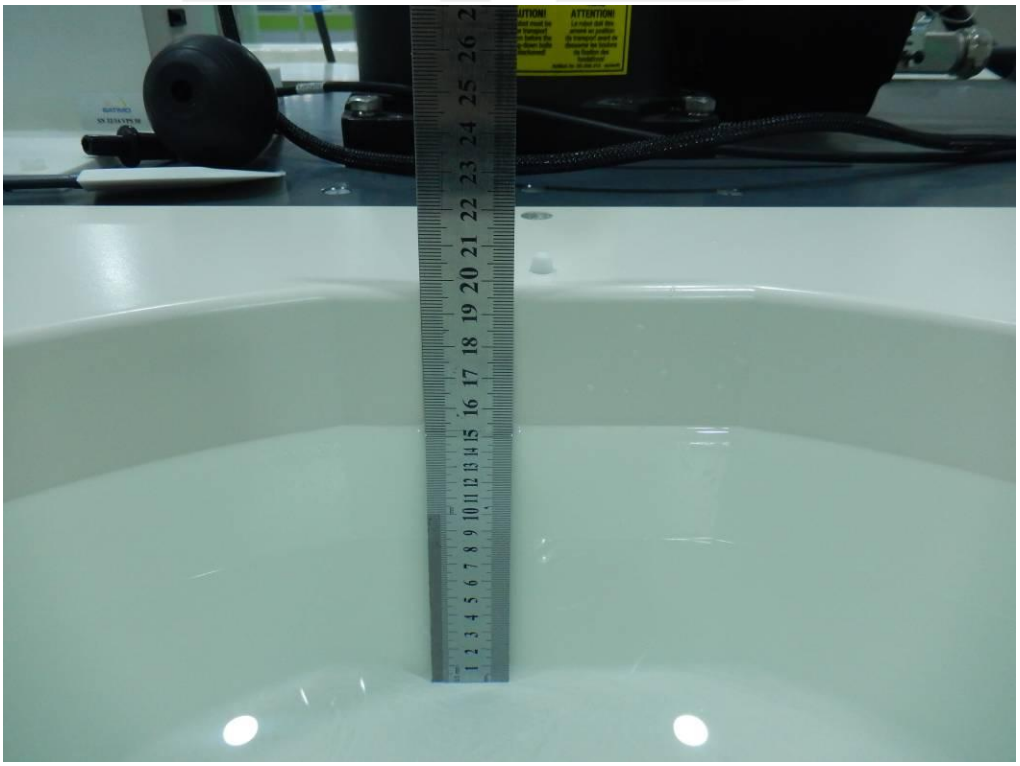
11.2 Setup Photo

Head



Note: Due to the curve radian, it is impractical to make the inner surface directly touch a flat phantom, thus a curved region of SAM phantom was used to keep the inner surface touching the phantom in testing, fully complying with the intended use condition.

Liquid depth (15 cm)



12. SAR Result Summary

12.1 Head Liquid SAR

802.11b（Antenna A）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 2.4G	802.11b	Head	11	0.046	1.59	22	21.74	100%	**0.049**	1

802.11b（Antenna B）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 2.4G	802.11b	Head	11	0.021	-0.88	21	20.34	100%	**0.024**	2

802.11n（Antenna A）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 2.4G	802.11n	Head	11	0.073	-3.98	20	19.90	100%	**0.075**	3

802.11n（Antenna B）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 2.4G	802.11n	Head	11	0.022	-1.88	19	18.62	100%	**0.024**	4

802.11a（Antenna A）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 5.8G	802.11a	Head	157	0.230	1.59	16	15.84	100%	**0.239**	5

802.11a（Antenna B）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 5.8G	802.11a	Head	165	0.190	2.01	15	14.87	100%	**0.196**	6

802.11n（Antenna A）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 5.8G	802.11n	Head	149	0.233	-0.69	16.1	16.07	100%	**0.235**	7

802.11n（Antenna B）

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Duty cycle(%)	Scaled SAR (W/Kg)	Meas. No.
WLAN 5.8G	802.11n	Head	149	0.067	3.94	15	14.75	100%	**0.071**	8

Note:

1. The test separation of all above table is 0mm.
2. Per KDB 447498 D01v05r01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For WWAN: Scaled SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor

Simultaneous Multi-band Transmission Evaluation:

1. Bluetooth and WLAN can't simultaneous transmission at the same time.
2. 2.4G WLAN and 5.8G WLAN can't simultaneous transmission at the same time.
3. For simultaneous transmission at head and body exposure position, 2 transmitters simultaneous transmission was the worst state.
4. Based upon KDB 447498 D01, BT SAR is excluded as below table.
5. If the test separation distance is <5mm, 5mm is used for excluded SAR calculation.
6. For minimum test separation distance≦50mm,Bluetooth standalone SAR is excluded according to [(max. power of channel, including tune-up tolerance, mW)/ (min. test separation distance, mm) ·[√f (GHz) /x] ≦3.0 for 1-g SAR and ≦7.5 for 10-g extremity SAR
7. The reported SAR summation is calculated based on the same configuration and test position.
8. KDB 447498 / 4.3.2 (2) when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
   a) (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.
   b) 0.4W/Kg for 1-g SAR and 1.0W/Kg for 10-g SAR, when the separation distance is >50mm.

Estimated SAR		Maximum Power		Antenna to user(mm)	Frequency(GHz)	Stand alone SAR(1g) [W/kg]
		dBm	mW			
BT	Head	3	1.995	5	2.480	0.084

Band	Mode	Liquid	Scaled SAR (W/Kg)		A+B
2.4G WLAN (MIMO)	802.11n	Head	Antenna A	0.075	**0.099**
			Antenna B	0.024	
5.8G WLAN (MIMO)	802.11ac	Head	Antenna A	0.235	**0.306**
			Antenna B	0.071	

13. Equipment List

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
2450MHzDipole	SATIMO	SID2450	SN 30/14 DIP2G450-335	2017.08.15	2020.08.14
Waveguide	SATIMO	SWG5500	SN 13/14 WGA32	2017.08.15	2020.08.14
E-Field Probe	MVG	SSE2	SN 45/15 EPGO281	2018.04.10	2019.04.09
Dielectric Probe Kit	SATIMO	SCLMP	SN 32/14 OCPG67	2017.12.03	2018.12.02
Antenna	SATIMO	ANTA3	SN 07/13 ZNTA52	N/A	N/A
Phantom1	SATIMO	SAM	SN 32/14 SAM115	2014.09.01	N/A
Phantom2	SATIMO	SAM	SN 32/14 SAM116	2014.09.01	N/A
Phone holder	SATIMO	N/A	SN 32/14 MSH97	2014.09.01	N/A
Laptop holder	SATIMO	N/A	SN 32/14 LSH29	2014.09.01	N/A
Network Analyzer	Agilent	8753ES	US38432810	2018.03.08	2019.03.07
Multi Meter	Keithley	Multi Meter 2000	4050073	2017.10.15	2018.10.14
Signal Generator	Agilent	N5182A	MY50140530	2017.10.15	2018.10.14
Wireless Communication Test Set	Agilent	8960-E5515C	MY48360751	2017.10.15	2018.10.14
Power Amplifier	DESAY	ZHL-42W	9638	2017.10.15	2018.10.14
Power Meter	R&S	NRP	100510	2017.10.15	2018.10.14
Power Meter	Agilent	E4418B	GB43312526	2017.10.15	2018.10.14
Power Sensor	R&S	NRP-Z11	101919	2017.10.15	2018.10.14
Power Sensor	Agilent	E9301A	MY41497725	2017.10.15	2018.10.14
9dB Attenuator	Agilent	99899	DC-18GHz	2018.05.09	2019.05.08
11dB Attenuator	Agilent	8494B	DC-18GHz	2018.05.09	2019.05.08
110dB Attenuator	Agilent	8494B	DC-18GHz	2018.05.09	2019.05.08
Dual Directional Coupler	Agilent	SHWPDI-1080S	N/A	2017.10.15	2018.10.14
hygrothermograph	MiEO	HH660	N/A	2017.10.18	2018.10.17
Thermograph	Elitech	RC-4	S/N EF7176501537	2017.11.10	2018.11.09

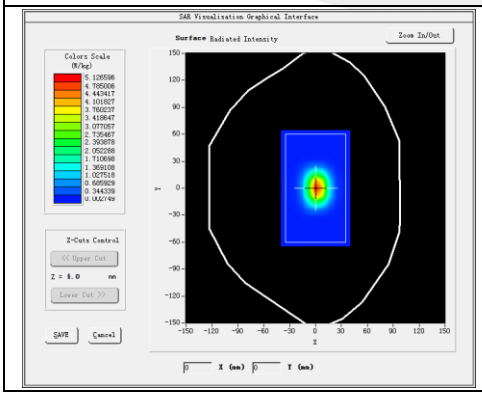
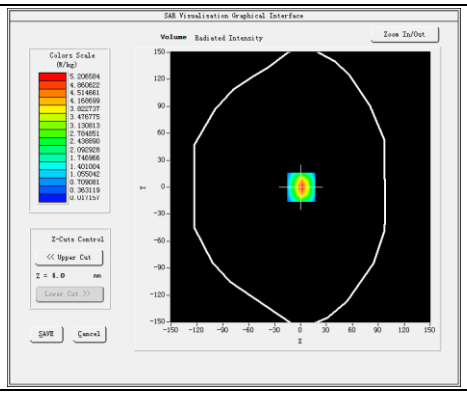
Appendix A. System Validation Plots

System Performance Check Data (2450MHz Head)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2018-10-12
Measurement duration: 13 minutes 51seconds

Experimental conditions.

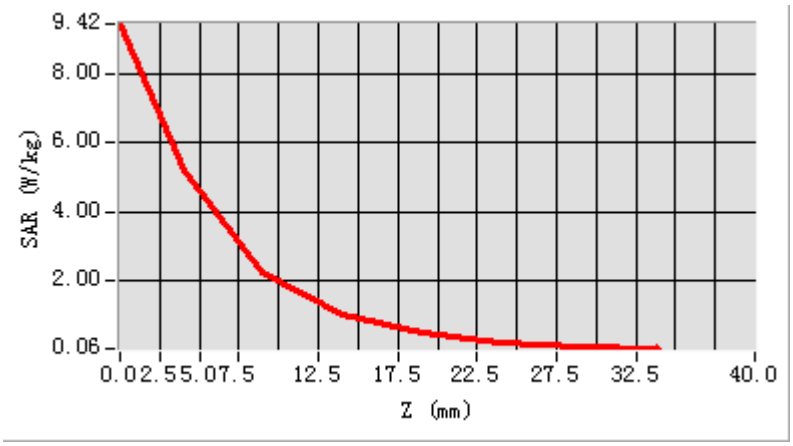
Device Position	Validation plane
Band	2450 MHz
Channels	-
Signal	CW
Frequency (MHz)	2450
Relative permittivity	38.96
Conductivity (S/m)	1.75
Power drift (%)	-0.38
Probe	SN 45/15 EPGO281
ConvF	2.21
Crest factor:	1:1

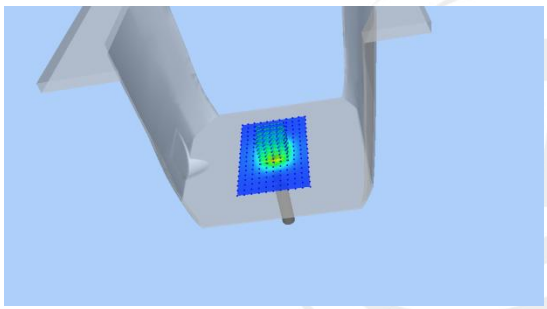
SURFACE SAR	VOLUME SAR
	

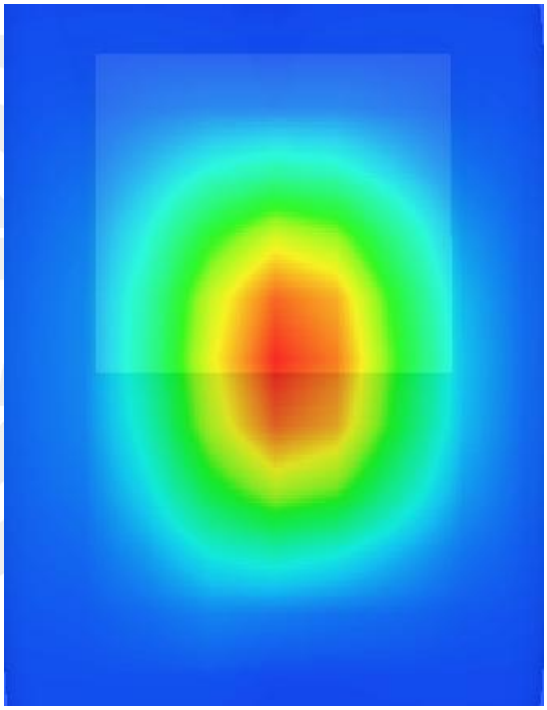
Maximum location: X=1.00, Y=0.00

SAR 10g (W/Kg)	2.425901
SAR 1g (W/Kg)	5.266810

Z Axis Scan


9.42
8.00
6.00
4.00
2.00
0.06
SAR (W/kg)
0.0 2.5 5.0 7.5 12.5 17.5 22.5 27.5 32.5 40.0
Z (mm)



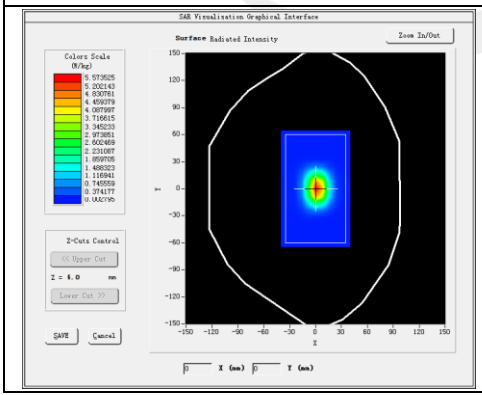
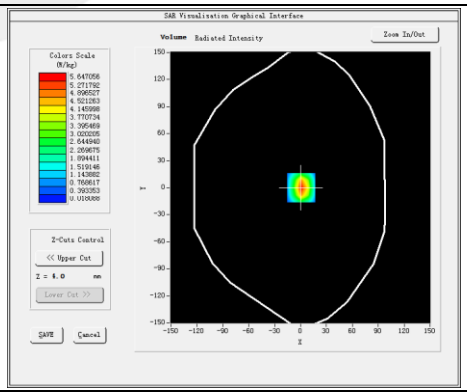


System Performance Check Data(5800MHz Head)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=4mm, dy=4mm, dz=2mm
Date of measurement: 2018-10-13

Experimental conditions.

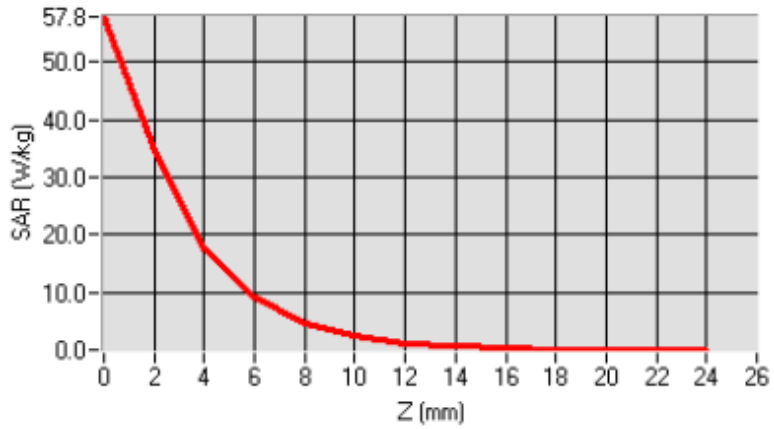
Device Position	Validation plane
Band	5800 MHz
Channels	-
Signal	CW
Frequency (MHz)	5800
Relative permittivity	35.45
Conductivity (S/m)	5.30
Power drift (%)	2.74
Probe	SN 45/15 EPGO281
ConvF	2.53
Crest factor:	1:1

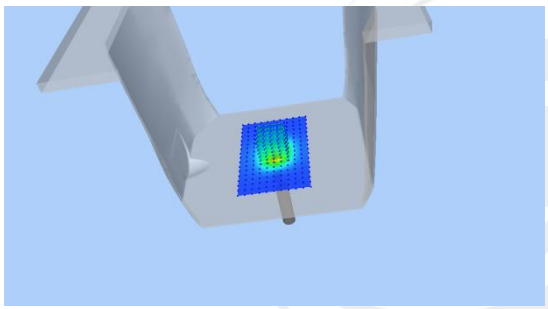
SURFACE SAR	VOLUME SAR
	

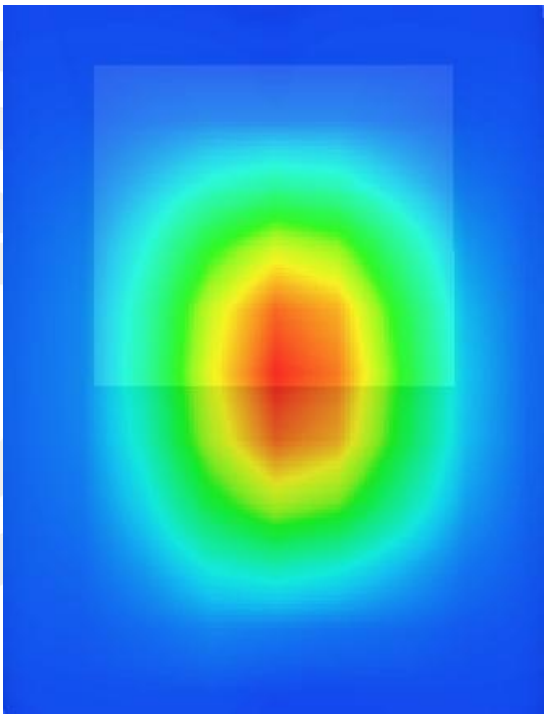
Maximum location: X=7.00, Y=2.00

SAR 10g (W/Kg)	5.818102
SAR 1g (W/Kg)	17.852147

Z Axis Scan


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





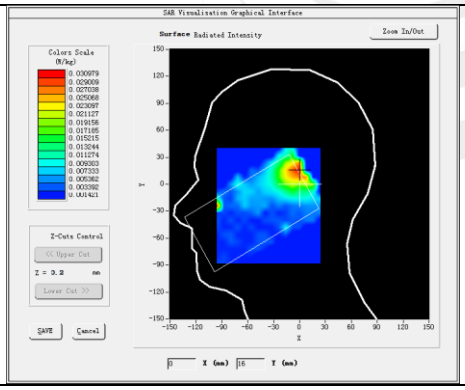
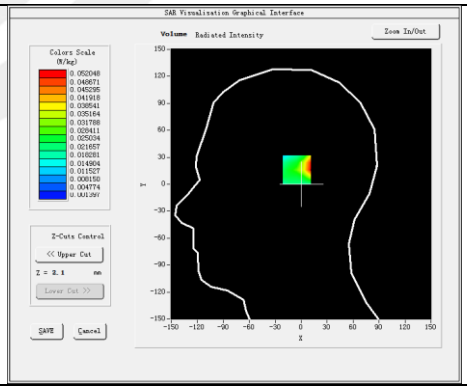
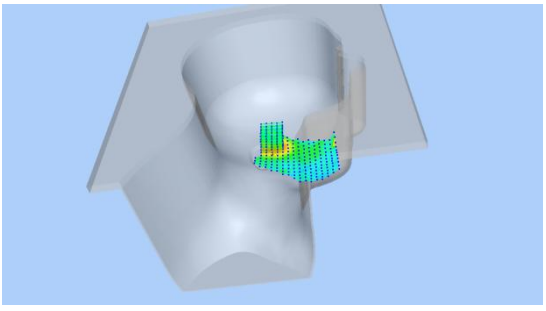
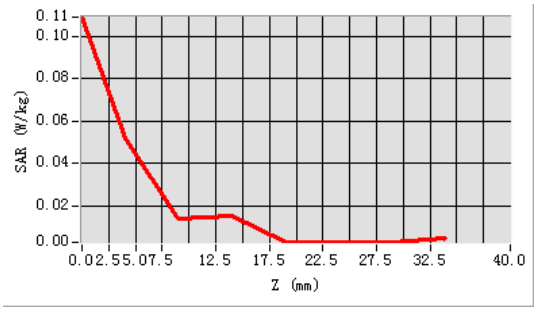
Appendix B. SAR Test Plots

Plot 1: DUT: Mixed Reality HDM; EUT Model: Action One A01

Test Date	2018-10-12
Probe	SN 45/15 EPGO281
ConvF	2.28
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Head
Antenna	A
Band	IEEE 802.11b ISM
Channels	High
Signal	IEEE802.b (Crest factor: 1.0)
Frequency (MHz)	2462
Relative permittivity (real part)	39.2
Conductivity (S/m)	1.80
Variation (%)	1.59

Maximum location: X=0.00, Y=16.00
SAR Peak: 0.09 W/kg

SAR 10g (W/Kg)	0.020203
SAR 1g (W/Kg)	0.046014

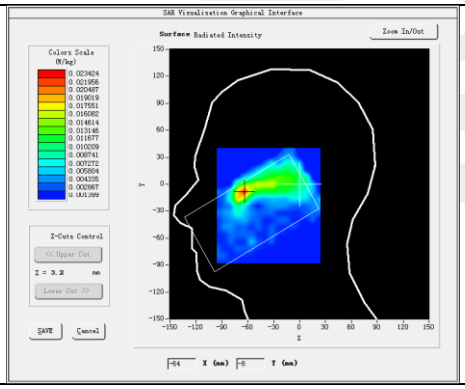
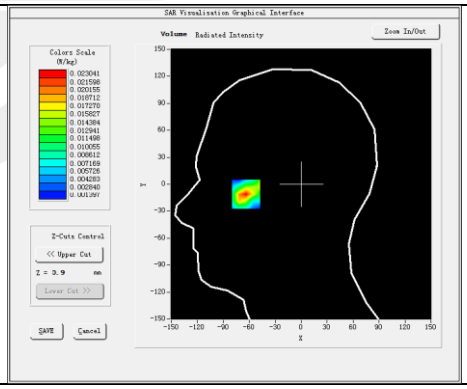
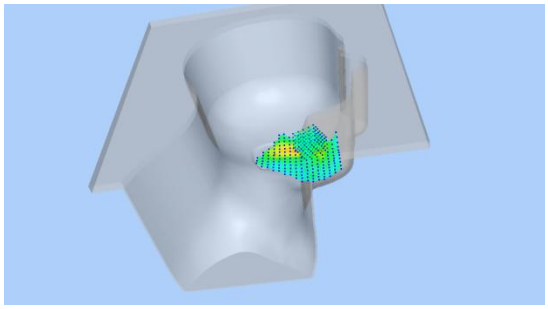
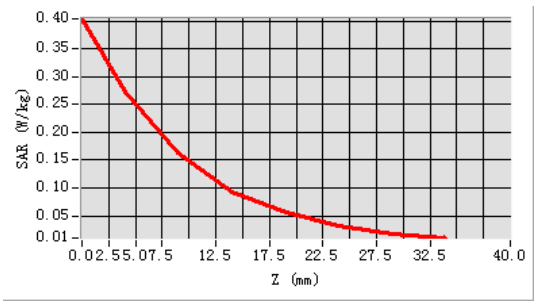
SURFACE SAR	VOLUME SAR
	
3D	**Z Axis Scan**
	

Plot 2: DUT: Mixed Reality HDM; EUT Model: Action One A01

Test Date	2018-10-12
Probe	SN 45/15 EPGO281
ConvF	2.28
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Head
Antenna	B
Band	IEEE 802.11b ISM
Channels	High
Signal	IEEE802.b (Crest factor: 1.0)
Frequency (MHz)	2462
Relative permittivity (real part)	39.2
Conductivity (S/m)	1.80
Variation (%)	-0.88

Maximum location: X=-64.00, Y=-8.00
SAR Peak: 0.04 W/kg

SAR 10g (W/Kg)	0.008936
SAR 1g (W/Kg)	0.021231

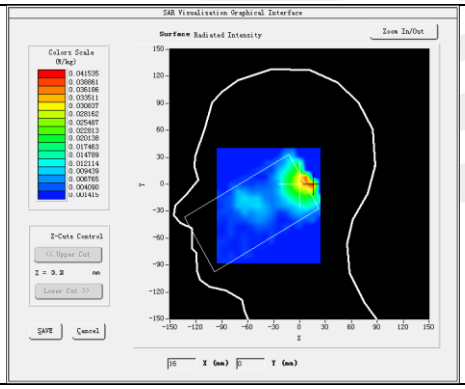
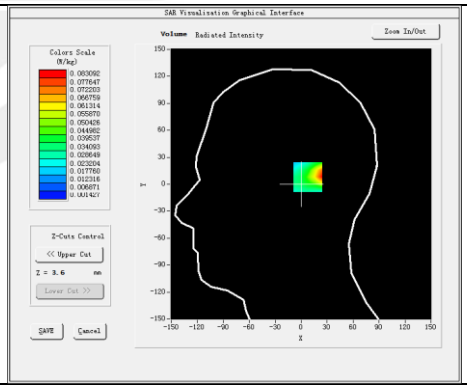
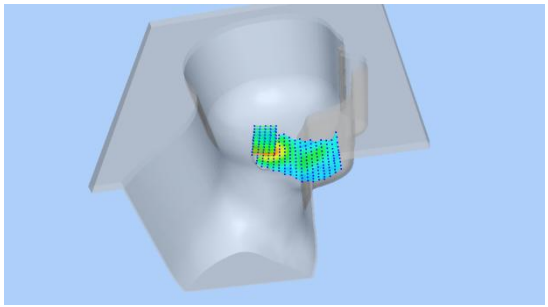
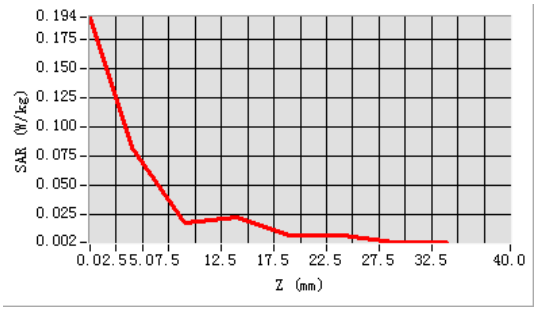
SURFACE SAR	VOLUME SAR
	
3D	**Z Axis Scan**
	

Plot 3: DUT: Mixed Reality HDM; EUT Model: Action One A01

Test Date	2018-10-12
Probe	SN 45/15 EPGO281
ConvF	2.28
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Head
Antenna	A
Band	IEEE 802.11n ISM
Channels	High
Signal	IEEE802.b (Crest factor: 1.0)
Frequency (MHz)	2462
Relative permittivity (real part)	39.2
Conductivity (S/m)	1.80
Variation (%)	-3.98

Maximum location: X=16.00, Y=8.00
SAR Peak: 0.14 W/kg

SAR 10g (W/Kg)	0.031724
SAR 1g (W/Kg)	0.072894

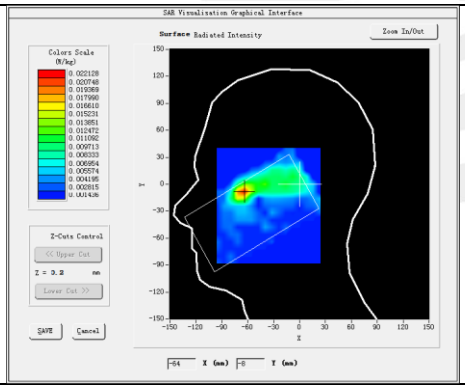
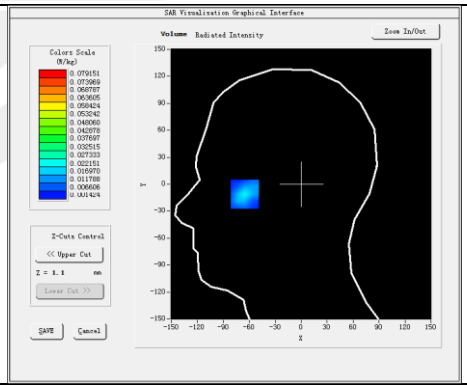
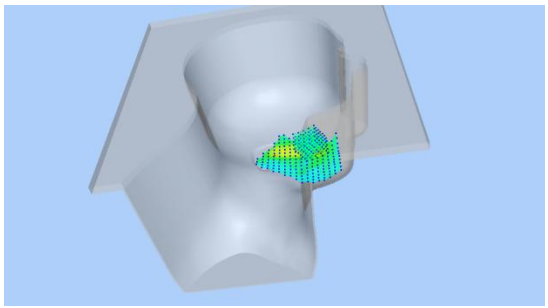
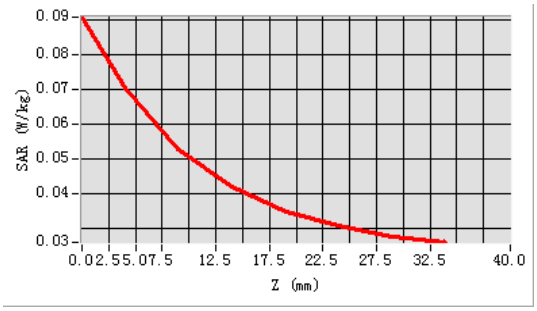
SURFACE SAR	VOLUME SAR
	
3D	**Z Axis Scan**
	

Plot 4: DUT: Mixed Reality HDM; EUT Model: Action One A01

Test Date	2018-10-12
Probe	SN 45/15 EPGO281
ConvF	2.28
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Head
Antenna	B
Band	IEEE 802.11n ISM
Channels	High
Signal	IEEE802.b (Crest factor: 1.0)
Frequency (MHz)	2462
Relative permittivity (real part)	39.2
Conductivity (S/m)	-1.40
Variation (%)	-1.88

Maximum location: X=-65.00, Y=-8.00
SAR Peak: 0.09 W/kg

SAR 10g (W/Kg)	0.008468
SAR 1g (W/Kg)	0.022325

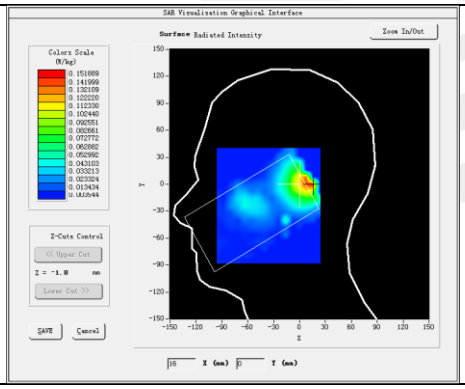
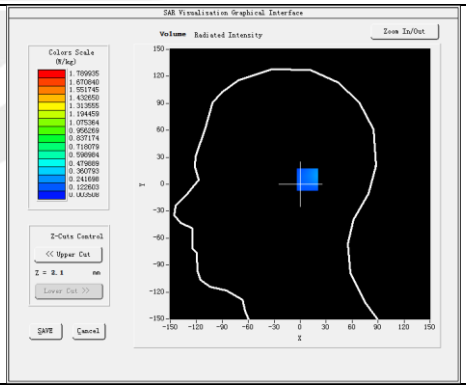
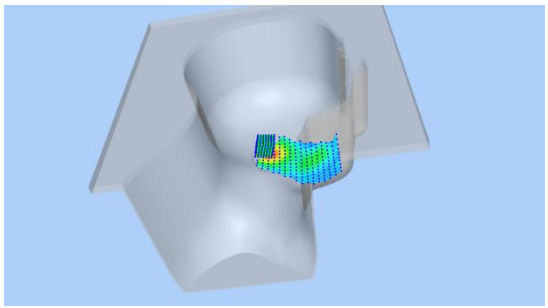
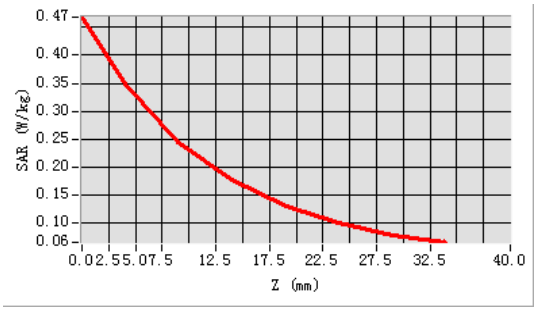
SURFACE SAR	VOLUME SAR
	
3D	**Z Axis Scan**
	

Plot 5: DUT: Mixed Reality HDM; EUT Model: Action One A01

Test Date	2018-10-13
Probe	SN 45/15 EPGO281
ConvF	2.52
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Head
Antenna	A
Band	IEEE 802.11a ISM
Channels	Middle
Signal	IEEE802.a (Crest factor: 1.0)
Frequency (MHz)	5785
Relative permittivity (real part)	35.3
Conductivity (S/m)	5.27
Variation (%)	1.59

Maximum location: X=16.00, Y=5.00
SAR Peak: 0.47 W/kg

SAR 10g (W/Kg)	0.097151
SAR 1g (W/Kg)	0.230212

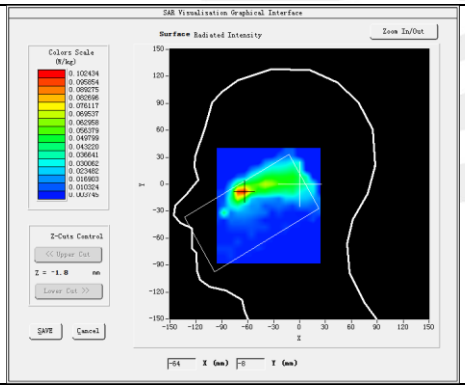
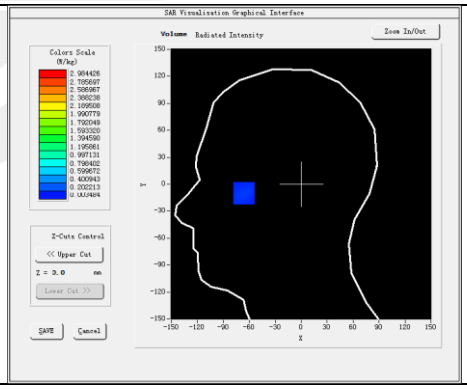
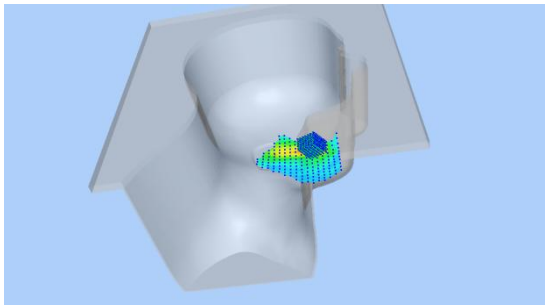
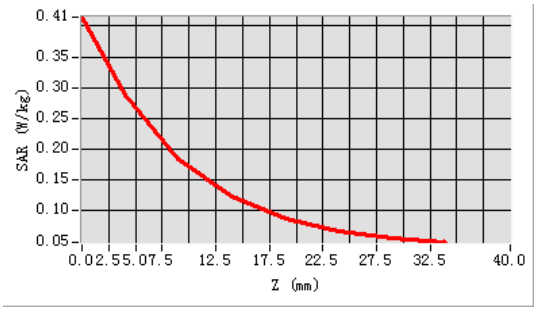
SURFACE SAR	VOLUME SAR
	
3D	**Z Axis Scan**
	

Plot 6: DUT: Mixed Reality HDM; EUT Model: Action One A01

Test Date	2018-10-13
Probe	SN 45/15 EPGO281
ConvF	2.52
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Head
Antenna	B
Band	IEEE 802.11a ISM
Channels	High
Signal	IEEE802.a (Crest factor: 1.0)
Frequency (MHz)	5825
Relative permittivity (real part)	35.3
Conductivity (S/m)	5.27
Variation (%)	2.01

Maximum location: X=-66.00, Y=-8.00
SAR Peak: 0.41 W/kg

SAR 10g (W/Kg)	0.064490
SAR 1g (W/Kg)	0.190246

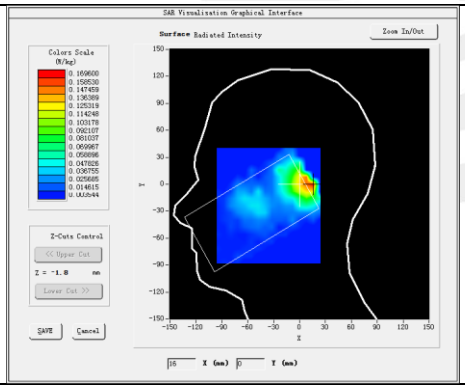
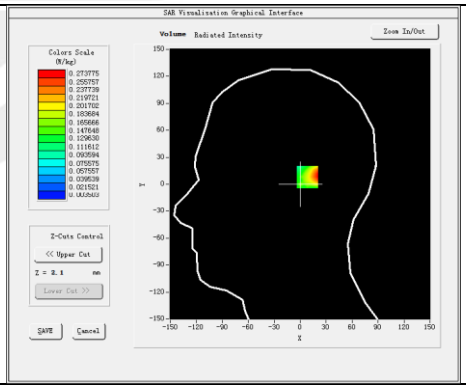
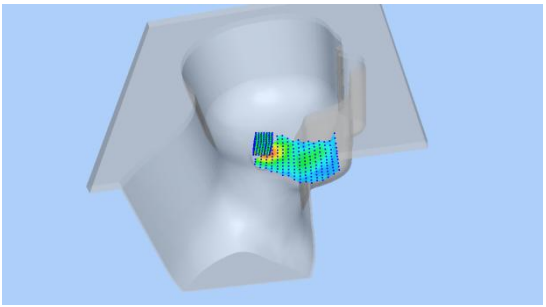
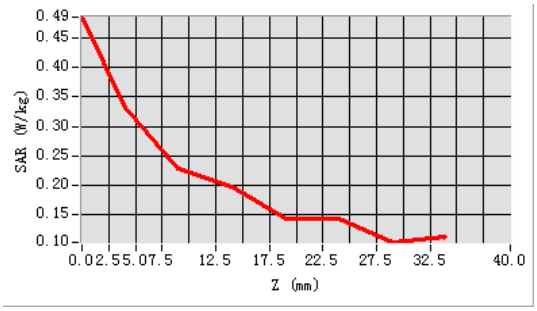
SURFACE SAR	VOLUME SAR
	
3D	**Z Axis Scan**
	

Plot 7: DUT: Mixed Reality HDM; EUT Model: Action One A01

Test Date	2018-10-13
Probe	SN 45/15 EPGO281
ConvF	2.52
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Head
Antenna	A
Band	IEEE 802.11ac ISM
Channels	Low
Signal	IEEE802.ac (Crest factor: 1.0)
Frequency (MHz)	5745
Relative permittivity (real part)	35.3
Conductivity (S/m)	5.27
Variation (%)	-0.69

Maximum location: X=16.00, Y=8.00
SAR Peak: 0.49 W/kg

SAR 10g (W/Kg)	0.107237
SAR 1g (W/Kg)	0.233204

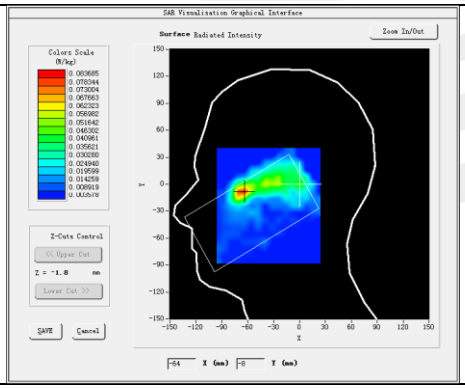
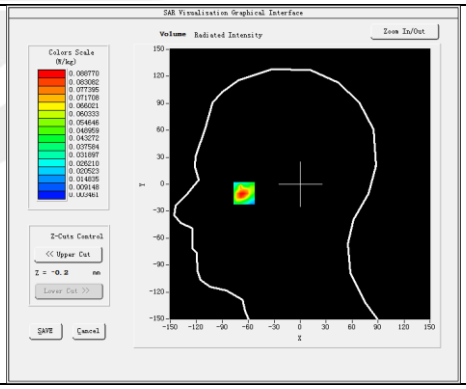
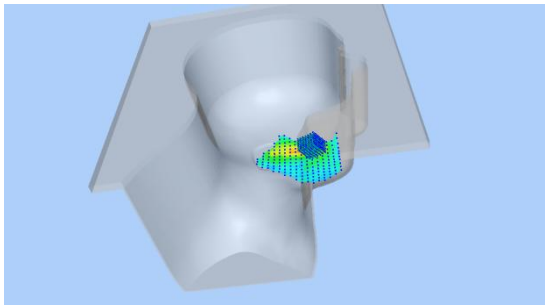
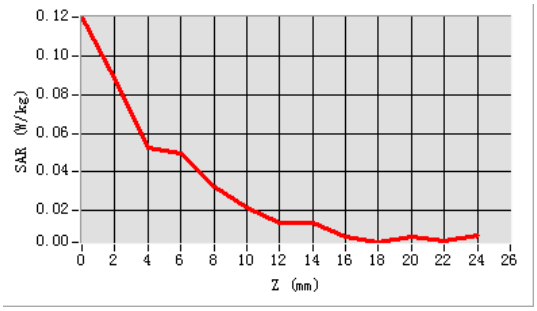
SURFACE SAR	VOLUME SAR
	
3D	**Z Axis Scan**
	

Plot 8: DUT: Mixed Reality HDM; EUT Model: Action One A01

Test Date	2018-10-13
Probe	SN 45/15 EPGO281
ConvF	2.52
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x12,dx=4mm dy=4mm dz=2mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Head
Antenna	B
Band	IEEE 802.11ac ISM
Channels	Low
Signal	IEEE802.ac (Crest factor: 1.0)
Frequency (MHz)	5745
Relative permittivity (real part)	35.3
Conductivity (S/m)	5.27
Variation (%)	3.94

Maximum location: X=-65.00, Y=-8.00
SAR Peak: 0.20 W/kg

SAR 10g (W/Kg)	0.031609
SAR 1g (W/Kg)	0.066726

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

Appendix C. Probe Calibration And Dipole Calibration Report

Refer the appendix Calibration Report.

※※※※※END OF THE REPORT※※※※※