FCC SAR TEST REPORT

Report No: STS1710103H01

Issued for

Fujian Wanhua Electron & Technology Co., Ltd.

No.926 Nanhuan Road Licheng District Quanzhou Fujian, China

Product Name:	Digital Two-way Radio
Brand Name:	Olywiz
Model Name:	ATS-200
Series Name:	ATS-100
FCC ID:	2AMMP-ATS-200
Test Standard:	IEEE 1528: 2013
	47CFR §2.1093
Max. Report SAR (1g):	Face up : 1.042 W/kg
	Body touch: 1.730 W/kg

Shenzhen STS Test Services Co., Ltd.
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TEL: +86-755 3688 6288   FAX: +86-755 3688 6277   E-mail:sts@stsapp.com

Test Report Certification

Applicant's name ....: Fujian Wanhua Electron & Technology Co., Ltd.

Address ....: No.926 Nanhuan Road Licheng District Quanzhou Fujian, China

Manufacture's Name ....: Fujian Wanhua Electron & Technology Co., Ltd.

Address ....: No.926 Nanhuan Road Licheng District Quanzhou Fujian, China

Product description

Product name ....: Digital Two-way Radio

Brand name ....: Olywiz

Model name ....: ATS-200

Series name...........................: ATS-100

Standards ....: IEEE 1528:2013
47CFR §2.1093

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 ....: 28 Nov. 2017

Date of Issue..: 29 Nov. 2017

Test Result...: **Pass**

Testing Engineer :

(Aaron Bu)

Technical Manager :

(John Zou)

Authorized Signatory :

(Vita Li)

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1.General Information

1.1 EUT Description

Product Name	Digital Two-way Radio		
Brand Name	Olywiz		
Model Name.	ATS-200		
Series Name	ATS-100		
FCC ID	2AMMP-ATS-200		
Model Difference	Only different are appearance and model name.		
Adapter	Input: AC 100-240V, 250mA, 50/60 Hz Output: DC 12V, 500mA		
Battery	Rated Voltage: 7.4V; Charge Limit: 8.4V; Capacity: 1400mAh		
Rated Power:	5W/0.5W		
Device Category	Portable		
Product stage	Production unit		
RF Exposure Environment	General Population / Uncontrolled		
Hardware Version	ATS200U1		
Software Version	ATS200-DCDC-170405.hex		
Frequency Range	406.1 MHz – 470 MHz		
Channel Spacing:	12.5KHz		
Max. Reported SAR(1g):	with 50% duty cycle	Face up (W/kg)	Body touch (W/kg)
		1.042	1.730
Modulation Type:	4FSK		
Exposure Category:	Occupational/Controlled Exposure		
Note: 1. 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	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
2	Health Canada's Safety Code 6	Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3KHz to 300 GHz - Safety Code 6 (2009)
3	RSS 102 Issue 5,March 2015	Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)
4	KDB 447498 D01 v06	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
5	KDB 865664 D01 v01r04	SAR Measurement 100 MHz to 6 GHz
6	KDB 865664 D02 v01r02	RF Exposure Reporting
7	KDB 643646 D01 v01r03	SAR Test for PTT Radios

(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 8.0 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:

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

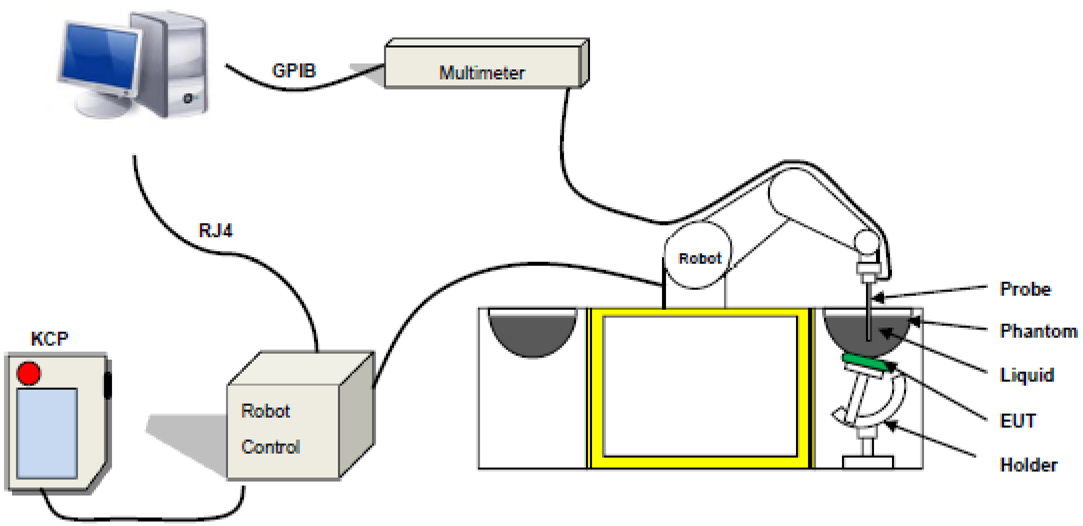
SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

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

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

MVG SAR System Diagram:



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

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

The following figure shows the system.

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

3.2.1 Probe

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

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

Figure 1-MVG COMOSAR Dosimetric E field Dipole

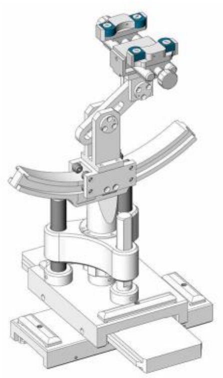
3.2.2 Phantom

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

Figure-SN 32/14 SAM115

Figure-SN 32/14 SAM116

3.2.3 Device Holder



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

4. Tissue Simulating Liquids

4.1 Simulating Liquids Parameter Check

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

Frequency (MHz)	Bactericide	DGBE	HEC	NaCl	Sucrose	1,2-Propanediol	X100	Water	Conductivity	Permittivity
	%	%	%	%	%	%	%	%	σ	εr
450	0.19	/	0.98	3.95	56.32	/	/	38.56	0.85	43.4
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]					
2017-11-28	23.2	51	450 MHz	22.7	Permittivity:	43.50	43.05	-1.03	± 5
					Conductivity	0.87	0.87	0.00	± 5

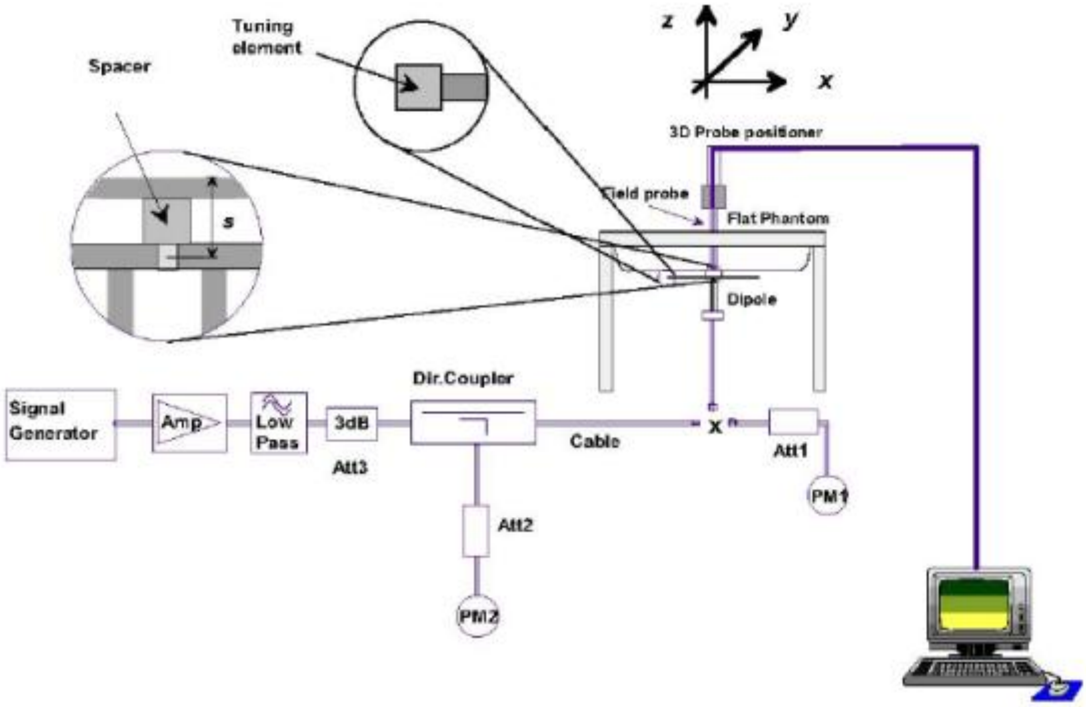
Date	Ambient condition		Body Simulating Liquid		Parameters	Target	Measured	Deviation [%]	Limited [%]
	Temp. [°C]	Humidity [%]	Frequency	Temp. [°C]					
2017-11-28	23.2	51	450 MHz	22.7	Permittivity:	56.7	55.72	-1.73	± 5
					Conductivity	0.94	0.92	-2.13	± 5

5. SAR System Validation

5.1 Validation System

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

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



5.2 Validation Result

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

Freq.(MHz)	Power(mW)	Tested Value (W/Kg)	Normalized SAR (W/kg)	Target(W/Kg)	Tolerance(%)	Date
450 Head	100	0.460	4.60	4.58	0.65	2017-11-28
450 Body	100	0.473	4.73	4.58	2.89	2017-11-28

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 Digital Two-way Radio 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.

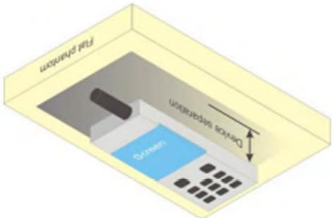
When the 1-g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

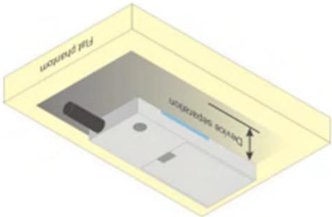
7. EUT Test Position

This EUT was tested in Front Face and Rear Face.

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.

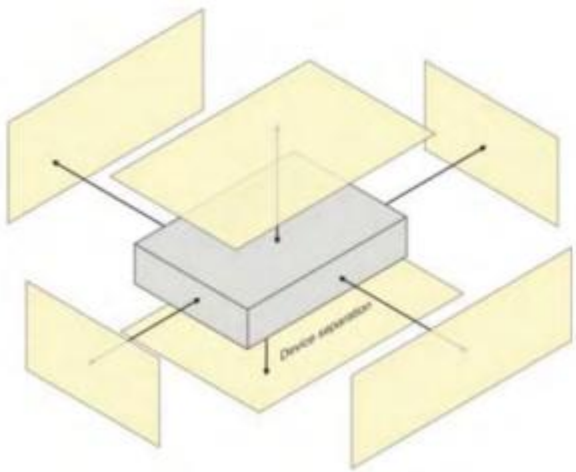




7.1 Body mode exposure position condition

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

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



8. Uncertainty

8.1 Measurement Uncertainty

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

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

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

8.2 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	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.43	1.43	∞
3	Hemispherical isotropy	5.9	R	√3	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
4	Boundary effect	1.0	R	√3	1	1	0.58	0.58	∞
5	Linearity	4.7	R	√3	1	1	2.71	2.71	∞
6	System Detection limits	1.0	R	√3	1	1	0.58	0.58	∞
7	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%	

9. Conducted Power Measurement

Test Result

Modulation Type	Channel Separation	Mode	Test Channel	Test Frequency	Transmitter Power Rated High power level (dBm)	Transmitter Power Rated High power level (Watts)	Tune up Power High power level (dBm)
Digital/4FSK	12.5KHz	1	CH01	406.5 MHz	36.323	4.288	37.0
			CH02	435.0 MHz	36.021	4.000	37.0
			CH03	469.5 MHz	36.073	4.049	37.0
		2	CH01	406.5 MHz	26.178	0.415	27.0
			CH02	435.0 MHz	25.910	0.390	26.0
			CH03	469.5 MHz	26.056	0.403	27.0

Mode 1:

The equipment is set with 4FSK modulation and 12.5KHz bandwidth at maximum rated power for transmitter, powered by DC 13.60V.

Mode 2:

The equipment is set with 4FSK modulation and 12.5KHz bandwidth at minimum rated power for transmitter, powered by DC 13.60V.

10. EUT And Test Setup Photo

10.1 EUT Photo

Front side

Back side

Top side

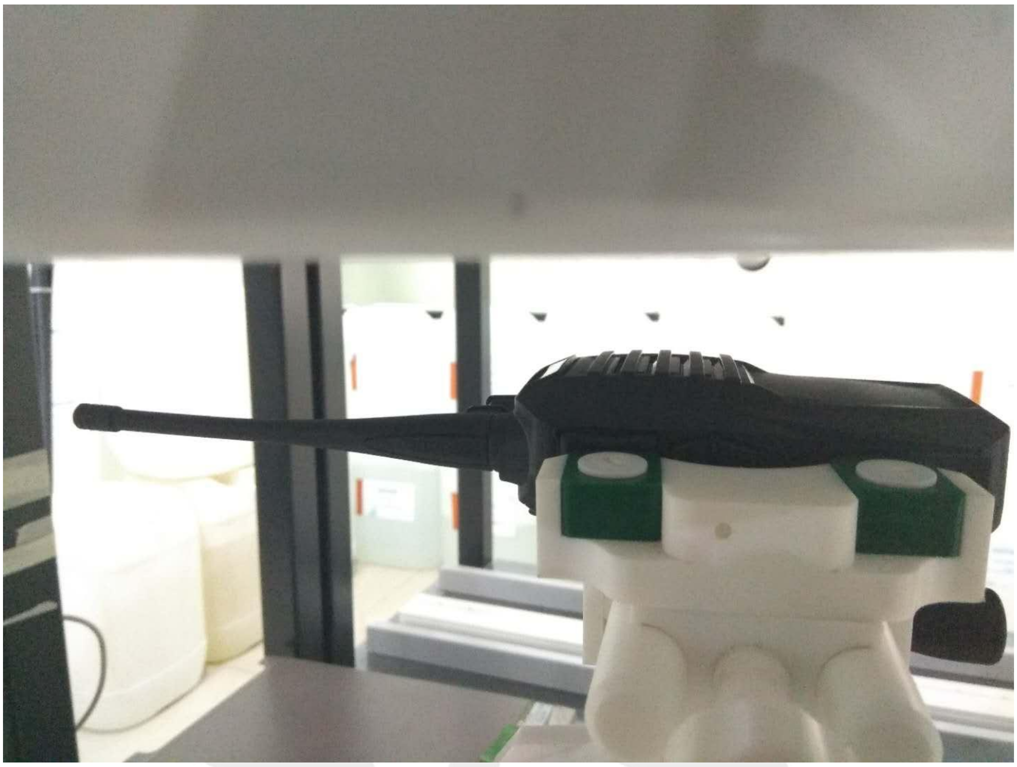
Bottom side

Left side

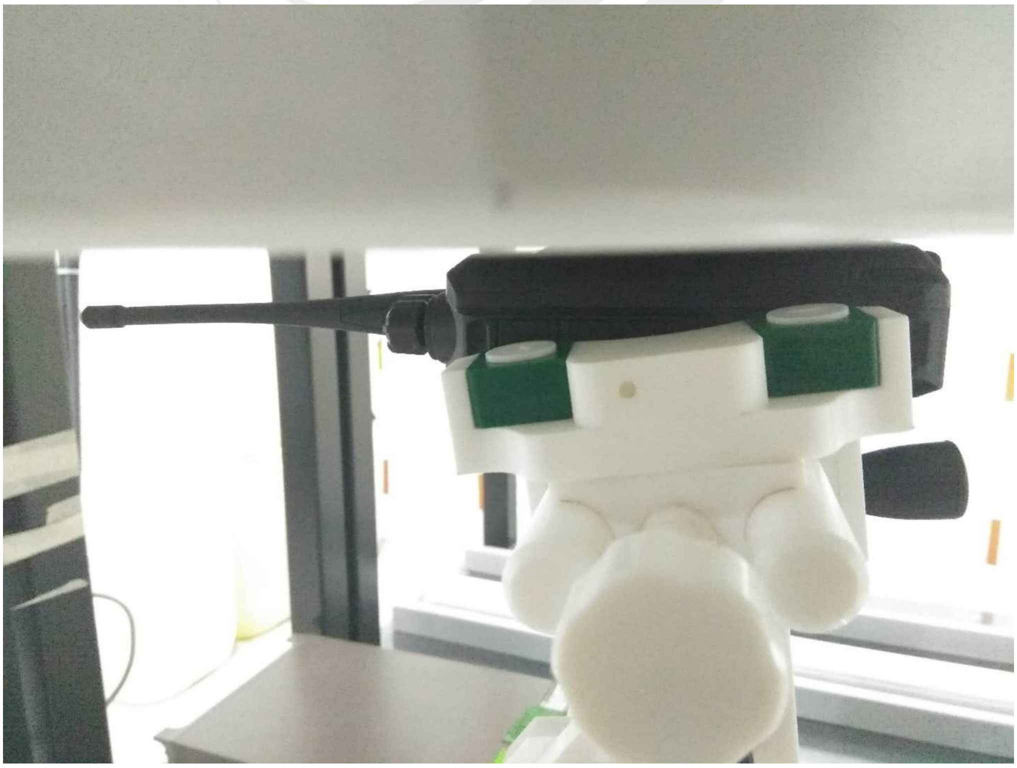
Right side

10.2 Setup Photo

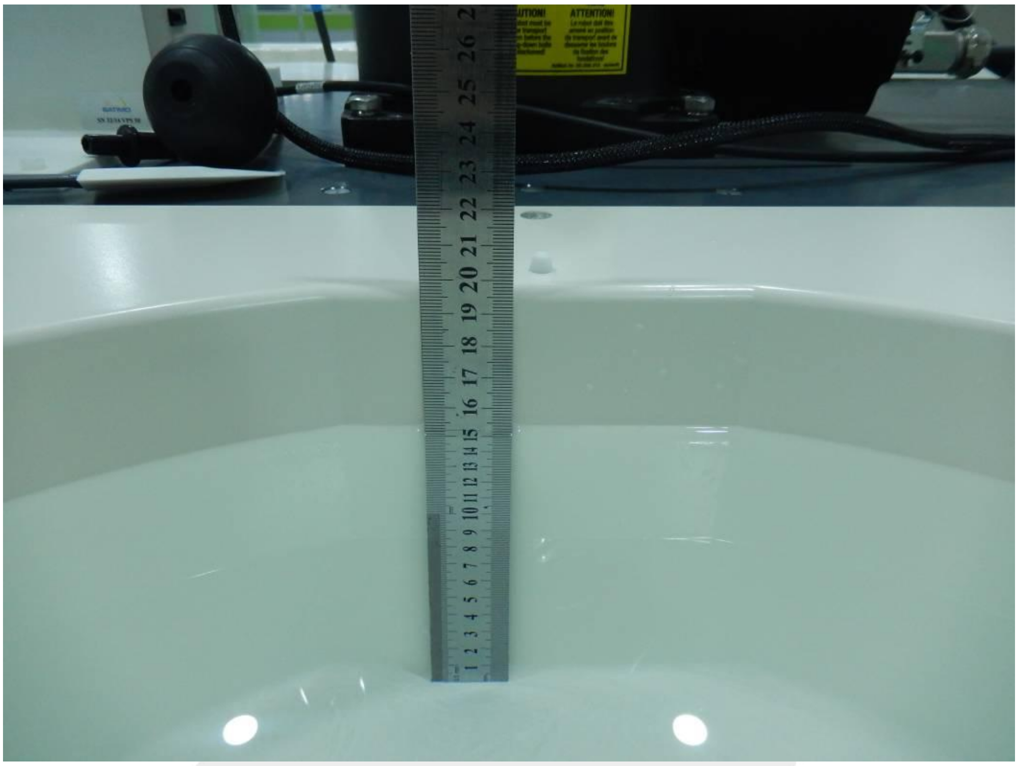
Body Front side(separation distance is 25mm)



Body Back side(separation distance is 0mm)



Liquid depth (15 cm)



11. SAR Result Summary

Summary of Measurement Result

Phantom Configurations	Frequency	Mode	Power Drift(%)	SAR 1g with 100% duty cycle (W/Kg)	SAR 1g with 50% duty cycle (W/Kg)	Scaling Factor	Scaling SAR (W/Kg)	Limit (W/Kg)	Meas. No.
Face up (2.5 cm Separation)	406.5	1	2.37	1.782	0.891	1.169	**1.042**	8.0	1
Back touch (direct)	406.5		1.13	2.959	1.480	1.169	**1.730**	8.0	2
Face up (2.5 cm Separation)	435.0		-1.65	1.537	0.769	1.253	0.963	8.0	/
Back touch (direct)	435.0		0.01	2.631	1.316	1.253	1.648	8.0	/
Face up (2.5 cm Separation)	469.5		-2.74	1.594	0.797	1.238	0.987	8.0	/
Back touch (direct)	469.5		3.82	2.644	1.322	1.238	1.637	8.0	/
Face up (2.5 cm Separation)	406.5	2	-1.49	0.572	0.286	1.208	0.345	8.0	/
Back touch (direct)	406.5		0.27	1.223	0.612	1.208	0.739	8.0	/
Face up (2.5 cm Separation)	435.0		-1.65	0.531	0.266	1.021	0.271	8.0	/
Back touch (direct)	435.0		-0.57	1.158	0.579	1.021	0.591	8.0	/
Face up (2.5 cm Separation)	469.5		-3.11	0.548	0.274	1.243	0.341	8.0	/
Back touch (direct)	469.5		3.78	1.194	0.597	1.243	0.742	8.0	/
Note: when the 1-g SAR of middle channel is≤3.5W/Kg, testing for other channel is optional. Refer to KDB 643646.									

Note:

1. When devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body-worn accessories, must be tested for SAR compliance using a conservative minimum test separation distance ≤ 5 mm to support compliance refer to KDB447498.
2. Except when area scan based 1-g SAR estimation applies, a zoom scan measurement is required at the highest peak SAR location determined in the area scan to determine the 1-g SAR. 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 refer to KDB865664D01v01r04.
3. When the highest reported SAR is <6.0 W/Kg (based on 50% Duty Cycle), PBA is not required according to KDB643646 and KDB388624 D02;
4. Testing antennas with the default battery: Starting by testing a PTT radio with a standard battery (default battery) that is supplied with the radio to measure the head SAR of each antenna on the highest output power channel, according to test channels required by KDB447498 and in the frequency range covered by each antenna within the operating frequency bands of the radio. When

multiple standard batteries are supplied with a radio, the battery with the highest capacity is considered the default battery for making head SAR measurements:

When the head SAR of antenna tested in above description is:

a. ≤3.5 W/Kg. testing of all other required channels is not necessary for that antenna;
b. >3.5 W/Kg and ≤4.0 W/Kg, testing of the required immediately adjacent channel(s) is not necessary, testing of the other required channels maybe still be required.
c. >4.0 W/Kg and ≤6.0 W/Kg, Head SAR should be measured for that antenna on the required immediately adjacent channel(s) is not necessary, testing of the other required channels still needs consideration.
d. >6.0 W/Kg, test all required channels for that antenna.
e. For the remaining channels that cannot be excluded in b) and c), which still require consideration, the 3.5 W/Kg exclusion in a) and 4.0 W/Kg exclusion in b) may be applied recursively with respect to the highest output power channel among the remaining channels; measure the SAR for the remaining channels that cannot be excluded.

i) If an immediately adjacent channel measured in c) or a remaining channel measured in e)is >6.0 W/Kg, test all required channels for that antenna.

5. Testing antennas with the default battery: Starting by testing a PTT radio with the thinnest battery and standard (default) body-worn accessory that are both supplied with the radio and if applicable, a default audio accessory, to measure the body SAR of each antenna on the highest output power channel, according to test channels required by KDB447498 and in the frequency range covered by each antenna within the operating frequency bands of the radio. When multiple standard body-worn accessories are supplied with a radio, the standard body-worn accessory expected to result in the highest SAR based on its exposure conditions is considered the default body-worn accessory for making body-worn SAR measurements:

   When the head SAR of antenna tested in above description is:

   a. ≤3.5 W/Kg. testing of all other required channels is not necessary for that antenna;
   b. >3.5 W/Kg and ≤4.0 W/Kg, testing of the required immediately adjacent channel(s) is not necessary, testing of the other required channels maybe still be required.
   c. >4.0 W/Kg and ≤6.0 W/Kg, Head SAR should be measured for that antenna on the required immediately adjacent channel(s) is not necessary, testing of the other required channels still needs consideration.
   d. >6.0 W/Kg, test all required channels for that antenna.
   e. For the remaining channels that cannot be excluded in b) and c), which still require consideration, the 3.5 W/Kg exclusion in a) and 4.0 W/Kg exclusion in b) may be applied recursively with respect to the highest output power channel among the remaining channels; measure the SAR for the remaining channels that cannot be excluded.
      ii) If an immediately adjacent channel measured in c) or a remaining channel measured in e) is >6.0 W/Kg, test all required channels for that antenna.

12. Equipment List

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
450MHz Dipole	MVG	SID450	SN 30/14 DIP0G450-330	2017.08.15	2020.08.14
E-Field Probe	MVG	SSE5	SN 14/16 EP309	2016.12.05	2017.12.04
Dielectric Probe Kit	MVG	SCLMP	SN 32/14 OCPG67	2016.12.05	2017.12.04
Antenna	MVG	ANTA3	SN 07/13 ZNTA52	N/A	N/A
Phantom1	MVG	SAM	SN 32/14 SAM115	2014.09.01	N/A
Phantom2	MVG	SAM	SN 32/14 SAM116	2014.09.01	N/A
Phone holder	MVG	N/A	SN 32/14 MSH97	2014.09.01	N/A
Laptop holder	MVG	N/A	SN 32/14 LSH29	2014.09.01	N/A
Network Analyzer	Agilent	8753ES	US38432810	2017.03.16	2018.03.15
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	2017.05.10	2018.05.09
11dB Attenuator	Agilent	8494B	DC-18GHz	2017.05.10	2018.05.09
110dB Attenuator	Agilent	8494B	DC-18GHz	2017.05.10	2018.05.09
Dual Directional Coupler	Agilent	SHWPDI-1080S	N/A	2017.05.09	2018.05.08
Temperature & Humitidy	MiEO	HH660	N/A	2017.10.18	2018.10.17

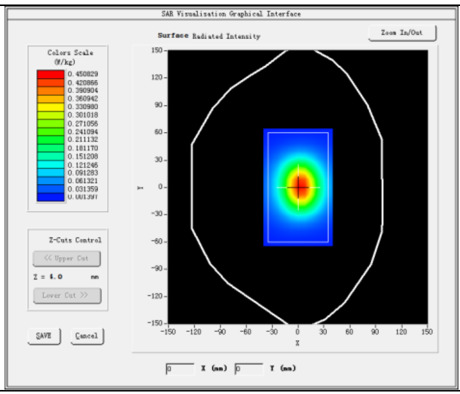
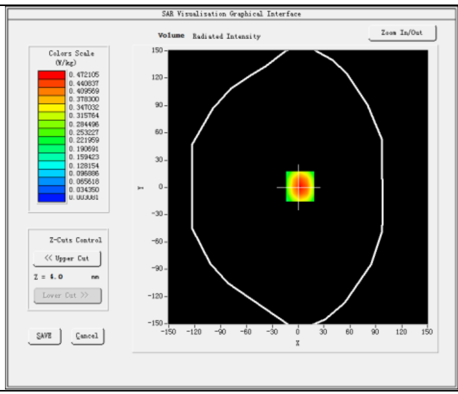
Appendix A. System Validation Plots

System Performance Check Data (450MHz Head)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017-11-28
Measurement duration: 14 minutes 13 seconds

Experimental conditions.

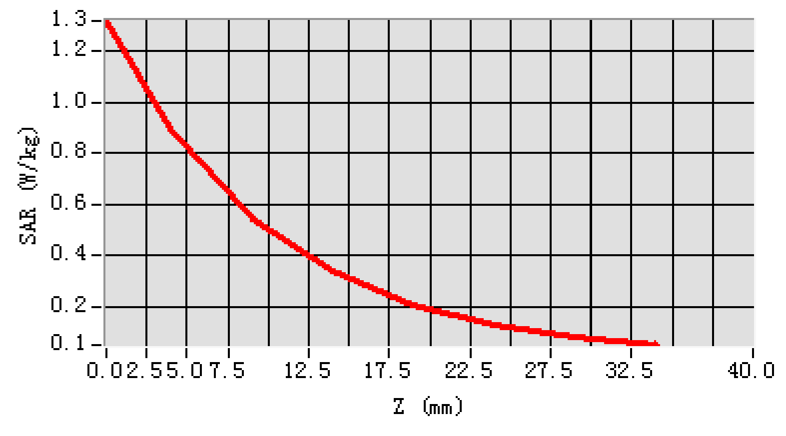
Probe	
Phantom	Validation plane
Device Position	-
Band	450MHz
Channels	-
Signal	CW
Frequency (MHz)	450MHz
Relative permittivity	43.05
Conductivity (S/m)	0.87
Power drift (%)	2.61
Probe	SN 14/16 EP309
ConvF:	5.74
Crest factor:	1:1

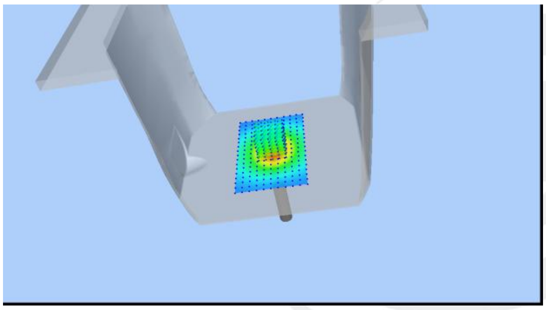
SURFACE SAR	VOLUME SAR
	

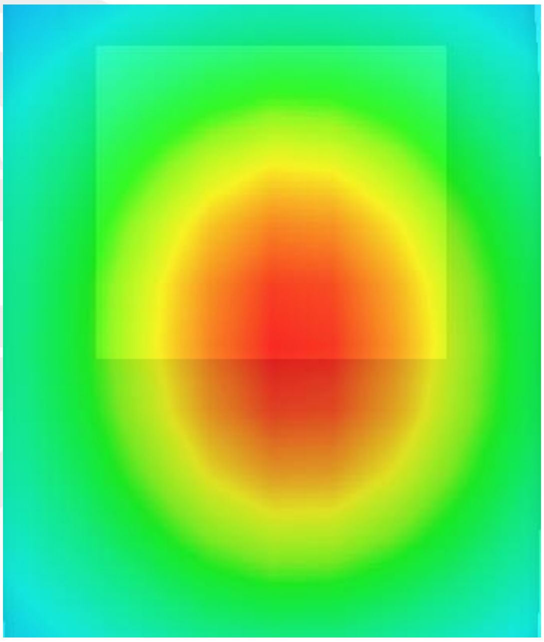
Maximum location: X=-7.00, Y=-1.00

SAR 10g (W/Kg)	0.314857
SAR 1g (W/Kg)	0.460386

Z Axis Scan


1.3
1.2
1.0
0.8
0.6
0.4
0.2
0.1
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)



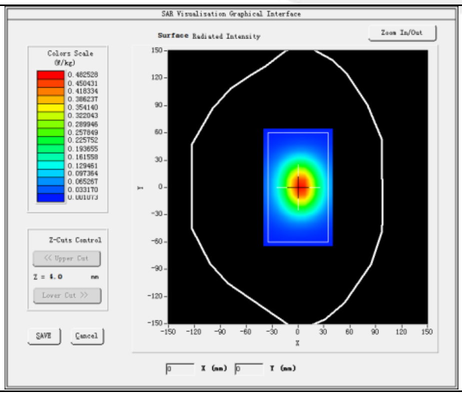
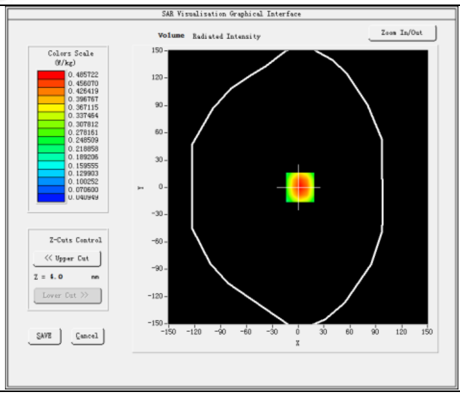


System Performance Check Data (450MHz Body)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017-11-28
Measurement duration: 14 minutes 13 seconds

Experimental conditions.

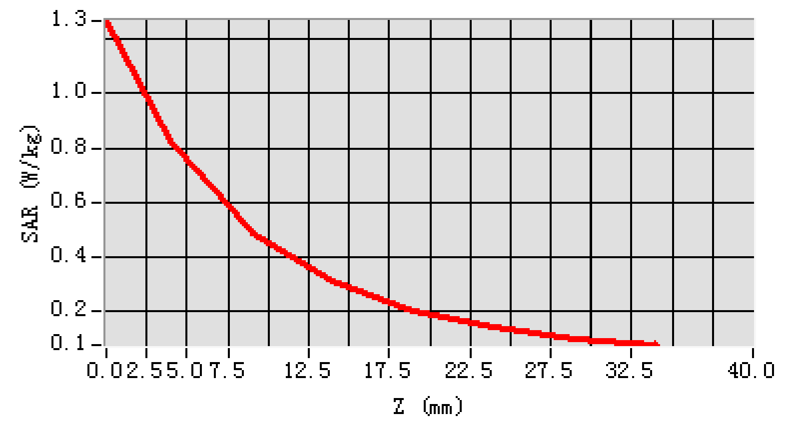
Probe	
Phantom	Validation plane
Device Position	-
Band	450MHz
Channels	-
Signal	CW
Frequency (MHz)	450MHz
Relative permittivity	55.72
Conductivity (S/m)	0.92
Power drift (%)	1.34
Probe	SN 14/16 EP309
ConvF:	5.88
Crest factor:	1:1

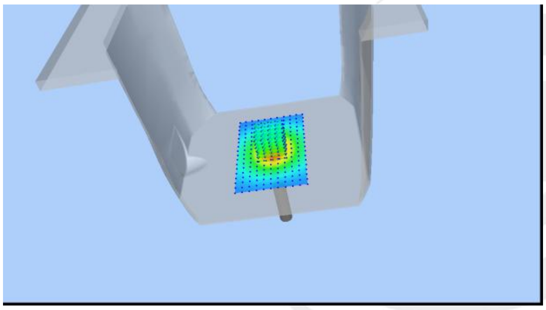
SURFACE SAR	VOLUME SAR
	

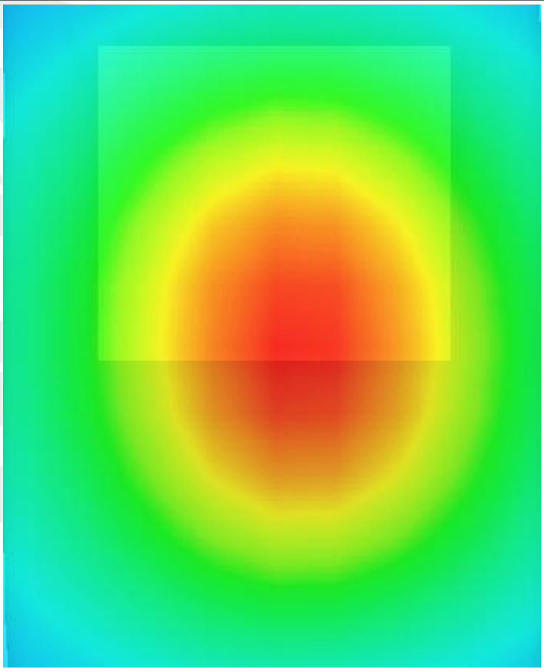
Maximum location: X=-7.00, Y=-1.00

SAR 10g (W/Kg)	0.316608
SAR 1g (W/Kg)	0.472907

Z Axis Scan







Appendix B. SAR Test Plots

Plot 1: DUT: Digital Two-way Radio; EUT Model: ATS-200

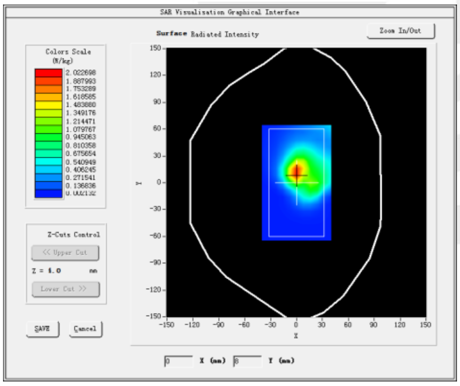
Test Date	2017-11-28
Probe	SN 14/16 EP309
ConvF	5.74
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Face up (2.5 cm Separation)
Signal	Crest factor: 1
Frequency (MHz)	406.5
Relative permittivity (real part)	43.50
Conductivity (S/m)	0.87
Variation (%)	2.37

Maximum location: X=0.00, Y=10.00

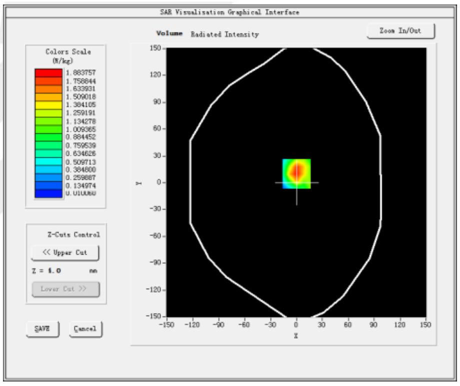
SAR Peak: 3.03 W/kg

SAR 10g (W/Kg)	0.895846
SAR 1g (W/Kg)	1.781639

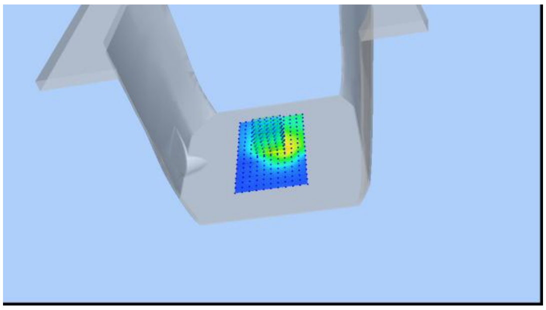
SURFACE SAR



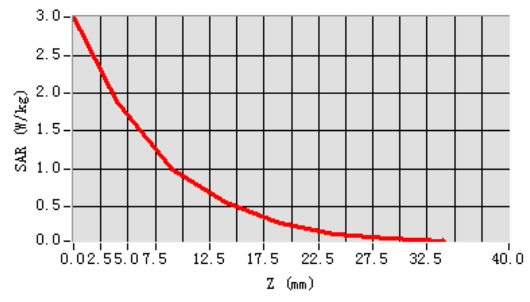
VOLUME SAR



3D screen shot



Z Axis Scan



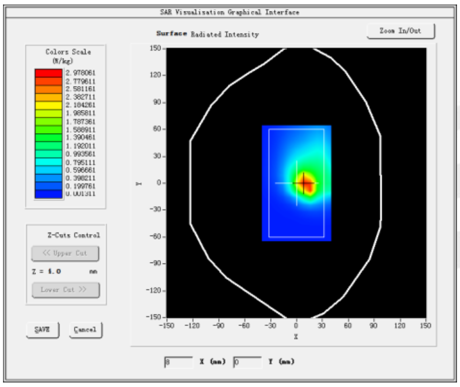
Plot 2: DUT: Digital Two-way Radio; EUT Model: ATS-200

Test Date	2017-11-28
Probe	SN 14/16 EP309
ConvF	5.90
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Back touch (direct)
Signal	Crest factor: 1
Frequency (MHz)	406.5
Relative permittivity (real part)	56.70
Conductivity (S/m)	0.94
Variation (%)	1.13

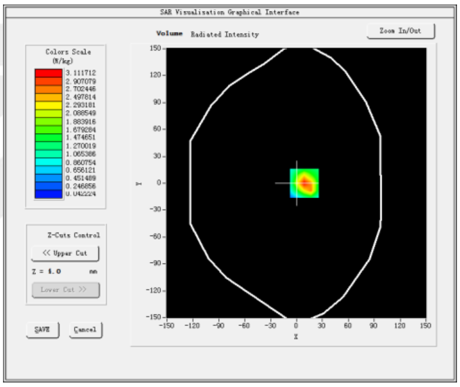
Maximum location: X=9.00, Y=0.00
SAR Peak: 5.35 W/kg

SAR 10g (W/Kg)	1.416226
SAR 1g (W/Kg)	2.958661

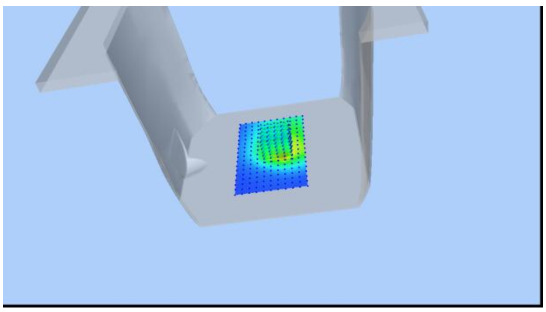
SURFACE SAR



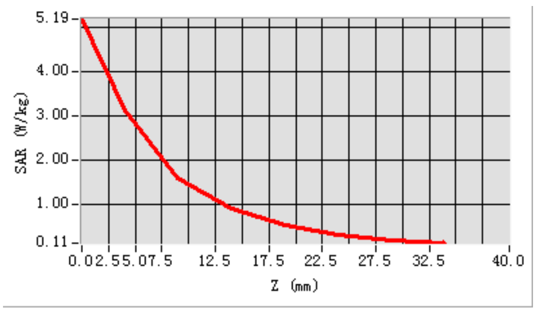
VOLUME SAR



3D screen shot



Z Axis Scan



Appendix C. Probe Calibration And Dipole Calibration Report

Refer the appendix Calibration Report.

※※※※※END OF THE REPORT※※※※※