FCC SAR TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

Personal Theater

ISSUED TO
Shenzhen NED Optics Co., LTD.

Rm W101, 1/F, West Block, PKU-HKUST SZ-HK Institution, No 15 , Gaoxinnan 7th Rd , Nanshan District , Shenzhen , P.R.China

Report No.:	BL-SZ1750088-702
EUT Name:	Personal Theater
Model Name:	G1
Brand Name:	GOOVIS
FCC ID:	2AL39-GOOVISG1
Test Standard:	FCC 47 CFR Part 2.1093 ANSI C95.1: 1999 IEEE 1528: 2013
Maximum SAR:	Body (1 g): 0.421 W/kg
Test Conclusion:	Pass
Test Date:	Mar. 23, 2017 ~ Mar. 26, 2017
Date of Issue:	Jun. 15, 2017

Tested by: Zong Liyao
Zong Liyao
(Engineer)
Date Jun. 15, 2017

Approved by:
Liao Jianming
(Technical Director)
Date Jun. 15. 2017

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Revision History

Version	Issue Date	Revisions Content
Rev. 01	Jun. 15, 2017	Initial Issue

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1 GENERAL INFORMATION

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1. The laboratory has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are 832625. The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Test Environment Condition

Ambient Temperature	20 to 23℃
Ambient Relative Humidity	36 to 49%
Ambient Pressure	100 to 102KPa

1.4 Announce

(1) The test report reference to the report template version v2.2.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

(4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.

(5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.

(6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Shenzhen NED Optics Co. , LTD.
Address	Rm W101, 1/F, West Block, PKU-HKUST SZ-HK Institution, No 15, Gaoxinnan 7th Rd, Nanshan District, Shenzhen, P.R.China

2.2 Manufacturer Information

Manufacturer	Shenzhen NED Optics Co. , LTD.
Address	Rm W101, 1/F, West Block, PKU-HKUST SZ-HK Institution, No 15, Gaoxinnan 7th Rd, Nanshan District, Shenzhen, P.R.China

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	Personal Theater
Model Name Under Test	G1
Series Model Name	N/A
Description of Model Name Differentiation	N/A
Hardware Version	4.1
Software Version	1.0
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A
Network and Wireless connectivity	WIFI 802.11a, 802.11b, 802.11g, 802.11n(HT20); Bluetooth

2.5 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	N/A
	Model No.	Media
	Capacitance	5900 mAh
	Rated Voltage	3.8 V
	Limit Charge Voltage	4.35 V
Ancillary Equipment 2	Adapter	
	Brand Name	N/A
	Model No.	NEDO-200C1G1
	Rated Input	~ 100 - 240 V, 500 mA, 50/60 Hz
	Rated Output	⎓ 5 V, 2000 mA

2.6 Technical Information

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	2.4GWLAN, 5GWLAN, Bluetooth	
Frequency Range	802.11b/g	2400 ~2483.5 MHz
	802.11n(HT20)	2400 ~2483.5 MHz
	802.11 a	5150 ~ 5250 MHz
		5725 ~ 5850 MHz
	802.11 n(HT20)	5150 ~ 5250 MHz
		5725 ~ 5850 MHz
	Bluetooth	2400 ~2483.5 MHz
Antenna Type	WLAN	PIFA
	Bluetooth	PIFA
Hotspot Function	N/A	
Power Reduction	Not Support	
Exposure Category	General Population/Uncontrolled exposure	
EUT Stage	Portable Device	
Product	Type	
	☒ Production unit	☐ Identical prototype

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
2	ANSI/IEEE Std. C95.1-1999	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	Mobile 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 865664 D02 v01r02	RF Exposure Reporting
7	KDB 248227 D01 v02r02	SAR Guidance for IEEE 802.11 (Wi-Fi) Transmitters

3.2 Device Category and SAR Limit

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

Table of Exposure Limits:

Body Position	SAR Value (W/Kg)	
	General Population/ Uncontrolled Exposure	Occupational/ Controlled Exposure
Whole-Body SAR (averaged over the entire body)	0.08	0.4
Partial-Body SAR (averaged over any 1 gram of tissue)	1.60	8.0
SAR for hands, wrists, feet and ankles (averaged over any 10 grams of tissue)	4.0	20.0

NOTE:

General Population/Uncontrolled: Locations where there is the exposure of individuals who have no knowledge or control of their exposure. General population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Occupational/Controlled: Locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

3.3 Test Result Summary

3.3.1 Highest SAR (1 g Value)

Band	Maximum Scaled SAR (W/kg)	Maximum Report SAR (W/kg)	Limit (W/kg)
	Body (0mm)	Body (0mm)	
2.4G WLAN	**0.421**	0.421	1.6
5.2G WLAN	0.221		
5.8G WLAN	0.142		
Verdict	Pass		

3.3.2 Highest Simultaneous SAR

The 2.4G WLAN, 5G WLAN and Bluetooth share the same antenna and can't transmit simultaneously.

3.4 Test Uncertainty

According to KDB 865664 D01, when the highest measured 1 g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis is not required in SAR reports submitted for equipment approval.

The maximum 1 g SAR for the EUT in this report is 0.421 W/kg, which is lower than 1.5 W/kg, so the the extensive SAR measurement uncertainty analysis is not required in this report.

4 SAR MEASUREMENT SYSTEM

4.1 Definition of Specific Absorption Rate (SAR)

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

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

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

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

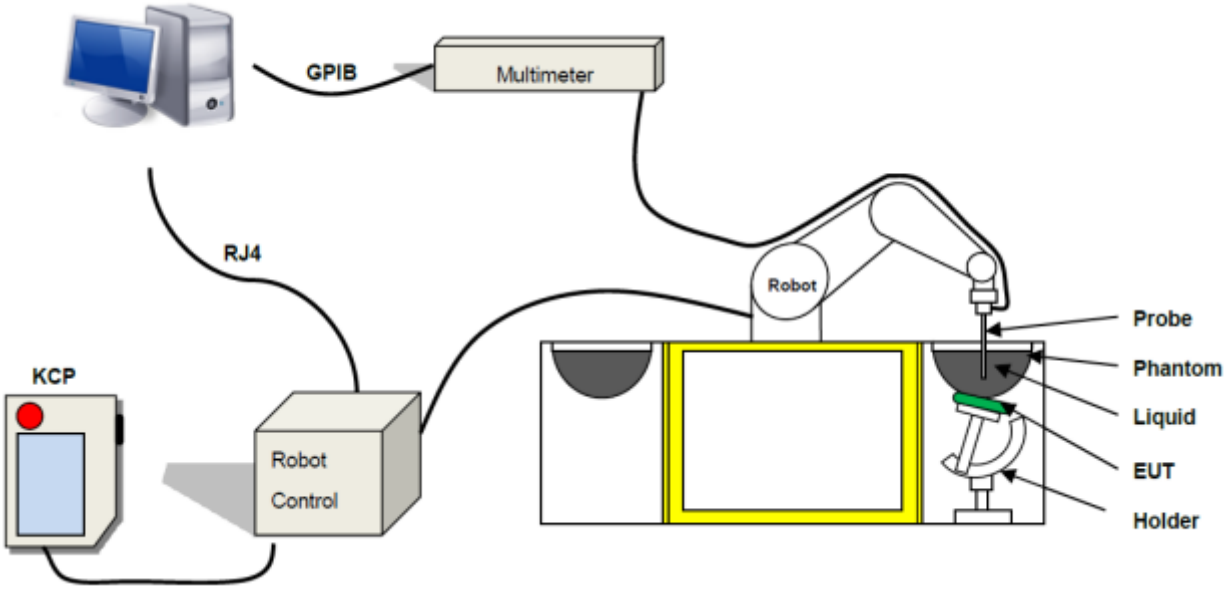
$$\mathbf{SAR} = \frac{\sigma \mathrm{E}^2}{\rho}$$

Where: σ is the conductivity of the tissue,

ρ is the mass density of the tissue and E is the RMS electrical field strength.

4.2 SATIMO SAR System

4.2.1 SATIMO SAR System Diagram



These measurements were performed with the automated near-field scanning system OPENSAR from SATIMO. The system is based on a high precision robot (working range: 850 mm), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit.

The SAR measurements were conducted with dosimetric probe (manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in SAR standard with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in SAR standard and found to be better than ±0.25 dB. The phantom used was the SAM Phantom as described in FCC supplement C, IEEE P1528.

4.2.2 Robot

The SATIMO SAR system uses the high precision robots from KUKA. For the 6-axis controller system, the robot controller version (KUKA) from KUKA is used. The KUKA robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

4.2.3 E-Field Probe

For the measurements the Specific Dosimetric E-Field Probe SN 34/15 EPGO 265 with following specifications is used

-- Dynamic range: 0.01-100 W/kg

- Tip Diameter : 2.5 mm
- Lower detection limit : 7 mW/kg

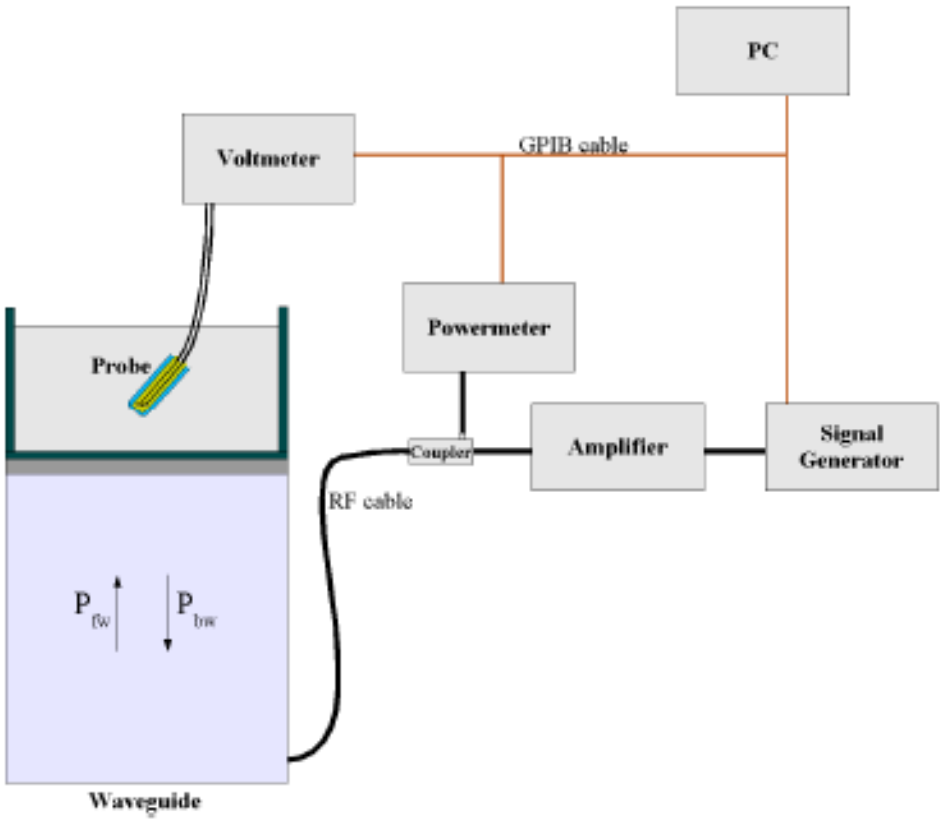
(repeatability better than +/- 1mm)

- Probe linearity: +/- 0.07 dB
- Calibration range: 450 MHz to 5800 MHz for head & body simulating liquid.

Angle between probe axis (evaluation axis) and surface normal line: less than 30°

E-Field Probe Calibration Process

Probe calibration is realized, in compliance with CENELEC EN 62209-1/-2 and IEEE 1528 std, with CALISAR, Antennessa proprietary calibration system. The calibration is performed with the IEC62209-1/2 annexe technique using reference guide at the five frequencies.



$$SAR = \frac{4(P_{fw} - P_{bw})}{ab\sigma} \cos^2\left(\pi \frac{y}{a}\right) c^{(2\pi/\sigma)}$$

Where :

Pfw	=	Forward Power
Pbw	=	Backward Power
a and b	=	Waveguide Dimensions
ı	=	Skin Depth

Keithley configuration

Rate = Medium; Filter =ON; RDGS=10; FILTER TYPE =MOVING AVERAGE; RANGE AUTO After each calibration, a SAR measurement is performed on a validation dipole and compared with a NPL calibrated probe, to verify it.

The calibration factors, CF(N), for the 3 sensors corresponding to dipole 1, dipole 2 and dipole 3 are:

CF(N)=SAR(N)/Vlin(N) (N=1,2,3)

The linearised output voltage Vlin(N) is obtained from the displayed output voltage V(N) using

Vlin(N)=V(N)*(1+V(N)/DCP(N)) (N=1,2,3)

Where the DCP is the diode compression point in mV.

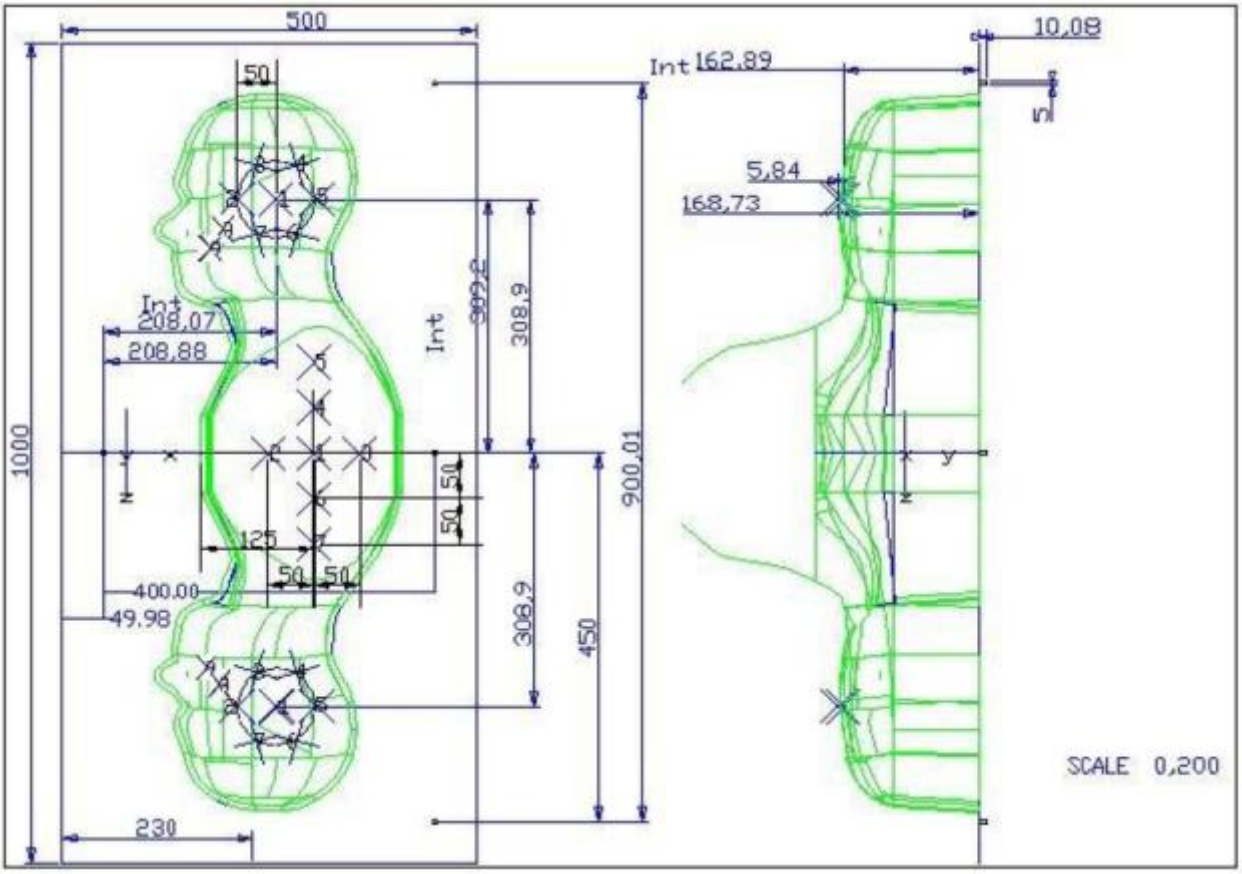
4.2.4 Phantoms

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.

Photo of Phantom SN 30/13 SAM103

Photo of Phantom SN 30/13 SAM104

Serial Number	Positionner Material	Permittivity	Loss Tangent
SN 30/13 SAM103	Gelcoat with fiberglass	3.4	0.02
SN 30/13 SAM104	Gelcoat with fiberglass	3.4	0.02



Serial Number	Left Head		Right Head		Flat Part	
SN 30/13 SAM103	2	2.00	2	2.03	1	2.09
	3	2.02	3	2.05	2	2.10
	4	2.04	4	2.04	3	2.09
	5	2.04	5	2.07	4	2.11
	6	2.02	6	2.07	5	2.11
	7	2.01	7	2.09	6	2.09
	8	2.04	8	2.10	7	2.11
	9	2.02	9	2.09	-	-
SN 30/13 SAM104	2	2.05	2	2.06	1	2.03
	3	2.08	3	2.03	2	2.03
	4	2.05	4	2.03	3	2.01
	5	2.06	5	2.02	4	2.03
	6	2.08	6	2.02	5	2.03
	7	2.06	7	2.04	6	2.00
	8	2.07	8	2.04	7	1.98
	9	2.07	9	2.05	-	-

4.2.5 Device Holder

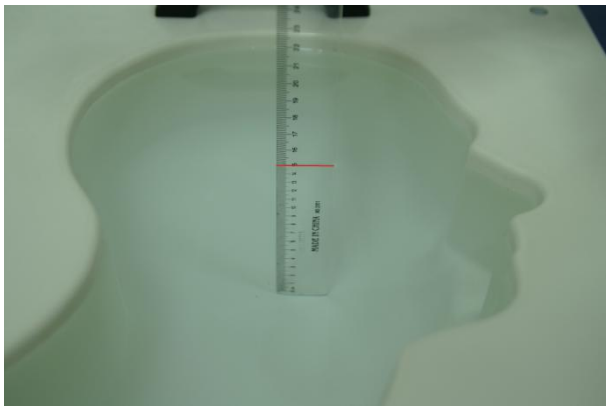
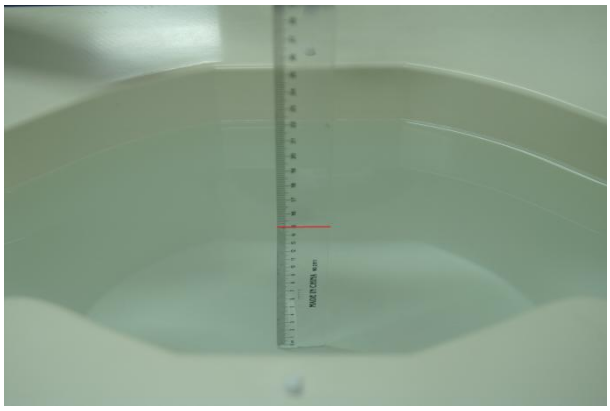
The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for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

Serial Number	Holder Material	Permittivity	Loss Tangent
SN 25/13 MSH87	Deirin	3.7	0.005
SN 25/13 MSH88	Deirin	3.7	0.005

The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is lower than 1°.

4.2.6 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 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5%.

Head Liquid Depth	Body Liquid Depth
	

The following table gives the recipes for tissue simulating liquid and the theoretical Conductivity/Permittivity.

Head (Reference IEEE1528)								
Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity σ (S/m)	Permittivity ε
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.4	40.0
2450	55.0	0	0	0.1	0	44.9	1.80	39.2
2600	54.9	0	0	0.1	0	45.0	1.96	39.0
Frequency(MHz)	Water (%)	Hexyl Carbitol (%)			Triton X-100 (%)		Conductivity σ (S/m)	Permittivity ε
5200	62.52	17.24			17.24		4.66	36.0
5800	62.52	17.24			17.24		5.27	35.3
Body (From instrument manufacturer)								
Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity σ (S/m)	Permittivity ε
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0.1	0	31.3	1.95	52.7
2600	68.2	0	0	0.1	0	31.7	2.16	52.5

Frequency(MHz)	Water	DGBE (%)	Salt (%)	Conductivity σ (S/m)	Permittivity ε
5200	78.60	21.40	/	5.54	47.86
5800	78.50	21.40	0.1	6.0	48.20

5 SYSTEM VERIFICATION

5.1 Antenna Port Test Requirement

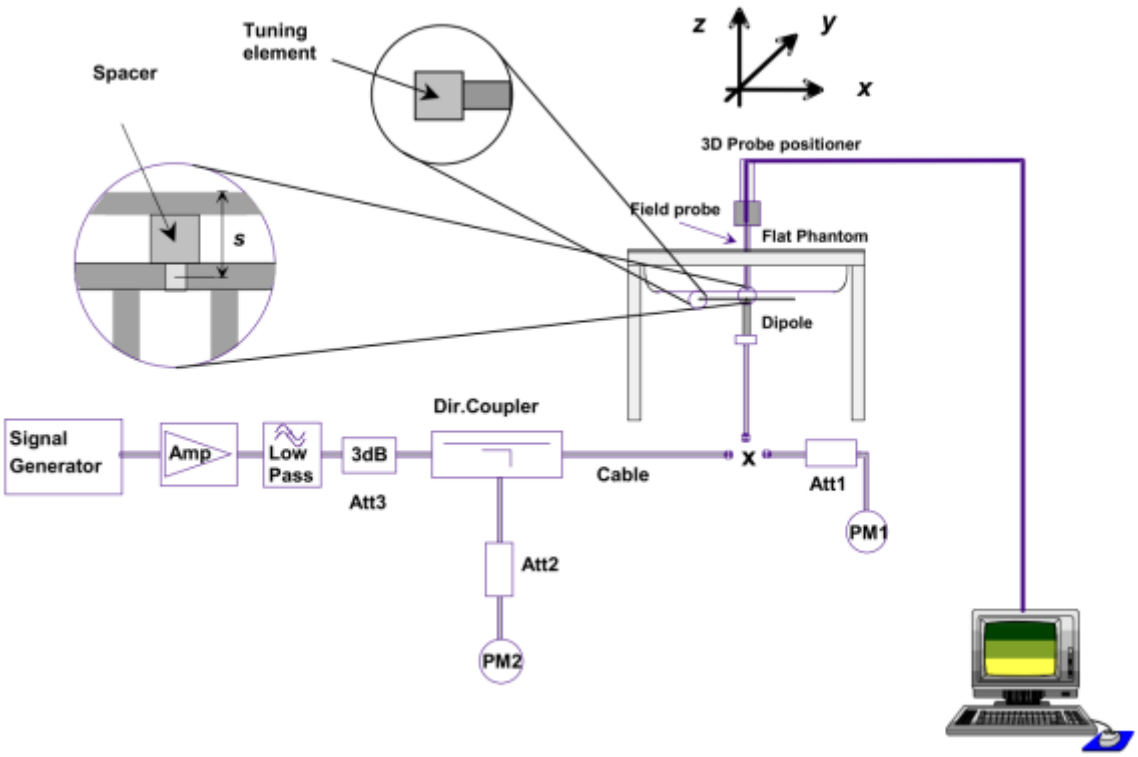
The SATIMO SAR system is equipped with one or more system validation kits. These units together with the predefined measurement procedures within the SATIMO software enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

5.2 Purpose of System Check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

5.3 System Check Setup

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:



6 EUT TEST POSITION CONFIGURATUONS

According to KDB 648474 D04 Handset , handsets are tested for SAR compliance in head, body-worn accessory and other use configurations described in the following subsections.

6.1 Head Exposure Conditions

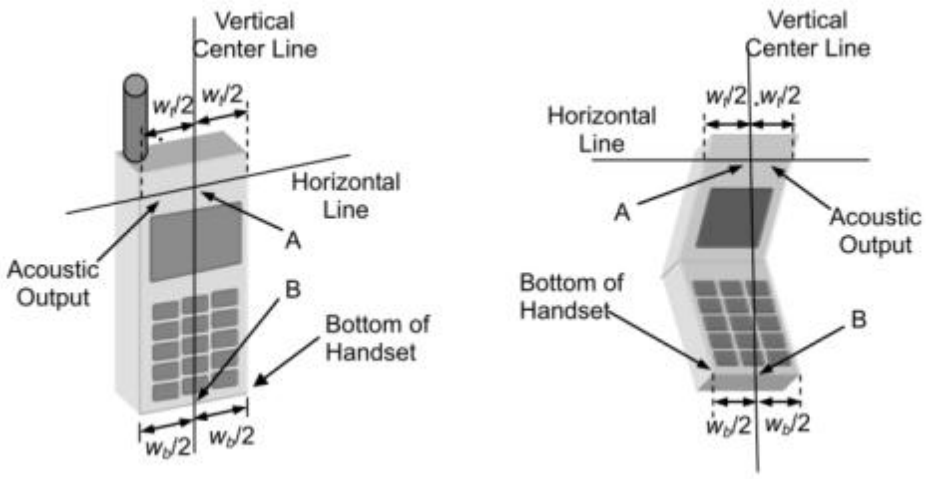
Head exposure is limited to next to the ear voice mode operations. Head SAR compliance is tested according to the test positions defined in IEEE Std 1528-2013 using the SAM phantom illustrated as below.

6.1.1 Define two imaginary lines on the handset

(a) The vertical center line passes through two points on the front side of the handset - the midpoint of the width w t of the handset at the level of the acoustic output, and the midpoint of the width w b of the bottom of the handset.

(b) 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.

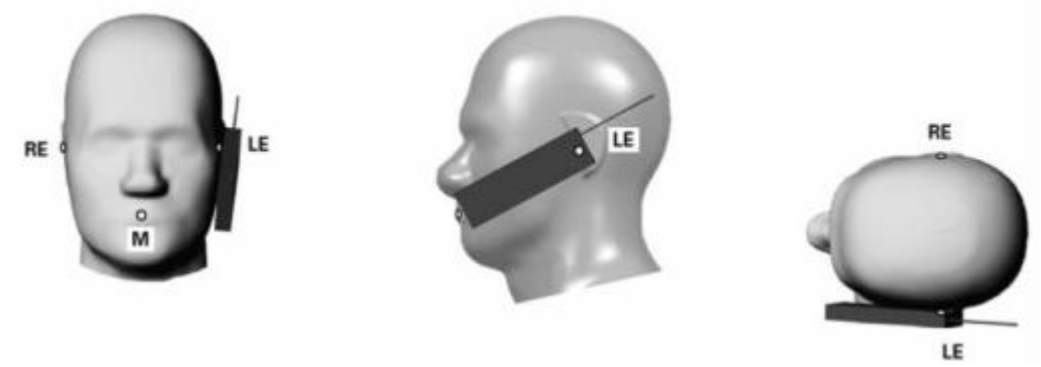
(c) The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.



6.1.2 Cheek Position

(a) 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 three 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.

(b) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the 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.



6.1.3 Tilted Position

(a) To position the device in the “cheek” position described above.

(b) While maintaining the device 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 contact with the ear is lost.

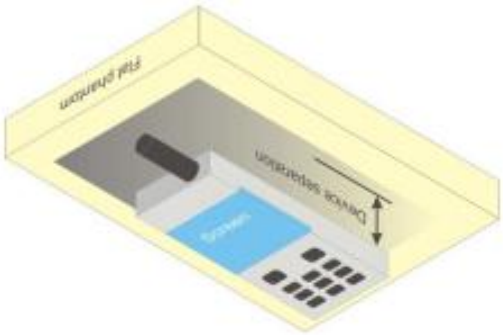
6.2 Body-worn Position Conditions

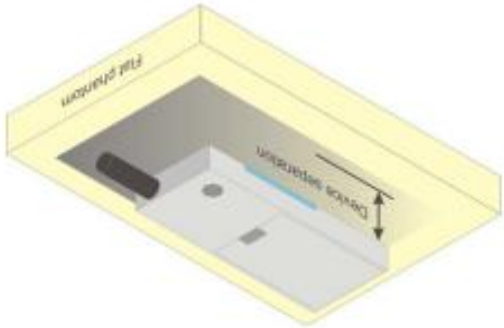
Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB 447498 are used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode. 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 that body-worn accessory with a headset attached to the handset.

Body-worn accessories that do not contain metallic or conductive components may be tested according to worst-case exposure configurations, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics. All body-worn accessories containing metallic components are tested in conjunction with the host device.

Body-worn accessory SAR compliance is based on a single minimum test separation distance for all wireless and operating modes applicable to each body-worn accessory used by the host, and according to the relevant voice and/or data mode transmissions and operations. If a body-worn accessory supports voice only operations in its normal and expected use conditions, testing of data mode for body-worn compliance is not required. A conservative minimum test separation distance for supporting off-the-shelf body-worn accessories that may be acquired by

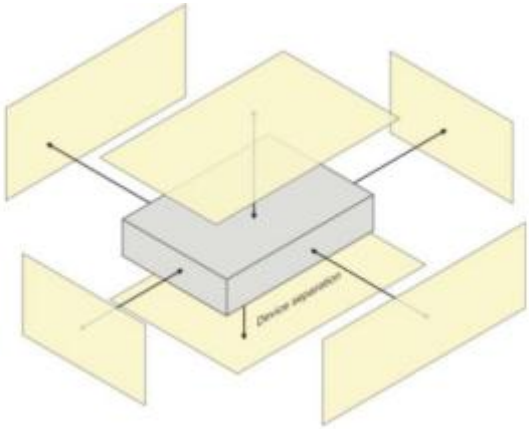
users of consumer handsets is used to test for body-worn accessory SAR compliance. This distance is determined by the handset manufacturer, according to the requirements of Supplement C 01-01. Devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body-worn accessories, will be tested using a conservative minimum test separation distance <= 5 mm to support compliance.





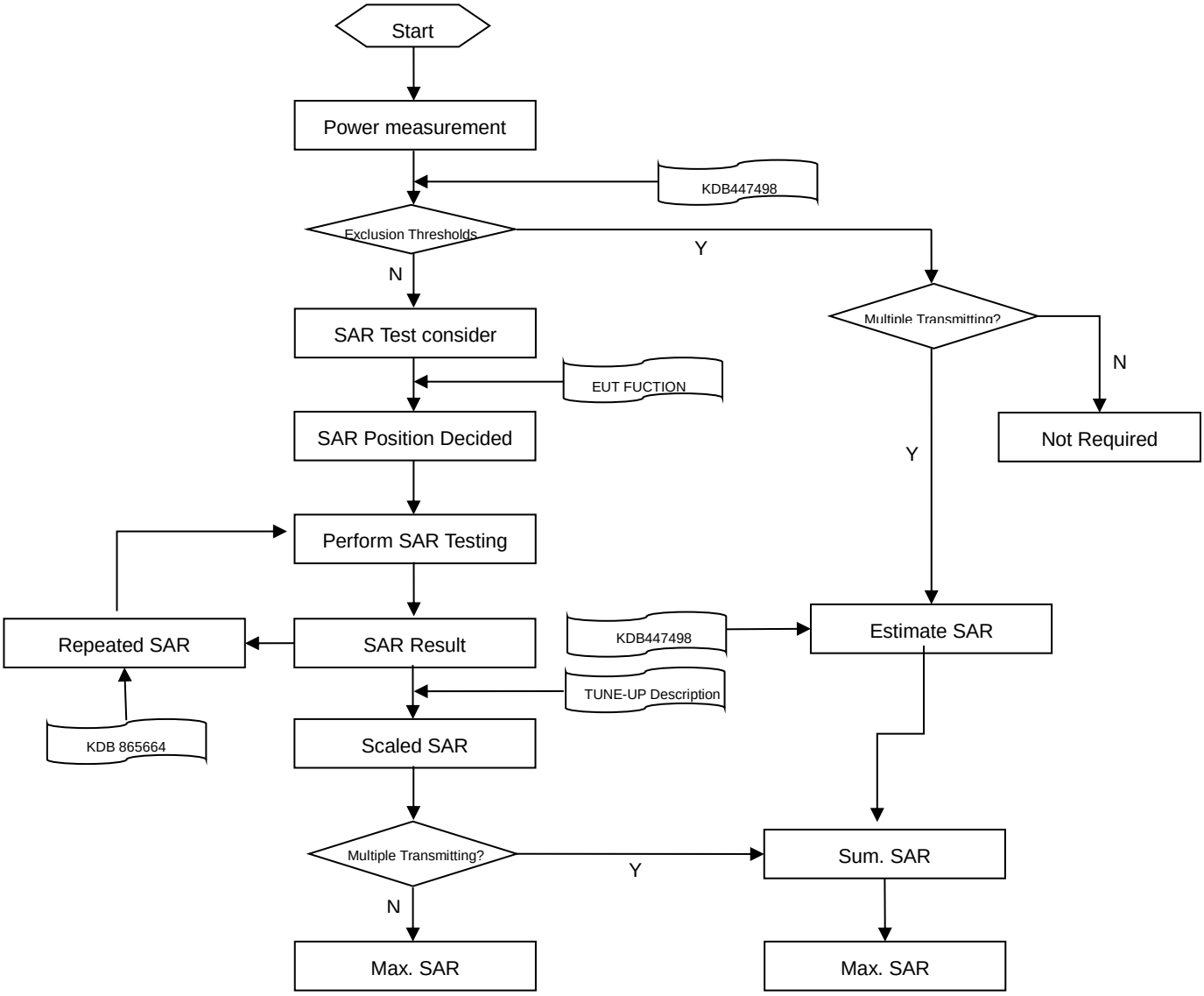
6.3 Hotspot Mode Exposure Position Conditions

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing functions, the relevant hand and body exposure conditions 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 surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge. When the form factor of a handset is smaller than 9 cm x 5 cm, a test separation distance of 5 mm (instead of 10 mm) is required for testing hotspot mode. When the separation 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).



7 SAR MEASUREMENT PROCEDURES

7.1 SAR Measurement Process Diagram



7.2 SAR Scan General Requirements

Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2013.

<table>
<tr><th colspan="3"></th><th>≤3GHz</th><th>>3GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5±1 mm</td><td>½·δ·ln(2)±0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30°±1°</td><td>20°±1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx Area , Δy Area</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3–4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ⩽ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx Zoom , Δy Zoom</td><td>≤ 2 GHz: ≤ 8 mm
2 –3 GHz: ≤ 5 mm*</td><td>3–4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="6">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2" rowspan="3">uniform grid: Δz Zoom (n)</td><td rowspan="3">≤ 5 mm</td><td>3–4 GHz: ≤ 4 mm</td></tr>
<tr><td>4–5 GHz: ≤ 3 mm</td></tr>
<tr><td>5–6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="3">graded grid</td><td rowspan="2">Δz Zoom (1): between 1st two points closest to phantom surface</td><td rowspan="2">≤ 4 mm</td><td>3–4 GHz: ≤ 3 mm</td></tr>
<tr><td>4–5 GHz: ≤ 2.5 mm
5–6 GHz: ≤ 2 mm</td></tr>
<tr><td>Δz Zoom (n>1): between subsequent points</td><td colspan="2">≤ 1.5·Δz Zoom (n-1)</td></tr>
<tr><td rowspan="3">Minimum zoom scan volume</td><td colspan="2" rowspan="3">x, y, z</td><td rowspan="3">≥30 mm</td><td>3–4 GHz: ≥ 28 mm</td></tr>
<tr><td>4–5 GHz: ≥ 25 mm</td></tr>
<tr><td>5–6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note:
1. δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
2. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ⩽ 1.4 W/kg, ⩽ 8 mm, ⩽ 7 mm and ⩽ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

7.3 SAR Measurement Procedure

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.

7.4 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. Area scan and zoom scan resolution setting follows KDB 865664 D01 quoted below.

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

8 CONDUCTED RF OUPUT POWER

8.1 2.4G WIFI

Band (GHz)	Mode	Channel	Freq. (MHz)	Avg. Power (dBm)	SAR Test Require.
2.4 (2.4~2.4835)	802.11b	1	2412	10.04	No
		6	2437	14.61	Yes
		11	2462	14.46	No
	802.11g	1	2412	**19.01**	Yes
		6	2437	18.61	No
		11	2462	18.92	No
	802.11n(HT20)	1	2412	18.25	No
		6	2437	18.39	No
		11	2462	17.11	No

8.2 5G WIFI

Band (GHz)	Mode	Channel	Freq. (MHz)	Avg. Power (dBm)	SAR Test Require.
5.2 (5.15~5.25)	802.11a	36	5180	12.87	No
		44	5220	**13.12**	Yes
		48	5240	13.08	No
	802.11n(HT20)	36	5180	11.45	No
		44	5220	12.36	No
		48	5240	12.61	No
5.8 (5.725~5.850)	802.11a	149	5745	13.25	No
		157	5785	13.14	No
		165	5825	13.72	No
	802.11n(HT20)	149	5745	13.85	No
		157	5785	**14.26**	Yes
		165	5825	13.22	No

8.3 Bluetooth

Mode	GFSK			π/4-DQPSK		
Channel	0	39	78	0	39	78
Frequency (MHz)	2402	2441	2480	2402	2441	2480
Avg. Power (dBm)	0.27	2.95	**3.31**	-2.26	0.65	0.99
Mode	8-DPSK			/		
Channel	0	39	78	/	/	/
Frequency (MHz)	2402	2441	2480	/	/	/
Avg.Power (dBm)	-2.01	0.78	1.15	/	/	/

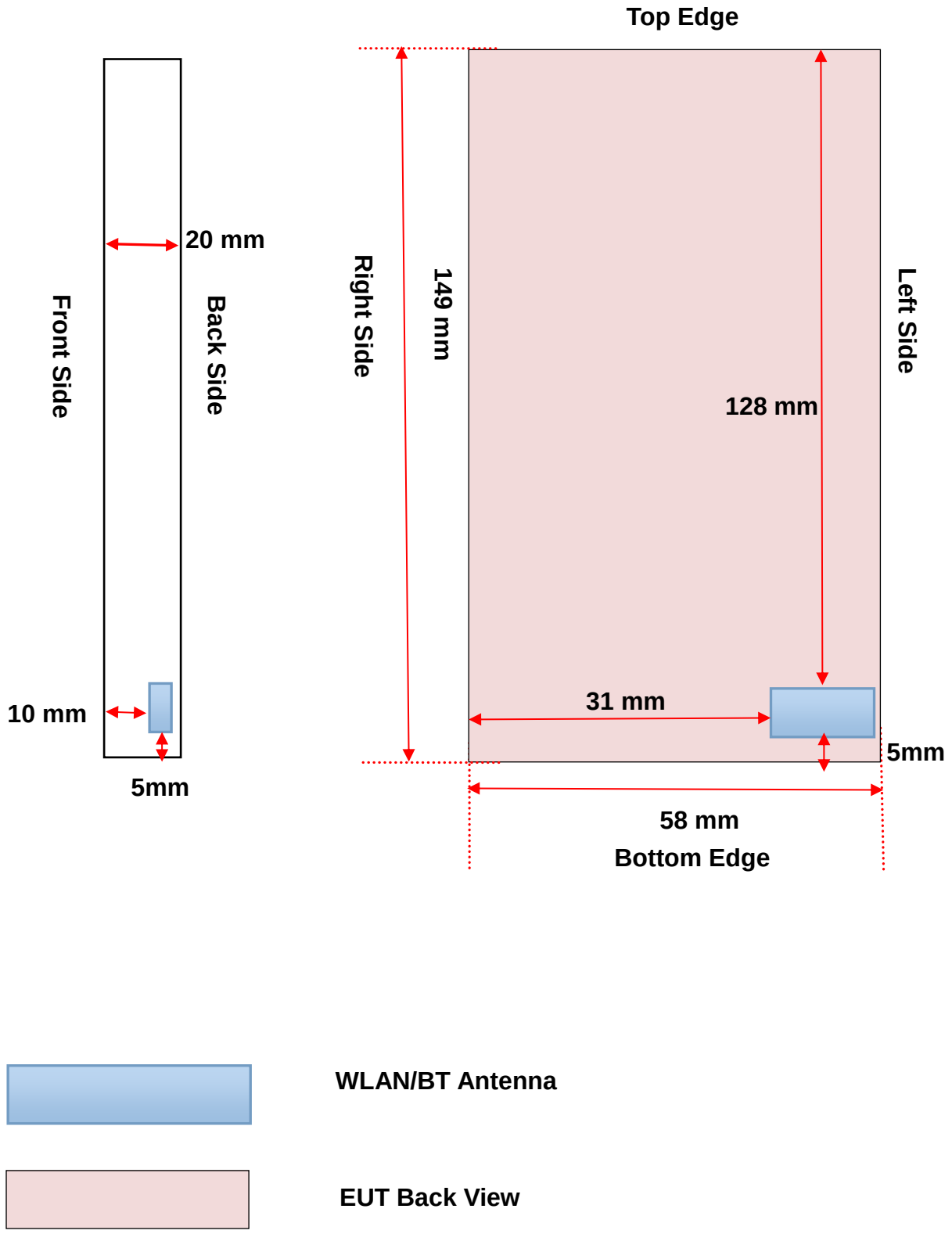
8.4 Rated RF Power Output

Band (GHz)	Mode	Range(dBm)
2.4 (2.4~2.4835)	802.11b	9.90-14.70
	802.11g	18.50-19.10
	802.11n(HT20)	17.00-18.50

Band (GHz)	Mode	Range(dBm)
5.2 (5.15~5.25)	802.11a	12.75-13.25
	802.11n(HT20)	11.35-12.70
5.8 (5.725~5.850)	802.11a	13.05-13.85
	802.11n(HT20)	13.10-14.35

Band (GHz)	Mode	Range(dBm)
Bluetooth	GFSK	0.15-3.40
	π/4-DQPSK	(-2.35)-1.10
	8-DPSK	(-2.10)-1.25

9 EUT ANTENNA LOCATION SKETCH



9.1 SAR Test Exclusion Consider Table

According with FCC KDB 447498 D01, Appendix A, <SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm> Table, this Device SAR test configurations consider as following :

Band	Mode	Max. Peak Power		Test Position Configurations					
		dBm	mW	Front	Back	Left Edge	Right Edge	Top Edge	Bottom Edge
WLAN 2.4 G	Distance to User			10mm	<5mm	<5mm	31mm	128mm	5mm
	802.11b	14.70	29.51	Yes	Yes	Yes	Yes	No	Yes
	802.11g	19.10	81.28	Yes	Yes	Yes	Yes	No	Yes
	802.11n(HT20)	18.50	70.79	No	No	No	No	No	No
WLAN 5.2 G	Distance to User			10mm	<5mm	<5mm	31mm	128mm	5mm
	802.11a	13.25	21.13	Yes	Yes	Yes	Yes	No	Yes
	802.11n(HT20)	12.70	18.62	No	No	No	No	No	No
WLAN 5.8 G	Distance to User			10mm	<5mm	<5mm	31mm	128mm	5mm
	802.11a	13.85	24.27	No	No	No	No	No	No
	802.11n(HT20)	14.35	27.23	Yes	Yes	Yes	Yes	No	Yes
Bluetooth	Distance to User			10mm	<5mm	<5mm	31mm	128mm	5mm
	Bluetooth BR/EDR	3.40	2.19	No	No	No	No	No	No

Note:

1. Maximum power is the source-based time-average power and represents the maximum RF output power among production units.
2. Per KDB 447498 D01, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
3. Per KDB 447498 D01, standalone SAR test exclusion threshold is applied; If the distance of the antenna to the user is < 5mm, 5mm is used to determine SAR exclusion threshold
4. Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
   [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
   a. f(GHz) is the RF channel transmit frequency in GHz
   b. Power and distance are rounded to the nearest mW and mm before calculation
   c. The result is rounded to one decimal place for comparison
   d. For < 50 mm distance, we just calculate mW of the exclusion threshold value (3.0) to do compare.

   This formula is [3.0] / [√f(GHz)] ·[(min. test separation distance, mm)] = exclusion threshold of mW.
5. Per KDB 447498 D01, at 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following:
   a. [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
   b. [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz
6. Per KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions.
   a. When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
   b. When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel.

7. Per KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions.
   a. When KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.
   b. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
8. Per KDB 248227 D01 SAR is not required for the following U-NII-1 and U-NII-2A bands conditions.
   a. When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.
   b. When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.
9. Per KDB 248227 D01 5G WLAN Subsequent Test Configuration Procedures

   SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units.
   a. When SAR test exclusion provisions of KDB Publication 447498 D01 are applicable and SAR measurement is not required for the initial test configuration, SAR is also not required for the next highest maximum output power transmission mode subsequent test configuration(s) in that frequency band or aggregated band and exposure configuration.
   b. When the highest reported SAR for the initial test configuration (when applicable, include subsequent highest output channels), according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

10 TEST RESULTS

10.1WIFI 2.4GHz

Fre. Band	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	1 g Meas. SAR (W/Kg)	Meas. Power (dBm)	Max. tune-up Power(dBm)	Scaling Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Body												
2.4G	802.11b	Front Side	0	6	2437	-4.77	0.065	14.61	14.70	1.02	0.066	/
		Back Side	0	6	2437	4.10	0.302	14.61	14.70	1.02	**0.308**	1#
		Left Edge	0	6	2437	-1.15	0.102	14.61	14.70	1.02	0.104	/
		Right Edge	0	6	2437	-4.83	0.066	14.61	14.70	1.02	0.067	/
		BottomEdge	0	6	2437	2.59	0.094	14.61	14.70	1.02	0.096	/
2.4G	802.11g	Front Side	0	1	2412	3.11	0.080	19.01	19.10	1.02	0.082	/
		Back Side	0	1	2412	-2.46	0.412	19.01	19.10	1.02	**0.421**	2#
		Left Edge	0	1	2412	3.38	0.159	19.01	19.10	1.02	0.162	/
		Right Edge	0	1	2412	2.09	0.073	19.01	19.10	1.02	0.075	/
		Bottom Edge	0	1	2412	-3.41	0.119	19.01	19.10	1.02	0.121	/

Note 1: Refer to ANNEX C for the detailed test data for each test configuration.

2: The product is used in combination with Control Box and Glasses, when testing Bottom Edge, in order to get most conservative SAR value, Control Box was not connected to Glasses through the HDMI cable.

10.2 WIFI 5GHz

Fre. Band	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	1 g Meas. SAR (W/Kg)	Meas. Power (dBm)	Max. tune-up Power(dBm)	Scaling Factor	1 g Scaled SAR (W/Kg)	Meas. No.
Body												
5.2G	802.11a	Front Side	0	44	5220	-3.41	0.089	13.12	13.25	1.03	0.092	/
		Back Side	0	44	5220	-2.42	0.214	13.12	13.25	1.03	**0.221**	3#
		Left Edge	0	44	5220	-2.38	0.182	13.12	13.25	1.03	0.188	/
		Right Edge	0	44	5220	-1.18	0.105	13.12	13.25	1.03	0.108	/
		Bottom Edge	0	44	5220	0.12	0.135	13.12	13.25	1.03	0.139	/
5.8G	802.11 n(HT-20)	Front Side	0	157	5785	4.01	0.095	14.26	14.35	1.02	0.097	/
		Back Side	0	157	5785	-3.94	0.139	14.26	14.35	1.02	**0.142**	4#
		Left Edge	0	157	5785	-1.13	0.137	14.26	14.35	1.02	0.140	/
		Right Edge	0	157	5785	-1.03	0.115	14.26	14.35	1.02	0.117	/
		Bottom Edge	0	157	5785	3.15	0.118	14.26	14.35	1.02	0.120	/

Note 1: Refer to ANNEX C for the detailed test data for each test configuration.

2: The product is used in combination with Control Box and Glasses, when testing Bottom Edge, in order to get most conservative SAR value, Control Box was not connected to Glasses through the HDMI cable.

11 SAR Measurement Variability

According to KDB 865664 D01, SAR measurement variability was assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. Alternatively, if the highest measured SAR for both head and body tissue-equivalent media are ≤ 1.45 W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is ≤ 1.10, the highest SAR configuration for either head or body tissue-equivalent medium may be used to perform the repeated measurement. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR repeated measurement procedure:

1. When the highest measured SAR is < 0.80 W/kg, repeated measurement is not required.
2. When the highest measured SAR is >= 0.80 W/kg, repeat that measurement once.
3. If the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20, or when the original or repeated measurement is >= 1.45 W/kg, perform a second repeated measurement.
4. If the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20, and the original, first or second repeated measurement is >= 1.5 W/kg, perform a third repeated measurement.

The highest measured SAR is 0.421 W/kg less than 0.80 W/kg, repeated measurement is not required.

12 SIMULTANEOUS TRANSMISSION

Note1: The 2.4G WLAN, 5G WLAN and Bluetooth share the same antenna and can't transmit simultaneously.
Note2: The 2.4G and 5G WLAN can't work at the same time.

13 TEST EQUIPMENTS LIST

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
PC	Dell	N/A	N/A	N/A	N/A
2450 MHz Dipole	SATIMO	SID 2450	S/N 25/13 DIP 2G450-251	2015/03/16	2018/03/15
Waveguide	SATIMO	SWG5500	S/N 30/13 DIP WGA24	2015/03/16	2018/03/15
E-Field Probe	MVG	SSE2	S/N 34/15 EPGO 265	2016/09/15	2017/09/14
Phantom1	SATIMO	SAM	SN 30/13 SAM103	N/A	N/A
Phantom2	SATIMO	SAM	SN 30/13 SAM104	N/A	N/A
Dielectric Probe Kit	SATIMO	SCLMP	SN 25/13 OCPG56	2016/07/13	2017/07/12
MultiMeter	Keithley	MultiMeter 2000	4024022	2016/07/13	2017/07/12
Signal Generator	R&S	SMF100A	1167.0000k02/104260	2016/07/13	2017/07/12
Power Meter	Agilent	E4419B	GB40201833	2016/07/13	2017/07/12
Power Sensor	R&S	NRP-Z21	103971	2016/07/13	2017/07/12
Power Amplifier	SATIMO	6552B	22374	N/A	N/A
Network Analyzer	R&S	ZVL-6	101380	2016/07/13	2017/07/12
Attenuator	COM-MW	ZA-S1-31	1305003187	N/A	N/A
Directional coupler	AA-MCS	AAMCS-UDC	000272	N/A	N/A

Note: Per KDB 865664 Dipole SAR Validation Verification, BALUN 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 in within 20% of calibrated measurement.

ANNEX A SIMULATING LIQUID VERIFICATION RESULT

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an SCLMP Dielectric Probe Kit.

Date	Liquid Type	Fre. (MHz)	Temp. (℃)	Meas. Conductivity (σ) (S/m)	Meas. Permittivity (ε)	Target Conductivity (σ) (S/m)	Target Permittivity (ε)	Conductivity Tolerance (%)	Permittivity Tolerance (%)
2017.05.23	Body	2450	21.1	1.95	52.83	1.95	52.70	0.00	0.25
2017.05.24	Body	5200	20.9	5.25	49.16	5.30	49.01	-0.94	0.31
2017.05.26	Body	5800	22.1	6.08	47.31	6.00	48.20	1.33	-1.85
Note: The tolerance limit of Conductivity and Permittivity is± 5%.									

ANNEX B SYSTEM CHECK RESULT

Comparing to the original SAR value provided by SATIMO, the validation data should be within its specification of 10%(for 1 g).

Date	Liquid Type	Freq. (MHz)	Power (mW)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Dipole SAR (W/kg)	Tolerance (%)	Targeted SAR(W/kg)	Tolerance (%)
2017.05.23	Body	2450	100	5.470	54.70	54.70	0.00	52.40	4.39
2017.05.24	Body	5200	100	15.401	154.01	155.12	-0.72	159.00	-3.14
2017.05.26	Body	5800	100	17.371	173.71	173.19	0.30	181.20	-4.13

Note [1]: The tolerance limit of System validation is ±10%.

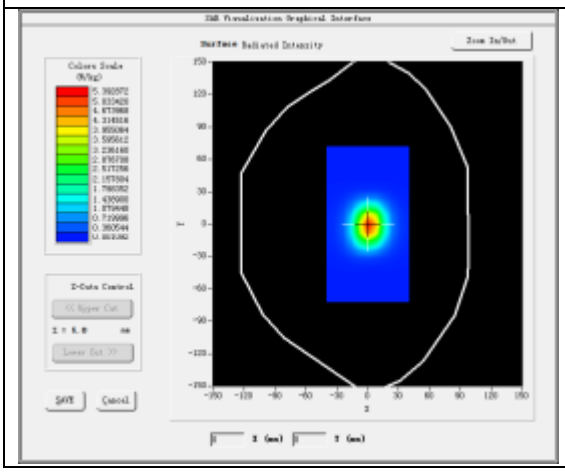
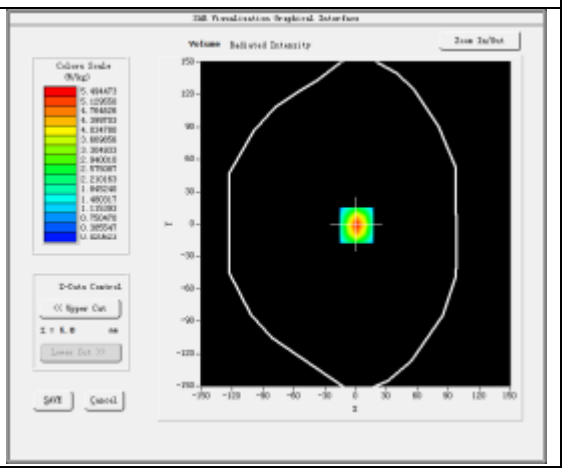
Note [2]: Using waveguide to system check for 5200 MHz to 5800 MHz.

System Performance Check Data(2450 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=5mm, dy=5mm, dz=5mm
Date of measurement: 2017.05.23
Measurement duration: 19 minutes 48 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2450MHz
Signal	CW
Frequency (MHz)	2450.000000
Relative permittivity (real part)	52.831055
Conductivity (S/m)	1.951561
Power drift (%)	0.160000
Ambient Temperature:	22.4°C
Liquid Temperature:	21.1°C
ConvF:	2.55
Crest factor:	1:1

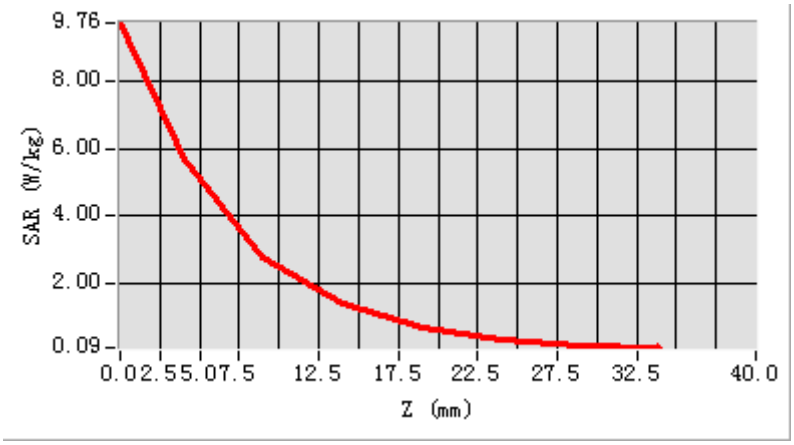
SURFACE SAR	VOLUME SAR
	

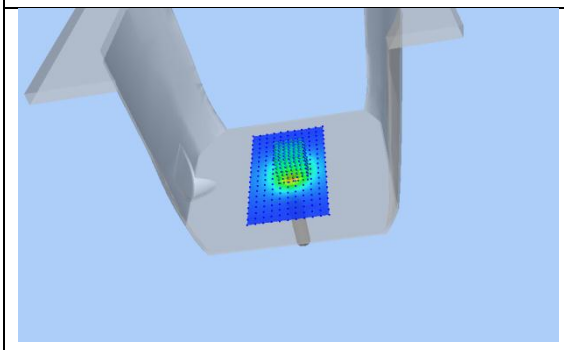
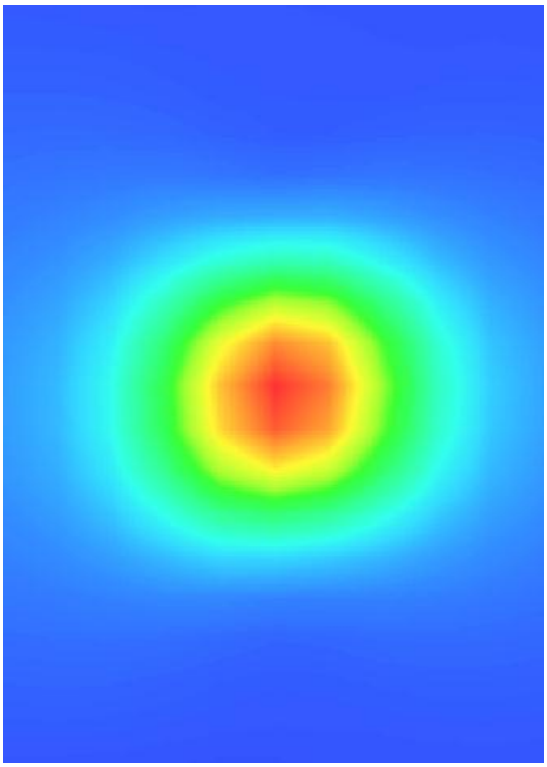
Maximum location: X=1.00, Y=0.00

SAR Peak: 9.71W/kg

SAR 10g (W/Kg)	2.324308
SAR 1g (W/Kg)	5.470135

Z Axis Scan



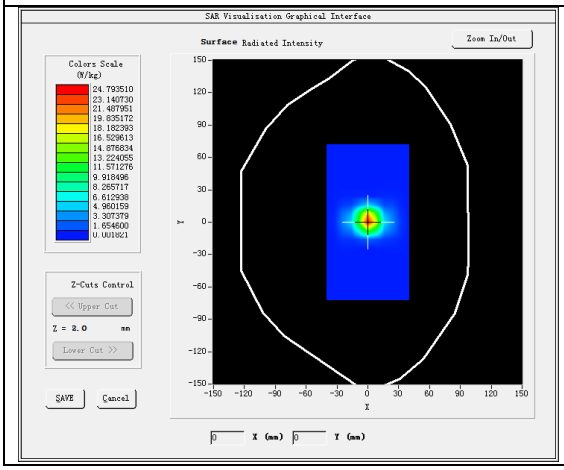
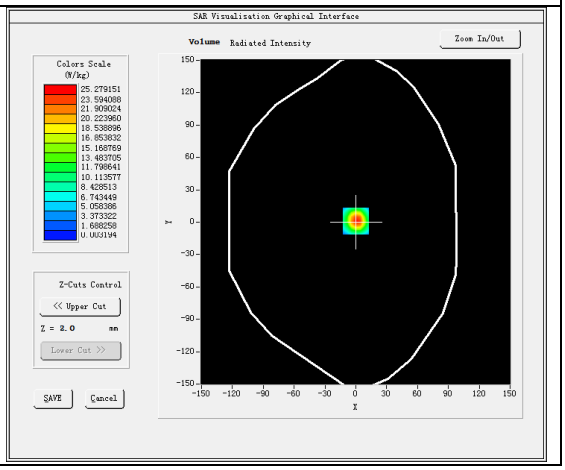
3D screen shot	Hot spot position
	

System Performance Check Data(5200 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=4 mm, dy=4 mm, dz=2 mm
Date of measurement: 2017.05.24
Measurement duration: 29 minutes 48 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5200 MHz
Signal	CW
Frequency (MHz)	5200.000000
Relative permittivity (real part)	49.162814
Conductivity (S/m)	5.249103
Power drift (%)	0.230000
Ambient Temperature:	22.1°C
Liquid Temperature:	20.9°C
ConvF:	1.85
Crest factor:	1:1

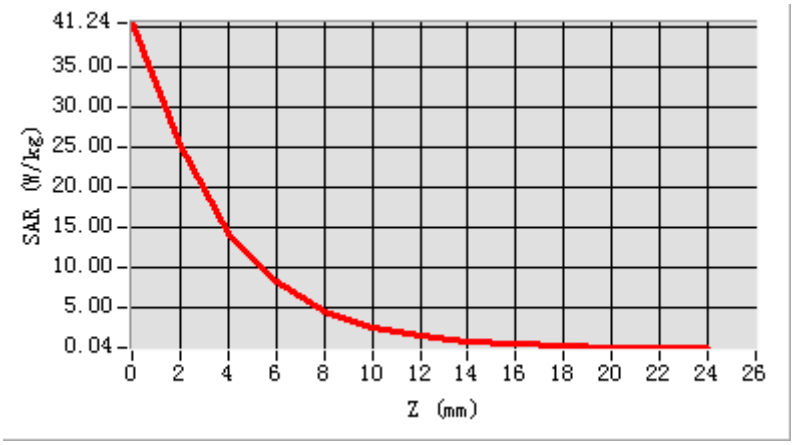
SURFACE SAR	VOLUME SAR
	

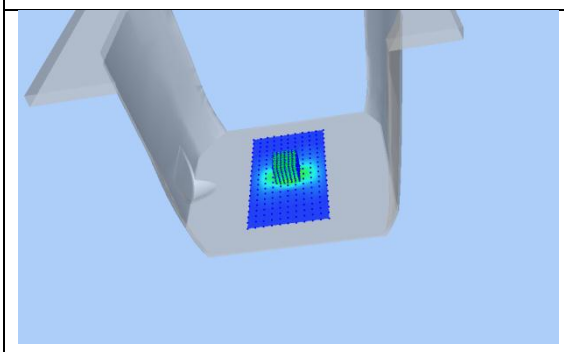
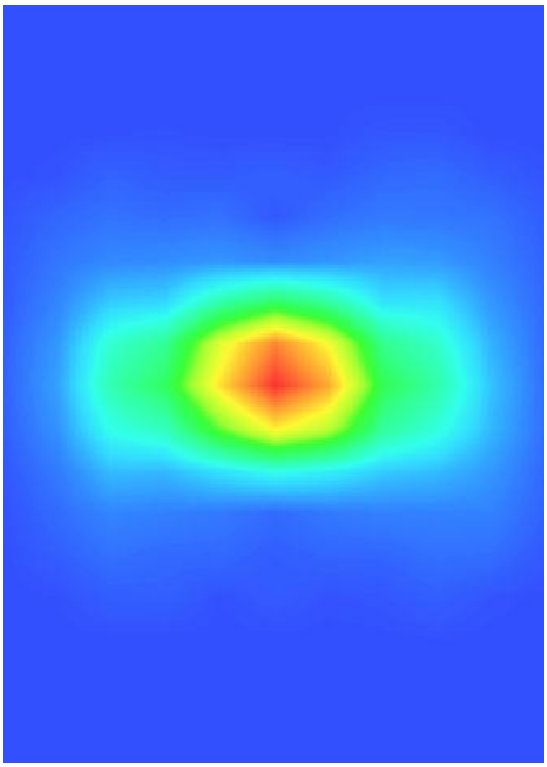
Maximum location: X=0.00, Y=0.00

SAR Peak: 41.09 W/kg

SAR 10 g (W/Kg)	5.424169
SAR 1 g (W/Kg)	15.401350

Z Axis Scan



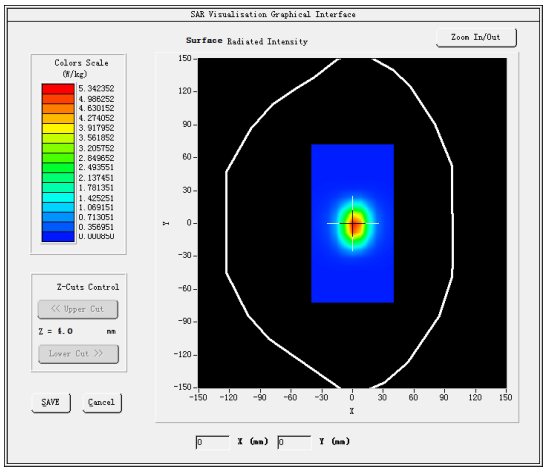
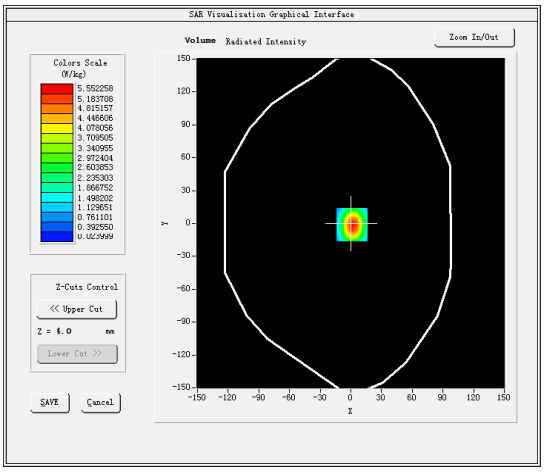
3D screen shot	Hot spot position
	

System Performance Check Data(5800 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=4 mm, dy=4 mm, dz=2 mm
Date of measurement: 2017.05.26
Measurement duration: 29 minutes 48 seconds

Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5800 MHz
Signal	CW
Frequency (MHz)	5800.000000
Relative permittivity (real part)	47.311492
Conductivity (S/m)	6.076138
Power drift (%)	0.210000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.1°C
ConvF:	1.93
Crest factor:	1:1

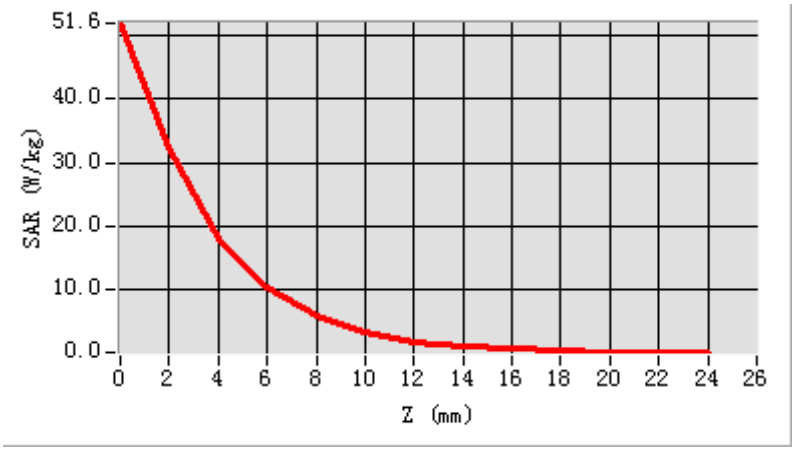
SURFACE SAR	VOLUME SAR
	

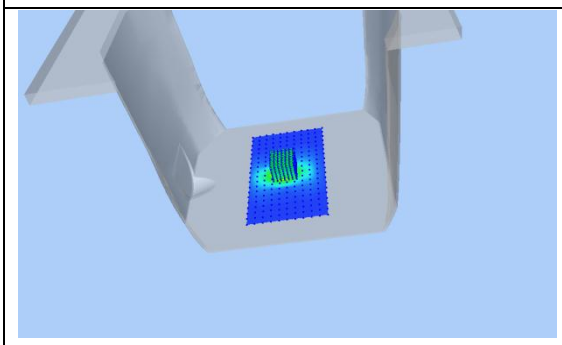
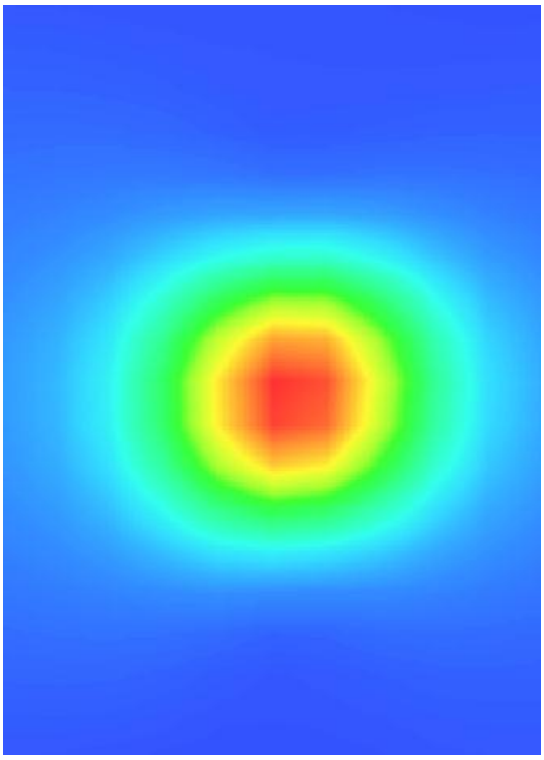
Maximum location: X=1.00, Y=-2.00

SAR Peak: 51.33 W/kg

SAR 10 g (W/Kg)	5.891467
SAR 1 g (W/Kg)	17.371064

Z Axis Scan



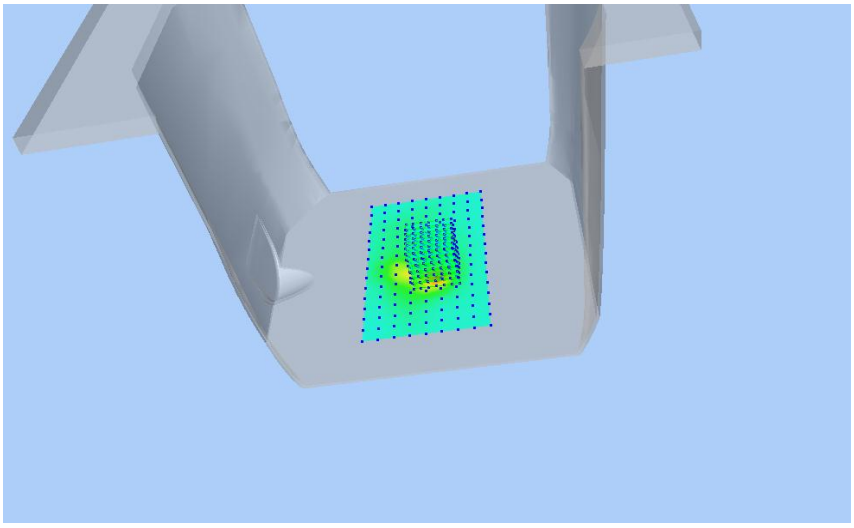
3D screen shot	Hot spot position
	

ANNEX C TEST DATA

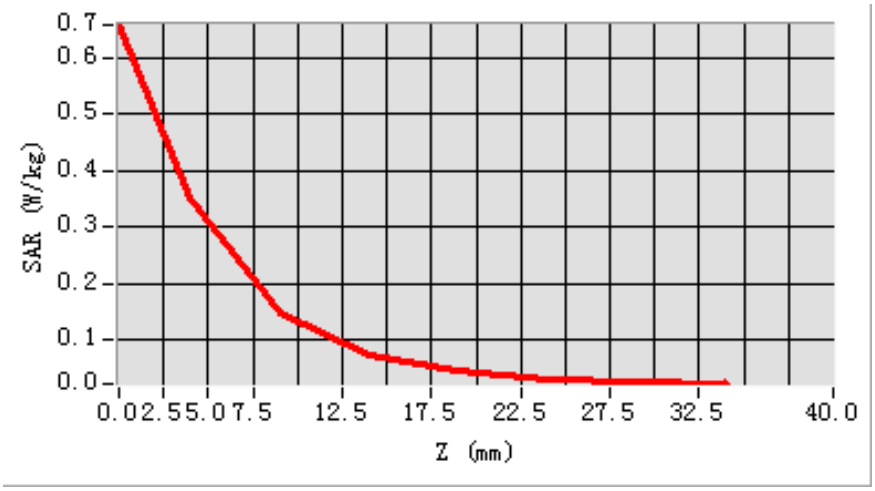
MEAS. 1 Body Plane with Back Side 0mm on Middle Channel in IEEE 802.b mode

Test Date:	23/5/2017
Measurement duration:	18 minutes 26 seconds
Signal:	WLAN, f=2437.0 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 53.34; Conductivity: 1.93 S/m
Test condition:	Ambient Temperature: 22.4°C, Liquid Temperature: 21.1°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 2.55
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	7x7x7,dx=5mm, dy=5mm, dz=5mm,Complete
Maximum location:	X=10.000000, Y=-12.000000
SAR 10g (W/Kg):	0.127756
SAR 1g (W/Kg):	0.302341
Power drift (%):	4.10

3D screen shot



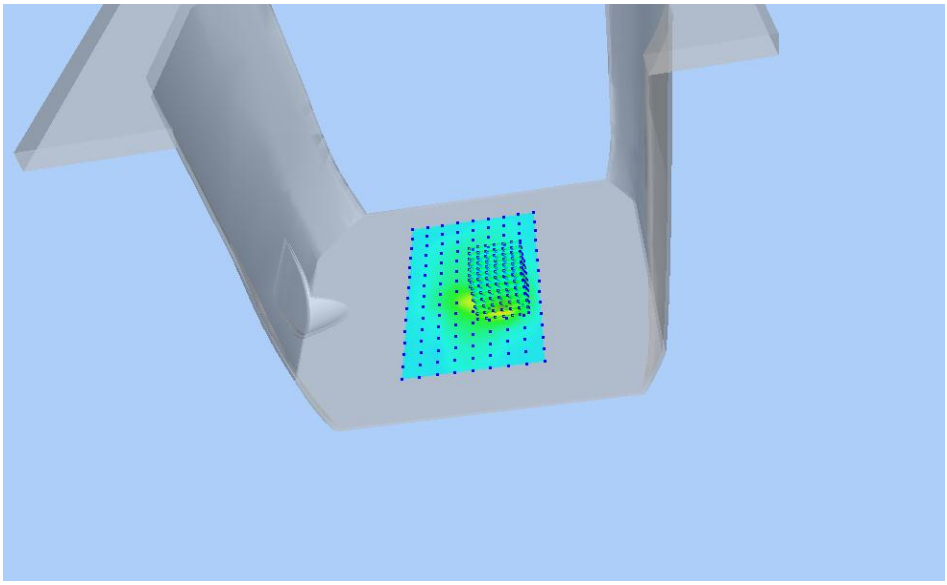
Z Axis Scan



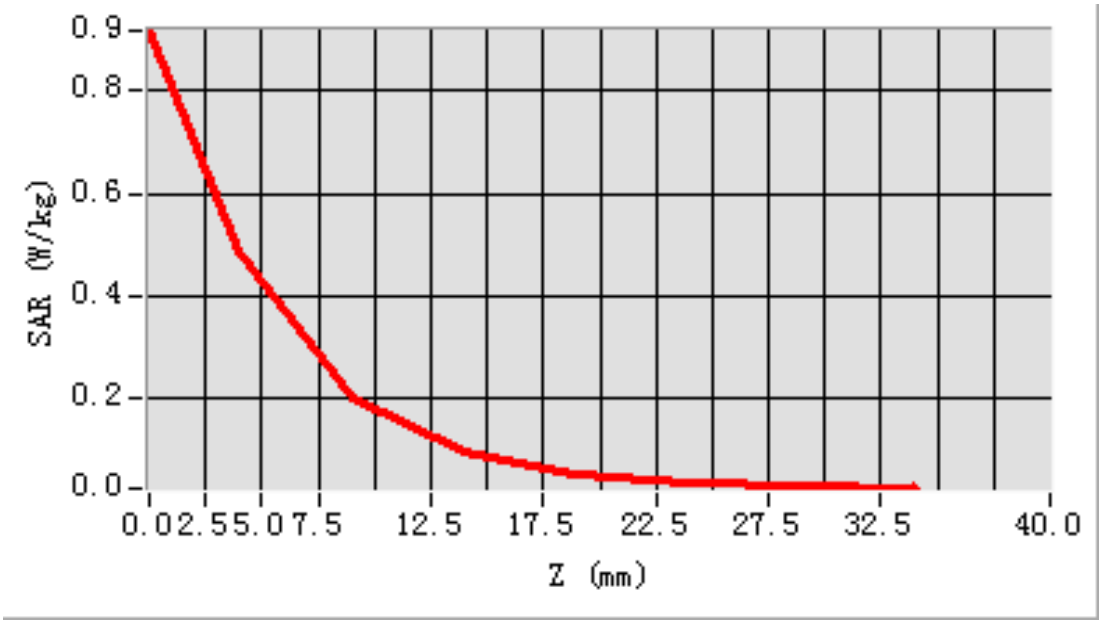
MEAS. 2 Body Plane with Back Side 0mm on Low Channel in IEEE 802.g mode

Test Date:	23/5/2017
Measurement duration:	18 minutes 36 seconds
Signal:	WLAN, f=2412.0 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 53.86; Conductivity: 1.92 S/m
Test condition:	Ambient Temperature: 22.4°C, Liquid Temperature: 21.1°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 2.55
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	7x7x7,dx=5mm, dy=5mm, dz=5mm,Complete
Maximum location:	X=20.000000, Y=-12.000000
SAR 10g (W/Kg):	0.167122
SAR 1g (W/Kg):	0.411549
Power drift (%):	-2.46

3D screen shot



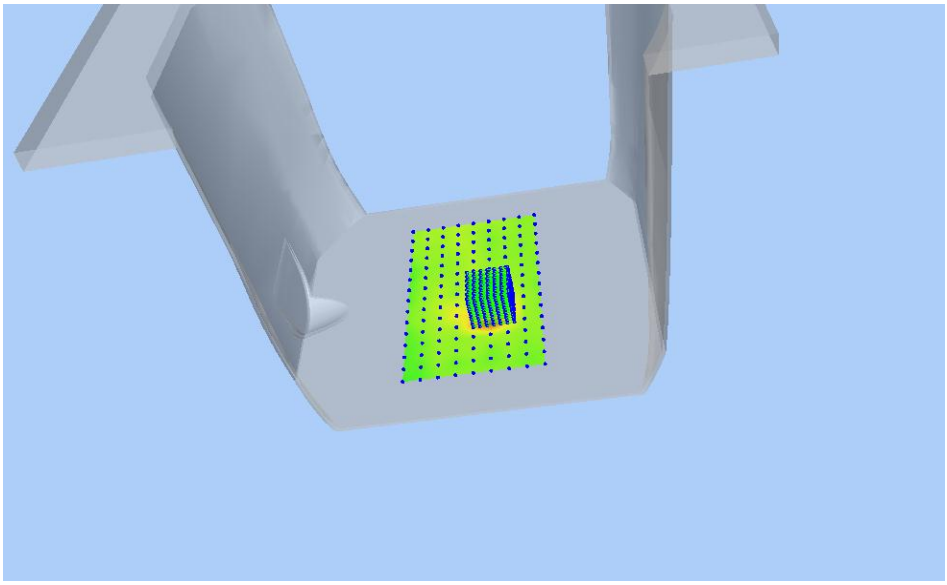
Z Axis Scan



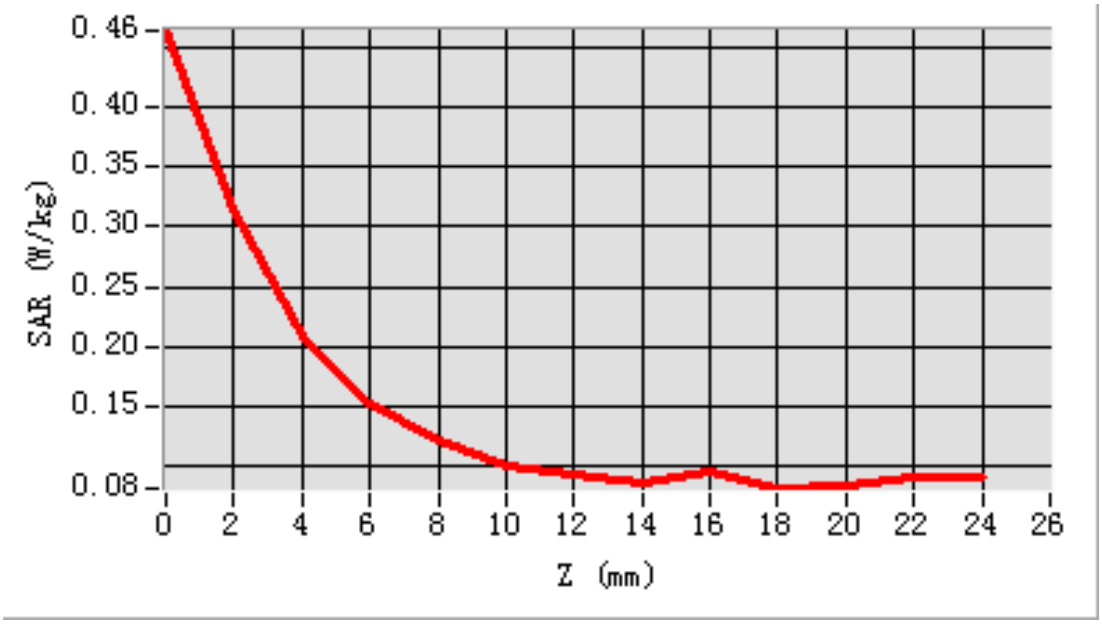
MEAS. 3 Body Plane with Back Side 0mm on Channel 44 in IEEE 802.a mode

Test Date:	24/5/2017
Measurement duration:	28 minutes 57 seconds
Signal:	WLAN, f=5220.0 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 48.62; Conductivity: 5.27 S/m
Test condition:	Ambient Temperature: 22.1°C, Liquid Temperature: 20.9°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 1.85
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location:	X=10.000000, Y=-22.000000
SAR 10g (W/Kg):	0.127430
SAR 1g (W/Kg):	0.213990
Power drift (%):	-2.42

3D screen shot



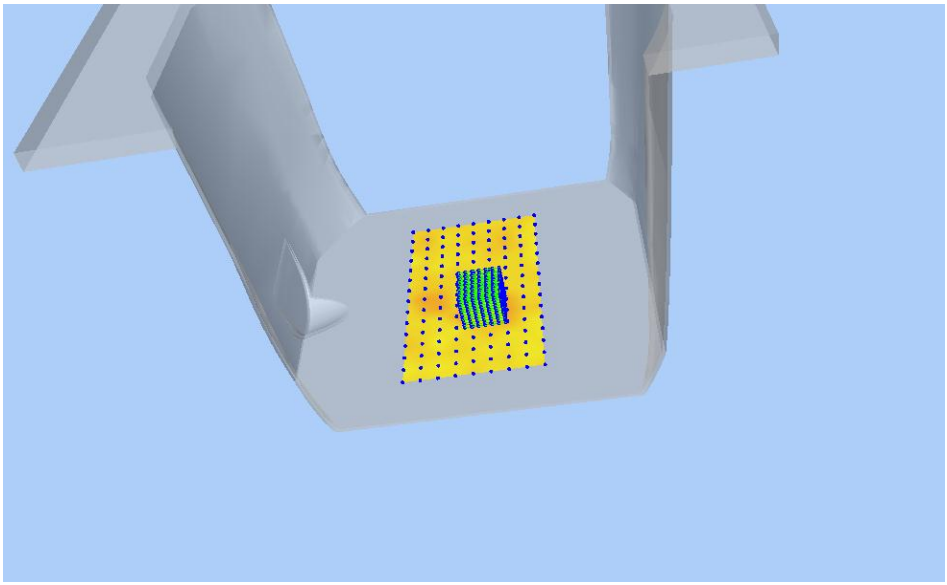
Z Axis Scan



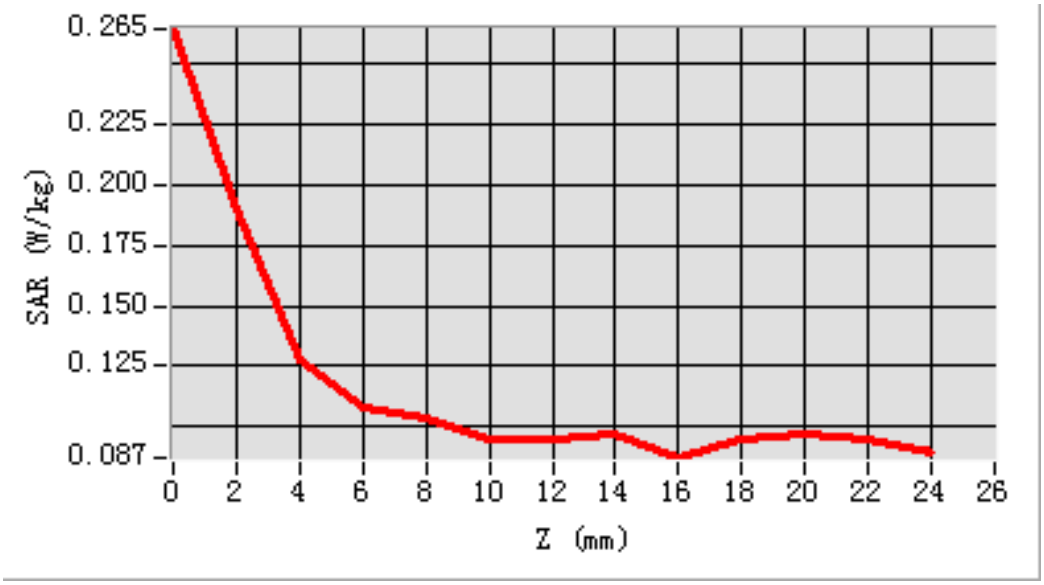
MEAS. 4 Body Plane with Back Side 0mm on Channel 157 in IEEE 802.n(HT-20) mode

Test Date:	26/5/2017
Measurement duration:	29 minutes 28 seconds
Signal:	WLAN, f=5785.0 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 48.63; Conductivity: 6.02 S/m
Test condition:	Ambient Temperature: 22.3°C, Liquid Temperature: 21.1°C
Probe:	SN 34/15 SSE2 EPGO265, ConvF: 1.93
Area Scan:	sam_direct_droit2_surf10mm.txt, h= 5.00 mm
Zoom Scan:	7x7x12,dx=4mm, dy=4mm, dz=2mm,Complete
Maximum location:	X=10.000000, Y=-22.000000
SAR 10g (W/Kg):	0.109711
SAR 1g (W/Kg):	0.139078
Power drift (%):	-3.94

3D screen shot



Z Axis Scan



ANNEX D EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ1750088-AW.pdf”.

ANNEX E SAR TEST SETUP PHOTOS

Please refer the document “BL-SZ1750088-AS2.pdf”.

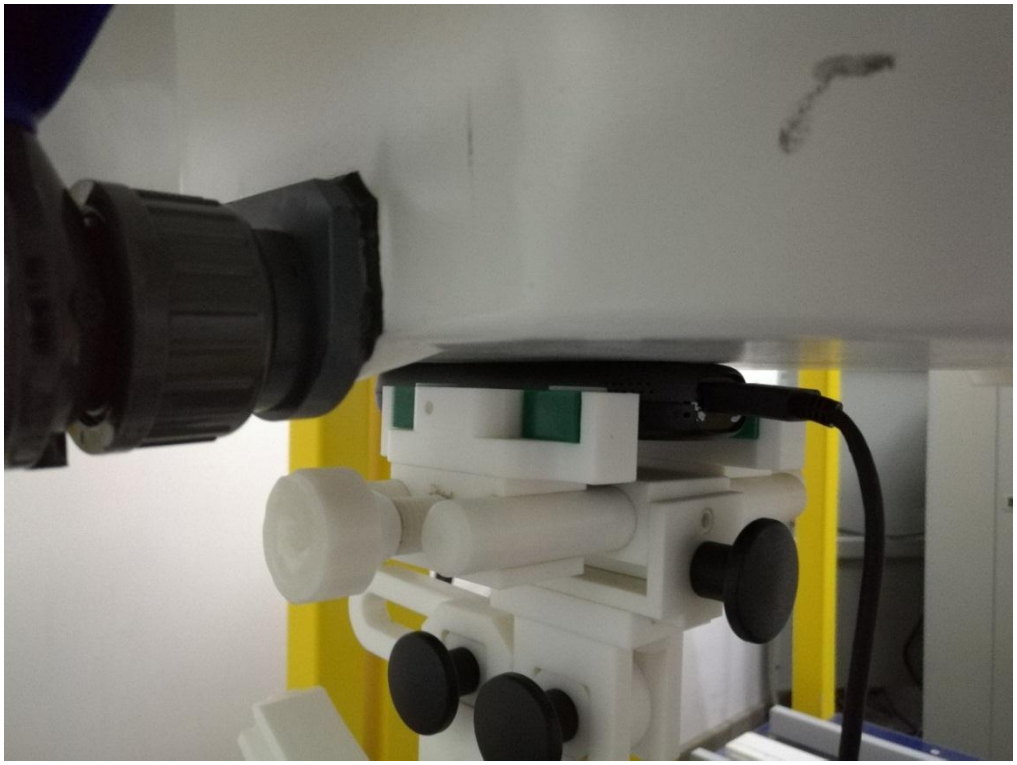
ANNEX F CALIBRATION REPOR

Please refer the document “CALIBRATION REPORT .pdf”.

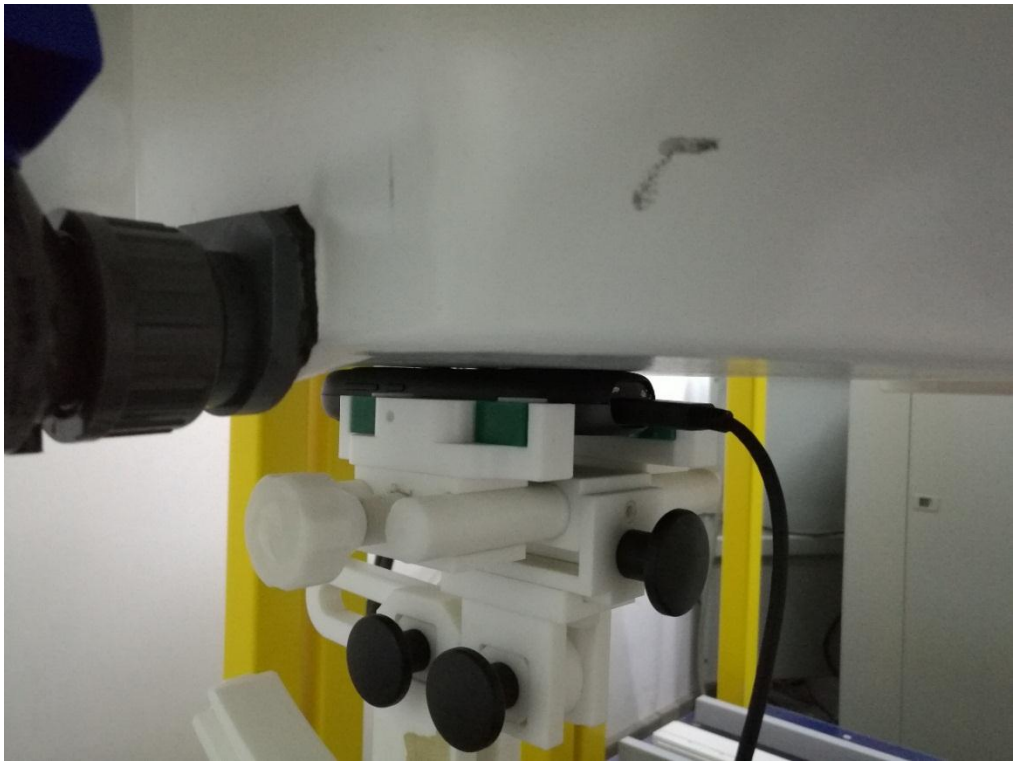
--END OF REPORT--

SAR TEST SETUP PHOTO

Back Side (0 mm)



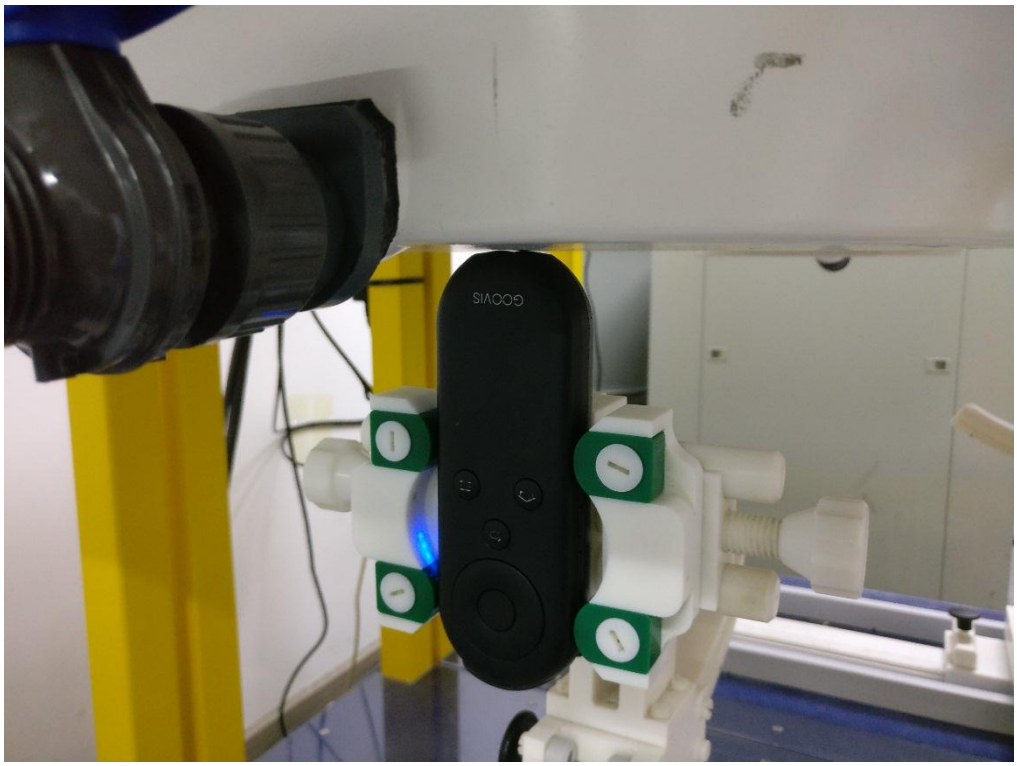
Front Side (0 mm)



Left Side (0 mm)

Right Side (0 mm)

Bottom Side (0 mm)



ANNEX C EUT EXTERNAL PHOTOS

EUT- Control Box Whole View

EUT – Control Box Front View

EUT - Control Box Rear View

EUT – Control Box Side View

EUT – Control Box Side View

EUT – Control Box Side View

EUT – Control Box Side View

EUT – Control Box Port View

EUT –Glasses Front View

EUT –Glasses Rear View

EUT –Glasses Side View-1

EUT –Glasses Side View-2

EUT –Glasses Side View

EUT –Glasses Side View

EUT –Adapter View

EUT –USB Line View

SAR

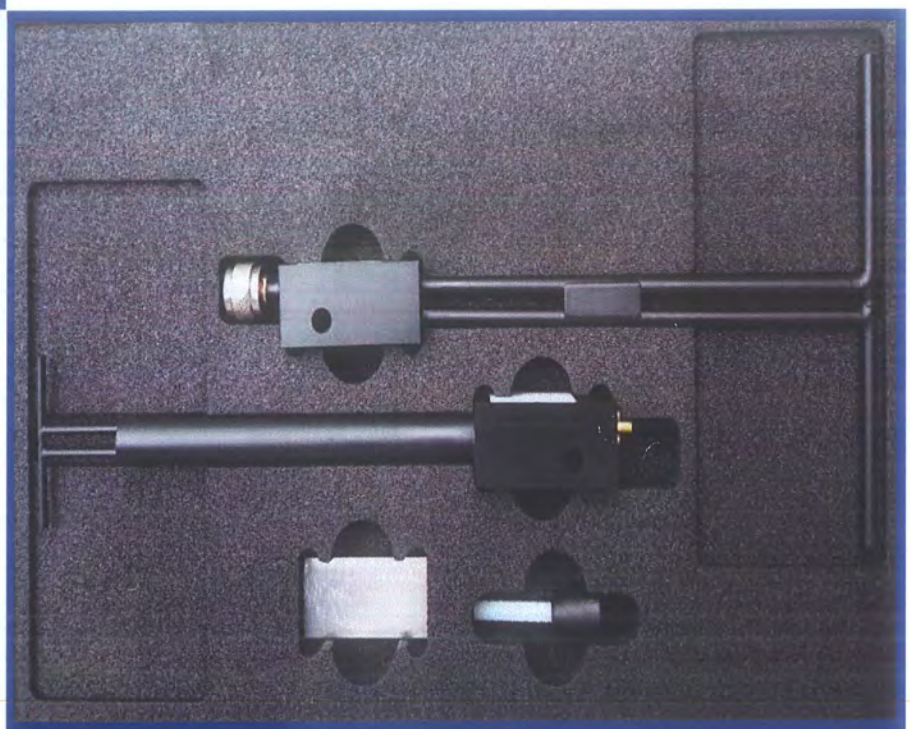
Dipole & Waveguide

Performance Measurement Report

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

Validation Dipoles & Waveguide



Report No.:	LW-SZ17C0366-701
EUT Type:	SAR Validation Dipole and Waveguide
Model Name:	DIP 0G750-253,DIP 0G835-246 DIP 0G900-247,DIP 1G800-248 DIP 1G900-249,DIP 2G000-250 DIP 2G450-251,DIP 2G600-254 SWG 5500-WGA24
Brand Name:	SATIMO
Test Conclusion:	Pass
Test Date:	Mar. 1, 2017 ~ Mar. 4, 2017
Date of Issue:	Mar. 18, 2017

Tested by: Tu Lang
(Engineer)

Approved by: Liao Jianming
(Technical Director)

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Email: info@baluntek.com
www.baluntek.com

1 GENERAL INFORMATION

1.1 Introduction

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDB 865664 D01 for reference dipoles used for SAR measurement system validations. Instead of the typical annual calibration recommended by measurement standards, the reference dipoles were demonstrated that the SAR target, impedance and return loss have remain stable, so the longer calibration interval is acceptable.

1.2 General Description for Equipment under Test (EUT)

Model	Frequency	Serial Number	Product Condition (New/ Used)	Last Cal. Date
Dipole				
DIP 0G750	750 MHz	SN 25/13 DIP 0G750-253	Used	2015/03/16
DIP 0G835	835 MHz	SN 25/13 DIP 0G835-246	Used	2015/03/16
DIP 0G900	900 MHz	SN 25/13 DIP 0G900-247	Used	2015/03/16
DIP 1G800	1800 MHz	SN 25/13 DIP 1G900-248	Used	2015/03/16
DIP 1G900	1900 MHz	SN 25/13 DIP 1G900-249	Used	2015/03/16
DIP 2G000	2000 MHz	SN 25/13 DIP 2G000-250	Used	2015/03/16
DIP 2G450	2450 MHz	SN 25/13 DIP 2G450-251	Used	2015/03/16
DIP 2G600	2600 MHz	SN 25/13 DIP 2G600-254	Used	2015/03/16
Waveguide				
SWG5500	5GHz-6GHz	SN 30/13 WGA24	Used	2015/03/16

1.3 EUT Photos

DIP 0G750-253

DIP 0G835-246

DIP 0G900-247
DIP 1G800-248

DIP 1G900-249
DIP 2G000-250
DIP 2G450-251

DIP 2G600-254

Waveguide SWG5500

2 SIMULATING LIQUID VERIFICATION

Liquid Type	Fre. (MHz)	Meas. Conductivity (σ) (S/m)	Meas. Permittivity (ε)	Target Conductivity (σ) (S/m)	Target Permittivity (ε)	Conductivity Tolerance (%)	Permittivity Tolerance (%)
Head	750	0.90	41.88	0.89	41.94	1.12	-0.14
Body		0.93	56.89	0.96	55.53	-3.12	2.45
Head	835	0.88	42.96	0.90	41.50	-2.22	3.52
Body		0.98	54.27	0.97	55.20	1.03	-1.68
Head	900	0.98	41.01	0.97	41.50	1.03	-1.18
Body		1.08	53.62	1.05	55.00	2.86	-2.51
Head	1800	1.42	38.81	1.40	40.00	1.43	-2.97
Body		1.49	54.35	1.52	53.30	-1.97	1.97
Head	1900	1.43	39.83	1.40	40.00	2.14	-0.43
Body		1.54	54.02	1.52	53.30	1.32	1.35
Head	2000	1.43	38.79	1.40	40.00	2.14	-3.03
Body		1.55	51.51	1.52	53.30	1.97	-3.36
Head	2450	1.81	38.86	1.80	39.20	0.56	-0.87
Body		1.95	52.91	1.95	52.70	0.00	0.40
Head	2600	1.98	38.09	1.96	39.01	1.02	-2.36

Body		2.14	53.39	2.16	52.51	-0.93	1.68
Head	5200	4.62	36.73	4.66	35.99	-0.86	2.06
Body		5.21	50.08	5.30	49.01	-1.70	2.18
Head	5400	4.82	36.22	4.86	35.76	-0.82	1.29
Body		5.53	50.13	5.53	48.74	0.00	2.85
Head	5600	5.13	34.25	5.07	35.53	1.18	-3.60
Body		5.91	49.14	5.77	48.47	2.43	1.38
Head	5800	5.33	34.62	5.27	35.30	1.14	-1.93
Body		6.05	47.54	6.00	48.20	0.83	-1.37

3 DIPOLE IMPEDANCE AND RETURN LOSS

The dipoles are designed to have low return loss when presented against a flat phantom at the specified distance. A Vector Network Analyzer was used to perform a return loss measurement on the specific dipole when in the measurement location against the phantom and the distance was specified by the manufacturer with a special, low loss and low relative permittivity spacer.
The impedance was measured at the SMA-connector with the network analyzer.

The measurement of verification with return loss should not deviate by more than 20% and minimum of 20 dB of the return loss, and the impedance (real or imaginary parts) should not deviate by more than 5 Ohms from the previous measurement using network analyzer.

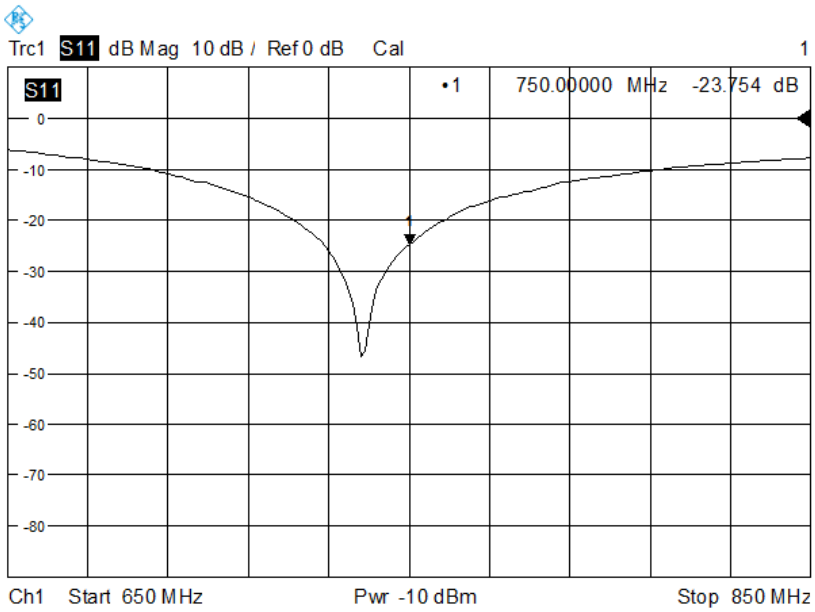
Note:
The “Previous Meas.” in the following table refer to dipoles or other equivalent RF sources calibration reports.

3.1 DIP 0G750

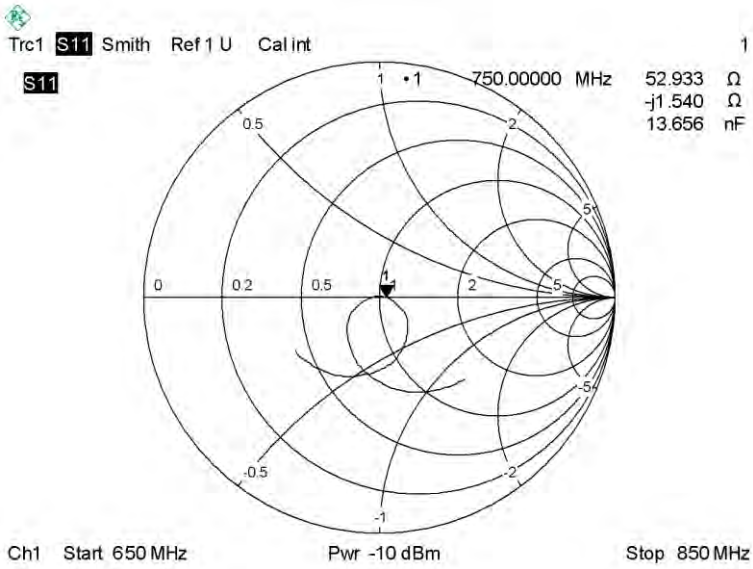
RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-23.75	-24.73	3.96 %
Impedance	52.9 Ω - 1.5 jΩ	56.1 Ω - 1.3 jΩ	3.2 Ω (Real part)

Return Loss



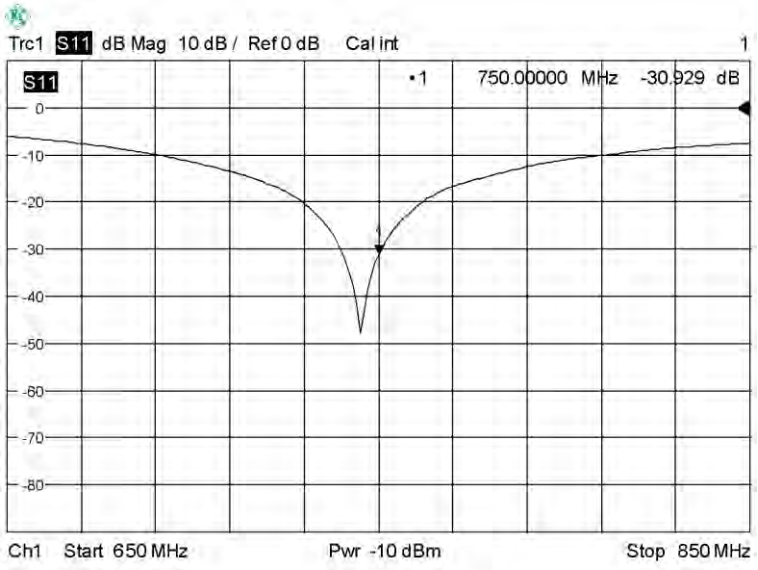
Impedance



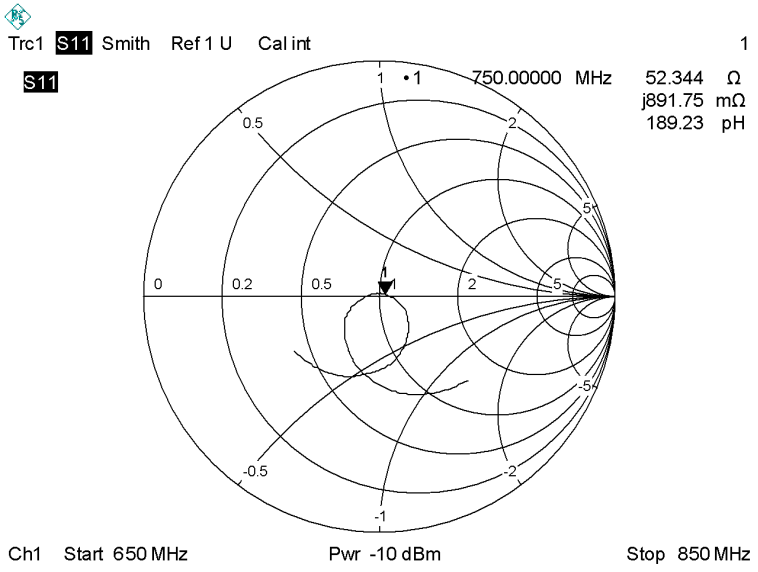
RETURN LOSS AND IMPEDANCE IN BODY LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-30.93	-27.47	12.6 %
Impedance	52.3 Ω + 0.9 jΩ	55.8 Ω + 2.6 jΩ	3.5 Ω (Real part)

Return Loss



Impedance

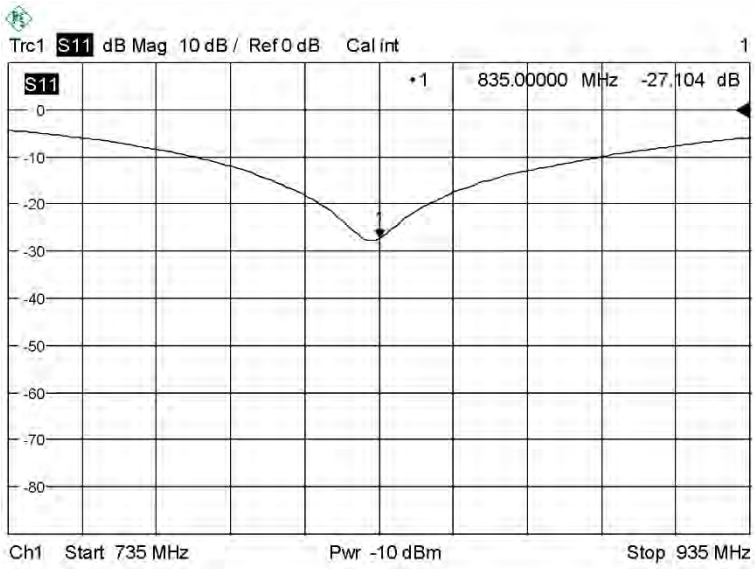


3.2 DIP 0G835

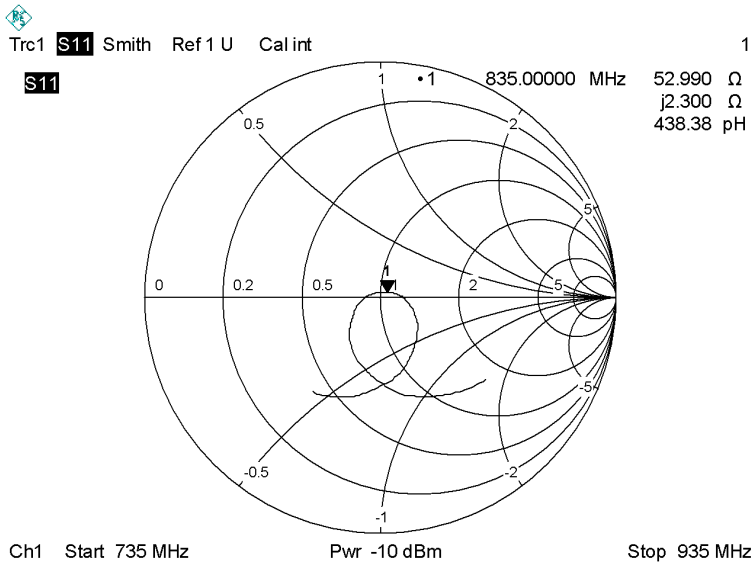
RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-27.10	-25.89	4.67 %
Impedance	53.0 Ω + 2.3 jΩ	55.0 Ω + 0.7 jΩ	2.0 Ω (Real part)

Return Loss



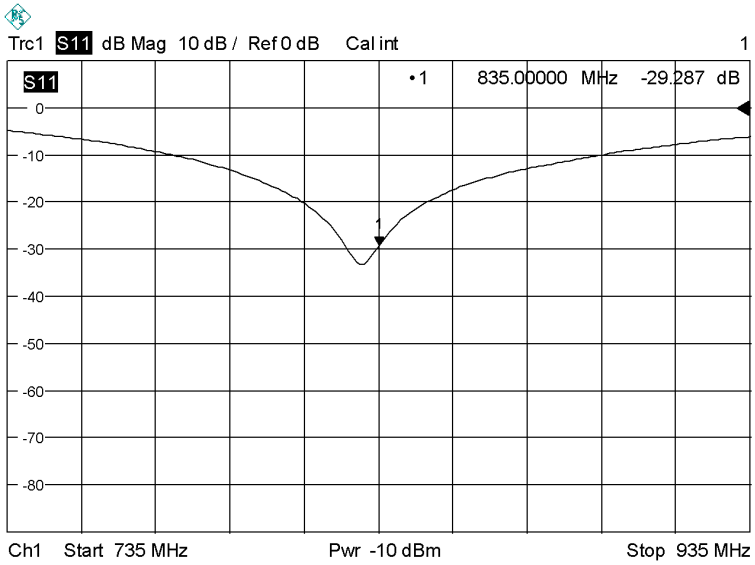
Impedance



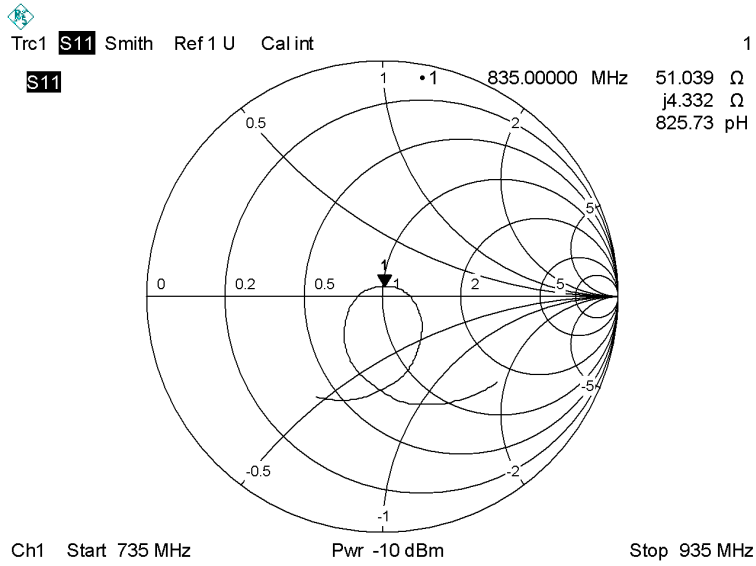
RETURN LOSS AND IMPEDANCE IN BODY LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-29.29	-27.60	6.12 %
Impedance	51.0 Ω + 4.3 jΩ	53.6 Ω + 2.5 jΩ	2.6 Ω (Real part)

Return Loss



Impedance

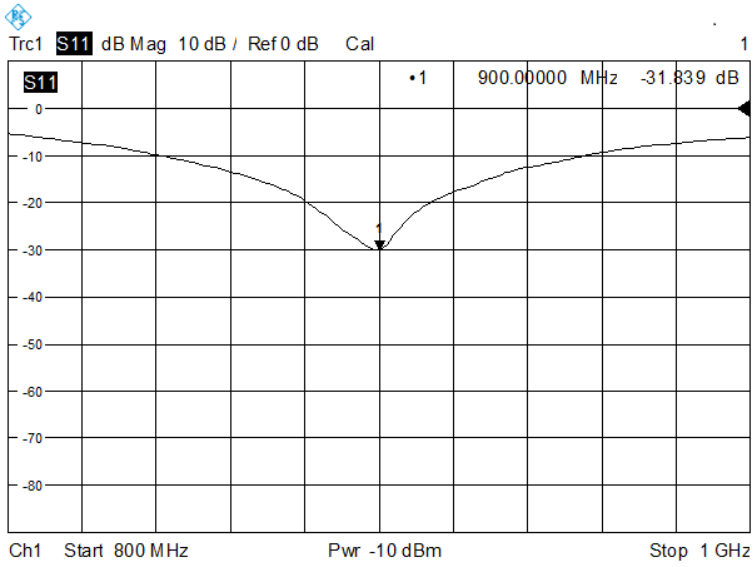


3.3 DIP 0G900

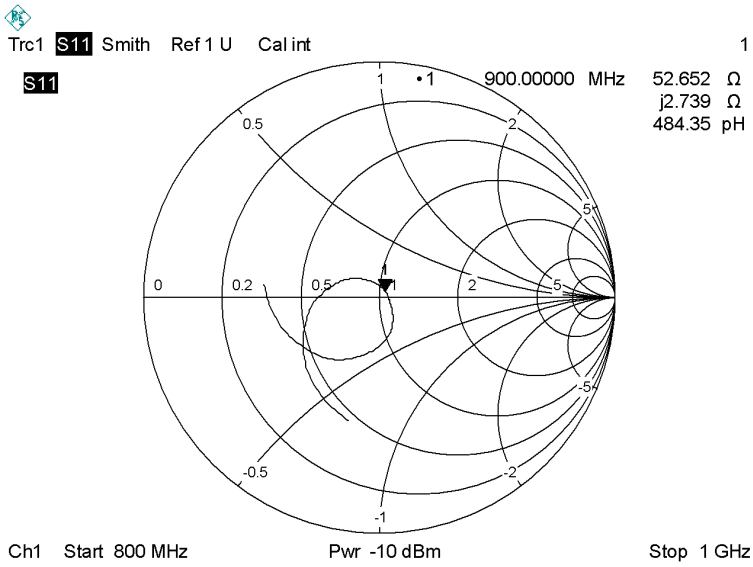
RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-31.8	-31.9	0.3 %
Impedance	52.7 Ω + 2.7 jΩ	53.2 Ω + 1.4 jΩ	1.3 Ω (Imaginary part)

Return Loss



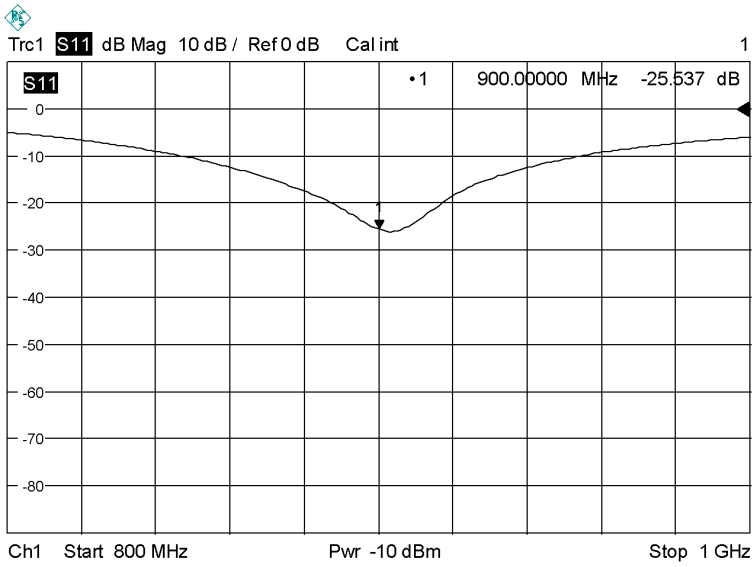
Impedance



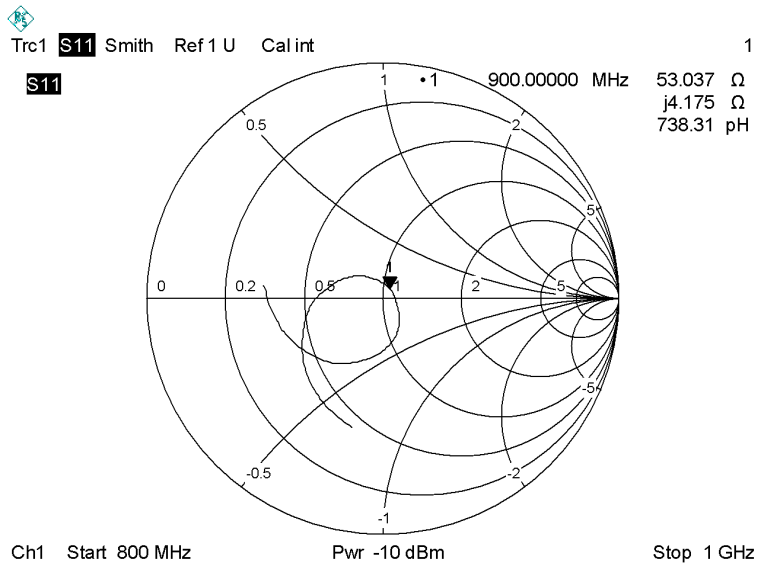
RETURN LOSS AND IMPEDANCE IN BODY LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-25.54	-27.20	6.1 %
Impedance	53.0 Ω + 4.2 jΩ	53.2 Ω + 3.2 jΩ	1.0 Ω (Imaginary part)

Return Loss



Impedance

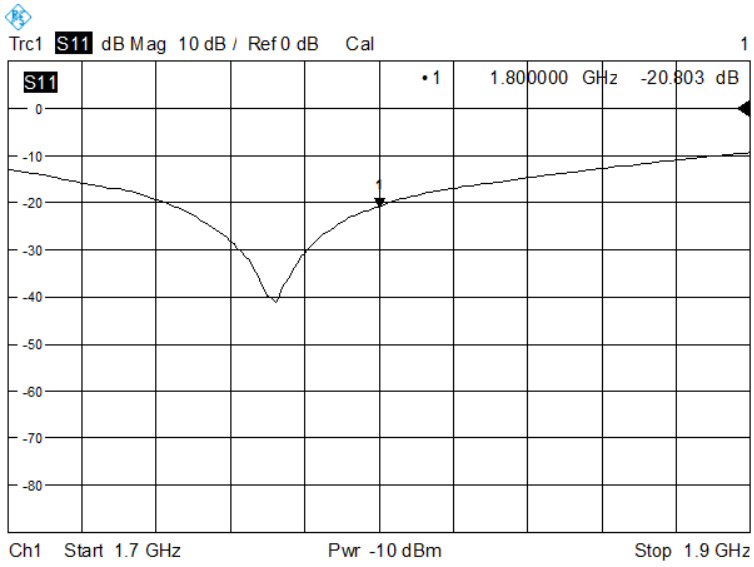


3.4 DIP 1G800

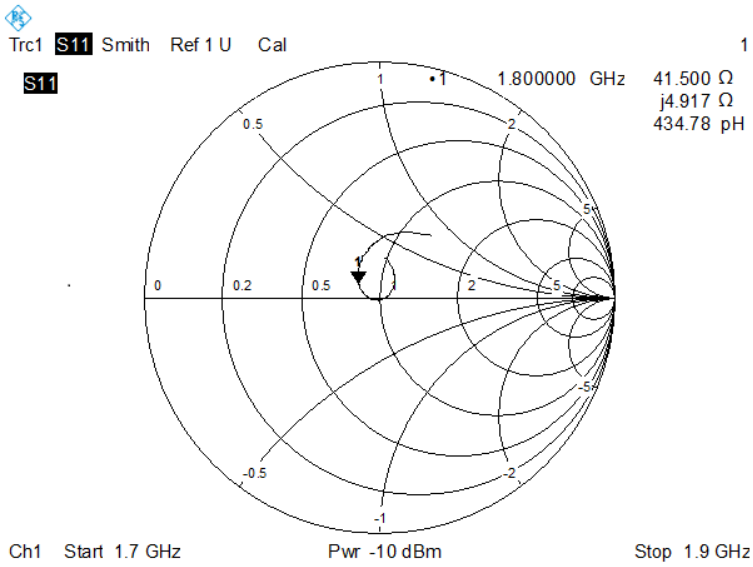
RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-20.80	-22.41	7.2 %
Impedance	41.5 Ω + 4.9 jΩ	42.4 Ω + 3.9 jΩ	1.0 Ω (Imaginary part)

Return Loss



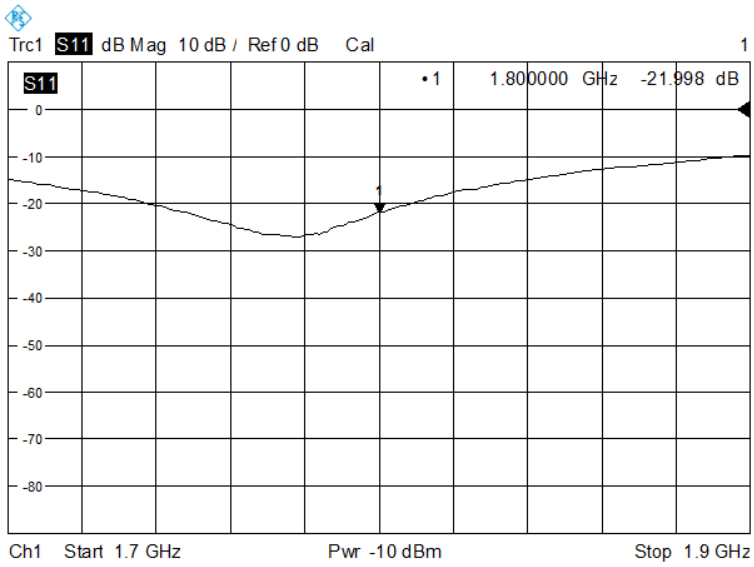
Impedance



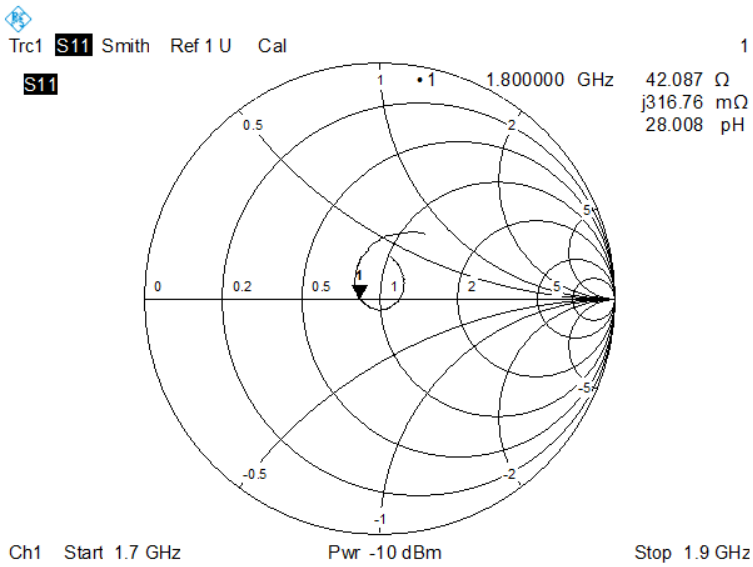
RETURN LOSS AND IMPEDANCE IN BODY LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-22.00	-22.09	0.4 %
Impedance	42.1 Ω + 0.3 jΩ	42.9 Ω + 0.7 jΩ	0.8 Ω (Real part)

Return Loss



Impedance

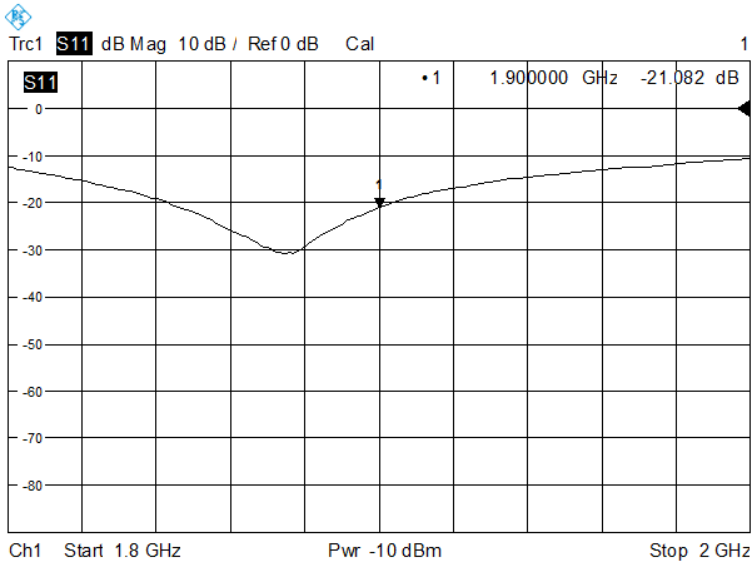


3.5 DIP 1G900

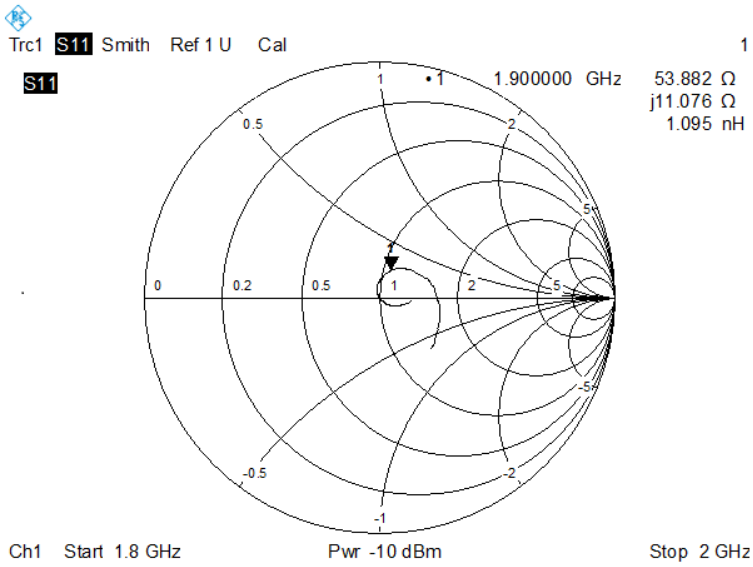
RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-21.08	-20.99	0.4 %
Impedance	53.9 Ω + 11.1 jΩ	56.6 Ω + 12.2 jΩ	2.7 Ω (Real part)

Return Loss



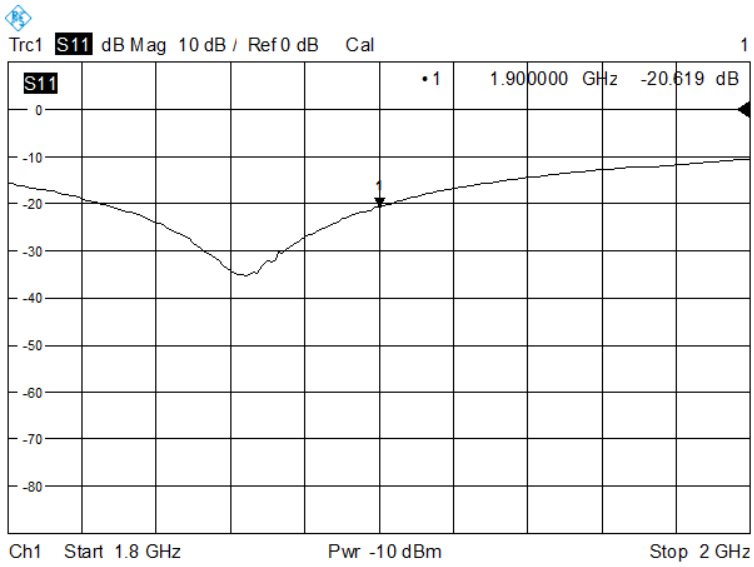
Impedance



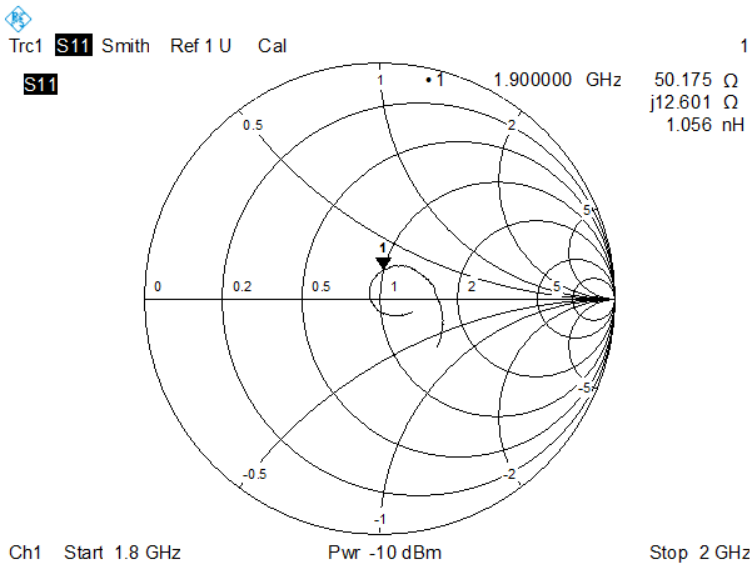
RETURN LOSS AND IMPEDANCE IN BODY LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-20.62	-21.79	5.4 %
Impedance	50.2 Ω + 12.6 jΩ	51.0 Ω + 13.2 jΩ	0.8 Ω (Real part)

Return Loss



Impedance

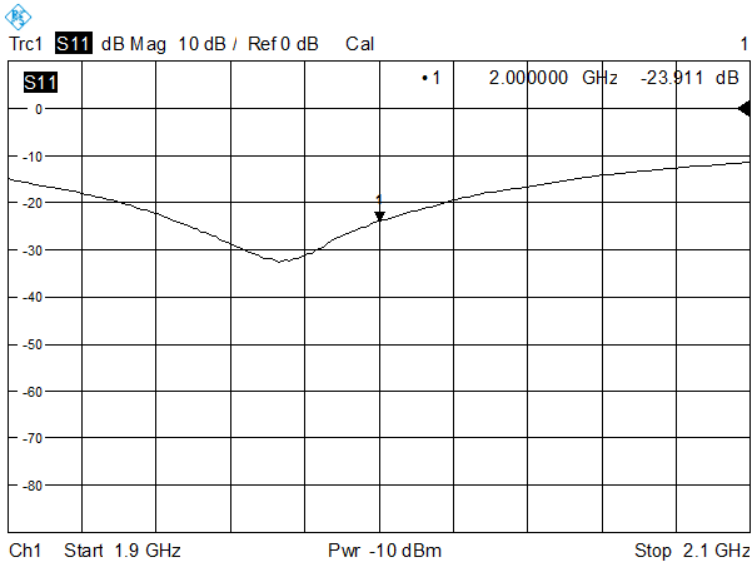


3.6 DIP 2G000

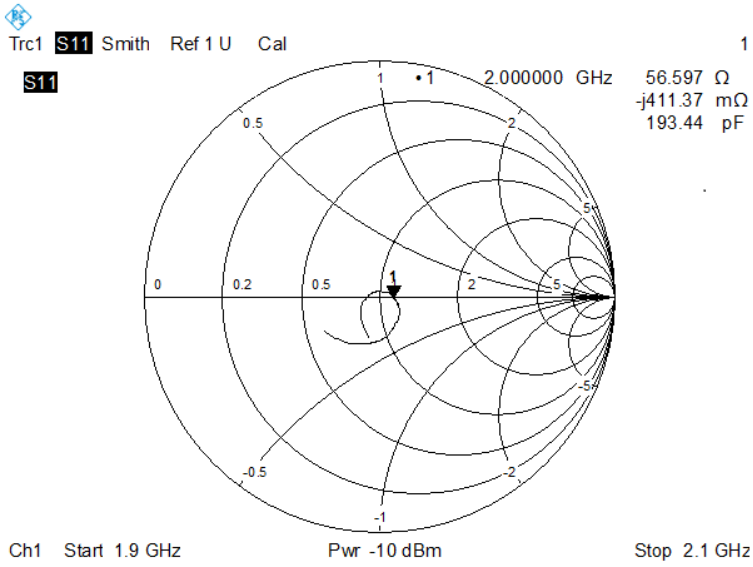
RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-23.91	-25.62	.7%
Impedance	56.6 Ω – 0.4 jΩ	54.3 Ω - 4.1 jΩ	3.7 Ω (Imaginary part)

Return Loss



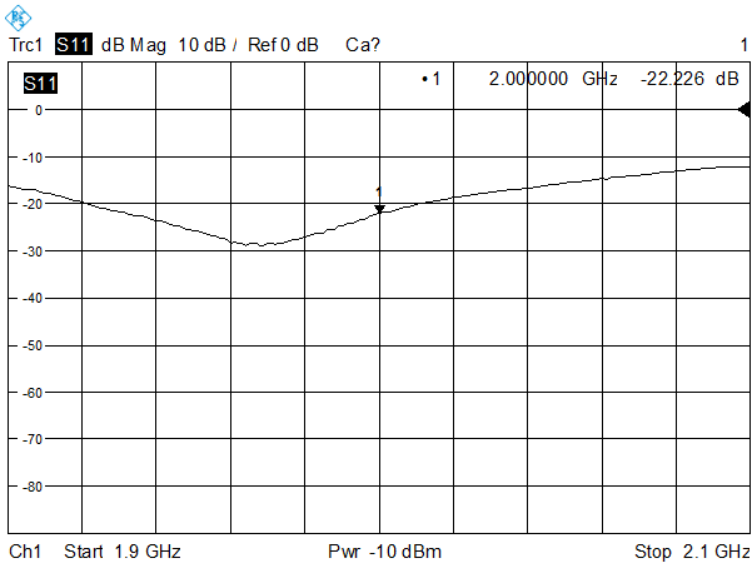
Impedance



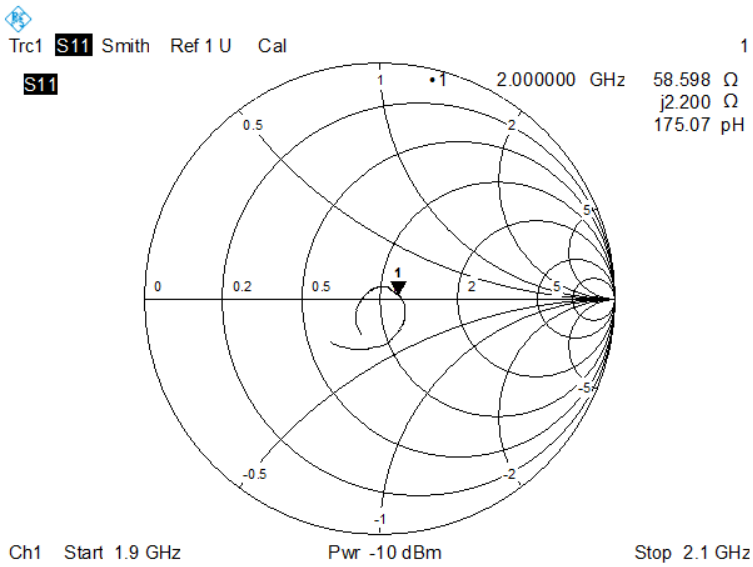
RETURN LOSS AND IMPEDANCE IN BODY LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-22.23	-22.40	0.8 %
Impedance	58.6 Ω + 2.20 jΩ	55.7 Ω + 2.61 jΩ	2.9 Ω (Real part)

Return Loss



Impedance

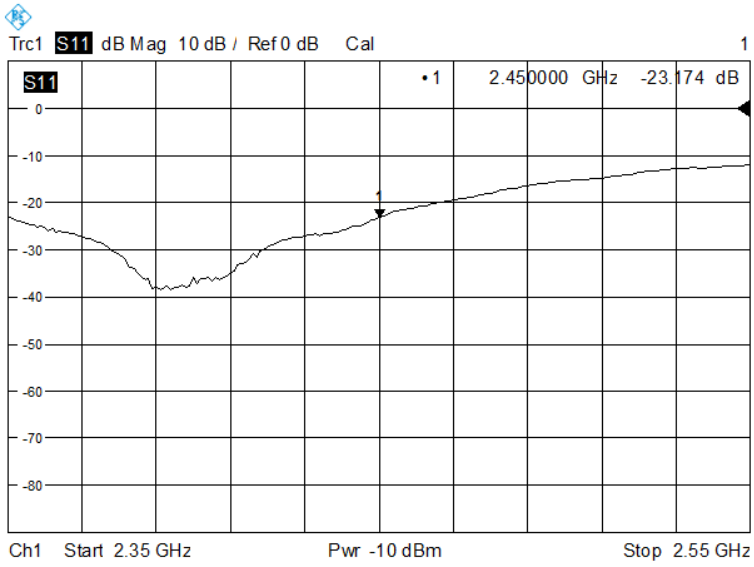


3.7 DIP 2G450

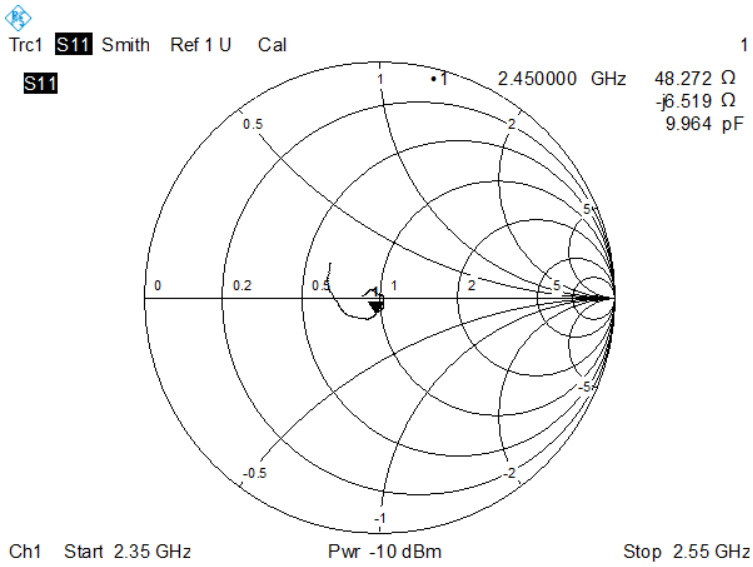
RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-23.17	-23.68	2.2 %
Impedance	48.3 Ω + 6.5 jΩ	47.0 Ω + 5.8 jΩ	1.3 Ω (Real part)

Return Loss



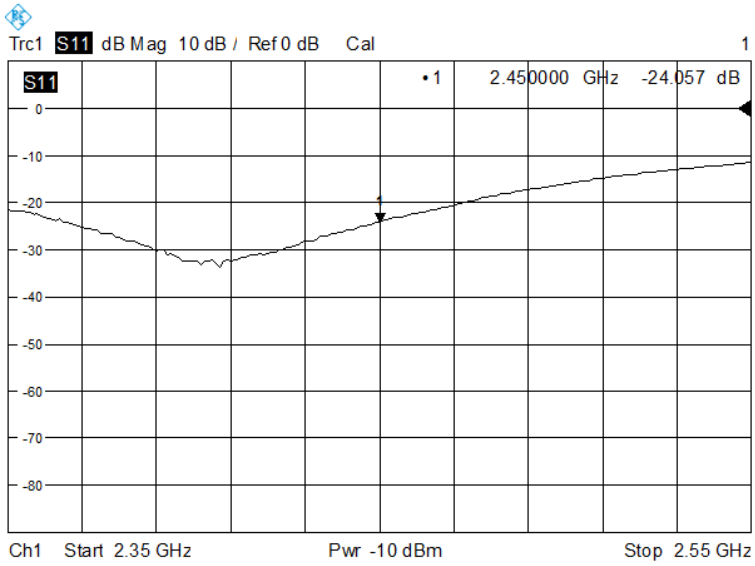
Impedance



RETURN LOSS AND IMPEDANCE IN BODY LIQUID

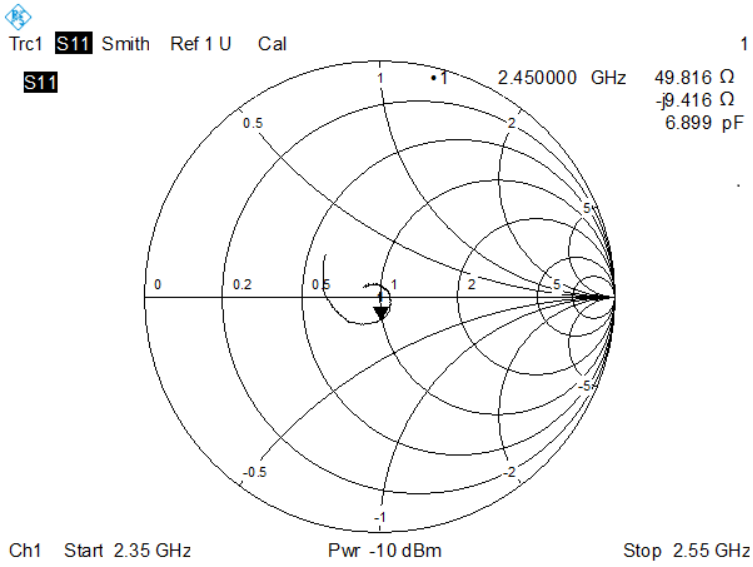
Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-24.06	-24.48	3.5 %
Impedance	49.8 Ω – 9.4 jΩ	49.4 Ω – 5.9 jΩ	3.5 Ω (Imaginary part)

Return Loss



.0

Impedance

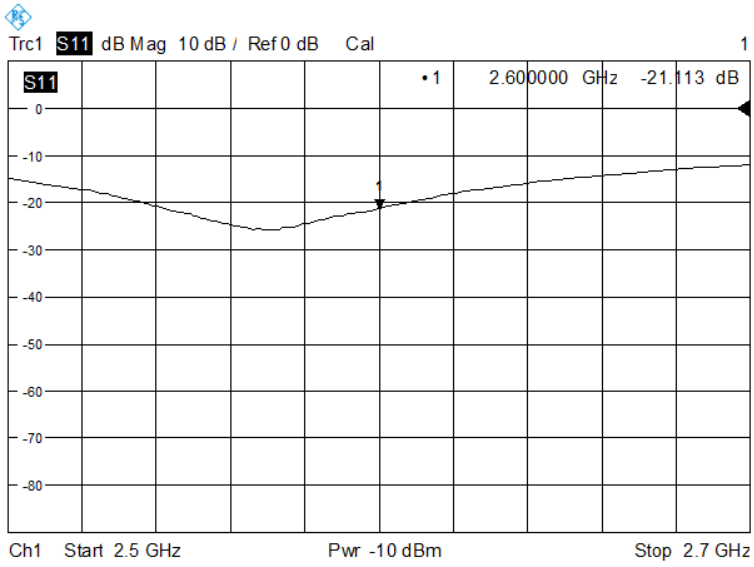


3.8 DIP 2G600

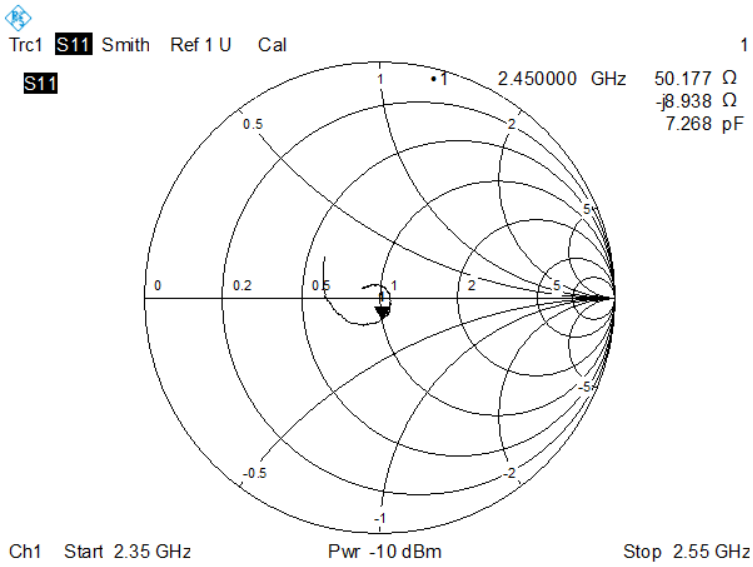
RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-21.11	-20.83	1.34 %
Impedance	50.2 Ω + 8.9 jΩ	51.0 Ω + 11.4 jΩ	2.5 Ω (Imaginary part)

Return Loss



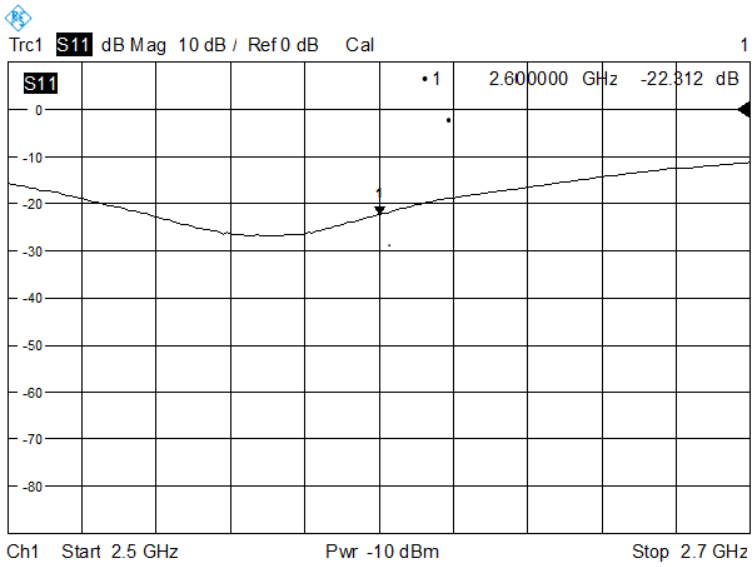
Impedance



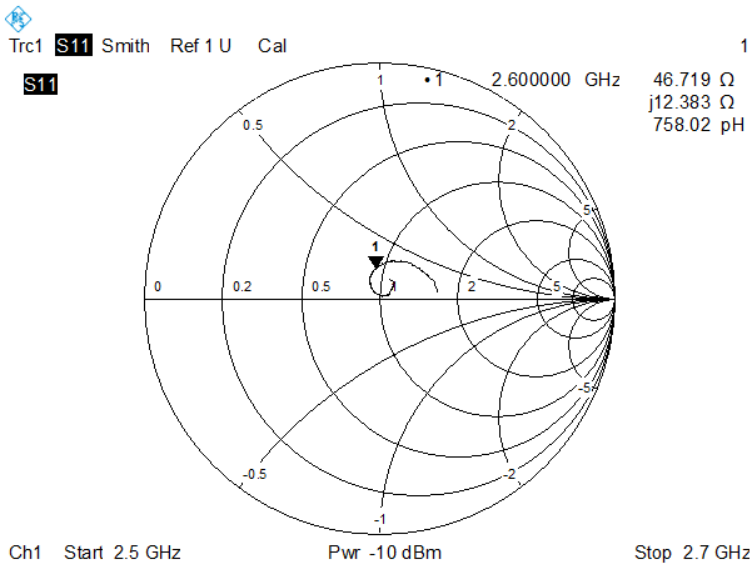
RETURN LOSS AND IMPEDANCE IN BODY LIQUID

Meas. Results	Current Meas.	Previous Meas.	Max. Deviation
Return Loss (dB)	-22.31	-21.11	5.7 %
Impedance	46.7 Ω + 12.4 jΩ	47.6 Ω + 11.1 jΩ	1.3 Ω (Imaginary part)

Return Loss



Impedance



4 WAVEGUIDE IMPEDANCE AND RETURN LOSS

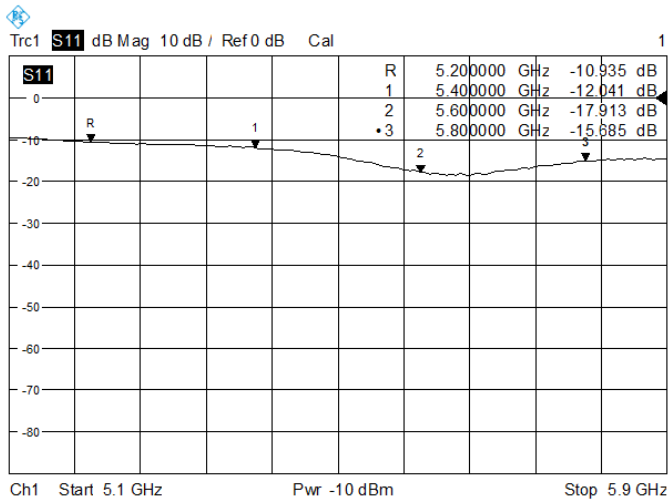
The waveguide are designed to have low return loss when presented against a flat phantom at the specified distance. A Vector Network Analyzer was used to perform a return loss measurement on the specific waveguide when in the measurement location against the phantom and the distance was specified by the manufacturer with a special, low loss and low relative permittivity spacer.
The impedance was measured at the SMA-connector with the network analyzer.

4.1 SWG5500

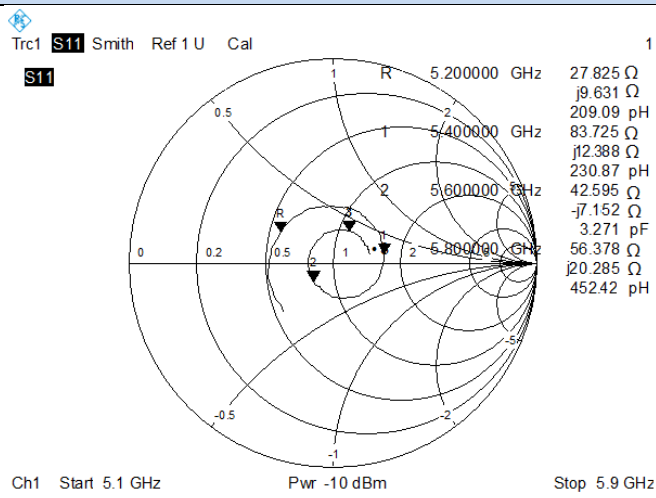
RETURN LOSS AND IMPEDANCE IN HEAD LIQUID

Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
5200	-10.94	-8.0	27.8 Ω + 9.6 jΩ
5400	-12.04	-8.0	83.7 Ω + 12.3 jΩ
5600	-17.91	-8.0	42.6 Ω - 7.2 jΩ
5800	-15.79	-8.0	56.4 Ω + 20.3 jΩ

Return Loss



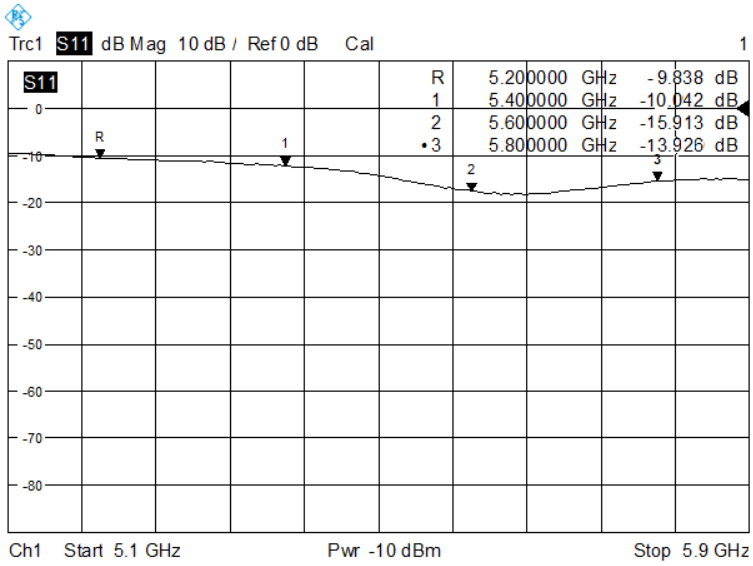
Impedance



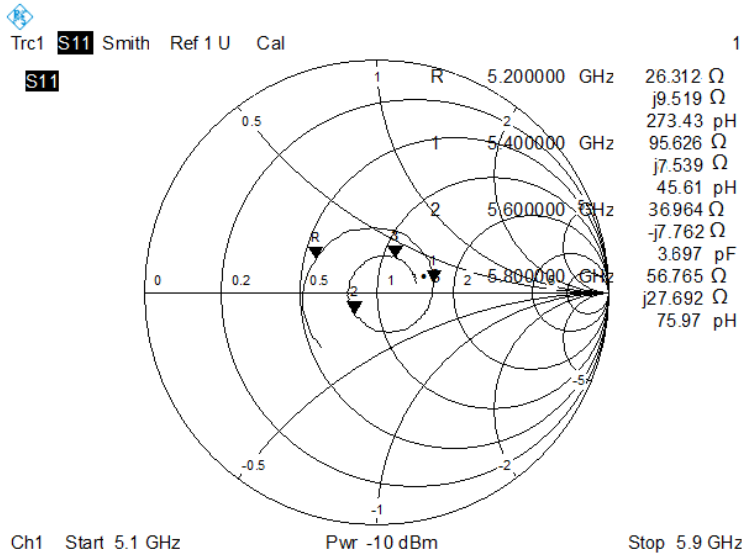
RETURN LOSS AND IMPEDANCE IN BODY LIQUID

Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
5200	-9.84	-8.0	26.3 Ω + 9.5 jΩ
5400	-10.04	-8.0	95.6 Ω + 7.5 jΩ
5600	-15.91	-8.0	37.0 Ω - 7.8 jΩ
5800	-13.93	-8.0	56.8 Ω + 27.7 jΩ

Return Loss

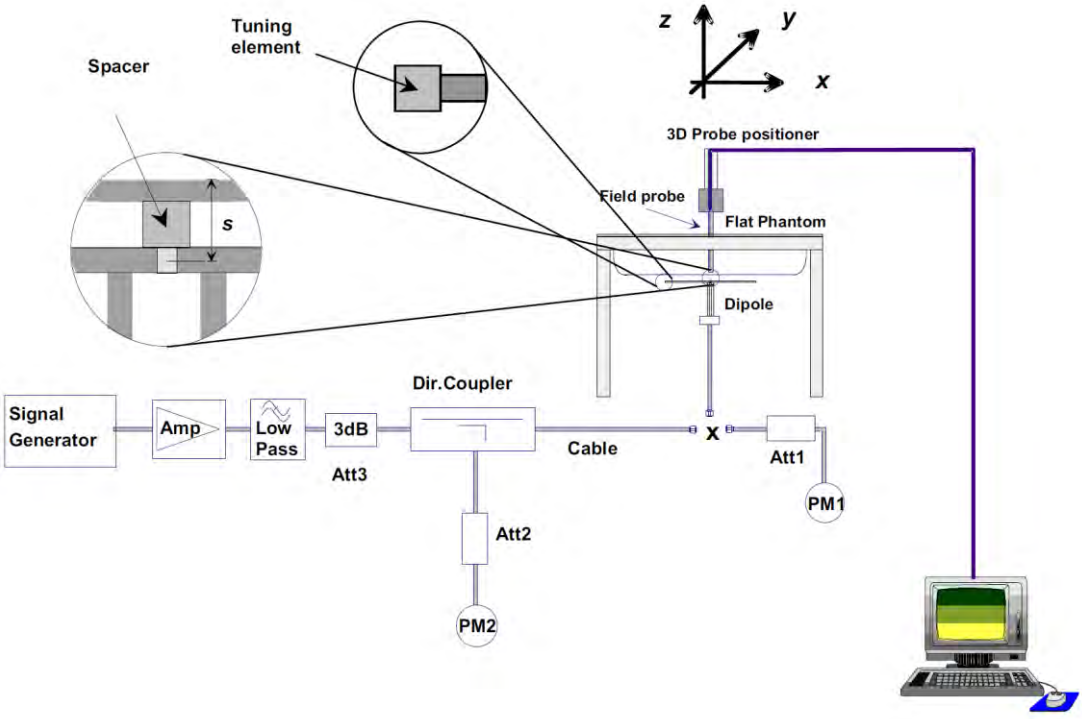


Impedance



5 VALIDATION MEASUREMENT

The IEEE Std. 1528, FCC KDBs and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.



5.1 Dipole and Waveguide SAR Validation Measurement Result

Freq. (MHz)	Liquid Type	Power (mW)	1 g Measured SAR (W/kg)	Normalized SAR (W/kg)	10 g Measured SAR (W/kg)	Normalized SAR (W/kg)	1 g Targeted SAR (W/kg)	Tolerance (%)	10 g Targeted SAR (W/kg)	Tolerance (%)
750	Head	100	0.864	8.64	0.573	5.73	8.49	1.77	5.55	3.24
	Body	100	0.865	8.65	0.589	5.89	8.49	1.88	5.55	6.13
835	Head	100	0.977	9.77	0.603	6.03	9.56	2.20	6.22	-3.05
	Body	100	1.009	10.09	0.661	6.61	9.56	5.54	6.22	6.27
900	Head	100	1.086	10.86	0.723	7.23	10.9	-0.37	6.99	3.43
	Body	100	1.140	11.40	0.752	7.52	10.9	4.59	6.99	7.58
1800	Head	100	3.888	38.88	1.966	19.66	38.40	1.25	20.10	-2.19
	Body	100	3.923	39.23	1.992	19.92	38.40	2.16	20.10	-0.90
1900	Head	100	3.902	39.02	1.922	19.22	39.70	-1.71	20.50	-6.24
	Body	100	3.951	39.51	2.010	20.10	39.70	-0.48	20.50	-1.95
2000	Head	100	4.020	40.20	2.063	20.63	41.10	-2.19	21.10	-2.23
	Body	100	4.215	42.15	2.153	21.53	41.10	2.55	21.10	2.04
2450	Head	100	5.303	53.03	2.479	24.79	52.40	1.20	24.00	3.29
	Body	100	5.103	51.03	2.448	24.48	52.40	-2.61	24.00	2.00
2600	Head	100	5.337	53.37	2.507	25.07	55.30	-3.49	24.60	1.91
	Body	100	5.168	51.68	2.375	23.75	55.30	-6.55	24.60	-3.46
5200	Head	100	15.372	153.72	5.458	54.58	159.00	-3.32	56.90	-4.08
	Body	100	15.227	152.27	5.328	53.28	159.00	-4.23	56.90	-6.36
5400	Head	100	15.893	158.93	5.522	55.22	166.40	-4.49	58.43	-5.49
	Body	100	15.760	157.60	5.602	56.02	166.40	-5.29	58.43	-4.12
5600	Head	100	16.458	164.58	5.788	57.88	173.80	-5.30	59.97	-3.49
	Body	100	15.892	158.92	5.643	56.43	173.80	-8.56	59.97	-5.90
5800	Head	100	17.698	176.98	5.986	59.86	181.20	-2.33	61.50	-2.67
	Body	100	16.971	169.71	5.843	58.43	181.20	-6.34	61.50	-4.99

5.2 DIP 0G750

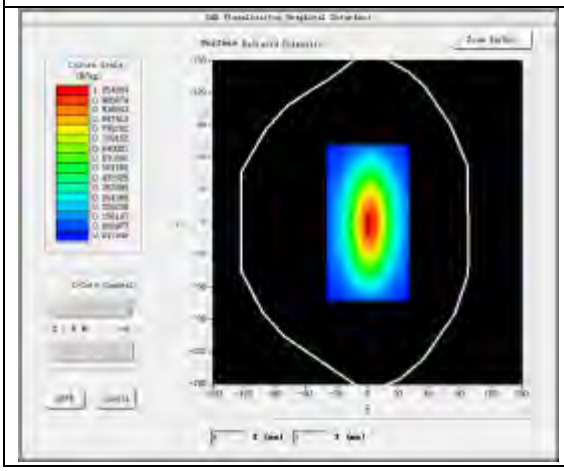
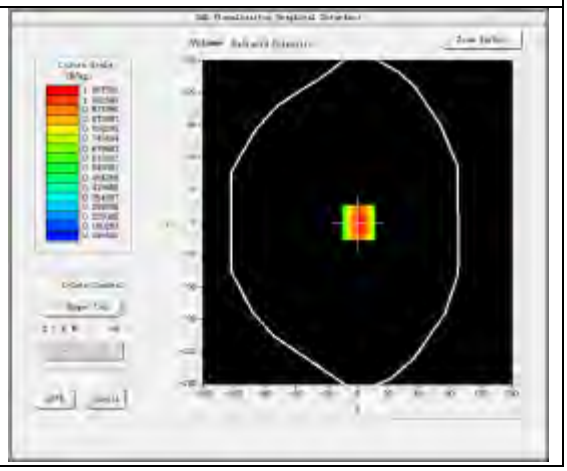
5.2.1 Dipole 750 MHz Validation Measurement for Head Tissue

System Performance Check Data(750 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017.03.01
Measurement duration: 13 minutes 33 seconds

Experimental conditions.

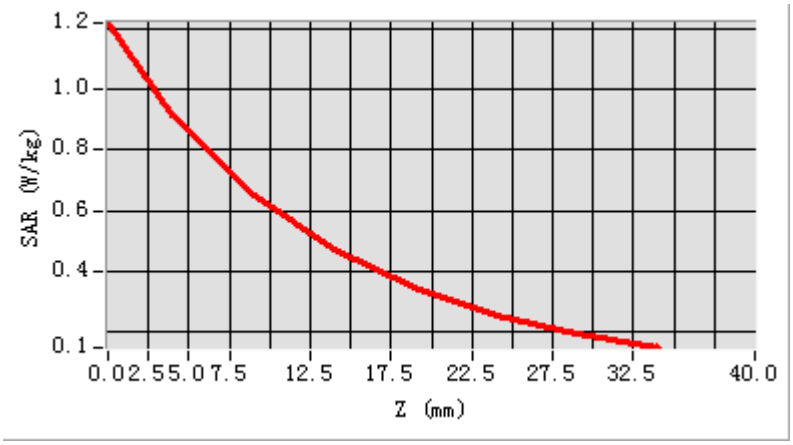
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	750MHz
Signal	CW
Frequency (MHz)	750MHz
Relative permittivity (real part)	41.882519
Conductivity (S/m)	0.898232
Power drift (%)	-2.200000
Ambient Temperature:	21.9℃
Liquid Temperature:	20.8℃
ConvF:	1.81
Crest factor:	1:1

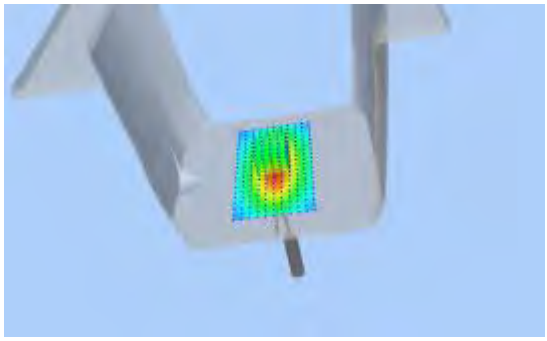
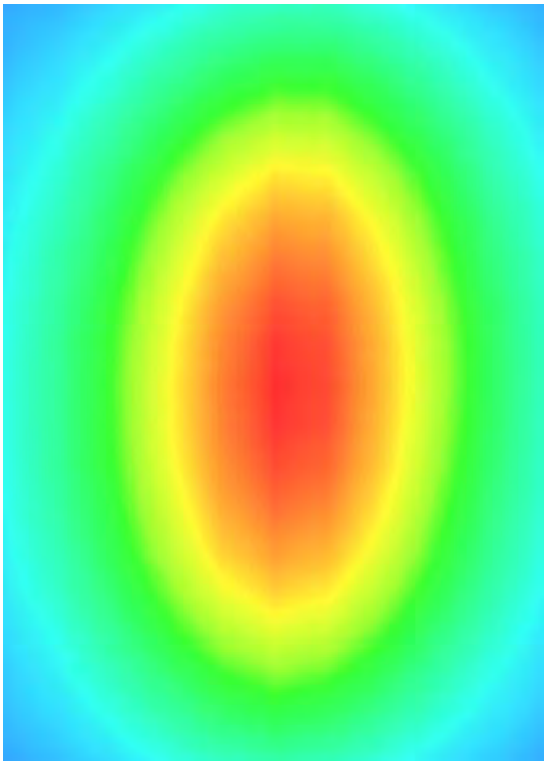
SURFACE SAR	VOLUME SAR
	

Maximum location: X=1.00, Y=0.00
SAR Peak: 1.19 W/kg

SAR 10g (W/Kg)	0.572936
SAR 1g (W/Kg)	0.863754

Z Axis Scan



3D screen shot	Hot spot position
	

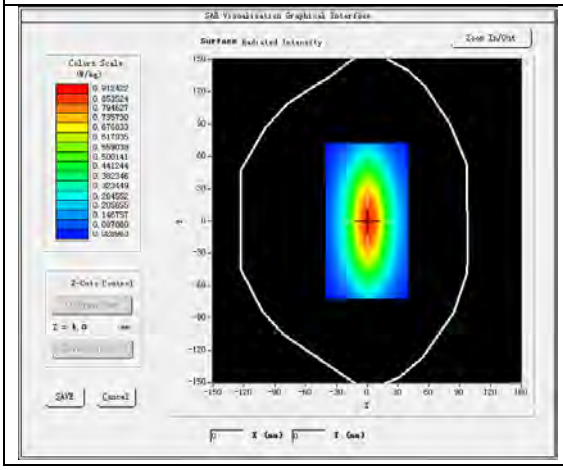
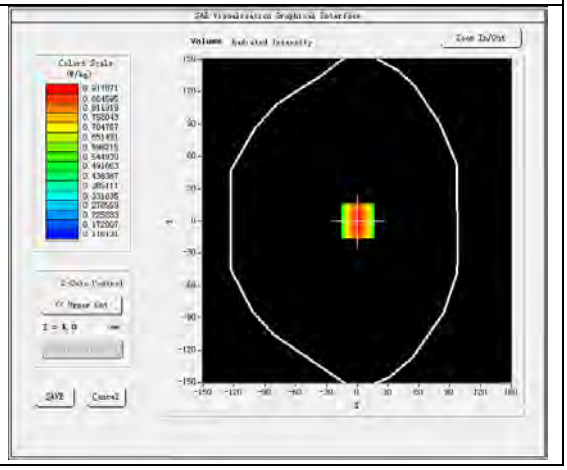
5.2.2 Dipole 750 MHz Validation Measurement for Body Tissue

System Performance Check Data(750 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017.03.01
Measurement duration: 13 minutes 32 seconds

Experimental conditions.

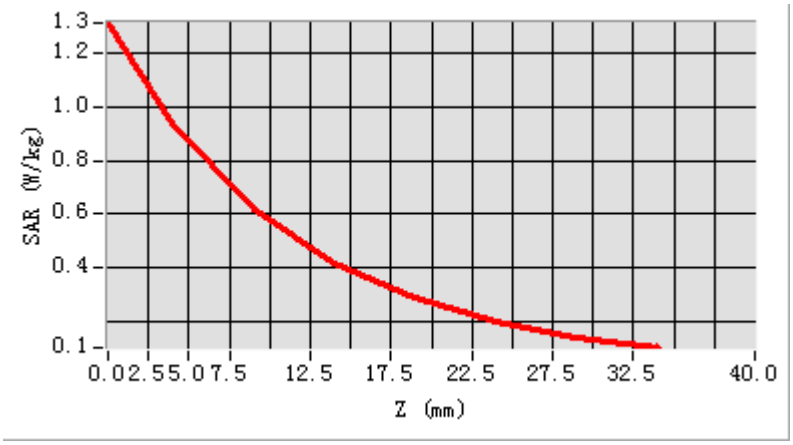
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	750MHz
Signal	CW
Frequency (MHz)	750MHz
Relative permittivity (real part)	56.892521
Conductivity (S/m)	0.931288
Power drift (%)	-0.600000
Ambient Temperature:	21.9℃
Liquid Temperature:	20.8℃
ConvF:	1.88
Crest factor:	1:1

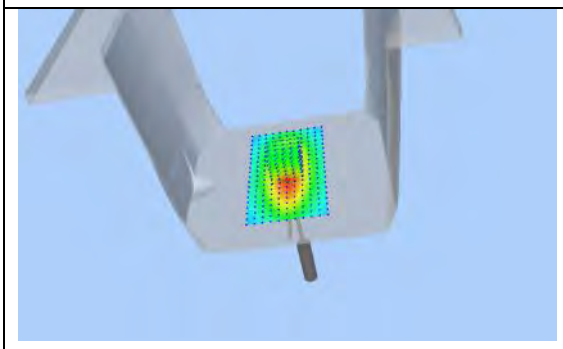
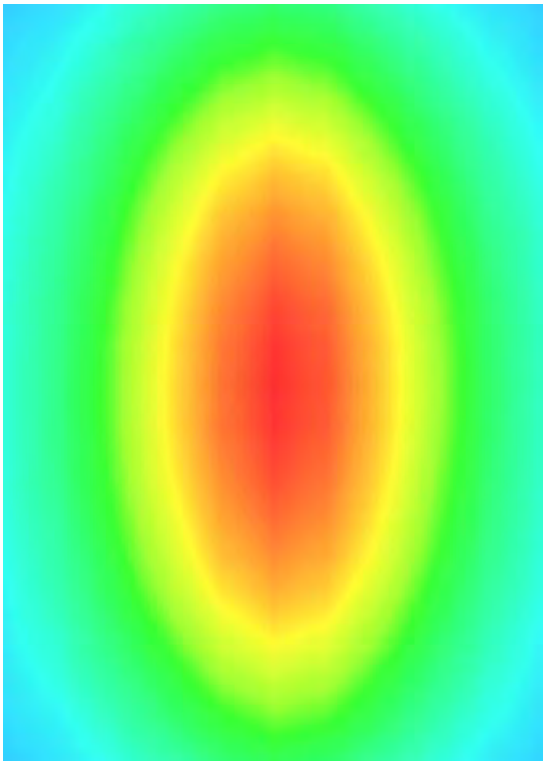
SURFACE SAR	VOLUME SAR
	

Maximum location: X=1.00, Y=0.00
SAR Peak: 1.29 W/kg

SAR 10g (W/Kg)	0.589147
SAR 1g (W/Kg)	0.865284

Z Axis Scan



3D screen shot	Hot spot position
	

5.3 DIP 0G835

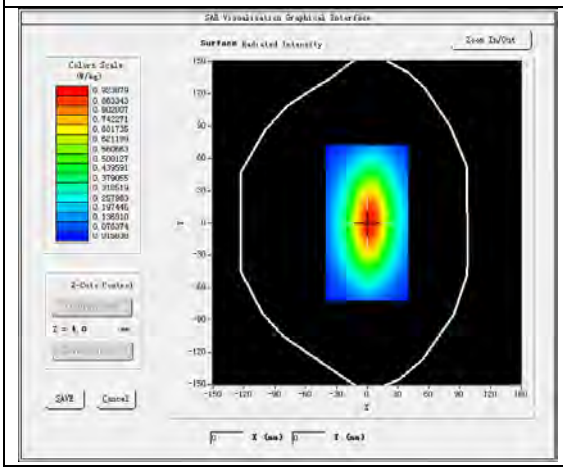
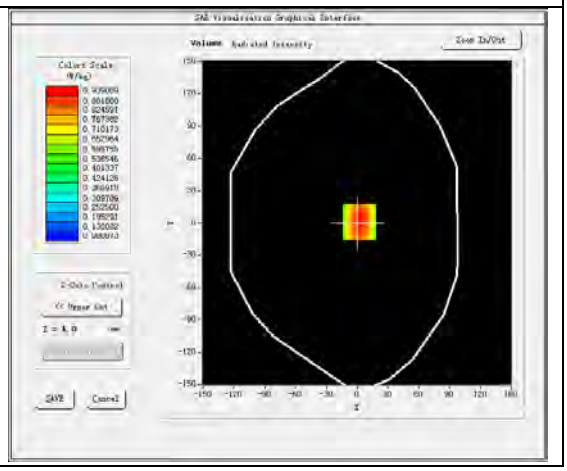
5.3.1 Dipole 835 MHz Validation Measurement for Head Tissue

System Performance Check Data(835 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=8 mm, dy=8 mm, dz=5 mm
Date of measurement: 2017.03.01
Measurement duration: 14 minutes 12 seconds

Experimental conditions.

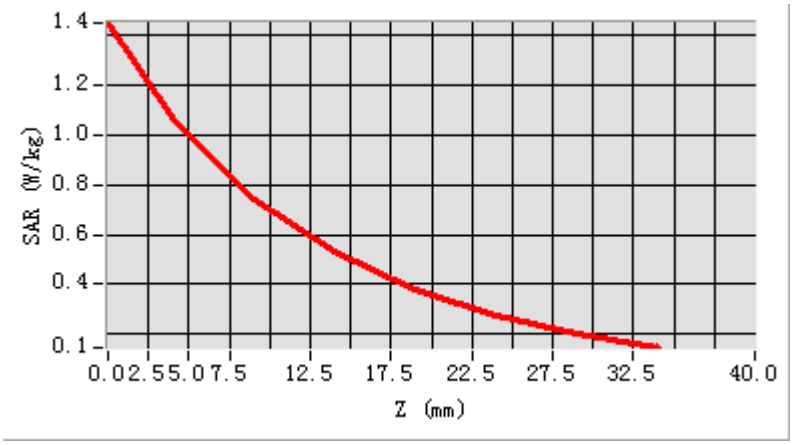
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	835 MHz
Signal	CW
Frequency (MHz)	835.000000
Relative permittivity (real part)	42.956251
Conductivity (S/m)	0.883985
Power drift (%)	-0.350000
Ambient Temperature:	21.6℃
Liquid Temperature:	21.1℃
ConvF:	2.04
Crest factor:	1:1

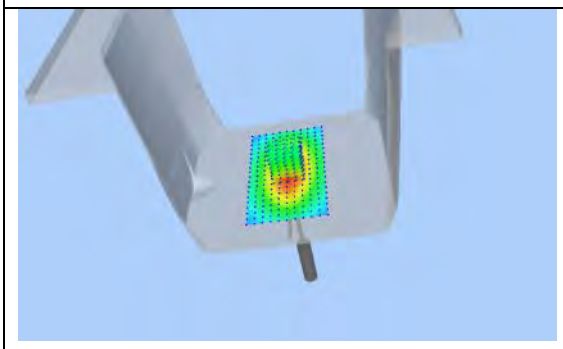
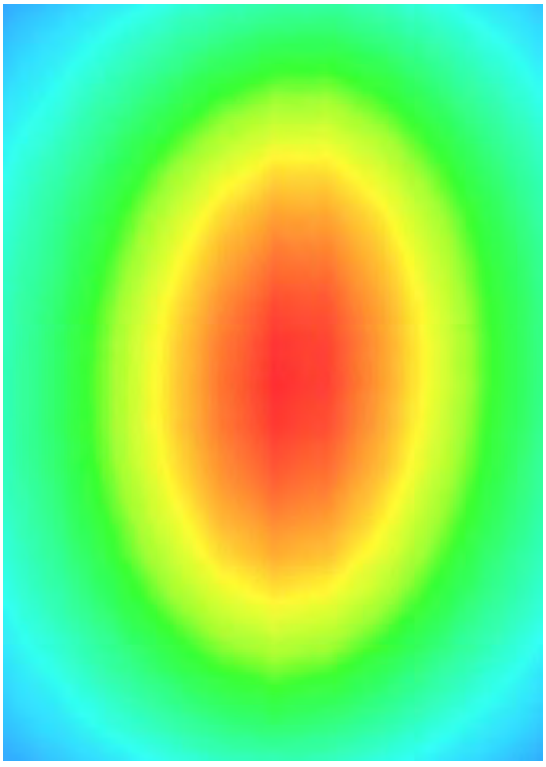
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 1.40 W/kg

SAR 10 g (W/Kg)	0.602548
SAR 1 g (W/Kg)	0.976925

Z Axis Scan



3D screen shot	Hot spot position
	

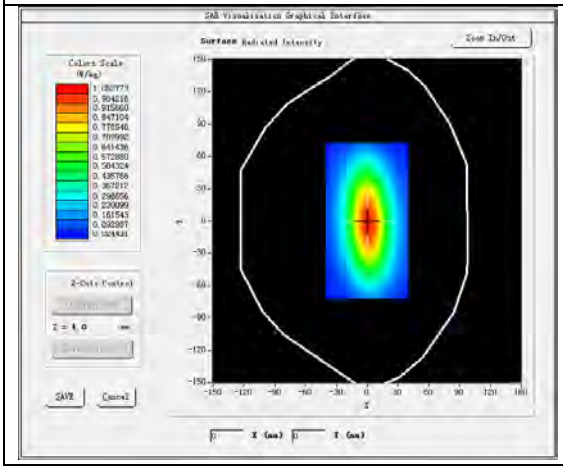
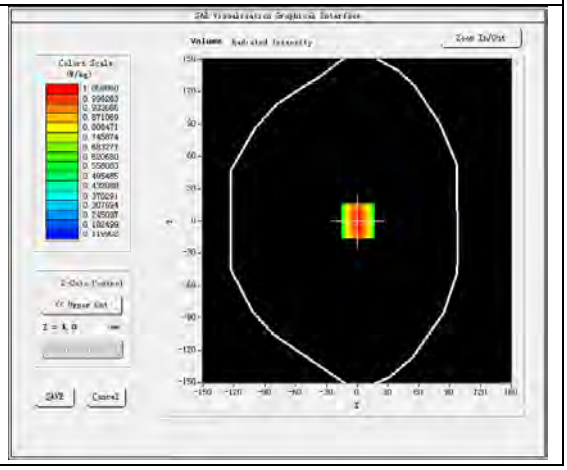
5.3.2 Dipole 835 MHz Validation Measurement for Body Tissue

System Performance Check Data(835 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=8 mm, dy=8 mm, dz=5 mm
Date of measurement: 2017.03.01
Measurement duration: 14 minutes 8 seconds

Experimental conditions.

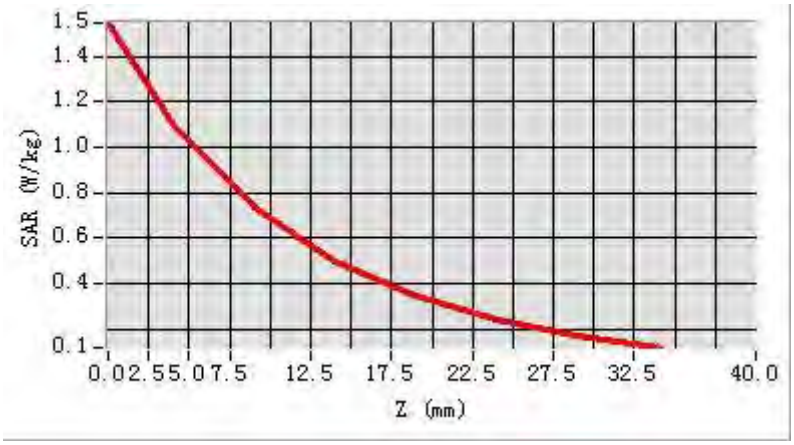
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	835 MHz
Signal	CW
Frequency (MHz)	835.000000
Relative permittivity (real part)	54.269521
Conductivity (S/m)	0.980688
Power drift (%)	0.390000
Ambient Temperature:	21.6℃
Liquid Temperature:	21.1℃
ConvF:	2.12
Crest factor:	1:1

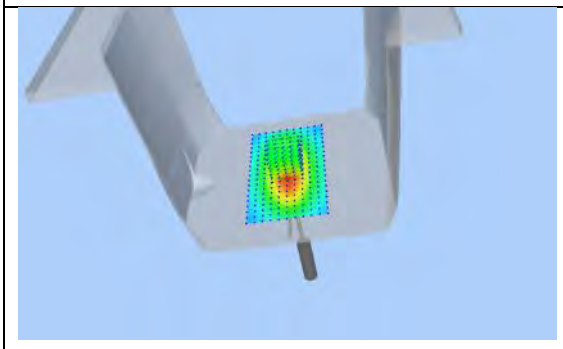
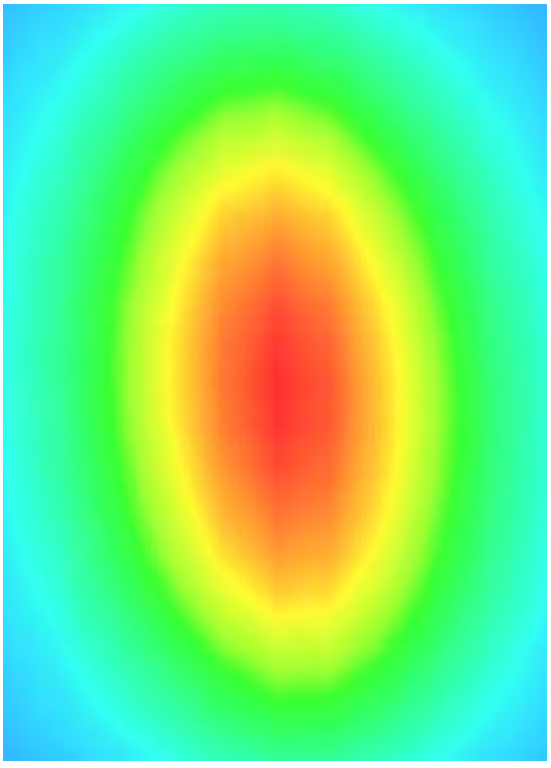
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 1.46 W/kg

SAR 10 g (W/Kg)	0.661254
SAR 1 g (W/Kg)	1.009362

Z Axis Scan



3D screen shot	Hot spot position
	

5.4 DIP 0G900

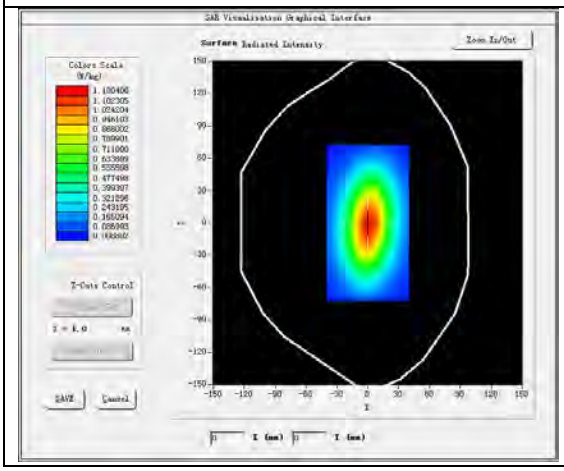
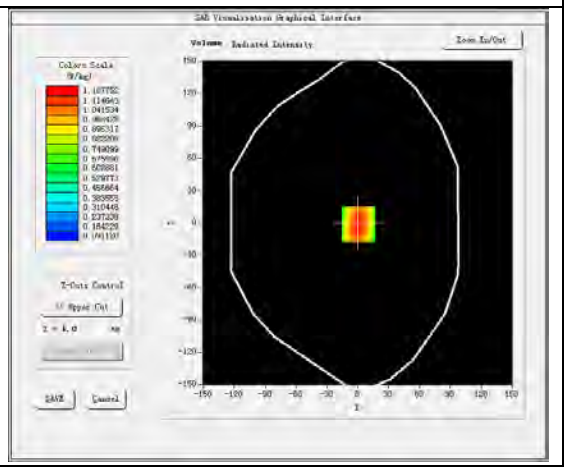
5.4.1 Dipole 900 MHz Validation Measurement for Head Tissue

System Performance Check Data(900 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=8 mm, dy=8 mm, dz=5 mm
Date of measurement: 2017.03.01
Measurement duration: 13 minutes 59 seconds

Experimental conditions.

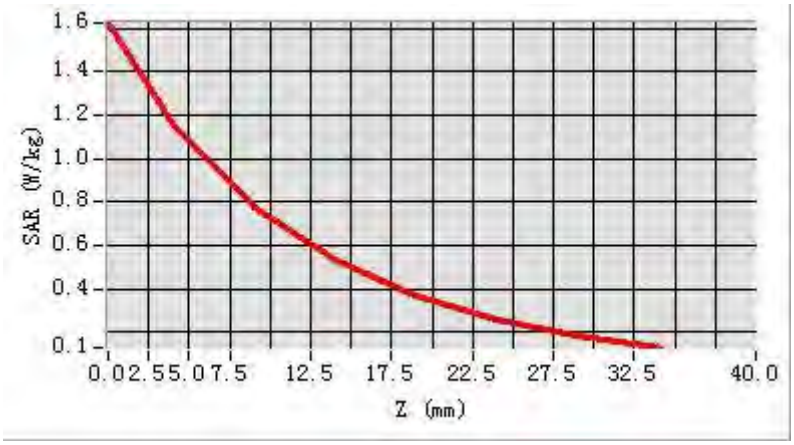
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	900 MHz
Signal	CW
Frequency (MHz)	900.000000
Relative permittivity (real part)	41.012785
Conductivity (S/m)	0.982695
Power drift (%)	0.240000
Ambient Temperature:	21.9℃
Liquid Temperature:	20.8℃
ConvF:	1.86
Crest factor:	1:1

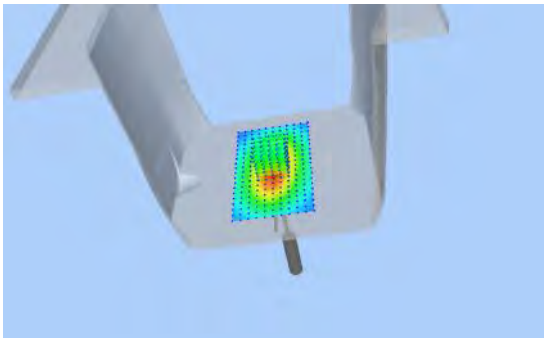
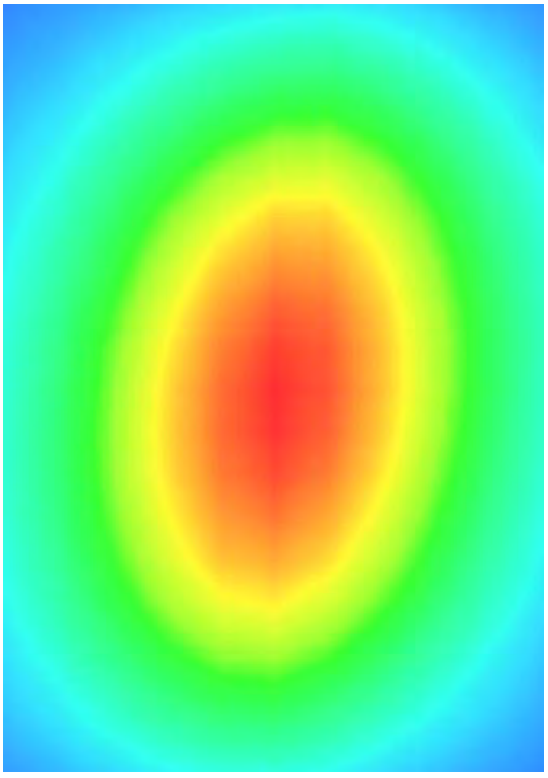
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 1.59 W/kg

SAR 10 g (W/Kg)	0.722569
SAR 1 g (W/Kg)	1.086216

Z Axis Scan



3D screen shot	Hot spot position
	

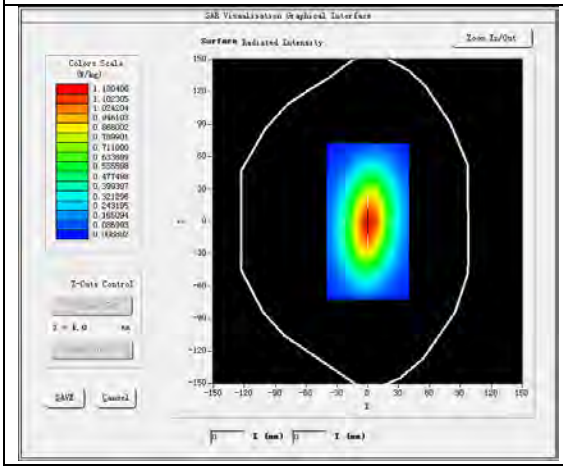
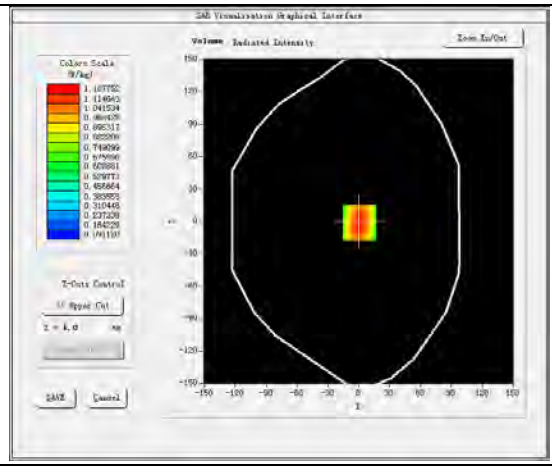
5.4.2 Dipole 900 MHz Validation Measurement for Body Tissue

System Performance Check Data(900 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=8 mm, dy=8 mm, dz=5 mm
Date of measurement: 2017.03.01
Measurement duration: 13 minutes 49 seconds

Experimental conditions.

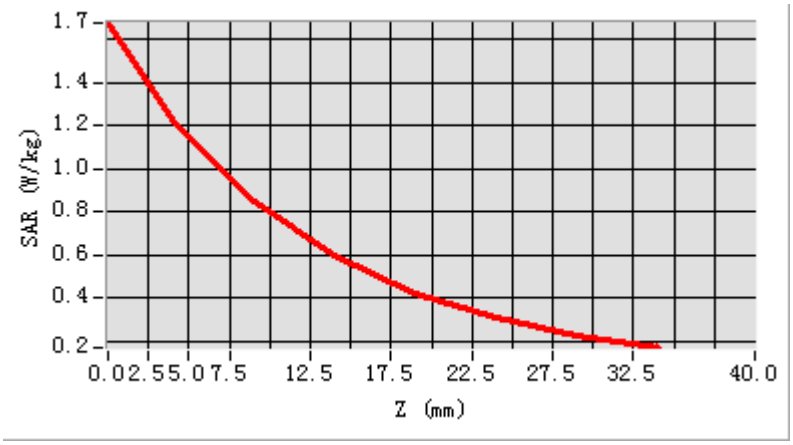
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	900 MHz
Signal	CW
Frequency (MHz)	900.000000
Relative permittivity (real part)	53.623571
Conductivity (S/m)	1.07252
Power drift (%)	-0.370000
Ambient Temperature:	21.9℃
Liquid Temperature:	20.8℃
ConvF:	1.92
Crest factor:	1:1

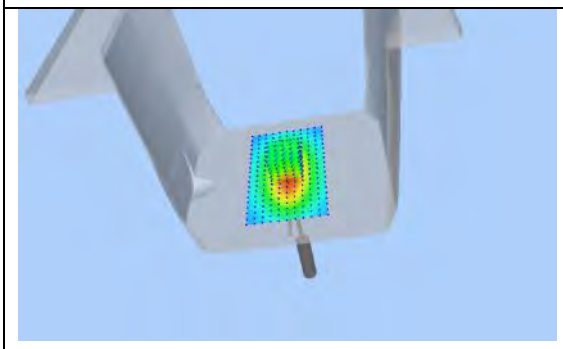
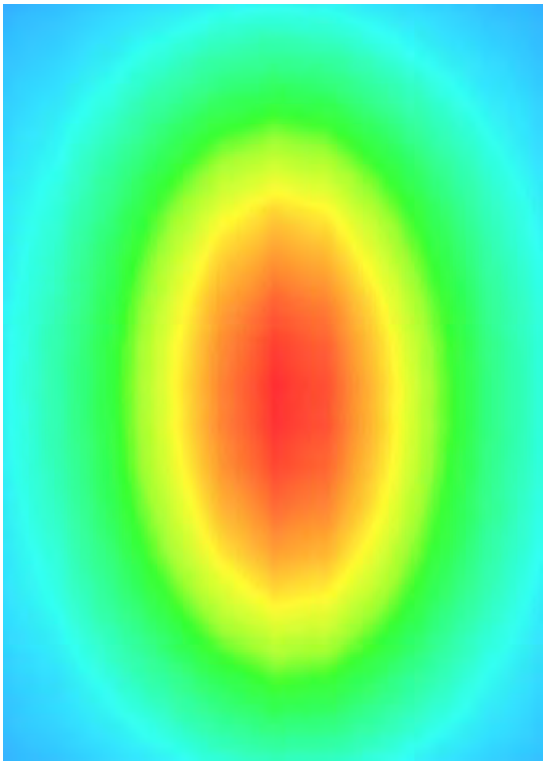
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 1.69 W/kg

SAR 10 g (W/Kg)	0.752336
SAR 1 g (W/Kg)	1.140385

Z Axis Scan



3D screen shot	Hot spot position
	

5.5 DIP 1G800

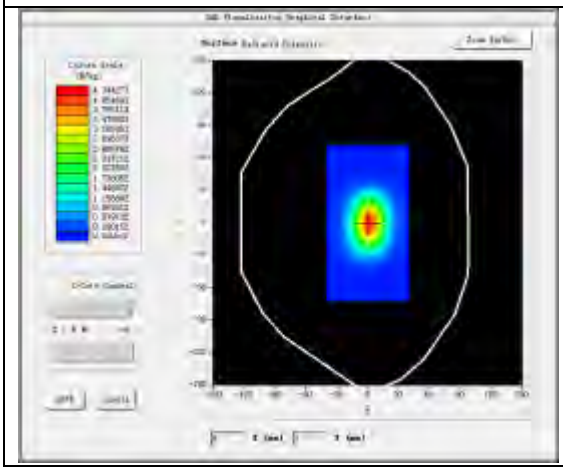
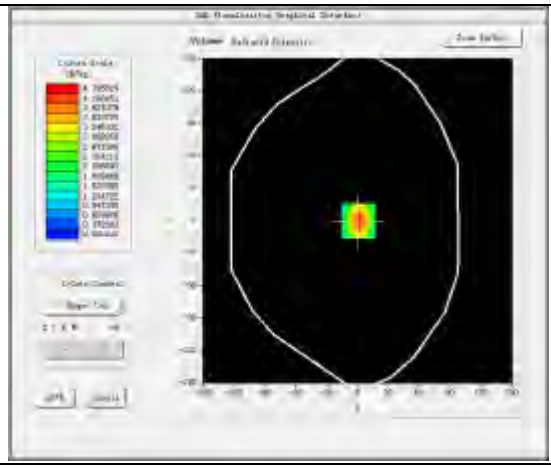
5.5.1 Dipole 1800 MHz Validation Measurement for Head Tissue

System Performance Check Data(1800 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017.03.02
Measurement duration: 13 minutes 39 seconds

Experimental conditions.

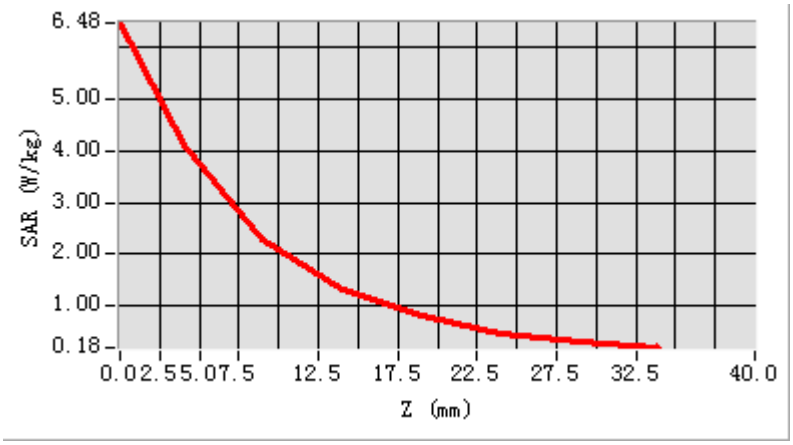
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	1800MHz
Signal	CW
Frequency (MHz)	1800.000000
Relative permittivity (real part)	38.812571
Conductivity (S/m)	1.422596
Power drift (%)	0.330000
Ambient Temperature:	22.4℃
Liquid Temperature:	21.3℃
ConvF:	2.04
Crest factor:	1:1

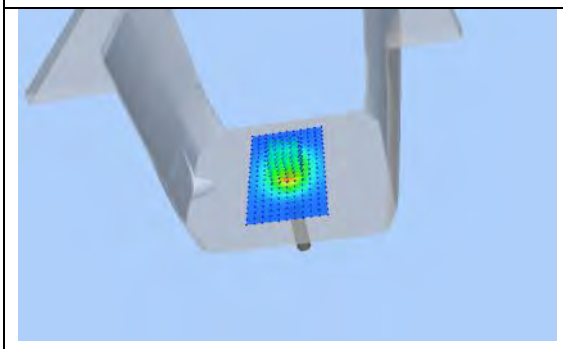
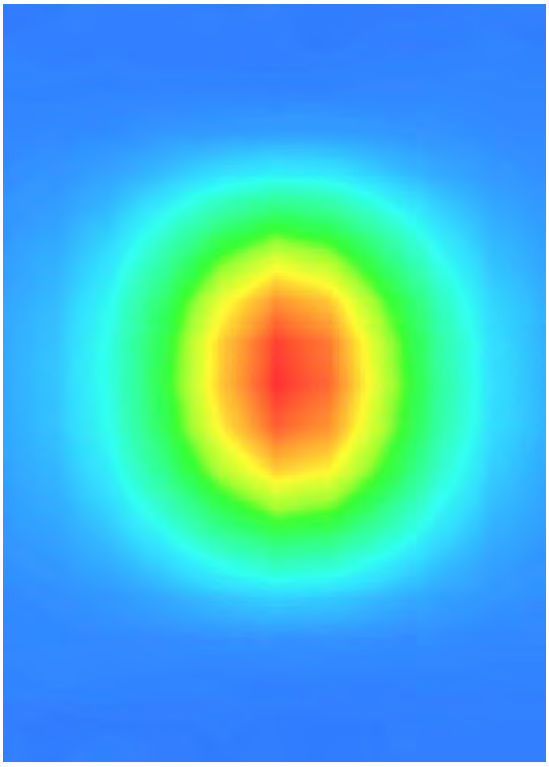
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 6.48 W/kg

SAR 10 g (W/Kg)	1.965521
SAR 1g (W/Kg)	3.887922

Z Axis Scan



3D screen shot	Hot spot position
	

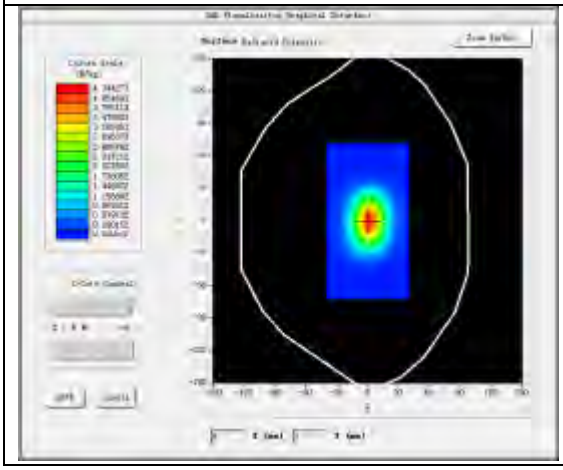
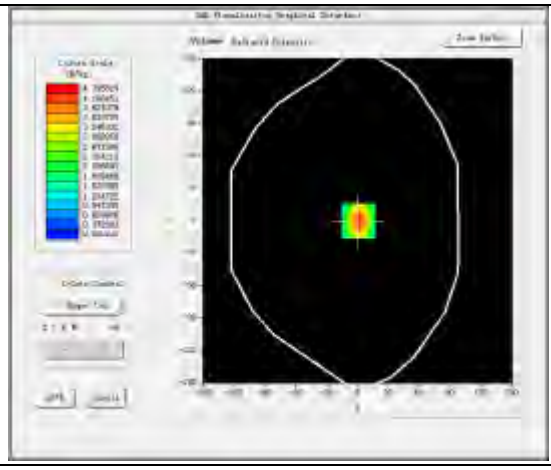
5.5.2 Dipole 1800 MHz Validation Measurement for Body Tissue

System Performance Check Data(1800 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017.03.02
Measurement duration: 13 minutes 52 seconds

Experimental conditions.

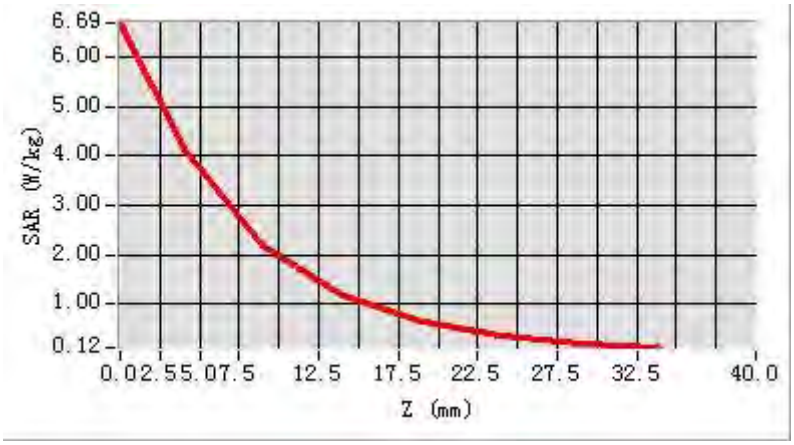
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	1800MHz
Signal	CW
Frequency (MHz)	1800.000000
Relative permittivity (real part)	54.352581
Conductivity (S/m)	1.492574
Power drift (%)	0.680000
Ambient Temperature:	22.4℃
Liquid Temperature:	21.3℃
ConvF:	2.08
Crest factor:	1:1

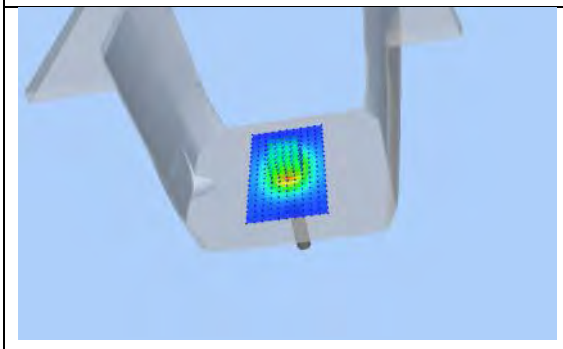
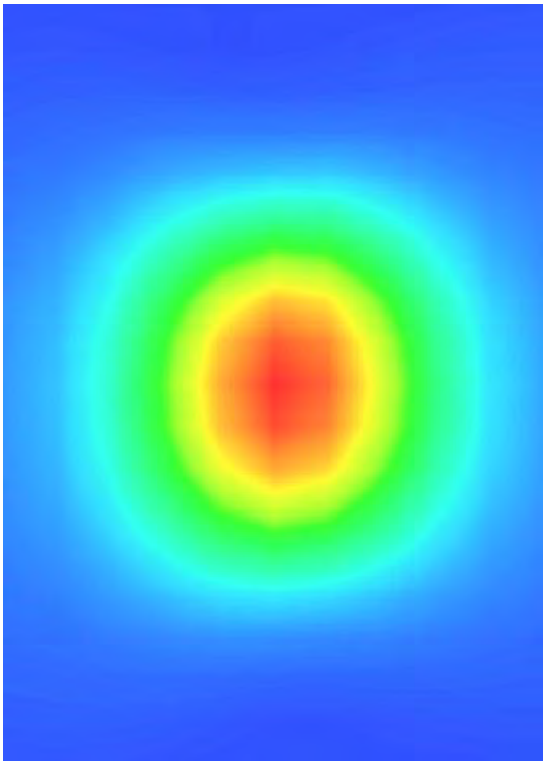
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 6.55 W/kg

SAR 10 g (W/Kg)	1.992361
SAR 1g (W/Kg)	3.923758

Z Axis Scan



3D screen shot	Hot spot position
	

5.6 DIP 1G900

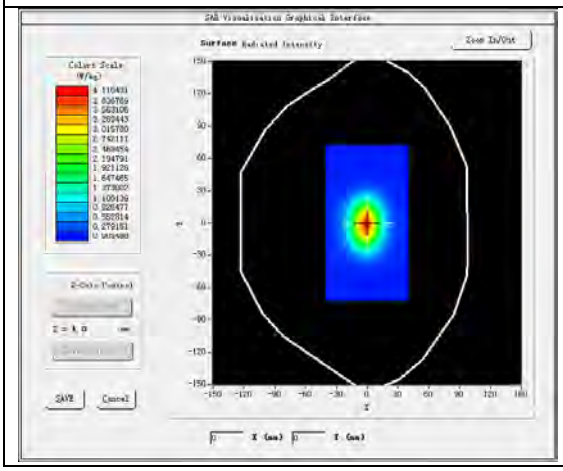
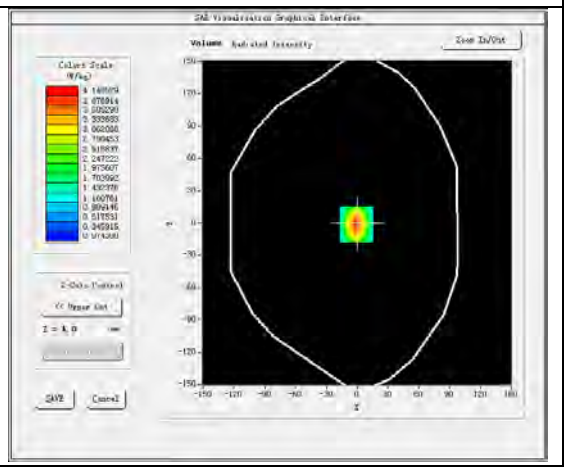
5.6.1 Dipole 1900 MHz Validation Measurement for Head Tissue

System Performance Check Data(1900 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017.03.02
Measurement duration: 13 minutes 42 seconds

Experimental conditions.

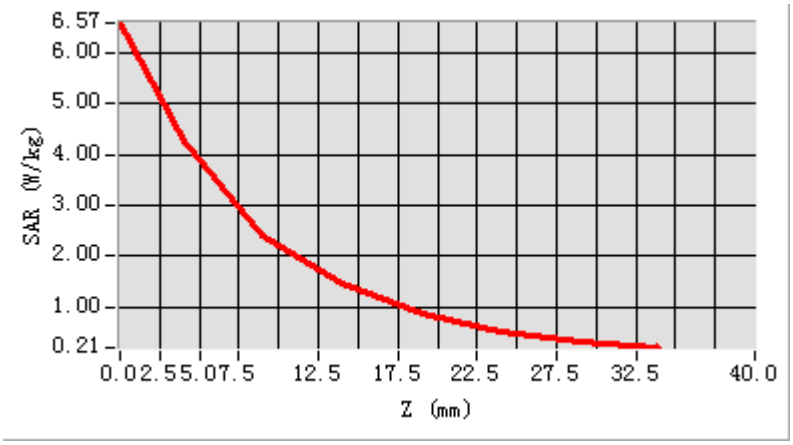
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	1900MHz
Signal	CW
Frequency (MHz)	1900.000000
Relative permittivity (real part)	39.826257
Conductivity (S/m)	1.426126
Power drift (%)	1.190000
Ambient Temperature:	22.4℃
Liquid Temperature:	21.3℃
ConvF:	2.35
Crest factor:	1:1

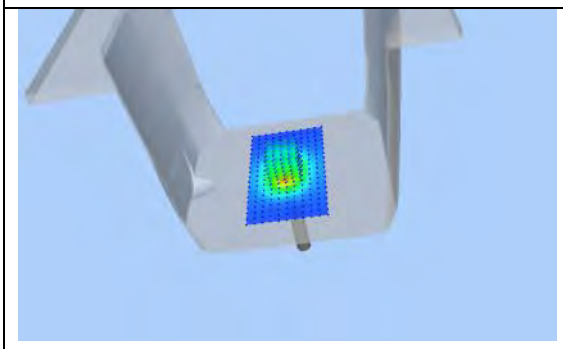
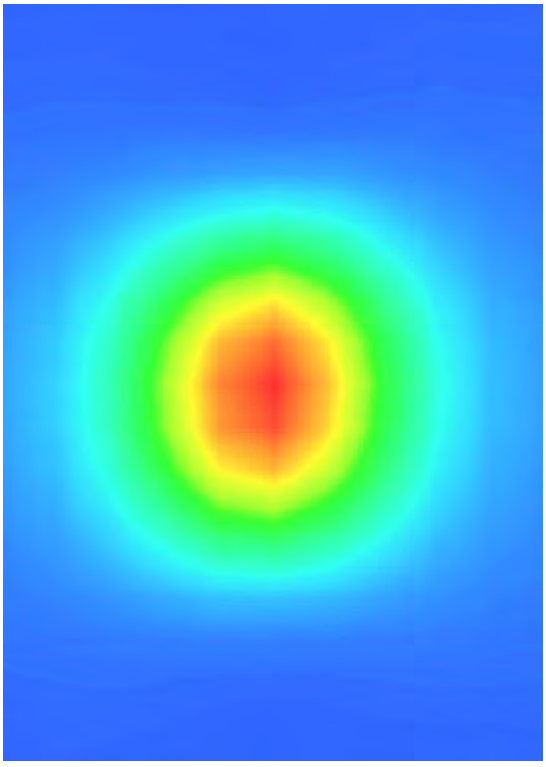
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 6.49W/kg

SAR 10g (W/Kg)	1.921565
SAR 1g (W/Kg)	3.902425

Z Axis Scan



3D screen shot	Hot spot position
	

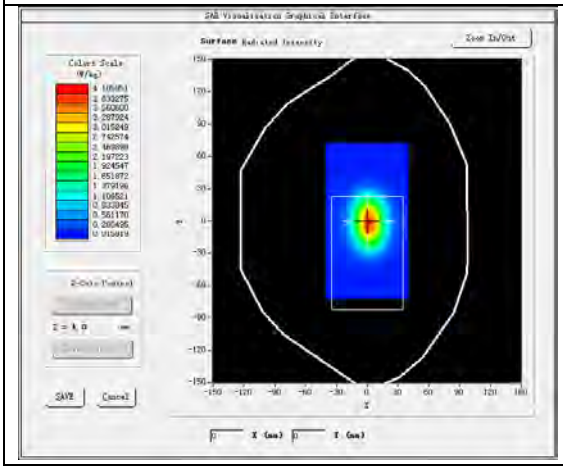
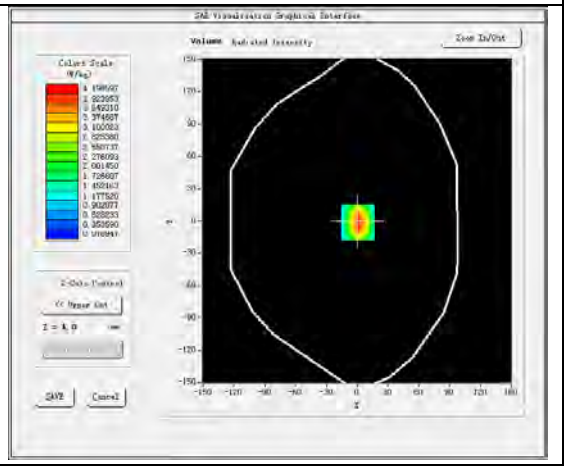
5.6.2 Dipole 1900 MHz Validation Measurement for Body Tissue

System Performance Check Data(1900 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017.03.02
Measurement duration: 13 minutes 38 seconds

Experimental conditions.

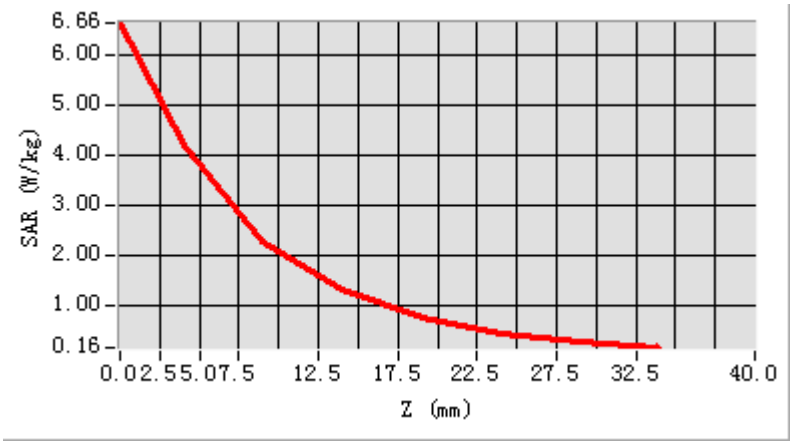
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	1900 MHz
Signal	CW
Frequency (MHz)	1900.000000
Relative permittivity (real part)	54.023651
Conductivity (S/m)	1.540215
Power drift (%)	0.230000
Ambient Temperature:	22.4℃
Liquid Temperature:	21.3℃
ConvF:	2.42
Crest factor:	1:1

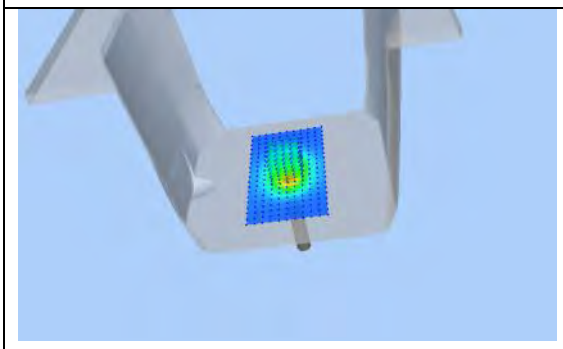
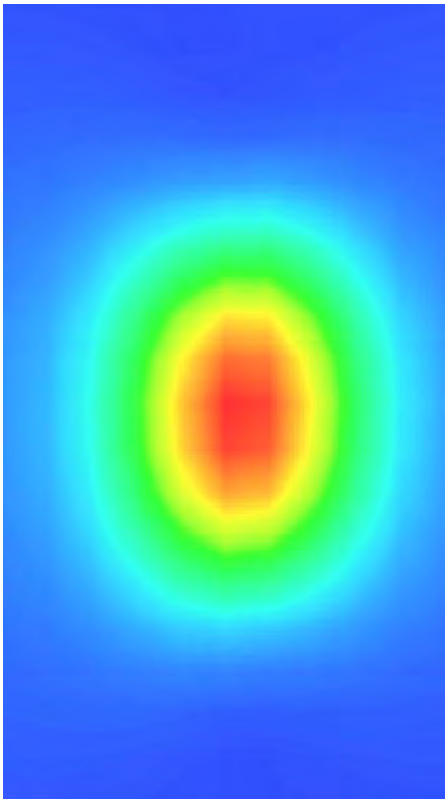
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 6.66W/kg

SAR 10g (W/Kg)	2.010256
SAR 1g (W/Kg)	3.951364

Z Axis Scan



3D screen shot	Hot spot position
	

5.7 DIP 2G000

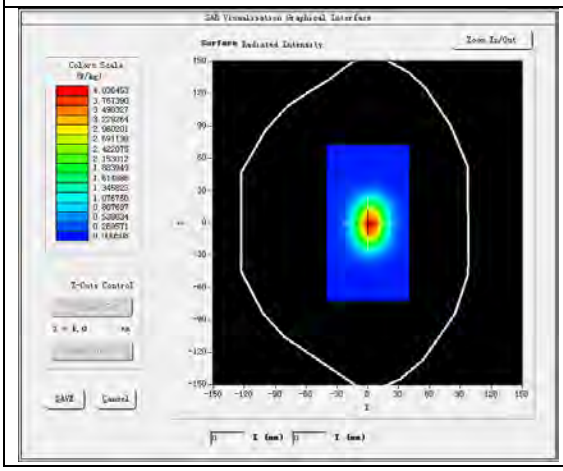
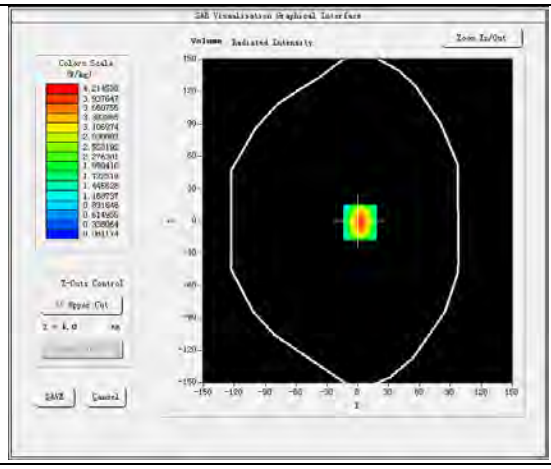
5.7.1 Dipole 2000 MHz Validation Measurement for Head Tissue

System Performance Check Data(2000 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=8 mm, dy=8 mm, dz=5 mm
Date of measurement: 2017.03.02
Measurement duration: 14 minutes 17 seconds

Experimental conditions.

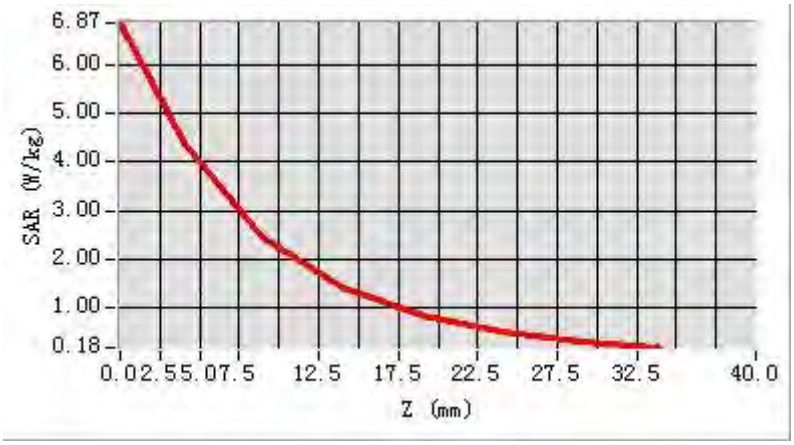
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2000 MHz
Signal	CW
Frequency (MHz)	2000.000000
Relative permittivity (real part)	38.789355
Conductivity (S/m)	1.4251543
Power drift (%)	0.660000
Ambient Temperature:	22.4℃
Liquid Temperature:	21.3℃
ConvF:	2.23
Crest factor:	1:1

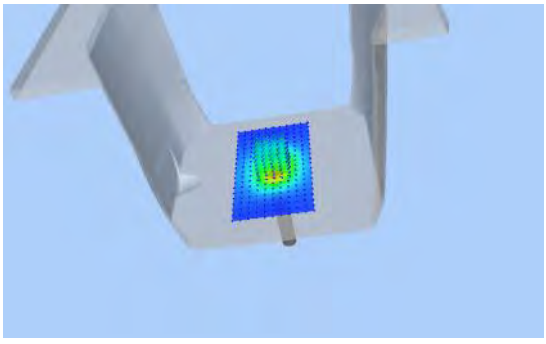
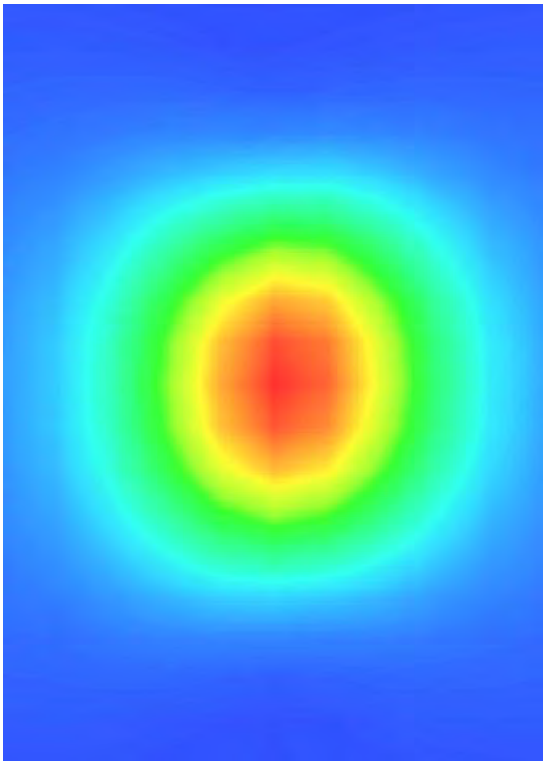
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 6.69 W/kg

SAR 10 g (W/Kg)	2.062551
SAR 1 g (W/Kg)	4.020365

Z Axis Scan



3D screen shot	Hot spot position
	

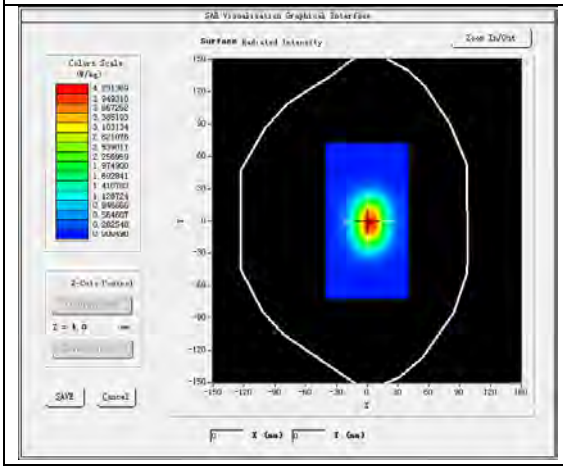
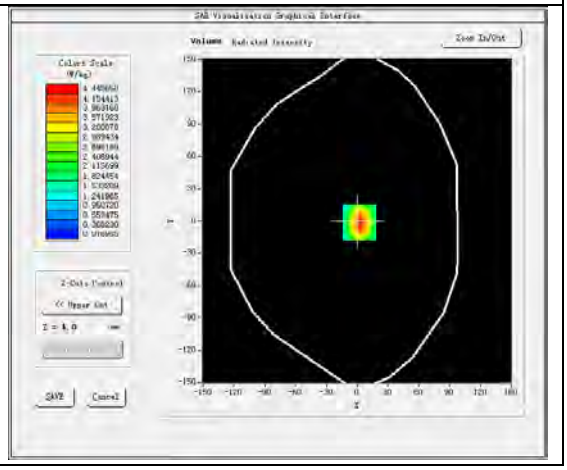
5.7.2 Dipole 2000 MHz Validation Measurement for Body Tissue

System Performance Check Data(2000 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=8 mm, dy=8 mm, dz=5 mm
Date of measurement: 2017.03.02
Measurement duration: 14 minutes 11 seconds

Experimental conditions.

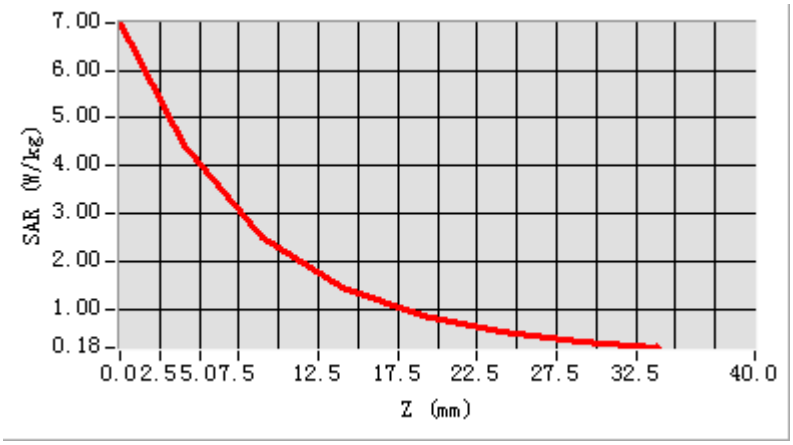
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2000 MHz
Signal	CW
Frequency (MHz)	2000.000000
Relative permittivity (real part)	51.512549
Conductivity (S/m)	1.549334
Power drift (%)	0.510000
Ambient Temperature:	22.4℃
Liquid Temperature:	21.3℃
ConvF:	2.32
Crest factor:	1:1

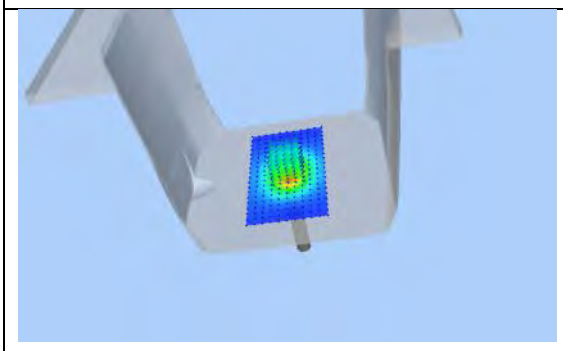
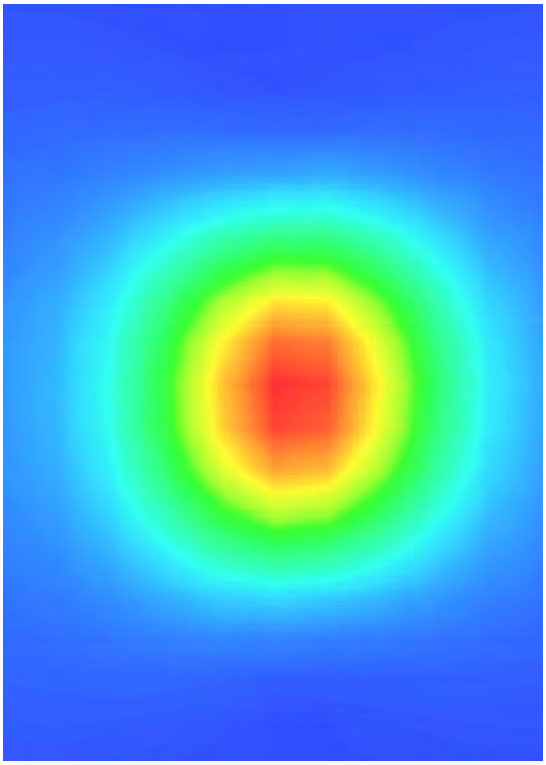
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 6.98 W/kg

SAR 10 g (W/Kg)	2.189137
SAR 1 g (W/Kg)	4.215283

Z Axis Scan



3D screen shot	Hot spot position
	

5.8 DIP 2G450

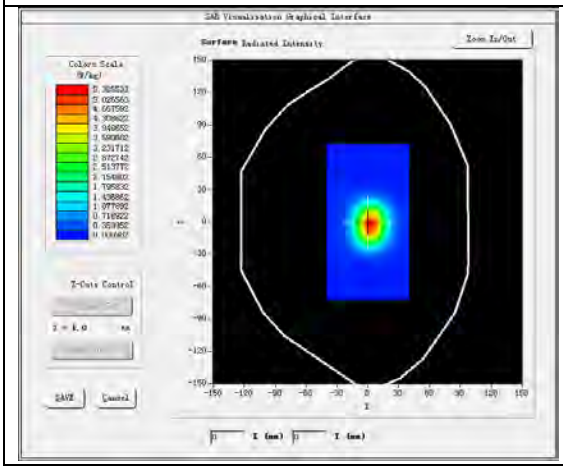
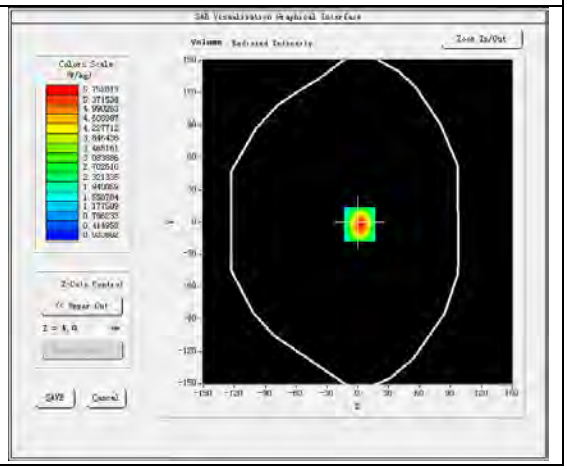
5.8.1 Dipole 2450 MHz Validation Measurement for Head Tissue

System Performance Check Data(2450 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=5mm, dy=5mm, dz=5mm
Date of measurement: 2017.03.02
Measurement duration: 18 minutes 37 seconds

Experimental conditions.

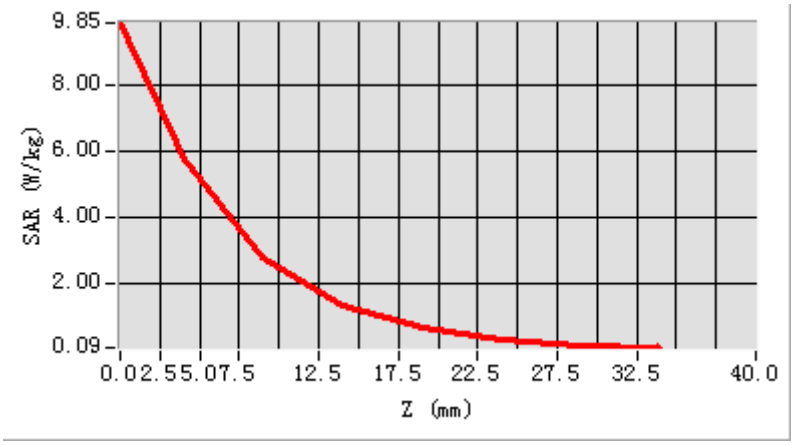
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2450MHz
Signal	CW
Frequency (MHz)	2450.000000
Relative permittivity (real part)	38.863623
Conductivity (S/m)	1.810263
Power drift (%)	1.240000
Ambient Temperature:	22.4℃
Liquid Temperature:	21.3℃
ConvF:	2.47
Crest factor:	1:1

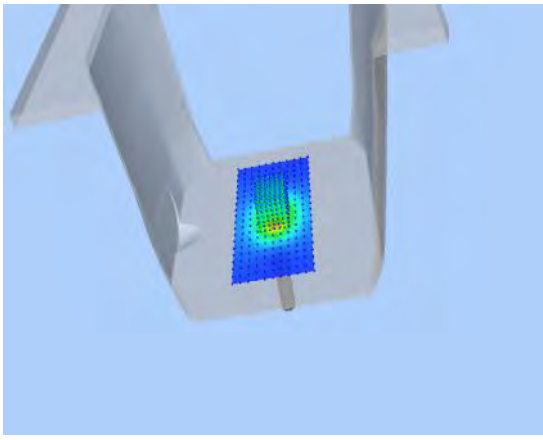
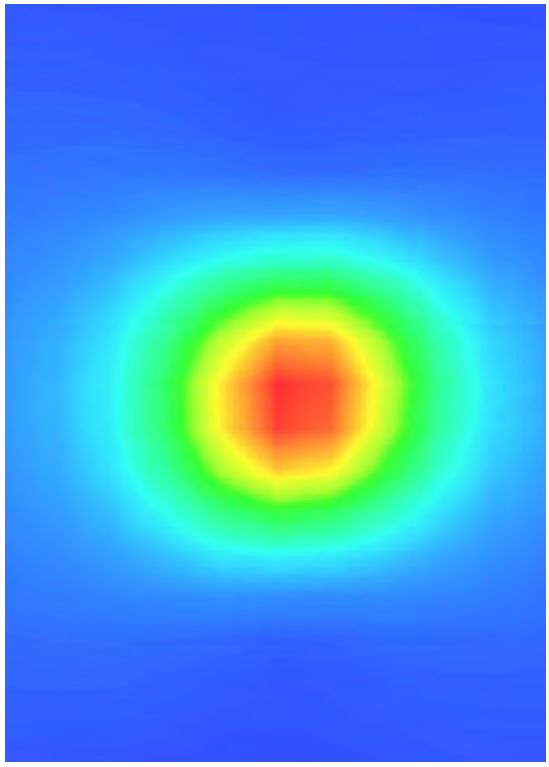
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 9.79 W/kg

SAR 10g (W/Kg)	2.479365
SAR 1g (W/Kg)	5.302546

Z Axis Scan



3D screen shot	Hot spot position
	

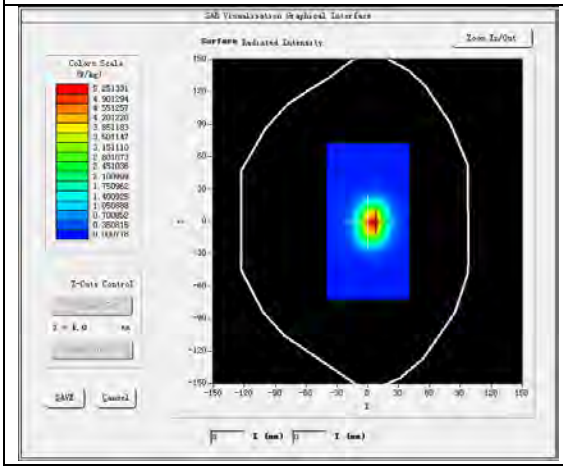
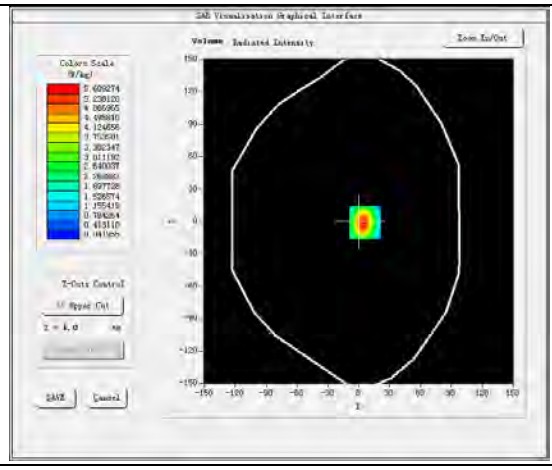
5.8.2 Dipole 2450 MHz Validation Measurement for Body Tissue

System Performance Check Data(2450 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=5 mm, dy=5 mm, dz=5 mm
Date of measurement: 2017.03.02
Measurement duration: 19 minutes 15 seconds

Experimental conditions.

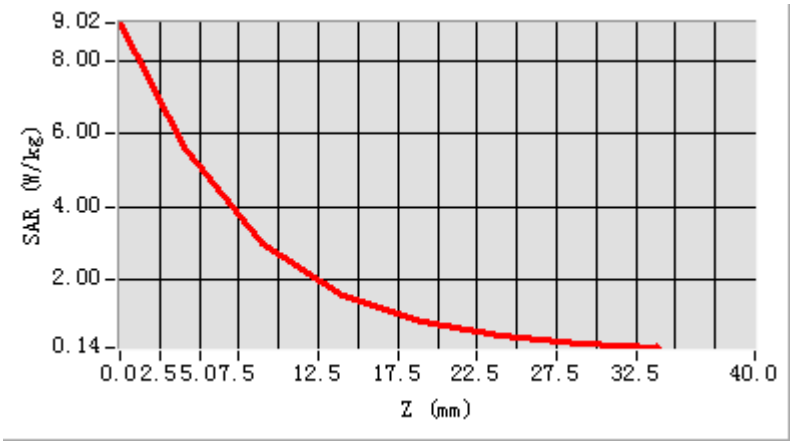
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2450 MHz
Signal	CW
Frequency (MHz)	2450.000000
Relative permittivity (real part)	52.912582
Conductivity (S/m)	1.952326
Power drift (%)	-0.110000
Ambient Temperature:	22.4℃
Liquid Temperature:	21.3℃
ConvF:	2.55
Crest factor:	1:1

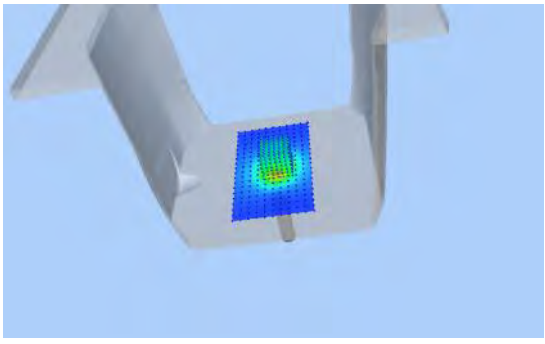
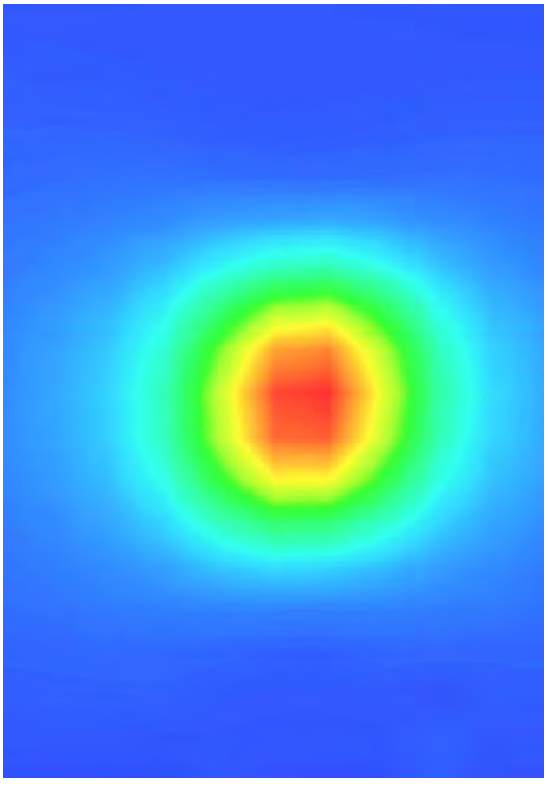
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 9.01 W/kg

SAR 10 g (W/Kg)	2.448257
SAR 1 g (W/Kg)	5.102686

Z Axis Scan



3D screen shot	Hot spot position
	

5.9 DIP 2G600

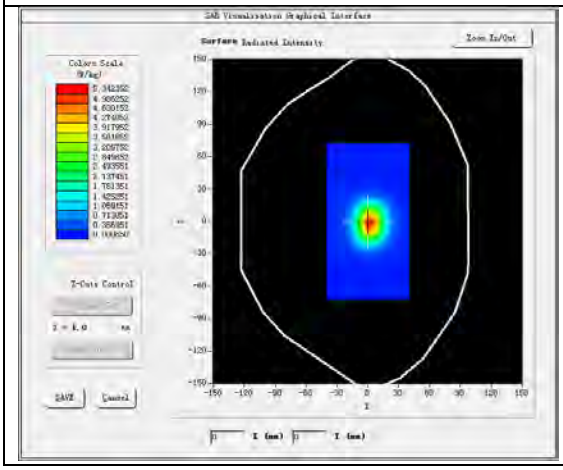
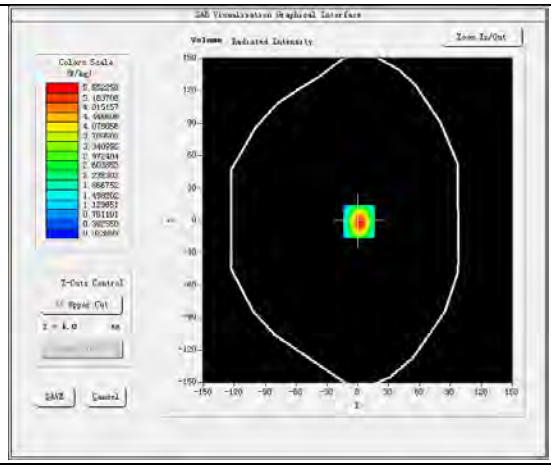
5.9.1 Dipole 2600 MHz Validation Measurement for Head Tissue

System Performance Check Data(2600 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=5 mm, dy=5 mm, dz=5 mm
Date of measurement: 2017.03.03
Measurement duration: 19 minutes 16 seconds

Experimental conditions.

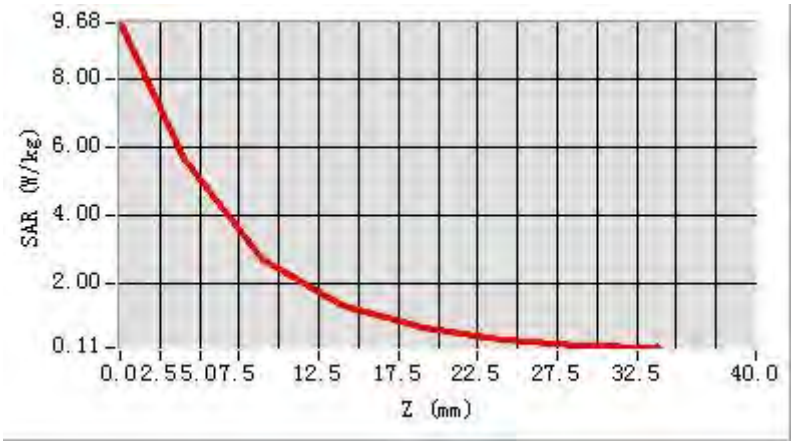
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2600 MHz
Signal	CW
Frequency (MHz)	2600.000000
Relative permittivity (real part)	38.085257
Conductivity (S/m)	1.982546
Power drift (%)	-0.050000
Ambient Temperature:	22.2℃
Liquid Temperature:	21.2℃
ConvF:	2.36
Crest factor:	1:1

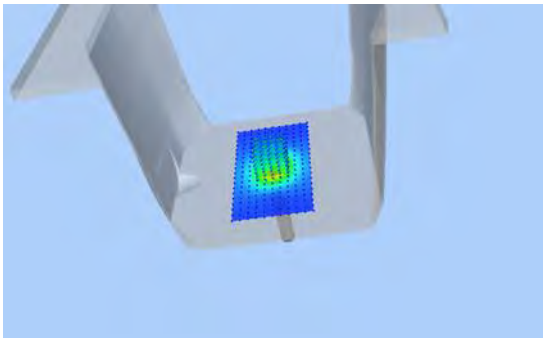
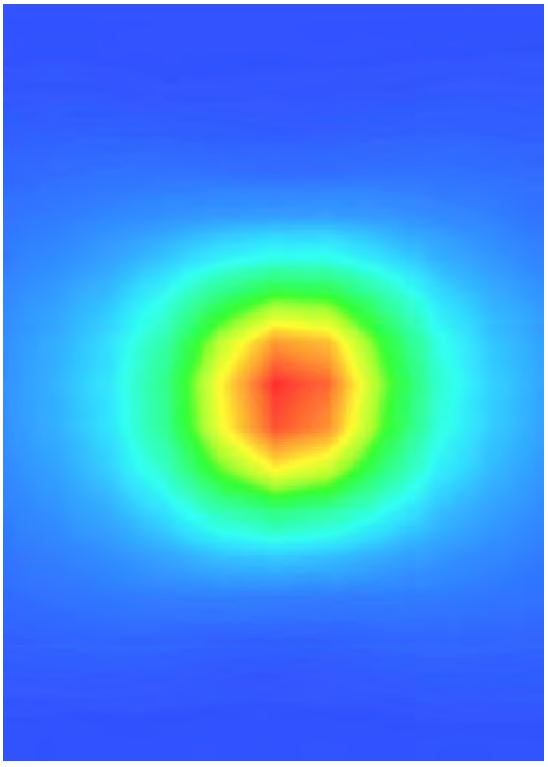
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 9.66 W/kg

SAR 10 g (W/Kg)	2.506594
SAR 1 g (W/Kg)	5.336598

Z Axis Scan



3D screen shot	Hot spot position
	

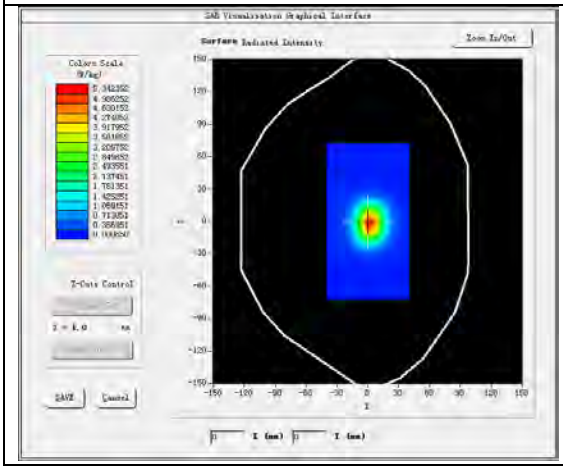
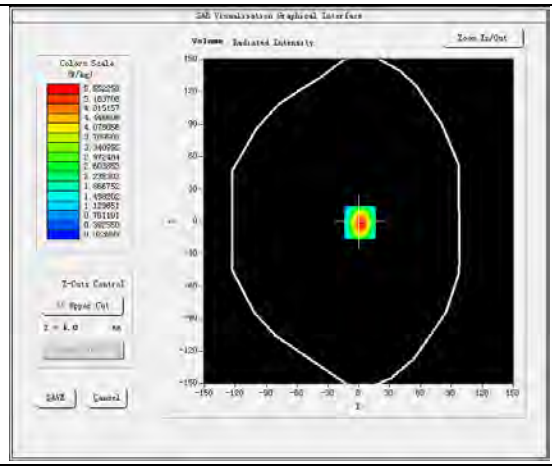
5.9.2 Dipole 2600 MHz Validation Measurement for Body Tissue

System Performance Check Data(2600 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8 mm,dy=8 mm
Zoom scan resolution: dx=5 mm, dy=5 mm, dz=5 mm
Date of measurement: 2017.03.03
Measurement duration: 19 minutes 11 seconds

Experimental conditions.

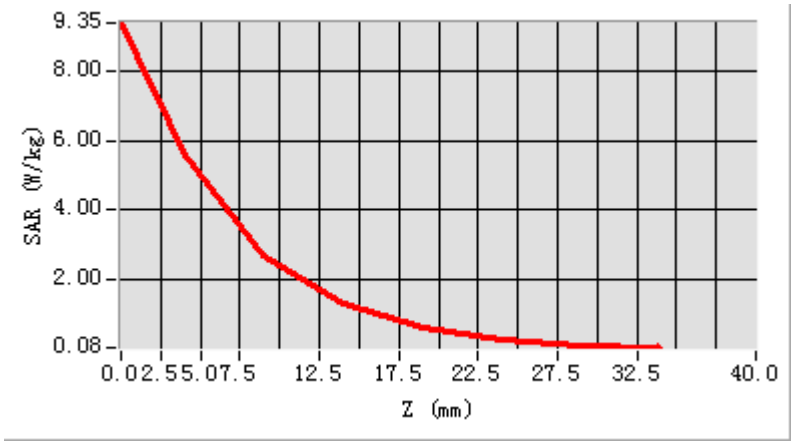
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	2600 MHz
Signal	CW
Frequency (MHz)	2600.000000
Relative permittivity (real part)	53.385272
Conductivity (S/m)	2.138941
Power drift (%)	0.550000
Ambient Temperature:	22.2℃
Liquid Temperature:	21.2℃
ConvF:	2.43
Crest factor:	1:1

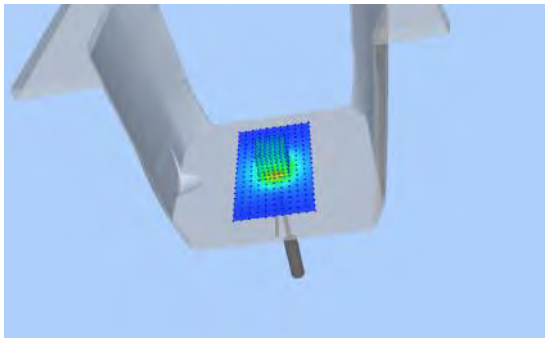
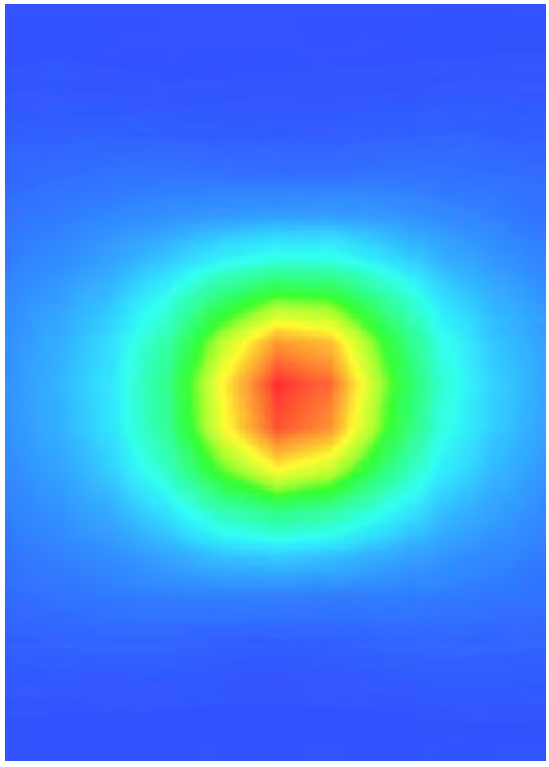
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 9.33 W/kg

SAR 10 g (W/Kg)	2.375266
SAR 1 g (W/Kg)	5.167828

Z Axis Scan



3D screen shot	Hot spot position
	

5.10 SWG5500

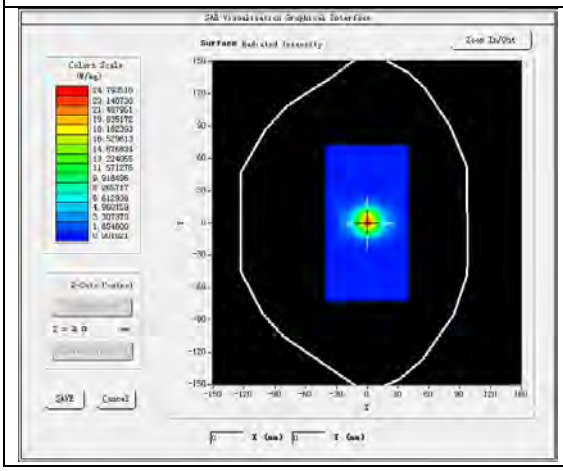
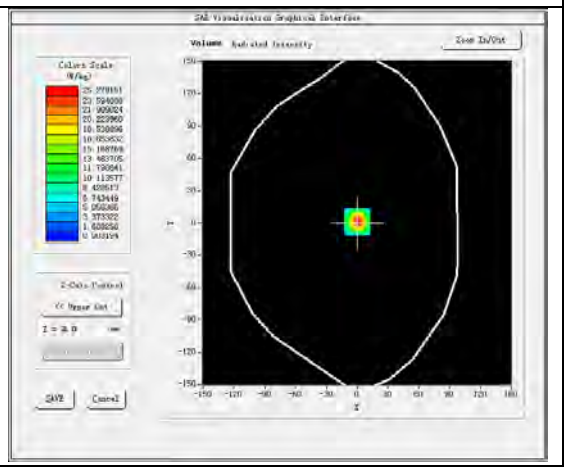
5.10.1 Waveguide 5 GHz Validation Measurement for Head Tissue

System Performance Check Data(5200 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=4mm, dy=4mm, dz=2mm
Date of measurement: 2017.03.04
Measurement duration: 29 minutes 20 seconds

Experimental conditions.

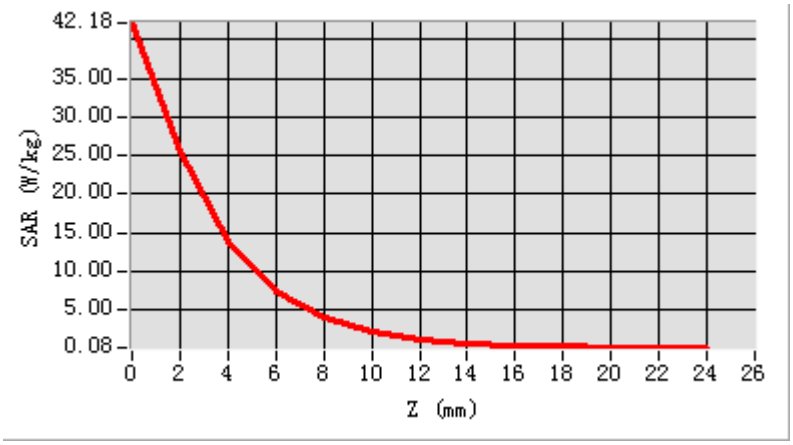
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5200 MHz
Signal	CW
Frequency (MHz)	5200.000000
Relative permittivity (real part)	36.726545
Conductivity (S/m)	4.619563
Power drift (%)	0.170000
Ambient Temperature:	22.3℃
Liquid Temperature:	21.2℃
ConvF:	1.81
Crest factor:	1:1

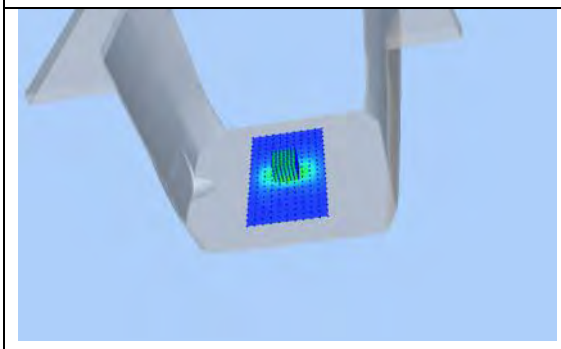
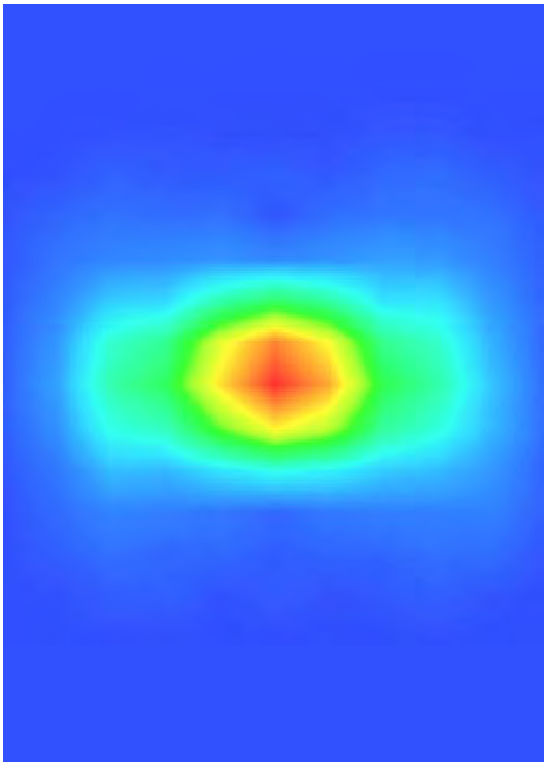
SURFACE SAR	VOLUME SAR
	

Maximum location: X=3.00, Y=1.00
SAR Peak: 42.16 W/kg

SAR 10g (W/Kg)	5.458332
SAR 1g (W/Kg)	15.372378

Z Axis Scan



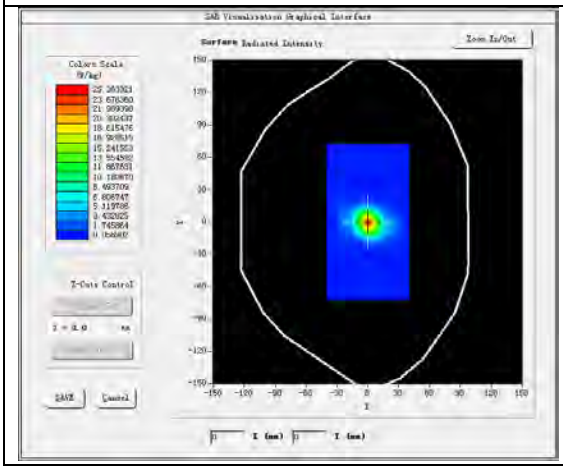
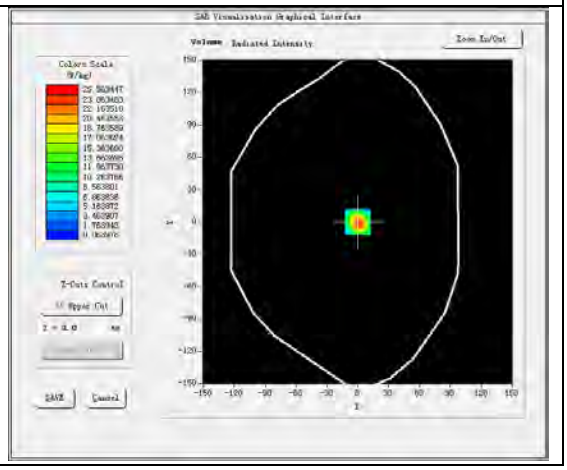
3D screen shot	Hot spot position
	

System Performance Check Data(5400 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=4mm, dy=4mm, dz=2mm
Date of measurement: 2017.03.04
Measurement duration: 29 minutes 19 seconds

Experimental conditions.

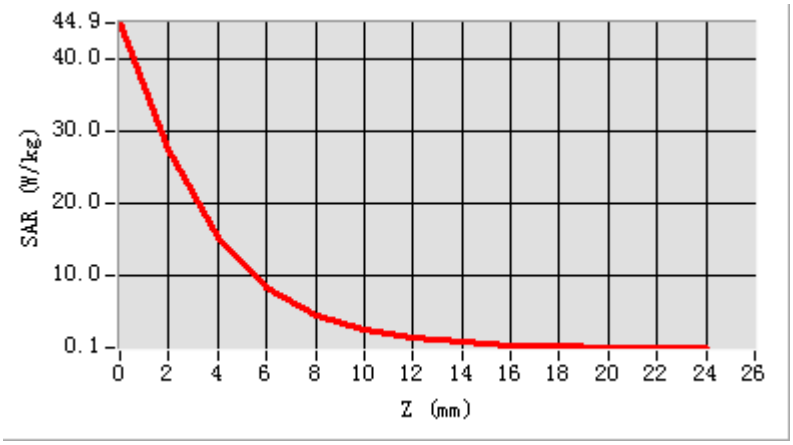
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5400 MHz
Signal	CW
Frequency (MHz)	5400.000000
Relative permittivity (real part)	36.215425
Conductivity (S/m)	4.818762
Power drift (%)	1.120000
Ambient Temperature:	22.3℃
Liquid Temperature:	21.2℃
ConvF:	2.04
Crest factor:	1:1

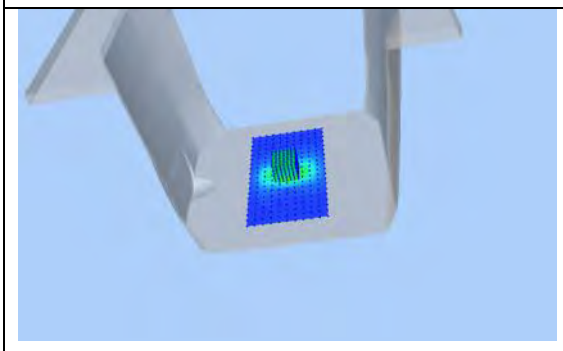
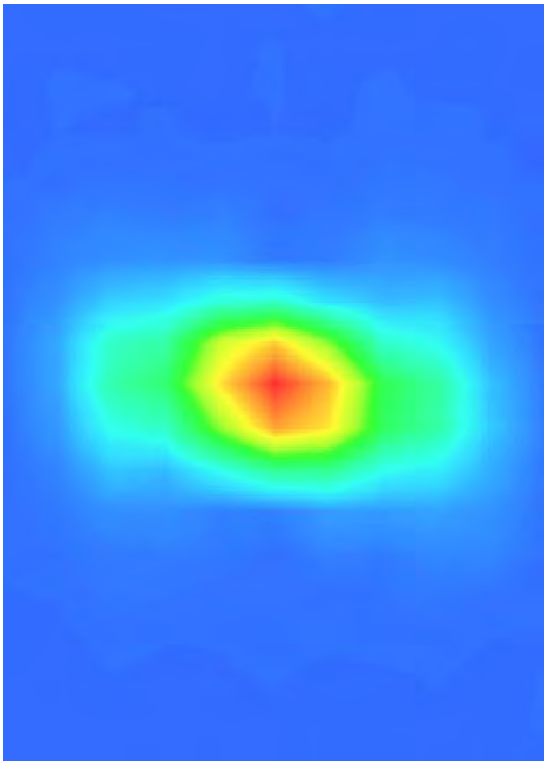
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 44.75 W/kg

SAR 10g (W/Kg)	5.521578
SAR 1g (W/Kg)	15.893652

Z Axis Scan



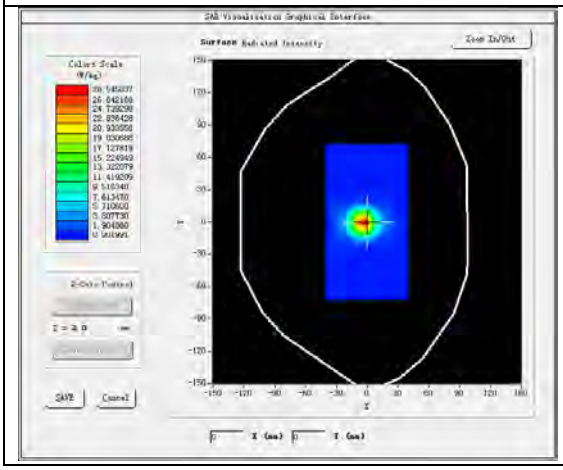
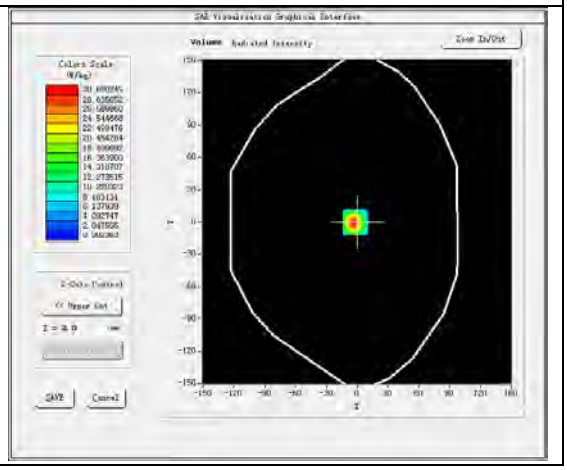
3D screen shot	Hot spot position
	

System Performance Check Data(5600 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=4mm, dy=4mm, dz=2mm
Date of measurement: 2017.03.04
Measurement duration: 29 minutes 28 seconds

Experimental conditions.

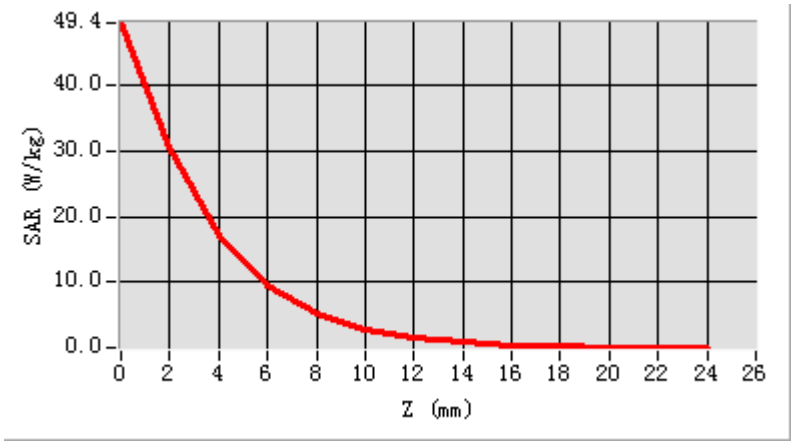
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5600 MHz
Signal	CW
Frequency (MHz)	5600.000000
Relative permittivity (real part)	34.254845
Conductivity (S/m)	5.132262
Power drift (%)	1.380000
Ambient Temperature:	22.3℃
Liquid Temperature:	21.2℃
ConvF:	2.08
Crest factor:	1:1

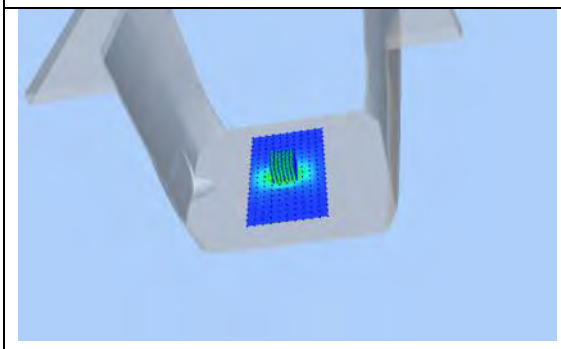
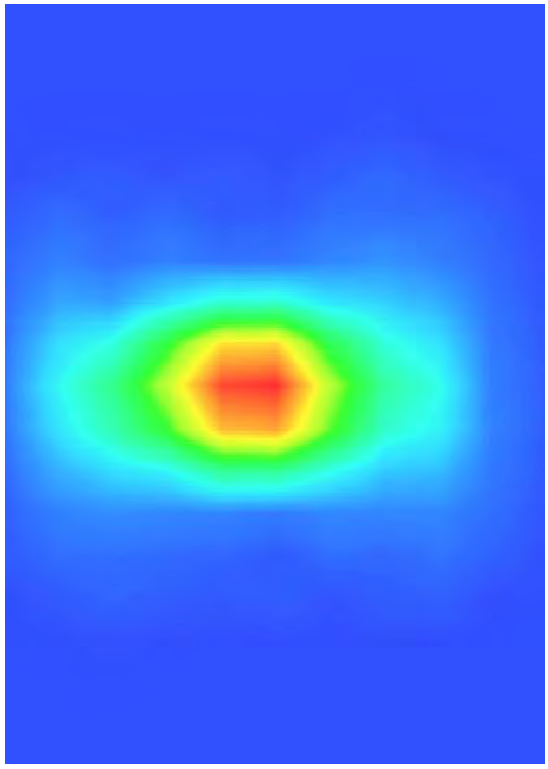
SURFACE SAR	VOLUME SAR
	

Maximum location: X=1.00, Y=1.00
SAR Peak: 49.55 W/kg

SAR 10g (W/Kg)	5.788135
SAR 1g (W/Kg)	16.458215

Z Axis Scan



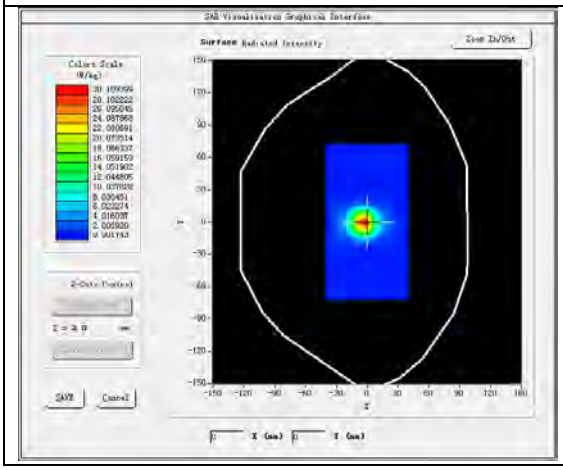
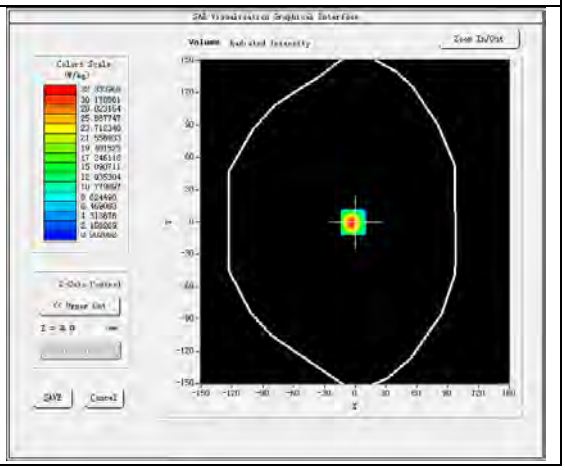
3D screen shot	Hot spot position
	

System Performance Check Data(5800 MHz Head)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=4mm, dy=4mm, dz=2mm
Date of measurement: 2017.03.04
Measurement duration: 29 minutes 38 seconds

Experimental conditions.

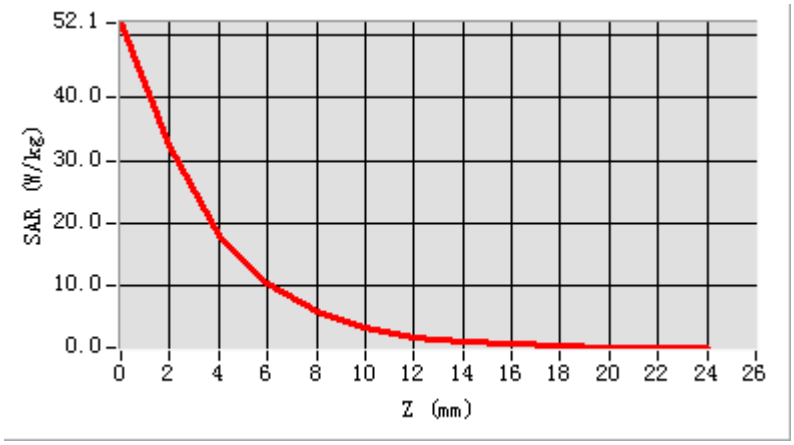
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5800 MHz
Signal	CW
Frequency (MHz)	5800.000000
Relative permittivity (real part)	34.623258
Conductivity (S/m)	5.332958
Power drift (%)	1.180000
Ambient Temperature:	22.3℃
Liquid Temperature:	21.2℃
ConvF:	1.88
Crest factor:	1:1

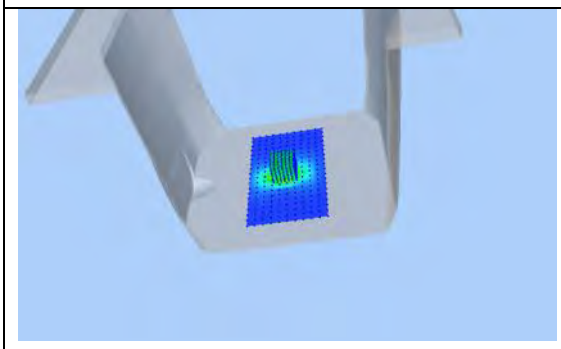
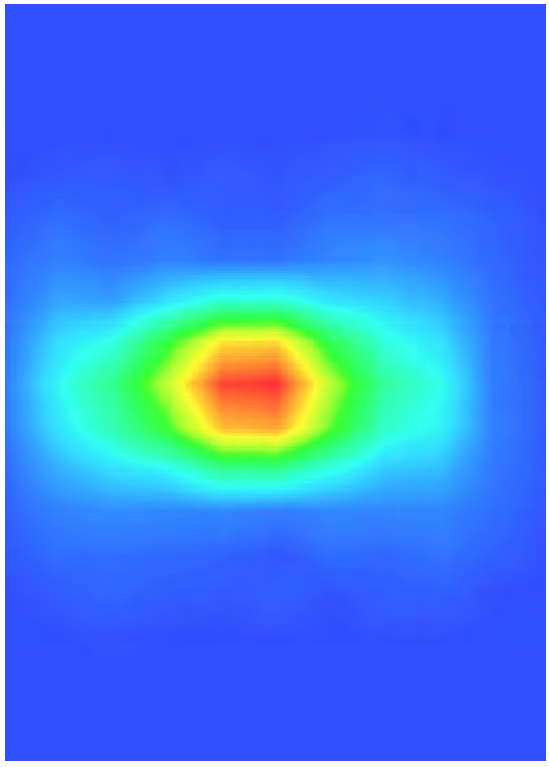
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 51.75 W/kg

SAR 10g (W/Kg)	5.986358
SAR 1g (W/Kg)	17.698213

Z Axis Scan



3D screen shot	Hot spot position
	

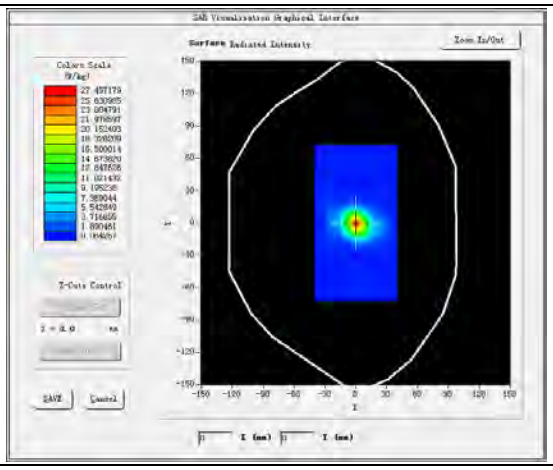
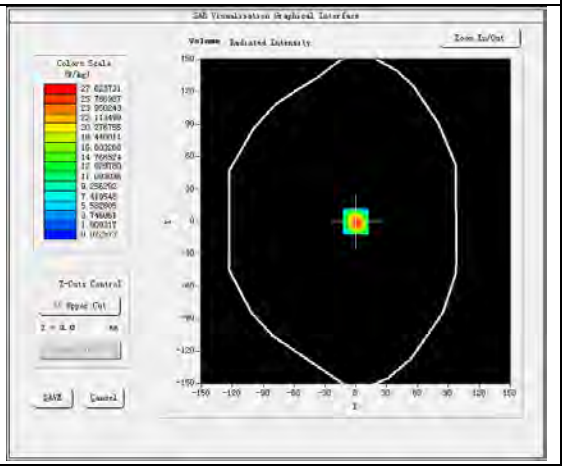
5.10.2 Waveguide 5 GHz Validation Measurement for Body Tissue

System Performance Check Data(5200MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=4mm, dy=4mm, dz=2mm
Date of measurement: 2017.03.04
Measurement duration: 29 minutes 26 seconds

Experimental conditions.

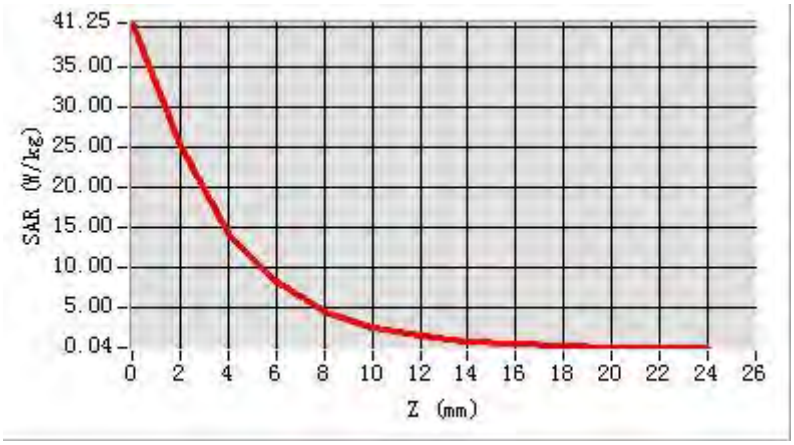
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5200 MHz
Signal	CW
Frequency (MHz)	5200.000000
Relative permittivity (real part)	50.082542
Conductivity (S/m)	5.212548
Power drift (%)	0.680000
Ambient Temperature:	22.3℃
Liquid Temperature:	21.2℃
ConvF:	1.85
Crest factor:	1:1

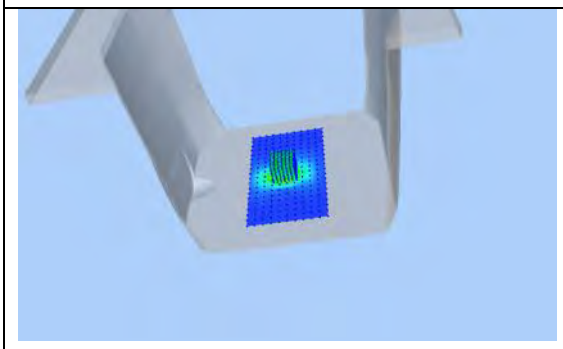
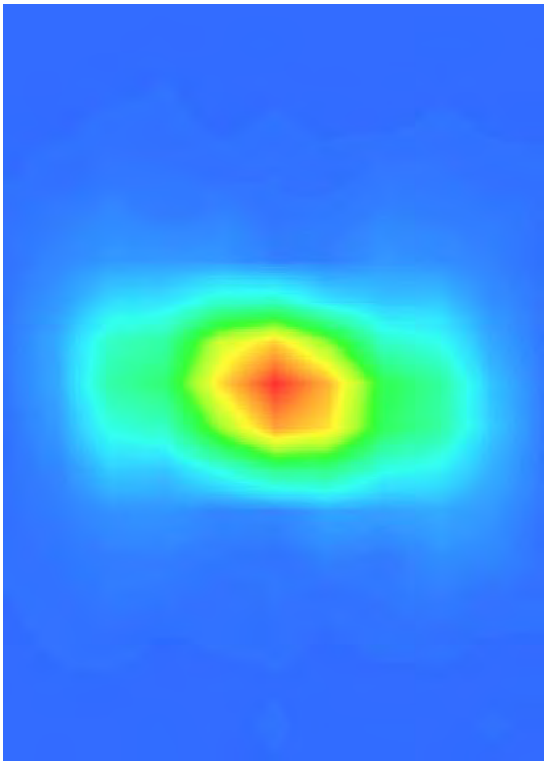
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 40.52 W/kg

SAR 10g (W/Kg)	5.328147
SAR 1g (W/Kg)	15.226524

Z Axis Scan



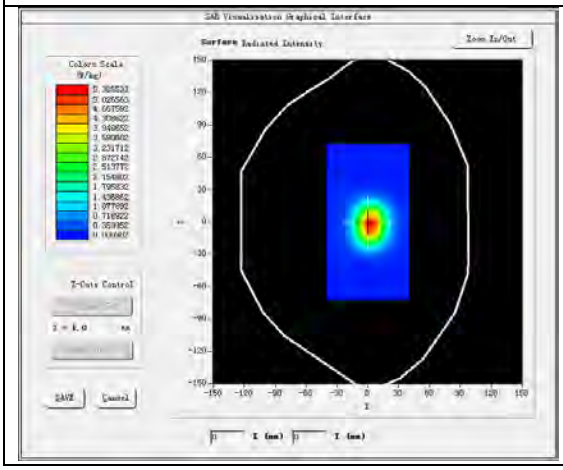
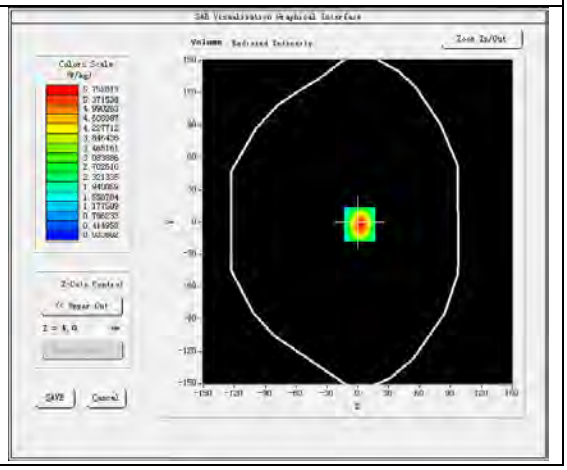
3D screen shot	Hot spot position
	

System Performance Check Data (5400 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=4mm, dy=4mm, dz=2mm
Date of measurement: 2017.03.044
Measurement duration: 29 minutes 32 seconds

Experimental conditions.

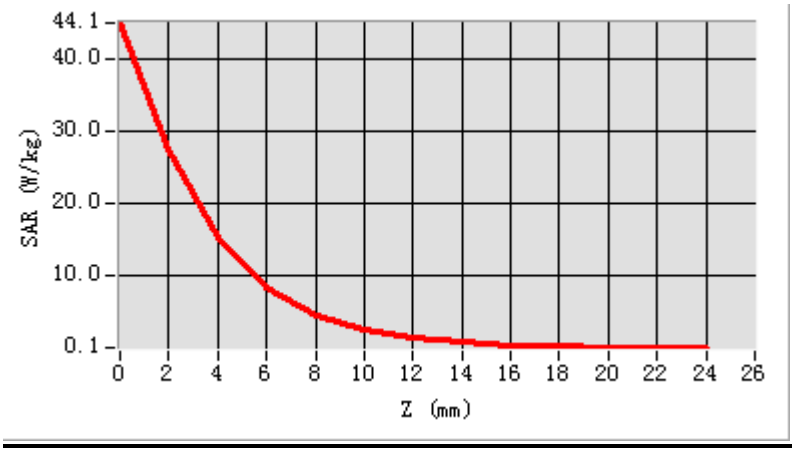
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5400 MHz
Signal	CW
Frequency (MHz)	5400.000000
Relative permittivity (real part)	50.132355
Conductivity (S/m)	5.525699
Power drift (%)	0.160000
Ambient Temperature:	21.9°C
Liquid Temperature:	20.9℃
ConvF:	2.11
Crest factor:	1:1

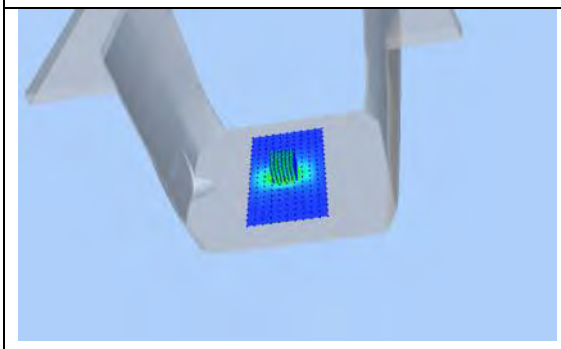
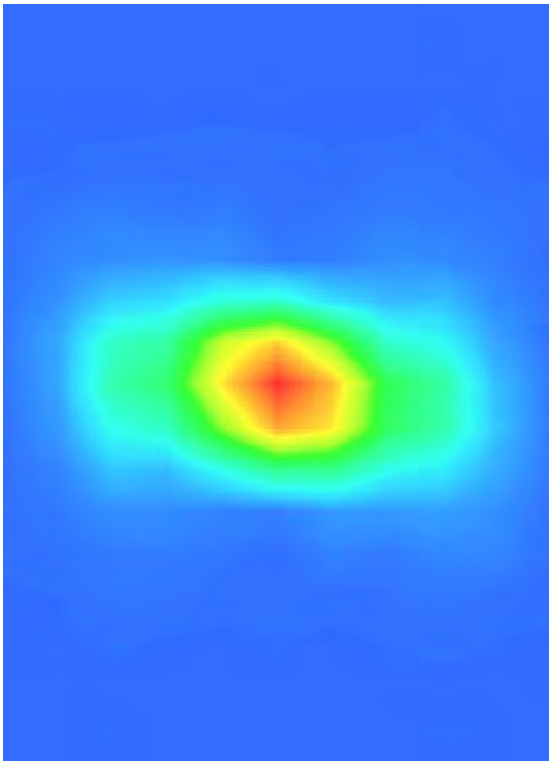
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 43.88 W/kg

SAR 10g (W/Kg)	5.602659
SAR 1g (W/Kg)	15.759821

Z Axis Scan



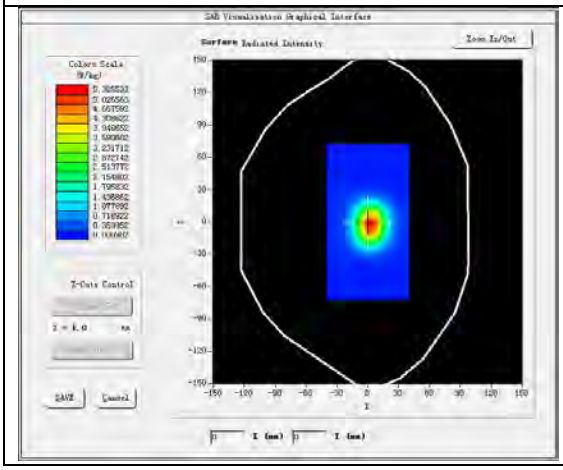
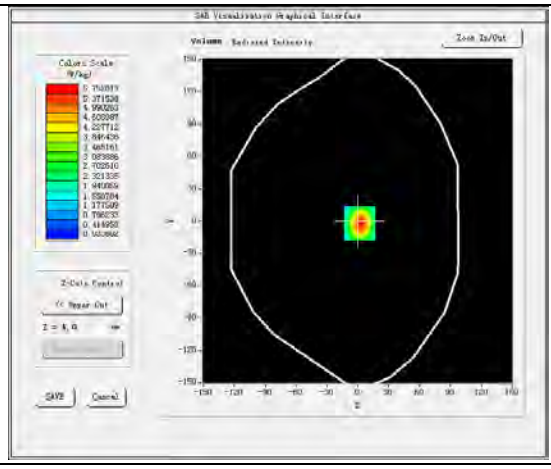
3D screen shot	Hot spot position
	

System Performance Check Data (5600 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=4mm, dy=4mm, dz=2mm
Date of measurement: 2017.03.044
Measurement duration: 29 minutes 32 seconds

Experimental conditions.

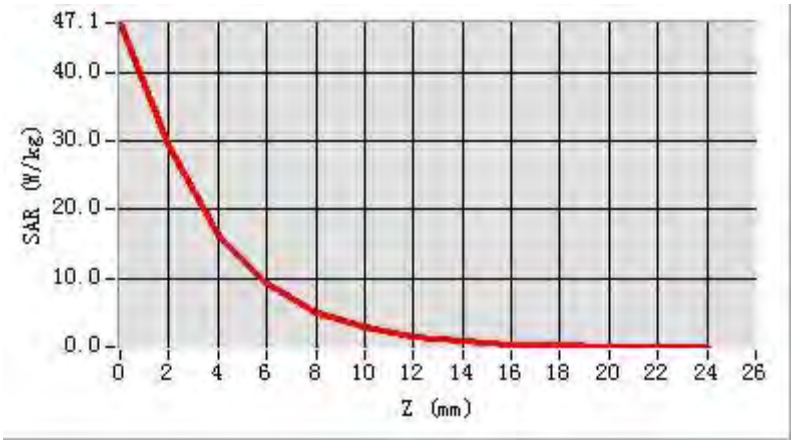
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5600 MHz
Signal	CW
Frequency (MHz)	5600.000000
Relative permittivity (real part)	49.136522
Conductivity (S/m)	5.906785
Power drift (%)	1.20000
Ambient Temperature:	21.9°C
Liquid Temperature:	20.9℃
ConvF:	2.15
Crest factor:	1:1

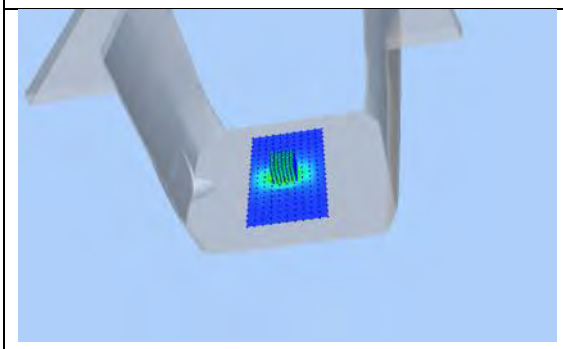
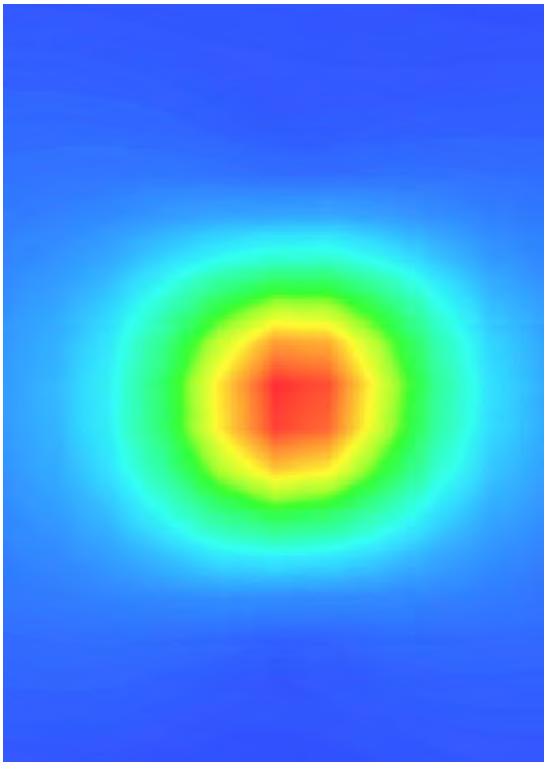
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 46.38W/kg

SAR 10g (W/Kg)	5.643362
SAR 1g (W/Kg)	15.892147

Z Axis Scan



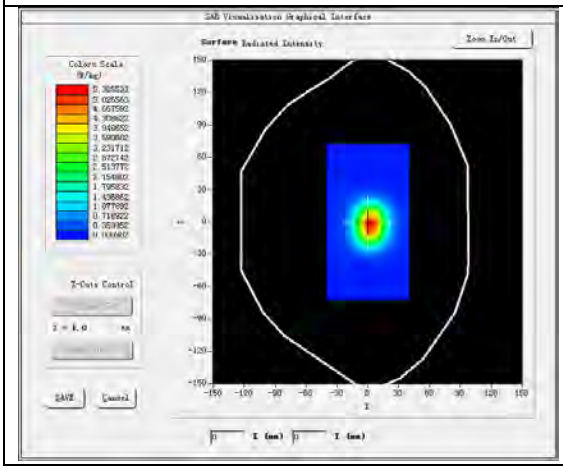
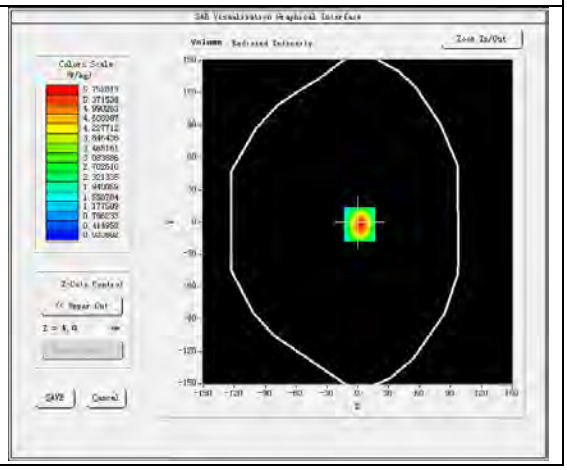
3D screen shot	Hot spot position
	

System Performance Check Data (5800 MHz Body)

Type: Phone measurement (Complete)
E-Field Probe: SN 34/15 SSE2 EPGO265
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=4mm, dy=4mm, dz=2mm
Date of measurement: 2017.03.044
Measurement duration: 29 minutes 36 seconds

Experimental conditions.

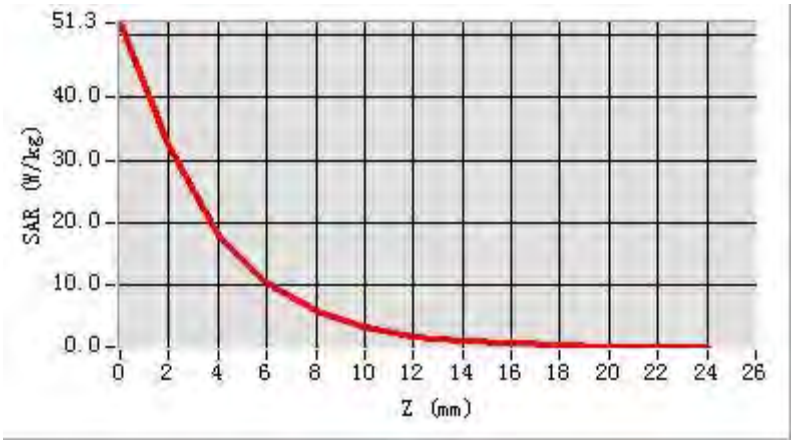
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Band	5800 MHz
Signal	CW
Frequency (MHz)	5800.000000
Relative permittivity (real part)	47.536522
Conductivity (S/m)	6.052548
Power drift (%)	0.130000
Ambient Temperature:	21.9℃
Liquid Temperature:	20.9℃
ConvF:	1.93
Crest factor:	1:1

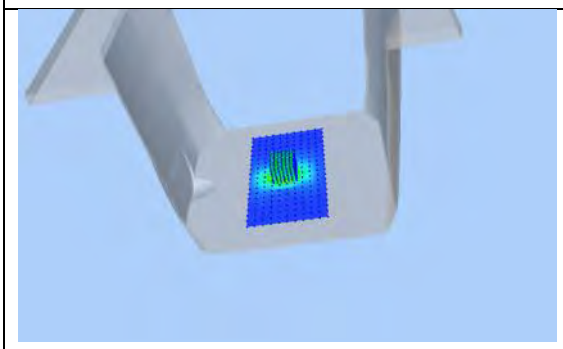
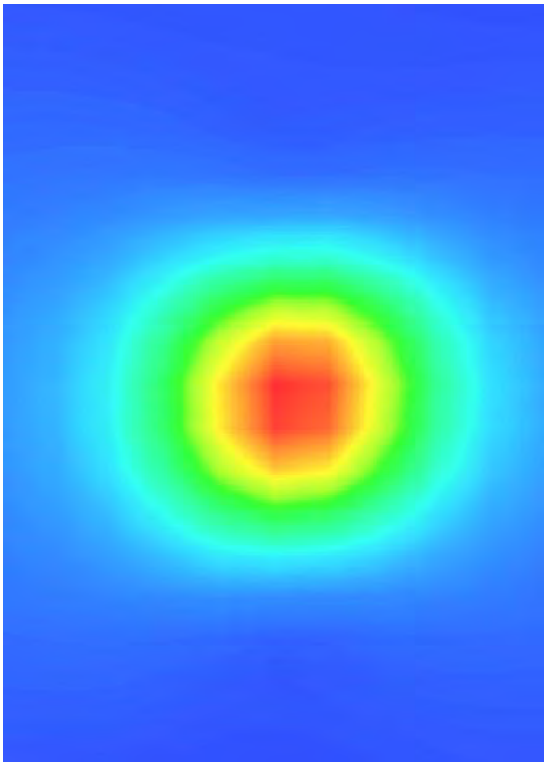
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00
SAR Peak: 50.15W/kg

SAR 10g (W/Kg)	5.842582
SAR 1g (W/Kg)	16.971256

Z Axis Scan



3D screen shot	Hot spot position
	

--END OF REPORT--