FCC SAR TEST REPORT

Report No: 1708129H01

Issued for

Micromax Informatics FZE

Plot no. 21/14, Block A, Naraina Industrial area, Phase- II, New Delhi -110028, India

Product Name:	GSM Mobile Phone
Brand Name:	micromax
Model Name:	X415
Series Model:	N/A
FCC ID:	2ANCWX415
Test Standard:	ANSI/IEEE Std. C95.1
	FCC 47 CFR Part 2 (2.1093)
	IEEE 1528: 2013
Max. Report SAR (1g):	Head: 0.646 W/kg
	Body: 0.507 W/kg

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Test Report Certification

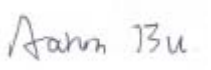
Applicant's name	:	Micromax Informatics FZE
Address	:	Plot no. 21/14, Block A, Naraina Industrial area, Phase- II, New Delhi -110028, India
Manufacture's Name	:	Shenzhen Infinity Informatics Limited
Address	:	4th Floor, East Plaza, 301 Building, Tairan Industry & Trade Park, Chegongmiao, Futian District, Shenzhen, China

Product description

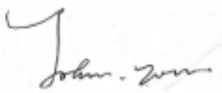
Product name	:	GSM Mobile Phone
Trademark	:	micromax
Model and/or type reference	:	X415
Series Model	:	N/A
Standards	:	ANSI/IEEE Std. C95.1-1992 FCC 47 CFR Part 2 (2.1093) IEEE 1528: 2013

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

Date of Test	:	
Date (s) of performance of tests	:	20 Jun. 2017
Date of Issue	:	21 Jun. 2017
Test Result	:	**Pass**

Testing Engineer **:** 

(Aaron Bu)

Technical Manager **:** 

(John Zou)

Authorized Signatory **:** 

(Vita Li)

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1.General Information

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

1.1 EUT Description

Equipment	GSM Mobile Phone			
Brand Name	micromax			
Model No.	X415			
Series Model	N/A			
FCC ID	2ANCWX415			
Model Difference	N/A			
Adapter	Input: AC100-240V,150mA, 50/60 Hz Output: DC 5V, 500mA			
Battery	Rated Voltage: 3.7V; Charge Limit: 4.2V; Capacity: 1000mAh			
Device Category	Portable			
Product stage	Production unit			
Exposure Environment	General Population / Uncontrolled			
IMEI	352108010002300			
Hardware Version	F153-V00			
Software Version	MMX_X415_SW_V1.0_HW_V1.0_060517			
Frequency Range	GSM 850:824.2~848.8MHz PCS1900:1850.2~1909.8MHz Bluetooth:2402~ 2480MHz			
Max. Reported SAR(1g) (Limit:1.6W/kg)	Band	Mode	Head (W/kg)	Body Worn (W/kg)
	PCE	GSM 850	0.076	0.507
	PCE	GSM 1900	0.646	0.451
	DSS	Bluetooth Note	0.007	0.003
1-g Sum SAR			0.653	0.510
FCC Equipment Class	Licensed Portable Transmitter Held to Ear (PCE) Part 15 Spread Spectrum Transmitter (DSS)			
Operating Mode	GSM: GSM Voice; GPRS Class 12; Bluetooth: V3.0 + EDR (GFSK, π/4DQPSK, 8DPSK) ;			
Antenna Specification	GSM: PIFA Antenna BT: MONOPOLE Antenna			
SIM Card	Support dual-SIM, dual standby, the multiple SIM card with two lines cannot transmitting at the same time			

Note:
1. Bluetooth SAR was estimated
2. The dual SIM card mobile has 2 SIM slots and supports dual SIM dual standby. The WWAN radio transmission will be enabled by either one SIM at a time (Single active)
3. After pre-scan two SIM cards power, we found test result of the SIM1 was the worse, so we chose SIM1 card to perform all tests.
4. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power

1.2 Test Environment

Ambient conditions in the SAR laboratory:

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

1.3 Test Factory

BZT Testing Technology Co., Ltd
Add. : Buliding 17, Xinghua Road Xingwei industrial Park Fuyong, Baoan District, Shenzhen, Guangdong, China

FCC Registration No.: 701733

2.Test Standards And Limits

No.	Identity	Document Title
1	47 CFR Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
2	ANSI/IEEE Std. C95.1-1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
3	IEEE Std. 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
4	FCC KDB 447498 D01 v06	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

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

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

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

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

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

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

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

NOTE

GENERAL POPULATION/UNCONTROLLED EXPOSURE

PARTIAL BODY LIMIT

1.6 W/kg

3. SAR Measurement System

3.1 Definition Of Specific Absorption Rate (SAR)

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

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

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

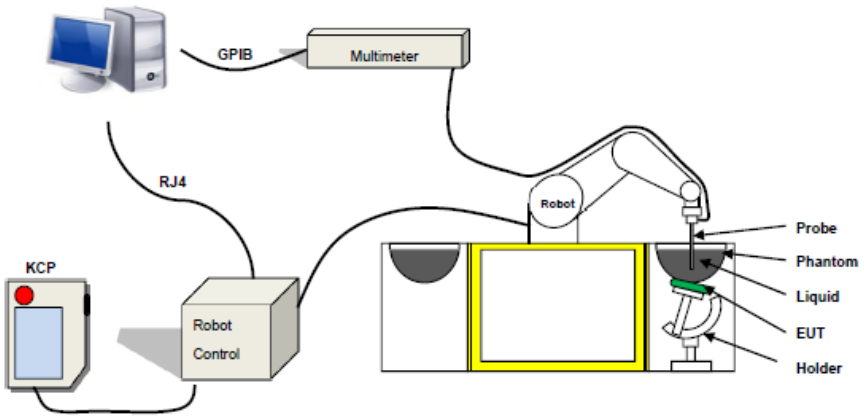
SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

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

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

3.2 SAR System

SATIMO SAR System Diagram:



Comosar is a system that is able to determine the SAR distribution inside a phantom of human being according to different standards. The Comosar system consists of the following items:
- Main computer to control all the system
- 6 axis robot
- Data acquisition system
- Miniature E-field probe
- Phone holder
- Head simulating tissue

The following figure shows the system.

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

3.2.1 Probe

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

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

Figure 1-MVG COMOSAR Dosimetric E field Dipole

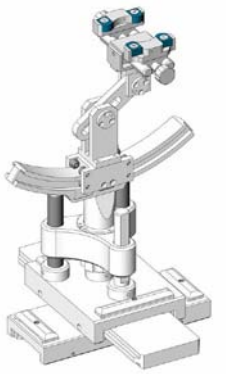
3.2.2 Phantom

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

SN 32/14 SAM115

SN 32/14 SAM116

3.2.3 Device Holder



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

4. Tissue Simulating Liquids

4.1 Simulating Liquids Parameter Check

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

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

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

LIQUID MEASUREMENT RESULTS

Date	Ambient condition		Head Simulating Liquid		Parameters	Target	Measured	Deviation [%]	Limited [%]
	Temp. [°C]	Humidity [%]	Frequency	Temp. [°C]					
2017-06-20	23.3	56	835 MHz	23.0	Permitivity:	41.50	41.46	-0.09	±5
					Conductivity:	0.90	0.89	-0.62	± 5
2017-06-20	23.3	56	1900 MHz	23.0	Permitivity:	40.00	39.84	-0.39	± 5
					Conductivity:	1.40	1.42	1.08	± 5

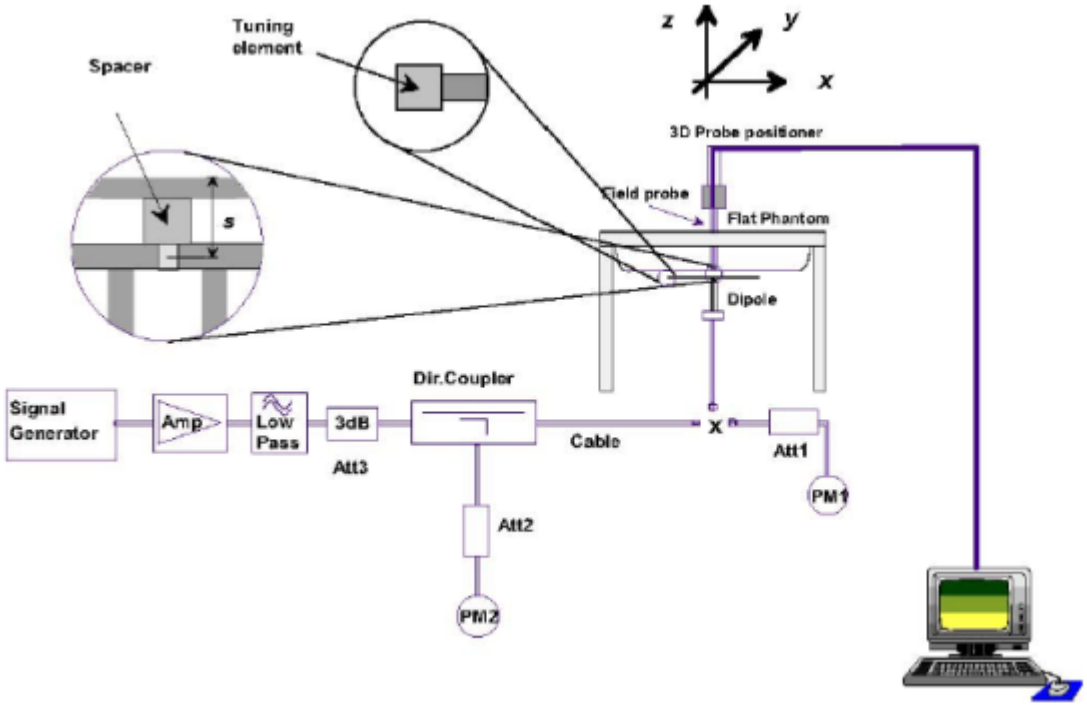
Date	Ambient condition		Body Simulating Liquid		Parameters	Target	Measured	Deviation [%]	Limited [%]
	Temp. [°C]	Humidity [%]	Frequency	Temp. [°C]					
2017-06-20	23.3	56	835 MHz	23.0	Permitivity:	55.20	55.59	0.70	± 5
					Conductivit:	0.97	0.96	-1.29	± 5
2017-06-20	23.3	56	1900 MHz	23.0	Permitivity:	53.30	52.45	-1.60	± 5
					Conductivity	1.52	1.47	-3.00	± 5

5. SAR System Validation

5.1 Validation System

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

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



5.2 Validation Result

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

Freq.(MHz)	Power(mW)	Tested Value (W/Kg)	Normalized SAR (W/kg)	Target(W/Kg)	Tolerance(%)	Date
835 Head	100	0.955	9.551	9.56	-0.09	2017-06-20
835 Body	100	0.964	9.640	9.56	0.83	2017-06-20
1900 Head	100	3.861	38.612	39.7	-2.74	2017-06-20
1900 Body	100	4.160	41.595	39.7	4.77	2017-06-20

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

6. SAR Evaluation Procedures

The procedure for assessing the average SAR value consists of the following steps:

- Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface.

- Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.

- Measurement of the SAR distribution with a grid of 8 to 16mm * 8 to16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.

- Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

Area Scan& Zoom Scan:

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

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

7. EUT Test Position

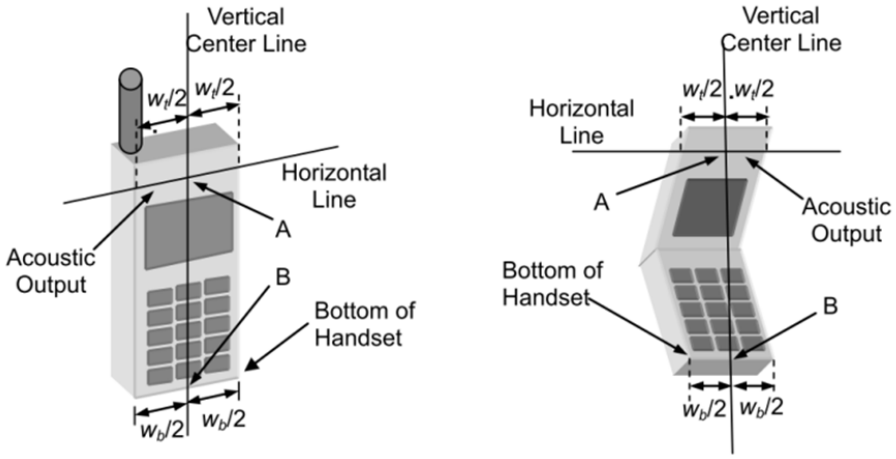
This EUT was tested in Right Cheek, Right Titled, Left Cheek, Left Titled, Front Face and Rear Face.

7.1 Define Two Imaginary Lines On The Handset

1)The vertical centerline passes through two points on the front side of the handset the midpoint of the width wt of the handset at the level of the acoustic output, and the midpoint of the width wb of the handset.

2)The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.

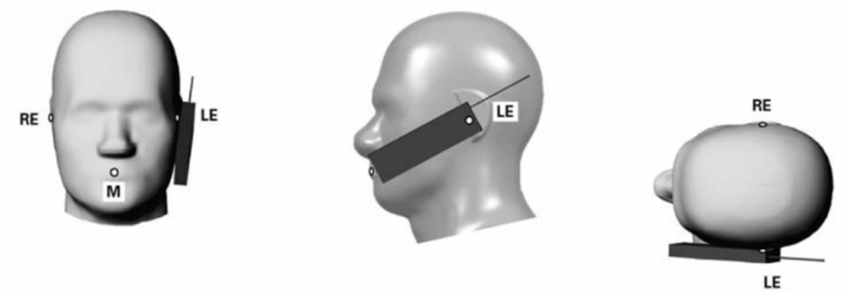
3)The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily to the front face of the handset, especially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



Cheek Position

1)To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

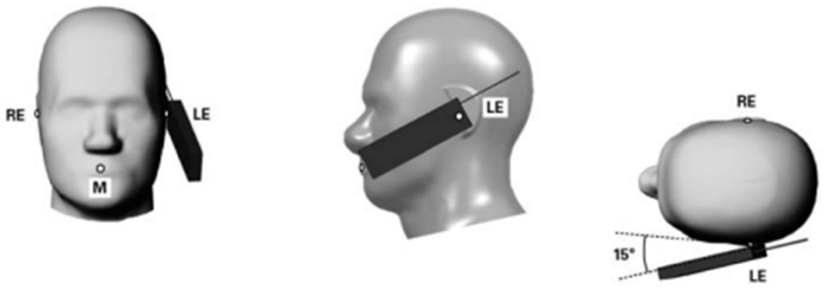
2)To move the device towards the phantom with the ear piece aligned with the the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost



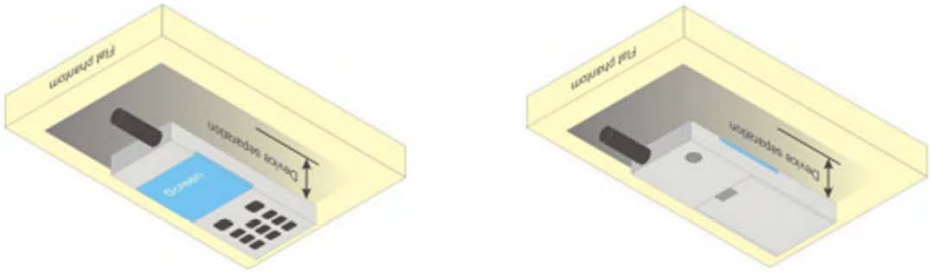
Title Position

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

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

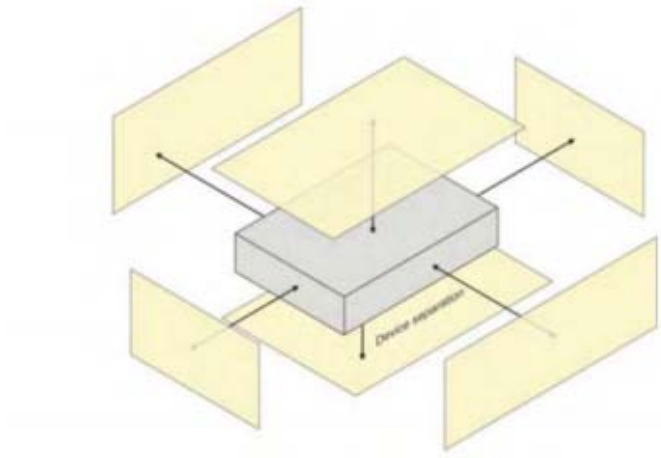


Body-worn Position Conditions:
Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB Publication 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset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



7.2 Hotspot mode exposure position condition

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



8. Uncertainty

8.1 Measurement Uncertainty

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

NO	Source	Tol(%)	Prob. Dist.	Div. k	ci (1g)	ci (10g)	1gUi	10gUi	Veff
Measurement System□									
1	Probe calibration	5.8	N	1	1	1	5.8	5.8	∞
2	Axial isotropy	3.5	R	√3	(1-cp)1/2	(1-cp)1/2	1.43	1.43	∞
3	Hemispherical isotropy	5.9	R	√3	√Cp	√Cp	2.41	2.41	∞
4	Boundary effect	1.0	R	√3	1	1	0.58	0.58	∞
5	Linearity	4.7	R	√3	1	1	2.71	2.71	∞
6	System Detection limits	1.0	R	√3	1	1	0.58	0.58	∞
7	Readout electronics	0.5	N	1	1	1	0.50	0.50	∞
8	Response time	0	R	√3	1	1	0	0	∞
9	Integration time	1.4	R	√3	1	1	0.81	0.81	∞
10	Ambient noise	3.0	R	√3	1	1	1.73	1.73	∞
11	Ambient reflections	3.0	R	√3	1	1	1.73	1.73	∞
12	Probe positioner mech. restrictions	1.4	R	√3	1	1	0.81	0.81	∞
13	Probe positioning with respect to phantom shell	1.4	R	√3	1	1	0.81	0.81	∞
14	Max.SAR evaluation	1.0	R	√3	1	1	0.6	0.6	∞
Test sample related									
15	Device positioning	2.6	N	1	1	1	2.6	2.6	11
16	Device holder	3	N	1	1	1	3.0	3.0	7
17	Drift of output power	5.0	R	√3	1	1	2.89	2.89	∞
Phantom and set-up									
18	Phantom uncertainty	4.0	R	√3	1	1	2.31	2.31	∞
19	Liquid conductivity (target)	2.5	N	1	0.78	0.71	1.95	1.78	5
20	Liquid conductivity (meas)	4	N	1	0.23	0.26	0.92	1.04	5
21	Liquid Permittivity (target)	2.5	N	1	0.78	0.71	1.95	1.78	∞
22	Liquid Permittivity (meas)	5.0	N	1	0.23	0.26	1.15	1.30	∞
Combined standard			RSS	$U_C = \sqrt{\sum_{i=1}^{n} C_i^2 U_i^2}$			10.63%	10.54%	
Expanded uncertainty (P=95%)		$U = k\, U_C$,k=2					21.26%	21.08%	

8.2 System validation Uncertainty

NO	Source	Tol(%)	Prob. Dist.	Div. k	ci (1g)	ci (10g)	1gUi	10gUi	Veff
Measurement System□									
1	Probe calibration	5.8	N	1	1	1	5.8	5.8	∞
2	Axial isotropy	3.5	R	√3	(1-cp)1/2	(1-cp)1/2	1.43	1.43	∞
3	Hemispherical isotropy	5.9	R	√3	√Cp	√Cp	2.41	2.41	∞
4	Boundary effect	1.0	R	√3	1	1	0.58	0.58	∞
5	Linearity	4.7	R	√3	1	1	2.71	2.71	∞
6	System Detection limits	1.0	R	√3	1	1	0.58	0.58	∞
7	Modulation response	0	N	1	1	1	0	0	∞
8	Readout electronics	0.5	N	1	1	1	0.50	0.50	∞
9	Response time	0	R	√3	1	1	0	0	∞
10	Integration time	1.4	R	√3	1	1	0.81	0.81	∞
11	Ambient noise	3.0	R	√3	1	1	1.73	1.73	∞
12	Ambient reflections	3.0	R	√3	1	1	1.73	1.73	∞
13	Probe positioner mech. restrictions	1.4	R	√3	1	1	0.81	0.81	∞
14	Probe positioning with respect to phantom shell	1.4	R	√3	1	1	0.81	0.81	∞
15	Max.SAR evaluation	1.0	R	√3	1	1	0.6	0.6	∞
Dipole									
16	Deviation of experimental source from	4	N	1	1	1	4.00	4.00	∞
17	Input power and SAR drift mea.	5	R	√3	1	1	2.89	2.89	∞
18	Dipole Axis to liquid Distance	2	R	√3	1	1			∞
Phantom and set-up									
19	Phantom uncertainty	4.0	R	√3	1	1	2.31	2.31	∞
20	Uncertainty in SAR correction for deviation(in	2.0	N	1	1	0.84	2	1.68	∞
21	Liquid conductivity (target)	2	N	1	1	0.84	2.00	1.68	∞
22	Liquid conductivity (temperature uncertainty)	2.5	N	1	0.78	0.71	1.95	1.78	5
23	Liquid conductivity (meas)	4	N	1	0.23	0.26	0.92	1.04	5
24	Liquid Permittivity (target)	2.5	N	1	0.78	0.71	1.95	1.78	∞
25	Liquid Permittivity (temperature uncertainty)	2.5	N	1	0.78	0.71	1.95	1.78	5
26	Liquid Permittivity (meas)	5.0	N	1	0.23	0.26	1.15	1.30	∞
Combined standard			RSS	$U_C = \sqrt{\sum_{i=1}^{n} C_i^2 U_i^2}$			10.15%	10.05%	
Expanded uncertainty (P=95%)		$U = k\, U_C$,k=2					20.29%	20.10%	

9. Conducted Power Measurement

9.1 Test Result

Burst Average Power (dBm)						
Band	GSM 850			PCS 1900		
Channel	128	190	251	512	661	810
Frequency (MHz)	824.2	836.6	848.8	1850.2	1880.0	1909.8
GSM(GMSK, 1-Slot)	31.15	31.23	31.26	28.19	27.88	27.81
GPRS (GMSK, 1-Slot)	31.12	31.21	31.24	28.15	27.86	27.79
GPRS (GMSK, 2-Slot)	30.65	30.72	30.81	27.68	27.41	27.37
GPRS (GMSK, 3-Slot)	29.18	29.32	29.36	26.20	25.93	25.97
GPRS (GMSK, 4-Slot)	28.69	28.89	28.94	25.80	25.46	25.49
EGPRS(8PSK, 1-Slot)	-	-	-	-	-	-
EGPRS(8PSK, 2-Slot)	-	-	-	-	-	-
EGPRS(8PSK, 3-Slot)	-	-	-	-	-	-
EGPRS(8PSK, 4-Slot)	-	-	-	-	-	-

Remark: GPRS, CS4 coding scheme. EGPRS, MCS9 coding scheme.
Multi-Slot Class 8 , Support Max 4 downlink, 1 uplink , 5 working link
Multi-Slot Class 10 , Support Max 4 downlink, 2 uplink , 5 working link
Multi-Slot Class 12 , Support Max 4 downlink, 4 uplink , 5 working link

Fram- Average Power(dBm)						
Band	GSM 850			PCS 1900		
Channel	128	190	251	512	661	810
Frequency (MHz)	824.2	836.6	848.8	1850.2	1880.0	1909.8
GSM(GMSK, 1-Slot)	22.12	22.20	22.23	19.16	18.85	18.78
GPRS (GMSK, 1-Slot)	22.09	22.18	22.21	19.12	18.83	18.76
GPRS (GMSK, 2-Slot)	24.63	24.70	24.79	21.66	21.39	21.35
GPRS (GMSK, 3-Slot)	24.92	25.06	25.10	21.94	21.67	21.71
GPRS (GMSK, 4-Slot)	25.68	25.88	25.93	22.79	22.45	22.48
EGPRS(8PSK, 1-Slot)	-	-	-	-	-	-
EGPRS(8PSK, 2-Slot)	-	-	-	-	-	-
EGPRS(8PSK, 3-Slot)	-	-	-	-	-	-
EGPRS(8PSK, 4-Slot)	-	-	-	-	-	-

Remark :
1. SAR testing was performed on the maximum frame-averaged power mode.
2. The frame-averaged power is linearly proportion to the slot number configured and it is linearly scaled the maximum
burst-averaged power based on time slots. The calculated method is shown as below:
Frame-averaged power = Burst averaged power (1 Tx Slot) – 9.03 dB
Frame-averaged power = Burst averaged power (2 Tx Slots) – 6.02 dB
Frame-averaged power = Burst averaged power (3 Tx Slots) - 4.26 dB
Frame-averaged power = Burst averaged power (4 Tx Slots) – 3.01 dB

Bluetooth

Mode	Channel Number	Frequency (MHz)	Average Power (dBm)
GFSK(1Mbps)	0	2402	-9.69
	39	2441	-9.63
	78	2480	-9.59
π/4-DQPSK(2Mbps)	0	2402	-12.43
	39	2441	-12.41
	78	2480	-12.36
8DPSK(3Mbps)	0	2402	-12.46
	39	2441	-12.42
	78	2480	-12.39

9.2 Tune-up Power

Mode	GSM850(AVG)	GSM1900(AVG)
GSM/PCS	31±1dBm	28±1dBm
GPRS (1 Slot)	31±1dBm	28±1dBm
GPRS (2 Slot)	30±1dBm	27±1dBm
GPRS (3 Slot)	29±1dBm	26±1dBm
GPRS (4 Slot)	28±1dBm	25±1dBm

Mode	BT(AVG)
GFSK	-9±1dBm
π/4-DQPSK	-12±1dBm
8DPSK	-12±1dBm

9.3 SAR Test Exclusions Applied

Per FCC KDB 447498D01, the 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHZ)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

- f(GHZ) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 3.0$$

Based on the maximum conducted power of **Bluetooth Head** (rounded to the nearest mW) and the antenna to user separation distance,

Bluetooth Head SAR was not required; [(0.158/5)* √2.480] = **0.05** < 3.0.

Based on the maximum conducted power of **Bluetooth Body** (rounded to the nearest mW) and the antenna to user separation distance,

Bluetooth Body SAR was not required; [(0.158/10)* √2.480] = **0.02** < 3.0.

10. EUT And Test Setup Photo

10.1 EUT Photo

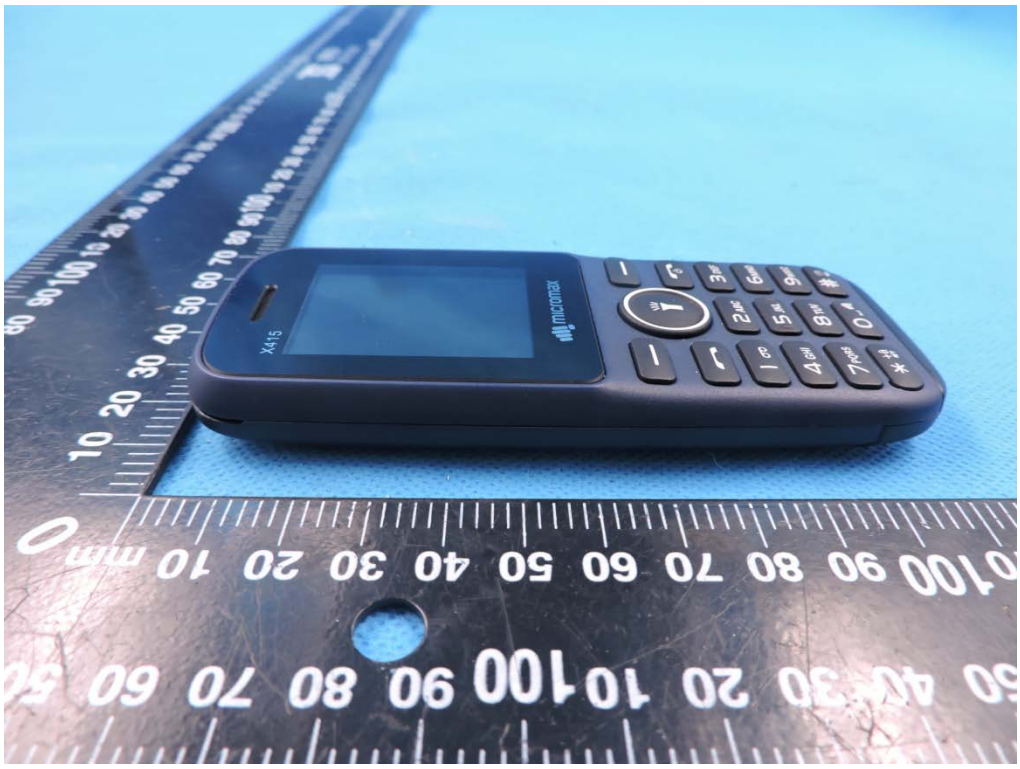
Front side

Back side

Top side

Bottom side

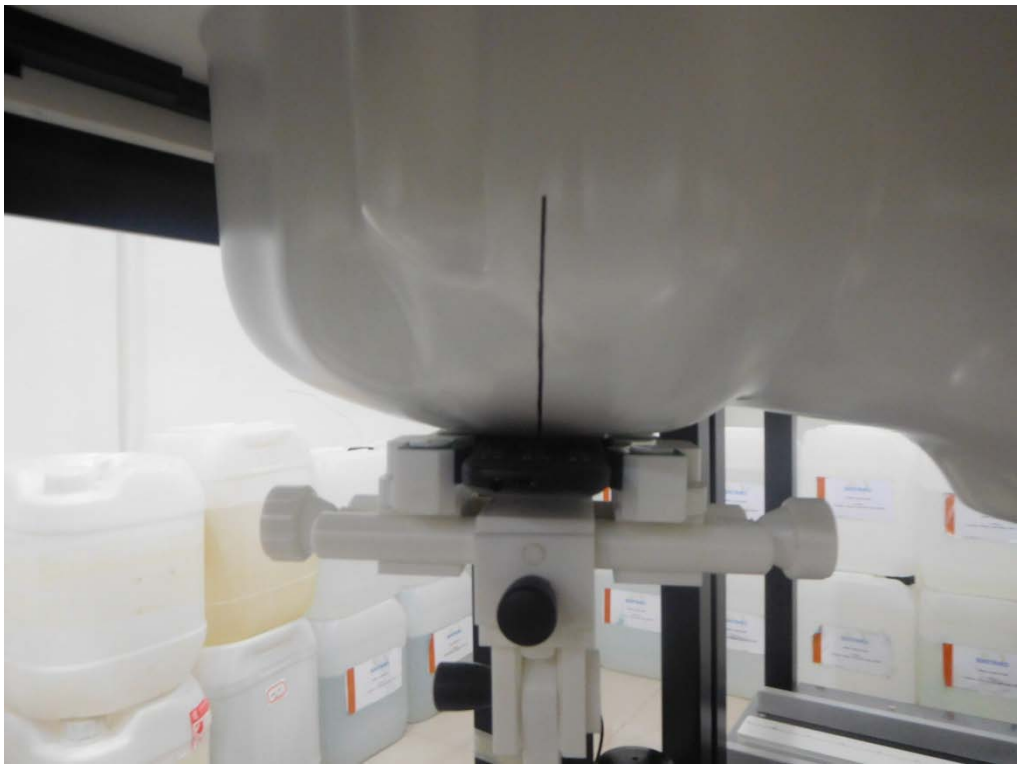
Left side



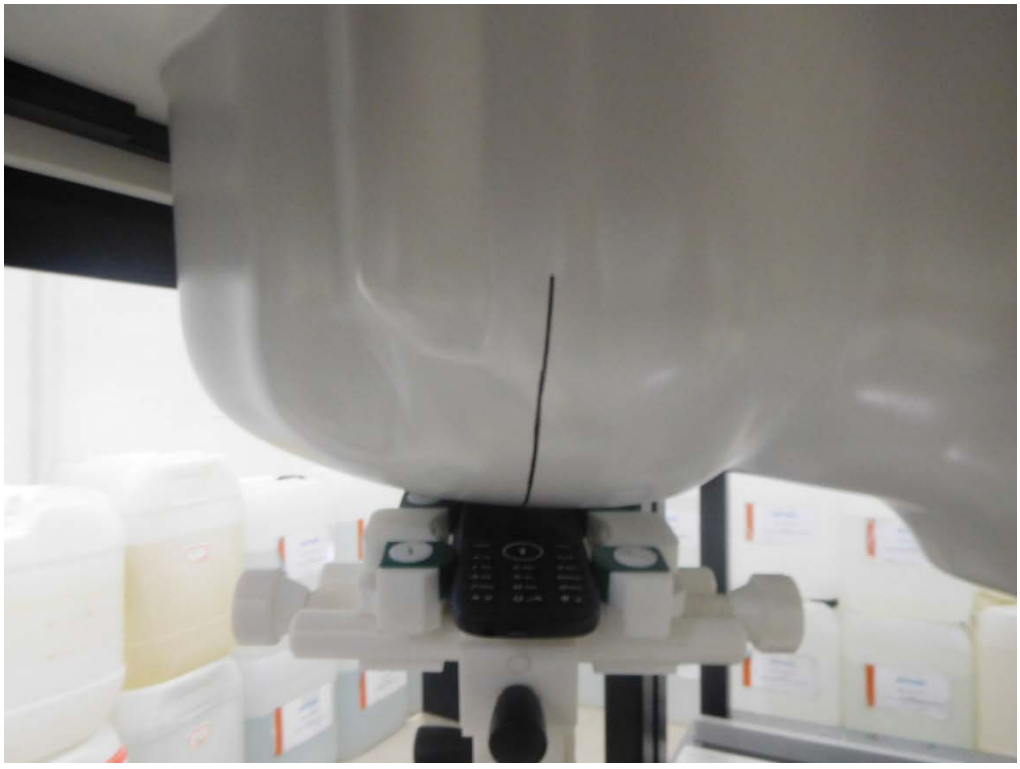
Right side

10.2 Setup Photo

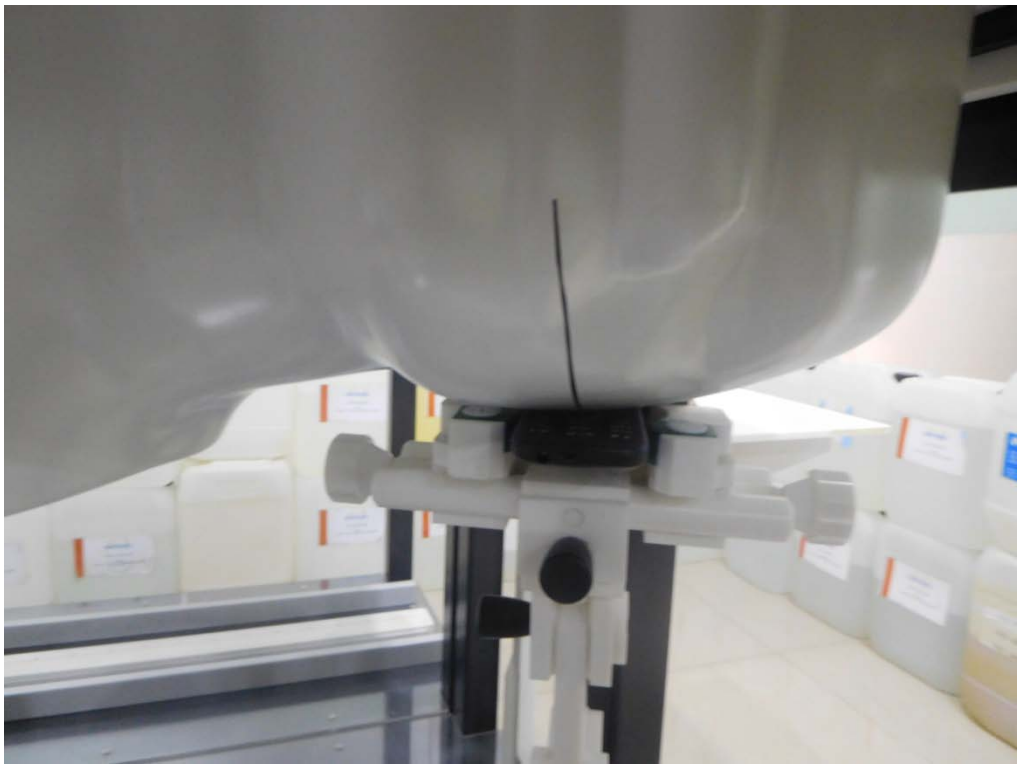
Right Touch



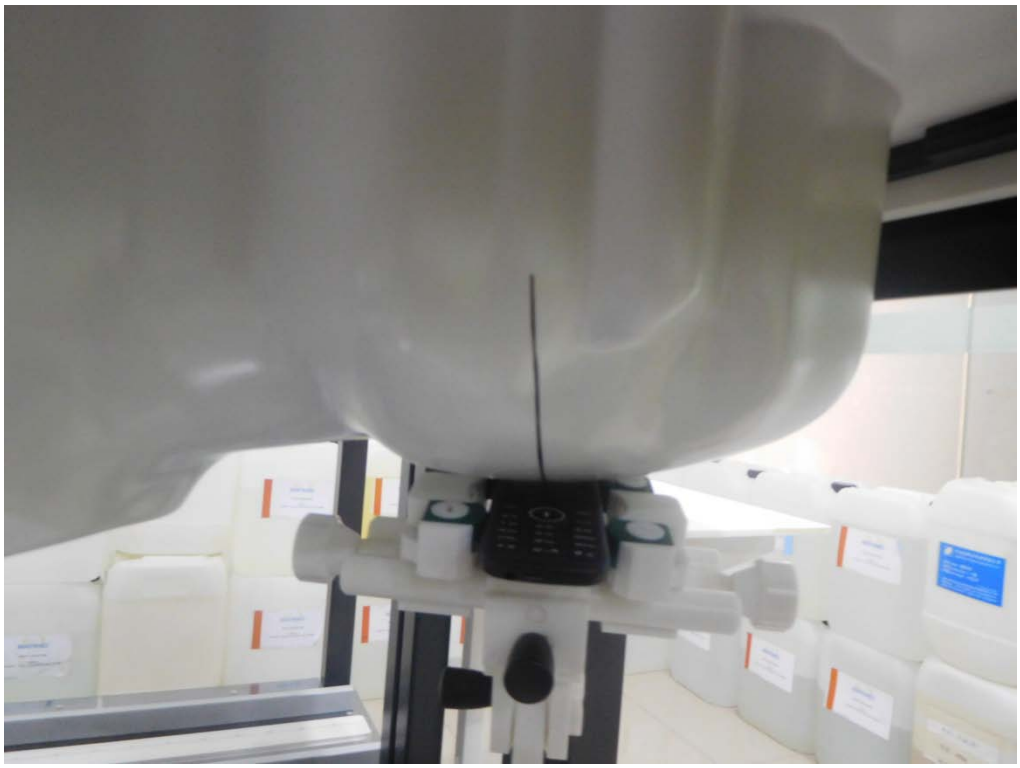
Right Tilt



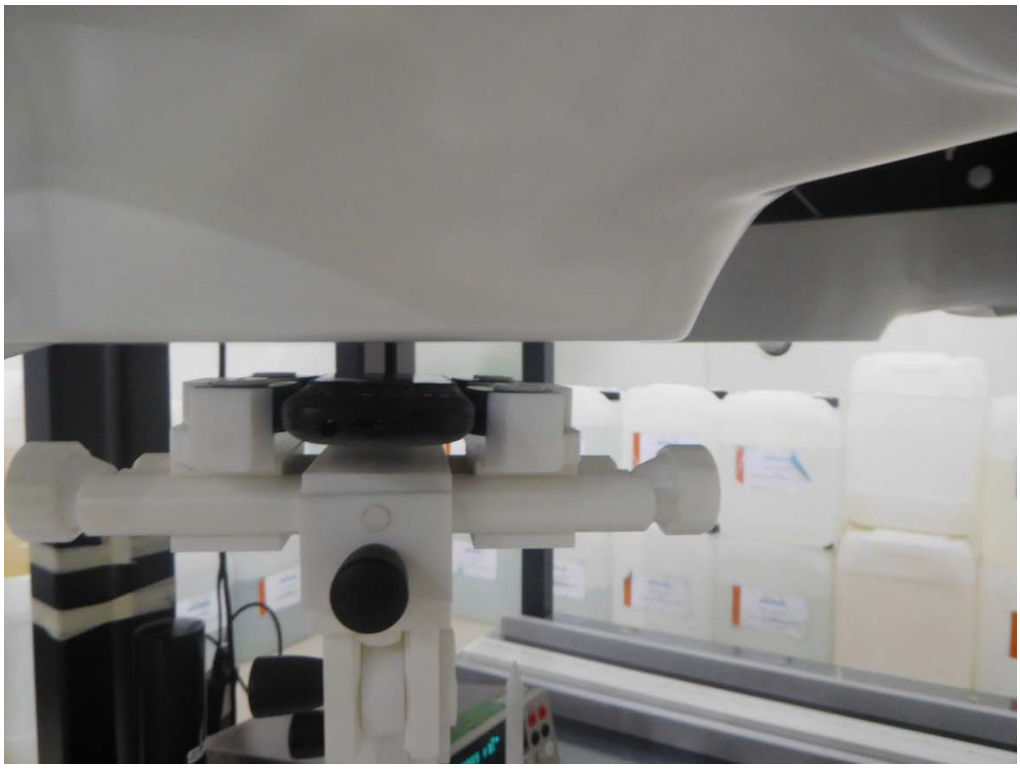
Left Touch



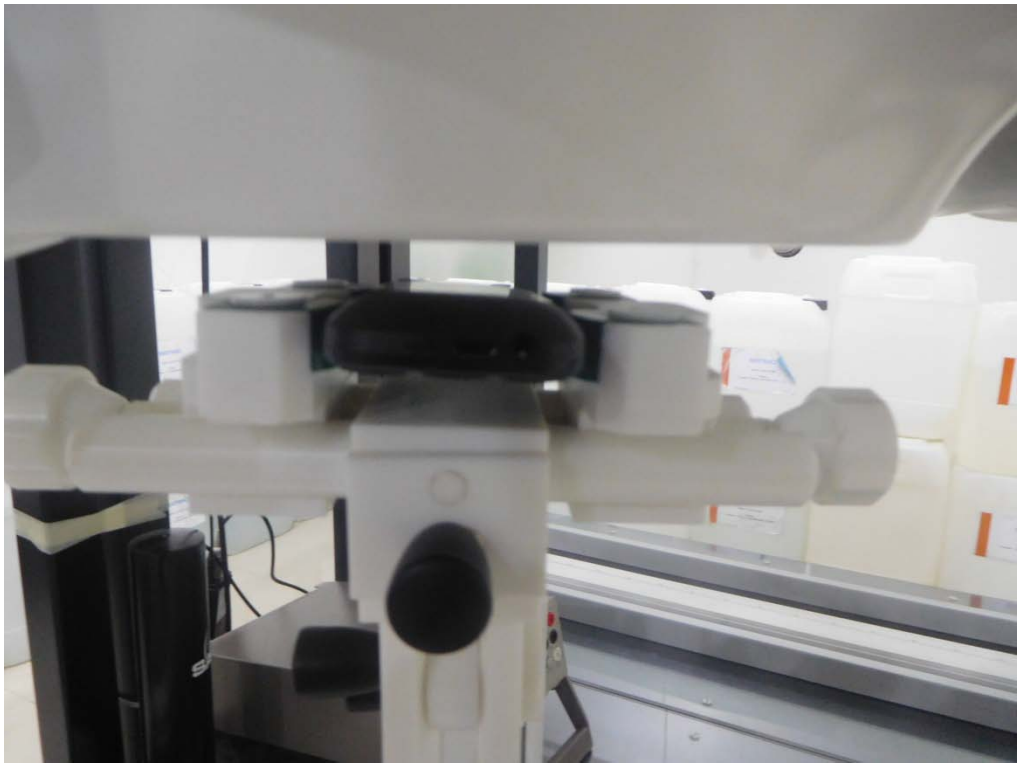
Left Tilt



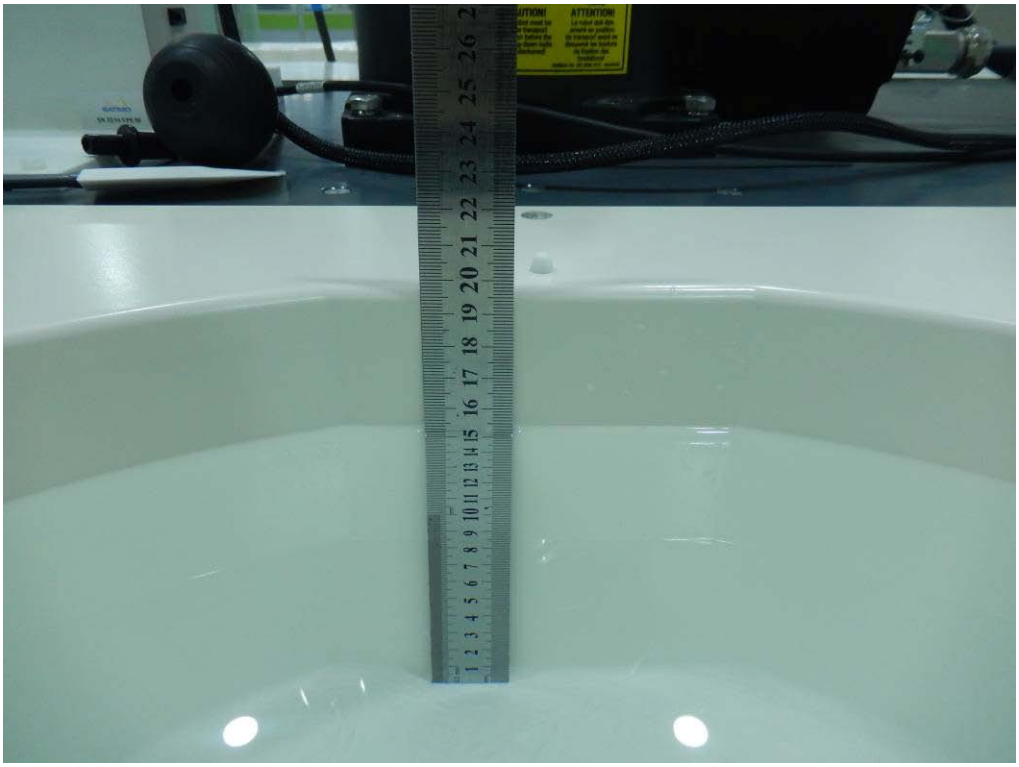
Body Front side(separation distance is 10mm)



Body Back side(separation distance is 10mm)



Liquid depth (15 cm)



11. SAR Result Summary

11.1 Head SAR

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Scaled SAR (W/Kg)	Meas. No.
GSM 850	Voice	Right Cheek	251	0.064	-3.08	32	31.26	**0.076**	1
		Right Tilt	251	0.045	-1.94	32	31.26	0.053	/
		Left Cheek	251	0.044	-2.41	32	31.26	0.052	/
		Left Tilt	251	0.033	1.55	32	31.26	0.039	/
GSM1900	Voice	Right Cheek	512	0.536	-3.51	29	28.19	**0.646**	3
		Right Tilt	512	0.186	2.60	29	28.19	0.224	/
		Left Cheek	512	0.415	0.73	29	28.19	0.500	/
		Left Tilt	512	0.151	-3.22	29	28.19	0.182	/

11.2 Body-worn SAR

Band	Mode	Test Position	Ch.	Result 1g (W/Kg)	Power Drift(%)	Max.Turn-up Power(dBm)	Meas.Output Power(dBm)	Scaled SAR (W/Kg)	Meas. No.
GSM 850	GPRS Data-4 Slot	Front side	251	0.267	-2.75	29	28.94	0.271	/
		Back side	251	0.500	1.13	29	28.94	**0.507**	2
GSM1900	GPRS Data-4 Slot	Front side	512	0.197	-1.25	26	25.80	0.206	/
		Back side	512	0.431	-1.66	26	25.80	**0.451**	4

Note:

1. The test separation of all above table is 10mm.
2. Per KDB865664 D01, Repeated measurement is not required when the original highest measured SAR is <0.80 W/kg

Simultaneous Multi-band Transmission Evaluation:

Application Simultaneous Transmission information:

Position	Simultaneous state
Head	1. GSM + Bluetooth
Body	1. GSM + Bluetooth

NOTE:

1. For simultaneous transmission at head and body exposure position, 2 transmitters simultaneous transmission was the worst state.
2. Based upon KDB 447498 D01 v05, BT SAR is excluded as below table.
3. If the test separation distance is <5mm, 5mm is used for excluded SAR calculation.
4. For minimum test separation distance≦50mm,Bluetooth standalone SAR is excluded according to [(max. power of channel, including tune-up tolerance, mW)/ (min. test separation distance, mm)·[√f (GHz) /x] ≦3.0 for 1-g SAR and ≦7.5 for 10-g extremity SAR
5. The reported SAR summation is calculated based on the same configuration and test position.
6. KDB 447498 / 4.3.2 (2) when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
   a) (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f (GHz) /x] W/kg for test separation distances≤ 50 mm; Where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
   b) 0.4W/Kg for 1-g SAR and 1.0W/Kg for 10-g SAR, when the separation distance is >50mm.

Estimated SAR		Maximum Power		Antenna to user(mm)	Frequency(GHz)	Stand alone SAR(1g) [W/kg]
		dBm	mW			
BT	Head	-8	0.158	5	2.480	0.007
	Body			10	2.480	0.003

Simultaneous Mode	Position	Mode	Max. 1-g SAR (W/kg)	1-g Sum SAR (W/kg)
GSM + Bluetooth	Head	GSM Voice	0.646	**0.653**
		Bluetooth	0.007	
	Body	GSM Data	0.507	**0.510**
		Bluetooth	0.003	

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna.

When the sum of SAR 1g of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit (SAR-1g 1.6 W/kg), the simultaneous transmission SAR is not required. When the sum of SAR 1g is greater than the SAR limit (SAR-1g 1.6 W/kg), SAR test exclusion is determined by the SPLSR.

12. Equipment List

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
835MHz Dipole	SATIMO	SID835	SN 30/14 DIP0G835-332	2014.09.01	2017.08.31
1900MHz Dipole	SATIMO	SID1900	SN 30/14 DIP1G900-333	2014.09.01	2017.08.31
E-Field Probe	SATIMO	SSE5	SN 14/16 EP309	2016.12.05	2017.12.04
Dielectric Probe Kit	SATIMO	SCLMP	SN 32/14 OCPG67	2016.12.05	2017.12.04
Antenna	SATIMO	ANTA3	SN 07/13 ZNTA52	N/A	N/A
Phantom1	SATIMO	SAM	SN 32/14 SAM115	2014.09.01	N/A
Phantom2	SATIMO	SAM	SN 32/14 SAM116	2014.09.01	N/A
Phone holder	SATIMO	N/A	SN 32/14 MSH97	2014.09.01	N/A
Laptop holder	SATIMO	N/A	SN 32/14 LSH29	2014.09.01	N/A
Network Analyzer	Agilent	8753ES	US38432810	2017.03.16	2018.03.15
Multi Meter	Keithley	Multi Meter 2000	4050073	2016.10.23	2017.10.22
Signal Generator	Agilent	N5182A	MY50140530	2016.10.23	2017.10.22
Wireless Communication Test Set	Agilent	8960-E5515C	MY48360751	2016.10.23	2017.10.22
Power Amplifier	DESAY	ZHL-42W	9638	2016.10.23	2017.10.22
Power Meter	R&S	NRP	100510	2016.10.23	2017.10.22
Power Meter	Agilent	E4418B	GB43312526	2016.10.23	2017.10.22
Power Sensor	R&S	NRP-Z11	101919	2016.10.23	2017.10.22
Power Sensor	Agilent	E9301A	MY41497725	2016.10.23	2017.10.22
9dB Attenuator	Agilent	99899	DC-18GHz	2017.05.10	2018.05.09
11dB Attenuator	Agilent	8494B	DC-18GHz	2017.05.10	2018.05.09
110dB Attenuator	Agilent	8494B	DC-18GHz	2017.05.10	2018.05.09
Dual Directional Coupler	Agilent	SHWPDI-1080S	N/A	2017.05.09	2018.05.08
Temperature & Humitidy	MiEO	HH660	N/A	2016.10.25	2017.10.24

Appendix A. System Validation Plots

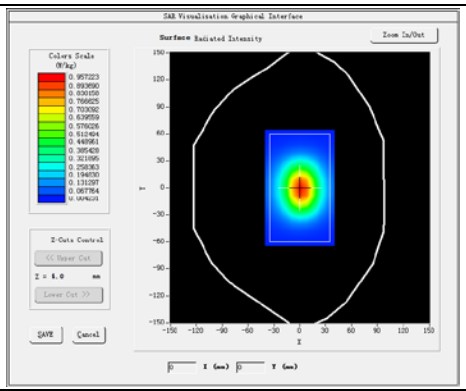
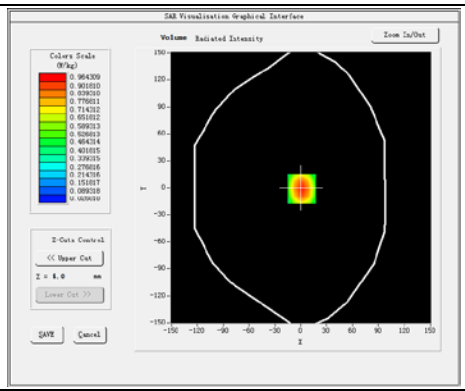
System Performance Check Data (835MHz Head)

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017-06-20
Measurement duration: 13 minutes 27 seconds

Experimental conditions

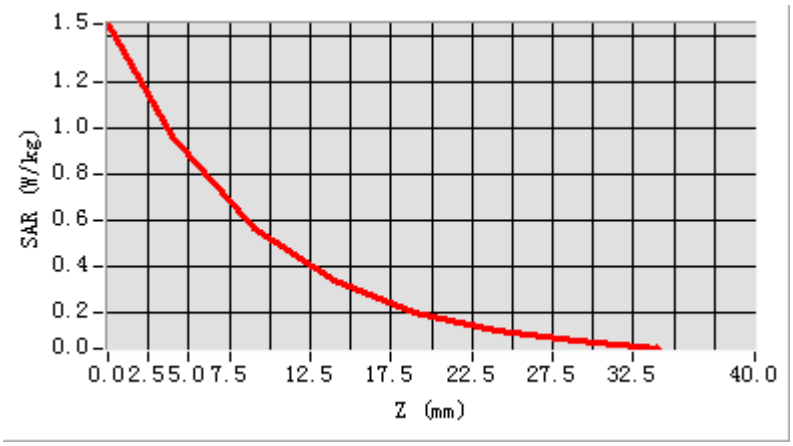
Phantom	Validation plane
Device Position	-
Band	835MHz
Channels	-
Signal	CW
Frequency (MHz)	835MHz
Relative permittivity	41.46
Conductivity (S/m)	0.89
Power drift (%)	0.19
Probe	SN 14/16 EP309
ConvF:	5.74
Crest factor:	1:1

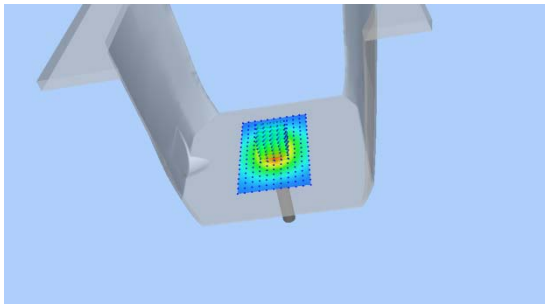
SURFACE SAR	VOLUME SAR
	

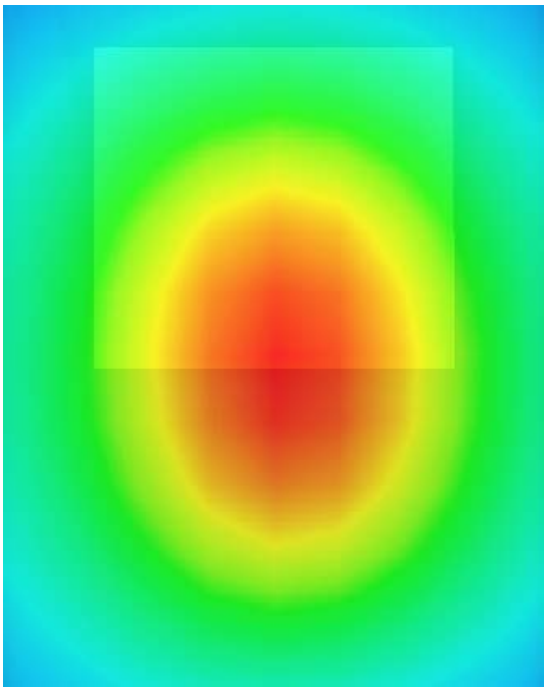
Maximum location: X=1.00, Y=-1.00

SAR 10g (W/Kg)	0.605367
SAR 1g (W/Kg)	0.955127

Z Axis Scan


1.5
1.2
1.0
0.8
0.6
0.4
0.2
0.0
SAR (W/kg)
0.0 2.5 5.0 7.5 12.5 17.5 22.5 27.5 32.5 40.0
Z (mm)



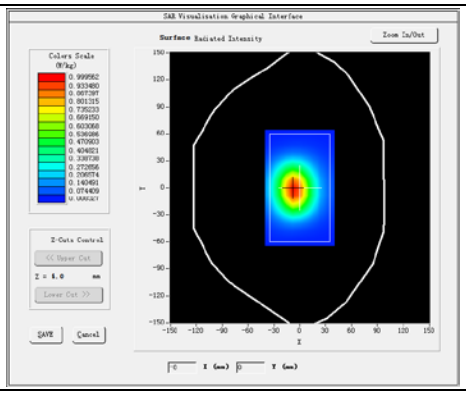
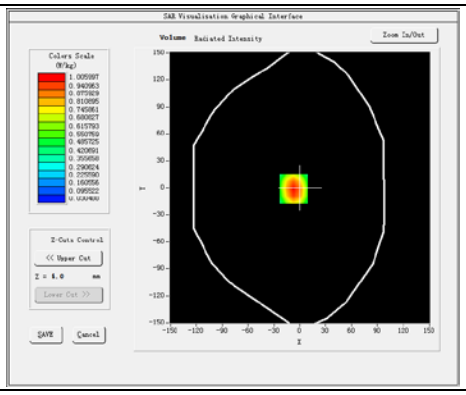


System Performance Check Data (835MHz Body)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017-06-20
Measurement duration: 14 minutes 13 seconds

Experimental conditions.

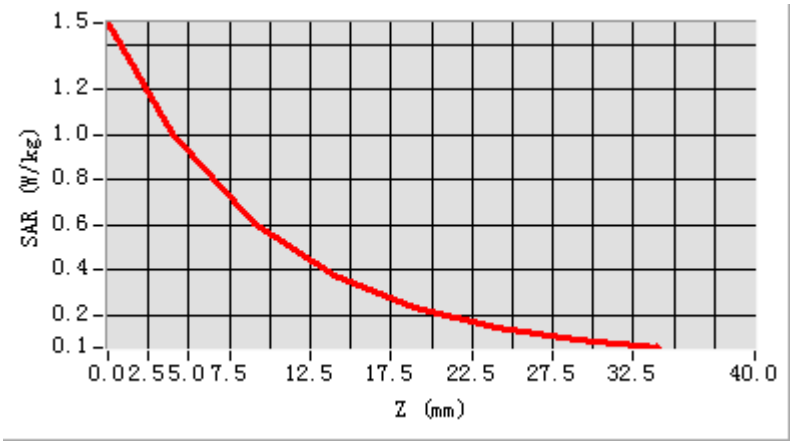
Probe	
Phantom	Validation plane
Device Position	-
Band	835MHz
Channels	-
Signal	CW
Frequency (MHz)	835MHz
Relative permittivity	55.59
Conductivity (S/m)	0.96
Power drift (%)	0.19
Probe	SN 14/16 EP309
ConvF:	5.90
Crest factor:	1:1

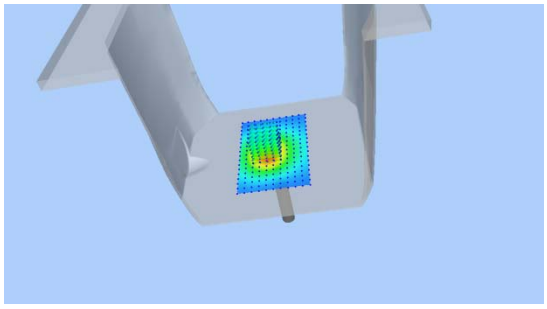
SURFACE SAR	VOLUME SAR
	

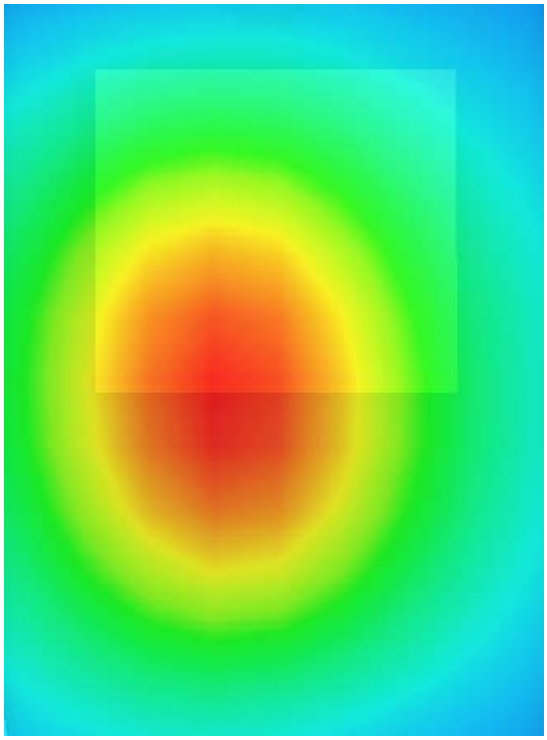
Maximum location: X=-7.00, Y=-1.00

SAR 10g (W/Kg)	0.629084
SAR 1g (W/Kg)	0.963973

Z Axis Scan


1.5
1.2
1.0
0.8
0.6
0.4
0.2
0.1
SAR (W/kg)
0.0 2.5 5.0 7.5 12.5 17.5 22.5 27.5 32.5 40.0
Z (mm)



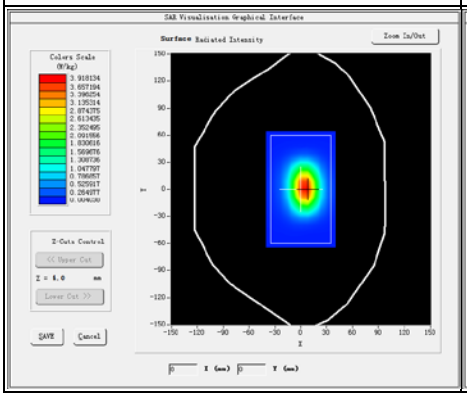
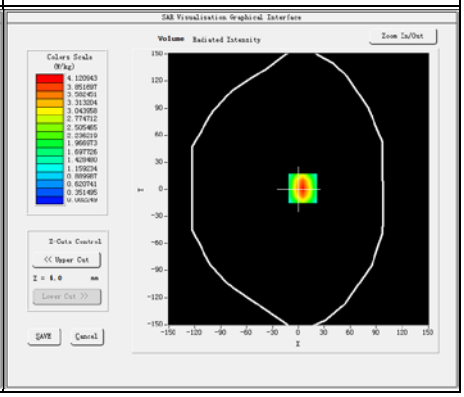


System Performance Check Data (1900MHz Head)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017-06-20
Measurement duration: 14 minutes 12 seconds

Experimental conditions.

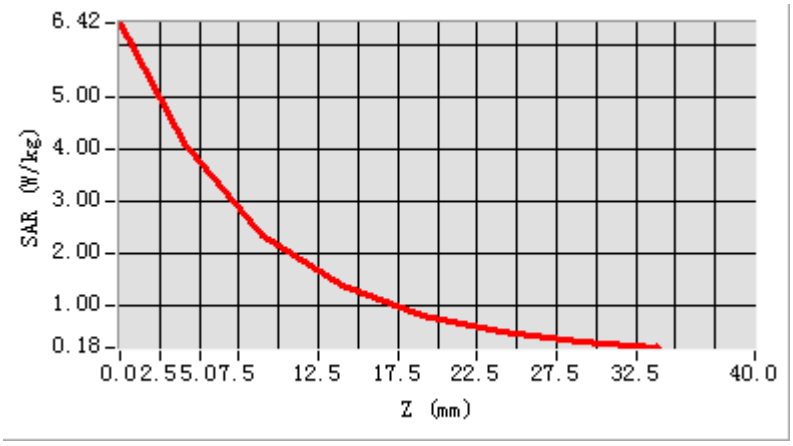
Phantom	Validation plane
Device Position	-
Band	1900MHz
Channels	-
Signal	CW
Frequency (MHz)	1900MHz
Relative permittivity	39.84
Conductivity (S/m)	1.42
Power drift (%)	-0.43
Probe	SN 14/16 EP309
ConvF:	5.46
Crest factor:	1:1

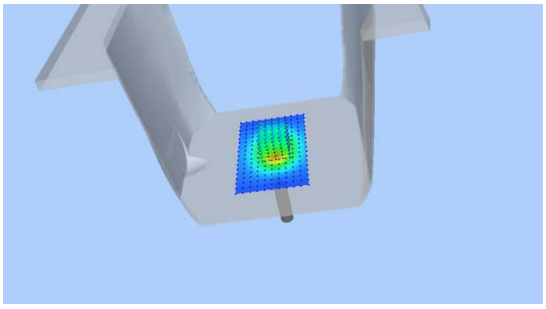
SURFACE SAR	VOLUME SAR
	

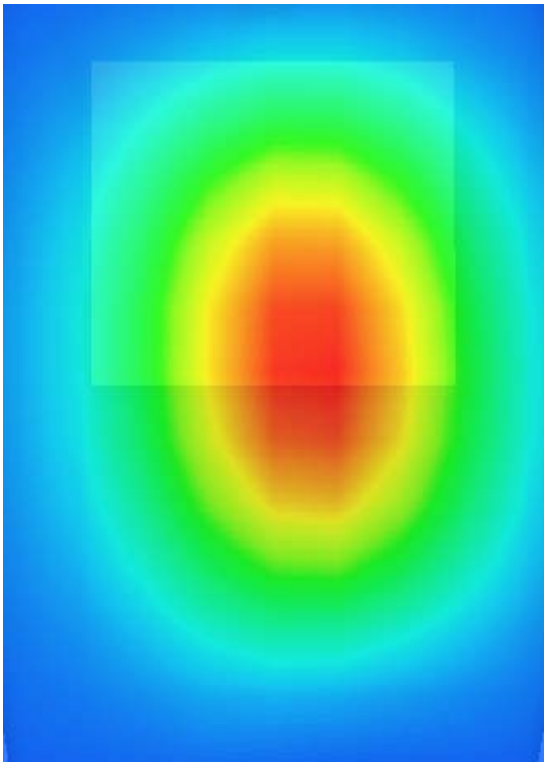
Maximum location: X=5.00, Y=1.00

SAR 10g (W/Kg)	2.013658
SAR 1g (W/Kg)	3.861167

Z Axis Scan


6.42
5.00
4.00
3.00
2.00
1.00
0.18
SAR (W/kg)
0.0 2.5 5.0 7.5 12.5 17.5 22.5 27.5 32.5 40.0
Z (mm)



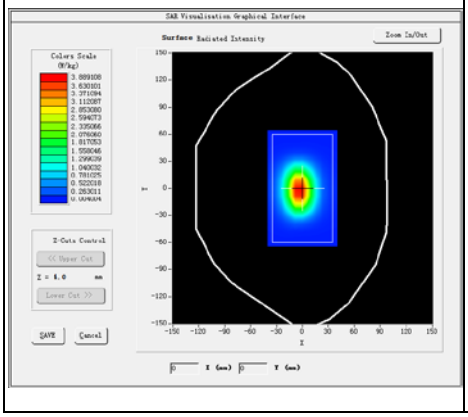
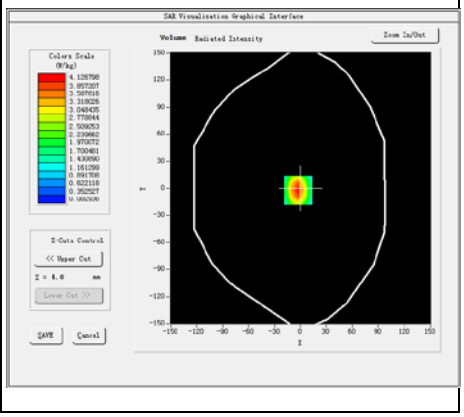


System Performance Check Data (1900MHz Body)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2017-06-20
Measurement duration: 14 minutes 46 seconds

Experimental conditions.

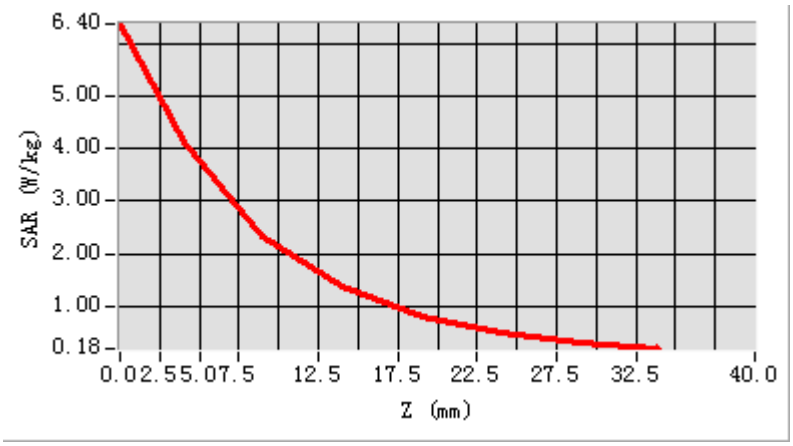
Device Position	-
Band	1900MHz
Channels	-
Signal	CW
Frequency (MHz)	1900
Relative permittivity	52.45
Conductivity (S/m)	1.47
Power drift (%)	-0.60
Probe	SN 14/16 EP309
ConvF:	5.67
Crest factor:	1:1

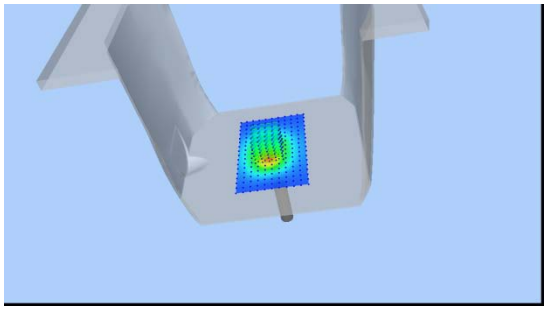
SURFACE SAR	VOLUME SAR
	

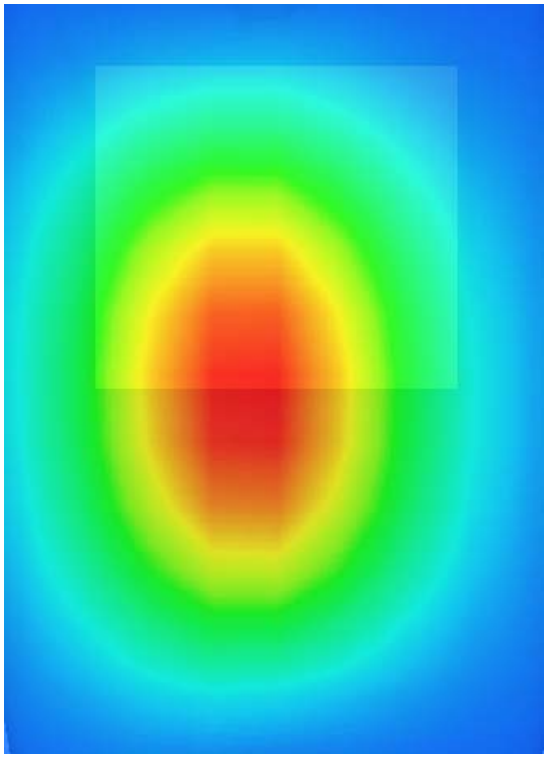
Maximum location: X=-3.00, Y=-2.00

SAR 10g (W/Kg)	2.102215
SAR 1g (W/Kg)	4.159517

Z Axis Scan


6.40
5.00
4.00
3.00
2.00
1.00
0.18
SAR (W/kg)
0.0 2.5 5.0 7.5 12.5 17.5 22.5 27.5 32.5 40.0
Z (mm)





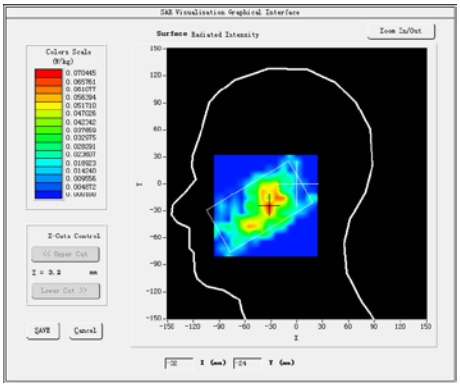
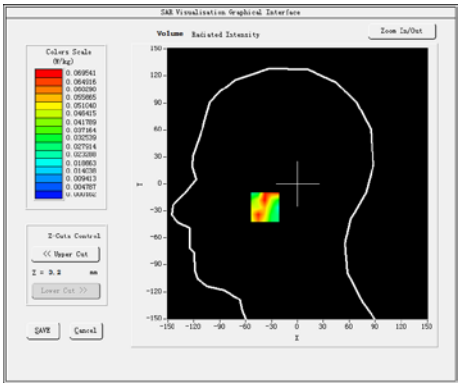
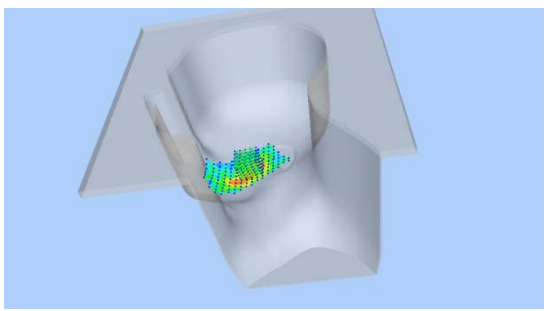
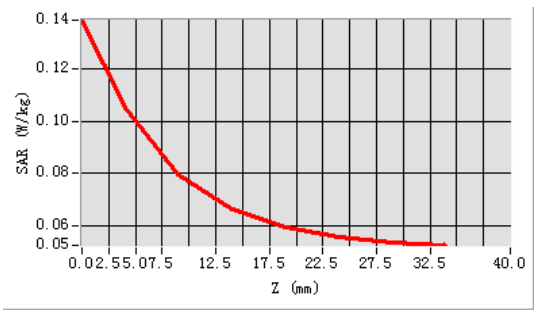
Appendix B. SAR Test Plots

Plot 1: DUT: GSM Mobile Phone; EUT Model: X415

Test Date	2017-06-20
Probe	SN 14/16 EP309
ConvF	5.74
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Right head
Device Position	Cheek
Band	GSM850
Channels	High
Signal	TDMA (Crest factor: 8.32)
Frequency (MHz)	848.8
Relative permittivity (real part)	41.5
Conductivity (S/m)	0.90
Variation (%)	-3.08

Maximum location: X=-32.00, Y=-26.00
SAR Peak: 0.14 W/kg

SAR 10g (W/Kg)	0.039694
SAR 1g (W/Kg)	0.064355

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

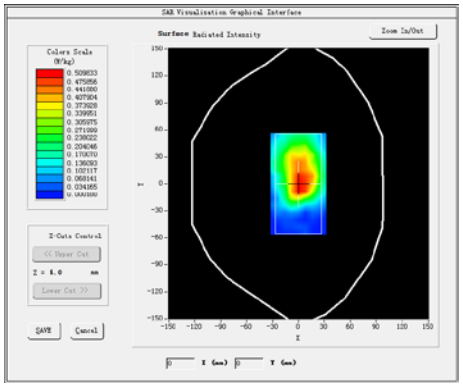
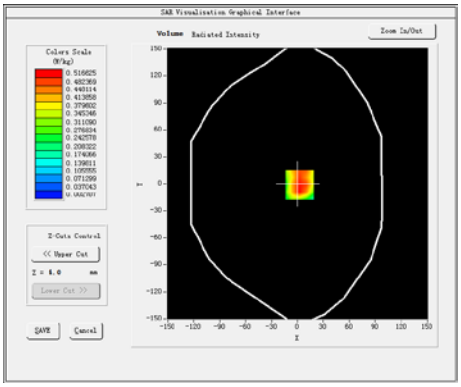
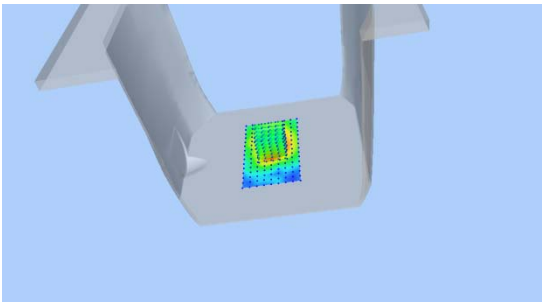
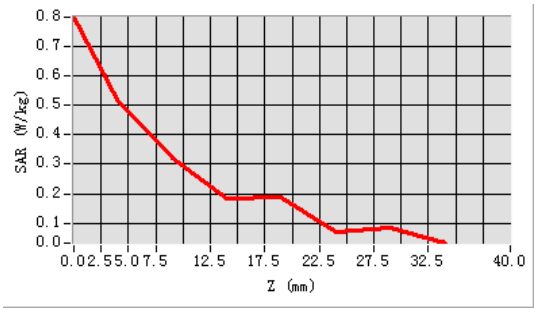
Plot 2: DUT: GSM Mobile Phone; EUT Model: X415

Test Date	2017-06-20
Probe	SN 14/16 EP309
ConvF	5.90
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body Back
Band	GPRS 850
Channels	High
Signal	Duty Cycle: 1:2.00 (Crest factor: 2.0)
Frequency (MHz)	848.8
Relative permittivity (real part)	55.20
Conductivity (S/m)	0.97
Variation (%)	1.13

Maximum location: X=2.00, Y=-1.00

SAR Peak: 0.78 W/kg

SAR 10g (W/Kg)	0.302928
SAR 1g (W/Kg)	0.500151

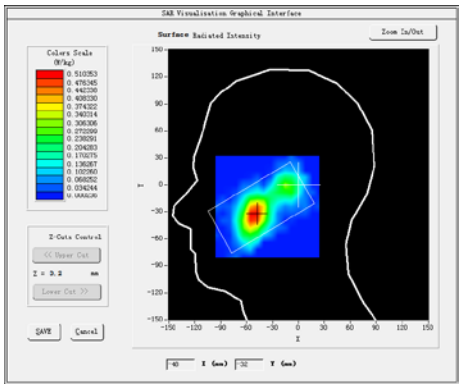
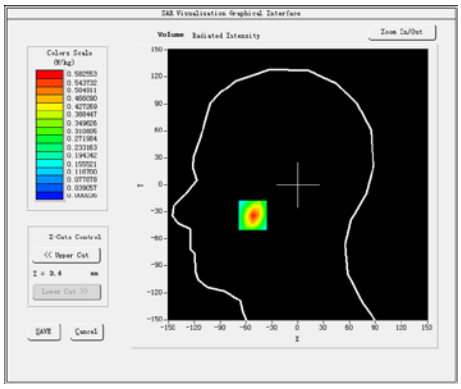
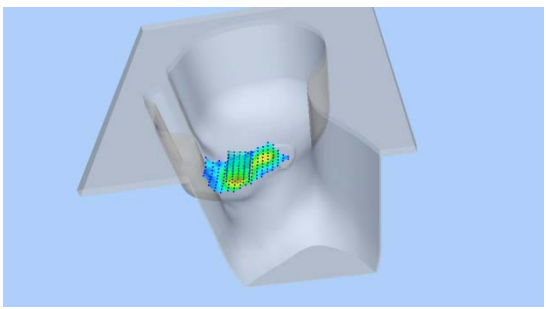
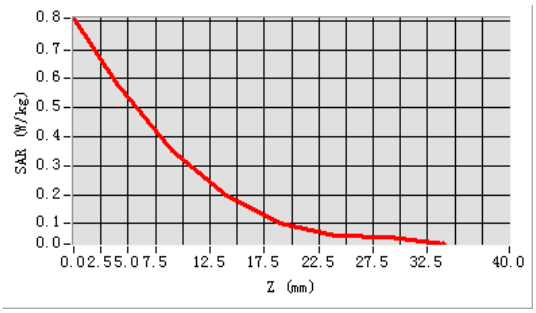
SURFACE SAR	VOLUME SAR
	
3D screen shot	**Z Axis Scan**
	

Plot 3: DUT: GSM Mobile Phone; EUT Model: X415

Test Date	2017-06-20
Probe	SN 14/16 EP309
ConvF	5.46
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Right head
Device Position	Cheek
Band	GSM1900
Channels	Low
Signal	TDMA (Crest factor: 8.32)
Frequency (MHz)	1850.2
Relative permittivity (real part)	40.00
Conductivity (S/m)	1.40
Variation (%)	-3.51

Maximum location: X=-52.00, Y=-34.00
SAR Peak: 0.84 W/kg

SAR 10g (W/Kg)	0.281239
SAR 1g (W/Kg)	0.536380

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

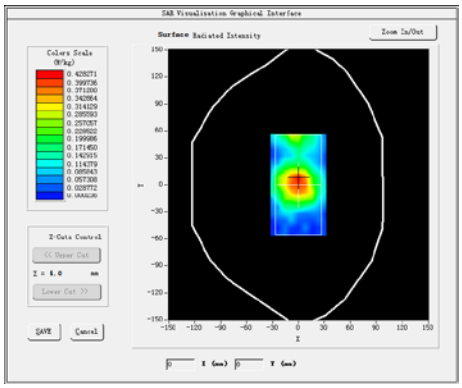
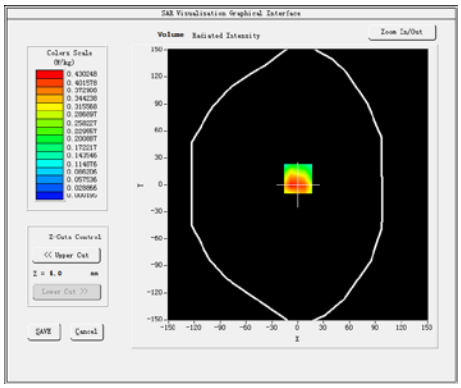
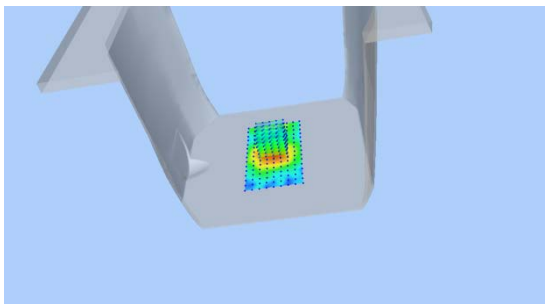
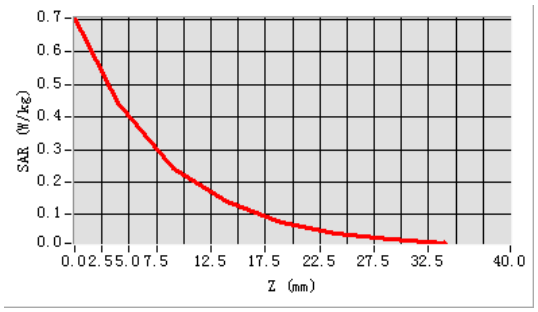
Plot 4: DUT: GSM Mobile Phone; EUT Model: X415

Test Date	2017-06-20
Probe	SN 14/16 EP309
ConvF	5.67
Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm, Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body Behind
Band	GPRS 1900
Channels	Low
Signal	Duty Cycle: 1:2.00 (Crest factor: 2.0)
Frequency (MHz)	1850.2
Relative permittivity (real part)	53.30
Conductivity (S/m)	1.52
Variation (%)	-1.66

Maximum location: X=0.00, Y=7.00

SAR Peak: 0.74 W/kg

SAR 10g (W/Kg)	0.228419
SAR 1g (W/Kg)	0.430748

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

Appendix C. Probe Calibration And Dipole Calibration Report

Refer the appendix Calibration Report.

※※※※※END OF THE REPORT※※※※※