FCC SAR TEST REPORT

Report No.:	SET2015-04152
Product:	GSM digital mobile phone
Model No.:	M220
FCC ID:	SG720150318M220
Applicant:	Haier Telecom (Qingdao) Co., Ltd.
Address:	No1. Haier Road , Hi-tech Zone, Qingdao China
Issued by:	CCIC-SET
Lab Location:	Building 28/29, Shigudong,Xili Industrial Area,Xili Street,Nanshan District,Shenzhen,Guangdong,China
Tel:	86 755 26627338 Fax：86 755 26627238
Mail:	manager@ccic-set.com Website：http://www.ccic-set.com

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Test Report

Product. …….:	GSM digital mobile phone
Model No. ……..:	M220
Brand Name……..:	Haier
FCC ID…….:	SG720150318M220
Applicant……..:	Haier Telecom (Qingdao) Co., Ltd.
Applicant Address…….:	No1. Haier Road , Hi-tech Zone, Qingdao China
Manufacturer……:	Haier Telecom (Qingdao) Co., Ltd.
Manufacturer Address:	No1. Haier Road , Hi-tech Zone, Qingdao China
Test Standards…….:	**447CFR § 2.1093-** Radiofrequency Radiation Exposure Evaluation: Portable Devices; **ANSI C95.1–1992:** Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991) **IEEE 1528–2003:** IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques;
Test Result……:	Pass

Tested by ……..: Mei Chun 2015-04-08

Chun Mei, Test Engineer

Reviewed by……: Shuangwen Zhang 2015-04-08

Shuangwen Zhang,Senior Egineer

Approved by……: Wu Lian 2015-04-08

Wu Li'an , Manager

Contents

This Test Report consists of the following Annexes:

1. GENERAL CONDITIONS

1.1 This report only refers to the item that has undergone the test.

1.2 This report standalone does not constitute or imply by its own an approval of the product by the certification Bodies or competent Authorities.

1.3 This document is only valid if complete; no partial reproduction can be made without written approval of CCIC-SET

1.4 This report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of CCIC-SET and the Accreditation Bodies, if it applies.

2. Administrative Date

2.1. Identification of the Responsible Testing Laboratory

Company Name:	CCIC-SET
Department:	EMC & RF Department
Address:	Building 28/29, Shigudong,Xili Industrial Area,Xili Street, Nanshan District,Shenzhen,Guangdong,China
Telephone:	+86-755-26629676
Fax:	+86-755-26627238
Responsible Test Lab Managers:	Mr. Wu Li'an

2.2. Identification of the Responsible Testing Location(s)

Company Name:	CCIC-SET
Address:	Building 28/29, Shigudong,Xili Industrial Area,Xili Street,Nanshan District,Shenzhen,Guangdong,China

2.3. Organization Item

CCIC-SET Report No.:	SET2015-04152
CCIC-SET Project Leader:	Mr. Li Sixiong
CCIC-SET Responsible for accreditation scope:	Mr. Wu Li'an
Start of Testing:	2015-03-24
End of Testing:	2015-03-25

2.4. Identification of Applicant

Company Name:	Haier Telecom (Qingdao) Co., Ltd.
Address:	No1. Haier Road , Hi-tech Zone, Qingdao China

2.5. Identification of Manufacture

Company Name:	Haier Telecom (Qingdao) Co., Ltd.
Address:	No1. Haier Road , Hi-tech Zone, Qingdao China

Notes: This data is based on the information by the applicant.

3. Equipment Under Test (EUT)

3.1. Identification of the Equipment under Test

Sample Name: GSM digital mobile phone

Type Name: M220

Brand Name: Haier

General description:	Support Band	GSM850MHz/1900MHz,BT 3.0
	Test Band	GSM 850MHz/ GSM 1900MHz, GPRS 850MHz/ GPRS 1900MHz,
	Multislot Class	GPRS: Class 12
	GPRS Class	Class B
	Development Stage	Identical Prototype
	Accessories	Power Supply
	Battery type	3.7V 600mAh
	Antenna type	PIFI Antenna
	Operation mode	GSM / GPRS,GFSK, π /4-DQPSK, 8-DPSK
	Modulation mode	GMSK
	IMEI	135790246811220
	Max. RF Power	33.15dBm
	Max. SAR Value	Head:0.164w/kg; Body:0.204w/kg;

NOTE:

a. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

b. This device supports GPRS operation up to class12(max.uplin:4, max.downlink:4, total timeslots:5)

4 SAR SUMMARY

Highest Measured Standalone SAR Summary

Exposure Position	Frequency Band	Scaled 1g-SAR(W/kg)	Highest Scaled 1g-SAR(W/kg)
Head	GSM850	0.016	0.164
	GSM1900	0.018	
	BT	0.164	
Body-worn (10mm Gap)	GSM850	0.204	0.204
	GSM1900	0.029	
	BT	0.082	

Highest Simultaneous SAR Summary

Exposure Position	Frequency Band	Scaled 1g-SAR(W/kg)	Highest Scaled 1g-SAR(W/kg)
Body-worn (10mm Gap)	GPRS850&BT	0.204+0.082	0.286
	GPRS1900&BT	0.039+0.082	

5 Specific Absorption Rate (SAR)

5.1 Introduction

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.

5.2 SAR Definition

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 (). The equation description is as below:

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

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$\mathrm{SAR} = C\frac{\delta T}{\delta t}$$

where C is the specific head capacity, δT is the temperature rise and δt the exposure duration, or related to the electrical field in the tissue by

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

where σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the rms electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

5.3 Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SATIMO. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).

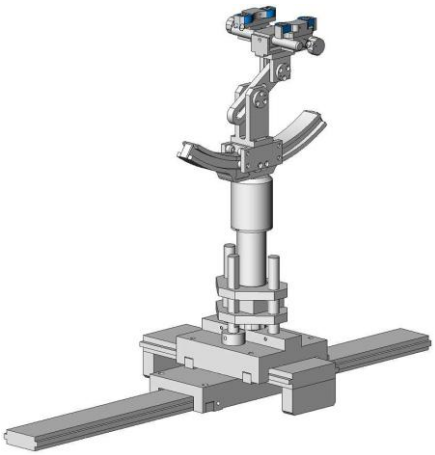
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM Twin Phantom

5.4 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SATIMO as an integral part of the COMOSAR test system.

The device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.



Device holder

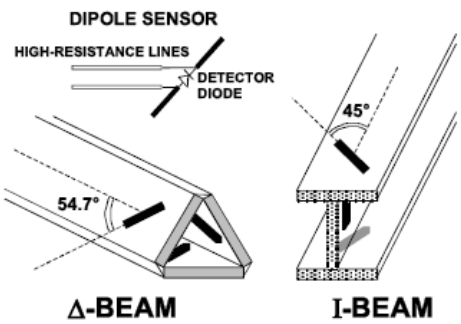
5.5 Probe Specification

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	700 MHz to 3 GHz; Linearity: ± 0.5 dB (700 MHz to 3 GHz)
Directivity	± 0.25 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	1.5 µW/g to 100 mW/g; Linearity: ± 0.5 dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 5 mm (Body: 8 mm) Distance from probe tip to dipole centers: <2.7 mm
Application	General dosimetry up to 3 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones
Compatibility	COMOSAR

Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



6 OPERATIONAL CONDITIONS DURING TEST

6.1 Schematic Test Configuration

During SAR test, EUT was operating in Traffic Mode (Channel Allocated) at Normal Voltage Condition. A communication link is set up with a System Simulator (SS) by air link, and a call is established.

The Absolute Radio Frequency Channel Number (ARFCN) was allocated to 128, 189 and 251 respectively in the case of GSM 850MHz, or to 512, 661 and 810 respectively in the case of PCS 1900MHz. The EUT was commanded to operate at maximum transmitting power.

The EUT should use its internal transmitter. The antenna(s), battery and accessories shall be those specified by the manufacturer. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. If a wireless link was used, the antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the handset.

The signal transmitted by the simulator to the antenna feeding point should be lower than the output power level of the handset by at least 35 dB

6.2 SAR Measurement System

The SAR measurement system being used is the SATIMO system, the system is controlled remotely from a PC, which contains the software to control the robot and data acquisition equipment. The software also displays the data obtained from test scans.

In operation, the system first does an area (2D) scan at a fixed depth within the liquid from the inside wall of the phantom. When the maximum SAR point has been found, the system will then carry out a 3D scan centred at that point to determine volume averaged SAR level.

6.2.1 Tissue Dielectric Parameters for Head and Body Phantoms

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 Power drifts 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.

Table 1: Recommended Dielectric Performance of Tissue

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.46	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (Nacl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Table 2 Recommended Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue		Body Tissue	
	ε_r	σ(S/m)	ε_r	σ(S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

6.2.2 Simulant liquids

For measurements against the phantom head, the “cheek” and “tilt” position on both the left hand and the right hand sides of the phantom. For body-worn measurements, the EUT was tested against flat phantom representing the user body. The EUT was put on in the belt holder. Simulant liquids that are used for testing at frequencies of GSM 850MHz/1900MHz, which are made mainly of sugar, salt and water solutions may be left in the phantoms.

Table 3: Dielectric Performance of Head Tissue Simulating Liquid

Temperature: 23.2°C; Humidity: 64%;			
/	Frequency	Permittivity ε	Conductivity σ (S/m)
Target value	835MHz	41.5±5%	0.90±5%
Validation value (Mar. 24th, 2015)	835MHz	41.37	0.91
Target value	1900MHz	40.0±5%	1.40±5%
Validation value (Mar. 25th, 2015)	1900MHz	39.87	1.41

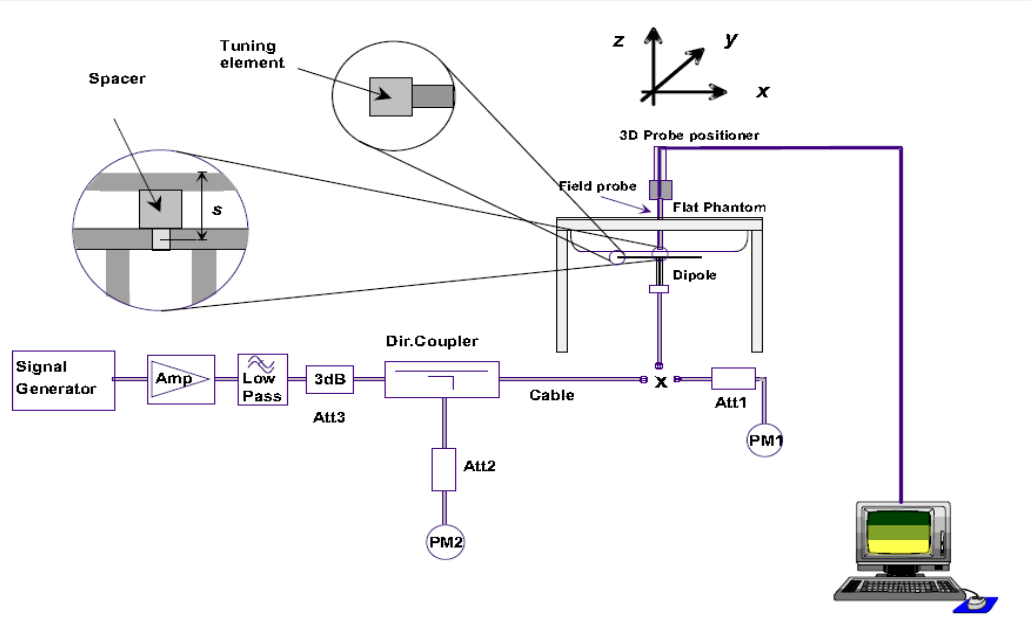
Table 4: Dielectric Performance of Body Tissue Simulating Liquid

Temperature: 23.2°C; Humidity: 64%;			
/	Frequency	Permittivity ε	Conductivity σ (S/m)
Target value	835MHz	55.2±5%	0.97±5%
Validation value (Mar. 24th, 2015)	835MHz	55.16	0.98
Target value	1900MHz	53.3±5%	1.52±5%
Validation value (Mar. 25th, 2015)	1900MHz	53.23	1.53

6.3 Equipments and results of validation testing

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

The following procedure, recommended for performing validation tests using box phantoms is based on the procedures described in the IEEE standard P1528 2003. Setup according to the setup diagram below :



With the SG and Amp and with directional coupler in place, set up the source signal at the relevant frequency and use a power meter to measure the power at the end of the SMA cable that you intend to connect to the balanced dipole. Adjust the SG to make this, say, 0.25W (24 dBm). If this level is too high to read directly with the power meter sensor, insert a calibrated attenuator (e.g. 10 or 20 dB) and make a suitable correction to the power meter reading.

Note 1: In this method, the directional coupler is used for monitoring rather than setting the exact feed power level. If, however, the directional coupler is used for power measurement, you should check the frequency range and power rating of the coupler and measure the coupling factor (referred to output) at the test frequency using a VNA.

Note 2: Remember that the use of a 3dB attenuator (as shown in Figure 8.1 of P1528) means that you need an RF amplifier of 2 times greater power for the same feed power. The other issue is the cable length. You might get up to 1dB of loss per meter of cable, so the cable length after the coupler needs to be quite short.

Note 3: For the validation testing done using CW signals, most power meters are suitable. However, if you are measuring the output of a modulated signal from either a signal generator or a handset, you must ensure that the power meter correctly reads the modulated signals.

The measured 1-gram averaged SAR values of the device against the phantom are provided in Tables 7 and Table 8. The humidity and ambient temperature of test facility were 64% and 23.2°C respectively. The body phantom were full of the body tissue simulating liquid. The EUT was supplied with full-charged battery for each measurement.

The distance between the back of the EUT and the bottom of the flat phantom is 5 mm (taking into account of the IEEE 1528 and the place of the antenna).

Table 7: Head SAR system validation (1g)

Frequency	Duty cycle	Target value （W/kg）	Test value (W/kg)	
			250 mW	1W
835MHz(Mar. 24th, 2015)	1:1	9.77	2.45	9.80
1900MHz(Mar. 25th, 2015)	1:1	40.37	9.79	39.16

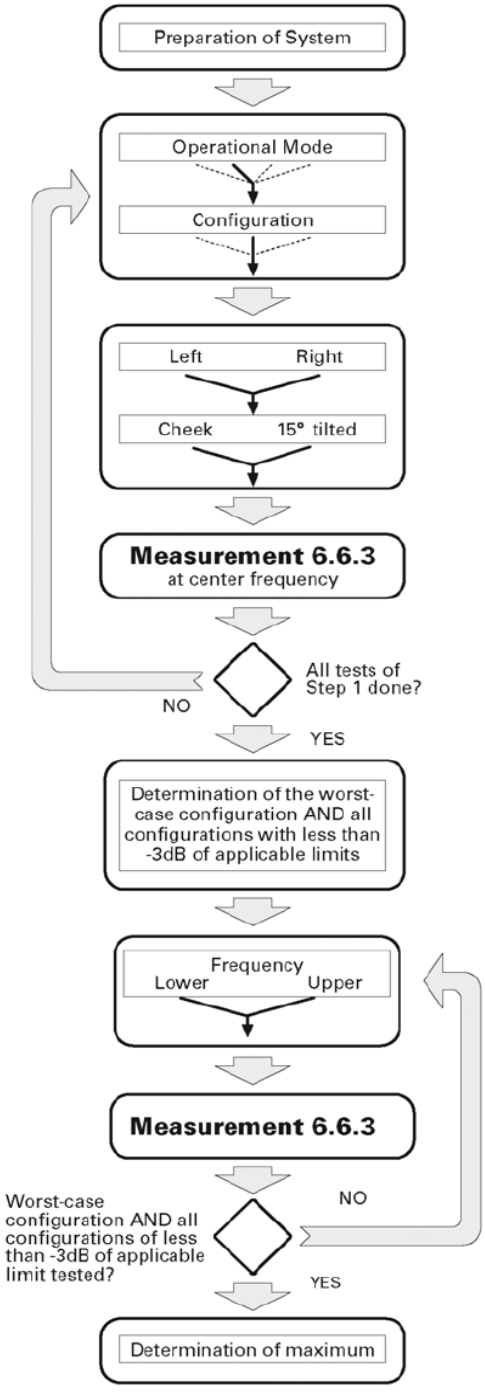
Table 8: Body SAR system validation (1g)

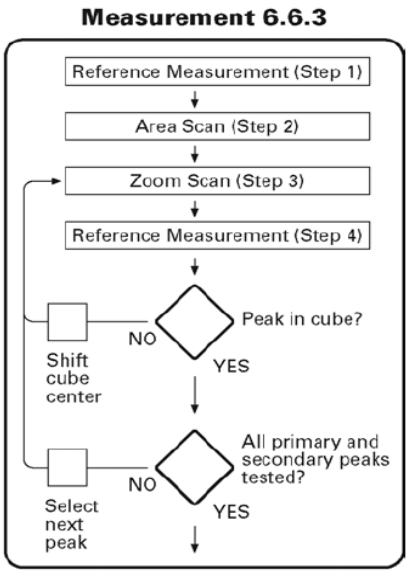
Frequency	Duty cycle	Target value （W/kg）	Test value (W/kg)	
			250 mW	1W
835MHz(Mar. 24th, 2015)	1:1	10.31	2.46	9.84
1900MHz(Mar. 25th, 2015)	1:1	40.81	9.98	39.92

* Note: Target value was referring to the measured value in the calibration certificate of reference dipole.
Note: All SAR values are normalized to 1W forward power.

6.4 SAR measurement procedure

The SAR test against the head phantom was carried out as follow:





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

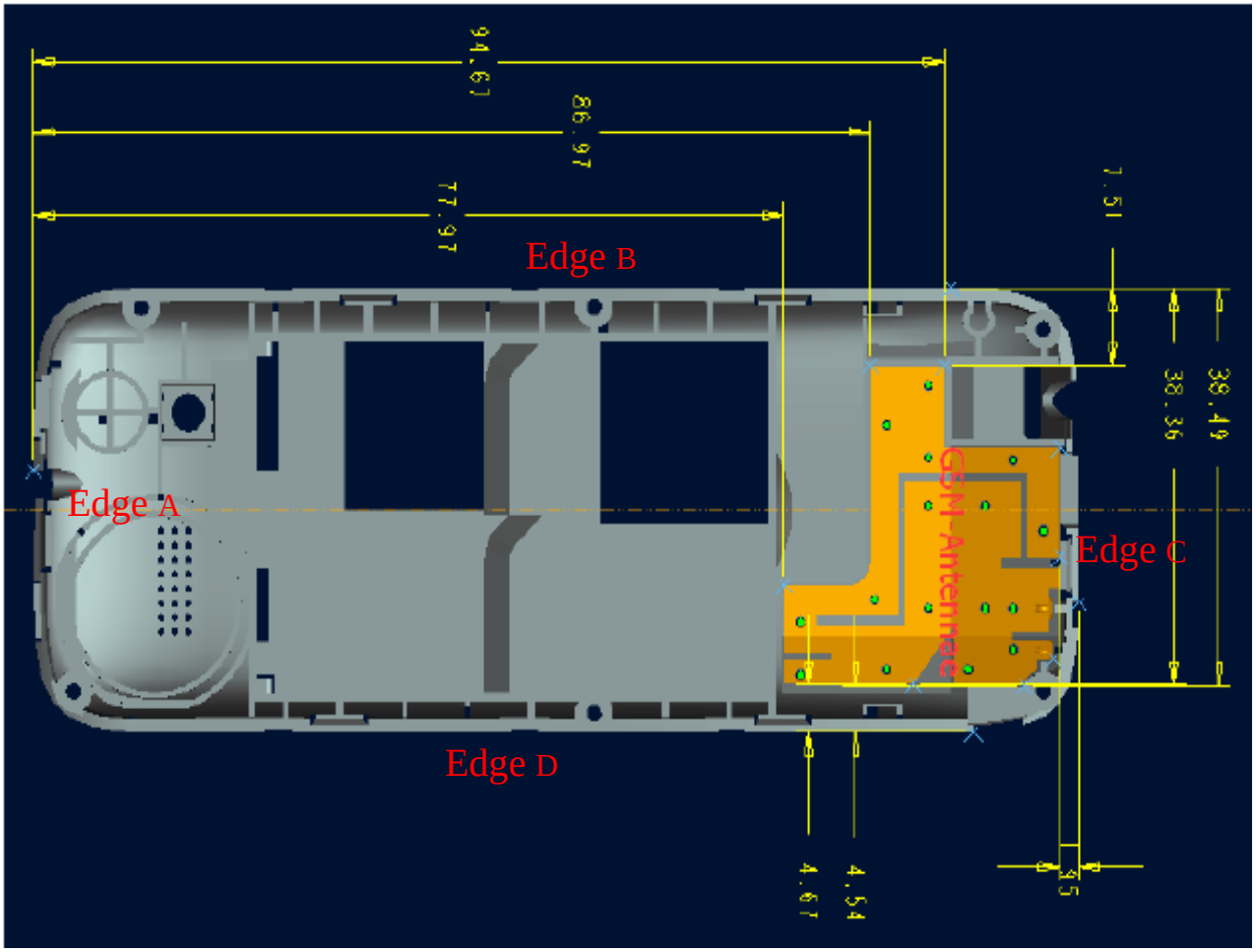
After an area scan has been done at a fixed distance of 2mm from the surface of the phantom on the source side, a 3D scan is set up around the location of the maximum spot SAR. First, a point within the scan area is visited by the probe and a SAR reading taken at the start of testing. At the end of testing, the probe is returned to the same point and a second reading is taken. Comparison between these start and end readings enables the power drift during measurement to be assessed.

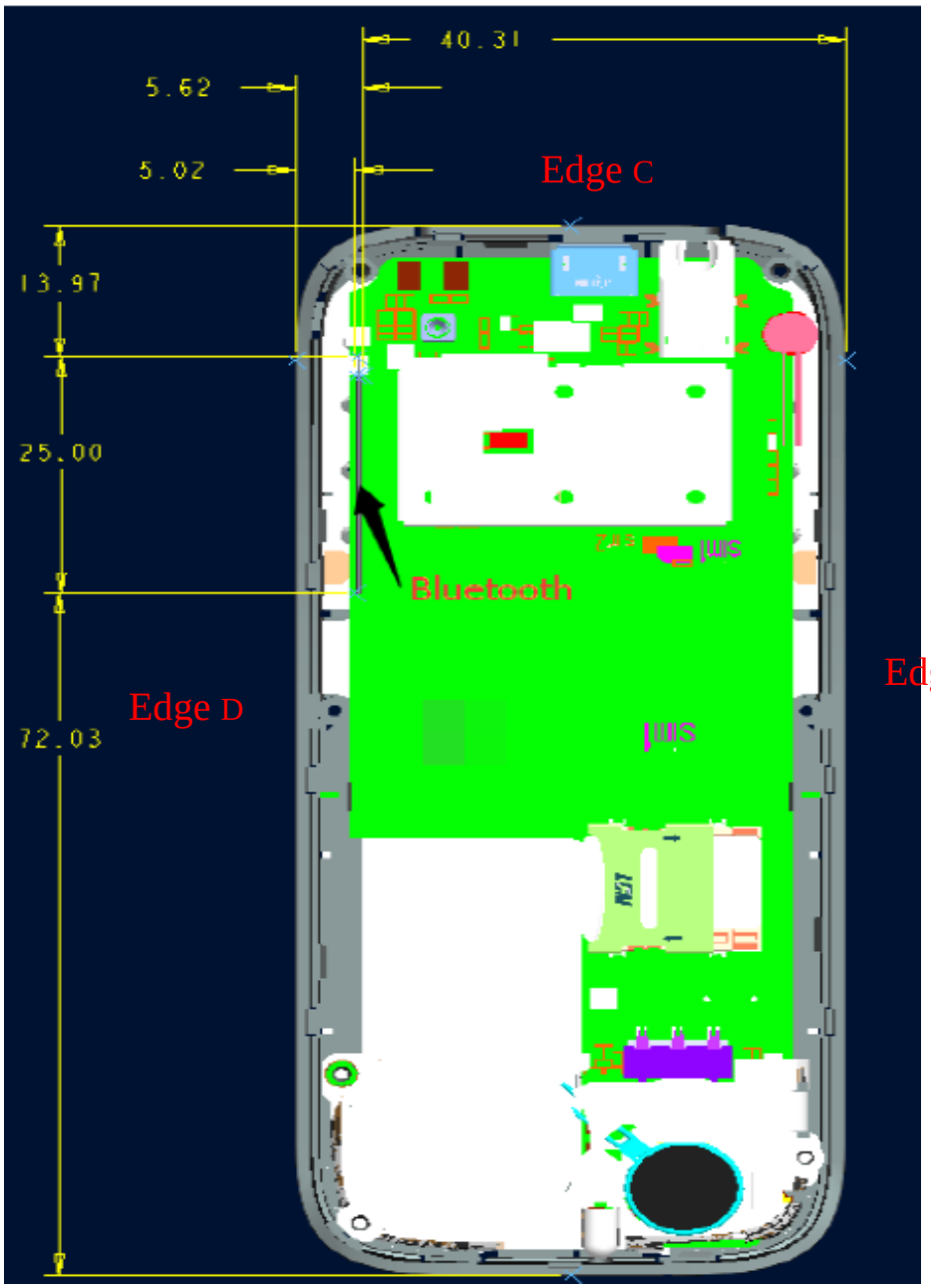
Above is the scanning procedure flow chart and table from the IEEEp1528 standard. This is the procedure for which all compliant testing should be carried out to ensure that all variations of the device position and transmission behaviour are tested.

For body-worn measurement, the EUT was tested under two position: face upward and back upward.

6.5 Transmitting antenna information

There are GSM antenna, BT antenna inside the EUT




40.31
5.62
5.02
Edge C
13.97
25.00
Bluetooth
Edge B
Edge D
72.03
Edge A

7 Applicable Measurement Standards

47CFR § 2.1093- Radiofrequency Radiation Exposure Evaluation: Portable Devices;

ANSI C95.1–1992: Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991)

IEEE 1528–2003: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques;

IEEE Std 1528a-2005: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques

FCC KDB 865664 D01 v01r03 SAR Measurement 100MHz to 6GHz

FCC KDB 865664 D02 v01r01 RF Exposure Reporting

FCC KDB 447498 D01 v05r02 General RF Exposure Guidance v05r02

FCC KDB 648474 D04 v01r02 SAR Evaluation Considerations for Wireless Handsets

FCC KDB 941225 D01 v03 SAR test for 3G devices

8 LABORATORY ENVIRONMENT

8.1 The Ambient Conditions during SAR Test

Temperature	Min. = 18 ℃, Max. = 25 ℃
Atmospheric pressure	Min.=86 kPa, Max.=106 kPa
Relative humidity	Min. = 45%, Max. = 75%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

9.Conducted RF Output Power

9.1 GSM Conducted Power

Band		Burst Average Power (dBm)			Frame-Average Power (dBm)		
GSM850	TX Channel	128	190	251	128	190	251
	Frequency(MHz)	824.2	836.4	848.8	824.2	836.4	848.8
	GSM	33.12	33.10	33.15	24.09	24.07	24.12
	GPRS (Slot 1)	32.79	32.93	32.84	23.76	23.9	23.81
	GPRS (Slot 2)	29.99	30.02	29.91	**23.97**	**24.00**	**23.89**
	GPRS (Slot 3)	28.08	28.10	28.14	23.82	23.84	23.88
	GPRS (Slot 4)	26.49	26.47	26.27	23.48	23.46	23.26
GSM1900	TX Channel	512	661	810	512	661	810
	Frequency(MHz)	1850.2	1880	1909.8	1850.2	1880	1909.8
	GSM	30.19	30.23	30.26	21.16	21.20	21.23
	GPRS (Slot 1)	29.78	29.61	30.01	20.75	20.58	20.98
	GPRS (Slot 2)	27.01	26.96	27.02	**20.99**	**20.94**	**21.00**
	GPRS (Slot 3)	25.36	25.20	25.40	21.10	20.94	21.14
	GPRS (Slot 4)	23.52	23.18	23.72	20.51	20.17	20.71

Note: Per KDB 447498 D01 v05r02, the maximum output power channel is used for SAR testing and for further SAR test reduction.

For Head SAR testing, GSM should be evaluated, therefore the EUT was set in GSM Voice for GSM850 and GSM1900 due to its highest frame-average power.

For Body worn SAR testing, GSM should be evaluated, therefore the EUT was set in GSM Voice for GSM850 and GSM 1900 due to its highest frame-average power.

GPRS should be evaluated, therefore the EUT was set in GPRS（2Tx slots）due to its highest frame-average power.

Timeslot consignations:

No. Of Slots	Slot 1	Slot 2	Slot 3	Slot 4
Slot Consignation	1Up4Down	2Up3Down	3Up2Down	4Up1Down
Duty Cycle	1:8	1:4	1:267	1:2
Crest Factor	-9.03dB	-6.02dB	-4.26dB	-3.01dB

Bluetooth Conducted Power

Channel	Frequency (MHz)	BT3.0 Output Power(dBm)		
		GFSK	π /4-DQPSK	8-DPSK
CH 0	2402	5.74	3.70	3.99
CH 39	2441	5.09	2.84	3.13
CH 78	2480	5.31	3.05	3.35

Note:

1. Per KDB 447498 D01v05r02, the 1-g and 10-g SAR test exclusion thrssholds for 100MHz to 6GHz at test separation distances ≤ 50mm are determined by:[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] •[$\sqrt{f}$ (GHz)] ≤3.0 for 1-g SAR and ≤7.5 for 10-g extremity SAR
   (1) f(GHz) is the RF channel transmit frequency in GHz
   (2) Power and distance are round to the nearest mW and mm before calculation
   (3) The result is rounded to one decimal place for comparison
   (4) If the test separation diatance(antenna-user) is < 5mm, 5mm is used for excluded SAR calculation

Bluetooth Max Power (dBm)	mW	Test Distance (mm)	Frequency(Ghz)	Exclusion Thresholds
6	3.981	5	2.4	1.233

Per KDB 447498 D01v05r02 exclusion thresholds is 1.233<3, RF exposure evaluation is not required.

BT estimated SAR value=Exclusion Thresholds/7.5=1.233/7.5=0.164W/Kg

Bluetooth Max Power (dBm)	mW	Test Distance (mm)	Frequency(Ghz)	Exclusion Thresholds
6	3.981	10	2.4	0.617

Per KDB 447498 D01v05r02 exclusion thresholds is 0.617<3, RF exposure evaluation is not required.

BT estimated SAR value=Exclusion Thresholds/7.5=0.617/7.5=0.082W/Kg

The estimated SAR value is used for simultaneous transmission analysis.

General Note:

1. Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
2. Per KDB447498 D01v05r02, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is: ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is≤ 100 MHz. When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
3. The maximum reported SAR of each test band is shown in **bold** letters.
4. Per KDB941225 D06v02, the DUT Dimension is bigger than 9 cm x 5 cm, so 10mm is chosen as the test separation distance.
5. Per KDB 865664 D01v01r03,for each frequency band,repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/Kg,only one repeated measurement is required.
6. Per KDB865664 D02v01r01, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing(Refer to appendix D for details).
7. Per KDB941225 D01, when multiple slots can be used, the GPRS/EDGE slot configuration with the highest frame–averaged output power was selected for SAR testing.
8. Per KDB941225 D01v03, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

. Scaling Factor calculation

Operation Mode	Channel	Output Power(dBm)	Tune up Power in tolerance(dBm)	Scaling Factor
GSM 850	128	33.12	33.00 ±0.5	1.091
	190	33.10	33.00 ±0.5	1.096
	251	33.15	33.00 ±0.5	1.084
GPRS 850(2Tx)	128	29.99	30.00 ±0.5	1.125
	190	30.02	30.00±0.5	1.117
	251	29.91	30.00 ±0.5	1.146
GSM1900	512	30.19	30.00 ±0.5	1.074
	661	30.23	30.00 ±0.5	1.064
	810	30.26	30.00 ±0.5	1.057
GPRS1900(2Tx)	512	27.01	27.00 ±0.5	1.119
	661	26.96	27.00 ±0.5	1.132
	810	27.02	27.00 ±0.5	1.117
BT GFSK	2402	5.74	5 ± 1	1.062
	2441	5.09	5 ± 1	1.233
	2480	5.31	5 ± 1	1.172

10 TEST RESULTS

10.1 Summary of Power Measurement Results

According the description above, the measurements against the head phantom were executed on the operation mode: GSM850 /1900MHz, while the tests against the body-worn were carried out on the operation mode : GSM850/1900MHz, GPRS 850 /1900MHz.

Table 1: SAR Values of GSM 850MHz Band

Temperature: 22.0~23.5°C, humidity: 62~64%.					
Test Positions			Channel /Frequency (MHz)	SAR(W/Kg), 1.6 (1g average)	
				SAR(W/Kg1g Peak)	Scaled SAR(W/Kg),1g
Right Side of Head	Cheek		190/836.6	0.014	0.015
	Tilt 15 degrees		190/836.6	0.012	0.013
Left Side of Head	Cheek		190/836.6	**0.015**	0.016
	Tilt 15 degrees		190/836.6	0.012	0.013
Body (10mm Separation)	GSM	Face Upward	190/836.6	0.021	0.023
		Back Upward	190/836.6	**0.186**	0.204
		Edge A	190/836.6	0.002	0.002
		Edge B	190/836.6	0.011	0.012
		Edge C	190/836.6	0.005	0.005
		Edge D	190/836.6	0.016	0.018
	GPRS (2Tx)	Face Upward	190/836.6	0.019	0.021
		Back Upward	190/836.6	**0.182**	0.204
		Edge A	190/836.6	0.002	0.002
		Edge B	190/836.6	0.012	0.013
		Edge C	190/836.6	0.005	0.006
		Edge D	190/836.6	0.015	0.017

Table 2: SAR Values of GSM1900 MHz Band

Temperature: 22.0~23.5°C, humidity: 62~64%.					
Test Positions			Channel /Frequency (MHz)	SAR(W/Kg), 1.6 (1g average)	
				SAR(W/Kg1g Peak)	Scaled SAR(W/Kg),1g
Right Side of Head	Cheek		661/1880.0	**0.017**	0.018
	Tilt 15 degrees		661/1880.0	0.013	0.014
Left Side of Head	Cheek		661/1880.0	0.016	0.017
	Tilt 15 degrees		661/1880.0	0.012	0.013
Body (10mm Separation)	GSM	Face Upward	661/1880.0	0.007	0.007
		Back Upward	661/1880.0	**0.027**	0.029
		Edge A	661/1880.0	0.002	0.002
		Edge B	661/1880.0	0.006	0.006
		Edge C	661/1880.0	0.008	0.009
		Edge D	661/1880.0	0.007	0.007
	GPRS (2Tx)	Face Upward	661/1880.0	0.008	0.009
		Back Upward	661/1880.0	**0.034**	0.039
		Edge A	661/1880.0	0.002	0.002
		Edge B	661/1880.0	0.007	0.008
		Edge C	661/1880.0	0.008	0.009
		Edge D	661/1880.0	0.006	0.007

Note:

When the 1-g SAR for the mid-band channel or the channel with the Highest output power satisfy the following conditions, testing of the other channels in the band is not required.(Per KDB 447498 D01 General RF Exposure Guidance v05r02)

• ≤ 0.8 W/kg, when the transmission band is ≤ 100 MHz

• ≤ 0.6 W/kg, when the transmission band is between 100 MHz and 200 MHz

• ≤ 0.4 W/kg, when the transmission band is ≥ 200 MHz

SIMULTANEOUS TRANSMISSION ANALYSIS

Test Position		Right Cheek	Right Title	Left Cheek	Left Tilt
Head MAX 1-g SAR(W/Kg)	GSM850	0.015	0.013	0.016	0.013
	GSM1900	0.018	0.014	0.017	0.013
	BT	*0.164	*0.164	*0.164	*0.164
Simultaneous ∑1-g SAR(W/Kg)		0.182	0.178	0.181	0.177

Simultaneous Tx Combination of GSM and BT (Head).

The estimated SAR value with * Signal

Test Position		Face	Back	Edge A	Edge B	Edge C	Edge D
Body 10mm separation MAX 1-g SAR(W/Kg)	GSMS850	0.023	0.204	0.002	0.013	0.006	0.018
	GSM1900	0.009	0.039	0.002	0.008	0.009	0.007
	BT	*0.082	*0.082	*0.082	*0.082	*0.082	*0.082
Simultaneous ∑1-g SAR(W/Kg)		0.105	0.286	0.084	0.095	0.088	0.100

Simultaneous Tx Combination of GSM and BT (Body).

The estimated SAR value with * Signal

SAR to Peak Location Separation Ratio (SPLSR)

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required

11 Measurement Uncertainty

No.	Uncertainty Component	Type	Uncertainty Value (%)	Probability Distribution	k	ci	Standard Uncertainty (%) ui(%)	Degree of freedom Veff or vi
	Measurement System							
1	– Probe Calibration	B	5.8	N	1	1	5.8	∞
2	– Axial isotropy	B	3.5	R	$\sqrt{3}$	0.5	1.43	∞
3	–Hemispherical Isotropy	B	5.9	R	$\sqrt{3}$	0.5	2.41	∞
4	– Boundary Effect	B	1	R	$\sqrt{3}$	1	0.58	∞
5	– Linearity	B	4.7	R	$\sqrt{3}$	1	2.71	∞
6	– System Detection Limits	B	1.0	R	$\sqrt{3}$	1	0.58	∞
7	Modulation response	B	3	N	1	1	3.00	
8	– Readout Electronics	B	0.5	N	1	1	0.50	∞
9	– Response Time	B	1.4	R	$\sqrt{3}$	1	0.81	∞
10	– Integration Time	B	3.0	R	$\sqrt{3}$	1	1.73	∞
11	– RF Ambient Conditions	B	3.0	R	$\sqrt{3}$	1	1.73	∞
12	– Probe Position Mechanical tolerance	B	1.4	R	$\sqrt{3}$	1	0.81	∞
13	– Probe Position with respect to Phantom Shell	B	1.4	R	$\sqrt{3}$	1	0.81	∞
14	– Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation	B	2.3	R	$\sqrt{3}$	1	1.33	∞
	Uncertainties of the DUT							
15	– Position of the DUT	A	2.6	N	$\sqrt{3}$	1	2.6	5

16	– Holder of the DUT	A	3	N	$\sqrt{3}$	1	3.0	5
17	– Output Power Variation –SAR drift measurement	B	5.0	R	$\sqrt{3}$	1	2.89	∞
Phantom and Tissue Parameters								
18	– Phantom Uncertainty(shape and thickness tolerances)	B	4	R	$\sqrt{3}$	1	2.31	∞
19	Uncertainty in SAR correction for deviation(in permittivity and conductivity)	B	2	N	1	1	2.00	
20	– Liquid Conductivity Target –tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
21	– Liquid Conductivity –measurement Uncertainty)	B	4	N	$\sqrt{3}$	1	0.92	9
22	– Liquid Permittivity Target tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
23	– Liquid Permittivity –measurement uncertainty	B	5	N	$\sqrt{3}$	1	1.15	∞
Combined Standard Uncertainty				RSS			10.63	
Expanded uncertainty (Confidence interval of 95 %)				K=2			21.26	

System Check Uncertainty

No.	Uncertainty Component	Type	Uncertainty Value (%)	Probability Distribution	k	ci	Standard Uncertainty (%) ui(%)	Degree of freedom Veff or vi
	Measurement System							
1	– Probe Calibration	B	5.8	N	1	1	5.8	∞
2	– Axial isotropy	B	3.5	R	$\sqrt{3}$	0.5	1.43	∞
3	–Hemispherical Isotropy	B	5.9	R	$\sqrt{3}$	0.5	2.41	∞
4	– Boundary Effect	B	1	R	$\sqrt{3}$	1	0.58	∞
5	– Linearity	B	4.7	R	$\sqrt{3}$	1	2.71	∞
6	– System Detection Limits	B	1	R	$\sqrt{3}$	1	0.58	∞

7	Modulation response	B	0	N	1	1	0.00	
8	– Readout Electronics	B	0.5	N	1	1	0.50	∞
9	– Response Time	B	0.00	R	$\sqrt{3}$	1	0.00	∞
10	– Integration Time	B	1.4	R	$\sqrt{3}$	1	0.81	∞
11	– RF Ambient Conditions	B	3.0	R	$\sqrt{3}$	1	1.73	∞
12	– Probe Position Mechanical tolerance	B	1.4	R	$\sqrt{3}$	1	0.81	∞
13	– Probe Position with respect to Phantom Shell	B	1.4	R	$\sqrt{3}$	1	0.81	∞
14	– Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation	B	2.3	R	$\sqrt{3}$	1	1.33	∞
	Uncertainties of the DUT							
15	Deviation of experimental source from numberical source	A	4	N	1	1	4.00	5
16	Input Power and SAR drift measurement	A	5	R	$\sqrt{3}$	1	2.89	5
17	Dipole Axis to Liquid Distance	B	2	R	$\sqrt{3}$	1	1.2	∞
Phantom and Tissue Parameters								
18	– Phantom Uncertainty(shape and thickness tolerances)	B	4	R	$\sqrt{3}$	1	2.31	∞
19	Uncertainty in SAR correction for deviation(in permittivity and conductivity)	B	2	N	1	1	2.00	
20	– Liquid Conductivity Target –tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
21	– Liquid Conductivity –measurement Uncertainty)	B	4	N	$\sqrt{3}$	1	0.92	9
22	– Liquid Permittivity Target tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
23	– Liquid Permittivity –measurement uncertainty	B	5	N	$\sqrt{3}$	1	1.15	∞
Combined Standard Uncertainty				RSS			10.15	

Expanded uncertainty (Confidence interval of 95 %)			K=2			20.29	

12 MAIN TEST INSTRUMENTS

No.	EQUIPMENT	TYPE	Series No.	Last Calibration	Due Date
1	System Simulator	E5515C	GB 47200710	2015/02/23	1 Year
2	System Simulator	CMW500	130805	2014/06/10	1 Year
3	SAR Probe	SATIMO	SN 09/13 EP169	2014/04/05	1 Year
4	SAR Probe	SATIMO	SN 27/14 EPG210	2014/05/16	1 Year
5	Dipole	SID835	SN09/13 DIP0G835-217	2014/08/28	1 Year
6	Dipole	SID1900	SN09/13 DIP1G900-218	2014/08/28	1 Year
7	Network Analyzer	ZVB8	A0802530	2014/06/13	1 Year
8	Signal Generator	SMR27	A0304219	2014/06/10	1 Year
9	Amplifier	Nucletudes	143060	2014/04/05	1 Year
10	Directional Coupler	DC6180A	305827	2014/06/10	1 Year
11	Power Meter	NRVS	1020.1809.02	2014/06/13	1 Year
12	Power Sensor	NRV-Z4	100069	2014/06/10	1 Year
13	Power Meter	NRP2	A140401673	2014/04/04	1 Year
14	Power Sensor	NPR-Z11	1138.3004.02-114072-nq	2014/04/04	1 Year
15	Multimeter	Keithley2000	4014020	2015/03/27	1 Year
16	Device Holder	SATIMO	SN 09/13 MSH80	2014/04/05	1 Year
17	SAM Phantom	SAM97	SN 09/13 SAM97	2014/04/05	1 Year

ANNEX A

of

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-04152

Haier Telecom (Qingdao) Co., Ltd.

GSM digital mobile phone

Type Name: M220

Hardware Version： **M721C_FS_MB_V0.1**

Software Version： **M721C_LD_SINGLE_CARD_F08_WNRL_V003_20150312**

Accreditation Certificate

This Annex consists of 2 pages

Date of Report: 2015-04-08

China National Accreditation Service for Conformity Assessment

LABORATORY ACCREDITATION CERTIFICATE

(Registration No. CNAS L1659)

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.

Building 28/29, Shigudong, Xili Industrial Area, Xili Street,

Nanshan District, Shenzhen, Guangdong, China

is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) *for the competence of testing and calibration.*

The scope of accreditation is detailed in the attached appendices bearing the same registration number as above. The appendices form an integral part of this certificate.

Date of Issue: 2012-09-29

Date of Expiry: 2015-09-28

Date of Initial Accreditation: 1999-08-03

Date of Update: 2012-09-29

Signed on behalf of China National Accreditation Service for Conformity Assessment

China National Accreditation Service for Conformity Assessment (CNAS) is authorized by Certification and Accreditation Administration of the People's Republic of China (CNCA) to operate the national accreditation schemes for conformity assessment. CNAS is the signatory to International Laboratory Accreditation Cooperation Multilateral Recognition Arrangement (ILAC MRA) and Asia Pacific Laboratory Accreditation Cooperation Multilateral Recognition Arrangement (APLAC MRA).

No.CNAS AL 2

0005210

ANNEX B

of

CCIC-SET

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-04152

Haier Telecom (Qingdao) Co., Ltd.

GSM digital mobile phone

Type Name: M220

Hardware Version： **M721C_FS_MB_V0.1**

Software Version： **M721C_LD_SINGLE_CARD_F08_WNRL_V003_20150312**

TEST LAYOUT

This Annex consists of 7 pages

Date of Report: 2015-04-08

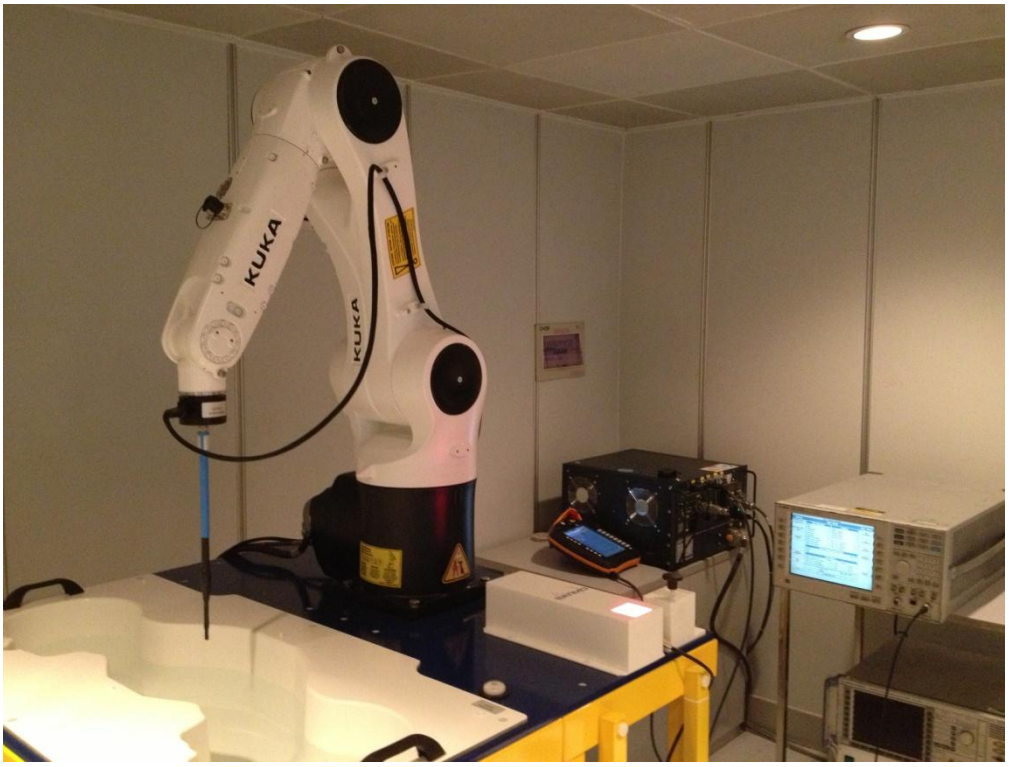


Fig.1 COMO SAR Test System

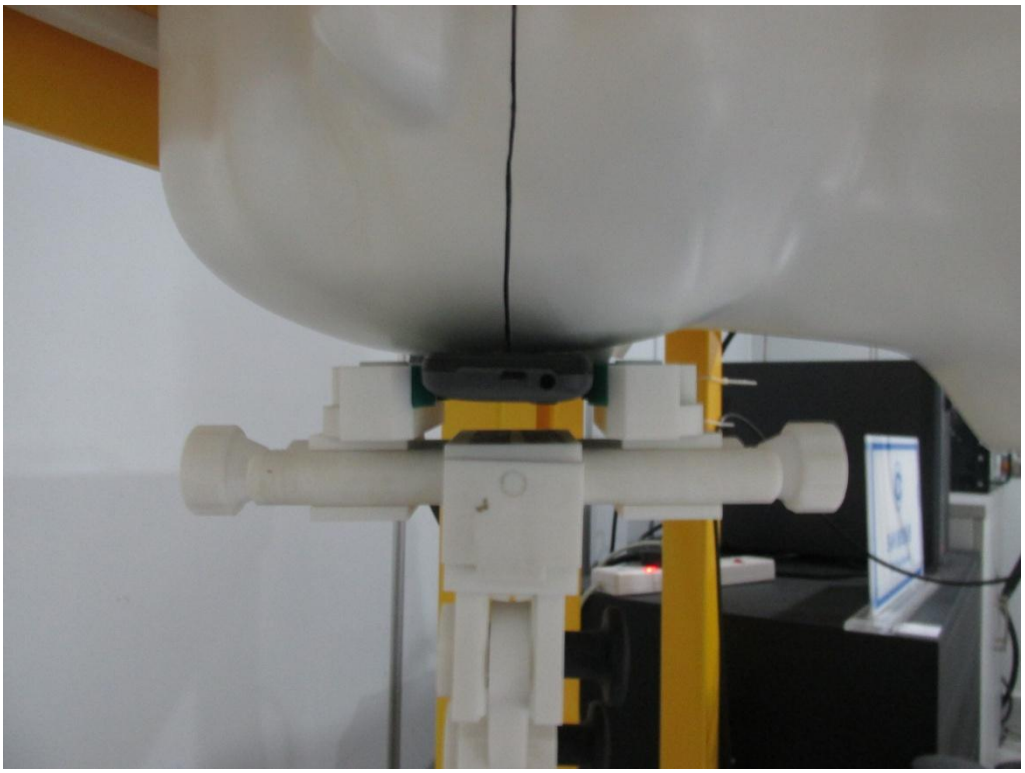


Fig.2 Right_Cheek

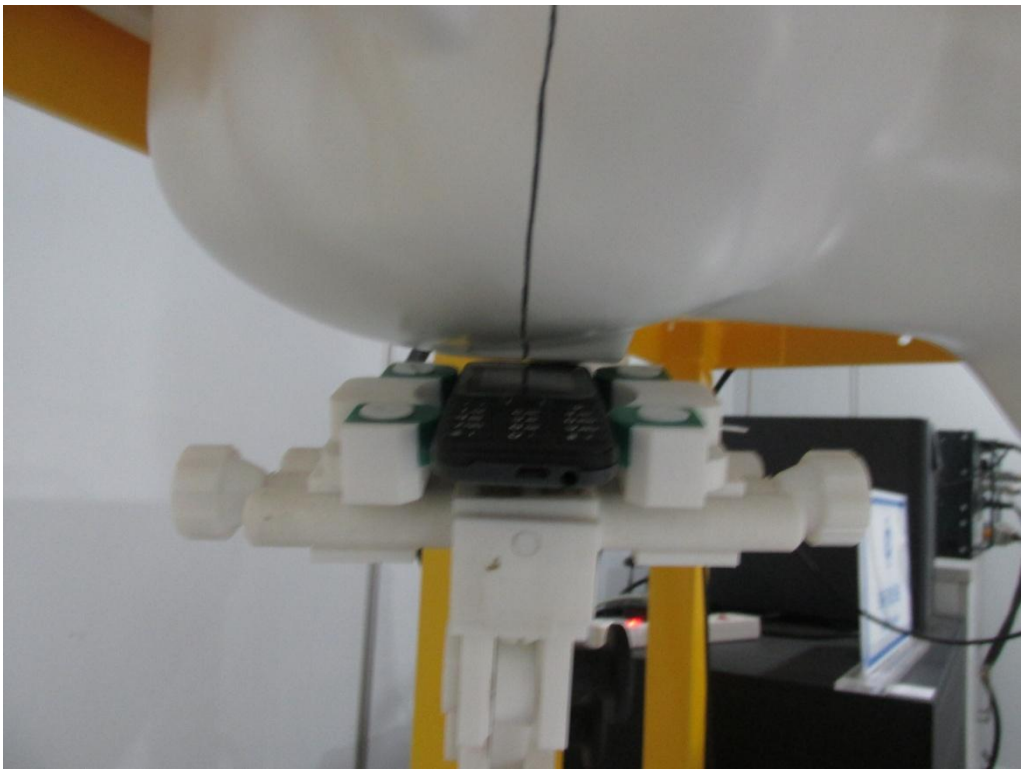


Fig.3 Right_Tilt

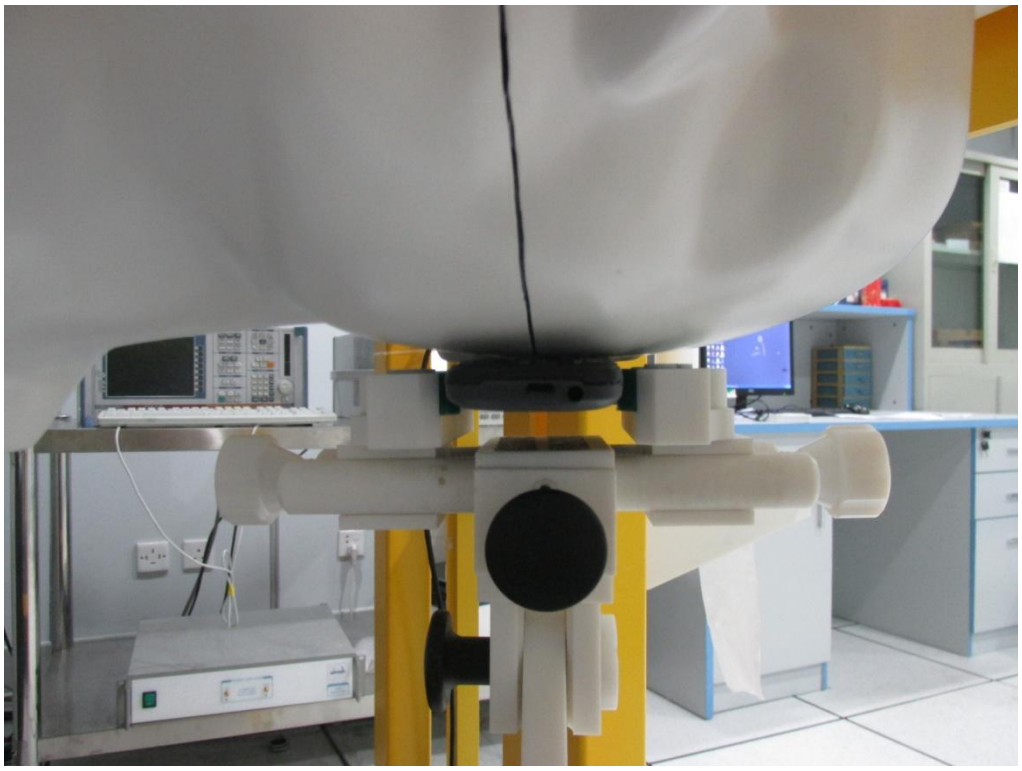


Fig.4 Left Cheek

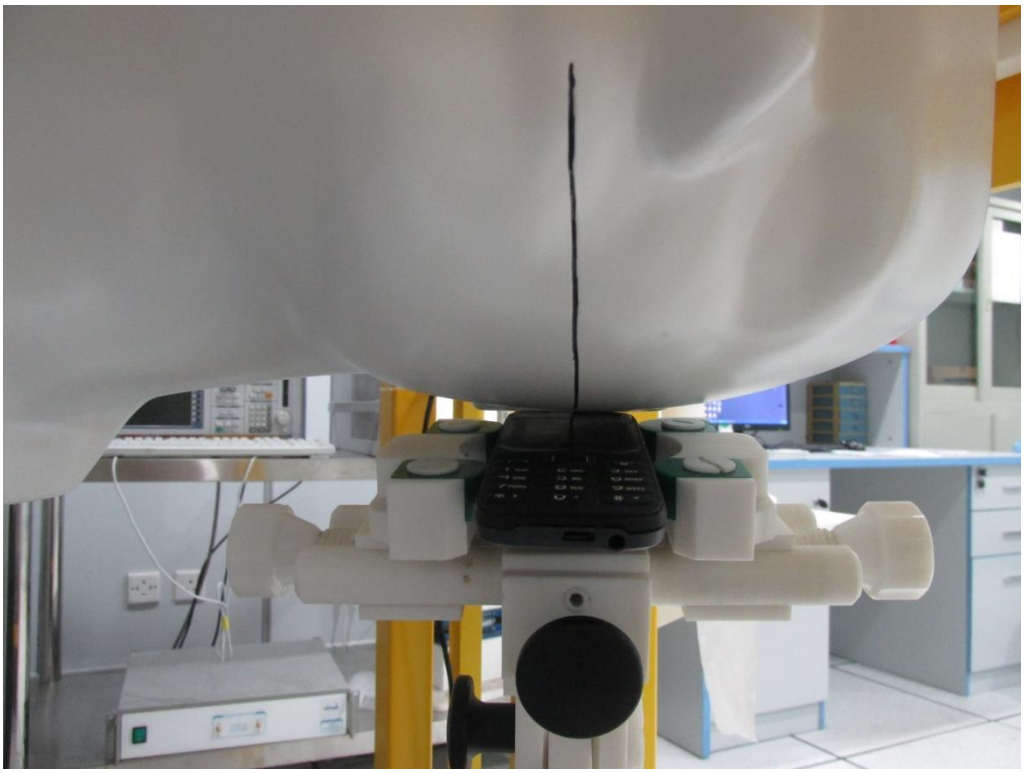


Fig.5 Left_Tilt

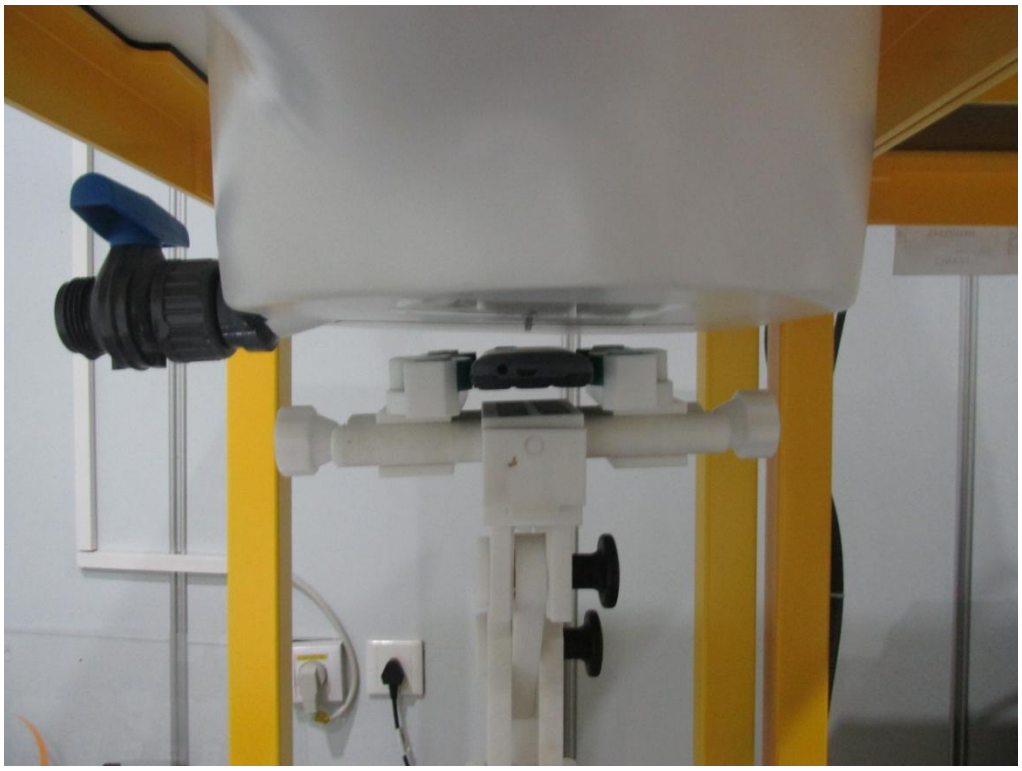


Fig.6 Body(Back upside,10mm seperation)

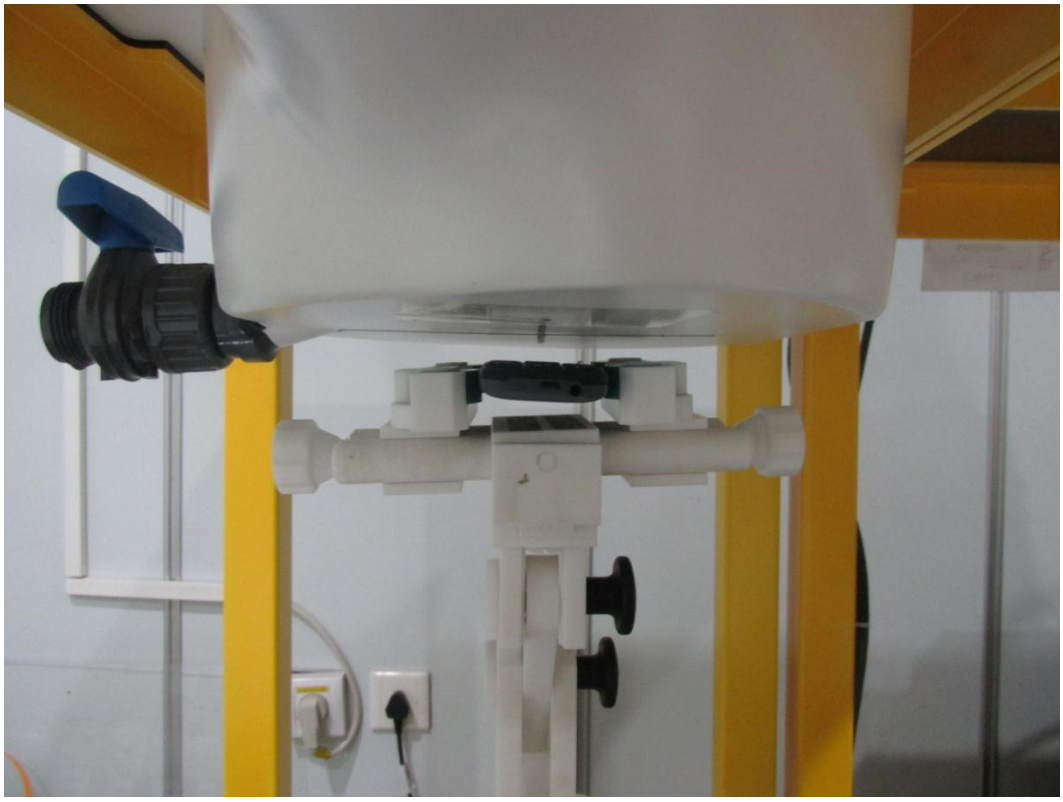


Fig.7 Body(Face upside,10mm seperation)

Fig.8 Body Edge A(UP,10mm seperation)

Fig.9 Body Edge B(Right upside,10mm separation)

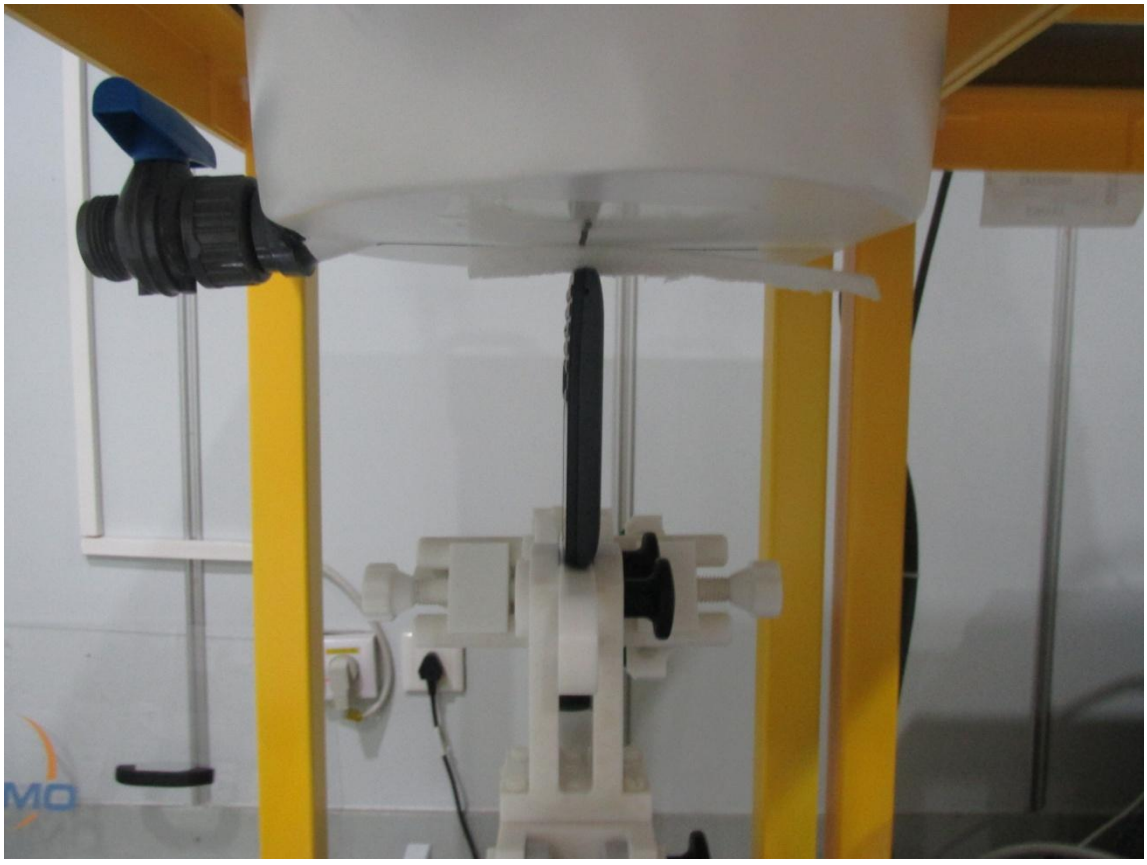


Fig.10 Body Edge C(Down,10mm seperation)

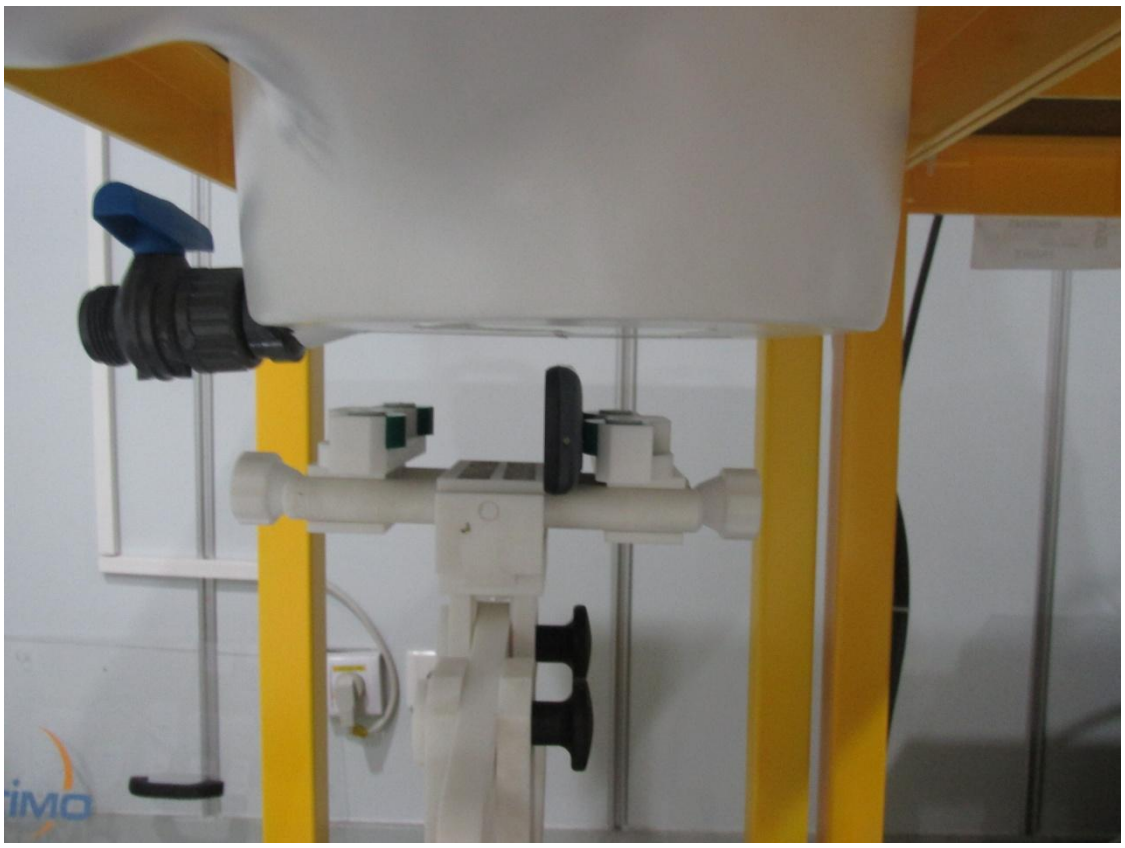


Fig.11 Body Edge D(Left upside,10mm separation)

Fig.12 Head Liquid of 835MHz(15cm)

Fig.13 Body Liquid of 835MHz(15cm)

Fig.14 Head Liquid of 1900MHz(15cm)

Fig.15 Body Liquid of 1900MHz(15cm)

ANNEX C

of

CCIC-SET

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-04152

GSM digital mobile phone

Type Name: M220

Hardware Version: M721C_FS_MB_V0.1

Software Version: M721C_LD_SINGLE_CARD_F08_WNRL_V003_20150312

Sample Photographs

This Annex consists of 2 pages

Date of Report: 2015-04-08

1. Appearance

Appearance and size (obverse)

Appearance and size (reverse)

ANNEX D

of

CCIC-SET

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-04152

GSM digital mobile phone

Type Name: M220

Hardware Version： **M721C_FS_MB_V0.1**

Software Version： **M721C_LD_SINGLE_CARD_F08_WNRL_V003_20150312**

System Performance Check Data and Highest SAR Plots

This Annex consists of 50 pages

Date of Report：2015-04-08

System Performance Check (Head, 835MHz)

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement:24/03/2015

Measurement duration: 12 minutes 57 seconds

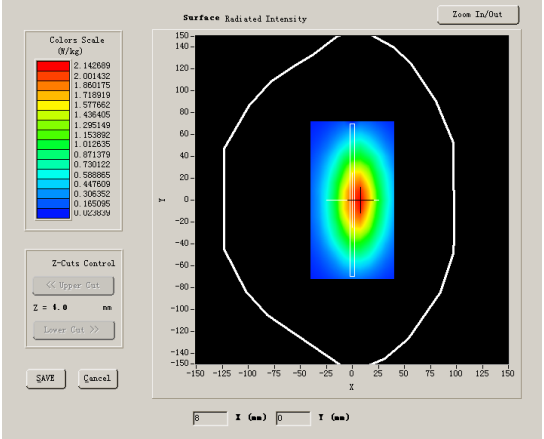
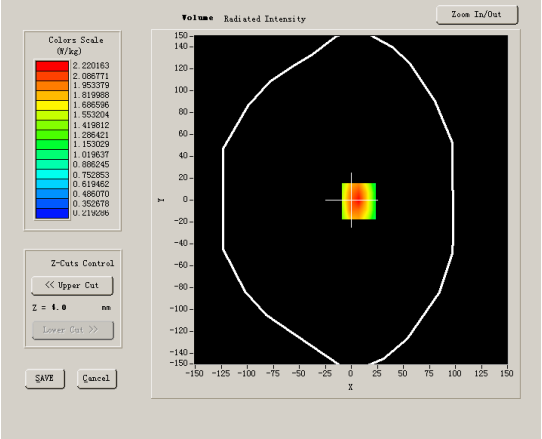
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat Plane
Device Position	
Band	835MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	835.000000
Relative permittivity (real part)	41.37
Relative permittivity	19.62
Conductivity (S/m)	0.91
Power drift (%)	-0.430000
Ambient Temperature:	23.2 ℃
Liquid Temperature:	23.5 ℃
ConvF:	5.51
Duty factor:	1:1

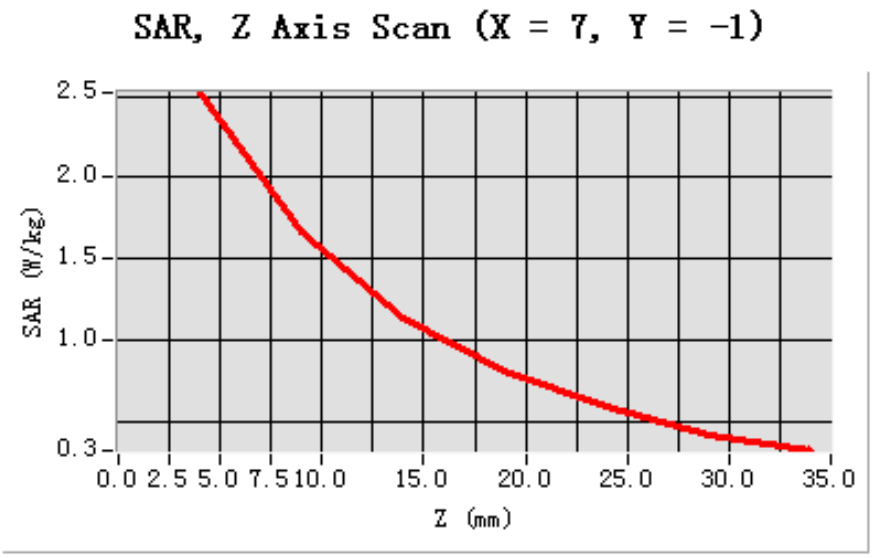
SURFACE SAR	VOLUME SAR
	

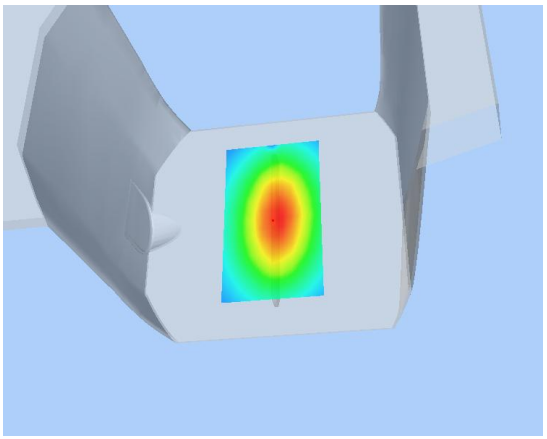
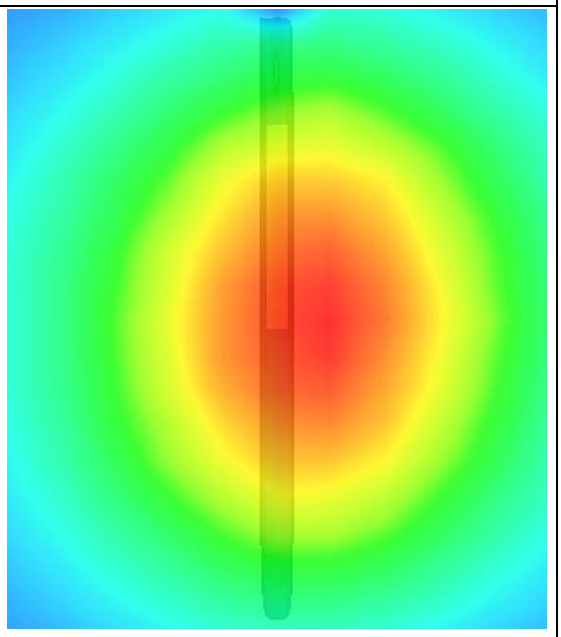
Maximum location: X=7.00, Y=-1.00

SAR 10g (W/Kg)	1.824256
SAR 1g (W/Kg)	2.454673

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	2.5214	1.6624	1.1451	0.8065	0.5875	0.4153



3D sceen shot	Hot spot position
	

System Performance Check (Head, 1900MHz)

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 25/03/2015

Measurement duration: 12 minutes 57 seconds

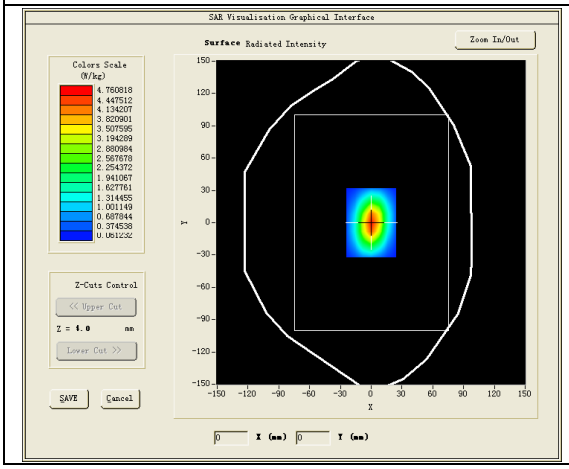
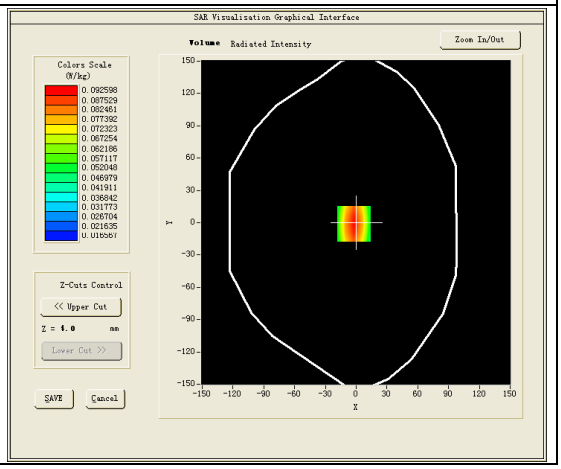
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat Plane
Device Position	
Band	1900MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	1900.000000
Relative permittivity (real part)	39.87
Relative permittivity	13.36
Conductivity (S/m)	1.41
Power drift (%)	-0.150000
Ambient Temperature:	22.3 ℃
Liquid Temperature:	22.6 ℃
ConvF:	5.49
Duty factor:	1:1

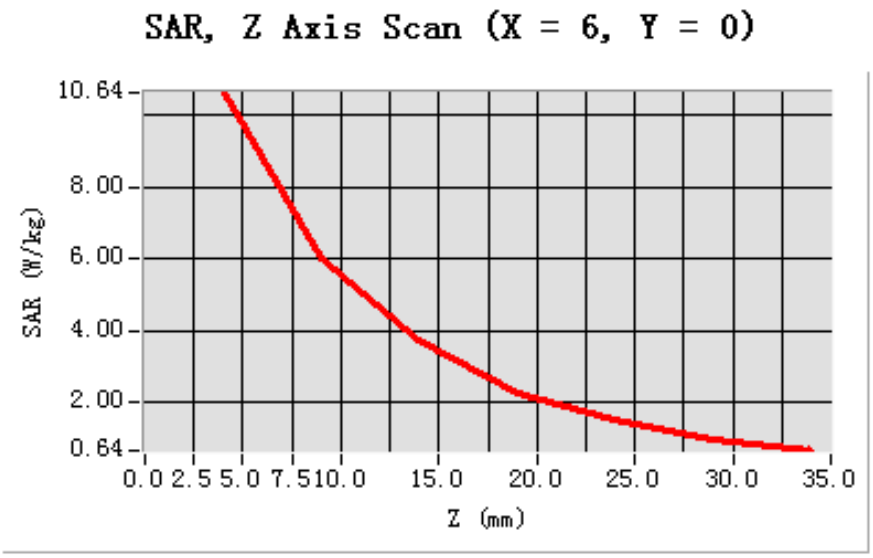
SURFACE SAR	VOLUME SAR
	

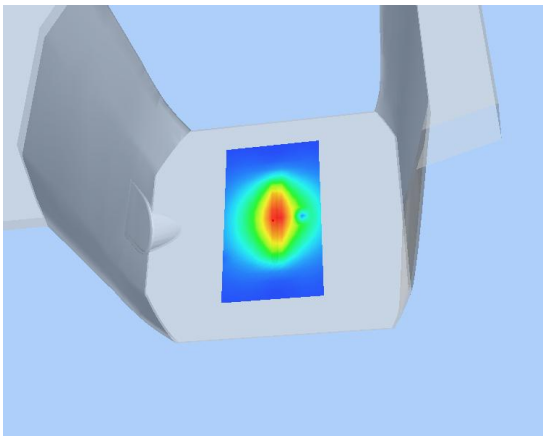
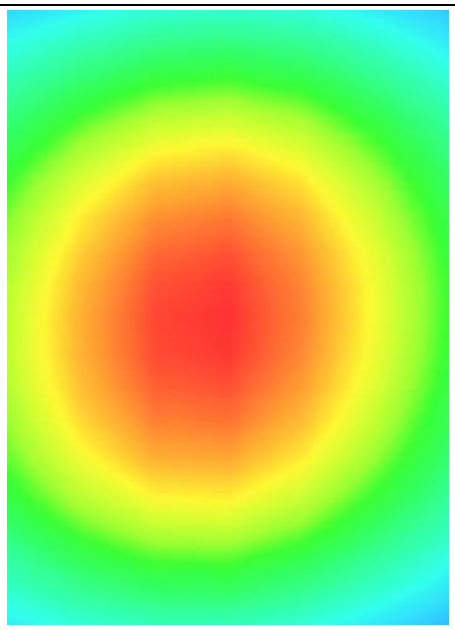
Maximum location: X=6.00, Y=0.00

SAR 10g (W/Kg)	5.142873
SAR 1g (W/Kg)	9.794237

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	10.6418	6.0044	3.7296	2.2605	1.5117	0.9790



3D sceen shot	Hot spot position
	

System Performance Check (Body, 835MHz)

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 24/03/2015

Measurement duration: 13 minutes 12 seconds

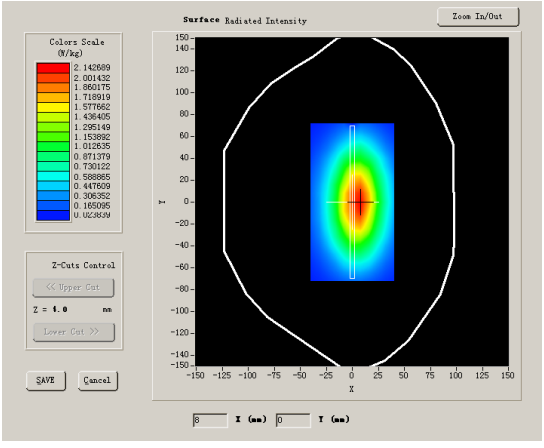
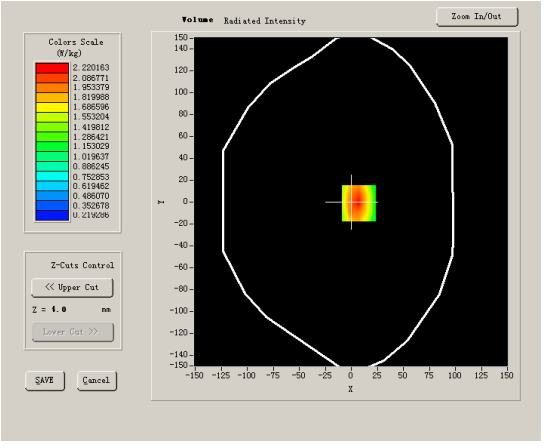
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat Plane
Device Position	
Band	835MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	835.000000
Relative permittivity (real part)	55.16
Relative permittivity	21.12
Conductivity (S/m)	0.98
Power drift (%)	-0.270000
Ambient Temperature:	23.2 ℃
Liquid Temperature:	23.5 ℃
ConvF:	5.68
Duty factor:	1:1

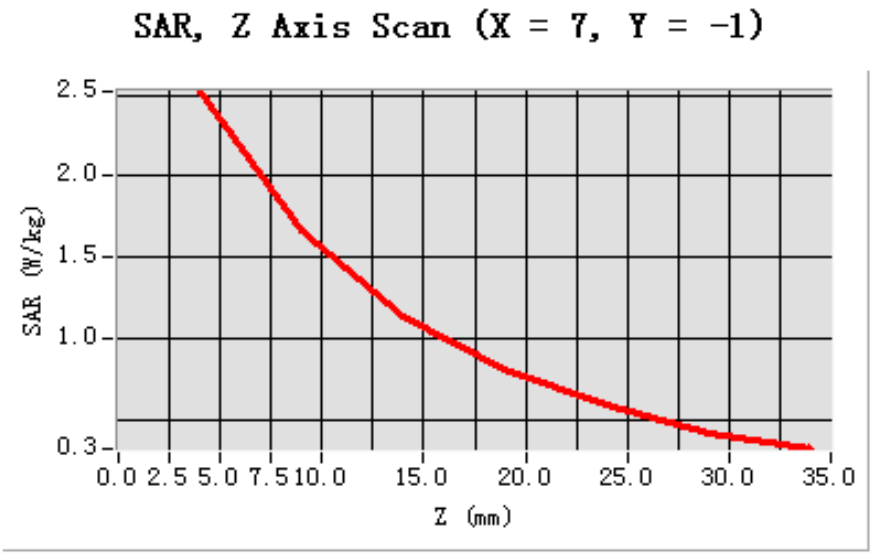
SURFACE SAR	VOLUME SAR
	

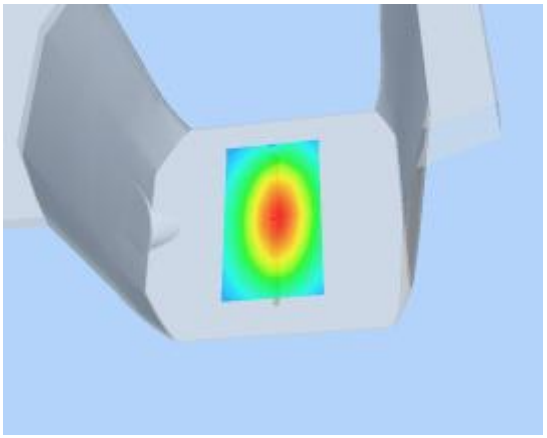
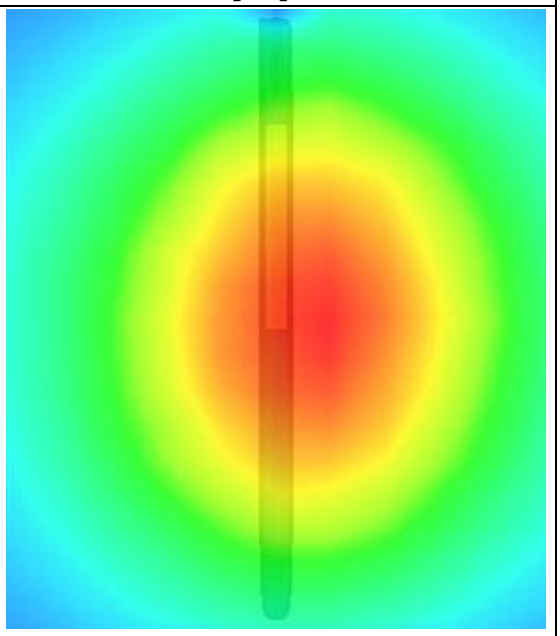
Maximum location: X=7.00, Y=-1.00

SAR 10g (W/Kg)	1.735712
SAR 1g (W/Kg)	2.463547

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	2.5212	1.6645	1.1443	0.8082	0.5893	0.4148



3D sceen shot	Hot spot position
	

System Performance Check (Body, 1900MHz)

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 25/03/2015

Measurement duration: 13 minutes 12 seconds

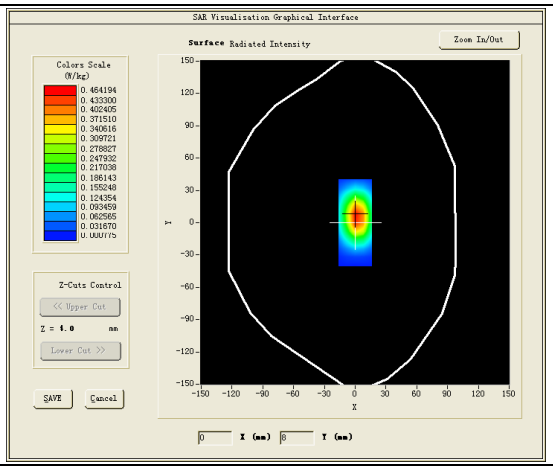
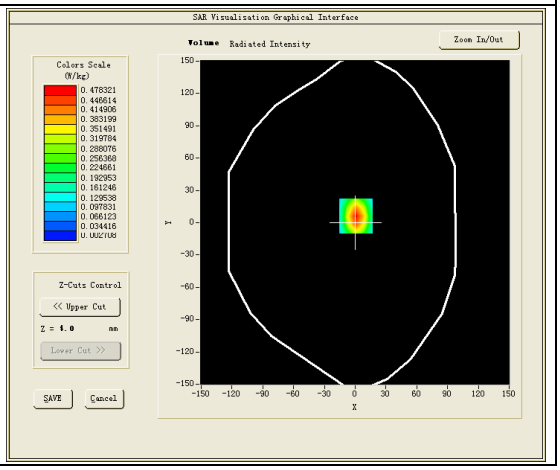
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	
Band	1900MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	1900.000000
Relative permittivity (real part)	53.23
Relative permittivity	14.49
Conductivity (S/m)	1.53
Power Drift (%)	0.410000
Ambient Temperature:	22.0 ℃
Liquid Temperature:	21.8 ℃
ConvF:	5.65
Duty factor:	1:1

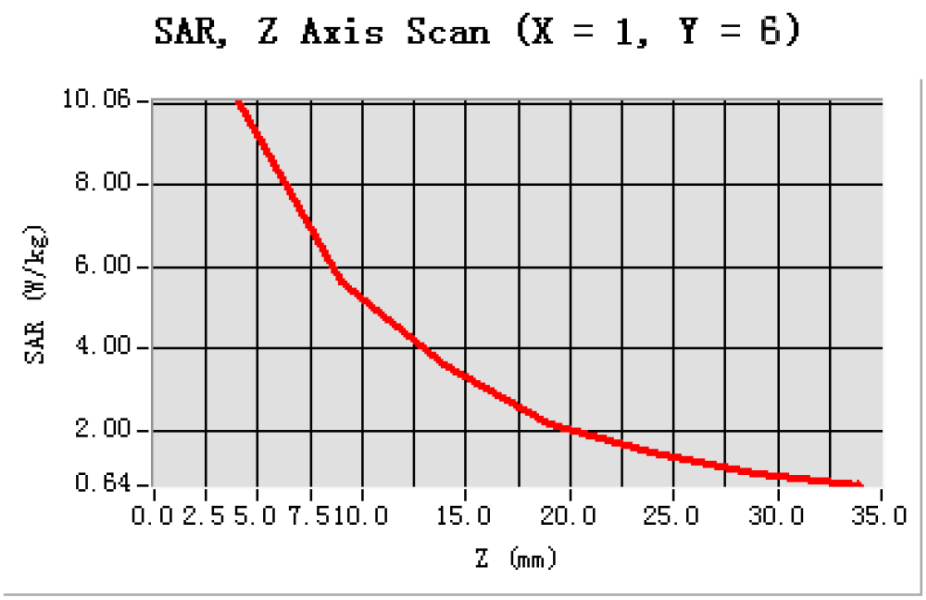
SURFACE SAR	VOLUME SAR
	

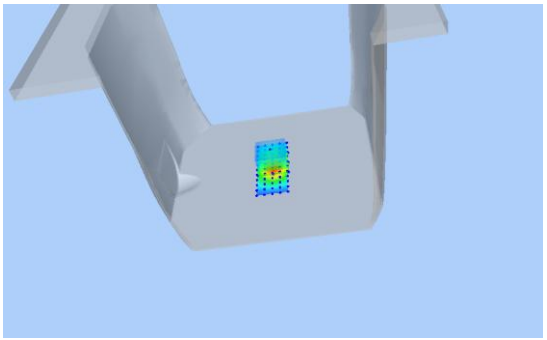
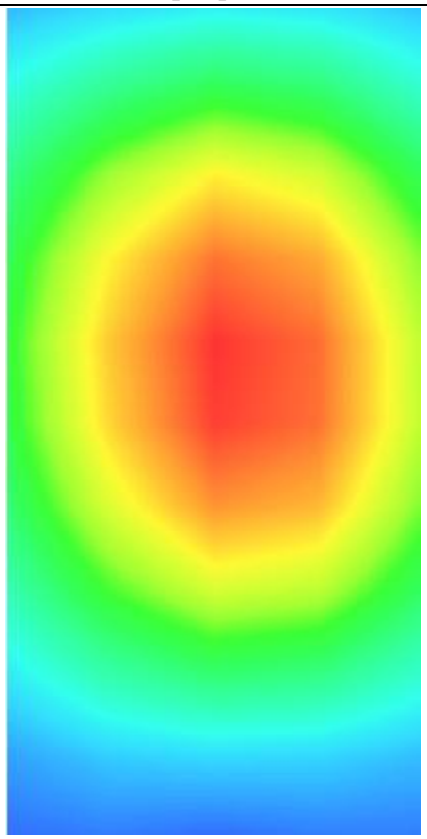
Maximum location: X=1.00, Y=6.00

SAR 10g (W/Kg)	5.215326
SAR 1g (W/Kg)	9.982523

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.0000	10.0613	5.7282	3. 6529	2.0314



3D sceen shot	Hot spot position
	

GSM850, Left Cheek, Middle

Type: Phone measurement (11 points in the volume)

Date of measurement: 24/03/2015

Measurement duration: 6 minutes 35 seconds

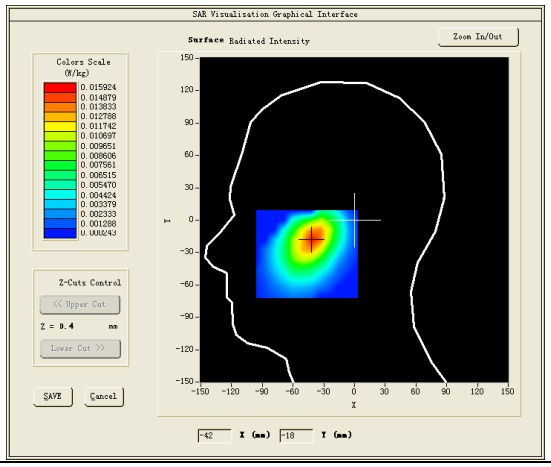
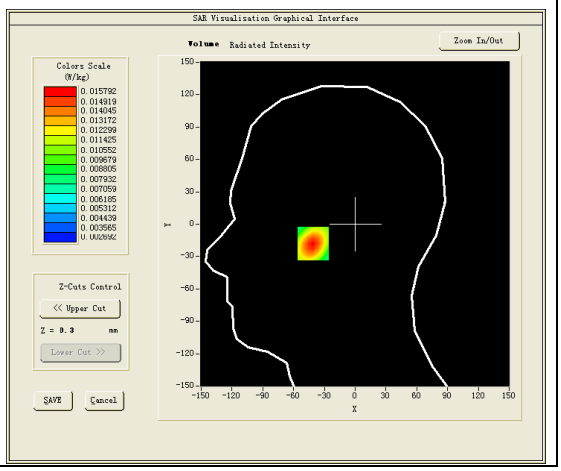
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	sam_direct_droit2_surf8mm.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Left head
Device Position	Cheek
Band	GSM850
Channels	190
Signal	GSM (Duty cycle: 1:8)

B. SAR Measurement Results

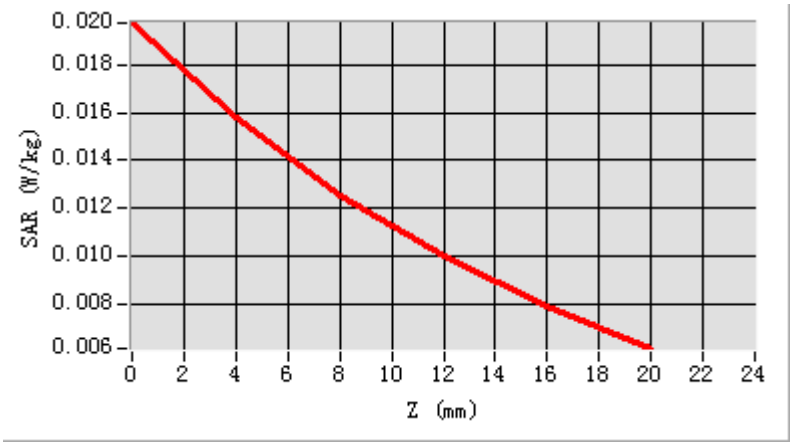
Frequency (MHz)	836.6
Relative permittivity (real part)	41.37
Relative permittivity (imaginary part)	19.62
Conductivity (S/m)	0.91
Variation (%)	-1.080000
ConvF:	5.51

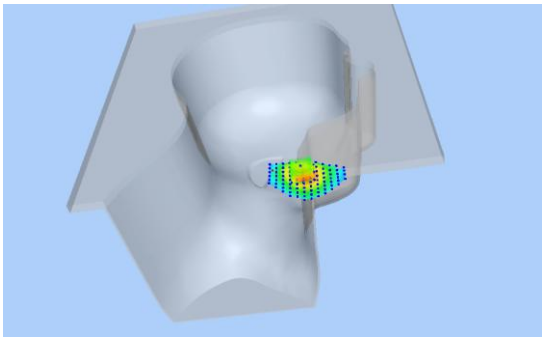
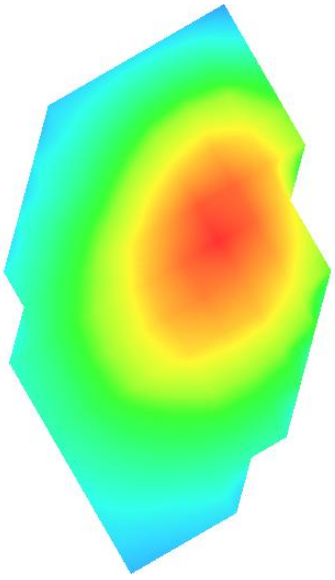
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-41.00, Y=-18.00

SAR 10g (W/Kg)	0.010074
SAR 1g (W/Kg)	0.014785

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.0198	0.0158	0.0126	0.0100	0.0079



3D screen shot	Hot spot position
	

GSM850, Back, Middle

Type: Phone measurement (11 points in the volume)

Date of measurement: 24/03/2015

Measurement duration: 7 minutes 32 seconds

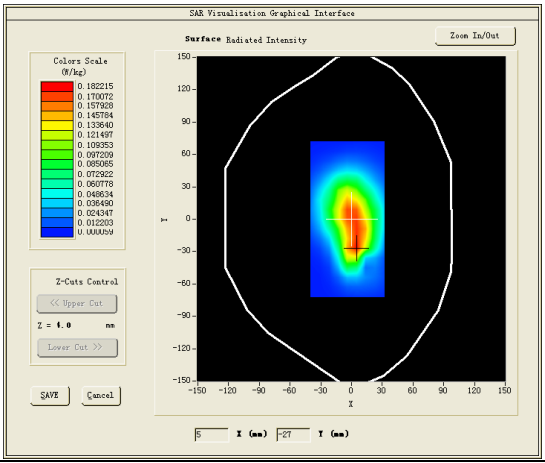
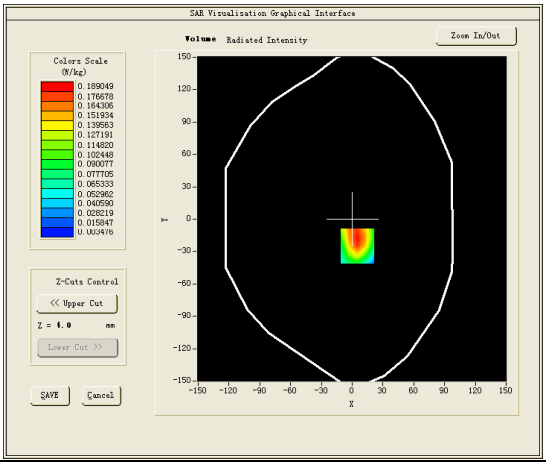
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	surf_sam_plan.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Back
Band	GSM850
Channels	190
Signal	GSM(Duty cycle: 1:8)

B. SAR Measurement Results

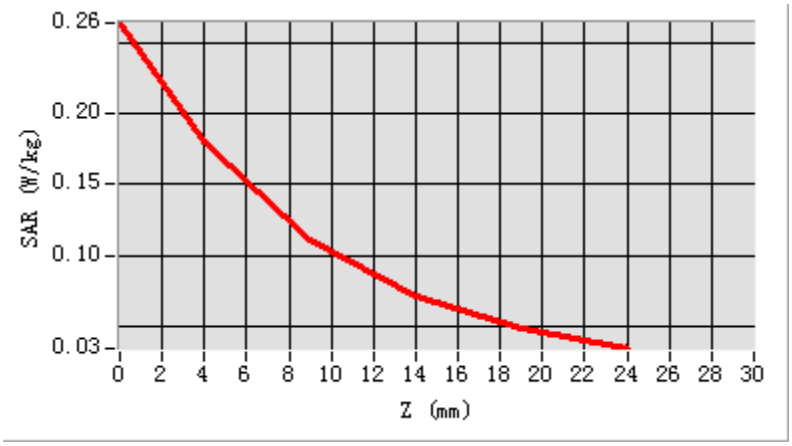
Frequency (MHz)	836.6
Relative permittivity (real part)	55.16
Relative permittivity (imaginary part)	21.12
Conductivity (S/m)	0.98
Variation (%)	0.060000
ConvF:	5.68

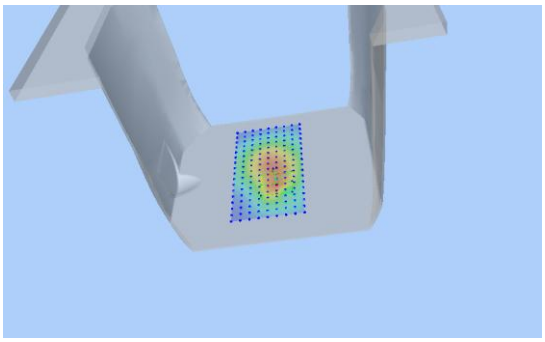
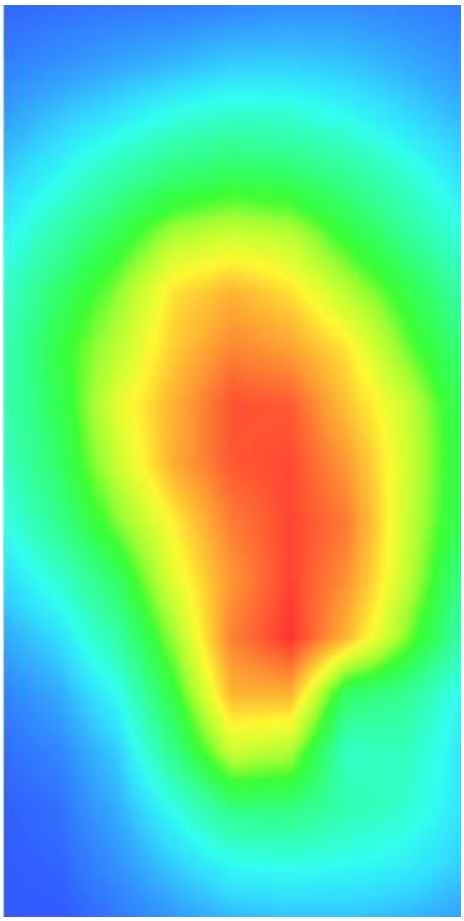
SURFACE SAR	VOLUME SAR
	

Maximum location: X=5.00, Y=-25.00

SAR 10g (W/Kg)	0.110868
SAR 1g (W/Kg)	0.186105

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.2636	0.1797	0.1112	0.0713	0.0489



3D screen shot	Hot spot position
	

GPRS 850, Back, Middle

Type: Phone measurement (11 points in the volume)

Date of measurement: 24/03/2015

Measurement duration: 7 minutes 33 seconds

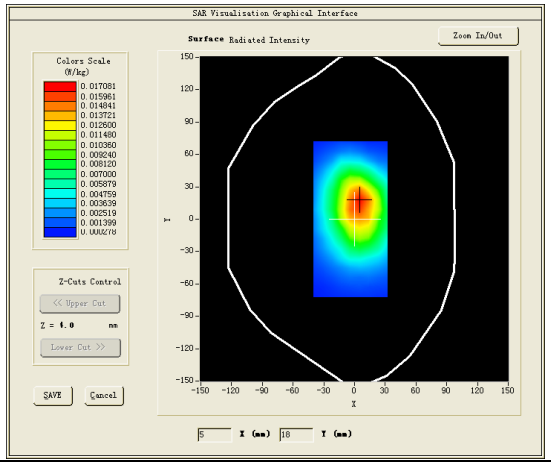
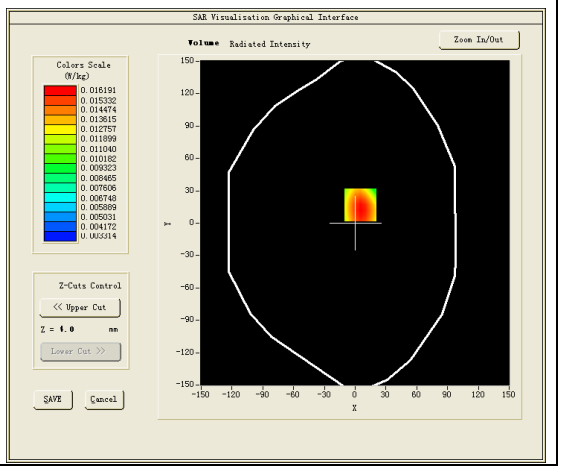
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	surf_sam_plan.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Back
Band	CUSTOM (GPRS850_2Tx)
Channels	190
Signal	GPRS(Duty cycle: 1:4)

B.SAR Measurement Results

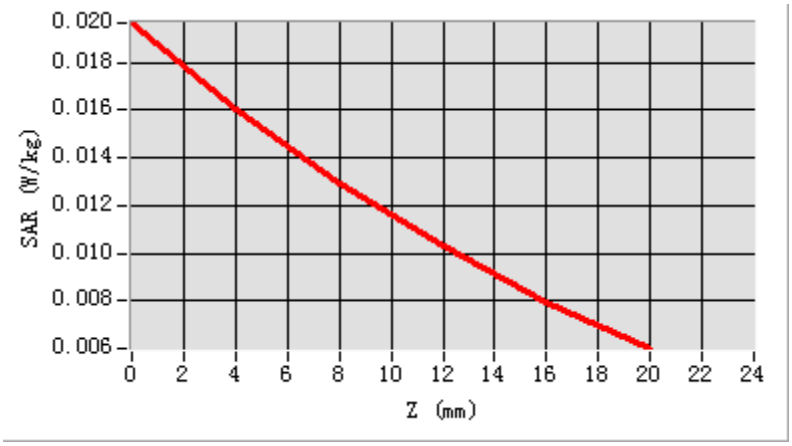
Frequency (MHz)	836.6
Relative permittivity (real part)	55.16
Relative permittivity (imaginary part)	21.12
Conductivity (S/m)	0.98
Variation (%)	0.870000
ConvF:	5.68

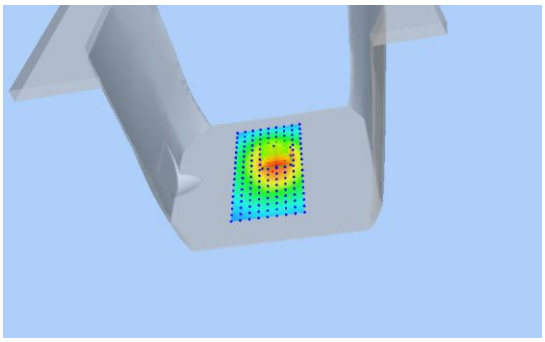
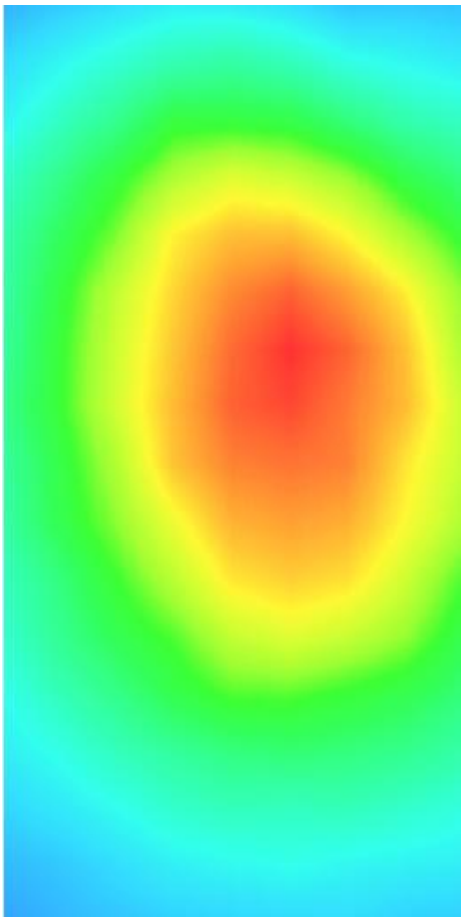
SURFACE SAR	VOLUME SAR
	

Maximum location: X=5.00, Y=17.00

SAR 10g (W/Kg)	0.011413
SAR 1g (W/Kg)	0.018191

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.0197	0.0161	0.0129	0.0103	0.0080



3D screen shot	Hot spot position
	

GSM1900, Right Cheek, Middle

Type: Phone measurement (11 points in the volume)

Date of measurement: 25/03/2015

Measurement duration: 7 minutes 37 seconds

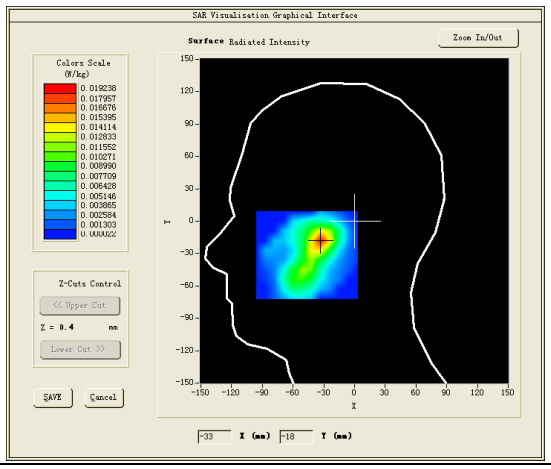
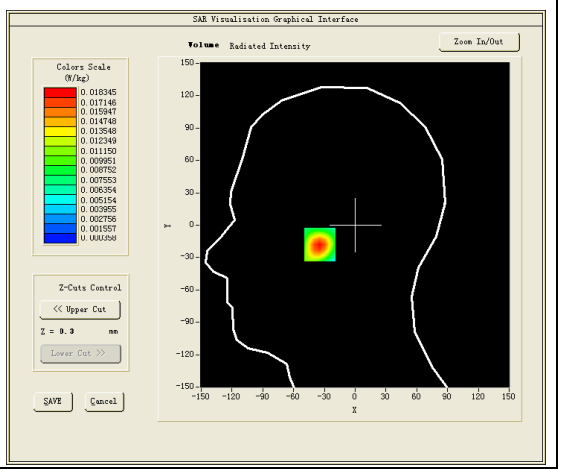
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	sam_direct_droit2_surf8mm.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Right head
Device Position	Cheek
Band	GSM1900
Channels	661
Signal	GSM (Duty cycle: 1:8)

B.SAR Measurement Results

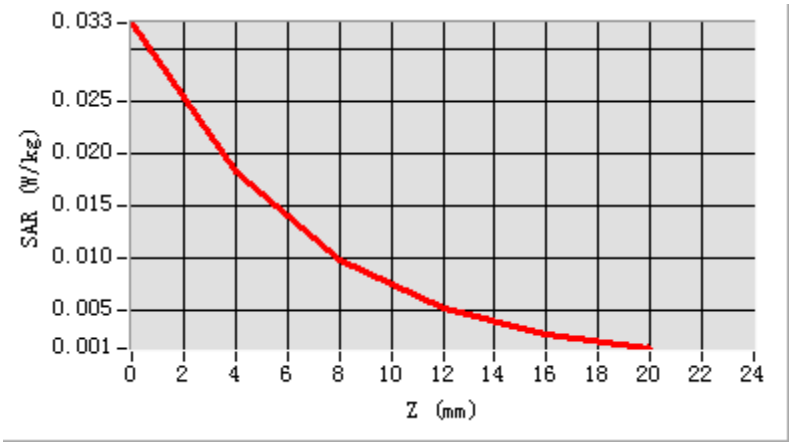
Frequency (MHz)	1880
Relative permittivity (real part)	39.87
Relative permittivity (imaginary part)	13.36
Conductivity (S/m)	1.41
Variation (%)	-4.530000
ConvF:	5.49

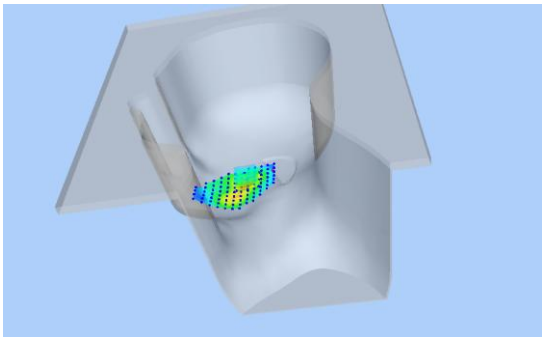
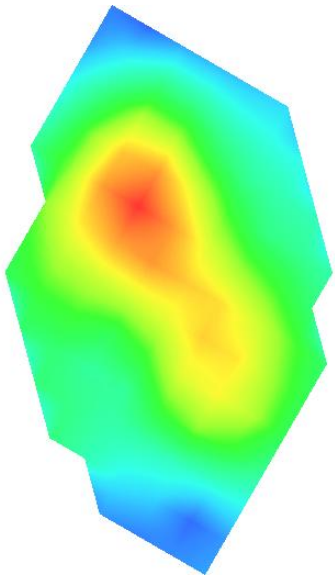
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-33.00, Y=-18.00

SAR 10g (W/Kg)	0.008024
SAR 1g (W/Kg)	0.016806

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.0325	0.0183	0.0099	0.0053	0.0028



3D screen shot	Hot spot position
	

GSM1900, Back, Middle

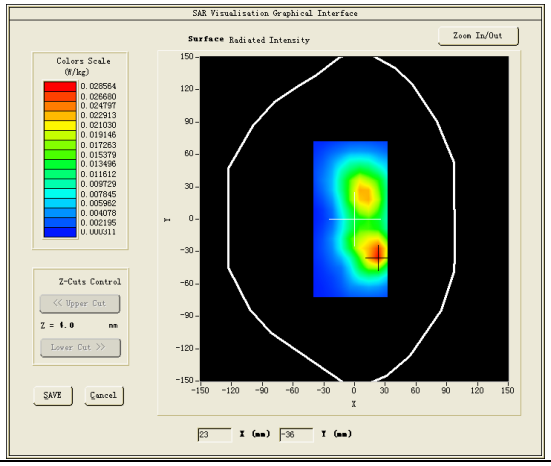
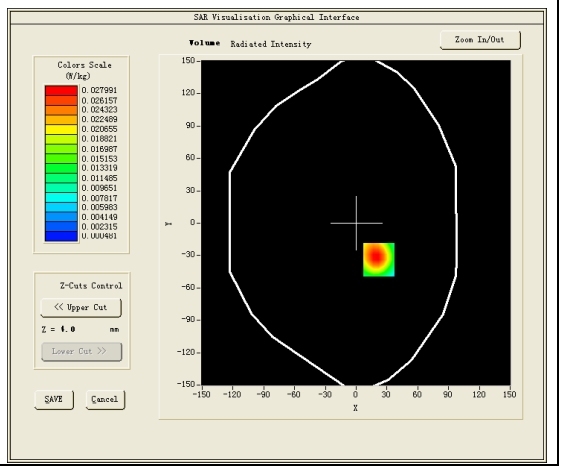
Type: Phone measurement (11 points in the volume)
Date of measurement: 25/03/2015
Measurement duration: 6 minutes 52 seconds
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	dx=8mm dy=8mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Back
Band	GSM1900
Channels	661
Signal	GSM (Duty cycle: 1:8)

B. SAR Measurement Results

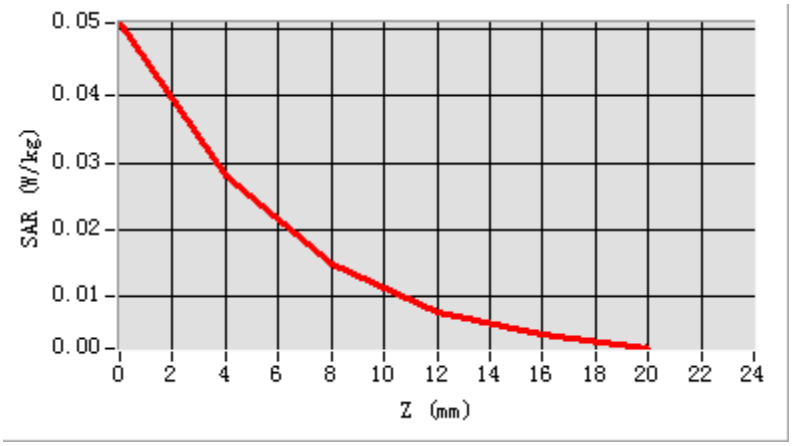
Frequency (MHz)	1880.0
Relative permittivity (real part)	53.23
Relative permittivity (imaginary part)	14.49
Conductivity (S/m)	1.53
Variation (%)	-2.960000
ConvF:	5.65

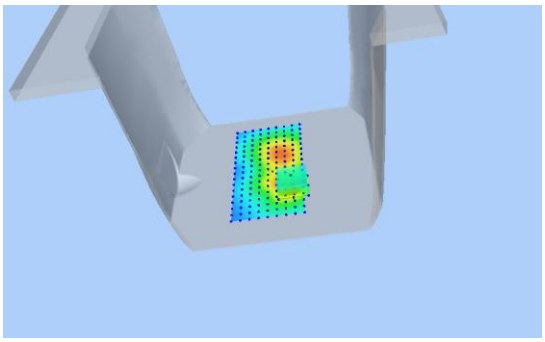
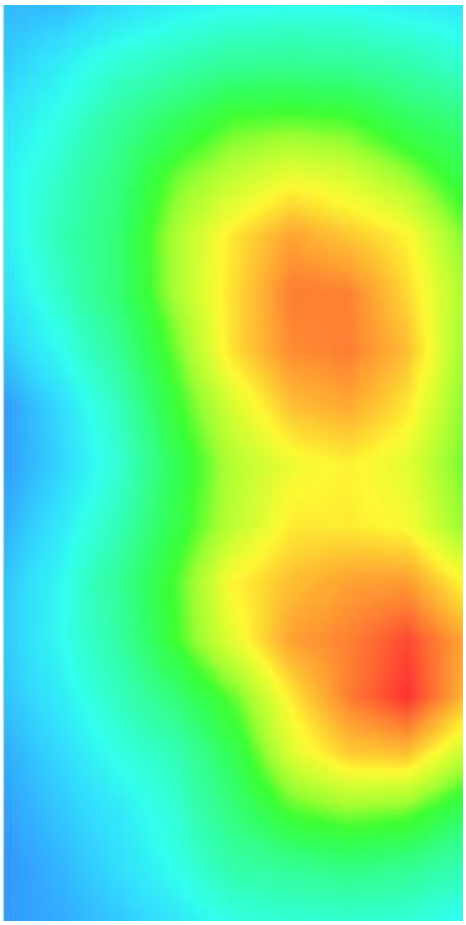
SURFACE SAR	VOLUME SAR
	

Maximum location: X=22.00, Y=-34.00

SAR 10g (W/Kg)	0.013194
SAR 1g (W/Kg)	0.026988

Z (mm)	0.00	4.00	8.00	12.00	16.00
SAR (W/Kg)	0.0510	0.0280	0.0147	0.0077	0.0042



3D screen shot	Hot spot position
	

GPRS1900, BACK, Middle

Type: Phone measurement (11 points in the volume)

Date of measurement: 25/03/2015

Measurement duration: 7 minutes 24 seconds

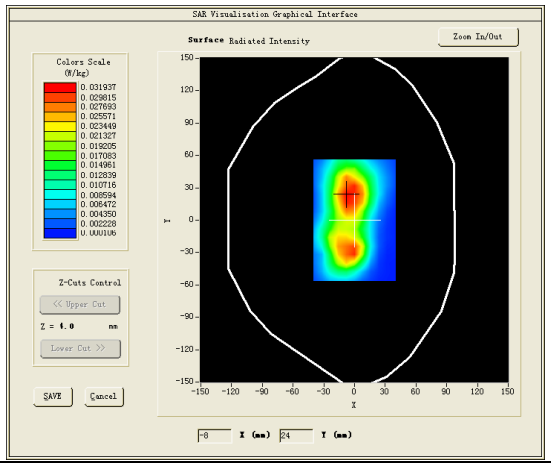
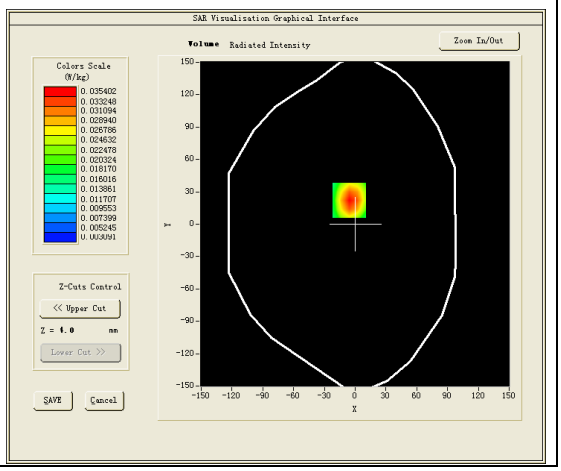
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	surf_sam_plan.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	CUSTOM (GPRS1900_2Tx)
Channels	661
Signal	GPRS (Duty cycle: 1:4)

B. SAR Measurement Results

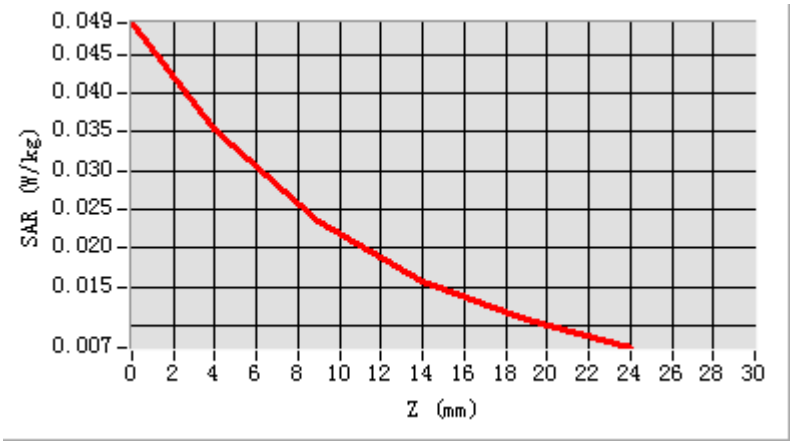
Frequency (MHz)	1880.0
Relative permittivity (real part)	53.23
Relative permittivity (imaginary part)	14.49
Conductivity (S/m)	1.53
Variation (%)	-0.300000
ConvF:	5.65

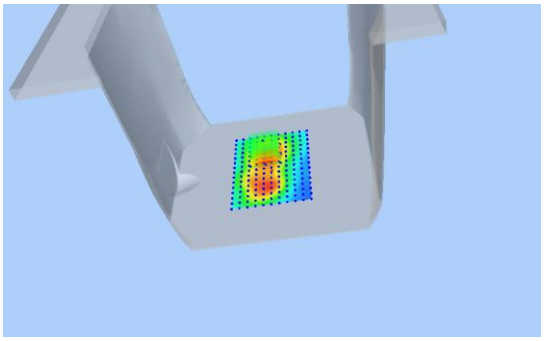
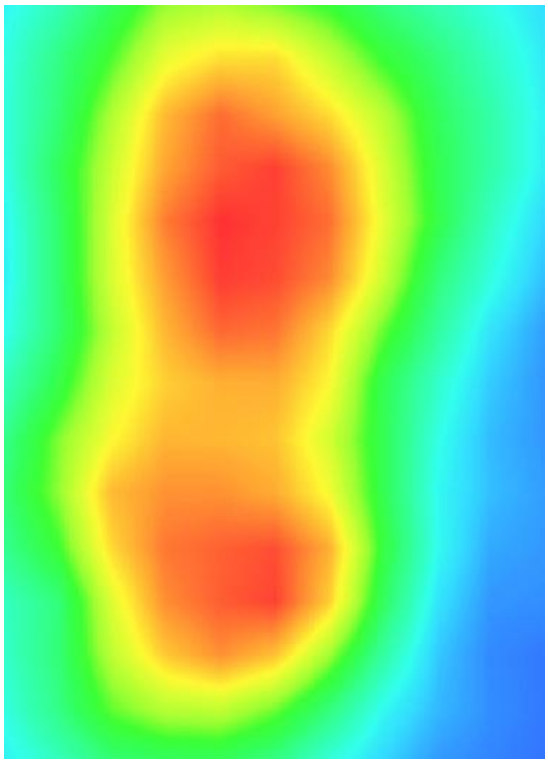
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-6.00, Y=22.00

SAR 10g (W/Kg)	0.020921
SAR 1g (W/Kg)	0.034235

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.0490	0.0354	0.0234	0.0157	0.0107



3D screen shot	Hot spot position
	

ANNEX E

of

CCIC-SET

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-04152

GSM digital mobile phone

Type Name: M220

Hardware Version： **M721C_FS_MB_V0.1**

Software Version： **M721C_LD_SINGLE_CARD_F08_WNRL_V003_20150312**

Calibration Certificate of Probe and Dipoles

This Annex consists of 45 pages

Date of Report：2015-04-08

Probe Calibration Ceriticate

COMOSAR E-Field Probe Calibration Report

Ref : ACR.96.2.14.SATU.A

CCIC SOUTHERN ELECTRONIC PRODUCT TESTING (SHENZHEN) Co., Ltd

ELECTRONIC TESTING BUILDING, SHAHE ROAD, XILI TOWN, SHENZHEN, P.R. CHINA (POST CODE:518055)

SATIMO COMOSAR DOSIMETRIC E-FIELD PROBE

SERIAL NO.: SN 09/13 EP169

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED

04/05/14

Summary:

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed in SATIMO USA using the CALISAR / CALIBAIR test bench, for use with a SATIMO COMOSAR system only. All calibration results are traceable to national metrology institutions.

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	04/05/2014	
Checked by :	Jérôme LUC	Product Manager	04/05/2014	
Approved by :	Kim RUTKOWSKI	Quality Manager	04/08/2014	

	Customer Name
Distribution :	CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd

Issue	Date	Modifications
A	04/08/2014	Initial release

TABLE OF CONTENTS

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	Satimo
Model	SSE5
Serial Number	SN 09/13 EP169
Product Condition (new / used)	new
Frequency Range of Probe	0.7 GHz-3GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.223 MΩ Dipole 2: R2=0.233 MΩ Dipole 3: R3=0.222 MΩ

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

Satimo's COMOSAR E field Probes are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards.

Figure 1 – *Satimo COMOSAR Dosimetric E field Dipole*

Probe Length	330 mm
Length of Individual Dipoles	4.5 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	5 mm
Distance between dipoles / probe extremity	2.7 mm

3 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.

3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 - 360 degrees in 15 degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.5 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the probe calibration in waveguide

ERROR SOURCES	Uncertainty value (%)	Probability Distribution	Divisor	ci	Standard Uncertainty (%)
Incident or forward power	3.00%	Rectangular	$\sqrt{3}$	1	1.733%
Reflected power	3.00%	Rectangular	$\sqrt{3}$	1	1.733%
Liquid conductivity	5.00%	Rectangular	$\sqrt{3}$	1	2.886%
Liquid permittivity	4.00%	Rectangular	$\sqrt{3}$	1	2.310%
Field homogeneity	3.00%	Rectangular	$\sqrt{3}$	1	1.733%
Field probe positioning	5.00%	Rectangular	$\sqrt{3}$	1	2.886%
Field probe linearity	3.00%	Rectangular	$\sqrt{3}$	1	1.733%

Combined standard uncertainty					5.832%
Expanded uncertainty 95 % confidence level k = 2					12.1%

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	23 °C
Lab Temperature	23 °C
Lab Humidity	58 %

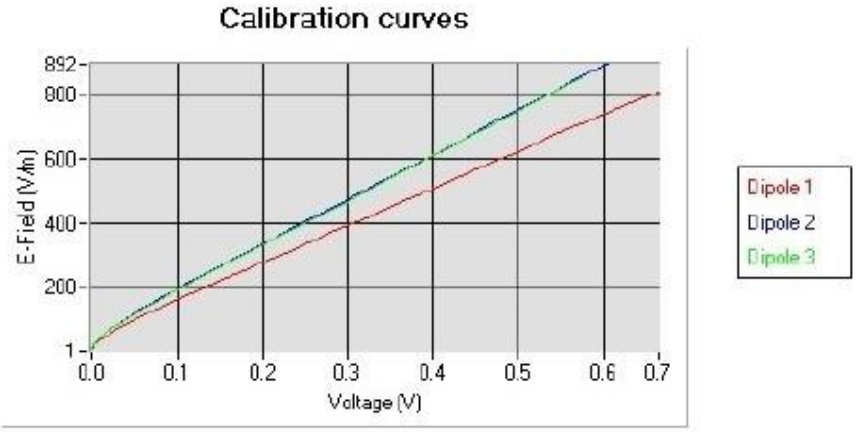
5.1 SENSITIVITY IN AIR

Normx dipole 1 (μV/(V/m)^2)	Normy dipole 2 (μV/(V/m)^2)	Normz dipole 3 (μV/(V/m)^2)
7.23	6.10	5.74

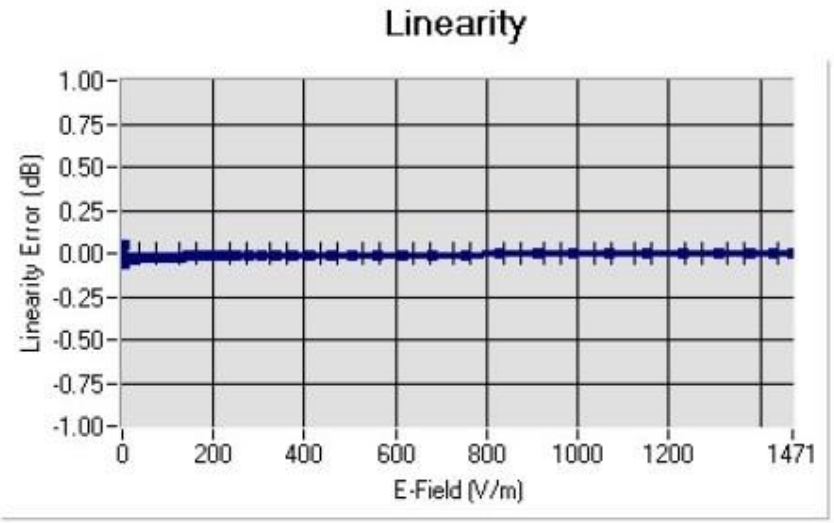
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
93.2	93.1	90.2

Calibration curves ei=f(V) (i=1,2,3) allow to obtain H-field value using the formula:

$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



5.2 LINEARITY



Linearity: +/-1.42% (+/-0.06dB)

5.3 SENSITIVITY IN LIQUID

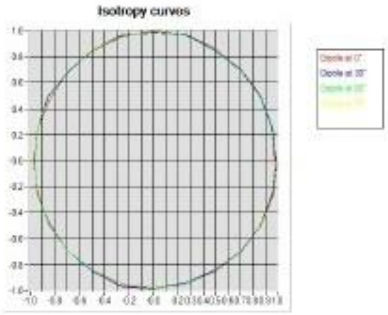
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL850	835	42.56	0.87	5.51
BL850	835	55.26	0.97	5.68
HL900	900	41.79	0.97	5.20
BL900	900	55.98	1.05	5.33
HL1800	1750	40.17	1.39	4.80
BL1800	1750	52.05	1.49	4.94
HL1900	1880	39.80	1.45	5.49
BL1900	1880	52.55	1.52	5.65
HL2000	1950	38.93	1.42	4.80
BL2000	1950	53.12	1.50	5.02
HL2450	2450	38.64	1.83	4.81
BL2450	2450	52.02	1.95	4.91

LOWER DETECTION LIMIT: 9mW/kg

5.4 ISOTROPY

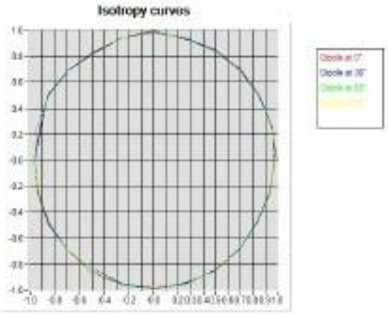
HL900 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.04 dB



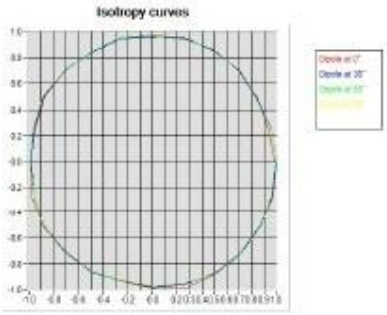
HL1800 MHz

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.06 dB



HL2450 MHz

- Axial isotropy: 0.07 dB
- Hemispherical isotropy: 0.08 dB



6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Reference Probe	Satimo	EP 94 SN 37/08	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Multimeter	Keithley 2000	1188656	11/2013	11/2016
Signal Generator	Agilent E4438C	MY49070581	12/2013	12/2016
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2013	11/2016
Power Sensor	HP ECP-E26A	US37181460	11/2013	11/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	11-661-9	3/2014	3/2016

SID835 Dipole Calibration Ceriticate

SAR Reference Dipole Calibration Report

Ref : ACR.240.1.14.SATU.A

CCIC SOUTHERN ELECTRONIC PRODUCT TESTING (SHENZHEN) CO., LTD

ELECTRONIC TESTING BUILDING, SHAHE ROAD, XILI TOWN

SHENZHEN, P.R. CHINA (POST CODE:518055)

SATIMO COMOSAR REFERENCE DIPOLE

FREQUENCY: 835 MHZ

SERIAL NO.: SN 09/13 DIP0G835-217

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED

Calibration CERT #2246-02

08/28/14

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

SATIMO

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.240.1.14.SATU.A

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	8/29/2014	
Checked by :	Jérôme LUC	Product Manager	8/29/2014	
Approved by :	Kim RUTKOWSKI	Quality Manager	8/29/2014	

	Customer Name
Distribution :	CCIC SOUTHERN ELECTRONIC PRODUCT TESTING (SHENZHEN) Co., Ltd

Issue	*Date*	*Modifications*
A	8/29/2014	Initial release

TABLE OF CONTENTS

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 835 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID835
Serial Number	SN 09/13 DIP0G835-217
Product Condition (new / used)	used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.

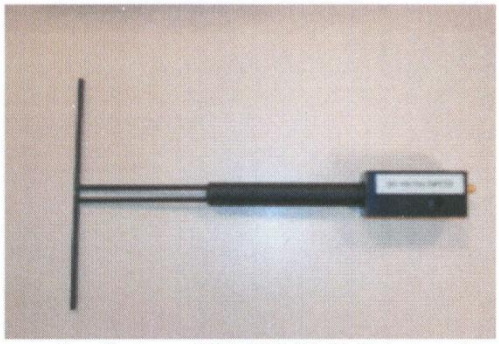


Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constucted as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %