SAR TEST REPORT

Report No.:	SET2015-00532
Product Name:	Android Moblie Data Terminal
Model No.:	Z-220X
Brand Name:	ZEBEX
FCC ID:	**JNF-Z-220X**
Applicant:	ZEBEX INDUSTRIES INC.
Address:	B1-1,NO.207 SEC3,BEIXIN ED,XINDIAN DIST,NEW TAIPEI CITY 23142,TAIWAN.
Issued by:	CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.
Lab Location:	Electronic Testing Building, Shahe Road，Xili, Nanshan District, Shenzhen, 518055, P. R. China.
Tel:	86 755 26627338 Fax：86 755 26627238
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Test Report

Product...................................: Android Moblie Data Terminal
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FCC ID…………..…………...: **JNF-Z-220X**
Applicant……………………...: ZEBEX INDUSTRIES INC.
Applicant Address…………..: B1-1,NO.207 SEC3,BEIXIN ED,XINDIAN DIST,NEW TAIPEI CITY 23142,TAIWAN.

Manufacturer…………………: Mexxen Technology(ShangHai)INC.
Manufacturer Address……...: Unit B,12F,Building 11,No. 518,xinzhuan Rd., Songjiang District,Shanghai,China.
Rating ....: 5Vdc 1000mA(Charger) or 3.7V 3500mAh(Battery)

Test Standards………………..: IEEE Std. 1528-2013, 47CFR § 2.1093, ANSI C95.1–1999, FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)

Maximum SAR : **Body(1g):0.191W/Kg**

Test Result……………………: Pass

Tested by ……………………..: 2014-12-19
Signature, Date

Reviewed by………………….: 2015-01-05
Signature, Date

Approved by………………….: 2015-01-05
Signature, Date

Contents

1. GENERAL CONDITIONS

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

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

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2. Administrative Date

2.1. Identification of the Responsible Testing Laboratory

Company Name:	CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.
Department:	EMC & RF Department
Address:	Electronic Testing Building, Shahe Road, Nanshan District, ShenZhen, P. R. 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 Southern Electronic Product Testing (Shenzhen) Co., Ltd.
Address:	Electronic Testing Building, Shahe Road, Nanshan District, Shenzhen, P. R. China

2.3. Organization Item

CCIC-SET Report No.:	SET2015-00532
CCIC-SET Project Leader:	Mr. Li Sixiong
CCIC-SET Responsible for accreditation scope:	Mr. Wu Li’an
Start of Testing:	2014-12-19
End of Testing:	2014-12-19

2.4. Identification of Applicant

Company Name:	ZEBEX INDUSTRIES INC.
Address:	B1-1,NO.207 SEC3,BEIXIN ED,XINDIAN DIST,NEW TAIPEI CITY 23142,TAIWAN.

2.5. Identification of Manufacture

Company Name:	Mexxen Technology(ShangHai)INC.
Address:	Unit B,12F,Building 11,No. 518,xinzhuan Rd., Songjiang District,Shanghai,China.

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

3. General Information

3.1. Description Of Equipment Under Test (EUT)

<table>
<tr><td>Sample Name:</td><td colspan="2">Android Moblie Data Terminal</td></tr>
<tr><td>Type Name:</td><td colspan="2">Z-220X</td></tr>
<tr><td>Brand Name:</td><td colspan="2">ZEBEX</td></tr>
<tr><td>Mobile phone capability</td><td colspan="2">Class B</td></tr>
<tr><td>Simultaneous transmission</td><td colspan="2">WLAN transmit simultaneously with Bluetooth</td></tr>
<tr><td rowspan="6">General description:</td><td>Support Band and Frequency Range</td><td>WLAN 2.4GHz: 2412MHz-2462MHz
Bluetooth: 2402MHz-2480MHz
NFC:13.56MHz</td></tr>
<tr><td>Development Stage</td><td>Identical Prototype</td></tr>
<tr><td>Accessories</td><td>Power Supply</td></tr>
<tr><td>Battery specification</td><td>3500mAh 3.7V</td></tr>
<tr><td>Antenna type</td><td>PIFA antenna and FPCB antenna</td></tr>
<tr><td>Modulation mode</td><td>DSSS, OFDM, GFSK/8-DPSK, ASK</td></tr>
</table>

NOTE:

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

4 Specific Absorption Rate (SAR)

4.1 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.

4.2 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:

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

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

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

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

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

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

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.

4.3 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).

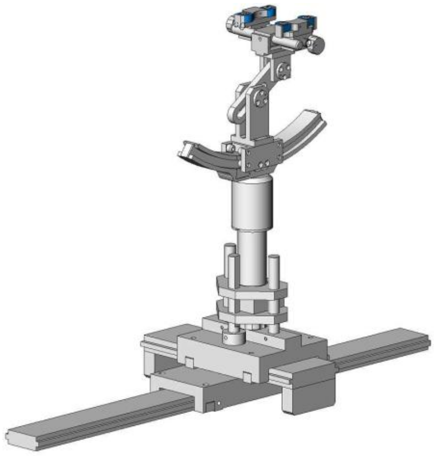
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM Twin Phantom

4.4 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

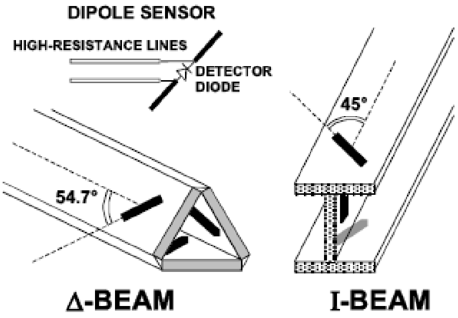
4.5 Probe Specification

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:



5 OPERATIONAL CONDITIONS DURING TEST

5.1 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 WIFI 802.11b. 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

5.2 SAR Measurement System

The SAR measurement system being used is the DASY4 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.

5.2.1 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	41.45	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

5.2.2 Simulant liquids

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 Wi-Fi 2.4GHz, which are made mainly of sugar, salt and water solutions may be left in the phantoms.

Table 3: Dielectric Performance of Body Tissue Simulating Liquid

Temperature: 22.5°C; Humidity: 64%;			
/	Frequency	Permittivity ε	Conductivity σ (S/m)
Target value	2450MHz	52.02	1.95
Validation value (Dec. 19th,2014)	2450MHz	52.26	1.93

Fig. 1 Configuration of body tissue

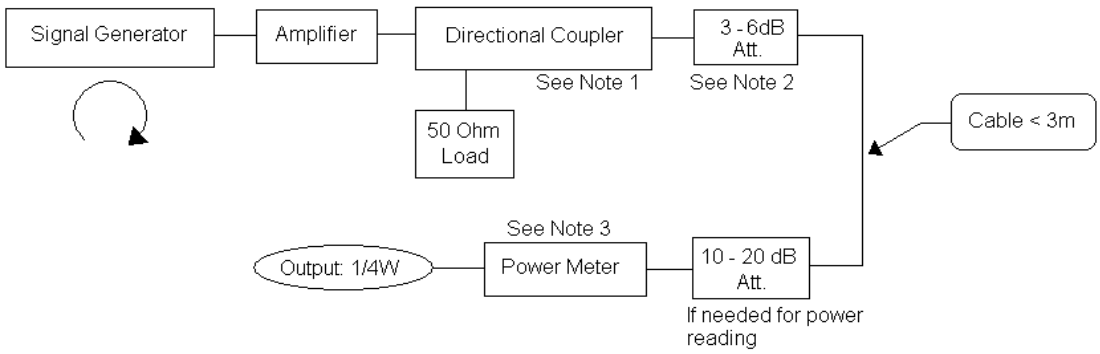
5.2.3 Equipments and results of validation testing

Important equipments :

Equipment description	Manufacturer/Model	Identification No.
System Simulator	E5515C	GB 47200710
SAR Probe	SATIMO	SN 09/13 EP169
Dipole	SID2450	SN 09/13 DIP 2G450-220
Vector Network Analyzer	ZVB8	A0802530
Signal Generator	SMR27	A0304219
Amplifier	Nucletudes	143060
Power Meter	NRVS	1020.1809.02
Power Sensor	NRV-Z4	100069
Multimeter	Keithley-2000	4014020
Device Holder	SATIMO	SN 09/13 MSH80
SAM Phantom	SAM97	SN 09/13 SAM97

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 draft IEEE standard P1528. 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 5 and Table 6. 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.

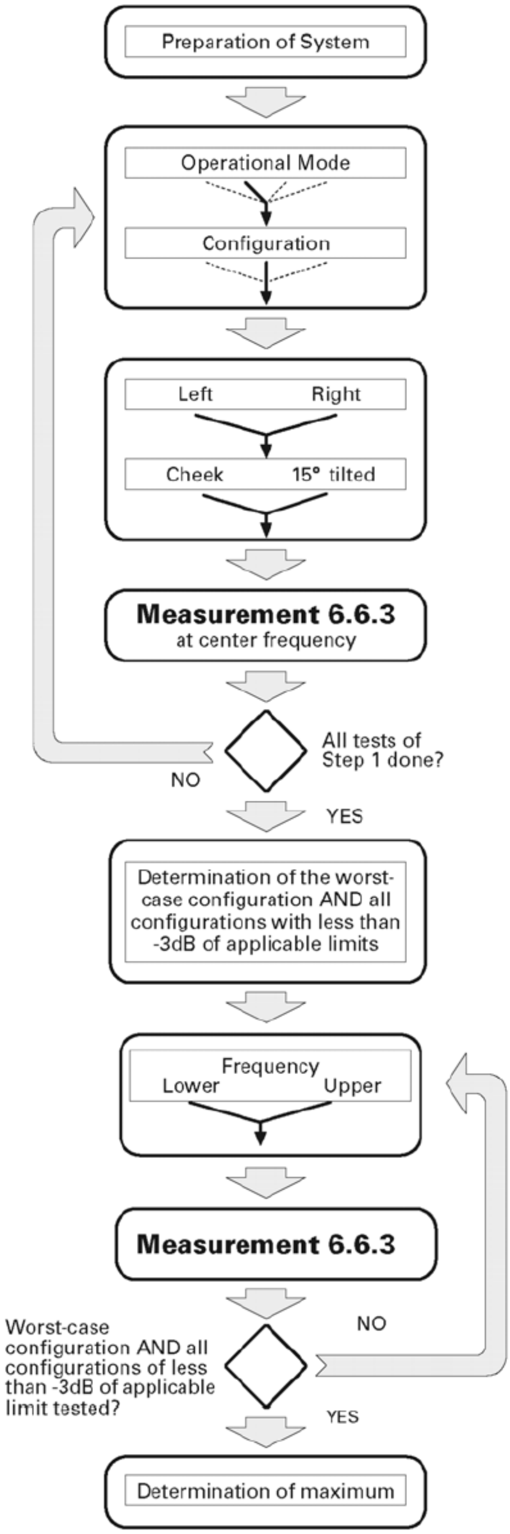
The distance between the back of the EUT and the bottom of the flat phantom is 10 mm (taking into account of the IEEE 1528-2013 and the place of the antenna).

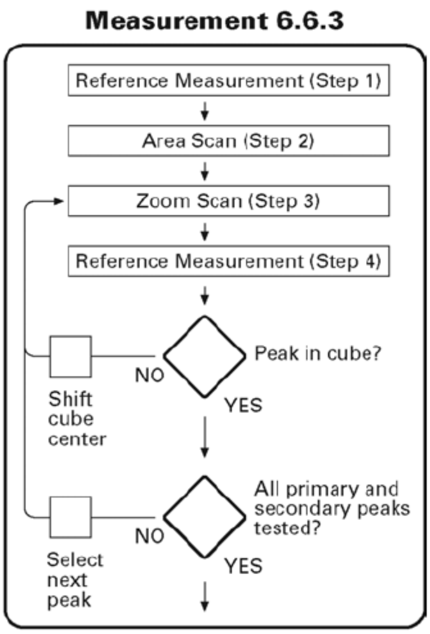
Table 4: Body Liquid Verification Results (1g)

Frequency	Duty cycle	Target value （W/kg）	Test value (W/kg)	
			250 mW	1W
2450MHz (September 19th, 2013)	1:1	52.66	13.22	52.88

5.2.4 SAR measurement procedure

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





The SAR test against the body-worn was carried out as follow:

The EUT was controlled to operate in 802.11b mode in channel 6 and 802.11g channel 6 with the maximum output power.

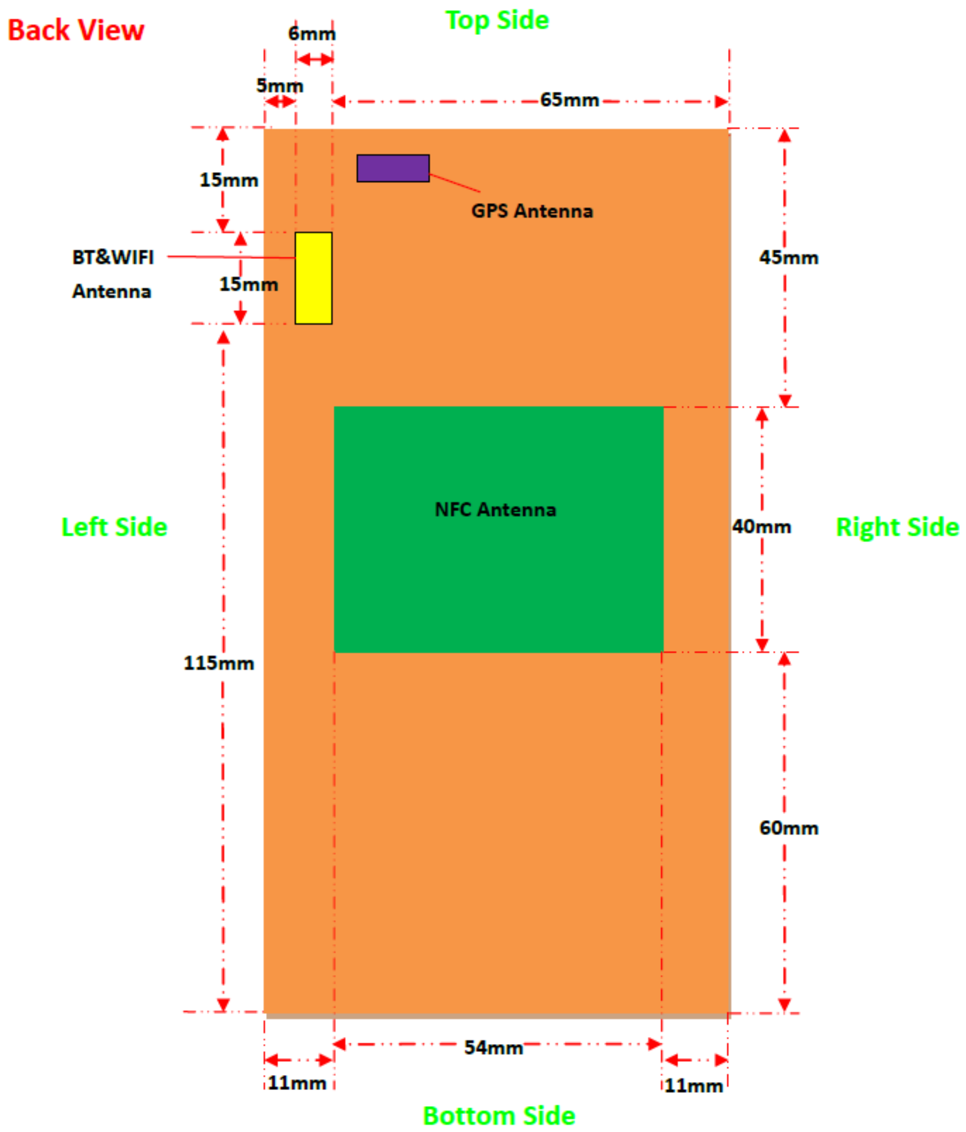
After an area scan has been done at a fixed distance of 8mm from the surface of the phantom on the source side, a 3D scan is set up around the location of the maximum spot SAR. First, a point within the scan area is visited by the probe and a SAR reading taken at the start of testing. At the end of testing, 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.

The same procedure should be also executed for 802.11b/802.11g mode in channel 1 and 11.

Above is the scanning procedure flow chart and table from the IEEE1528-2013 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.

5.2.5 Transmitting antenna information

There are three antennas (WLAN/BT antenna, NFC antenna and GPS antenna) inside the EUT, the former two antennas are the transmitting source, and they are types of PIFA antenna and FPCB antenna, the following picture shows the position of the antennas.



Note 1: The GPS antenna is charged for receive, the SAR result would not be affected by them.

Antennas	Wireless Interface
Bluetooth Antenna <Tx / Rx>	Bluetooth
WLAN Antenna <Tx / Rx>	WLAN 2.4GHz Band

6 CHARACTERISTICS OF THE TEST

6.1 Applicable Limit Regulations

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

FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01): Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields;

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz;

IEEE 1528–2013: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques;

It specifies the maximum exposure limit of **1.6 W/kg** as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

6.2 Applicable Measurement Standards

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this is in accordance with the following standards:

FCC 47 CFR Part2 (2.1093)
FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)
ANSI/IEEE C95.1-1992
IEEE 1528-2003
IC RSS 102 Issue 4
FCC KDB 447498 D02 v01r01 Dipole Requirements for SAR System Validation and Verification
FCC KDB 447498 D01 v05r02 General RF Exposure Guidance v05r01
FCC KDB 616217 D04 SAR for laptop and tablets v01r01
FCC KDB 648474 D04 v01r02 SAR Evaluation Considerations for Wireless Handsets
FCC KDB 248227 D01 v01r02 SAR Measurement Procedures-802.11a/b/g Transmitters
FCC KDB 865664 D01 v01r03 SAR Measurement 100MHz to 6GHz
FCC KDB 865664 D02 v01r01 SAR Reporting

7 LABORATORY ENVIRONMENT

7.1 The Ambient Conditions during SAR Test

Temperature	Min. = 15 °C, Max. = 30 °C
Atmospheric pressure	Min.=86 kPa, Max.=106 kPa
Relative humidity	Min. = 30%, Max. = 70%
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.	

7.2 Test Configuration

During WLAN SAR testing EUT is configured with the WLAN continuous TX tool, and the transmission duty factor was monitored on the spectrum analyzer with zero-span setting

Duty factor observed as below:

WLAN 2.4GHz 802.11b, 1Mbps:97.5%

For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal.

8.Conducted RF Output Power

8.1 WLAN 2.4GHz Band Conducted Power

Channel	Frequency (MHz)	WIFI Output Average Power(dBm)		
		802.11b	802.11g	802.11n-20
CH 01	2412	16.82	17.03	16.58
CH 06	2437	16.81	16.98	16.67
CH 11	2462	17.01	17.21	16.35

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion
2. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at lowest data rate
3. Per KDB 248227 D01 v01r02, 802.11g /11n-HT20 is not required, for the maximum average output power is less than 1/4dB higher than measured on the corresponding 802.11b mode. Thus the SAR can be excluded.

Bluetooth Conducted Power

Channel	Frequency (MHz)	BT2.0 Output Average Power(dBm)		
		GFSK	Π /4-DQPSK	8-DPSK
CH 0	2402	2.156	0.195	0.286
CH 39	2441	**2.508**	0.785	0.965
CH 78	2480	2.411	0.089	0.171

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
4	2.512	5	2.441	0.785

2. Per KDB 447498 exclusion thresholds is 0.785<3, RF exposure evaluation is not required.

8.2 NFC Band Power

Channel	Frequency(MHz)	Output Average Power(dBm)
/	13.56	0.28

9. SAR DATA SUMMARY

9.1 Standalone Body Worn SAR DATA

WLAN SAR DATA:

Band	Mode	Test Position	Ch	Freq. MHz	Average Power (dBm)	Tune -up Limit dBm	Scaling Factor	Duty Cycle %	Duty Cycle compensate	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
WLAN 2.4GHz	802.11b	Front	11	2462	17.01	20	1.43	97.5	1.026	0.038	0.085
		Back	11	2462	17.01	20	1.43	97.5	1.026	0.061	0.153
		Top Side	11	2462	17.01	20	1.43	97.5	1.026	0.016	0.038
		Right Side	11	2462	17.01	20	1.43	97.5	1.026	0.075	**0.183**

Band	Mode	Test Position	Ch	Freq. MHz	Average Power (dBm)	Tune -up Limit dBm	Scaling Factor	Duty Cycle %	Duty Cycle compen sate	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
WLAN 2.4GHz	802.11g	Front	11	2462	17.21	20	1.41	97.5	1.026	0.040	0.093
		Back	11	2462	17.21	20	1.41	97.5	1.026	0.076	0.164
		Top Side	11	2462	17.21	20	1.41	97.5	1.026	0.037	0.052
		Left Side	11	2462	17.21	20	1.41	97.5	1.026	0.082	**0.191**

General Note:

1. Per KDB 447498 D01v05r01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power(mW)/EUT RF power(mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle , the measured SAR is scaled-up by the duty cycle scaling factor which is equal to “1/(duty cycle)”
   c. For WWAN: Reported SAR(W/kg)=Measured SAR(W/kg)*Tune-up Scaling Factor
2. Per KDB 447498 D01v05r01, for each exposure position, if the highest output channel reported SAR≤0.8W/kg, other channels SAR testing is not necessary.
3. Body-worn SAR testing was performed at 0mm separation, and this distance is determined by the handset manufacturer that there will be body-worn accessories with the required minimum separation.
4. Per KDB 648474 D04v01r01,when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤1.2W/kg, SAR testing with a headset connected to the handset is not required.
5. Per KDB 865664 D01V01r01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg
6. Simultaneous Transmission Analysis
   :

Simultaneous Transmission Configurations	Portable Handset Exposure positions
	Body-worn
Bluetooth + WLAN 2.4GHz	NO

10 Measurement Uncertainty

Table 5:Measurement Uncertainty according to IEEE 1528

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	6	N	1	1	3.5	∞
2	—Axial isotropy	B	4.7	R	1.732	1	2.7	∞
3	—Hemispherical Isotropy	B	9.4	R	1.732	1	5.4	∞
4	—Boundary Effect	B	11.0	R	1.732	1	6.4	∞
5	—Linearity	B	4.7	R	1.732	1	2.7	∞
6	—System Detection Limits	B	1.0	R	1.732	1	0.6	∞
7	—Readout Electronics	B	1.0	N	1	1	1.00	∞
8	—Response Time	B	0.00	R	1.732	1	0.00	∞
9	—Integration Time	B	0.00	R	1.732	1	0.00	∞
10	—RF Ambient Conditions	B	3.0	R	1.732	1	1.73	∞
11	—Probe Position Mechanical tolerance	B	0.4	R	1.732	1	0.2	∞
12	—Probe Position with respect to Phantom Shell	B	2.9	R	1.732	1	1.7	∞
13	—Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation	B	3.9	R	1.732	1	2.3	∞

	Uncertainties of the DUT							
14	—Position of the DUT	A	4.8	N	1	1	4.8	5
15	—Holder of the DUT	A	7.1	N	1	1	7.1	5

16	—Output Power Variation –SAR drift measurement	B	5.0	R	1.732	1	2.9	∞
	Phantom and Tissue Parameters							
17	—Phantom Uncertainty(shape and thickness tolerances)	B	1.0	R	1.732	1	0.6	∞
18	—Liquid Conductivity Target –tolerance	B	5.0	R	1.732	0.6	1.7	∞
19	—Liquid Conductivity –measurement Uncertainty)	B	0.23	N	1	1	0.23	9
20	—Liquid Permittivity Target tolerance	B	5.0	R	1.732	0.6	1.7	∞
21	—Liquid Permittivity –measurement uncertainty	B	0.46	N	1	1	0.46	∞
Combined Standard Uncertainty				RSS			12.92	35.15
Expanded uncertainty (Confidence interval of 95 %)				K=2			25.84	

Table 6:Measurement Uncertainty for Body Worn Test according to IEC 62209-2

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	6	N	1	1	3.5	∞
2	—Isotropy	B	14.1	R	1.732	1	4.1	∞
3	—Hemispherical Isotropy	B	9.4	R	1.732	1	5.4	∞
4	—Boundary Effect	B	11.0	R	1.732	1	6.4	∞
5	—Linearity	B	4.7	R	1.732	1	2.7	∞
6	—System Detection Limits	B	1.0	R	1.732	1	0.6	∞
7	—Readout Electronics	B	1.0	N	1	1	1.00	∞

8	—Response Time	B	0.00	R	1.732	1	0.00	∞
9	—Integration Time	B	0.00	R	1.732	1	0.00	∞
10	—RF Ambient Conditions	B	3.0	R	1.732	1	1.73	∞
11	—Probe Position Mechanical tolerance	B	0.4	R	1.732	1	0.2	∞
12	—Probe Position with respect to Phantom Shell	B	2.9	R	1.732	1	1.7	∞
13	—Post-processing	B	5.0	R	1.732	1	2.9	∞
14	—Probe modulation response	B	0.4	R	1.732	1	0.2	∞

	Uncertainties of the DUT							
15	—Position of the DUT	A	4.8	N	1	1	4.8	5
16	—Holder of the DUT	A	7.1	N	1	1	7.1	5
17	—Power Scaling	B	1.0	R	1.732	1	0.6	∞
18	—Output Power Variation –SAR drift measurement	B	5.0	R	1.732	1	2.9	∞
	Phantom and Tissue Parameters							
19	—Phantom Uncertainty(shape and thickness tolerances)	B	1.0	R	1.732	1	0.6	∞
20	—Liquid Conductivity Target –tolerance	B	5.0	R	1.732	0.6	1.7	∞
21	—Liquid Conductivity –measurement Uncertainty)	B	0.23	N	1	1	0.23	9
22	—Liquid Permittivity Target tolerance	B	5.0	R	1.732	0.6	1.7	∞
23	—Liquid Permittivity –measurement uncertainty	B	0.46	N	1	1	0.46	∞
24	—liquid temperature uncertainty	B	1	N	1	1	1	∞
Combined Standard Uncertainty				RSS			13.12	44.15
Expanded uncertainty (Confidence interval of 95 %)				K=2			26.24	

11 MAIN TEST INSTRUMENTS

No.	EQUIPMENT	TYPE	Series No.	Last Calibratio	Due Date
1	System Simulator	E5515C	GB 47200710	2014/02/23	1 Year
2	SAR Probe	SATIMO	SN 09/13 EP169	2014/04/05	1 Year
3	Dipole	SID835	SN09/13 DIP0G835-217	2014/08/28	1 Year
4	Dipole	SID1800	SN09/13 DIP1G800-216	2014/08/28	1 Year
5	Dipole	SID1900	SN09/13 DIP1G900-218	2014/08/28	1 Year
6	Dipole	SID2450	SN09/13 DIP2G450-220	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	Power Meter	NRVS	1020.1809.02	2014/06/13	1 Year
11	Power Sensor	NRV-Z4	100069	2014/06/10	1 Year
12	Multimeter	Keithley-2000	4014020	2013/01/29	2 Year
13	Device Holder	SATIMO	SN 09/13 MSH80	2014/04/05	1 Year
14	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

SET2015-00532

Android Moblie Data Terminal

Type Name: Z-220X

Hardware Version: V3.0

Software Version: GST_A81_M20_4500XXXX_MUL_V03_20141201

TEST LAYOUT

This Annex consists of 3 pages

Date of Report: 2014-12-29

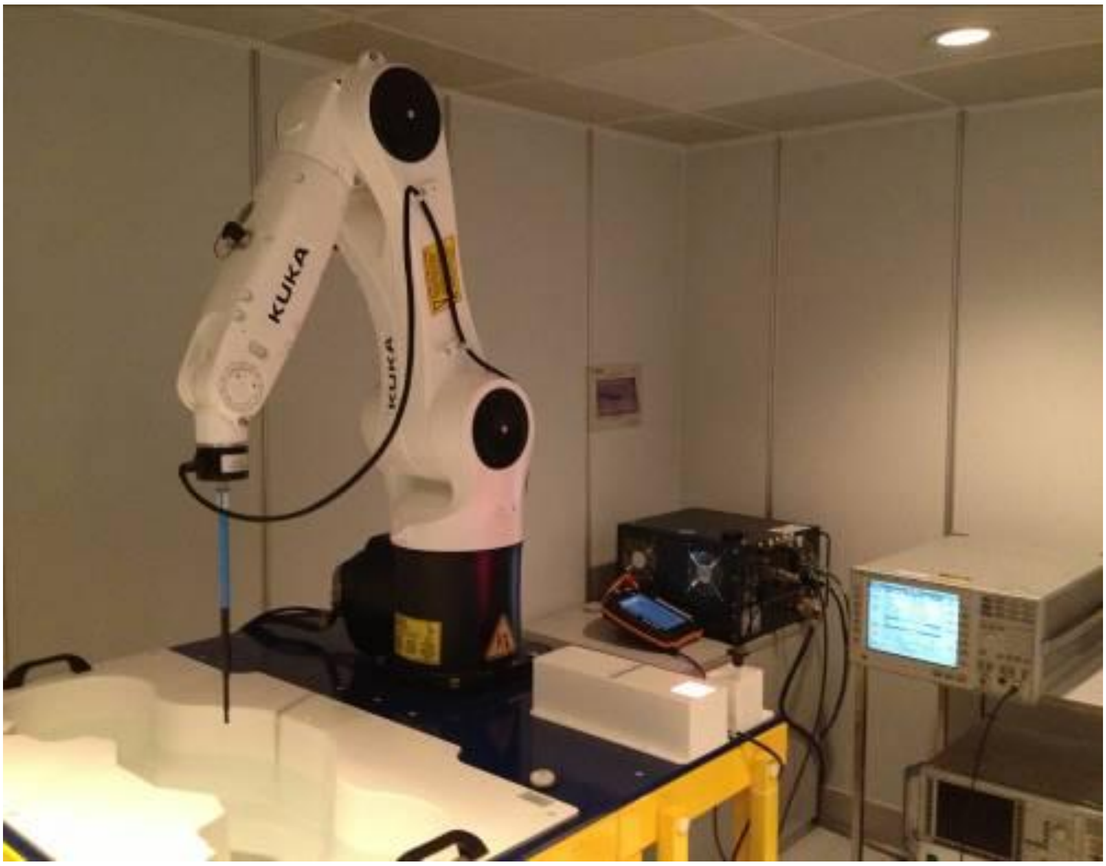


Fig.1 COMO SAR Test System

Fig.2 Body Position (Face Upward)

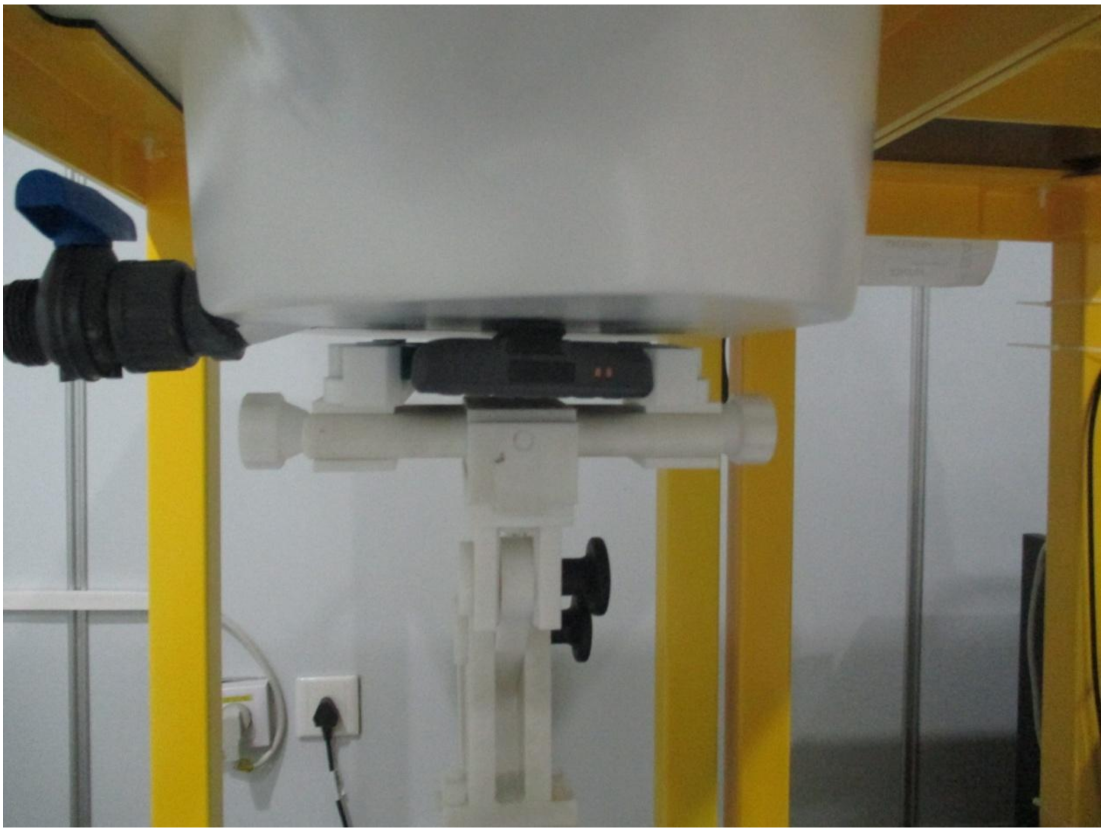


Fig.3 Body Position (Back Upward)

Fig.4 Body Position (Top Side)

Fig.5 Body Position (Right Side)

ANNEX B

of

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

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-00532

Android Moblie Data Terminal

Type Name: Z-220X

Hardware Version: V3.0

Software Version: GST_A81_M20_4500XXXX_MUL_V03_20141201

Sample Photographs

This Annex consists of 5 pages

Date of Report: 2014-12-29

1. Appearance

Appearance and size (obverse)

Appearance and size (reverse)

2. Battery

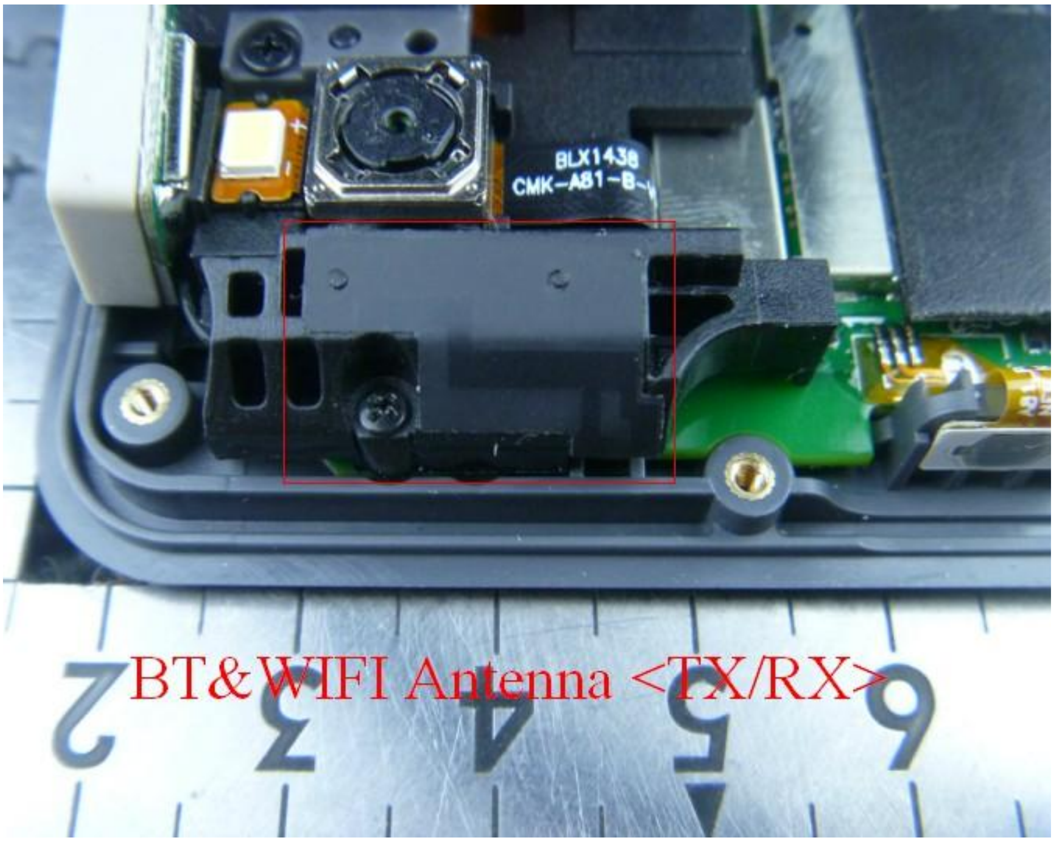

聚合物锂离子电池
Li-Polymer Battery Pack
标称电压：3.7 V
额定容量：3500 mAh
充电限制电压：4.2 V
Nominal Voltage：3.7 V
Rated Capacity：3500 mAh
Charging Voltage limit：4.2V
中山天贸电池有限公司制造
Manufactured by TMB Battery Co.,LTD
S/N:MX521410004298

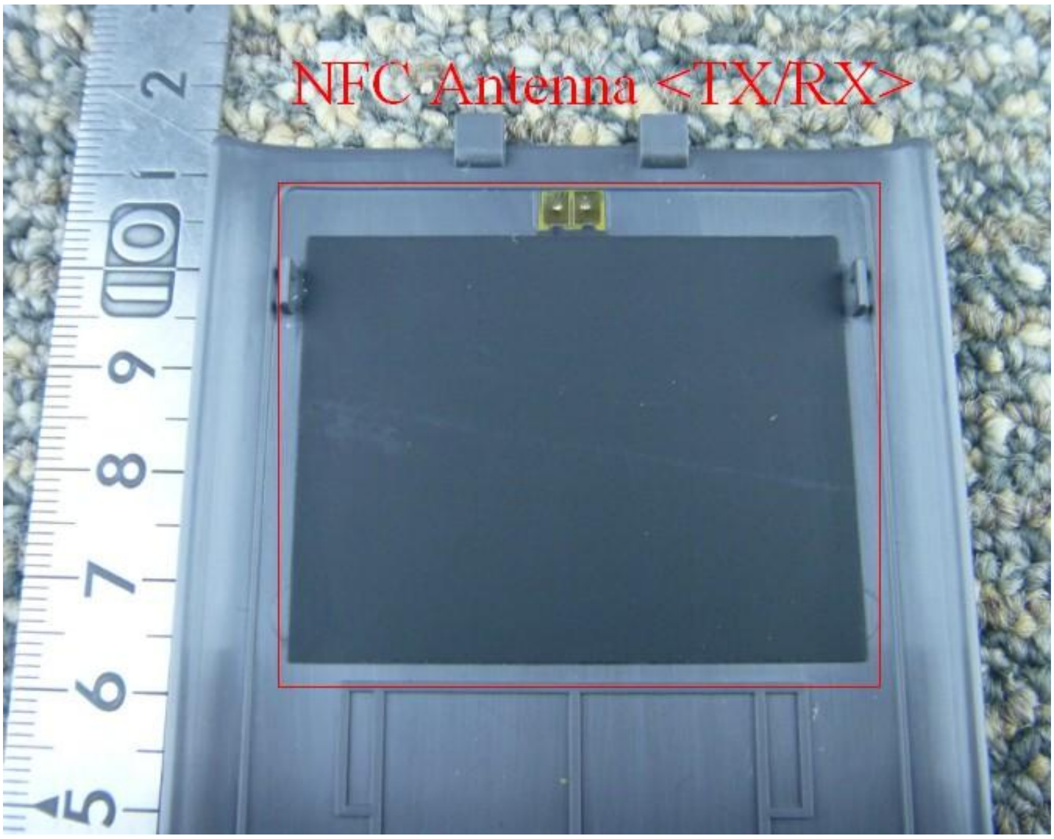

警告 Warning
* 切勿撞击、拆毁、焚烧、加热超过60˚C
或短路电池正负极
* 必须使用指定充电器充电
* 切勿将电池与金属物品一起放置
* 弃于火内将可能引致爆炸
*DO NOT CRUSH, DISASSEMBLE, HEAT ABOVE
60 ℃，SHORT CIRCUIT OR INCINERATE
*USE ONLY WITH THE SPECIFIED CHARGER
*KEEP CONTACTS AWAY FROM METAL PARTS
*MAY EXPLODE IF DISPOSED OF IN FIRE
Made in China

3. Adapter


Tenwei
TRAVEL CHARGER
MODEL:TS22-501000U
INPUT:100-240V~ 50/60Hz 0.2A
OUTPUT:5.0V ⎓ 1000mA
V
1501
LISTED
E247214
I.T.E POWER SUPPLY
JIANGSU TENWEI ELECTRONIC CO., LTD.

4. Position of antennas





ANNEX C

of

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

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-00532

Android Moblie Data Terminal

Type Name: Z-220X

Hardware Version: V3.0

Software Version: GST_A81_M20_4500XXXX_MUL_V03_20141201

System Performance Check Data and Highest SAR Plots

This Annex consists of 4 pages

Date of Report：2014-12-29

System Performance Check (Body, 2450MHz)

Type: Phone measurement (Complete)

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

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

Date of measurement: 19/12/2014

Measurement duration: 12 minutes 55 seconds

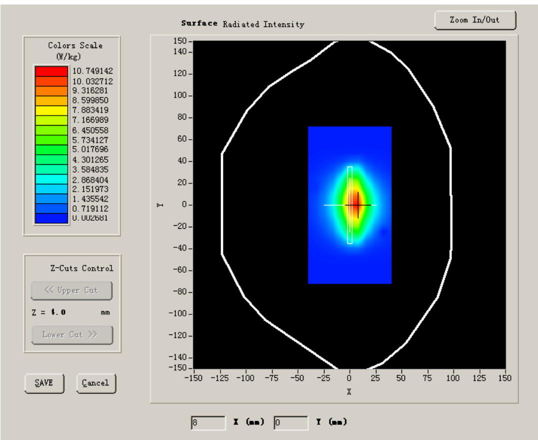
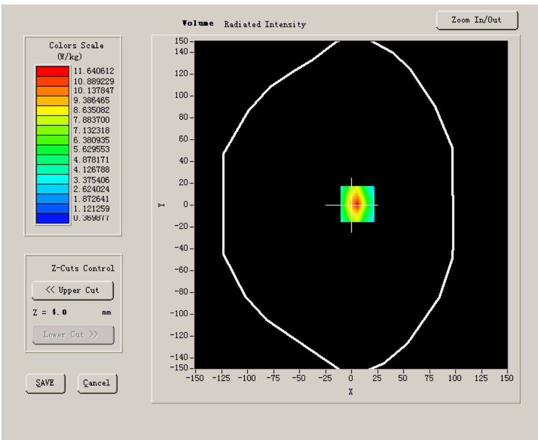
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	
Band	2450MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	2450.000000
Relative permittivity (real part)	52.263753
Relative permittivity	12.991650
Conductivity (S/m)	1.928476
Power Drift (%)	1.080000
Ambient Temperature:	23.2 ℃
Liquid Temperature:	22.8 ℃
Crest factor:	1:1
ConvF	4.91

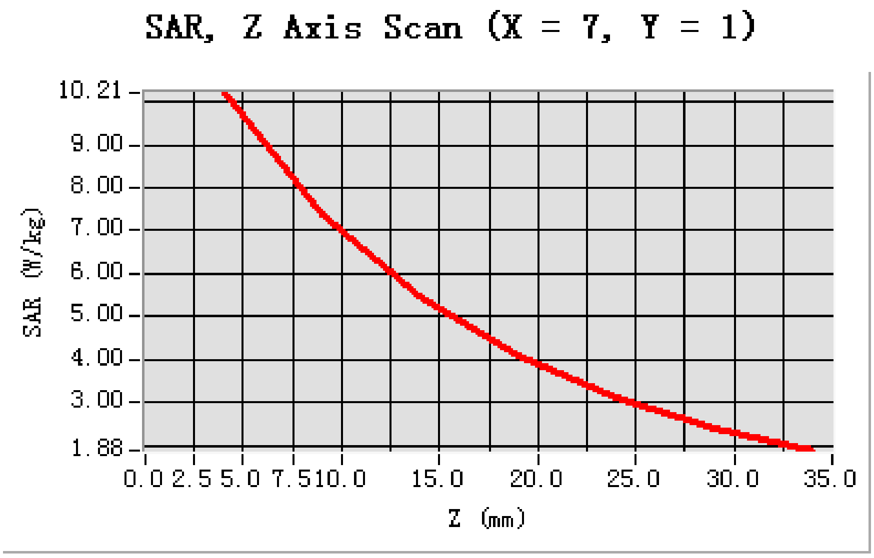
SURFACE SAR	VOLUME SAR
	

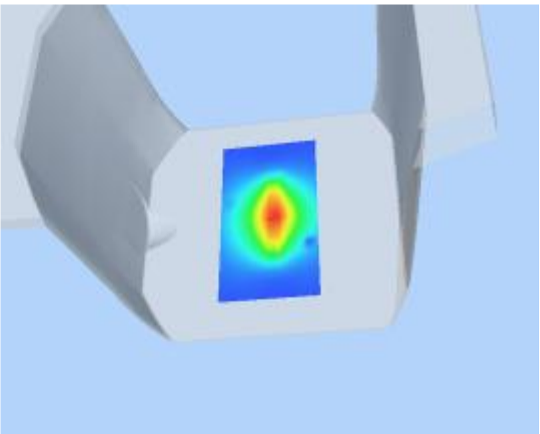
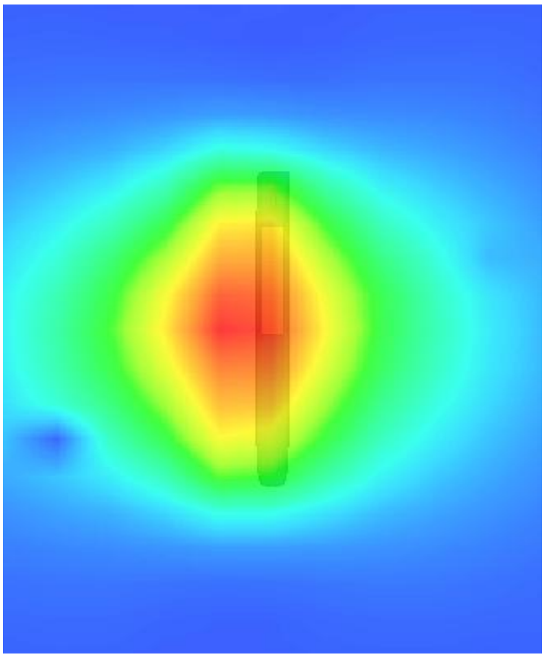
Maximum location: X=7.00, Y=1.00

SAR 10g (W/Kg)	5.924573
SAR 1g (W/Kg)	13.223690

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.0000	13.1279	6.8312	3. 5991	1.3473



3D sceen shot	Hot spot position
	

WIFI 802.11g ,Right Side,High

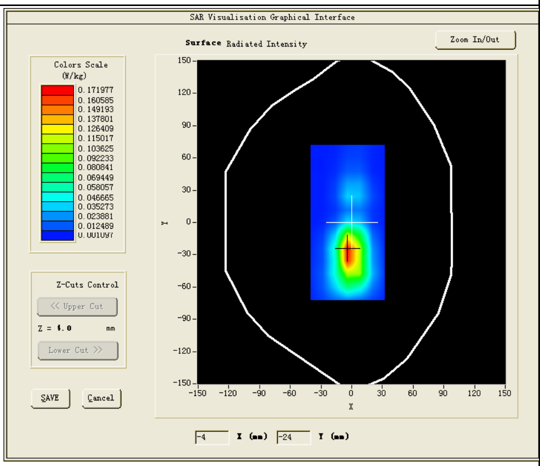
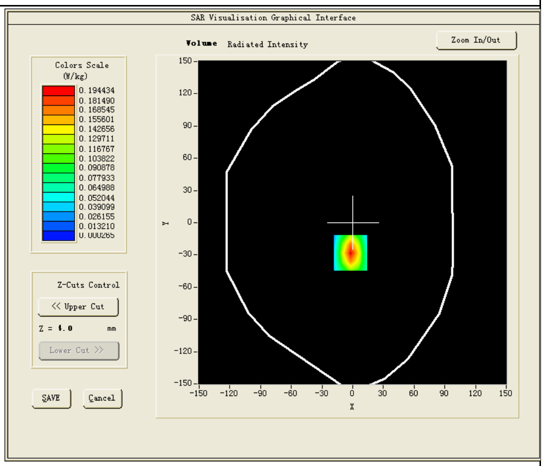
Type: Phone measurement (Very fast, 11 points in the volume)
Date of measurement: 29/12/2014
Measurement duration: 6 minutes 48 seconds
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	**surf_sam_plan.txt, h= 5.00 mm**
ZoomScan	**5x5x7,dx=8mm dy=8mm dz=5mm,Very fast/nsurf_sam_plan.txt, h= 5.00 mm**
Phantom	**Validation plane**
Device Position	**Body**
Band	**IEEE 802.11g ISM**
Channels	**High**
Signal	**IEEE802.b (Crest factor: 1.0)**

B. SAR Measurement Results

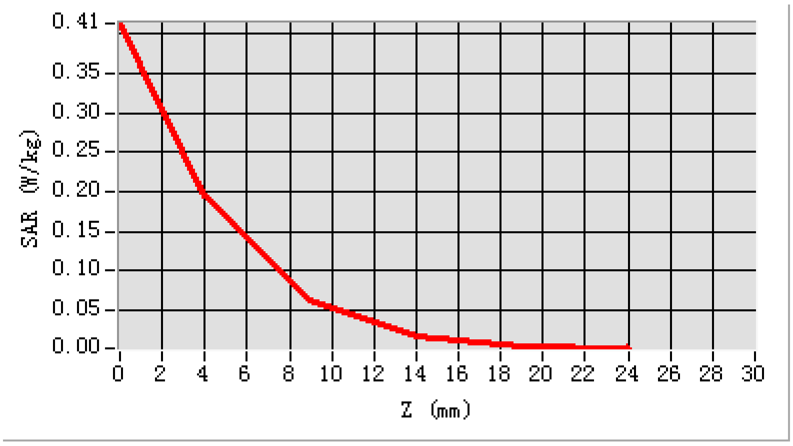
Frequency (MHz)	**2462.000000**
Relative permittivity (real part)	**39.183998**
Relative permittivity (imaginary part)	**13.248000**
Conductivity (S/m)	**1.812032**
Variation (%)	**-0.130000**

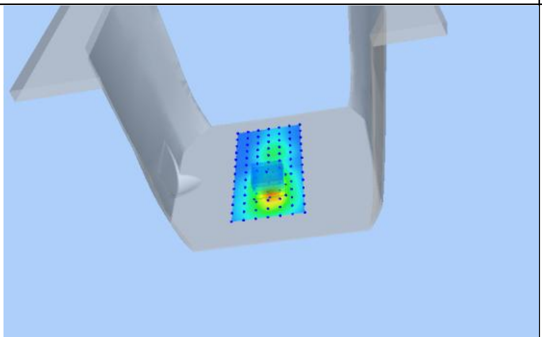
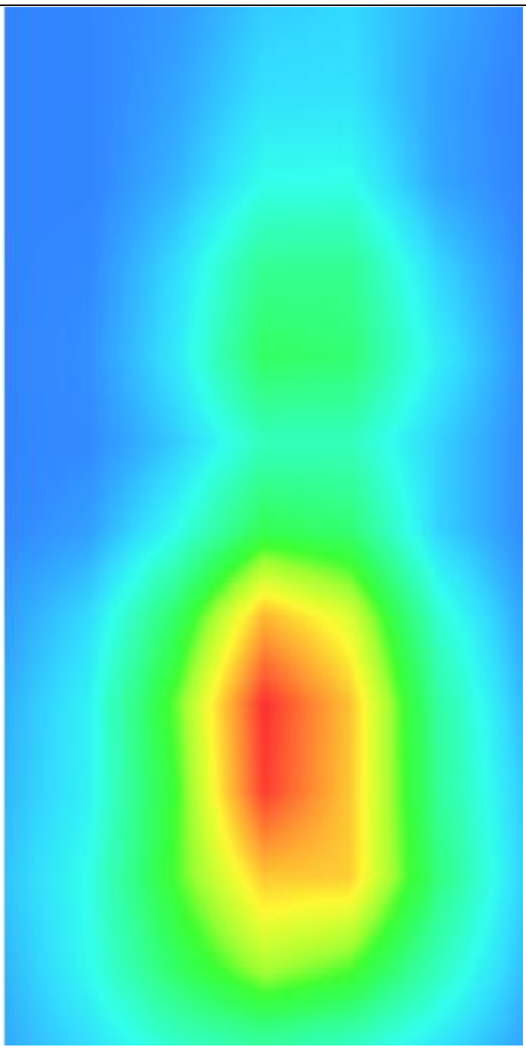
SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=-2.00, Y=-28.00

SAR 10g (W/Kg)	**0.082345**
SAR 1g (W/Kg)	**0.191356**

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.4142	0.1953	0.0643	0.0181	0.0049



3D screen shot	Hot spot position
	

ANNEX D

of

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

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-00532

Android Moblie Data Terminal

Type Name: Z-220X

Hardware Version: V3.0

Software Version: GST_A81_M20_4500XXXX_MUL_V03_20141201

Calibration Certificate of Probe and Dipoles

This Annex consists of 22 pages

Date of Report：2014-12-19

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

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	[signature]
Checked by :	Jérôme LUC	Product Manager	04/05/2014	[signature]
Approved by :	Kim RUTKOWSKI	Quality Manager	04/08/2014	[signature]

	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 %

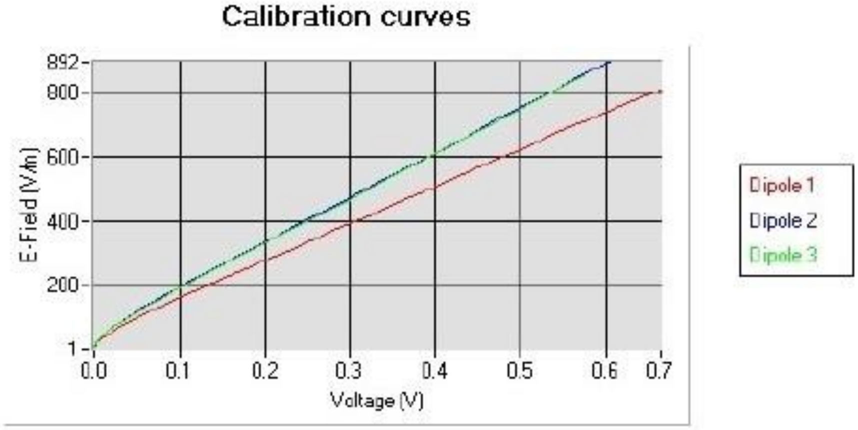
5.1 SENSITIVITY IN AIR

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

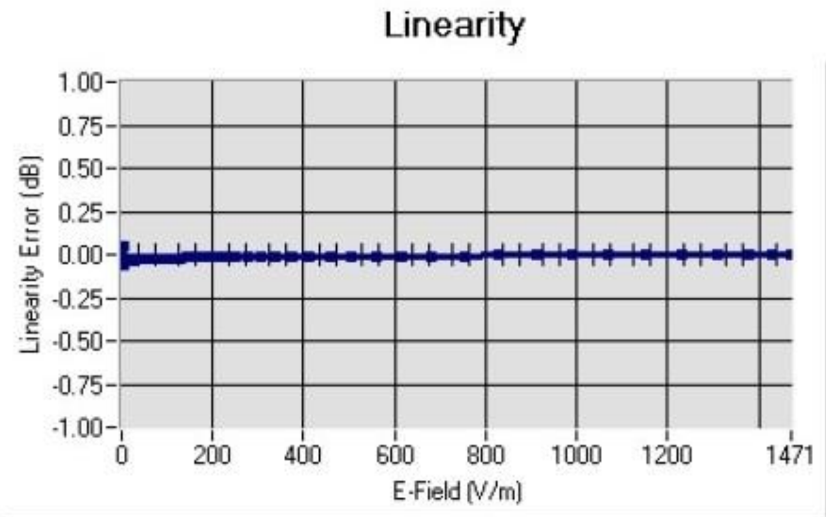
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
93.2	93.1	90.2

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

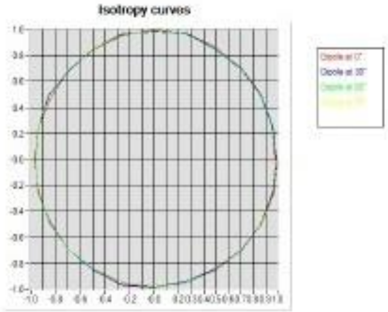
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL850	835	42.56	0.87	5.51
BL850	835	55.26	0.97	5.68
HL900	900	41.79	0.97	5.20
BL900	900	55.98	1.05	5.33
HL1800	1750	40.17	1.39	4.80
BL1800	1750	52.05	1.49	4.94
HL1900	1880	39.80	1.45	5.49
BL1900	1880	52.55	1.52	5.65
HL2000	1950	38.93	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

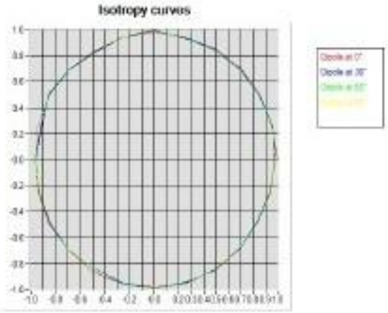
HL900 MHz

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



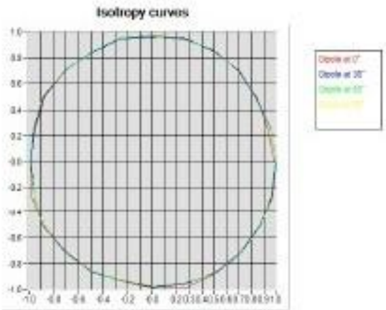
HL1800 MHz

- 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

SID2450 Dipole Calibration Ceriticate

SATIMO
The microwave vision company

SAR Reference Dipole Calibration Report

Ref : ACR.240.6.14.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: 2450 MHZ
SERIAL NO.: SN 09/13 DIP2G450-220

Calibrated at SATIMO US
2105 Barrett Park Dr. - Kennesaw, GA 30144

ilac-MRA ACCREDITED

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.

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

	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 2450 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID2450
Serial Number	SN 09/13 DIP2G450-220
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

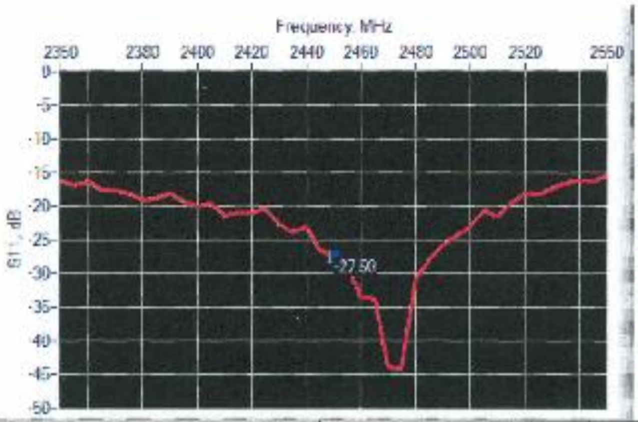
5.3 VALIDATION MEASUREMENT

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 %

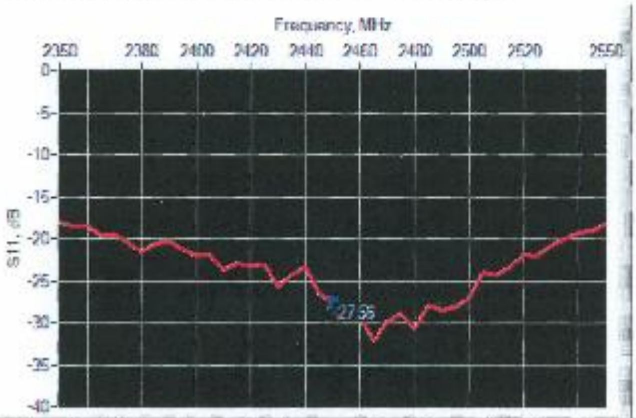
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-27.50	-20	51.7 Ω + 3.8 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-27.56	-20	54.3 Ω + 0.9 jΩ

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	

900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.	PASS	30.4 ±1 %.	PASS	3.6 ±1 %.	PASS
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	

2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %	PASS	1.80 ±5 %	PASS
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

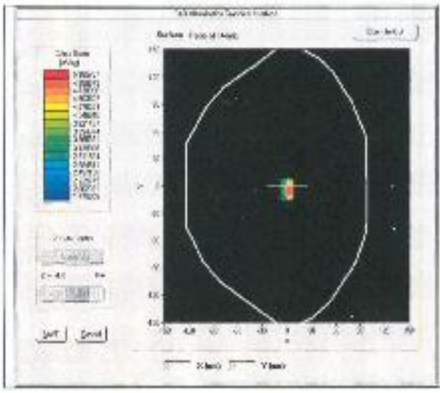
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

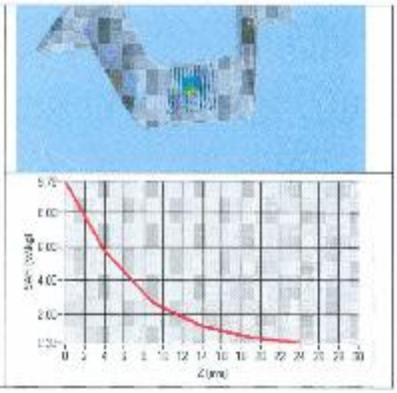
The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 39.0 sigma : 1.77
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	

2450	52.4	53.60 (5.36)	24	23.77 (2.38)
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	





7.3 BODY LIQUID MEASUREMENT

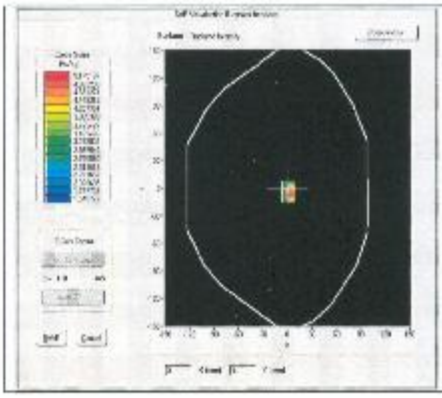
Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %		1.52 ±5 %	
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %	PASS	1.95 ±5 %	PASS
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	

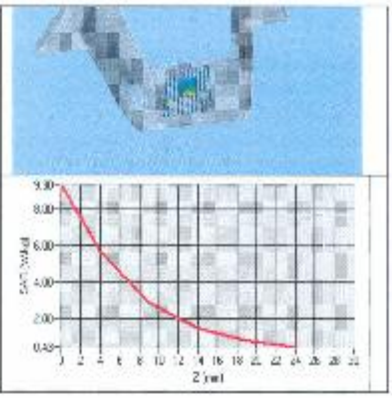
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 53.0 sigma : 1.93
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2450	52.66 (5.27)	23.73 (2.37)





8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
SAM 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
Calipers	Carrera	CALIPER-01	12/2013	12/2016
Reference Probe	Satimo	EPG122 SN 18/11	10/2013	10/2014
Multimeter	Keithley 2000	1188656	12/2013	12/2016
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	12/2013	12/2016
Power Sensor	HP ECP-E26A	US37181460	12/2013	12/2016
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2012	8/2015

Calibration Certificate of Keithley 2000 Multimeter

KEITHLEY
A Tektronix Company

A Greater Measure of Confidence

TRACEABLE CALIBRATION
2000, 4014020
Cal Date: 30-JAN-2013
Cal Due: Lab: Kei
KEITHLEY

KEITHLEY INSTRUMENTS, INC • 28775 AURORA RD, CLEVELAND, OHIO - USA • 440-248-0400 • Fax: 440-248-6168 • 1-888-KEITHLEY • www.keithley.com

Calibration Facility: This product was calibrated for Keithley Instruments by
Tektronix (China) Co. Ltd., 1227 Chuan Qiao Road, Pudong New District, Shanghai, China 201206

Calibration Certificate

Certificate No: PCXPTG6FZX
Manufacturer: Keithley
Description: Multimeter, 6 1/2 digit
Calibration Date: 30-JAN-2013

Revision: 00
Model: 2000
Temperature: 23.0 °C
Date Placed In Service: __________*

Serial No: 4014020
Humidity: 46 %
Due Date: __________*

* Optional customer entry fields: The due date may be established by adding the Keithley recommended cal interval stated in the product manual to the "Date placed in service"

Initial Condition: Not applicable, new product **Final Condition:** In Tolerance

- Keithley Instruments, Inc. certifies that the above instrument meets its published measurement specifications.
- This instrument has been calibrated using measurement standards traceable to the International System of Units (SI) through the PRC National Institute of Metrology (NIM), or other National Metrology Institutes (such as NIST, NPL, PTB, etc.).
- The policies and procedures used for the calibration of this product are based upon ANSI/NCSL Z540.1-1994 (R2002).
- The quality system used by the calibration facility is ISO 9001 registered.
- This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.
- This calibration certificate shall not be reproduced, except in full, without the written approval of Keithley Instruments, Inc.

Calibration Procedure Used: MANIFEST:Product_Dmm_KeithleyDMM_Full VERSION:107

Calibration Standards Used:

Manufacturer/Model	Model Description	ID Number	Due Date
Fluke 5720A	Calibrator	KI10138	18-Nov-2013
Fluke 5725A	Power Amplifier	KI5554	09-Jan-2014
Keithley 3390	Function/Arbitrary Waveform Gen	KI10261	16-Nov-2013

Issued By: [signature]
Quality Director: Cui, Hu Wa

Certified By: Lin Qing Zhu
Date Issued: 30-JAN-2013

2000 4014020 Page 1 of 1 PA-1061A

———End of the Report———