FCC SAR TEST REPORT

Report No.:	SET2014-14451
Product Name:	GALAZ N1 Tablet PC
Brand Name:	GALAZ
Model No.:	GAL-N1139
FCC ID:	2ADK8-TRJ1412
Applicant:	Galapad Technology Limited
Address:	Unit 1601, 16/F, Exchange Tower, 33 Wang Chiu Road, Kowloon Bay, Kowloon, Hong Kong

Issued by:	CCIC-SET
Lab Location:	Electronic Testing Building, Shahe Road，Xili, Nanshan District, Shenzhen, 518055, P. R. China
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Test Report

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FCC ID	2ADK8-TRJ1412
Applicant	Galapad Technology Limited
Applicant Address	Unit 1601, 16/F, Exchange Tower, 33 Wang Chiu Road, Kowloon Bay, Kowloon, Hong Kong
Manufacturer	Shen Zhen Galapad Technology Co.,Ltd.
Manufacturer Address	Unit 603,Tower B Tian'an Hi-Tech Venture Park,Futian District,Shenzhen City
Test Standards	**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 1528–2003:** 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 2014-12-22 Mei Chun, Test Engineer
Reviewed by	Shuangwen Zhang 2014-12-22 Shuangwen Zhang, Senior Egineer
Approved by	Wu Li'an 2014-12-22 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:	Electronic Testing Building, Shahe Road, Nanshan District, Shenzhen, P. R. China
Telephone:	+86-755-26628676
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:	Electronic Testing Building, Shahe Road, Nanshan District, Shenzhen, P. R. China

2.3. Organization Item

CCIC-SET Report No.:	SET2014-14451
CCIC-SET Project Leader:	Mr. Li Sixiong
CCIC-SET Responsible for accreditation scope:	Mr. Wu Li'an
Start of Testing:	2014-12-22
End of Testing:	2014-12-22

2.4. Identification of Applicant

Company Name:	Galapad Technology Limited
Address:	Unit 1601, 16/F, Exchange Tower, 33 Wang Chiu Road, Kowloon Bay, Kowloon, Hong Kong

2.5. Identification of Manufacture

Company Name:	Shen Zhen Galapad Technology Co.,Ltd.
Address:	Unit 603,Tower B Tian'an Hi-Tech Venture Park,Futian District,Shenzhen City

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:	GALAZ N1 Tablet PC	
Type Name:	GALAZ	
General description:	Support band	Wi-Fi 2.4 GHz, BT3.0, BT4.0
	Test band	Wi-Fi 2.4 GHz
	Development Stage	Identical Prototype
	Accessories	Power Supply
	Battery type	MLP337567-2P
	Battery specification	3.8V 4950mA/H
	Antenna type	PIFA Antenna
	Operation mode	802.11b, 802.11g, 802.11n-20MHz, Bluetooth
	Modulation mode	GFSK/π /4-DQPSK/8-DPSK, DSSS, OFDM
	S/N	GB140700100
	Max. SAR Value	0.759 W/Kg

NOTE:

a. The EUT is a model of GALAZ N1, it could support 802.11b, 802.11g, 802.11n-20MHz, BT3.0, BT4.0.

b. Since the EUT didn’t support voice function, only support data function, the tests were carried out against body.

c. Please refer to Appendix C for the photographs of the EUT. For a more detailed features description about the EUT, please refer to User’s Manual.

d. The Reported SAR Value is Scaled Factory*SAR testing Value at the correspondence Mode, Frequency and Channel.

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:

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

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.

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).

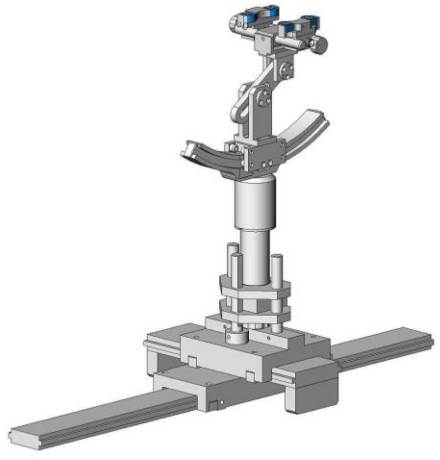
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

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

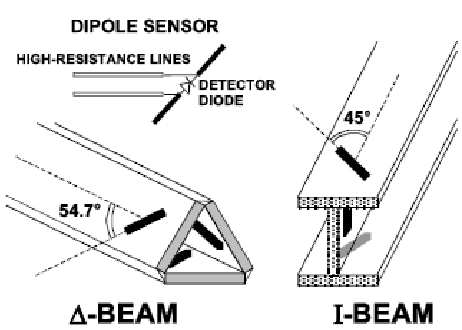
4.5 Probe Specification

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 is in Traffic Mode (Channel Allocated) at Normal Voltage Condition. The SAR for this devices is measured using chipset based test mode software to ensure the results are consistent and reliable.

The EUT shall 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.The power level results listed in the following table:

Table 1: Maximum Conducted Transmitting Power

Test Mode	Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Tune up Power in tolerance (dBm)	Scaled Factory
802.11b	1	2412	17.61	17±1	1.094
	6	2437	17.26	17±1	1.186
	11	2462	16.58	17±1	1.387
802.11g	1	2412	18.76	18±1	1.057
	6	2437	18.49	18±1	1.125
	11	2462	18.08	18±1	1.236
802.11n-20MHz	1	2412	16.83	16±1	1.040
	6	2437	16.66	16±1	1.081
	11	2462	16.19	16±1	1.205
GFSK	0	2402	4.34	4±1	1.164
	39	2441	3.81	4±1	1.315
	78	2480	3.85	4±1	1.303
π /4-DQPSK	0	2402	4.26	4±1	1.186
	39	2441	3.77	4±1	1.327
	78	2480	3.87	4±1	1.297
8-DPSK	0	2402	4.14	4±1	1.219
	39	2441	3.89	4±1	1.291
	78	2480	4.87	4±1	1.030

Test Mode	Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Tune up Power in tolerance (dBm)	Scaled Factory
BT 4.0	0	2402	4.87	4±1	1.030
	19	2440	4.63	4±1	1.089
	39	2480	4.70	4±1	1.072

RF exposure evaluation

According to § 1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy lever in excess of Commission's guideline.

According to 447498 D01 General RF Exposure Guidance v05r02, exclusion threshold values at selected frequencies and distances table as following.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

MHz	30	35	40	45	50	mm
150	232	271	310	349	387	SAR Test Exclusion Threshold (mW)
300	164	192	219	246	274	
450	134	157	179	201	224	
835	98	115	131	148	164	
900	95	111	126	142	158	
1500	73	86	98	110	122	
1900	65	76	87	98	109	
2450	57	67	77	86	96	
3600	47	55	63	71	79	
5200	39	46	53	59	66	
5400	39	45	52	58	65	
5800	37	44	50	56	62	

Routine SAR evaluation refers to the specifically required by §2.1093, using measurements or computer simulation. When routine SAR evolution is not required, the portable transmitters with output power greater than the applicable low threshold SAR evolution to qualify for TCB approval.

Result:

This is portable device and the Max conducted peak output power is 4.87dBm, the maximum gain of antenna is 2dBi, the maximum turn up power is 5dBm (3.069mW), which is lower than the exclusion threshold 10mW, at frequency 2450MHz, and distance is 5mm.

The Bluetooth SAR measurement is not required.

5.2 SAR Measurement System

The SAR measurement system being used is the COMOSAR test 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 extrapolated according to the head parameters specified in P1528.

Table 2: 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 3 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 4: Dielectric Performance of Body Tissue Simulating Liquid

Temperature: 23.2°C; Humidity: 64%			
/	Frequency	Permittivity ε	Conductivity σ (S/m)
Target value	2450	52.02	1.95
Validation value (Dec. 22th, 2014)	2450	52.68	1.93

Fig. 1 Configuration of body tissue

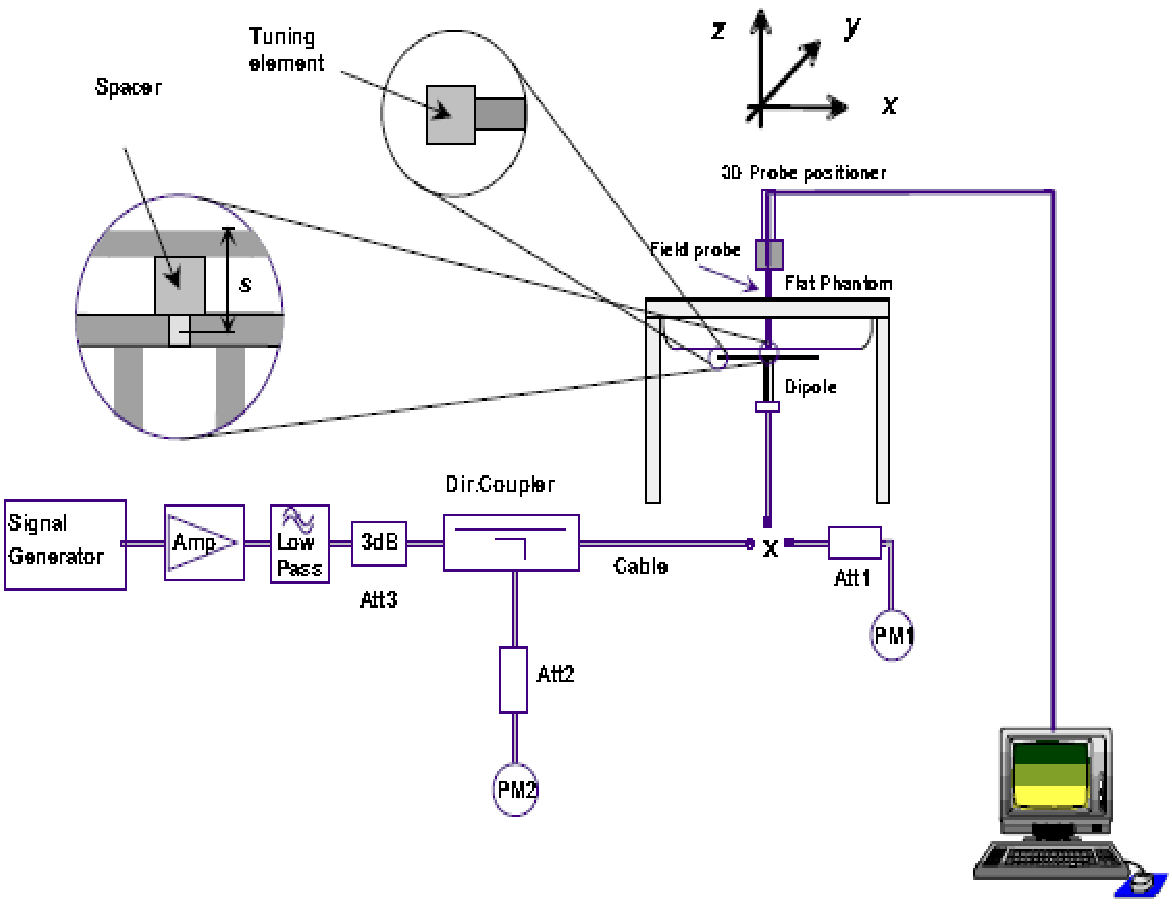
5. 3 Equipments and results of validation testing

Table 5: Important equipments :

Equipment description	Manufacturer/Model	Identification No.
System Simulator	E5515C	GB 47200710
SAR Probe	SATIMO	SN_0913_EP169
Dipole	SID2450	SN_0913_DIP2G450-220
Vector Network Analyzer	ZVB8	A0802530
Signal Generator	SMR27	A0304219
Amplifier	Nucletudes	143060
Power Meter	NRVS	1020.1809.02
Power Sensor	NRV-Z4	100069
Power Meter	NRP2	A140401673
Power Sensor	NPR-Z11	1138.3004.02-114072-nq
Multimeter	Keithley-2000	4014020
Device Holder	MSH80	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 head and body were provided in Table 6. The humidity and ambient temperature of test facility were 64% and 23.2°C respectively. The phantom was full of the body tissue simulating liquid while testing against the body-worn measurement. The EUT was supplied with full-charged battery for each measurement.

For the body-worn measurement, the EUT was directly against the phantom, and the EUT was tested at the lowest, middle and highest frequencies in the transmit band.

Table 6: Liquid Verification Results (Body)

Frequency	Duty cycle	Target value（W/kg）		Test value（W/kg）	
		10g	1g	10g	1g
2450MHz (Dec. 22th, 2014)	1:1	23.73	52.65	23.88	52.60

*Note: The target value referred to the calibration report of the dipole, and all SAR values are normalized to 1W forward power.

5. 4 SAR measurement procedure

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

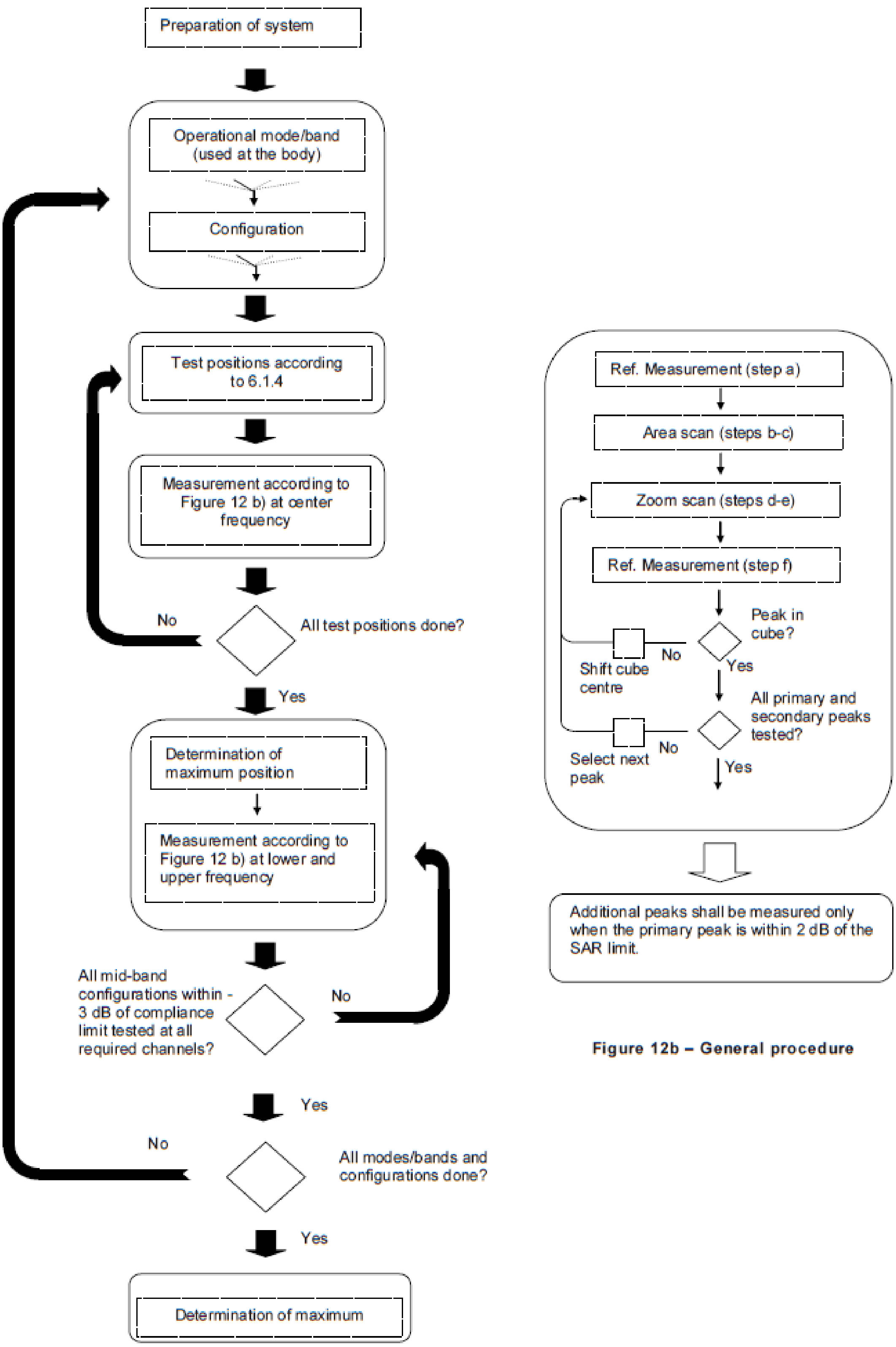


Figure 12b – General procedure

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 with the maximum output power.

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.

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

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.

5. 5 Antennas position and test position

There's only one antenna (Wi-Fi antenna) inside the EUT, and it is the transmitting source. The following pictures showed position of the antenna:

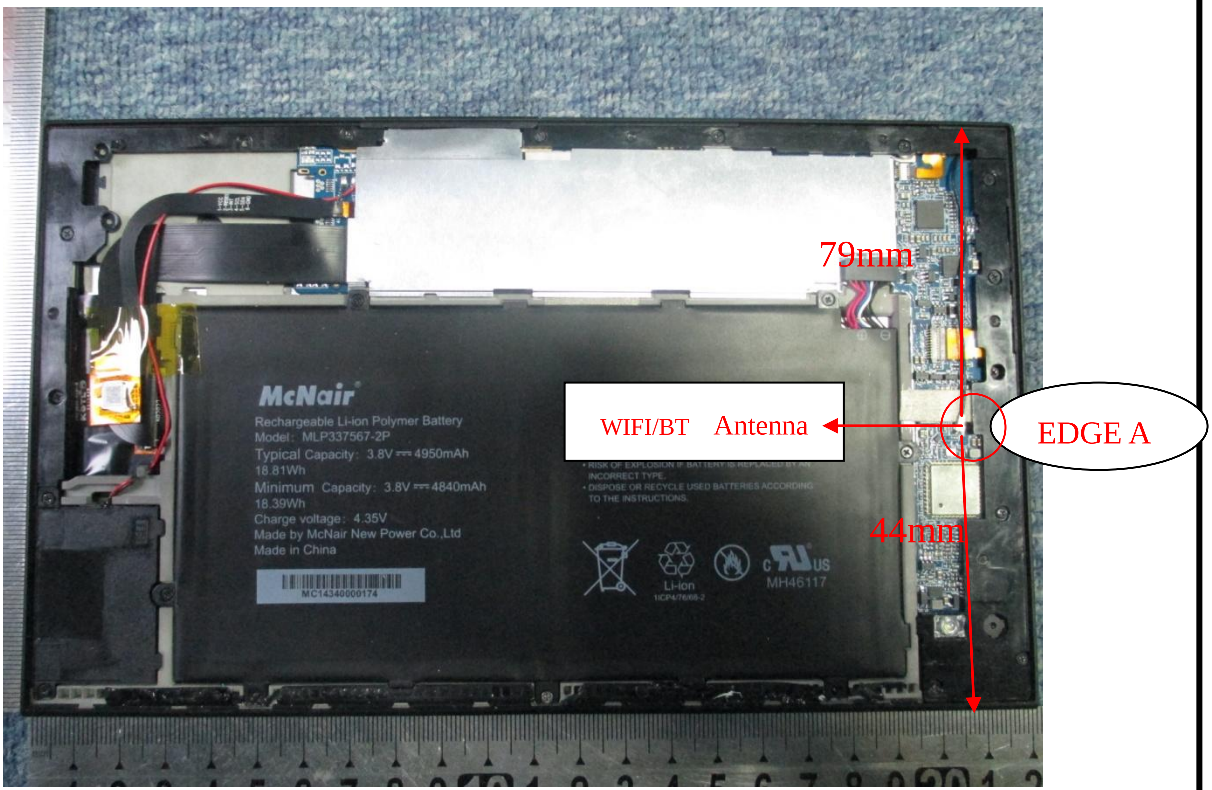


Fig. 3 Position of antenna

Since the EUT does not support hotspot, the tests should be executed under the following positions according to KDB 616217 and KDB447498:

a. Display Upward (the display directly against the phantom);
b. Back Upward (the back directly against the phantom);
c. Edge A (the side of Edge A directly against the phantom);

6 CHARACTERISTICS OF THE TEST

6.1 Applicable Limit Regulations

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

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;

7 LABORATORY ENVIRONMENT

Table 7: The Ambient Conditions during SAR Test

Temperature	Min. = 22 °C, Max. = 25 °C
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.	

8 TEST RESULTS

8.1 Summary of Measurement Results

According the description above, the measurements against the body phantom were executed on the WIFI 802.11b, 802.11g mode.

Table 8: SAR Values of WIFI 802.11b

Temperature: 23.0~23.5°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
802.11b	Edge A	1/2412	0.238	0.260
	Face Upward	1/2412	0.693	0.758
	Back Upward	1/2412	0.694	0.759

Table 9: SAR Values of WIFI 802.11g

Temperature: 23.0~23.5°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
802.11g	Edge A	1/2412	0.165	0.174
	Face Upward	1/2412	0.441	0.466
	Back Upward	1/2412	0.454	0.480

Note:

a. 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 (KDB 248227).

b. The SAR test shall be performed at the middle channel.If the SAR measured is at least 3.0dB lower than the SAR limit (<0.8W/kg),testing at the other channels is optional.

c. 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

f(GHz) is the RF channel transmit frequency in GHz

Power and distance are round to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

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
5	3.162	5	2.48	0.996

Per KDB 447498 D01v05r02 exclusion thresholds is 0.996<3, RF exposure evaluation is not required.

d. Simultaneous Transmission SAR evaluation is not required for BT and WIFI, because the software mechanism have been incorporated to guarantee that the WLAN and Bluetooth transmitter would not simultaneously operate.

8.2 Conclusion

Localized Specific Absorption Rate (SAR) of this portable wireless device has been measured in all cases requested by the relevant standards cited in Clause 5.2 of this report. Maximum localized SAR is **below** exposure limits specified in the relevant standards.

9 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	

10 MAIN TEST INSTRUMENTS

No.	EQUIPMENT	TYPE	Series No.	Last Calibration	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	SID2450	SN09/13 DIP2G450-220	2014/08/28	1 Year
4	Network Analyzer	ZVB8	A0802530	2014/06/13	1 Year
5	Signal Generator	SMR27	A0304219	2014/06/10	1 Year
6	Amplifier	Nucletudes	143060	2014/04/05	1 Year
7	Power Meter	NRVS	1020.1809.02	2014/06/13	1 Year
8	Power Sensor	NRV-Z4	100069	2014/06/10	1 Year
9	Power Meter	NRP2	A140401673	2014/03/04	1 Year
10	Power Sensor	NPR-Z11	1138.3004.02-114072-nq	2014/03/04	1 Year
11	Multimeter	Keithley-2000	4014020	2014/04/16	1 Year
12	Device Holder	SATIMO	SN 09/13 MSH80	2014/04/05	1 Year
13	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

SET2014-14451

GALAZ

Type Name: GALAZ N1 Tablet PC

Accreditation Certificate

This Annex consists of 2 pages

Date of Report: 2014-12-22

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

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2014-14451

ShenZhen GALAZ Digital Technology Co.,Ltd.

GALAZ

Type Name: GALAZ N1 Tablet PC

Hardware Version： 0X02

Software Version： 4.4.4

Typical Test Layout

This Annex consists of 3 pages

Date of Report: 2014-12-22

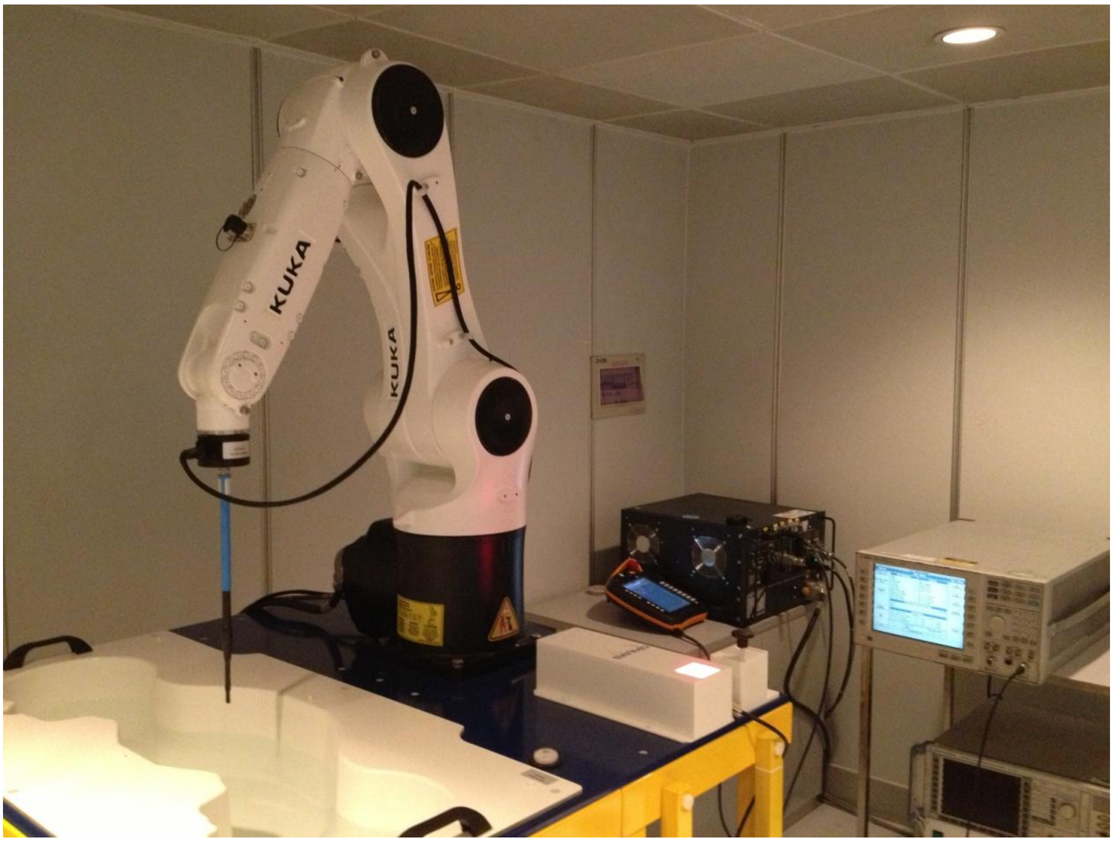


Fig.1 COMO SAR Test System

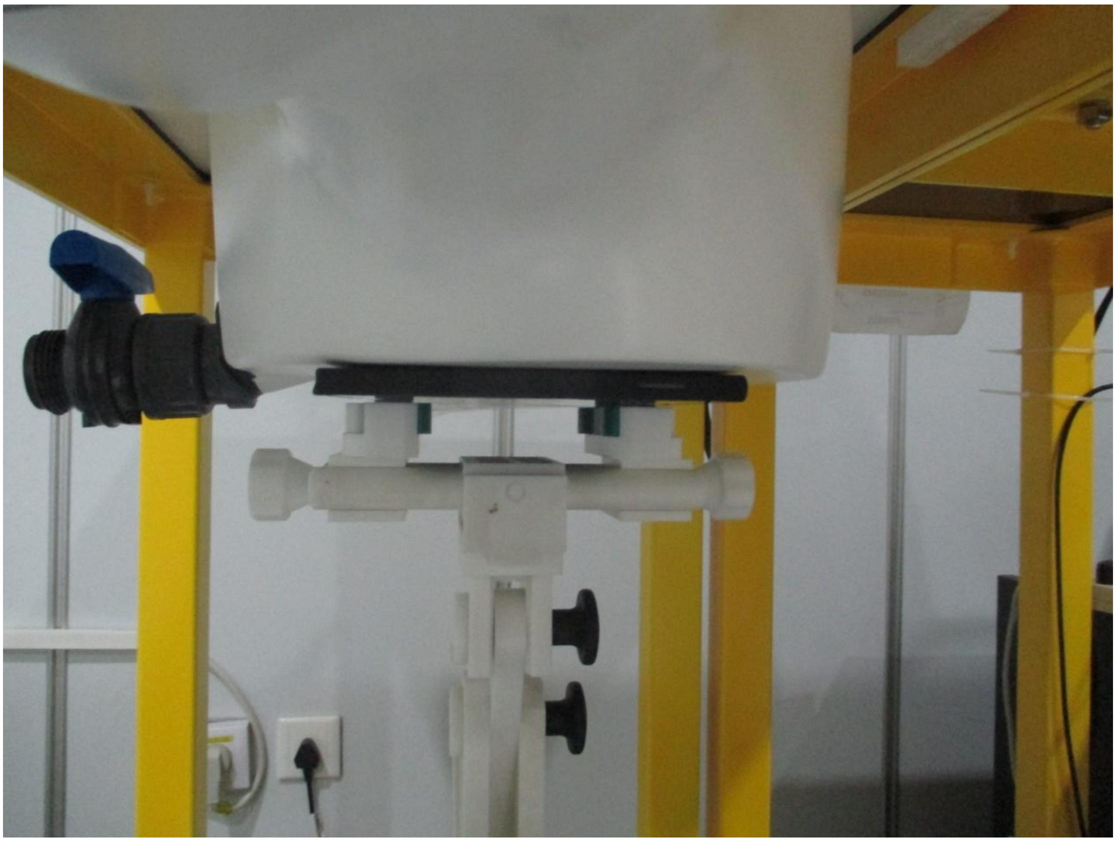


Fig.2 Back Upward

Fig.3 Face Upward

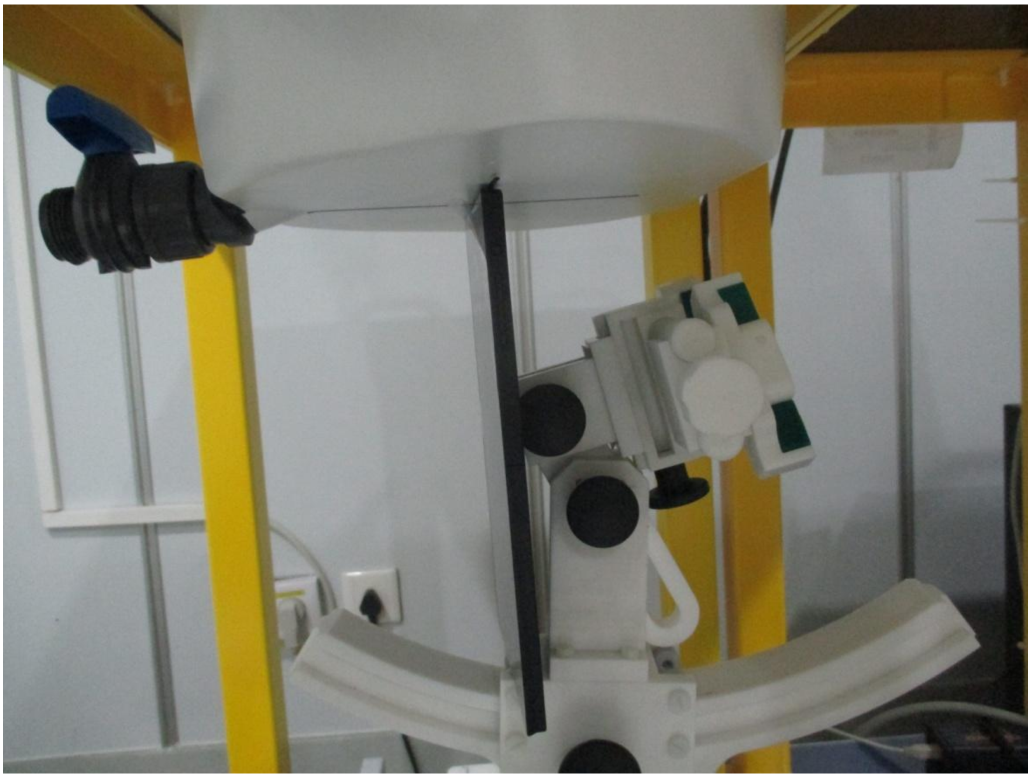


Fig.4 Edge A Upward

ANNEX C

of

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

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2014-14451

ShenZhen GALAZ Digital Technology Co.,Ltd.

GALAZ

Type Name: GALAZ N1 Tablet PC

Hardware Version： 0X02

Software Version： 4.4.4

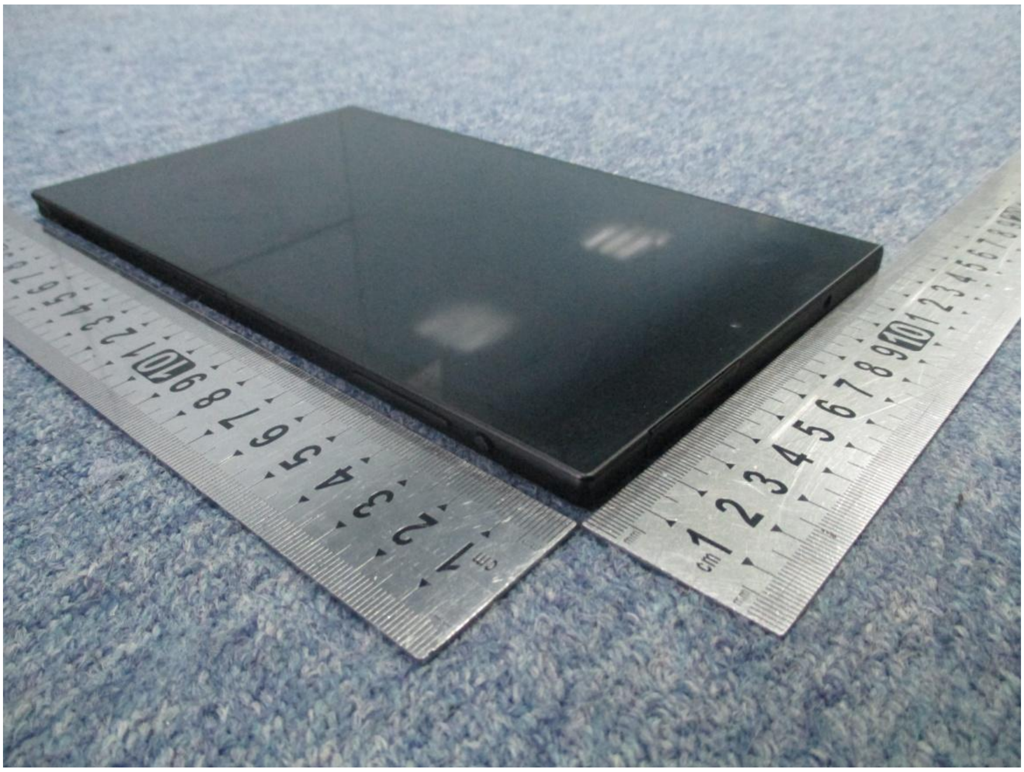
Sample Photographs

This Annex consists of 2 pages

Date of Report: 2014-12-22

Photograph of the Equipment under Test

1. Appearance



Appearance and size (obverse)

Appearance and size (reverse)

ANNEX D

of

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

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2014-14451

ShenZhen GALAZ Digital Technology Co.,Ltd.

GALAZ

Type Name: MID

Hardware Version： 0X02

Software Version： 4.4.4

System Performance Check Data and Highest SAR Plots

This Annex consists of 9 pages

Date of Report：2014-12-22

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: 22/12/2014

Measurement duration: 12 minutes 55 seconds

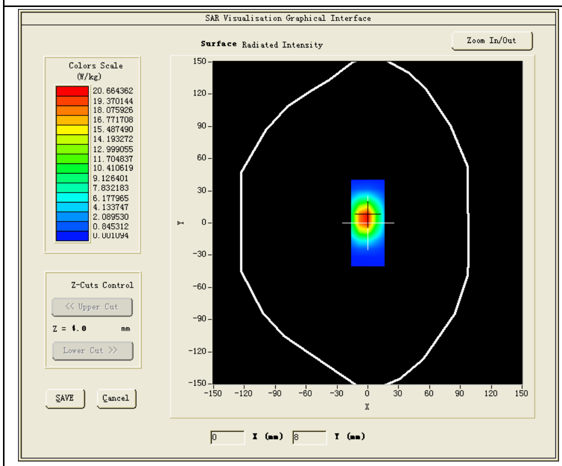
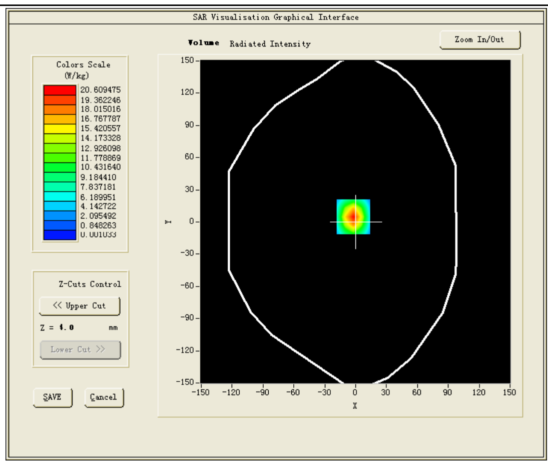
A. Experimental conditions.

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)	52.681243
Relative permittivity	12.991650
Conductivity (S/m)	1.932453
Power Drift (%)	1.080000
Ambient Temperature:	23.2 ℃
Liquid Temperature:	22.7 ℃
ConvF:	4.91
Crest factor:	1:1

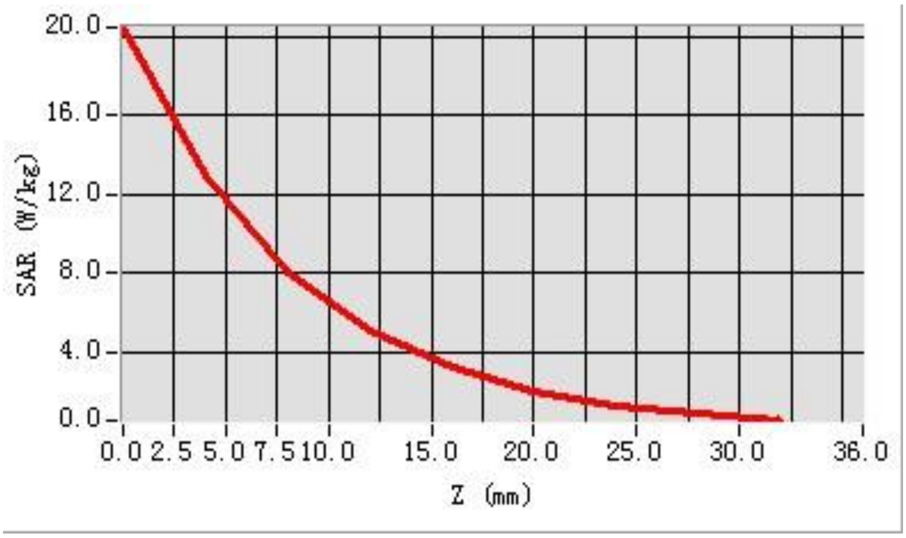
SURFACE SAR	**VOLUME SAR**
	

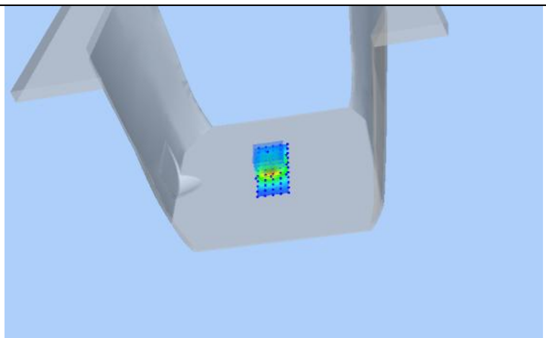
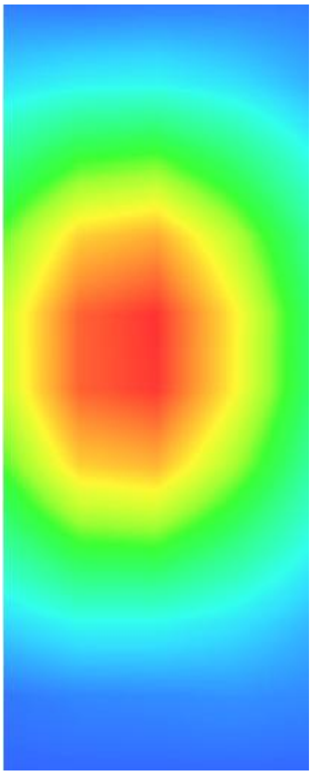
Maximum location: X=7.00, Y=1.00

SAR 10g (W/Kg)	5.973532
SAR 1g (W/Kg)	13.153658

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	20.8276	13.2788	6.8972	4.1326	1.0321



3D sceen shot	Hot spot position
	

WIFI 802.11b , Back, Low

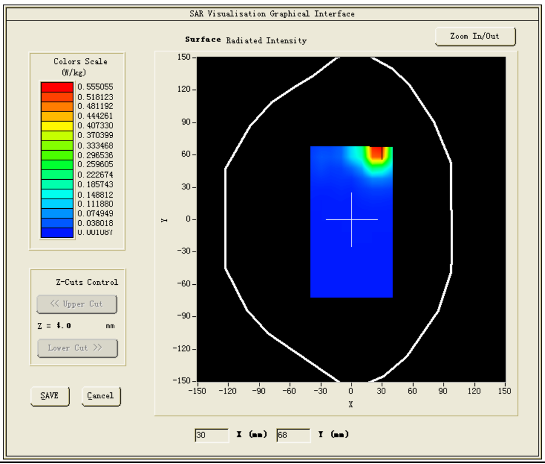
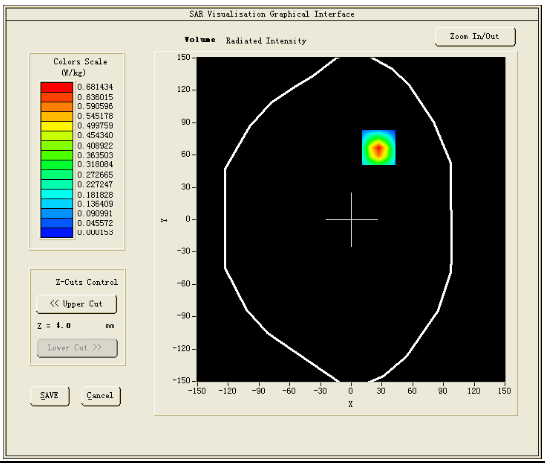
Type: Phone measurement (Very fast, 11 points in the volume)
Date of measurement: 22/12/2014
Measurement duration: 6 minutes 47 seconds
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	dx=8mm dy=8mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Very fast
Phantom	Validation plane
Device Position	Back
Band	IEEE 802.11b ISM
Channels	1
Signal	IEEE802.b (Duty cycle: 1:1)

B. SAR Measurement Results

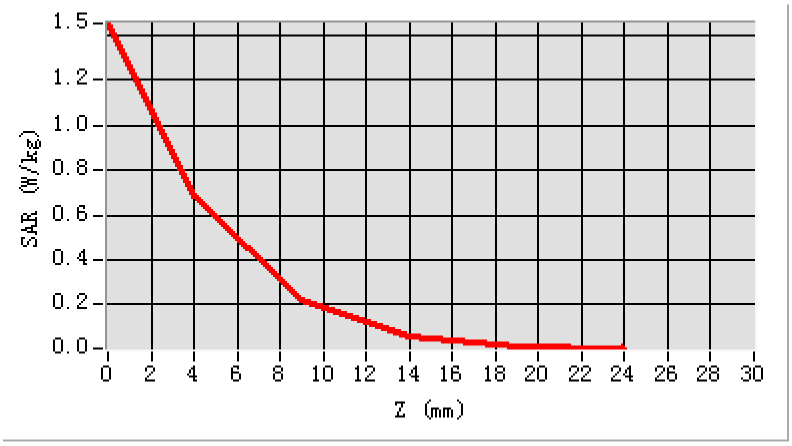
Frequency (MHz)	2412
Relative permittivity (real part)	52.681243
Relative permittivity (imaginary part)	12.991650
Conductivity (S/m)	1.932453
Power Drift (%)	--
ConvF:	4.91

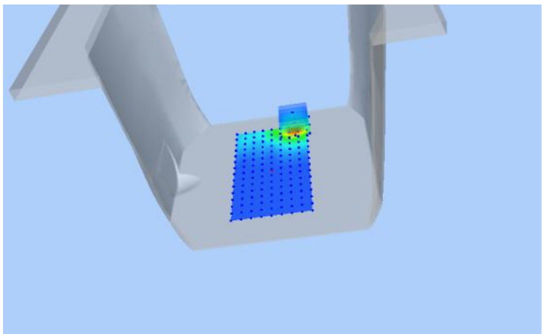
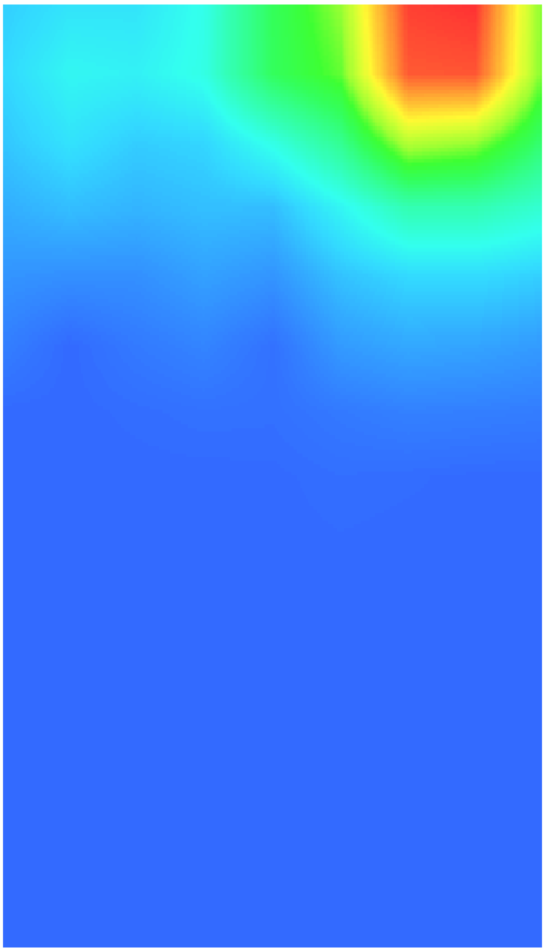
SURFACE SAR	VOLUME SAR
	

Maximum location: X=27.00, Y=67.00

SAR 10g (W/Kg)	0.266651
SAR 1g (W/Kg)	0.694018

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.4539	0.6814	0.2193	0.0594	0.0177



3D screen shot	Hot spot position
	

WIFI 802.11g , Back, Low

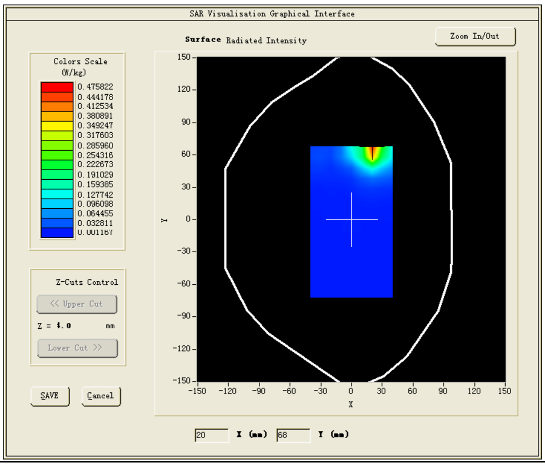
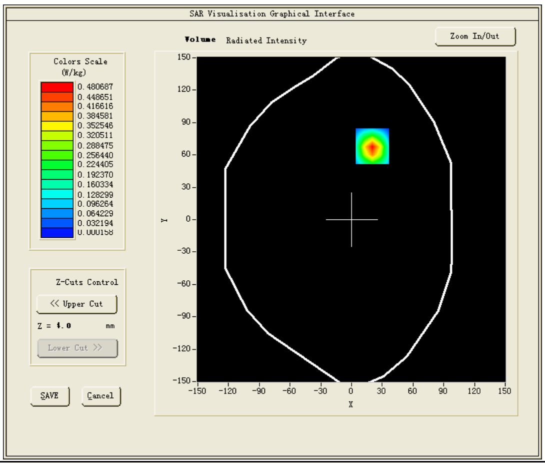
Type: Phone measurement (Very fast, 11 points in the volume)
Date of measurement: 22/12/2014
Measurement duration: 6 minutes 44 seconds
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	dx=8mm dy=8mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Very fast
Phantom	Validation plane
Device Position	Back
Band	IEEE 802.11g ISM
Channels	1
Signal	IEEE802.g (Duty cycle: 1:1)

B. SAR Measurement Results

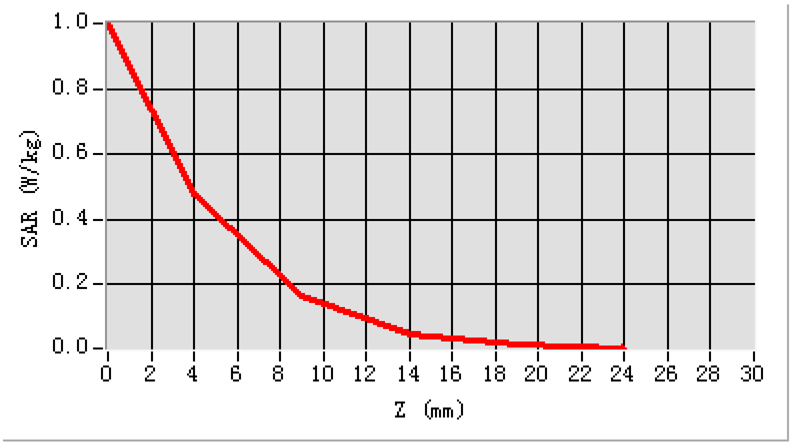
Frequency (MHz)	2412
Relative permittivity (real part)	52.681243
Relative permittivity (imaginary part)	12.991650
Conductivity (S/m)	1.932453
Power Drift (%)	--
ConvF:	4.91

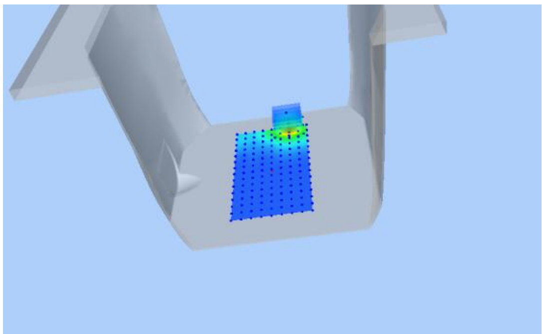
SURFACE SAR	VOLUME SAR
	

Maximum location: X=20.00, Y=68.00

SAR 10g (W/Kg)	0.177562
SAR 1g (W/Kg)	0.454399

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.0028	0.4807	0.1616	0.0464	0.0140



3D screen shot	Hot spot position
	

ANNEX E

of

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

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2014-14451

ShenZhen GALAZ Digital Technology Co.,Ltd.

GALAZ

Type Name: GALAZ N1 Tablet PC

Hardware Version: 0X02

Software Version: 4.4.4

Calibration Certificate of Probe and Dipoles

This Annex consists of 22 pages

Date of Report：2014-12-22

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
Calibration CERT #2246.02

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	JS
Checked by :	Jérôme LUC	Product Manager	04/05/2014	JS
Approved by :	Kim RUTKOWSKI	Quality Manager	04/08/2014	Kim Rutkowski

	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 %

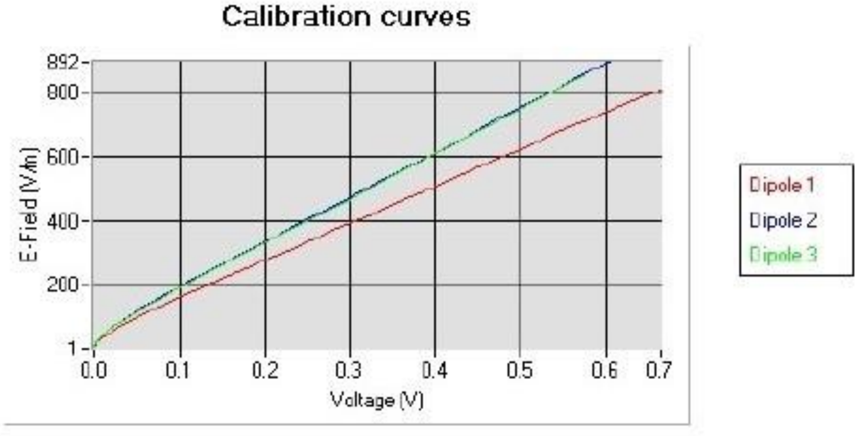
5.1 SENSITIVITY IN AIR

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

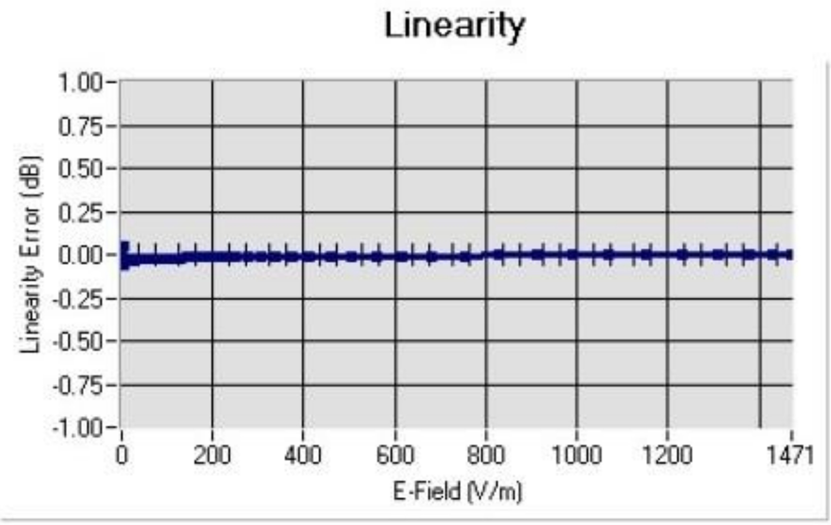
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
93.2	93.1	90.2

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

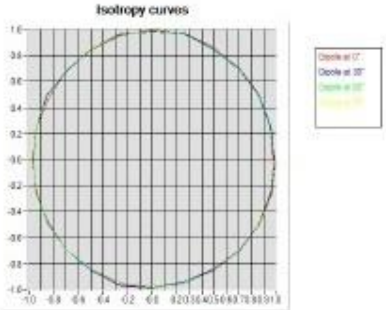
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL850	835	42.56	0.87	5.51
BL850	835	55.26	0.97	5.68
HL900	900	41.79	0.97	5.20
BL900	900	55.98	1.05	5.33
HL1800	1750	40.17	1.39	4.80
BL1800	1750	52.05	1.49	4.94
HL1900	1880	39.80	1.45	5.49
BL1900	1880	52.55	1.52	5.65
HL2000	1950	38.93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

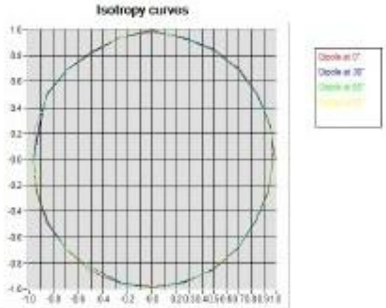
HL900 MHz

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



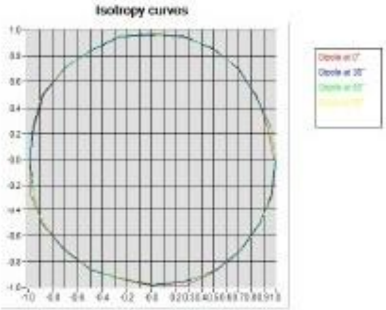
HL1800 MHz

- 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	
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 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.

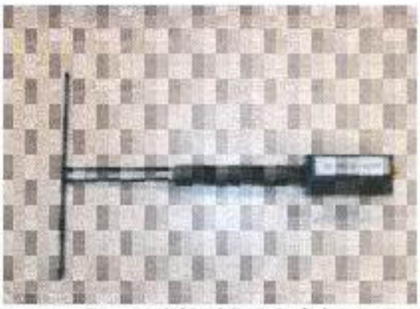


Figure 1 – *Satimo COMOSAR Validation Dipole*

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

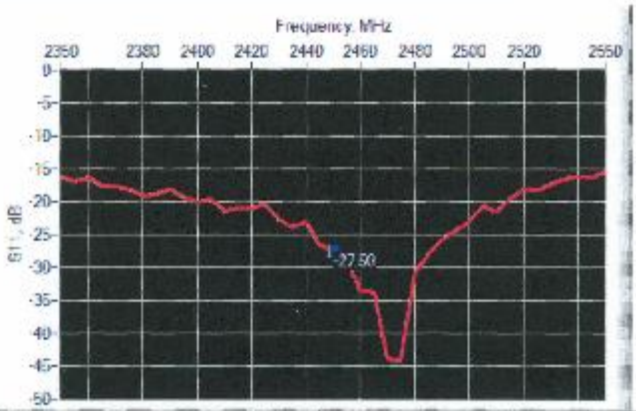
5.3 VALIDATION MEASUREMENT

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 %

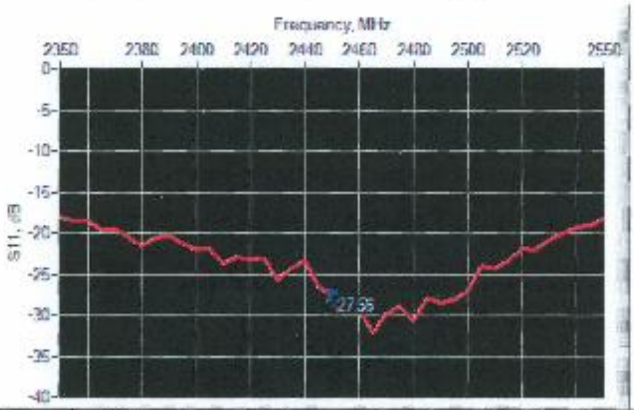
6 CALIBRATION MEASUREMENT RESULTS

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 %	

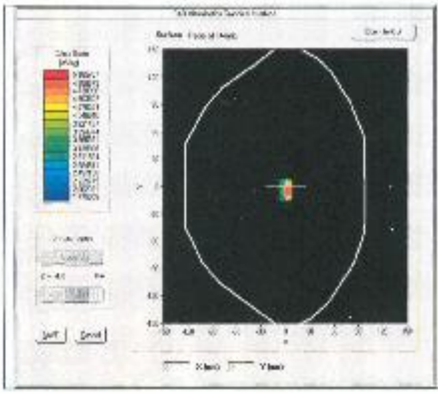
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

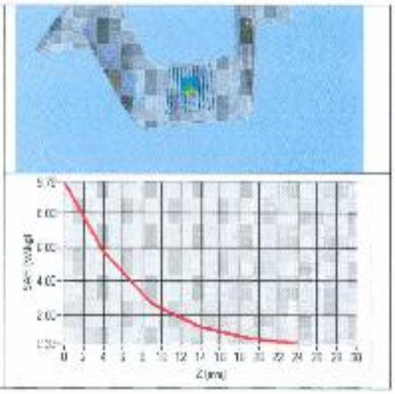
The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is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

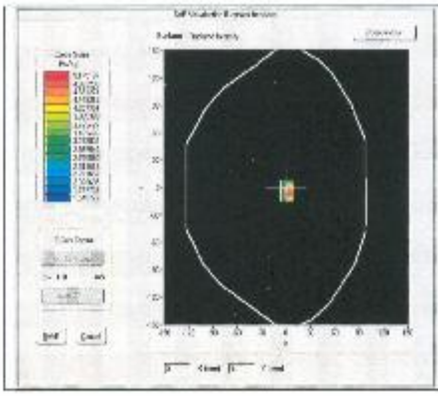
Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		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 %	

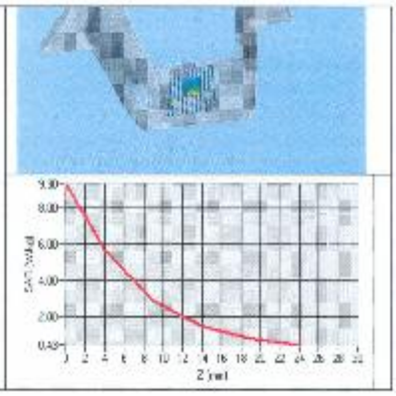
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

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

———End of the Report———