FCC SAR TEST REPORT

Report No.:	SET2015-08377
Product:	EYE1
Model No.:	EYE1
Brand Name:	SIOEYE
FCC ID:	2AE44EYE1
Applicant:	Sioeye LLC
Address:	4265 San Felipe #1100 Houston TX 77027 USA
Issued by:	CCIC-SET
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. ……………….:	EYE1
Model No. ……………..:	EYE1
Brand Name…………..:	SIOEYE
FCC ID……………..…….:	2AE44EYE1
Applicant………………..:	Sioeye LLC
Applicant Address…….:	4265 San Felipe #1100 Houston TX 77027 USA
Manufacturer…………:	CK Telecom Limited
Manufacturer Address:	Technology Road.High-Tech Development Zone. Heyuan, Guangdong,P.R.China.
Test Standards……….:	**47CFR § 2.1093-** Radiofrequency Radiation Exposure Evaluation: Portable Devices; **ANSI C95.1–1992:** IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz; (IEEE Std C95.1-1991) **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;
Test Result……………:	Pass

Tested by …………..: Mei Chun 2015-06-17

Chun Mei, Test Engineer

Reviewed by………….: Shuangwen Zhang 2015-06-17

Shuangwen Zhang,Senior Egineer

Approved by……………: Wu Li'an 2015-06-17

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:	+86-755-26629676
Fax:	+86-755-26627238
Responsible Test Lab Managers:	Mr. Wu Li'an

2.2. Identification of the Responsible Testing Location(s)

Company Name:	CCIC-SET
Address:	Electronic Testing Building, Shahe Road, Nanshan District, Shenzhen, P. R. China

2.3. Organization Item

CCIC-SET Report No.:	SET2015-08377
CCIC-SET Project Leader:	Mr. Li Sixiong
CCIC-SET Responsible for accreditation scope:	Mr. Wu Li'an
Start of Testing:	2015-01-05
End of Testing:	2015-06-04

2.4. Identification of Applicant

Company Name:	Sioeye LLC
Address:	4265 San Felipe #1100 Houston TX 77027 USA

2.5. Identification of Manufacture

Company Name:	CK Telecom Limited
Address:	Technology Road.High-Tech Development Zone. Heyuan, Guangdong,P.R.China.

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

3. Equipment Under Test (EUT)

3.1.Identification of the Equipment under Test

Sample Name:	EYE1	
Type Name:	EYE1	
Brand Name:	SIOEYE	
General description:	Support Band	WCDMA 850MHz/1900MHz/2100MHz Wi-Fi802.11b,802.11g,802.11n-20,802.11n-40 LTE Band 4,17, Bluetooth
	Test Band	WCDMA 850MHz/ WCDMA 1900MHz LTE Band 4,17, Wi-Fi 802.11b
	Development Stage	Identical Prototype
	Accessories	Power Supply
	Battery type	3.8V 1160mAh
	Antenna type	Interior Antenna
	Operation mode	WCDMA / LTE/ Bluetooth / WIFI
	Modulation mode	QPSK,DSSS, OFDM, GFSK/π /4-DQPSK/8-DPSK
	Max. RF Power	23.66dBm
	Max. SAR Value	Body:0.660w/kg

NOTE:

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

b. The EUT does not support 16QAM uplink function in HSPA+ mode.

4 SAR SUMMARY

Highest Measured Standalone SAR Summary

Exposure Position	Frequency Band	Scaled 1g-SAR(W/kg)	Highest Scaled 1g-SAR(W/kg)
Body	WCDMA Band 850	0.099	0.660
	WCDMA Band 1900	0.163	
	LTE FDD Band 4	0.660	
	LTE FDD Band 17	0.180	
	WIFI	0.117	
	BT	*0.236	

Highest Simultaneous SAR Summary

Exposure Position	Frequency Band	Scaled 1g-SAR(W/kg)	Highest Scaled 1g-SAR(W/kg)
Hotspot (0mm Gap)	WCDMA 850 & WIFI	0.099	0.660
	WCDMA 1900 & WIFI	0.163	
	LTE Band 4 & WIFI	0.660	
	LTE Band 17 & WIFI	0.169	

5 Specific Absorption Rate (SAR)

5.1 Introduction

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

5.2 SAR Definition

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

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

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

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

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

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

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

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

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

5.3 Phantoms

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

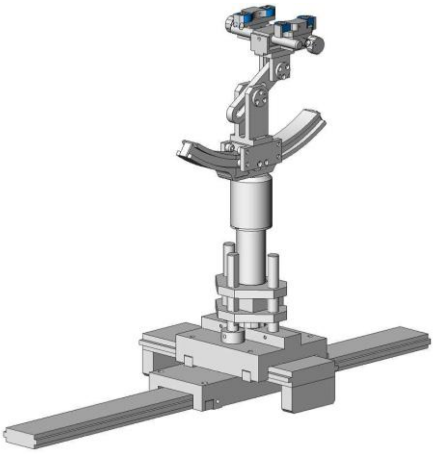
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM Twin Phantom

5.4 Device Holder

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

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




Device holder

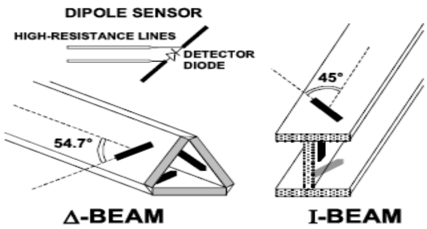
5.5 Probe Specification

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	700 MHz to 3 GHz; Linearity: ± 0.5 dB (700 MHz to 3 GHz)
Directivity	± 0.25 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	1.5 µW/g to 100 mW/g; Linearity: ± 0.5 dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 5 mm (Body: 8 mm) Distance from probe tip to dipole centers: <2.7 mm
Application	General dosimetry up to 3 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones
Frequency	450 MHz to 6 GHz; Linearity: ± 0.5 dB (450 MHz to 6 GHz)
Dimensions	Overall length: 330 mm Tip diameter: 2.5 mm Distance from probe tip to dipole centers: 1 mm
Compatibility	COMOSAR

Isotropic E-Field Probe

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

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



6 OPERATIONAL CONDITIONS DURING TEST

6.1 Schematic Test Configuration

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

The Absolute Radio Frequency Channel Number (ARFCN) was allocated to 4132, 4183 and 4233 respectively in the case of WCDMA 850MHz, or to 9262, 9400 and 9538 respectively in the case of WCDMA 1900MHz, or to High, Middle, and Low Channel respectively in the case of LTE Band 4,17, and 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

6.2 SAR Measurement System

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

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

6.2.1 Tissue Dielectric Parameters for Head and Body Phantoms

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

Table 1: Recommended Dielectric Performance of Tissue

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

Table 2 Recommended Tissue Dielectric Parameters

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

6.2.2 Simulant liquids

For 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 WCDMA 850MHz /1900MHz, LTE Band 4,17 and 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: 23.2°C; Humidity: 64%;			
/	Frequency	Permittivity ε	Conductivity σ (S/m)
Target value	750MHz	55.2	0.97
Validation value (Jan. 5th, 2015)	750MHz	54.82	0.96
Target value	850MHz	55.2	0.97
Validation value (Jan. 5th, 2015)	850MHz	55.26	0.98
Target value	1900MHz	53.3	1.52
Validation value (Jan. 6th, 2015)	1900MHz	53.28	1.53
Target value	2450MHz	52.7	1.95
Validation value (Jan. 6th, 2015)	2450MHz	52.65	1.96
Target value	1800MHz	53.3	1.52
Validation value (June. 4th, 2015)	1800MHz	53.28	1.53

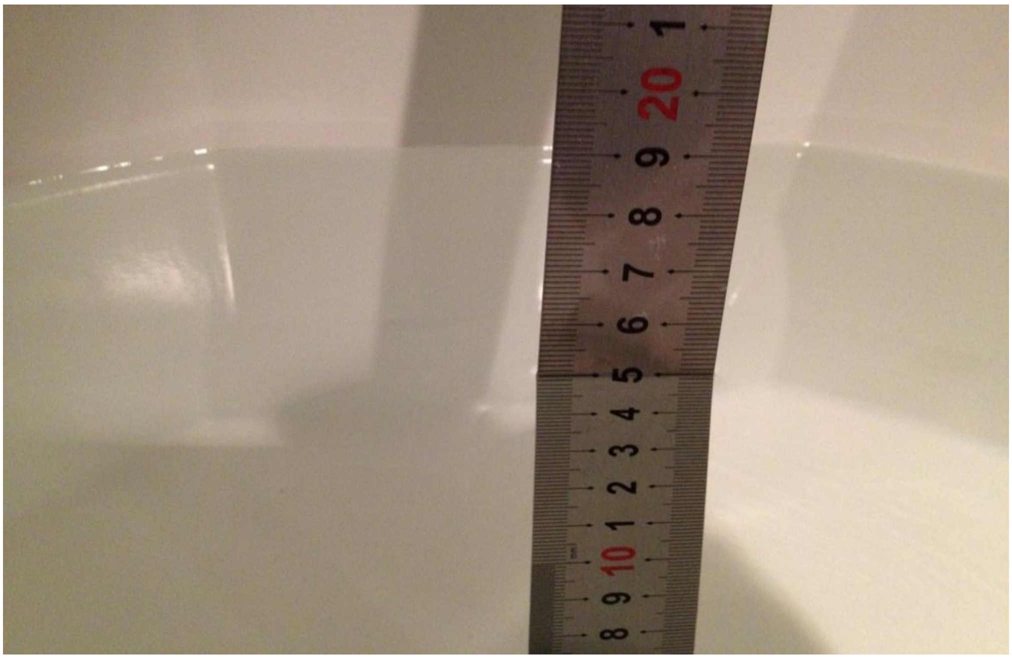
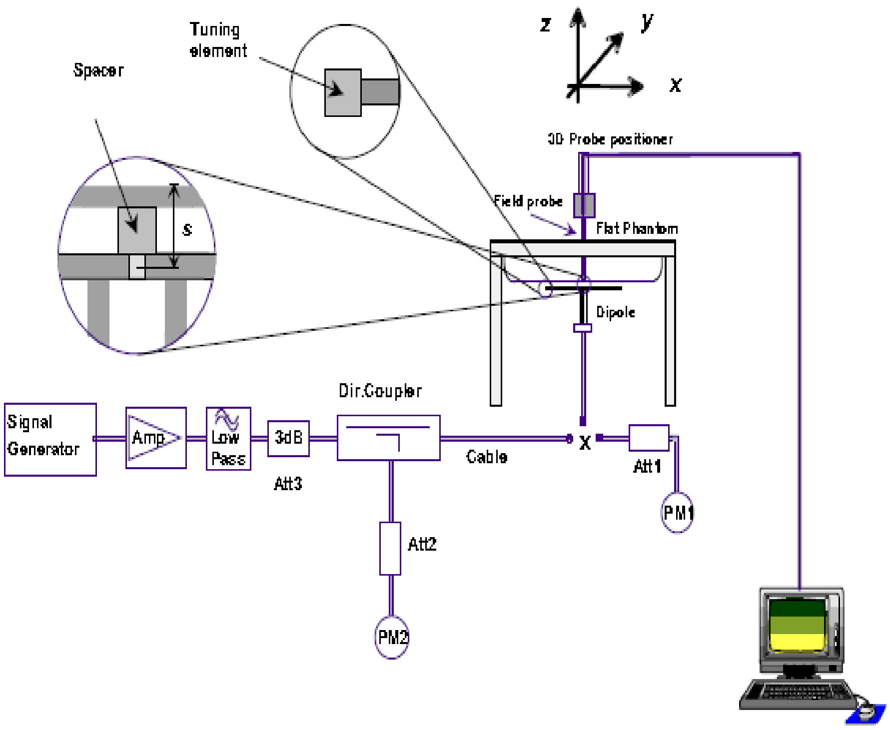


Fig. 1 Configuration of body tissue

6.3 Results of validation testing

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

The following procedure, recommended for performing validation tests using box phantoms is based on the procedures described in the IEEE standard P1528. 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 4. 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 0 mm (taking into account of the IEEE 1528 and the place of the antenna).

Table 4: Body SAR system validation (1g)

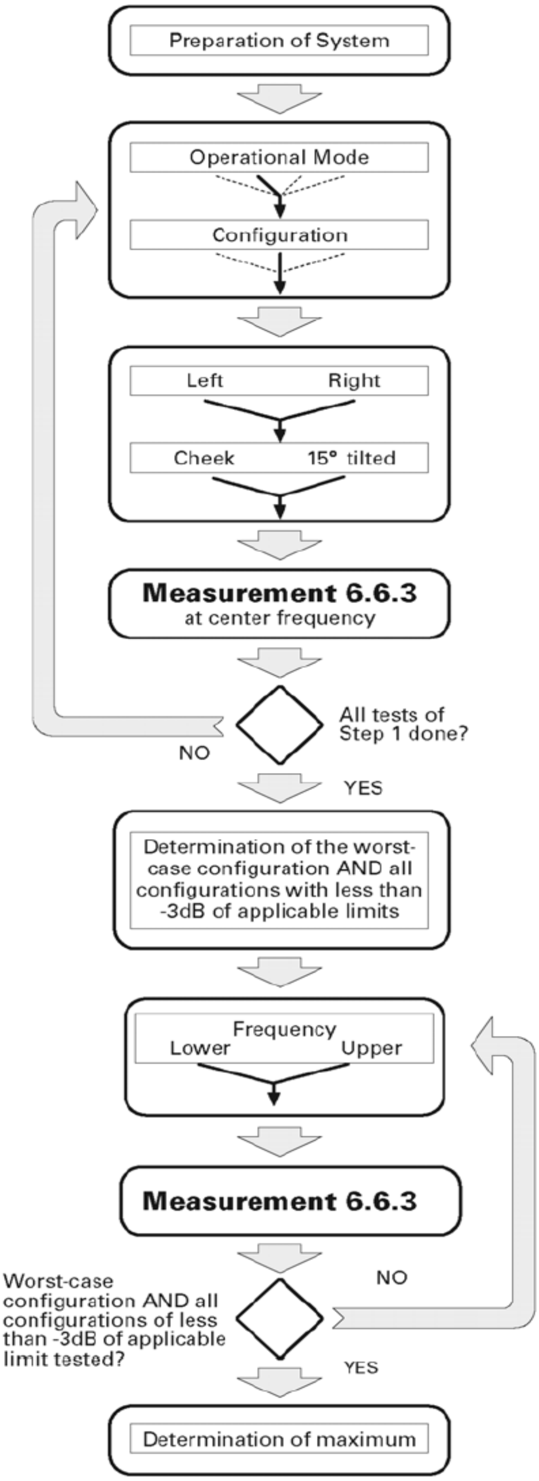
Frequency	Duty cycle	Target value （W/kg）	Test value (W/kg)	
			250 mW	1W
750MHz(Jan. 5th, 2015)	1:1	8.21	1.99	7.96
850MHz(Jan. 5th, 2015)	1:1	10.31	2.46	9.84
1900MHz(Jan. 6th, 2015)	1:1	40.81	9.98	39.92
2450MHz(Jan. 6th, 2015)	1:1	52.66	13.08	52.32
1800MHz(June 4th, 2015)	1:1	40.07	9.68	38.72

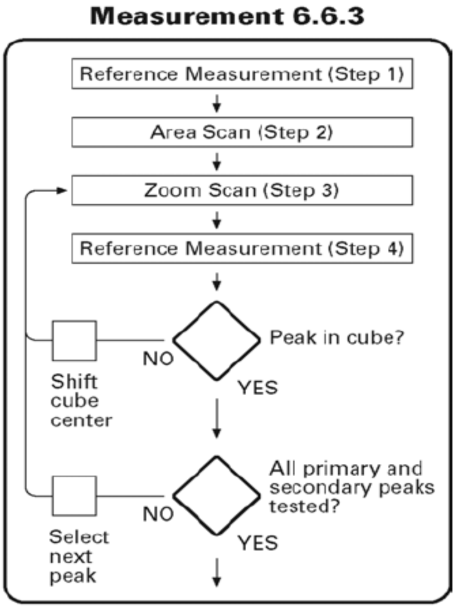
* Note: Target value was referring to the measured value in the calibration certificate of reference dipole.

Note: All SAR values are normalized to 1W forward power.

6.4 SAR measurement procedure

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





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

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

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

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

6.5 Transmitting antenna information

There are two antennas (WCDMA&LTE antenna, WIFI&BT antenna) inside the EUT, and they are a type of PIFA antenna.

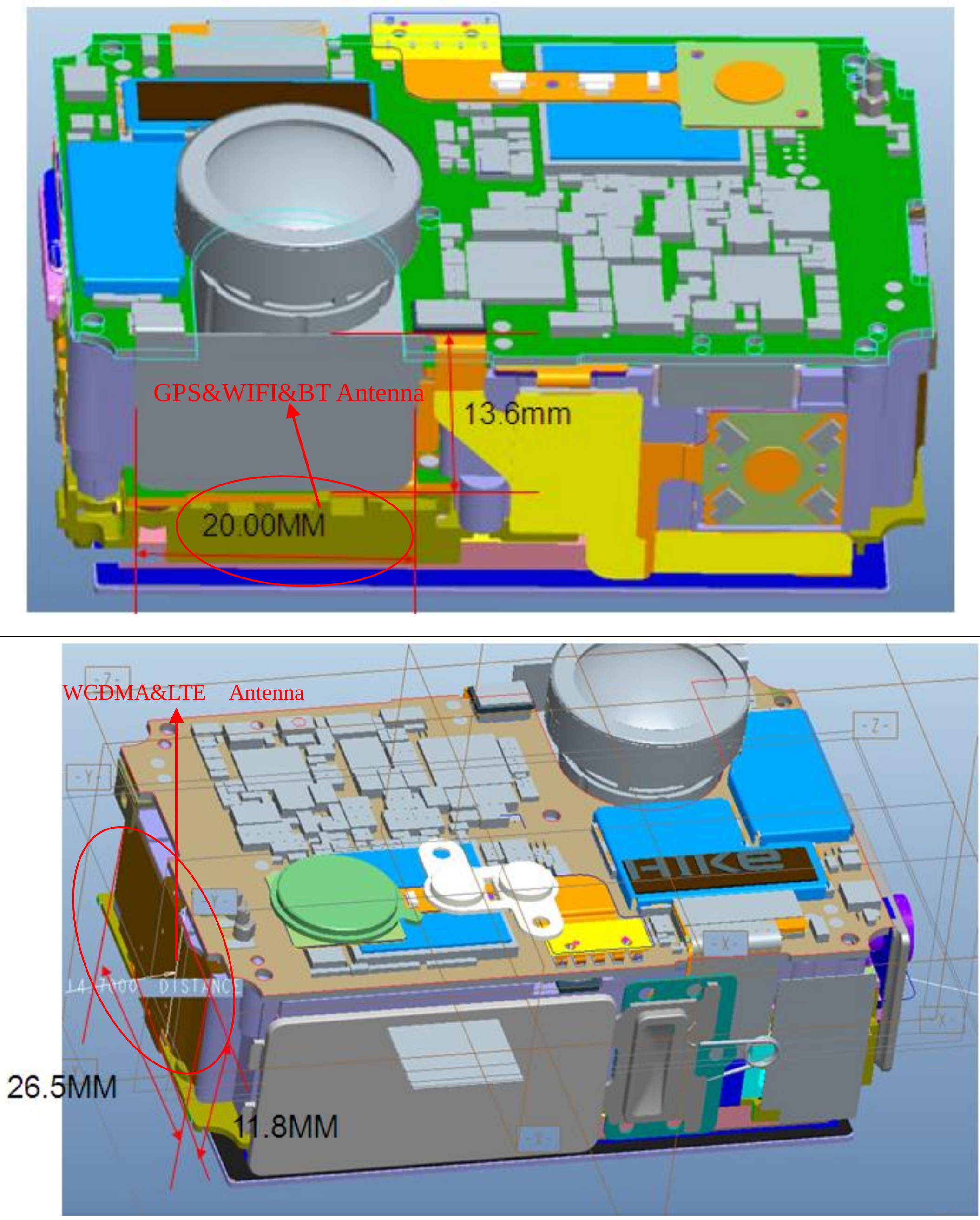


Fig. 3 Position of the antennas

7 CHARACTERISTICS OF THE TEST

7.1 Applicable Limit Regulations

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

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

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

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

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.

7.2 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 v05r02

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 RF Exposure Reporting

FCC KDB 941225 D01 v02 SAR test for 3G devices

FCC KDB 941225 D05 v02r03 SAR for LTE devices

FCC KDB 941225 D06 v01r01 Hot Spot SAR

8 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.

9.Conducted RF Output Power

9.1 WCDMA Conducted peak output Power

Item (RMC)	band	WCDMA 850			WCDMA 1900		
	ARFCN	4132	4182	4233	9262	9400	9538
	subtest	dBm			dBm		
RMC 12.2kbps	non	**22.84**	22.76	22.61	22.63	**22.86**	22.79
AMR	non	22.65	22.59	22.57	22.48	22.75	22.58
HSDPA	1	22.41	22.08	22.18	22.18	22.08	22.08
	2	22.19	22.01	22.09	22.07	22.01	22.00
	3	21.68	21.91	21.78	21.85	21.89	21.95
	4	21.79	21.54	21.61	21.77	21.94	21.83
HSUPA	1	22.04	22.07	22.17	22.14	22.07	21.97
	2	21.99	22.14	22.21	22.03	21.89	21.74
	3	21.86	22.09	22.08	22.17	22.01	22.08
	4	22..05	22.04	22.33	21.99	21.51	21.74
	5	22.23	22.16	22.11	22.05	22.25	22.08
HSPA+	1	22.23	22.18	22.25	22.01	22.05	22.07
Note:	The Conducted RF Output Power test of WCDMA /HSDPA /HSUPA /HSPA+ was tested by power meter.						

HSUPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1)*	β_{ec}	β_{ed} *(Note 5) (Note 6)*	β_{ed} *(SF)*	β_{ed} *(Codes)*	CM *(dB) (Note 2)*	MPR *(dB) (Note 2)*	*AG Index (Note 6)*	*E-TFCI*
1	11/15 *(Note 3)*	15/15 *(Note 3)*	64	11/15 *(Note 3)*	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 *(Note 4)*	15/15 *(Note 4)*	64	15/15 *(Note 4)*	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.
Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.
Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Setup Configuration

HSDPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Note:

1. Per KDB941225 D01v03, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.
2. It is expected by the manufacturer that MPR for some HSPA subtests may be up to 2dB more than specified by 3GPP,but also as low as 0dB according to the chipset implementation in this model.

9.2 LTE Band 4 Conducted Power Test Verdict:

BW(MHz)	Modulation	RB Size	RB Offset	Power(dBm) Low Ch./Freq.	Power(dBm) Middle Ch./Freq.	Power(dBm) High Ch./Freq.
Channel				20050	20175	20300
Frequency(MHz)				1720	1732.5	1745
20	QPSK	1	0	23.62	**23.66**	23.59
20	QPSK	1	49	23.54	23.55	23.57
20	QPSK	1	99	23.61	23.57	23.55
20	QPSK	50	0	22.72	22.87	22.84
20	QPSK	50	24	22.82	22.75	22.81
20	QPSK	50	49	22.74	22.72	22.82
20	QPSK	100	0	22.71	22.75	22.85
20	16QAM	1	0	22.60	22.63	22.61
20	16QAM	1	49	22.54	22.45	22.63
20	16QAM	1	99	22.44	22.50	22.54
20	16QAM	50	0	21.87	21.75	21.78
20	16QAM	50	24	21.79	21.77	21.80
20	16QAM	50	49	21.81	21.71	21.86
20	16QAM	100	0	21.74	21.65	21.81

Channel				20025	20175	20325
Frequency(MHz)				1717.5	1732.5	1747.5
15	QPSK	1	0	23.57	23.65	23.62
15	QPSK	1	37	23.53	23.51	23.64
15	QPSK	1	74	23.59	23.57	23.51
15	QPSK	36	0	22.82	22.77	22.84
15	QPSK	36	18	22.88	22.76	22.81
15	QPSK	36	37	22.76	22.74	22.80
15	QPSK	75	0	22.79	22.76	22.92
15	16QAM	1	0	22.46	22.57	22.63
15	16QAM	1	37	22.50	22.66	22.59
15	16QAM	1	74	22.57	22.62	22.58
15	16QAM	36	0	21.76	21.73	21.84
15	16QAM	36	18	21.69	21.73	21.77
15	16QAM	36	37	21.79	21.70	21.83
15	16QAM	75	0	21.78	21.71	21.81

BW(MHz)	Modulation	RB Size	RB Offset	Power(dBm) Low Ch./Freq.	Power(dBm) Middle Ch./Freq.	Power(dBm) High Ch./Freq.
Channel				20000	20175	20350
Frequency(MHz)				1715	1732.5	1750
10	QPSK	1	0	23.57	23.60	23.62
10	QPSK	1	24	23.62	23.65	23.65
10	QPSK	1	49	23.62	23.59	23.63
10	QPSK	25	0	22.94	22.86	22.85
10	QPSK	25	12	22.82	22.79	22.80
10	QPSK	25	24	22.78	22.80	22.85
10	QPSK	50	0	22.76	22.82	22.91
10	16QAM	1	0	22.67	22.55	22.64
10	16QAM	1	24	22.61	22.52	22.65
10	16QAM	1	49	22.68	22.72	22.56
10	16QAM	25	0	21.80	21.73	21.86
10	16QAM	25	12	21.84	21.75	21.82
10	16QAM	25	24	21.79	21.75	21.84
10	16QAM	50	0	21.82	21.74	21.79
Channel				19975	20175	20375
Frequency(MHz)				1712.5	1732.5	1752.5
5	QPSK	1	0	23.57	23.59	23.62
5	QPSK	1	12	23.55	23.58	23.60
5	QPSK	1	24	23.61	**23.63**	23.58
5	QPSK	12	0	22.71	22.77	22.82

5	QPSK	12	6	22.81	22.82	22.78
5	QPSK	12	11	22.81	22.73	22.77
5	QPSK	25	0	22.85	22.78	22.75
5	16QAM	1	0	22.47	22.46	22.60
5	16QAM	1	12	22.51	22.47	22.39
5	16QAM	1	24	22.59	22.51	22.55
5	16QAM	12	0	21.73	21.71	21.82
5	16QAM	12	6	21.66	21.62	21.69
5	16QAM	12	11	21.70	21.75	21.72
5	16QAM	25	0	21.83	21.72	21.70

BW(MHz)	Modulation	RB Size	RB Offset	Power(dBm) Low Ch./Freq.	Power(dBm) Middle Ch./Freq.	Power(dBm) High Ch./Freq.
Channel				19965	20175	20385
Frequency(MHz)				1711.5	1732.5	1753.5
3	QPSK	1	0	23.56	23.59	23.58
3	QPSK	1	7	23.53	23.60	23.50
3	QPSK	1	14	23.52	23.52	23.58
3	QPSK	8	0	22.77	22.71	22.76
3	QPSK	8	4	22.75	22.75	22.78
3	QPSK	8	7	22.69	22.70	22.70
3	QPSK	15	0	22.67	22.67	22.68
3	16QAM	1	0	22.31	22.45	22.49
3	16QAM	1	7	22.47	22.45	22.43
3	16QAM	1	14	22.38	22.30	22.36
3	16QAM	8	0	21.63	21.80	21.82
3	16QAM	8	4	21.64	21.68	21.68
3	16QAM	8	7	21.63	21.62	21.65
3	16QAM	15	0	21.52	21.56	21.58
Channel				19957	20175	20393
Frequency(MHz)				1710.7	1732.5	1754.3
1.4	QPSK	1	0	23.55	23.60	23.49
1.4	QPSK	1	2	23.59	23.52	23.58
1.4	QPSK	1	5	23.49	23.49	23.45
1.4	QPSK	3	0	23.53	23.58	23.42
1.4	QPSK	3	1	23.57	23.47	23.52
1.4	QPSK	3	2	23.56	23.37	23.41
1.4	QPSK	6	0	23.57	23.46	23.53
1.4	16QAM	1	0	22.72	22.77	22.61
1.4	16QAM	1	2	22.63	22.84	22.71
1.4	16QAM	1	5	22.81	22.91	22.94

1.4	16QAM	3	0	22.79	22.74	22.85
1.4	16QAM	3	1	22.52	22.73	22.67
1.4	16QAM	3	2	22.50	22.55	22.67
1.4	16QAM	6	0	22.49	22.55	22.66

LTE Band 17 Conducted Power Test Verdict:

BW(MHz)	Modulation	RB Size	RB Offset	Power(dBm) Low Ch./Freq.	Power(dBm) Middle Ch./Freq.	Power(dBm) High Ch./Freq.
Channel				23780	23790	23800
Frequency(MHz)				709	710	711
10	QPSK	1	0	23.21	23.25	23.34
10	QPSK	1	24	23.12	23.29	23.49
10	QPSK	1	49	**23.58**	23.43	23.51
10	QPSK	25	0	22.65	22.59	22.57
10	QPSK	25	12	22.56	22.47	22.62
10	QPSK	25	24	22.45	22.53	22.55
10	QPSK	50	0	22.23	22.17	22.20
10	16QAM	1	0	22.43	22.34	22.41
10	16QAM	1	24	22.30	22.24	22.51
10	16QAM	1	49	21.43	21.53	21.40
10	16QAM	25	0	21.56	21.61	21.47
10	16QAM	25	12	21.39	21.67	21.57
10	16QAM	25	24	21.55	21.47	21.53
10	16QAM	50	0	21.61	21.49	21.56
Channel				23755	23790	23825
Frequency(MHz)				706.5	710	713.5
5	QPSK	1	0	23.13	23.24	23.19
5	QPSK	1	12	23.11	23.17	23.24
5	QPSK	1	24	23.35	23.31	23.35
5	QPSK	12	0	22.34	22.33	22.29
5	QPSK	12	6	22.42	22.38	22.46
5	QPSK	12	11	22.34	22.52	22.45
5	QPSK	25	0	22.20	22.15	22.11
5	16QAM	1	0	22.14	22.20	22.21
5	16QAM	1	12	22.25	22.19	22.34
5	16QAM	1	24	22.35	22.48	22.39
5	16QAM	12	0	21.44	21.53	21.27
5	16QAM	12	6	21.29	21.48	21.41
5	16QAM	12	11	21.52	21.42	21.49
5	16QAM	25	0	21.43	21.40	21.44

9.3 WLAN 2.4GHz Band Conducted Power

Channel	Frequency (MHz)	WIFI Output Power(dBm)		
		802.11b	802.11g	802.11n-20
CH 01	2412	16.95	16.48	16.14
CH 06	2437	17.31	16.80	16.40
CH 11	2462	17.01	16.77	16.26

Channel	Frequency (MHz)	WIFI Output Power(dBm)
		802.11n-40
CH 03	2422	15.69
CH 06	2437	15.86
CH 09	2452	15.72

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-HT20/11n-HT40 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)	BT3.0 Output Power(dBm)		
		GFSK	Π /4-DQPSK	8-DPSK
CH 0	2402	6.29	5.67	5.70
CH 39	2441	6.79	6.20	6.16
CH 78	2480	7.34	6.66	6.47

Channel	Frequency(MHz)	BT 4.0
CH 0	2402	0.94
CH 20	2442	1.24
CH 39	2480	0.97

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
7.5	5.623	5	2.48	1.771

2. Per KDB 447498 D01v05r02 exclusion thresholds is 1.771<3, RF exposure evaluation is not required.

   BT estimated SAR value=Exclusion Thresholds/7.5=1.771/7.5=0.236W/Kg

General Note:

1. Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
2. Per KDB447498 D01v05r02, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is: ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is≤ 100 MHz. When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
3. Per KDB 865664 D01v01r03,for each frequency band,repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/Kg,only one repeated measurement is required.
4. Per KDB865664 D02v01r01, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing(Refer to appendix D for details).
5. Per KDB941225 D01 v03, when multiple slots can be used, the GPRS/EDGE slot configuration with the highest frame–averaged output power was selected for SAR testing.
6. Per KDB941225 D01v03, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.
7. Per KDB 248227 D01 v01r02, 802.11g /11n-HT20/11n-HT40 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.
8. 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.

6. Scaling Factor calculation

Operation Mode	Channel	Output Power(dBm)	Tune up Power in tolerance(dBm)	Scaling Factor
WCDMA850	4132	22.84	22.10 ± 0.8	1.014
	4183	22.76	22.10 ± 0.8	1.033
	4233	22.61	22.10 ± 0.8	1.069
WCDMA1900	9262	22.63	22.10 ± 0.8	1.064
	9400	22.86	22.10 ± 0.8	1.009
	9538	22.79	22.10 ± 0.8	1.026
LTE Band 4 1RB	20050	23.62	23.10± 0.8	1.117
	20175	23.66	23.10± 0.8	1.107
	20300	23.59	23.10± 0.8	1.125
LTE Band 4 50%RB	20050	22.72	23.10± 0.8	1.374
	20175	22.87	23.10± 0.8	1.327
	20300	22.84	23.10± 0.8	1.337
LTE Band17 1RB	23780	23.58	22.90 ± 0.8	1.028
	23790	23.43	22.90 ± 0.8	1.064
	23800	23.51	22.90 ± 0.8	1.045
LTE Band17 50%RB	23780	22.65	22.90 ± 0.8	1.274
	23790	22.59	22.90 ± 0.8	1.291
	23800	22.57	22.90 ± 0.8	1.297
802.11b	2412	16.95	17.00 ± 0.5	1.135
	2437	17.31	17.00 ± 0.5	1.045
	2462	17.01	17.00 ± 0.5	1.119
BT 3.0 GFSK	2480	7.34	6.50 ± 1	1.038

10 TEST RESULTS

10.1 Summary of Power Measurement Results

According the description above, the measurements against the body-worn were carried out on the operation mode : WCDMA850/1900MHz,LTE Band 4 and Band17,WIFI 802.11b.

Table 1: SAR Values of WCDMA850

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
Body (0mm distance)	Face Upward	4132/826.4	0.027	0.027
	Back Upward	4132/826.4	0.023	0.023
	Edge B	4132/826.4	0.034	0.034
	Edge C	4132/826.4	**0.098**	0.099
	Edge D	4132/826.4	0.042	0.043

Table 2: SAR Values of WCDMA1900

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
Body(0mm distance)	Face Upward	9400/1880.0	0.032	0.032
	Back Upward	9400/1880.0	0.030	0.030
	Edge B	9400/1880.0	0.054	0.054
	Edge C	9400/1880.0	**0.162**	0.163
	Edge D	9400/1880.0	0.072	0.073

Table 3: SAR Values of LTE Band 4, QPSK, 20M

Temperature: 23.0~23.5°C, humidity: 62~64%.						
Test Positions		Channel /Frequency (MHz)	RB Size	RB Offest	SAR(W/Kg), 1.6 (1g average)	
					SAR(W/Kg 1g Peak)	Scaled SAR(W/Kg),1g
Body (0mm distance)	Face Upward	2175/1732.5	1	0	0.034	0.038
			50	0	0.026	0.035
	Back Upward	2175/1732.5	1	0	0.048	0.053
			50	0	0.039	0.052
	Edge B	2175/1732.5	1	0	0.015	0.017
			50	0	0.013	0.017
	Edge C	2175/1732.5	1	0	**0.596**	0.660
			50	0	0.473	0.623
	Edge D	2175/1732.5	1	0	0.059	0.065
			50	0	0.048	0.064

Table 4: SAR Values of LTE Band 17, QPSK, 10M

Temperature: 23.0~23.5°C, humidity: 62~64%.						
Test Positions		Channel /Frequency (MHz)	RB Size	RB Offest	SAR(W/Kg), 1.6 (1g average)	
					SAR(W/Kg 1g Peak)	Scaled SAR(W/Kg),1g
Body(0mm distance)	Face Upward	23780/709	1	49	0.037	0.038
			25	0	0.015	0.019
	Back Upward	23780/709	1	49	0.049	0.049
			25	0	0.050	0.064
	Edge B	23780/709	1	49	0.034	0.035
			25	0	0.042	0.054
	Edge C	23780/709	1	49	0.164	0.169
			25	0	0.110	0.140
	Edge D	23780/709	1	49	**0.175**	0.180
			25	0	0.092	0.117

Table 5:SAR Values of Wi-Fi 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 (0mm distance)	Edge A	6/2437	**0.112**	0.117
	Edge B	6/2437	0.071	0.074
	Face Upward	6/2437	0.042	0.044
	Back Upward	6/2437	0.050	0.052

Note:

a) According to KDB 941225 D01, since the maximum average output of each RF channel with HSDPA/HSUPA active is less than that measured without HSDPA/HSUPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is less 1.2 W/kg, the measurement against HSDPA and HSUPA were ignored in this report.

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

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

SIMULTANEOUS TRANSMISSION ANALYSIS

Test Position		Face	Back	Edge A	Edge B	Edge C	Edge D
Body 10mm separation MAX 1-g SAR(W/Kg)	WCDMAS850	0.027	0.023	-	0.034	0.099	0.043
	WCDMA1900	0.032	0.030	-	0.054	0.163	0.073
	LTE Band 4	0.038	0.053	-	0.017	0.660	0.065
	LTE Band 17	0.038	0.064	-	0.054	0.169	0.180
	WIFI 802.11b	0.044	0.052	0.117	0.074	-	-
	BT	*0.236	*0.236	*0.236	*0.236	*0.236	*0.236
BT Simultaneous ∑1-g SAR(W/Kg)		0.274	0.300	0.236	0.290	**0.896**	0.416
WiFi Simultaneous ∑1-g SAR(W/Kg)		0.082	0.116	0.117	0.128	**0.660**	0.180

Simultaneous Tx Combination of WCDMA/LTE and BT/WIFI (Body).

The estimated SAR value with * Signal

SAR to Peak Location Separation Ratio (SPLSR)

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

10.2 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 6 of this report. Maximum localized SAR is **below** exposure limits specified in the relevant standards.

11 Measurement Uncertainty

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

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

System Check Uncertainty

No.	Uncertainty Component	Type	Uncertainty Value (%)	Probability Distribution	k	ci	Standard Uncertainty (%) ui(%)	Degree of freedom Veff or vi
	Measurement System							
1	—Probe Calibration	B	5.8	N	1	1	5.8	∞
2	—Axial isotropy	B	3.5	R	$\sqrt{3}$	0.5	1.43	∞
3	—Hemispherical Isotropy	B	5.9	R	$\sqrt{3}$	0.5	2.41	∞
4	—Boundary Effect	B	1	R	$\sqrt{3}$	1	0.58	∞
5	—Linearity	B	4.7	R	$\sqrt{3}$	1	2.71	∞
6	—System Detection Limits	B	1	R	$\sqrt{3}$	1	0.58	∞
7	Modulation response	B	0	N	1	1	0.00	

8	—Readout Electronics	B	0.5	N	1	1	0.50	∞
9	—Response Time	B	0.00	R	$\sqrt{3}$	1	0.00	∞
10	—Integration Time	B	1.4	R	$\sqrt{3}$	1	0.81	∞
11	—RF Ambient Conditions	B	3.0	R	$\sqrt{3}$	1	1.73	∞
12	—Probe Position Mechanical tolerance	B	1.4	R	$\sqrt{3}$	1	0.81	∞
13	—Probe Position with respect to Phantom Shell	B	1.4	R	$\sqrt{3}$	1	0.81	∞
14	—Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation	B	2.3	R	$\sqrt{3}$	1	1.33	∞
	Uncertainties of the DUT							
15	Deviation of experimental source from numberical source	A	4	N	1	1	4.00	5
16	Input Power and SAR drift measurement	A	5	R	$\sqrt{3}$	1	2.89	5
17	Dipole Axis to Liquid Distance	B	2	R	$\sqrt{3}$	1	1.2	∞
Phantom and Tissue Parameters								
18	—Phantom Uncertainty(shape and thickness tolerances)	B	4	R	$\sqrt{3}$	1	2.31	∞
19	Uncertainty in SAR correction for deviation(in permittivity and conductivity)	B	2	N	1	1	2.00	
20	—Liquid Conductivity Target –tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
21	—Liquid Conductivity –measurement Uncertainty)	B	4	N	$\sqrt{3}$	1	0.92	9
22	—Liquid Permittivity Target tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
23	—Liquid Permittivity –measurement uncertainty	B	5	N	$\sqrt{3}$	1	1.15	∞
Combined Standard Uncertainty				RSS			10.15	
Expanded uncertainty (Confidence interval of 95 %)				K=2			20.29	

12 MAIN TEST INSTRUMENTS

No.	EQUIPMENT	TYPE	Series No.	Last Calibration	Due Date
1	System Simulator	E5515C	GB 47200710	2015/08/14	1 Year
2	SAR Probe	SATIMO	SN 09/13 EP166	2014/08/05	1 Year
3	SAR Probe	SATIMO	SN 27/14 EPG210	2014/05/16	1 Year
4	Dipole	SID750	SN25/13 DIP0G750-253	2014/08/17	1 Year
5	Dipole	SID835	SN09/13 DIP0G835-217	2014/08/28	1 Year
6	Dipole	SID1900	SN09/13 DIP1G900-218	2014/08/28	1 Year
7	Dipole	SID2450	SN09/13 DIP2G450-220	2014/08/28	1 Year
8	Network Analyzer	ZVB8	A0802530	2015/06/02	1 Year
9	Signal Generator	SMR27	A0304219	2015/03/28	1 Year
10	Amplifier	Nucletudes	143060	2015/03/28	1 Year
11	Power Meter	NRVS	1020.1809.02	2015/03/28	1 Year
12	Power Sensor	NRV-Z4	100069	2015/03/28	1 Year
13	Power Meter	NRP2	A140401673	2015/03/28	1 Year
14	Power Sensor	NPR-Z11	1138.3004.02-114072-nq	2015/03/28	1 Year
15	Multimeter	Keithley-2000	4014020	2015/03/28	1 Year

ANNEX A

of

CCIC-SET

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-08377

CK Telecom Limited

EYE1

Type Name: EYE1

Hardware Version: **HICAM-V2.0**

Software Version: **HICAM01A-S10A_Sioeye_L2EN_140_150618**

TEST LAYOUT

This Annex consists of 6 pages

Date of Report: 2015-06-17

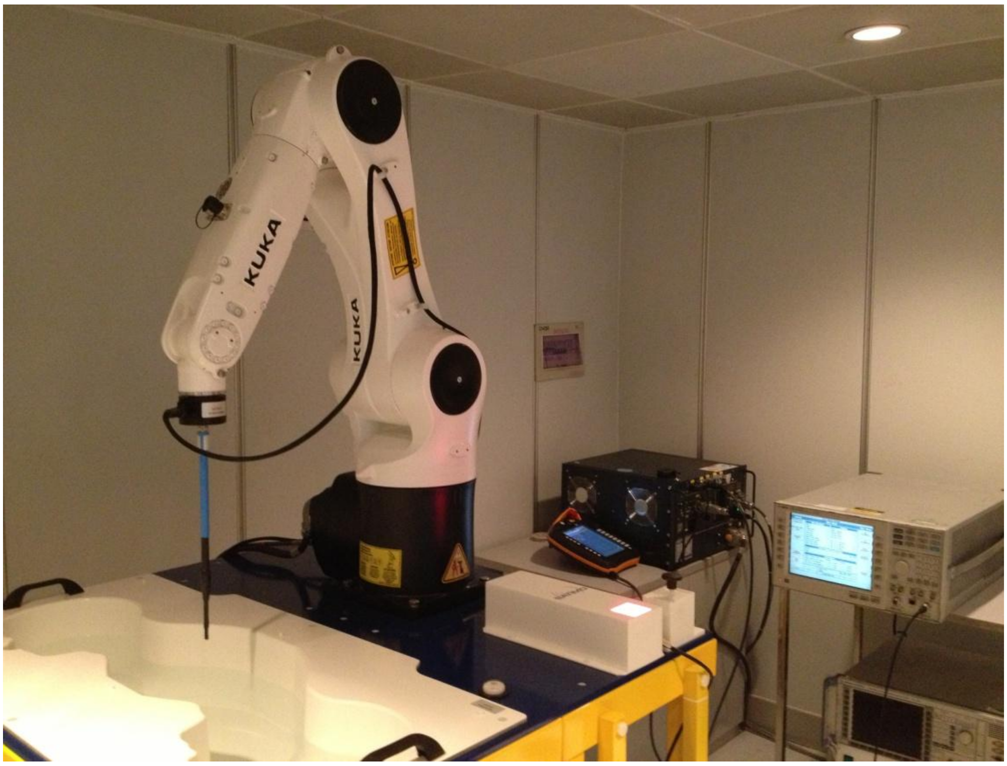


Fig.1 COMOSAR Test System

Fig.2 Body(Back upside) (0mm distance)

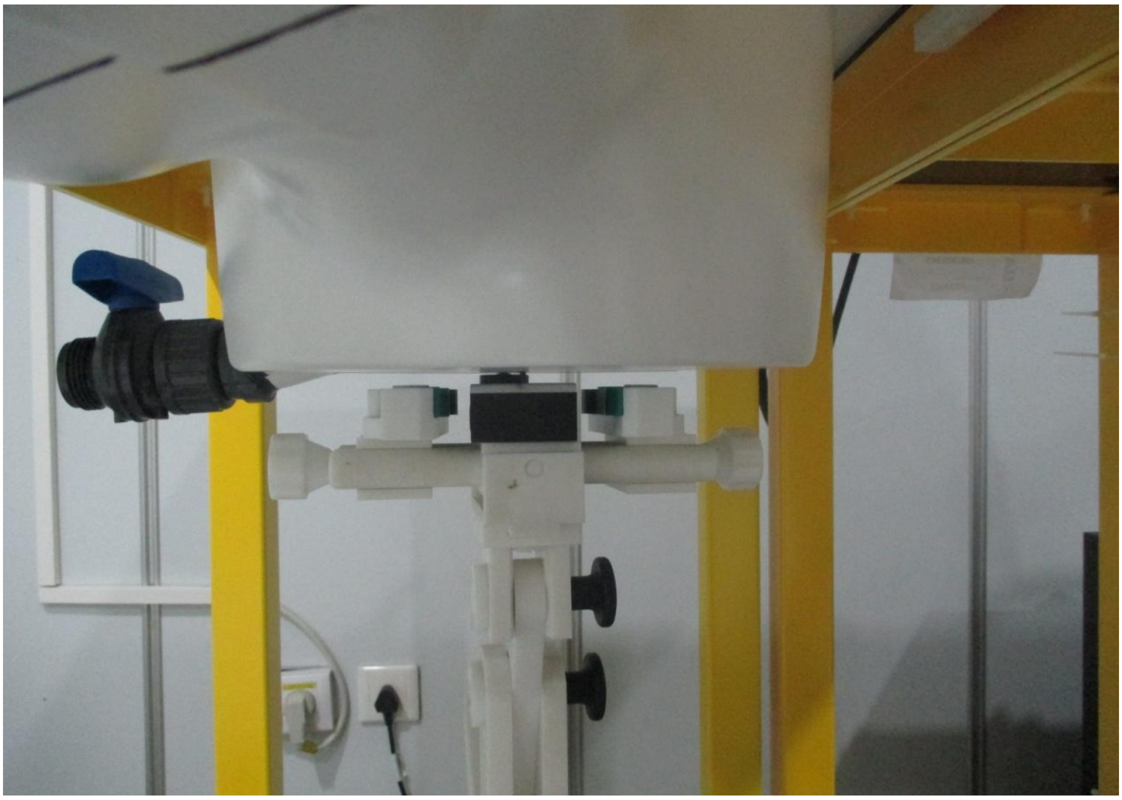


Fig.3 Body(Face upside) (0mm distance)

Fig.4 Body Edge A(0mm distance)

Fig.5 Body Edge B(0mm distance)

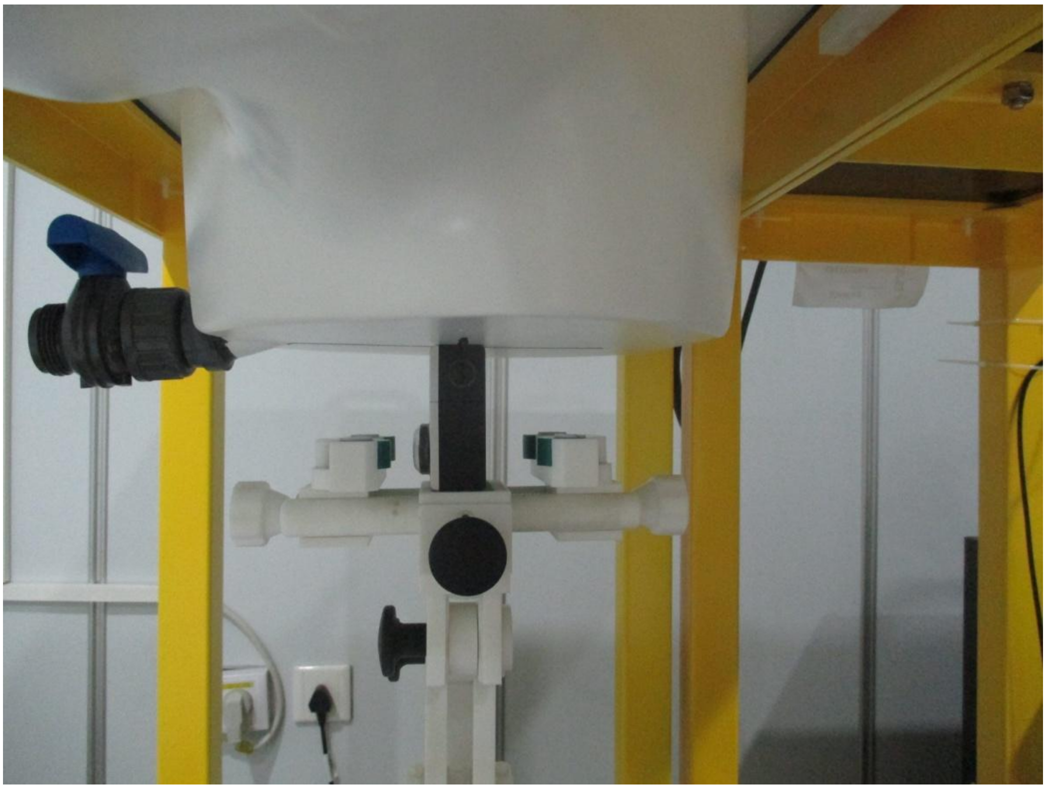


Fig.6 Body Edge C(0mm distance)

Fig.7 Body Edge D(0mm distance)

Fig.8 Body Liquid of 835MHz(15cm)

Fig.9 Body Liquid of 1900MHz(15cm)

Fig.10 Head Liquid of 2450MHz(15cm)

Fig.11 Body Liquid of 1800MHz(15cm)

ANNEX B

of

CCIC-SET

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-08377

EYE1

Type Name: EYE1

Hardware Version: HICAM-V2.0

Software Version: HICAM01A-S10A_Sioeye_L2EN_140_150618

Sample Photographs

This Annex consists of 2 pages

Date of Report: 2015-06-17

1. Appearance

Appearance and size (obverse)

Appearance and size (reverse)

ANNEX C

of

CCIC-SET

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-08377

EYE1

Type Name: EYE1

Hardware Version: **HICAM-V2.0**

Software Version: **HICAM01A-S10A_Sioeye_L2EN_140_150618**

System Performance Check Data and Highest SAR Plots

This Annex consists of 50 pages

Date of Report：2015-06-17

System Performance Check (Body, 750MHz)

Type: Validation measurement (Complete)

Date of measurement: 05/01/2015

Measurement duration: 20 minutes 52 seconds

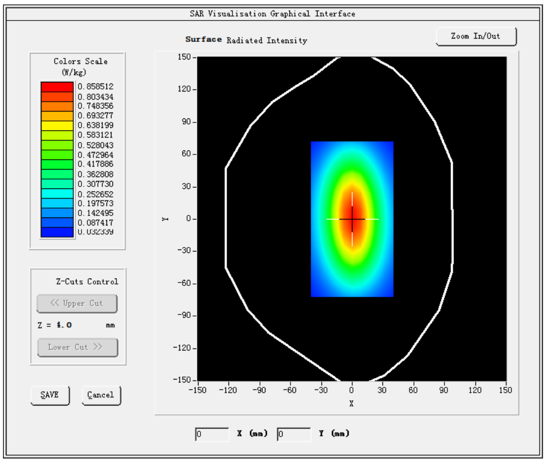
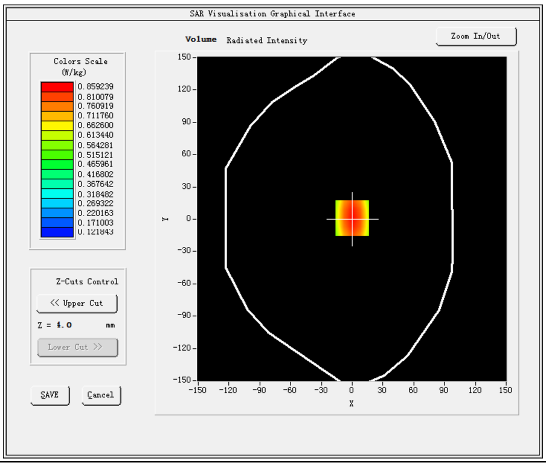
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Body
Band	CW750
Channels	Middle
Signal	CW (Crest factor: 1.0)

B. SAR Measurement Results

Frequency (MHz)	750.000000
Relative permittivity (real part)	55.531170
Relative permittivity (imaginary part)	24.594805
Conductivity (S/m)	1.024784
Variation (%)	-0.170000
ConvF	23.36

SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=1.00

SAR 10g (W/Kg)	0.965604
SAR 1g (W/Kg)	1.988657

System Performance Check (Body, 835MHz)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 05/01/2015
Measurement duration: 20 minutes 12 seconds

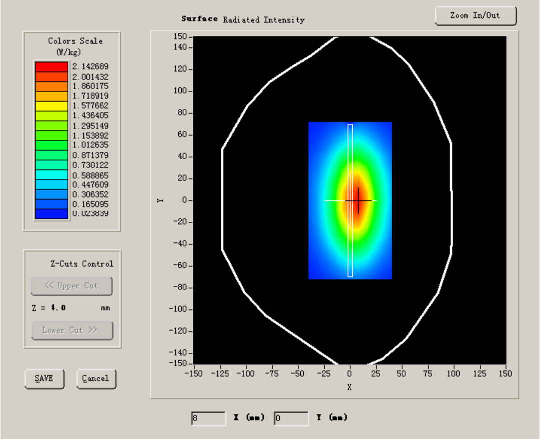
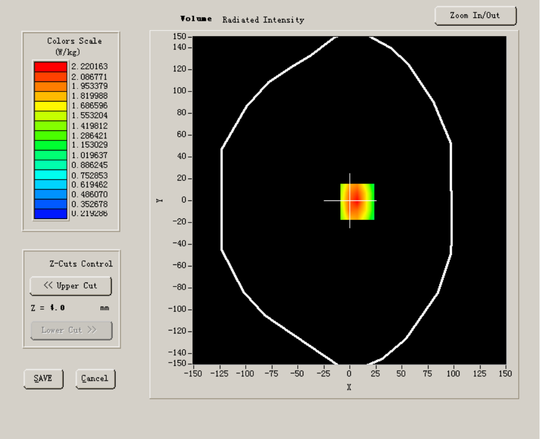
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat Plane
Device Position	
Band	CW850
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	835.000000
Relative permittivity (real part)	55.26
Relative permittivity	21.71
Conductivity (S/m)	0.98
Power drift (%)	-0.270000
Ambient Temperature:	23.2 ℃
Liquid Temperature:	23.5 ℃
ConvF:	5.84
Duty factor:	1:1

SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=7.00, Y=-1.00

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

System Performance Check (Body, 1900MHz)

Type: Phone measurement (Complete)

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

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

Date of measurement: 06/01/2015

Measurement duration: 21 minutes 12 seconds

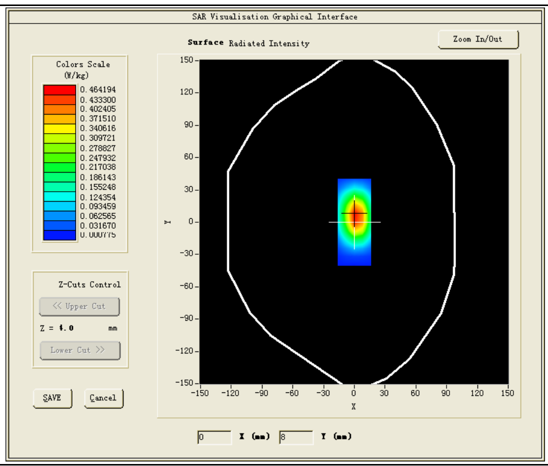
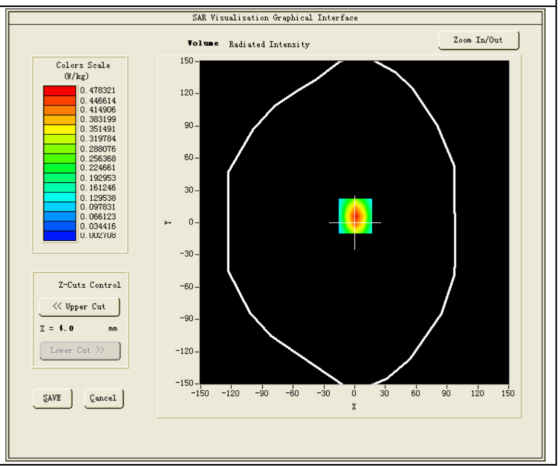
A. Experimental conditions.

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

B. SAR Measurement Results

Band SAR

Frequency (MHz)	1900.000000
Relative permittivity (real part)	53.28
Relative permittivity	12.99
Conductivity (S/m)	1.53
Power Drift (%)	0.410000
Ambient Temperature:	22.0 ℃
Liquid Temperature:	21.8 ℃
ConvF:	5.42
Duty factor:	1:1

SURFACE SAR	VOLUME SAR
	

Maximum location: X=1.00, Y=6.00

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

System Performance Check (Body, 2450MHz)

Type: Phone measurement (Complete)

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

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

Date of measurement: 06/01/2015

Measurement duration: 13 minutes 21 seconds

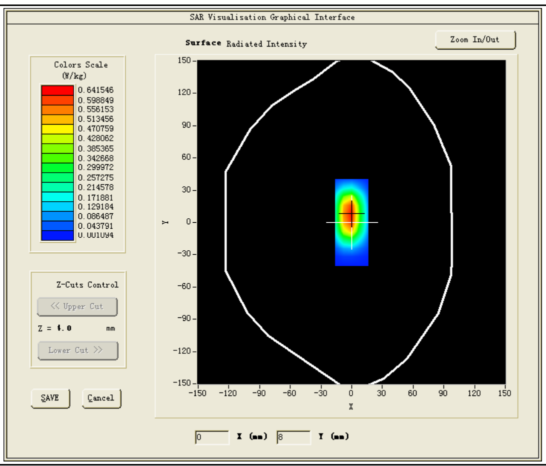
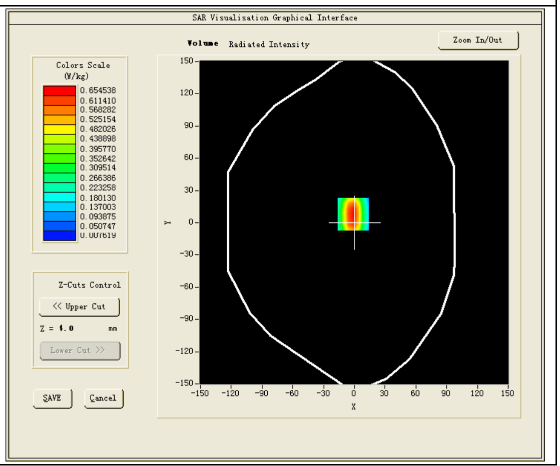
A. Experimental conditions.

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

B. SAR Measurement Results

Band SAR

Frequency (MHz)	2450.000000
Relative permittivity (real part)	52.65
Relative permittivity	13.02
Conductivity (S/m)	1.96
Power Drift (%)	-0.310000
Duty factor:	1:1
ConvF:	5.07

SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=8.00

SAR 10g (W/Kg)	6.032464
SAR 1g (W/Kg)	13.087432

System Performance Check (Body, 1800MHz)

Type: Phone measurement (Complete)

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

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

Date of measurement: 15/06/2015

Measurement duration: 21 minutes 12 seconds

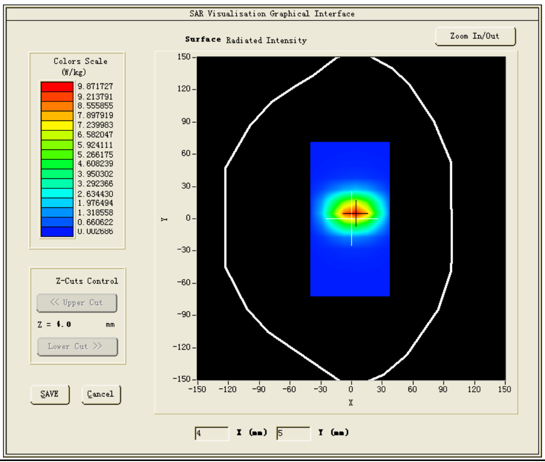
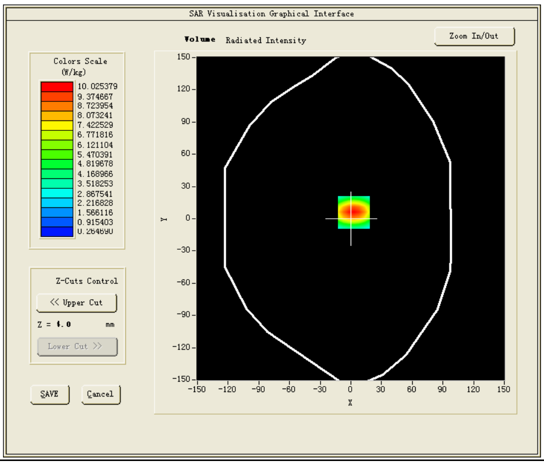
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	
Band	1800MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	1800.000000
Relative permittivity (real part)	53.283302
Relative permittivity	15.305300
Conductivity (S/m)	1.533530
Power Drift (%)	-0.350000
Ambient Temperature:	22.5 ℃
Liquid Temperature:	22.2 ℃
ConvF:	4.93
Duty factor:	1:1

SURFACE SAR	VOLUME SAR
	

Maximum location: X=3.00, Y=6.00

SAR 10g (W/Kg)	5.041437
SAR 1g (W/Kg)	9.684023

WCDMA850, Edge C, Low

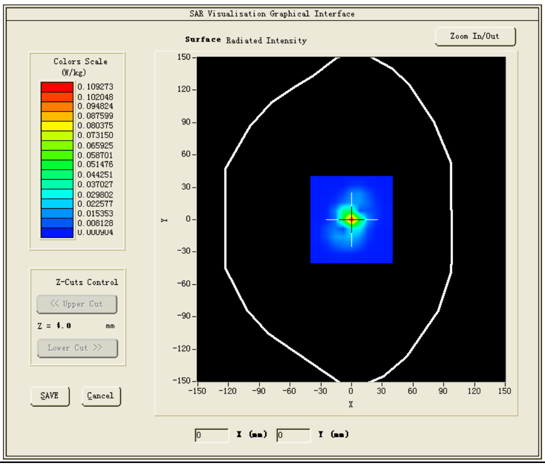
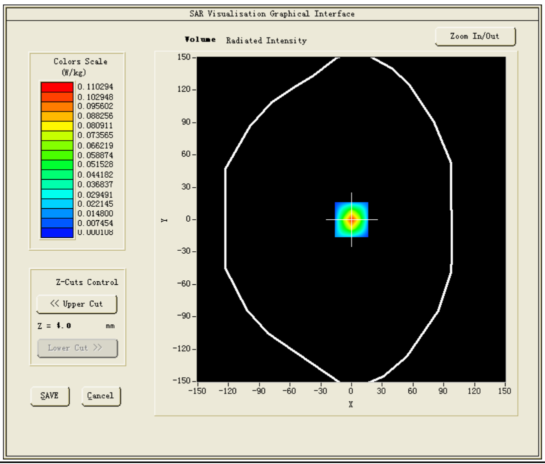
Type: Phone measurement
Date of measurement: 05/01/2015
Measurement duration: 7 minutes 26 seconds
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	surf_sam_plan.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band5_WCDMA850
Channels	4132
Signal	WCDMA (Crest factor: 1:1)

B. SAR Measurement Results

Frequency (MHz)	826.4
Relative permittivity (real part)	55.26
Relative permittivity (imaginary part)	21.71
Conductivity (S/m)	0.98
Variation (%)	0.510000
ConvF:	5.84

SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00

SAR 10g (W/Kg)	0.036825
SAR 1g (W/Kg)	0.097761

WCDMA1900, Edge C, Middle

Type: Phone measurement

Date of measurement: 06/01/2015

Measurement duration: 7 minutes 37 seconds

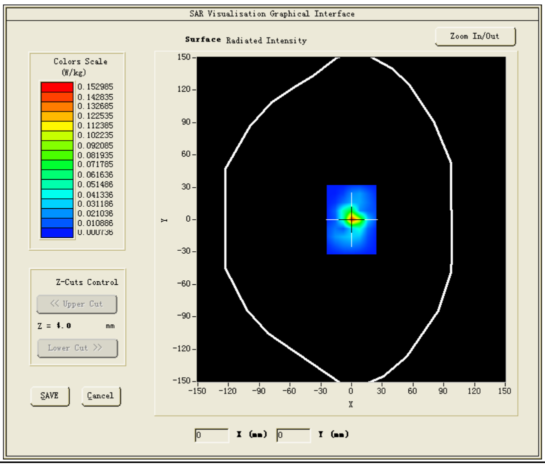
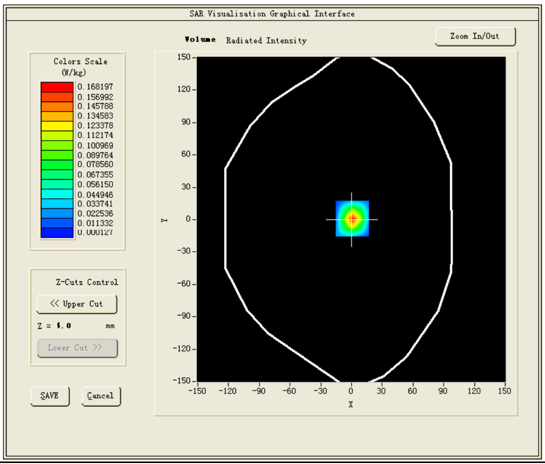
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	surf_sam_plan.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band2_WCDMA1900
Channels	9400
Signal	WCDMA (Duty cycle: 1:1)

B. SAR Measurement Results

Frequency (MHz)	1880.0
Relative permittivity (real part)	53.28
Relative permittivity (imaginary	12.99
Conductivity (S/m)	1.53
Variation (%)	0.220000
ConvF:	5.42

SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=1.00, Y=1.00

SAR 10g (W/Kg)	0.060632
SAR 1g (W/Kg)	0.162076

LET Band4, Edge C, Middle,20M,1RB#0

Type: Phone measurement

Date of measurement: 04/06/2015

Measurement duration: 7 minutes 23 seconds

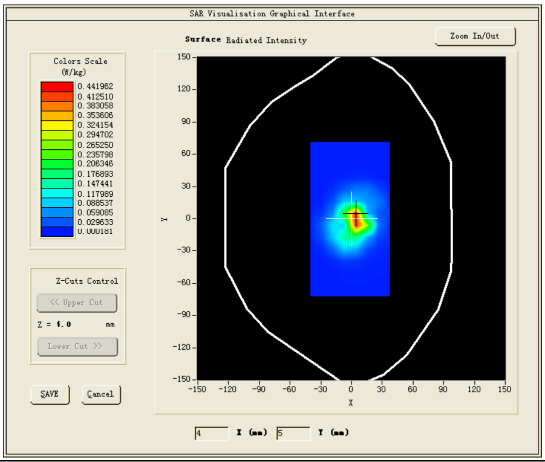
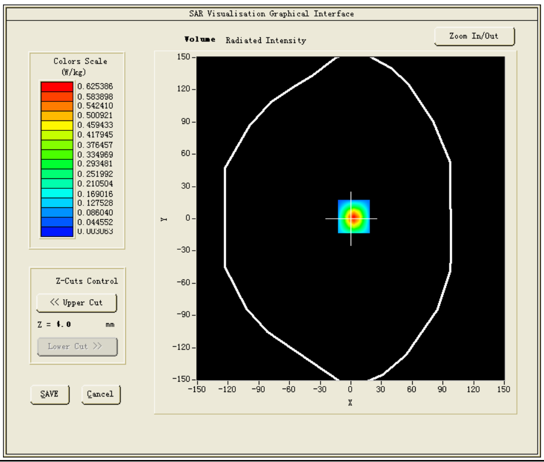
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	surf_sam_plan.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	LTE Band 4
Channels	Middle
Signal	LTE

B. SAR Measurement Results

Frequency (MHz)	1732.5
Relative permittivity (real part)	53.283302
Relative permittivity (imaginary part)	15.305300
Conductivity (S/m)	1.533530
Variation (%)	-4.120000
ConvF:	4.93

SURFACE SAR	VOLUME SAR
	

Maximum location: X=3.00, Y=2.00

SAR 10g (W/Kg)	0.231937
SAR 1g (W/Kg)	0.595842

LET Band17, Edge D, Low,10M,1RB#49

Type: Phone measurement

Date of measurement: 05/01/2015

Measurement duration: 7 minutes 26 seconds

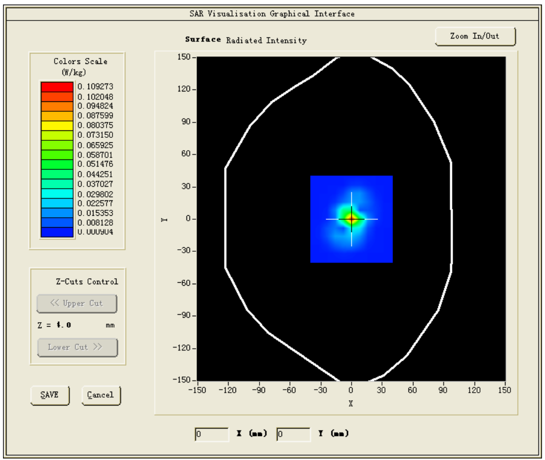
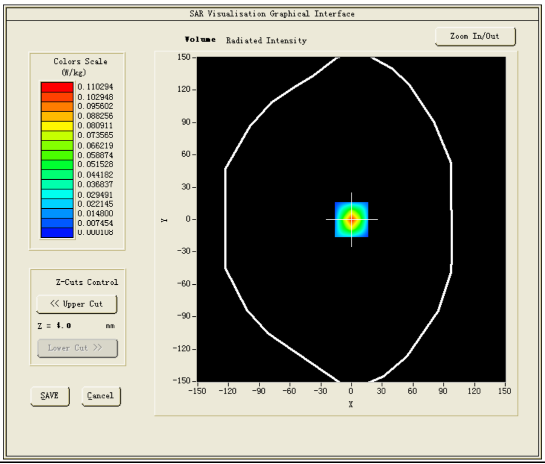
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	surf_sam_plan.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	LTE Band 17
Channels	Low
Signal	LTE

B. SAR Measurement Results

Frequency (MHz)	709
Relative permittivity (real part)	55.531170
Relative permittivity (imaginary part)	24.594805
Conductivity (S/m)	1.024784
Variation (%)	4.510000
ConvF:	23.36

SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=0.00

SAR 10g (W/Kg)	0.076008
SAR 1g (W/Kg)	0.175128

Wi-Fi 802.11b , Edge A, Middle

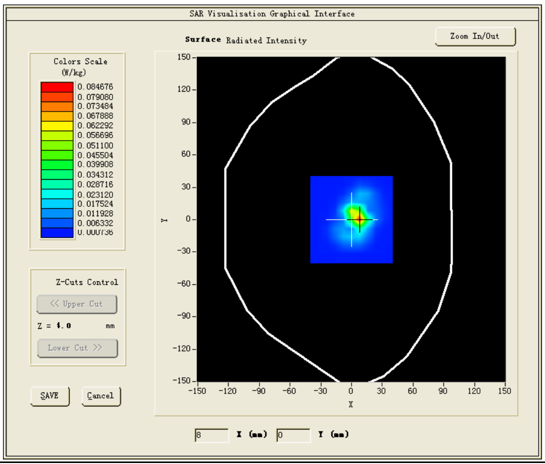
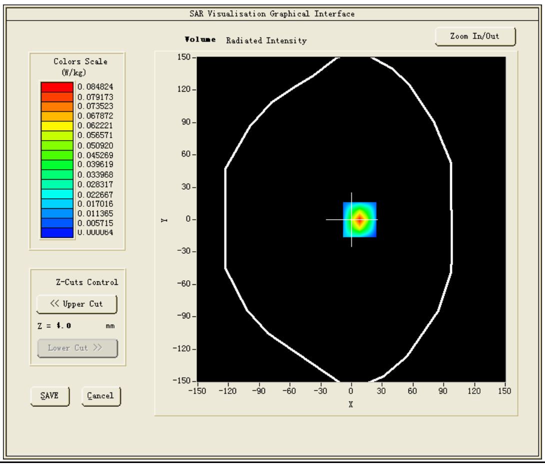
Type: Phone measurement (11 points in the volume)
Date of measurement: 06/01/2015
Measurement duration: 7 minutes 11 seconds
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	dx=8mm dy=8mm
ZoomScan	5x5x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b ISM
Channels	6
Signal	DSSS (Crest factor: 1:1)

B. SAR Measurement Results

Frequency (MHz)	2437
Relative permittivity (real part)	52.65
Relative permittivity (imaginary part)	13.02
Conductivity (S/m)	1.96
Variation (%)	0.560000
ConvF:	5.07

SURFACE SAR	VOLUME SAR
	

Maximum location: X=8.00, Y=0.00

SAR 10g (W/Kg)	0.061527
SAR 1g (W/Kg)	0.112314

ANNEX D

of

CCIC-SET

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-08377

EYE1

Type Name: EYE1

Hardware Version： **HICAM-V2.0**

Software Version： **HICAM01A-S10A_Sioeye_L2EN_140_150618**

Calibration Certificate of Probe and Dipoles

This Annex consists of 45 pages

Date of Report：2015-06-17

Probe Calibration Ceriticate

COMOSAR E-Field Probe Calibration Report

Ref : ACR.227.15.14.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 04/13 EP166

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

Calibration CERT #2246-02

08/14/2014

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	8/15/2014	
Checked by :	Jérôme LUC	Product Manager	8/15/2014	
Approved by :	Kim RUTKOWSKI	Quality Manager	8/15/2014	Kim Rutkowski

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

Issue	*Date*	*Modifications*
A	8/15/2014	Initial release

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1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	Satimo
Model	SSE5
Serial Number	SN 04/13 EP166
Product Condition (new / used)	Used
Frequency Range of Probe	0.7 GHz-3GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.232 MΩ Dipole 2: R2=0.226 MΩ Dipole 3: R3=0.228 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.

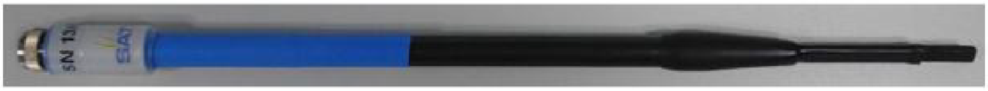


Figure 1 – *Satimo COMOSAR Dosimetric E field Dipole*

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	1.732%
Reflected power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Liquid conductivity	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Liquid permittivity	4.00%	Rectangular	$\sqrt{3}$	1	2.309%
Field homogeneity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Field probe positioning	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Field probe linearity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%

Combined standard uncertainty					5.831%
Expanded uncertainty 95 % confidence level k = 2					12.0%

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

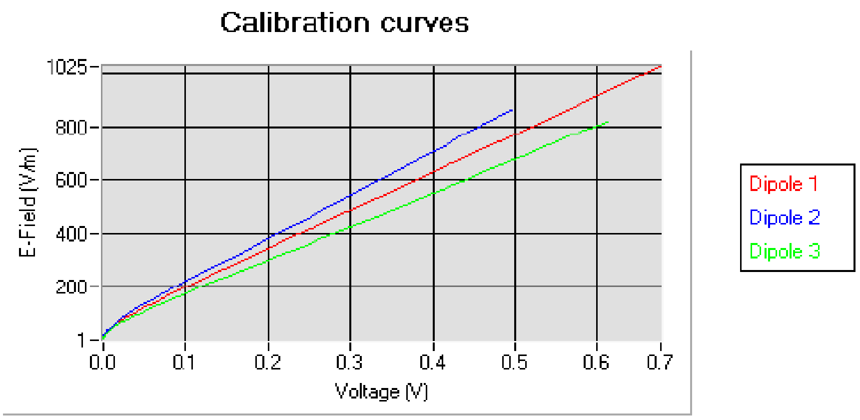
5.1 SENSITIVITY IN AIR

Normx dipole 1 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
8.57	4.83	7.15

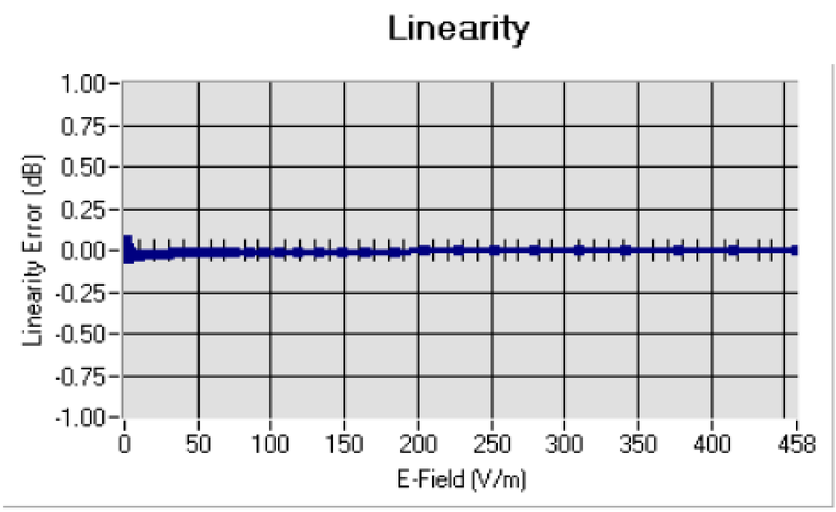
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
92	90	95

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:+/-1.55% (+/-0.07dB)

5.3 SENSITIVITY IN LIQUID

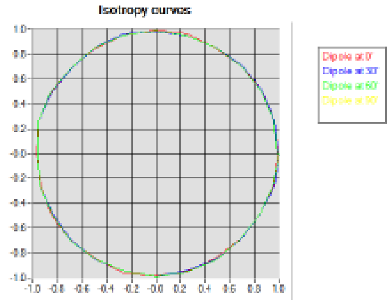
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL850	835	42.81	0.89	5.68
BL850	835	53.46	0.96	5.84
HL900	900	42.47	0.96	5.34
BL900	900	56.69	1.08	5.54
HL1800	1800	41.31	1.38	4.75
BL1800	1800	53.27	1.51	4.93
HL1900	1900	41.09	1.42	5.25
BL1900	1900	54.20	1.54	5.42
HL2000	2000	39.72	1.43	4.81
BL2000	2000	53.91	1.53	4.91
HL2450	2450	39.05	1.77	4.93
BL2450	2450	52.97	1.93	5.07
HL2600	2600	38.35	1.92	5.02
BL2600	2600	51.81	2.19	5.22

LOWER DETECTION LIMIT: 7mW/kg

5.4 ISOTROPY

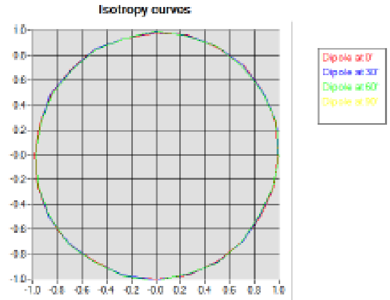
HL900 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.07 dB



HL1800 MHz

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.07 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	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.
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	8/2012	8/2015

SID835 Dipole Calibration Ceriticate

SATIMO

The microwave vision company

SAR Reference Dipole Calibration Report

Ref : ACR.240.1.14.SATU.A

CCIC SOUTHERN ELECTRONIC PRODUCT TESTING (SHENZHEN) CO., LTD
ELECTRONIC TESTING BUILDING, SHAHE ROAD, XILI TOWN
SHENZHEN, P.R. CHINA (POST CODE:518055)
SATIMO COMOSAR REFERENCE DIPOLE
FREQUENCY: 835 MHZ
SERIAL NO.: SN 09/13 DIP0G835-217

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

ilac-MRA

A2LA 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

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1 INTRODUCTION

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

2 DEVICE UNDER TEST

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

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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

Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

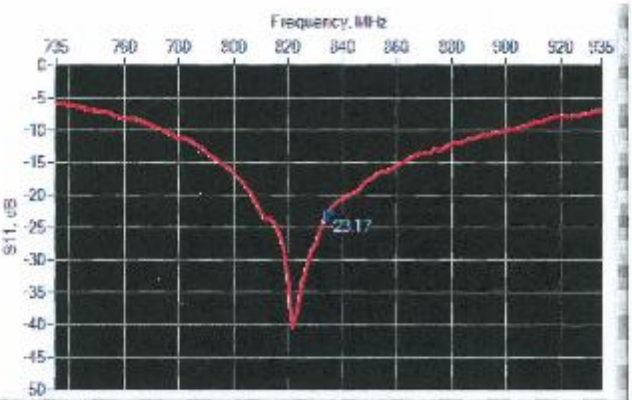
5.3 VALIDATION MEASUREMENT

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

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

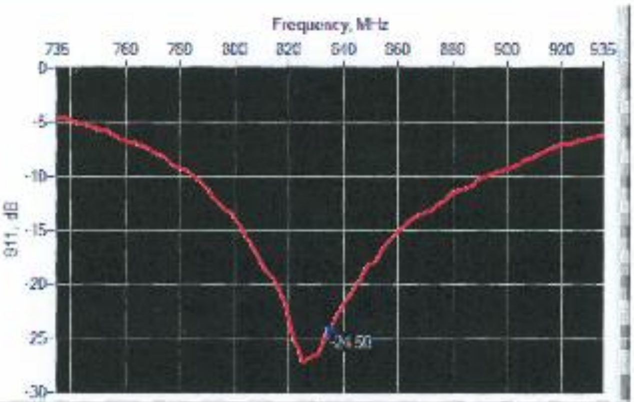
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-23.17	-20	57.4 Ω - 0.2 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
835	-24.50	-20	55.0 Ω + 3.9 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 %.	PASS	89.8 ±1 %.	PASS	3.6 ±1 %.	PASS

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 %.		30.4 ±1 %.		3.6 ±1 %.	
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 %	PASS	0.90 ±5 %	PASS
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 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

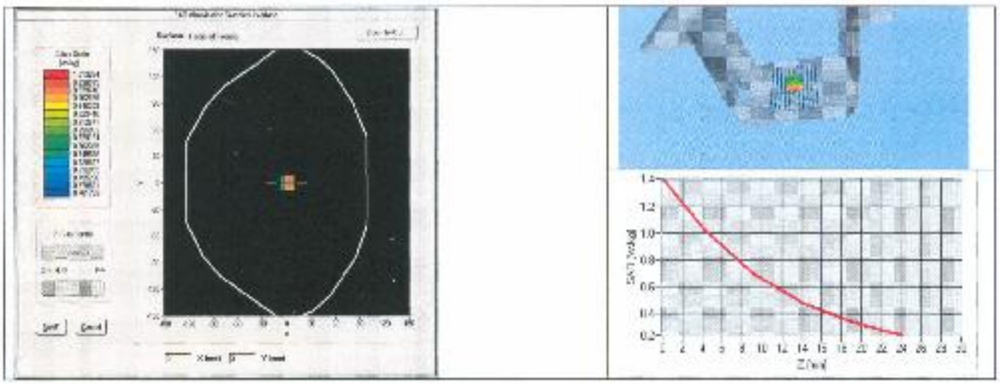
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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' : 42.3 sigma : 0.92
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	835 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	9.77 (0.98)	6.22	6.30 (0.63)
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		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

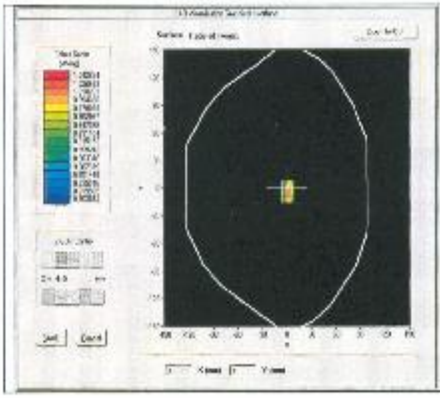
Frequency MHz	Relative permittivity (ε,')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %	PASS	0.97 ±5 %	PASS
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±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 %		1.95 ±5 %	
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 %	

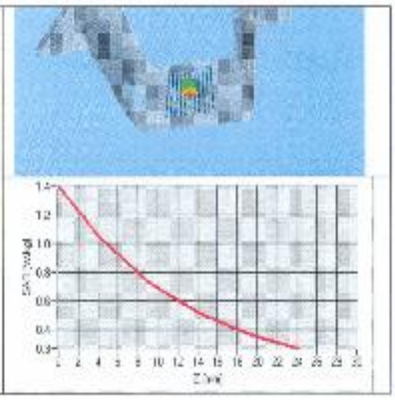
5500	48.5 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

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' : 54.1 sigma : 0.97
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	835 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
835	10.31 (1.03)	6.74 (0.67)





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

SID1800 Dipole Calibration Ceriticate

SAR Reference Dipole Calibration Report

Ref : ACR.240.3.14.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: 1800 MHZ
SERIAL NO.: SN 09/13 DIP1G800-216

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

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

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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 1800 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID1800
Serial Number	SN 09/13 DIP1G800-216
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.

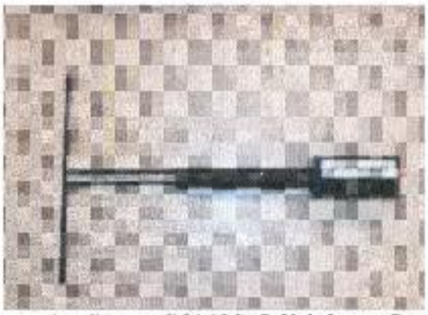


Figure 1 – *Satimo COMOSAR Validation Dipole*

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

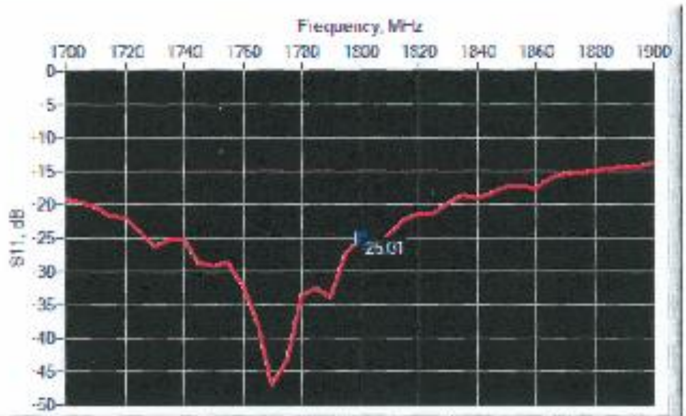
5.3 VALIDATION MEASUREMENT

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 %

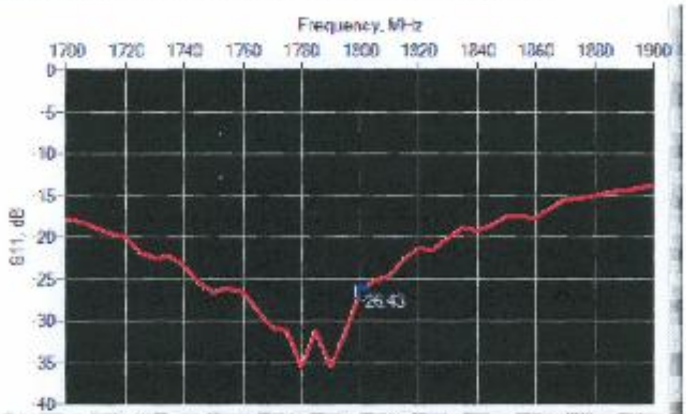
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-25.01	-20	46.7 Ω + 4.5 jΩ

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-26.43	-20	45.8 Ω + 1.3 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 %.	