FCC SAR TEST REPORT

Report No.:	SET2015-04252
Product:	Mobile WiFi
Brand Name:	Huawei
Model No.:	E5338
FCC ID:	QISE5338
Applicant:	Huawei Technologies Co., Ltd.
Address:	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C
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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Applicant Address…….: Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

Manufacturer…………: Huawei Technologies Co., Ltd.
Manufacturer Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

Test Standards……….: **47CFR § 2.1093-** Radiofrequency Radiation Exposure Evaluation: Portable Devices;

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

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

Test Result……………: Pass

Tested by …………..: Mei Chun 2015-04-21

Mei Chun, Test Engineer

Reviewed by………….: Shuangwen Zhang 2015-04-21

Shuangwen Zhang,Senior Egineer

Approved by……………: Wu Li'an 2015-04-21

Wu Li'an , Manager

Contents

This Test Report consists of the following Annexes:

Annex A: Accreditation Certificate

Annex B: System Performance Check Data and Highest SAR Plots

Annex C: Calibration Certificate of Probe and Dipoles

Annex D: Test Set Up

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.:	SET2015-04252
CCIC-SET Project Leader:	Mr. Li Sixiong
CCIC-SET Responsible for accreditation scope:	Mr. Wu Li'an
Start of Testing:	2015-03-30
End of Testing:	2015-04-20

2.4. Identification of Applicant

Company Name:	Huawei Technologies Co., Ltd.
Address:	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

2.5. Identification of Manufacture

Company Name:	Huawei Technologies Co., Ltd.
Address:	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

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

3. Equipment Under Test (EUT)

3.1.Identification of the Equipment under Test

device type :	portable device	
DUT Name:	Mobile WiFi	
Type Identification:	E5338	
S/N :	U3EBY15120000055	
IMEI No :	864711020056757	
exposure category:	uncontrolled environment / general population	
test device production information	production unit	
operating mode(s)	GSM850/1900,UMTS Band II/IV/V, WiFi(Tested)	
Test modulation	GSM(GMSK/8PSK),UMTS(QPSK), WIFI(DSSS,OFDM)	
Device Class :	B	
operating frequency range(s)	transmitter frequency range	receiver frequency range
GSM850 (tested):	824-849 MHz	869-894 MHz
GSM1900 (tested):	1850-1910 MHz	1930-1990 MHz
UMTS Band II (tested):	1850-1910 MHz	1930-1990 MHz
UMTS Band IV (tested):	1710-1755 MHz	2110-2155 MHz
UMTS Band V (tested):	824-849 MHz	896-894 MHz
WiFi(tested):	2417-2462MHz	2417-2462 MHz
Multislot Class:	GPRS :12, EGPRS:12,	
Category:	HSDPA :14, HSUPA:6	
Power class :	tested with power level 5(GSM850)	
	tested with power level 0(GSM1900)	
	tested with power control “all 1”(UMTS Band II)	
	tested with power control “all 1”(UMTS Band IV)	
	tested with power control “all 1”(UMTS Band V)	

test channels (low-mid-high) :	128-190-251 (GSM850)	
	512-661-810(GSM1900)	
	9262-9400-9538(UMTS Band II)	
	1312-1413-1513(UMTS Band IV)	
	4132-4183-4233(UMTS Band V)	
	2-6-11 (WiFi 2450)	
hardware version :	CH1E5338SM	
software version :	21.210.05.01.983	
antenna type :	Integrated antenna	
battery options :	SCUD(FUJUAN) Electronics Co., Ltd. Sunwoda Electronic CO., LTD..(1#)	Li-polymer Battery Battery Model: HB474364EAW Rated capacity: 1500mAh Nominal Voltage: ⎓ +3.7V Charging Voltage: ⎓ +4.2V

4 SAR Summary

The Highest Measured Standalone SAR Summary

Exposure Position	Frequency Band	Scaled 1g-SAR(W/kg)	Max. Reported 1g-SAR(W/kg)
Body (10mm Gap)	GSM850	0.929	1.191
	GSM1900	0.663	
	WCDMA Band Ⅱ	1.191	
	WCDMA Band Ⅳ	1.002	
	WCDMA Band Ⅴ	1.074	
	WIFI	0.048	

The Highest Simultaneous SAR Summary

Exposure Position	Frequency Band	Scaled 1g-SAR(W/kg)	Max. Reported 1g-SAR(W/kg)
Simultaneous Body (10mm Gap)	GSM850&WIFI	0.929+0.029	1.220
	GSM1900&WIFI	0.663+0.001	
	WCDMA Band Ⅱ&WIFI	1.191+0.029	
	WCDMA Band Ⅳ&WIFI	1.002+0.029	
	WCDMA Band Ⅴ&WIFI	1.074+0.029	

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:

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

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

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

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

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

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

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).

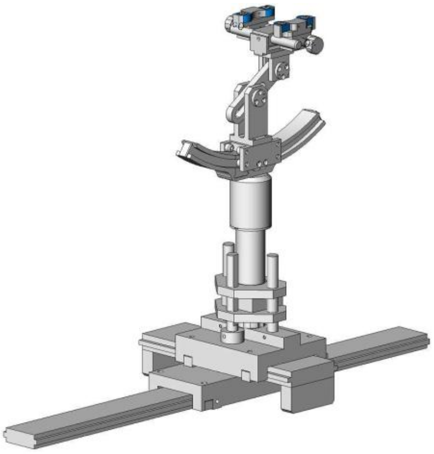
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

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

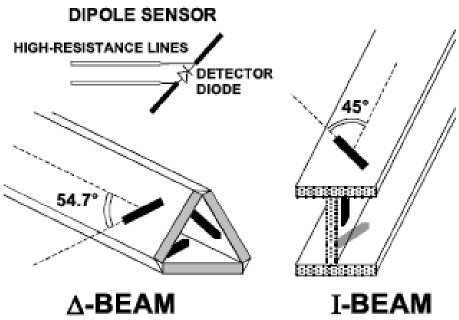
5.5 Probe Specification

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

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 General Description

E5338 is a support UMTS/GSM Wireless mobile WiFi; it can be used as a WiFi hotspot based on standard of IEEE802.11 b/g/n. It supports 2G GSM, 3G WCDMA wireless internet accessing function. For WCDMA wireless mode, it supports WCDMA and HSDPA/HSUPA, operating in Band II/ Band IV/ Band V, and GSM mode supports EDGE/GPRS 1900MHz/850MHz. The WiFi supports 2.4G 802.11b/g/n.

GSM Test Configuration

The tests in the band of GSM850 and GSM1900 are performed in the mode of GPRS/EGPRS function. Using Agilent 8960 the power lever is set to "5"and "0" in SAR of GPRS850 and GPRS1900. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5. The EGPRS class is 12 for this EUT, it has at most 4 timeslots in uplink, and at most 4 timeslots in downlink, the maximum total timeslot is 5.

When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot.

The allowed power reduction in the multi-slot configuration is as following:

Number of timeslots in uplink assignment		Reduction of maximum output power (dB)		
Band	Time Slots	GPRS(GMSK）	EGPRS(GMSK)	EGPRS(8PSK)
GSM850	1 TX slot	0	0	0
	2 TX slots	2.5	2.5	2
	3 TX slots	4.5	4.5	4
	4 TX slots	6.5	6.5	6.5
GSM1900	1 TX slot	0	0	0
	2 TX slots	2	2	2
	3 TX slots	4.5	4.5	4.5
	4 TX slots	6.5	6.5	6

UMTS Test Configuration

1) Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the procedures description in section 5.2 of 3GPP TS 34.121,using the appropriate RMC or AMR with TPC(transmit power control) set to all "1s" for WCDMA/HSDPA or applying the required inner loop power control procedure to maintain maximum output power while HSUPA is active. Result for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HSDPA, HSPA)Should be tabulated in the SAR report .All configuration that are not supported by the DUT or cannot be measured due to technical or equipment limitation should be clearly identified.

2) WCDMA

Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits configured to all “1s”. SAR for other spreading codes and multiple DPDCHn, when supported by the EUT, are not required when the maximum average outputs of each RF channel, for each spreading code and DPDCHn configuration, are less than ¼ dB higher than those measured in 12.2 kbps RMC. SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits configured to all “1s”. SAR for other spreading codes and multiple DPDCHn, when supported by the EUT, are not required when the maximum average outputs of each RF channel, for each spreading code and DPDCHn configuration, are less than ¼ dB higher than those measured in 12.2 kbps RMC.

3) HSDPA

SAR for body exposure configurations is measured according to the “Body SAR Measurements”” procedures of 3G device. In addition, body SAR is also measured for HSDPA when the maximum average outputs of each RF channel with HSDPA active is at ¼ dB higher than that measured without HSDPA using 12.2kbps RMC or the maximum SAR 12.2kbps RMC is above 75% of the SAR limit. Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA.

HSDPA should be configured according to UE category of a test device. The number of HS-DSCH/HS- PDSCHs, HAPRQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission condition, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. The β_c and β_d gain factors for DPCCH and DPDCH were set according to the values in the below table, β_{hs} for HS-DPCCH is set automatically to the correct value when ΔACK,ΔNACK,ΔCQI=8.The variation of the β_c / β_d ratio causes a power reduction at sub-tests 2- 4.

Sub-test	□ β_c	□ β_d	□ β_d (SF)	□ β_c / β_d	□ β_{hs} (1)	CM(dB)(2)	MPR (dB)
1	2/15	15/15	64	2/15	4/15	0.0	0
2	12/15(3)	15/15(3)	64	12/15(3)	24/15	1.0	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: ΔACK, ΔNACK and ΔCQI = 8□. $A_{hs} = \beta_{hs}/\beta_c$ = 30/15□. β_{hs} = 30/15 * β_c

Note 2 : CM = 1 for β_c/β_d = 12/15, β_{hs}/β_c = 24/15

Note 3 : 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

The measurements were performed with a Fixed Reference Channel (FRC) and H-Set 1 QPSK.

Parameter	Value
Nominal average inf. bit rate	534 kbit/s
Inter-TTI Distance	3 TTI's
Number of HARQ Processes	2 Processes
Information Bit Payload	3202 Bits
MAC-d PDU size	336 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	4800 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	9600 SMLs
Coding Rate	0.67
Number of Physical Channel Codes	5

settings of required H-Set 1 QPSK acc. to 3GPP 34.121

HS-DSCH Category	Maximum HS-DSCH Codes Received	Minimum Inter-TTI Interval	Maximum HS-DSCH Transport Block Bits/HS-DSCH TTI	Total Soft Channel Bits
1	5	3	7298	19200
2	5	3	7298	28800
3	5	2	7298	28800
4	5	2	7298	38400
5	5	1	7298	57600
6	5	1	7298	67200
7	10	1	14411	115200
8	10	1	14411	134400
9	15	1	25251	172800
10	15	1	27952	172800
11	5	2	3630	14400
12	5	1	3630	28800
13	15	1	34800	259200
14	15	1	42196	259200
15	15	1	23370	345600
16	15	1	27952	345600

HSDPA UE category

3) HSUPA

Body SAR is also measured for HSDPA when the maximum average outputs of each RF channel with HSDPA active is at ¼ dB higher than that measured without HSDPA using 12.2kbps RMC or the maximum SAR 12.2kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-set 1 and QPSK for FRC and 12.2kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA.

Due to inner loop power control requirements in HSDPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSDPA should be configured according to the β values indicated below as well as other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Device' sections of 3G device.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}[1]	β_{ec}	β_{ed}	β_{ec} (SF)	β_{ed} (code)	CM[2] (dB)	MPR (dB)	AG[4] Index	E-TFCI
1	11/15[3]	15/15[3]	64	11/15[3]	22/15	209/225	1039/225	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_{ed1}:47/15 β_{ed2}:47/15	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[4]	15/15[4]	64	15/15[4]	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: ΔACK, ΔNACK and ΔCQI = 8 $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. 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 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g

Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Subtests for HSUPA.

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI(ms)	Minimum Speading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00

5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	10	2SF2&2SF4	11484	5.76
	4	4	2		20000	2.00
7 (No DPDCH)	4	8	2	2SF2&2SF4	22996	
	4	4	10		20000	
NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4. UE categories 1 to 6 support QPSK only. UE category 7 supports QPSK and 16QAM.(TS25.306-7.3.0)						

HSUPA UE category

WiFi 2.4G Test Configuration

For the 802.11b/g SAR tests, a communication link is set up with the test mode software for WiFi mode test. The Absolute Radio Frequency Channel Number(ARFCN) is allocated to 2 ,6 and 11 respectively in the case of 2450 MHz. During the test,at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate.

802.11b/g operating modes are tested independently according to the service requirements in each frquency band. 802.11b/g modes are tested on channel 2, 6, 11; however, if output power reduction is necessary for channels 2 and/or 11 to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

The frequencies of E5338 allocated is F (MHz) =2412+5*(n-1) (2<=n<=11). The lowest, middle, highest channel numbers of the EUT used and tested in this report are separately 2 (2417MHz), 6(2437MHz) and 11(2462MHz) for 802.11b/g/n-20MHz.

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.

Dielectric Performance of Tissue

Ingredients (% by weight)	Frequency (MHz)					
	450	835	915	1800	1900	2450
Tissue Type	Body	Body	Body	Body	Body	Body
Water	51.16	52.4	56.0	69.91	69.91	73.2
Salt (Nacl)	1.49	1.4	0.76	0.13	0.13	0.04
Sugar	46.78	45.0	41.76	0.0	0.0	0.0
HEC	0.52	1.0	1.21	0.0	0.0	0.0
Bactericide	0.05	0.1	0.27	0.0	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	0.0	29.96	29.96	26.7

6.2.2 Simulant liquids

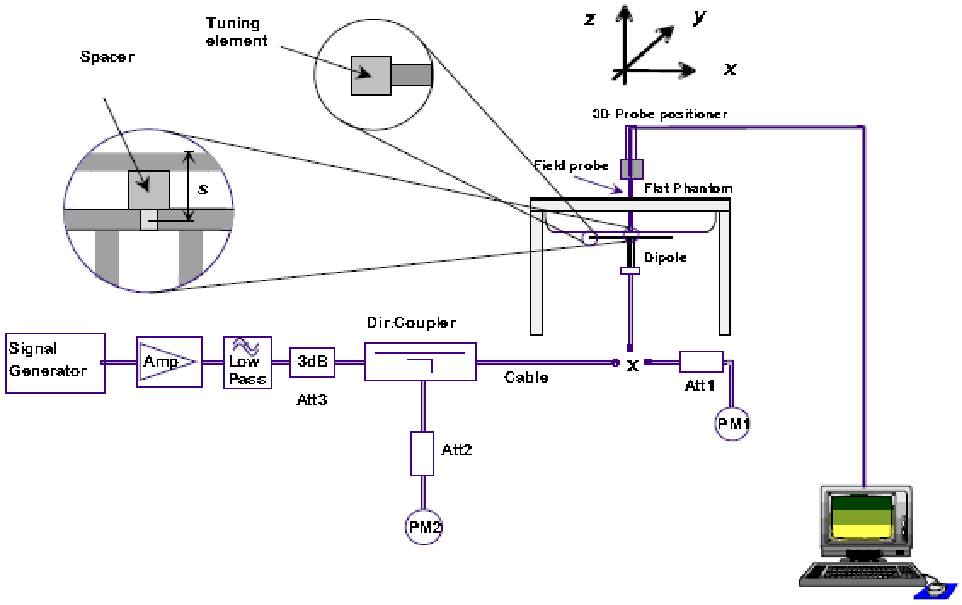
For body-worn measurements, the EUT was tested against flat phantom representing the user body. The EUT was put on in the belt holder. Simulant liquids that are used for testing at frequencies of GSM 850MHz/1900MHz, WCDMA850MHz/1700MHz/1900MHz, and Wi-Fi 2.4GHz, which are made mainly of sugar, salt and water solutions may be left in the phantoms.

Dielectric Performance of Body Tissue Simulating Liquid

Temperature: 23.2°C; Humidity: 64%;			
/	Frequency	Permittivity ε	Conductivity σ (S/m)
Target value	835MHz	55.2±5%	0.97±5%
Validation value(Mar.. 30th, 2015)	835MHz	55.04	0.98
Target value	1750 MHz	53.3±5%	1.52±5%
Validation value(Mar.. 31th, 2015)	1750 MHz	53.41	1.53
Target value	1900MHz	53.3±5%	1.52±5%
Validation value(April. 02th, 2015)	1900MHz	53.18	1.50
Target value	2450MHz	52.7±5%	1.93±5%
Validation value(April. 20th, 2015)	2450MHz	52.62	1.91

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

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



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

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

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

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

The measured 1-gram averaged SAR values of the device against the phantom are provided in following table . The humidity and ambient temperature of test facility were 64% and 22.2°C respectively. The body phantom were full of the body tissue simulating liquid. The EUT was supplied with full-charged battery for each measurement.

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

Body SAR system validation (1g)

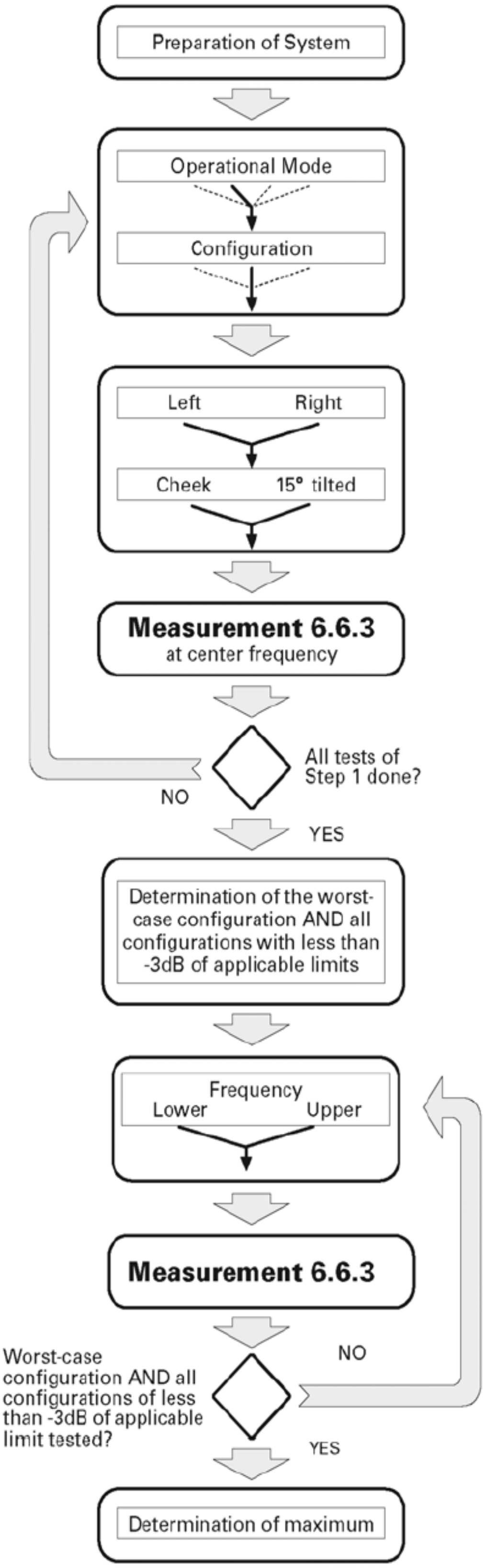
Frequency	Duty cycle	Target valueW/kg）	Test value (W/kg)	
			250 mW	1W
835MHz(Mar.. 30th, 2015)	1:1	10.31±10%	2.53	10.12
1750MHz(Mar.. 31th, 2015)	1:1	40.07±10%	9.84	39.36
1900MHz(April. 02th, 2015)	1:1	40.81±10%	10.15	40.60
2450MHz(April. 20th, 2015)	1:1	52.66±10%	12.80	51.20

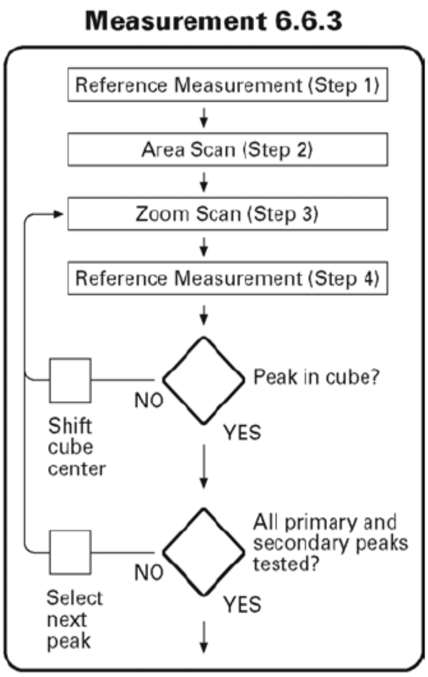
* Note: Target value was referring to the measured value in the calibration certificate of reference dipole.

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

6.4 SAR measurement procedure

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





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

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

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

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

6.5 Transmitting antenna information

There are GSM &WCDMA antenna and WIFI antenna inside the EUT,

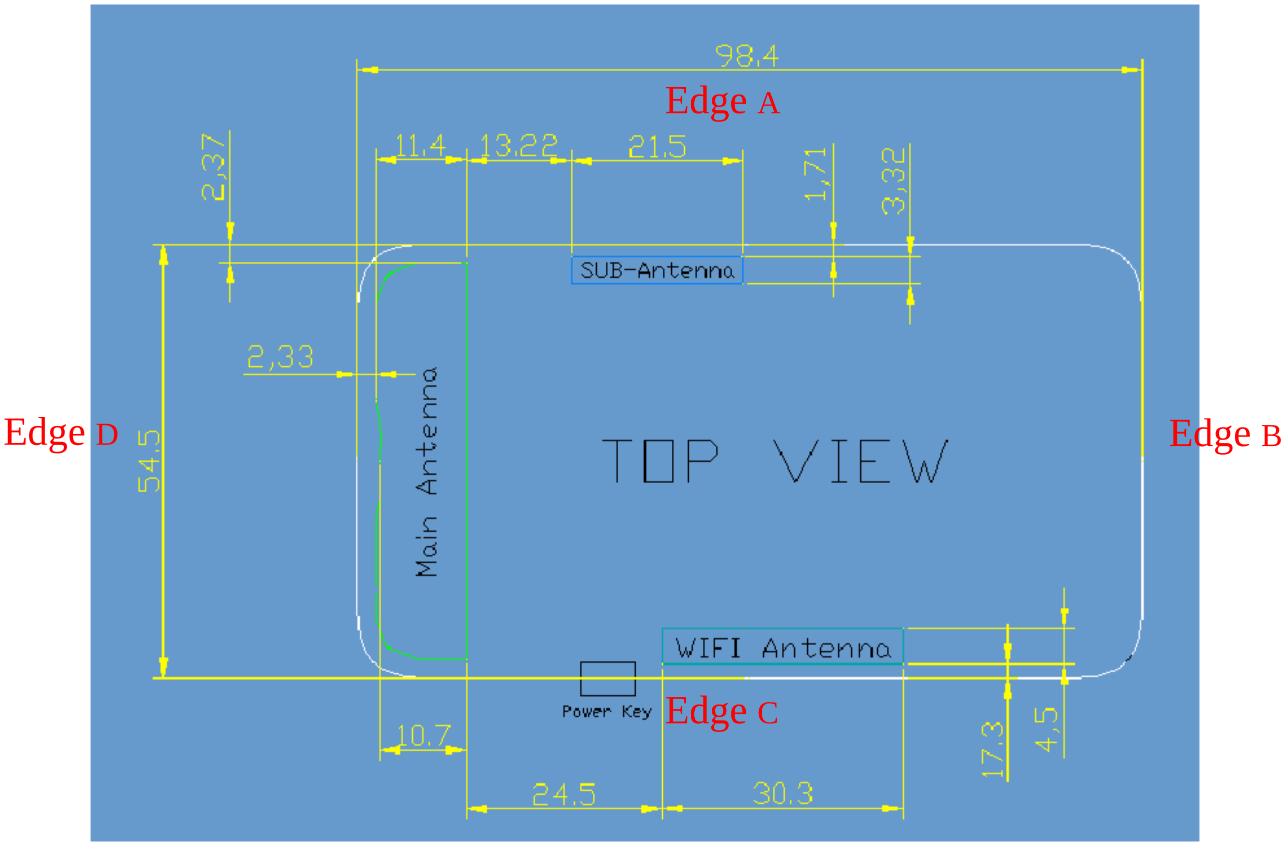


Fig. 3 Position of the antennas

7 Applicable Measurement Standards

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

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

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

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

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

FCC KDB 865664 D02 v01r01 RF Exposure Reporting

FCC KDB 447498 D01 v05r02 General RF Exposure Guidance v05r02

FCC KDB 941225 D01 v03 SAR test for 3G devices

FCC KDB 941225 D06 v02 Hotspot Mode

FCC KDB 248227 D01 v01r02 SAR Measurement Procedures-802.11a/b/g Transmitters

8 Laboratory Environment

8.1 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.	

9.Conducted RF Output Power

For the measurements a Rohde & Schwarz Radio Communication Tester CMU 200 was used.
SAR drift measured at the same position in liquid before and after each SAR test as below.
The signalling modes differ as follows:

mode	coding scheme	modulation
• GPRS	• CS1 to CS4	• GMSK
• EDGE	• MCS1 to MCS4	• GMSK
• EDGE	• MCS5 to MCS9	• 8PSK

Apart from modulation change (GMSK/8PSK) coding schemes differ in code rate without influence on the RF signal.Therefore one coding scheme per mode was selected for conducted power measurements.

9.1 GSM Conducted Power

Band		Burst Average Power (dBm)			Frame-Average Power (dBm)		
GSM850	TX Channel	128	190	251	128	190	251
	Frequency(MHz)	824.2	836.4	848.8	824.2	836.4	848.8
GPRS/ EDGE850 (GMSK)	1Tx Slot	32.12	32.21	32.13	23.09	23.18	23.1
	2Tx Slots	30.07	30.2	30.09	**24.05**	**24.18**	**24.07**
	3Tx Slots	28.04	28.12	28.04	23.78	23.86	23.78
	4Tx Slots	25.99	26.13	26.06	22.98	23.12	23.05
EDGE850 (8PSK)	1Tx Slot	25.96	25.96	25.96	16.93	16.93	16.93
	2Tx Slots	23.46	23.46	23.46	17.44	17.44	17.44
	3Tx Slots	21.05	21.05	21.05	16.79	16.79	16.79
	4Tx Slots	18.84	18.84	18.84	15.83	15.83	15.83
GSM1900	TX Channel	512	661	810	512	661	810
	Frequency(MHz)	1850.2	1880	1909.8	1850.2	1880	1909.8
GPRS/ EDGE1900 (GMSK)	1Tx Slot	29.38	29.41	29.42	20.35	20.38	20.39
	2Tx Slots	27.28	27.31	27.32	**21.26**	**21.29**	**21.3**
	3Tx Slots	25.3	25.28	25.3	21.04	21.02	21.04
	4Tx Slots	23.2	23.21	23.22	20.19	20.2	20.21
EDGE1900 (8PSK)	1Tx Slot	25.1	24.79	24.8	16.07	15.76	15.77
	2Tx Slots	22.55	22.69	22.57	16.53	16.67	16.55
	3Tx Slots	19.91	19.88	19.91	15.65	15.62	15.65
	4Tx Slots	18.59	18.56	18.55	15.58	15.55	15.54

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

For Body worn SAR testing, GSM should be evaluated, therefore the EUT was set in GPRS850 and GPRS 1900 due to its highest frame-average power.

Per KDB 941225 D01, the bolded GPRS 850 2Tx mode was selected for SAR testing according to the highest frame-averaged output power table.

Per KDB 941225 D01, the bolded GPRS 1900 2Tx mode was selected for SAR testing according to the highest frame-averaged output power table.

Timeslot consignations:

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

9.2 WCDMA Conducted peak output Power

Item	band	WCDMA 850			WCMDA1700			WCDMA 1900		
	ARFCN	4132	4183	4233	1312	1413	1513	9262	9400	9538
	subtest	dBm			dBm			dBm		
RMC 12.2kbps	non	22.61	22.59	22.7	22.02	22.28	22.13	22.1	22.24	21.97
RMC 64kbps	non	22.58	22.56	22.68	22.03	22.32	22.15	22.16	22.26	21.96
RMC 144kbps	non	22.65	22.54	22.66	22.02	22.3	22.16	22.12	22.25	21.96
RMC 384kbps	non	22.62	22.54	22.64	22.07	22.27	22.15	22.18	22.23	21.93
HSDPA	1	22.55	22.44	22.63	22.07	22.34	22.11	22.13	22.21	21.9
	2	22.3	22.18	22.37	21.77	21.98	21.83	21.82	21.89	21.61
	3	21.59	21.47	21.72	21.19	21.43	21.23	21.24	21.34	21.03
	4	21.58	21.55	21.64	21.17	21.42	21.23	21.17	21.33	21
HSUPA	1	21.92	21.29	21.55	20.82	21.27	20.17	21.08	21.18	20.68
	2	19.74	19.73	20.42	19.07	19.38	20.02	19.59	19.25	19.08
	3	20.87	21.22	20.89	20.37	20.61	20.62	20.72	20.53	20.19
	4	19.04	18.92	19.14	18.27	18.44	18.3	18.76	18.75	18.52

	5	21.83	21.27	21.89	21.46	21.58	20.59	21.82	21.52	21.19
Note:	The Conducted RF Output Power test of WCDMA /HSDPA/HSUPA was tested by power meter.									

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 HSDPA/HSUPA 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.

9.3 WLAN 2.4GHz Band Conducted Power

Wi-Fi 2.4GHz	Channel	Average Power (dBm) for Data Rates (Mbps)							
		1	2	5.5	11	/	/	/	/
802.11b	2	14.57	14.71	14.48	14.35	/	/	/	/
	6	14.18	14.08	14.27	14.28	/	/	/	/
	11	14.61	14.54	14.57	14.42	/	/	/	/
	Channel	6.00	9.00	12.00	18.00	24.00	36.00	48.00	54.00
802.11g	2	11.15	11.08	10.97	10.91	10.94	10.87	10.85	10.78
	6	11.26	11.41	11.27	11.19	11.24	11.04	11.15	11.23
	11	11.17	11.24	11.16	11.05	11.34	11.05	11.41	10.87
	Channel	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n 20M:(SISO)	2	9.11	8.78	8.01	8.49	8.52	8.75	8.48	8.57
	6	9.37	9.18	8.97	8.76	9.06	8.76	8.86	8.46
	11	9.35	8.57	9.15	9.05	9.27	8.97	9.11	9.21

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
2. During the test, at each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate. As Bold in the Output Power table above.
3. 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

9.4General 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 KDB941225 D06v02, the DUT Dimension is bigger than 9 cm x 5 cm, so 10mm is chosen as the test separation distance for Hotspot mode. When the antenna-to-edge distance is greater than 2.5cm, such position does not need to be tested.
4. 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.
5. 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).
6. 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.
7. 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.
8. 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.

9.

9.5 SIMULTANEOUS TRANSMISSION ANALYSIS

Simultaneous Transmission Possibilities			
	2G Data	3G Data	WLAN2.4G
2G Data	——	No	Yes
3G Data	No	——	Yes
WLAN 2.4G	Yes	Yes	——

Test Position of Body (10mm separation)		Face	Back	Edge A	Edge B	Edge C	Edge D
MAX 1-g SAR(W/Kg)	GPRS850	0.929	0.795	0.374	0.084	0.023	0.336
	GPRS1900	0.430	0.605	0.663	0.410	0.059	0.180
	WCDMA1900	1.191	0.693	0.618	0.114	0.444	0.157
	WCDMA1700	1.002	0.741	0.184	0.113	0.068	0.355
	WCDMA 850	1.074	0.971	0.395	0.102	0.026	0.442
	2.4G WiFi SISO	0.029	0.033	0.001	0.004	0.048	0.003
∑1-g SAR(W/Kg)		1.220	1.004	0.664	0.414	0.492	0.445

Simultaneous Tx Combination of GSM/WCDMA and 2.4G WiFi.

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 Test Results

10.1 Summary of SAR Measurement Results

According the description above, while the tests against the body-worn were carried out on the operation mode : GPRS 850/1900MHz, WCDMA850/1700/1900MHz, WIFI 802.11b.

Table 1: SAR Values of GPRS 850MHz Band

Temperature: 22.0~23.5°C, humidity: 62~64%.							
Body Positions (10mm separation)		Channel /Frequency (MHz)	Power drift(%)	Tune up power (dBm)	Scaling Factor	SAR(W/Kg), 1.6 (1g average)	
						Measured SAR	Scaled SAR
GPRS (2Tx)	Face Upward	128/824.2	-4.68	30.5	1.104	0.820	0.905
		190/836.6	-0.04	30.5	1.072	0.747	0.801
		251/848.8	2.38	30.5	1.099	**0.845**	0.929
		251/848.8	0.56	30.5	1.099	0.842	0.925
	Face Upward With Battery1#	251/848.8	-0.66	30.5	1.099	0.722	0.793
	Back Upward	190/836.6	-4.68	30.5	1.072	0.742	0.795
	Edge A	190/836.6	-4.01	30.5	1.072	0.349	0.374
	Edge B	190/836.6	-2.93	30.5	1.072	0.078	0.084
	Edge C	190/836.6	3.43	30.5	1.072	0.021	0.023
	Edge D	190/836.6	-1.63	30.5	1.072	0.313	0.336

Table 2: SAR Values of GPRS1900 MHz Band

Temperature: 22.0~23.5°C, humidity: 62~64%.							
Body Positions (10mm separation)		Channel /Frequency (MHz)	Power drift(%)	Tune up power (dBm)	Scaling Factor	SAR(W/Kg), 1.6 (1g average)	
						Measured SAR	Scaled SAR
GPRS (2Tx)	Face Upward	661/1880.0	1.37	28.5	1.315	0.327	0.430
	Back Upward	661/1880.0	-1.81	28.5	1.315	0.347	0.456
	Back Upward With Battery1#	661/1880.0	2.55	28.5	1.315	0.460	0.605
	Edge A	661/1880.0	1.00	28.5	1.315	**0.504**	0.663
	Edge B	661/1880.0	-2.61	28.5	1.315	0.312	0.410
	Edge C	661/1880.0	-4.34	28.5	1.315	0.045	0.059
	Edge D	661/1880.0	-1.44	28.5	1.315	0.137	0.180

Table 3: SAR Values of WCDMA850

Temperature: 22.0~23.5°C, humidity: 62~64%.						
Test Positions of Body (10mm separation)	Channel /Frequency (MHz)	Power drift(%)	Tune up power (dBm)	Scaling Factor	SAR(W/Kg), 1.6 (1g average)	
					Measured SAR	Scaled SAR
Face Upward	4132/826.4	0.47	23.2	1.146	0.925	1.060
	4183/836.6	-0.03	23.2	1.151	**0.933**	1.074
	4183/836.6 Repeated	-0.35	23.2	1.151	0.839	0.966
	4233/846.6	-0.66	23.2	1.122	0.926	1.039
Face Upward With Battery1#	4183/836.6	-4.56	23.2	1.151	0.670	0.771
Back Upward	4132/826.4	-0.36	23.2	1.146	0.834	0.956
	4183/836.6	-0.45	23.2	1.151	0.743	0.855
	4183/836.6 Repeated	-0.33	23.2	1.151	0.844	0.971
	4233/846.6	-0.43	23.2	1.122	0.843	0.946
Edge A	4183/836.6	-1.62	23.2	1.151	0.343	0.395
Edge B	4183/836.6	-0.38	23.2	1.151	0.089	0.102
Edge C	4183/836.6	0.28	23.2	1.151	0.023	0.026
Edge D	4183/836.6	-0.08	23.2	1.151	0.384	0.442

Table 4: SAR Values of WCDMA1700

Temperature: 22.0~23.5°C, humidity: 62~64%.						
Test Positions of Body (10mm separation)	Channel /Frequency (MHz)	Power drift(%)	Tune up power (dBm)	Scaling Factor	SAR(W/Kg), 1.6 (1g average)	
					Measured SAR	Scaled SAR
Face Upward	1312/1712.4	-0.11	23	1.253	0.794	0.995
	1413/1732.6	-0.89	23	1.180	0.763	0.900
	1513/1752.6	-0.25	23	1.222	**0.820**	1.002
	1513/1752.6 Repeated	-0.15	23	1.222	0.817	0.998
Face Upward With Battery1#	1413/1732.6	-1.33	23	1.180	0.677	0.799
Back Upward	1413/1732.6	-0.37	23	1.180	0.628	0.741
Edge A	1413/1732.6	-0.81	23	1.180	0.156	0.184
Edge B	1413/1732.6	-2.59	23	1.180	0.096	0.113
Edge C	1413/1732.6	-0.98	23	1.180	0.058	0.068
Edge D	1413/1732.6	-0.03	23	1.180	0.301	0.355

Table 5: SAR Values of WCDMA1900

Temperature: 22.0~23.5°C, humidity: 62~64%.						
Test Positions of Body (10mm separation)	Channel /Frequency (MHz)	Power drift(%)	Tune up power (dBm)	Scaling Factor	SAR(W/Kg), 1.6 (1g average)	
					Measured SAR	Scaled SAR
Face Upward	9262/1852.4	-3.48	23	1.230	0.937	1.153
	9400/1880.0	-3.27	23	1.191	**0.947**	1.128
	9400/1880.0	-0.15	23	1.191	0.922	1.098
	9538/1907.6	-2.03	23	1.268	0.939	1.191
Face Upward With Battery1#	9262/1852.4	0.24	23	1.230	0.713	0.877
	9400/1880.0	-1.09	23	1.191	0.712	0.848
	9538/1907.6	2.10	23	1.268	0.708	0.898
Back Upward	9400/1880.0	-1.08	23	1.191	0.582	0.693
Edge A	9400/1880.0	-0.42	23	1.191	0.519	0.618
Edge B	9400/1880.0	-0.73	23	1.191	0.096	0.114
Edge C	9400/1880.0	2.16	23	1.191	0.373	0.444
Edge D	9400/1880.0	-0.42	23	1.191	0.132	0.157

Table 6:SAR Values of Wi-Fi 802.11b

Temperature: 22.0~23.5°C, humidity: 62~64%.							
Body Positions (10mm separation)		Channel /Frequency (MHz)	Power drift(%)	Tune up power (dBm)	Scaling Factor	SAR(W/Kg), 1.6 (1g average)	
						Measured SAR	Scaled SAR
802.11b	Edge A	11/2462	-0.38	16	1.377	0.001	0.001
	Edge B	11/2462	-0.34	16	1.377	0.003	0.004
	Edge C	11/2462	-2.33	16	1.377	**0.035**	0.048
	Edge C With Battery 1#	11/2462	-0.21	16	1.377	0.034	0.047
	Edge D	11/2462	-3.64	16	1.377	0.002	0.003
	Face Upward	11/2462	-4.19	16	1.377	0.021	0.029
	Back Upward	11/2462	4.77	16	1.377	0.024	0.033

Note:

When the 1-g SAR for the mid-band channel or the channel with the Highest output power≤ 0.8 W/kg, when the transmission band is ≤ 100 MHz, testing of the other channels in the band is not required.(Per KDB 447498 D01 General RF Exposure Guidance v05r02)

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 7 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	0	R	1	1	0	∞
10	– Integration Time	B	1.4	R	$\sqrt{3}$	1	0.81	∞
11	– RF Ambient Conditions-Noise	B	3.0	R	$\sqrt{3}$	1	1.73	∞
12	– RF Ambient Conditions-Reflections	B	3.0	R	$\sqrt{3}$	1	1.73	∞
13	– Probe Position Mechanical tolerance	B	1.4	R	$\sqrt{3}$	1	0.81	∞
14	– Probe Position with respect to Phantom Shell	B	1.4	R	$\sqrt{3}$	1	0.81	∞
15	– Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation	B	2.3	R	$\sqrt{3}$	1	1.33	∞
	Uncertainties of the DUT							
16	– Position of the DUT	A	2.6	N	$\sqrt{3}$	1	2.6	5

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

System Check Uncertainty

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

5	– Linearity	B	4.7	R	$\sqrt{3}$	1	2.71	∞
6	– System Detection Limits	B	1	R	$\sqrt{3}$	1	0.58	∞
7	Modulation response	B	0	N	1	1	0.00	
8	– Readout Electronics	B	0.5	N	1	1	0.50	∞
9	– Response Time	B	0.00	R	$\sqrt{3}$	1	0.00	∞
10	– Integration Time	B	1.4	R	$\sqrt{3}$	1	0.81	∞
11	– RF Ambient Conditions	B	3.0	R	$\sqrt{3}$	1	1.73	∞
12	– Probe Position Mechanical tolerance	B	1.4	R	$\sqrt{3}$	1	0.81	∞
13	– Probe Position with respect to Phantom Shell	B	1.4	R	$\sqrt{3}$	1	0.81	∞
14	– Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation	B	2.3	R	$\sqrt{3}$	1	1.33	∞
	Uncertainties of the DUT							
15	Deviation of experimental source from numberical source	A	4	N	1	1	4.00	5
16	Input Power and SAR drift measurement	A	5	R	$\sqrt{3}$	1	2.89	5
17	Dipole Axis to Liquid Distance	B	2	R	$\sqrt{3}$	1	1.2	∞
Phantom and Tissue Parameters								
18	– Phantom Uncertainty(shape and thickness tolerances)	B	4	R	$\sqrt{3}$	1	2.31	∞
19	Uncertainty in SAR correction for deviation(in permittivity and conductivity)	B	2	N	1	1	2.00	
20	– Liquid Conductivity Target –tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
21	– Liquid Conductivity –measurement Uncertainty)	B	4	N	$\sqrt{3}$	1	0.92	9

22	– Liquid Permittivity Target tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
23	– Liquid Permittivity –measurement uncertainty	B	5	N	$\sqrt{3}$	1	1.15	∞
Combined Standard Uncertainty				RSS			10.15	
Expanded uncertainty (Confidence interval of 95 %)				K=2			20.29	

12 Main Test Instruments

No.	EQUIPMENT	TYPE	Series No.	Last Calibration	Due Date
1	System Simulator	E5515C	GB 47200710	2015/02/23	1 Year
2	System Simulator	CMU200	A0304212	2014/06/10	1 Year
3	SAR Probe	E-Field Probe	SN 09/13 EP166	2014/08/14	1 Year
4	Dipole	SID835	SN09/13 DIP0G835-217	2014/08/28	1 Year
5	Dipole	SID1800	SN09/13 DIP1G800-216	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	2014/06/13	1 Year
9	Signal Generator	SMR27	A0304219	2014/06/10	1 Year
10	Amplifier	Nucletudes	143060	2015/03/28	1 Year
11	Directional Coupler	DC6180A	305827	2014/06/10	1 Year
12	Power Meter	NRVS	1020.1809.02	2014/06/13	1 Year
13	Power Sensor	NRV-Z4	100069	2014/06/10	1 Year
14	Power Meter	NRP2	A140401673	2015/03/28	1 Year
15	Power Sensor	NPR-Z11	1138.3004.02-114072-nq	2015/03/28	1 Year
16	Multimeter	Keithley-2000	4014020	2015/03/28	1 Year

ANNEX A

of

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

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-04252

Huawei Technologies Co., Ltd.

Mobile WiFi

Type Name: E5338

Hardware Version： CH1E5338SM

Software Version： 21.210.05.01.983

Accreditation Certificate

This Annex consists of 2 pages

Date of Report: 2015-04-21

China National Accreditation Service for Conformity Assessment

LABORATORY ACCREDITATION CERTIFICATE

(Registration No. CNAS L1659)

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

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

Nanshan District, Shenzhen, Guangdong, China

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

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

Date of Issue：2012-09-29

Date of Expiry：2015-09-28

Date of Initial Accreditation：1999-08-03

Date of Update： 2012-09-29

Signed on behalf of China National Accreditation Service for Conformity Assessment

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

No.CNAS AL 2 0005210

ANNEX B

of

CCIC-SET

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-04252

Mobile WiFi

Type Name: E5338

Hardware Version： **CH1E5338SM**

Software Version： **21.210.05.01.983**

System Performance Check Data and Highest SAR Plots

This Annex consists of 12 pages

Date of Report：2015-04-21

GRAPH TEST RESULTS

BAND	PAPAMETERS
GPRS 850 (2Tx)	Flat Plane with Face Body device position on High Channel in GPRS mode (10mm distance)
GPRS 1900 (2Tx)	Flat Plane with Edge A Body device position on Middle Channel in GPRS mode (10mm distance)
WCDMA 850	Flat Plane with Face Body device position on Middle Channel in RMC mode(10mm distance)
WCDMA 1700	Flat Plane with Face Body device position on High Channel in RMC mode(10mm distance)
WCDMA 1900	Flat Plane with Face Body device position on Middle Channel in RMC mode (10mm distance)
WIFI 802.11b	Flat Plane with Edge B Body device position on Middle Channel in DSSS mode (10mm distance)

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: 30/03/2015
Measurement duration: 13 minutes 12 seconds

A. Experimental conditions.

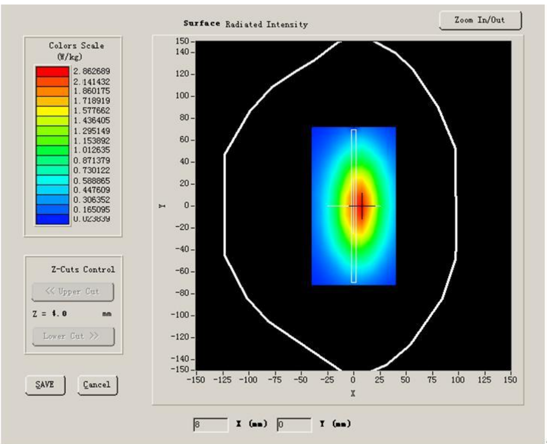
Phantom File	surf_sam_plan.txt
Phantom	Flat Plane
Device Position	Dipole
Band	835MHz
Channels	
Signal	CW

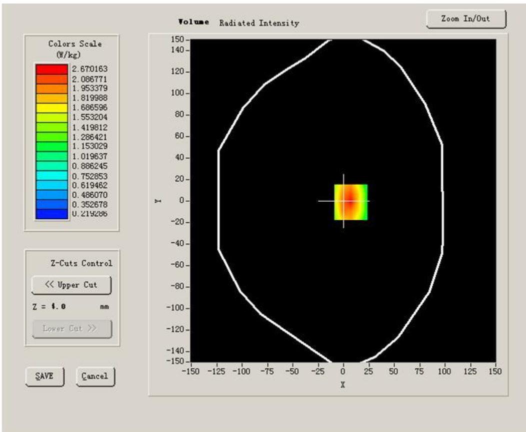
B. SAR Measurement Results

Band SAR

Frequency (MHz)	835
Relative permittivity (real part)	55.04
Relative permittivity	21.12
Conductivity (S/m)	0.98
Power drift (%)	-1.02
Ambient Temperature:	22.2 ℃
Liquid Temperature:	22.5 ℃
ConvF:	5.84
Duty factor:	1:1

SURFACE SAR	**VOLUME SAR**





Maximum location: X=7.00, Y=-1.00

SAR 10g (W/Kg)	1.603124
SAR 1g (W/Kg)	2.528962

System Performance Check (Body, 1750MHz)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 31/03/2015
Measurement duration: 13 minutes 06 seconds

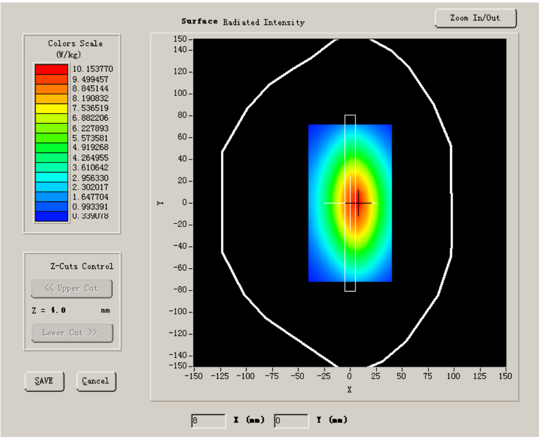
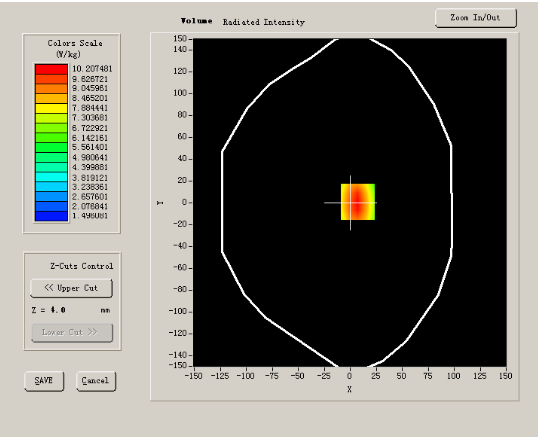
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Flat Plane
Device Position	Dipole
Band	1750MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	1750
Relative permittivity (real part)	53.41
Relative permittivity	15.74
Conductivity (S/m)	1.53
Power drift (%)	0.940000
Ambient Temperature:	22.2 ℃
Liquid Temperature:	22.6 ℃
ConvF:	4.93
Crest factor:	1:1

SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=7.00, Y=1.00

SAR 10g (W/Kg)	5.230842
SAR 1g (W/Kg)	9.840723

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: 02/04/2015

Measurement duration: 13 minutes 12 seconds

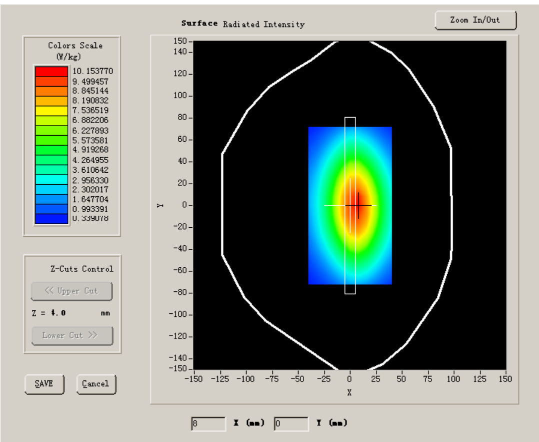
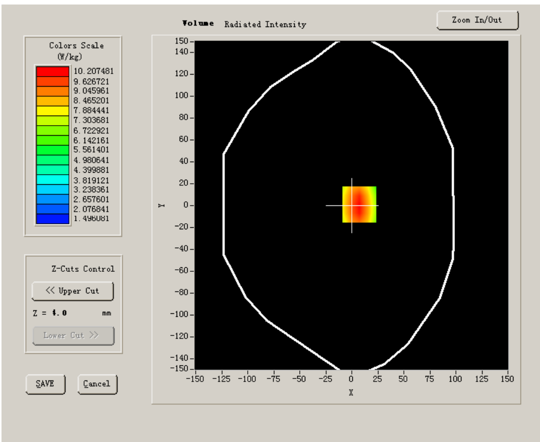
A. Experimental conditions.

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

B. SAR Measurement Results

Band SAR

Frequency (MHz)	1900
Relative permittivity (real part)	53.18
Relative permittivity	14.21
Conductivity (S/m)	1.50
Power Drift (%)	0.270000
Ambient Temperature:	22.0 ℃
Liquid Temperature:	22.8 ℃
ConvF:	5.42
Duty factor:	1:1

SURFACE SAR	VOLUME SAR
	

Maximum location: X=1.00, Y=6.00

SAR 10g (W/Kg)	5.264217
SAR 1g (W/Kg)	10.153415

System Performance Check (Body, 2450MHz)

Type: Validation measurement (Complete)

Date of measurement: 20/04/2015

Measurement duration: 22 minutes 59 seconds

Mobile Phone IMEI number: --

A. Experimental conditions.

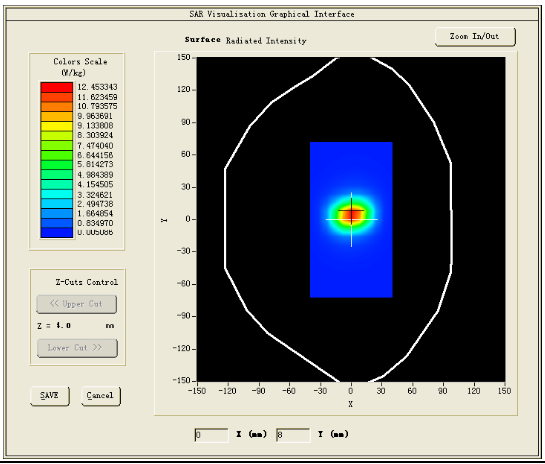
Phantom File	surf_sam_plan.txt, h= 5.00 mm
Phantom	7x7x8,dx=5mm dy=5mm dz=4mm,Complete/nsurf_sam_plan.txt, h= 5.00 mm
Device Position	Dipole
Band	2450MHz
Channels	
Signal	CW

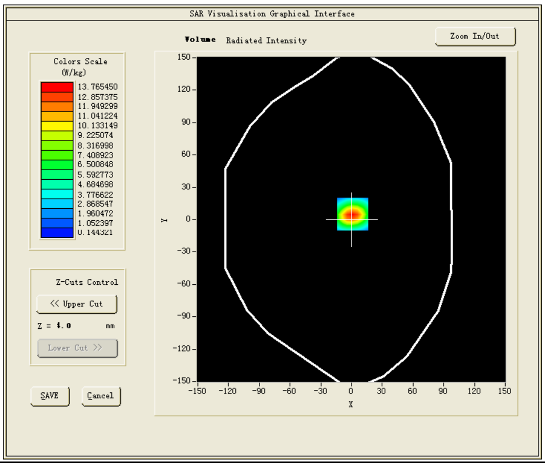
B. SAR Measurement Results

Band SAR

Frequency (MHz)	2450
Relative permittivity (real part)	52.62
Relative permittivity	14.03
Conductivity (S/m)	1.91
Power Drift (%)	0.30
Ambient Temperature:	22.0 ℃
Liquid Temperature:	22.6 ℃
Duty factor:	1:1
ConvF:	5.07

SURFACE SAR	VOLUME SAR





Maximum location: X=1.00, Y=5.00

SAR Peak: 22.36 W/kg

SAR 10g (W/Kg)	6.1967342
SAR 1g (W/Kg)	12.799515

GPRS 850, Face, High

Type: Phone measurement (11 points in the volume)

Date of measurement: 30/03/2015

Measurement duration: 7 minutes 33 seconds

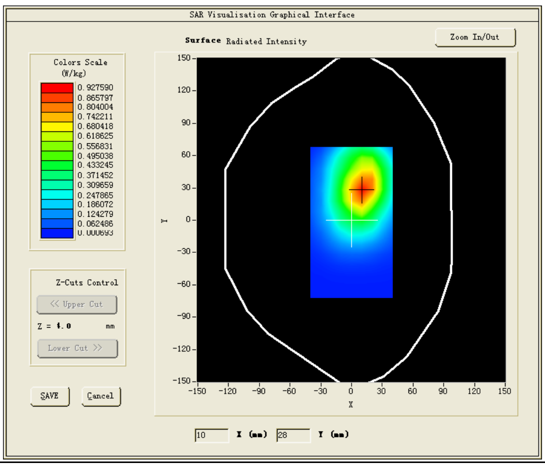
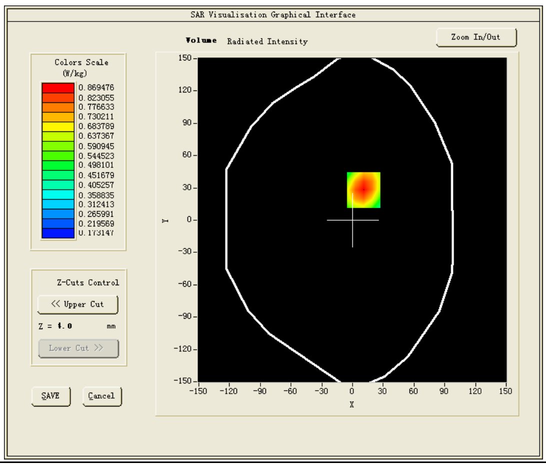
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	surf_sam_plan.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Face
Band	CUSTOM (GPRS850_2Tx)
Channels	251
Signal	GPRS(Duty cycle: 1:4)

B.SAR Measurement Results

Frequency (MHz)	848.8
Relative permittivity (real part)	55.04
Relative permittivity (imaginary part)	21.12
Conductivity (S/m)	0.98
Variation (%)	2.38
ConvF:	5.84

SURFACE SAR	VOLUME SAR
	

Maximum location: X=11.00, Y=28.00

SAR Peak: 1.01 W/kg

SAR 10g (W/Kg)	0.619499
SAR 1g (W/Kg)	0.845138

GPRS1900, Edge A, Middle

Type: Phone measurement (11 points in the volume)

Date of measurement: 02/04/2015

Measurement duration: 7 minutes 31 seconds

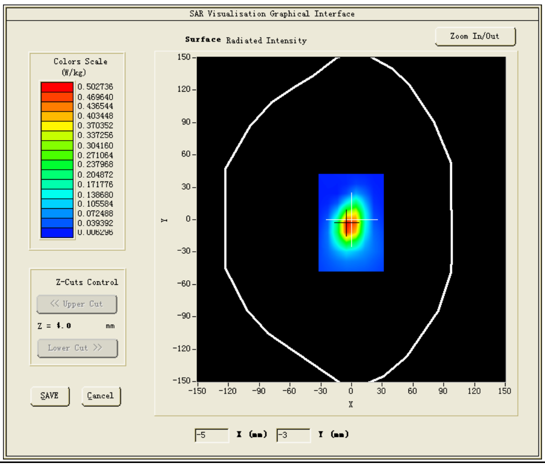
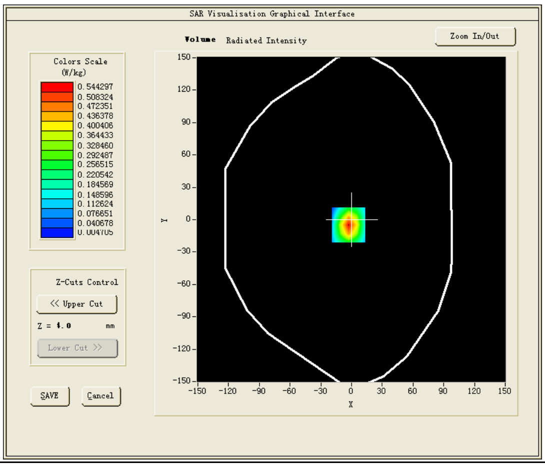
Mobile Phone IMEI number: --

A. Experimental conditions.

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

B. SAR Measurement Results

Frequency (MHz)	1880.0
Relative permittivity (real part)	53.18
Relative permittivity (imaginary part)	14.21
Conductivity (S/m)	1.50
Variation (%)	1.00
ConvF:	5.42

SURFACE SAR	VOLUME SAR
	

Maximum location: X=-3.00, Y=-5.00

SAR Peak: 0.81 W/kg

SAR 10g (W/Kg)	0.257778
SAR 1g (W/Kg)	0.503820

WCDMA850, FACE, Middle

Type: Phone measurement (11 points in the volume)

Date of measurement: 30/03/2015

Measurement duration: 6 minutes 09 seconds

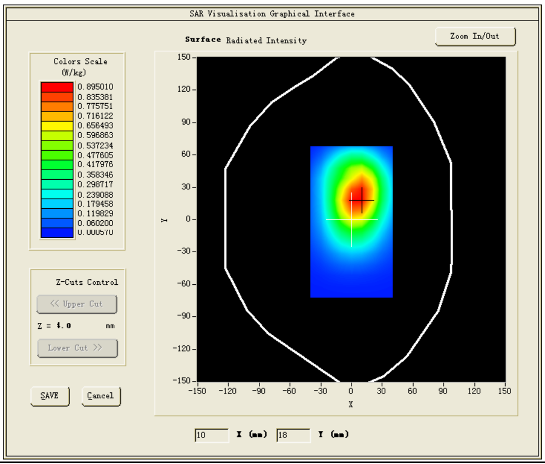
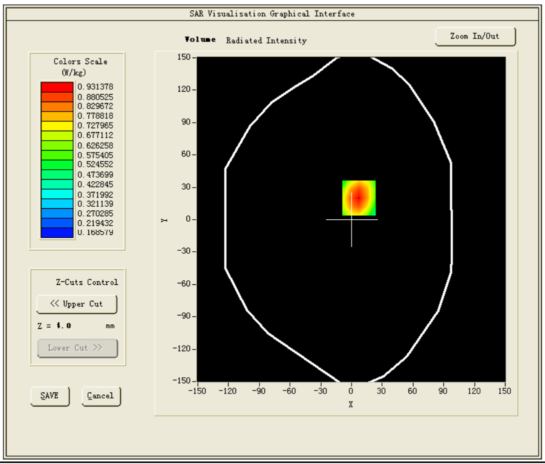
Mobile Phone IMEI number: --

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	4183
Signal	WCDMA (Crest factor: 1:1)

B. SAR Measurement Results

Frequency (MHz)	836.6
Relative permittivity (real part)	55.04
Relative permittivity (imaginary part)	21.12
Conductivity (S/m)	0.98
Variation (%)	-0.03
ConvF:	5.84

SURFACE SAR	VOLUME SAR
	

Maximum location: X=7.00, Y=20.00

SAR Peak: 1.17 W/kg

SAR 10g (W/Kg)	0.674225
SAR 1g (W/Kg)	0.933014

WCDMA1900, FACE, Middle

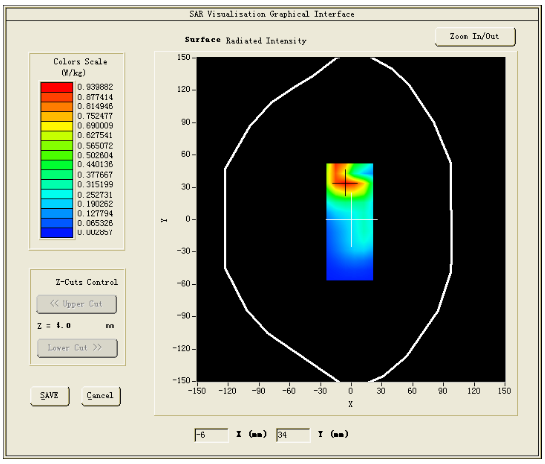
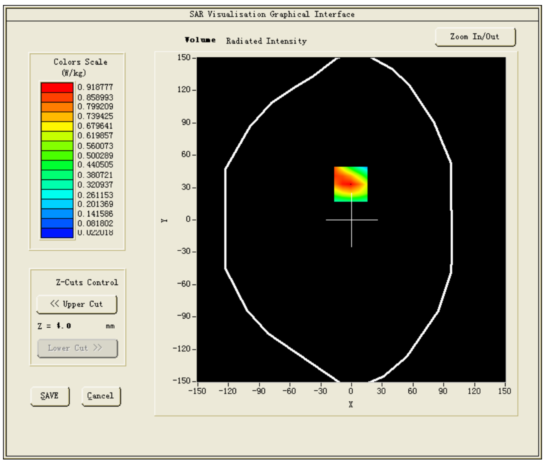
Type: Phone measurement (11 points in the volume)
Date of measurement: 02/04/2015
Measurement duration: 7 minutes 37 seconds
Mobile Phone IMEI number: --

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)	53.18
Relative permittivity (imaginary	14.21
Conductivity (S/m)	1.50
Variation (%)	-3.27
ConvF:	5.42

SURFACE SAR	VOLUME SAR
	

Maximum location: X=-1.00, Y=33.00

SAR Peak: 1.38 W/kg

SAR 10g (W/Kg)	0.500131
SAR 1g (W/Kg)	0.947457

WCDMA1700, Face, High

Type: Phone measurement (11 points in the volume)

Date of measurement: 31/03/2015

Measurement duration: 7 minutes 37 seconds

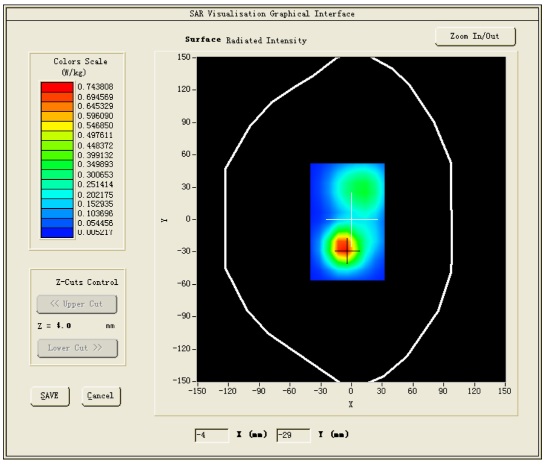
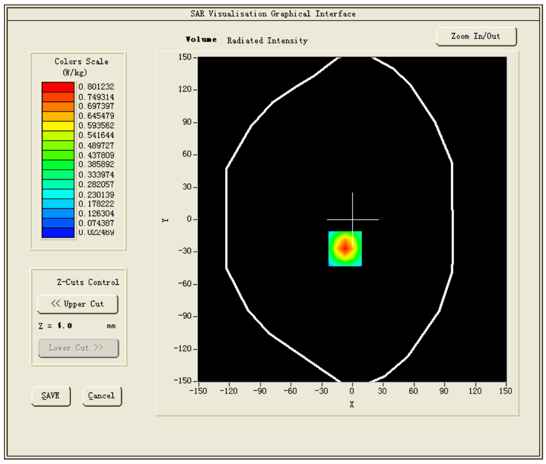
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	surf_sam_plan.txt
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Body
Band	Band4_WCDMA1700
Channels	1513
Signal	WCDMA (Duty cycle: 1:1)

B. SAR Measurement Results

Frequency (MHz)	1752.6
Relative permittivity (real part)	53.41
Relative permittivity (imaginary	15.74
Conductivity (S/m)	1.53
Variation (%)	-0.25
ConvF:	4.93

SURFACE SAR	VOLUME SAR
	

Maximum location: X=-7.00, Y=-27.00

SAR Peak: 1.20 W/kg

SAR 10g (W/Kg)	0.438324
SAR 1g (W/Kg)	0.820390

Wi-Fi 802.11b , Edge C, Middle

Type: Phone measurement (Complete)

Date of measurement: 20/04/2015

Measurement duration: 20 minutes 24 seconds

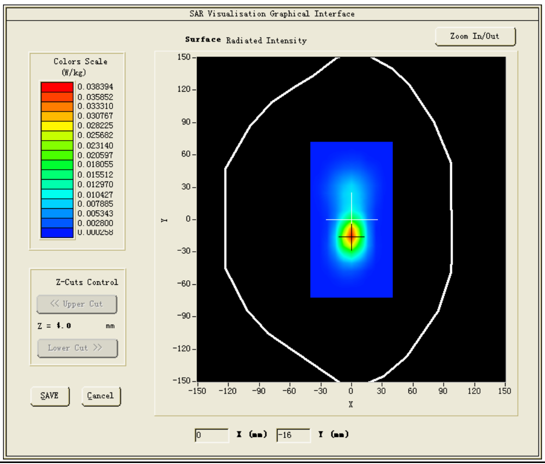
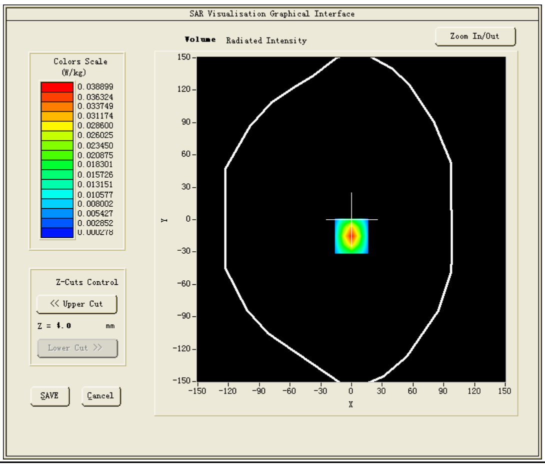
Mobile Phone IMEI number: --

A. Experimental conditions.

Area Scan	dx=8mm dy=8mm, h= 5.00 mm
ZoomScan	7x7x8,dx=5mm dy=5mm dz=4mm,Complete/ndx=8mm dy=8mm, h= 5.00 mm
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11b
Channels	11
Signal	DSSS (Crest factor: 1:1)

B. SAR Measurement Results

Frequency (MHz)	2462
Relative permittivity (real part)	52.62
Relative permittivity (imaginary part)	14.03
Conductivity (S/m)	1.91
Variation (%)	-2.33
ConvF:	5.07

SURFACE SAR	**VOLUME SAR**
	

Maximum location: X=0.00, Y=-15.00

SAR Peak: 0.06 W/kg

SAR 10g (W/Kg)	0.016300
SAR 1g (W/Kg)	0.034738

ANNEX C

of

CCIC-SET

CONFORMANCE TEST REPORT FOR

HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-04252

Mobile WiFi

Type Name: E5338

Hardware Version： **CH1E5338SM**

Software Version： **21.210.05.01.983**

Calibration Certificate of Probe and Dipoles

This Annex consists of 54 pages

Date of Report：2015-04-21

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	

	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.

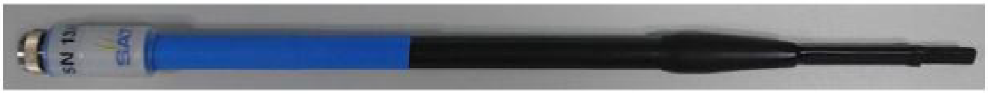


Figure 1 – *Satimo COMOSAR Dosimetric E field Dipole*

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 %

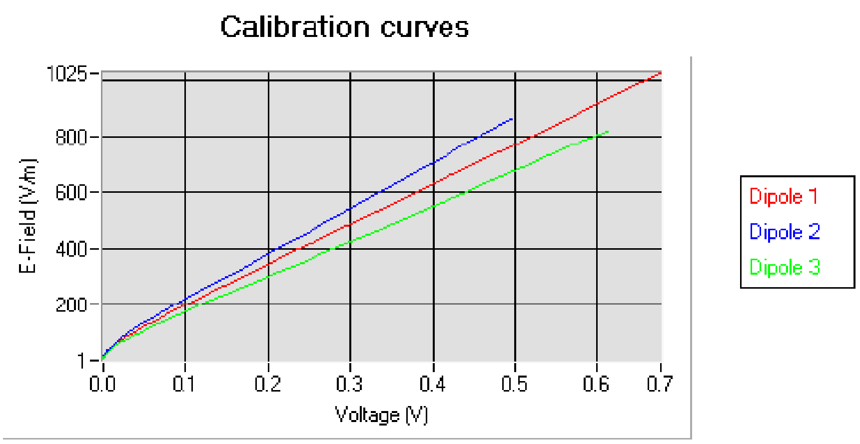
5.1 SENSITIVITY IN AIR

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

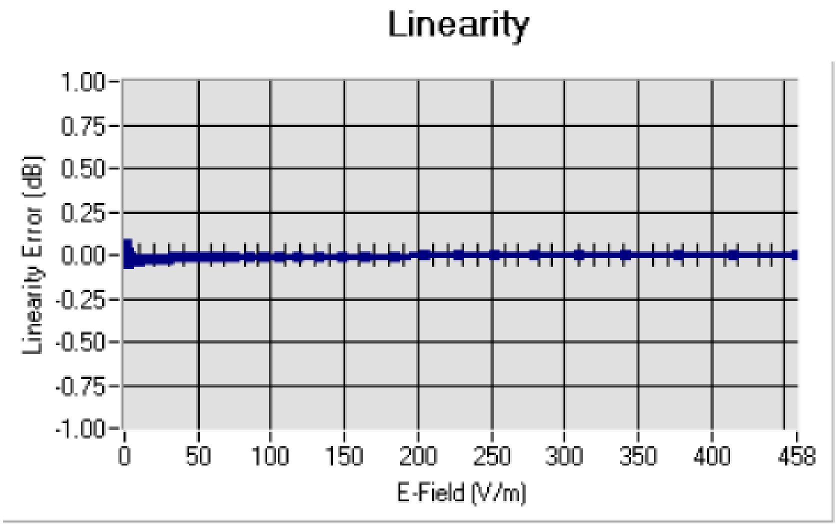
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
92	90	95

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

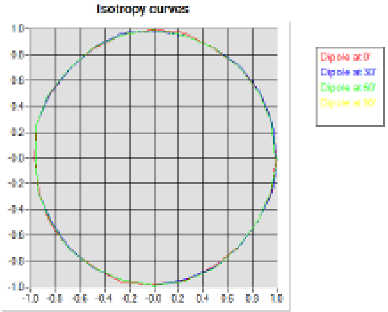
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL850	835	42.81	0.89	5.68
BL850	835	53.46	0.96	5.84
HL900	900	42.47	0.96	5.34
BL900	900	56.69	1.08	5.54
HL1800	1800	41.31	1.38	4.75
BL1800	1800	53.27	1.51	4.93
HL1900	1900	41.09	1.42	5.25
BL1900	1900	54.20	1.54	5.42
HL2000	2000	39.72	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

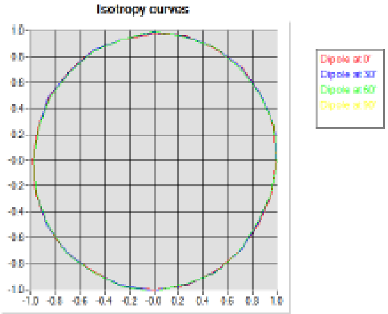
HL900 MHz

- 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

SAR Reference Dipole Calibration Report

Ref : ACR.240.1.14.SATU.A

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

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

ACCREDITED
Calibration CERT #2246-02

08/28/14

Summary:

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

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.240.1.14.SATU.A

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

	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.

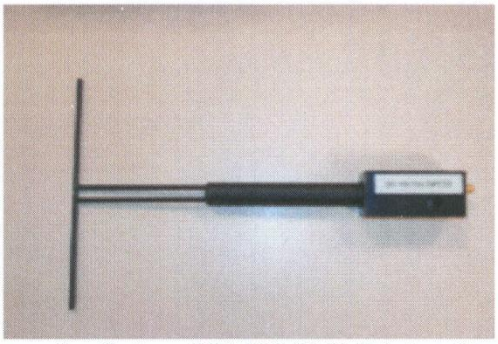


Figure 1 – *Satimo COMOSAR Validation Dipole*

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

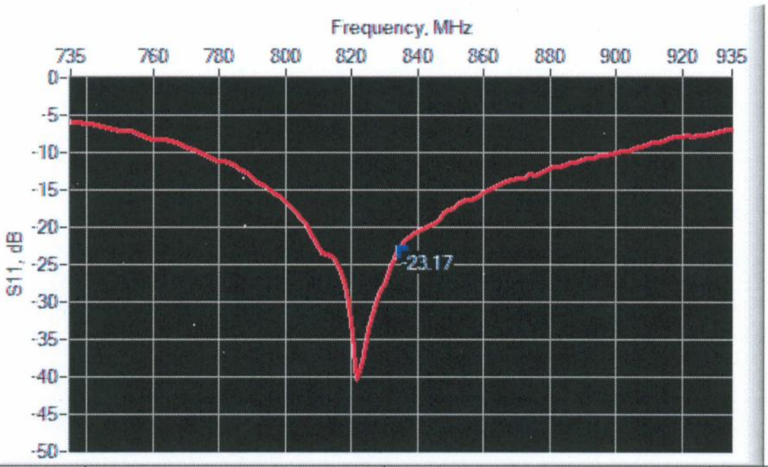
5.3 VALIDATION MEASUREMENT

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 %

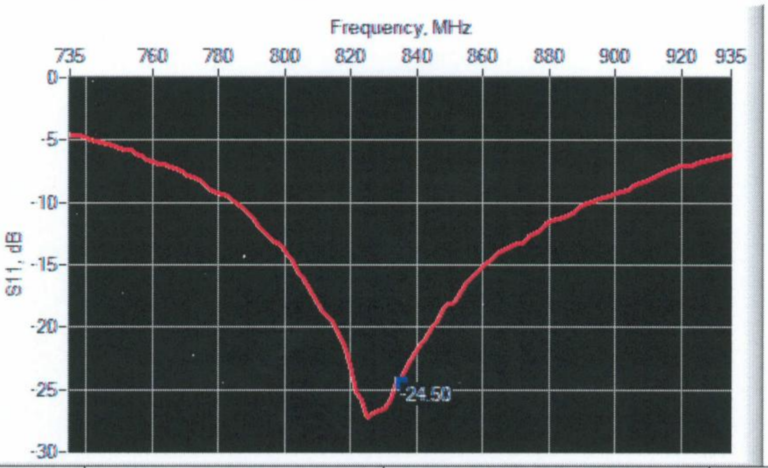
6 CALIBRATION MEASUREMENT RESULTS

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	