

SAR TEST REPORT

Report No.: SET2015-11063

Product: Android Mobile Data Terminal

Model No.: MX-5050-1D

Brand Name: MEXXEN

FCC ID: 2ADXO-MX-5050

Applicant: Mexxen Technology(ShangHai)INC.

Address: Unit B,12F,Building 11,No. 518,xinzhan Rd., Songjiang District,Shanghai,China

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

Product.....: Android Mobile Data Terminal

Model No.....: MX-5050-1D

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Applicant.....: Mexzen Technology(ShangHai)INC.

Applicant Address.....: Unit B,12F,Building 11,No. 518,xinzhan Rd., Songjiang District,Shanghai,China

Manufacturer.....: Mexzen Technology(ShangHai)INC.

Manufacturer Address.....: Unit B,12F,Building 11,No. 518,xinzhan Rd., Songjiang District,Shanghai,China

Rating.....: AC input: AC 100~240V 50/60Hz
3.7V 5000mAh(Battery)

Test Standards.....: IEEE Std. 1528-2003, 47CFR § 2.1093
RSS-102 Issue 4 March 2010

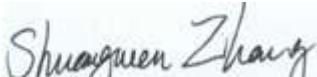
Test Result.....: Pass

Tested by



Signature

Reviewed by



Signature

Approved by



Signature

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This Test Report consists of the following Annexes:

Annex A: Test Layout

Annex B: Sample Photographs

Annex C: System Performance Check Data

Annex D: Calibration Certificate of Probe and Dipoles

1. GENERAL CONDITIONS

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

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

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**

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Responsible Test Lab Mr. Wu Li'an

Managers:

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.: SET2015-11063

CCIC-SET Project Leader: Mr. Li Sixiong

CCIC-SET Responsible for accreditation scope: Mr. Wu Li'an

Start of Testing: 2015-08-05

End of Testing: 2015-08-07

2.4. Identification of Applicant

Company Name: Mexxen Technology(ShangHai)INC.

Address: Unit B,12F,Building 11,No. 518,xinzhuhan Rd., Songjiang District,Shanghai,China

2.5. Identification of Manufacture

Company Name: Mexxen Technology(ShangHai)INC.

Address: Unit B,12F,Building 11,No. 518,xinzhuhan Rd., Songjiang District,Shanghai,China

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

3. General Information

3.1. Description Of Equipment Under Test (EUT)

| | | |
|---|----------------------------------|--|
| Sample Name: | Android Mobile Data Terminal | |
| Type Name: | MX-5050-1D | |
| Brand Name: | MEXXEN | |
| Dual Transfer Mode (DTM) per 3GPP 51.010 | Not supported | |
| General description: | Support Band and Frequency Range | GSM 850: 824.2MHz to 848.8MHz PCS 1900: 1850.2MHz to 1909.8MHz WIFI: 2412MHz~2472MHz BT:2402MHz~2480MHz NFC:13.56MHz |
| | Development Stage | Identical Prototype |
| | Accessories | AC input: AC 100~240V 50/60Hz |
| | Battery type | BAT-5050-01A |
| | Battery specification | 3.7V 5000mAh |
| | Antenna type | Internal Antenna |
| | Modulation mode | GSM:GMSK BT: GFSK, $\pi/4$ -DQPSK, 8-DPSK NFC: GMSK WIFI: BPSK/QPSK/16QAM/64QAM |

NOTE:

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

4 Specific Absorption Rate (SAR)

4.1 Introduction

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

4.2 SAR Definition

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

4.3 Phantoms

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

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

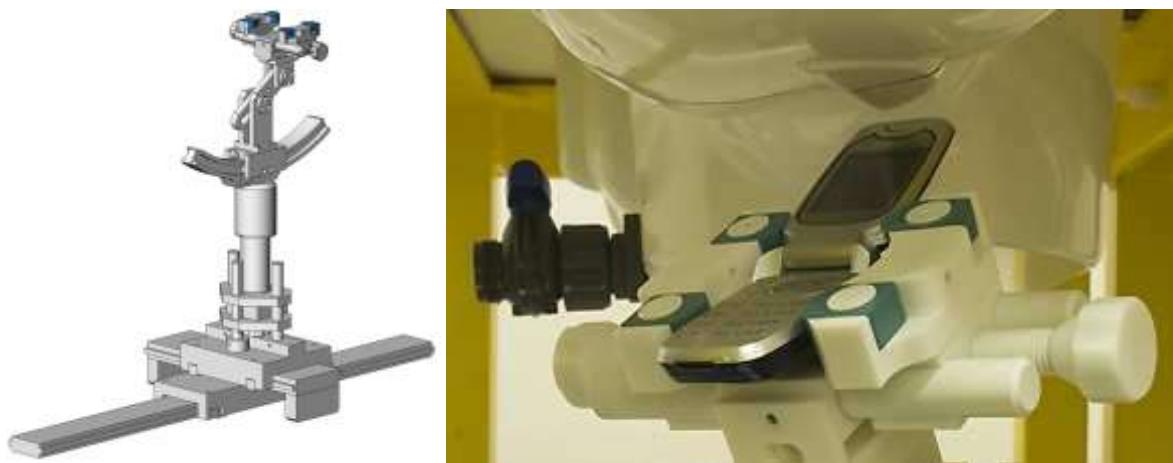


SAM Twin Phantom

4.4 Device Holder

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

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



Device holder

4.5 Probe Specification



Construction Symmetrical design with triangular core

Interleaved sensors

Built-in shielding against static charges

PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration ISO/IEC 17025 calibration service available.

Frequency 700 MHz to 3 GHz;
Linearity: ± 0.5 dB (700 MHz to 3 GHz)

Directivity ± 0.25 dB in HSL (rotation around probe axis)
 ± 0.5 dB in tissue material (rotation normal to probe axis)

Dynamic Range 1.5 μ W/g to 100 mW/g;
Linearity: ± 0.5 dB

Dimensions Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 5 mm (Body: 8 mm)
Distance from probe tip to dipole centers: <2.7 mm

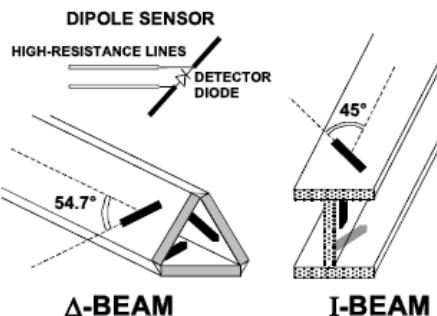
Application General dosimetry up to 3 GHz
Dosimetry in strong gradient fields
Compliance tests of mobile phones

Compatibility COMOSAR

Isotropic E-Field Probe

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

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



5 OPERATIONAL CONDITIONS DURING TEST

5.1 Schematic Test Configuration

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

The Absolute Radio Frequency Channel Number (ARFCN) was allocated to 128, 189 and 251 respectively in the case of GSM 850, to 512, 661, and 810 respectively in the case of PCS1900, to CH1,CH6 and CH11 respectively in the case of WIFI . The EUT was commanded to operate at maximum transmitting power.

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

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

5.2 SAR Measurement System

The SAR measurement system being used is the DASY4 system, the system is controlled remotely from a PC, which contains the software to control the robot and data acquisition equipment. The software also displays the data obtained from test scans.

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

5.2.1 Tissue Dielectric Parameters for Head and Body Phantoms

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

Table 1: Recommended Dielectric Performance of Tissue

| Ingredients (% by weight) | Frequency (MHz) | | | | | | | | | |
|-------------------------------|-----------------|-------|-------|------|-------|-------|-------|------|------|------|
| | 450 | | 835 | | 915 | | 1900 | | 2450 | |
| Tissue Type | Head | Body | Head | Body | Head | Body | Head | Body | Head | Body |
| Water | 38.56 | 51.16 | 41.45 | 52.4 | 41.05 | 56.0 | 54.9 | 40.4 | 62.7 | 73.2 |
| Salt (NaCl) | 3.95 | 1.49 | 1.45 | 1.4 | 1.35 | 0.76 | 0.18 | 0.5 | 0.5 | 0.04 |
| Sugar | 56.32 | 46.78 | 56.0 | 45.0 | 56.5 | 41.76 | 0.0 | 58.0 | 0.0 | 0.0 |
| HEC | 0.98 | 0.52 | 1.0 | 1.0 | 1.0 | 1.21 | 0.0 | 1.0 | 0.0 | 0.0 |
| Bactericide | 0.19 | 0.05 | 0.1 | 0.1 | 0.1 | 0.27 | 0.0 | 0.1 | 0.0 | 0.0 |
| Triton x-100 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 36.8 | 0.0 |
| DGBE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 44.92 | 0.0 | 0.0 | 26.7 |
| Dielectric Constant | 43.42 | 58.0 | 42.54 | 56.1 | 42.0 | 56.8 | 39.9 | 54.0 | 39.8 | 52.5 |
| Conductivity (s/m) | 0.85 | 0.83 | 0.91 | 0.95 | 1.0 | 1.07 | 1.42 | 1.45 | 1.88 | 1.78 |

Table 2 Recommended Tissue Dielectric Parameters

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

5.2.2 Simulant liquids

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

Table 4: Dielectric Performance of Head Tissue Simulating Liquid

| Temperature: 23.2°C; Humidity: 64%; | | | |
|-------------------------------------|-----------|-------------------------|-----------------------------|
| / | Frequency | Permittivity ϵ | Conductivity σ (S/m) |
| Target value | 835MHz | 41.5 \pm 5% | 0.90 \pm 5% |
| Validation value (Aug. 5th, 2015) | 835MHz | 41.18 | 0.88 |
| Target value | 1900MHz | 40.0 \pm 5% | 1.40 \pm 5% |
| Validation value (Aug. 6th, 2015) | 1900MHz | 39.59 | 1.39 |
| Target value | 2450MHz | 39.2 \pm 5% | 1.80 \pm 5% |
| Validation value (Aug. 7th, 2015) | 2450MHz | 38.65 | 1.78 |

Table 5: 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 \pm 5% | 0.97 \pm 5% |
| Validation value (Aug. 5th, 2015) | 835MHz | 54.68 | 0.95 |
| Target value | 1900MHz | 53.3 \pm 5% | 1.52 \pm 5% |
| Validation value (Aug. 6th, 2015) | 1900MHz | 52.72 | 1.50 |
| Target value | 2450MHz | 52.7 \pm 5% | 1.95 \pm 5% |
| Validation value (Aug. 7th, 2015) | 2450MHz | 52.27 | 1.93 |

For head SAR testing, the liquid height from the ear reference point(ERP) of the phantom to the liquid top surface is larger than 15cm,which is shown in Fig 1.

For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm, which is shown in Fig 2.



Fig. 1 Configuration of head tissue

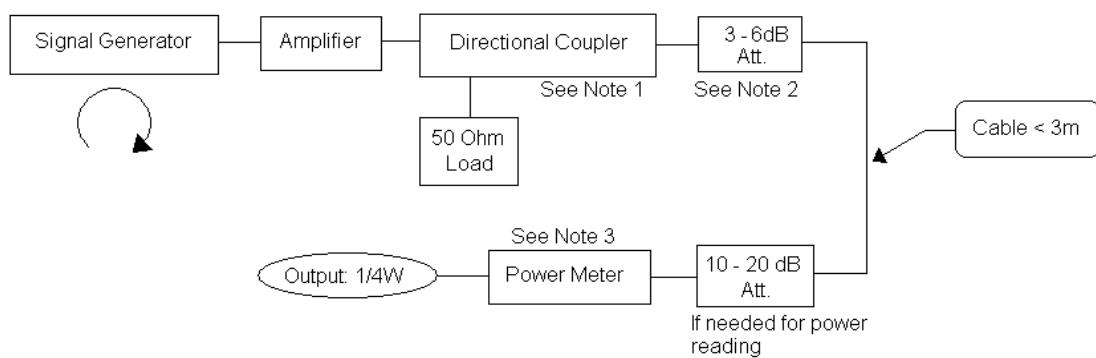


Fig. 2 Configuration of body tissue

5.2.3 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 $\pm 10\%$. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

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



With the SG and Amp and with directional coupler in place, set up the source signal at the relevant frequency and use a power meter to measure the power at the end of the SMAcable 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 mare provided in Tables 6、7. The humidity and ambient temperature of test facility were 64% and 23.2°C respectively. The EUT was supplied with full-charged battery for each measurement.

Tables 6 Head SAR system validation (1g)

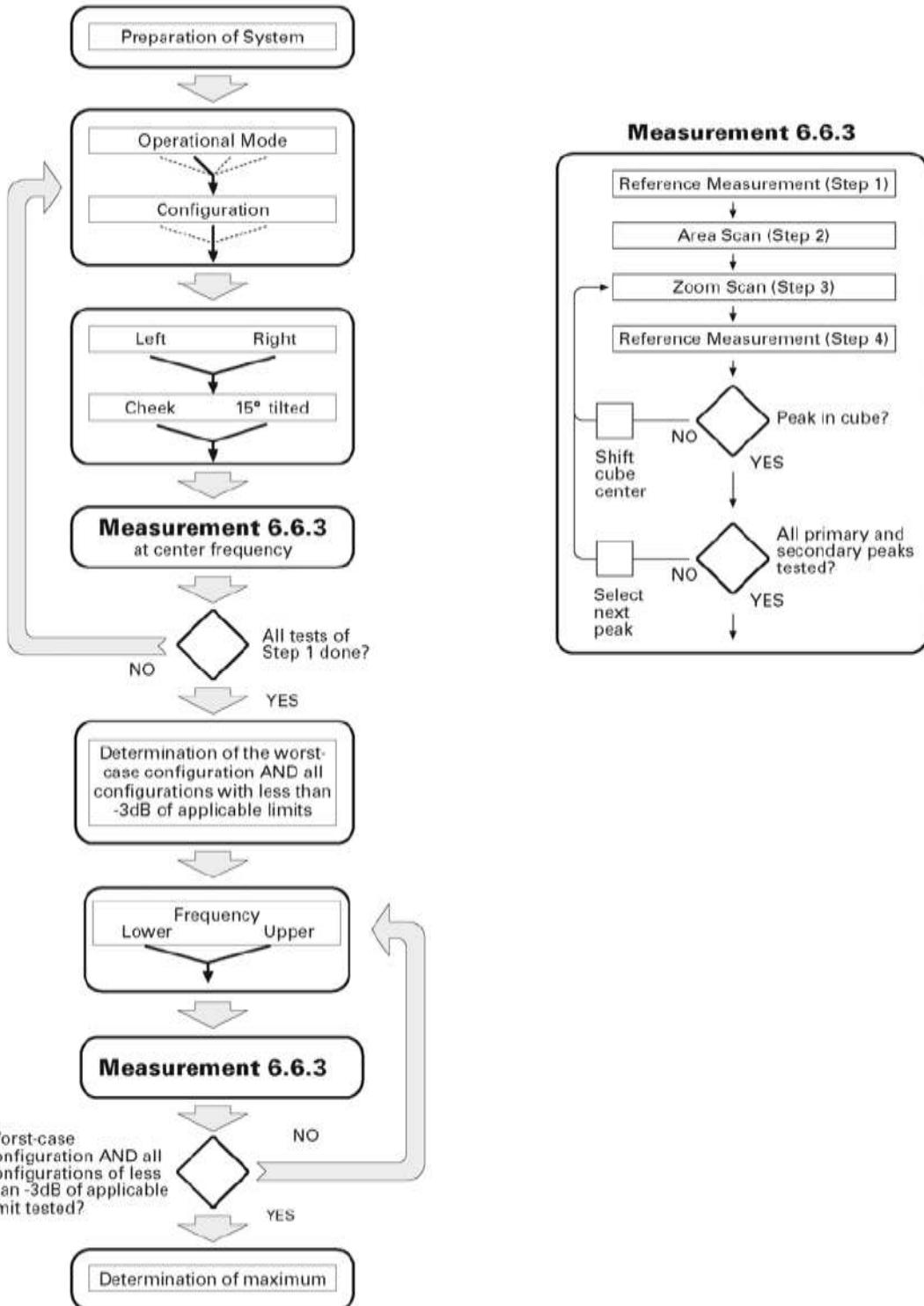
| Frequency | Duty cycle | Target value (W/kg) | Test value (W/kg) | |
|-------------------------|------------|------------------------|-------------------|-------|
| | | | 250 mW | 1W |
| 835MHz(Aug. 5th, 2015) | 1:1 | 9.77 ± 10% | 2.40 | 9.60 |
| 1900MHz(Aug. 6th, 2015) | 1:1 | 40.37 ± 10% | 9.84 | 39.36 |
| 2450MHz(Aug. 7th, 2015) | 1:1 | 53.60 ± 10% | 12.97 | 51.88 |

Table 7: Body SAR system validation (1g)

| Frequency | Duty cycle | Target value (W/kg) | Test value (W/kg) | |
|-------------------------|------------|------------------------|-------------------|-------|
| | | | 250 mW | 1W |
| 835MHz(Aug. 5th, 2015) | 1:1 | 10.31 ± 10% | 2.52 | 10.08 |
| 1900MHz(Aug. 6th, 2015) | 1:1 | 40.81 ± 10% | 10.06 | 40.24 |
| 2450MHz(Aug. 7th, 2015) | 1:1 | 52.66 ± 10% | 12.95 | 51.80 |

5.2.4 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 8mm from the surface of the phantom on the source side, a 3D scan is set up around the location of the maximum spot SAR. First, a point within the scan area is visited by the probe and a SAR reading taken at

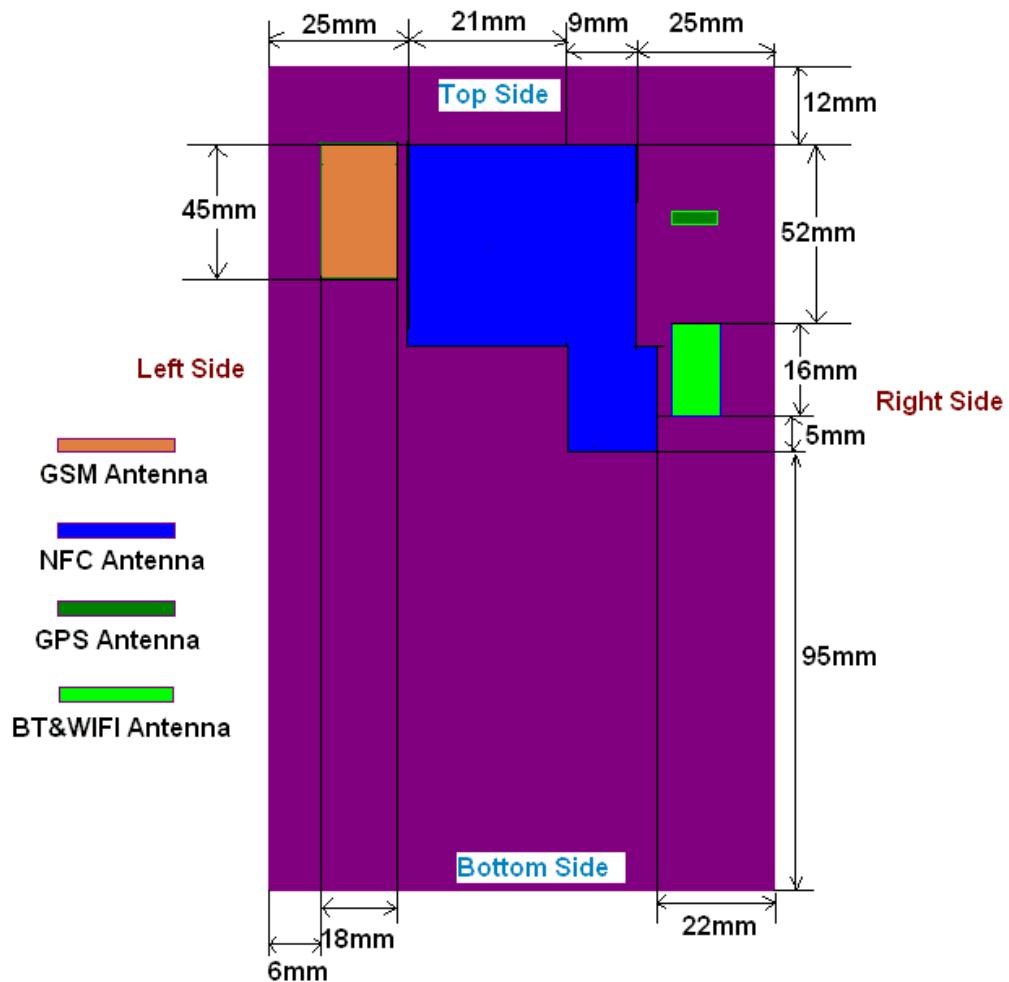
the start of testing. At the end of testing, the probe is returned to the same point and a second reading is taken. Comparison between these start and end readings enables the power drift during measurement to be assessed.

Above is the scanning procedure flow chart and table from the IEEE1528-2013 standard. This is the procedure for which all compliant testing should be carried out to ensure that all variations of the device position and transmission behavior are tested.

For body-worn measurement, the EUT was tested under five position: face upward 、 back upward 、 left side 、 right side and top side .

5.2.5 Transmitting antenna information

There are four antennas(GSM antenna 、BT&WIFI antenna 、GPS antenna and NFC antenna) inside the EUT, the GSM 、BT&WIFI antenna are the transmitting source, which is a type of internal antenna, the following picture shows the position of the antenna.



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

| Antennas | Wireless Interface |
|--------------------------|--------------------|
| GSM Antenna <Tx / Rx> | GSM 1900/850 |
| BT&WIFI Antenna<Tx / Rx> | \ |
| NFC Antenna | \ |
| GPS Antenna<Rx> | GPS receiving only |

5.2.6 Exposure Conditions Analysis

| antenna | Back | Front | Top side | Bottom side | Right side | Left side |
|----------|------|-------|----------|-------------|------------|-----------|
| GSM main | YES | YES | YES | NO | NO | YES |
| BT&WIFI | YES | YES | NO | NO | YES | NO |

1. Head/Body-worn mode SAR assessments are required.
2. Referring to KDB 941225 D06, when the overall device and width are $\geq 9\text{cm} \times 5\text{cm}$, the test distance is 10mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface and edge.
3. For GSM antenna, SAR measurement at Top side are not required since the nearest distance between the antenna and Bottom and Right side surface $> 25\text{mm}$.
4. For BT&WIFI antenna, SAR measurement at Top side are not required since the nearest distance between the antenna and Top, Bottom and Left side surface $> 25\text{mm}$.
5. BT output power(4.847 dBm) $\leq P_{\text{Ref}}(30\text{dBm})$. Based on the output power, plus WLAN 2.4G operates at the same frequency where BT output power is far less than 802.11b (output power (max:15.29 dBm), therefore SAR measurements for WLAN 2.4G&BT antenna are based on WLAN 2.4G in SAR assessment.
6. Per KDB 865664 D01v01r03, for each frequency band, repeated SAR measurement is required only when the measured SAR is $\geq 0.8\text{W/Kg}$; if the deviation among the repeated measurement is $\leq 20\%$, and the measured SAR $< 1.45\text{W/Kg}$, only one repeated measurement is required.
7. 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 $> 1.5\text{ W/kg}$, or $> 7.0\text{ W/kg}$ 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).
8. Per KDB941225 D01v03, when multiple slots can be used, the GPRS/EDGE slot configuration with the highest frame-averaged output power was selected for SAR testing.
9. Per KDB941225 D01v03, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}\text{ dB}$ 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 $\leq 1.2\text{ W/kg}$, SAR measurement is not required for the secondary mode.
10. Per KDB 248227 D01 v02r01, 802.11g /11n-HT20/11n-HT40 is not required. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is $\leq 1.2\text{W/Kg}$. Thus the SAR can be excluded.

6 CHARACTERISTICS OF THE TEST

6.1 Applicable Limit Regulations

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

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

RSS-102-2010: Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)

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

6.2 Applicable Measurement Standards

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

FCC 47 CFR Part2 (2.1093)

ANSI/IEEE C95.1-1992

IEEE 1528-2013

FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r01

FCC KDB 447498 D01 v05r02 General RF Exposure Guidance

FCC KDB 648474 D04 v01r02 Handset SAR

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

FCC KDB 865664 D02 v01r01 SAR Exposure Reporting

FCC KDB 941225 D01 v03 3G SAR Procedures

7 LABORATORY ENVIRONMENT

7.1 The Ambient Conditions during SAR Test

| | |
|--------------------------|------------------------------|
| Temperature | Min. = 15 ° C, Max. = 30 ° C |
| Relative humidity | Min. = 30%, Max. = 70% |
| Ground system resistance | < 0.5 Ω |

Ambient noise is checked and found very low and in compliance with requirement of standards.

Reflection of surrounding objects is minimized and in compliance with requirement of standards.

7.2 Test Configuration

For WWAN SAR testing, the device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the EUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30dB smaller than output power of EUT.

Duty factor observed as below: WLAN 2.4GHz 802.11b :86%

For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide

continuous transmitting RF signal.

8.Conducted RF Output Power

8.1 GSM Conducted Power

| Conducted Power (Unit: dBm) | | | | | | |
|-------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Band | GSM 850 | | | PCS 1900 | | |
| Channel | 128 | 189 | 251 | 512 | 661 | 810 |
| Frequency | 524.2 | 836.5 | 848.8 | 1850.2 | 1880 | 1909.8 |
| GSM(GMSK, 1 Tx slot) CS1 | 31.52 | 31.54 | 31.53 | 29.72 | 29.70 | 30.24 |
| GPRS (GMSK, 1 Tx slot) CS1 | 31.52 | 31.54 | 31.52 | 29.73 | 29.72 | 30.26 |
| GPRS (GMSK, 2 Tx slot) CS1 | 30.70 | 30.73 | 30.72 | 27.97 | 27.90 | 27.87 |
| GPRS (GMSK, 3 Tx slot) CS1 | 29.33 | 29.38 | 29.37 | 26.56 | 26.43 | 26.42 |
| GPRS (GMSK, 4 Tx slot) CS1 | 27.73 | 27.79 | 27.78 | 24.38 | 24.20 | 24.20 |
| EGPRS (8PSK,1 Tx slot) CS1 | 27.94 | 27.87 | 27.99 | 26.12 | 26.03 | 25.94 |
| EGPRS (8PSK,2 Tx slot) CS1 | 27.24 | 27.36 | 27.18 | 25.03 | 24.92 | 24.87 |
| EGPRS (8PSK,3 Tx slot) CS1 | 26.09 | 25.88 | 25.94 | 23.57 | 23.44 | 23.29 |
| EGPRS (8PSK,4 Tx slot) CS1 | 23.17 | 23.04 | 23.11 | 21.25 | 20.98 | 20.97 |

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 | 1:2.67 | 1:2 |
| Crest Factor | -9.03dB | -6.02dB | -4.26dB | -3.01dB |

8.2 WIFI Conducted Power

| Conducted Power (Unit: dBm) | | | | | | |
|-----------------------------|-------------------|-------|-------|--------------------|-------|-------|
| Band | 802.11b 11Mbps | | | 802.11g 54Mbps | | |
| Channel | 1 | 6 | 11 | 1 | 6 | 11 |
| Frequency | 2412 | 2437 | 2462 | 2412 | 2437 | 2462 |
| Power | 15.13 | 15.29 | 15.17 | 15.04 | 15.15 | 14.95 |
| Band | 802.11n 20 65Mbps | | | 802.11n 40 135Mbps | | |
| Channel | 1 | 6 | 11 | 3 | 6 | 9 |
| Frequency | 2412 | 2437 | 2462 | 2422 | 2437 | 2452 |
| Power | 15.06 | 15.25 | 15.13 | 15.72 | 15.89 | 15.63 |

Per KDB 248227, 11g output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded. For each frequency band, testing at higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4 dB higher than those measured at the lowest data rate.

8.3 BT 2.1 Conducted Power

| Conducted Power (Unit: dBm) | | | | | | | | | |
|-----------------------------|-------|------|------|------------|------|------|--------|------|------|
| Modulation Type | GFSK | | | Π /4-DQPSK | | | 8-DPSK | | |
| Channel | 0 | 39 | 78 | 0 | 39 | 78 | 0 | 39 | 78 |
| Frequency | 2402 | 2441 | 2480 | 2402 | 2441 | 2480 | 2402 | 2441 | 2480 |
| Power | -0.32 | 0.66 | 0.56 | 0.05 | 0.03 | 0.60 | 0.45 | 0.72 | 1.26 |

8.4 BT 4.0 Conducted Power

| Conducted Power (Unit: dBm) | | | |
|-----------------------------|------|------|------|
| Modulation Type | GFSK | | |
| Channel | 0 | 39 | 78 |
| Frequency | 2402 | 2441 | 2480 |
| Power | 4.85 | 3.92 | 4.58 |

Note:

1. Per KDB941225 D01, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. GPRS (GMSK, 3 Tx slot) and 802.11b are used for Body-worn accessory SAR measurements.

9. SAR DATASUMMARY

General Note:

1. Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - a. Tune-up scaling Factor =tune-up limit power(mW)/EUT RF power(mW), where tune-up limit is the maximum rated power among all production units.
 - b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to “1/(duty cycle)”
 - c. For WWAN: Reported SAR(W/kg)=Measured SAR(W/kg)*Tune-up Scaling Factor
 - d. For WLAN: Reported SAR(W/kg)=Measured SAR(W/kg)*Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v05r02, for each exposure position, if the highest output channel reported $SAR \leq 0.8W/kg$, other channels SAR testing is not necessary.
3. Per KDB 648474 D04v01r02, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is $\leq 1.2W/kg$, SAR testing with a headset connected to the handset is not required.
4. Per KDB 865664 D01V01r03, for each frequency band, repeated SAR measurement is required only when the measured SAR is $\geq 0.8W/Kg$

9.1 Standalone Head Worn SAR DATA

| Band | Phantom | Test Position | Gap (cm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Scaling Factor | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|----------|------------|---------------|-----------|-----|-------------|---------------------|---------------------|----------------|------------------------|------------------------|
| GSM 850 | Right head | Cheek | 1.0 | 189 | 836.4 | 31.54 | 35 | 1.11 | 0.053 | 0.059 |
| GSM 850 | Right head | Tilt | 1.0 | 189 | 836.4 | 31.54 | 35 | 1.11 | 0.044 | 0.049 |
| GSM 850 | Left head | Cheek | 1.0 | 189 | 836.4 | 31.54 | 35 | 1.11 | 0.061 | 0.068 |
| GSM 850 | Left head | Tilt | 1.0 | 189 | 836.4 | 31.54 | 35 | 1.11 | 0.050 | 0.056 |
| Band | Phantom | Test Position | Gap (cm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Scaling Factor | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
| PCS 1900 | Right head | Cheek | 1.0 | 810 | 1909.8 | 30.26 | 32 | 1.06 | 0.059 | 0.063 |
| PCS 1900 | Right head | Tilt | 1.0 | 810 | 1909.8 | 30.26 | 32 | 1.06 | 0.041 | 0.043 |
| PCS 1900 | Left head | Cheek | 1.0 | 810 | 1909.8 | 30.26 | 32 | 1.06 | 0.034 | 0.036 |
| PCS 1900 | Left head | Tilt | 1.0 | 810 | 1909.8 | 30.26 | 32 | 1.06 | 0.032 | 0.034 |

| Band | Phantom | Test Position | Gap (cm) | Ch | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Scaling Factor | Duty Cycle % | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|------|------------|---------------|-----------|----|-------------|---------------------|---------------------|----------------|--------------|------------------------|------------------------|
| 11b | Right head | Cheek | 1.0 | 6 | 2437 | 15.29 | 30 | 1.96 | 86 | 0.075 | 0.171 |
| 11b | Right head | Tilt | 1.0 | 6 | 2437 | 15.29 | 30 | 1.96 | 86 | 0.029 | 0.066 |
| 11b | Left head | Cheek | 1.0 | 6 | 2437 | 15.29 | 30 | 1.96 | 86 | 0.110 | 0.251 |
| 11b | Left head | Tilt | 1.0 | 6 | 2437 | 15.29 | 30 | 1.96 | 86 | 0.108 | 0.246 |

NOTE: We can get that the maximum SAR summation value is 0.319W/Kg(WWAN 0.068+WLAN 0.251) according to the analysis from above data, it less than 1.6W/Kg, so simultaneous transmission SAR is compliant per KDB 447498 D01v05r01.

9.2 Standalone Body SAR DATA

| Band | Mode | Test Position | Gap (cm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Scaling Factor | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|-----------|-----------|---------------|-----------|-----|-------------|---------------------|---------------------|----------------|------------------------|------------------------|
| GPRS 850 | 3 Tx slot | Back | 1.0 | 189 | 836.4 | 29.38 | 35 | 1.19 | 0.099 | 0.118 |
| GPRS 850 | 3 Tx slot | Face | 1.0 | 189 | 836.4 | 29.38 | 35 | 1.19 | 0.041 | 0.049 |
| GPRS 850 | 3 Tx slot | Left Side | 1.0 | 189 | 836.4 | 29.38 | 35 | 1.19 | 0.031 | 0.037 |
| GPRS 850 | 3 Tx slot | Top side | 1.0 | 189 | 836.4 | 29.38 | 35 | 1.19 | 0.035 | 0.042 |
| Band | Mode | Test Position | Gap (cm) | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Scaling Factor | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
| GPRS 1900 | 3 Tx slot | Back | 1.0 | 512 | 1850.2 | 26.56 | 32 | 1.21 | 0.128 | 0.155 |
| GPRS 1900 | 3 Tx slot | Face | 1.0 | 512 | 1850.2 | 26.56 | 32 | 1.21 | 0.020 | 0.024 |
| GPRS 1900 | 3 Tx slot | Left Side | 1.0 | 512 | 1850.2 | 26.56 | 32 | 1.21 | 0.043 | 0.052 |
| GPRS 1900 | 3 Tx slot | Top side | 1.0 | 512 | 1850.2 | 26.56 | 32 | 1.21 | 0.029 | 0.035 |

| Band | Phantom | Test Position | Gap (cm) | Ch | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Scaling Factor | Duty Cycle % | Measured 1g SAR (W/kg) | Reported 1g SAR (W/kg) |
|------|---------|---------------|-----------|----|-------------|---------------------|---------------------|----------------|--------------|------------------------|------------------------|
| 11b | \ | Back | 1.0 | 6 | 2437 | 15.29 | 30 | 1.96 | 86 | 0.066 | 0.150 |
| 11b | \ | Face | 1.0 | 6 | 2437 | 15.29 | 30 | 1.96 | 86 | 0.018 | 0.041 |
| 11b | \ | Right Side | 1.0 | 6 | 2437 | 15.29 | 30 | 1.96 | 86 | 0.069 | 0.157 |

Note:

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

- ≤ 0.8 W/kg, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg, when the transmission band is between 100 MHz and 200 MHz

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

2. NOTE: We can get that the maximum SAR summation value is 0.312W/Kg(WWAN 0.155+WLAN 0.157) according to the analysis from above data, it less than 1.6W/Kg, so simultaneous transmission SAR is compliant per KDB 447498 D01v05r01.

9.3 Highest SAR Test Plots

GSM 850, Left head, Cheek ,Middle

Type: Phone measurement

Date of measurement: 05/08/2015

Measurement duration: 3 minutes 35 seconds

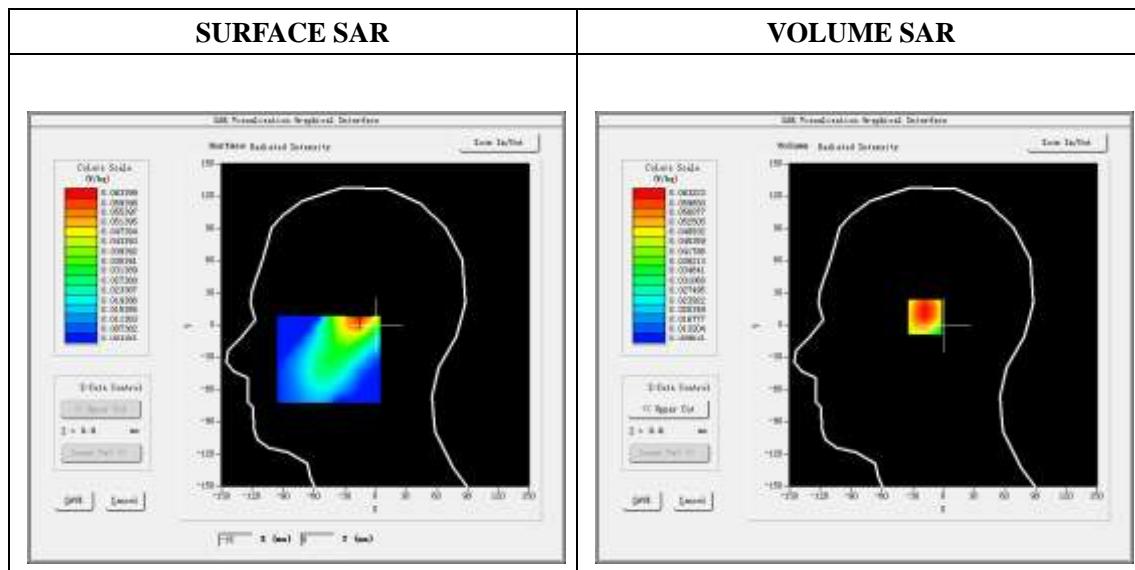
Mobile Phone IMEI number: --

A. Experimental conditions.

| | |
|------------------------|----------------------------|
| Area Scan | dx=8mm dy=8mm |
| ZoomScan | 5x5x7,dx=8mm dy=8mm dz=5mm |
| Phantom | Left head |
| Device Position | Cheek |
| Band | GSM 850 |
| Channels | Middle |
| Signal | GSM 850 (Duty cycle: 1:1) |

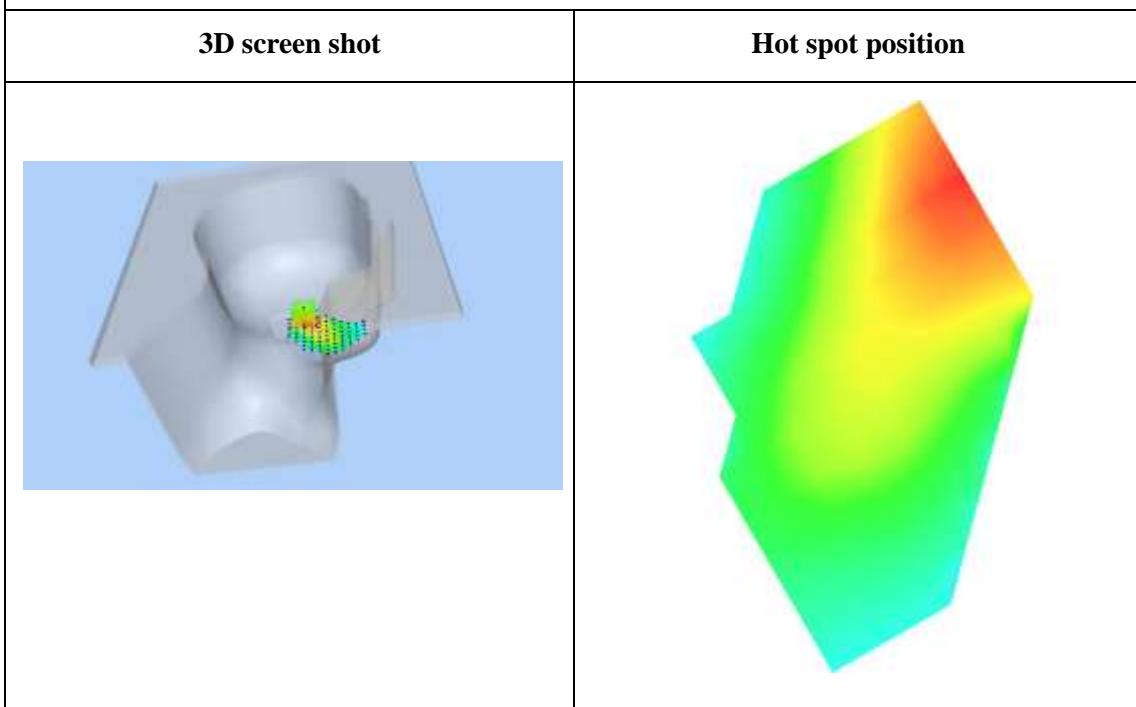
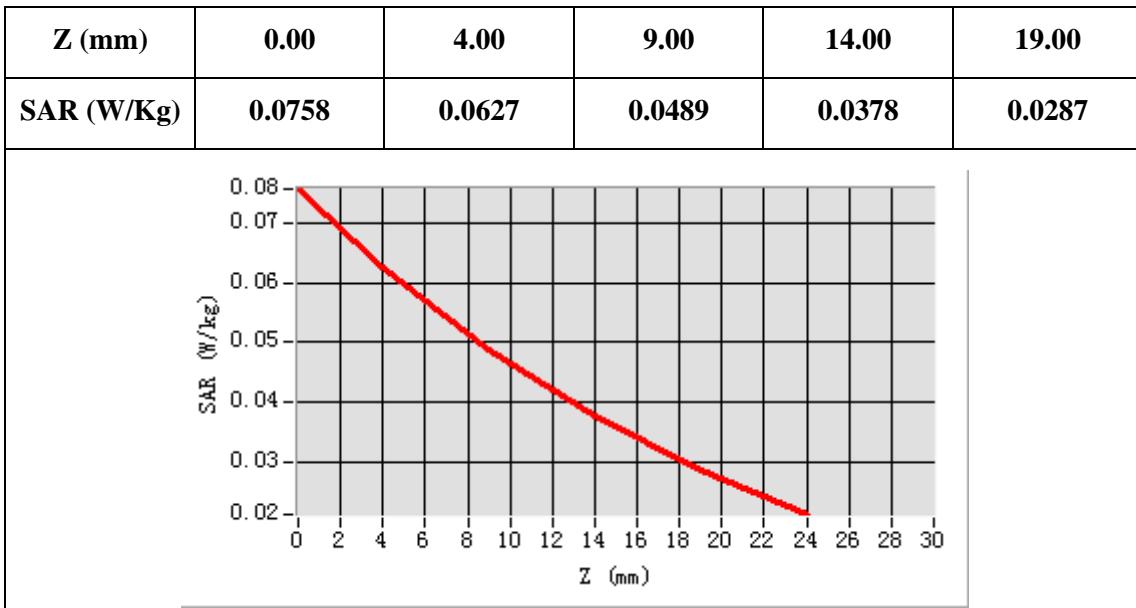
B. SAR Measurement Results

| | |
|---|----------------|
| Frequency (MHz) | 836.4 |
| Relative permittivity (real part) | 41.18 |
| Relative permittivity (imaginary part) | 18.97 |
| Conductivity (S/m) | 0.88 |
| Variation (%) | -3.72 |
| ConvF: | 5.68 |
| Probe serial number | SN 04/13 EP166 |



Maximum location: X=16.00, Y=-8.00
SAR Peak: 0.08 W/kg

| | |
|-----------------------|-------|
| SAR 10g (W/Kg) | 0.044 |
| SAR 1g (W/Kg) | 0.061 |



GSM 1900, Right head, Cheek ,High

Type: Phone measurement

Date of measurement: 06/08/2015

Measurement duration: 6 minutes 56 seconds

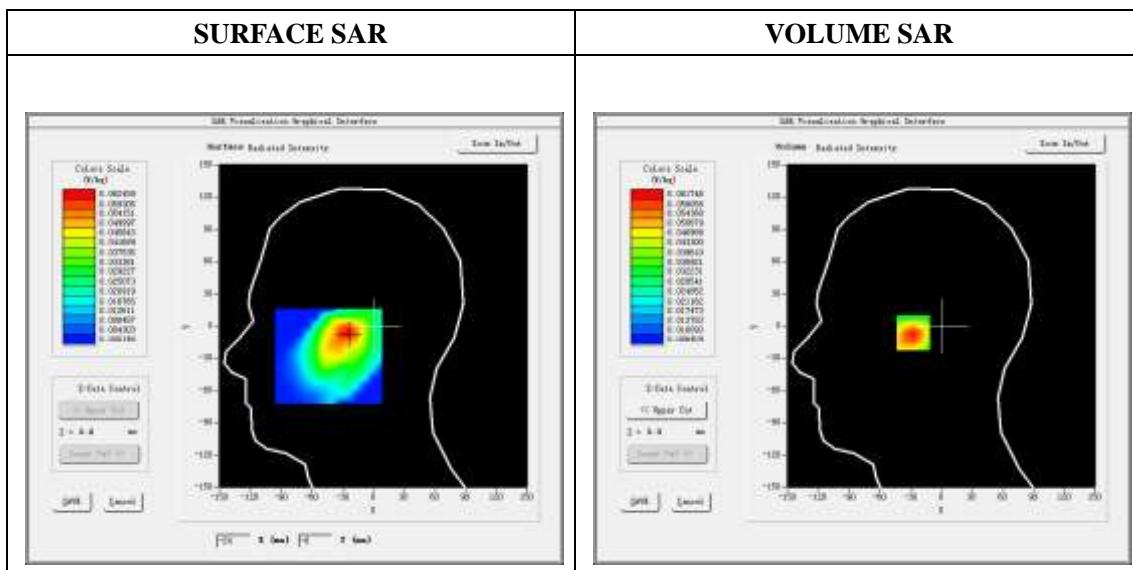
Mobile Phone IMEI number: --

A. Experimental conditions.

| | |
|------------------------|----------------------------|
| Area Scan | dx=8mm dy=8mm |
| ZoomScan | 5x5x7,dx=8mm dy=8mm dz=5mm |
| Phantom | Right head |
| Device Position | Cheek |
| Band | GSM 1900 |
| Channels | High |
| Signal | GSM (Duty cycle: 1:1) |

B. SAR Measurement Results

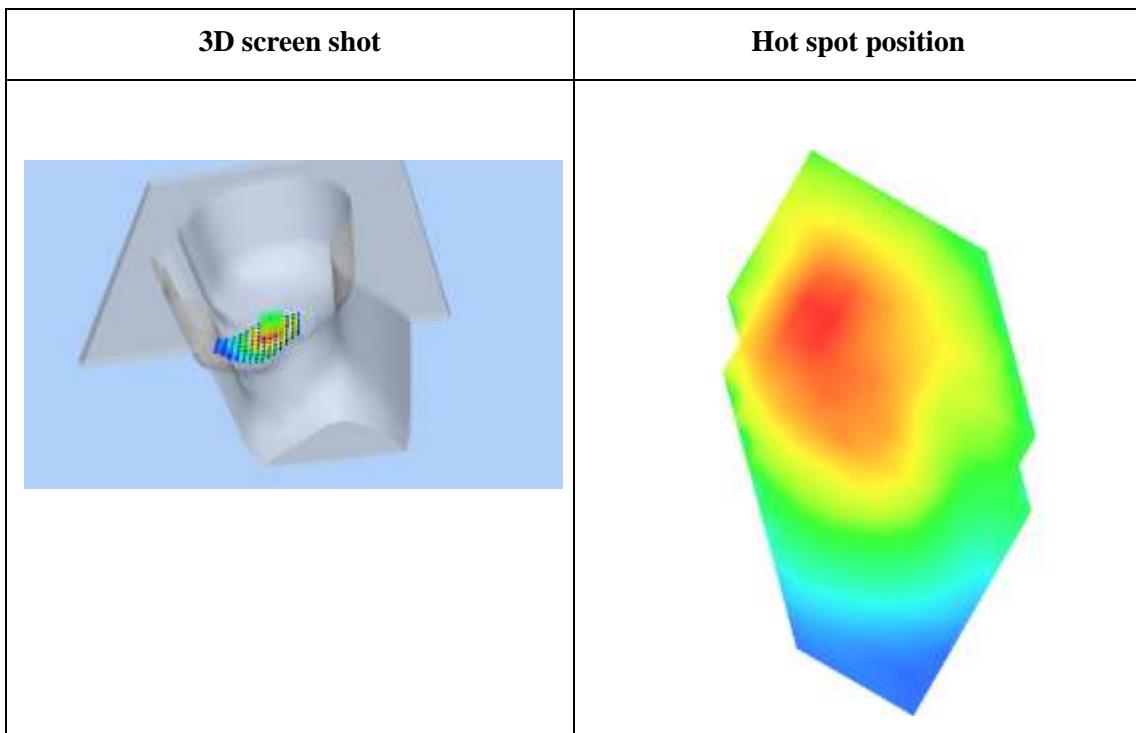
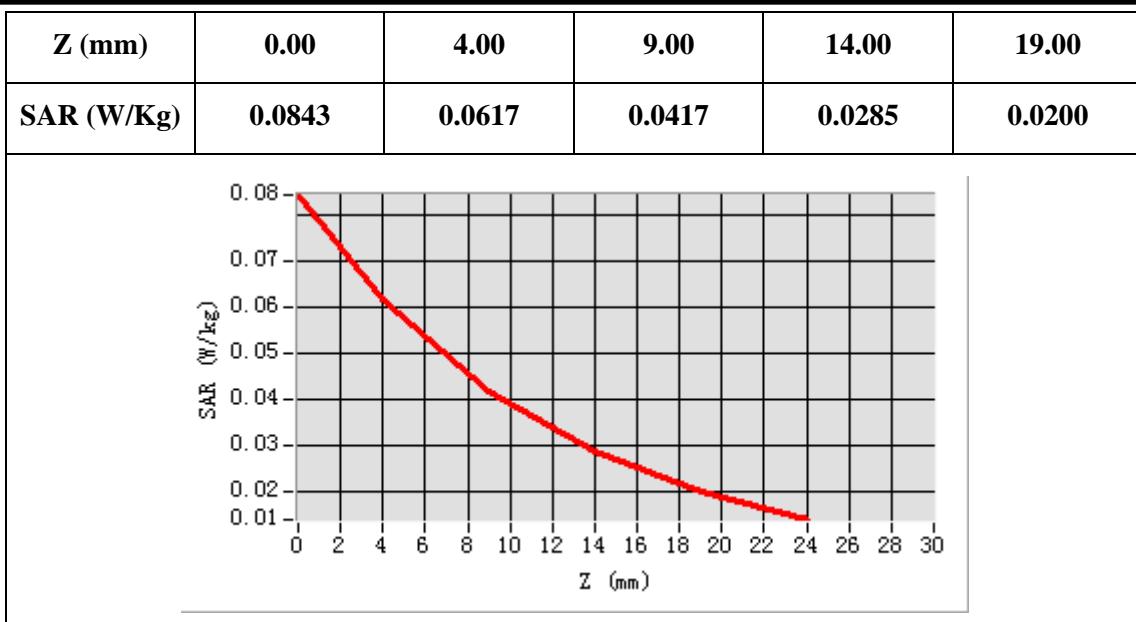
| | |
|---|----------------|
| Frequency (MHz) | 1909.8 |
| Relative permittivity (real part) | 39.59 |
| Relative permittivity (imaginary part) | 13.17 |
| Conductivity (S/m) | 1.39 |
| Variation (%) | -4.04 |
| ConvF: | 5.25 |
| Probe serial number | SN 04/13 EP166 |



Maximum location: X=-25.00, Y=-6.00

SAR Peak: 0.09 W/kg

| | |
|-----------------------|----------|
| SAR 10g (W/Kg) | 0.036752 |
| SAR 1g (W/Kg) | 0.058691 |



WIFI , Left head, Cheek, Middle

Type: Phone measurement

Date of measurement: 07/08/2015

Measurement duration: 6minutes 52 seconds

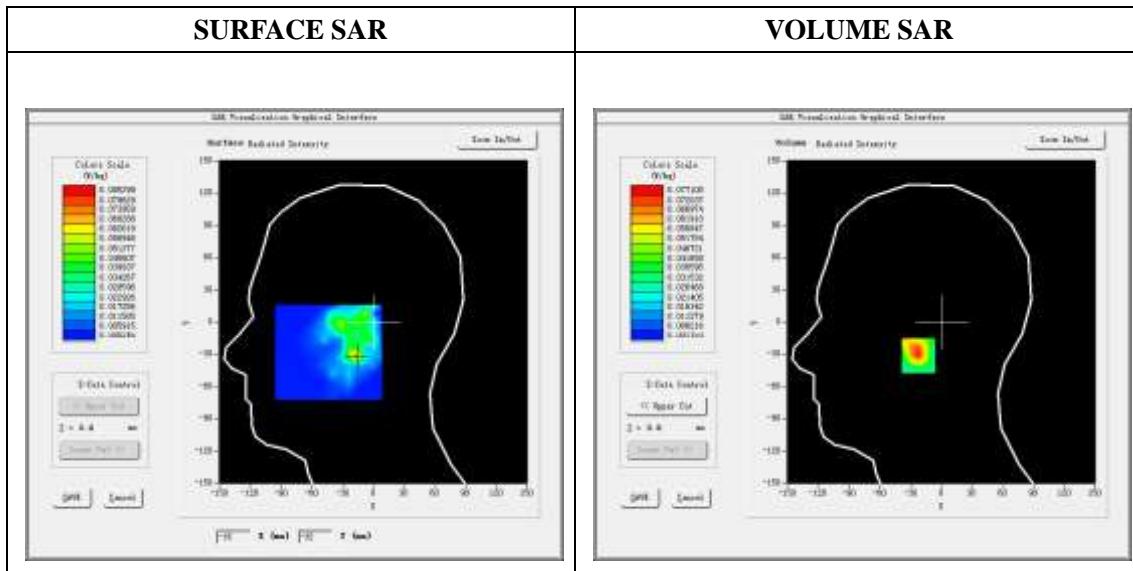
Mobile Phone IMEI number: --

A. Experimental conditions.

| | |
|------------------------|----------------------------|
| Area Scan | dx=8mm dy=8mm |
| ZoomScan | 7x7x8,dx=5mm dy=5mm dz=4mm |
| Phantom | Left head |
| Device Position | Cheek |
| Band | IEEE 802.11b |
| Channels | Middle |
| Signal | WIFI (Duty cycle: 1:1) |

B. SAR Measurement Results

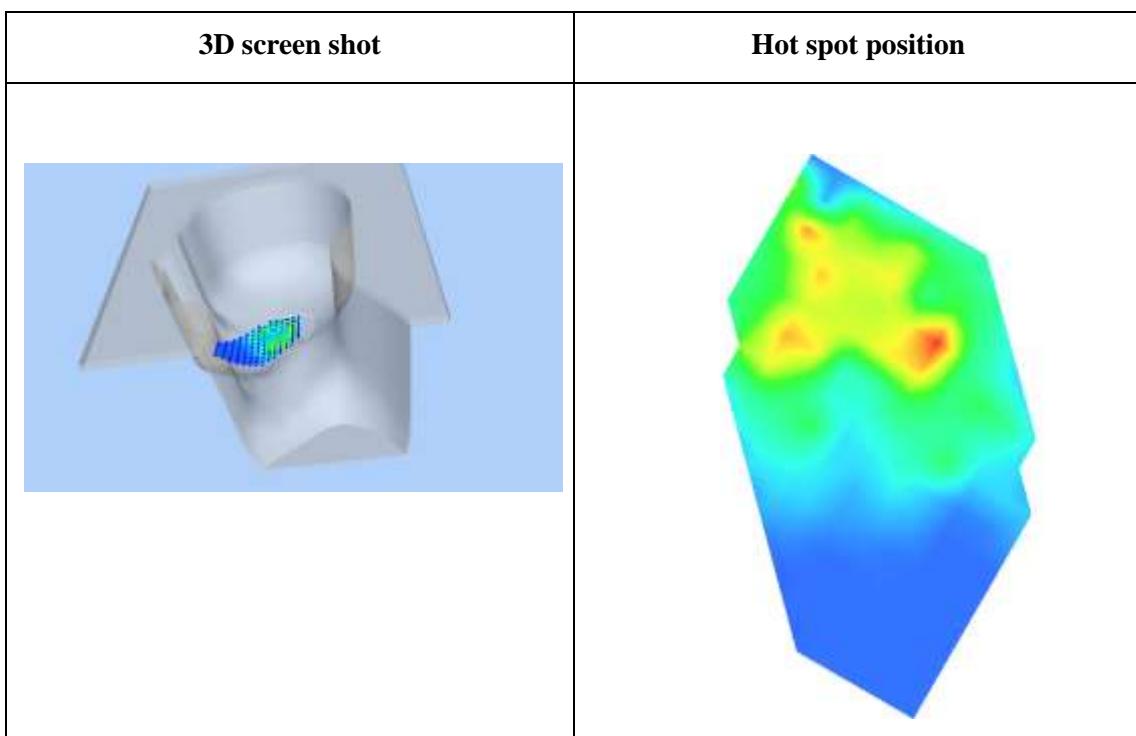
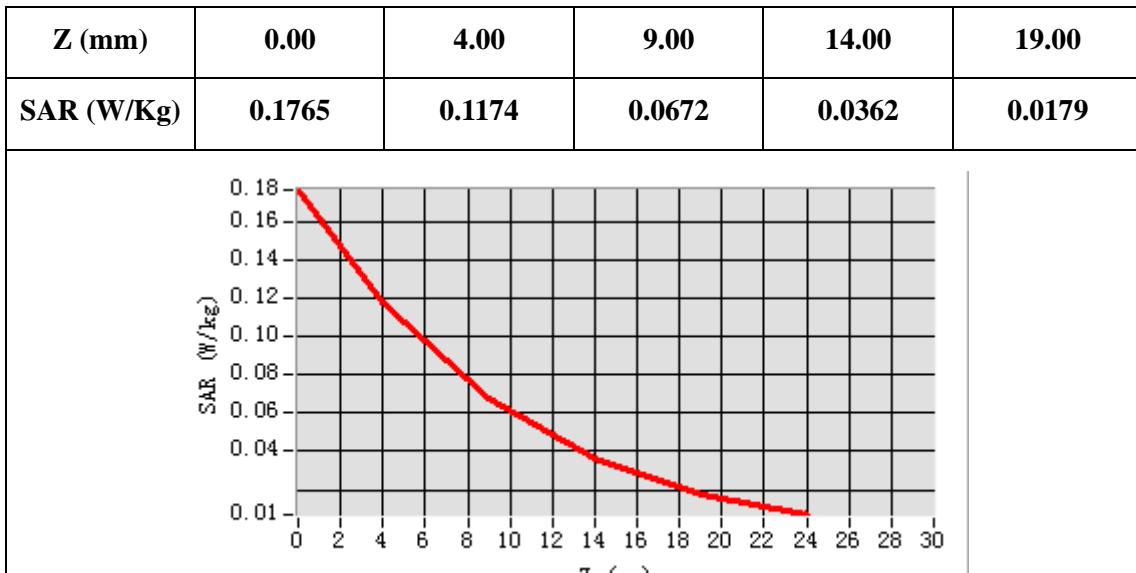
| | |
|---|----------------|
| Frequency (MHz) | 2432 |
| Relative permittivity (real part) | 38.65 |
| Relative permittivity (imaginary part) | 13.08 |
| Conductivity (S/m) | 1.78 |
| Variation (%) | -4.5 |
| ConvF: | 4.93 |
| Probe serial number | SN 04/13 EP166 |



Maximum location: X=-24.00, Y=-16.00

SAR Peak: 0.18 W/kg

| | |
|----------------|----------|
| SAR 10g (W/Kg) | 0.055351 |
| SAR 1g (W/Kg) | 0.110023 |



GPRS 850, Back, Middle

Type: Phone measurement

Date of measurement: 05/08/2015

Measurement duration: 6 minutes 42 seconds

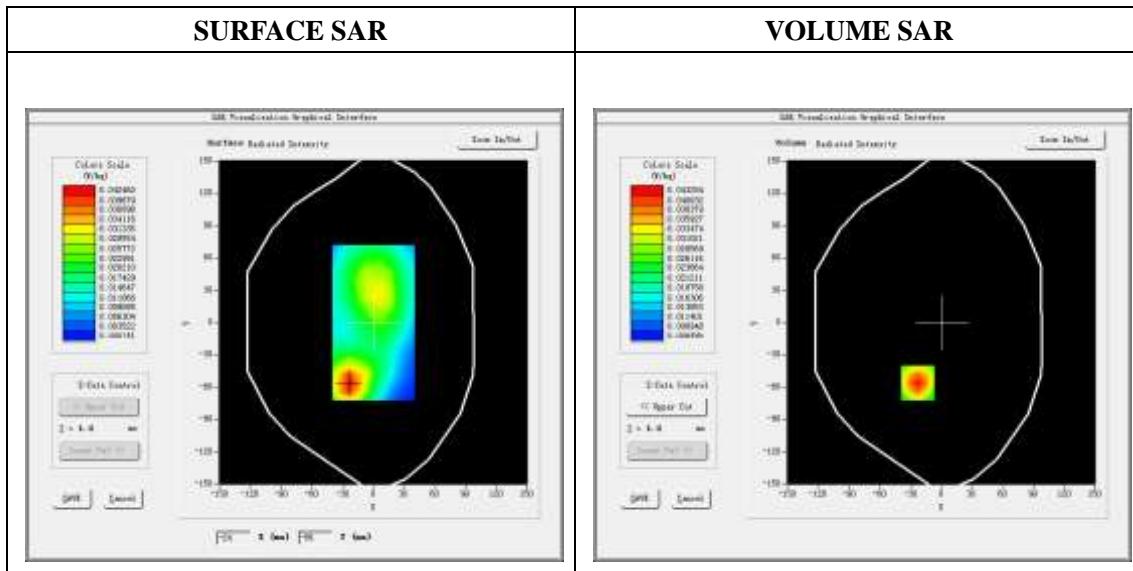
Mobile Phone IMEI number: --

A. Experimental conditions.

| | |
|-----------------|-------------------------------|
| Area Scan | dx=8mm dy=8mm |
| ZoomScan | 5x5x7,dx=8mm dy=8mm dz=5mm |
| Phantom | Validation plane |
| Device Position | Back |
| Band | GPRS850_3Tx |
| Channels | Middle |
| Signal | GPRS 850 (Duty cycle: 1:2.67) |

B. SAR Measurement Results

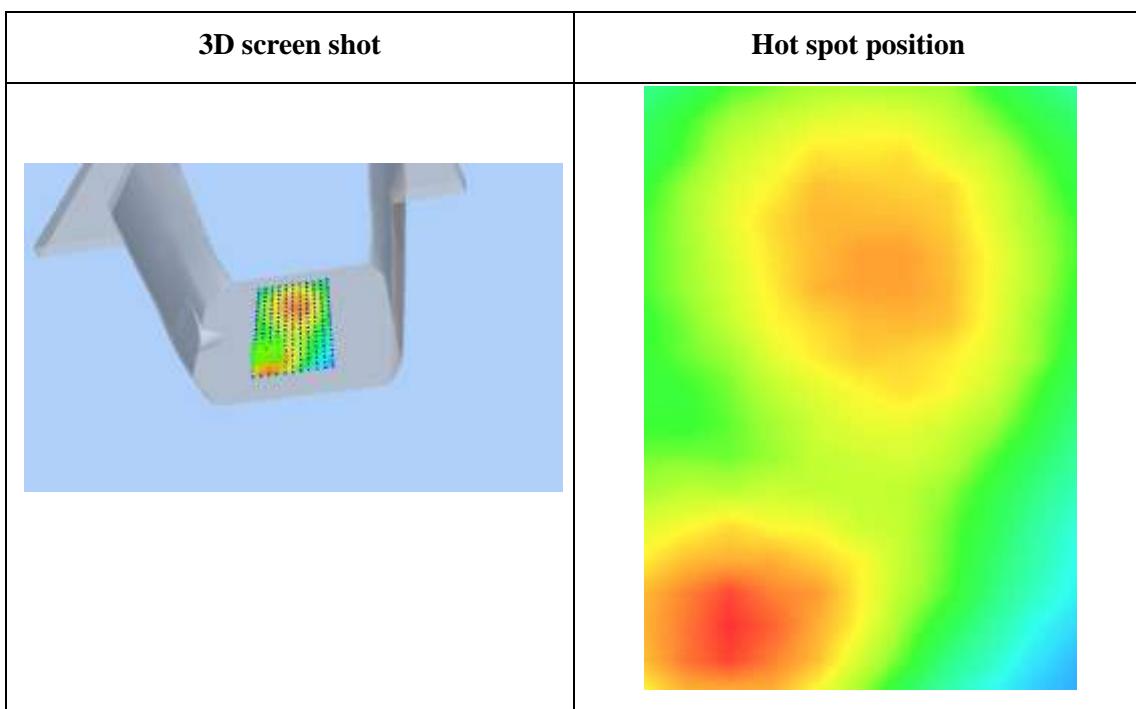
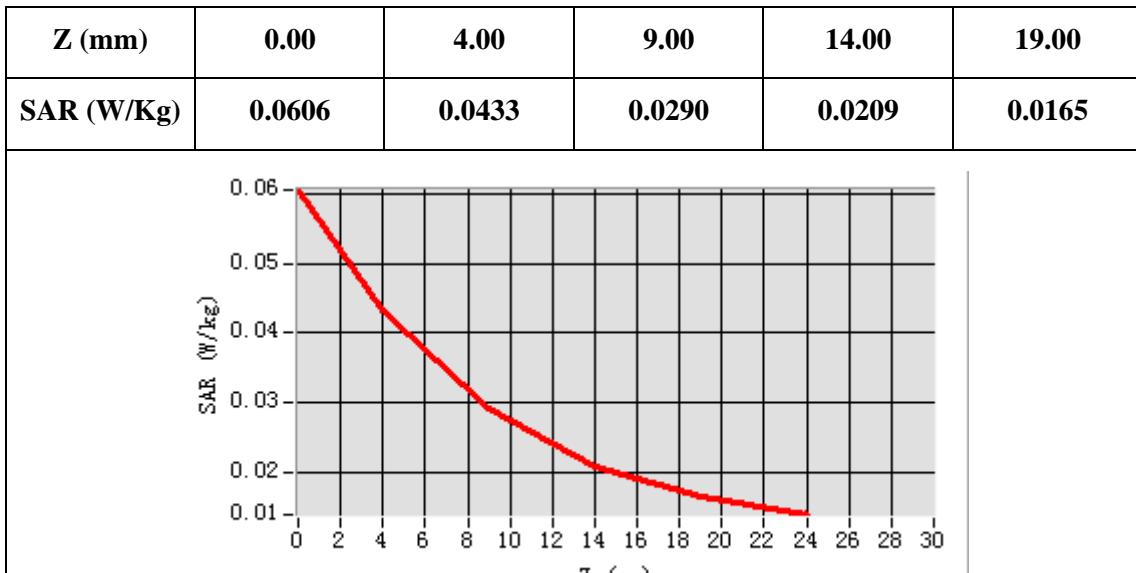
| | |
|-----------------------------------|----------------|
| Frequency (MHz) | 836.5 |
| Relative permittivity (real part) | 54.68 |
| Relative permittivity (imaginary) | 20.48 |
| Conductivity (S/m) | 0.95 |
| Variation (%) | -1.36 |
| ConvF: | 5.84 |
| Probe serial number | SN 04/13 EP166 |



Maximum location: X=-23.00, Y=-26.00

SAR Peak: 0.06 W/kg

| | |
|----------------|----------|
| SAR 10g (W/Kg) | 0.026999 |
| SAR 1g (W/Kg) | 0.041032 |



GPRS 1900, Back, Low

Type: Phone measurement

Date of measurement: 07/08/2015

Measurement duration: 6 minutes 42 seconds

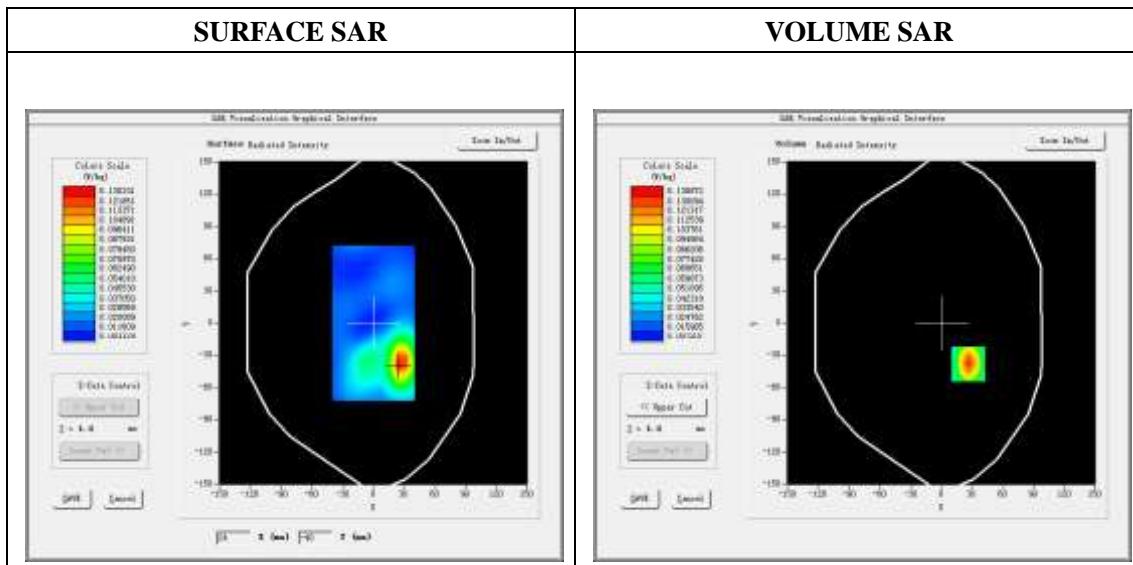
Mobile Phone IMEI number: --

A. Experimental conditions.

| | |
|------------------------|--------------------------------|
| Area Scan | dx=8mm dy=8mm |
| ZoomScan | 5x5x7,dx=8mm dy=8mm dz=5mm |
| Phantom | Validation plane |
| Device Position | Back |
| Band | GPRS 1900_3Tx |
| Channels | Low |
| Signal | GPRS 1900 (Duty cycle: 1:2.67) |

B. SAR Measurement Results

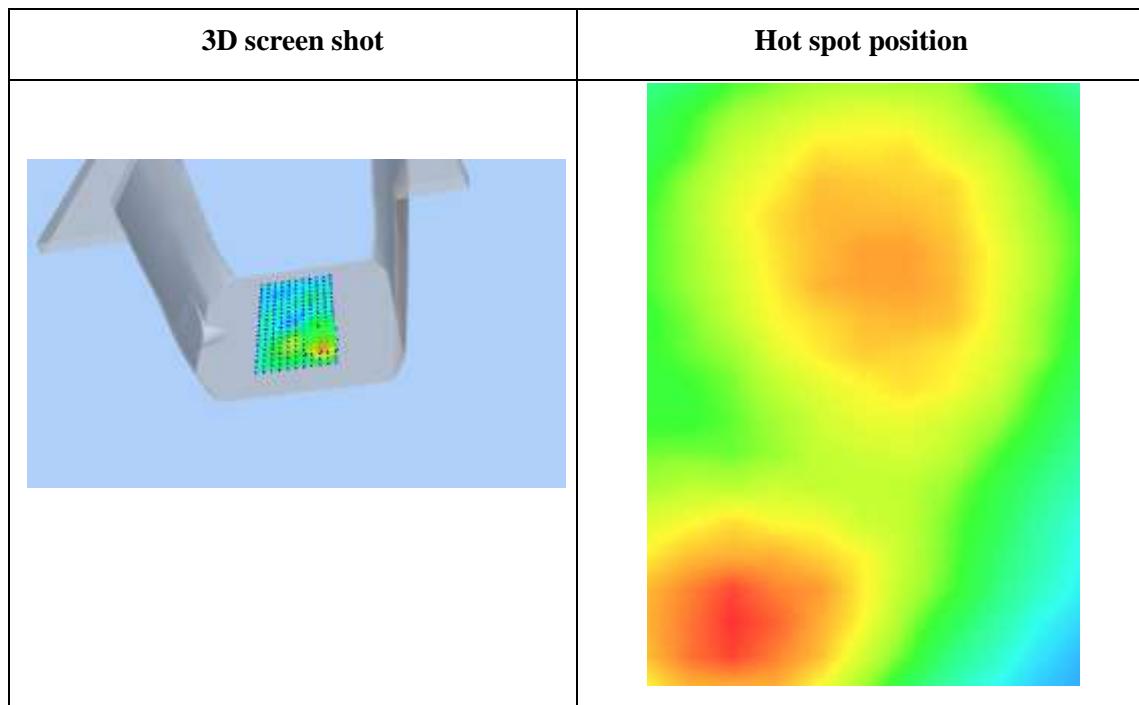
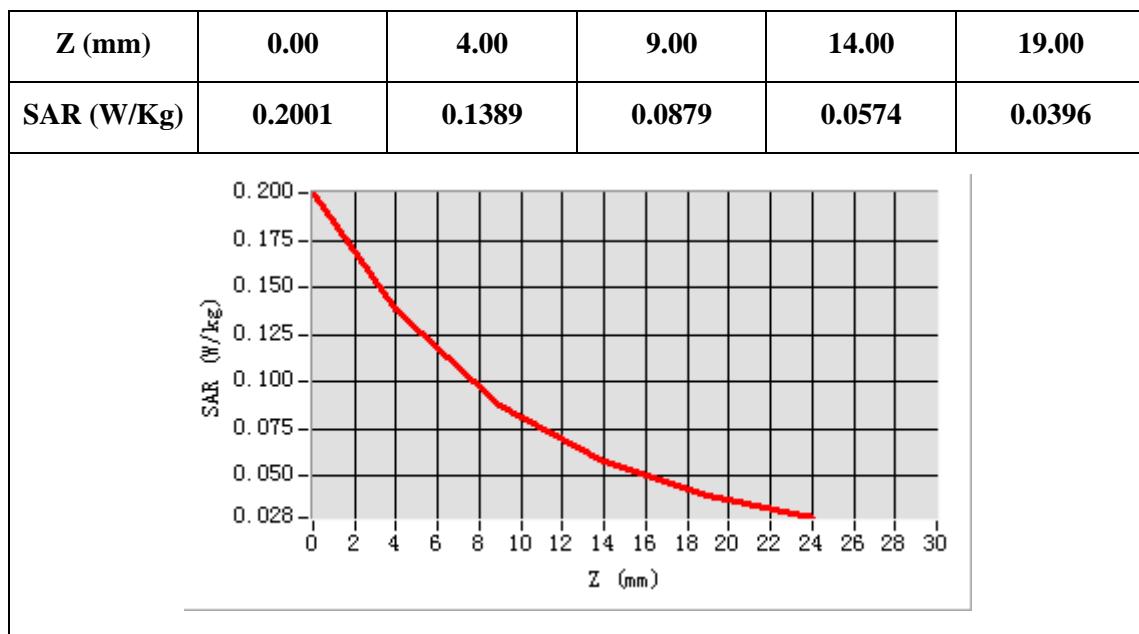
| | |
|--|--------|
| Frequency (MHz) | 1850.2 |
| Relative permittivity (real part) | 52.72 |
| Relative permittivity (imaginary) | 14.21 |
| Conductivity (S/m) | 1.50 |
| Variation (%) | -1.36 |
| ConvF: | 5.42 |



Maximum location: X=26.00, Y=38.00

SAR Peak: 0.2 W/kg

| | |
|-----------------------|-------|
| SAR 10g (W/Kg) | 0.073 |
| SAR 1g (W/Kg) | 0.128 |



WIFI , Right side , Middle

Type: Phone measurement

Date of measurement: 07/08/2015

Measurement duration: 6 minutes 52 seconds

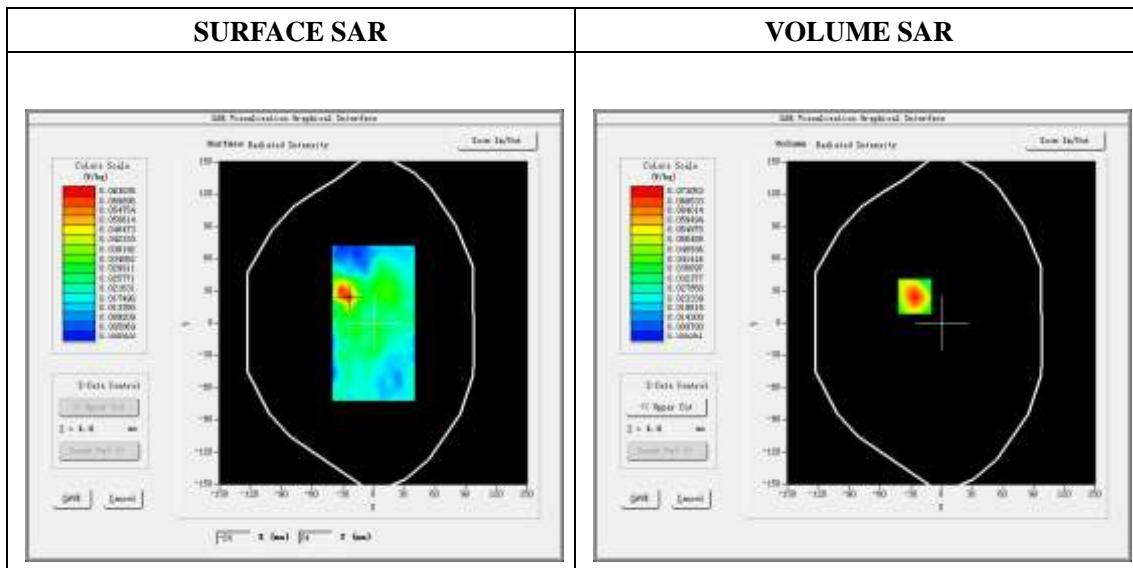
Mobile Phone IMEI number: --

A. Experimental conditions.

| | |
|------------------------|-----------------------------|
| Area Scan | dx=8mm dy=8mm |
| ZoomScan | 7x7x8,dx=5mm dy=5mm dz=4mm |
| Phantom | Validation plane |
| Device Position | Right side |
| Band | 802.11b |
| Channels | Middle |
| Signal | IEEE802.b (Duty cycle: 1:1) |

B. SAR Measurement Results

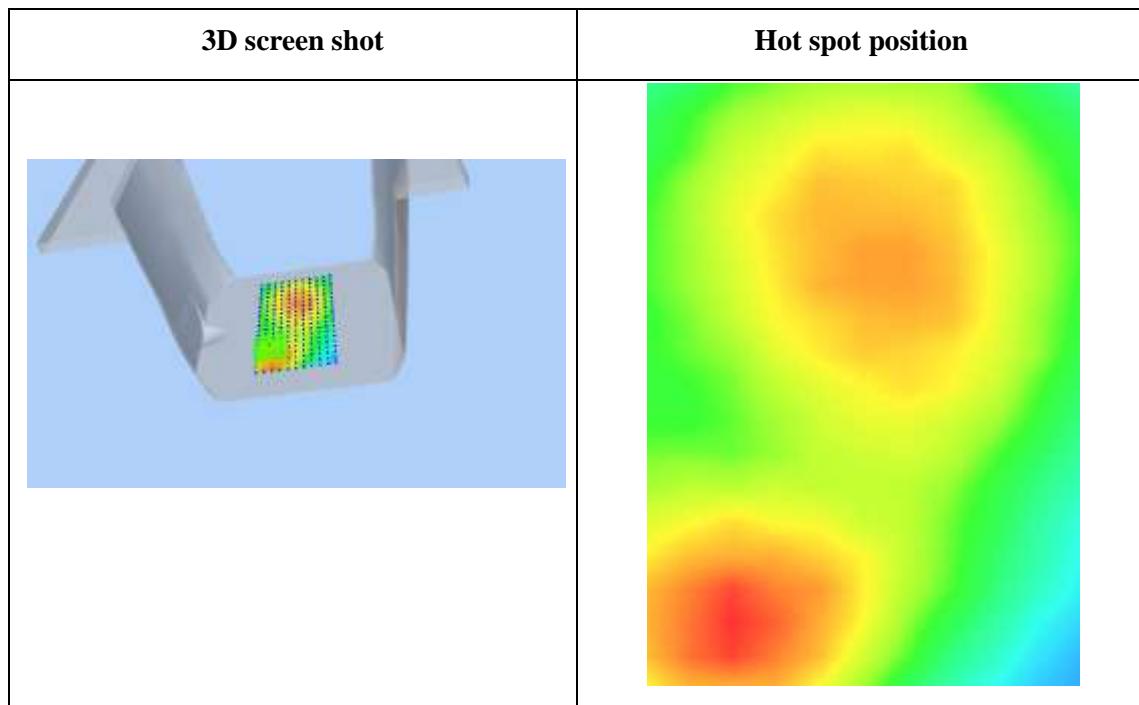
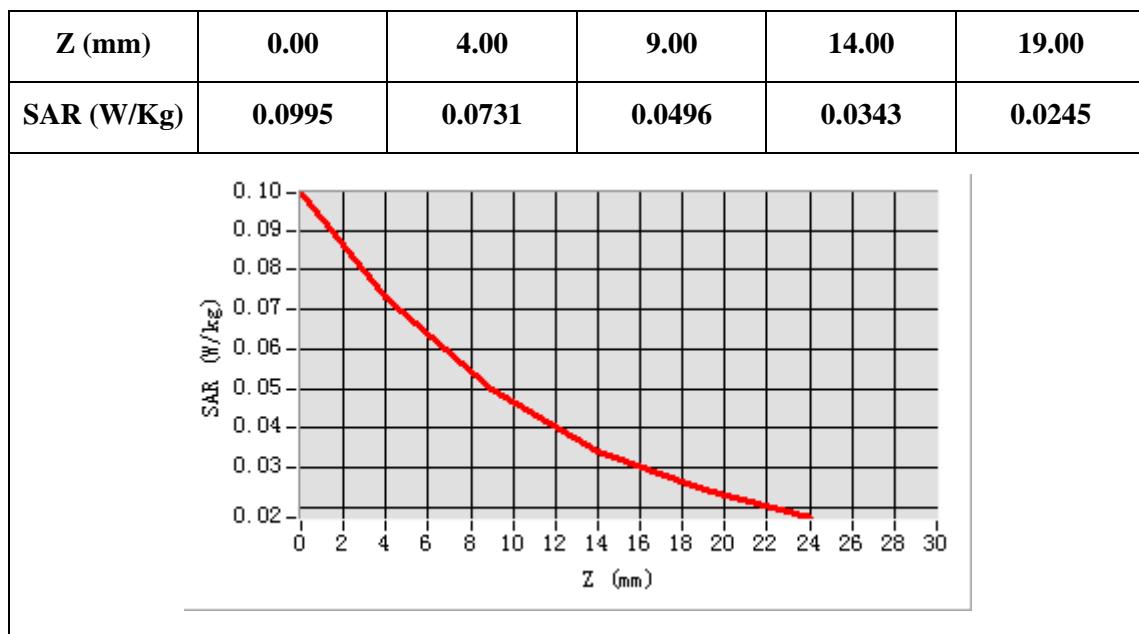
| | |
|--|-------|
| Frequency (MHz) | 2437 |
| Relative permittivity (real part) | 52.27 |
| Relative permittivity (imaginary) | 14.18 |
| Conductivity (S/m) | 1.93 |
| Variation (%) | 4.31 |
| ConvF: | 5.07 |



Maximum location: X=-26.00, Y=25.00

SAR Peak: 0.10 W/kg

| | |
|-----------------------|----------|
| SAR 10g (W/Kg) | 0.042775 |
| SAR 1g (W/Kg) | 0.068563 |



10 Measurement Uncertainty

Table 6: Measurement Uncertainty according to IEEE 1528

| No. | Uncertainty Component | Type | Uncertainty Value (%) | Probability Distribution | k | ci | Standard Uncertainty(%) ui(%) | Degree of freedom Veff for vi |
|---------------------------|--|------|-----------------------|--------------------------|-------|----|-------------------------------|-------------------------------|
| Measurement System | | | | | | | | |
| 1 | —Probe Calibration | B | 6 | N | 1 | 1 | 3.5 | ∞ |
| 2 | —Axialisotropy | B | 4.7 | R | 1.732 | 1 | 2.7 | ∞ |
| 3 | —Hemispherical Isotropy | B | 9.4 | R | 1.732 | 1 | 5.4 | ∞ |
| 4 | —Boundary Effect | B | 11.0 | R | 1.732 | 1 | 6.4 | ∞ |
| 5 | —Linearity | B | 4.7 | R | 1.732 | 1 | 2.7 | ∞ |
| 6 | —System Detection Limits | B | 1.0 | R | 1.732 | 1 | 0.6 | ∞ |
| 7 | —Readout Electronics | B | 1.0 | N | 1 | 1 | 1.00 | ∞ |
| 8 | —Response Time | B | 0.00 | R | 1.732 | 1 | 0.00 | ∞ |
| 9 | —Integration Time | B | 0.00 | R | 1.732 | 1 | 0.00 | ∞ |
| 10 | —RF Ambient Conditions | B | 3.0 | R | 1.732 | 1 | 1.73 | ∞ |
| 11 | —Probe Position Mechanical tolerance | B | 0.4 | R | 1.732 | 1 | 0.2 | ∞ |
| 12 | —Probe Position with respect to Phantom Shell | B | 2.9 | R | 1.732 | 1 | 1.7 | ∞ |
| 13 | —Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation | B | 3.9 | R | 1.732 | 1 | 2.3 | ∞ |

| Uncertainties of the DUT | | | | | | | | |
|--|--|---|------|-----|-------|-----|-------|----------|
| 14 | —Position of the DUT | A | 4.8 | N | 1 | 1 | 4.8 | 5 |
| 15 | —Holder of the DUT | A | 7.1 | N | 1 | 1 | 7.1 | 5 |
| 16 | —Output Power Variation —SAR drift measurement | B | 5.0 | R | 1.732 | 1 | 2.9 | ∞ |
| Phantom and Tissue Parameters | | | | | | | | |
| 17 | —Phantom Uncertainty(shape and thickness tolerances) | B | 1.0 | R | 1.732 | 1 | 0.6 | ∞ |
| 18 | —Liquid Conductivity Target —tolerance | B | 5.0 | R | 1.732 | 0.6 | 1.7 | ∞ |
| 19 | —Liquid Conductivity —measurement Uncertainty) | B | 0.23 | N | 1 | 1 | 0.23 | 9 |
| 20 | —Liquid Permittivity Target tolerance | B | 5.0 | R | 1.732 | 0.6 | 1.7 | ∞ |
| 21 | —Liquid Permittivity —measurement uncertainty | B | 0.46 | N | 1 | 1 | 0.46 | ∞ |
| Combined Standard Uncertainty | | | | RSS | | | 12.92 | 35.15 |
| Expanded uncertainty (Confidence interval of 95 %) | | | | K=2 | | | 25.84 | |

Table 7: Measurement Uncertainty for Body Worn Test according to IEC 62209-2

| No. | Uncertainty Component | Type | Uncertainty Value (%) | Probability Distribution | k | ci | Standard Uncertainty(%) ui(%) | Degree of freedom Veff for vi |
|---------------------------|---|------|-----------------------|--------------------------|-------|----|-------------------------------|-------------------------------|
| Measurement System | | | | | | | | |
| 1 | —Probe Calibration | B | 6 | N | 1 | 1 | 3.5 | ∞ |
| 2 | —Isotropy | B | 14.1 | R | 1.732 | 1 | 4.1 | ∞ |
| 3 | —Hemispherical Isotropy | B | 9.4 | R | 1.732 | 1 | 5.4 | ∞ |
| 4 | —Boundary Effect | B | 11.0 | R | 1.732 | 1 | 6.4 | ∞ |
| 5 | —Linearity | B | 4.7 | R | 1.732 | 1 | 2.7 | ∞ |
| 6 | —System Detection Limits | B | 1.0 | R | 1.732 | 1 | 0.6 | ∞ |
| 7 | —Readout Electronics | B | 1.0 | N | 1 | 1 | 1.00 | ∞ |
| 8 | —Response Time | B | 0.00 | R | 1.732 | 1 | 0.00 | ∞ |
| 9 | —Integration Time | B | 0.00 | R | 1.732 | 1 | 0.00 | ∞ |
| 10 | —RF Ambient Conditions | B | 3.0 | R | 1.732 | 1 | 1.73 | ∞ |
| 11 | —Probe Position Mechanical tolerance | B | 0.4 | R | 1.732 | 1 | 0.2 | ∞ |
| 12 | —Probe Position with respect to Phantom Shell | B | 2.9 | R | 1.732 | 1 | 1.7 | ∞ |
| 13 | —Post-processing | B | 5.0 | R | 1.732 | 1 | 2.9 | ∞ |
| 14 | —Probe modulation response | B | 0.4 | R | 1.732 | 1 | 0.2 | ∞ |

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

11 MAIN TEST INSTRUMENTS

| No. | EQUIPMENT | TYPE | Series No. | Due Date |
|-----|-------------------------|---------------|------------------------|------------|
| 1 | System Simulator | E5515C | GB 47200710 | 2015/09/15 |
| 2 | SAR Probe | SATIMO | SN_0413_EP166 | 2015/08/14 |
| 3 | Dipole | SATIMO | SN 25/13DIP0G750-253 | 2015/08/16 |
| 4 | Dipole | SID835 | SN09/13 DIP0G835-217 | 2015/08/27 |
| 5 | Dipole | SID1900 | SN09/13 DIP1G900-218 | 2015/08/27 |
| 6 | Dipole | SID2450 | SN09/13 DIP2G450-220 | 2015/08/27 |
| 7 | Vector Network Analyzer | ZVB8 | A0802530 | 2016/06/08 |
| 8 | Signal Generator | SMR27 | A0304219 | 2016/06/08 |
| 9 | Power Meter | NRP2 | A140401673 | 2016/03/27 |
| 10 | Power Sensor | NPR-Z11 | 1138.3004.02-114072-nq | 2016/03/27 |
| 11 | Amplifier | Nucleitudes | 143060 | 2016/03/27 |
| 12 | Directional Coupler | DC6180A | 305827 | 2016/03/27 |
| 15 | Power Meter | NRVS | A0802531 | 2016/03/27 |
| 16 | Power Sensor | NRV-Z4 | 100069 | 2016/03/27 |
| 17 | Multimeter | Keithley-2000 | 4014020 | 2016/03/27 |

ANNEX A

of

CCIC-SET

CONFORMANCE TEST REPORT FOR
HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-11063

Mexzen Technology(ShangHai) INC

Android Mobile Data Terminal

Type Name: MX-5050-1D

Hardware Version: V3.0

Software Version: GST_A82_M30_3110955E_MUL_V02_20150619

TEST LAYOUT

This Annex consists of 3pages

Date of Report: 2015-08-10

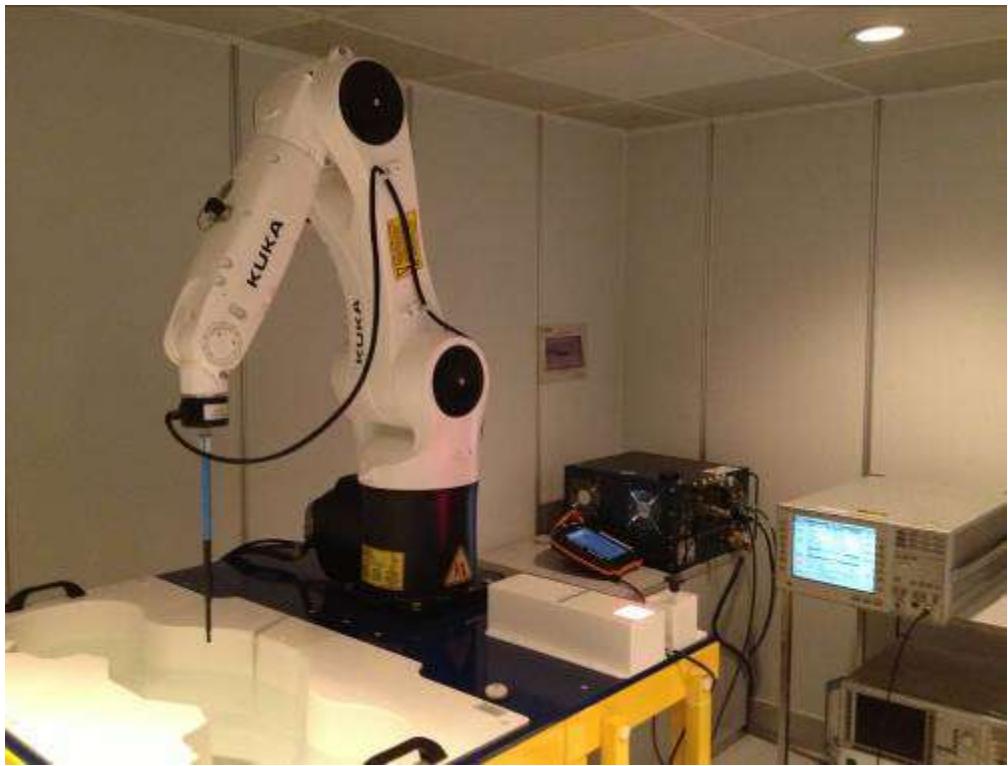


Fig.3 COMO SAR Test System



Fig.4 Head Position (Left Cheek)

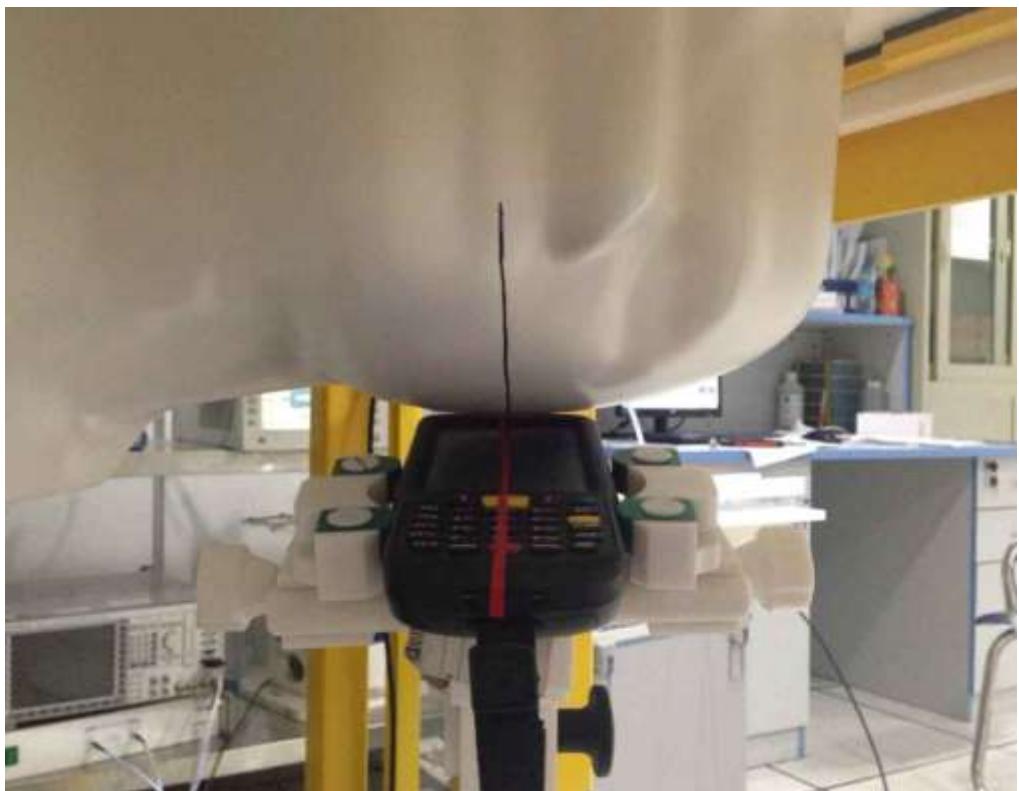


Fig.5 Head Position (Left Tilt)

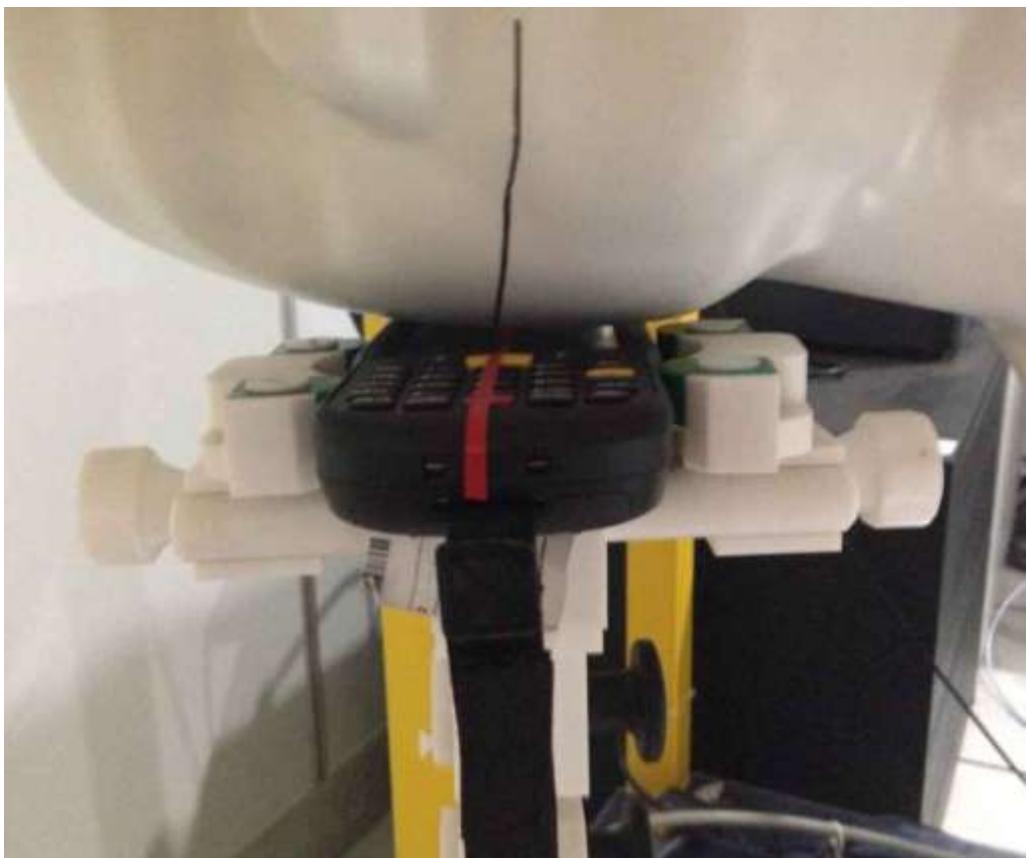


Fig.6 Head Position (Right Cheek)

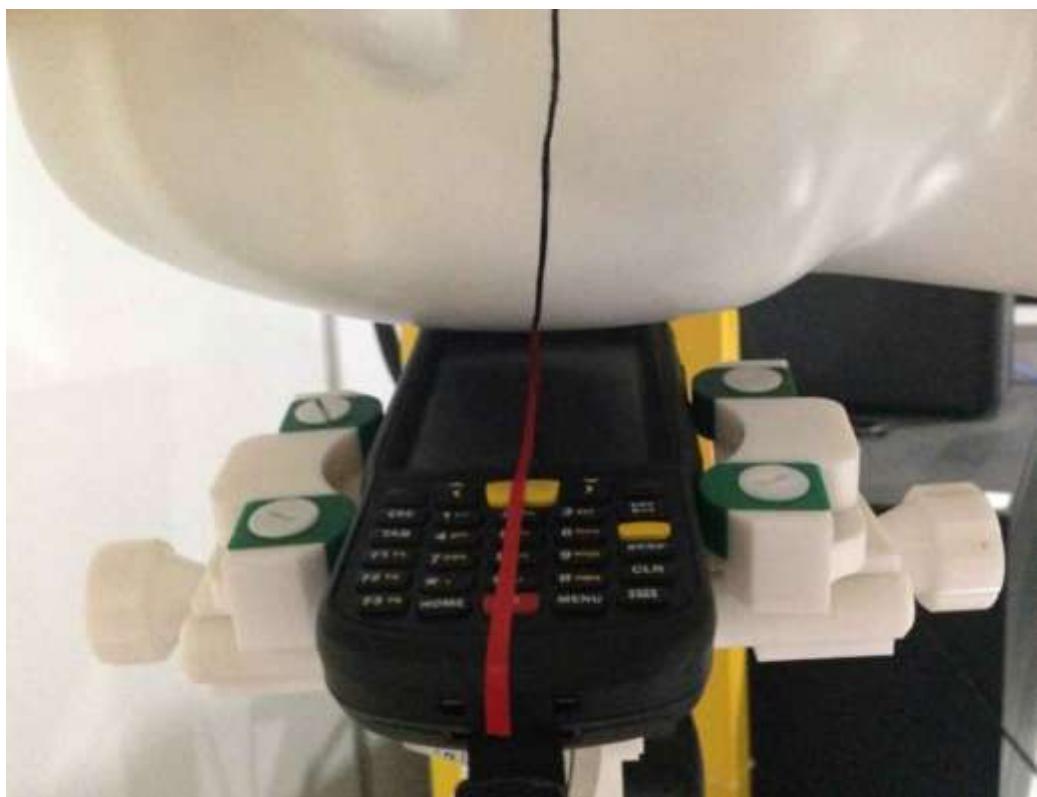


Fig.7 Head Position (Right Tilt)



Fig.8 Body Position (Top side)



Fig.9 Body Position (Back Upward)

NOTE: The gap between battery shell and phantom is 10mm



Fig.10 Body Position(Right Side)

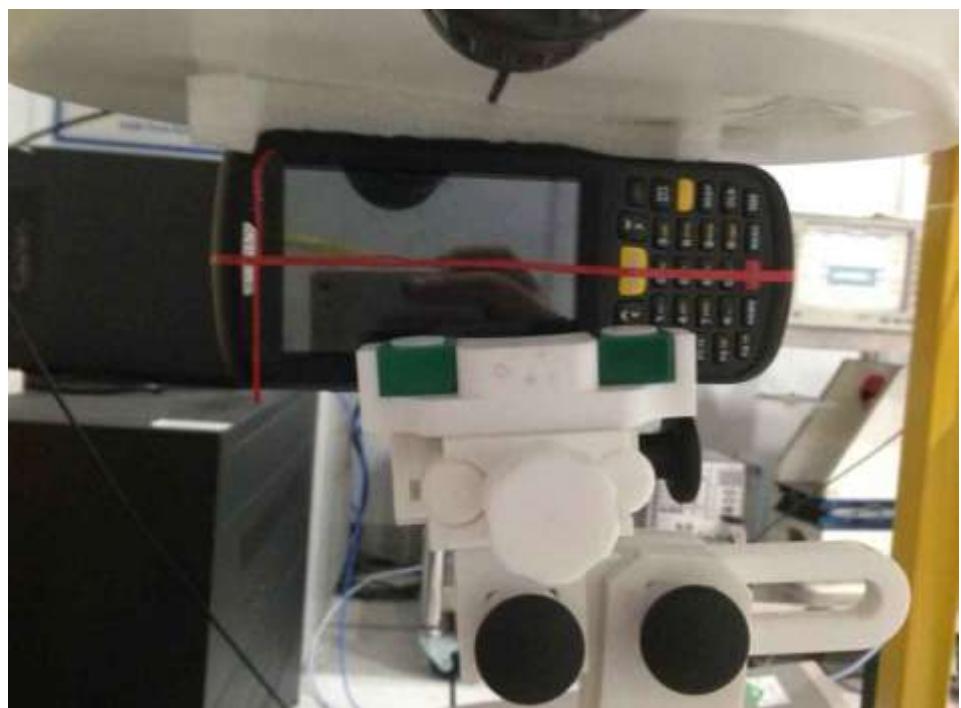


Fig.11 Body Position(Left Side)



Fig.12 Body Position(Face Side)

ANNEX B
of
CCIC-SET

CONFORMANCE TEST REPORT FOR
HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-11063

Mexxen Technology(ShangHai) INC

Android Mobile Data Terminal

Hardware Version: V3.0

Software Version: GST_A82_M30_3110955E_MUL_V02_20150619

Sample Photographs

This Annex consists of 3 pages

Date of Report:2015-08-10

1. Appearance



Appearance and size (obverse)



Appearance and size (reverse)

1. Inside



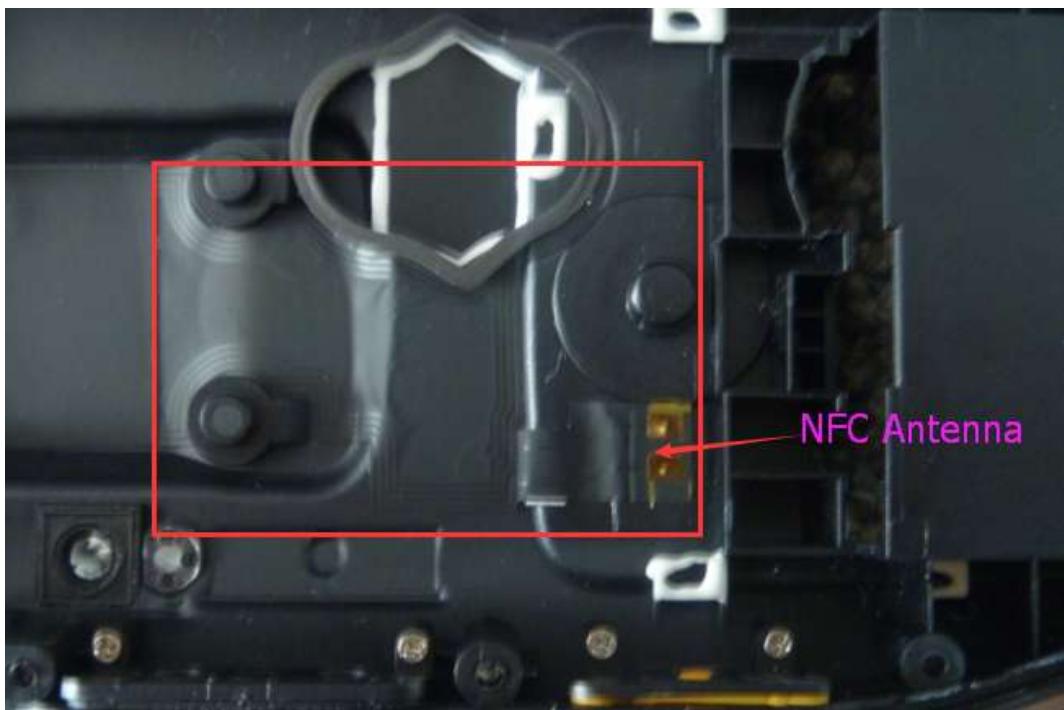
2. Battery

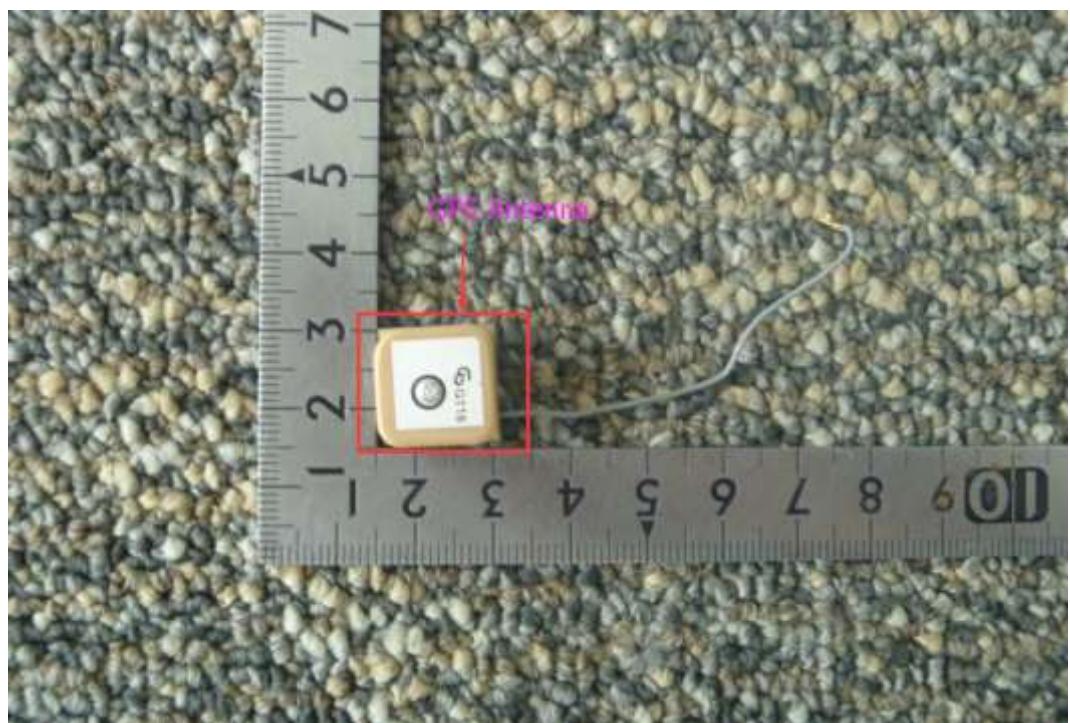
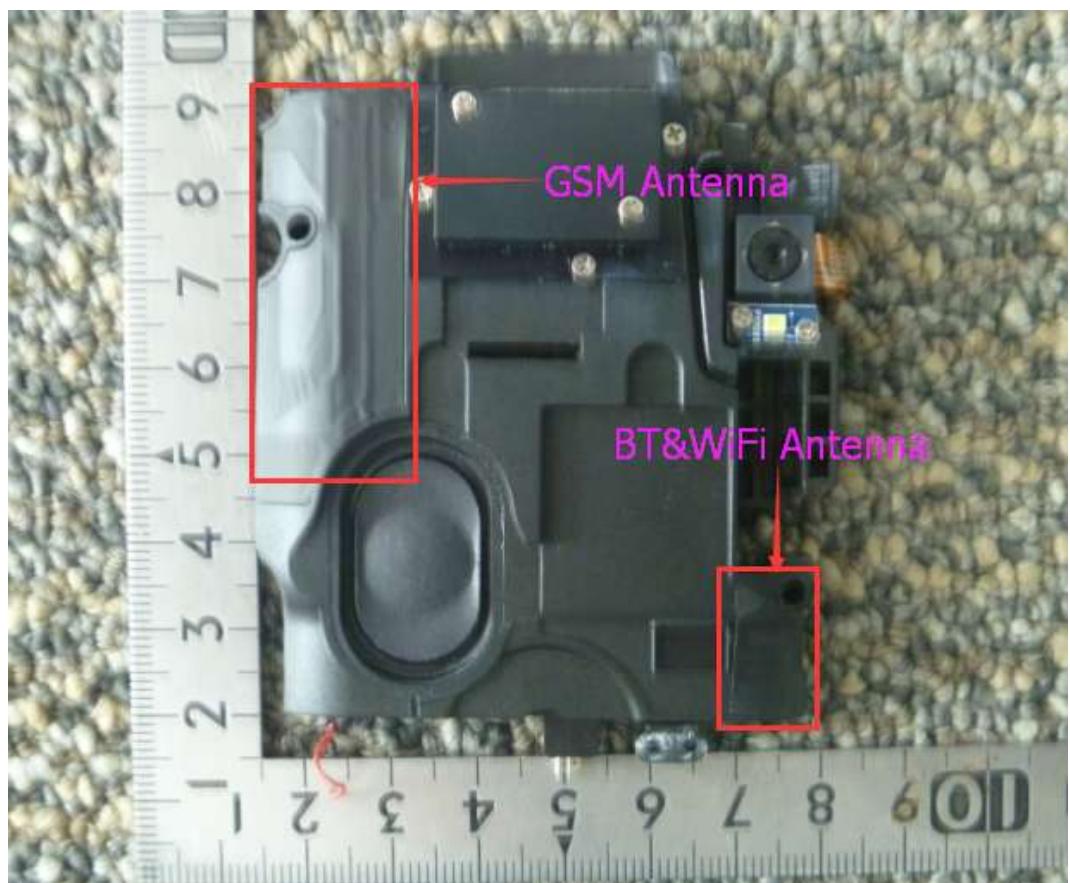


4. Adapter



5. Position of antennas





ANNEX C
of
CCIC-SET

CONFORMANCE TEST REPORT FOR
HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-11063

Mexxen Technology(ShangHai) INC

Android Mobile Data Terminal

Hardware Version: V3.0

Software Version: GST_A82_M30_3110955E_MUL_V02_20150619

This Annex consists of 4pages

Date of Report: 2015-08-10

System Performance Check (Head, 835MHz)

Type: Validation measurement

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

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

Date of measurement: 05/08/2015

Measurement duration: 21 minutes 22 seconds

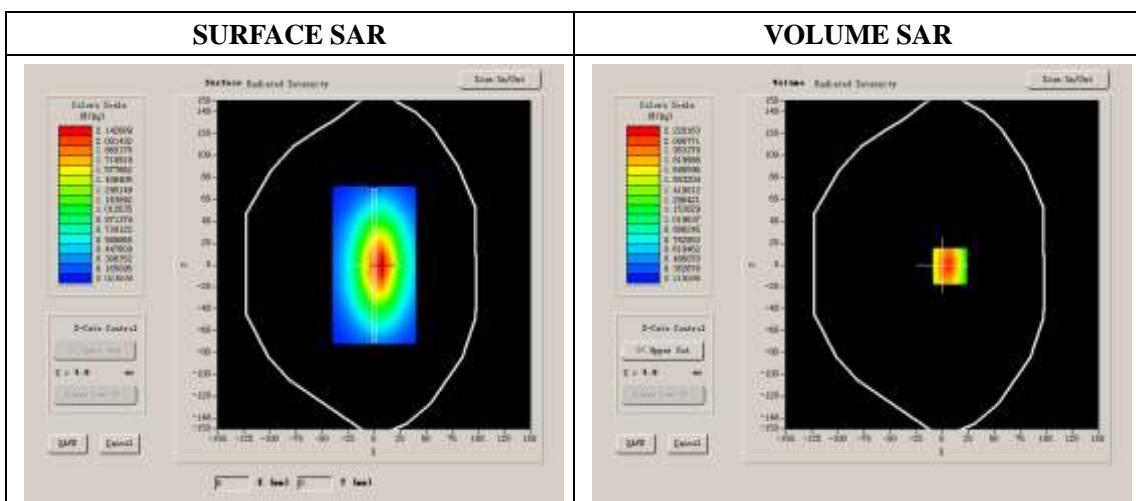
A. Experimental conditions.

| | |
|------------------------|----------------------------|
| Phantom File | dx=8mm dy=8mm |
| Phantom | 5x5x7,dx=8mm dy=8mm dz=5mm |
| Device Position | |
| Band | 835MHz |
| Channels | |
| Signal | CW |

B. SAR Measurement Results

Band SAR

| | |
|--|------------|
| Frequency (MHz) | 835.000000 |
| Relative permittivity (real part) | 41.18 |
| Relative permittivity | 18.97 |
| Conductivity (S/m) | 0.88 |
| Power drift (%) | -1.32 |
| Ambient Temperature: | 23.2°C |
| Liquid Temperature: | 23.5°C |
| ConvF: | 5.68 |
| Duty factor: | 1:1 |



Maximum location: X=7.00, Y=-1.00

| | |
|-----------------------|----------|
| SAR 10g (W/Kg) | 1.820261 |
| SAR 1g (W/Kg) | 2.404573 |

System Performance Check (Head, 1900MHz)

Type: Validation measurement

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

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

Date of measurement: 06/08/2015

Measurement duration: 21minutes 05 seconds

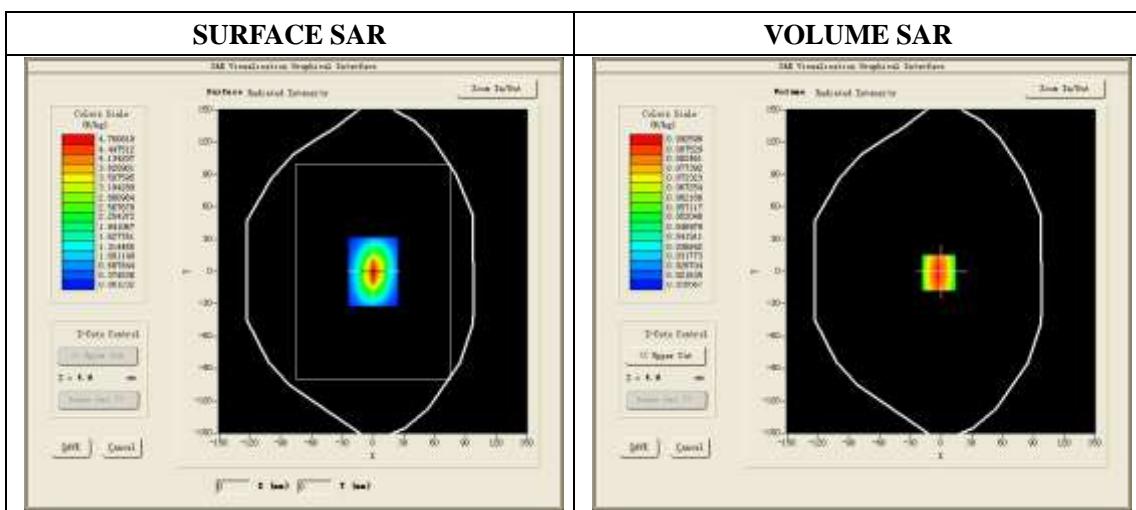
A. Experimental conditions.

| | |
|------------------------|-------------------------------|
| Phantom File | $dx=8mm dy=8mm$ |
| Phantom | $5x5x7, dx=8mm dy=8mm dz=5mm$ |
| Device Position | |
| Band | 1900MHz |
| Channels | |
| Signal | CW |

B. SAR Measurement Results

Band SAR

| | |
|--|-------------|
| Frequency (MHz) | 1900.000000 |
| Relative permittivity (real part) | 39.59 |
| Relative permittivity | 13.17 |
| Conductivity (S/m) | 1.39 |
| Power drift (%) | 0.34 |
| Ambient Temperature: | 22.2°C |
| Liquid Temperature: | 22.5°C |
| ConvF: | 5.25 |
| Duty factor: | 1:1 |



Maximum location: X=6.00, Y=0.00

| | |
|-----------------------|----------|
| SAR 10g (W/Kg) | 5.124314 |
| SAR 1g (W/Kg) | 9.836842 |

System Performance Check (Head, 2450MHz)

Type: Validation measurement

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

Zoom scan resolution: dx=5mm, dy=5mm, dz=4mm

Date of measurement: 07/08/2015

Measurement duration: 21 minutes 12 seconds

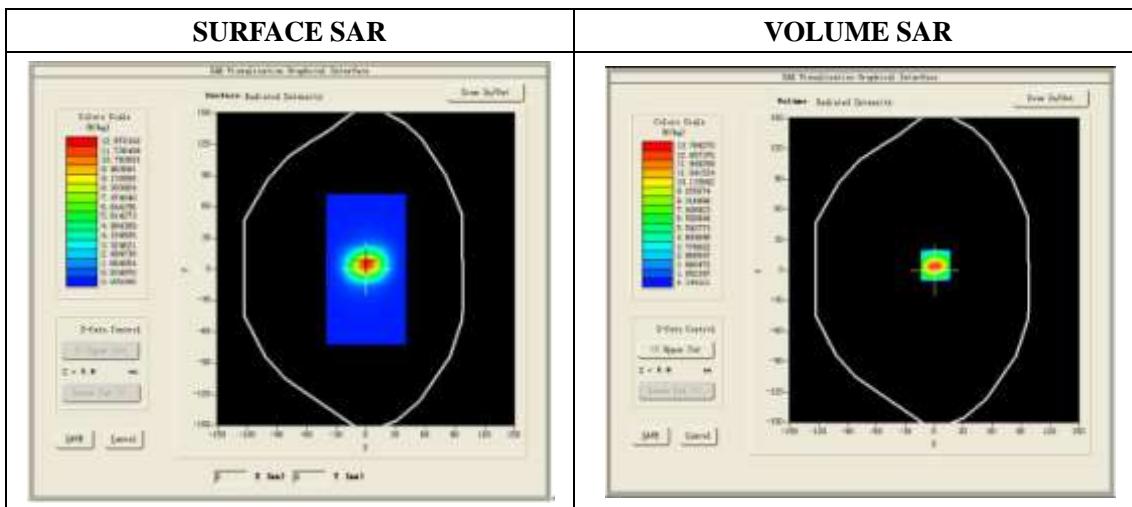
A. Experimental conditions.

| | |
|------------------------|----------------------------|
| Phantom File | dx=8mm,dy=8mm |
| Phantom | 7x7x8,dx=5mm dy=5mm dz=4mm |
| Device Position | Dipole |
| Band | 2450MHz |
| Channels | |
| Signal | CW |

B. SAR Measurement Results

Band SAR

| | |
|--|--------|
| Frequency (MHz) | 2450 |
| Relative permittivity (real part) | 38.65 |
| Relative permittivity | 13.08 |
| Conductivity (S/m) | 1.78 |
| Power Drift (%) | -0.39 |
| ConvF: | 4.93 |
| Duty factor: | 0.86:1 |



Maximum location: X=0.00, Y=7.00

| | |
|-----------------------|-----------|
| SAR 10g (W/Kg) | 5.648620 |
| SAR 1g (W/Kg) | 12.970632 |

System Performance Check (Body, 835MHz)

Type: Validation measurement

Area scan resolution: $dx=8\text{mm}, dy=8\text{mm}$

Zoom scan resolution: $dx=8\text{mm}, dy=8\text{mm}, dz=5\text{mm}$

Date of measurement: 05/08/2015

Measurement duration: 20 minutes 04 seconds

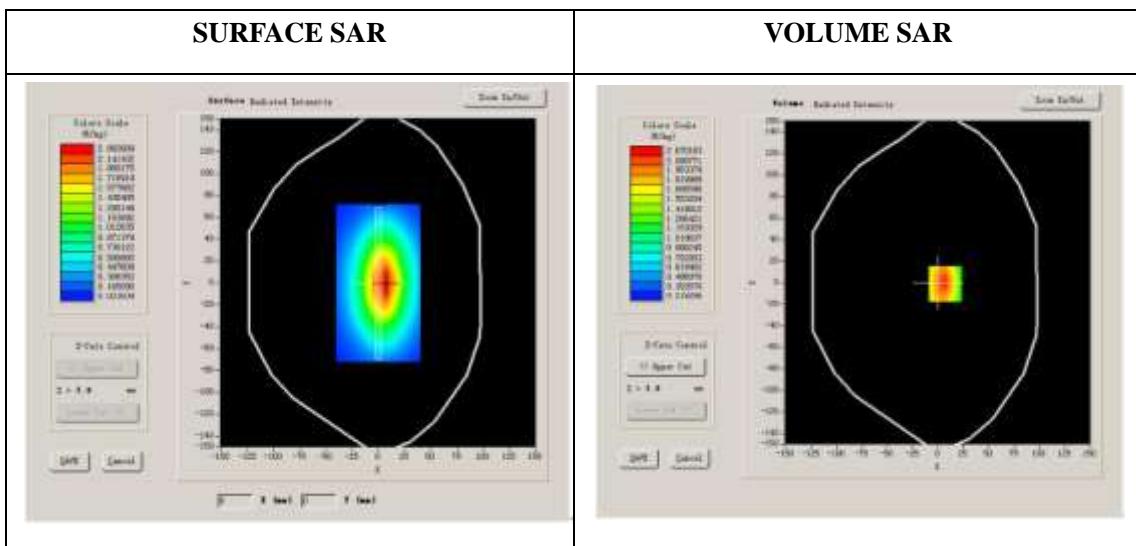
A. Experimental conditions.

| | |
|------------------------|--|
| Phantom File | $dx=8\text{mm} dy=8\text{mm}$ |
| Phantom | $5 \times 5 \times 7, dx=8\text{mm} dy=8\text{mm} dz=5\text{mm}$ |
| Device Position | Dipole |
| Band | 835MHz |
| Channels | |
| Signal | CW |

B. SAR Measurement Results

Band SAR

| | |
|--|----------------|
| Frequency (MHz) | 835 |
| Relative permittivity (real part) | 54.68 |
| Relative permittivity | 20.48 |
| Conductivity (S/m) | 0.95 |
| Power drift (%) | -2.51 |
| Ambient Temperature: | 22.2°C |
| Liquid Temperature: | 22.5°C |
| ConvF: | 5.84 |
| Duty factor: | 1:1 |
| Probe serial number | SN 04/13 EP166 |



Maximum location: X=7.00, Y=-1.00

| | |
|-----------------------|----------|
| SAR 10g (W/Kg) | 1.603562 |
| SAR 1g (W/Kg) | 2.523541 |

System Performance Check (Body, 1900MHz)

Type: Validation measurement

Area scan resolution: $dx=8\text{mm}, dy=8\text{mm}$

Zoom scan resolution: $dx=8\text{mm}, dy=8\text{mm}, dz=5\text{mm}$

Date of measurement: 06/08/2015

Measurement duration: 21 minutes 10 seconds

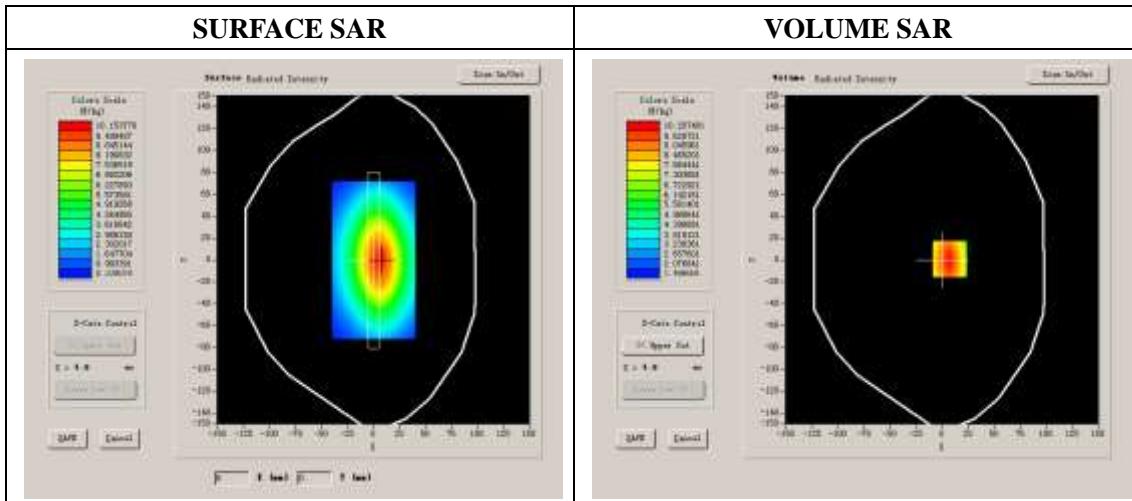
A. Experimental conditions.

| | |
|------------------------|---|
| Phantom File | $dx=8\text{mm} dy=8\text{mm}$ |
| Phantom | $5\times 5 \times 7, dx=8\text{mm} dy=8\text{mm} dz=5\text{mm}$ |
| Device Position | Dipole |
| Band | 1900MHz |
| Channels | |
| Signal | CW |

B. SAR Measurement Results

Band SAR

| | |
|--|----------------|
| Frequency (MHz) | 1900 |
| Relative permittivity (real part) | 52.72 |
| Relative permittivity | 14.21 |
| Conductivity (S/m) | 1.50 |
| Power Drift (%) | 1.02 |
| Ambient Temperature: | 22.1°C |
| Liquid Temperature: | 22.6°C |
| ConvF: | 5.42 |
| Duty factor: | 1:1 |
| Probe serial number | SN 04/13 EP166 |



Maximum location: X=1.00, Y=6.00

| | |
|-----------------------|-----------|
| SAR 10g (W/Kg) | 5.136751 |
| SAR 1g (W/Kg) | 10.063452 |

System Performance Check (Body, 2450MHz)

Type: Validation measurement

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

Zoom scan resolution: dx=5mm, dy=5mm, dz=4mm

Date of measurement: 07/08/2015

Measurement duration: 22 minutes 08 seconds

Mobile Phone IMEI number: --

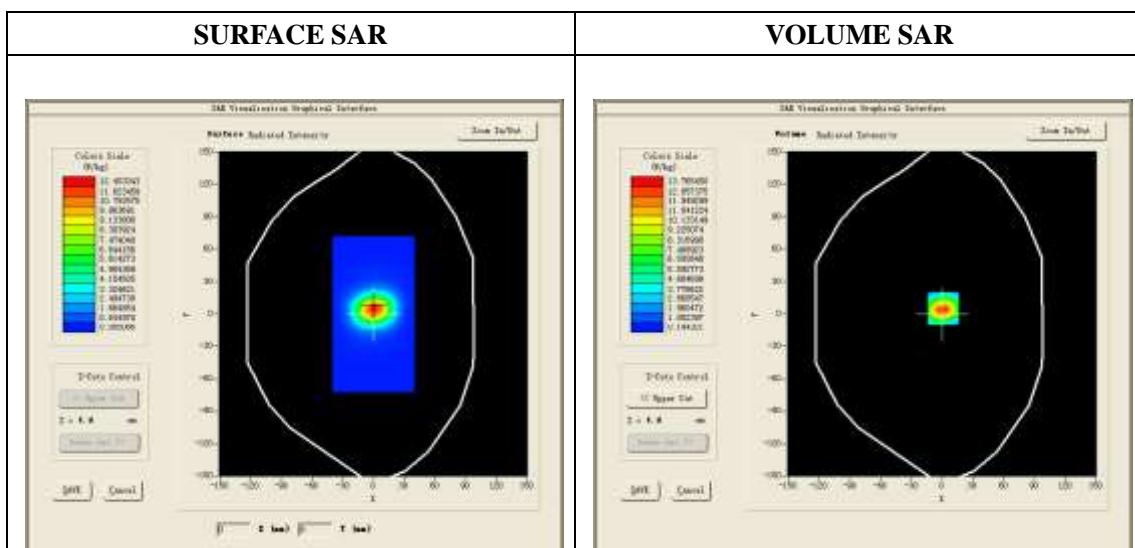
A. Experimental conditions.

| | |
|------------------------|----------------------------|
| Phantom File | dx=8mm,dy=8mm |
| Phantom | 7x7x8,dx=5mm dy=5mm dz=4mm |
| Device Position | Dipole |
| Band | 2450MHz |
| Channels | |
| Signal | CW |

B. SAR Measurement Results

Band SAR

| | |
|--|---------|
| Frequency (MHz) | 2450 |
| Relative permittivity (real part) | 52.27 |
| Relative permittivity | 14.18 |
| Conductivity (S/m) | 1.93 |
| Power Drift (%) | -0.20 |
| Ambient Temperature: | 22.1 °C |
| Liquid Temperature: | 22.6 °C |
| Duty factor: | 0.86:1 |
| ConvF: | 5.07 |



Maximum location: X=1.00, Y=5.00

| | |
|-----------------------|-----------|
| SAR 10g (W/Kg) | 6.108426 |
| SAR 1g (W/Kg) | 12.953471 |

ANNEX D

of

CCIC-SET

CONFORMANCE TEST REPORT FOR
HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

SET2015-11063

Satimo

Type Name: SSE5

Calibration Certificate of Probe and Dipoles

This Annex consists of 33pages

Date of Report: 2015-08-10

Probe Calibration Certificate



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



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.



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.227.15.14.SATU.A

| | 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 |
| | | |
| | | |
| | | |

Page: 2/9

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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 Efield 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% |

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| | | | | | |
|---|--|--|--|--|--------|
| 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 % | |

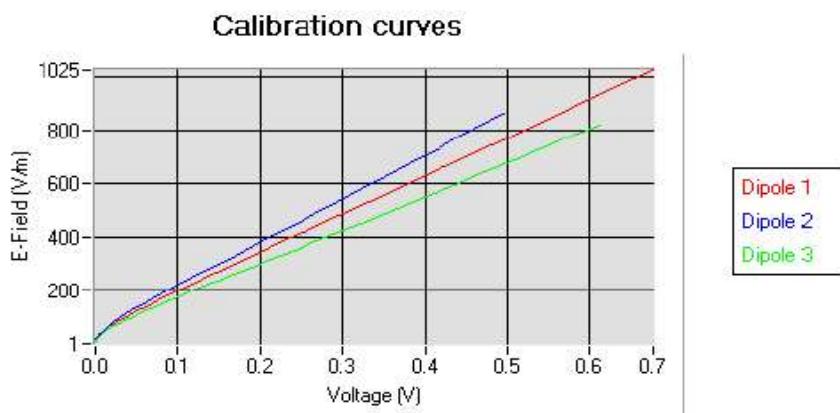
5.1 SENSITIVITY IN AIR

| Normx dipole 1 ($\mu\text{V}/(\text{V}/\text{m})^2$) | Normy dipole 2 ($\mu\text{V}/(\text{V}/\text{m})^2$) | Normz dipole 3 ($\mu\text{V}/(\text{V}/\text{m})^2$) |
|--|--|--|
| 8.57 | 4.83 | 7.15 |

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

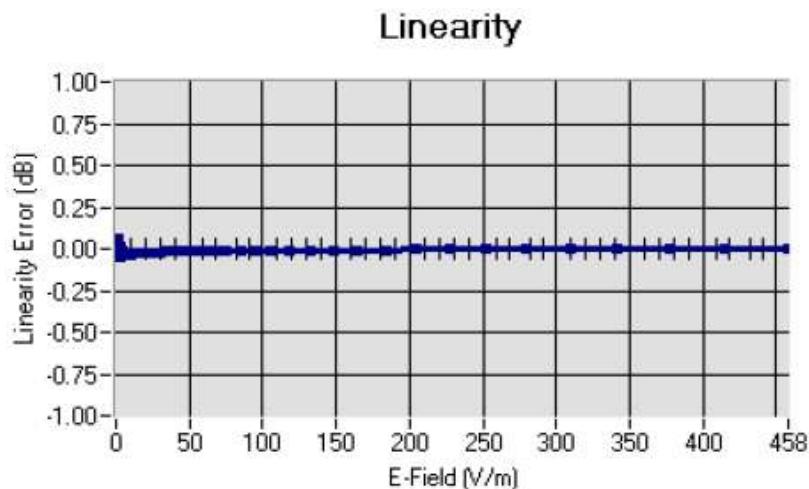
Calibration curves $e_i=f(V)$ ($i=1,2,3$) allow to obtain H-field value using the formula:

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



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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

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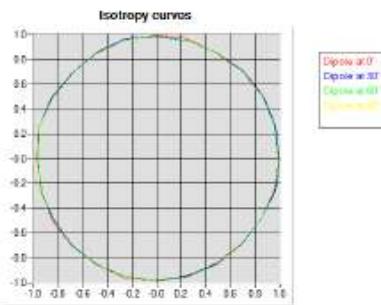
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5.4 ISOTROPY

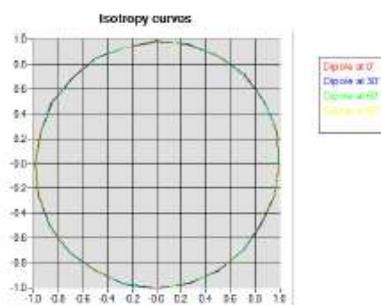
HL900 MHz

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



HL1800 MHz

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.07 dB



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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 |

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SID835 Dipole Calibration Certificate



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



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: ACIR 2011-14 SATIMO

| | 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 constructed 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 % |

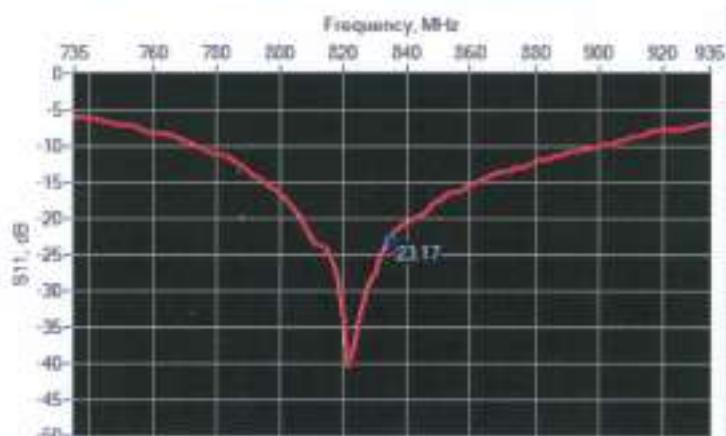
Page: 5/11

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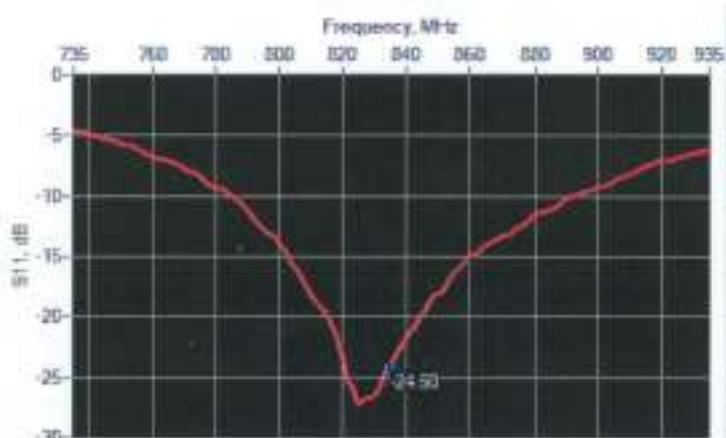
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



| Frequency (MHz) | Return Loss (dB) | Requirement (dB) | Impedance |
|-----------------|------------------|------------------|-----------------------------|
| 835 | -23.17 | -20 | $57.4 \Omega + 0.2 j\Omega$ |

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



| Frequency (MHz) | Return Loss (dB) | Requirement (dB) | Impedance |
|-----------------|------------------|------------------|-----------------------------|
| 835 | -24.50 | -20 | $55.0 \Omega + 3.9 j\Omega$ |

6.3 MECHANICAL DIMENSIONS

| Frequency MHz | L mm | | B mm | | d mm | |
|---------------|------------------|----------|------------------|----------|-----------------|----------|
| | required | measured | required | measured | required | measured |
| 300 | $420.0 \pm 1 \%$ | | $250.0 \pm 1 \%$ | | $6.35 \pm 1 \%$ | |
| 450 | $290.0 \pm 1 \%$ | | $166.7 \pm 1 \%$ | | $6.35 \pm 1 \%$ | |
| 750 | $176.0 \pm 1 \%$ | | $100.0 \pm 1 \%$ | | $6.35 \pm 1 \%$ | |
| 835 | $161.0 \pm 1 \%$ | PASS | $89.8 \pm 1 \%$ | PASS | $3.6 \pm 1 \%$ | PASS |



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.240.1.14.SATU.A

| | | | | | | |
|------|-----------------|--|----------------|--|---------------|--|
| 900 | 149.0 \pm 1 % | | 83.3 \pm 1 % | | 3.6 \pm 1 % | |
| 1450 | 89.1 \pm 1 % | | 51.7 \pm 1 % | | 3.6 \pm 1 % | |
| 1500 | 80.5 \pm 1 % | | 50.0 \pm 1 % | | 3.6 \pm 1 % | |
| 1640 | 79.0 \pm 1 % | | 45.7 \pm 1 % | | 3.6 \pm 1 % | |
| 1750 | 75.2 \pm 1 % | | 42.9 \pm 1 % | | 3.6 \pm 1 % | |
| 1800 | 72.0 \pm 1 % | | 41.7 \pm 1 % | | 3.6 \pm 1 % | |
| 1900 | 68.0 \pm 1 % | | 39.5 \pm 1 % | | 3.6 \pm 1 % | |
| 1950 | 66.3 \pm 1 % | | 38.5 \pm 1 % | | 3.6 \pm 1 % | |
| 2000 | 64.5 \pm 1 % | | 37.5 \pm 1 % | | 3.6 \pm 1 % | |
| 2100 | 61.0 \pm 1 % | | 35.7 \pm 1 % | | 3.6 \pm 1 % | |
| 2300 | 55.5 \pm 1 % | | 32.6 \pm 1 % | | 3.6 \pm 1 % | |
| 2450 | 51.5 \pm 1 % | | 30.4 \pm 1 % | | 3.6 \pm 1 % | |
| 2600 | 48.5 \pm 1 % | | 28.8 \pm 1 % | | 3.6 \pm 1 % | |
| 3000 | 41.5 \pm 1 % | | 25.0 \pm 1 % | | 3.6 \pm 1 % | |
| 3500 | 37.0 \pm 1 % | | 26.4 \pm 1 % | | 3.6 \pm 1 % | |
| 3700 | 34.7 \pm 1 % | | 26.4 \pm 1 % | | 3.6 \pm 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 \pm 5 % | | 0.87 \pm 5 % | |
| 450 | 43.5 \pm 5 % | | 0.87 \pm 5 % | |
| 750 | 41.9 \pm 5 % | | 0.89 \pm 5 % | |
| 835 | 41.5 \pm 5 % | PASS | 0.90 \pm 5 % | PASS |
| 900 | 41.5 \pm 5 % | | 0.97 \pm 5 % | |
| 1450 | 40.5 \pm 5 % | | 1.20 \pm 5 % | |
| 1500 | 40.4 \pm 5 % | | 1.23 \pm 5 % | |
| 1640 | 40.2 \pm 5 % | | 1.31 \pm 5 % | |
| 1750 | 40.1 \pm 5 % | | 1.37 \pm 5 % | |
| 1800 | 40.0 \pm 5 % | | 1.40 \pm 5 % | |
| 1900 | 40.0 \pm 5 % | | 1.40 \pm 5 % | |
| 1950 | 40.0 \pm 5 % | | 1.40 \pm 5 % | |
| 2000 | 40.0 \pm 5 % | | 1.40 \pm 5 % | |

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.240.1.04.SATIMO

| | | | | |
|------|-----------|--|-----------|--|
| 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: $\epsilon\mu$: 42.3 sigma : 0.92 |
| Distance between dipole center and liquid | 15.0 mm |
| Area scan resolution | dx=8mm/dy=8mm |
| Zoom Scan Resolution | dx=8mm/dy=8mm/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 | |

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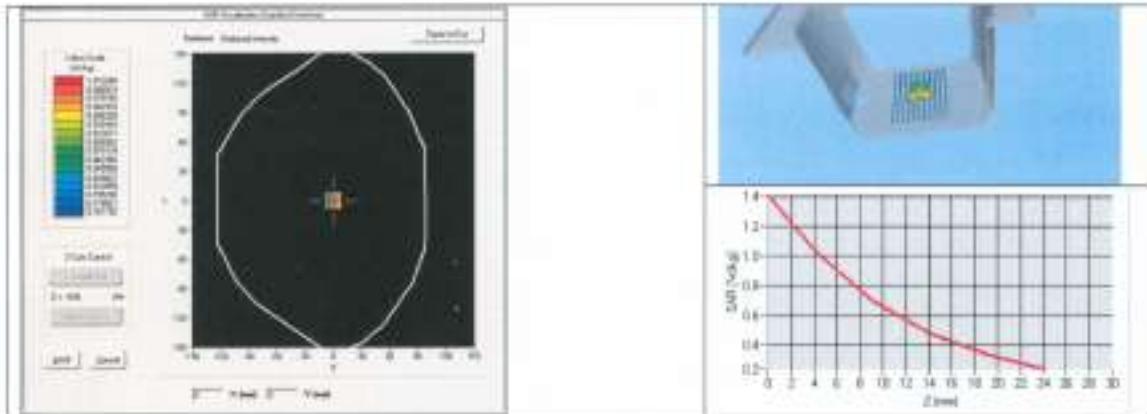
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR 240.1.14.SAT11A

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

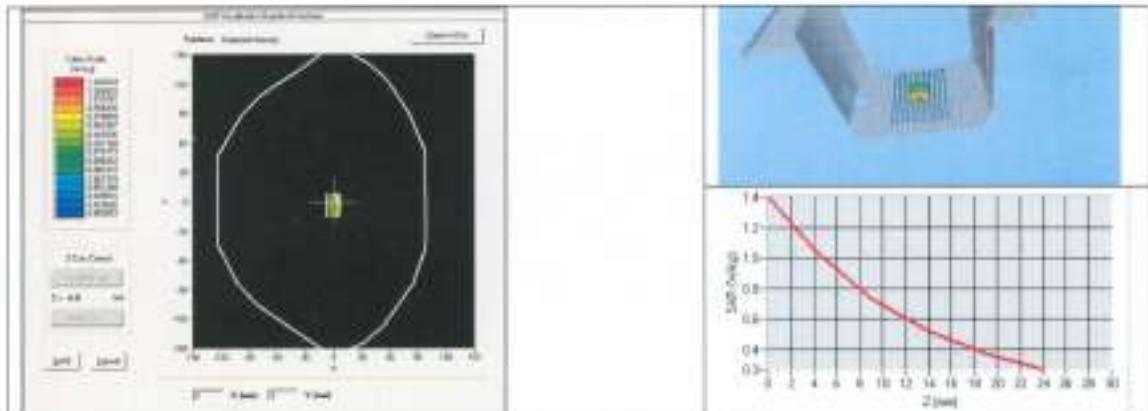
Ref: ACI.240.1,14.5ATU.A

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

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

| | |
|---|--|
| Software | OPEN SAR V4 |
| Phantom | SN 20/09 SAM71 |
| Probe | SN 18/11 EPG122 |
| Liquid | Body Liquid Values: $\epsilon\mu$: 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=8mm/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 |

SID1900 Dipole Calibration Certificate



SAR Reference Dipole Calibration Report

Ref : ACR.240.4.14.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: 1900 MHZ
SERIAL NO.: SN 09/13 DIP1G900-218

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.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.240.4.14.SATU.A

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

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

| Issue | Date | Modifications |
|-------|-----------|-----------------|
| A | 8/29/2014 | Initial release |
| | | |
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| | | |



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| 7.4 | SAR Measurement Result With Body Liquid | 10 |
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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 1900 MHz REFERENCE DIPOLE |
| Manufacturer | Satimo |
| Model | SID1900 |
| Serial Number | SN 09/13 DIP1 G900-218 |
| 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 constructed 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 % |

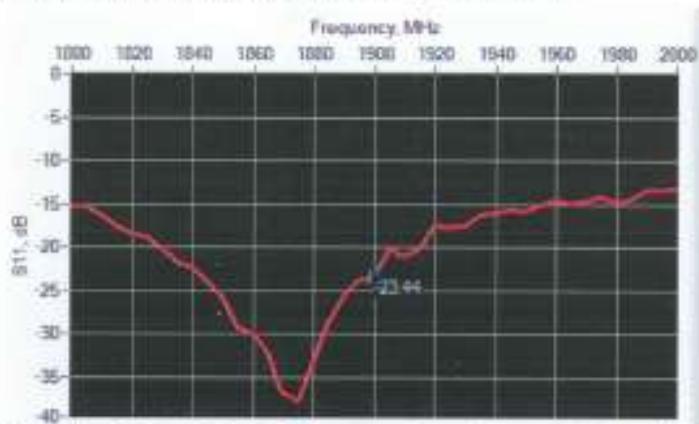
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6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



| Frequency (MHz) | Return Loss (dB) | Requirement (dB) | Impedance |
|-----------------|------------------|------------------|-----------------------------|
| 1900 | -23.44 | -20 | $55.4 \Omega + 5.2 j\Omega$ |

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



| Frequency (MHz) | Return Loss (dB) | Requirement (dB) | Impedance |
|-----------------|------------------|------------------|-----------------------------|
| 1900 | -27.36 | -20 | $51.7 \Omega + 4.4 j\Omega$ |

6.3 MECHANICAL DIMENSIONS

| Frequency MHz | L mm | | h mm | | d mm | |
|---------------|-----------------|----------|-----------------|----------|----------------|----------|
| | required | measured | required | measured | required | measured |
| 300 | $420.0 \pm 1\%$ | | $250.0 \pm 1\%$ | | $6.35 \pm 1\%$ | |
| 450 | $290.0 \pm 1\%$ | | $166.7 \pm 1\%$ | | $6.35 \pm 1\%$ | |
| 750 | $176.0 \pm 1\%$ | | $100.0 \pm 1\%$ | | $6.35 \pm 1\%$ | |
| 835 | $161.0 \pm 1\%$ | | $89.8 \pm 1\%$ | | $3.6 \pm 1\%$ | |

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACIC 240 4.14.SATIMO

| | | | | | | |
|------|-----------------|------|----------------|------|---------------|------|
| 300 | 149.0 \pm 1 % | | 85.3 \pm 1 % | | 3.6 \pm 1 % | |
| 1450 | 89.1 \pm 1 % | | 51.7 \pm 1 % | | 3.6 \pm 1 % | |
| 1500 | 80.5 \pm 1 % | | 50.0 \pm 1 % | | 3.6 \pm 1 % | |
| 1640 | 79.0 \pm 1 % | | 45.7 \pm 1 % | | 3.6 \pm 1 % | |
| 1750 | 75.2 \pm 1 % | | 42.9 \pm 1 % | | 3.6 \pm 1 % | |
| 1800 | 72.0 \pm 1 % | | 41.7 \pm 1 % | | 3.6 \pm 1 % | |
| 1900 | 68.0 \pm 1 % | PASS | 39.5 \pm 1 % | PASS | 3.6 \pm 1 % | PASS |
| 1950 | 66.3 \pm 1 % | | 38.5 \pm 1 % | | 3.6 \pm 1 % | |
| 2000 | 64.5 \pm 1 % | | 37.5 \pm 1 % | | 3.6 \pm 1 % | |
| 2100 | 61.0 \pm 1 % | | 35.7 \pm 1 % | | 3.6 \pm 1 % | |
| 2300 | 55.5 \pm 1 % | | 32.6 \pm 1 % | | 3.6 \pm 1 % | |
| 2450 | 51.5 \pm 1 % | | 30.4 \pm 1 % | | 3.6 \pm 1 % | |
| 2600 | 48.5 \pm 1 % | | 28.8 \pm 1 % | | 3.6 \pm 1 % | |
| 3000 | 41.5 \pm 1 % | | 25.0 \pm 1 % | | 3.6 \pm 1 % | |
| 3500 | 37.0 \pm 1 % | | 26.4 \pm 1 % | | 3.6 \pm 1 % | |
| 3700 | 34.7 \pm 1 % | | 26.4 \pm 1 % | | 3.6 \pm 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 \pm 5 % | | 0.87 \pm 5 % | |
| 450 | 43.5 \pm 5 % | | 0.87 \pm 5 % | |
| 750 | 41.9 \pm 5 % | | 0.89 \pm 5 % | |
| 835 | 41.5 \pm 5 % | | 0.90 \pm 5 % | |
| 900 | 41.5 \pm 5 % | | 0.97 \pm 5 % | |
| 1450 | 40.5 \pm 5 % | | 1.20 \pm 5 % | |
| 1500 | 40.4 \pm 5 % | | 1.23 \pm 5 % | |
| 1640 | 40.2 \pm 5 % | | 1.31 \pm 5 % | |
| 1750 | 40.1 \pm 5 % | | 1.37 \pm 5 % | |
| 1800 | 40.0 \pm 5 % | | 1.40 \pm 5 % | |
| 1900 | 40.0 \pm 5 % | PASS | 1.40 \pm 5 % | PASS |
| 1950 | 40.0 \pm 5 % | | 1.40 \pm 5 % | |
| 2000 | 40.0 \pm 5 % | | 1.40 \pm 5 % | |

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref ACR 240.4.14 SATIMO

| | | | | |
|------|-----------|--|-----------|--|
| 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 2009 SAM71 |
| Probe | SN 18/11 EPG122 |
| Liquid | Head Liquid Values: eps ² : 41.1 sigma : 1.42 |
| Distance between dipole center and liquid | 10.0 mm |
| Area scan resolution | dx=8mm/dy=8mm |
| Zoom Scan Resolution | dx=8mm/dy=8mm/dz=5mm |
| Frequency | 1900 MHz |
| Input power | 20 dBm |
| Liquid Temperature | 21 °C |
| Lab Temperature | 21 °C |
| Lab Humidity | 45 % |

| Frequency MHz | 1 g SAR (W/kg/W) | | 10 g SAR (W/kg/W) | |
|------------------|------------------|--------------|-------------------|--------------|
| | required | measured | required | measured |
| 300 | 2.85 | | 1.94 | |
| 450 | 4.58 | | 3.06 | |
| 750 | 8.49 | | 5.55 | |
| 835 | 9.56 | | 6.22 | |
| 900 | 10.8 | | 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 | 40.37 (4.04) | 20.5 | 20.62 (2.06) |
| 1950 | 40.5 | | 20.9 | |
| 2000 | 41.1 | | 21.1 | |
| 2100 | 43.6 | | 21.9 | |
| 2300 | 48.7 | | 23.3 | |

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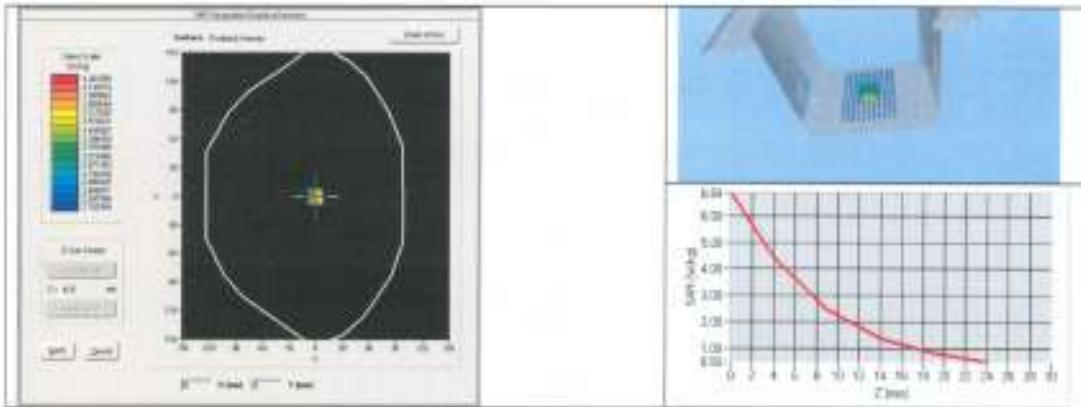
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR 240.4.14.SATU.A

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

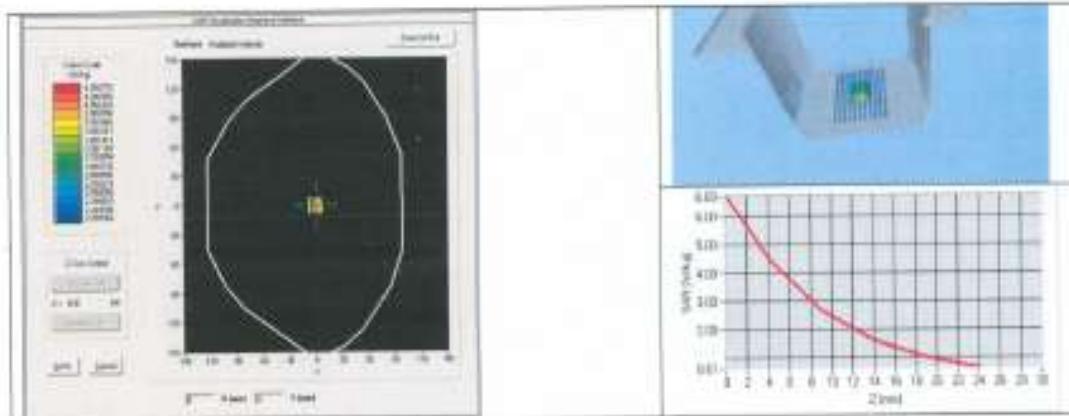
Ref: ACR.240.4.14.SATIMO

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

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

| | |
|---|---|
| Software | OPENSAR V4 |
| Phantom | SN 20/09 SAM71 |
| Probe | SN 18/11 EPGH122 |
| Liquid | Body Liquid Values: $\epsilon_{\text{pr}}^{\prime\prime}$: 54.2 sigma : 1.54 |
| Distance between dipole center and liquid | 10.0 mm |
| Area scan resolution | dx=8mm/dy=8mm |
| Zoom Scan Resolution | dx=8mm/dy=8mm/dz=5mm |
| Frequency | 1900 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 |
| 1900 | 40.81 (4.08) | 71.21 (2.12) |



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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 | US37181480 | 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 |

SID2450 Dipole Calibration Cerificate



SAR Reference Dipole Calibration Report

Ref : ACR.240.6.14.SATU.A

**CCIC SOUTHERN ELECTRONIC PRODUCT
TESTING (SHENZHEN) CO., LTD**
ELECTRONIC TESTING BUILDING, SHAHE ROAD, XILI
TOWN
SHENZHEN, P.R. CHINA (POST CODE:518055)
SATIMO COMOSAR REFERENCE DIPOLE
FREQUENCY: 2450 MHZ
SERIAL NO.: SN 09/13 DIP2G450-220

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



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 340.6 (4.8ATJA)

| | 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 2450 MHz REFERENCE DIPOLE |
| Manufacturer | Satimo |
| Model | SID2450 |
| Serial Number | SN 09/13 DIP2G450-220 |
| Product Condition (new / used) | Used |

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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



Figure 1 – Satimo COMOSAR Validation Dipole



4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed 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 % |

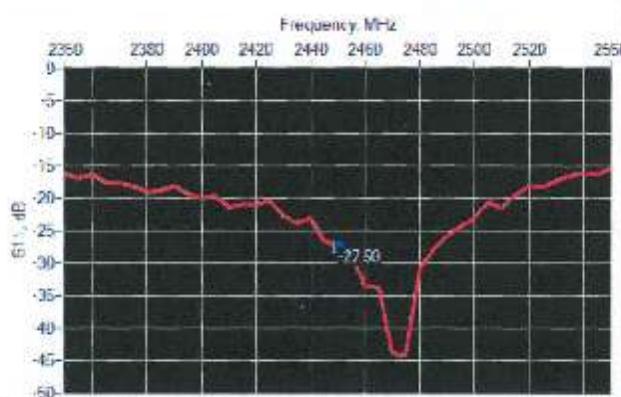
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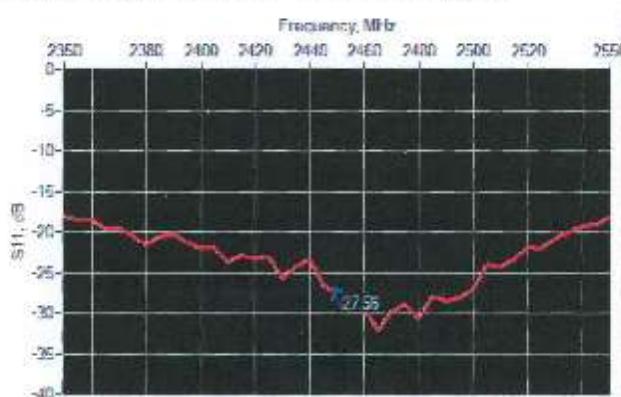
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



| Frequency (MHz) | Return Loss (dB) | Requirement (dB) | Impedance |
|-----------------|------------------|------------------|-----------------------------|
| 2450 | -27.50 | -20 | $51.7 \Omega + 3.8 j\Omega$ |

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



| Frequency (MHz) | Return Loss (dB) | Requirement (dB) | Impedance |
|-----------------|------------------|------------------|-----------------------------|
| 2450 | -27.56 | -20 | $54.3 \Omega + 0.9 j\Omega$ |

6.3 MECHANICAL DIMENSIONS

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref ACR.249.6.14.SATU.A

| | | | | | | |
|------|-------------|------|------------|------|-----------|------|
| 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 %. | | 32.5 ±1 %. | | 3.6 ±1 %. | |
| 2450 | 51.5 ±1 %. | PASS | 30.4 ±1 %. | PASS | 3.6 ±1 %. | PASS |
| 2500 | 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 | 49.3 ±5 % | | 0.87 ±5 % | |
| 450 | 43.5 ±5 % | | 0.87 ±5 % | |
| 750 | 41.9 ±5 % | | 0.89 ±5 % | |
| 835 | 41.5 ±5 % | | 0.90 ±5 % | |
| 900 | 41.5 ±5 % | | 0.97 ±5 % | |
| 1450 | 40.5 ±5 % | | 1.20 ±5 % | |
| 1500 | 40.4 ±5 % | | 1.23 ±5 % | |
| 1640 | 40.2 ±5 % | | 1.31 ±5 % | |
| 1750 | 40.1 ±5 % | | 1.37 ±5 % | |
| 1800 | 40.0 ±5 % | | 1.40 ±5 % | |
| 1900 | 40.0 ±5 % | | 1.40 ±5 % | |
| 1950 | 40.0 ±5 % | | 1.40 ±5 % | |
| 2000 | 40.0 ±5 % | | 1.40 ±5 % | |

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR 240.6.14.SATUA

| | | | | |
|------|------------|------|------------|------|
| 2100 | 35.8 ± 5 % | | 1.49 ± 5 % | |
| 2300 | 35.5 ± 5 % | | 1.67 ± 5 % | |
| 2450 | 36.2 ± 5 % | PASS | 1.80 ± 5 % | PASS |
| 2600 | 35.0 ± 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: egs ¹ : 39.0 sigma : 1.77 |
| Distance between dipole center and liquid | 10.0 mm |
| Area scan resolution | dx=8mm/dy=8mm |
| Zoom Scan Resolution | dx=8mm/dy=8mm/dz=5mm |
| Frequency | 2150 MHz |
| Input power | 20 dBm |
| Liquid Temperature | 21 °C |
| Lab Temperature | 21 °C |
| Lab Humidity | 45 % |

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

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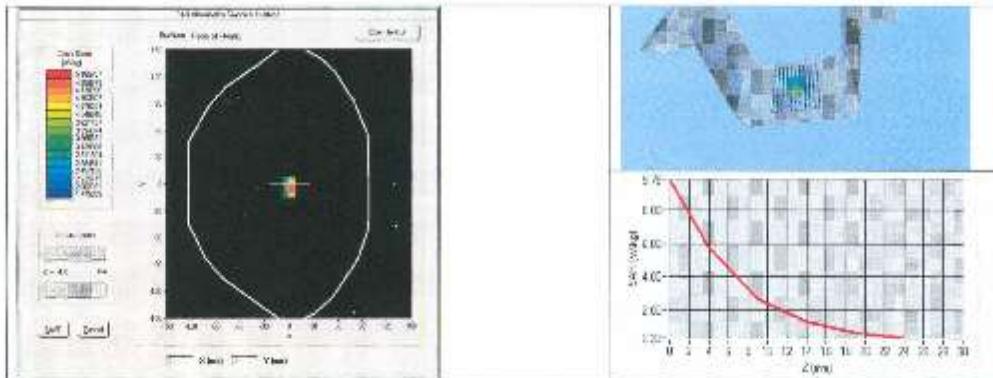
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref. ACR.240.6.14-SATU.A

| | | | | |
|------|------|--------------|------|--------------|
| 2450 | 52.4 | 53.60 (5.36) | 24 | 23.77 (2.38) |
| 2600 | 55.3 | | 24.6 | |
| 3000 | 53.8 | | 25.7 | |
| 3500 | 67.1 | | 25 | |



7.3 BODY LIQUID MEASUREMENT

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

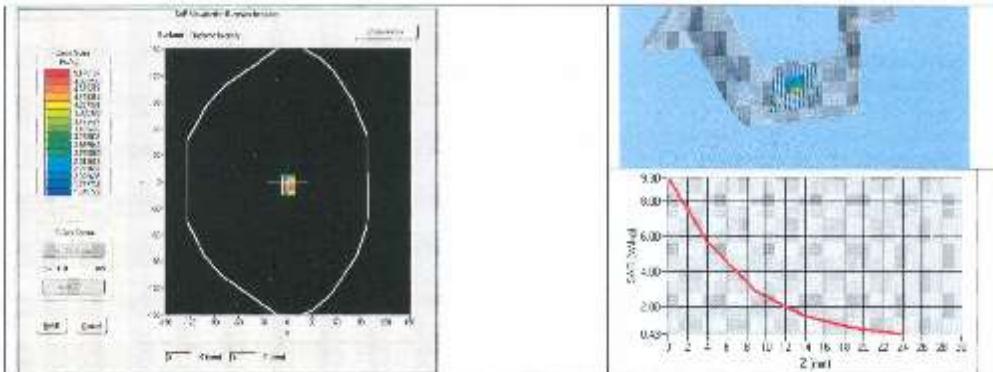
Ref' ACR.240.6.14.SATU.A

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

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

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

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



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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 E46 | 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 |

SAR System Validation

Per FCC KDB 865664 D02v01, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in FCC KDB 865664 D 01 v01 and IEEE 1528-2003. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

| Freq. MHz | Date | probe | position | COND | PERM | CW validation | | | Mod validation | | |
|--------------|----------|----------------|----------|----------|------------|---------------|--------------------|-------------------|----------------|----------------|-----|
| | | | | σ | ϵ | Sensitivity | Probe linearity | Probe isotropy | Mod type | Duty factor | PAR |
| 835 | 20140712 | SN07/14 EPG211 | Body | 0.95 | 55.12 | PASS | PASS | PASS | QPSK | PASS | N/A |
| 1900 | 20140824 | SN09/13 EP169 | Body | 1.52 | 53.28 | PASS | PASS | PASS | QPSK | PASS | N/A |

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB publication 865664 D01v01 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to KDB 865664

—————End of the Report—————