



## SAR TEST REPORT

For

OAXIS ASIA PTE LTD

myFirst Fone R1s, S11

Test Model: KW1305, G4K1

Prepared for	: OAXIS ASIA PTE LTD
Address	: 31 Woodlands Close #01-22 Singapore 737855
Prepared by	: Shenzhen LCS Compliance Testing Laboratory Ltd.
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Date of receipt of test sample	: June 23, 2020
Number of tested samples	: 1
Serial number	: Prototype
Date of Test	: June 23, 2020~July 03, 2020
Date of Report	: July 01, 2022



Scan code to check authenticity



SAR TEST REPORT	
Report Reference No. .... :	LCS220121029AEB001
Date Of Issue .....	July 01, 2022
Testing Laboratory Name .....	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address .....	Room 101, 201, Building A and Room 301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Street, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure .....	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name..... :	OAXIS ASIA PTE LTD
Address .....	31 Woodlands Close #01-22 Singapore 737855
<b>Test Specification:</b>	
SAR Max. Values is..... :	0.832W/kg (10g) for Front to face and 3.589W/kg (10g) for Wrist worn.
Standard .....	EN50663:2017& EN50566:2017& EN62209-2:2010+A1:2019
Test Report Form No. .... :	LCSEMC-1.0
TRF Originator .....	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF .....	Dated 2017-12
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Test Item Description. .... :	myFirst Fone R1s, S11
Trade Mark .....	MyFirst, UMEOX
Model/Type Reference .....	KW1305, G4K1
Ratings .....	DC 3.7V by Rechargeable Li-Polymer Battery(580mAh)
Result .....	Positive

Compiled by:

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Supervised by:

Cary Luo/ Technique principal

Approved by:

Gavin Liang/ Manager



## SAR -- TEST REPORT

**Test Report No. : LCS220121029AEB001**July 01, 2022  
Date of issue

Type / Model..... : KW1305, G4K1

EUT..... : myFirst Fone R1s, S11

**Applicant..... : OAXIS ASIA PTE LTD**

Address..... : 31 Woodlands Close #01-22 Singapore 737855

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**Factory..... : OAXIS ASIA PTE LTD**

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**Test Result****Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.



## Revision History

Revision	Issue Date	Revisions	Revised By
000	January 26, 2022	Initial Issue	Gavin Liang
001	July 01, 2022	See Remark	Gavin Liang

**Remark:**

1. Declared by applicant, Model/Type reference of the product is modified from “KW1305M” to “KW1305”, other information and results contained in this report are not changed, original test report become invalid.
2. Declared by applicant, require to re-sign the test report, “Date of issue” is replaced from “January 26, 2022” by “July 01, 2022”, other information and results contained in this report are not changed, original test report become invalid.





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## 1. TEST STANDARDS AND TEST DESCRIPTION

### 1.1. Test Standards

The tests were performed according to following standards:

EN 62209-2:2010+A1:2019: Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices. Human models, instrumentation, and procedures. Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)

EN 50663:2017: Generic standard for assessment of low power electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (10 MHz - 300 GHz)

EN 50566:2017: Product standard to demonstrate the compliance of wireless communication devices with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 30 MHz to 6 GHz: hand-held and body-mounted devices in close proximity to the human body

### 1.2. Test Description

The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power





### 1.3. Product Description

Product Name:	myFirst Fone R1s, S11	
Test Model:	KW1305, G4K1	
Hardware Version:	HK839_MB_V1.0	
Software Version:	k11_V1.0.0	
Power supply:	DC 3.7V by Rechargeable Li-Polymer Battery(580mAh)	
<b>2G</b>		
Support Band:	<input checked="" type="checkbox"/> GSM 900 (EU-Band) <input checked="" type="checkbox"/> DCS 1800 (EU-Band) <input checked="" type="checkbox"/> GSM 850 (U.S.-Band) <input checked="" type="checkbox"/> PCS 1900 (U.S.-Band)	
Power Class:	GSM 900: Level 5, DCS 1800: Level 0	
Uplink:	GSM 900: 880MHz ~ 915MHz DCS 1800: 1710MHz ~ 1785MHz	
Downlink:	GSM 900: 925MHz ~ 960MHz DCS 1800: 1805MHz ~ 1880MHz	
Modulation Type:	GMSK for GSM/GPRS;	
GSM Release Version	R99	
GPRS Multislot Class	12	
EGPRS Multislot Class	/	
Antenna Description:	Internal Antenna; 1.2dBi (max.) For GSM 850; 1.2dBi (max.) For GSM 900; 1.2dBi (max.) For DCS 1800; 1.2dBi (max.) For PCS 1900	
<b>WCDMA</b>		
Support Band:	<input type="checkbox"/> WCDMA Band II (U.S.-Band) <input type="checkbox"/> WCDMA Band V (U.S.-Band) <input type="checkbox"/> WCDMA Band IV (U.S.-Band) <input checked="" type="checkbox"/> WCDMA Band I (EU-Band) <input checked="" type="checkbox"/> WCDMA Band VIII (EU-Band)	
Power Class:	Level 3	
Uplink:	WCDMA Band I: 1920MHz ~ 1980MHz WCDMA Band VIII: 880MHz~915MHz	
Downlink:	WCDMA Band I: 2110MHz ~ 2170MHz WCDMA Band VIII: 925MHz~960MHz	
Modulation Type:	WCDMA: BPSK; HSDPA/HSUPA: BPSK	
WCDMA Release Version:	R8	
DC-HSUPA Release Version:	Not Supported	
Antenna Description:	Internal Antenna; 1.2dBi (max.) For WCDMA Band I; 1.2dBi (max.) For WCDMA Band VIII	
<b>LTE</b>		
Support Band:	<input checked="" type="checkbox"/> E-UTRA Band 1(EU-Band) <input checked="" type="checkbox"/> E-UTRA Band 3(EU-Band) <input checked="" type="checkbox"/> E-UTRA Band 7(EU-Band) <input checked="" type="checkbox"/> E-UTRA Band 8(EU-Band) <input checked="" type="checkbox"/> E-UTRA Band 20(EU-Band)	
Power Class:	Class 3	
FDD Band:	Uplink: E-UTRA Band 1: 1920MHz ~ 1980MHz E-UTRA Band 3: 1710MHz~1785MHz E-UTRA Band 7: 2500MHz ~ 2570MHz	





	E-UTRA Band 8: 880MHz ~ 915MHz E-UTRA Band 20: 832MHz ~ 862MHz Downlink: E-UTRA Band 1: 2110MHz ~ 2170MHz E-UTRA Band 3: 1805MHz~1880MHz E-UTRA Band 7: 2620MHz ~ 2690MHz E-UTRA Band 8: 925MHz ~ 960MHz E-UTRA Band 20: 791MHz ~ 821MHz
Modulation Type:	QPSK/16QAM
LTE Release Version:	R9
Antenna Description:	Internal Antenna; 1.2dBi (max.) For E-UTRA Band 1; 1.2dBi (max.) For E-UTRA Band 3; 1.2dBi (max.) For E-UTRA Band 7; 0.7dBi (max.) For E-UTRA Band 8; 1.2dBi (max.) For E-UTRA Band 20
<b>WIFI(2.4G Band)</b>	
Frequency Range:	2412MHz ~ 2472MHz
Supported type:	802.11b/802.11n(HT20&HT40)
Modulation:	802.11b: DSSS; 802.11g/n: OFDM
Channel number:	13 Channel for 20MHz bandwidth(2412~2472MHz) 9 channels for 40MHz bandwidth(2422~2462MHz)
Channel separation:	5MHz
Antenna Description:	Internal Antenna, 1.2dBi(Max.)
<b>Bluetooth</b>	
Version:	V4.1
Modulation:	GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V4.1(BDR/EDR) GFSK for Bluetooth V4.1(BT LE)
Operation frequency:	2402MHz~2480MHz
Channel number:	79/40
Channel Spacing:	1MHz/2MHz
Antenna Description:	Internal Antenna, 1.97dBi(Max.)
<b>GPS Receiver</b>	
Receive Frequency:	1575.42MHz
Channel Number:	1
Antenna Description:	Internal Antenna, 0dBi(Max.)



## 1.4. Summary SAR Results

Table 1:Max. SAR Measured(10g)

Exposure Configuration	Technoloxy Band	Highest Measured SAR 10g(W/kg)
Front to face	GSM900	0.355
	DCS1800	0.698
	WCDMA Band VIII	0.314
	WCDMA Band I	<b>0.832</b>
	WLAN2450	0.133
	E-UTRA Band 1	0.429
	E-UTRA Band 3	0.812
	E-UTRA Band 7	0.802
	E-UTRA Band 8	0.247
	E-UTRA Band 20	0.130
Wrist worn	GSM900	1.543
	DCS1800	0.356
	WCDMA Band VIII	1.183
	WCDMA Band I	1.315
	WLAN2450	0.405
	E-UTRA Band 1	1.174
	E-UTRA Band 3	<b>3.589</b>
	E-UTRA Band 7	2.165
	E-UTRA Band 8	0.743
	E-UTRA Band 20	1.038

Note:

1.The SAR values found for the EUT below the maximum recommended levels of 2.0W/Kg as averaged over for 10g tissue according to EN62209. Wrist worn of EUT below the maximum recommended levels of 4.0W/Kg as averaged over for 10g.

2.The maximum SAR value is obtained at the case of (Table 1), and the maximum value is:0.832 W/kg (10g) for Front to face and 3.589 W/kg (10g) for Wrist worn.

3. The EUT has One SIM card slots(SIM1). The result for GSM/WCDMA/LTE card slot(SIM1) is the worst case which was only recorded.

## 1.5. EUT operation mode

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

## 1.6. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

○	Power Cable	Length (m) :	/
		Shield :	/
		Detachable :	/
○	Multimeter	Manufacturer :	/
		Model No. :	/



## 2. TEST ENVIRONMENT

### 2.1. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

Site Description

EMC Lab. : NVLAP Accreditation Code is 600167-0.  
FCC Designation Number is CN5024.  
CAB identifier is CN0071.  
CNAS Registration Number is L4595.

### 2.2. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	18-25 ° C
Humidity:	40-65 %
Atmospheric pressure:	950-1050mbar

### 2.3. SAR Limits

EXPOSURE LIMITS	CE Limit (10g Tissue)	
	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average(averaged over the whole body)	0.08	0.4
Spatial Peak(averaged over any 1 g of tissue)	2.0	10
Spatial Peak(hands/wrists/ feet/anklesaveraged over 10 g)	4.0	20.0

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).



## 2.4. Equipments Used during the Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	PC	Lenovo	G5005	MY42081102	N/A	N/A
2	SAR Measurement system	SATIMO	4014_01	SAR_4014_01	N/A	N/A
3	Signal Generator	Agilent	E4438C	MY49072627	2020-06-11	2021-06-10
4	Multimeter	Keithley	MiltiMeter 2000	4059164	2019-11-15	2020-11-14
5	S-parameter Network Analyzer	Agilent	8753ES	US38432944	2019-11-15	2020-11-14
6	Wideband Radio Communication Tester	R&S	CMW500	103818-1	2019-11-22	2020-11-21
7	E-Field PROBE	SATIMO	SSE2	SN 17/14 EPGO324	2019-10-08	2020-10-07
8	DIPOLE 900	SATIMO	SID 900	SN 07/14 DIP 0G900-300	2018-10-01	2021-09-30
9	DIPOLE 1800	SATIMO	SID 1800	SN 07/14 DIP 1G800-301	2018-10-01	2021-09-30
10	DIPOLE 2000	SATIMO	SID 2000	SN 07/14 DIP 2G000-305	2018-10-01	2021-09-30
11	DIPOLE 2450	SATIMO	SID 2450	SN 07/14 DIP 2G450-306	2018-10-01	2021-09-30
12	DIPOLE 2600	SATIMO	SID 2600	SN 38/18 DIP 2G600-468	2018-09-24	2021-09-23
13	COMOSAR OPENCoaxial Probe	SATIMO	OCPG 68	SN 40/14 OCPG68	2019-11-15	2020-11-14
14	SAR Locator	SATIMO	VPS51	SN 40/14 VPS51	2019-11-15	2020-11-14
15	Communication Antenna	SATIMO	ANTA57	SN 39/14 ANTA57	2019-11-15	2020-11-14
16	FEATURE PHONEPOSITIONING DEVICE	SATIMO	MSH98	SN 40/14 MSH98	N/A	N/A
17	DUMMY PROBE	SATIMO	DP60	SN 03/14 DP60	N/A	N/A
18	SAM PHANTOM	SATIMO	SAM117	SN 40/14 SAM117	N/A	N/A
19	Liquid measurement Kit	HP	85033D	3423A03482	2019-11-15	2020-11-14
20	Power meter	Agilent	E4419B	MY45104493	2020-06-11	2021-06-10
21	Power meter	Agilent	E4419B	MY45100308	2019-11-22	2020-11-21
22	Power sensor	Agilent	E9301H	MY41495616	2019-11-22	2020-11-21
23	Power sensor	Agilent	E9301H	MY41495234	2020-06-11	2021-06-10
24	Directional Coupler	MCLI/USA	4426-20	03746	2020-06-11	2021-06-10

### 3.SAR MEASUREMENTS SYSTEM CONFIGURATION

#### 3.1. SAR Measurement Set-up

The OPENSAR system for performing compliance tests consist of the following items:

A standard high precision 6-axis robot (KUKA) with controller and software.

KUKA Control Panel (KCP)

A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with a Video Positioning System(VPS).

The stress sensor is composed with mechanical and electronic when the electronic part detects a change on the electro-mechanical switch,It sends an “Emergency signal” to the robot controller that to stop robot's moves

A computer operating Windows XP.

OPENSAR software

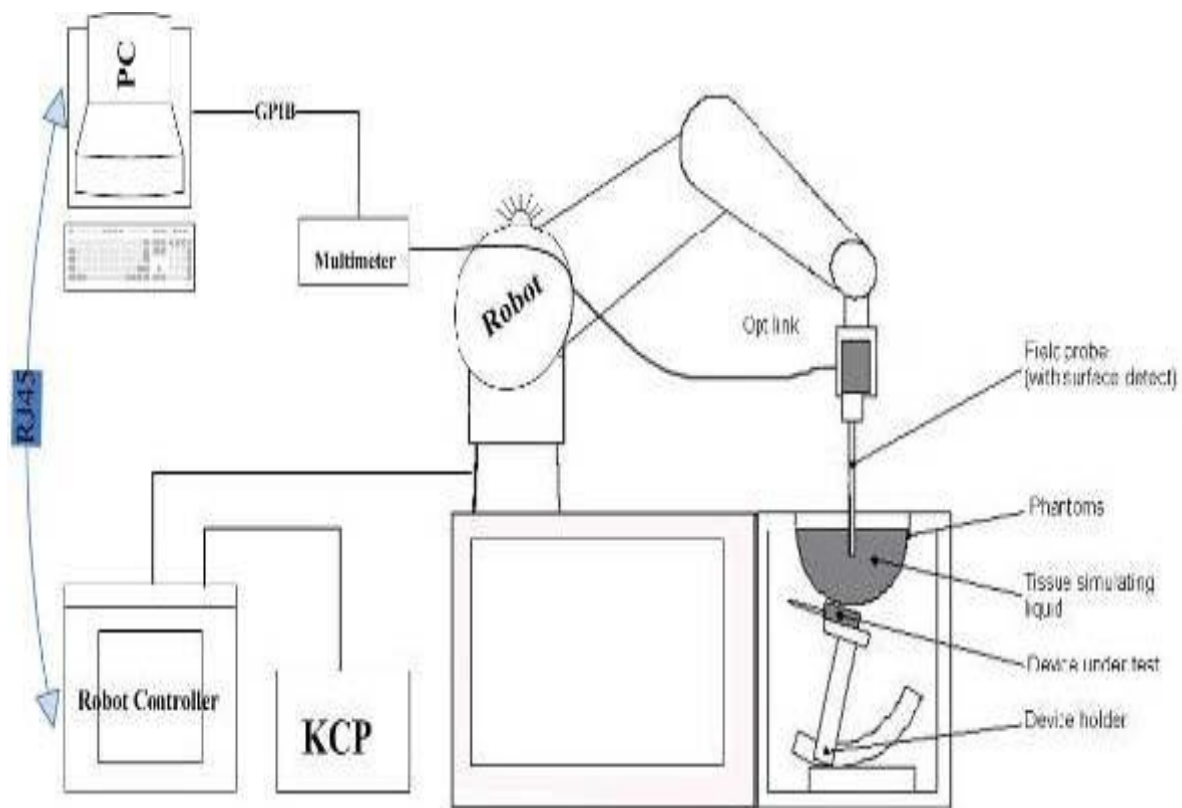
Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

The SAM phantom enabling testing left-hand right-hand and body usage.

The Position device for handheld EUT

Tissue simulating liquid mixed according to the given recipes .

System validation dipoles to validate the proper functioning of the system.





### 3.2. OPENSAR E-field Probe System

The SAR measurements were conducted with the dosimetric probe EPGO324 (manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation.

#### 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.

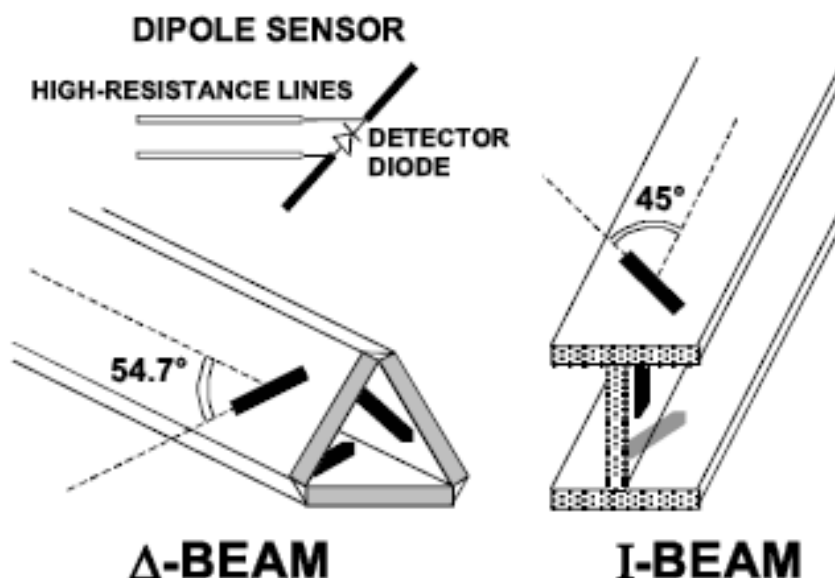
Frequency	450 MHz to 6 GHz; Linearity: 0.25dB(450 MHz to 6 GHz)
Directivity	0.25 dB in HSL (rotation around probe axis) 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	0.01W/kg to > 100 W/kg; Linearity: 0.25 dB
Dimensions	Overall length: 330 mm (Tip: 16mm) Tip diameter: 5 mm (Body: 8 mm) Distance from probe tip to sensor centers: 2.5 mm
Application	General dosimetry up to 6 GHz Dosimetry in strong gradient fields Compliance tests of Mobile Phones



#### Isotropic E-Field Probe

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

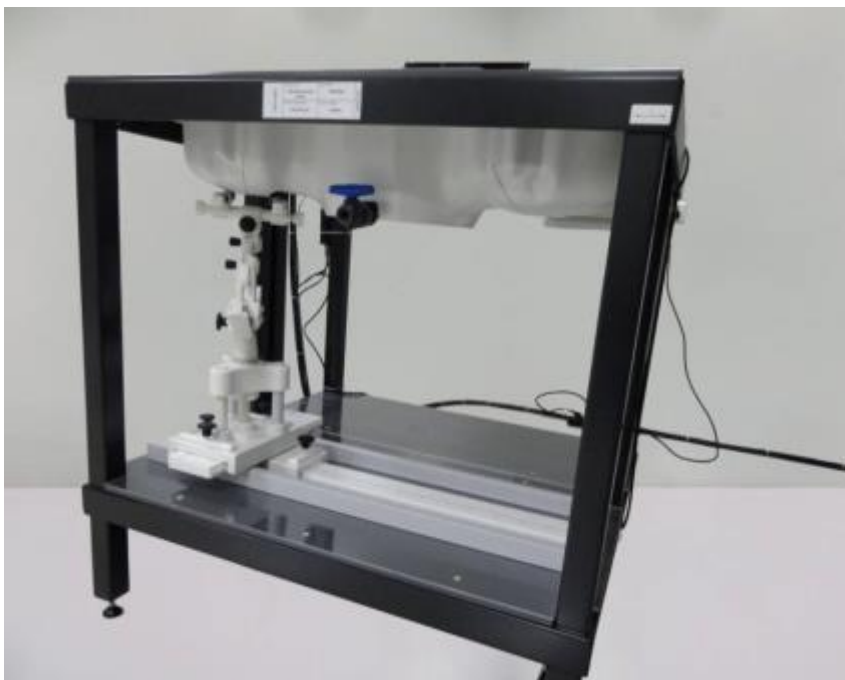
The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



### 3.3. Phantoms

The SAM Phantom SAM117 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is in compliance with the specification set in IEEE 1528 and EN62209-1, EN62209-2. The phantom enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

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

### 3.4. Device Holder

In combination with the Generic Twin Phantom SAM117, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).



Device holder supplied by SATIMO



### 3.5. Scanning Procedure

The procedure for assessing the peak spatial-average SAR value consists of the following steps

#### Power Reference Measurement

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

#### Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in OPENSAR software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, grid was at to 15 mm by 15 mm and can be edited by a user.

#### Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures 5 x 5 x 4 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more than one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

#### Power Drift measurement

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have OPENSAR software stop the measurements if this limit is exceeded.

### 3.6. Data Storage and Evaluation

#### Data Storage

The OPENSAR software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

#### Data Evaluation

The OPENSAR software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	$\sigma$
	- Density	$\rho$



These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the OPENSAR components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

With  $V_i$  = compensated signal of channel  $i$  ( $i = x, y, z$ )

$U_i$  = input signal of channel  $i$  ( $i = x, y, z$ )

$cf$  = crest factor of exciting field

$dcp_i$  = diode compression point

From the compensated input signals the primary field data for each channel can be evaluated:

$$E - \text{fieldprobes : } E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$H - \text{fieldprobes : } H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

With  $V_i$  = compensated signal of channel  $i$  ( $i = x, y, z$ )

$Norm_i$  = sensor sensitivity of channel  $i$  ( $i = x, y, z$ )  
[mV/(V/m)<sup>2</sup>] for E-field Probes

$ConvF$  = sensitivity enhancement in solution

$a_{ij}$  = sensor sensitivity factors for H-field probes

$f$  = carrier frequency [GHz]

$E_i$  = electric field strength of channel  $i$  in V/m

$H_i$  = magnetic field strength of channel  $i$  in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

with  $SAR$  = local specific absorption rate in mW/g

$E_{tot}$  = total field strength in V/m

$\sigma$  = conductivity in [mho/m] or [Siemens/m]

$\rho$  = equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

### 3.7. Position of the wireless device in relation to the phantom

#### General considerations

This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.

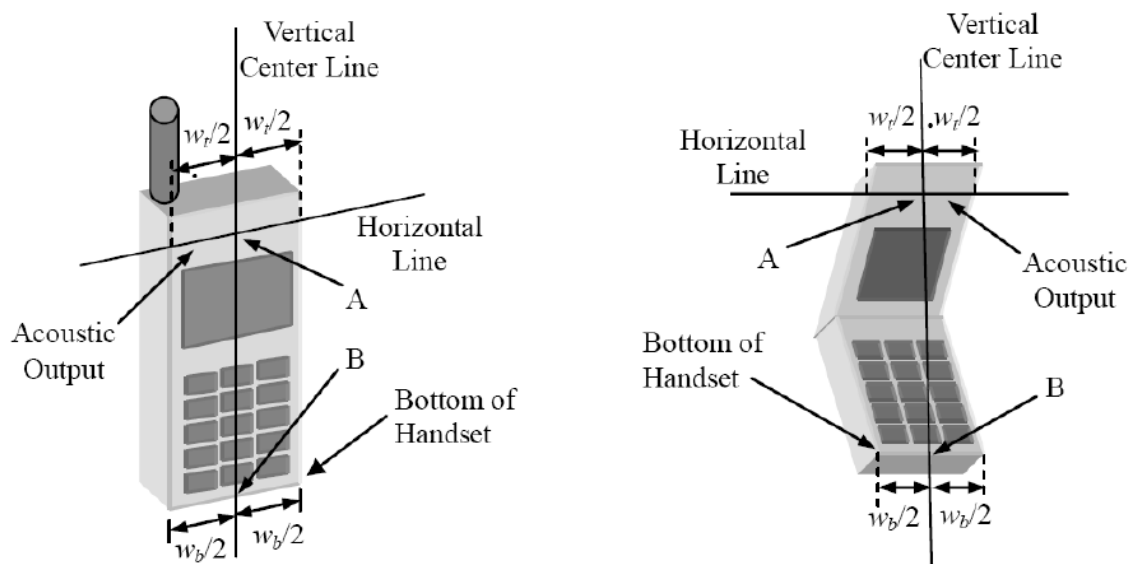
The power flow density is calculated assuming the excitation field as a free space field

$$P_{(pwe)} = \frac{E_{tot}^2}{3770} \text{ or } P_{(pwe)} = H_{tot}^2 \cdot 37.7$$

Where  $P_{pwe}$  = Equivalent power density of a plane wave in mW/cm<sup>2</sup>

$E_{tot}$  = total electric field strength in V/m

$H_{tot}$  = total magnetic field strength in A/m



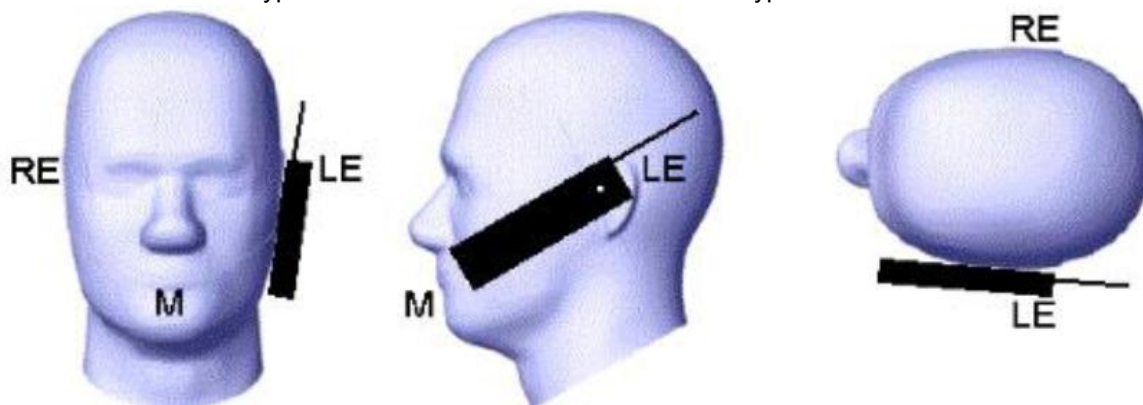
$W_t$  Width of the handset at the level of the acoustic

$W_b$  Width of the bottom of the handset

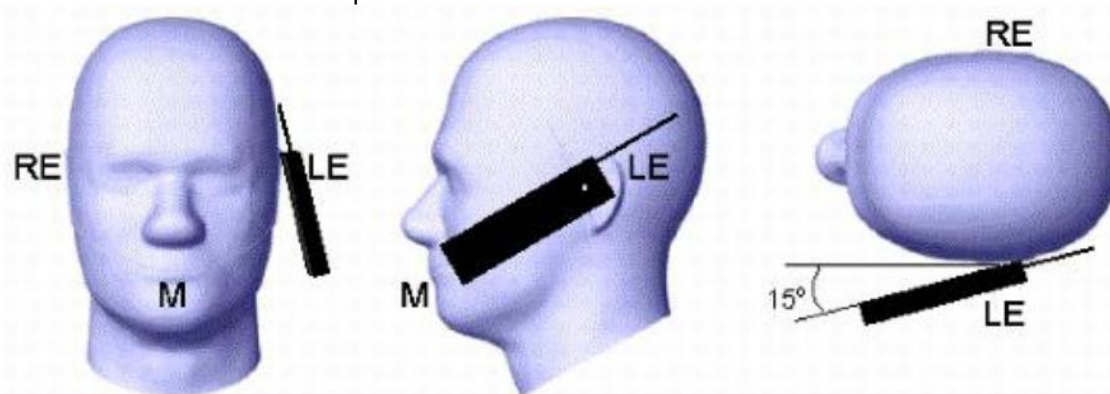
A Midpoint of the width  $w_t$  of the handset at the level of the acoustic output

B Midpoint of the width  $w_b$  of the bottom of the handset

Picture 1-a Typical "fixed" case handset Picture 1-b Typical "clam-shell" case handset



Picture 2 Cheek position of the wireless device on the left side of SAM

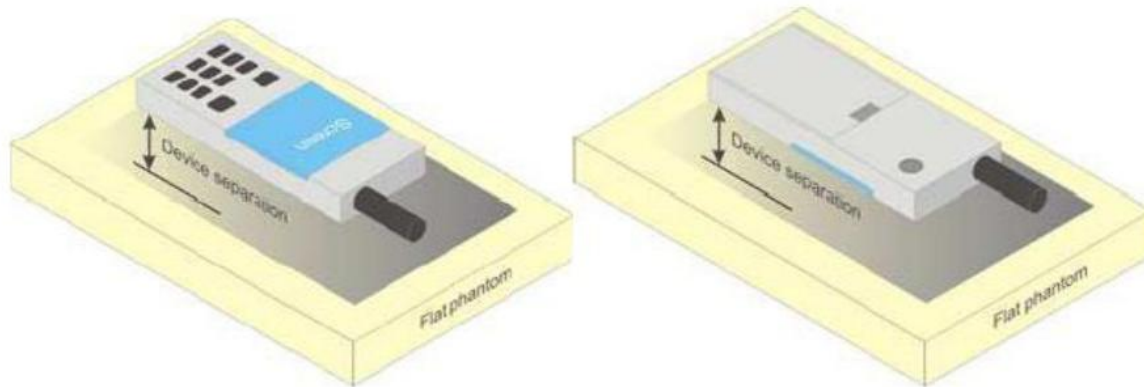


Picture 3 Tilt position of the wireless device on the left side of SAM



**Body-worn device**

A typical example of a body-worn device is a Mobile Phone, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.



Picture 4 Test positions for body-worn devices

**Devices with hinged or swivel antenna(s)**

For devices that employ one or more external antennas with variable positions (e.g. antenna extended, retracted, rotated), these shall be positioned in accordance with the user instructions provided by the manufacturer. For a device with only one antenna, if no intended antenna position is specified, tests shall be performed if applicable in both the horizontal and vertical positions relative to the phantom, and with the antenna oriented away from the body of the DUT (Figure 5) and/or with the antenna extended and retracted such as to obtain the highest exposure condition. For antennas that may be rotated through one or two planes, an evaluation should be made and documented in the measurement report to the highest exposure scenario and only that position(s) need(s) to be tested. For devices with multiple detachable antennas see provisions of 6.2.2.

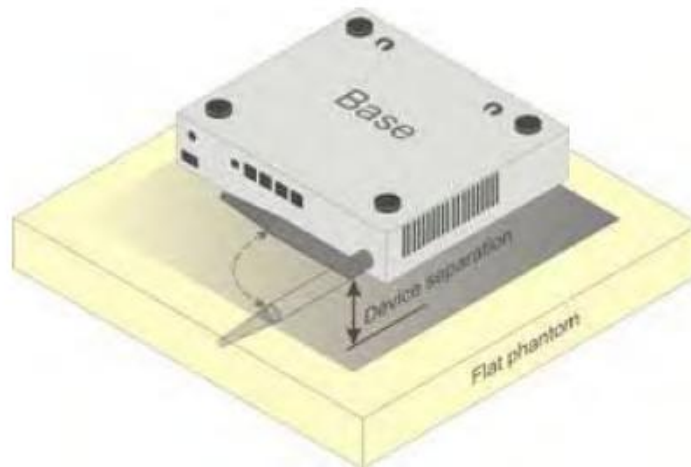


Figure 5– Device with swivel antenna (example of desktop device)

**Body-supported device**

A typical example of a body supported device is a wireless enabled laptop device that among other orientations may be supported on the thighs of a sitting user. To represent this orientation, the device shall be positioned with its base against the flat phantom. Other orientations may be specified by the manufacturer in the user instructions. If the intended use is not specified, the device shall be tested directly against the flat phantom in all usable orientations.

The screen portion of the device shall be in an open position at a 90° angle as seen in Figure 6a (left side), or at an operating angle specified for intended use by the manufacturer in the operating instructions. Where a body supported device has an integral screen required for normal operation, then the screen-side will not need to be tested if the antenna(s) integrated in it ordinarily remain(s) 200 mm from the body. Where a screen mounted antenna is present, the measurement shall be performed with the screen against the flat phantom as shown in Figure 6a) (right side), if operating the screen against the body is consistent with the intended use.

Other devices that fall into this category include tablet type portable computers and credit card transaction authorisation terminals, point-of-sale and/or inventory terminals. Where these devices may be torso or limb-supported, the same principles for body-supported devices are applied.

The example in Figure 6b) shows a tablet form factor portable computer for which SAR should be separately assessed with

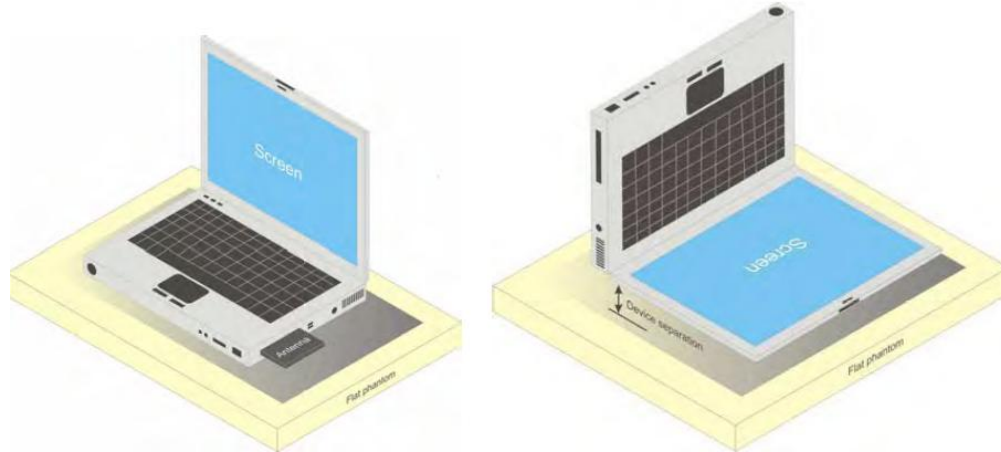
c). each surface and

d). the separation distances

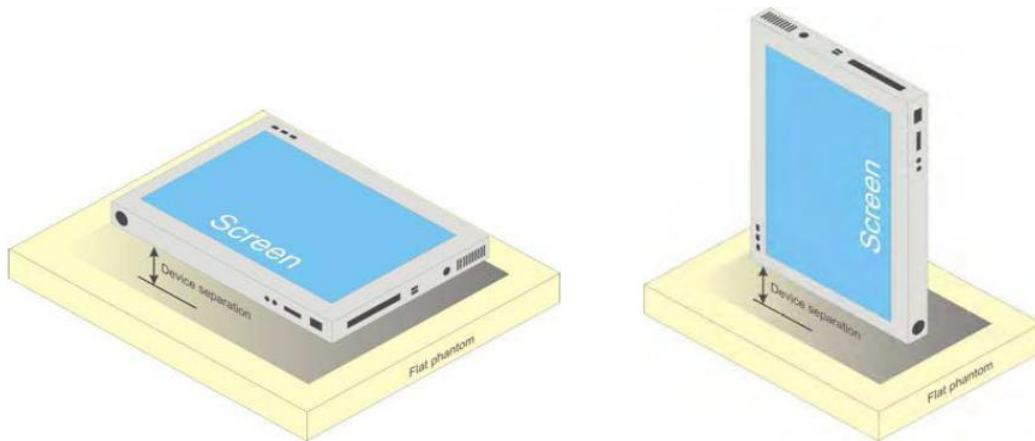
positioned against the flat phantom that correspond to the intended use as specified by the manufacturer. If the intended use is not specified in the user instructions, the device shall be tested directly against the flat phantom in all usable orientations.

Some body-supported devices may allow testing with an external power supply (e.g. a.c. adapter) supplemental to the battery, but it shall be verified and documented in the measurement report that SAR is still conservative.

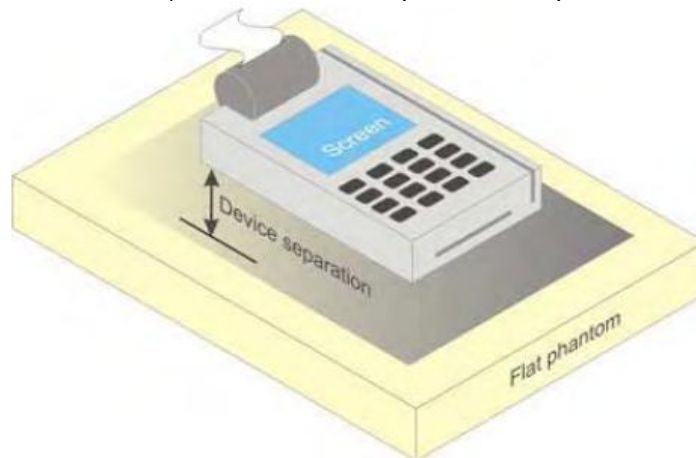
For devices that employ an external antenna with variable positions (e.g. swivel antenna), see 6.1.4.5 and Figure 5.



a) Portable computer with external antenna plug-in-radio-card (left side) or with internal antenna located in screen section (right side)



b) Tablet form factor portable computer



c) Wireless credit card transaction authorisation terminal

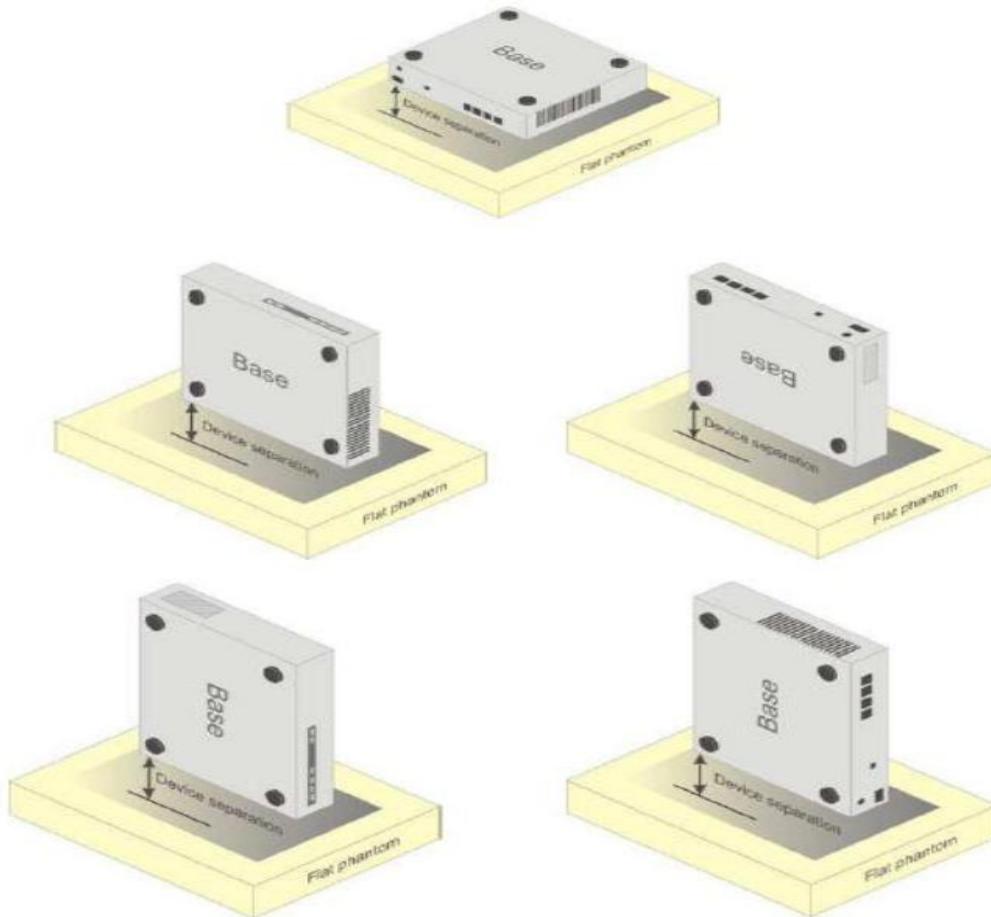
Figure 6 – Test positions for body supported devices



### Desktop device

A typical example of a desktop device is a wireless enabled desktop computer placed on a table or desk when used.

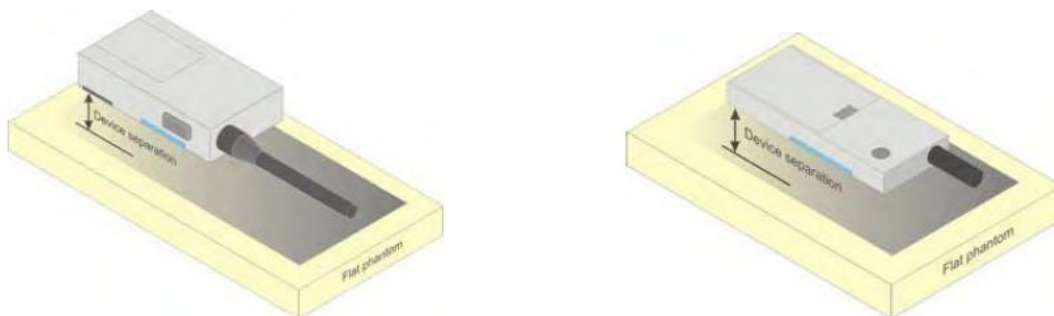
The DUT shall be positioned at the distance and in the orientation to the phantom that corresponds to the intended use as specified by the manufacturer in the user instructions. For devices that employ an external antenna with variable positions, tests shall be performed for all antenna positions specified. Picture 14 shows positions for desktop device SAR tests. If the intended use is not specified, the device shall be tested directly against the flat phantom.



Picture 7 Test positions for desktop devices

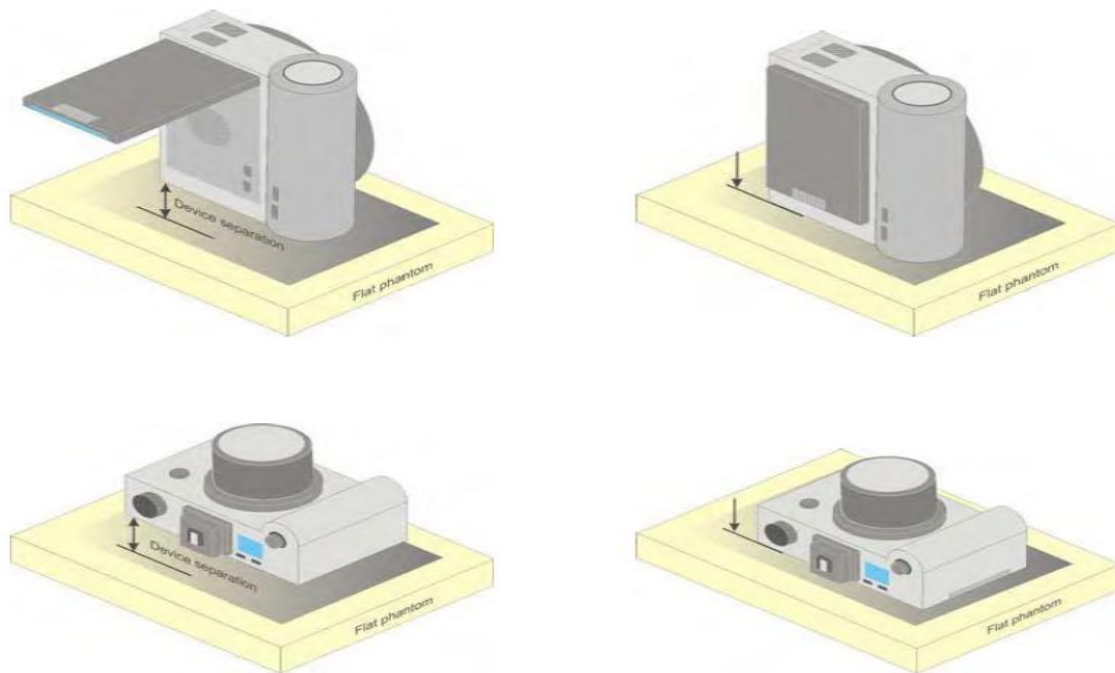
### Front-of-face device

A typical example of a front-of-face device is a two-way radio that is held at a distance from the face of the user when transmitting. In these cases the device under test shall be positioned at the distance to the phantom surface that corresponds to the intended use as specified by the manufacturer in the user instructions (Figure 8a). If the intended use is not specified, a separation distance of 25 mm between the phantom surface and the device shall be used.



a) Two-way radios





b) Still cameras and video cameras

Figure 8 – Test positions for front-of-face devices

Other devices that fall into this category include wireless-enabled still cameras and video cameras that can send data to a network or other device (Figure 8b). In the case of a device whose intended use requires a separation distance from the user (e.g., device with a viewing screen), this shall be positioned at the distance to the phantom surface that corresponds to the intended use as specified by the manufacturer in the user instructions (Figure 8b, left side). If the intended use is not specified, a separation distance of 25 mm between the phantom surface and the device shall be used.

For a device whose intended use requires the user's face to be in contact with the device (e.g., device with an optical viewfinder), this shall be placed directly against the phantom (Figure 8b, right side).

#### Hand-held usage of the device, not at the head or torso

Additional studies remain needed for devising a representative method for evaluating SAR in the hand of hand-held devices. Future versions of this standard are intended to contain a test method based on scientific data and rationale. Annex J presents the currently available test procedure.

#### Limb-worn device

A limb-worn device is a unit whose intended use includes being strapped to the arm or leg of the user while transmitting (except in idle mode). It is similar to a body-worn device. Therefore, the test positions of 6.1.4.4 also apply. The strap shall be opened so that it is divided into two parts as shown in Figure 9. The device shall be positioned directly against the phantom surface with the strap straightened as much as possible and the back of the device towards the phantom.

If the strap cannot normally be opened to allow placing in direct contact with the phantom surface, it may be necessary to break the strap of the device but ensuring to not damage the antenna.

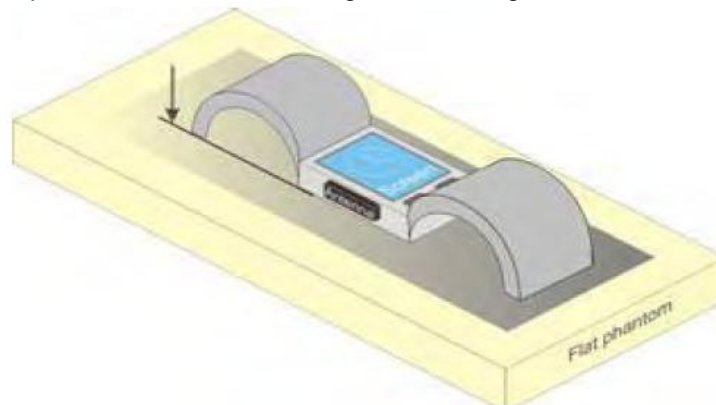


Figure 9 – Test position for limb-worn devices

**Clothing-integrated device**

A typical example of a clothing-integrated device is a wireless device (Mobile Phone ) integrated into a jacket to provide voice communications through an embedded speaker and microphone. This category also includes headgear with integrated wireless devices.

All wireless or RF transmitting components shall be placed in the orientation and at the separation distance to the phantom surface that correspond to intended use of the device when it is integrated into the clothing (Figure 10).

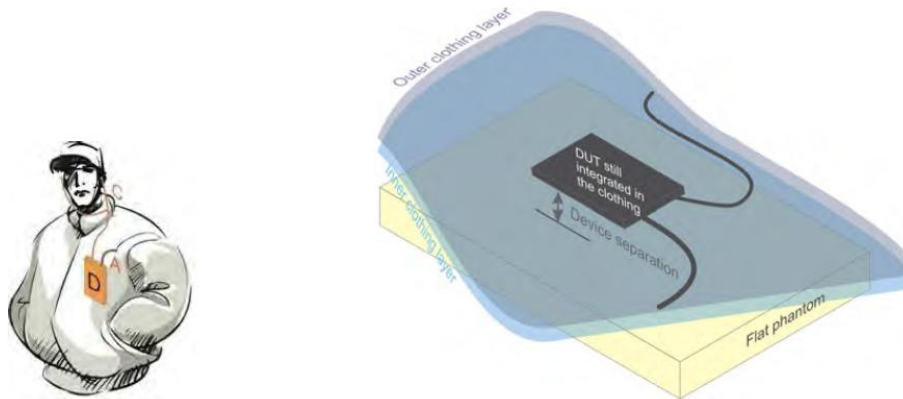


Figure 10– Test position for clothing-integrated wireless devices



### 3.8. Tissue Dielectric Parameters for Head and Body Phantoms

The liquid used for the frequency range of 700-3000 MHz consisted of water, sugar, salt and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table 3 and 4 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.

Table 2. Composition of the Head Tissue Equivalent Matter

Frequency (MHz)	Bactericide	DGBE	HEC	NaCl	Sucrose	1,2-Propanediol	X100	Water	Conductivity	Permittivity
	%	%	%	%	%	%	%	%	$\sigma$	$\epsilon_r$
750	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
835	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
900	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
1800	/	13.84	/	0.35	/	/	30.45	55.36	1.38	41.0
1900	/	13.84	/	0.35	/	/	30.45	55.36	1.38	41.0
2000	/	7.99	/	0.16	/	/	19.97	71.88	1.55	41.1
2450	/	7.99	/	0.16	/	/	19.97	71.88	1.88	40.3
2600	/	7.99	/	0.16	/	/	19.97	71.88	1.88	40.3

Table 3. Targets for tissue simulating liquid

Frequency (MHz)	Liquid Type	Liquid Type ( $\sigma$ )	$\pm 5\%$ Range	Permittivity ( $\epsilon$ )	$\pm 5\%$ Range
300	Head	0.87	0.83~0.91	45.30	43.04~47.57
450	Head	0.87	0.83~0.91	43.50	41.33~45.68
835	Head	0.90	0.86~0.95	41.50	39.43~43.58
900	Head	0.97	0.92~1.02	41.50	39.43~43.58
1450	Head	1.20	1.14~1.26	40.50	38.48~42.53
1800	Head	1.40	1.33~1.47	40.00	38.00~42.00
1900	Head	1.40	1.33~1.47	40.00	38.00~42.00
1950	Head	1.40	1.33~1.47	40.00	38.00~42.00
2000	Head	1.40	1.33~1.47	40.00	38.00~42.00
2450	Head	1.80	1.71~1.89	39.20	37.24~41.16
3000	Head	2.40	2.28~2.52	38.50	36.58~40.43
300	Body	0.87	0.83~0.91	45.30	43.04~47.57
450	Body	0.87	0.83~0.91	43.50	41.33~45.68
835	Body	0.90	0.86~0.95	41.50	39.43~43.58
900	Body	0.97	0.92~1.02	41.50	39.43~43.58
1450	Body	1.20	1.14~1.26	40.50	38.48~42.53
1800	Body	1.40	1.33~1.47	40.00	38.00~42.00
1900	Body	1.40	1.33~1.47	40.00	38.00~42.00
1950	Body	1.40	1.33~1.47	40.00	38.00~42.00
2000	Body	1.40	1.33~1.47	40.00	38.00~42.00
2100	Body	1.49	1.42~1.56	39.80	37.81~41.79
2450	Body	1.80	1.71~1.89	39.20	37.24~41.16
2600	Body	1.96	1.86~2.06	39.00	37.05~40.95
3000	Body	2.40	2.28~2.52	38.50	36.58~40.43
3500	Body	2.91	2.77~3.06	37.90	36.01~39.80
4000	Body	3.43	3.26~3.61	37.40	35.53~39.27
4500	Body	3.94	3.74~4.14	36.80	34.96~38.64
5000	Body	4.45	4.23~4.67	36.20	34.39~38.01
5200	Body	4.66	4.43~4.89	36.00	34.20~37.80
5400	Body	4.86	4.62~5.10	35.80	34.01~37.59
5600	Body	5.07	4.82~5.32	35.50	33.73~37.28
5800	Body	5.27	5.01~5.53	35.30	33.54~37.07
6000	Body	5.48	5.21~5.75	35.10	33.35~36.86

### 3.9. Test Condition and Dielectric Performance

Test Condition and Test Date

Test Engineer: Cherrie Wang			
Liquid Frequency	Measurement temperature	Measurement humidity	Measurement Date
900 MHz	22.6°C	52.9%	June 23, 2020
1800 MHz	23.2°C	51.8%	June 28, 2020
2000 MHz	22.9°C	51.4%	June 30, 2020
2450 MHz	22.4°C	52.5%	July 02, 2020
2600 MHz	23.0°C	53.7%	July 03, 2020

Dielectric Performance of Head Tissue Simulating Liquid

Measured Frequency (MHz)	Target Tissue		Measured Tissue			
	$\sigma$	$\epsilon_r$	$\sigma$	Dev.	$\epsilon_r$	Dev.
900	0.97	41.5	0.94	-3.09%	42.58	2.60%
1800	1.40	40.0	1.43	2.14%	40.64	1.60%
2000	1.40	40.0	1.42	1.43%	39.17	-2.08%
2450	1.80	39.2	1.78	-1.11%	38.35	-2.17%
2600	1.96	39.0	1.90	-3.06%	40.35	3.46%

### 3.10. System Check

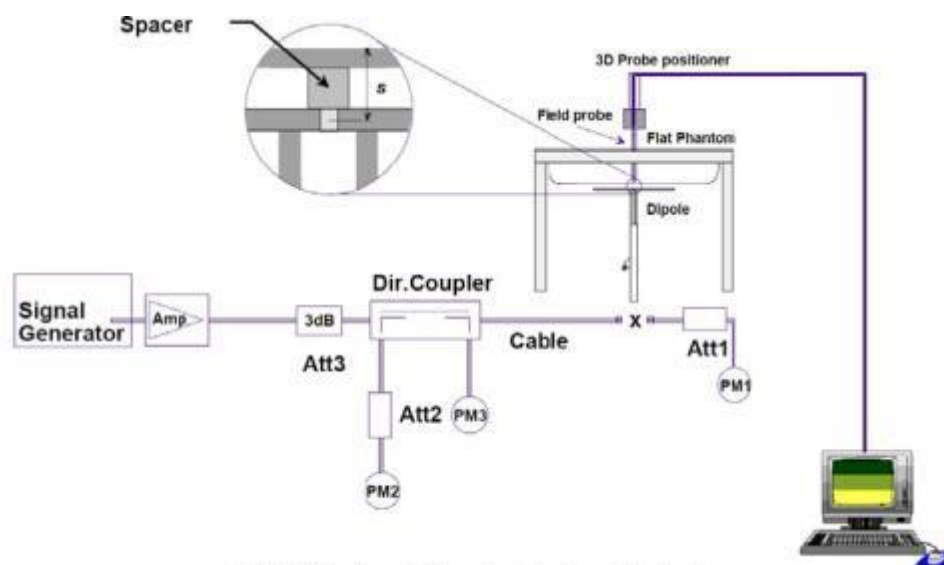


Fig 8.1 System Setup for System Evaluation

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:

- 1 Signal Generator
- 2 Amplifier
- 3 Directional Coupler



- 4 Power Meter  
5 Calibrated Dipole

The output power on dipole port must be calibrated to 20 dBm (100 mW) before dipole is connected.



Photo of Dipole Setup

System Validation of Head

Verification results	Frequency (MHz)	Target value (W/kg)		Measured value (W/kg)		Deviation	
		1 g Average	10 g Average	1 g Average	10 g Average	1 g Average	10 g Average
	900	10.9	6.99	11.4	7.21	4.59%	3.15%
	1800	38.4	20.1	40.1	18.9	4.43%	-5.97%
	2000	41.1	21.1	40.5	19.6	-1.46%	-7.11%
	2450	52.4	24.0	49.8	23.4	-4.96%	-2.50%
	2600	55.3	24.6	56.1	24.5	1.45%	-0.41%

### 3.11. Measurement Procedures

#### Tests to be performed

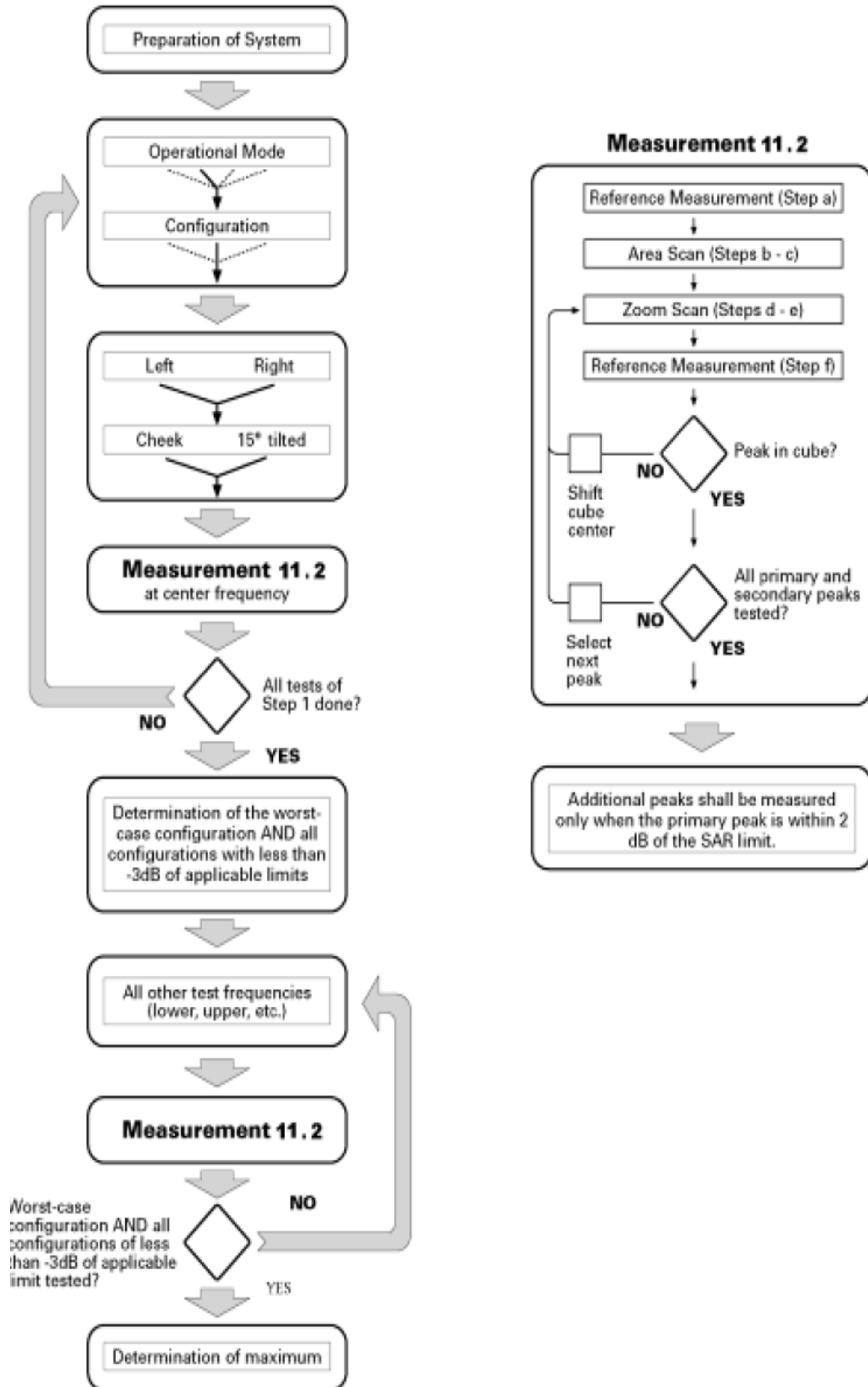
In order to determine the highest value of the peak spatial-average SAR of a handset, all device positions, configurations and operational modes shall be tested for each frequency band according to steps 1 to 3 below. A flowchart of the test process is shown in Picture 11

Step 1: The tests described in 11.2 shall be performed at the channel that is closest to the centre of the transmit frequency band ( $f_c$ ) for:

- all device positions (cheek and tilt, for both left and right sides of the SAM phantom, as described in Chapter 8),
- all configurations for each device position in a), e.g., antenna extended and retracted, and
- all operational modes, e.g., analogue and digital, for each device position in a) and configuration in b) in each frequency band.
- If more than three frequencies need to be tested according to 11.1 (i.e.,  $N_c > 3$ ), then all frequencies, configurations and modes shall be tested for all of the above test conditions.

Step 2: For the condition providing highest peak spatial-average SAR determined in Step 1, perform all tests described in 11.2 at all other test frequencies, i.e., lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the peak spatial-average SAR value determined in Step 1 is within 3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

Step 3: Examine all data to determine the highest value of the peak spatial-average SAR found in Steps 1 to 2.



Picture 11 Block diagram of the tests to be performed

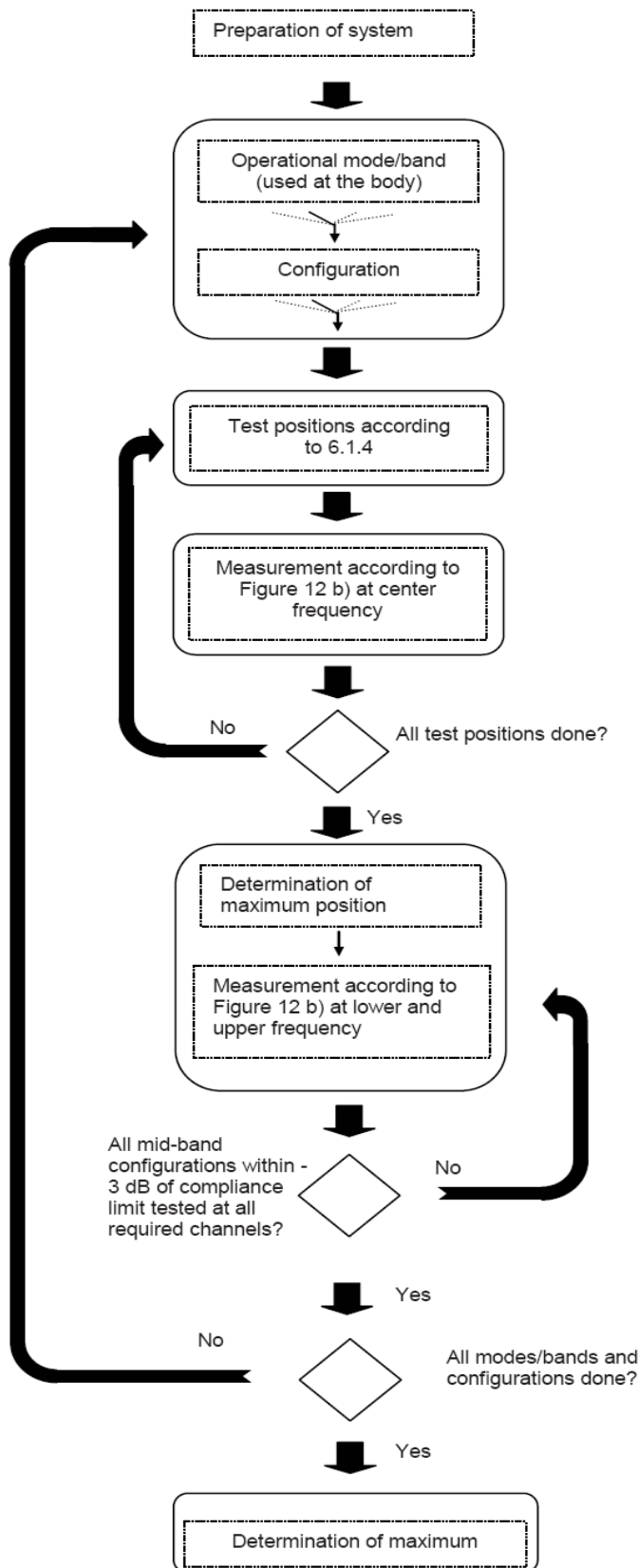


Figure 12a – Tests to be performed

Picture 12 Block diagram of the tests to be performed

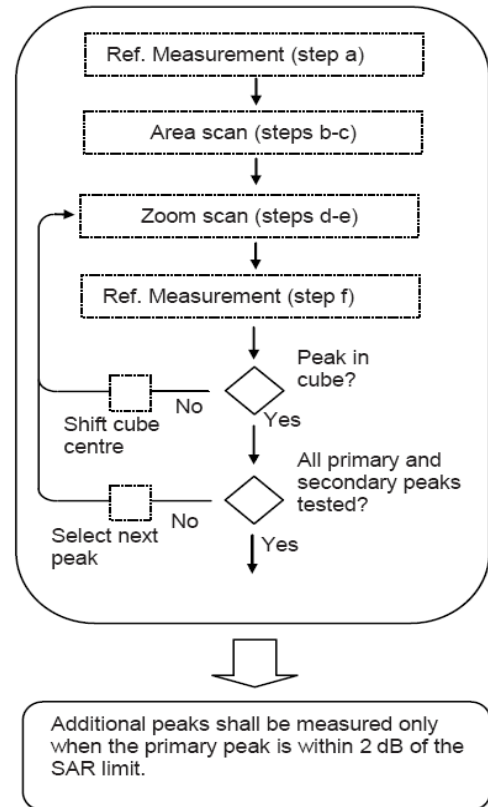


Figure 12b – General procedure





### Measurement procedure

The following procedure shall be performed for each of the test conditions (see Picture 11) described in 11.1:

- a) Measure the local SAR at a test point within 4 mm or less in the normal direction from the inner surface of the phantom.
- b) Measure the two-dimensional SAR distribution within the phantom (area scan procedure). The boundary of the measurement area shall not be closer than 20 mm from the phantom side walls. The distance between the measurement points should enable the detection of the location of local maximum with an accuracy of better than half the linear dimension of the tissue cube after interpolation. A maximum grid spacing of 20 mm for frequencies below 3 GHz and  $(60/f \text{ [GHz]})$  mm for frequencies of 3 GHz and greater is recommended. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz and  $\delta \ln(2)/2$  mm for frequencies of 3 GHz and greater, where  $\delta$  is the plane wave skin depth and  $\ln(x)$  is the natural logarithm. The maximum variation of the sensor-phantom surface shall be  $\pm 1$  mm for frequencies below 3 GHz and  $\pm 0.5$  mm for frequencies of 3 GHz and greater. At all measurement points the angle of the probe with respect to the line normal to the surface should be less than  $5^\circ$ . If this cannot be achieved for a measurement distance to the phantom inner surface shorter than the probe diameter, additional measurement distance to the phantom inner surface shorter than the probe diameter, additional
- c) From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that are not within the zoom-scan volume; additional peaks shall be measured only when the primary peak is within 2 dB of the SAR limit. This is consistent with the 2 dB threshold already stated;
- d) Measure the three-dimensional SAR distribution at the local maxima locations identified in step
- e) The horizontal grid step shall be  $(24 / f \text{ [GHz]})$  mm or less but not more than 8 mm. The minimum zoom size of 30 mm by 30 mm and 30 mm for frequencies below 3 GHz. For higher frequencies, the minimum zoom size of 22 mm by 22 mm and 22 mm. The grid step in the vertical direction shall be  $(8 - f \text{ [GHz]})$  mm or less but not more than 5 mm, if uniform spacing is used. If variable spacing is used in the vertical direction, the maximum spacing between the two closest measured points to the phantom shell shall be  $(12 / f \text{ [GHz]})$  mm or less but not more than 4 mm, and the spacing between further points shall increase by an incremental factor not exceeding 1.5. When variable spacing is used, extrapolation routines shall be tested with the same spacing as used in measurements. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz and  $\delta \ln(2)/2$  mm for frequencies of 3 GHz and greater, where  $\delta$  is the plane wave skin depth and  $\ln(x)$  is the natural logarithm. Separate grids shall be centered on each of the local SAR maxima found in step c). Uncertainties due to field distortion between the media boundary and the dielectric enclosure of the probe should also be minimized, which is achieved if the distance between the phantom surface and physical tip of the probe is larger than probe tip diameter. Other methods may utilize correction procedures for these boundary effects that enable high precision measurements closer than half the probe diameter. For all measurement points, the angle of the probe with respect to the flat phantom surface shall be less than  $5^\circ$ . If this cannot be achieved an additional uncertainty evaluation is needed.
- f) Use post processing (e.g. interpolation and extrapolation) procedures to determine the local SAR values at the spatial resolution needed for mass averaging.

### WCDMA Measurement Procedures for SAR

The following procedures are applicable to WCDMA handsets operating under 3GPP Release 99, Release 5 and Release 6. The default test configuration is to measure SAR with an established radio link between the DUT and a communication test set using a 12.2 kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations (DPCCH & DPDCH), HSDPA and HSPA (HSUPA/HSDPA) modes according to output power, exposure conditions and device operating capabilities. Both uplink and downlink should be configured with the same RMC or AMR, when required. SAR for Release 5 HSDPA and Release 6 HSPA are measured using the applicable FRC (fixed reference channel) and E-DCH reference channel configurations. Maximum output power is verified according to applicable versions of 3GPP TS 34.121 and SAR must be measured according to the maximum output conditions. When Maximum Power Reduction (MPR) is not implemented according to Cubic Metric (CM) requirements for Release 6 HSPA, the following procedures do not apply.



**For Release 5 HSDPA Data Devices:**

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c / \beta_d$	$\beta_{hs}$	CM/dB
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15	15/15	64	12/15	24/25	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

**For Release 6 HSUPA Data Devices**

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c / \beta_d$	$\beta_{hs}$	$\beta_{ec}$	$\beta_{ed}$	$\beta_{ed}$ (SF)	$\beta_{ed}$ (codes)	CM (dB)	MPR (dB)	AG Index	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}:47/15$ $\beta_{ed2}:47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	3.0	2.0	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	1.0	0.0	21	81



## 4. TEST CONDITIONS AND RESULTS

### 4.1. Conducted Power Results

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMW500) to ensure the maximum power transmission and proper modulation. This result contains conducted output power for the EUT. In all cases, the measured peak output power should be greater and within 5% than EMI measurement.

**The conducted power measurement results for GSM900/DCS1800**

GSM900	Conducted Power (dBm)		
	Channel 124 (914.80MHz)	Channel 37 (897.40MHz)	Channel 975 (880.20MHz)
	32.71	32.58	32.68
DCS1800	Conducted Power (dBm)		
	Channel 885 (1784.80MHz)	Channel 698 (1747.40MHz)	Channel 512 (1710.20MHz)
	29.59	29.59	29.56

**The conducted power measurement results for GPRS**

GPRS 900 (GMSK)	Measured Power (dBm)			Calculation (dB)	Averaged Power (dBm)		
	880.2 MHz	897.4 MHz	914.8 MHz		880.2 MHz	897.4 MHz	914.8 MHz
1 Txslot	30.92	31.02	31.08	-9.03	21.89	21.99	22.05
2 Txslot	<b>29.42</b>	<b>29.43</b>	<b>29.45</b>	<b>-6.02</b>	<b>23.40</b>	<b>23.41</b>	<b>23.43</b>
3 Txslot	27.21	27.20	27.09	-4.26	22.95	22.94	22.83
4 Txslot	26.46	26.57	26.50	-3.01	23.45	23.56	23.49
GPRS 1800 (GMSK)	Measured Power (dBm)			Calculation (dB)	Averaged Power (dBm)		
	1710.2 MHz	1747.4 MHz	1784.8 MHz		1710.2 MHz	1747.4 MHz	1784.8 MHz
1 Txslot	28.20	28.17	28.19	-9.03	19.17	19.14	19.16
2 Txslot	<b>26.39</b>	<b>26.27</b>	<b>26.22</b>	<b>-6.02</b>	<b>20.37</b>	<b>20.25</b>	<b>20.20</b>
3 Txslot	23.63	23.59	23.59	-4.26	19.37	19.33	19.33
4 Txslot	20.99	20.99	21.09	-3.01	17.98	17.98	18.08

**Note:**

1. Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

2. According to the conducted power as above, the body measurements are performed with 2Txslots for 900MHz and 2Txslots for 1800MHz for GPRS.

**The conducted power measurement results for WCDMA**

Item	band	FDD Band VIII result (dBm)			FDD Band I result (dBm)		
		Test Channel			Test Channel		
	sub-test	2713	2788	2862	9612	9750	9888
WCDMA	\	22.70	22.73	22.76	22.72	22.80	22.74
HSDPA	1	22.73	22.69	22.70	22.67	22.66	22.66
	2	22.43	22.51	22.62	22.66	22.39	22.47
	3	22.21	22.37	22.31	22.39	22.34	22.45
	4	21.98	22.23	22.05	22.08	21.98	22.32
HSUPA	1	22.64	22.68	22.67	22.59	22.62	22.67
	2	22.48	22.66	22.71	22.63	22.38	22.39
	3	22.48	22.41	22.52	22.48	22.15	22.48
	4	22.26	22.38	22.46	22.29	22.18	22.27
	5	22.09	22.28	22.42	22.18	22.12	22.37

**The conducted power measurement results for WLAN**

Mode	Channel	Frequency (MHz)	Conducted Output Power	Test Rate Data
			(dBm)	
802.11b	1	2412	13.22	1 Mbps
	7	2442	12.54	1 Mbps
	13	2472	12.91	1 Mbps
802.11g	1	2412	11.30	6 Mbps
	7	2442	10.79	6 Mbps
	13	2472	10.86	6 Mbps
802.11n(20MHz)	1	2412	11.06	6.5 Mbps
	7	2442	10.73	6.5 Mbps
	13	2472	10.91	6.5 Mbps
802.11n(40MHz)	1	2412	11.42	13 Mbps
	7	2442	10.87	13 Mbps
	13	2472	10.85	13 Mbps

**The conducted power measurement results for Bluetooth V4.1**

Mode	Channel	Frequency (MHz)	Conducted Output Power
			(dBm)
BLE	00	2402	-1.12
	19	2440	-2.04
	39	2480	-0.70
GFSK	00	2402	1.77
	39	2441	1.91
	78	2480	2.06
8DPSK	00	2402	1.53
	39	2441	1.26
	78	2480	1.52
$\pi/4$ -DQPSK	00	2402	1.78
	39	2441	1.25
	78	2480	1.57



**Note:** 1. because the output power(eirp) of Bluetooth of the EUT is less than 20mW(13dBm), so standalone SAR are exempt according EN50663.

**The conducted power measurement results for LTE****LTE-BAND1**

Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
		RB Size	RB Offset		
5 MHz	Low range	1	0	22.71	22.03
			max	22.29	21.57
		Partial	0	22.57	21.88
			max	22.53	21.90
	Mid range	1	0	22.71	22.04
			max	22.88	22.19
		Partial	0	22.75	22.04
			max	22.83	22.10
	High range	1	0	21.60	20.89
			max	21.51	20.72
		Partial	0	21.58	20.86
			max	21.57	20.91
20MHz	Low range	1	0	22.61	21.92
			max	21.73	21.06
		Partial	0	22.47	21.79
			max	21.70	21.01
	Mid range	1	0	22.79	22.11
			max	23.22	22.58
		Partial	0	22.74	22.09
			max	23.12	22.47
	High range	1	0	22.69	21.95
			max	21.37	20.64
		Partial	0	22.54	21.90
			max	21.46	20.81

**LTE-BAND3**

Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
		RB Size	RB Offset		
1.4MHz	Low range	1	0	22.64	21.96
			max	22.26	21.53
		Partial	0	22.60	21.87
			max	22.52	21.83
	Mid range	1	0	22.85	22.13
			max	22.92	22.17
		Partial	0	22.75	22.08
			max	22.77	22.02
	High range	1	0	21.64	20.94
			max	21.56	20.77
		Partial	0	21.54	20.89
			max	21.56	20.93
5 MHz	Low range	1	0	22.61	21.92
			max	21.64	20.90
		Partial	0	22.39	21.67
			max	21.72	21.02
	Mid range	1	0	22.70	21.98
			max	23.18	22.40
		Partial	0	22.66	21.97
			max	23.10	22.44
	High range	1	0	22.70	22.00
			max	21.43	20.66
		Partial	0	22.50	21.85
			max	21.56	20.85
20MHz	Low range	1	0	21.40	20.66
			max	21.55	20.82
		Partial	0	21.23	20.55
			max	22.10	21.45
	Mid range	1	0	22.54	21.85
			max	24.04	23.37
		Partial	0	22.64	21.88
			max	23.99	23.25
	High range	1	0	23.05	22.33
			max	20.63	19.87
		Partial	0	22.97	22.23
			max	21.61	20.91

**LTE-BAND7**

Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
		RB Size	RB Offset		
5 MHz	Low range	1	0	22.74	22.06
			max	22.28	21.61
		Partial	0	22.53	21.82
			max	22.45	21.80
	Mid range	1	0	22.75	22.11
			max	22.86	22.18
		Partial	0	22.68	22.01
			max	22.76	22.08
	High range	1	0	21.65	20.93
			max	21.58	20.79
		Partial	0	21.51	20.78
			max	21.45	20.76
20MHz	Low range	1	0	22.62	21.98
			max	21.77	21.07
		Partial	0	22.42	21.77
			max	21.77	21.14
	Mid range	1	0	22.73	21.99
			max	23.20	22.52
		Partial	0	22.69	22.09
			max	23.04	22.40
	High range	1	0	22.73	22.05
			max	21.44	20.74
		Partial	0	22.57	21.88
			max	21.49	20.79

**LTE-AND8**

Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
		RB Size	RB Offset		
1.4 MHz	Low range	1	0	22.62	21.88
			max	22.22	21.56
		Partial	0	22.60	21.83
			max	22.52	21.89
	Mid range	1	0	22.83	22.13
			max	22.93	22.25
		Partial	0	22.75	22.02
			max	22.68	22.04
	High range	1	0	21.60	20.87
			max	21.56	20.79
		Partial	0	21.51	20.77
			max	21.44	20.76
5 MHz	Low range	1	0	22.60	21.88
			max	21.73	20.99
		Partial	0	22.39	21.69
			max	21.75	21.07
	Mid range	1	0	22.77	22.10
			max	23.26	22.51
		Partial	0	22.79	22.09
			max	23.05	22.34
	High range	1	0	22.65	22.03
			max	21.37	20.68
		Partial	0	22.61	21.86
			max	21.48	20.80
10MHz	Low range	1	0	21.39	20.62
			max	21.65	20.94
		Partial	0	21.21	20.52
			max	22.14	21.42
	Mid range	1	0	22.51	21.83
			max	24.11	23.36
		Partial	0	22.56	21.93
			max	24.04	23.40
	High range	1	0	23.03	22.37
			max	20.70	20.01
		Partial	0	22.88	22.13
			max	21.68	21.04

**LTE-BAND20**

Channel Bandwidth	Channel	RB allocation		Average Power (dBm) QPSK	Average Power (dBm) 16-QAM
		RB Size	RB Offset		
5 MHz	Low range	1	0	22.64	21.93
			max	22.22	21.45
		Partial	0	22.56	21.85
			max	22.41	21.75
	Mid range	1	0	22.86	22.15
			max	22.88	22.17
		Partial	0	22.71	22.02
			max	22.79	22.09
	High range	1	0	21.69	20.91
			max	21.60	20.87
		Partial	0	21.54	20.87
			max	21.46	20.76
20MHz	Low range	1	0	22.52	21.86
			max	21.65	21.01
		Partial	0	22.42	21.72
			max	21.78	21.10
	Mid range	1	0	22.77	22.08
			max	23.24	22.55
		Partial	0	22.72	22.07
			max	23.09	22.45
	High range	1	0	22.58	21.86
			max	21.42	20.77
		Partial	0	22.57	21.78
			max	21.57	20.88





## 4.2. Test reduction procedure

### Maximum power level

The maximum power level,  $P_{\max,m}$ , that can be transmitted by a device before the SAR averaged over a mass,  $m$ , exceeds a given limit,  $SAR_{\lim}$ , can be defined. Any device transmitting at power levels below  $P_{\max,m}$  can then be excluded from SAR testing. The lowest possible value for  $P_{\max,m}$  is:  $P_{\max,m} = SAR_{\lim} \cdot m$ .

When working alone, the averages transmit power of BT module should be less than 20mW. According to the test results, when working alone, the testing of BT module is not necessary.

### Simultaneous Multi-band Transmission SAR Analysis List of Mode for Simultaneous Multi-band

#### Transmission

No.	Configurations	Head SAR	Body SAR
1	GSM + 2.4G WLAN	Yes	Yes
2	WCDMA + 2.4G WLAN	Yes	Yes
3	LTE + 2.4G WLAN	Yes	Yes
4	GSM + Bluetooth	Yes	Yes
5	WCDMA + Bluetooth	Yes	Yes
6	LTE + Bluetooth	Yes	Yes

#### Remark:

One way of determining the threshold power level available to the secondary transmitter ( $P_{\text{available}}$ ) is to calculate it from the measured peak spatial-average SAR of the primary transmitter ( $SAR_1$ ) according to the equation:

$$P_{\text{available}} = P_{\text{th},m} \times (SAR_{\lim} - SAR_1) / SAR_{\lim}$$

where  $P_{\text{th},m}$  is the threshold exclusion power level taken from Annex B of EN 50663 for the frequency of the secondary transmitter at the separation distance used in the testing.

For simultaneous transmission analysis, Bluetooth SAR is below:

Bluetooth:

	Average Power (dBm)	Output Power (mW)	$P_{\text{th},m}$ (mW)	$SAR_{\lim}$ (W/kg)	$SAR_1$ (W/kg)	$P_{\text{available}}$ (mW)
Front to face	2.06	1.607	20	2.0	0.832	11.68
Body Worn	2.06	1.607	20	4.0	3.589	2.055

The Bluetooth output power of the secondary transmitter is less than  $P_{\text{available}}$ , So SAR measurement for the secondary transmitter is not necessary.



**Maximum SAR value and the sum of the 10-g SAR for WWAN & WLAN- Front to face**

WWAN Band	WWAN Max SAR (W/kg)	2.4G WLAN Max SAR (W/kg)	Max SAR Sum (W/kg)	Limit (W/kg)
GSM900	0.355	0.133	0.488	2.0
DCS1800	0.698	0.133	0.831	
WCDMA900	0.314	0.133	0.447	
WCDMA2100	0.832	0.133	<b>0.965</b>	
LTE Band 1	0.429	0.133	0.562	
LTE Band 3	0.812	0.133	0.945	
LTE Band 7	0.802	0.133	0.935	
LTE Band 8	0.247	0.133	0.380	
LTE Band 20	0.130	0.133	0.263	

**Maximum SAR value and the sum of the 10-g SAR for WWAN & WLAN –Wrist worn**

WWAN Band	WWAN Max SAR (W/kg)	2.4G WLAN Max SAR (W/kg)	Max SAR Sum (W/kg)	Limit (W/kg)
GSM900	1.543	0.406	1.949	4.0
DCS1800	0.356	0.406	0.762	
WCDMA900	1.183	0.406	1.589	
WCDMA2100	1.315	0.406	1.721	
LTE Band 1	1.174	0.406	1.580	
LTE Band 3(L)	3.258	0.406	3.664	
LTE Band 3	3.589	0.406	<b>3.995</b>	
LTE Band 3(H)	3.410	0.406	3.816	
LTE Band 7(L)	1.847	0.406	2.253	
LTE Band 7	2.165	0.406	2.571	
LTE Band 7(H)	1.958	0.406	2.364	
LTE Band 8	0.743	0.406	1.149	
LTE Band 20	1.038	0.406	1.444	

**Remark:**

- 1 WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
- 2 GSM ,WCDMA and LTE share the same antenna, and cannot transmit simultaneously.
- 3 The maximum SAR summation is calculated based on the same configuration and test position.  
If 10g-SAR summation < 2.0W/kg for Front to face or 10g-SAR summation < 4.0W/kg for Wrist worn, simultaneous SAR measurement is not necessary.
- 4 When the maximum SAR summation  $\geq 1.0$ W/kg on Front to face and the maximum SAR summation  $\geq 2.0$ W/kg on Wrist worn, WWAN, WLAN 2.4G for low and high Channels are necessary to be tested and the test results please refer to the SAR Measurement Results.



### 4.3. SAR Measurement Results

#### Front of face SAR Data

##### 10-g SAR

##### Front of face SAR

Frequency		Mode/Band	Separation Distance(mm)	Test Position	SAR(10g) (W/kg)	Power Drift(%)	Limit (w/kg)	Ref.Plot #
MHz	Channel							
897.4	37	GSM900(voice)	5	Front	0.355	-3.99	2.0	1
1747.6	699	DCS1800(voice)	5	Front	0.698	-1.36	2.0	2
897.6	2788	WCDMA Band VIII	5	Front	0.314	0.01	2.0	3
1950.0	9750	WCDMA Band I	5	Front	0.832	-1.44	2.0	4
2442.0	7	802.11b	5	Front	0.133	-1.28	2.0	5
1950.0	18300	LTE1	5	Front	0.429	3.12	2.0	6
1747.5	19575	LTE3	5	Front	0.812	1.17	2.0	7
897.5	21625	LTE7	5	Front	0.802	2.62	2.0	8
2595.0	38000	LTE8	5	Front	0.247	1.34	2.0	9
1900.0	38450	LTE20	5	Front	0.130	-0.04	2.0	10

**Note:**

- 1.When the 10-g SAR is  $\leq 1.0\text{W/kg}$ , testing for low and high channel is optional.
- 2.The EUT is a Class B mobile phone which can be attached to both GPRS and GSM services,using one service at a time

#### Wrist-Worn SAR Data

##### 10-g SAR

##### Wrist-Worn SAR

Frequency		Mode/Band	Separation Distance(mm)	Test Position	SAR(10g) (W/kg)	Power Drift(%)	Limit (w/kg)	Ref.Plot #
MHz	Channel							
897.4	37	GSM900(2 slots)	0	Back	1.543	-0.90	4.0	11
1747.6	699	DCS1800(2 slots)	0	Back	0.356	3.30	4.0	12
897.6	2788	WCDMA Band VIII	0	Back	1.183	0.24	4.0	13
1950.0	9750	WCDMA Band I	0	Back	1.315	-2.49	4.0	14
2442.0	7	802.11b	0	Back	0.406	-0.86	4.0	15
1950.0	18300	LTE1	0	Back	1.174	-0.01	4.0	16
1747.5	19575	LTE3	0	Back	3.589	-4.49	4.0	17
1720.0	19300	LTE3	0	Back	3.258	1.56	4.0	--
1775.0	19850	LTE3	0	Back	3.410	0.23	4.0	--
2535.0	21100	LTE7	0	Back	2.165	-0.11	4.0	18
2510.0	20850	LTE7	0	Back	1.847	3.62	4.0	--
2560.0	21350	LTE7	0	Back	1.958	0.17	4.0	--
2595.0	38000	LTE8	0	Back	0.743	0.93	4.0	19
1900.0	38450	LTE20	0	Back	1.038	-0.04	4.0	20

**Note:**

- 1.When the 1-g SAR is  $\leq 2.0\text{W/kg}$ , testing for low and high channel is optional.
- 2.The EUT is a Class B TD-LTE wireless data terminal which can be attached to GSM /WCDMA/LTE service
- 3.The Multi-slot Classes of EUT is Class 12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 2, when perform the multiple slots scan, 1DL+2UL is the worse case.



#### 4.4. Measurement Uncertainty (450MHz-6GHz)

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in IEEE 1528: 2013. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Uncertainty Component	Tol (+-%)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Veff
Measurement System								
Probe calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	√3	$\sqrt{1 - C_p}$	$\sqrt{1 - C_p}$	1.43	1.43	∞
Hemispherical Isotropy	5.9	R	√3	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
Boundary effect	1.0	R	√3	1	1	0.58	0.58	∞
Linearity	4.7	R	√3	1	1	2.71	2.71	∞
System detection limits	1.0	R	√3	1	1	0.58	0.58	∞
Readout Electronics	0.5	N	1	1	1	0.50	0.50	∞
Response Time	0.0	R	√3	1	1	0.00	0.00	∞
Integration Time	1.4	R	√3	1	1	0.81	0.81	∞
RF ambient Conditions - Noise	3.0	R	√3	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	3.0	R	√3	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	1.4	R	√3	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.4	R	√3	1	1	0.81	0.81	∞
Max. SAR Evaluation	1.0	R	√3	1	1	0.6	0.6	∞
Test sample Related								
Device positioning	2.6	N	1	1	1	2.6	2.6	11
Device holder	3.0	N	1	1	1	3.0	3.0	7
Drift of output power	5.0	N	√3	1	1	2.89	2.89	∞
Phantom and Tissue Parameters								
Phantom uncertainty	4.00	R	√3	1	1	2.31	2.31	∞
Liquid conductivity (target)	2.50	N	1	0.78	0.71	1.95	1.78	5
Liquid conductivity (meas)	4.00	N	1	0.23	0.26	0.92	1.04	5
Liquid Permittivity (target)	2.50	N	1	0.78	0.71	1.95	1.78	∞
Liquid Permittivity (meas)	5.00	N	1	0.23	0.26	1.15	1.30	∞
Combined Standard		RSS	$U_c = \sqrt{\sum_{i=1}^n C_i^2 U_i^2}$			10.63 %	10.54%	
Expanded Uncertainty (95% Confidence interval)	U = k U <sub>C</sub> , k=2					21.26 %	21.08%	



## 4.5. System Check Results

Test mode:900MHz

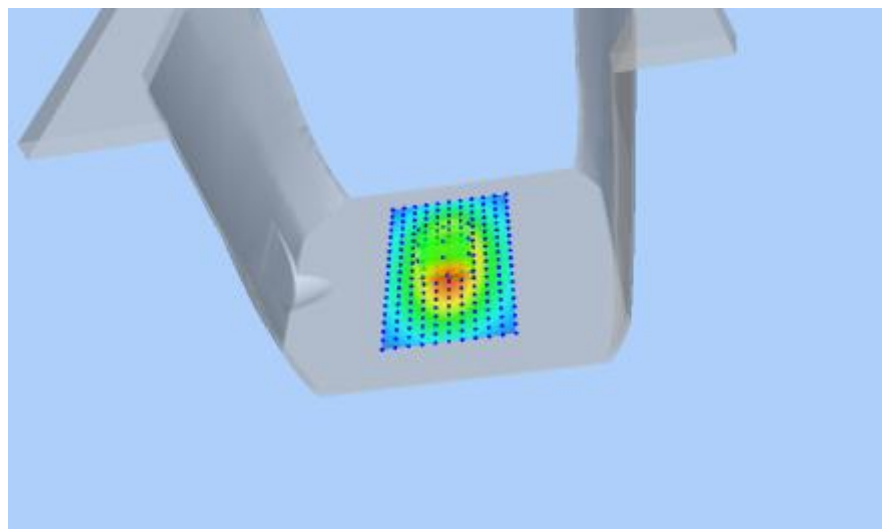
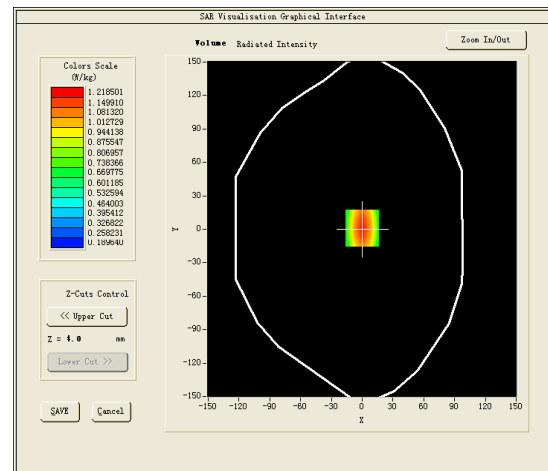
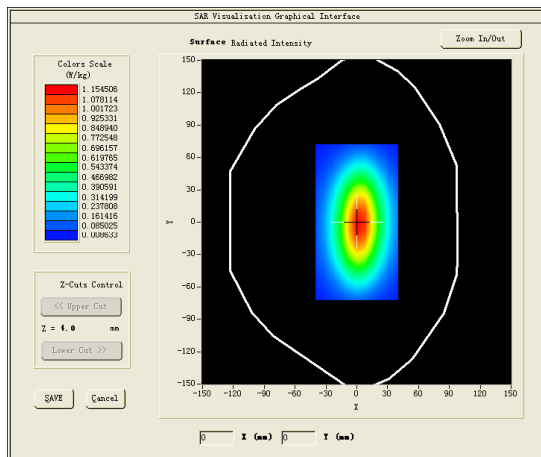
Product Description:Validation

Model:Dipole SID900

E-Field Probe: SSE2(SN 31/17 EPGO324)

Test Date: June 23, 2020

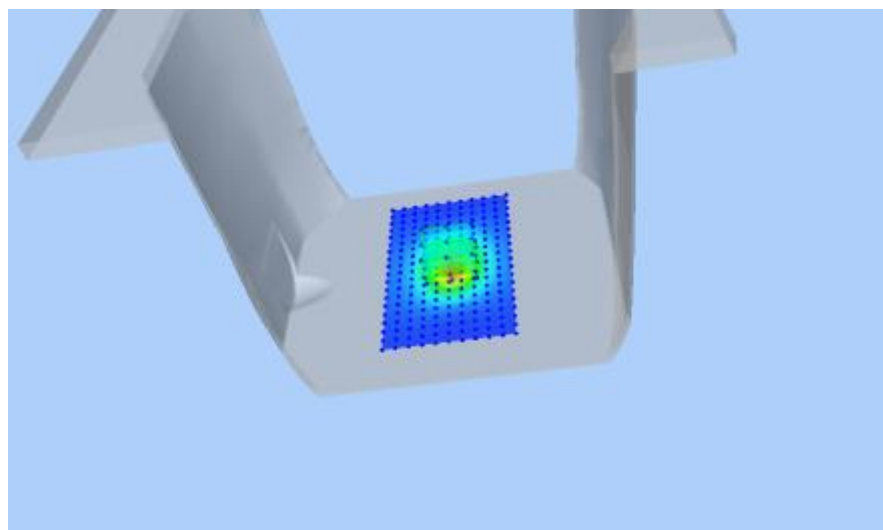
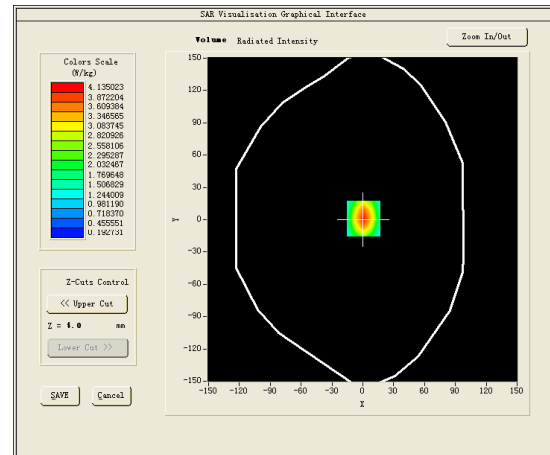
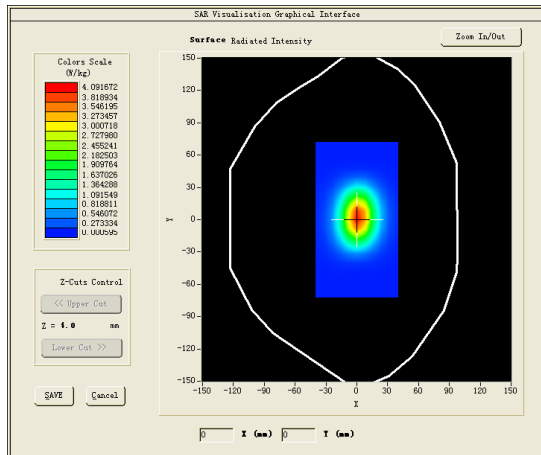
Medium(liquid type)	HSL_900
Frequency (MHz)	900.0000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.94
Input power	100mW
Crest Factor	1.0
Conversion Factor	1.54
Variation (%)	-1.410000
SAR 10g (W/Kg)	0.721496
SAR 1g (W/Kg)	1.143251
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





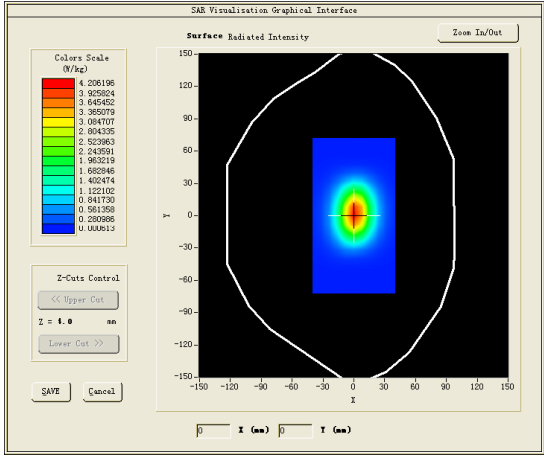
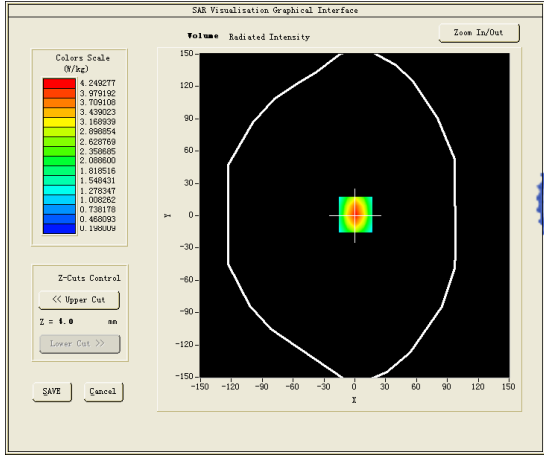
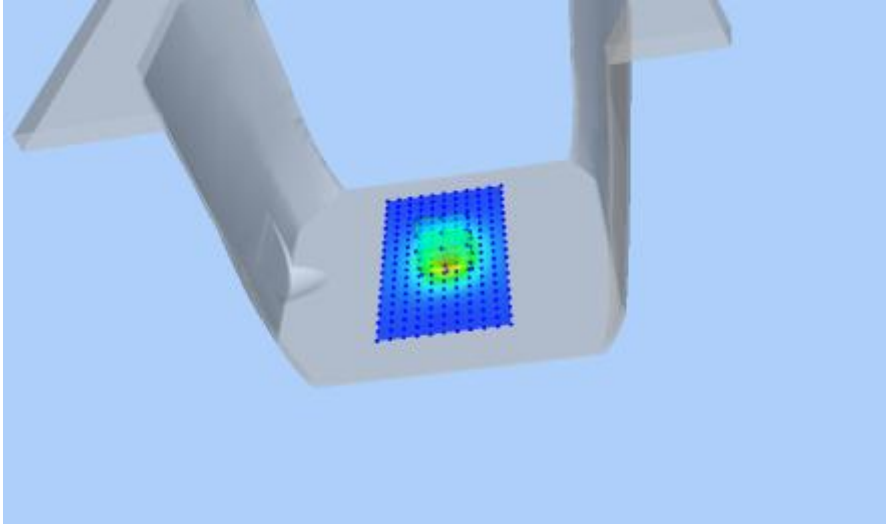
Test mode:1800MHz  
Product Description:Validation  
Model:Dipole SID1800  
E-Field Probe: SSE2(SN 31/17 EPGO324)  
Test Date: June 28, 2020

Medium(liquid type)	HSL_1800
Frequency (MHz)	1800.0000
Relative permittivity (real part)	40.64
Conductivity (S/m)	1.43
Input power	100mW
Crest Factor	1.0
Conversion Factor	1.65
Variation (%)	-3.460000
SAR 10g (W/Kg)	1.887692
SAR 1g (W/Kg)	4.013524
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





Test mode:2000MHz  
Product Description:Validation  
Model:Dipole SID2000  
E-Field Probe: SSE2(SN 31/17 EPGO324)  
Test Date: June 30, 2020

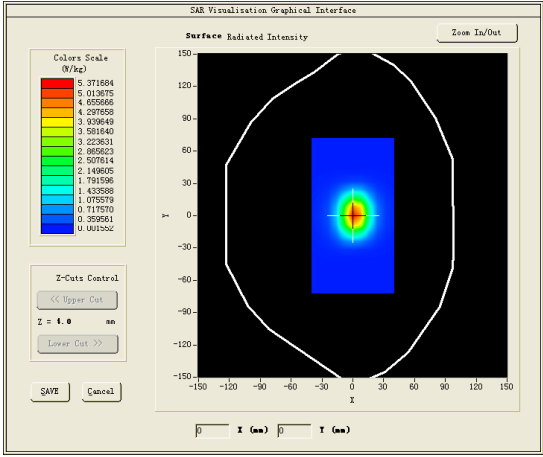
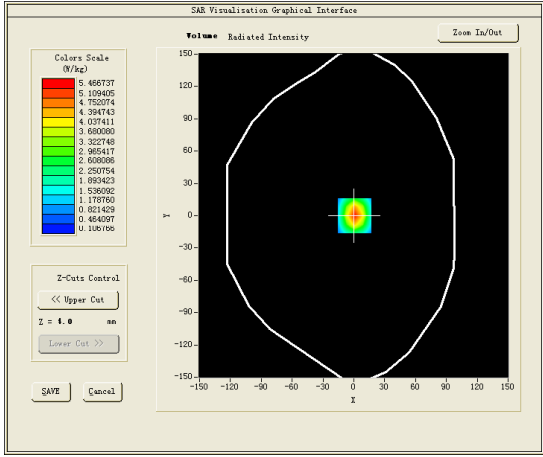
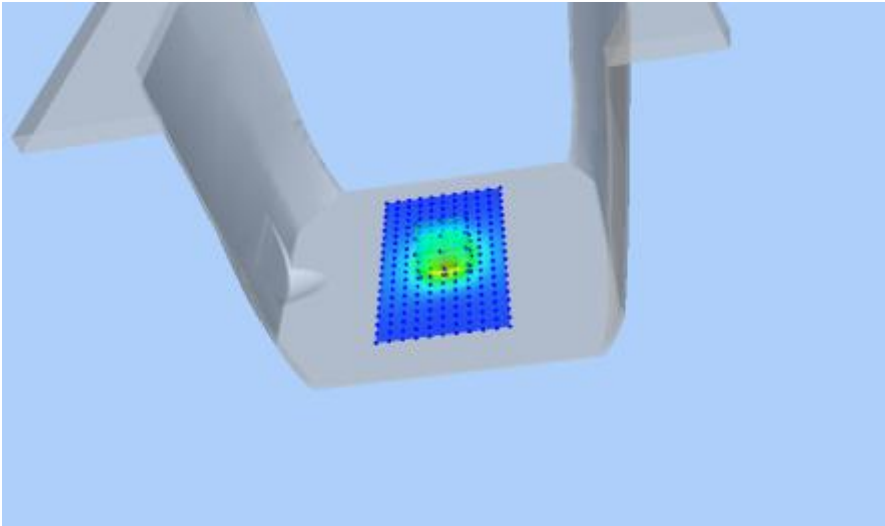
Medium(liquid type)	HSL_2000
Frequency (MHz)	2000.0000
Relative permittivity (real part)	39.17
Conductivity (S/m)	1.42
Input power	100mW
Crest Factor	1.0
Conversion Factor	1.83
Variation (%)	-3.970000
SAR 10g (W/Kg)	1.957112
SAR 1g (W/Kg)	4.046892
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>
	
	





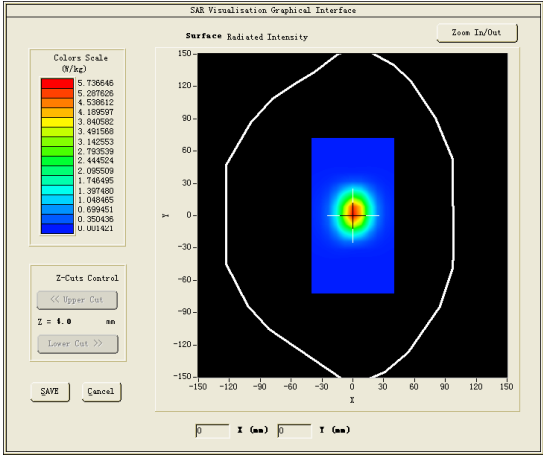
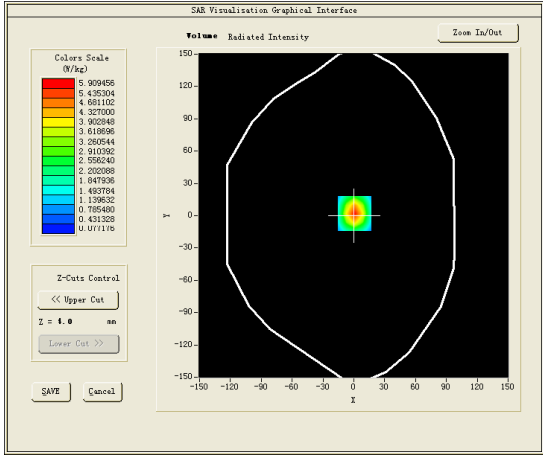
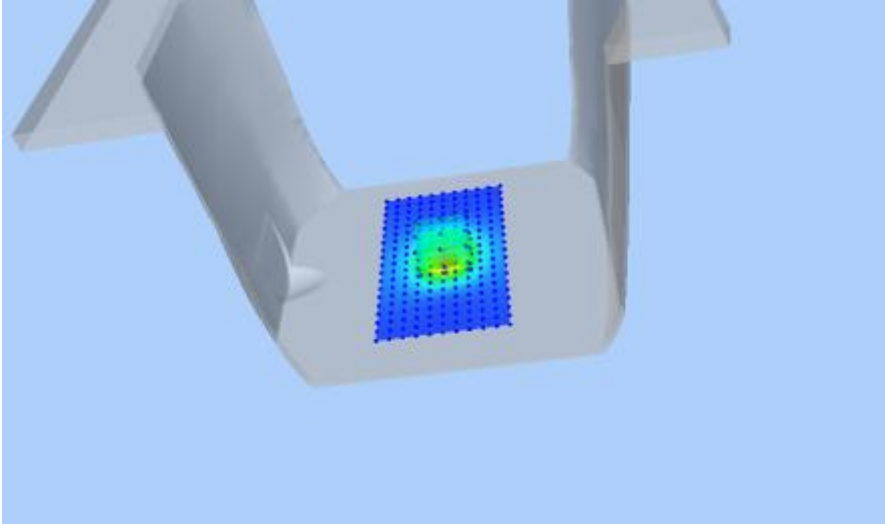


Test mode:2450MHz  
Product Description:Validation  
Model:Dipole SID2450  
E-Field Probe: SSE2(SN 31/17 EPGO324)  
Test Date: July 02, 2020

Medium(liquid type)	HSL_2450
Frequency (MHz)	2450.0000
Relative permittivity (real part)	38.35
Conductivity (S/m)	1.78
Input power	100mW
Crest Factor	1.0
Conversion Factor	1.94
Variation (%)	-1.790000
SAR 10g (W/Kg)	2.339756
SAR 1g (W/Kg)	4.976425
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>
	
	



Test mode:2600MHz  
Product Description:Validation  
Model:Dipole SID2600  
E-Field Probe: SSE2(SN 31/17 EPGO324)  
Test Date: July 03, 2020

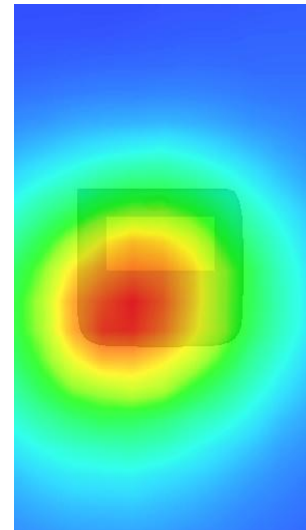
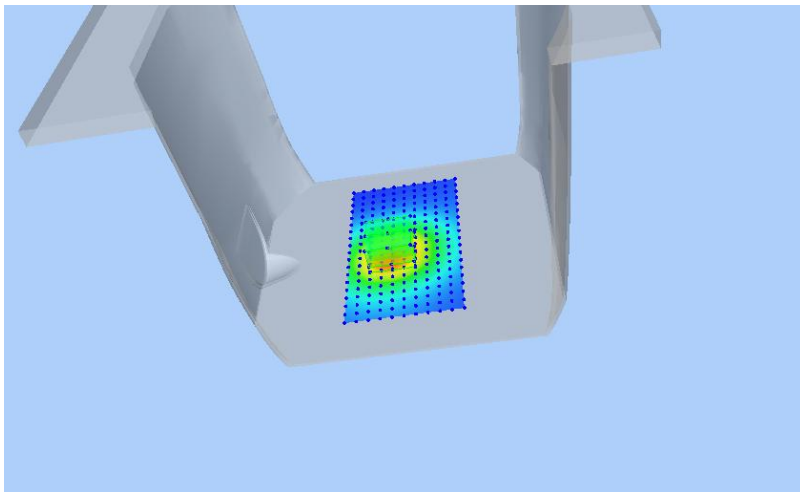
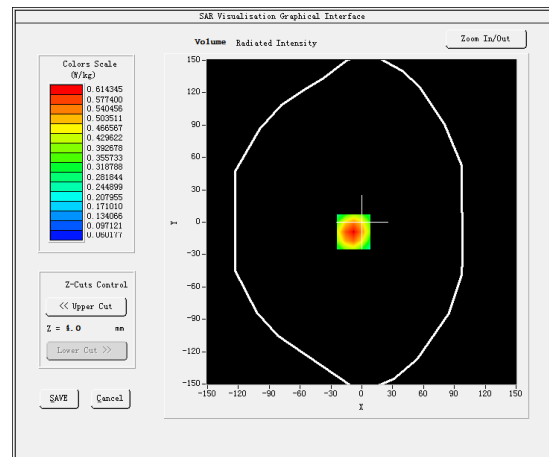
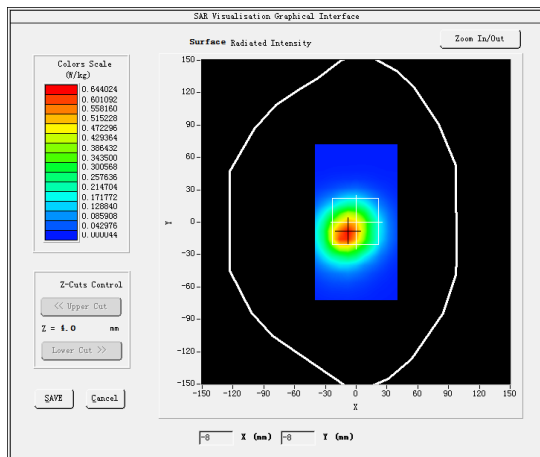
Medium(liquid type)	HSL_2600
Frequency (MHz)	2600.0000
Relative permittivity (real part)	40.35
Conductivity (S/m)	1.90
Input power	100mW
Crest Factor	1.0
Conversion Factor	1.89
Variation (%)	-1.270000
SAR 10g (W/Kg)	2.453607
SAR 1g (W/Kg)	5.610637
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>
	
	



#### 4.6. SAR Test Graph Results

#1 Test Mode: GSM900MHz, Middle channel (Front of face)  
Product Description: myFirst Fone R1s, S11  
Model: KW1305, G4K1  
Test Date: June 23, 2020

Medium (liquid type)	HSL_900
Frequency (MHz)	897.4000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.94
E-Field Probe	SN 31/17 EPGO324
Crest Factor	8.0
Conversion Factor	1.54
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7, dx=8mm dy=8mm dz=5mm
Variation (%)	-3.990000
SAR 10g (W/Kg)	0.355173
SAR 1g (W/Kg)	0.579348
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#2

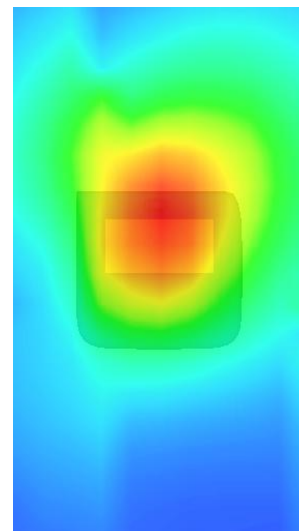
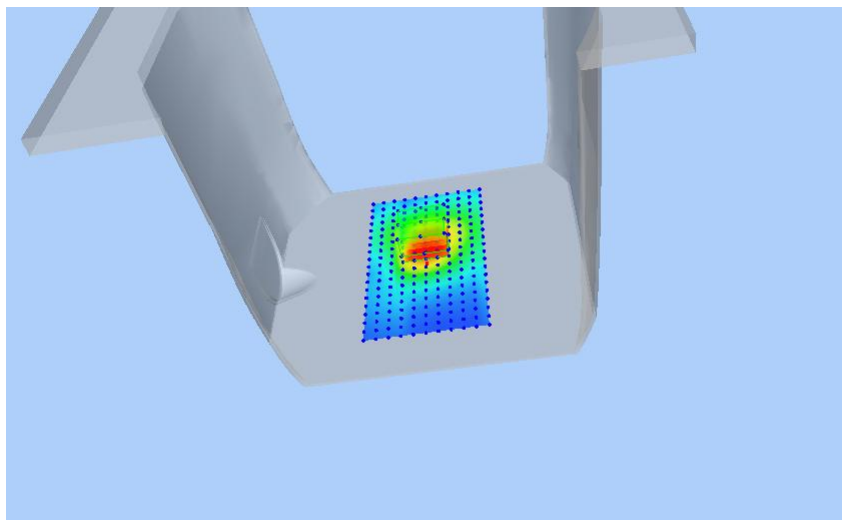
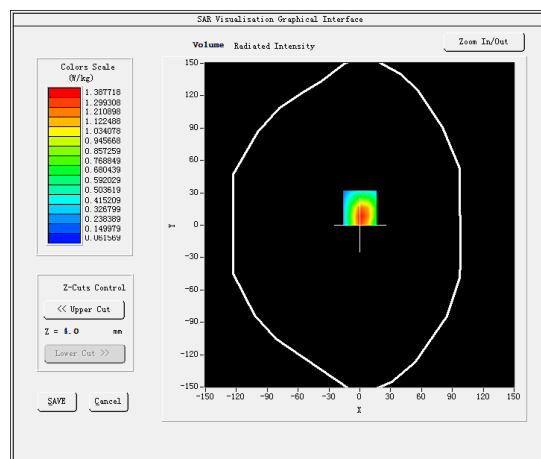
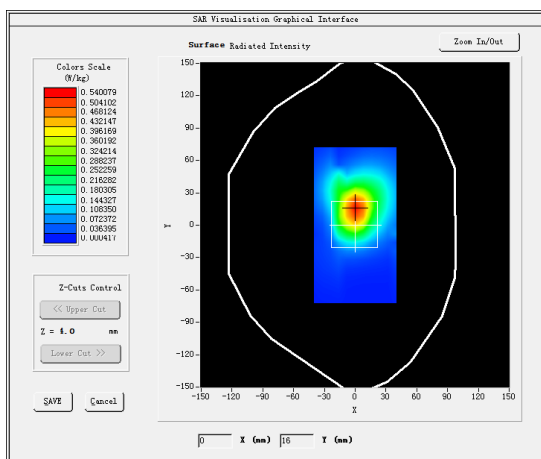
Test Mode: GSM1800MHz, Middle channel (Front of face)

Product Description: myFirst Fone R1s, S11

Model: KW1305, G4K1

Test Date: June 28, 2020

Medium (liquid type)	HSL_1800
Frequency (MHz)	1747.4000
Relative permittivity (real part)	40.64
Conductivity (S/m)	1.43
E-Field Probe	SN 31/17 EPG0324
Crest Factor	8.0
Conversion Factor	1.65
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7, dx=8mm dy=8mm dz=5mm
Variation (%)	-1.360000
SAR 10g (W/Kg)	0.698328
SAR 1g (W/Kg)	1.301498
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#3

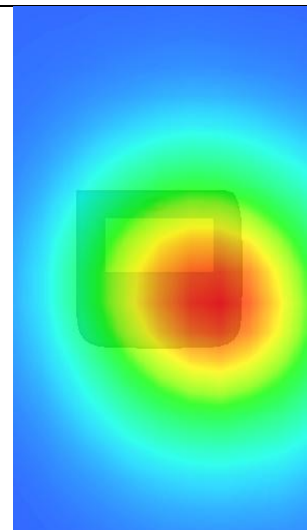
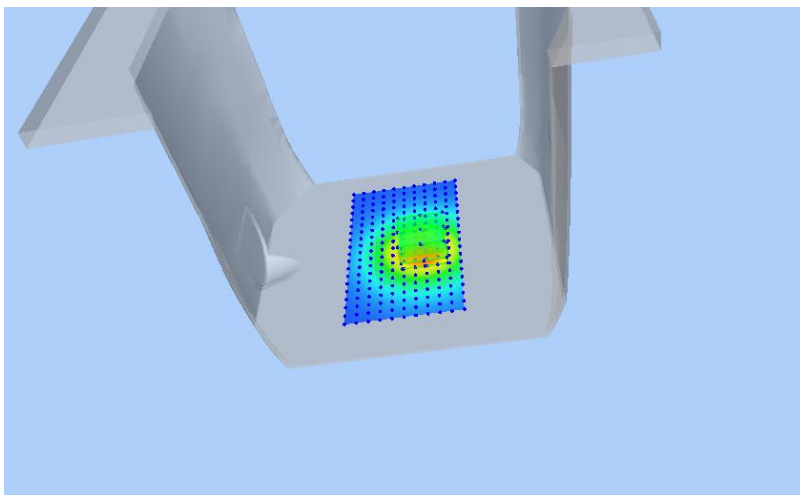
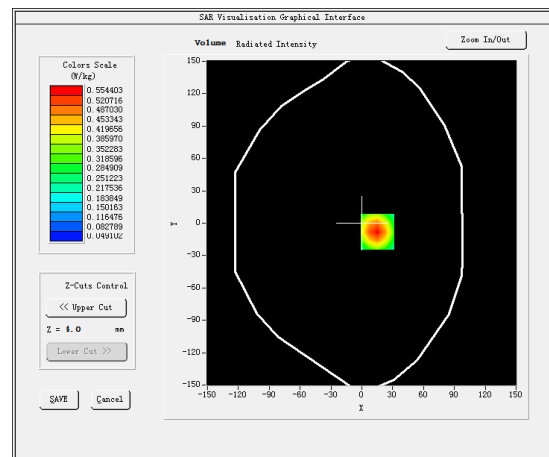
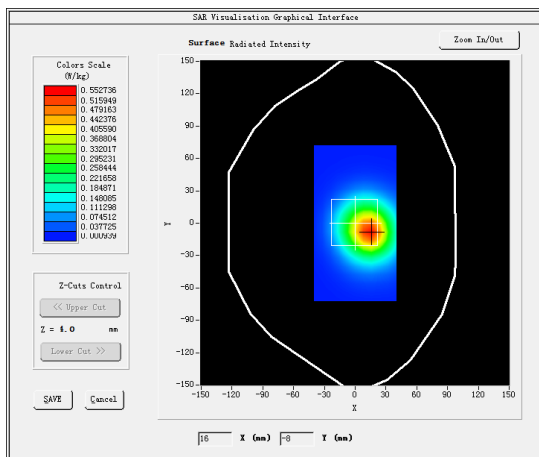
Test Mode:WCDMA 900MHz,Middle channel(Front of face)

Product Description: myFirst Fone R1s, S11

Model: KW1305, G4K1

Test Date: June 23, 2020

Medium(liquid type)	HSL_900
Frequency (MHz)	897.6000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.94
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.54
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.010000
SAR 10g (W/Kg)	0.314159
SAR 1g (W/Kg)	0.525966
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#4

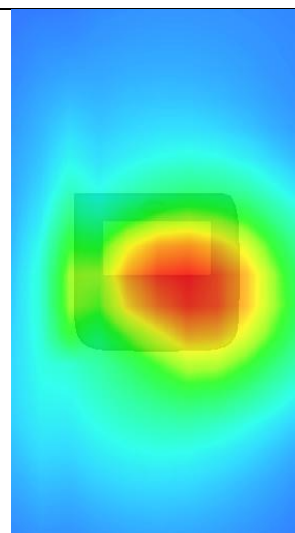
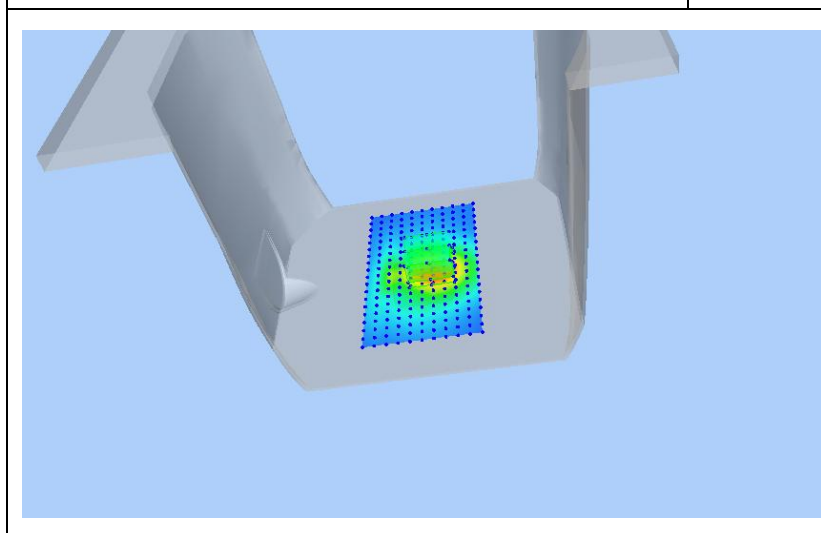
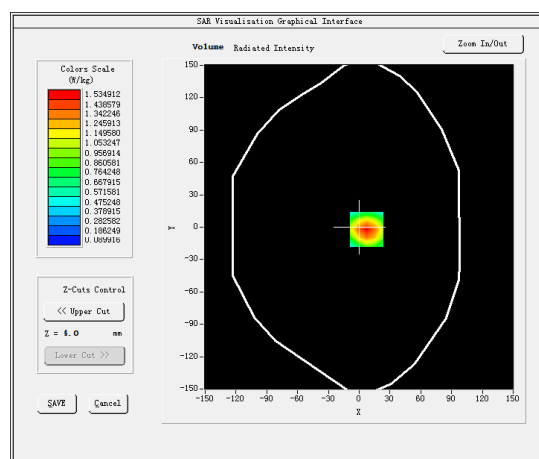
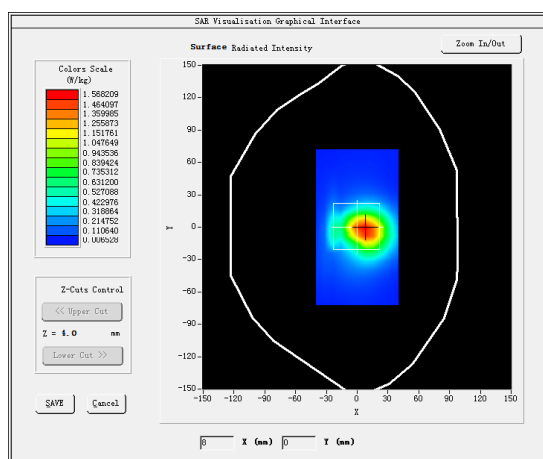
Test Mode:WCDMA2100MHz,Middle channel(Front of face)

Product Description: myFirst Fone R1s, S11

Model:KW1305, G4K1

Test Date: June 30, 2020

Medium(liquid type)	HSL_2000
Frequency (MHz)	1950.0000
Relative permittivity (real part)	39.17
Conductivity (S/m)	1.42
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.83
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.440000
SAR 10g (W/Kg)	0.832052
SAR 1g (W/Kg)	1.439506
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#5

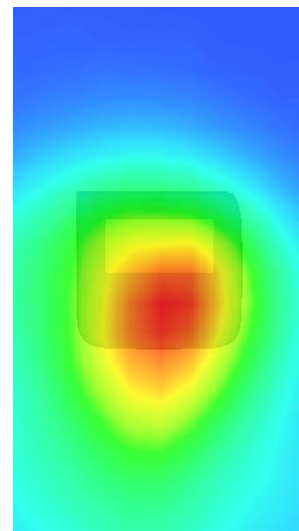
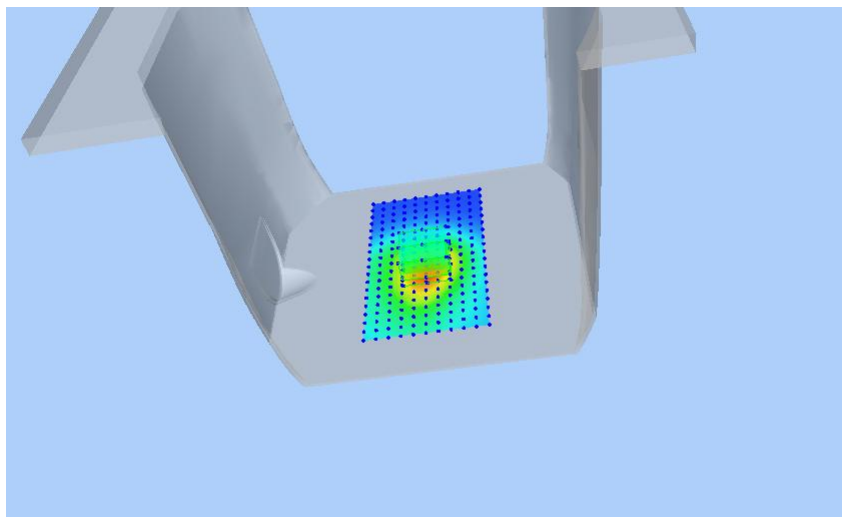
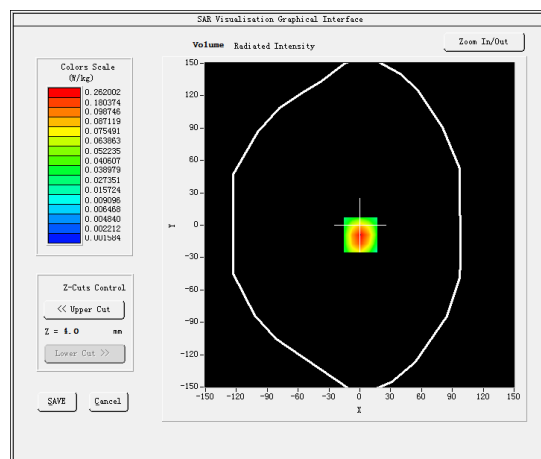
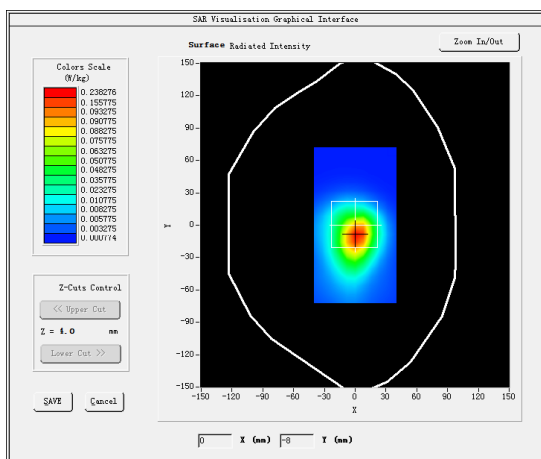
Test Mode:802.11B,Middle channel(Front of face)

Product Description: myFirst Fone R1s, S11

Model:KW1305, G4K1

Test Date: July 02, 2020

Medium(liquid type)	HSL_2450
Frequency (MHz)	2442.0000
Relative permittivity (real part)	38.35
Conductivity (S/m)	1.78
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.91
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.280000
SAR 10g (W/Kg)	0.133139
SAR 1g (W/Kg)	0.238103
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>







#6

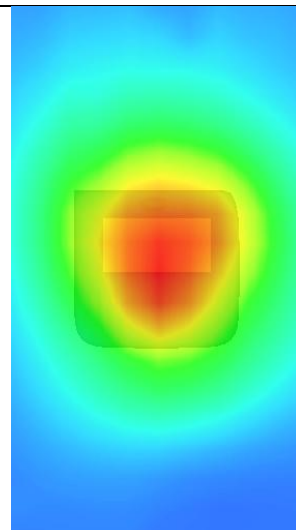
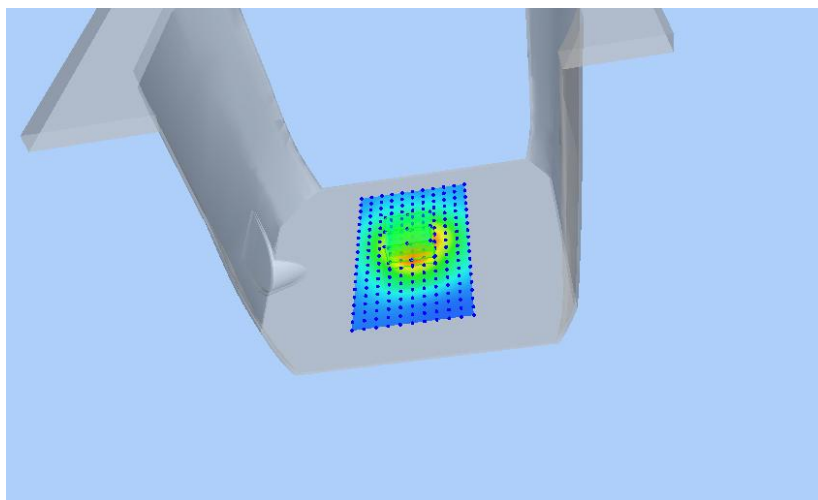
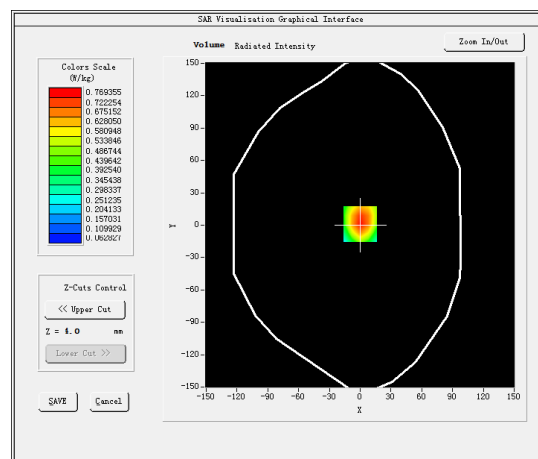
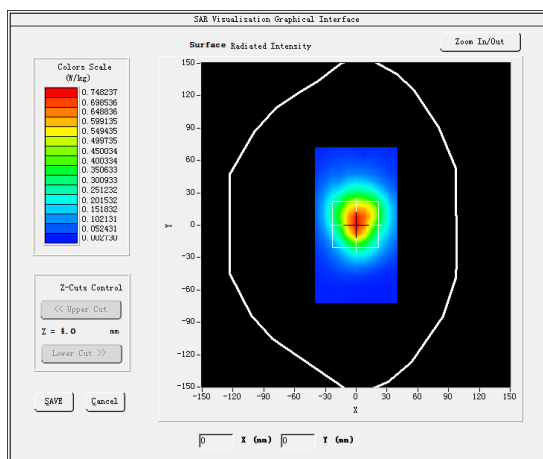
Test Mode:E-UTRA Band1,Middle channel( Front of face )

Product Description: myFirst Fone R1s, S11

Model: KW1305, G4K1

Test Date: June 30, 2020

Medium(liquid type)	HSL_2000
Frequency (MHz)	1950.0000
Relative permittivity (real part)	39.17
Conductivity (S/m)	1.42
E-Field Probe	SN 31/17 EPG0324
Crest Factor	1.0
Conversion Factor	1.83
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	3.120000
SAR 10g (W/Kg)	0.428916
SAR 1g (W/Kg)	0.730291
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#7

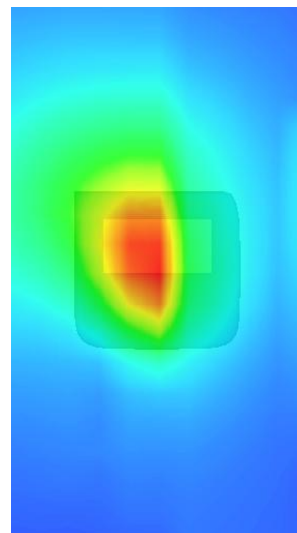
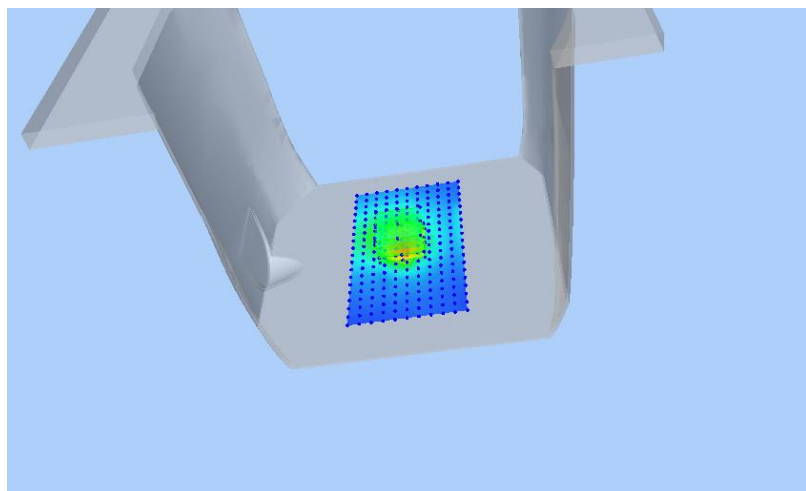
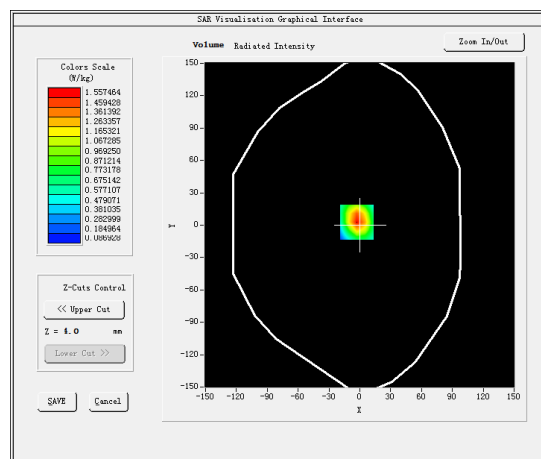
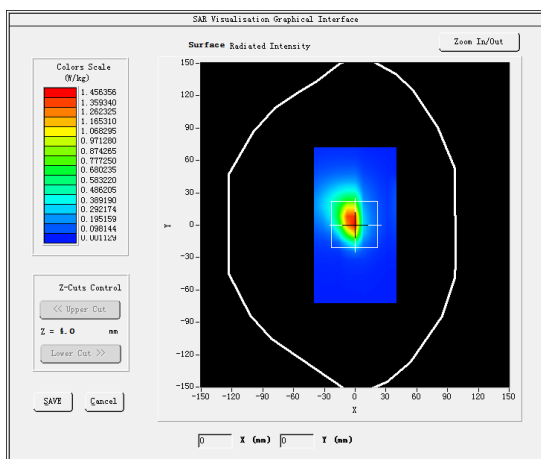
Test Mode:E-UTRA3,Middle channel(Front of face)

Product Description: myFirst Fone R1s, S11

Model:KW1305, G4K1

Test Date: June 28, 2020

Medium(liquid type)	HSL_1800
Frequency (MHz)	1747.5000
Relative permittivity (real part)	40.64
Conductivity (S/m)	1.43
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.65
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	1.170000
SAR 10g (W/Kg)	0.812127
SAR 1g (W/Kg)	1.444408
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#8

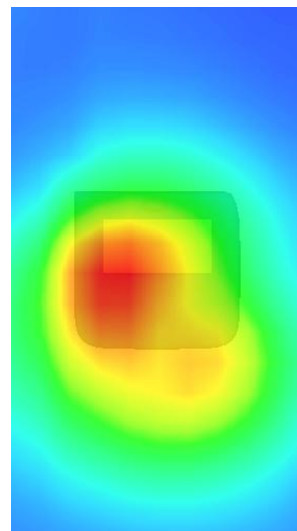
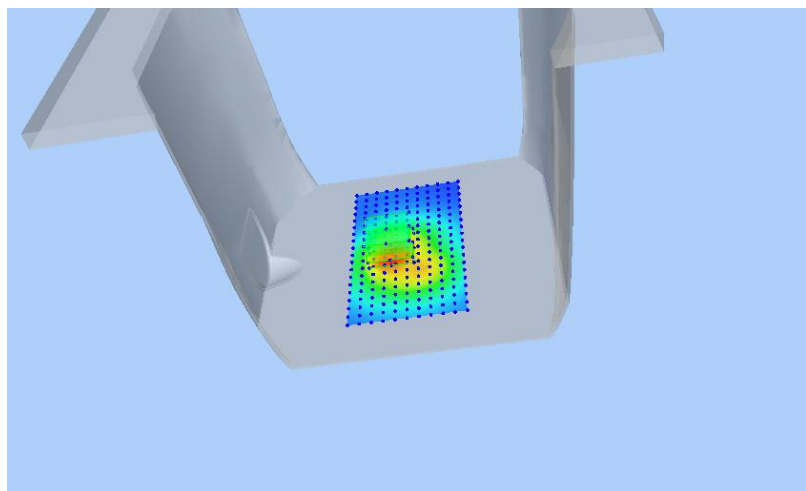
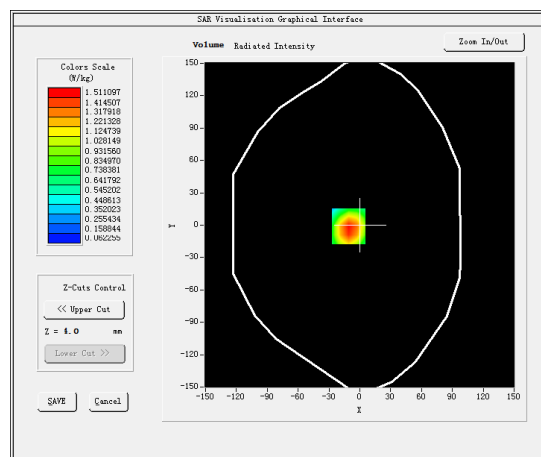
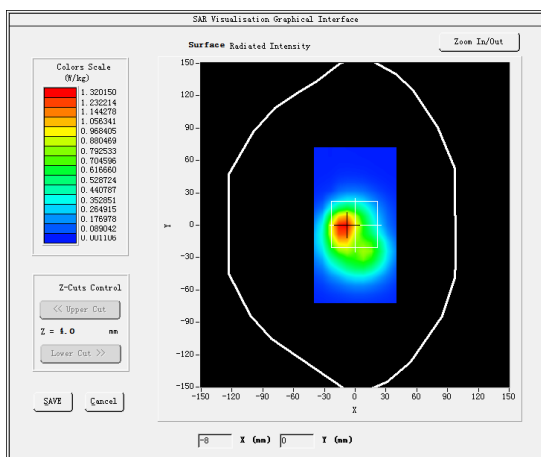
Test Mode: E-UTRA7,Middle channel(Front of face)

Product Description: myFirst Fone R1s, S11

Model:KW1305, G4K1

Test Date: July 03, 2020

Medium(liquid type)	HSL_2600
Frequency (MHz)	2535.0000
Relative permittivity (real part)	40.35
Conductivity (S/m)	1.90
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.89
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	2.620000
SAR 10g (W/Kg)	0.801868
SAR 1g (W/Kg)	1.431586
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#9

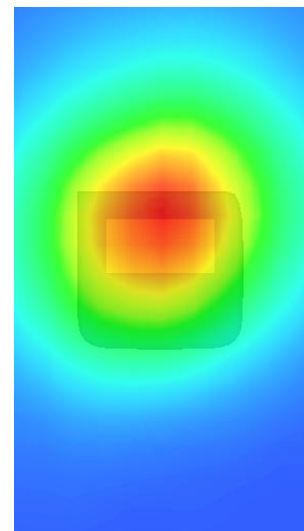
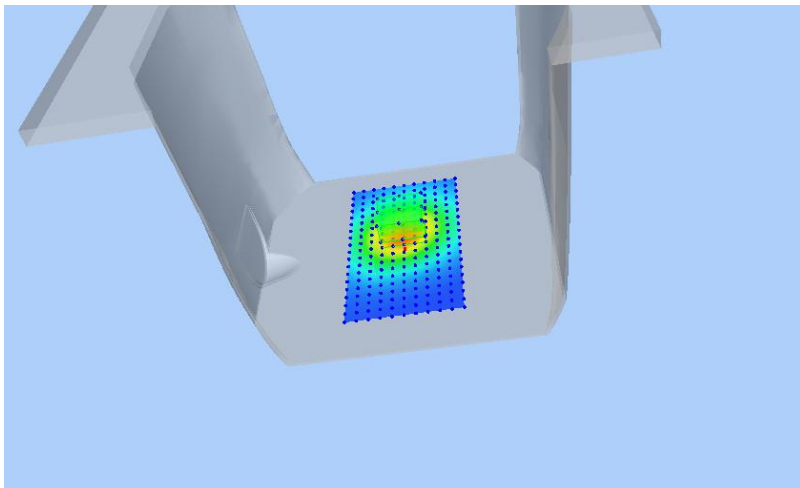
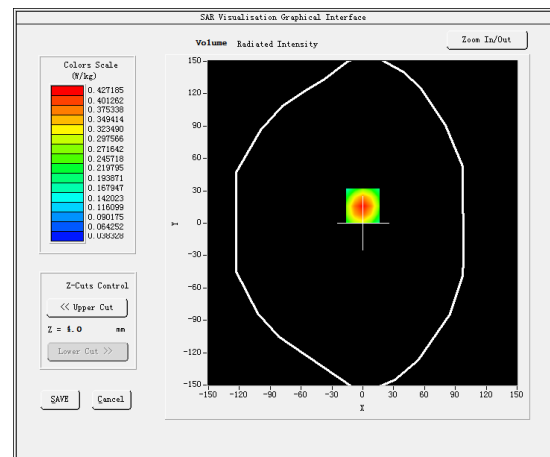
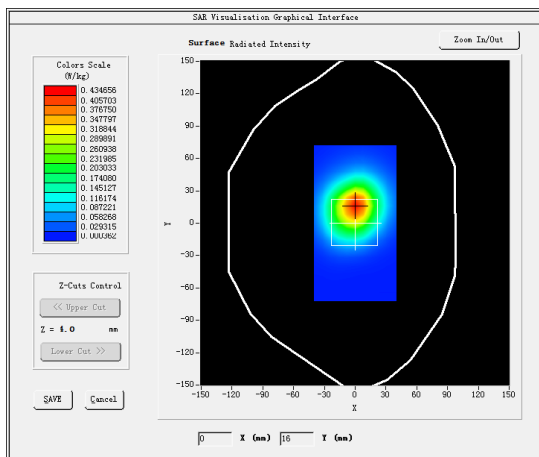
Test Mode: E-UTRA8,Middle channel(Front of face)

Product Description: myFirst Fone R1s, S11

Model: KW1305, G4K1

Test Date: June 23, 2020

Medium(liquid type)	HSL_900
Frequency (MHz)	897.5000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.94
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.54
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	1.340000
SAR 10g (W/Kg)	0.247475
SAR 1g (W/Kg)	0.413053
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#10

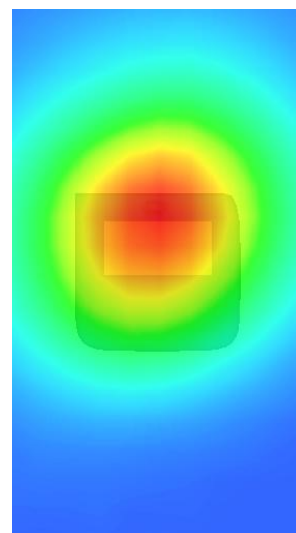
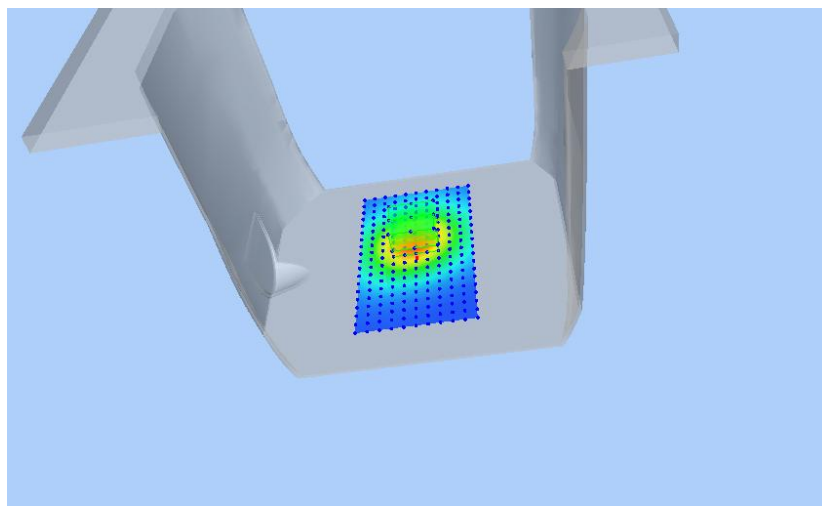
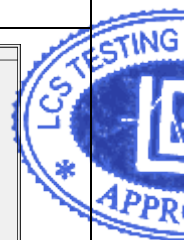
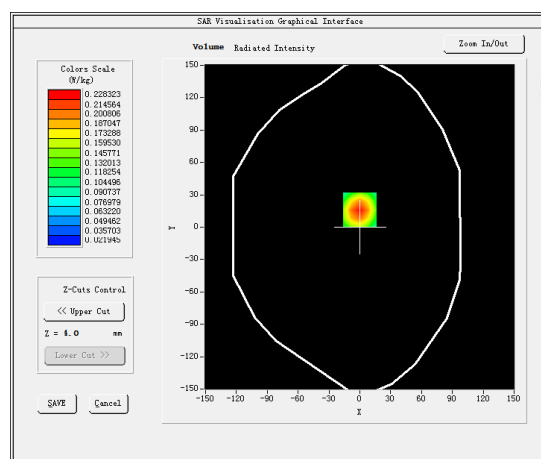
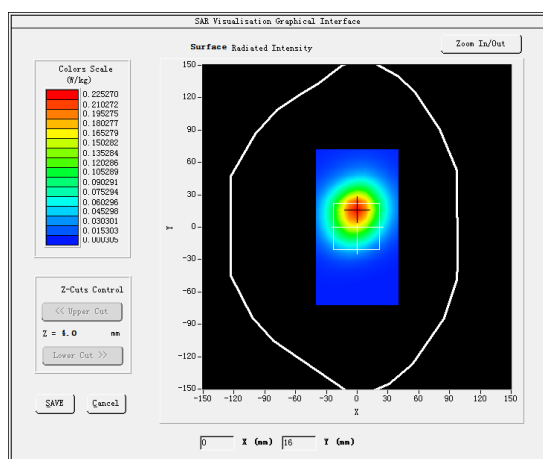
Test Mode: E-UTRA20,Middle channel(Front of face)

Product Description: myFirst Fone R1s, S11

Model: KW1305, G4K1

Test Date: June 23, 2020

Medium(liquid type)	HSL_900
Frequency (MHz)	847.0000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.94
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.54
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.040000
SAR 10g (W/Kg)	0.130177
SAR 1g (W/Kg)	0.215515
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#11

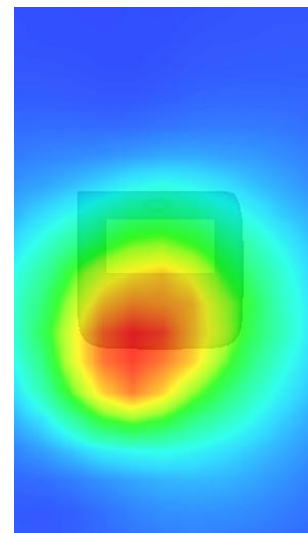
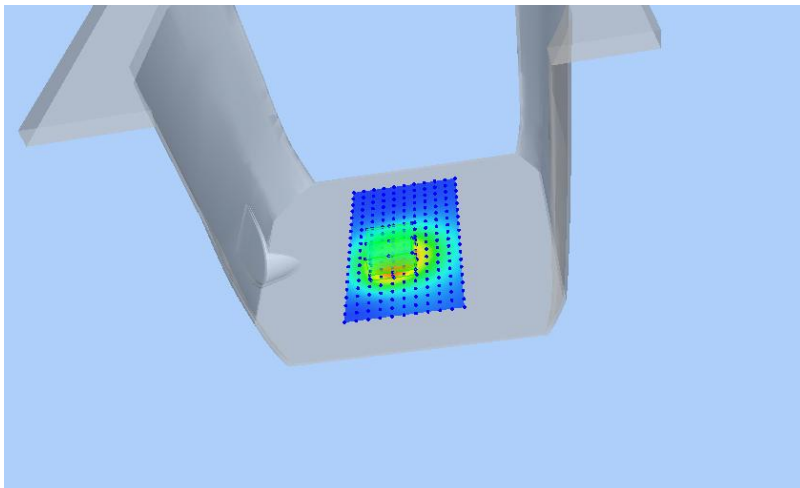
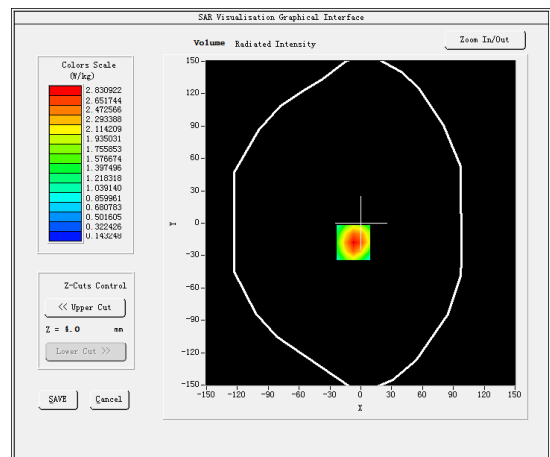
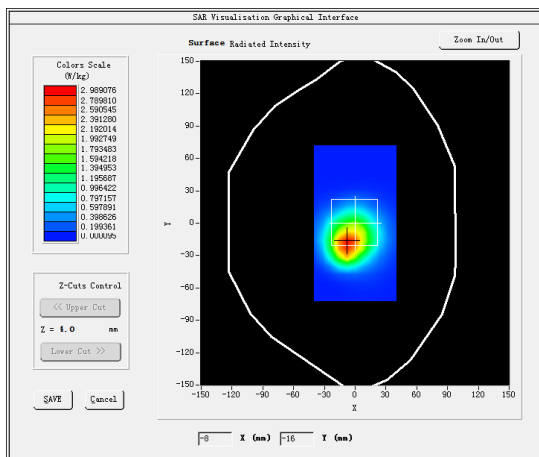
Test Mode:GPRS900MHz,Middle channel(Body-LCD Down)

Product Description:myFirst Fone R1s, S11

Model:KW1305, G4K1

Test Date: June 23, 2020

Medium(liquid type)	HSL_900
Frequency (MHz)	897.4000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.94
E-Field Probe	SN 31/17 EPG0324
Crest Factor	4.0
Conversion Factor	1.54
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.900000
SAR 10g (W/Kg)	1.543393
SAR 1g (W/Kg)	2.677112
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#12

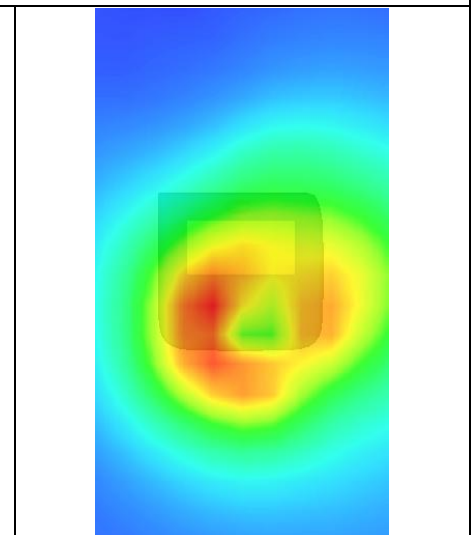
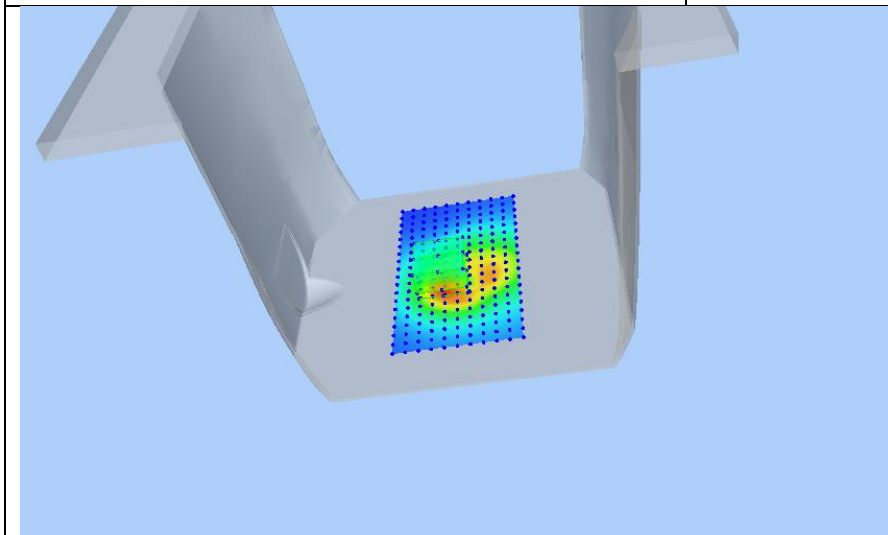
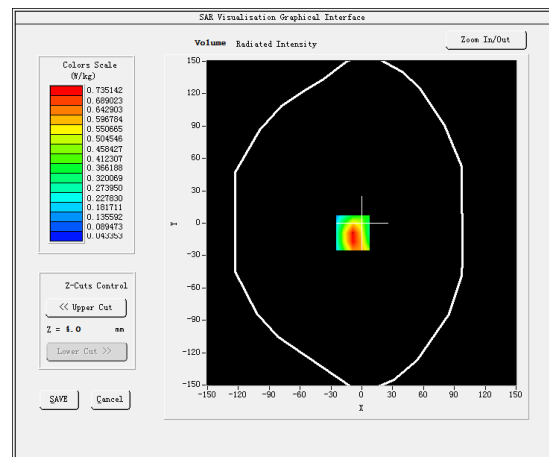
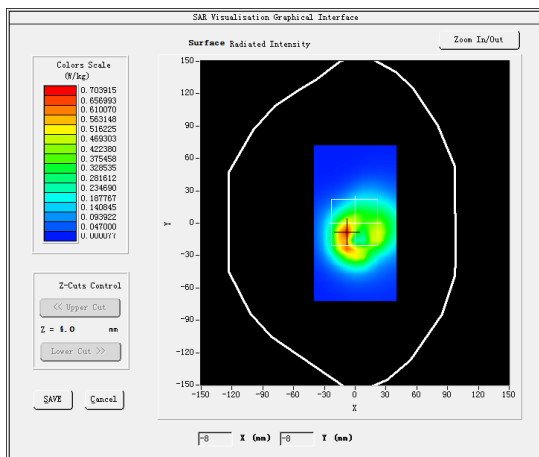
Test Mode:GPRS1800MHz,Middle channel(Body-LCD Down)

Product Description: myFirst Fone R1s, S11

Model:KW1305, G4K1

Test Date: June 28, 2020

Medium(liquid type)	HSL_1800
Frequency (MHz)	1747.4000
Relative permittivity (real part)	40.64
Conductivity (S/m)	1.43
E-Field Probe	SN 31/17 EPGO324
Crest Factor	4.0
Conversion Factor	1.65
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	3.300000
SAR 10g (W/Kg)	0.356310
SAR 1g (W/Kg)	0.703503
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>







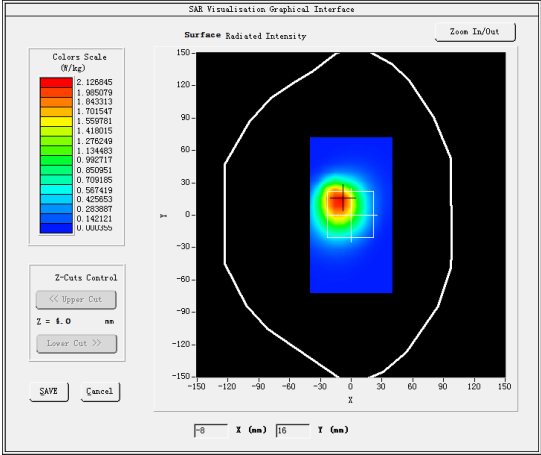
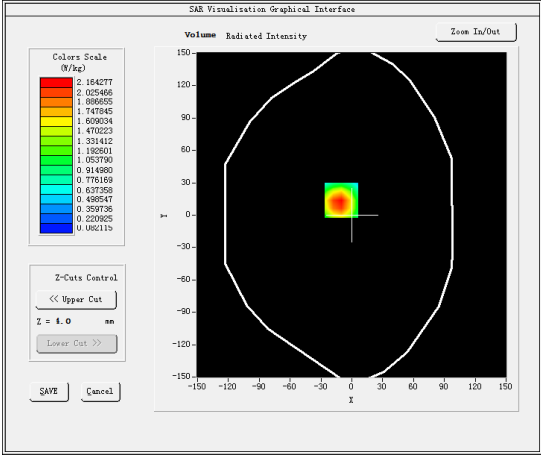
## #13

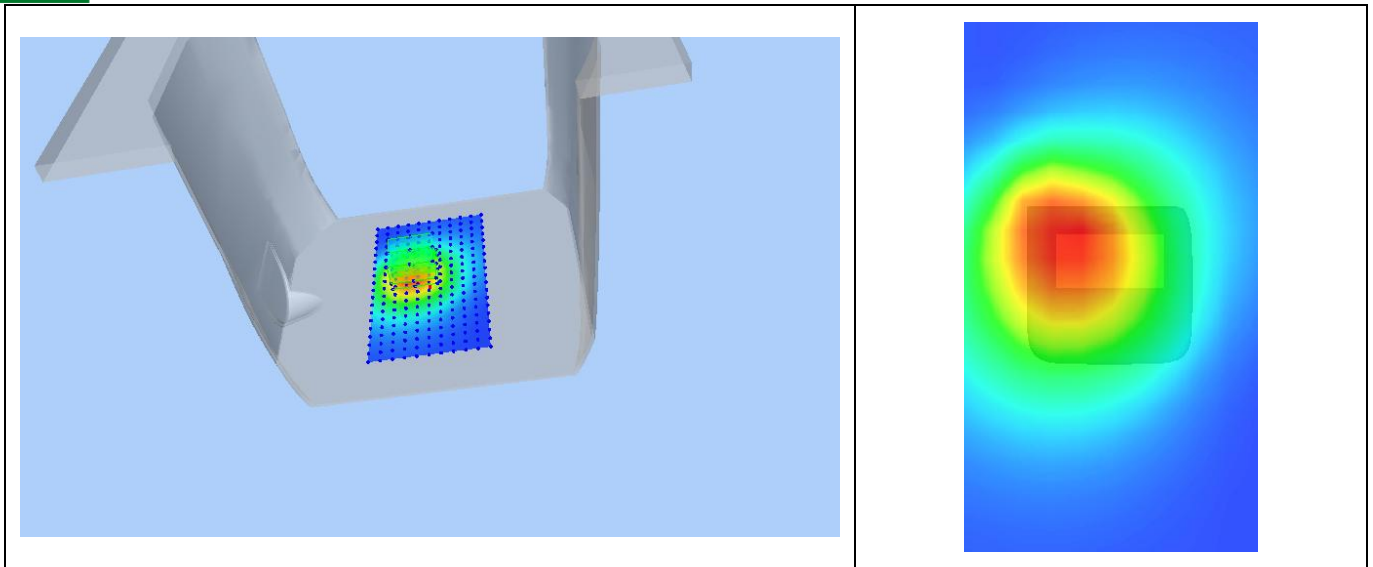
Test Mode:WCDMA 900MHz,Middle channel(Body-LCD Down )

Product Description: myFirst Fone R1s, S11

Model:KW1305, G4K1

Test Date: June 23, 2020

Medium(liquid type)	HSL_900
Frequency (MHz)	897.6000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.94
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.54
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.240000
SAR 10g (W/Kg)	1.183124
SAR 1g (W/Kg)	2.086142
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>
	



## #14

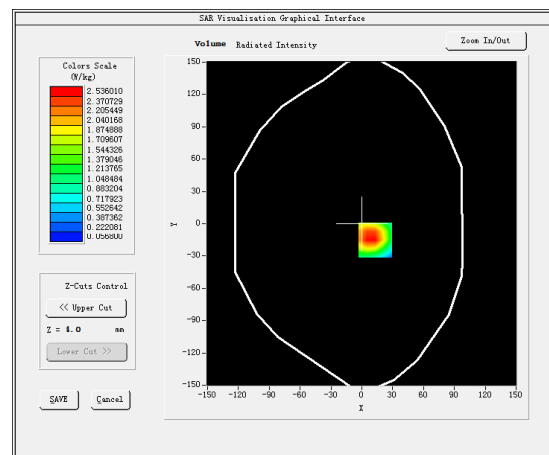
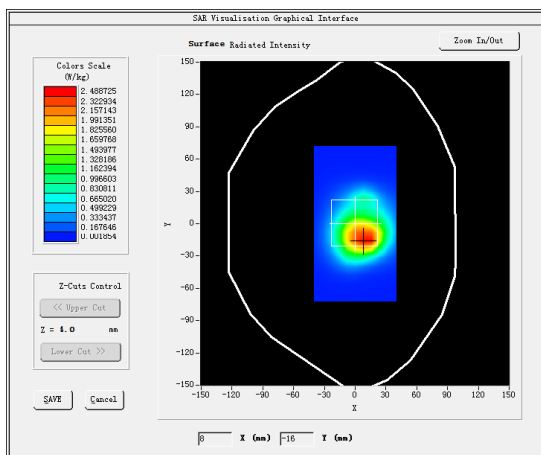
Test Mode:WCDMA2100MHz,Middle channel(Body-LCD Down)

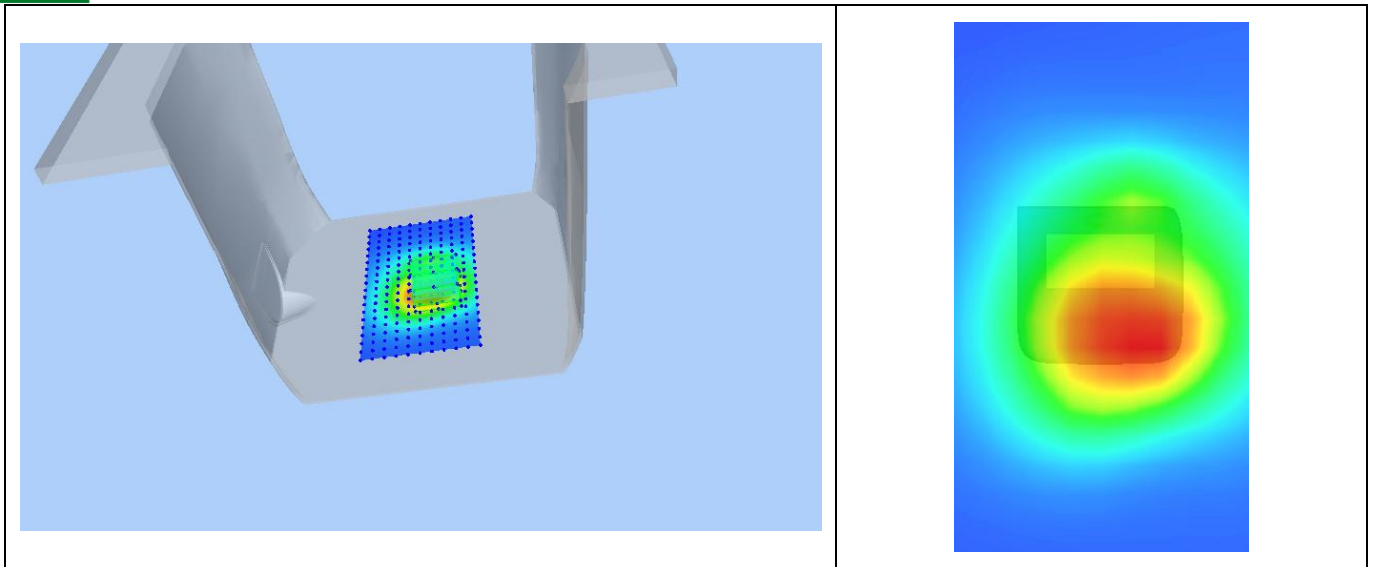
Product Description: myFirst Fone R1s, S11

Model: KW1305, G4K1

Test Date: June 30, 2020

Medium(liquid type)	HSL_2000
Frequency (MHz)	1950.0000
Relative permittivity (real part)	39.17
Conductivity (S/m)	1.42
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.83
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-2.490000
SAR 10g (W/Kg)	1.314964
SAR 1g (W/Kg)	2.481486
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





## #15

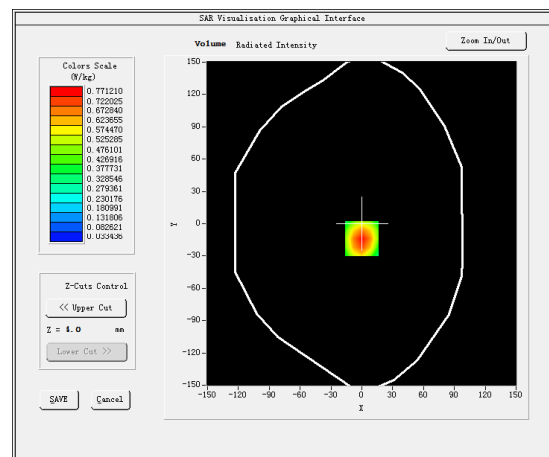
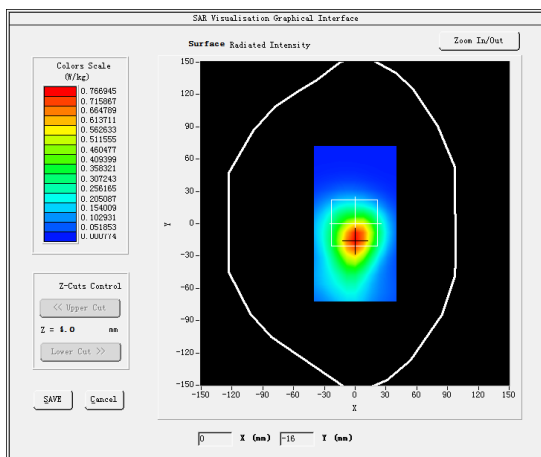
Test Mode:802.11B,Middle channel(Body-LCD Down)

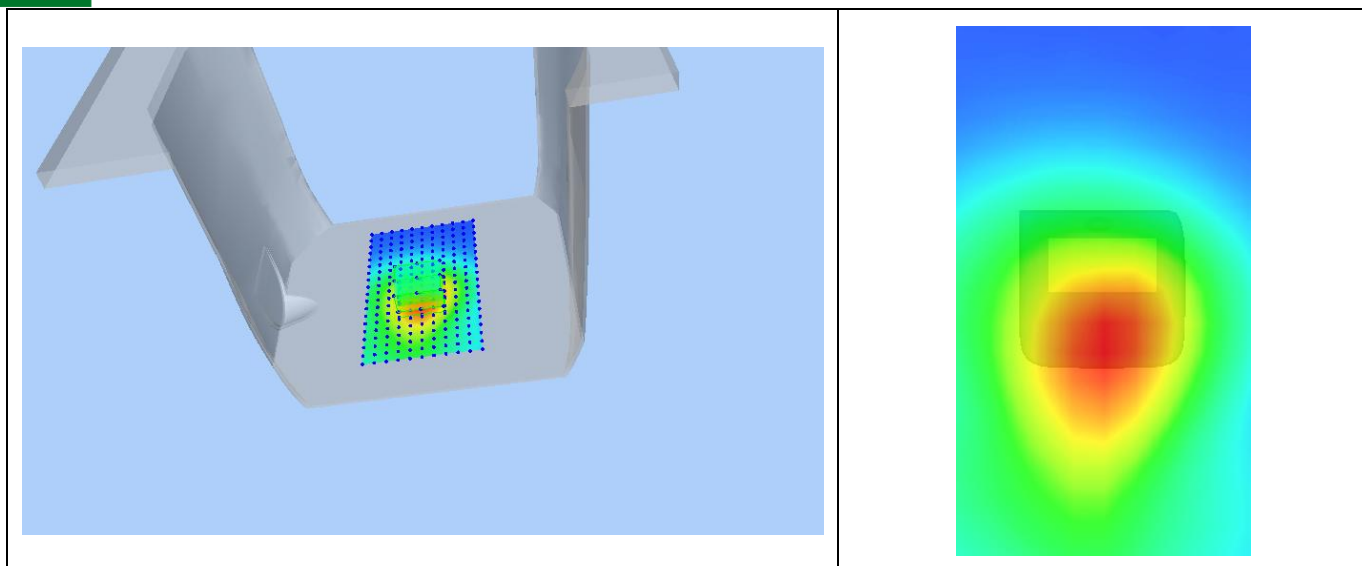
Product Description:myFirst Fone R1s, S11

Model:KW1305, G4K1

Test Date: July 02, 2020

Medium(liquid type)	HSL_2450
Frequency (MHz)	2442.0000
Relative permittivity (real part)	38.35
Conductivity (S/m)	1.78
E-Field Probe	SN 31/17 EPG0324
Crest Factor	1.0
Conversion Factor	1.91
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.860000
SAR 10g (W/Kg)	0.406054
SAR 1g (W/Kg)	0.727216
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#16

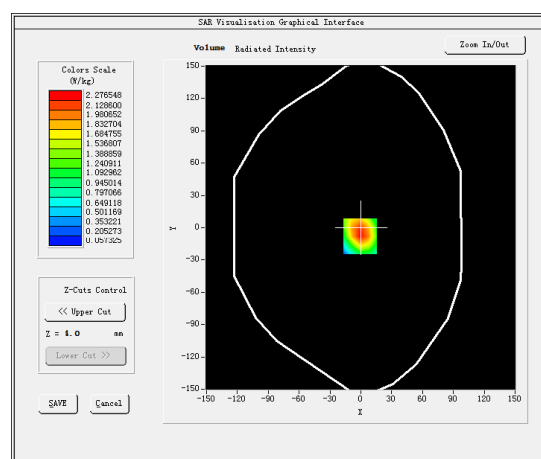
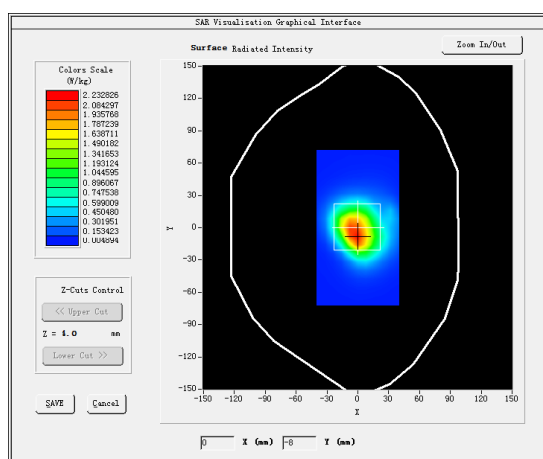
Test Mode: E-UTRA Band1,Middle channel(Body-LCD Down)

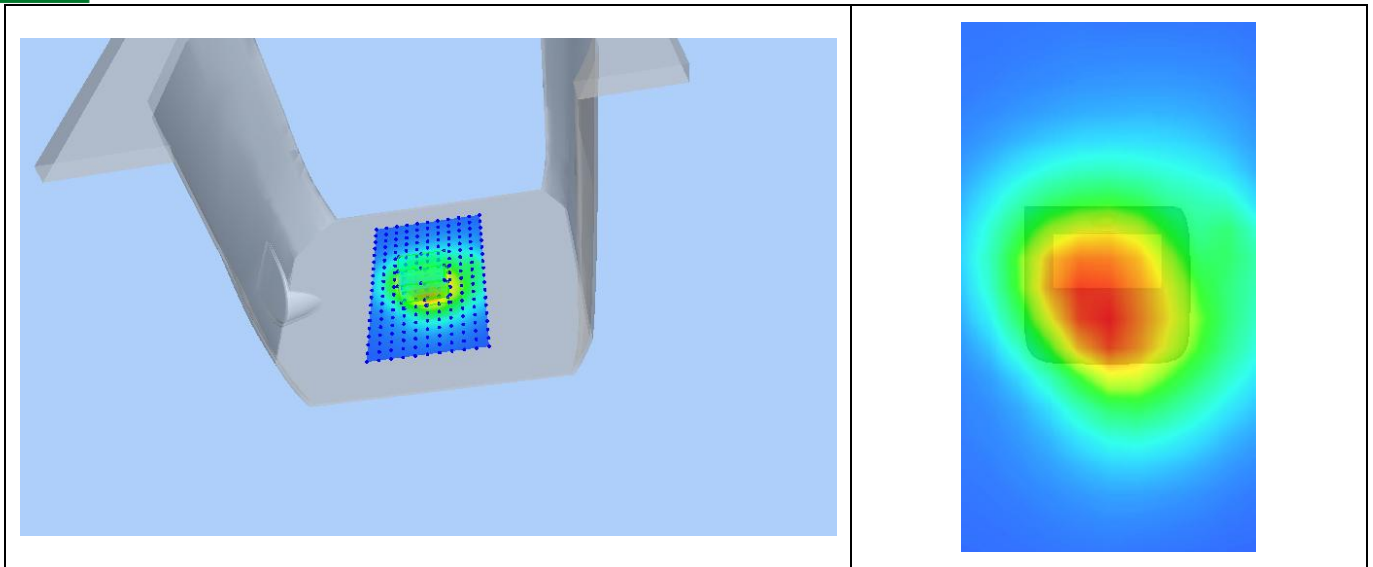
Product Description: myFirst Fone R1s, S11

Model: KW1305, G4K1

Test Date: June 30, 2020

Medium(liquid type)	HSL_2000
Frequency (MHz)	1950.0000
Relative permittivity (real part)	39.17
Conductivity (S/m)	1.42
E-Field Probe	SN 31/17 EPG0324
Crest Factor	1.0
Conversion Factor	1.83
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.610000
SAR 10g (W/Kg)	1.173920
SAR 1g (W/Kg)	2.166576
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





#17

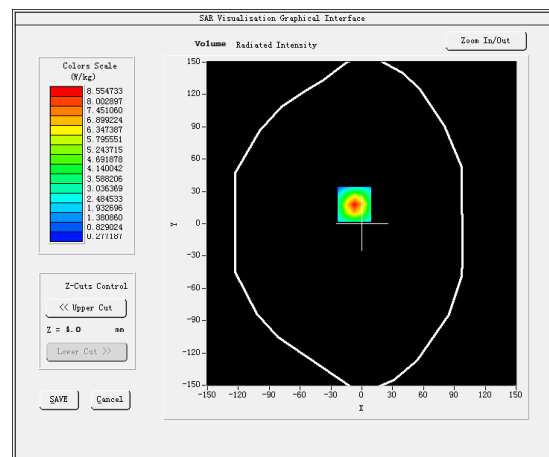
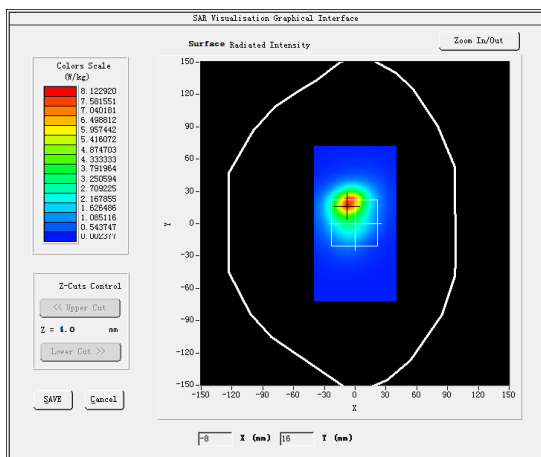
Test Mode: E-UTRA3,Middle channel(Body-LCD Down)

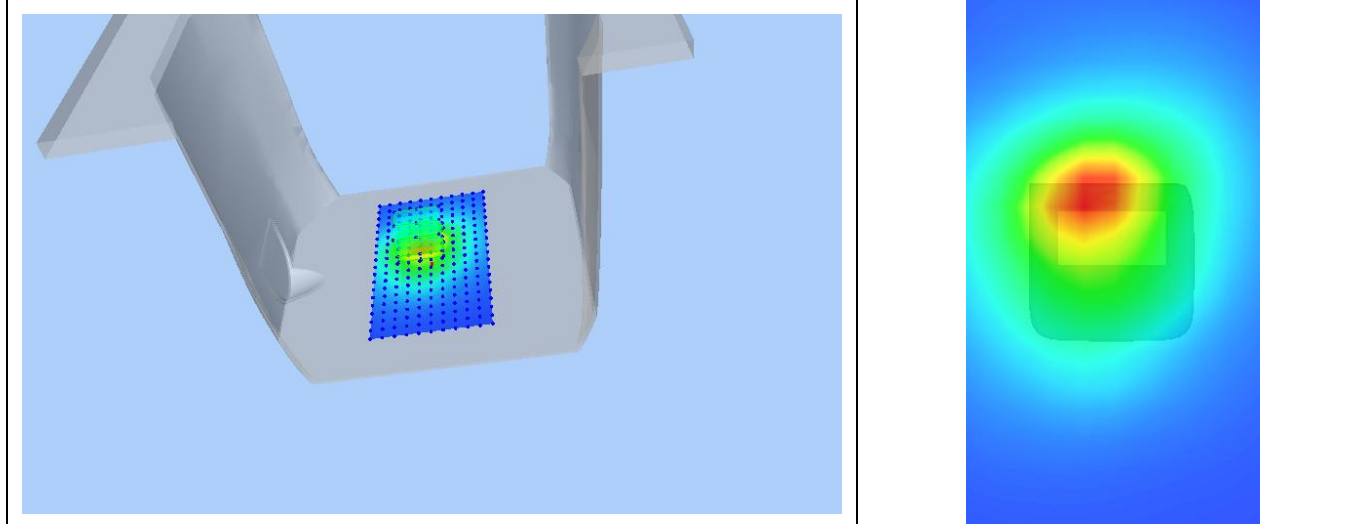
Product Description: myFirst Fone R1s, S11

Model:KW1305, G4K1

Test Date: June 28, 2020

Medium(liquid type)	HSL_1800
Frequency (MHz)	1747.5000
Relative permittivity (real part)	40.64
Conductivity (S/m)	1.43
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.65
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-4.490000
SAR 10g (W/Kg)	3.588539
SAR 1g (W/Kg)	7.843354
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





# #18

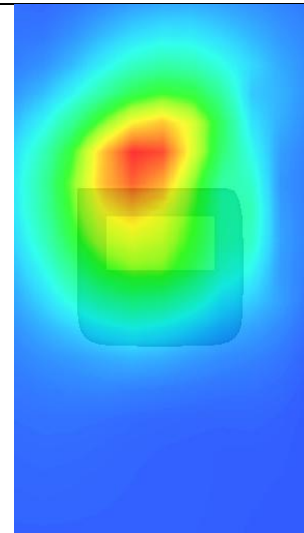
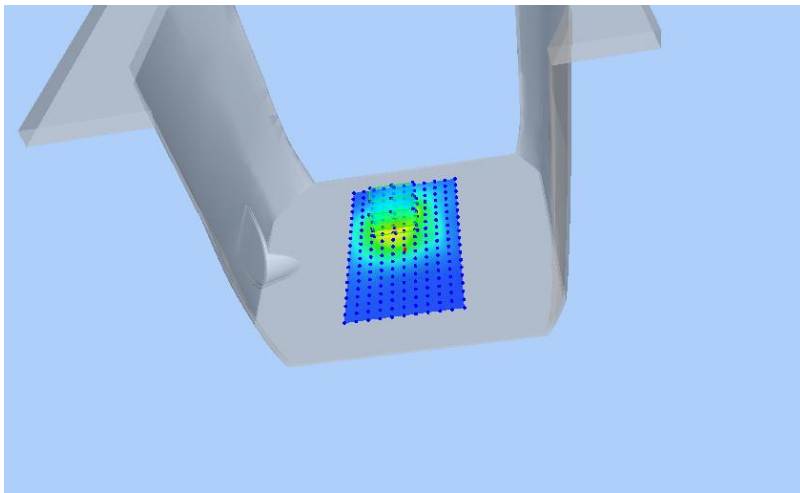
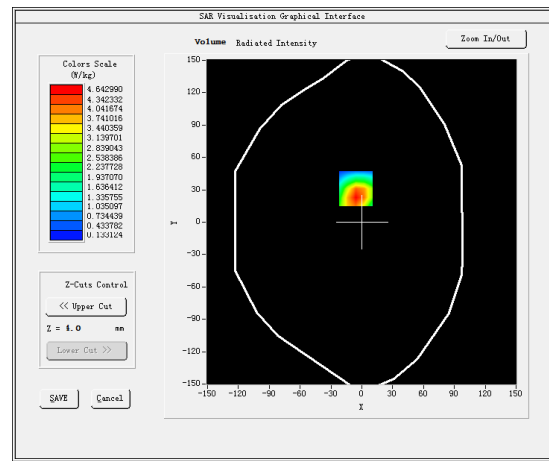
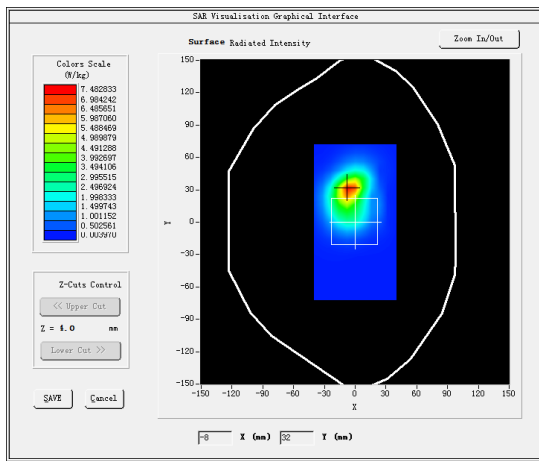
Test Mode: E-UTRA7,Middle channel(Body-LCD Down)

Product Description: myFirst Fone R1s, S11

Model:KW1305, G4K1

Test Date: July 03, 2020

Medium(liquid type)	HSL_2600
Frequency (MHz)	2535.0000
Relative permittivity (real part)	40.35
Conductivity (S/m)	1.90
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.89
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.110000
SAR 10g (W/Kg)	2.165452
SAR 1g (W/Kg)	4.467645
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>



## #19

Test Mode: E-UTRA8, Middle channel(Body-LCD Down)

Product Description: myFirst Fone R1s, S11

Model: KW1305, G4K1

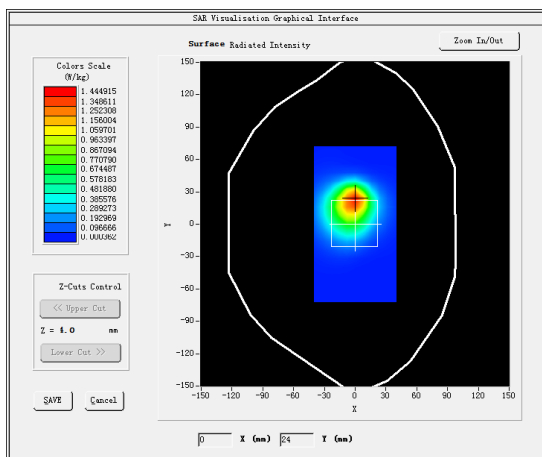
Test Date: June 23, 2020

Medium(liquid type)	HSL_900
Frequency (MHz)	897.5000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.94
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.54
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.930000
SAR 10g (W/Kg)	0.743225
SAR 1g (W/Kg)	1.412986

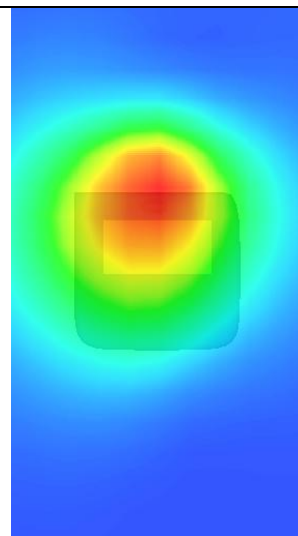
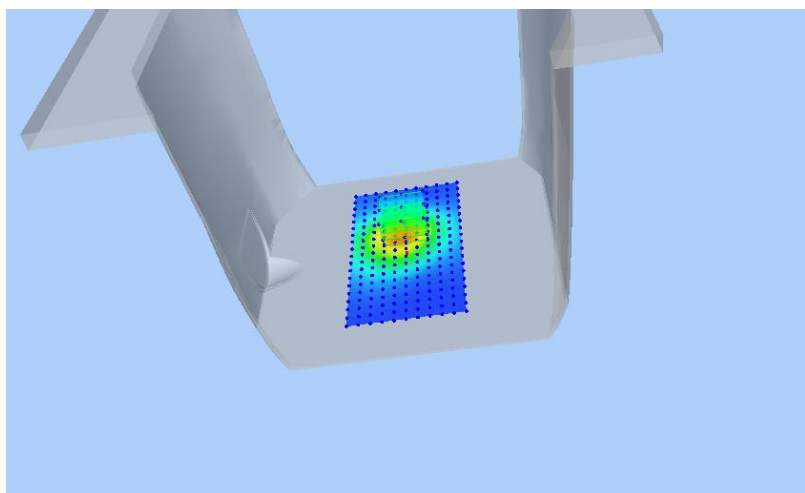
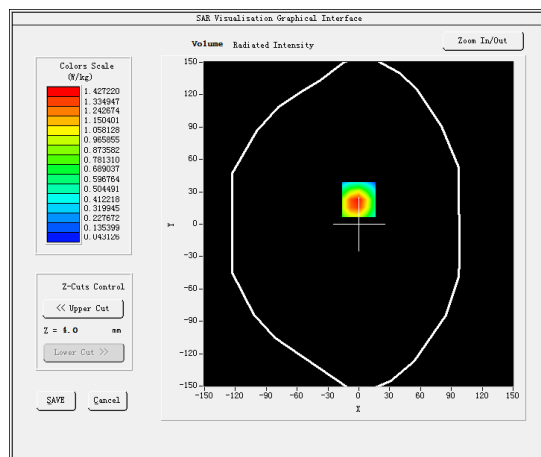




## SURFACE SAR



## VOLUME SAR





#20

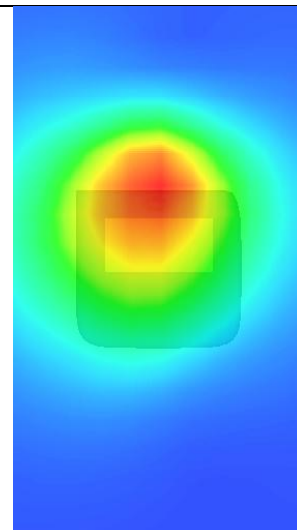
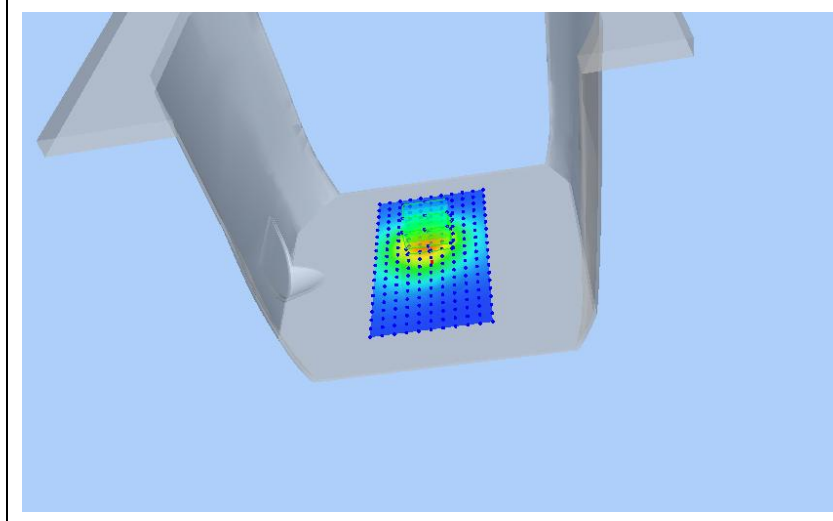
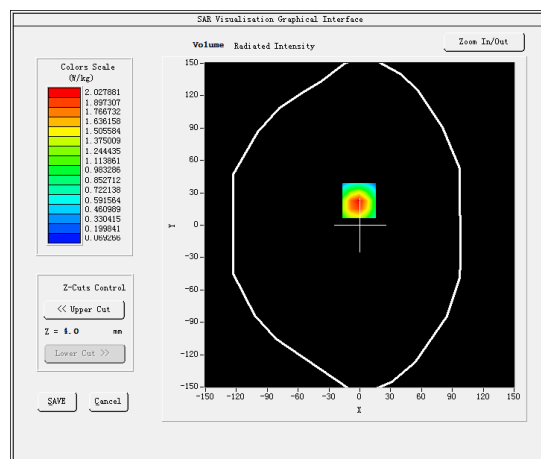
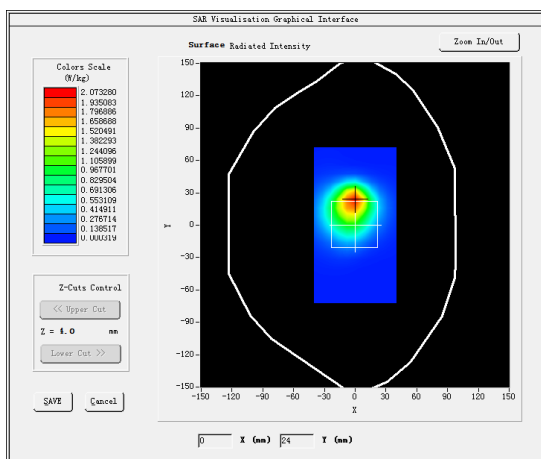
Test Mode: E-UTRA20,Middle channel(Body-LCD Down)

Product Description: myFirst Fone R1s, S11

Model: KW1305, G4K1

Test Date: June 23, 2020

Medium(liquid type)	HSL_900
Frequency (MHz)	847.0000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.94
E-Field Probe	SN 31/17 EPGO324
Crest Factor	1.0
Conversion Factor	1.54
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.040000
SAR 10g (W/Kg)	1.037651
SAR 1g (W/Kg)	1.945370
<b>SURFACE SAR</b>	<b>VOLUME SAR</b>





## 5. CALIBRATION CERTIFICATE

### SARTIMO Calibration Certificate-Extended Dipole Calibrations

According to KDB 450824 D02, Dipoles must be recalibrated at least once every three years; however, immediate re-calibration is required for following conditions. The test laboratory must ensure that the required supporting information and documentation have been included in the SAR report to qualify for extended 3-year calibration interval.

- 1) When the most recent return-loss, measured at least annually, deviates by more than 20% from the previous measurement (i.e. 0.2 of the dB value) or not meeting the required -20 dB return-loss specification
- 2) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, deviates by more than 5Ω from the previous measurement

Summary Result:

SID900 SN 07/14 DIP 0G900-300 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2018-10-01	-23.55		52.8		5.4	
2019-10-01	-23.49	-0.26	52.5	-0.3	5.3	-0.1

SID1800 SN 30/14 DIP 1G800-301 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2018-10-01	-20.26		43.1		6.9	
2019-10-01	-20.13	-0.64	42.9	-0.2	6.7	-0.2

SID2000 SN 07/14 DIP 2G000-305 Extend Dipole Calibrations

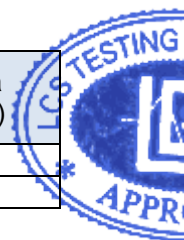
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2018-09-01	-23.67		50.8		6.2	
2019-09-01	-23.46	-0.89	51.0	0.2	6.5	0.3

SID2450 SN 07/14 DIP 2G450-306 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2018-10-01	-25.59		44.7		-1.1	
2019-10-01	-25.68	0.35	44.8	0.1	-1.0	0.1

SID2600 SN 38/18 DIP 2G600-468 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2018-09-24	-29.14		49.2		3.4	
2019-09-24	-29.12	-0.07	49.1	-0.1	3.2	-0.1





## 5.1 Probe-EPGO324 Calibration Certificate



### COMOSAR E-Field Probe Calibration Report

Ref : ACR.281.2.18.SATU.A

#### **SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.**

**1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,  
BAO'AN BLVD**

**BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA**

**MVG COMOSAR DOSIMETRIC E-FIELD PROBE**

**SERIAL NO.: SN 31/17 EPGO324**

**Calibrated at MVG US**

**2105 Barrett Park Dr. - Kennesaw, GA 30144**



**Calibration Date: 10/08/2019**

#### *Summary:*

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed in MVG USA using the CALISAR / CALIBAIR test bench, for use with a COMOSAR system only. All calibration results are traceable to national metrology institutions.



## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.281.2.18.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	10/8/2019	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	10/8/2019	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	10/8/2019	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen LCS Compliance Testing Laboratory Ltd.

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	10/8/2019	Initial release



## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.281.2.18.SATU.A

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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.281.2.18.SATU.A

## 1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 31/17 EPG0324
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.189 MΩ Dipole 2: R2=0.203 MΩ Dipole 3: R3=0.218 MΩ

A yearly calibration interval is recommended.

## 2 PRODUCT DESCRIPTION

### 2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Dipole

Probe Length	330 mm
Length of Individual Dipoles	2 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	2.5 mm
Distance between dipoles / probe extremity	1 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.

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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.281.2.18.SATU.A

### 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%

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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.281.2.18.SATU.A

Field probe linearity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Combined standard uncertainty					5.831%
Expanded uncertainty 95 % confidence level k = 2					12.0%

## 5 CALIBRATION MEASUREMENT RESULTS

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

## 5.1 SENSITIVITY IN AIR

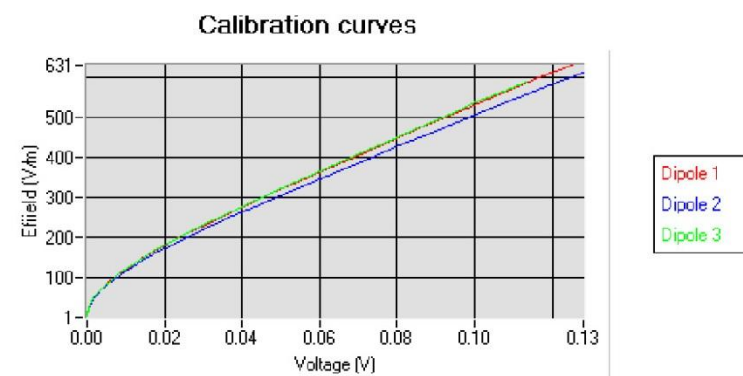
Normx dipole 1 ( $\mu\text{V}/(\text{V}/\text{m})^2$ )	Normy dipole 2 ( $\mu\text{V}/(\text{V}/\text{m})^2$ )	Normz dipole 3 ( $\mu\text{V}/(\text{V}/\text{m})^2$ )
0.80	0.83	0.68

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
95	90	93



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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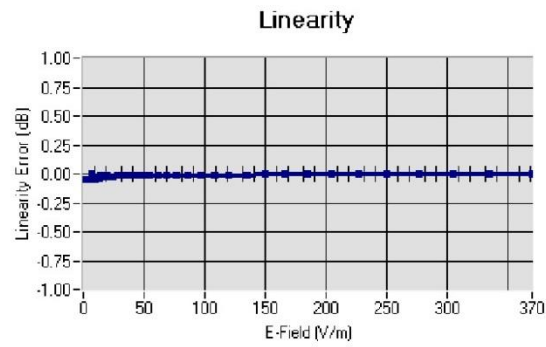
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## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.281.2.18.SATU.A

## 5.2 LINEARITY

Linearity:  $\pm 1.13\%$  ( $\pm 0.05\text{dB}$ )

## 5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL450	450	42.17	0.86	1.56
BL450	450	57.65	0.95	1.60
HL750	750	40.03	0.93	1.45
BL750	750	56.83	1.00	1.50
HL850	835	42.19	0.90	1.55
BL850	835	54.67	1.01	1.59
HL900	900	42.08	1.01	1.54
BL900	900	55.25	1.08	1.60
HL1800	1800	41.68	1.46	1.65
BL1800	1800	53.86	1.46	1.68
HL1900	1900	38.45	1.45	1.86
BL1900	1900	53.32	1.56	1.93
HL2000	2000	38.26	1.38	1.83
BL2000	2000	52.70	1.51	1.89
HL2300	2300	39.44	1.62	1.95
BL2300	2300	54.52	1.77	2.01
HL2450	2450	37.50	1.80	1.91
BL2450	2450	53.22	1.89	1.95
HL2600	2600	39.80	1.99	1.89
BL2600	2600	52.52	2.23	1.94
HL5200	5200	35.64	4.67	1.50
BL5200	5200	48.64	5.51	1.56
HL5400	5400	36.44	4.87	1.44
BL5400	5400	46.52	5.77	1.47
HL5600	5600	36.66	5.17	1.48
BL5600	5600	46.79	5.77	1.53
HL5800	5800	35.31	5.31	1.50
BL5800	5800	47.04	6.10	1.55

LOWER DETECTION LIMIT: 9mW/kg

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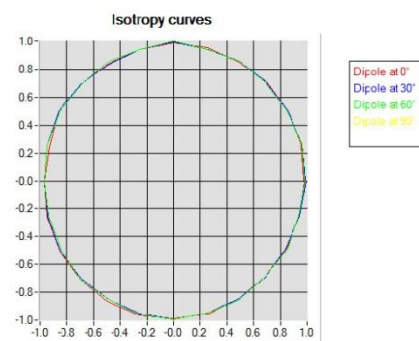
## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.281.2.18.SATU.A

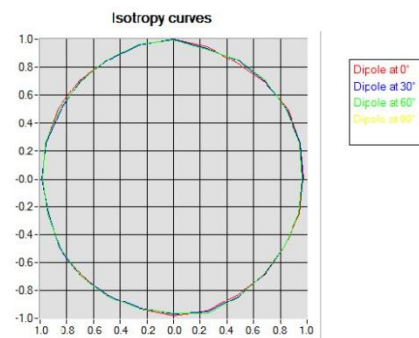
## 5.4 ISOTROPY

**HL900 MHz**

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

**HL1800 MHz**

- Axial isotropy: 0.06 dB
- Hemispherical isotropy: 0.07 dB



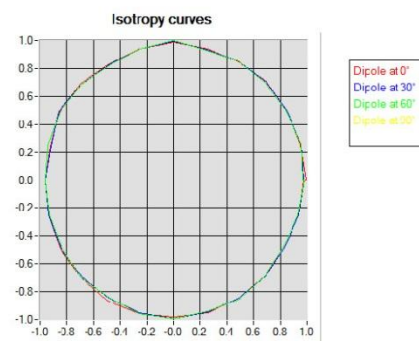


COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.281.2.18.SATU.A

**HL5600 MHz**

- Axial isotropy: 0.06 dB
- Hemispherical isotropy: 0.10 dB







## COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.281.2.18.SATU.A

## 6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat Phantom	MVG	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	02/2016	02/2019
Reference Probe	MVG	EP 94 SN 37/08	10/2017	10/2019
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Signal Generator	Agilent E4438C	MY49070581	01/2017	01/2020
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2017	01/2020
Power Sensor	HP ECP-E26A	US37181460	01/2017	01/2020
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	150798832	11/2017	11/2020

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## 5.2 SID900 Dipole Calibration Certificate



### SAR Reference Dipole Calibration Report

Ref : ACR.287.5.14.SATU.A

#### **SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.**

**1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,  
BAO'AN BLVD  
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA**

#### **SATIMO COMOSAR REFERENCE DIPOLE**

**FREQUENCY: 900 MHZ**

**SERIAL NO.: SN 07/14 DIP 0G900-300**

**Calibrated at SATIMO US**

**2105 Barrett Park Dr. - Kennesaw, GA 30144**



**10/01/2018**

#### *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.287.5.14.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	10/14/2018	<i>JS</i>
Checked by :	Jérôme LUC	Product Manager	10/14/2018	<i>JS</i>
Approved by :	Kim RUTKOWSKI	Quality Manager	10/14/2018	<i>Kim Rutkowski</i>

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Date	Modifications
A	10/14/2018	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 900 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID900
Serial Number	SN 07/14 DIP 0G900-300
Product Condition (new / used)	New

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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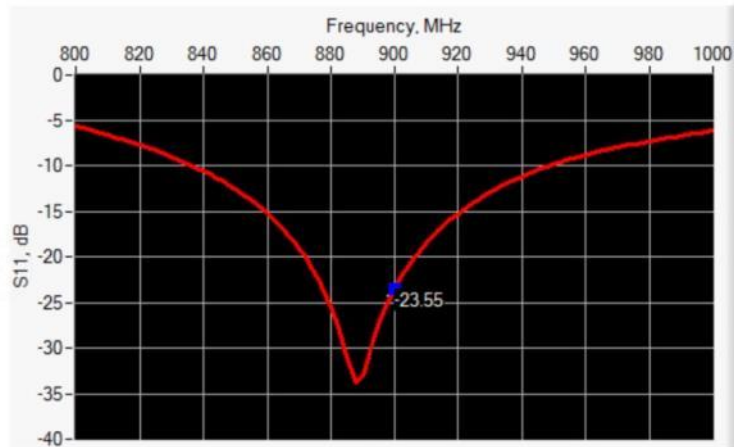


## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.5.14.SATU.A

## 6 CALIBRATION MEASUREMENT RESULTS

### 6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
900	-23.55	-20	52.8 $\Omega$ - 5.4 j $\Omega$

### 6.2 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 %.	
900	149.0 $\pm$ 1 %.	PASS	83.3 $\pm$ 1 %.	PASS	3.6 $\pm$ 1 %.	PASS
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 %.	

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## 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 ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) 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 %	PASS	0.97 $\pm$ 5 %	PASS
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 %	
2100	39.8 $\pm$ 5 %		1.49 $\pm$ 5 %	
2300	39.5 $\pm$ 5 %		1.67 $\pm$ 5 %	
2450	39.2 $\pm$ 5 %		1.80 $\pm$ 5 %	
2600	39.0 $\pm$ 5 %		1.96 $\pm$ 5 %	
3000	38.5 $\pm$ 5 %		2.40 $\pm$ 5 %	
3500	37.9 $\pm$ 5 %		2.91 $\pm$ 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: $\epsilon_r'$ : 42.5 sigma : 0.96
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm

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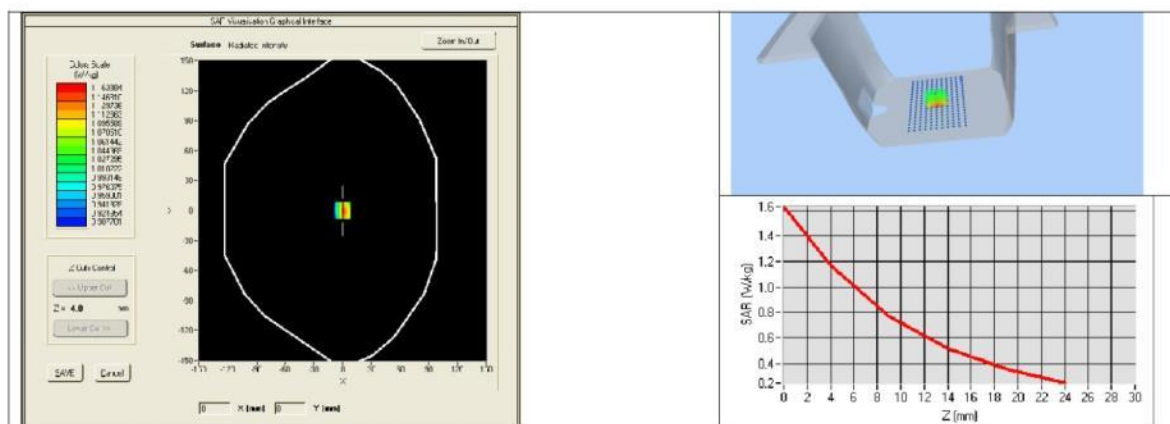


## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.5.14.SATU.A

Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	900 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	11.12 (1.11)	6.99	7.01 (0.70)
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.5.14.SATU.A

## 7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) 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 %	PASS	1.05 $\pm$ 5 %	PASS
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 %	
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %		5.77 $\pm$ 10 %	
5800	48.2 $\pm$ 10 %		6.00 $\pm$ 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: $\epsilon_r'$ : 56.7 sigma : 1.08
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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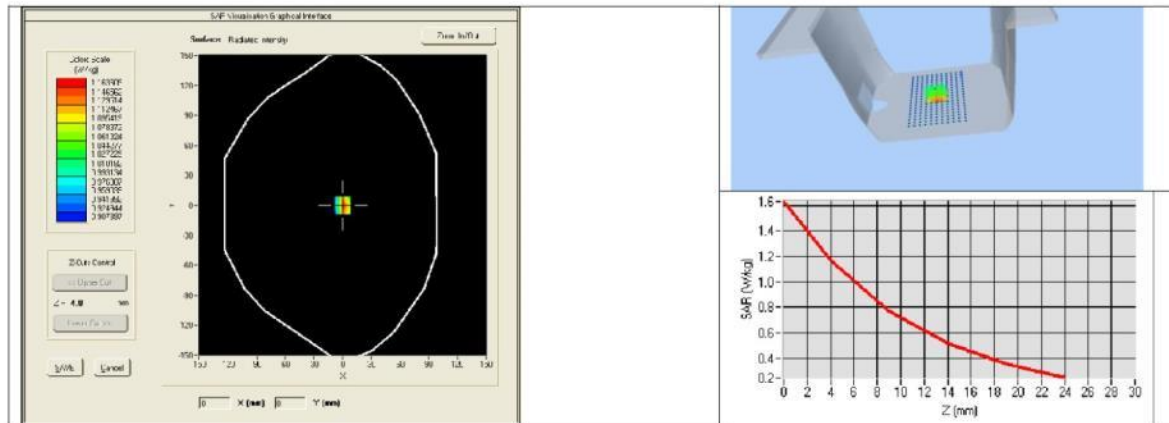
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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.5.14.SATU.A

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
900	11.34 (1.13)	7.15 (0.72)





## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.5.14.SATU.A

## 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	02/2016	02/2019
Calipers	Carrera	CALIPER-01	12/2016	12/2019
Reference Probe	Satimo	EPG122 SN 18/11	10/2018	10/2019
Multimeter	Keithley 2000	1188656	12/2016	12/2019
Signal Generator	Agilent E4438C	MY49070581	12/2016	12/2019
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2016	12/2019
Power Sensor	HP ECP-E26A	US37181460	12/2016	12/2019
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	8/2016	8/2019

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## 5.3 SID1800 Dipole Calibration Certificate



### SAR Reference Dipole Calibration Report

Ref : ACR.287.6.14.SATU.A

#### **SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.**

**1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,  
BAO'AN BLVD  
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA**

#### **SATIMO COMOSAR REFERENCE DIPOLE**

**FREQUENCY: 1800 MHZ**

**SERIAL NO.: SN 07/14 DIP 1G800-301**

**Calibrated at SATIMO US**

**2105 Barrett Park Dr. - Kennesaw, GA 30144**



**10/01/2018**

#### *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.287.6.14.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	10/14/2018	<i>JS</i>
Checked by :	Jérôme LUC	Product Manager	10/14/2018	<i>JS</i>
Approved by :	Kim RUTKOWSKI	Quality Manager	10/14/2018	<i>Kim Rutkowski</i>

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Date	Modifications
A	10/14/2018	Initial release



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## 1 INTRODUCTION

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

## 2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1800 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID1800
Serial Number	SN 07/14 DIP 1G800-301
Product Condition (new / used)	New

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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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.6.14.SATU.A

## 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 ( $\epsilon_r$ )		Conductivity ( $\sigma$ ) 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 %	PASS	1.40 $\pm$ 5 %	PASS
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 %	
2100	39.8 $\pm$ 5 %		1.49 $\pm$ 5 %	
2300	39.5 $\pm$ 5 %		1.67 $\pm$ 5 %	
2450	39.2 $\pm$ 5 %		1.80 $\pm$ 5 %	
2600	39.0 $\pm$ 5 %		1.96 $\pm$ 5 %	
3000	38.5 $\pm$ 5 %		2.40 $\pm$ 5 %	
3500	37.9 $\pm$ 5 %		2.91 $\pm$ 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: $\epsilon_r$ : 41.3 sigma : 1.38
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm

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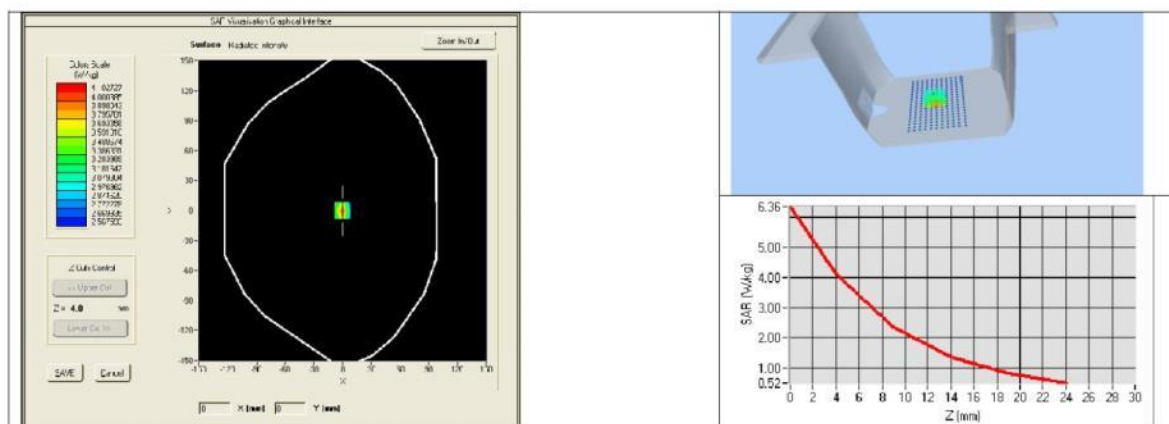


## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.6.14.SATU.A

Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	1800 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	38.13 (3.81)	20.1	20.20 (2.02)
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.6.14.SATU.A

## 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	02/2016	02/2019
Calipers	Carrera	CALIPER-01	12/2016	12/2019
Reference Probe	Satimo	EPG122 SN 18/11	10/2018	10/2019
Multimeter	Keithley 2000	1188656	12/2016	12/2019
Signal Generator	Agilent E4438C	MY49070581	12/2016	12/2019
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2016	12/2019
Power Sensor	HP ECP-E26A	US37181460	12/2016	12/2019
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	8/2016	8/2019

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## 5.4 SID2000 Dipole Calibration Certificate



### SAR Reference Dipole Calibration Report

Ref : ACR.287.7.14.SATU.A

#### SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.

1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,  
BAO'AN BLVD  
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA  
SATIMO COMOSAR REFERENCE DIPOLE

FREQUENCY: 2000 MHZ

SERIAL NO.: SN 07/14 DIP 2G000-305

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



10/01/2018

#### 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.287.7.14.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	10/14/2018	<i>JS</i>
Checked by :	Jérôme LUC	Product Manager	10/14/2018	<i>JS</i>
Approved by :	Kim RUTKOWSKI	Quality Manager	10/14/2018	<i>Kim Rutkowski</i>

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Date	Modifications
A	10/14/2018	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 2000 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID2000
Serial Number	SN 07/14 DIP 2G000-305
Product Condition (new / used)	New

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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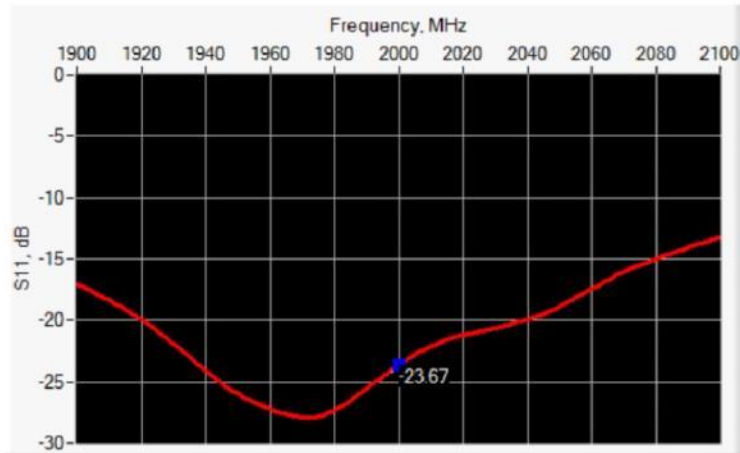


## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.7.14.SATU.A

## 6 CALIBRATION MEASUREMENT RESULTS

### 6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2000	-23.67	-20	50.8 $\Omega$ - 6.2 j $\Omega$

### 6.2 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 %.	
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 %.	PASS	37.5 $\pm$ 1 %.	PASS	3.6 $\pm$ 1 %.	PASS
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 %.	

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## 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 ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) 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 %		1.40 $\pm$ 5 %	
1950	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2000	40.0 $\pm$ 5 %	PASS	1.40 $\pm$ 5 %	PASS
2100	39.8 $\pm$ 5 %		1.49 $\pm$ 5 %	
2300	39.5 $\pm$ 5 %		1.67 $\pm$ 5 %	
2450	39.2 $\pm$ 5 %		1.80 $\pm$ 5 %	
2600	39.0 $\pm$ 5 %		1.96 $\pm$ 5 %	
3000	38.5 $\pm$ 5 %		2.40 $\pm$ 5 %	
3500	37.9 $\pm$ 5 %		2.91 $\pm$ 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: $\epsilon_r'$ : 39.7 sigma : 1.43
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm

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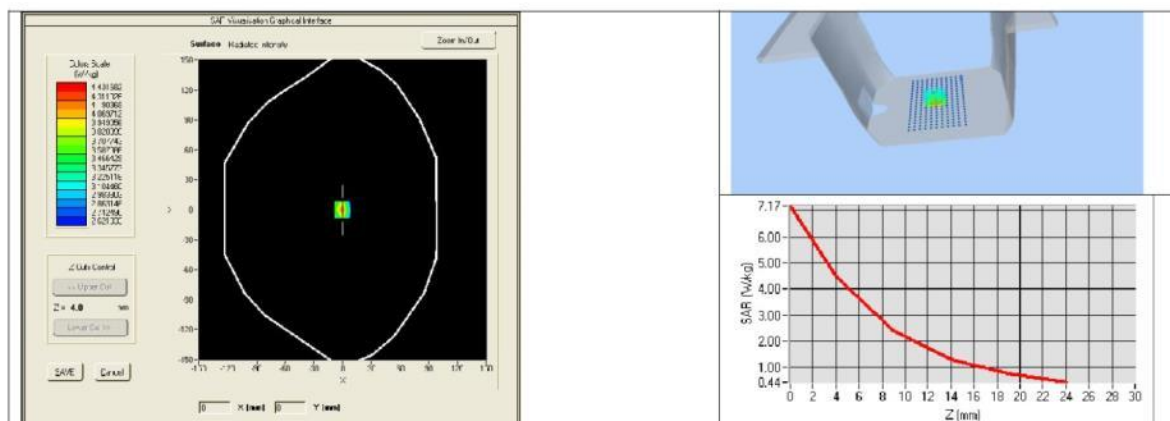


## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.7.14.SATU.A

Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2000 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	43.00 (4.30)	21.1	21.20 (2.12)
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	





## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.7.14.SATU.A

## 7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) 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 %		1.52 $\pm$ 5 %	
2000	53.3 $\pm$ 5 %	PASS	1.52 $\pm$ 5 %	PASS
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 %	
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %		5.77 $\pm$ 10 %	
5800	48.2 $\pm$ 10 %		6.00 $\pm$ 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: $\epsilon_r'$ : 53.9 sigma : 1.53
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2000 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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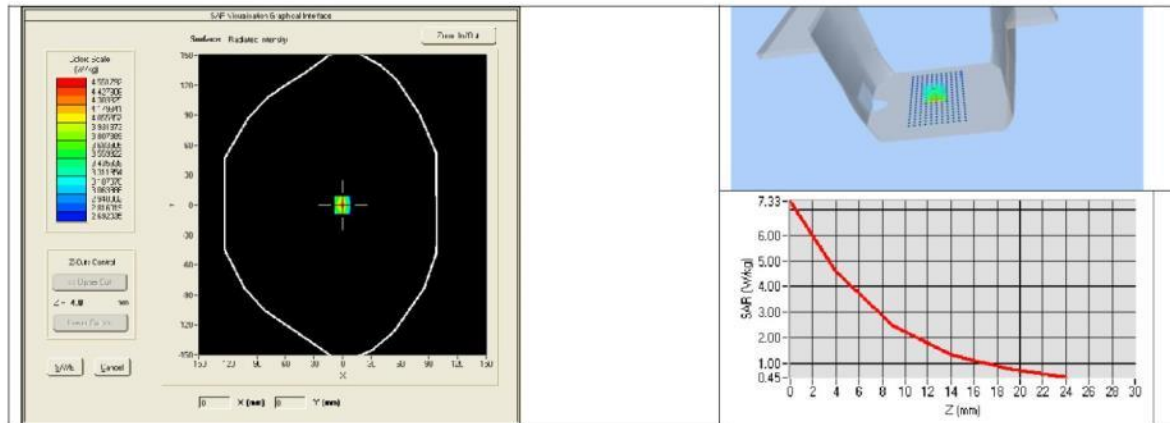
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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.7.14.SATU.A

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2000	45.84 (4.58)	22.30 (2.23)







## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.7.14.SATU.A

## 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	02/2016	02/2019
Calipers	Carrera	CALIPER-01	12/2016	12/2019
Reference Probe	Satimo	EPG122 SN 18/11	10/2018	10/2019
Multimeter	Keithley 2000	1188656	12/2016	12/2019
Signal Generator	Agilent E4438C	MY49070581	12/2016	12/2019
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2016	12/2019
Power Sensor	HP ECP-E26A	US37181460	12/2016	12/2019
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	8/2016	8/2019

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## 5.5SID2450 Dipole Calibration Certificate



### SAR Reference Dipole Calibration Report

Ref : ACR.287.8.14.SATU.A

#### SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.

1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,  
BAO'AN BLVD  
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA  
SATIMO COMOSAR REFERENCE DIPOLE

FREQUENCY: 2450 MHZ

SERIAL NO.: SN 07/14 DIP 2G450-306

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



10/01/2018

#### 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.287.8.14.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	10/14/2018	<i>JS</i>
Checked by :	Jérôme LUC	Product Manager	10/14/2018	<i>JS</i>
Approved by :	Kim RUTKOWSKI	Quality Manager	10/14/2018	<i>Kim Rutkowski</i>

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Date	Modifications
A	10/14/2018	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 07/14 DIP 2G450-306
Product Condition (new / used)	New

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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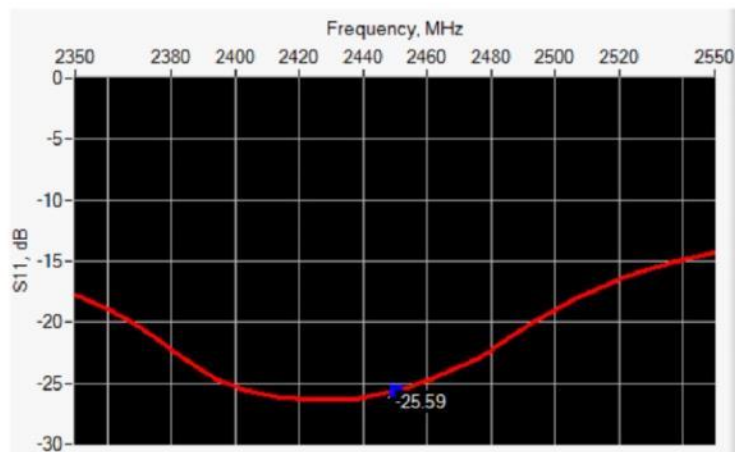


## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

## 6 CALIBRATION MEASUREMENT RESULTS

### 6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-25.59	-20	44.7 $\Omega$ - 1.1 j $\Omega$

### 6.2 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 %.	
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 %.	PASS	30.4 $\pm$ 1 %.	PASS	3.6 $\pm$ 1 %.	PASS
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 %.	

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## 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 ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) 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 %		1.40 $\pm$ 5 %	
1950	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2000	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2100	39.8 $\pm$ 5 %		1.49 $\pm$ 5 %	
2300	39.5 $\pm$ 5 %		1.67 $\pm$ 5 %	
2450	39.2 $\pm$ 5 %	PASS	1.80 $\pm$ 5 %	PASS
2600	39.0 $\pm$ 5 %		1.96 $\pm$ 5 %	
3000	38.5 $\pm$ 5 %		2.40 $\pm$ 5 %	
3500	37.9 $\pm$ 5 %		2.91 $\pm$ 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: $\epsilon_r'$ : 39.0 sigma : 1.77
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm

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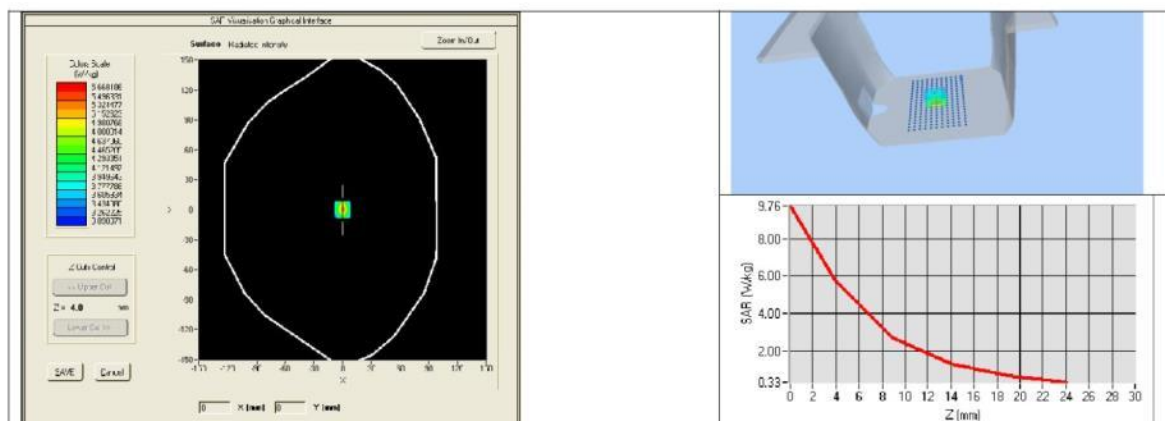


## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4	53.89 (5.39)	24	24.15 (2.42)
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	





## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

## 7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) 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 %		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 %	PASS	1.95 $\pm$ 5 %	PASS
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 %	
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %		5.77 $\pm$ 10 %	
5800	48.2 $\pm$ 10 %		6.00 $\pm$ 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: $\epsilon_r'$ : 53.0 sigma : 1.93
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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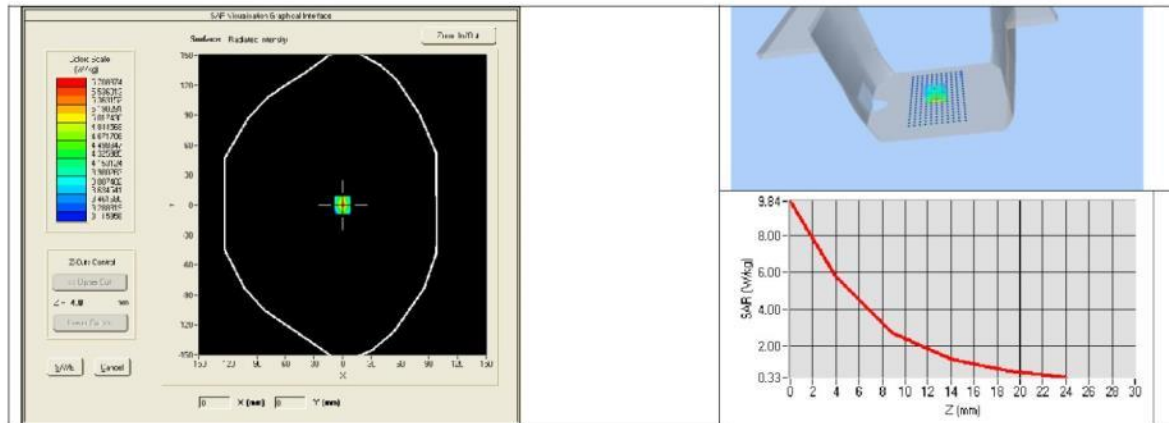
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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2450	54.65 (5.46)	24.58 (2.46)





## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

## 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	02/2016	02/2019
Calipers	Carrera	CALIPER-01	12/2016	12/2019
Reference Probe	Satimo	EPG122 SN 18/11	10/2018	10/2019
Multimeter	Keithley 2000	1188656	12/2016	12/2019
Signal Generator	Agilent E4438C	MY49070581	12/2016	12/2019
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2016	12/2019
Power Sensor	HP ECP-E26A	US37181460	12/2016	12/2019
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	8/2016	8/2019

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## 5.6 SID2600 Dipole Calibration Certificate



### SAR Reference Dipole Calibration Report

Ref : ACR.273.4.18.SATU.A

#### **SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.**

**1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,  
BAO'AN BLVD  
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA  
MVG COMOSAR REFERENCE DIPOLE**

**FREQUENCY: 2600 MHZ**

**SERIAL NO.: SN 38/18 DIP 2G600-468**

**Calibrated at MVG US**

**2105 Barrett Park Dr. - Kennesaw, GA 30144**



**Calibration Date: 09/24/2018**

#### *Summary:*

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



## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.273.4.18.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	09/30/2018	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	09/30/2018	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	09/30/2018	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen LCS Compliance Testing Laboratory Ltd.

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	09/30/2018	Initial release





## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.273.4.18.SATU.A

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.273.4.18.SATU.A

## 1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDBs 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 2600 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2600
Serial Number	SN 38/18 DIP 2G600-468
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

## 3 PRODUCT DESCRIPTION

### 3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



**Figure 1** – MVG COMOSAR Validation Dipole

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

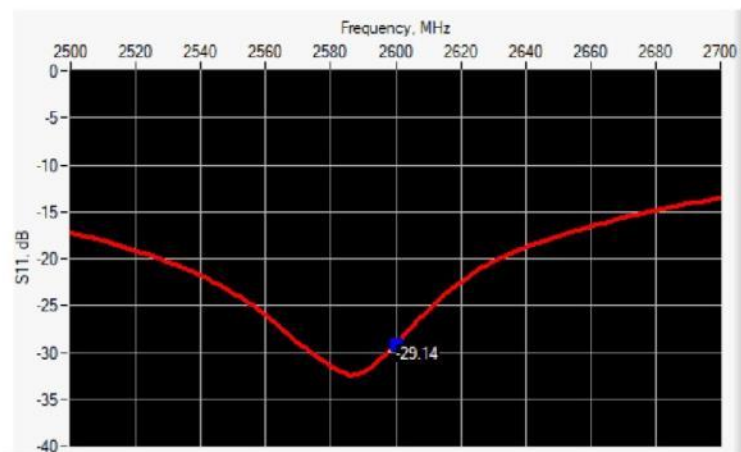
Ref: ACR.273.4.18.SATU.A

10 g

20.1 %

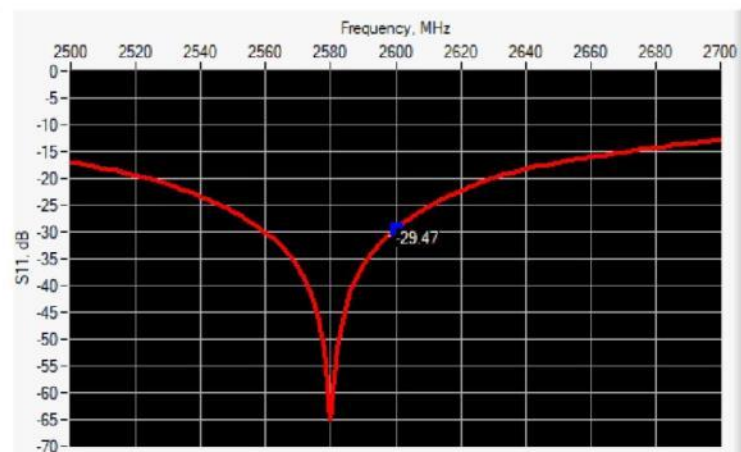
## 6 CALIBRATION MEASUREMENT RESULTS

### 6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2600	-29.14	-20	$49.2 \Omega + 3.4 j\Omega$

### 6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2600	-29.47	-20	$47.5 \Omega + 2.2 j\Omega$

### 6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	$420.0 \pm 1 \%$		$250.0 \pm 1 \%$		$6.35 \pm 1 \%$	

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450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.	PASS	28.8 ±1 %.	PASS	3.6 ±1 %.	PASS
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, FCC KDBs 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 ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	

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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.273.4.18.SATU.A

1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %	PASS	1.96 ±5 %	PASS
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

## 7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 39.8 sigma : 1.99
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2600 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	

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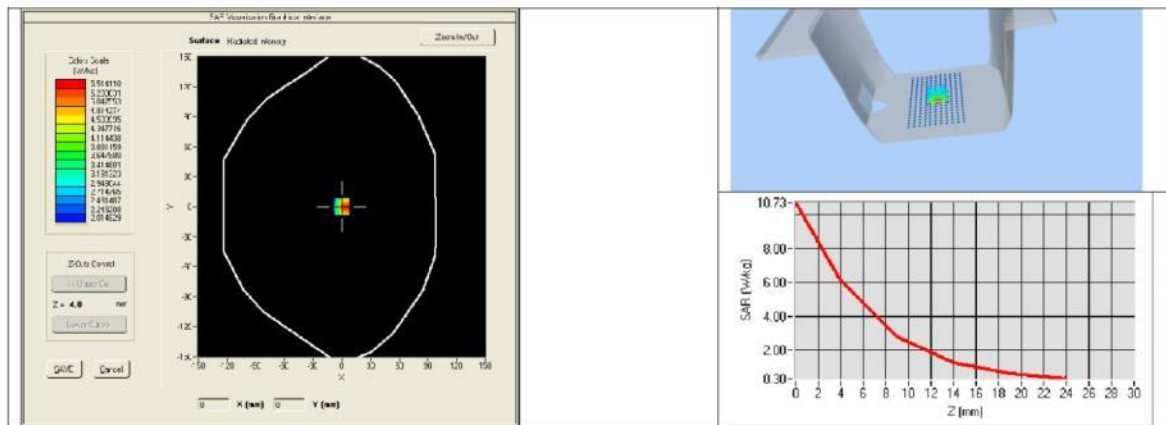
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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.273.4.18.SATU.A

1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3	56.91 (5.69)	24.6	24.69 (2.47)
3000	63.8		25.7	
3500	67.1		25	
3700	67.4		24.2	



## 7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity ( $\epsilon_r'$ )		Conductivity ( $\sigma$ ) 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 %		1.52 $\pm$ 5 %	
2000	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2100	53.2 $\pm$ 5 %		1.62 $\pm$ 5 %	

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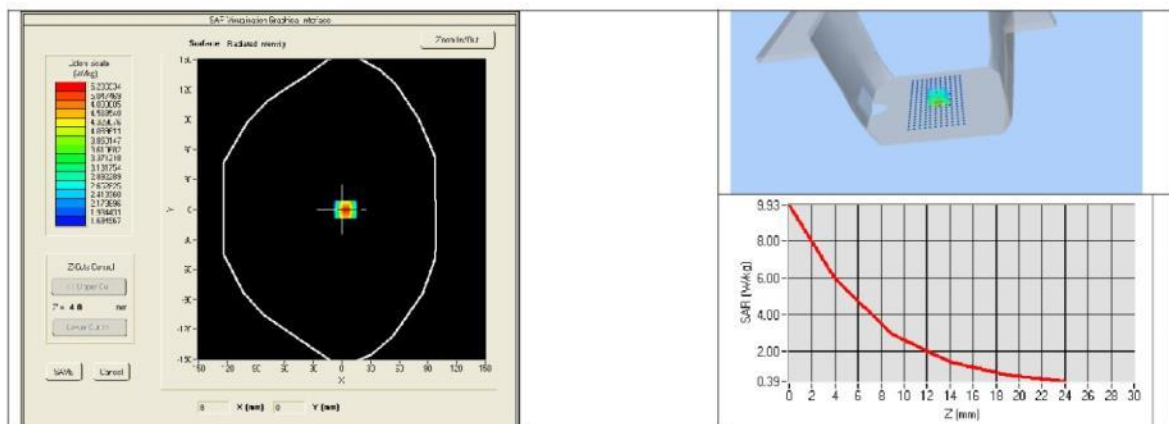
2300	52.9 ±5 %		1.81 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %	PASS	2.16 ±5 %	PASS
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
3700	51.0 ±5 %		3.55 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

## 7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 52.5 sigma : 2.23
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2600 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
2600	54.14 (5.41)	24.13 (2.41)



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## SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.273.4.18.SATU.A

## 8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	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	02/2016	02/2019
Calipers	Carrera	CALIPER-01	01/2017	01/2020
Reference Probe	MVG	EPG122 SN 18/11	10/2017	10/2018
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Signal Generator	Agilent E4438C	MY49070581	01/2017	01/2020
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2017	01/2020
Power Sensor	HP ECP-E26A	US37181460	01/2017	01/2020
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	150798832	11/2017	11/2020

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## 6.SAR System PHOTOGRAPHS



Liquid depth  $\cong$  15cm



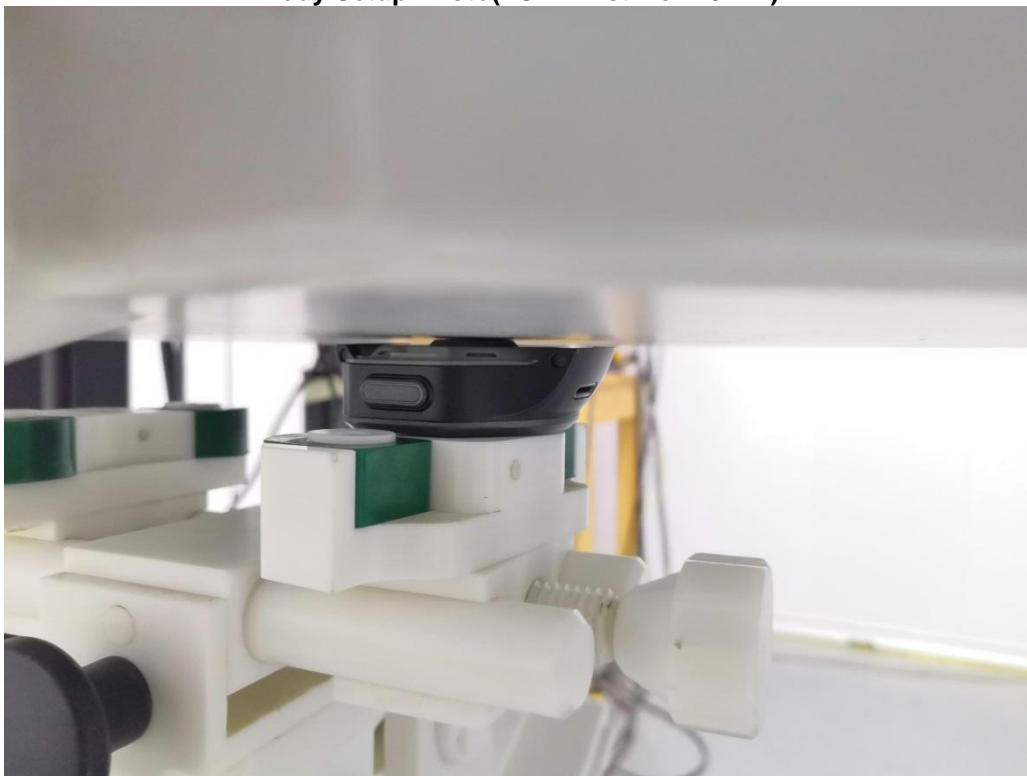


## 7.SETUP PHOTOGRAPHS

Body Setup Photo(LCD Front to face 5mm)



Body Setup Photo(LCD Wrist worn 0mm)







## 8.EUT PHOTOGRAPHS



Fig.1



Fig.2

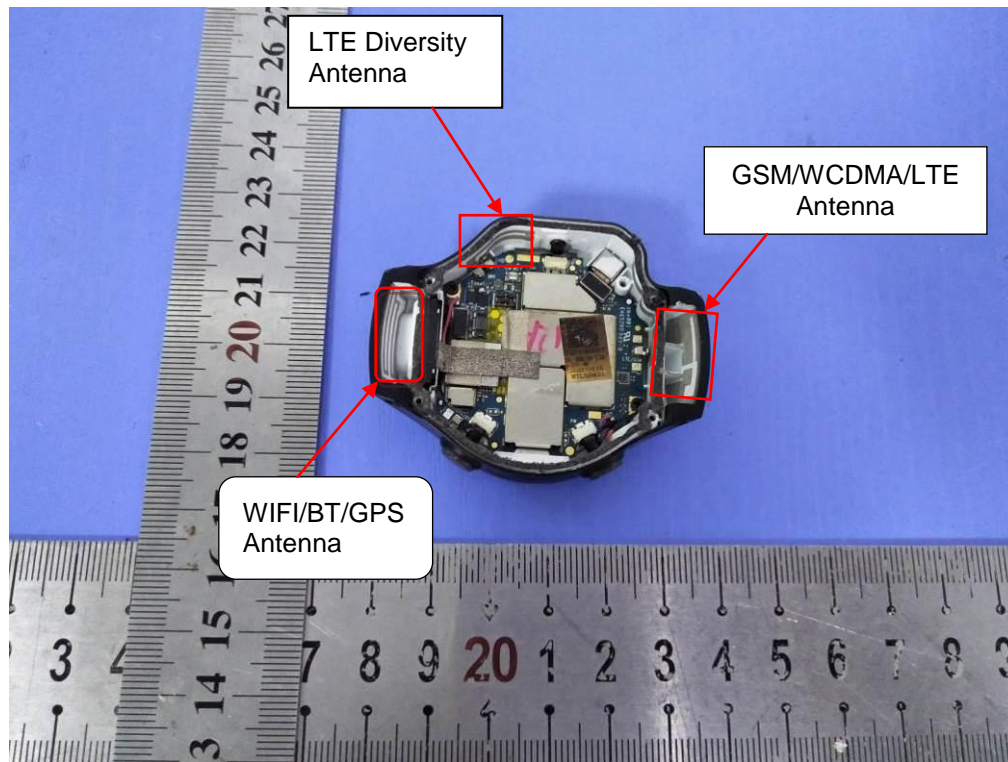


Fig.3

.....The End of Test Report.....