FCC SAR TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

XipPos

ISSUED TO
NEAREX PTE LTD.

80B Bencoolen Street, #12-05 The Bencoolen, Singapore 189648

Report No.:	BL-SZ1550225-701
EUT Type:	XipPos
Model Name:	XipPos
Brand Name:	N/A
FCC ID:	2AFM3XIPPOS
Test Standard:	FCC 47 CFR Part 2.1093
	ANSI C95.1: 1992
	IEEE 1528: 2013
Maximum SAR:	Body (1 g): 0.772 W/kg
Test Conclusion:	Pass
Test Date:	Jul.1, 2015
Date of Issue:	Sep.15, 2015

Tested by: Tu Lang
Tu Lang
(Engineer)
Date Sep. 15, 2015

Approved by: Wei Yanquan
Wei Yanquan
(Chief Engineer)
Date Sep. 15, 2015

NOTE: This test report can be duplicated completely for the legal use with the approval of the applicant; it shall not be reproduced except in full, without the written approval of Shenzhen BALUN Technology Co., Ltd. BALUN Laboratory. Any objections should be raised within thirty days from the date of issue. To validate the report, please visit BALUN website.

Revision History

Version	Issue Date	Revisions
Rev. 01	Sep. 15, 2015	Initial Issue

TABLE OF CONTENTS

1 GENERAL INFORMATION

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100
Fax Number	+86 755 6182 4271

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1. The laboratory has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are 832625. The laboratory has met the requirements of the IAS Accreditation Criteria for Testing Laboratories (AC89), has demonstrated compliance with ISO/IEC Standard 17025:2005. The accreditation certificate number is TL-588. The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Test Environment Condition

Ambient Temperature	20 to 23 ℃
Ambient Relative Humidity	35 to 50 %
Ambient Pressure	100 to 102 kPa

1.4 Announce

(1) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.

(2) The test report is invalid if there is any evidence and/or falsification.

(3) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.

(4) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.

(5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

2 PRODUCT INFORMATION

2.1 Applicant

Applicant	NEAREX PTE LTD.
Address	80B Bencoolen Street, #12-05 The Bencoolen, Singapore 189648

2.2 Manufacturer

Manufacturer	NEAREX PTE LTD.
Address	80B Bencoolen Street, #12-05 The Bencoolen, Singapore 189648

2.3 General Description for Equipment under Test (EUT)

EUT Type	XipPos
EUT Model Name	XipPos
Hardware Version	N/A
Software Version	N/A
Dimensions	84×54×8 mm
Weight	43.5 g
Network and Wireless connectivity	GPRS 850 / 1900 Class 12 Bluetooth

2.4 Technical Information

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	GSM, Bluetooth		
Frequency Range	GSM 850	TX: 824 MHz ~ 849 MHz	RX: 869 MHz ~ 894 MHz
	GSM 1900	TX: 1850 MHz ~ 1910 MHz	RX: 1930 MHz ~ 1990 MHz
	Bluetooth	2400 ~ 2483.5 MHz	
Antenna Type	WWAN: PIFA Antenna Bluetooth: PIFA Antenna		
DTM	Not Support		
Hotspot Function	Not Support		
Environment	Uncontrolled		
EUT Stage	Portable Device		

2.5 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	N/A
	Model No.	XHP373646
	Serial No.	N/A
	Capacitance	600mAh
	Rated Voltage	3.7 V
	Extreme Voltage	Low: 3.5 V / High:4.35 V
Ancillary Equipment 2	AC Adapter (Charger for Battery)	
	Brand Name	N/A
	Model No.	K-T50501000U1
	Serial No.	N/A
	Rated Input	~ 100 - 240 V, 150 mA, 50/60 Hz
	Rated Output	⎓ 5 V, 1000 mA

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
2	ANSI/IEEE Std. C95.1 - 1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
3	IEEE Std. 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
4	FCC KDB 447498 D01 v05r02	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
5	FCC KDB 941225 D06 v01r01	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities
6	FCC KDB 865664 D01 v01r04	SAR Measurement 100 MHz to 6 GHz
7	FCC KDB 865664 D02 v01r01	RF Exposure Reporting

3.2 Device Category and SAR Limit

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

Table of Exposure Limits:

Body Position	SAR Value (W/Kg)	
	General Population/ Uncontrolled Exposure	Occupational/ Controlled Exposure
Whole-Body SAR (averaged over the entire body)	0.08	0.4
Partial-Body SAR (averaged over any 1 gram of tissue)	1.60	8.0
SAR for hands, wrists, feet and ankles (averaged over any 10 grams of tissue)	4.0	20.0

NOTE:

General Population/Uncontrolled: Locations where there is the exposure of individuals who have no knowledge or control of their exposure. General population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Occupational/Controlled: Locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

3.3 Test Result Summary

3.3.1 Highest SAR (1 g Value)

<table>
<tr><th>Position</th><th>Band</th><th>Maximum Scaled SAR (W/kg)</th><th>Maximum Report SAR (W/kg)</th><th>Limit (W/kg)</th><th>Verdict</th></tr>
<tr><td rowspan="2">Body - worn</td><td>GSM 850</td><td>0.547</td><td rowspan="2">0.772</td><td rowspan="2">1.6</td><td>Pass</td></tr>
<tr><td>GSM 1900</td><td>0.772</td><td>Pass</td></tr>
<tr><td colspan="6">Note: The power of Bluetooth is:1.399 (dBm) = 1.38 (mW), which is less than the exclusion threshold limit 10 mW, the SAR evaluation test is not required.</td></tr>
</table>

3.4 Test Uncertainty

3.4.1 Measurement uncertainly evaluation for SAR test

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in IEEE 1528: 2003. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2. The system measurement uncertainty frequency range is from 300 MHz to 3 GHz.

Uncertainty Component	Tol. (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System								
Probe calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	$\sqrt{3}$	0.7	0.7	1.41	1.41	∞
Hemispherical Isotropy	5.9	R	$\sqrt{3}$	0.7	0.7	2.38	2.38	∞
Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	0.5	N	1	1	1	0.50	0.50	∞
Reponse Time	0.0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF ambient Conditions - Noise	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
Test sample Related								
Test sample positioning	2.6	N	1	1	1	2.60	2.60	N−1
Device Holder Uncertainty	1.0	N	1	1	1	1.00	1.00	N−1
Output power Variation - SAR drift measurement	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
SAR scaling	2.00	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and Tissue Parameters								
Phantom Uncertainty (Shape and thickness tolerances)	4.0	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid conductivity (deviation from target values)	2.5	N	$\sqrt{3}$	0.64	0.43	0.92	0.62	∞
Liquid conductivity - measurement uncertainty	5.0	N	1	0.64	0.43	3.20	2.15	M
Liquid permittivity (deviation from target values)	2.5	N	$\sqrt{3}$	0.60	0.49	0.87	0.71	∞
Liquid permittivity - measurement uncertainty	5.0	N	1	0.60	0.49	3.00	2.45	M
Combined Standard Uncertainty		RSS				10.14	9.67	
Expanded Uncertainty (95% Confidence interval)		k				20.29	19.35	

3.4.2 Measurement uncertainly evaluation for system check

This measurement uncertainty budget is suggested by IEEE 1528. The break down of the individual uncertainties is as follows:

Uncertainty Component	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System								
Probe calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	$\sqrt{3}$	0.7	0.7	1.41	1.41	∞
Hemispherical Isotropy	5.9	R	$\sqrt{3}$	0.7	0.7	2.38	2.38	∞
Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Probe Linearity	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	0.5	N	1	1	1	0.50	0.50	∞
Reponse Time	0.0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF ambient Conditions - Noise	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
Dipole								
Deviation of experimental dipole	5.5	R	$\sqrt{3}$	1	1	3.20	3.20	∞
Dipole axis to liquid distance	2.0	R	1	1	1	1.20	1.20	∞
Power drift	4.7	R	$\sqrt{3}$	1	1	2.70	2.70	∞
Phantom and Tissue Parameters								
Phantom Uncertainty (Shape and thickness tolerances)	4.0	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid conductivity (deviation from target values)	2.5	N	$\sqrt{3}$	0.64	0.43	0.92	0.62	∞
Liquid conductivity - measurement uncertainty	5.0	N	1	0.64	0.43	3.20	2.15	M
Liquid permittivity (deviation from target values)	2.5	N	$\sqrt{3}$	0.60	0.49	0.87	0.71	∞
Liquid permittivity - measurement uncertainty	5.0	N	1	0.60	0.49	3.00	2.45	M
Combined Standard Uncertainty		RSS				10.22	9.75	
Expanded Uncertainty (95% Confidence interval)		k				20.44	19.50	

4 SAR MEASUREMENT SYSTEM

4.1 Definition of Specific Absorption Rate (SAR)

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

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

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

SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

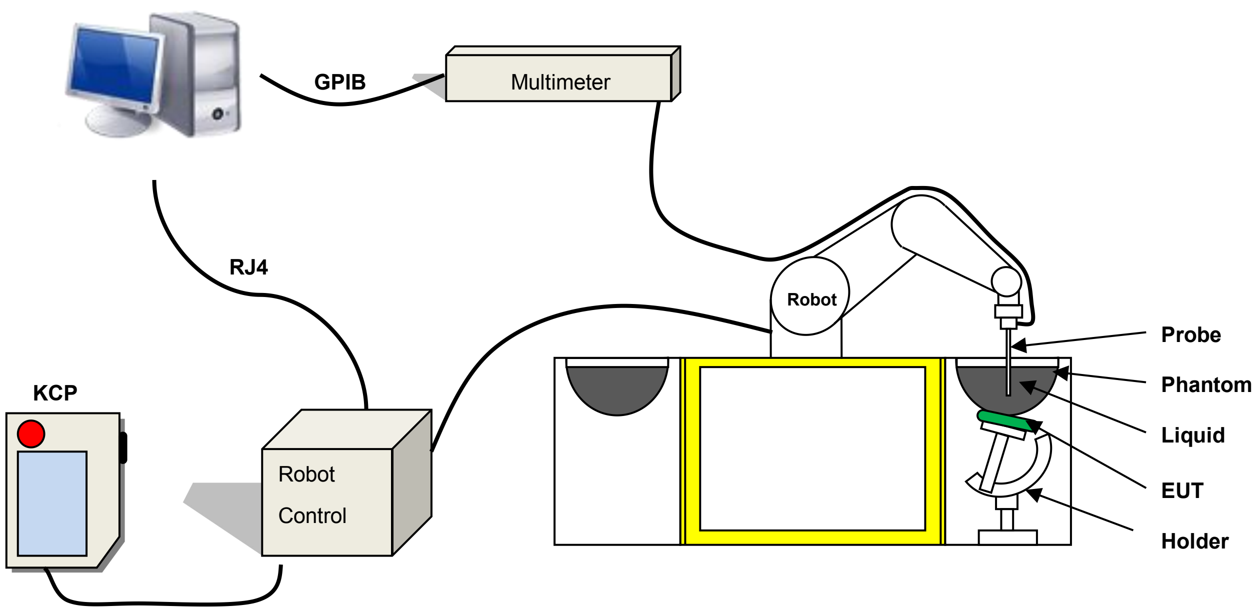
$$\mathbf{SAR} = \frac{\sigma E^2}{\rho}$$

Where: σ is the conductivity of the tissue,

ρ is the mass density of the tissue and E is the RMS electrical field strength.

4.2 SATIMO SAR System

4.2.1 SATIMO SAR System Diagram



These measurements were performed with the automated near-field scanning system OPENSAR from SATIMO. The system is based on a high precision robot (working range: 850 mm), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit.

The SAR measurements were conducted with dosimetric probe (manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in SAR standard with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in SAR standard and found to be better than ±0.25 dB. The phantom used was the SAM Phantom as described in FCC supplement C, IEEE P1528 and CENELEC EN62209-1/-2.

4.2.2 Robot

The SATIMO SAR system uses the high precision robots from KUKA. For the 6-axis controller system, the robot controller version (KUKA) from KUKA is used. The KUKA robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

4.2.3 E-Field Probe

For the measurements the Specific Dosimetric E-Field Probe SN 27/13 EP187 with following specifications is used

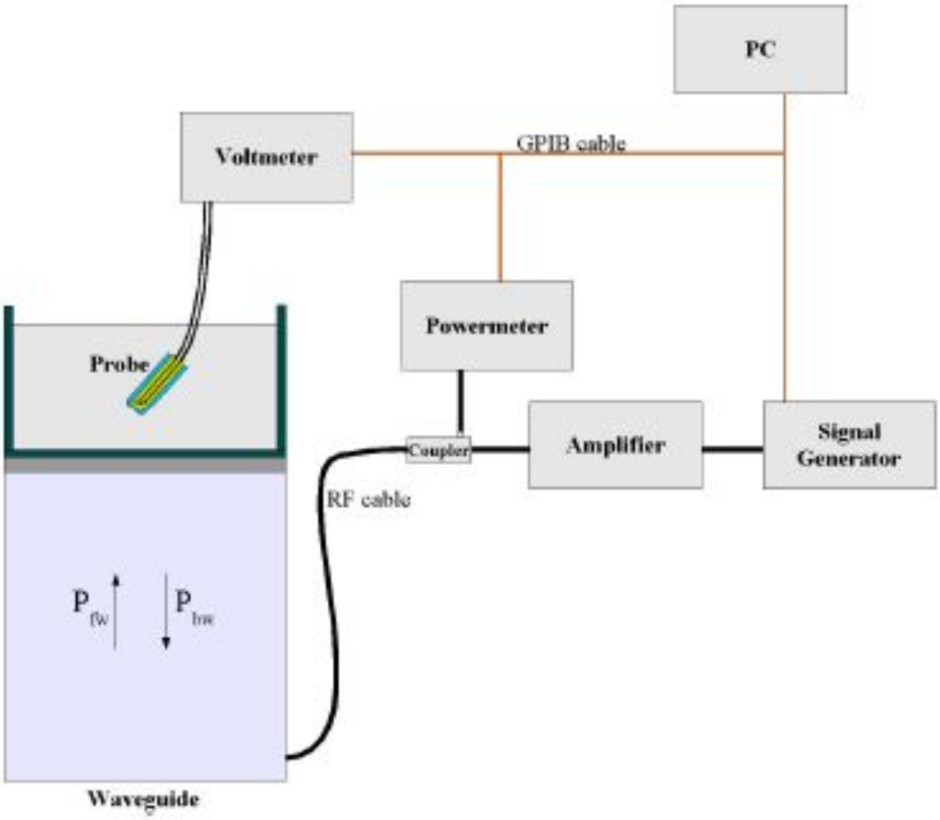
- Dynamic range: 0.01-100 W/kg
- Tip Diameter : 2.5 mm
- Distance between probe tip and sensor center: 1.0mm
- Distance between sensor center and the inner phantom surface: 4 mm

(repeatability better than +/- 1mm)
- Probe linearity: +/- 0.06 dB
- Axial Isotropy: ＜0.15 dB
- Spherical Isotropy: ＜0.15 dB
- Calibration range: 750MHz to 2600MHz for head & body simulating liquid.

Angle between probe axis (evaluation axis) and surface normal line: less than 30°

E-Field Probe Calibration Process

Probe calibration is realized, in compliance with CENELEC EN 62209-1/-2 and IEEE 1528 std, with CALISAR, Antennessa proprietary calibration system. The calibration is performed with the EN 62209-1/2 annexe technique using reference guide at the five frequencies.



Where :

Pfw = Forward Power

Pbw = Backward Power

a and b = Waveguide dimensions

ι = Skin depth

Keithley configuration

Rate = Medium; Filter =ON; RDGS=10; FILTER TYPE =MOVING AVERAGE; RANGE AUTO After each calibration, a SAR measurement is performed on a validation dipole and compared with a NPL calibrated probe, to verify it.

The calibration factors, CF(N), for the 3 sensors corresponding to dipole 1, dipole 2 and dipole 3 are:

CF(N)=SAR(N)/Vlin(N)   (N=1,2,3)

The linearised output voltage Vlin(N) is obtained from the displayed output voltage V(N) using

Vlin(N)=V(N)*(1+V(N)/DCP(N))   (N=1,2,3)

Where the DCP is the diode compression point in mV.

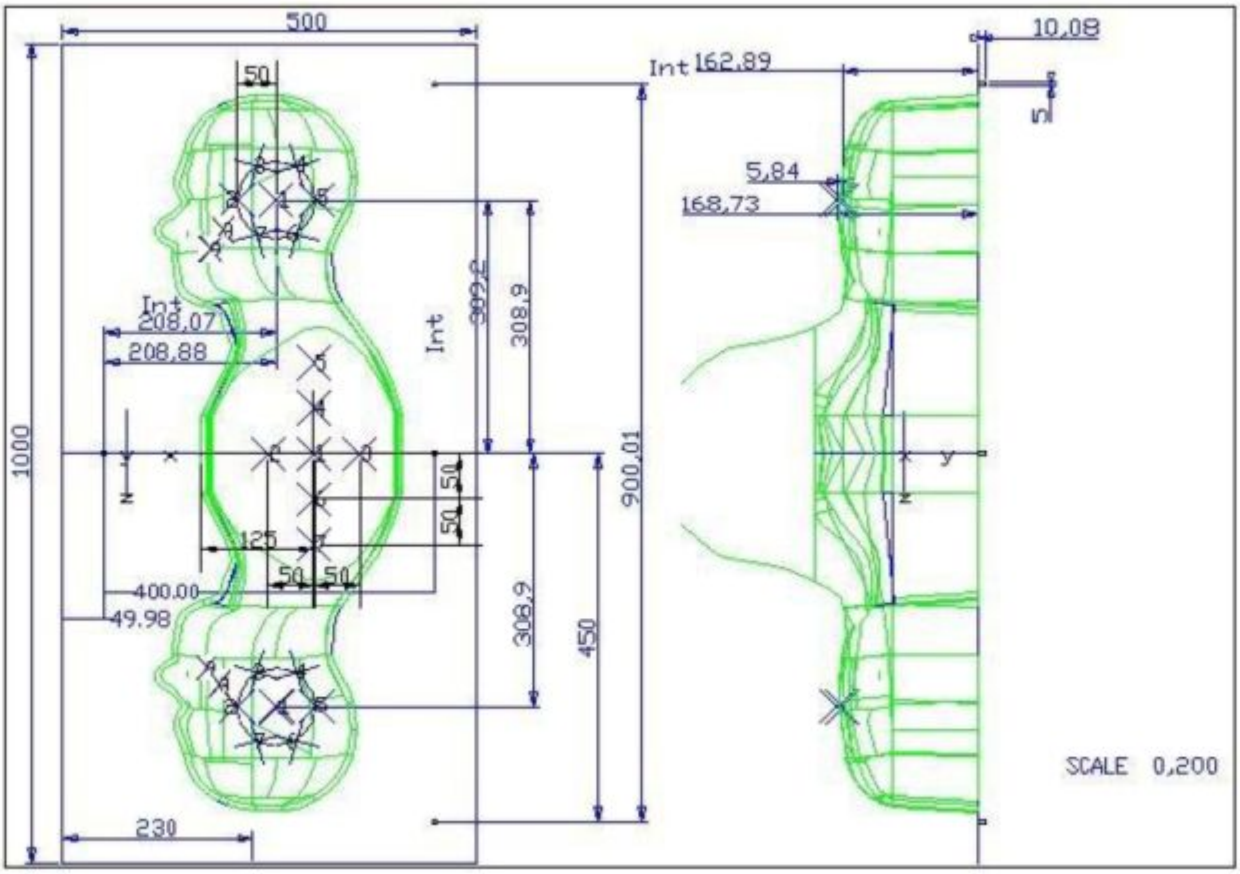
4.2.4 Phantoms

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.

Photo of Phantom SN 30/13 SAM103

Photo of Phantom SN 30/13 SAM104

Serial Number	Positionner Material	Permittivity	Loss Tangent
SN 30/13 SAM103	Gelcoat with fiberglass	3.4	0.02
SN 30/13 SAM104	Gelcoat with fiberglass	3.4	0.02



Serial Number	Left Head		Right Head		Flat Part	
SN 30/13 SAM103	2	2.00	2	2.03	1	2.09
	3	2.02	3	2.05	2	2.10
	4	2.04	4	2.04	3	2.09
	5	2.04	5	2.07	4	2.11
	6	2.02	6	2.07	5	2.11
	7	2.01	7	2.09	6	2.09
	8	2.04	8	2.10	7	2.11
	9	2.02	9	2.09	-	-
SN 30/13 SAM104	2	2.05	2	2.06	1	2.03
	3	2.08	3	2.03	2	2.03
	4	2.05	4	2.03	3	2.01
	5	2.06	5	2.02	4	2.03
	6	2.08	6	2.02	5	2.03
	7	2.06	7	2.04	6	2.00
	8	2.07	8	2.04	7	1.98
	9	2.07	9	2.05	-	-

4.2.5 Device Holder

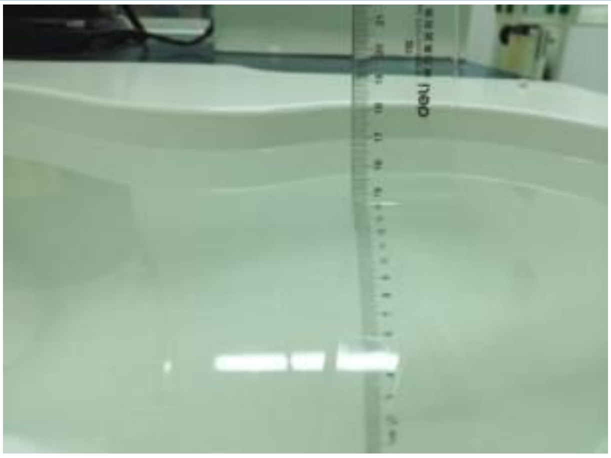
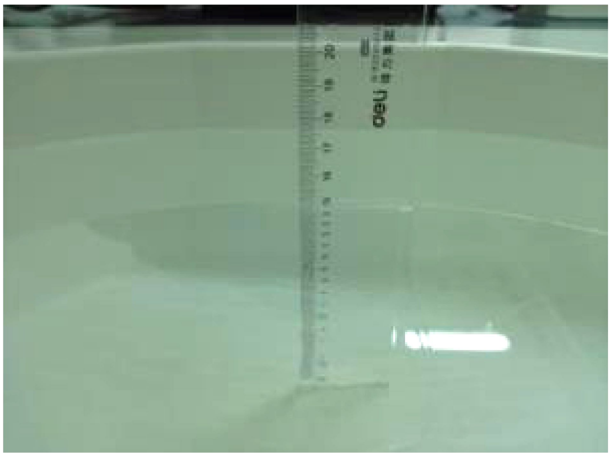
The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

Serial Number	Holder Material	Permittivity	Loss Tangent
SN 25/13 MSH87	Deirin	3.7	0.005
SN 25/13 MSH88	Deirin	3.7	0.005

The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is lower than 1°.

4.2.6 Simulating Liquid

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5%.

Head Liquid Depth	Body Liquid Depth
	

The following table gives the recipes for tissue simulating liquid.

Frequency (MHz)	Water %	Sugar %	Cellulose %	Salt %	Preventol %	DGBE %	Conductivity σ	Permittivity ε
Head(Reference IEEE1528)								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.4	40.0
2450	55.0	0	0	0.1	0	44.9	1.80	39.2
2600	54.9	0	0	0.1	0	45.0	1.96	39.0
Body(From instrument manufacturer: SATIMO)								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0.1	0	31.3	1.95	52.7
2600	68.2	0	0	0.1	0	31.7	2.16	52.5

5 SYSTEM VERIFICATION

5.1 Antenna Port Test Requirement

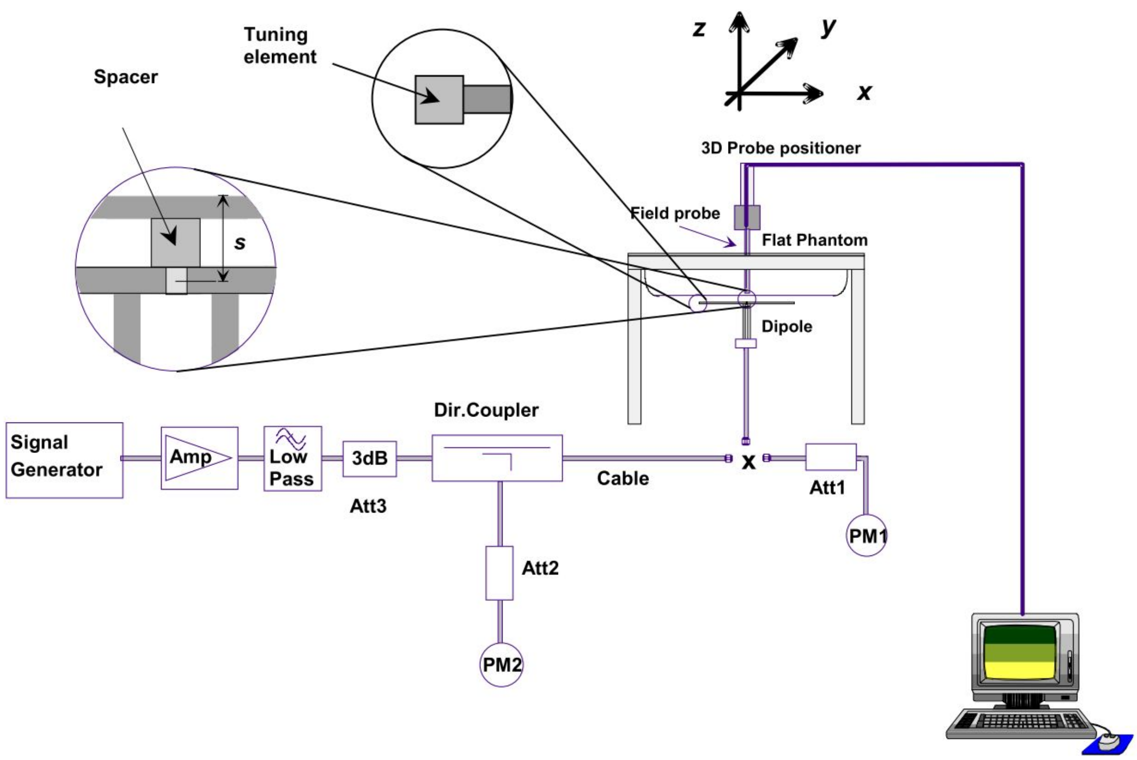
The SATIMO SAR system is equipped with one or more system validation kits. These units together with the predefined measurement procedures within the SATIMO software enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

5.2 Purpose of System Check

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.

5.3 System Check Setup

In the simplified setup for system evaluation, the EUT 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:



6 EUT TEST POSITION CONFIGURATUONS

According to KDB 648474 D04 Handset v01r02, handsets are tested for SAR compliance in head, body-worn accessory and other use configurations described in the following subsections.

6.1 Head Exposure Conditions

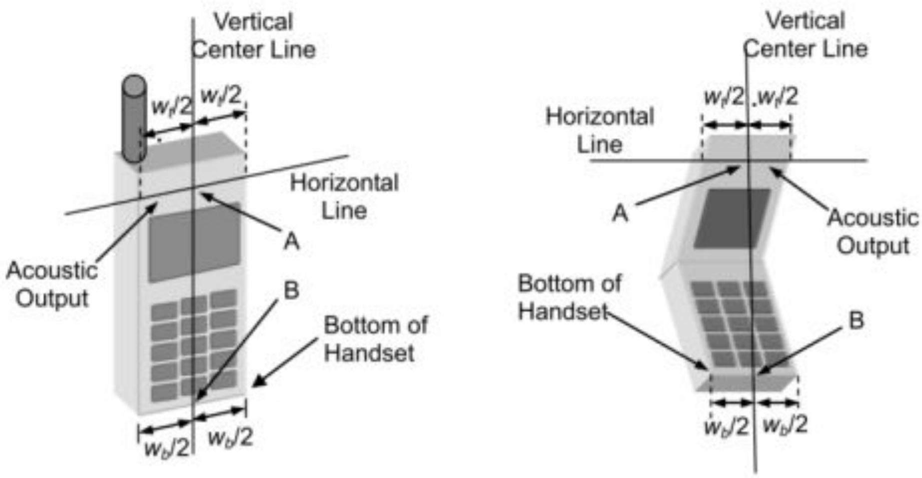
Head exposure is limited to next to the ear voice mode operations. Head SAR compliance is tested according to the test positions defined in IEEE Std 1528-2013 using the SAM phantom illustrated as below.

6.1.1 Define two imaginary lines on the handset

(a) The vertical centerline passes through two points on the front side of the handset - the midpoint of the width w t of the handset at the level of the acoustic output, and the midpoint of the width w b of the bottom of the handset.

(b) The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.

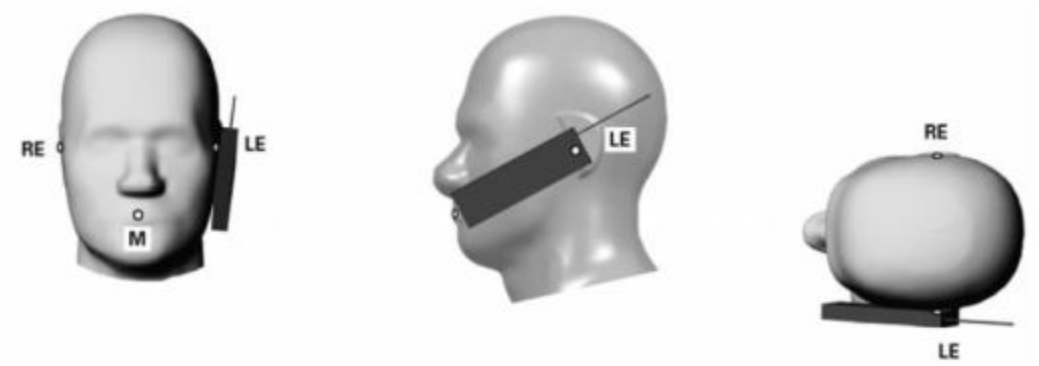
(c) The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.



6.1.2 Cheek Position

(a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

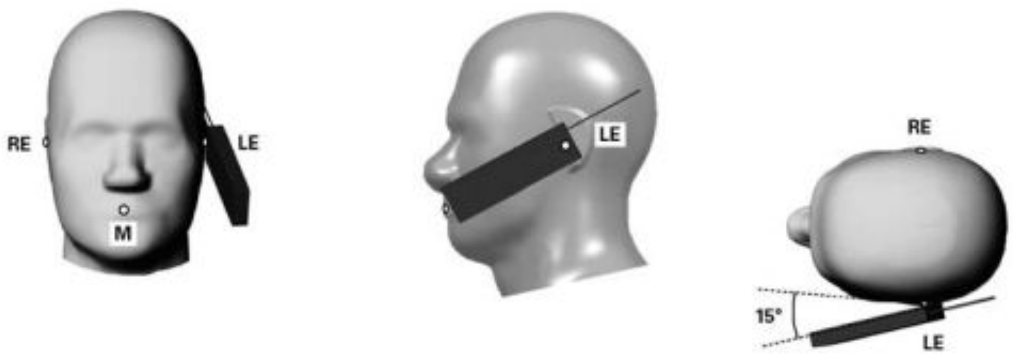
(b) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost.



6.1.3 Tilted Position

(a) To position the device in the “cheek” position described above.

(b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost.

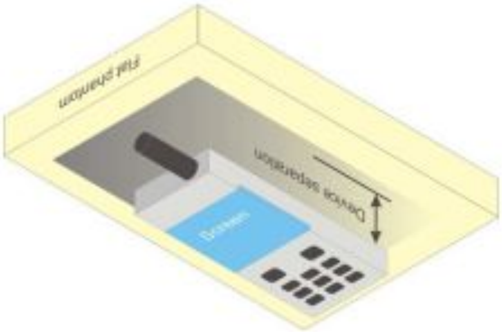


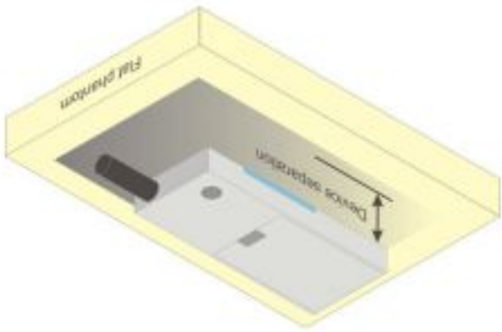
6.2 Body-worn Position Conditions

Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB 447498 are used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

Body-worn accessories that do not contain metallic or conductive components may be tested according to worst-case exposure configurations, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics. All body-worn accessories containing metallic components are tested in conjunction with the host device.

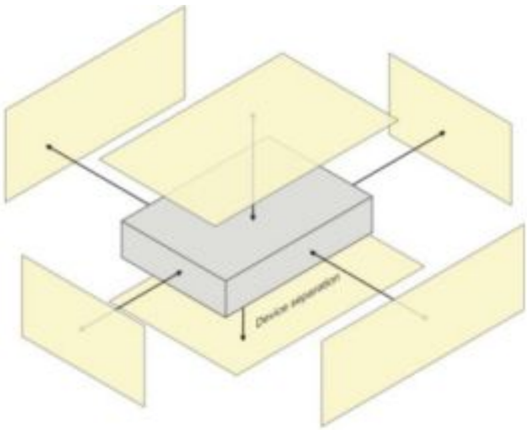
Body-worn accessory SAR compliance is based on a single minimum test separation distance for all wireless and operating modes applicable to each body-worn accessory used by the host, and according to the relevant voice and/or data mode transmissions and operations. If a body-worn accessory supports voice only operations in its normal and expected use conditions, testing of data mode for body-worn compliance is not required. A conservative minimum test separation distance for supporting off-the-shelf body-worn accessories that may be acquired by users of consumer handsets is used to test for body-worn accessory SAR compliance. This distance is determined by the handset manufacturer, according to the requirements of Supplement C 01-01. Devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body-worn accessories, will be tested using a conservative minimum test separation distance <= 5 mm to support compliance.





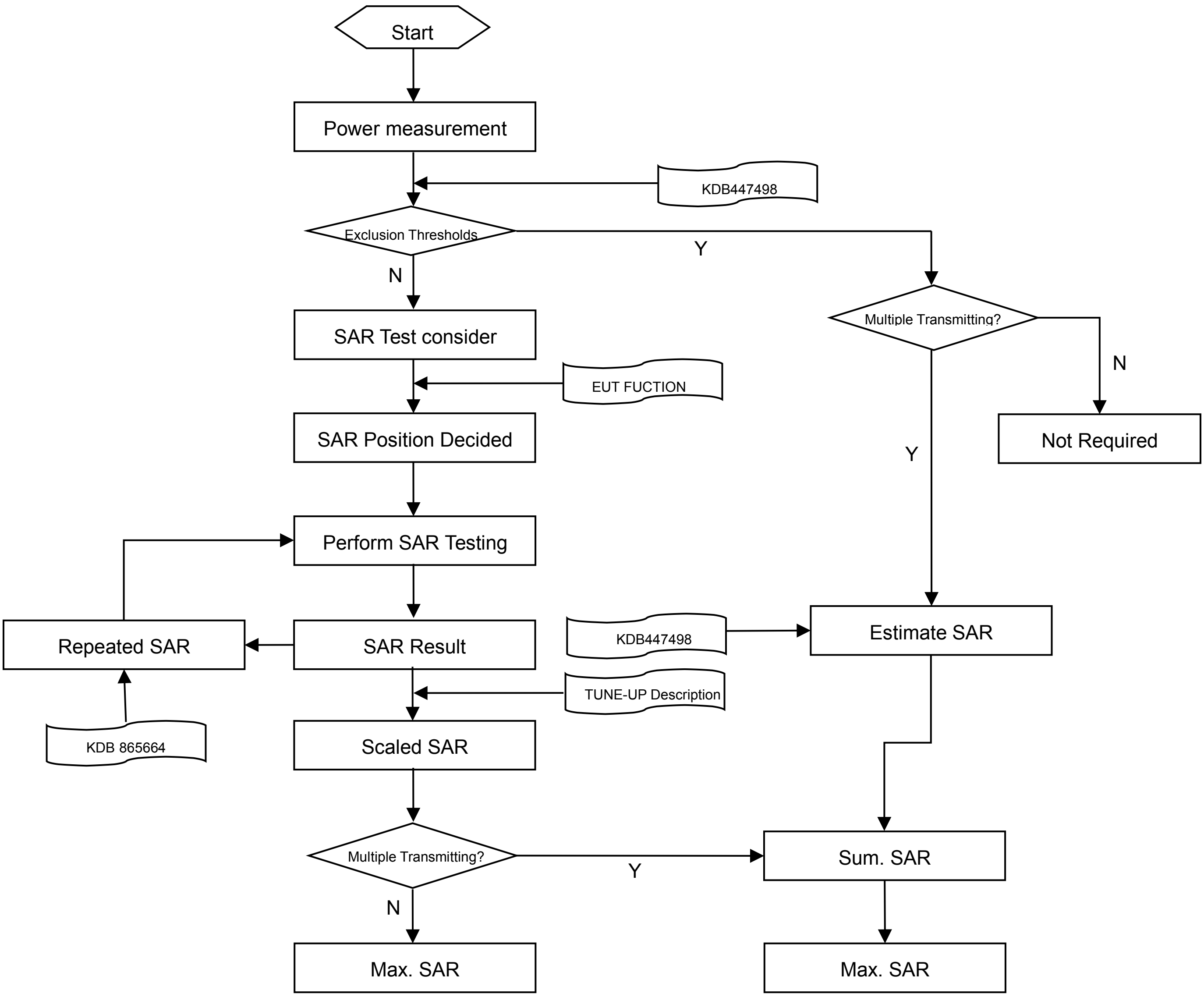
6.3 Hotspot Mode Exposure Position Conditions

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing functions, the relevant hand and body exposure conditions are tested according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge. When the form factor of a handset is smaller than 9 cm x 5 cm, a test separation distance of 5 mm (instead of 10 mm) is required for testing hotspot mode. When the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface).



7 SAR MEASUREMENT PROCEDURES

7.1 SAR Measurement Process Diagram



7.2 SAR Scan General Requirements

Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2013.

<table>
<tr><th colspan="3"></th><th>≤3GHz</th><th>>3GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5±1 mm</td><td>½·δ·ln(2)±0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30°±1°</td><td>20°±1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx Area , Δy Area</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3–4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx Zoom , Δy Zoom</td><td>≤ 2 GHz: ≤ 8 mm
2 –3 GHz: ≤ 5 mm*</td><td>3–4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="7">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2" rowspan="3">uniform grid: Δz Zoom (n)</td><td rowspan="3">≤ 5 mm</td><td>3–4 GHz: ≤ 4 mm</td></tr>
<tr><td>4–5 GHz: ≤ 3 mm</td></tr>
<tr><td>5–6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="4">graded grid</td><td rowspan="3">Δz Zoom (1): between 1st two points closest to phantom surface</td><td rowspan="3">≤ 4 mm</td><td>3–4 GHz: ≤ 3 mm</td></tr>
<tr><td>4–5 GHz: ≤ 2.5 mm</td></tr>
<tr><td>5–6 GHz: ≤ 2 mm</td></tr>
<tr><td>Δz Zoom (n>1): between subsequent points</td><td colspan="2">≤ 1.5·Δz Zoom (n-1)</td></tr>
<tr><td rowspan="3">Minimum zoom scan volume</td><td colspan="2" rowspan="3">x, y, z</td><td rowspan="3">≥30 mm</td><td>3–4 GHz: ≥ 28 mm</td></tr>
<tr><td>4–5 GHz: ≥ 25 mm</td></tr>
<tr><td>5–6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note:
1. δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
2. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

7.3 SAR Measurement Procedure

The following steps are used for each test position

- Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface
- Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
- Measurement of the SAR distribution with a grid of 8 to 16mm * 8 to16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.
- Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.
-

7.4 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r03 quoted below.

When the 1-g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

8 CONDUCTED RF OUPUT POWER

GSM						
GSM 850 Band	Burst Average Power(dBm)			Frame-averaged power(dBm)		
Channel	128	190	251	128	190	251
Frequency (MHz)	824.2	836.6	848.8	824.2	836.6	848.8
GPRS (GMSK, 1-Slot)	32.14	32.25	32.29	23.14	23.25	23.29
GPRS (GMSK, 2-Slots)	30.19	30.33	30.29	24.19	24.33	24.29
GPRS (GMSK, 3-Slots)	25.24	25.21	25.23	20.98	20.95	20.97
GPRS (GMSK, 4-Slots)	23.30	23.27	23.24	20.30	20.27	20.24
GSM 1900 Band	Burst Average Power (dBm)			Frame-averaged power(dBm)		
Channel	512	661	810	512	661	810
Frequency (MHz)	1850.2	1880.0	1909.8	1850.2	1880.0	1909.8
GPRS (GMSK, 1-Slot)	29.38	29.26	29.12	20.38	20.26	20.12
GPRS (GMSK, 2-Slots)	27.38	27.19	26.90	21.38	21.19	21.38
GPRS (GMSK, 3-Slots)	25.26	25.10	25.03	21.00	20.84	20.77
GPRS (GMSK, 4-Slots)	23.31	23.22	23.15	20.31	20.22	20.15

Note:

1. SAR testing was performed on the maximum frame-averaged power mode.
2. The frame-averaged power is linearly proportion to the slot number configured and it is linearly scaled the maximum burst-averaged power based on time slots. The calculated method is shown as below:

   Frame-averaged power = Burst averaged power (1 Tx Slot) - 9 dB

   Frame-averaged power = Burst averaged power (2 Tx Slots) - 6 dB

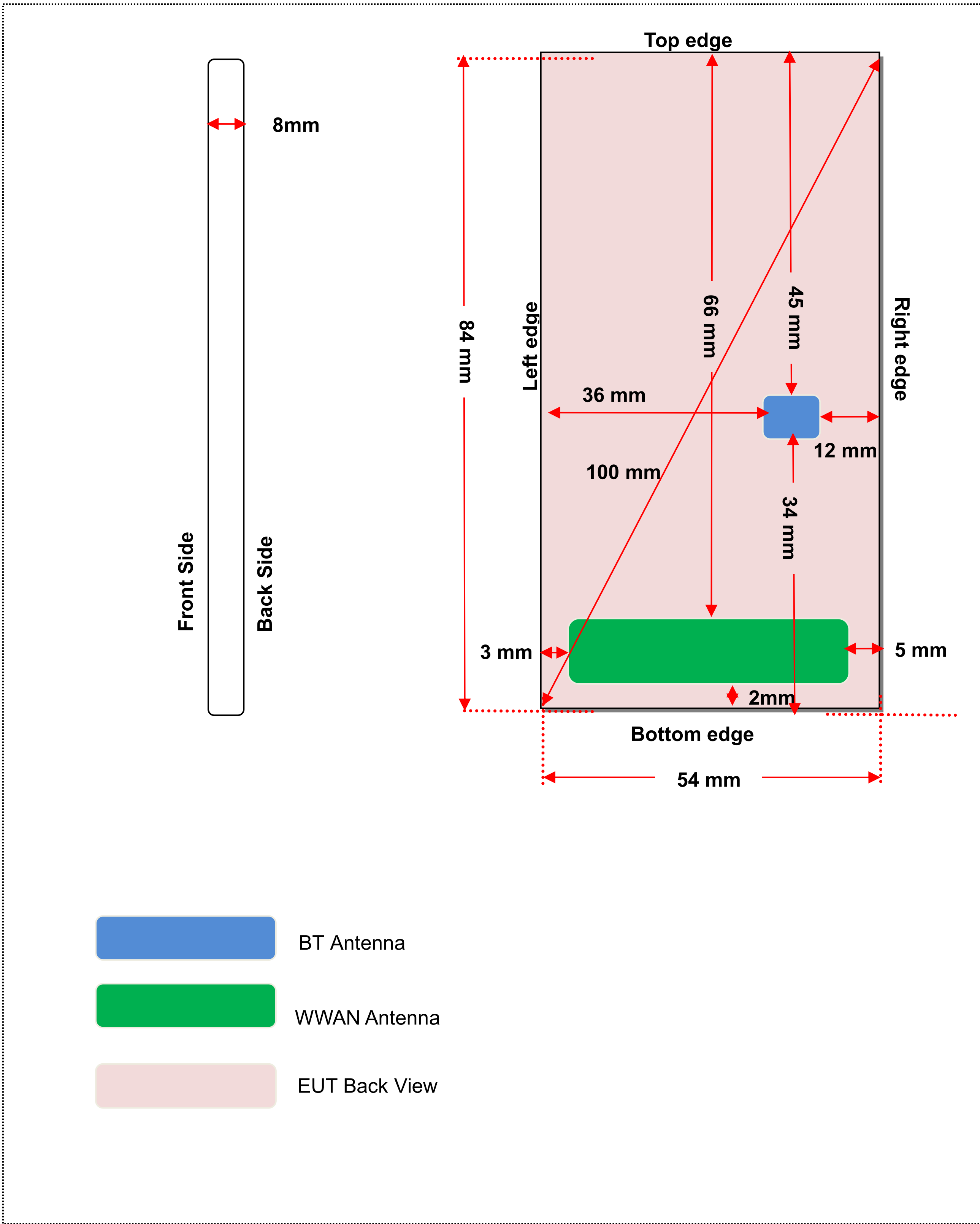
   Frame-averaged power = Burst averaged power (3 Tx Slots) - 4.26 dB

   Frame-averaged power = Burst averaged power (4 Tx Slots) - 3 dB

BLUETOOTH						
Mode	GFSK			π/4-DQPSK		
Channel	1	39	79	1	39	79
Frequency (MHz)	2402	2441	2480	2402	2441	2480
Peak Power (dBm)	1.131	1.162	**1.399**	0.589	0.752	0.693
Mode	8-DPSK			BLE		
Channel	1	39	79	1	19	40
Frequency (MHz)	2402	2441	2480	2402	2440	2480
Peak Power (dBm)	0.363	0.427	0.514	N/A	N/A	N/A

Note: The power of Bluetooth is: 1.399 (dBm) = 1.38 (mW). which is less than the exclusion threshold limit 10 mW, the SAR evaluation test is not required.

9 EUT ANTENNA LOCATION SKETCH



9.1 SAR Test Exclusion Consider Table

According with FCC KDB 447498 D01v05r02, Appendix A, <SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm> Table, this Device SAR test configurations consider as following :

Band	Mode	Max. Peak Power		Test Position Configurations					
		dBm	mW	Head	Front/ Back	Left Edge	Right Edge	Top Edge	Bottom Edge
GSM 850	Distance to User			<5mm	<5mm	3mm	<5mm	66mm	<5mm
	Data	32.14	1636.82	No	Yes	Yes	Yes	No	Yes
GSM 1900	Distance to User			<5mm	<5mm	3mm	<5mm	66mm	<5mm
	Data	29.38	866.96	No	Yes	Yes	Yes	No	Yes

Note:

1. Maximum power is the source-based time-average power and represents the maximum RF output power among production units
2. Per KDB 447498 D01v05r02, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
3. Per KDB 447498 D01v05r02, standalone SAR test exclusion threshold is applied; If the distance of the antenna to the user is < 5mm, 5mm is used to determine SAR exclusion threshold
4. Per KDB 447498 D01v05r02, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
   [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
   a. f(GHz) is the RF channel transmit frequency in GHz
   b. Power and distance are rounded to the nearest mW and mm before calculation
   c. The result is rounded to one decimal place for comparison
   d. For < 50 mm distance, we just calculate mW of the exclusion threshold value (3.0) to do compare.
   This formula is [3.0] / [√f(GHz)] ·[(min. test separation distance, mm)] = exclusion threshold of mW.
5. Per KDB 447498 D01v05r02, at 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following
   a. [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
   b. [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz
6. Per KDB 248227 D01 v02, choose the highest output power channel to test SAR and determine further SAR exclusion.8. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate

10 TEST RESULTS

10.1 Body-worn Mode SAR (5mm separation)

Band	Mode	Position	Ch.	Freq. (MHz)	Power Drift	Meas. SAR (W/Kg)	Meas. Power (dBm)	Max. tune-up Power(dBm)	Scaling Factor	Scaled SAR(W/Kg)	Meas. No.
GSM850	GPRS Data	Front Side	128	824.2	-2.81	0.264	23.30	23.40	1.023	0.270	1#
		Back Side	128	824.2	1.11	**0.547**	23.30	23.40	1.023	**0.560**	2#
		Left Edge	128	824.2	0.09	0.202	23.30	23.40	1.023	0.207	3#
		Right Edge	128	824.2	0.61	0.119	23.30	23.40	1.023	0.122	4#
		BottomEdge	128	824.2	-2.8	0.094	23.30	23.40	1.023	0.096	5#
GSM 1900	GPRS Data	Front Side	512	1850.2	0.44	0.401	23.31	23.40	1.021	0.409	6#
		Back Side	512	1850.2	-0.98	**0.722**	23.31	23.40	1.021	**0.737**	7#
		Left Edge	512	1850.2	-0.15	0.193	23.31	23.40	1.021	0.197	8#
		Right Edge	512	1850.2	-2.48	0.070	23.31	23.40	1.021	0.071	9#
		BottomEdge	512	1850.2	-2.0	0.438	23.31	23.40	1.021	0.447	10#

11 SIMULTANEOUS TRANSMISSION

11.1 Simultaneous Transmission Mode Consider

Simultaneous Transmitting （Yes/NO）	BT	GSM Data
GSM Data	Yes	-
BT	-	-
Note: The power of Bluetooth is: 1.399 (dBm) =1.38 (mW), which is less than the exclusion threshold limit 10 mW, the SAR evaluation test is not required.		

11.2 Estimated SAR Calculation

According to KDB 447498 D01v05r02, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR was estimated according to following formula to result in substantially conservative SAR values of <= 0.4 W/kg to determine simultaneous transmission SAR test exclusion.

$$Estimate\ SAR = \frac{Max.Tune\ Up\ Power_{(mW)}}{Min.Test\ Separation\ Distance_{(mm)}} * \frac{\sqrt{f_{GHz}}}{7.5}$$

If the minimum test separation distance is < 5 mm, a distance of 5 mm is used for estimated SAR calculation.

When the test separation distance is > 50 mm, the 0.4 W/kg is used for SAR-1g.

Band	Mode	Position	Antenna To user (mm)	SAR Testing	Max. Tune-up Power (dBm)	Max. Tune-up Power (mW)	Frequency (GHz)	Calculation Distance/Gap (mm)	Estimated SAR (W/kg)
Bluetooth	GFSK	Front Side	5	NO	1.50	1.41	2.480	5	0.059
		Back Side	5	NO	1.50	1.41	2.480	5	0.059
		Left Edge	5	NO	1.50	1.41	2.480	5	0.059
		Right Edge	5	NO	1.50	1.41	2.480	5	0.059
		Bottom	5	NO	1.50	1.41	2.480	5	0.059

11.3 Sum SAR of Simultaneous Transmission

Simultaneous Mode	Position	Mode	Max. 1g SAR (W/kg)	1g Sum SAR (W/kg)
GSM DATA + BT	Body	GSM DATA	0.772	0.831
		BT	0.059	

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna. When the sum of SAR 1g of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit (SAR 1g 1.6 W/kg), the simultaneous transmission SAR is not required. When the sum of SAR 1g is greater than the SAR limit (SAR 1g 1.6 W/kg), SAR test exclusion is determined by the SPLSR.

12 TEST EQUIPMENTS LIST

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
PC	Dell	N/A	N/A	N/A	N/A
835MHz Dipole	SATIMO	SID 835	S/N 25/13 DIP 0G835-246	2015/03/16	2016/03/15
1900MHz Dipole	SATIMO	SID 1900	S/N 25/13 DIP 1G900-249	2015/03/16	2016/03/15
E-Field Probe	SATIMO	SSE1	SN 27/13 EP187	2014/08/17	2015/08/16
Antenna	SATIMO	ANTA3	SN 17/13 ZNTA45	N/A	N/A
Phantom1	SATIMO	SAM	SN 30/13 SAM013	N/A	N/A
Phantom2	SATIMO	SAM	SN 30/13 SAM014	N/A	N/A
Dielectric Probe Kit	SATIMO	SCLMP	SN 25/13 OCPG56	2014/08/17	2015/08/16
MultiMeter	Keithley	MultiMeter 2000	4024022	2014/12/13	2015/12/12
Signal Generator	R&S	SMF100A	1167.0000k02/104260	2015/07/06	2016/07/05
Power Meter	Agilent	5738A	11290	2014/10/18	2015/10/17
Power Sensor	R&S	NRP-Z21	103971	2014/11/03	2015/11/02
Power Amplifier	SATIMO	6552B	22374	N/A	N/A
Wireless Communication Test Set	Agilent	8960-E5515C	MY50260493	2015/01/30	2016/01/29
Network Analyzer	Agilent	5071C	EMY46103472	2014/11/03	2015/11/02
Attenuator	COM-MW	ZA-S1-31	1305003187	N/A	N/A
Directional coupler	AA-MCS	AAMCS-UDC	000272	N/A	N/A

ANNEX A SIMULATING LIQUID VERIFICATION RESULT

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an SATIMO SCLMP Dielectric Probe Kit and a Network Analyzer.

Date	Liquid Type	Freq. (MHz)	Temp. (℃)	Meas. Conductivity (σ)	Meas. Permittivity (ε)	Target conductivity (σ)	Target Permittivity (ε)	Conductivity tolerance (%)	Permittivity tolerance (%)
2015.07.01	Body	835	22.2	0.95	55.89	0.97	55.20	-2.06	1.25
2015.07.01	Body	1900	22.2	1.49	54.26	1.52	53.30	-1.97	1.80
Note: The tolerance limit of Conductivity and Permittivity is ± 5%.									

ANNEX B SYSTEM CHECK RESULT

Comparing to the original SAR value provided by SATIMO, the validation data should be within its specification of 10% (for 1 g).

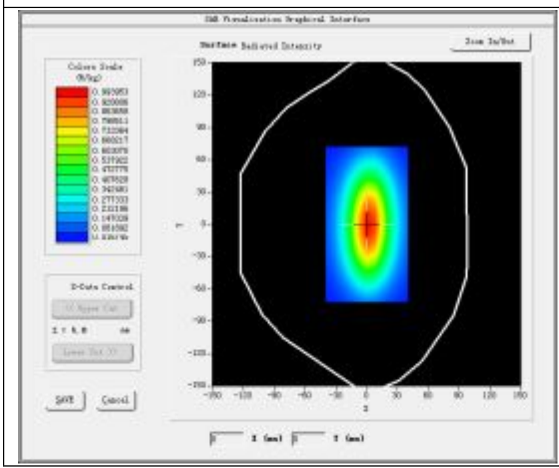
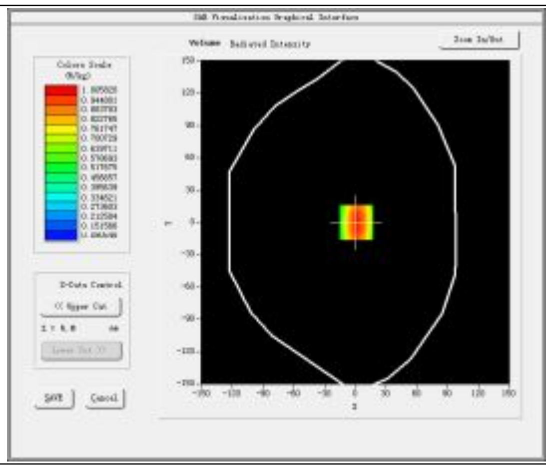
Date	Liquid Type	Freq. (MHz)	Power (mW)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Dipole SAR (W/kg)	Tolerance (%)	Targeted SAR(W/kg)	Tolerance (%)
2015.07.01	Body	835	100	1.005	10.05	10.53	-4.56	9.56	5.13
2015.07.01	Body	1900	100	4.116	41.16	42.06	-2.14	39.70	3.68
Note: The tolerance limit of System validation ±10%.									

System Performance Check Data(835MHz Body)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2015.07.01
Measurement duration: 14 minutes 13 seconds

Experimental conditions.

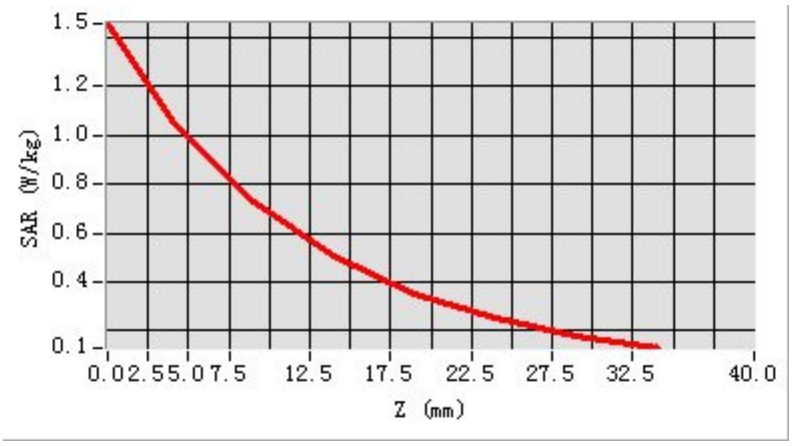
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	-
Band	835MHz
Channels	-
Signal	CW
Frequency (MHz)	835MHz
Relative permittivity (real part)	55.892359
Relative permittivity	21.253685
Conductivity (S/m)	0.954365
Power drift (%)	0.090000
Ambient Temperature:	22.8°C
Liquid Temperature:	22.2°C
ConvF:	3.58
Crest factor:	1:1

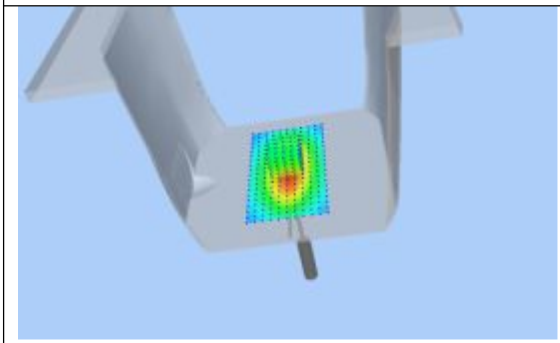
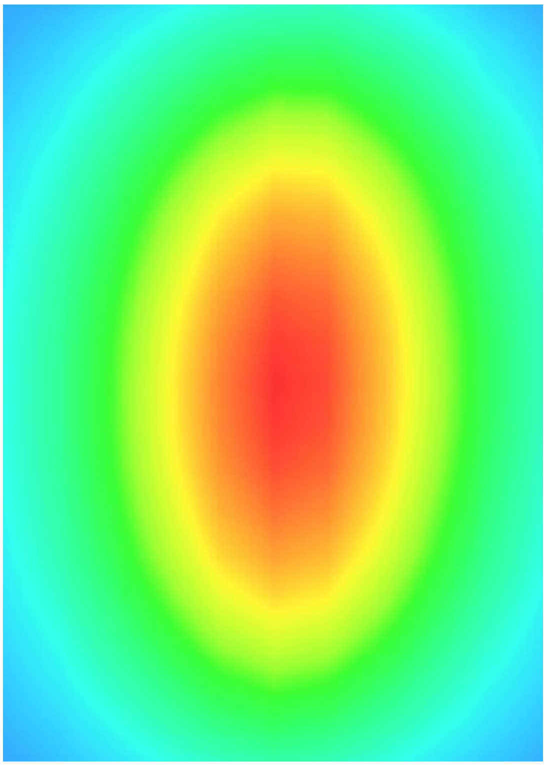
SURFACE SAR	VOLUME SAR
	

Maximum location: X=1.00, Y=0.00
SAR Peak: 1.47 W/kg

SAR 10g (W/Kg)	0.687623
SAR 1g (W/Kg)	1.004952

Z Axis Scan



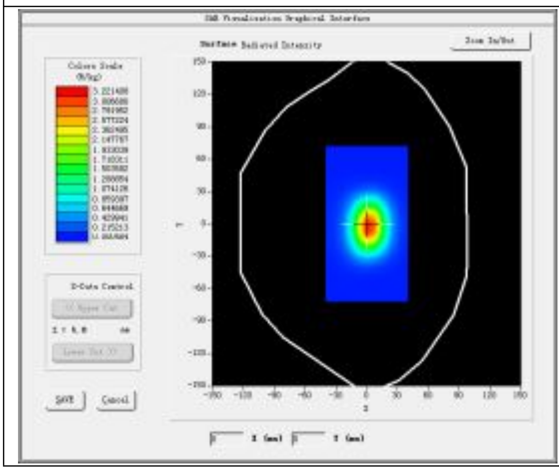
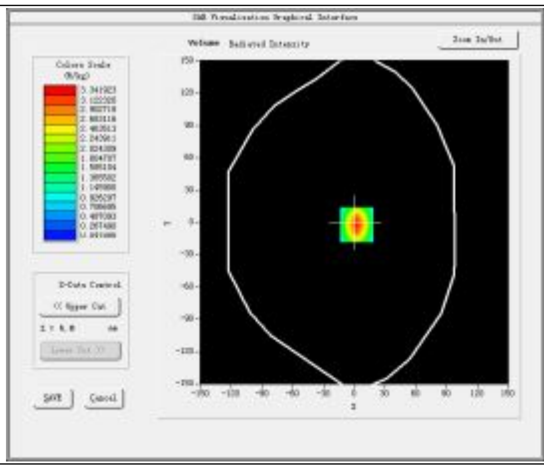
3D screen shot	Hot spot position
	

System Performance Check Data(1900MHz Body)

Type: Phone measurement (Complete)
Area scan resolution: dx=8mm,dy=8mm
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm
Date of measurement: 2015.07.01
Measurement duration: 14 minutes 46 seconds

Experimental conditions.

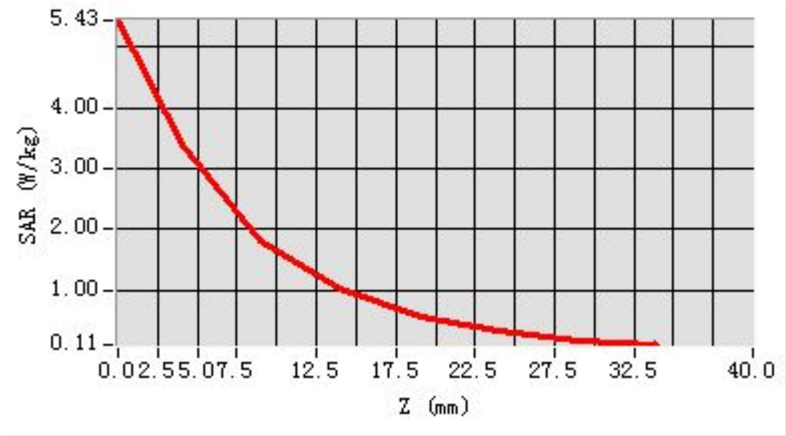
Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	-
Band	1900MHz
Channels	-
Signal	CW
Frequency (MHz)	1900.000000
Relative permittivity (real part)	54.262684
Relative permittivity	12.905356
Conductivity (S/m)	1.490023
Power drift (%)	0.370000
Ambient Temperature:	22.8°C
Liquid Temperature:	22.2°C
ConvF:	4.38
Crest factor:	1:1

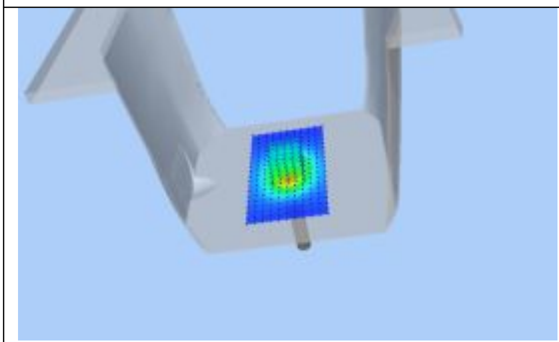
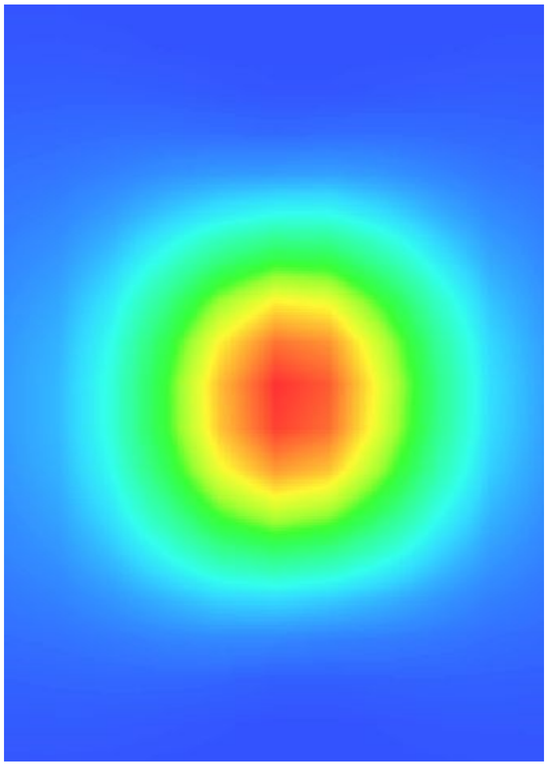
SURFACE SAR	VOLUME SAR
	

Maximum location: X=2.00, Y=-2.00
SAR Peak: 5.38 W/kg

SAR 10g (W/Kg)	1.985632
SAR 1g (W/Kg)	4.115863

Z Axis Scan



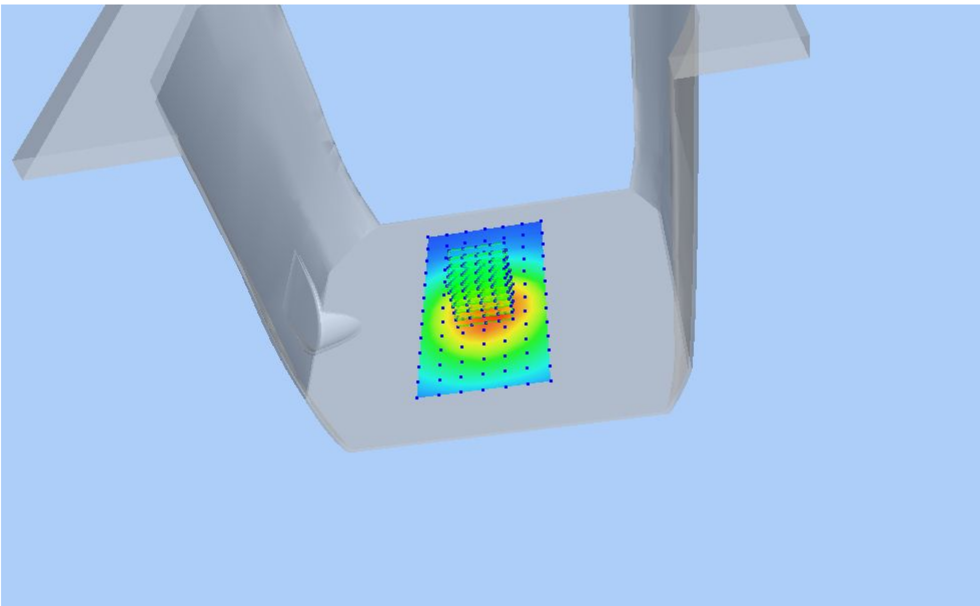
3D screen shot	Hot spot position
	

ANNEX C TEST DATA

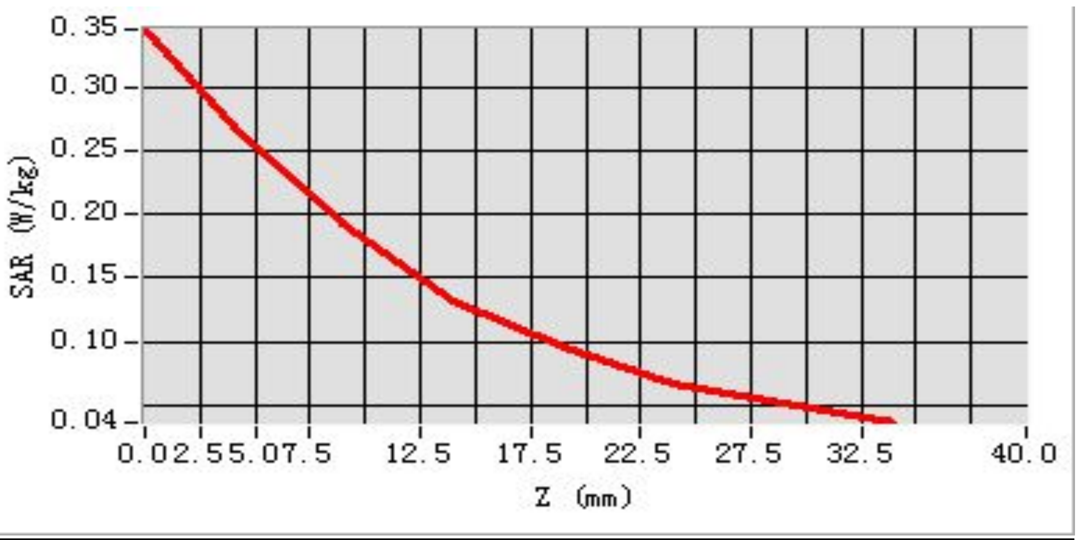
MEAS. 1 Body Plane with Front Side on Low Channel in GPRS850-12 mode

Test Date:	1/7/2015
Signal:	GSM, f=824.2 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 55.95; Conductivity: 0.98 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 22.1°C
Probe:	EP187, ConvF: 3.58
Area Scan:	sam_direct_droit2_surf12mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-4.000000, Y=0.000000
SAR 10g (W/Kg):	0.175970
SAR 1g (W/Kg):	0.264103
Power drift (%):	-2.81

3D screen shot



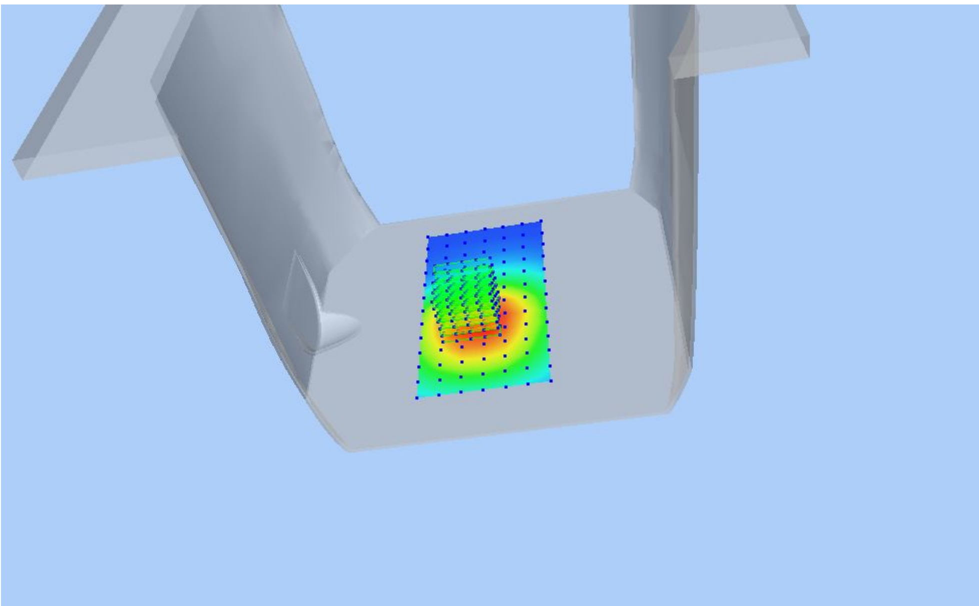
Z Axis Scan



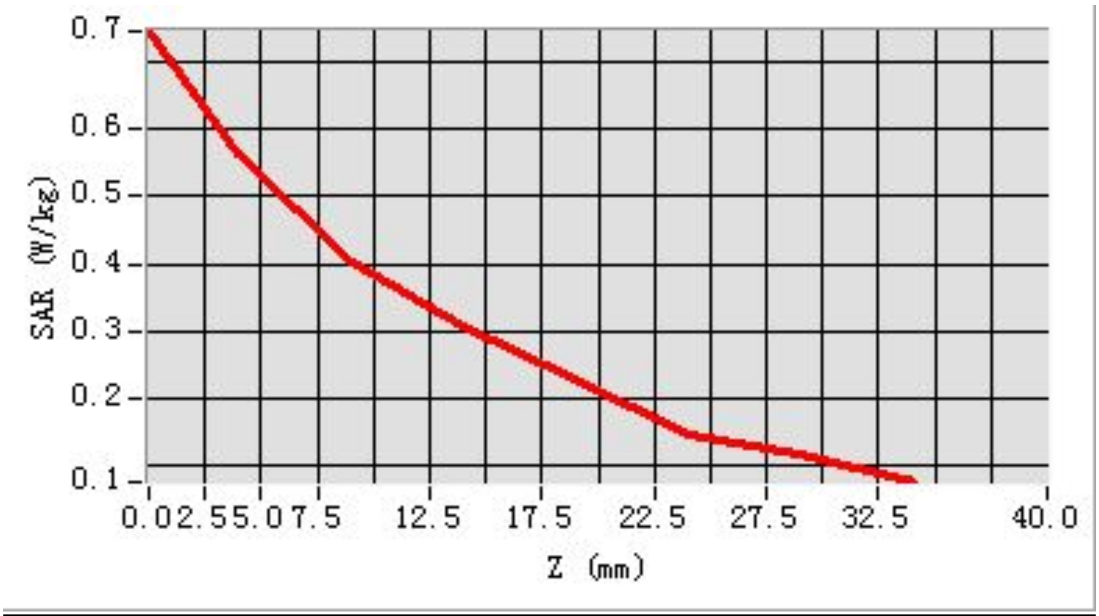
MEAS. 2 Body Plane with Back Side on Low Channel in GPRS850-12 mode

Test Date:	1/7/2015
Signal:	GSM, f=824.2 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 55.95; Conductivity: 0.98 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 22.1°C
Probe:	EP187, ConvF: 3.58
Area Scan:	sam_direct_droit2_surf12mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-16.000000, Y=-12.000000
SAR 10g (W/Kg):	0.377783
SAR 1g (W/Kg):	0.546880
Power drift (%):	1.11

3D screen shot



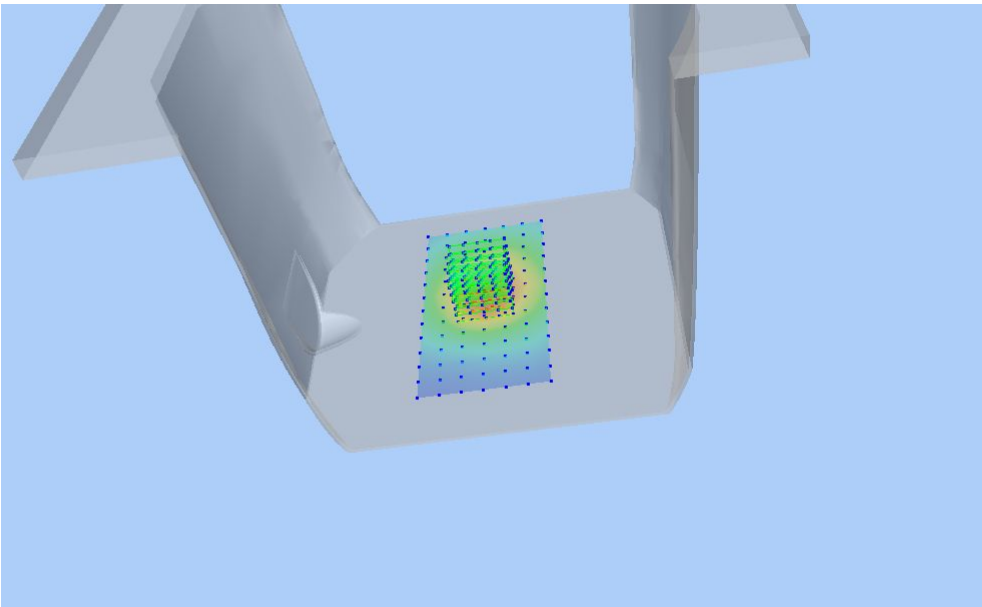
Z Axis Scan



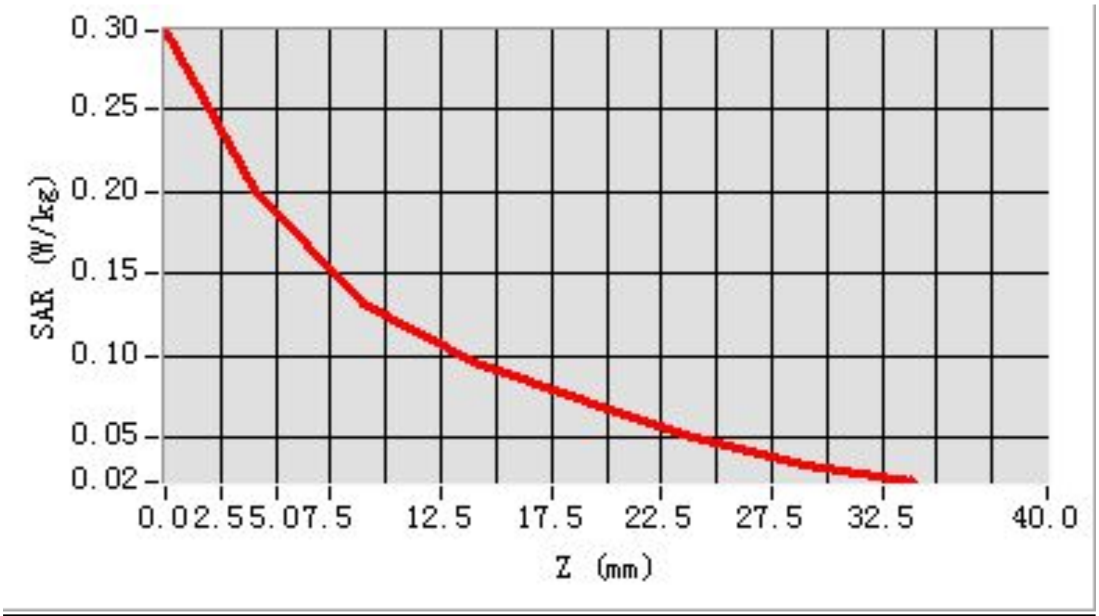
MEAS. 3 Body Plane with Left Edge on Low Channel in GPRS850-12 mode

Test Date:	1/7/2015
Signal:	GSM, f=824.2 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 55.95; Conductivity: 0.98 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 22.1°C
Probe:	EP187, ConvF: 3.58
Area Scan:	sam_direct_droit2_surf12mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-4.000000, Y=0.000000
SAR 10g (W/Kg):	0.130342
SAR 1g (W/Kg):	0.201921
Power drift (%):	0.09

3D screen shot



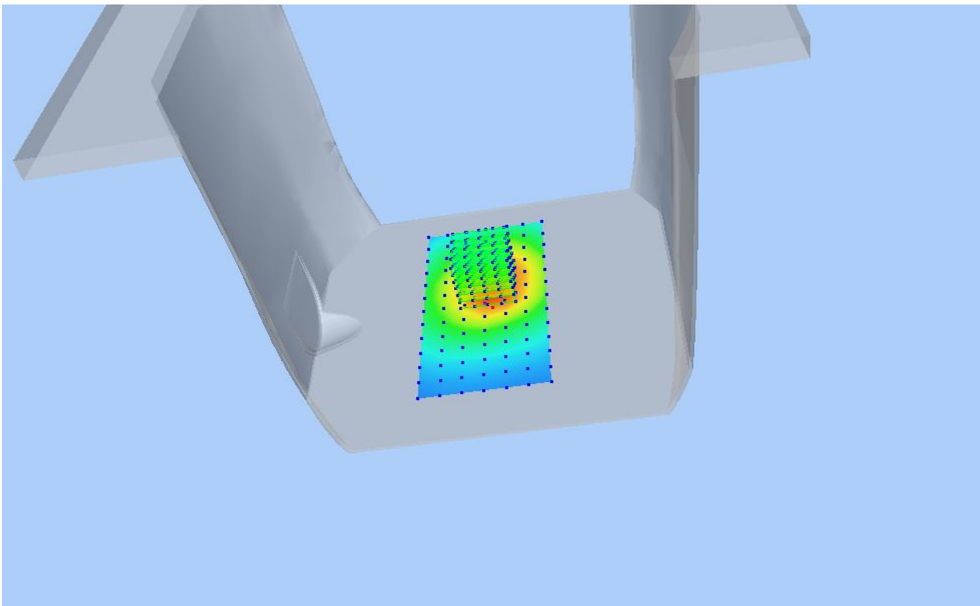
Z Axis Scan



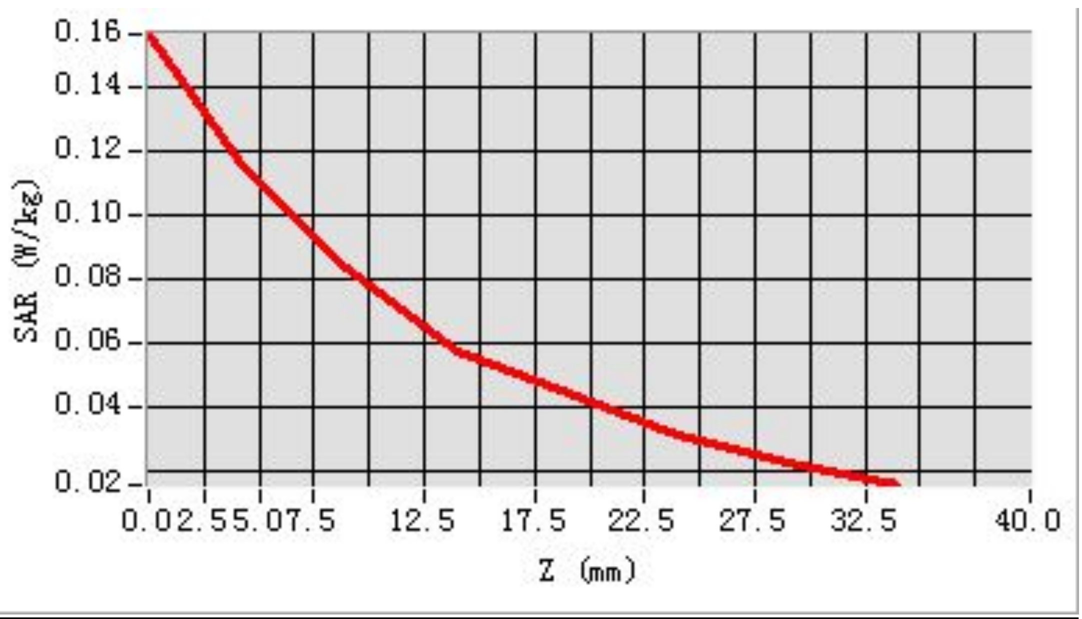
MEAS. 4 Body Plane with Right Edge on Low Channel in GPRS850-12 mode

Test Date:	1/7/2015
Signal:	GSM, f=824.2 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 55.95; Conductivity: 0.98 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 22.1°C
Probe:	EP187, ConvF: 3.58
Area Scan:	sam_direct_droit2_surf12mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-4.000000, Y=12.000000
SAR 10g (W/Kg):	0.078633
SAR 1g (W/Kg):	0.118986
Power drift (%):	0.61

3D screen shot



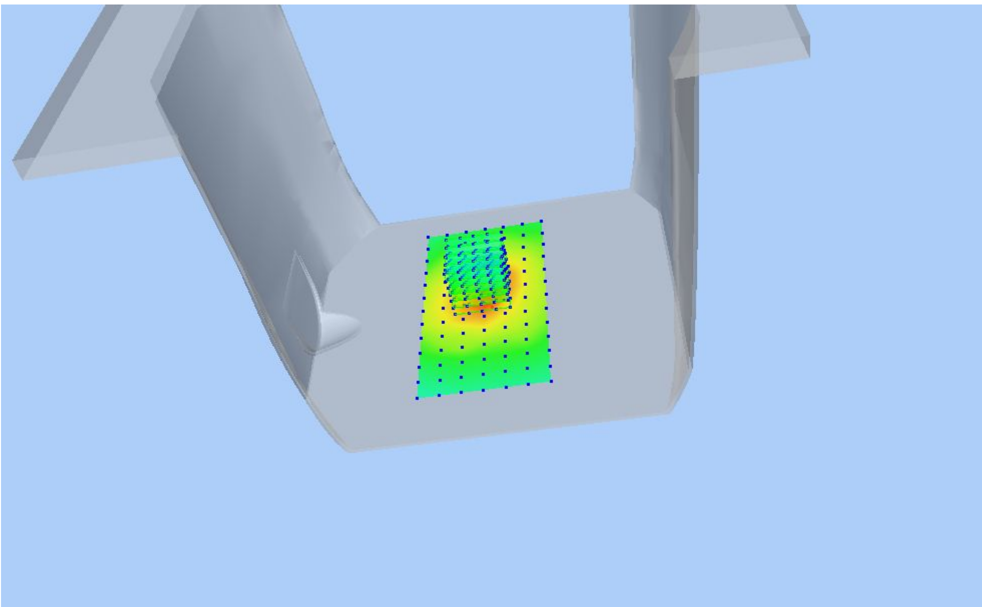
Z Axis Scan



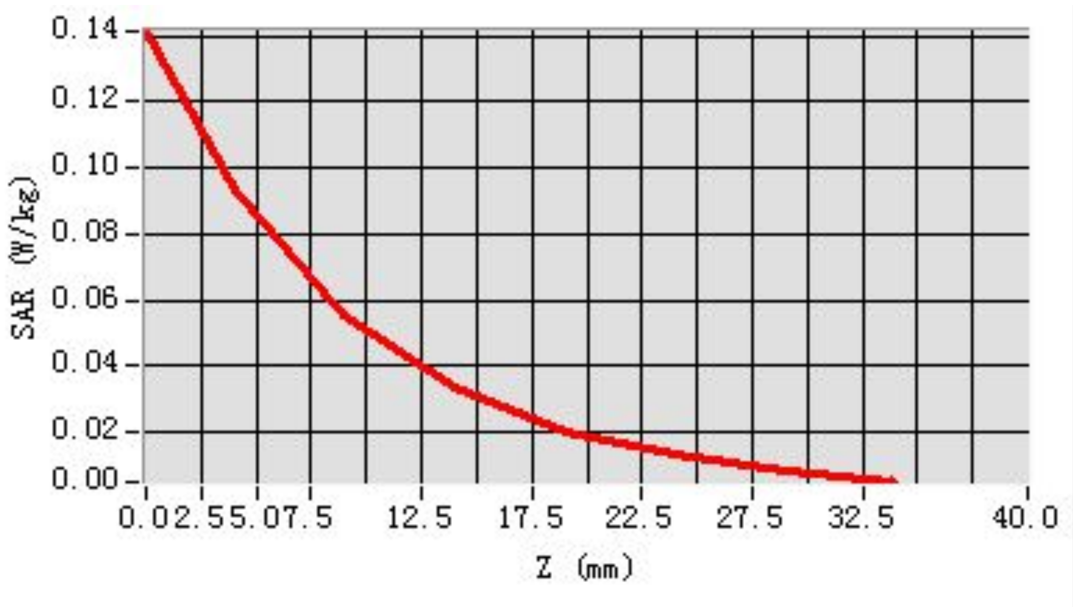
MEAS. 5 Body Plane with Bottom Edge on Low Channel in GPRS850-12 mode

Test Date:	1/7/2015
Signal:	GSM, f=824.2 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 55.95; Conductivity: 0.98 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 22.1°C
Probe:	EP187, ConvF: 3.58
Area Scan:	sam_direct_droit2_surf12mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-4.000000, Y=12.000000
SAR 10g (W/Kg):	0.053635
SAR 1g (W/Kg):	0.094058
Power drift (%):	-2.80

3D screen shot



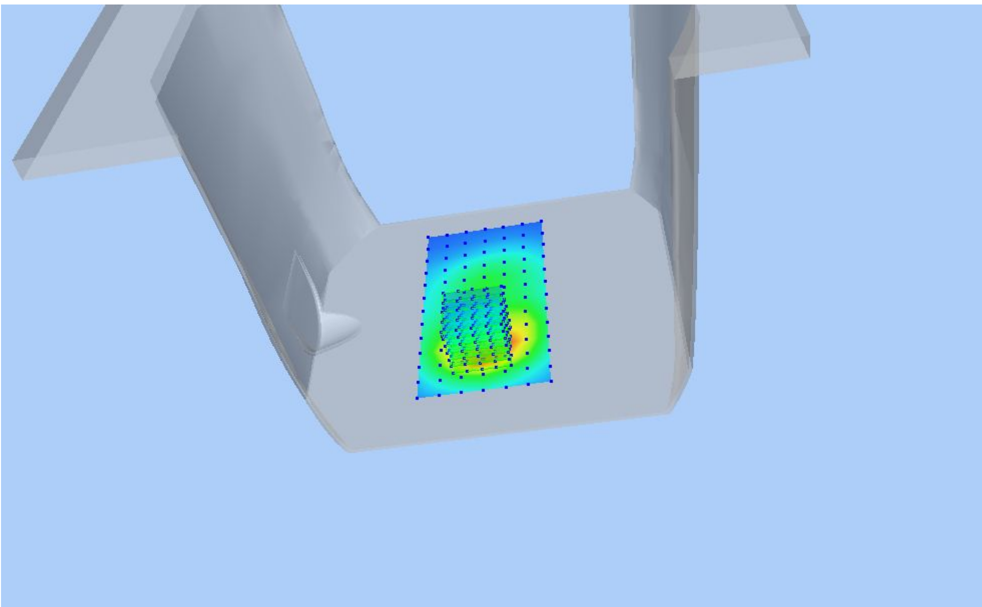
Z Axis Scan



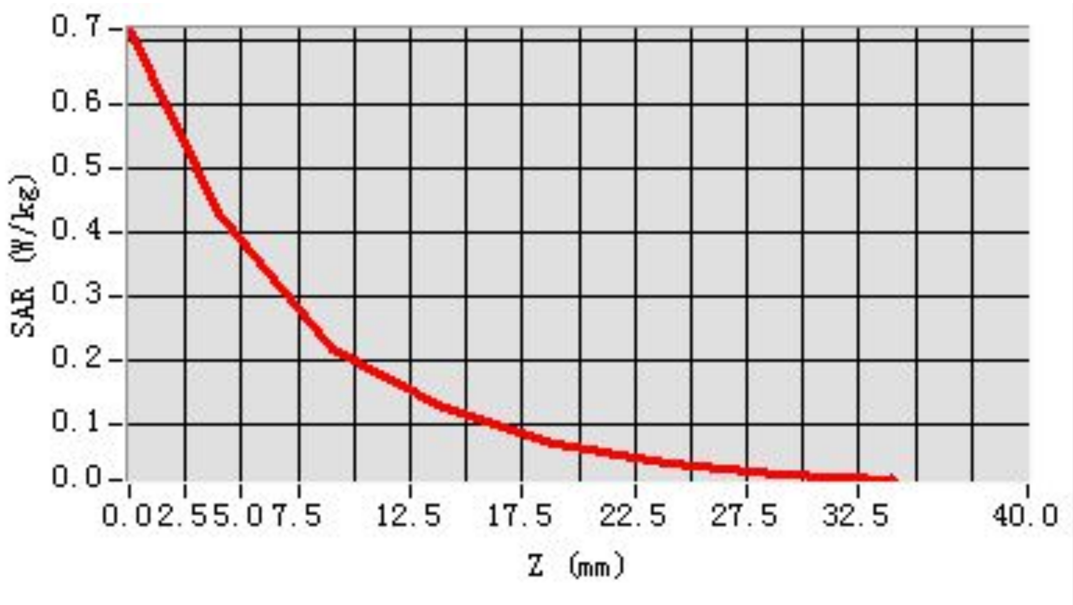
MEAS. 6 Body Plane with Front Side on Low Channel in GPRS1900-12 mode

Test Date:	1/7/2015
Signal:	GSM, f=1850.2 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 54.36; Conductivity: 1.49 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 22.1°C
Probe:	EP187, ConvF: 4.38
Area Scan:	sam_direct_droit2_surf12mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=-4.000000, Y=-36.000000
SAR 10g (W/Kg):	0.197892
SAR 1g (W/Kg):	0.400519
Power drift (%):	0.44

3D screen shot



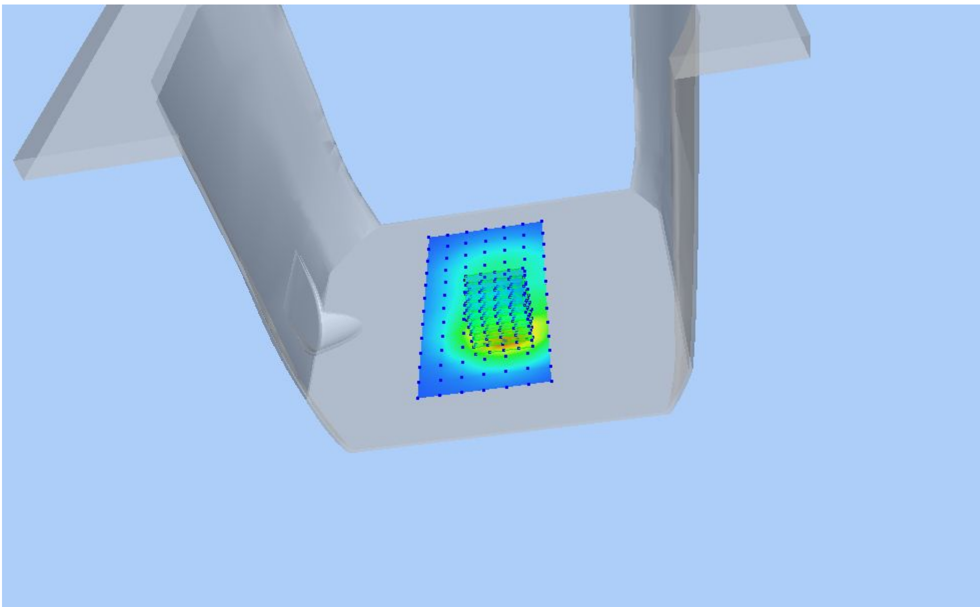
Z Axis Scan



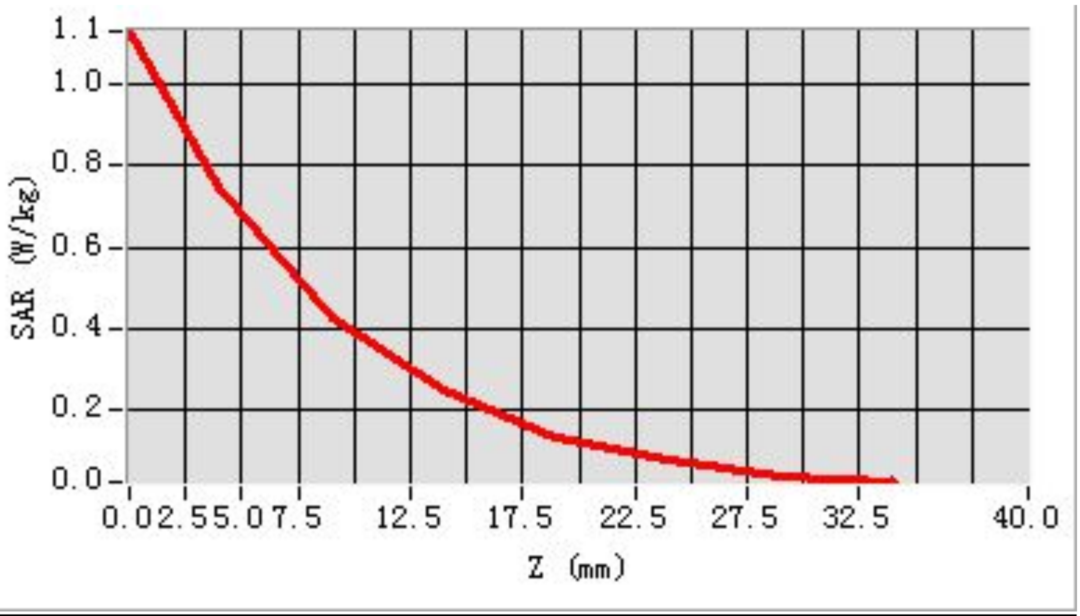
MEAS. 7 Body Plane with Back Side on Low Channel in GPRS1900-12 mode

Test Date:	1/7/2015
Signal:	GSM, f=1850.2 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 54.36; Conductivity: 1.49 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 22.1°C
Probe:	EP187, ConvF: 4.38
Area Scan:	sam_direct_droit2_surf12mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=8.000000, Y=-24.000000
SAR 10g (W/Kg):	0.359350
SAR 1g (W/Kg):	0.722348
Power drift (%):	-0.98

3D screen shot



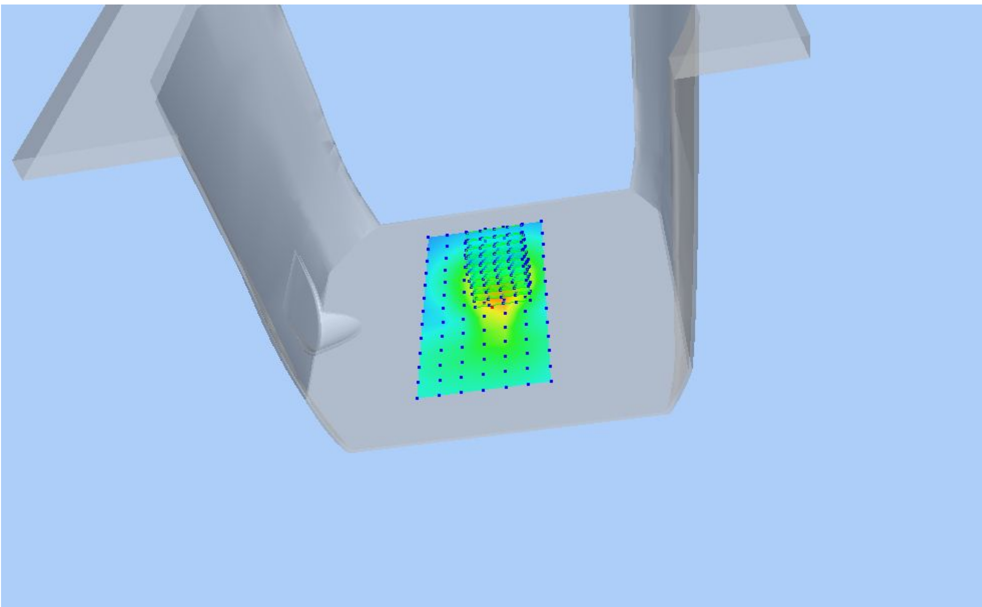
Z Axis Scan



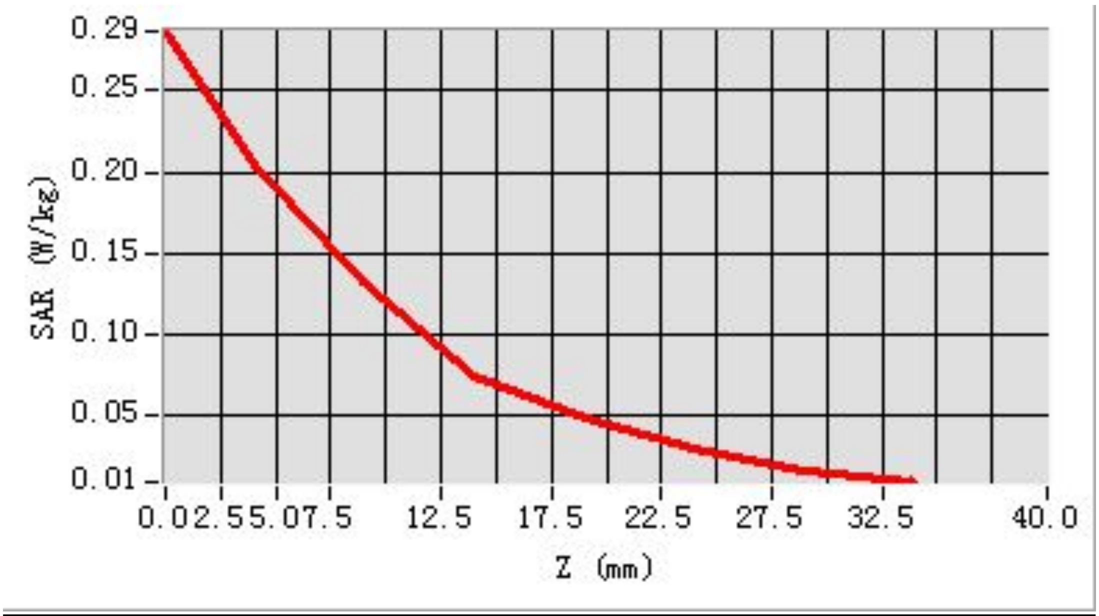
MEAS. 8 Body Plane with Left Edge on Low Channel in GPRS1900-12 mode

Test Date:	1/7/2015
Signal:	GSM, f=1850.2 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 54.36; Conductivity: 1.49 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 22.1°C
Probe:	EP187, ConvF: 4.38
Area Scan:	sam_direct_droit2_surf12mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=8.000000, Y=12.000000
SAR 10g (W/Kg):	0.113394
SAR 1g (W/Kg):	0.193393
Power drift (%):	-0.15

3D screen shot



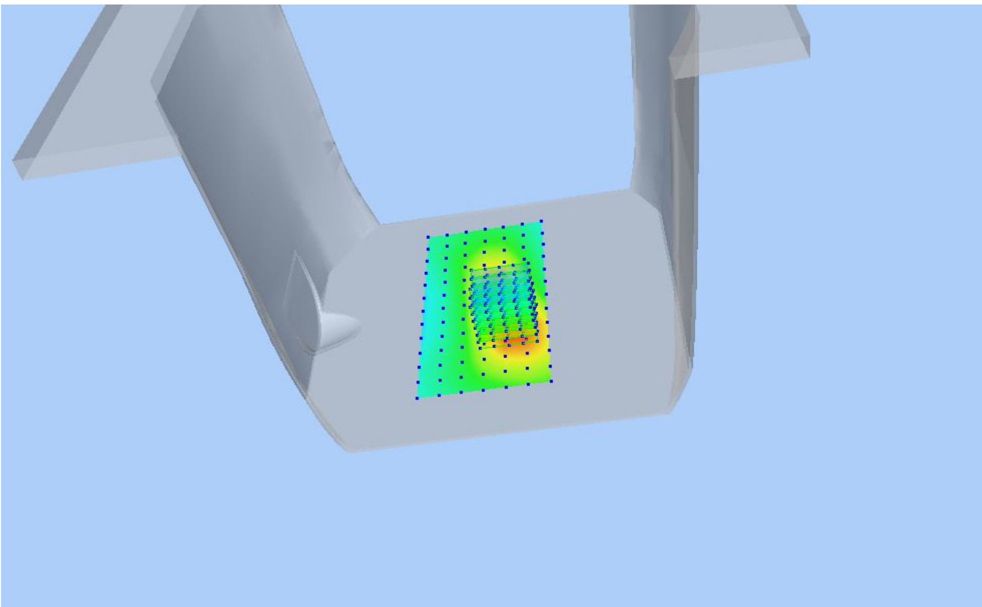
Z Axis Scan



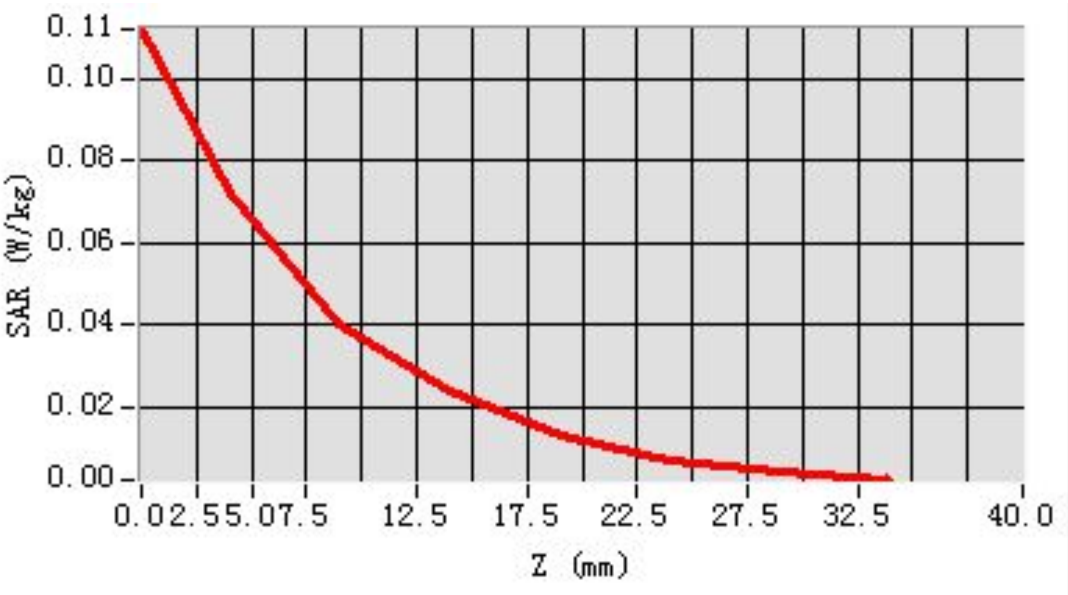
MEAS. 9 Body Plane with Right Edge on Low Channel in GPRS1900-12 mode

Test Date:	1/7/2015
Signal:	GSM, f=1850.2 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 54.36; Conductivity: 1.49 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 22.1°C
Probe:	EP187, ConvF: 4.38
Area Scan:	sam_direct_droit2_surf12mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=8.000000, Y=-24.000000
SAR 10g (W/Kg):	0.039325
SAR 1g (W/Kg):	0.069713
Power drift (%):	-2.48

3D screen shot



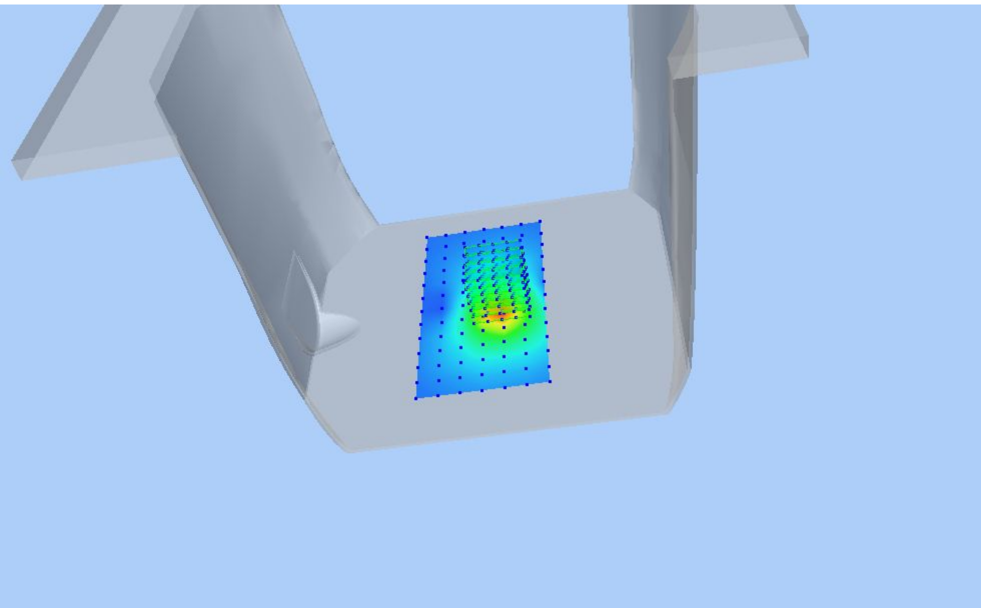
Z Axis Scan



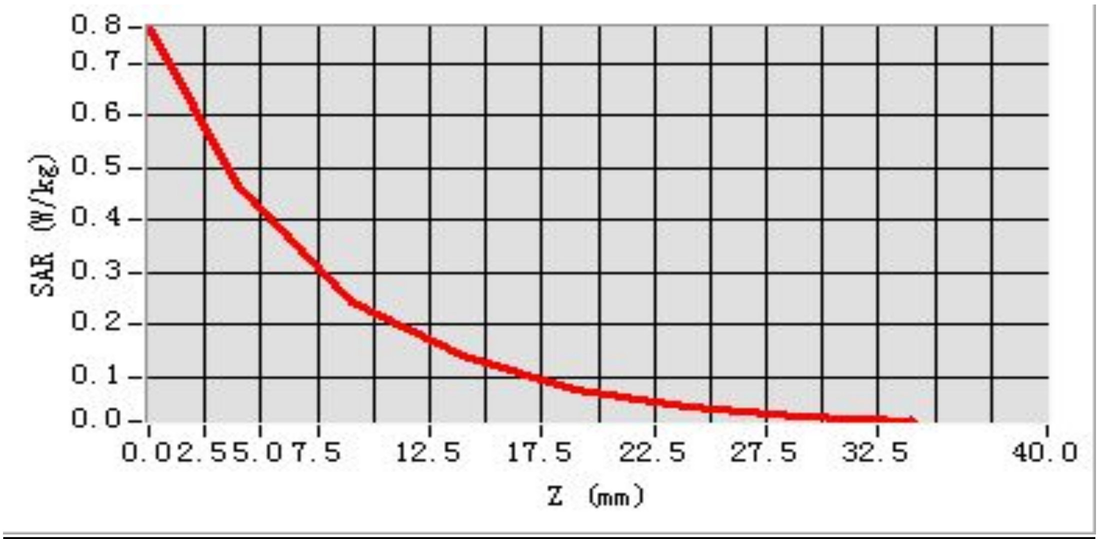
MEAS. 10 Body Plane with Bottom Edge on Low Channel in GPRS1900-12 mode

Test Date:	1/7/2015
Signal:	GSM, f=1850.2 MHz, Duty Cycle: 1:1.0
Liquid Parameters:	Permittivity: 54.36; Conductivity: 1.49 S/m
Test condition:	Ambient Temperature: 22.6°C, Liquid Temperature: 22.1°C
Probe:	EP187, ConvF: 4.38
Area Scan:	sam_direct_droit2_surf12mm.txt, h= 5.00 mm
Zoom Scan:	5x5x7,dx=8mm, dy=8mm, dz=5mm,Complete
Maximum location:	X=8.000000, Y=0.000000
SAR 10g (W/Kg):	0.214341
SAR 1g (W/Kg):	0.437765
Power drift (%):	-2.00

3D screen shot

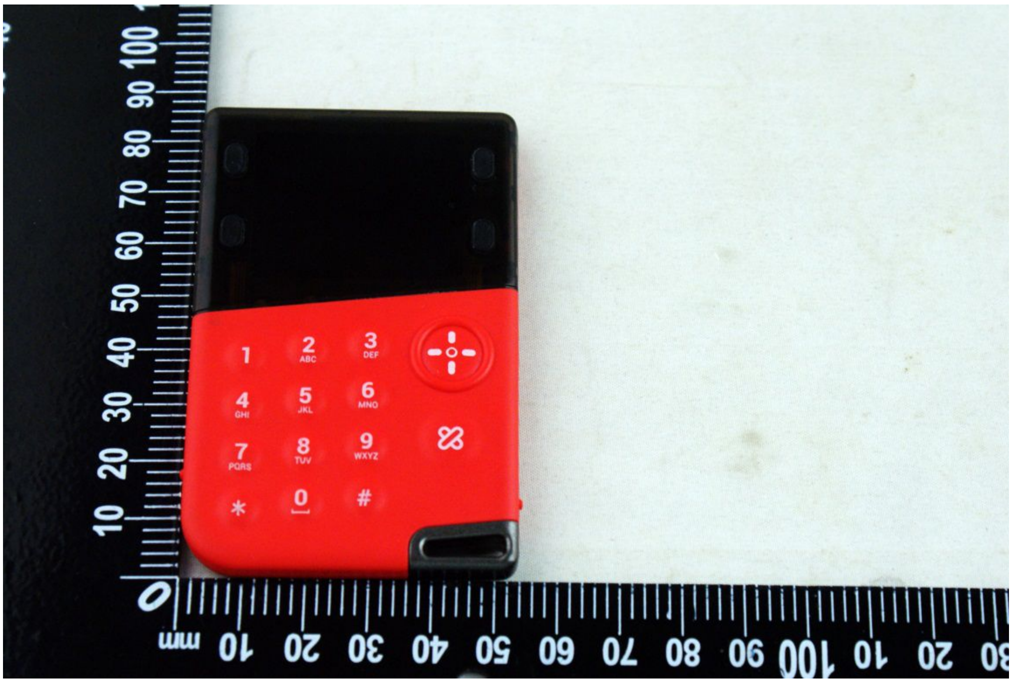


Z Axis Scan



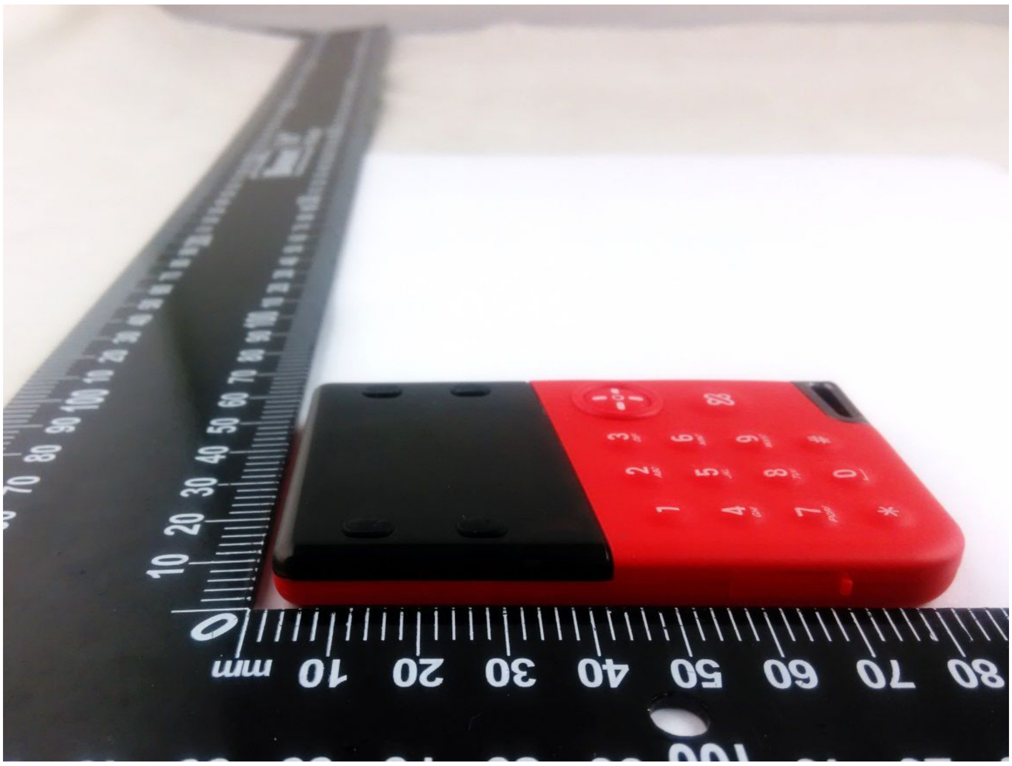
ANNEX D EUT PHOTO

THE FRONT OF EUT

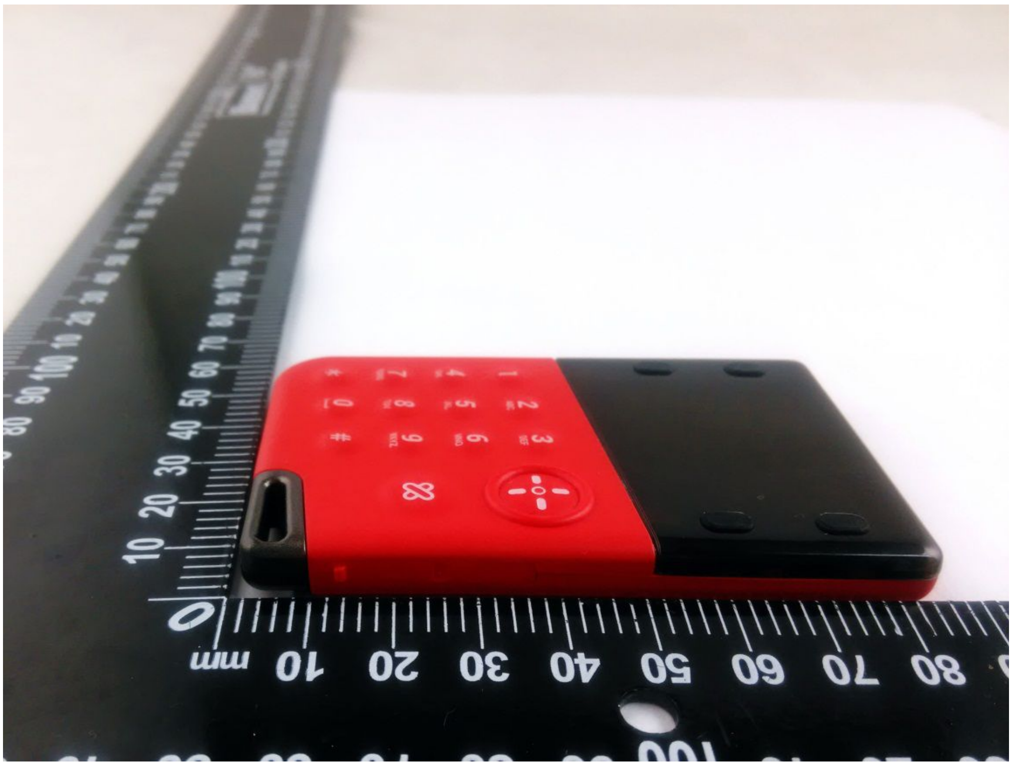


THE BACK OF EUT

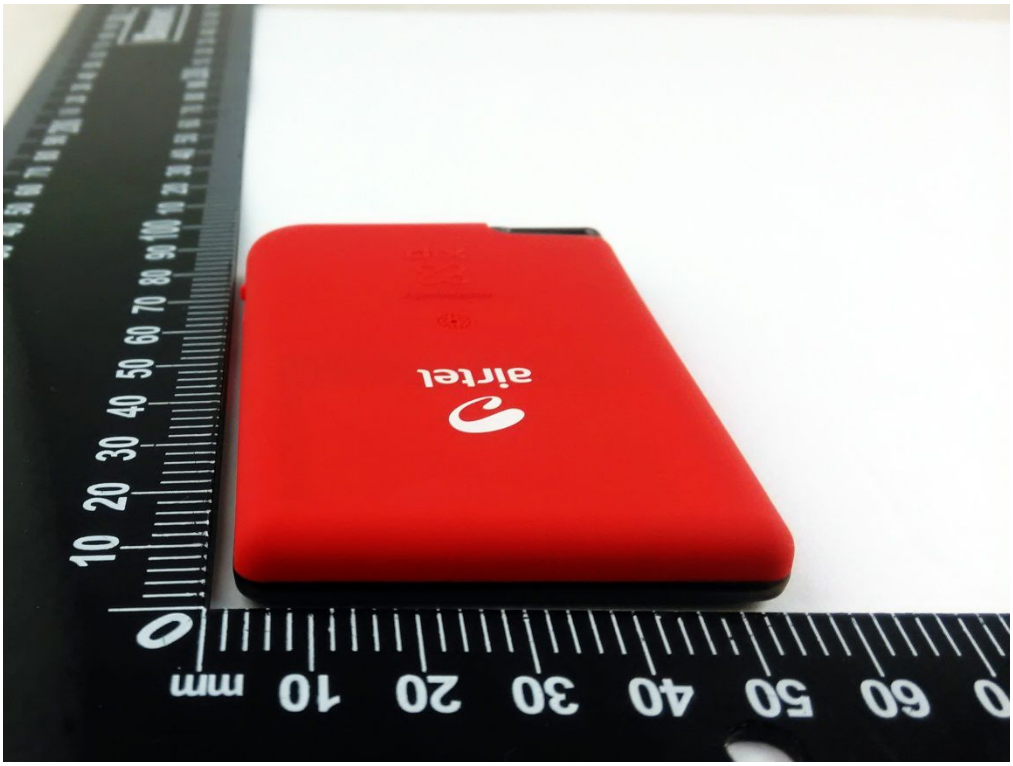
THE LEFT OF EUT



THE RIGHT OF EUT

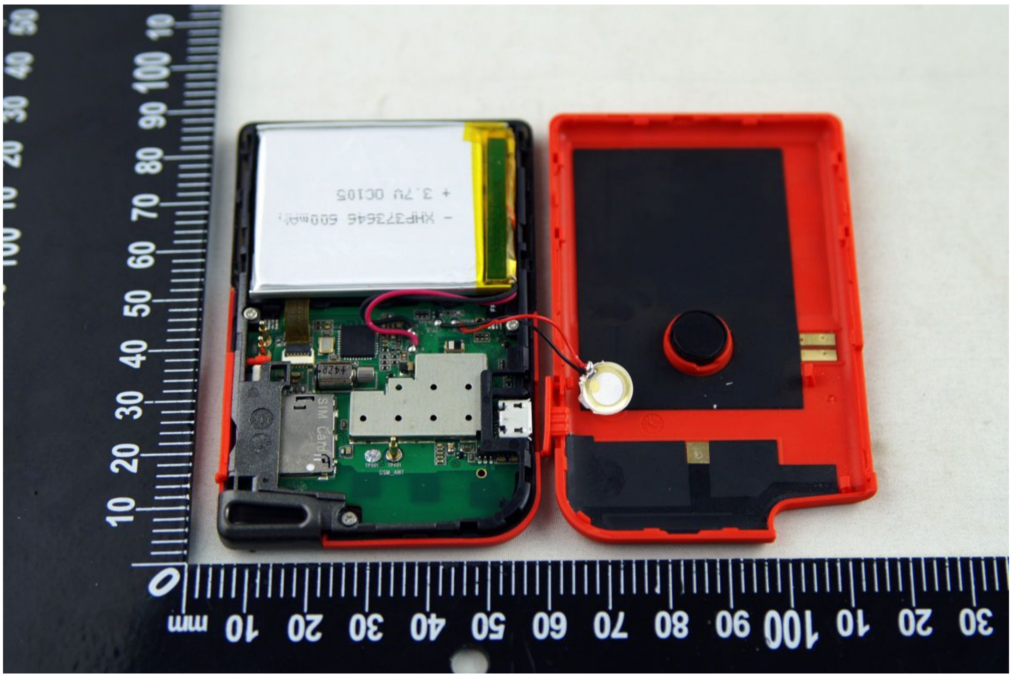


THE UP OF EUT



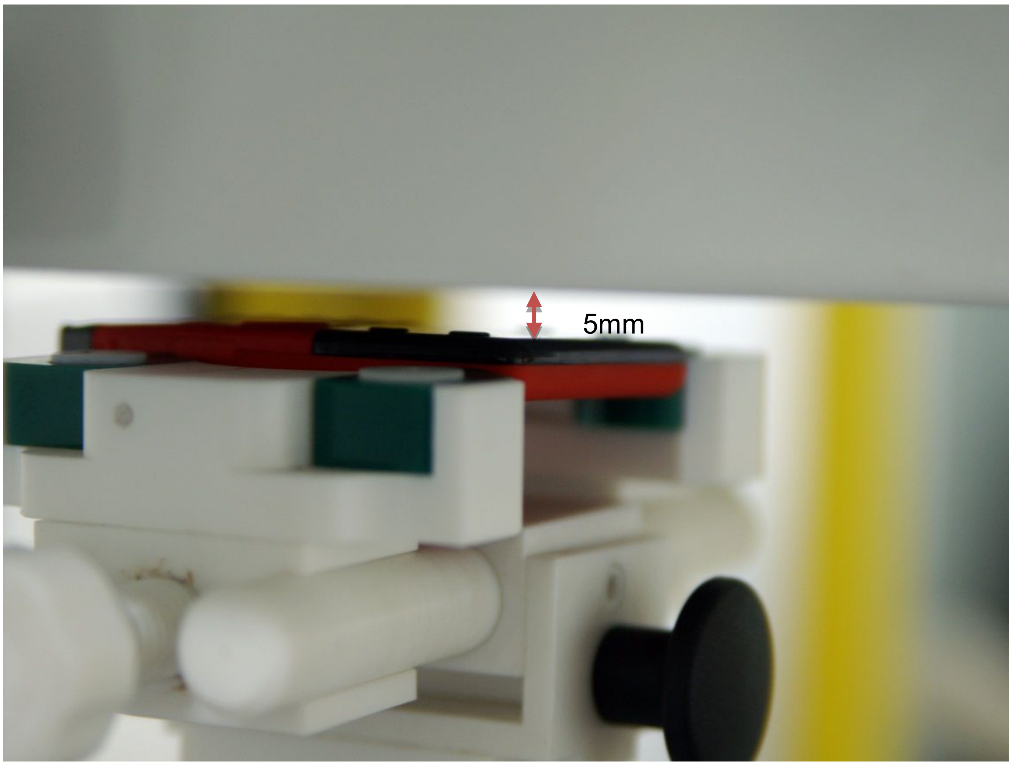
THE DOWN OF EUT

THE INSIDE OF EUT

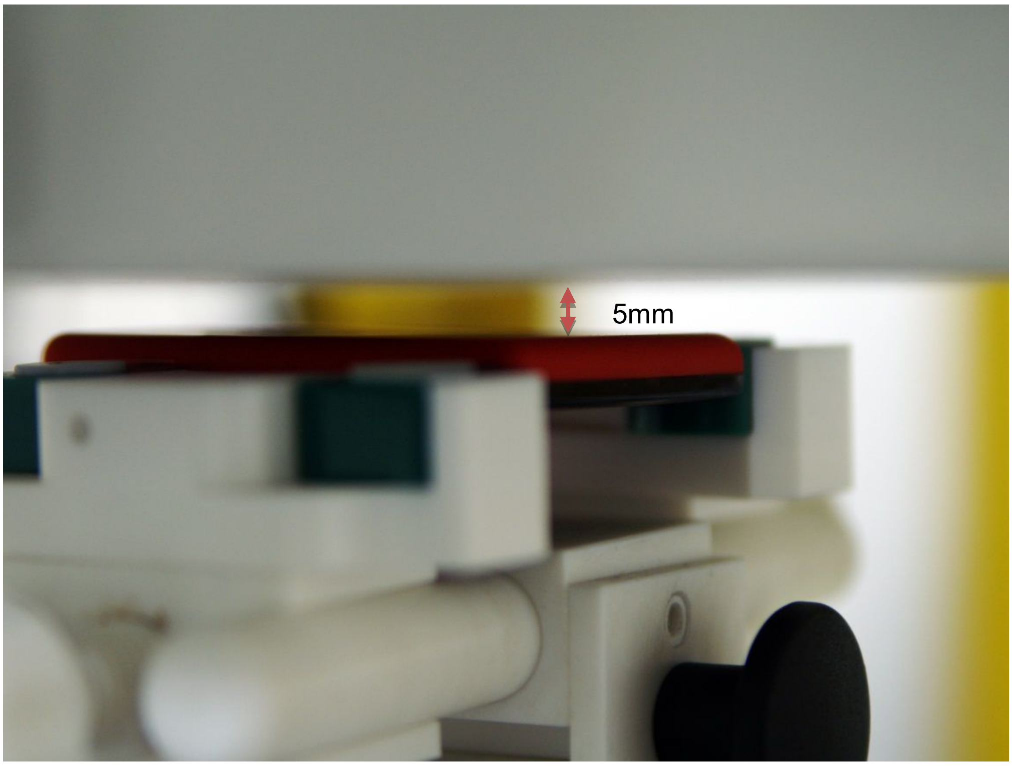


ANNEX E TEST SETUP PHOTOS

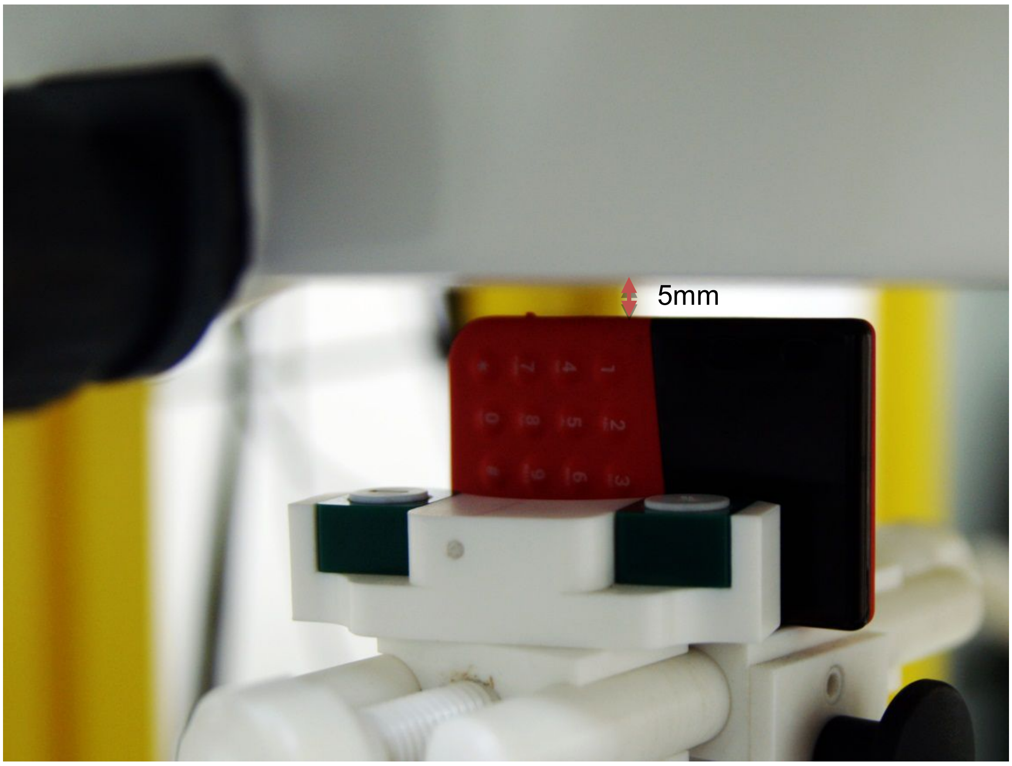
Front Side (5mm separation)



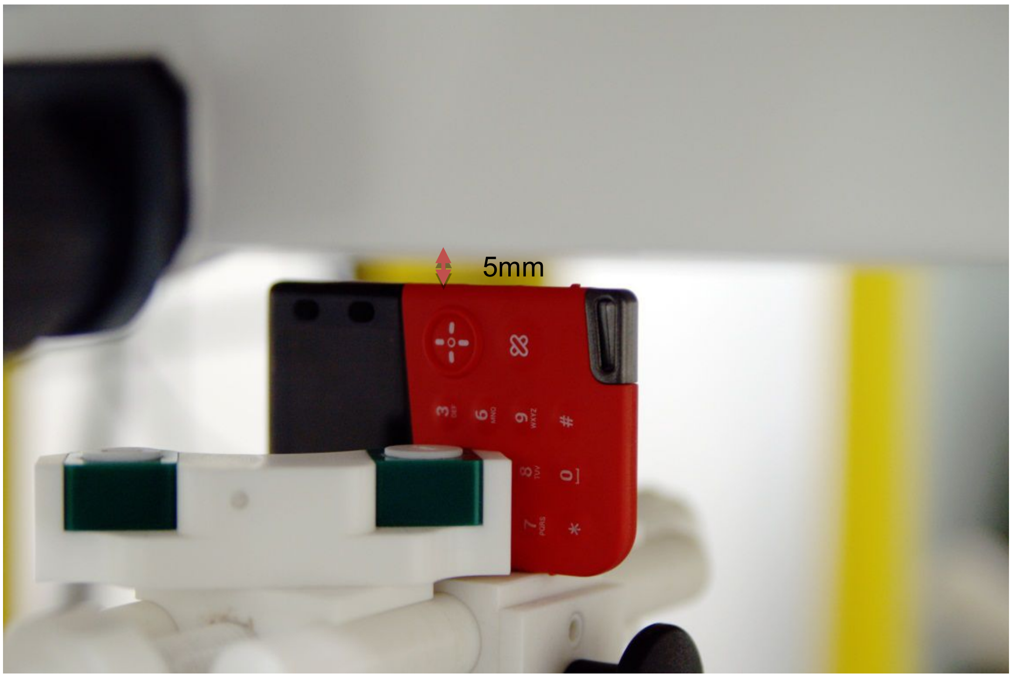
Back Side (5mm separation)



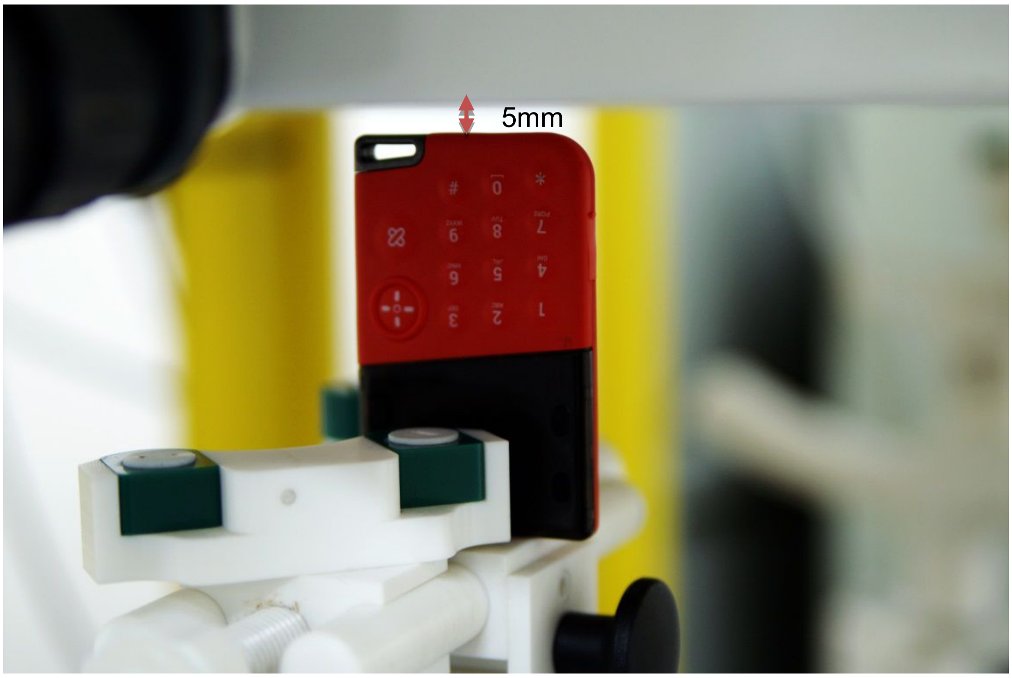
Left Edge (5mm separation)



Right Edge (5mm separation)



Bottom Edge (10mm separation)



ANNEX F CALIBRATION REPORT

F.1 E-Field Probe

SATIMO
The microwave vision company

受控文件

COMOSAR E-Field Probe Calibration Report

Ref : ACR.219.1.13.SATU.A

SHENZHEN BALUN TECHNOLOGY CO., LTD.
BLOCK B, FL 1, BAISHA SCIENCE AND TECHNOLOGY PARK, SHAHE XI ROAD, NANSHAN DISTRICT, SHENZHEN, GUANGDONG PROVINCE, 518055 P. R. CHINA
SATIMO COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: SN 27/13 EP187

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

ACCREDITED
Calibration CERT #2246.02

17/08/2014

Summary:

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

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	8/17/2014	[signature]
Checked by :	Jérôme LUC	Product Manager	8/17/2014	[signature]
Approved by :	Kim RUTKOWSKI	Quality Manager	8/17/2014	[signature]

	Customer Name
Distribution :	Shenzhen Balun Technology Co.,Ltd.

Issue	*Date*	*Modifications*
A	8/17/2014	Initial release

TABLE OF CONTENTS

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	Satimo
Model	SSE1
Serial Number	SN 27/13 EP187
Product Condition (new / used)	New
Frequency Range of Probe	0.1 GHz-3GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.1482 MΩ Dipole 2: R2=0.2189 MΩ Dipole 3: R3=0.1968 MΩ

A yearly calibration interval is recommended.

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

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

Figure 1 – *Satimo COMOSAR Dosimetric E field Dipole*

Probe Length	330 mm
Length of Individual Dipoles	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.

3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.

3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 - 360 degrees in 15 degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.5 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	**Uncertainty value (%)**	**Probability Distribution**	**Divisor**	**ci**	**Standard Uncertainty (%)**
Incident or forward power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Reflected power	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Liquid conductivity	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Liquid permittivity	4.00%	Rectangular	$\sqrt{3}$	1	2.309%
Field homogeneity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%
Field probe positioning	5.00%	Rectangular	$\sqrt{3}$	1	2.887%
Field probe linearity	3.00%	Rectangular	$\sqrt{3}$	1	1.732%

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

5 CALIBRATION MEASUREMENT RESULTS

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

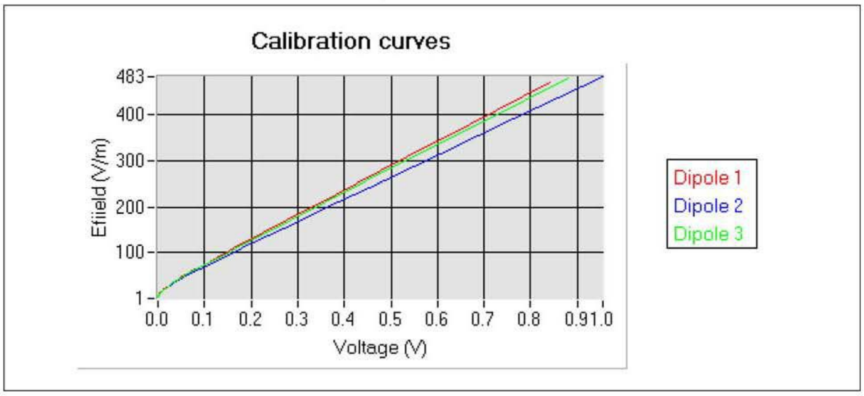
5.1 SENSITIVITY IN AIR

Normx dipole 1 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
0.52	0.53	0.52

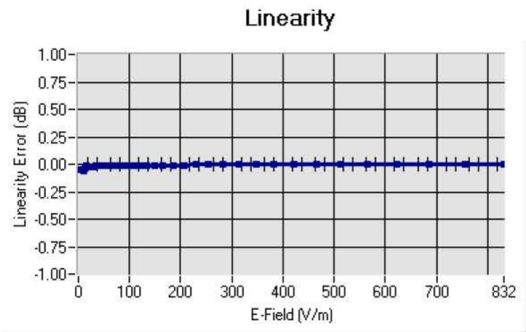
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
98	99	97

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

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



5.2 LINEARITY



Linearity: +/-1.42% (+/-0.06dB)

5.3 SENSITIVITY IN LIQUID

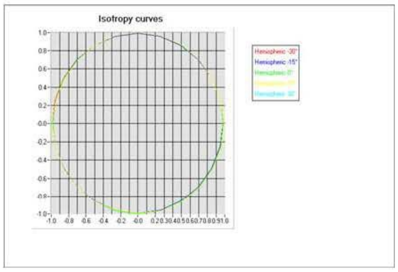
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
Hl750	750	41.90	0.89	3.17
BL750	750	55.70	0.96	3.20
HL850	835	42.56	0.88	3.34
BL850	835	55.26	0.96	3.58
HL900	900	41.79	0.96	3.31
BL900	900	55.98	1.04	3.44
HL1800	1800	40.17	1.38	3.68
BL1800	1800	52.05	1.48	3.79
HL1900	1900	39.80	1.43	4.27
BL1900	1900	52.55	1.50	4.38
HL2000	2000	38.93	1.44	4.11
BL2000	2000	53.12	1.51	4.19
HL2450	2450	38.64	1.82	4.38
BL2450	2450	52.02	1.94	4.42
HL2600	2600	38.31	1.95	4.73
BL2600	2600	51.97	2.17	4.91

LOWER DETECTION LIMIT: 9mW/kg

5.4 ISOTROPY

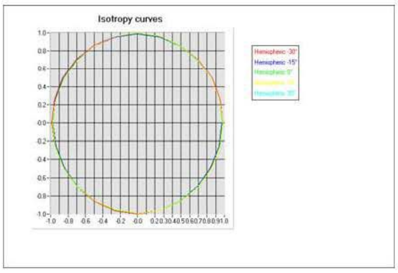
HL900 MHz

- Axial isotropy: 0.04 dB
- Hemispherical isotropy: 0.06 dB



HL1800 MHz

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.06 dB



6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2013	02/2016
Reference Probe	Satimo	EP 94 SN 37/08	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Multimeter	Keithley 2000	1188656	12/2012	12/2015
Signal Generator	Agilent E4438C	MY49070581	12/2012	12/2015
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2012	11/2015
Power Sensor	HP ECP-E26A	US37181460	11/2012	11/2015
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	Mega Industries	069Y7-158-13-712	Validated. No cal required.	Validated. No cal required.
Waveguide Transition	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Waveguide Termination	Mega Industries	069Y7-158-13-701	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Control Company	11-661-9	3/2013	3/2015