SAR TEST REPORT

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Report No.: **SL13011502-EMC-001_FCC, IC (SAR) Rev1.0**
Supersede Report No.: NONE

Applicant	:	Socket Mobile, Inc.
Product Name	:	Bluetooth Radio Module
Model No.	:	KwikBlue4-M1
Host Model No.	:	CHS 7Ci, CHS 7Di, CHS 7DiRx, CHS 7Mi, CHS 7Pi, CHS 7Xi, CHS 7XiRx
Test Standard	:	47CFR 2.1093, IEEE 1528: 2003, IEEE C95.1-1999OET 65 C (Ed 01-01), RSS 102 Issue 4.0, IEC 62209-2: 2010
Test Method	:	IEEE 1528: 2003, IEC 62209-2: 2010 KDB 447498 D01 General RF Exposure Guidance v05r01 KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01
FCC ID	:	LUBBTM-4D
IC ID	:	2529A-BTM4D
Dates of test	:	June 27th , 2013
Issue Date	:	8/1/2013
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X] Equipment did not comply with the specification [ ]		

This Test Report is Issued Under the Authority of:	
David Zhang	Choon Sian Ooi
Test Engineer	Engineer Reviewer

SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

Test result pres ... **y.**
entative sample only.

ACCREDITED
TESTING CERT # 2742-01

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Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

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Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC , RF/Wireless , Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless , Telecom
Taiwan	BSMI , NCC , NIST	EMC, RF, Telecom , Safety
Hong Kong	OFTA , NIST	RF/Wireless ,Telecom
Australia	NATA, NIST	EMC, RF, Telecom , Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF , Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC , RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom , Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC , RF , Telecom
Canada	IC FCB , NIST	EMC , RF , Telecom
Singapore	iDA, NIST	EMC , RF , Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF , Telecom
HongKong	OFTA (US002)	RF , Telecom

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1. Report Revision History

Report No.	Report Version	Description	Issue Date
SL13011502-EMC-001_FCC, IC (SAR)	Original	-	07/25/2013
SL13011502-EMC-001_FCC, IC (SAR) Rev1.0	Rev1.0	Update EUT info	08/01/2013

2. Executive Summary

The purpose of this test programme was to demonstrate compliance of the FCC certified radio module, Bluetooth Radio Module (FCC ID: LUBBTM-4D, IC ID: 2529A-BTM4D), from Socket Mobile, Inc., and Model: KwikBlue4-M1, to be installed into host model: CHS 7Ci, CHS 7Di, CHS 7DiRx, CHS 7Mi, CHS 7Pi, CHS 7Xi, CHS 7XiRx, against the current Stipulated Standards. The Bluetooth Radio Module has demonstrated compliance with the 47CFR 2.1093, IEEE 1528: 2003 and IEEE C95.1-1999.

3. Customer information

Applicant Name	:	Socket Mobile, Inc.
Applicant Address	:	39700 Eureka Drive, Newark, CA, 94560 US
Manufacturer Name	:	Socket Mobile, Inc.
Manufacturer Address	:	39700 Eureka Drive, Newark, CA, 94560 US

4. Test site information

Lab performing tests	:	SIEMIC Laboratories
Lab Address	:	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	:	881796
IC Test Site No.	:	4842D-2
VCCI Test Site No.	:	A0133

5. Modification

Index	Item	Description	Note
-	-	-	-

6. EUT Information

6.1 EUT Description

Product introduction

EUT a Bluetooth radio module.
The host is a portable handheld barcode scanner that is small, light, and comfortable to scan data from 2D and 1D barcodes into a wide variety of computers, smartphones and PDAs.

Customer declares that the host models CHS 7Ci, CHS 7Di, CHS 7DiRx, CHS 7Mi, CHS 7Pi, CHS 7Xi, CHS 7XiRx are similar. They all have same BT module, antenna, BT RF power, housing form factor, and dimensions.

For SAR testing purpose, the measurement will be made on the representative model, CHS 7Xi.

Product Name	:	Bluetooth Radio Module			
Model No.	:	KwikBlue4-M1			
Trade Name	:	Socket			
Serial No.	:	N/A			
Input Power	:	3.3VDC			
Power Adapter Manu/Model	:	N/A			
Power Adapter SN	:	N/A			
Host Product Name	:	Socket 7 Series BT Hand Scanner			
Host Model No.	:	CHS 7Ci, CHS 7Di, CHS 7DiRx, CHS 7Mi, CHS 7Pi, CHS 7Xi, CHS 7XiRx			
Host Serial No.	:	13238550000620155			
Hardware version	:	V2.0			
Software version	:	V2.0			
Date of EUT received	:	June 27th, 2013			
Equipment Class/ Category	:	DSS			
Clock Frequencies	:	25MHz			
Port/Connectors	:	N/A			
FCC ID	:	LUBBTM-4D			
IC ID	:	2529A-BTM4D			
Rated, Measured conducted RF output Power and SAR	:	Mode	Rated Power	Measured Max Power	Highest 1g SAR
		Bluetooth	18.136dBm	17.78dBm	0.048 w/kg(body)
Wi-Fi Chipset	:	-			
Bluetooth Chipset	:	-			
IMEI	:	-			
Classification per Standard	:	Portable			
Co-located TX	:	N/A			
Antenna Separation distances	:	N/A			

6.2 Radio Description

Radio IC Manu	Cambridge Silicon Radio
Radio IC Model	BC417143B-ES-IQN-E
Radio Module SN	N/A

Spec for Radio –

Radio Type	Bluetooth
Operating Frequency	2402-2480MHz
Modulation	GFSK, DQPSK, 8DPSK
Channel Spacing	1MHz
Number of Channels	79
Antenna Type	Chip Antenna
Antenna Dimension	N/A
Antenna Gain	-2.83 dbi
Antenna Connector Type	N/A

Test Channel list

Type		Channel No.	Frequency (MHz)	Available (Y/N)
Bluetooth	2402-2480MHz	1	2402	Y
		40	2441	Y
		79	2480	Y

7. Accessories/Software and cabling Description

Accessories List

Index	Accessories Description	Model	Serial No.	Manu	Note
-	-	-	-	-	-

Battery options List

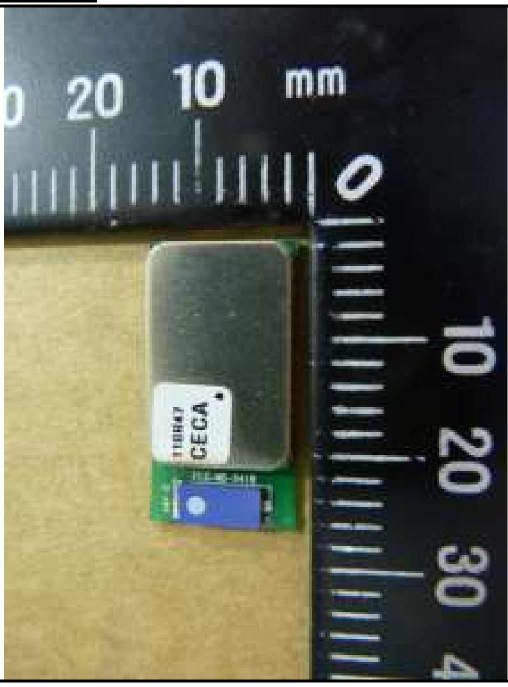
Index	Battery option Description	Model	Serial No.	Manu	Note
-	-	-	-	-	-

Test Software Description

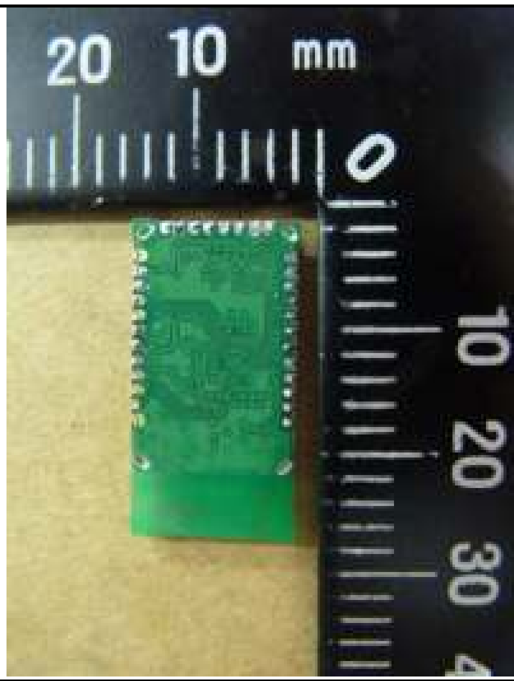
Test Item	Software	Description
SAR	CRS Bluetest	Set the EUT to different modulation and channel

8. EUT & Host Photos

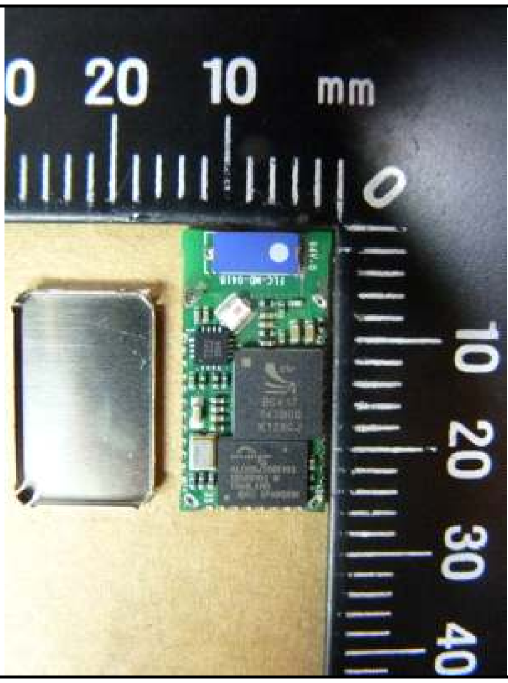
EUT Photos



External - Top



External - Bottom



Internal

Host Photos (CHS 7Xi) – External

Top

Bottom

Front

Rear

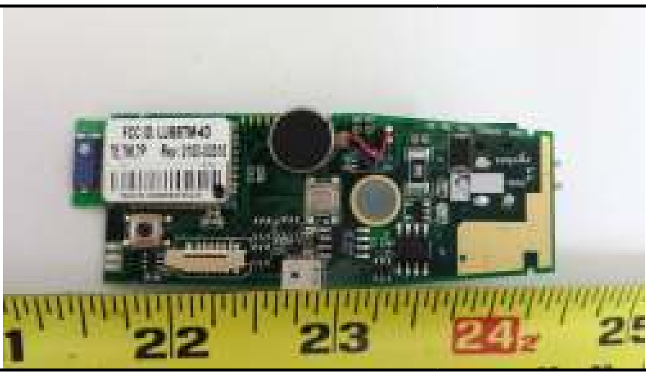
Left Side

Right Side

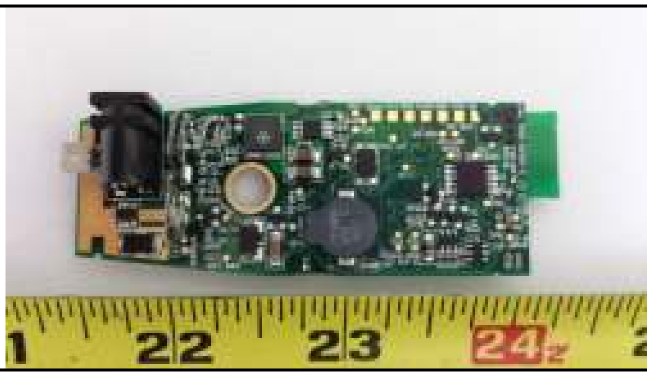
Host Photos (CHS 7Xi) - Internal

Host Cover off view-1

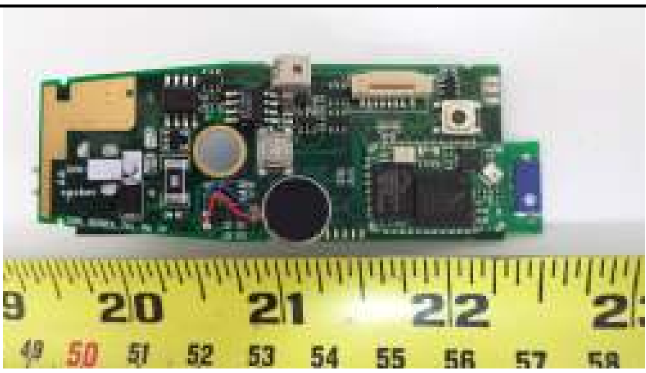
Host Cover off view-2



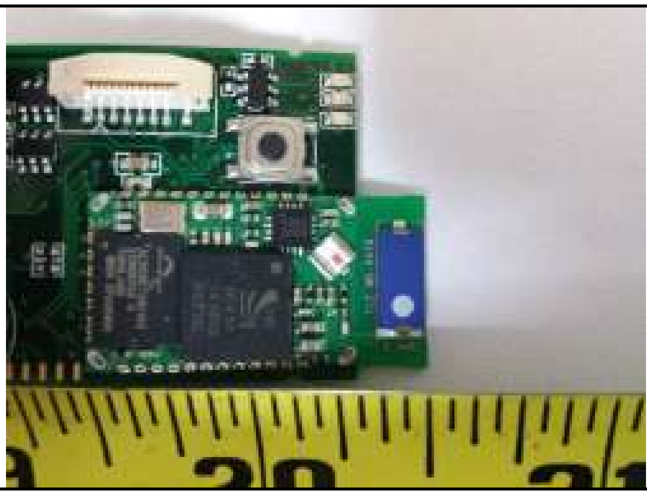
Main Board – Top view



Main Board – Bottom view



Main Board – Top View (without shielding)



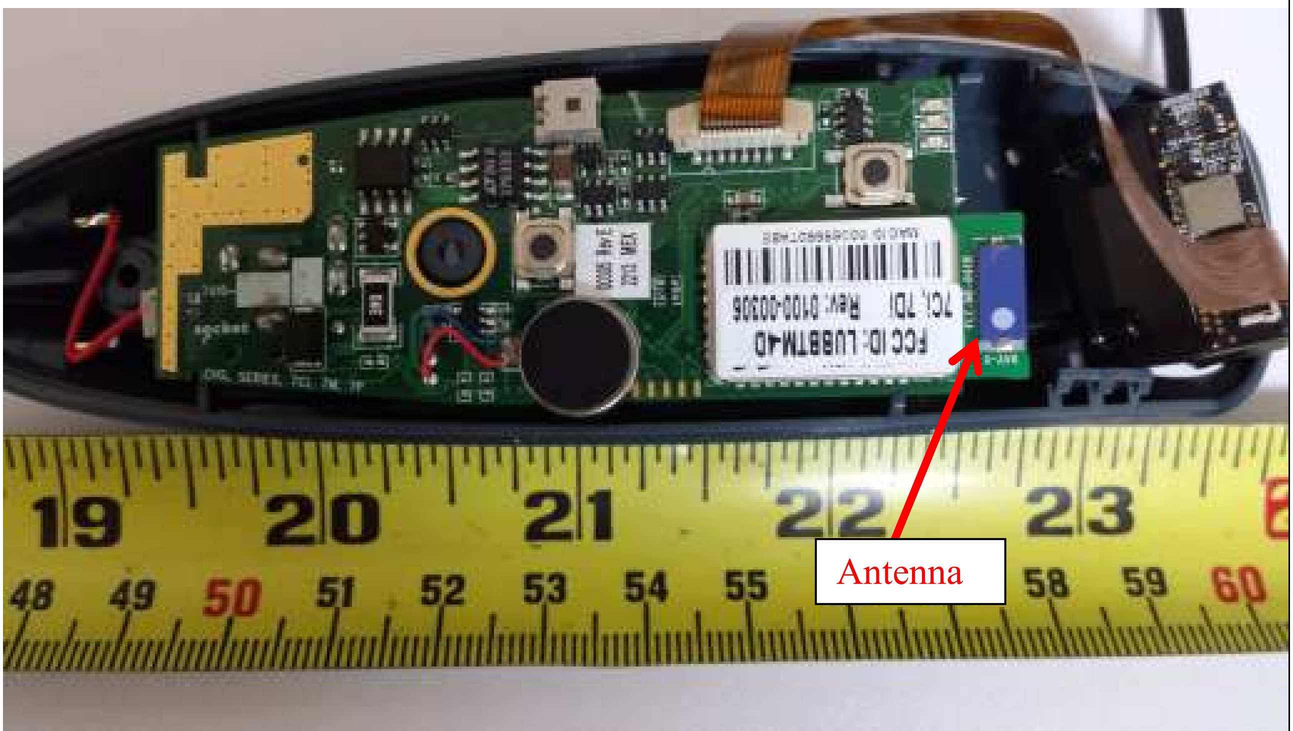
Radio module & Antenna– Zoom in View

9. KDB Consideration

Item	Applicable	Note
Applicable KDB	☒ 447498 D01 General RF Exposure Guidance v05r01	-
Exposure condition	☒ Portable ☐ Mobile ☐ Mixed Mobile &Portable	-
Exposure limit	☒ General/public ☐ Occupational	-
Operating Config	☒ Standalone ☐ Simultaneous Transmission	-
Enhanced Zoom Scan	☐ Yes ☒ No	-
Volume scan post-processing	☐ Yes ☒ No	-
Tune-up power	☒ Output power < 2dB lower than tune-up tolerance	-
Scale SAR to tune-up	☒ Scale SAR to the maximum tune-up tolerance limit	See SAR result table
Antenna variation	☐ Yes ☒ N/A	-
List of body-worn accessories	☐ Yes ☒ N/A	-
SAR Test exclusion		
Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:		Not applicable for IC
transmission band is ≤ 100 MHz	☐ ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively	
transmission band between 100 MHz-200 MHz	☐ ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively	
transmission band is ≥ 200 MHz	☐ ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively	

Simultaneous SAR Evaluation

Test Case	TX Ant1	TX Ant2	Tx Ant3	The shortest distance between Ant & Ant2 (mm)
-	-	-	-	-
-	-	-	-	-
Remark:	N/A. EUT uses one antenna only.			

Antenna Location & Separation distance	
	
Remark:	N/A

EUT Test Position for SAR

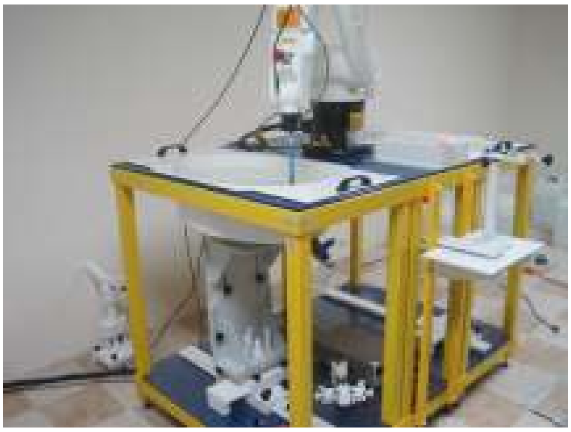
Top position against flat phantom
(separation distance – 0cm)

Left Edge position against flat phantom
(separation distance – 0cm)

Right Edge position against flat phantom
(separation distance – 0cm)

Remark:	N/A

EUT Test Setup Photos

	
SAR Test System	**Test setup – Top Position**
	
Test setup – Left Edge Position	**Test setup – Right Edge Position**

10. Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
SAR	FCC	47CFR2.1093	FCC	IEEE 1528: 2003 OET 65 C (Ed 01-01) KDB 447498 D01 General RF Exposure Guidance v05r01 KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01	☒ Pass ☐ N/A
SAR	IC	RSS 102 Issue 4	IC	IEEE 1528 – 2003 IEC 62209-2: 2010 KDB 447498 D01 General RF Exposure Guidance v05r01 KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01	☒ Pass ☐ N/A

11. SAR Introduction

Introduction

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

SAR Definition

Specific Absorption Rate is defined as 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).

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

SAR is expressed in units of watts per kilogram (W/kg). SAR can be related to the electric field at a point by

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

Where:

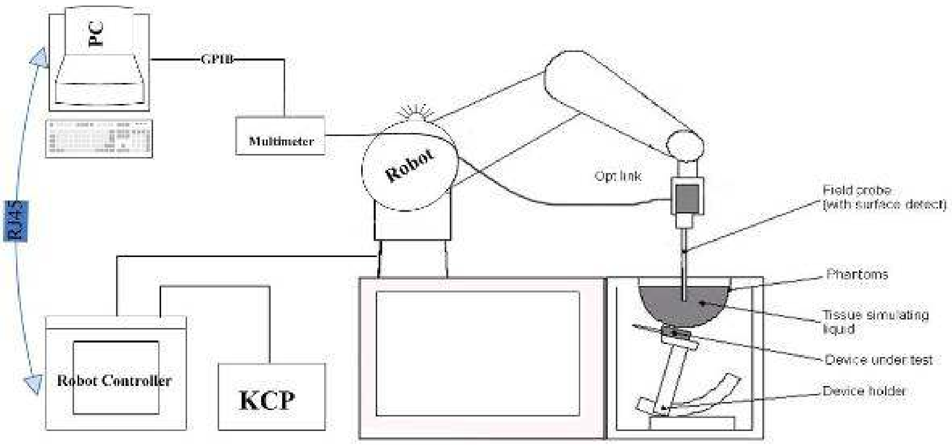
σ = conductivity of the tissue (S/m)
ρ = mass density of the tissue (kg/m3)
E = RMS electric field strength (V/m)

12. SAR Measurement Setup

Dosimetric Assessment System

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.

Measurement System Diagram



The OPENSAR

- 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 an optical surface detector system.
- 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.

EP100 Probe

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%.

It is connected to the KRC box on the robot arm and provides an automatic detection of the phantom surface. The 3D file of the phantom is include in OpenSAR software. The Video Positioning System allow the system to take the automatic reference and to move the probe safely and accurately on the phantom.

Parameter	Description
Frequency Range	100 MHz to 6 GHz
Linearity	0.25 dB (100 MHz to 6 GHz)
Directivity	0.25 dB in brain tissue (rotation around probe axis) 0.5 dB in brain tissue (rotation normal probe axis)
Dynamic	0.001W/kg to > 100W/kg
Range Linearity	0.25 dB
Surface	0.2 mm repeatability in air and liquids
Dimensions Overall length	330 mm
Tip length	16 mm
Body diameter	8 mm
Tip diameter	2.6 mm
Distance from probe tip to dipole centers	<1.5 mm

E-Field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure described in SAR standard with accuracy better than +/-10%. The spherical isotropy was evaluated with the procedure described in SAR standard and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.
The free space E-field from probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 0.8 GHz, and in a waveguide above 0.8 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. E-field correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue.

SAM Phantom

The SAM Phantom SAM29 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 P1528 and CENELEC EN62209-1.
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.

Shell Thickness: 0.2 mm
Filling Volume: Approx. 25 liters
Dimensions (H x L x W): 810 x 1000 x 500 mm

Liquid is filled to at least 15mm from the bottom of Phantom.

Device Holder

In combination with the Generic Twin Phantom V3.0, 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).

Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produce infinite number of configurations [10]. To produce the worst-case condition. (the hand absorbs antenna output power), the hand is omitted during the tests.

Data Evaluation

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

Probe Parameters	- Sensitivity	$Norm_i$
	- Conversion factor	ConvFi
	- Diode compression point	Dcpi
Device Parameter	- Frequency	f
	- Crest factor	cf
Media Parameters	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can either be found in the component documents or are imported into the software from the configuration files issued for the OPENSAR components.

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

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

Where 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 (DASY parameter)
dcp_i = Diode compression point (DASY parameter)

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

E-field probes: $$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

H-field probes: $$H_i = \sqrt{Vi} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

Where V_i = Compensated signal of channel i (i = x, y, z)
$Norm_i$ = Sensor sensitivity of channel i (i = x, y, z) μV/(V/m)2 for E0field 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.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

where SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [siemens/m]
ρ = equivalent tissue density in g/cm3

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.

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

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

where P_{pwe} = Equivalent power density of a plane wave in mW/cm2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

SAR Evaluation – Peak Spatial - Average

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 7 points within a cube whose base faces are centered on 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.

SAR Evaluation – Peak SAR

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1529 standard. It can be conducted for 1 g and 10 g. The OPENSAR system allows evaluations that combine measured data and robot positions, such as:

- Maximum search
- Extrapolation
- Boundary correction
- Peak search for averaged SAR

During a maximum search, global and local maximum searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation

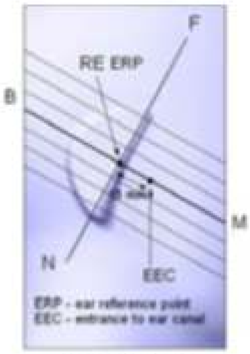
Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.
They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the fourth order least square polynomial method for extrapolation. For a grid using 5x5x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

Device Reference Points

Definition of Reference Points

Ear Reference Point

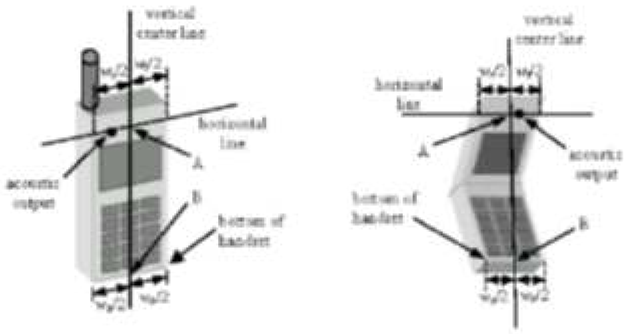
Figure 6.2 shows the front, back and side views of the SAM Phantom. The point “M” is the reference point for the center of the mouth, “LE” is the left ear reference point (ERP), and “RE” is the right ERP. The ERPs are 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 6.1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 6.1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].



Close-up
side view of ERP’s

Front, back and side view of SAM

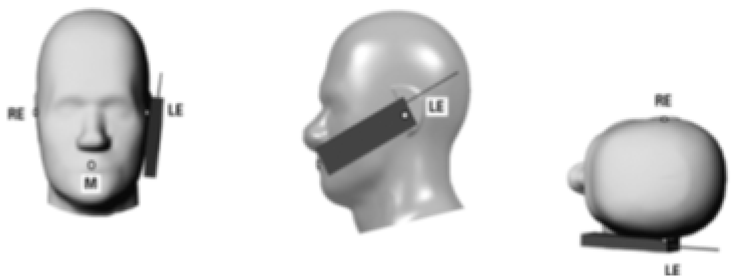
Two imaginary lines on the device need to be established: the vertical centerline and the horizontal line. The test device is placed in a normal operating position with the “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (See Fig. 6.3). The “test device reference point” is than located at the same level as the center of the ear reference point. The test device is positioned so that the “vertical centerline” is bisecting the front surface of the device at it’s top and bottom edges, positioning the “ear reference point” on the outer surface of both the left and right head phantoms on the ear reference point.



Handset Vertical Center & Horizontal Line Reference Points

Test Configuration – Positioning for Cheek / Touch

1. Position the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure below), such that the plane defined by the vertical center line and the horizontal line of the device is approximately parallel to the sagittal plane of the phantom

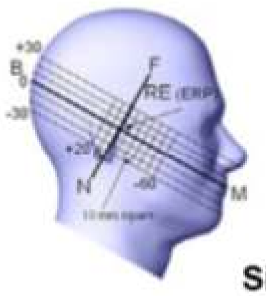


Front, Side and Top View of Cheek/Touch Position

2. Translate the device towards the phantom along the line passing through RE and LE until the device touches the ear.

3. While maintaining the device in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane).
4. Rotate the device around the vertical centerline until the device (horizontal line) is symmetrical with respect to the line NF.

5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE and maintaining the device contact with the ear, rotate the device about the line NF until any point on the device is in contact with a phantom point below the ear (cheek). See Figure below.

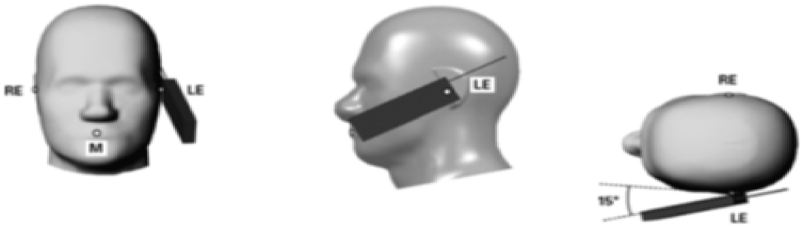


Side view w/ relevant markings

Test Configuration – Positioning for Ear / 15° Tilt

With the test device aligned in the Cheek/Touch Position":

1. While maintaining the orientation of the device, retracted the device parallel to the reference plane far enough to enable a rotation of the device by 15 degrees.
2. Rotate the device around the horizontal line by 15 degrees.
3. While maintaining the orientation of the device, move the device parallel to the reference plane until any part of the device touches the head. (In this position, point A is located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, the angle of the device shall be reduced. The tilted position is obtained when any part of the device is in contact with the ear as well as a second part of the device is in contact with the head (see Figure below).



Front, Side and Top View of Ear/15° Tilt Position

Test Position – Body Worn Configurations

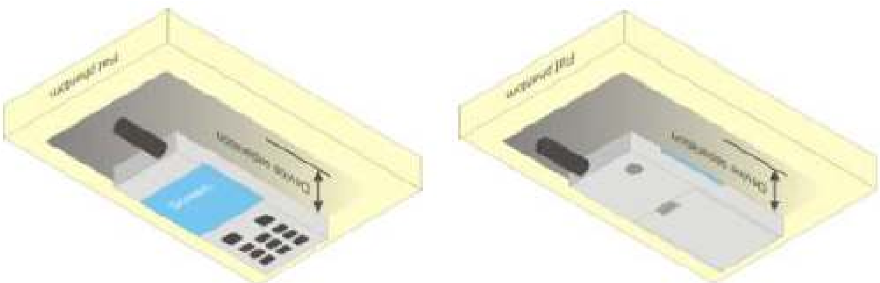
Body-worn operating configurations are tested with the accessories attached to the device and positioned against a flat phantom in a normal use configuration. A device with a headset output is tested with a headset connected to the device. Body dielectric parameters are used.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then, when multiple accessories that contain metallic components are supplied with the device, the device is tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration where a separation distance between the back of the device and the flat phantom is used. All test position spacing are documented.

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessory(ies), including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning. Worst-case positioning is then documented and used to perform Body SAR testing.



13. Measurement Uncertainty

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table below :

Uncertainty Distribution	*Normal*	*Rectangle*	*Triangular*	*U Shape*
Multi-plying Factor[(a)]	$1/k^{(b)}$	$1 / \sqrt{3}$	$1 / \sqrt{6}$	$1 / \sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity
(b) κ is the coverage factor

Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type -sum-by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %.

The COMOSAR Uncertainty Budget is show in below table:

Uncertainty Budget of COMOSAR for frequency range 300 MHz to 6 GHz

Uncertainty Component	Tolerances %	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Uncertainty 1g(%)	Uncertainty 10g(%)
Measurement System Related							
Probe Calibration	6	N	1	1	1	6	6
Axial Isotropy	3	R	√3	√ (1-Cp)	√ (1-Cp)	1.22474	1.22474
Hemispherical Isotropy	4	R	√3	√ Cp	√ Cp	1.63299	1.63299
Boundary Effect	1	R	√3	1	1	0.57735	0.57735
Linearity	5	R	√3	1	1	2.88675	2.88675
System Detection Limits	1	R	√3	1	1	0.57735	0.57735
Readout Electronics	0.5	N	1	1	1	0.5	0.5
Response Time	0.2	R	√3	1	1	0.11547	0.11547
Integration Time	2	R	√3	1	1	1.1547	1.1547
RF Ambient Conditions	3	R	√3	1	1	1.73205	1.73205
Probe Positioner Mechanical Tolerances	2	R	√3	1	1	1.1547	1.1547
Probe Positioning with respect to Phantom Shell	1	R	√3	1	1	0.57735	0.57735
Extrapolation, Interpolation and integration Algorithms for Max. SAR Evaluation.	1.5	R	√3	1	1	0.86603	0.86603
Test Sample Related							
Test Sample Positioning	1.5	N	1	1	1	1.5	1.5
Device Holder Uncertainty	5	N	1	1	1	5	5
Output Power Variation – SAR Drift measurement	3	R	√3	1	1	1.73205	1.73205
Phantom and Tissue Parameters Related							
Phantom Uncertainty (Shape and thickness Tolerances)	4	R	√3	1	1	2.3094	2.394
Liquid Conductivity – deviation from target value	5	R	√3	0.64	0.43	1.84752	1.2413
Liquid Conductivity – Measurement Uncertainty	2.5	N	1	0.64	0.43	1.6	1.075
Liquid Permittivity – deviation from target value	3	R	√3	0.6	0.49	1.03923	0.8487
Liquid Permittivity – Measurement Uncertainty	2.5	N	1	0.6	0.49	1.5	1.225
Combined Standard Uncertainty						9.66051 %	9.52428 %
Expanded Standard Uncertainty (K=2 , confidence 95%)						18.9346 %	18.6676 %

14. Liquid Validation

Liquid Validation

The dielectric parameters were checked prior to assessment using the HP85070C dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

Photo of Liquid Height

IEEE SCC-34/SC-2 P1528 recommended Tissue Dielectric Parameters

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

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

Note: *ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3*

Liquid Confirmation Result:

Frequency (MHz)	Target Permittivity	Target Conductivity	Measured Permittivity	Measured Conductivity	Permittivity Deviation	Conductivity Deviation	Limit
2450	52.75	1.91	52.642	1.965	-0.20	2.88	5
2402	52.72	1.94	52.823	1.929	0.20	-0.57	5
2441	52.70	1.95	52.803	1.961	0.20	0.56	5
2480	52.68	1.97	52.438	2.009	-0.46	1.98	5
Remark	Measure Date 06/27/2013 Temperature 22oC Relative Humidity 56% Atmospheric Pressure 1019mbar						

15. System Validation and System Verification

System Validation

The system validation procedure evaluates the system against reference SAR values and the performance of the probe, readout electronics, and software. The test setup utilizes a flat phantom and a reference dipole.

Thus, the system validation process does not include data scatter due to the use of anthropomorphic phantoms or uncertainty due to handset positioning variability. System validation should be performed annually, or when a new system is put into operation, or whenever modifications have been made to the system, such as a new software release, different readout electronics or different types of probes. The probe used in the test system to be validated should be properly calibrated.

System validation provides a means of system-level validation. The test system utilizes a flat phantom and a reference dipole. Thus, system validation verifies the system accuracy against its specifications but does not include the uncertainty due to the use of anthropomorphic phantoms, nor does it include the uncertainty due to handset positioning variability. This test is performed annually (e.g., after probe calibration), before measurements related to inter laboratory comparison and every time modifications have been made to the system, such as a new software release, different readout electronics, and for different types of probes.

System Validation procedure is at below,

a) **SAR evaluation**: A complete 1 g or 10 g averaged SAR measurement is performed. The reference dipole input power is adjusted to produce a 1 g averaged SAR value falling in the range of 0.4–10 W/kg. The 1 g or 10 g averaged SAR is measured at frequencies in reference table within the range to be used in compliance tests. The results are normalized to 1 W forward input power and compared with the reference SAR values shown in reference value. The differences from the reference values should be less than the tolerance specified for the SAR measurement system by the manufacturer or designer, i.e., within the expanded uncertainty for the system validation.
b) **Extrapolation routine**: Local SAR values are measured along a vertical axis directly above the reference dipole feed-point using the same test grid-point spacing as used for handset SAR evaluations. This measurement is repeated along another vertical axis with a 2 cm transverse offset from the reference dipole feed-point. SAR values at the phantom surface are extrapolated and compared with the numerical values given in reference table. The difference from the reference values should be less than the tolerance specified for the SAR measurement system by the manufacturer or designer, i.e., within the expanded uncertainty for system validation.
c) **Probe linearity**: The measurement in step a) is repeated using different reference dipole input power levels. The power levels are selected for each frequency to produce 1 g averaged SAR values of approximately 10 W/kg, 2 W/kg, and 0.4 W/kg. The measured SAR values are normalized to 1 W forward input power and compared with the 1 W normalized value from step a). The difference between these values should be less than the tolerance specified for the SAR measurement system by the manufacturer or designer, i.e., within the expanded uncertainty for the linearity component.
d) **Modulation response**: The measurements in step a) are repeated with pulse-modulated signals having a duty factor of 0.1 and pulse repetition rate of 10 Hz. The power is adjusted to produce a 1 g-averaged SAR of approximately 8 W/kg with the pulse modulated signal (corresponding to a peak spatial-average SAR of approximately 80 W/kg). The measured SAR values are normalized to 1 W forward input power and duty factor of 1, and compared with the 1 W normalized values from step a). The difference between these values should be less than the tolerance specified for the SAR measurement system by the manufacturer or designer, i.e., within the expanded uncertainty for system validation.
e) **System offset**: The measurements in step a) are repeated with a reference dipole input forwardpower that produces a 1 g or 10 g averaged SAR of approximately 0.05 W/kg. The measured SAR values are normalized to 1 W forward input power and compared with the 1 W normalized values from step a). The difference between these values should be less than the tolerance specified for the SAR measurement system by the manufacturer or designer, i.e., within the expanded uncertainty for system validation.
f) **Probe axial isotropy**: The center point of the probe's sensors is placed directly above the reference dipole center at a measurement distance of approximately 5–10 mm from the phantom inner surface. The probe (or reference dipole, if precise rotations are supported by the dipole fixture) is rotated around its axis ± 180° in steps no larger than 15°. The maximum and minimum SAR readings are recorded. The difference between these values should be less than the tolerance specified for the SAR measurement system by the manufacturer or designer, i.e., within the expanded uncertainty for the axial isotropy component.

Numerical reference SAR values (W/kg) for reference dipole and flat phantom

Frequency (MHz)	1 g SAR	10 g SAR	Local SAR at surface (above feed-point)	Local SAR at surface (y = 2 cm offset from feed-point)[a]
300	3.0	2.0	4.4	2.1
450	4.9	3.3	7.2	3.2
835	9.5	6.2	4.1	4.9
900	10.8	6.9	16.4	5.4
1450	29.0	16.0	50.2	6.5
1800	38.1	19.8	69.5	6.8
1900	39.7	20.5	72.1	6.6
2000	41.1	21.1	74.6	6.5
2450	52.4	24.0	104.2	7.7
3000	63.8	25.7	140.2	9.5

Target and measurement SAR after Normalized

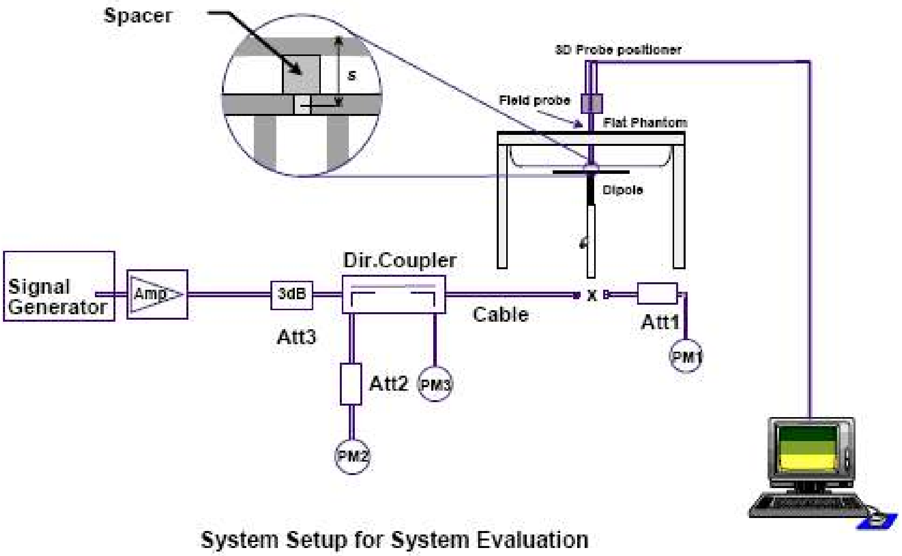
System Validation Status

Frequency (MHz)	Temp (oC)	Humidity (%)	Validation Date	Probe SN	Validation Cycle	Validation Due
835	21	58	Oct 23rd, 2012	2611_EPG129	1 year	Oct 23rd, 2013
900	21	58	Oct 23rd, 2012	2611_EPG129	1 year	Oct 23rd, 2013
1800	21	58	Oct 23rd, 2012	2611_EPG129	1 year	Oct 23rd, 2013
1900	21	58	Oct 23rd, 2012	2611_EPG129	1 year	Oct 23rd, 2013
2000	21	58	Oct 23rd, 2012	2611_EPG129	1 year	Oct 23rd, 2013
2450	21	58	Oct 23rd, 2012	2611_EPG129	1 year	Oct 23rd, 2013
5200	21	58	Oct 23rd, 2012	2611_EPG129	1 year	Oct 23rd, 2013
5500	21	58	Oct 23rd, 2012	2611_EPG129	1 year	Oct 23rd, 2013
5800	21	58	Oct 23rd, 2012	2611_EPG129	1 year	Oct 23rd, 2013

System Verification

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:



System Setup for System Evaluation

Note: Equipment description

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. Calibrated Dipole

System Verification Results

Measurement Date	Temp (oC)	Humidity (%)	Frequency (MHz)	Phantom/ Liquid	Target SAR1g (W/kg)	Input Power (dBm)	Measured SAR1g (W/kg)	1W Normalized SAR1g (W/kg)	Deviation (%)
June 27th, 2013	22	56	2450	Body	55.61	20	5.262	52.62	-5.38

16. Measurements, Examination and Derived Results

Output Power Measurement Result

Requirement(s):

Spec	Item	Requirement		Applicable
-	-	Time averaged conducted output power to be measured		☒
Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v03r01 DTS Method AVGSA-1 (trace averaging with the EUT transmitting at full power throughout each sweep)			
Test Date	06/27/2013	Environmental condition	Temperature 22oC Relative Humidity 56% Atmospheric Pressure 1019mbar	
Remark	NONE			
Result	☒ Pass ☐ Fail			

Equipment Setting

TEST	RBW	VBW	SPAN	Detector	SWEEP	Trace	NOTES
AV output power	1MHz	≥3MHz	≥EBW or 99% OBW	RMS	Auto	Average on 100 traces	CH PW on 99% OBW

Test Data ☒ Yes ☐ N/A

Output Power measurement result

2.4GHz band- Bluetooth

Test Mode	Data Rates (Mbps)	CH (MHz)	Measured Output Power (dBm)	Rated Power (dBm)	Time Average Factor	Calculated time averaged output Power (dBm)	Ant Gain (dBi)	Average E.I.R.P (dBm)
BDR-GFSK	1	2402	10.17	10.17±0.203	0	10.17	-2.83	7.34
		2441	10.17	10.17±0.203	0	10.17	-2.83	7.34
		2480	10.98	10.98±0.220	0	10.98	-2.83	8.15
EDR-8DPSK	3	2402	16.20	16.20±0.324	0	16.20	-2.83	13.37
		2441	17.06	17.06±0.341	0	17.06	-2.83	14.23
		2480	17.78	17.78±0.356	0	17.78	-2.83	14.95
Remark	None							

SAR Measurement Result

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR2.1093, RSS-102 Issue 4-SAR	1	SAR limit for devices used by the General public (Uncontrolled Environment) in localized Head and Trunk is 1.6 W/kg	☒
	2	SAR limit for Controlled Use Devices (Controlled Environment) in localized Head and Trunk is 8 W/kg	☐
Test Method	IEEE 1528: 2003 IEC 62209-2: 2010 447498 D01 General RF Exposure Guidance v05r01 KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01		
Test Setup	Refer to Section 6: SAR Measurement Setup		
Test Procedure	**Steps:** 1. Use client test software to set EUT transmit RF power in cont-TX mode in the highest power channel 2. Measure output power through spectrum analyzer 3. Place the DUT in the positions selected 4. Set scan area, grid size and other setting on the SATIMO software 5. Make SAR measurement for the selected highest output power channel at each testing position 6. Find out the position with highest SAR result 7. Measure additional SAR for other modes at the highest SAR position SAR measurement system will proceed the following basic steps: 1. Initial power reference measurement 2. Area Scan 3. Zoom Scan 4. Power drift measurement		
Test Date	06/27/2013	Environmental condition	Temperature 22oC Relative Humidity 56% Atmospheric Pressure 1019mbar
Remark	-		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (Attached in separate document) ☐ N/A

SAR Measurement result to determine the worst case position configuration

SAR Type	Body SAR								
Test Mode	Freq (MHz)	Position	Rated Max Power (dBm)	Measured Output Power (dBm)	Raw SAR 1g (W/kg)	Crest factor	Power Drift (%)	Scaled SAR (Tune-up & Duty Cycle)	1g SAR Limit (W/kg)
EDR-8DPSK	2480	Top	18.136	17.78	0.044	1	-3.47	0.048	1.6
EDR-8DPSK	2480	Left	18.136	17.78	0.032	1	0	0.035	1.6
EDR-8DPSK	2480	Right	18.136	17.78	0.026	1	-0.50	0.028	1.6
Note:	1. Separation distance : 0cme 2. The worst case configuration is Top position.								

Additional SAR measurement on worst case position configuration

SAR Type	Body SAR								
Freq Band	Freq (MHz)	Position	Rated Max Power (dBm)	Measured Output Power (dBm)	Raw SAR 1g (W/kg)	Crest Factor	Power Drift (%)	Scaled SAR (Tune-up & Duty Cycle)	1g SAR Limit (W/kg)
EDR-8DPSK	2402	Top	16.524	16.20	0.021	1	-1.14	0.023	1.6
EDR-8DPSK	2441	Top	17.401	17.06	0.020	1	0.80	0.022	1.6
Note:	1. Separation distance : 0cm 2. Duty cycle scale is not necessary								

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
SAR						
P C	PV 3.06GHz	375052-AA1	N/A	N/A	N/A	☑
Signal Generator	8665B-008	3744A01304	5/17/2013	1 Year	05/17/2014	☑
Multi-meter	Multi-meter 2000	1259033	08/13/2012	1 Year	08/13/2013	☑
S-Parameter Network Analyzer	8753ES	US38161019	05/11/2013	1 Year	05/11/2014	☑
Power Meter	437B	3038A03648	04/25/2013	1 Year	04/25/2014	☐
E-field PROBE	EPG129	SN26/11 EPG129	10/09/2012	1 Year	10/09/2013	☑
DIPOLE 2450	DIPOLE 2450MHz	SN 31/10 DIPJ138	06/13/2012	1 Year	06/13/2013	☑
WaveGuide 5/6 GHz	Wave Guide 5/6GHz	SN 31/10 DIPWGA13	06/13/2012	1 Year	06/13/2013	☑
COMOSAR Open Coaxial Probe	OCP36	SN 31/10 OCP36	06/13/2012	1 Year	06/13/2013	☑
Communication Antenna	ANTA30	SN 31/10 ANTA30	N/A	N/A	N/A	☑
Laptop POSITIONING DEVICE	LSH63	SN 31/10 LSH13	N/A	N/A	N/A	☑
Mobile Phone POSITIONING DEVICE	MSH63	SN 31/10 MSH63	N/A	N/A	N/A	☑
DUMMY PROBE	None	SN 31/10	N/A	N/A	N/A	☐
SAM PHANTOM	SAM77	SN 31/10 SAM77	N/A	N/A	N/A	☐
Elliptic Phantom	ELLI17	SN 31-10 ELLI17	N/A	N/A	N/A	☑
PHANTOM TABLE	N/A	N/A	N/A	N/A	N/A	☑
6 AXIS ROBOT	KR5	949319	N/A	N/A	N/A	☑
Medium Power Solid State Amplifier (0.8~4.2GHz)	S41-25	M629-0408	N/A	N/A	N/A	☑

Annex B. USER MANUAL, BLOCK & CIRCUIT DIAGRAM

Please see attachment

Annex C. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
HongKong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		**Radio** : A1. Terminal equipment for purpose of calling **Telecom** : B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI**EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measuremet
Australia CAB Regocnition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radiocommunications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2

Annex D. Calibration report

COMOSAR E-Field Probe Calibration Report

Ref : ACR.287.1.12.SATU.A

SIEMIC TESTING AND CERTIFICATION SERVICES

SHENZHEN, CHINA

SATIMO COMOSAR DOSIMETRIC E-FIELD PROBE

SERIAL NO.: SN 26/11 EPG129

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED

Calibration CERT #2246.02

10/09/2012

Summary:

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

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	10/13/2012	
Checked by :	Jérôme LUC	Product Manager	10/13/2012	
Approved by :	Kim RUTKOWSKI	Quality Manager	10/13/2012	

	Customer Name
Distribution :	SIEMIC Testing and Certification Services

Issue	*Date*	*Modifications*
A	10/13/2012	Initial release

TABLE OF CONTENTS

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	Satimo
Model	SSE2
Serial Number	SN 26/11 EPG129
Product Condition (new / used)	used
Frequency Range of Probe	0.7 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.151 MΩ Dipole 2: R2=0.215 MΩ Dipole 3: R3=0.194 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.

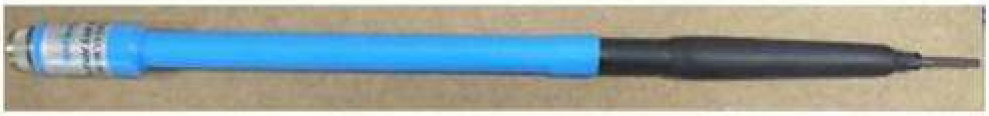


Figure 1 – *Satimo COMOSAR Dosimetric E field Dipole*

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					11.662%

5 CALIBRATION MEASUREMENT RESULTS

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

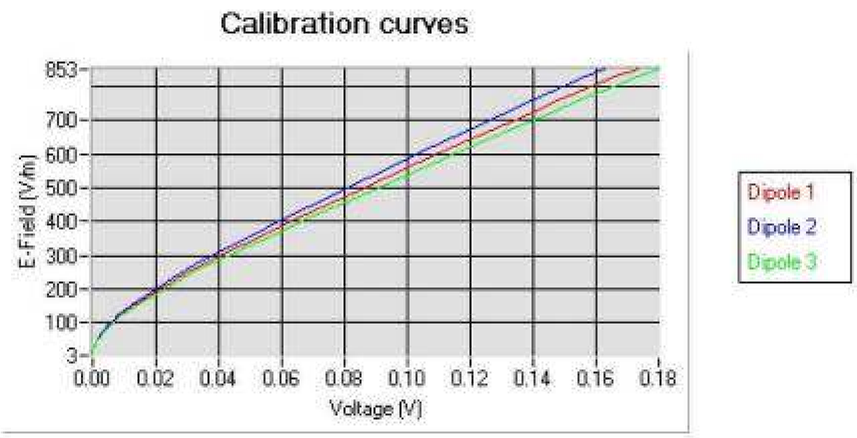
5.1 SENSITIVITY IN AIR

Normx dipole 1 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
0.62	0.59	0.68

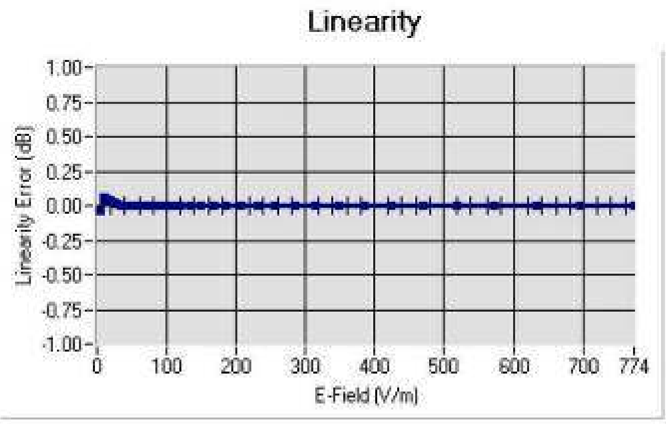
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
110	103	104

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

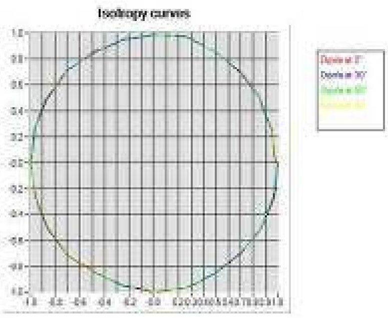
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL850	835	41.43	0.90	7.78
BL850	835	54.07	0.98	8.00
HL900	900	41.99	0.97	7.47
BL900	900	53.46	1.04	7.75
HL1800	1750	39.09	1.39	7.50
BL1800	1750	53.98	1.52	7.79
HL1900	1880	40.08	1.41	8.03
BL1900	1880	54.23	1.52	8.29
HL2000	1950	40.67	1.43	7.31
BL2000	1950	53.76	1.50	7.46
HL2450	2450	38.66	1.83	7.67
BL2450	2450	52.46	1.98	7.89
HL3500	3500	36.93	2.88	6.96
BL3500	3500	51.43	3.14	7.23
HL5200	5200	35.73	4.22	5.51
BL5200	5200	49.33	5.11	5.69
HL5400	5400	35.09	4.43	6.40
BL5400	5400	49.75	5.64	6.58
HL5600	5600	35.01	5.02	6.17
BL5600	5600	49.34	5.99	6.31
HL5800	5800	34.77	5.55	6.14
BL5800	5800	47.96	6.01	6.34

LOWER DETECTION LIMIT: 9mW/kg

5.4 ISOTROPY

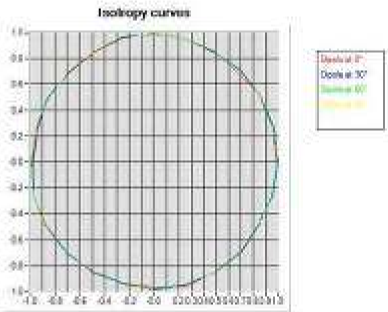
HL900 MHz

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.09 dB

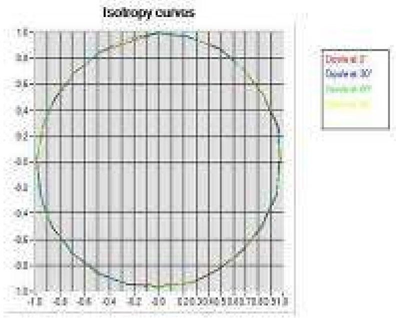


HL1800 MHz

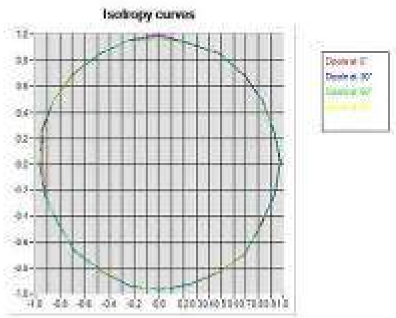
- Axial isotropy: 0.08 dB
- Hemispherical isotropy: 0.10 dB



HL2450 MHz
- Axial isotropy: 0.07 dB
- Hemispherical isotropy: 0.11 dB



HL5400 MHz
- Axial isotropy: 0.10 dB
- Hemispherical isotropy: 0.15 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	02/2010	02/2013
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	11/2010	11/2013
Signal Generator	Agilent E4438C	MY49070581	12/2010	12/2013
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2010	11/2013
Power Sensor	HP ECP-E26A	US37181460	11/2010	11/2013
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	3/2012	3/2014

SAR Reference Dipole Calibration Report

Ref : ACR.170.7.12.SATU.A

SIEMIC TESTING AND CERTIFICATION SERVICES
2206 RINGWOOD AVE.
SAN JOSE, CA 95131, USA
SATIMO COMOSAR REFERENCE DIPOLE
FREQUENCY: 2450 MHZ
SERIAL NO.: SN 31/10 DIPJ138

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

ACCREDITED
Calibration CERT #2246.02

06/13/2012

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	6/18/2012	
Checked by :	Jérôme LUC	Product Manager	6/18/2012	
Approved by :	Kim RUTKOWSKI	Quality Manager	6/18/2012	

	Customer Name
Distribution :	SIEMIC Testing and Certification Services

Issue	*Date*	*Modifications*
A	6/18/2012	Initial release

TABLE OF CONTENTS

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 31/10 DIPJ138
Product Condition (new / used)	used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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

Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

4.2 MECHANICAL REQUIREMENTS

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

5 MEASUREMENT UNCERTAINTY

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

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

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

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

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

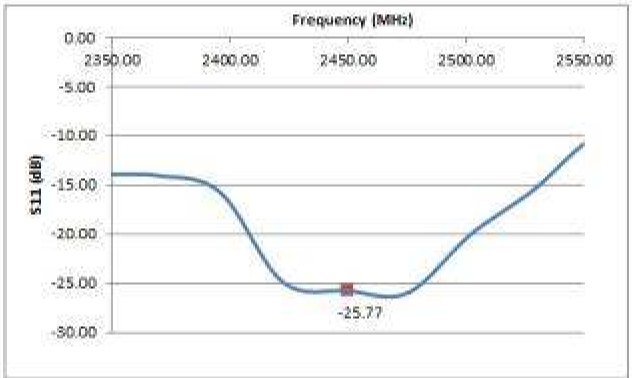
5.3 VALIDATION MEASUREMENT

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

Scan Volume	Expanded Uncertainty
1 g	16.19 %
10 g	15.86 %

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS



Frequency (MHz)	Return Loss (dB)	Requirement (dB)
2450	-25.77	-20

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
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 %.	PASS	30.4 ±1 %.	PASS	3.6 ±1 %.	PASS
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 MEASUREMENT CONDITION

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 39.0 sigma : 1.88
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 %

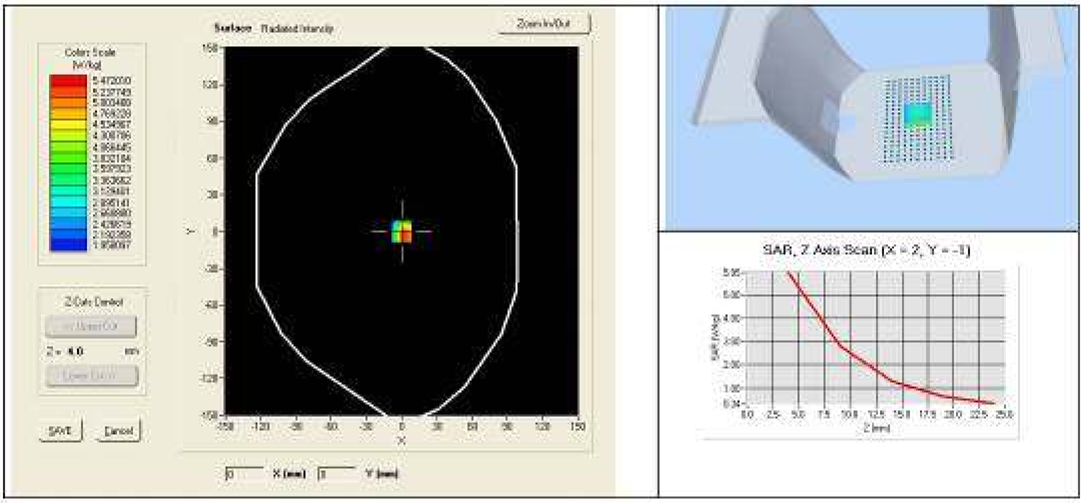
7.2 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %	PASS	1.80 ±5 %	PASS
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.3 MEASUREMENT RESULT

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.

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	54.82 (5.48)	24	24.50 (2.45)
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



8 LIST OF EQUIPMENT

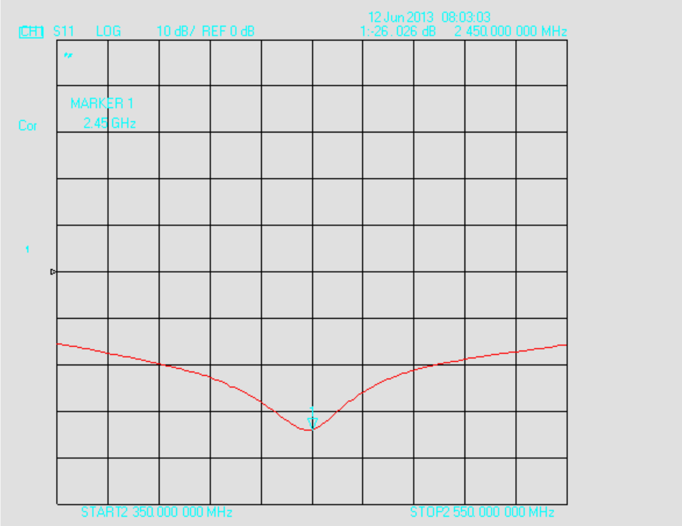
Equipment Summary Sheet				
Equipment Description	**Manufacturer / Model**	**Identification No.**	**Current Calibration Date**	**Next Calibration Date**
Flat Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2010	02/2013
Calipers	Carrera	CALIPER-01	12/2010	12/2013
Reference Probe	Satimo	EPG122 SN 18/11	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Multimeter	Keithley 2000	1188656	11/2010	11/2013
Signal Generator	Agilent E4438C	MY49070581	12/2010	12/2013
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2010	11/2013
Power Sensor	HP ECP-E26A	US37181460	11/2010	11/2013
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	3/2012	3/2014

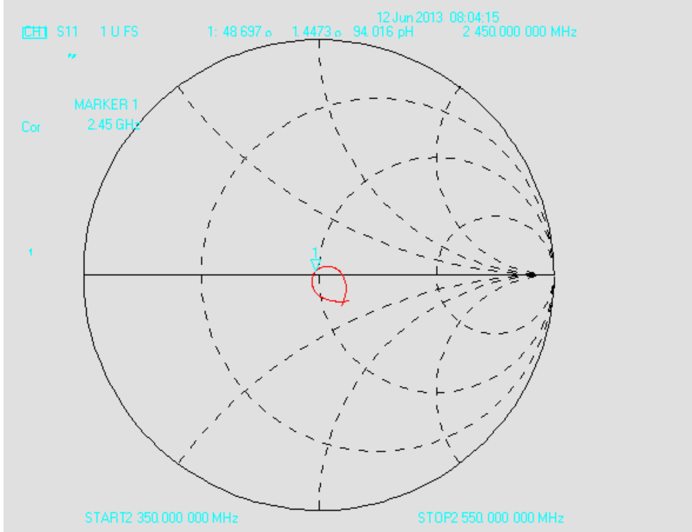
SARTIMO Calibration Certificate-Extended Dipole Calibrations

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 5 Ω from the previous measurement

Dipole Verification plot: SID2450
2450MHz for Head:





Summary results:

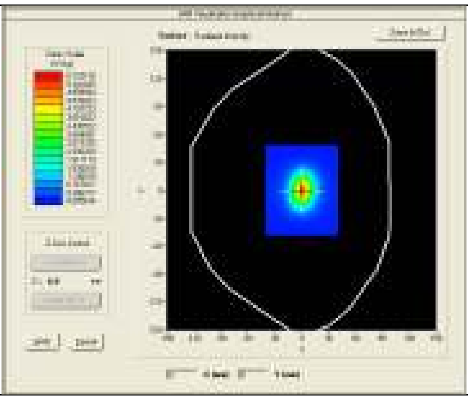
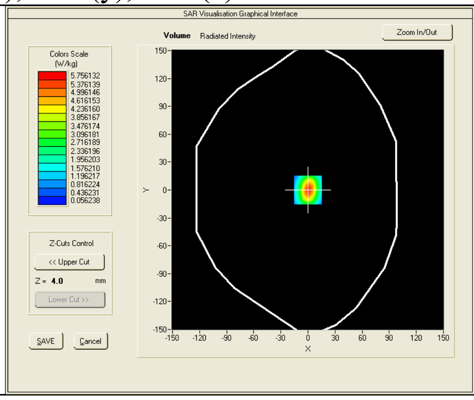
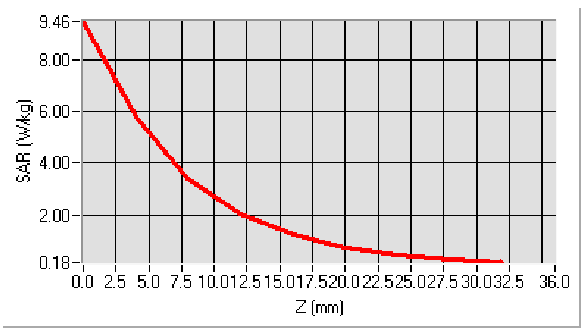
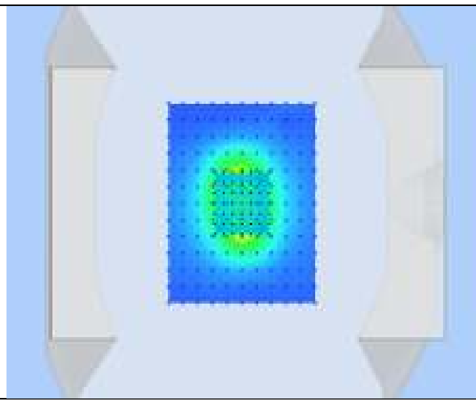
SID 2450					
Return- Loss (dB)	**Deviate (dB)**	**Real Impedance (Ω)**	**Imaginary Impedance (Ω)**	**Deviate (Ω)**	**Calibrate Date**
-25.77	-----	-----	50	-----	06/13/2012
-26.026	-0.256	48.697	50	-1.303	06/12/2013

According to up table, the return loss is <-20dB, deviates by less than 20% from the previous measurement; the real Impedance are all within 5 Ω compared to the required Impedance (50 Ω).

Annex E. SAR Test Plots

System Verification Plots

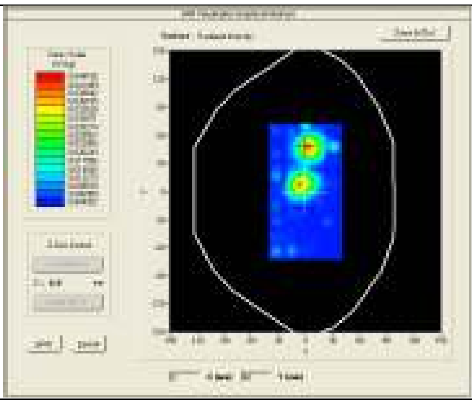
Test specification:	System Verification_2450MHz			
Environ Conditions:	Temp(oC):	22	Result:	Pass
	Humidity(%):	56		
	Atmospheric(mPa):	1008		
Mains Power:	5VDC			
Test Date:	6/27/2013			
Tested by:	David Zhang			
Remarks:	-			

Frequency (MHz)	2450.000000
Relative permittivity (real part)	52.642
Conductivity (S/m)	1.965
Transmission Duty Factor	1.0
Probe SN	2611_EPG129
Conversion Factor (dB)	7.89
Area Scan Resolution	8 mm
Zoom Scan Resolution	dx=5mm, dy=5mm, dz=4mm
Zoom Scan Size	30x30x32 mm
Measurement Drifts (%)	-0.920
Highest Extrapolated SAR (W/Kg)	9.5601
SAR 1g (W/Kg)	5.2622
Peak SAR Location	0mm(x),0mm(y),4mm(z)
	
SURFACE SAR	VOLUME SAR
	
Z-axis plot	3D View Plot

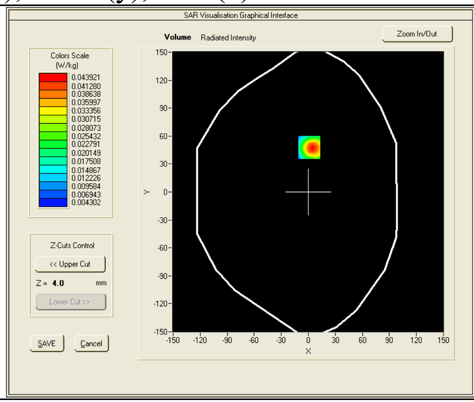
SAR Measurement Plots – Determine worst case configuration

Test specification:	Bluetooth-8DPSK-2480MHz-Body SAR-Top position			
Environ Conditions:	Temp(oC):	22	Result:	Pass
	Humidity(%):	56		
	Atmospheric(mPa):	1008		
Mains Power:	5VDC			
Test Date:	6/27/2013			
Tested by:	David Zhang			
Remarks:	-			

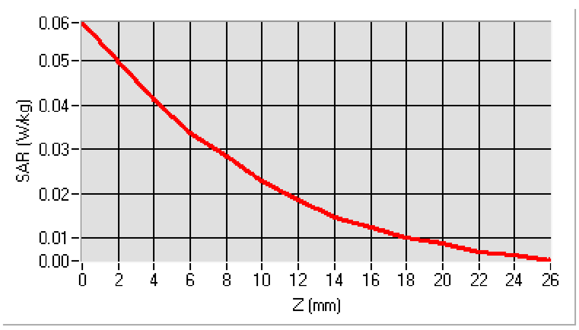
Frequency (MHz)	2480.000000
Relative permittivity (real part)	52.438
Conductivity (S/m)	2.009
Transmission Duty Factor	1.0
Probe SN	2611_EPG129
Conversion Factor (dB)	7.89
Area Scan Resolution	8 mm
Zoom Scan Resolution	dx=4mm, dy=4mm, dz=2mm
Zoom Scan Size	24x24x24 mm
Measurement Drifts (%)	-3.470
Highest Extrapolated SAR (W/Kg)	0.0729
SAR 1g (W/Kg)	0.0441
Peak SAR Location	1mm(x),48mm(y),4mm(z)



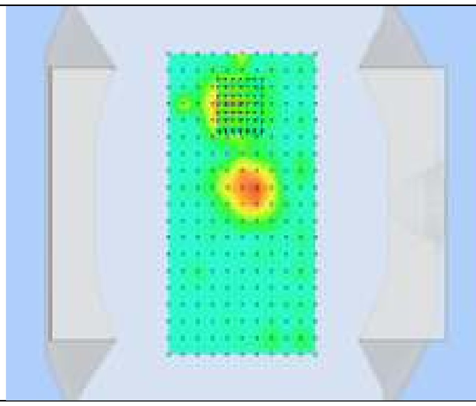
SURFACE SAR



VOLUME SAR



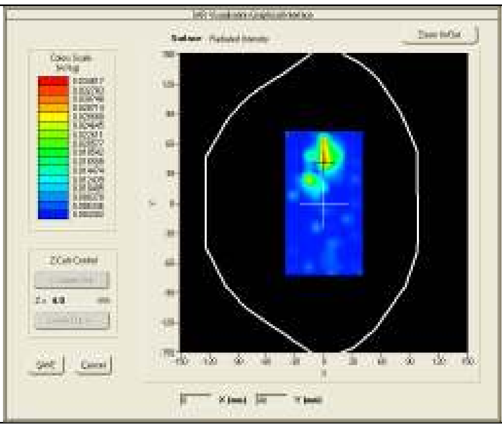
Z-axis plot



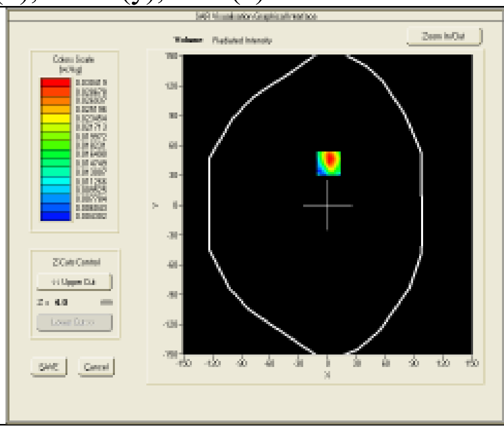
3D View Plot

Test specification:	Bluetooth-8DPSK-2480MHz-Body SAR-Left position			
Environ Conditions:	Temp(oC):	22	Result:	Pass
	Humidity(%):	56		
	Atmospheric(mPa):	1008		
Mains Power:	5VDC			
Test Date:	6/27/2013			
Tested by:	David Zhang			
Remarks:	-			

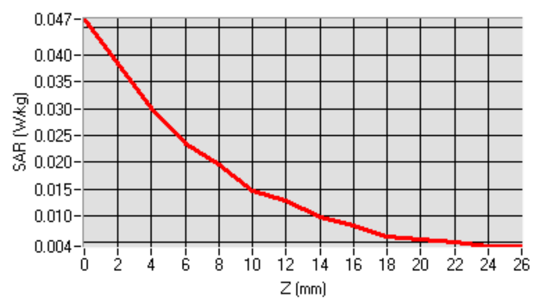
Frequency (MHz)	2480.000000
Relative permittivity (real part)	52.438
Conductivity (S/m)	2.009
Transmission Duty Factor	1.0
Probe SN	2611_EPG129
Conversion Factor (dB)	7.89
Area Scan Resolution	8 mm
Zoom Scan Resolution	dx=4mm, dy=4mm, dz=2mm
Zoom Scan Size	24x24x24 mm
Measurement Drifts (%)	0.000
Highest Extrapolated SAR (W/Kg)	0.0533
SAR 1g (W/Kg)	0.0315
Peak SAR Location	1mm(x),42mm(y),4mm(z)



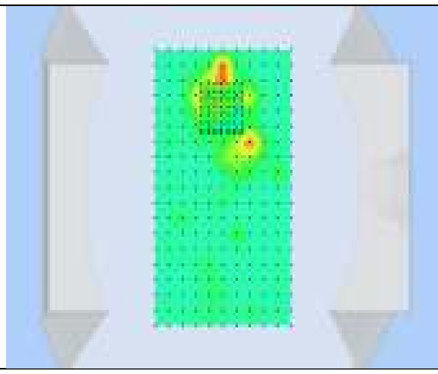
SURFACE SAR



VOLUME SAR



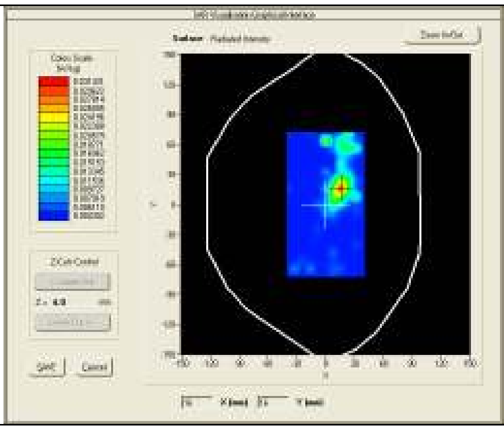
Z-axis plot



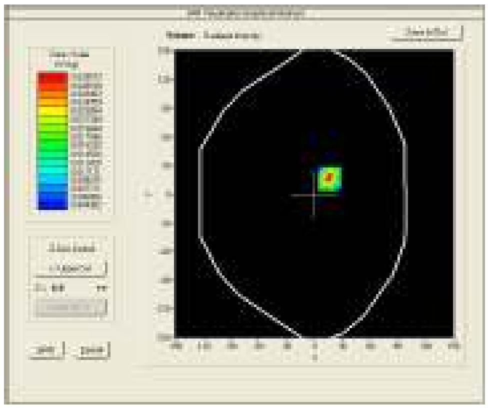
3D View Plot

Test specification:	Bluetooth-8DPSK-2480MHz-Body SAR-Right position			
Environ Conditions:	Temp(oC):	22	Result:	Pass
	Humidity(%):	56		
	Atmospheric(mPa):	1008		
Mains Power:	5VDC			
Test Date:	6/27/2013			
Tested by:	David Zhang			
Remarks:	-			

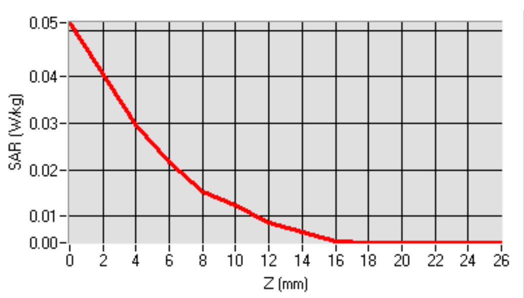
Frequency (MHz)	2480.000000
Relative permittivity (real part)	52.438
Conductivity (S/m)	2.009
Transmission Duty Factor	1.0
Probe SN	2611_EPG129
Conversion Factor (dB)	7.89
Area Scan Resolution	8 mm
Zoom Scan Resolution	dx=4mm, dy=4mm, dz=2mm
Zoom Scan Size	24x24x24 mm
Measurement Drifts (%)	-0.500
Highest Extrapolated SAR (W/Kg)	0.0721
SAR 1g (W/Kg)	0.0264
Peak SAR Location	16mm(x),16mm(y),4mm(z)



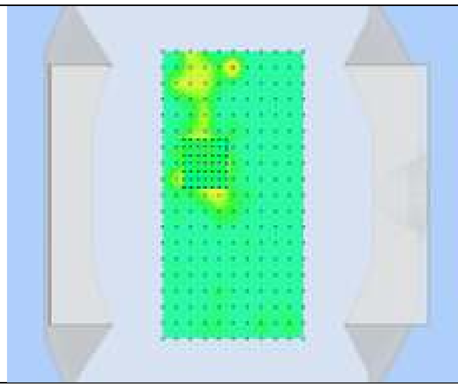
SURFACE SAR



VOLUME SAR



Z-axis plot

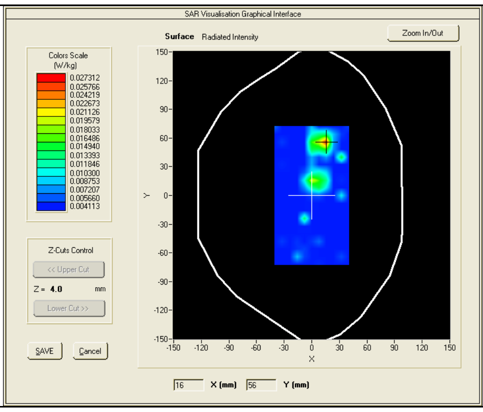


3D View Plot

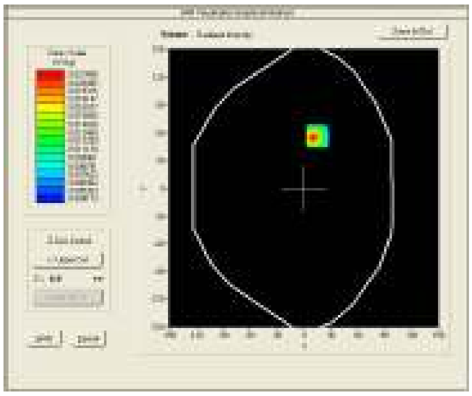
SAR Measurement Plots – Additional measurement on worst configuration

Test specification:	Bluetooth-8DPSK-2402MHz-Body SAR-Top position			
Environ Conditions:	Temp(oC):	22	Result:	Pass
	Humidity(%):	56		
	Atmospheric(mPa):	1008		
Mains Power:	5VDC			
Test Date:	6/27/2013			
Tested by:	David Zhang			
Remarks:	-			

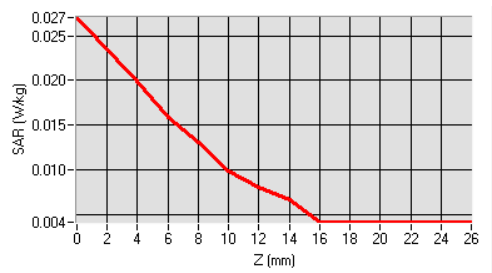
Frequency (MHz)	2402.000000
Relative permittivity (real part)	52.823
Conductivity (S/m)	1.929
Transmission Duty Factor	1.0
Probe SN	2611_EPG129
Conversion Factor (dB)	7.89
Area Scan Resolution	8 mm
Zoom Scan Resolution	dx=4mm, dy=4mm, dz=2mm
Zoom Scan Size	24x24x24 mm
Measurement Drifts (%)	-1.140
Highest Extrapolated SAR (W/Kg)	0.0349
SAR 1g (W/Kg)	0.0213
Peak SAR Location	15mm(x),56mm(y),4mm(z)



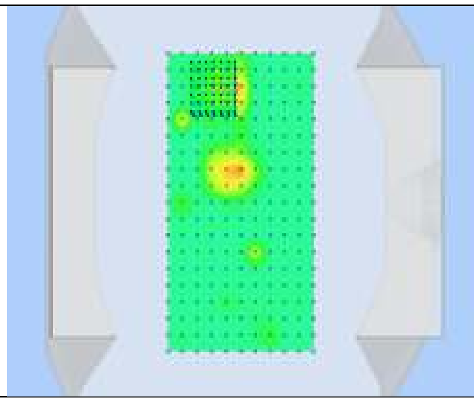
SURFACE SAR



VOLUME SAR



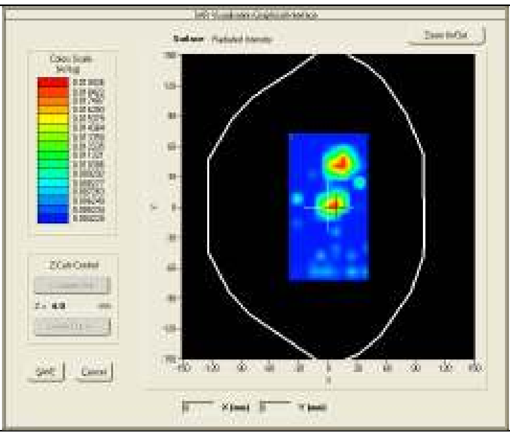
Z-axis plot



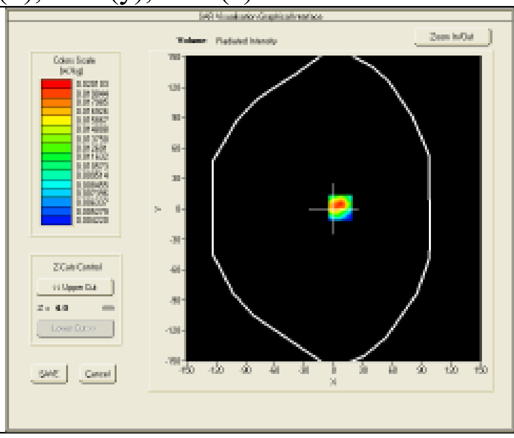
3D View Plot

Test specification:	Bluetooth-8DPSK-2441Hz-Body SAR-Top position			
Environ Conditions:	Temp(oC):	22	Result:	Pass
	Humidity(%):	56		
	Atmospheric(mPa):	1008		
Mains Power:	5VDC			
Test Date:	6/27/2013			
Tested by:	David Zhang			
Remarks:	-			

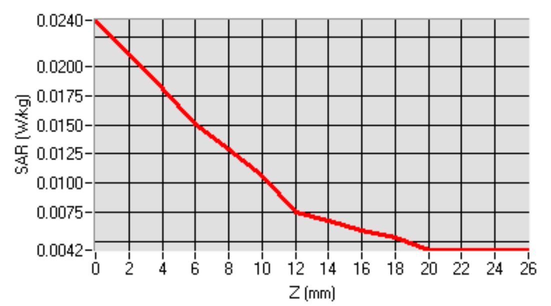
Frequency (MHz)	2441.000000
Relative permittivity (real part)	52.803
Conductivity (S/m)	1.961
Transmission Duty Factor	1.0
Probe SN	2611_EPG129
Conversion Factor (dB)	7.89
Area Scan Resolution	8 mm
Zoom Scan Resolution	dx=4mm, dy=4mm, dz=2mm
Zoom Scan Size	24x24x24 mm
Measurement Drifts (%)	0.800
Highest Extrapolated SAR (W/Kg)	0.0358
SAR 1g (W/Kg)	0.0201
Peak SAR Location	7mm(x),1mm(y),4mm(z)



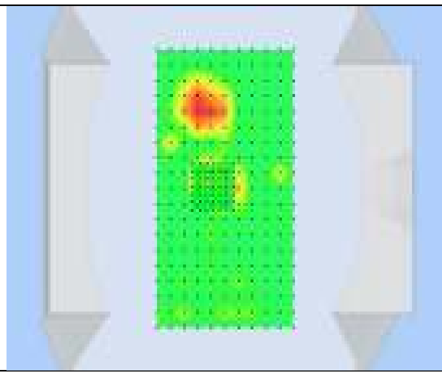
SURFACE SAR



VOLUME SAR



Z-axis plot



3D View Plot

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