INTERMEC TECHNOLOGIES CORPORATION

MOBILE COMPUTER

Model: CN50

Sep 20th 2011

Report No.: SL11080304-ICT-024_CN50 (FCC_SAR) Rev1.1

(This report supersedes SL11080304-ICT-024_CN50 (FCC_SAR) Rev1.0)

Numerical Keypad Version

QWERT Keypad Version

Modifications made to the product : None

This Test Report is Issued Under the Authority of:	
David Zhang Compliance Engineer	Leslie Bai Director of Certification

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All Test Data Presented in this report is only applicable to presented Test sample.

SAR Test Report

To: C95.1 , IEEE 1528 , OET Bulletin 65 Suppl. C , RSS 102 and Safety Code 6

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Europe	A2LA, NIST	EMC, RF, Telecom , Safety, SAR

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Country	Accreditation Body	Scope
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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 Executive Summary & EUT information

The purpose of this test programmed was to demonstrate compliance of the Intermec Technologies Corporation Model: CN50 against the current Stipulated Standards. The Mobile Computer have demonstrated compliance with the C95.1 , IEEE 1528, OET Bulletin 65 Supplement C and Safety Code 6. The test has demonstrated that this unit complies with stipulated standards.

EUT Information

EUT Description	:	Mobile Computer
Model No	:	CN50
Serial No	:	#1: 185V1100687 (GSM/WCDMA) #2: 175V1000466 (CDMA/EV-DO)
HW version	:	N/A
SW version		01.61.15.0054 Build: Jul 25 2011
IMEI	:	IMEI 1: 011789001790505 (GSM/WCDMA) IMEI 2: 011789000775911 (CDMA/EV-DO)
Input Power	:	3.7V 3.9Ah, 14.5Wh

Average Conducted Output Power to Antenna	GSM	GSM850	:32.32 dBm	GSM1900	:29.35 dBm
		GPRS850	:32.39 dBm	GPRS1900	:29.02 dBm
		EGPRS850	:27.08 dBm	EGPRS1900	:25.58 dBm
	UMTS R99	UMTS850	:24.49 dBm		
		UMTS1900	:24.54 dBm		
		UMTS1700	:24.23 dBm		
	HSDPA	HSDPA850	:24.27 dBm		
		HSDPA1900	:24.19 dBm		
		HSDPA 1700	:24.25 dBm		
	HSPA	HSPA850	:24.27 dBm		
		HSPA1900	:24.16 dBm		
		HSPA1700	:23.62 dBm		
	CDMA2000 1xRTT	Cellular band	:24.18 dBm		
		PCS band	:24.26 dBm		
	EV-DO Rev 0/A	Cellular band	:24.02 dBm		
		PCS band	:24.06 dBm		
	EV-DO Rev 0/A	Cellular band	:24.11 dBm		
		PCS band	:24.10 dBm		
Transmitter category/ Equipment category	: Portable Device				

Co-located TX	:	WWAN can transmit simultaneously with 802.11g WWAN can transmit simultaneously with Bluetooth 802.11g can transmit simultaneously with Bluetooth			
Antenna	:	Internal			
Antenna Gain description	:	Cellular Band : -2dBi	PCS Band : -1dBi	WIFI / Bluetooth: 1dBi	
Antenna Separation distances	:	0.49 cm - WWAN antenna-to-WiFi (802.11g) 1.40 cm - WWAN antenna-to-Bluetooth antenna 0.96 cm - WiFi (802.11g)-to-Bluetooth antenna			
Measured Highest SAR	:	GSM	Highest SAR Value:	0.164 0.774	(Head) (Body)
		UMTS	Highest SAR Value:	0.283 0.719	(Head) (Body)
		CDMA2000	Highest SAR Value:	0.247 0.244	(Head) (Body)
		WLAN	Highest SAR Value:	0.026 0.038	(Head) (Body)

Note: 1. The SAR of CN50 was measured and found compliance with FCC regulation per original FCC ID: EHA-01CN50 and IC ID: 1223A-01CN50. The purpose of SAR testing in this report was to verify that it's still compliant with FCC regulation after the modification of original unit by replacing the camera hardware from 3 mega pixel to 5mega pixel. Only the worst result configuration in original test report was verified.

2. CN50 has 2 types of keypad version. Only the worst case version of numerical version was tested and the result was presented in this report.

3. This DUT supports GPRS multi-slot class 12 (max. 4 uplink, 4 downlink, total 5 active slots). It is class B device and it can't operate in DTM. Therefore, this DUT can't transmit voice (CS) and data (PS) simultaneously.

2 TECHNICAL DETAILS

Purpose	Compliance testing of Mobile Computer model CN50 with stipulated standard
Applicant / Client	Intermec Technologies Corporation
Manufacturer	Intermec Technologies Corporation 6001 36th Avenue West Everett, Washington 98203 United States
Laboratory performing the tests	SIEMIC Laboratories
Test report reference number	SL11080304-ICT-024_CN50 (FCC_SAR) Rev1.1
Date EUT received	Aug 18th 2011
Standard applied	See Page 9
Dates of test (from – to)	Aug 18th-Sep 20th 2011
No of Units:	3
Equipment Category:	PCE
Trade Name:	Intermec Technologies Corporation
Model Name:	CN50
RF Operating Frequency (ies)	GSM850 : 824.2 ~ 848.8 MHz(TX) / 869.2 ~ 893.8 MHz(RX) GSM1900 : 1850.2 ~ 1909.8 MHz(TX) / 1930.2 ~ 1989.8 MHz(RX) WCDMA Band V : 826.4 ~ 846.6 MHz(TX) / 871.4 ~ 891.6 MHz(RX) WCDMA Band IV :1712.4 ~ 1752.6 MHz(TX) / 2112.4MHz ~ 2152.6MHz(RX) WCDMA Band II : 1852.4 ~ 1907.6 MHz(TX) / 1932.4 ~ 1987.6 MHz(RX) CDMA2000 Band Class 0 : 824.7~848.31MHz (TX) / 869.7~ 893.31MHz(RX) CDMA2000 Band Class 1:1851.25~1908.75 MHz(TX) /1931.25~1987.75 MHz(RX) WLAN 802.11b/g: 2412 – 2462MHz(TX/RX) Bluetooth: 2402 – 2480MHz(TX/RX)
Number of Channels:	N/A
Modulation:	GSM / GPRS : GMSK EGPRS : 8PSK WCDMA : QPSK/BPSK CDMA2000: BPSK, HPSK/QPSK WLAN: DSSS,OFDM Bluetooth: GFSK ,π/4-DQPSK, 8-DPSK
FCC ID:	EHA-01CN50
IC ID:	1223A-01CN50

3 INTRODUCTION

Introduction

This measurement report shows compliance of the EUT with FCC OET Bulletin 65 Supplement C (Edition 01-01) & RSS 102 Issue 4.0.

The test procedures, as described in ANSI C95.1 – 1999 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [2], and ANSI C95.3 – 2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields [3], were employed.

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

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

where:

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

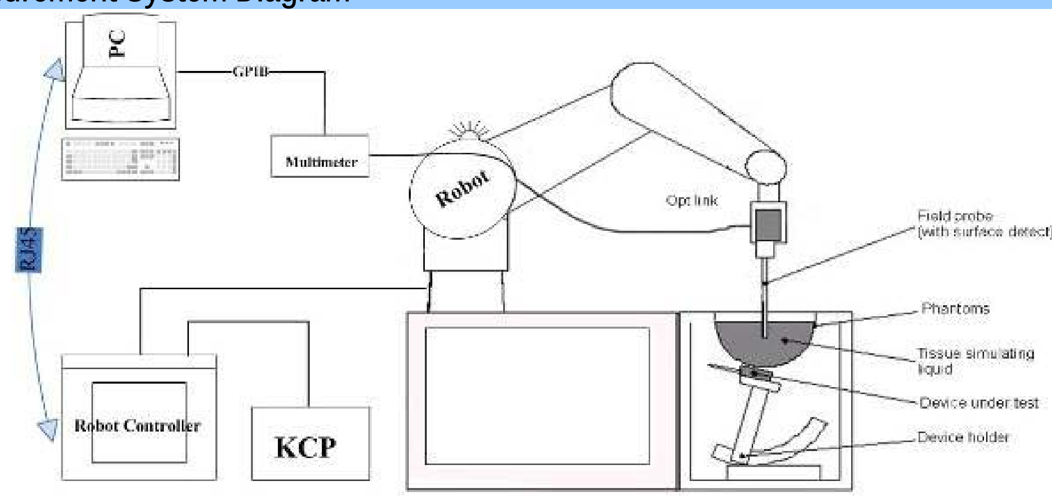
4 SAR Measurement Setup

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.

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 starndard 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.

Measurement System Diagram



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

1. A standard high precision 6-axis robot (KUKA) with controller and software.
2. KUKA Control Panel (KCP).
3. 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.
4. The functions of the PC plug-in card are to perform the time critical task such as signal filtering, surveillance of the robot operation fast movement interrupts.

5. A computer operating Windows XP.
6. OPENSAR software.
7. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
8. The SAM phantom enabling testing left-hand right-hand and body usage.
9. The Position device for handheld EUT.
10. Tissue simulating liquid mixed according to the given recipes (see Application Note).
11. System validation dipoles to validate the proper functioning of the system.

EP100 Probe

Construction Symmetrical design with triangular Core. Built-in shielding against static charges Calibration in air from 100 MHz to 2.5 GHz. In brain and muscle simulating tissue at frequencies from 800 to 6000 MHz (accuracy of 8%) .

Frequency 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

Application General dosimetric up to 6 GHz

Compliance tests of Mobile Computers

Fast automatic scanning in arbitrary phantoms

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique, with printed resistive lines on ceramic substrates.

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.

E-Field Probe Calibration Process

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 ntegrated 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: 2 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 produced 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 Parametrs	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can either be found in the component documents or be 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: $$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

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 around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then 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.

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].

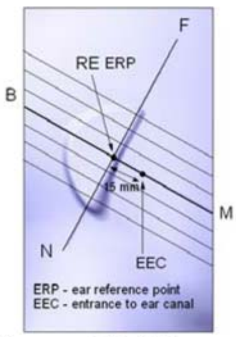


Figure 6.1 Close-up side view of ERP's

Figure 6.2 Front, back and side view of SAM

Device Reference Points

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 [5].

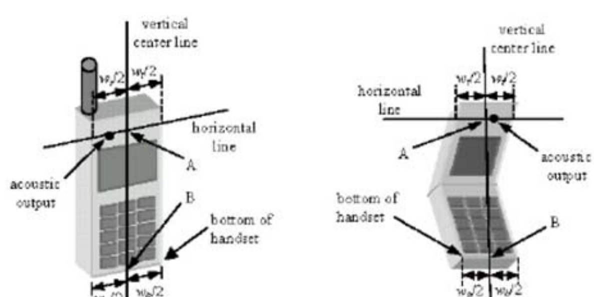


Figure 6.3 Handset Vertical Center & Horizontal Line Reference Points

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

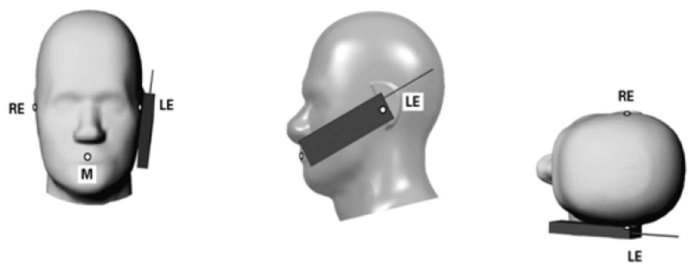


Figure 7.1 Front, Side and Top View of Cheek/Touch Position

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.

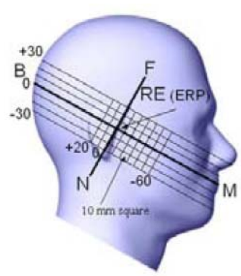


Figure 7.2 Side view w/ relevant markings

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).

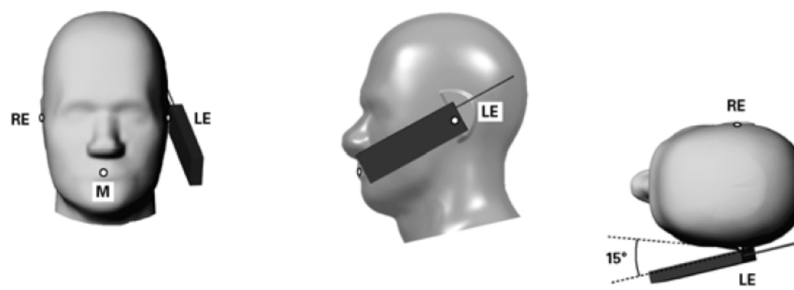


Figure 7.3 Front, Side and Top View of Ear/15˚ Tilt Position

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 spacings 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.

5 ANSI/IEEE C95.1 – 1999 RF Exposure Limit

In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and cautions statements are included in the user's manual.

Uncontrolled Environment

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

Controlled Environment

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

Table 8.1 Human Exposure Limits

	UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)	CONTROLLED ENVIROMENT Professional Population (W/kg) or (mW/g)
SPATIAL PEAK SAR[1] Brain	1.60	8.00
SPATIAL AVERAGE SAR[2] Whole Body	0.08	0.40
SPATIAL PEAK SAR[3] Hands, Feet, Ankles, Wrists	4.00	20.00

[1] The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
[2] The Spatial Average value of the SAR averaged over the whole body.
[3] The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

6 SYSTEM AND LIQUID VALIDATION

System Validation

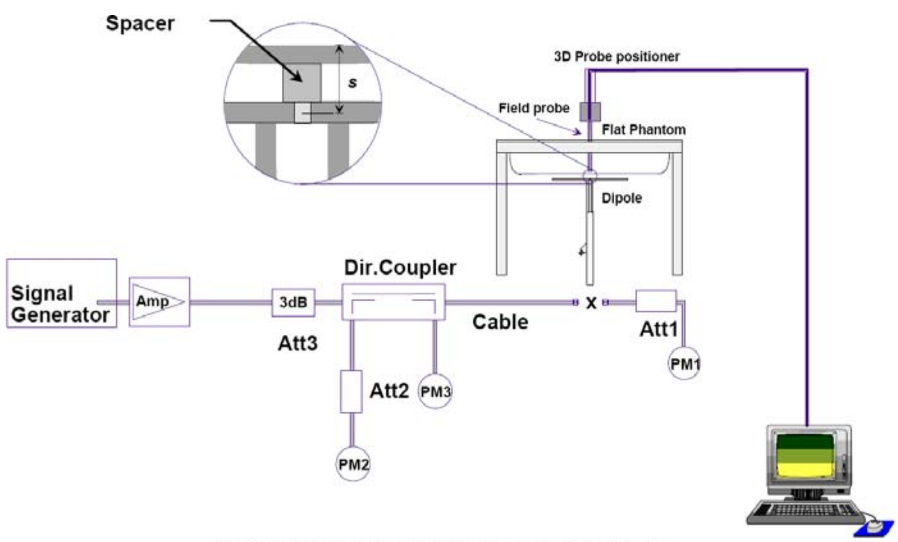


Fig 8.1 System Setup for System Evaluation

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

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

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

The output power on dipole port must be calibrated to 30 dBm (1000 mW) before dipole is connected.

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

Measurement Date	Frequency (MHz)	Liquid Configuration	Target SAR1g (W/kg)	Measured SAR1g (W/kg)	Deviation (%)
Sep 16th, 2011	835	Head	9.58	9.165	-4.33
Sep 16th, 2011	1900	Head	40.77	40.416	-0.87
Sep 16th, 2011	1700	Head	38.59	38.52	-0.18
Sep 16th, 2011	2450	Head	52.60	51.46	-2.17
Sep 16th, 2011	835	Body	9.98	9.64	-3.41
Sep 16th, 2011	1900	Body	43.42	41.65	-4.08
Sep 16th, 2011	1700	Body	40.63	40.42	-0.52
Sep 16th, 2011	2450	Body	55.61	54.53	-1.94

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.

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 xpected 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:

Temperature: 21°C			Relative humidity: 58%			
Freq(MHz)			Target	Measured	Deviation (%)	Limit (%)
835	Head	Permittivity	41.5	41.62	0.29	5
		Conductivity	0.90	0.868	-3.56	5
	Body	Permittivity	55.2	55.25	0.09	5
		Conductivity	0.97	0.958	-1.24	5
836.4	Head	Permittivity	41.5	41.434	-0.16	5
		Conductivity	0.9	0.939	4.29	5
	Body	Permittivity	55.2	55.294	0.17	5
		Conductivity	0.97	0.966	-0.38	5
836.52	Head	Permittivity	41.5	41.434	-0.16	5
		Conductivity	0.9	0.939	4.29	5
	Body	Permittivity	55.2	55.294	0.17	5
		Conductivity	0.97	0.966	-0.38	5

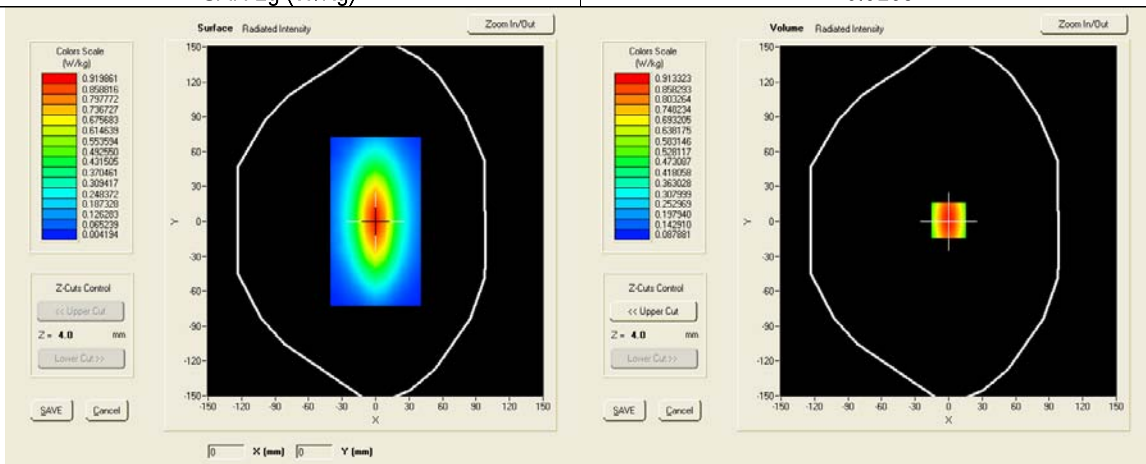
Temperature: 21°C			Relative humidity: 58%			
Freq(MHz)			Target	Measured	Deviation (%)	Limit (%)
1900	Head	Permittivity	40.00	40.53	1.33	5
		Conductivity	1.4	1.349	-3.64	5
	Body	Permittivity	53.3	53.521	0.41	5
		Conductivity	1.52	1.506	-0.92	5
1880	Head	Permittivity	40	38.748	-3.13	5
		Conductivity	1.4	1.415	1.04	5
	Body	Permittivity	53.3	53.092	-0.39	5
		Conductivity	1.52	1.506	-0.89	5
1800	Head	Permittivity	40.0	38.613	-0.92	5
		Conductivity	1.40	1.403	-3.47	5
	Body	Permittivity	53.3	53.038	0.21	5
		Conductivity	1.52	1.502	-0.49	5
1732.4	Head	Permittivity	40.14	40.06	-1.18	5
		Conductivity	1.36	1.32	-0.20	5
	Body	Permittivity	53.6	53.70	-2.94	5
		Conductivity	1.48	1.44	0.19	5

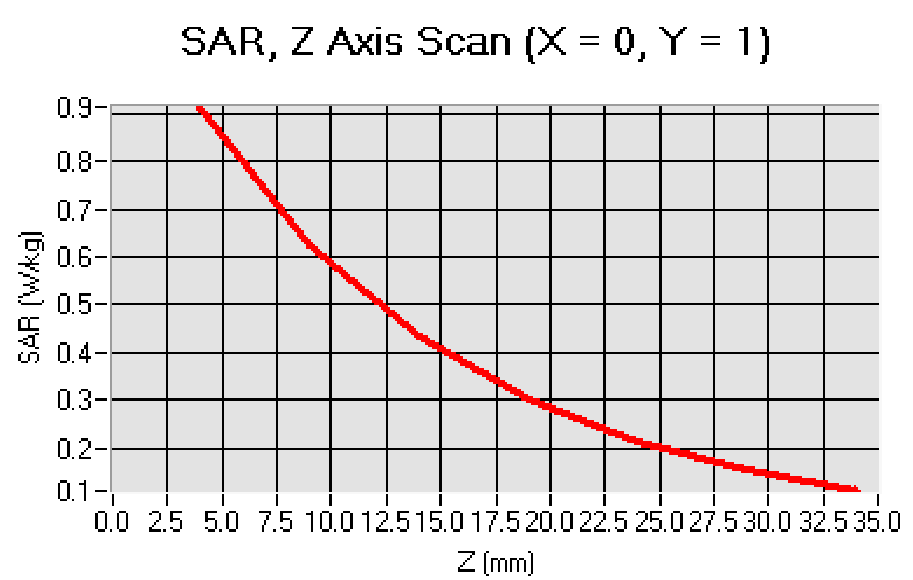
Temperature: 21°C			Relative humidity: 58%			
Freq(MHz)			Target	Measured	Deviation (%)	Limit (%)
2450	Head	Permittivity	39.2	39.42	0.56	5
		Conductivity	1.80	1.86	3.33	5
	Body	Permittivity	52.7	53.48	1.48	5
		Conductivity	1.95	1.93	-1.03	5
2437	Head	Permittivity	39.22	39.51	0.74	5
		Conductivity	1.80	1.87	3.89	5
	Body	Permittivity	52.73	53.98	2.37	5
		Conductivity	1.95	1.94	-0.51	5

System Validation Plots

Test Mode:	835MHz Validation (Body SAR)		
Position:	Flat Phantom		
Product Description:	N/A		
Model:	N/A	Test Date:	Sep 16th, 2011

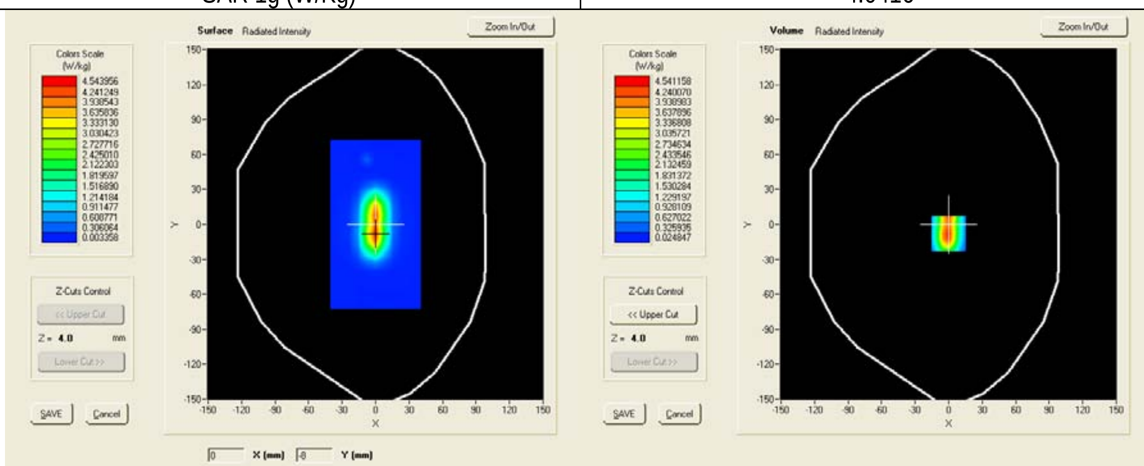
Frequency (MHz)	835.00 (Head Liquid)
Relative permitivity (real part)	41.62
Relative permitivity (imaginary part)	18.85
Conductivity (S/m)	0.868
Variation (%)	-1.65
SAR 1g (W/Kg)	0.9165

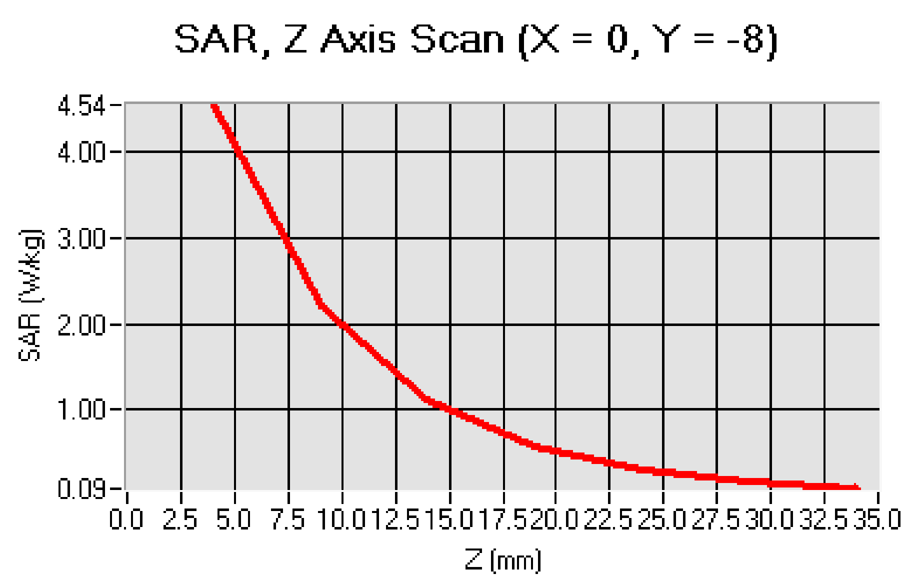




Test Mode:	1900MHz Validation (Body SAR)		
Position:	Flat Phantom		
Product Description:	N/A		
Model:	N/A	Test Date:	Sep 16th, 2011

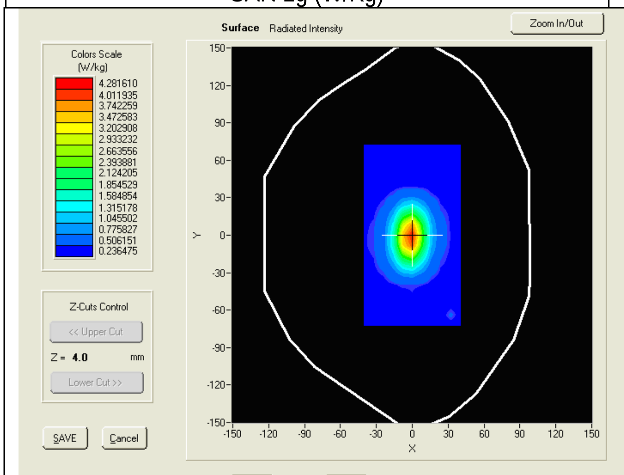
Frequency (MHz)	1900(Head Liquid)
Relative permitivity (real part)	40.53
Relative permitivity (imaginary part)	18.85
Conductivity (S/m)	1.349
Variation (%)	0.12
SAR 1g (W/Kg)	4.0416

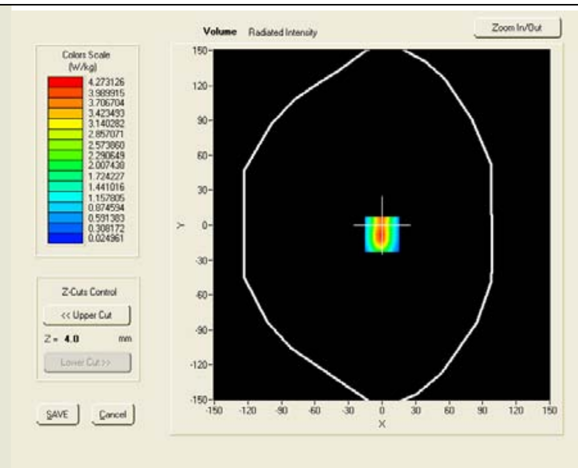


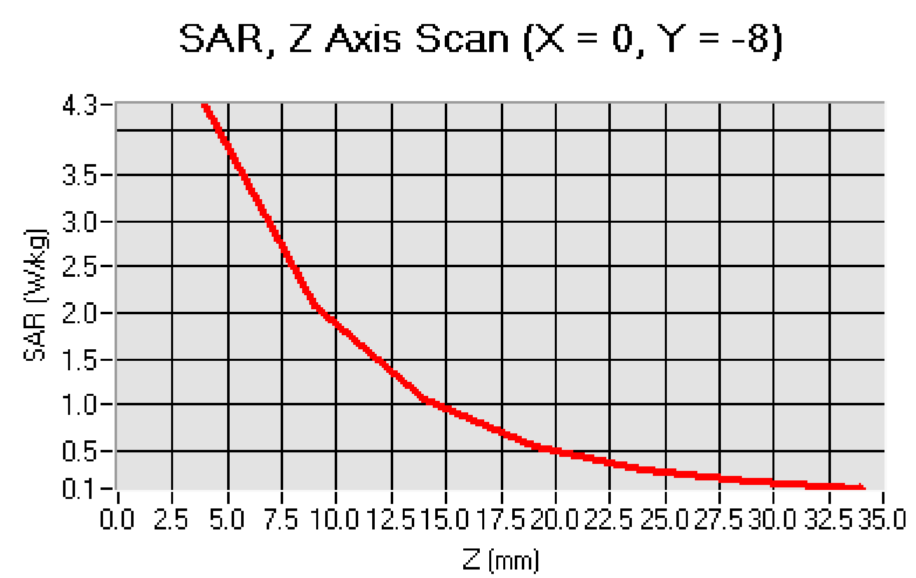


Test Mode:	1800MHz Validation (Body SAR)		
Position:	Flat Phantom		
Product Description:	N/A		
Model:	N/A	Test Date:	Sep 16th, 2011

Frequency (MHz)	1800.00 (Head Liquid)
Relative permitivity (real part)	38.613
Relative permitivity (imaginary part)	12.91
Conductivity (S/m)	1.403
Variation (%)	-0.090
SAR 1g (W/Kg)	3.961

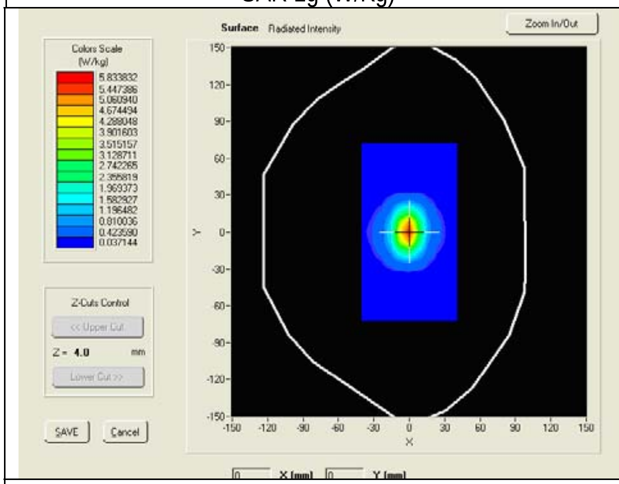


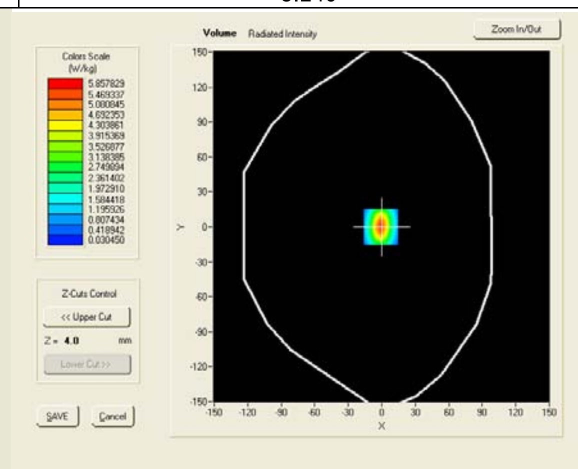


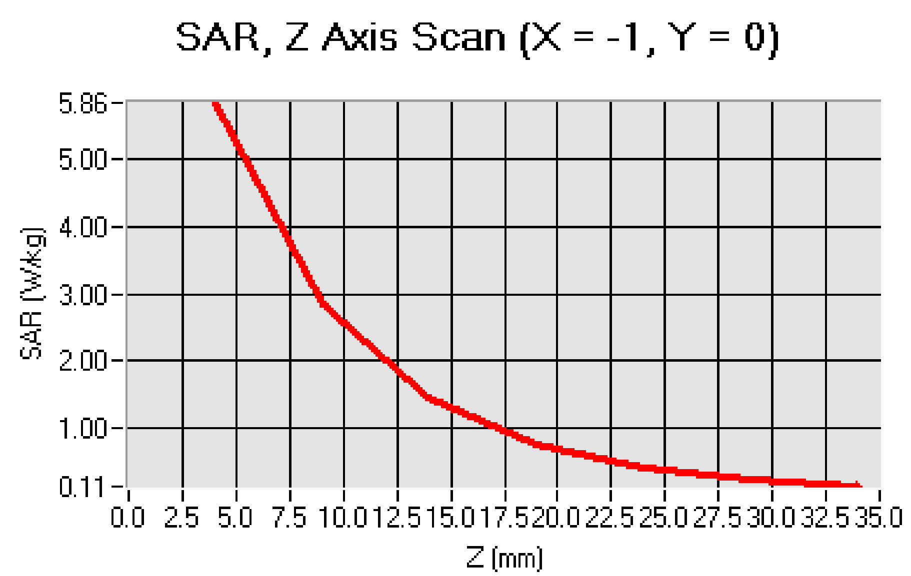


Test Mode:	2450MHz Validation (Body SAR)		
Position:	Flat Phantom		
Product Description:	N/A		
Model:	N/A	Test Date:	Sep 16th, 2011

Frequency (MHz)	2450.00 (Head Liquid)
Relative permitivity (real part)	39.42
Relative permitivity (imaginary part)	13.22
Conductivity (S/m)	1.86
Variation (%)	-0.39
SAR 1g (W/Kg)	5.146

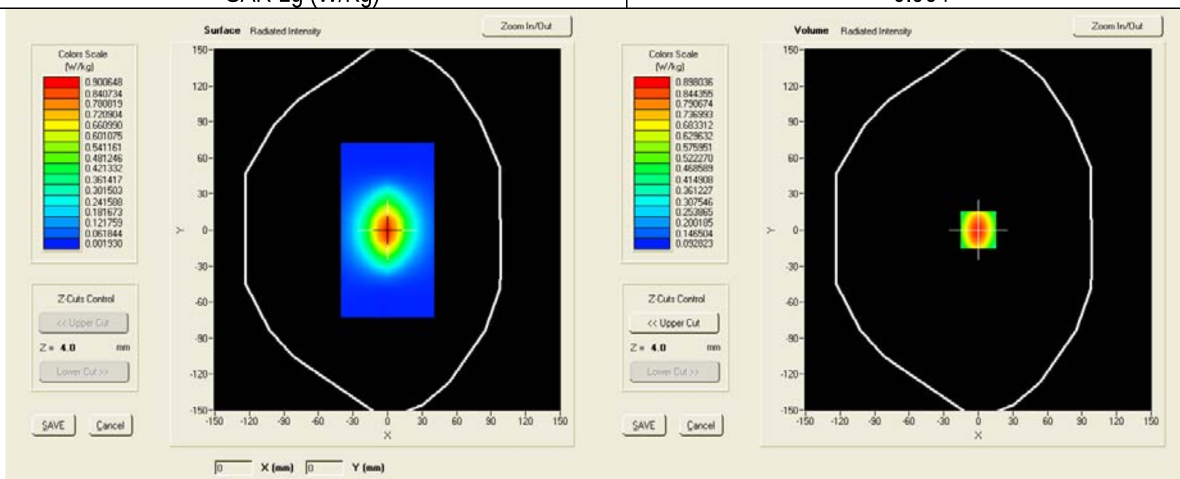


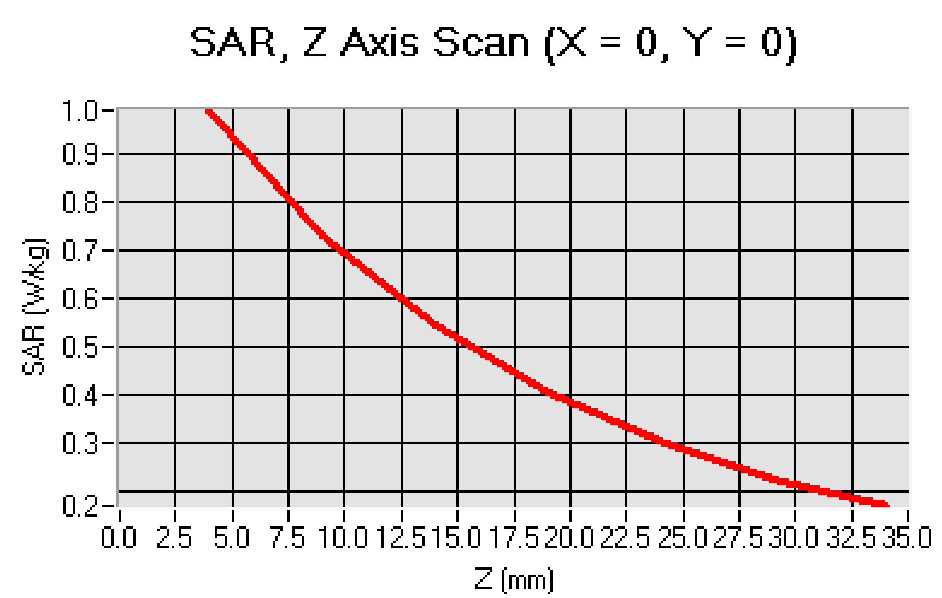




Test Mode: 835MHz Validation (Body SAR)
Position: Flat Phantom
Product Description: N/A
Model: N/A Test Date: Sep 16th, 2011

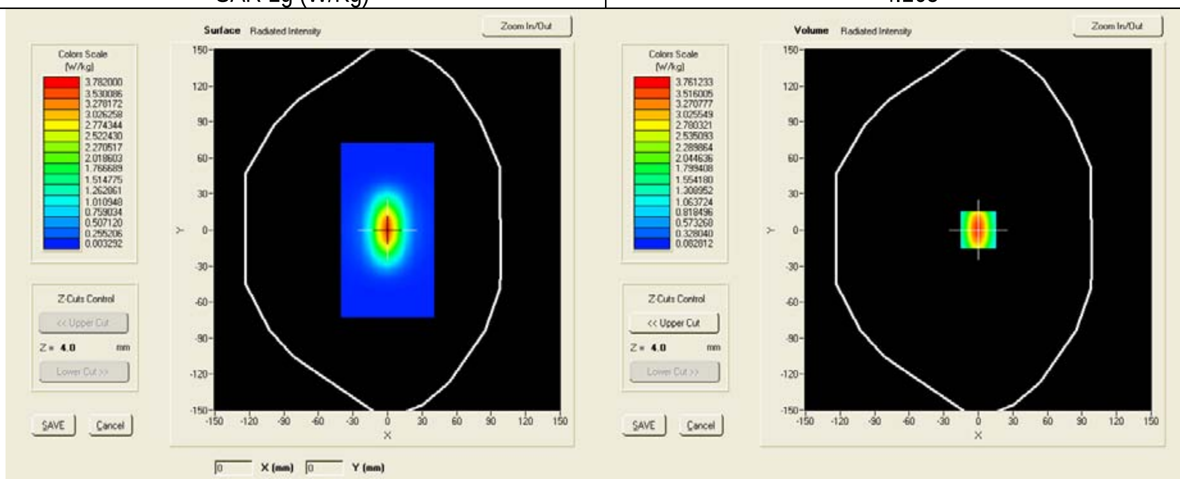
Frequency (MHz)	835.00 (Body Liquid)
Relative permitivity (real part)	55.25
Relative permitivity (imaginary part)	20.80
Conductivity (S/m)	0.958
Variation (%)	-0.53
SAR 1g (W/Kg)	0.964

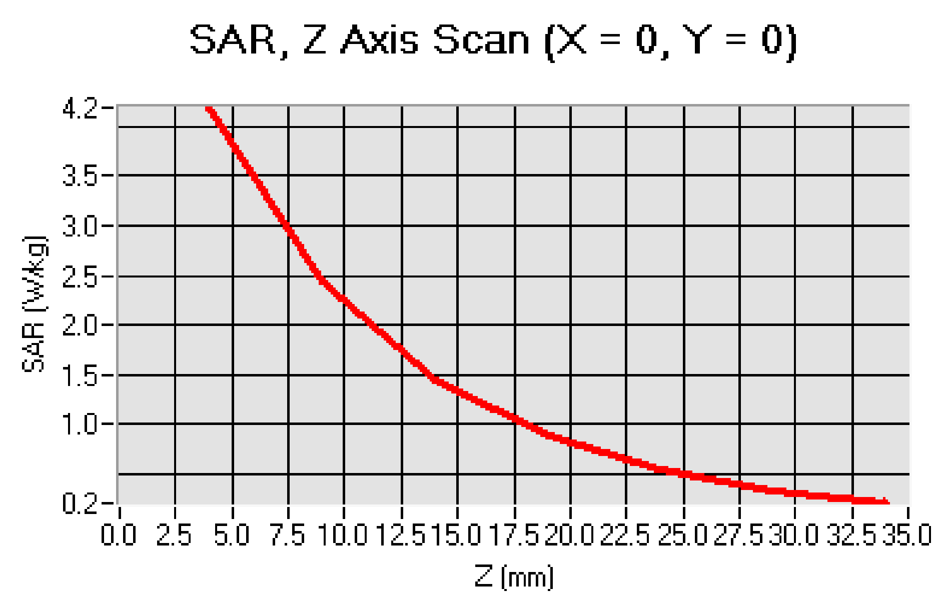




Test Mode:	1900MHz Validation (Body SAR)		
Position:	Flat Phantom		
Product Description:	N/A		
Model:	N/A	**Test Date:**	Sep 16th, 2011

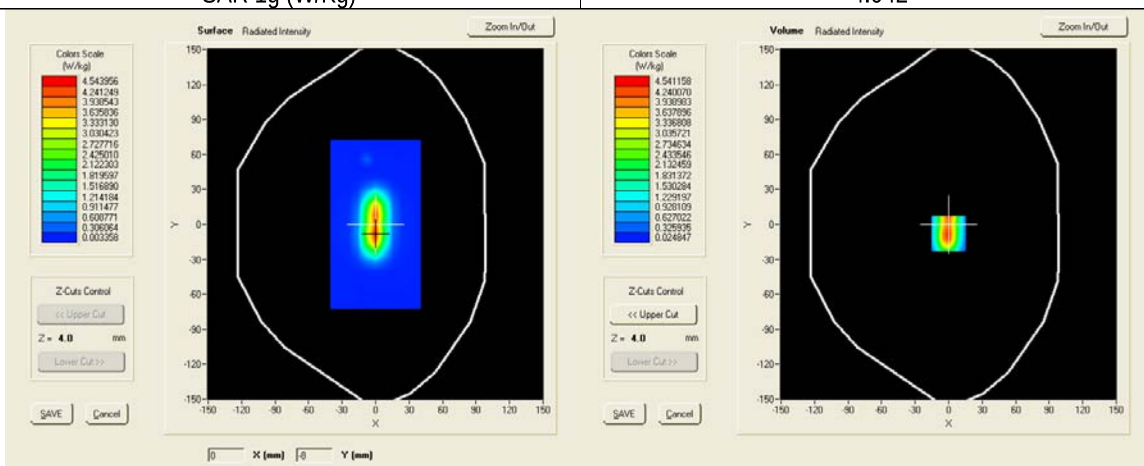
Frequency (MHz)	1900(Body Liquid)
Relative permittivity (real part)	53.521
Relative permittivity (imaginary part)	14.47
Conductivity (S/m)	1.506
Variation (%)	0.06
SAR 1g (W/Kg)	4.165

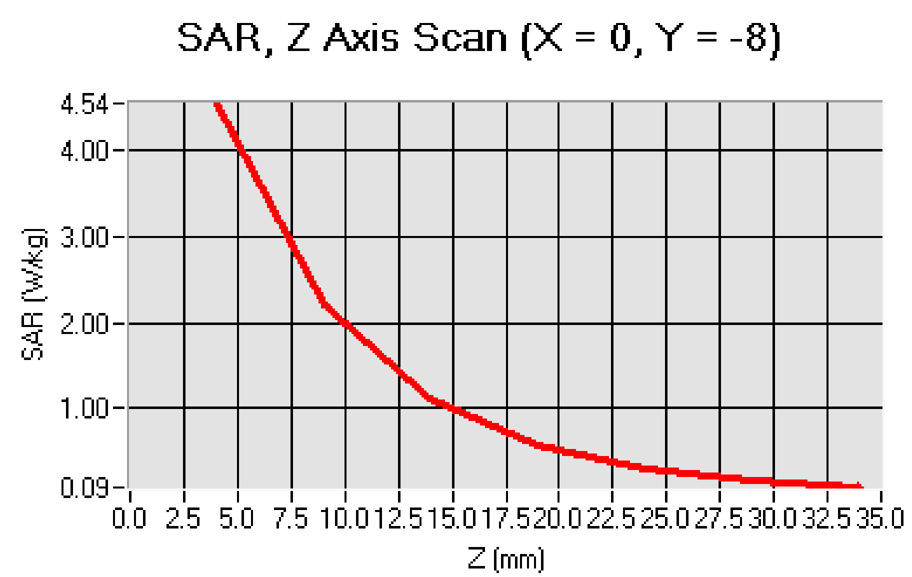




Test Mode:	1800MHz Validation (Body SAR)		
Position:	Flat Phantom		
Product Description:	N/A		
Model:	N/A	**Test Date:**	Sep 16th, 2011

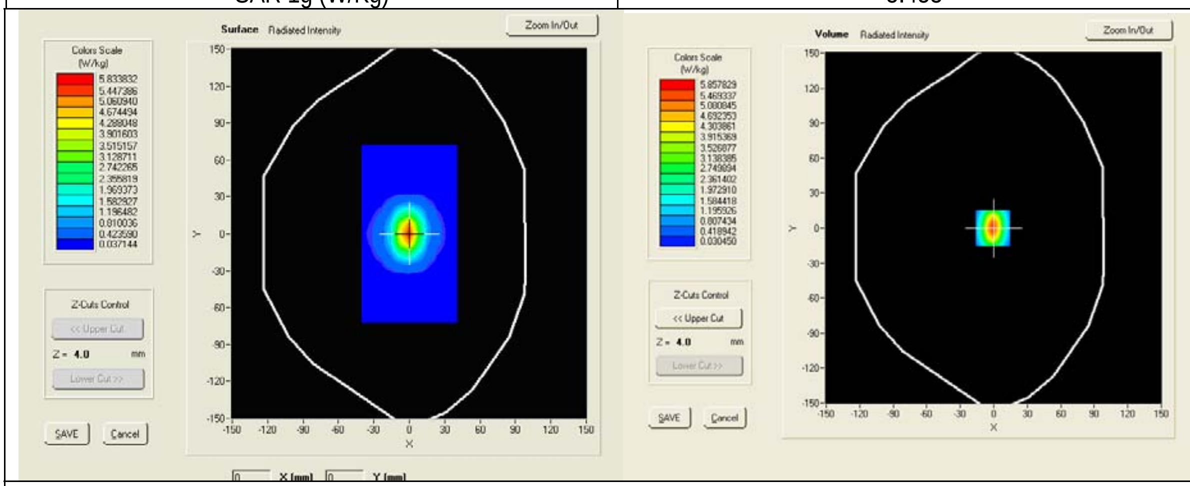
Frequency (MHz)	1800.00 (Body Liquid)
Relative permitivity (real part)	53.038
Relative permitivity (imaginary part)	15.36
Conductivity (S/m)	1.502
Variation (%)	0.120
SAR 1g (W/Kg)	4.042

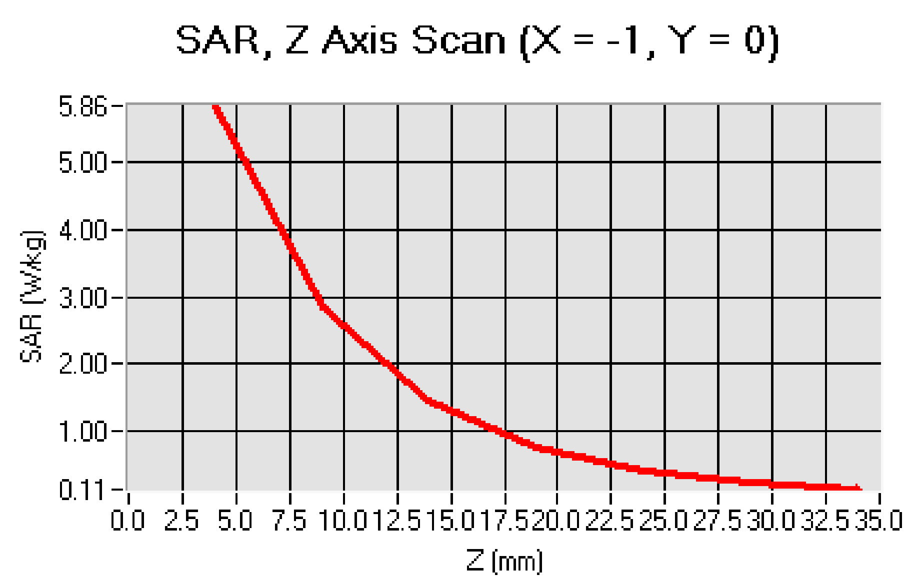




Test Mode: 2450MHz Validation (Body SAR)
Position: Flat Phantom
Product Description: N/A
Model: N/A Test Date: Sep 16th, 2011

Frequency (MHz)	2450.0000 (Body Liquid)
Relative permitivity (real part)	53.48
Relative permitivity (imaginary part)	14.31
Conductivity (S/m)	1.93
Variation (%)	-1.64
SAR 1g (W/Kg)	5.453





7 TYPE A 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 / √3	1 / √6	1 / √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 %

8 OUTPUT POWER VERIFICATION

Test Condition:

1.	Conducted Measurement EUT was set for low, mid, high channel with modulated mode and highest RF output power. The base station simulator was connected to the antenna terminal.		
2	Conducted Emissions Measurement Uncertainty All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.		
3	Environmental Conditions	Temperature Relative Humidity Atmospheric Pressure	23^{o}C 50% 1019mbar
4	Test Date : Sep 16th, 2011 Tested By :David Zhang		

Test Procedures:

GSM/GPRS/EGPRS Mobile phone radio output power measurement

1. The transmitter output port was connected to base station emulator.
2. Establish communication link between emulator and EUT and set EUT to operate at maximum output power all the time.
3. Select lowest, middle, and highest channels for each band and different possible test mode.
4. Measure the conducted peak burst power and conducted average burst power from EUT antenna port.

CDMA2000 1x RTT / EV-DO data devices output power measurement

Maximum output power is verified on the high, middle and low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E for 1xRTT, section 3.1.2.3.4 of 3GPP2 C.S0033-0/TIA-866 for Rel 0 and section 4.3.4 of 3GPP2 C.S0033-A for Rev A.

WCDMA / HSDPA/HSPA devices output power measurement

Maximum output power is verified on the high, middle and low channels according to the procedures described in section 5.2 of 3GPP TS 34.121, using RMC 12.2 kbps for WCDMA; section 5.2 of 3GPP TS 34.121 for HSDPA with sub-test 1-4 and HSPA with sub-test 1-5.

Other radio output power measurement

The output power was measured using power meter at low, mid, and hi channels.

Test Configuration for GSM/GPRS/EGPRS:

EUT supports GSM mode and GPRS multislot class 12, which supports maximum 4 uplink and 4 downlink, totally 5 active slots. The measurement was made under GSM voice call mode, and each possible different uplink configuration, including 1 UL slot, 2 UL slots, 3 UL slots and 4 UL slots.

Source-based Time Averaged Burst Power Calculation:

For TDMA, the following duty cycle factor was used to calculate the source-based time average power

Number of Time slot	1	2	3	4
Duty Cycle	1:8	1:4	1:2.66	1:2
Duty cycle factor	-9.03 dB	-6.02 dB	-4.26 dB	-3.01 dB
Crest Factor	8	4	2.66	2

Remark: *Time slot duty cycle factor = 10 * log (1 / Time Slot Duty Cycle)*
Source based time averaged power = Maximum burst averaged power (1 Uplink) – 9.03 dB
Source based time averaged power = Maximum burst averaged power (2 Uplink) – 6.02 dB
Source based time averaged power = Maximum burst averaged power (4 Uplink) – 3.01 dB

Test Result:

GSM/GPRS Output Power Test Result:

Test Configuration:	GSM Voice Call, GMSK modulation						
Frequency Band	Channel No.	Frequency (MHz)	Rated Peak RF Output Power & Tune Up Power(dBm)	Conducted Peak Burst Power(dBm)	Conducted Average Burst Power(dBm)	Duty Cycle Factor (dB)	Time Averaged Burst Power(dBm)
GSM850	Low(128)	824.2	33±2	32.40	32.26	9.03	23.23
	Mid(190)	836.4	33±2	32.34	32.32	9.03	23.29
	High(251)	848.8	33±2	32.20	32.12	9.03	23.09
GSM1900	Low(512)	1850.2	28±2	29.40	29.21	9.03	20.18
	Mid(661)	1880.0	28±2	29.54	29.35	9.03	20.32
	High(810)	1909.8	28±2	29.36	29.17	9.03	20.14

Test Configuration:	GPRS multislot, GMSK modulation, MCS4 coding scheme							
Frequency Band	Slot Config	Channel No.	Frequency (MHz)	Rated Peak RF Output Power & Tune Up Power(dBm)	Conducted Peak Burst Power(dBm)	Conducted Average Burst Power(dBm)	Duty Cycle Factor (dB)	Time Averaged Burst Power(dBm)
GPRS850	1 UL Slot	Low(128)	824.20	33±2	32.63	32.55	9.03	23.52
		Mid(190)	836.40	33±2	32.65	32.56	9.03	23.53
		High(251)	848.80	33±2	32.57	32.49	9.03	23.46
	2 UL Slot	Low(128)	824.20	33±2	32.29	32.20	6.02	26.18
		Mid(190)	836.40	33±2	32.48	32.28	6.02	26.26
		High(251)	848.80	33±2	32.43	32.37	6.02	26.35
	3 UL Slot	Low(128)	824.20	33±2	32.38	32.31	4.26	28.05
		Mid(190)	836.40	33±2	32.39	32.32	4.26	28.06
		High(251)	848.80	33±2	32.38	32.29	4.26	28.03
	4 UL Slot	Low(128)	824.20	33±2	32.29	32.20	3.01	29.19
		Mid(190)	836.40	33±2	32.41	32.39	3.01	29.38
		High(251)	848.80	33±2	32.27	32.18	3.01	29.17
GPRS1900	1 UL Slot	Low(512)	1850.20	28±2	29.10	29.02	6.02	23.00
		Mid(661)	1880.00	28±2	29.14	29.12	6.02	23.10
		High(810)	1909.80	28±2	29.09	29.05	6.02	23.03
	2 UL Slot	Low(512)	1850.20	28±2	29.15	29.09	6.02	23.07
		Mid(661)	1880.00	28±2	29.05	28.96	6.02	22.94
		High(810)	1909.80	28±2	29.10	28.94	6.02	22.92
	3 UL Slot	Low(512)	1850.20	28±2	29.39	28.95	4.26	24.69
		Mid(661)	1880.00	28±2	29.28	29.03	4.26	24.77
		High(810)	1909.80	28±2	29.27	29.01	4.26	24.75
	4 UL Slot	Low(512)	1850.20	28±2	29.19	29.02	3.01	26.01
		Mid(661)	1880.00	28±2	29.16	28.99	3.01	25.98
		High(810)	1909.80	28±2	29.07	28.92	3.01	25.91

Test Configuration:	EGPRS multislot, GMSK modulation, MCS4 coding scheme							
Frequency Band	Slot Config	Channel No.	Frequency (MHz)	Rated Peak RF Output Power & Tune Up Power(dBm)	Conducted Peak Burst Power(dBm)	Conducted Average Burst Power(dBm)	Duty Cycle Factor (dB)	Time Averaged Burst Power(dBm)
EGPRS850	1 UL Slot	Low(128)	824.20	27±2	27.06	26.99	9.03	17.96
		Mid(190)	836.40	27±2	27.10	27.08	9.03	18.05
		High(251)	848.80	27±2	27.05	27.02	9.03	17.99
	2 UL Slot	Low(128)	824.20	27±2	27.11	27.05	6.02	21.03
		Mid(190)	836.40	27±2	27.02	26.93	6.02	20.91
		High(251)	848.80	27±2	27.06	26.91	6.02	20.89
	3 UL Slot	Low(128)	824.20	27±2	27.33	26.92	4.26	22.66
		Mid(190)	836.40	27±2	27.23	27.00	4.26	22.74
		High(251)	848.80	27±2	27.22	26.98	4.26	22.72
	4 UL Slot	Low(128)	824.20	27±2	27.15	26.99	3.01	23.98
		Mid(190)	836.40	27±2	27.12	26.96	3.01	23.95
		High(251)	848.80	27±2	27.04	26.90	3.01	23.89
EGPRS1900	1 UL Slot	Low(512)	1850.20	27±2	25.56	25.49	9.03	16.46
		Mid(661)	1880.00	27±2	25.60	25.58	9.03	16.55
		High(810)	1909.80	27±2	25.55	25.52	9.03	16.49
	2 UL Slot	Low(512)	1850.20	27±2	25.61	25.55	6.02	19.53
		Mid(661)	1880.00	27±2	25.52	25.43	6.02	19.41
		High(810)	1909.80	27±2	25.56	25.41	6.02	19.39
	3 UL Slot	Low(512)	1850.20	27±2	25.83	25.42	4.26	21.16
		Mid(661)	1880.00	27±2	25.73	25.50	4.26	21.24
		High(810)	1909.80	27±2	25.72	25.48	4.26	21.22
	4 UL Slot	Low(512)	1850.20	27±2	25.62	25.46	3.01	22.45
		Mid(661)	1880.00	27±2	25.65	25.49	3.01	22.48
		High(810)	1909.80	27±2	25.54	25.40	3.01	22.39

UMTS Mode

Test Configuration:	R99 RMC (12.2kps)				
Frequency Band	Channel No.	Frequency (MHz)	Rated Average RF Output Power & Tune Up Power(dBm)	Conducted Maximum Peak Power(dBm)	Maximum Average Power(dBm)
UMTS850 (Band V)	Low(4132)	826.4	24+1.7/-3.7	28.12	24.44
	Mid(4182)	836.4	24+1.7/-3.7	28.17	24.49
	High(4233)	846.6	24+1.7/-3.7	28.05	24.37
UMTS1900 (Band II)	Low(9262)	1852.4	24+1.7/-3.7	28.04	24.33
	Mid(9400)	1880.0	24+1.7/-3.7	28.25	24.54
	High(9538)	1907.6	24+1.7/-3.7	28.23	24.52
UMTS1700 (Band IV)	Low(1312)	1712.4	24+1.7/-3.7	27.96	24.23
	Mid(1412)	1732.4	24+1.7/-3.7	27.96	24.23
	High(1512)	1752.6	24+1.7/-3.7	27.93	24.20

Rel 6 HSDPA Mode

Test Configuration:	Rel 6 HSDPA					
Frequency Band	Mode	UL Channel No.	Frequency	Rated Average RF Output Power & Tune Up Power(dBm)	Conducted Maximum Peak Power(dBm)	Maximum Average Power(dBm)
HSDPA850 (Band V)	Subtest 1	Low(4132)	826.4	24+1.7/-3.7	27.85	24.26
		Mid(4182)	836.4	24+1.7/-3.7	27.86	24.27
		High(4233)	846.6	24+1.7/-3.7	27.86	24.27
	Subtest 2	Low(4132)	826.4	24+1.7/-3.7	27.85	24.24
		Mid(4182)	836.4	24+1.7/-3.7	27.82	24.22
		High(4233)	846.6	24+1.7/-3.7	27.78	24.18
	Subtest 3	Low(4132)	826.4	24+1.7/-3.7	27.85	24.24
		Mid(4182)	836.4	24+1.7/-3.7	27.84	24.23
		High(4233)	846.6	24+1.7/-3.7	27.71	24.10
	Subtest 4	Low(4132)	826.4	24+1.7/-3.7	27.81	24.19
		Mid(4182)	836.4	24+1.7/-3.7	27.83	24.21
		High(4233)	846.6	24+1.7/-3.7	27.85	24.23
HSDPA1900 (Band II)	Subtest 1	Low(9262)	1852.4	24+1.7/-3.7	27.14	23.56
		Mid(9400)	1880.0	24+1.7/-3.7	27.77	24.19
		High(9538)	1907.6	24+1.7/-3.7	27.09	23.51
	Subtest 2	Low(9262)	1852.4	24+1.7/-3.7	27.65	24.05
		Mid(9400)	1880.0	24+1.7/-3.7	27.31	23.71
		High(9538)	1907.6	24+1.7/-3.7	27.76	24.16
	Subtest 3	Low(9262)	1852.4	24+1.7/-3.7	27.43	23.82
		Mid(9400)	1880.0	24+1.7/-3.7	27.75	24.14
		High(9538)	1907.6	24+1.7/-3.7	27.42	23.81
	Subtest 4	Low(9262)	1852.4	24+1.7/-3.7	27.67	24.06
		Mid(9400)	1880.0	24+1.7/-3.7	27.65	24.04
		High(9538)	1907.6	24+1.7/-3.7	27.55	23.94
HSDPA1700 (Band IV)	Subtest 1	Low(1312)	1712.4	24+1.7/-3.7	27.19	23.63
		Mid(1412)	1732.4	24+1.7/-3.7	27.79	24.25
		High(1512)	1752.6	24+1.7/-3.7	27.14	23.57
	Subtest 2	Low(1312)	1712.4	24+1.7/-3.7	27.71	24.11
		Mid(1412)	1732.4	24+1.7/-3.7	27.29	23.77
		High(1512)	1752.6	24+1.7/-3.7	27.78	24.22
	Subtest 3	Low(1312)	1712.4	24+1.7/-3.7	27.45	23.88
		Mid(1412)	1732.4	24+1.7/-3.7	27.78	24.20
		High(1512)	1752.6	24+1.7/-3.7	27.45	23.87
	Subtest 4	Low(1312)	1712.4	24+1.7/-3.7	27.89	24.12
		Mid(1412)	1732.4	24+1.7/-3.7	27.79	24.10
		High(1512)	1752.6	24+1.7/-3.7	27.71	24.00

Rel 6 HSPA Mode

Test Configuration:	Rel 6 HSPA					
Frequency Band	Mode	UL Channel No.	Frequency	Rated Average RF Output Power & Tune Up Power(dBm)	Conducted Maximum Peak Power(dBm)	Maximum Average Power(dBm)
HSPA850 (Band V)	Subtest 1	Low(4132)	826.4	24+1.7/-3.7	27.85	24.26
		Mid(4182)	836.4	24+1.7/-3.7	27.86	24.27
		High(4233)	846.6	24+1.7/-3.7	27.86	24.27
	Subtest 2	Low(4132)	826.4	24+1.7/-3.7	26.75	23.14
		Mid(4182)	836.4	24+1.7/-3.7	26.72	23.12
		High(4233)	846.6	24+1.7/-3.7	26.68	23.08
	Subtest 3	Low(4132)	826.4	24+1.7/-3.7	26.75	23.14
		Mid(4182)	836.4	24+1.7/-3.7	26.74	23.13
		High(4233)	846.6	24+1.7/-3.7	26.62	23.01
	Subtest 4	Low(4132)	826.4	24+1.7/-3.7	26.71	23.09
		Mid(4182)	836.4	24+1.7/-3.7	26.73	23.11
		High(4233)	846.6	24+1.7/-3.7	26.75	23.13
	Subtest 5	Low(4132)	826.4	24+1.7/-3.7	26.74	23.08
		Mid(4182)	836.4	24+1.7/-3.7	26.76	23.09
		High(4233)	846.6	24+1.7/-3.7	26.73	23.04
HSPA1900 (Band II)	Subtest 1	Low(9262)	1852.4	24+1.7/-3.7	27.63	24.05
		Mid(9400)	1880.0	24+1.7/-3.7	27.29	23.71
		High(9538)	1907.6	24+1.7/-3.7	27.74	24.16
	Subtest 2	Low(9262)	1852.4	24+1.7/-3.7	25.75	22.15
		Mid(9400)	1880.0	24+1.7/-3.7	26.35	22.75
		High(9538)	1907.6	24+1.7/-3.7	25.72	22.12
	Subtest 3	Low(9262)	1852.4	24+1.7/-3.7	26.38	22.77
		Mid(9400)	1880.0	24+1.7/-3.7	26.68	23.07
		High(9538)	1907.6	24+1.7/-3.7	26.37	22.76
	Subtest 4	Low(9262)	1852.4	24+1.7/-3.7	26.60	22.99
		Mid(9400)	1880.0	24+1.7/-3.7	26.58	22.97
		High(9538)	1907.6	24+1.7/-3.7	26.50	22.89
	Subtest 5	Low(9262)	1852.4	24+1.7/-3.7	26.49	22.94
		Mid(9400)	1880.0	24+1.7/-3.7	26.53	22.92
		High(9538)	1907.6	24+1.7/-3.7	26.50	22.89
HSPA1700 (Band IV)	Subtest 1	Low(1312)	1712.4	24+1.7/-3.7	25.69	22.15
		Mid(1412)	1732.4	24+1.7/-3.7	26.77	23.22
		High(1512)	1752.6	24+1.7/-3.7	25.71	22.10
	Subtest 2	Low(1312)	1712.4	24+1.7/-3.7	27.09	23.51
		Mid(1412)	1732.4	24+1.7/-3.7	26.75	23.18
		High(1512)	1752.6	24+1.7/-3.7	27.18	23.62
	Subtest 3	Low(1312)	1712.4	24+1.7/-3.7	25.99	22.45
		Mid(1412)	1732.4	24+1.7/-3.7	27.21	23.55
		High(1512)	1752.6	24+1.7/-3.7	26.23	22.40
	Subtest 4	Low(1312)	1712.4	24+1.7/-3.7	27.08	23.52
		Mid(1412)	1732.4	24+1.7/-3.7	27.09	23.50
		High(1512)	1752.6	24+1.7/-3.7	26.95	23.41
	Subtest 5	Low(1312)	1712.4	24+1.7/-3.7	27.03	23.48
		Mid(1412)	1732.4	24+1.7/-3.7	27.04	23.51
		High(1512)	1752.6	24+1.7/-3.7	27.01	23.48

CDMA2000 1xRTT Mode

Test Configuration:	CDMA2000 1xRTT Cellular band (Band Class 0)						
Radio Configuration	Service Option		UL Channel No.	Frequency (MHz)	Power Control	Conducted Peak Output Power (dBm)	Conducted Average Power(dBm)
RC1 (Fwd1, Rvs1)	55	Loopback	Low(1013)	824.7	All up	28.28	24.17
			Mid(384)	836.52	All up	28.29	24.18
			High(777)	848.31	All up	28.29	24.18
RC3 (Fwd3, Rvs3)	55	Loopback	Low(1013)	824.7	All up	27.26	24.08
			Mid(384)	836.52	All up	27.25	24.06
			High(777)	848.31	All up	27.21	24.02
	32	FCH	Low(1013)	824.7	All up	27.26	24.08
			Mid(384)	836.52	All up	27.26	24.09
			High(777)	848.31	All up	27.14	23.95
	32	FCH+SCH	Low(1013)	824.7	All up	27.22	24.03
			Mid(384)	836.52	All up	27.24	24.07
			High(777)	848.31	All up	27.26	24.05

Test Configuration:	CDMA2000 1xRTT PCS band(Band Class 1)						
Radio Configuration	Service Option		UL Channel No.	Frequency (MHz)	Power Control	Conducted Peak Output Power (dBm)	Conducted Average Power(dBm)
RC1 (Fwd1, Rvs1)	55	Loopback	Low(25)	1851.25	All up	28.35	24.25
			Mid(600)	1880	All up	28.36	24.26
			High(1175)	1908.75	All up	28.36	24.26
RC3 (Fwd3, Rvs3)	55	Loopback	Low(25)	1851.25	All up	27.36	24.16
			Mid(600)	1880	All up	27.34	24.18
			High(1175)	1908.75	All up	27.31	24.13
	32	FCH	Low(25)	1851.25	All up	27.36	24.18
			Mid(600)	1880	All up	27.35	24.17
			High(1175)	1908.75	All up	27.25	24.06
	32	FCH+SCH	Low(25)	1851.25	All up	27.32	24.14
			Mid(600)	1880	All up	27.33	24.15
			High(1175)	1908.75	All up	27.35	24.17

EV-DO Rev 0 Mode

Test Configuration:	EV-DO Rev 0 Cellular band(Band Class 0)					
Radio Configuration	UL Channel No.	Frequency (MHz)	Data Rates	Power Control	Conducted Peak Output Power (dBm)	Conducted Average Power(dBm)
Subtype: 0	Low(1013)	824.7	RTAP 153.6 kbps	All up	28.08	23.96
	Mid(384)	836.52	RTAP 153.6 kbps	All up	28.14	24.02
	High(777)	848.31	RTAP 153.6 kbps	All up	28.09	23.97

Test Configuration:	EV-DO Rev 0 PCS band(Band Class 1)					
Radio Configuration	UL Channel No.	Frequency (MHz)	Data Rates	Power Control	Conducted Peak Output Power (dBm)	Conducted Average Power(dBm)
Subtype: 0	Low(25)	1851.25	RTAP 153.6 kbps	All up	28.08	24.01
	Mid(600)	1880	RTAP 153.6 kbps	All up	28.14	24.06
	High(1175)	1908.75	RTAP 153.6 kbps	All up	28.09	23.98

EV-DO Rev A Mode

Test Configuration:	EV-DO Rev A Cellular band					
Radio Configuration	UL Channel No.	Frequency (MHz)	Data Rates	Power Control	Conducted Peak Output Power (dBm)	Conducted Average Power(dBm)
Subtype: 0	Low(1013)	824.7	RETAP 4096 kbps	All up	28.15	24.03
	Mid(384)	836.52	RETAP 4096 kbps	All up	28.22	24.11
	High(777)	848.31	RETAP 4096 kbps	All up	28.19	24.08

Test Configuration:	EV-DO Rev A PCS band					
Radio Configuration	UL Channel No.	Frequency (MHz)	Data Rates	Power Control	Conducted Peak Output Power (dBm)	Conducted Average Power(dBm)
Subtype: 0	Low(25)	1851.25	RETAP 4096 kbps	All up	28.18	24.06
	Mid(600)	1880	RETAP 4096 kbps	All up	28.21	24.10
	High(1175)	1908.75	RETAP 4096 kbps	All up	28.19	24.07

WLAN Mode

802.11b mode

Channel No.	Frequency (MHz)	Data Rate	Conducted Average Power(dBm)
1	2412	11 Mbps	13.54
6	2437	11 Mbps	14.43
11	2462	11 Mbps	12.84

802.11g mode

Channel No.	Frequency (MHz)	Data Rate	Conducted Average Power(dBm)
1	2412	54 Mbps	14.12
6	2437	54 Mbps	14.08
11	2462	54 Mbps	13.94

Bluetooth Mode

Bluetooth Measurement Result (EDR mode)

Channel No.	Frequency (MHz)	Data Rate	Conducted Average Power(dBm)
0	2402	3 Mbps	-0.50
39	2441	3 Mbps	-0.47
78	2480	3 Mbps	-0.82

Note: The power of the others mode of BT was measured and only the worst case output power result was presented here.

9 SAR TEST RESULTS

Test Condition:

1. SAR Measurement
The distance between the EUT and the antenna of the emulator is more than 50 cm and the output power radiated from the emulator antenna is at least 30 dB less than the output power of EUT.

2	Measurement Uncertainty: See page 26 for detail		
3	Environmental Conditions	Temperature	23°C
		Relative Humidity	50%
		Atmospheric Pressure	1019mbar
4	Test Date : Sep 16th, 2011		
	Tested By :David Zhang		

Test Procedures:

1. Establish communication link between EUT and base station emulation by air link.
2. Consider the SAR test reduction per FCC KDB guide line. For GSM/GPRS/EGPRS, set EUT into highest output power channel with test mode which has the maximum source-based time-averaged burst power listed in power table. If the source-based time-average output power for each data mode of GPRS/EGPRS is lower than that in normal GSM voice mode, then testing under GPRS/EGPRS mode is not necessary. The same conclusion will be achieved between GPRS and EGPRS; for WCDMA/HSDPA/HSPA, if the output power of each channel of HSDPA/HSPA is not ¼ dB higher than the output power of respective channel under WCDMA mode, then the SAR measurement for HSDPA/HSPA mode is not necessary; the same conclusion will be achieved between CDMA2000 1xRTT and EV-DO Rev 0/ Rev A.
3. Place the EUT in the selected test position. (Cheek, tilt or flat)
4. Perform SAR testing at highest output power channel under the selected test mode. If the measured 1-g SAR is ≤ 0.8 W/kg, then testing for the other channel will not be performed.
4. Measure the conducted peak burst power and conducted average burst power from EUT antenna port.

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 Configuration:

EUT was tested under GSM voice call mode for head SAR. Testing on GPRS was performed under 4 uplink slots mode body SAR because this mode has greater source-based time averaged power than other slot configuration.

Crest factor is 8.3 for GSM and GPRS/EDGE multi-slot class 8, 4 for GPRS/EDGE multi-slot class 10, and 2 for GPRS/EDGE multi-slot class 12.

GSM/GPRS Mode

Head SAR

Test Configuration , **Left Head , Touch /Tilt**			Crest Factor : 9		Date of Measured : Sep 16th, 2011		
Freq Band	Mode	Channel	Position	SAR 10g (W/kg)	Power Drift (%)	SAR 1g (W/kg)	1g SAR Limit (W/kg)
GSM850	Voice Call	Mid	Left Cheek	0.022	3.72	0.029	1.6
GSM1900	Voice Call	Mid	Left Cheek	0.096	0.18	0.164	1.6

Body Worn (Separation distance: 2cm)

Test Configuration , **Body**			Crest Factor : 3		Date of Measured : Sep 16th, 2011		
Freq Band	Mode	Channel	Position	SAR 10g (W/kg)	Power Drift (%)	SAR 1g(W/kg)	1g SAR Limit (W/kg)
GPRS850	4 UL slots	Mid	LCD down	0.483	-1.63	0.763	1.6
GPRS1900	4 UL slots	Mid	LCD down	0.487	1.15	0.774	1.6

UMTS Mode

Head SAR

Test Configuration , **Left Head , Touch /Tilt**			Crest Factor : 0		Date of Measured : Sep 16th, 2011		
Freq Band	Mode	Channel	Position	SAR 10g (W/kg)	Power Drift (%)	SAR 1g (W/kg)	1g SAR Limit (W/kg)
UMTS850	12.2kbps, RMC	Mid	Right Cheek	0.158	-0.04	0.198	1.6
UMTS1900	12.2kbps, RMC	Mid	Left Cheek	0.177	4.12	0.283	1.6
UMTS1700	12.2kbps, RMC	Mid	Right Cheek	0.041	-4.14	0.063	1.6

Body SAR (Separation distance: 2cm)

Test Configuration , **Body**			Crest Factor : 0		Date of Measured : Sep 16th, 2011		
Freq Band	Mode	Channel	Position	SAR 10g (W/kg)	Power Drift (%)	SAR 1g(W/kg)	1g SAR Limit (W/kg)
UMTS850	12.2kbps, RMC	Mid	LCD down	0.331	0.38	0.719	1.6
UMTS1900	12.2kbps, RMC	Mid	LCD down	0.188	1.32	0.297	1.6
UMTS1700	12.2kbps, RMC	Mid	LCD down	0.072	-0.59	0.113	1.6

CDMA2000 Mode

Head SAR

Test Configuration , **Left Head , Touch /Tilt**				Crest Factor : 0		Date of Measured : Sep 16th, 2011	
Freq Band	Mode	Channel	Position	SAR 10g (W/kg)	Power Drift (%)	SAR 1g (W/kg)	1g SAR Limit (W/kg)
CDMA2000 Cell band	RC3, SO55	Mid	Right Cheek	0.142	0.40	0.247	1.6
CDMA2000 PCS band	RC3, SO55	Mid	Righ Cheek	0.191	0.73	0.233	1.6

Body SAR (Separation distance: 2cm)

Test Configuration , **Body**				Crest Factor : 0		Date of Measured : Sep 16th, 2011	
Freq Band	Mode	Channel	Position	SAR 10g (W/kg)	Power Drift (%)	SAR 1g(W/kg)	1g SAR Limit (W/kg)
CDMA2000 Cell band	RC3, SO32	Mid	LCD down	0.136	1.27	0.198	1.6
CDMA2000 PCS band	RC3, SO32	Mid	LCD down	0.169	-1.45	0.244	1.6

WIFI Mode

Head SAR

Test Configuration , **Left Head , Touch /Tilt**			Crest Factor : 0		Date of Measured : Sep 16th, 2011		
Freq Band	Mode	Channel	Position	SAR 10g (W/kg)	Power Drift (%)	SAR 1g (W/kg)	1g SAR Limit (W/kg)
2437MHz	802.11b	Mid	Right tilt	0.017	-0.68	0.026	1.6

Body Worn (Separation distance: 2cm)

Test Configuration , **Body**			Crest Factor : 0		Date of Measured : Sep 16th, 2011		
Freq Band	Mode	Channel	Position	SAR 10g (W/kg)	Power Drift (%)	SAR 1g(W/kg)	1g SAR Limit (W/kg)
2437MHz	802.11b	Mid	LCD down	0.024	-3.26	0.038	1.6

Bluetooth Mode

<u>N/A</u>

Note: SAR for Bluetooth mode was not applicable because of the low output power.

Test Summary:

The SAR of CN50 was measured and found compliance with FCC regulation per original FCC ID: EHA-01CN50 and IC ID: 1223A-01CN50. The purpose of SAR testing in this report was to verify that it's still compliant with FCC regulation after the modification of original unit by replacing the camera hardware from 3 mega pixel to 5mega pixel. Only the worst result configuration in original test report was verified.

Note:

1. BT SAR was not measured due to low output power of BT. BT output power is less than Pref, so the stand-alone SAR is not necessary.
2. Only the worst case configurations of SAR result in original FCC filing were verified in this test report; the 1-g SAR for the highest output channel is less than 0.8 W/kg, where the transmission band corresponding to all channels is ≤ 100 MHz, testing for the other channels is not required;
3. For GPRS, only test mode with 4 uplink slots was performed since it has the maximum source-based time average power.
4. The SAR of RC1 configuration for CDMA2000 1xRTT is not necessary since the output power under RC1 is not ¼ dB higher than RC3 configuration.
5. Only the LCD down of EUT position were tested which could represent the worst case SAR result.

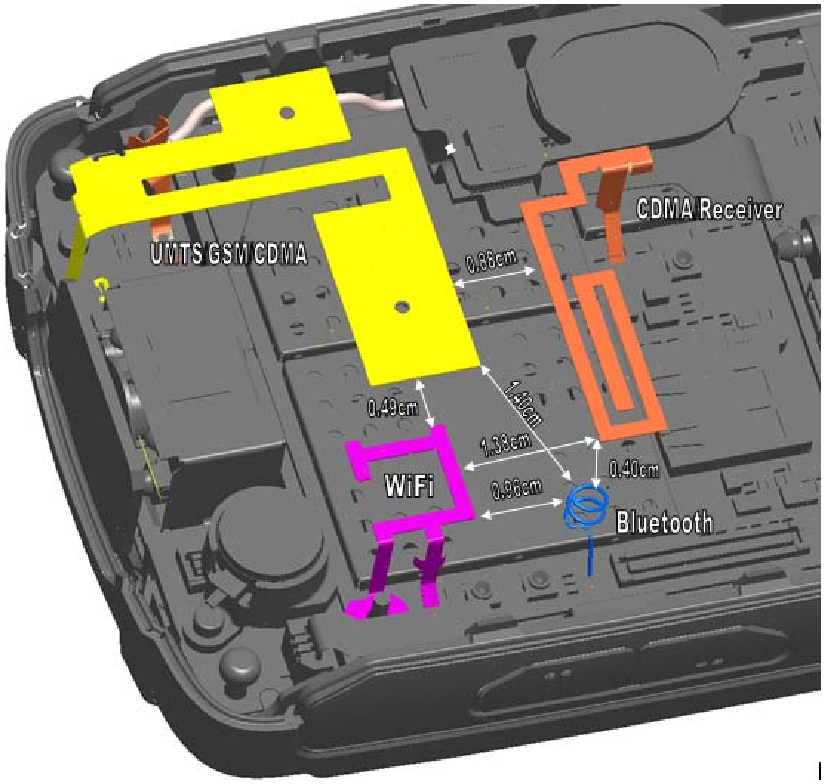
KDB & Simultaneous SAR Evaluation.

Antenna Separation Information:

Test Case	TX Ant1	TX Ant2	The shortest distance between Ant & Ant2 (mm)
1	WWAN	BT	14.0 mm
2	WWAN	WLAN	4.9 mm
3	WIFI	BT	9.6 mm

Antenna Pair	Justification	Simultaneous SAR required ?
WWAN/BT	1-g SAR summing = WWAN SAR max + BT SAR max = 0.774 W/kg + 0 W/kg = 0.774 W/kg < 1.6 W/kg	No
WWAN/WLAN	1-g SAR summing = WWAN SAR max + BT SAR max = 0.774 W/kg + 0.038 W/kg = 0.812 W/kg < 1.6 W/kg	No
WLAN/BT	1-g SAR summing = WLAN SAR max + BT SAR max = 0.038 W/kg + 0 W/kg = 0.038 W/kg < 1.6 W/kg	No

EUT Internal picture:



Antenna co-location view

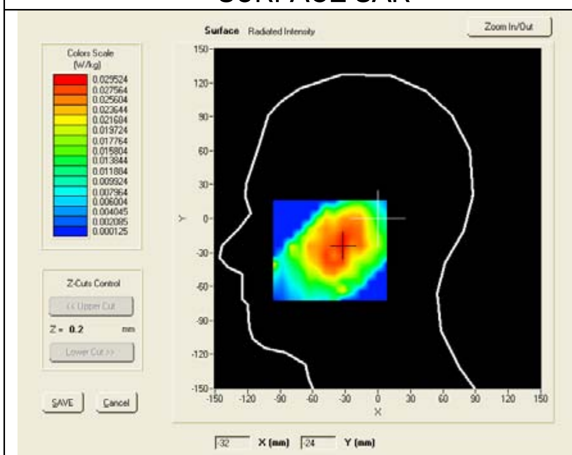
Main PCB Board View

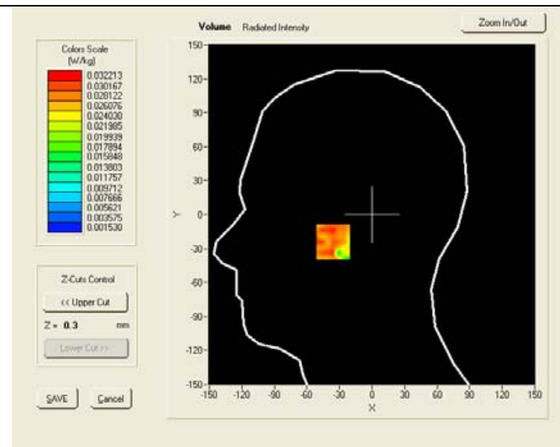
SAR measurement Plots

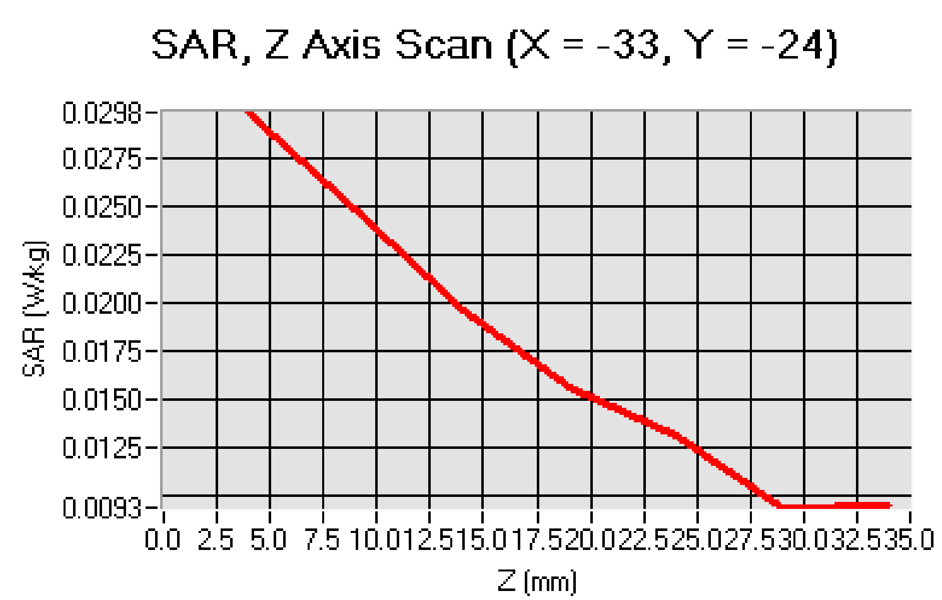
GSM850 Mode

Test Mode: GSM850MHz, Voice Call, GMSK, Mid channel (Head SAR)
Position: Left Head, Cheek
Product Description: Mobile Phone
Model: CN50 Test Date: Sep 16th, 2011

Frequency (MHz)	836.40 (Left Head , Cheek)
Relative permittivity (real part)	41.434
Relative permittivity (imaginary part)	18.85
Conductivity (S/m)	0.939
Variation (%)	3.72
SAR 1g (W/Kg)	0.029
SAR 10g (W/Kg)	0.022
SURFACE SAR	VOLUME SAR

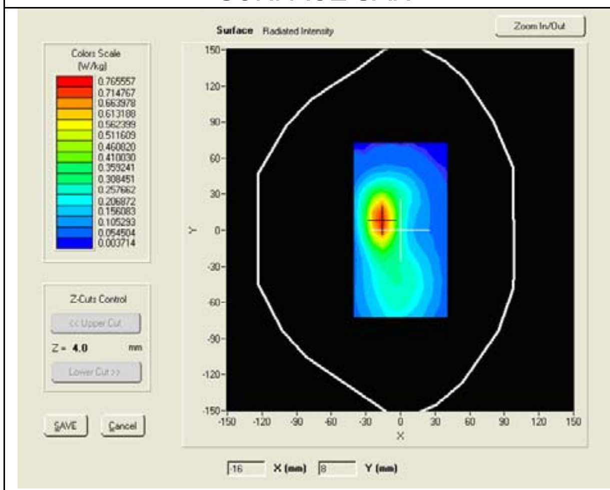


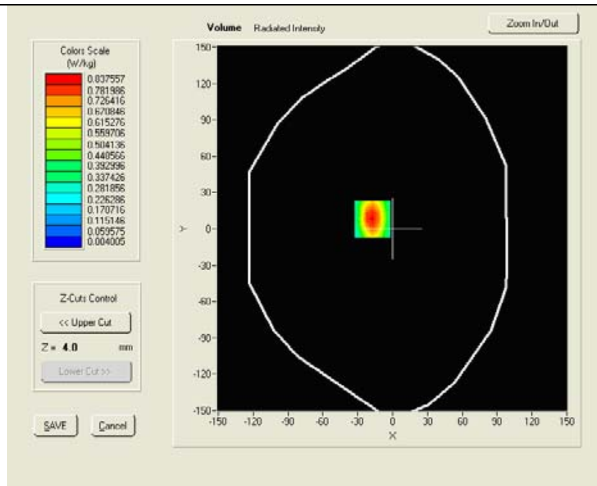


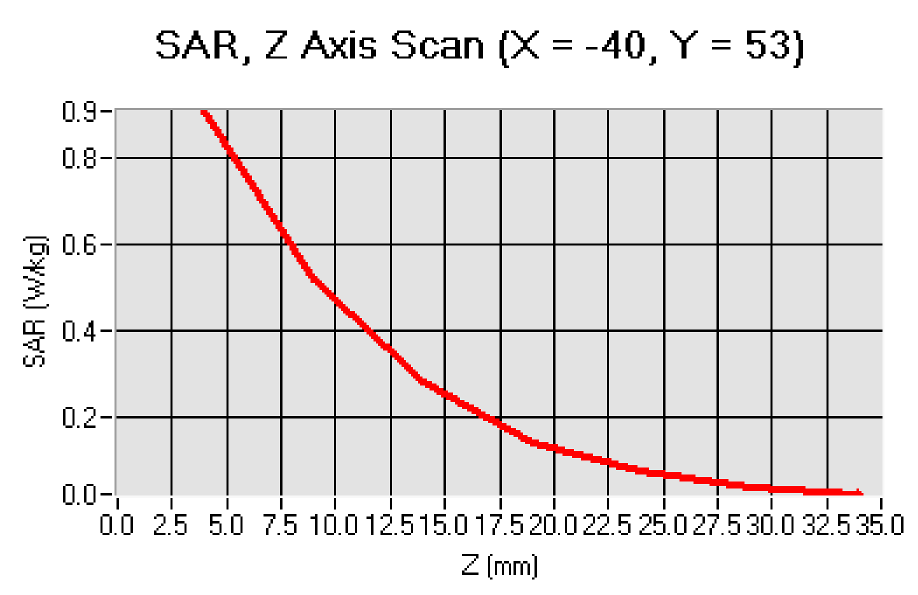


Test Mode: GPRS850MHz,4 uplink slots, MCS4 coding scheme, Mid channel (Body SAR)
Position: Flat Phantom, Body, LCD Down
Product Description: Mobile Phone
Model: CN50 Test Date: Sep 16th, 2011

Frequency (MHz)	836.40 (Flat, Body)
Relative permittivity (real part)	55.294
Relative permittivity (imaginary part)	20.91
Conductivity (S/m)	0.966
Variation (%)	0.18
SAR 1g (W/Kg)	0.763
SAR 10g (W/Kg)	0.483
SURFACE SAR	VOLUME SAR



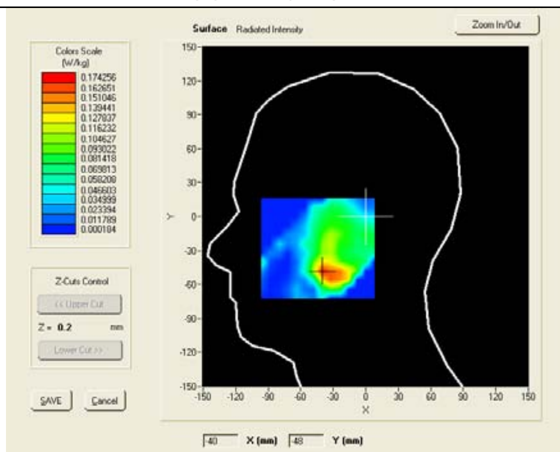


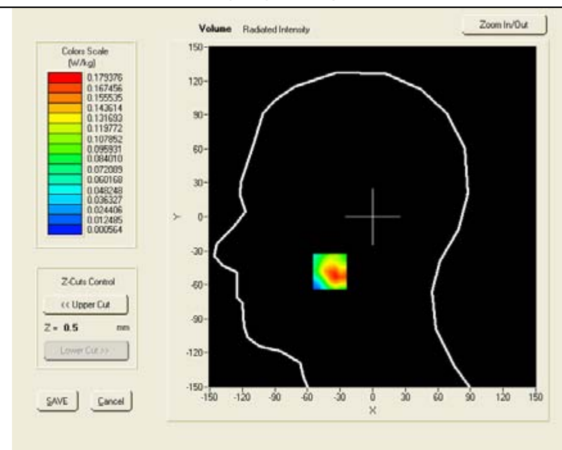


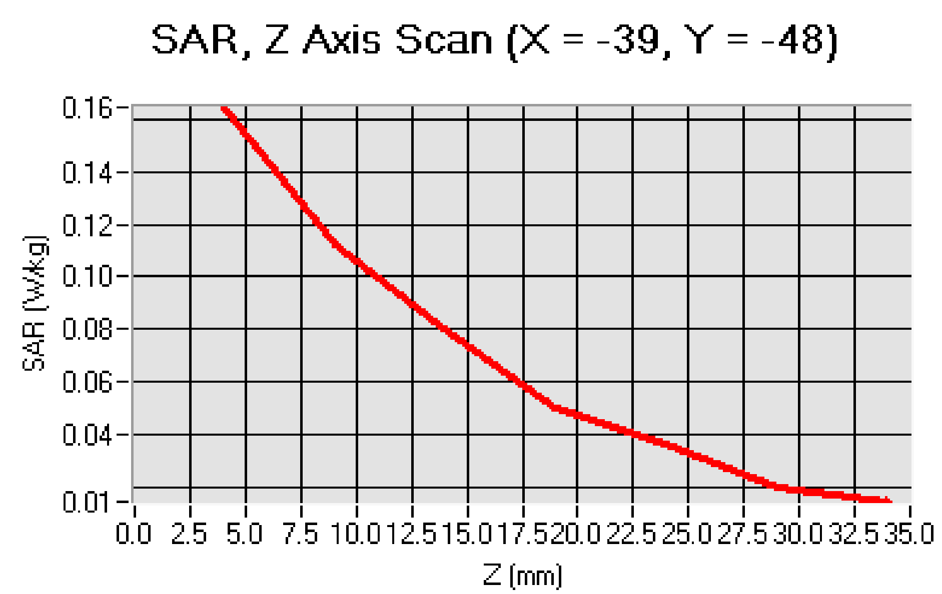
GSM1900 Mode

Test Mode: GSM1900MHz, Voice Call, GMSK, Mid channel (Head SAR)
Position: Left Head, Cheek
Product Description: Mobile Phone
Model: CN50 Test Date: Sep 16th, 2011

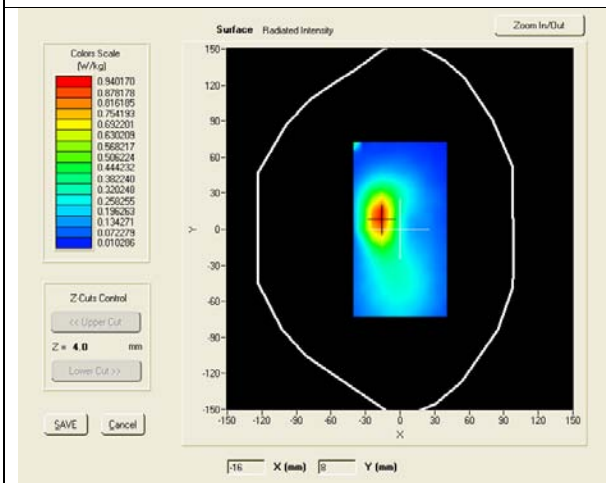
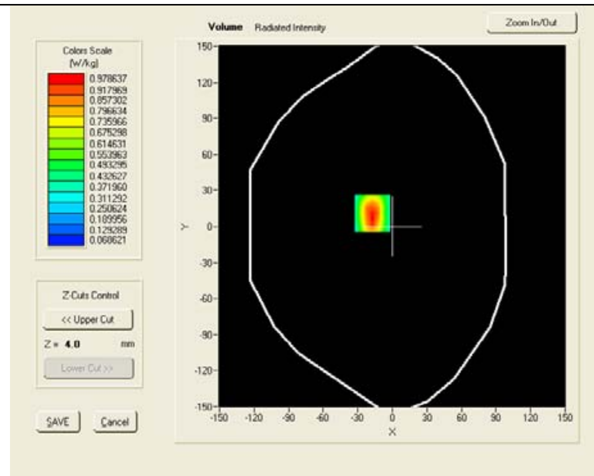
Frequency (MHz)	1880.00 (Left Head , Cheek)
Relative permittivity (real part)	38.748
Relative permittivity (imaginary part)	12.99
Conductivity (S/m)	1.415
Variation (%)	-1.63
SAR 1g (W/Kg)	0.164
SAR 10g (W/Kg)	0.096
SURFACE SAR	VOLUME SAR

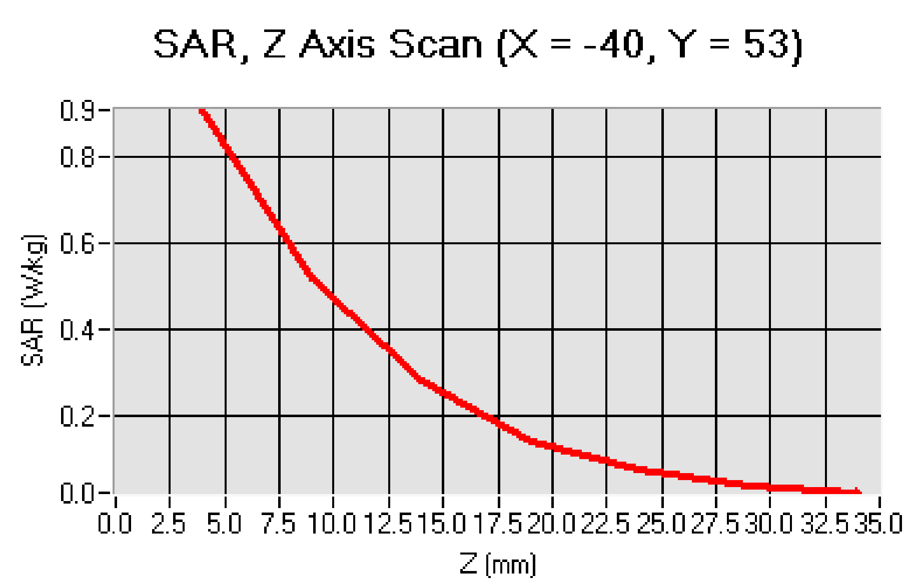






Test Mode:	GPRS1900MHz, 4 uplink slots, MCS4 coding scheme, Mid channel (Body SAR)		
Position:	Flat Phantom, Body, LCD Down		
Product Description:	Mobile Phone		
Model:	CN50	Test Date:	Sep 16th, 2011

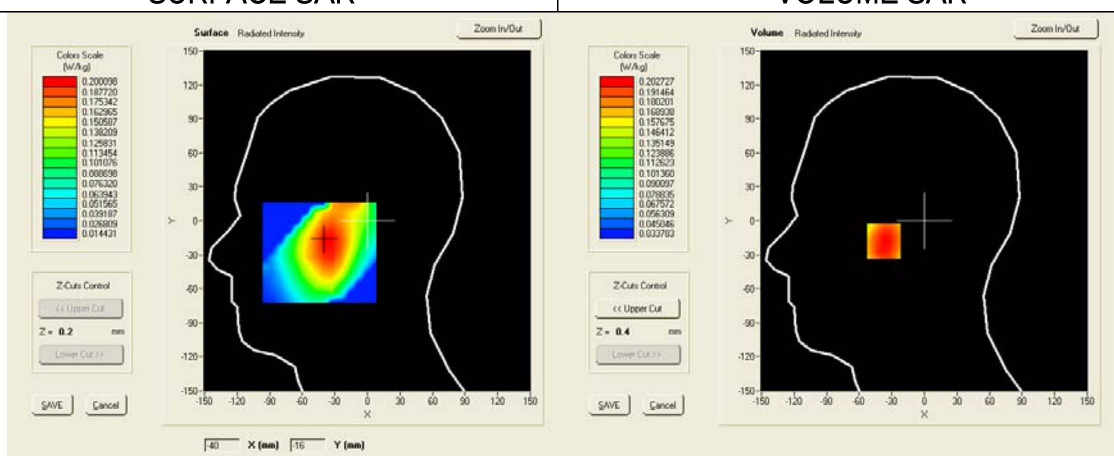
Frequency (MHz)	1880.00 (Flat, Body)
Relative permittivity (real part)	53.092
Relative permittivity (imaginary part)	14.47
Conductivity (S/m)	1.506
Variation (%)	1.15
SAR 1g (W/Kg)	0.774
SAR 10g (W/Kg)	0.487
SURFACE SAR	VOLUME SAR
	

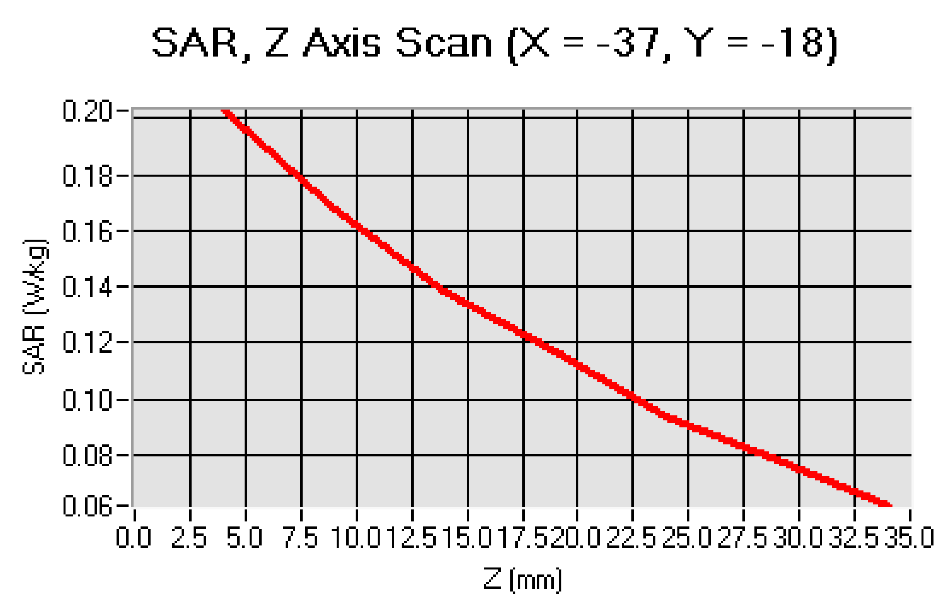


UMTS850 Mode

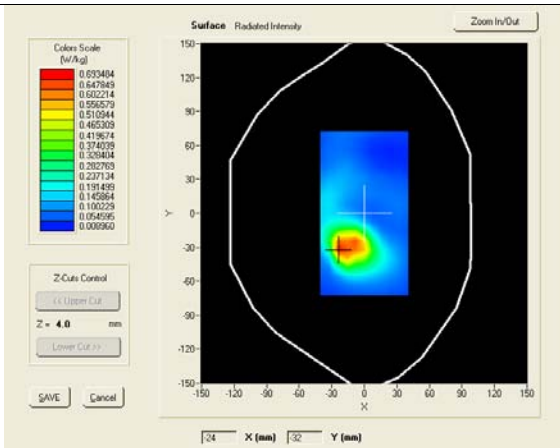
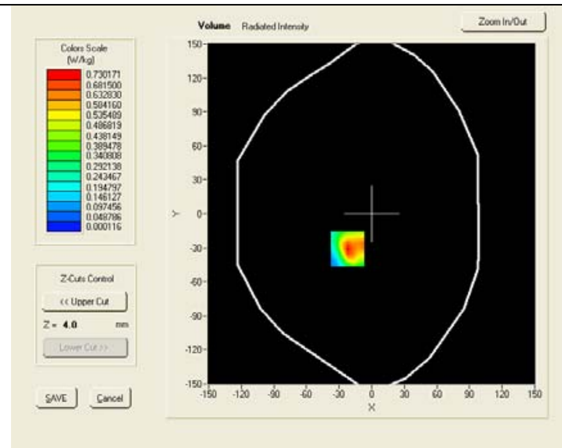
Test Mode:	UMTS850MHz, RMC 12.2kbps, Mid channel (Head SAR)		
Position:	Right Head, Cheek		
Product Description:	Mobile Phone		
Model:	CN50	Test Date:	Sep 16th, 2011

Frequency (MHz)	836.40 (Right Head , Cheek)
Relative permitivity (real part)	41.434
Relative permitivity (imaginary part)	18.85
Conductivity (S/m)	0.939
Variation (%)	-0.04
SAR 1g (W/Kg)	0.198
SAR 10g (W/Kg)	0.158
SURFACE SAR	VOLUME SAR

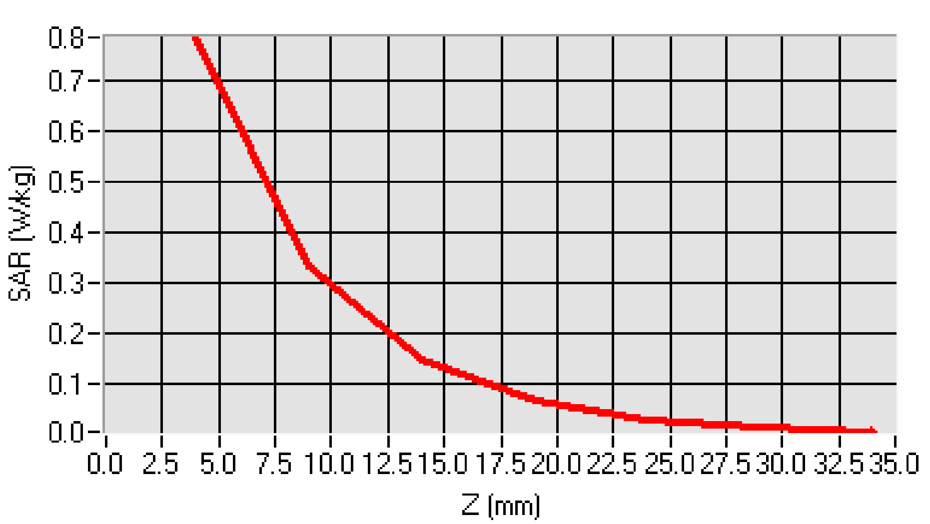




Test Mode:	UMTS850MHz, RMC 12.2kbps, Mid channel (Body SAR)		
Position:	Flat Phantom, Body, LCD Down		
Product Description:	Mobile Phone		
Model:	CN50	Test Date:	Sep 16th, 2011

Frequency (MHz)	836.40 (Body, LCD Down)
Relative permitivity (real part)	55.294
Relative permitivity (imaginary part)	20.91
Conductivity (S/m)	0.966
Variation (%)	0.38
SAR 1g (W/Kg)	0.719
SAR 10g (W/Kg)	0.331
SURFACE SAR	VOLUME SAR
	

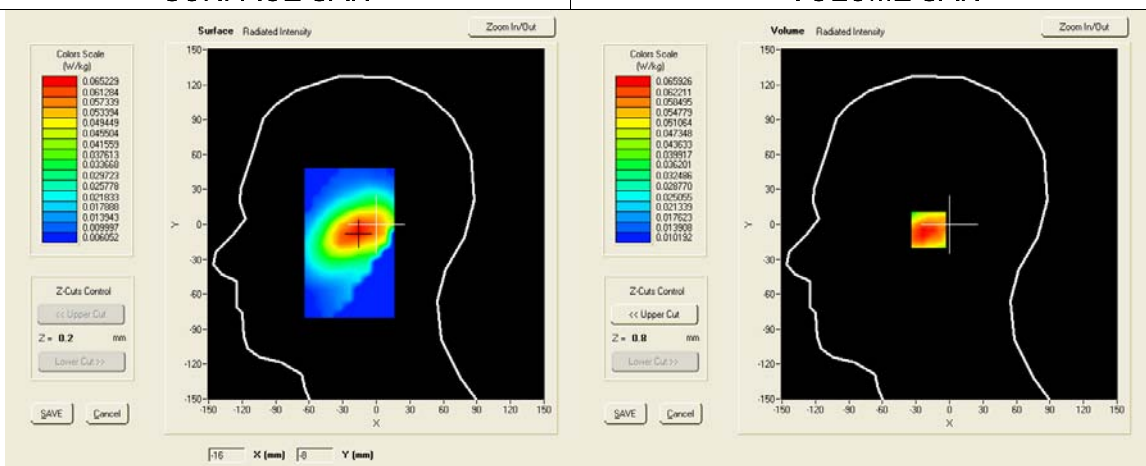
SAR, Z Axis Scan (X = -22, Y = -31)

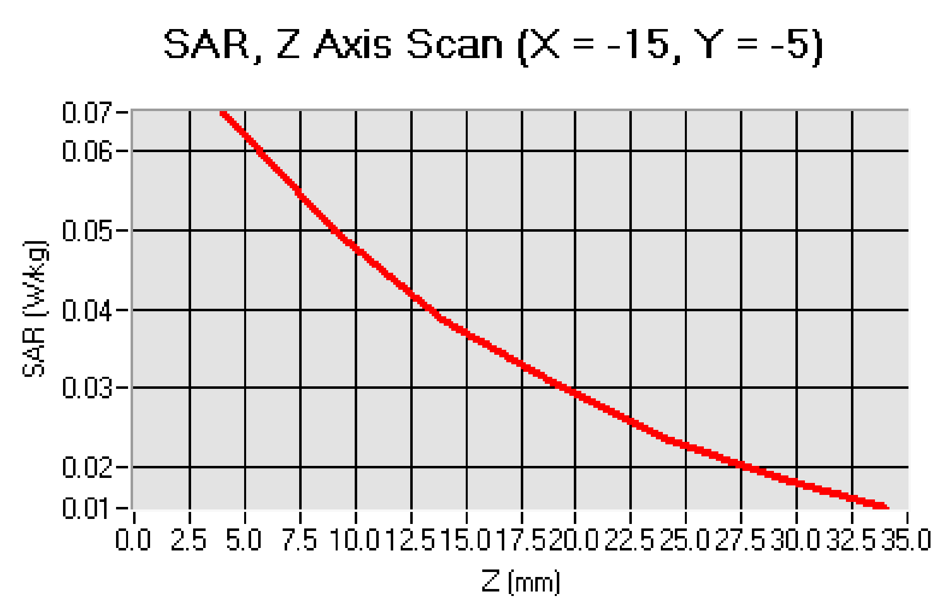


UMTS1700 Mode

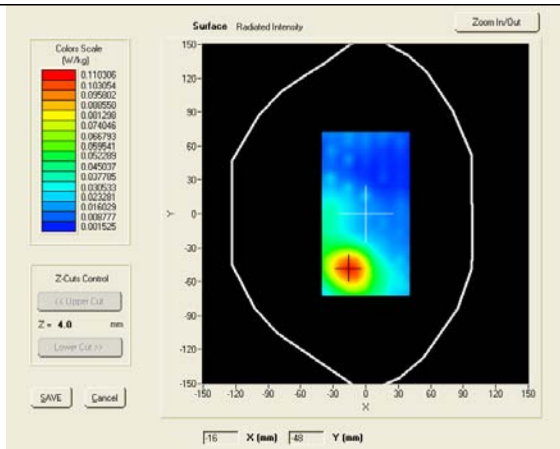
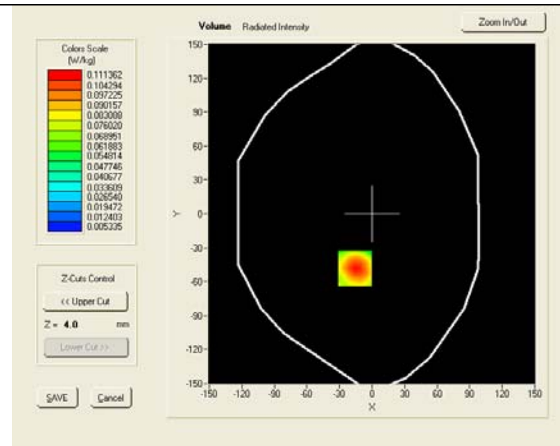
Test Mode:	UMTS1700MHz, RMC 12.2kbps, Mid channel (Head SAR)		
Position:	Left Head, Cheek		
Product Description:	Mobile Phone		
Model:	CN50	Test Date:	Sep 16th, 2011

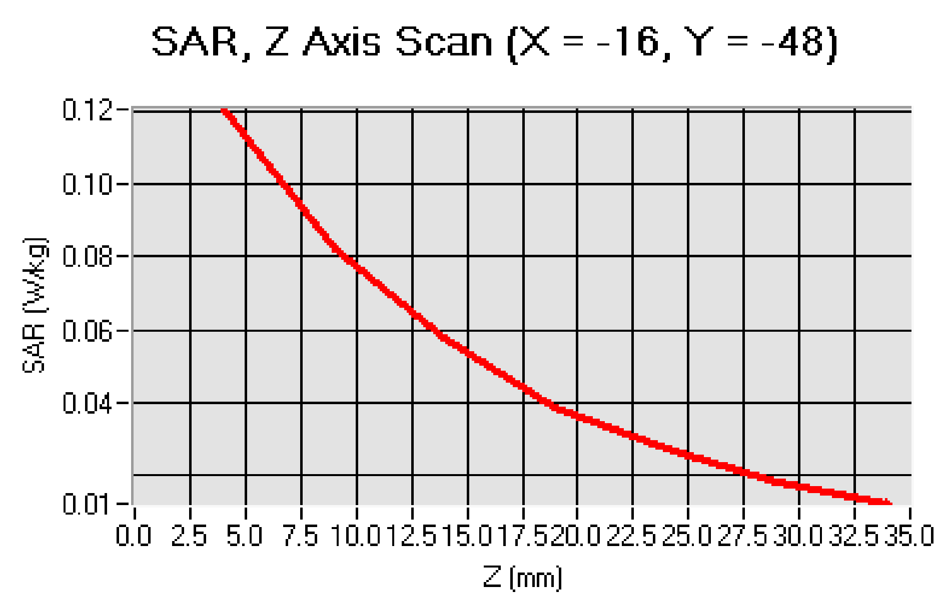
Frequency (MHz)	1732.00 (Left Cheek, Head)
Relative permitivity (real part)	40.06
Relative permitivity (imaginary part)	12.91
Conductivity (S/m)	1.32
Variation (%)	-4.14
SAR 1g (W/Kg)	0.063
SAR 10g (W/Kg)	0.041
SURFACE SAR	VOLUME SAR





Test Mode:	UMTS1700MHz, RMC 12.2kbps, Mid channel (Body SAR)
Position:	Flat Phantom, Body, LCD Down
Product Description:	Mobile Phone
Model:	CN50 Test Date: Sep 16th, 2011

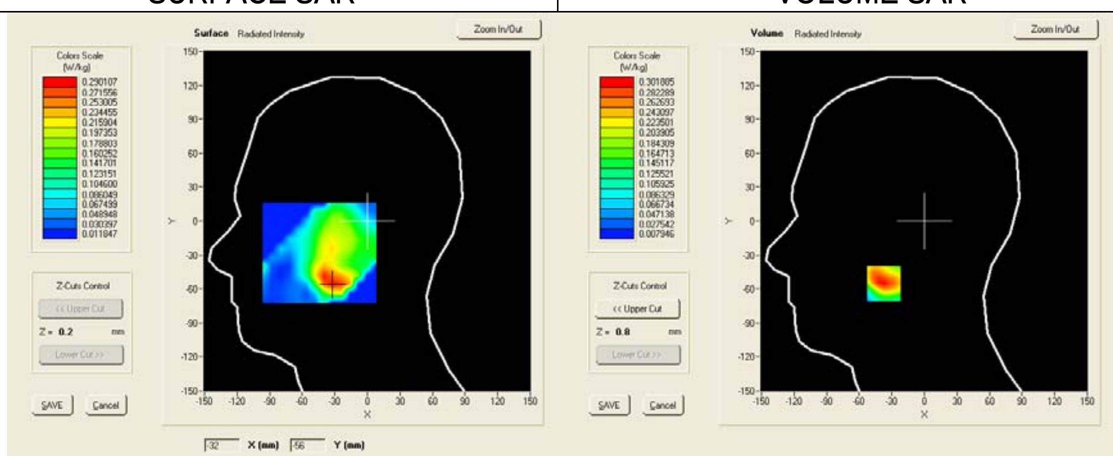
Frequency (MHz)	1732.00 (Body, LCD Down)
Relative permitivity (real part)	52.70
Relative permitivity (imaginary part)	15.36
Conductivity (S/m)	1.44
Variation (%)	0.59
SAR 1g (W/Kg)	0.113
SAR 10g (W/Kg)	0.072
SURFACE SAR	VOLUME SAR
	

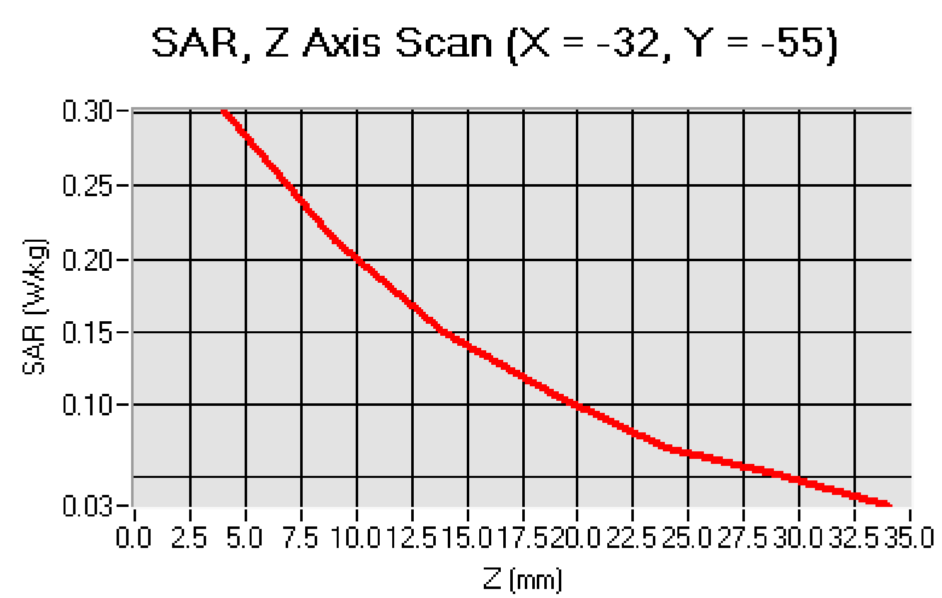


UMTS1900 Mode

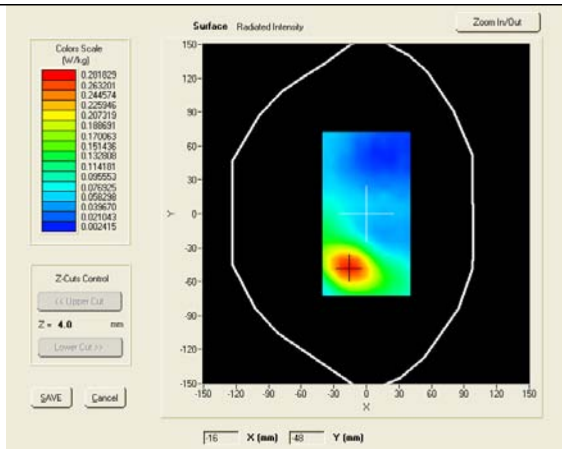
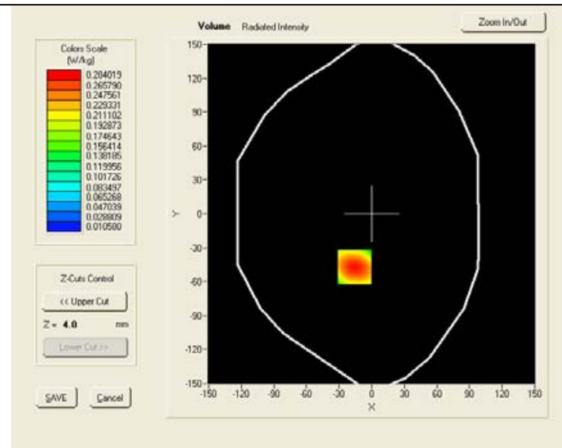
Test Mode:	UMTS1700MHz, RMC 12.2kbps, Mid channel (Head SAR)		
Position:	Left Head, Cheek		
Product Description:	Mobile Phone		
Model:	CN50	Test Date:	Sep 16th, 2011

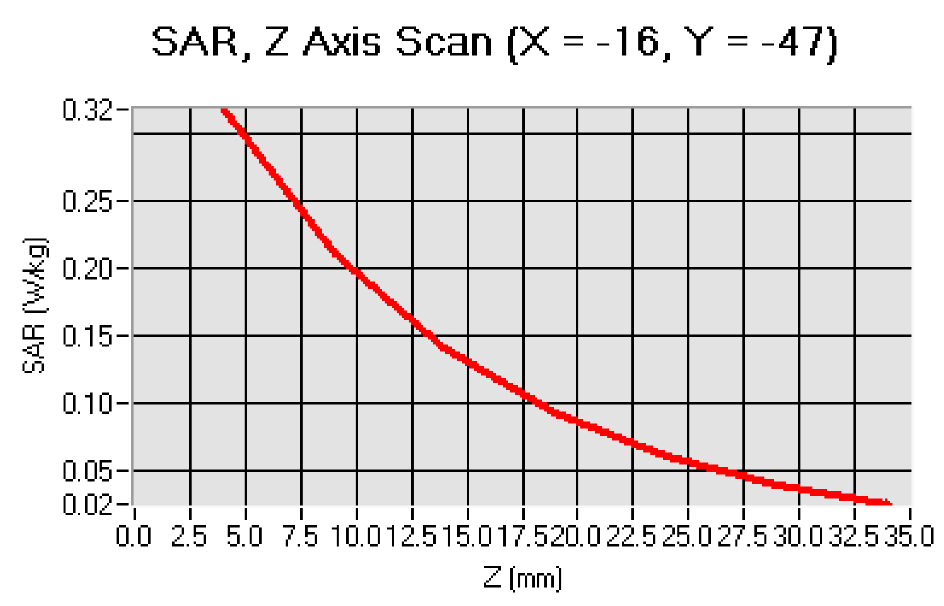
Frequency (MHz)	1880.00 (Left Cheek, Head)
Relative permitivity (real part)	38.748
Relative permitivity (imaginary part)	12.99
Conductivity (S/m)	1.415
Variation (%)	4.12
SAR 1g (W/Kg)	0.283
SAR 10g (W/Kg)	0.177
SURFACE SAR	VOLUME SAR





Test Mode: UMTS1900MHz, RMC 12.2kbps, Mid channel (Body SAR)
Position: Flat Phantom, Body, LCD Down
Product Description: Mobile Phone
Model: CN50 Test Date: Sep 16th, 2011

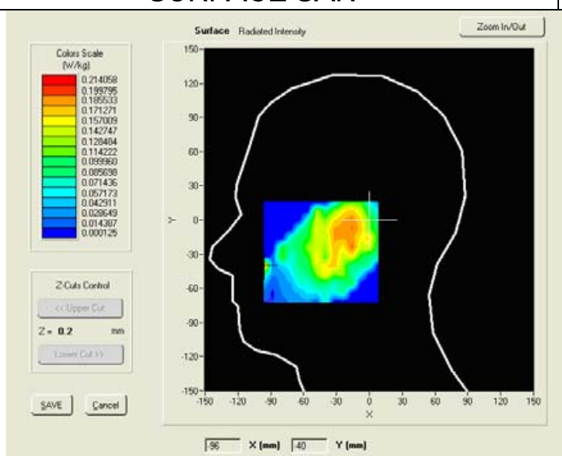
Frequency (MHz)	1880.00 (Body, LCD Down)
Relative permitivity (real part)	53.092
Relative permitivity (imaginary part)	14.56
Conductivity (S/m)	1.506
Variation (%)	1.32
SAR 1g (W/Kg)	0.297
SAR 10g (W/Kg)	0.188
SURFACE SAR	VOLUME SAR
	

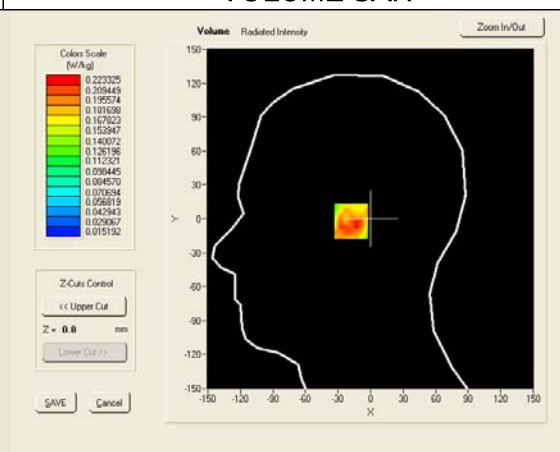


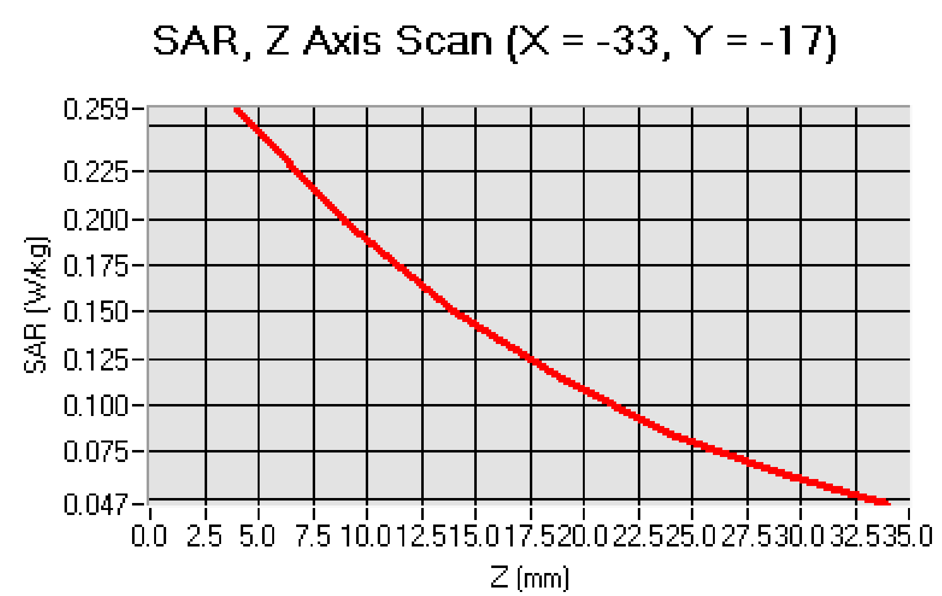
CDMA2000 Cellular Band Mode

Test Mode:	CDMA2000 Cellular band, RC3, SO55, Mid channel (Head SAR)		
Position:	Left Head, Cheek		
Product Description:	Mobile Phone		
Model:	CN50	Test Date:	Sep 16th, 2011

Frequency (MHz)	836.52 (Left Cheek, Head)
Relative permitivity (real part)	40.434
Relative permitivity (imaginary part)	12.99
Conductivity (S/m)	0.939
Variation (%)	0.40
SAR 1g (W/Kg)	0.247
SAR 10g (W/Kg)	0.142
SURFACE SAR	VOLUME SAR

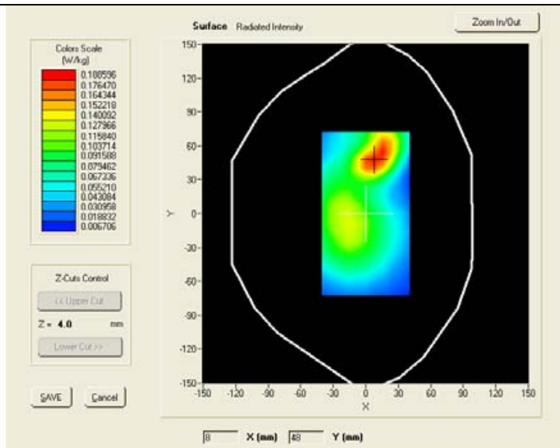


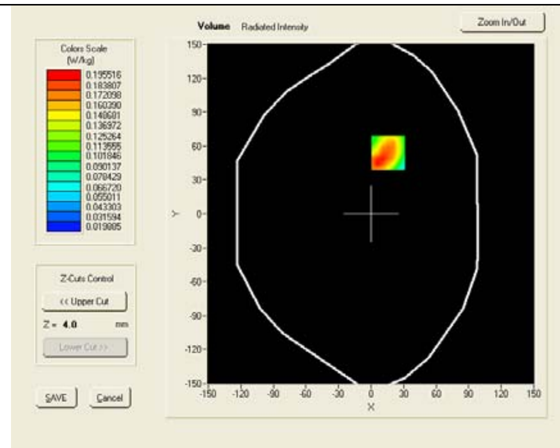


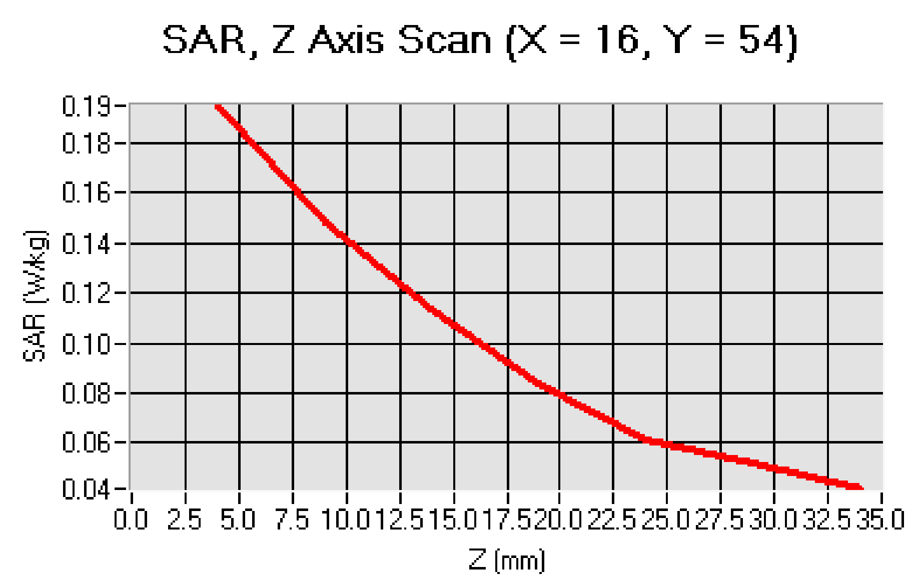


Test Mode:	CDMA2000 Cellular band, RC3, SO32, Mid channel (Body SAR)		
Position:	Flat Phantom, Body, LCD Down		
Product Description:	Mobile Phone		
Model:	CN50	Test Date:	Sep 16th, 2011

Frequency (MHz)	836.52 (Body, LCD Down)
Relative permitivity (real part)	55.294
Relative permitivity (imaginary part)	20.91
Conductivity (S/m)	0.966
Variation (%)	1.27
SAR 1g (W/Kg)	0.198
SAR 10g (W/Kg)	0.136
SURFACE SAR	VOLUME SAR



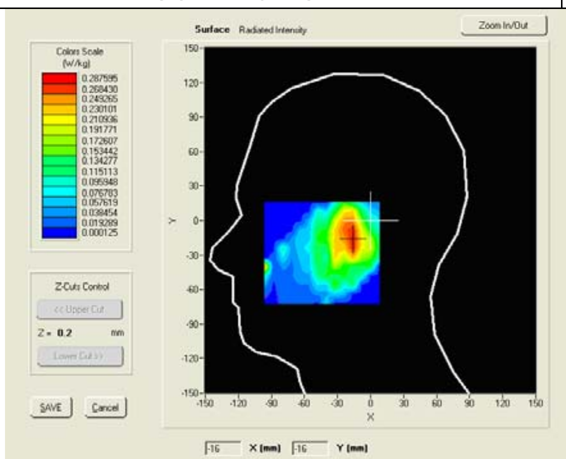


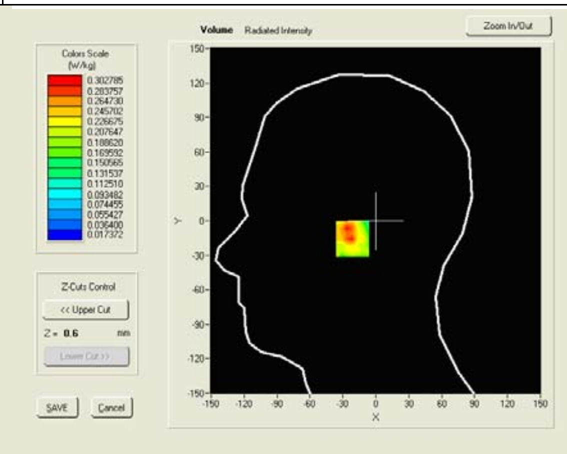


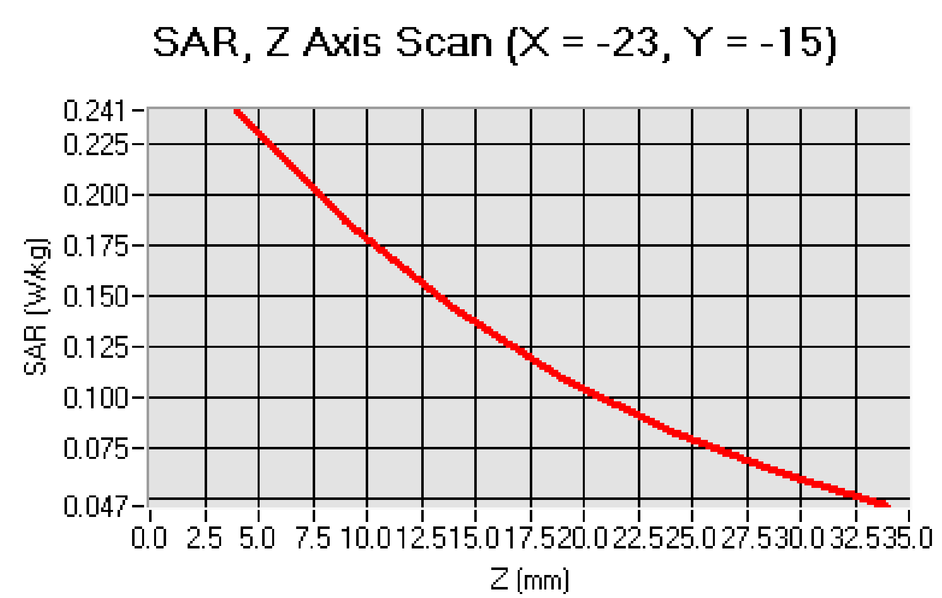
CDMA2000 PCS band Mode

Test Mode:	CDMA2000 PCS band, RC3, SO55, Mid channel (Head SAR)
Position:	Left Head, Cheek
Product Description:	Mobile Phone
Model:	CN50 Test Date: Sep 16th, 2011

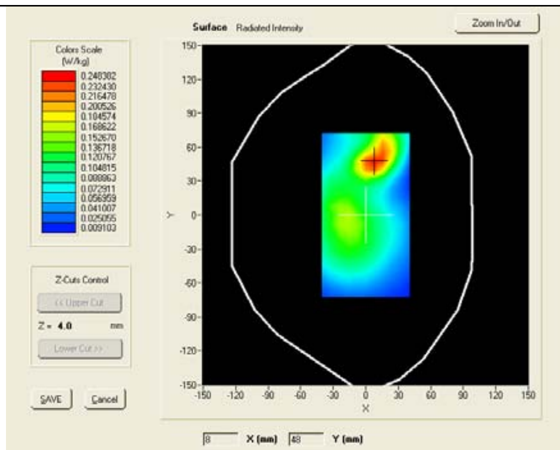
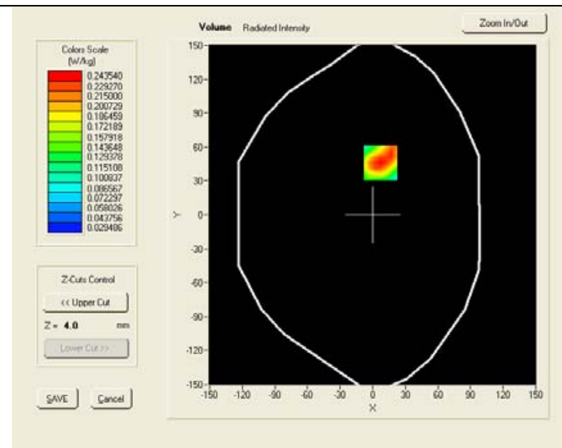
Frequency (MHz)	1880.00 (Left Cheek, Head)
Relative permitivity (real part)	38.748
Relative permitivity (imaginary part)	19.40
Conductivity (S/m)	1.415
Variation (%)	0.73
SAR 1g (W/Kg)	0.233
SAR 10g (W/Kg)	0.191
SURFACE SAR	VOLUME SAR

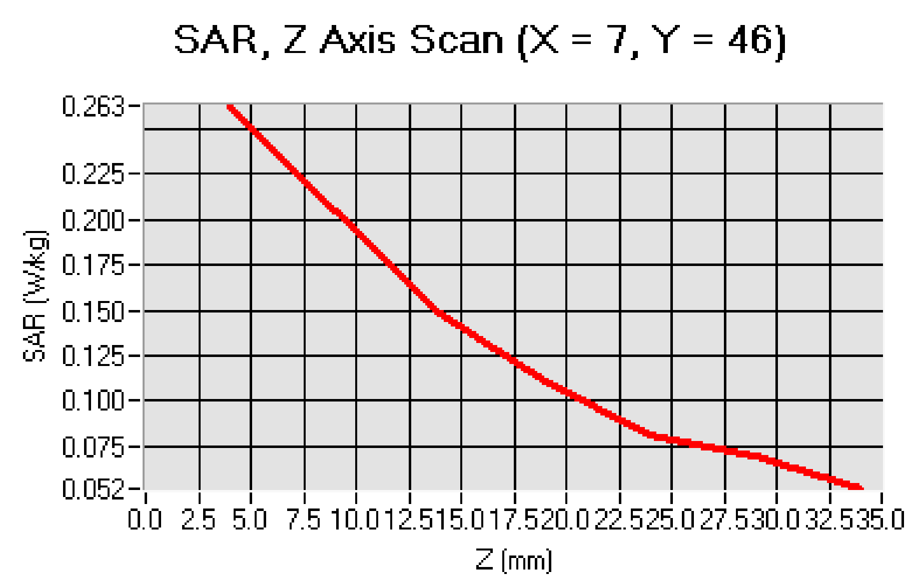






Test Mode:	CDMA2000 PCS band, RC3, SO32, Mid channel (Body SAR)		
Position:	Flat Phantom, Body, LCD Down		
Product Description:	Mobile Phone		
Model:	CN50	Test Date:	Sep 16th, 2011

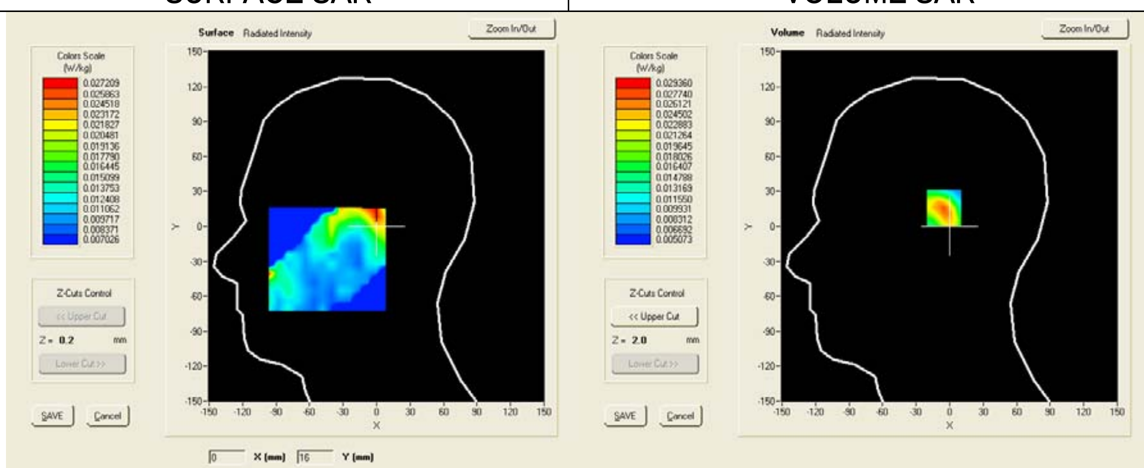
Frequency (MHz)	1880.00 (Body, LCD Down)
Relative permitivity (real part)	55.092
Relative permitivity (imaginary part)	20.912
Conductivity (S/m)	1.506
Variation (%)	-1.45
SAR 1g (W/Kg)	0.244
SAR 10g (W/Kg)	0.169
SURFACE SAR	VOLUME SAR
	

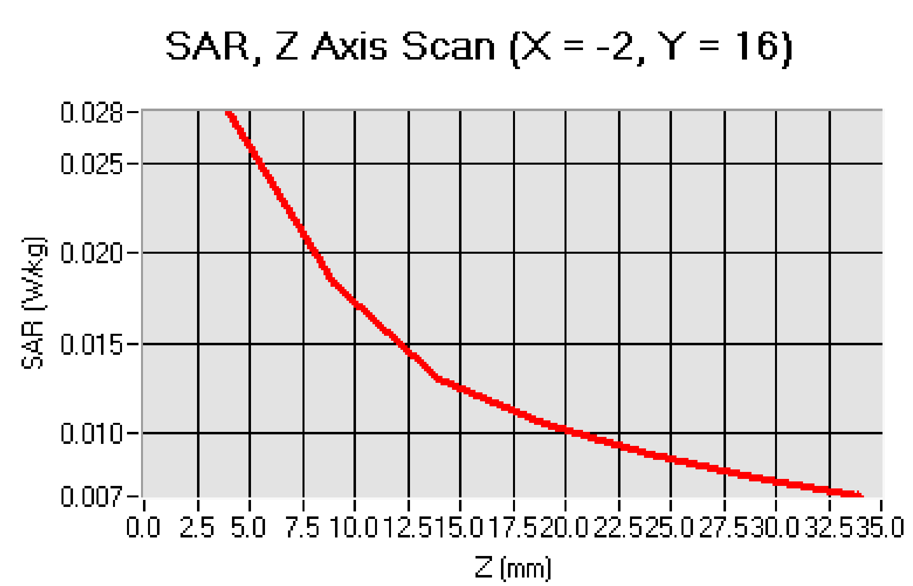


WLAN Test Mode

Test Mode:	WLAN 802.11b mode, Mid channel (Head SAR)		
Position:	Left Head, tilt		
Product Description:	Mobile Phone		
Model:	CN50	Test Date:	Sep 16th, 2011

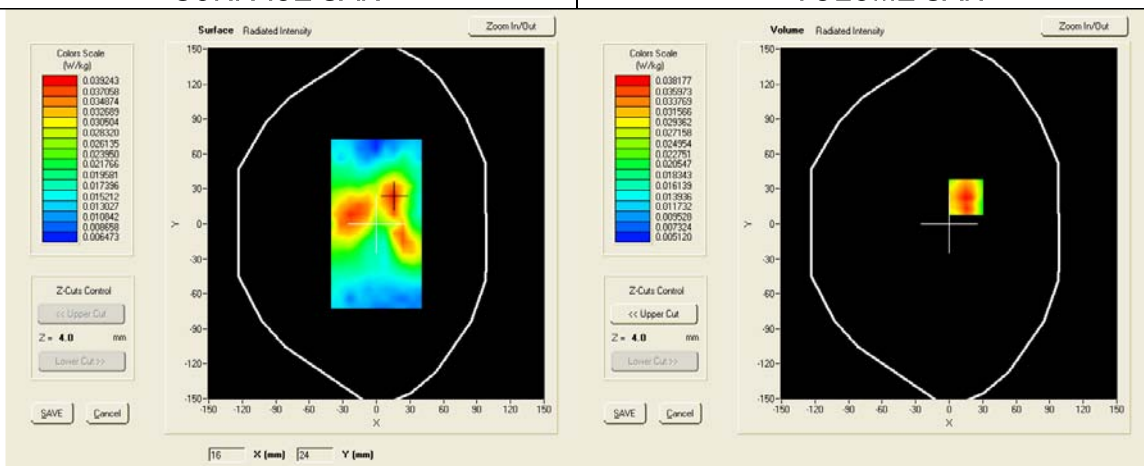
Frequency (MHz)	2437.000000 (Left Head , Tilt)
Relative permitivity (real part)	39.42
Relative permitivity (imaginary part)	13.22
Conductivity (S/m)	1.86
Variation (%)	-0.68
SAR 1g (W/Kg)	0.026
SAR 10g (W/Kg)	0.017
SURFACE SAR	VOLUME SAR





Test Mode:	WLAN 802.11b mode, Mid channel (Body SAR)		
Position:	Flat Phantom, Body, LCD Down		
Product Description:	Mobile Phone		
Model:	CN50	Test Date:	Sep 16th, 2011

Frequencfy (MHz)	2437.000000 (Body, LCD DOWN)
Relative permitivity (real part)	53.98
Relative permitivity (imaginary part)	14.33
Conductivity (S/m)	1.94
Variation (%)	-3.26
SAR 1g (W/Kg)	0.038
SAR 10g (W/Kg)	0.024
SURFACE SAR	VOLUME SAR



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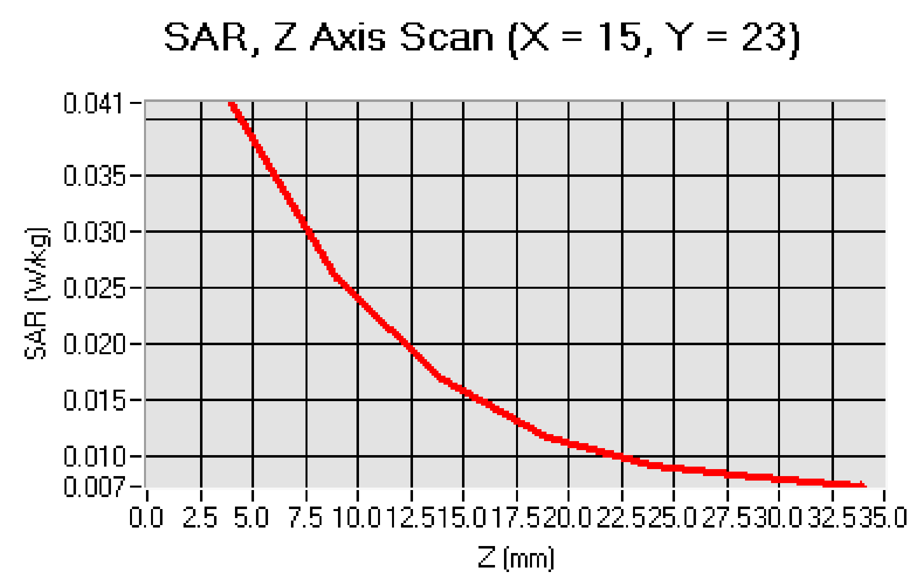


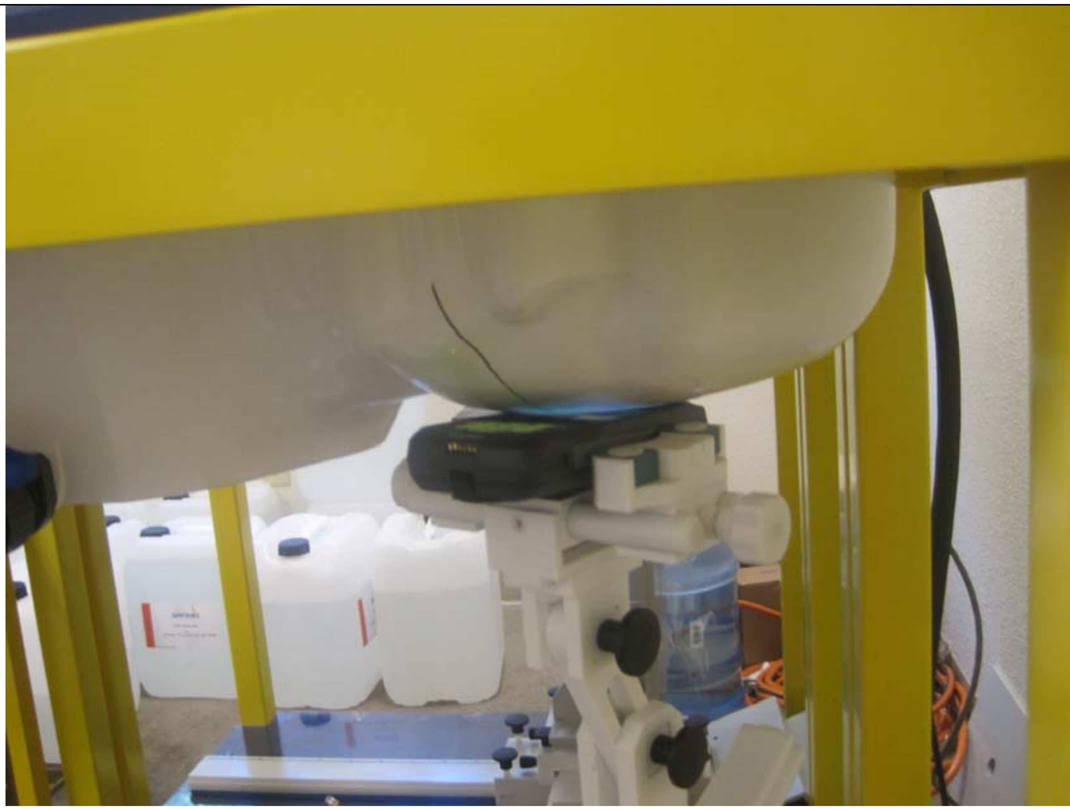
Annex A. TEST INSTRUMENT & METHOD

Annex A.i. TEST INSTRUMENTATION & GENERAL PROCEDURES

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Due
P C	Compaq	PV 3.06GHz	375052-AA1	N/A
Signal Generator	Agilent	8665B-008	3744A01304	5/17/2012
MultiMeter	Keithley	MiltiMeter 2000	1259033	08/13/2012
S-Parameter Network Analyzer	Agilent	8753ES	US38161019	08/04/2012
Wireless Communication Test Set	R & S	CMU200	111078	2/22/2012
Power Meter	HP	437B	3038A03648	5/17/2012
E-field PROBE	SATIMO	EPG111	SN 18/11 EPG125	07/19/2012
DIPOLE 835	SATIMO	DIPOLE 835MHz	SN 18/11 DIPC 150	06/01/2013
DIPOLE 900	SATIMO	DIPOLE 900MHz	SN 18/11 DIPC 151	06/01/2013
DIPOLE 1800	SATIMO	DIPOLE 1800MHz	SN 18/11 DIPC 152	06/01/2013
DIPOLE 1900	SATIMO	DIPOLE 1900MHz	SN 18/11 DIPC 153	06/01/2013
DIPOLE 2000	SATIMO	DIPOLE 2000MHz	SN 18/11 DIPC 154	06/01/2013
DIPOLE 2450	SATIMO	DIPOLE 2450MHz	SN 18/11 DIPC 155	06/01/2013
DIPOLE 3500	SATIMO	DIPOLE 3500MHz	SN 18/11 DIPC 156	06/01/2013
WaveGuide 5/6 GHz	SATIMO	Wave Guide 5/6GHz	SN 31/10 DIPWGA13	06/01/2013
COMOHAC E-Field Probe	SATIMO	EPH30	SN 24/11 EPH30	06/01/2012
COMOHAC H-Field Probe	SATIMO	HPH42	SN 43/10 HPH42	06/01/2012
COMOSAR Open Coaxial Probe	SATIMO	OCP43	SN 24/11 OCPG43	06/01/2012
T-Coil Probe	SATIMO	TCP21	SN 24/11 TCP21	06/01/2012
Communication Antenna	SATIMO	ANTA3	SN 20/11 ANTA 3	06/20/2012
Laptop POSITIONING DEVICE	SATIMO	LSH15	SN 24/11 LSH15	N/A
Mobile Phone POSITIONING DEVICE	SATIMO	MSH73	SN 24/11 MSH73	N/A
COMOHAC Broadband Dipole 800-950	SATIMO	COMOHAC Broadband Dipole 800-950MHz	SN 24/11 DHA31	06/01/2013
COMOHAC Broadband Dipole 1700-2000	SATIMO	COMOHAC Broadband Dipole 1700-2000MHz	SN 24/11 DHB32	06/01/2013
COMOHAC TELEPHONE MAGNETIC FIELD SIMULATOR	SATIMO	TMFS12	SN 24/11 TMFS12	06/01/2013
DUMMY PROBE	ANTENNESSA	DP41	SN 24/11DP41	N/A
Hygro Hermograph	Sekonic	ST-50	HE01-000092	06/04/2012

SAM PHANTOM	SATIMO	SAM77	SN 31/10 SAM77	N/A
Elliptic Phantom	SATIMO	ELLI17	SN 31-10 ELLI17	N/A
PHANTOM TABLE	SATIMO	N/A	N/A	N/A
6 AXIS ROBOT	KUKA	KR5	949319	N/A
High Power Solid State Amplifier (80MHz~1000MHz)	Instruments for Industry	CMC150	M631-0408	N/A
Medium Power Solid State Amplifier (0.8~4.2GHz)	Instruments for Industry	S41-25	M629-0408	N/A
Wave Tube Amplifier 4-8 GHz at 20Watt	Hughes Aircraft Company	1277H02F000	81	N/A

Annex B EUT AND TEST SETUP PHOTOGRAPHS



SAR test setup -1

SAR test Setup -2

Annex C CALIBRATION REPORTS

COMOSAR E-Field Probe Calibration Report

Ref : ACR.200.1.11.SATU.A

SIEMIC TESTING AND CERTIFICATION SERVICES

SUITE 311, BUILDING 1, SECTION 30 ,NO.2 KEFA ROAD, SCIENCE AND TECHNOLOGY PARK

NAN SHAN DISTRICT, SHENZHEN 518057 , GUANGDONG ,P.R.C.

SATIMO COMOSAR DOSIMETRIC E-FIELD PROBE

SERIAL NO.: SN 18/11 EPG122

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED

Calibration CERT #2246.02

06/01/2011

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	7/19/2011	JS
Checked by :	Jérôme LUC	Product Manager	7/19/2011	JS
Approved by :	Kim RUTKOWSKI	Quality Manager	7/19/2011	Kim Rutkowski

	Customer Name
Distribution :	SIEMIC Testing and Certification Services

Issue	*Date*	*Modifications*
A	7/19/2011	Initial release

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1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	Satimo
Model	SSE2
Serial Number	SN 18/11 EPG122
Product Condition (new / used)	new
Frequency Range of Probe	0.7 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.189 MΩ Dipole 2: R2=0.191 MΩ Dipole 3: R3=0.184 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.

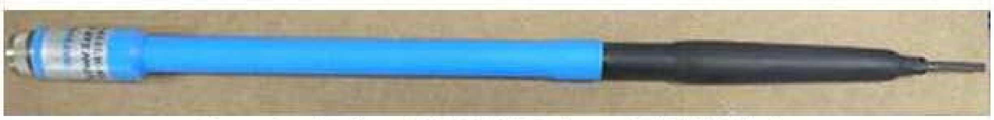


Figure 1 – *Satimo COMOSAR Dosimetric E field Dipole*

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 %

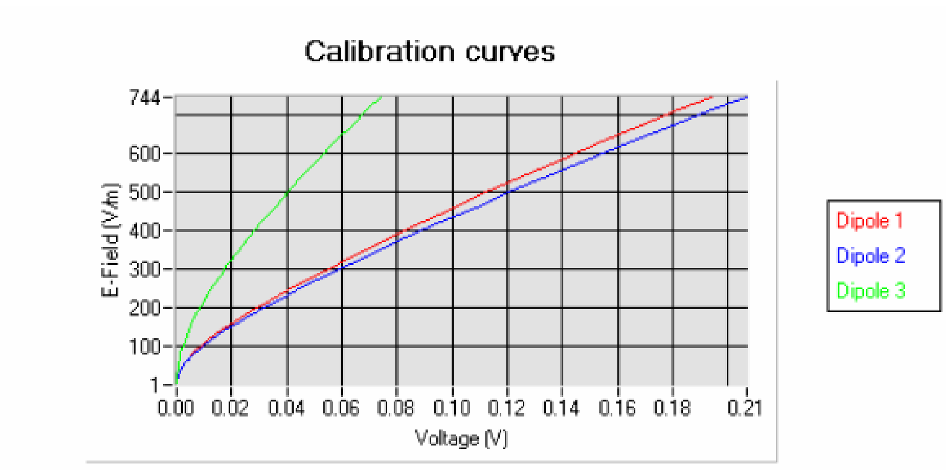
5.1 SENSITIVITY IN AIR

Normx dipole 1 ($\mu V/(V/m)^2$)	Normy dipole 2 ($\mu V/(V/m)^2$)	Normz dipole 3 ($\mu V/(V/m)^2$)
0.89	0.98	0.22

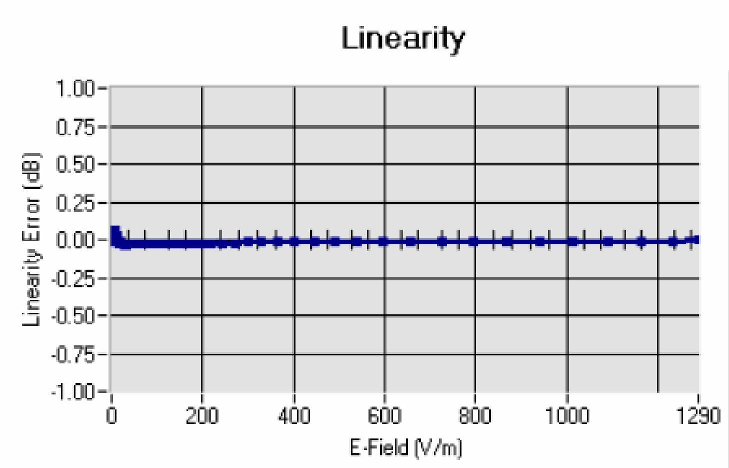
DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
115	117	122

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:0+/-1.47% (+/-0.06dB)

5.3 SENSITIVITY IN LIQUID

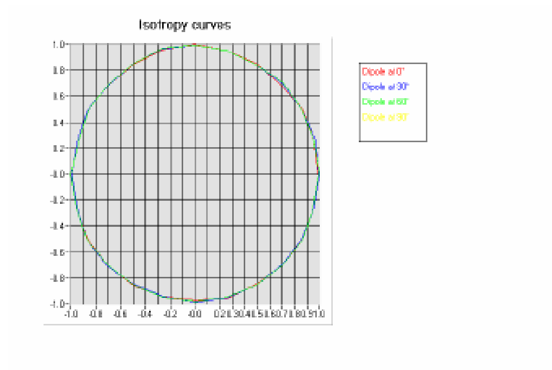
Liquid	Frequency (MHz +/- 100MHz)	Permittivity	Epsilon (S/m)	ConvF
HL850	835	43.04	0.88	6.04
BL850	835	54.21	0.98	6.21
HL900	900	41.99	0.96	5.84
BL900	900	53.68	1.04	6.06
HL1800	1750	38.73	1.37	5.78
BL1800	1750	53.55	1.51	5.99
HL1900	1880	38.51	1.42	6.18
BL1900	1880	54.65	1.54	6.38
HL2000	1950	38.55	1.46	5.75
BL2000	1950	53.54	1.49	5.87
HL2450	2450	38.77	1.88	5.81
BL2450	2450	52.36	1.97	5.98
HL3500	3500	38.69	2.87	6.03
BL3500	3500	51.87	3.21	6.27
HL5200	5200	36.80	4.87	4.93
BL5200	5200	49.25	5.06	5.09
HL5500	5500	35.83	5.35	4.69
BL5500	5500	48.28	5.58	4.91
HL5800	5800	34.75	5.77	4.71
BL5800	5800	47.51	6.07	4.84

LOWER DETECTION LIMIT: 7mW/kg

5.4 ISOTROPY

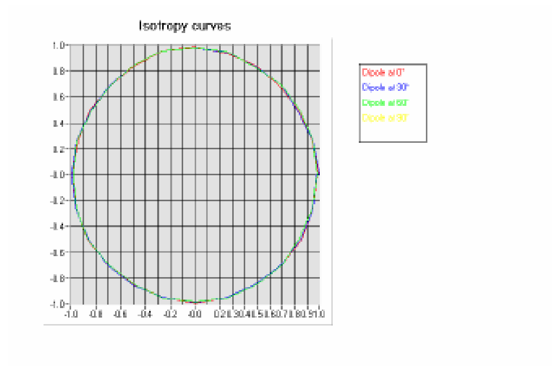
HL900 MHz

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



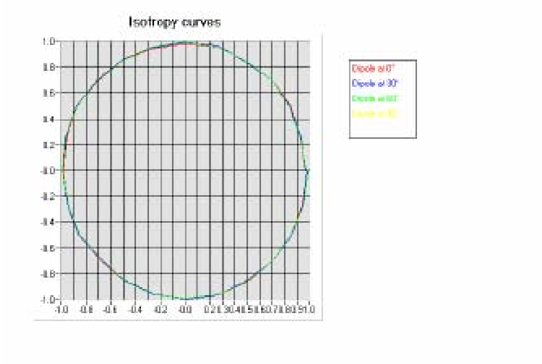
HL1800 MHz

- Axial isotropy: 0.05 dB
- Hemispherical isotropy: 0.08 dB



HL5500 MHz

- Axial isotropy: 0.09 dB
- Hemispherical isotropy: 0.13 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	3/2010	3/2012

SAR Reference Dipole Calibration Report

Ref : ACR.158.4.11.SATU.A

SIEMIC TESTING AND CERTIFICATION SERVICES

SUITE 311, BUILDING 1, SECTION 30 ,NO.2 KEFA ROAD, SCIENCE AND TECHNOLOGY PARK

NAN SHAN DISTRICT, SHENZHEN 518057 , GUANGDONG ,P.R.C.

SATIMO COMOSAR REFERENCE DIPOLE

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED
Calibration CERT #2246.02

06/01/2011

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.

SATIMO

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.158.4.11.SATU.A

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	6/7/2011	
Checked by :	Jérôme LUC	Product Manager	6/7/2011	
Approved by :	Kim RUTKOWSKI	Quality Manager	6/7/2011	

	Customer Name
Distribution :	SIEMIC Testing and Certification Services

Issue	*Date*	*Modifications*
A	6/7/2011	Initial release

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1 INTRODUCTION

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

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 835 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID835
Serial Number	SN 18/11 DIPC150
Product Condition (new / used)	new

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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

Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

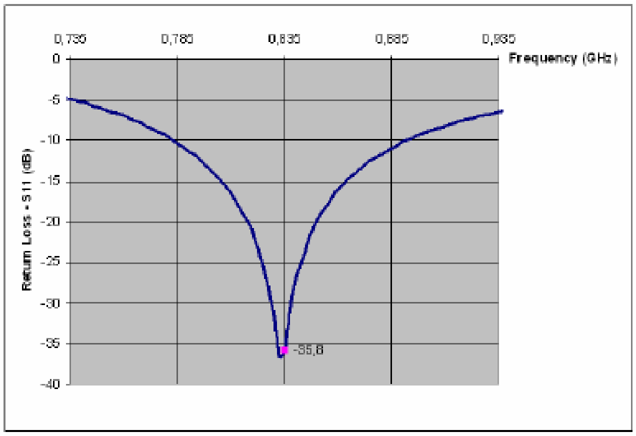
5.3 VALIDATION MEASUREMENT

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)
835	-35.8	-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 %.	PASS	89.8 ±1 %.	PASS	3.6 ±1 %.	PASS
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

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

7.1 MEASUREMENT CONDITION

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 43.0 sigma : 0.88
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8m/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

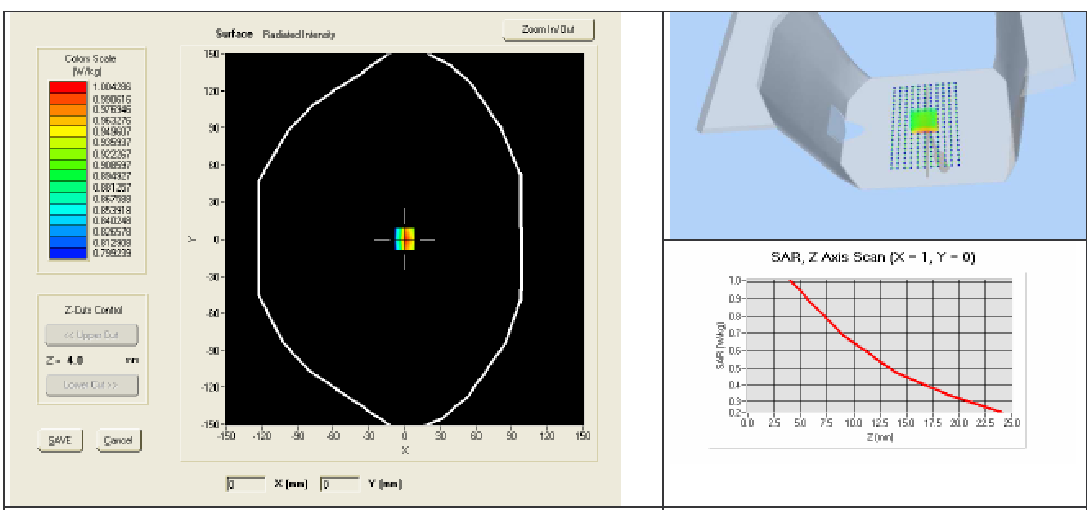
7.2 HEAD LIQUID MEASUREMENT

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 %	PASS	0.90 ±5 %	PASS
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.3 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	9.59 (0.96)	6.22	6.25 (0.62)
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		24	
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	3/2010	3/2012

SATIMO
The microwave vision company

SAR Reference Dipole Calibration Report

Ref : ACR.158.6.11.SATU.A

SIEMIC TESTING AND CERTIFICATION SERVICES

SUITE 311, BUILDING 1, SECTION 30 ,NO.2 KEFA ROAD, SCIENCE AND TECHNOLOGY PARK

NAN SHAN DISTRICT, SHENZHEN 518057 , GUANGDONG ,P.R.C.

SATIMO COMOSAR REFERENCE DIPOLE

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED
Calibration CERT #2246.02

06/01/2011

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	6/7/2011	[signature]
Checked by :	Jérôme LUC	Product Manager	6/7/2011	[signature]
Approved by :	Kim RUTKOWSKI	Quality Manager	6/7/2011	Kim Rutkowski

	Customer Name
Distribution :	SIEMIC Testing and Certification Services

Issue	*Date*	*Modifications*
A	6/7/2011	Initial release

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1 INTRODUCTION

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

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1800 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID1800
Serial Number	SN 18/11 DIPF152
Product Condition (new / used)	new

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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

Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

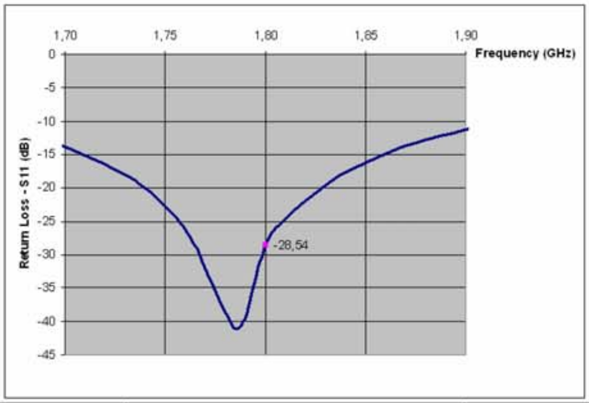
5.3 VALIDATION MEASUREMENT

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)
1800	-28.5	-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 %.	PASS	41.7 ±1 %.	PASS	3.6 ±1 %.	PASS
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

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

7.1 MEASUREMENT CONDITION

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 38.7 sigma : 1.37
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	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

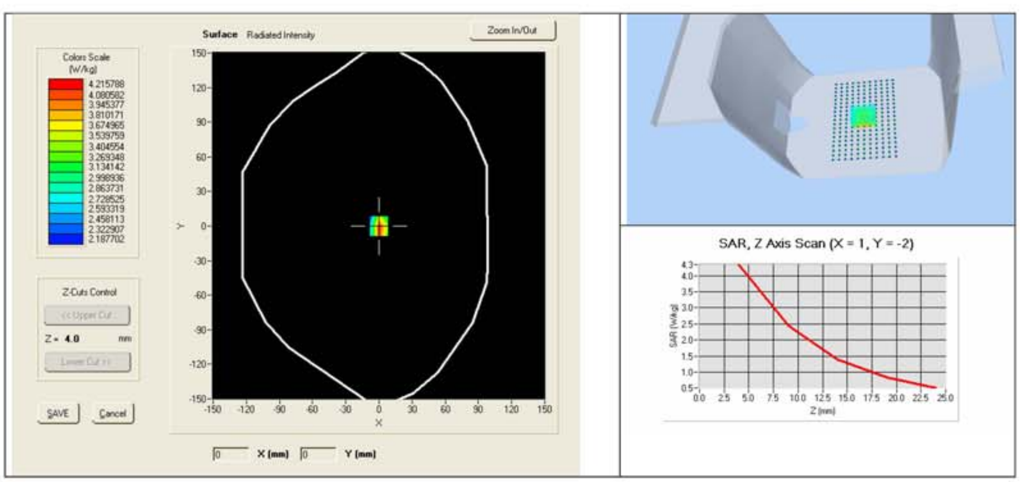
7.2 HEAD LIQUID MEASUREMENT

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

7.3 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	40.02 (4.00)	20.1	20.71 (2.07)
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



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	3/2010	3/2012

SATIMO
The microwave vision company

SAR Reference Dipole Calibration Report

Ref : ACR.158.7.11.SATU.A

SIEMIC TESTING AND CERTIFICATION SERVICES

SUITE 311, BUILDING 1, SECTION 30 ,NO.2 KEFA ROAD, SCIENCE AND TECHNOLOGY PARK

NAN SHAN DISTRICT, SHENZHEN 518057 , GUANGDONG ,P.R.C.

SATIMO COMOSAR REFERENCE DIPOLE

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

A2LA ACCREDITED
Calibration CERT #2246.02

06/01/2011

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	6/7/2011	
Checked by :	Jérôme LUC	Product Manager	6/7/2011	
Approved by :	Kim RUTKOWSKI	Quality Manager	6/7/2011	

	Customer Name
Distribution :	SIEMIC Testing and Certification Services

Issue	*Date*	*Modifications*
A	6/7/2011	Initial release

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1 INTRODUCTION

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

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1900 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID1900
Serial Number	SN 18/11 DIPG153
Product Condition (new / used)	new

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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

Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

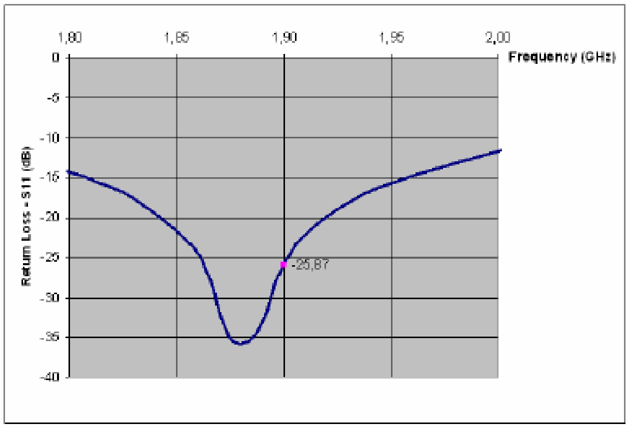
5.3 VALIDATION MEASUREMENT

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)
1900	-25.9	-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 %.	PASS	39.5 ±1 %.	PASS	3.6 ±1 %.	PASS
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

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

7.1 MEASUREMENT CONDITION

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 38.5 sigma : 1.42
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	1900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

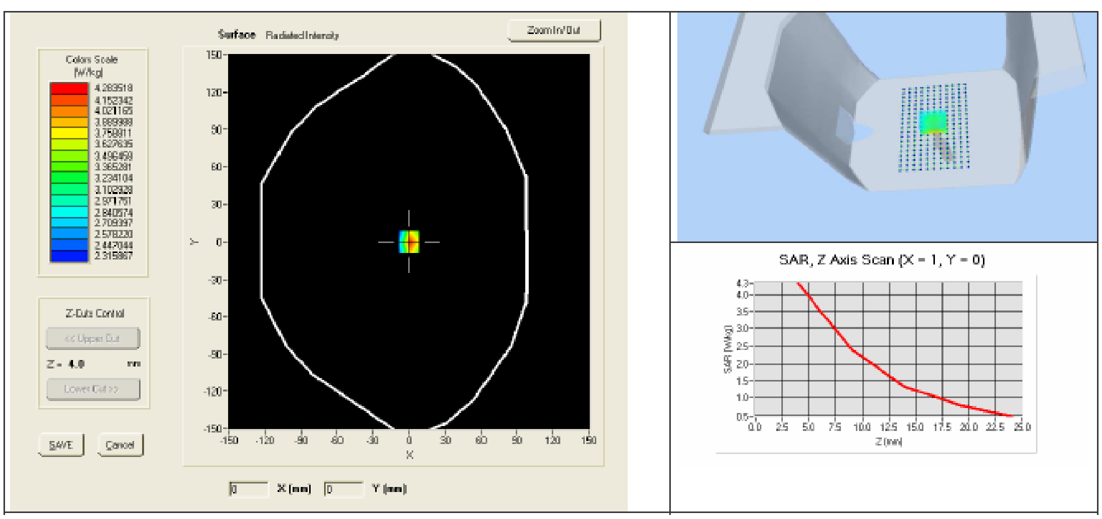
7.2 HEAD LIQUID MEASUREMENT

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

7.3 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	39.92 (3.99)	20.5	20.49 (2.05)
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



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	3/2010	3/2012

SAR Reference Dipole Calibration Report

Ref : ACR.158.9.11.SATU.A

SIEMIC TESTING AND CERTIFICATION SERVICES

SUITE 311, BUILDING 1, SECTION 30 ,NO.2 KEFA ROAD, SCIENCE AND TECHNOLOGY PARK

NAN SHAN DISTRICT, SHENZHEN 518057 , GUANGDONG ,P.R.C.

SATIMO COMOSAR REFERENCE DIPOLE

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144

ACCREDITED
Calibration CERT #2246.02

06/01/2011

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	6/7/2011	[signature]
Checked by :	Jérôme LUC	Product Manager	6/7/2011	[signature]
Approved by :	Kim RUTKOWSKI	Quality Manager	6/7/2011	Kim Rutkowski [signature]

	Customer Name
Distribution :	SIEMIC Testing and Certification Services

Issue	*Date*	*Modifications*
A	6/7/2011	Initial release

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1 INTRODUCTION

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

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2450 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID2450
Serial Number	SN 18/11 DIPJ155
Product Condition (new / used)	new

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

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

Figure 1 – *Satimo COMOSAR Validation Dipole*

4 MEASUREMENT METHOD

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

4.1 RETURN LOSS REQUIREMENTS

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

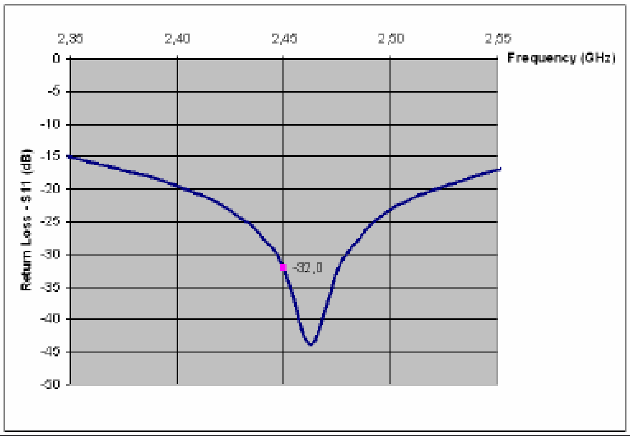
5.3 VALIDATION MEASUREMENT

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	-32.00	-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' : 38.8 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 %

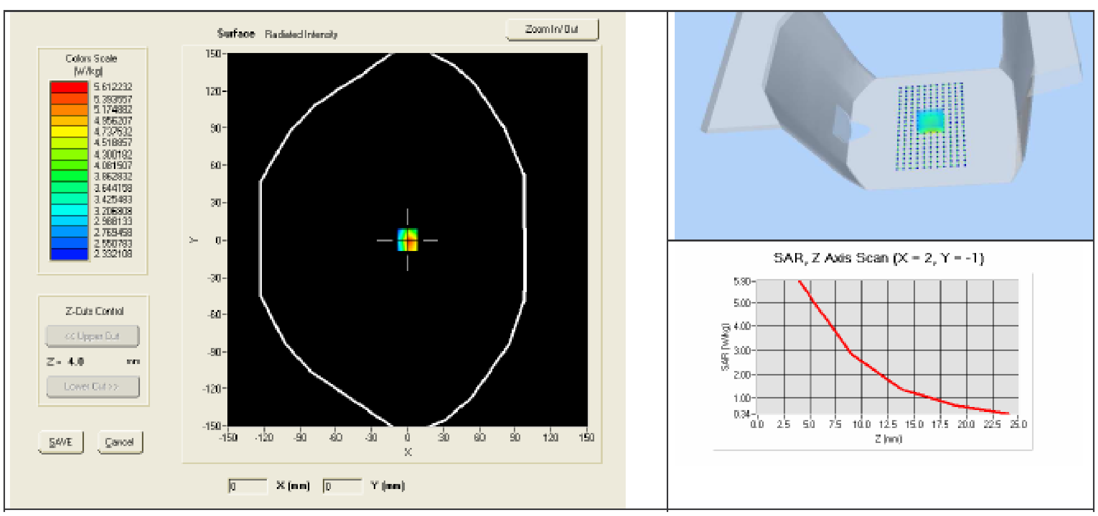
7.2 HEAD LIQUID MEASUREMENT

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	53.82 (5.38)	24	24.12 (2.41)
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	3/2010	3/2012