



**SAR Evaluation Report  
for  
FCC OET Bulletin 65 Supplement C  
and  
Industry Standard RSS-102 Issue2**

**Report No.: SSAR1010029**



Client : Hannspree Inc.  
Product : HANNSpad  
Model : HSG1164  
FCC ID : VD2-HSG1164  
Manufacturer/ supplier : WANLIDA GROUP CO., LTD  
Date test item received : Nov 18,2010  
Date test campaign completed : Nov 21,2010  
Date of issue : Nov 22,2010  
Test Result : ☒ Compliance ☐ Not Compliance

**Statement of Compliance:**

The SAR values measured for the test sample are below the maximum recommended level of 1.6 W/kg averaged over any 1g tissue according to FCC OET Bulletin 65 Supplement C(Edition 01-01, June 2001)

**The test result only corresponds to the tested sample. It is not permitted to copy this report, in part or in full, without the permission of the test laboratory.**

*Total number of pages of this test report: 111 pages*

Test Engineer:  _____ Jack Li	Approved by:  _____ Clinton Kao
---	---

The testing described in this report has been carried out to the best of our knowledge and ability, and our responsibility is limited to the exercise of reasonable care. This certification is not intended to believe the sellers from their legal and/or contractual obligations.



## Applicant Information

<b>Client</b>	: Hannspree Inc.
<b>Address</b>	: 4F.,No.48,Wucyuan Rd.,Wugu Industrial Zone,Taipei County 248,Taiwan
<b>Manufacturer</b>	: WANLIDA GROUP CO., LTD
<b>Address</b>	: WANLIDA INDUSTRY ZONE, NANJING ,FUJIAN, CHINA.
<b>EUT</b>	: HANNSpad
<b>Model No.</b>	: HSG1164
<b>Standard Applied</b>	: FCC OET 65 Supplement C (Edition 01-01, June 2001) IEEE Standard 1528-2003
<b>Laboratory</b>	: CERPASS TECHNOLOGY CORP. No.66,Tangzhuang Road, Suzhou Industrial Park, Jiangsu 215006, China.
<b>Test Location</b>	: No.789, Pu Xing Road, Shanghai, China
<b>Test Result</b>	: Maximum SAR Measurement 802.11b: 0.790 W/kg(1g) 802.11g: 0.716 W/kg(1g) 802.11n, HT20: 0.266 W/kg(1g)

**The HANNSpad is in compliance with the FCC Report and Order 93-326 and Health Canada Safety Code 6, and the tests were performed according to the FCC OET65c for uncontrolled exposure.**



## Contents

<b>1. General Information .....</b>	<b>5</b>
1.1. Description of Equipment under Test.....	5
1.2. Photograph of EUT .....	5
1.3. Characteristics of Device .....	6
1.4. Description of support units .....	6
1.5. Environment Condition .....	7
1.6. FCC Requirement of SAR Compliance Testing .....	7
1.7. The SAR Measurement Procedure.....	8
<b>2. Description of the Test Equipment.....</b>	<b>9</b>
2.1. Test Equipment List.....	9
2.2. ALSAS-10-U Measurement System .....	10
2.3. DAQ-PAQ (Analog to Digital Electronics) .....	11
2.4. APREL Phantom.....	12
2.5. Device Holder .....	13
2.6. Specification of probes.....	14
2.7. SAR Measurement Procedures in ALSAS-10-U.....	16
2.8. Simulating Liquids.....	16
2.9. System Performance Check .....	17
<b>3. Results .....</b>	<b>19</b>
3.1. Summary of Test Results .....	19
3.2. Description for EUT test position .....	19
3.3. Conducted power(Average).....	19
3.4. Check the position for the worst result.....	21
3.5. Measurement Position .....	22
<b>4. The Description of Test Procedure for FCC .....</b>	<b>23</b>
4.1. Scan Procedure .....	23
4.2. SAR Averaging Methods.....	23
4.3. Data Storage .....	23
4.4. Data Evaluation.....	24
<b>5. Measurement Uncertainty .....</b>	<b>26</b>
<b>6. Reference .....</b>	<b>28</b>
<b>7. APPENDIX A PHOTOGRAPHS of EUT.....</b>	<b>29</b>
<b>8. APPENDIX B SYSTEM PERFORMANCE CHECK PLOT .....</b>	<b>34</b>
<b>9. APPENDIX C SAR TEST PLOT.....</b>	<b>39</b>
<b>10.APPENDIX D CALIBRATION CERTIFICATE .....</b>	<b>111</b>



## **Executive Summary**

The EUT is a HANNSpad from Hannspree Inc..products operating in the 2.4GHz frequency ranges. This device contains wireless functions that are operational in IEEE 802.11b, 802.11g, and IEEE802.11n HT20 mode. The measurements was conducted by CERPASS and carried out with the dosimetric assessment system under ALSAS-10-U.

The measurements were conducted according to FCC OET 65 Supplement C [Reference 5] for evaluating compliance with requirements of FCC Report and Order 96-326 [Reference 3]



## 1. General Information

### 1.1. Description of Equipment under Test

EUT Type	Production unit <input checked="" type="checkbox"/> Identical prototype <input type="checkbox"/>
EUT	HANNSpad
Model Name	HSG1164
Hardware Version	N/A
Software Version	N/A
TX Frequency	2412-2462Mhz
RX Frequency	2412-2462Mhz
Antenna Type	Internal PIFA
Device Category	Portable
RF Exposure Environment	General Population/ Uncontrolled
Crest Factor	1

### 1.2. Photograph of EUT





### 1.3. Characteristics of Device

The EUT is a 2.4 GHz HANNSpad. It conforms to the bluetooth and IEEE 802.11b/g/n protocol and operates in the unlicensed ISM Band at 2.4 GHz.

RF Chain	1T1R
Frequency Range	IEEE802.11b/g/n HT20:2412Mhz-2462Mhz
Channel Spacing	IEEE802.11b/g/n: 5Mhz
Channel Number	IEEE802.11b/g/n HT20:11 channels
Transmit Data Rate	802.11b: 11, 5.5, 2, 1 Mbps 802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps 802.11n: up to 130Mbps
Type of Modulation	DSSS, OFDM

### 1.4. Description of support units

The SAR evaluation was performed on the following hosts:

Host#	Description	Manufacturer	Model	Overall Dimension
1	N/A	N/A	N/A	N/A

Cable#	Description	Manufacturer	Type	Length
1	N/A	N/A	N/A	N/A



### 1.5. Environment Condition

Item	Target	Measured
Ambient Temperature(°C)	18~25	22±1
Temperature of Simulant(°C)	20~24	22±1
Relative Humidity(%RH)	30~70	60~70

### 1.6. FCC Requirement of SAR Compliance Testing

According to the FCC order “Guidelines for Evaluating the Environmental Effects of RF Radiation”, for consumer products, the SAR limit is **1.6 W/kg** for an uncontrolled environment and **8.0 W/kg** for an occupational/controlled environment. Pursuant to the Supplement C of OET Bulletin 65 “Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields”, released on June 29, 2001 by FCC, the equipment under test should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for intended or normal operation, incorporating normal antenna operating positions, equipment under test peak performance frequencies and positions for maximum RF power coupling.

#### 1.6.1 RF Exposure Limits

	Whole-Body	Partial-Body	Arms and Legs
Population/ Uncontrolled Environments(W/kg)	0.08	1.6	4.0
Occupational/ Controlled Environments(W/Kg)	0.4	8.0	20.0

#### Notes:

1. Population/Uncontrolled Environments: Locations where there is the exposure of individuals who have no sense or control of their exposure.
2. Occupational/Controlled Environments: Locations where there is exposure that may be incurred by people who have knowledge of the potential for exposure.
3. Whole-Body: SAR is averaged over the entire body.
4. Partial-Body: SAR is averaged over any 1g of tissue volume as defined in specification.
5. Arms and Legs: SAR is averaged over 10g of tissue volume as defined in specification.



## **1.7. The SAR Measurement Procedure**

### **1.7.1 General Requirements**

The test should be performance in a laboratory without influence on SAR measurements by ambient RF sources and any reflection from the environment inside. The ambient temperature should be kept in the range of 20°C to 22°C with a maximum variation within  $\pm 2^\circ\text{C}$  during the test.

### **1.7.2 Phantom Requirements**

The phantoms used in test are simplified representations of the human head and body as a specific shaped container for the head or body simulating liquids. The physical characteristics of the phantom models should resemble the head and the body of a mobile user since the shape is a dominant parameter for exposure. The shell of the phantom should be made of low loss and low permittivity material and the thickness tolerance should be less than 0.2 mm. In addition, the phantoms should provide simulations of both right and left hand operations.

### **1.7.3 Test Positions**

1. The horizontal-down and horizontal-up of EUT contact to the flat phantom. The transmitted antenna of the EUT located under the reference point of the flat phantom. The separation distance is 5mm between the top of the EUT and the bottom of the flat phantom. The area scan size is 41 x 61 points.
2. The vertical-back and vertical-front of EUT contact to the flat phantom. The transmitted antenna of the EUT located under the reference point of the flat phantom. The separation distance is 5mm between the top of the EUT and the bottom of the flat phantom. The area scan size is 31 x 61 points.

### **1.7.4 Test Procedures**

The EUT (HANNSpad) plugged into the notebook. Use the software to control the EUT channel and transmission power. Then record the conducted power before the testing. Place the EUT to the specific test location. After the testing, must writing down the conducted power of the EUT into the report. The SAR value was calculated via the 3D spine interpolation algorithm that has been implemented in the software of ALSAS-10-U SAR measurement system manufactured and calibrated by APREL.





## 2. Description of the Test Equipment

ALSAS-10-U is fully compliant with the technical and scientific requirements of IEEE 1528, IEC 62209, CENELEC, ARIB, ACA, and the Federal Communications Commission. The system comprises of a six axes articulated robot which utilizes a dedicated controller. ALSAS-10U uses the latest methodologies and FDTD order to provide a platform which is repeatable with minimum uncertainty. Applications: Predefined measurement procedures compliant with the guidelines of CENELEC, IEEE, IEC, FCC, etc are utilized during the assessment for the device. Automatic detection for all SAR maxima are embedded within the core architecture for the system, ensuring that peak locations used for centering the zoom scan are within a 1mm resolution and a 0.05mm repeatable position. System operation range currently is available up to 6 GHz in simulated tissue.

### 2.1. Test Equipment List

Instrument	Manufacture	Model No.	Serial No.	Last Calibration
Universal Work Station	Aprel	ALS-UWS	100-00154	Sep.2010
Data Acquisition Package	Aprel	ALS-DAQ-PAQ-3	110-00215	Sep.2010
Probe Mounting Device and Boundary Detection Sensor System	Aprel	ALS-PMDPS-3	120-00265	Sep.2010
Miniature E-Field Probe	Aprel	ALS-E-020	273-B	Sep.2010
Left ear SAM Phantom	Aprel	ALS-P-SAM-L	130-00312	N/A
Right ear SAM Phantom	Aprel	ALS-P-SAM-R	140-00362	N/A
Universal SAM Phantom	Aprel	ALS-P-SU-1	150-00410	N/A
Reference Validation Dipole 2450MHz	Aprel	ALS-D-2450-S-2	2450-220-00755	May.2009
Dielectric Probe Kit	Aprel	ALS-PR-DIEL	260-00955	Sep.2010
Device Holder 2.0	Aprel	ALS-H-E-SET-2	170-00506	N/A
SAR software	Aprel	ALS-SAR-AL-10	Ver.2.3.6	N/A
CRS C500C Controller	Thermo	ALS-C500	RCF0504291	N/A
CRS F3 Robot	Aprel	ALS-F3-SW	N/A	N/A
Power Amplifier	Mini-Circuit	SN0974	040306	Sep.2010
Directional Coupler	Agilent	778D-012	N/A	Sep.2010
Universal Radio Communication Tester	Rohde&Schwarz	CMU200	104845	Sep.2010
Vector Network	Anritsu	MS4623B	N/A	Sep.2010
Signal Generator	Agilent	E8257D	N/A	Sep.2010



Power Meter	Rohde&Schwarz	NRP	N/A	Sep.2010
-------------	---------------	-----	-----	----------

## 2.2. ALSAS-10-U Measurement System

The ALSAS-10-U Measurement System





The ALSAS-10-U system consists of the following items:

- A fixed-on-ground high precision 6-axis robot with controller and software and an arm extension for moving the DAQ-PAQ and Probe.
- A dosimetric probe, an isotropic E-field probe optimized and calibrated for usage in head or body tissue simulating liquids. Some of the probes are equipped with an optical surface detector system.
- A DAQ-PAQ performing the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. DAQ-PAQ is powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- A unit to operate the optical surface detector which is connected to Electro-Optical Coupler (EOC).
- The EOC performs the conversion from the optical into a digital electric signal of the DAQ-PAQ. The EOC is connected to the ALSAS-10-U measurement server.
- The ALSAS-10-U measurement server performing all real-time data evaluation for field measurements and surface detection, controlling robot movements and handling safety operation..
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed well according to the given recipes.
- System validation dipoles is used to validate the proper functioning of the system

### 2.3. DAQ-PAQ (Analog to Digital Electronics)

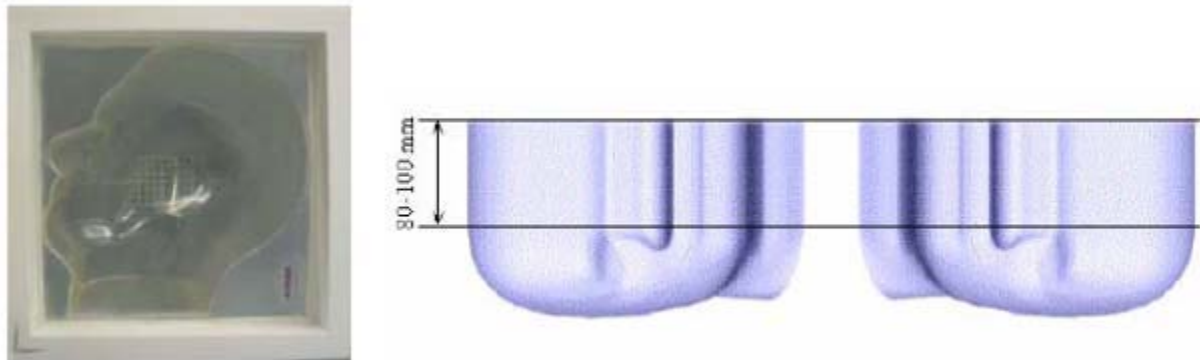
ALSAS-10U incorporates a fully calibrated SAQ-PAQ (analog to digital conversion system) which has a 4 channel input stage, sent via a 2 stage auto-set amplifier module. The input signal is amplified accordingly so as to offer a dynamic range from  $5\ \mu\text{V}$  to 800mV. Integration of the fields measured is carried out at board level utilizing a Co-Processor which then sends the measured fields down into the main computational module in digitized form via a RS232 communications port. Probe linearity and duty cycle compensation is carried out within the main DAQ-PAQ module.

<b>ADC</b>	12 Bit
Amplifier Range	20mV to 200mV and 150mV to 800mV
Field Integration	Local Co-Processor utilizing proprietary integration algorithms
Number of Input Channels	4 in total 3 dedicated and 1 spare
Communication	Packet data via RS232



## 2.4. APREL Phantom

The SAM phantoms developed using the IEEE SAM CAD file. They are fully compliant with the requirements for both IEEE 1528 and FCC Supplement C. Both the left and right SAM phantoms are interchangeable, transparent and include the IEEE 1528 grid with visible NF and MB lines



### APREL Laboratories Universal Phantom

The Universal Phantom is used on the ALSAS-10U as a system validation phantom. The Universal Phantom has been fully validated both experimentally from 800MHz to 6GHz and numerically using XFDTD numerical software. The shell thickness is 2mm overall, with a 4mm spacer located at the NF/MB intersection providing an overall thickness of 6mm in line with the requirements of IEEE-1528.

The design allows for fast and accurate measurements, of handsets, by allowing the conservative SAR to be evaluated at on frequency for both left and right head experiments in one measurement.





## **2.5. Device Holder**

The universal device positioner allows complete freedom of movement of the EUT. Developed to hold a EUT in a free-space scenario any additional loading attributable to the material used in the construction of the positioner has been eliminated. Repeatability has been enhanced through the linear scales which form the design used to indicate positioning for any given test scenario in all major axes. A 15° tilt movements for head SAR analysis. Overall uncertainty for measurements has been reduced due to the design of the Universal device positioner, which allows positioning of a device in as near to a free-space scenario as possible, and by providing the means for complete repeatability.



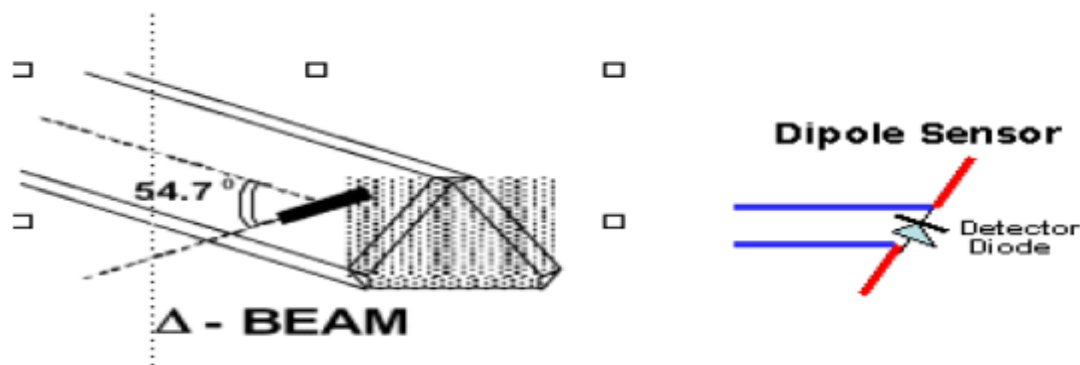


## 2.6. Specification of probes

The isotropic E-Field probe has been fully calibrated and assessed for isotropic, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change. A number of methods is used for calibrating probes, and these are outlined in the table below:

Calibration Frequency	Air Calibration	Tissue Calibration
900MHz	TEM Cell	Temperature
1800MHz	TEM Cell	Temperature

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



SAR is assessed with a calibrated probe which moves at a default height of 5mm from the center of the diode, which is mounted to the sensor, to the phantom surface (in the Z Axis). The 5mm offset height has been selected so as to minimize any resultant boundary effect due to the probe being in close proximity to the phantom surface.

The following algorithm is an example of the function used by the system for linearization of the output from the probe when measuring complex modulation schemes.

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



<b>Calibration in Air</b>	Frequency Dependent Below 2GHz Calibration in air performed in a TEM Cell Above 2GHz Calibration in air performed in waveguide
<b>Sensitivity</b>	0.70 $\mu\text{V}/(\text{V}/\text{m})^2$ to 0.85 $\mu\text{V}/(\text{V}/\text{m})^2$
<b>Dynamic Range</b>	0.0005 W/kg to 100W/kg
<b>Isotropic Response</b>	Better than 0.2dB
<b>Diode Compression point (DCP)</b>	Calibration for Specific Frequency
<b>Probe Tip Radius</b>	< 5mm
<b>Sensor Offset</b>	1.56 (+/- 0.02mm)
<b>Probe Length</b>	290mm
<b>Video Bandwidth</b>	@ 500 Hz: 1dB @1.02 KHz: 3dB
<b>Boundary Effect</b>	Less than 2% for distance greater than 2.4mm
<b>Spatial Resolution</b>	Diameter less than 5mm Compliant with Standards

#### Boundary detection Unit and Probe Mounting Device

ALSAS-10U incorporates a boundary detection unit with a sensitivity of 0.05mm for detecting all types of surfaces. The robust design allows for detecting during probe tilt (probe normalize) exercises, and utilizes a second stage emergency stop. The signal electronics are directly into the robot controller for high accuracy surface detection in lateral and axial detection modes (X, Y, &Z).

The probe is mounted directly onto the Boundary Detection unit for accurate tooling and displacement calculations controlled by the robot kinematics. The probe is connected to an isolated probe interconnect where the output stage of the probe is fed directly into the amplifier stage of the DAQ-PAQ.



## 2.7. SAR Measurement Procedures in ALSAS-10-U

### Step 1 Setup a Call Connection

Establish a call in handset at the maximum power level with a base station simulator via air interface.

### Step 2 Power Reference Measurements

To measure the local E-field value at a fixed location which value will be taken as a reference value for calculating a possible power drift.

### Step 3 Area Scan

To measure the SAR distribution with a grid with spacing of 15 mm x 15 mm and kept with a constant distance to the inner surface of the phantom. Additional all peaks within 3 dB of the maximum SAR are searched.

### Step 4 Zoom Scan

At these points (maximum number of SAR peaks is two), a cube of 30 mm x 30 mm x 30 mm is applied to and measured with 7 x 7 x 7 points. With these measured data, a peak spatial-average SAR value can be calculated by APREL software.

### Step 5 Power Drift Measurements

Repetition of the E-field measurement at the fixed location mentioned in Step 1 to make sure the two results differ by less than  $\pm 0.2$  dB.

## 2.8. Simulating Liquids

Liquids Recipes for this test report are as following:

BSL 2450 MHz band (Body)

Ingredient	% by weight
Water	68.12
DGBE	31.72
Salt	0.15





## 2.9. System Performance Check

### 2.10.1 Purpose

1. To verify the simulating liquids are valid for testing.
2. To verify the performance of testing system is valid for testing.

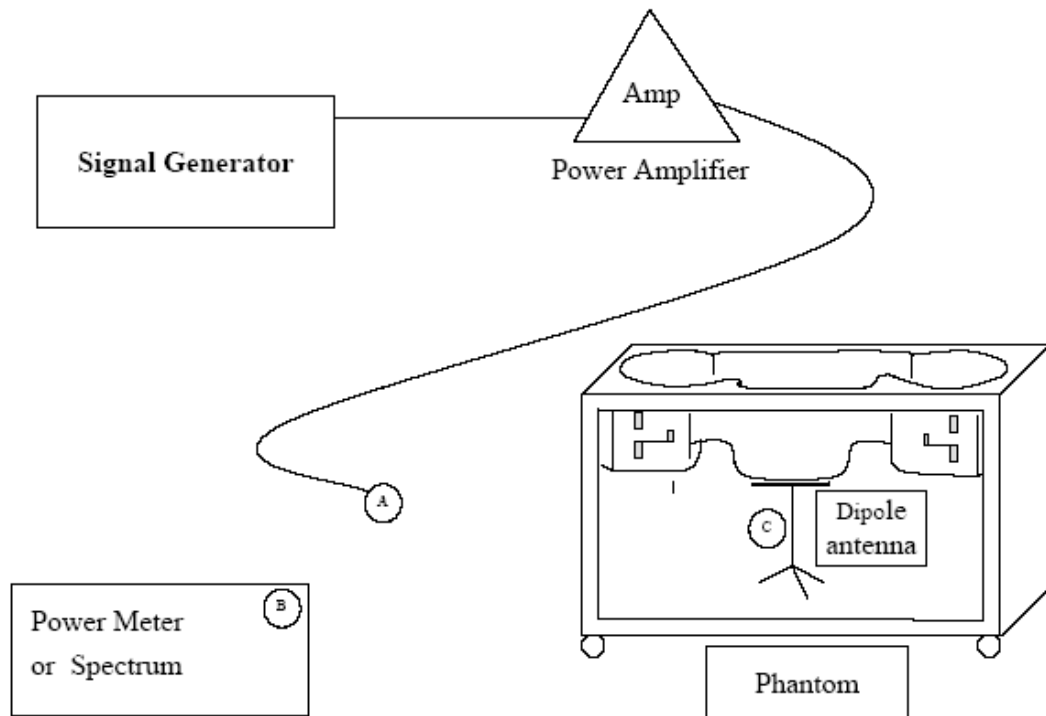
### 2.10.2 System Performance Check Procedure

The ALSAS-10-U installation includes predefined files with recommended procedures for measurements and the system performance check. They are read-only document files and destined as fully defined but unmeasured masks, so the finished system performance check must be saved under a different name. The system performance check document requires the SAM Twin Phantom, so this phantom must be properly installed in your system. (User defined measurement procedures can be created by opening a new document or editing an existing document file). Before you start the system performance check, you need only to tell the system with which components (probe, medium, and device) you are performing the system performance check; the system will take care of all parameters.

- **The Power Reference Measurement and Power Drift Measurement** jobs are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the amplifier output power. If it is too high (above  $\pm 0.1$  dB), the system performance check should be repeated; some amplifiers have very high drift during warm-up. A stable amplifier gives drift results in the ALSAS-10-U system below  $\pm 0.02$  dB.
- **The Surface Check** job tests the optical surface detection system of the ALSAS-10-U system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above  $\pm 0.1$  mm). In that case it is better to abort the system performance check and stir the liquid.
- **The Area Scan** job measures the SAR above the dipole on a plane parallel to the surface. It is used to locate the approximate location of the peak SAR. The proposed scan uses large grid spacing for faster measurement; due to the symmetric field, the peak detection is reliable. APREL Lab, ALSAS-10-U Manual, System Performance Check Application Notes If a finer graphic is desired, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result.
- **The Zoom Scan** job measures the field in a volume around the peak SAR value assessed in the previous Area Scan job (for more information see the application note on SAR evaluation). If the system performance check gives reasonable results, the SAR peak, 1 g and 10 g spatial average SAR values normalized to 1W dipole input power give reference data for comparisons. The next sections analyze the expected uncertainties of these values, as well as additional checks for further information or troubleshooting.



### 2.10.3 System Performance Check Setup



Note :

1. A connected to B is used to make sure whether the input power is 250mW for target frequency..
2. A connected to C is used to input the measured power to dipole antenna

### 2.10.4 Result of System Performance Check: Valid Result

Date of Measurement And Reference Value	SAR@1g [W/kg]	Dielectric Parameters		Temperatures [°C]
		$\epsilon_r$	$\sigma$ [S/m]	
Body 2450MHz Recommended Value	$5.31 \pm 10\%$ [4.779 ~ 5.841]	$39.2 \pm 10\%$ [37.24 ~ 41.16]	$1.8 \pm 5\%$ [1.71 ~ 1.89]	$20.0 \pm 2$ [21 ~ 23]
	5.27	39.6	1.79	20.0



### 3. Results

#### 3.1. Summary of Test Results

No deviations form the technical specification(s) were ascertained in the course of the tests performed	<input checked="" type="checkbox"/>
The deviations as specified in this chapter were ascertained in the course of the tests Performed.	<input type="checkbox"/>

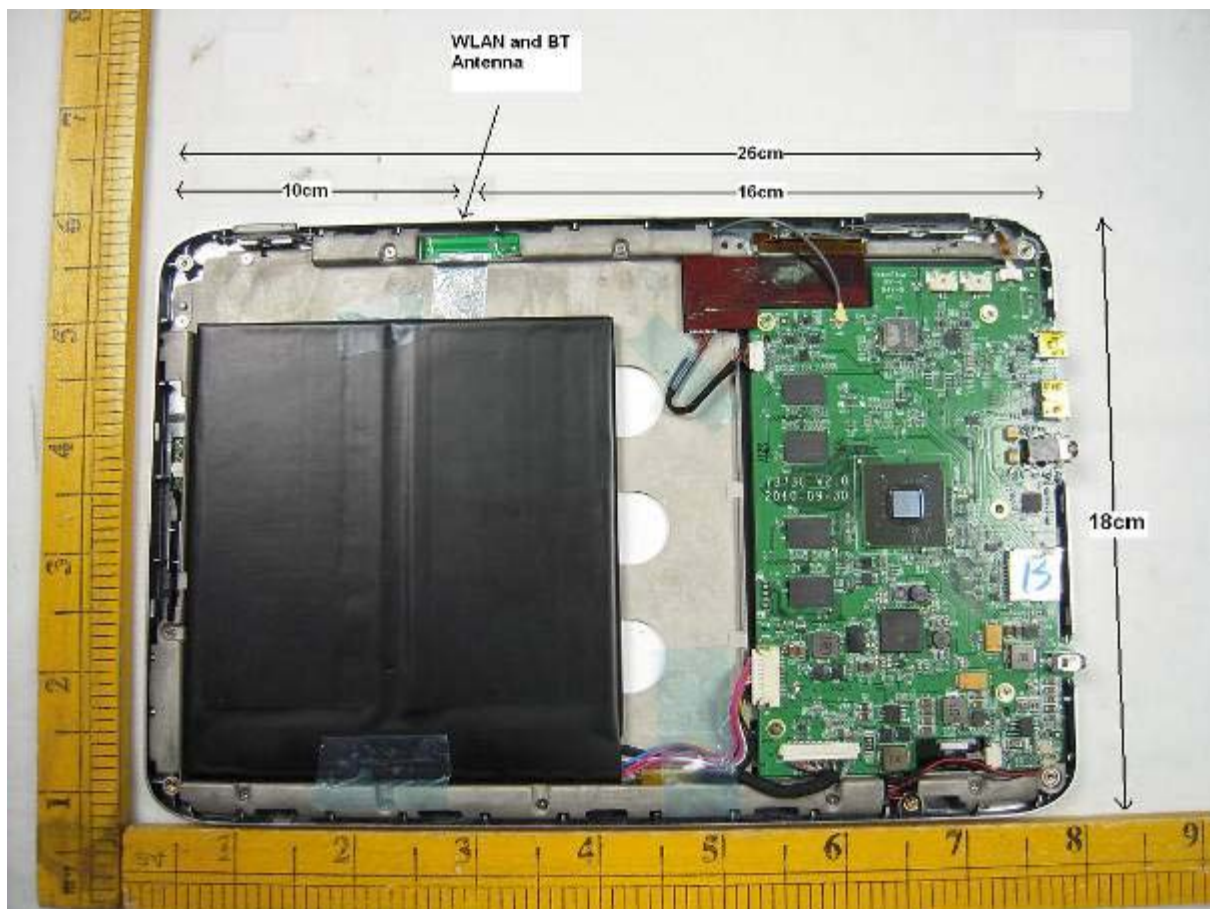
#### 3.2. Description for EUT test position

The following procedure had been used to prepare the EUT for the SAR test.

- o The client supplied a special driver to program the EUT, allowing it to continually transmit the specified maximum power and change the channel frequency.
- o The output power(dBm) we measured before SAR test in different channel
- o Performing the highest output power channel first
- o SAR test Tip edge and Bottom Flat mode.
- o The distance between WLAN Tx antenna and Right edge is 16cm(higher than 5cm), SAR evaluation for Right edge is not required. The distance between WLAN Tx antenna and Left edge is 10cm(higher than 5cm), SAR evaluation for Left edge is not required. The distance between WLAN Tx antenna and Rear edge is 18cm(higher than 5cm), SAR evaluation for Rear edge is not required.

#### 3.3. Conducted power (Average)

Mode	Channel	Power(dBm)	Note
BLUETOOTH	2402	-6.28	
	2441	-6.01	
	2480	-6.08	
Mode	Channel	Power(dBm)	Note
802.11b	2412	15.57	
	2437	16.40	
	2462	16.97	
Mode	Channel	Power(dBm)	Note
802.11g	2412	19.01	
	2437	19.87	
	2462	20.48	
Mode	Channel	Power(dBm)	Note
802.11g HT20	2412	16.83	
	2437	17.77	
	2462	18.29	



**RF Exposure Assessments:**

- (1) This EUT is a Tablet PC the display size is 26cm (10.23 inch) and less then 12" KDB447498 is applicable for this EUT.
- (2) There are one kinds antennas(WLAN and Bluetooth) build-in this EUT, and can't transmit simultaneous.
- (3) according KDB447498 4) b) iii) 1) WLAN Tx antenna to Tip edge is less than 5cm and the sum of the stand-alone 1-g SAR(0.79W/kg) is less than SAR limit(1.6W/kg).

*Base on (1)~(3) Simultaneous SAR not required.*



### 3.4. Check the position for the worst result

Test mode: 802.11b, Rate:1M, Crest Factor:1, Depth of liquid: 15.0cm						
EUT Position	Antenna	Frequency		Liquid	SAR(1g)	Limit
		Channel	MHz	Temp	(w/kg)	(w/kg)
Bottom Flat	WLAN TX	1	2412	20.0	0.602	1.6
Bottom Flat	WLAN TX	6	2437	20.0	0.609	
Bottom Flat	WLAN TX	11	2462	20.0	0.653	
Tip Edge	WLAN TX	1	2412	20.0	0.661	
Tip Edge	WLAN TX	6	2437	20.0	0.749	
Tip Edge	WLAN TX	11	2462	20.0	0.790	
Test mode: 802.11g, Rate:6M, Crest Factor:1, Depth of liquid: 15.0cm						
Bottom Flat	WLAN TX	1	2412	20.0	0.346	1.6
Bottom Flat	WLAN TX	6	2437	20.0	0.499	
Bottom Flat	WLAN TX	11	2462	20.0	0.555	
Tip Edge	WLAN TX	1	2412	20.0	0.585	
Tip Edge	WLAN TX	6	2437	20.0	0.640	
Tip Edge	WLAN TX	11	2462	20.0	0.716	
Test mode: n HT20,Rate:1M, Crest Factor:1, Depth of liquid: 15.0cm						
Bottom Flat	WLAN TX	1	2412	20.0	0.140	1.6
Bottom Flat	WLAN TX	6	2437	20.0	0.189	
Bottom Flat	WLAN TX	11	2462	20.0	0.227	
Tip Edge	WLAN TX	1	2412	20.0	0.229	
Tip Edge	WLAN TX	6	2437	20.0	0.241	
Tip Edge	WLAN TX	11	2462	20.0	0.266	



### 3.5. Measurement Position

EUT Orientation A of Bottom Flat



EUT Orientation B of Tip Edge







## **4. The Description of Test Procedure for FCC**

### **4.1. Scan Procedure**

First coarse scans were used for determination of the field distribution. Next a cube scan, 5x5x7 points covering a volume of 32x32x30mm was performed around the highest E-field value to determine the averaged SAR value. Drift was determined by measuring the same point at the start of the coarse scan and again at the end of the cube scan.

### **4.2. SAR Averaging Methods**

The maximum SAR value was averaged over a cube of tissue using interpolation and extrapolation. The interpolation, extrapolation and maximum search routines within ALSAS-10-U are all based on the modified Quadratic Shepard's method (Robert J. Renka, "Multivariate Interpolation Of Lagre Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).

The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighbouring points by a least-square method. For the cube scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics. In the cube scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

### **4.3. Data Storage**

The ALSAS-10-U software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension .DA4. The post processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings.

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



#### 4.4. Data Evaluation

The DASY4 postprocessing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	$Norm_i, a_{i0}, a_{i1}, a_{i2}$
	- Conversion factor	$ConvF_i$
	- Diode compression point	$dcp_i$
Device parameters:	- Frequency	$f$
	- Crest factor	$cf$
Media parameters:	- Conductivity	$\sigma$
	- Density	$\rho$

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

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

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

with $V_i$	= compensated signal of channel i	(i = x, y, z)
$U_i$	= input signal of channel i	(i = x, y, z)
$cf$	= crest factor of exciting field	(DASY parameter)
$dcp_i$	= diode compression point	(DASY parameter)

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

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

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





with  $V_i$  = compensated signal of channel i (i = x, y, z)  
 $Norm_i$  = sensor sensitivity of channel i (i = x, y, z)  
 $\mu V/(V/m)^2$  for E-field Probes  
 $ConvF$  = sensitivity enhancement in solution  
 $a_{ij}$  = sensor sensitivity factors for H-field probes  
 $f$  = carrier frequency [GHz]  
 $E_i$  = electric field strength of channel i in V/m  
 $H_i$  = magnetic field strength of channel i in A/m

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

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

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

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

with  $SAR$  = local specific absorption rate in mW/g  
 $E_{tot}$  = total field strength in V/m  
 $\sigma$  = conductivity in [mho/m] or [Siemens/m]  
 $\rho$  = equivalent tissue density in g/cm<sup>3</sup>

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.



## 5. Measurement Uncertainty

### Exposure Assessment Measurement Uncertainty

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	$c_i^1$ (1-g)	$c_i^1$ (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech.	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
Restriction							
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test Sample Positioning	4.0	normal	1	1	1	4.0	4.0
Device Holder Uncertainty	2.0	normal	1	1	1	2.0	2.0
Drift of Output Power	0.6	rectangular	$\sqrt{3}$	1	1	0.3	0.3
Phantom and Setup							
Phantom Uncertainty(shape & thickness tolerance)	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
Liquid Conductivity(target)	5.0	rectangular	$\sqrt{3}$	0.7	0.5	2.0	1.4
Liquid Conductivity(meas.)	0.0	normal	1	0.7	0.5	0.0	0.0
Liquid Permittivity(target)	5.0	rectangular	$\sqrt{3}$	0.6	0.5	1.7	1.4
Liquid	2.4	normal	1	0.6	0.5	1.4	1.2



Permittivity(meas.)							
Combined Uncertainty		RSS				9.3	9.2
Combined Uncertainty (coverage factor=2)		Normal (k=2)				18.7	18.3



## 6. Reference

### 1. [ANSI/IEEE C95.1-1992]

Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. The Institute of Electrical and Electronics Engineers, Inc. (IEEE), 1992.

### 2. [ANSI/IEEE C95.3-1992]

Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave". The Institute of Electrical and Electronics Engineers, Inc. (IEEE), 1992.

### 3. [FCC Report and Order 96-326]

Federal Communications Commission, "Report and order: Guidelines for evaluating the environmental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, 1996.

### 4. [FCC OET Bulletin 65]

Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. OET Bulletin 65 Edition 97-01, August 1997. Federal Communications Commission (FCC), Office of Engineering & Technology. (OET)

### 5. [FCC OET Bulletin 65 Supplement C]

Additional Information for Evaluating Compliance of Mobile and Portable Device with FCC Limits for Human Exposure to Radiofrequency Emissions. Supplement C (Edition 01-01) to OET Bulletin 65, June 2001. Federal Communications Commission (FCC), Office of Engineering & Technology. (OET)

### 6. [ALSAS-10-U 4]

Schmid & Partner Engineering AG: ALSAS-10-U 4 Manual, September 2005.

### 7. [IEEE 1528-2003]

IEEE Std 1528-2003: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques. 1528-2003, 19<sup>th</sup> December, 2003, The Institute of Electrical and Electronics Engineers, Inc. (IEEE).

### 8. [RSS-102, Issue 2]

Radio Standards Specification 102, Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) sets out the requirements and measurement techniques used to evaluate radio frequency (RF) exposure compliance of radiocommunication apparatus designed to be used within the vicinity of the human body. November, 2005. Industry Canada.

### 9. [Health Canada Safety Code 6]

Canada's Safety Code 6: Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3Khz to 300Ghz (99-EHD-237).

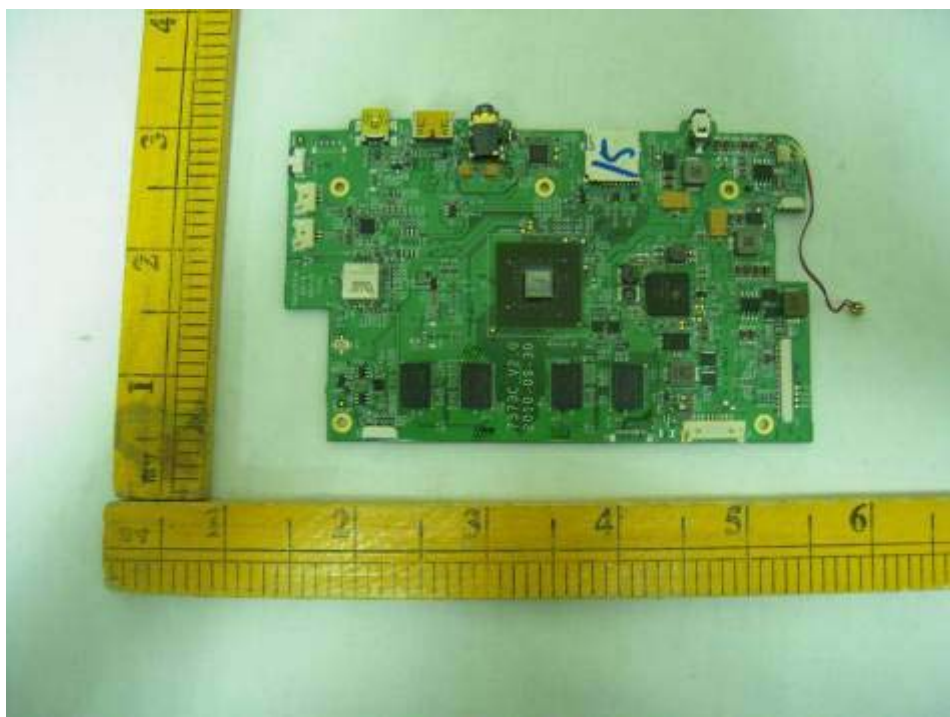


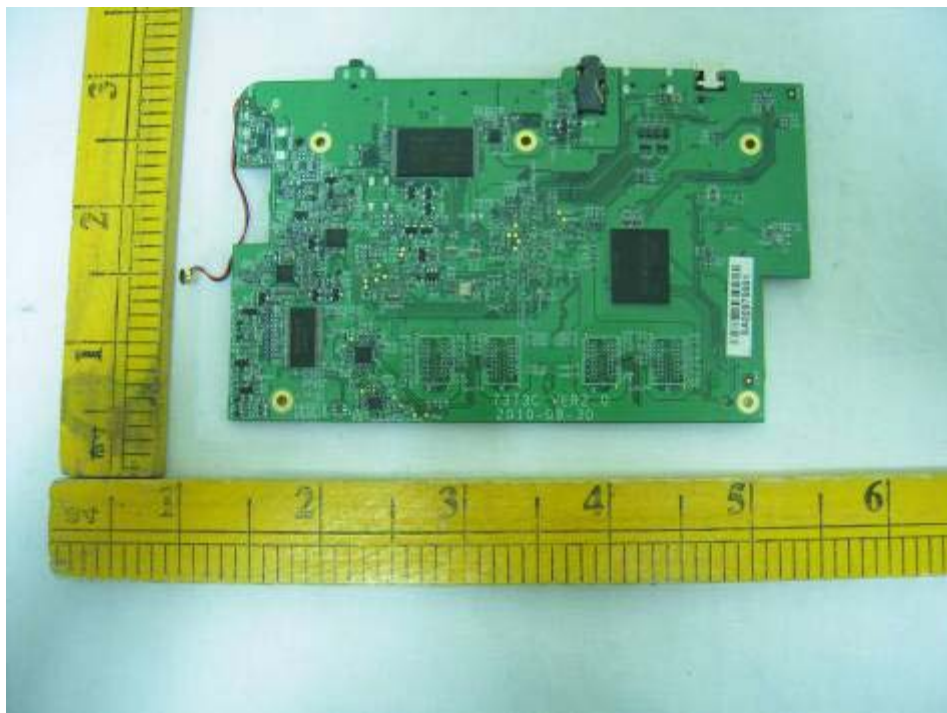
## 7. APPENDIX A PHOTOGRAPHS of EUT

















## 8. APPENDIX B SYSTEM PERFORMANCE CHECK PLOT

### SAR Test Report

Report Date : 16-NOV-2010  
By Operator : 123  
Measurement Date : 16-NOV-2010  
Starting Time : 16-NOV-2010 03:27:27 PM  
End Time : 16-NOV-2010 03:43:06 PM  
Scanning Time : 939 secs

#### Product Data

Device Name : Dipole-2450  
Serial No. : ALS-D-2450-S-2  
Type : Dipole  
Model : 1  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 13 min(s)  
Length : 3.6 mm  
Width : 54 mm  
Depth : 3.6 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 6.667 W/kg  
Power Drift-Finish: 6.488 W/kg  
Power Drift (%) : -2.685  
Picture :

#### Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni



Tissue Data

Type : HEAD  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 37.60 F/m  
Sigma : 1.79 S/m  
Density : 1000.00 kg/cu. m

Probe Data

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data

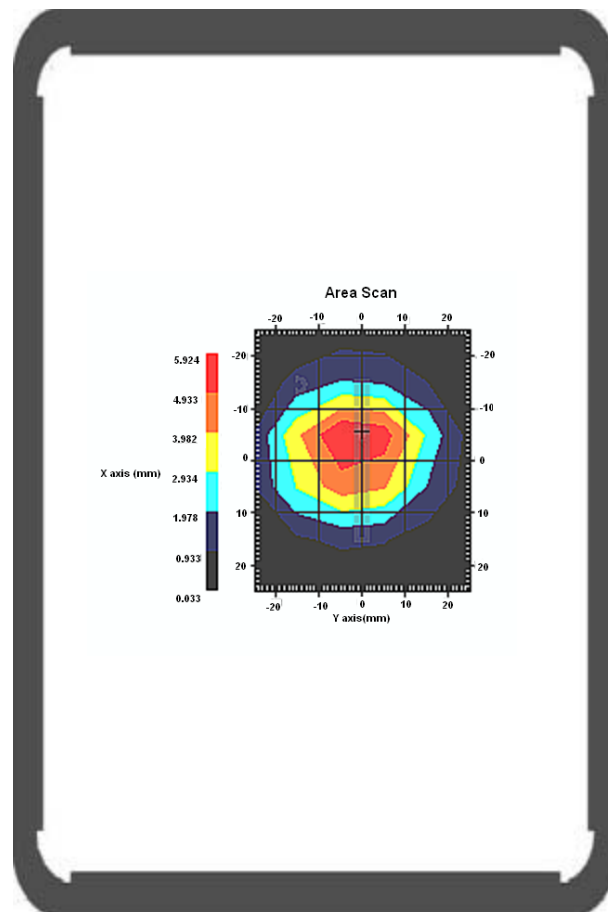
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-NOV-2010  
Set-up Time : 3:10:51 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data

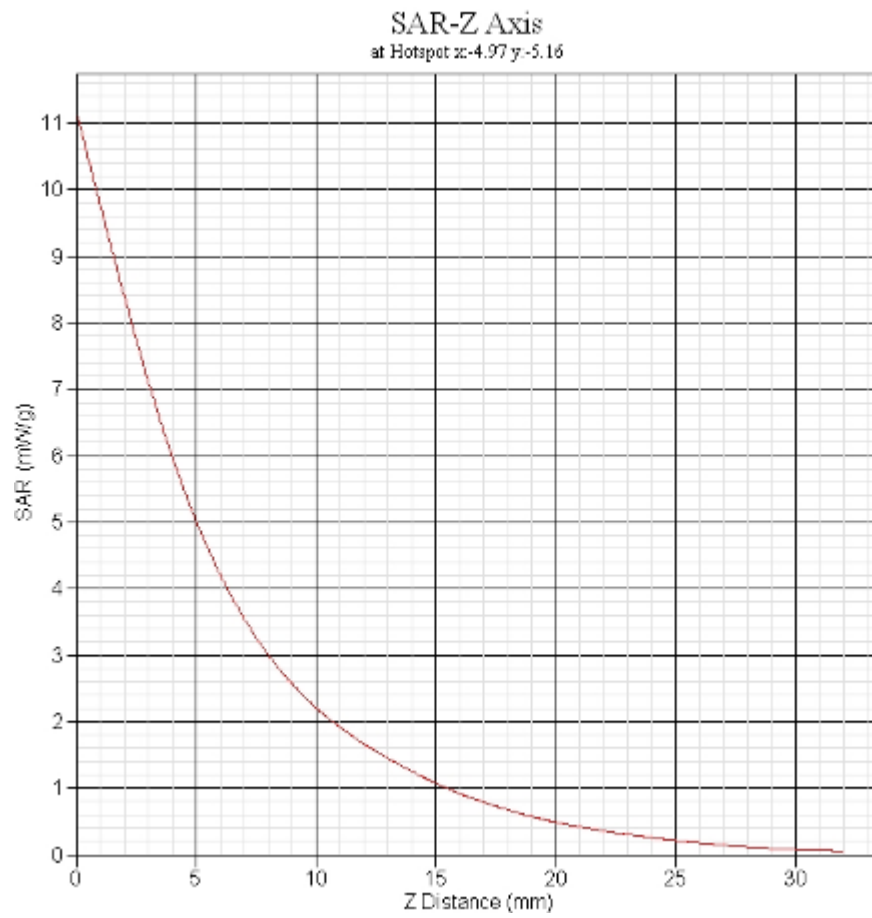
DUT Position : Touch



Separation : 0  
Channel : Mid



1 gram SAR value : 5.268 W/kg  
10 gram SAR value : 2.379 W/kg  
Area Scan Peak SAR : 5.925 W/kg  
Zoom Scan Peak SAR : 11.190 W/kg





## 9. APPENDIX C SAR TEST PLOT

### SAR Test Report

802.11b bottom low

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 09:19:34 AM  
End Time : 16-Nov-2010 09:34:42 AM  
Scanning Time : 908 secs

#### Product Data

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.392 W/kg  
Power Drift-Finish: 0.546 W/kg  
Power Drift (%) : 3.279  
Picture :

#### Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

#### Tissue Data

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

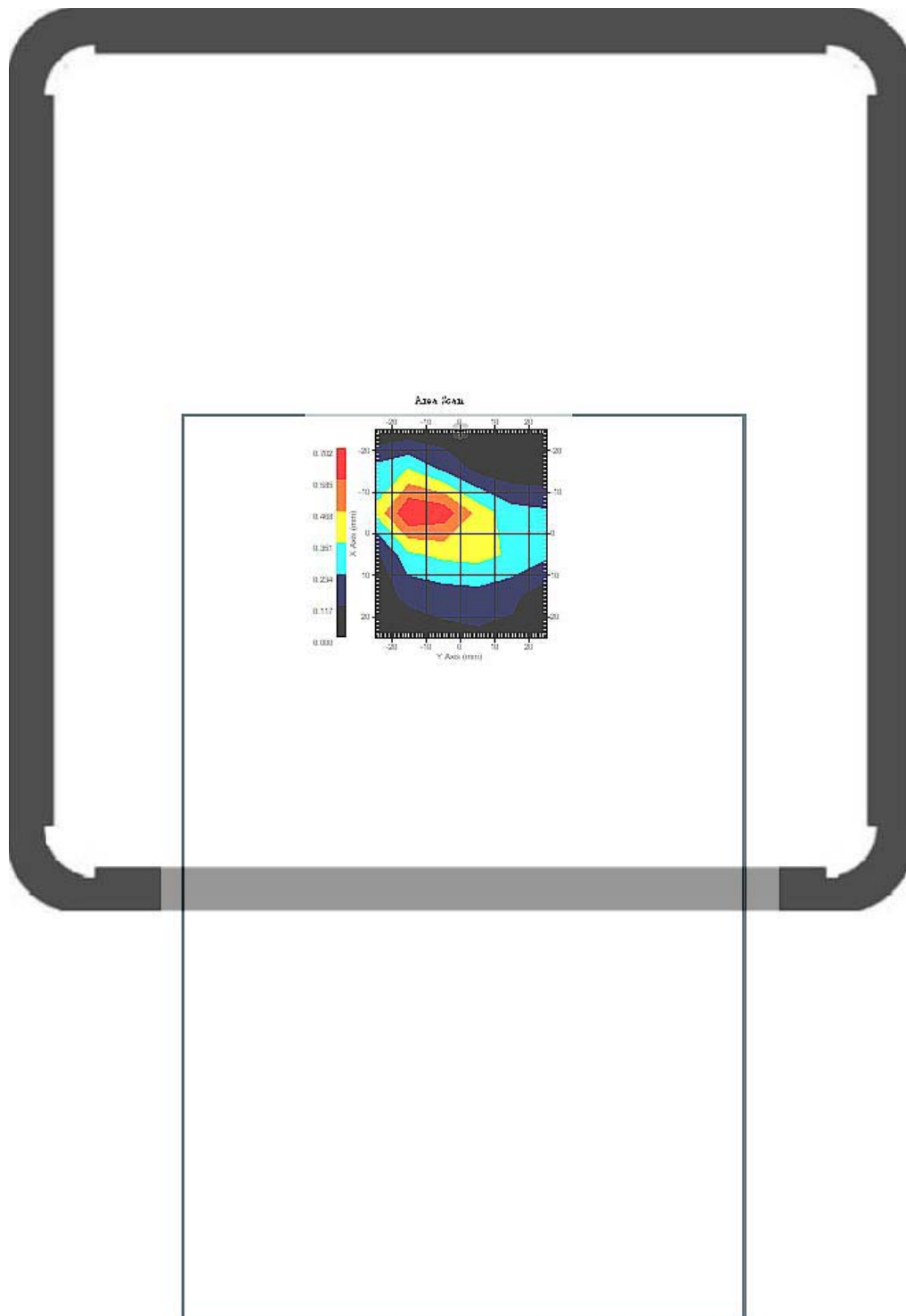
Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 9:19:30 AM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

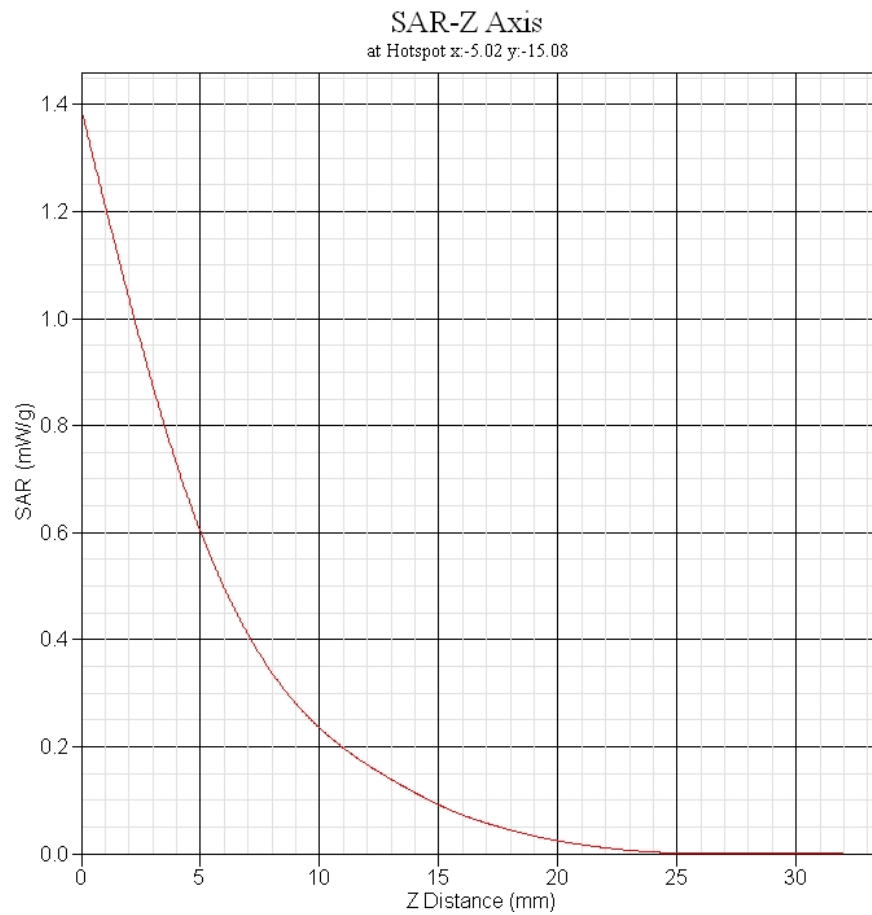
Other Data

DUT Position : Touch  
Separation : 0  
Channel : Low





1 gram SAR value : 0.602 W/kg  
10 gram SAR value : 0.246 W/kg  
Area Scan Peak SAR : 0.700 W/kg  
Zoom Scan Peak SAR : 1.391 W/kg





802.11b bottom mid

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 09:43:25 AM  
End Time : 16-Nov-2010 09:59:06 AM  
Scanning Time : 941 secs

Product Data

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.596 W/kg  
Power Drift-Finish: 0.634 W/kg  
Power Drift (%) : 6.378  
Picture :

Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

Tissue Data

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

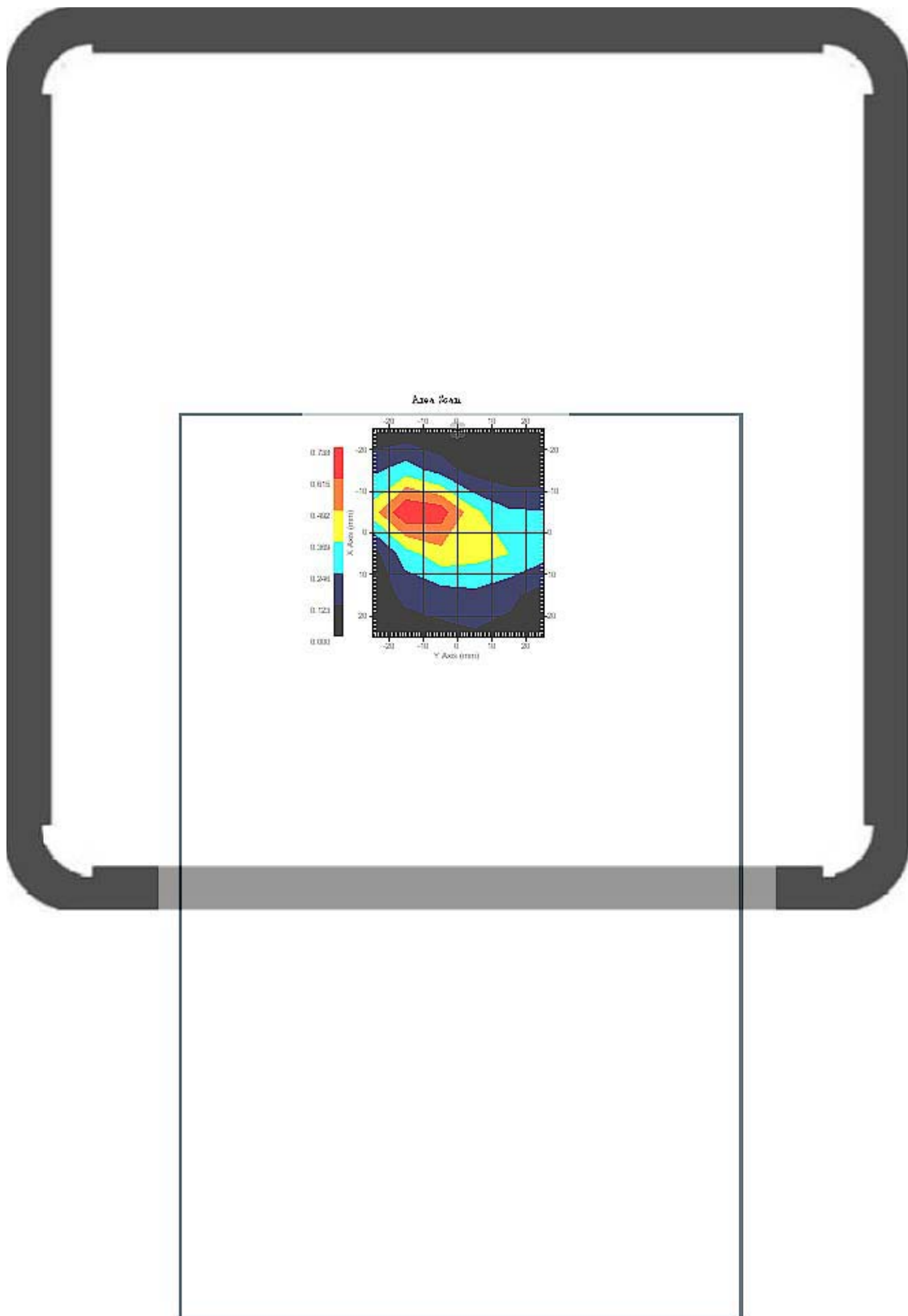
Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 9:42:52 AM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

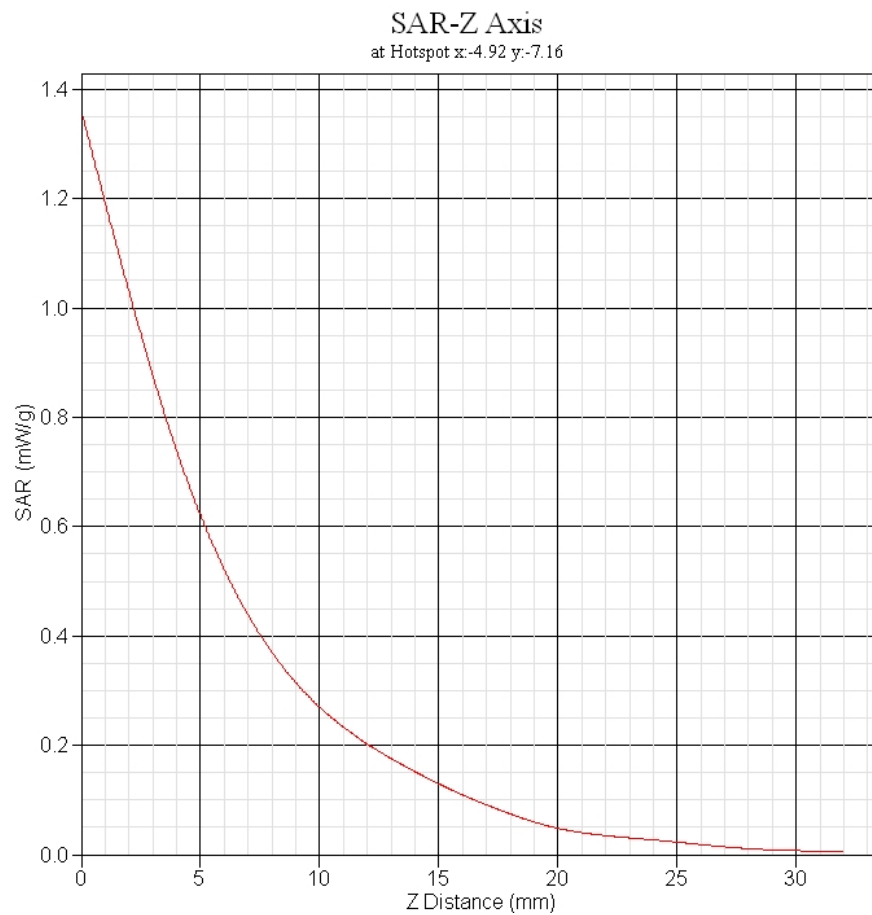
Other Data

DUT Position : Touch  
Separation : 0  
Channel : Mid





1 gram SAR value : 0.609 W/kg  
10 gram SAR value : 0.249 W/kg  
Area Scan Peak SAR : 0.737 W/kg  
Zoom Scan Peak SAR : 1.361 W/kg





802.11b bottom high

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 10:20:43 AM  
End Time : 16-Nov-2010 10:36:03 AM  
Scanning Time : 920 secs

Product Data

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.717 W/kg  
Power Drift-Finish: 0.741 W/kg  
Power Drift (%) : 3.328  
Picture :

Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

Tissue Data

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

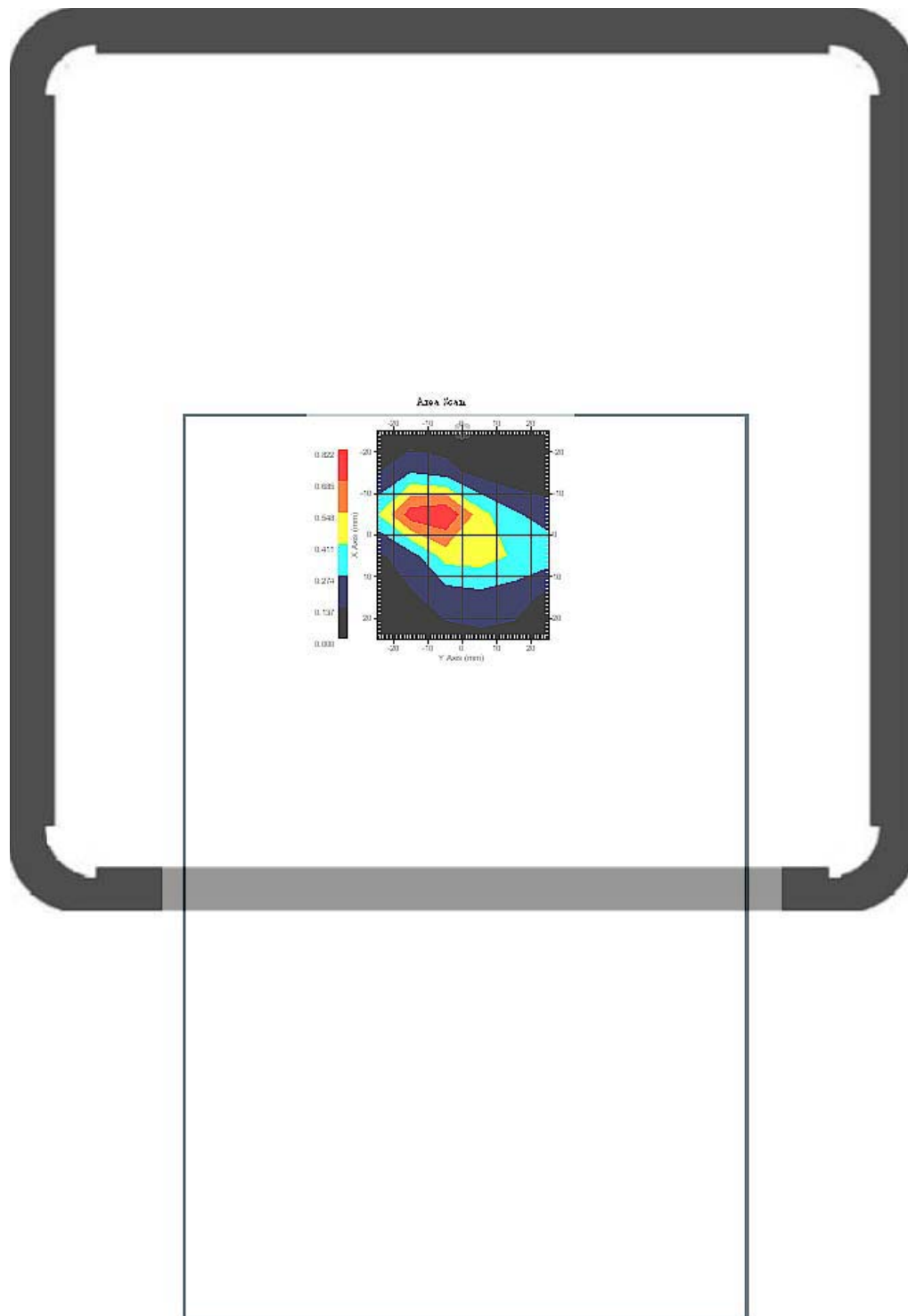
Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 10:20:39 AM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

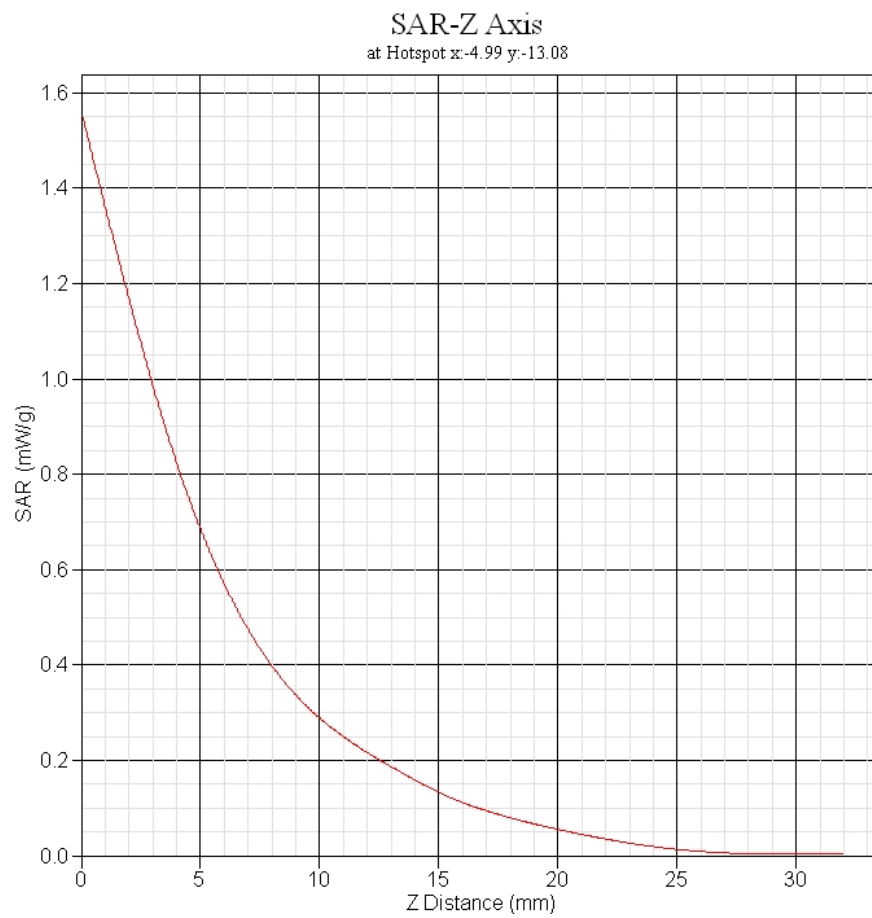
Other Data

DUT Position : Touch  
Separation : 0  
Channel : High





1 gram SAR value : 0.653 W/kg  
10 gram SAR value : 0.255 W/kg  
Area Scan Peak SAR : 0.819 W/kg  
Zoom Scan Peak SAR : 1.561 W/kg





802.11b tip edge low

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 04:59:51 PM  
End Time : 16-Nov-2010 05:15:21 PM  
Scanning Time : 930 secs

Product Data

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.499 W/kg  
Power Drift-Finish: 0.495 W/kg  
Power Drift (%) : -0.803  
Picture :

Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

Tissue Data

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

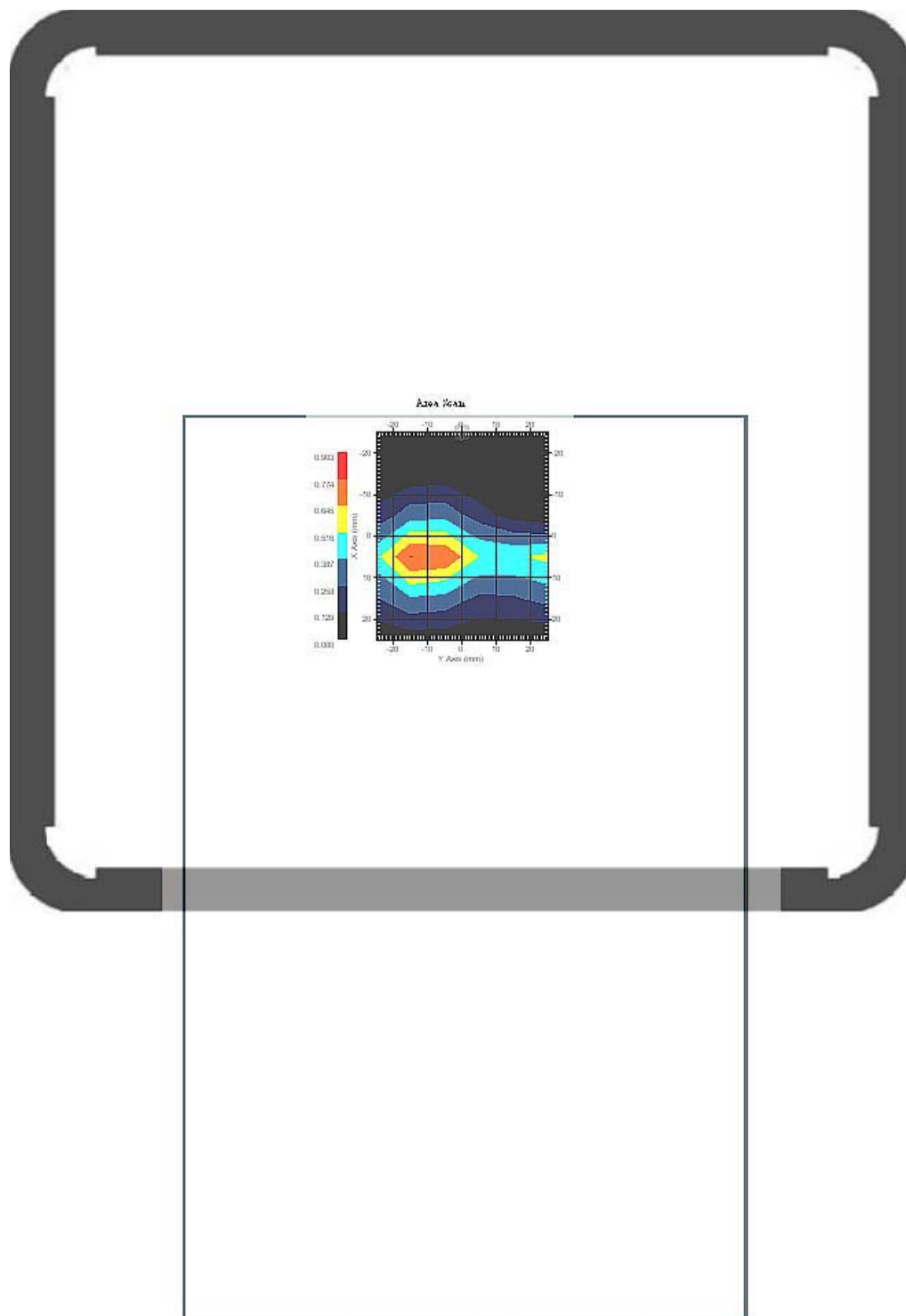
Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data

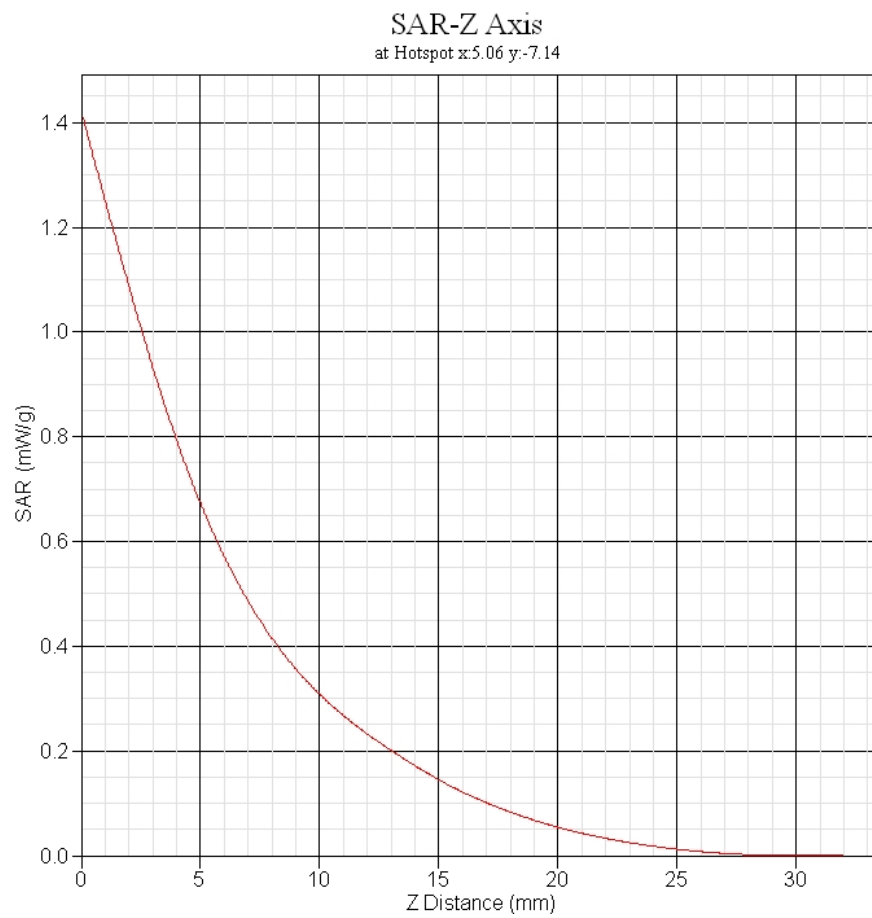
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 4:59:47 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data

DUT Position : Touch  
Separation : 0  
Channel : Low



1 gram SAR value : 0.661 W/kg  
10 gram SAR value : 0.274 W/kg  
Area Scan Peak SAR : 0.775 W/kg  
Zoom Scan Peak SAR : 1.421 W/kg





802.11b tip edge mid

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 05:19:47 PM  
End Time : 16-Nov-2010 05:35:24 PM  
Scanning Time : 937 secs

Product Data

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.543 W/kg  
Power Drift-Finish: 0.544 W/kg  
Power Drift (%) : 0.059  
Picture :

Phantom Data

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

Tissue Data

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

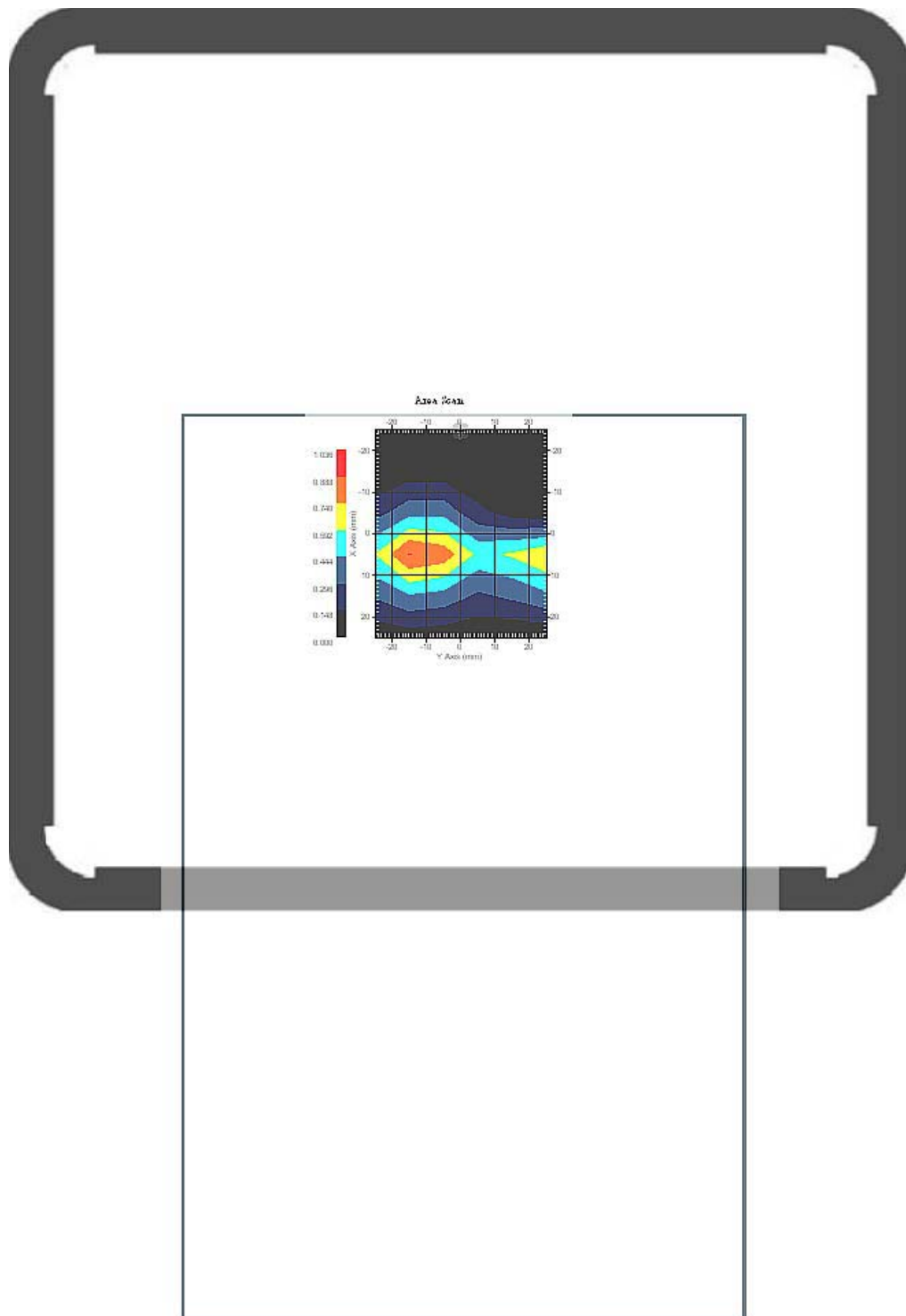
Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 5:19:43 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

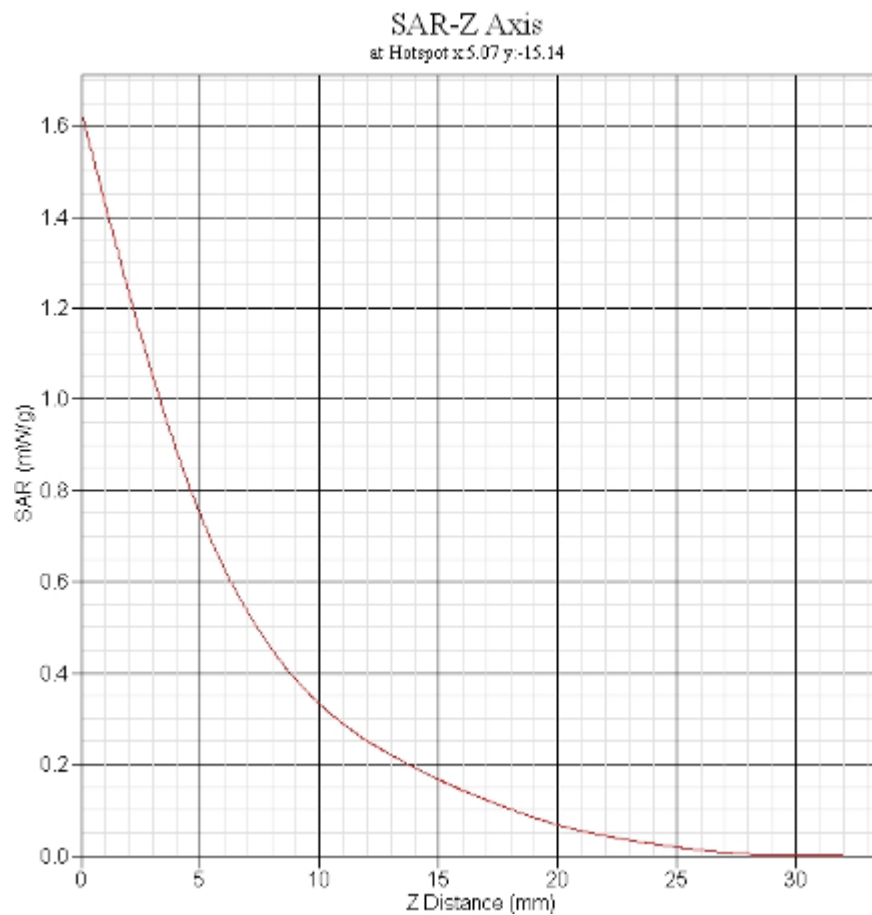
Other Data

DUT Position : Touch  
Separation : 0  
Channel : Mid





1 gram SAR value : 0.749 W/kg  
10 gram SAR value : 0.322 W/kg  
Area Scan Peak SAR : 0.891 W/kg  
Zoom Scan Peak SAR : 1.631 W/kg





802.11b tip edge high

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 05:44:44 PM  
End Time : 16-Nov-2010 06:00:24 PM  
Scanning Time : 940 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.514 W/kg  
Power Drift-Finish: 0.540 W/kg  
Power Drift (%) : 4.977  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m

**Probe Data**

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV



Offset : 1.56 mm

**Measurement Data**

Crest Factor : 1

Scan Type : Complete

Tissue Temp. : 20.00 °C

Ambient Temp. : 20.00 °C

Set-up Date : 16-Nov-2010

Set-up Time : 5:44:40 PM

Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm

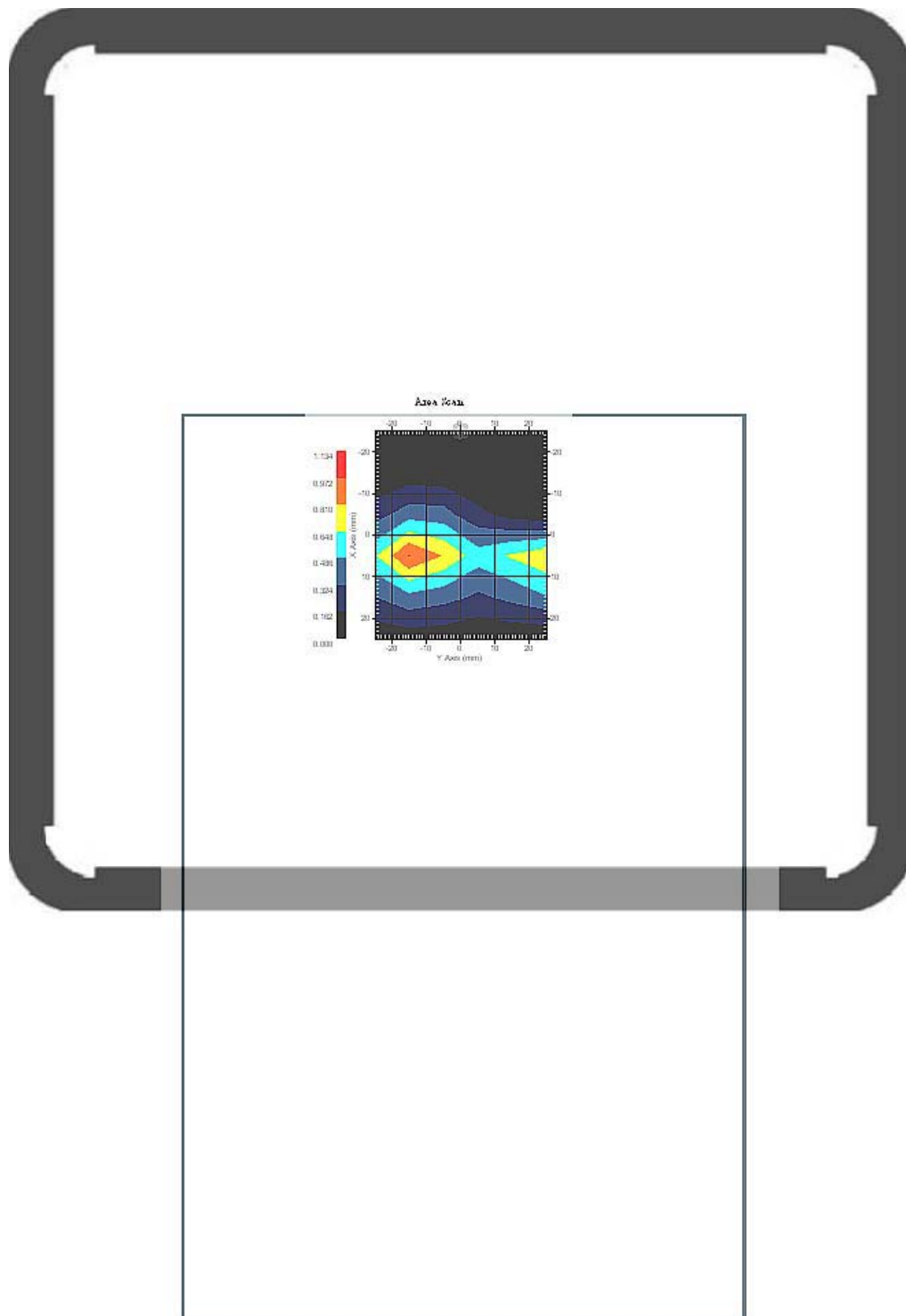
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

**Other Data**

DUT Position : Touch

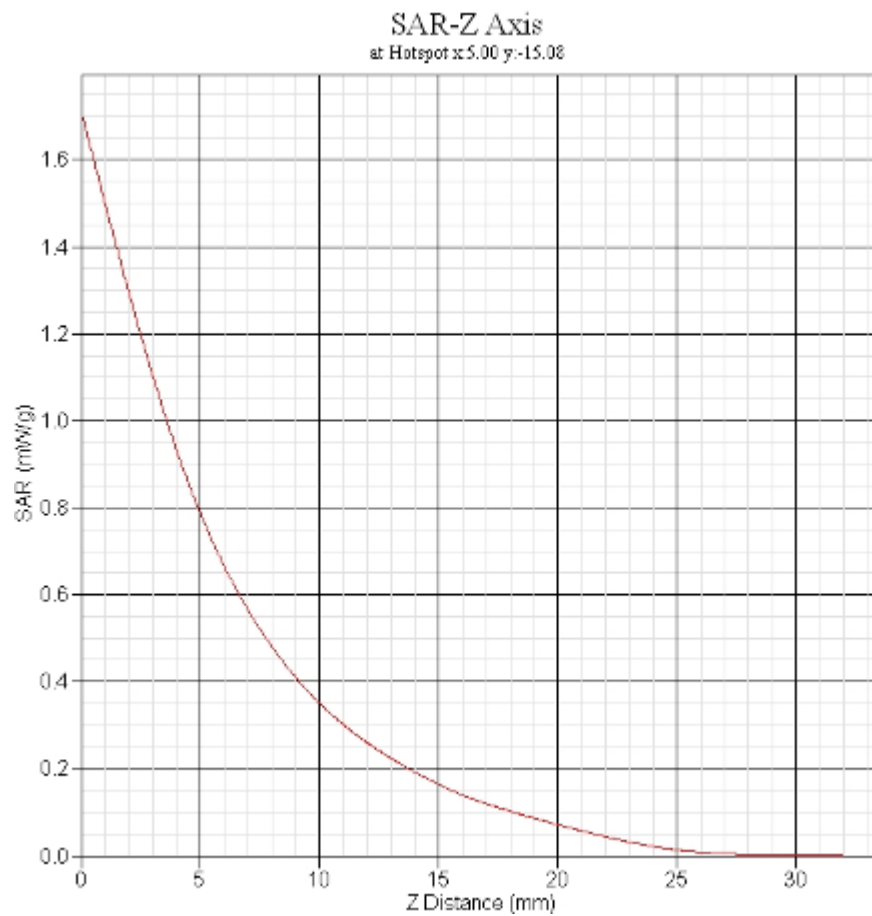
Separation : 0

Channel : High





1 gram SAR value : 0.790 W/kg  
10 gram SAR value : 0.340 W/kg  
Area Scan Peak SAR : 0.974 W/kg  
Zoom Scan Peak SAR : 1.711 W/kg





802.11g bottom low

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 10:44:52 AM  
End Time : 16-Nov-2010 11:00:28 AM  
Scanning Time : 936 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.417 W/kg  
Power Drift-Finish: 0.396 W/kg  
Power Drift (%) : -5.029  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

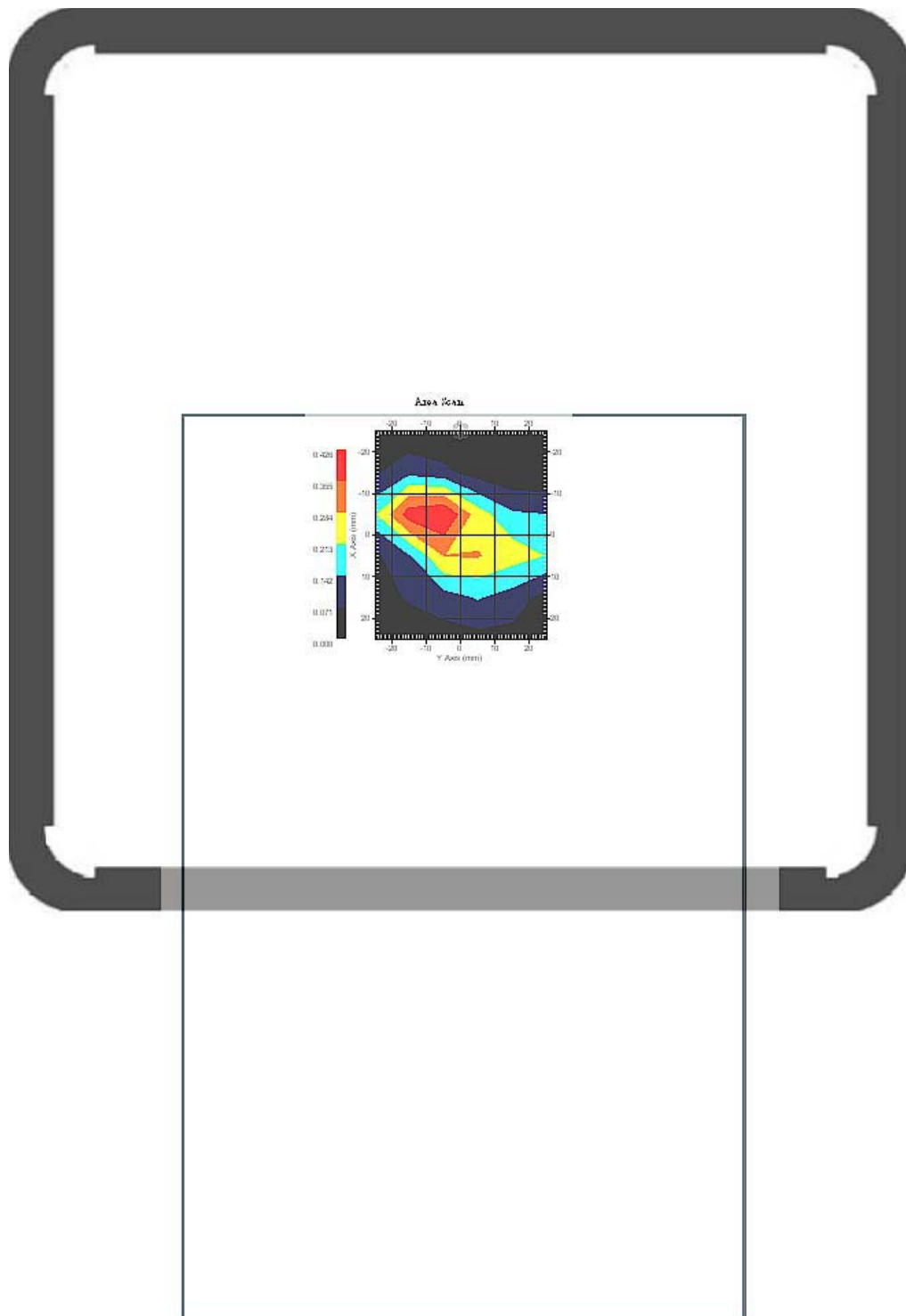
Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 10:44:48 AM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data

DUT Position : Touch  
Separation : 0  
Channel : Low



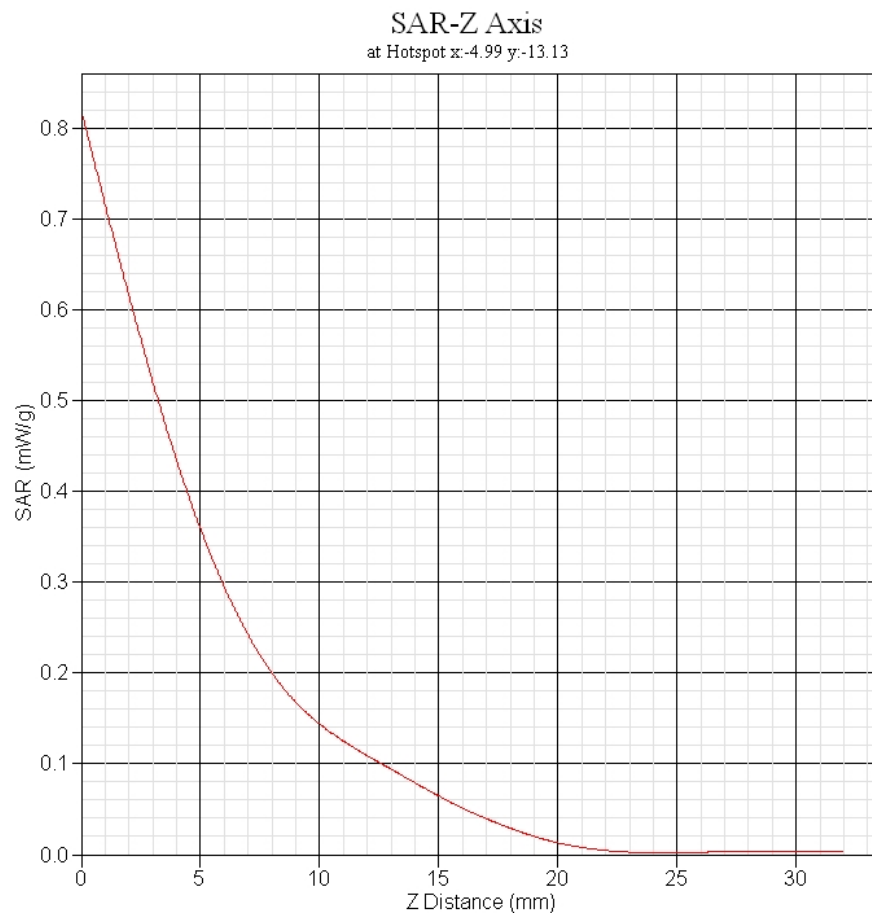


1 gram SAR value : 0.346 W/kg

10 gram SAR value : 0.135 W/kg

Area Scan Peak SAR : 0.426 W/kg

Zoom Scan Peak SAR : 0.820 W/kg





802.11g bottom mid

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 11:11:25 AM  
End Time : 16-Nov-2010 11:27:27 AM  
Scanning Time : 962 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.595 W/kg  
Power Drift-Finish: 0.603 W/kg  
Power Drift (%) : 1.244  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

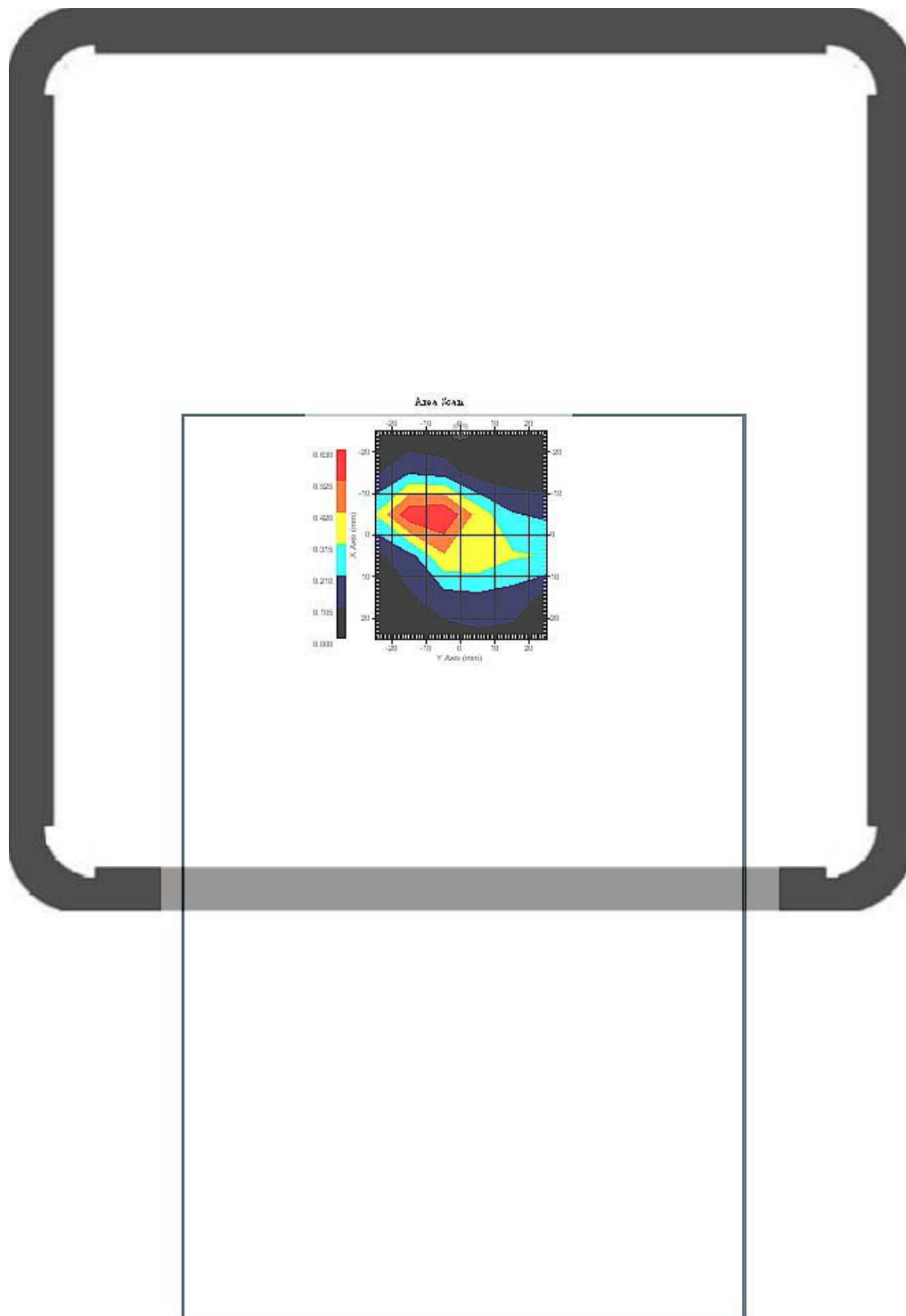
Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data

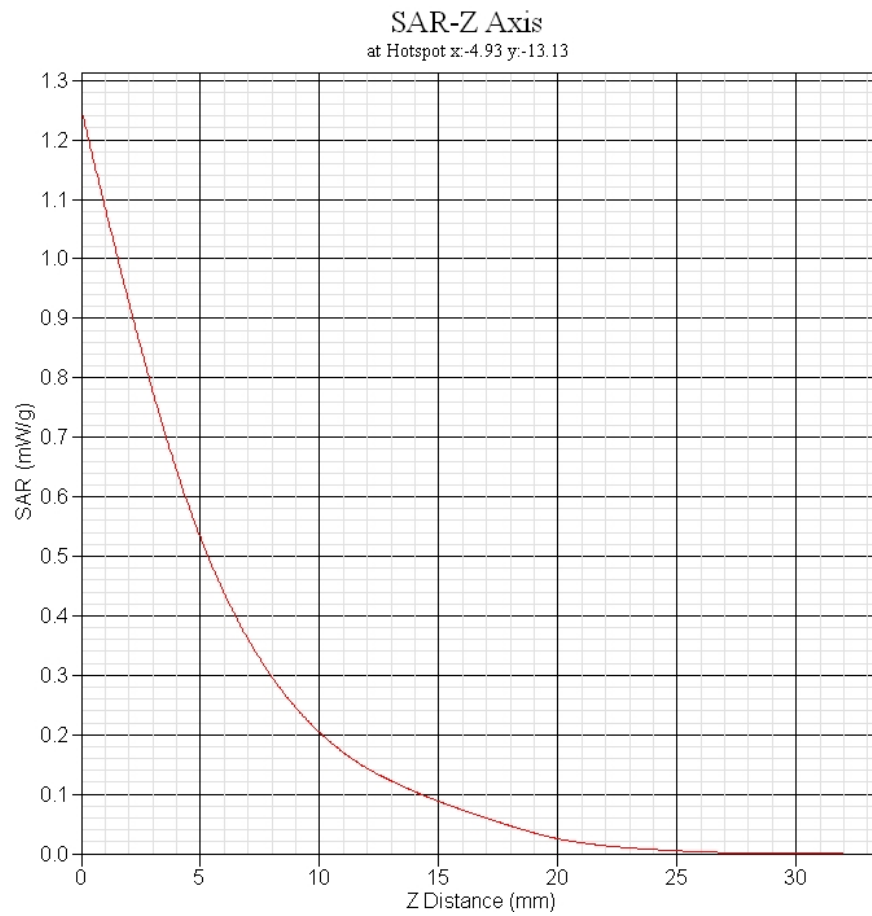
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 11:11:21 AM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data

DUT Position : Touch  
Separation : 0  
Channel : Mid



1 gram SAR value : 0.499 W/kg  
10 gram SAR value : 0.189 W/kg  
Area Scan Peak SAR : 0.629 W/kg  
Zoom Scan Peak SAR : 1.251 W/kg





802.11g bottom high

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 11:35:51 AM  
End Time : 16-Nov-2010 11:51:47 AM  
Scanning Time : 956 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.580 W/kg  
Power Drift-Finish: 0.630 W/kg  
Power Drift (%) : 8.708  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



**Probe Data**

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

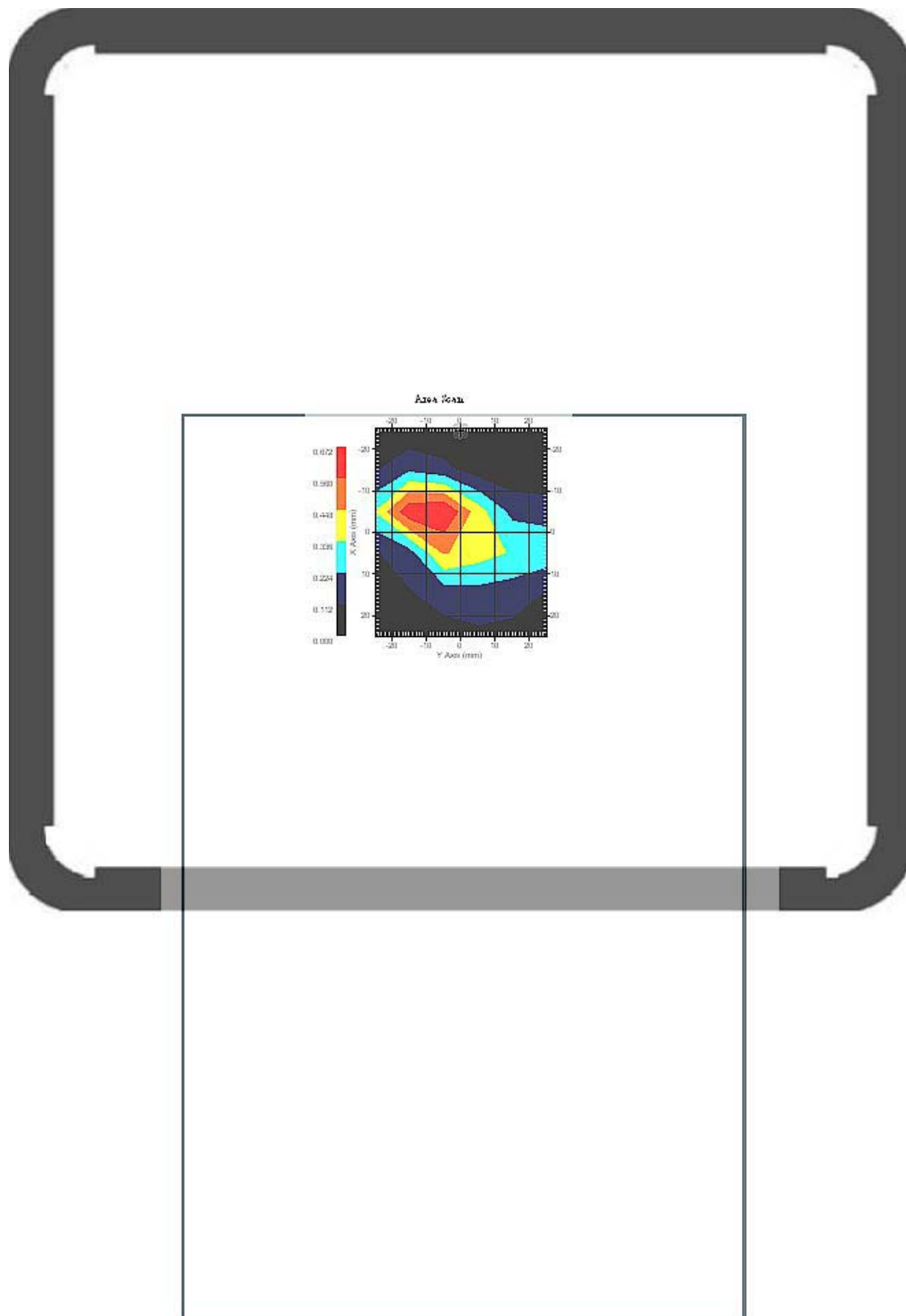
**Measurement Data**

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 11:35:47 AM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

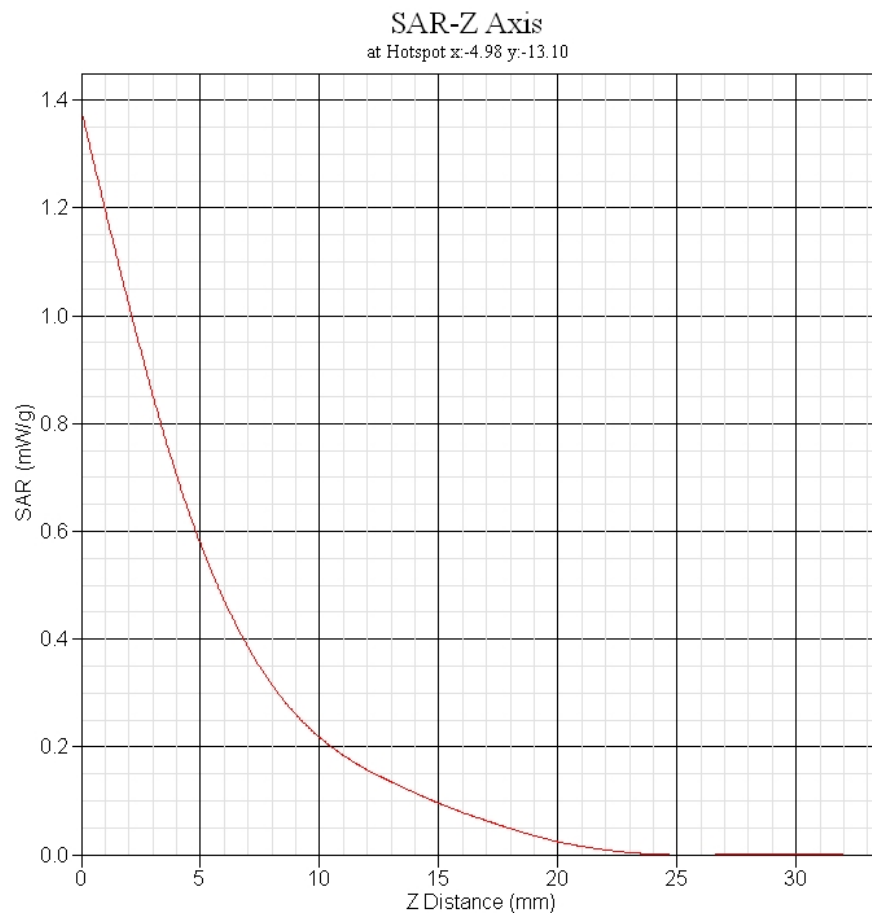
**Other Data**

DUT Position : Touch  
Separation : 0  
Channel : High





1 gram SAR value : 0.555 W/kg  
10 gram SAR value : 0.211 W/kg  
Area Scan Peak SAR : 0.672 W/kg  
Zoom Scan Peak SAR : 1.381 W/kg





802.11g tip edge low

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 03:54:38 PM  
End Time : 16-Nov-2010 04:10:01 PM  
Scanning Time : 923 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.441 W/kg  
Power Drift-Finish: 0.457 W/kg  
Power Drift (%) : 3.638  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

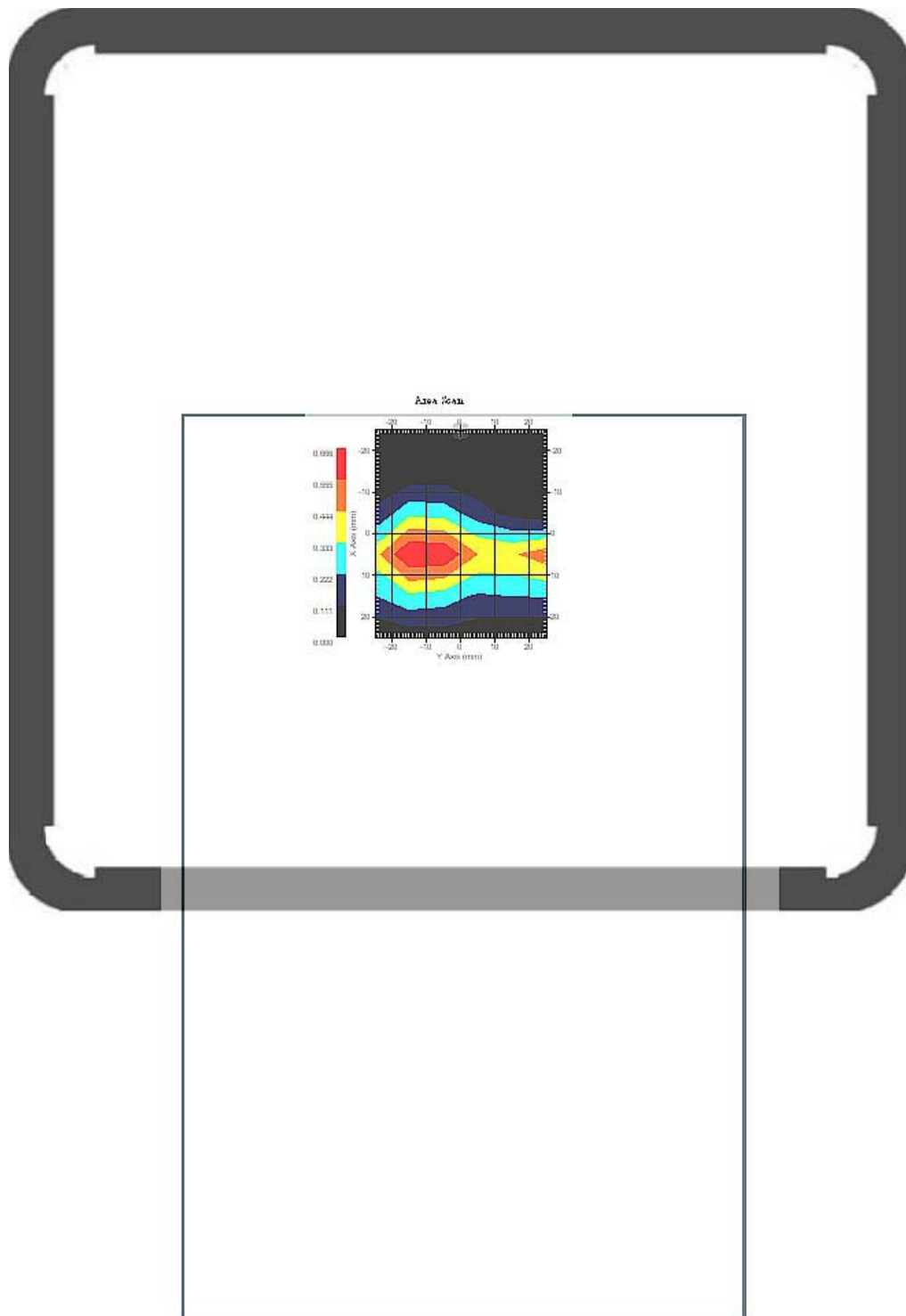
Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data

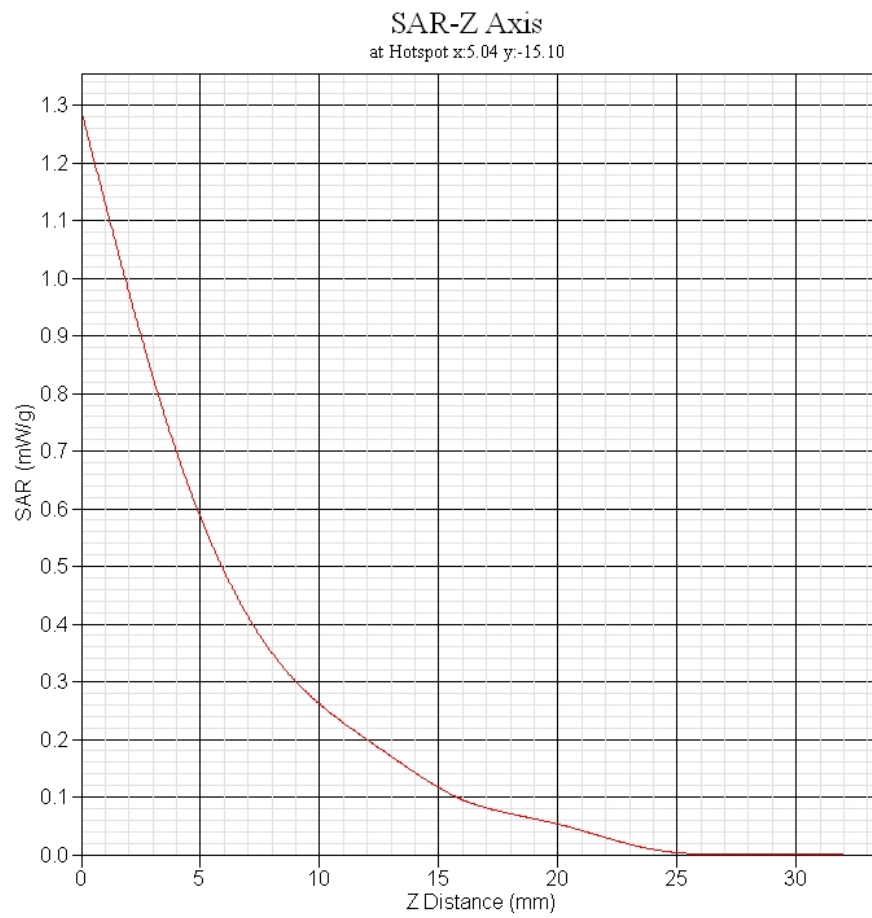
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 3:54:34 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data

DUT Position : Touch  
Separation : 0  
Channel : Low



1 gram SAR value : 0.585 W/kg  
10 gram SAR value : 0.249 W/kg  
Area Scan Peak SAR : 0.666 W/kg  
Zoom Scan Peak SAR : 1.291 W/kg





802.11g tip edge mid

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 04:14:54 PM  
End Time : 16-Nov-2010 04:30:35 PM  
Scanning Time : 941 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.486 W/kg  
Power Drift-Finish: 0.460 W/kg  
Power Drift (%) : -5.331  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

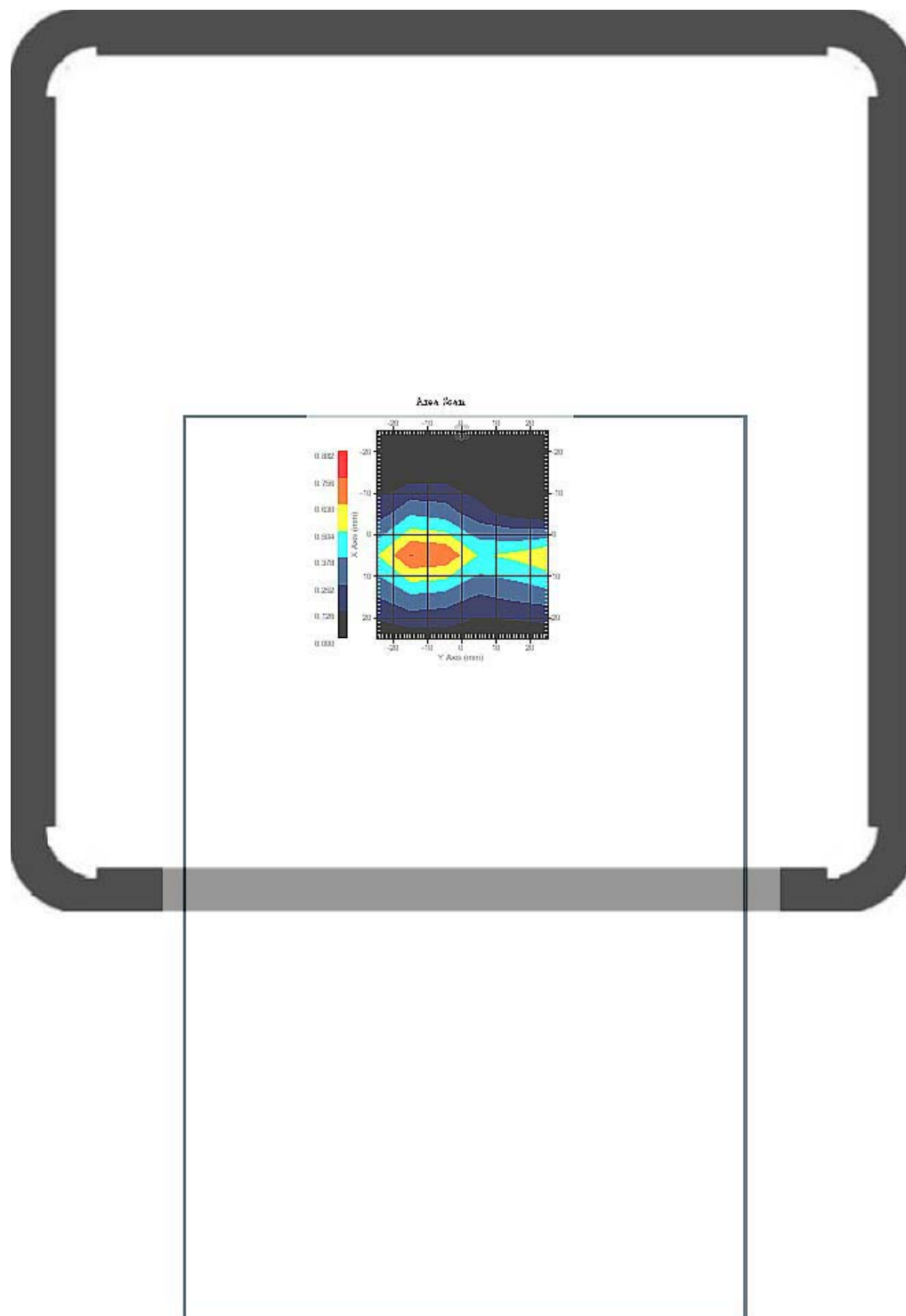
Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 4:14:50 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

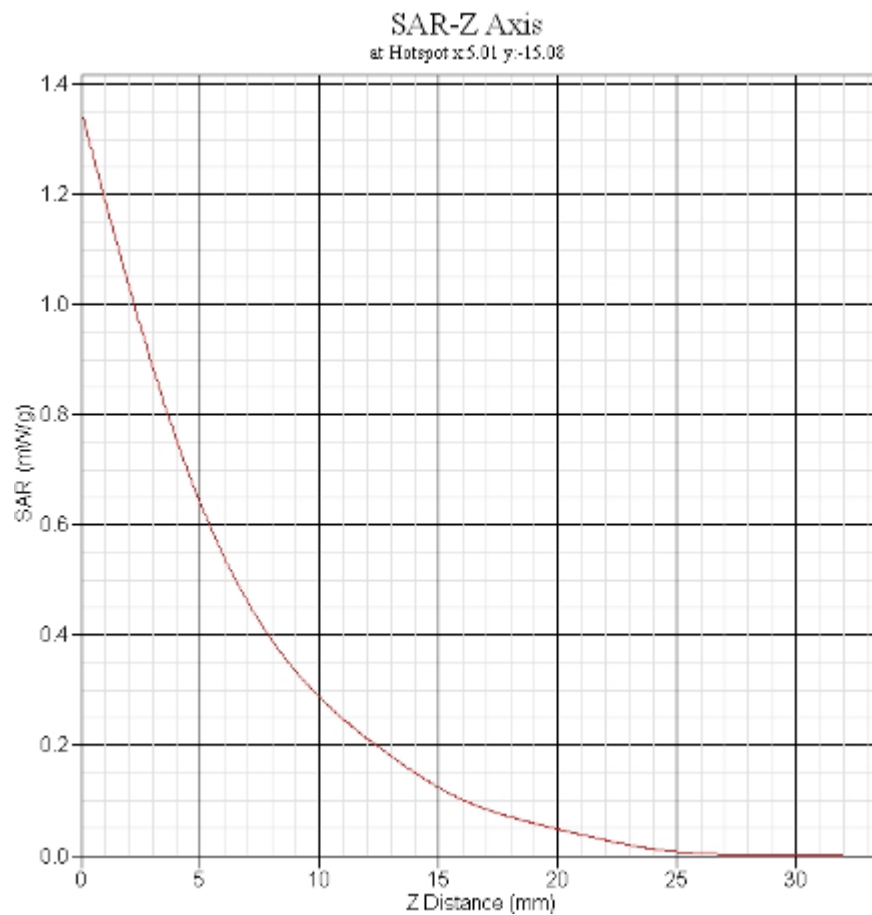
Other Data

DUT Position : Touch  
Separation : 0  
Channel : Mid





1 gram SAR value : 0.640 W/kg  
10 gram SAR value : 0.275 W/kg  
Area Scan Peak SAR : 0.757 W/kg  
Zoom Scan Peak SAR : 1.351 W/kg





802.11g tip edge high

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 04:41:45 PM  
End Time : 16-Nov-2010 04:57:13 PM  
Scanning Time : 928 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.500 W/kg  
Power Drift-Finish: 0.503 W/kg  
Power Drift (%) : 0.683  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

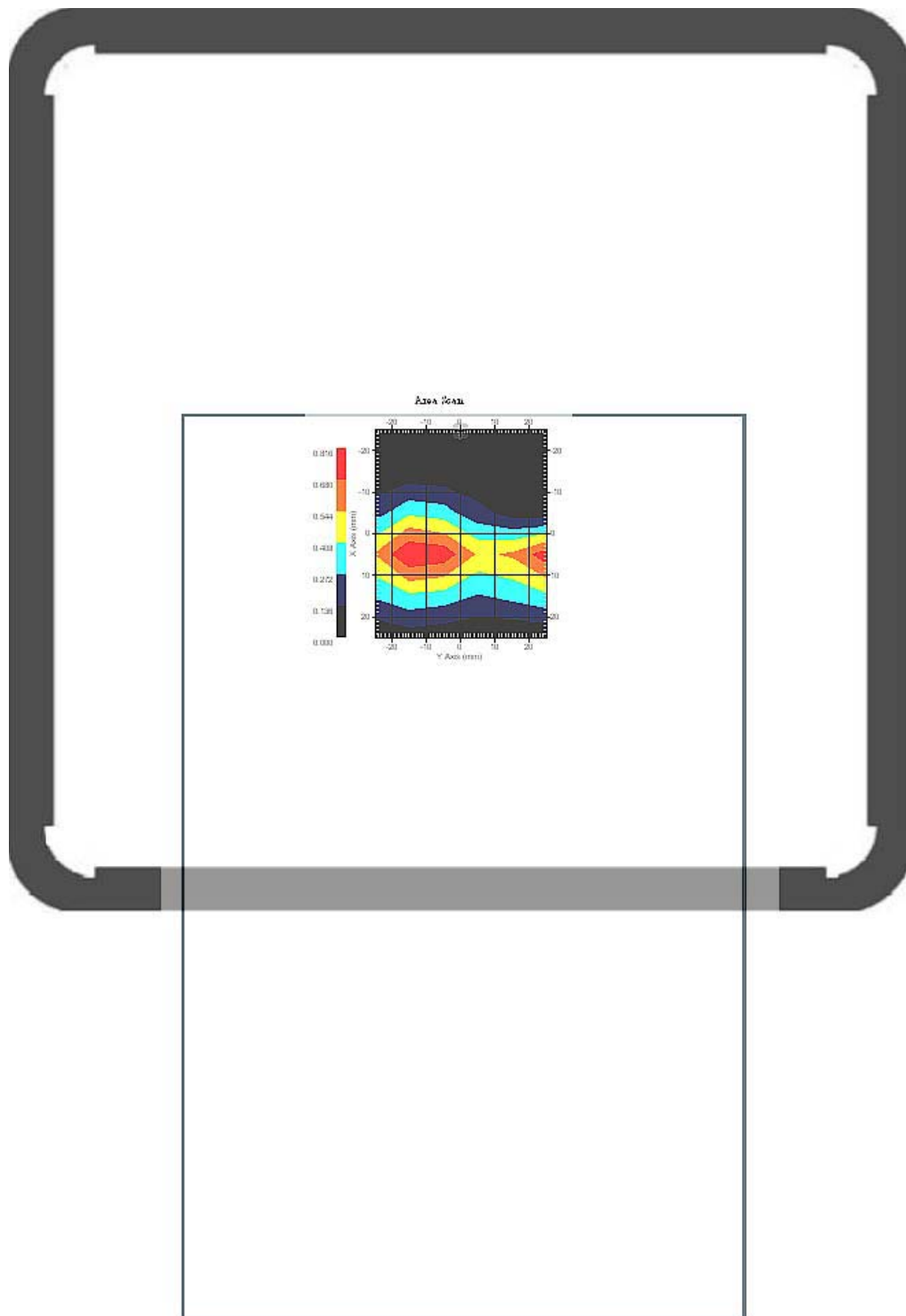
Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 4:41:41 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data

DUT Position : Touch  
Separation : 0  
Channel : High

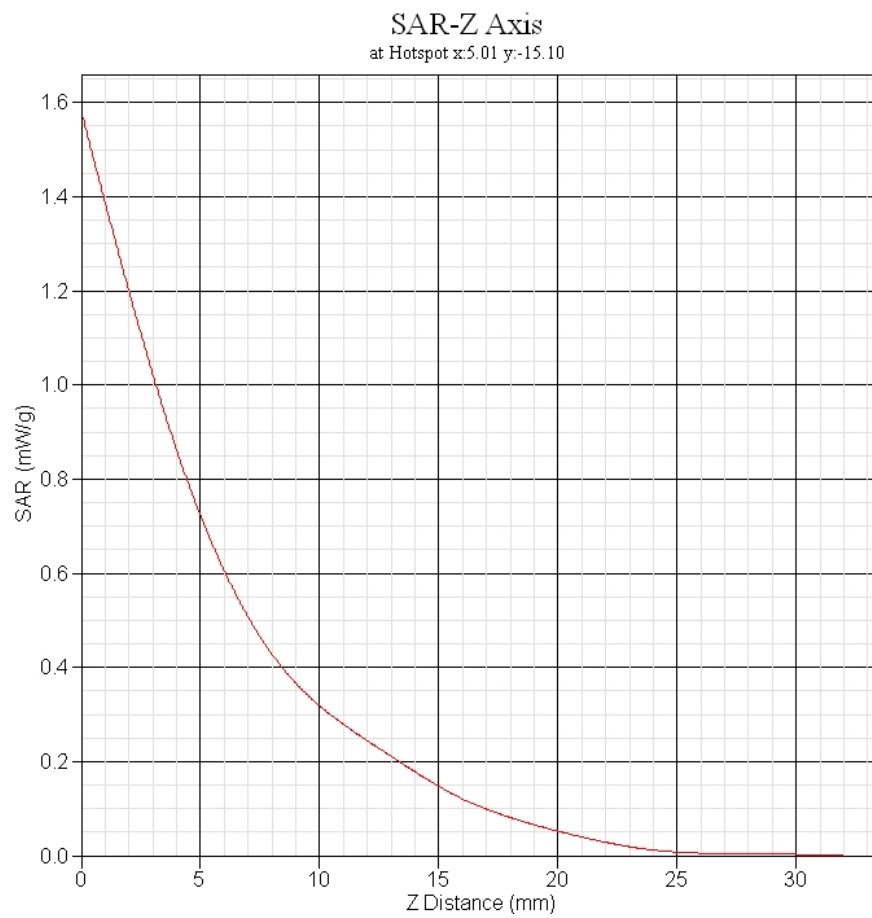


1 gram SAR value : 0.716 W/kg

10 gram SAR value : 0.303 W/kg

Area Scan Peak SAR : 0.814 W/kg

Zoom Scan Peak SAR : 1.581 W/kg





802.11n20 bottom low

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 12:07:18 PM  
End Time : 16-Nov-2010 12:23:13 PM  
Scanning Time : 955 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.157 W/kg  
Power Drift-Finish: 0.146 W/kg  
Power Drift (%) : -7.101  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

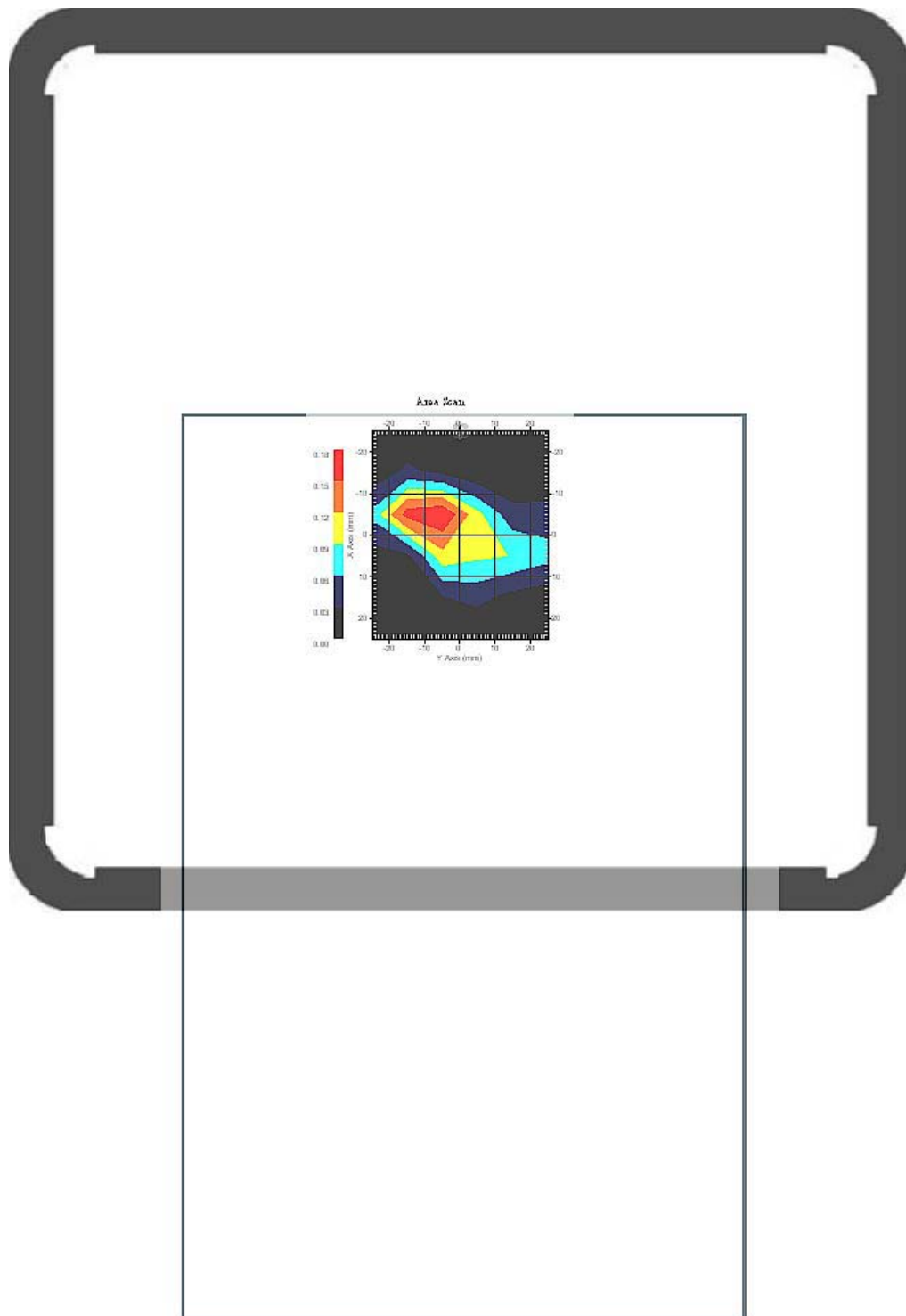
Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 12:07:14 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

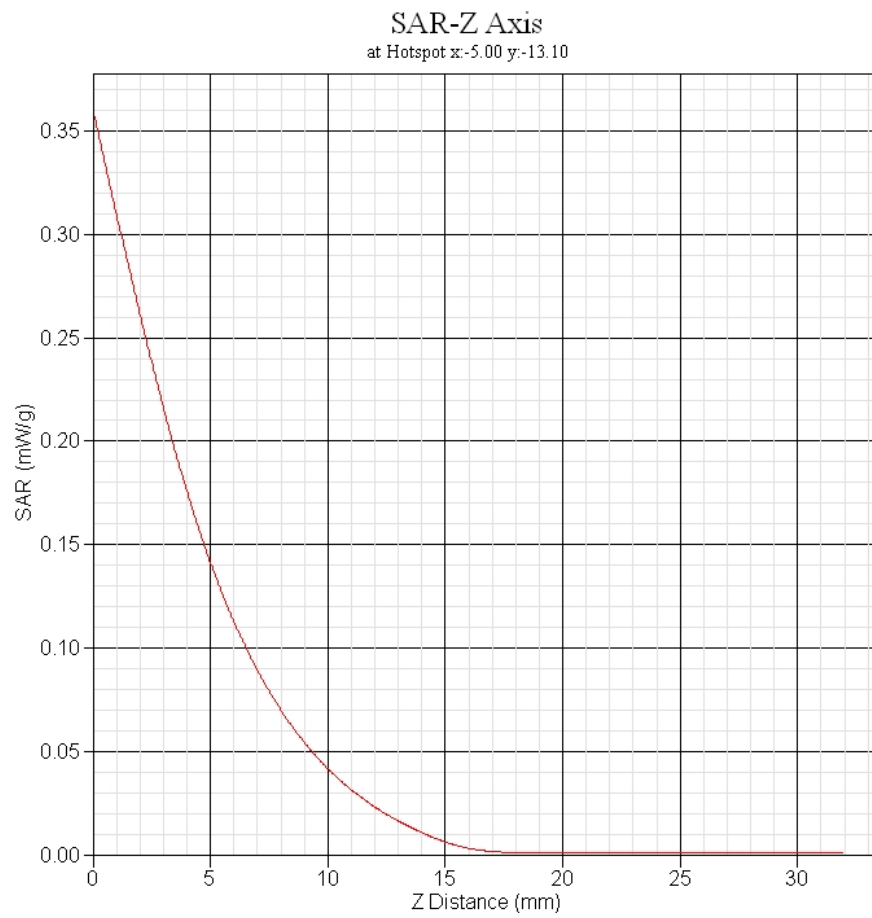
Other Data

DUT Position : Touch  
Separation : 0  
Channel : Low





1 gram SAR value : 0.140 W/kg  
10 gram SAR value : 0.048 W/kg  
Area Scan Peak SAR : 0.179 W/kg  
Zoom Scan Peak SAR : 0.360 W/kg





802.11n20 bottom mid

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 12:32:54 PM  
End Time : 16-Nov-2010 12:48:40 PM  
Scanning Time : 946 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.221 W/kg  
Power Drift-Finish: 0.224 W/kg  
Power Drift (%) : 1.554  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

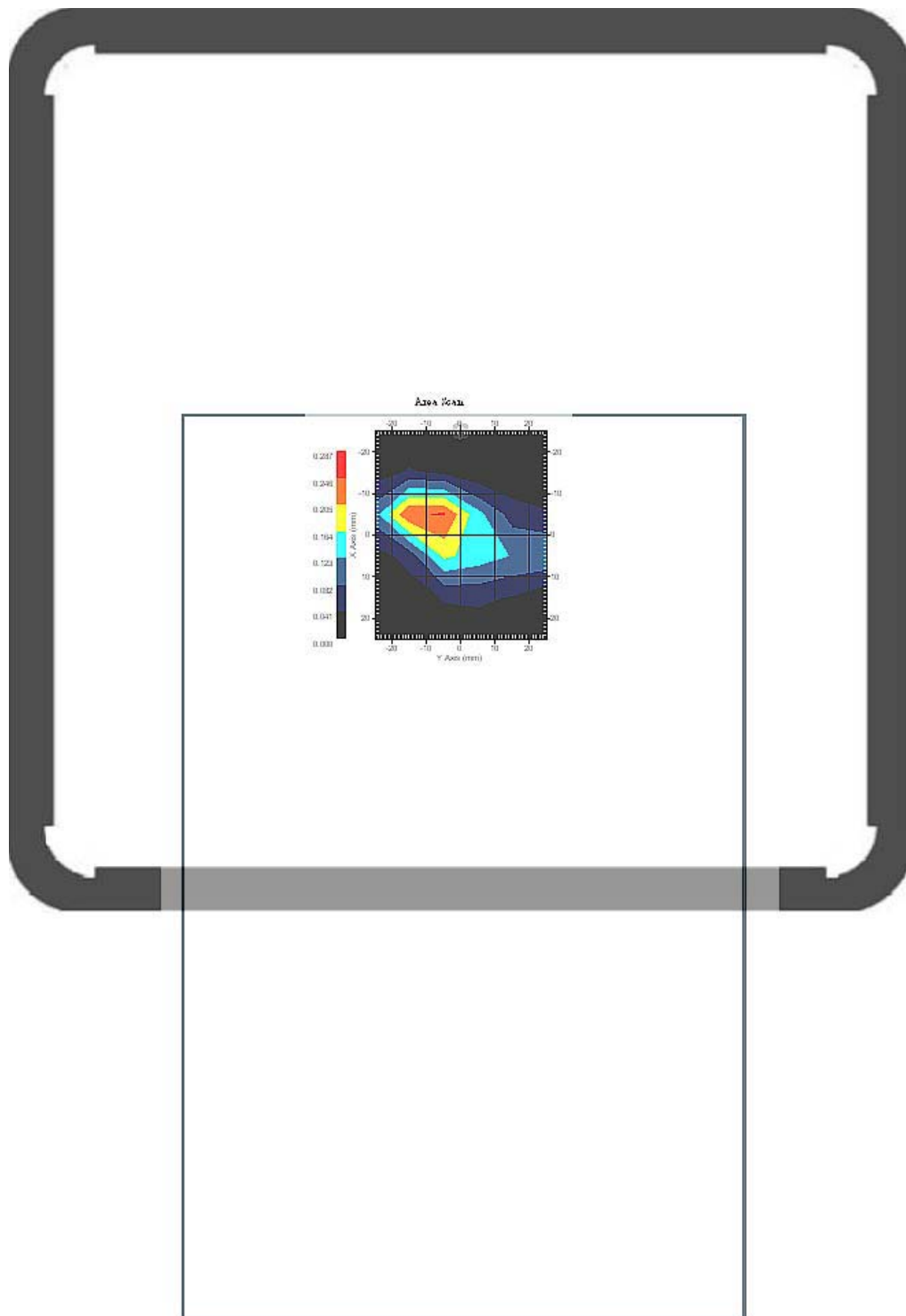
Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data

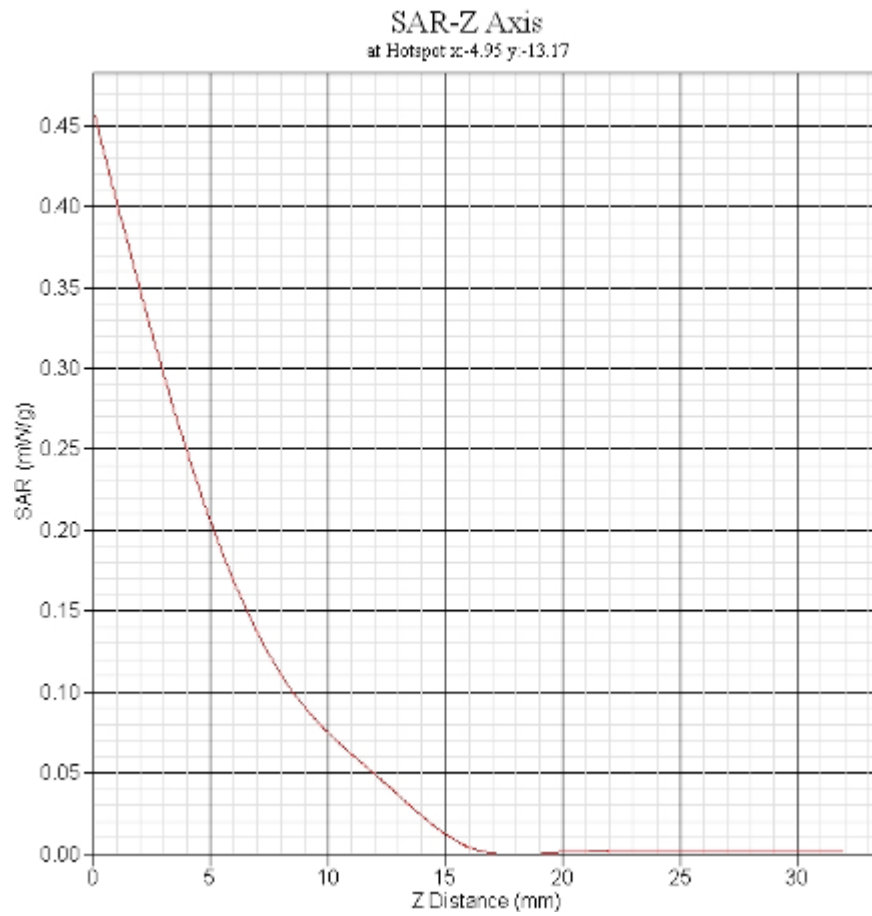
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 12:32:49 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data

DUT Position : Touch  
Separation : 0  
Channel : Mid



1 gram SAR value : 0.189 W/kg  
10 gram SAR value : 0.067 W/kg  
Area Scan Peak SAR : 0.248 W/kg  
Zoom Scan Peak SAR : 0.460 W/kg





802.11n20 bottom high

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 01:02:51 PM  
End Time : 16-Nov-2010 01:18:07 PM  
Scanning Time : 916 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.230 W/kg  
Power Drift-Finish: 0.275 W/kg  
Power Drift (%) : 1.546  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

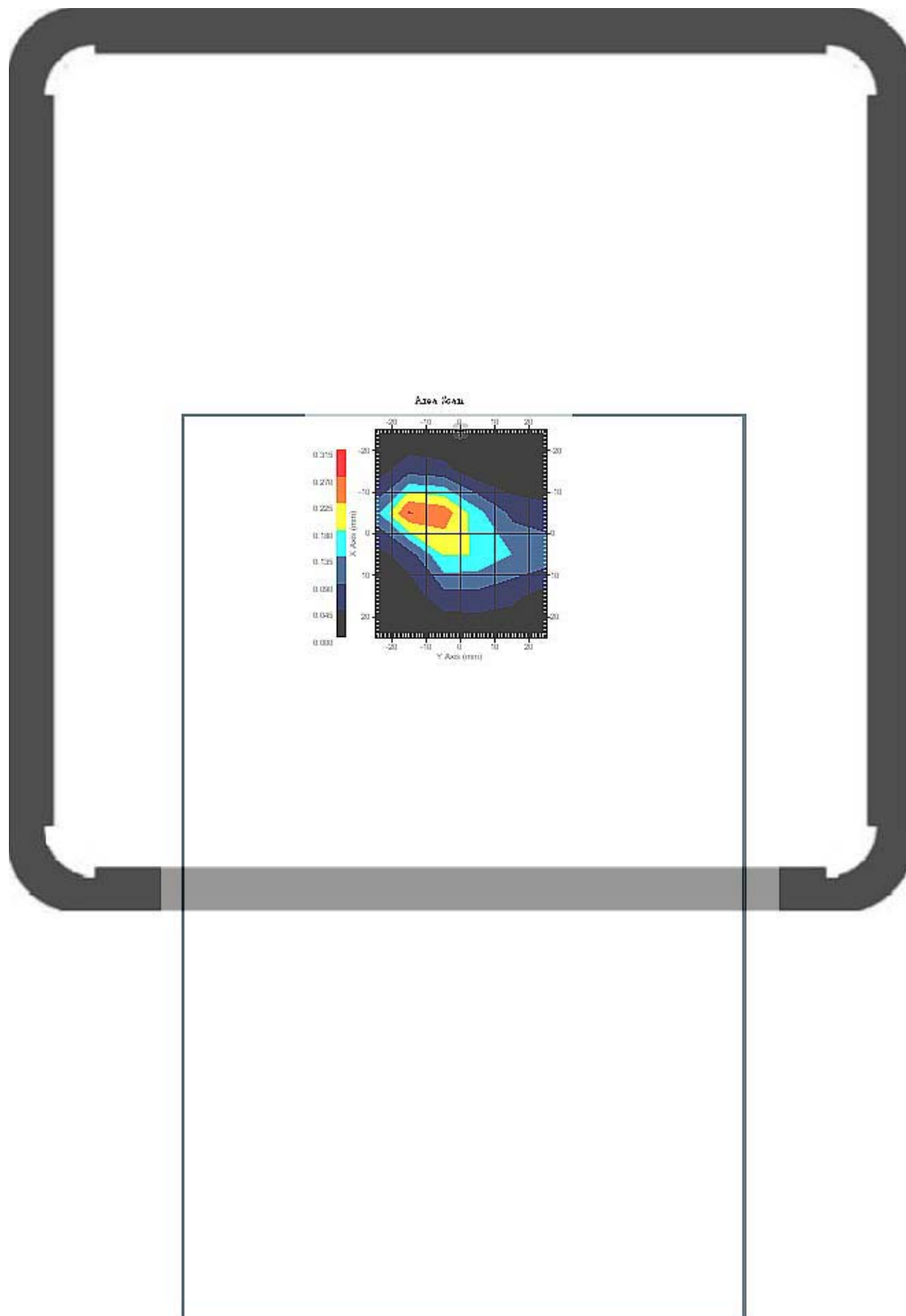
Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 1:02:45 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

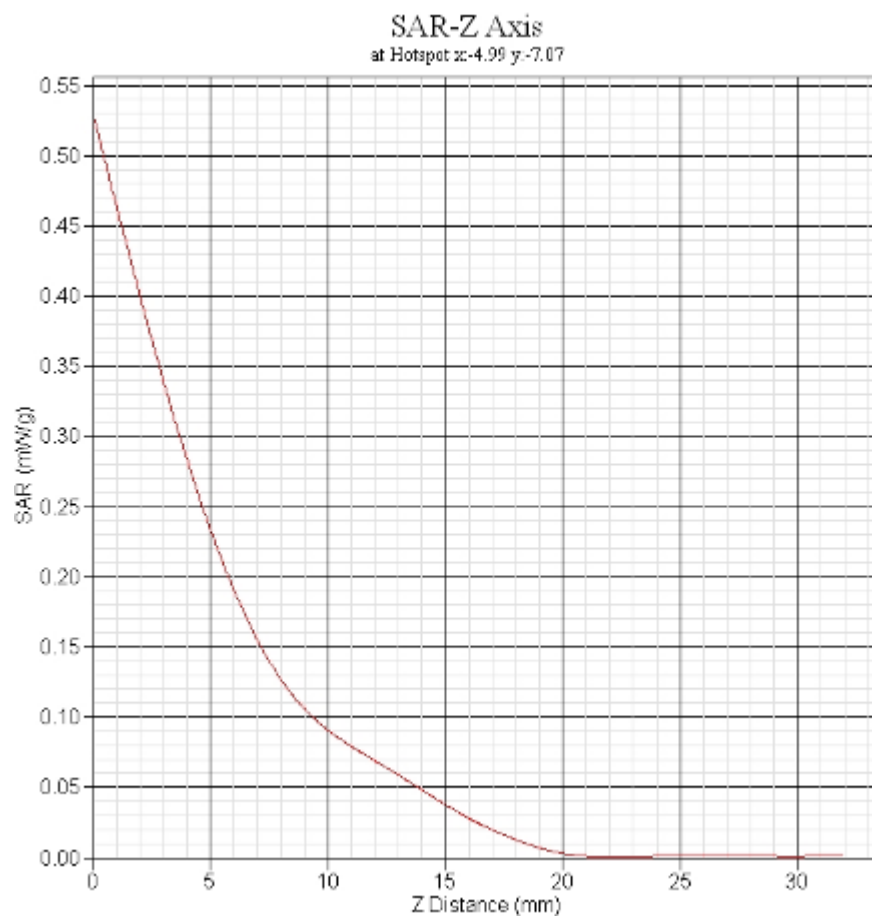
Other Data

DUT Position : Touch  
Separation : 0  
Channel : High





1 gram SAR value : 0.227 W/kg  
10 gram SAR value : 0.084 W/kg  
Area Scan Peak SAR : 0.272 W/kg  
Zoom Scan Peak SAR : 0.530 W/kg





802.11n20 tip edge low

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 03:35:11 PM  
End Time : 16-Nov-2010 03:51:23 PM  
Scanning Time : 972 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.162 W/kg  
Power Drift-Finish: 0.157 W/kg  
Power Drift (%) : -3.266  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

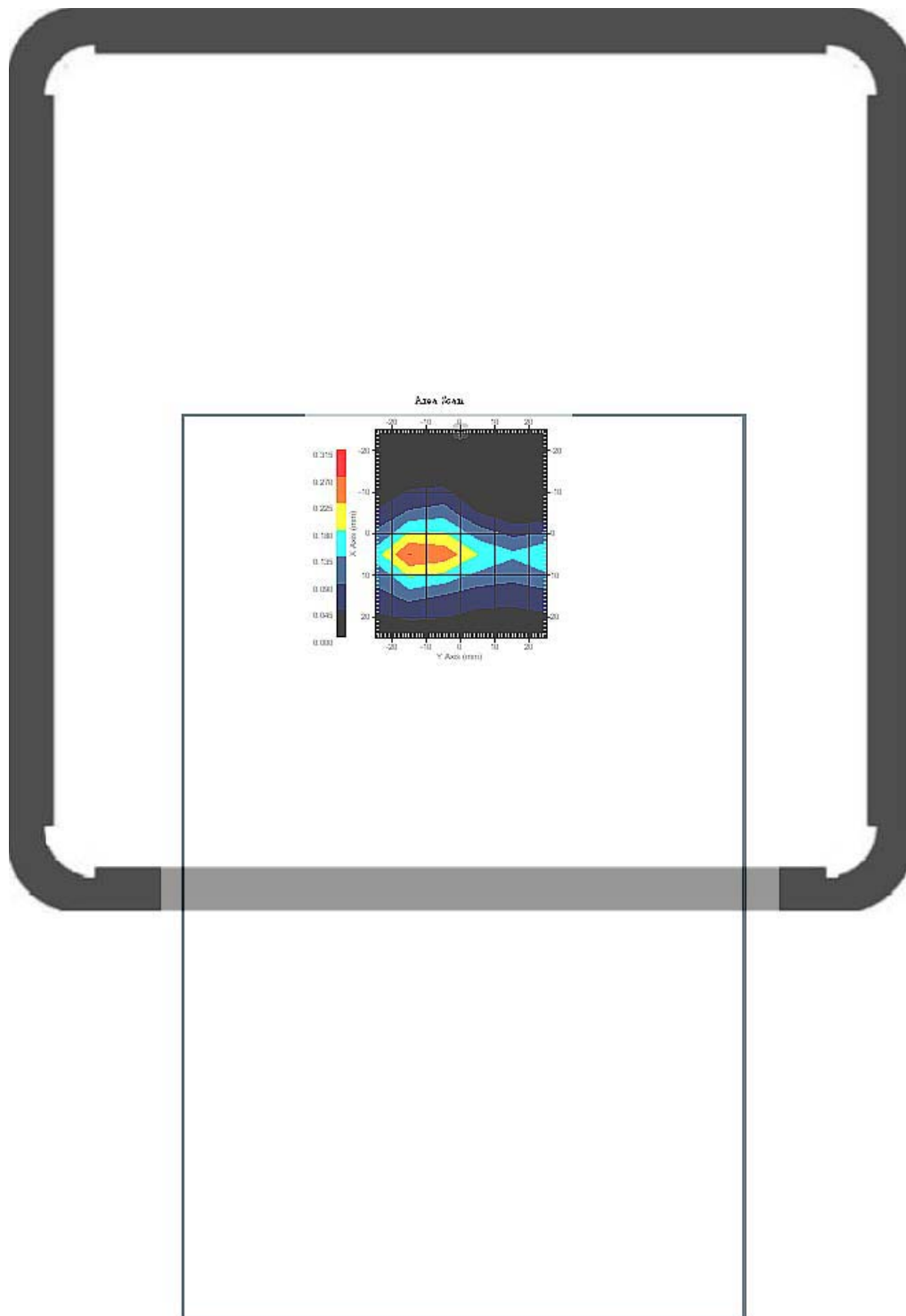
Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data

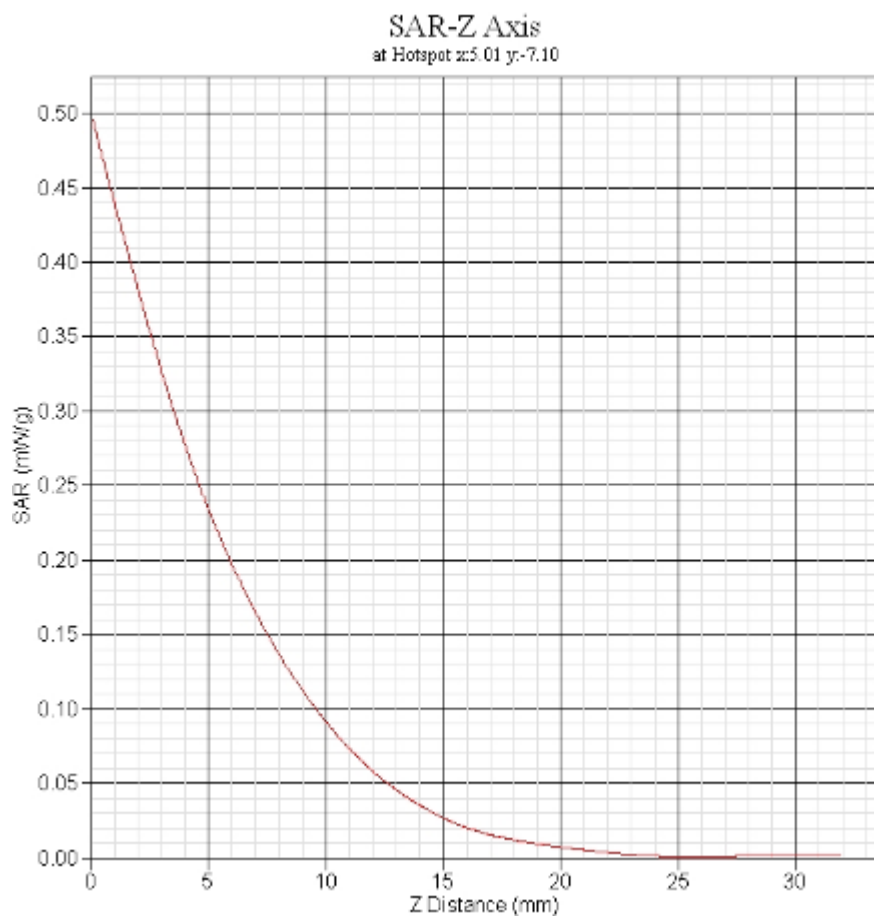
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 3:35:07 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data

DUT Position : Touch  
Separation : 0  
Channel : Low



1 gram SAR value : 0.229 W/kg  
10 gram SAR value : 0.085 W/kg  
Area Scan Peak SAR : 0.271 W/kg  
Zoom Scan Peak SAR : 0.500 W/kg





802.11n20 tip edge mid

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 02:54:01 PM  
End Time : 16-Nov-2010 03:09:16 PM  
Scanning Time : 915 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.164 W/kg  
Power Drift-Finish: 0.173 W/kg  
Power Drift (%) : 5.767  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



**Probe Data**

Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

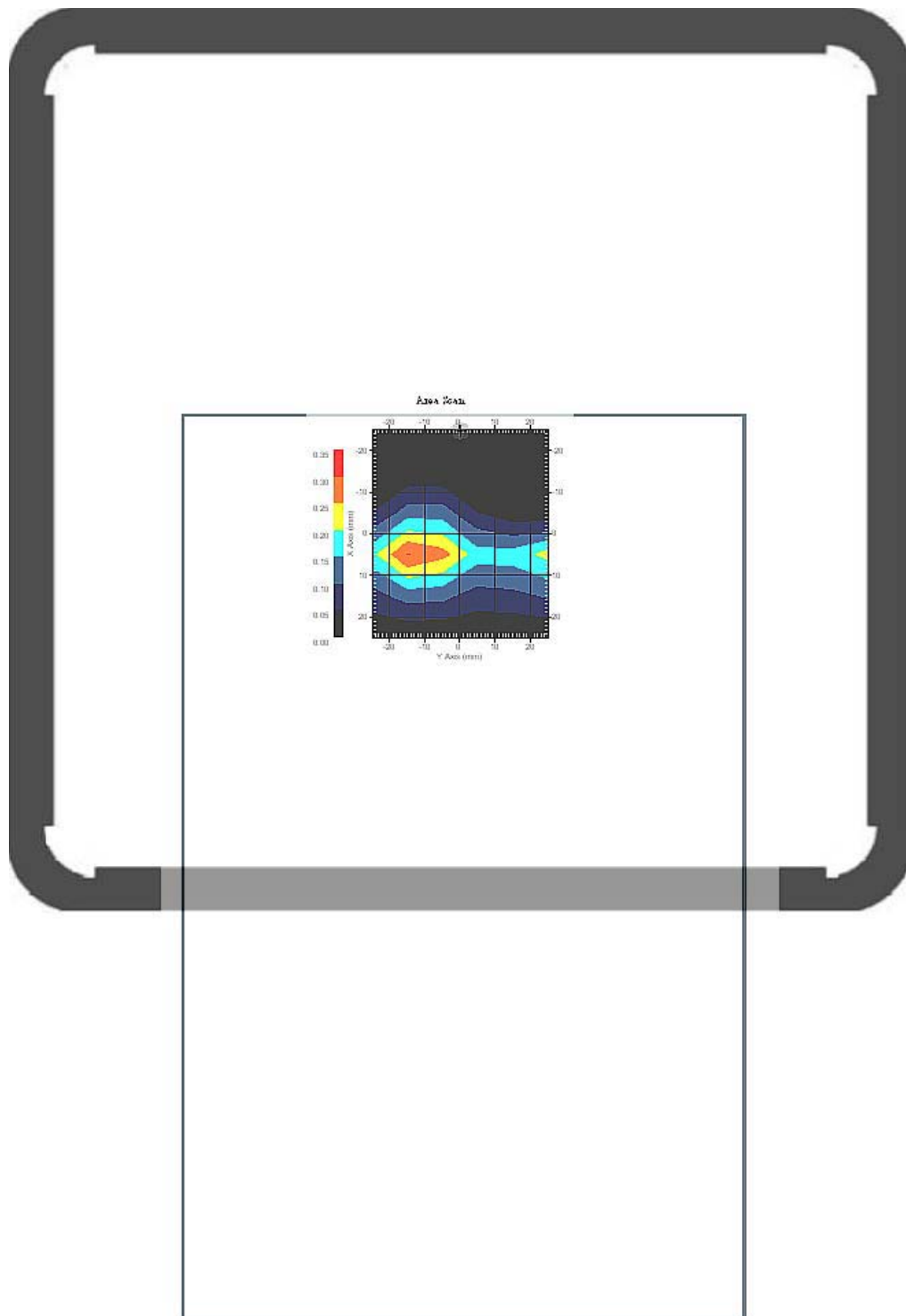
**Measurement Data**

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 2:53:54 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

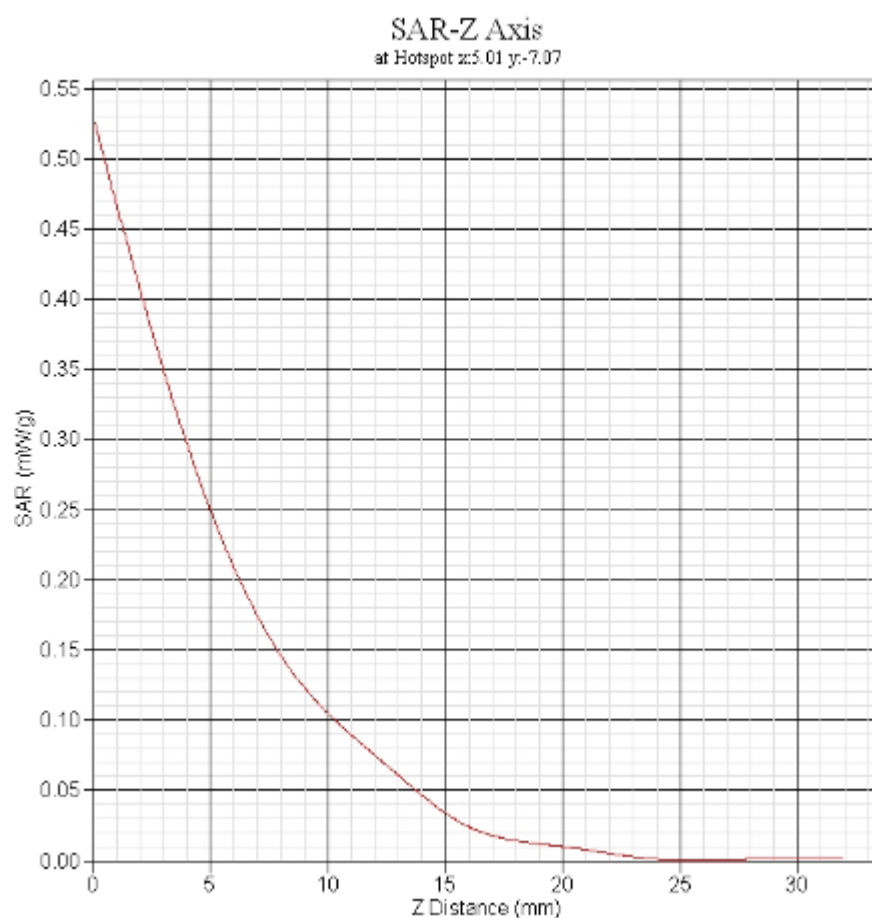
**Other Data**

DUT Position : Touch  
Separation : 0  
Channel : Mid





1 gram SAR value : 0.241 W/kg  
10 gram SAR value : 0.094 W/kg  
Area Scan Peak SAR : 0.302 W/kg  
Zoom Scan Peak SAR : 0.530 W/kg





802.11n20 tip edge high

Report Date : 16-Nov-2010  
By Operator : 123  
Measurement Date : 16-Nov-2010  
Starting Time : 16-Nov-2010 03:14:05 PM  
End Time : 16-Nov-2010 03:29:41 PM  
Scanning Time : 936 secs

**Product Data**

Device Name : Computer  
Serial No. : 123  
Type : Std Form Cell Phone  
Model : 123  
Frequency : 2400.00 MHz  
Max. Transmit Pwr : 1 W  
Drift Time : 0 min(s)  
Length : 255 mm  
Width : 160 mm  
Depth : 10 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 0.182 W/kg  
Power Drift-Finish: 0.170 W/kg  
Power Drift (%) : -6.539  
Picture :

**Phantom Data**

Name : APREL-Uni  
Type : Uni-Phantom  
Size (mm) : 280 x 280 x 200  
Serial No. : User Define  
Location : Center  
Description : uni

**Tissue Data**

Type : BODY  
Serial No. : IAC Tissue - 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 15-May-2008  
Temperature : 20.00 °C  
Ambient Temp. : 20.00 °C  
Humidity : 50.00 RH%  
Epsilon : 48.01 F/m  
Sigma : 1.89 S/m  
Density : 1000.00 kg/cu. m



Probe Data

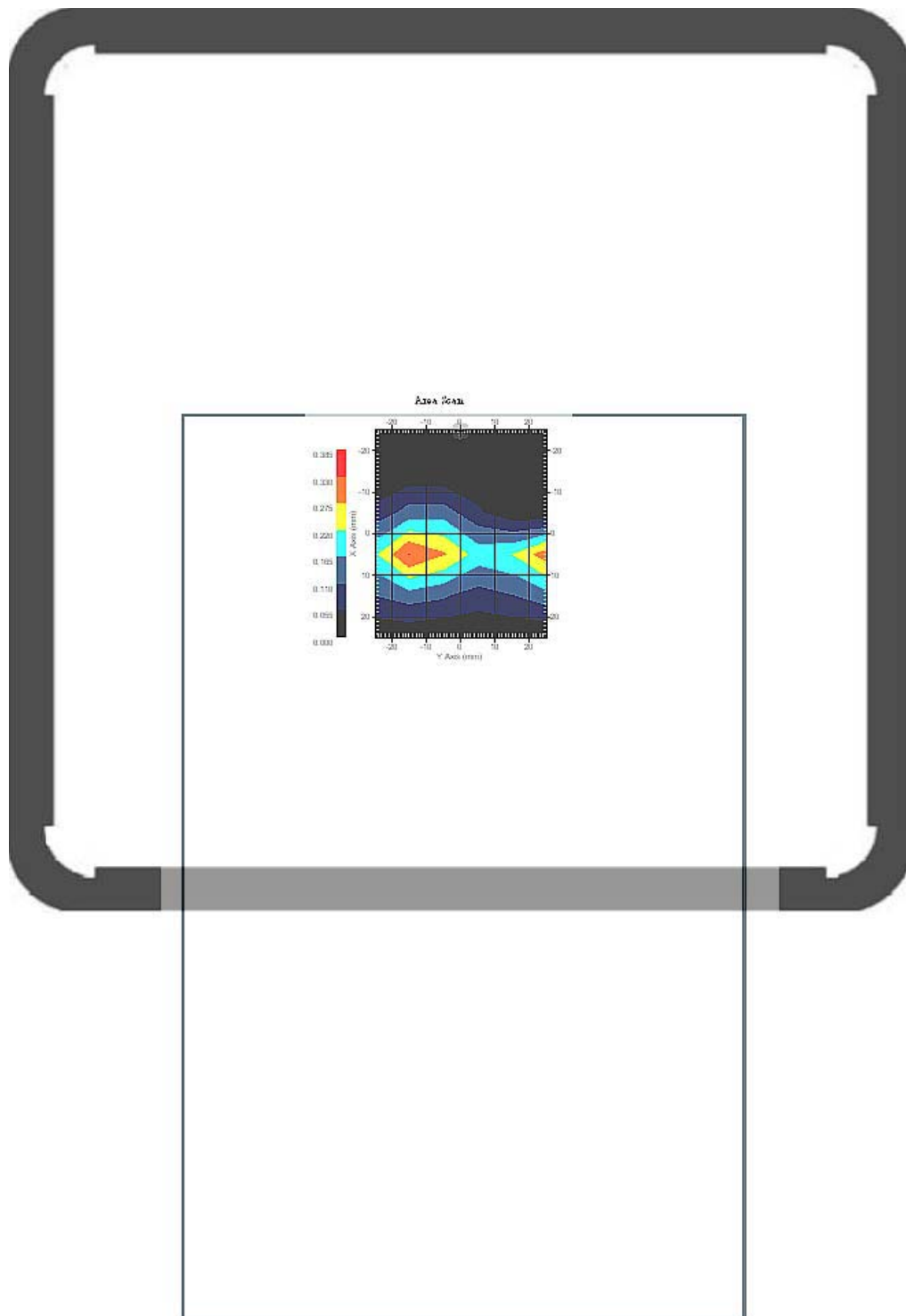
Name : IAC-273  
Model : E020  
Type : E-Field Triangle  
Serial No. : 273  
Last Calib. Date : 13-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 3.6  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data

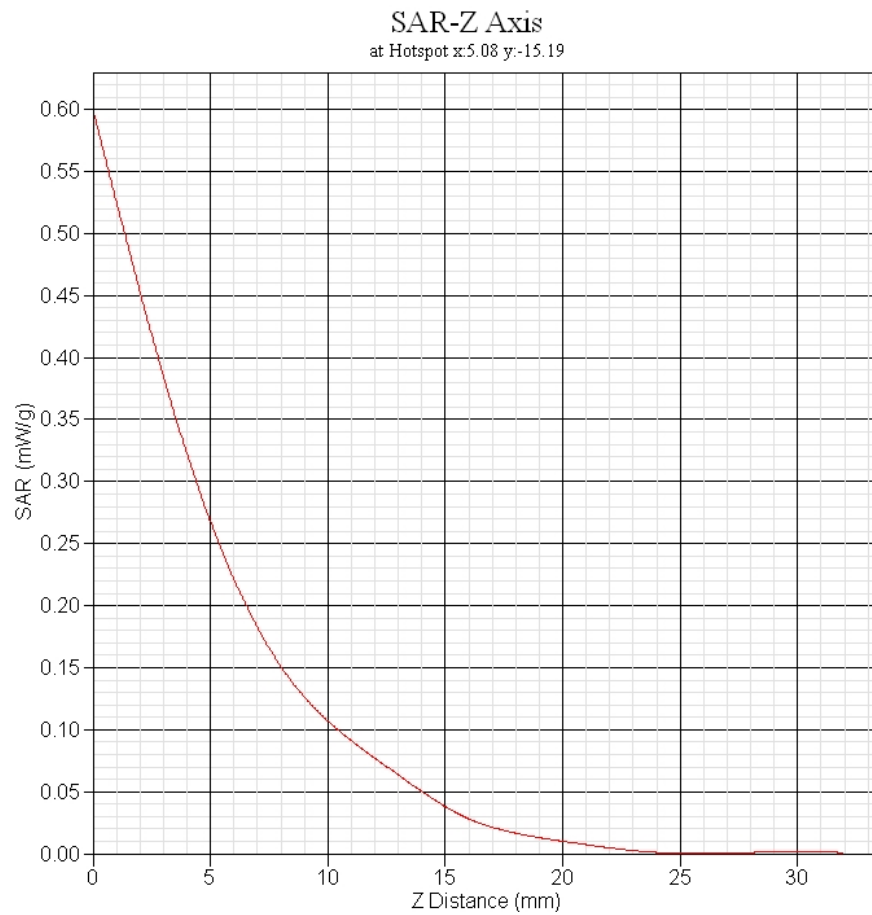
Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 20.00 °C  
Set-up Date : 16-Nov-2010  
Set-up Time : 3:14:02 PM  
Area Scan : 6x6x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data

DUT Position : Touch  
Separation : 0  
Channel : High



1 gram SAR value : 0.266 W/kg  
10 gram SAR value : 0.106 W/kg  
Area Scan Peak SAR : 0.332 W/kg  
Zoom Scan Peak SAR : 0.600 W/kg





## 10. APPENDIX D CALIBRATION CERTIFICATE

Dipole-DC608-2450-MHz-2450-220-00755

### NCL CALIBRATION LABORATORIES

Calibration File No: DC-608  
Project Number: INKB—D2450-cal-5449

## CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Inventec Validation Dipole

Manufacturer: APREL Laboratories

Part number: ALS-D-2450-S-2

Frequency: 2450 MHz

Serial No: 2450-220-00755

Customer: IAC

Calibrated: May 28 2009  
Released on: May 28 2009

This Calibration Certificate is incomplete Unless Accompanied with the Calibration Results Summary

Released By: \_\_\_\_\_

**NCL** CALIBRATION LABORATORIES

51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1E6

Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4162



**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Conditions**

Dipole 2450-220-00755 client calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C  
Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

Stuart Nicol

C. Teodorian





NCL Calibration Laboratories  
Division of APREL Laboratories.

#### Calibration Results Summary

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

#### Mechanical Dimensions

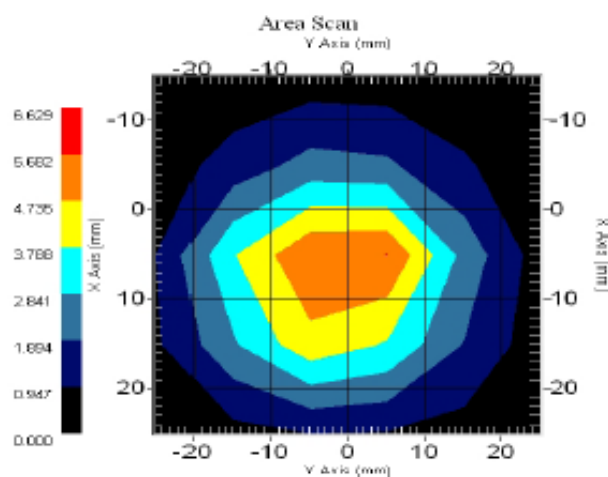
Length: 52.7 mm  
Height: 31.2 mm

#### Electrical Specification

SWR: 1.06 U  
Return Loss: -31.2 dB  
Impedance: 47.9  $\Omega$

#### System Validation Results

Frequency	1 Gram	10 Gram	Peak
2460 MHz	5.31	2.44	10.18



This page has been reviewed for content and attested to by signature within this document.



**NCL Calibration Laboratories**  
Division of APREL Laboratories.

---

## Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 2450-220-00755. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

## References

SSI-TP-018-ALSAS Dipole Calibration Procedure  
SSI-TP-016 Tissue Calibration Procedure  
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

## Conditions

Dipole 2450-220-00755 was client's.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C  
Temperature of the Tissue: 20 °C +/- 0.5°C



**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Dipole Calibration Results**

**Mechanical Verification**

APREL Length	APREL Height	Measured Length	Measured Height
51.5 mm	30.4 mm	52.7mm	31.2 mm

**Tissue Validation**

Head Tissue 2450 MHz	Measured
Dielectric constant, $\epsilon_r$	39.2
Conductivity, $\sigma$ [S/m]	1.80



**NCL Calibration Laboratories**

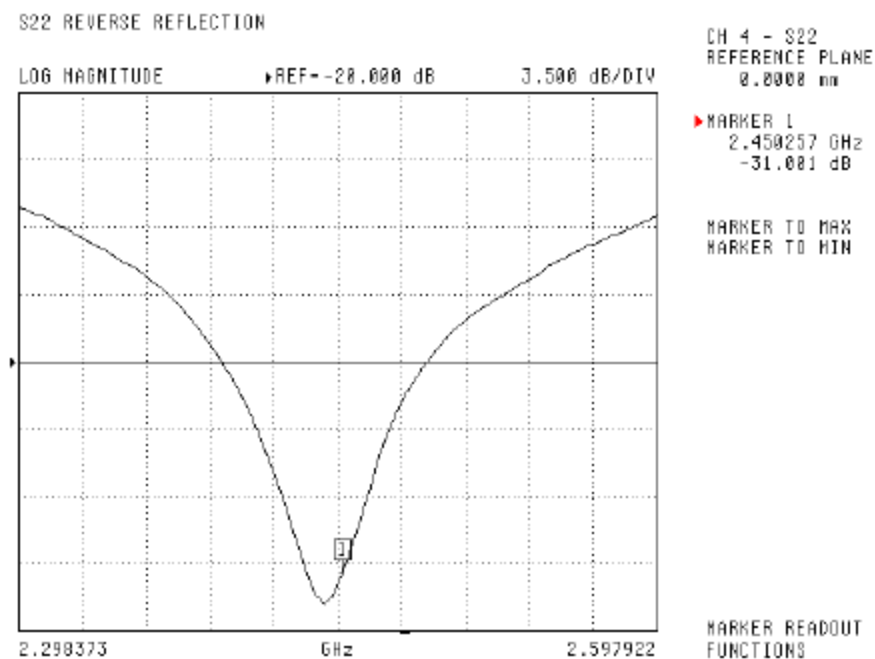
Division of APREL Laboratories.

**Electrical Calibration**

Test	Result
S11 R/L	-31.2 dB
SWR	1.06 U
Impedance	47.9 $\Omega$

The Following Graphs are the results as displayed on the Vector Network Analyzer.

**S11 Parameter Return Loss**

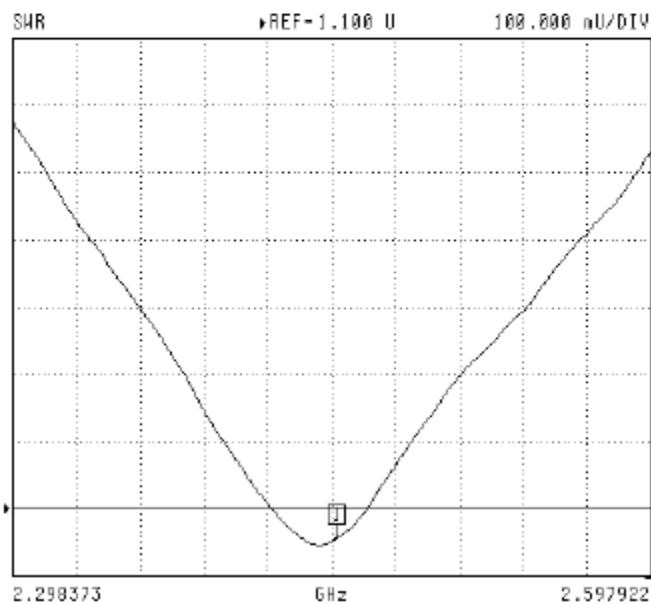




NCL Calibration Laboratories  
Division of APREL Laboratories.

## SWR

S22 REVERSE REFLECTION



CH 4 - S22  
REFERENCE PLANE  
0.0000 mm

MARKER 1  
2.450257 GHz  
1.055 U

MARKER TO MAX  
MARKER TO MIN

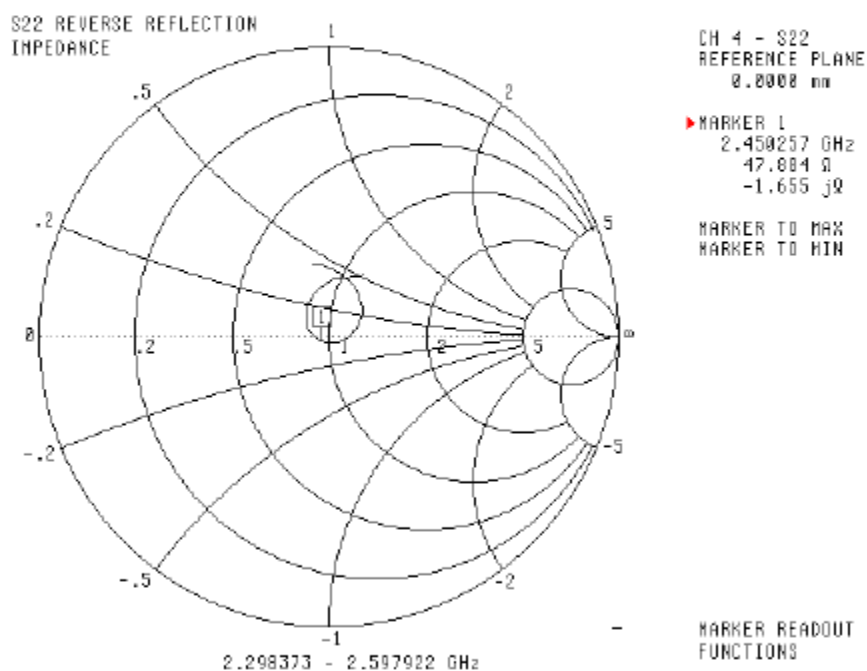
MARKER READOUT  
FUNCTIONS



NCL Calibration Laboratories

Division of APREL Laboratories.

Smith Chart Dipole Impedance

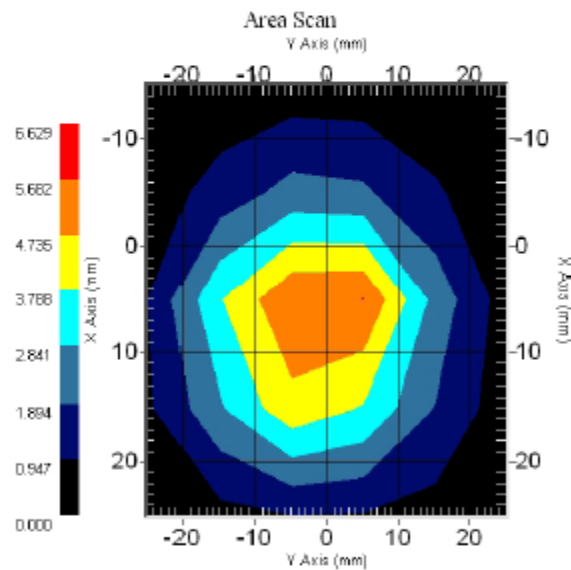




NCL Calibration Laboratories  
Division of APREL Laboratories.

System Validation Results Using the Electrically Calibrated Dipole

Head Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
2450 MHz	5.31	2.44	10.18



This page has been reviewed for content and attested to by signature within this document.



**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server  
R:\NCL\Calibration Equipment\Instrument List





IAC\_2450\_cp-1152b-e020-278

**NCL CALIBRATION LABORATORIES**

Calibration File No.: CP-1152

Client.: IAC

**CERTIFICATE OF CALIBRATION**

It is certified that the equipment identified below has been calibrated in the  
**NCL CALIBRATION LABORATORIES** by qualified personnel following recognized  
procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 2450 MHz

Manufacturer: APREL Laboratories

Model No.: E-020

Serial No.: 273-B

Body Calibration

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2

Project No: SGLB-IAC rep-E020-5538

Calibrated: 13 September 2010

Released on: 17 September 2010

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: \_\_\_\_\_

**NCL** CALIBRATION LABORATORIES

17 Bentley Avenue  
NEPEAN, ONTARIO  
CANADA K2E 6T7

Division of APREL Lab.  
TEL: (613) 820-4988  
FAX: (613) 820-4161



NCL Calibration Laboratories  
Division of APREL Laboratories.

## Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 278.

## References


SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure  
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"  
SSI-TP-011 Tissue Calibration Procedure  
IEC 62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1 & 2: Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"  
IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

## Conditions

Probe 273-B was a new-calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C  
Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this probe has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

  
Stuart Nicol

  
J. Hones



**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Calibration Results Summary**

Probe Type:	E-Field Probe E-020
Serial Number:	273-B
Frequency:	2450 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	<5 mm
Tip Length:	60 mm
Total Length:	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

**Sensitivity in Air**

Channel X:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Y:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Channel Z:	$1.2 \mu\text{V}/(\text{V}/\text{m})^2$
Diode Compression Point:	95 mV



NCL Calibration Laboratories

Division of APREL Laboratories.

**Sensitivity in Body Tissue Measured**

**Frequency:** 2450 MHz

**Epsilon:** 50.89 (+/-5%) **Sigma:** 1.94 S/m (+/-5%)

ConvF

Channel X: 3.6

Channel Y: 3.6

Channel Z: 3.6

Tissue sensitivity values were calculated using the load impedance of the APREL Laboratories Daq-Paq.

**Boundary Effect:**

Uncertainty resulting from the boundary effect is less than 2% for the distance between the tip of the probe and the tissue boundary, when less than 2.44mm.

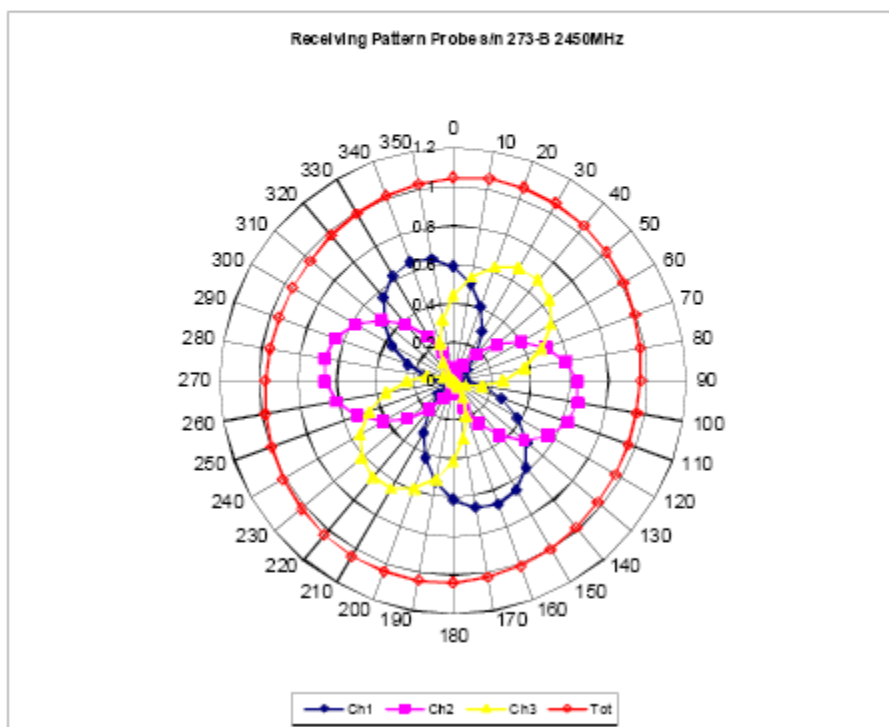
**Spatial Resolution:**

The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.



NCL Calibration Laboratories  
Division of APREL Laboratories.

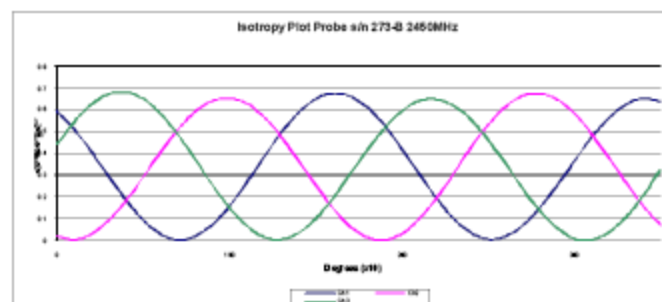
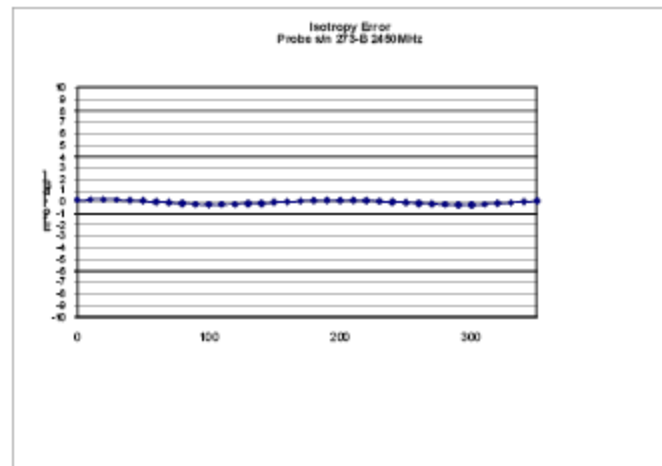
### Receiving Pattern 2450 MHz (Air)





NCL Calibration Laboratories  
Division of APREL Laboratories.

Isotropy Error 2450 MHz (Air)



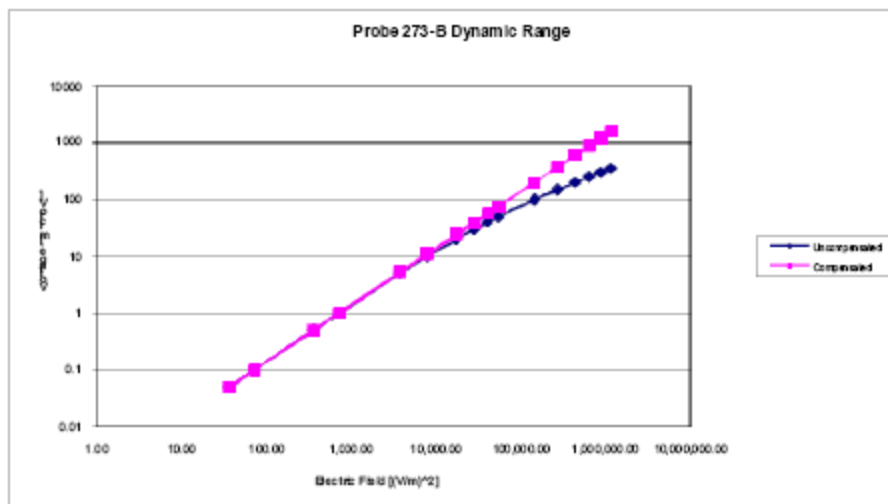
Isotropicity in Tissue:

0.10 dB



NCL Calibration Laboratories  
Division of APREL Laboratories.

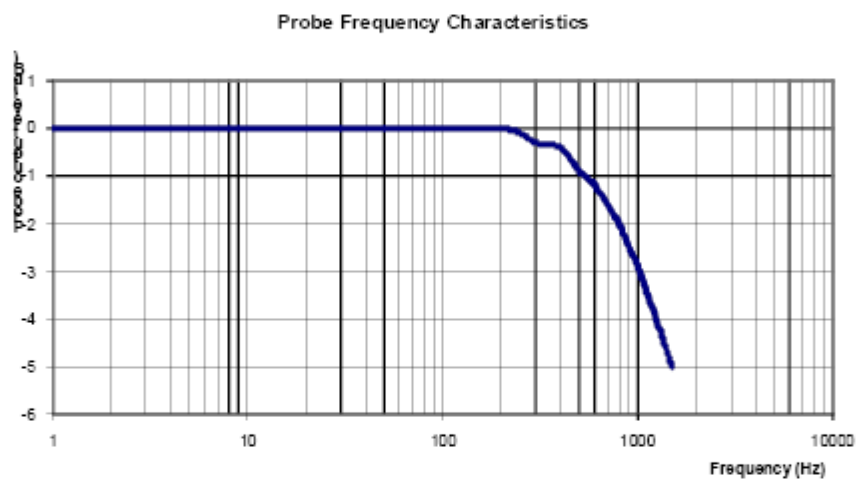
## Dynamic Range





NCL Calibration Laboratories  
Division of APREL Laboratories.

## Video Bandwidth



Video Bandwidth at 500 Hz            1 dB  
Video Bandwidth at 1.02 KHz:        3 dB



**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Conversion Factor Uncertainty Assessment**

**Frequency:** 2450MHz  
**Epsilon:** 50.89 (+/-5%) **Sigma:** 1.94 S/m (+/-5%)

**ConvF**

**Channel X:** 3.6 7%(K=2)  
**Channel Y:** 3.6 7%(K=2)  
**Channel Z:** 3.6 7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

**Boundary Effect:**

For a distance of 2.4mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

**NCL Calibration Laboratories**

Division of APREL Laboratories.

**Test Equipment**

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List 2010.