

# RF Exposure Lab

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## CERTIFICATE OF COMPLIANCE SAR EVALUATION

HM Electronics, Inc.  
14110 Stowe Drive  
Poway, CA 92064

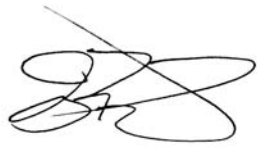
Dates of Test: May 23, 2011  
Test Report Number: SAR.20110506  
Revision B

|                        |  |
|------------------------|--|
| FCC ID:                | BYMC61   |
| IC Certificate:        | 1860A-C61  |
| Model(s):              | COM6100  |
| Test Sample:           | Engineering Unit same as Production                  |
| Serial No.:            | F13N0046   |
| Equipment Type:        | Wireless Body Worn Transceiver                       |
| Classification:        | Portable Transmitter Next to Body                    |
| TX Frequency Range:    | 2401 – 2482 MHz                                      |
| Frequency Tolerance:   | ± 25 ppm   |
| Maximum RF Output:     | 2450 Mhz – 18.1 dBm Peak Conducted                   |
| Signal Modulation:     | GFSK   |
| Antenna Type (Length): | Internal (HM Electronics, Inc., P/N Inv F PCB)       |
| Battery:               | Std. (HM Electronics, Inc, P/N 104G036) Battery Pack |
| Application Type:      | Certification  |
| FCC Rule Parts:        | Part 15C, Sec. 15.247                                |
| Industry Canada:       | RSS-102, Safety Code 6                               |
| Maximum SAR Value:     | 0.250 W/kg   |
| Separation Distance:   | 0 mm   |

This wireless mobile and/or portable device has been shown to be compliant for localized specific absorption rate (SAR) for uncontrolled environment/general exposure limits specified in ANSI/IEEE Std. C95.1-1999 and had been tested in accordance with the measurement procedures specified in IEEE 1528-2003, OET Bulletin 65 Supp. C, RSS-102 and Safety Code 6 (See test report).

I attest to the accuracy of the data. All measurements were performed by myself or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RF Exposure Lab, LLC certifies that no party to this application has been denied FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).



Jay M. Moulton  
Vice President



Certificate # 2387.01

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## 1. Introduction

This measurement report shows compliance of the HM Electronics, Inc. Model COM6100 Wireless Body Worn Transceiver FCC ID: BYMC61 with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices and IC Certificate: 1860A-C61 with RSS102 & Safety Code 6. The FCC have adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on August 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC regulated portable devices. [1], [6]

The test procedures, as described in ANSI C95.1 – 1999 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [2], ANSI C95.3 – 2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields [3], FCC OET Bulletin 65 Supp. C – 2001 [4], IEEE Std.1528 – 2003 Recommended Practice [5], and Industry Canada Safety Code 6 Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz were employed.

### SAR Definition [5]

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy ( $dW$ ) absorbed by (dissipated in) an incremental mass ( $dm$ ) contained in a volume element ( $dV$ ) of a given density ( $\rho$ ).

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

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

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

where:

$\sigma$  = conductivity of the tissue (S/m)

$\rho$  = mass density of the tissue (kg/m<sup>3</sup>)

$E$  = rms electric field strength (V/m)

## 2. SAR Measurement Setup

### Robotic System

The measurements are conducted utilizing the ALSAS-10-U automated dosimetric assessment system. The ALSAS-10-U is designed and manufactured by Aprel Laboratories in Nepean, Ontario, Canada. The system utilizes a Robcomm 3 robot manufactured by ThermoCRS located in Michigan USA.

### System Hardware

The system consists of a six axis articulated arm, controller for precise probe positioning (0.05 mm repeatability), a power supply, a teach pendant for teaching area scans, near field probe, an IBM Pentium 4™ 2.66 GHz PC with Windows XP Pro™, and custom software developed to enable communications between the robot controller software and the host operating system.

An amplifier is located on the articulated arm, which is isolated from the custom designed end effector and robot arm. The end effector provides the mechanical touch detection functionality and probe connection interface. The amplifier is functionally validated within the manufacturer's site and calibrated at NCL Calibration Laboratories. A Data Acquisition Card (DAC) is used to collect the signal as detected by the isotropic e-field probe. The DAC manufacturer calibrates the DAC to NIST standards. A formal validation is executed using all mechanical and electronic components to prove conformity of the measurement platform as a whole.

### System Description

The ALSAS-10-U has been designed to measure devices within the compliance environment to meet all recognized standards. The system also conforms to standards, which are currently being developed by the scientific and manufacturing community.

The course scan resolution is defined by the operator and reflects the requirements of the standard to which the device is being tested. Precise measurements are made within the predefined course scan area and the values are logged.

The user predefines the sample rate for which the measurements are made so as to ensure that the full duty-cycle of a pulse modulation device is covered during the sample. The following algorithm is an example of the function used by the system for linearization of the output for the probe.

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



The April E-Field probe is evaluated to establish the diode compression point.

A complex algorithm is then used to calculate the values within the measured points down to a resolution of 1mm. The data from this process is then used to provide the co-ordinates from which the cube scan is created for the determination of the 1 g and 10 g averages.

Cube scan averaging consists of a number of complex algorithms, which are used to calculate the one, and ten gram averages. The basis for the cube scan process is centered on the location where the maximum measured SAR value was found. When a secondary peak value is found which is within 60% of the initial peak value, the system will report this back to the operator who can then assess the need for further analysis of both the peak values prior to the one and ten-gram cube scan averaging process. The algorithm consists of 3D cubic Spline, and Lagrange extrapolation to the surface, which form the matrix for calculating the measurement output for the one and ten gram average values. The resolution for the physical scan integral is user defined with a final calculated resolution down to 1mm.

In-depth analysis for the differential of the physical scanning resolution for the cube scan analysis has been carried out, to identify the optimum setting for the probe positioning steps, and this has been determined at 8mm increments on the X, & Y planes. The reduction of the physical step increment increased the time taken for analysis but did not provide a better uncertainty or return on measured values.

The final output from the system provides data for the area scan measurements, physical and splined (1mm resolution) cube scan with physical and calculated values (1mm resolution).

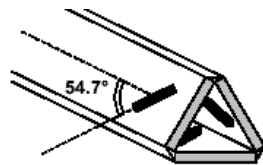
The overall uncertainty for the methodology and algorithms the ALSAS-10-U used during the SAR calculation was evaluated using the data from IEEE 1528 f3 algorithm:

$$f_3(x, y, z) = A \frac{a^2}{\frac{a^2}{4} + x'^2 + y'^2} \left( e^{-\frac{2z}{a}} + \frac{a^2}{2(a + 2z)^2} \right)$$

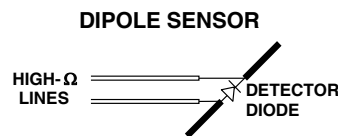
The probe used during the measurement process has been assessed to provide values for diode compression. These values are calculated during the probe calibration exercise and are used in the mathematical calculations for the assessment of SAR.

## E-Field Probe ALS-E-020

The E-field probe used by RF Exposure Lab, LLC, has been fully calibrated and assessed for isotropic, and boundary effect. The probe utilizes a triangular sensor arrangement as detailed in the diagram below right.



**Δ-BEAM**



The SAR is assessed with the 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 (Z height). The diagram above right shows how the center of the sensor is defined with the location of the diode placed at the center of the dipole. The 5mm default in the Z axis is the optimum height for assessing SAR where the boundary effect is at its least, with the probe located closest to the phantom surface (boundary).

The manufacturer specified precision of the robot is  $\pm 0.05$  mm and the precision of the APREL bottom detection device is  $\pm 0.1$  mm. These precisions are calibrated and tested in the manufacturing process of the bottom detection device. A constant distance is maintained because the surface of the phantom is dynamically detected for each point. The surface detection algorithm corrects the position of the robot so that the probe rests on the surface of the phantom. The probe is then moved to the measurement location 2.44 mm above the phantom surface resulting in the probe center location to be at 4.0 mm above the phantom surface. Therefore, the probe sensor will be at 4.0 mm above the phantom surface  $\pm 0.1$  mm for each SAR location for frequencies below 3 GHz. The probe is moved to the measurement location 1.44 mm above the phantom surface resulting in the probe center location to be at 2.0 mm above the phantom surface. Therefore, the probe sensor will be at 2.0 mm above the phantom surface  $\pm 0.1$  mm for each SAR location for frequencies above 3 GHz.

The probe boundary effect compensation cannot be disabled in the ALSAS-10U testing system. The probe tip will always be at least half a probe tip diameter from the phantom surface. For frequencies up to 3 GHz, the probe diameter is 5 mm. With the sensor offset set at 1.54 mm (default setting), the sensor to phantom gap will be 4.0 mm which is greater than half the probe tip diameter. For frequencies greater than 3 GHz, the probe diameter is 3 mm. With the sensor offset set at 0.56 mm (default setting), the sensor to phantom gap will be 3.0 mm which is greater than half the probe tip diameter.

The separation of the first 2 measurement points in the zoom scan is specified in the test setup software. For frequencies below 3 GHz, the user must specify a zoom scan resolution of less than 6 mm in the z-axis to have the first two measurements within 1 cm of the surface. The z-axis is set to 4 mm as shown on each of the data sheets in Appendix B. For frequencies above 3 GHz, the user must specify a zoom scan resolution of less than 3 mm in the z-axis to have the first two measurements within 5 mm of the surface. The z-axis is set to 2 mm as shown on each of the data sheets in Appendix B.

The zoom scan volume for devices  $\leq 3$  GHz with a cube scan of 5x5x8 yields a volume of 32x32x28 mm<sup>3</sup>. For devices  $>3$  GHz and  $<4.5$  GHz, the cube scan of 9x9x9 yields a volume of 32x32x24 mm<sup>3</sup>. For devices  $\geq 4.5$  GHz, the cube scan of 7x7x12 yields a volume of 24x24x22 mm<sup>3</sup>.

### 3. Robot Specifications

#### Specifications

Positioner: ThermoCRS, Robot Model: Robocomm 3  
Repeatability: 0.05 mm  
No. of axis: 6

#### Data Acquisition Card (DAC) System

##### Cell Controller

Processor: Pentium 4™  
Clock Speed: 2.66 GHz  
Operating System: Windows XP Pro™

##### Data Converter

Features: Signal Amplifier, End Effector, DAC  
Software: ALSAS 10-U Software

#### E-Field Probe

Model: ALS-E-020  
Serial Number: RFE-217  
Construction: Triangular Core Touch Detection System  
Frequency: 10MHz to 6GHz

#### Phantom

Phantom: Uniphantom, Right Phantom, Left Phantom



## **4. Probe and Dipole Calibration**

**See Appendix D and E.**



## 5. Phantom & Simulating Tissue Specifications

### SAM Phantom



The Aprel system utilizes three separate phantoms. Each phantom for SAR assessment testing is a low loss dielectric shell, with shape and dimensions derived from the anthropomorphic data of the 90<sup>th</sup> percentile adult male head dimensions as tabulated by the US Army. The SAM phantom shell is bisected along the mid sagittal plane into right and left halves. The perimeter sidewalls of each phantom half is extended to allow filling with liquid to a depth of 15 cm that is sufficient to minimize reflections from the upper surface [5]. See photos in Appendix C.

### Brain & Muscle Simulating Mixture Characterization

The brain and muscle mixtures consist of a glycol based chemical and saline solution. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 have been incorporated in the following tables. Other head and body tissue parameters that have not been specified in P1528 are derived from the issue dielectric parameters computed from the 4-Cole-Cole equations.

**Table 5.1 Typical Composition of Ingredients for Tissue**

| Ingredients         |        | Simulating Tissue |
|---------------------|--------|-------------------|
|                     |        | 2450 MHz Body     |
| Mixing Percentage   |        |                   |
| Water               |        | 73.20             |
| Sugar               |        | 0.00              |
| Salt                |        | 0.04              |
| HEC                 |        | 0.00              |
| Bactericide         |        | 0.00              |
| DGBE                |        | 26.70             |
| Dielectric Constant | Target | 52.70             |
| Conductivity (S/m)  | Target | 1.95              |

### Device Holder



In combination with the SAM phantom, the scissor jack mounting device with 6 inches of Styrofoam enables the ability to mount the device under test to the uni-phantom. The devices can easily, accurately, and repeatably be positioned according to the FCC specifications.

## 6. ANSI/IEEE C95.1 – 1999 RF Exposure Limits [2]

### Uncontrolled Environment

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

### Controlled Environment

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

**Table 6.1 Human Exposure Limits**

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

<sup>1</sup> The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

<sup>2</sup> The Spatial Average value of the SAR averaged over the whole body.

<sup>3</sup> The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

## 7. Measurement Uncertainty

### Exposure Assessment Measurement Uncertainty

| Source of Uncertainty                             | Tolerance Value | Probability Distribution | Divisor    | $c_i^1$<br>(1-g) | $c_i^1$<br>(10-g) | Standard Uncertainty<br>(1-g) % | Standard Uncertainty<br>(10-g) % | $v_i$    |
|---|-----------------|--------------------------|------------|------------------|-------------------|---------------------------------|----------------------------------|----------|
| Measurement System                                |                 |                          |            |                  |                   |                                 |                                  |          |
| Probe Calibration                                 | 3.5             | normal                   | 1          | 1                | 1                 | 3.5                             | 3.5                              | $\infty$ |
| Axial Isotropy                                    | 3.7             | rectangular              | $\sqrt{3}$ | 0.7              | 0.7               | 1.5                             | 1.5                              | $\infty$ |
| Hemispherical Isotropy                            | 10.9            | rectangular              | $\sqrt{3}$ | 0.7              | 0.7               | 4.4                             | 4.4                              | $\infty$ |
| Boundary Effect                                   | 1.0             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 0.6                             | 0.6                              | $\infty$ |
| Linearity   | 4.7             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 2.7                             | 2.7                              | $\infty$ |
| Detection Limit                                   | 1.0             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 0.6                             | 0.6                              | $\infty$ |
| Readout Electronics                               | 1.0             | normal                   | 1          | 1                | 1                 | 1.0                             | 1.0                              | $\infty$ |
| Response Time                                     | 0.8             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 0.5                             | 0.5                              | $\infty$ |
| Integration Time                                  | 1.7             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 1.0                             | 1.0                              | $\infty$ |
| RF Ambient Condition                              | 3.0             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 1.7                             | 1.7                              | $\infty$ |
| Probe Positioner Mech. Restriction                | 0.4             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 0.2                             | 0.2                              | $\infty$ |
| Probe Positioning with respect to Phantom Shell   | 2.9             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 1.7                             | 1.7                              | $\infty$ |
| Extrapolation and Integration                     | 3.7             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 2.1                             | 2.1                              | $\infty$ |
| Test Sample Positioning                           | 4.0             | normal                   | 1          | 1                | 1                 | 4.0                             | 4.0                              | 7        |
| Device Holder Uncertainty                         | 2.0             | normal                   | 1          | 1                | 1                 | 2.0                             | 2.0                              | 2        |
| Drift of Output Power                             | 4.2             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 2.4                             | 2.4                              | $\infty$ |
| Phantom and Setup                                 |                 |                          |            |                  |                   |                                 |                                  |          |
| Phantom Uncertainty (shape & thickness tolerance) | 3.4             | rectangular              | $\sqrt{3}$ | 1                | 1                 | 2.0                             | 2.0                              | $\infty$ |
| Liquid Conductivity (target)                      | 5.0             | rectangular              | $\sqrt{3}$ | 0.7              | 0.5               | 2.0                             | 1.4                              | $\infty$ |
| Liquid Conductivity (meas.)                       | 0.5             | normal                   | 1          | 0.7              | 0.5               | 0.4                             | 0.3                              | 5        |
| Liquid Permittivity (target)                      | 5.0             | rectangular              | $\sqrt{3}$ | 0.6              | 0.5               | 1.7                             | 1.4                              | $\infty$ |
| Liquid Permittivity (meas.)                       | 1.0             | normal                   | 1          | 0.6              | 0.5               | 0.6                             | 0.5                              | 5        |
| Combined Uncertainty                              |                 | RSS                      |            |                  |                   | 9.6                             | 9.4                              | >500     |
| Combined Uncertainty (coverage factor=2)          |                 | Normal (k=2)             |            |                  |                   | 19.1                            | 18.8                             | >500     |

## 8. System Validation

### Tissue Verification

**Table 8.1 Measured Tissue Parameters**

|                                 |      |               |          |
|---------------------------------|------|---------------|----------|
|                                 |      | 2450 MHz Body |          |
| Date(s)                         |      | May 23, 2011  |          |
| Liquid Temperature (°C)         | 20.0 | Target        | Measured |
| Dielectric Constant: $\epsilon$ |      | 52.70         | 52.51    |
| Conductivity: $\sigma$          |      | 1.95          | 1.98     |

See Appendix A for data printout.

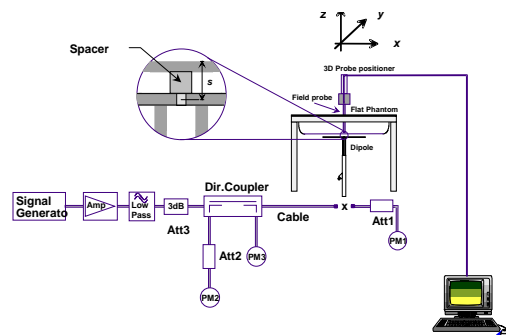
### Test System Verification

Prior to assessment, the system is verified to the  $\pm 10\%$  of the specifications at the test frequency by using the system kit. Power is normalized to 1 watt. (Graphic Plots Attached)

**Table 8.2 System Dipole Validation Target & Measured**

|             | Test Frequency | Targeted SAR <sub>1g</sub> (W/kg) | Measure SAR <sub>1g</sub> (W/kg) | Tissue Used for Verification | Deviation (%) |
|-------------|----------------|-----------------------------------|----------------------------------|------------------------------|---------------|
| 23-May-2011 | 2450 MHz       | 51.50                             | 51.30                            | Body                         | - 0.39        |

See Appendix A for data plots.



**Figure 8.1 Dipole Validation Test Setup**

## 9. SAR Test Data Summary

### See Measurement Result Data Pages

See Appendix B for SAR Test Data Plots.  
 See Appendix C for SAR Test Setup Photos.

### Procedures Used To Establish Test Signal

The device was placed into simulated transmit mode using the manufacturer’s test codes. Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR. When test modes are not available or inappropriate for testing a device, the actual transmission is activated through a base station simulator or similar equipment. See data pages for actual procedure used in measurement.

### Device Test Condition

The device is battery operated. Each SAR measurement was taken with a fully charged battery. In order to verify that the device was tested at full power, conducted output power measurements were performed before and after each SAR measurement to confirm the output power unless otherwise noted. If a conducted power deviation of more than 5% occurred, the test was repeated.

The unit was required to be disassembled to measure the conducted power. To insure that the integrity of the device was not compromised, the power measurements were conducted at the completion of all testing.

The device was tested on the back, front and side which was closest to the user.


| Conducted Transmit Power Measurements |            |         |       |
|---------------------------------------|------------|---------|-------|
| Freq                                  | Modulation | Antenna | Power |
| 2401.920                              | GFSK       | Ant 0   | 18.1  |
| 2441.664                              | GFSK       | Ant 0   | 18.1  |
| 2481.408                              | GFSK       | Ant 0   | 17.9  |
| 2401.920                              | GFSK       | Ant 1   | 18.0  |
| 2441.664                              | GFSK       | Ant 1   | 18.0  |
| 2481.408                              | GFSK       | Ant 1   | 17.7  |

**SAR Data Summary – 2450 MHz Body**

| MEASUREMENT RESULTS |         |           |     |            |           |          |            |
|---------------------|---------|-----------|-----|------------|-----------|----------|------------|
| Side                | Antenna | Frequency |     | Modulation | End Power |          | SAR (W/kg) |
|                     |         | MHz       | Ch. |            | (dBm)     | Battery  |            |
| Front               | Ant 0   | 2401.920  | 0   | GFSK       | 18.1      | Standard | 0.213      |
|                     |         | 2441.664  | 23  | GFSK       | 18.1      | Standard | 0.211      |
|                     |         | 2481.408  | 46  | GFSK       | 17.9      | Standard | 0.233      |
|                     | Ant 1   | 2401.920  | 0   | GFSK       | 18.0      | Standard | 0.250      |
|                     |         | 2441.664  | 23  | GFSK       | 18.0      | Standard | 0.248      |
|                     |         | 2481.408  | 46  | GFSK       | 17.7      | Standard | 0.205      |
| Back                | Ant 0   | 2401.920  | 0   | GFSK       | 18.1      | Standard | 0.133      |
|                     |         | 2441.664  | 23  | GFSK       | 18.1      | Standard | 0.111      |
|                     |         | 2481.408  | 46  | GFSK       | 17.9      | Standard | 0.129      |
|                     | Ant 1   | 2401.920  | 0   | GFSK       | 18.0      | Standard | 0.148      |
|                     |         | 2441.664  | 23  | GFSK       | 18.0      | Standard | 0.142      |
|                     |         | 2481.408  | 46  | GFSK       | 17.7      | Standard | 0.152      |
| End                 | Ant 0   | 2401.920  | 0   | GFSK       | 18.1      | Standard | 0.118      |
|                     |         | 2441.664  | 23  | GFSK       | 18.1      | Standard | 0.135      |
|                     |         | 2481.408  | 46  | GFSK       | 17.9      | Standard | 0.131      |
| Side                | Ant 1   | 2401.920  | 0   | GFSK       | 18.0      | Standard | 0.122      |
|                     |         | 2441.664  | 23  | GFSK       | 18.0      | Standard | 0.126      |
|                     |         | 2481.408  | 46  | GFSK       | 17.7      | Standard | 0.134      |

**Muscle**  
**1.6 W/kg (mW/g)**  
 averaged over 1 gram

1. Battery is fully charged for all tests.  
 Power Measured       Conducted       ERP       EIRP
2. SAR Measurement  
 Phantom Configuration       Left Head       Uniphantom       Right Head  
 SAR Configuration       Head       Body
3. Test Signal Call Mode       Test Code       Base Station Simulator
4. Test Configuration       With Belt Clip       Without Belt Clip       N/A
5. Tissue Depth 15.1 cm



\_\_\_\_\_  
 Jay M. Moulton  
 Vice President

## 10. Test Equipment List

**Table 10.1 Equipment Specifications**

| Type   | Calibration Due Date | Serial Number   |
|--|----------------------|-----------------|
| ThermoCRS Robot                              | N/A                  | RAF0338198      |
| ThermoCRS Controller                         | N/A                  | RCF0338224      |
| ThermoCRS Teach Pendant (Joystick)           | N/A                  | STP0334405      |
| IBM Computer, 2.66 MHz P4                    | N/A                  | 8189D8U KCPR08N |
| Apriel E-Field Probe ALS-E020                | 09/22/2011           | RFE-215         |
| Apriel E-Field Probe ALS-E030                | 07/14/2011           | E030-001        |
| Apriel Dummy Probe                           | N/A                  | 023             |
| Apriel Left Phantom                          | N/A                  | RFE-267         |
| Apriel Right Phantom                         | N/A                  | RFE-268         |
| Apriel UniPhantom                            | N/A                  | RFE-273         |
| Apriel Validation Dipole ALS-D-450-S-2 Head  | 01/12/2012           | RFE-362         |
| Apriel Validation Dipole ALS-D-450-S-2 Body  | 01/19/2012           | RFE-362         |
| Apriel Validation Dipole ALS-D-750-S-2 Head  | 01/14/2012           | 177-00501       |
| Apriel Validation Dipole ALS-D-750-S-2 Body  | 11/15/2011           | 177-00501       |
| Apriel Validation Dipole ALS-D-835-S-2 Head  | 01/14/2012           | 180-00561       |
| Apriel Validation Dipole ALS-D-835-S-2 Body  | 11/16/2011           | 180-00561       |
| Apriel Validation Dipole ALS-D-900-S-2 Head  | 01/12/2012           | RFE-275         |
| Apriel Validation Dipole ALS-D-900-S-2 Body  | 11/19/2011           | RFE-275         |
| Apriel Validation Dipole ALS-D-1900-S-2 Head | 01/15/2012           | 210-00713       |
| Apriel Validation Dipole ALS-D-1900-S-2 Body | 11/16/2011           | 210-00713       |
| Apriel Validation Dipole ALS-D-2450-S-2 Head | 01/12/2012           | RFE-278         |
| Apriel Validation Dipole ALS-D-2450-S-2 Body | 11/18/2011           | RFE-278         |
| Apriel Validation Dipole RFE-D-2600-S-2 Body | 01/18/2012           | RFE-121         |
| Apriel Validation Dipole RFE-D-BB-S-2 Head   | 01/12/2012           | 235-00801       |
| Apriel Validation Dipole RFE-D-BB-S-2 Body   | 02/09/2012           | 235-00801       |
| Agilent (HP) 437B Power Meter                | 03/30/2012           | 3125U08837      |
| Agilent (HP) 8481B Power Sensor              | 03/30/2012           | 3318A05384      |
| Agilent N1911A Power Meter                   | 03/30/2012           | GB45100254      |
| Agilent N1922A Power Sensor                  | 03/30/2012           | MY45240464      |
| Advantest R3261A Spectrum Analyzer           | 03/30/2012           | 31720068        |
| Agilent (HP) 8350B Signal Generator          | 03/31/2012           | 2749A10226      |
| Agilent (HP) 83525A RF Plug-In               | 03/31/2012           | 2647A01172      |
| Agilent (HP) 8753C Vector Network Analyzer   | 03/30/2012           | 3135A01724      |
| Agilent (HP) 85047A S-Parameter Test Set     | 03/31/2012           | 2904A00595      |
| Agilent (HP) 8960 Base Station Sim.          | 03/25/2012           | MY48360364      |
| R&S CMW500 Wideband Radio Comm. Box          | 08/14/2011           | 101383          |
| Apriel Dielectric Probe Assembly             | N/A                  | 0011            |
| Head Equivalent Matter (450 MHz)             | N/A                  | N/A             |
| Head Equivalent Matter (835/900 MHz)         | N/A                  | N/A             |
| Head Equivalent Matter (1900 MHz)            | N/A                  | N/A             |
| Head Equivalent Matter (2450 MHz)            | N/A                  | N/A             |
| Body Equivalent Matter (450 MHz)             | N/A                  | N/A             |
| Body Equivalent Matter (750 MHz)             | N/A                  | N/A             |
| Body Equivalent Matter (835/900 MHz)         | N/A                  | N/A             |
| Body Equivalent Matter (1900 MHz)            | N/A                  | N/A             |
| Body Equivalent Matter (2450 MHz)            | N/A                  | N/A             |
| Body Equivalent Matter (2600 MHz)            | N/A                  | N/A             |
| Body Equivalent Matter (5200 MHz)            | N/A                  | N/A             |
| Body Equivalent Matter (5800 MHz)            | N/A                  | N/A             |

## 11. Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body is a very complex phenomena that depends on the mass, shape, and size of the body; the orientation of the body with respect to the field vectors; and, the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]



## 12. References

- [1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radio Frequency Radiation, August 1996
- [2] ANSI/IEEE C95.1 – 1999, American National Standard Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300kHz to 100GHz, New York: IEEE, 1992.
- [3] ANSI/IEEE C95.3 – 2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, 1992.
- [4] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, July 2001.
- [5] IEEE Standard 1528 – 2003, IEEE Recommended Practice for Determining the Peak-Spatial Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques, October 2003.
- [6] Industry Canada, RSS – 102e, Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), November 2005.
- [7] Industry Canada, Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz, 1999.

## Appendix A – System Validation Plots and Data

```

*****
Test Result for UIM Dielectric Parameter
Mon 23/May/2011 06:04:26
Freq  Frequency(GHz)
FCC_eH      FCC Bulletin 65 Supplement C ( June 2001) Limits for Head Epsilon
FCC_sH      FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB      FCC Limits for Body Epsilon
FCC_sB      FCC Limits for Body Sigma
Test_e      Epsilon of UIM
Test_s      Sigma of UIM
*****
Freq      FCC_eB      FCC_sB      Test_e      Test_s
2.4200    52.74      1.92      52.58      1.92
2.4300    52.73      1.93      52.56      1.95
2.4400    52.71      1.94      52.53      1.96
2.4500    52.70      1.95      52.51      1.98
2.4600    52.69      1.96      52.50      1.99
2.4700    52.67      1.98      52.47      2.00
2.4800    52.66      1.99      52.45      2.01

```

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 06:13:22 AM  
End Time : 23-May-2011 06:26:16 AM  
Scanning Time : 774 secs

## Product Data

Device Name : Validation  
Serial No. : 2450  
Type : Dipole  
Model : ALS-D-2450-S-2  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 51.5 mm  
Width : 3.6 mm  
Depth : 30.4 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 6.390 W/kg  
Power Drift-Finish: 6.601 W/kg  
Power Drift (%) : 3.301

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 45.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

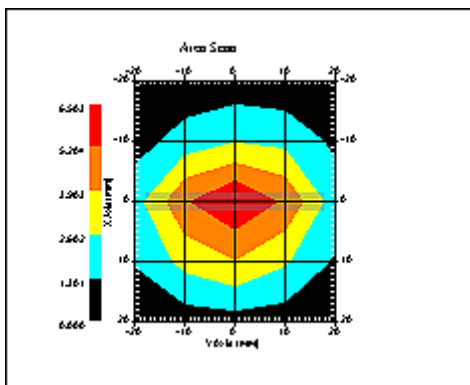
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:40:13 AM  
Area Scan : 5x5x1 : Measurement x=10mm, y=10mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

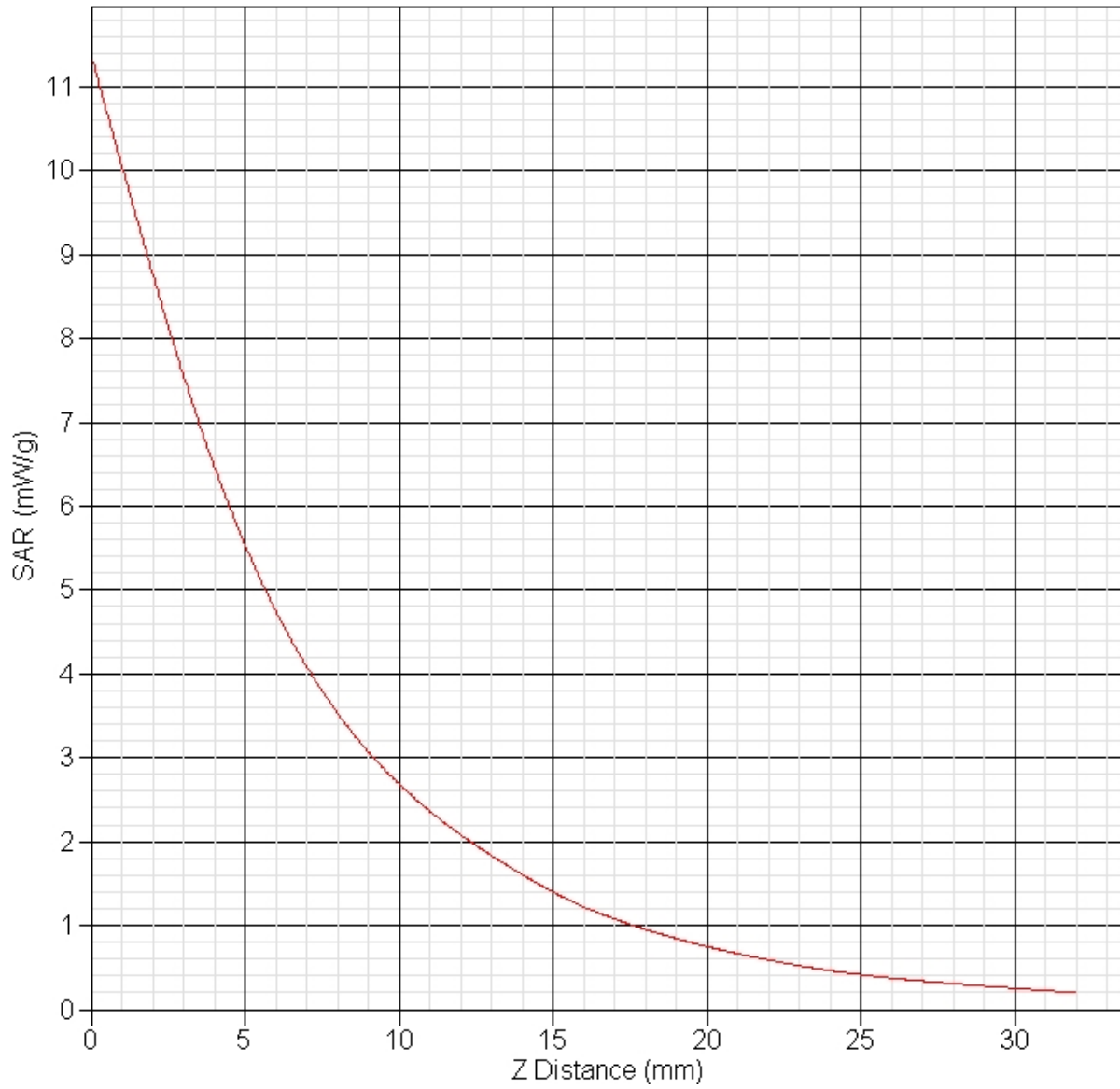
Other Data

DUT Position : Touch  
Separation : 10 mm  
Channel : Mid



1 gram SAR value : 5.130 W/kg  
10 gram SAR value : 2.336 W/kg  
Area Scan Peak SAR : 6.503 W/kg  
Zoom Scan Peak SAR : 11.390 W/kg

**SAR-Z Axis**  
at Hotspot x:0.24 y:-0.17



## Appendix B – SAR Test Data Plots

**Note:** In all data sheets in Appendix B, the frequency noted in the ‘Product Data’ section is the frequency band which the device was transmitting. This frequency does not refer to the actual frequency and channel of the test. The channel is listed in the ‘Other Data’ section of the data sheet as Low, Mid or High. The actual test frequency is listed in Section 10 in each of the data summary sheets.

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 07:43:00 AM  
End Time : 23-May-2011 08:00:19 AM  
Scanning Time : 1039 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 0  
Orientation : Front  
Power Drift-Start : 0.168 W/kg  
Power Drift-Finish: 0.161 W/kg  
Power Drift (%) : -4.207

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

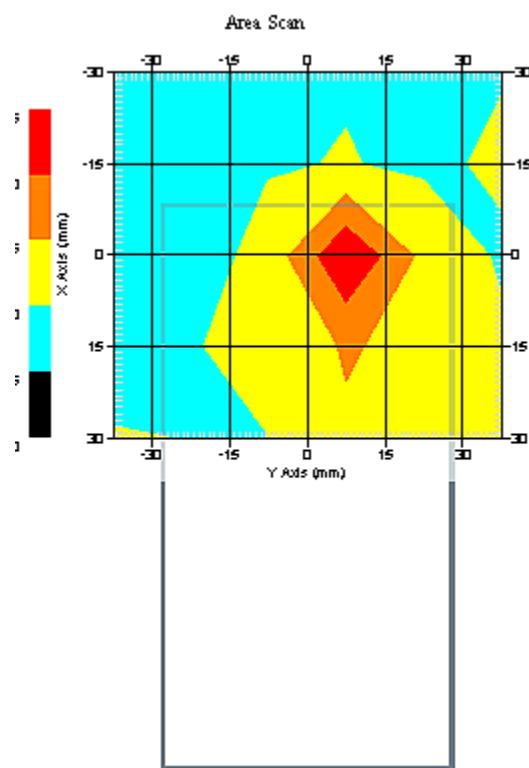
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : Front  
Separation : 0 mm  
Channel : Low



1 gram SAR value : 0.213 W/kg  
10 gram SAR value : 0.145 W/kg  
Area Scan Peak SAR : 0.248 W/kg  
Zoom Scan Peak SAR : 0.370 W/kg



**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 08:39:00 AM  
End Time : 23-May-2011 08:56:32 AM  
Scanning Time : 1052 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 0  
Orientation : Front  
Power Drift-Start : 0.160 W/kg  
Power Drift-Finish: 0.157 W/kg  
Power Drift (%) : -1.810

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

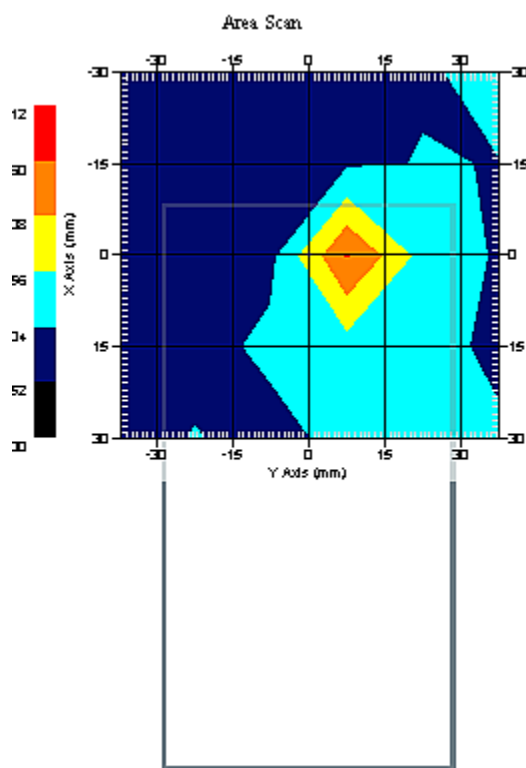
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Front  
Separation : 0 mm  
Channel : Mid



1 gram SAR value : 0.211 W/kg  
10 gram SAR value : 0.152 W/kg  
Area Scan Peak SAR : 0.262 W/kg  
Zoom Scan Peak SAR : 0.340 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 09:35:57 AM  
End Time : 23-May-2011 09:53:26 AM  
Scanning Time : 1049 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 0  
Orientation : Front  
Power Drift-Start : 0.164 W/kg  
Power Drift-Finish: 0.167 W/kg  
Power Drift (%) : 1.715

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

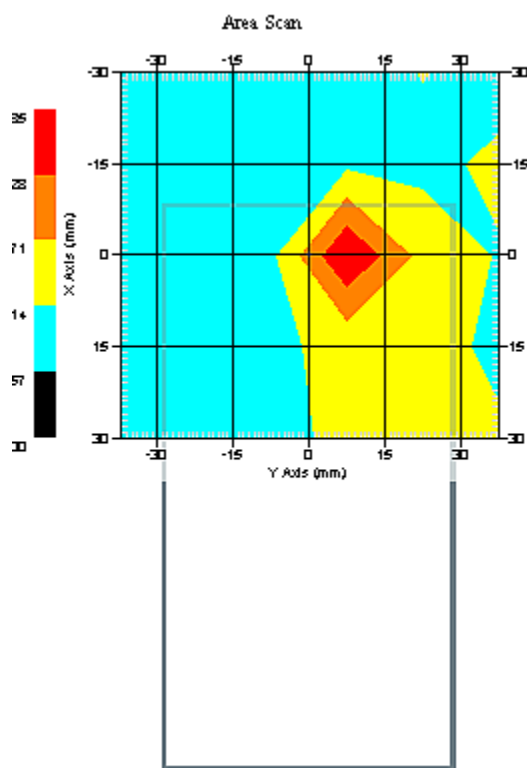
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : Front  
Separation : 0 mm  
Channel : High



1 gram SAR value : 0.233 W/kg  
10 gram SAR value : 0.153 W/kg  
Area Scan Peak SAR : 0.285 W/kg  
Zoom Scan Peak SAR : 0.320 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 12:52:49 PM  
End Time : 23-May-2011 01:10:52 PM  
Scanning Time : 1083 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 1  
Orientation : Front  
Power Drift-Start : 0.150 W/kg  
Power Drift-Finish: 0.152 W/kg  
Power Drift (%) : 1.331

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

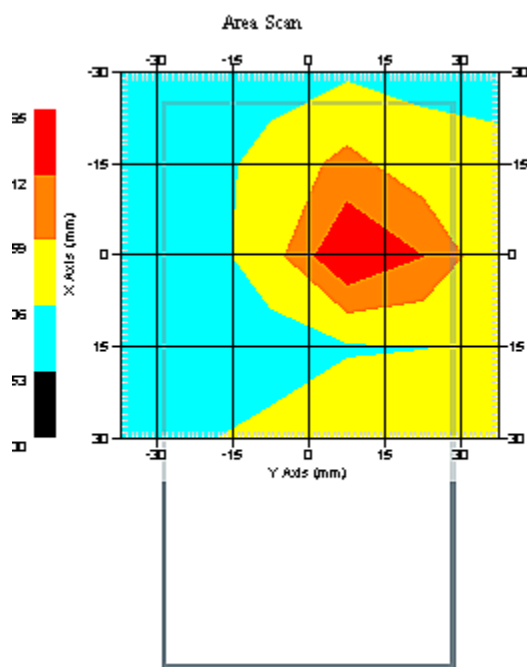
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

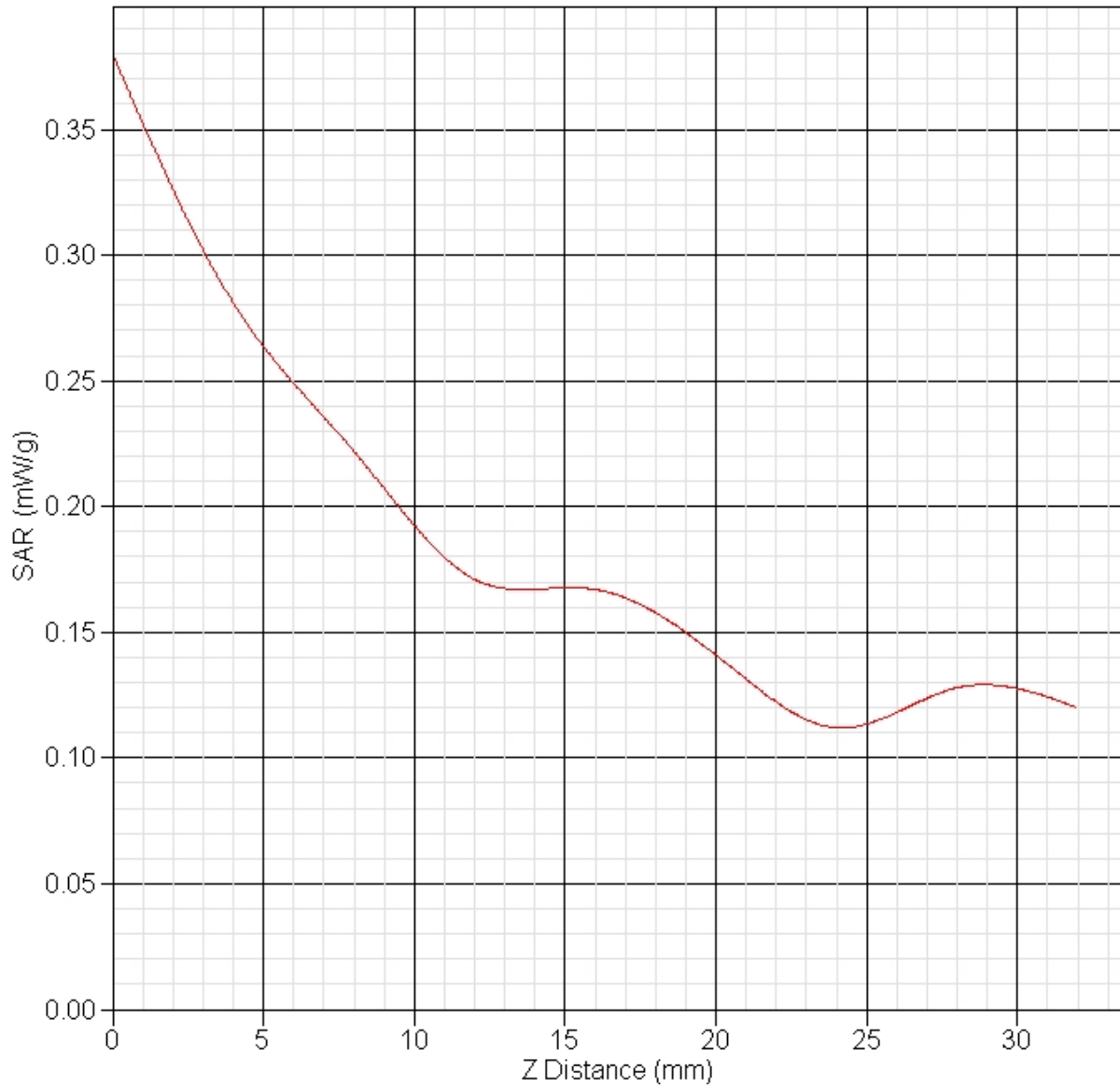
### Other Data

DUT Position : Front  
Separation : 0 mm  
Channel : Low



1 gram SAR value : 0.250 W/kg  
10 gram SAR value : 0.162 W/kg  
Area Scan Peak SAR : 0.264 W/kg  
Zoom Scan Peak SAR : 0.380 W/kg

**SAR-Z Axis**  
at Hotspot x:0.12 y:16.05



**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 11:34:49 AM  
End Time : 23-May-2011 11:52:17 AM  
Scanning Time : 1048 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 1  
Orientation : Front  
Power Drift-Start : 0.119 W/kg  
Power Drift-Finish: 0.123 W/kg  
Power Drift (%) : 3.365

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
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

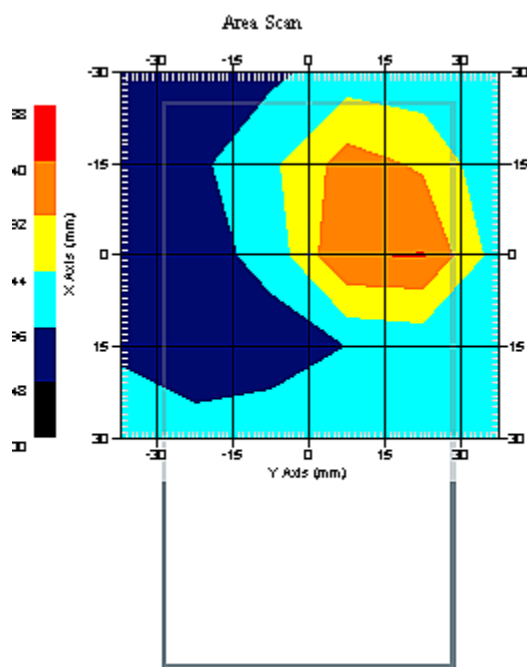


### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : Front  
Separation : 0 mm  
Channel : Mid



1 gram SAR value : 0.248 W/kg  
10 gram SAR value : 0.160 W/kg  
Area Scan Peak SAR : 0.242 W/kg  
Zoom Scan Peak SAR : 0.420 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 10:35:43 AM  
End Time : 23-May-2011 10:53:56 AM  
Scanning Time : 1093 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 1  
Orientation : Front  
Power Drift-Start : 0.136 W/kg  
Power Drift-Finish: 0.141 W/kg  
Power Drift (%) : 3.665

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

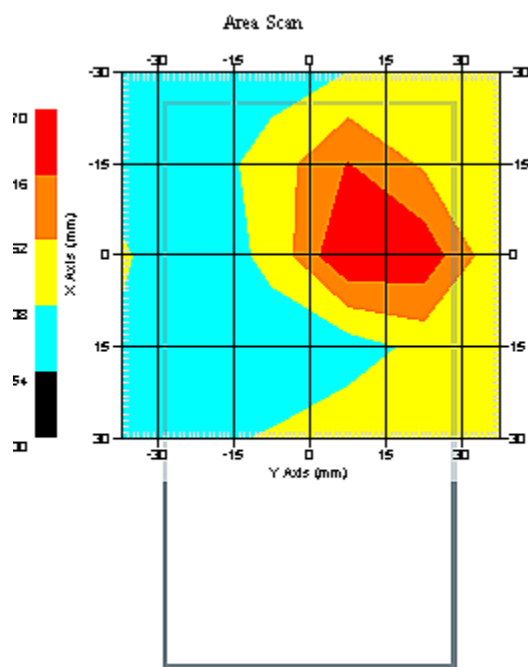
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : Front  
Separation : 0 mm  
Channel : High



1 gram SAR value : 0.205 W/kg  
10 gram SAR value : 0.144 W/kg  
Area Scan Peak SAR : 0.270 W/kg  
Zoom Scan Peak SAR : 0.330 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 07:24:04 AM  
End Time : 23-May-2011 07:41:13 AM  
Scanning Time : 1029 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 0  
Orientation : Back  
Power Drift-Start : 0.123 W/kg  
Power Drift-Finish: 0.121 W/kg  
Power Drift (%) : -1.798

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

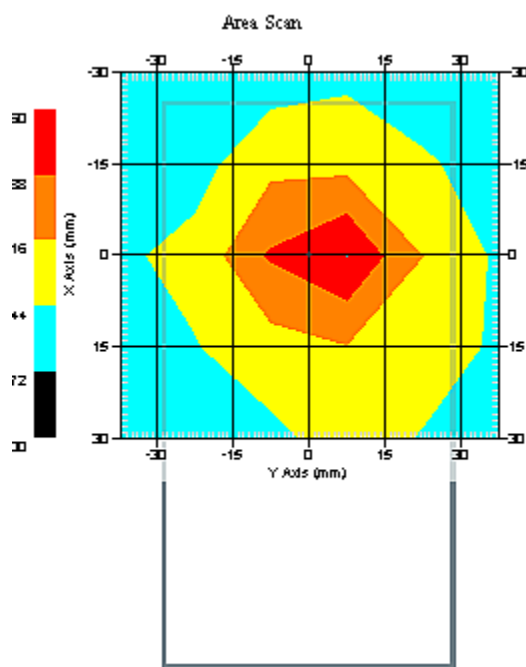
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : Back  
Separation : 0 mm  
Channel : Low



1 gram SAR value : 0.133 W/kg  
10 gram SAR value : 0.102 W/kg  
Area Scan Peak SAR : 0.158 W/kg  
Zoom Scan Peak SAR : 0.030 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 08:58:09 AM  
End Time : 23-May-2011 09:15:19 AM  
Scanning Time : 1030 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 0  
Orientation : Back  
Power Drift-Start : 0.088 W/kg  
Power Drift-Finish: 0.090 W/kg  
Power Drift (%) : 2.275

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

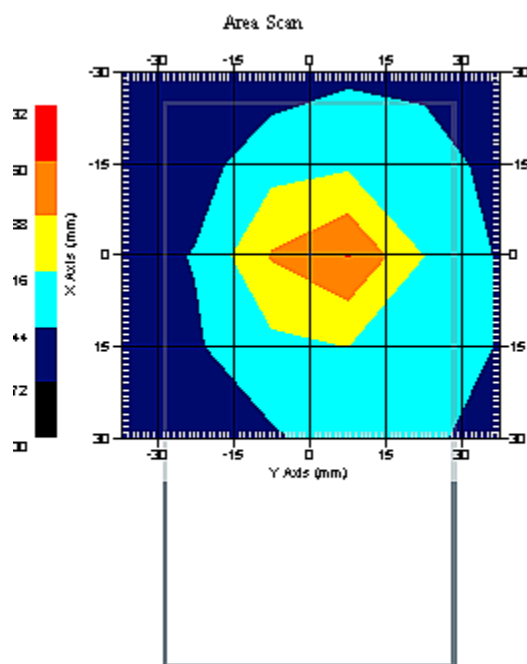
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Back  
Separation : 0 mm  
Channel : Mid



1 gram SAR value : 0.111 W/kg  
10 gram SAR value : 0.101 W/kg  
Area Scan Peak SAR : 0.152 W/kg  
Zoom Scan Peak SAR : 0.230 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 09:17:03 AM  
End Time : 23-May-2011 09:34:26 AM  
Scanning Time : 1043 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 0  
Orientation : Back  
Power Drift-Start : 0.097 W/kg  
Power Drift-Finish: 0.099 W/kg  
Power Drift (%) : 2.063

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
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

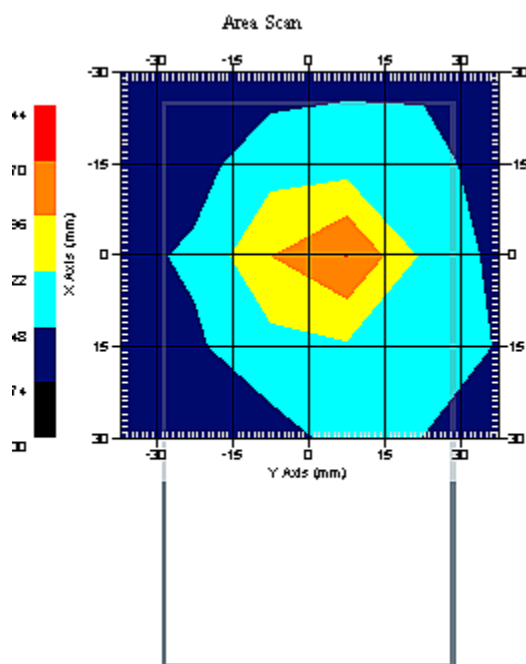


## Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Back  
Separation : 0 mm  
Channel : High



1 gram SAR value : 0.129 W/kg  
10 gram SAR value : 0.105 W/kg  
Area Scan Peak SAR : 0.151 W/kg  
Zoom Scan Peak SAR : 0.220 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 12:14:54 PM  
End Time : 23-May-2011 12:31:51 PM  
Scanning Time : 1017 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 1  
Orientation : Back  
Power Drift-Start : 0.077 W/kg  
Power Drift-Finish: 0.080 W/kg  
Power Drift (%) : 3.891

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

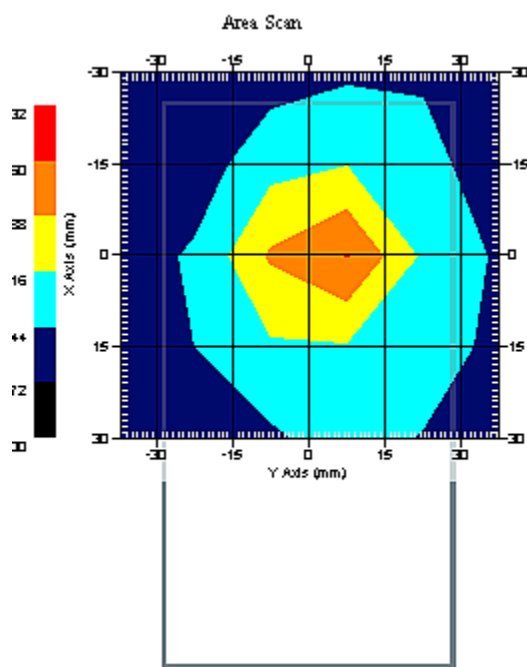
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : Back  
Separation : 0 mm  
Channel : Low



1 gram SAR value : 0.148 W/kg  
10 gram SAR value : 0.121 W/kg  
Area Scan Peak SAR : 0.147 W/kg  
Zoom Scan Peak SAR : 0.140 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 11:15:31 AM  
End Time : 23-May-2011 11:32:55 AM  
Scanning Time : 1044 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 1  
Orientation : Back  
Power Drift-Start : 0.118 W/kg  
Power Drift-Finish: 0.120 W/kg  
Power Drift (%) : 1.695

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

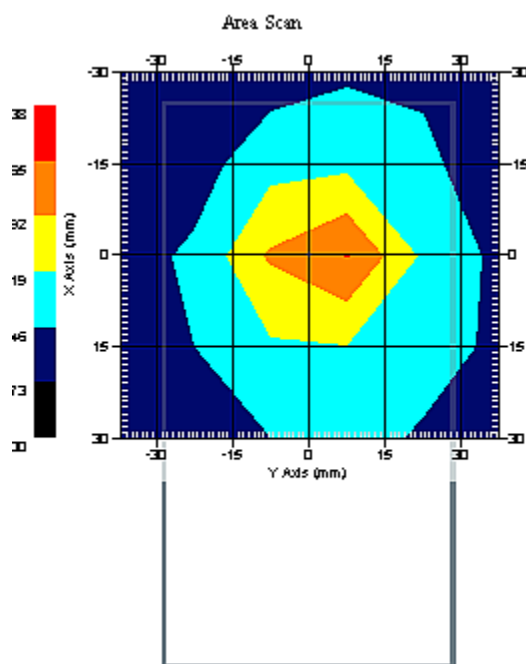
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Back  
Separation : 0 mm  
Channel : Mid



1 gram SAR value : 0.142 W/kg  
10 gram SAR value : 0.116 W/kg  
Area Scan Peak SAR : 0.168 W/kg  
Zoom Scan Peak SAR : 0.140 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 10:55:25 AM  
End Time : 23-May-2011 11:12:54 AM  
Scanning Time : 1049 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 1  
Orientation : Back  
Power Drift-Start : 0.122 W/kg  
Power Drift-Finish: 0.124 W/kg  
Power Drift (%) : 1.631

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

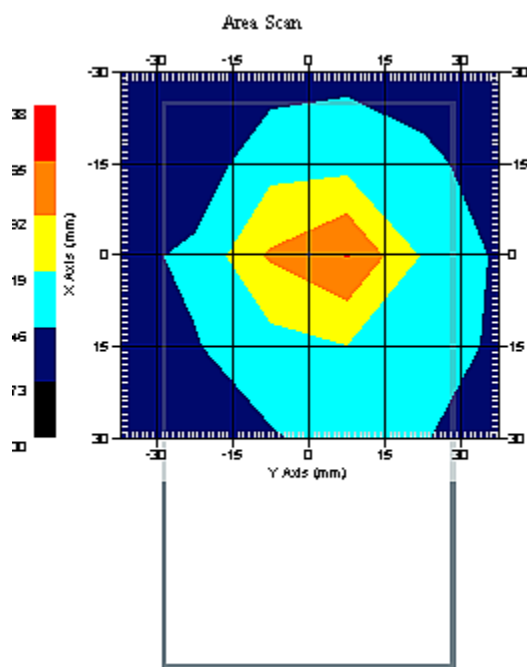
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : Back  
Separation : 0 mm  
Channel : High



1 gram SAR value : 0.152 W/kg  
10 gram SAR value : 0.120 W/kg  
Area Scan Peak SAR : 0.185 W/kg  
Zoom Scan Peak SAR : 0.140 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 08:02:04 AM  
End Time : 23-May-2011 08:18:54 AM  
Scanning Time : 1010 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 25 mm  
Width : 58 mm  
Depth : 110 mm  
Antenna Type : Internal - Ant 0  
Orientation : End  
Power Drift-Start : 0.094 W/kg  
Power Drift-Finish: 0.097 W/kg  
Power Drift (%) : 3.194

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
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

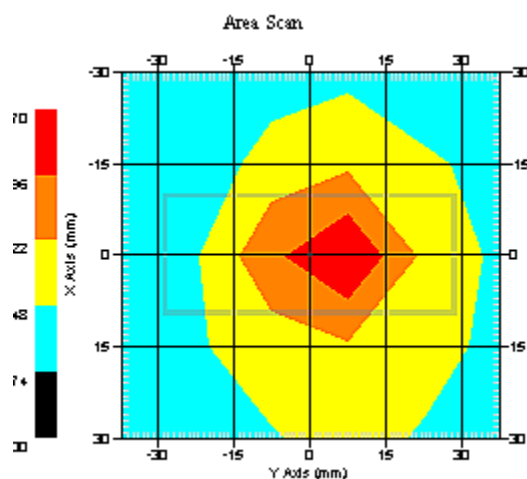


### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : End  
Separation : 0 mm  
Channel : Low



1 gram SAR value : 0.118 W/kg  
10 gram SAR value : 0.108 W/kg  
Area Scan Peak SAR : 0.150 W/kg  
Zoom Scan Peak SAR : 0.150 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 08:20:28 AM  
End Time : 23-May-2011 08:37:16 AM  
Scanning Time : 1008 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 25 mm  
Width : 58 mm  
Depth : 110 mm  
Antenna Type : Internal - Ant 0  
Orientation : End  
Power Drift-Start : 0.086 W/kg  
Power Drift-Finish: 0.086 W/kg  
Power Drift (%) : 0.283

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

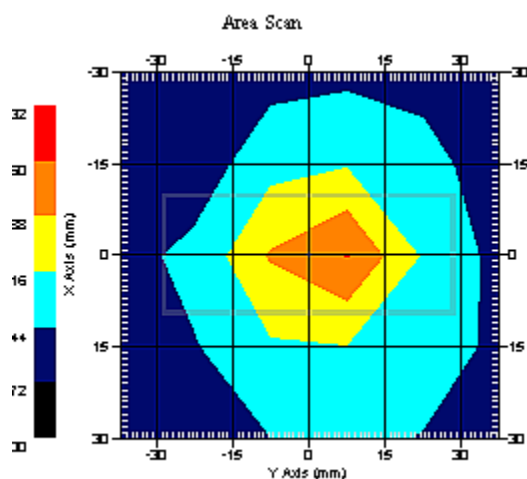
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : End  
Separation : 0 mm  
Channel : Mid



1 gram SAR value : 0.135 W/kg  
10 gram SAR value : 0.116 W/kg  
Area Scan Peak SAR : 0.162 W/kg  
Zoom Scan Peak SAR : 0.200 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 09:57:02 AM  
End Time : 23-May-2011 10:13:50 AM  
Scanning Time : 1008 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 25 mm  
Width : 58 mm  
Depth : 110 mm  
Antenna Type : Internal - Ant 0  
Orientation : End  
Power Drift-Start : 0.078 W/kg  
Power Drift-Finish: 0.078 W/kg  
Power Drift (%) : 0.581

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

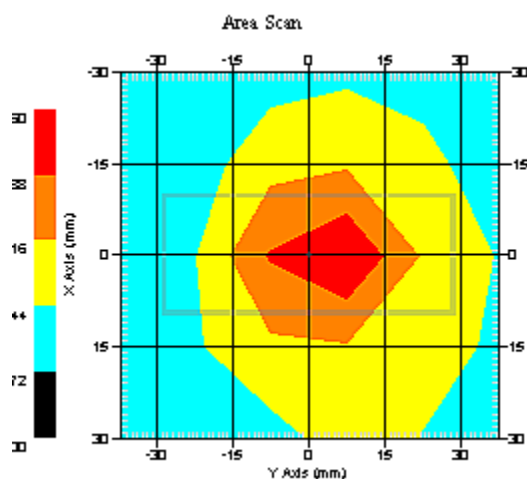
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : End  
Separation : 0 mm  
Channel : High



1 gram SAR value : 0.131 W/kg  
10 gram SAR value : 0.116 W/kg  
Area Scan Peak SAR : 0.141 W/kg  
Zoom Scan Peak SAR : 0.240 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 12:34:19 PM  
End Time : 23-May-2011 12:51:10 PM  
Scanning Time : 1011 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 25 mm  
Depth : 58 mm  
Antenna Type : Internal - Ant 1  
Orientation : Side  
Power Drift-Start : 0.091 W/kg  
Power Drift-Finish: 0.090 W/kg  
Power Drift (%) : -1.099

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

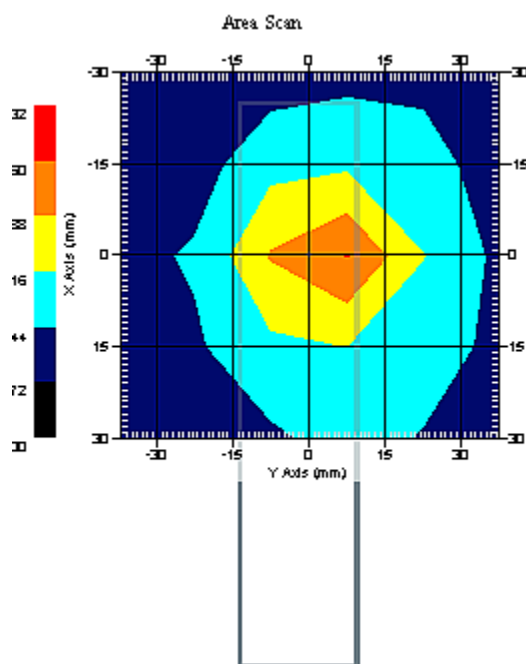
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : Side  
Separation : 0 mm  
Channel : Low



1 gram SAR value : 0.122 W/kg  
10 gram SAR value : 0.111 W/kg  
Area Scan Peak SAR : 0.154 W/kg  
Zoom Scan Peak SAR : 0.140 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 11:55:54 AM  
End Time : 23-May-2011 12:12:45 PM  
Scanning Time : 1011 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 58 mm  
Depth : 25 mm  
Antenna Type : Internal - Ant 1  
Orientation : Side  
Power Drift-Start : 0.100 W/kg  
Power Drift-Finish: 0.103 W/kg  
Power Drift (%) : 2.802

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
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

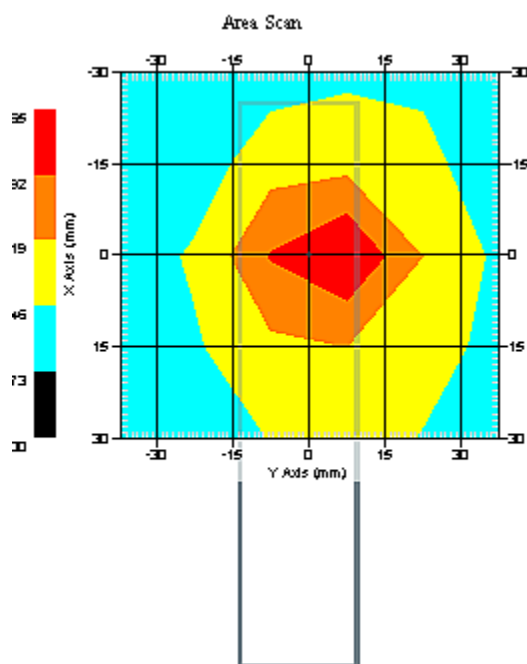


### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : Side  
Separation : 0 mm  
Channel : Mid



1 gram SAR value : 0.126 W/kg  
10 gram SAR value : 0.101 W/kg  
Area Scan Peak SAR : 0.155 W/kg  
Zoom Scan Peak SAR : 0.160 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 23-May-2011  
Starting Time : 23-May-2011 10:16:39 AM  
End Time : 23-May-2011 10:33:57 AM  
Scanning Time : 1038 secs

## Product Data

Device Name : HM Electronics  
Serial No. : F13N0046  
Mode : GFSK  
Model : COM6100  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 110 mm  
Width : 25 mm  
Depth : 58 mm  
Antenna Type : Internal - Ant 1  
Orientation : Side  
Power Drift-Start : 0.091 W/kg  
Power Drift-Finish: 0.088 W/kg  
Power Drift (%) : -3.794

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2450  
Frequency : 2450.00 MHz  
Last Calib. Date : 23-May-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.51 F/m  
Sigma : 1.98 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

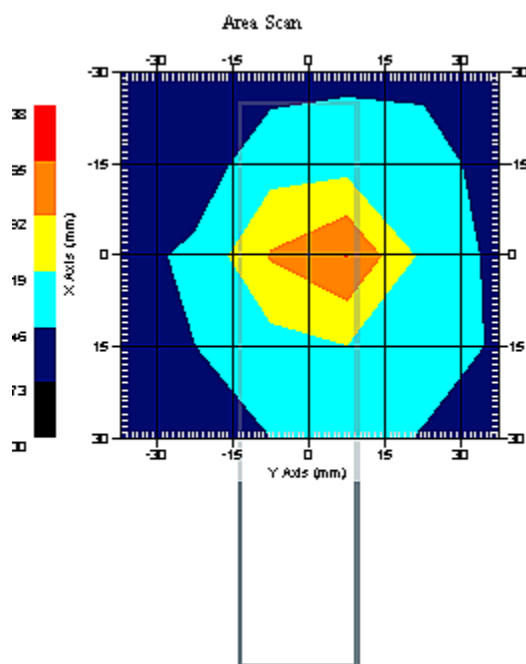
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 20  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V}/\text{m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

### Measurement Data

Crest Factor : 20  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 23-May-2011  
Set-up Time : 7:01:15 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

### Other Data

DUT Position : Side  
Separation : 0 mm  
Channel : High



1 gram SAR value : 0.134 W/kg  
10 gram SAR value : 0.114 W/kg  
Area Scan Peak SAR : 0.156 W/kg  
Zoom Scan Peak SAR : 0.230 W/kg

## Appendix C – SAR Test Setup Photos



**System Body Configuration**



**Front Test Position**



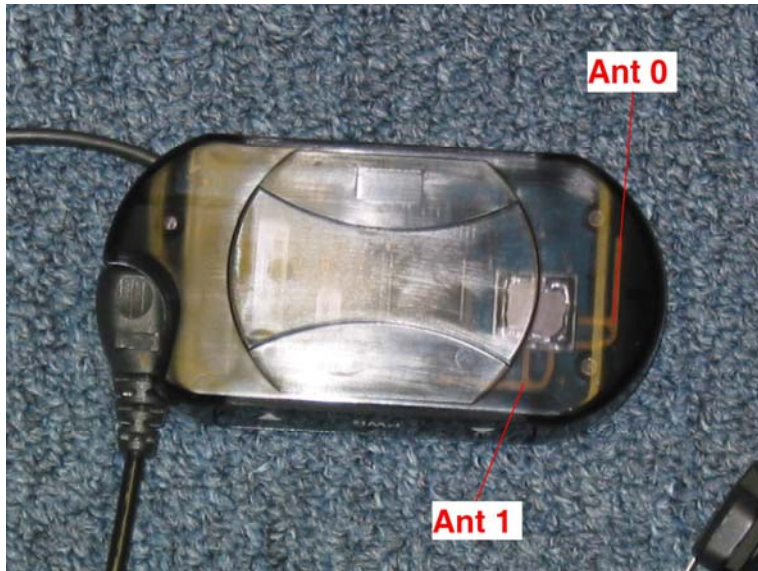
**Back Test Position**



**End Test Position**



**Side Test Position**



**Front of Device and Antenna Locations**



**Back of Device**



**System**



## Appendix D – Probe Calibration Data Sheets

# NCL CALIBRATION LABORATORIES

Calibration File No.: CP-1164

Client.: RFEL

## 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.: 215

Body Calibration

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

Project No: RFEL-E-020-Cal-5539

Calibrated: 22 September 2010

Released on: 27 September 2010

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary  
This calibration has been conducted in line with the SCC ISO-IEC 17025 Scope of Accreditation  
Accredited Laboratory Number 48

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

**NCL** CALIBRATION LABORATORIES

17 Bentley Ave  
NEPEAN, ONTARIO  
CANADA K2E 6T7

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

## 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-020 215.

## References

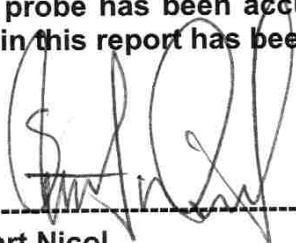
SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure  
IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"  
IEEE 1309 "IEEE Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9 KHz to 40 GHz" 2005  
SSI-TP-011 Tissue Calibration Procedure  
IEC 62209 "Human exposure to radio frequency fields from handheld and body-mounted wireless communication devices –Human models, instrumentation and procedures Part 1 & 2: Procedure to determine the Specific Absorption Rate (SAR) for handheld devices used in close proximity of the ear (frequency range of 200MHz to 3GHz)"

## Conditions

Probe 215 was a re-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**

  
-----  
**Jesse Hones**

## Calibration Results Summary

|                       |                     |
|-----------------------|---------------------|
| <b>Probe Type:</b>    | E-Field Probe E-020 |
| <b>Serial Number:</b> | 215                 |
| <b>Frequency:</b>     | 2450 MHz            |
| <b>Sensor Offset:</b> | 1.56 mm             |
| <b>Sensor Length:</b> | 2.5 mm              |
| <b>Tip Enclosure:</b> | Ertalyte*           |
| <b>Tip Diameter:</b>  | <5 mm               |
| <b>Tip Length:</b>    | 60 mm               |
| <b>Total Length:</b>  | 290 mm              |

\*Resistive to recommended tissue recipes per IEEE-1528

## Sensitivity in Air

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

## **Sensitivity in Body Tissue Measured**

**Frequency:** 2450 MHz

**Epsilon:** 53.0 (+/-5%)                      **Sigma:** 1.98 S/m (+/-5%)

### **ConvF**

**Channel X:** 4.5

**Channel Y:** 4.5

**Channel Z:** 4.5

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

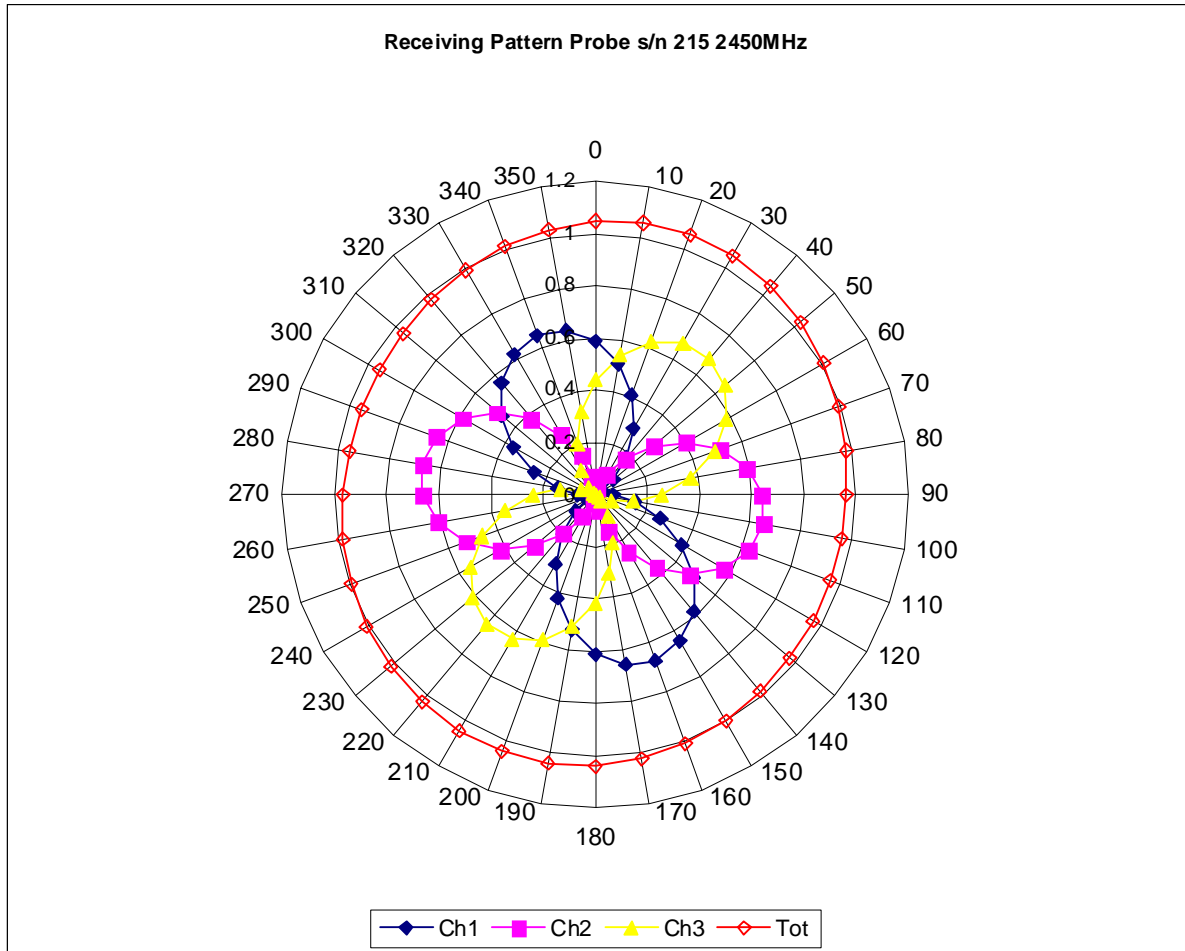
### **Boundary Effect:**

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.

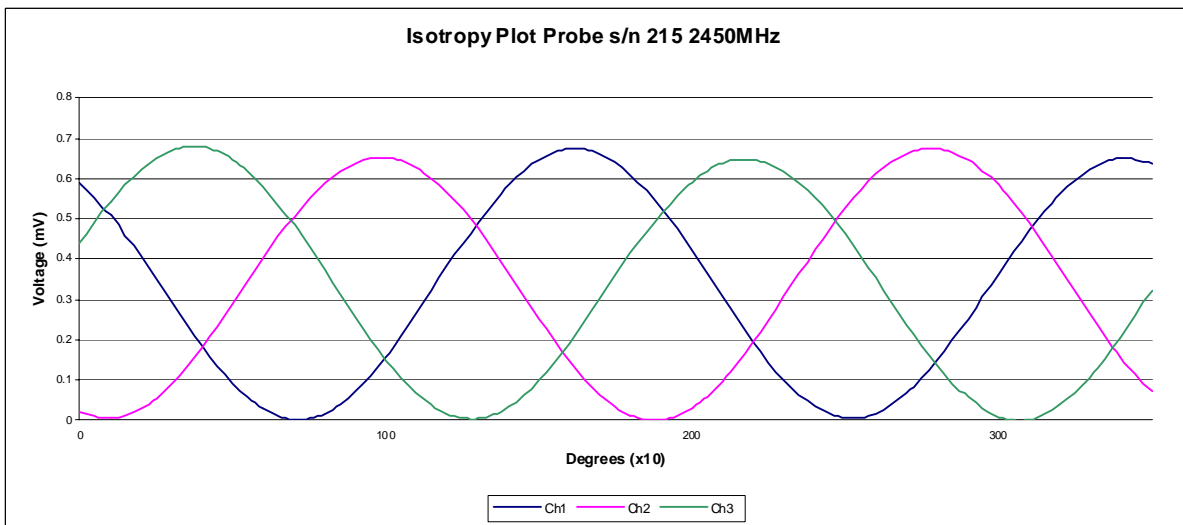
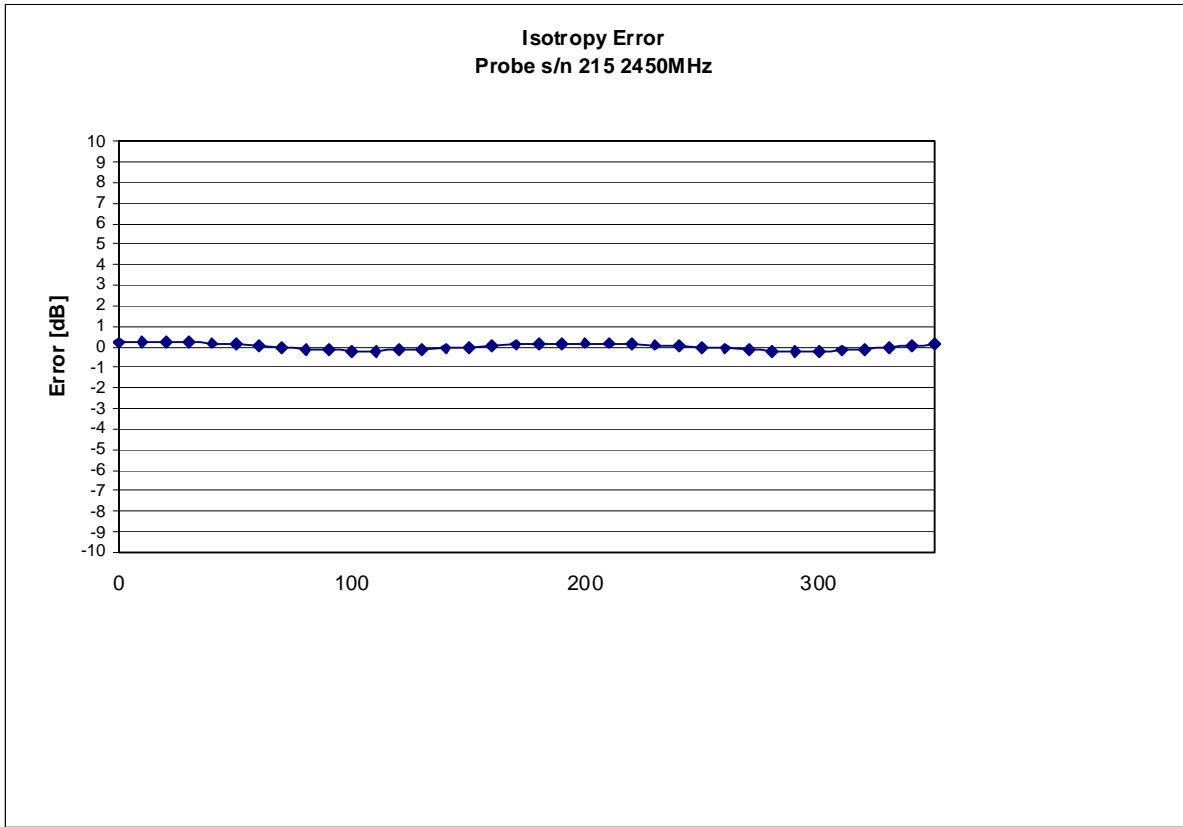
### **Spatial Resolution:**

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.

## Receiving Pattern 2450 MHz (Air)



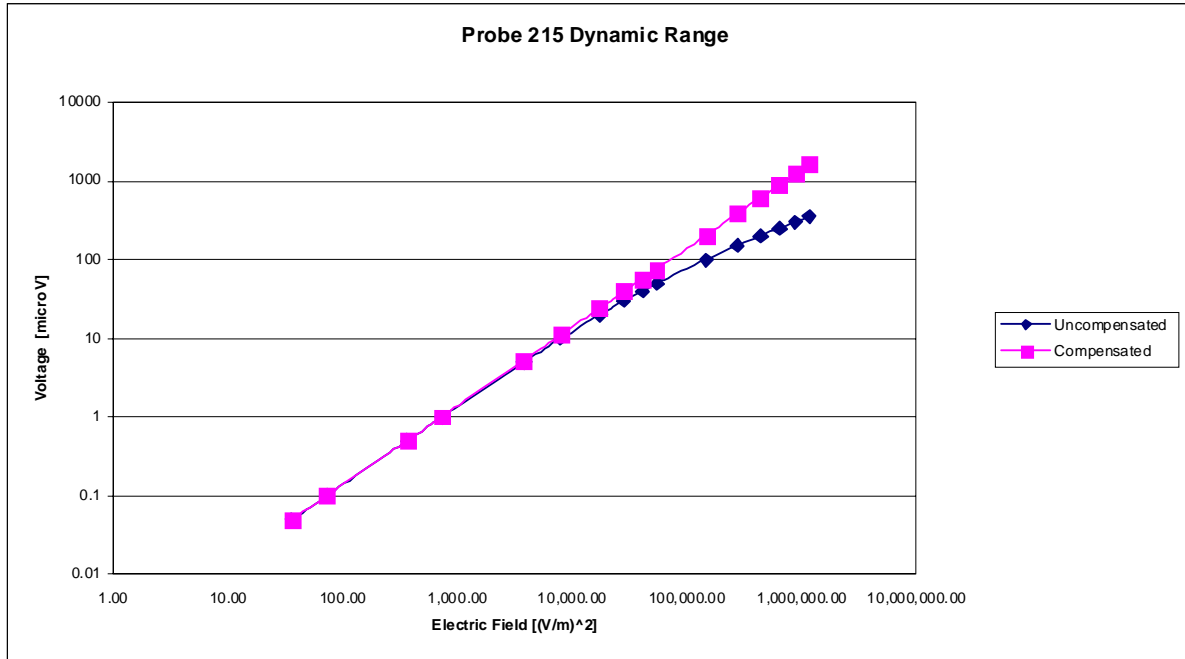
### Isotropy Error 2450 MHz (Air)



Isotropicity Tissue:

0.10 dB

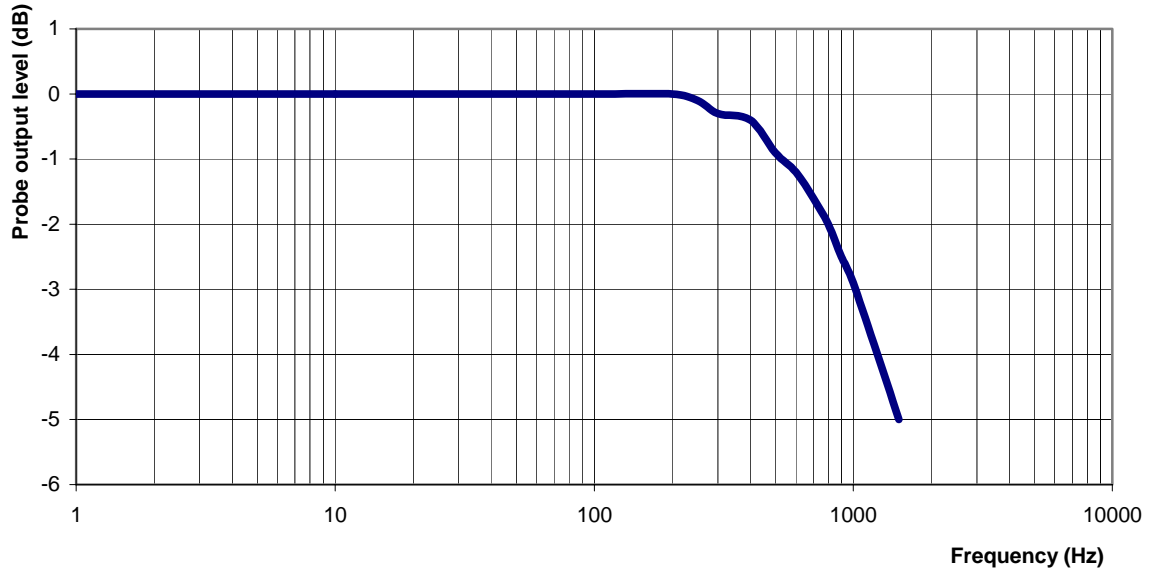
## Dynamic Range





## Video Bandwidth

**Probe Frequency Characteristics**



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

## **Conversion Factor Uncertainty Assessment**

### **Sensitivity in Body Tissue**

**Frequency:** 2450 MHz

**Epsilon:** 53.0 (+/-5%)      **Sigma:** 1.98 S/m (+/-5%)

#### **ConvF**

**Channel X:** 4.5      7%(K=2)

**Channel Y:** 4.5      7%(K=2)

**Channel Z:** 4.5      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 2.5mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

## **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 May 2010.

## Appendix E – Dipole Calibration Data Sheets

# NCL CALIBRATION LABORATORIES

Calibration File No: DC-1182

Project Number: RFEB-5552

## 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.

Validation Dipole

Manufacturer: APREL Laboratories

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

Frequency: 2450 MHz

Serial No: RFE-278

Customer: RFEL

Body Calibration

Calibrated: 18<sup>th</sup> November 2010  
Released on: 19<sup>th</sup> November 2010

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

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



### **NCL** CALIBRATION LABORATORIES

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

## NCL Calibration Laboratories

---

Division of APREL Laboratories.

### Conditions

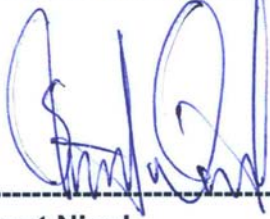
Dipole RFE-278 was a new calibration.

**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 device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.**

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**

## Calibration Results Summary

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

### Mechanical Dimensions

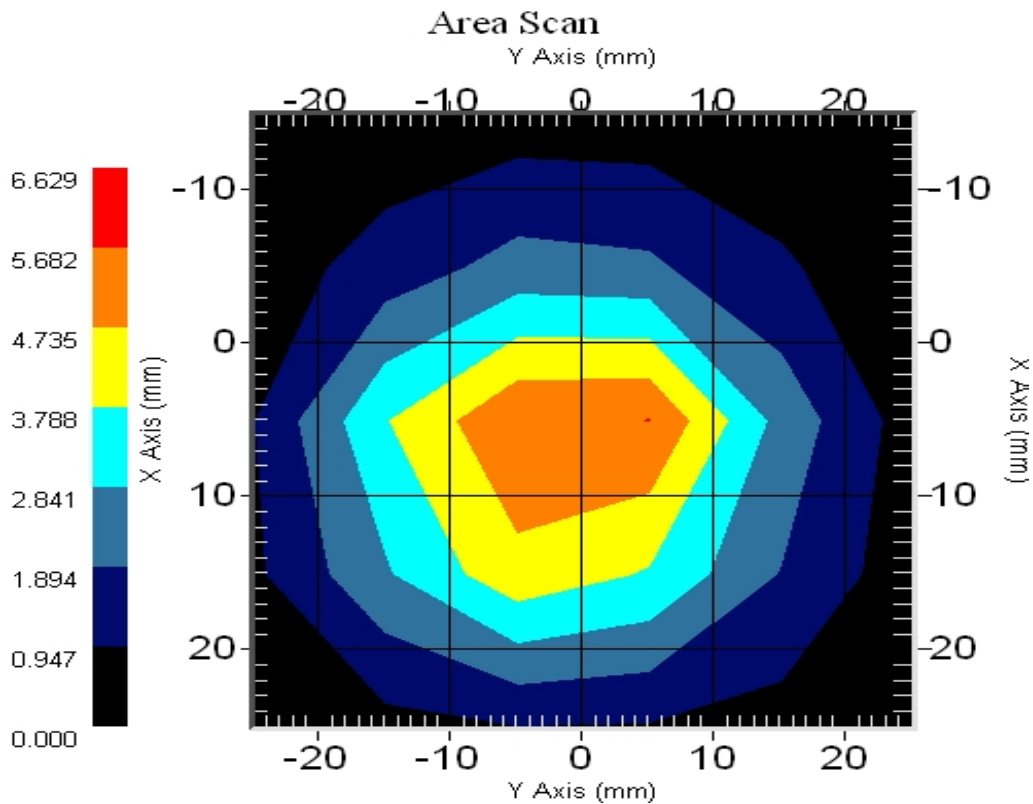
**Length:** 51.5 mm  
**Height:** 30.4 mm

### Electrical Specification

**SWR:** 1.249 U  
**Return Loss:** -19.170 dB  
**Impedance:** 42.223  $\Omega$

### System Validation Results @ 100mW

| Frequency | 1 Gram | 10 Gram | Peak  |
|-----------|--------|---------|-------|
| 2450 MHz  | 5.15   | 2.31    | 10.01 |



## **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 RFE-278. 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 226.

## **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 RFE-278 was a re-calibration.

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

**Temperature of the Tissue:** 20 °C +/- 0.5°C



## Dipole Calibration Results

### Mechanical Verification

| <b>APREL Length</b> | <b>APREL Height</b> | <b>Measured Length</b> | <b>Measured Height</b> |
|---------------------|---------------------|------------------------|------------------------|
| 51.5 mm             | 30.4 mm             | 52.1 mm                | 31.0 mm                |

### Tissue Validation

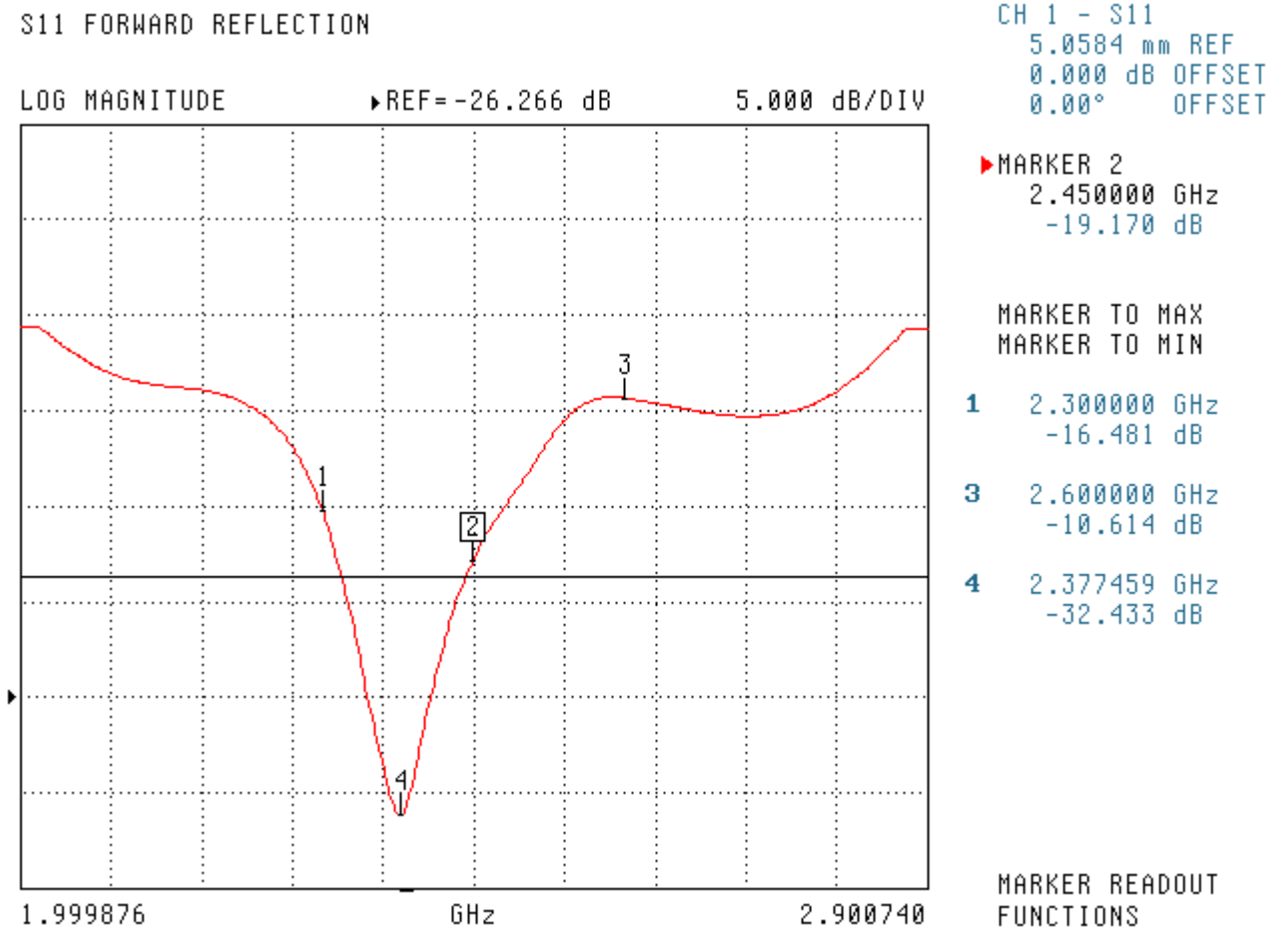
| <b>Body Tissue 2450 MHz</b>                         | <b>Measured</b> |
|---|-----------------|
| <b>Dielectric constant, <math>\epsilon_r</math></b> | 52.0            |
| <b>Conductivity, <math>\sigma</math> [S/m]</b>      | 1.92            |

**Electrical Calibration**

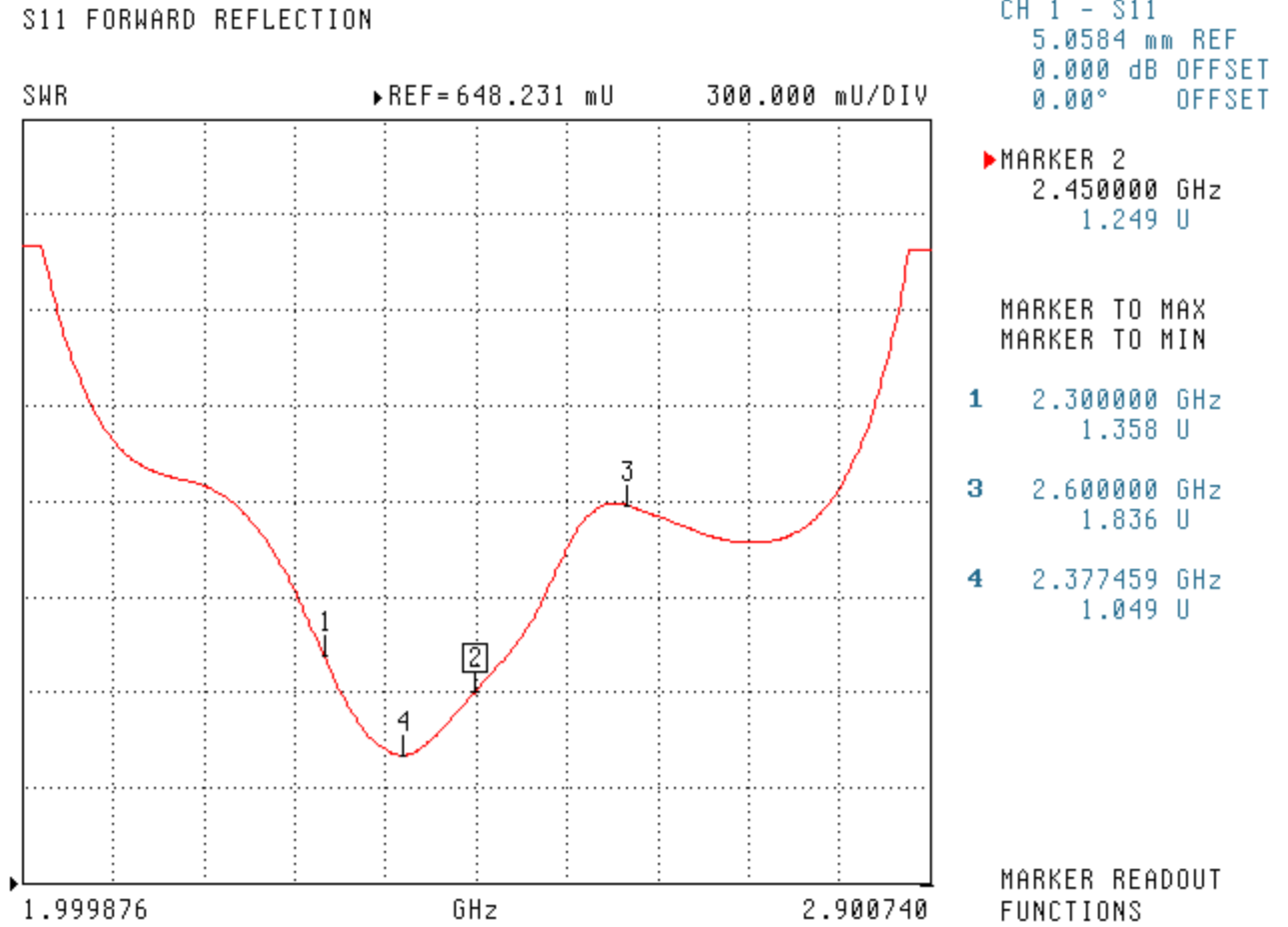
| Test      | Result          |
|-----------|-----------------|
| S11 R/L   | -19.170 dB      |
| SWR       | 1.249 U         |
| Impedance | 42.223 $\Omega$ |

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

**S11 Parameter Return Loss**

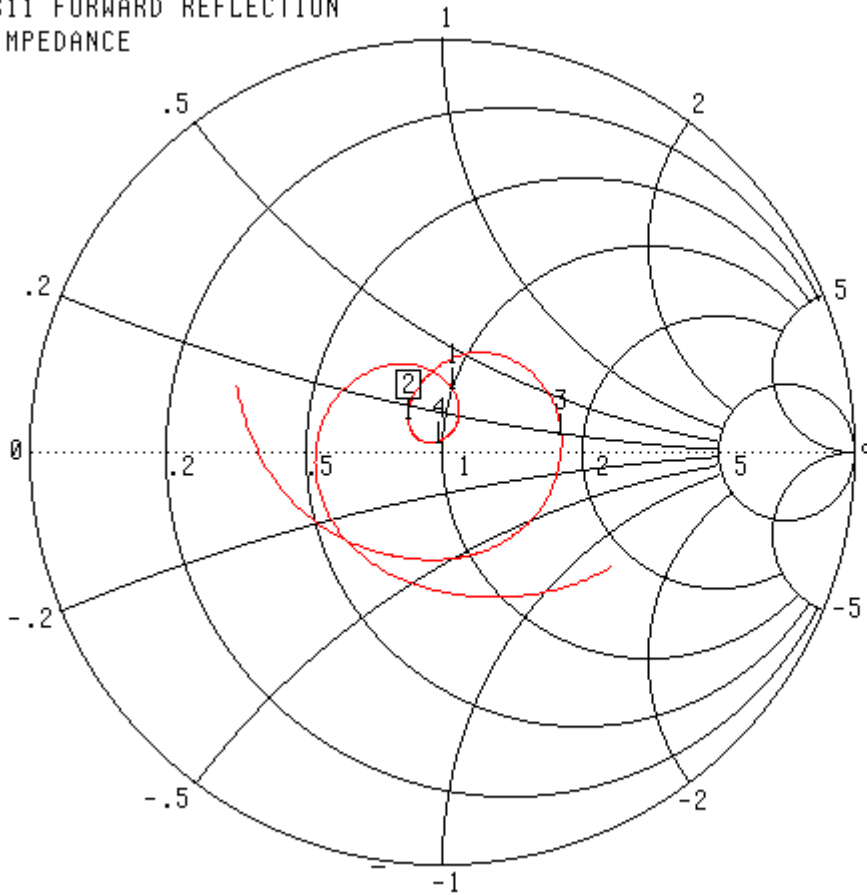


SWR



### Smith Chart Dipole Impedance

S11 FORWARD REFLECTION  
IMPEDANCE



CH 1 - S11  
5.0584 mm REF  
0.000 dB OFFSET  
0.00° OFFSET

▶ MARKER 2  
2.450000 GHz  
42.223 Ω  
6.687 jΩ

MARKER TO MAX  
MARKER TO MIN

- 1 2.300000 GHz  
50.520 Ω  
15.426 jΩ
- 3 2.600000 GHz  
90.912 Ω  
7.723 jΩ
- 4 2.377459 GHz  
49.380 Ω  
2.028 jΩ

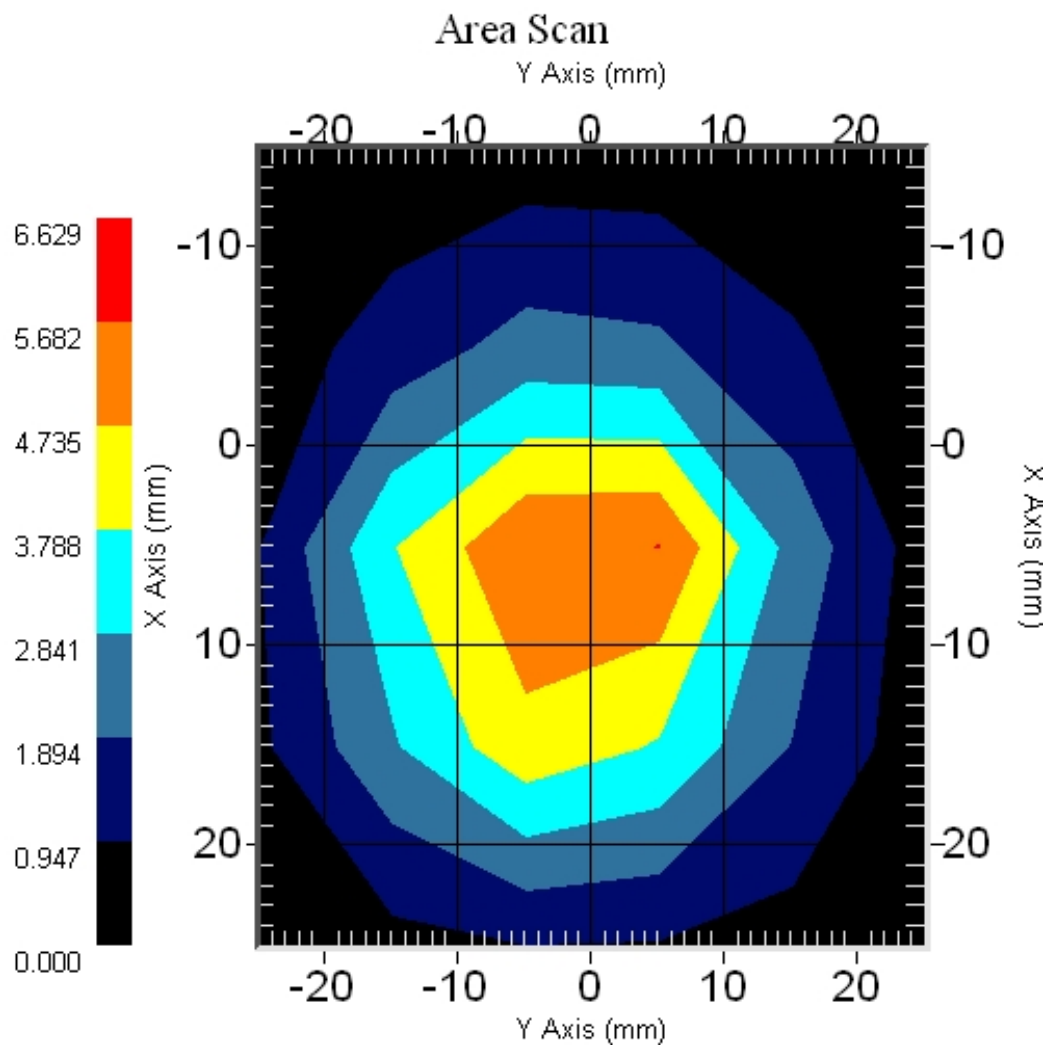
MARKER READOUT  
FUNCTIONS

1.999876 - 2.900740 GHz

**System Validation Results Using the Electrically Calibrated Dipole**

**Results @ 100mW**

| Body Tissue Frequency | 1 Gram | 10 Gram | Peak Above Feed Point |
|-----------------------|--------|---------|-----------------------|
| 2450 MHz              | 5.15   | 2.31    | 10.01                 |



## **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 May 2010.

## **Appendix F – Phantom Calibration Data Sheets**

## NCL CALIBRATION LABORATORIES

Calibration File No.: RFE-273

# 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 National Standards.

Thickness of the UniPhantom is 2 mm  $\pm$  10%  
Pinna thickness is 6 mm  $\pm$  10%

|             |         |                |          |
|-------------|---------|----------------|----------|
| Resolution: | 0.01 mm | Calibrated to: | 0.0 mm   |
| Stability:  | OK      | Accuracy:      | < 0.1 mm |

Calibrated By: Karen K. Feb 17/04.

### **NCL** CALIBRATION LABORATORIES

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