RF EXPOSURE LAB, LLC

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CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Novatel Wireless
9645 Scranton Road, Suite 205
San Diego, CA 92121

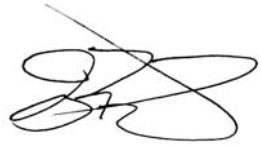
Dates of Test: January 20 - 23, 2009
Test Report Number: SAR.20090102

FCC ID:	PKRNVWE760
IC Certificate:	3229B-E760
Model(s):	E760 in Dell Inspiron 910
Atheros WLAN Module:	Model: AR5BXB63 FCCID: PPD-AR5BXB63
Broadcom WLAN Module:	Model: BCM94312MCG FCCID: QDS-BRCM1028
Test Sample:	Engineering Unit Same as Production
Serial No.:	Q01_015
Equipment Type:	Wireless Computer
Classification:	Portable Transmitter Next to Body
TX Frequency Range:	2412 – 2462 MHz, 824.2 – 848.8 MHz, 1850.2 – 1909.8 MHz
Frequency Tolerance:	± 25 ppm
Maximum RF Output:	835 MHz – 24.30 dBm, 1900 MHz – 24.05 dBm, 2450 MHz (b) – 20.94 dBm, 2450 MHz (g) – 20.76 dBm Conducted
Signal Modulation:	DSSS, OFDM, CDMA
Antenna Type (Length):	WWAN – Internal Left Top LCD 16.0 cm from User WLAN – Internal Left (Main) Right (Aux) Top LCD 16.0 cm from User
Battery:	Laptop Supplied
Application Type:	Class II Permissive Change
FCC Rule Parts:	Part 15, 22, 24
Industry Canada:	RSS-102

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

ACCREDITED
Certificate # 2387.01

Table of Contents

1. Introduction

This measurement report shows compliance of the Novatel Wireless Model E760 in Dell Inspiron 910 FCC ID: PKRNVWE760 with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices and IC Certificate: 3229B-E760 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 (ρ).

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

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

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

where:

σ = conductivity of the tissue (S/m)

ρ = mass density of the tissue (kg/m^3)

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 pendent 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.

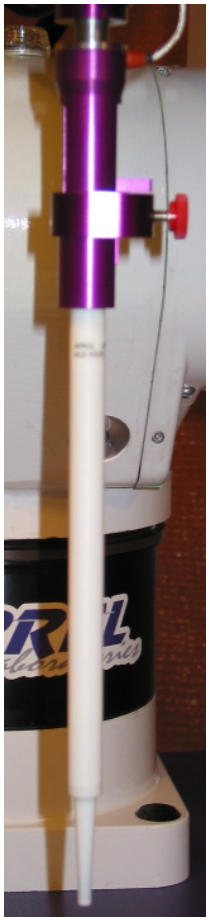
System Description

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 Aprel 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).

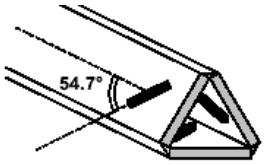
The overall uncertainty for the methodology and algorithms the ALSAS-10-U used during the SAR calculation was evaluated using the data from IEEE 1528 f3 algorithm:

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

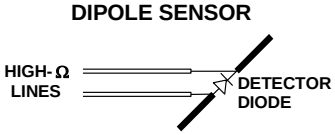
The probe used during the measurement process has been assessed to provide values for diode compression. These values are calculated during the probe calibration exercise and are used in the mathematical calculations for the assessment of SAR.

E-Field Probe

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 ± 0.05 mm and the precision of the APREL bottom detection device is ± 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 ± 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 ± 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 ≤3 GHz with a cube scan of 5x5x8 yields a volume of 32x32x28 mm^3. For devices >3 GHz and <4.5 GHz, the cube scan of 9x9x9 yields a volume of 32x32x24 mm^3. For devices ≥4.5 GHz, the cube scan of 7x7x12 yields a volume of 24x24x22 mm^3.

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

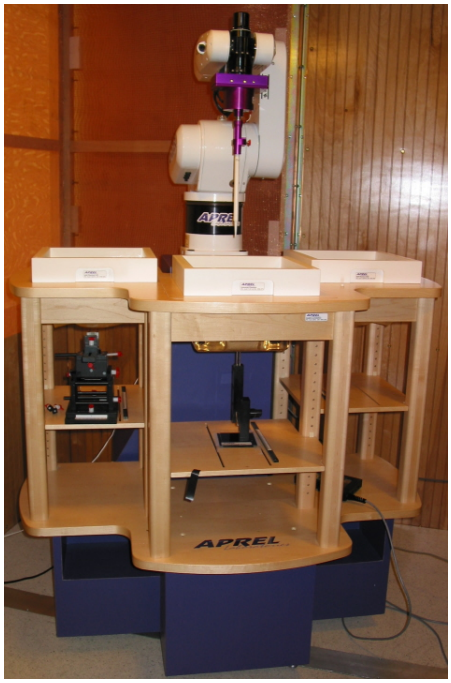
Features:	Signal Amplifier, End Effector, DAC
Software:	ALSAS 10-U Software

E-Field Probe

Model:	Various See Probe Calibration Sheet
Serial Number:	Various See Probe Calibration Sheet
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 90th percentile adult male head dimensions as tabulated by the US Army. The SAM phantom shell is bisected along the mid sagittai 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		
		835 MHz Muscle	1900 MHz Muscle	2450 MHz Muscle
Mixing Percentage				
Water		52.40	69.91	73.20
Sugar		0.00	29.96	0.00
Salt		45.00	0.00	0.04
HEC		1.40	0.13	0.00
Bactericide		0.10	0.00	0.00
DGBE		1.00	0.00	26.70
Dielectric Constant	Target	55.20	53.30	52.70
Conductivity (S/m)	Target	0.97	1.52	1.95

Device Holder

In combination with the SAM phantom, the mounting device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation point is the ear opening. The devices can easily, accurately, and repeatably be positioned according to the FCC specifications. The device holder can be locked at different phantom locations (left head, right head, and uni-phantom).

6. Definition of Reference Points

Ear Reference Point

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

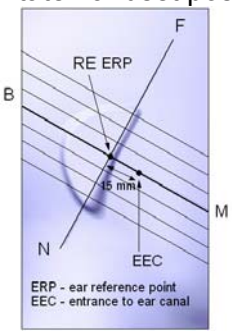


Figure 6.1 Close-up side view of ERP's

Figure 6.2 Front, back and side view of SAM

Device Reference Points

Two imaginary lines on the device need to be established: the vertical centerline and the horizontal line. The test device is placed in a normal operating position with the "test device reference point" located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (See Fig. 6.3). The "test device reference point" is than located at the same level as the center of the ear reference point. The test device is positioned so that the "vertical centerline" is bisecting the front surface of the device at it's top and bottom edges, positioning the "ear reference point" on the outer surface of both the left and right head phantoms on the ear reference point [5].

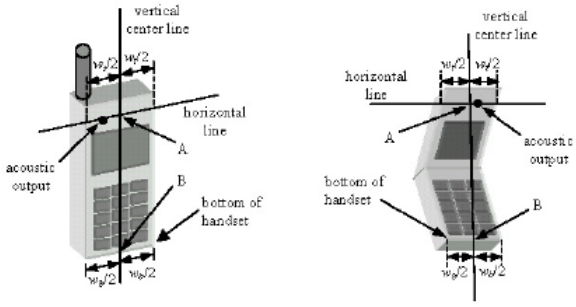


Figure 6.3 Handset Vertical Center & Horizontal Line Reference Points

7. Test Configuration Positions

Positioning for Cheek/Touch [5]

1. Position the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 7.1), such that the plane defined by the vertical center line and the horizontal line of the device is approximately parallel to the sagittal plane of the phantom.

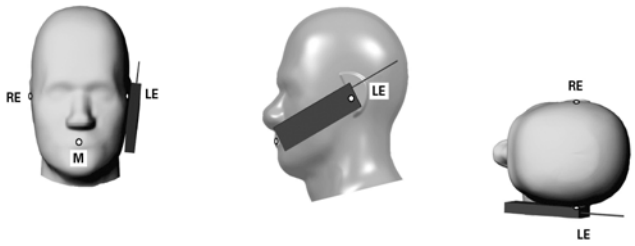


Figure 7.1 Front, Side and Top View of Cheek/Touch Position

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

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

4. Rotate the device around the vertical centerline until the device (horizontal line) is symmetrical with respect to the line NF.

5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE and maintaining the device contact with the ear, rotate the device about the line NF until any point on the device is in contact with a phantom point below the ear (cheek). See Figure 7.2.

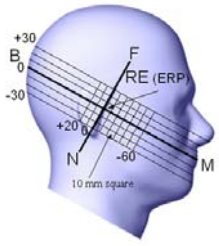


Figure 7.2 Side view w/ relevant markings

Positioning for Ear / 15° Tilt [5]

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

1. While maintaining the orientation of the device, retracted the device parallel to the reference plane far enough to enable a rotation of the device by 15 degrees.

2. Rotate the device around the horizontal line by 15 degrees.

3. While maintaining the orientation of the device, move the device parallel to the reference plane until any part of the device touches the head. (In this position, point A is located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, the angle of the device shall be reduced. The tilted position is obtained when any part of the device is in contact with the ear as well as a second part of the device is in contact with the head (see Figure 7.3).

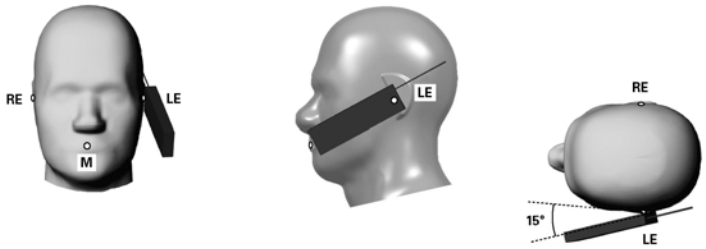


Figure 7.3 Front, Side and Top View of Ear/15° Tilt Position

Body Worn Configurations

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

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

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

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

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

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

8. 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 8.1 Human Exposure Limits

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

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

9. Measurement Uncertainty

Exposure Assessment Measurement Uncertainty

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

10. System Validation

Tissue Verification

Table 10.1 Measured Tissue Parameters

		835 MHz Body		1900 MHz Body		2450 MHz Body	
Date(s)		Jan. 21, 2009		Jan. 20, 2009		Jan. 22, 2009	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		55.20	55.12	53.30	53.11	52.70	52.56
Conductivity: σ		0.97	0.97	1.52	1.53	1.95	197

		2450 MHz Body	
Date(s)		Jan. 24, 2009	
Liquid Temperature (˚C)	20.0	Target	Measured
Dielectric Constant: ε		52.70	52.49
Conductivity: σ		1.95	1.96

See Appendix A for data printout.

Test System Verification

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

Table 10.2 System Dipole Validation Target & Measured

	Test Frequency	Targeted SAR_{1g} (W/kg)	Measure SAR_{1g} (W/kg)	Deviation (%)
21-Jan-2009	835 MHz	9.75	9.74	- 0.10
20-Jan-2009	1900 MHz	40.99	39.48	- 3.68
22-Jan-2009	2450 MHz	53.55	53.44	- 0.21
24-Jan-2009	2450 MHz	53.55	52.82	- 1.36

See Appendix A for data plots.

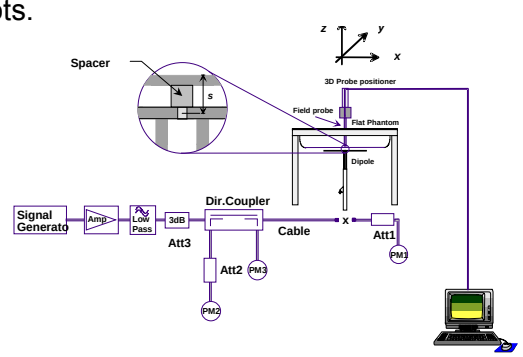


Figure 10.1 Dipole Validation Test Setup

11. 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 testing was conducted in the normal use position. The main and auxiliary antennas for WLAN were both 16.0 cm from the user. The antenna to user distance of the WWAN is 16.0 cm. The WWAN and main WLAN antenna are 8.6 mm apart. The WWAN and aux WLAN antennas are 69.35 mm apart. The SAR for the simultaneous transmission was determined by added the highest SAR in WWAN with the highest SAR in WLAN. The total was below the limit to meet SAR requirements; therefore, the device was considered to pass.

The 1xRTT testing was conducted in RC3 with the device configured using TDSO/SO32 with FCH transmitting at full rate. The power control was set to "All Bits Up." Multiple code channels were not tested due to the conducted power measured was less than ¼ dB higher than with FCH only.

The Rev. 0 and Rev. A Subtype 0/1 testing was conducted with the Reverse Data Channel rate of 153.6 kbps. The Forward Traffic Channel data rate is set to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots. The power control was set to "All Bits Up." Other rates were not tested due to the conducted power measured was less than ¼ dB higher than 153.6 kbps.

The Rev. A Subtype 2 testing was conducted with the Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots. The Forward Traffic Channel data rate is set to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots. The power control was set to "All Bits Up." Other rates were not tested due to the conducted power measured was less than ¼ dB higher than 4096 bits.

The WWAN Auxiliary Antenna is a receive only antenna. Therefore, it does not require any SAR evaluation. The Bluetooth device is a Class 2 device. The power level is less than f(GHz)/60 mW. Therefore, it does not require stand only testing. Also, since the distance from the BT antenna to any of the WLAN or WWAN antennas is greater than 20 cm, it does not require any simultaneous evaluation.

12. Conducted Power Measurement Procedures

Power measurements were performed using a base station simulator under average power.

12.1 Procedures Used to Establish RF Signal for SAR

The device was placed into a simulated call using a base station simulator in a screen room. Such test signals offer a consistent means for testing SAR and re recommended for evaluating SAR. SAR measurements were taken with a fully charged battery. The SAR measurement software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5% occurred, the tests were repeated.

12.2 SAR Measurement Conditions for CDMA2000, 1xEV-DO

12.2.1 Output Power Verification 1xRTT

Use CDMA2000 Rev 6 protocol in the call box.

1) Test for Reverse/Forward TCH RC1, Reverse/Forward TCH RC2, and RC3 Reverse FCH and demodulation of RC 3, 4 and 5.
    a. Set up a call using Fundamental Channel Test Mode 1 (RC1, SO 2) with 9600 bps data rate only.
    b. As per C.S0011 or TIA/EIA-98-F Table 4.4.5.2-1, set the test parameters.
    c. Send continuously ‘0’ power control bits to the UNDP-1.
    d. Measure the output power at UNDP-1 antenna connector as recorded on the power meter with values corrected for cables losses.
    e. Repeat step b through d for Fundamental Channel Test Mode:
        i. RC1, SO55
        ii. RC2, SO9
        iii. RC2, SO55
        iv. RC3, SO55
2) Test for RC 3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC 3, 4 and 5.
    a. Set up a call using Supplemental Channel Test Mode 3 (RC 3, SO 32) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
    b. As per C.S0011 or TIA/EIA-98-F Table 4.4.5.2-2, set the test parameters.
    c. Send alternating ‘0’ and ‘1’ power control bit to the UNDP-1
    d. Determine the active channel configuration. If the desired channel configuration is not the active channel configuration, increase Îor by 1 dB and repeat the verification. Repeat this step until the desired channel configuration becomes active.
    e. Measure the output power at the UNDP-1 antenna connector.
    f. Decrease Îor by 0.5 dB.
    g. Determine the active channel configuration. If the active channel configuration is the desired channel configuration, measure the output power at the UNDP-1 antenna connector.
    h. Repeat step f and g until the output power no longer increases or the desired channel configuration is no longer active. Record the highest output power achieved with the desired channel configuration active.
    i. Repeat step a through h ten times and average the result.

12.2.2 Output Power Verification 1xRTT

1) Use 1xEV-DO Rel 0 protocol in the call box 8960.
   a. FTAP
      - Select Test Application Protocol to FTAP
      - Set FTAP Rate to 307.2 kbps (2 Slot, QPSK)
      - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots
      - Set Îor to -60 dBm/1.23 MHz
      - Send continuously '0' power control bits
      - Measure the power at UNDP-1 antenna connector
   b. RTAP
      - Select Test Application Protocol to RTAP
      - Set RTAP Rate to 9.6 kbps
      - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots
      - Set Îor to -60 dBm/1.23 MHz
      - Send continuously '0' power control bits
      - Measure the power at UNDP-1 antenna connector
      - Repeat above steps for RTAP Rate = 19.2 kbps, 38.4 kbps, 76.8 kbps and 153.6 kbps respectively
2) Use 1xEV-DO Rev A protocol in the call box 8960
   a. FETAP
      - Select Test Application Protocol to FETAP
      - Set FETAP Rate to 307.2 kbps (2 Slot, QPSK)
      - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots
      - Set Îor to -60 dBm/1.23 MHz
      - Send continuously '0' power control bits
      - Measure the power at UNDP-1 antenna connector
   b. RETAP
      - Select Test Application Protocol to RETAP
      - F-Traffic Format -> 4 (1024, 2, 128) Canonical (307.2k, QPSK) • Set R-Data Pkt Size to 128
      - Protocol Subtype Config -> Release A Physical Layer Subtype -> Subtype 2 ->PL Subtype 2 Access Channel MAC Subtype -> Default (Subtype 0)
      - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots ->ACK R-Data After -> Subpacket 0 (All ACK)
      - Set Îor to -60 dBm/1.23 MHz
      - Send continuously '0' power control bits
      - Measure the power at UNDP-1 antenna connector
      - Repeat above steps for R-Data Pkt Size = 256, 512, 768, 1024, 1536, 2048, 3072, 4096, 6144, 8192, 12288 respectively.

1xRTT Power Measurements

IS-2000	Channel	SO2 [dBm]	SO55 [dBm]	SO9 [dBm]	SO55 [dBm]	SO55 [dBm]	SO32 [dBm]
	F-RC	RC1	RC1	RC2	RC2	RC3	RC3
Band	Vocoder Rate	Full	Full	Full	Full	Full	Full
Cellular	1013	24.05	24.01	23.99	24.16	24.09	24.04
	384	24.26	24.25	24.16	24.30	24.21	24.23
	777	24.16	24.13	24.09	24.24	24.18	24.12
PCS	25	23.71	23.75	23.72	23.71	23.69	23.67
	600	23.79	23.81	23.81	23.77	23.75	23.71
	1175	23.82	23.86	23.89	23.81	23.79	23.77

EvDo Rev 0 Power Measurements

1x EvDo Rev. 0 [dBm] - FTAP rate = 2 Slot Version 307.2 kbps						
	RTAP Rate	9.6 kbps	19.2 kbps	38.4 kbps	76.8 kbps	153.6 kbps
Band	Channel					
Cellular	1013	23.91	23.95	23.97	23.92	23.96
	384	24.08	24.09	24.02	24.01	24.06
	777	23.95	23.98	24.00	23.96	23.98
PCS	25	23.68	23.82	23.87	23.85	23.81
	600	23.71	23.86	23.89	23.88	23.87
	1175	23.79	23.89	23.94	23.92	23.90

EvDo Rev A Power Measurements

1x EvDo Rev. A Type 2 [dBm] - FTAP rate = 2 Slot Version 307.2 kbps, ACK On all slots													
	RETAP Payload	128 bits	256 bits	512 bits	768 bits	1024 bits	1536 bits	2048 bits	3072 bits	4096 bits	6144 bits	8192 bits	12288 bits
Band	Channel												
Cellular	1013	23.87	24.02	24.06	24.05	24.09	24.02	24.03	24.08	24.10	24.09	24.13	24.07
	384	23.95	24.16	24.18	24.19	24.17	24.15	24.16	24.19	24.21	24.20	24.25	24.19
	777	23.91	24.11	24.13	24.16	24.14	24.12	24.11	24.15	24.17	24.18	24.19	24.15
PCS	25	23.61	23.62	23.75	23.79	23.75	23.74	23.70	23.71	23.85	23.92	23.91	23.94
	600	23.68	23.69	23.82	23.86	23.81	23.85	23.79	23.76	23.91	23.98	23.99	23.98
	1175	23.76	23.75	23.89	23.87	23.86	23.89	23.84	23.80	23.96	24.01	24.03	24.05

Power Control was set in "All Bits Up" for all measurements.

802.11b				
Freq	Channel	Data Rate	Antenna	Power
2412	1	1	Main	18.78
2437	6	1	Main	18.86
2462	11	1	Main	18.91
2412	1	1	Aux	18.71
2437	6	1	Aux	18.80
2462	11	1	Aux	18.87
802.11g				
Freq	Channel	Data Rate	Antenna	Power
2417	2	6	Main	18.89
2437	6	6	Main	19.60
2457	10	6	Main	17.89
2417	2	6	Aux	18.76
2437	6	6	Aux	19.51
2457	10	6	Aux	17.80

Broadcom 1028 Conduct Power Measurements

802.11b				
Freq	Channel	Data Rate	Antenna	Power
2412	1	1	Main	20.68
2437	6	1	Main	20.63
2462	11	1	Main	20.94
2412	1	1	Aux	20.61
2437	6	1	Aux	20.59
2462	11	1	Aux	20.91
802.11g				
Freq	Channel	Data Rate	Antenna	Power
2417	2	6	Main	17.59
2437	6	6	Main	20.76
2457	10	6	Main	17.61
2417	2	6	Aux	17.51
2437	6	6	Aux	20.72
2457	10	6	Aux	17.58

Atheros AR5 Conduct Power Measurements

SAR Data Summary – 835 MHz Body

MEASUREMENT RESULTS								
Position	**Mode**	**Frequency**		**Modulation**	**End Power**	**Rev Ch/ Tx Level/RMC**	**Fwd Ch/Multi Slot/Test Set Up**	**SAR (W/kg)**
		MHz	**Ch.**		**(dBm)**			
Touch	EV-DO Rev 0	836.6	384	CDMA	24.06	153.6 kbps	2 Slot 307.2 kbps	0.343
					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

Jay M. Moulton
Vice President

SAR Data Summary – 1900 MHz Body

MEASUREMENT RESULTS								
Position	**Mode**	**Frequency**		**Modulation**	**End Power**	**Rev Ch/ Tx Level/RMC**	**Fwd Ch/Multi Slot/Test Set Up**	**SAR (W/kg)**
		MHz	**Ch.**		**(dBm)**			
Touch	EV-DO Rev 0	1880.00	600	CDMA	23.87	153.6 kbps	2 Slot 307.2 kbps	0.608
					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

Jay M. Moulton
Vice President

SAR Data Summary – 2450 MHz Body

MEASUREMENT RESULTS									
Position	**Module**	**Band**	**Antenna**	**Frequency**		**Modulation**	**End Power**	**Battery**	**SAR (W/kg)**
				MHz	**Ch.**		**(dBm)**		
Touch	1028	b	Main	2462	11	DSSS	18.91	Standard	0.189
			Aux	2462	11	DSSS	18.87	Standard	0.191
		g	Main	2437	6	OFDM	19.60	Standard	0.169
			Aux	2437	6	OFDM	19.51	Standard	0.179
	AR5	b	Main	2462	11	DSSS	20.94	Standard	0.180
			Aux	2462	11	DSSS	20.91	Standard	0.185

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

Jay M. Moulton
Vice President

SAR Data Summary – Simultaneous Transmission

MEASUREMENT RESULTS										
WWAN	Frequency		Modulation	WLAN Module	Frequency		Modulation	WWAN SAR	WLAN SAR	Total SAR (W/kg)
	MHz	Ch			MHz	Ch				
835	836.6	384	CDMA	1028	2462	11	OFDM	0.343	0.191	0.534
	836.6	384	CDMA	AR5	2462	11	OFDM	0.343	0.185	0.528
1900	1880.00	600	CDMA	1028	2462	11	OFDM	0.608	0.191	0.799
	1880.00	600	CDMA	AR5	2462	11	OFDM	0.608	0.185	0.793

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

Jay M. Moulton
Vice President

12.1 Test Equipment List

Table 12.1 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
Aprel E-Field Probe ALS-E020	12/03/2008	RFE-217
Aprel E-Field Probe ALS-E030	04/30/2008	AL-E3P1
Aprel Dummy Probe	N/A	023
Aprel Left Phantom	N/A	RFE-267
Aprel Right Phantom	N/A	RFE-268
Aprel UniPhantom	N/A	RFE-273
Aprel Validation Dipole ALS-D-450-S-2	04/30/2009	RFE-362
Aprel Validation Dipole ALS-D-835-S-2	02/22/2010	RFE-274
Aprel Validation Dipole ALS-D-1900-S-2	02/21/2010	RFE-277
Aprel Validation Dipole ALS-D-2450-S-2	02/20/2010	RFE-278
Aprel Validation Dipole ALS-D-BB-S-2	05/23/2009	5258-235-00801
Agilent (HP) 437B Power Meter	12/01/2009	3125U08837
Agilent (HP) 8481B Power Sensor	12/02/2009	3318A05384
Advantest R3261A Spectrum Analyzer	12/02/2009	31720068
Agilent (HP) 8350B Signal Generator	12/01/2009	2749A10226
Agilent (HP) 83525A RF Plug-In	12/01/2009	2647A01172
Agilent (HP) 8753C Vector Network Analyzer	12/01/2009	3135A01724
Agilent (HP) 85047A S-Parameter Test Set	12/01/2009	2904A00595
Agilent (HP) E55125C Base Station Sim.	10/30/2010	MY4860364
Aprel Dielectric Probe Assembly	N/A	0011
Brain Equivalent Matter (450 MHz)	N/A	N/A
Brain Equivalent Matter (835 MHz)	N/A	N/A
Brain Equivalent Matter (1900 MHz)	N/A	N/A
Brain Equivalent Matter (2450 MHz)	N/A	N/A
Muscle Equivalent Matter (450 MHz)	N/A	N/A
Muscle Equivalent Matter (835 MHz)	N/A	N/A
Muscle Equivalent Matter (1900 MHz)	N/A	N/A
Muscle Equivalent Matter (2450 MHz)	N/A	N/A
Muscle Equivalent Matter (5200 MHz)	N/A	N/A
Muscle Equivalent Matter (5800 MHz)	N/A	N/A

13.1 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]

14.1 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
Wed 21/Jan/2009 08:03:26
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
0.8050	55.32	0.97	55.36	0.95
0.8150	55.28	0.97	55.29	0.96
0.8250	55.24	0.97	55.21	0.97
0.8350	55.20	0.97	55.12	0.98
0.8450	55.17	0.98	55.06	0.99
0.8550	55.14	0.99	54.99	1.00
0.8650	55.11	1.01	54.93	1.02

```
************************************************************
Test Result for UIM Dielectric Parameter
Tue 20/Jan/2009 09:14:42
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
1.8700	53.30	1.52	53.38	1.50
1.8800	53.30	1.52	53.29	1.51
1.8900	53.30	1.52	53.23	1.52
1.9000	53.30	1.52	53.11	1.53
1.9100	53.30	1.52	53.06	1.54
1.9200	53.30	1.52	53.00	1.56
1.9300	53.30	1.52	52.93	1.57

```
************************************************************
Test Result for UIM Dielectric Parameter
Thu 22/Jan/2009 08:12:25
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	52.77	1.93
2.4300	52.73	1.93	52.73	1.95
2.4400	52.71	1.94	52.65	1.96
2.4500	52.70	1.95	52.56	1.97
2.4600	52.69	1.96	52.48	1.98
2.4700	52.67	1.98	52.39	1.99
2.4800	52.66	1.99	52.30	2.01

```
************************************************************
Test Result for UIM Dielectric Parameter
Sat 24/Jan/2009 08:24:25
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	52.70	1.94
2.4300	52.73	1.93	52.64	1.95
2.4400	52.71	1.94	52.57	1.95
2.4500	52.70	1.95	52.49	1.96
2.4600	52.69	1.96	52.42	1.97
2.4700	52.67	1.98	52.34	1.98
2.4800	52.66	1.99	52.28	2.00

SAR Test Report

By Operator : Jay
Measurement Date : 21-Jan-2009
Starting Time : 21-Jan-2009 08:29:47 AM
End Time : 21-Jan-2009 08:45:15 AM
Scanning Time : 928 secs

Product Data
Device Name : Validation
Serial No. : 835
Type : Dipole
Model : ALS-D-835-S-2
Frequency : 835.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 161 mm
Width : 3.6 mm
Depth : 89.8 mm
Antenna Type : Internal
Orientation : Touch
Power Drift-Start : 1.061 W/kg
Power Drift-Finish: 1.044 W/kg
Power Drift (%) : -1.661

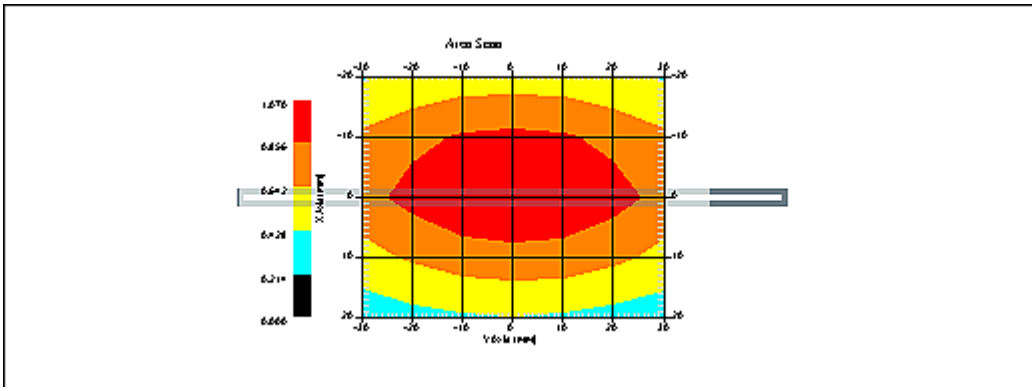
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 835
Frequency : 835.00 MHz
Last Calib. Date : 21-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 24.00 °C
Humidity : 40.00 RH%
Epsilon : 55.12 F/m
Sigma : 0.98 S/m
Density : 1000.00 kg/cu. m

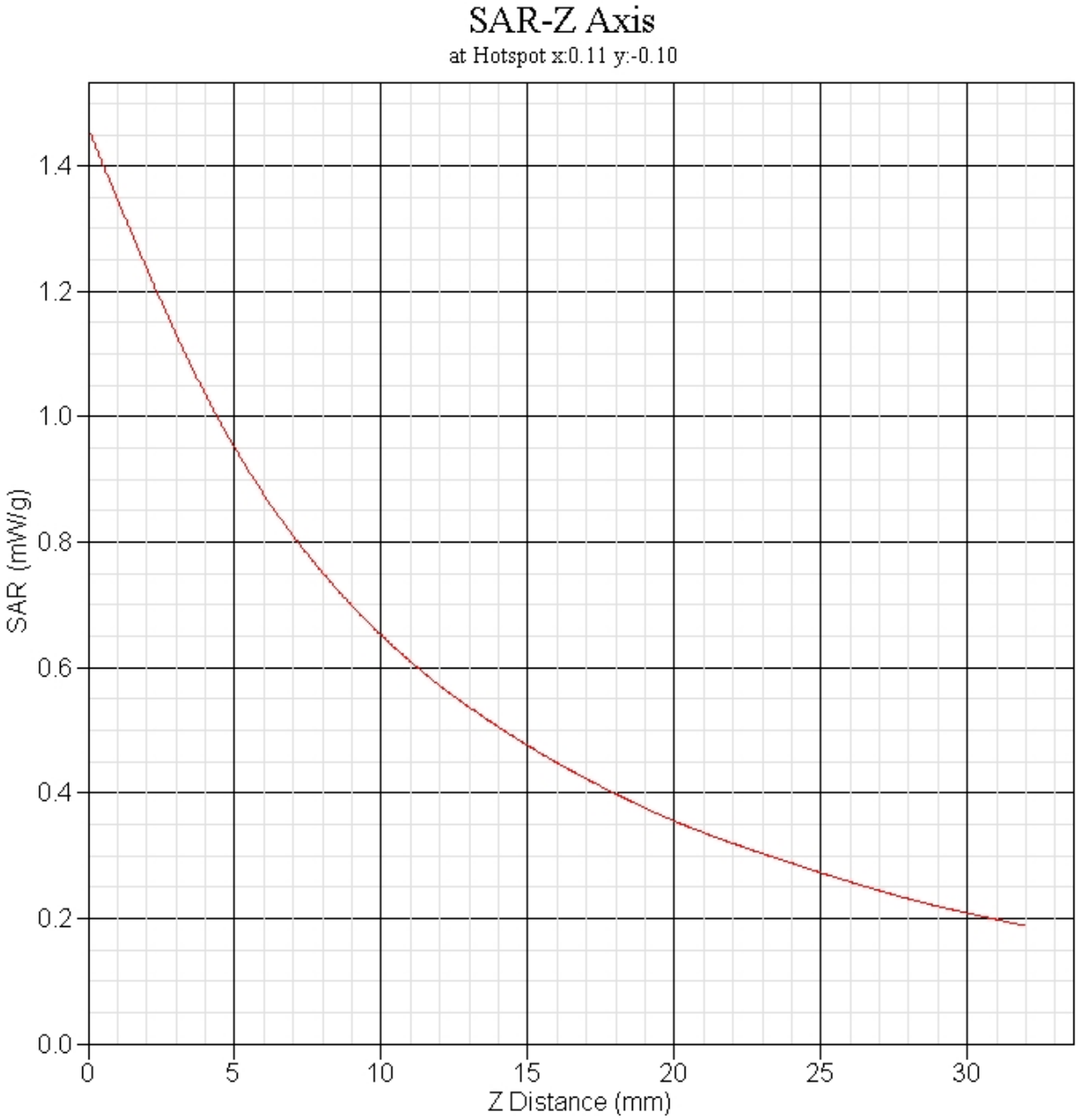
Probe Data
Name : Probe 215 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 215
Last Calib. Date : 03-Nov-2008
Frequency : 835.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 6.3
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point: 95.00 mV
Offset : 1.56 mm

```
Measurement Data
Crest Factor      : 1
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 24.00 °C
Set-up Date       : 21-Jan-2009
Set-up Time       : 9:21:48 AM
Area Scan         : 5x7x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 15 mm
Channel           : Mid
```



```
1 gram SAR value    : 0.974 W/kg
10 gram SAR value   : 0.645 W/kg
Area Scan Peak SAR  : 1.069 W/kg
Zoom Scan Peak SAR  : 1.461 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 20-Jan-2009
Starting Time : 20-Jan-2009 09:17:42 AM
End Time : 20-Jan-2009 09:30:28 AM
Scanning Time : 766 secs

Product Data
Device Name : Validation
Serial No. : 1900
Type : Dipole
Model : ALS-D-1900-S-2
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 68 mm
Width : 3.6 mm
Depth : 39.5 mm
Antenna Type : Internal
Orientation : Touch
Power Drift-Start : 5.300 W/kg
Power Drift-Finish: 5.224 W/kg
Power Drift (%) : -1.432

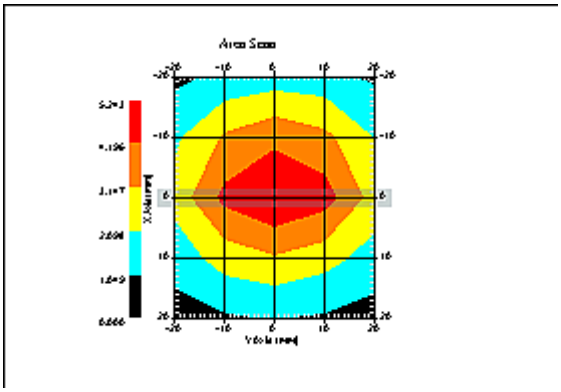
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 1900
Frequency : 1900.00 MHz
Last Calib. Date : 20-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 43.00 RH%
Epsilon : 53.11 F/m
Sigma : 1.53 S/m
Density : 1000.00 kg/cu. m

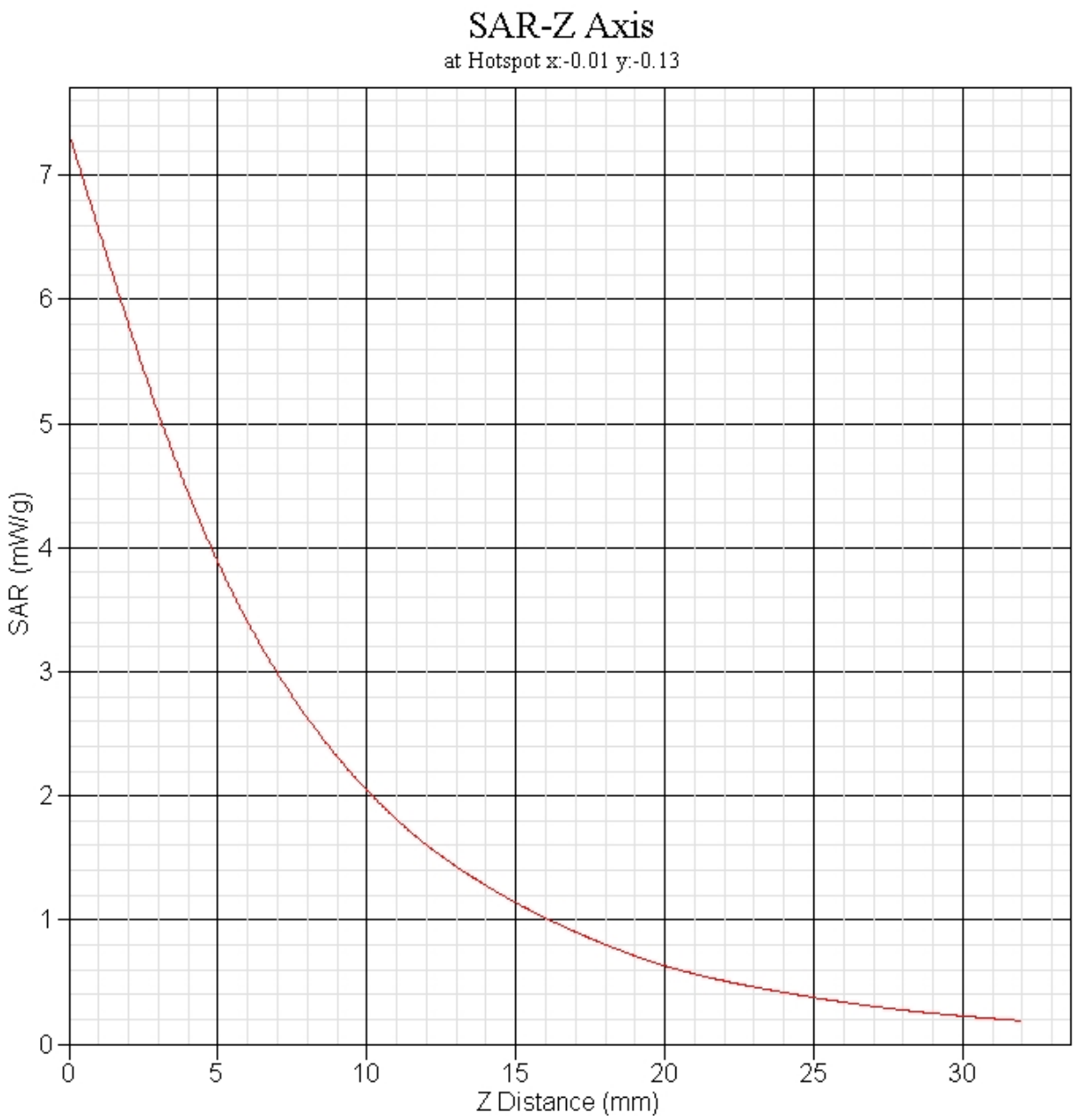
Probe Data
Name : Probe 215 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 215
Last Calib. Date : 03-Nov-2008
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 5
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point: 95.00 mV
Offset : 1.56 mm

```
Measurement Data
Crest Factor      : 1
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 20-Jan-2009
Set-up Time       : 8:21:16 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    : 3.948 W/kg
10 gram SAR value   : 2.018 W/kg
Area Scan Peak SAR  : 5.243 W/kg
Zoom Scan Peak SAR  : 7.346 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 22-Jan-2009
Starting Time : 22-Jan-2009 08:18:21 AM
End Time : 22-Jan-2009 08:31:15 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 : 6.002 W/kg
Power Drift-Finish: 6.167 W/kg
Power Drift (%) : 2.745

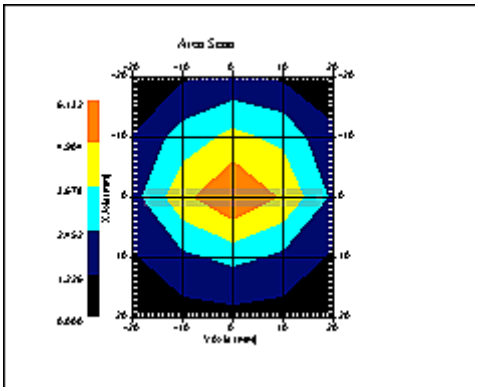
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 2450
Frequency : 2450.00 MHz
Last Calib. Date : 22-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 41.00 RH%
Epsilon : 52.56 F/m
Sigma : 1.97 S/m
Density : 1000.00 kg/cu. m

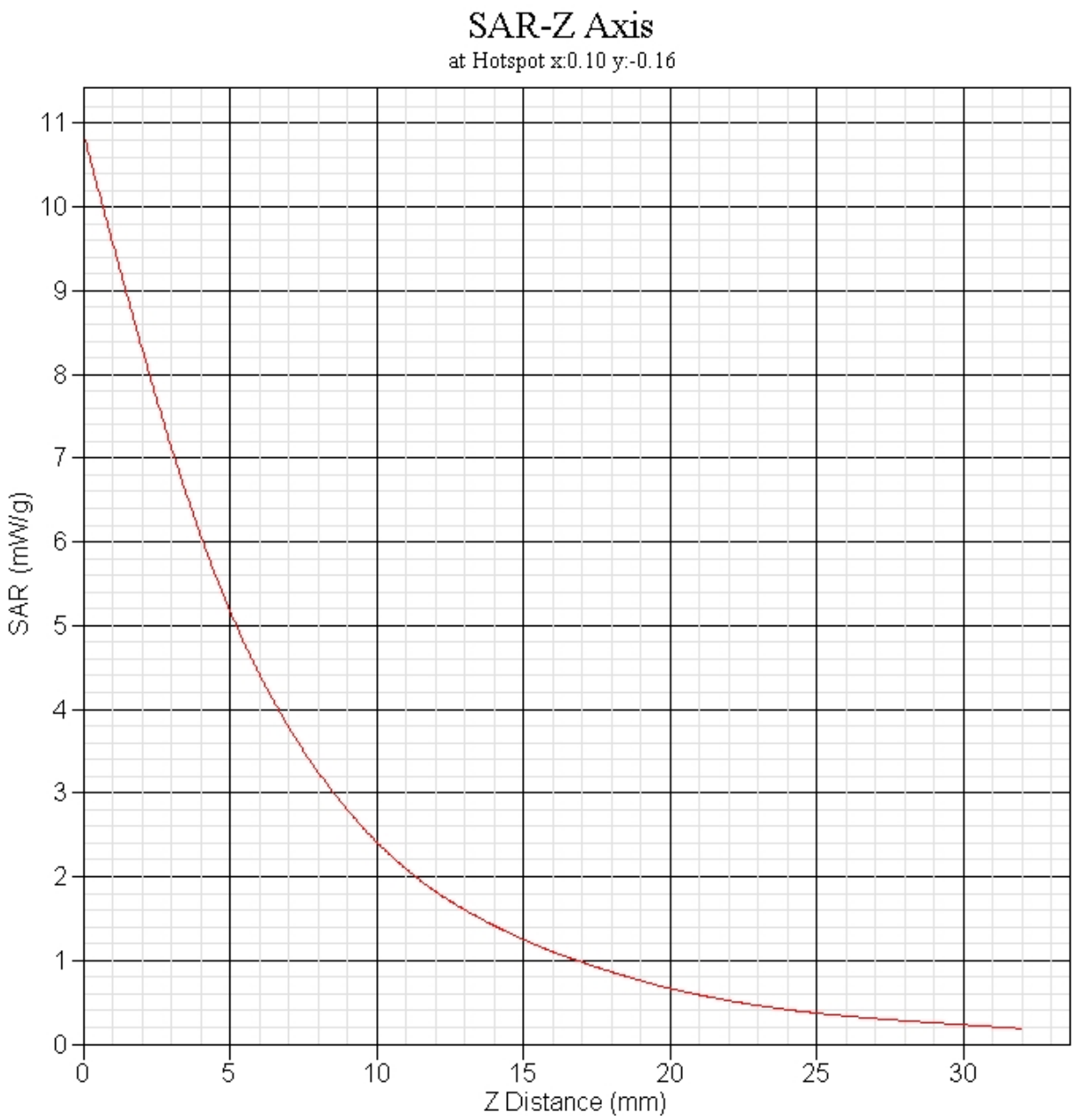
Probe Data
Name : Probe 215 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 215
Last Calib. Date : 03-Nov-2008
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.5
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point: 95.00 mV
Offset : 1.56 mm

```
Measurement Data
Crest Factor      : 1
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 22-Jan-2009
Set-up Time       : 7:57:03 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    : 5.344 W/kg
10 gram SAR value   : 2.501 W/kg
Area Scan Peak SAR  : 6.132 W/kg
Zoom Scan Peak SAR  : 10.890 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 24-Jan-2009
Starting Time : 24-Jan-2009 08:31:56 AM
End Time : 24-Jan-2009 08:44:45 AM
Scanning Time : 769 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 : 6.302 W/kg
Power Drift-Finish: 6.172 W/kg
Power Drift (%) : -2.063

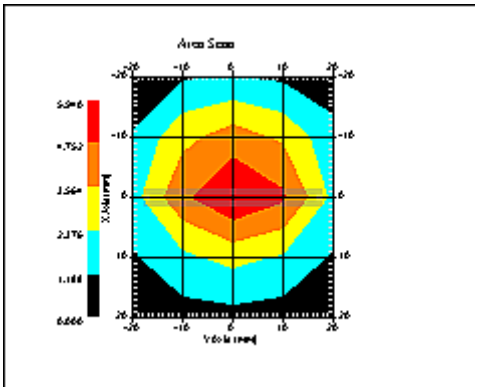
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 2450
Frequency : 2450.00 MHz
Last Calib. Date : 24-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 41.00 RH%
Epsilon : 52.49 F/m
Sigma : 1.96 S/m
Density : 1000.00 kg/cu. m

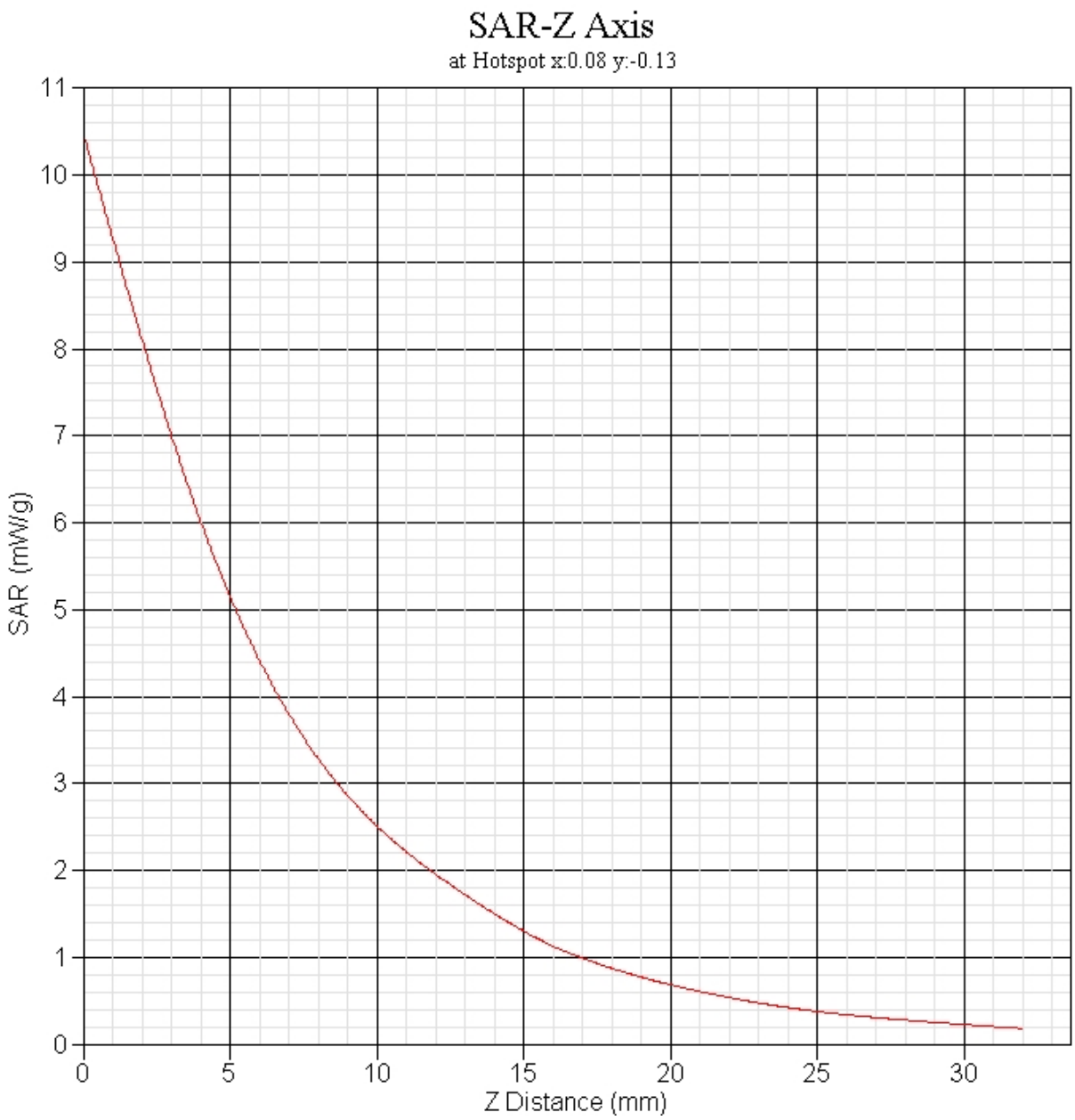
Probe Data
Name : Probe 215 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 215
Last Calib. Date : 03-Nov-2008
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.5
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point: 95.00 mV
Offset : 1.56 mm

```
Measurement Data
Crest Factor      : 1
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 24-Jan-2009
Set-up Time       : 7:57:03 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    : 5.282 W/kg
10 gram SAR value   : 2.493 W/kg
Area Scan Peak SAR  : 5.940 W/kg
Zoom Scan Peak SAR  : 10.490 W/kg
```



Appendix B – SAR Test Data Plots

SAR Test Report

By Operator : Jay
Measurement Date : 21-Jan-2009
Starting Time : 21-Jan-2009 12:12:09 PM
End Time : 21-Jan-2009 12:29:36 PM
Scanning Time : 1047 secs

Product Data
Device Name : Novatel Wireless
Serial No. : Q01_015
Mode : EvDo Rev 0
Model : E760 In Dell Inspiron 910
Frequency : 835.00 MHz
Max. Transmit Pwr : 0.25 W
Drift Time : 0 min(s)
Length : 233 mm
Width : 170 mm
Depth : 27 mm
Antenna Type : Internal
Orientation : Touch
Power Drift-Start : 0.346 W/kg
Power Drift-Finish: 0.355 W/kg
Power Drift (%) : 2.600

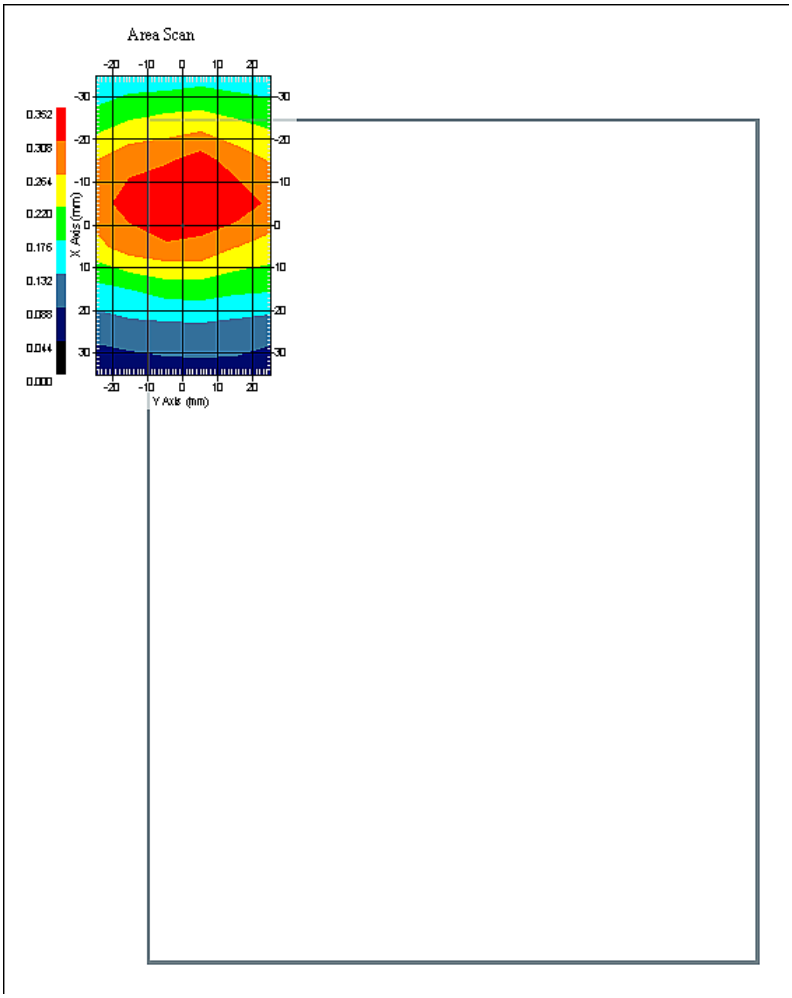
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 835
Frequency : 835.00 MHz
Last Calib. Date : 21-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 24.00 °C
Humidity : 40.00 RH%
Epsilon : 55.12 F/m
Sigma : 0.98 S/m
Density : 1000.00 kg/cu. m

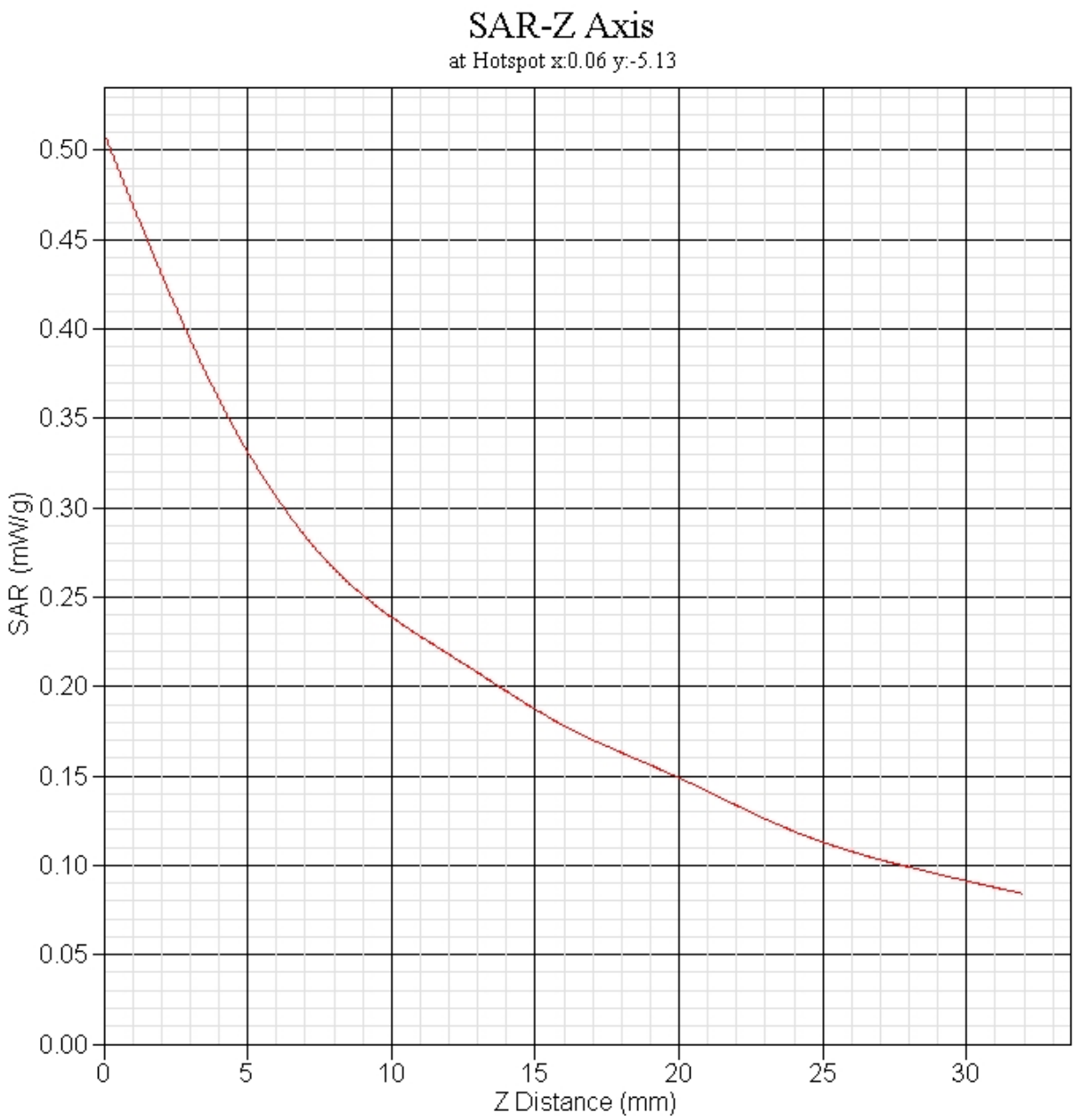
Probe Data
Name : Probe 215 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 215
Last Calib. Date : 03-Nov-2008
Frequency : 835.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 6.3
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point: 95.00 mV
Offset : 1.56 mm

```
Measurement Data
Crest Factor      : 1
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 21-Jan-2009
Set-up Time       : 12:11:57 PM
Area Scan         : 8x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 0
Channel           : Mid
```




```
1 gram SAR value    : 0.343 W/kg
10 gram SAR value   : 0.241 W/kg
Area Scan Peak SAR  : 0.351 W/kg
Zoom Scan Peak SAR  : 0.510 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 20-Jan-2009
Starting Time : 20-Jan-2009 12:37:15 PM
End Time : 20-Jan-2009 12:54:43 PM
Scanning Time : 1048 secs

Product Data
Device Name : Novatel Wireless
Serial No. : Q01_015
Mode : EvDo Rev 0
Model : E760 In Dell Inspiron 910
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.25 W
Drift Time : 0 min(s)
Length : 233 mm
Width : 170 mm
Depth : 27 mm
Antenna Type : Internal
Orientation : Touch
Power Drift-Start : 0.657 W/kg
Power Drift-Finish: 0.632 W/kg
Power Drift (%) : -3.676

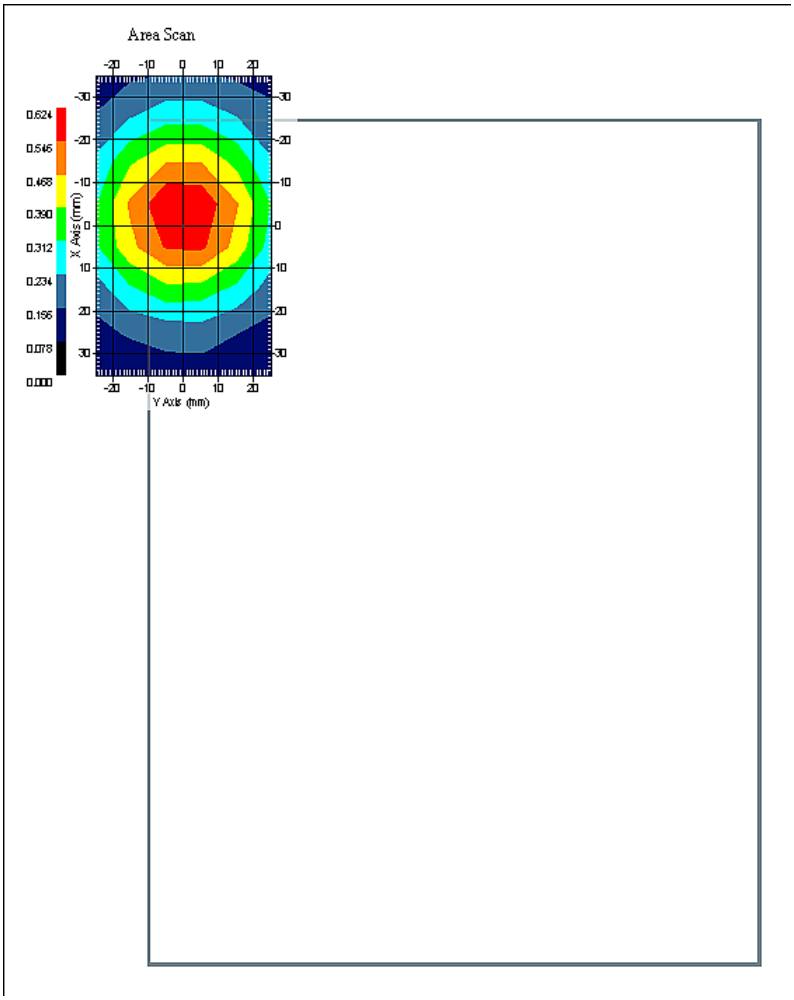
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 1900
Frequency : 1900.00 MHz
Last Calib. Date : 20-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 43.00 RH%
Epsilon : 53.11 F/m
Sigma : 1.53 S/m
Density : 1000.00 kg/cu. m

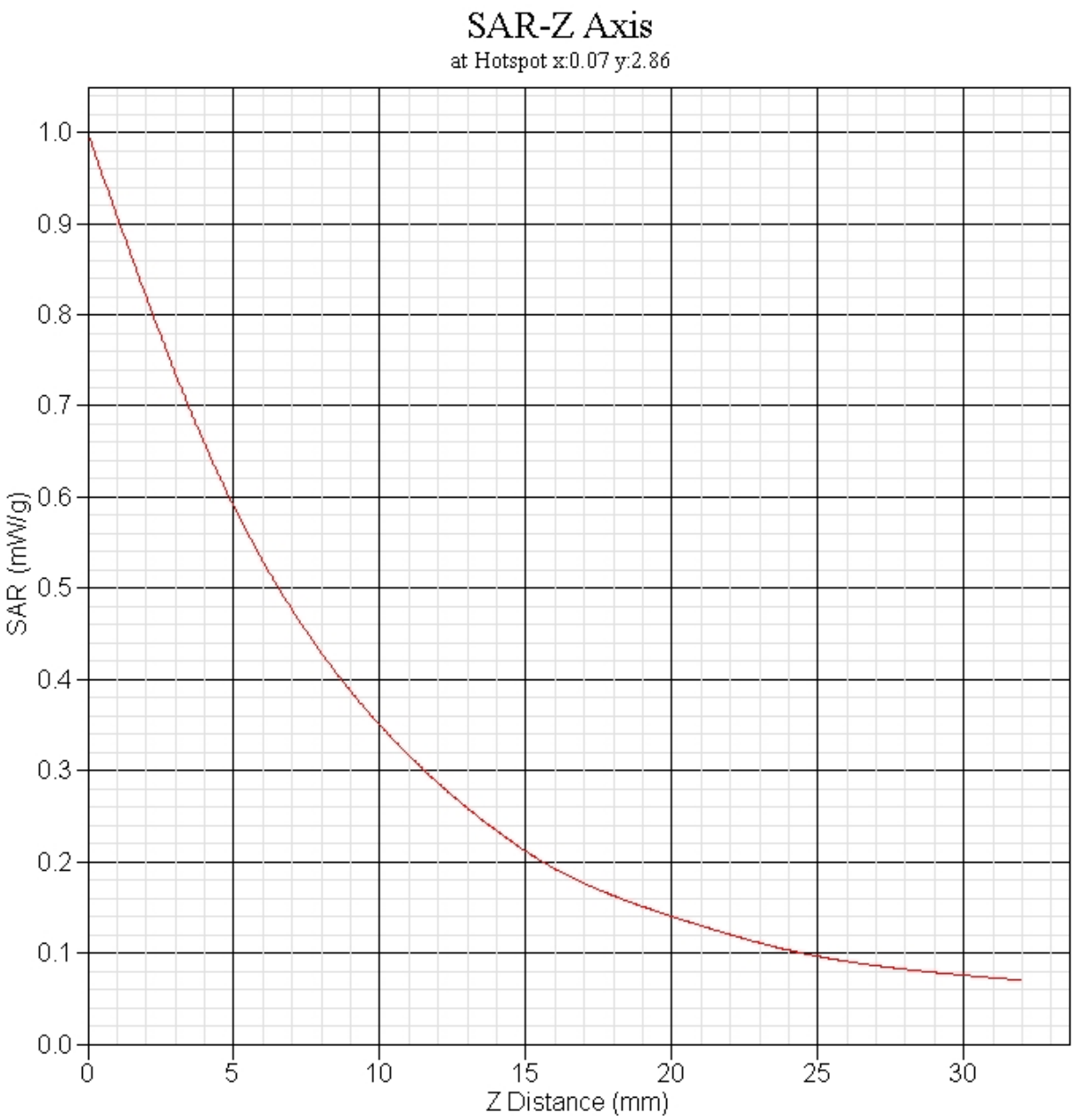
Probe Data
Name : Probe 215 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 215
Last Calib. Date : 03-Nov-2008
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 5
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point: 95.00 mV
Offset : 1.56 mm

```
Measurement Data
Crest Factor      : 1
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 20-Jan-2009
Set-up Time       : 10:25:41 AM
Area Scan         : 8x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 0
Channel           : Mid
```




```
1 gram SAR value    : 0.608 W/kg
10 gram SAR value   : 0.349 W/kg
Area Scan Peak SAR  : 0.621 W/kg
Zoom Scan Peak SAR  : 1.000 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 23-Jan-2009
Starting Time : 23-Jan-2009 08:36:30 AM
End Time : 23-Jan-2009 08:54:39 AM
Scanning Time : 1089 secs

Product Data
Device Name : Novatel Wireless
Serial No. : Q01_015
Module - Mode : Broadcom 1028 - b
Model : E760 In Dell Inspiron 910
Frequency : 2450.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 233 mm
Width : 170 mm
Depth : 27 mm
Antenna Type : Internal - Main
Orientation : Touch
Power Drift-Start : 0.173 W/kg
Power Drift-Finish: 0.173 W/kg
Power Drift (%) : 0.578

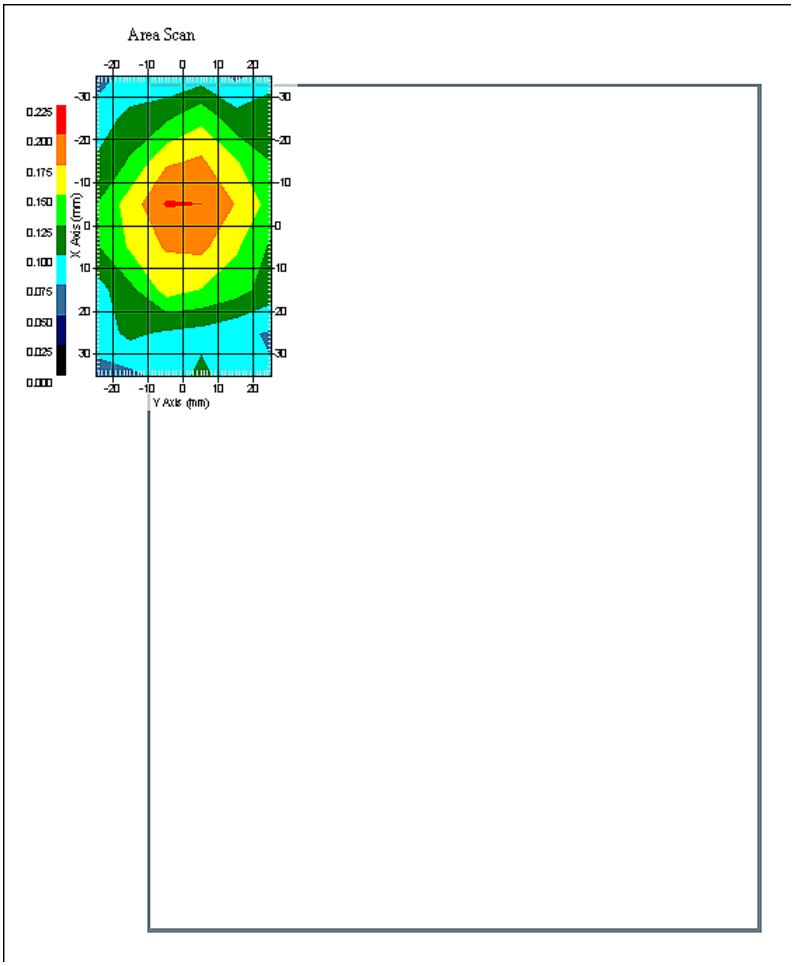
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 2450
Frequency : 2450.00 MHz
Last Calib. Date : 22-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 41.00 RH%
Epsilon : 52.56 F/m
Sigma : 1.97 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 : 03-Nov-2008
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.5
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
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-Jan-2009
Set-up Time       : 7:43:11 AM
Area Scan         : 8x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 0
Channel           : High
```




```
1 gram SAR value    : 0.189 W/kg
10 gram SAR value   : 0.128 W/kg
Area Scan Peak SAR  : 0.202 W/kg
Zoom Scan Peak SAR  : 0.260 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 23-Jan-2009
Starting Time : 23-Jan-2009 09:22:43 AM
End Time : 23-Jan-2009 09:40:02 AM
Scanning Time : 1039 secs

Product Data
Device Name : Novatel Wireless
Serial No. : Q01_015
Module - Mode : Broadcom 1028 - b
Model : E760 In Dell Inspiron 910
Frequency : 2450.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 233 mm
Width : 170 mm
Depth : 27 mm
Antenna Type : Internal - Aux
Orientation : Touch
Power Drift-Start : 0.209 W/kg
Power Drift-Finish: 0.210 W/kg
Power Drift (%) : 0.207

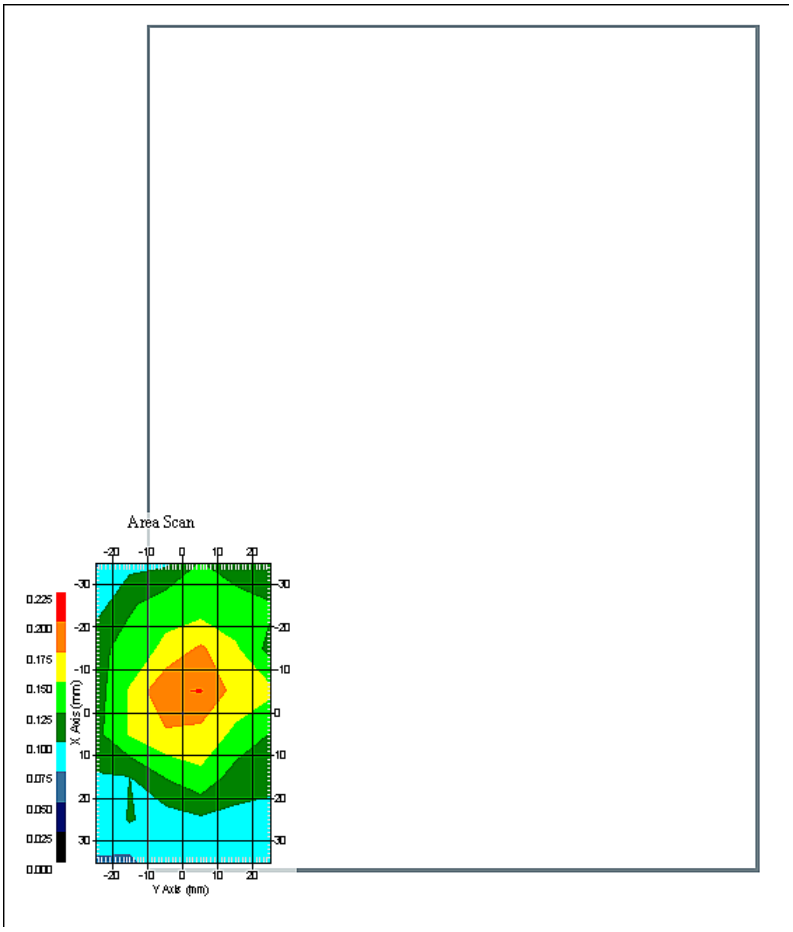
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 2450
Frequency : 2450.00 MHz
Last Calib. Date : 22-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 41.00 RH%
Epsilon : 52.56 F/m
Sigma : 1.97 S/m
Density : 1000.00 kg/cu. m

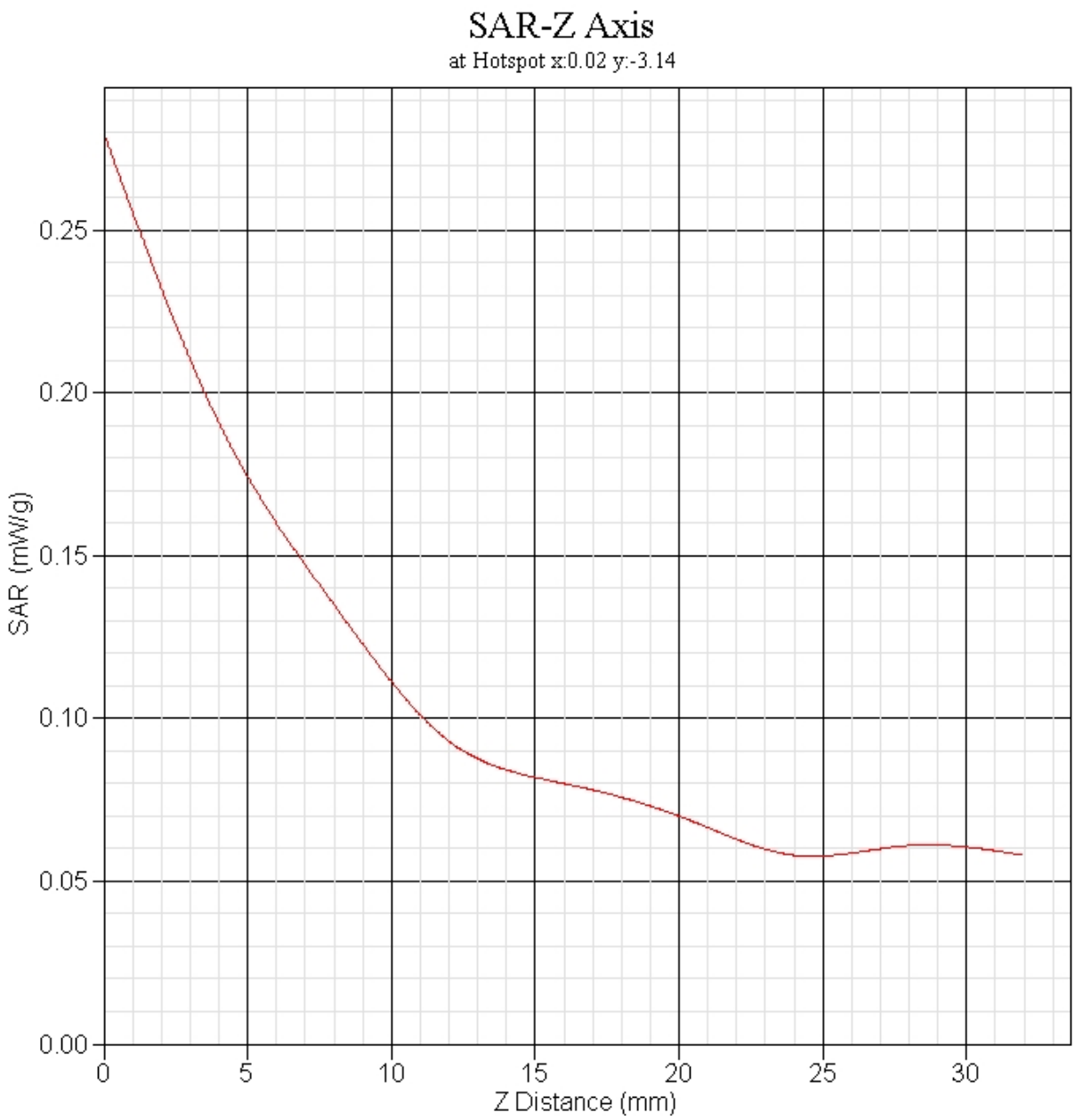
Probe Data
Name : Probe 215 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 215
Last Calib. Date : 03-Nov-2008
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.5
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point: 95.00 mV
Offset : 1.56 mm

```
Measurement Data
Crest Factor      : 1
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 23-Jan-2009
Set-up Time       : 7:43:11 AM
Area Scan         : 8x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 0
Channel           : High
```




```
1 gram SAR value    : 0.191 W/kg
10 gram SAR value   : 0.132 W/kg
Area Scan Peak SAR  : 0.201 W/kg
Zoom Scan Peak SAR  : 0.280 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 23-Jan-2009
Starting Time : 23-Jan-2009 08:59:12 AM
End Time : 23-Jan-2009 09:16:41 AM
Scanning Time : 1049 secs

Product Data
Device Name : Novatel Wireless
Serial No. : Q01_015
Module - Mode : Broadcom 1028 - g
Model : E760 In Dell Inspiron 910
Frequency : 2450.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 233 mm
Width : 170 mm
Depth : 27 mm
Antenna Type : Internal - Main
Orientation : Touch
Power Drift-Start : 0.194 W/kg
Power Drift-Finish: 0.189 W/kg
Power Drift (%) : -2.523

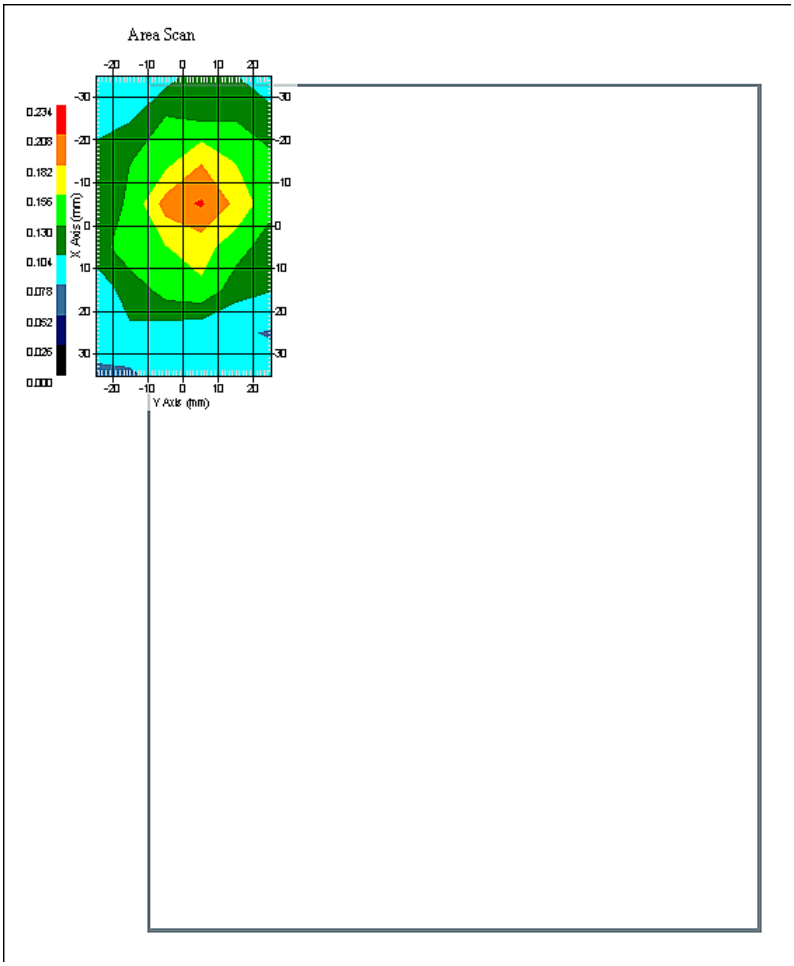
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 2450
Frequency : 2450.00 MHz
Last Calib. Date : 22-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 41.00 RH%
Epsilon : 52.56 F/m
Sigma : 1.97 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 : 03-Nov-2008
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.5
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
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-Jan-2009
Set-up Time       : 7:43:11 AM
Area Scan         : 8x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 0
Channel           : Mid
```




```
1 gram SAR value    : 0.169 W/kg
10 gram SAR value   : 0.121 W/kg
Area Scan Peak SAR  : 0.211 W/kg
Zoom Scan Peak SAR  : 0.260 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 23-Jan-2009
Starting Time : 23-Jan-2009 10:21:32 AM
End Time : 23-Jan-2009 10:38:56 AM
Scanning Time : 1044 secs

Product Data
Device Name : Novatel Wireless
Serial No. : Q01_015
Module - Mode : Broadcom 1028 - g
Model : E760 In Dell Inspiron 910
Frequency : 2450.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 233 mm
Width : 170 mm
Depth : 27 mm
Antenna Type : Internal - Aux
Orientation : Touch
Power Drift-Start : 0.197 W/kg
Power Drift-Finish: 0.200 W/kg
Power Drift (%) : 1.526

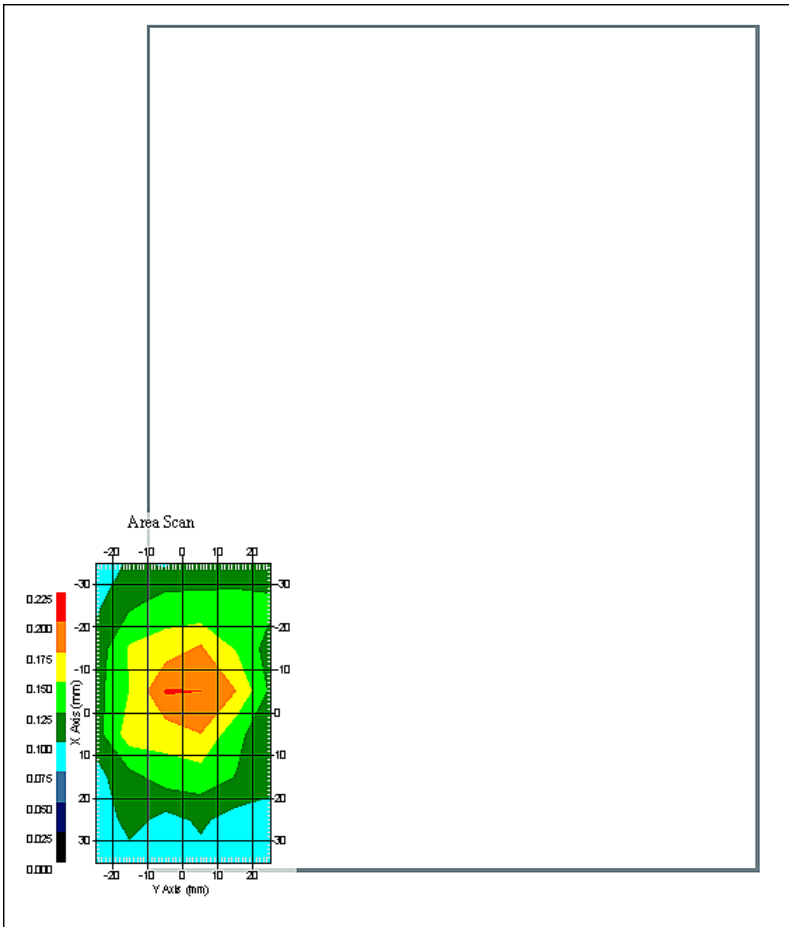
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 2450
Frequency : 2450.00 MHz
Last Calib. Date : 22-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 41.00 RH%
Epsilon : 52.56 F/m
Sigma : 1.97 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 : 03-Nov-2008
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.5
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
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-Jan-2009
Set-up Time       : 7:43:11 AM
Area Scan         : 8x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 0
Channel           : Mid
```




```
1 gram SAR value    : 0.179 W/kg
10 gram SAR value   : 0.120 W/kg
Area Scan Peak SAR  : 0.202 W/kg
Zoom Scan Peak SAR  : 0.280 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 24-Jan-2009
Starting Time : 24-Jan-2009 08:59:36 AM
End Time : 24-Jan-2009 09:16:47 AM
Scanning Time : 1031 secs

Product Data
Device Name : Novatel Wireless
Serial No. : Q01_015
Module - Mode : Atheros AR5 - b
Model : E760 In Dell Inspiron 910
Frequency : 2450.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 233 mm
Width : 170 mm
Depth : 27 mm
Antenna Type : Internal - Main
Orientation : Touch
Power Drift-Start : 0.203 W/kg
Power Drift-Finish: 0.196 W/kg
Power Drift (%) : -3.444

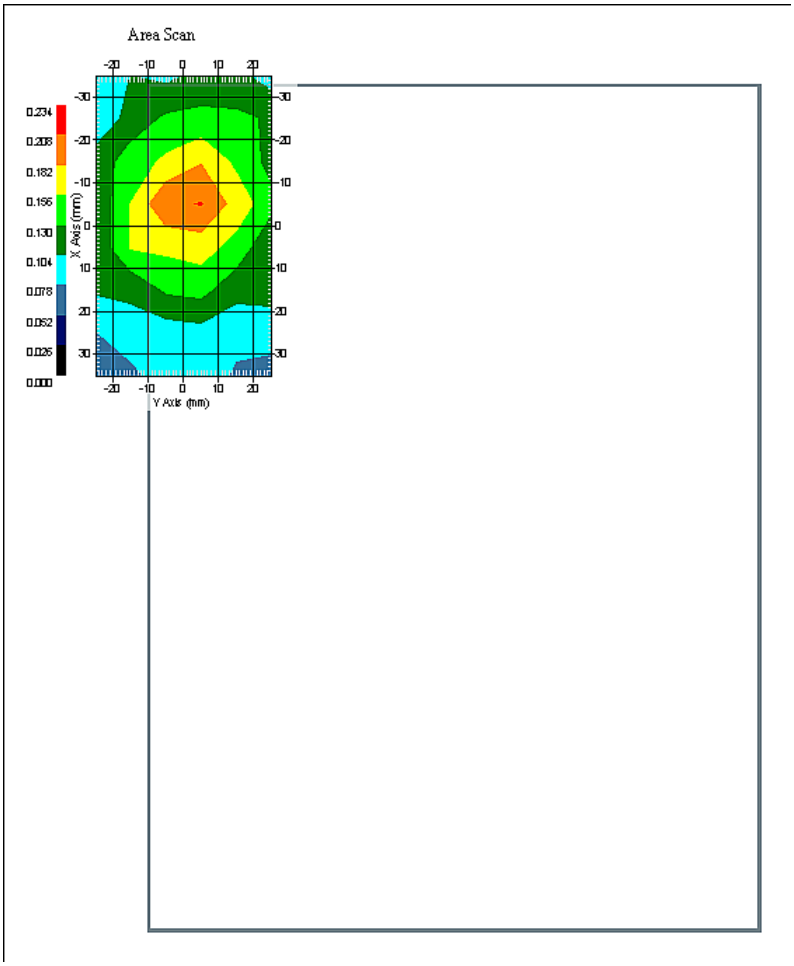
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 2450
Frequency : 2450.00 MHz
Last Calib. Date : 24-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 41.00 RH%
Epsilon : 52.49 F/m
Sigma : 1.96 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 : 03-Nov-2008
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.5
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
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       : 24-Jan-2009
Set-up Time       : 7:43:11 AM
Area Scan         : 8x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 0
Channel           : High
```




```
1 gram SAR value    : 0.180 W/kg
10 gram SAR value   : 0.124 W/kg
Area Scan Peak SAR  : 0.209 W/kg
Zoom Scan Peak SAR  : 0.270 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 24-Jan-2009
Starting Time : 24-Jan-2009 09:20:16 AM
End Time : 24-Jan-2009 09:37:31 AM
Scanning Time : 1035 secs

Product Data
Device Name : Novatel Wireless
Serial No. : Q01_015
Module - Mode : Atheros AR5 - b
Model : E760 In Dell Inspiron 910
Frequency : 2450.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 233 mm
Width : 170 mm
Depth : 27 mm
Antenna Type : Internal - Aux
Orientation : Touch
Power Drift-Start : 0.197 W/kg
Power Drift-Finish: 0.195 W/kg
Power Drift (%) : -1.012

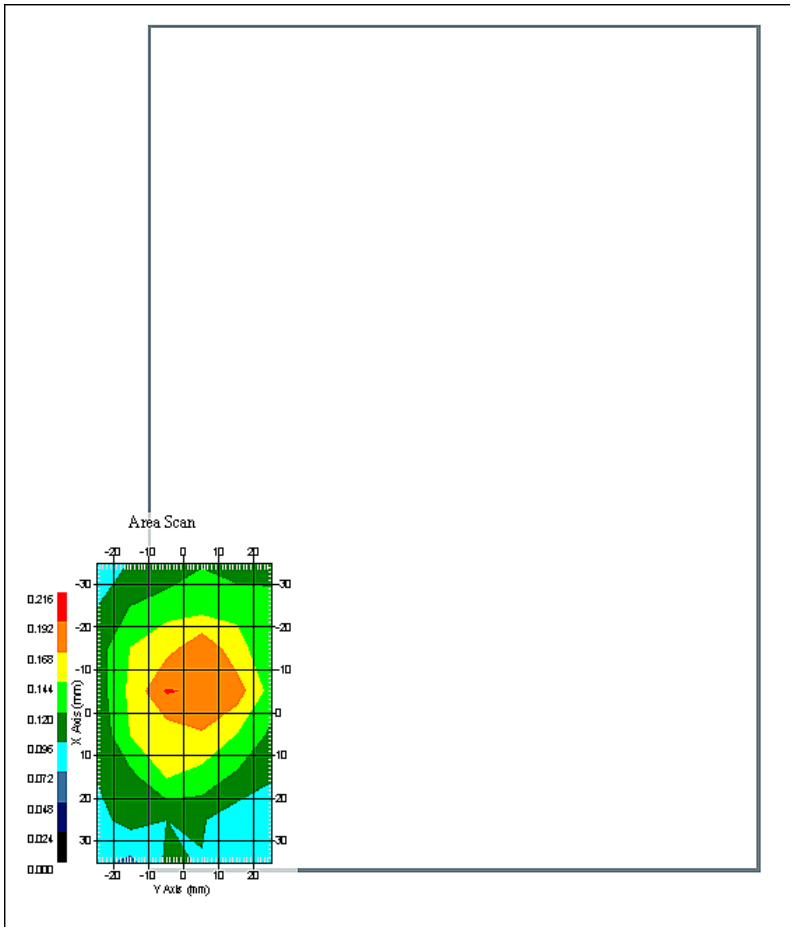
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Size (mm) : 280 x 280 x 200
Serial No. : System Default
Location : Center
Description : Uni-Phantom

Tissue Data
Type : BODY
Serial No. : 2450
Frequency : 2450.00 MHz
Last Calib. Date : 24-Jan-2009
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 41.00 RH%
Epsilon : 52.49 F/m
Sigma : 1.96 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 : 03-Nov-2008
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.5
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point: 95.00 mV
Offset : 1.56 mm

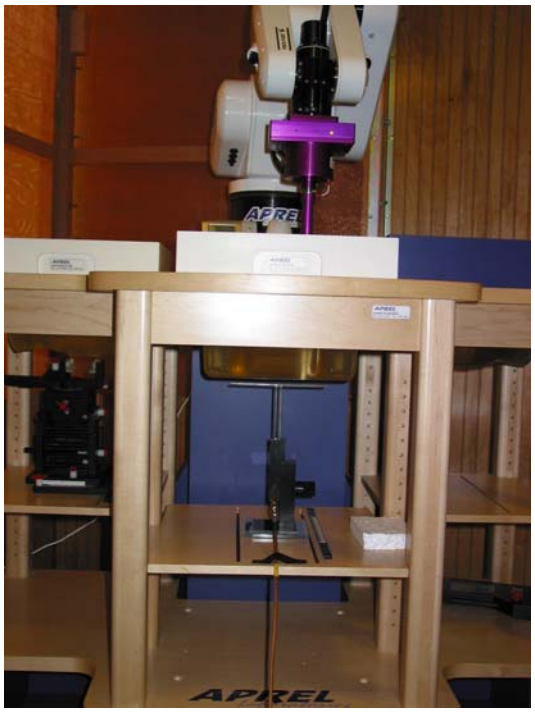
```
Measurement Data
Crest Factor      : 1
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 24-Jan-2009
Set-up Time       : 7:43:11 AM
Area Scan         : 8x6x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 0
Channel           : High
```

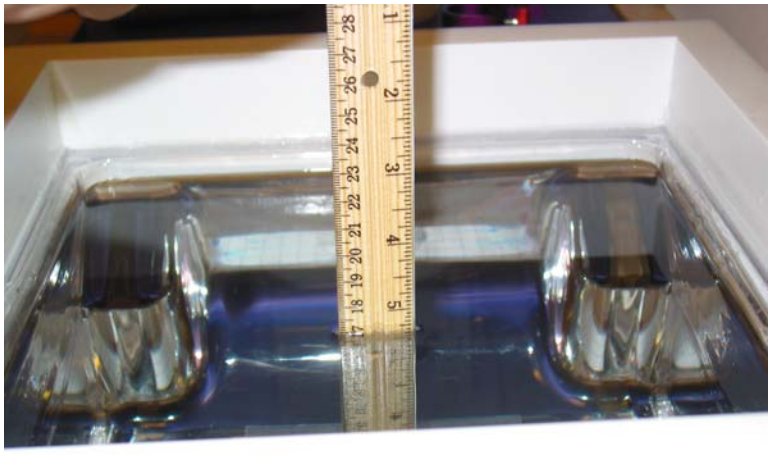



```
1 gram SAR value    : 0.185 W/kg
10 gram SAR value   : 0.127 W/kg
Area Scan Peak SAR  : 0.194 W/kg
Zoom Scan Peak SAR  : 0.280 W/kg
```

Appendix C – SAR Test Setup Photos



System Body Configuration



Body Tissue Depth

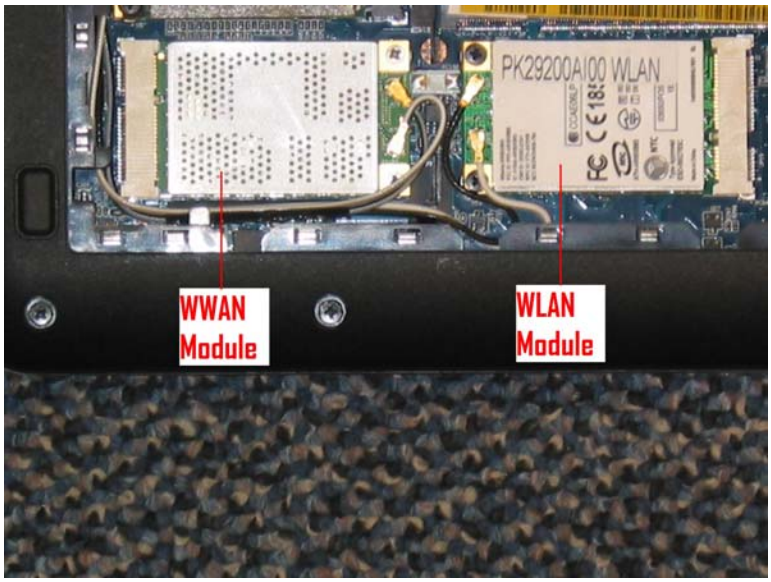
WWAN & Main Antenna WLAN Test Configuration

Auxiliary Antenna WLAN Test Configuration

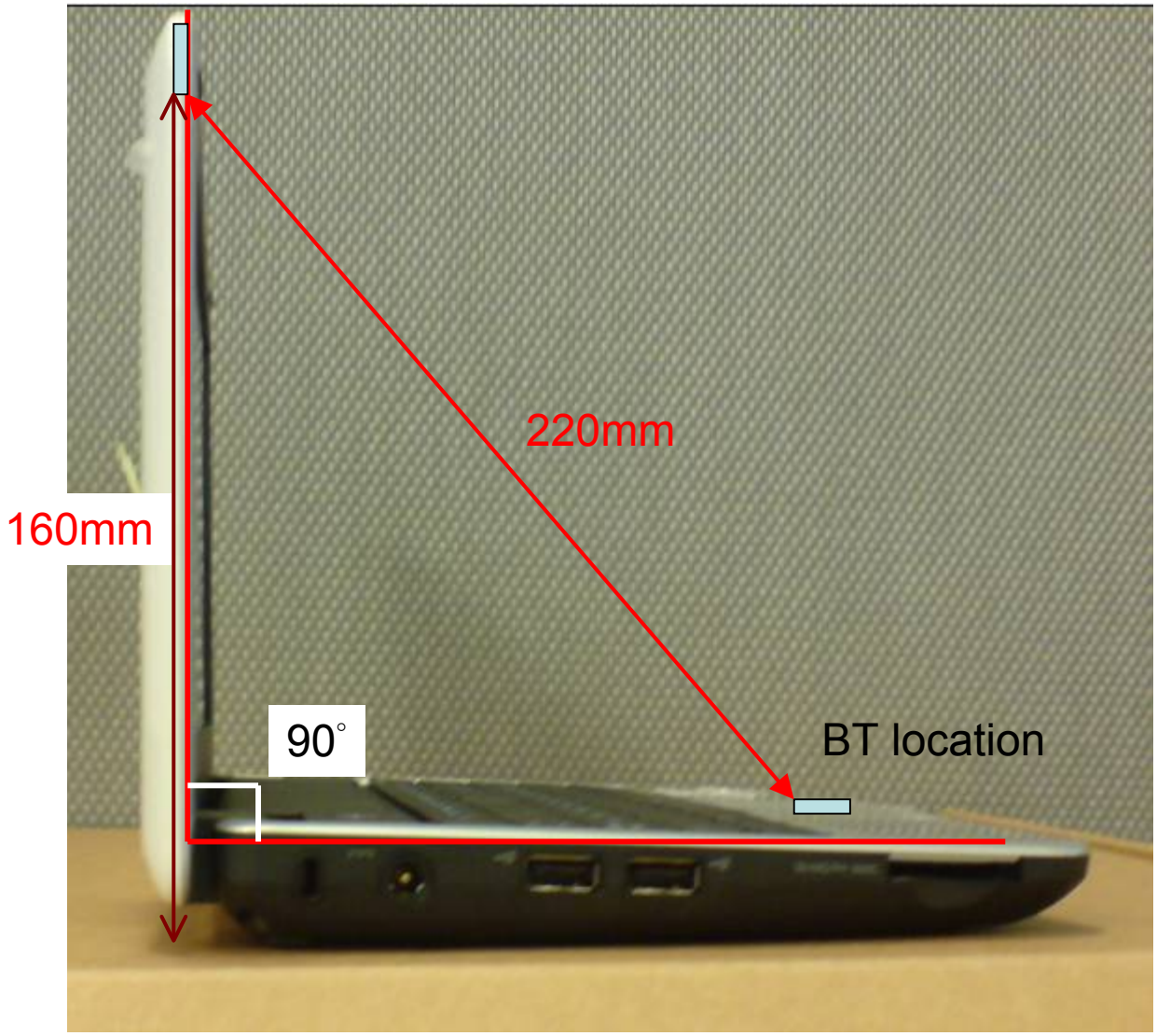
Front of Device

Back of Device

Back of Device with Cover Removed

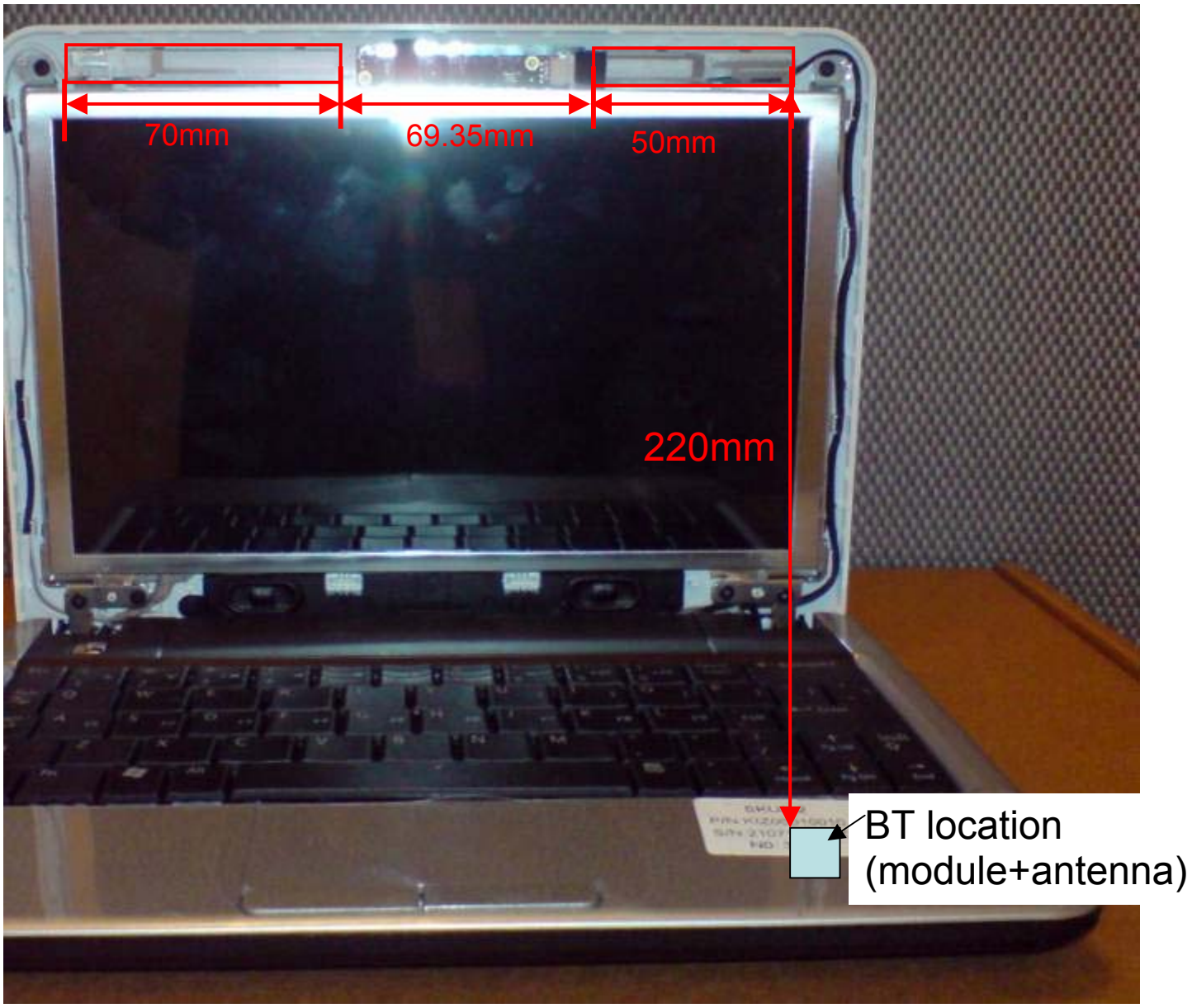


WWAN & WLAN Modules Location



Antenna Distances

WWAN Main+WLAN Main WWAN Aux+WLAN Aux



Antenna to Antenna Distance and BT Distance

Appendix D – Probe Calibration Data Sheets

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-926

Client.: RFEL

C E R T I F I C A T E OF C A L I B R A T I O N

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 835 MHz
BODY Calibration
Manufacturer: APREL Laboratories
Model No.: E-020
Serial No.: 215

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2
Project No: RFEL-00150-CAL-5367

Calibrated: 3rd November 2008
Released on: 3rd November 2008

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
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
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

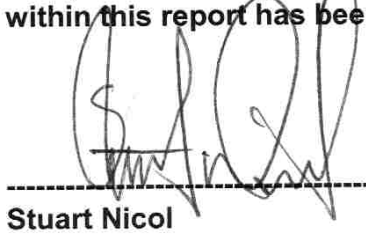
SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure
IEEE 1528 “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”
IEEE 1309 “IEEE Standard for Calibration of Electromagnetic 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

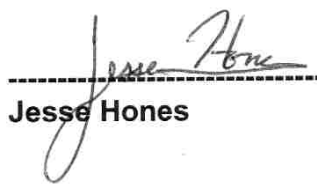
Probe 215 was a re-calibration.

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

Probe Type:	E-Field Probe E-020
Serial Number:	215
Frequency:	835 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	**<**5 mm
Tip Length:	60 mm
Total Length:	290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

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

Sensitivity in Body Tissue Measured

Frequency: 835 MHz

Epsilon: 55.2 (+/-5%) **Sigma:** 1.05 S/m (+/-10%)

ConvF

Channel X: 6.3

Channel Y: 6.3

Channel Z: 6.3

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

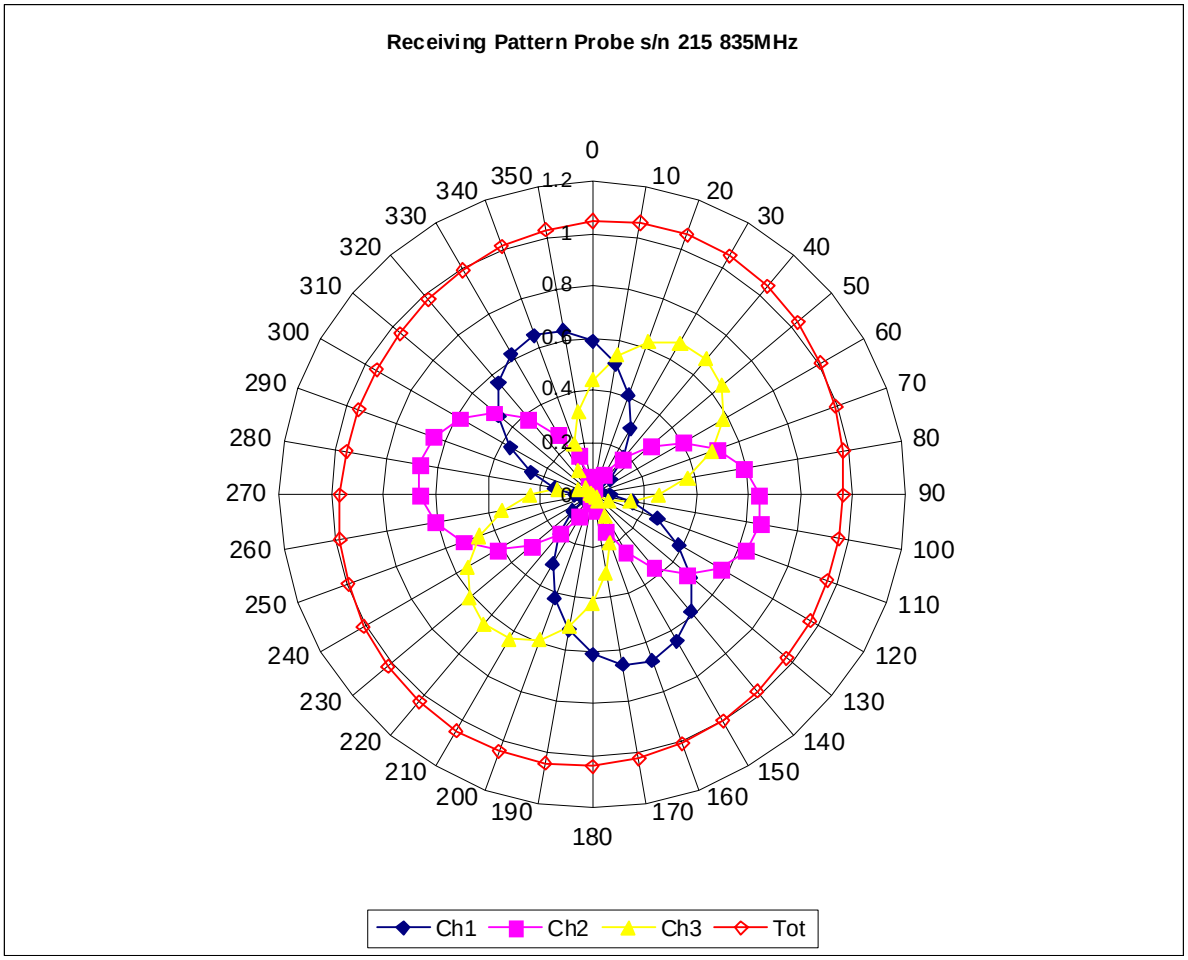
Boundary Effect:

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.

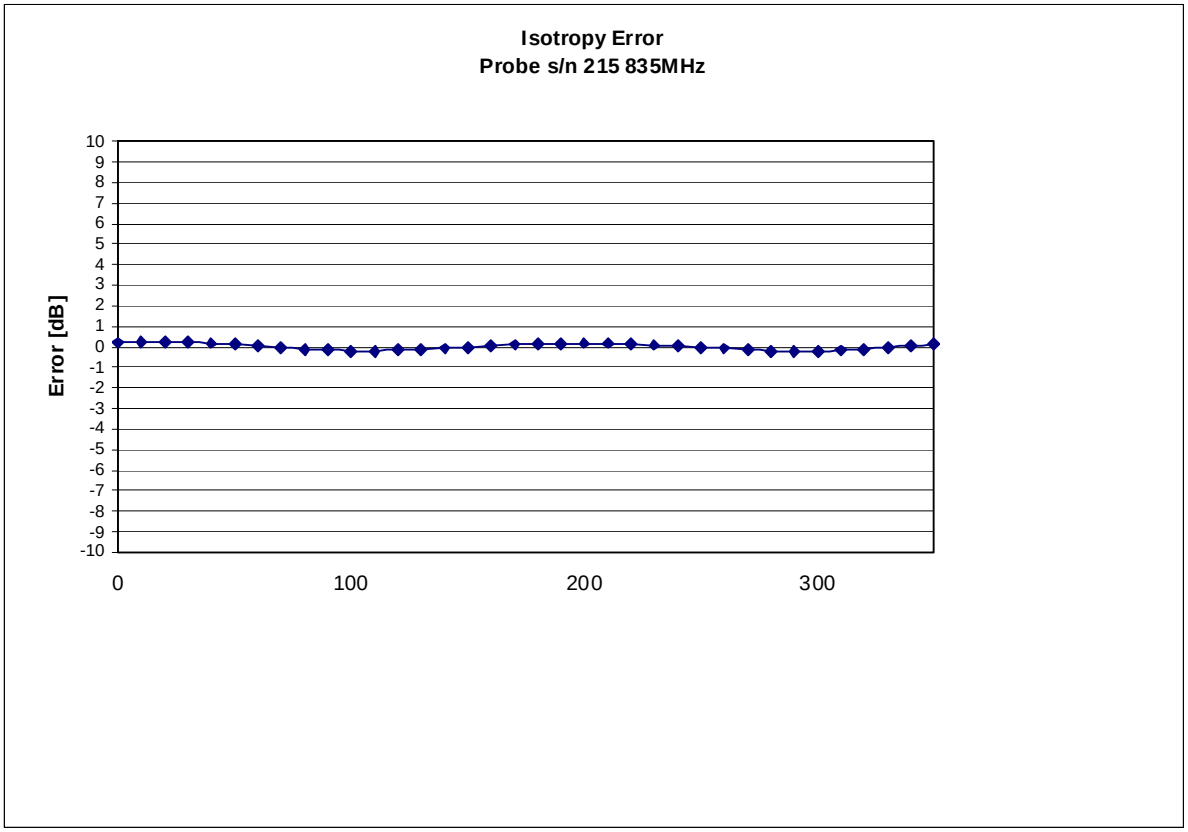
Spatial Resolution:

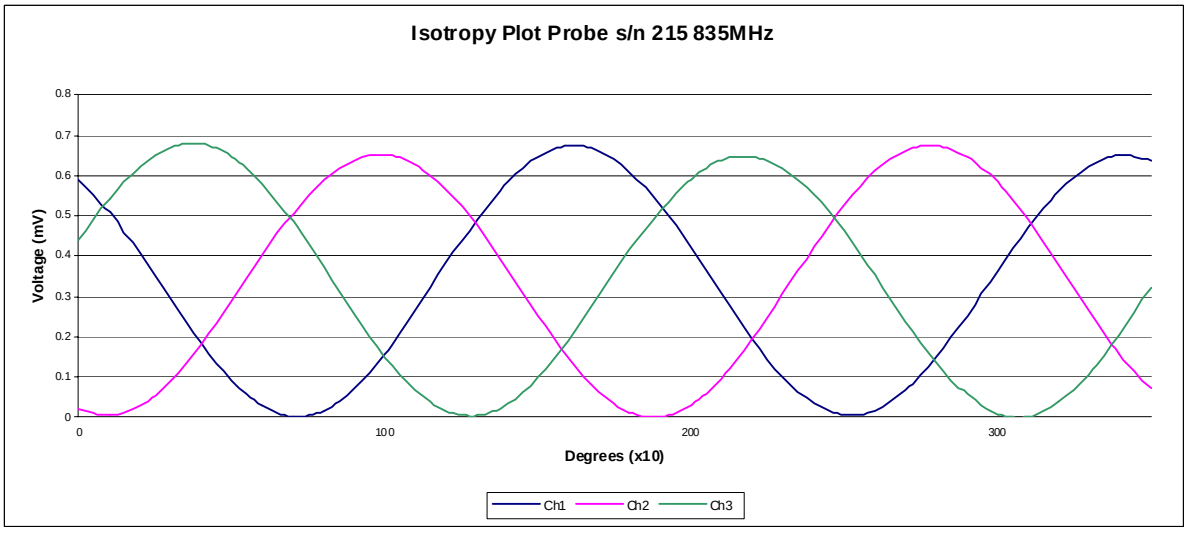
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 835 MHz (Air)



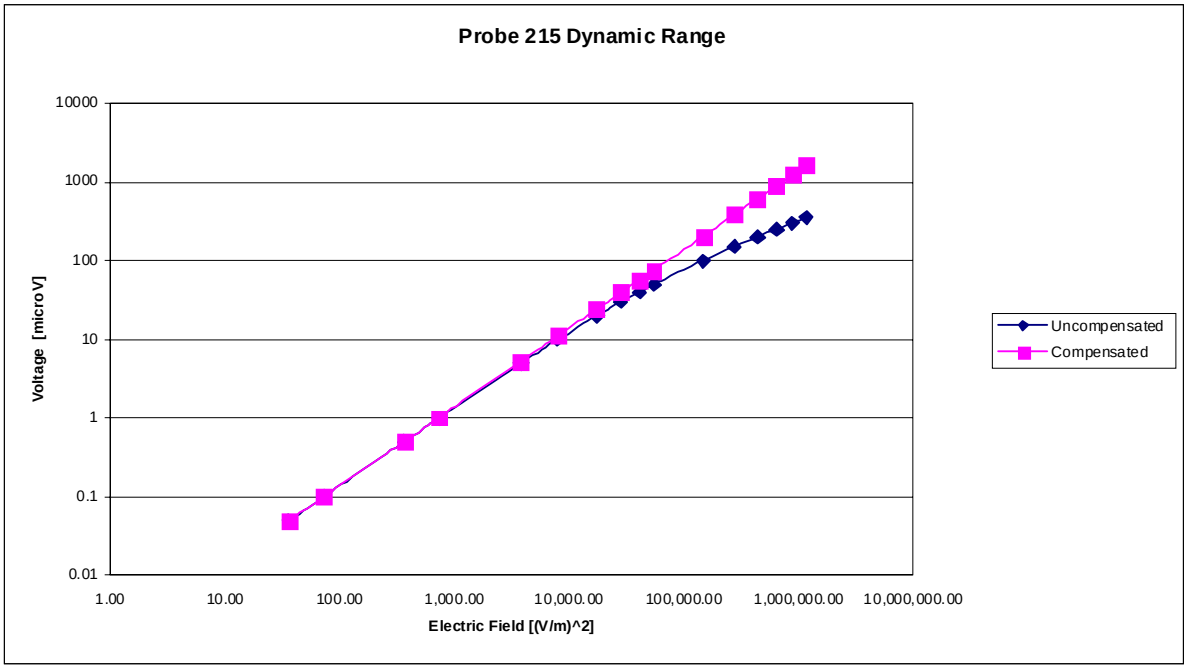
Isotropy Error 835 MHz (Air)



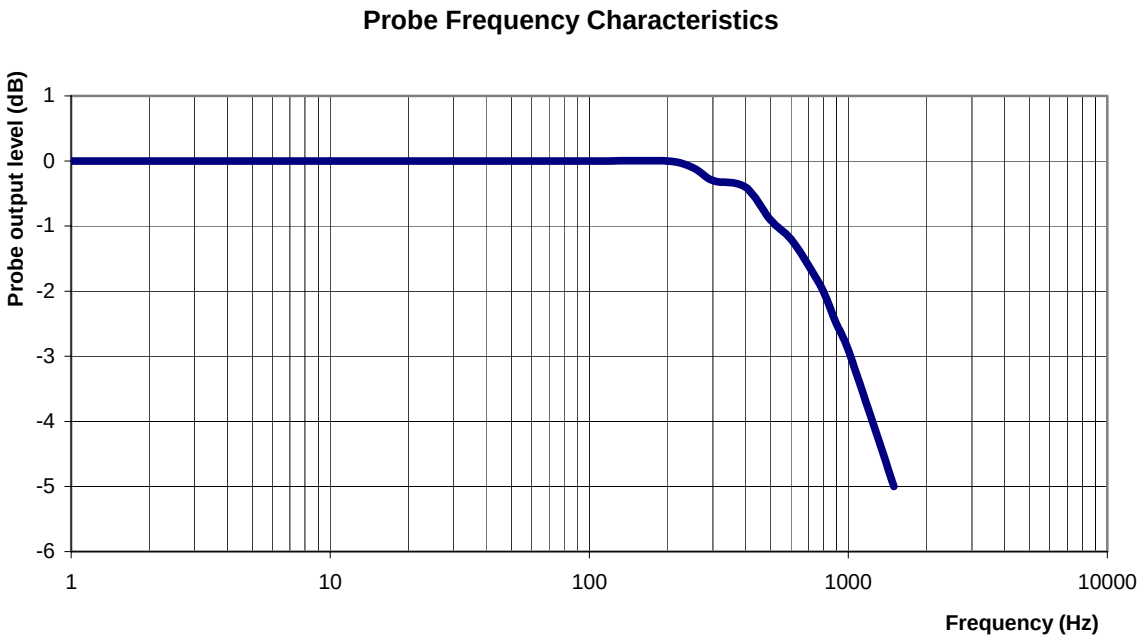


Isotropicity Tissue: 0.10 dB

Dynamic Range



Video Bandwidth



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

Conversion Factor Uncertainty Assessment Measured

Sensitivity in Body Tissue

Frequency:		835 MHz	
Epsilon:	55.2 (+/-5%)	**Sigma:**	1.05 S/m (+/-10%)
ConvF			
Channel X:	6.3	7%(K=2)	
Channel Y:	6.3	7%(K=2)	
Channel Z:	6.3	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 2008.

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-933

Client.: RFEL

C E R T I F I C A T E OF C A L I B R A T I O N

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 1900 MHz
BODY Calibration
Manufacturer: APREL Laboratories
Model No.: E-020
Serial No.: 215

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2
Project No: RFEL-00150-CAL-5367

Calibrated: 3rd November 2008
Released on: 3rd November 2008

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
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
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

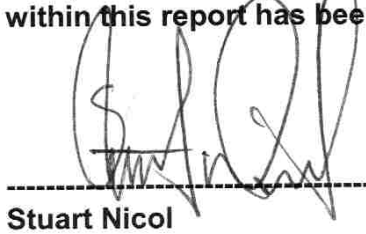
SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure
IEEE 1528 “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”
IEEE 1309 “IEEE Standard for Calibration of Electromagnetic 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

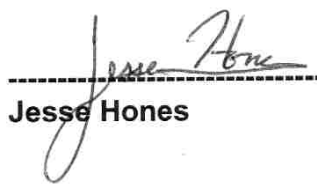
Probe 215 was a re-calibration.

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

Probe Type:	E-Field Probe E-020
Serial Number:	215
Frequency:	1900 MHz
Sensor Offset:	1.56 mm
Sensor Length:	2.5 mm
Tip Enclosure:	Ertalyte*
Tip Diameter:	**<**5 mm
Tip Length:	60 mm
Total Length:	290 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

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

Sensitivity in Body Tissue Measured

Frequency: 1900 MHz

Epsilon: 54.2 (+/-5%) **Sigma:** 1.57 S/m (+/-5%)

ConvF

Channel X: 5.0

Channel Y: 5.0

Channel Z: 5.0

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

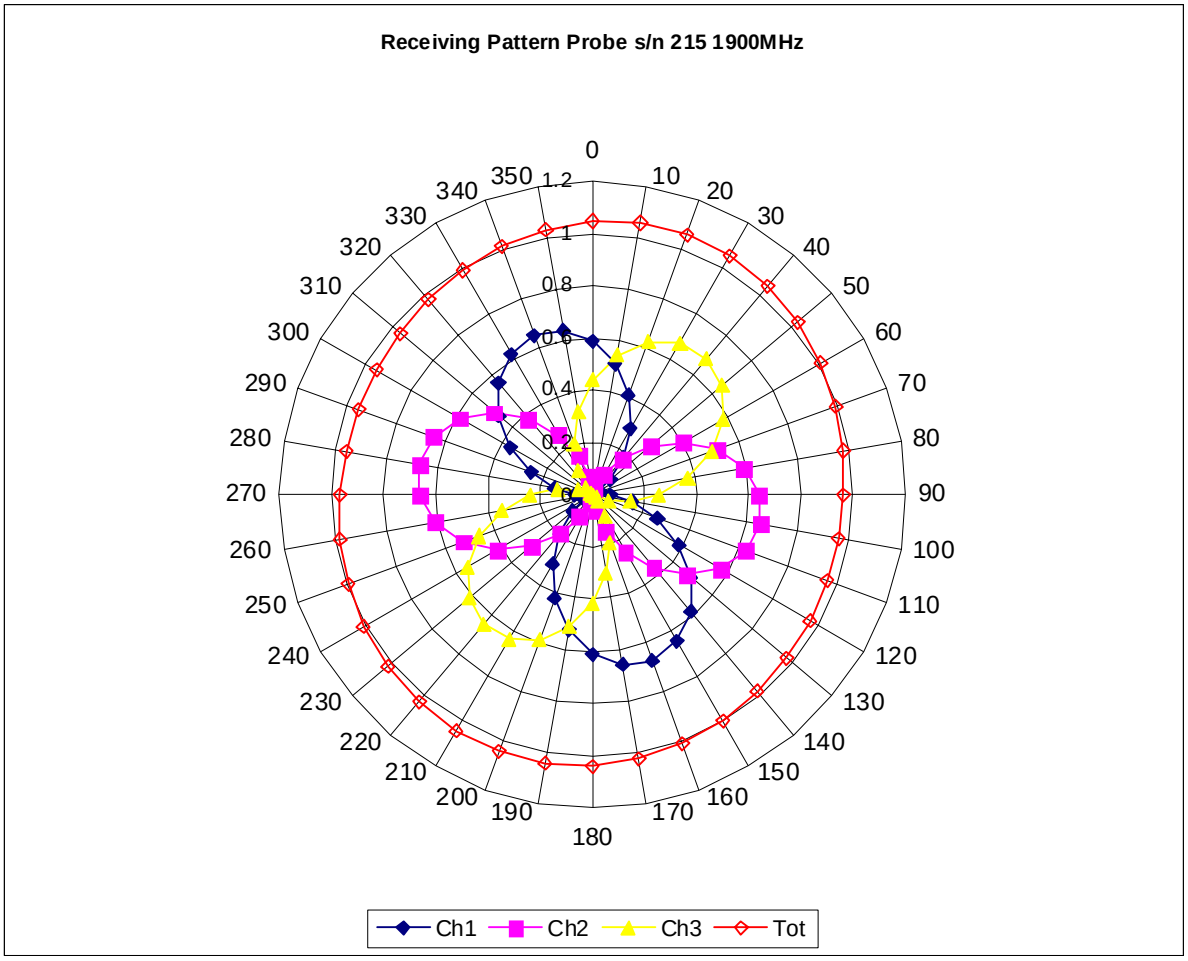
Boundary Effect:

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.

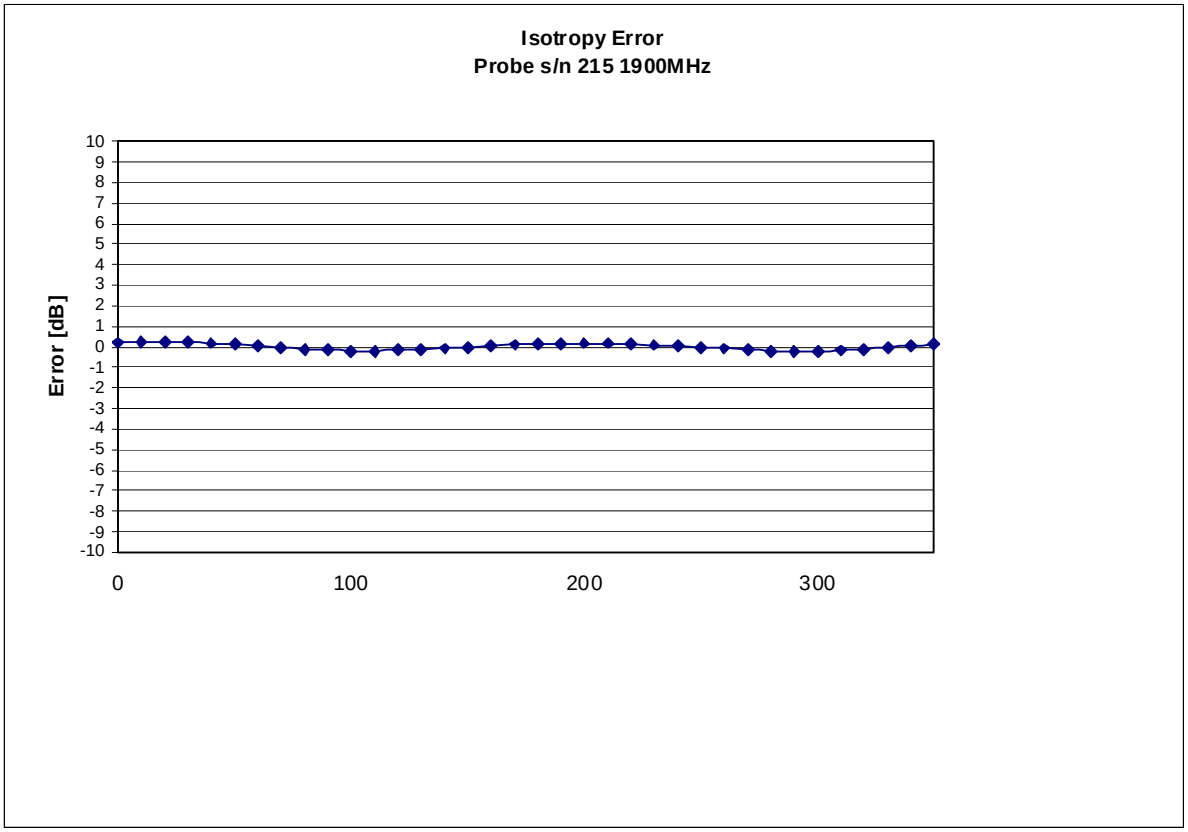
Spatial Resolution:

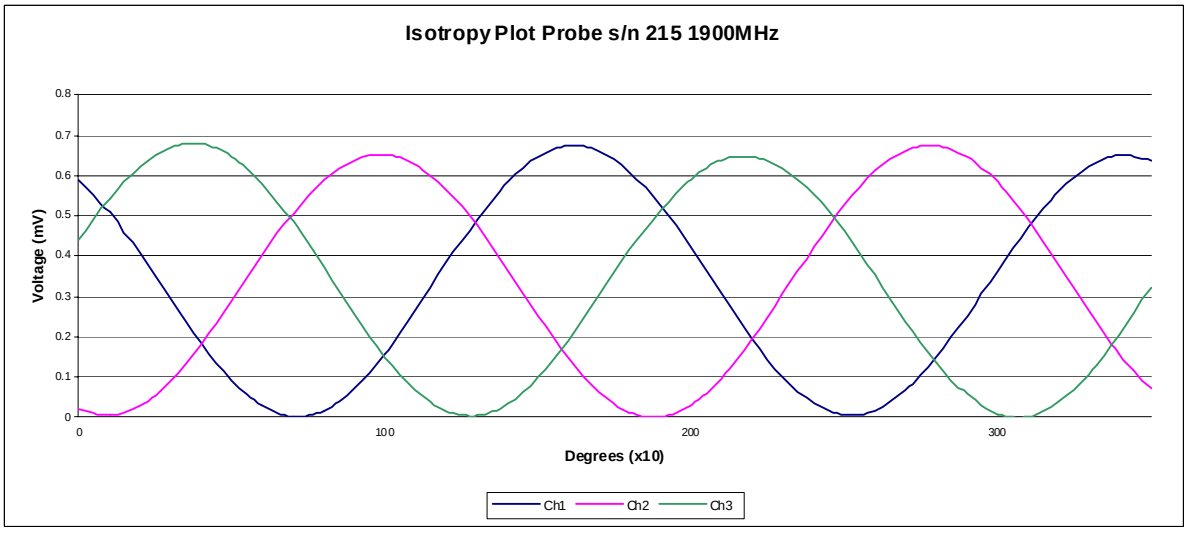
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 1900 MHz (Air)



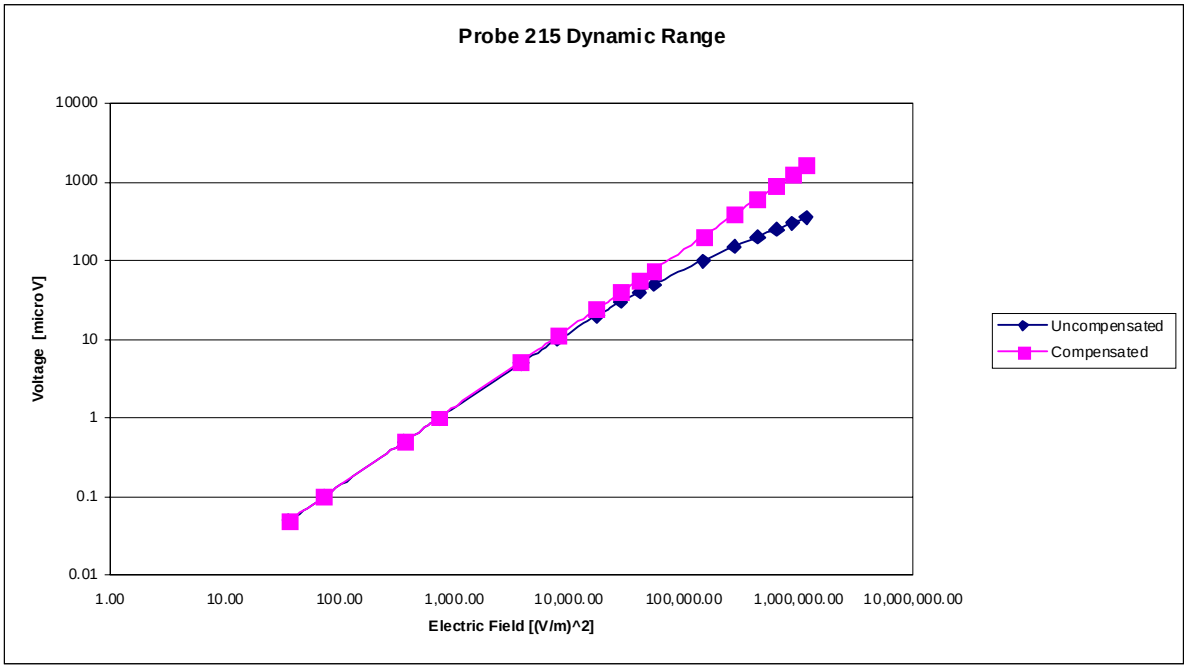
Isotropy Error 1900 MHz (Air)



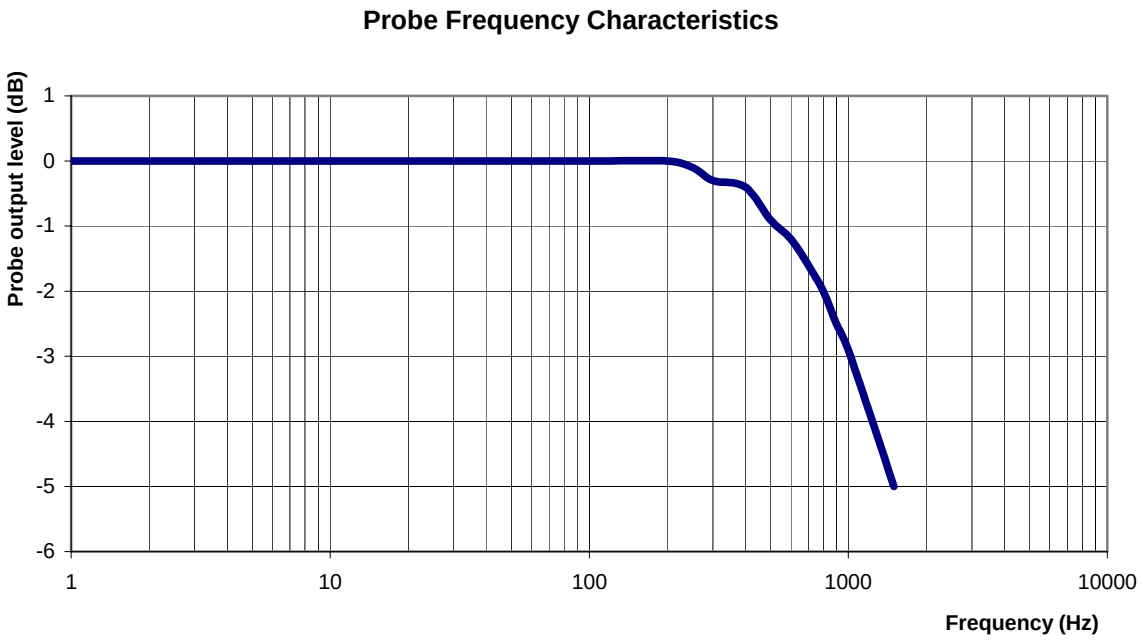


Isotropicity Tissue: 0.10 dB

Dynamic Range



Video Bandwidth



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

Conversion Factor Uncertainty Assessment Measured

Sensitivity in Body Tissue

Frequency:		1900 MHz	
Epsilon:	54.2 (+/-5%)	**Sigma:**	1.57 S/m (+/-5%)
ConvF			
Channel X:	5.0	7%(K=2)	
Channel Y:	5.0	7%(K=2)	
Channel Z:	5.0	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 2008.

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-935

Client.: RFEL

C E R T I F I C A T E OF C A L I B R A T I O N

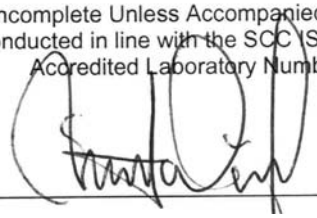
It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe 2450 MHz
BODY Calibration
Manufacturer: APREL Laboratories
Model No.: E-020
Serial No.: 215

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2
Project No: RFEL-00150-CAL-5367

Calibrated: 3rd November 2008
Released on: 3rd November 2008

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

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

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

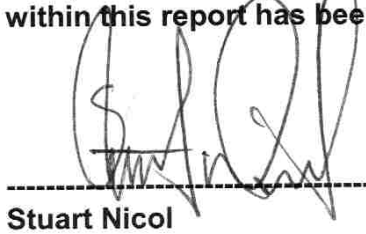
SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure
IEEE 1528 “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”
IEEE 1309 “IEEE Standard for Calibration of Electromagnetic 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

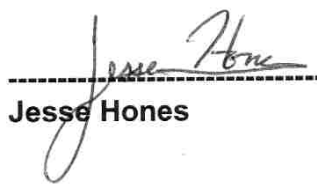
Probe 215 was a re-calibration.

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

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

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

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

Sensitivity in Body Tissue Measured

Frequency: 2450 MHz

Epsilon: 53.8 (+/-5%) **Sigma:** 1.99 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.

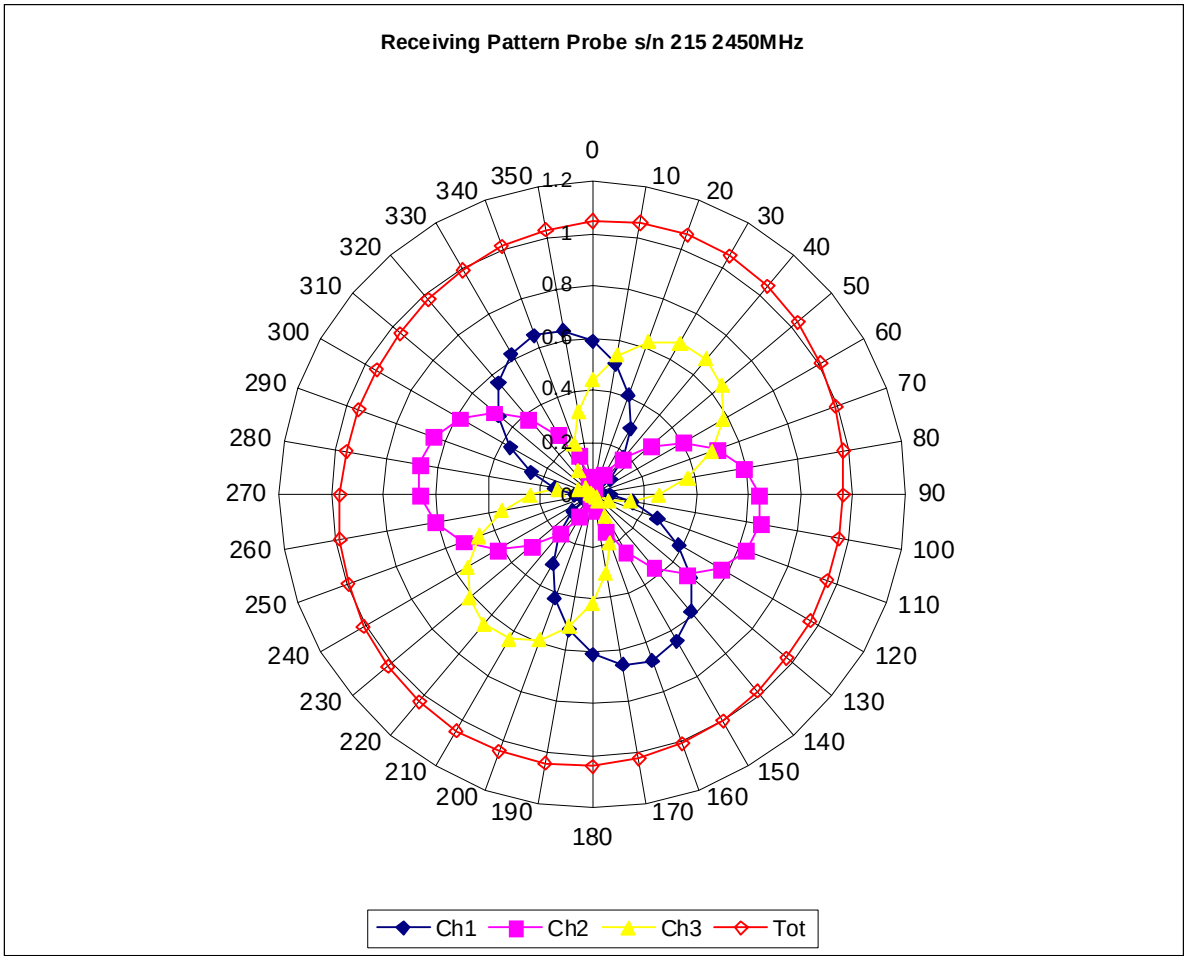
Boundary Effect:

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.

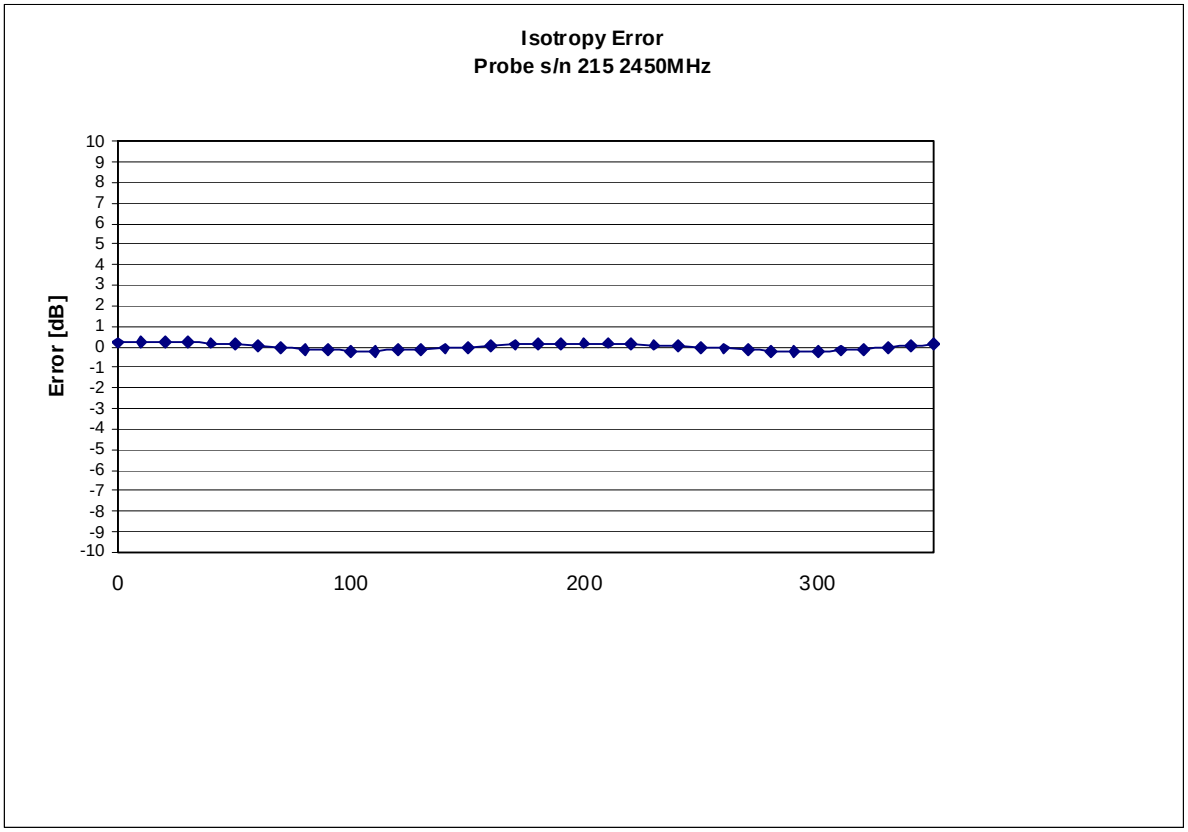
Spatial Resolution:

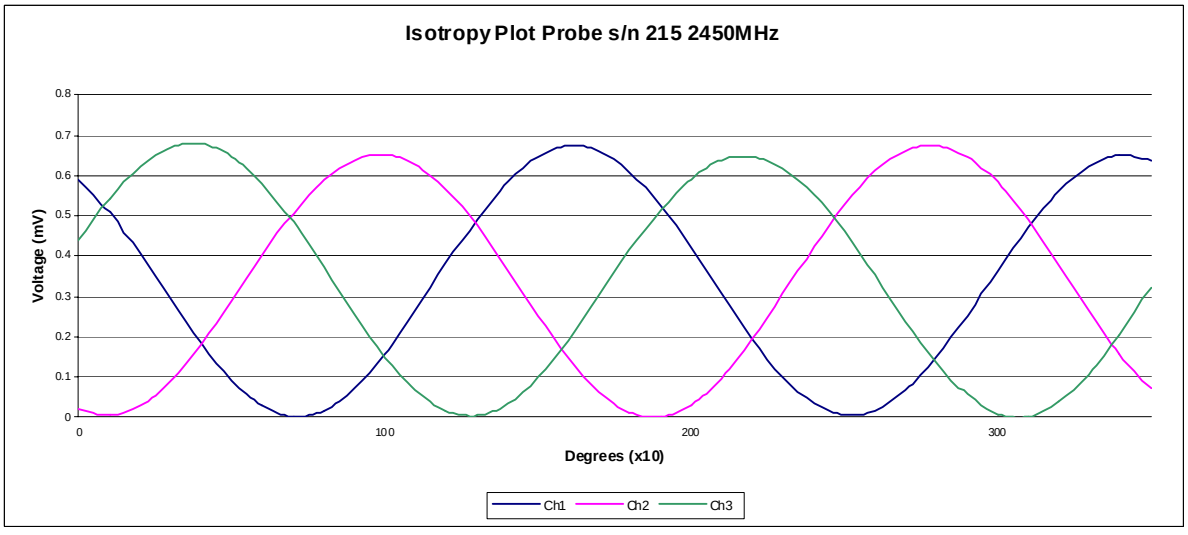
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 2450 MHz (Air)



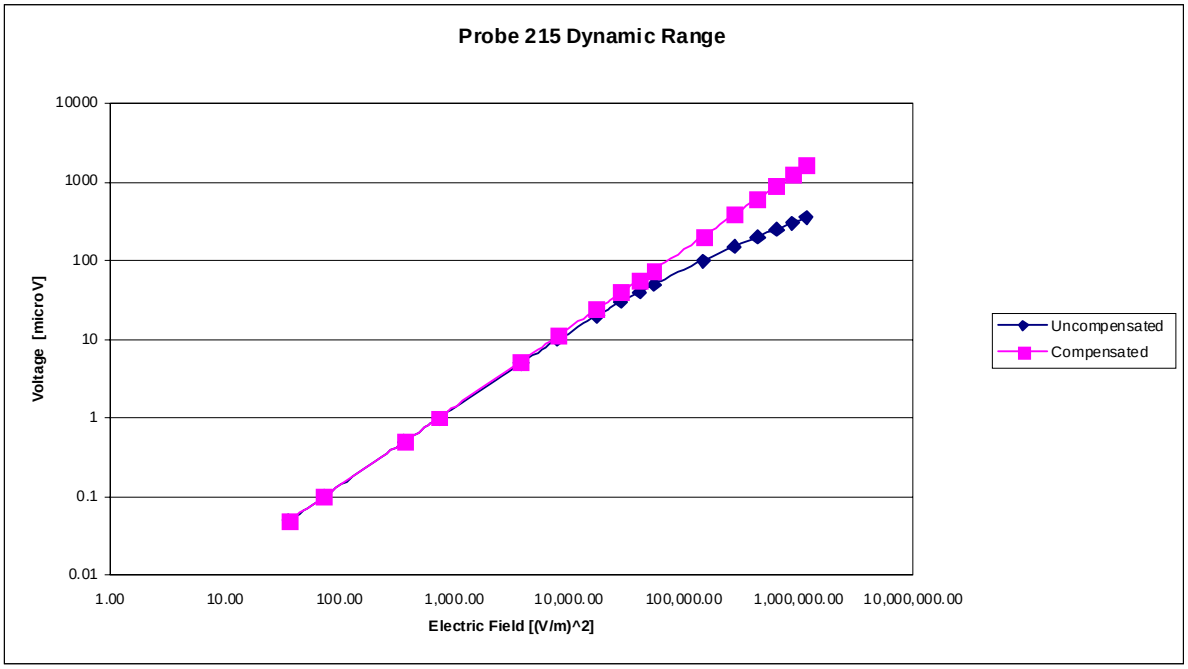
Isotropy Error 2450 MHz (Air)



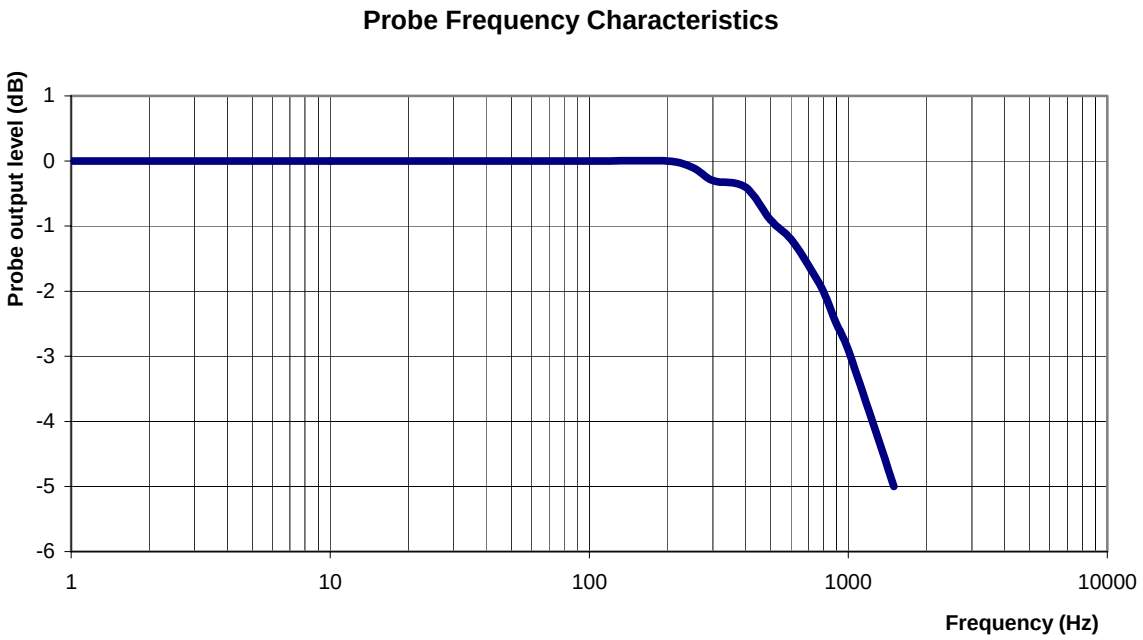


Isotropicity Tissue: 0.10 dB

Dynamic Range



Video Bandwidth



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:	53.8 (+/-5%)	**Sigma:**	1.99 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 2008.

Appendix E – Dipole Calibration Data Sheets

RF Exposure Lab, LLC

Calibration File No: CAL.20080203

C E R T I F I C A T E O F C A L I B R A T I O N

It is certified that the equipment identified below has been calibrated at RF Exposure Lab, LLC by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Validation Dipole

Manufacturer: APREL Laboratories

Part Number: ALS-D-835-S-2

Frequency: 835 MHz

Serial No: RFE-274

Manufactured: 20 February 2004
Calibrated: 22 February 2008

Calibrated By: Signature on File
Jay Moulton – Technical Manager

Approved By: Signature on File
Tamara Moulton – Quality Manager

Measurement Uncertainty:

Repeatability:	2.3%
Tissue Uncertainty:	3.2%
Network Analyzer:	2.5%

RF EXPOSURE LAB, LLC

2867 Progress Place, Suite 4D
Escondido, CA 92029

Tel: (760) 737-3131
FAX: (760) 737-9131

Calibration Results Summary

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

Mechanical Dimensions

Length: 161.8 mm
Height: 91.1 mm

Electrical Specifications

Head

SWR: 1.1182 U
Return Loss: -27.508 dB
Impedance: 49.648 Ω

System Validation Results

Frequency	1 Gram	10 Gram
835 MHz	9.500	6.000

Body

SWR: 1.1533 U
Return Loss: -23.596 dB
Impedance: 51.395 Ω

System Validation Results

Frequency	1 Gram	10 Gram
835 MHz	9.750	6.240

Head Measurement Conditions

The measurements were performed in the Uni-Phantom filled with head simulating liquid of the following electrical parameters at 835 MHz:

Relative Dielectricity	41.48	± 5%
Conductivity	0.92 mho/m	± 5%

The APREL Laboratories ALSAS system with a dosimetric E-field probe E-020 (SN:217, Conversion factor 6.0 at 835 MHz) was used for the measurements.

The dipole was mounted so that the dipole feed point was positioned below the center marking of the flat phantom and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from the dipole center to the solution surface.

The coarse grid with a grid spacing of 10mm was aligned with the dipole. The 5x5x8 fine cube was chosen for cube integration. The dipole input power (forward power) was 100mW ± 3%. The results are normalized to 1W input power.

The laboratories environmental conditions were as follows during the calibration sequence.

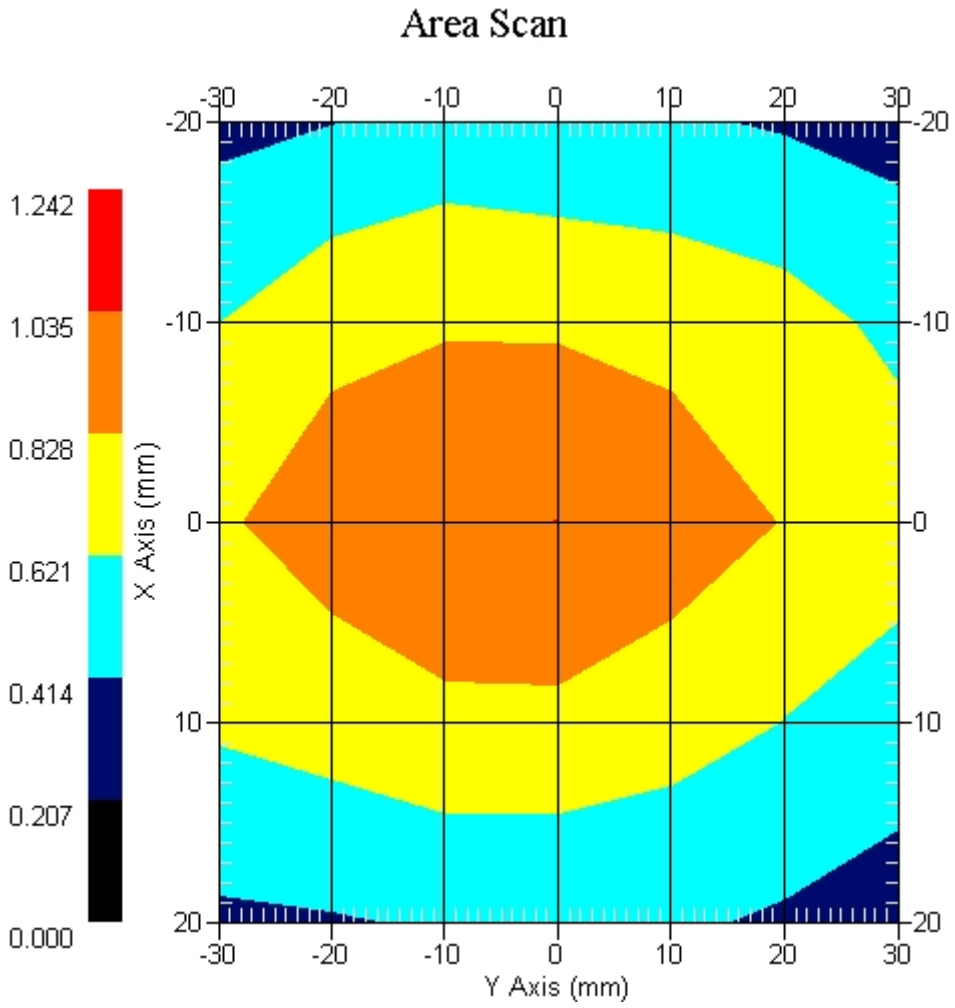
Ambient Temperature of the Laboratory:	24 ºC ± 1.0 ºC
Temperature of the Tissue:	20 ºC ± 1.0 ºC
Relative Humidity:	40%

SAR Measurement

Standard SAR measurements were performed according to the measurement conditions described above. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR values measured with the dosimetric probe E-020 SN:217 and applying the advanced extrapolation are:

Averaged over 1 cm^3 (1 g) of tissue: 9.500 mW/g ± 19.0% (k=2)[1]

Averaged over 10 cm^3 (10 g) of tissue: 6.000 mW/g ± 18.5% (k=2)[1]



1 gram SAR value : 0.950 W/kg
10 gram SAR value : 0.600 W/kg
Area Scan Peak SAR : 1.037 W/kg
Zoom Scan Peak SAR : 1.541 W/kg

[1] validation uncertainty

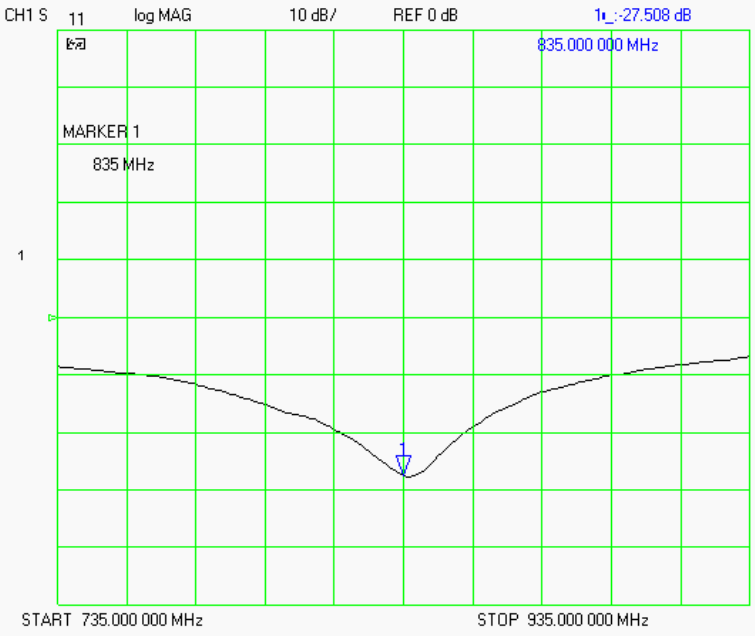
Dipole Impedance and Return Loss

The impedance was measured at the SMA connector with a network analyzer. The dipole was positioned at the flat phantom sections according to measurement conditions stated above during impedance measurements.

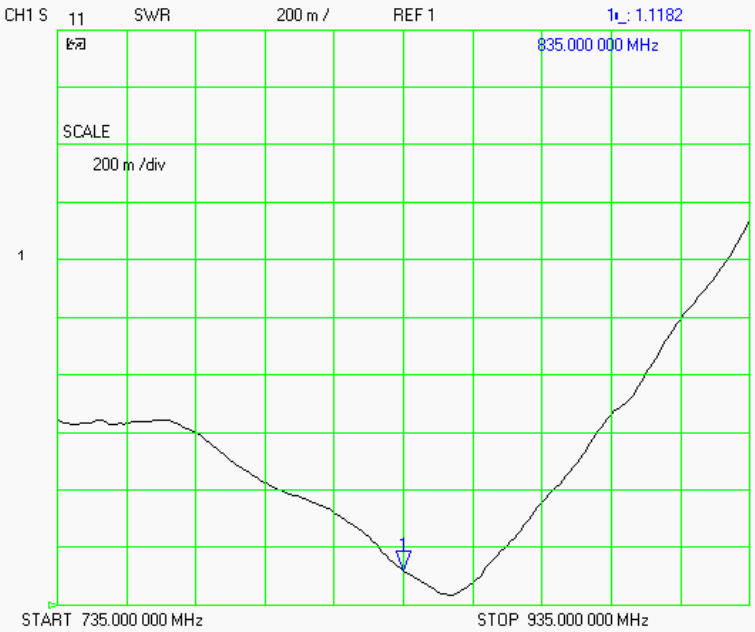
Test	Result
S11 R/L	-27.508 dB
SWR	1.1182 U
Impedance	49.648 Ω

The following graphs are the results as displayed on the Vector Network Analyzer.

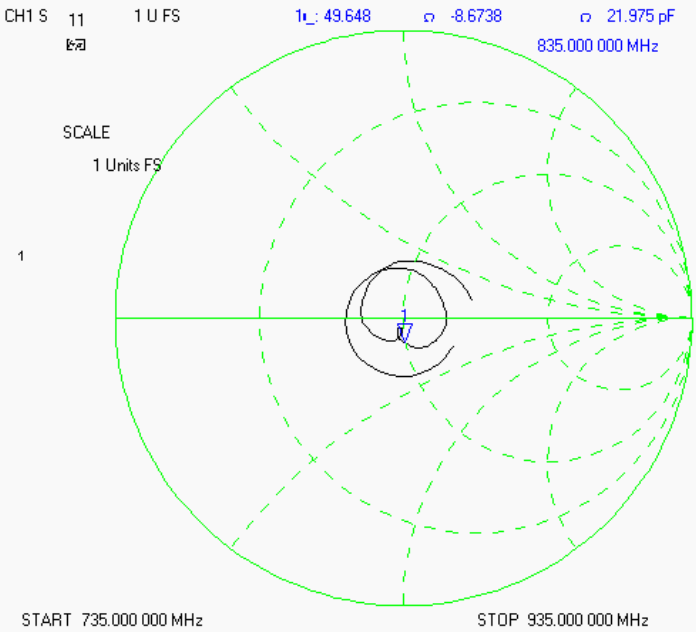
S11 Parameter Return Loss



SWR



Smith Chart Dipole Impedance



Body Measurement Conditions

The measurements were performed in the Uni-Phantom filled with body simulating liquid of the following electrical parameters at 835 MHz:

Relative Dielectricity	55.20	± 5%
Conductivity	0.96 mho/m	± 5%

The APREL Laboratories ALSAS system with a dosimetric E-field probe E-020 (SN:217, Conversion factor 6.1 at 835 MHz) was used for the measurements.

The dipole was mounted so that the dipole feed point was positioned below the center marking of the flat phantom and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15mm from the dipole center to the solution surface.

The coarse grid with a grid spacing of 10mm was aligned with the dipole. The 5x5x8 fine cube was chosen for cube integration. The dipole input power (forward power) was 100mW ± 3%. The results are normalized to 1W input power.

The laboratories environmental conditions were as follows during the calibration sequence.

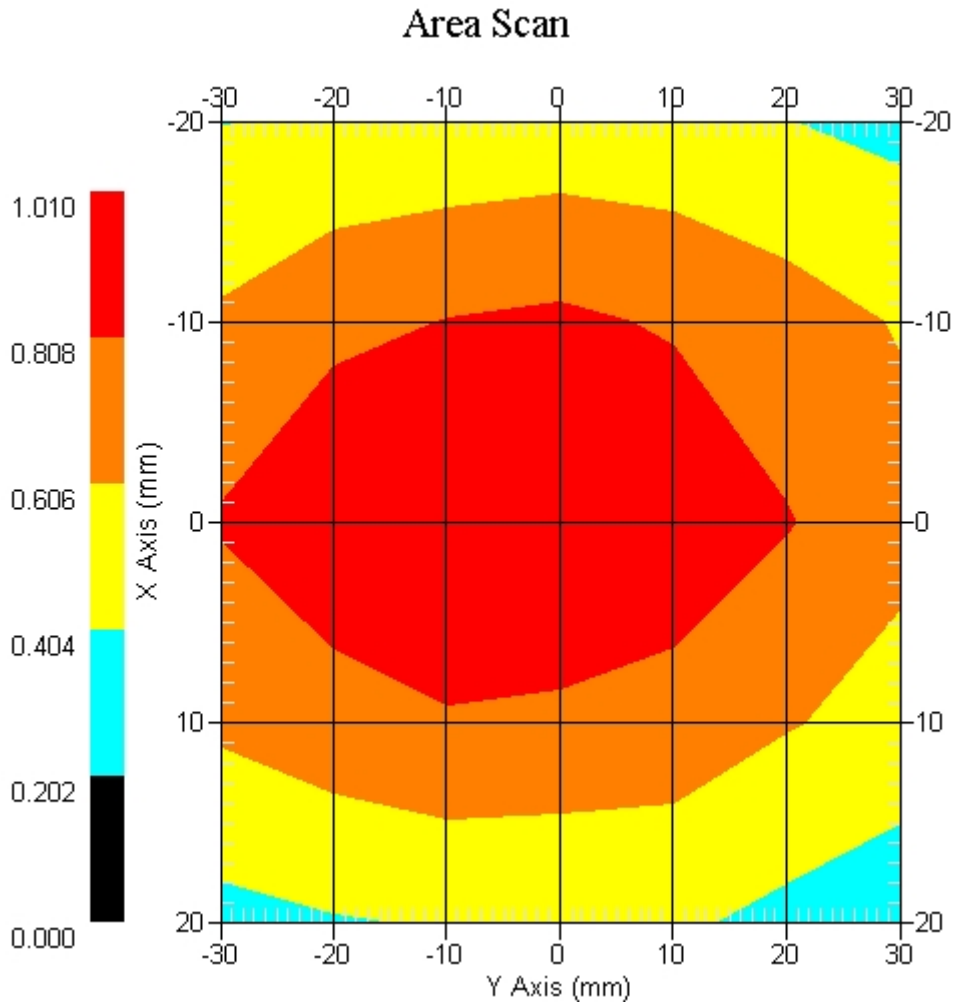
Ambient Temperature of the Laboratory:	24 ºC ± 1.0 ºC
Temperature of the Tissue:	20 ºC ± 1.0 ºC
Relative Humidity:	40%

SAR Measurement

Standard SAR measurements were performed according to the measurement conditions described above. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR values measured with the dosimetric probe E-020 SN:217 and applying the advanced extrapolation are:

Averaged over 1 cm^3 (1 g) of tissue: 9.750 mW/g ± 19.1% (k=2)[1]

Averaged over 10 cm^3 (10 g) of tissue: 6.240 mW/g ± 18.6% (k=2)[1]



1 gram SAR value : 0.975 W/kg
10 gram SAR value : 0.624 W/kg
Area Scan Peak SAR : 1.009 W/kg
Zoom Scan Peak SAR : 1.571 W/kg

[1] validation uncertainty

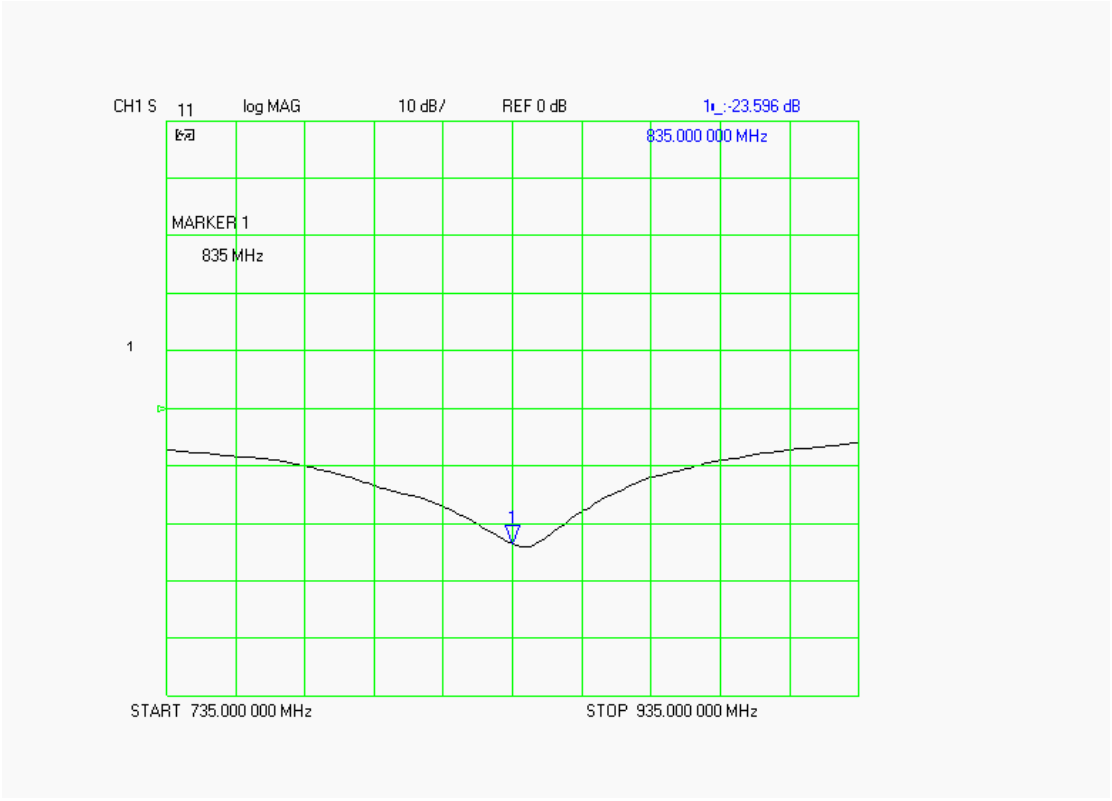
Dipole Impedance and Return Loss

The impedance was measured at the SMA connector with a network analyzer. The dipole was positioned at the flat phantom sections according to measurement conditions stated above during impedance measurements.

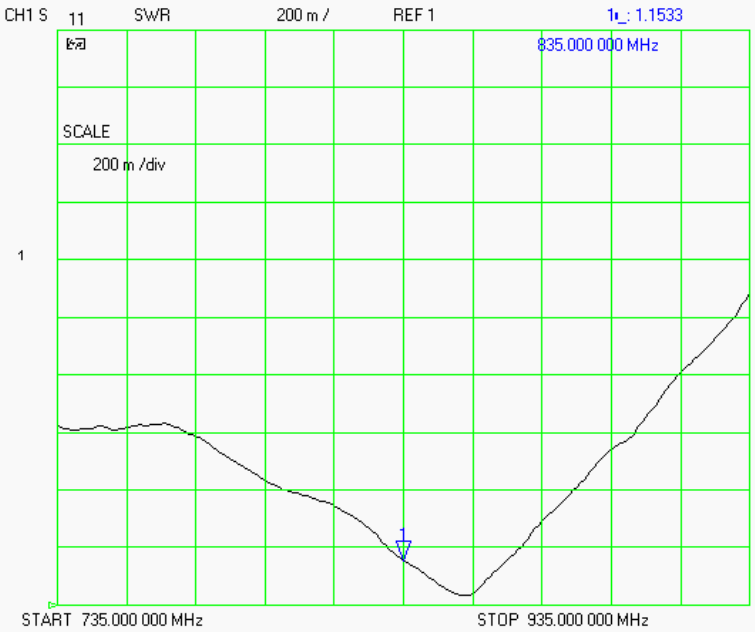
Test	Result
S11 R/L	-23.596 dB
SWR	1.1533 U
Impedance	51.395 Ω

The following graphs are the results as displayed on the Vector Network Analyzer.

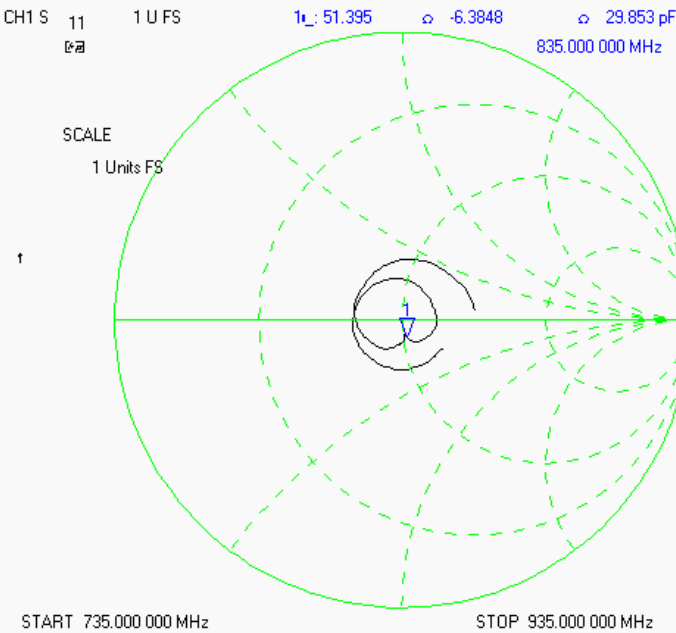
S11 Parameter Return Loss



SWR



Smith Chart Dipole Impedance



Test Equipment List

The test equipment used during Dipole Calibration, manufacturer, model number and, current calibration status are listed and located on the RF Exposure Lab, LLC system computer C:\Test Equipment\Calibration Equipment\Instrument List February 2008.

RF Exposure Lab, LLC

Calibration File No: CAL.20080202

C E R T I F I C A T E O F C A L I B R A T I O N

It is certified that the equipment identified below has been calibrated at RF Exposure Lab, LLC by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Validation Dipole

Manufacturer: APREL Laboratories

Part Number: ALS-D-1900-S-2

Frequency: 1.9 GHz

Serial No: RFE-277

Manufactured: 20 February 2004
Calibrated: 21 February 2008

Calibrated By: Signature on File
Jay Moulton – Technical Manager

Approved By: Signature on File
Tamara Moulton – Quality Manager

Measurement Uncertainty:

Repeatability:	2.3%
Tissue Uncertainty:	3.2%
Network Analyzer:	2.5%

RF EXPOSURE LAB, LLC

2867 Progress Place, Suite 4D
Escondido, CA 92029

Tel: (760) 737-3131
FAX: (760) 737-9131

Calibration Results Summary

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

Mechanical Dimensions

Length: 68.0 mm
Height: 37.5 mm

Electrical Specifications

Head

SWR: 1.0793 U
Return Loss: -38.514 dB
Impedance: 49.063 Ω

System Validation Results

Frequency	1 Gram	10 Gram
1.9 GHz	39.380	20.270

Body

SWR: 1.1006 U
Return Loss: -41.682 dB
Impedance: 53.580 Ω

System Validation Results

Frequency	1 Gram	10 Gram
1.9 GHz	40.990	21.090

Head Measurement Conditions

The measurements were performed in the Uni-Phantom filled with head simulating liquid of the following electrical parameters at 1900 MHz:

Relative Dielectricity	39.97	± 5%
Conductivity	1.41 mho/m	± 5%

The APREL Laboratories ALSAS system with a dosimetric E-field probe E-020 (SN:217, Conversion factor 4.65 at 1900 MHz) was used for the measurements.

The dipole was mounted so that the dipole feed point was positioned below the center marking of the flat phantom and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from the dipole center to the solution surface.

The coarse grid with a grid spacing of 10mm was aligned with the dipole. The 5x5x8 fine cube was chosen for cube integration. The dipole input power (forward power) was 100mW ± 3%. The results are normalized to 1W input power.

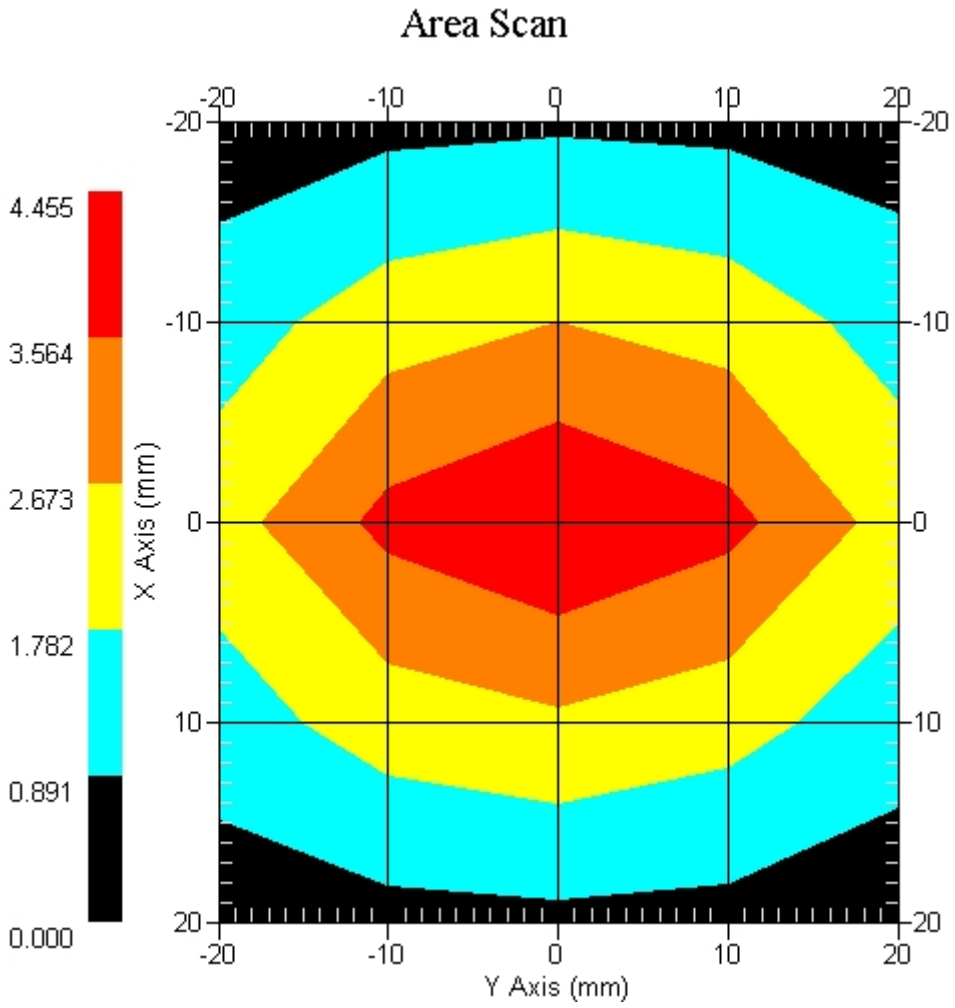
The laboratories environmental conditions were as follows during the calibration sequence.

Ambient Temperature of the Laboratory:	23 ºC ± 1.0 ºC
Temperature of the Tissue:	20 ºC ± 1.0 ºC
Relative Humidity:	40%

SAR Measurement

Standard SAR measurements were performed according to the measurement conditions described above. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR values measured with the dosimetric probe E-020 SN:217 and applying the advanced extrapolation are:

Averaged over 1 cm^3 (1 g) of tissue:	39.380 mW/g ± 19.2% (k=2)[1]
Averaged over 10 cm^3 (10 g) of tissue:	20.270 mW/g ± 18.8% (k=2)[1]



1 gram SAR value : 3.938 W/kg
10 gram SAR value : 2.027 W/kg
Area Scan Peak SAR : 4.455 W/kg
Zoom Scan Peak SAR : 7.246 W/kg

[1] validation uncertainty

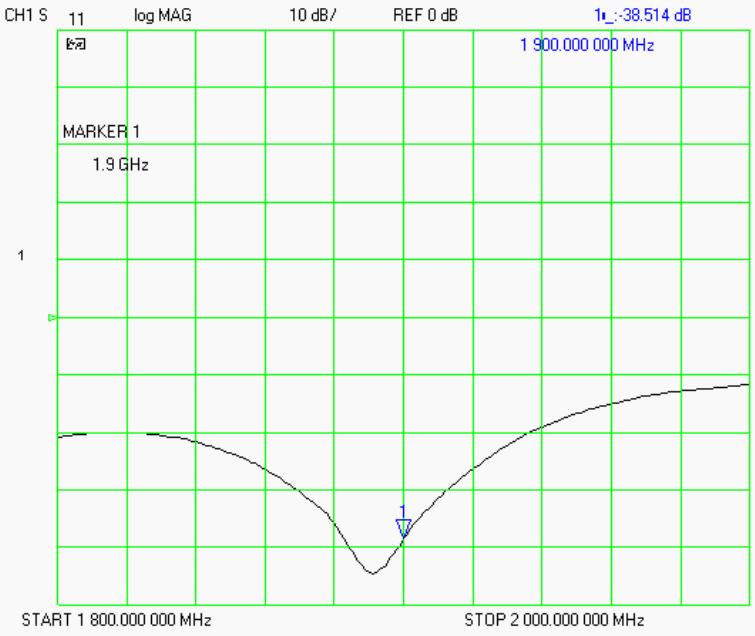
Dipole Impedance and Return Loss

The impedance was measured at the SMA connector with a network analyzer. The dipole was positioned at the flat phantom sections according to measurement conditions stated above during impedance measurements.

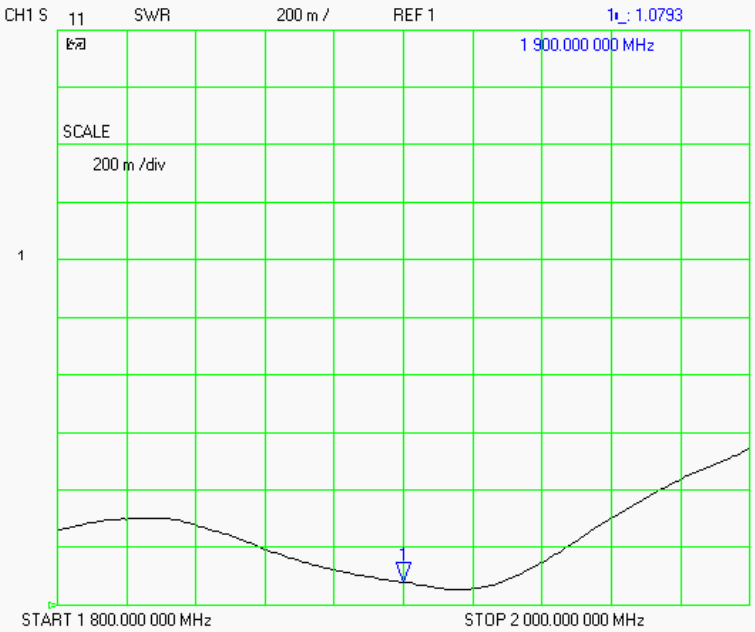
Test	Result
S11 R/L	-38.514 dB
SWR	1.0793 U
Impedance	49.063 Ω

The following graphs are the results as displayed on the Vector Network Analyzer.

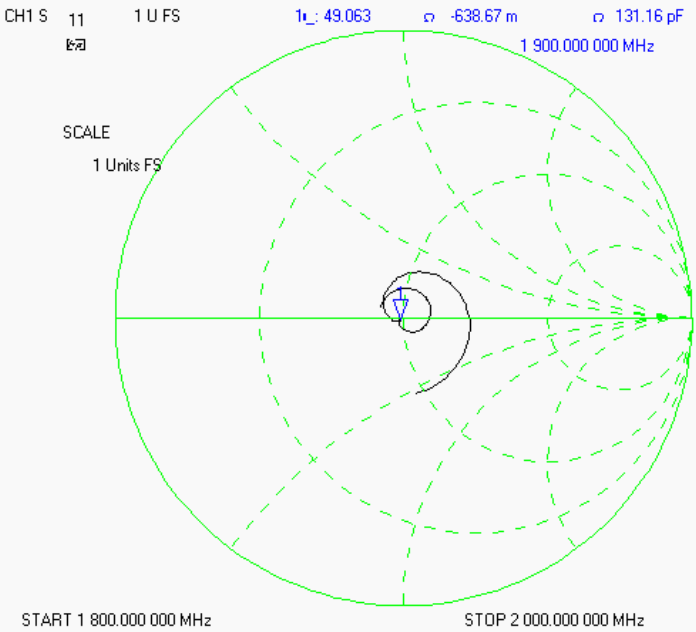
S11 Parameter Return Loss



SWR



Smith Chart Dipole Impedance



Body Measurement Conditions

The measurements were performed in the Uni-Phantom filled with body simulating liquid of the following electrical parameters at 1900 MHz:

Relative Dielectricity	53.27	± 5%
Conductivity	1.50 mho/m	± 5%

The APREL Laboratories ALSAS system with a dosimetric E-field probe E-020 (SN:217, Conversion factor 4.85 at 1900 MHz) was used for the measurements.

The dipole was mounted so that the dipole feed point was positioned below the center marking of the flat phantom and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from the dipole center to the solution surface.

The coarse grid with a grid spacing of 10mm was aligned with the dipole. The 5x5x8 fine cube was chosen for cube integration. The dipole input power (forward power) was 100mW ± 3%. The results are normalized to 1W input power.

The laboratories environmental conditions were as follows during the calibration sequence.

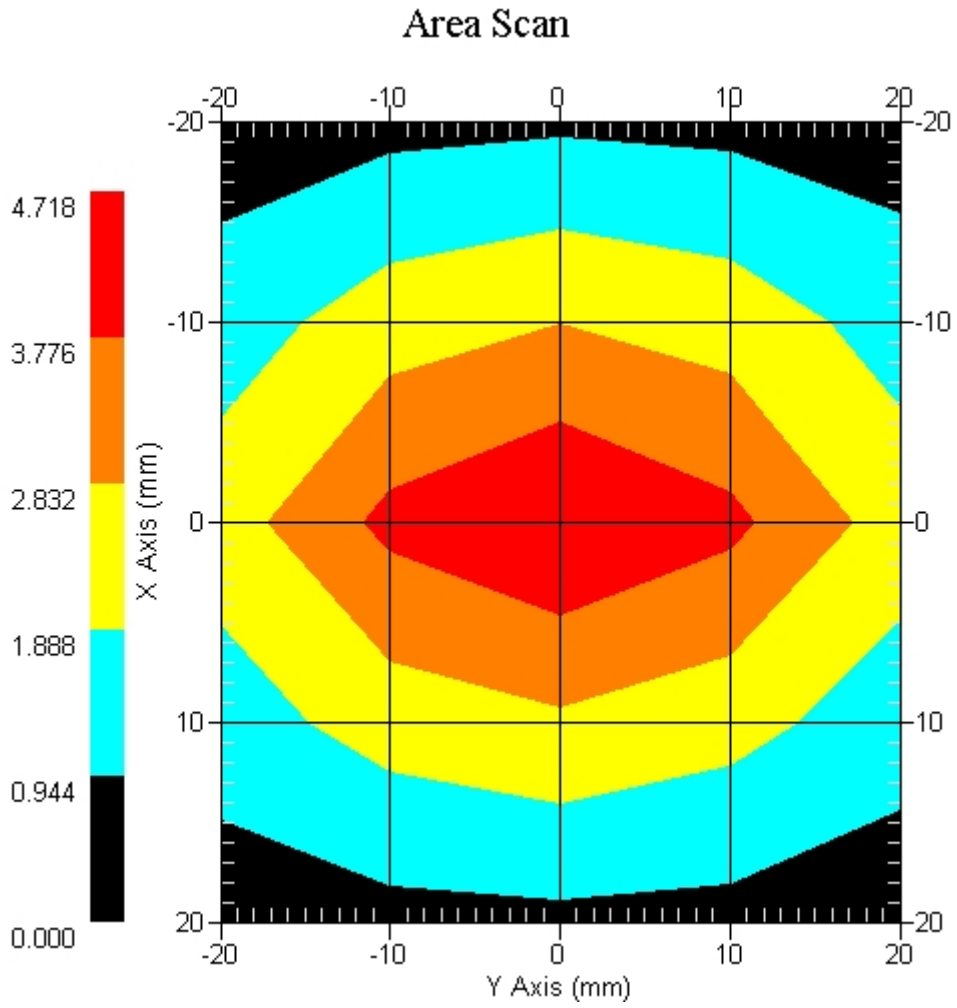
Ambient Temperature of the Laboratory:	23 ºC ± 1.0 ºC
Temperature of the Tissue:	20 ºC ± 1.0 ºC
Relative Humidity:	40%

SAR Measurement

Standard SAR measurements were performed according to the measurement conditions described above. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR values measured with the dosimetric probe E-020 SN:217 and applying the advanced extrapolation are:

Averaged over 1 cm^3 (1 g) of tissue: 40.990 mW/g ± 18.9% (k=2)[1]

Averaged over 10 cm^3 (10 g) of tissue: 21.090 mW/g ± 18.5% (k=2)[1]



1 gram SAR value : 4.099 W/kg
10 gram SAR value : 2.109 W/kg
Area Scan Peak SAR : 4.718 W/kg
Zoom Scan Peak SAR : 7.606 W/kg

[1] validation uncertainty

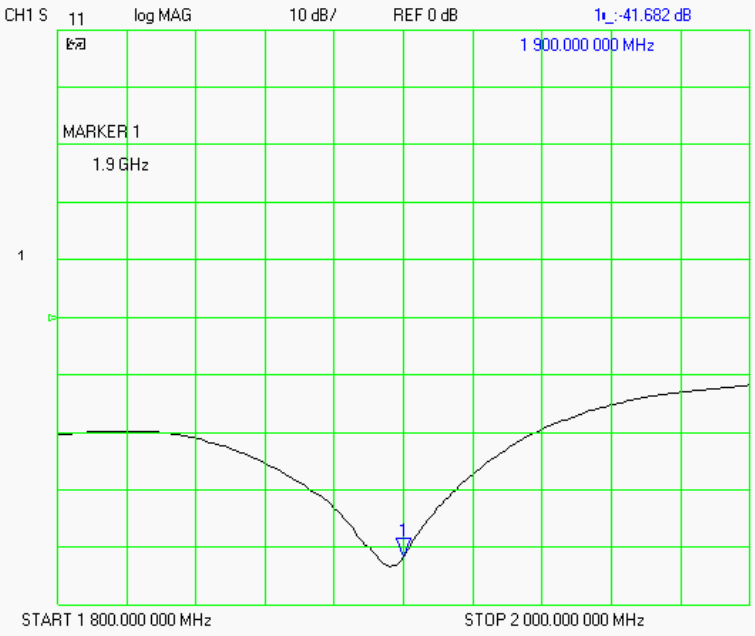
Dipole Impedance and Return Loss

The impedance was measured at the SMA connector with a network analyzer. The dipole was positioned at the flat phantom sections according to measurement conditions stated above during impedance measurements.

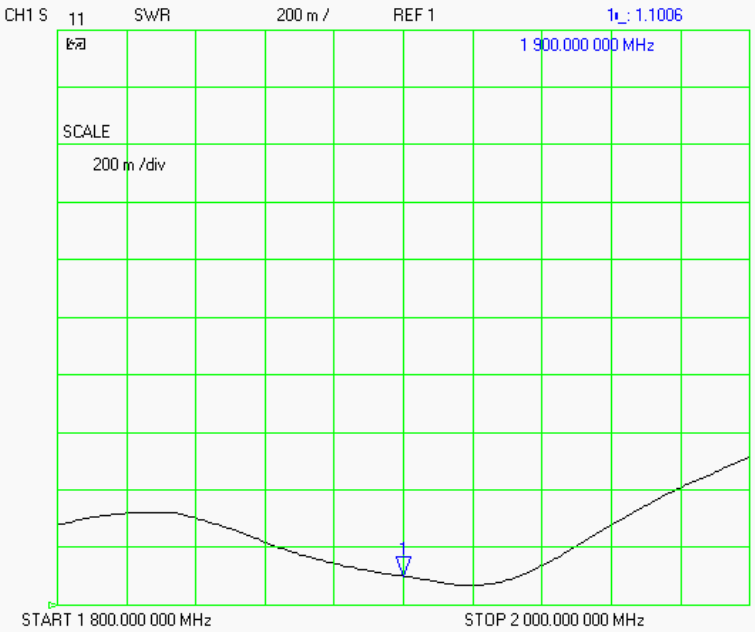
Test	Result
S11 R/L	-41.682 dB
SWR	1.1006 U
Impedance	53.580 Ω

The following graphs are the results as displayed on the Vector Network Analyzer.

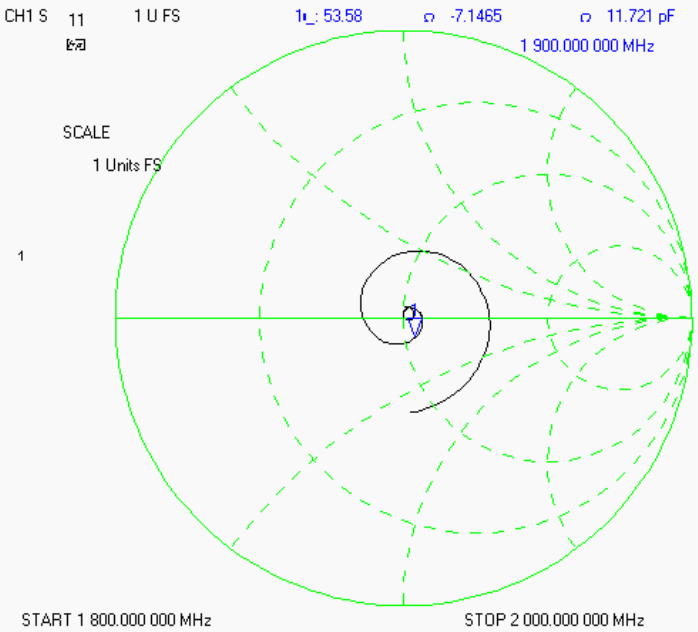
S11 Parameter Return Loss



SWR



Smith Chart Dipole Impedance



Test Equipment List

The test equipment used during Dipole Calibration, manufacturer, model number and, current calibration status are listed and located on the RF Exposure Lab, LLC system computer C:\Test Equipment\Calibration Equipment\Instrument List February 2008.

RF Exposure Lab, LLC

Calibration File No: CAL.20080201

C E R T I F I C A T E O F C A L I B R A T I O N

It is certified that the equipment identified below has been calibrated at RF Exposure Lab, LLC 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: 2.4 GHz

Serial No: RFE-278

Manufactured: 20 February 2004
Calibrated: 20 February 2008

Calibrated By: Signature on File
Jay Moulton – Technical Manager

Approved By: Signature on File
Tamara Moulton – Quality Manager

Measurement Uncertainty:

Repeatability:	2.3%
Tissue Uncertainty:	3.2%
Network Analyzer:	2.5%

RF EXPOSURE LAB, LLC

2867 Progress Place, Suite 4D
Escondido, CA 92029

Tel: (760) 737-3131
FAX: (760) 737-9131

Calibration Results Summary

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

Mechanical Dimensions

Length: 51.5 mm
Height: 30.5 mm

Electrical Specifications

Head

SWR: 1.0953 U
Return Loss: -29.601 dB
Impedance: 53.854 Ω

System Validation Results

Frequency	1 Gram	10 Gram
2.45 GHz	52.880	24.500

Body

SWR: 1.1354 U
Return Loss: -31.173 dB
Impedance: 54.146 Ω

System Validation Results

Frequency	1 Gram	10 Gram
2.45 GHz	53.550	24.710

Head Measurement Conditions

The measurements were performed in the Uni-Phantom filled with head simulating liquid of the following electrical parameters at 2450 MHz:

Relative Dielectricity	39.37	± 5%
Conductivity	1.78 mho/m	± 5%

The APREL Laboratories ALSAS system with a dosimetric E-field probe E-020 (SN:217, Conversion factor 3.4 at 2450 MHz) was used for the measurements.

The dipole was mounted so that the dipole feed point was positioned below the center marking of the flat phantom and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from the dipole center to the solution surface.

The coarse grid with a grid spacing of 10mm was aligned with the dipole. The 5x5x8 fine cube was chosen for cube integration. The dipole input power (forward power) was 100mW ± 3%. The results are normalized to 1W input power.

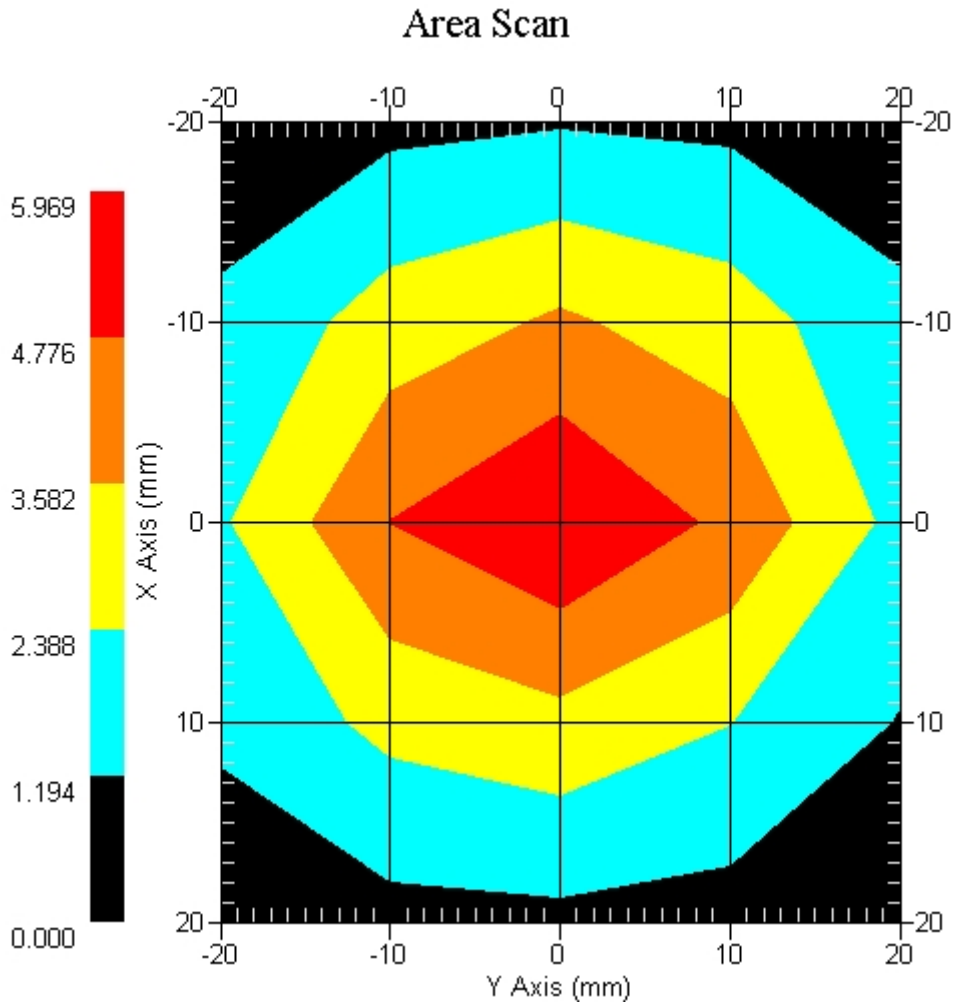
The laboratories environmental conditions were as follows during the calibration sequence.

Ambient Temperature of the Laboratory:	24 ºC ± 1.0 ºC
Temperature of the Tissue:	20 ºC ± 1.0 ºC
Relative Humidity:	41%

SAR Measurement

Standard SAR measurements were performed according to the measurement conditions described above. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR values measured with the dosimetric probe E-020 SN:217 and applying the advanced extrapolation are:

Averaged over 1 cm^3 (1 g) of tissue:	52.880 mW/g ± 19.7% (k=2)[1]
Averaged over 10 cm^3 (10 g) of tissue:	24.500 mW/g ± 19.4% (k=2)[1]



1 gram SAR value : 5.288 W/kg
10 gram SAR value : 2.450 W/kg
Area Scan Peak SAR : 5.969 W/kg
Zoom Scan Peak SAR : 10.890 W/kg

[1] validation uncertainty

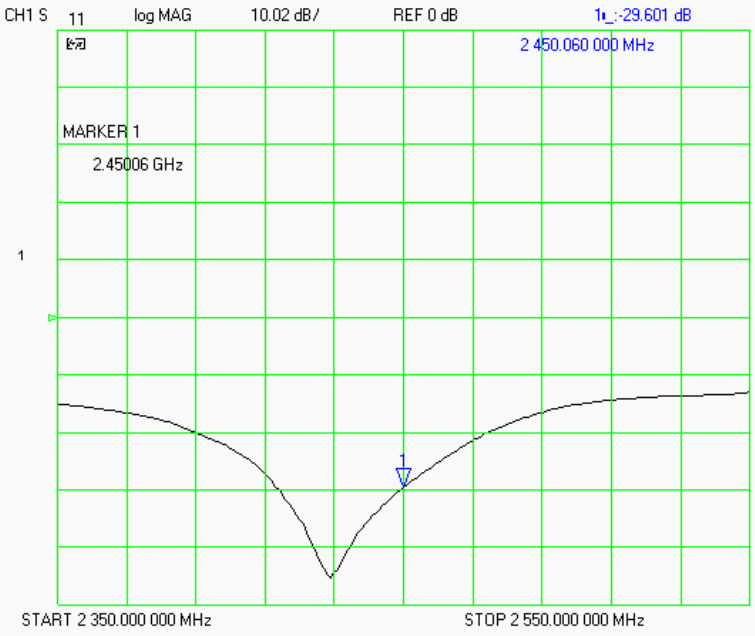
Dipole Impedance and Return Loss

The impedance was measured at the SMA connector with a network analyzer. The dipole was positioned at the flat phantom sections according to measurement conditions stated above during impedance measurements.

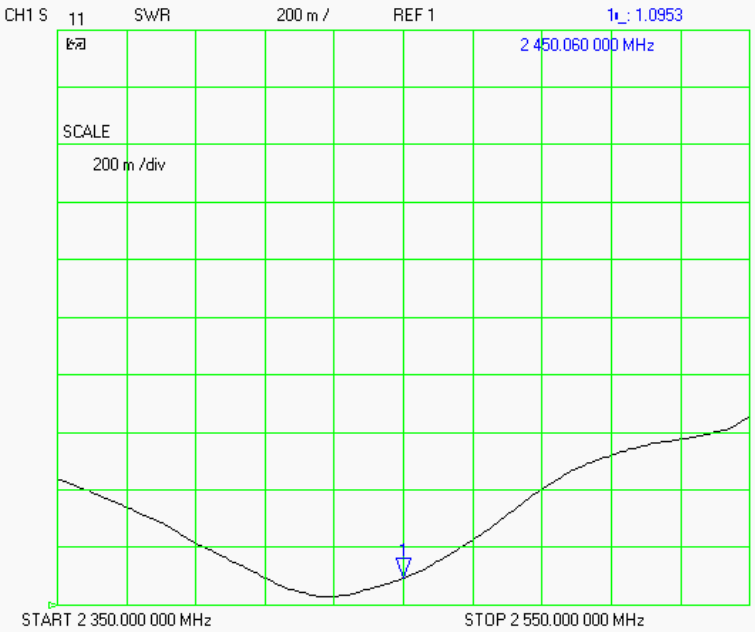
Test	Result
S11 R/L	-29.601 dB
SWR	1.0953 U
Impedance	53.854 Ω

The following graphs are the results as displayed on the Vector Network Analyzer.

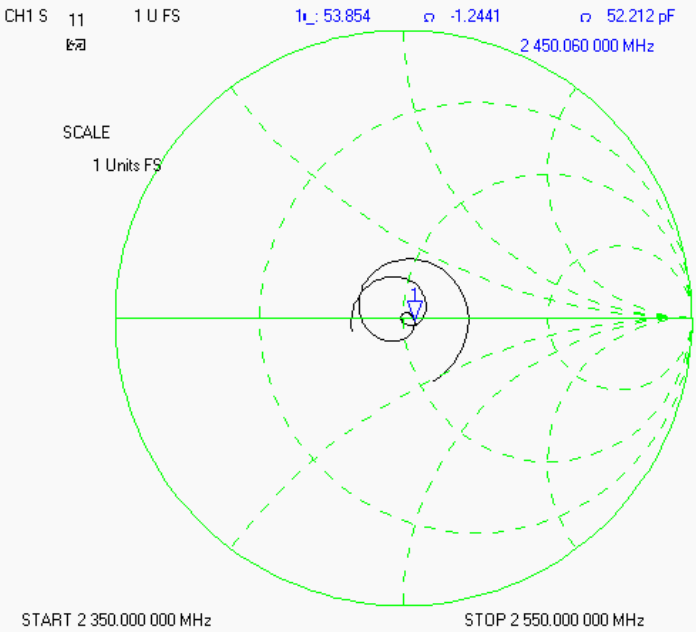
S11 Parameter Return Loss



SWR



Smith Chart Dipole Impedance



Body Measurement Conditions

The measurements were performed in the Uni-Phantom filled with body simulating liquid of the following electrical parameters at 2450 MHz:

Relative Dielectricity	52.59	± 5%
Conductivity	1.92 mho/m	± 5%

The APREL Laboratories ALSAS system with a dosimetric E-field probe E-020 (SN:217, Conversion factor 3.61 at 2450 MHz) was used for the measurements.

The dipole was mounted so that the dipole feed point was positioned below the center marking of the flat phantom and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from the dipole center to the solution surface.

The coarse grid with a grid spacing of 10mm was aligned with the dipole. The 5x5x8 fine cube was chosen for cube integration. The dipole input power (forward power) was 100mW ± 3%. The results are normalized to 1W input power.

The laboratories environmental conditions were as follows during the calibration sequence.

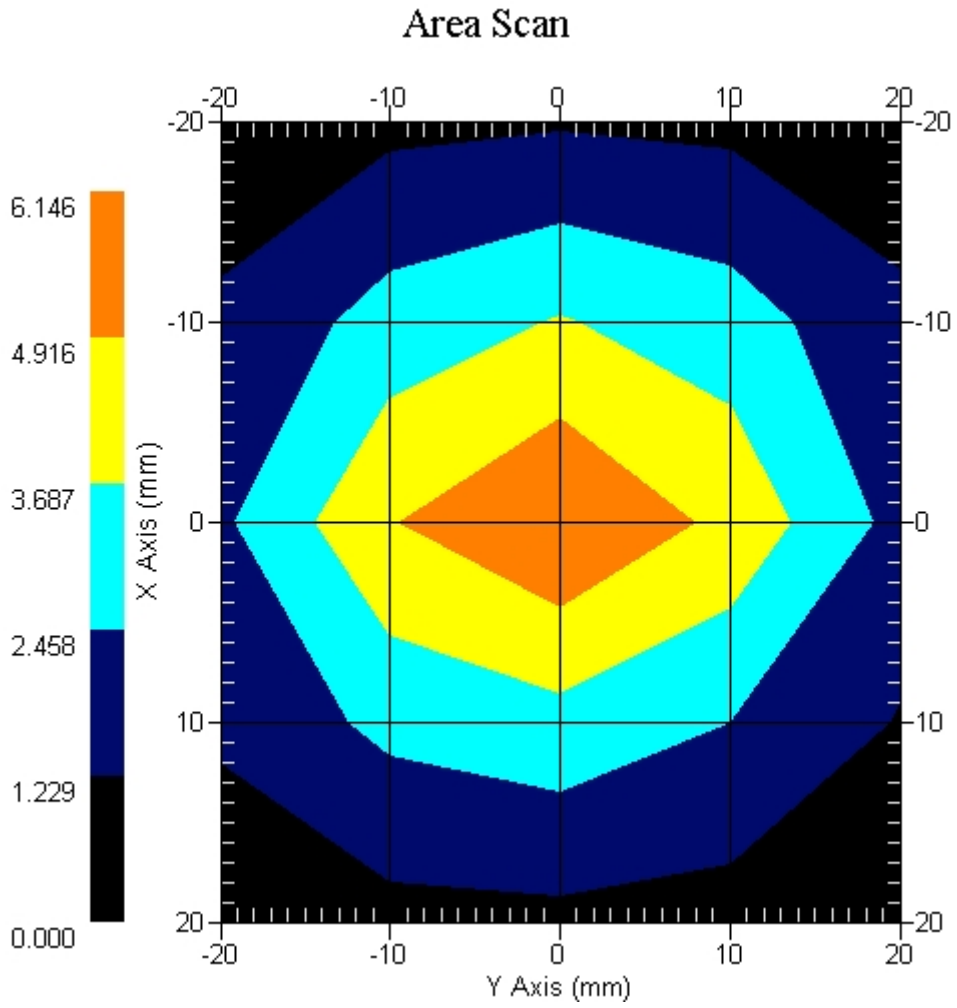
Ambient Temperature of the Laboratory:	24 ºC ± 1.0 ºC
Temperature of the Tissue:	20 ºC ± 1.0 ºC
Relative Humidity:	41%

SAR Measurement

Standard SAR measurements were performed according to the measurement conditions described above. The results have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR values measured with the dosimetric probe E-020 SN:217 and applying the advanced extrapolation are:

Averaged over 1 cm^3 (1 g) of tissue: 53.550 mW/g ± 18.8% (k=2)[1]

Averaged over 10 cm^3 (10 g) of tissue: 24.710 mW/g ± 18.4% (k=2)[1]



1 gram SAR value : 5.355 W/kg
10 gram SAR value : 2.471 W/kg
Area Scan Peak SAR : 6.146 W/kg
Zoom Scan Peak SAR : 11.090 W/kg

[1] validation uncertainty

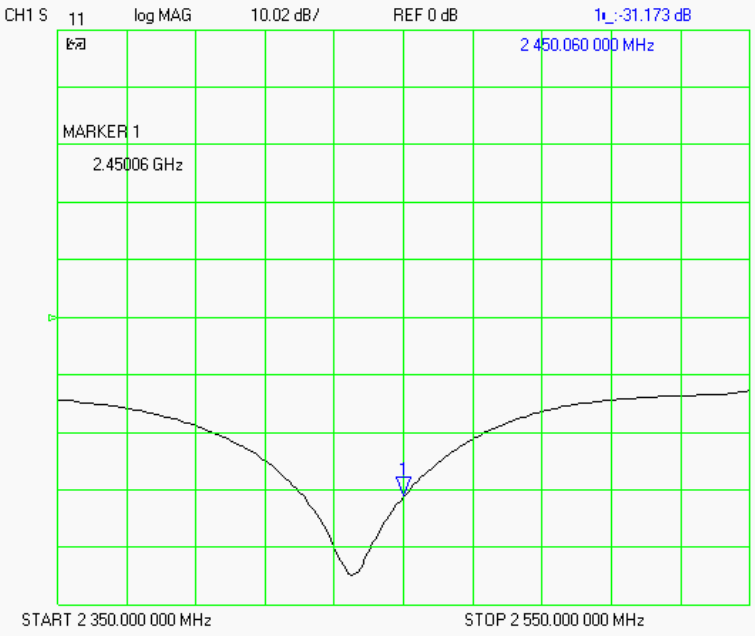
Dipole Impedance and Return Loss

The impedance was measured at the SMA connector with a network analyzer. The dipole was positioned at the flat phantom sections according to measurement conditions stated above during impedance measurements.

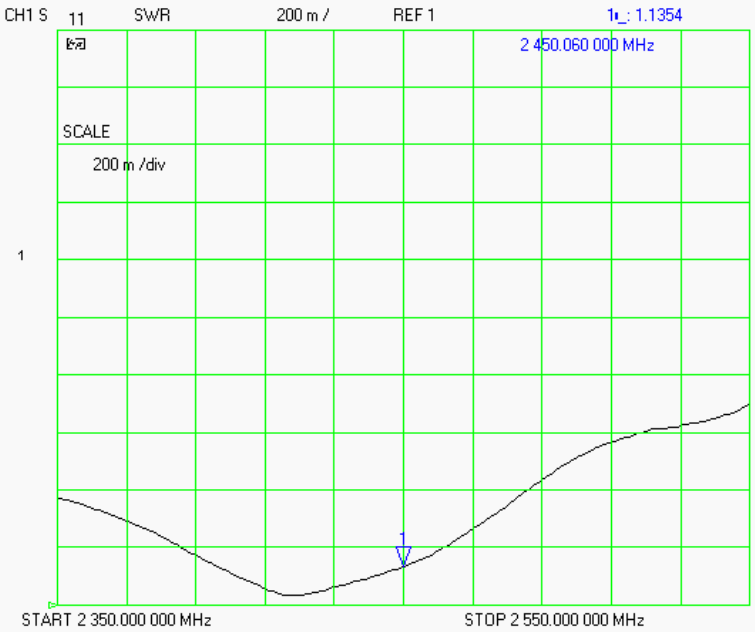
Test	Result
S11 R/L	-31.173 dB
SWR	1.1354 U
Impedance	54.146 Ω

The following graphs are the results as displayed on the Vector Network Analyzer.

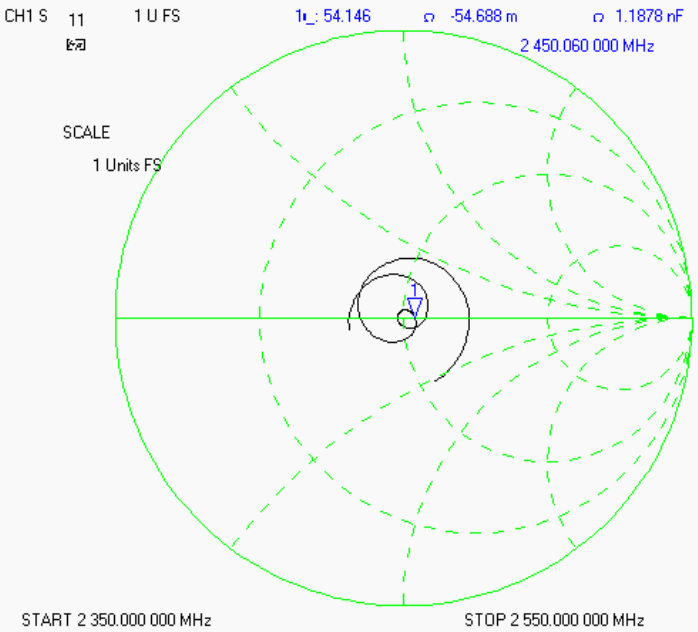
S11 Parameter Return Loss



SWR



Smith Chart Dipole Impedance



Test Equipment List

The test equipment used during Dipole Calibration, manufacturer, model number and, current calibration status are listed and located on the RF Exposure Lab, LLC system computer C:\Test Equipment\Calibration Equipment\Instrument List February 2008.

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 ± 10%
Pinna thickness is 6 mm ± 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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