RF Exposure Lab

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CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Novatel Wireless		Dates of Test:	July 17 - 20, 2010
6715 8th Street N.E.		Test Report Number:	SAR.20100701
Calgary, Alberta, Canada T2E 7H7			Revision A

FCC ID:	NBZNRM-MIFI2352R
IC Certificate:	3229A-MIFI2352R
Model(s):	NRM-MiFi2352R
Test Sample:	Production Unit
Serial No.:	0026E8A23E3A
Equipment Type:	Wireless Personal Router
Classification:	Portable Transmitter Next to Body
TX Frequency Range:	824.2 – 848.8 MHz, 1850.2 – 1909.8 MHz, 2412 – 2462 MHz
Frequency Tolerance:	± 25 ppm
Maximum RF Output:	850 MHz (GSM) – 32.54 dBm, 1900 MHz (GSM) – 29.92 dBm 1900 MHz (WCDMA) – 24.49 dBm, 2450 MHz – 15.39 dBm Conducted
Signal Modulation:	GMSK, 8PSK, WCDMA, DSSS, OFDM
Antenna Type (Length):	Internal
Application Type:	Certification
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. C95.1-2005 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 NRM-MiFi2352R FCC ID: NBZNRM-MIFI2352R with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices and IC Certificate: 3229A-MIFI2352R 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.

For Personal Router transmitters, the device is required to be tested on all six sides of the modem. The testing was conducted on only three sides closest to the antenna per FCC guidance approval for reducing the number of tests.

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.

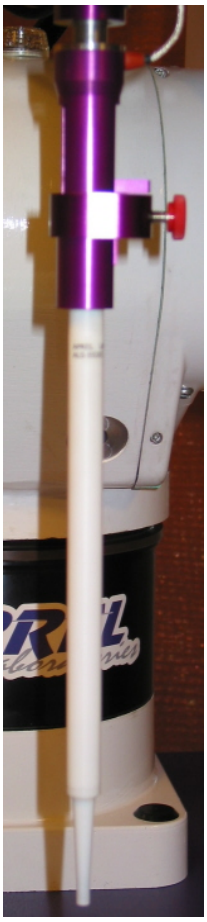
System Description

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).

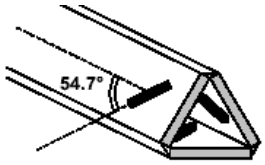
The overall uncertainty for the methodology and algorithms the ALSAS-10-U used during the SAR calculation was evaluated using the data from IEEE 1528 f3 algorithm:

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

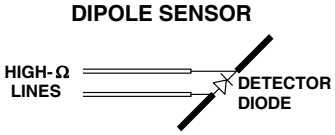
The probe used during the measurement process has been assessed to provide values for diode compression. These values are calculated during the probe calibration exercise and are used in the mathematical calculations for the assessment of SAR.

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

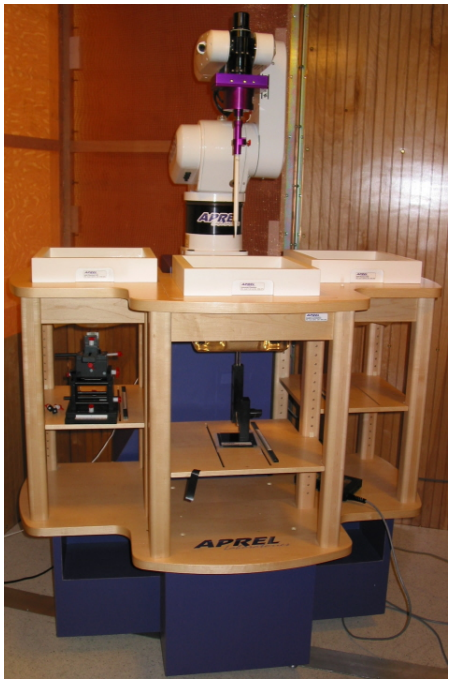
Features:	Signal Amplifier, End Effector, DAC
Software:	ALSAS 10-U Software

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]. The Uni-Phantom is used to conduct body measurements and held to face measurements. The depth of the phantom allows for 15 cm of tissue material to be filled within the phantom. See photos in Appendix C.

Brain & Muscle Simulating Mixture Characterization

The brain and muscle mixtures consist of the material based on the table listed below. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. 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		
		850 MHz Muscle	1900 MHz Muscle	2450 MHz Muscle
Mixing Percentage				
Water		52.40	69.91	73.20
Sugar		45.00	0.00	0.00
Salt		1.40	0.13	0.04
HEC		1.00	0.00	0.00
Bactericide		0.10	0.00	0.00
DGBE		0.00	29.96	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].

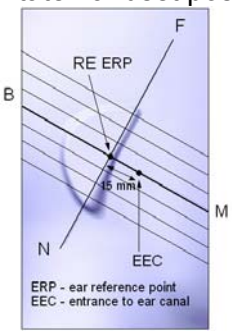


Figure 6.1 Close-up side view of ERP's

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].

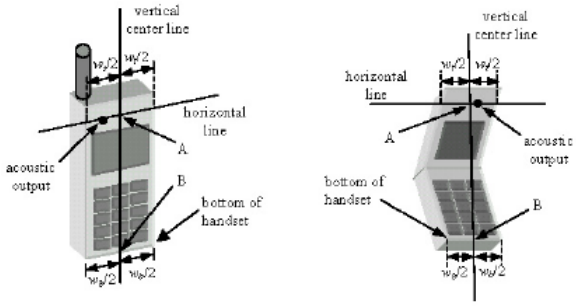


Figure 6.3 Handset Vertical Center & Horizontal Line Reference Points

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.

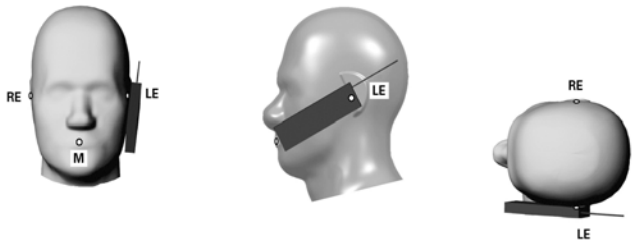


Figure 7.1 Front, Side and Top View of Cheek/Touch Position

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.

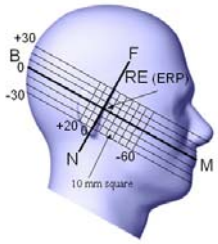


Figure 7.2 Side view w/ relevant markings

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).

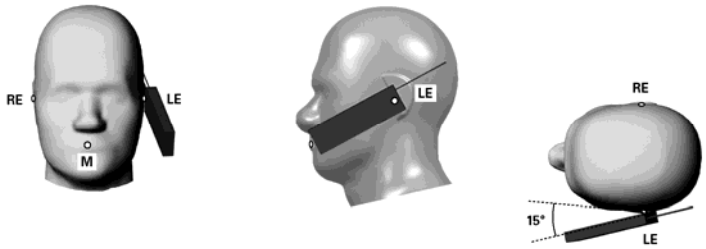


Figure 7.3 Front, Side and Top View of Ear/15˚ Tilt Position

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	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	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

		1900 MHz Body		1900 MHz Body		835 MHz Body	
Date(s)		Jul. 17, 2010		Jul. 18, 2010		Jul. 19, 2010	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		53.30	53.16	53.30	53.02	55.20	55.01
Conductivity: σ		1.52	1.55	1.52	1.54	0.97	0.98
		2450 MHz Body		835 MHz Body		1900 MHz Body	
Date(s)		Jul. 23, 2010		Sep. 14, 2010		Sep. 12, 2010	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		52.70	52.41	55.20	54.97	53.30	53.07
Conductivity: σ		1.95	1.97	0.97	0.99	1.52	1.54
		2450 MHz Body					
Date(s)		Sep. 13, 2010					
Liquid Temperature (˚C)	20.0	Target	Measured				
Dielectric Constant: ε		52.70	52.04				
Conductivity: σ		1.95	1.97				

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 (%)
19-Jul-2010	835 MHz	9.49	9.58	+ 0.95
17-Jul-2010	1900 MHz	38.70	38.76	+ 0.16
18-Jul-2010	1900 MHz	38.70	40.01	+ 3.39
23-Jul-2010	2450 MHz	53.10	55.30	+ 4.14
14-Sep-2010	835 MHz	9.49	9.51	+ 0.21
12-Sep-2010	1900 MHz	38.70	38.91	+ 0.54
13-Sep-2010	2450 MHz	53.10	54.26	+ 2.18

See Appendix A for data plots.

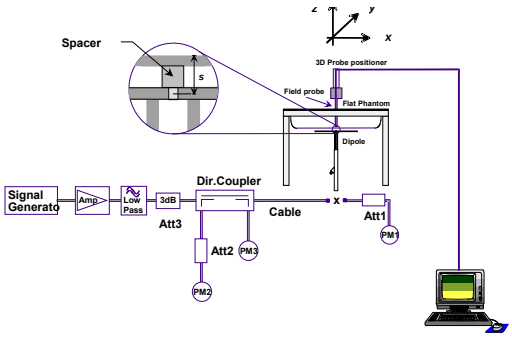


Figure 10.1 Dipole Validation Test Setup

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

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 on top, bottom and edge closest to each antenna. The top and bottom edge testing was conducted at the top edge of the device for the WWAN antenna and on the left edge for the WLAN antenna. See the photo in Appendix C for a pictorial of the setups.

This device is capable of operating in 850/1900 GSM/GPRS/EDGE frequency bands. In GSM/GPRS mode, the device is in Class 4 for 850 MHz and Class 1 for 1900 MHz. In EDGE mode, the device is in Class E2 for 850/1900 MHz. The GSM/GPRS testing was conducted in the GPRS mode. The GPRS mode has 1-slot and 2-slot configurations. The power measured is peak power. The average power in GSM is lower than the average power in GPRS 1-slot which is higher than 2-slot . The EDGE mode is 3 dB lower than its equivalent slot configuration for GPRS. Therefore, the device was only tested in the highest power configuration which was 1-slot GPRS.

The WCDMA testing was conducted using 12.2 kbps RMC configured in Test Loop Mode 1. The HSPA testing was conducted with HS-DPCCH, E-DPCCH and E-DPDCH all enabled and a 12.2 kbps RMC. FRC was configured according to HS-DPCCH Sub-Test 1 using H-set 1 and QPSK.

For simultaneous transmission, the area scan for the worst case position in the highest SAR WWAN band was evaluated compared to the exact scan in the WLAN configuration. The evaluation is included in the tables on page 26. If the sum of the two points was less than 5% at the peak, simultaneous volume testing was not conducted as the WLAN was have little to no effect on the WWAN. The distance between the two antennas was 4.7 cm.

12. FCC Measurement Procedures – March 2008

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 recommended for evaluating SAR. 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 WCDMA/HSDPA/HSUPA

Configure the call box 8960 to support all WCDMA tests in respect to the 3GPP 34.121 (listed in Table below). Measure the power at Ch4132, 4182 and 4233 for US cell; Ch9262, 9400 and 9538 for US PCS band.

For Rel99

- Set a Test Mode 1 loop back with a 12.2kbps Reference Measurement Channel (RMC).
- Set and send continuously Up power control commands to the UNDP-1
- Measure the power at the UNDP-1 antenna connector using the power meter with average detector.

For HSDPA Rel 6

- Establish a Test Mode 1 look back with both 1 12.2kbps RMC channel and a H-Set1 Fixed Reference Channel (FRC). With the 8820 this is accomplished by setting the signal Channel Coding to “Fixed Reference Channel” and configuring for HSET-1 QKSP.
- Set beta values and HSDPA settings for HSDPA Subtest1 according to Table below.
- Send continuously Up power control commands to the UNDP-1
- Measure the power at the UNDP-1 antenna connector using the power meter with modulated average detector.
- Repeat the measurement for the HSDPA Subtest2, 3 and 4 as given in Table below.

For HSUPA Rel 6

- Use UL RMC 12.2kbps and FRC H-Set1 QPSK, Test Mode 1 loop back. With the 8960 this is accomplished by setting the signal Channel Coding to “E-DCH Test Channel” and configuring the equipment category to Cat5_10ms.
- Set the Absolute Grant for HSUPA Subtest1 according to Table below.
- Set the UNDP power to be at least 5dB lower than the Maximum output power
- Send power control bits to give one TPC_cmd = +1 command to the UNDP. If UNDP doesn’t send any E-DPCH data with decreased E-TFCI within 500ms, then repeat this process until the decreased E-TFCI is reported.
- Confirm that the E-TFCI transmitted by the UNDP is equal to the target E-TFCI in Table below. If the E-TFCI transmitted by the UNDP is not equal to the target E-TFCI, then send power control bits to give one TPC_cmd = -1 command to the UE. If UE sends any E-DPCH data with decreased E-TFCI within 500 ms, send new

power control bits to give one TPC_cmd = -1 command to the UE. Then confirm that the E-TFCI transmitted by the UE is equal to the target E-TFCI in Table below.

- Measure the power using the power meter with modulated average detector.
- Repeat the measurement for the HSUPA Subtest 2, 3, 4 and 5 as given in Table below.

12.3 SAR Measurement Conditions for GSM

Configure the 8960 box to support GMSK and 8PSK call respectively, and set one timeslot and two timeslot transmission for GMSK GSM/GPRS and 8PSK EDGE. Measure and record power outputs for both modulations.

GSM		
Band	**Channel**	**Power**
Cellular	128	32.18
	190	32.02
	251	32.46
PCS	512	29.81
	661	29.73
	810	29.75

GPRS/1 slot		
Band	**Channel**	**Power**
Cellular	128	32.26
	190	32.15
	251	32.54
PCS	512	29.92
	661	29.85
	810	29.86

GPRS/2 slot		
Band	**Channel**	**Power**
Cellular	128	29.07
	190	28.97
	251	29.31
PCS	512	26.72
	661	26.60
	810	26.63

EDGE/1 slot		
Band	**Channel**	**Power**
Cellular	128	29.26
	190	29.17
	251	29.69
PCS	512	26.46
	661	26.31
	810	26.35

EDGE/2 slot		
Band	**Channel**	**Power**
Cellular	128	26.01
	190	26.07
	251	26.35
PCS	512	23.21
	661	23.12
	810	23.18

3GPP Release Version	Mode	PCS Band [dBm]			Sub-Test (See Table Below)	MPR
		9262	9400	9538		
99	WCDMA	24.07	24.32	24.49	-	-
6	HSDPA	24.02	24.29	24.31	1	0
6		23.99	24.31	24.42	2	0
6		23.59	23.85	23.95	3	0.5
6		23.51	23.79	23.97	4	0.5
6	HSUPA	24.02	24.27	24.36	1	0
6		22.06	22.43	22.49	2	2
6		23.09	23.26	23.29	3	1
6		21.99	22.37	22.52	4	2
6		24.01	24.12	24.38	5	0

Sub-Test Setup for Release 6 HSDPA

Sub-Test	β_c	β_d	B_c/β_d	β_{hs}
1	2/15	15/15	2/15	4/15
2	12/15	15/15	15/15	24/15
3	15/15	8/15	15/8	30/15
4	15/15	4/15	15/4	30/15
Δ_{ack}, Δ_{nack} and Δ_{cqi} = 8				

Sub-Test Setup for Release 6 HSUPA

Sub-Test	β_c	β_d	B_c/β_d	β_{hs}	B_{ec}	B_{ed}	MPR	AG Index	E-TFCI
1	11/15	15/15	11/15	22/15	209/225	1039/225	0.0	20	75
2	6/15	15/15	6/15	12/15	12/15	94/75	2.0	12	67
3	15/15	9/15	15/9	30/15	30/15	47/15	1.0	15	92
4	2/15	15/15	2/15	4/15	2/15	56/15	2.0	17	71
5	15/15	15/15	15/15	30/15	24/15	134/15	0.0	21	81
Δ_{ack}, Δ_{nack} and Δ_{cqi} = 8									

802.11b			
Freq	**Channel**	**Data Rate**	**Power**
2412	1	1	11.61
2437	6	1	11.98
2462	11	1	11.53
2437	6	2	11.82
2437	6	5.5	10.76
2437	6	11	11.72
802.11g			
Freq	**Channel**	**Data Rate**	**Power**
2412	1	6	14.62
2437	6	6	15.39
2462	11	6	14.86
2437	6	9	15.31
2437	6	12	14.83
2437	6	18	13.90
2437	6	24	15.09
2437	6	36	15.31
2437	6	48	15.34
2437	6	54	15.27

SAR Data Summary – 850 MHz Body – GPRS 1-Slot

MEASUREMENT RESULTS									
Gap	**Side**	**Frequency**		**Modulation**	**Begin/End Power**		**TX Level**	**Multislot Configuration**	**SAR (W/kg)**
		MHz	**Ch.**		**(dBm)**	**(dBm)**			
12 mm	Top	824.2	128	GMSK	32.26	32.20	0	1 Slot	0.685
		836.6	190	GMSK	32.15	32.01	0	1 Slot	0.902
		848.8	251	GMSK	32.54	32.41	0	1 Slot	1.046
	Bottom	848.8	251	GMSK	32.48	32.36	0	1 Slot	0.725
	Top Edge	848.8	251	GMSK	32.50	32.44	0	1 Slot	0.119
					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

Note: When the mid channel is 3 dB or more below the limit the low and high channel are not required to be tested per KDB 447498 section 1) e).

SAR Data Summary – 1900 MHz Body – GPRS 1-Slot

MEASUREMENT RESULTS									
Gap	**Side**	**Frequency**		**Modulation**	**Begin/End Power**		**TX Level**	**Multislot Configuration**	**SAR (W/kg)**
		MHz	**Ch.**		**(dBm)**	**(dBm)**			
12 mm	Top	1850.2	512	GMSK	29.92	29.90	0	1 Slot	0.464
	Bottom	1850.2	512	GMSK	29.87	29.82	0	1 Slot	0.560
	Top Edge	1850.2	512	GMSK	29.90	29.87	0	1 Slot	0.427
					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

Note: When the mid channel is 3 dB or more below the limit the low and high channel are not required to be tested per KDB 447498 section 1) e).

SAR Data Summary – 1900 MHz Body - WCDMA

MEASUREMENT RESULTS									
Gap	Side	Frequency		Modulation	Begin/End Power		RMC	Test Set Up	SAR (W/kg)
		MHz	Ch.						
12 mm	Top	1850.2	512	WCDMA	24.07	24.00	12.2 kbps	Test Loop 1	1.158
		1880.0	661	WCDMA	24.32	24.26	12.2 kbps	Test Loop 1	1.167
		1909.8	810	WCDMA	24.49	24.37	12.2 kbps	Test Loop 1	1.245
	Bottom	1909.8	810	WCDMA	24.49	24.37	12.2 kbps	Test Loop 1	0.627
	Top Edge	1850.2	512	WCDMA	24.01	23.98	12.2 kbps	Test Loop 1	1.508
		1880.0	661	WCDMA	24.27	24.13	12.2 kbps	Test Loop 1	1.460
		1909.8	810	WCDMA	24.48	24.36	12.2 kbps	Test Loop 1	1.569

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

Note: When the mid channel is 3 dB or more below the limit the low and high channel are not required to be tested per KDB 447498 section 1) e).

SAR Data Summary – 2450 MHz Body

MEASUREMENT RESULTS							
Gap	**Side**	**Frequency**		**Modulation**	**Begin/End Power**		**SAR (W/kg)**
		MHz	**Ch.**				
12 mm	Top	2437	6	DSSS	11.98	11.95	0.226
	Bottom	2437	6	DSSS	11.97	11.93	0.201
	Edge	2437	6	DSSS	11.92	11.87	0.170
	Top	2437	6	OFDM	15.39	15.32	0.227
				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

Note: When the mid channel is 3 dB or more below the limit the low and high channel are not required to be tested per KDB 447498 section 1) e).

SAR Data Summary – Simultaneous Evaluation

MiFi2352				
1900 MHz WCDMA Top 12 mm High Channel				
0.094	0.183	0.305	0.280	0.143
0.129	0.340	0.846	0.749	0.249
0.141	0.468	1.483	1.215	0.311
0.124	0.352	1.164	0.938	0.244
0.094	0.179	0.438	0.365	0.146
0.084	0.093	0.133	0.124	0.113
0.087	0.087	0.088	0.086	0.076
2450 MHz g mode Top 10 mm Mid Channel				
0.059	0.053	0.046	0.047	0.068
0.058	0.063	0.066	0.053	0.095
0.058	0.069	0.070	0.081	0.169
0.061	0.072	0.151	0.177	0.336
0.065	0.065	0.140	0.198	0.257
0.059	0.061	0.112	0.197	0.203
0.051	0.058	0.101	0.194	0.145
Sum Divided by 1900 MHz Peak				
162.77%	128.96%	115.08%	116.79%	147.55%
144.96%	118.53%	107.80%	107.08%	138.15%
141.13%	114.74%	104.72%	106.67%	154.34%
149.19%	120.45%	112.97%	118.87%	237.70%
169.15%	136.31%	131.96%	154.25%	276.03%
170.24%	165.59%	184.21%	258.87%	279.65%
158.62%	166.67%	214.77%	325.58%	290.79%

13. 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	10/21/2010	RFE-217
Aprel E-Field Probe ALS-E030	07/12/2011	E030-001
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	01/12/2011	RFE-362
Aprel Validation Dipole ALS-D-835-S-2	01/14/2011	180-00561
Aprel Validation Dipole ALS-D-900-S-2	01/12/2011	RFE-275
Aprel Validation Dipole ALS-D-1900-S-2	01/15/2011	210-00713
Aprel Validation Dipole ALS-D-2450-S-2	01/12/2011	RFE-278
Aprel Validation Dipole RFE-D-2600-S-2	01/18/2011	RFE-121
Aprel Validation Dipole RFE-D-BB-S-2	01/12/2011	235-00801
Agilent (HP) 437B Power Meter	03/24/2011	3125U08837
Agilent (HP) 8481B Power Sensor	03/24/2011	3318A05384
Advantest R3261A Spectrum Analyzer	03/24/2011	31720068
Agilent (HP) 8350B Signal Generator	04/19/2011	2749A10226
Agilent (HP) 83525A RF Plug-In	04/19/2011	2647A01172
Agilent (HP) 8753C Vector Network Analyzer	03/25/2011	3135A01724
Agilent (HP) 85047A S-Parameter Test Set	03/25/2011	2904A00595
Agilent (HP) E55125C Base Station Sim.	03/25/2012	MY48360364
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

14. 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]

15. References

[1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radio Frequency Radiation, August 1996

[2] ANSI/IEEE C95.1 – 1999, American National Standard Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300kHz to 100GHz, New York: IEEE, 1992.

[3] ANSI/IEEE C95.3 – 2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, 1992.

[4] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, July 2001.

[5] IEEE Standard 1528 – 2003, IEEE Recommended Practice for Determining the Peak-Spatial Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques, October 2003.

[6] Industry Canada, RSS – 102e, Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), November 2005.

[7] Industry Canada, Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz, 1999.

Appendix A – System Validation Plots and Data

```
************************************************************
Test Result for UIM Dielectric Parameter
Mon 19/Jul/2010 06:41:37
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        55.19       0.91
0.8150      55.28       0.97        55.13       0.92
0.8250      55.24       0.97        55.08       0.95
0.8350      55.20       0.97        55.01       0.98
0.8450      55.17       0.98        54.97       1.00
0.8550      55.14       0.99        54.93       1.02
0.8650      55.11       1.01        54.88       1.03
```

```
************************************************************
Test Result for UIM Dielectric Parameter
Sat 17/Jul/2010 07:38:34
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        53.27       1.50
1.8800      53.30       1.52        53.23       1.52
1.8900      53.30       1.52        53.19       1.53
1.9000      53.30       1.52        53.16       1.55
1.9100      53.30       1.52        53.14       1.57
1.9200      53.30       1.52        53.11       1.58
1.9300      53.30       1.52        53.08       1.60
```

```
**********************************************************
Test Result for UIM Dielectric Parameter
Sun 18/Jul/2010 06:32:18
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	53.09	1.49
1.8800	53.30	1.52	53.06	1.51
1.8900	53.30	1.52	53.05	1.53
1.9000	53.30	1.52	53.02	1.54
1.9100	53.30	1.52	53.00	1.55
1.9200	53.30	1.52	52.98	1.57
1.9300	53.30	1.52	52.96	1.59

```
**********************************************************
Test Result for UIM Dielectric Parameter
Fri 23/Jul/2010 08:03:29
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	52.49	1.94
2.4300	52.73	1.93	52.46	1.95
2.4400	52.71	1.94	52.43	1.96
2.4500	52.70	1.95	52.41	1.97
2.4600	52.69	1.96	52.40	1.98
2.4700	52.67	1.98	52.38	1.99
2.4800	52.66	1.99	52.36	2.01

```
**********************************************************
Test Result for UIM Dielectric Parameter
Tue 14/Sep/2010 10:49:26
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	55.12	0.90
0.8150	55.28	0.97	55.07	0.93
0.8250	55.24	0.97	55.02	0.97
0.8350	55.20	0.97	54.97	0.99
0.8450	55.17	0.98	54.92	1.00
0.8550	55.14	0.99	54.89	1.03
0.8650	55.11	1.01	54.85	1.05

```
**********************************************************
Test Result for UIM Dielectric Parameter
Sun 12/Sep/2010 09:16:36
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	53.13	1.50
1.8800	53.30	1.52	53.10	1.51
1.8900	53.30	1.52	53.09	1.52
1.9000	53.30	1.52	53.07	1.54
1.9100	53.30	1.52	53.05	1.55
1.9200	53.30	1.52	53.02	1.56
1.9300	53.30	1.52	53.00	1.58

```
**********************************************************
Test Result for UIM Dielectric Parameter
Mon 13/Sep/2010 07:58:53
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	52.12	1.93
2.4300	52.73	1.93	52.09	1.94
2.4400	52.71	1.94	52.06	1.96
2.4500	52.70	1.95	52.04	1.97
2.4600	52.69	1.96	52.01	1.98
2.4700	52.67	1.98	51.98	2.00
2.4800	52.66	1.99	51.96	2.02

SAR Test Report

By Operator : Jay
Measurement Date : 19-Jul-2010
Starting Time : 19-Jul-2010 06:47:43 AM
End Time : 19-Jul-2010 07:02:55 AM
Scanning Time : 912 secs

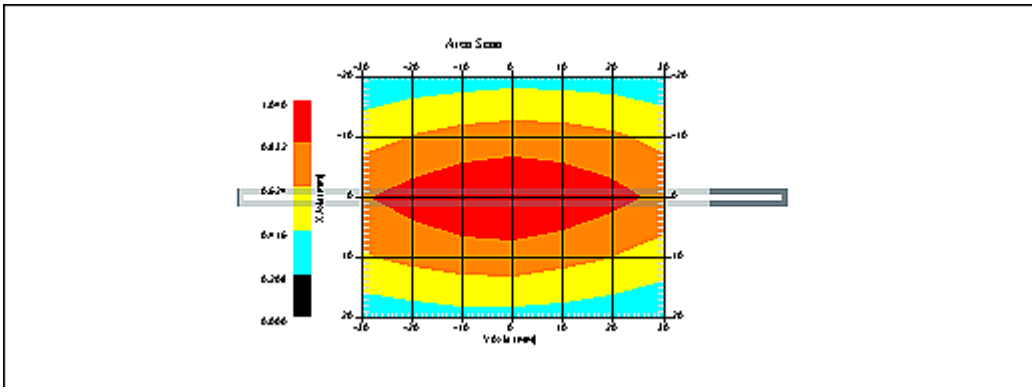
Product Data
Device Name : Validation
Serial No. : 835
Type : Dipole
Model : ALS-D-835-S-2
Frequency : 835.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 161 mm
Width : 3.6 mm
Depth : 89.8 mm
Antenna Type : Internal
Orientation : Touch
Power Drift-Start : 1.040 W/kg
Power Drift-Finish: 1.039 W/kg
Power Drift (%) : -0.129

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

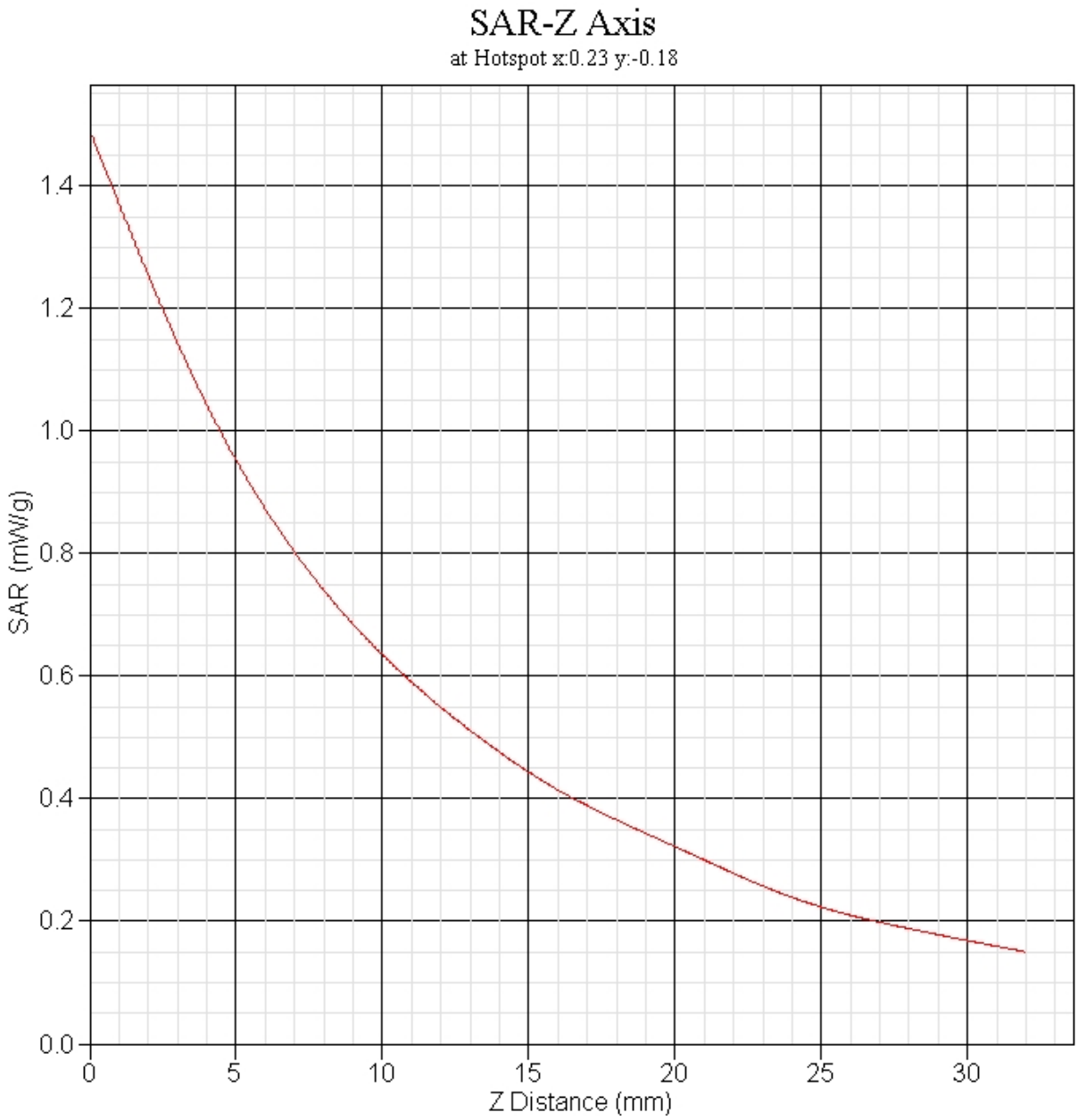
Tissue Data
Type : BODY
Serial No. : 835
Frequency : 835.00 MHz
Last Calib. Date : 19-Jul-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 49.00 RH%
Epsilon : 55.01 F/m
Sigma : 0.98 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : Probe 217 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 835.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 6.1
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.     : 25.00 °C
Set-up Date       : 19-Jul-2010
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    : 0.958 W/kg
10 gram SAR value   : 0.604 W/kg
Area Scan Peak SAR  : 1.038 W/kg
Zoom Scan Peak SAR  : 1.491 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 17-Jul-2010
Starting Time : 17-Jul-2010 07:47:44 AM
End Time : 17-Jul-2010 08:00:46 AM
Scanning Time : 782 secs

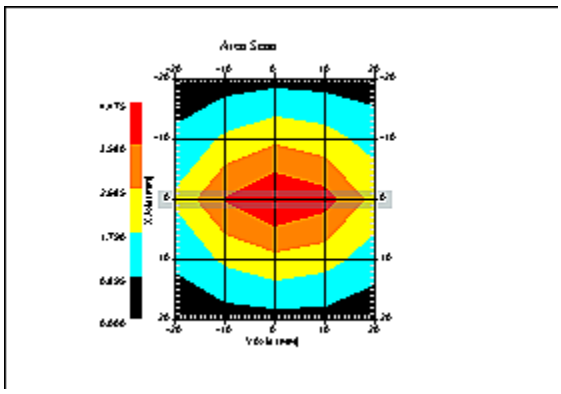
Product Data
Device Name : Validation
Serial No. : 1900
Type : Dipole
Model : ALS-D-1900-S-2
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 68 mm
Width : 3.6 mm
Depth : 39.5 mm
Antenna Type : Internal
Orientation : Touch
Power Drift-Start : 4.453 W/kg
Power Drift-Finish: 4.504 W/kg
Power Drift (%) : 1.134

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

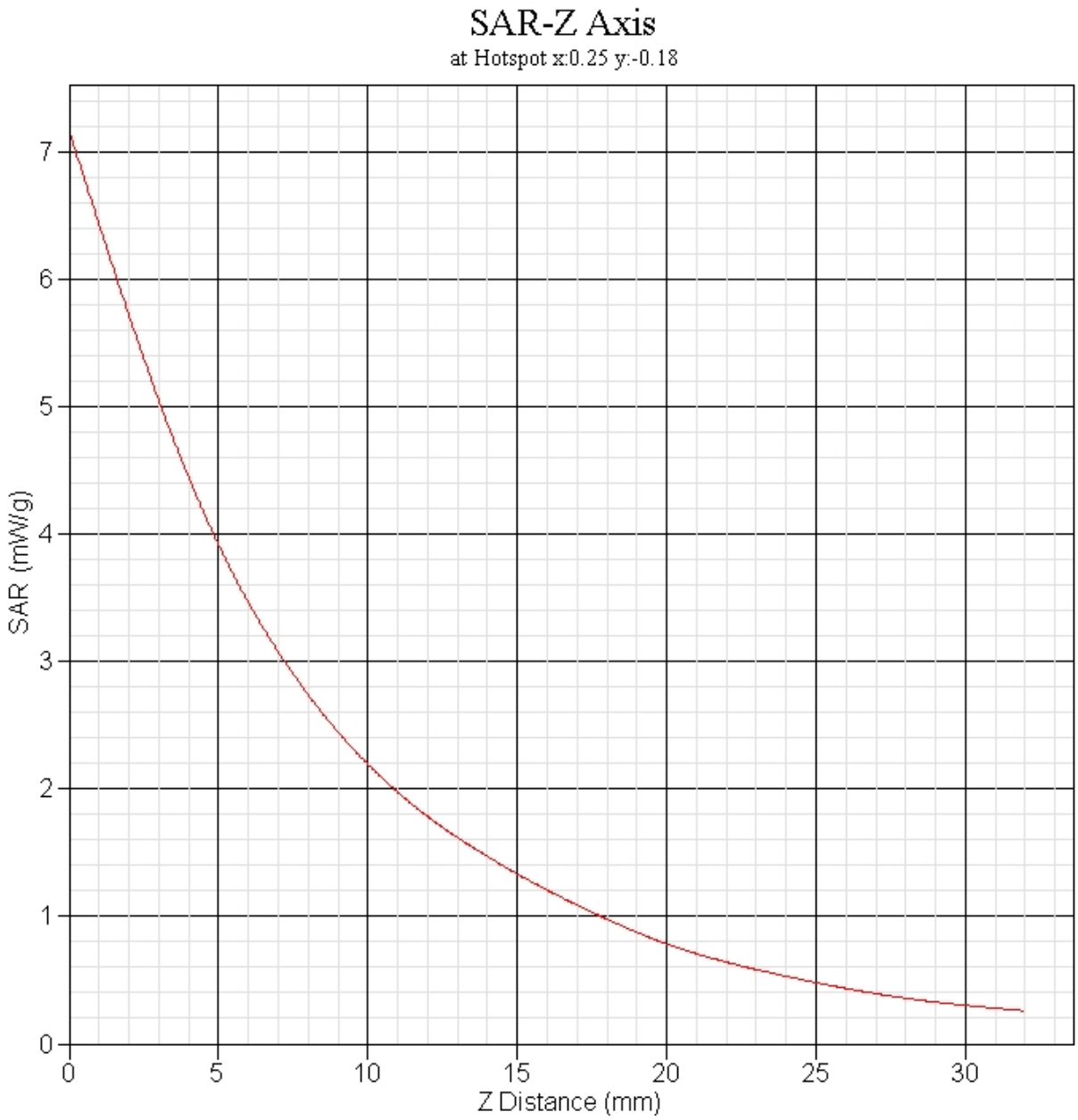
Tissue Data
Type : BODY
Serial No. : 1900
Frequency : 1900.00 MHz
Last Calib. Date : 17-Jul-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 49.00 RH%
Epsilon : 53.16 F/m
Sigma : 1.55 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : Probe 217 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.85
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       : 17-Jul-2010
Set-up Time       : 8:03:12 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    : 3.876 W/kg
10 gram SAR value   : 1.987 W/kg
Area Scan Peak SAR  : 4.475 W/kg
Zoom Scan Peak SAR  : 7.176 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 18-Jul-2010
Starting Time : 18-Jul-2010 06:42:33 AM
End Time : 18-Jul-2010 06:55:43 AM
Scanning Time : 790 secs

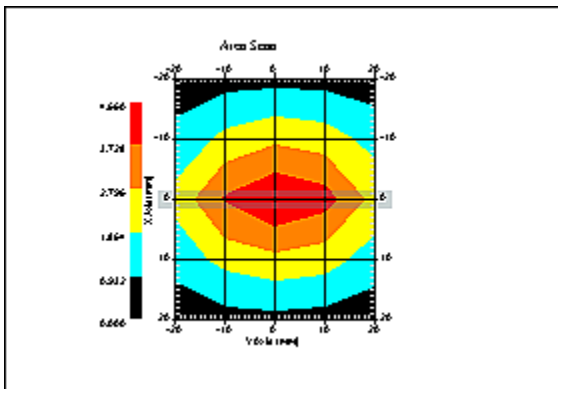
Product Data
Device Name : Validation
Serial No. : 1900
Type : Dipole
Model : ALS-D-1900-S-2
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 68 mm
Width : 3.6 mm
Depth : 39.5 mm
Antenna Type : Internal
Orientation : Touch
Power Drift-Start : 4.597 W/kg
Power Drift-Finish: 4.622 W/kg
Power Drift (%) : 0.544

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

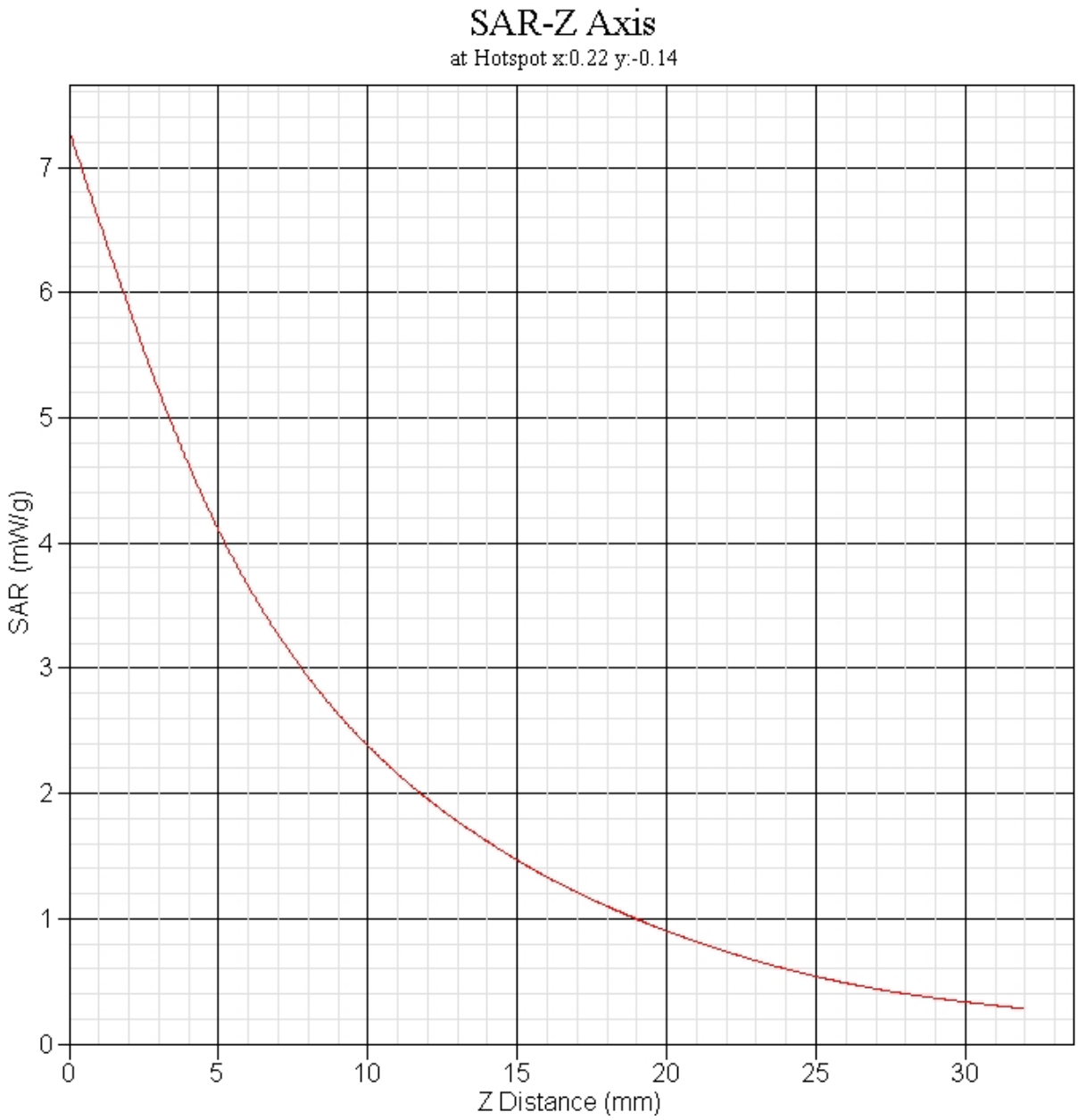
Tissue Data
Type : BODY
Serial No. : 1900
Frequency : 1900.00 MHz
Last Calib. Date : 18-Jul-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 49.00 RH%
Epsilon : 53.02 F/m
Sigma : 1.54 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : Probe 217 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.85
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       : 18-Jul-2010
Set-up Time       : 8:39:41 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    : 4.001 W/kg
10 gram SAR value   : 2.082 W/kg
Area Scan Peak SAR  : 4.660 W/kg
Zoom Scan Peak SAR  : 7.296 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 23-Jul-2010
Starting Time : 23-Jul-2010 08:09:35 AM
End Time : 23-Jul-2010 08:22:29 AM
Scanning Time : 774 secs

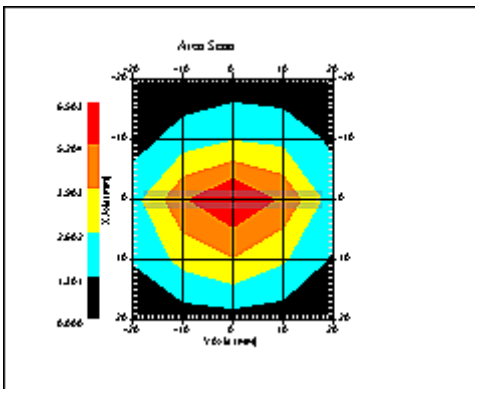
Product Data
Device Name : Validation
Serial No. : 2450
Type : Dipole
Model : ALS-D-2450-S-2
Frequency : 2450.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 51.5 mm
Width : 3.6 mm
Depth : 30.4 mm
Antenna Type : Internal
Orientation : Touch
Power Drift-Start : 6.390 W/kg
Power Drift-Finish: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

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

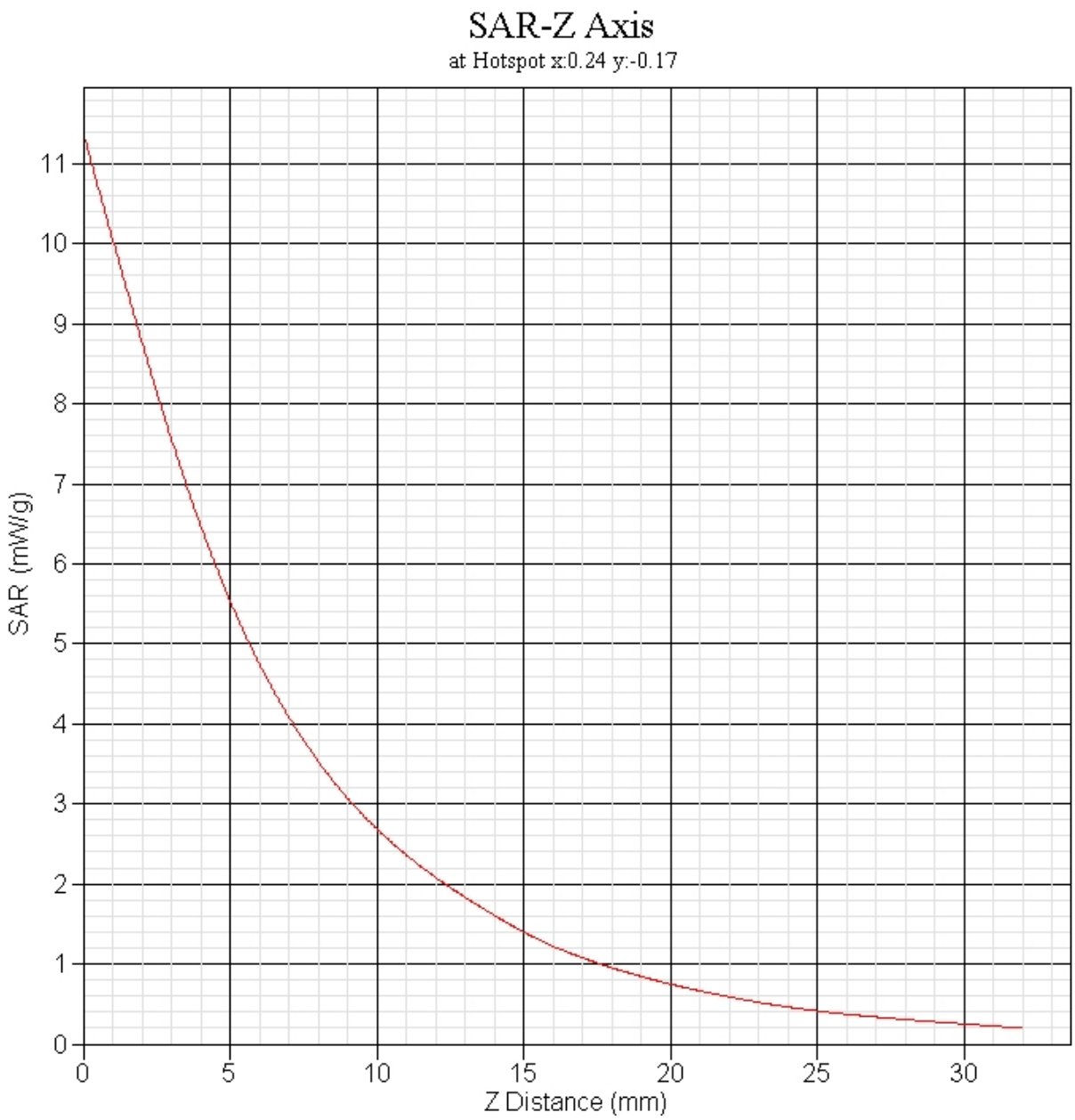
Tissue Data
Type : BODY
Serial No. : 2450
Frequency : 2450.00 MHz
Last Calib. Date : 23-Jul-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 45.00 RH%
Epsilon : 52.41 F/m
Sigma : 1.97 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 3.61
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-Jul-2010
Set-up Time       : 7:40:13 AM
Area Scan         : 5x5x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 10 mm
Channel           : Mid
```



```
1 gram SAR value    : 5.530 W/kg
10 gram SAR value   : 2.536 W/kg
Area Scan Peak SAR  : 6.503 W/kg
Zoom Scan Peak SAR  : 11.390 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 14-Sep-2010
Starting Time : 14-Sep-2010 10:54:19 AM
End Time : 14-Sep-2010 11:09:26 AM
Scanning Time : 907 secs

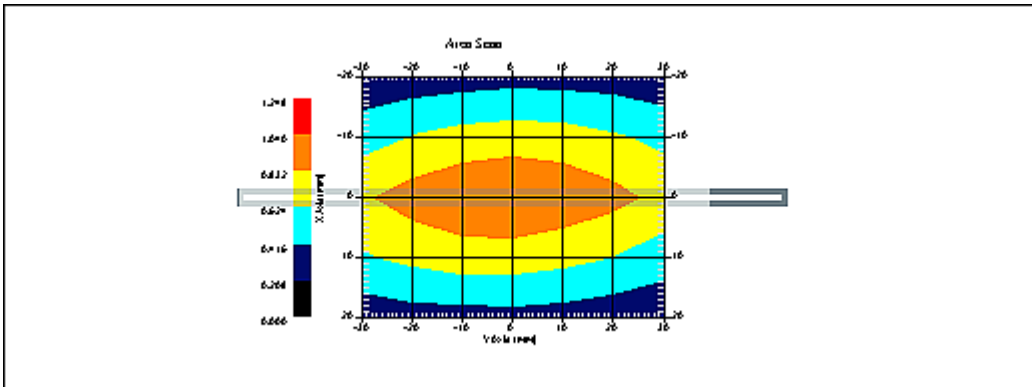
Product Data
Device Name : Validation
Serial No. : 835
Type : Dipole
Model : ALS-D-835-S-2
Frequency : 835.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 161 mm
Width : 3.6 mm
Depth : 89.8 mm
Antenna Type : Internal
Orientation : Touch
Power Drift-Start : 1.038 W/kg
Power Drift-Finish: 1.045 W/kg
Power Drift (%) : 0.605

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

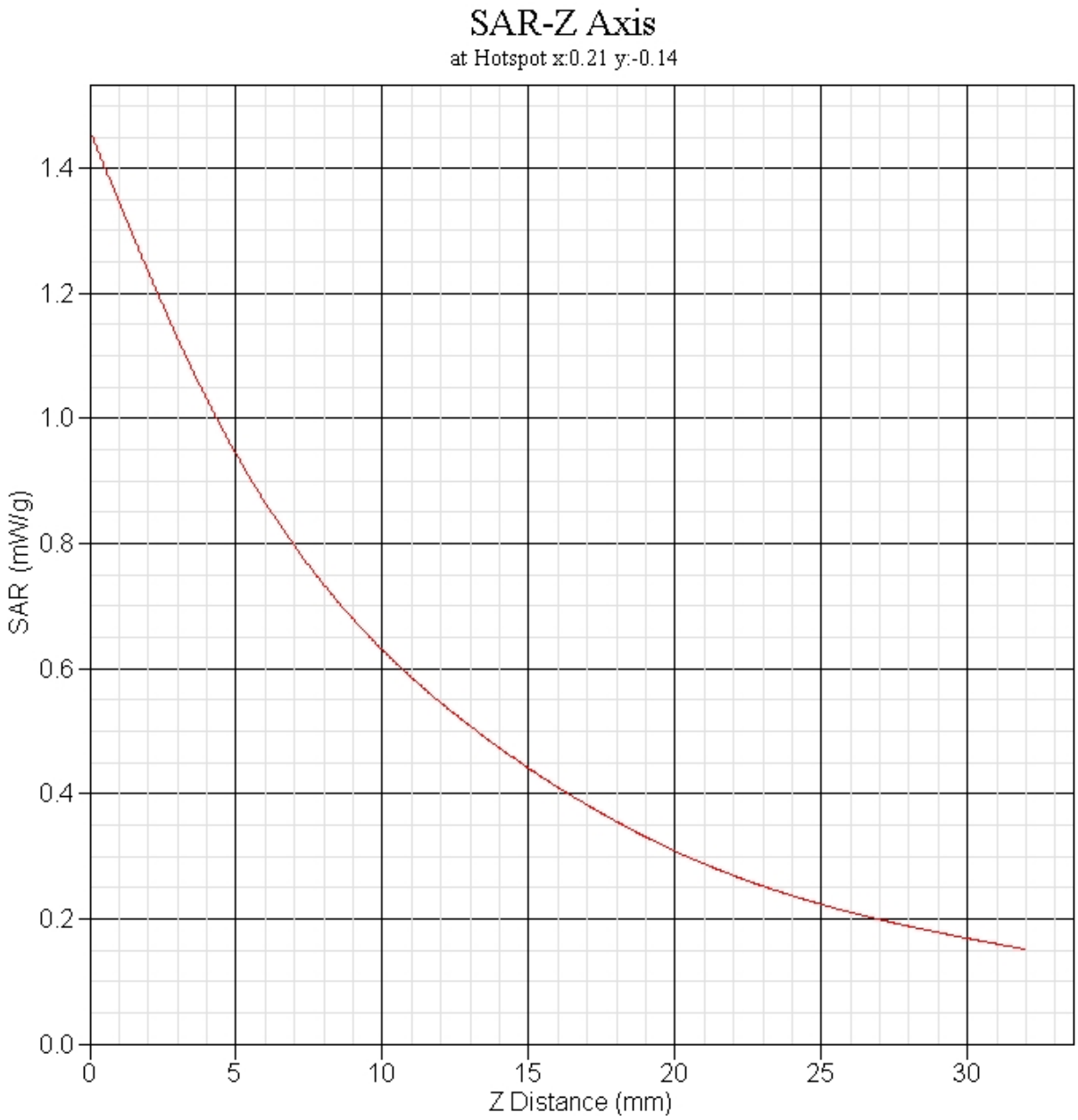
Tissue Data
Type : BODY
Serial No. : 835
Frequency : 835.00 MHz
Last Calib. Date : 14-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 49.00 RH%
Epsilon : 54.97 F/m
Sigma : 0.99 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : Probe 217 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 835.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 6.1
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.     : 25.00 °C
Set-up Date       : 14-Sep-2010
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           : Low
```



```
1 gram SAR value    : 0.951 W/kg
10 gram SAR value   : 0.603 W/kg
Area Scan Peak SAR  : 1.042 W/kg
Zoom Scan Peak SAR  : 1.461 W/kg
```



SAR Test Report

By Operator : Jay
Measurement Date : 12-Sep-2010
Starting Time : 12-Sep-2010 09:26:43 AM
End Time : 12-Sep-2010 09:39:47 AM
Scanning Time : 784 secs

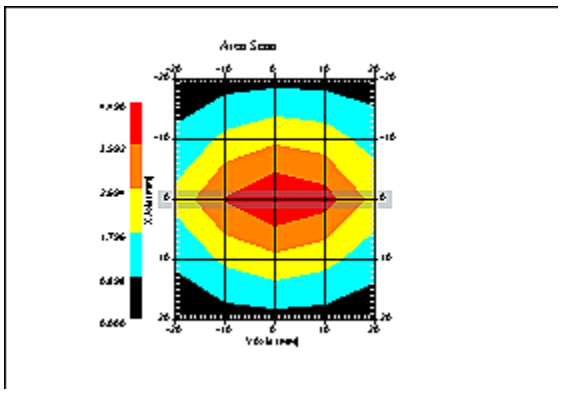
Product Data
Device Name : Validation
Serial No. : 1900
Type : Dipole
Model : ALS-D-1900-S-2
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.1 W
Drift Time : 0 min(s)
Length : 68 mm
Width : 3.6 mm
Depth : 39.5 mm
Antenna Type : Internal
Orientation : Touch
Power Drift-Start : 4.458 W/kg
Power Drift-Finish: 4.423 W/kg
Power Drift (%) : -0.792

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

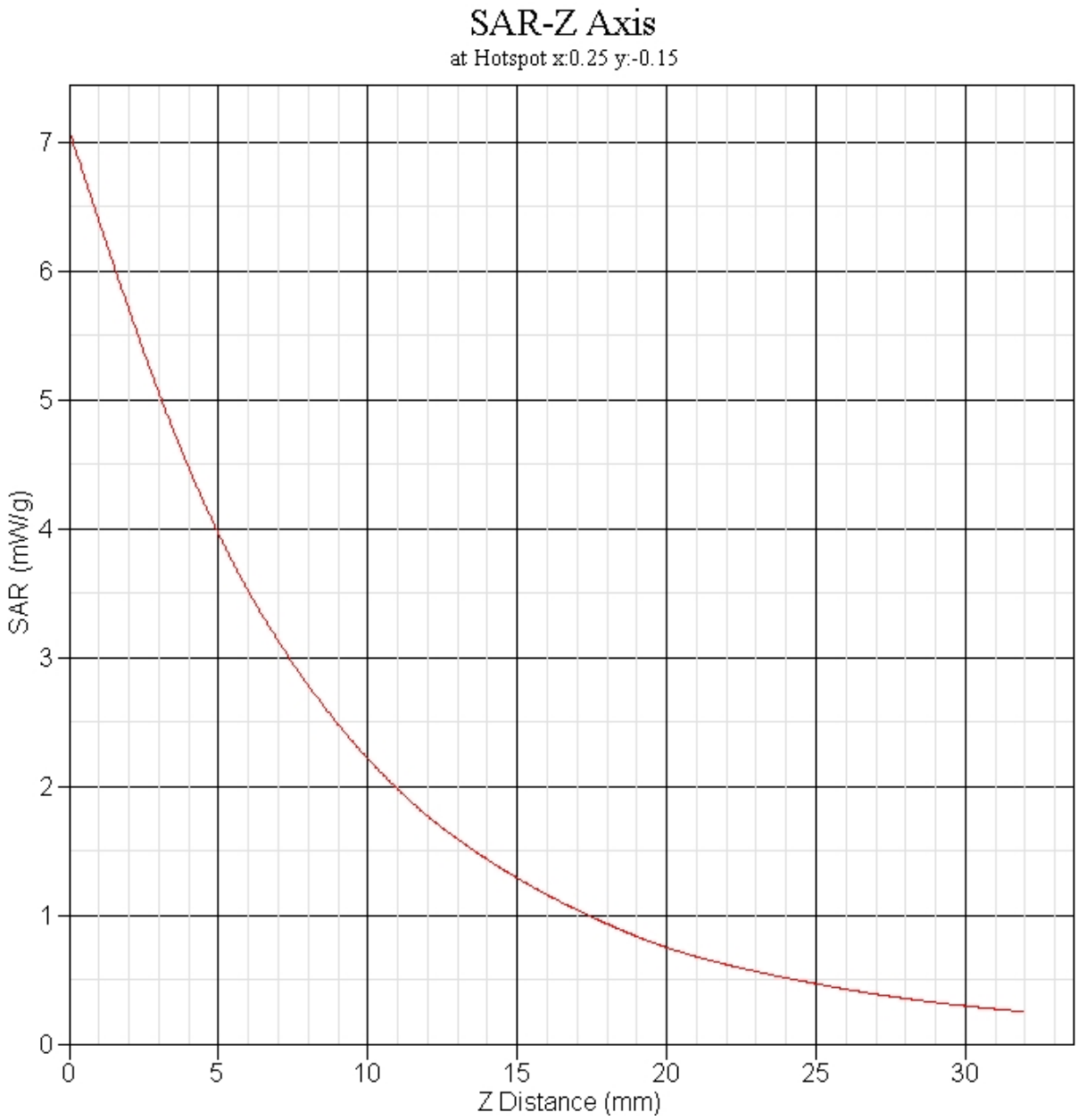
Tissue Data
Type : BODY
Serial No. : 1900
Frequency : 1900.00 MHz
Last Calib. Date : 12-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 49.00 RH%
Epsilon : 53.07 F/m
Sigma : 1.54 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : Probe 217 - RFEL
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.85
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       : 12-Sep-2010
Set-up Time       : 8:03:12 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
```



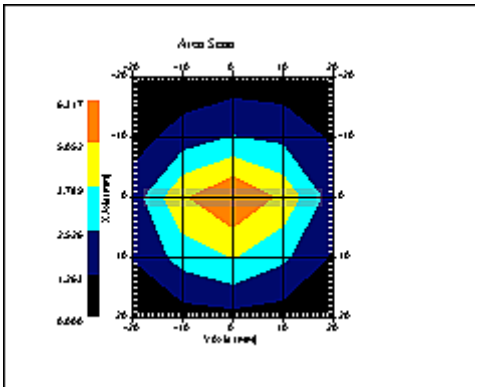
```
1 gram SAR value    : 3.891 W/kg
10 gram SAR value   : 1.987 W/kg
Area Scan Peak SAR  : 4.490 W/kg
Zoom Scan Peak SAR  : 7.096 W/kg
```



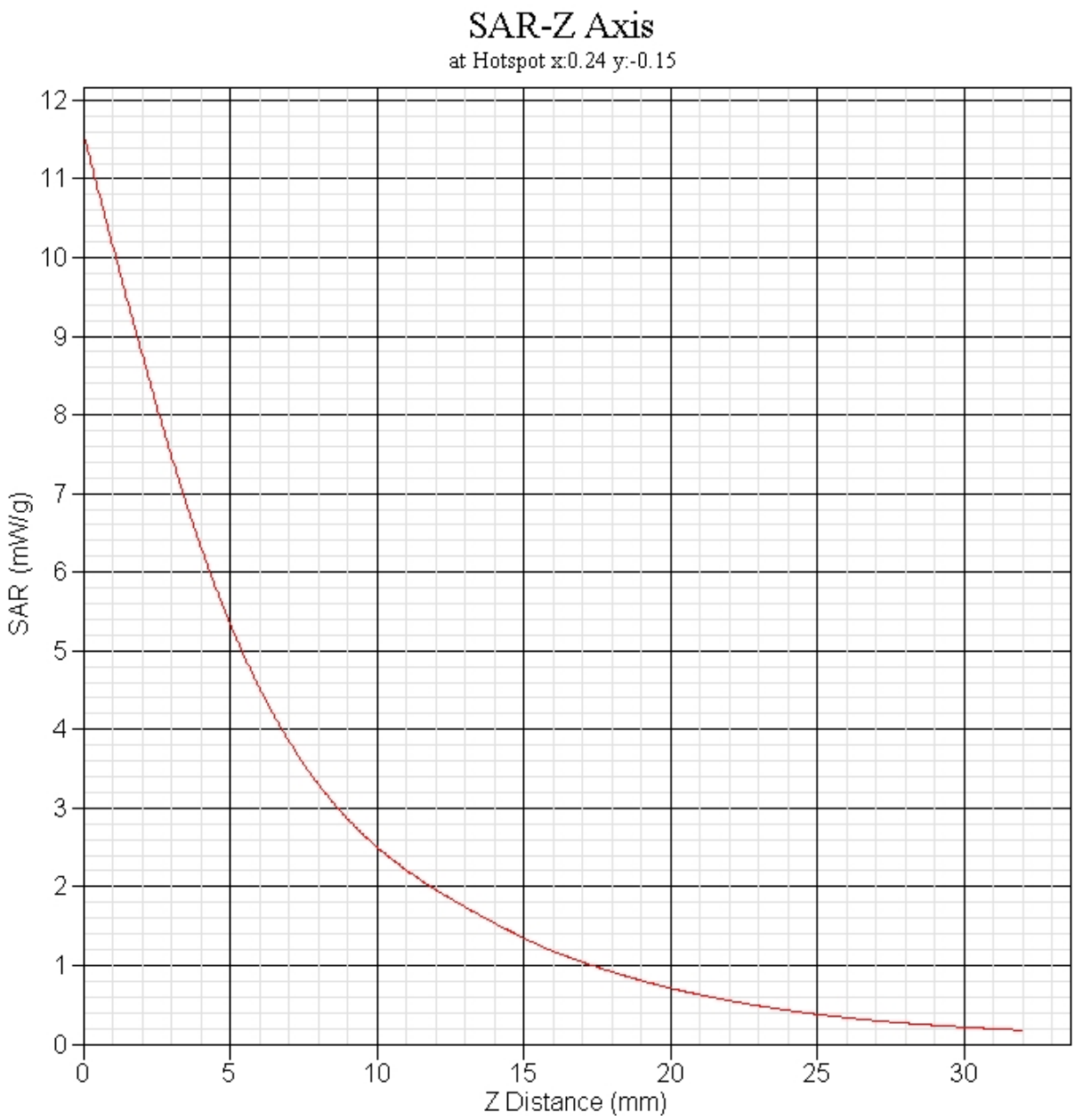
SAR Test Report

```
By Operator       : Jay
Measurement Date  : 13-Sep-2010
Starting Time     : 13-Sep-2010  07:19:29 AM
End Time          : 13-Sep-2010  08:13:47 AM
Scanning Time     : 858 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 : 6.373 W/kg
Power Drift-Finish: 6.568 W/kg
Power Drift (%)   : 3.061

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  : 13-Sep-2010
Temperature       : 20.00 °C
Ambient Temp.     : 23.00 °C
Humidity          : 45.00 RH%
Epsilon           : 52.04 F/m
Sigma             : 1.97 S/m
Density           : 1000.00 kg/cu. m

Probe Data
Name              : Probe 217 - RFEL
Model             : E020
Type              : E-Field Triangle
Serial No.        : 217
Last Calib. Date  : 21-Oct-2009
Frequency         : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 3.61
Probe Sensitivity: 1.20  1.20  1.20   µV/(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       : 13-Sep-2010
Set-up Time       : 7:40:13 AM
Area Scan         : 5x5x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Touch
Separation        : 10 mm
Channel           : Mid
```



```
1 gram SAR value    : 5.426 W/kg
10 gram SAR value   : 2.459 W/kg
Area Scan Peak SAR  : 6.317 W/kg
Zoom Scan Peak SAR  : 11.590 W/kg
```

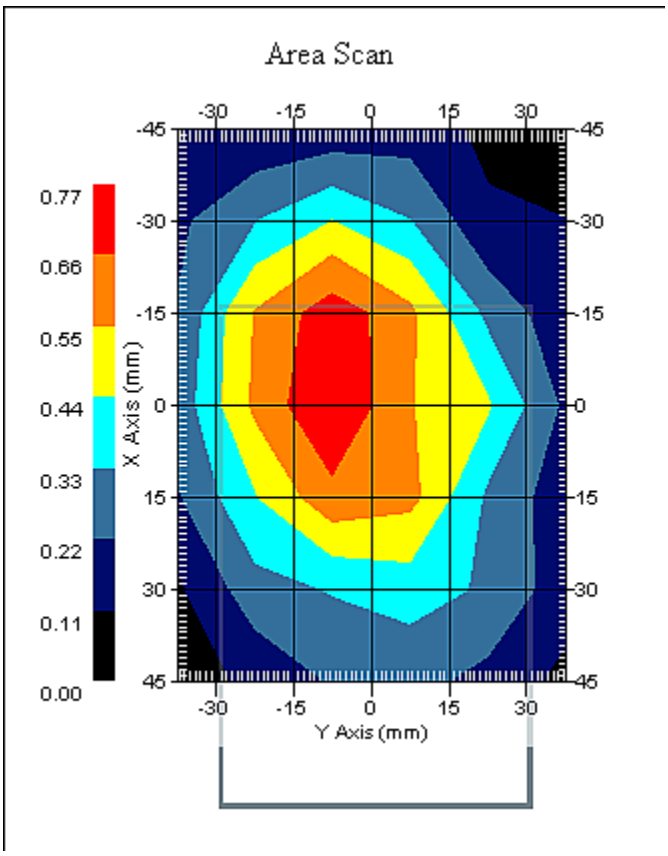


Appendix B – SAR Test Data Plots

SAR Test Report

```
By Operator       : Jay
Measurement Date  : 14-Sep-2010
Starting Time     : 14-Sep-2010  12:35:32 PM
End Time          : 14-Sep-2010  12:51:42 PM
Scanning Time     : 970 secs

Product Data
Device Name       : Novatel Wireless
Serial No.        : 0026E8A23E3A
Mode              : GPRS 1-Slot
Model             : MiFi3352
Frequency         : 850.00 MHz
Max. Transmit Pwr : 2 W
Drift Time        : 0 min(s)
Length            : 98 mm
Width             : 62 mm
Depth             : 15 mm
Antenna Type      : Internal
Orientation       : Top
Power Drift-Start : 0.667 W/kg
Power Drift-Finish: 0.655 W/kg
Power Drift (%)   : -1.793

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  : 14-Sep-2010
Temperature       : 20.00 °C
Ambient Temp.     : 23.00 °C
Humidity          : 40.00 RH%
Epsilon           : 54.97 F/m
Sigma             : 0.99 S/m
Density           : 1000.00 kg/cu. m

Probe Data
Name              : RFEL 217
Model             : E020
Type              : E-Field Triangle
Serial No.        : 217
Last Calib. Date  : 21-Oct-2009
Frequency         : 835.00 MHz
Duty Cycle Factor: 8
Conversion Factor: 6.1
Probe Sensitivity: 1.20  1.20  1.20   µV/(V/m)^2
Compression Point: 95.00 mV
Offset            : 1.56 mm
```

```
Measurement Data
Crest Factor      : 8
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 14-Sep-2010
Set-up Time       : 8:18:07 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top
Separation        : 12 mm
Channel           : Mid
```




```
1 gram SAR value    : 0.685 W/kg
10 gram SAR value   : 0.477 W/kg
Area Scan Peak SAR  : 0.770 W/kg
Zoom Scan Peak SAR  : 0.810 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 14-Sep-2010
Starting Time : 14-Sep-2010 12:17:16 PM
End Time : 14-Sep-2010 12:33:31 PM
Scanning Time : 975 secs

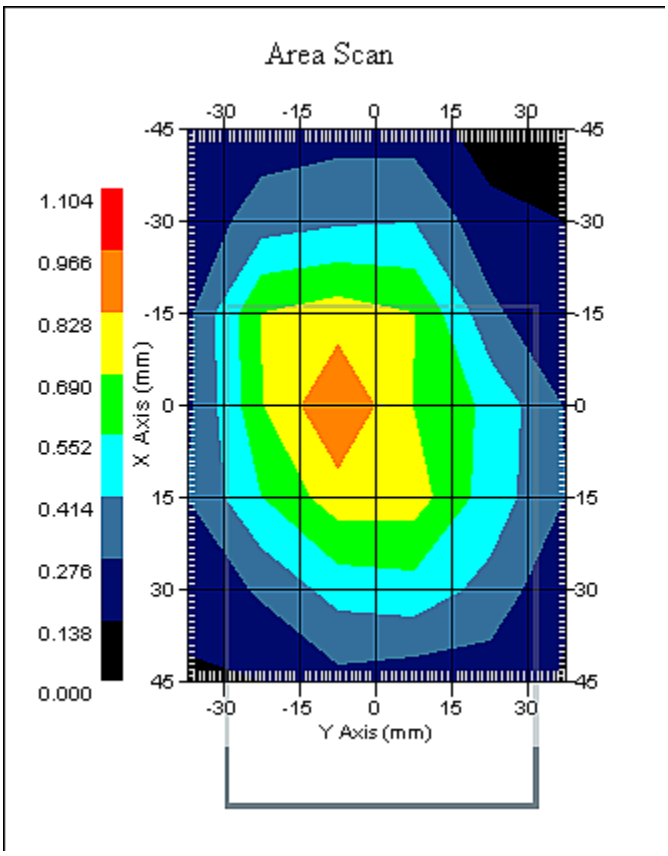
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : GPRS 1-Slot
Model : MiFi3352
Frequency : 850.00 MHz
Max. Transmit Pwr : 2 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 62 mm
Depth : 15 mm
Antenna Type : Internal
Orientation : Top
Power Drift-Start : 0.649 W/kg
Power Drift-Finish: 0.650 W/kg
Power Drift (%) : 0.151

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 : 14-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 40.00 RH%
Epsilon : 54.97 F/m
Sigma : 0.99 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 835.00 MHz
Duty Cycle Factor: 8
Conversion Factor: 6.1
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      : 8
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 14-Sep-2010
Set-up Time       : 8:18:07 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top
Separation        : 12 mm
Channel           : Mid
```




```
1 gram SAR value    : 0.902 W/kg
10 gram SAR value   : 0.596 W/kg
Area Scan Peak SAR  : 0.967 W/kg
Zoom Scan Peak SAR  : 1.301 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 14-Sep-2010
Starting Time : 14-Sep-2010 11:42:32 AM
End Time : 14-Sep-2010 11:58:49 AM
Scanning Time : 977 secs

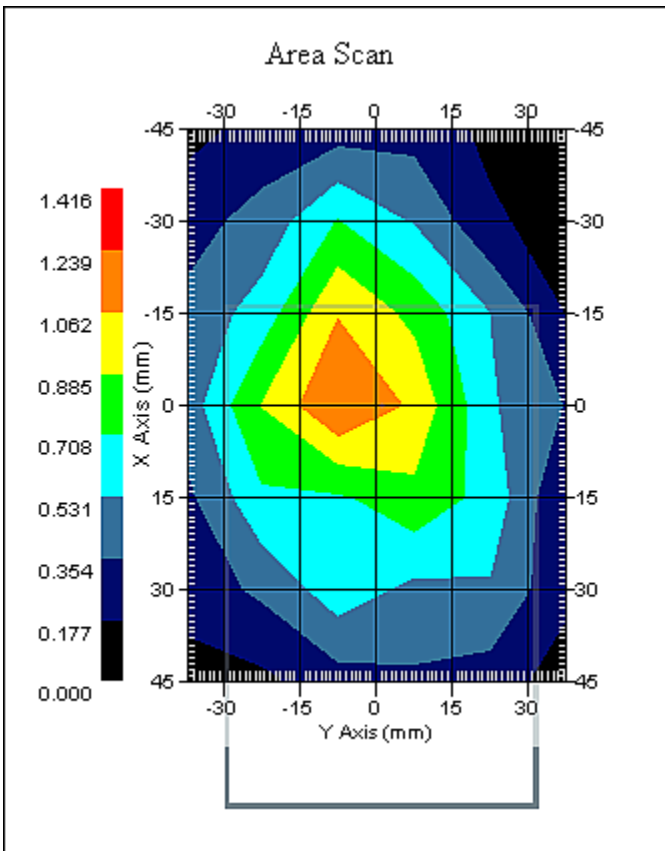
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : GPRS 1-Slot
Model : MiFi3352
Frequency : 850.00 MHz
Max. Transmit Pwr : 2 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 62 mm
Depth : 15 mm
Antenna Type : Internal
Orientation : Top
Power Drift-Start : 0.840 W/kg
Power Drift-Finish: 0.877 W/kg
Power Drift (%) : 4.406

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 : 14-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 40.00 RH%
Epsilon : 54.97 F/m
Sigma : 0.99 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 835.00 MHz
Duty Cycle Factor: 8
Conversion Factor: 6.1
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      : 8
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 14-Sep-2010
Set-up Time       : 8:18:07 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top
Separation        : 12 mm
Channel           : High
```

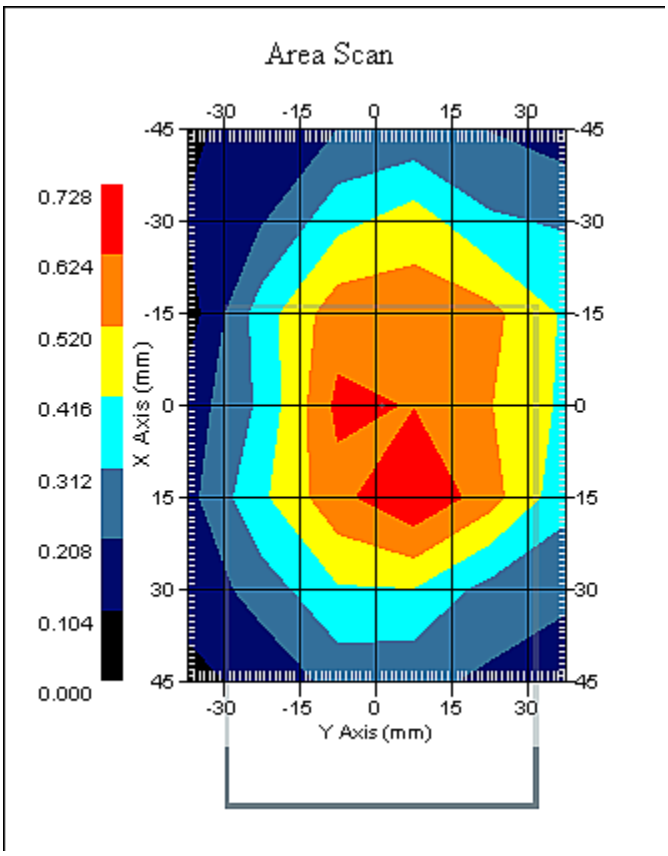



```
1 gram SAR value    : 1.046 W/kg
10 gram SAR value   : 0.720 W/kg
Area Scan Peak SAR  : 1.240 W/kg
Zoom Scan Peak SAR  : 1.621 W/kg
```

SAR Test Report

```
By Operator       : Jay
Measurement Date  : 14-Sep-2010
Starting Time     : 14-Sep-2010  12:53:13 PM
End Time          : 14-Sep-2010  01:09:23 PM
Scanning Time     : 970 secs

Product Data
Device Name       : Novatel Wireless
Serial No.        : 0026E8A23E3A
Mode              : GPRS 1-Slot
Model             : MiFi3352
Frequency         : 850.00 MHz
Max. Transmit Pwr : 2 W
Drift Time        : 0 min(s)
Length            : 98 mm
Width             : 62 mm
Depth             : 15 mm
Antenna Type      : Internal
Orientation       : Bottom
Power Drift-Start : 0.719 W/kg
Power Drift-Finish: 0.694 W/kg
Power Drift (%)   : -3.406

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  : 14-Sep-2010
Temperature       : 20.00 °C
Ambient Temp.     : 23.00 °C
Humidity          : 40.00 RH%
Epsilon           : 54.97 F/m
Sigma             : 0.99 S/m
Density           : 1000.00 kg/cu. m

Probe Data
Name              : RFEL 217
Model             : E020
Type              : E-Field Triangle
Serial No.        : 217
Last Calib. Date  : 21-Oct-2009
Frequency         : 835.00 MHz
Duty Cycle Factor: 8
Conversion Factor: 6.1
Probe Sensitivity: 1.20  1.20  1.20   µV/(V/m)^2
Compression Point: 95.00 mV
Offset            : 1.56 mm
```

```
Measurement Data
Crest Factor      : 8
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 14-Sep-2010
Set-up Time       : 8:18:07 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Bottom
Separation        : 12 mm
Channel           : High
```




```
1 gram SAR value    : 0.725 W/kg
10 gram SAR value   : 0.485 W/kg
Area Scan Peak SAR  : 0.726 W/kg
Zoom Scan Peak SAR  : 0.960 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 14-Sep-2010
Starting Time : 14-Sep-2010 01:11:22 PM
End Time : 14-Sep-2010 01:27:38 PM
Scanning Time : 976 secs

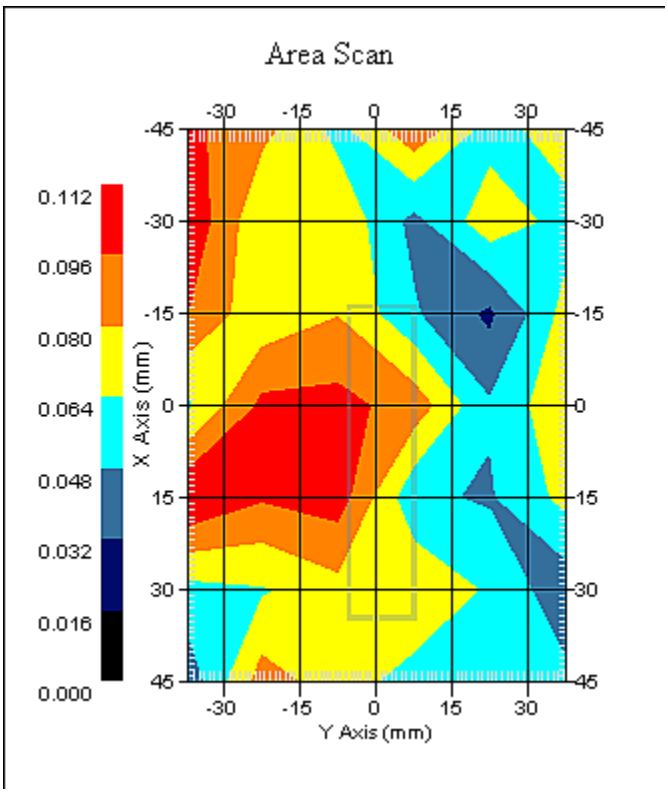
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : GPRS 1-Slot
Model : MiFi3352
Frequency : 850.00 MHz
Max. Transmit Pwr : 2 W
Drift Time : 0 min(s)
Length : 62 mm
Width : 15 mm
Depth : 98 mm
Antenna Type : Internal
Orientation : Top Edge
Power Drift-Start : 0.112 W/kg
Power Drift-Finish: 0.110 W/kg
Power Drift (%) : -1.785

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 : 14-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 40.00 RH%
Epsilon : 54.97 F/m
Sigma : 0.99 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 835.00 MHz
Duty Cycle Factor: 8
Conversion Factor: 6.1
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      : 8
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 14-Sep-2010
Set-up Time       : 8:18:07 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top Edge
Separation        : 12 mm
Channel           : High
```




```
1 gram SAR value    : 0.119 W/kg
10 gram SAR value   : 0.072 W/kg
Area Scan Peak SAR  : 0.112 W/kg
Zoom Scan Peak SAR  : 0.290 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 12-Sep-2010
Starting Time : 12-Sep-2010 01:14:47 PM
End Time : 12-Sep-2010 01:31:07 PM
Scanning Time : 980 secs

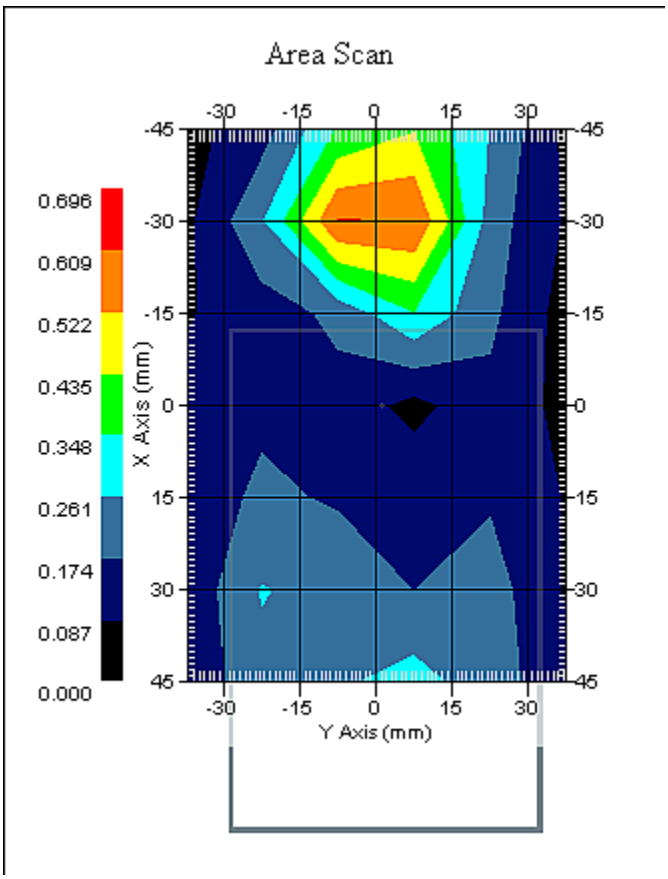
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : GPRS 1-Slot
Model : MiFi3352
Frequency : 1900.00 MHz
Max. Transmit Pwr : 1 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 62 mm
Depth : 15 mm
Antenna Type : Internal
Orientation : Top
Power Drift-Start : 0.286 W/kg
Power Drift-Finish: 0.275 W/kg
Power Drift (%) : -3.844

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 : 12-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 36.00 RH%
Epsilon : 53.07 F/m
Sigma : 1.54 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 8
Conversion Factor: 4.85
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       : 12-Sep-2010
Set-up Time       : 7:30:04 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top
Separation        : 12 mm
Channel           : Low
```




```
1 gram SAR value    : 0.464 W/kg
10 gram SAR value   : 0.258 W/kg
Area Scan Peak SAR  : 0.612 W/kg
Zoom Scan Peak SAR  : 0.910 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 12-Sep-2010
Starting Time : 12-Sep-2010 01:33:08 PM
End Time : 12-Sep-2010 01:49:20 PM
Scanning Time : 972 secs

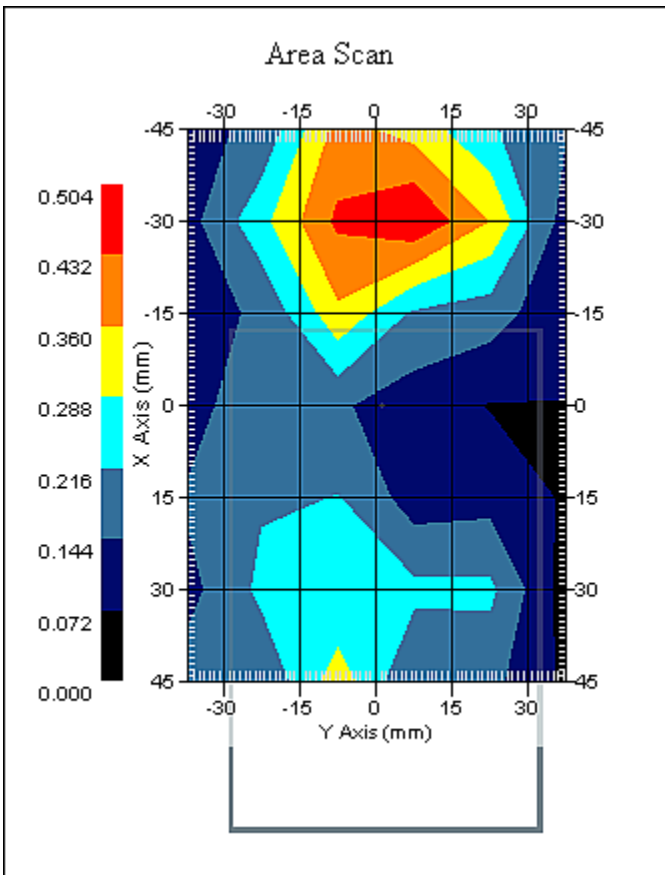
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : GPRS 1-Slot
Model : MiFi3352
Frequency : 1900.00 MHz
Max. Transmit Pwr : 1 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 62 mm
Depth : 15 mm
Antenna Type : Internal
Orientation : Bottom
Power Drift-Start : 0.271 W/kg
Power Drift-Finish: 0.266 W/kg
Power Drift (%) : -1.878

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 : 12-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 36.00 RH%
Epsilon : 53.07 F/m
Sigma : 1.54 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 8
Conversion Factor: 4.85
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       : 12-Sep-2010
Set-up Time       : 7:30:04 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Bottom
Separation        : 12 mm
Channel           : Low
```




```
1 gram SAR value    : 0.560 W/kg
10 gram SAR value   : 0.333 W/kg
Area Scan Peak SAR  : 0.502 W/kg
Zoom Scan Peak SAR  : 1.110 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 12-Sep-2010
Starting Time : 12-Sep-2010 12:38:41 PM
End Time : 12-Sep-2010 12:55:00 PM
Scanning Time : 979 secs

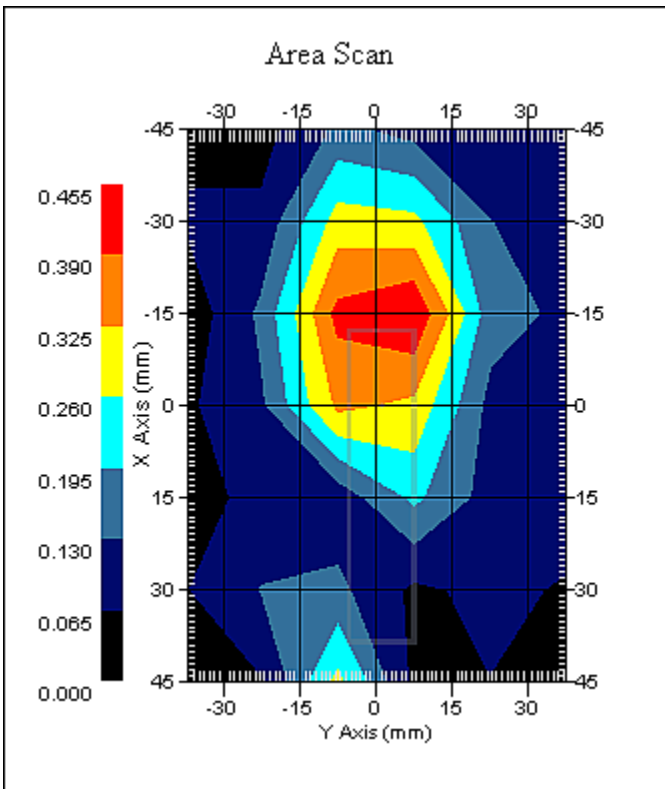
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : GPRS 1-Slot
Model : MiFi3352
Frequency : 1900.00 MHz
Max. Transmit Pwr : 1 W
Drift Time : 0 min(s)
Length : 62 mm
Width : 15 mm
Depth : 98 mm
Antenna Type : Internal
Orientation : Top Edge
Power Drift-Start : 0.408 W/kg
Power Drift-Finish: 0.426 W/kg
Power Drift (%) : 4.415

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 : 12-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 36.00 RH%
Epsilon : 53.07 F/m
Sigma : 1.54 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 8
Conversion Factor: 4.85
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       : 12-Sep-2010
Set-up Time       : 7:30:04 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top Edge
Separation        : 12 mm
Channel           : Low
```




```
1 gram SAR value    : 0.427 W/kg
10 gram SAR value   : 0.245 W/kg
Area Scan Peak SAR  : 0.452 W/kg
Zoom Scan Peak SAR  : 0.320 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 12-Sep-2010
Starting Time : 12-Sep-2010 08:28:23 AM
End Time : 12-Sep-2010 08:44:34 AM
Scanning Time : 971 secs

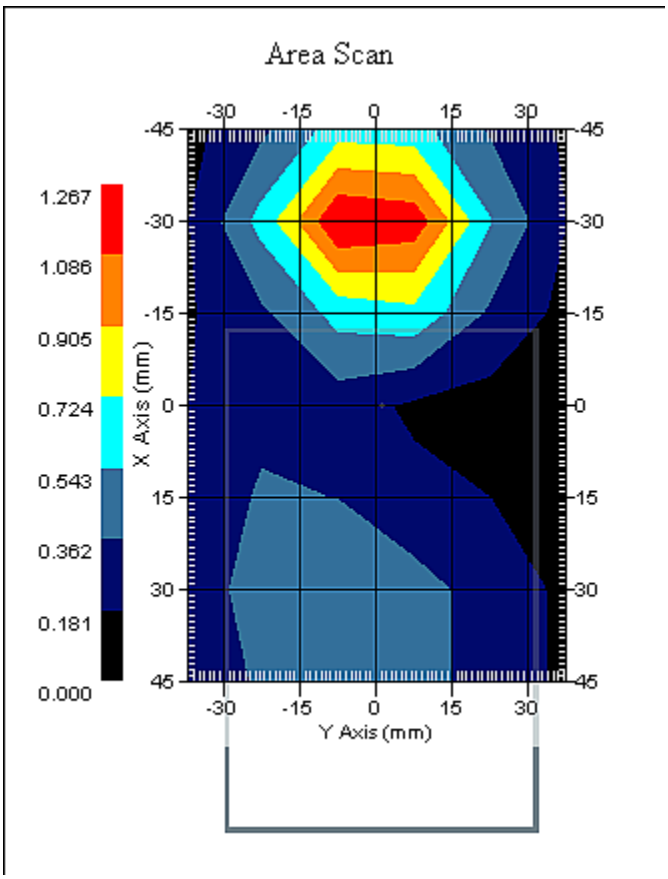
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : WCDMA
Model : MiFi3352
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.25 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 62 mm
Depth : 15 mm
Antenna Type : Internal
Orientation : Top
Power Drift-Start : 0.740 W/kg
Power Drift-Finish: 0.725 W/kg
Power Drift (%) : -2.044

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 : 12-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 36.00 RH%
Epsilon : 53.07 F/m
Sigma : 1.54 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.85
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       : 12-Sep-2010
Set-up Time       : 7:30:04 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top
Separation        : 12 mm
Channel           : Low
```




```
1 gram SAR value    : 1.158 W/kg
10 gram SAR value   : 0.652 W/kg
Area Scan Peak SAR  : 1.164 W/kg
Zoom Scan Peak SAR  : 1.791 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 12-Sep-2010
Starting Time : 12-Sep-2010 08:06:44 AM
End Time : 12-Sep-2010 08:23:11 AM
Scanning Time : 987 secs

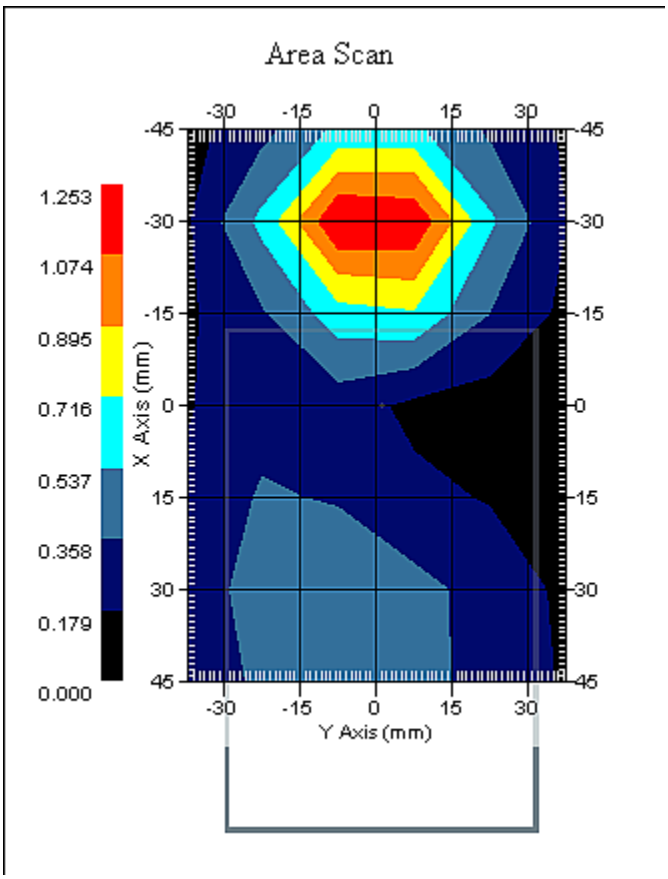
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : WCDMA
Model : MiFi3352
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.25 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 62 mm
Depth : 15 mm
Antenna Type : Internal
Orientation : Top
Power Drift-Start : 0.740 W/kg
Power Drift-Finish: 0.762 W/kg
Power Drift (%) : 2.945

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 : 12-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 36.00 RH%
Epsilon : 53.07 F/m
Sigma : 1.54 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.85
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       : 12-Sep-2010
Set-up Time       : 7:30:04 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top
Separation        : 12 mm
Channel           : Mid
```




```
1 gram SAR value    : 1.167 W/kg
10 gram SAR value   : 0.654 W/kg
Area Scan Peak SAR  : 1.252 W/kg
Zoom Scan Peak SAR  : 1.921 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 12-Sep-2010
Starting Time : 12-Sep-2010 09:02:52 AM
End Time : 12-Sep-2010 09:18:59 AM
Scanning Time : 967 secs

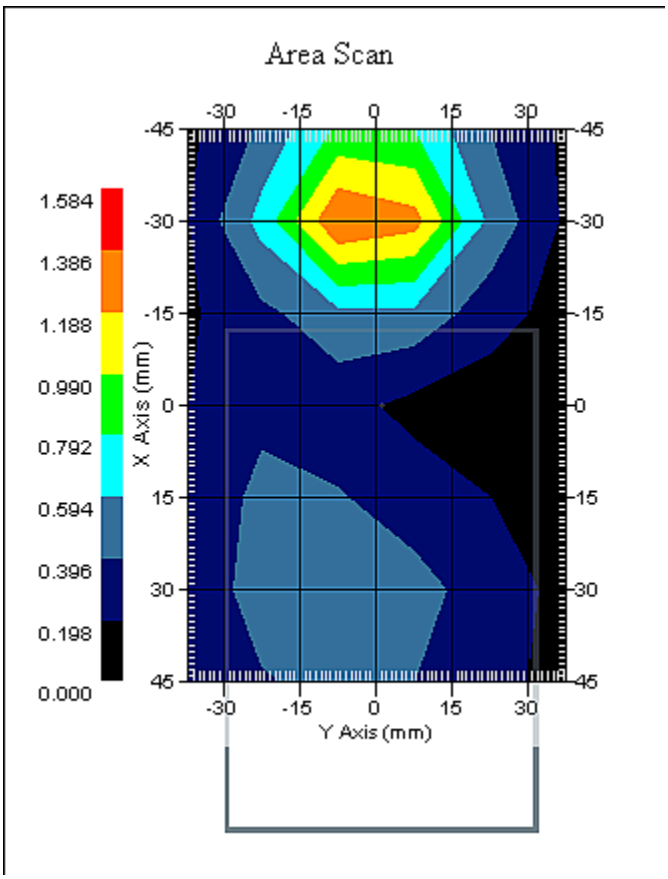
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : WCDMA
Model : MiFi3352
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.25 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 62 mm
Depth : 15 mm
Antenna Type : Internal
Orientation : Top
Power Drift-Start : 0.606 W/kg
Power Drift-Finish: 0.591 W/kg
Power Drift (%) : -2.473

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 : 12-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 36.00 RH%
Epsilon : 53.07 F/m
Sigma : 1.54 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.85
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       : 12-Sep-2010
Set-up Time       : 7:30:04 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top
Separation        : 12 mm
Channel           : High
```




```
1 gram SAR value    : 1.245 W/kg
10 gram SAR value   : 0.694 W/kg
Area Scan Peak SAR  : 1.388 W/kg
Zoom Scan Peak SAR  : 2.082 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 12-Sep-2010
Starting Time : 12-Sep-2010 09:21:15 AM
End Time : 12-Sep-2010 09:37:16 AM
Scanning Time : 961 secs

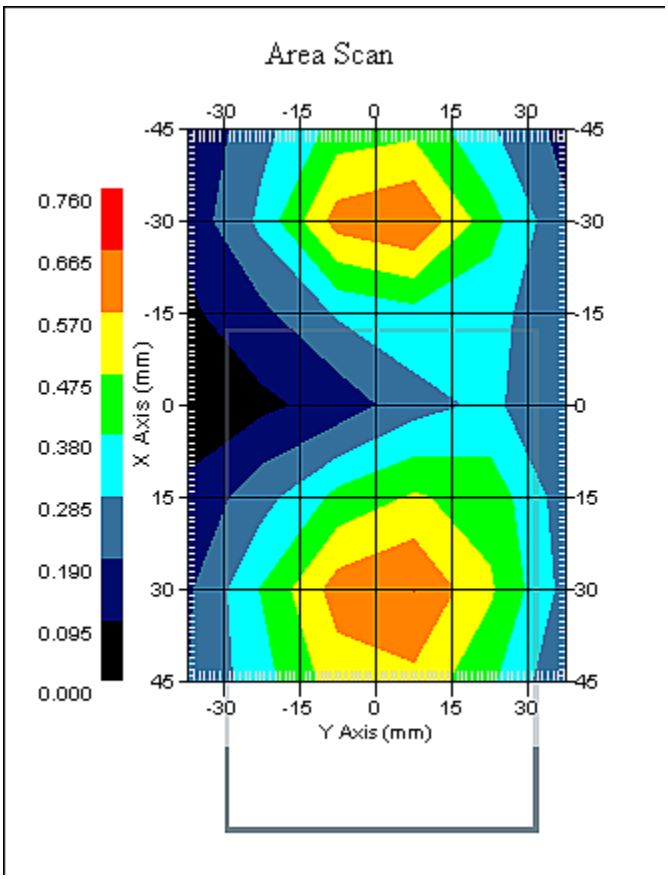
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : WCDMA
Model : MiFi3352
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.25 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 62 mm
Depth : 15 mm
Antenna Type : Internal
Orientation : Bottom
Power Drift-Start : 0.332 W/kg
Power Drift-Finish: 0.337 W/kg
Power Drift (%) : 1.497

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 : 12-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 36.00 RH%
Epsilon : 53.07 F/m
Sigma : 1.54 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.85
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       : 12-Sep-2010
Set-up Time       : 7:30:04 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Bottom
Separation        : 12 mm
Channel           : High
```




```
1 gram SAR value    : 0.627 W/kg
10 gram SAR value   : 0.410 W/kg
Area Scan Peak SAR  : 0.666 W/kg
Zoom Scan Peak SAR  : 0.900 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 17-Jul-2010
Starting Time : 17-Jul-2010 07:50:38 PM
End Time : 17-Jul-2010 08:05:22 PM
Scanning Time : 884 secs

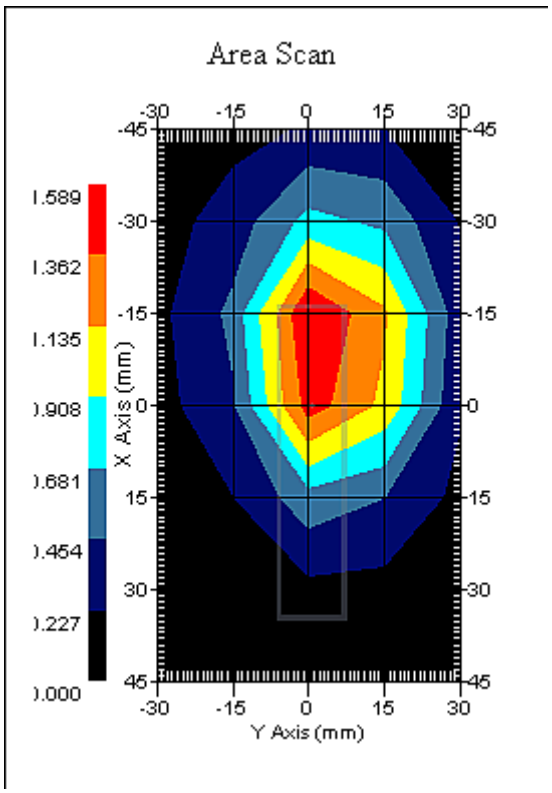
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : WCDMA
Model : MiFi2352
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.25 W
Drift Time : 0 min(s)
Length : 62 mm
Width : 15 mm
Depth : 98 mm
Antenna Type : Internal
Orientation : Top Edge
Power Drift-Start : 1.377 W/kg
Power Drift-Finish: 1.382 W/kg
Power Drift (%) : 0.362

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 : 17-Jul-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 36.00 RH%
Epsilon : 53.16 F/m
Sigma : 1.55 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.85
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       : 17-Jul-2010
Set-up Time       : 10:28:50 AM
Area Scan         : 7x5x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top Edge
Separation        : 12 mm
Channel           : Low
```




```
1 gram SAR value    : 1.508 W/kg
10 gram SAR value   : 0.808 W/kg
Area Scan Peak SAR  : 1.589 W/kg
Zoom Scan Peak SAR  : 2.742 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 17-Jul-2010
Starting Time : 17-Jul-2010 07:32:34 PM
End Time : 17-Jul-2010 07:47:12 PM
Scanning Time : 878 secs

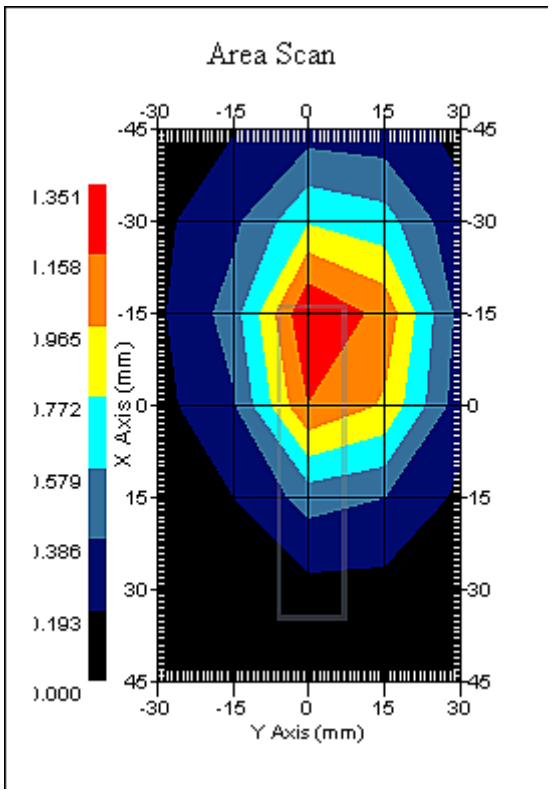
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : WCDMA
Model : MiFi2352
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.25 W
Drift Time : 0 min(s)
Length : 62 mm
Width : 15 mm
Depth : 98 mm
Antenna Type : Internal
Orientation : Top Edge
Power Drift-Start : 1.624 W/kg
Power Drift-Finish: 1.551 W/kg
Power Drift (%) : -4.494

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 : 17-Jul-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 36.00 RH%
Epsilon : 53.16 F/m
Sigma : 1.55 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.85
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       : 17-Jul-2010
Set-up Time       : 10:28:50 AM
Area Scan         : 7x5x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top Edge
Separation        : 12 mm
Channel           : Mid
```




```
1 gram SAR value    : 1.460 W/kg
10 gram SAR value   : 0.793 W/kg
Area Scan Peak SAR  : 1.350 W/kg
Zoom Scan Peak SAR  : 2.272 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 17-Jul-2010
Starting Time : 17-Jul-2010 08:08:21 PM
End Time : 17-Jul-2010 08:23:03 PM
Scanning Time : 882 secs

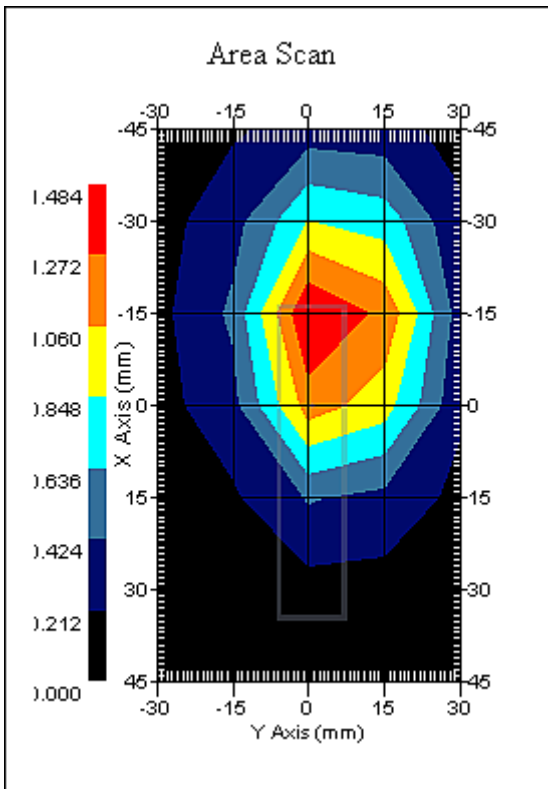
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : WCDMA
Model : MiFi2352
Frequency : 1900.00 MHz
Max. Transmit Pwr : 0.25 W
Drift Time : 0 min(s)
Length : 62 mm
Width : 15 mm
Depth : 98 mm
Antenna Type : Internal
Orientation : Top Edge
Power Drift-Start : 1.483 W/kg
Power Drift-Finish: 1.436 W/kg
Power Drift (%) : -3.169

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

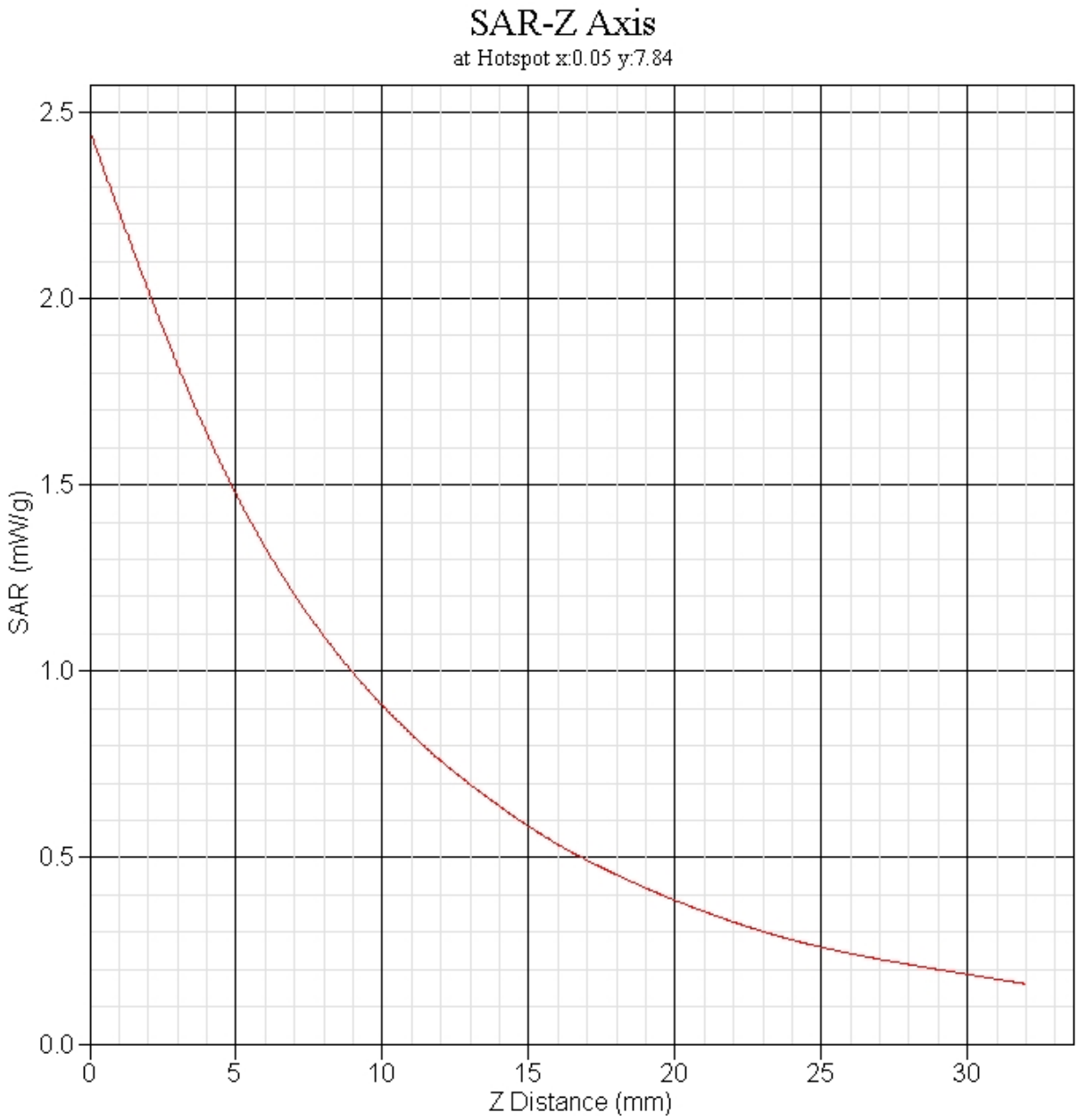
Tissue Data
Type : BODY
Serial No. : 1900
Frequency : 1900.00 MHz
Last Calib. Date : 17-Jul-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 36.00 RH%
Epsilon : 53.16 F/m
Sigma : 1.55 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 1900.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 4.85
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       : 17-Jul-2010
Set-up Time       : 10:28:50 AM
Area Scan         : 7x5x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top Edge
Separation        : 12 mm
Channel           : High
```



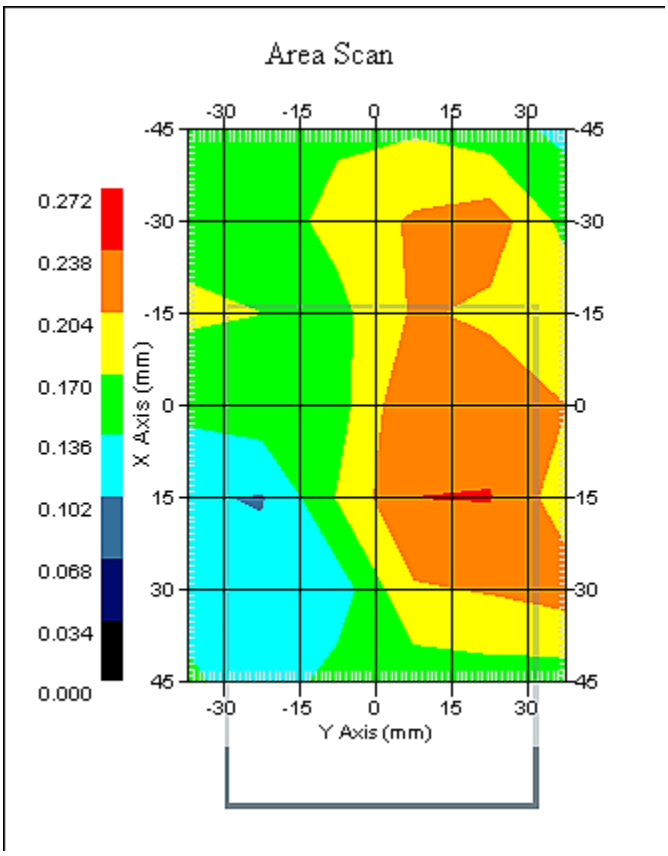

```
1 gram SAR value    : 1.569 W/kg
10 gram SAR value   : 0.738 W/kg
Area Scan Peak SAR  : 1.483 W/kg
Zoom Scan Peak SAR  : 2.452 W/kg
```



SAR Test Report

```
By Operator       : Jay
Measurement Date  : 13-Sep-2010
Starting Time     : 13-Sep-2010  08:06:11 AM
End Time          : 13-Sep-2010  08:22:37 AM
Scanning Time     : 986 secs

Product Data
Device Name       : Novatel Wireless
Serial No.        : 0026E8A23E3A
Mode              : 802.11b
Model             : MiFi3352
Frequency         : 2450.00 MHz
Max. Transmit Pwr : 0.035 W
Drift Time        : 0 min(s)
Length            : 98 mm
Width             : 62 mm
Depth             : 15 mm
Antenna Type      : Internal
Orientation       : Top
Power Drift-Start : 0.210 W/kg
Power Drift-Finish: 0.204 W/kg
Power Drift (%)   : -2.470

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  : 13-Sep-2010
Temperature       : 20.00 °C
Ambient Temp.     : 23.00 °C
Humidity          : 46.00 RH%
Epsilon           : 52.04 F/m
Sigma             : 1.97 S/m
Density           : 1000.00 kg/cu. m

Probe Data
Name              : RFEL 217
Model             : E020
Type              : E-Field Triangle
Serial No.        : 217
Last Calib. Date  : 21-Oct-2009
Frequency         : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 3.61
Probe Sensitivity: 1.20  1.20  1.20   µV/(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       : 13-Sep-2010
Set-up Time       : 6:35:34 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top
Separation        : 12 mm
Channel           : Mid
```




```
1 gram SAR value    : 0.226 W/kg
10 gram SAR value   : 0.176 W/kg
Area Scan Peak SAR  : 0.239 W/kg
Zoom Scan Peak SAR  : 0.250 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 13-Sep-2010
Starting Time : 13-Sep-2010 11:31:48 AM
End Time : 13-Sep-2010 11:47:55 AM
Scanning Time : 967 secs

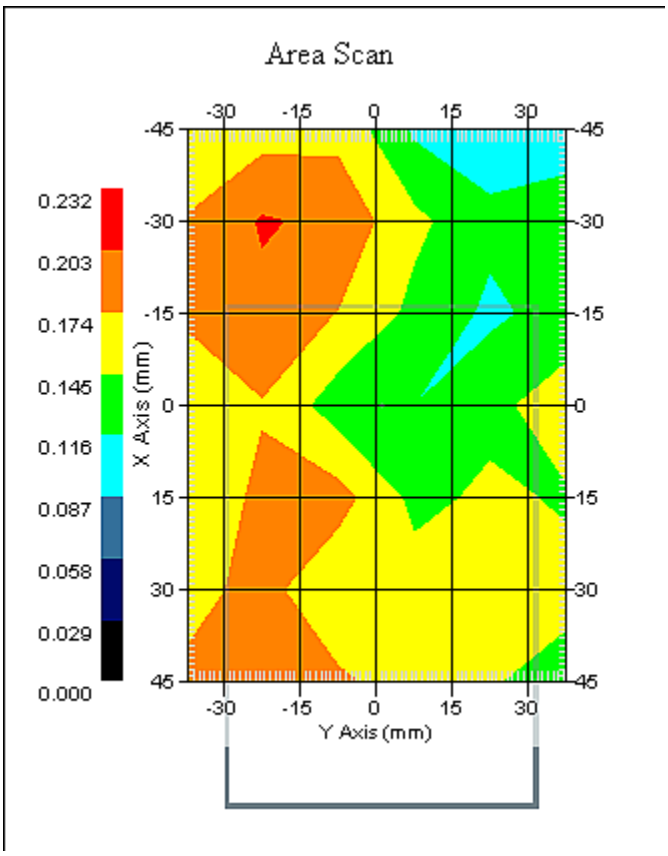
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : 802.11b
Model : MiFi3352
Frequency : 2450.00 MHz
Max. Transmit Pwr : 0.035 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 62 mm
Depth : 15 mm
Antenna Type : Internal
Orientation : Bottom
Power Drift-Start : 0.128 W/kg
Power Drift-Finish: 0.131 W/kg
Power Drift (%) : 2.341

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 : 13-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 46.00 RH%
Epsilon : 52.04 F/m
Sigma : 1.97 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 3.61
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       : 13-Sep-2010
Set-up Time       : 6:35:34 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Bottom
Separation        : 12 mm
Channel           : Mid
```




```
1 gram SAR value    : 0.201 W/kg
10 gram SAR value   : 0.164 W/kg
Area Scan Peak SAR  : 0.206 W/kg
Zoom Scan Peak SAR  : 0.350 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 13-Sep-2010
Starting Time : 13-Sep-2010 10:10:56 AM
End Time : 13-Sep-2010 10:27:15 AM
Scanning Time : 979 secs

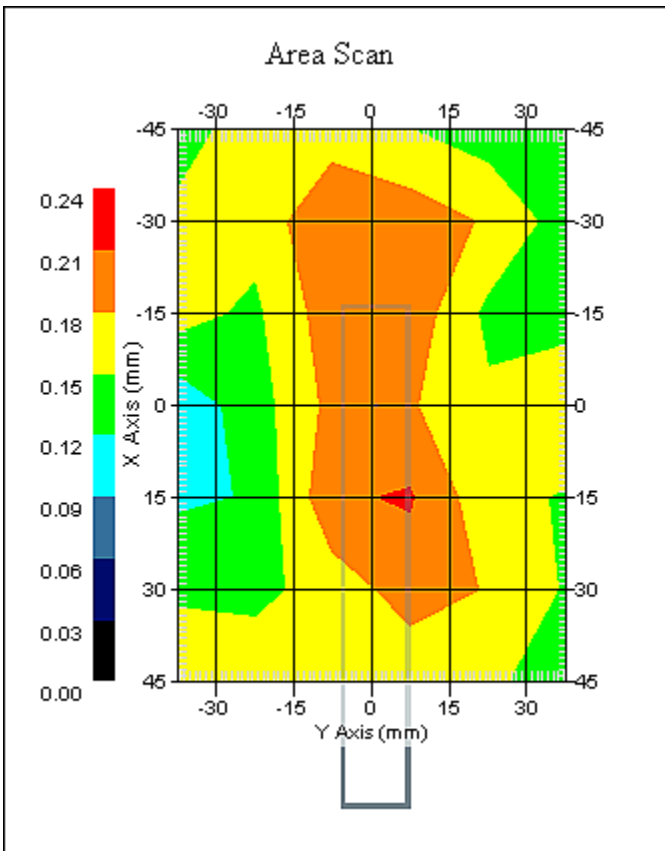
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : 802.11b
Model : MiFi3352
Frequency : 2450.00 MHz
Max. Transmit Pwr : 0.035 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 15 mm
Depth : 62 mm
Antenna Type : Internal
Orientation : Side
Power Drift-Start : 0.207 W/kg
Power Drift-Finish: 0.211 W/kg
Power Drift (%) : 1.931

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 : 13-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 46.00 RH%
Epsilon : 52.04 F/m
Sigma : 1.97 S/m
Density : 1000.00 kg/cu. m

Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 3.61
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       : 13-Sep-2010
Set-up Time       : 6:35:34 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Side
Separation        : 12 mm
Channel           : Mid
```




```
1 gram SAR value    : 0.170 W/kg
10 gram SAR value   : 0.151 W/kg
Area Scan Peak SAR  : 0.213 W/kg
Zoom Scan Peak SAR  : 0.280 W/kg
```

SAR Test Report

By Operator : Jay
Measurement Date : 13-Sep-2010
Starting Time : 13-Sep-2010 10:46:18 AM
End Time : 13-Sep-2010 11:02:33 AM
Scanning Time : 975 secs

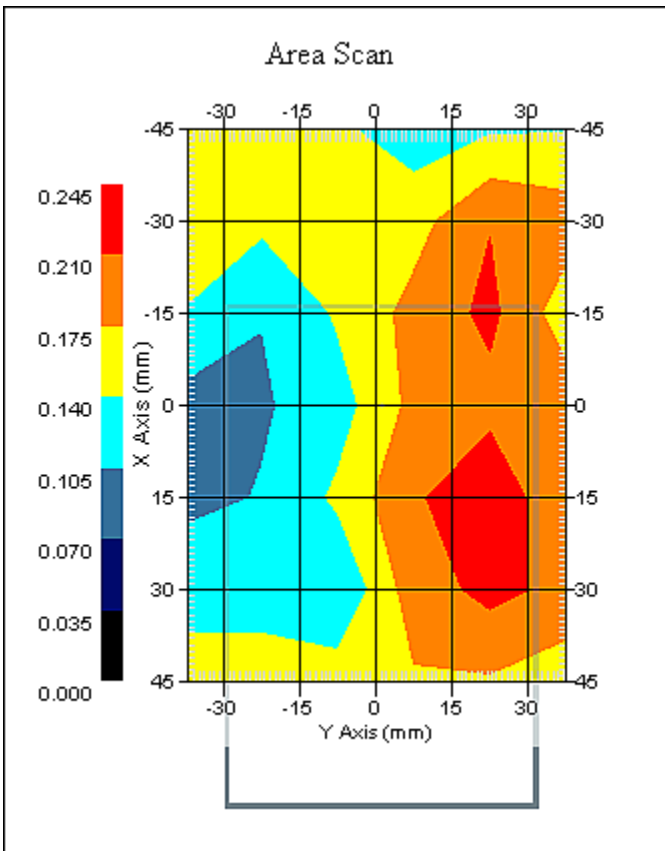
Product Data
Device Name : Novatel Wireless
Serial No. : 0026E8A23E3A
Mode : 802.11g
Model : MiFi3352
Frequency : 2450.00 MHz
Max. Transmit Pwr : 0.035 W
Drift Time : 0 min(s)
Length : 98 mm
Width : 62 mm
Depth : 15 mm
Antenna Type : Internal
Orientation : Top
Power Drift-Start : 0.145 W/kg
Power Drift-Finish: 0.150 W/kg
Power Drift (%) : 3.447

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 : 13-Sep-2010
Temperature : 20.00 °C
Ambient Temp. : 23.00 °C
Humidity : 46.00 RH%
Epsilon : 52.04 F/m
Sigma : 1.97 S/m
Density : 1000.00 kg/cu. m

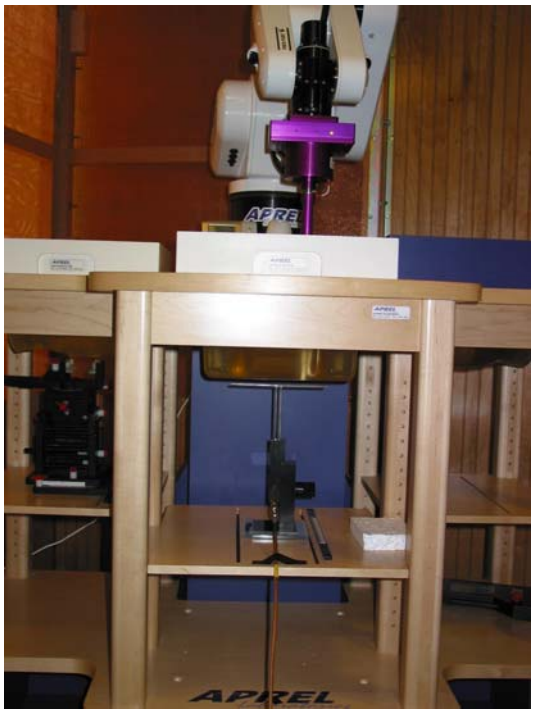
Probe Data
Name : RFEL 217
Model : E020
Type : E-Field Triangle
Serial No. : 217
Last Calib. Date : 21-Oct-2009
Frequency : 2450.00 MHz
Duty Cycle Factor: 1
Conversion Factor: 3.61
Probe Sensitivity: 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point: 95.00 mV
Offset : 1.56 mm

```
Measurement Data
Crest Factor      : 1
Scan Type         : Complete
Tissue Temp.      : 20.00 °C
Ambient Temp.     : 23.00 °C
Set-up Date       : 13-Sep-2010
Set-up Time       : 6:35:34 AM
Area Scan         : 7x6x1 : Measurement x=15mm, y=15mm, z=4mm
Zoom Scan         : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

Other Data
DUT Position      : Top
Separation        : 12 mm
Channel           : Mid
```

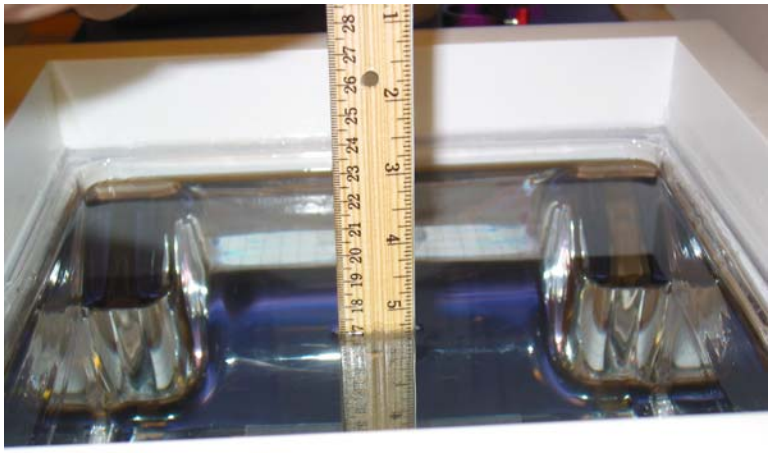



```
1 gram SAR value    : 0.227 W/kg
10 gram SAR value   : 0.176 W/kg
Area Scan Peak SAR  : 0.242 W/kg
Zoom Scan Peak SAR  : 0.280 W/kg
```

Appendix C – SAR Test Setup Photos



System Body Configuration



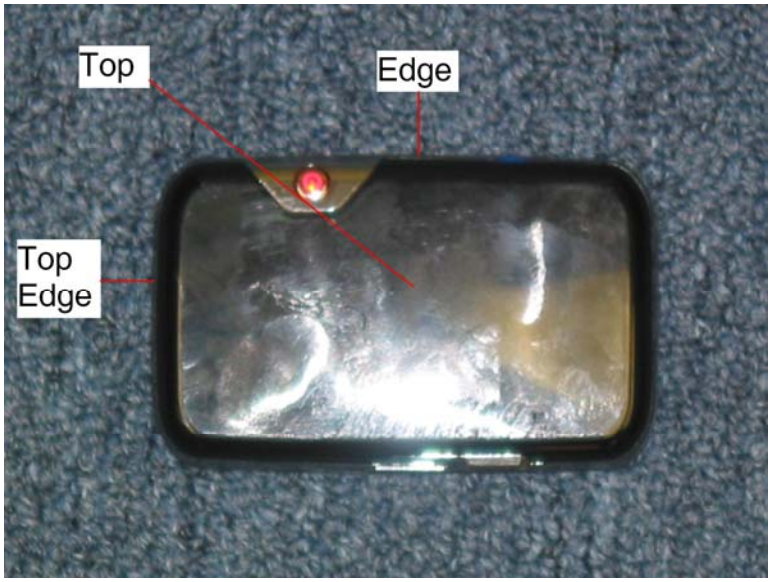
Body Tissue Depth

Top Configuration 12 mm

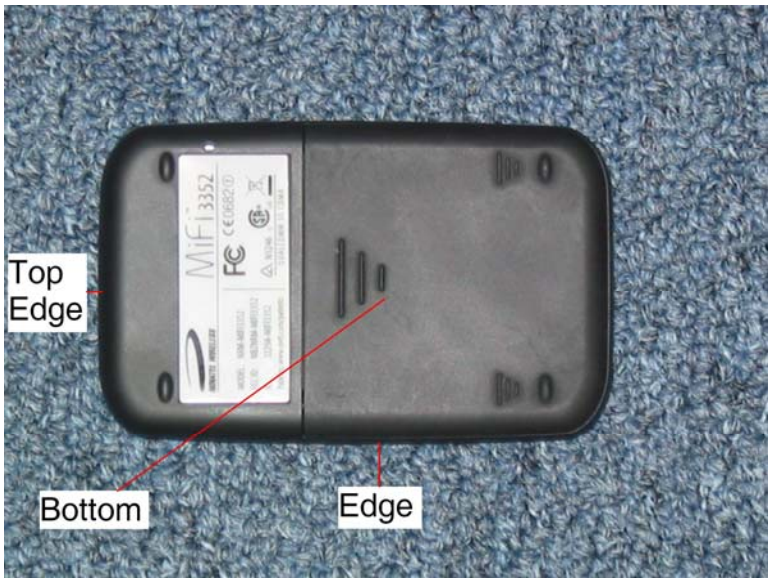
Bottom Configuration 12 mm

Top Edge Configuration 12 mm

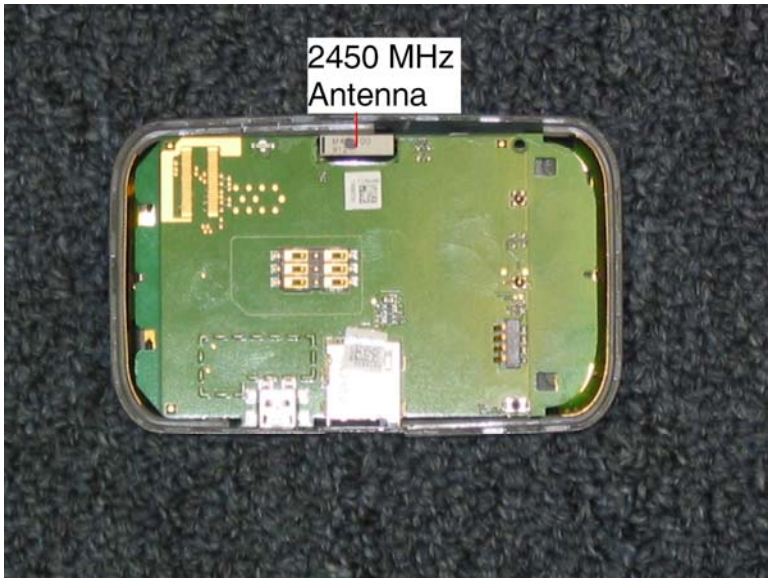
Edge Configuration 12 mm



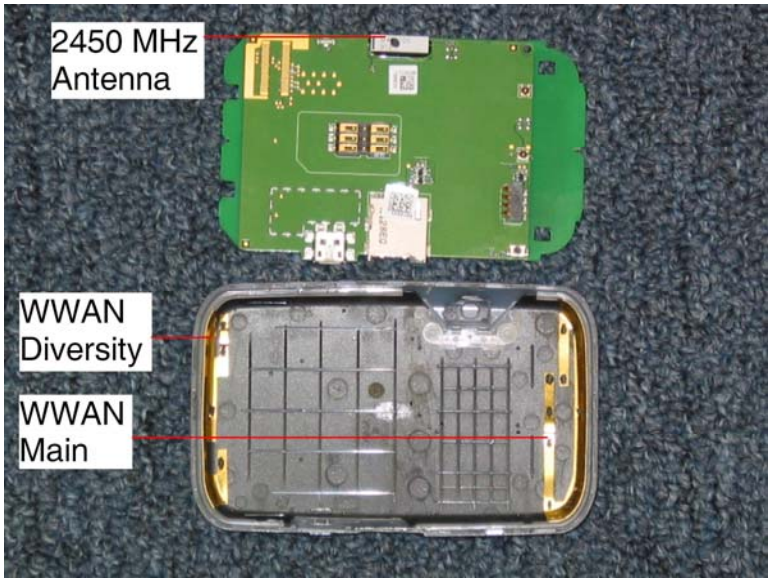
Top/Front of Device



Bottom/Back of Device



2450 MHz Antenna Location



All Antenna Locations

Appendix D – Probe Calibration Data Sheets

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-1079

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.: 217

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2
Project No: RFEL-E020-CAL-5477

Calibrated: 21st October 2009
Released on: 28th October 2009

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-020 217.

References

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

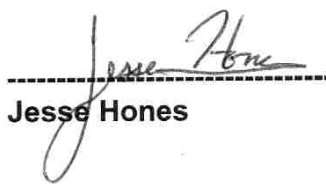
Conditions

Probe 217 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:	217
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: 54.9 (+/-5%) **Sigma:** 1.04 S/m (+/-5%)

ConvF

Channel X: 6.1

Channel Y: 6.1

Channel Z: 6.1

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

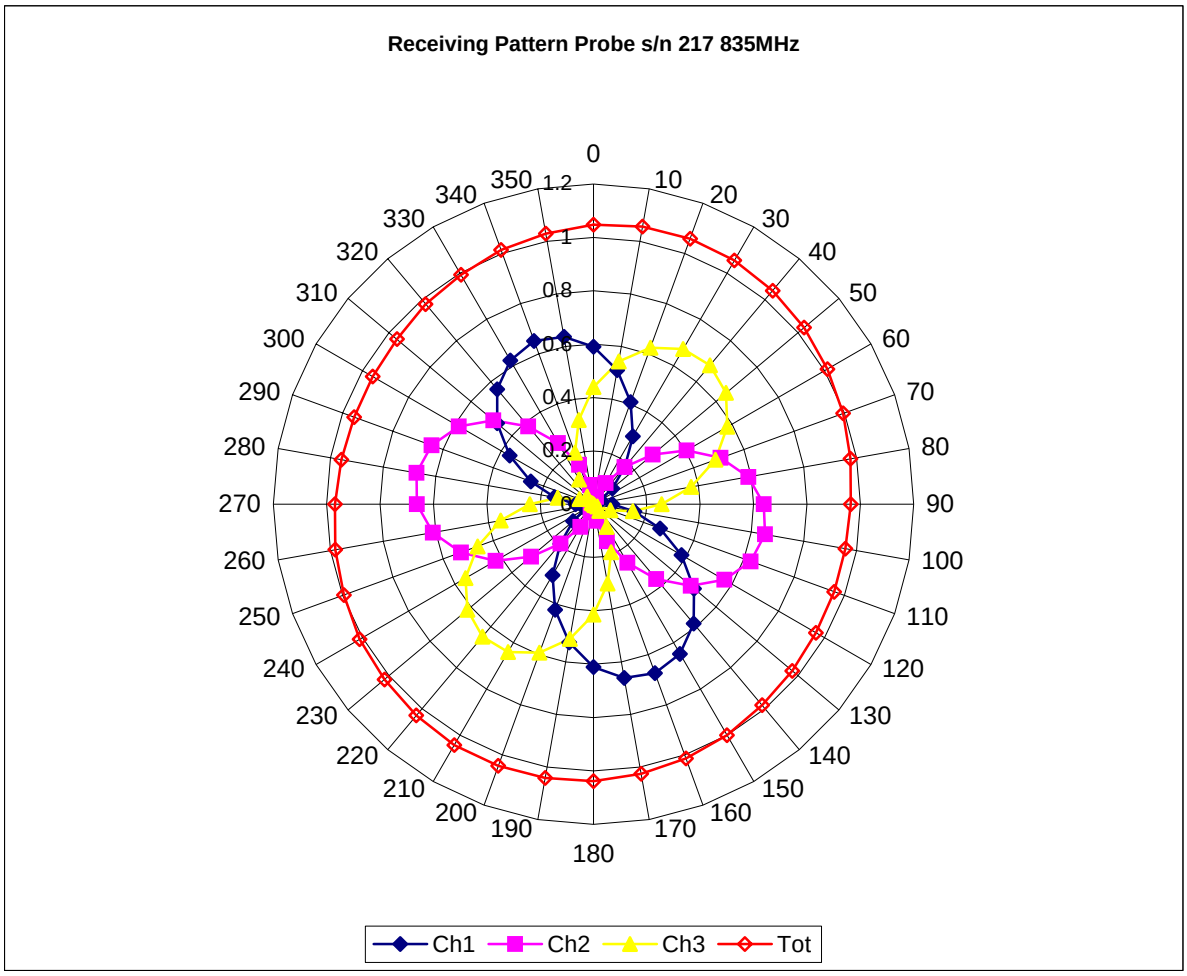
Boundary Effect:

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.

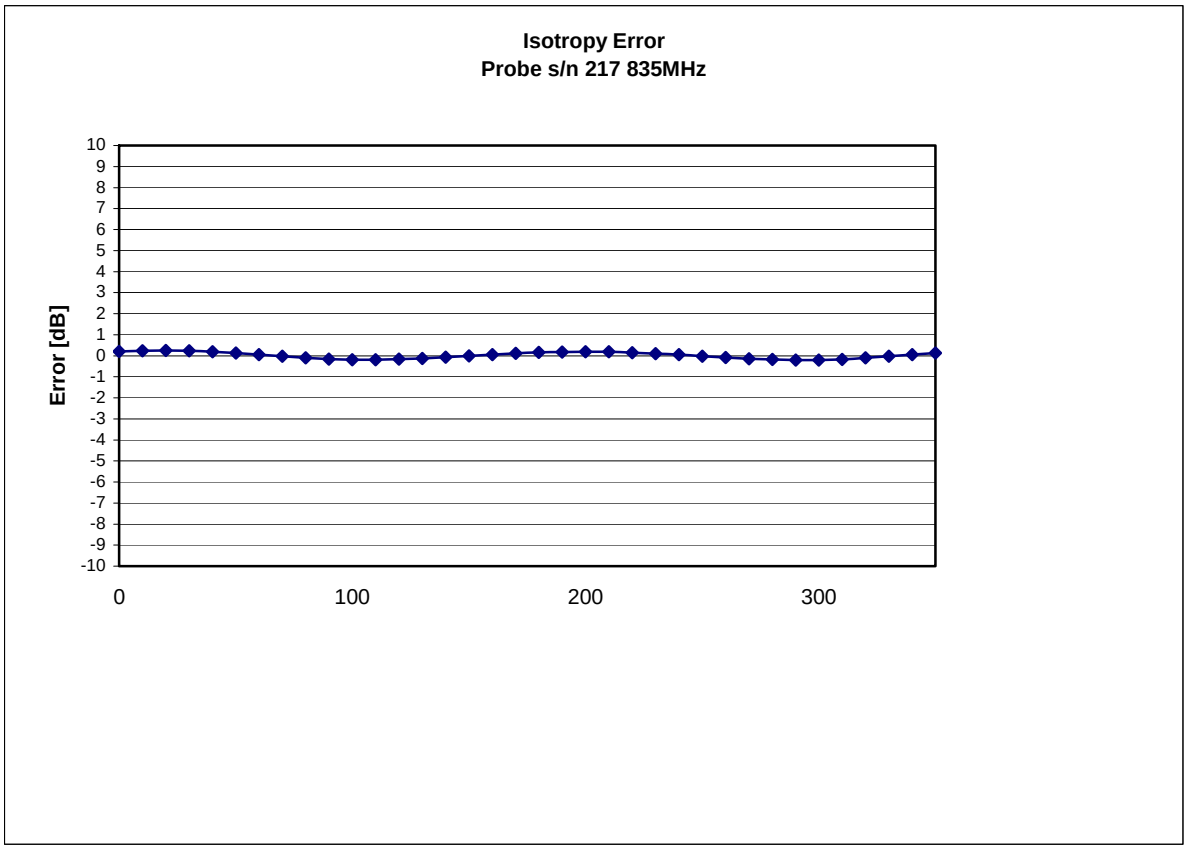
Spatial Resolution:

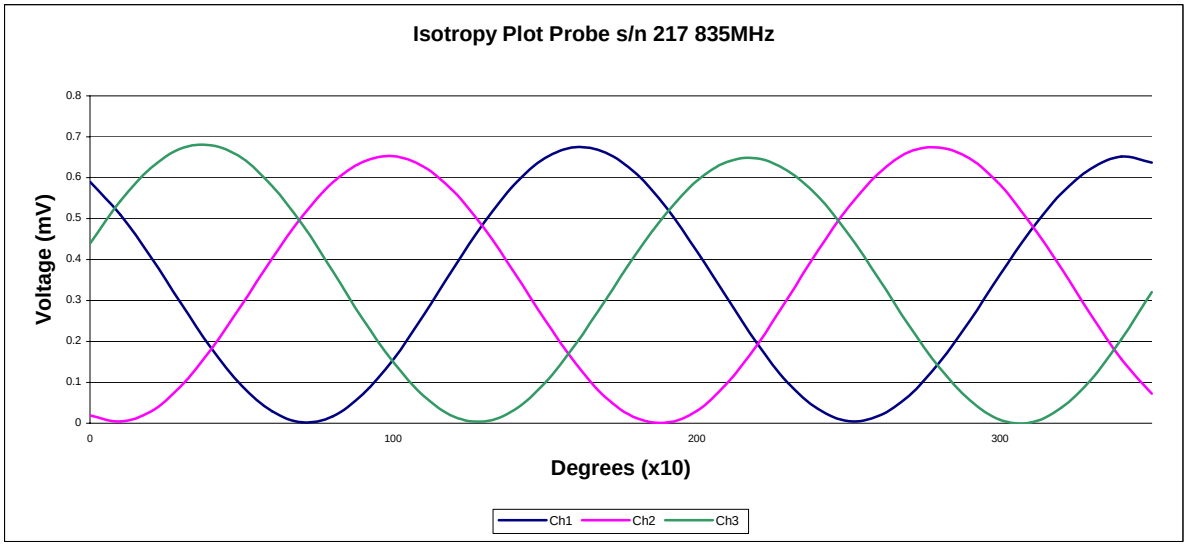
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 835 MHz (Air)



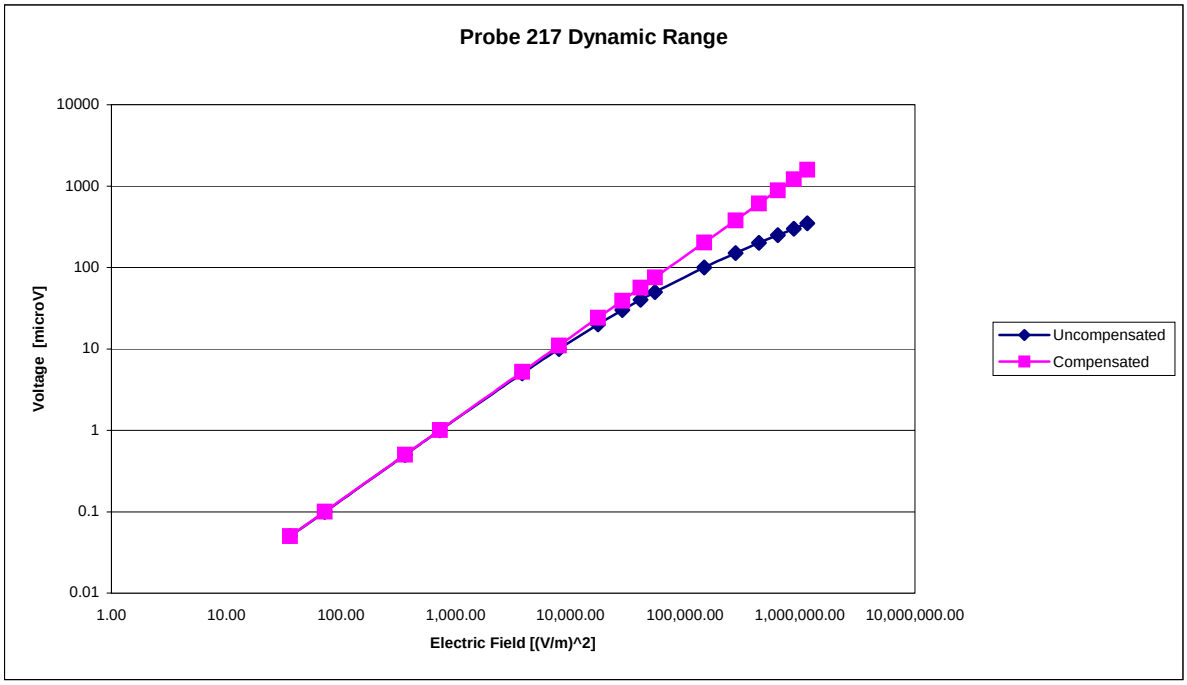
Isotropy Error 835 MHz (Air)



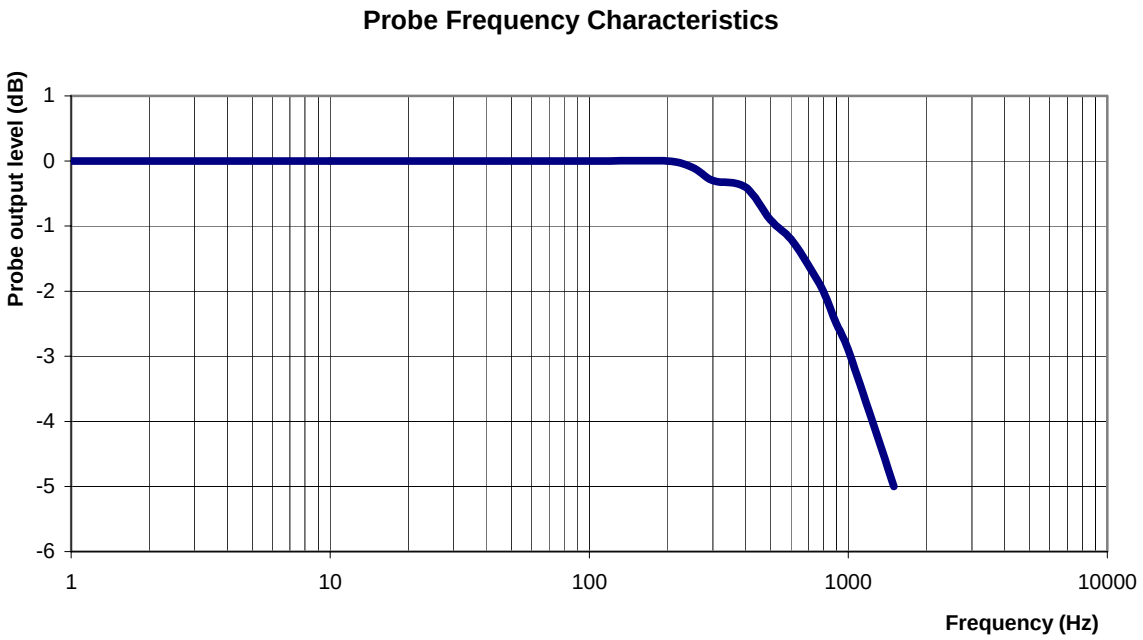


Isotropicity Tissue: 0.10 dB

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:	54.9 (+/-5%)	**Sigma:**	1.04 S/m (+/-5%)
ConvF			
Channel X:	6.1	7%(K=2)	
Channel Y:	6.1	7%(K=2)	
Channel Z:	6.1	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 2009.

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-1084

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.: 217

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2
Project No: RFEL-E020-CAL-5477

Calibrated: 21st October 2009
Released on: 28th October 2009

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-020 217.

References

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

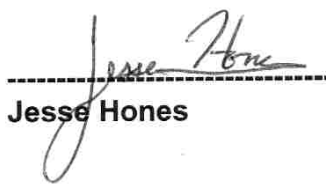
Conditions

Probe 217 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:	217
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: 54.6 (+/-5%) **Sigma:** 1.55 S/m (+/-5%)

ConvF

Channel X: 4.85

Channel Y: 4.85

Channel Z: 4.85

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

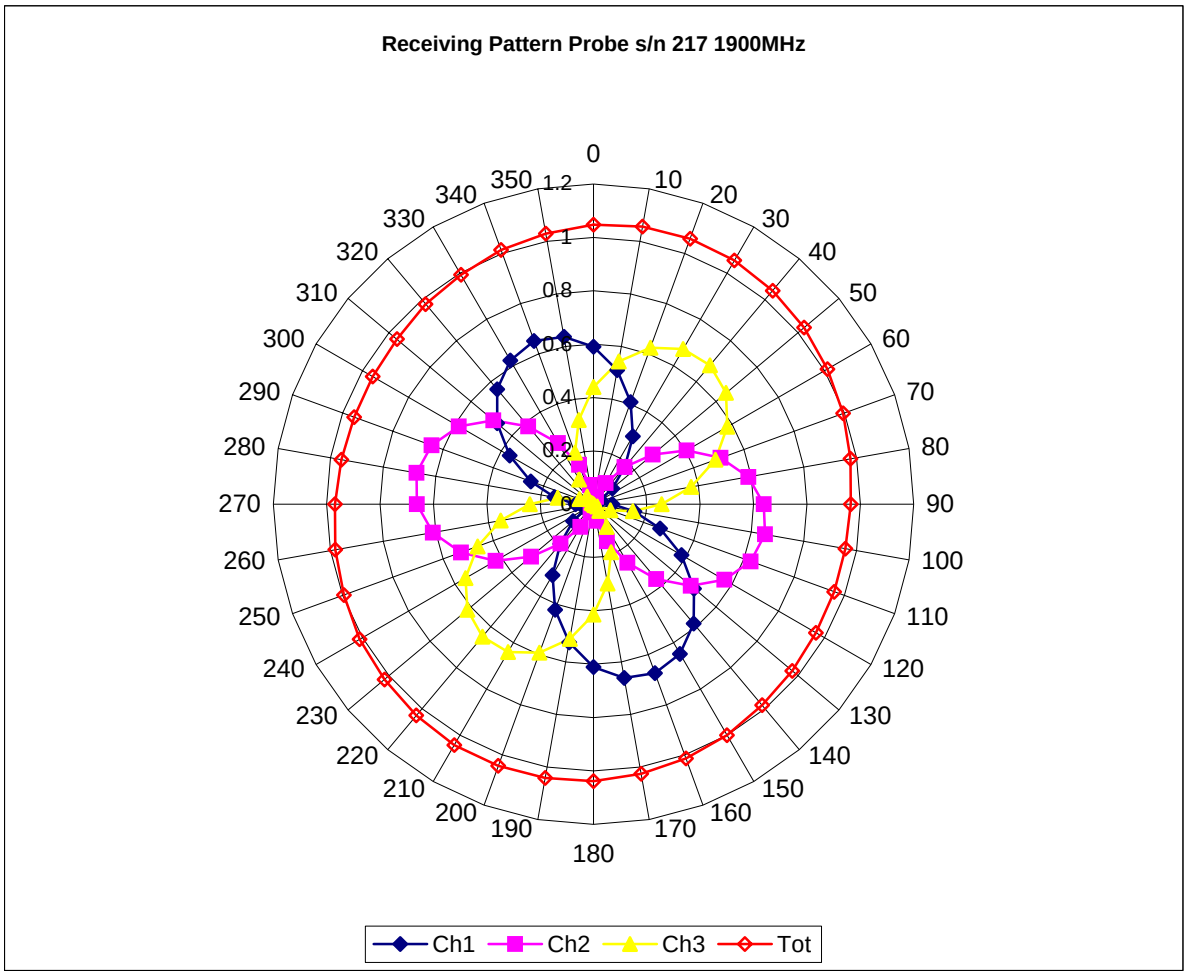
Boundary Effect:

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.

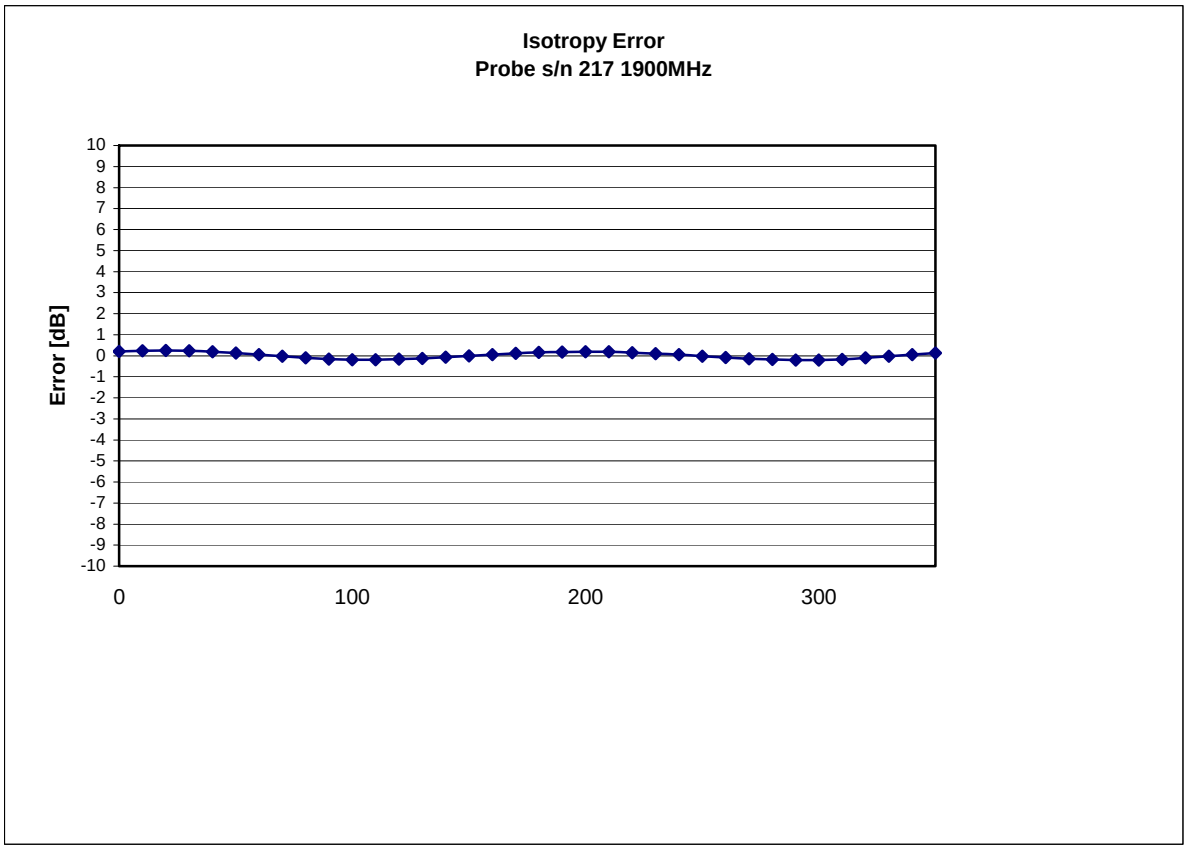
Spatial Resolution:

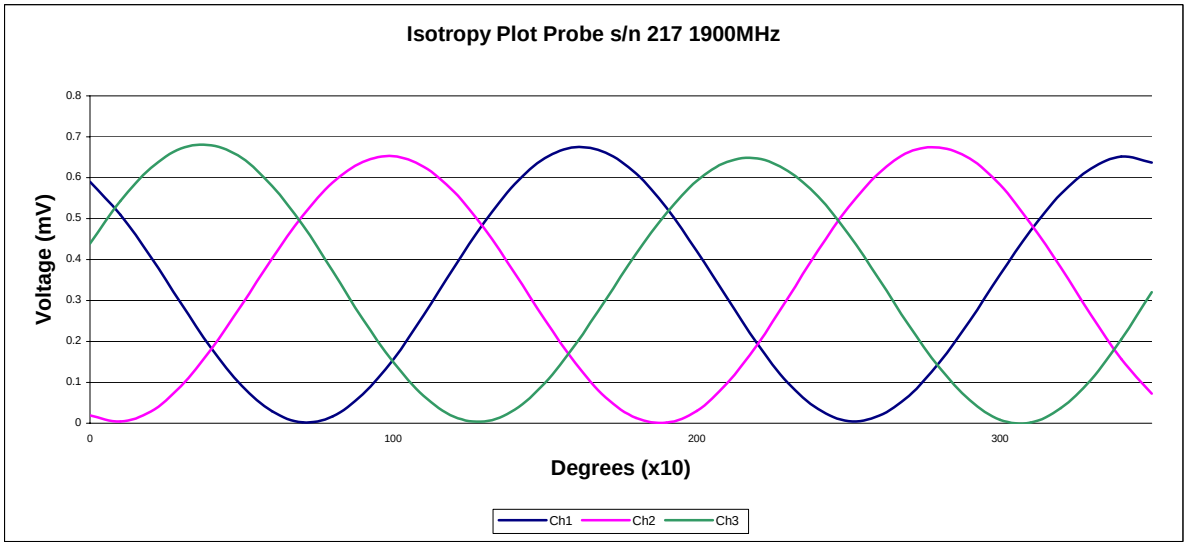
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 1900 MHz (Air)



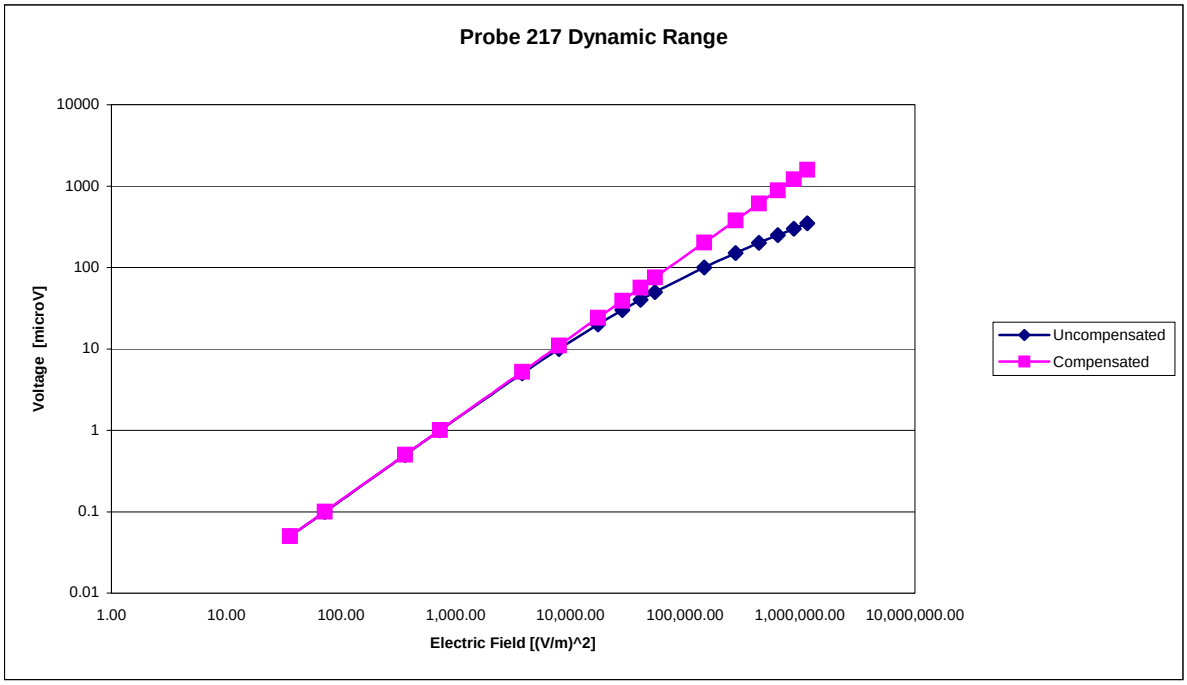
Isotropy Error 1900 MHz (Air)



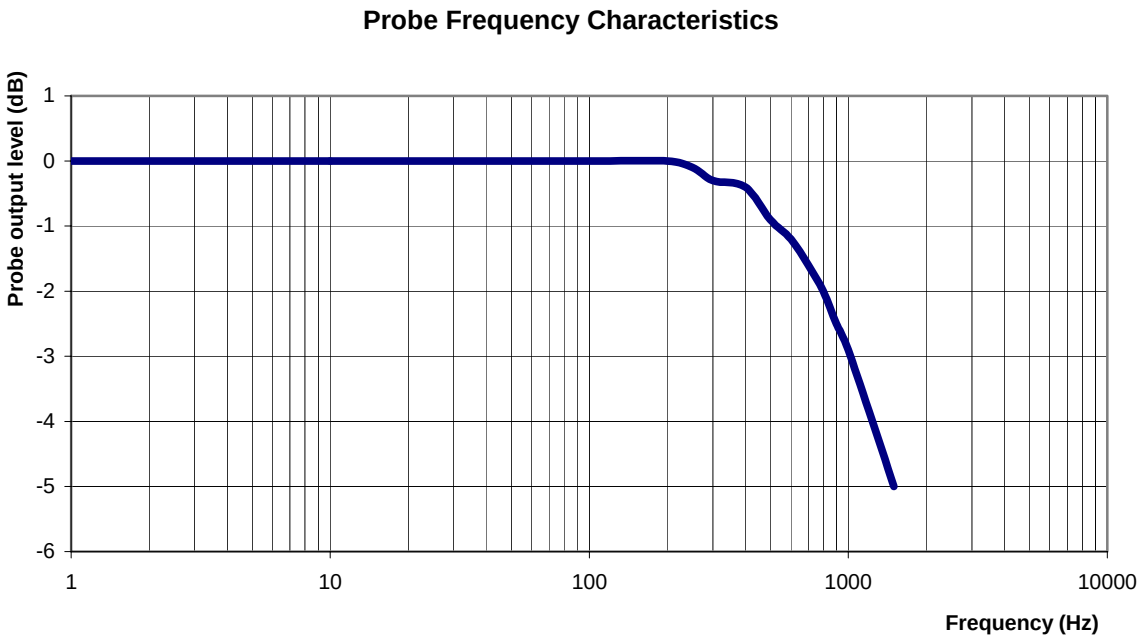


Isotropicity Tissue: 0.10 dB

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:	54.6 (+/-5%)	**Sigma:**	1.55 S/m (+/-5%)
ConvF			
Channel X:	4.85	7%(K=2)	
Channel Y:	4.85	7%(K=2)	
Channel Z:	4.85	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 2009.

NCL CALIBRATION LABORATORIES

Calibration File No.: CP-1086

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

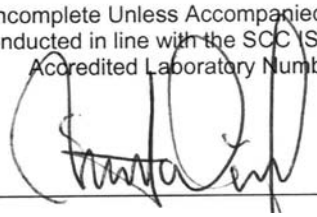
Model No.: E-020

Serial No.: 217

Calibration Procedure: SSI/DRB-TP-D01-032-E020-V2
Project No: RFEL-E020-CAL-5477

Calibrated: 21st October 2009
Released on: 28th October 2009

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-020 217.

References

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

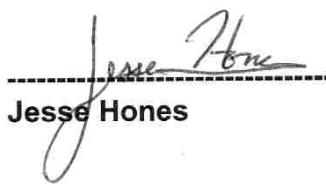
Conditions

Probe 217 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:	217
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: 53.4 (+/-5%) **Sigma:** 1.95 S/m (+/-5%)

ConvF

Channel X: 3.61

Channel Y: 3.61

Channel Z: 3.61

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

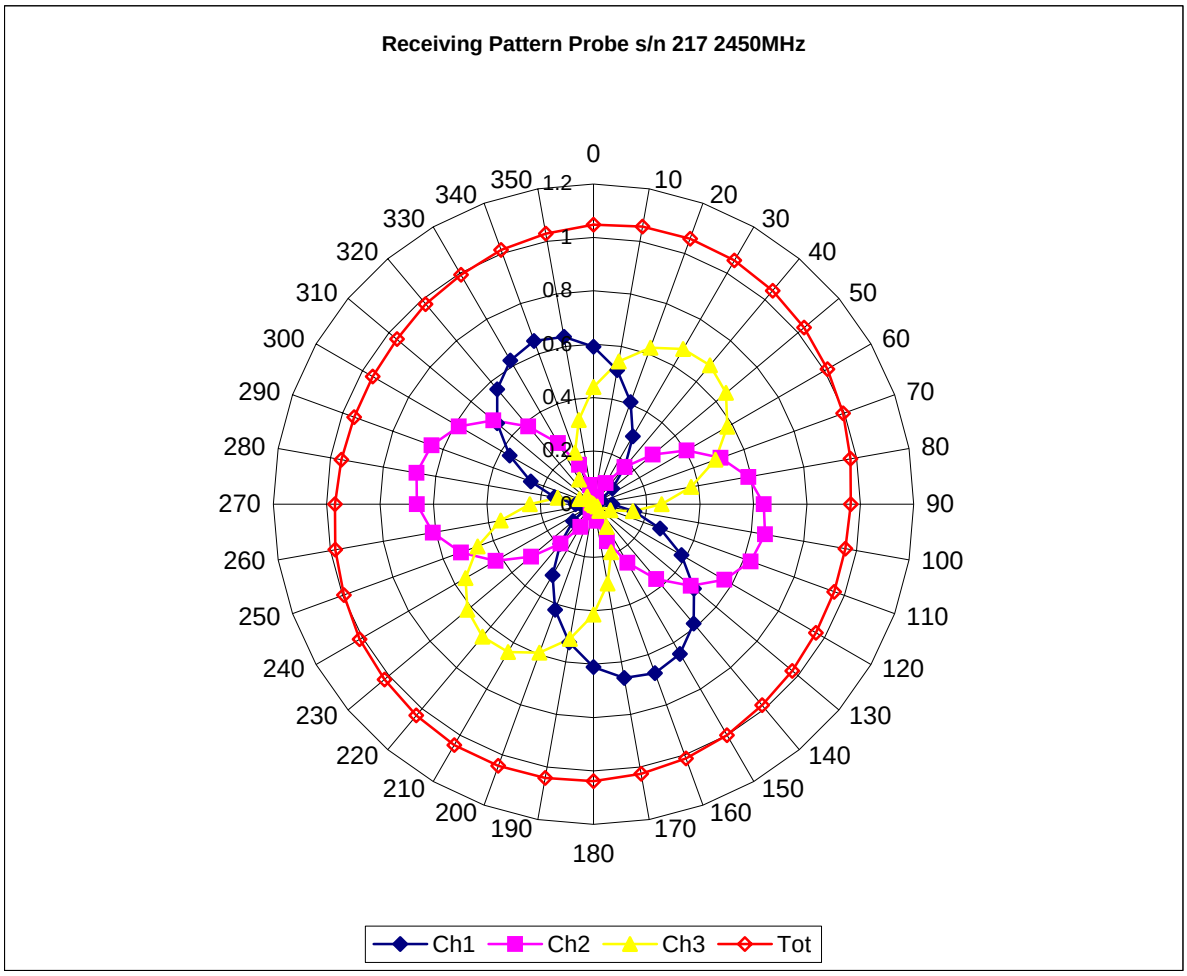
Boundary Effect:

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.

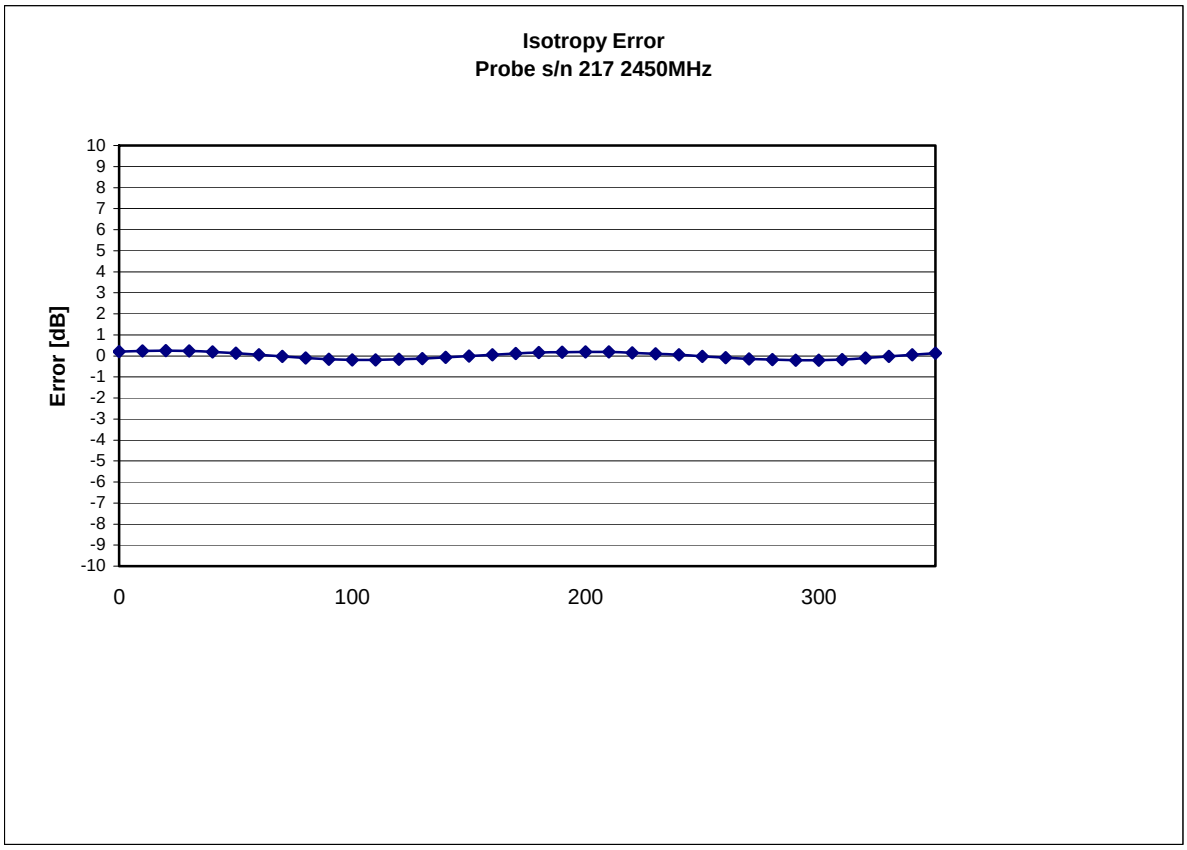
Spatial Resolution:

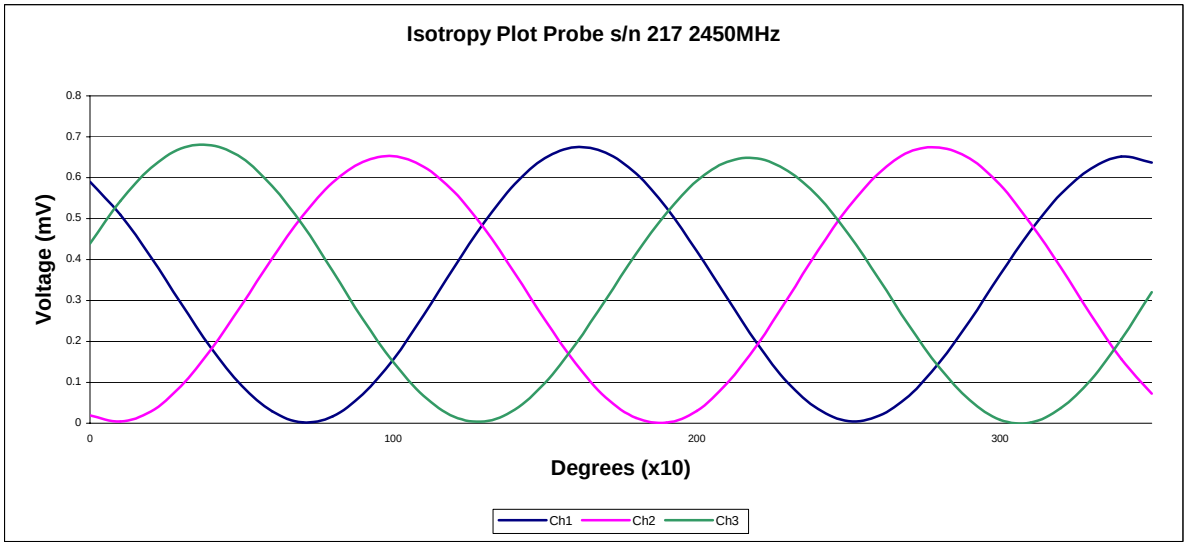
The measured probe tip diameter is 5 mm (+/- 0.01 mm) and therefore meets the requirements of SSI/DRB-TP-D01-032 for spatial resolution.

Receiving Pattern 2450 MHz (Air)



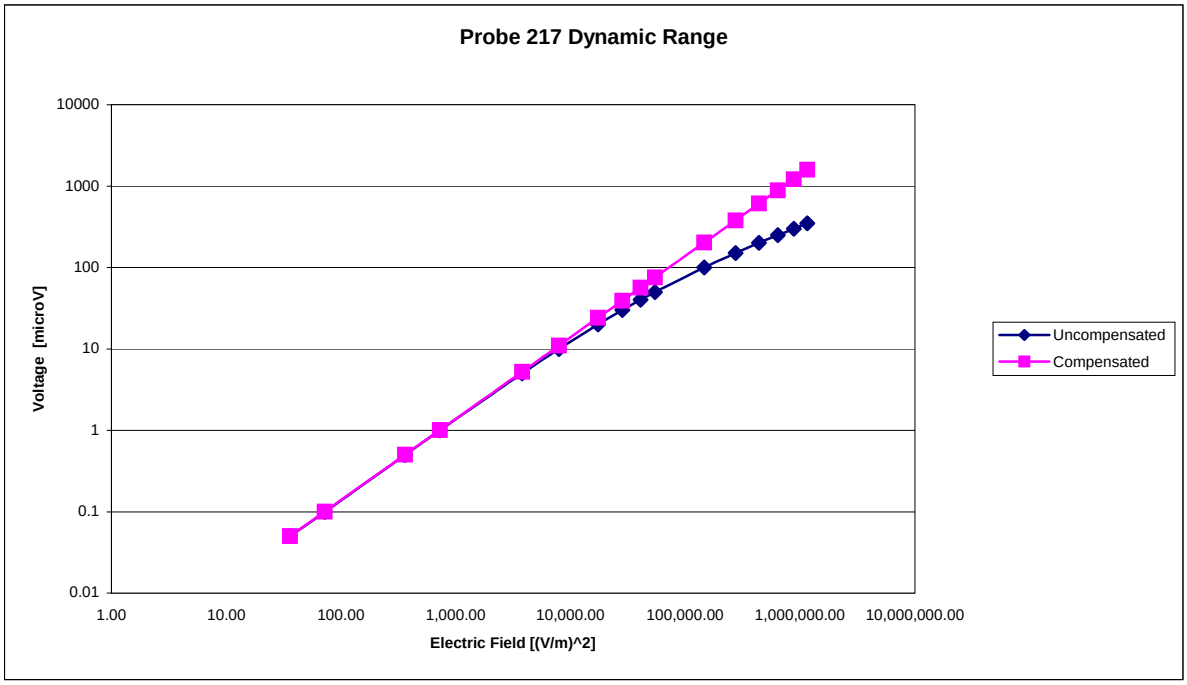
Isotropy Error 2450 MHz (Air)



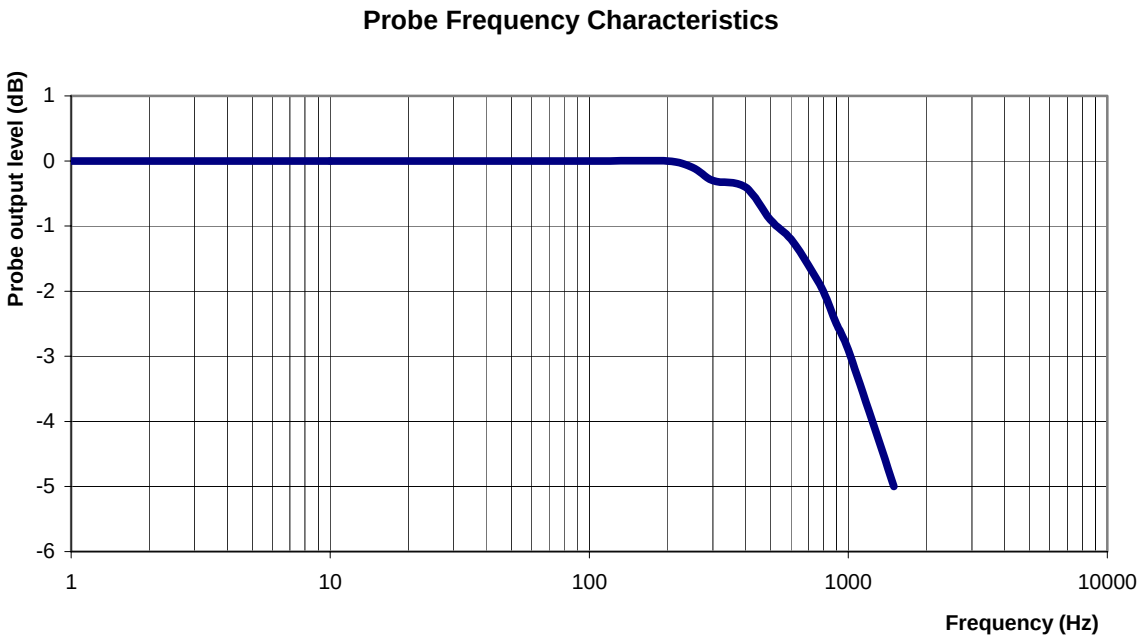


Isotropicity Tissue: 0.10 dB

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:	53.4 (+/-5%)	**Sigma:**	1.95 S/m (+/-5%)
ConvF			
Channel X:	3.61	7%(K=2)	
Channel Y:	3.61	7%(K=2)	
Channel Z:	3.61	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 2009.

Appendix E – Dipole Calibration Data Sheets

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1114
Project Number: RFEL-835-Dipole-5480

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.

Validation Dipole

Manufacturer: APREL Laboratories
Part number: ALS-D-835-S-2
Frequency: 835 MHz
Serial No: 180-00561

Customer: RFEL

Calibrated: 14th January 2010
Released on: 19th January 2010

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

Released By: _____

NCL CALIBRATION LABORATORIES
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4162

Conditions

Dipole 180-00561 was a new calibration.

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

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

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

Stuart Nicol

C. Teodorian

Calibration Results Summary

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

Mechanical Dimensions

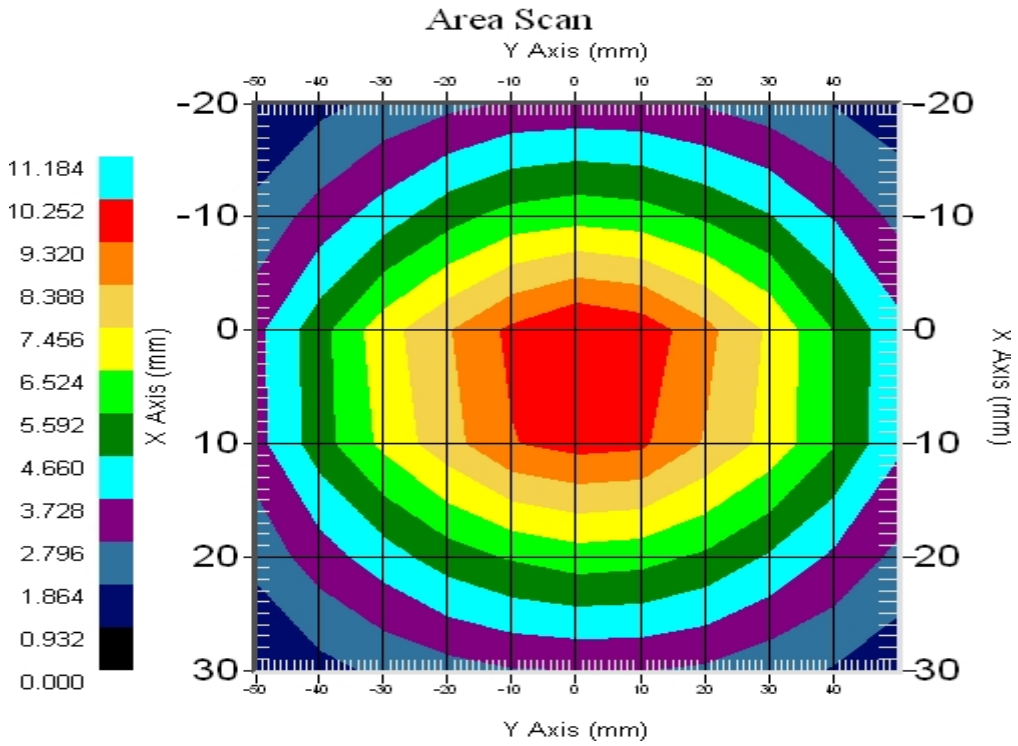
Length: 161.0 mm
Height: 89.8 mm

Electrical Specification

SWR: 1.009U
Return Loss: -47.751 dB
Impedance: 50.065 Ω

System Validation Results

Frequency	1 Gram	10 Gram	Peak
835 MHz	9.49	6.1	14.21



Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 180-00561. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 2225.

References

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

Conditions

Dipole 180-00561 was a new calibration.

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

Dipole Calibration Results

Mechanical Verification

APREL Length	APREL Height	Measured Length	Measured Height
161.0 mm	89.8 mm	162.1 mm	89.8 mm

Tissue Validation

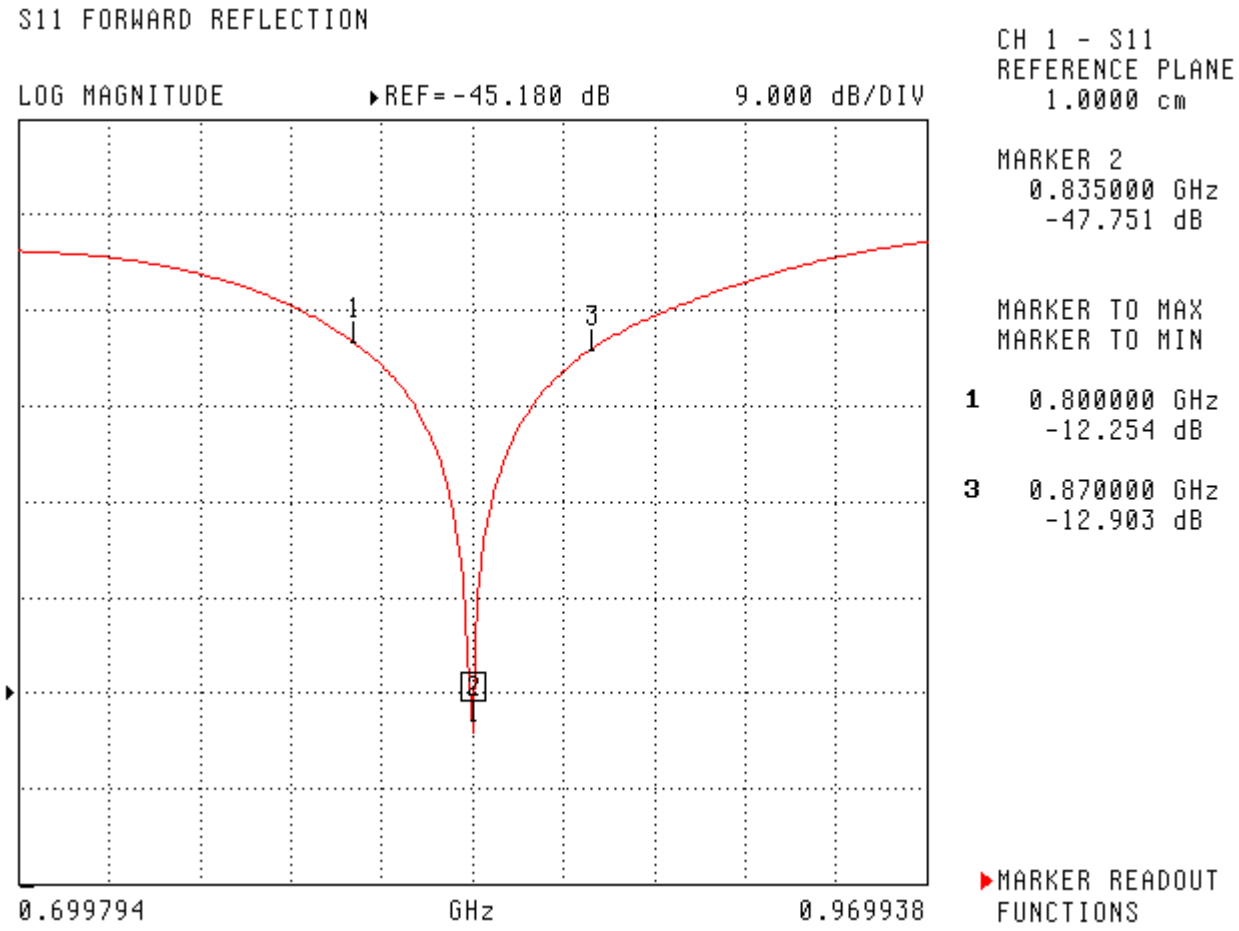
Head Tissue 835MHz	Measured
Dielectric constant, ε_r	41.54
Conductivity, σ [S/m]	0.91

Electrical Calibration

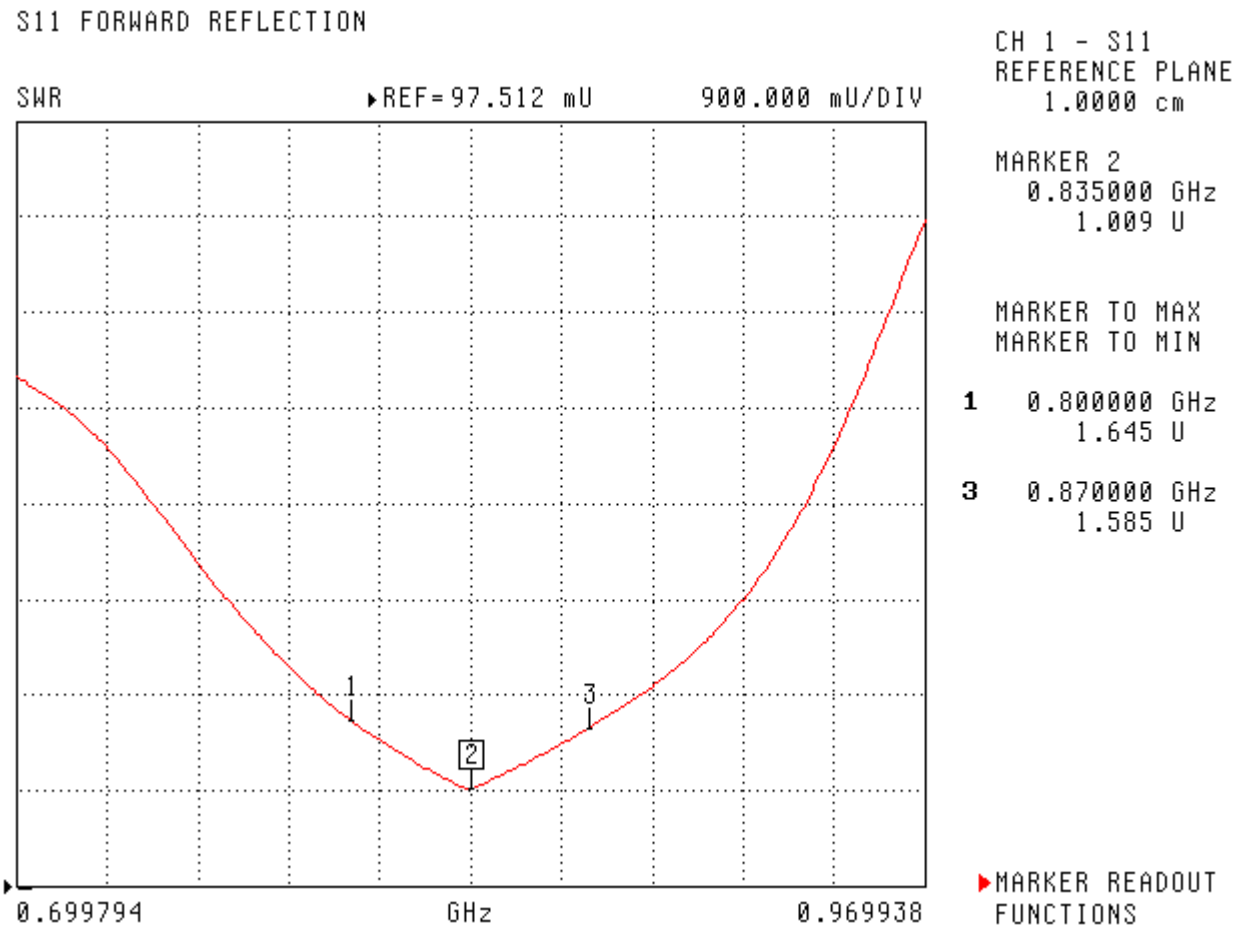
Test	Result
S11 RL	-47.751dB
SWR	1.009U
Impedance	50.065 Ω

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

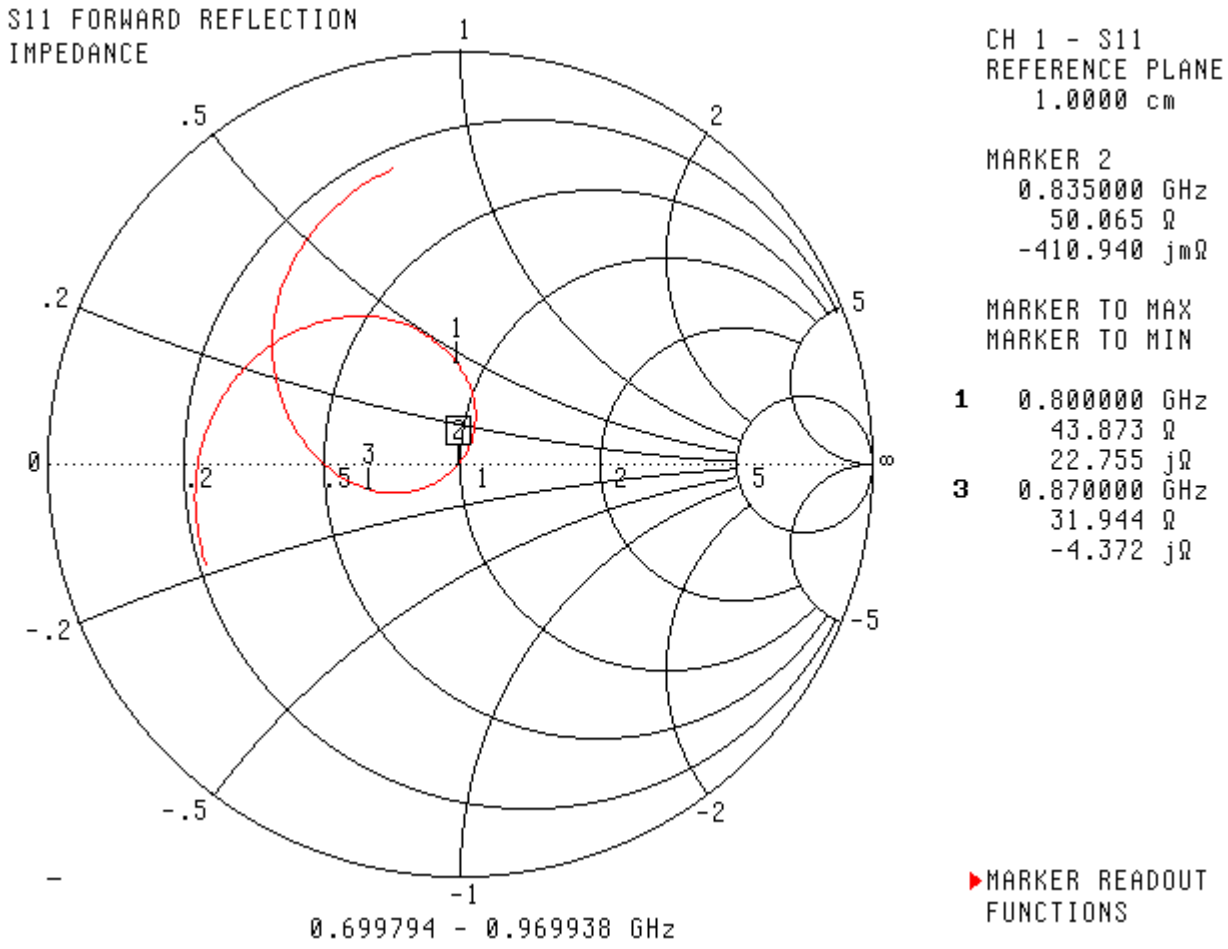
S11 Parameter Return Loss



SWR

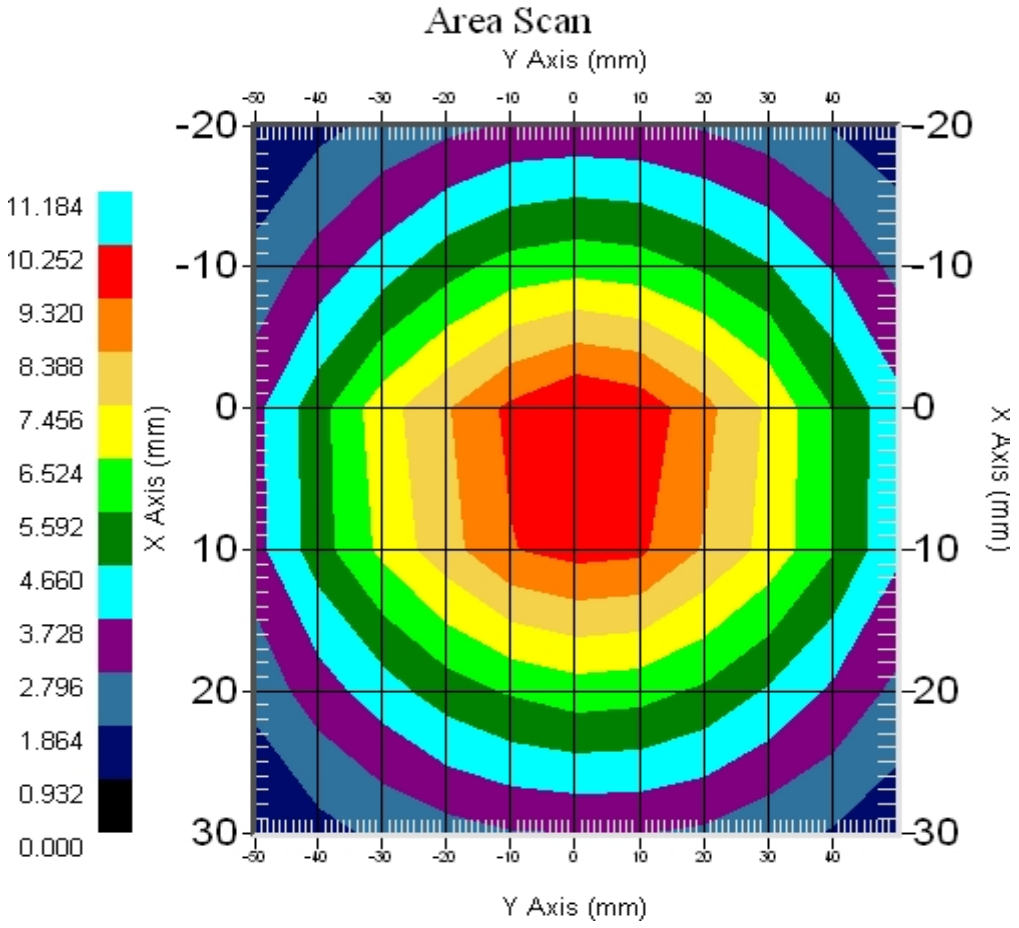


Smith Chart Dipole Impedance



System Validation Results Using the Electrically Calibrated Dipole

Head Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
835 MHz	9.49	6.1	14.21



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 2009.

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1115
Project Number: RFEL-1900-Dipole-5481

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.

Validation Dipole

Manufacturer: APREL Laboratories
Part number: ALS-D-1900-S-2
Frequency: 1900 MHz
Serial No: 210-00713

Customer: RFEL

Calibrated: 15th January 2010
Released on: 19th January 2010

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

Released By: _____

NCL CALIBRATION LABORATORIES

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

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

Conditions

Dipole 210-00713 was new and taken from stock prior to calibration.

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

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

Stuart Nicol

C. Teodorian

Calibration Results Summary

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

Mechanical Dimensions

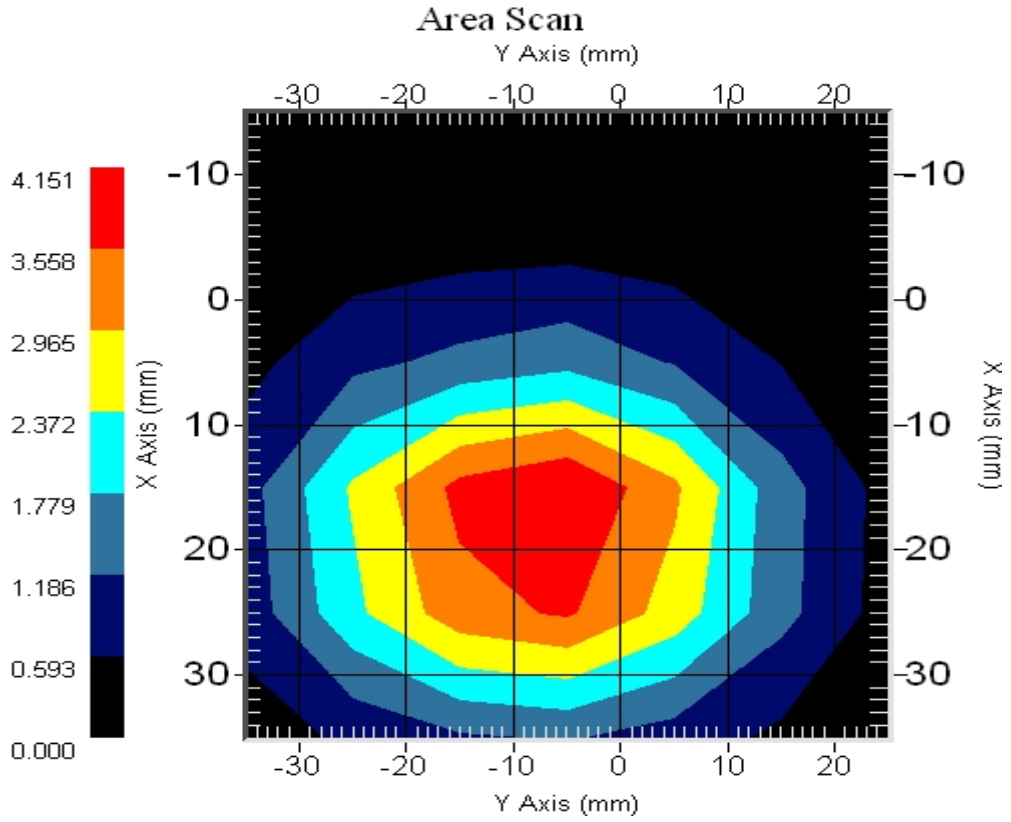
Length: 67.1 mm
Height: 38.9 mm

Electrical Specification

SWR: 1.011U
Return Loss: -45.642dB
Impedance: 50.194Ω

System Validation Results

Frequency	1 Gram	10 Gram	Peak
1900 MHz	38.7	20.5	69.7



Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 210-00713. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 226.

References

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

Conditions

Dipole 210-00713 was new taken from stock.

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

Dipole Calibration Results

Mechanical Verification

APREL Length	APREL Height	Measured Length	Measured Height
68.0 mm	39.5 mm	67.1mm	38.9 mm

Tissue Validation

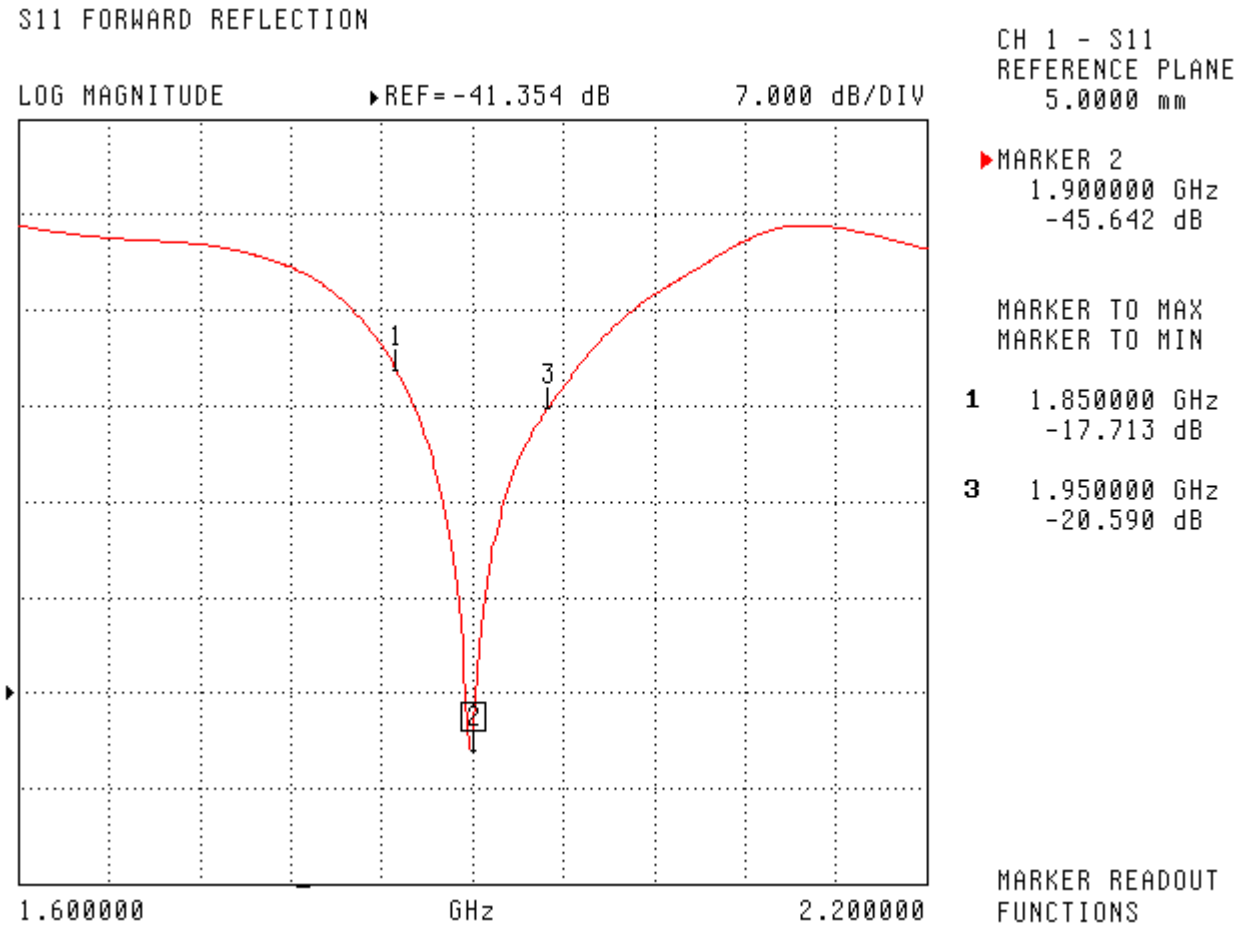
Head Tissue 1900 MHz	Measured
Dielectric constant, ε_r	40.03
Conductivity, σ [S/m]	1.38

Electrical Calibration

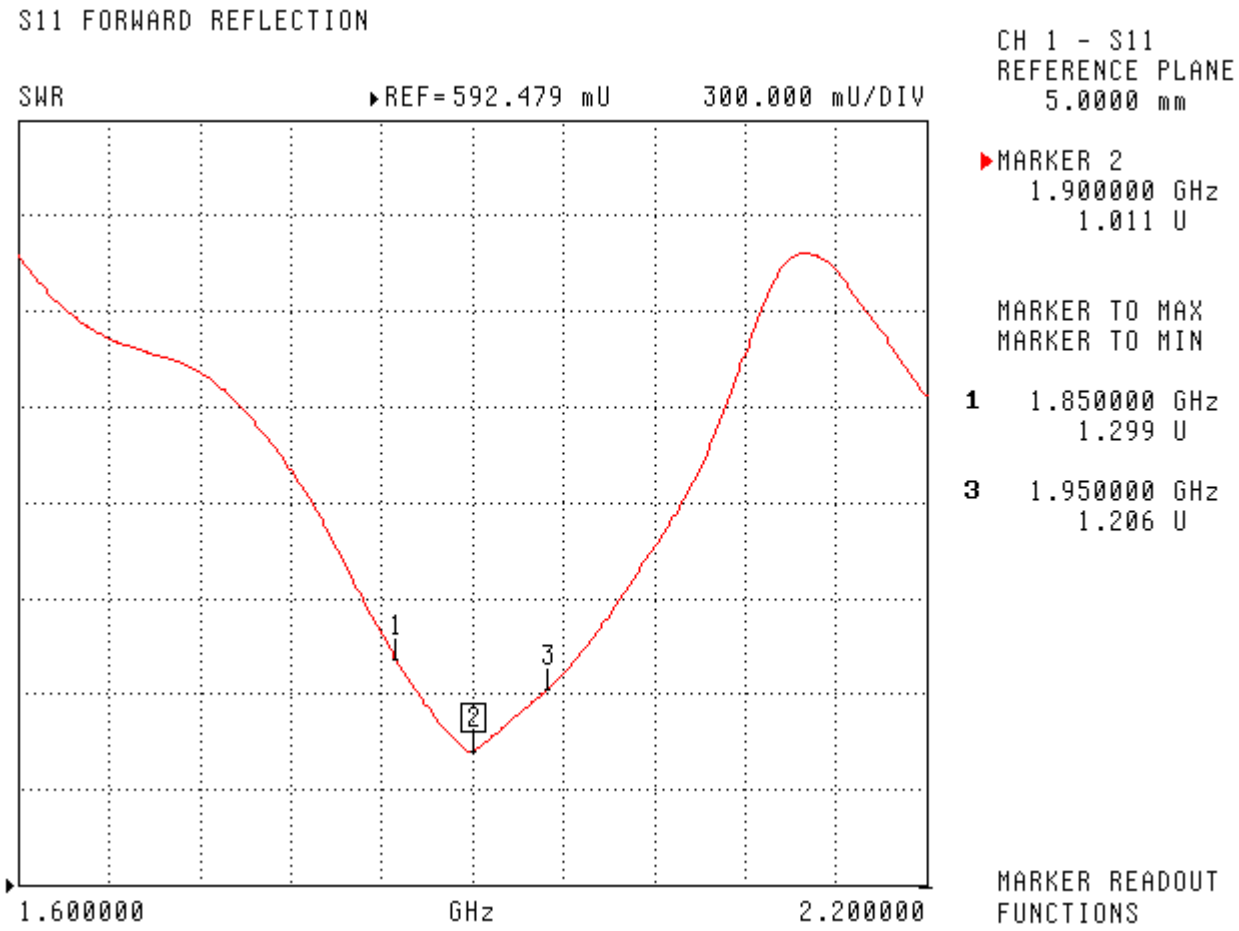
Test	Result
S11 R/L	-45.642dB
SWR	1.011U
Impedance	50.194 Ω

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

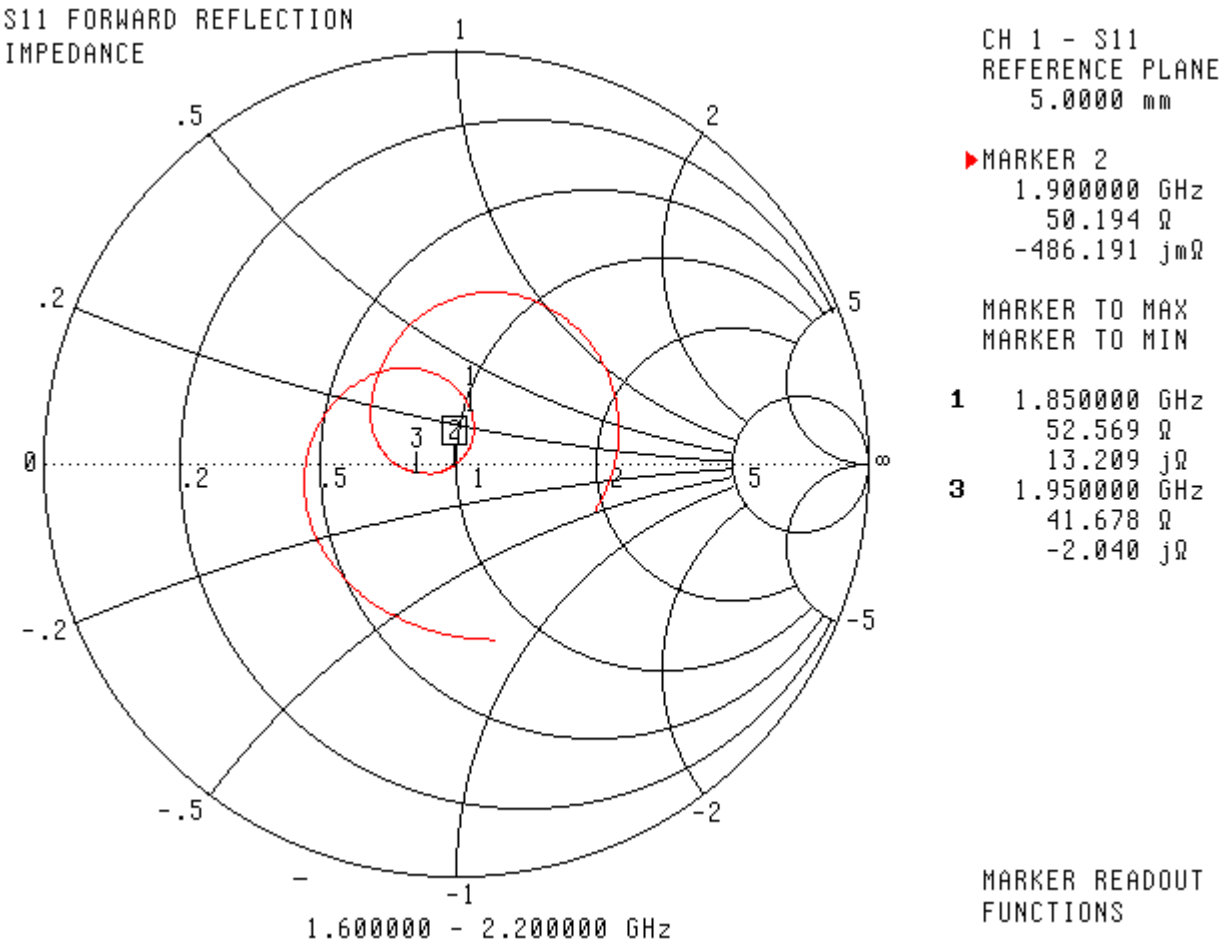
S11 Parameter Return Loss



SWR

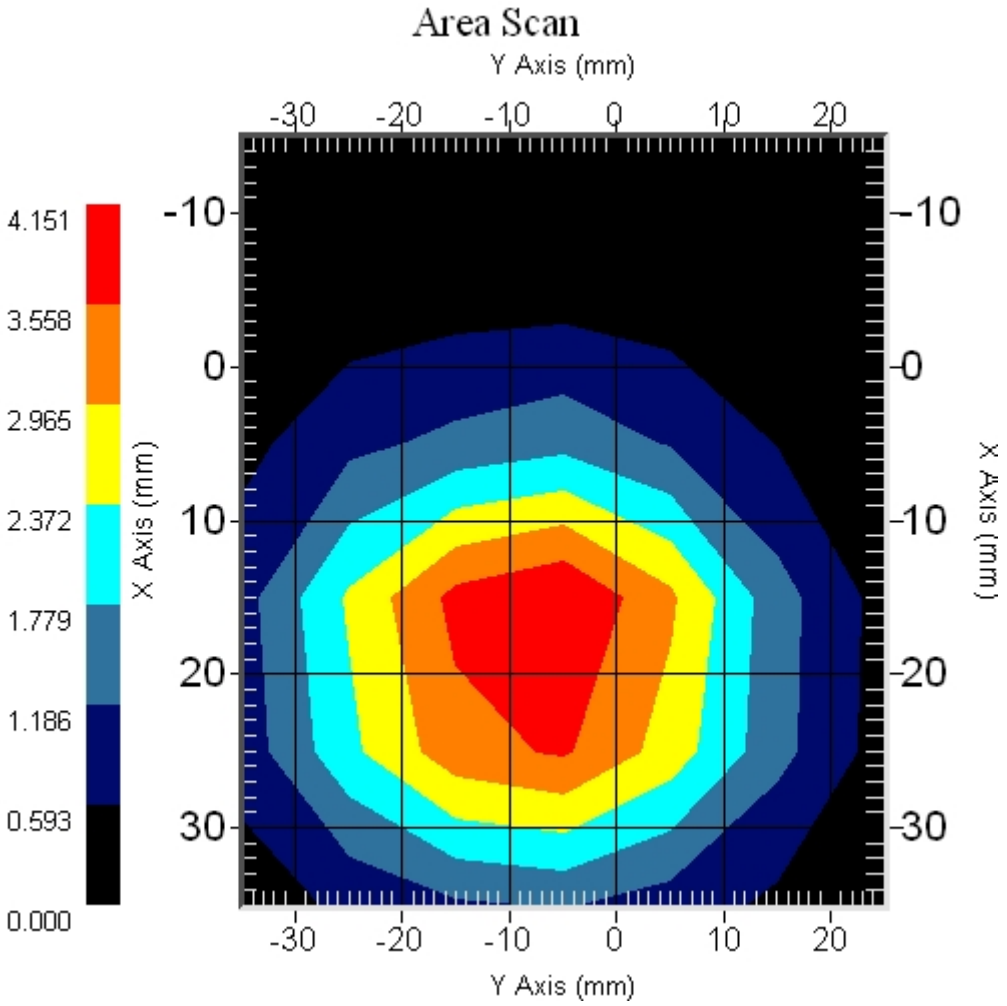


Smith Chart Dipole Impedance



System Validation Results Using the Electrically Calibrated Dipole

Head Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
1900 MHz	38.7	20.5	69.7



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 2009.

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1109
Project Number: RFEB-5495

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.

Validation Dipole

Manufacturer: APREL Laboratories
Part number: ALS-D-2450-S-2
Frequency: 2450 MHz
Serial No: RFE-278

Customer: RFEL

Calibrated: 12th January 2010
Released on: 12th January 2010

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

Released By: _____

NCL CALIBRATION LABORATORIES
51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6
Division of APREL Lab.
TEL: (613) 820-4988
FAX: (613) 820-4162

Conditions

Dipole RFE-278 was a new calibration.

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

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

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

Stuart Nicol

C. Teodorian

Calibration Results Summary

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

Mechanical Dimensions

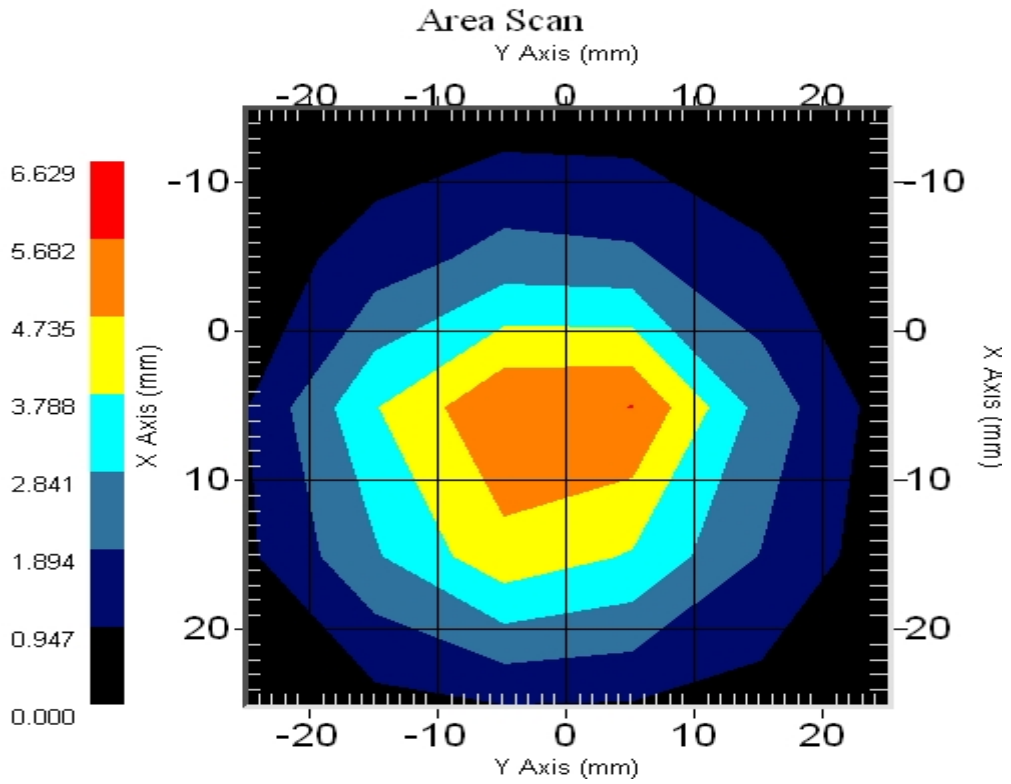
Length: 51.5 mm
Height: 30.4 mm

Electrical Specification

SWR: 1.070 U
Return Loss: -29.451 dB
Impedance: 50.710 Ω

System Validation Results @ 100mW

Frequency	1 Gram	10 Gram	Peak
2450 MHz	5.31	2.44	10.18



Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole RFE-278. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 226.

References

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

Conditions

Dipole RFE-278 was a re-calibration.

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

Dipole Calibration Results

Mechanical Verification

APREL Length	APREL Height	Measured Length	Measured Height
51.5 mm	30.4 mm	52.1 mm	31.0 mm

Tissue Validation

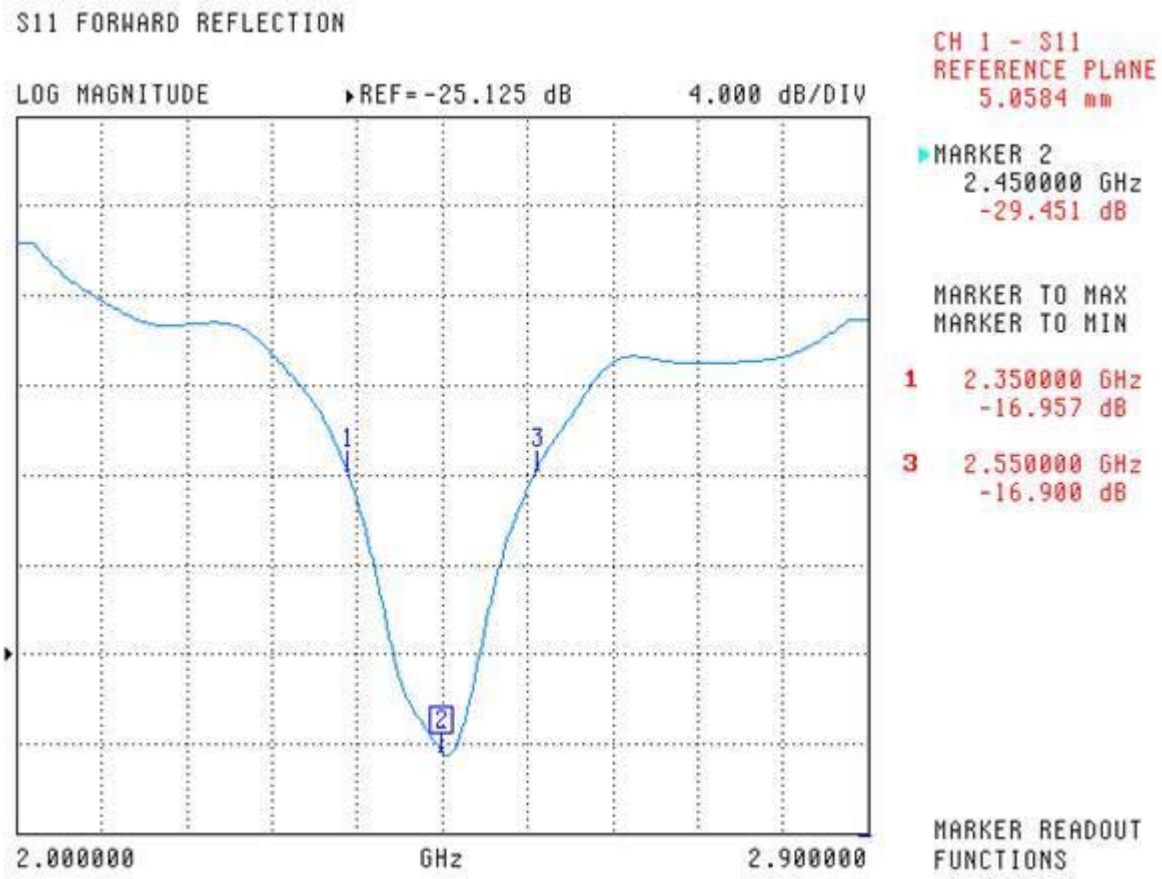
Head Tissue 2450 MHz	Measured
Dielectric constant, ε_r	39.8
Conductivity, σ [S/m]	1.85

Electrical Calibration

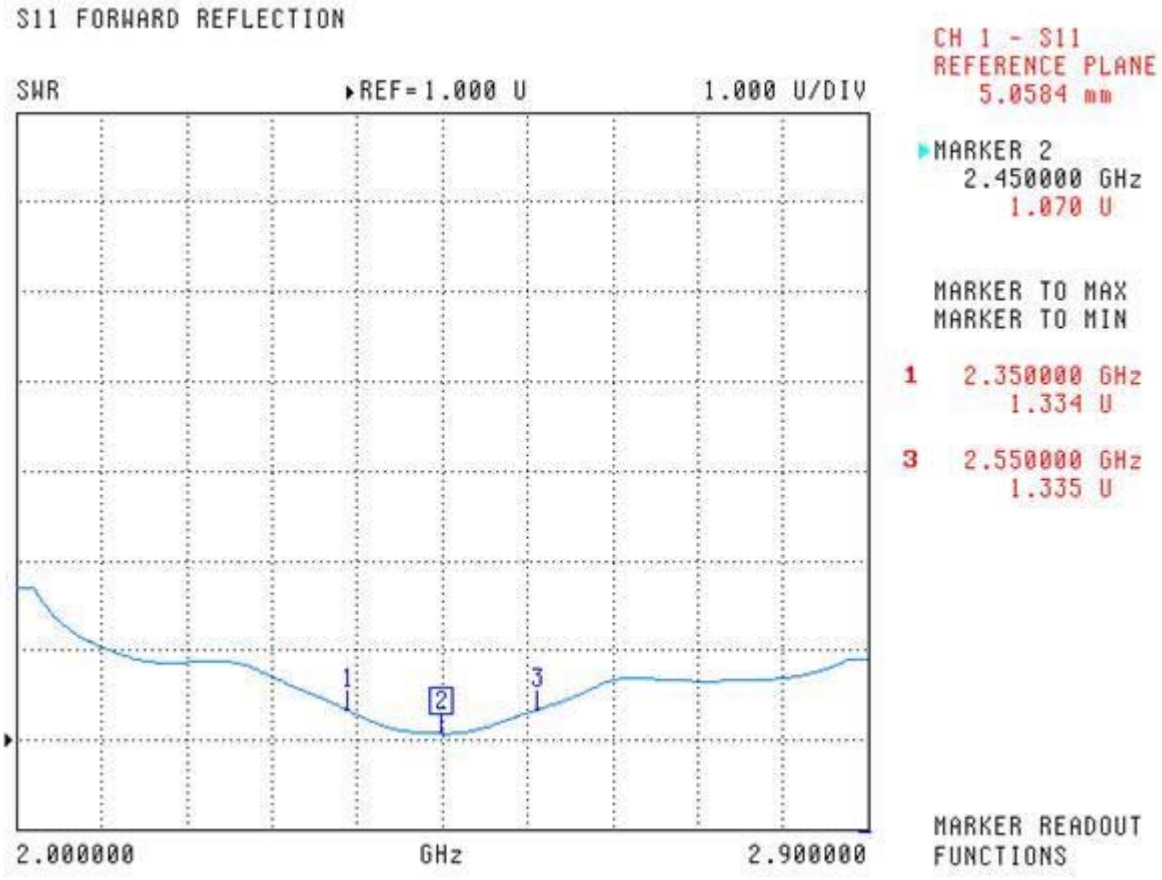
Test	Result
S11 R/L	-29.451 dB
SWR	1.070 U
Impedance	50.710 Ω

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

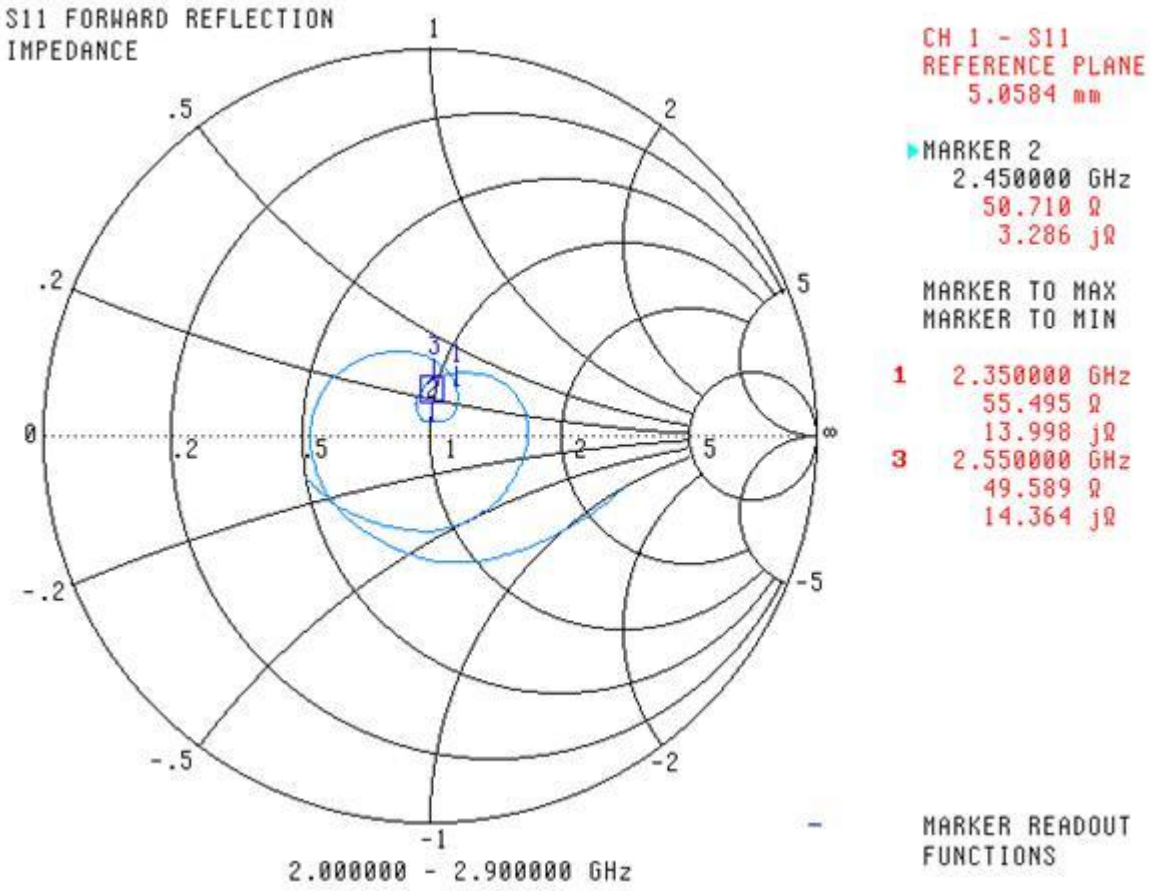
S11 Parameter Return Loss



SWR



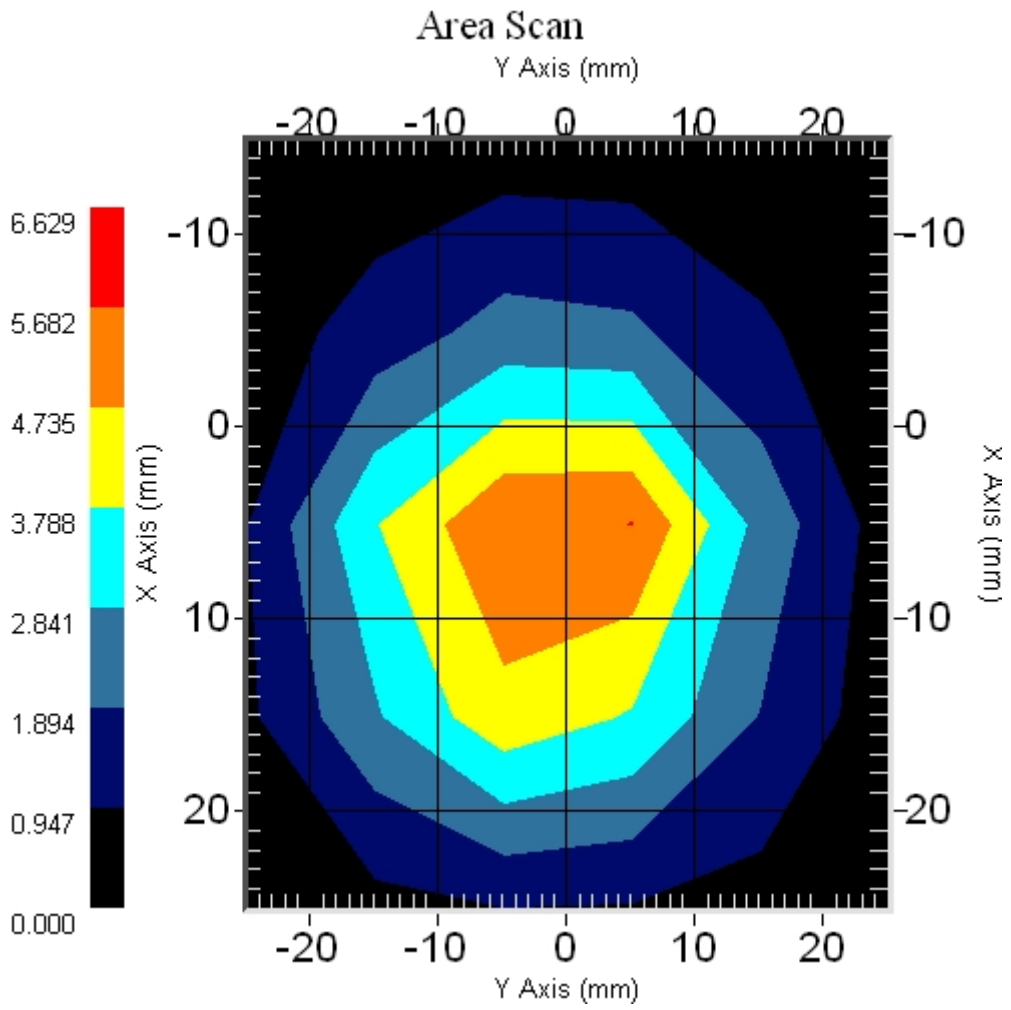
Smith Chart Dipole Impedance



System Validation Results Using the Electrically Calibrated Dipole

Results @ 100mW

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



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 2009.

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
51 SPECTRUM WAY
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CANADA K2R 1E6

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TEL: (613) 820-4988
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