

# RF Exposure Lab

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## CERTIFICATE OF COMPLIANCE SAR EVALUATION

Intel Corporation  
100 Center Point Circle, Suite 200  
Columbia, SC 29210

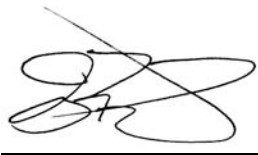
Dates of Test: June 1 & 10, 2011  
Test Report Number: SAR.20110604  
Revision B

FCC ID:	PD9612BNXH & PD9612BNXHU
Model(s):	Intel® Centrino® Wireless-N+WiMax 6150 (Model 612BNXH & 612BNXHU)
Test Sample:	Engineering Unit Same as Production
WiFi MAC Address:	4025C2002764
WiMax MAC Address:	502DA200099F
Equipment Type:	Wireless Module
Classification:	Portable Transmitter Next to Body
TX Frequency Range:	2412 – 2462 MHz; 2498.5 – 2687.5 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	2450 MHz (b) – 16.79 dB, 2450 MHz (g) – 16.61 dB, 2450 MHz (n20) – 16.52 dB, 2450 MHz (n40) – 16.68 dB, 2600 MHz (5 MHz) – 23.98 dB, 2600 MHz (10 MHz) – 23.46 dB Conducted
Signal Modulation:	DSSS, OFDM, QPSK, 16QAM
Antenna Type:	Shanghai Universe Communications Electron Co., Ltd., PIFA Antenna
Application Type:	Certification
FCC Rule Parts:	Part 2, 15C, 27
KDB Test Methodology:	KDB 447498, KDB 248227, KDB 616217, KDB 615223
Maximum SAR Value:	0.375 W/kg

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. C95.1-1992 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 are subject to denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 863(a).



Jay M. Moulton  
Vice President



Certificate # 2387.01

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## 1. Introduction

This measurement report shows compliance of the Intel Corporation Model Intel® Centrino® Wireless-N+6150 (Model 612BNXH & 612BNXHU) FCC ID: PD9612BNXH & PD9612BNXHU with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices. 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 module is sold under two different FCC/IC ID numbers. The ID's ending in "U" are intended to allow user install conditions and host systems must be provided with a BIOS locking feature that prevents installation of unauthorized device.

The test procedures, as described in ANSI C95.1 – 1992 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 Health Canada Safety Code 6 Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz were employed.

## SAR Definition [5]

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

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

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

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

where:

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

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

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

## 2. SAR Measurement Setup

### Robotic System

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

### System Hardware

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

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

### System Description

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

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

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

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



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

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

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

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

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

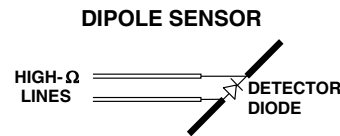
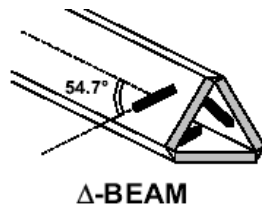
The overall uncertainty for the methodology and algorithms the ALSAS-10-U used during the SAR calculation was evaluated using the data from IEEE 1528 f3 algorithm:

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

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

## E-Field Probe

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.



The SAR is assessed with the probe which moves at a default height of 4 mm 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 4 mm default in the Z axis is the optimum height for assessing SAR where the boundary effect is at its least, with the probe located closest to the phantom surface (boundary).

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

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

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

The zoom scan volume for devices  $\leq 3$  GHz with a cube scan of  $5 \times 5 \times 8$  yields a volume of  $32 \times 32 \times 28$  mm<sup>3</sup>. For devices  $> 3$  GHz and  $< 4.5$  GHz, the cube scan of  $9 \times 9 \times 9$  yields a volume of  $32 \times 32 \times 24$  mm<sup>3</sup>. For devices  $\geq 4.5$  GHz, the cube scan of  $7 \times 7 \times 12$  yields a volume of  $24 \times 24 \times 22$  mm<sup>3</sup>.



### 3. Robot Specifications

#### Specifications

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

#### Data Acquisition Card (DAC) System

##### Cell Controller

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

##### Data Converter

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

##### E-Field Probe

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

**See Appendix D and E.**



## 5. Phantom & Simulating Tissue Specifications

### SAM Phantom



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

### Head & Body Simulating Mixture Characterization

The head and body 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 tissue dielectric parameters computed from the 4-Cole-Cole equations.

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

Ingredients		Simulating Tissue	
		2450 MHz Body	2600 MHz Body
Mixing Percentage			
Water		73.20	69.83
Sugar		0.00	0.00
Salt		0.04	0.00
HEC		0.00	0.00
Bactericide		0.00	0.00
DGBE		26.70	30.17
Dielectric Constant	Target	52.70	52.51
Conductivity (S/m)	Target	1.95	2.16

### 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. ANSI/IEEE C95.1 – 1992 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 ENVIRONMENT Professional Population (W/kg) or (mW/g)
SPATIAL PEAK SAR <sup>1</sup> Head	1.60	8.00
SPATIAL AVERAGE SAR <sup>2</sup> Whole Body	0.08	0.40
SPATIAL PEAK SAR <sup>3</sup> Hands, Feet, Ankles, Wrists	4.00	20.00

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

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

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

## 7. Measurement Uncertainty

### Exposure Assessment Measurement Uncertainty

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

## 8. System Validation

### Tissue Verification

**Table 8.1 Measured Tissue Parameters**

		2450 MHz Body		2590 MHz Body	
Date(s)		Jun. 1, 2011		Jun. 10, 2011	
Liquid Temperature (°C)	20.0	Target	Measured	Target	Measured
Dielectric Constant: $\epsilon$		52.70	52.36	52.52	52.28
Conductivity: $\sigma$		1.95	1.96	2.15	2.18

See Appendix A for data printout.

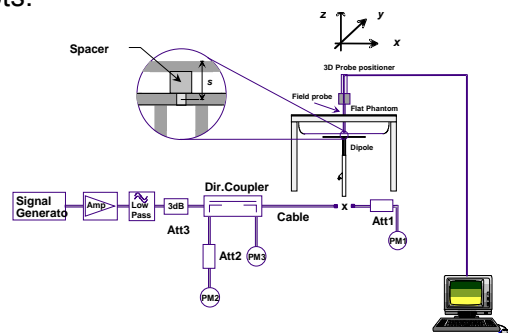
### Test System Verification

Prior to assessment, the system is verified to the  $\pm 10\%$  of the specifications at the test frequency by using the system kit. Power is normalized to 1 watt. Body Tissue used for all validation test setups. The probe is valid to  $\pm 100$  MHz for 835 and 1900 MHz, and  $\pm 5\%$  for 2600 MHz. The dipole is valid over the same frequency range. (Graphic Plots Attached)

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

	Test Frequency	Target 1W SAR <sub>1g</sub> (W/kg) per Certificate	Tissue Used for Calibration	Tissue Used for Verification	Measure SAR <sub>1g</sub> (W/kg)	Deviation (%)
01-Jun-2011	2450 MHz	51.50	Body	Body	53.79	+ 4.45
10-Jun-2011	2600 MHz	56.42	Body	Body	55.40	- 1.81

See Appendix A for data plots.



**Figure 8.1 Dipole Validation Test Setup**

## **9. SAR Test Data Summary**

### **See Measurement Result Data Pages**

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

### **Procedures Used To Establish Test Signal**

The actual transmission is activated through a base station simulator or similar equipment. The DUT did not contain any test software to facilitate any of the required signaling for the tests. 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 power drift of each test is measured at the start of the test and again at the end of the test. The drift percentage is calculated by the formula  $((\text{end}/\text{start})-1)*100$  and rounded to three decimal places. The drift percentage is calculated into the resultant SAR value on the data sheet for each test.

The EUT was installed into a laptop computer. The laptop computer was used to configure the EUT to continuously transmit at a maximum output power on the channel specified in the test data.

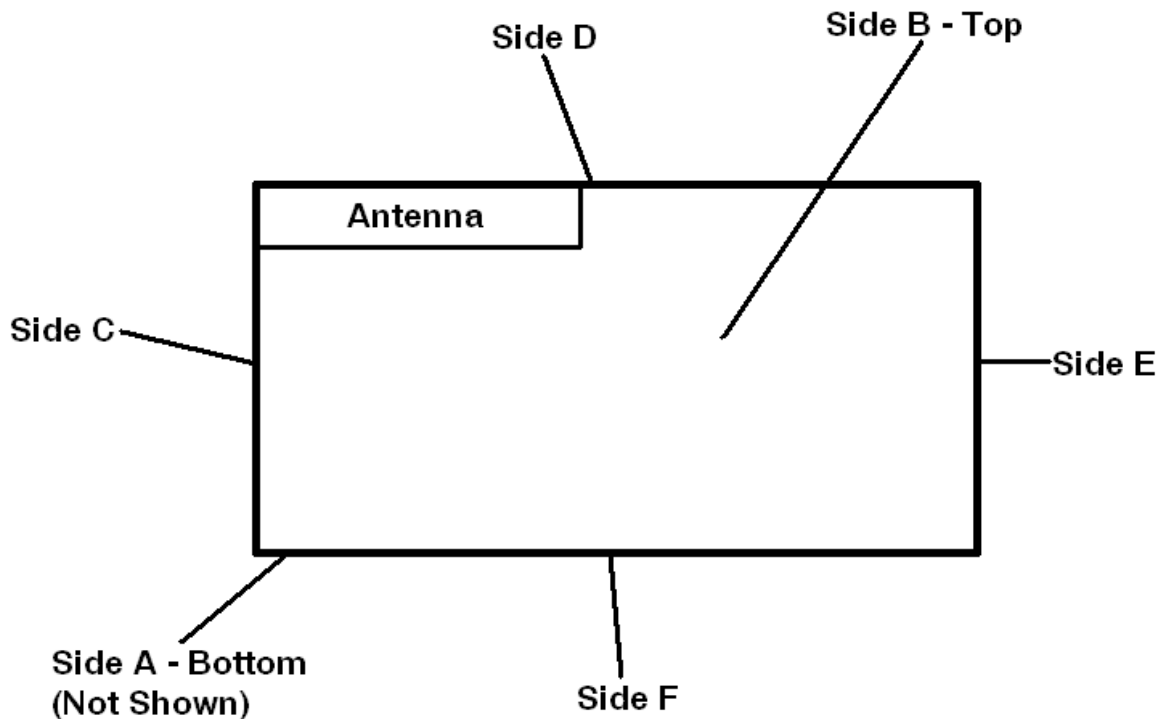
The data rates used when evaluating the WiFi transmitter were the lowest data rates for each mode. The device was operating at its maximum output power at the lowest data rate for all measurements.

The PC was using the Intel test utility DRTU Version 1.2.12-0197 and the device driver was version 14.0.0.39.

The EUT antenna is a two-antenna PIFA antenna system – Shanghai Universe Communication Electron Co., Ltd. The antenna connects to the EUT via a non-standard antenna connector.

The antenna was tested on all six sides of the antenna device. During each test, the antenna was on a minimum of 10 cm of Styrofoam during the test. The coaxial cable from the module to the antenna was 500 mm in length. The laptop was set to be >10 cm from the antenna during the test. The following is a pictorial drawing of the locations.

### SAR Location Diagram



802.11b					2450 GHz n HT20				
Freq	Channel	Data Rate	Antenna	Power	Freq	Channel	Data Rate	Antenna	Power
2412	1	1	Chain A	16.72	2412	1	6	Chain A	16.50
2437	6	1	Chain A	16.79	2437	6	6	Chain A	16.52
2462	11	1	Chain A	16.61	2462	11	6	Chain A	14.68
802.11g					2450 GHz n HT40				
Freq	Channel	Data Rate	Antenna	Power	Freq	Channel	Data Rate	Antenna	Power
2412	1	6	Chain A	16.57	2422	3	6	Chain A	13.85
2437	6	6	Chain A	16.61	2437	6	6	Chain A	16.68
2462	11	6	Chain A	15.35	2452	9	6	Chain A	11.72

## 10. WiMax System Description

The device is a 2.5 GHz WiMax transceiver in a module configuration using Intel chipset which supports 2xTx and 2xRx for this device. Both antennas are used for both transmitting and receiving. Its uplink is capable of both 10 MHz and 5 MHz bandwidths. The uplink sub-frame is triggered by an Allocation Start Time contained in the information of UL-MAP. This information specifies the starting times of the Uplink and Downlink frames. In any UL sub-frame, the duty factor ranging and bandwidth information is used to ensure optimal system operation. In normal device transmission, the device will transmit control signaling at the first 3 uplink symbols and then use the rest of the uplink symbols for data traffic bursts in the uplink sub-frame. Since the first 3 symbols are also used for ranging detection purposes and are shared among other device users, its transmitting power is much smaller than the data burst symbol power. The Signal Generator contained the Intel test software to generate the correct signal with the first 3 bits low. During the testing modes, the first 3 symbols have no power output and the data traffic bursts are always running at the maximum output power level. In the real usage, the data burst power will be adjusted according to the signal strength of the communication. In this way, by using the test software mode arrangement, we are transmitting at a worst case RF level during the data portion Symbols 4 to 18.

The data burst zone can operate in one mode:

### PUSC

For the 10 MHz bandwidth, it has 35 sub-channels structured from 1024 subcarriers; 184 are used as spare/safeguard subcarriers, leaving 840 available for transmission. From this, 560 subcarriers for data transmission with 280 subcarriers intended for pilot use. For the 5 MHz bandwidth, it contains 17 sub-channels using 512 subcarriers; 104 subcarriers are spare/safeguard subcarriers, 272 for data transmission, and 136 for pilot.

The signal generator (Agilent E4438C-504 Digital RF Signal Generator) contains Intel control firmware within the signal generator to establish the required signaling. The E4438C-504 produces a downlink DL burst every 5 milliseconds which simulates the transmission of a base-station operating under normal mode. This DL burst instructs the mobile station MS to transmit for 15 symbols in the UL data zone. This UL transmission is repeated every 5 milliseconds. The TX power of the mobile station is set to maximum power. The Digital RF Signal Generator and MS use the same frequency. The Digital RF Signal Generator power is much lower than the MS Tx power (~80 dB lower) and does not affect the SAR readings.

The MS synchronizes to the signal from the Digital RF Signal Generator in frequency and time. It then demodulates two maps contained in the Digital RF Signal Generator DL frame. The first map (DL map) specifies the number of DL symbols (29). The second map (UL map) specifies the number of UL symbols (18). The UL map also tells the MS to transmit a burst which occupies all data symbols and all sub-channels. No control channel transmissions are requested by the Digital RF Signal Generator. Measurements are taken in this configuration with the MS transmitting using the 29:18 ratio, but since there is no energy in the control symbols, the effective power is only across 15 symbols.

As mentioned above the DL:UL frame is specified in the DL and UL maps respectively. There is no ranging present when there is data traffic. The other types of control traffic are HARQ ACK/NACK, CQICH (CINR reporting) and bandwidth BW requests. BW requests are piggy-



backed onto the data symbols when traffic is present. Since the BW requests are shared across the Control Symbols (traffic versus non-traffic modes), the control traffic that is relevant to the SAR calculation is CQICH and HARQ ACK/NACK. The maximum power for this control traffic is 32.73 mW (5/35 of 229.09 mW) for 10 MHz and 77.36 mW (5/17 of 263.03 mW) for 5 MHz.

In the test mode, the UL operates in PUSC with all data sub-channels (All 35 sub-channels for 10 MHz) occupied with data. During normal operation, the MS will transmit on all sub-channels when the maximum UL throughput is required. It is possible for the MS to transmit with fewer sub-channels. The sub-channels consist of tones that are distributed over the entire signal BW and a jump every three symbols so that the spectral density and hence SAR for the fractional sub-channel case will be similar to the full sub-channel case that is tested. (Note: In the WiMax standard, a sub-channel consists of tones that are spread across the occupied bandwidth. After every three symbols, the tones that make up the sub-channel switch to a new set of frequencies spread across the band. This “jumping” is called sub-channel rotation and helps to give the sub-channel frequency diversity.)

Equipment Used for network side:

Agilent E4438C-504 Digital RF Signal Generator

The testing was done using a common 29:18 ratio as this is the maximum achievable ratio for the product. The 29 indicates the number of downlink (from the base station) symbols, and the 18 indicates the number of uplink (transmitted from the MS) symbols. Inside the uplink, 15 symbols are used for data, and three of the symbols are used for sending control information to the network. During the testing, the control symbols contained no information, so did not contribute to the total energy transmitted. To compensate for the maximum energy which may be present in the 3 control symbols, the following scheme is used for the scaling factor:

Maximum output power of 5 MHz is 24.20 dBm = 263.03 mW

The maximum power in 5 MHz control traffic is 77.36 mW (5/17 of 263.03 mW)

**Scaled factor for 5 MHz Bandwidth = see table below**

Maximum output power of 10 MHz is 23.60 dBm = 229.09 mW

The maximum power in 10 MHz control traffic is 32.73 mW (5/35 of 229.09 mW)

**Scaled factor for 10 MHz Bandwidth = see table below**

**Conversion Factor for 5 MHz Bandwidth =  $1/(15/48) = 3.2$**

**Conversion Factor for 10 MHz Bandwidth =  $1/(14/48) = 3.4$**

### 10.1.1 WiMax Conducted Power Measurements

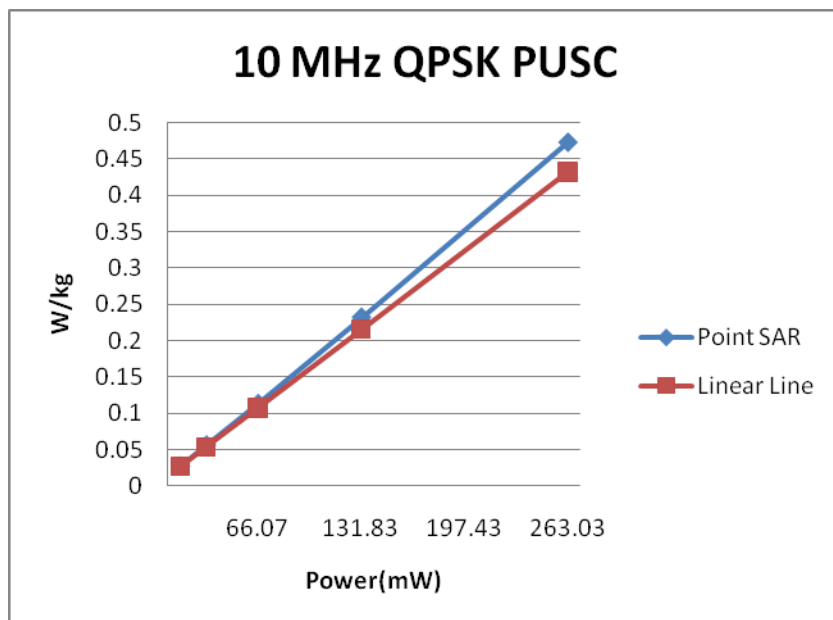
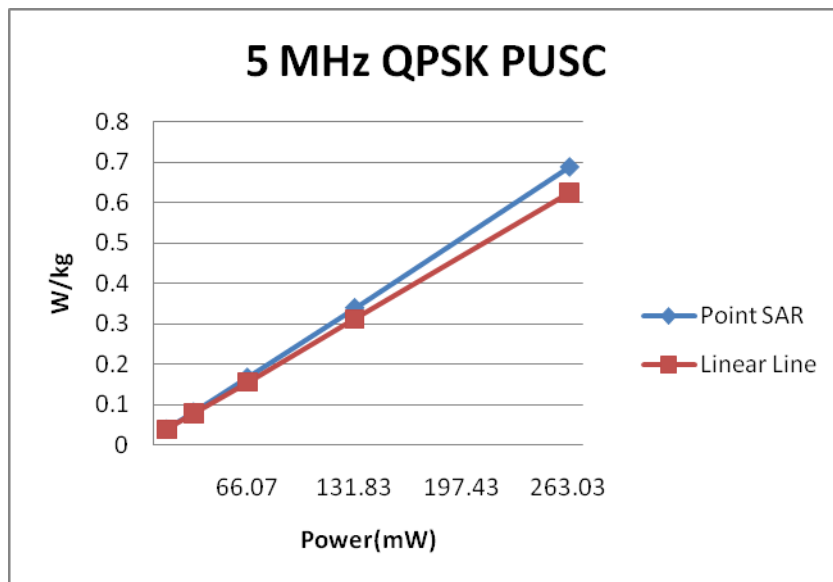
Zone Type	Modulation	Coding Rate	Frequency	Chain A - Main			Chain B - Diversity		
				Peak Power	Average Power	PAPR	Peak Power	Average Power	PAPR
PUSC	QPSK (BW 5 MHz)	1/2	2498.5	33.18	23.97	9.21	33.23	23.92	9.31
			2593.0	32.65	23.98	8.67	32.87	23.95	8.92
			2687.5	32.64	23.92	8.72	32.60	23.89	8.71
		3/4	2498.5	33.25	23.90	9.35	32.66	23.87	8.79
			2593.0	32.54	23.87	8.67	32.58	23.91	8.67
			2687.5	32.79	23.82	8.97	32.74	23.82	8.92
	16QAM (BW 5 MHz)	1/2	2498.5	33.30	23.84	9.46	33.34	23.88	9.46
			2593.0	32.66	23.91	8.75	33.30	23.93	9.37
			2687.5	32.59	23.92	8.67	32.43	23.84	8.59
		3/4	2498.5	33.46	23.85	9.61	33.44	23.76	9.68
			2593.0	32.81	23.87	8.94	32.86	23.71	9.15
			2687.5	32.93	23.94	8.99	33.04	23.80	9.24
	QPSK (BW 10 MHz)	1/2	2501.0	33.10	23.40	9.70	33.01	23.30	9.71
			2593.0	32.18	23.46	8.72	32.15	23.32	8.83
			2685.0	32.30	23.39	8.91	32.55	23.29	9.26
		3/4	2501.0	32.69	23.24	9.45	33.00	23.31	9.69
			2593.0	32.12	23.29	8.83	31.83	23.26	8.57
			2685.0	32.30	23.36	8.94	32.52	23.23	9.29
	16QAM (BW 10 MHz)	1/2	2501.0	33.08	23.41	9.67	32.89	23.31	9.58
			2593.0	32.16	23.37	8.79	32.58	23.24	9.34
			2685.0	32.58	23.42	9.16	32.11	23.22	8.89
		3/4	2501.0	32.11	23.40	8.71	32.44	23.30	9.14
			2593.0	32.23	23.35	8.88	32.65	23.19	9.46
			2685.0	32.19	23.38	8.81	32.42	23.21	9.21

Note: An Agilent wideband power meter was used for measuring the conducted power.

The SAR probe used in the measurements is calibrated with a sinusoidal CW signal. Since the DL:UL symbol ratio configuration used in the SAR tests provides a periodic uplink burst, the duty factor can be compensated by selecting the correct conversion factor (cf) for the SAR measurements. The high PAPR of OFDM/OFDMA is expected to introduce additional SAR measurement errors because the SAR probe is not calibrated for this type of random noise-like signals with large amplitude and phase variations within the bursts. The SAR error is also expected to vary with the average power and average PAPR at each measurement point, both temporally and spatially. In order to estimate the measurement error due to PAPR issues, the configuration with the highest SAR in each channel bandwidth and frequency band is measured at various power levels, from 16.60 mW for 5 MHz BW and 14.45 mW for 10 MHz BW, in 3 dB steps, until the maximum power level is reached with the antenna positioned 18 mm from the phantom surface. As shown by the results and plot below, SAR is linear to power only when the probe sensors are operating within the square-law region. As power continues to increase, the measured SAR error becomes increasingly larger. Since these are single point peak SAR values measured with the probe positioned at the peak SAR location, at 2 mm from the phantom surface, the values are substantially higher than the 1-g SAR required to determine compliance. Based on the linearity plots, SAR is not being underestimated.

## Linearity Response Check PUSC QPSK

Output Power	dBm	12.20	15.20	18.20	21.20	24.20
	mW	16.60	33.11	66.07	131.83	263.03
5 MHz Single Point SAR (W/kg)		0.039	0.081	0.167	0.339	0.687
5 MHz Linear Line		0.039	0.078	0.156	0.312	0.624
Percent Deviation		0.00	3.85	7.05	8.65	10.09
Output Power	dBm	11.60	14.60	17.60	20.60	23.60
	mW	14.45	28.84	57.54	114.82	229.08
10 MHz Single Point SAR (W/kg)		0.027	0.056	0.113	0.232	0.473
10 MHz Linear Line		0.027	0.054	0.108	0.216	0.432
Percent Deviation		0.00	3.70	4.63	7.41	9.49



PUSC (Chain A – Main)				
	High	Middle	Low	Max. Rated Power
	QPSK	QPSK	QPSK	QPSK
5 MHz	247	250	249	251
Scaling Factor	1.078	1.063	1.065	
10 MHz	218	222	219	224
Scaling Factor	1.056	1.039	1.053	

PUSC (Chain B – Diversity)				
	High	Middle	Low	Max. Rated Power
	QPSK	QPSK	QPSK	QPSK
5 MHz	245	248	247	251
Scaling Factor	1.085	1.070	1.078	
10 MHz	213	215	214	224
Scaling Factor	1.080	1.073	1.078	

#### 5 MHz calculation of Scaling Factor formula used is as follows:

$$[(\text{Rated Power} \times 5/17) \times 3 + (\text{Rated Power} \times 15)] / [\text{Measured Power} \times 15]$$

#### 10 MHz calculation of Scaling Factor formula used is as follows:

$$[(\text{Rated Power} \times 5/35) \times 3 + (\text{Rated Power} \times 15)] / [\text{Measured Power} \times 15]$$

Sample of Scaling Factor Calculation:

Using High Channel 5 MHz QPSK on Chain B the measured average power was 245 mW. The maximum rated power of the device is 251 mW.

$$[(251 \text{ mW} \times 5/17) \times 3 + (251 \text{ mW} \times 15)] / [245 \text{ mW} \times 15] = 1.085$$

Using High Channel 10 MHz QPSK on Chain B the measured average power was 213 mW. The maximum rated power of the device is 237 mW.

$$[(224 \text{ mW} \times 5/35) \times 3 + (224 \text{ mW} \times 15)] / [213 \text{ mW} \times 15] = 1.080$$

### 10.2.1 Spectrum Analyzer Plots (See Appendix G for additional Plots)

SAR Test Configurations for WiMax									
				QPSK 1/2			QPSK 3/4		
			Side	Low	Mid	High	Low	Mid	High
Antenna 1	PUSC	5 MHz	A	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			B	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			C	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			D	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			E	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			F	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
		10 MHz	A	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			B	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			C	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			D	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			E	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			F	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
Antenna 2	PUSC	5 MHz	A	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			B	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			C	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			D	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			E	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			F	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
		10 MHz	A	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			B	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			C	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			D	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			E	Note 1	Tested	Note 1	Note 2	Note 2	Note 2
			F	Note 1	Tested	Note 1	Note 2	Note 2	Note 2

Note 1 - Reduced Per TCB Workshop Notes October 2010 page 34.

Note 2 - Reduced per TCB Workshop Notes April 2010 page 9

SAR Test Configurations for WiMax									
				16QAM 1/2			16QAM 3/4		
			Side	Low	Mid	High	Low	Mid	High
Antenna 1	PUSC	5 MHz	A	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			B	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			C	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			D	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			E	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			F	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
		10 MHz	A	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			B	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			C	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			D	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			E	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			F	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
Antenna 2	PUSC	5 MHz	A	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			B	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			C	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			D	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			E	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			F	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
		10 MHz	A	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			B	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			C	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			D	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			E	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3
			F	Note 3	Note 3	Note 3	Note 3	Note 3	Note 3

Note 3 - Reduced per TCB Workshop Notes October 2010 page 33

## SAR Data Summary – 2450 MHz Body 802.11b

MEASUREMENT RESULTS							
Gap	Position	Frequency		Modulation	Antenna	End Power	SAR (W/kg)
		MHz	Ch.			(dBm)	
18 mm	Side A	2437	6	DSSS	Chain A	16.79	0.120
	Side B	2437	6	DSSS	Chain A	16.79	0.115
	Side C	2437	6	DSSS	Chain A	16.79	0.169
	Side D	2437	6	DSSS	Chain A	16.79	0.133
	Side E	2437	6	DSSS	Chain A	16.79	0.090
	Side F	2437	6	DSSS	Chain A	16.79	0.070
<b>Body</b> <b>1.6 W/kg (mW/g)</b> <small>averaged over 1 gram</small>							

1. Battery is fully charged for all tests.

Power Measured

☒ Conducted

☐ ERP

☐ EIRP

2. SAR Measurement

Phantom Configuration

☐ Left Head

☒ Uniphantom

☐ Right Head

SAR Configuration

☐ Head

☒ Body

3. Test Signal Call Mode

☒ Test Code

☐ Base Station Simulator

4. Test Configuration

☐ With Belt Clip

☐ Without Belt Clip ☒ N/A

5. Tissue Depth is at least 15.0 cm



Jay M. Moulton  
Vice President

Note: SAR Tested on the Highest output power channel. When the measured channel is 3 dB or more below the limit the remaining channels are not required to be tested per KDB 447498 section 1) e). SAR is not required for 802.11g/HT20/HT40 channels when the maximum average output power is less than ¼ dB higher than that measured in the 802.11b. The testing was conducted on all sides of the antenna. All testing was conducted per KDB 447498, 248227, 616217 and OET Bulletin 65. See the photo in Appendix C and diagram on page 14 for a pictorial of the setup and labeling of the test locations.



## SAR Data Summary – 2600 MHz Body – WiMax 5 MHz PUSC

### MEASUREMENT RESULTS

Gap	Antenna	Side	Frequency		Modulation	End Power (dBm)	SAR (W/kg)	Scaling Factor	Calculated SAR
			MHz	Ch.					
18 mm	Chain A	A	2593.0	Mid	QPSK ½	23.98	0.337	1.063	0.358
		B	2593.0	Mid	QPSK ½	23.98	0.292	1.063	0.310
		C	2593.0	Mid	QPSK ½	23.98	0.343	1.063	0.365
		D	2593.0	Mid	QPSK ½	23.98	0.353	1.063	0.375
		E	2593.0	Mid	QPSK ½	23.98	0.195	1.063	0.207
		F	2593.0	Mid	QPSK ½	23.98	0.205	1.063	0.218
	Chain B	A	2593.0	Mid	QPSK ½	23.95	0.289	1.070	0.309
		B	2593.0	Mid	QPSK ½	23.95	0.304	1.070	0.325
		C	2593.0	Mid	QPSK ½	23.95	0.325	1.070	0.348
		D	2593.0	Mid	QPSK ½	23.95	0.213	1.070	0.228
		E	2593.0	Mid	QPSK ½	23.95	0.161	1.070	0.172
		F	2593.0	Mid	QPSK ½	23.95	0.223	1.070	0.239

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

- Power Measured ☒ Conducted ☐ ERP ☐ EIRP
- SAR Measurement  
 Phantom Configuration ☐ Left Head ☒ Uniphantom ☐ Right Head  
 SAR Configuration ☐ Head ☒ Body
- Test Signal Call Mode ☐ Test Code ☒ Base Station Simulator
- Test Configuration ☐ With Belt Clip ☐ Without Belt Clip ☒ N/A
- All Testing conducted using KDB 447498 Section 2 and KDB 615223.



Jay M. Moulton  
 Vice President

Note: When the highest SAR channel is 3 dB or more below the limit the remaining channels are not required to be tested per KDB 447498 section 1) e). Test reduction was based on TCB workshop slides from April and October of 2010.

## SAR Data Summary – 2600 MHz Body – WiMax 10 MHz PUSC

### MEASUREMENT RESULTS

Gap	Antenna	Side	Frequency		Modulation	End Power	SAR (W/kg)	Scaling Factor	Calculated SAR
			MHz	Ch.		(dBm)			
18 mm	Chain A	A	2593.0	Mid	QPSK ½	23.46	0.339	1.039	0.352
		B	2593.0	Mid	QPSK ½	23.46	0.320	1.039	0.332
		C	2593.0	Mid	QPSK ½	23.46	0.301	1.039	0.313
		D	2593.0	Mid	QPSK ½	23.46	0.258	1.039	0.268
		E	2593.0	Mid	QPSK ½	23.46	0.192	1.039	0.199
		F	2593.0	Mid	QPSK ½	23.46	0.130	1.039	0.135
	Chain B	A	2593.0	Mid	QPSK ½	23.32	0.301	1.073	0.323
		B	2593.0	Mid	QPSK ½	23.32	0.286	1.073	0.307
		C	2593.0	Mid	QPSK ½	23.32	0.319	1.073	0.342
		D	2593.0	Mid	QPSK ½	23.32	0.224	1.073	0.240
		E	2593.0	Mid	QPSK ½	23.32	0.175	1.073	0.188
		F	2593.0	Mid	QPSK ½	23.32	0.164	1.073	0.176

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

- Power Measured ☒ Conducted ☐ ERP ☐ EIRP
- SAR Measurement  
 Phantom Configuration ☐ Left Head ☒ Uniphantom ☐ Right Head  
 SAR Configuration ☐ Head ☒ Body
- Test Signal Call Mode ☐ Test Code ☒ Base Station Simulator
- Test Configuration ☐ With Belt Clip ☐ Without Belt Clip ☒ N/A
- All Testing conducted using KDB 447498 Section 2 and KDB 615223.



Jay M. Moulton  
 Vice President

Note: When the highest SAR channel is 3 dB or more below the limit the remaining channels are not required to be tested per KDB 447498 section 1) e). Test reduction was based on TCB workshop slides from April and October of 2010.

## 11. Enhanced Energy Coupling

Worst-case test configuration	Band	Antenna-to-person distance (mm)		Peak SAR (W/kg)	Percent Change
Side A	2450 MHz	Initial	18	0.318	-----
		1	23	0.196	38.4
		2	28	0.051	84.0
Side B	2450 MHz	Initial	18	0.305	-----
		1	23	0.182	40.3
		2	28	0.046	85.0
Side C	2450 MHz	Initial	18	0.419	-----
		1	23	0.267	36.3
		2	28	0.067	84.0
Side D	2450 MHz	Initial	18	0.276	-----
		1	23	0.149	46.0
		2	28	0.045	83.7
Side E	2450 MHz	Initial	18	0.284	-----
		1	23	0.168	40.8
		2	28	0.049	82.7
Side F	2450 MHz	Initial	18	0.113	-----
		1	23	0.072	36.3
		2	28	0.020	82.3
Side A	2600 MHz	Initial	18	0.583	-----
		1	23	0.356	38.9
		2	28	0.091	84.4
Side B	2600 MHz	Initial	18	0.504	-----
		1	23	0.299	40.7
		2	28	0.076	84.9
Side C	2600 MHz	Initial	18	0.596	-----
		1	23	0.342	42.6
		2	28	0.089	85.1
Side D	2600 MHz	Initial	18	0.631	-----
		1	23	0.386	38.8
		2	28	0.099	84.3
Side E	2600 MHz	Initial	18	0.302	-----
		1	23	0.175	42.1
		2	28	0.047	84.4
Side F	2600 MHz	Initial	18	0.215	-----
		1	23	0.124	42.3
		2	28	0.036	83.3

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

### 13. 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.

## 14. 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 – 1992, 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 – 1992, 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, June 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), March 2010.
- [7] Health Canada, Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz, 2009.

## Appendix A – System Validation Plots and Data

\*\*\*\*\*

Test Result for UIM Dielectric Parameter

Wed 01/Jun/2011 07:10:38

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	52.42	1.91
2.4300	52.73	1.93	52.42	1.94
2.4400	52.71	1.94	52.38	1.95
2.4500	52.70	1.95	52.36	1.96
2.4600	52.69	1.96	52.28	1.98
2.4700	52.67	1.98	52.27	1.99
2.4800	52.66	1.99	52.19	2.00

\*\*\*\*\*

Test Result for UIM Dielectric Parameter

Fri 10/Jun/2011 07:12:51

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
2.5600	52.56	2.11	52.35	2.13
2.5700	52.55	2.12	52.33	2.15
2.5800	52.53	2.13	52.31	2.16
2.5900	52.52	2.15	52.28	2.18
2.6000	52.51	2.16	52.26	2.19
2.6100	52.50	2.18	52.24	2.21
2.6200	52.48	2.19	52.21	2.23



**SAR Test Report**

By Operator : Jay  
Measurement Date : 01-Jun-2011  
Starting Time : 01-Jun-2011 07:19:13 AM  
End Time : 01-Jun-2011 07:32:07 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 : 6.215 W/kg  
Power Drift-Finish: 6.280 W/kg  
Power Drift (%) : 1.050

## 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 : 01-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 45.00 RH%  
Epsilon : 52.36 F/m  
Sigma : 1.96 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

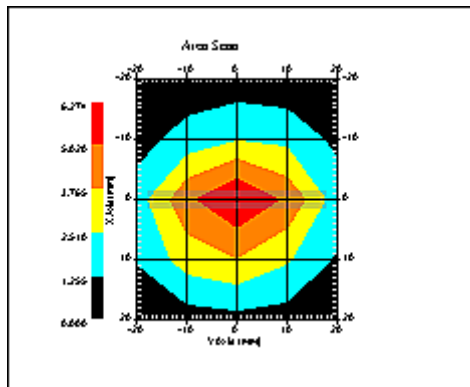
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56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

## Measurement Data

Crest Factor : 1  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 01-Jun-2011  
 Set-up Time : 7:40:13 AM  
 Area Scan : 5x5x1 : Measurement x=10mm, y=10mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

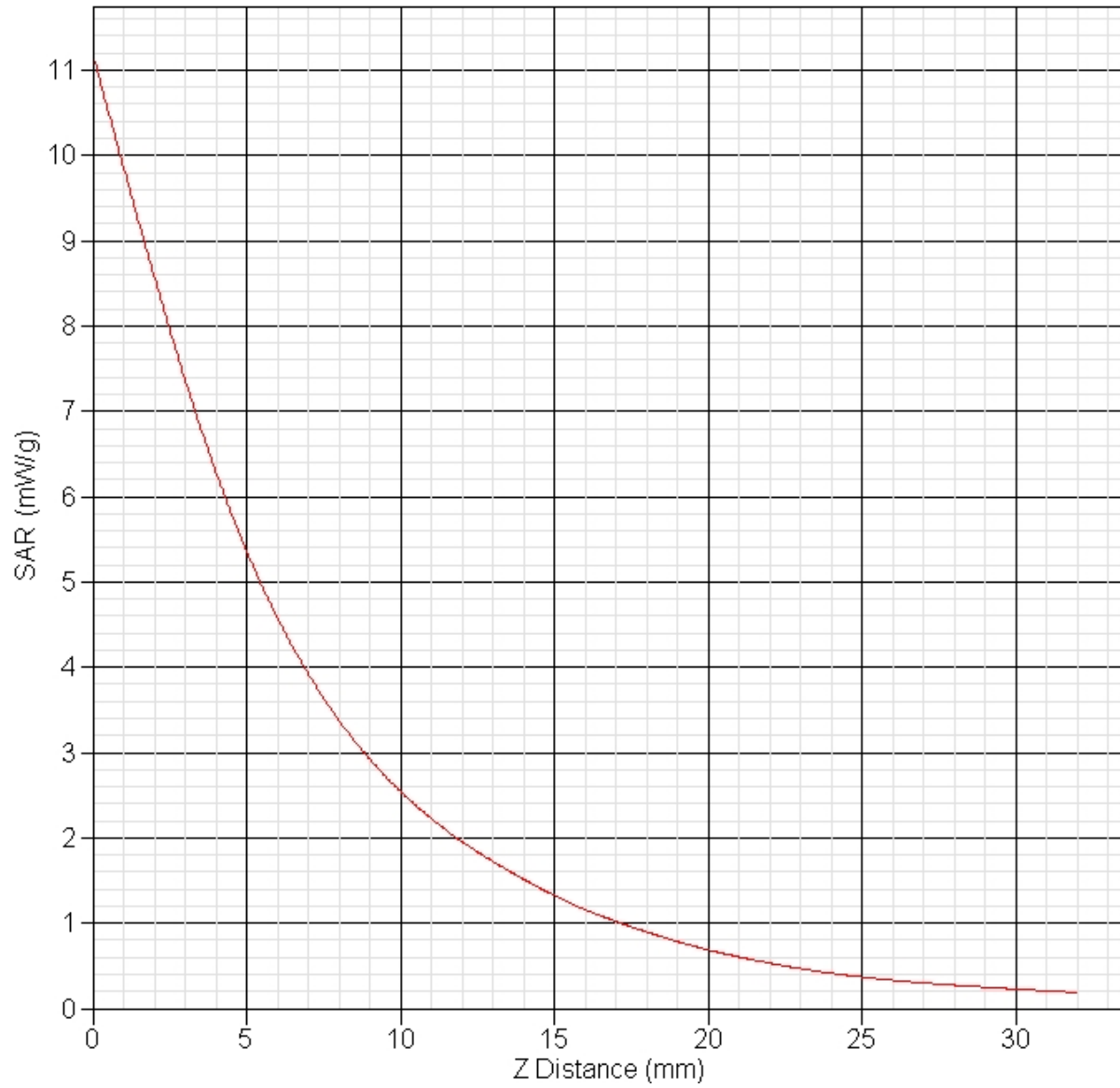
DUT Position : Touch  
 Separation : 10 mm  
 Channel : Mid



1 gram SAR value : 5.379 W/kg  
 10 gram SAR value : 2.452 W/kg  
 Area Scan Peak SAR : 6.274 W/kg  
 Zoom Scan Peak SAR : 11.190 W/kg

### SAR-Z Axis

at Hotspot x:0.24 y:-0.13



**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 07:22:56 AM  
End Time : 10-Jun-2011 07:36:02 AM  
Scanning Time : 786 secs

## Product Data

Device Name : Validation  
Serial No. : 2600  
Type : Dipole  
Model : RFE-D-2600-S-2  
Frequency : 2600.00 MHz  
Max. Transmit Pwr : 0.1 W  
Drift Time : 0 min(s)  
Length : 49.5 mm  
Width : 3.6 mm  
Depth : 30.0 mm  
Antenna Type : Internal  
Orientation : Touch  
Power Drift-Start : 6.381 W/kg  
Power Drift-Finish: 6.404 W/kg  
Power Drift (%) : 0.355

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 45.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

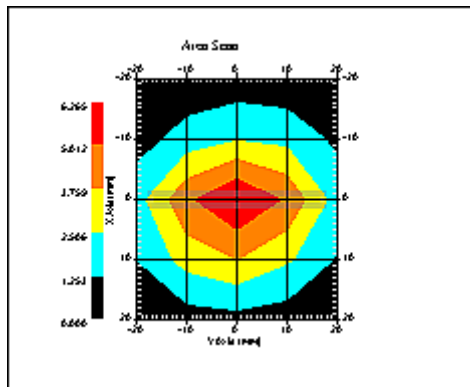
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

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

## Other Data

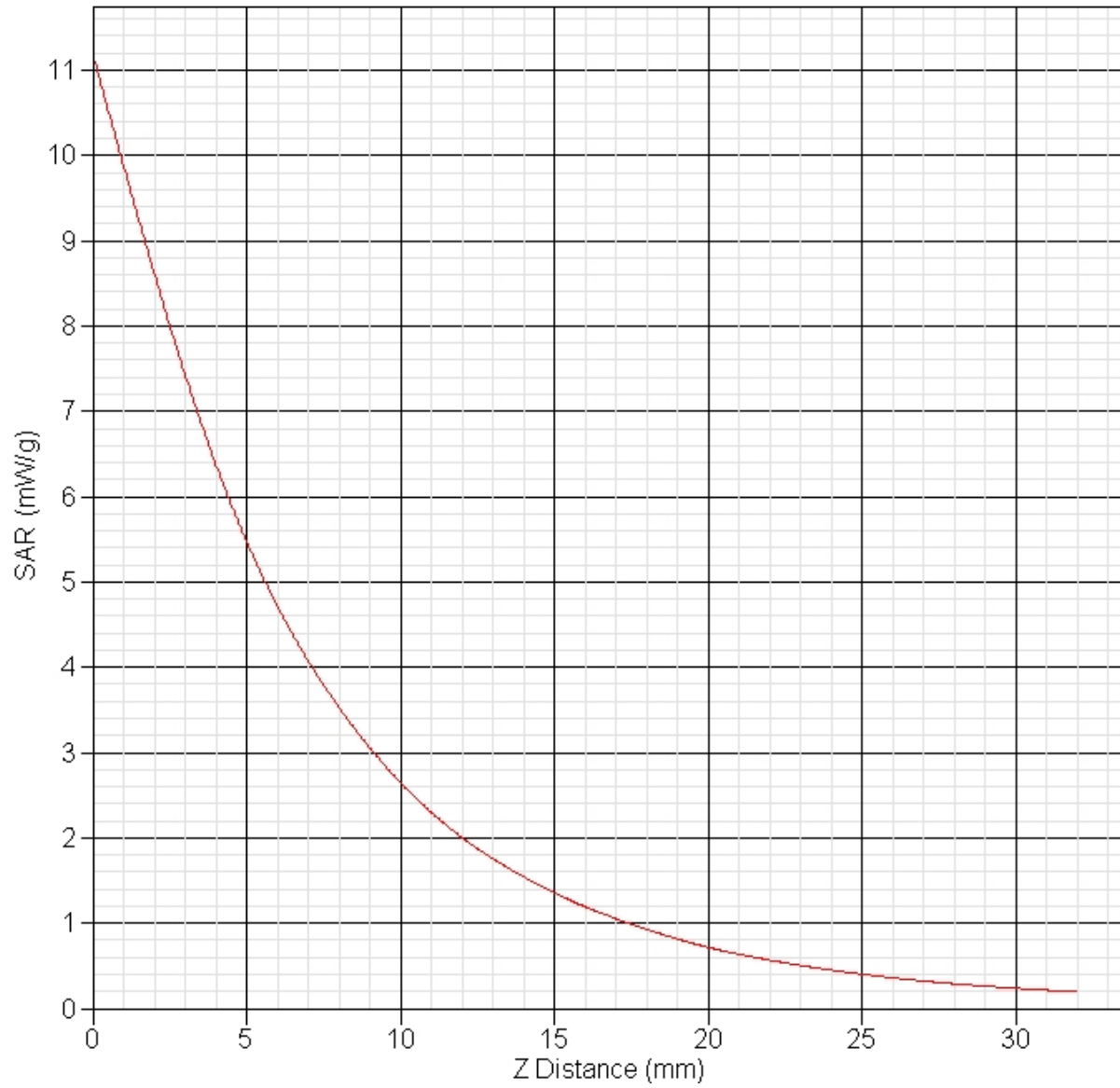
DUT Position : Touch  
 Separation : 10 mm  
 Channel : Mid



1 gram SAR value : 5.540 W/kg  
 10 gram SAR value : 2.516 W/kg  
 Area Scan Peak SAR : 6.265 W/kg  
 Zoom Scan Peak SAR : 11.190 W/kg

### SAR-Z Axis

at Hotspot x:0.24 y:-0.18



## Appendix B – SAR Test Data Plots

**Note:** In all data sheets in Appendix B, the frequency noted in the ‘Product Data’ section is the frequency band which the device was transmitting. This frequency does not refer to the actual frequency and channel of the test. The channel is listed in the ‘Other Data’ section of the data sheet as Low, Mid or High. The actual test frequency is listed in Section 12 in each of the data summary sheets.



**SAR Test Report**

By Operator : Jay  
Measurement Date : 01-Jun-2011  
Starting Time : 01-Jun-2011 09:19:37 AM  
End Time : 01-Jun-2011 09:36:31 AM  
Scanning Time : 1014 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 4025C2002764  
Mode : 802.11b  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.06 W  
Drift Time : 0 min(s)  
Length : 40 mm  
Width : 75 mm  
Depth : 8 mm  
Antenna Type : Internal - Chain A  
Orientation : Side A  
Power Drift-Start : 0.236 W/kg  
Power Drift-Finish: 0.244 W/kg  
Power Drift (%) : 3.385

## 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 : 01-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.36 F/m  
Sigma : 1.96 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

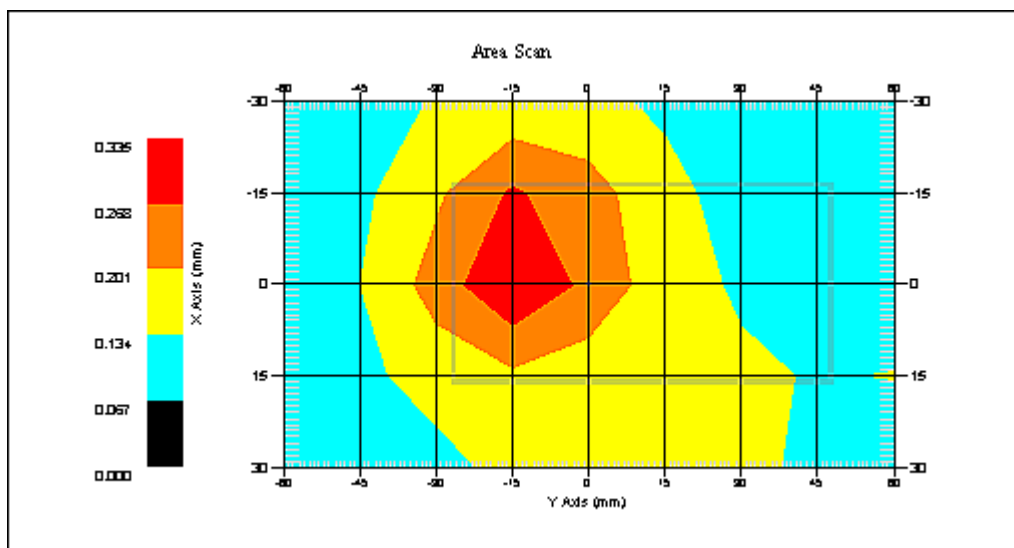
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56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

## Measurement Data

Crest Factor : 1  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 01-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x9x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side A  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.120 W/kg  
 10 gram SAR value : 0.090 W/kg  
 Area Scan Peak SAR : 0.134 W/kg  
 Zoom Scan Peak SAR : 0.310 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 01-Jun-2011  
Starting Time : 01-Jun-2011 09:38:18 AM  
End Time : 01-Jun-2011 09:55:14 AM  
Scanning Time : 1016 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 4025C2002764  
Mode : 802.11b  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.06 W  
Drift Time : 0 min(s)  
Length : 40 mm  
Width : 75 mm  
Depth : 8 mm  
Antenna Type : Internal - Chain A  
Orientation : Side B  
Power Drift-Start : 0.226 W/kg  
Power Drift-Finish: 0.226 W/kg  
Power Drift (%) : -0.001

## 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 : 01-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.36 F/m  
Sigma : 1.96 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

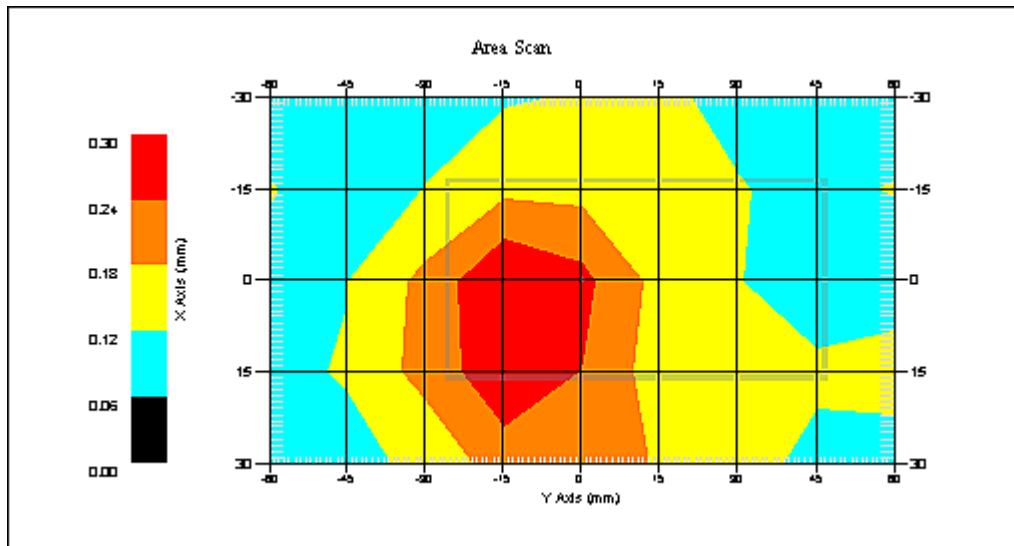
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56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

## Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 01-Jun-2011  
Set-up Time : 7:02:24 AM  
Area Scan : 5x9x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side B  
Separation : 18 mm  
Channel : Mid



1 gram SAR value : 0.115 W/kg  
10 gram SAR value : 0.093 W/kg  
Area Scan Peak SAR : 0.198 W/kg  
Zoom Scan Peak SAR : 0.300 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 01-Jun-2011  
Starting Time : 01-Jun-2011 07:43:25 AM  
End Time : 01-Jun-2011 07:57:31 AM  
Scanning Time : 846 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 4025C2002764  
Mode : 802.11b  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.06 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 40 mm  
Depth : 75 mm  
Antenna Type : Internal - Chain A  
Orientation : Side C  
Power Drift-Start : 0.348 W/kg  
Power Drift-Finish: 0.358 W/kg  
Power Drift (%) : 2.879

## 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 : 01-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.36 F/m  
Sigma : 1.96 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

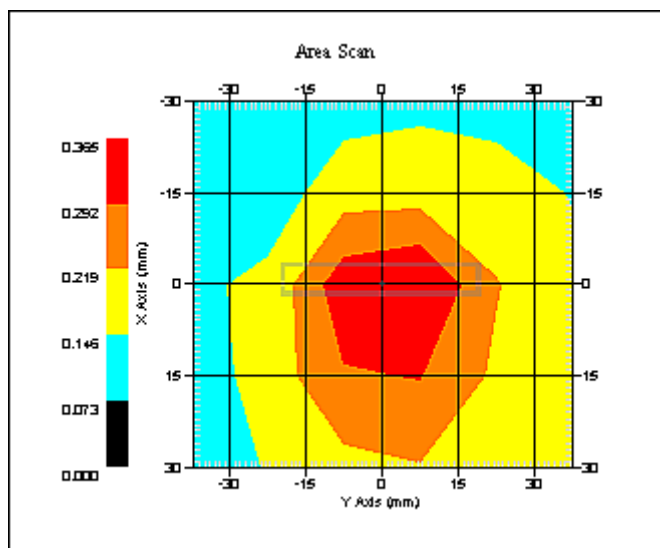
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56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

## Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 01-Jun-2011  
Set-up Time : 7:02:24 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

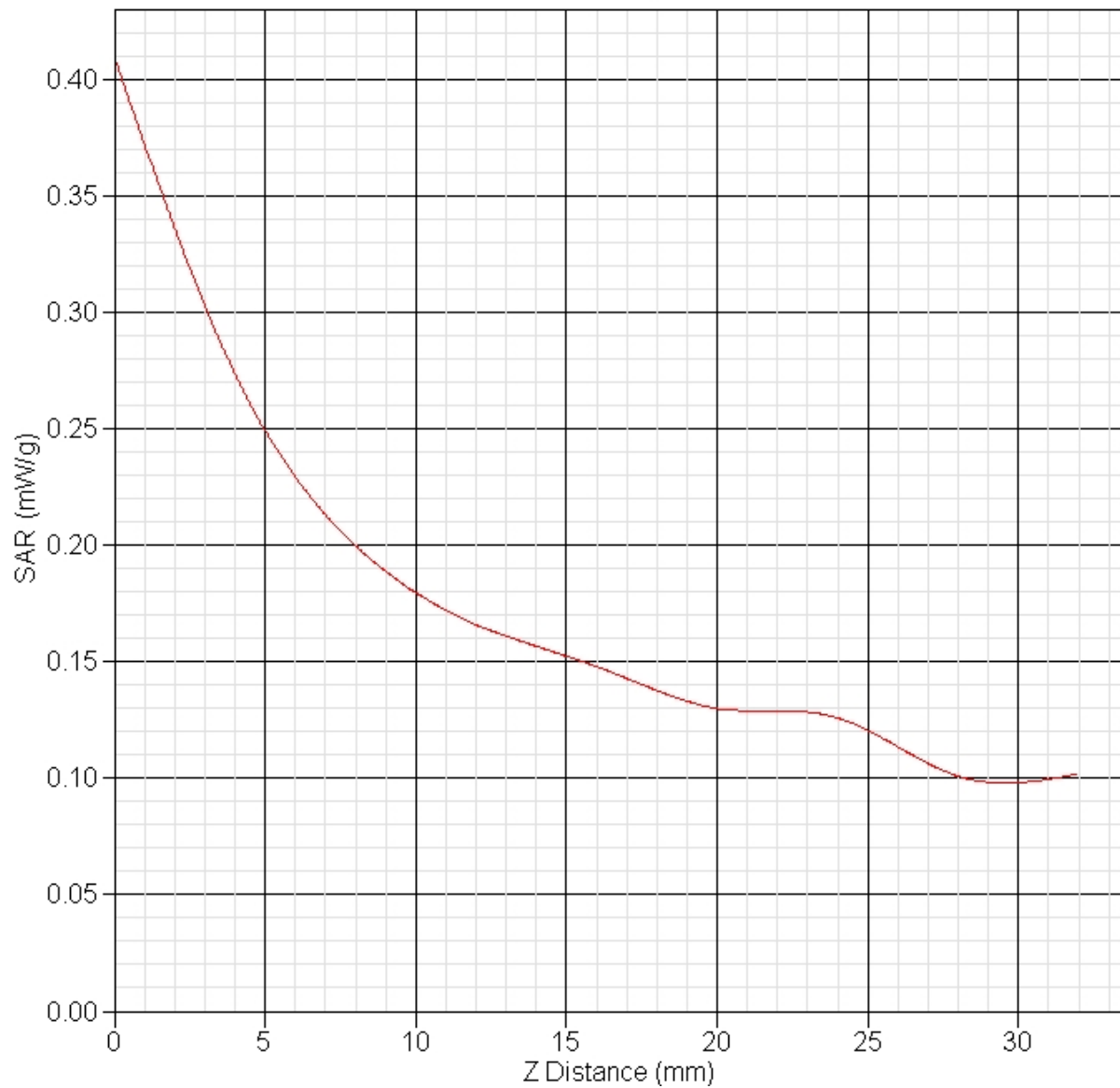
DUT Position : Side C  
Separation : 18 mm  
Channel : Mid



1 gram SAR value : 0.169 W/kg  
10 gram SAR value : 0.093 W/kg  
Area Scan Peak SAR : 0.265 W/kg  
Zoom Scan Peak SAR : 0.410 W/kg

### SAR-Z Axis

at Hotspot x:0.20 y:-6.94



**SAR Test Report**

By Operator : Jay  
Measurement Date : 01-Jun-2011  
Starting Time : 01-Jun-2011 08:34:10 AM  
End Time : 01-Jun-2011 08:48:05 AM  
Scanning Time : 835 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 4025C2002764  
Mode : 802.11b  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.06 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 75 mm  
Depth : 40 mm  
Antenna Type : Internal - Chain A  
Orientation : Side D  
Power Drift-Start : 0.275 W/kg  
Power Drift-Finish: 0.284 W/kg  
Power Drift (%) : 3.172

## 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 : 01-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.36 F/m  
Sigma : 1.96 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

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

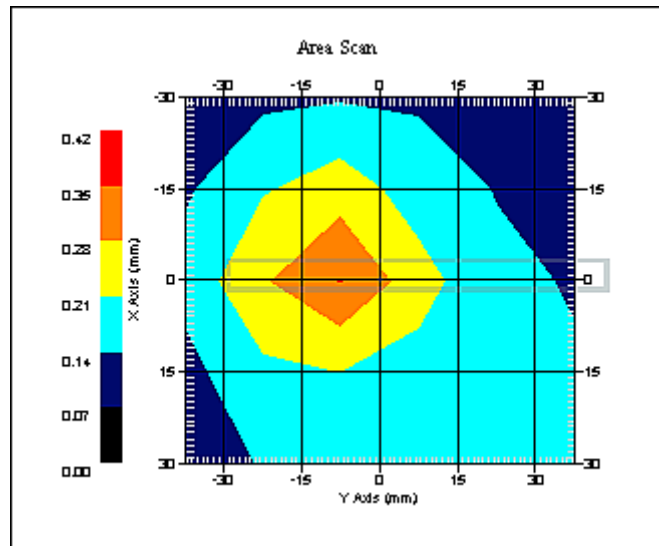


## Measurement Data

Crest Factor : 1  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 01-Jun-2011  
Set-up Time : 7:02:24 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side D  
Separation : 18 mm  
Channel : Mid



1 gram SAR value : 0.133 W/kg  
10 gram SAR value : 0.087 W/kg  
Area Scan Peak SAR : 0.152 W/kg  
Zoom Scan Peak SAR : 0.280 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 01-Jun-2011  
Starting Time : 01-Jun-2011 08:00:40 AM  
End Time : 01-Jun-2011 08:14:37 AM  
Scanning Time : 837 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 4025C2002764  
Mode : 802.11b  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.06 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 40 mm  
Depth : 75 mm  
Antenna Type : Internal - Chain A  
Orientation : Side E  
Power Drift-Start : 0.272 W/kg  
Power Drift-Finish: 0.276 W/kg  
Power Drift (%) : 1.126

## 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 : 01-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.36 F/m  
Sigma : 1.96 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

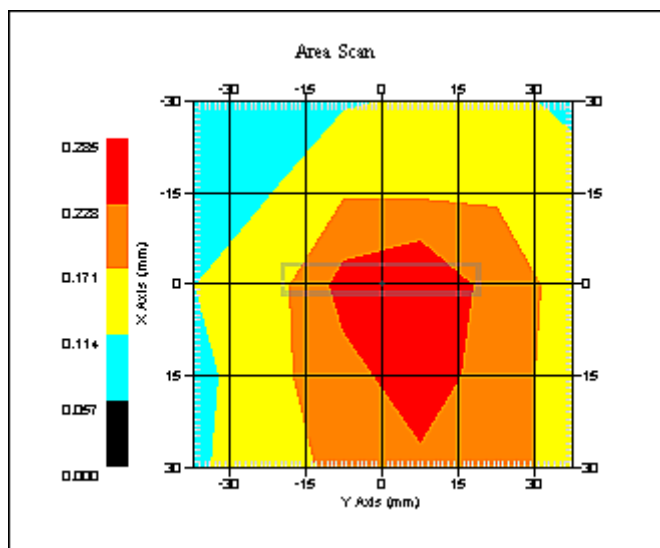
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56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

## Measurement Data

Crest Factor : 1  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 01-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side E  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.090 W/kg  
 10 gram SAR value : 0.075 W/kg  
 Area Scan Peak SAR : 0.184 W/kg  
 Zoom Scan Peak SAR : 0.280 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 01-Jun-2011  
Starting Time : 01-Jun-2011 08:17:37 AM  
End Time : 01-Jun-2011 08:31:32 AM  
Scanning Time : 835 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 4025C2002764  
Mode : 802.11b  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2450.00 MHz  
Max. Transmit Pwr : 0.06 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 75 mm  
Depth : 40 mm  
Antenna Type : Internal - Chain A  
Orientation : Side F  
Power Drift-Start : 0.249 W/kg  
Power Drift-Finish: 0.258 W/kg  
Power Drift (%) : 3.547

## 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 : 01-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.36 F/m  
Sigma : 1.96 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

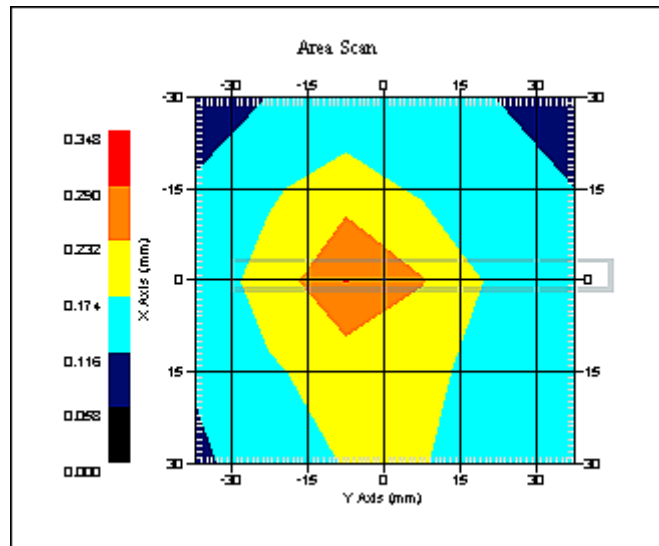
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2450.00 MHz  
Duty Cycle Factor: 1  
Conversion Factor: 4.5  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56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

## Measurement Data

Crest Factor : 1  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 01-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side F  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.070 W/kg  
 10 gram SAR value : 0.060 W/kg  
 Area Scan Peak SAR : 0.091 W/kg  
 Zoom Scan Peak SAR : 0.110 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 07:40:53 AM  
End Time : 10-Jun-2011 07:57:31 AM  
Scanning Time : 998 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 40 mm  
Width : 75 mm  
Depth : 8 mm  
Antenna Type : Internal - Chain A  
Orientation : Side A  
Power Drift-Start : 0.260 W/kg  
Power Drift-Finish: 0.253 W/kg  
Power Drift (%) : -2.698

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

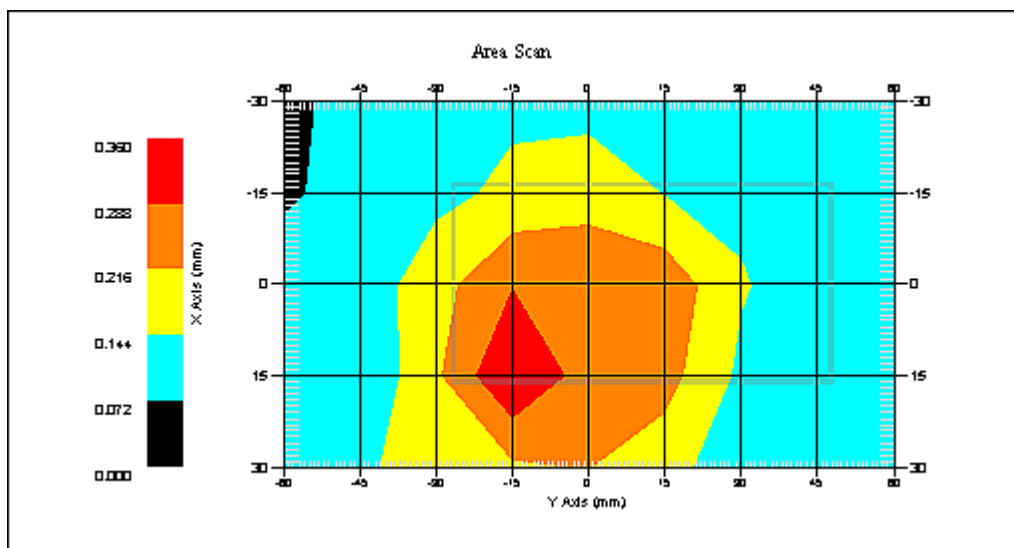
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 10-Jun-2011  
Set-up Time : 7:02:24 AM  
Area Scan : 5x9x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side A  
Separation : 18 mm  
Channel : Mid



1 gram SAR value : 0.337 W/kg  
10 gram SAR value : 0.209 W/kg  
Area Scan Peak SAR : 0.360 W/kg  
Zoom Scan Peak SAR : 0.580 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 08:01:39 AM  
End Time : 10-Jun-2011 08:18:23 AM  
Scanning Time : 1004 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 40 mm  
Width : 75 mm  
Depth : 8 mm  
Antenna Type : Internal - Chain A  
Orientation : Side B  
Power Drift-Start : 0.245 W/kg  
Power Drift-Finish: 0.251 W/kg  
Power Drift (%) : 2.440

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

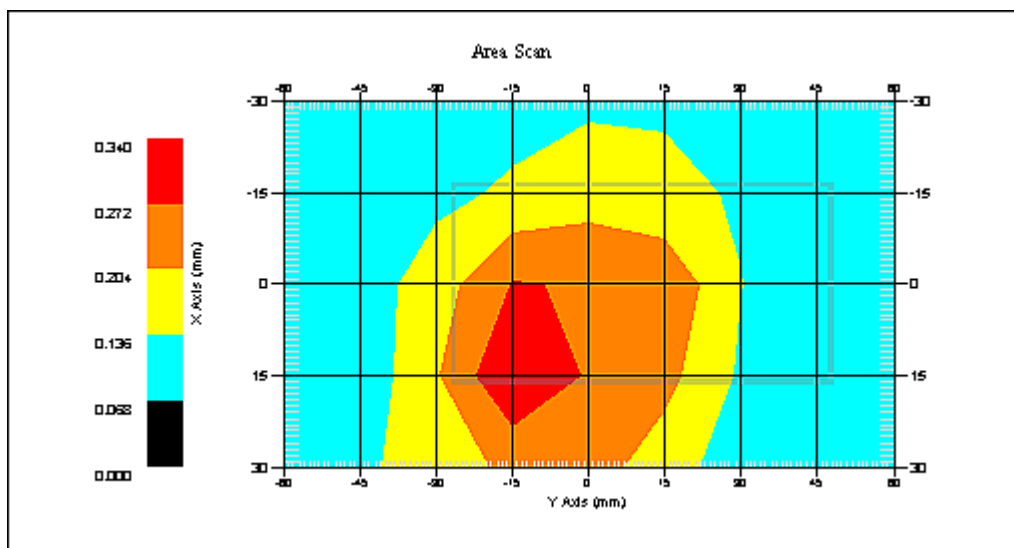


## Measurement Data

Crest Factor : 3.2  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x9x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side B  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.292 W/kg  
 10 gram SAR value : 0.180 W/kg  
 Area Scan Peak SAR : 0.340 W/kg  
 Zoom Scan Peak SAR : 0.510 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 08:21:19 AM  
End Time : 10-Jun-2011 08:35:21 AM  
Scanning Time : 842 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 40 mm  
Depth : 75 mm  
Antenna Type : Internal - Chain A  
Orientation : Side C  
Power Drift-Start : 0.257 W/kg  
Power Drift-Finish: 0.261 W/kg  
Power Drift (%) : 1.187

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

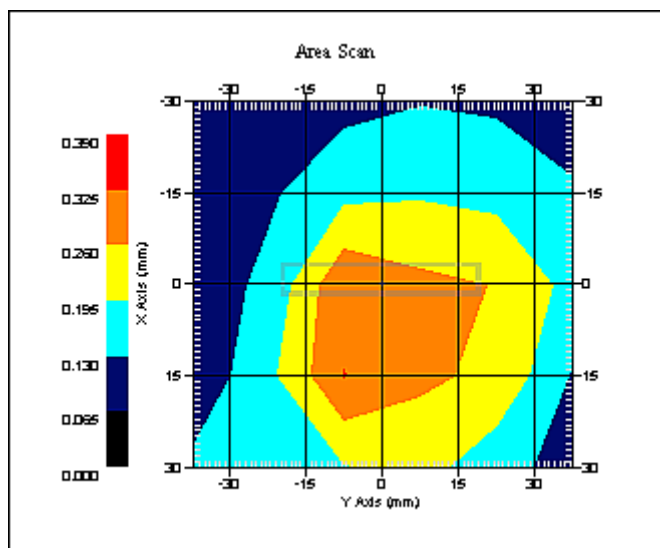
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 10-Jun-2011  
Set-up Time : 7:02:24 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side C  
Separation : 18 mm  
Channel : Mid



1 gram SAR value : 0.343 W/kg  
10 gram SAR value : 0.211 W/kg  
Area Scan Peak SAR : 0.326 W/kg  
Zoom Scan Peak SAR : 0.590 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 08:58:20 AM  
End Time : 10-Jun-2011 09:12:06 AM  
Scanning Time : 826 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 75 mm  
Depth : 40 mm  
Antenna Type : Internal - Chain A  
Orientation : Side D  
Power Drift-Start : 0.256 W/kg  
Power Drift-Finish: 0.263 W/kg  
Power Drift (%) : 2.930

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

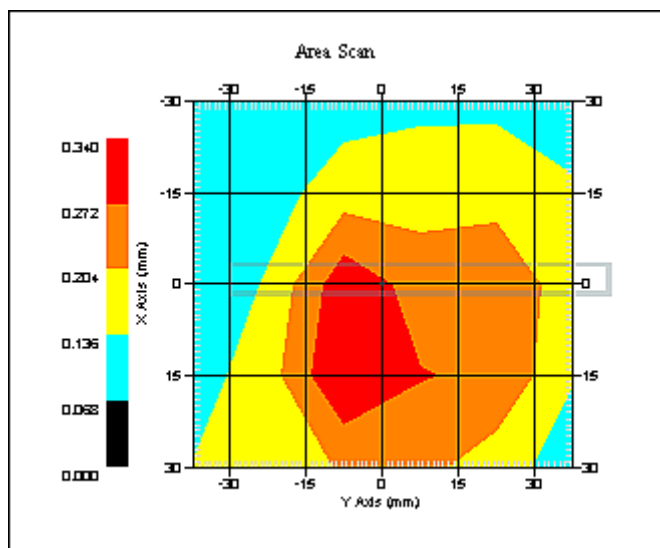
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

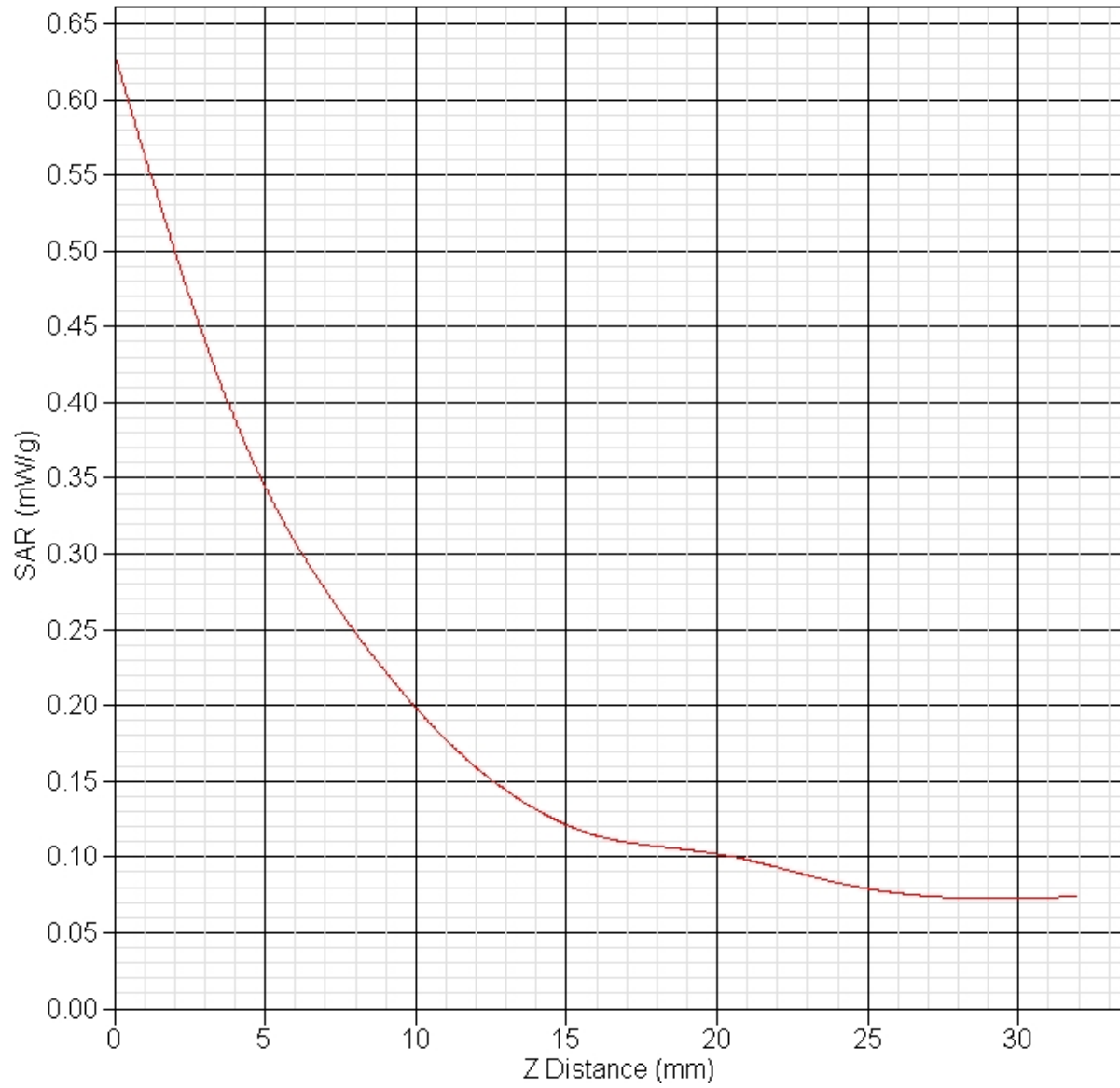
DUT Position : Side D  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.353 W/kg  
 10 gram SAR value : 0.213 W/kg  
 Area Scan Peak SAR : 0.340 W/kg  
 Zoom Scan Peak SAR : 0.630 W/kg

### SAR-Z Axis

at Hotspot x:7.13 y:-6.94



**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 08:39:25 AM  
End Time : 10-Jun-2011 08:53:15 AM  
Scanning Time : 830 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 40 mm  
Depth : 75 mm  
Antenna Type : Internal - Chain A  
Orientation : Side E  
Power Drift-Start : 0.180 W/kg  
Power Drift-Finish: 0.184 W/kg  
Power Drift (%) : 2.315

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

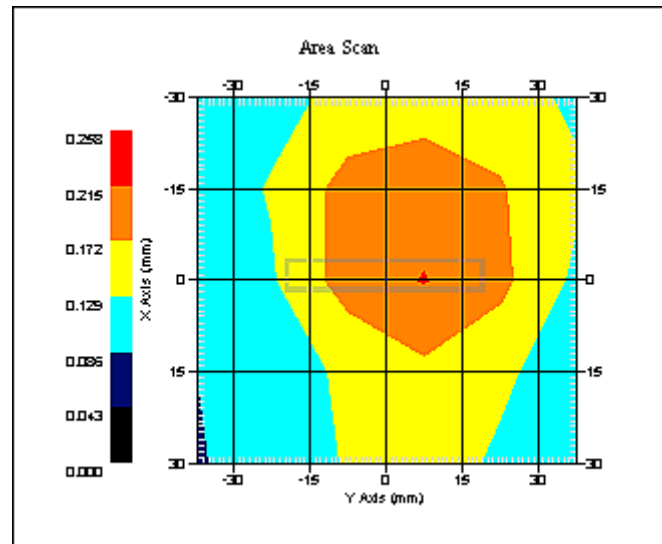
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 10-Jun-2011  
Set-up Time : 7:02:24 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side E  
Separation : 18 mm  
Channel : Mid



1 gram SAR value : 0.195 W/kg  
10 gram SAR value : 0.150 W/kg  
Area Scan Peak SAR : 0.217 W/kg  
Zoom Scan Peak SAR : 0.310 W/kg



**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 09:19:03 AM  
End Time : 10-Jun-2011 09:32:50 AM  
Scanning Time : 827 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 75 mm  
Depth : 40 mm  
Antenna Type : Internal - Chain A  
Orientation : Side F  
Power Drift-Start : 0.183 W/kg  
Power Drift-Finish: 0.178 W/kg  
Power Drift (%) : -2.789

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

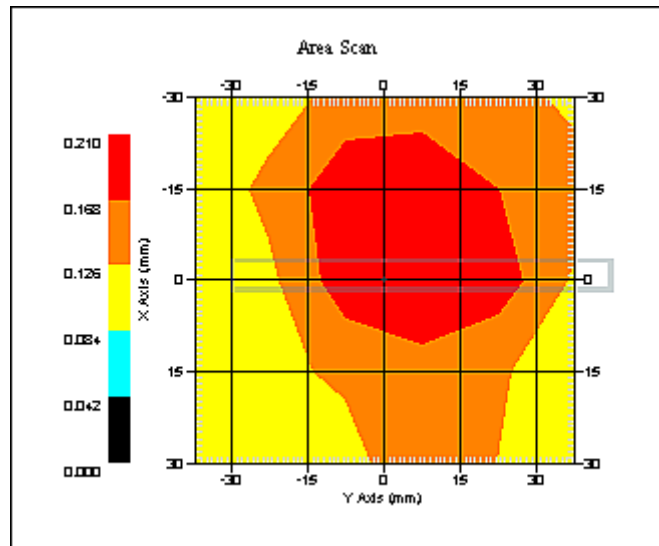
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
Scan Type : Complete  
Tissue Temp. : 20.00 °C  
Ambient Temp. : 23.00 °C  
Set-up Date : 10-Jun-2011  
Set-up Time : 7:02:24 AM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side F  
Separation : 18 mm  
Channel : Mid



1 gram SAR value : 0.205 W/kg  
10 gram SAR value : 0.153 W/kg  
Area Scan Peak SAR : 0.210 W/kg  
Zoom Scan Peak SAR : 0.220 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 11:13:18 AM  
End Time : 10-Jun-2011 11:33:23 AM  
Scanning Time : 1205 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 40 mm  
Width : 75 mm  
Depth : 8 mm  
Antenna Type : Internal - Chain B  
Orientation : Side A  
Power Drift-Start : 0.166 W/kg  
Power Drift-Finish: 0.174 W/kg  
Power Drift (%) : 4.664

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

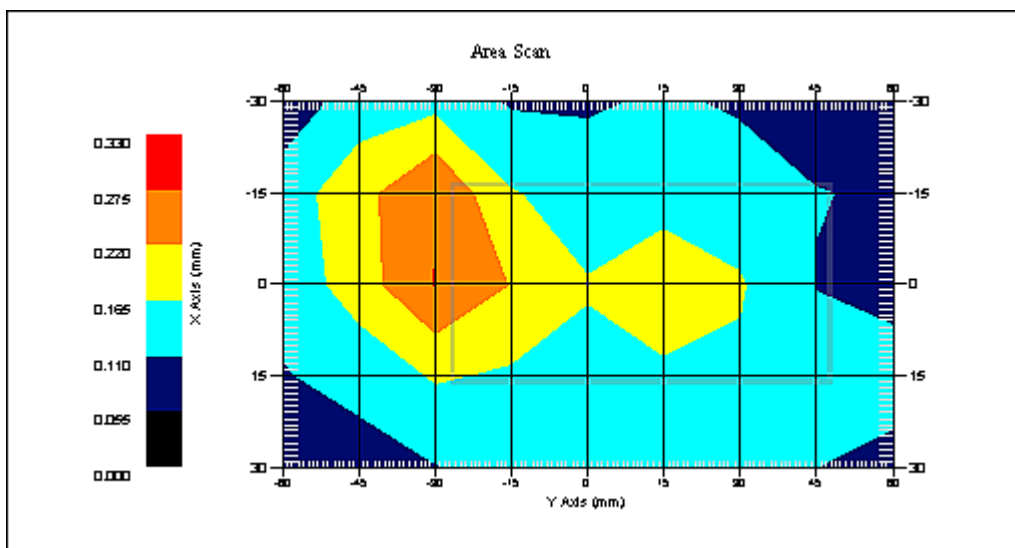
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x9x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side A  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.289 W/kg  
 10 gram SAR value : 0.192 W/kg  
 Area Scan Peak SAR : 0.276 W/kg  
 Zoom Scan Peak SAR : 0.460 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 11:36:34 AM  
End Time : 10-Jun-2011 11:56:48 AM  
Scanning Time : 1214 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 40 mm  
Width : 75 mm  
Depth : 8 mm  
Antenna Type : Internal - Chain B  
Orientation : Side B  
Power Drift-Start : 0.255 W/kg  
Power Drift-Finish: 0.255 W/kg  
Power Drift (%) : -0.110

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

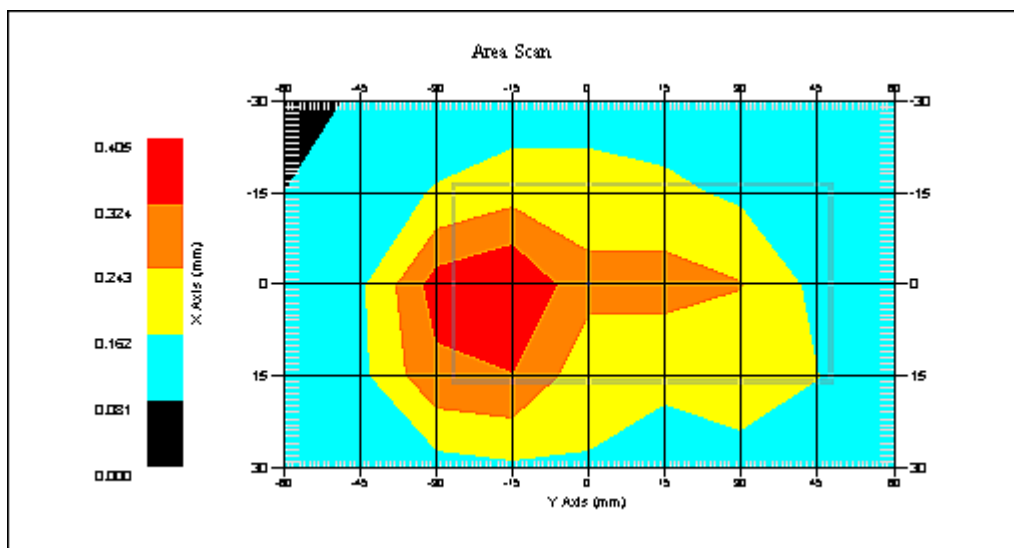
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x9x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side B  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.304 W/kg  
 10 gram SAR value : 0.201 W/kg  
 Area Scan Peak SAR : 0.404 W/kg  
 Zoom Scan Peak SAR : 0.580 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 10:25:57 AM  
End Time : 10-Jun-2011 10:44:12 AM  
Scanning Time : 1095 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 40 mm  
Depth : 75 mm  
Antenna Type : Internal - Chain B  
Orientation : Side C  
Power Drift-Start : 0.372 W/kg  
Power Drift-Finish: 0.366 W/kg  
Power Drift (%) : -1.673

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

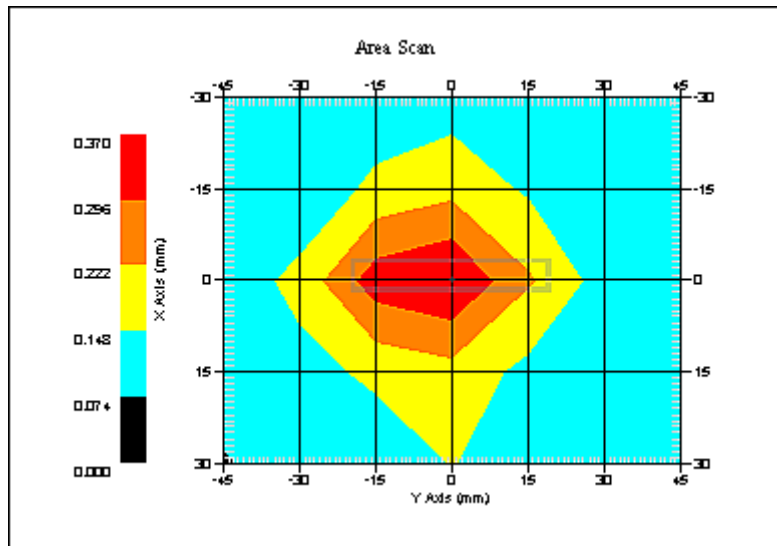
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x7x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side C  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.325 W/kg  
 10 gram SAR value : 0.217 W/kg  
 Area Scan Peak SAR : 0.370 W/kg  
 Zoom Scan Peak SAR : 0.600 W/kg



**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 09:40:38 AM  
End Time : 10-Jun-2011 09:58:38 AM  
Scanning Time : 1080 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 75 mm  
Depth : 40 mm  
Antenna Type : Internal - Chain B  
Orientation : Side D  
Power Drift-Start : 0.129 W/kg  
Power Drift-Finish: 0.126 W/kg  
Power Drift (%) : -1.940

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

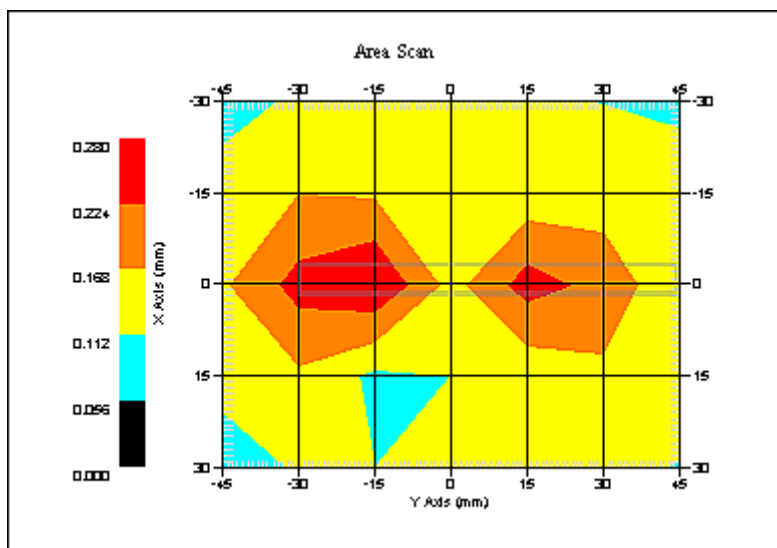
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x7x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side D  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.213 W/kg  
 10 gram SAR value : 0.147 W/kg  
 Area Scan Peak SAR : 0.279 W/kg  
 Zoom Scan Peak SAR : 0.310 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 10:52:23 AM  
End Time : 10-Jun-2011 11:09:54 AM  
Scanning Time : 1051 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 40 mm  
Depth : 75 mm  
Antenna Type : Internal - Chain B  
Orientation : Side E  
Power Drift-Start : 0.120 W/kg  
Power Drift-Finish: 0.116 W/kg  
Power Drift (%) : -3.339

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

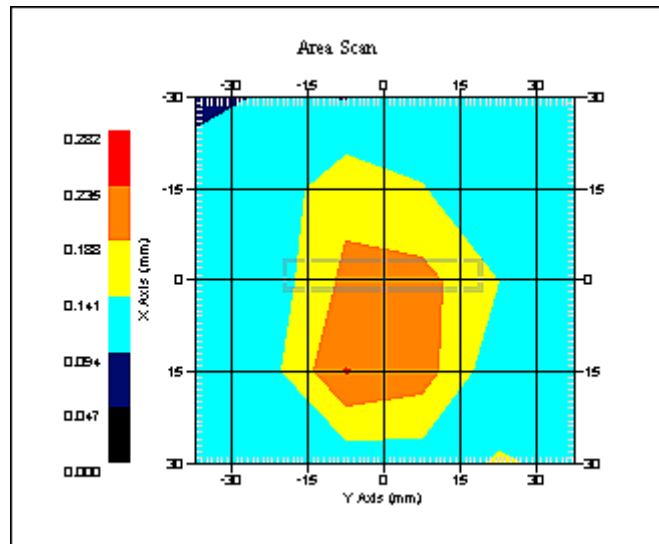
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side E  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.161 W/kg  
 10 gram SAR value : 0.116 W/kg  
 Area Scan Peak SAR : 0.144 W/kg  
 Zoom Scan Peak SAR : 0.140 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 10:01:10 AM  
End Time : 10-Jun-2011 10:19:11 AM  
Scanning Time : 1081 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  5 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.263 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 75 mm  
Depth : 40 mm  
Antenna Type : Internal - Chain B  
Orientation : Side F  
Power Drift-Start : 0.144 W/kg  
Power Drift-Finish: 0.151 W/kg  
Power Drift (%) : 4.867

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 20.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 46.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

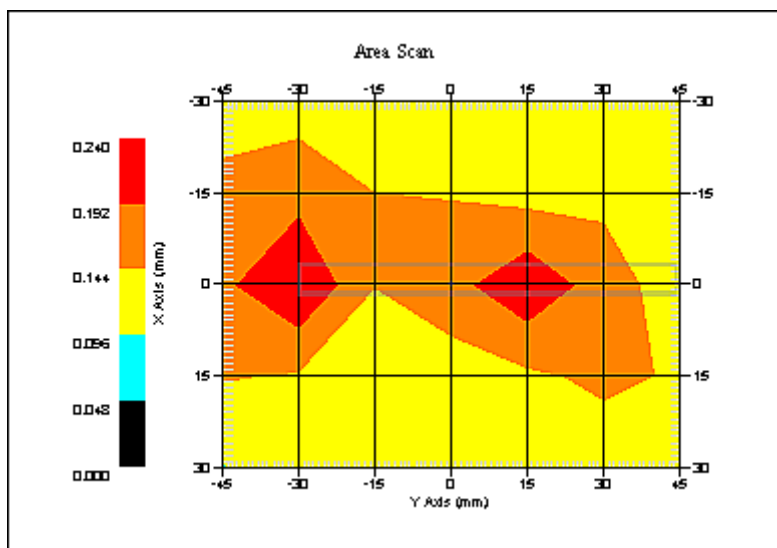
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.2  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.2  
 Scan Type : Complete  
 Tissue Temp. : 20.00 °C  
 Ambient Temp. : 23.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 7:02:24 AM  
 Area Scan : 5x7x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side F  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.223 W/kg  
 10 gram SAR value : 0.156 W/kg  
 Area Scan Peak SAR : 0.239 W/kg  
 Zoom Scan Peak SAR : 0.330 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 12:03:55 PM  
End Time : 10-Jun-2011 12:24:07 PM  
Scanning Time : 1212 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 40 mm  
Width : 75 mm  
Depth : 8 mm  
Antenna Type : Internal - Chain A  
Orientation : Side A  
Power Drift-Start : 0.191 W/kg  
Power Drift-Finish: 0.192 W/kg  
Power Drift (%) : 0.970

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

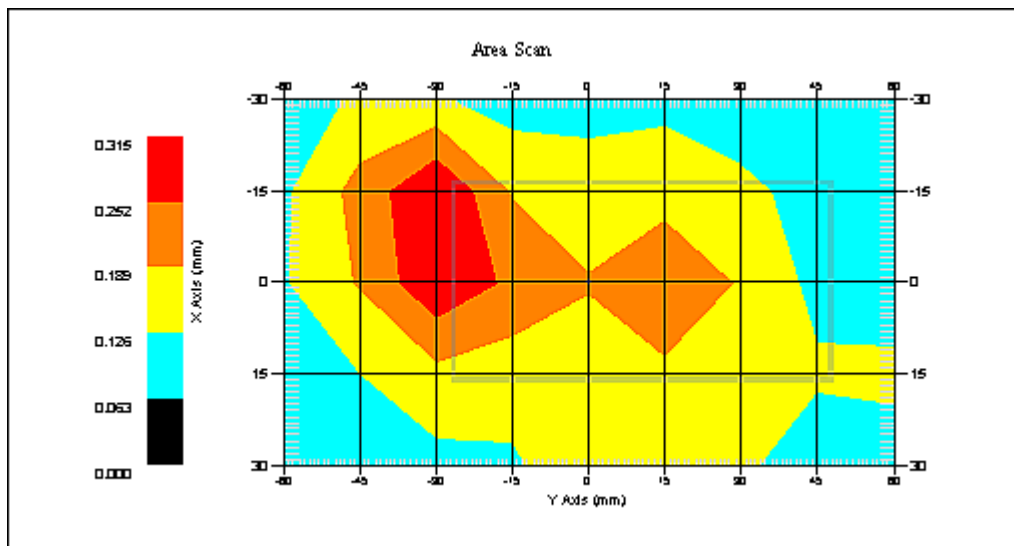
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.4  
Scan Type : Complete  
Tissue Temp. : 21.00 °C  
Ambient Temp. : 25.00 °C  
Set-up Date : 10-Jun-2011  
Set-up Time : 1:53:13 PM  
Area Scan : 5x9x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side A  
Separation : 18 mm  
Channel : Mid

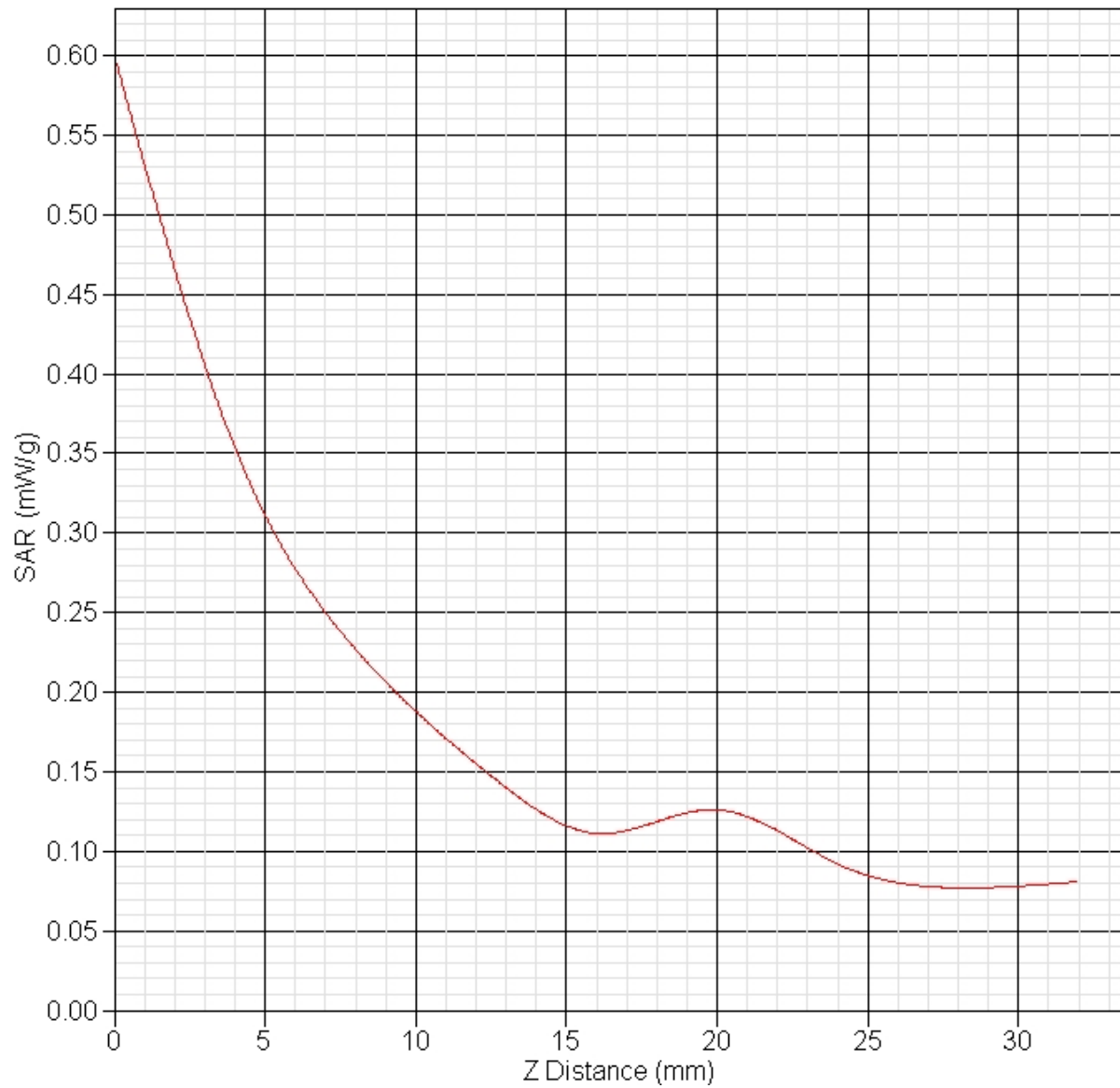


1 gram SAR value : 0.339 W/kg  
10 gram SAR value : 0.204 W/kg  
Area Scan Peak SAR : 0.314 W/kg  
Zoom Scan Peak SAR : 0.600 W/kg



**SAR-Z Axis**

at Hotspot x:-6.88 y:-29.97



**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 12:27:34 PM  
End Time : 10-Jun-2011 12:47:20 PM  
Scanning Time : 1186 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 40 mm  
Width : 75 mm  
Depth : 8 mm  
Antenna Type : Internal - Chain A  
Orientation : Side B  
Power Drift-Start : 0.238 W/kg  
Power Drift-Finish: 0.239 W/kg  
Power Drift (%) : 0.313

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

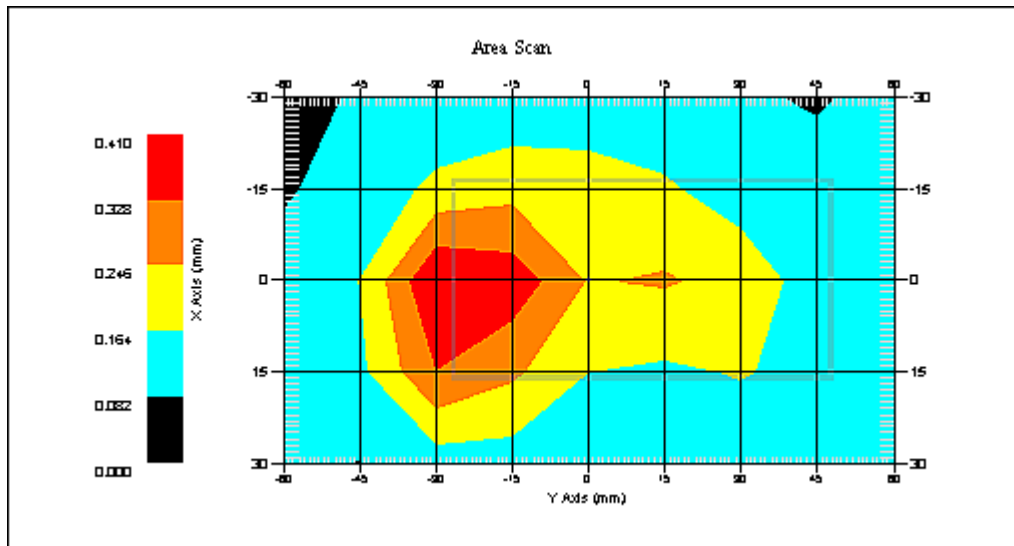
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.4  
 Scan Type : Complete  
 Tissue Temp. : 21.00 °C  
 Ambient Temp. : 25.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 1:53:13 PM  
 Area Scan : 5x9x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side B  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.320 W/kg  
 10 gram SAR value : 0.207 W/kg  
 Area Scan Peak SAR : 0.410 W/kg  
 Zoom Scan Peak SAR : 0.620 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 12:54:56 PM  
End Time : 10-Jun-2011 01:13:30 PM  
Scanning Time : 1114 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 40 mm  
Depth : 75 mm  
Antenna Type : Internal - Chain A  
Orientation : Side C  
Power Drift-Start : 0.247 W/kg  
Power Drift-Finish: 0.242 W/kg  
Power Drift (%) : -2.022

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

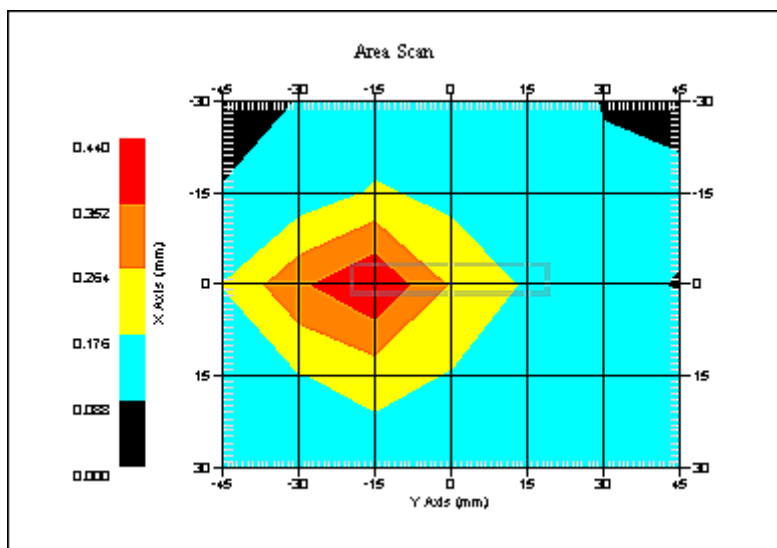
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.4  
 Scan Type : Complete  
 Tissue Temp. : 21.00 °C  
 Ambient Temp. : 25.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 1:53:13 PM  
 Area Scan : 5x7x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side C  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.301 W/kg  
 10 gram SAR value : 0.174 W/kg  
 Area Scan Peak SAR : 0.408 W/kg  
 Zoom Scan Peak SAR : 0.600 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 01:39:50 PM  
End Time : 10-Jun-2011 01:57:56 PM  
Scanning Time : 1086 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 75 mm  
Depth : 40 mm  
Antenna Type : Internal - Chain A  
Orientation : Side D  
Power Drift-Start : 0.146 W/kg  
Power Drift-Finish: 0.151 W/kg  
Power Drift (%) : 3.420

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

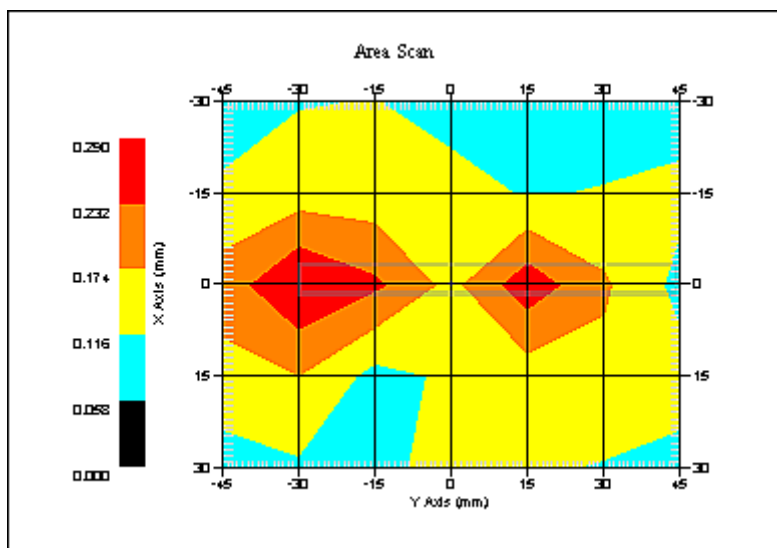
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.4  
 Scan Type : Complete  
 Tissue Temp. : 21.00 °C  
 Ambient Temp. : 25.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 1:53:13 PM  
 Area Scan : 5x7x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side D  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.258 W/kg  
 10 gram SAR value : 0.164 W/kg  
 Area Scan Peak SAR : 0.290 W/kg  
 Zoom Scan Peak SAR : 0.380 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 01:17:37 PM  
End Time : 10-Jun-2011 01:35:20 PM  
Scanning Time : 1063 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 40 mm  
Depth : 75 mm  
Antenna Type : Internal - Chain A  
Orientation : Side E  
Power Drift-Start : 0.203 W/kg  
Power Drift-Finish: 0.204 W/kg  
Power Drift (%) : 0.862

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

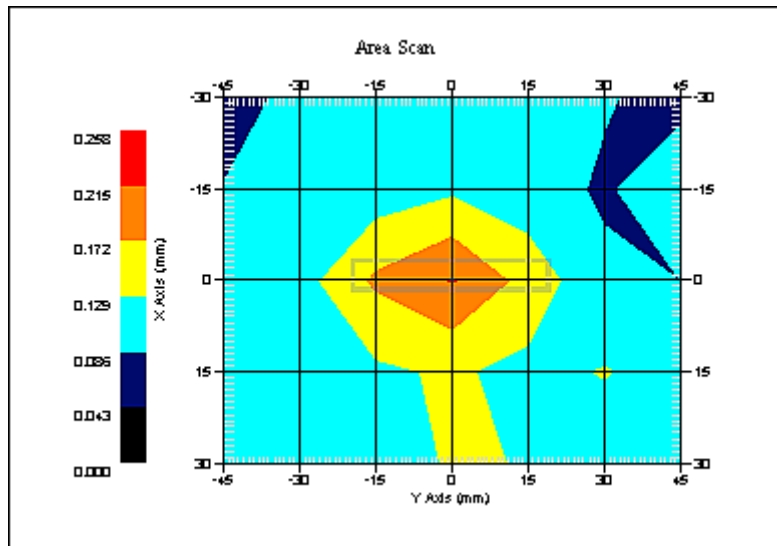


## Measurement Data

Crest Factor : 3.4  
 Scan Type : Complete  
 Tissue Temp. : 21.00 °C  
 Ambient Temp. : 25.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 1:53:13 PM  
 Area Scan : 5x7x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side E  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.192 W/kg  
 10 gram SAR value : 0.138 W/kg  
 Area Scan Peak SAR : 0.217 W/kg  
 Zoom Scan Peak SAR : 0.280 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 02:02:14 PM  
End Time : 10-Jun-2011 02:19:11 PM  
Scanning Time : 1017 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 75 mm  
Depth : 40 mm  
Antenna Type : Internal - Chain A  
Orientation : Side F  
Power Drift-Start : 0.113 W/kg  
Power Drift-Finish: 0.114 W/kg  
Power Drift (%) : 0.120

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

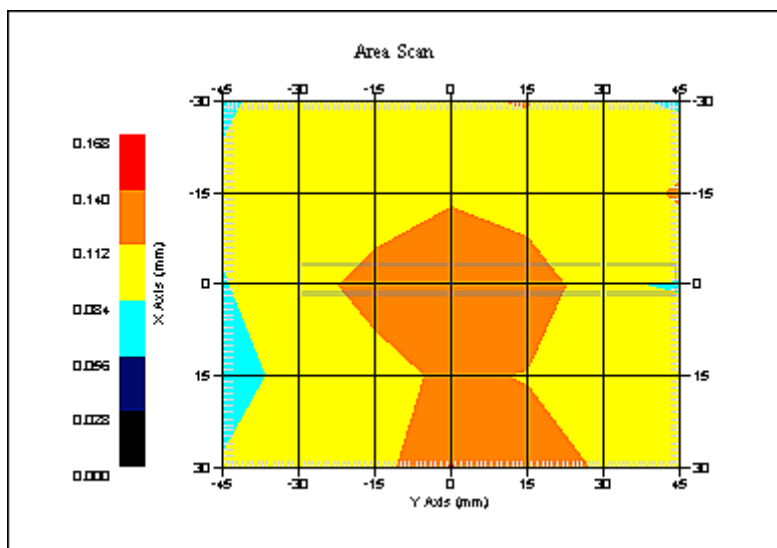
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.4  
 Scan Type : Complete  
 Tissue Temp. : 21.00 °C  
 Ambient Temp. : 25.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 1:53:13 PM  
 Area Scan : 5x7x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side F  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.130 W/kg  
 10 gram SAR value : 0.102 W/kg  
 Area Scan Peak SAR : 0.141 W/kg  
 Zoom Scan Peak SAR : 0.040 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 03:38:01 PM  
End Time : 10-Jun-2011 03:55:00 PM  
Scanning Time : 1019 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 40 mm  
Width : 75 mm  
Depth : 8 mm  
Antenna Type : Internal - Chain B  
Orientation : Side A  
Power Drift-Start : 0.092 W/kg  
Power Drift-Finish: 0.091 W/kg  
Power Drift (%) : -1.088

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

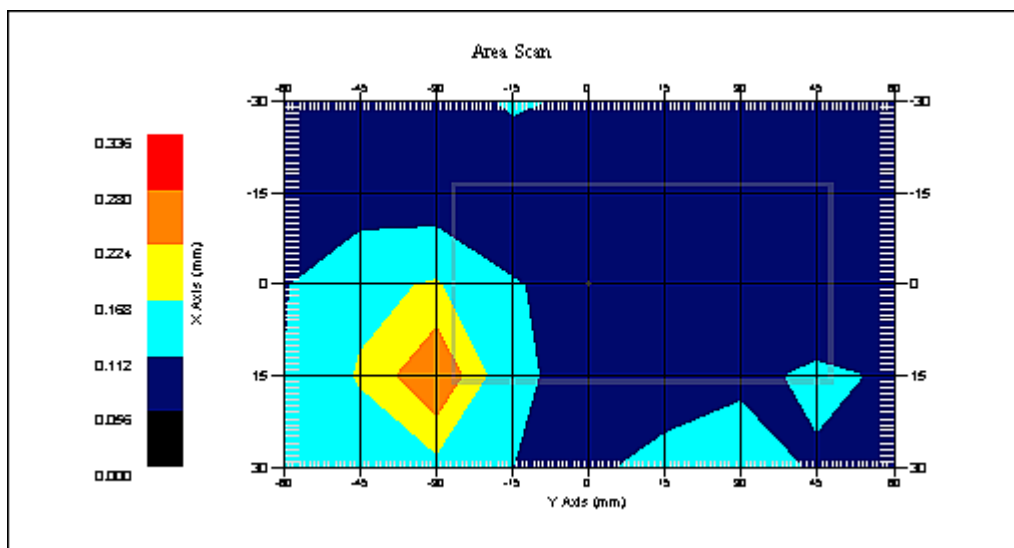
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.4  
 Scan Type : Complete  
 Tissue Temp. : 21.00 °C  
 Ambient Temp. : 25.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 1:53:13 PM  
 Area Scan : 5x9x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side A  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.301 W/kg  
 10 gram SAR value : 0.166 W/kg  
 Area Scan Peak SAR : 0.302 W/kg  
 Zoom Scan Peak SAR : 0.513 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 04:01:37 PM  
End Time : 10-Jun-2011 04:18:39 PM  
Scanning Time : 1022 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 40 mm  
Width : 75 mm  
Depth : 8 mm  
Antenna Type : Internal - Chain B  
Orientation : Side B  
Power Drift-Start : 0.085 W/kg  
Power Drift-Finish: 0.083 W/kg  
Power Drift (%) : -2.353

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

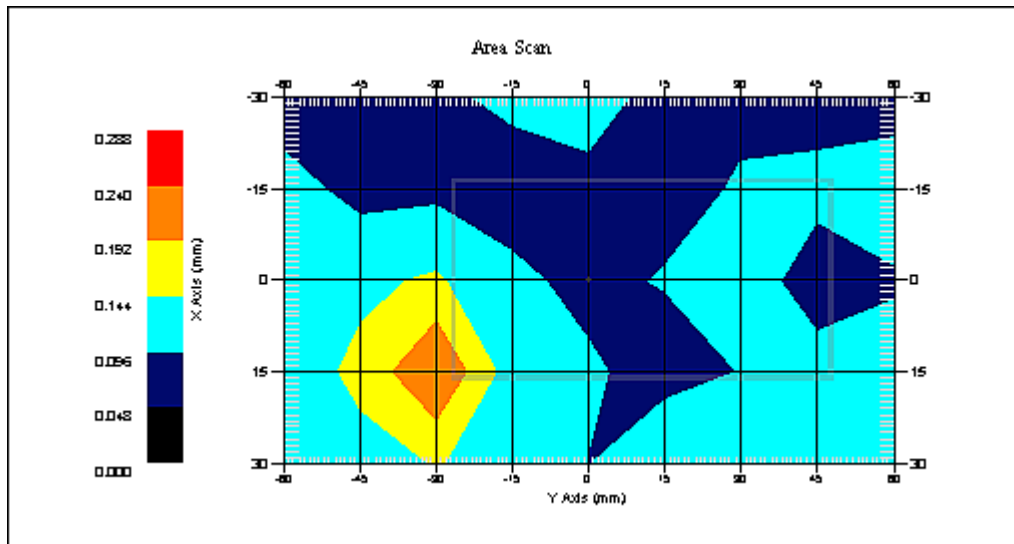
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.4  
 Scan Type : Complete  
 Tissue Temp. : 21.00 °C  
 Ambient Temp. : 25.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 1:53:13 PM  
 Area Scan : 5x9x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side B  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.286 W/kg  
 10 gram SAR value : 0.155 W/kg  
 Area Scan Peak SAR : 0.245 W/kg  
 Zoom Scan Peak SAR : 0.492 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 03:00:29 PM  
End Time : 10-Jun-2011 03:14:35 PM  
Scanning Time : 846 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 40 mm  
Depth : 75 mm  
Antenna Type : Internal - Chain B  
Orientation : Side C  
Power Drift-Start : 0.111 W/kg  
Power Drift-Finish: 0.109 W/kg  
Power Drift (%) : -1.802

## Phantom Data

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

## Tissue Data

Type : BODY  
Serial No. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

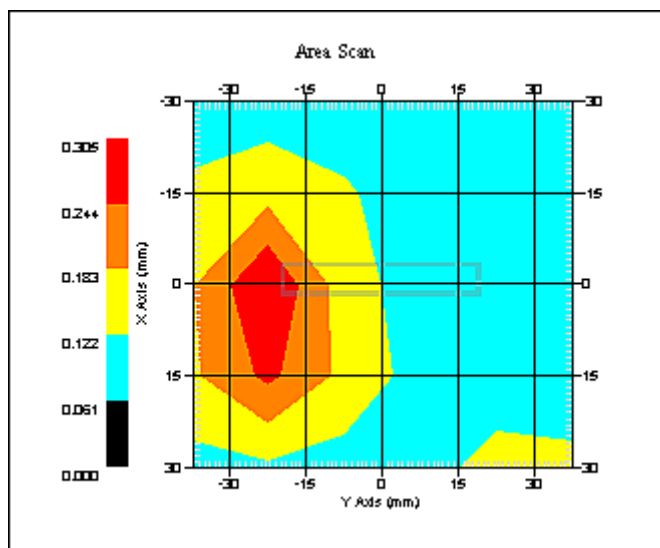


## Measurement Data

Crest Factor : 3.4  
 Scan Type : Complete  
 Tissue Temp. : 21.00 °C  
 Ambient Temp. : 25.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 1:53:13 PM  
 Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side C  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.319 W/kg  
 10 gram SAR value : 0.204 W/kg  
 Area Scan Peak SAR : 0.297 W/kg  
 Zoom Scan Peak SAR : 0.649 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 02:24:34 PM  
End Time : 10-Jun-2011 02:38:37 PM  
Scanning Time : 843 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 75 mm  
Depth : 40 mm  
Antenna Type : Internal - Chain B  
Orientation : Side D  
Power Drift-Start : 0.216 W/kg  
Power Drift-Finish: 0.207 W/kg  
Power Drift (%) : -4.160

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

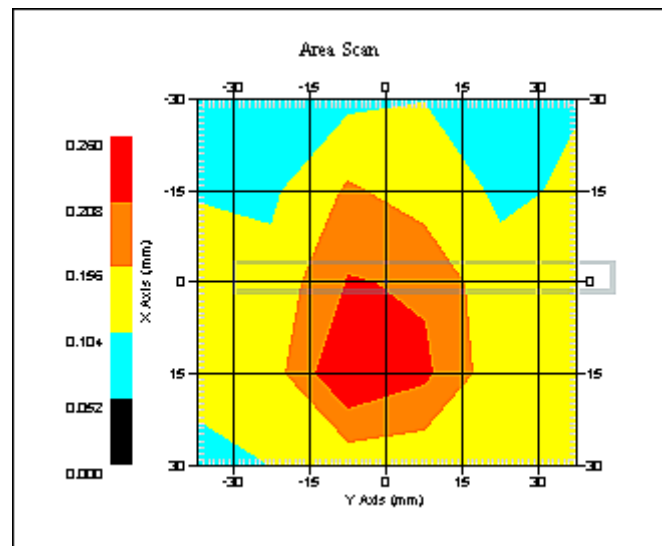
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.4  
Scan Type : Complete  
Tissue Temp. : 21.00 °C  
Ambient Temp. : 25.00 °C  
Set-up Date : 10-Jun-2011  
Set-up Time : 1:53:13 PM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side D  
Separation : 18 mm  
Channel : Mid



1 gram SAR value : 0.224 W/kg  
10 gram SAR value : 0.146 W/kg  
Area Scan Peak SAR : 0.241 W/kg  
Zoom Scan Peak SAR : 0.567 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 03:19:09 PM  
End Time : 10-Jun-2011 03:33:23 PM  
Scanning Time : 854 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 40 mm  
Depth : 75 mm  
Antenna Type : Internal - Chain B  
Orientation : Side E  
Power Drift-Start : 0.241 W/kg  
Power Drift-Finish: 0.236 W/kg  
Power Drift (%) : -2.075

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

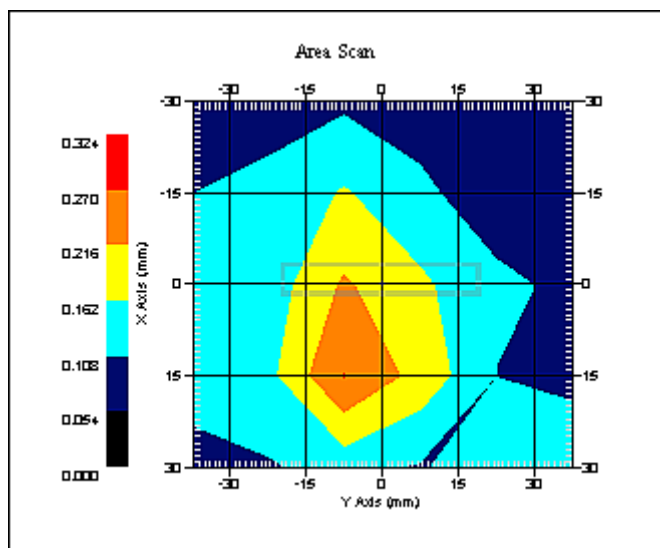
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.4  
 Scan Type : Complete  
 Tissue Temp. : 21.00 °C  
 Ambient Temp. : 25.00 °C  
 Set-up Date : 10-Jun-2011  
 Set-up Time : 1:53:13 PM  
 Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
 Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

## Other Data

DUT Position : Side E  
 Separation : 18 mm  
 Channel : Mid



1 gram SAR value : 0.175 W/kg  
 10 gram SAR value : 0.081 W/kg  
 Area Scan Peak SAR : 0.279 W/kg  
 Zoom Scan Peak SAR : 0.423 W/kg

**SAR Test Report**

By Operator : Jay  
Measurement Date : 10-Jun-2011  
Starting Time : 10-Jun-2011 02:42:00 PM  
End Time : 10-Jun-2011 02:56:12 PM  
Scanning Time : 852 secs

## Product Data

Device Name : Intel Corporation  
Serial No. : 502DA200099F  
Mode : QPSK  $\frac{1}{2}$  10 MHz  
Model : Intel®Centrino®Wireless+WiMax6150 (Model612BNXH&612BNXHU)  
Frequency : 2593.00 MHz  
Max. Transmit Pwr : 0.222 W  
Drift Time : 0 min(s)  
Length : 8 mm  
Width : 75 mm  
Depth : 40 mm  
Antenna Type : Internal - Chain B  
Orientation : Side F  
Power Drift-Start : 0.255 W/kg  
Power Drift-Finish: 0.246 W/kg  
Power Drift (%) : -3.527

## 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. : 2590  
Frequency : 2590.00 MHz  
Last Calib. Date : 10-Jun-2011  
Temperature : 21.00 °C  
Ambient Temp. : 23.00 °C  
Humidity : 42.00 RH%  
Epsilon : 52.28 F/m  
Sigma : 2.18 S/m  
Density : 1000.00 kg/cu. m

## Probe Data

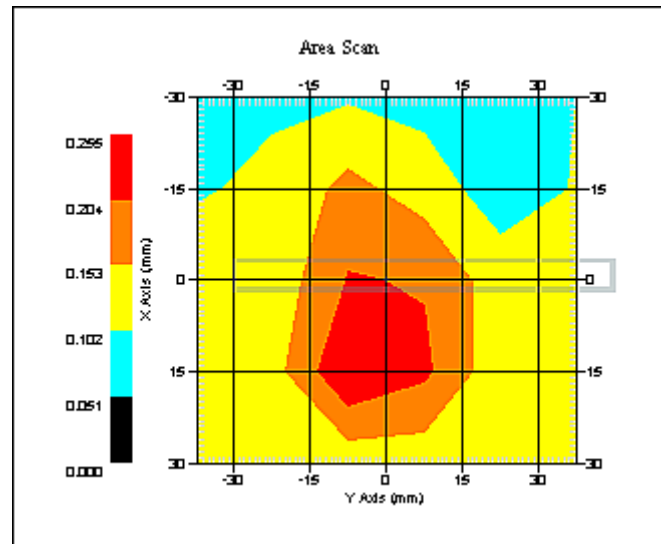
Name : Probe 215 - RFEL  
Model : E020  
Type : E-Field Triangle  
Serial No. : 215  
Last Calib. Date : 22-Sep-2010  
Frequency : 2600.00 MHz  
Duty Cycle Factor: 3.4  
Conversion Factor: 4.7  
Probe Sensitivity: 1.20 1.20 1.20  $\mu\text{V}/(\text{V/m})^2$   
Compression Point: 95.00 mV  
Offset : 1.56 mm

## Measurement Data

Crest Factor : 3.4  
Scan Type : Complete  
Tissue Temp. : 21.00 °C  
Ambient Temp. : 25.00 °C  
Set-up Date : 10-Jun-2011  
Set-up Time : 1:53:13 PM  
Area Scan : 5x6x1 : Measurement x=15mm, y=15mm, z=4mm  
Zoom Scan : 5x5x8 : Measurement x=8mm, y=8mm, z=4mm

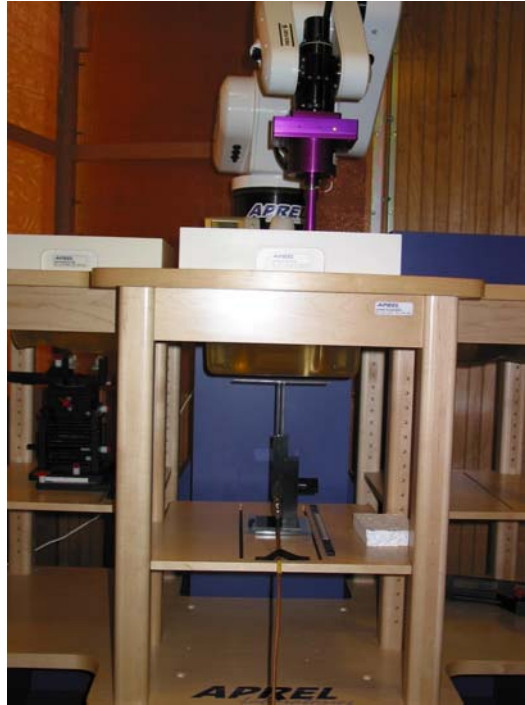
## Other Data

DUT Position : Side F  
Separation : 18 mm  
Channel : Mid

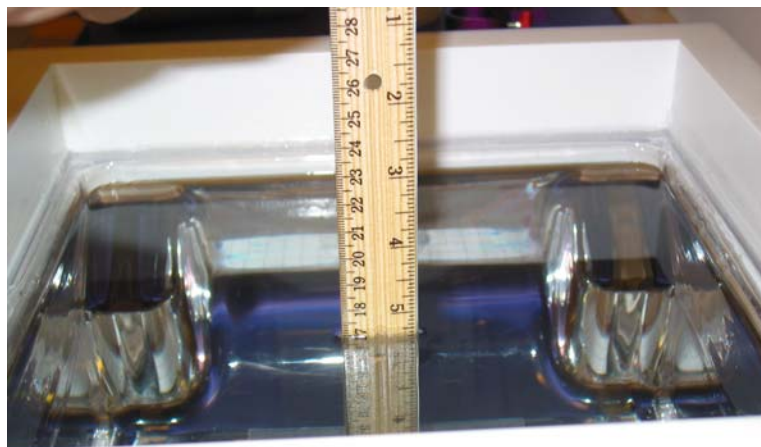


1 gram SAR value : 0.164 W/kg  
10 gram SAR value : 0.084 W/kg  
Area Scan Peak SAR : 0.213 W/kg  
Zoom Scan Peak SAR : 0.297 W/kg

## Appendix C – SAR Test Setup Photos

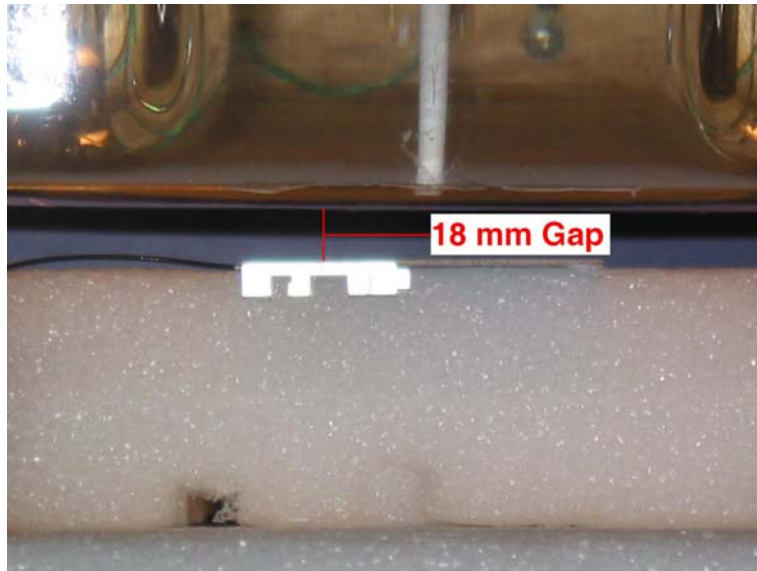


**System Body Configuration**

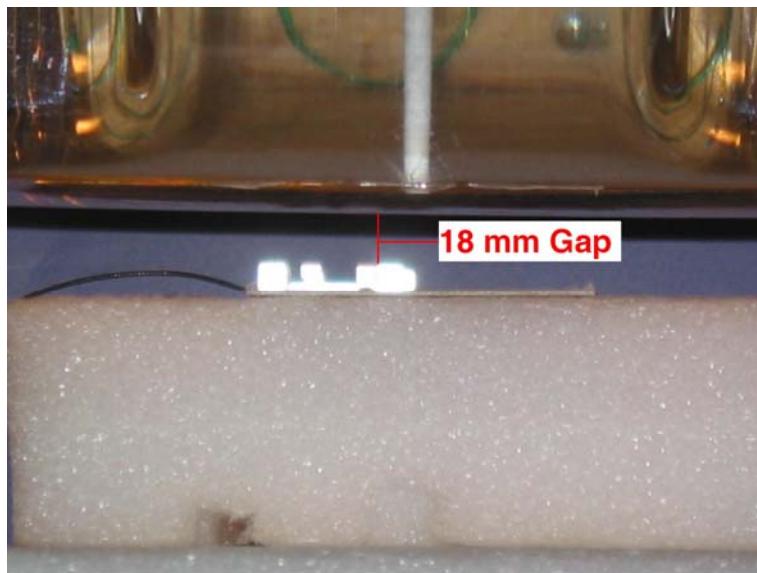


**Body Tissue Depth**

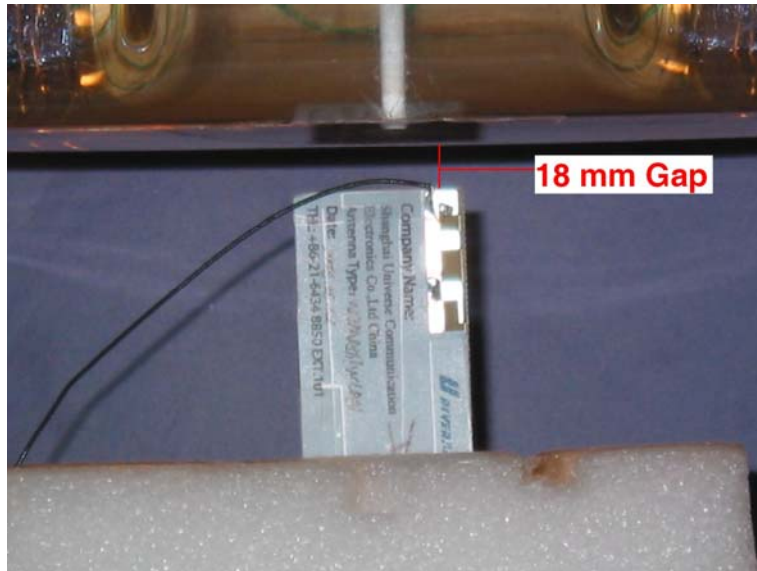




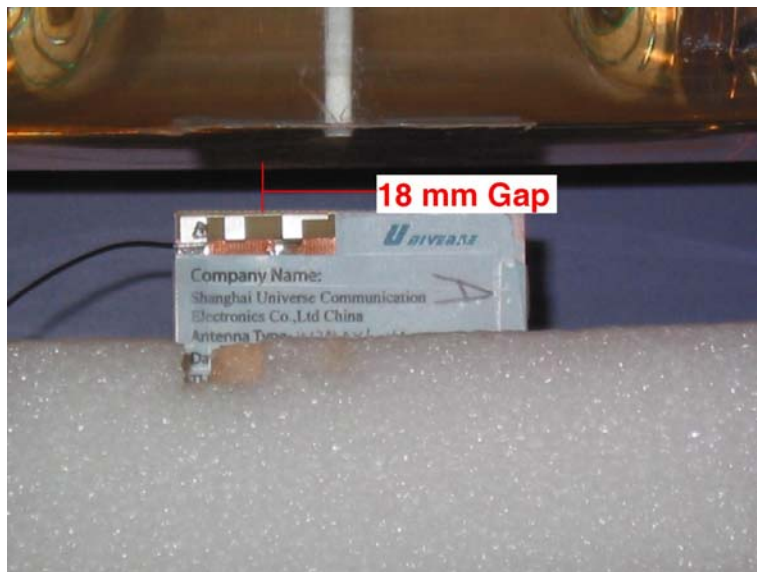
**Test Position Side A 18 mm Gap**



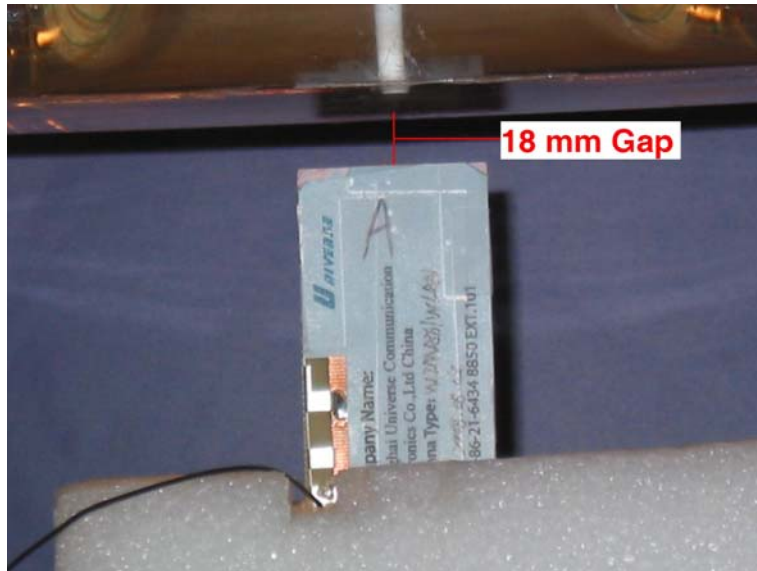
**Test Position Side B 18 mm Gap**



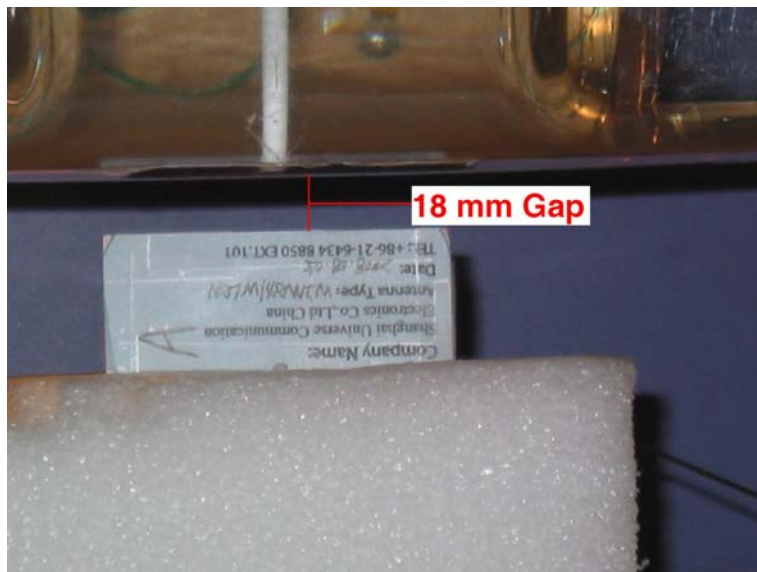
**Test Position Side C 18 mm Gap**



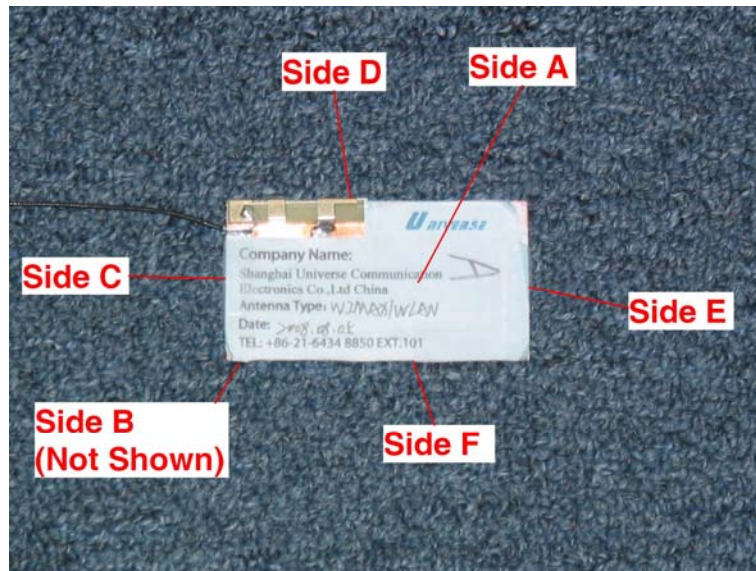
**Test Position Side D 18 mm Gap**



**Test Position Side E 18 mm Gap**



**Test Position Side F 18 mm Gap**

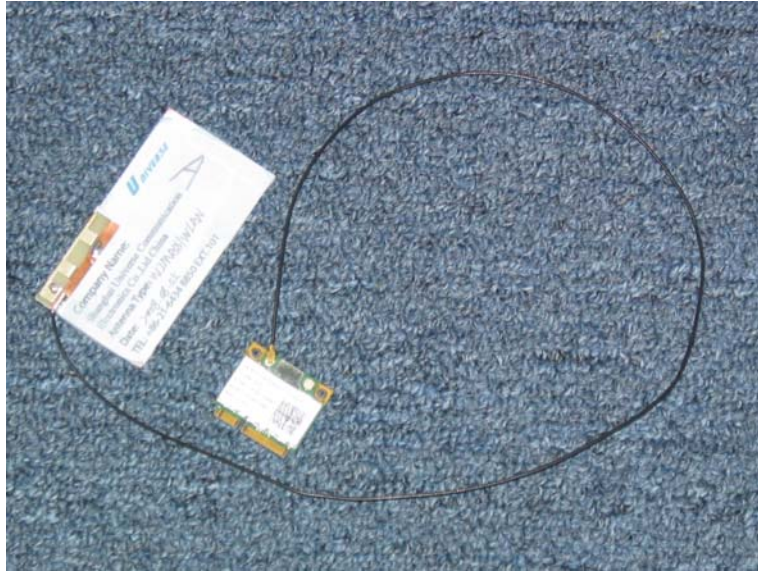


**Test Locations**



**Module**





**Test System**

## Appendix D – Probe Calibration Data Sheets

# NCL CALIBRATION LABORATORIES

Calibration File No.: CP-1164

Client.: RFEL

## CERTIFICATE OF CALIBRATION

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

Equipment: Miniature Isotropic RF Probe 2450 MHz

Manufacturer: APREL Laboratories

Model No.: E-020

Serial No.: 215

Body Calibration

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

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

Calibrated: 22 September 2010  
Released on: 27 September 2010

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

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

**NCL** CALIBRATION LABORATORIES

17 Bentley Ave  
NEPEAN, ONTARIO  
CANADA K2E 6T7

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

## Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 215.

## References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure

IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

IEEE 1309 "IEEE Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9 KHz to 40 GHz" 2005

SSI-TP-011 Tissue Calibration Procedure

IEC 62209 "Human exposure to radio frequency fields from handheld and body-mounted wireless communication devices –Human models, instrumentation and procedures Part 1 & 2: Procedure to determine the Specific Absorption Rate (SAR) for handheld devices used in close proximity of the ear (frequency range of 200MHz to 3GHz)"

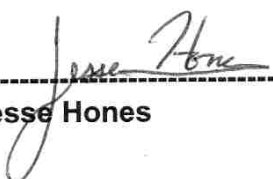
## Conditions

Probe 215 was a re-calibration.

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

**Temperature of the Tissue:** 21 °C +/- 0.5°C

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

  
-----  
**Stuart Nicol**  
-----  
**Jesse Hones**



## **Calibration Results Summary**

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

\*Resistive to recommended tissue recipes per IEEE-1528

## **Sensitivity in Air**

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

## **Sensitivity in Body Tissue Measured**

**Frequency:** 2450 MHz

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

### **ConvF**

**Channel X:** 4.5

**Channel Y:** 4.5

**Channel Z:** 4.5

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

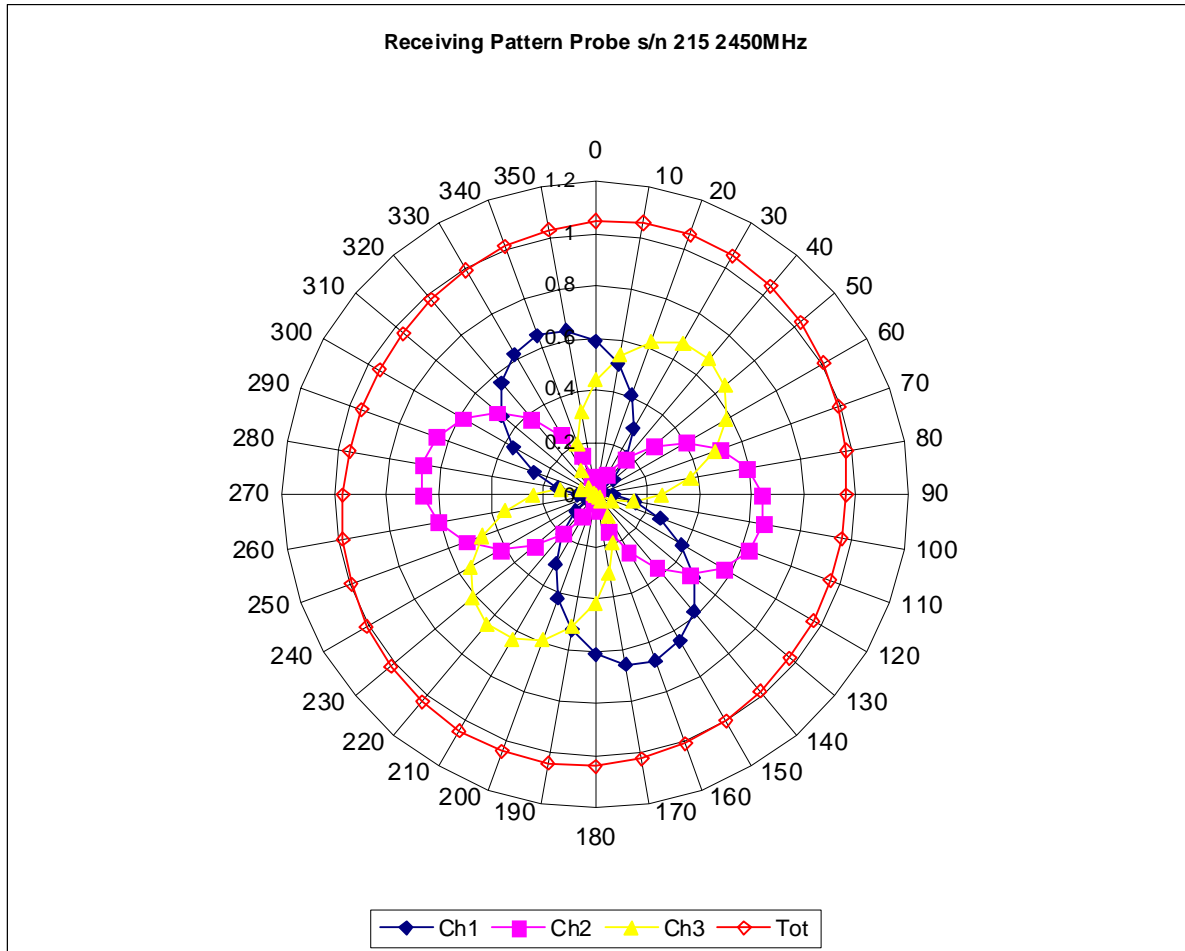
## **Boundary Effect:**

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

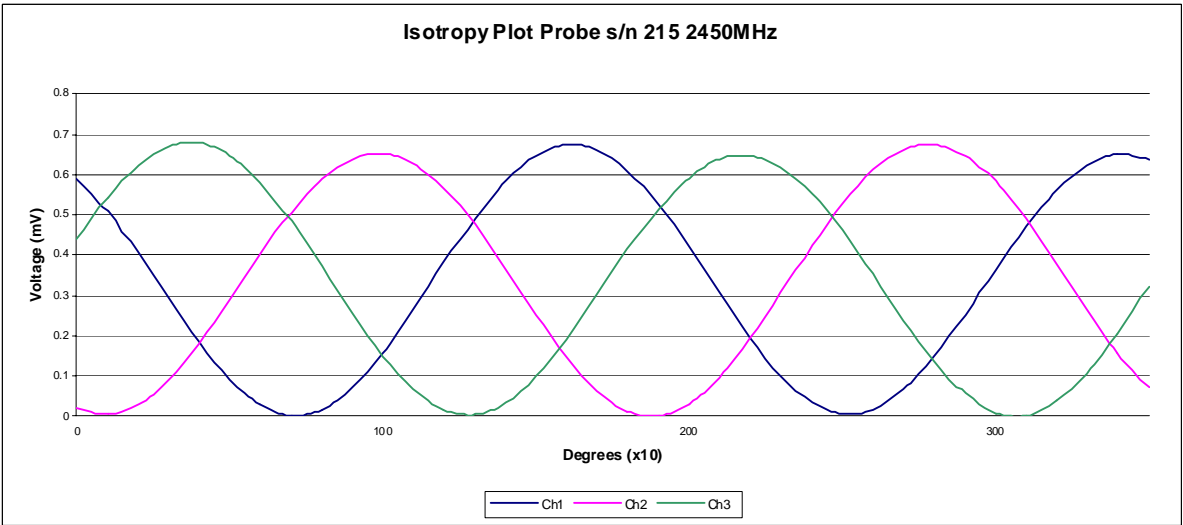
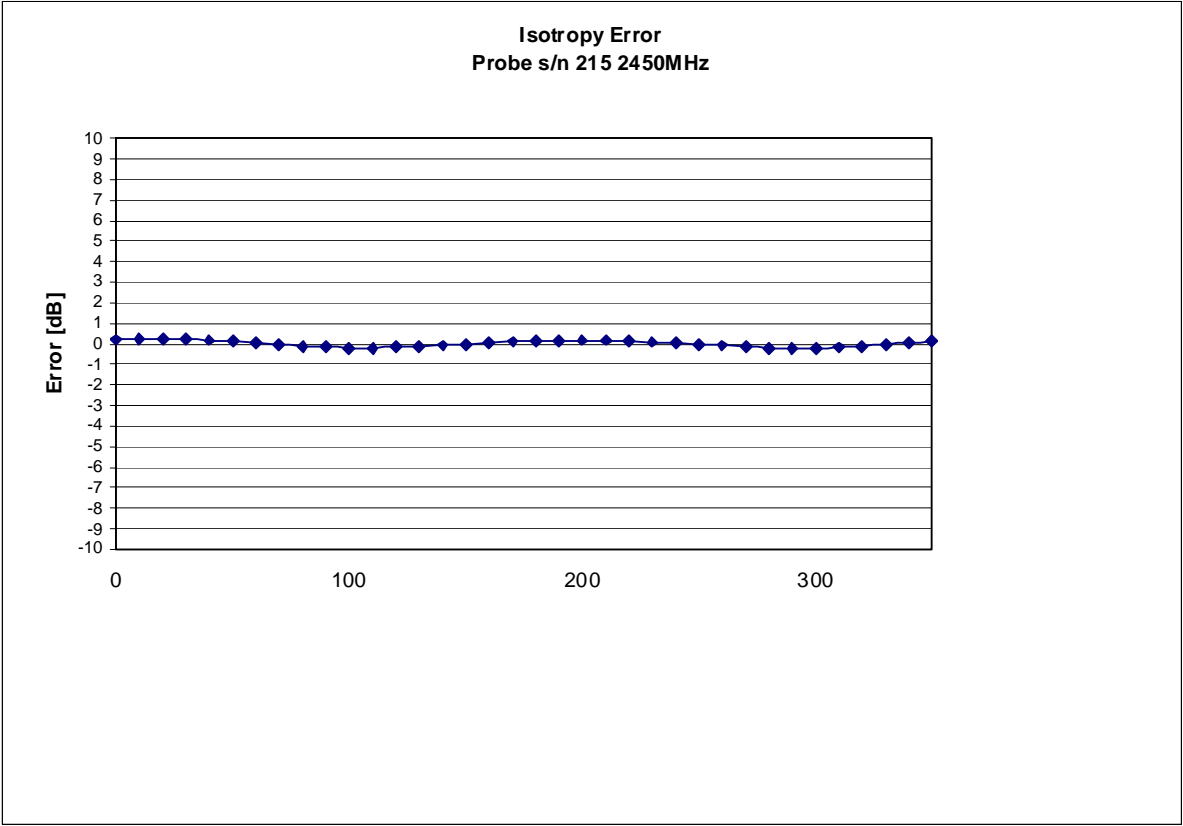
## **Spatial Resolution:**

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

## Receiving Pattern 2450 MHz (Air)



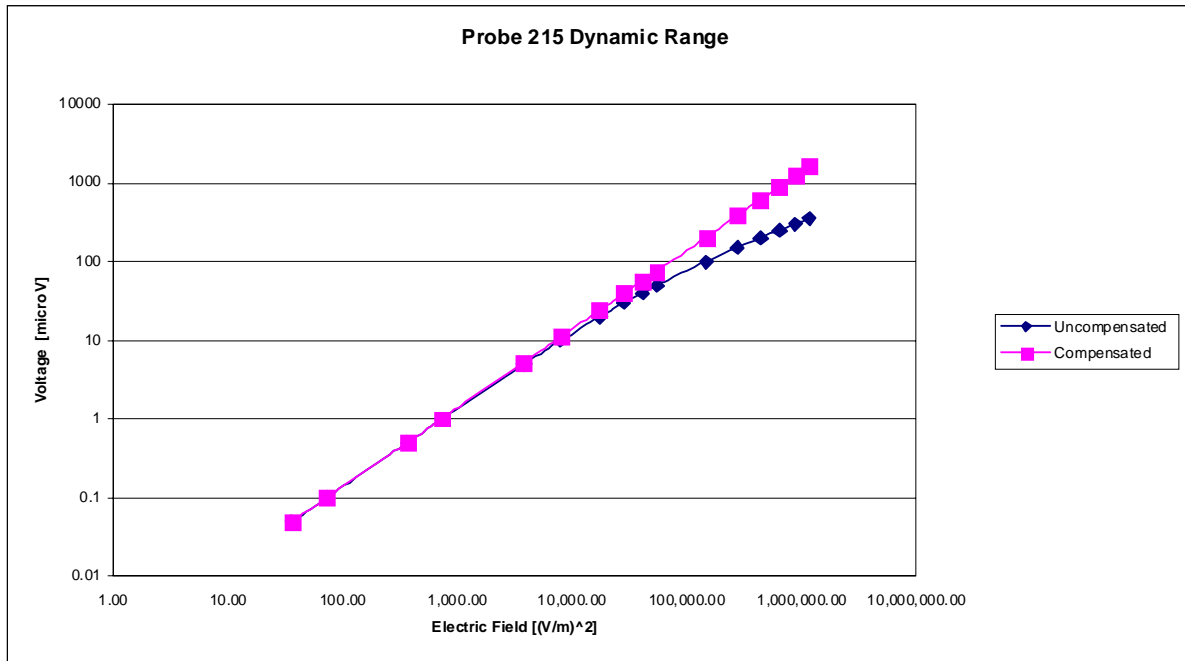
Isotropy Error 2450 MHz (Air)



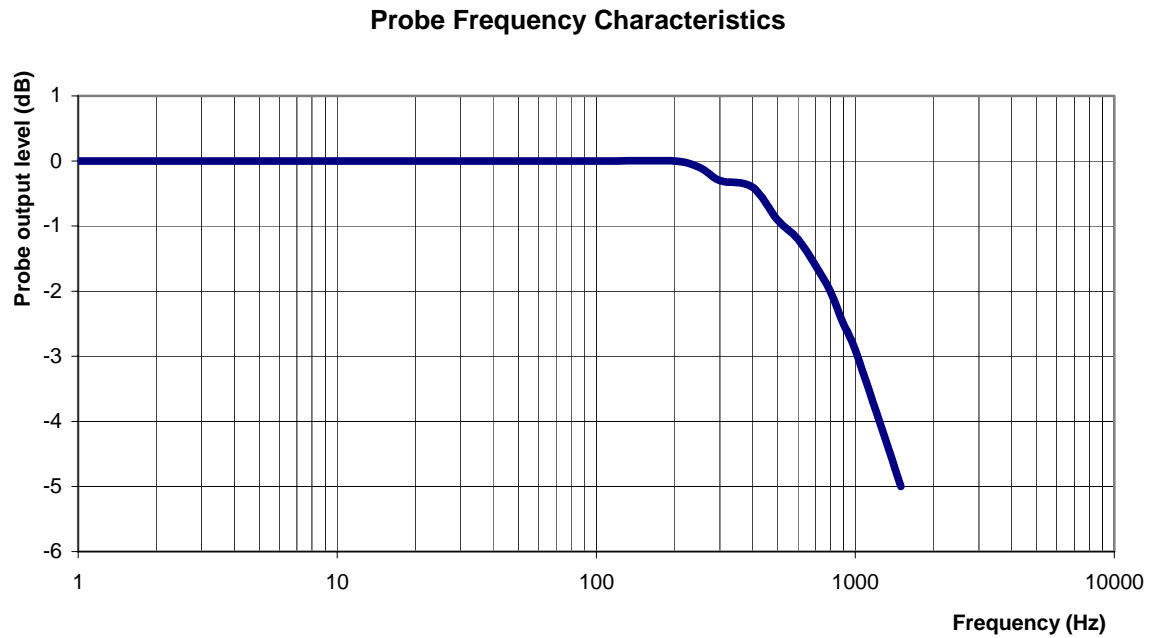
Isotropy Tissue:

0.10 dB

## Dynamic Range



## Video Bandwidth



<b>Video Bandwidth at 500 Hz</b>	<b>1 dB</b>
<b>Video Bandwidth at 1.02 KHz:</b>	<b>3 dB</b>

## **Conversion Factor Uncertainty Assessment**

### **Sensitivity in Body Tissue**

**Frequency:** 2450 MHz

**Epsilon:** 53.0 (+/-5%)

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

#### **ConvF**

**Channel X:** 4.5 7%(K=2)

**Channel Y:** 4.5 7%(K=2)

**Channel Z:** 4.5 7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 M $\Omega$ .

#### **Boundary Effect:**

For a distance of 2.5mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

## **Test Equipment**

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



# NCL CALIBRATION LABORATORIES

Calibration File No.: CP-1165

Client.: RFEL

## CERTIFICATE OF CALIBRATION

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

Equipment: Miniature Isotropic RF Probe 2600 MHz

Manufacturer: APREL Laboratories

Model No.: E-020

Serial No.: 215

Body Calibration

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

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

Calibrated: 22 September 2010  
Released on: 27 September 2010

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

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

**NCL** CALIBRATION LABORATORIES

17 Bentley Ave  
NEPEAN, ONTARIO  
CANADA K2E 6T7

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

## Introduction

This Calibration Report reproduces the results of the calibration performed in line with the SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure. The results contained within this report are for APREL E-Field Probe E-020 215.

## References

SSI/DRB-TP-D01-032-E020-V2 E-Field Probe Calibration Procedure

IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

IEEE 1309 "IEEE Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9 KHz to 40 GHz" 2005

SSI-TP-011 Tissue Calibration Procedure

IEC 62209 "Human exposure to radio frequency fields from handheld and body-mounted wireless communication devices –Human models, instrumentation and procedures Part 1 & 2: Procedure to determine the Specific Absorption Rate (SAR) for handheld devices used in close proximity of the ear (frequency range of 200MHz to 3GHz)"

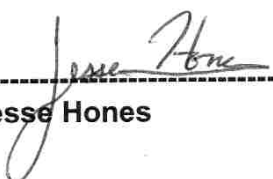
## Conditions

Probe 215 was a re-calibration.

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

**Temperature of the Tissue:** 21 °C +/- 0.5°C

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

  
-----  
**Stuart Nicol**  
-----  
**Jesse Hones**

## **Calibration Results Summary**

<b>Probe Type:</b>	E-Field Probe E-020
<b>Serial Number:</b>	215
<b>Frequency:</b>	2600 MHz
<b>Sensor Offset:</b>	1.56 mm
<b>Sensor Length:</b>	2.5 mm
<b>Tip Enclosure:</b>	Ertalyte*
<b>Tip Diameter:</b>	<5 mm
<b>Tip Length:</b>	60 mm
<b>Total Length:</b>	290 mm

\*Resistive to recommended tissue recipes per IEEE-1528

## **Sensitivity in Air**

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

## **Sensitivity in Body Tissue Measured**

**Frequency:** 2600 MHz

**Epsilon:** 51.95 (+/-5%)      **Sigma:** 2.08 S/m (+/-5%)

### **ConvF**

**Channel X:** 4.7 @ 2600MHz +/- 5%

**Channel Y:** 4.7 @ 2600MHz +/- 5%

**Channel Z:** 4.7 @ 2600MHz +/- 5%

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

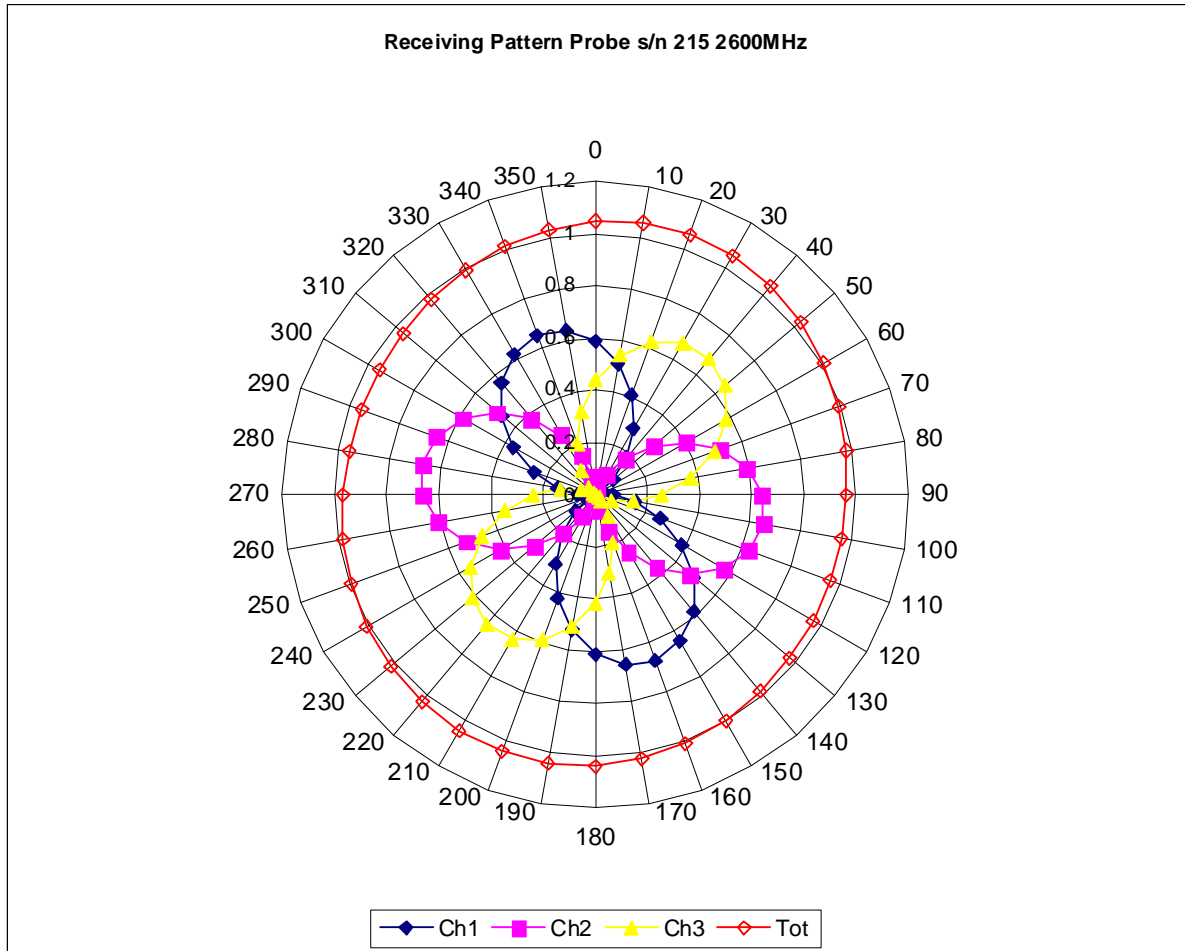
## **Boundary Effect:**

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

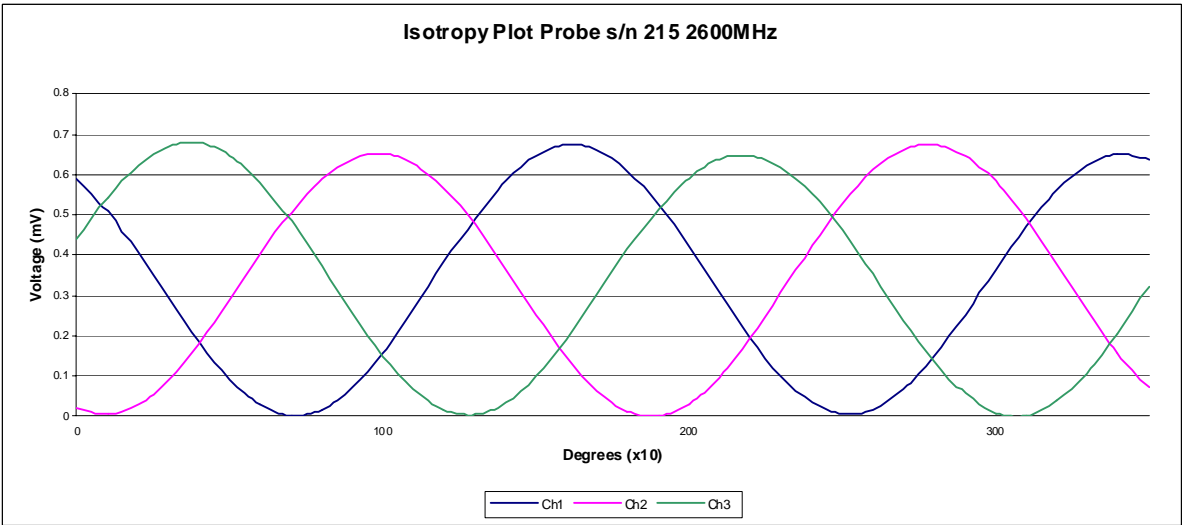
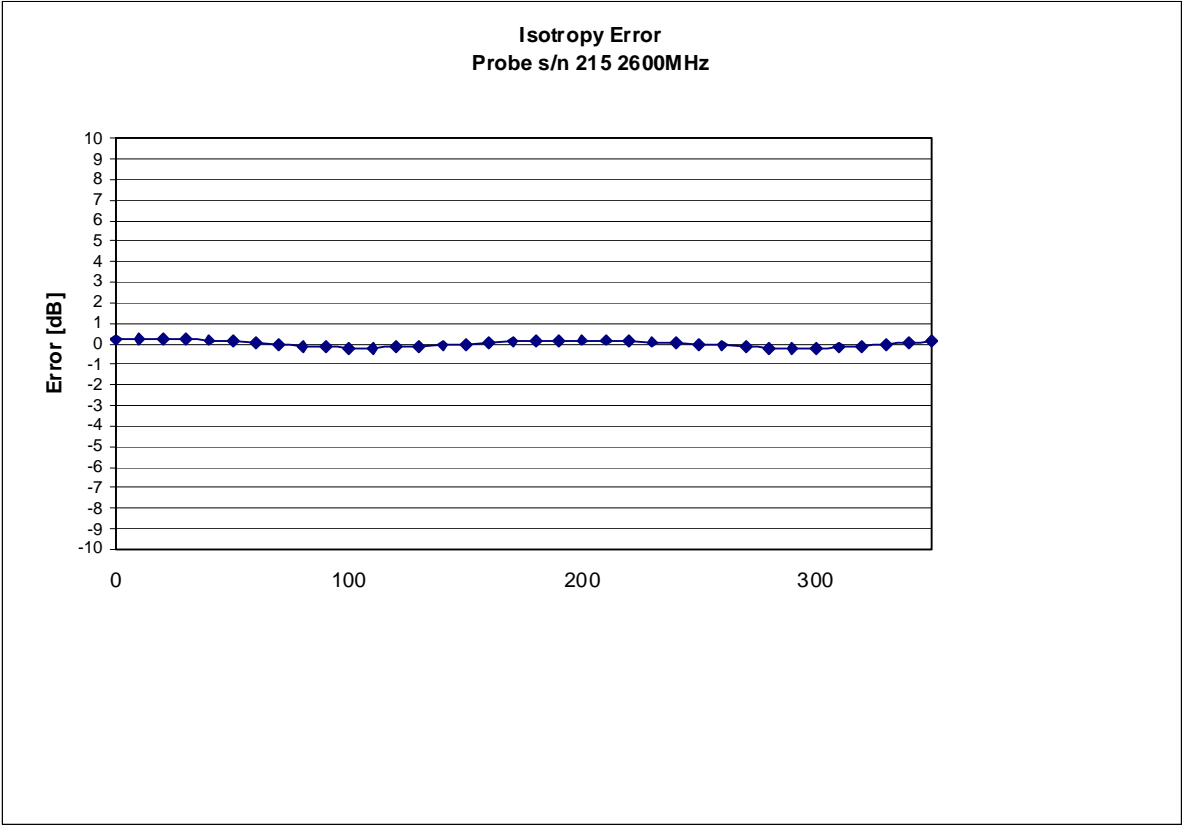
## **Spatial Resolution:**

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

## Receiving Pattern 2600 MHz (Air)



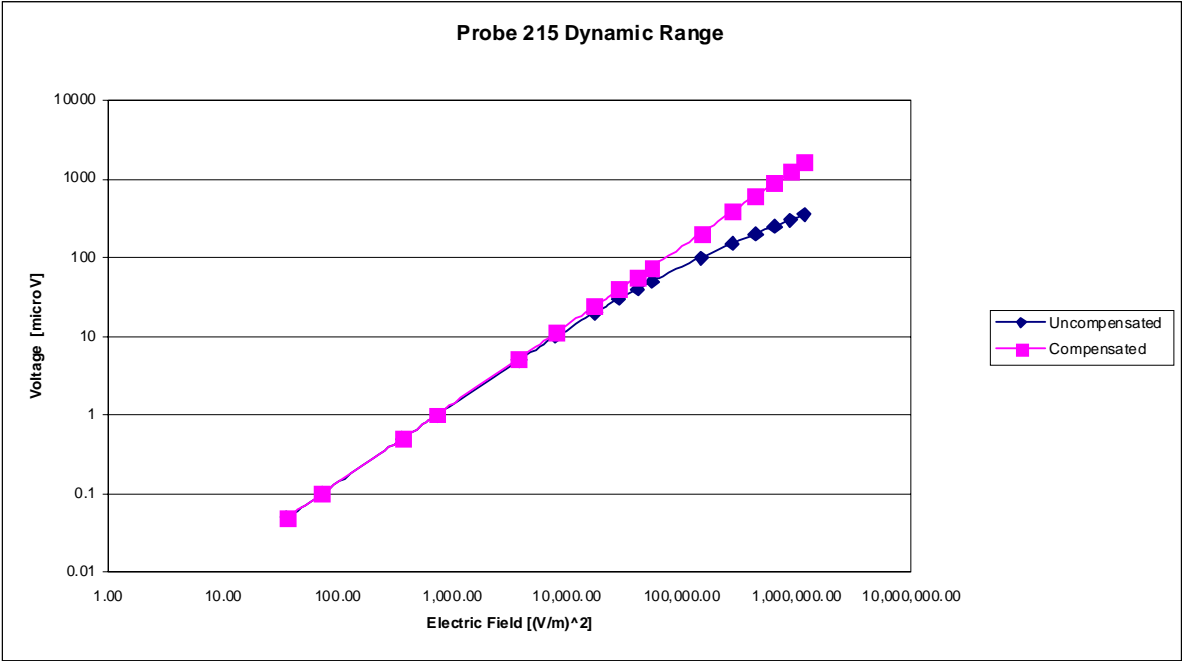
Isotropy Error 2600 MHz (Air)



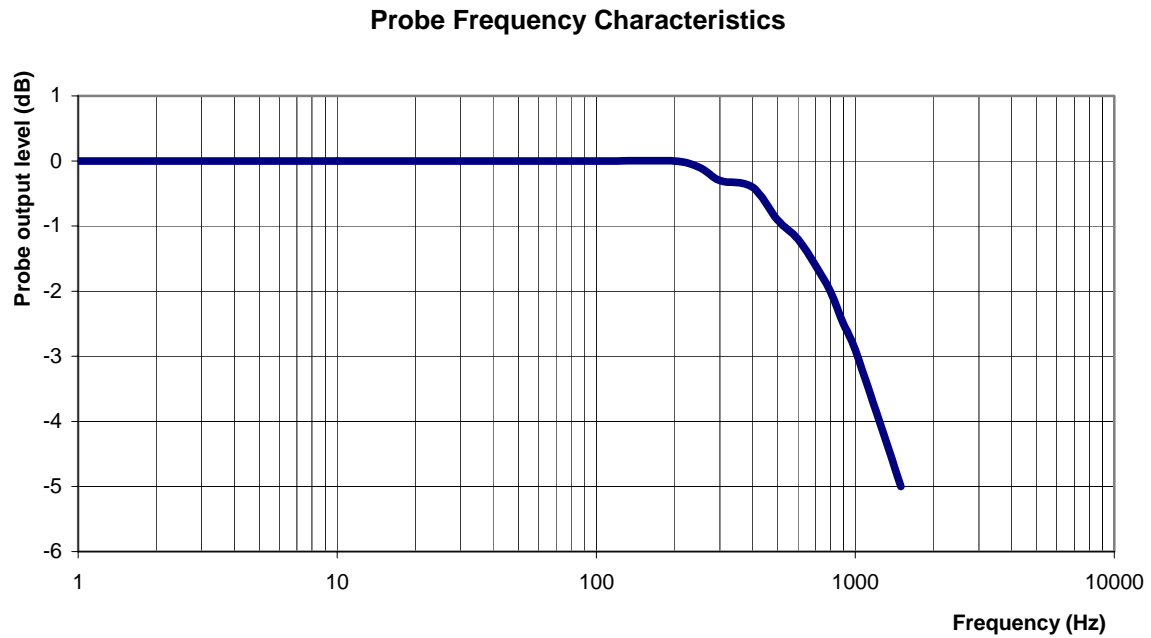
Isotropy Tissue:

0.10 dB

Dynamic Range



## Video Bandwidth



<b>Video Bandwidth at 500 Hz</b>	<b>1 dB</b>
<b>Video Bandwidth at 1.02 KHz:</b>	<b>3 dB</b>



## **Conversion Factor Uncertainty Assessment Measured**

### **Sensitivity in Body Tissue**

**Frequency:** 2600 MHz

**Epsilon:** 51.95 (+/-5%) **Sigma:** 2.08 S/m (+/-5%)

#### **ConvF**

**Channel X:** 4.7 7%(K=2)

**Channel Y:** 4.7 7%(K=2)

**Channel Z:** 4.7 7%(K=2)

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 M $\Omega$ .

#### **Boundary Effect:**

For a distance of 2.5mm the evaluated uncertainty (increase in the probe sensitivity) is less than 2%.

#### **Conversion Factor Validity:**

The conversion factor is valid to +/- 5% of 2600MHz.

## **Test Equipment**

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

## **Appendix E – Dipole Calibration Data Sheets**

## NCL CALIBRATION LABORATORIES

Calibration File No: DC-1182

Project Number: RFEB-5552

# CERTIFICATE OF CALIBRATION

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

Validation Dipole

Manufacturer: APREL Laboratories

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

Frequency: 2450 MHz

Serial No: RFE-278

Customer: RFEL

Body Calibration

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

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

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

**NCL** CALIBRATION LABORATORIES

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

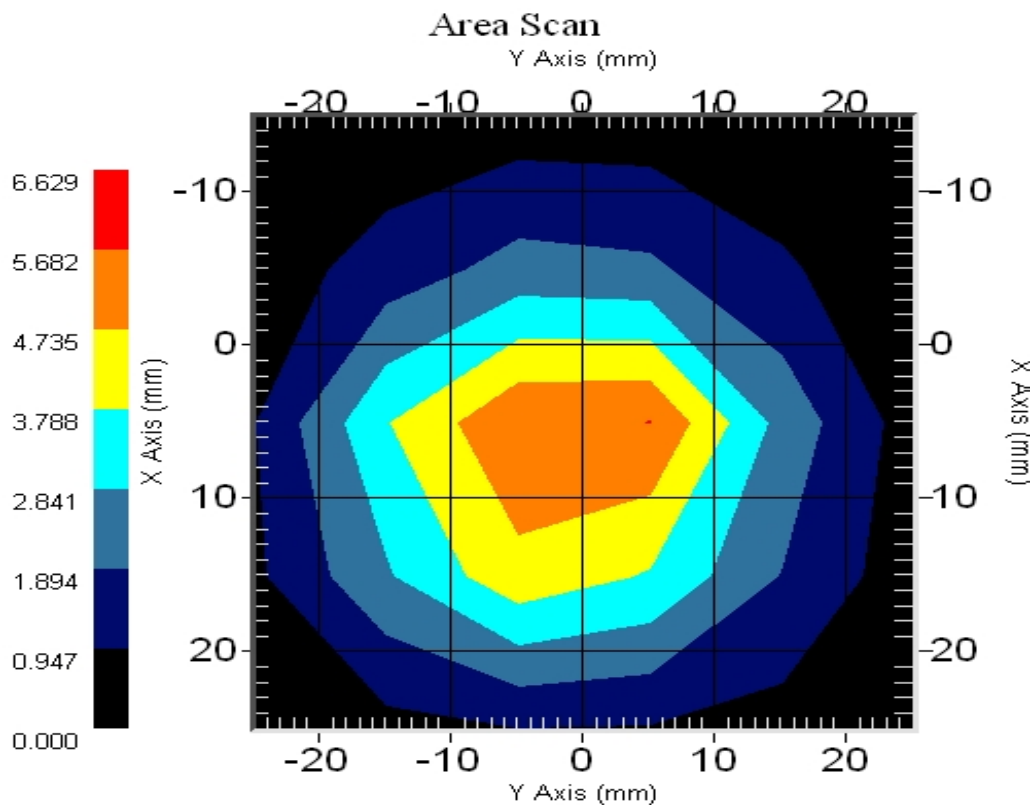
**Length:** 51.5 mm  
**Height:** 30.4 mm

### Electrical Specification

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

### System Validation Results @ 100mW

Frequency	1 Gram	10 Gram	Peak
2450 MHz	5.15	2.31	10.01



## **Introduction**

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

## **References**

SSI-TP-018-ALSAS Dipole Calibration Procedure

SSI-TP-016 Tissue Calibration Procedure

IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"

## **Conditions**

Dipole RFE-278 was a re-calibration.

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

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

## **Dipole Calibration Results**

### **Mechanical Verification**

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

### **Tissue Validation**

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

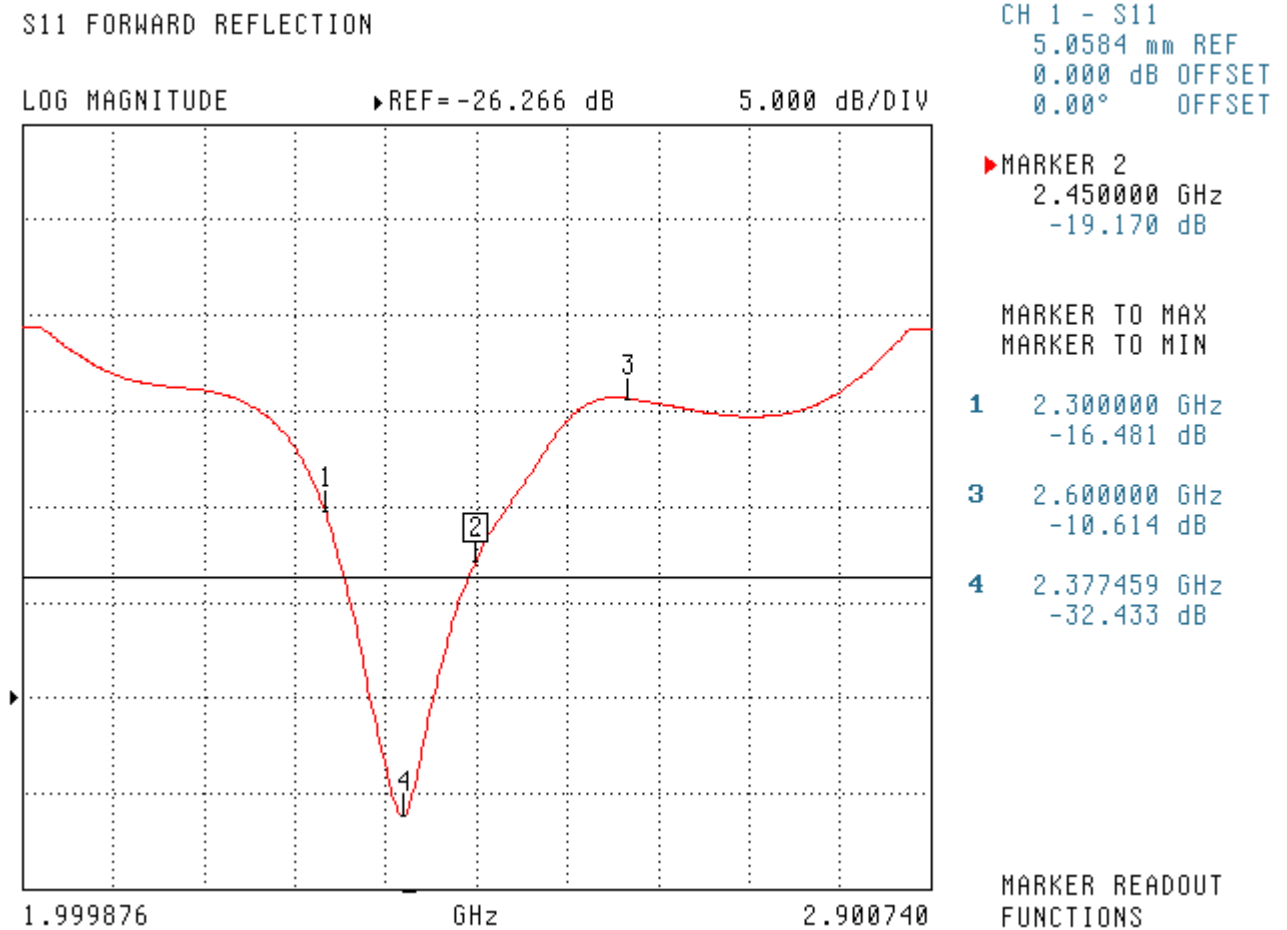


## Electrical Calibration

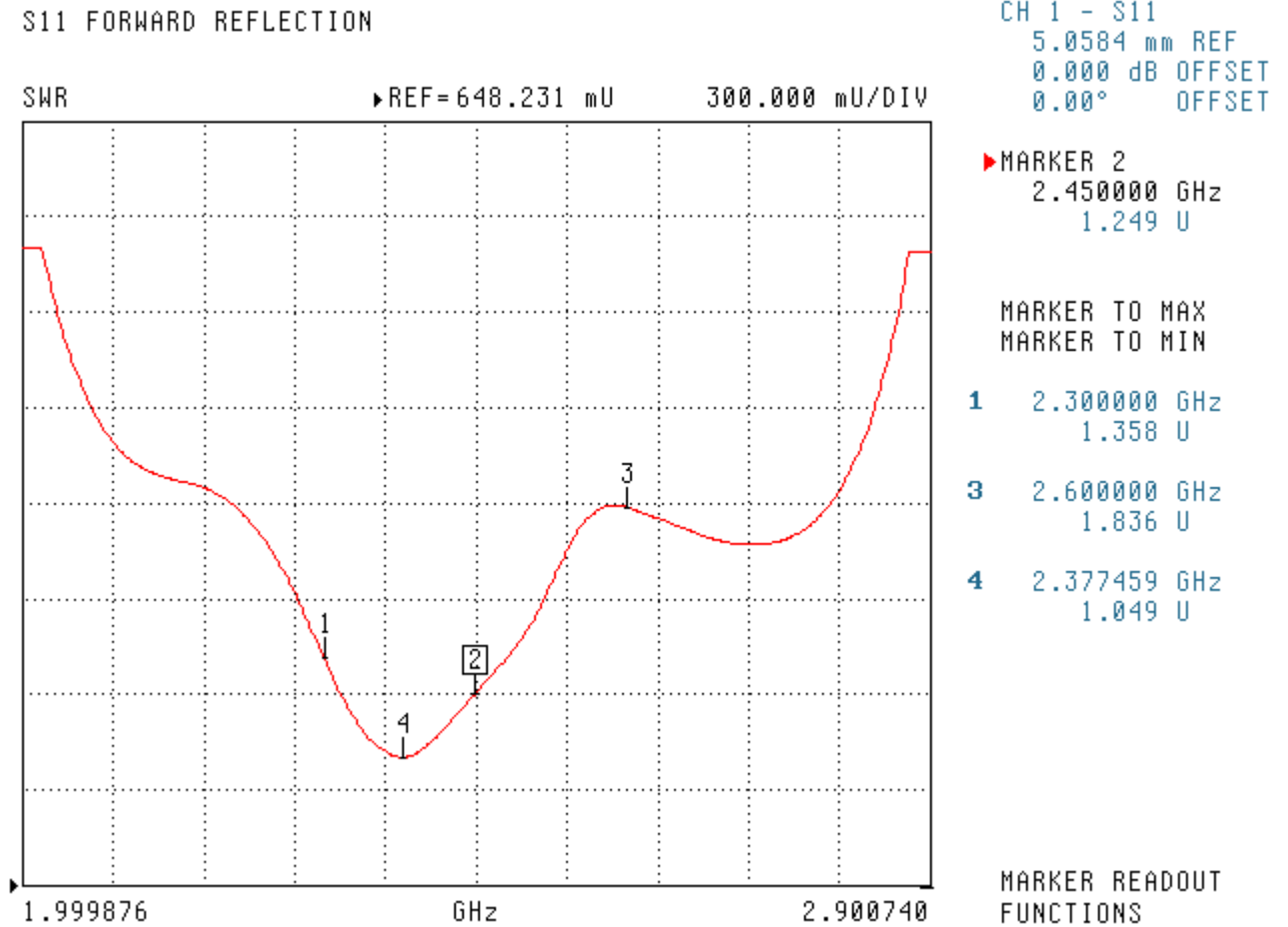
Test	Result
S11 R/L	-19.170 dB
SWR	1.249 U
Impedance	42.223 $\Omega$

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

### S11 Parameter Return Loss

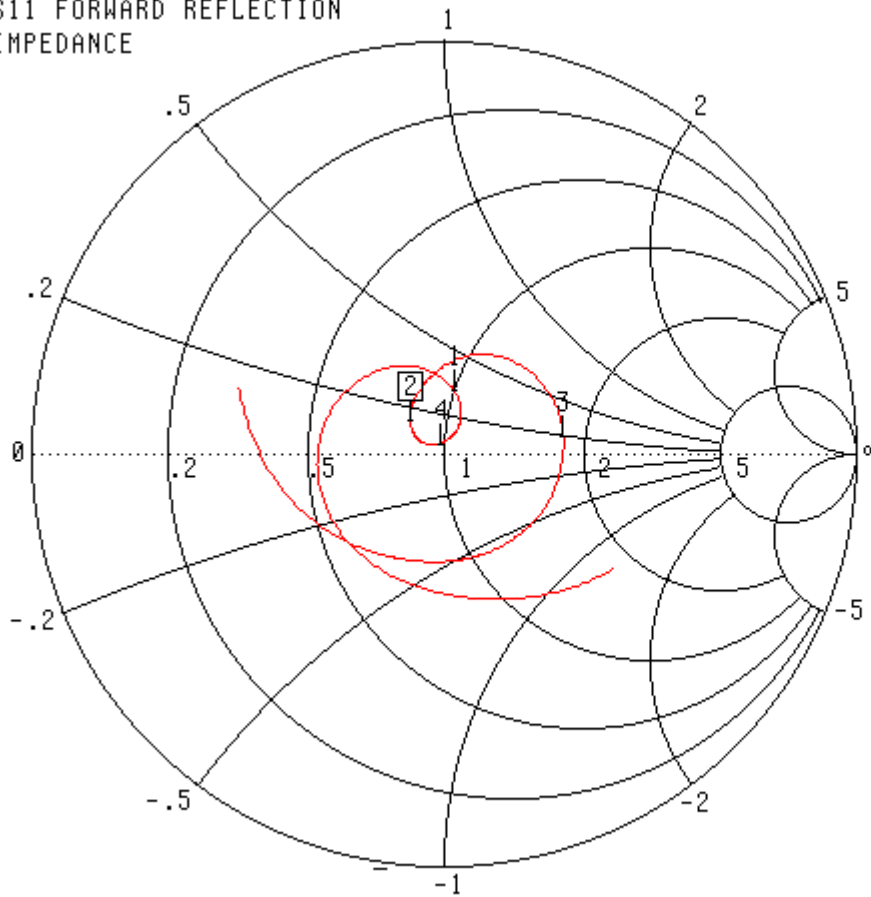


## SWR



## Smith Chart Dipole Impedance

S11 FORWARD REFLECTION  
IMPEDANCE



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

▶ MARKER 2  
2.450000 GHz  
42.223  $\Omega$   
6.687 j $\Omega$

MARKER TO MAX  
MARKER TO MIN

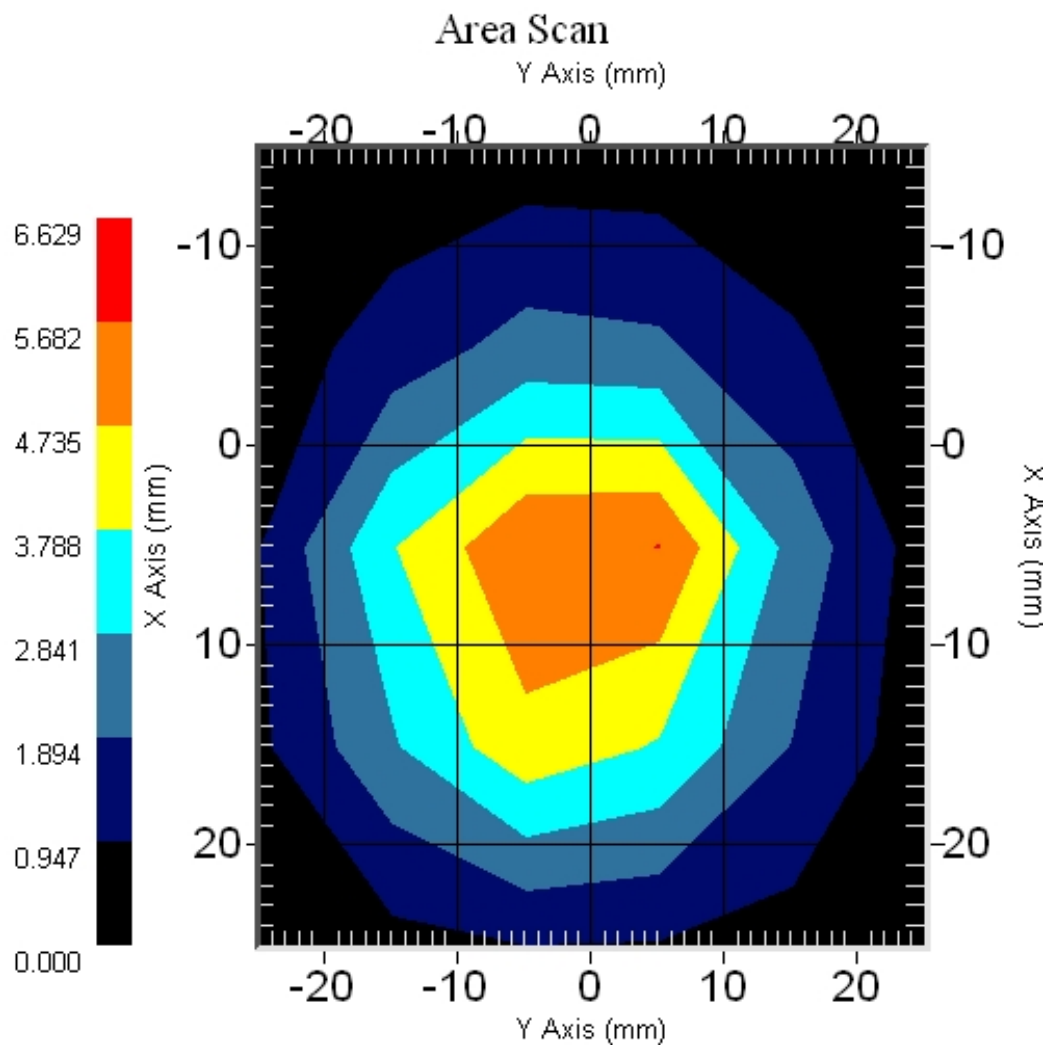
1 2.300000 GHz  
50.520  $\Omega$   
15.426 j $\Omega$   
3 2.600000 GHz  
90.912  $\Omega$   
7.723 j $\Omega$   
4 2.377459 GHz  
49.380  $\Omega$   
2.028 j $\Omega$

MARKER READOUT  
FUNCTIONS

## System Validation Results Using the Electrically Calibrated Dipole

### Results @ 100mW

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



## **Test Equipment**

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

# NCL CALIBRATION LABORATORIES

Calibration File No: DC-1116  
Project Number: RFEL-2600-Dipole-5482

## CERTIFICATE OF CALIBRATION

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

APREL Validation Dipole

Manufacturer: APREL Laboratories

Part number: ALS-D-2600-S-2

Frequency: 2600 MHz

Serial No: 225-00903

Customer: RFEL

BODY Calibration

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

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

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

**NCL** CALIBRATION LABORATORIES

17 Bentley Avenue  
NEPEAN, ONTARIO  
CANADA K2E 6T7

Division of APREL Lab.  
TEL: (613) 820-2730  
FAX: (613) 820-4161

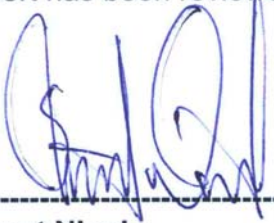
## Conditions

Dipole 225-00903 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:** 48.8 mm

**Height:** 32.8 mm

### Electrical Specification

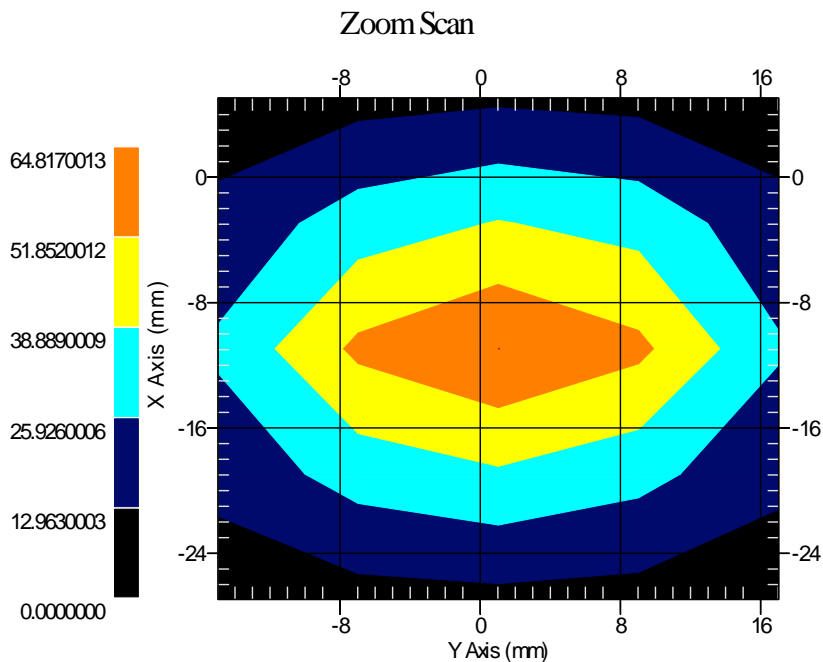
**SWR:** 1.013U

**Return Loss:** -43.521dB

**Impedance:** 49.355 ohm

### System Validation Results

Frequency	1 Gram	10 Gram	Peak
2600 MHz	56.42	24.68	119





## **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 225-00903. 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 225.

## **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 225-00903 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**

<b>Measured Length</b>	<b>Measured Height</b>
48.8 mm	32.8 mm

### **Tissue Validation**

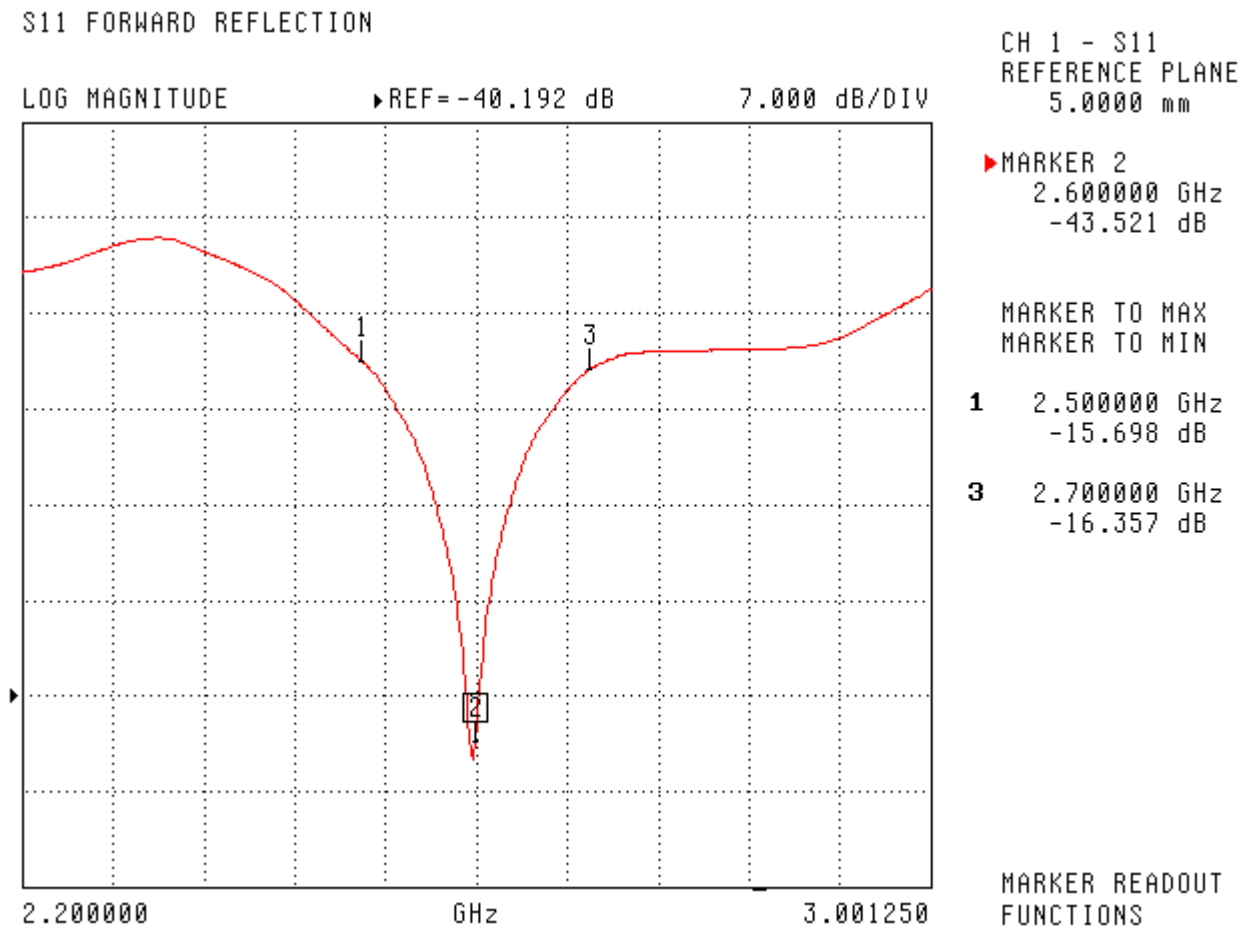
<b>Body Tissue 2600 MHz</b>	<b>Measured</b>
<b>Dielectric constant, <math>\epsilon_r</math></b>	51.15
<b>Conductivity, <math>\sigma</math> [S/m]</b>	2.13

## Electrical Calibration

Test	Result
S11 R/L	-43.521
SWR	1.013U
Impedance	49.355Ω

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

### S11 Parameter Return Loss



## SWR

S11 FORWARD REFLECTION

SWR

REF=670.142 mU

300.000 mU/DIV

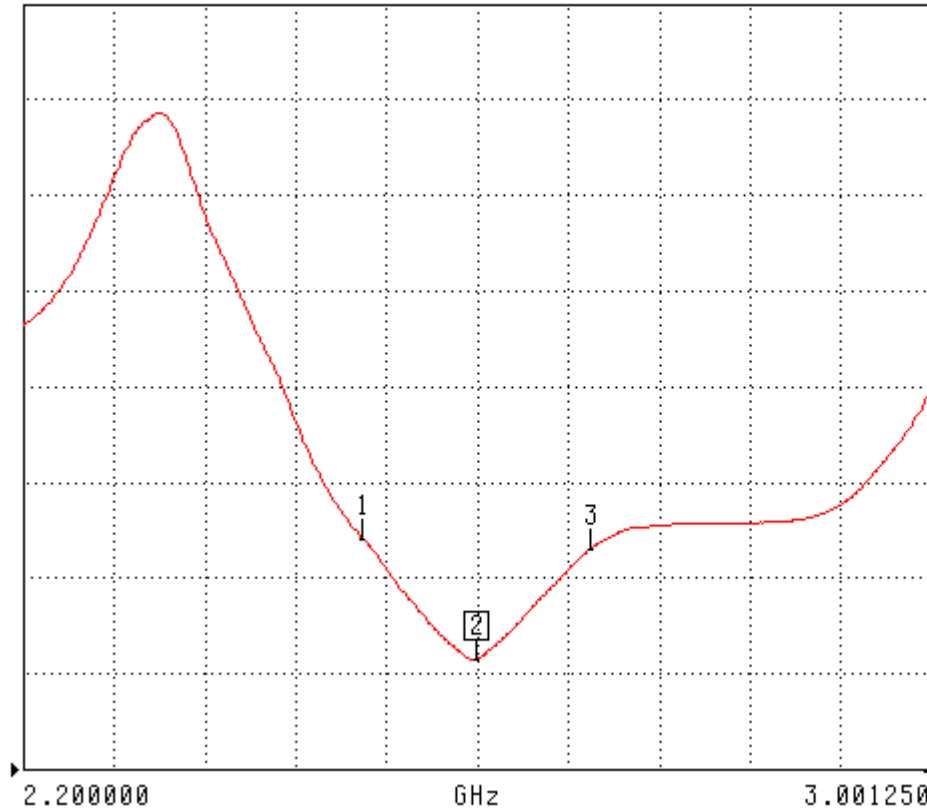
CH 1 - S11  
REFERENCE PLANE  
5.0000 mm

MARKER 2  
2.600000 GHz  
1.013 U

MARKER TO MAX  
MARKER TO MIN

**1** 2.500000 GHz  
1.393 U

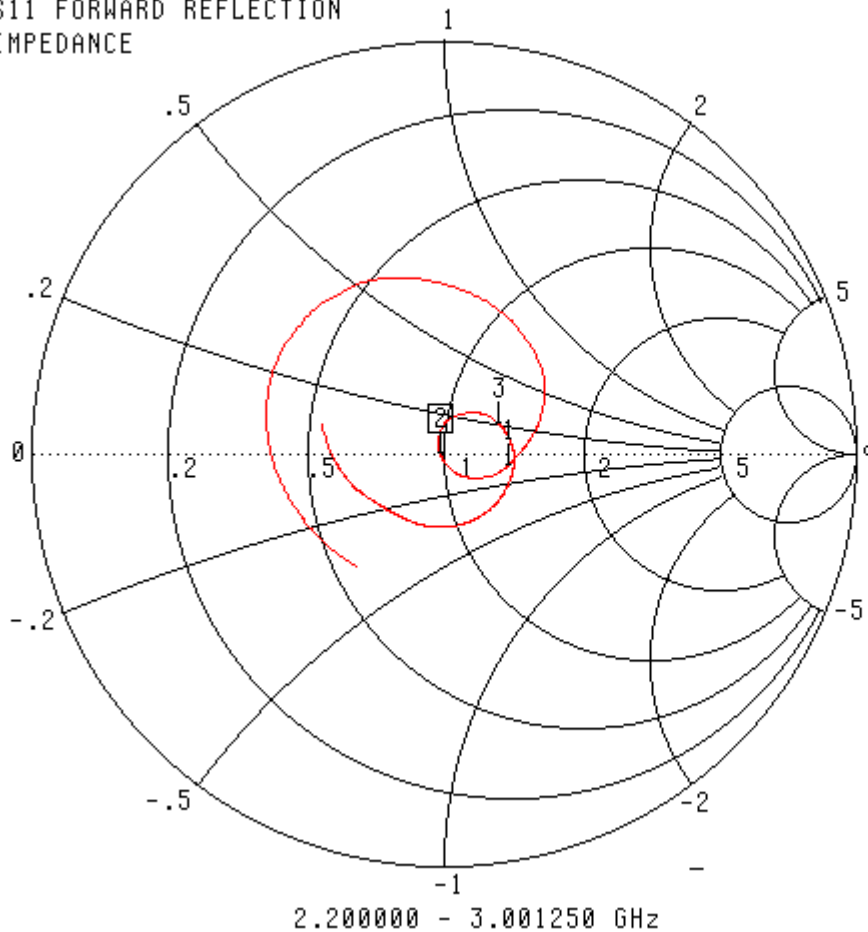
**3** 2.700000 GHz  
1.359 U



MARKER READOUT  
FUNCTIONS

## Smith Chart Dipole Impedance

S11 FORWARD REFLECTION  
IMPEDANCE



CH 1 - S11  
REFERENCE PLANE  
5.0000 mm

▶ MARKER 2  
2.600000 GHz  
49.355  $\Omega$   
150.779  $j\Omega$

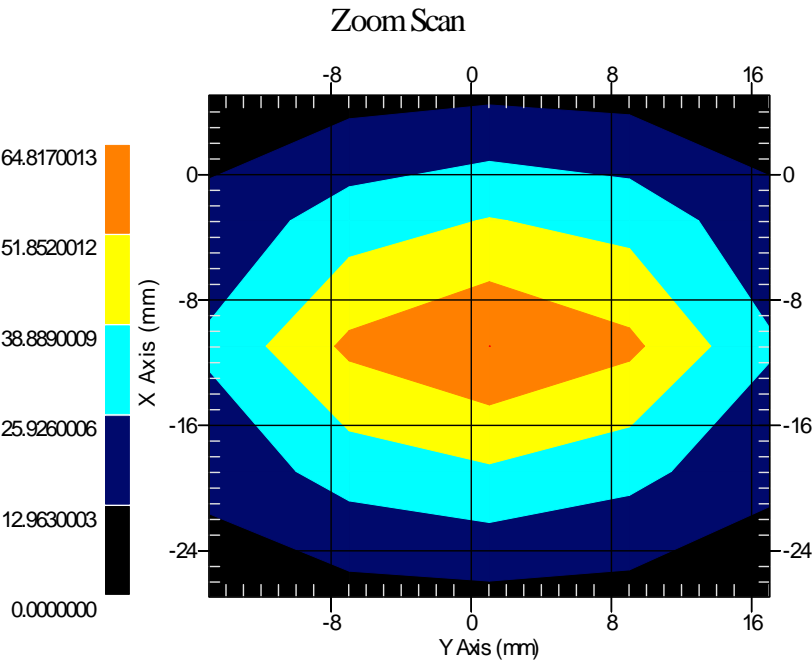
MARKER TO MAX  
MARKER TO MIN

**1** 2.500000 GHz  
69.141  $\Omega$   
-4.034  $j\Omega$   
**3** 2.700000 GHz  
64.623  $\Omega$   
9.606  $j\Omega$

MARKER READOUT  
FUNCTIONS

System Validation Results Using the Electrically Calibrated Dipole

Body Tissue Frequency	1 Gram	10 Gram	Peak Above Feed Point
2600 MHz	56 . 42	24 . 68	119



## **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  $\pm$  10%  
Pinna thickness is 6 mm  $\pm$  10%

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

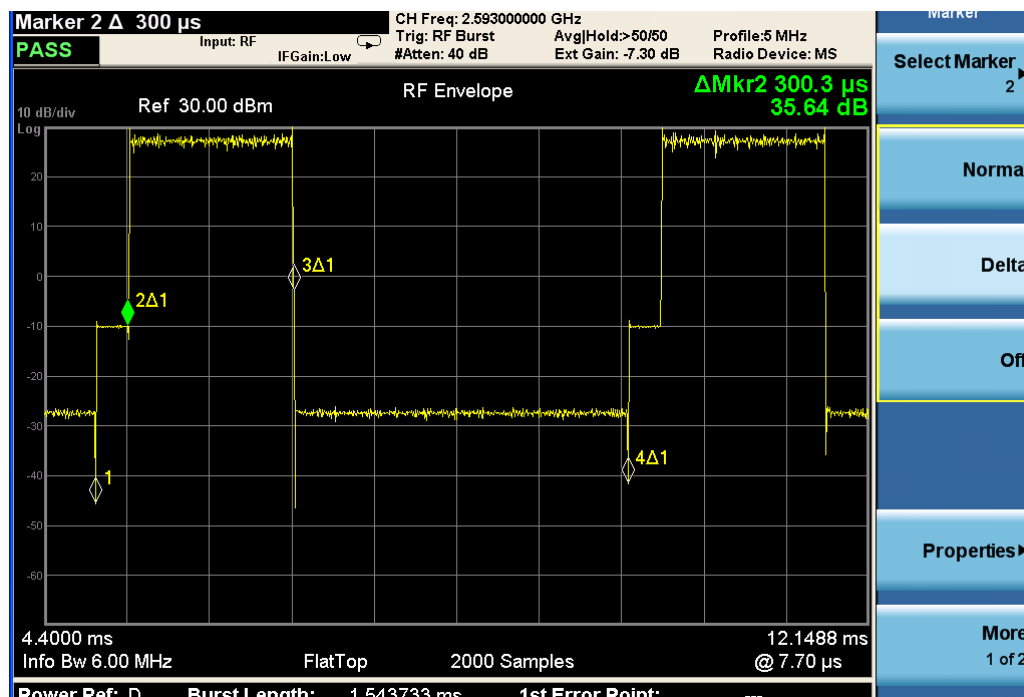
Calibrated By: Karen K. Feb 17/04.

### **NCL** CALIBRATION LABORATORIES

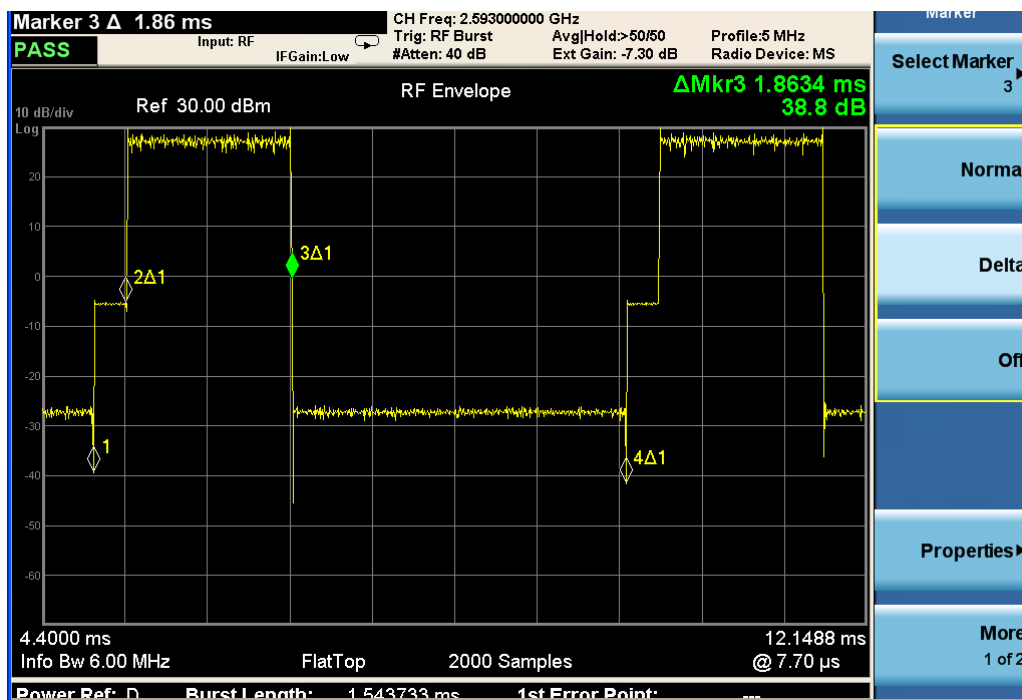
51 SPECTRUM WAY  
NEPEAN, ONTARIO  
CANADA K2R 1E6

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

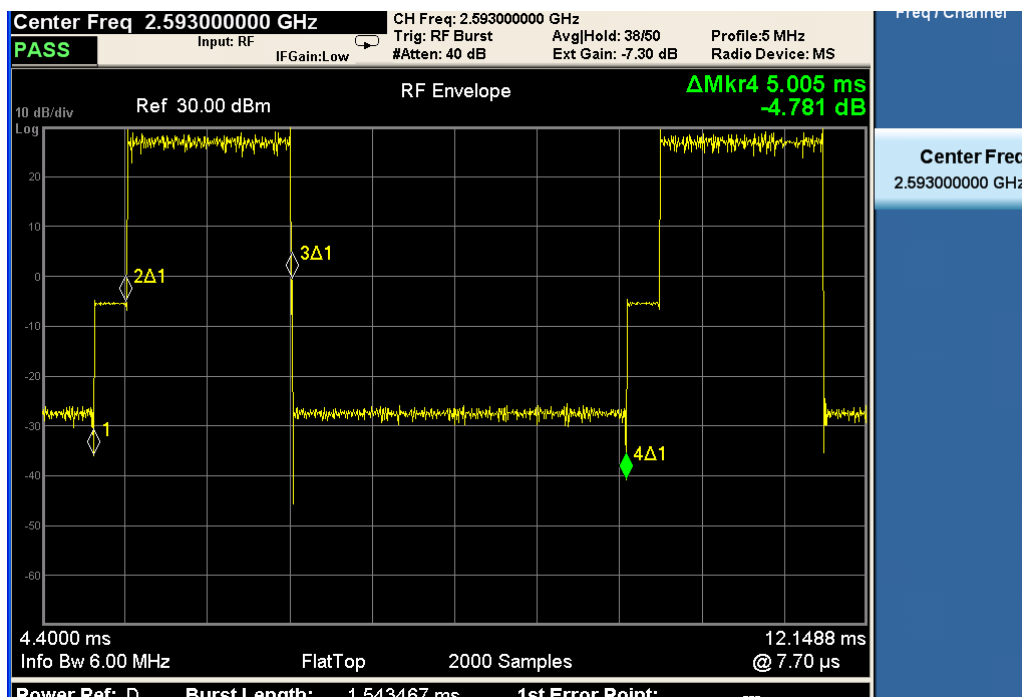
## Appendix G – Additional Plots



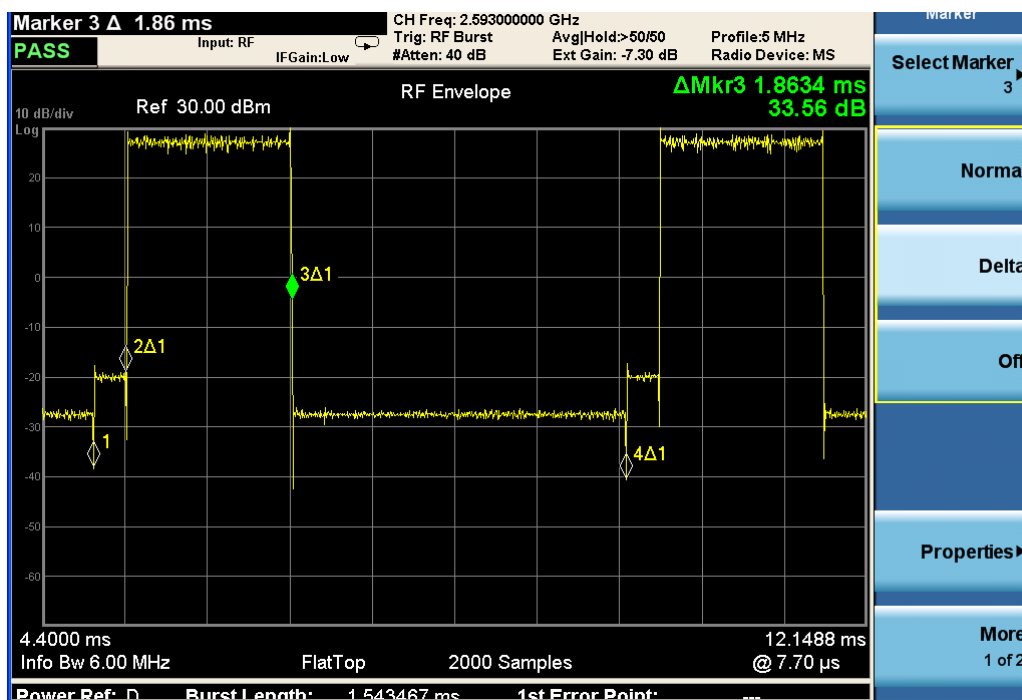
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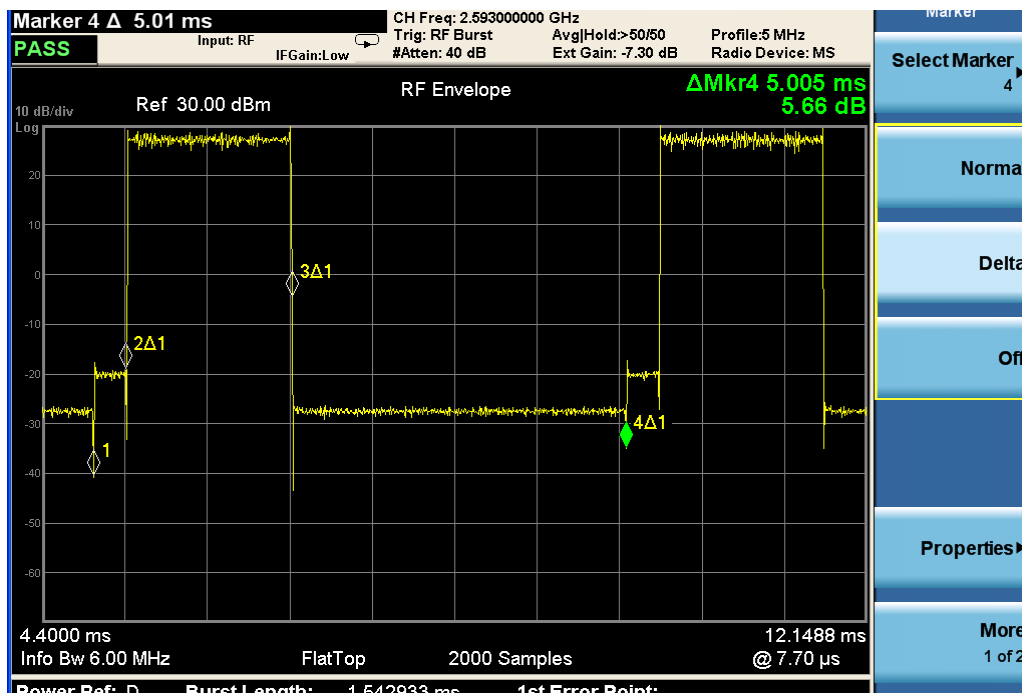
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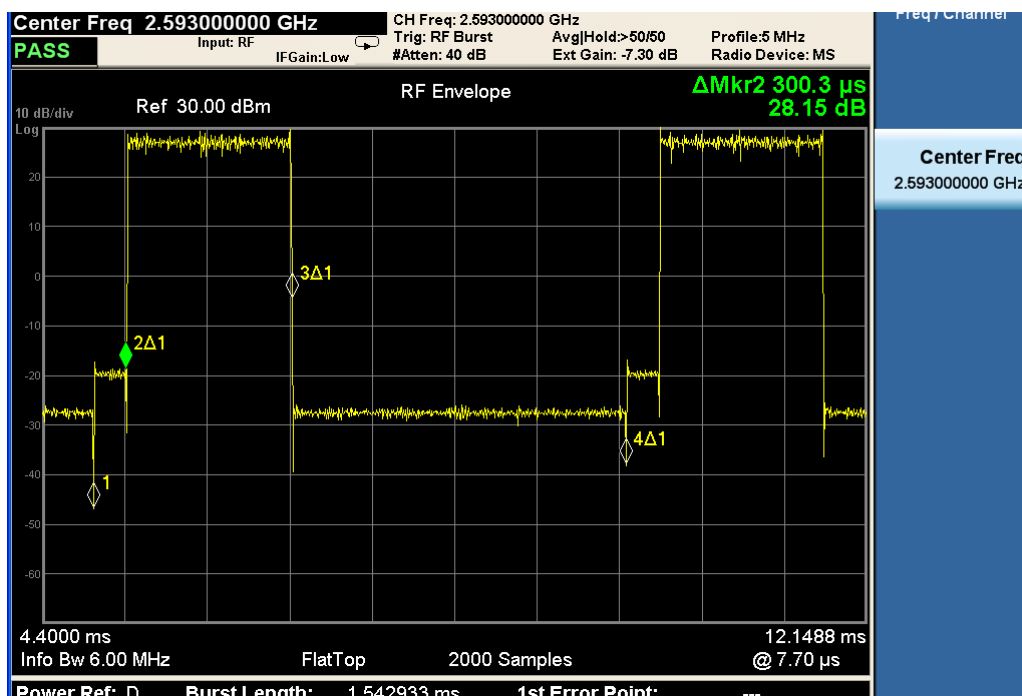
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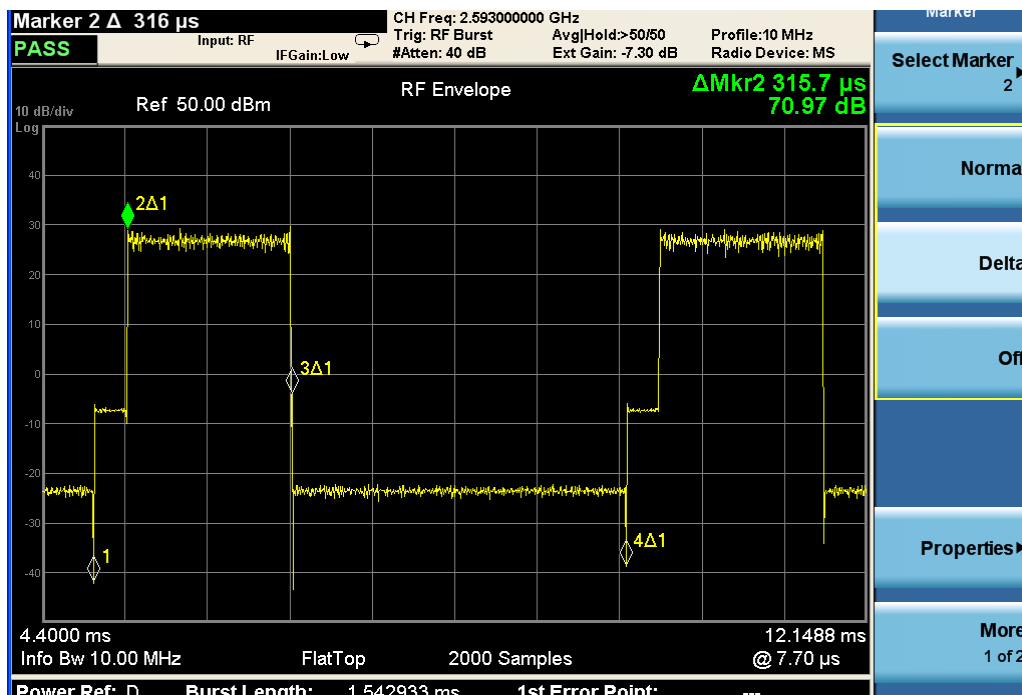
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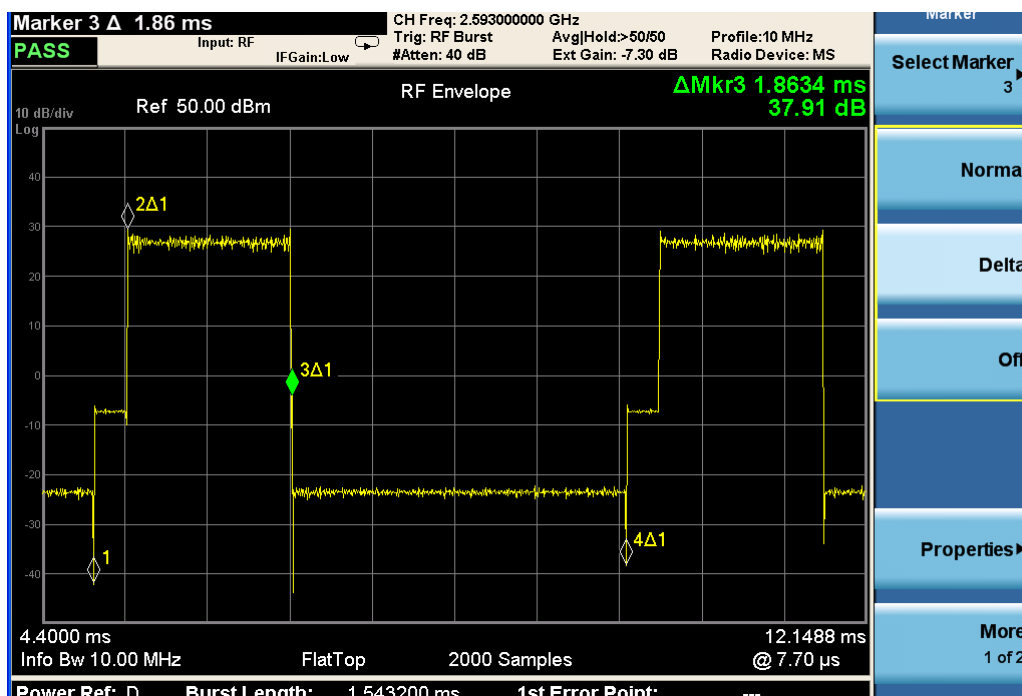
5MHz QPSK3/4 PUSC 2.593GHz DL: 29, UL: 18



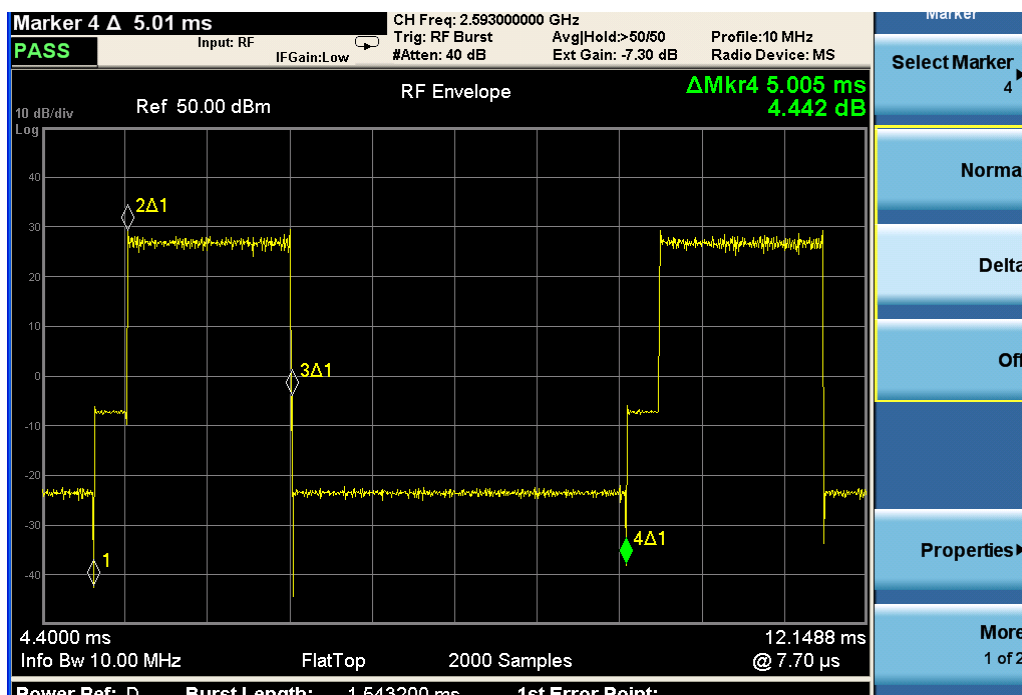
5MHz QPSK3/4 PUSC 2.593GHz DL: 29, UL: 18



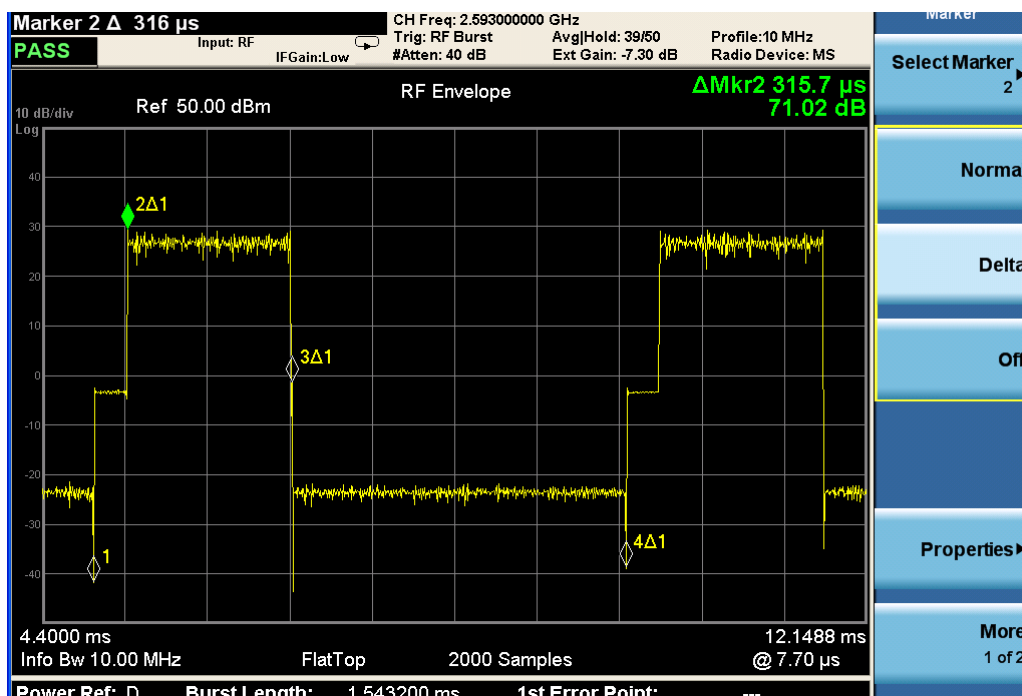
10MHz QPSK1/2 PUSC 2.593GHz DL: 29, UL: 18



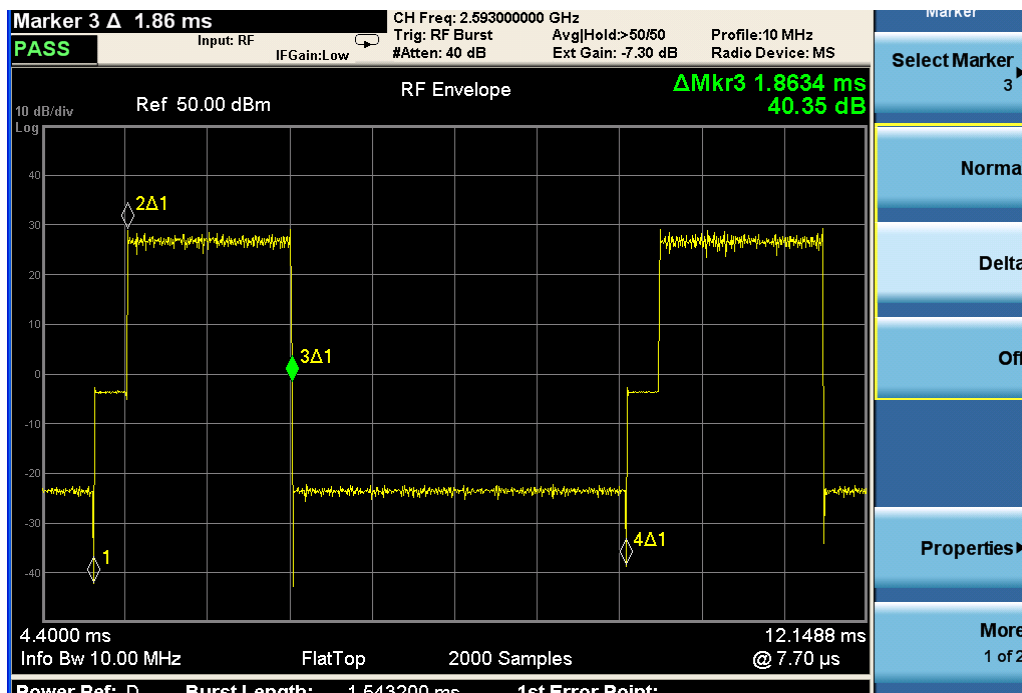
10MHz QPSK1/2 PUSC 2.593GHz DL: 29, UL: 18



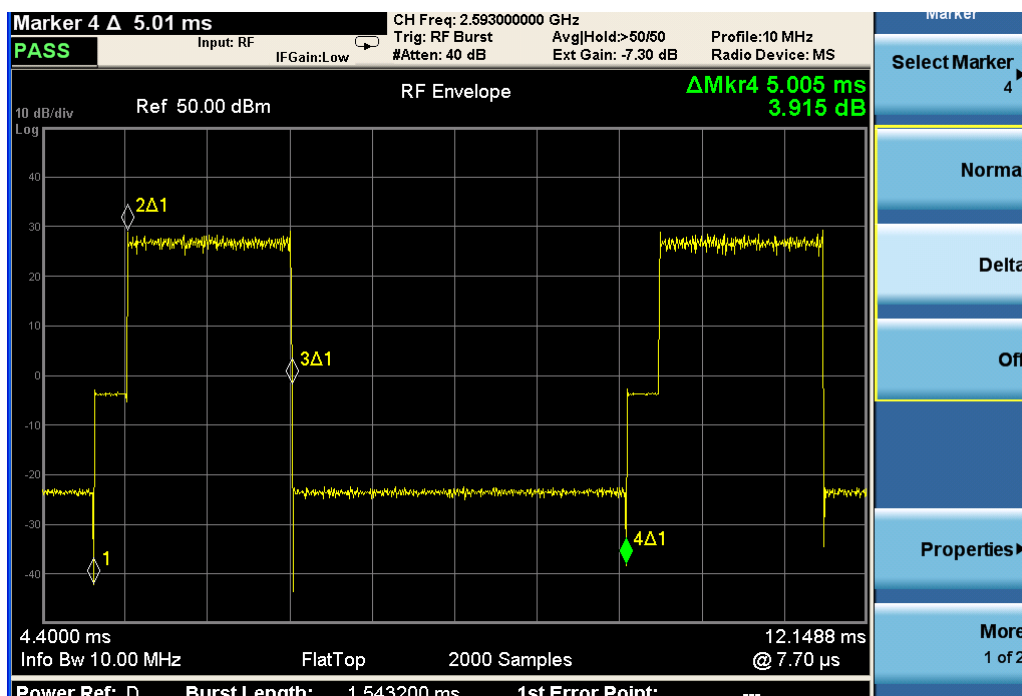
10MHz QPSK1/2 PUSC 2.593GHz DL: 29, UL: 18



10MHz QPSK3/4 PUSC 2.593GHz DL: 29, UL: 18

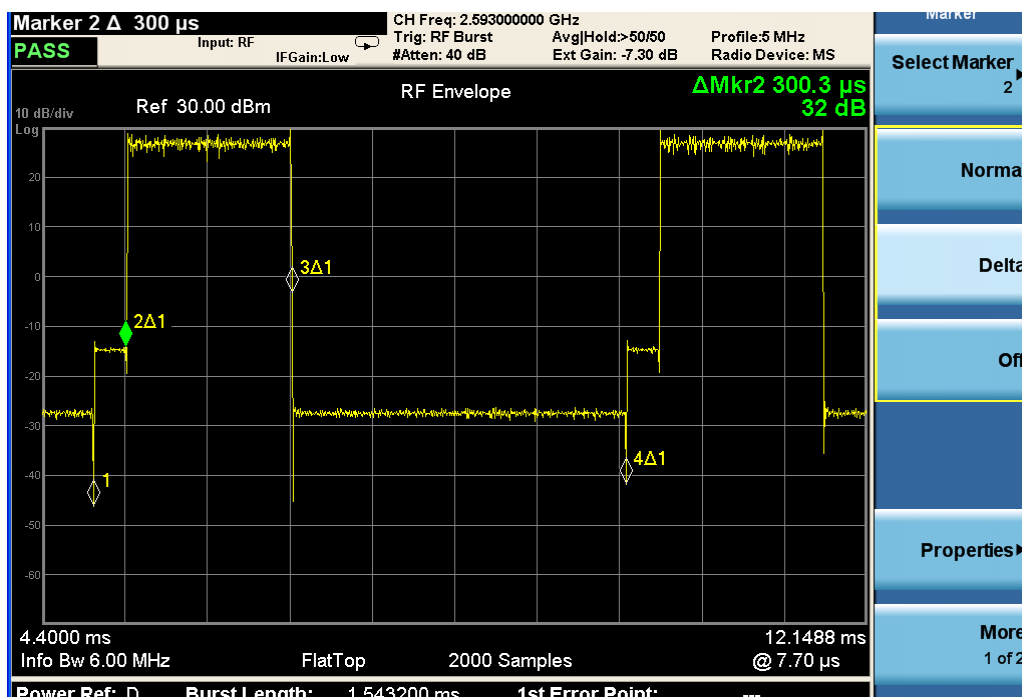


10MHz QPSK3/4 PUSC 2.593GHz DL: 29, UL: 18

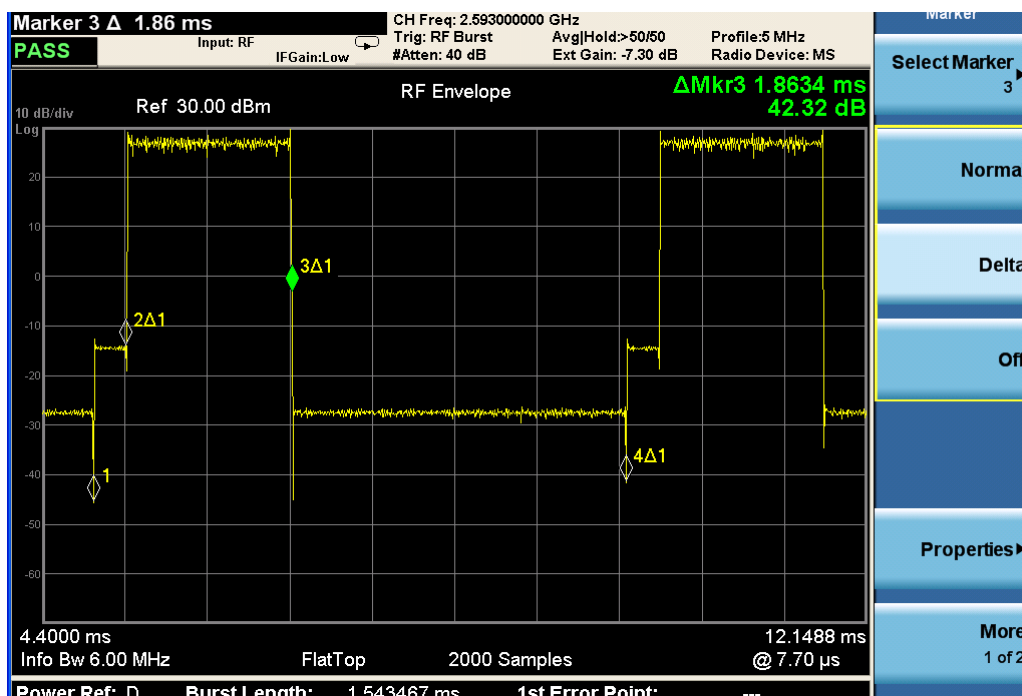


10MHz QPSK3/4 PUSC 2.593GHz DL: 29, UL: 18

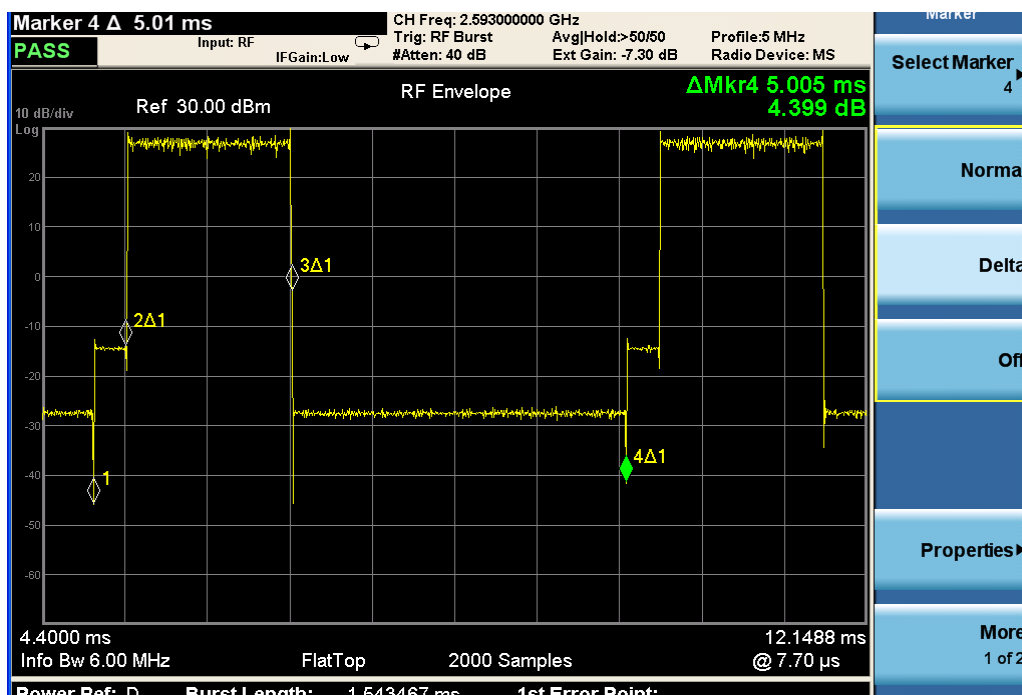




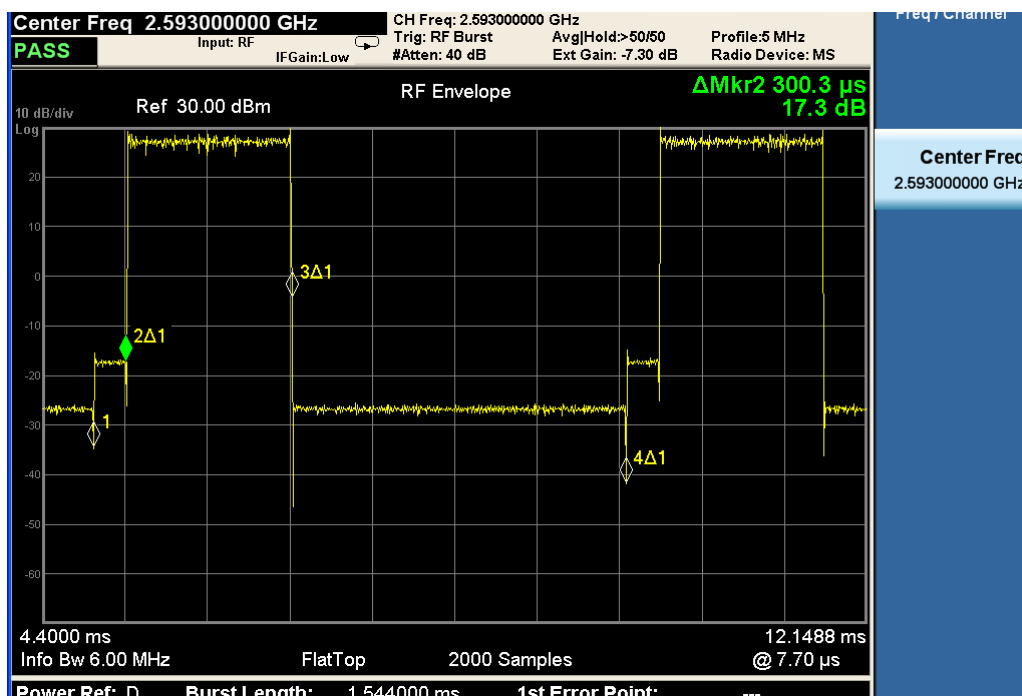
5MHz 16QAM1/2 PUSC 2.593GHz DL: 29, UL: 18



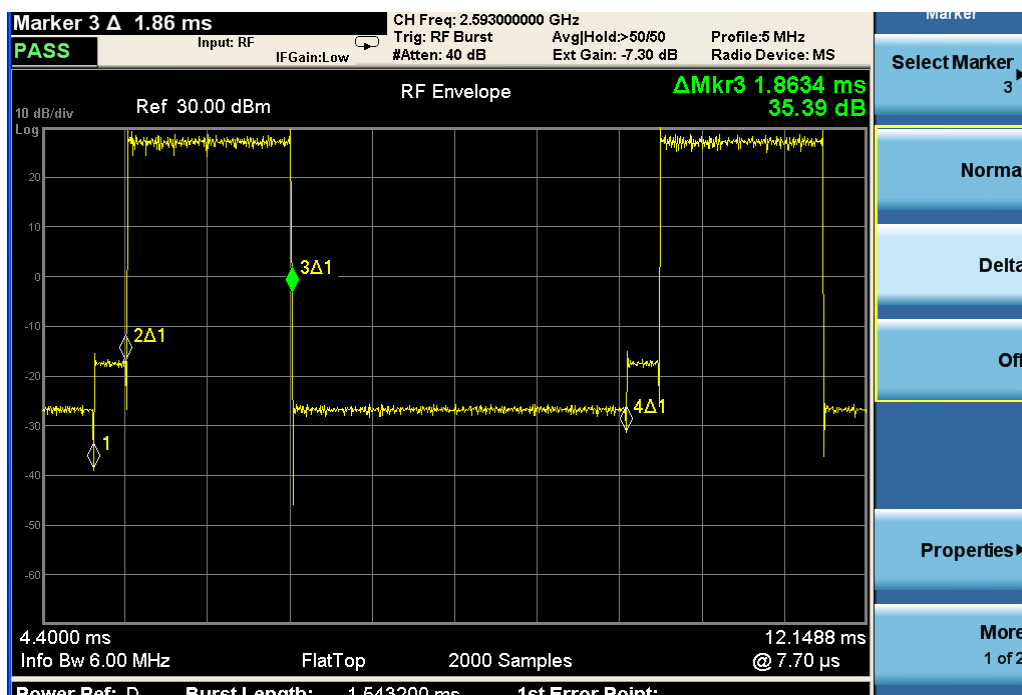
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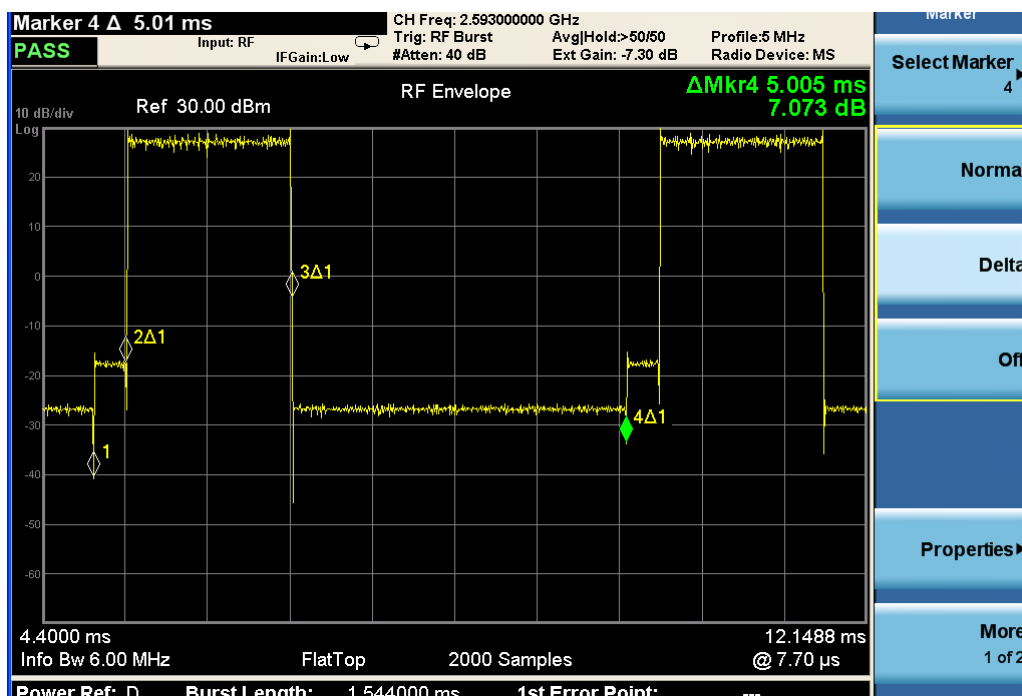
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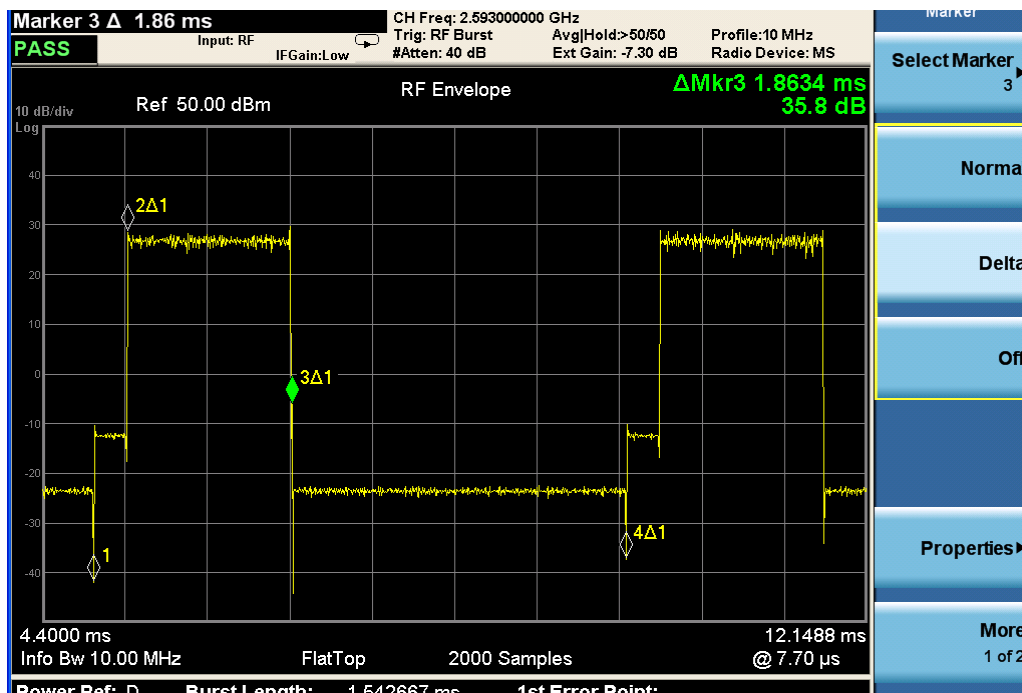
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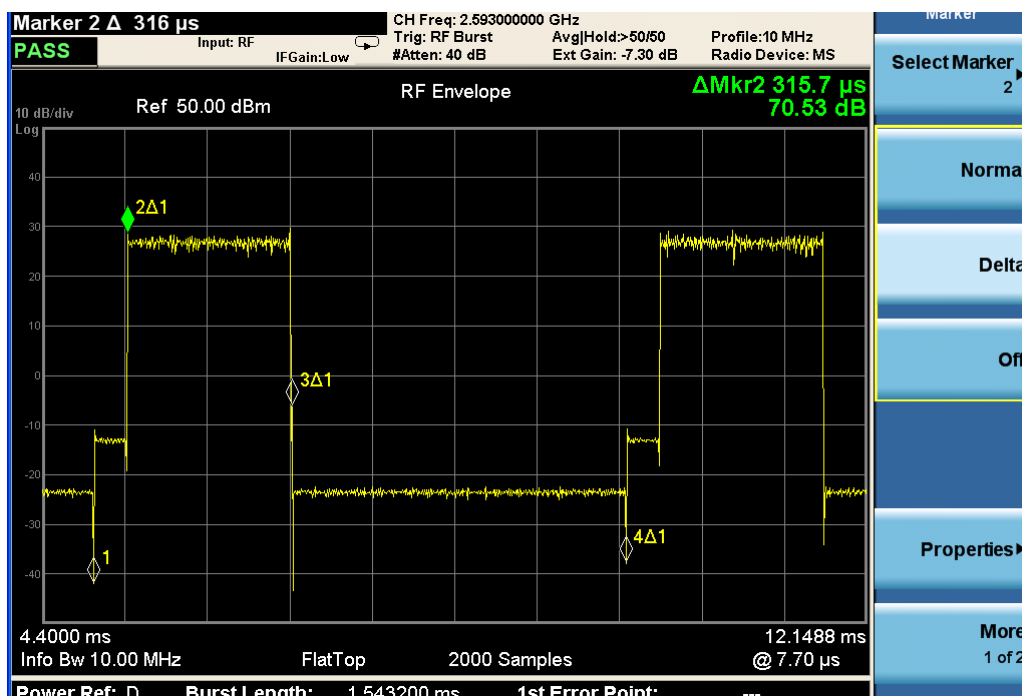
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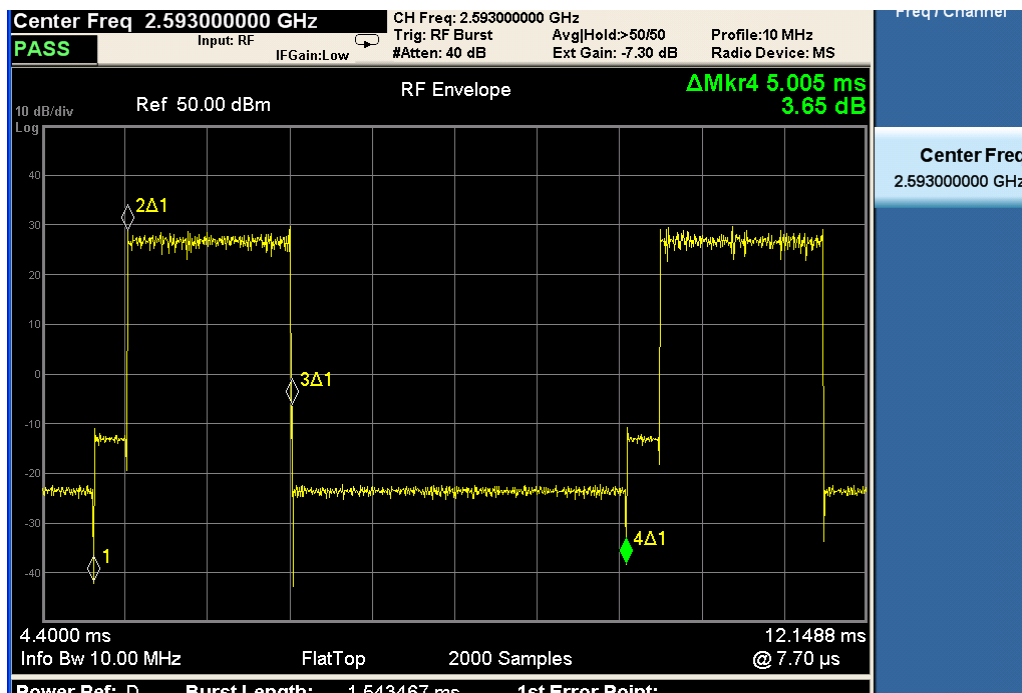
5MHz 16QAM3/4 PUSC 2.593GHz DL: 29, UL: 18



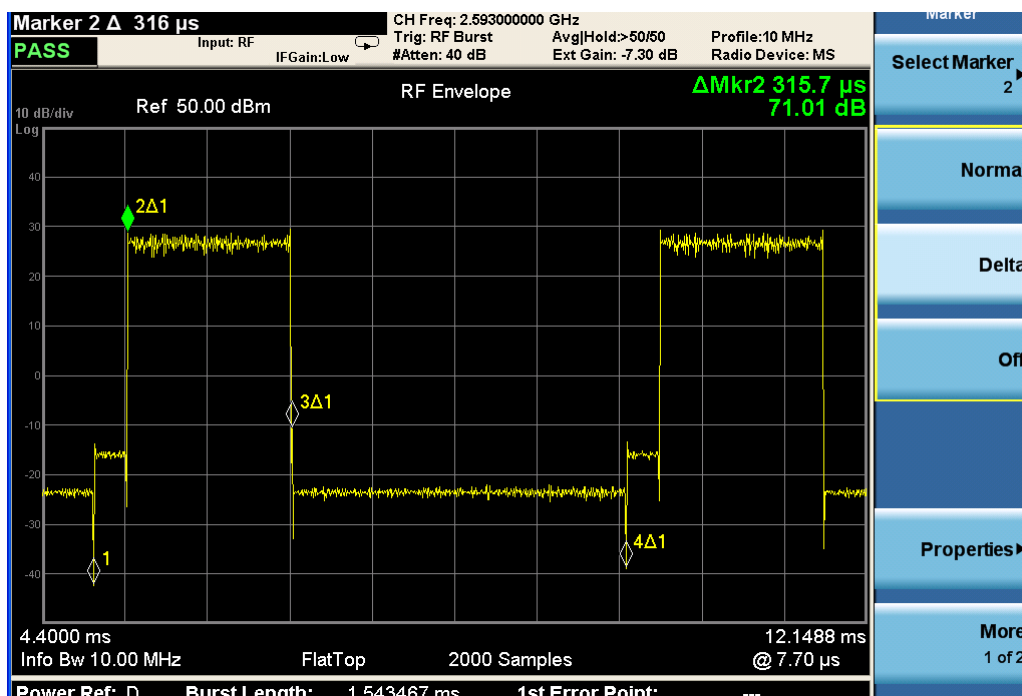
10MHz 16QAM1/2 PUSC 2.593GHz DL: 29, UL: 18



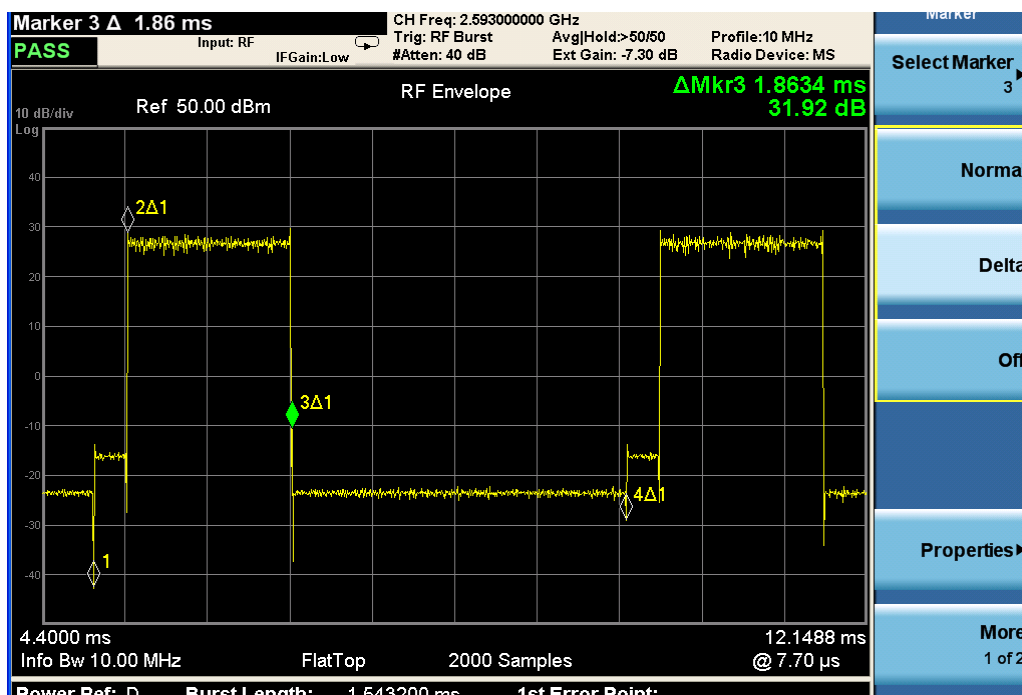
10MHz 16QAM1/2 PUSC 2.593GHz DL: 29, UL: 18



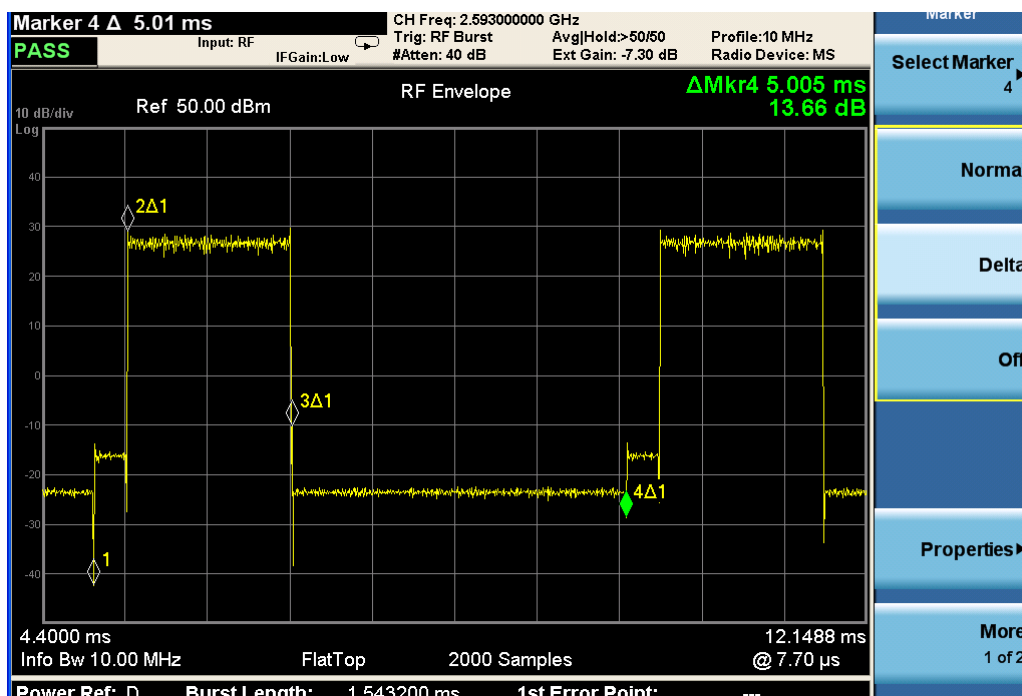
10MHz 16QAM1/2 PUSC 2.593GHz DL: 29, UL: 18



10MHz 16QAM3/4 PUSC 2.593GHz DL: 29, UL: 18



10MHz 16QAM3/4 PUSC 2.593GHz DL: 29, UL: 18



10MHz 16QAM3/4 PUSC 2.593GHz DL: 29, UL: 18