Engineering and Testing for EMC and Safety Compliance

Accredited under NVLAP Lab Code 200061-0

Certification Report

ARES Corporation
1800 N. Kent Street
Suite 1230
Arlington, VA 22209

Model: Dark Eyes 7010

Intrusion Detection Radar

FCC ID: VFN-DARKEYES7010

June 28, 2007

Standards Referenced for this Report	
Part 2: 2006	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 90: 2006	Private Land Mobile Radio Services

FCC Rule Parts	Frequency Range (MHz)	Output Power* (W)	Frequency Tolerance (ppm)	Emission Designator
90	8,750-10,038	1.0	0.4	625MPON

** Manufacturer's rated peak power*

Report Prepared By Test Engineer: Daniel Baltzell

Document Number: 2007188 R0.00

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1 General Information

The following certification report is prepared on behalf of ARES Corporation in accordance with the Federal Communications Commission rules and regulations. The Equipment Under Test (EUT) was the Dark Eyes 7010 Intrusion Detection Radar, FCC ID: VFN-DARKEYES7010. The test results reported in this document relate only to the item that was tested.

1.1 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

1.2 Related Submittal(s)/Grant(s)

This is an original certification application report.

1.3 Changes to Device

No modifications were made to the equipment during testing in order to achieve compliance with the standards used in this report.

2 Tested System Details

The test sample was received on February 26, 2004. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

Table 2-1: Components Used in Test Configuration

Part	Manufacturer	Model#	Serial Number	FCC ID	Cable Description	RTL Bar Code
Dark Eyes 7010	ARES Corporation	7010	NA	VFN-DARKEYES7010	0.3 m shielded USB and VGA pigtails; 1.6 m unshielded radar control box I/O	015714
Camera	ARES Corporation	NA	NA	N/A	N/A	015713
Pan Tilt Unit	Directed Perceptions	PTU 46+-70	NA	N/A	1.7 m shielded I/O	015712
Pan Tilt Unit	Directed Perceptions	PTU 46-70	NA	N/A	1.9 m unshielded I/O	015709
Antenna	Q-Par Angus, Ltd.	D752/9LB	2353	N/A	1.2 m shielded TX and RX	015708
Radome	Pacific Radomes, Inc.	PRI-19x19	002	N/A	N/A	015707
Monitor	Gateway, Inc.	EV500A	15052D002150	BEJCB575B	2 m power and I/O with ferrites	010511
12VDC Power Supply	Lambda Electronics, Inc.	LZS-250-2	0044010474	N/A	1.7 m unshielded DC; 1.9 m unshielded AC power	015743
USB Mouse	Logitech, Inc.	M-BJ58	LNA30215524	N/A	1.8 m shielded	015744
USB Keypad	Grandtec	FLX-500U	N/A	T3G2016271	1.5 m shielded	015745

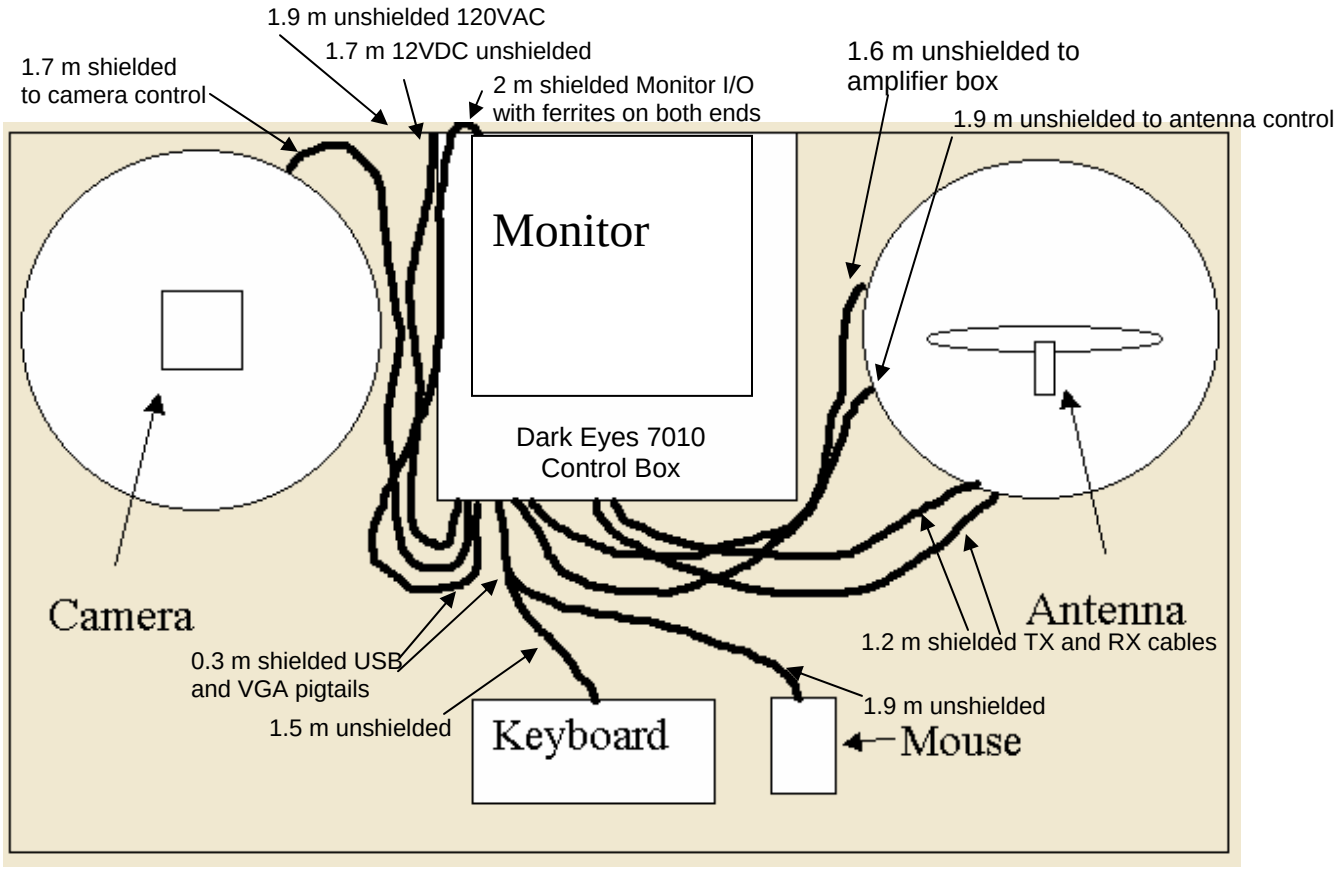


Figure 2-1: Configuration of Tested System

3 FCC Rules and Regulations Part 2 §2.202: Necessary Bandwidth and Emission Bandwidth

Type of Emission:

Necessary Bandwidth and Emission Bandwidth:

25ns Pulse Width Measurement

Measurement: 26 dB Occupied Bandwidth

Bn = 625 MHz

Emission designator: 625MPON

4 FCC Rules and Regulations Part 2 §2.1033(c)(8) Voltages and Currents Through The Final Amplifying Stage

Nominal DC Voltage: 12 VDC nominal, 15 VDC max.

Current: 500 ma nominal, 900 ma max.

5 FCC Rules and Regulations Part 2 §2.1046(a): RF Power Output: Conducted

5.1 Test Procedure

ANSI TIA-603-2002, section 2.2.1

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.
The transmitter output was measured with an Agilent power meter with an HP 8481B sensor.
The pulse repetition frequency (PRF) rate is software-selectable from 2 kHz to 300 kHz in 1 Hz increments. 2 kHz provides the highest correction factor, but 8.5 kHz is nominal for this device. The lowest, highest, and nominal cases are presented.

5.2 Test Data

Table 5-1: RF Average Power Output Test Data

Pulse Length (ns)	Average Power (dBm)	Average Power (mW)	2 kHz Pulse Repetition Frequency (PRF) Correction Factor (dB)	8.5 kHz Pulse Repetition Frequency (PRF) Nominal Correction Factor (dB)	300 kHz Pulse Repetition Frequency (PRF) Correction Factor (dB)	2 kHz PRF Peak Power (mW)	8.5 kHz PRF Peak Power (mW) Nominal	300 kHz PRF Peak Power (mW)
25	-9.6	0.1	43	36.7	21.2	1824.0	429.2	14.6
50	-5.3	0.3	40	33.7	18.2	2570.4	604.8	19.7
100	-1.8	0.7	37	30.7	15.2	3012.8	708.9	22.0
250	2.5	1.8	33	26.7	11.2	3319.2	781.0	23.7
500	5.6	3.6	30	23.7	8.2	3388.4	797.3	24.2
800	7.7	5.9	28	21.7	6.2	3434.6	808.1	24.5
1000	8.7	7.4	27	20.7	5.2	3459.2	813.9	24.7

Note: Duty cycle correction factor = 10 log 1/(PRF(Hz) x Pulse Length)

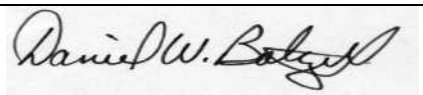
Table 5-2: RF Power Output (Peak Rated Power)

Rated Power
1.0 W

Table 5-3: Test Equipment Used For Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900769	Hewlett Packard	8481B	Sensor	2702A05059	09/09/04
901184	Agilent Technologies	E4416A	Power Meter	GB41050573	07/30/04

Test Personnel:

Daniel Baltzell		May 5, 2004
Test Technician/Engineer	Signature	Date Of Test

6 FCC Rules and Regulations Part 2 §2.1047(c)(1): Modulation Characteristics

The Series 3000 pulse input was measured with a Tektronix TDS 540 digital oscilloscope and verified with an HP 8566B spectrum analyzer at 0 span; plots of the analyzer display for pulse widths of 25, 500, and 1000 nanoseconds are provided.

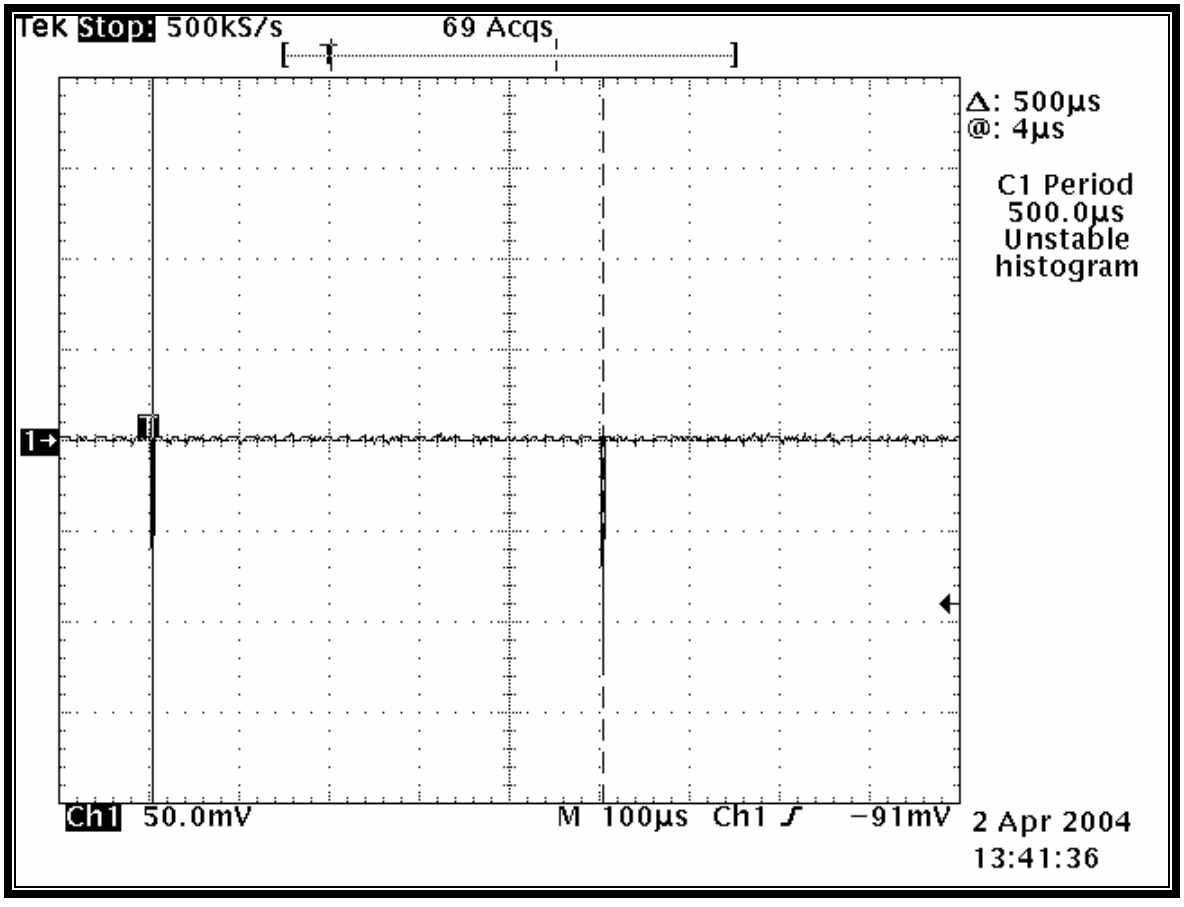
6.1 Test Procedure

ANSI TIA-603-2002, section 2.2.11

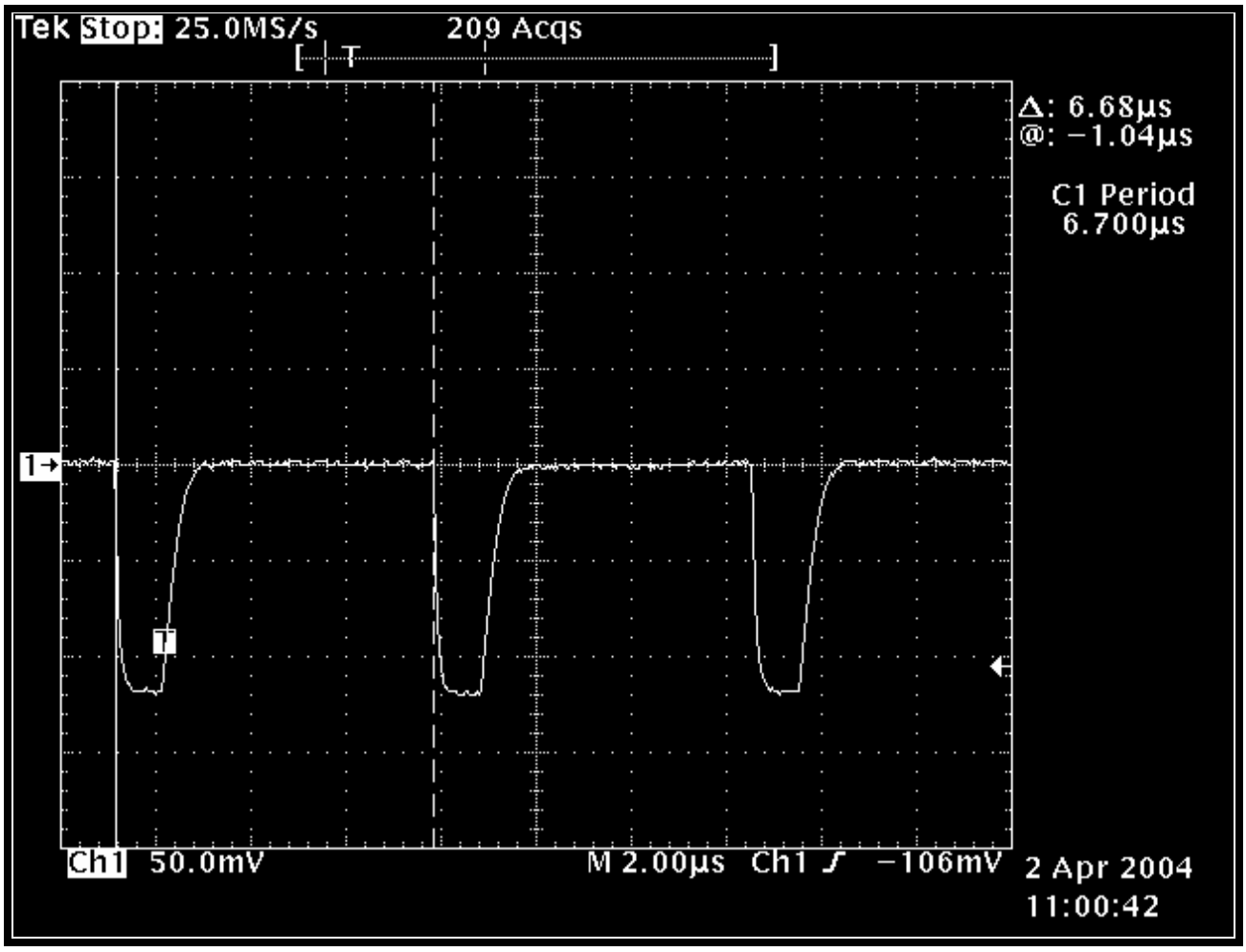
6.2 Test Data

Repetition:

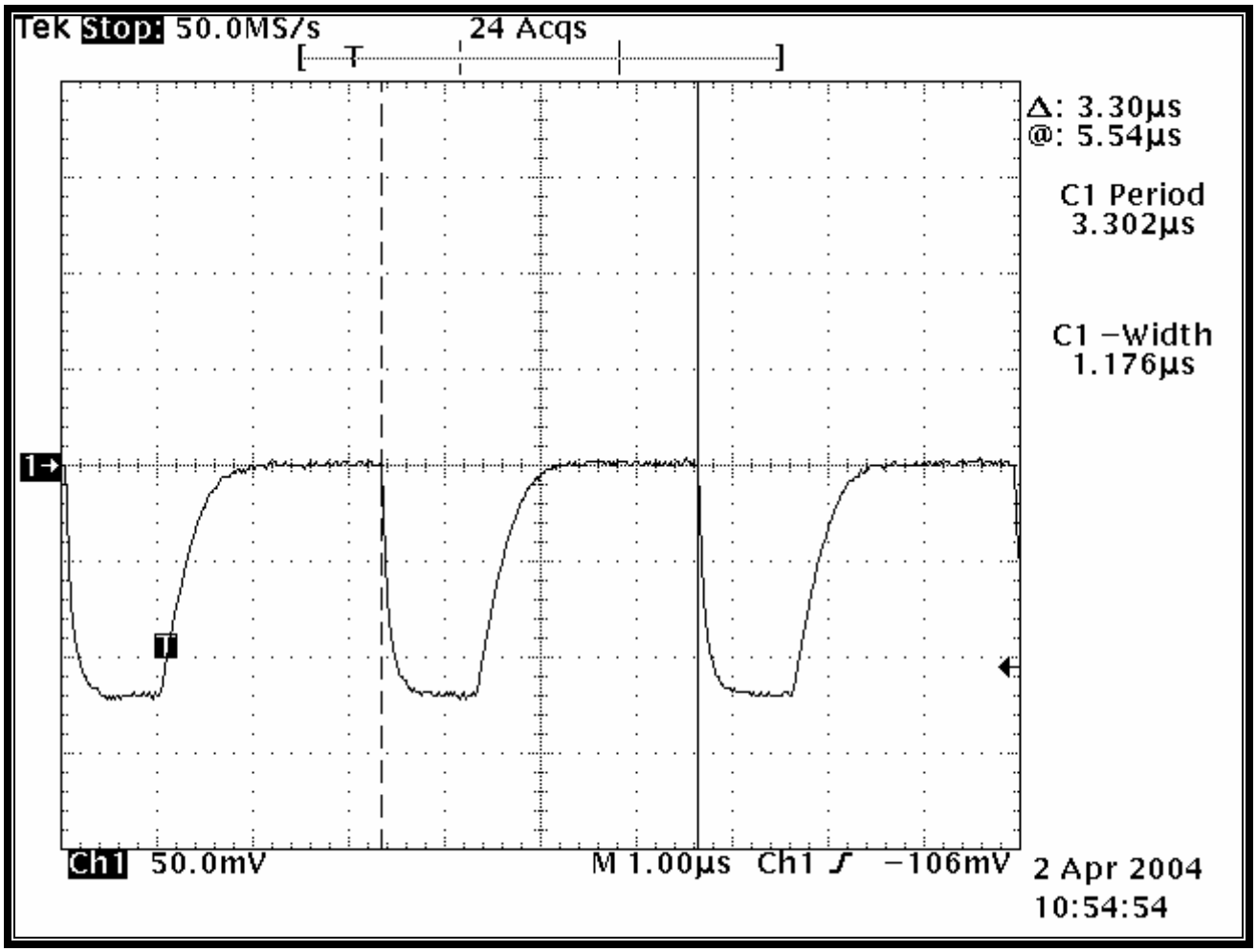
The pulse repetition frequency (PRF) rate is software-selectable from 2 kHz to 300 kHz in 1 Hz increments. Following are plots of 2 kHz PRF (500 us slowest rate); 150 kHz (6.7 us mid rate); 300 kHz (3.3 us highest rate).



Plot 6-1: Pulse Repetition Frequency (PRF); 2 kHz (500 us)

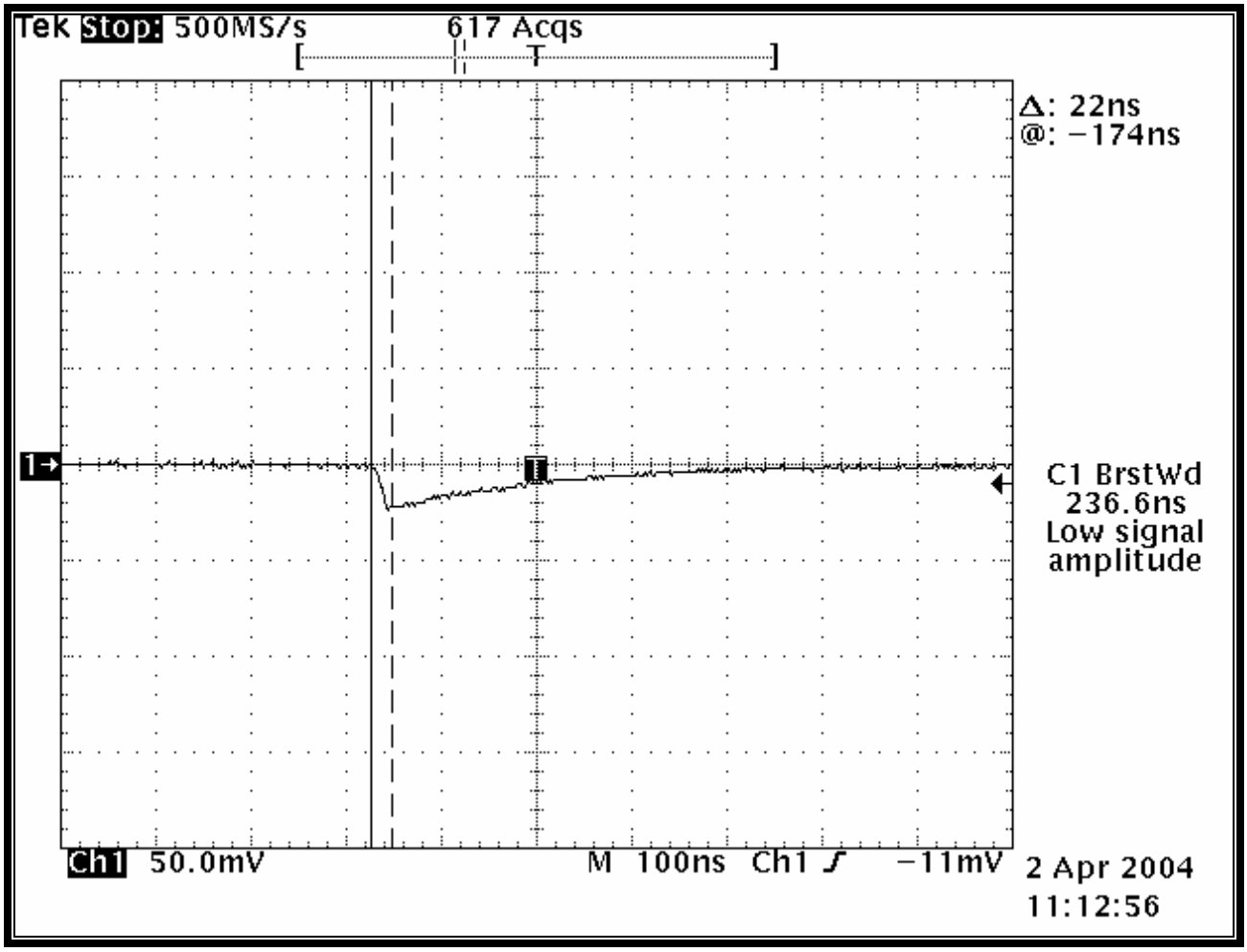


Plot 6-2: Pulse Repetition Frequency (PRF); 150 kHz (6.7 us)

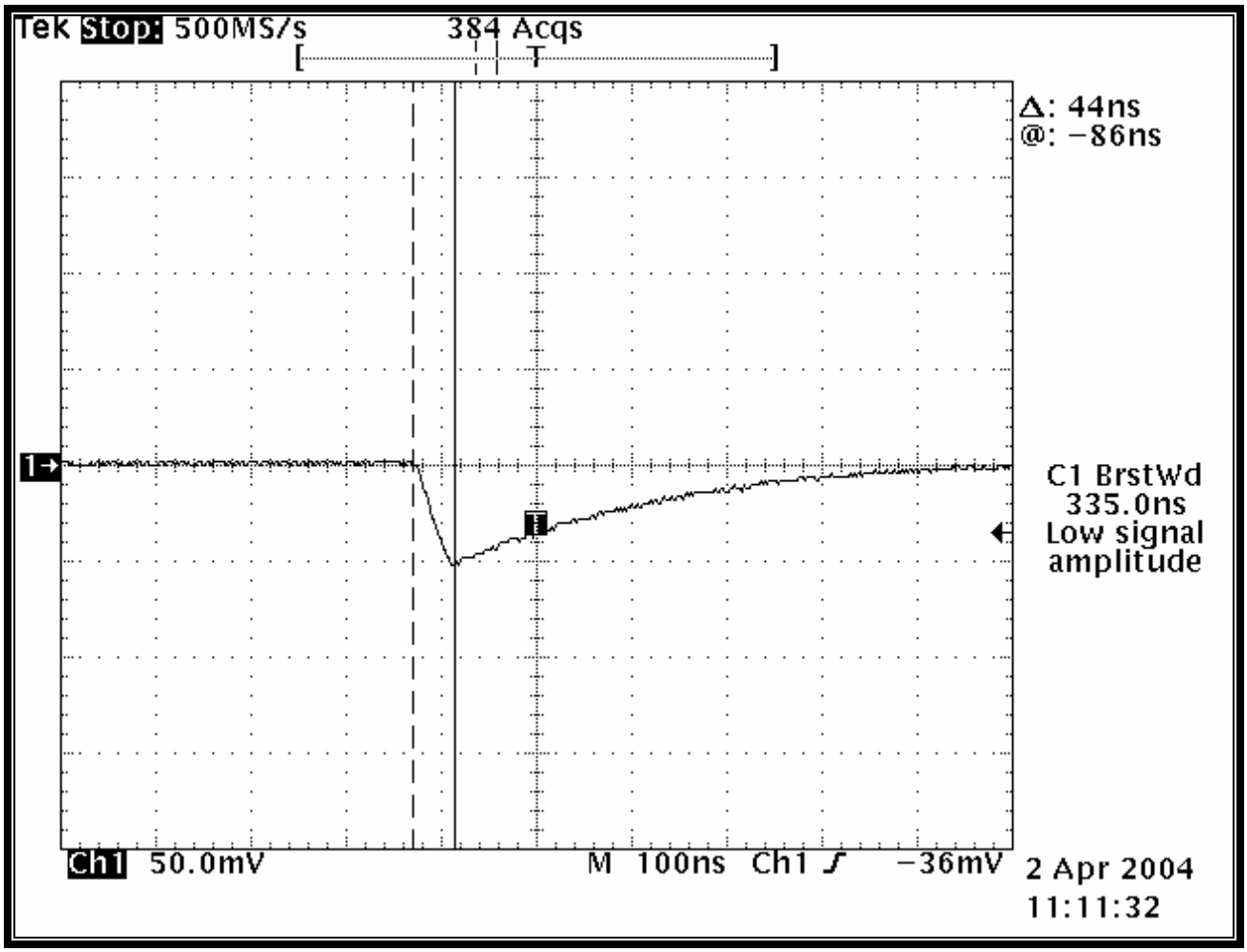


Plot 6-3: Pulse Repetition Frequency (PRF); 300 kHz (3.3 us)

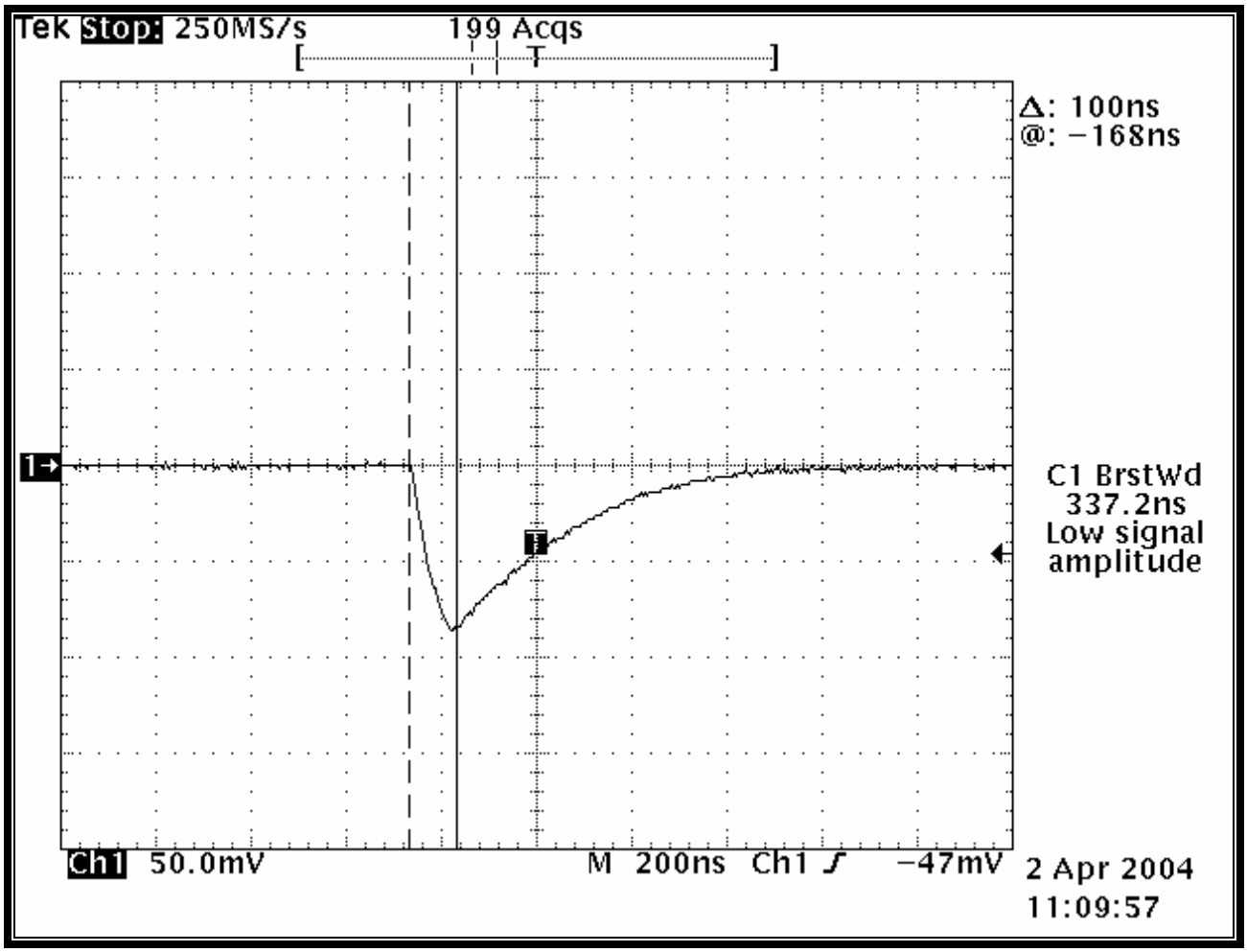
The following plots show the pulse widths of all available software selections (25 ns; 50 ns; 100 ns; 250 ns; 500 ns; 800 ns; and 1000 ns).



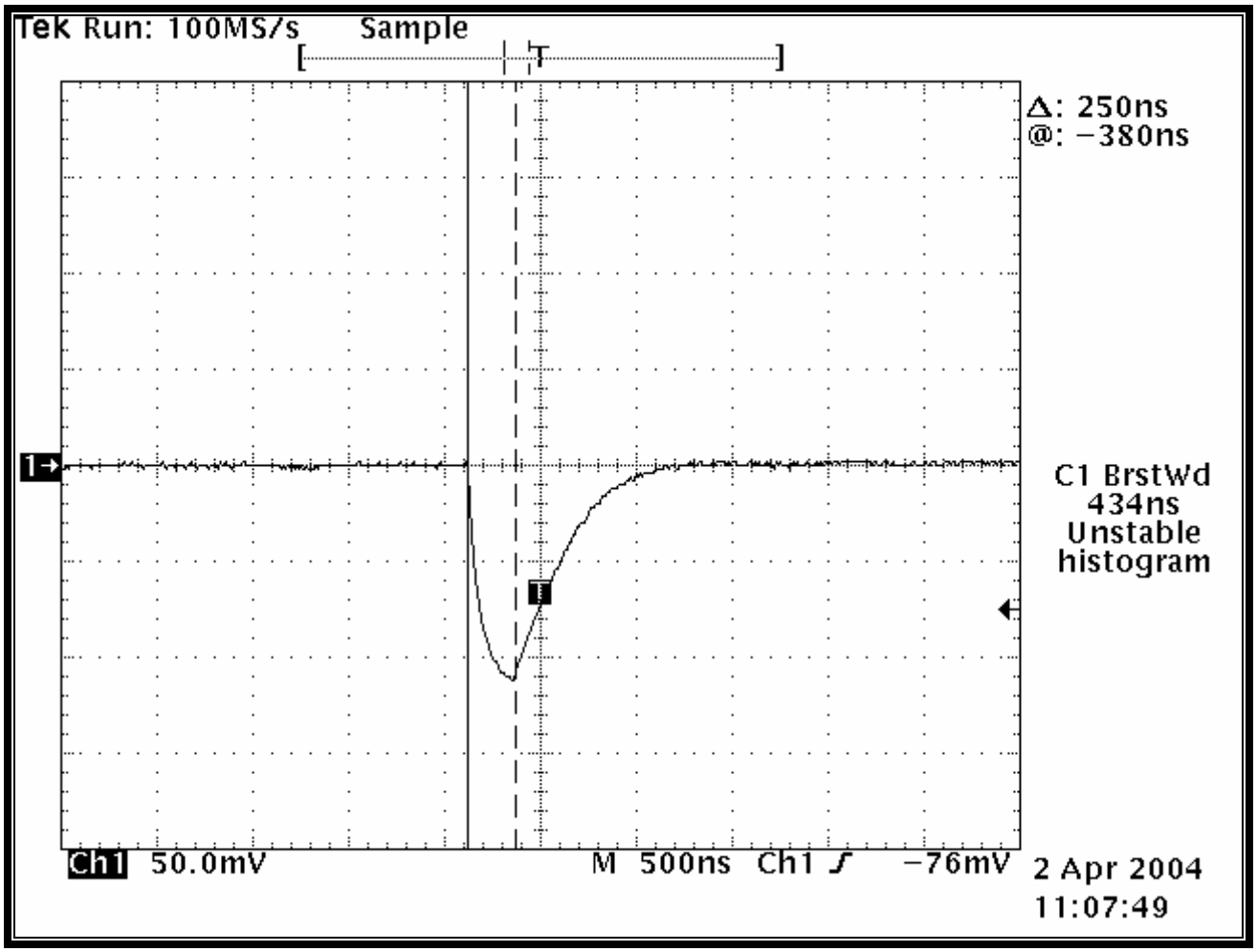
Plot 6-4: Pulse Width (25 ns)



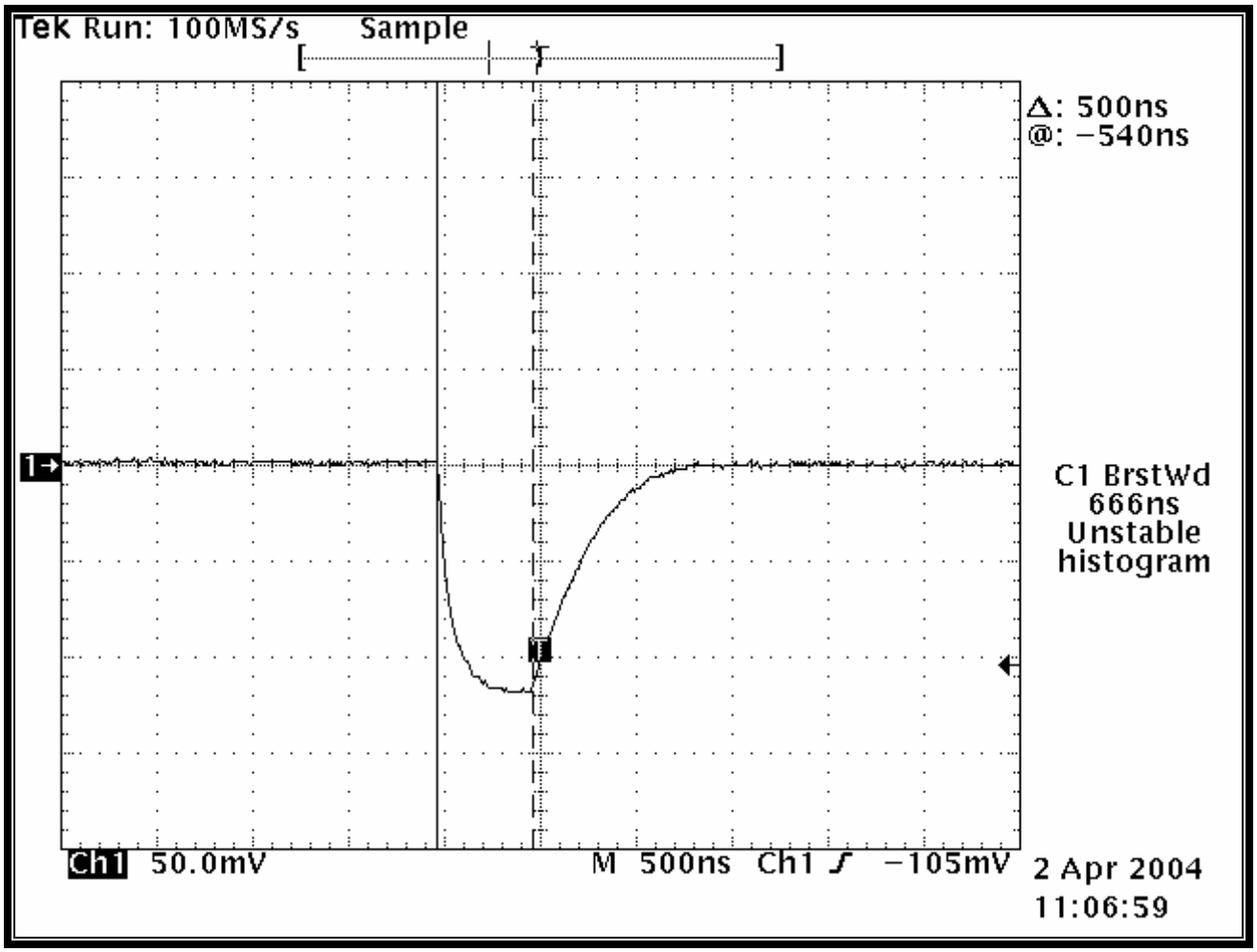
Plot 6-5: Pulse Width (50 ns)



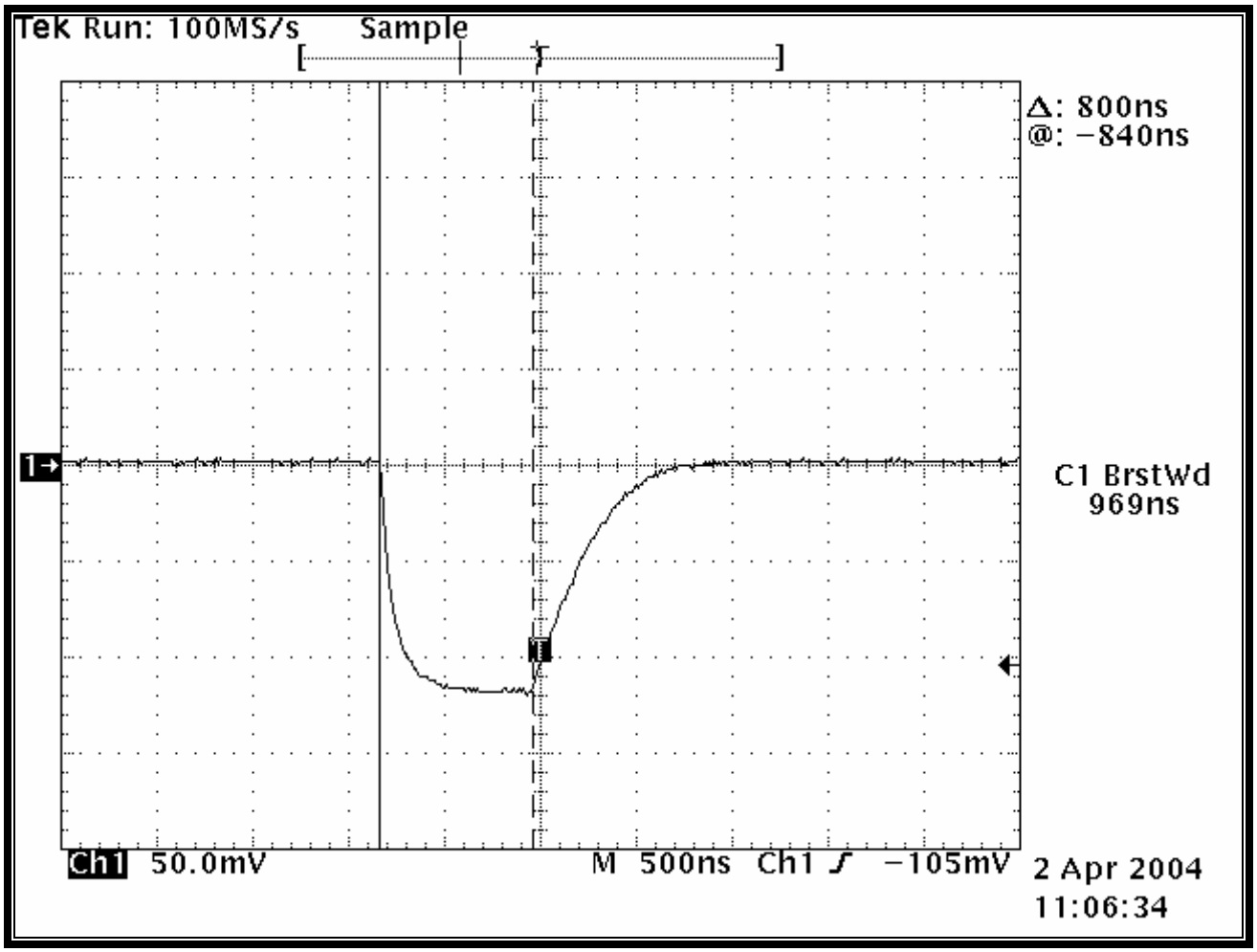
Plot 6-6: Pulse Width (100 ns)



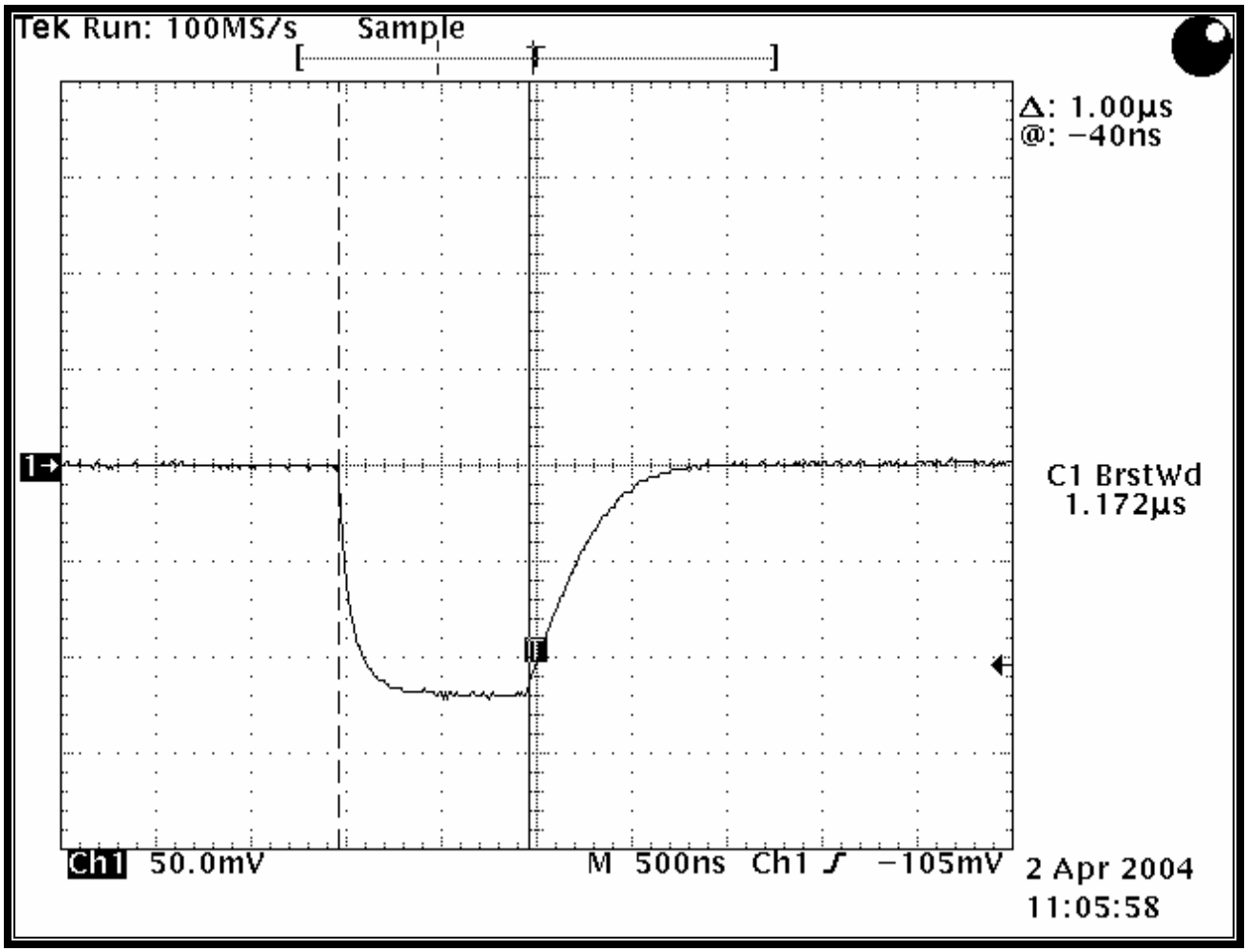
Plot 6-7: Pulse Width (250 ns)



Plot 6-8: Pulse Width (500 ns)

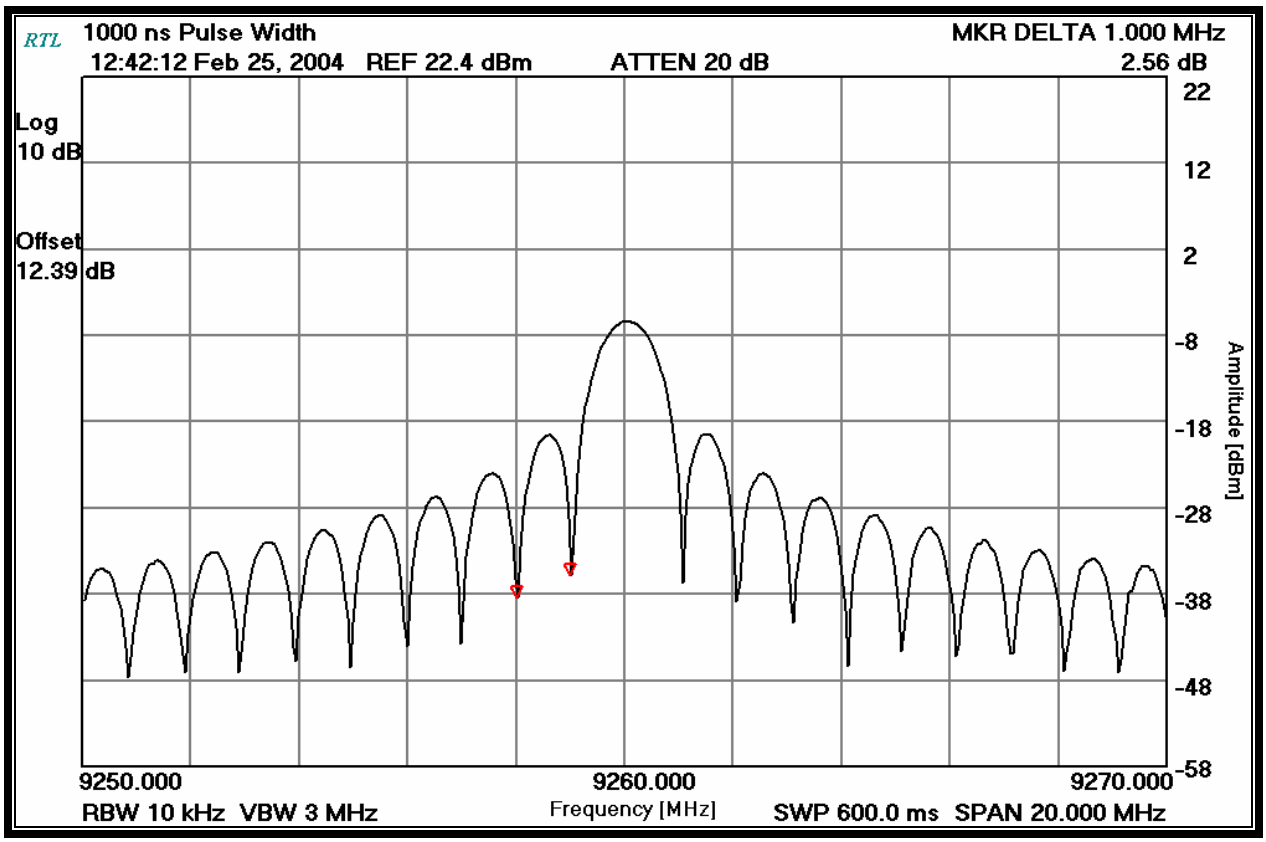


Plot 6-9: Pulse Width (800 ns)

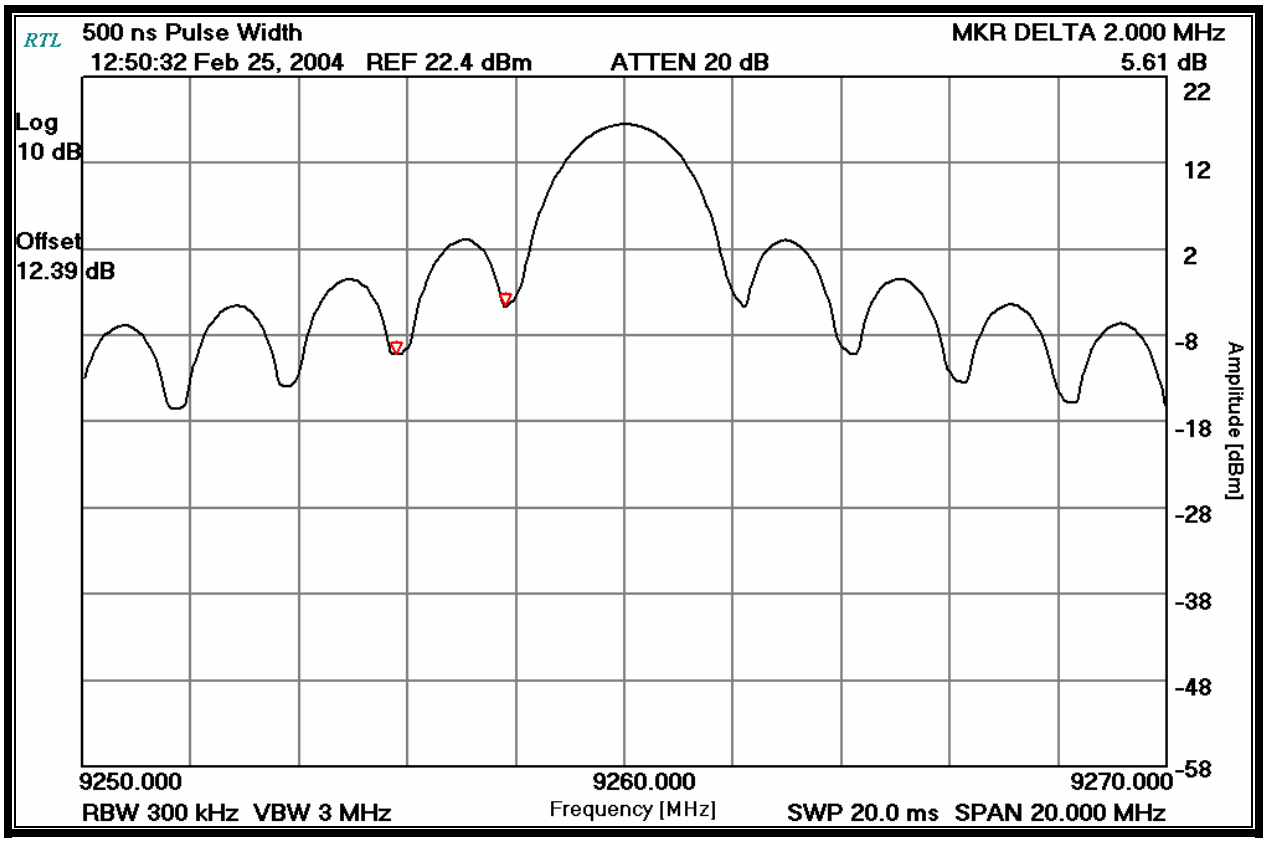


Plot 6-10: Pulse Width (1000 ns)

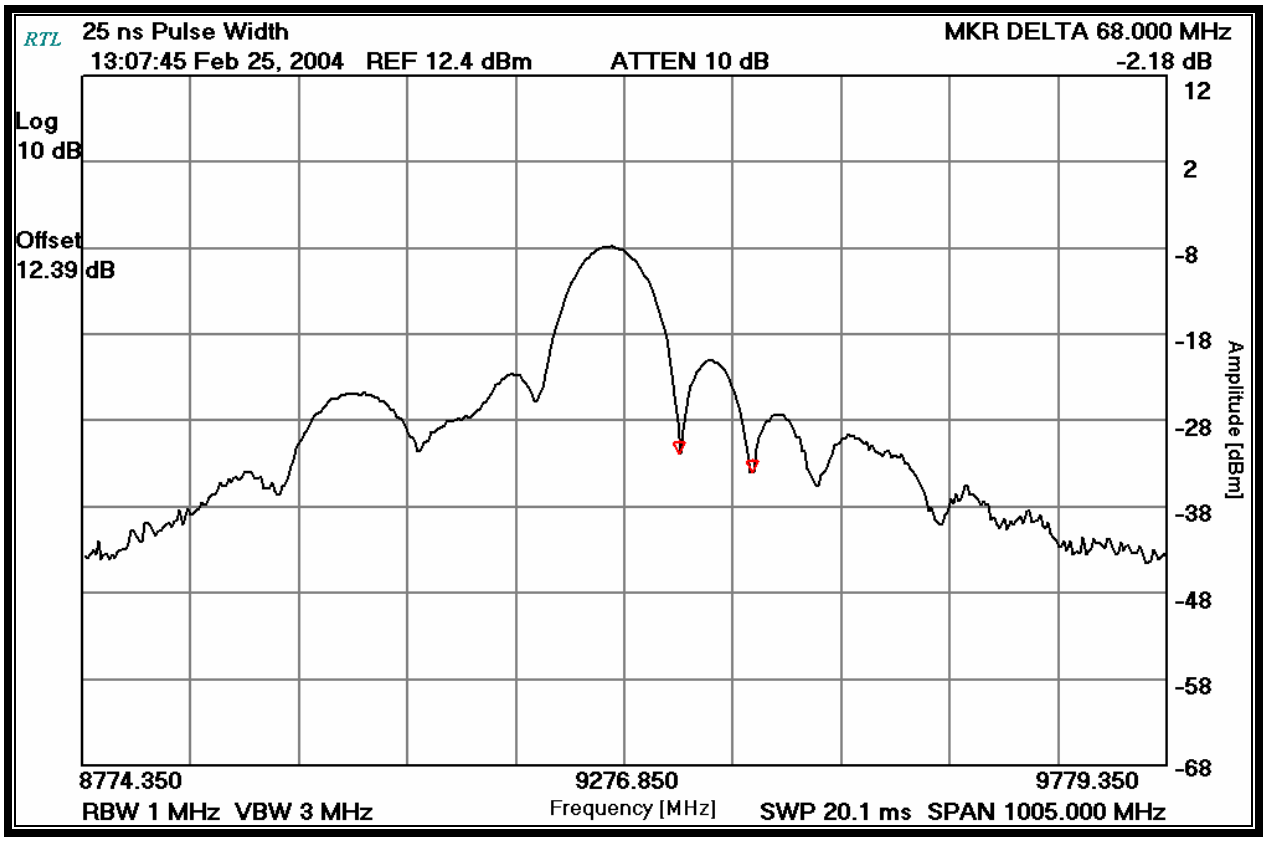
The following plots show spectrum analyzer views of the pulse lengths for the low (25 ns), mid (500 ns), and high (1000 ns) rates.



Plot 6-11: Pulse Length (1000 ns)



Plot 6-12: Pulse Length (500 ns)

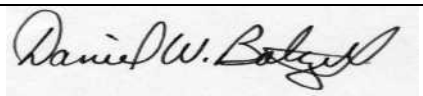


Plot 6-13: Pulse Length (25 ns)

Table 6-1: Test Equipment Used For Testing Modulation Characteristics

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	5/12/04
900561	Tektronix	TDS540B	Oscilloscope	B020129	3/25/05

Test Personnel:

Daniel Baltzell		February 25 & April 2, 2004
Test Technician/Engineer	Signature	Date Of Test

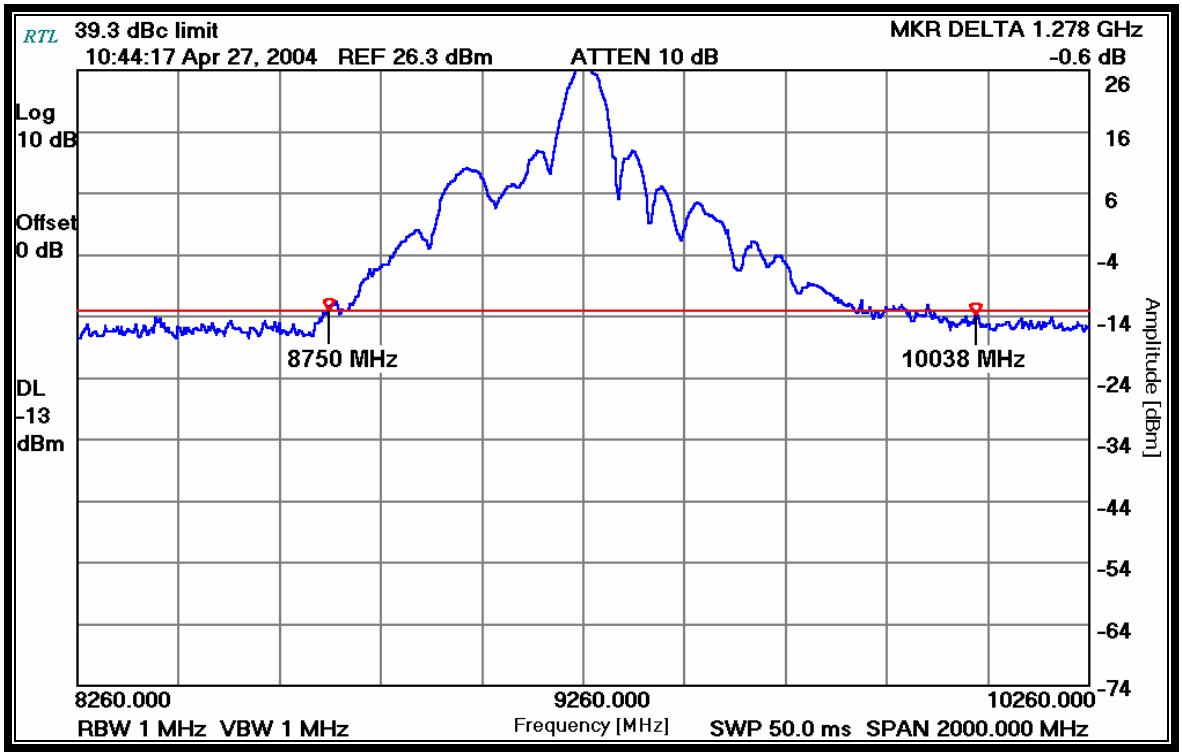
7 FCC Rules and Regulations Part 2 §2.1049(c)(1): Occupied Bandwidth

Occupied Bandwidth (99% Power Bandwidth) - Compliance with the Emission Mask

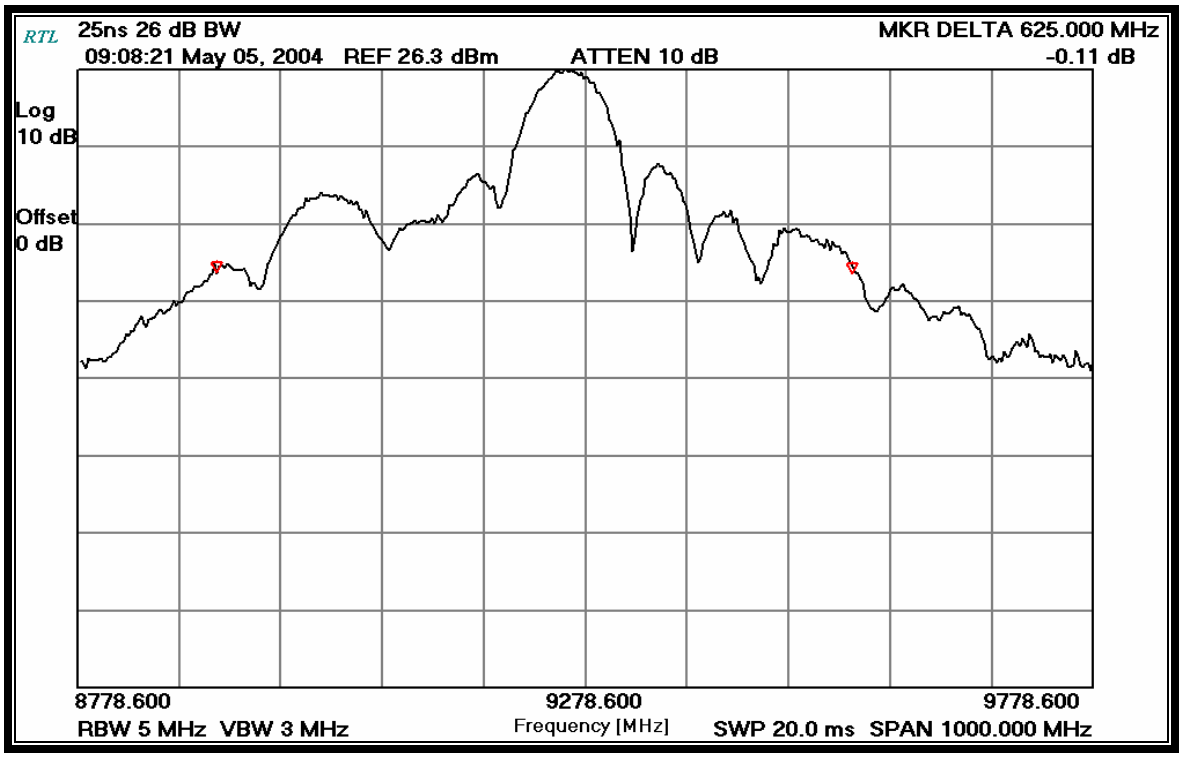
7.1 Test Procedure

ANSI TIA-603-2002, section 2.2.11

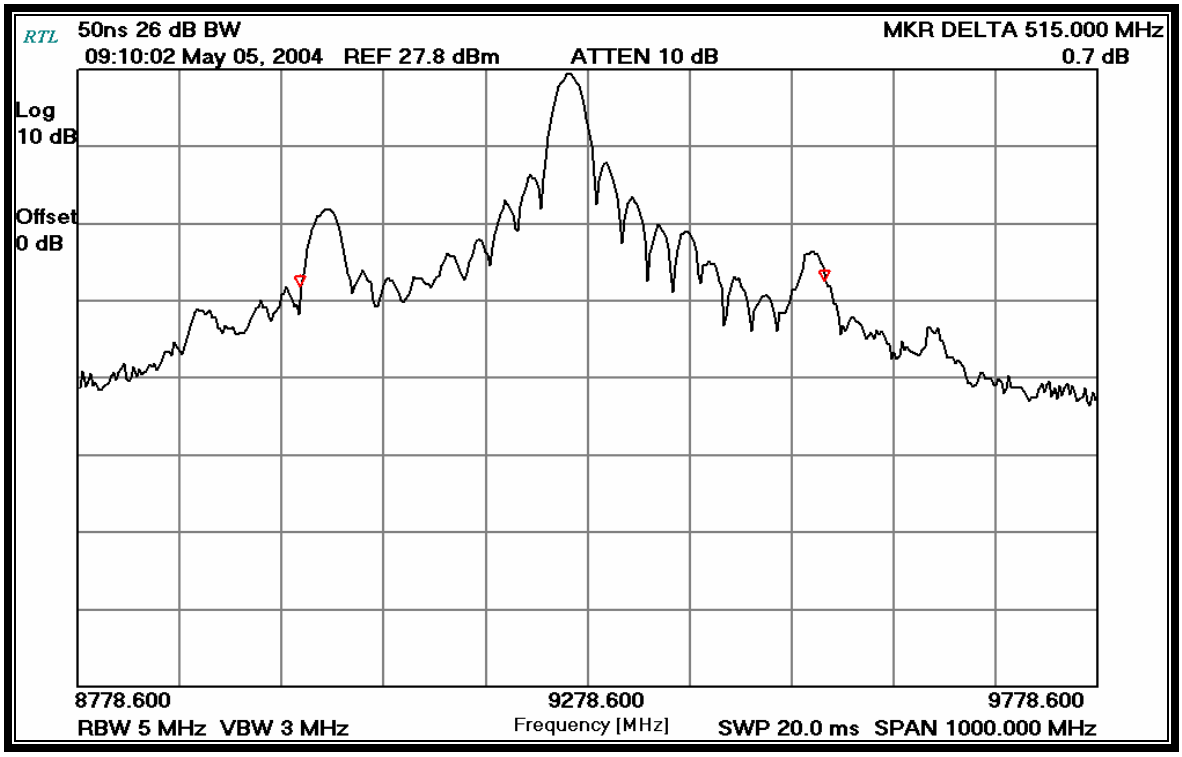
7.2 Test Data



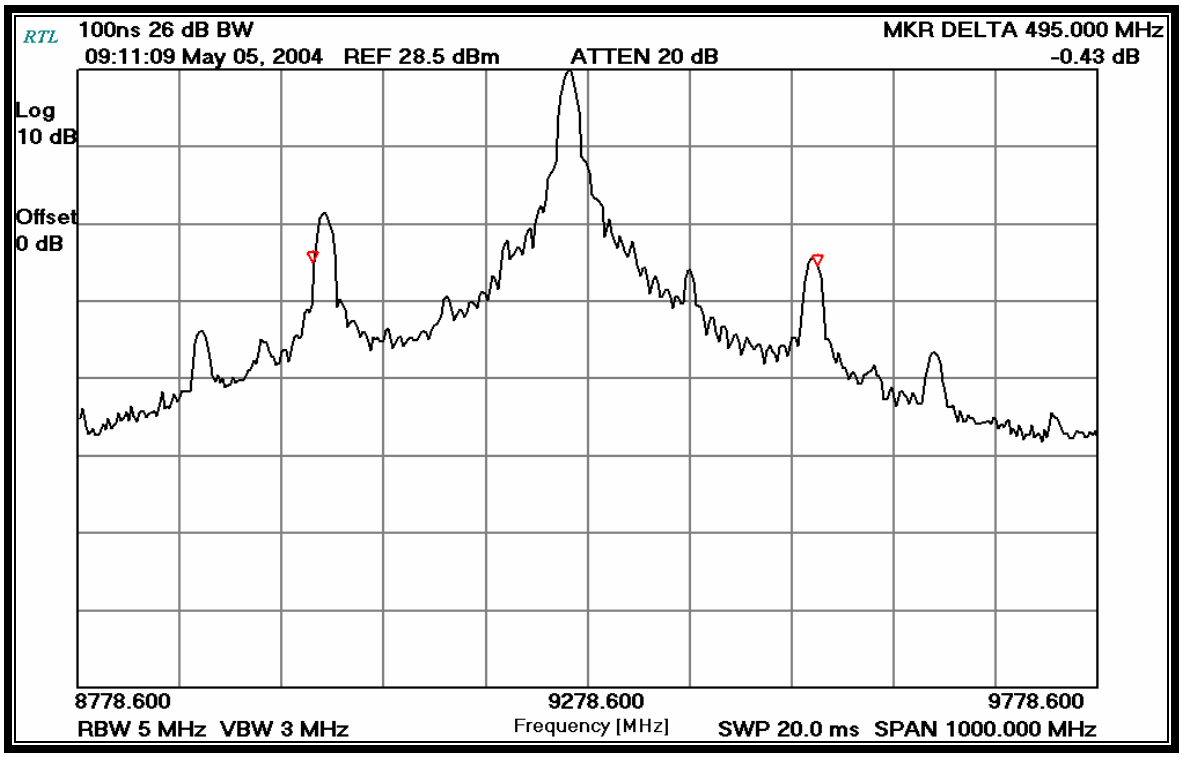
Plot 7-1: 39.3 dBc (25 ns Pulse Length)



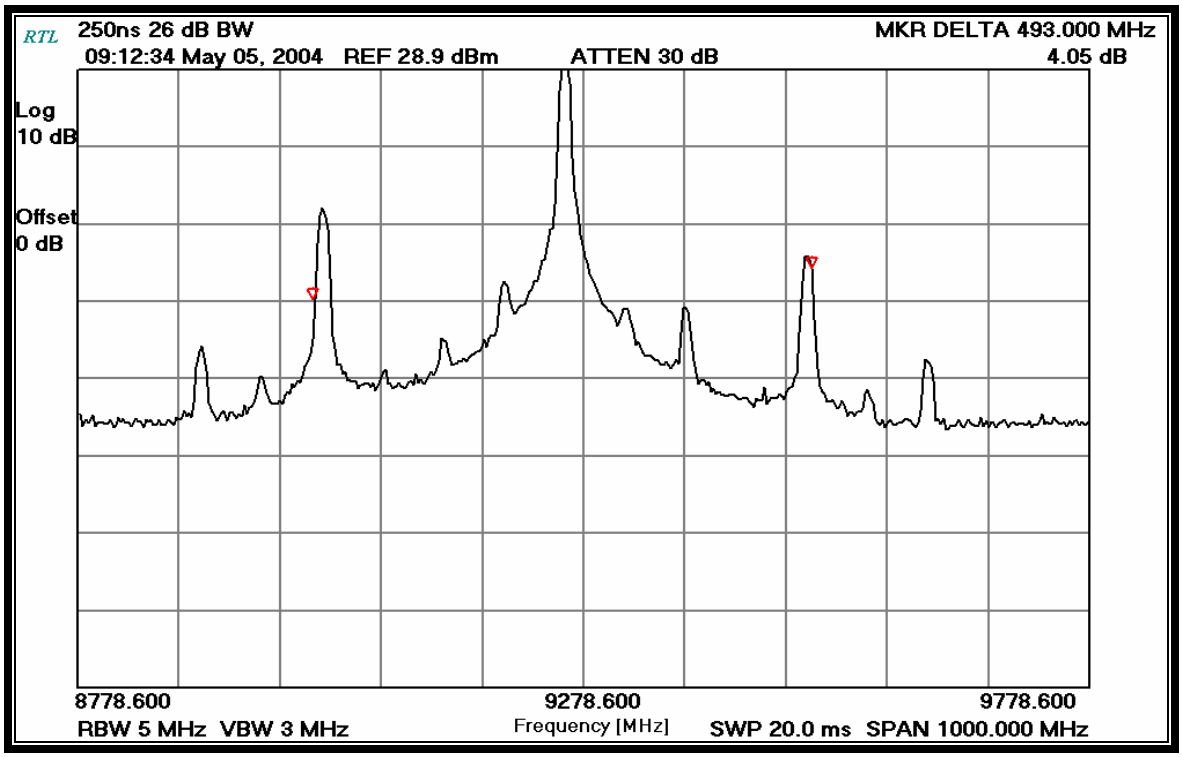
Plot 7-2: Occupied Bandwidth (25 ns)



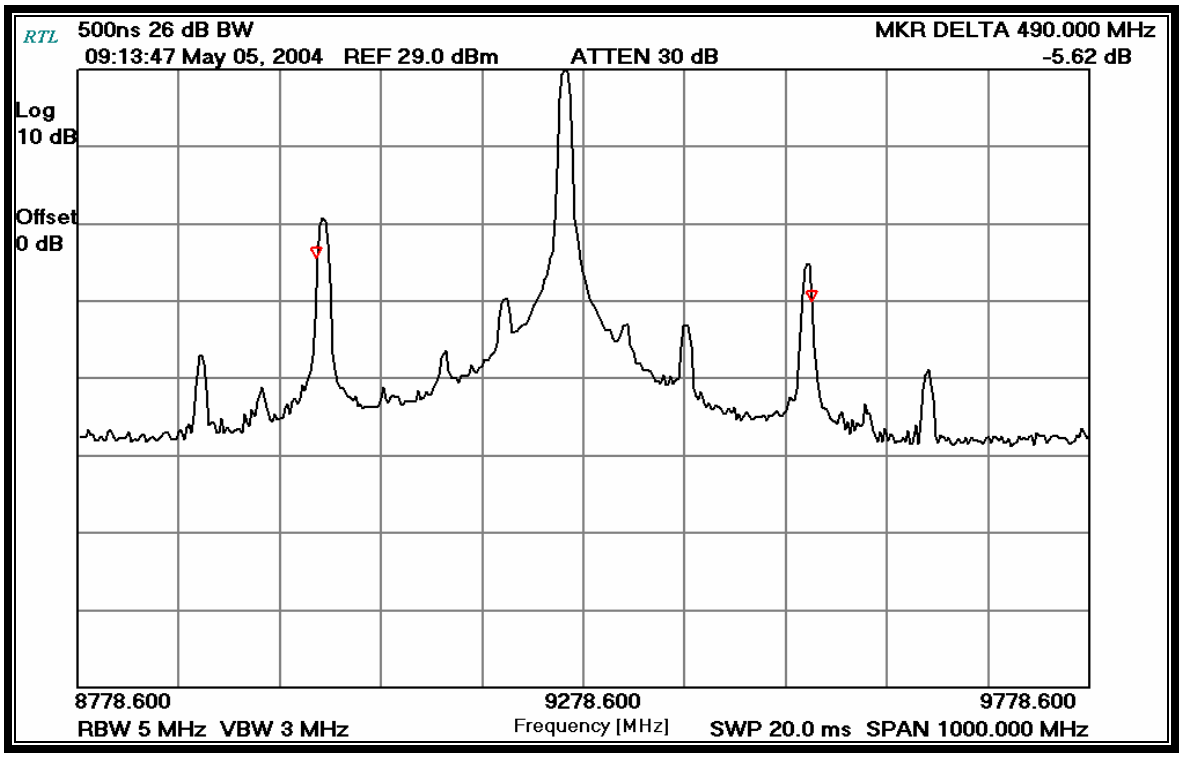
Plot 7-3: Occupied Bandwidth (50 ns)



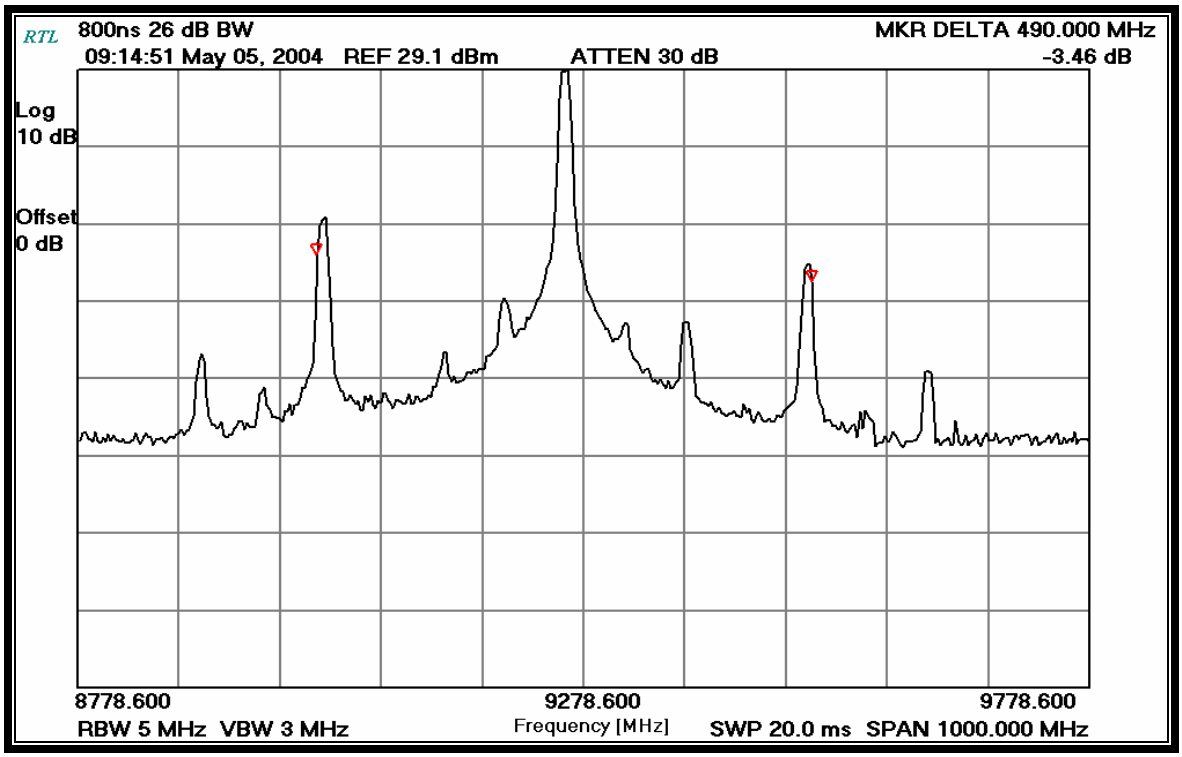
Plot 7-4: Occupied Bandwidth (100 ns)



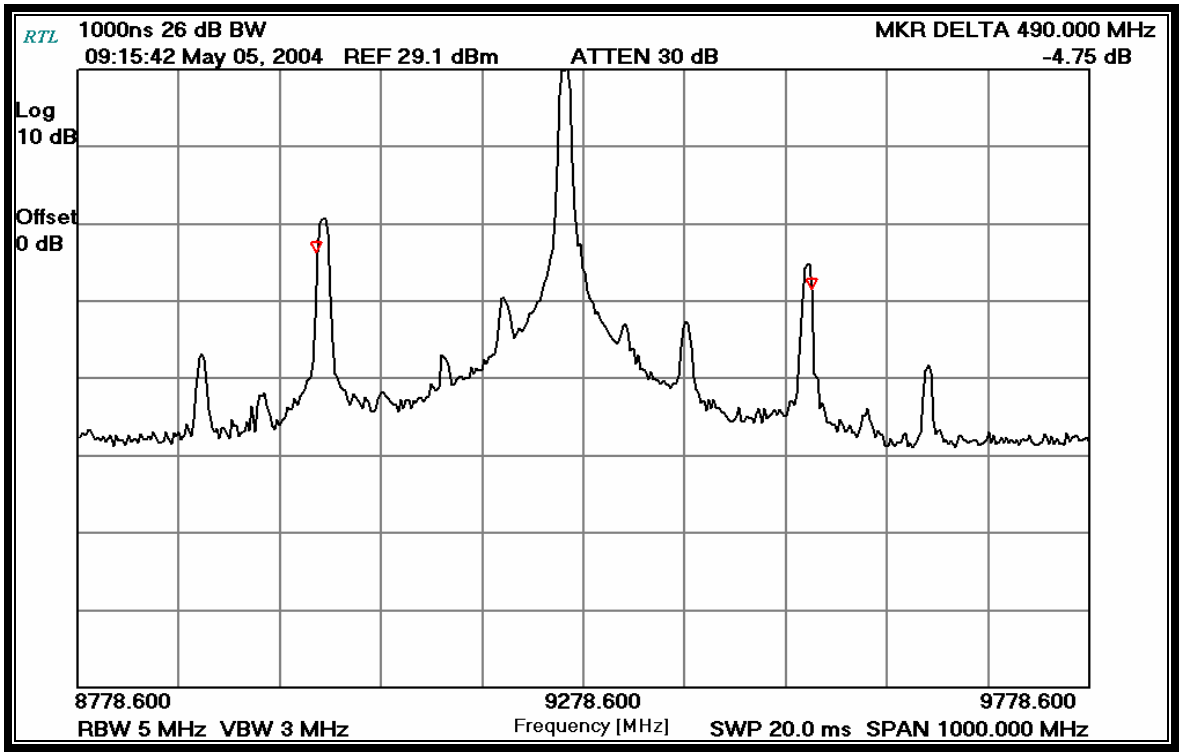
Plot 7-5: Occupied Bandwidth (250 ns)



Plot 7-6: Occupied Bandwidth (500 ns)



Plot 7-7: Occupied Bandwidth (800 ns)

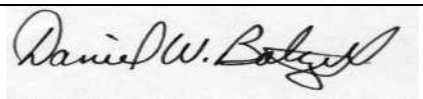


Plot 7-8: Occupied Bandwidth (1000 ns)

Table 7-1: Test Equipment Used For Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901215	Hewlett Packard	8596EM (9 kHz - 12.8 GHz)	EMC Analyzer	3826A00144	8/27/04

Test Personnel:

Daniel Baltzell		May 5, 2004
Test Technician/Engineer	Signature	Date Of Test

8 FCC Rules and Regulations Part 2 §2.1051: Spurious Emissions at Antenna Terminals

8.1 Test Procedure

ANSI TIA-603-2002, Section 2.2.13

Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc

Limits: P(dBm) – (43+10xLOG P(W))

The worse case (unwanted emissions) channels are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

The 3010 transmitter was tested for spurious emissions while the equipment was modulated with nominal pulse widths of 25, 500, and 1000 nanoseconds. Measurements were made with an HP 8546E Spectrum Analyzer coupled to the transmitter output waveguide through a directional coupler. The supply voltage was maintained at 12 VDC throughout the test. Spurious emissions were measured from 9 kHz to 40 GHz. Emissions that were between the required attenuation and the noise floor of the spectrum analyzer were recorded.

8.2 Test Data

The spectrum analyzer settings were RBW/VBW = 100 kHz.

Table 8-1: Conducted Spurious Emissions 1000 nanoseconds

(9260 MHz); Conducted power = 0.813 W; 1000 ns / 8.5 PRF

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin (dB)
18280.0	65.9	42.1	-23.8
18520.0	58.9	42.1	-16.8
27540.0	86.7	42.1	-44.6
27780.0	79.5	42.1	-37.4
36800.0	114.3	42.1	-72.2
37040.0	110.6	42.1	-68.5
46060.0	118.8	42.1	-76.7
46300.0	111.1	42.1	-69.0

Table 8-2: Conducted Spurious Emissions 500 nanoseconds

(9260 MHz); Conducted power = 0.797 W; 500 ns / 8.5 PRF

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin (dB)
18280.0	68.4	42.0	-26.4
18520.0	61.0	42.0	-19.0
27540.0	91.1	42.0	-49.1
27780.0	84.5	42.0	-42.5
36800.0	114.8	42.0	-72.8
37040.0	113.1	42.0	-71.1
46060.0	118.2	42.0	-76.2
46300.0	112.2	42.0	-70.2

Table 8-3: Conducted Spurious Emissions 250 nanoseconds

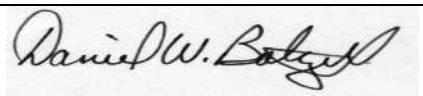
(9260 MHz); Conducted power = 0.781 W; 25 ns / 8.5 PRF

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin (dB)
18280.0	86.3	41.9	-44.4
18520.0	88.0	41.9	-46.1
27540.0	112.9	41.9	-71.0
27780.0	107.6	41.9	-65.7
36800.0	111.4	41.9	-69.5
37040.0	113.4	41.9	-71.5
46060.0	117.2	41.9	-75.3
46300.0	115.2	41.9	-73.3

Table 8-4: Test Equipment Used For Testing Conducted Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz – 40 GHz)	3943A01719	07/15/04
900392	Hewlett Packard	1197OK	Harmonic Mixer (18 – 26.5 GHz)	3525A00159	7/30/04
900126	Hewlett Packard	11970A	Harmonic Mixer (26 - 40 GHz)	2332A01199	7/30/04
900717	Hewlett Packard	11970U	Harmonic Mixer (40 - 60 GHz)	2332A01110	7/30/04
900715	Hewlett Packard	11970V	Harmonic Mixer (50 - 75 GHz)	2521A00512	7/30/04
900716	Hewlett Packard	11970W	Harmonic Mixer (75 - 110 GHz)	2521A00710	7/30/04
901231	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	1/30/05
901232	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	1/30/05

Test Personnel:

Daniel Baltzell		March 5, 2004
Test Technician/Engineer	Signature	Date Of Test

9 FCC Rules and Regulations Part 2 §2.1053(a): Field Strength of Spurious Radiation

9.1 Test Procedure

ANSI TIA-603-2002, section 2.2.12

The radar pulse width was measured at 25 ns, 500 ns, and 1000 ns, with a Pulse Repetition Frequency (PRF) setting of 8.5 nominal.

The EUT was set up at an antenna-to-EUT distance of 3 meters on an open area test site with the transmitter connected to the dummy load. The EUT was placed on a nonconductive turntable 1 meter above the ground plane.

The physical arrangement of the EUT and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. No measurements were found using either the horizontal or vertical antenna polarizations.

9.2 Test Data

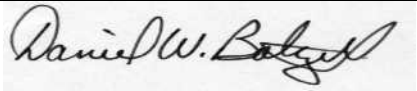
9.2.1 CFR 47 Part 90.210 Requirements

Since no radiated spurious emissions were found, and the magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded, no emissions are reported.

Table 9-1: Test Equipment Used For Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	07/03/04
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1-26.5 GHz)	3008A00505	4/22/04
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	07/15/04
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01-20 GHz)	3610A00866	08/05/04
900811	Rhein Tech Labs	PR-1040	Amplifier	1003	2/13/05
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	7/15/04
901231	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	1/30/05
901232	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	1/30/05
901235	IW Microwave Products	KPS-1503-360-KPS	High frequency RF cables	36"	1/30/05
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	3/15/04
900321	EMCO	3161-03	Horn Antennas (4 - 8,2 GHz)	9508-1020	4/10/04
900323	EMCO	3160-7	Horn Antennas (8,2 - 12,4 GHz)	9605-1054	6/10/04
900356	EMCO	3160-08	Horn Antenna (12.4-18 GHz)	9607-1044	6/10/04
900392	Hewlett Packard	1197OK	Harmonic Mixer (18 – 26.5 GHz)	3525A00159	7/30/04
901218	EMCO	3160-9	Horn Antenna (18-26.5 GHz)	960281-003	7/30/04
900126	Hewlett Packard	11970A	Harmonic Mixer (26 - 40 GHz)	2332A01199	7/30/04
901303	EMCO	3160-10	Horn Antenna (26-40.0 GHz)	960452-007	7/30/04
900717	Hewlett Packard	11970U	Harmonic Mixer (40 - 60 GHz)	2332A01110	7/30/04
901256	ATM	19-443-6R	Horn antenna. (40-60 GHz)	8041704-01	7/30/04
900715	Hewlett Packard	11970V	Harmonic Mixer (50 - 75 GHz)	2521A00512	7/30/04
900712	ATM	15-443-6R	Horn Antenna (50-75 GHz)	8051805-1	7/30/04
900716	Hewlett Packard	11970W	Harmonic Mixer (75 - 110 GHz)	2521A00710	7/30/04
900711	ATM	10-443-6R	Horn Antenna (75-110 GHz)	8051905-1	7/30/04

Test Personnel:

Daniel Baltzell		March 2, 2004
Test Technician/Engineer	Signature	Date Of Test

10 FCC Rules and Regulations Part 2 §2.1055: Frequency Stability

10.1 Test Procedure

ANSI TIA-603-2002, section 2.2.2

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

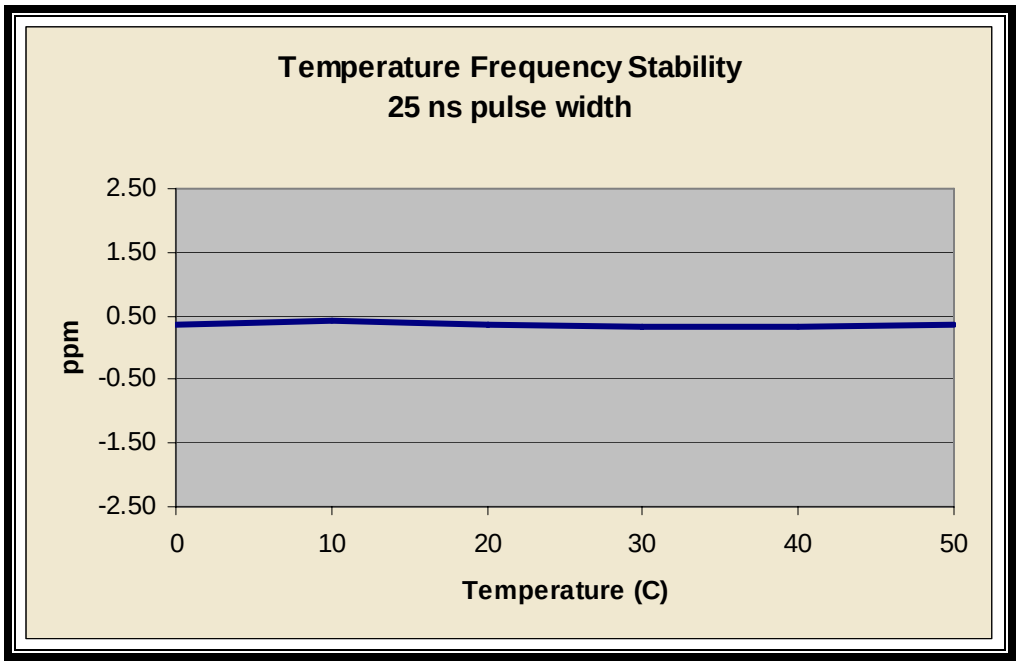
The EUT was evaluated over the temperature range 0°C to +50°C since the manufacturer has stated damage may occur to the unit below 0°C.

The temperature was initially set to 0°C and a 2-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter and thereafter for a period of one minute until 5 minutes had elapsed, then observed at 10 minutes and 15 minutes. The manufacturer has stated an elapsed time of 15 minutes is required for the device to reach stability, which was verified at each test temperature. The temperature was raised at intervals of 10 degrees centigrade through the range. A ½ hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured. Additionally, the power supply voltage of the EUT was varied from 85% to 115% of the nominal 12VDC voltage, but ceased transmission at 92% of the nominal voltage.

10.2 Test Data

10.2.1 Frequency Stability/Temperature Variation

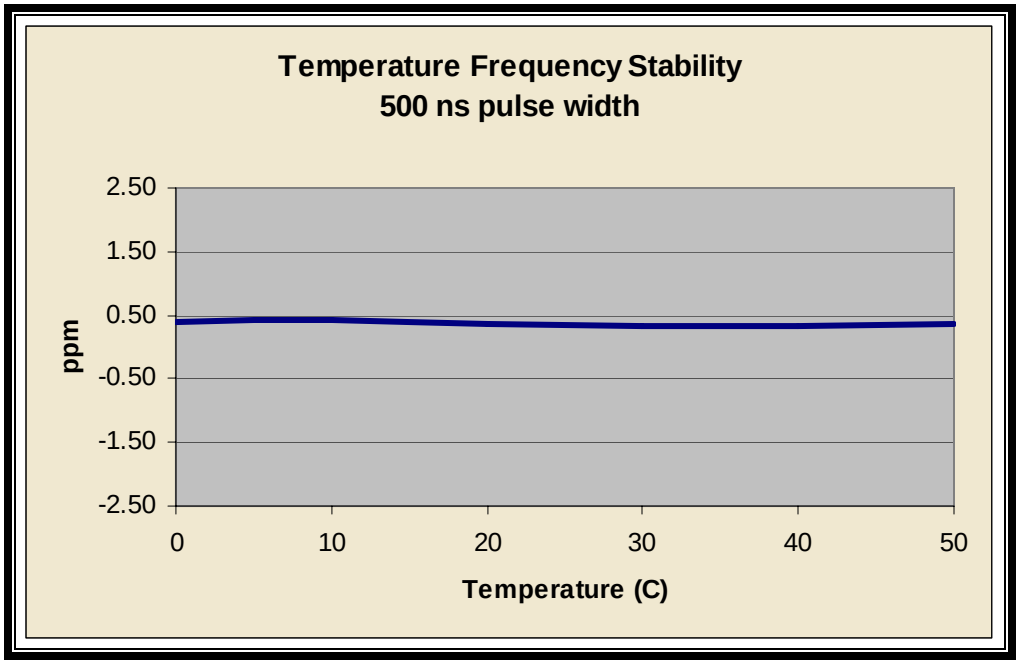
Worst-case deviation was found to be 0.42 ppm at 10°C for 25 ns pulse length.



Plot 10-1: Temperature Frequency Stability 25 ns Pulse Length

Table 10-1: Frequency Stability/Temperature Variation 25 ns Pulse Length

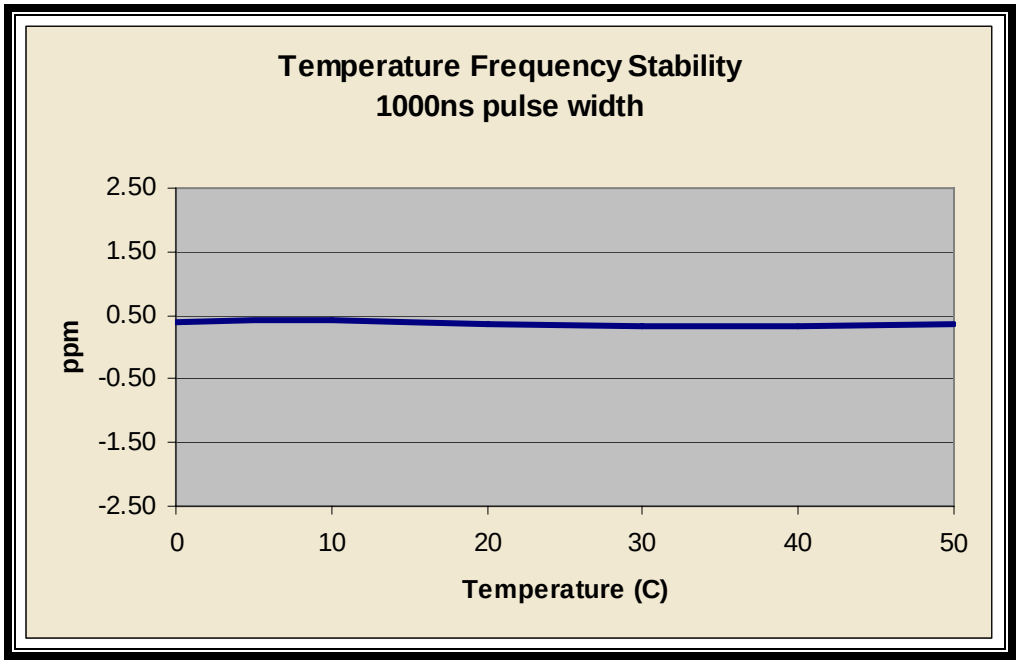
Temperature (°C)	Measured Frequency (MHz)	ppm
0	9260.003473	0.38
10	9260.003855	0.42
20	9260.003363	0.36
30	9260.002951	0.32
40	9260.003176	0.34
50	9260.003276	0.35



Plot 10-2: Temperature Frequency Stability 500 ns Pulse Length

Table 10-2: Frequency Stability/Temperature Variation 500 ns Pulse Length

Temperature °C	Measured Frequency (MHz)	ppm
0	9260.003566	0.39
10	9260.003810	0.41
20	9260.003313	0.36
30	9260.002938	0.32
40	9260.003176	0.34
50	9260.003288	0.36



Plot 10-3: Temperature Frequency Stability 1000 ns Pulse Length

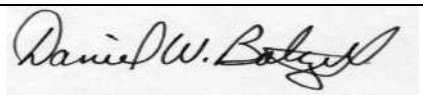
Table 10-3 Frequency Stability/Temperature Variation 1000 ns Pulse Length

Temperature (°C)	Measured Frequency (MHz)	ppm
0	9260.003680	0.40
10	9260.003825	0.41
20	9260.003226	0.35
30	9260.002963	0.32
40	9260.003176	0.34
50	9260.003276	0.35

Table 10-4: Test Equipment Used For Testing Frequency Stability/Temperature

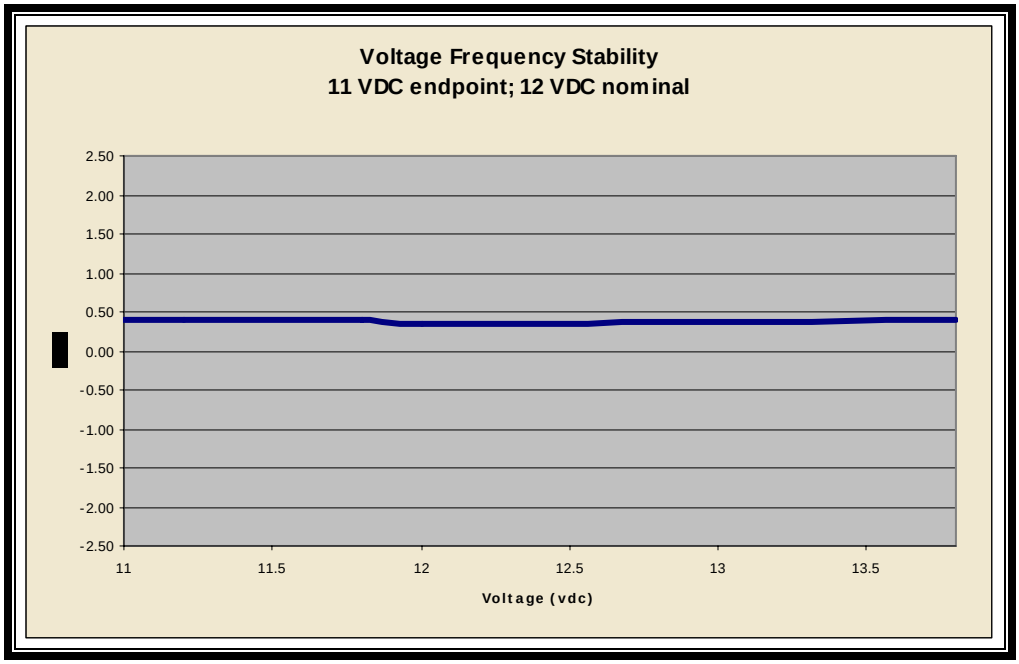
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	2/3/05
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	06/18/04

Test Personnel:

Daniel Baltzell		February 29, 2004
Test Technician/Engineer	Signature	Date Of Test

10.2.2 Frequency Stability/Voltage Variation

Worst-case variation is 0.39 ppm



Plot 10-4: Voltage Frequency Stability

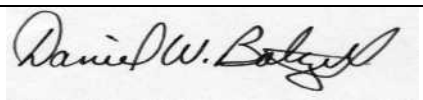
Table 10-5: Frequency Stability/Voltage Variation

Voltage (VDC)	Measured Frequency (MHz)	ppm
11.0	9260.003625	0.39
12	9260.003226	0.35
13.8	9260.003625	0.39

Table 10-6: Test Equipment Used For Testing Frequency Stability/Voltage

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	07/15/04
901247	Wavetek	DM25XT	Multimeter	40804098	2/14/05

Test Personnel:

Daniel Baltzell		February 29, 2004
Test Technician/Engineer	Signature	Date Of Test

11 Conclusion

The data in this measurement report shows that the ARES Corporation Model Dark Eyes 7010 Intrusion Detection Radar; FCC ID: VFN-DARKEYES7010, complies with all the applicable requirements of Parts 90 and 2 of the FCC Rules.

Appendix O: Radiated Emissions FCC 15.109; Conducted Line Emissions FCC 15.207

12 Radiated Emissions Measurements - §15.109

12.1.1 Site and Test Description

Before final radiated emissions measurements were made on the OATS, the EUT was scanned indoors at both one and three meter distances. This was done in order to determine its emission spectrum signal. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emission measurements on the OATS, at each frequency, in order to ensure that maximum emission amplitudes were measured.

Final radiated emissions measurements were made on the OATS at a distance of 10 meters. The EUT was placed on a nonconductive turntable at a height of 80 cm.

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emissions' maximum levels. Measurements were taken using both horizontal and vertical antenna polarization. The spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

12.1.2 Field Strength Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FI\left(dB\mu V/m\right) = SAR\left(dB\mu V\right) + SCF\left(dB/m\right)$$

FI=Field Intensity
SAR=Spectrum Analyzer Reading
SCF=Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

$$SCF\left(dB/m\right) = -PG\left(dB\right) + AF\left(dB/m\right) + CL\left(dB\right)$$

SCF=Site Correction Factor
PG=Pre-Amplifier Gain
AF=Antenna Factor
CL=Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI\left(\mu V/m\right) = 10^{FI\left(dB\mu V/m\right)/20}$$

For example, assume a signal frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is –11.5 dB/m. The actual radiated field strength is calculated as follows:

$$49.3dB\mu V - 11.5dB/m = 37.8dB\mu V/m$$
$$10^{37.8/20} = 10^{1.89} = 77.6\mu V/m$$

12.1.3 Radiated Emissions Limits Digital Interface – FCC §15.109

12.2 Digital Interface Radiated Emissions Limits Procedure

Emissions from the digital portion of the transceiver circuitry of the EUT were tested and found to comply with the requirements of FCC Part 15.109 Class A limits.

12.3 Digital Interface Radiated Emissions Test Equipment

Table 12-1: Test Equipment Used For Testing Digital Interface Radiated Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900889	Hewlett Packard	85685A	RF Preselector for HP 8566B or 8568B (20 Hz - 2 GHz)	3146A01309	3/10/05
900905	Rhein Tech Labs	PR-1040	Amplifier	900905	9/15/04
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	5/12/04
901053	Schaffner Chase	CBL6112B	Bi-Log Antenna (20 MHz - 2 GHz)	2648	7/03/04
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	5/12/04
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	5/12/04

12.4 Digital Interface Radiated Emissions Limits Test Data

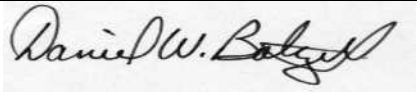
Table 12-2: Digital Interface Radiated Emissions

Class A limits/ 10 m distance

Temperature: 51°F Humidity: 36%									
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
53.620	Qp	V	90	1.0	59.5	-23.1	36.4	39.1	-2.7
166.688	Qp	H	30	1.2	60.3	-19.7	40.6	43.5	-2.9
199.999	Qp	H	20	1.1	56.2	-19.9	36.3	43.5	-7.2
221.181	Qp	H	0	1.5	59.3	-20.0	39.3	46.4	-7.1
233.348	Qp	H	230	1.0	64.1	-19.1	45.0	46.4	-1.4
288.050	Qp	H	230	1.1	54.3	-15.6	38.7	46.4	-7.7
300.015	Qp	H	30	1.0	59.5	-15.7	43.8	46.4	-2.6
366.684	Qp	H	180	1.0	53.1	-13.5	39.6	46.4	-6.8
528.100	Qp	H	120	1.0	44.6	-10.0	34.6	46.4	-11.8

Qp: Res. =100 kHz, VID= 100 kHz

Test Personnel:

Daniel Baltzell		March 4, 2004
Test Technician/Engineer	Signature	Date Of Test

13 Conducted Limits - §15.207

13.1 Test Methodology for Conducted Line Emissions Measurements

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech Quality Manual, Section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

13.2 Conducted Line Emissions Test

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 150 kHz to 30 MHz on the NEUTRAL SIDE and PHASE SIDE.

13.3 Conducted Line Emissions Test Equipment

Table 13-1: Test Equipment Used For Testing Conducted Line Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	5/12/04
901082	AFJ International	LS16	16A LISN	16010020081	11/5/04

13.4 Conducted Line Emissions Test Data

Table 13-2: Conducted Emissions (Neutral Side); Mode: 1000 ns Pulse Width

Class A limits

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.202	Pk	43.1	1.6	44.7	79.0	-34.3	66.0	-21.3
0.403	Pk	43.0	1.0	44.0	79.0	-35.0	66.0	-22.0
8.850	Pk	41.0	2.6	43.6	73.0	-29.4	60.0	-16.4
16.310	Qp	45.2	3.5	48.7	73.0	-24.3	60.0	-11.3
16.310	Av	40.6	3.5	44.1	73.0	-28.9	60.0	-15.9
21.560	Qp	43.6	4.0	47.6	73.0	-25.4	60.0	-12.4
21.560	Av	41.2	4.0	45.2	73.0	-27.8	60.0	-14.8

Table 13-3: Conducted Emissions (Phase Side); Mode: 1000 ns Pulse Width

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.202	Pk	43.0	1.6	44.6	79.0	-34.4	66.0	-21.4
0.402	Pk	42.1	1.0	43.1	79.0	-35.9	66.0	-22.9
9.050	Pk	40.4	2.6	43.0	73.0	-30.0	60.0	-17.0
16.580	Qp	44.2	3.5	47.7	73.0	-25.3	60.0	-12.3
16.580	Av	41.7	3.5	45.2	73.0	-27.8	60.0	-14.8
22.270	Qp	43.1	4.0	47.1	73.0	-25.9	60.0	-12.9
22.270	Av	44.0	4.0	48.0	73.0	-25.0	60.0	-12.0
26.656	Qp	42.3	4.3	46.6	73.0	-26.4	60.0	-13.4
26.656	Av	41.2	4.3	45.5	73.0	-27.5	60.0	-14.5

Test Personnel:

Daniel Baltzell		March 4, 2004
Test Technician/Engineer	Signature	Date Of Test