Engineering and Testing for EMC and Safety Compliance

Type Certification Report

4RF Communications Limited
26 Glover Street, Ngauranga
PO Box 13-506
Wellington 6032
New Zealand
Contact: Alan Turner
Phone: +64 4 499 6000
E-Mail: alan.turner@4rf.com

Model: XE 2500
2314.5 - 2317.5 MHz & 2346.5 - 2349.5 MHz

FCC ID: UIPN2500AAAA0200A

March 27, 2007

Standards Referenced for this Report	
Part 2: 10-01-2006	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 27: 10-01-2006	Miscellaneous Wireless Communications Services
ANSI TIA-603-C-2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
ANSI/TIA/EIA – 102.CAAA; 2002	Digital C4FM/CQPSK Transceiver Measurement Methods

Frequency Range (MHz)	Rated Transmit Power Conducted (W)	Measured Frequency Tolerance (ppm)	Emission Designator
2314.5-2317.5 & 2346.5-2349.5	0.7763	1.2	250KD7W
2314.5-2317.5 & 2346.5-2349.5	0.7763	1.2	500KD7W

Report Prepared by Test Engineer: Daniel W. Baltzell

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1 General Information

The following Type Certification Report is prepared on behalf of **4RF COMMUNICATIONS LIMITED,** in accordance with the Federal Communications Commission's radio specifications. The Equipment Under Test (EUT) was the **XE 2500, FCC ID: UIPN2500AAAA0200A.** The test results reported in this document relate only to the item that was tested.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations Parts 2, 15 and 27. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, coaxial attenuator, preamplifier and cables.

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.

1.2 Related Submittal(s)/Grant(s)

This is an original application report.

2 Tested System Details

The EUT is a paired channel fixed point-to-point base station radio that operates in the 2305-2320 and 2345-2350 MHz bands. The rated RF output power is 29.0 dBm. The EUT is digitally modulated using either a QPSK, 16 QAM, 32 QAM, or 64 QAM modulation type.

Two versions of the EUT will be marketed - the XE 2500-250-vv and the XE 2500-500-vv. The 250 version operates on a 250 kHz channel step size; the 500 version operates on a 500 kHz channel step size. The hardware is capable of both channel step sizes, but when marketed, each model will be limited via firmware to only one channel step size.

The test samples were received on November 27, 2006 and March 21, 2007. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

Model Tested	XE 2500
Frequency Band	2314.5-2317.5 and 2346.5-2349.5 MHz
Modulation Type	QPSK, 16 QAM, 32 QAM, and 64 QAM
Channel Step Size	250 and 500 kHz
Authorized Channel Bandwidth	250 and 500 kHz
Primary Power	115/230 VAC
Rated Transmitter Output Power	29.0 dBm
Duty Cycle	Continuous 100%

Table 2-1: Equipment Under Test (EUT)

Part	Manufacturer	Model Number	Serial Number	FCC ID	RTL Bar Code
Aprisa Radio (Upper Band)	4RFCommunications Limited	XE-2500-500-AC	21802954	UIPN2500AAAA0200A	17695
Aprisa Radio (Lower Band)	4RFCommunications Limited	XE-2500-250-AC	21802955	UIPN2500AAAA0200A	17694

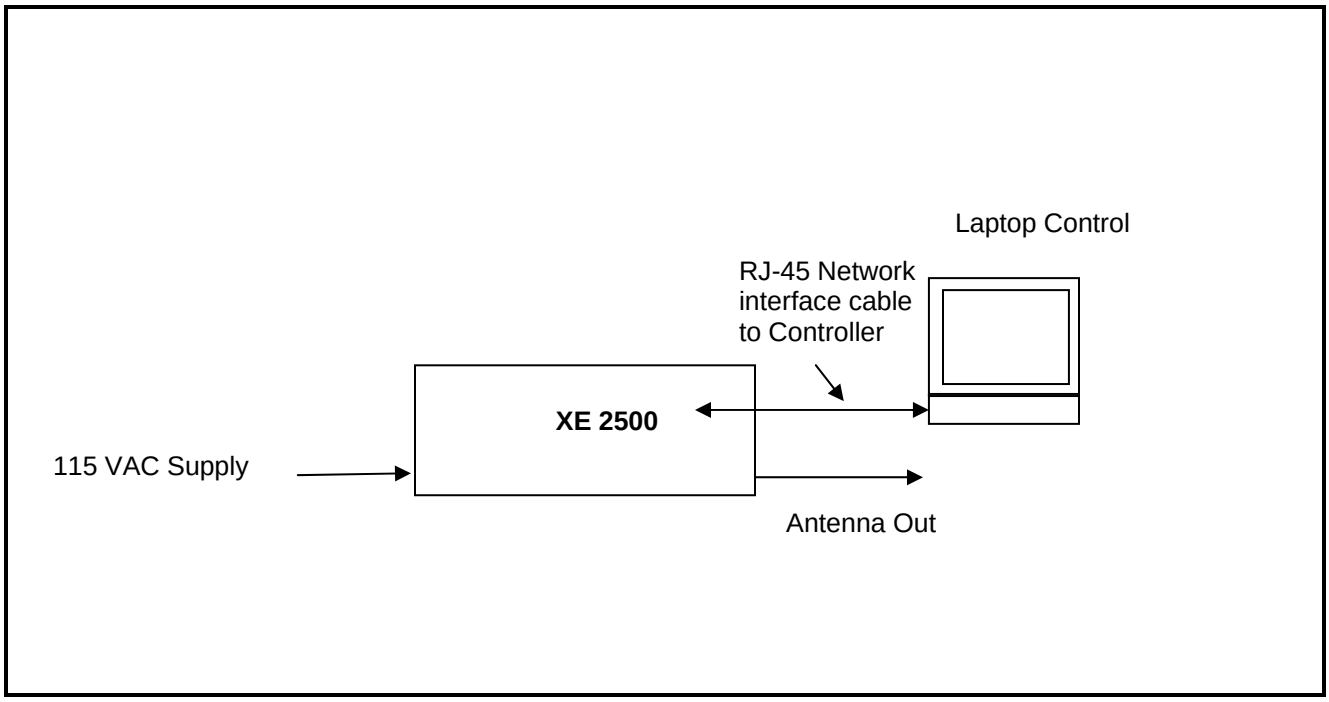
Table 2-2: Ports and Cabling (EUT)

Port	Cable Type	Quantity	Length (meter)	Shield
AC Power	10 AWG	1	3	No
RF Output	N-type	1	N/A	N/A
Ethernet	RJ-45	4	4.5	No
Alarm	RJ-45	1	2	No
Setup	RJ-45	1	N/A	No
QJET	RJ-45	4	1.5	No
HSS	High Density LFH-60 connector for standard CISCO WAN port serial interface cable	1	2.5	Yes

Table 2-3: Support Equipment

Part	Manufacturer	Model	PN/SN	ID	RTL Bar Code
Laptop Computer	Dell	Inspiron 6400	N/A	N/A	901465

Figure 2-1: Configuration of Tested System



3 RF Power Output: Conducted; FCC Rules and Regulations Part 27 §27.50(a)(1): Transmitter Output Power

3.1 Test Limits

Fixed, land, and radiolocation land stations transmitting are limited to 2000 watts peak equivalent isotropically radiated power (EIRP).

3.2 Test Procedure

ANSI TIA-603-C-2004, Section 2.2.1.

The EUT transmitter output was connected through an appropriate 50 ohm attenuator to a spectrum analyzer.

3.3 Test Data

Table 3-1: RF Power Output: Carrier Output Power

Channel	Frequency (MHz)	Power (dBm)
1 (lower band)	2314.5	28.9
3 (lower band)	2316.5	28.8
5 (lower band)	2317.5	28.8
1 (upper band)	2346.5	28.7
3 (upper band)	2348.5	28.7
5 (upper band)	2349.5	28.8

*Measurement accuracy: +/-.3 dB

Table 3-2: RF Power Output (Rated Power)

Manufacturer's Rated Power
29.0 dBm

Table 3-3: Test Equipment for Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901184/901186	Agilent Technologies	E4416A/E9323A	Power Meter/ Sensor	GB41050573/ S420.52510380	10/3/07
901138	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 5 W	BK5883	1/13/09

Test Personnel:

Daniel W. Baltzell		December 11, 2006 & March 21, 2007
Test Engineer	Signature	Dates of Tests

4 Spurious Emissions at Antenna Terminals; FCC Rules and Regulations Part 27 §27.53(a)(1)and(3): Emission Limits

4.1 Test Limits

For operations in the bands 2305–2320 MHz and 2345–2360 MHz, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by the following amounts:
(1) *For fixed, land, and radiolocation land stations:* by a factor not less than 80 + 10 log (p) dB on all frequencies between 2320 and 2345 MHz;
(3) *For fixed, land, mobile, radiolocation land and radiolocation mobile stations:* by a factor not less than 70 + 10 log (p) dB on all frequencies below 2300 MHz and on all frequencies above 2370 MHz; and not less than 43 + 10 log (p) dB on all frequencies between 2300 and 2320 MHz, and on all frequencies between 2345 and 2370 MHz that are outside the licensed bands of operation.

4.2 Test Procedure

ANSI TIA-603-C-2004, Section 2.2.13.

The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer.

Device with digital modulation: Modulated to its maximum extent using a 100% modulated duty cycle internal QPSK, 16 QAM, 32 QAM, and 64 QAM modulation. The insertion loss from the connecting cable and attenuator was measured together and added to the measurement level and compared to the limit. The resolution bandwidth used was 1 MHz for those measurements taken above 1 GHz; the video bandwidth was 3 MHz. Both 250 kHz and 500 kHz bandwidths were investigated, and the worst case data is shown.

4.3 Out of Band Spurious Test Data

Frequency range of measurement: 9 kHz to 10 x Fc.

Limits: P(dBm) – (43+10xLOG P(W))

The following channels (in MHz) were investigated: 2314.5, 2316.5, 2317.5, 2346.5, 2348.5 and 2349.5 MHz.

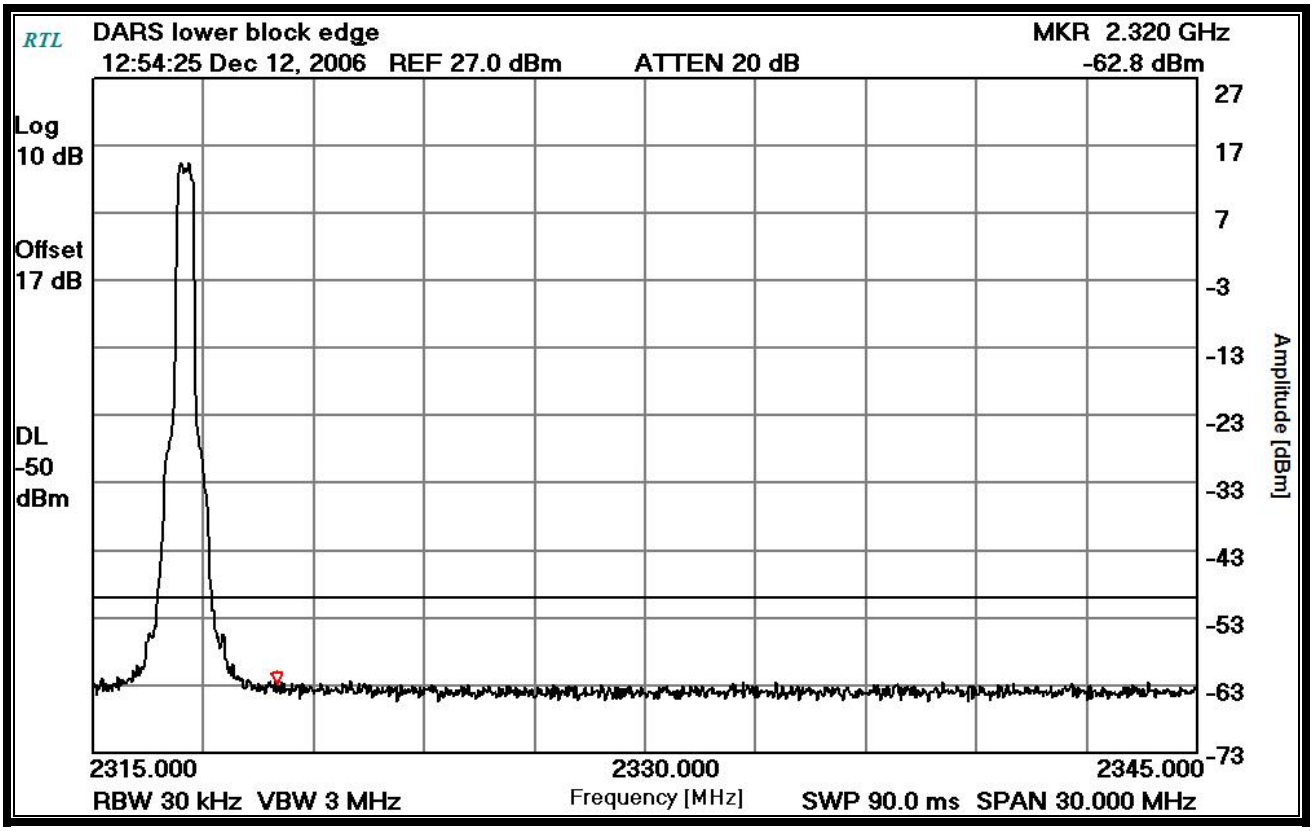
Per 47 CFR § 2.1053, no data is being reported since the magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

4.4 In Band Spurious Test Data

Frequency range of measurement: 2320 MHz – 2345 MHz (DARS)

Limits: P(dBm) – (80+10xLOG P(W)) = -50 dBm

Plot 4-1: Lower Band Edge of Satellite DARS Systems 2320-2345 MHz (2317.5 MHz, 500 kHz Bandwidth)



Plot 4-2: Upper Band Edge of Satellite DARS Systems 2320-2345 MHz (2346.5 MHz, 500 kHz Bandwidth)

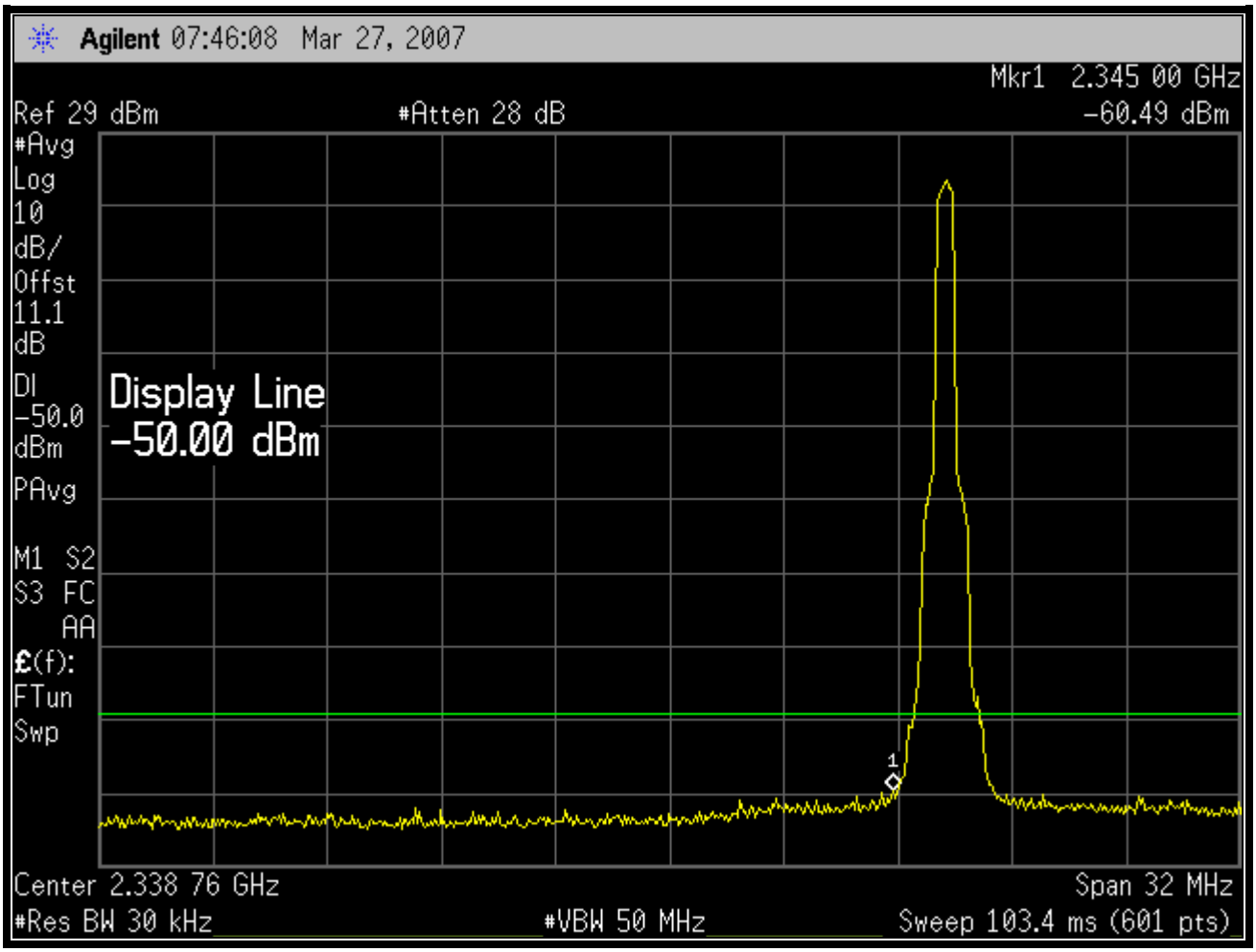
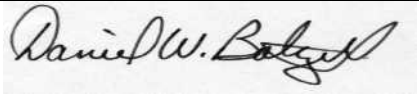


Table 4-1: Test Equipment for Testing Conducted Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900931	Hewlett Packard	8566B	Spectrum Analyzer	3138A07771	9/13/07
900307	InMet	6N-10dB	Attenuator 10 dB	N/A	1/11/08
901424	Insulated Wire	KPS-1503-	RF Cable 36"	NA	12/12/07
901137	Par Electronics	N/A	Notch Filter	N/A	2/1/09

Test Personnel:

Daniel W. Baltzell		December 12, 2006 & March 27, 2007
Test Technician/Engineer	Signature	Dates of Tests

5 Occupied Bandwidth

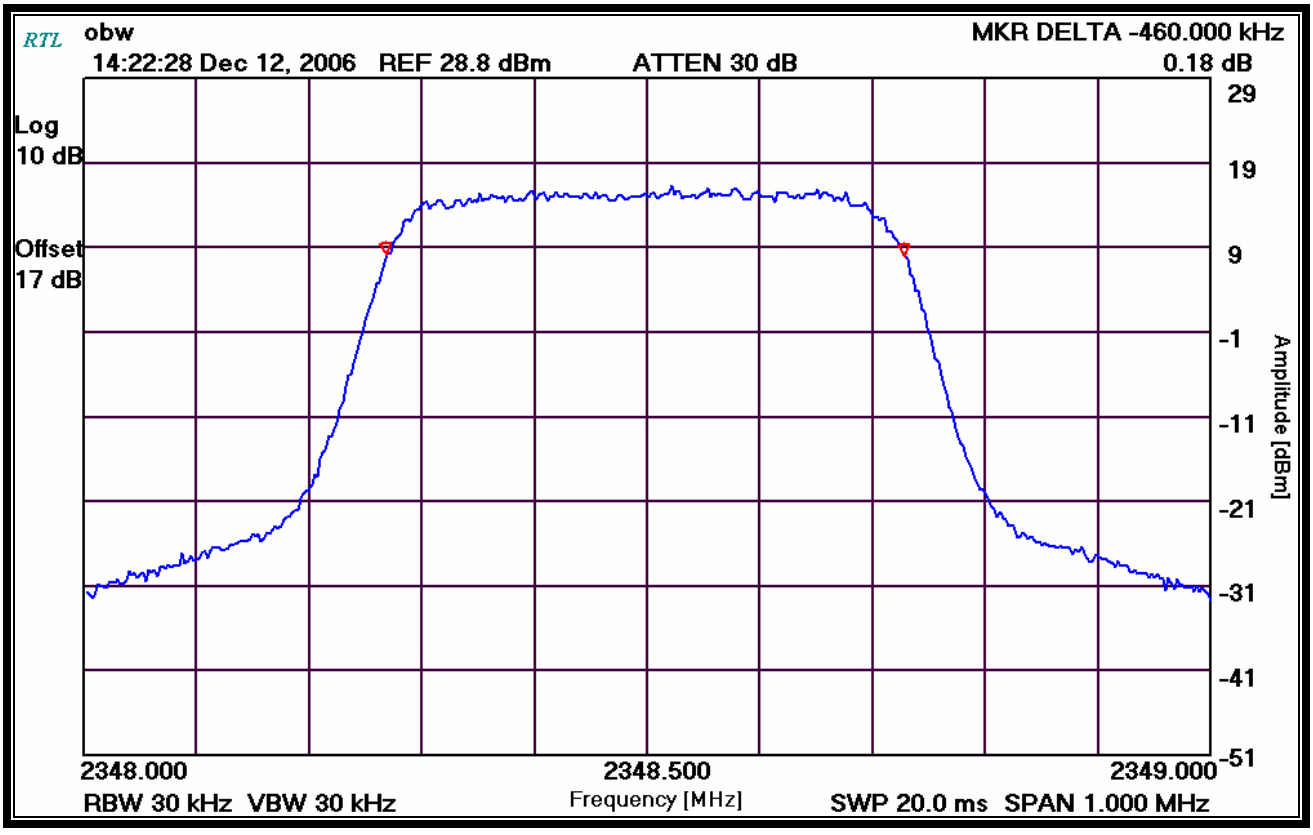
5.1 Test Procedure

Device with digital modulation: Modulated to its maximum extent using a 100% modulated duty cycle internal QPSK, 16 QAM, 32 QAM, and 64 QAM modulation. The cable loss and attenuator used were added, and an offset in the spectrum analyzer used, to compensate for these values.

ANSI TIA-603-C-2004, Section 2.2.11.

5.2 In Band Spurious Test Data

Plot 5-1: Occupied Bandwidth; 2348.5 MHz (500 kHz bandwidth)



Plot 5-2: Occupied Bandwidth; 2348.5 MHz (250 kHz bandwidth)

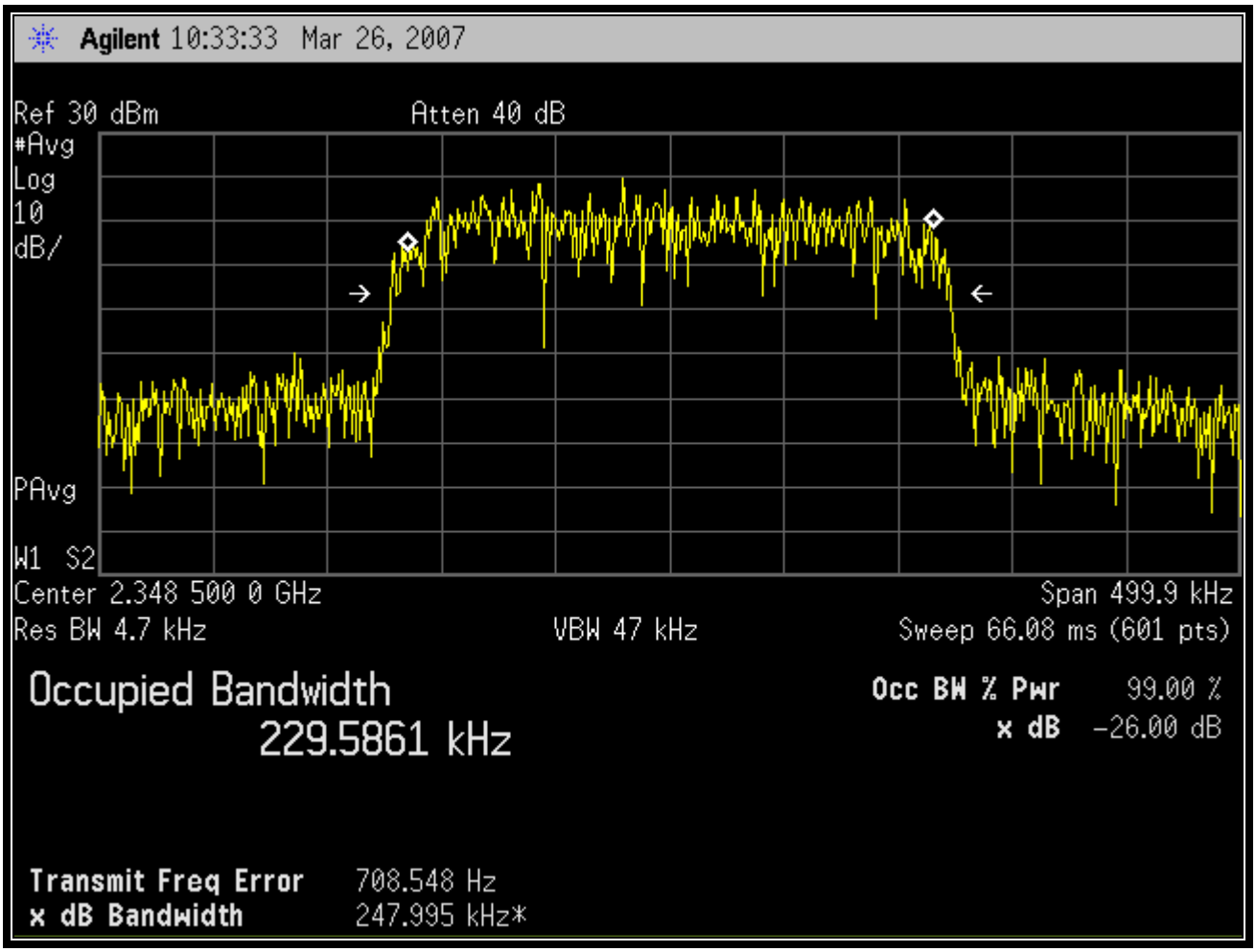


Table 5-1: Test Equipment for Testing Occupied Bandwidth/Emissions Masks

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900913	Hewlett Packard	8546A	Spectrum Analyzer	3325A00159	3/21/08
901413	Agilent	E4448A	Spectrum Analyzer	US44020346	12/14/07
900307	InMet	6N-10dB	Attenuator 10 dB	N/A	1/11/08
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/05/07

Test Personnel:

Daniel W. Baltzell		December 12, 2006 & March 26, 2007
Test Engineer	Signature	Dates of Tests

6 AC Conducted Emissions - FCC Rules and Regulations Part 15 §15.207: Conducted Limits

6.1 Limits of Conducted Emissions Measurement

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

6.2 Conducted Emissions Measurement Test Procedure

The conducted emissions measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 0.8 meters high. Power was fed to the EUT through a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an AC 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 AC 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 AC line through an isolation transformer. The 50 ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 7 kHz high-pass filter. The filter was used to prevent overload of the spectrum analyzer from noise below 7 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or average 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 were performed in a linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by decreasing the sweep time in order to obtain a calibrated measurement. The highest emissions amplitudes relative to the appropriate limits were measured and have been recorded in this report.

6.3 Conducted Emissions Test Results

Table 6-1: Conducted Emissions Transmit Channel 6 Neutral Side (Line 1)

Temperature: 74°F Humidity: 36%									
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)	Pass/ Fail
0.189	Qp	62.1	0.2	62.3	64.0	-1.7			Pass
0.189	Av	51.1	0.2	51.3			54.1	-2.8	Pass
0.237	Qp	58.3	0.1	58.4	62.2	-3.8			Pass
0.237	Av	46.3	0.1	46.4			52.2	-5.8	Pass
0.334	Qp	50.7	0.2	50.9	59.4	-8.5			Pass
0.334	Av	45.5	0.2	45.7			49.4	-3.7	Pass
0.380	Qp	48.5	0.3	48.8	58.3	-9.5			Pass
0.380	Av	47.4	0.3	47.7			48.3	-0.6	Pass
0.427	Qp	48.5	0.3	48.8	57.3	-8.5			Pass
0.427	Av	46.4	0.3	46.7			47.3	-0.6	Pass
0.475	Qp	45.7	0.2	45.9	56.4	-10.5			Pass
0.475	Av	43.7	0.2	43.9			46.4	-2.5	Pass
0.572	Qp	44.8	0.2	45.0	56.0	-11.0			Pass
0.572	Av	42.8	0.2	43.0			46.0	-3.0	Pass
3.230	Pk	41.2	1.0	42.2			46.0	-3.8	Pass
20.630	Pk	44.6	2.4	47.0			50.0	-3.0	Pass

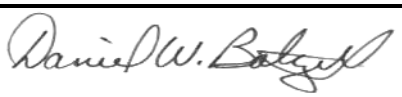
Table 6-2: Conducted Emissions Transmit Channel 6 Hot Side (Line 2)

Temperature: 74°F Humidity: 36%									
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)	Pass/ Fail
0.188	Qp	61.7	0.2	61.9	64.0	-2.1			Pass
0.188	Av	48.7	0.2	48.9			54.1	-5.2	Pass
0.236	Qp	58.5	0.1	58.6	62.2	-3.6			Pass
0.236	Av	44.7	0.1	44.8			52.2	-7.4	Pass
0.283	Qp	52.6	0.2	52.8	60.6	-7.8			Pass
0.283	Av	42.1	0.2	42.3			50.7	-8.4	Pass
0.426	Qp	44.5	0.2	44.7	57.3	-12.6			Pass
0.426	Av	38.4	0.3	38.7			47.3	-8.6	Pass
0.474	Qp	43.2	0.2	43.4	56.4	-13.0			Pass
0.474	Av	39.7	0.2	39.9			46.4	-6.5	Pass
0.522	Qp	41.1	0.2	41.3	56.0	-14.7			Pass
0.522	Av	37.7	0.2	37.9			46.0	-8.1	Pass
2.860	Pk	40.4	1.0	41.4			46.0	-4.6	Pass
20.490	Pk	46.0	2.4	48.4			50.0	-1.6	Pass

Table 6-3: Test Equipment for Testing Conducted Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900969	Hewlett Packard	85650A	Quasi-Peak Adapter	2412A00414	9/13/07
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	9/13/07
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	9/13/07
900889	Hewlett Packard	85685A	RF Preselector (20 Hz - 2 GHz)	3146A01309	4/12/07
901083	AFJ International	LS16	16A LISN (110 V)	16010020080	3/28/08
N/A	Rhein Tech Laboratories, Inc.	Automated Emission Tester	Emissions Testing Software Rev. 14.0.2	N/A	N/A

Test Personnel:

Daniel W. Baltzell		December 10, 2006 & March 22, 2007
Test Engineer	Signature	Dates of Tests

7 Radiated Emissions – FCC Rules and Regulations Part 15 §15.209: Radiated Emissions Limits

7.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any circumstances of modulation.

7.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. 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 emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane.

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 emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. 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.

7.3 Digital/Receiver Radiated Emissions Test Results

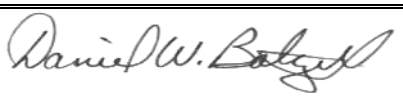
Table 7-1: Unintentional Radiated Emissions

Temperature: 48°F Humidity: 30%										
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)**	**Pass/ Fail**
44.900	Qp	V	120	1.0	54.0	-15.3	38.7	40.0	-1.3	Pass
73.225	Qp	V	120	1.0	60.0	-23.3	36.7	40.0	-3.3	Pass
225.710	Qp	V	40	1.0	51.7	-17.1	34.6	46.0	-11.4	Pass
250.005	Qp	V	180	1.0	51.3	-14.8	36.5	46.0	-9.5	Pass
250.008	Qp	H	90	1.0	56.8	-14.8	42.0	46.0	-4.0	Pass
300.000	Qp	V	95	1.0	46.6	-13.4	33.2	46.0	-12.8	Pass
300.007	Qp	H	350	1.0	50.8	-13.4	37.4	46.0	-8.6	Pass
350.000	Qp	V	170	1.0	53.6	-11.7	41.9	46.0	-4.1	Pass
350.007	Qp	H	90	1.0	56.3	-11.7	44.6	46.0	-1.4	Pass
450.007	Qp	H	180	1.0	43.4	-9.1	34.3	46.0	-11.7	Pass
825.000	Qp	V	180	1.0	38.8	-2.7	36.1	46.0	-9.9	Pass
900.000	Qp	H	180	1.0	43.3	-1.9	41.4	46.0	-4.6	Pass
900.000	Qp	V	180	1.0	39.9	-1.9	38.0	46.0	-8.0	Pass

Table 7-2: Test Equipment for Testing Radiated Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900151	Rohde and Schwarz	HFH2-Z2	Antenna (Loop, 9 kHz - 30 MHz)	827525/019	9/15/09
901365	Miteq	JS4-00102600-41-5P	Amplifier, 15 V, 0.1-26 GHz, 28 dB gain, power 5 dB	1094152	3/24/08
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	10/28/07
900905	Rhein Tech Labs	PR-1040	OATS 1 Preamplifier 40 dB (30 MHz – 2 GHz)	1006	3/15/08
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901426	Insulated Wire Inc.	KPS-1503-3600-KPS	RF cable, 30'	NA	12/05/07
901425	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	12/05/07
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/05/07
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	5/20/07
900321	EMCO	3161-03	Horn Antennas (4 - 8,2 GHz)	9508-1020	5/20/07
900323	EMCO	3160-7	Horn Antennas (8,2 - 12,4 GHz)	9605-1054	5/20/07
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	5/20/07
900325	EMCO	3160-9	Horn Antennas (18 - 26.5 GHz)	9605-1051	5/20/07
901218	EMCO	3301B	Horn Antenna (18 - 26.5 GHz)	960281-003	5/20/07
900392	Hewlett Packard	1197OK	Harmonic Mixer (18 – 26.5 GH)z	3525A00159	11/27/07
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	9/13/07
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	9/13/07
900889	Hewlett Packard	85685A	RF Preselector (20 Hz - 2 GHz)	3146A01309	4/12/07

Test Personnel:

Daniel W. Baltzell		December 10, 2006 & March 22, 2007
Test Engineer	Signature	Dates of Tests

8 Field Strength of Spurious Radiation; FCC Rules and Regulations Part 27 §27.53(a)(1)and(3): Emission Limits

8.1 Test Limits

For operations in the bands 2305–2320 MHz and 2345–2360 MHz, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by the following amounts:
(1) *For fixed, land, and radiolocation land stations:* by a factor not less than 80 + 10 log (p) dB on all frequencies between 2320 and 2345 MHz;
(3) *For fixed, land, mobile, radiolocation land and radiolocation mobile stations:* by a factor not less than 70 + 10 log (p) dB on all frequencies below 2300 MHz and on all frequencies above 2370 MHz; and not less than 43 + 10 log (p) dB on all frequencies between 2300 and 2320 MHz and on all frequencies between 2345 and 2370 MHz that are outside the licensed bands of operation.

8.2 Test Procedure

ANSI TIA-603-C-2004, section 2.2.12.

The EUT was set to channel 6 for each band and modulated to its maximum extent using a 100% modulated duty cycle internal QPSK, 16 QAM, 32 QAM, and 64 QAM. The EUT was placed on a non-conducting table 80 cm above the ground plane. The antenna-to-EUT distance is 3 m. The EUT is rotated through 360° to maximize emissions. The antenna is scanned in both vertical and horizontal polarizations. The spurious emissions levels were measured, and the device under test was replaced by a substitution antenna connected to a signal generator. This signal generator level was then corrected by subtracting the cable loss from the substitution antenna to the signal generator, and the gain of the transmit antenna added.

The EUT was scanned from 30 GHz to the 10^{th} harmonic of the fundamental. The spectrum analyzer resolution bandwidth is set to 1 MHz, and the video bandwidth is set to 1 MHz.

The spurious radiated emissions limit is calculated as follows:

Limits: P(dBm) – (70+10xLOG P(W))

8.3 Test Data

Table 8-1: Field Strength of Spurious Radiation: Channel 3 (Lower Band) – 2317 MHz

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	SG Level Corrected (dBc)	Limit	Margin (dB)
4634.0	28.4	-55.2	10.3	10.6	83.7	68.8	-14.9
6951.0	27.1	-56.2	12.4	11.5	85.9	68.8	-17.1
9268.0	24.5	-52.8	13.8	11.6	83.8	68.8	-15.0
11585.0	23.5	-52.6	14.7	12.5	83.6	68.8	-14.8
13902.0	26.5	-41.4	16.2	11.8	74.6	68.8	-5.8
16219.0	26.5	-42.7	17.6	16.2	72.9	68.8	-4.1

Table 8-2: Field Strength of Spurious Radiation: Channel 3 (Upper Band) - 2349 MHz

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss* (dB)	Antenna Gain (dBd)	SG Level Corrected (dBc)	Limit	Margin (dB)
4698.0	26.5	-57.4	10.3	10.6	85.9	68.8	-17.1
7047.0	30.5	-53.0	12.5	11.4	82.8	68.8	-14.1
9396.0	27.2	-50.1	13.6	11.7	80.8	68.8	-12.0
11745.0	24.7	-51.3	14.8	12.5	82.3	68.8	-13.6
14094.0	26.8	-43.4	16.4	11.6	76.9	68.8	-8.2
16443.0	26.7	-42.4	17.7	16.0	72.8	68.8	-4.0

Table 8-3: Test Equipment for Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	6/12/07
901365	MITEQ	JS4-00102600-41-5P	Amplifier, 0.1-26 GHz, 28 dB gain	1094152	3/24/07
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	10/28/07
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01 – 20 GHz)	3610A00866	11/10/07
900772	EMCO	3161-02	Horn Antennas (2 – 4 GHz)	9504-1044	5/20/07
900321	EMCO	3161-03	Horn Antennas (4 – 8 GHz)	9508-1020	5/20/07
900323	EMCO	3160-07	Horn Antennas (8.2 – 12 GHz)	9605-1054	5/20/07
901262	ETS	3115	Double Ridge Horn Antenna (1 – 26 GHz)	6748	4/19/08
901426	Insulated Wire Inc.	KPS-1503-3600-KPS	RF cable, 30'	NA	12/05/07
901425	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	12/05/07
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	12/05/07

Test Personnel:

Daniel W. Baltzell		December 10, 2006 & March 27, 2007
Test Engineer	Signature	Dates of Tests

9 Frequency Stability; FCC Rules and Regulations Part 27 §27.54: Frequency Stability

9.1 Test Limits

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

9.2 Test Procedure

ANSI TIA-603-C-2004, section 2.3.1 and 2.3.2.

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

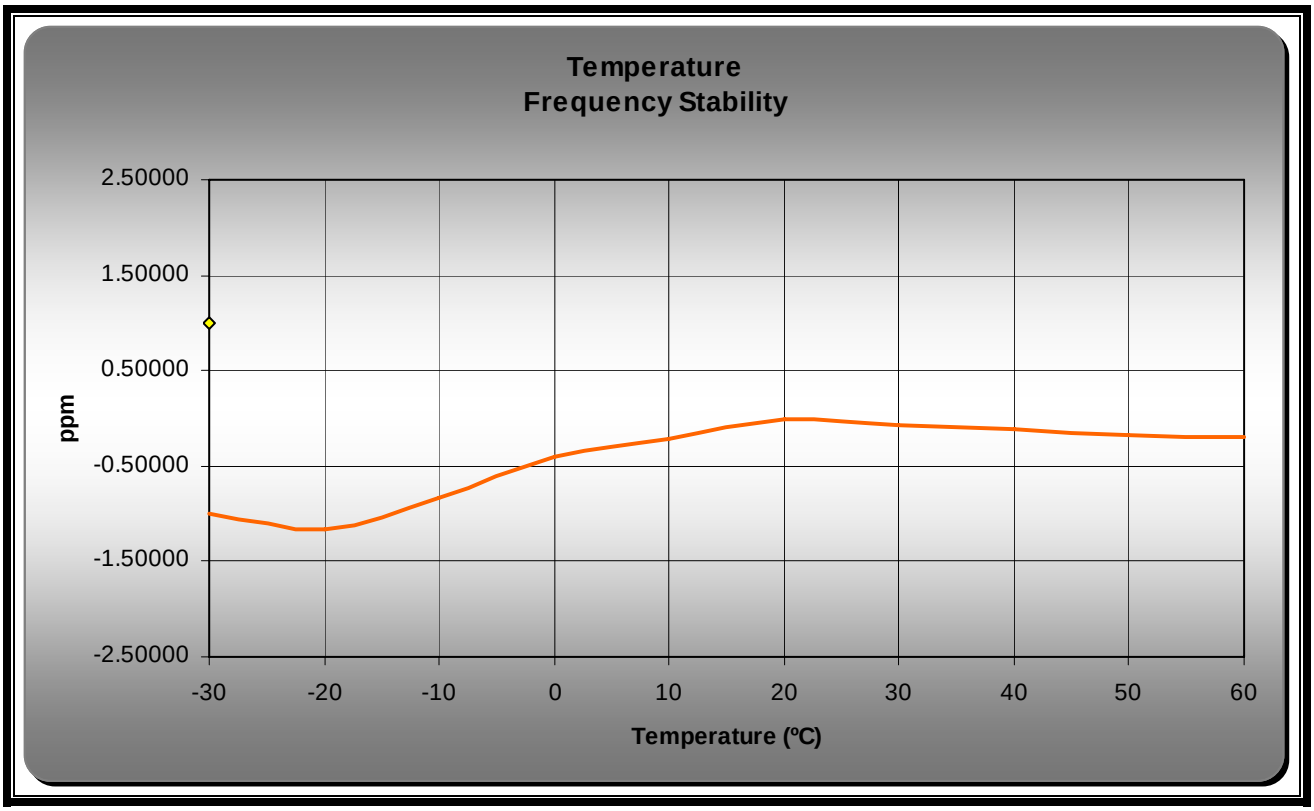
The EUT was evaluated over the temperature range -30°C to +60°C.

The temperature was initially set to -30°C and a 2-hour period was observed for stabilization of the EUT. The EUT was set to CW mode and measured with a frequency counter. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10°C through the range. A ½ hour period was observed to stabilize the EUT at each measurement step, and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied +/-15% nominal input voltage. Data normalized to nominal voltage/20°C is shown below.

9.3 Frequency Stability Test Data

Table 9-1: Frequency Stability – 2352.5 MHz

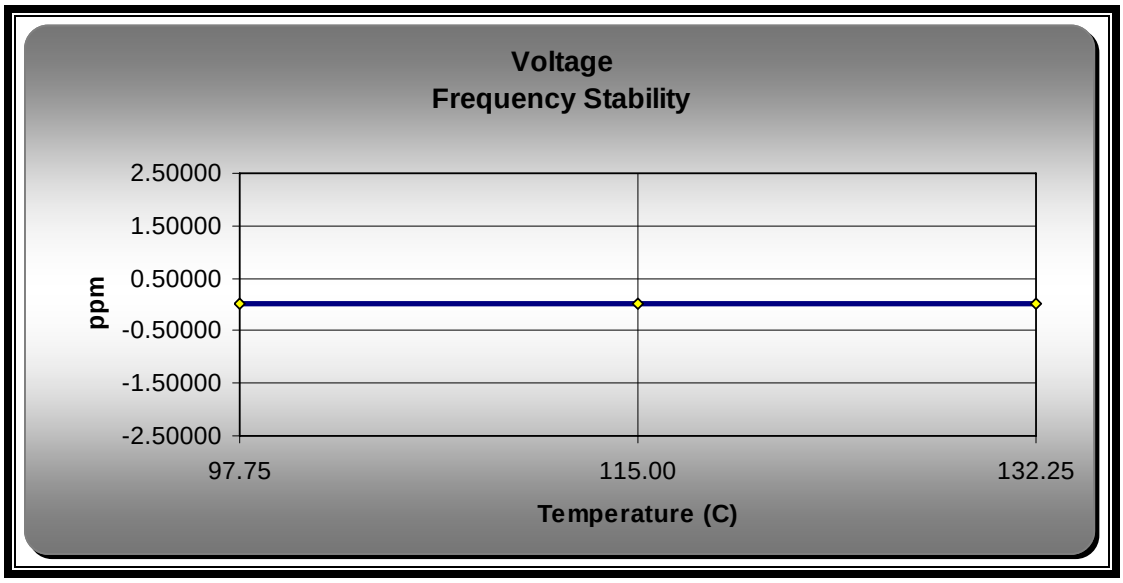
Temperature (C)	Frequency Measured (MHz)	Parts Per Million
-30	2352.497644	-1.01
-20	2352.497281	-1.16
-10	2352.498037	-0.84
0	2352.499056	-0.41
10	2352.49951	-0.21
20	2352.500015	0.00
30	2352.499823	-0.08
40	2352.499737	-0.12
50	2352.499609	-0.17
60	2352.499572	-0.19



Plot 9-1: Temperature Frequency Stability

Table 9-2: Voltage Stability – 2352.5 MHz

Voltage (DC)	Frequency Measured (MHz)	Parts Per Million
97.75	2352.500027	0.01
115.00	2352.500028	0.01
132.25	2352.50003	0.01

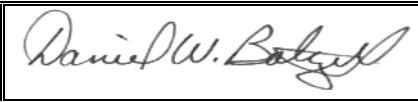


Plot 9-2: Voltage Frequency Stability

Table 9-3: Test Equipment for Testing Frequency Stability

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
900946	Tenney Engineering	TH65	Temperature Chamber with Humidity	11380	3/27/08
900307	InMet	6N-10dB	Attenuator 10 dB	N/A	1/11/08
901424	Insulated Wire	KPS-1503-360-KPS	RF cable 36"	NA	12/05/07
901354	Meterman	37XR	Digital Multimeter	N/A	10/19/07
900931	Hewlett Packard	8566B	Spectrum Analyzer	3138A07771	9/13/07

Test Personnel:

Daniel W. Baltzell		December 1, 2006 & March 27, 2007
Test Engineer	Signature	Dates of Tests

10 Necessary Bandwidth and Emission Bandwidth

Type of Emission: D7W

Calculation:

Data rate R = 2392 kilobits per second for 64 QAM
Number of state in each symbol S = 64; $Log_2S=6$
Peak deviation D = 280 kHz
K = 0.18
B(n) = ($R/Log_2S + 2DK$) = 500 kHz

Emission Designator: 500KD7W

Data rate R = 1240 kilobits per second for 64 QAM
Number of state in each symbol S = 64; $Log_2S=6$
Peak deviation D = 280 kHz
K = 0.078
B(n) = ($R/Log_2S + 2DK$) = 250 kHz

Emission Designator: 250KD7W

11 Conclusion

The data in this measurement report shows that the **4RF COMMUNICATIONS LIMITED, Model XE 2500, FCC ID: UIPN2500AAAA0200A,** complies with all the applicable requirements of FCC Part 2 and 27.