Engineering and Testing for EMC and Safety Compliance

Accredited under A2LA certificate # 2653.01

FCC Certification Report

Airorlite Communications, Inc.
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Model: 50289-BAM-8-800-DL
(851 - 869 MHz)

FCC ID: UT650289BAM8800DL

January 31, 2008

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
ANSI/TIA-603-C-2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

Frequency Range (MHz)	Conducted Power (W)	Frequency Tolerance (ppm)	Emission Designator
851 - 869	0.6*	Amp	F8E

** Power listed is conducted per carrier*

Report Prepared by Test Engineer: Daniel Baltzell

Document Number: 2007315

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1 General Information

The following Certification Report is prepared on behalf of **Airorlite Communications, Inc**. in accordance with the Federal Communications Commission Part 90 Rules and Regulations. The Equipment Under Test (EUT) was **Model 50289-BAM-8-800-DL, FCC ID: UT650289BAM8800DL**. 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 the applicable FCC Rules and Regulations in CFR 47. Calibration checks are performed regularly on the instruments, and all accessories including 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. 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 application report.

2 Tested System Details

The test sample was received on January 11, 2008. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

The Airorlite Communications, Inc. Model 50289-BAM-8-800 800 MHz Low Time Delay Bi-Directional Amplifier is composed of one directional 8 channel uplink amplifier and a one directional 8 channel downlink amplifier. Together, these two components form a full duplex Bi-Directional Amplifier system.

The multi-channel booster is divided into two independent 8 channel systems (8 high channels and 8 low channels) for full duplex operations. Downlink signals are received at the roof antenna, 8 selected frequencies are processed (filtering and amplification), and rebroadcast on a radiating cable. Conversely, uplink signals induced onto radiating cable are similarly processed and rebroadcast on the roof antenna (reference FCC ID: UT650289BAM8800UL). The uplink channels are the low band channels (806 - 824 MHz), and the 8 downlink channels are the high band (851 - 869 MHz). Note that the system as a whole is a "bi-directional booster"; this application is only for the downlink channels (the uplink channels are certified under FCC ID: UT650289BAM8800UL). We request that the grant notes reflect: "Part of booster system used with FCC ID: UT650289BAM8800UL."

Each system consists of a LNA/8-way splitter, 8 channel modules (down-up converters with synthesized LO) and 8 individual RF power amplifiers; the output of these 8 RF power amplifiers is combined in a single passive 8 channel combining device to produce a single RF power out. Typically these systems are used with an external duplexer which combines the uplink RF output and downlink RF input to a common "Off the Air" antenna.

The RF signal flow of the two systems is identical. RF band pass filters internal to the system modules determine high band or low band operations.

Note that the device does not translate frequencies, and therefore, the RF output will not change with temperature or voltage variation. Additionally, the device is designed to be used with FM input/output signals.

The system operates with an internal limiter set to the maximum output level and programmable attenuators are used to reduce this level to the desired output level for a particular application.

The EUT is a Class B signal booster which although it channelizes the signals, the level of channelization is such the several channels of information may pass through a single channel of the bi-directional amplifier.

The input drive level was set to cause the limiter to operate at full value.

The device cannot operate in saturation. The channel card is band limited by crystal filters which prevent spectral regrowth. The channel cards are limited to a max output of -18 dBm and the power amplifier gain is fixed at a level that does not result in saturation.

Table 2-1: Test System Details

Model Tested	50289-BAM-8-800-DL (bi-directional booster (downlink))
Frequency Band	851 - 869 MHz
Maximum Output Power	0.6 W conducted per carrier
Number of Channels	8
Channel Bandwidth	25 kHz nominal
Channel Spacing	25 kHz
Primary Power	95 - 132 VAC, 45-64 Hz, 15 Amps, Maximum
Duty Cycle	Continuous

Table 2-2: Equipment Under Test (EUT)

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Bi-Directional Booster	Airorlite Communications, Inc.	50289-BAM-8-800-DL	N/A	UT650289BAM8800DL	18251

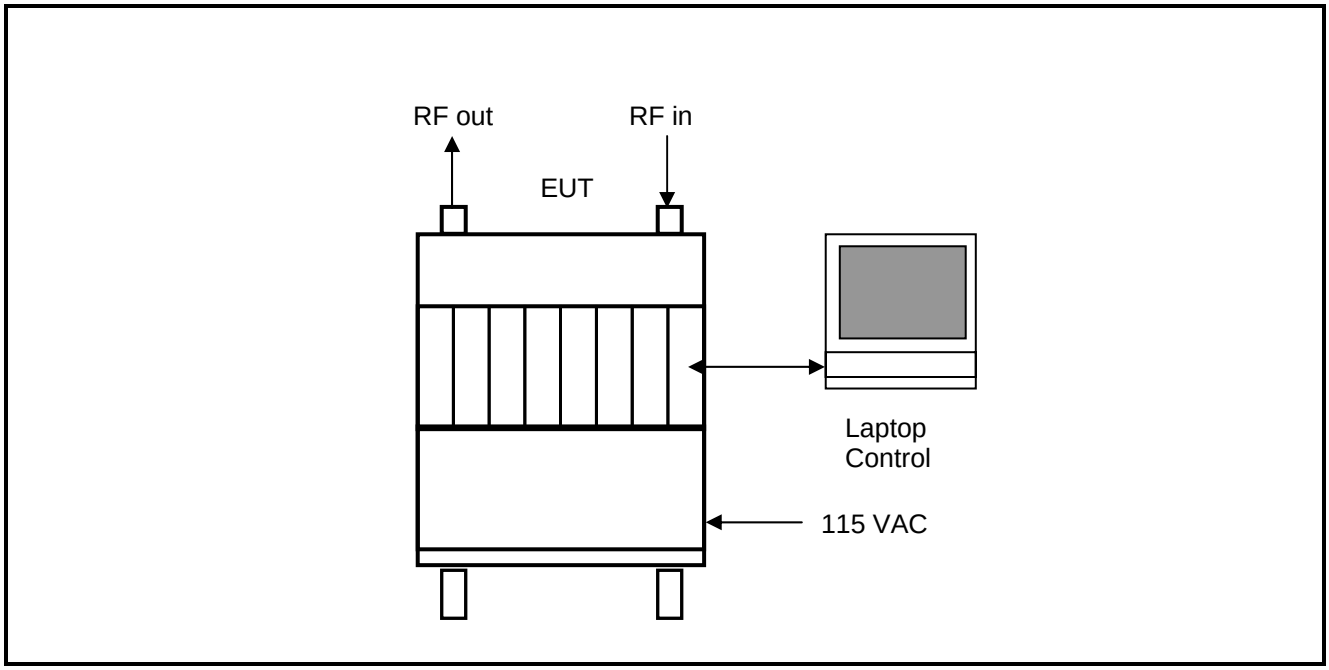
Table 2-3: Ports and Cabling (EUT)

Port	Cable Type	Quantity	Length (feet)	Shield
RF In	N type	1	N/A	N/A
RF Out	N type	1	N/A	N/A

Table 2-4: Support Equipment

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Notebook Computer	Dell	Inspiron 6400	N/A	N/A	901465
Serial Interface Cable	N/A	DB-9	N/A	N/A	N/A
12VDC Power Supply	Airorlite Communications, Inc.	50483PS12	N/A	N/A	18252

Figure 2-1: Configuration of Tested System



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

Nominal DC Voltage: 12 VDC
Current: 1.1 A

4 FCC Rules and Regulations Part 90 §90.219 and Part 2 §2.1046(a): Peak Output Power

4.1 Test Procedure

ANSI TIA-603-2004, section 2.2.1.

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance. Any cable losses were accounted for.

Though an antenna gain of 8.9 dBd (11 dBi) is used to show compliance with the 90.219 limit, RF exposure requirements dictate that the max antenna gain be -2 dBd (0.6 dBi). The downlink antenna is typically a leaky coax with 60 dB coupling. Per the manufacturer, -22.1 dBd (-20 dBi) is representative of the leaky coax gain.

4.2 Test Data

Table 4-1: RF Power Output: Carrier Output Power

Frequency MHz	Power Level Measured (dBm/carrier)	Antenna Gain (dBd)	ERP (W)	Limit §90.219 (W)
866.2125	25.04	8.9	2.5	5
867.8750	27.50	8.9	4.4	5
868.9125	27.63	8.9	4.5	5

*Measurement accuracy: +/- 0.3 dB

Table 4-2: Test Equipment for Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901184	Agilent Technologies	E4416A	Power Meter	GB41050573	10/24/08
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	10/24/08
901138	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40dB	BK5883	1/13/09
901157	Marconi Instruments	2022D	Signal Generator (10 kHz-1 GHz)	119161/056	12/12/08

Test Personnel:

Daniel Baltzell		January 14, 2008
Test Engineer	Signature	Date Of Tests

5 FCC Rules and Regulations Part 90 §90.210(b) and Part 2 §2.1049(c): Occupied Bandwidth (Emissions Masks)

5.1 Test Procedure

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

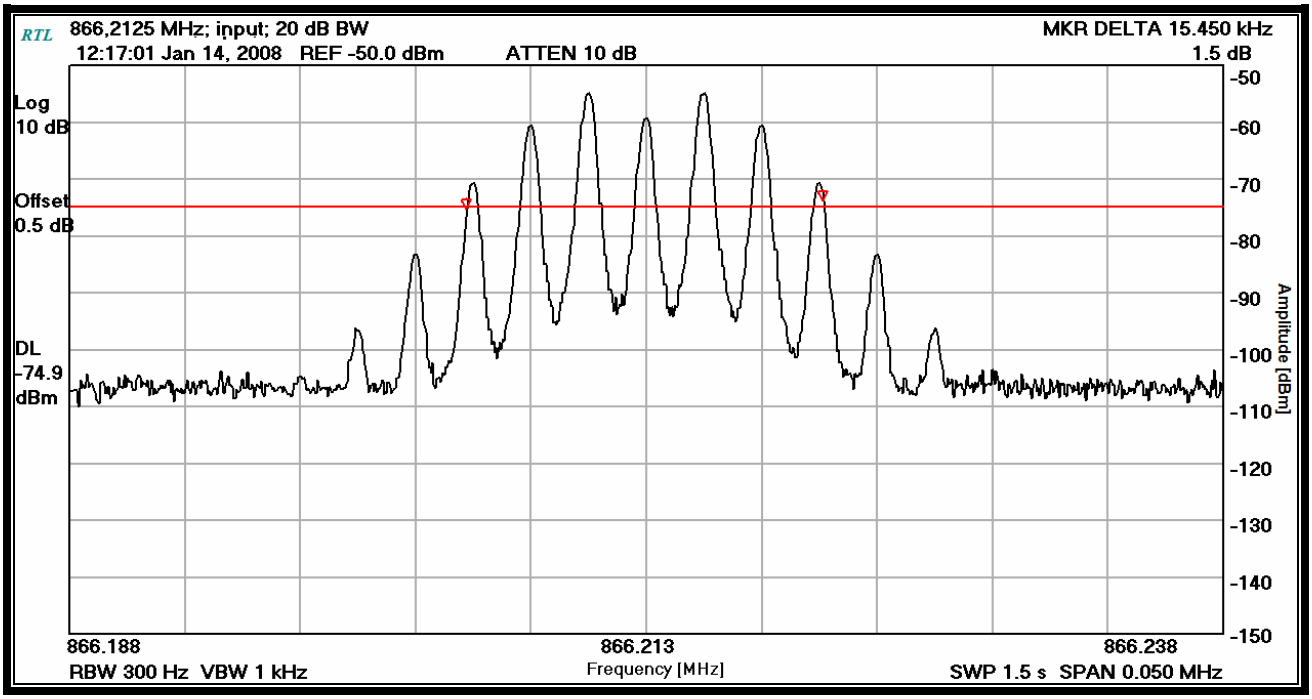
The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer. Cable losses were accounted for in measurement.

Full modulation was applied with 5 kHz deviation and a 2500 Hz tone. Signal input level was set to -75 dBm.

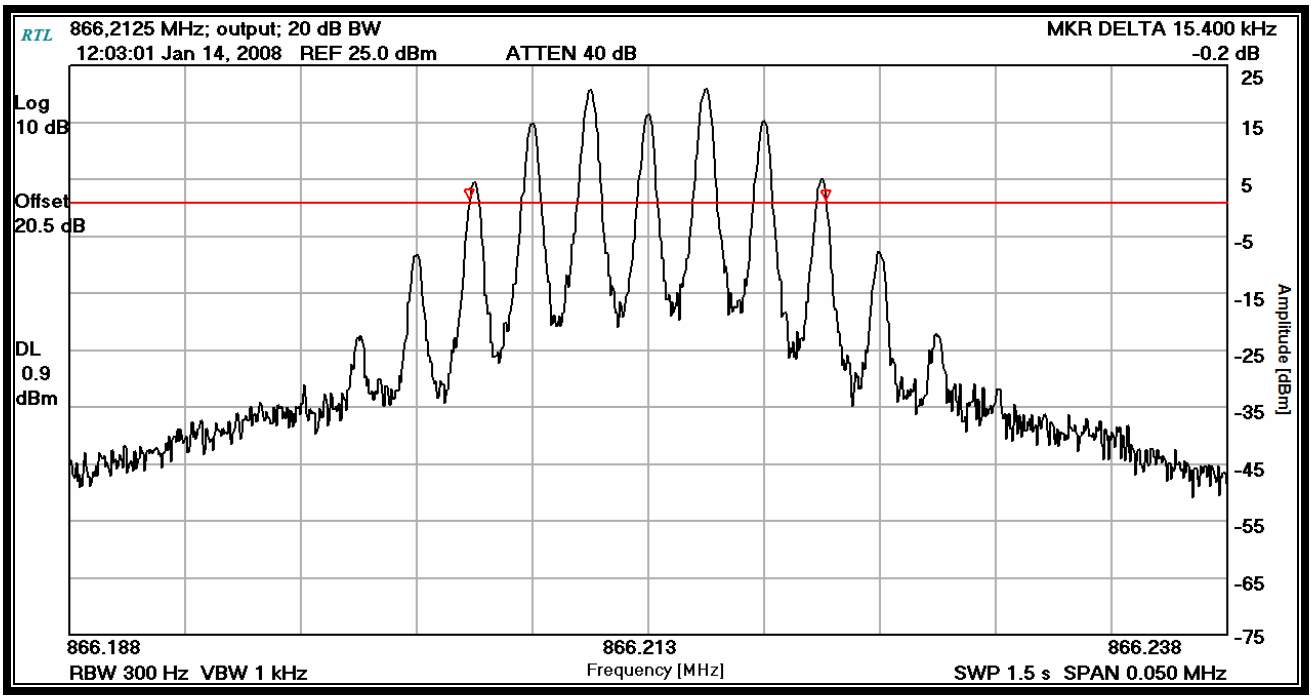
5.2 Test Data

Bandwidth Limit: 1 MHz

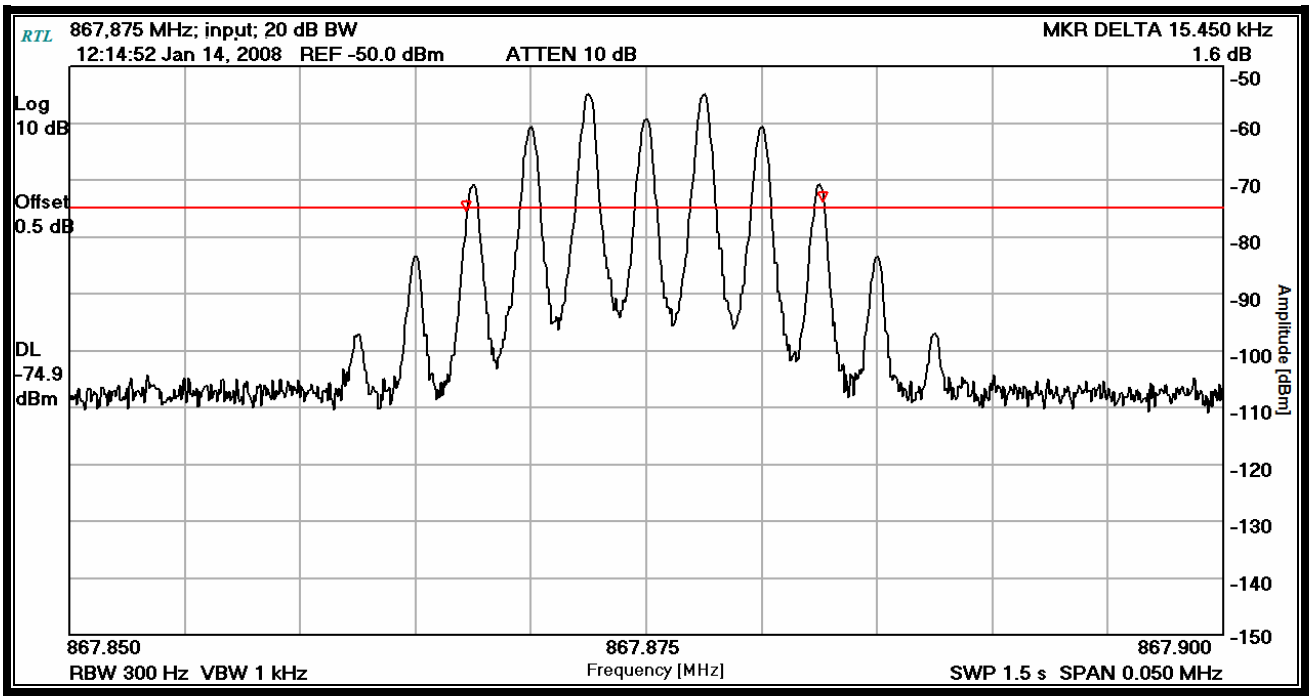
Plot 5-1: Occupied Bandwidth: Input to Booster; 20 dB bandwidth - 866.2125 MHz



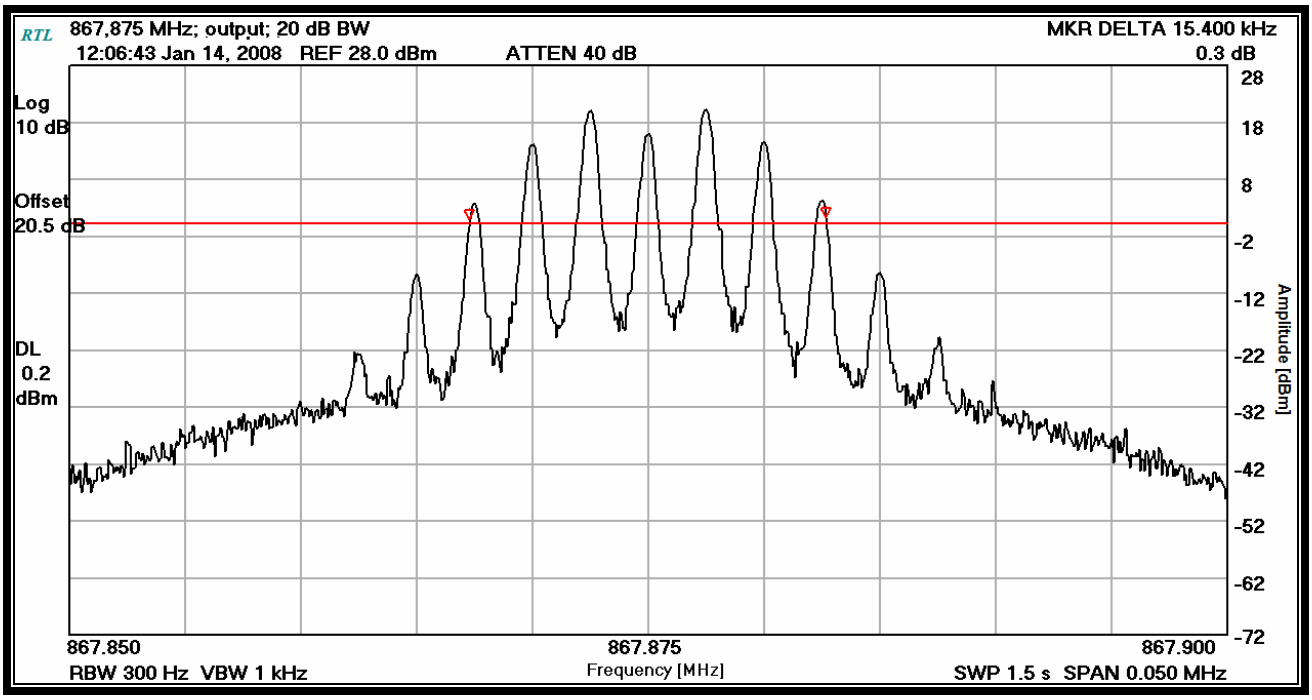
Plot 5-2: Occupied Bandwidth: Booster Output; 20 dB bandwidth - 866.2125 MHz



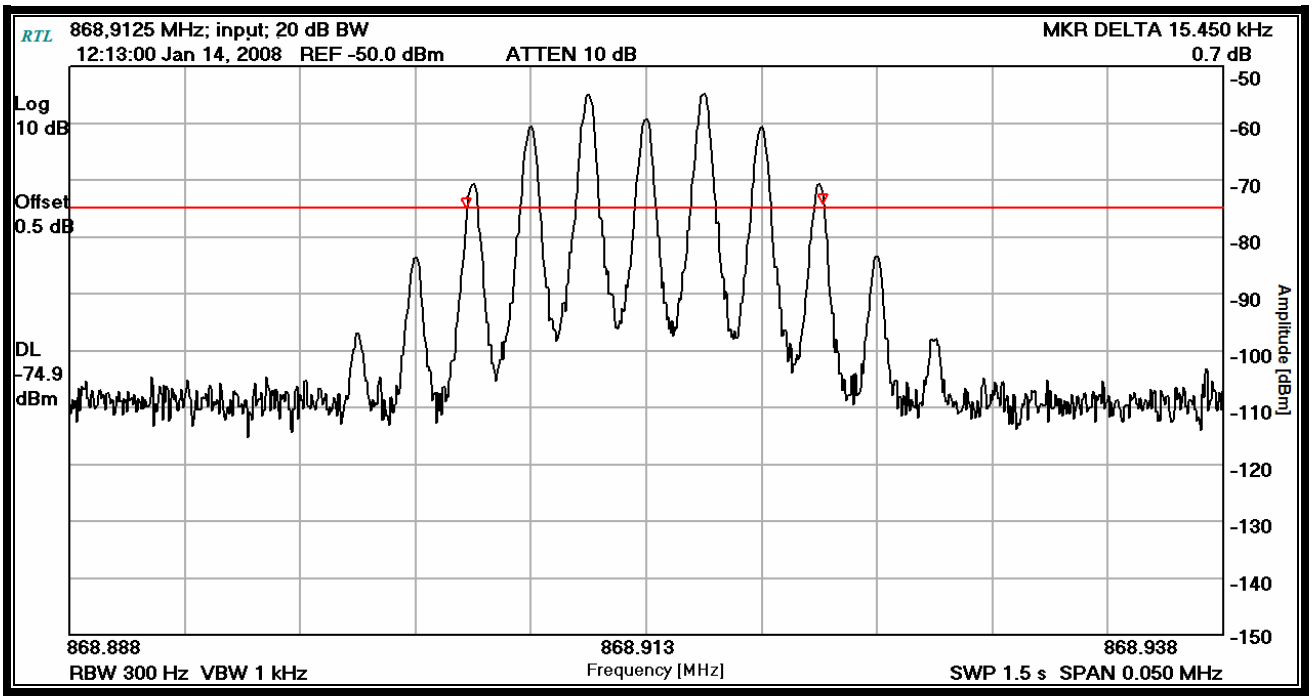
Plot 5-3: Occupied Bandwidth: Input to Booster; 20 dB bandwidth - 867.8750 MHz



Plot 5-4: Occupied Bandwidth: Booster Output; 20 dB bandwidth - 867.8750 MHz



Plot 5-5: Occupied Bandwidth: Input to Booster; 20 dB bandwidth - 868.9125 MHz



Plot 5-6: Occupied Bandwidth: Booster Output; 20 dB bandwidth - 868.9125 MHz

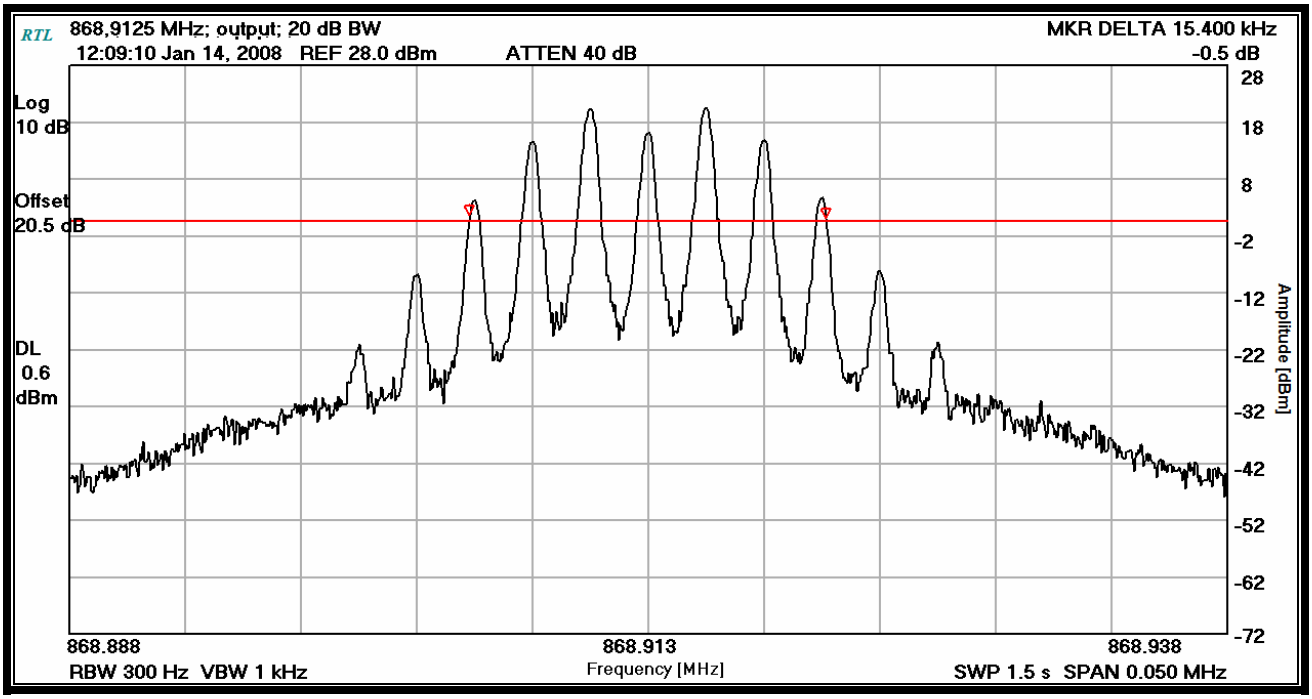


Table 5-1: Test Equipment for Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz–12.8 GHz)	3826A00144	10/17/08
901057	Hewlett Packard	3336B	Synthesizer/Level Generator (100 Hz-20 MHz)	2514A02585	12/13/08
901118	Hewlett Packard	HP8901B	Modulation Analyzer 150 kHz-1300 MHz	2406A00178	8/20/08
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/02/08
900099	Marconi	52022-910E	Signal Generator, 10 kHz-1 GHz	119044-189	3/28/08

Test Personnel:

Daniel Baltzell		January 14, 2008
Test Technician/Engineer	Signature	Date of Tests

6 Bandwidth Rejection

6.1 Test Procedure

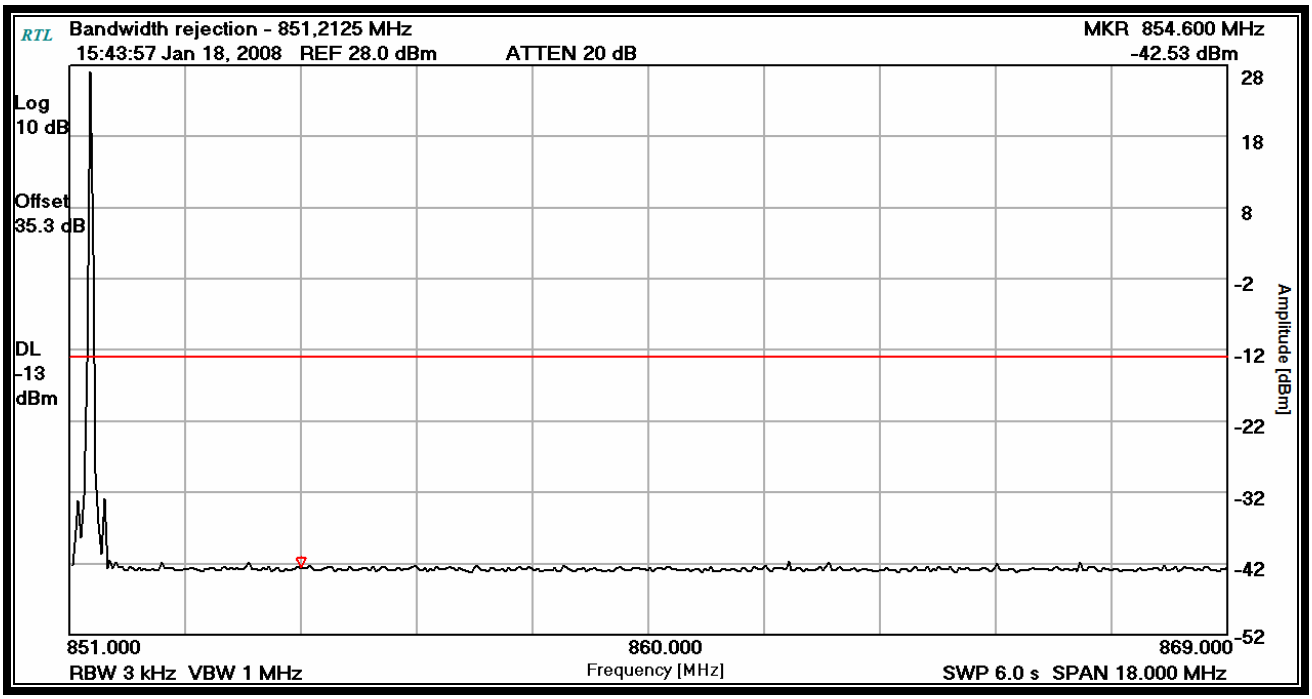
ANSI TIA-603-C-2004, Section 2.2.11.

Bandwidth rejection was performed by sweeping below and through the channel band with the spectrum analyzer on max hold. The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer. Cable losses were accounted for in measurement.

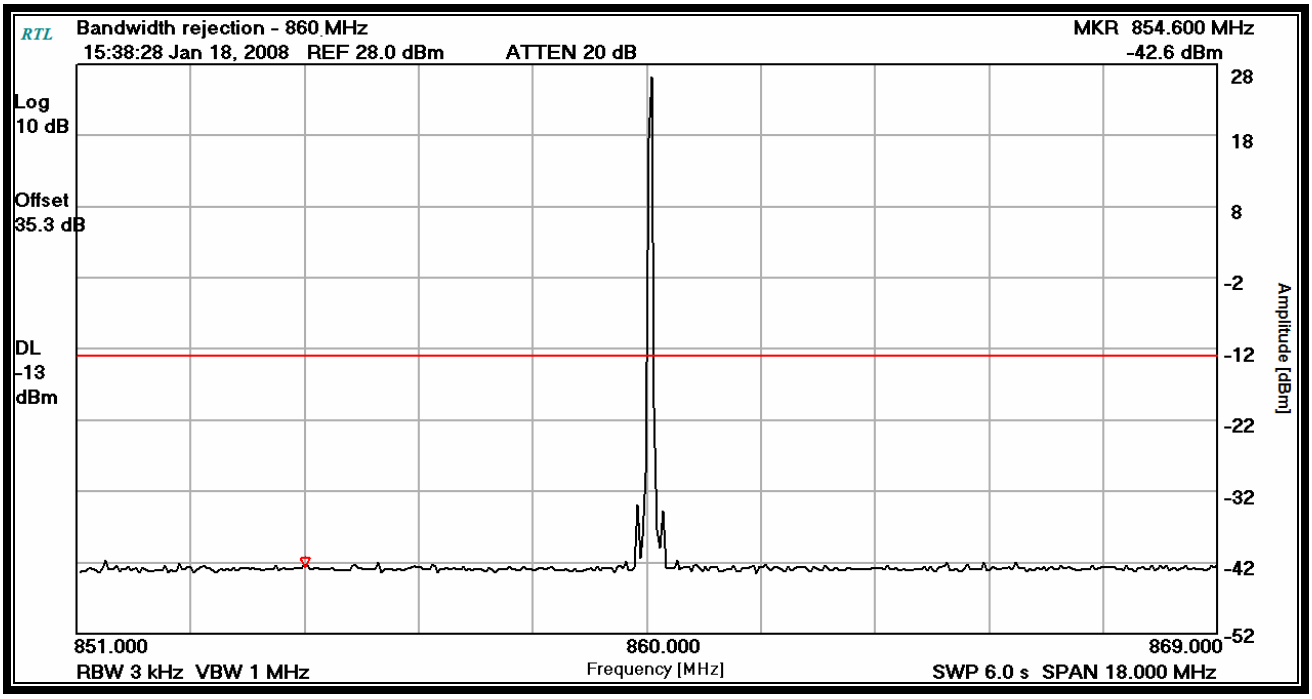
Full modulation was applied with 5 kHz deviation and a 2500 Hz tone.

6.2 Test Data

Plot 6-1: Bandwidth Rejection - 851.2125 MHz



Plot 6-2: Bandwidth Rejection – 860.0000 MHz



Plot 6-3: Bandwidth Rejection - 868.7875 MHz

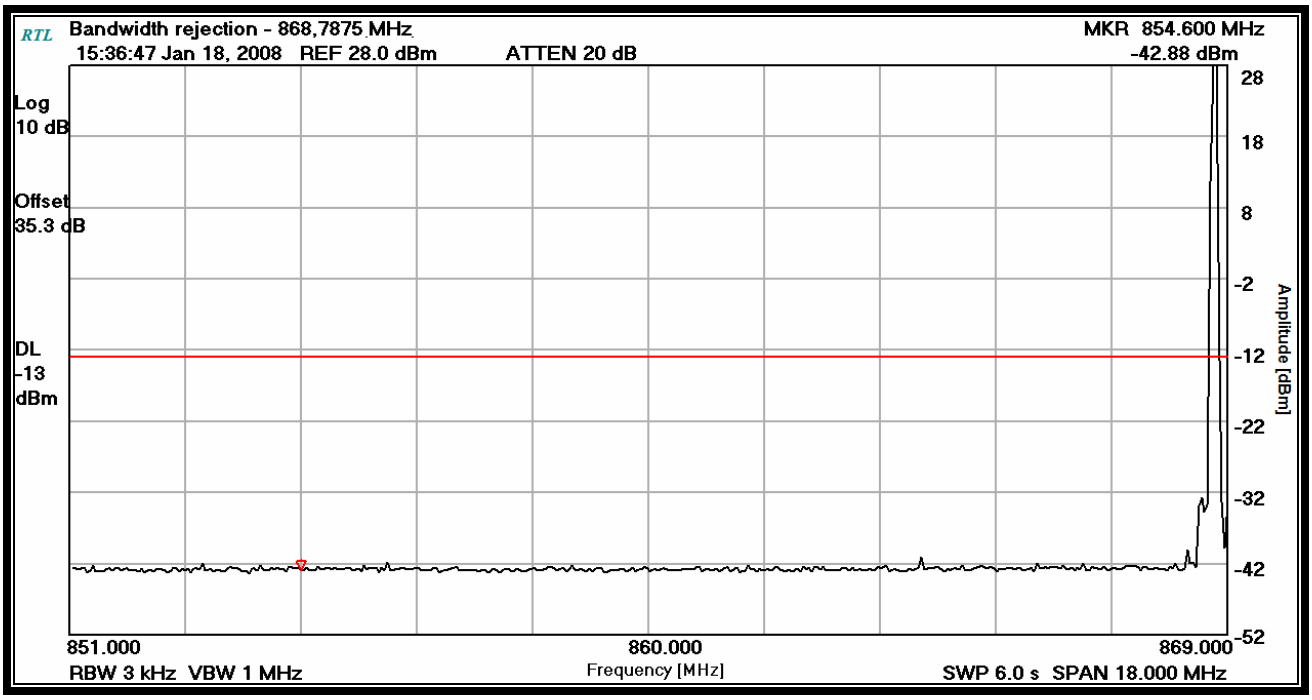


Table 6-1: Test Equipment for Testing Bandwidth Rejection

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz–12.8 GHz)	3826A00144	10/17/08
901057	Hewlett Packard	3336B	Synthesizer/Level Generator (100 Hz-20 MHz)	2514A02585	12/13/08
901118	Hewlett Packard	HP8901B	Modulation Analyzer (150 kHz-1300 MHz)	2406A00178	8/20/08
900099	Marconi	52022-910E	Signal Generator, (10 kHz-1 GHz)	119044-189	3/28/08
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 20dB	BK5859	1/13/09
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/5/08

Test Personnel:

Daniel Baltzell		January 18, 2008
Test Engineer	Signature	Date Of Tests

7 FCC Rules and Regulations Part 2 §2.1051: Spurious Emissions at Antenna Terminals; Part 90 §90.210: Emissions Masks

7.1 Test Procedure

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

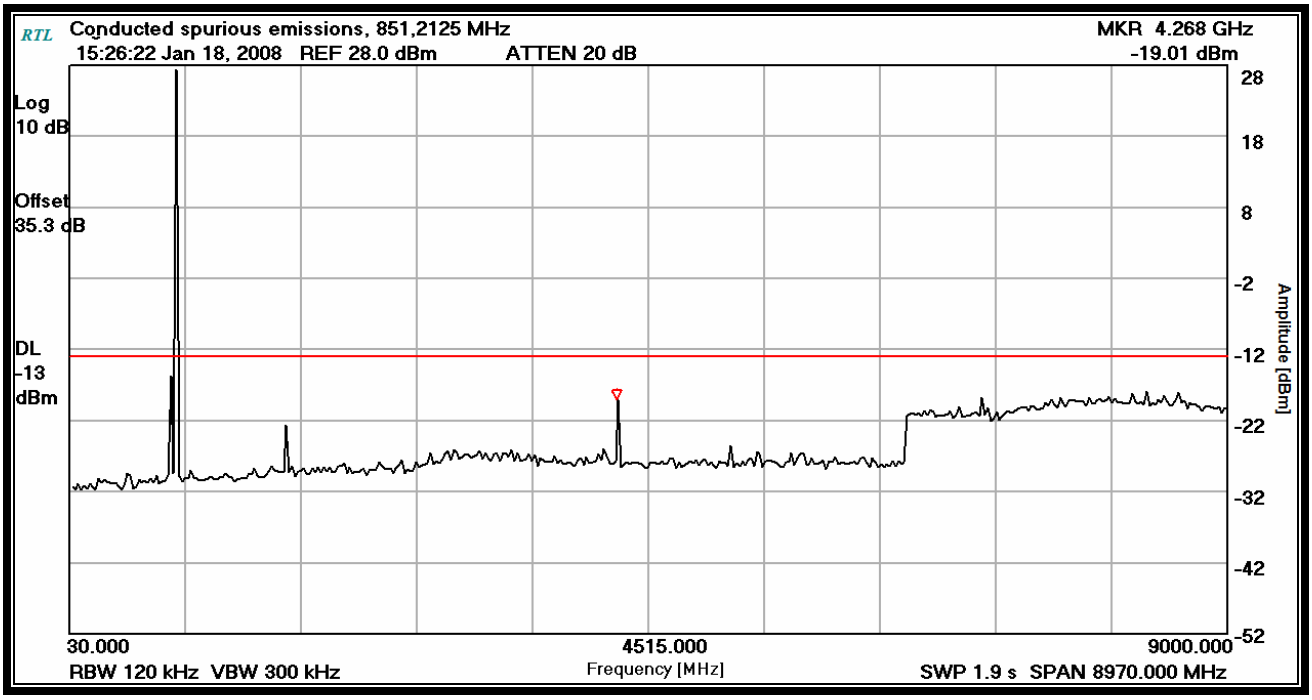
The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer. Cable losses were accounted for in measurement.

7.2 Test Data

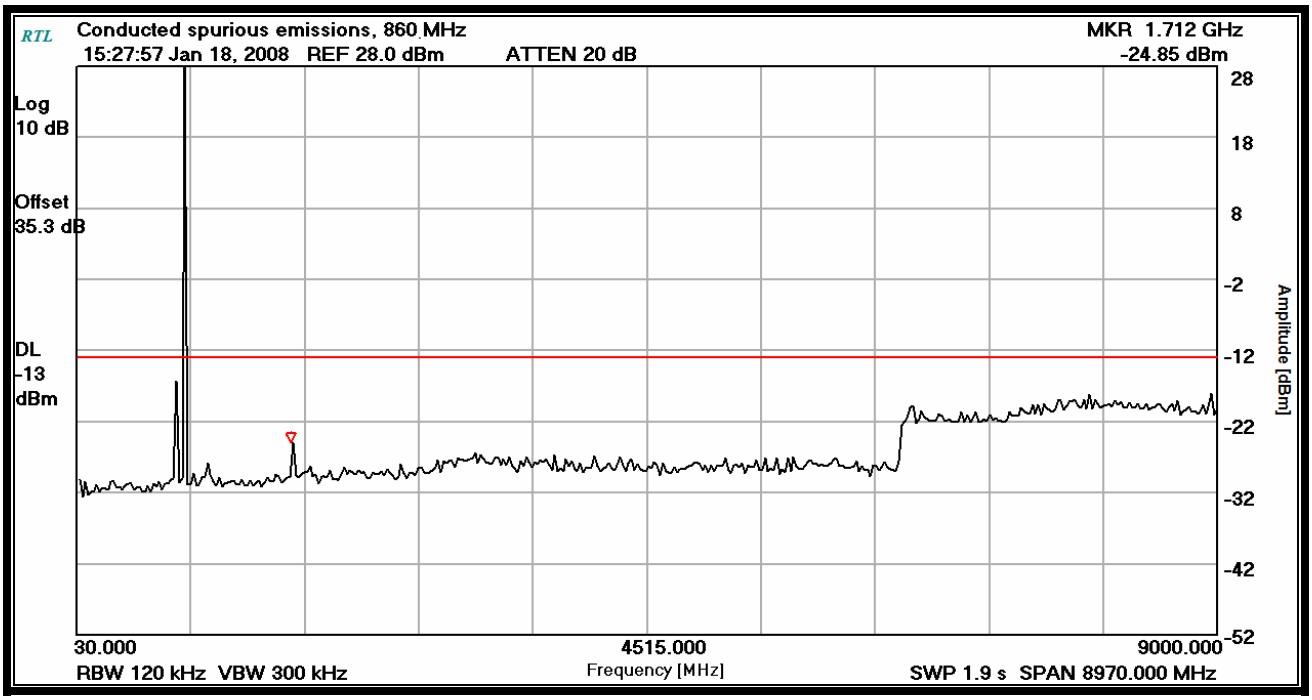
Frequency range of measurement per Part 2.1057: 9 kHz to 10xFc.

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

Plot 7-1: Conducted Spurious Emissions - 851.2125 MHz



Plot 7-2: Conducted Spurious Emissions – 860.0000 MHz



Plot 7-3: Conducted Spurious Emissions - 868.7875 MHz

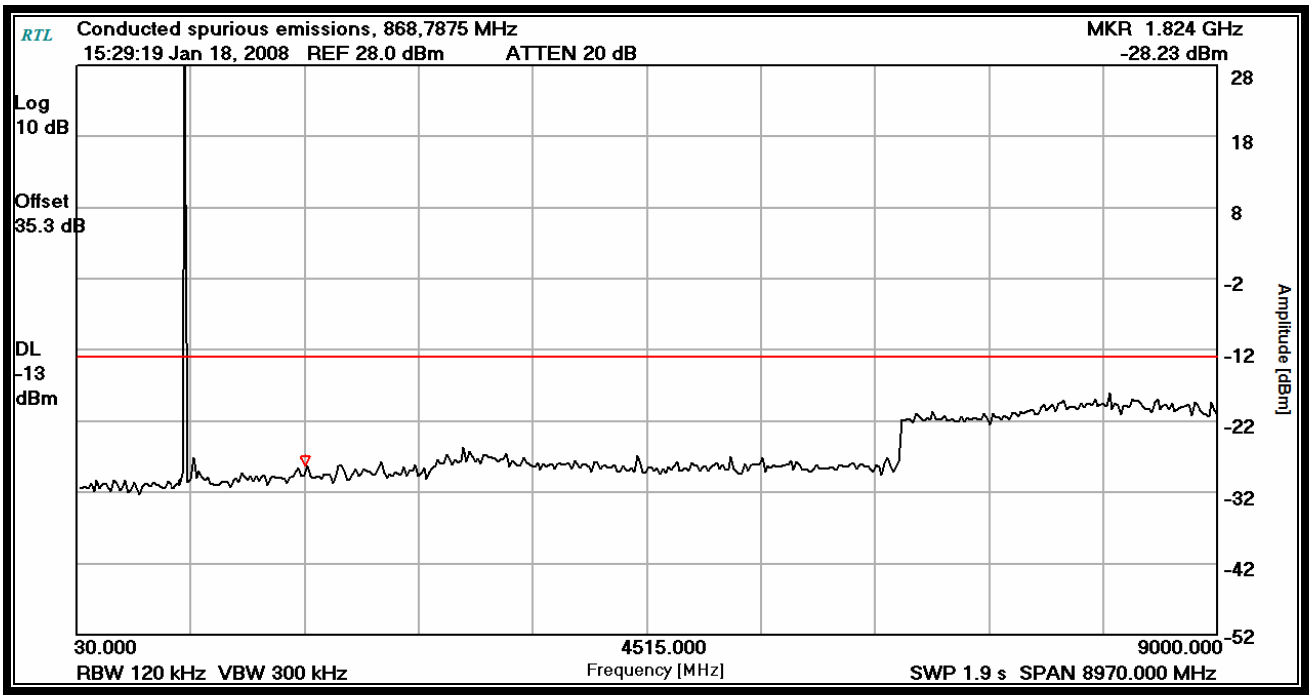


Table 7-1: Test Equipment for Testing Conducted Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz–12.8 GHz)	3826A00144	10/17/08
901057	Hewlett Packard	3336B	Synthesizer/Level Generator (100 Hz-20 MHz)	2514A02585	12/13/08
901118	Hewlett Packard	HP8901B	Modulation Analyzer (150 kHz-1300 MHz)	2406A00178	8/20/08
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 20dB	BK5859	1/13/09
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/5/08
901425	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	10/5/08
900099	Marconi	52022-910E	Signal Generator, (10 kHz-1 GHz)	119044-189	3/28/08

Test Personnel:

Daniel Baltzell		January 18, 2007
Test Engineer	Signature	Date Of Tests

8 Intermodulated Spurious Emissions

8.1 Test Procedure

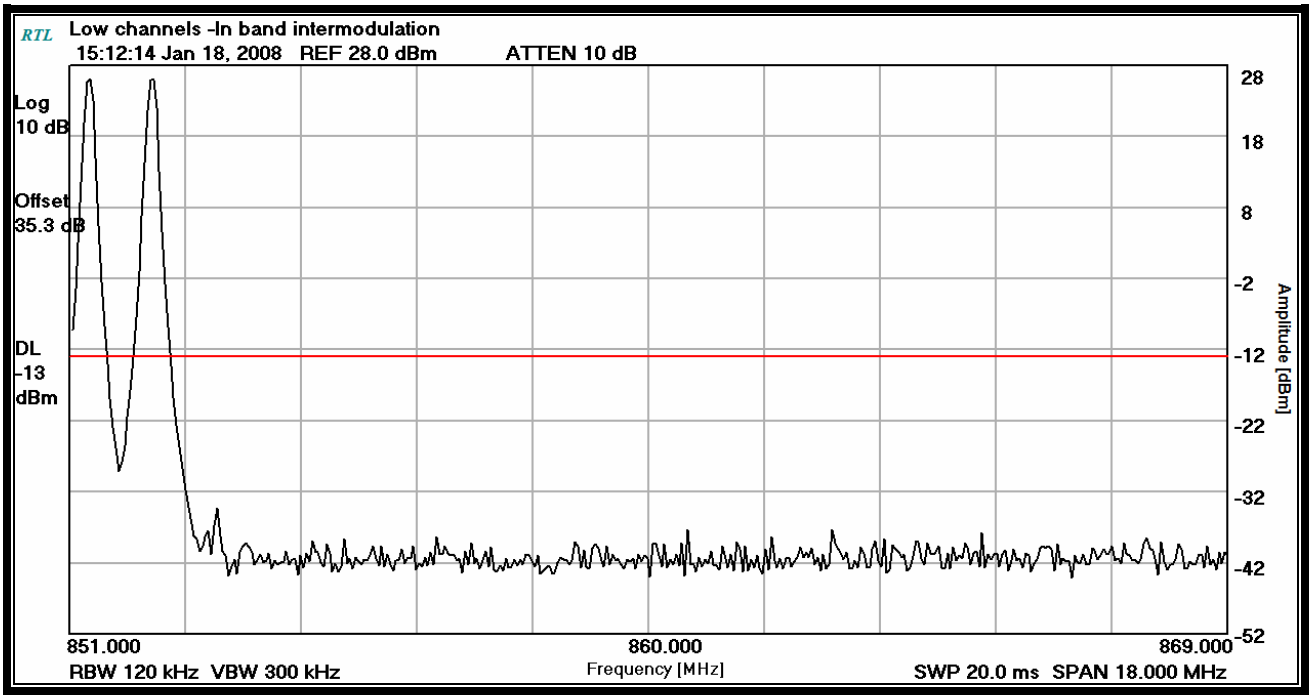
The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer. Cable losses were accounted for in the measurement. Two signal generators were used to produce interference signals. Two signals were injected on the low end of the band and two signals were injected on the high end of the band. Testing was performed from 30 MHz – 9 GHz.

Low end: Plots 8-1-8-3
851.2125 MHz – 5 kHz deviation, 2.5 kHz tone at -50 dBm
852.2125 MHz - 5 kHz deviation, 2.5 kHz tone at -50 dBm

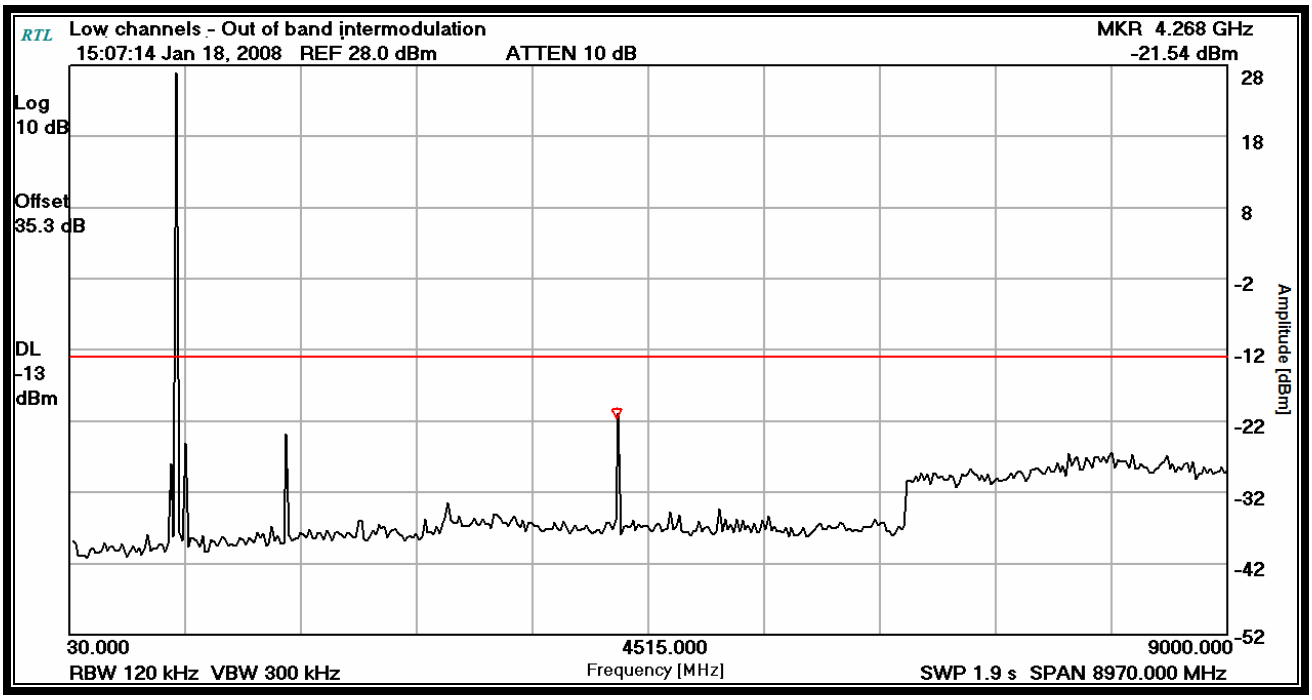
High end: Plots 8-4-8-6
867.7875 MHz – 5 kHz deviation, 1 kHz tone at -50 dBm
868.7875 MHz - 5 kHz deviation, 2.5 kHz tone at -50 dBm

8.2 Test Data

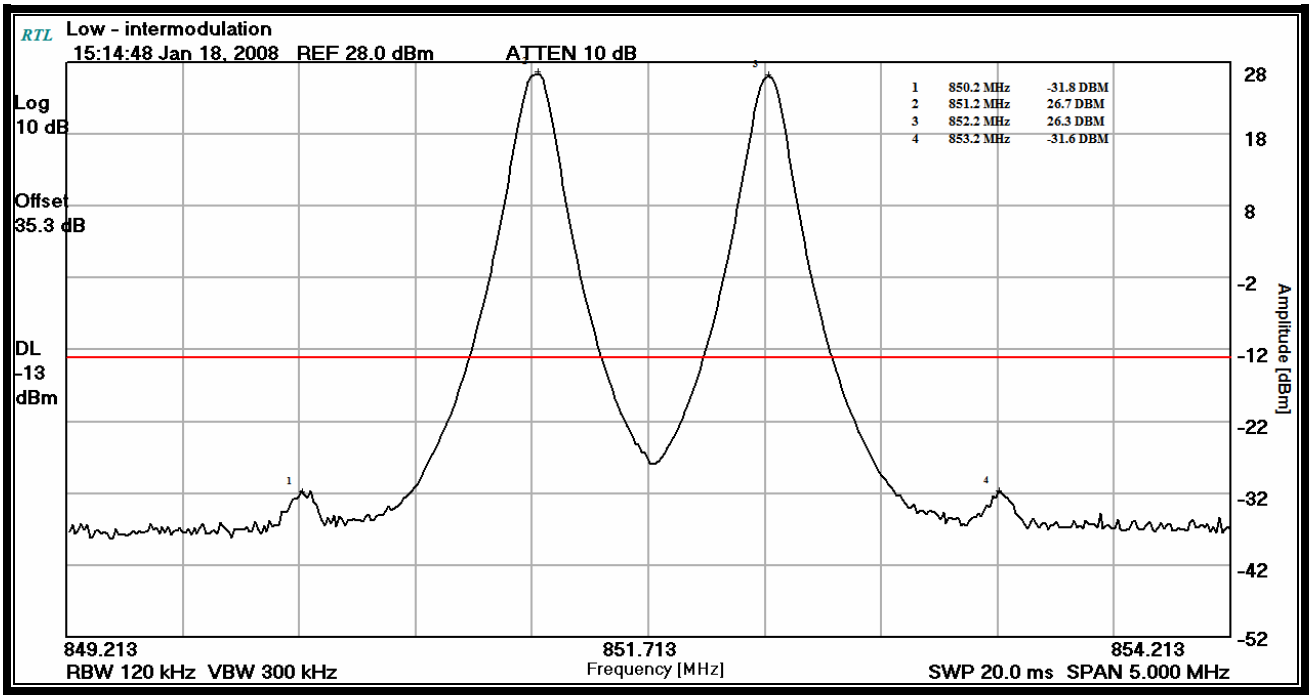
Plot 8-1: Intermodulated Spurious Emissions - Low Channels In-Band Intermodulation



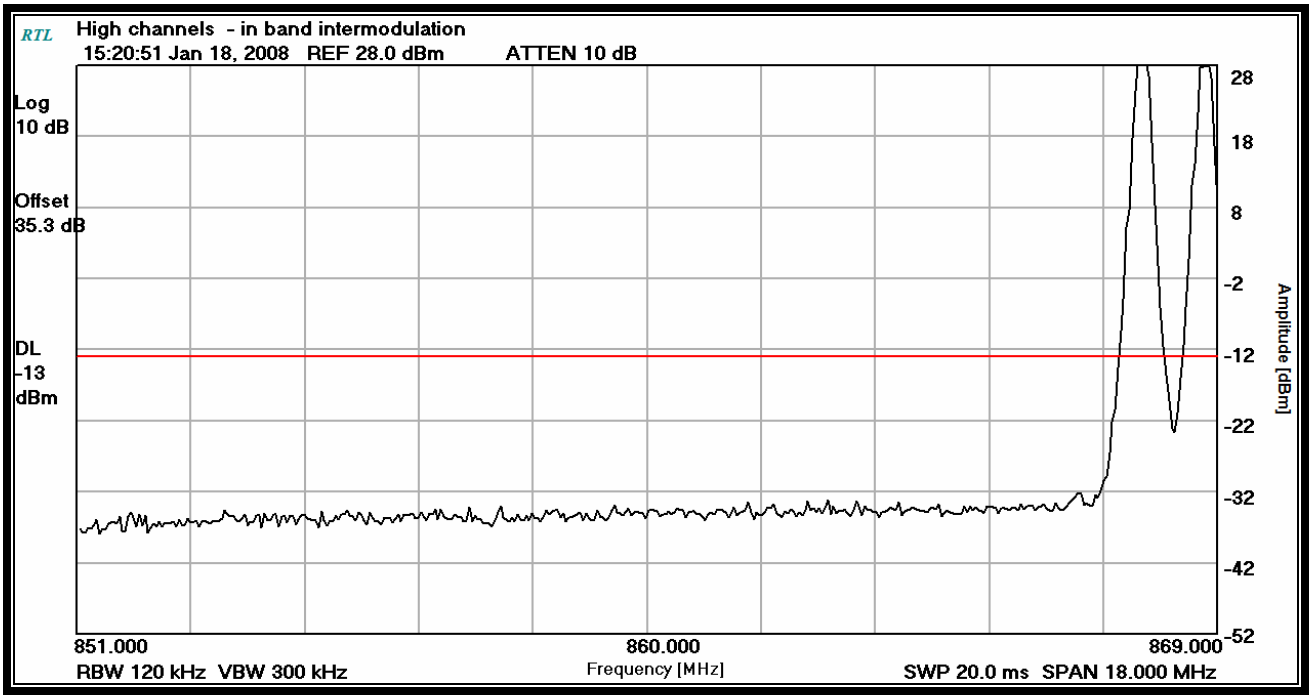
Plot 8-2: Intermodulated Spurious Emissions - Low Channels Out of Band Intermodulation



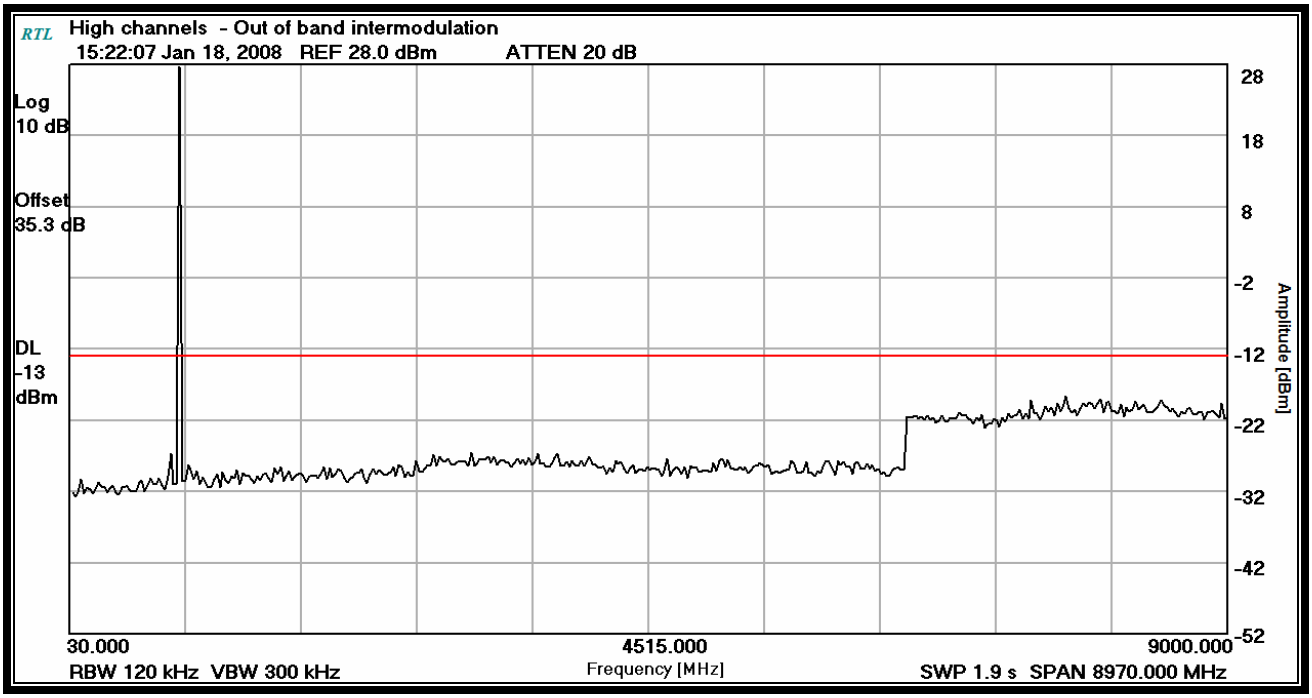
Plot 8-3: Intermodulated Spurious Emissions - Low Channels Intermodulation



Plot 8-4: Intermodulated Spurious Emissions - High Channels In-Band Intermodulation



Plot 8-5: Intermodulated Spurious Emissions - High Channels Out of Band Intermodulation



Plot 8-6: Intermodulated Spurious Emissions - High Channels Intermodulation

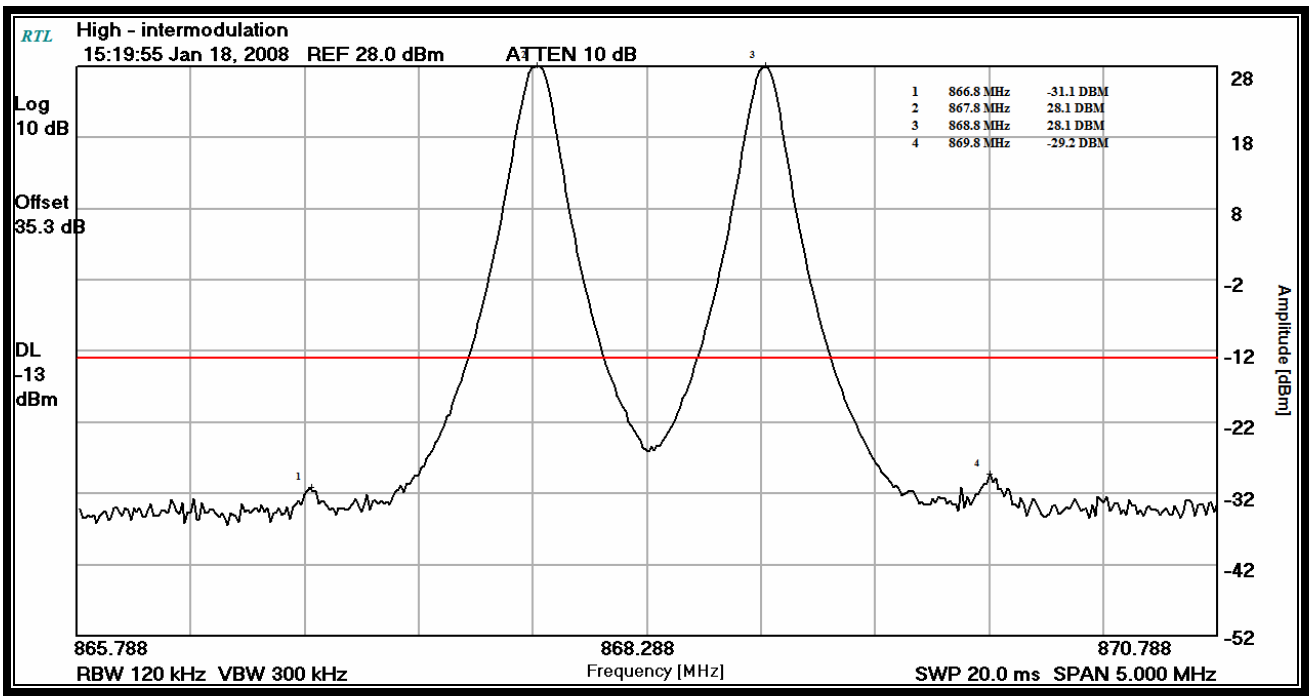


Table 8-1: Test Equipment for Testing Intermodulated Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901215	Hewlett Packard	8596EM	EMC Analyzer (9 kHz–12.8 GHz)	3826A00144	10/17/08
900352	Werlatone	C1795	Directional Coupler	4989	06/06/08
901157	Marconi Instruments	2022D	Signal Generator	119161/056	12/12/08
900099	Marconi	52022-910E	Signal Generator, (10 kHz-1GHz)	119044-189	3/28/08
901057	Hewlett Packard	3336B	Synthesizer/Level Generator (100 Hz-20 MHz)	2514A02585	12/13/08
901118	Hewlett Packard	HP8901B	Modulation Analyzer (150 kHz–1300 MHz)	2406A00178	8/20/08
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/5/08
901425	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	10/5/08
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 20dB	BK5859	1/13/09

Test Personnel:

Daniel Baltzell		January 18, 2008
Test Engineer	Signature	Date Of Tests

9 FCC Rules and Regulations Part 90 §90.210 and Part 2 §2.1053(a): Field Strength of Spurious Radiation

9.1 Test Procedure

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

The EUT was placed on a floor-mounted turntable at a distance of 3 meters from the receiving antenna. The receiving antenna was varied between 1–4 meters to maximize emissions. 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 antenna was further corrected to a half wave dipole.

The output was terminated with 50 Ω load.

9.2 Test Data

9.2.1 CFR 47 Part 90.210 Requirements

The worst-case emissions test data are shown.

Limit: P(dBm) – (43 + 10xLOG P(W))

Table 9-1: Field Strength of Spurious Radiation - 867.875 MHz Horizontal Polarity

Frequency (MHz)	Measured Level (dBuV)	Signal Gen. Level (dB)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBc)	Limit (dBc)	Margin (dB)
1735.750	33.8	-62.8	8.0	5.5	65.3	40.5	-24.8
2603.625	41.3	-45.7	9.7	7.2	48.2	40.5	-7.7
3471.500	29.4	-55.6	11.3	7.5	59.4	40.5	-18.9
4339.375	11.6	-69.2	12.7	8.1	73.8	40.5	-33.3
5207.250	9.4	-71.8	13.4	8.3	76.9	40.5	-36.4
6075.125	11.6	-70.5	14.5	8.9	76.1	40.5	-35.6
6943.000	12.3	-69.6	15.4	9.3	75.7	40.5	-35.2
7810.875	15.2	-64.5	15.6	8.8	71.3	40.5	-30.8
8678.750	12.2	-62.5	15.8	9.1	69.2	40.5	-28.7

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

Table 9-2: Field Strength of Spurious Radiation - 867.8750 MHz Vertical Polarity

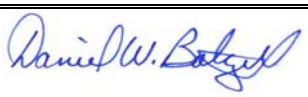
Frequency (MHz)	Measured Level (dBuV)	Signal Gen. Level (dB)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBc)	Limit (dBc)	Margin (dB)
1735.750	41.4	-51.9	8.0	5.5	54.4	40.5	-13.9
2603.625	41.4	-46.2	9.7	7.2	48.7	40.5	-8.2
3471.500	29.0	-53.1	11.3	7.5	56.9	40.5	-16.4
4339.375	14.4	-64.5	12.7	8.1	69.1	40.5	-28.6
5207.250	9.4	-70.6	13.4	8.3	75.7	40.5	-35.2
6075.125	10.9	-71.2	14.5	8.9	76.8	40.5	-36.3
6943.000	12.1	-70.7	15.4	9.3	76.8	40.5	-36.3
7810.875	12.7	-66.8	15.6	8.8	73.6	40.5	-33.1
8678.750	12.6	-62.5	15.8	9.1	69.2	40.5	-28.7

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

Table 9-3: Test Equipment for Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz–2 GHz)	2648	12/20/08
901365	MITEQ	JS4-00102600-41-5P	Amplifier, 0.1-26 GHz, 30dB gain	N/A	10/8/08
901215	Hewlett Packard	8596EM	Portable Spectrum Analyzer (9 kHz–12.8 GHz)	3826A00144	10/17/08
900928	Hewlett Packard	HP 83752A	Synthesized Sweeper (.01–20 GHz)	3610A00866	12/7/08
900772	EMCO	3161-02	Horn Antenna (2–4 GHz)	9504-1044	6/14/10
900321	EMCO	3161-03	Horn Antenna (4–8 GHz)	9508-1020	6/14/10
900323	EMCO	3160-07	Horn Antenna (8.2-12.4 GHz)	9605-1054	6/14/10
900814	Electrometrics	RGA-60	Double Ridge Horn Antenna (1–18 GHz)	2310	3/30/09
901424	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/5/08
901425	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	10/5/08
901426	Insulated Wire Inc.	KPS-1503-3600-KPS	RF cable, 30'	NA	10/5/08

Test Personnel:

Daniel Baltzell		January 16, 2008
Test Engineer	Signature	Date Of Tests

10 FCC Rules and Regulations Part 90 §90.213 and Part 2 §2.1055: Frequency Stability

There are no frequency determining elements, hence the EUT is not subject to frequency stability requirements.

11 Conclusion

The data in this measurement report shows that the **Airorlite Communications, Inc**. **Model 50289-BAM-8-800-DL, FCC ID: UT650289BAM8800DL,** complies with all the applicable requirements of FCC Parts 90 and 2.