

COMPLIANCE WORLDWIDE INC. TEST REPORT 118-07R1

In Accordance with the Requirements of

**Industry Canada RSS 310, Issue 6
Federal Communications Commission CFR Title 47 Part 15.249 Subpart C
Radio Communication Devices
Intentional Radiators**

Issued to

**Valeo Raytheon Systems, Inc.
46 River Road
Hudson, NH 03051-5227**


Tel: (603) 578-8000

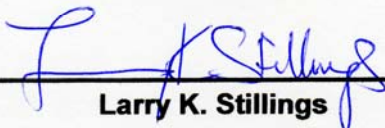
for

Blind-Spot Detection Sensor

FCC: ID UR8100206

Report Issued on February 13, 2007


Brian F. Breault

Reviewed By

Larry K. Stillings

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1. Scope

This test report certifies that the Valeo Raytheon Systems, Inc. Blind-Spot Detection Sensor, as tested, meets the RSS 310 Rules and FCC Part 15.249, requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required. This report replaces 118-07 to add the determination of averaging factor.

2. Product Details

- 2.1. Manufacturer:** Valeo Raytheon Systems, Inc.
- 2.2. Model Number:** Blind-Spot Detection System
- 2.3. Serial Number:** FC93409063200110
- 2.4. Description:** The Blind-Spot Detection system utilizes multi beam radar sensors located out of sight behind the bumper fascia. These sensors monitor the adjacent lanes of traffic on the left and right sides of the vehicle and alert the driver to the presence of objects of interest, such as cars, trucks and motorcycles, in the driver's blind spots.
- 2.5. Power Source:** 12 Volt DC (Automobile)
- 2.6. EMC Modifications:** Snubber filters on PC board Vias

3. Product Configuration

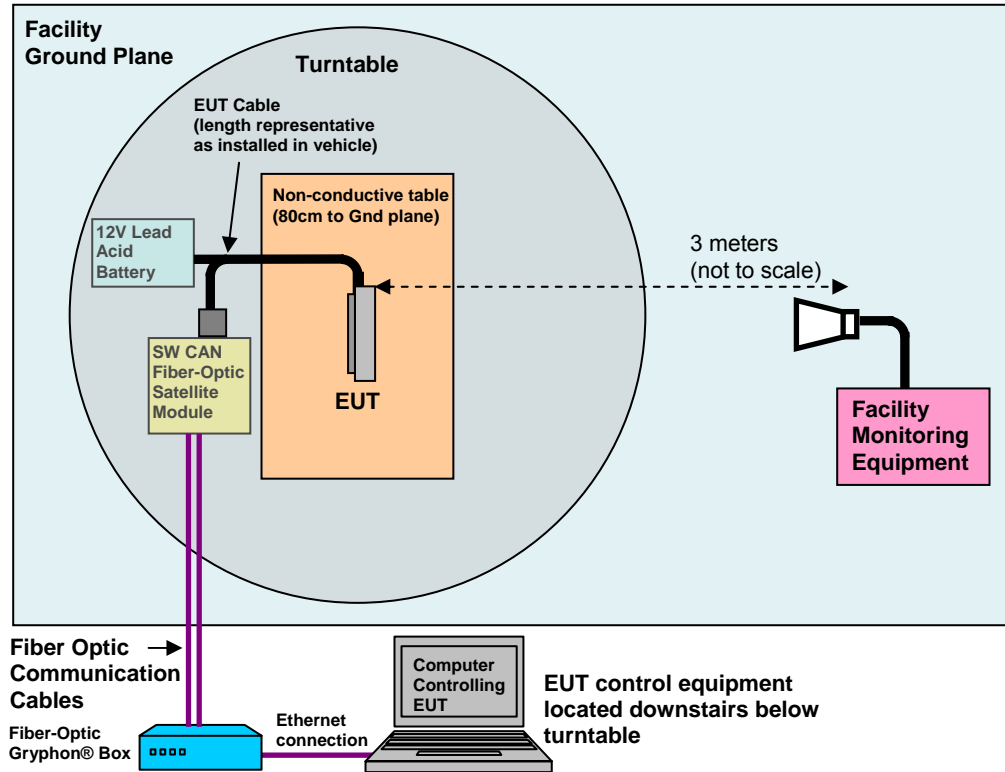
3.1. Operational Characteristics & Software

The Multi Beam Radar (MBR) is a frequency modulated continuous wave (FMCW) radar sensor module operating in the 24.0–24.25GHz band per FCC part 15, section 15.249. In order to ensure that the unit remains within the band limitations of 15.249, it undergoes a five point frequency calibration process every 256 milliseconds when it is operational. The unit is never operated without the frequency calibration process running when installed in a vehicle.

In order to satisfy test requirements, a special test feature has been incorporated so that the frequency sweep can be stopped at the low, mid and upper points of the band. This is accomplished by putting the Voltage Controlled Oscillator (VCO) control voltage at a fixed level that corresponds to the level determined by the last calibration. However, the software does not perform the frequency calibration process when the sweep is stopped. Consequently band edge compliance cannot be ensured in this mode of operation, and therefore it is critical that band edge compliance be verified with the unit in its operational mode. This special test feature is never enabled when the unit is installed in a vehicle.

3. Product Configuration (continued)

3.2. Block Diagram



4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due
Spectrum Analyzer	Hewlett Packard	8593E	3829A03887	3/13/2007
Spectrum Analyzer	Hewlett Packard	8563EC	3946A00623	2/09/2008
Microwave Preamplifier	Hewlett Packard	8449B	3008A01323	9/21/2008
Biconilog Antenna	Com-Power	AC220	25509	7/31/2007
Horn Antenna	Electro-Metrics	EM-6961	6337	8/25/2007
Horn Antenna	Com-Power	AH-840	3075	8/25/2007
Mixer Horn Antenna	Hewlett Packard Alpha Industries	11970A 861A/599	3003A08210 324	Not Req'd
Mixer Horn Antenna	Hewlett Packard M/A Com Baytron	11970U 3-19-720	2332A00425 N/A	Not Req'd
Mixer Horn Antenna	Hewlett Packard Aerowave	11970V 15-7025	2521A00357 N/A	Not Req'd
Mixer Horn Antenna	Hewlett Packard Alpha Industries	11970W 861A/387	2521A00230 359	Not Req'd

4. Measurements Parameters (continued)**4.2. Measurement & Equipment Setup**

Test Date:	2/09/2007
Test Engineer:	Larry K. Stillings Brian F. Breault
Normal Site Temperature (15 - 35°C):	21.6
Relative Humidity (20 -75%RH):	35
Frequency Range:	30.0 MHz – 100 GHz
Measurement Distance:	3 Meters ¹
EMI Receiver IF Bandwidth:	30 – 1000 MHz: 100 kHz Above 1 GHz : 1 MHz
EMI Receiver Avg Bandwidth:	30 – 1000 MHz: 300 kHz Above 1 GHz : 3 MHz
Detector Function:	30 – 1000 MHz: Quasi-Pk Above 1 GHz : Average

¹ See the footnotes for each section of this report for any variances in the measurement distance.

4.3. Measurement Procedure

Test measurements were made in accordance FCC Part 15.249: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

The test methods used to generate the data in this test report is in accordance with ANSI C63.4: 2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. Above 30 GHz, the FCC Millimeter Wave Test Procedures were followed.

In accordance with ANSI C63.4-2003, section 13.1.4.1, c), the device under test was rotated through three orthogonal axes to determine which attitude produced the highest emission relative to the limit. The attitude that produced the highest emission relative to the limit was used for all radiated emission measurements. This procedure was implemented for both the fundamental field strength measurements and spurious measurements.

5. Measurement Summary

Test Requirement	FCC Rule Requirement	Test Report Section	Result	Comment
Antenna Requirement	15.203	N.A	Compliant	Unit has an internal PCB etched antenna.
Radiated Field Strength of Fundamental	15.249 (a)	6.1	Compliant	
Radiated Field Strength of Harmonics	15.249 (a)	6.2	Compliant	
Occupied Bandwidth		6.3	Compliant	
99% Bandwidth	RSS 310	6.4	Compliant	
Band Edge Measurements	15.249 (d), 15.209	6.5	Compliant	
Spurious Radiated Emissions	15.249 (d), 15.209	6.6	Compliant	
Determination of Averaging Factor	15.35 (c)	6.7	Compliant	
Conducted Emissions	15.207	N/A	N/A	DUT is powered by the automotive electrical system.

6. Measurement Data

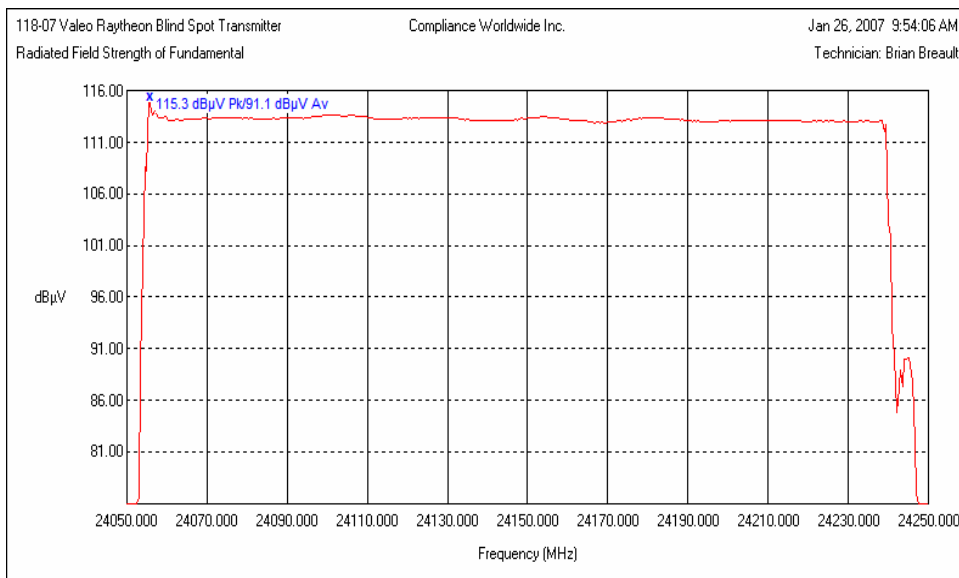
6.1. Radiated Field Strength of Fundamental (15.249, Section (a))

Requirement: The 3 meter field strength of the fundamental emissions from intentional radiators operated within the 24.0 to 24.25 GHz frequency bands shall comply with the following requirement: 250 millivolts/meter (108 dBμV/m), average mode measurement, peak may not exceed the average by more than 20 dB.

Meas. ¹	Frequency (GHz)	Amplitude ² (dBμV/m @ 3M)		Avg Limit	Margin (dB)	Ant Pol	Ant Ht	TT Pos	Result
		Peak	Average						
1	24.05475	114.72	97.12	108.0	-10.88	H	103	330	Passed
2	24.14650	114.53	96.93	108.0	-11.07	H	103	330	Passed
3	24.23875	114.23	96.63	108.0	-11.37	H	103	330	Passed

- Three points representing the low, middle and high points of the device under test were taken across the span of the measured signal in non-sweeping mode. Refer to Section 3.1 for additional information regarding sweeping vs. non-sweeping modes.
- Amplitude values include all correction factors.

6.1.1. Peak Radiated Field Strength of Fundamental



Meas. ¹	Frequency (GHz)	Amplitude ² (dBμV/m @ 3M)		Avg Limit	Margin (dB)	Ant Pol	Ant Ht	TT Pos	Result
		Peak	Average						
1	24.05475	115.30	97.7	108.0	-10.3	H	103	330	Passed

- Unit was in normal operational (sweeping) mode.
- Amplitude values include all correction factors.

6. Measurement Data (continued)

6.2. Radiated Field Strength of Harmonics (15.249, Section (a))

Requirement: The 3 meter field strength of the harmonic emissions from intentional radiators operated within the 24.0 to 24.25 frequency bands shall comply with the following: 2500 microvolts/meter (68 dB μ V/m), average mode measurement. Peak field strength may not be greater than 20 dB above the average limit (88 dB μ V/m).

Peak Reading – 1 MHz RBW / 3 MHz VBW

Average Reading – 1 MHz RBW / 10 Hz VBW

6.2.1. Measurement made with unit in normal operating mode.

1. Refer to Section 3.1 for information regarding sweeping vs. non-sweeping modes.
2. Corr. Fact. = Cable Loss + Antenna Factor + Distance Correction.

Frequency (MHz)	Amplitude (dB μ V)		Corr. Fact. (dB)	Amplitude (dB μ V/m)		Average Limit	Margin (dB)	Ant Pol	Ant Ht	TT Pos	Result
	Peak	Avg		Peak	Avg						
48.114 ¹	47.27	29.67	34.31	81.58	63.98	67.96	-3.98	V	105	60	Passed
72	There were no measurable emissions at 72 GHz										Passed
96	There were no measurable emissions at 96 GHz										Passed

¹ – Measurement as taken at 1 meter. Cable Loss + Antenna Factor = 43.85 dB. Distance Correction = -9.54 dB.

6.2.2. Measurement made with unit frequency sweep stopped.

1. Refer to Section 3.1 for information regarding sweeping vs. non-sweeping modes.
2. Corr. Fact. = Cable Loss + Antenna Factor + Distance Correction.

Band	Freq. (GHz)	Amplitude (dB μ V)		Corr. Factor (dB)	Amplitude (dB μ V/m)		Limit (dB μ V/m)	Margin (dB)	Pol (H/V)	El. (cm)	Az. (deg)
		Peak	Avg		Peak	Avg					
Low	48.108	48.50	30.90	34.31	82.81	65.21	67.96	-2.75	V	107	30
Mid	48.292	46.70	29.10	34.31	81.01	63.41	67.96	-4.55	V	107	35
High	48.475	46.83	29.23	34.31	81.14	63.54	67.96	-4.42	V	107	45

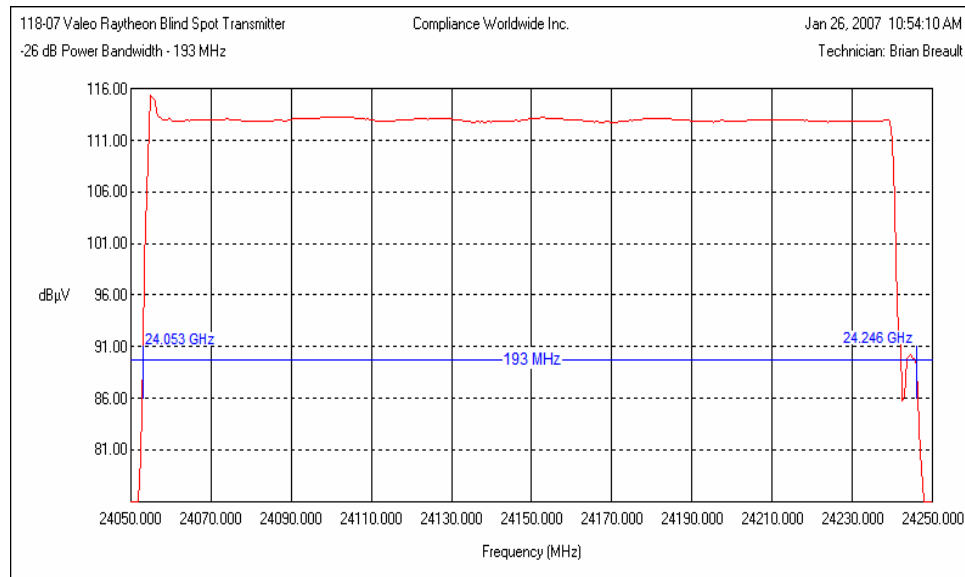
¹ – Measurement as taken at 1 meter. Cable Loss + Antenna Factor = 43.85 dB. Distance Correction = -9.54 dB.

6. Measurement Data (continued)

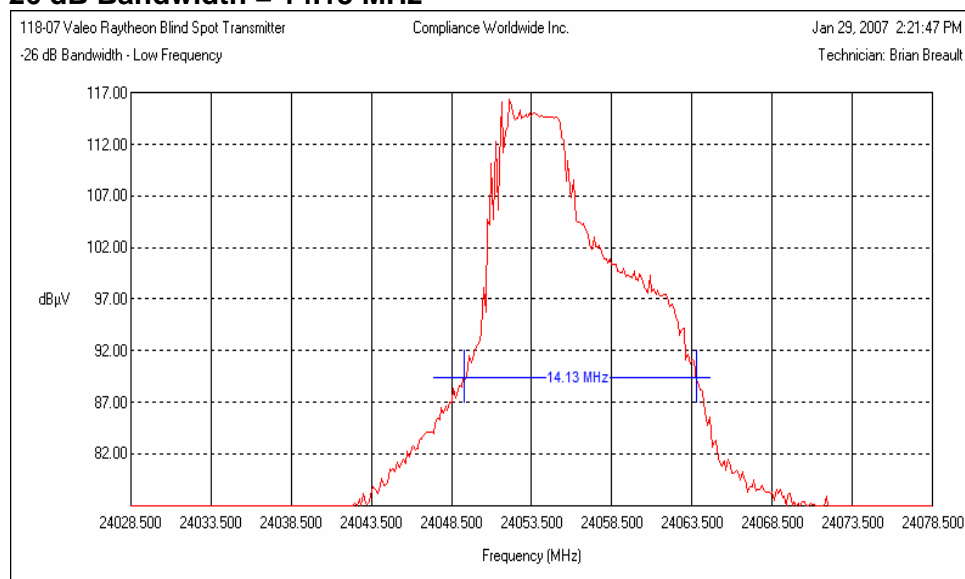
6.3 Occupied Bandwidth

Requirement: The occupied bandwidth measurements on an intentional radiator shall be made in accordance with the requirements outlined in ANSI C63.4-2003, Section 13.1.7.

6.3.1. Occupied Bandwidth, Normal Operation -26 dB Bandwidth = 193 MHz



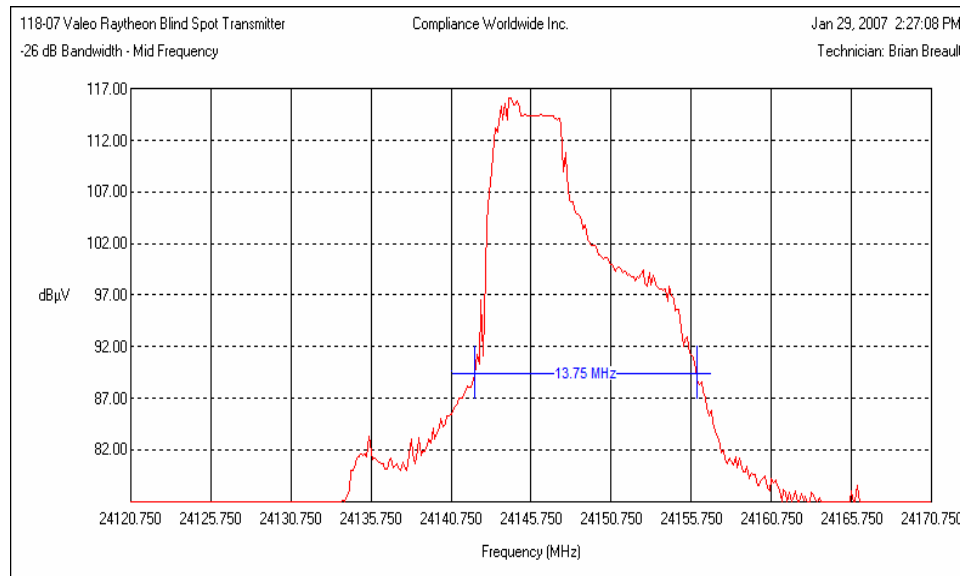
6.3.2. Occupied Bandwidth, Non-Sweeping Operation, Low Frequency -26 dB Bandwidth = 14.13 MHz



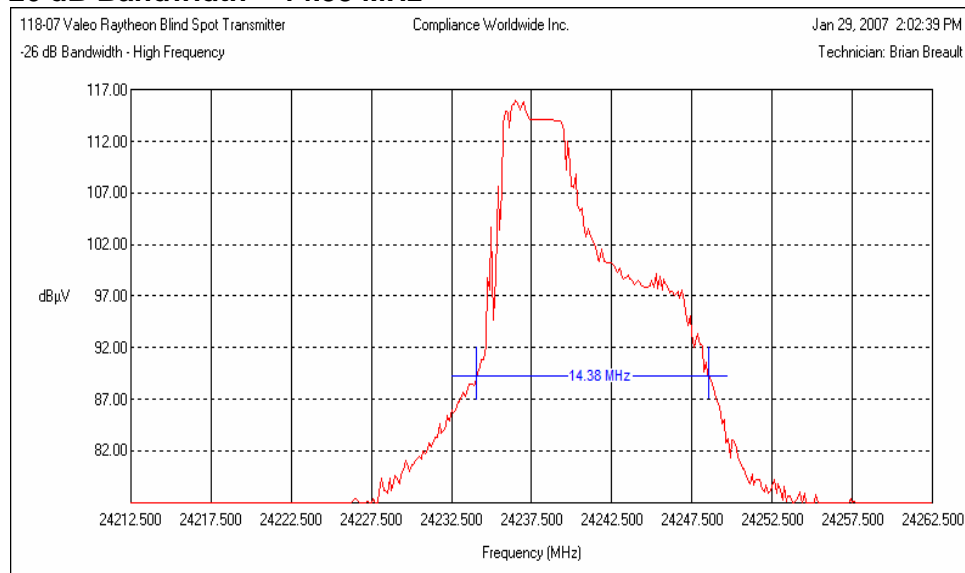
6. Measurement Data (continued)

6.3. Occupied Bandwidth (continued)

6.3.3. Occupied Bandwidth, Non-Sweeping Operation, Middle Frequency -26 dB Bandwidth = 13.75 MHz



6.3.4. Occupied Bandwidth, Non-Sweeping Operation, High Frequency -26 dB Bandwidth = 14.38 MHz

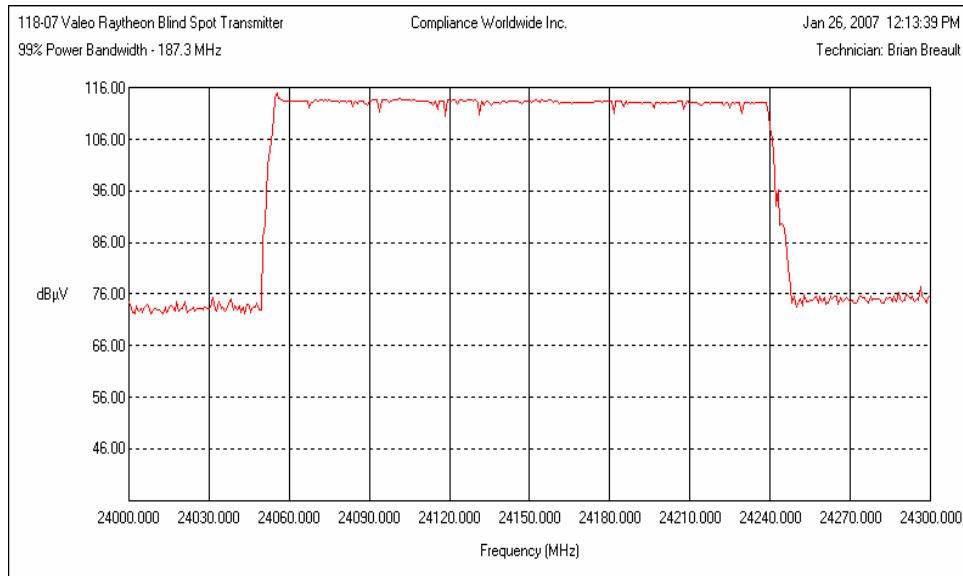


6. Measurement Data (continued)

6.4. 99% Bandwidth

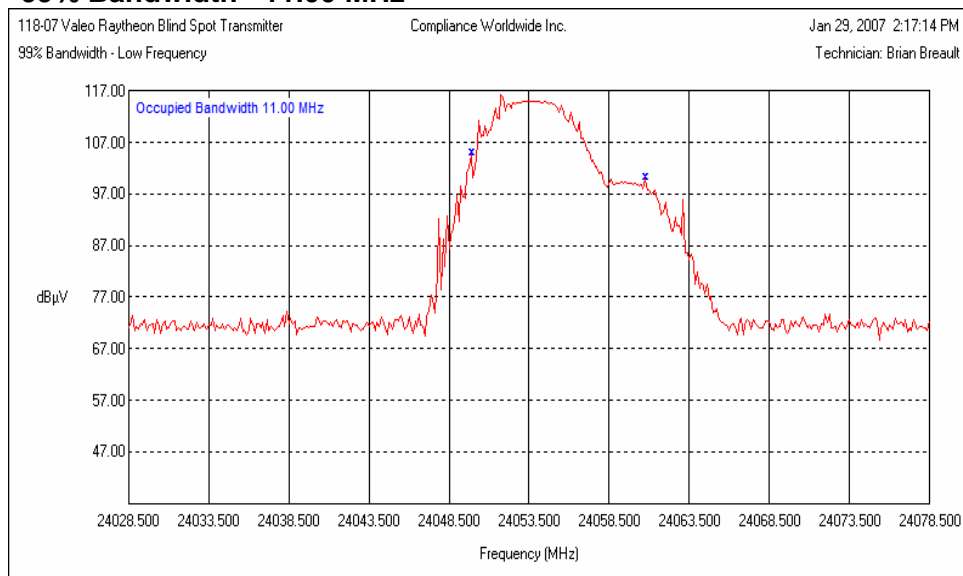
6.4.1. 99% Bandwidth, Normal Operation

99% Bandwidth= 187.3 MHz



6.4.2. 99% Bandwidth, Non-Sweeping Operation, Low Frequency

99% Bandwidth= 11.00 MHz

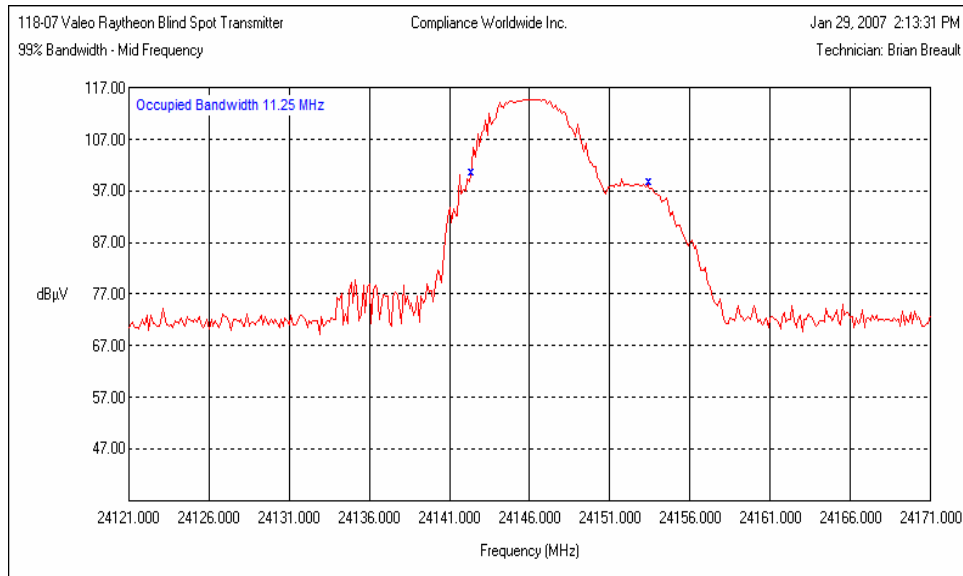


6. Measurement Data (continued)

6.4. 99% Bandwidth (continued)

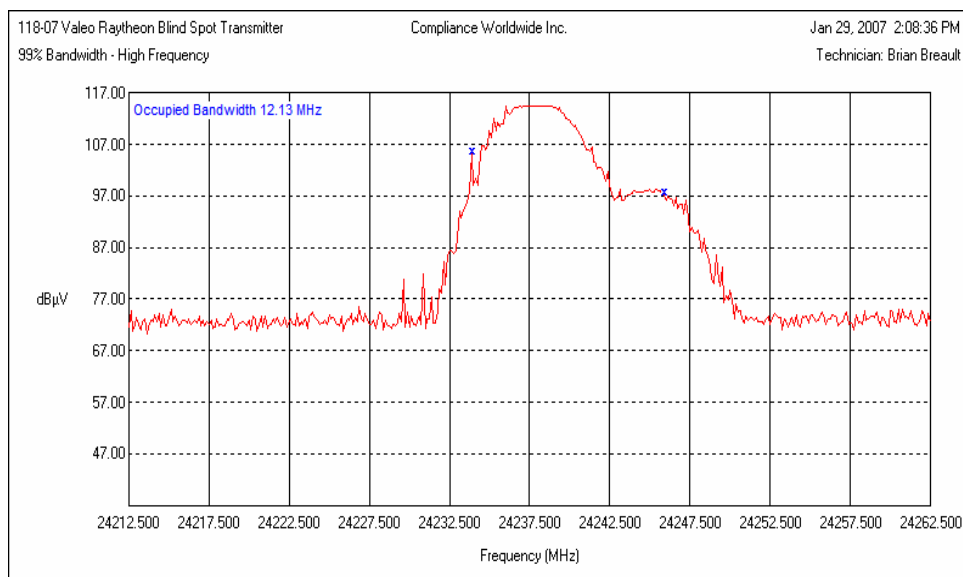
6.4.3. 99% Bandwidth, Non-Sweeping Operation, Middle Frequency

99% Bandwidth= 11.25 MHz



6.4.4. 99% Bandwidth, Non-Sweeping Operation, High Frequency

99% Bandwidth= 12.13 MHz



6. Measurement Data (continued)

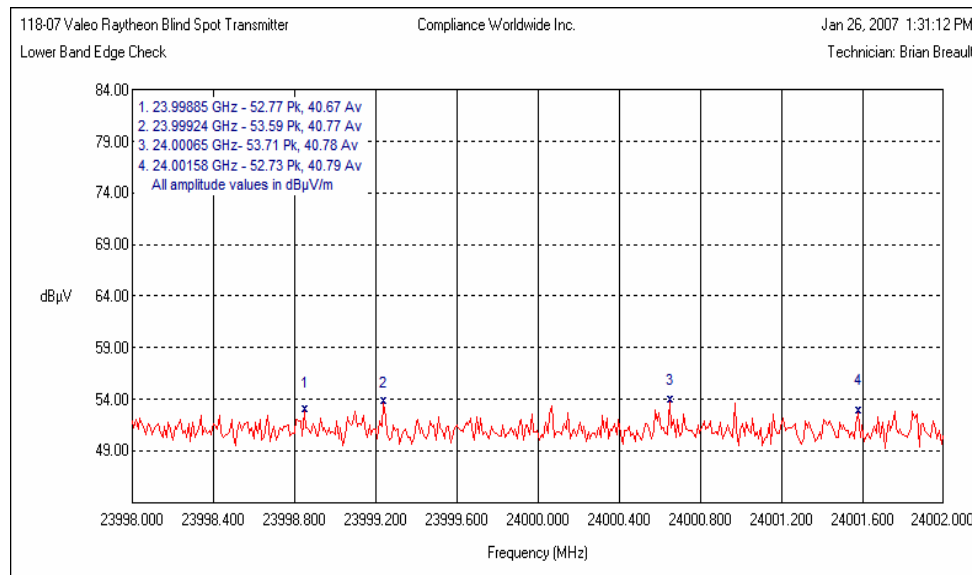
6.5. Band Edge Measurements

Requirement: Emissions radiated outside of the specified frequency band of 24 GHz to 24.25 GHz, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

6.5.1. Measurement Results – Lower Band Edge

While the device under test was running in its normal operating mode, a span of 4 MHz, centered at the lower band edge frequency of 24 GHz, was investigated. The worst case emissions in each of the two bandwidths (1 MHz) just outside the lower band edge were measured and recorded. In addition, the worst case emissions in each of the two bandwidths just inside the lower band edge were measured and recorded.

Freq. (GHz)	Amplitude (dBμV/m)		Limit (dBμV/m)	Margin (dB)	Result	Comment
	Peak	Average				
23.99885	52.8	40.7	54	-13.3	Passed	Second bandwidth outside the lower band edge.
23.99924	53.6	40.8	54	-13.2	Passed	First bandwidth outside the lower band edge.
24.00065	53.7	40.8	N/A	N/A	N/A	First bandwidth inside the lower band edge.
24.00158	52.7	40.8	N/A	N/A	N/A	Second bandwidth inside the lower band edge.



6. Measurement Data (continued)

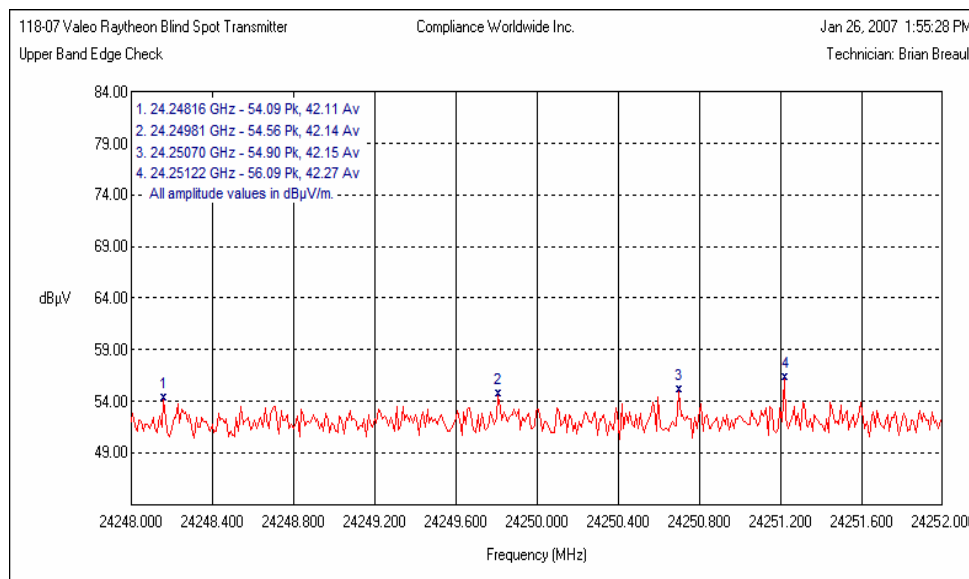
6.5. Band Edge Measurements (continued)

Requirement: Emissions radiated outside of the specified frequency band of 24 GHz to 24.25 GHz, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

6.5.2. Measurement Results – Upper Band Edge

While the device under test was running in its normal operating mode, a span of 4 MHz, centered at the upper band edge frequency of 24.25 GHz, was investigated. The worst case emissions in each of the two bandwidths (1 MHz) just outside the upper band edge were measured and recorded. In addition, the worst case emissions in each of the two bandwidths just inside the upper band edge were measured and recorded.

Freq. (GHz)	Amplitude (dBμV/m)		Limit (dBμV/m)	Margin (dB)	Result	Comment
	Peak	Average				
24.24816	54.1	42.1	N/A	N/A	N/A	Second bandwidth inside the upper band edge.
24.24981	54.6	42.1	N/A	N/A	N/A	First bandwidth inside the upper band edge.
24.25070	54.9	42.2	54	-11.8	Passed	First bandwidth outside the upper band edge.
24.25122	56.1	42.3	54	-11.7	Passed	Second bandwidth outside the upper band edge.



6. Measurement Data (continued)
6.6. Spurious Radiated Emissions, 30 MHz to EUT 10th Harmonic or 100 GHz, whichever is the lower value. (15.249, Section (d))

Requirement: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

6.6.1. Spurious Radiated Emissions, 30 MHz to EUT 10th Harmonic Test Setup
6.6.1.1. Regulatory Limit: FCC Part 209, Quasi-Peak & Average (above 1 GHz)

Frequency Range (MHz)	Distance (Meters)	Limit (dBµV/m)
30 to 88	3	40.0
88 to 216	3	43.5
216 to 960	3	46.0
Above 960	3	54.0

6.6.1.2. Measurement Equipment Used to Perform Test

The Measurement equipment used to perform spurious emissions testing is listed in section 4.1.

6.6.1.3. Measurement & Equipment Setup

Test Date:	1/11/2007
Test Engineer:	Brian Breault
Site Temperature (°C):	21.0
Relative Humidity (%RH):	36
Frequency Range:	30 MHz to 1 GHz
EMI Receiver IF Bandwidth :	120 kHz
EMI Receiver Avg Bandwidth:	300 kHz
Detector Functions:	Peak and Quasi-Peak
Frequency Range:	1 GHz to 10 th Harmonic
EMI Receiver IF Bandwidth :	1 MHz
EMI Receiver Avg Bandwidth:	3 MHz
Detector Functions:	Peak and Average
Antenna Height:	1 to 4 meters
Measurement Distance:	3 Meters ¹

¹ See the footnotes for each section of this report for any variances in the measurement distance.

6.6.1.4. Test Procedure

Test measurements were made in accordance with ANSI C63.4-2003, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz. Above 30 GHz, the FCC Millimeter Wave Test Procedures were followed.

6. Measurement Data (continued)

6.6. Spurious Radiated Emissions, 30 MHz to EUT 10th Harmonic (15.249, Section (d))

6.6.2. Spurious Radiated Emissions, 30 MHz – 1 GHz Test Results

There were no measurable spurious emissions from 30 MHz to 1 GHz.

6.6.3. Spurious Radiated Emissions, 1 GHz – 30 GHz Test Results

Peak Reading – 1 MHz RBW/3 MHz VBW

Average Reading – 1 MHz RBW/10 Hz VBW

Freq. (GHz)	Amplitude (dBμV)		Corr. Factor (dB)	Amplitude (dBμV/m)		Limit (dBμV/m)	Margin (dB)	Pol (H/V)	El. (cm)	Az. (deg)
	Peak	Avg		Peak	Avg					
1.510358	49.68	32.08	-9.28	40.40	22.80	54	-31.20	H	122	80
4.511725 ¹	50.26	32.66	0.56	50.82	33.22	54	-20.78	H	156	355
4.530050 ¹	50.20	32.60	0.56	50.76	33.16	54	-20.84	H	156	355
4.538215 ¹	50.03	32.43	0.56	50.59	32.99	54	-21.01	H	156	355
12.031400 ¹	48.86	31.26	10.86	59.72	42.12	54	-11.88	H	155	50
12.084543 ¹	50.84	33.24	10.86	61.70	44.10	54	-9.90	H	155	50
12.101803 ¹	50.98	33.38	10.86	61.84	44.24	54	-9.76	H	155	50
12.122288 ¹	51.10	33.50	10.86	61.96	44.36	54	-9.64	H	155	50

¹ – Multiple points were taken across the bandwidth of the emission. Measurement distance = 3 meters.

6.6.4. Spurious Radiated Emissions, 30 GHz – 100 GHz Test Results

6.6.4.1. Measurement made with unit in normal operating mode.

1. Refer to Section 3.1 for information regarding sweeping vs. non-sweeping modes.
2. Corr. Fact. = Cable Loss + Antenna Factor + Distance Correction.

Freq. (GHz)	Amplitude (dBμV)		Corr. Factor (dB)	Amplitude (dBμV/m)		Limit (dBμV/m)	Margin (dB)	Pol (H/V)	El. (cm)	Az. (deg)
	Peak	Avg		Peak	Avg					
36.245 ¹	43.00	25.40	16.87	56.87	42.27	54.0	-11.73	V	105	330

¹ – Measurement as taken at 1/3 meter. Cable Loss + Antenna Factor = 36.87 dB. Distance Correction = -20.0 dB.

6.6.4.2. Measurement made with unit frequency sweep stopped.

1. Refer to Section 3.1 for information regarding sweeping vs. non-sweeping modes.
2. Corr. Fact. = Cable Loss + Antenna Factor + Distance Correction.

Band	Freq. (GHz)	Amplitude (dBμV)		Corr. Factor (dB)	Amplitude (dBμV/m)		Limit (dBμV/m)	Margin (dB)	Pol (H/V)	El. (cm)	Az. (deg)
		Peak	Avg		Peak	Avg					
Low	36.005	40.80	23.20	16.87	57.67	40.07	54.0	-13.93	V	103	330
Mid	36.142	41.17	23.57	16.87	58.04	40.44	54.0	-13.56	V	103	330
High	36.278	39.40	21.80	16.87	56.27	38.67	54.0	-15.33	V	103	330

¹ – Measurement as taken at 1/3 meter. Cable Loss + Antenna Factor = 36.87 dB. Distance Correction = -20.0 dB.

6. Measurement Data (continued)

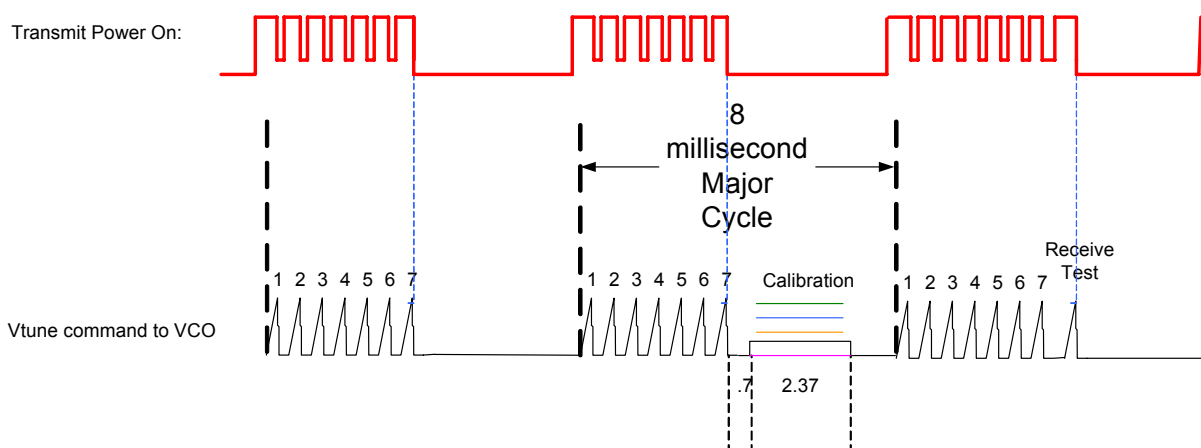
6.7. Determination of Averaging Factor

The EUT sweeps is VCO from 24.055 GHz to 24.245 GHz in 341 μ S, it repeats this sweep 7 times. There is a 150 μ S delay before each sweep begins, and after the succession of 7 pulses, there is an OFF time for calibration of the VCO at difference frequencies over the operational range. A total period for the 7 pulses and OFF time is 8 mS. This sequence is repeated 32 times, on the 32nd time there is an additional 150 μ S pulse for "receive chain testing". Therefore in a given period the device has 7 pulses of 150 μ S for a total ON time of 1.05 mS (not including the insignificant off time). Over a 100 mS period, the device completes 12.5 of 32 major cycles it performs. Using this determination the device has an ON time of

12.5 times in 100 mS. $12.5 * 1.05$ mS of ON time or a total ON time of 13.125 mS

13.125 mS (ON) / 100 mS max period = 0.13125

$20 * \text{Log}(0.13125) = -17.6$ dB averaging Factor



The test sequence for 32 major cycles is:

- | | | | |
|----------------------------------|-----------------------------|-----------------------------|-----------------------------|
| 1. Calibration Low | 9. Calibration Center Low | 17. Receive Chain Test | 25. Calibration Center Low |
| 2. Calibration Low Intermediate | 10. Calibration Center High | 18. Calibration Center High | 26. Calibration Center High |
| 3. Calibration Center | 11. Calibration Center Low | 19. Calibration Center Low | 27. Calibration Center Low |
| 4. Calibration High Intermediate | 12. Calibration Center High | 20. Calibration Center High | 28. Calibration Center High |
| 5. Calibration High | 13. Calibration Center Low | 21. Calibration Center Low | 29. Calibration Center Low |
| 6. Calibration Center High | 14. Calibration Center High | 22. Calibration Center High | 30. Calibration Center High |
| 7. Calibration Center Low | 15. Calibration Center Low | 23. Calibration Center Low | 31. Calibration Center Low |
| 8. Calibration Center High | 16. Calibration Center High | 24. Calibration Center High | 32. Calibration Center High |

High	= 24.245 GHz
High Intermediate	= 24.1975 GHz
Center	= 24.150 GHz
Low Intermediate	= 24.1025 GHz
Low	= 24.055 GHz

7. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with Federal Communications Commission (FCC) and Industry Canada standards. A description of the test sites is on file with the FCC (registration number **96392**) and Industry Canada (file number **IC 3023A-1**).

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane required by EN 55022.

Both sites are designed to test products or systems 1.5 meter W x 1.5 meter L x 2.0 meter H, floor standing or table top.