



Nemko

Test Report: 5W46573

Applicant: DragonWave Inc.

Apparatus: AirPair 24 GHz 24UL, Point to Point Radio and Modem

FCC ID: QB8-DWR24-000002

In Accordance With: FCC Part 15 Subpart C, 15.249
Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz
Class II Permissive Change

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Date: 24 June 2005

Total Number of Pages: 34

Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed:	AirPair 24 GHz 24UL, Point to Point Radio and Modem
Specification:	FCC Part 15 Subpart C, 15.249
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release

Author: Roman Kuleba

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TABLE OF CONTENTS

Report Summary.....	2
Section 1 : Equipment Under Test.....	4
1.1 Product Identification	4
1.2 Samples Submitted for Assessment.....	4
1.3 Theory of Operation	5
1.4 Technical Specifications of the EUT	6
1.5 Block Diagram of the EUT.....	6
Section 2 : Test Conditions.....	7
2.1 Specifications	7
2.2 Deviations From Laboratory Test Procedures	7
2.3 Test Environment	7
2.4 Test Equipment.....	7
Section 3 : Observations	8
3.1 Modifications Performed During Assessment	8
3.2 Record Of Technical Judgements	8
3.3 EUT Parameters Affecting Compliance	8
3.4 Test Deleted.....	8
Section 4 : Results Summary	9
4.1 FCC Part 15 Subpart C : Test Results	10
Appendix A : Test Results.....	11
1. Occupied Bandwidth.....	11
2. Field Strength of Emissions	18
3. Out of Band Emissions	20
Appendix B : Setup Photographs	33
Appendix C : Block Diagram of Test Setups.....	34

Section 1 : Equipment Under Test

1.1 Product Identification

The Equipment Under Test was identified as follows:

AirPair 24 GHz 24UL, Point to Point Radio and Modem

1.2 Samples Submitted for Assessment

The following samples of the apparatus have been submitted for type assessment:

Sample No.	Description	Serial No.
1	12" (1 ft) 24 GHz Antenna, Model No.: HPCPE – 24DW	986
2	24" (2 ft) 24 GHz Antenna, Model No.: HP2 – 24DW	12235
3	36" (3 ft) 24 GHz Antenna, Model No.: HP3 – 24DW	8877
4	DragonWave AirPair Modem	G006
5	DragonWave AirPair Radio	DW410155
6	120 VAC to 48 VDC Power Supply (Adaptor)	100480-000067

The first samples were received on: June 9, 2005

1.3 Theory of Operation

AirPair is a 24 GHz Point to Point Radio and Modem used as a building element for Ethernet systems, optimized for IP traffic. It can be deployed in a mesh, hub or point-to-point configuration enabling network availability of 99.999%, on distances of up to 4 km. The desired configuration depends on the target application:

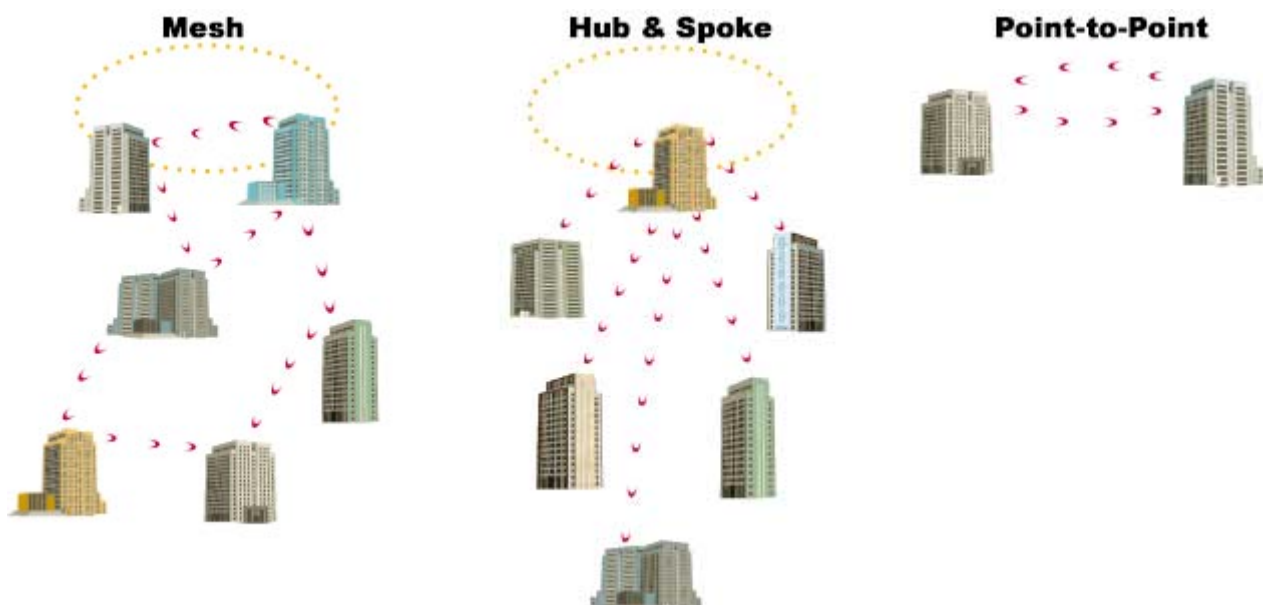
AirPair Mesh – Provides 99.999% availability at lowest cost

AirPair Hub – Enables service deployment across a wide area

AirPair Point-to-Point – Used for deployment of link-by link capacity

The AirPair system is designed for all-outdoor and split indoor/outdoor mounting. The Outdoor Unit (ODU) is designed with a weatherproof all-outdoor packaging. A custom cable is used to connect from the base to the modem. This cable contains the DC power to the modem as well as the Cat5 Ethernet cable for user data. A second 1.8 m (6ft) RG 214/U coaxial cable is used to connect the radio to the modem. A RS-232 port for craft and PDA access, as well as all LEDs are used for testing, installation and trouble shooting.

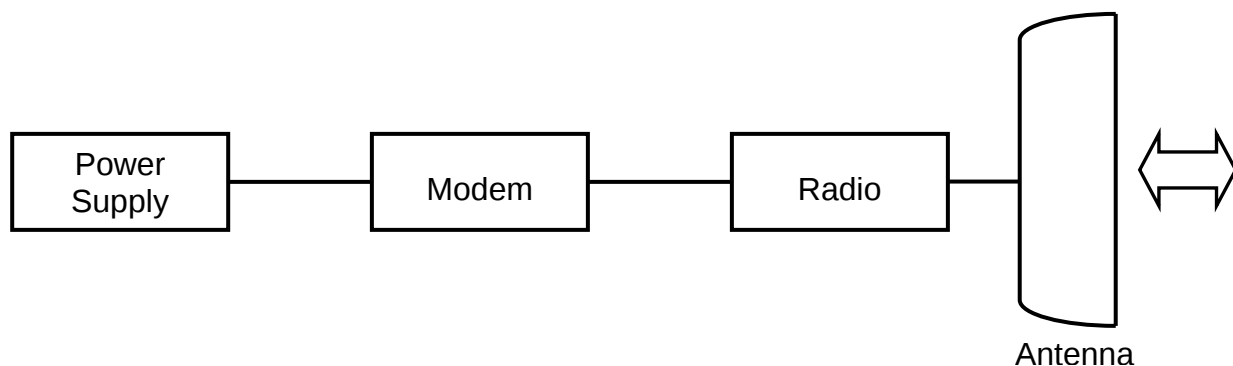
AirPair Network Configurations:



1.4 Technical Specifications of the EUT

Manufacturer:	DragonWave Inc.
Operating Frequency:	24.08 – 24.22 GHz
Emission Designator:	53MG1W
Modulation:	QPSK (at 50 mbps), 16 QAM (at 100 mbps), 32 QAM and 64 QAM (at 200 mbps)
Antenna Data:	12" 24 GHz Antenna HPCPE – 24DW, 35.3 dBi 24" 24 GHz Antenna HP2 – 24DW, 40.7 dBi 36" 24 GHz Antenna HP3 – 24DW, 44.2 dBi
Power Source:	120 VAC to 48 VDC

1.5 Block Diagram of the EUT



Section 2 : Test Conditions

2.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, §15.249

2.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

2.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	15 – 30 °C
Humidity range	:	20 - 75 %
Pressure range	:	86 - 106 kPa
Power supply range	:	+/- 5% of rated voltages

2.4 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Rhode & Schwarz	FSP40	FA001920	Mar. 22, 05	Mar. 22, 06
RF AMP	Narda	18 - 26.5GHz	FA001550	COU*	COU*
Variable Attenuator	Hewlett-Packard	8495	S/N: 3308A01551	COU*	COU*
Horn Antenna	EMCO #5	3116	FA001847	Apr 25, 05	Apr 25, 06

* COU (Calibrate on Use)

** NCR (No Calibration Required)

Section 3 : Observations

3.1 Modifications Performed During Assessment

No modifications were performed during assessment.

3.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

3.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

3.4 Test Deleted

No Tests were deleted from this assessment.

Section 4 : Results Summary

This section contains the following:

FCC Part 15 Subpart C: Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- N No : not applicable / not relevant.
- Y Yes : Mandatory i.e. the apparatus shall conform to these tests.
- N/T Not Tested, mandatory but not assessed. (See section 3.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

4.1 FCC Part 15 Subpart C : Test Results

Part 15	Test Description	Required	Result
15.207 (a)	Powerline Conducted Emissions	N	N/A
15.249 (a) (b)	Field Strength of Emissions (Fundamental)	Y	Pass
(c) (e)			
15.249 (d)	Out of Band Emissions	Y	Pass
15.249 (b) (2)	Frequency Stability	N	N/A

Notes:

This report is issued for a *Class II Permissive Change* to the originally certified 24GHz unlicensed band Point-to-Point Radio under FCC ID: QB8-DWR24-000002.

The originally certified 24UL radio featured data rates of 50 and 100 mbps using modulations of QPSK and 16 QAM respectively.

The change on the EUT is to add the availability of an increased data rate to 200 mbps using a 64 QAM modulation scheme. This increase in data rate is achieved through software and no changes in hardware have been done.

The IF input from the modem (ODU or IDU) will provide the various modulation schemes to the radio as shown below.

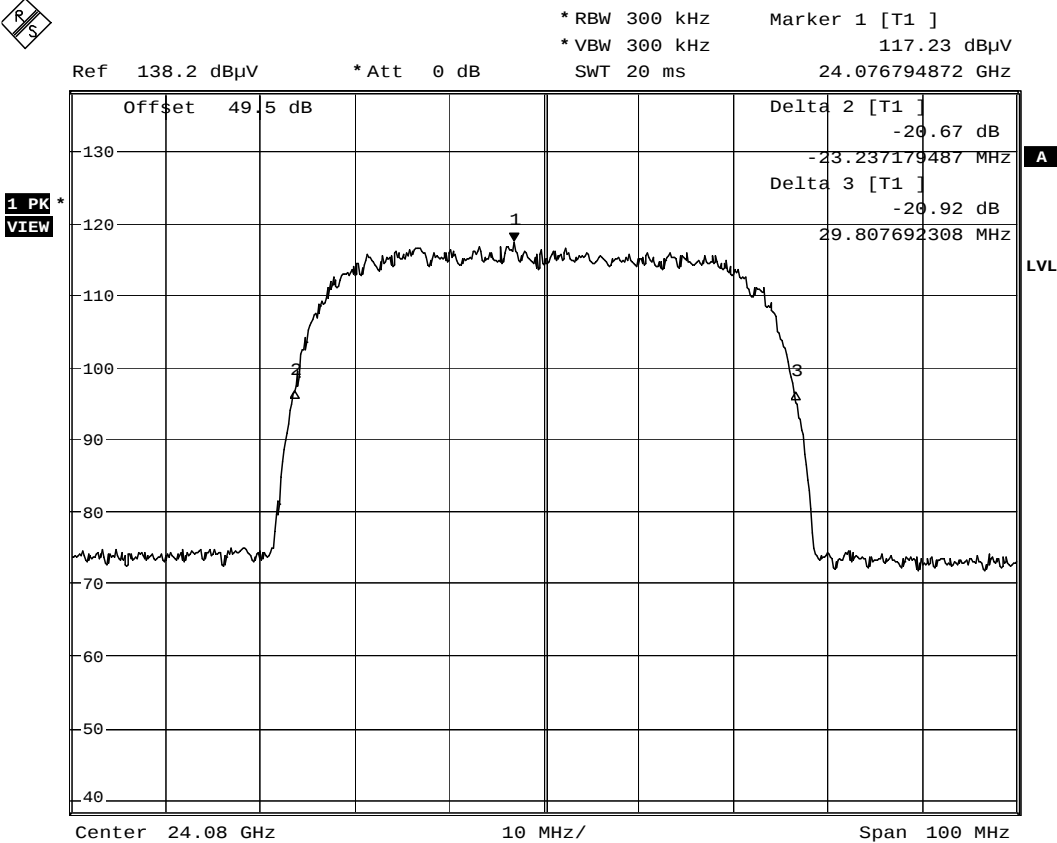
The ODU and IDU modems are functionally identical from an RF perspective.

Compliance data for these modems can be found in Nemko test report 5R38293, FCC part 15B, verification.

Appendix A : Test Results

1. Occupied Bandwidth

20 dB Occupied Bandwidth, Low Channel

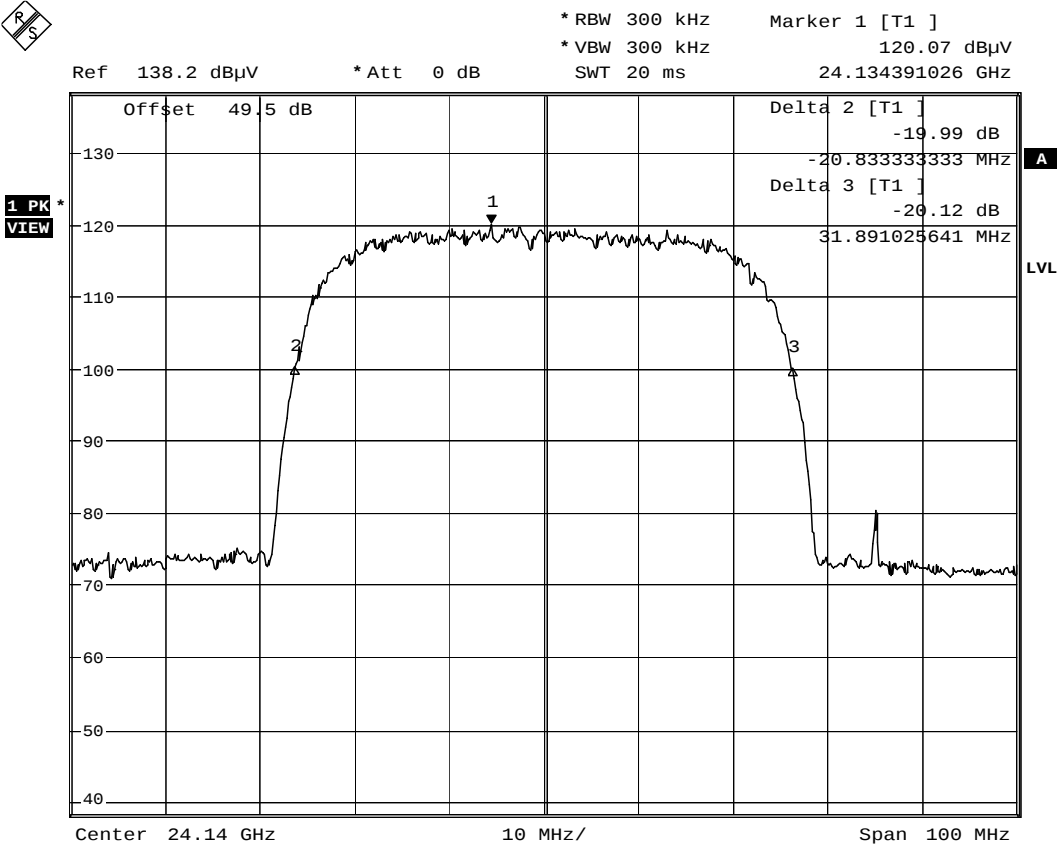


Date: 14.JUN.2005 12:46:21

Measured Bandwidth = 23.237 MHz + 29.808 MHz = 53.045 MHz

Occupied Bandwidth, continued

20 dB Occupied Bandwidth, Mid Channel

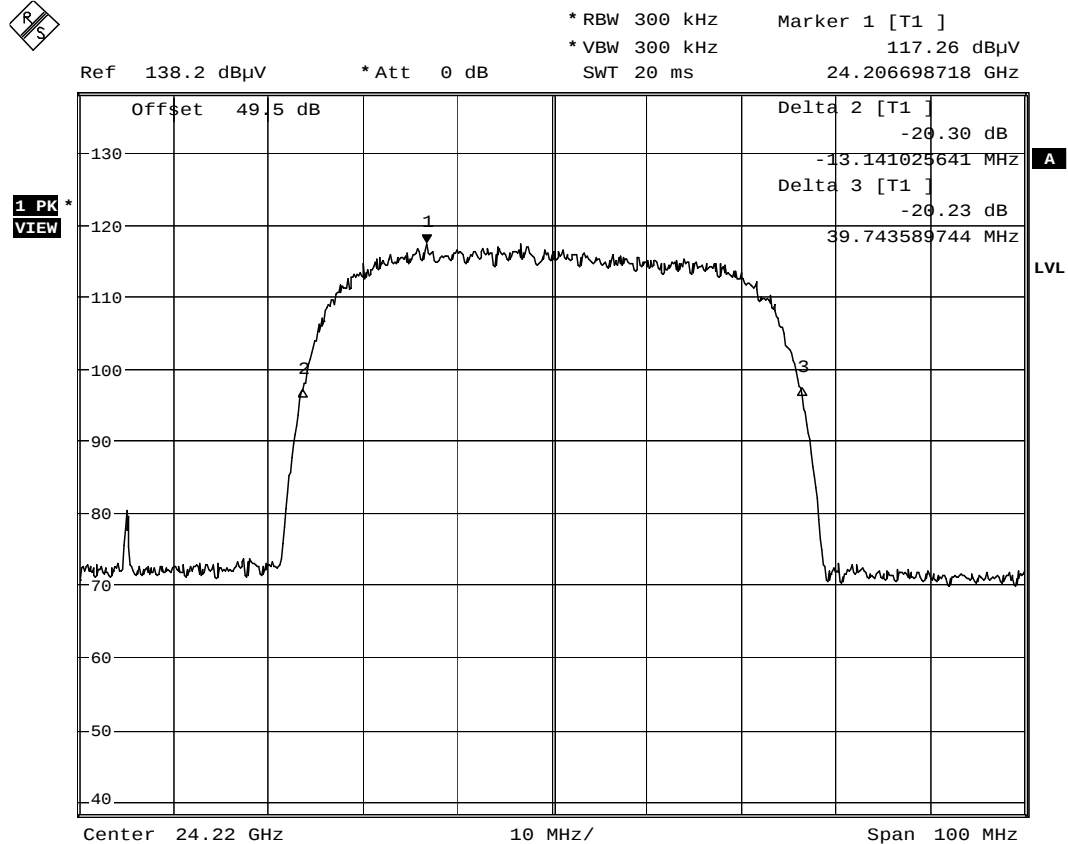


Date: 14.JUN.2005 12:38:31

Measured Bandwidth = 20.833 MHz + 31.891 MHz = 52.724 MHz

Occupied Bandwidth, continued

20 dB Occupied Bandwidth, High Channel

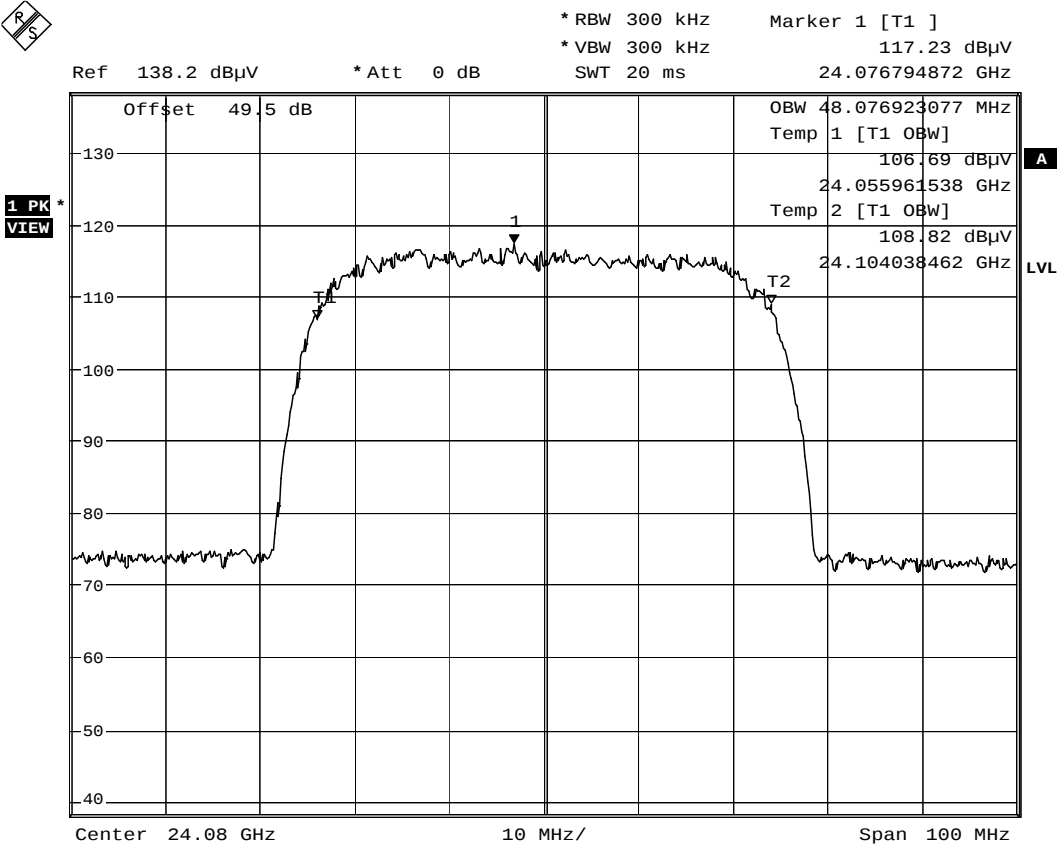


Date: 14.JUN.2005 12:52:46

Measured Bandwidth = 13.141 MHz + 39.744 MHz = 52.885 MHz

Occupied Bandwidth, continued

99 % Occupied Bandwidth, Low Channel

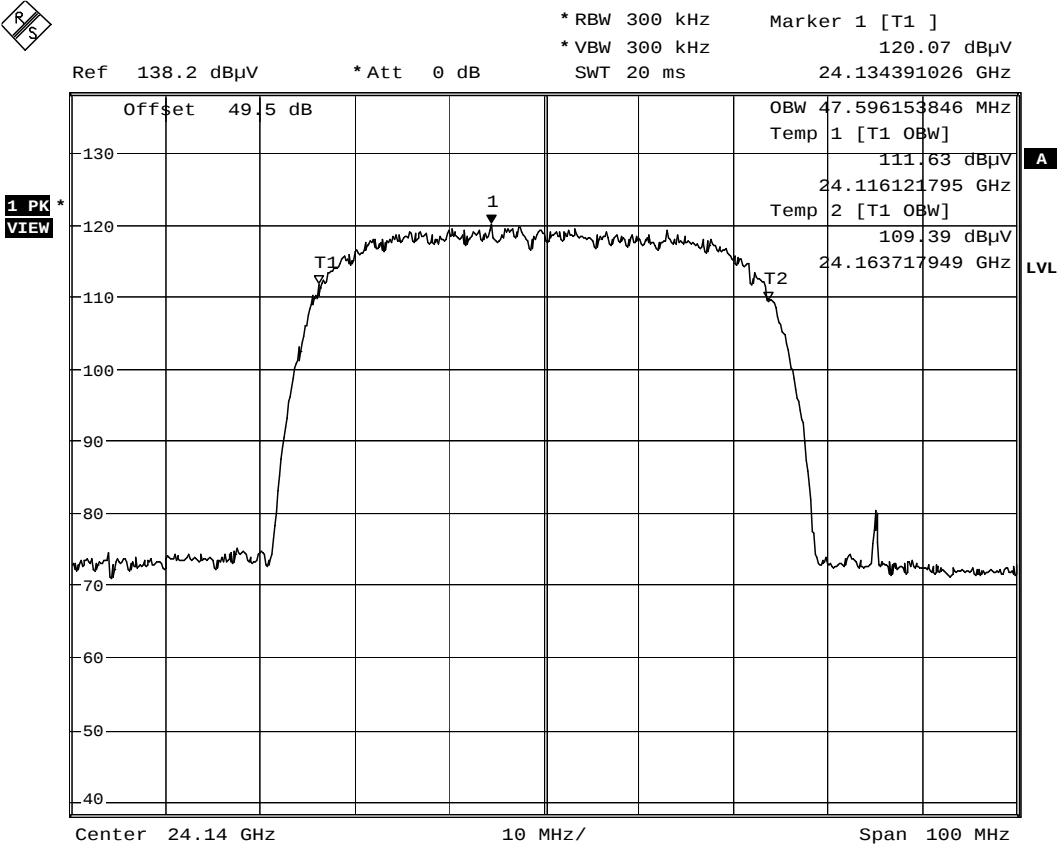


Date: 14.JUN.2005 12:47:18

Measured Bandwidth = 48.077 MHz

Occupied Bandwidth, continued

99 % Occupied Bandwidth, Mid Channel

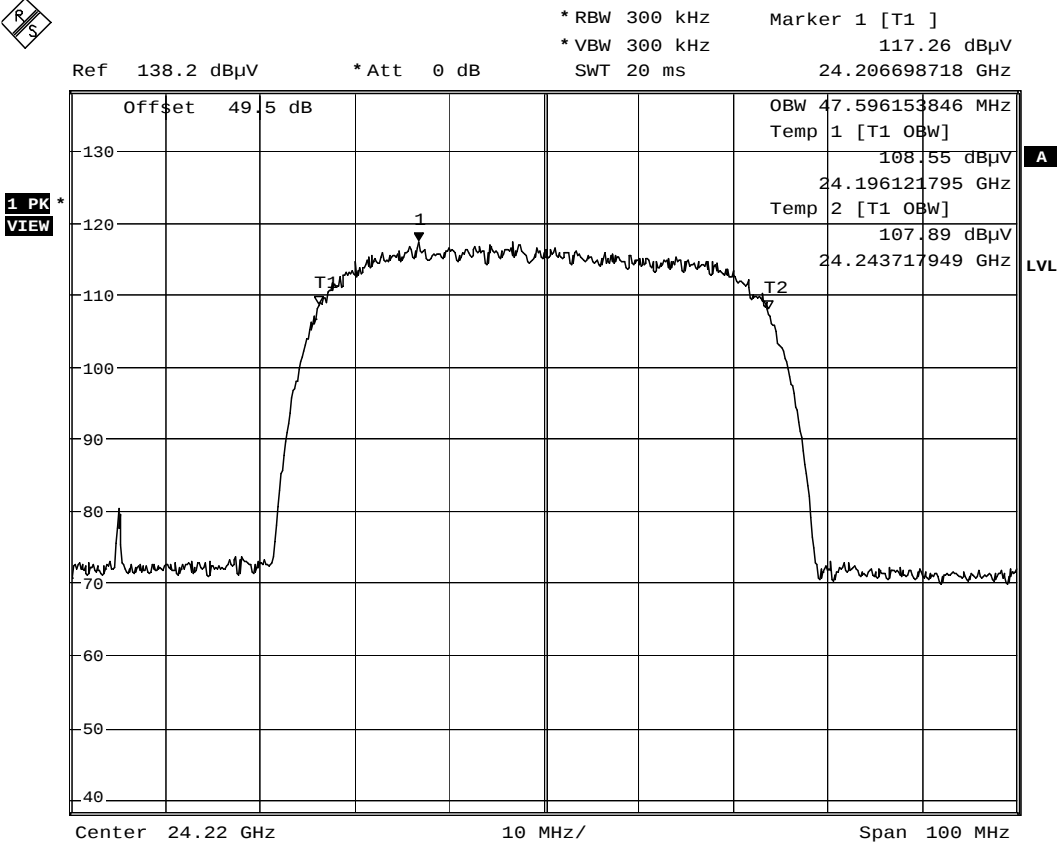


Date: 14.JUN.2005 12:40:12

Measured Bandwidth = 47.596 MHz

Occupied Bandwidth, continued

99 % Occupied Bandwidth, High Channel



Date: 14.JUN.2005 12:53:22

Measured Bandwidth = 47.596 MHz

Occupied Bandwidth, continued

Measured Occupied Bandwidth

Channel	Frequency (GHz)	20 dB OccBW (MHz)	99% OccBW (MHz)
Low	24.08	53.045	48.077
Mid	24.14	52.724	47.596
High	24.22	52.885	47.596

2. Field Strength of Emissions

Criteria: Clause 15.249(a)(b)(c)(e) Field Strength of Emissions from Intentional Radiators

§15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz.

§15.249 (a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

(b) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omni-directional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the **24.05 -24.25 GHz** band subject to the following conditions:

(1) The field strength of emissions in this band shall not exceed 2500 millivolts/meter.

(c) Field strength limits are specified at a distance of 3 meters.

(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. 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 condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

Test Conditions:

Sample Number:	5	Temperature:	23 °C
Date:	June 14, 2005	Humidity:	45 %
Modification State:	0	Tester:	Roman Kuleba
		Laboratory:	Ottawa

Test Results: See Attached Table for Results

Additional Observations:

All measurements were performed using a Peak Detector with 1MHz RBW at a test distance of 3 meters.

Field Strength of Emissions, continued

Test Antenna: Double Ridged WaveGuide Horn, 18 – 40 GHz

Polarization: Vertical

AF: 46.2 dB/m

Cable Loss: 3.3 dB

Distance: 3 m

Detector: Peak

RBW = VBW:1 MHz

Channel	Frequency (GHz)	Field Strength (dBuV/m)	Limit (dBuV/m)	Margin (dB)
12" (1 ft) 24 GHz Antenna (HPCPE – 24DW):				
Low	24.08	124.98	128	3.02
Mid	24.14	125.74	128	2.26
High	24.22	126.48	128	1.52
24" (2 ft) 24 GHz Antenna (HP2 – 24DW):				
Low	24.08	115.26	128	12.74
Mid	24.14	114.8	128	13.2
High	24.22	114.22	128	13.78
36" (3 ft) 24 GHz Antenna (HP3 – 24DW):				
Low	24.08	109.03	128	18.97
Mid	24.14	109.64	128	18.36
High	24.22	109.54	128	18.46

3. Out of Band Emissions

Criteria: Clause 15.249 (d) Out of Band Emissions

§15.249 (d) 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 §15.209, whichever is the lesser attenuation.

Test Conditions:

Sample Number:	5	Temperature:	23 °C
Date:	June 14, 2005	Humidity:	45 %
Modification State:	0	Tester:	Roman Kuleba
		Laboratory:	Ottawa

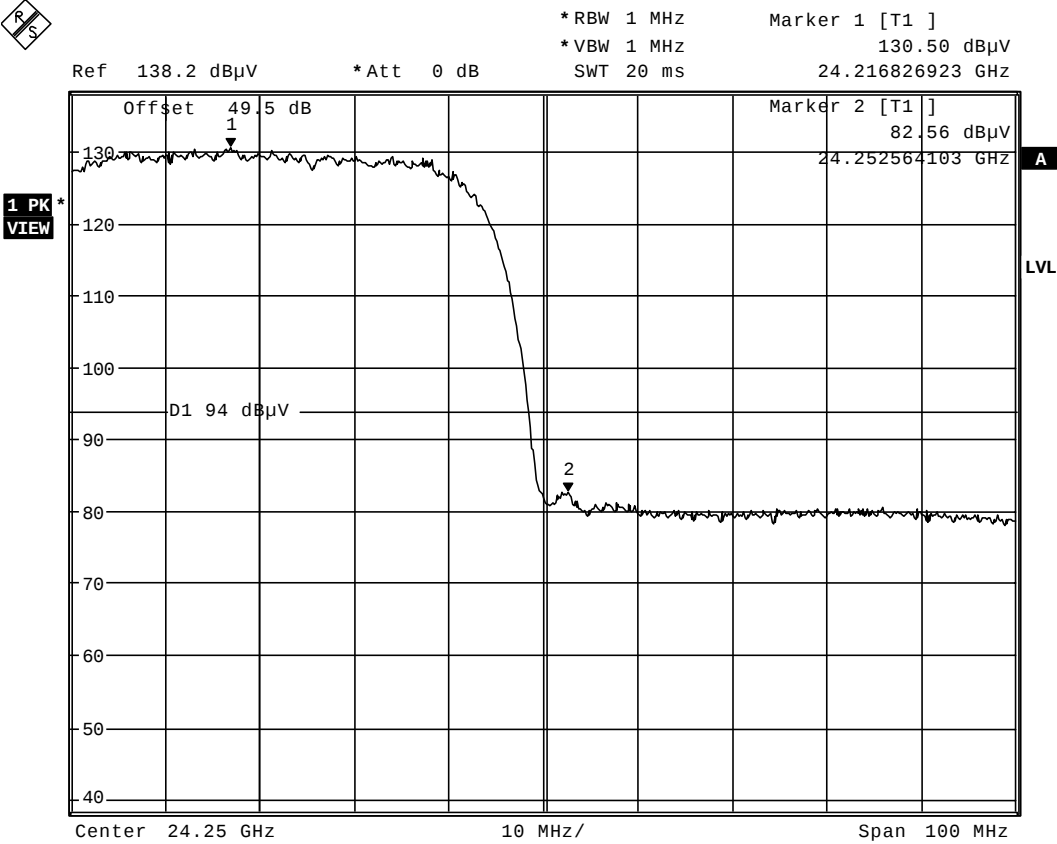
Test Results: See Attached Plots

Note:

Due to the un-sufficient sensitivity of the test equipment the emissions had to be measured at 0.3 m distance and the limits were extrapolated to correspond with the distance.

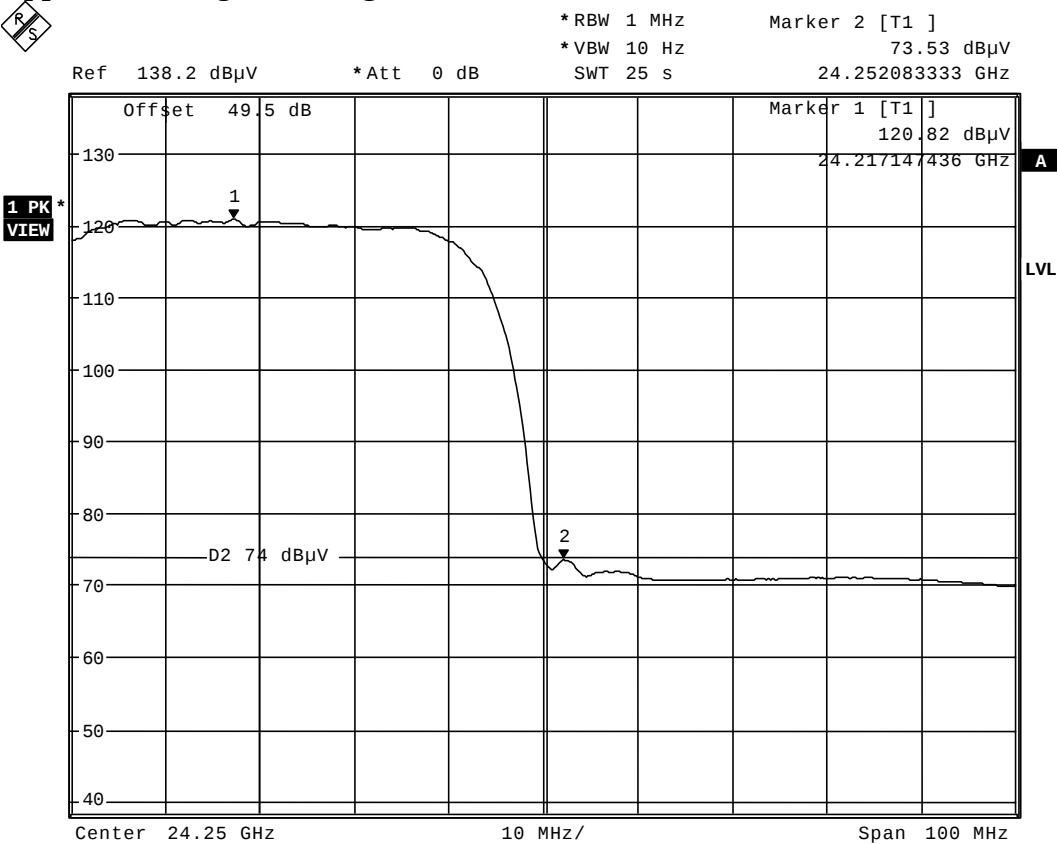
Out of Band Emissions, continued

Antenna: 12" (HPCPE – 24DW)
Upper Band Edge – Peak



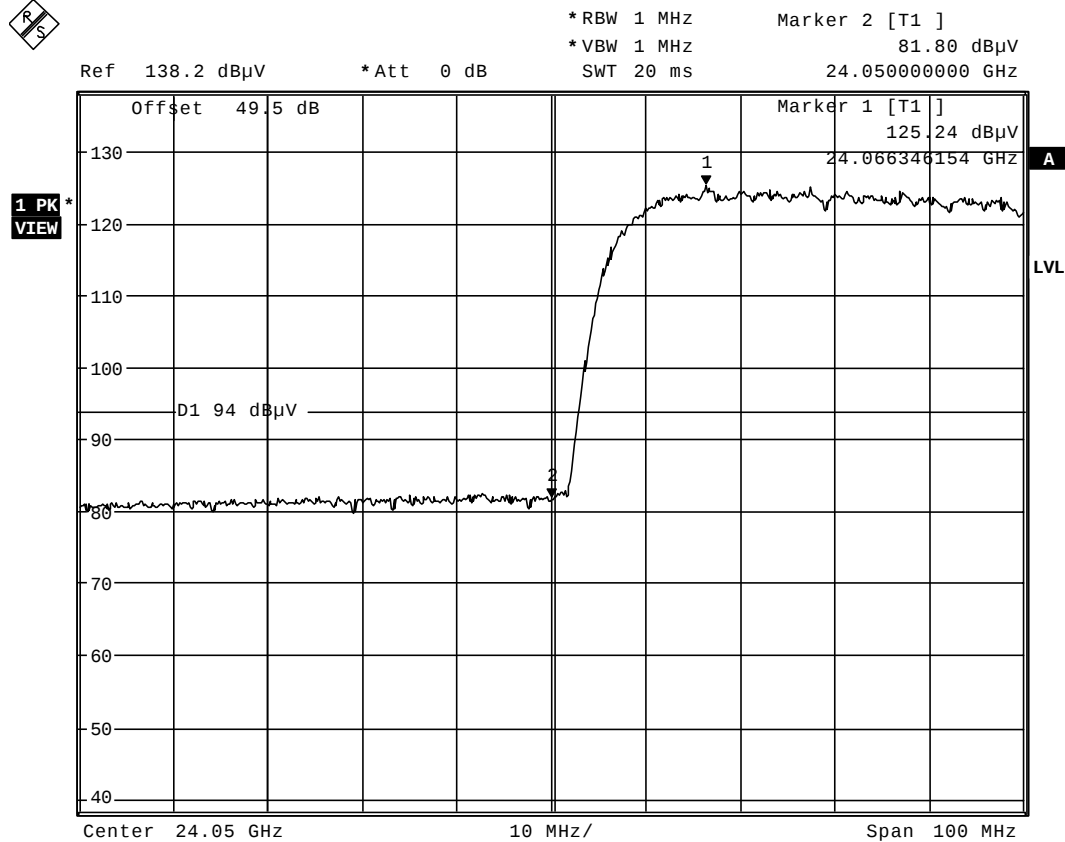
Out of Band Emissions, continued

Antenna: 12" (HPCPE – 24DW)
Upper Band Edge – Average



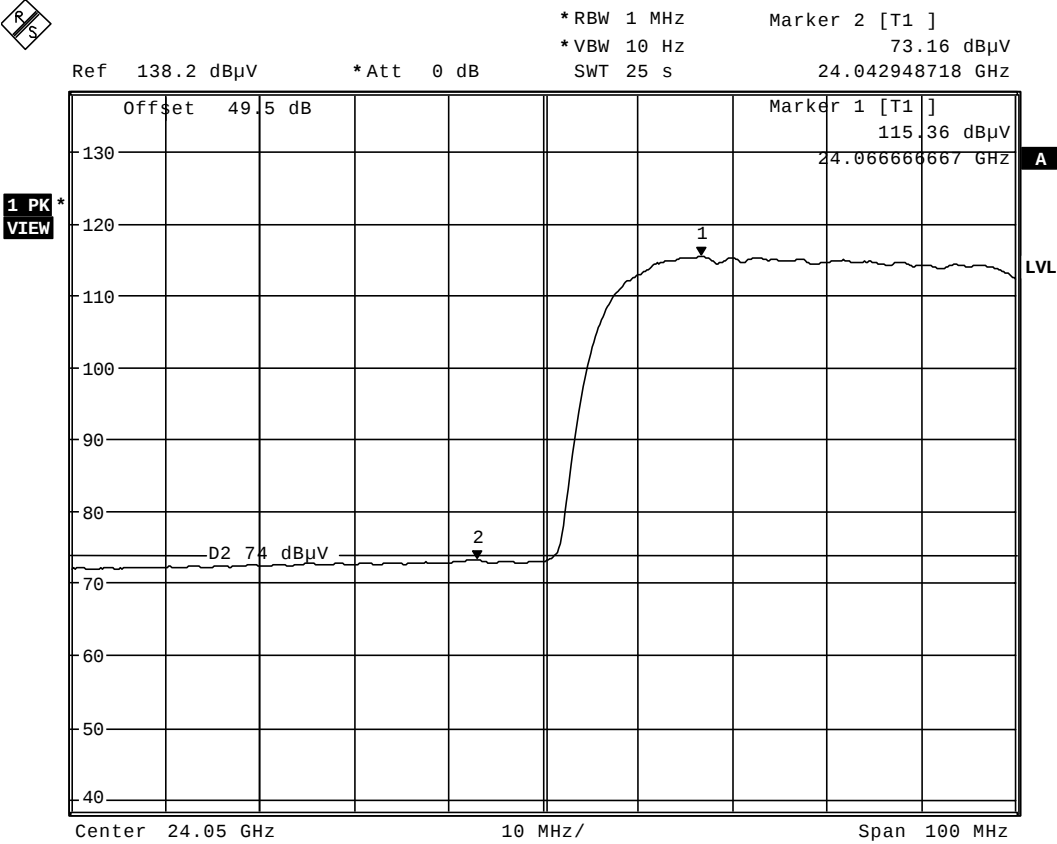
Out of Band Emissions, continued

Antenna: 12" (HPCPE – 24DW)
Lower Band Edge – Peak



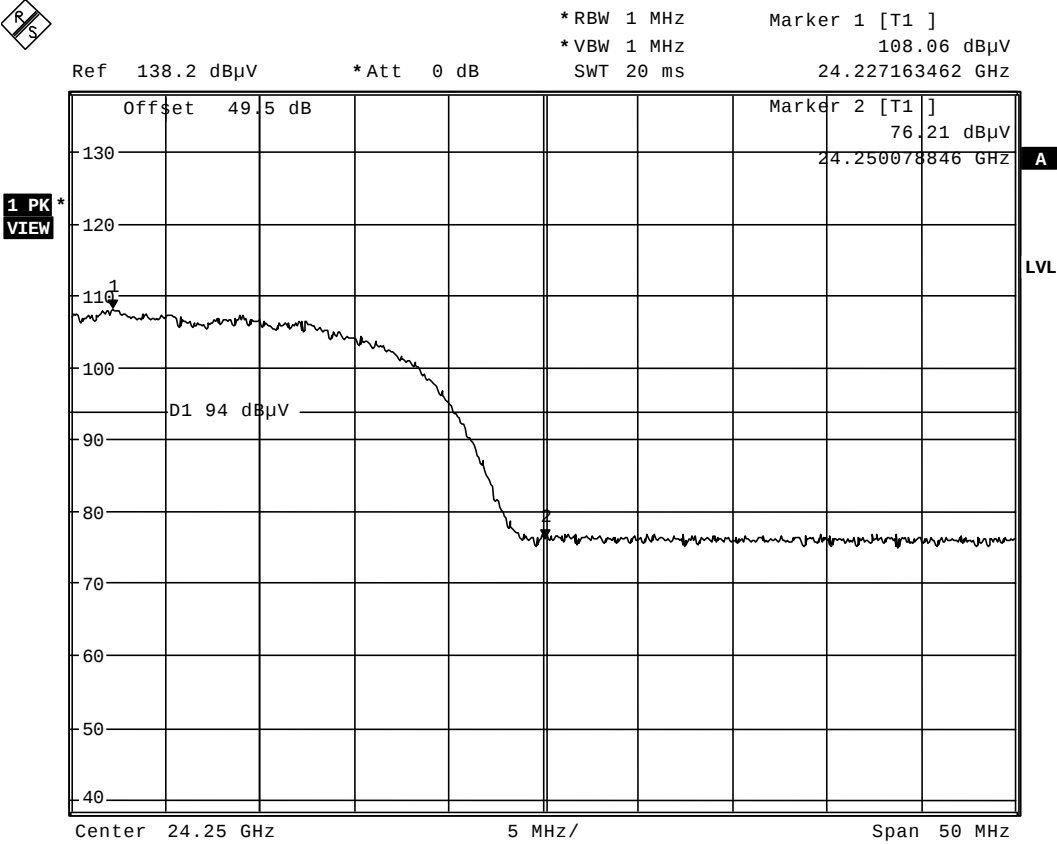
Out of Band Emissions, continued

Antenna: 12" (HPCPE – 24DW)
Lower Band Edge – Average



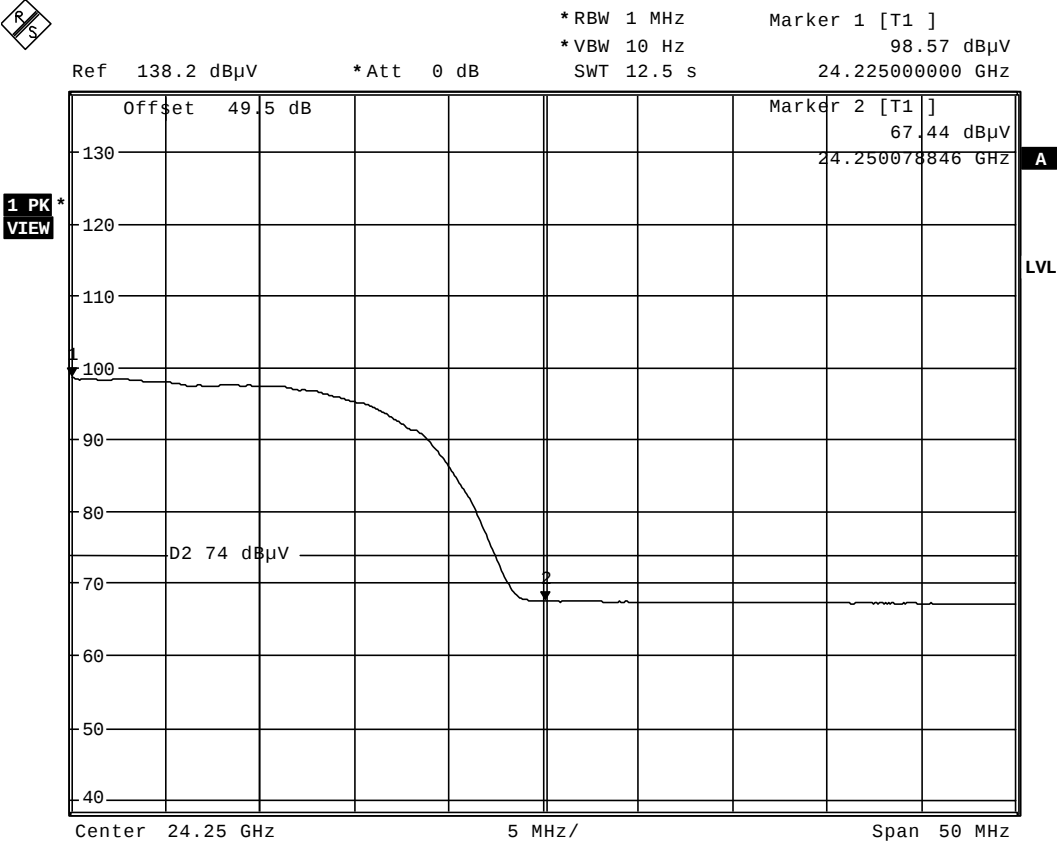
Out of Band Emissions, continued

Antenna: 24" (HP2 – 24DW)
Upper Band Edge – Peak



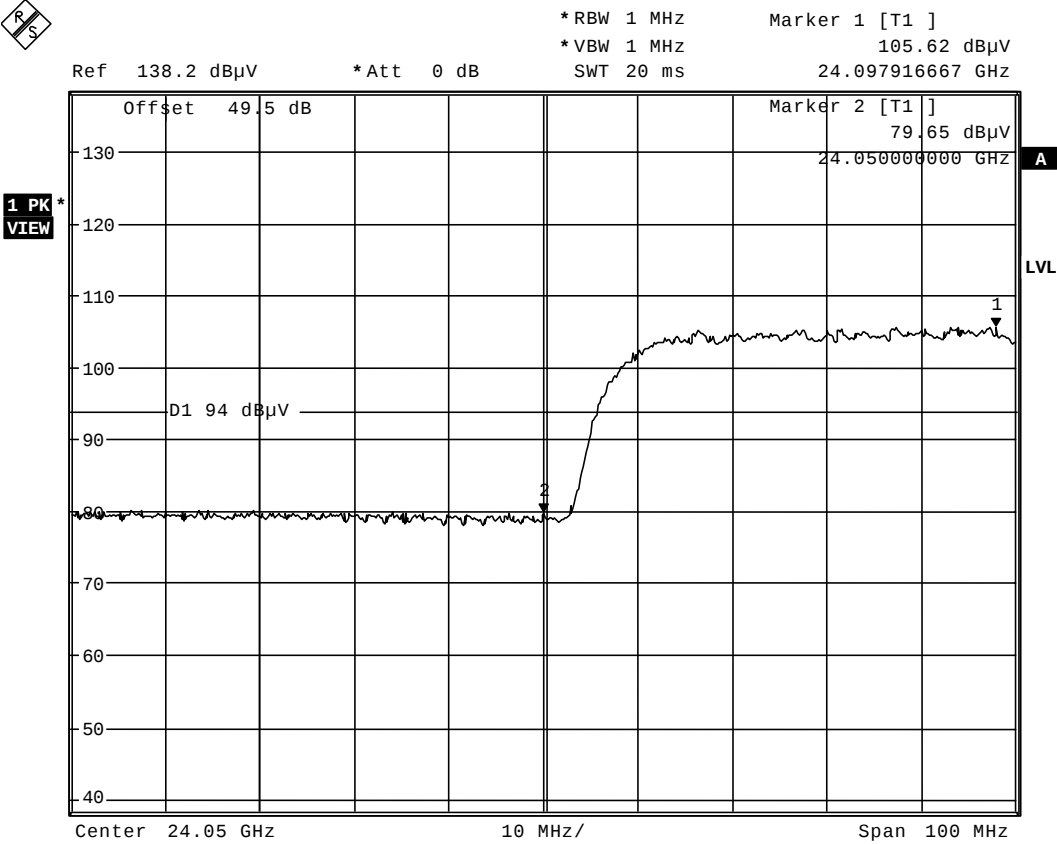
Out of Band Emissions, continued

Antenna: 24" (HP2 – 24DW)
Upper Band Edge – Average



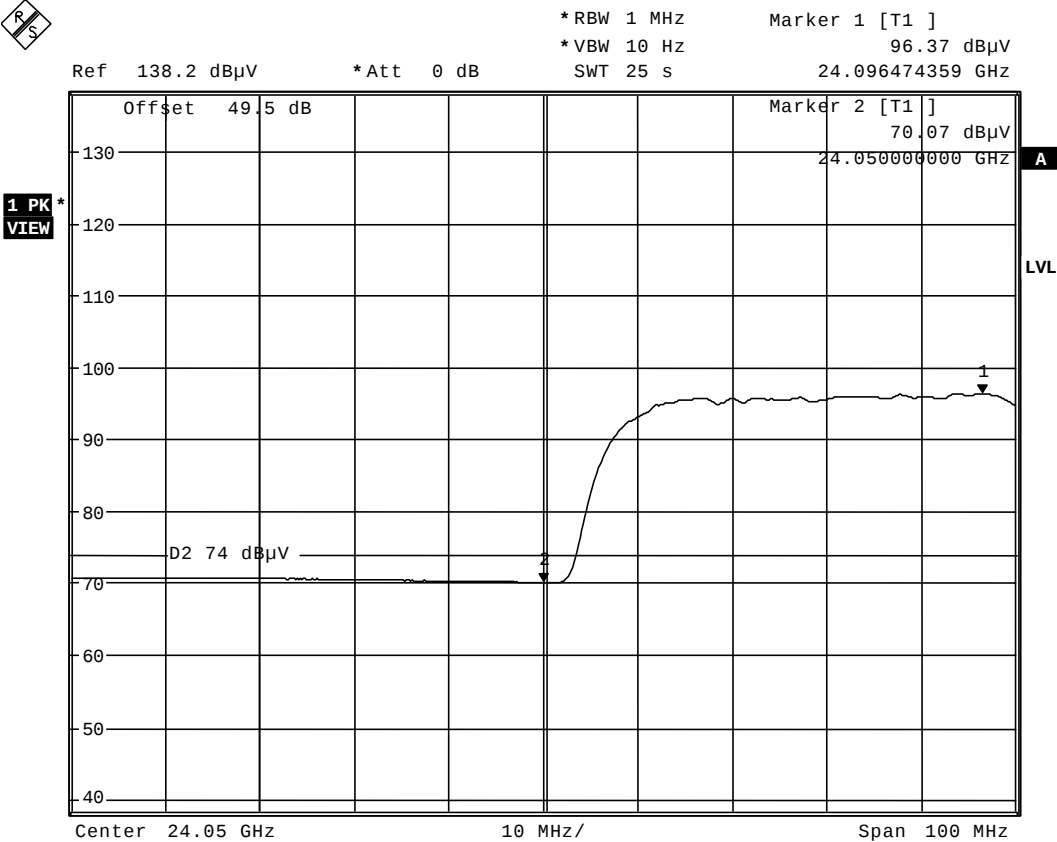
Out of Band Emissions, continued

Antenna: 24" (HP2 – 24DW)
Lower Band Edge – Peak



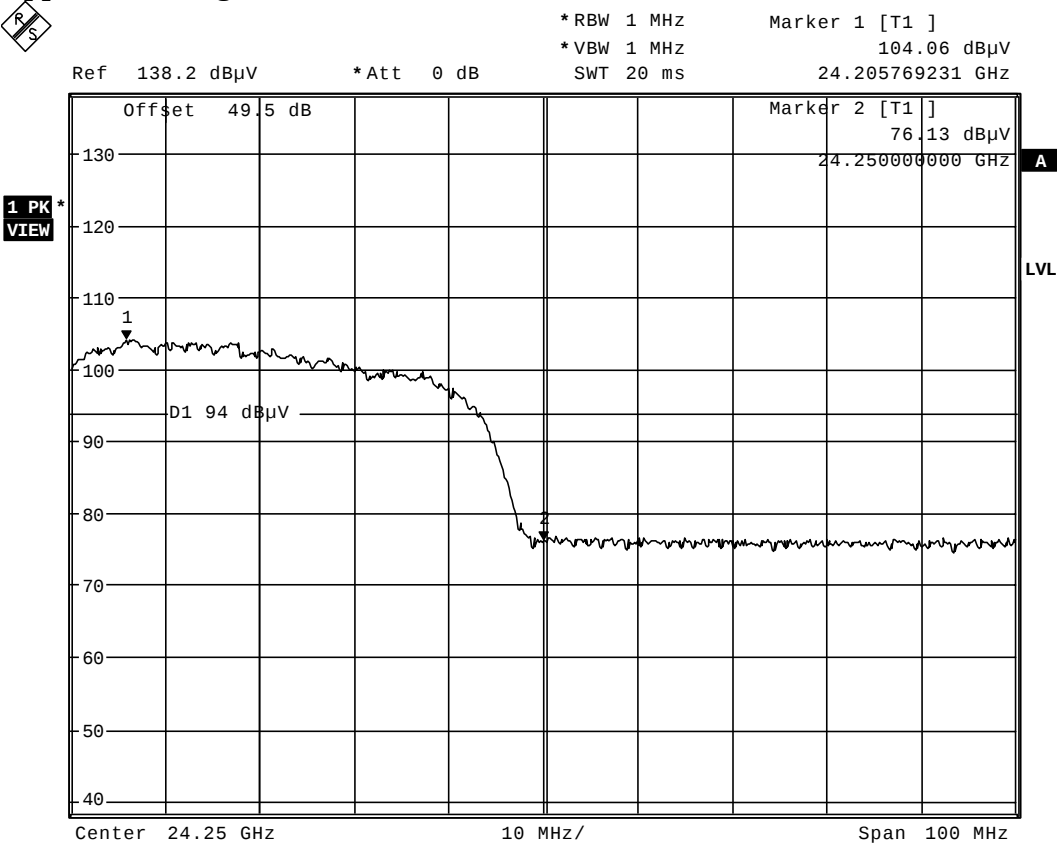
Out of Band Emissions, continued

Antenna: 24" (HP2 – 24DW)
Lower Band Edge – Average



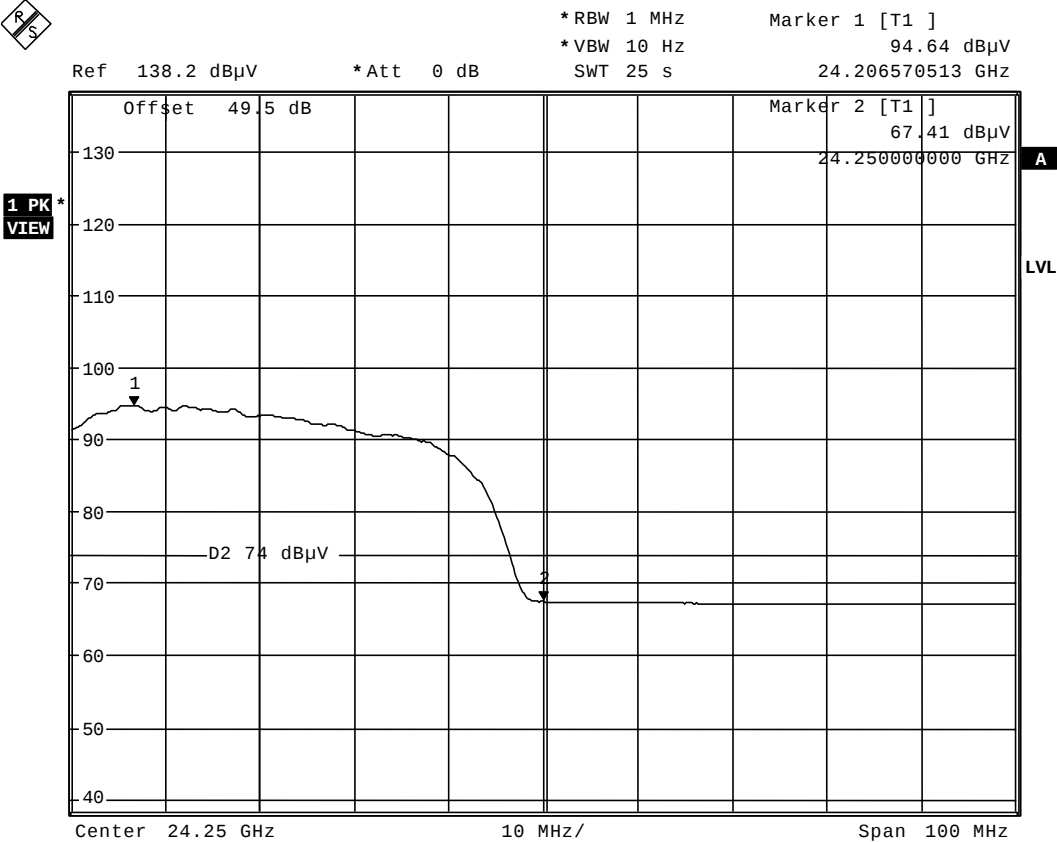
Out of Band Emissions, continued

Antenna: 36" (HP3 – 24DW)
Upper Band Edge – Peak



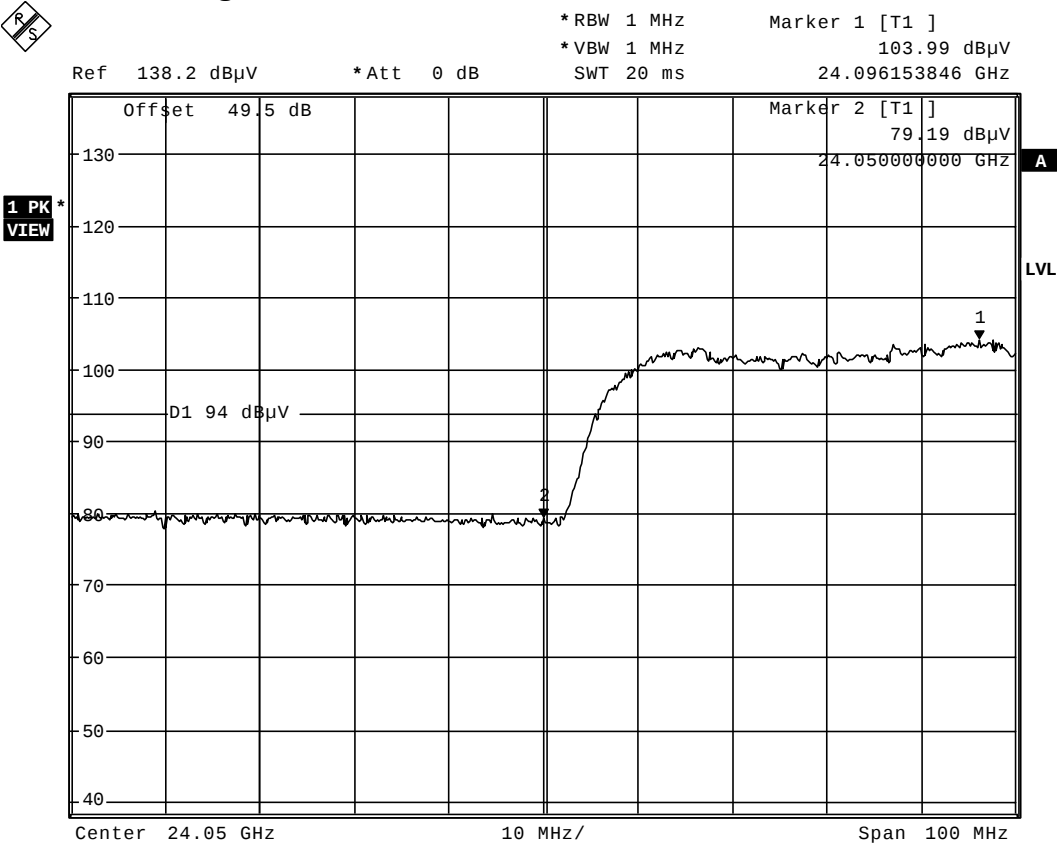
Out of Band Emissions, continued

Antenna: 36" (HP3 – 24DW)
Upper Band Edge – Average



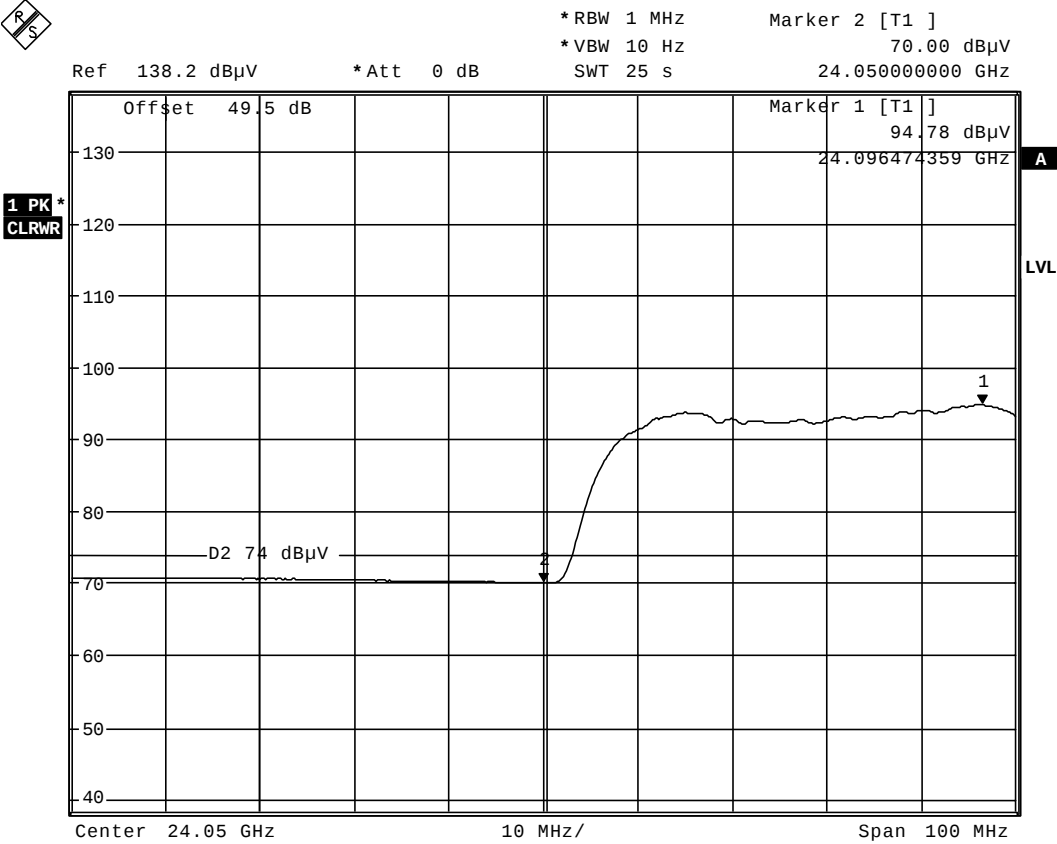
Out of Band Emissions, continued

Antenna: 36" (HP3 – 24DW)
Lower Band Edge – Peak



Out of Band Emissions, continued

Antenna: 36" (HP3 – 24DW)
Lower Band Edge – Average



Appendix B : Setup Photographs

Field Strength of Emissions (Fundamental) Test Setup Testing Distance 3 m

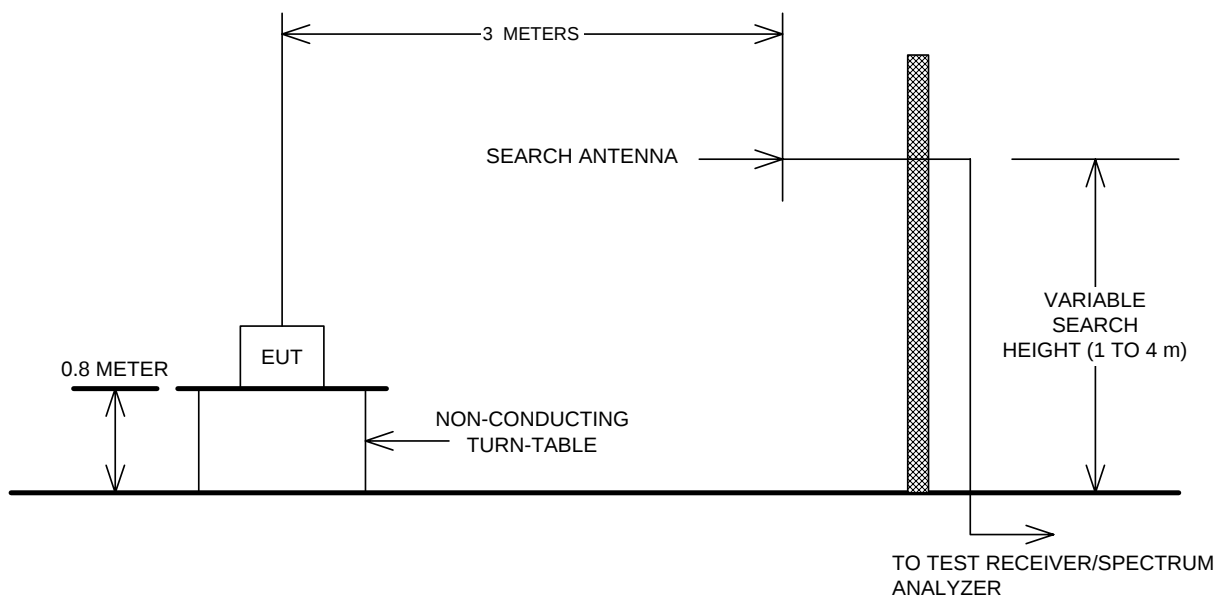


Out of Band Emissions Setup Testing Distance: 0.3 m



Appendix C : Block Diagram of Test Setups

Test Site For Radiated Emissions



Conducted Emissions

