Certification Test Report

CFR 47 FCC Part 15, Subpart C Section 15.247
Industry Canada RSS 210, Issue 7

Novatel Wireless Inc
MiFi-2352R

FCC ID # NBZNRM-MIFI2352R
IC ID # 3229A-MIFI2352R
Project Code CG-1290

(Report CG-1290-RA-2-2)
Revision: 2
(This report supersedes CG-1290-RA-2-1)

January 19, 2010

Prepared for:	Novatel Wireless Inc
Author:	Deniz Demirci Senior Wireless / EMC Technologist
Approved by:	Nick Kobrosly Director of Canadian Operations

Report Summary

Test Facility:	**National Technical Systems, Canada** Product Integrity Laboratory 5151-47th Street, N.E. Calgary Alberta T3J 3R2
Accreditation Numbers:	0214.22 Electrical 0214.23 Mechanical Accredited by A2LA The American Association for Laboratory Accreditation CLIENTS SERVED: All interested parties FIELDS OF TESTING: Electrical/Electronic, Mechanical/Physical ACCREDITATION DATE:: May 14, 2009 VALID TO: February 28, 2010
Applicant:	**FCC:** Novatel Wireless Inc. 9645 Scranton Rd, Suite 205 San Diego, CA 92121 **IC:** Novatel Wireless Technologies Ltd 6715 – 8th St N.E. Suite 200 Calgary, Alta. T2E-7H7
Customer Representative:	Mr. Jim Turner Regulatory Specialist Ph: (403) 295-4855 Fax: (403) 295-4801 E Mail: jturner@nvtl.com

Test Summary

Appendix	Test/Requirement Description	Deviations* from:			Pass / Fail	Applicable FCC Rule Parts	Applicable Industry Canada Rule Parts
		Base Standard	Test Basis	NTS Procedure			
A	Power line Conducted Emission	No	No	No	Pass	FCC Subpart C 15.207 (a)	RSS-Gen Issue 2 7.2.2
B	6 dB Bandwidth	No	No	No	Pass	FCC Subpart C 15.247 (a) (2)	RSS 210 Issue 7 A8.2 (a)
C	Occupied Bandwidth (99% emission bandwidth)	No	No	No	N/A	N/A	RSS-Gen Issue 2 4.6.1
D	Peak Power Output	No	No	No	Pass	FCC Subpart C 15.247 (b) (3)	RSS 210 Issue 7 A8.4 (4)
E	Power Spectral Density	No	No	No	Pass	FCC Subpart C 15.247 (e)	RSS 210 Issue 7 A8.2 (b)
F	Conducted Spurious Emissions	No	No	No	Pass	FCC Subpart C 15.247 (d)	RSS 210 Issue 7 A8.5
G	Conducted Spurious Emissions Band Edge	No	No	No	Pass	FCC Subpart C 15.247 (d)	RSS 210 Issue 7 A8.5
H	Radiated Spurious Emissions Band Edge	No	No	No	Pass	FCC Subpart C 15.247, 15.205	RSS 210 Issue 7 2.6, A8.5
I	Radiated Spurious Emissions (TX and RX)	No	No	No	Pass	FCC Subpart C 15.247, 15.205	RSS 210 Issue 7 2.6, A8.5 RSS Gen Issue 2 4.10

Test Result: The product presented for testing complied with test requirements as shown above.

Digitally signed by Deniz Demirci
Date: 2010.01.20 08:43:38 -07'00'

Prepared By: _____
Deniz Demirci
Senior Wireless / EMC Technologist

Glen Moore

Digitally signed by Glen Moore
DN: cn=Glen Moore, c=US, o=NTS, email=glen.moore@ntscorp.com
Date: 2010.01.20 09:52:28 -07'00'

Reviewed By: _____
Glen Moore
Wireless / EMC Manager

Alex Mathews
2010.01.20 11:43:46 -07'00'

Approved By: _____
Alex Mathews
Quality Management Representative

Table of Contents

Register of revisions

Revision	Date	Description of Revisions
1	December 9, 2009	Final release for customer review
2	January 19, 2010	Changes after TCB review

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Canada to demonstrate compliance of the MiFi 2352R Wireless Modem from Novatel Wireless Inc to FCC Part 15 Subpart C section 15.247 for DTS transmitter and the equivalent sections of Industry Canada's RSS 210, Issue 7

Note: The MiFi 2352R also has GSM 850, PCS 1900 and WCDMA Band II capability for which compliance test data is shown in report CG-1290-RA-1-2

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

	Name	Model	Revision / Description	Serial Number
EUT	MiFi 2352R	NRM-MiFi2352R	HW: Rev C1	001018000212028 001018000212036 PA MATCH MOD 28/10
	Power supply with Fair-Rite Part# 0461164281	KTEC KSAA0500120W 1UV-1	Input: 100-240VAC 50/60 Hz Output: 5.0V 1.2A	N/A
Classification	Mobile			
Operating Frequency Range	802.11b / 802.11g 11 channels from 2400 MHz to 2483.5 MHz Center frequency 2412 MHz to 2462 MHz			
Modulation	802.11b DQPSK, DBPSK, DSSS, CCK 802.11g BPSK, QPSK, 16QAM, OFDM			
Antenna Type/Gain	**Manufacturer:** Ethertronics Part no. M442100 See details in a separate exhibit			
Functional description	The equipment under test (EUT) is the MIFI2352R, a quad-band (850/900/1800/1900) GSM/GPRS, tri-band (900/1900/2100) WCDMA/HSPA diversity USB WWAN modem. The diversity support is in the 900, 1900 and 2100 MHz WCDMA bands. In addition to these features this product also supports 802.11 functionality, and can be operated using battery power or from a wall adapter			
Voltage/Power source	**AC Power Adaptor Input:** 100-240VAC 50/60 Hz **Output:** 5.0 V 1.2 Amps **DC Power (Battery) :** 3.7 VDC Nominal, 3.55 VDC end operating point			

Voltage/ current into final amplifier stage	The PAs are calibrated at a PA supply voltage of 4.0V. and have a current range of 10-500 mA for WCDMA operation and 500 – 2200 mA for GSM operation .
Tune up procedure	See separate exhibit
Composite device description	The MiFi 2352R also has GSM 850, PCS 1900 and WCDMA Band II capability for which compliance test data is shown in report CG-1290-RA-1-2
Emission Designators	802.11b 13M5G1D 802.11g 16M5G7D

2.2 MODE OF OPERATION DURING TESTS

The EUT was tested in all configurations to determine worst case results with 100 % duty cycle in 802.11b and 802.11g modes. See test appendices for specific EUT operating modes and conditions

3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION

The following equipment was used as the host system for the EUT

Peripheral / Device Description	Manufacturer	Model	Description	Serial Number
Laptop	DELL	INSPIRON E1420	NovAtel Wireless Test Bed 1	N/A
90W-AC Adapter	DELL	LA90PS0-00	NovAtel Wireless Test Bed 1	N/A

4.0 TEST ENVIRONMENT

4.1 NORMAL TEST CONDITIONS

Temperature:	20 – 23 °C
Relative Humidity:	28 – 35 %
Atmospheric pressure:	883 – 890 mbar
Nominal test voltage:	120 VAC 60Hz

The values are the limits registered during the test period.

APPENDICES

APPENDIX A: POWER LINE CONDUCTED EMISSION

A.1. Base Standard & Test Basis

Base Standard	FCC PART 15.207 (a) RSS-Gen Issue 2 7.2.2
Test Basis	ANSI C63.4-2003
Test Method	SOP-CAG- EMC-02

A.2. Specifications

Frequency	Limit	
	Quasi-Peak	Average
MHz	dBµV	dBµV
0.150 – 0.500	66 to 56[1]	56 to 46[1]
0.500 – 5.00	56	46
5.00 – 30.00	60	50

Note 1: decrease with the logarithm of the frequency

A.3. Test Procedure

ANSI C63.4-2003.
The EUT was pre tested in all modes including low, mid and high channel with the worst case test results being reported.
EUT was tested with DELL Laptop power supply, and KTEC power supply (See EUT description)

A.4. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

A.5. Test date

November 5, 2009

A.6. Test Results

A.6.1 Test result with DELL Laptop and power supply

Product Integrity Laboratory V2.5

Project Number: CG-1290 **Tester:** Deniz
Model: NovAtel Wireless MIFI 2352R **Test ID:** CE02tc-10m-1290
Comments: Conf71: Sample Build#4 Beta3, origHW, Rev G1, wDELLInspE1420+DELL 90W AC ps#LA90PS0-00 PCS EDGE 8PSK Ch661 1up 1down, MSTxIB 0 (2), 802.11g 54mbps 100%

Standard: FCC15_B

Voltage/Line	Frequency (MHz)	Measurement Detector	Measured Value (dBµV)	Correction Factors (dB)	Emission Level (dBµV)	Limit Type	Limit (dBµV)	Margin (dB)
AC 120V Line1A	0.161	QP	37.91	12.22	50.13	QP	65.41	**15.28**
AC 120V Line1A	0.221	QP	38.75	11.54	50.29	QP	62.77	**12.48**
AC 120V Line1A	0.274	QP	34.63	11.23	45.86	QP	61.01	**15.15**
AC 120V Line1A	0.312	QP	35.70	11.10	46.80	QP	59.91	**13.11**
AC 120V Line1A	0.463	QP	29.10	10.86	39.96	QP	56.64	**16.68**
AC 120V Line1A	0.626	QP	28.62	10.77	39.39	QP	56.00	**16.61**
AC 120V NeutralA	0.152	QP	36.46	12.20	48.66	QP	65.89	**17.23**
AC 120V NeutralA	0.230	QP	39.10	11.49	50.59	QP	62.46	**11.87**
AC 120V NeutralA	0.273	QP	34.74	11.17	45.91	QP	61.02	**15.11**
AC 120V NeutralA	0.312	QP	35.80	11.04	46.84	QP	59.91	**13.07**
AC 120V NeutralA	0.461	QP	32.40	10.80	43.20	QP	56.68	**13.48**
AC 120V NeutralA	0.625	QP	30.22	10.68	40.90	QP	56.00	**15.10**
AC 120V NeutralA	0.923	QP	26.81	10.67	37.48	QP	56.00	**18.52**
AC 120V Line1A	0.156	AV	23.97	12.32	36.29	AV	55.67	**19.38**
AC 120V Line1A	0.217	AV	27.60	11.57	39.17	AV	52.94	**13.77**
AC 120V Line1A	0.274	AV	32.48	11.21	43.69	AV	51.01	**7.32**
AC 120V Line1A	0.313	AV	34.61	11.10	45.71	AV	49.90	**4.19**
AC 120V Line1A	0.460	AV	16.68	10.86	27.54	AV	46.69	**19.15**
AC 120V Line1A	0.626	AV	23.28	10.77	34.05	AV	46.00	**11.95**
AC 120V NeutralA	0.152	AV	22.75	12.29	35.04	AV	55.89	**20.85**
AC 120V NeutralA	0.227	AV	27.19	11.52	38.71	AV	52.57	**13.86**
AC 120V NeutralA	0.273	AV	32.27	11.17	43.44	AV	51.01	**7.57**
AC 120V NeutralA	0.313	AV	34.66	11.05	45.71	AV	49.90	**4.19**
AC 120V NeutralA	0.452	AV	17.72	10.80	28.52	AV	46.85	**18.33**
AC 120V NeutralA	0.625	AV	23.87	10.69	34.56	AV	46.00	**11.44**
AC 120V NeutralA	0.936	AV	16.71	10.67	27.38	AV	46.00	**18.62**

The highest emission measured was 45.71 dBµV with average detector at 313 kHz. It has 4.19 dB margin to the FCC Part 15.207 and RSS-Gen Issue 2 7.2.2 limits.

A.6.2 Test result with KTEC power supply

Product Integrity Laboratory V2.5

Project Number: CG-1290 **Tester:** Deniz
Model: NovAtel Wireless MIFI 2352R **Test ID:** CE02tc-10m-1290
Comments: Conf54: Sample Build#4 Beta3, original HW, Rev G1 PCS EDGE 8PSK Ch661 1up 1 down, MS Tx level Burst 0 (2), 802.11g 54mbps 100% duty cycle Ch6 max power, Ktec AC ps

Standard: FCC15_B

Voltage/Line	Frequency (MHz)	Measurement Detector	Measured Value (dBµV)	Correction Factors (dB)	Emission Level (dBµV)	Limit Type	Limit (dBµV)	Margin (dB)
AC 120V Line1A	0.176	QP	27.72	12.00	39.72	QP	64.66	**24.94**
AC 120V Line1A	0.271	QP	25.52	11.25	36.77	QP	61.10	**24.33**
AC 120V Line1A	0.534	QP	25.69	10.80	36.49	QP	56.00	**19.51**
AC 120V Line1A	0.855	QP	21.73	10.76	32.49	QP	56.00	**23.51**
AC 120V Line1A	1.772	QP	17.24	10.81	28.05	QP	56.00	**27.95**
AC 120V Line1A	7.812	QP	18.35	11.14	29.49	QP	60.00	**30.51**
AC 120V NeutralA	0.195	QP	28.59	11.62	40.21	QP	63.81	**23.60**
AC 120V NeutralA	0.335	QP	26.86	10.98	37.84	QP	59.34	**21.50**
AC 120V NeutralA	0.489	QP	25.87	10.76	36.63	QP	56.19	**19.56**
AC 120V NeutralA	0.756	QP	23.15	10.68	33.83	QP	56.00	**22.17**
AC 120V NeutralA	7.413	QP	21.10	11.04	32.14	QP	60.00	**27.86**
AC 120V Line1A	0.171	AV	14.60	12.07	26.67	AV	54.91	**28.24**
AC 120V Line1A	0.269	AV	15.71	11.25	26.96	AV	51.14	**24.18**
AC 120V Line1A	0.540	AV	14.67	10.80	25.47	AV	46.00	**20.53**
AC 120V Line1A	0.858	AV	12.28	10.76	23.04	AV	46.00	**22.96**
AC 120V Line1A	1.778	AV	10.76	10.81	21.57	AV	46.00	**24.43**
AC 120V Line1A	7.813	AV	12.13	11.14	23.27	AV	50.00	**26.73**
AC 120V NeutralA	0.201	AV	18.58	11.66	30.24	AV	53.57	**23.33**
AC 120V NeutralA	0.330	AV	16.70	10.99	27.69	AV	49.44	**21.75**
AC 120V NeutralA	0.494	AV	15.33	10.76	26.09	AV	46.10	**20.01**
AC 120V NeutralA	0.754	AV	13.71	10.68	24.39	AV	46.00	**21.61**
AC 120V NeutralA	7.416	AV	12.77	11.04	23.81	AV	50.00	**26.19**

The highest emission measured was 36.49 dBµV with quasi-peak detector at 534 kHz. It has 19.51 dB margin to the FCC Part 15.207 and RSS-Gen Issue 2 7.2.2 limits.

Figure 1 Conducted Emission With Laptop 120 VAC Line - Quasi-peak Detector

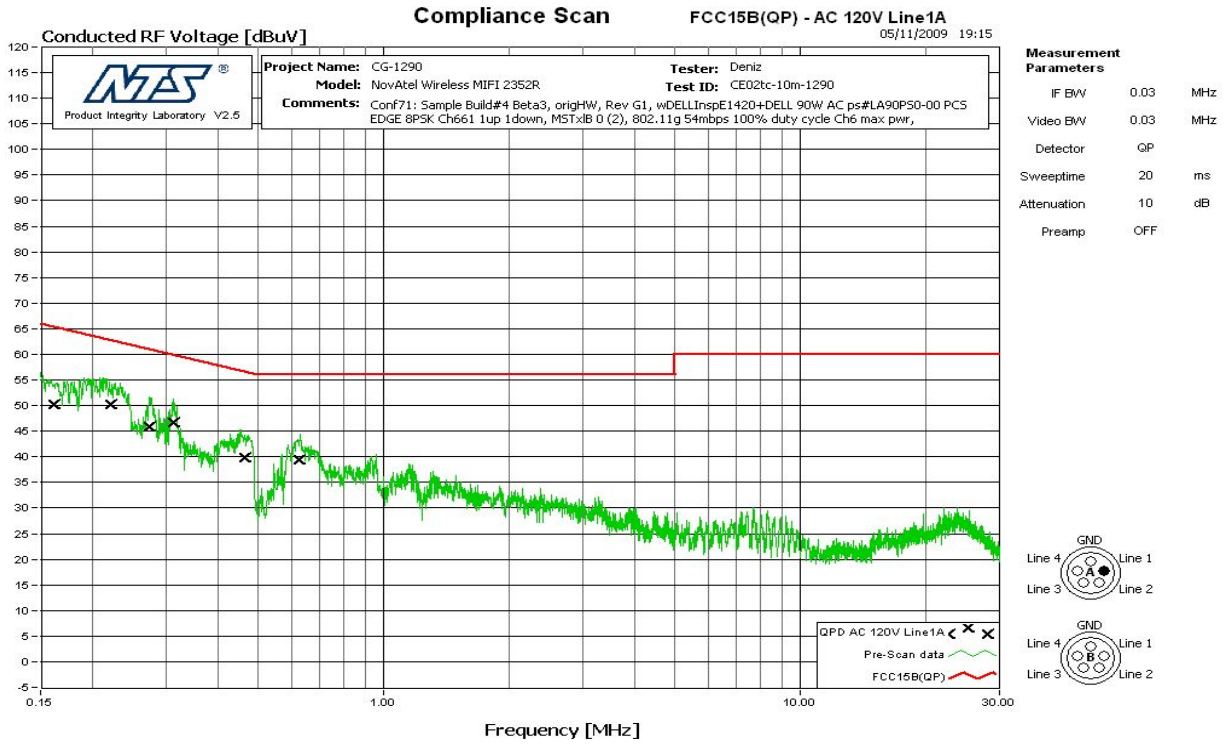


Figure 2 Conducted Emission With Laptop 120 VAC Return - Quasi-peak Detector

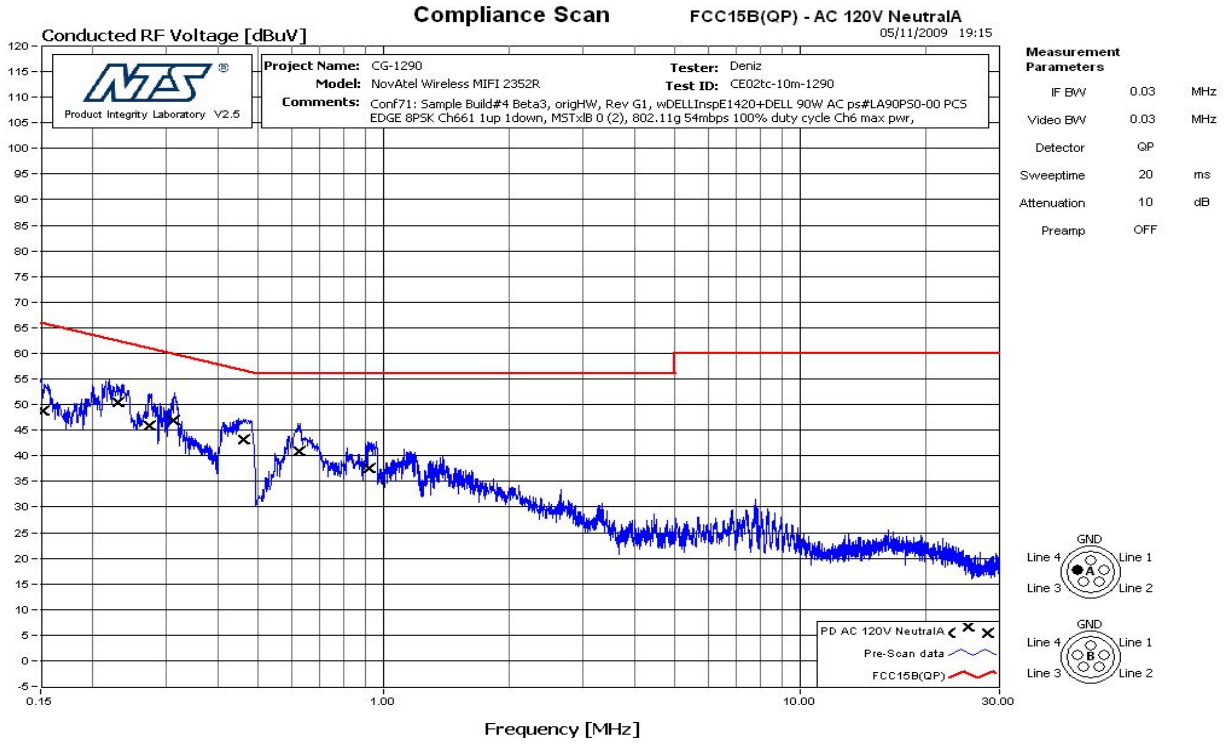


Figure 3 Conducted Emission With Laptop 120 VAC Line - Average Detector

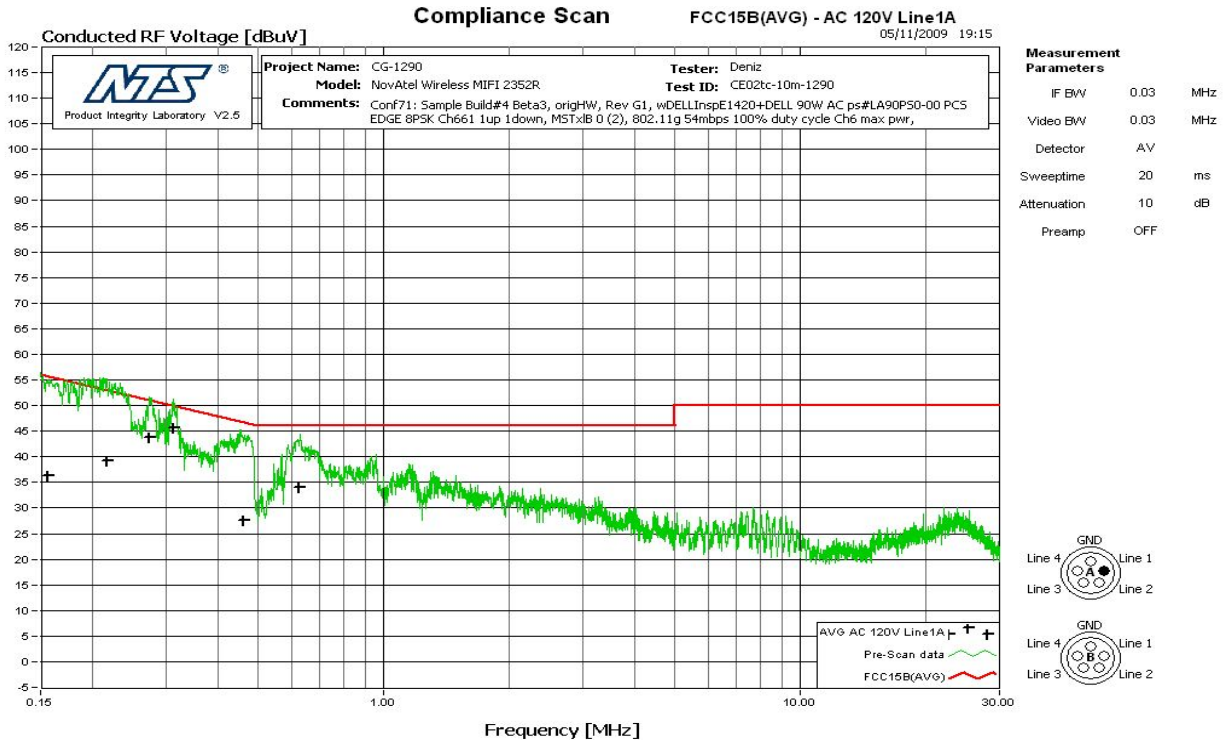


Figure 4 Conducted Emission With Laptop 120 VAC Return - Average Detector

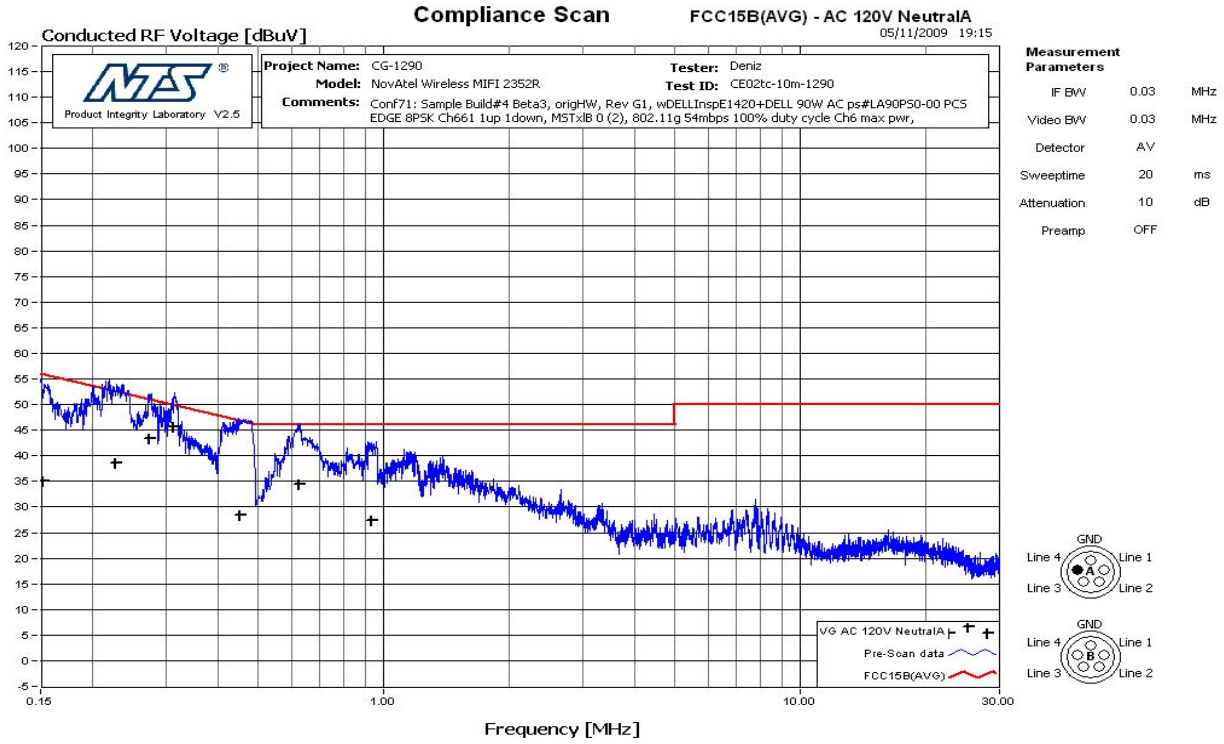


Figure 5 Conducted Emission With Power Supply 120 VAC Line - Quasi-peak Detector

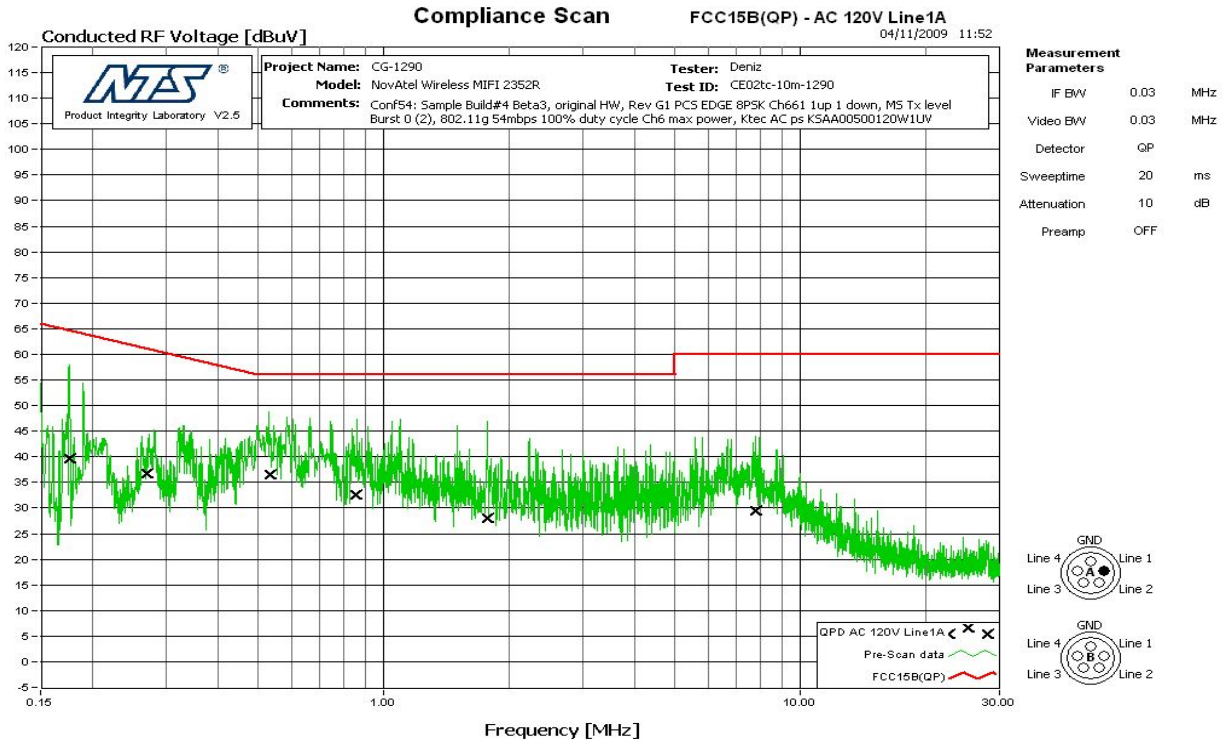


Figure 6 Conducted Emission With Power Supply 120 VAC Return - Quasi-peak Detector

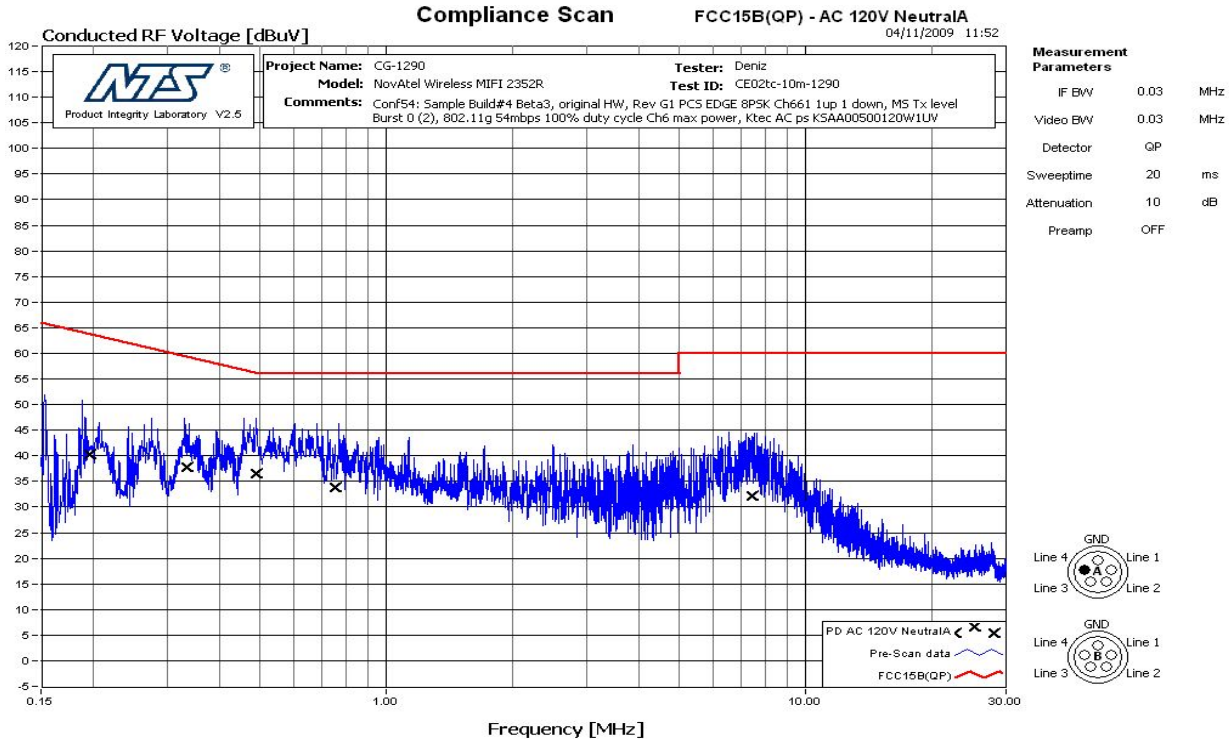


Figure 7 Conducted Emission With Power Supply 120 VAC Line - Average Detector

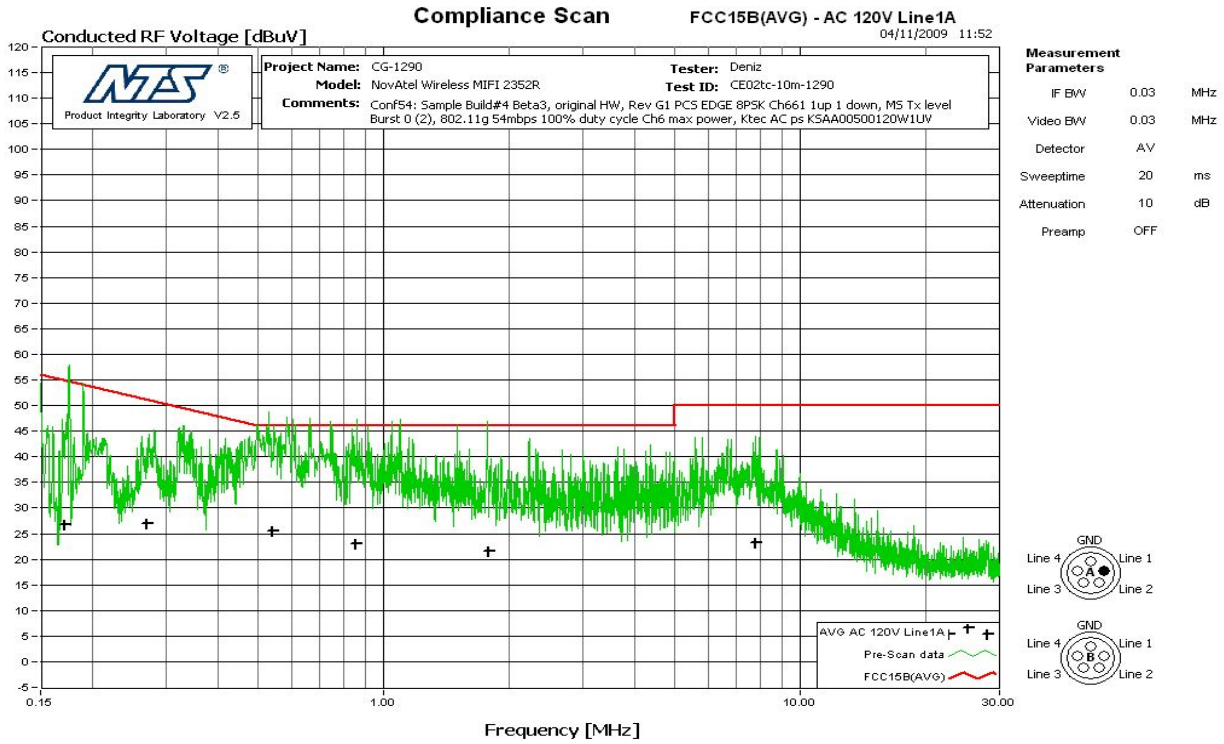
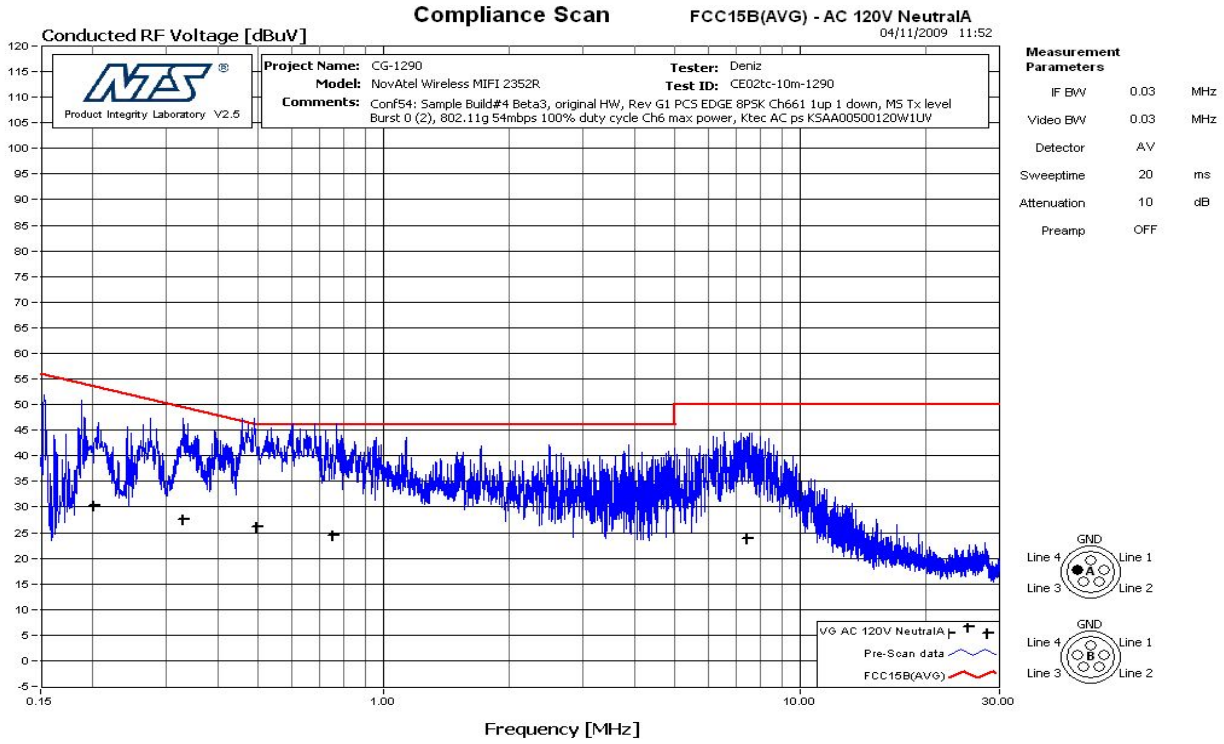


Figure 8 Conducted Emission With Power Supply 120 VAC Return - Average Detector



APPENDIX B: 6 DB BANDWIDTH

B.1. Base Standard & Test Basis

Base Standard	FCC PART 15.247 (a) (2) RSS 210 Issue 7 A8.2 (a)
Test Basis	FCC Publication 558074 RSS-Gen Issue 2 4.6.2
Test Method	FCC Publication 558074 RSS 210 Issue 7 A8.2 (a)

B.2. Specifications

15.247 2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

B.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
None						

B.4. Test Procedure

FCC Publication 558074.

B.5. Test Results

The EUT is in compliance with the requirement as specified above

Mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
802.11b	1	2412	10.421
	6	2437	10.461
	11	2462	10.340
802.11g	1	2412	16.593
	6	2437	16.593
	11	2462	16.593

All final reported values are corrected values.

B.6. Operating Mode During Test

The EUT was tuned to a low, middle and high channel in continuous transmit mode at maximum rated RF output power

B.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

B.8. Test date

November 16, 2009

Figure 9 802.11b 6 dB Bandwidth Low Channel

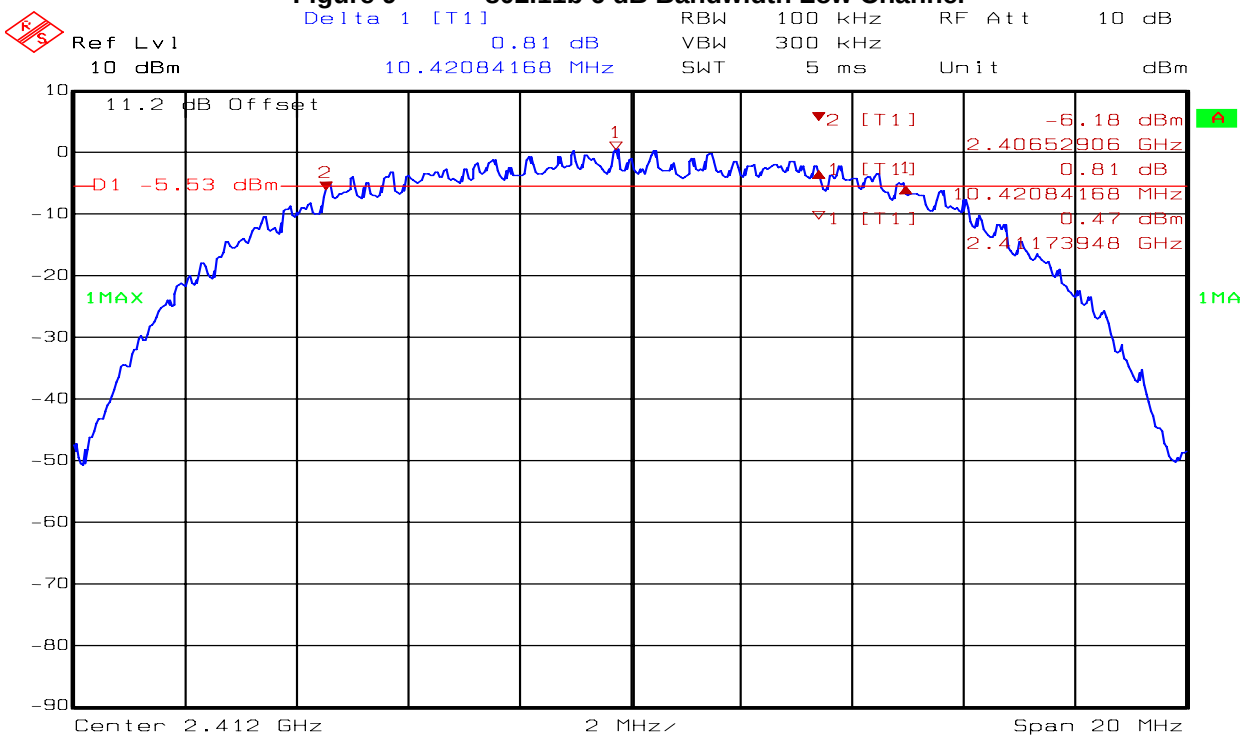


Figure 10 802.11b 6 dB Bandwidth Mid Channel

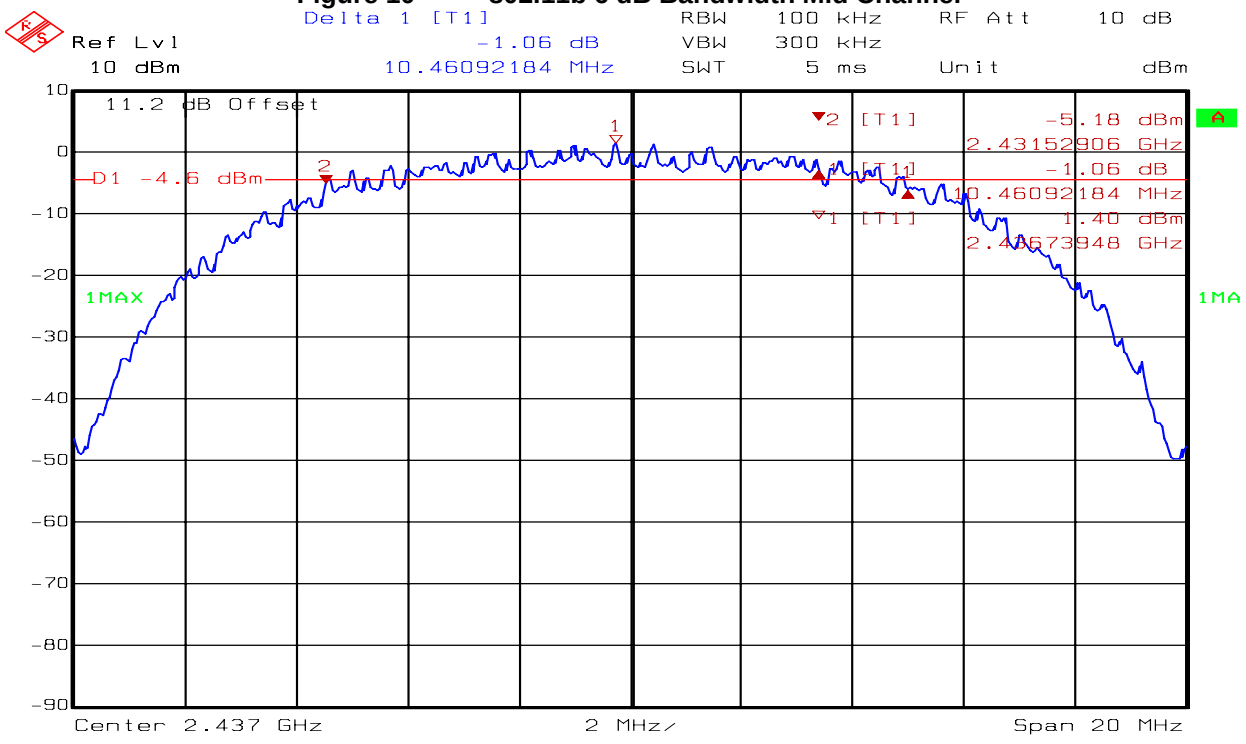
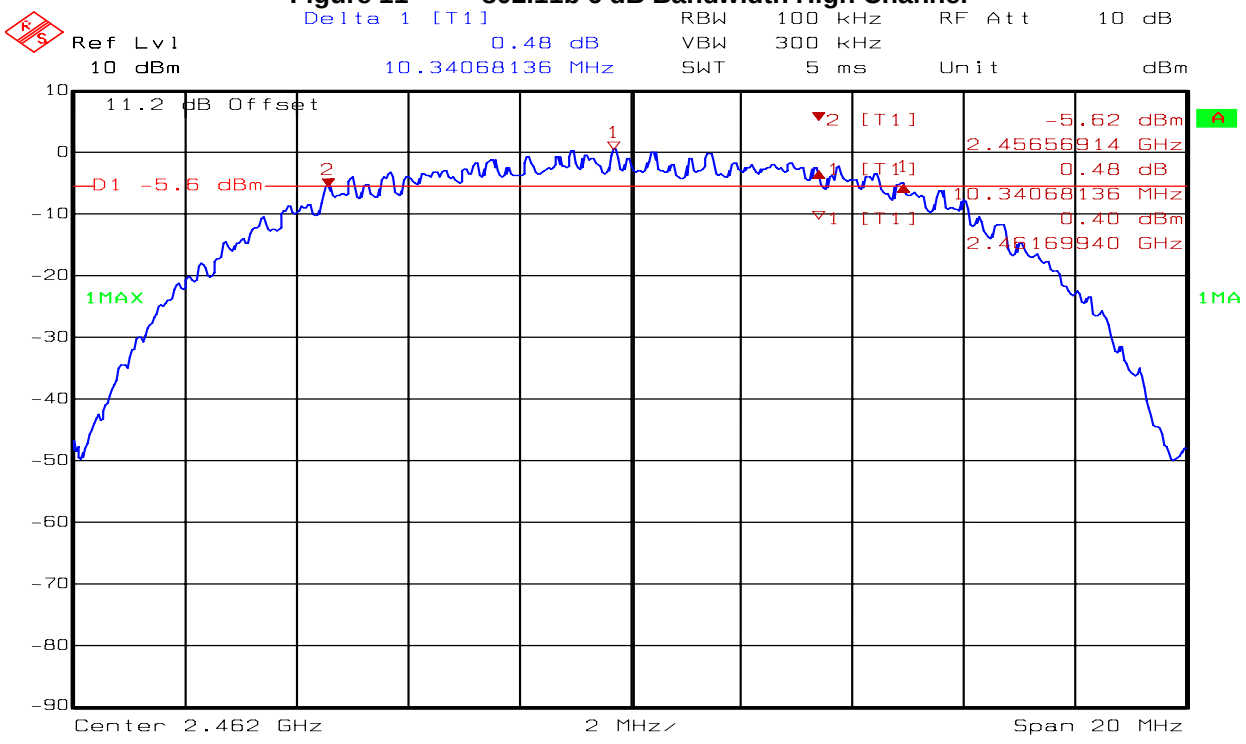
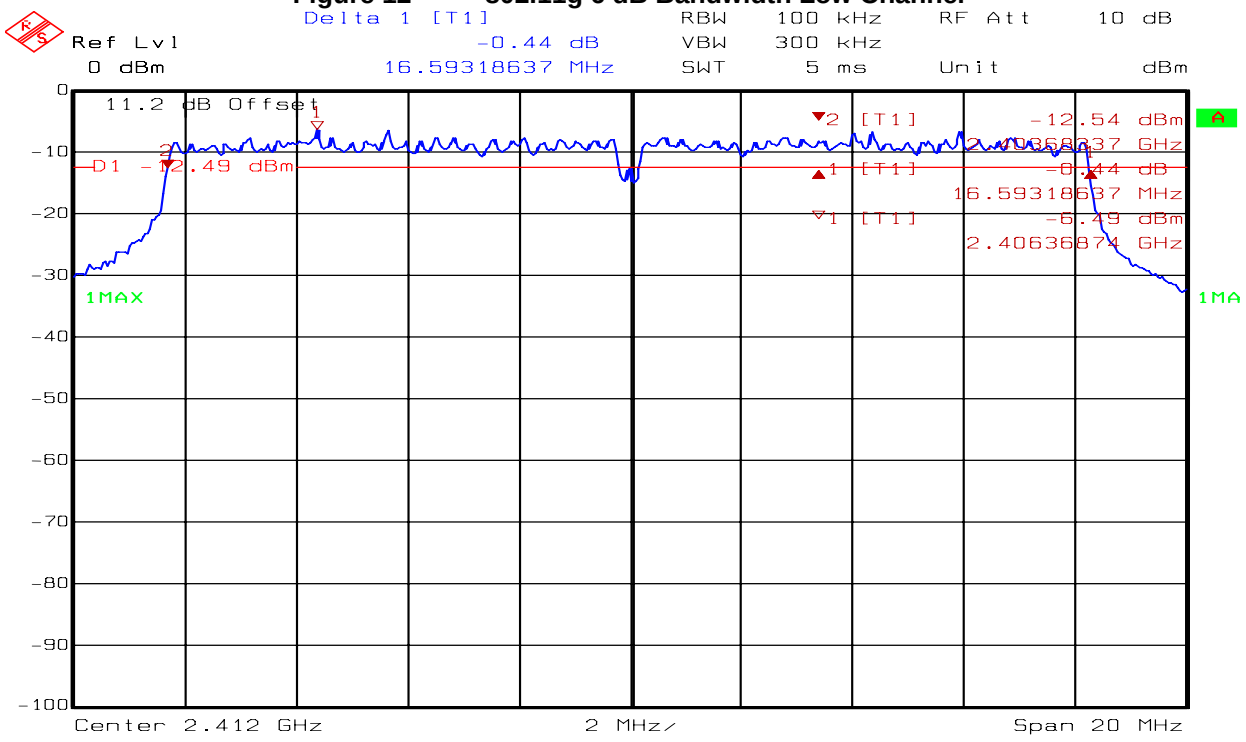


Figure 11 802.11b 6 dB Bandwidth High Channel



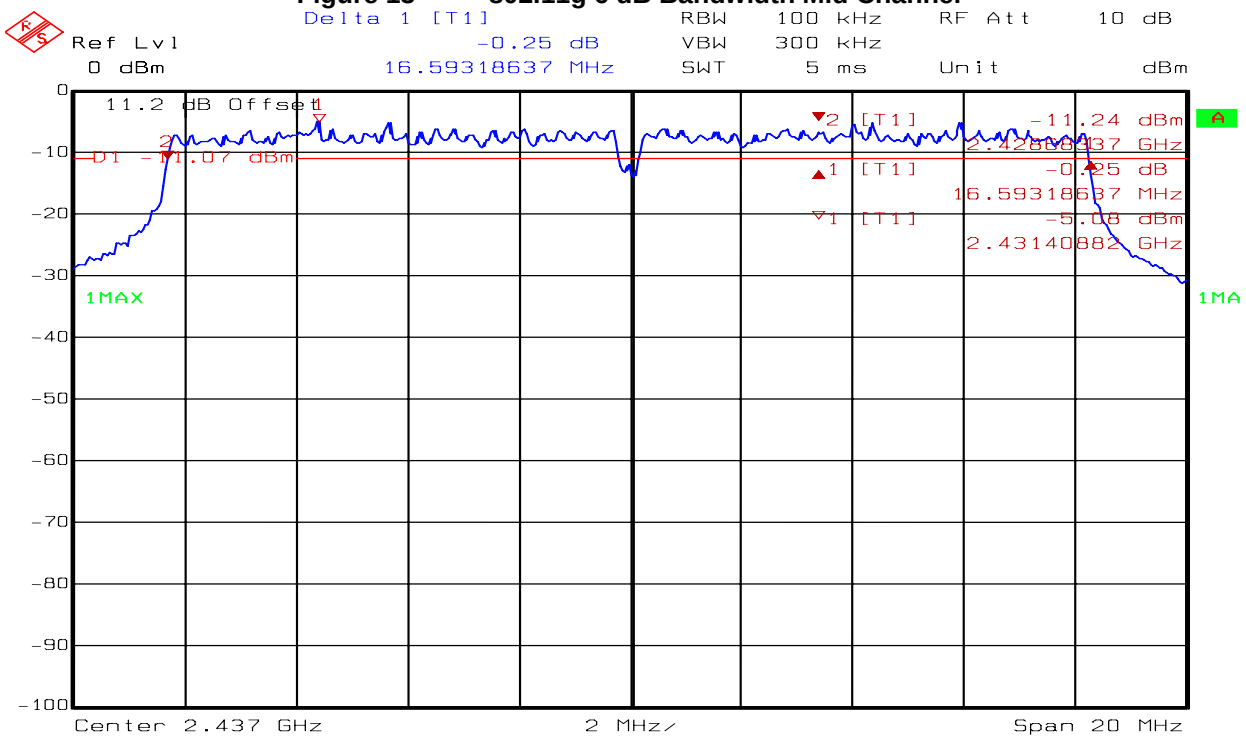
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11b Ch11 11mbps (P13)
Date: 16.NOV.2009 16:19:38

Figure 12 802.11g 6 dB Bandwidth Low Channel



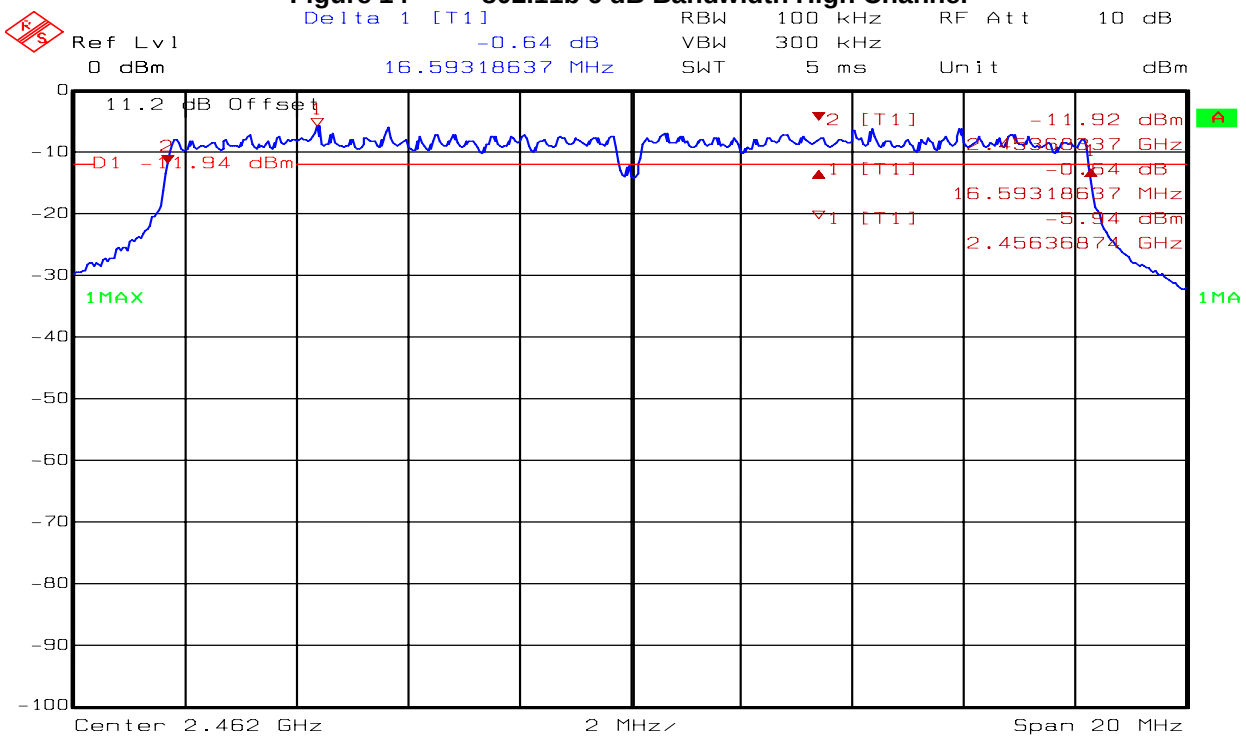
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch1 54mbps (P13)
Date: 16.NOV.2009 11:15:50

Figure 13 802.11g 6 dB Bandwidth Mid Channel



Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch6 54mbps (P13)
Date: 16.NOV.2009 13:11:46

Figure 14 802.11b 6 dB Bandwidth High Channel



Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch11 54mbps (P13)
Date: 16.NOV.2009 13:39:32

APPENDIX C: OCCUPIED BANDWIDTH

C.1. Base Standard & Test Basis

Base Standard	RSS-Gen Issue 2 4.6.1
Test Basis	RSS-Gen Issue 2 4.6.1
Test Method	RSS-Gen Issue 2 4.6.1

C.2. Specifications

4.6.1 When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

C.3. Test Procedure

RSS-Gen Issue 2

C.4. Test Results

Mode	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
802.11b	1	2412	13.547
	6	2437	13.547
	11	2462	13.547
802.11g	1	2412	16.513
	6	2437	16.513
	11	2462	16.513

All final reported values are corrected values

C.5. Operating Mode During Test

The EUT was tuned to a low, middle and high channel in continuous transmit mode at maximum rated RF output power

C.6. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

C.7. Test date

November 16, 2009

Figure 15 802.11b Occupied Bandwidth Low Channel

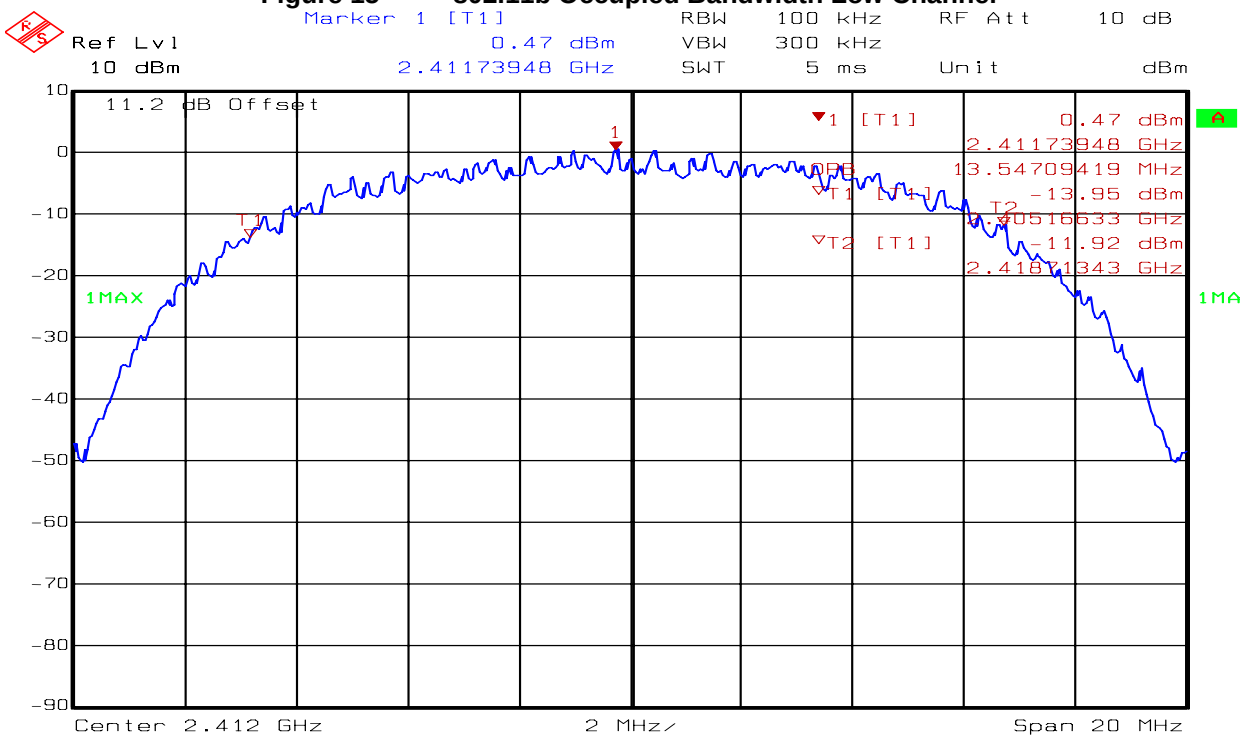


Figure 16 802.11b Occupied Bandwidth Mid Channel

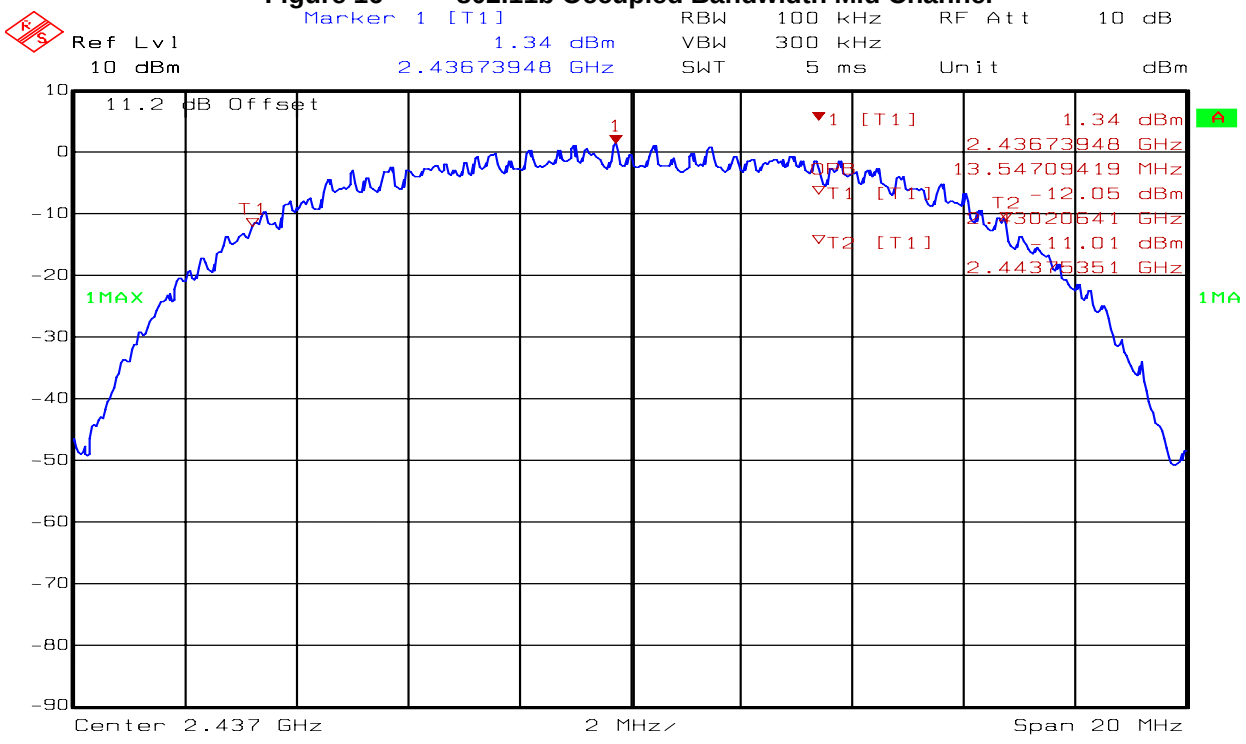
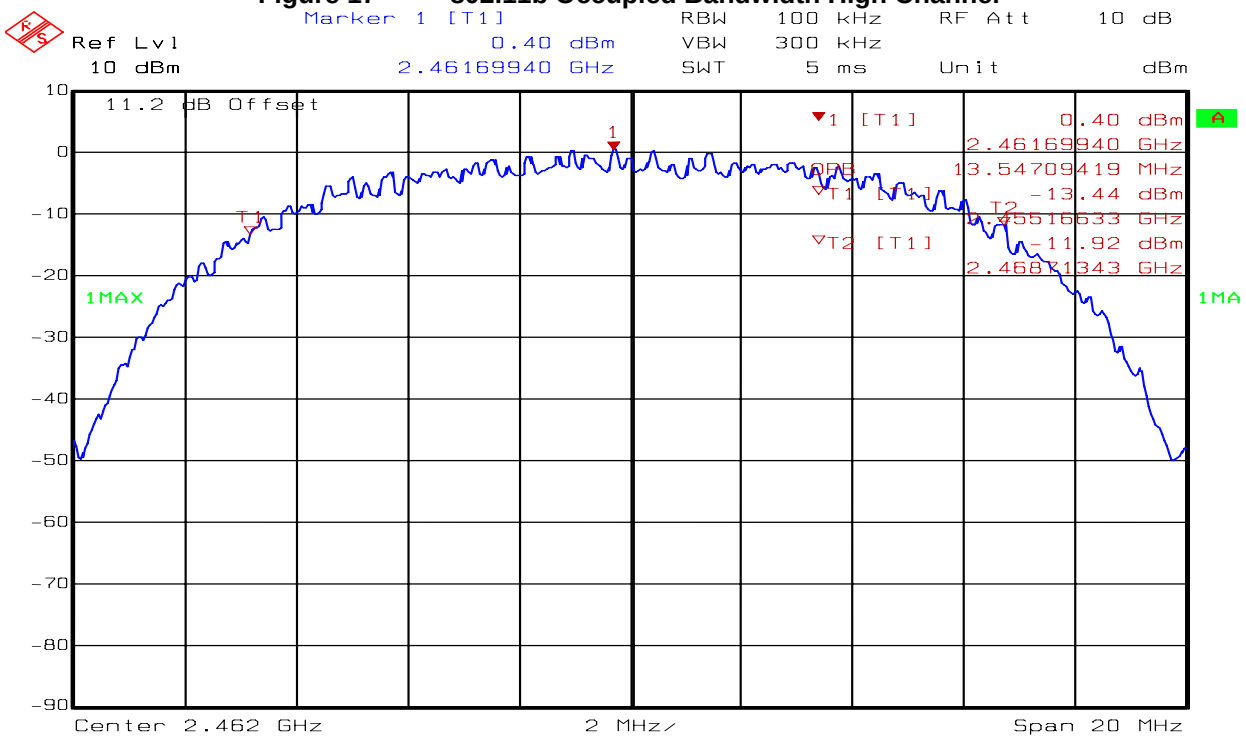
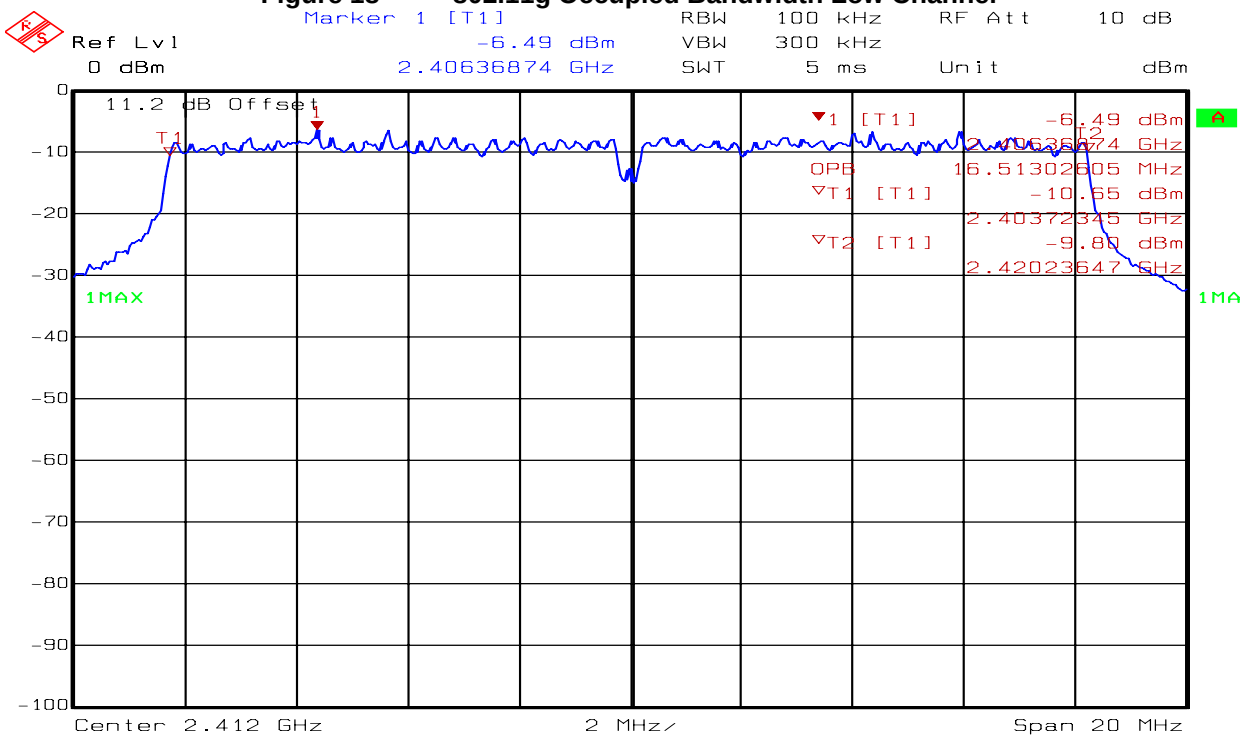


Figure 17 802.11b Occupied Bandwidth High Channel



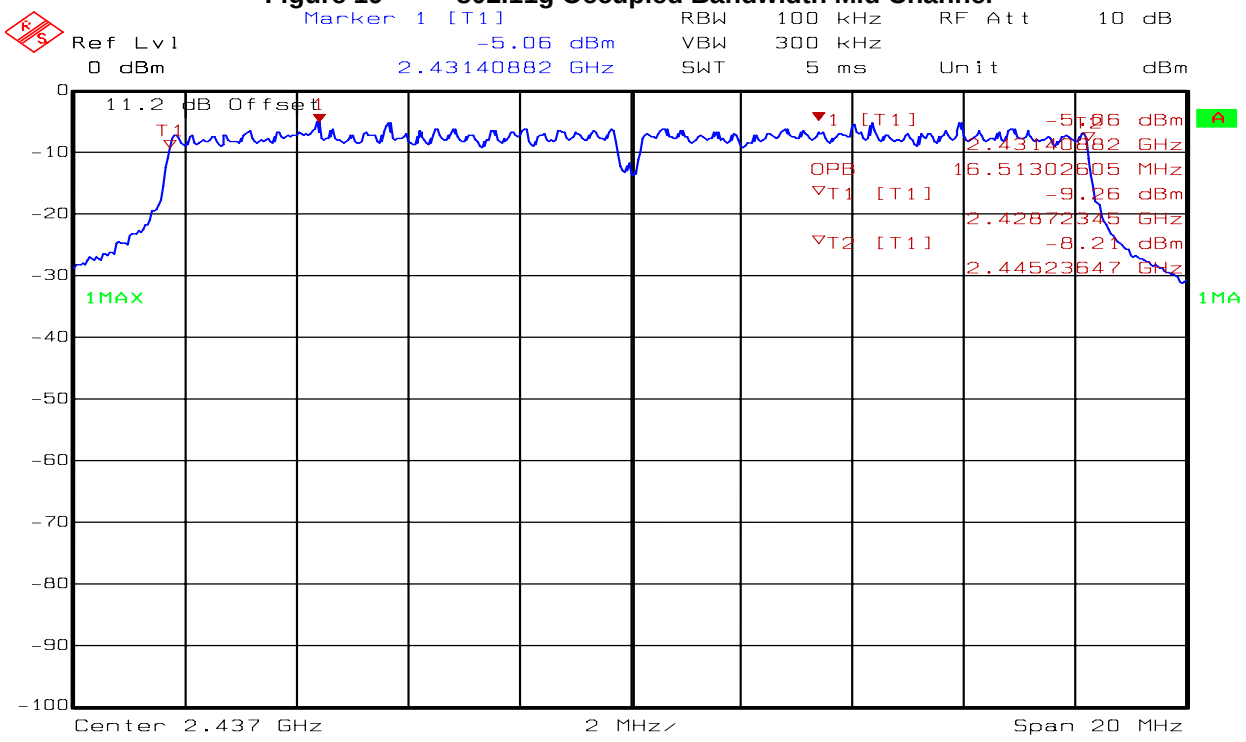
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11b Ch11 11mbps (P13)
Date: 16.NOV.2009 16:24:31

Figure 18 802.11g Occupied Bandwidth Low Channel



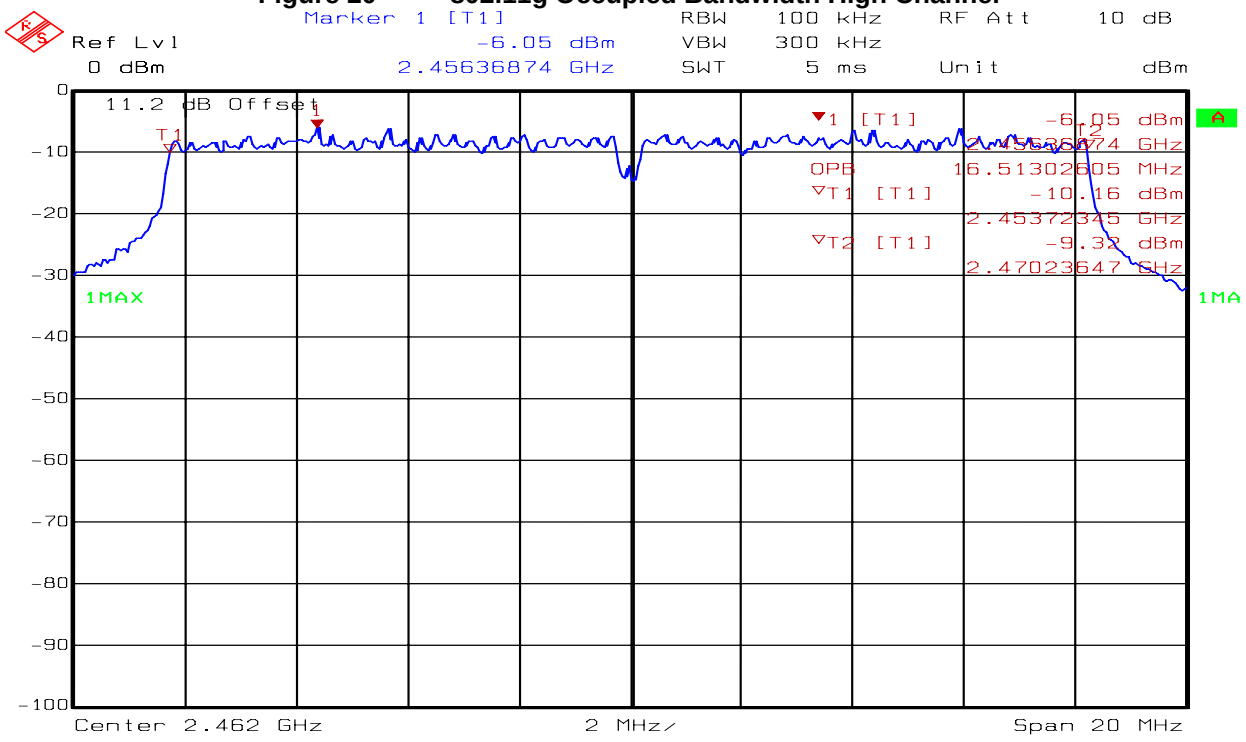
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch1 54mbps (P13)
Date: 16.NOV.2009 11:22:00

Figure 19 802.11g Occupied Bandwidth Mid Channel



Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch6 54mbps (P13)
Date: 16.NOV.2009 13:14:04

Figure 20 802.11g Occupied Bandwidth High Channel



Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch11 54mbps (P13)
Date: 16.NOV.2009 13:30:08

APPENDIX D: PEAK POWER OUTPUT

D.1. Base Standard & Test Basis

Base Standard	FCC 15.247 RSS 210 Issue 7 A8.4 (4)
Test Basis	FCC 15.247 as per FCC Publication 558074 RSS-Gen Issue 2 4.8
Test Method	FCC Publication 558074 and RSS-Gen Issue 2 4.8

D.2. Specifications

The maximum peak output power shall not exceed 30 dBm in the 2400 MHz- 2483.5 MHz band

D.3. Test Procedure

FCC Publication 558074 and RSS-Gen Issue 2 4.8 using Power Meter with Peak Power Detector

D.4. Operating Mode During Test

The EUT was tuned to a low, middle and high channel in continuous transmit mode at maximum rated RF output power with all available data rates

D.5. Test Results

Compliant – The maximum peak power was 11.9 dBm for 802.11b and 15.7 dBm for 802.11g as measured conducted at the RF output port supplied by customer

D.6. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

D.7. Test date

November 16, 2009

D.8. Test Data Summary

Mode	Channel	Data rate (Mbps)	Frequency (MHz)	Peak RF Power (dBm)
802.11b	1	1	2412	11.5
		2	2412	11.2
		5.5	2412	10.9
		11	2412	11.5
	6	1	2437	11.9
		2	2437	11.8
		5.5	2437	10.6
		11	2437	11.6
	11	1	2462	11.4
		2	2462	11.4
		5.5	2462	10.9
		11	2462	11.5
802.11g	1	6	2412	14.4
		9	2412	14.8
		12	2412	14.9
		18	2412	13.9
		24	2412	14.9
		36	2412	14.4
		48	2412	14.3
		54	2412	14.7
	6	6	2437	15.2
		9	2437	15.6
		12	2437	14.7
		18	2437	13.9
		24	2437	15.1
		36	2437	15.2
		48	2437	15.2
		54	2437	15.7
	11	6	2462	14.7
		9	2462	14.2
		12	2462	15.0
		18	2462	14.5
		24	2462	15.5
		36	2462	14.5
		48	2462	14.8
		54	2462	15.1

All final reported values are corrected values

APPENDIX E: POWER SPECTRAL DENSITY

E.1. Base Standard & Test Basis

Base Standard	FCC 15.247 (e) RSS 210 Issue 7 A8.2 (b)
Test Basis	FCC 15.247 as per FCC Publication 558074 RSS 210 Issue 7 A8.2 (b)
Test Method	FCC Publication 558074 and RSS 210 Issue 7 A8.2 (b)

E.2. Specifications

15.247 e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

E.3. Test Procedure

FCC Publication 558074

E.4. Operating Mode During Test

The EUT was tuned to the low, middle and high channel in continuous transmit mode at maximum rated RF output power.

E.5. Test Results

Compliant. The maximum measured power spectral density was -13.91 dBm as measured conducted at the RF output port supplied by customer

E.6. Test Data Summary

Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm)
802.11b	1	2412	-13.91
	6	2437	-14.38
	11	2462	-13.94
802.11g	1	2412	-19.49
	6	2437	-19.54
	11	2462	-19.28

All final reported values are corrected values

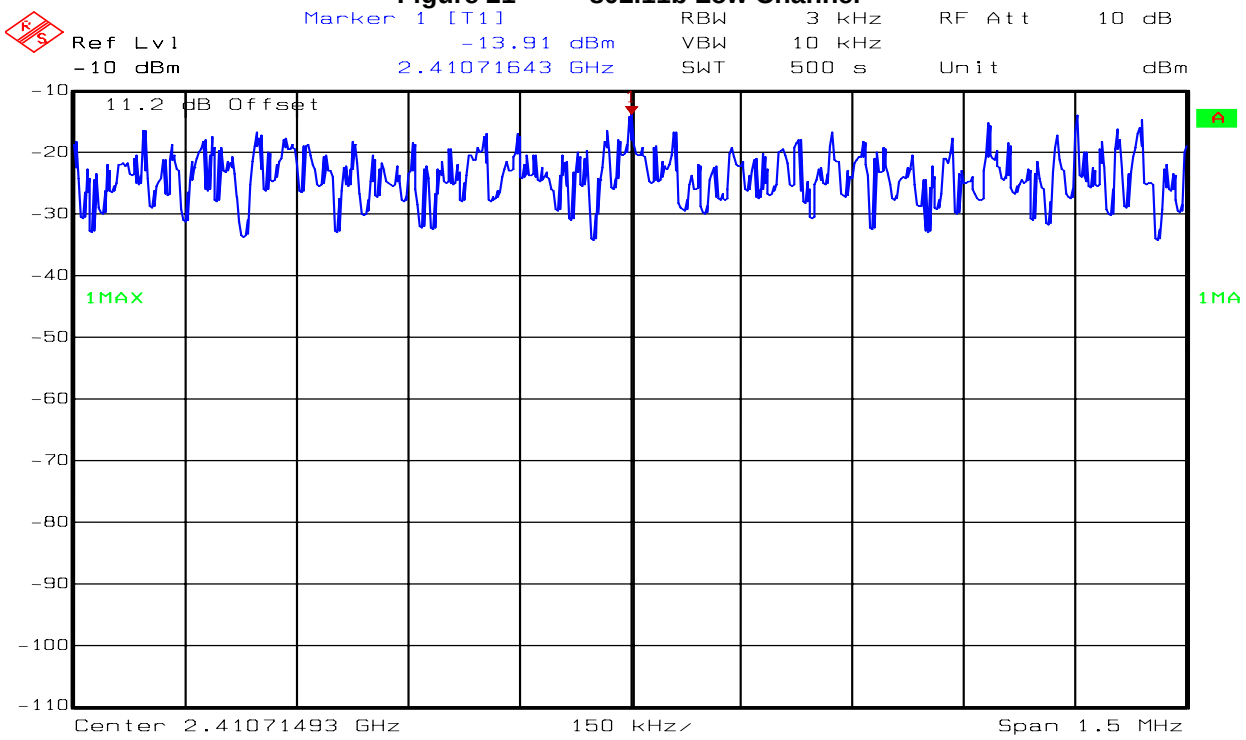
E.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

E.8. Test date

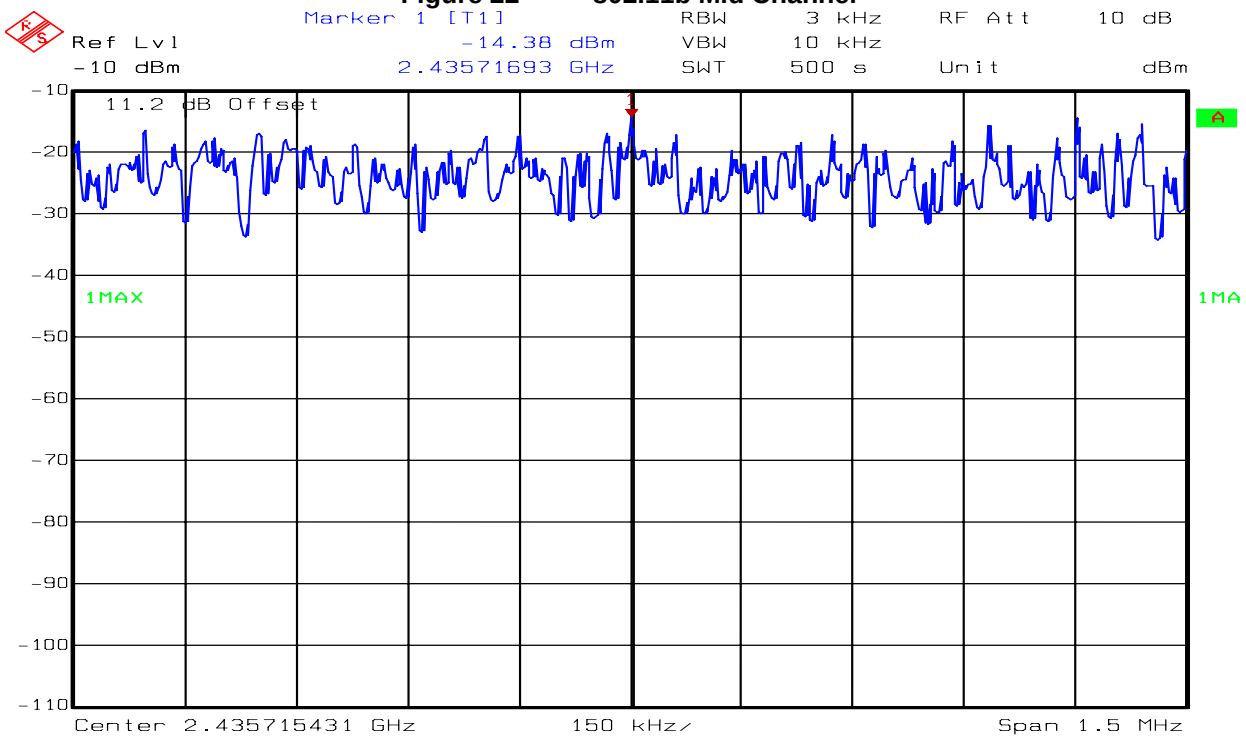
November 16, 2009

Figure 21 802.11b Low Channel



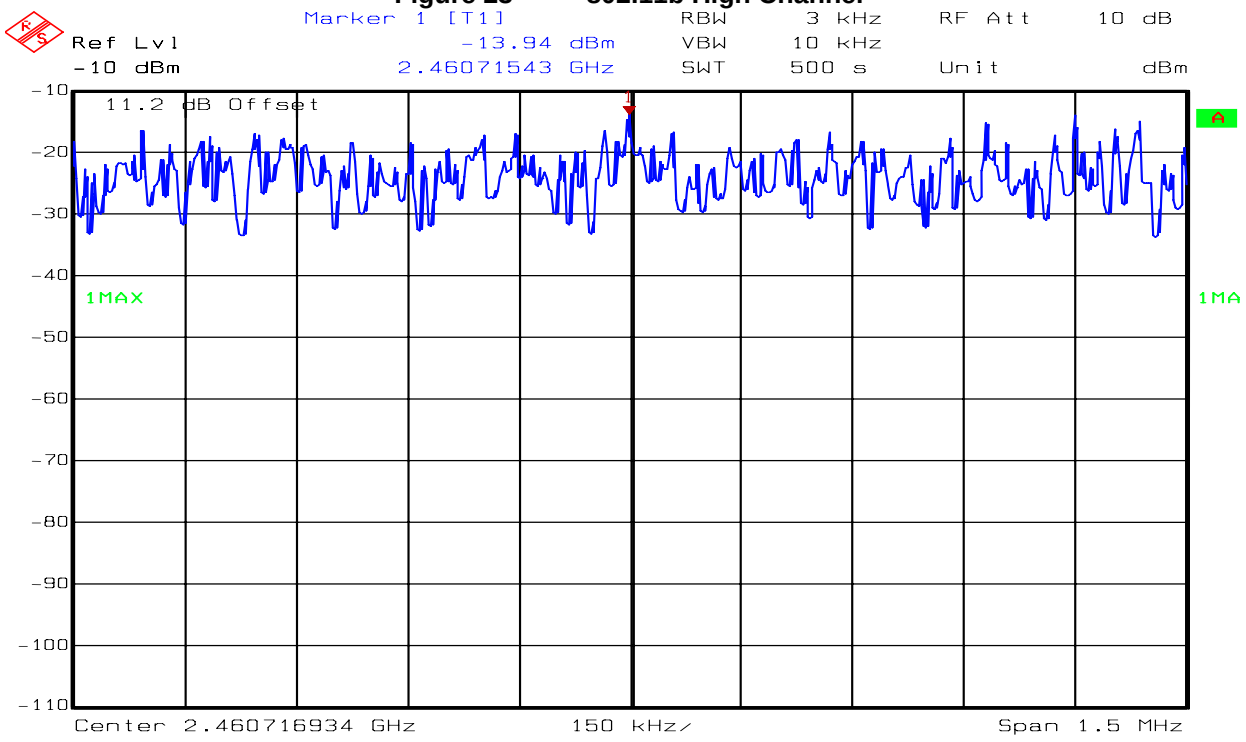
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11b Ch1 11mbps (P13)
Date: 17.NOV.2009 10:02:42

Figure 22 802.11b Mid Channel



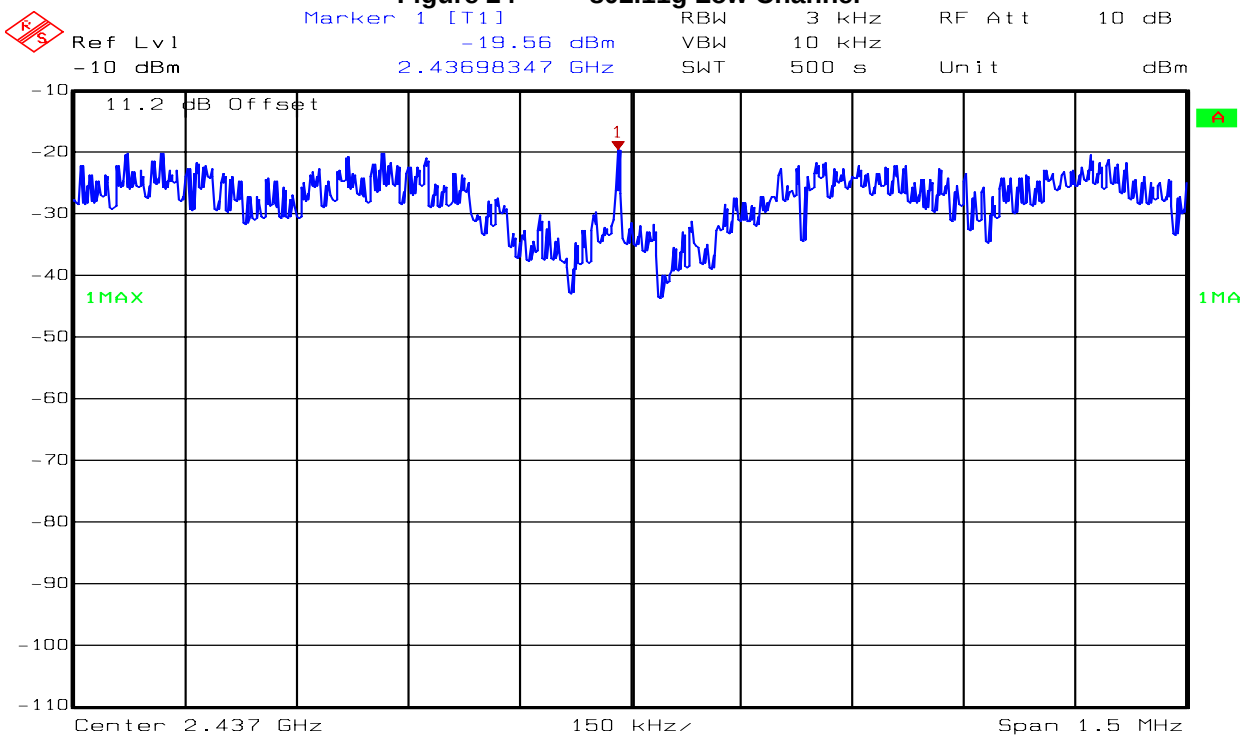
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11b Ch6 11mbps (P13)
Date: 17.NOV.2009 9:36:17

Figure 23 802.11b High Channel



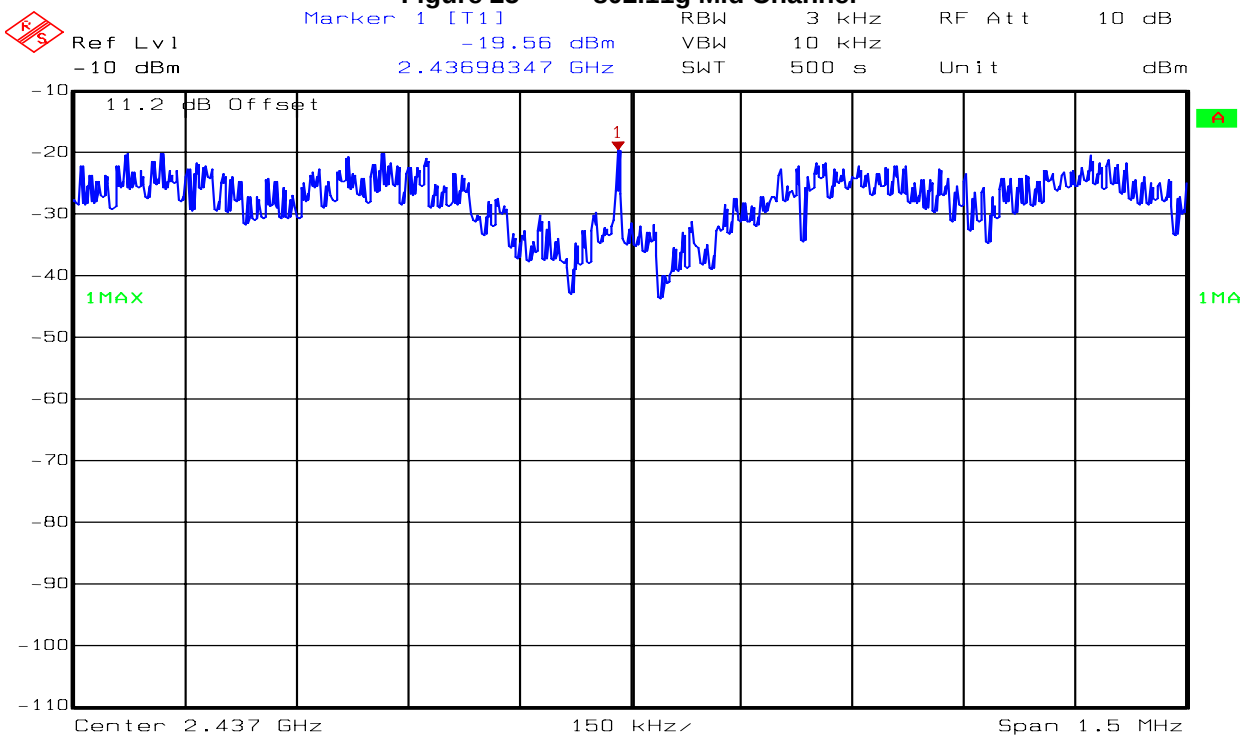
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11b Ch11 11mbps (P13)
Date: 16.NOV.2009 16:02:15

Figure 24 802.11g Low Channel



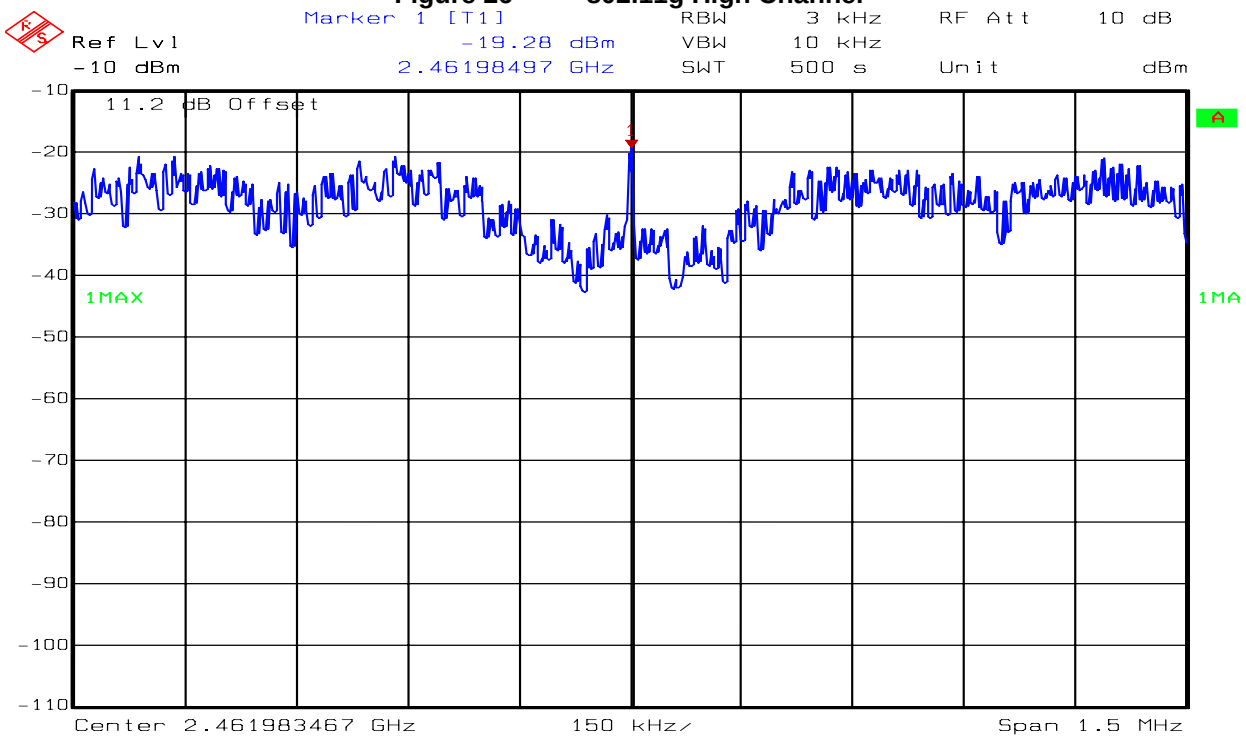
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch6 54mbps (P13)
Date: 16.NOV.2009 13:07:51

Figure 25 802.11g Mid Channel



Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch6 54mbps (P13)
Date: 16.NOV.2009 13:07:51

Figure 26 802.11g High Channel



Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch11 54mbps (P13)
Date: 16.NOV.2009 13:59:47

APPENDIX F: CONDUCTED SPURIOUS EMISSIONS (TX)

F.1. Base Standard & Test Basis

Base Standards	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.247 (d) RSS-210 Issue 7 A8.5
Test Basis	RF conducted as per FCC Publication 558074 RSS-210 Issue 7 A8.5
Test Method	RF conducted as per FCC Publication 558074 RSS-210 Issue 7 A8.5

F.2. Specifications

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

F.3. Test Procedure

FCC Publication 558074

F.4. Operating Mode During Test

The EUT was tuned to a low, middle and high channels in continuous transmit mode (100% duty cycle) at maximum rated RF output power in 802.11b and 802.11g modes

F.5. Test Results Summary

Compliant.

There was no measurable emission observed. The worst case noise floor level was 53.85 dB below the carrier power in channel 11 with 802.11g mode.

All final reported values are corrected values

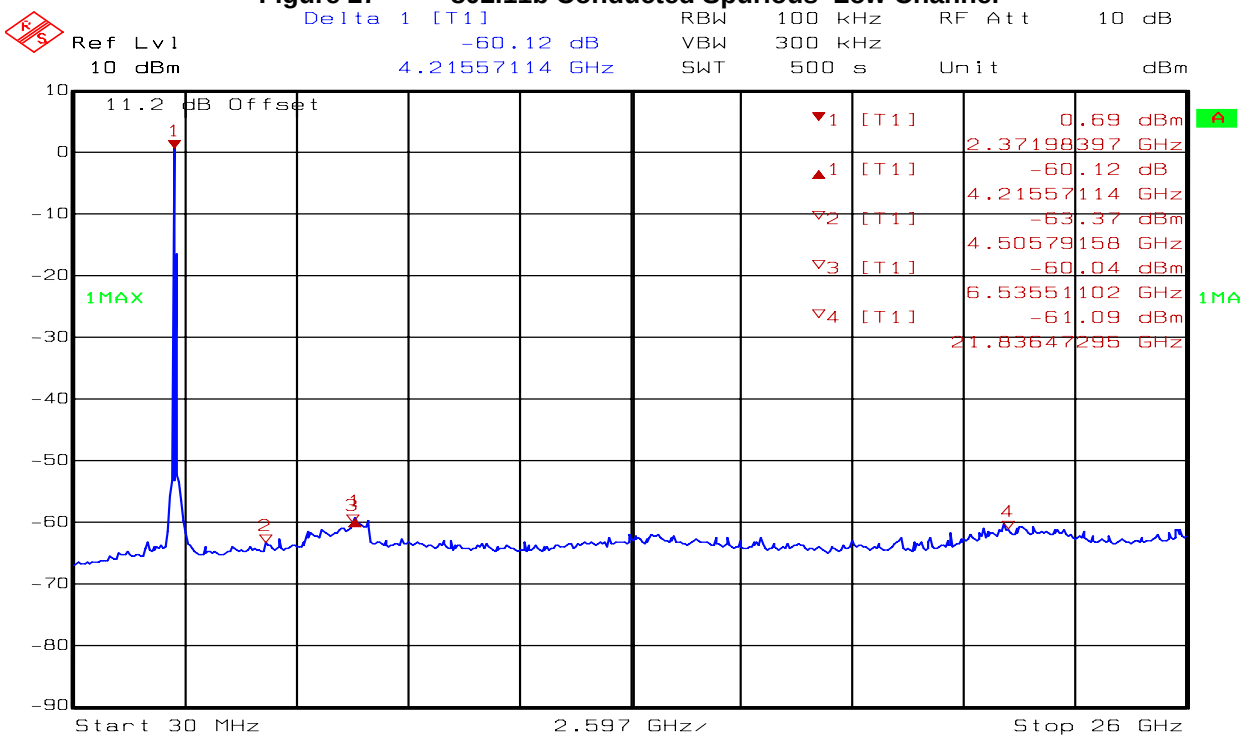
F.6. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

F.7. Test date

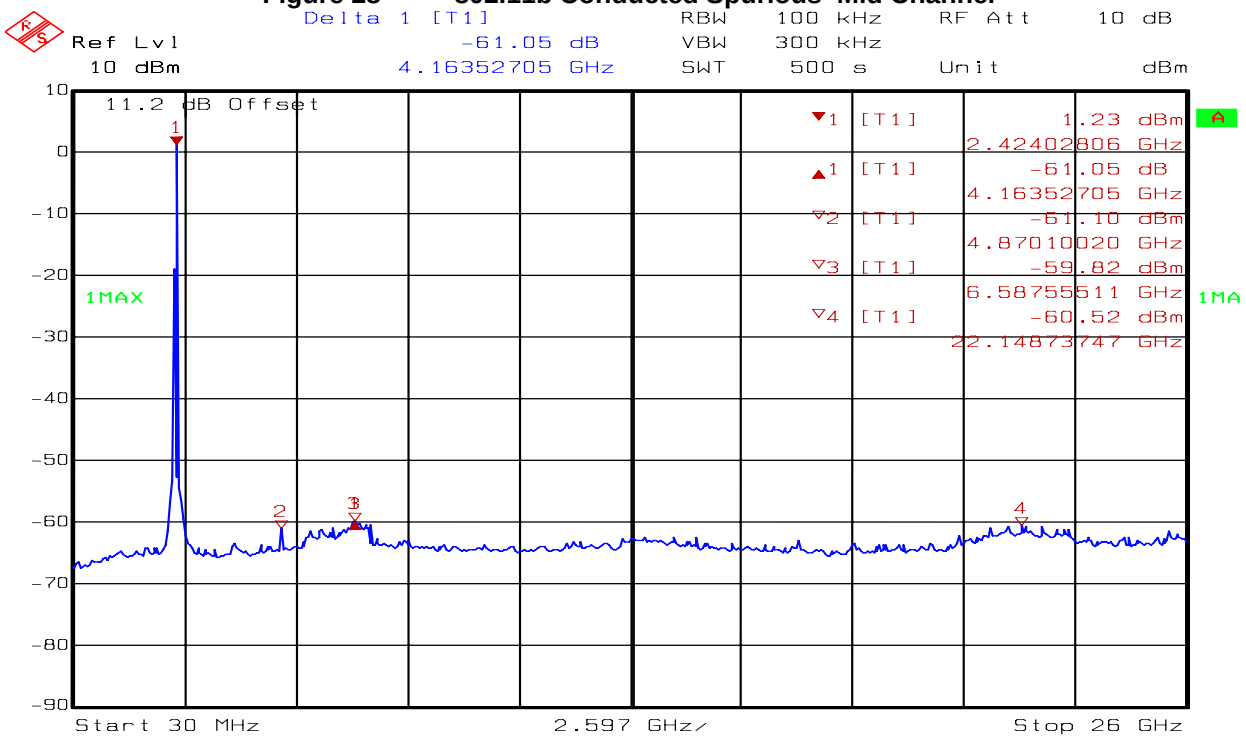
Started: November 16, 2009 Completed: November 17, 2009

Figure 27 802.11b Conducted Spurious Low Channel



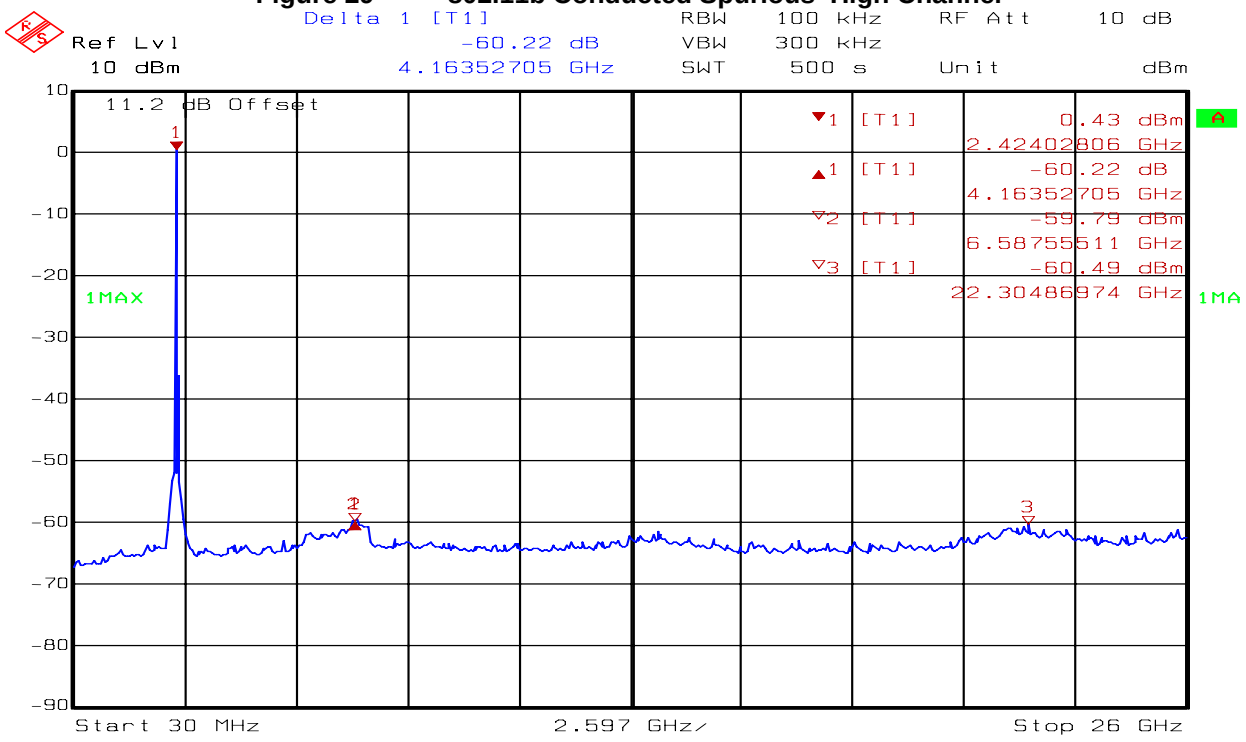
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11b Ch1 11mbps (P13)
Date: 17.NOV.2009 11:03:07

Figure 28 802.11b Conducted Spurious Mid Channel



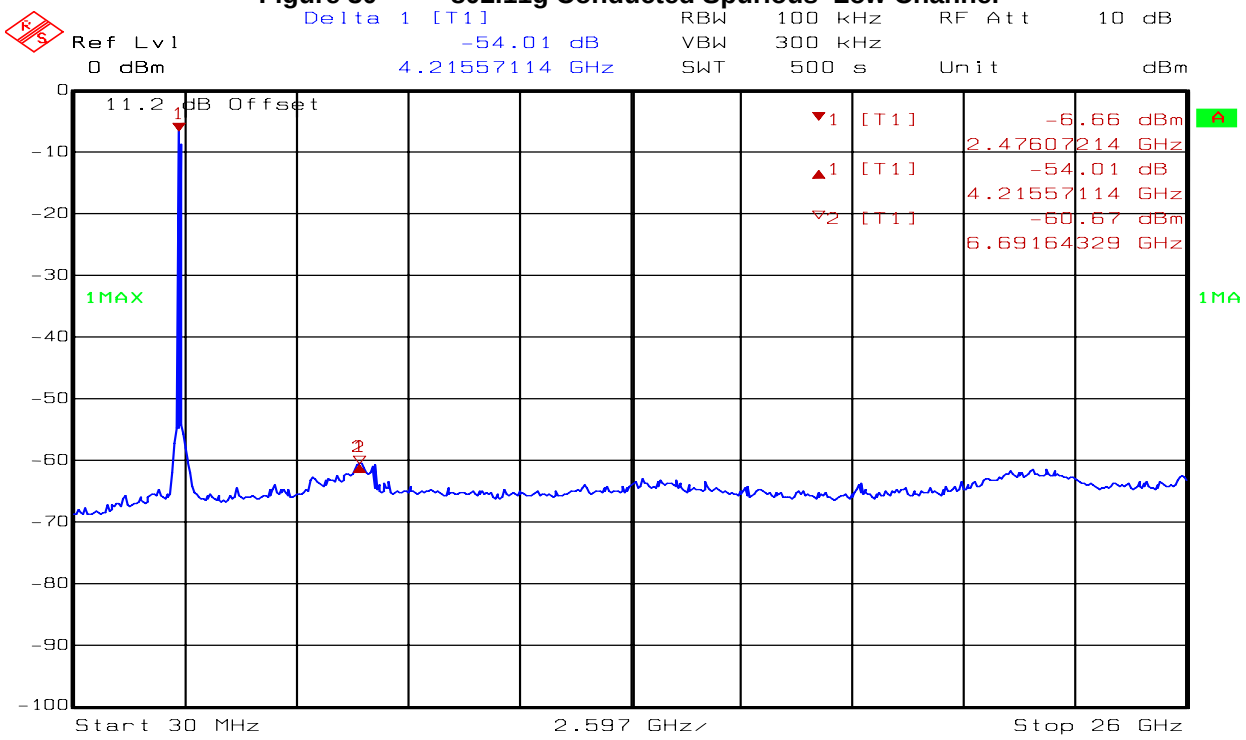
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11b Ch6 11mbps (P13)
Date: 16.NOV.2009 17:11:35

Figure 29 802.11b Conducted Spurious High Channel



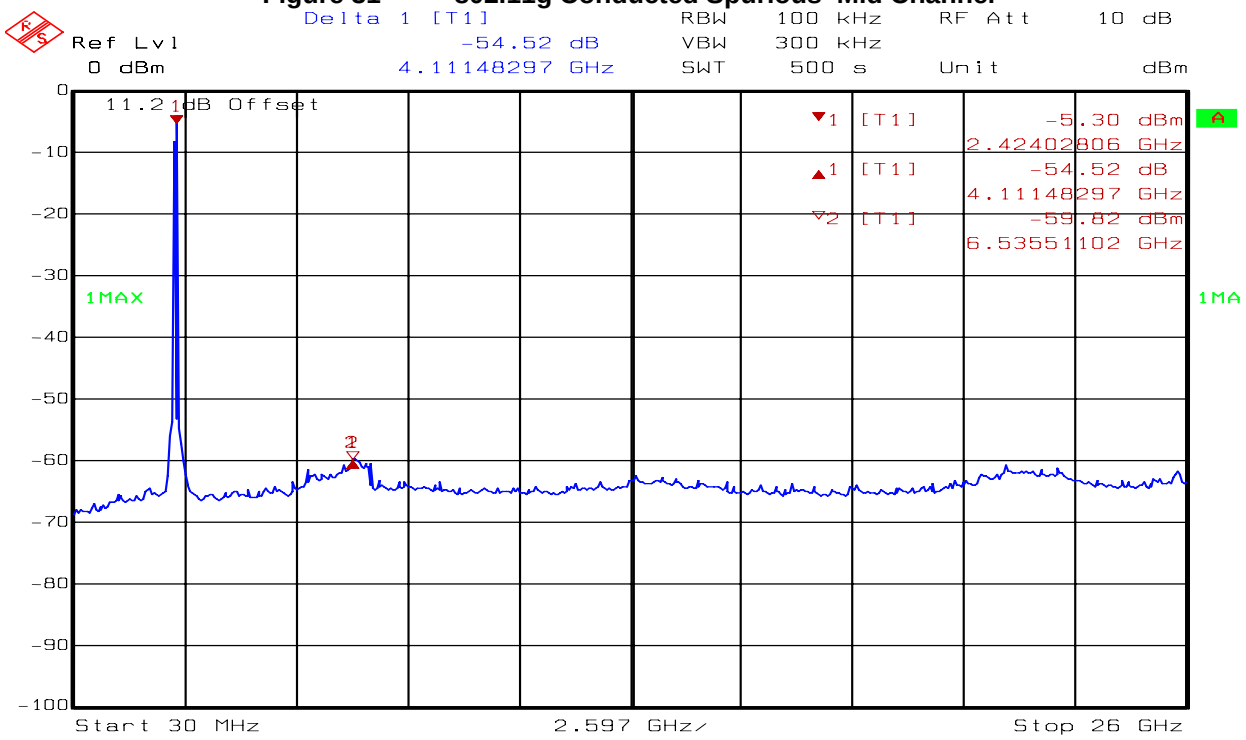
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11b Ch11 11mbps (P13)
Date: 16.NOV.2009 16:48:16

Figure 30 802.11g Conducted Spurious Low Channel



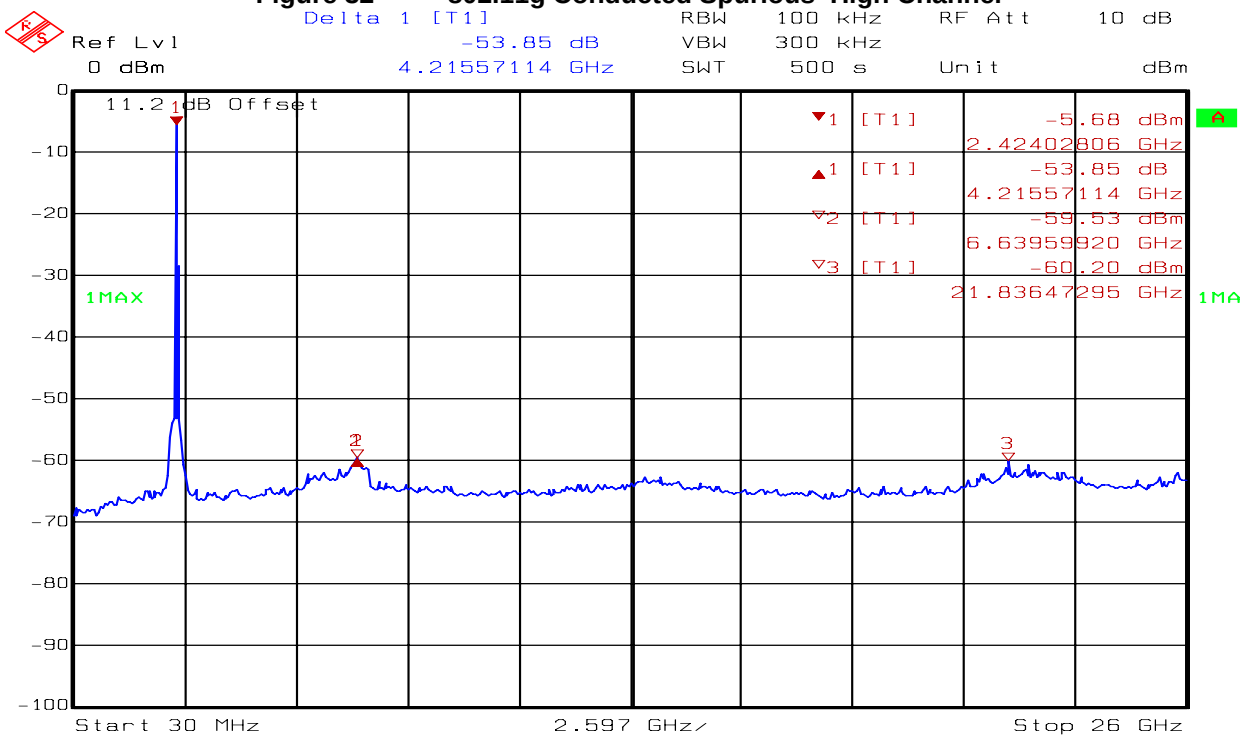
Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch1 54mbps (P13)
Date: 16.NOV.2009 12:08:58

Figure 31 802.11g Conducted Spurious Mid Channel



Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch6 54mbps (P13)
Date: 16.NOV.2009 12:51:28

Figure 32 802.11g Conducted Spurious High Channel



Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11g Ch11 54mbps (P13)
Date: 16.NOV.2009 14:20:36

APPENDIX G: CONDUCTED SPURIOUS EMISSIONS BAND EDGE

G.1. Base Standard & Test Basis

Base Standards	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.247 (d) RSS-210 Issue 7 A8.5
Test Basis	RF conducted as per FCC Publication 558074 RSS-210 Issue 7 A8.5
Test Method	RF conducted as per FCC Publication 558074 RSS-210 Issue 7 A8.5

G.2. Specifications

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

G.3. Test Procedure

FCC Publication 558074

G.4. Operating Mode During Test

The EUT was tuned to the low and high channel in continuous transmit mode (100% duty cycle) at maximum rated RF output power with 802.11b and 802.11g modes.

G.5. Test Results

Compliant.

Mode	Channel	Frequency (MHz)	Conducted Band edge (dB)
802.11b	1	2412	-46.42
	11	2462	-52.15
802.11g	1	2412	-31.69
	11	2462	-46.47

Worst case spurious emission was 31.69 dB below the carrier

All final reported values are corrected values

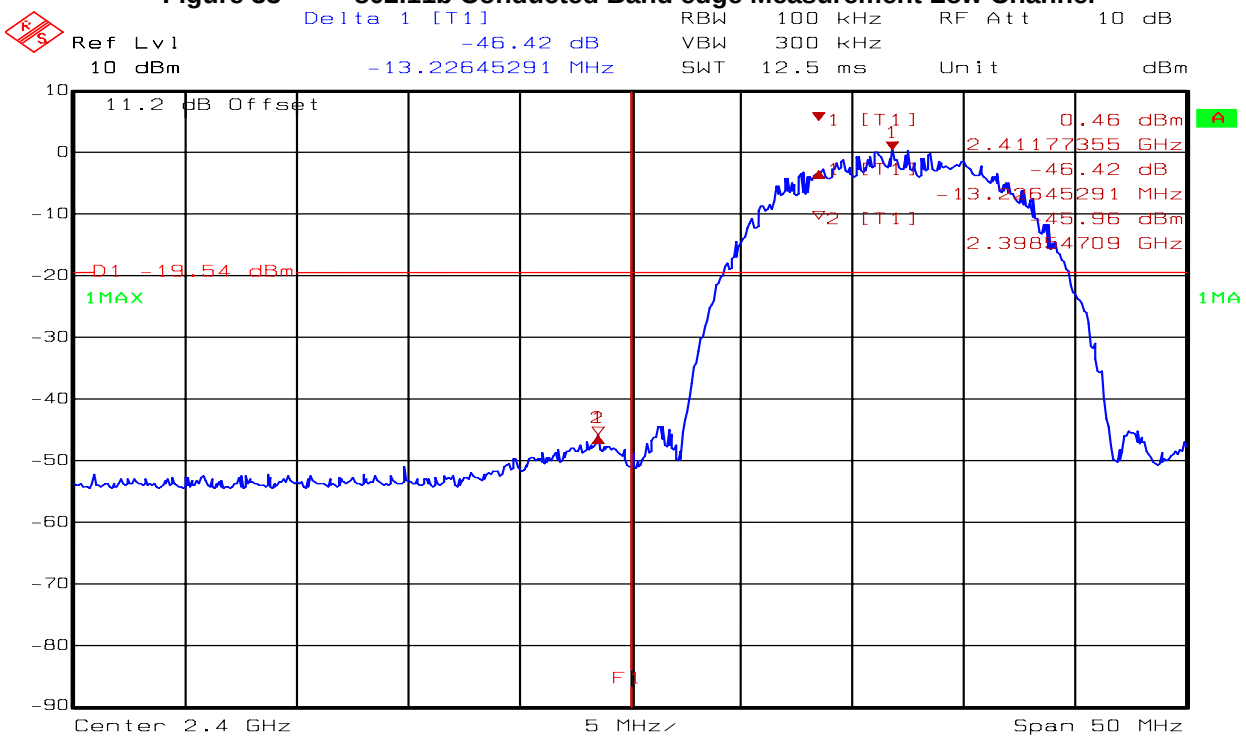
G.6. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

G.7. Test date

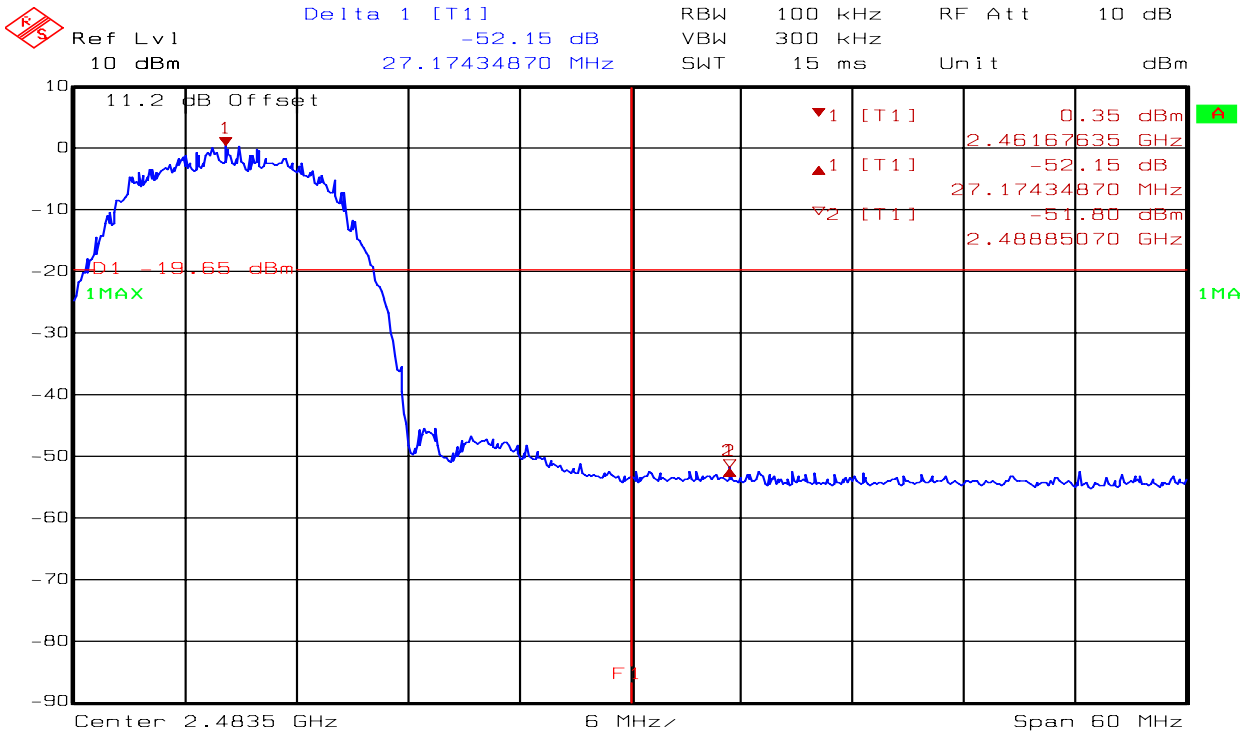
November 17, 2009

Figure 33 802.11b Conducted Band edge Measurement Low Channel



Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11b Ch1 11mbps (P13)
Date: 17.NOV.2009 11:08:16

Figure 34 802.11b Conducted Band edge Measurement High Channel



Title: CG-1290 NovAtel Wireless MIFI2352R
Comment A: Sample B2 Beta3, Orig.HW 802.11b Ch11 11mbps (P13)
Date: 16.NOV.2009 16:09:52

Figure 35 802.11g Conducted Band edge Measurement Low Channel

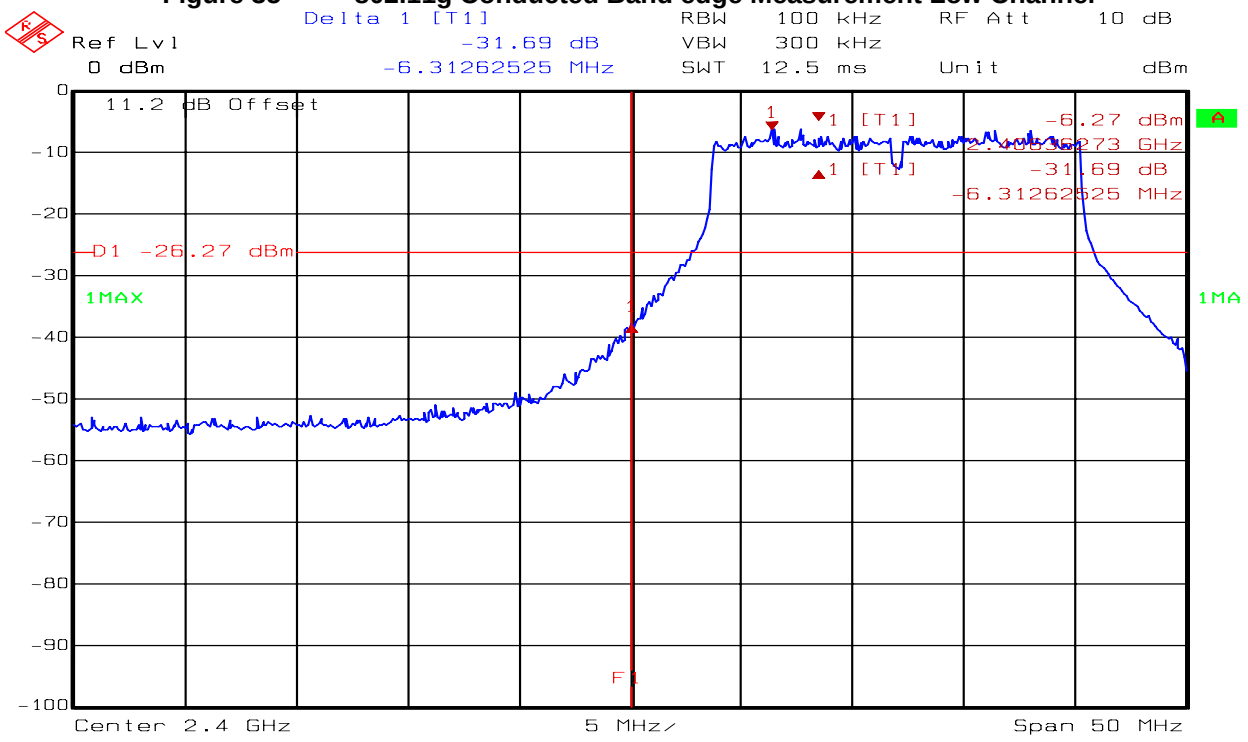
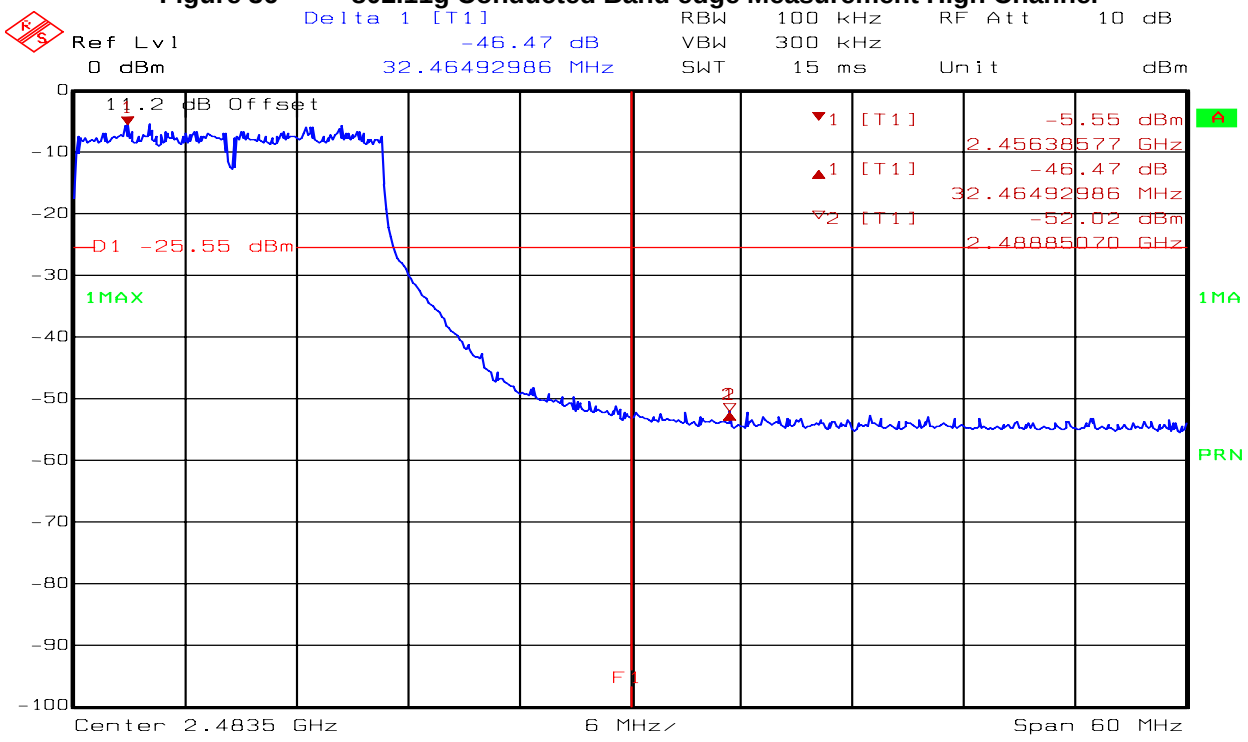


Figure 36 802.11g Conducted Band edge Measurement High Channel



APPENDIX H: RADIATED SPURIOUS EMISSIONS BAND EDGE

H.1. Base Standard & Test Basis

Base Standard	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.209 – Radio Frequency Devices, Part 15.205 – Restricted bands of operation RSS 210 Issue 7 A8.5
Test Basis	ANSI C63.4-2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz,
Test Method	NTS Radiated Emissions Test Method SOP-CAG-EMC-02 and FCC Publication 558074 FCC Publication 913591

H.2. Specifications: FCC 15.205 and RSS 210 Issue 7 2.2 Restricted bands of operation.

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1]0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	N/A
13.36–13.41	N/A	N/A	N/A

(b) The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

H.3. Test Procedure

RF radiated measurement at 3 meters distance.
For measurements above 1 GHz, RBW = 1 MHz, VBW = 1 MHz were used for peak measurements, RBW = 1 MHz, VBW = 10 Hz, were used for average measurements.

H.4. Operating Mode During Test

The EUT was tuned to the low and high channel in continuous transmit mode (100% duty cycle) at maximum rated RF output power

H.5. Test Results

Compliant

Mode	Channel	Frequency (MHz)	Polarization	Measured level (dBµV/m)	Detector	Limit (dBm)	Margin (dB)
802.11b	1	2383.83	H	61.86	Peak	73.98	12.12
		2390.00	H	48.18	Video Average	53.98	5.80
	11	2483.50	H	61.68	Peak	73.98	12.30
		2483.50	H	48.36	Video Average	53.98	5.62
802.11g	1	2386.24	H	64.94	Peak	73.98	9.04
		2390.00	H	47.59	Video Average	53.98	6.39
	11	2483.50	H	60.45	Peak	73.98	13.53
		2483.50	H	48.14	Video Average	53.98	5.84

Maximum peak measurement was 64.94 dBµV/m at 2386.24 MHz with 802.11g mode. It has 9.04 dB margin to the peak limit

Maximum average measurement was 48.36 dBµV/m at 2483.50 MHz with 802.11b mode. It has 5.62 dB margin to the average limit

H.6. Sample Calculations

Part 15.209 Average Limit: 500 µV/m @ 3m = 20*Log (500) = 53.98 dBµV/m, Peak limit = 73.98 dBµV/m

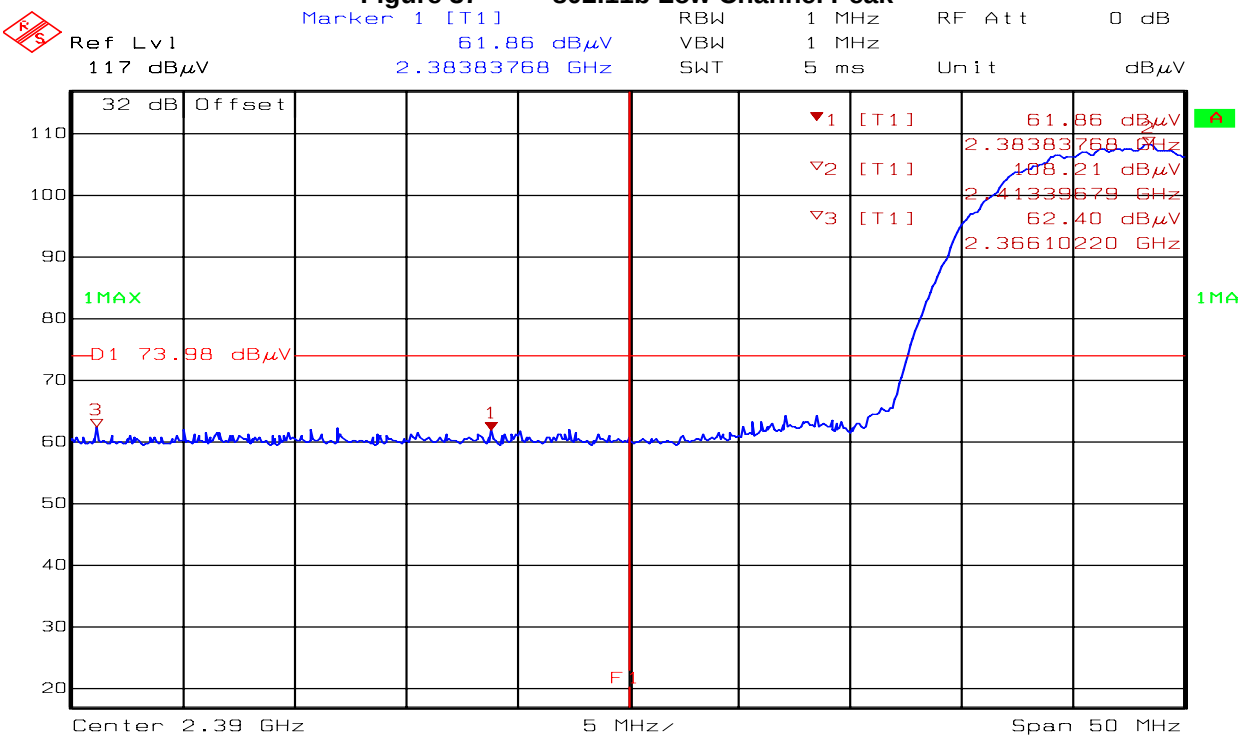
H.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior Wireless / EMC Technologist

H.8. Test date

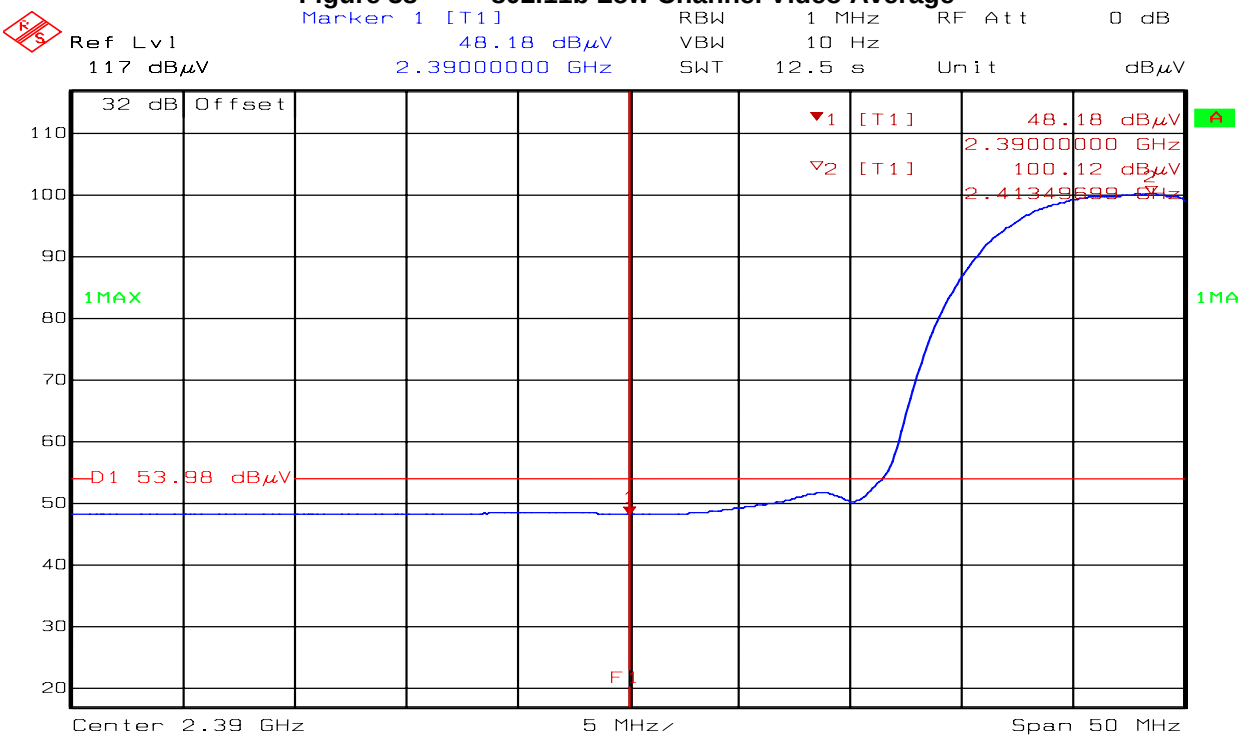
June 24, 2009

Figure 37 802.11b Low Channel Peak



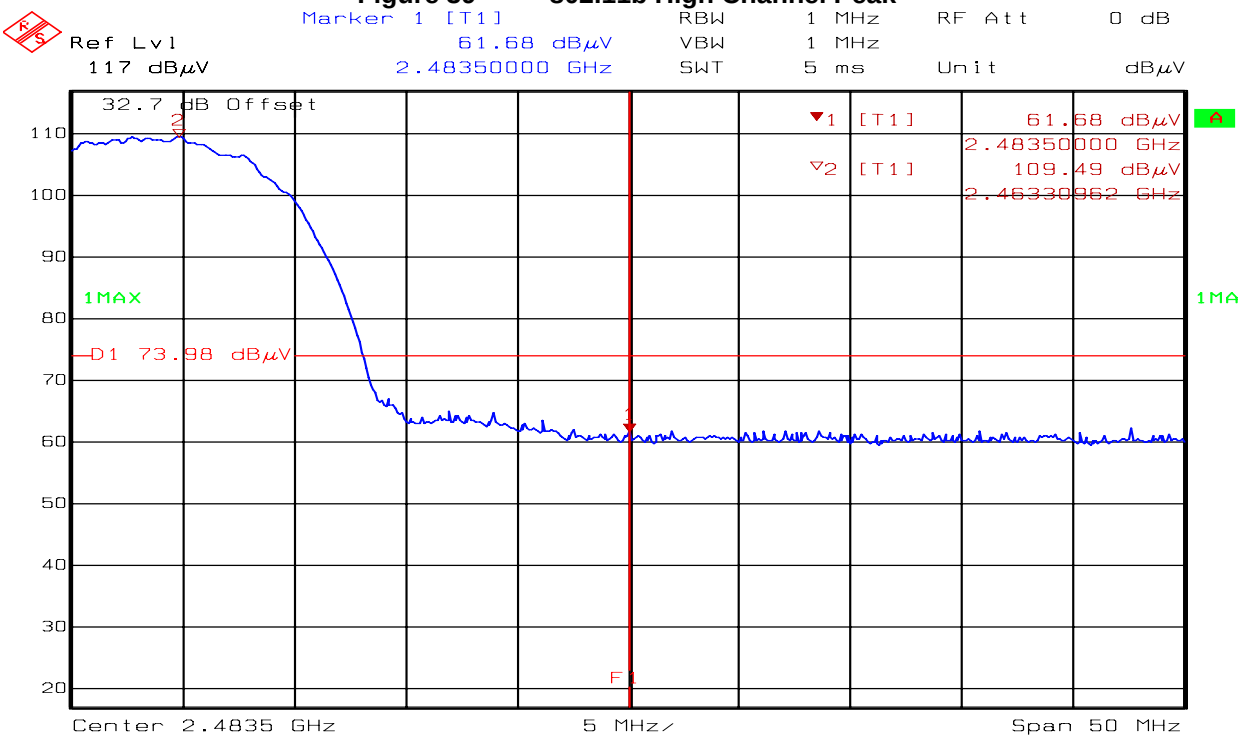
Title: CG-1290 NovAtel Wireless MIFI 2352R
Comment A: 802.11b, Ch1, 11mbps, 100% duty cycle, rated power output
Date: 30.NOV.2009 20:44:03

Figure 38 802.11b Low Channel Video Average



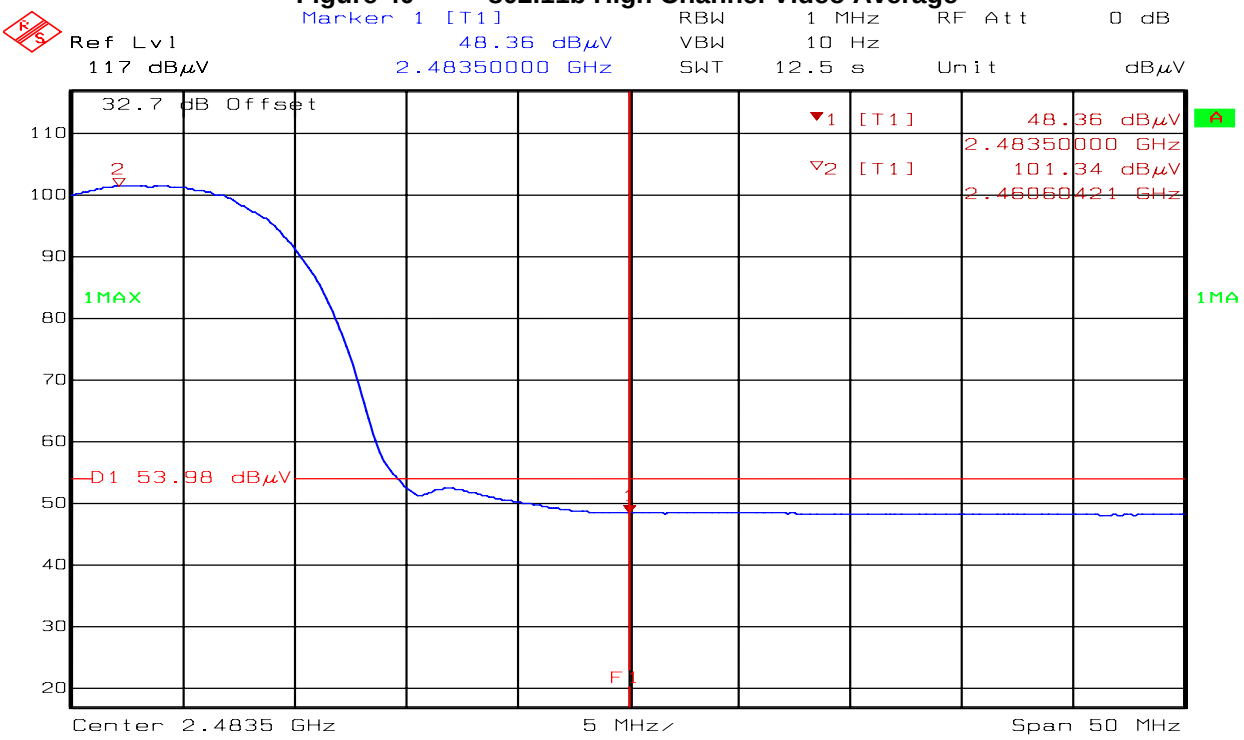
Title: CG-1290 NovAtel Wireless MIFI 2352R
Comment A: 802.11b, Ch1, 11mbps, 100% duty cycle, rated power output
Date: 30.NOV.2009 20:45:57

Figure 39 802.11b High Channel Peak



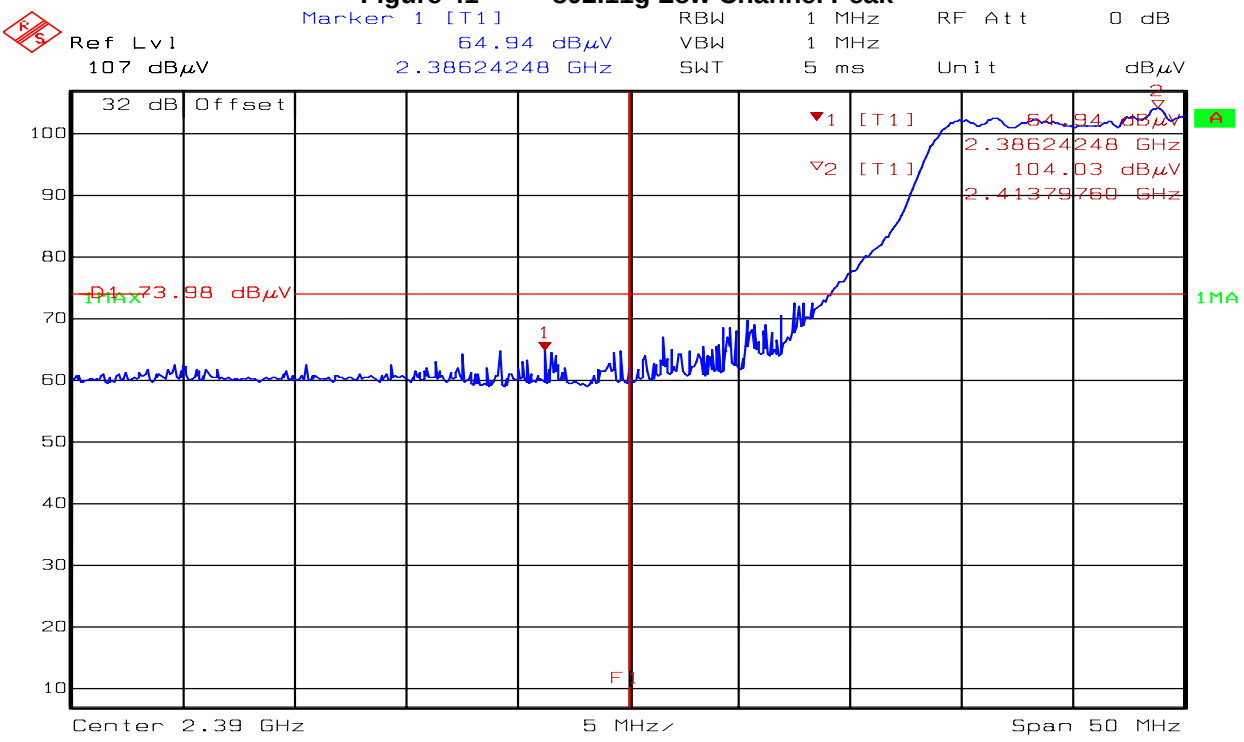
Title: CG-1290 NovAtel Wireless MIFI 2352R
Comment A: 802.11b Ch11, 11mbps, 100% duty cycle, max. rated power
Date: 30.NOV.2009 21:05:34

Figure 40 802.11b High Channel Video Average



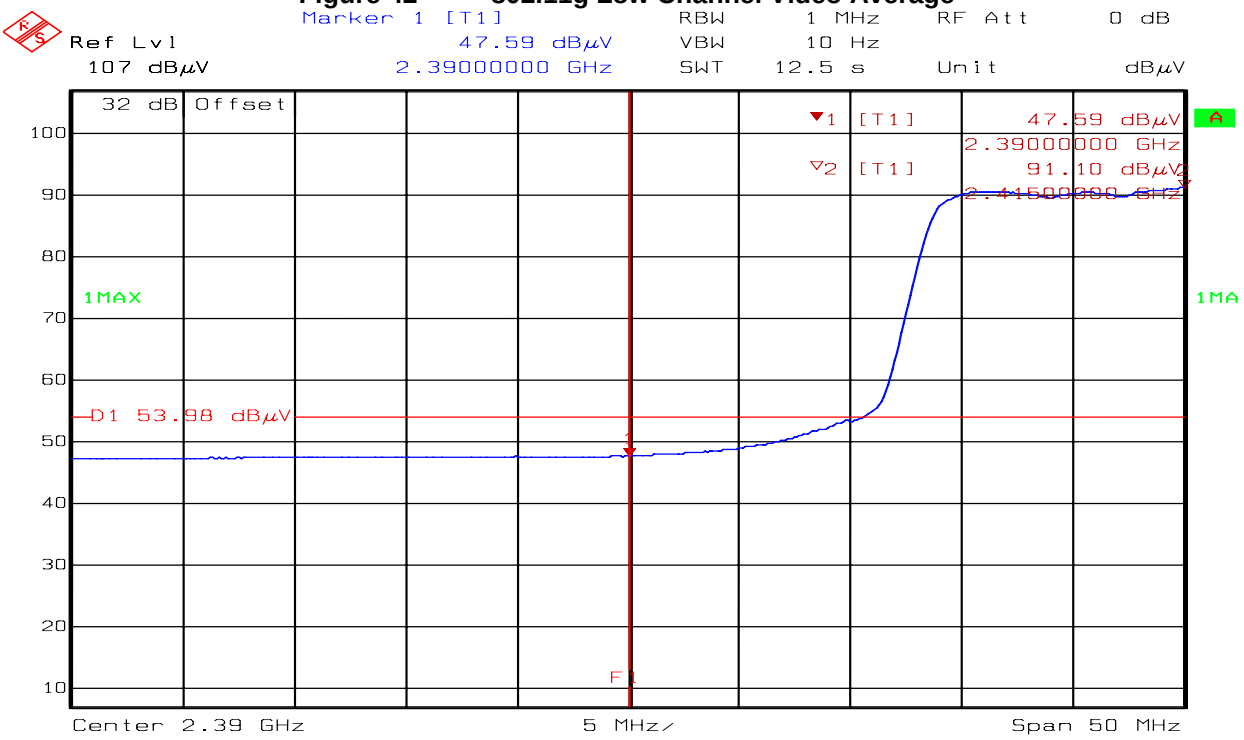
Title: CG-1290 NovAtel Wireless MIFI 2352R
Comment A: 802.11b Ch11, 11mbps, 100% duty cycle, max. rated power
Date: 30.NOV.2009 21:06:57

Figure 41 802.11g Low Channel Peak



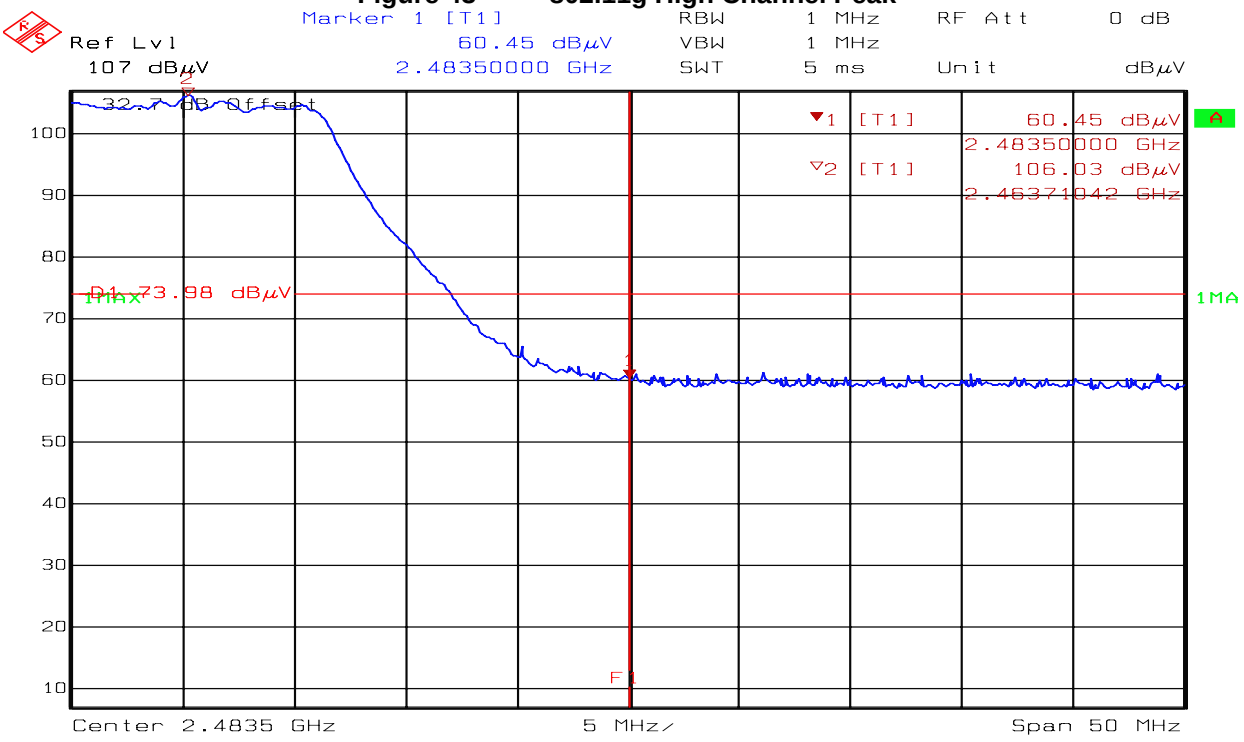
Title: CG-1290 NovAtel Wireless MIFI 2352R
Comment A: 802.11g, Ch1, 54mbps, 100% duty cycle, rated power output
Date: 30.NOV.2009 20:34:35

Figure 42 802.11g Low Channel Video Average



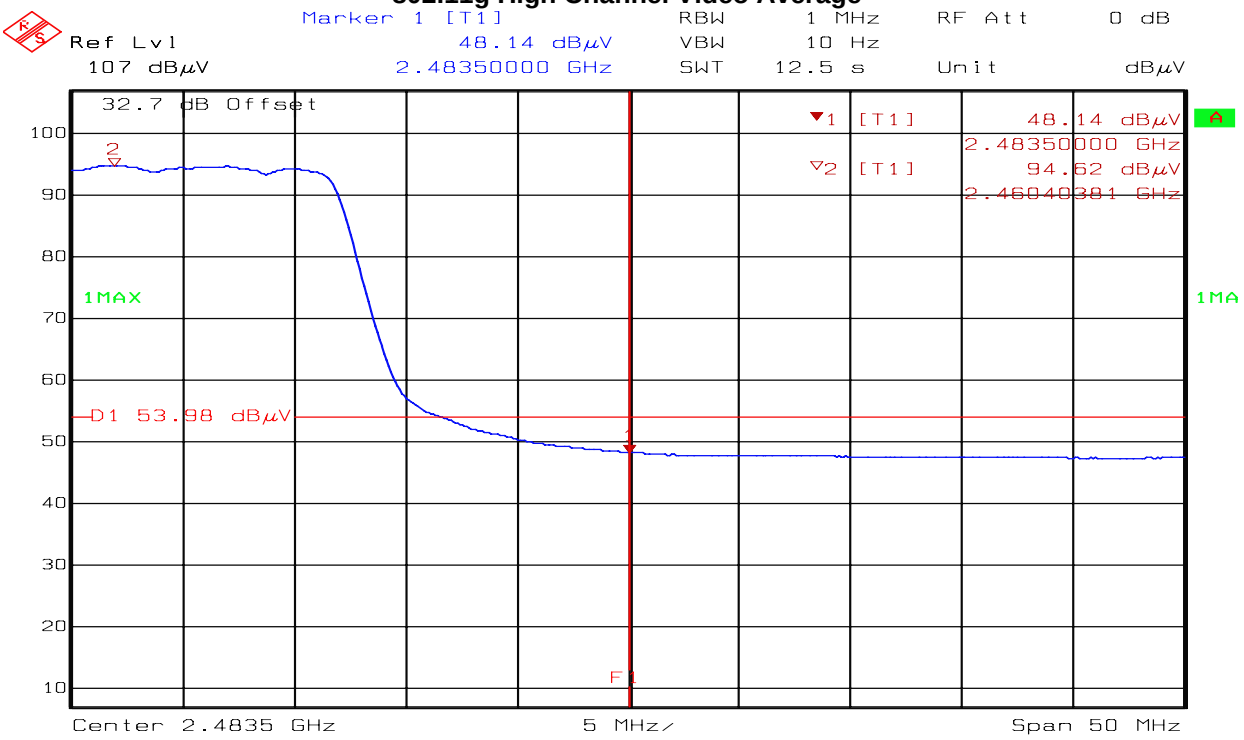
Title: CG-1290 NovAtel Wireless MIFI 2352R
Comment A: 802.11g, Ch1, 54mbps, 100% duty cycle, rated power output
Date: 30.NOV.2009 20:29:43

Figure 43 802.11g High Channel Peak



Title: CG-1290 NovAtel Wireless MIFI 2352R
Comment A: 802.11g Ch11, 54mbps, 100% duty cycle, max. rated power
Date: 30.NOV.2009 21:16:37

802.11g High Channel Video Average



Title: CG-1290 NovAtel Wireless MIFI 2352R
Comment A: 802.11g Ch11, 54mbps, 100% duty cycle, max. rated power
Date: 30.NOV.2009 21:14:06

APPENDIX I: RADIATED SPURIOUS EMISSIONS (TX AND RX)

I.1. Base Standard & Test Basis

Base Standard	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.209 – Radio Frequency Devices, Part 15.205 – Restricted bands of operation RSS 210 Issue 7 2.6 and A8.5 RSS Gen Issue 2 4.10 and 7.2.3 Receiver Spurious Emission
Test Basis	ANSI C63.4-2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz, FCC Publication 558074
Test Method	NTS Radiated Emissions Test Method SOP-CAG-EMC-02 and FCC Publication 558074

Specifications: FCC 15.205 and RSS 210 Issue 7 2.2 Restricted bands of operation.

(a) Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1]0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	N/A
13.36–13.41	N/A	N/A	N/A

(b) The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

I.2. Test Procedure

I.2.1 Transmitter Spurious Emission

For measurements above 1 GHz, RBW = 1 MHz, VBW = 1 MHz were used for peak measurements, RBW = 1 MHz, VBW = 10 Hz, were used for average measurements.

I.2.2 RSS Gen Issue 2, 4.10 Receiver Spurious Emission

The receiver shall be operated in the normal receive mode near the mid-point of the band over which the receiver is designed to operate.

Unless otherwise specified in the applicable RSS, the radiated emission measurement is the standard measurement method (with the device's antenna in place) to measure receiver spurious emissions.

Radiated emission measurements are to be performed using a calibrated open-area test site. As an alternative, the conducted measurement method may be used when the antenna is detachable. In such a case, the receiver spurious signal may be measured at the antenna port.

For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tuneable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

For emissions below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector with the same measurement bandwidth as that for CISPR quasi-peak measurements. Above 1 GHz, measurements shall be performed using an average detector and a resolution bandwidth of 300 kHz to 1 MHz.

Spurious Emission Limits for Receivers

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

I.3. Operating Mode During Test

The EUT was tuned to the low, mid and high channel in continuous transmit mode (100% duty cycle) at maximum rated RF output power in 802.11b and 802.11g modes for all TX spurious emissions.
For Tx spurious emissions, GSM was also configured as CELL GPRS Ch190, 836.6MHz 1up 1 down, MS Tx level Burst 5 (Max.)
For receiver spurious emissions the EUT was tuned to receive only mode in mid channel with 802.11b and 802.11g modes, GSM was attached to the call box
For GPS receiver emissions, the GPS receiver was activated and GPS data was logged to a file with the VisualGPS Application

I.4. Test Results

Pass, Worst case results reported

I.4.1 Rx mode

There was no Rx mode emissions observed in 802.11b, 802.11g and GPS receiver modes

I.4.2 TX Mode

Mode	Channel	Frequency (MHz)	Polarization	Measured level (dBµV/m)	Detector	Limit (dBm)	Margin (dB)
802.11b	1	4824.50	V	45.78	Peak	73.98	28.20
		4825.87	V	29.46	Video Average	53.98	24.52
	6	4874.17	V	45.44	Peak	73.98	28.54
		4872.13	V	29.11	Video Average	53.98	24.87
	11	4923.80	V	42.49	Peak	73.98	31.49
		4922.73	V	27.19	Video Average	53.98	26.79
802.11g	1	4829.08	V	46.17	Peak	73.98	27.81
		4825.67	V	26.79	Video Average	53.98	27.19
	6	4881.17	V	46.80	Peak	73.98	27.18
		4873.33	V	28.44	Video Average	53.98	25.54
	11	4924.58	V	43.81	Peak	73.98	30.17
		4926.00	V	26.10	Video Average	53.98	27.88

Worst case average spurious emission was 29.46 dBµV/m at 4825.87 MHz vertical polarization in Channel 1 with 802.11b mode. It has 24.52 dB margin to the average limit.

Worst case peak spurious emission was 46.80 dBµV/m at 4881.17 MHz vertical polarization in Channel 6 with 802.11g mode. It has 27.18 dB margin to the peak limit.

See test report CG-1290-RA-1-2 for Co-located spurious emissions

Observations:
CELL band Ch190 spurious emissions were observed at 1676.66 MHz (2nd harmonic of Ch190) and 9203.00 MHz (11th harmonic of Ch190) which was not related to 802.11b and 802.11g emissions
See test report CG-1290-RA-1-2 for CELL band related emissions

Note:
Plots were not provided in order to reduce file size

I.5. Sample Calculations

Average Limit for above 960 MHz = 500 µV/m @ 3m = 20*Log (500) = 53.98 dBµV/m
Peak Limit for above 960 MHz = Average Limit + 20 (dB) = 73.98 dBµV/m

I.6. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

I.7. Test date

Started: November 24, 2009 Completed: December 7, 2009

APPENDIX J: TEST EQUIPMENT LIST

Manufacturer	Type/Model		Asset #	Cal Due	Cal Date
Bilog Antenna	Teseq	CBL 6112B	CG0314	21SEP10	29OCT08
Horn Antenna (Rx) 1 GHz – 18 GHz	EMCO	3115	CG0103	06MAR11	30SEP08
Standard Gain Horn (Rx) 18 GHz – 26.5 GHz	EMCO	3160-09	CG0075	N/A (1)	27NOV01
LNA 1 GHz < f < 18 GHz	Miteq	JSD00121	CG0317	01DEC10	01DEC08
LNA 18GHz < f < 26.5GHz	Miteq	JSD00119	CG0482	02OCT11	02OCT09
High pass filter f > 1000 MHz	MicroTronics	HPM14576	CG0963	01DEC10	01DEC08
High pass filter f > 2800 MHz	MicroTronics	HPM50111	CG0964	N/A	N/A
Spectrum Analyzer 9 kHz – 40 GHz	Rohde & Schwarz	FSEK-20	CG0118	06AUG10	06AUG09
Test Receiver	Rohde & Schwarz	ESAI	CG0123 CG0124	26FEB10	26FEB09
Power Meter	Rohde & Schwarz	NRVD	CG0030	10NOV10	10NOV09
Power Meter Sensor	Rohde & Schwarz	NRV-Z31	CG0031	10NOV10	10NOV09
Wireless Communication Test Set	Agilent	8960 E5515C	CG-R-1286	02OCT11	24SEP09
Table Top LISN	EMCO	3825	CG0367	18JAN10	18JAN08
Test Receiver	Rohde & Schwarz	ESAI	CG0123 CG0124	26FEB10	26FEB09
HPIB Extender	HP	37204	CG0181	N/A	N/A
Mast Controller	EMCO	2090	CG0179	N/A	N/A
Turntable Controller	EMCO	2090	CG0178	N/A	N/A

(1): As per manufacturer recommend, this item does not require periodic calibration. Its electromagnetic performance is almost exclusively depended on the physical dimension of the horn. A thorough mechanical check is all that is needed to guarantee the antenna performance.

END OF DOCUMENT