TEST RESULT SUMMARY

FCC Part 15 Subpart C Section 15.247
Industry Canada RSS-210 Issue 8

MANUFACTURER	Digi International 11001 Bren Road East Minnetonka MN 55343
DESCRIPTION OF EQUIPMENT	Truck vehicle data bus to WiFi / Bluetooth adapter
NAME OF EQUIPMENT	Vehicle Adapter (Wi-Fi radio)
MODEL NUMBER(S) TESTED	50001817-02
SERIAL NUMBER(S) TESTED	0001
TEST REPORT NUMBER	NC1305468.2
TEST DATE(S)	08 July – 28 August 2013

TÜV SÜD America Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the applicable requirements of FCC Part 15 Subpart C Section 15.247 *"Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz",* and Industry Canada RSS-210 Issue 8 *"Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment".*

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

		Tested by:	Approved by:
Date:	05 November 2013		
Location:	Taylors Falls MN USA	Greg Jakubowski Senior EMC Technician	Joel T Schneider Senior EMC Engineer

Not Transferable

EMC TEST REPORT

Test Report No.	NC1305468.2	Date of issue:	05 November 2013
Product Description	Truck vehicle data bus to WiFi / Bluetooth adapter		
Product Name	Vehicle Adapter (Wi-Fi radio)		
Model No(s) Tested	50001817-02		
Serial No(s) Tested	0001		
Manufacturer	Digi International		
Address	11001 Bren Road East		
	Minnetonka MN 55343		

Test Result ■ **Positive** ☐ **Negative**

TÜV SÜD America Inc reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. TÜV SÜD America Inc shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD America Inc issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval. TÜV SÜD America's Wild River Lab maintains A2LA accreditation to ISO/IEC 17025 for the specific tests listed in A2LA Certificate #2955.12 as an Electrical Testing Laboratory and TÜV SÜD America's Oakwood Lab maintains A2LA accreditation to ISO/IEC 17025 for the specific tests listed in A2LA Certificate #2955.10 as an Electrical Testing Laboratory. A portion of the test results included in this report was performed at each facility.

TÜV SÜD America Inc and its professional staff hold government and professional organization certifications and are members of AAMI, ACIL, AEA, ANSI, IEEE, NARTE, and VCCI.

REVISION RECORD

REVISION	TOTAL NUMBER OF PAGES	DATE	DESCRIPTION
	81	05 November 2013	Initial Release

TEST REPORT CONTENTS **Page(s)**

Revision Record		2
Directory		3
Test Regulations		4
Environmental Conditions		4
Power Supply		4
Test Equipment Traceability		4
Test Information		
6 dB signal bandwidth	FCC 15.247(a)2), IC RSS-210 A8.2(a)	5 - 15
Fundamental emission output power	FCC 15.247(b)3), IC RSS-210 A8.4(4)	16 - 26
Maximum power spectral density	FCC 15.247(e), IC RSS-210 A8.2(b)	27 - 37
Emissions in non-restricted frequency bands	FCC 15.247(d), IC RSS-210 A8.5	38 - 48
Emissions in restricted frequency bands	FCC 15.247(d)	49
Band-edge measurements	FCC 15.247(d), IC RSS-210 A8.5	50 - 64
Test-setup Photos		65 - 69
Equipment Under Test Information		70
General Remarks, Deviations, Summary		71
Appendix A		
Constructional Data Form		72 - 79
Appendix B		
Measurement Protocol		80 - 81

EMC TEST REGULATIONS:
The tests were performed according to the following regulations:
- FCC Part 15 Subpart C Sections 15.247(a)2), (b)3), (d), (e)
- Industry Canada RSS-210 Issue 8 Sections A8.2(a)(b), A8.4(4), A8.5

ENVIRONMENTAL CONDITIONS IN THE LAB

	Actual
Temperature:	: 20-24°C
Atmospheric pressure	: 98-99 kPa
Relative Humidity	: 55-69%

POWER SUPPLY UTILIZED

Power supply system	: 13.5 VDC

TEST EQUIPMENT
All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated according to internal procedure.

SIGN EXPLANATIONS
☐ - not applicable
■ - applicable.

6 dB signal bandwidth

FCC 15.247(a)2), IC RSS-210 A8.2(a)

Test summary

The requirements are: ■ - MET ☐ - NOT MET
Testing per FCC D01 DTS Meas Guidance v03
The 6 dB signal bandwidth is > 10 MHz

Test location

☐ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)
■ - Wild River Shield Room 2

Test equipment

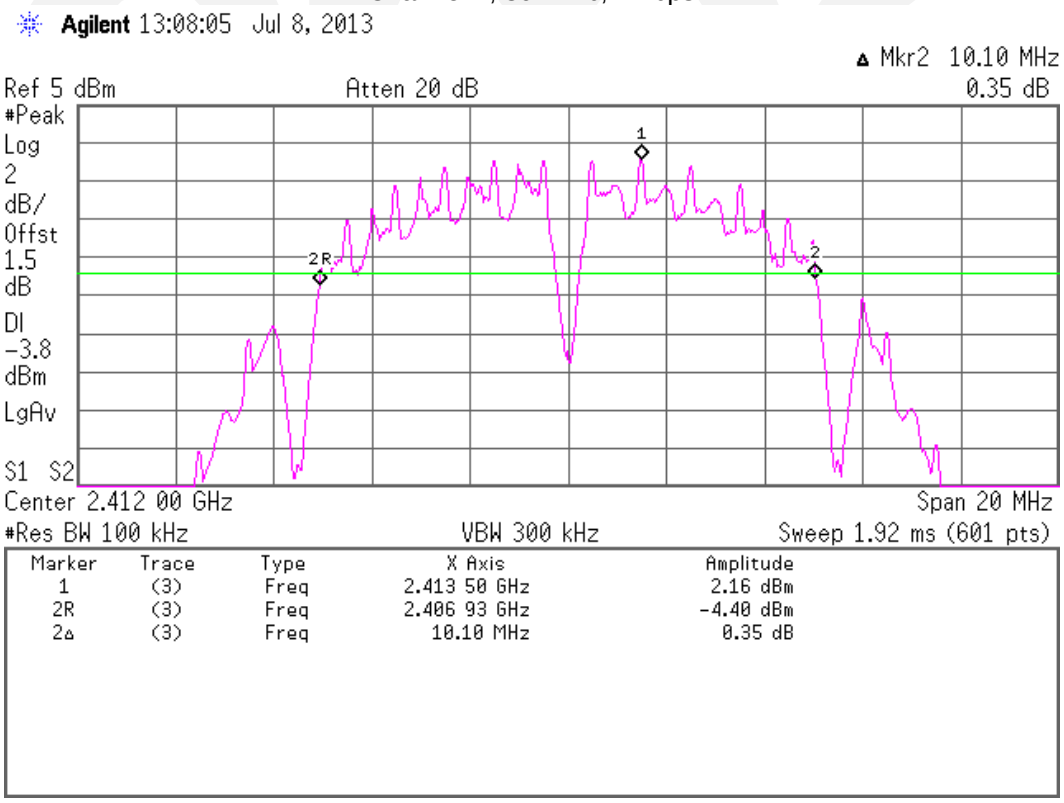
TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13

Test limit

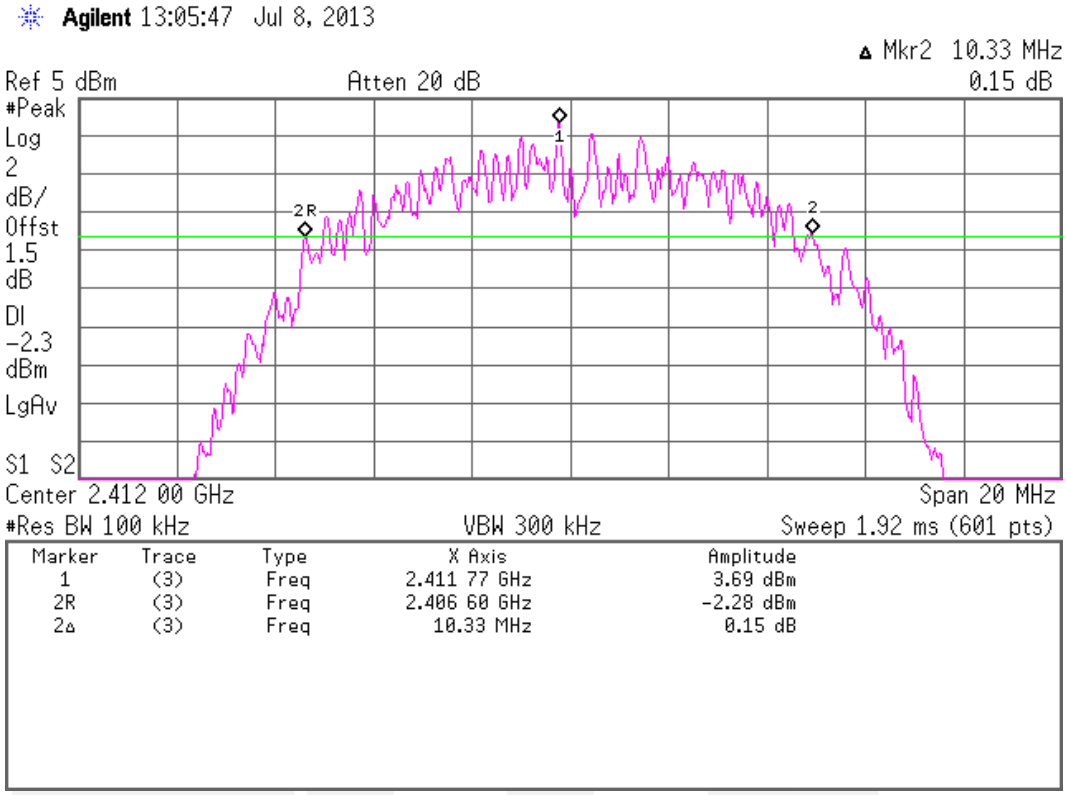
The minimum 6 dB bandwidth shall be at least 500 kHz.

Test data

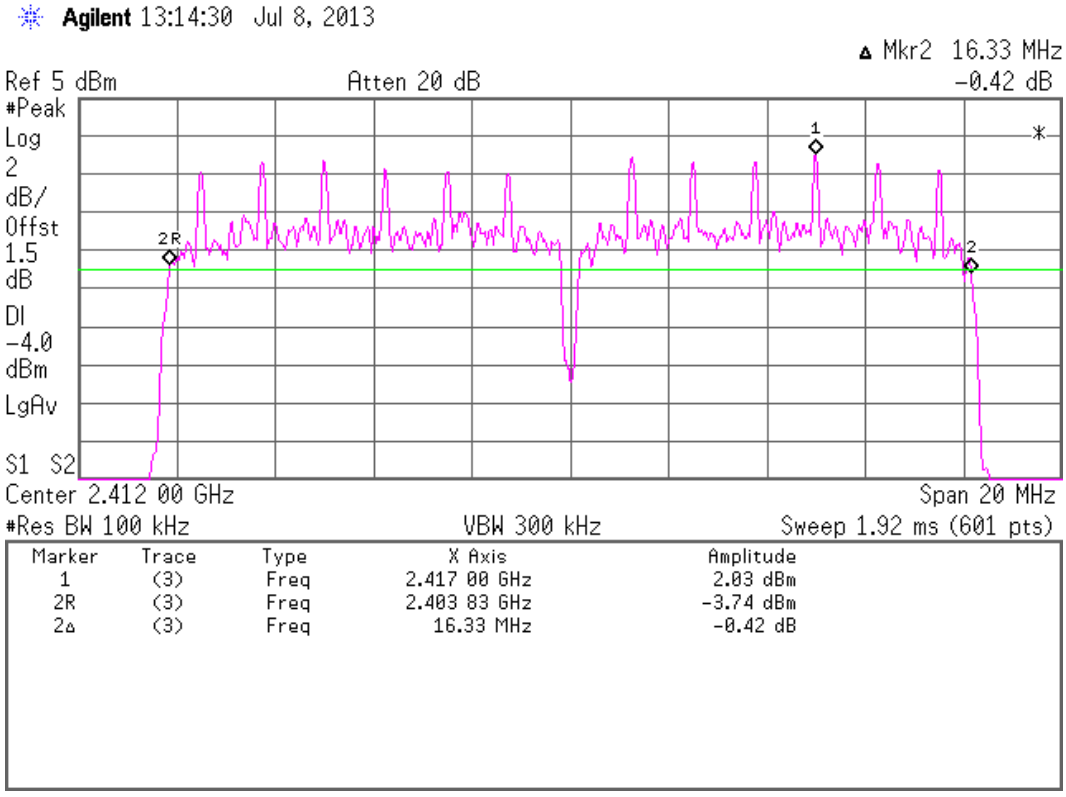
Channel 1, 802.11b, 1Mbps



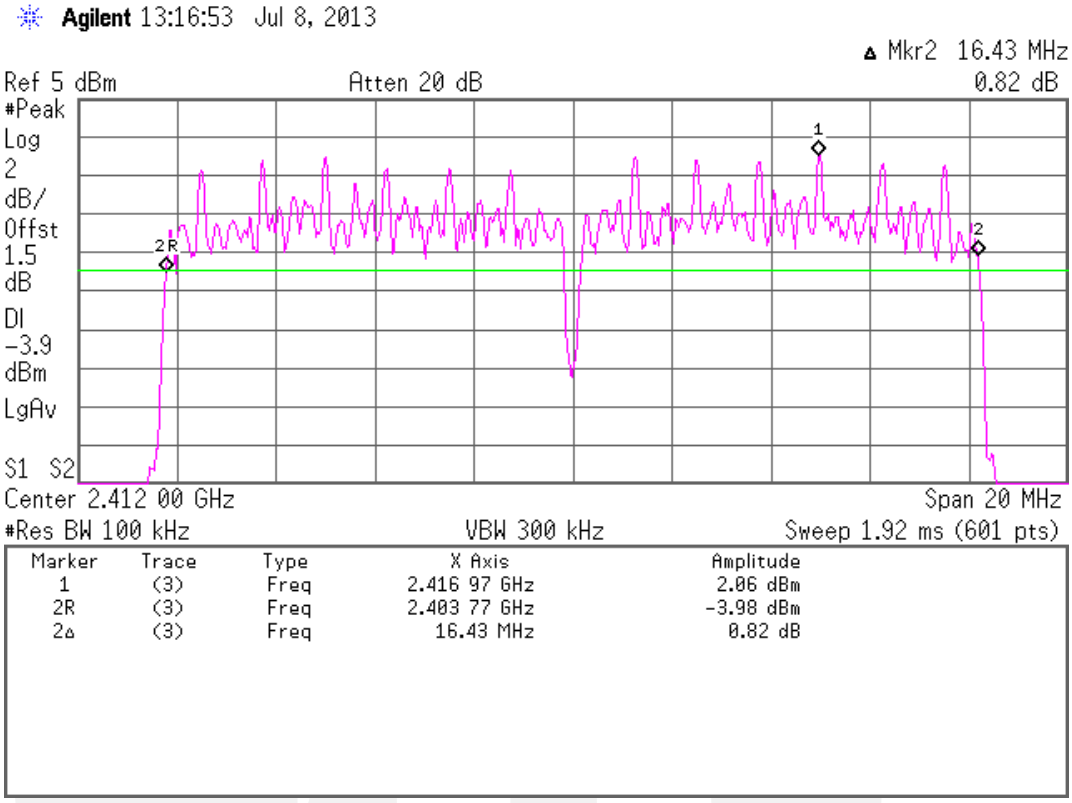
Channel 1, 802.11b, 11Mbps



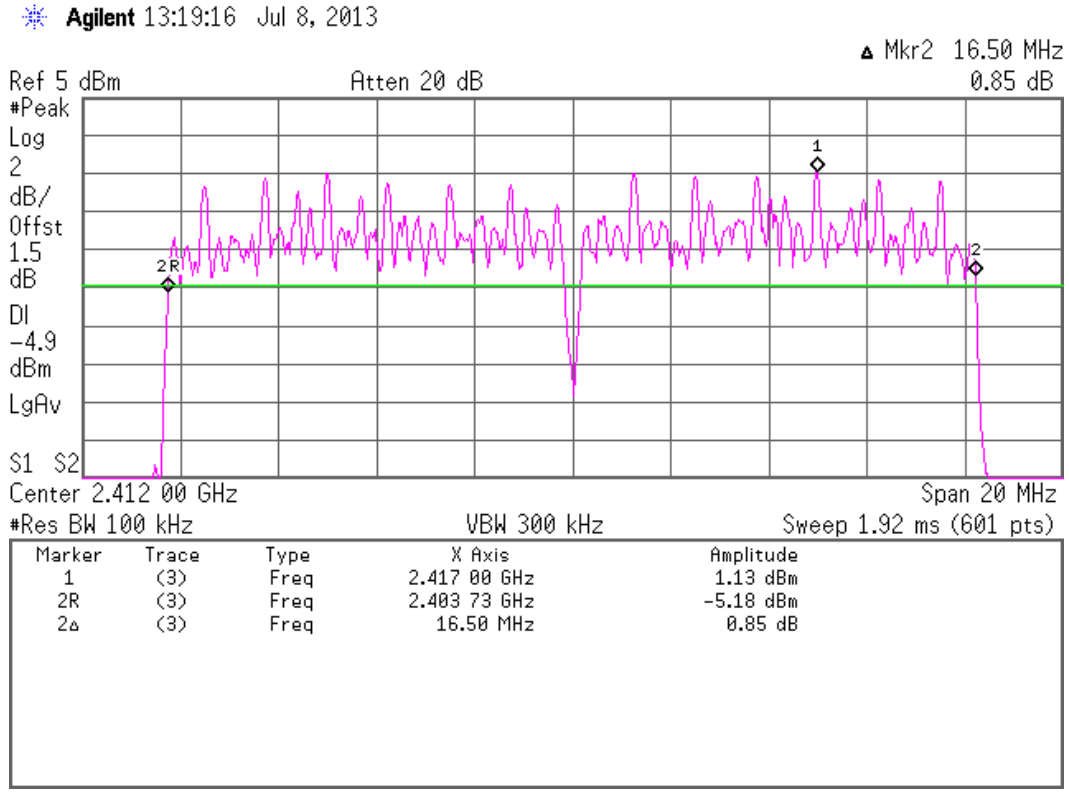
Channel 1, 802.11g, 6Mbps



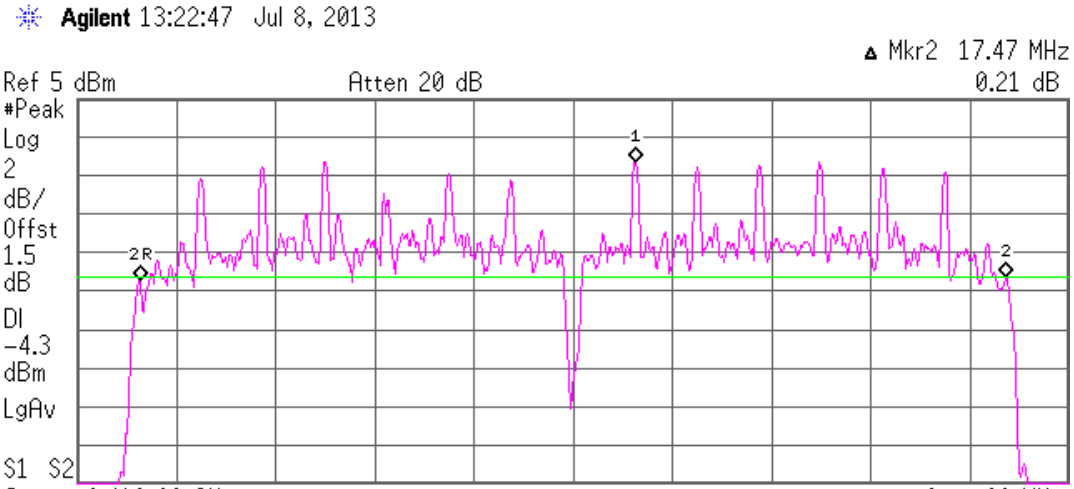
Channel 1, 802.11g, 36Mbps



Channel 1, 802.11g, 54Mbps

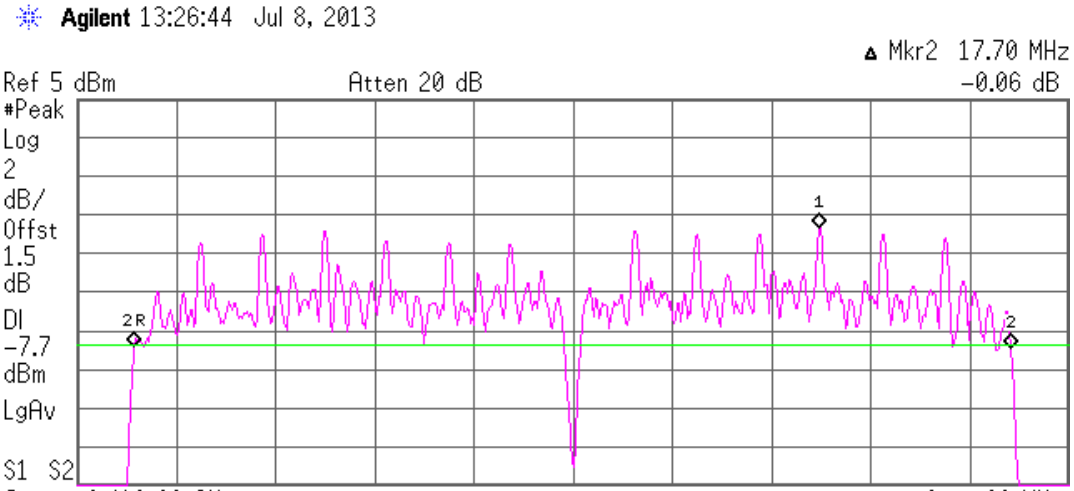


Channel 1, 802.11n, 6.5Mbps



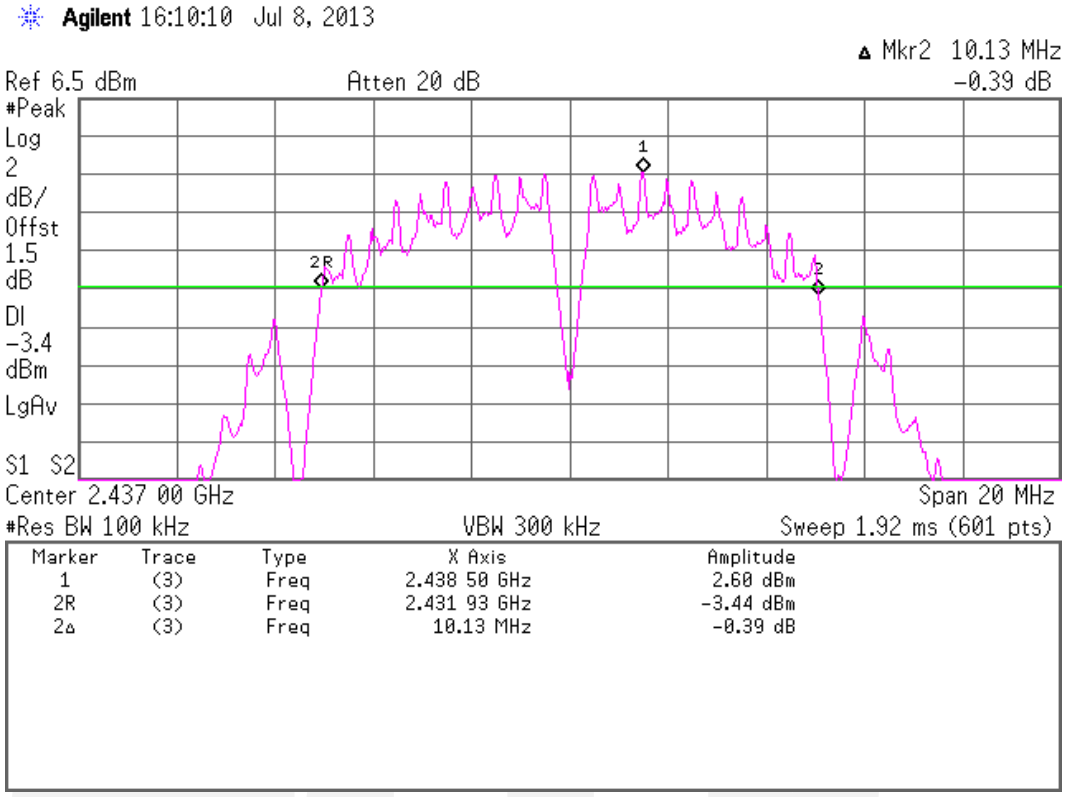
Marker	Trace	Type	X Axis	Amplitude
1	(3)	Freq	2.413 27 GHz	1.73 dBm
2R	(3)	Freq	2.403 27 GHz	-4.48 dBm
2Δ	(3)	Freq	17.47 MHz	0.21 dB

Channel 1, 802.11n, 65Mbps

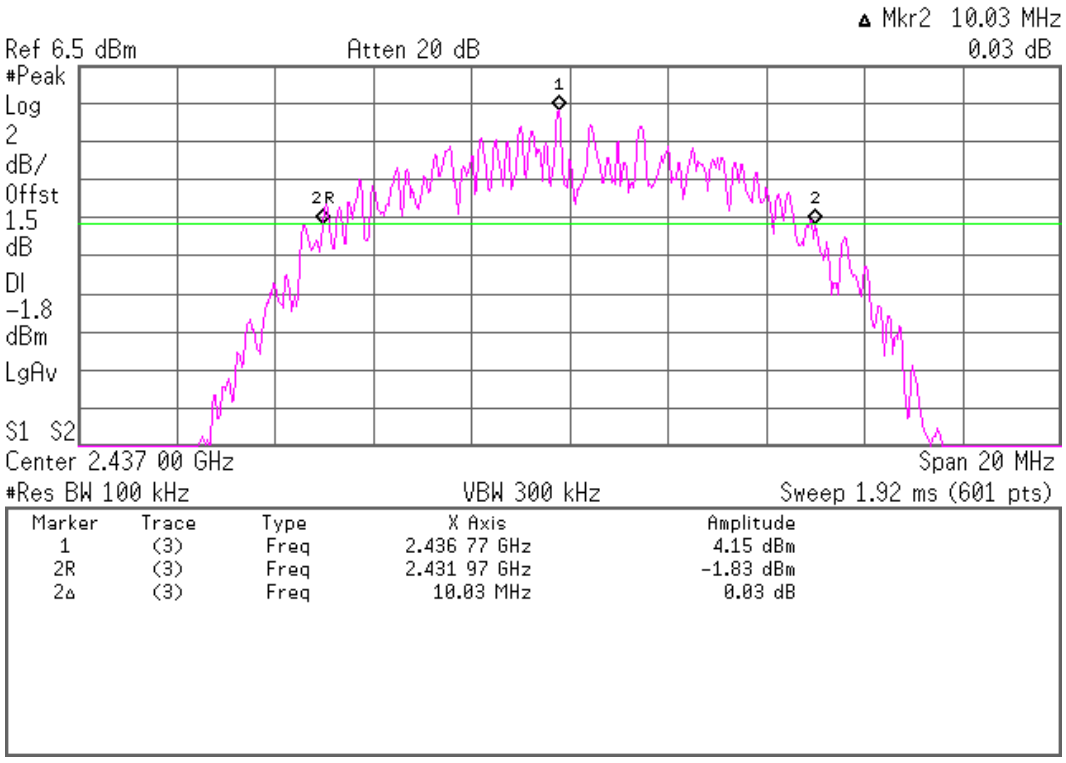


Marker	Trace	Type	X Axis	Amplitude
1	(3)	Freq	2.416 97 GHz	-1.66 dBm
2R	(3)	Freq	2.403 13 GHz	-7.83 dBm
2Δ	(3)	Freq	17.70 MHz	-0.06 dB

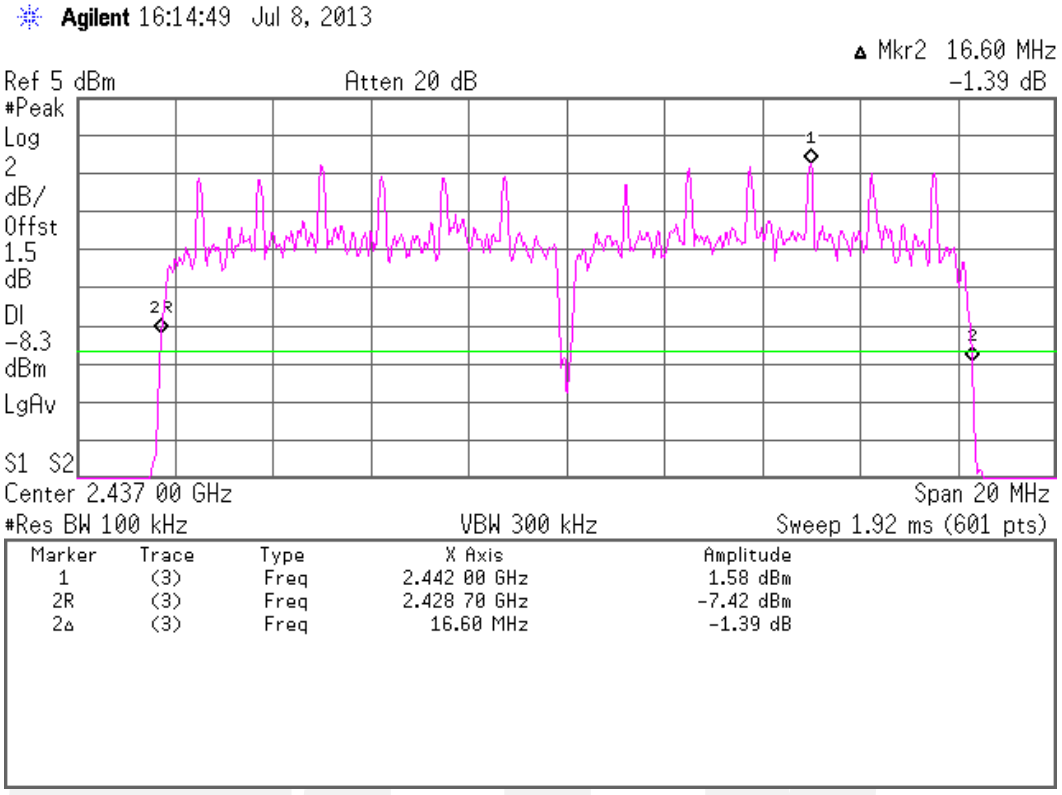
Channel 6, 802.11b, 1Mbps



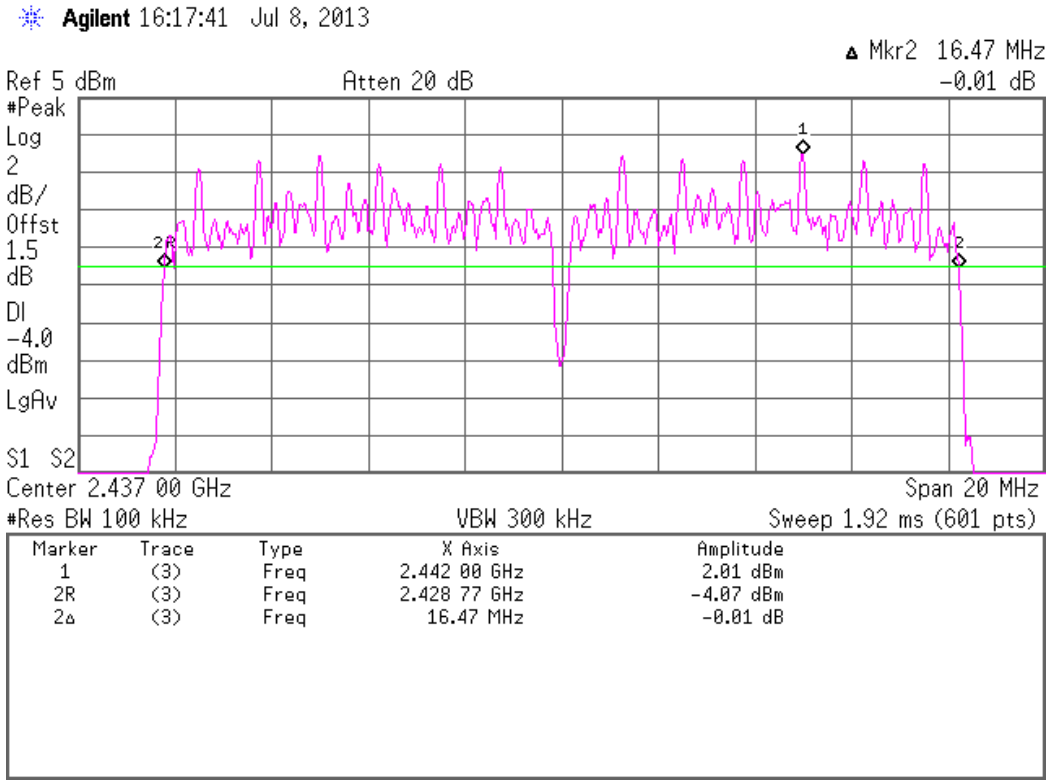
Channel 6, 802.11b, 11Mbps



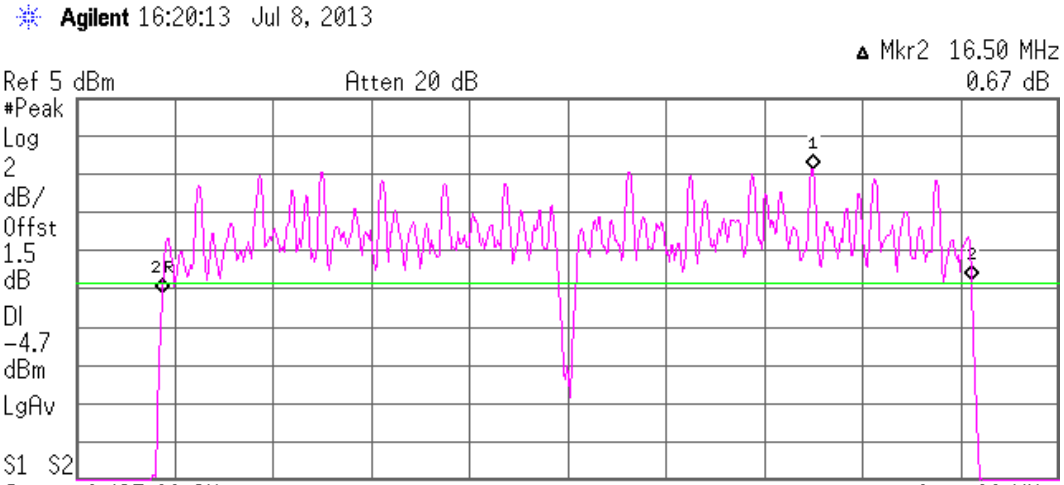
Channel 6, 802.11g, 6Mbps



Channel 6, 802.11g, 36Mbps

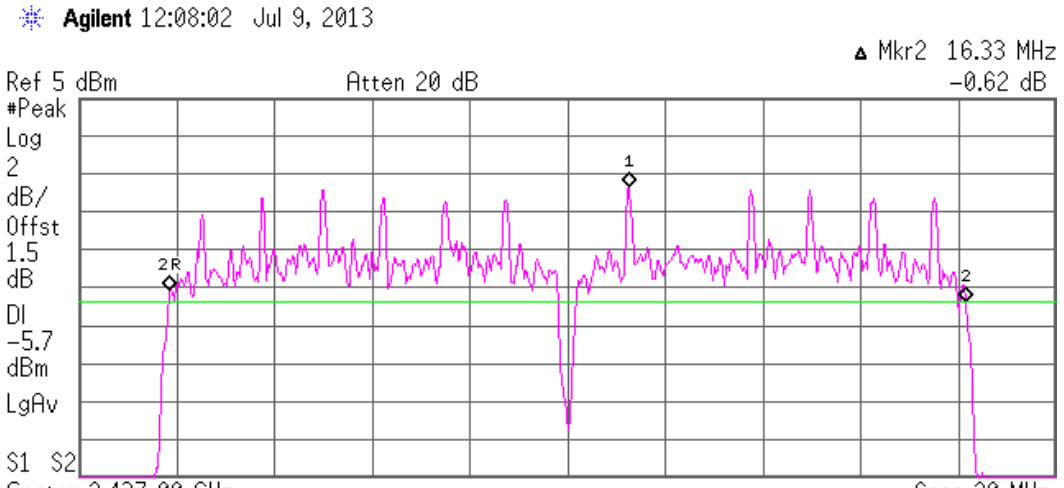


Channel 6, 802.11g, 54Mbps



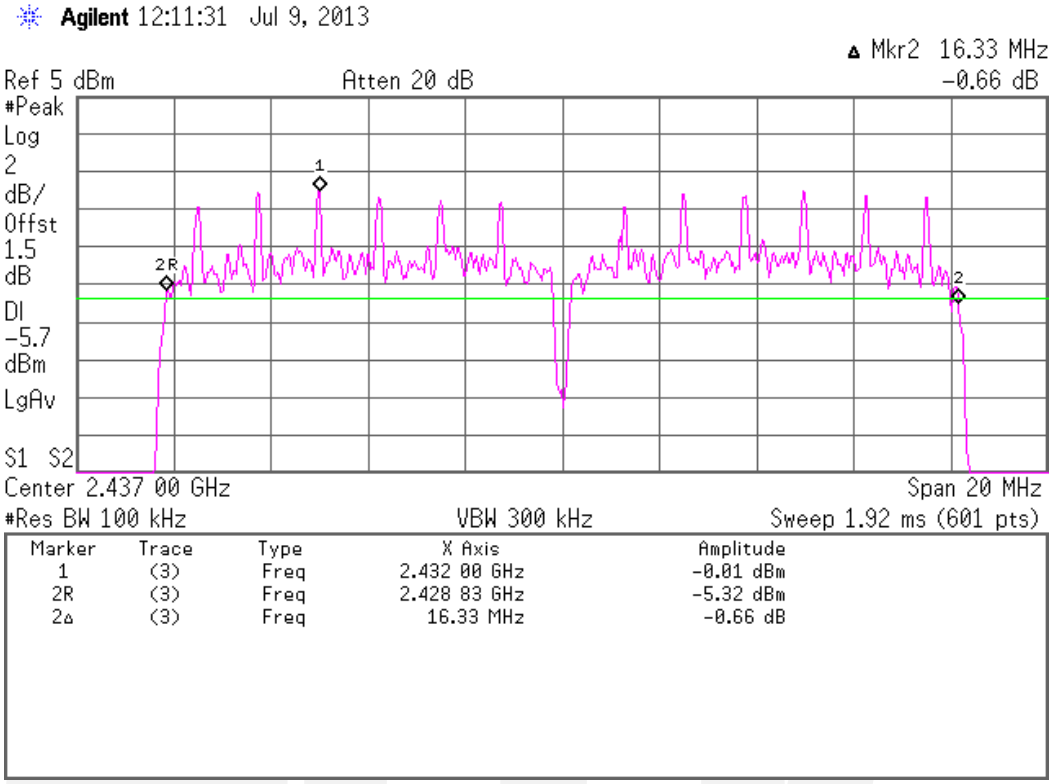
Marker	Trace	Type	X Axis	Amplitude
1	(3)	Freq	2.442 00 GHz	1.28 dBm
2R	(3)	Freq	2.428 73 GHz	-5.17 dBm
2Δ	(3)	Freq	16.50 MHz	0.67 dB

Channel 6, 802.11n, 6.5Mbps

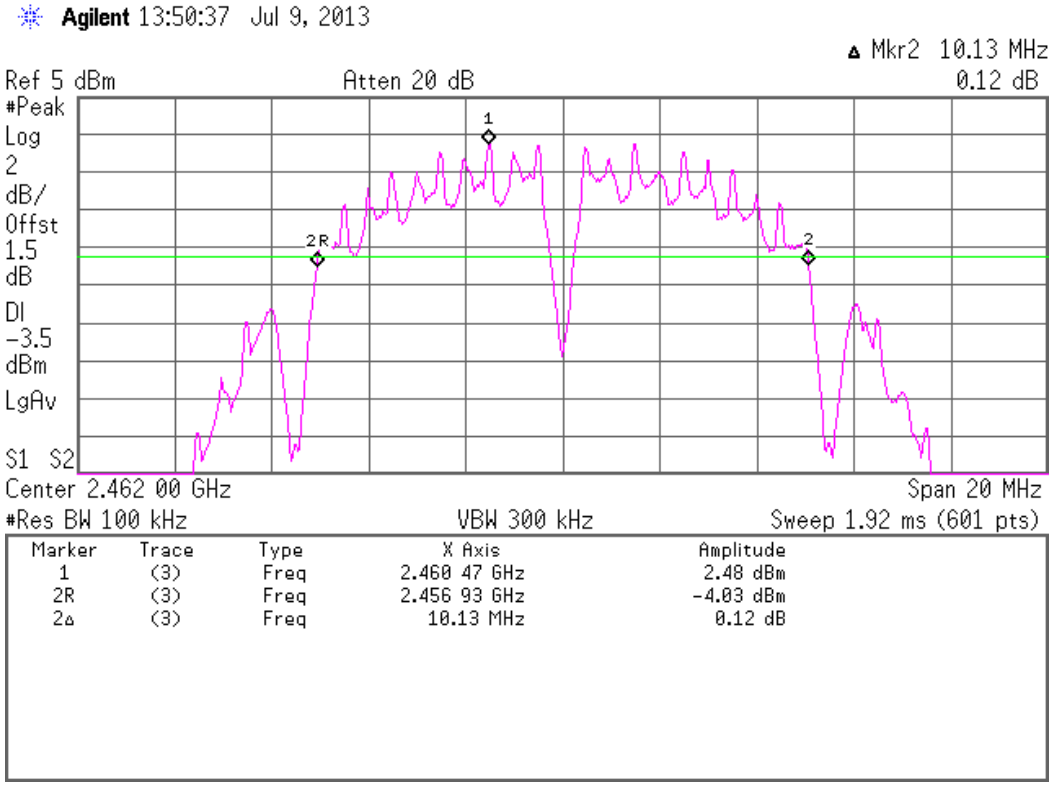


Marker	Trace	Type	X Axis	Amplitude
1	(3)	Freq	2.438 27 GHz	0.29 dBm
2R	(3)	Freq	2.428 83 GHz	-5.15 dBm
2Δ	(3)	Freq	16.33 MHz	-0.62 dB

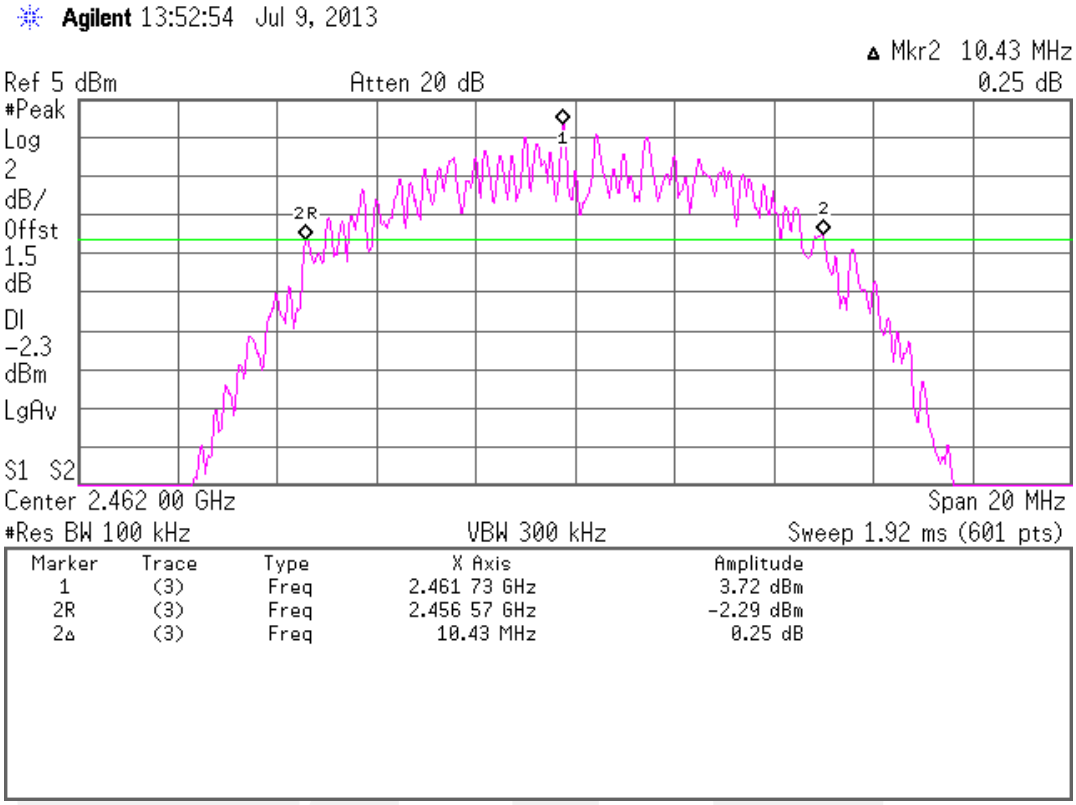
Channel 6, 802.11n, 65Mbps



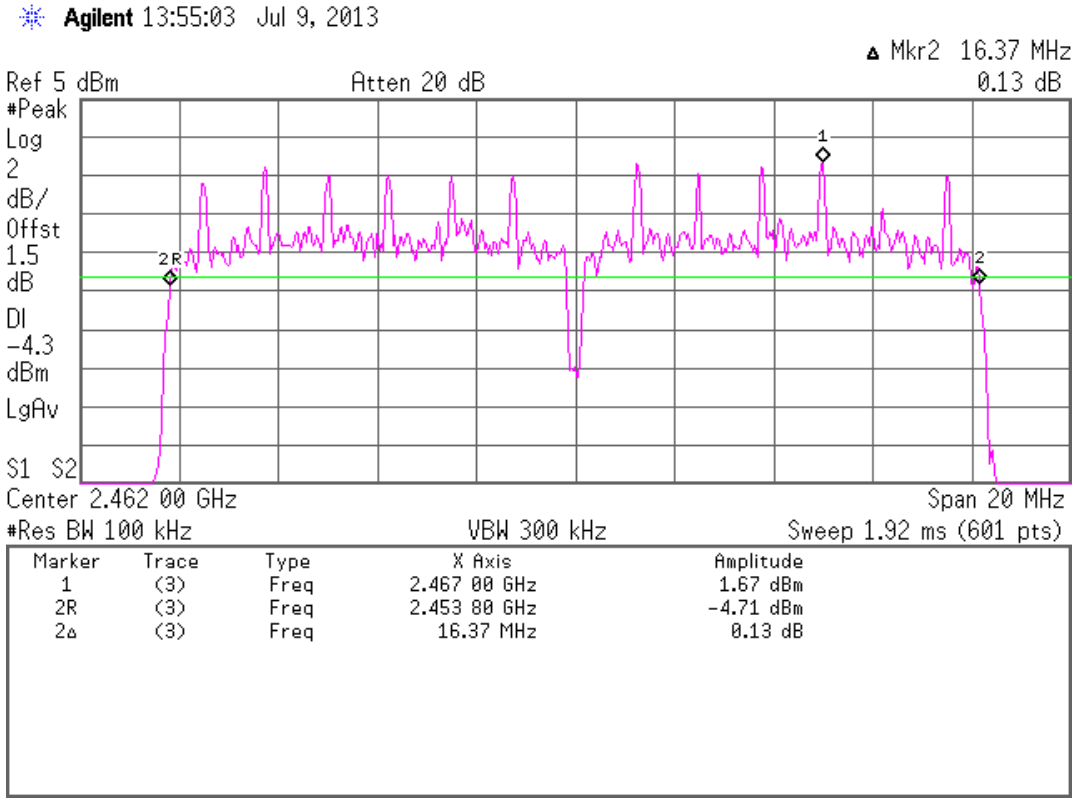
Channel 11, 802.11b, 1Mbps



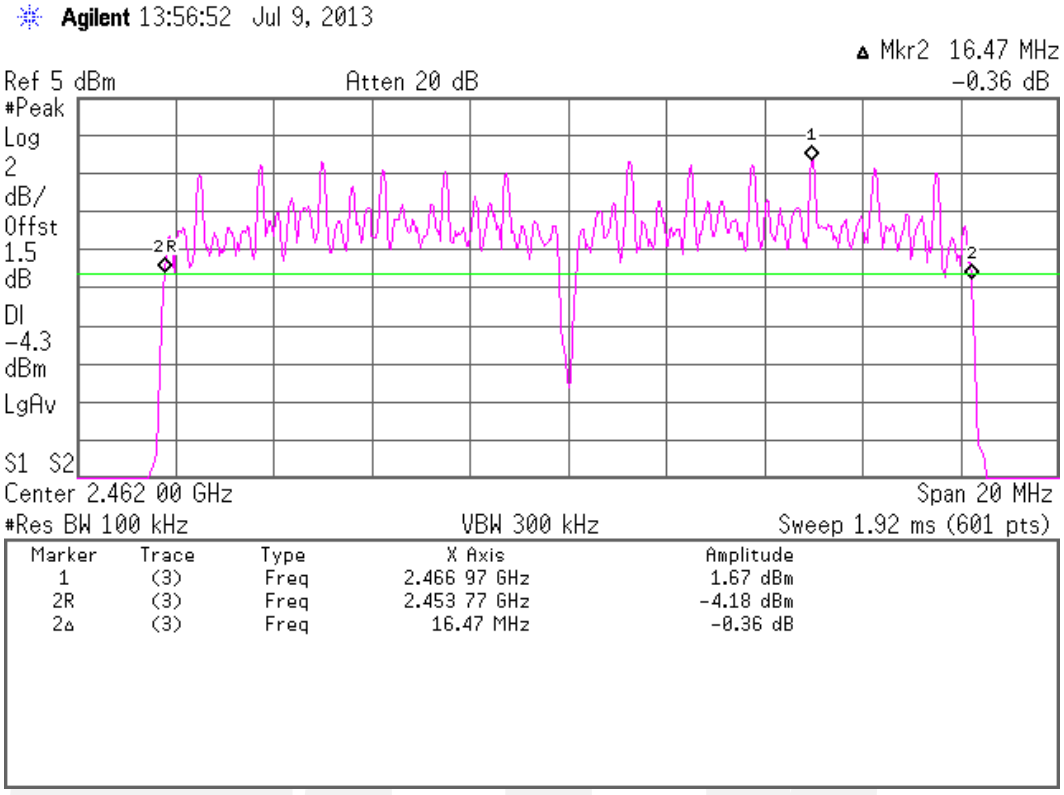
Channel 11, 802.11b, 11Mbps



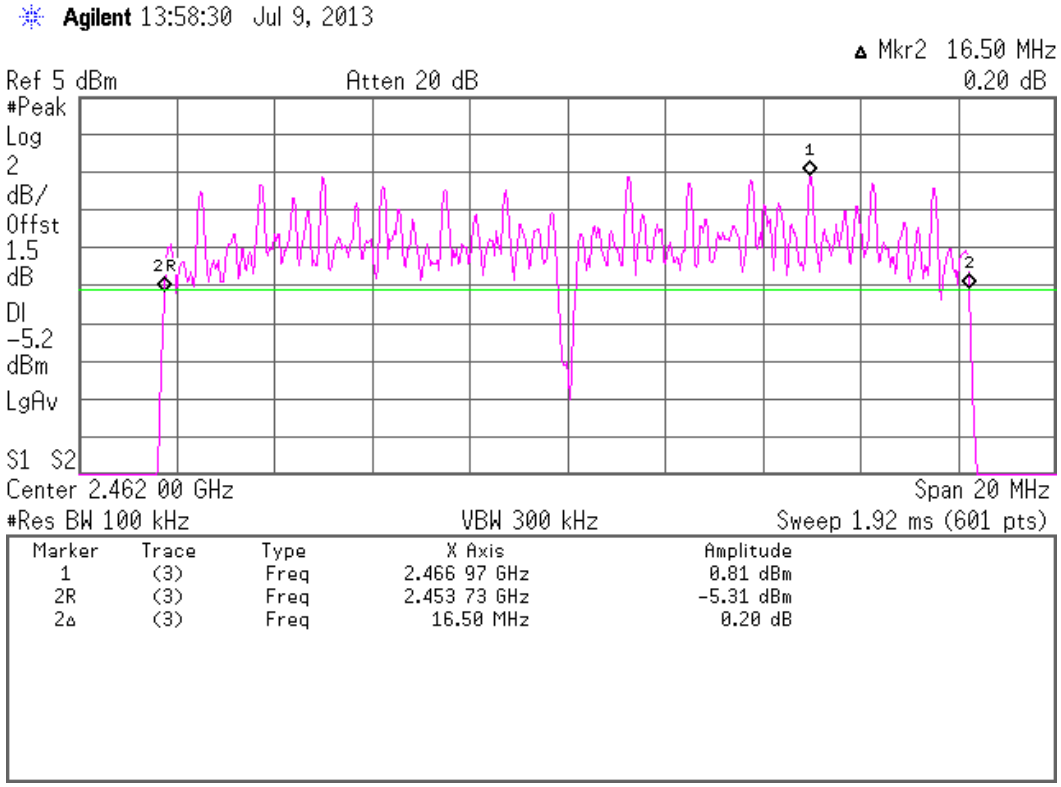
Channel 11, 802.11g, 6Mbps



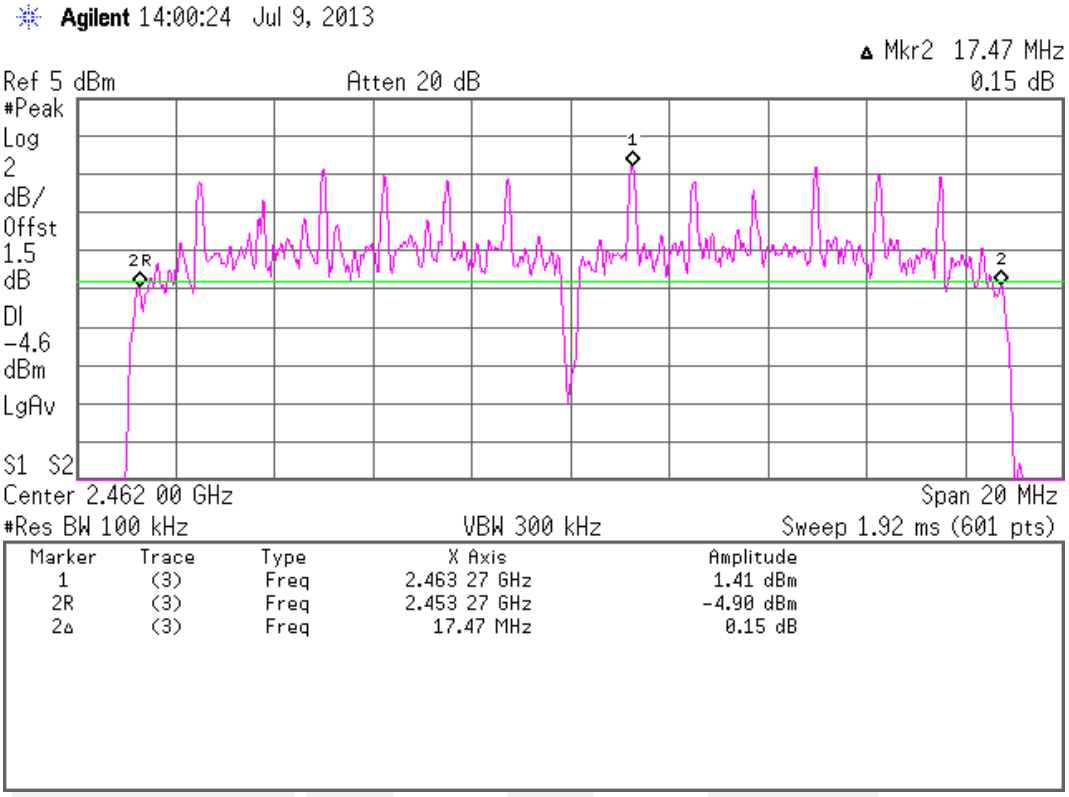
Channel 11, 802.11g, 36Mbps



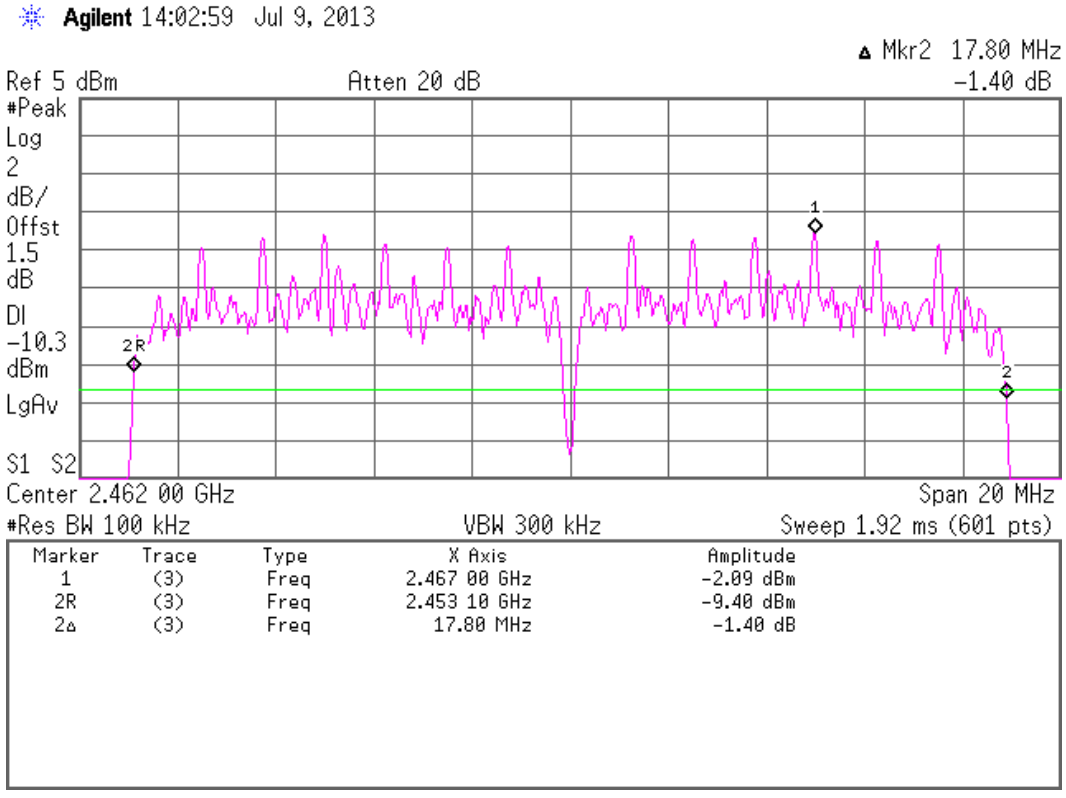
Channel 11, 802.11g, 54Mbps



Channel 11, 802.11n, 6.5Mbps



Channel 11, 802.11n, 65Mbps



Fundamental emission output power

FCC 15.247(b)3), IC RSS-210 A8.4(4)

Test summary

The requirements are: ■ - MET ☐ - NOT MET
Testing per FCC D01 DTS Meas Guidance v03, 9.1.2 Integrated band power method
The maximum Integrated band power is 0.047 W or 16.72 dBm

Test location

☐ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)
■ - Wild River Shield Room 2

Test equipment

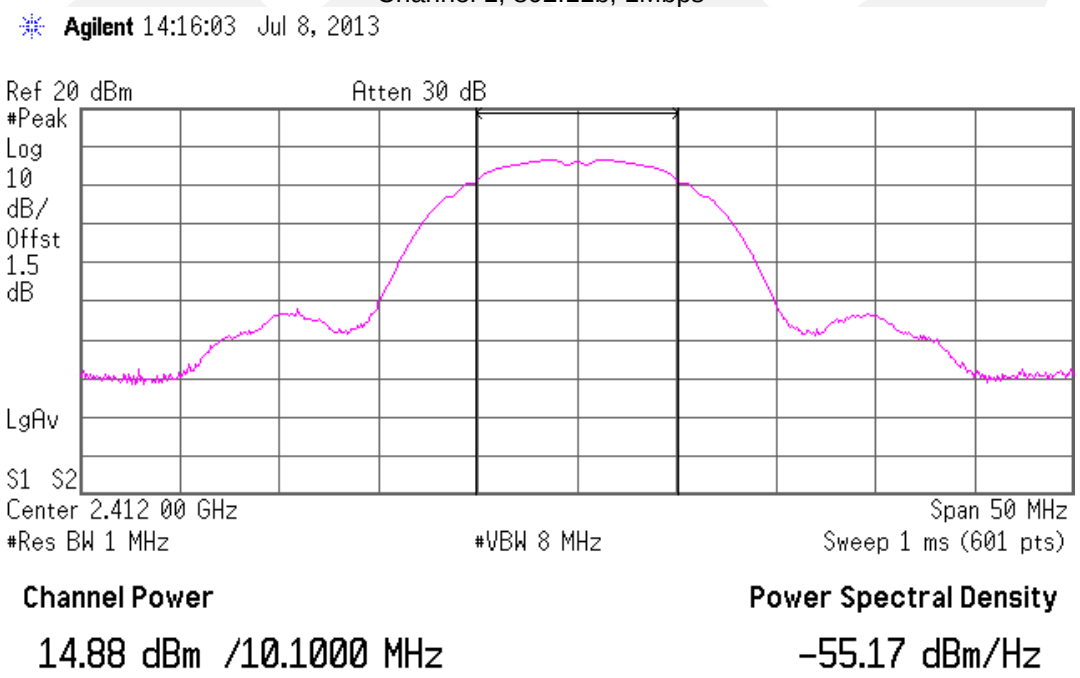
TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13

Test limit

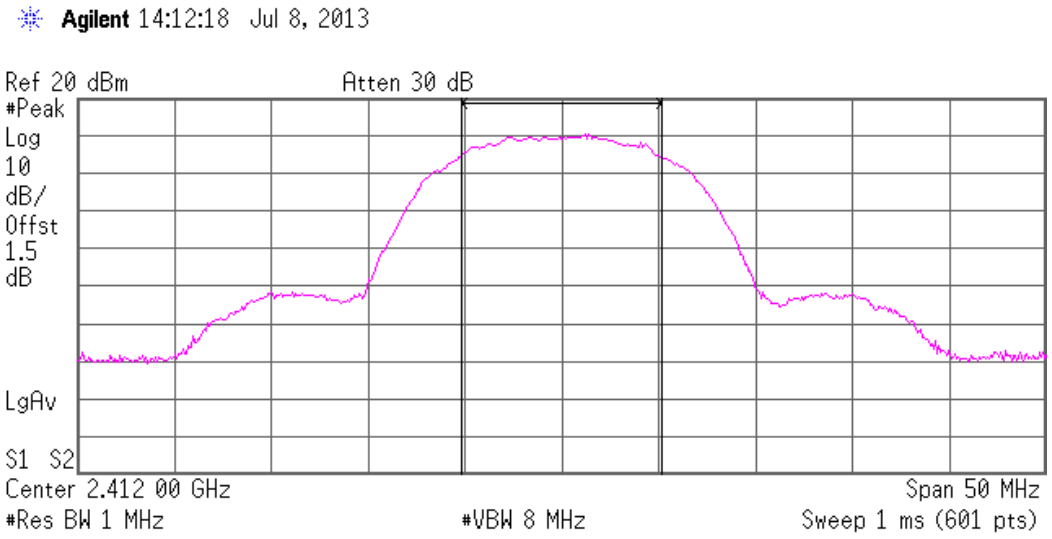
1 Watt or 30 dBm

Test data

Channel 1, 802.11b, 1Mbps



Channel 1, 802.11b, 11Mbps



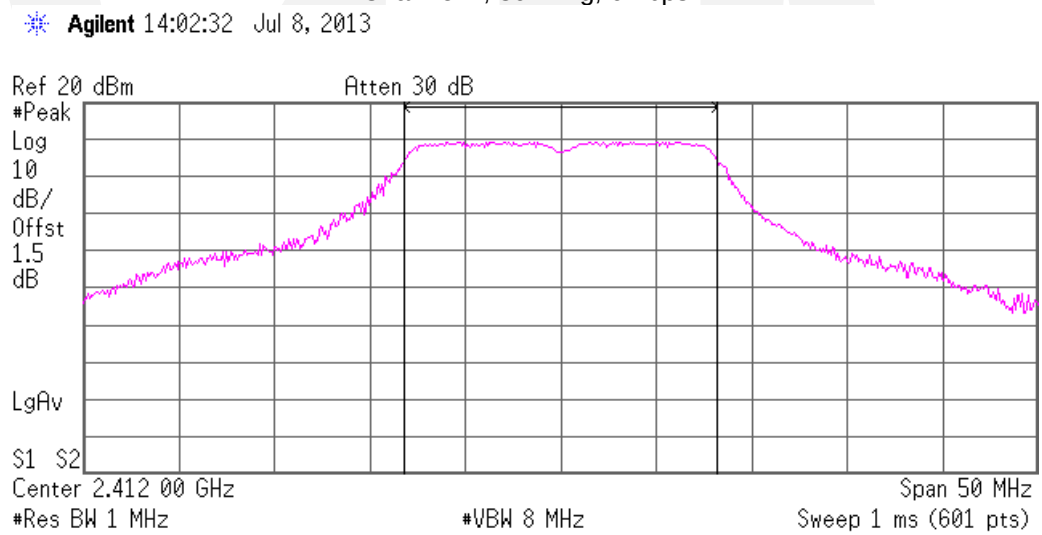
Channel Power

15.55 dBm /10.3300 MHz

Power Spectral Density

-54.59 dBm/Hz

Channel 1, 802.11g, 6Mbps



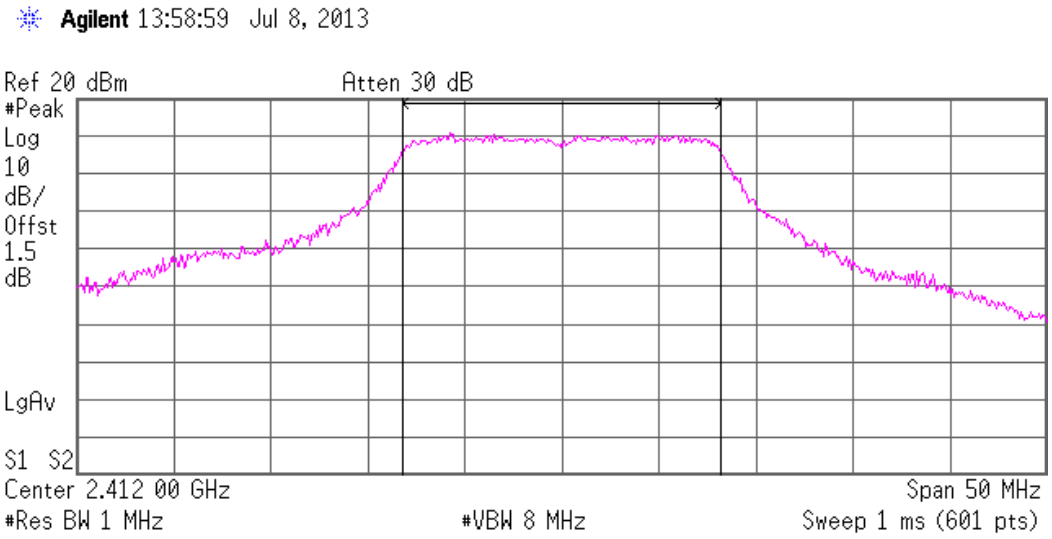
Channel Power

16.45 dBm /16.3300 MHz

Power Spectral Density

-55.68 dBm/Hz

Channel 1, 802.11g, 36Mbps



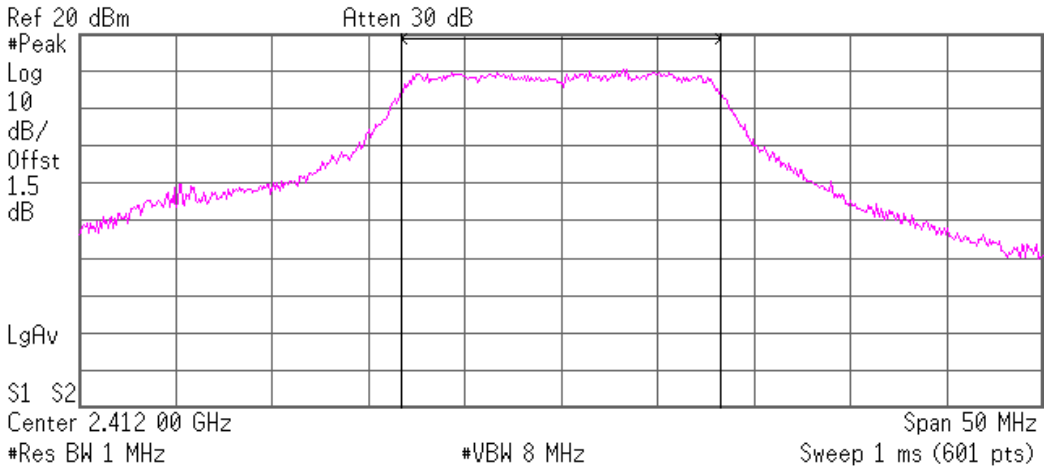
Channel Power

16.72 dBm /16.4300 MHz

Power Spectral Density

-55.43 dBm/Hz

Channel 1, 802.11g, 54Mbps



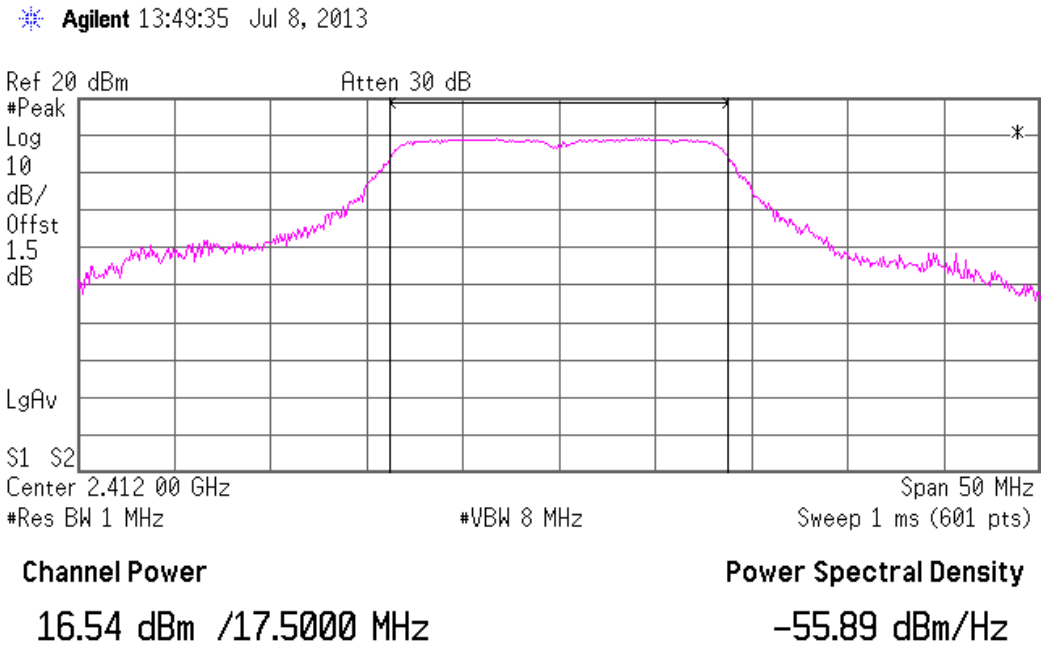
Channel Power

15.56 dBm /16.5000 MHz

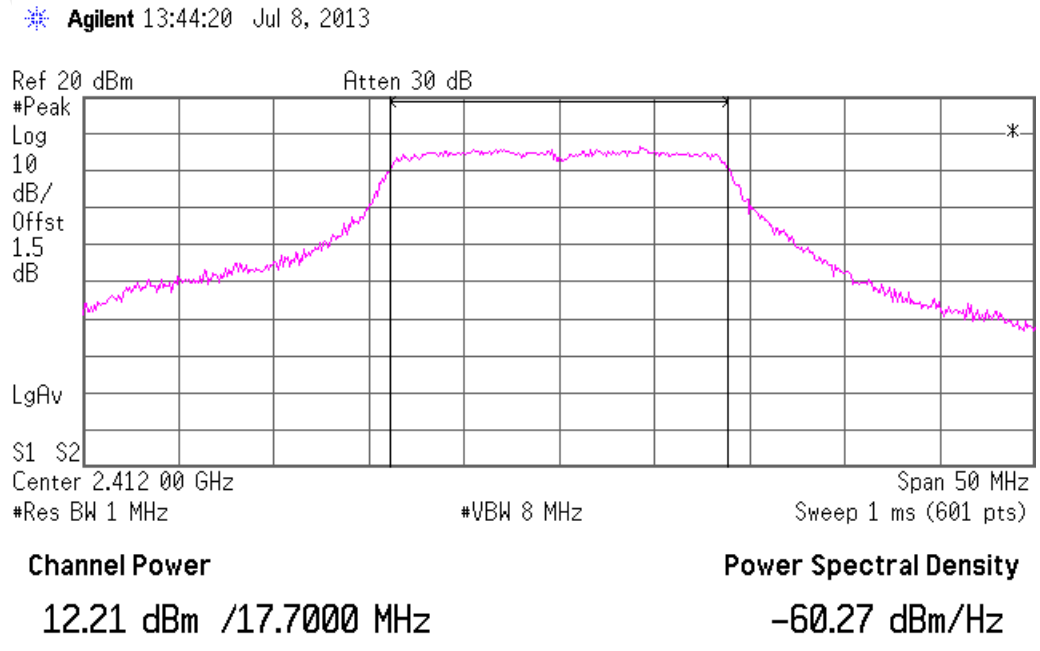
Power Spectral Density

-56.62 dBm/Hz

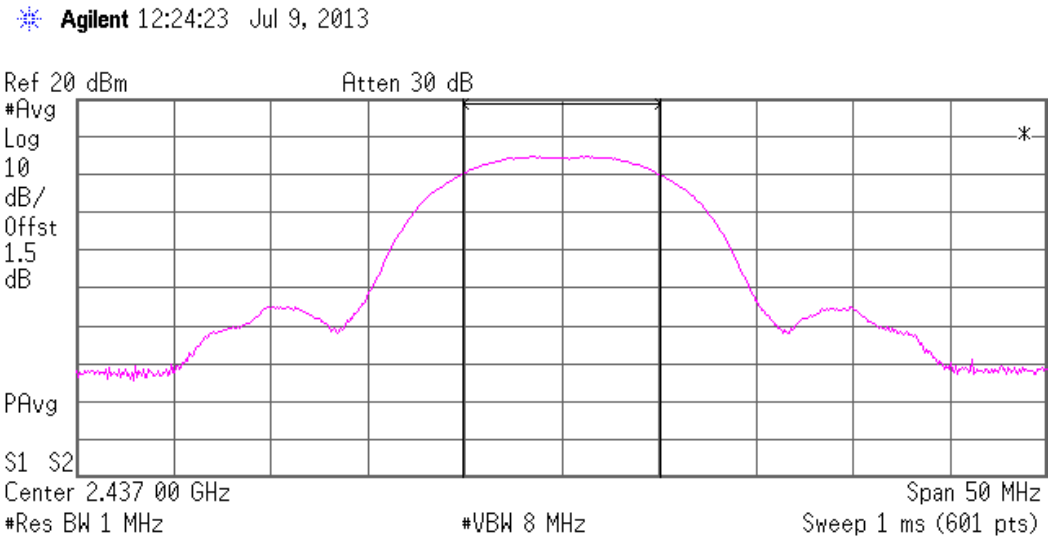
Channel 1, 802.11n, 6.5Mbps



Channel 1, 802.11n, 65Mbps



Channel 6, 802.11b, 1Mbps



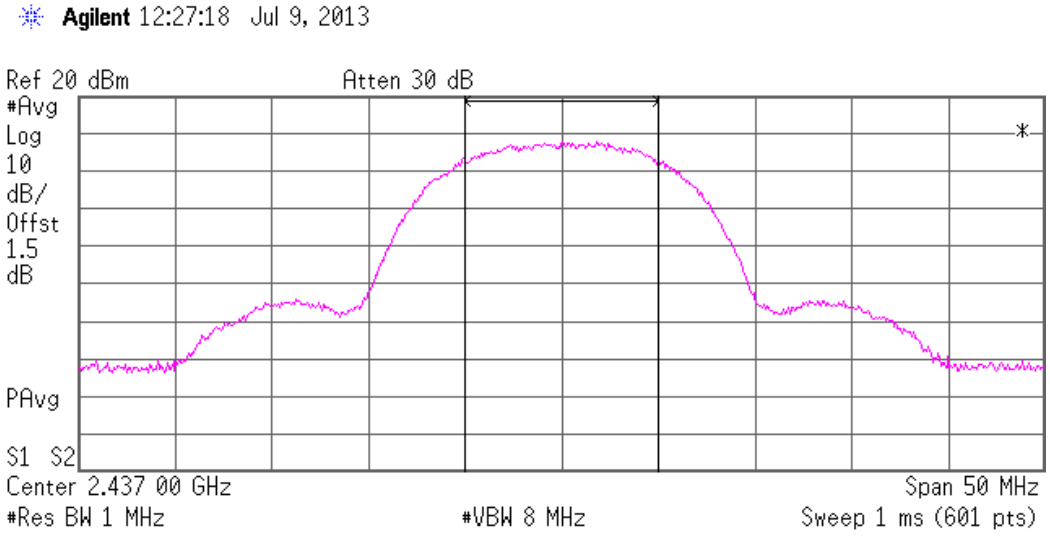
Channel Power

12.55 dBm /10.1300 MHz

Power Spectral Density

-57.51 dBm/Hz

Channel 6, 802.11b, 11Mbps



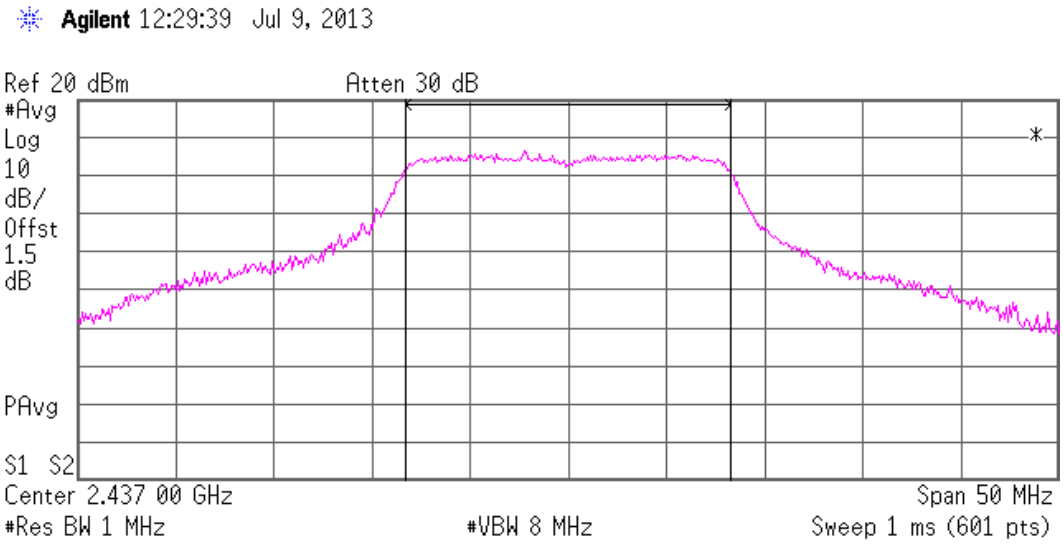
Channel Power

12.56 dBm /10.0300 MHz

Power Spectral Density

-57.45 dBm/Hz

Channel 6, 802.11g, 6Mbps



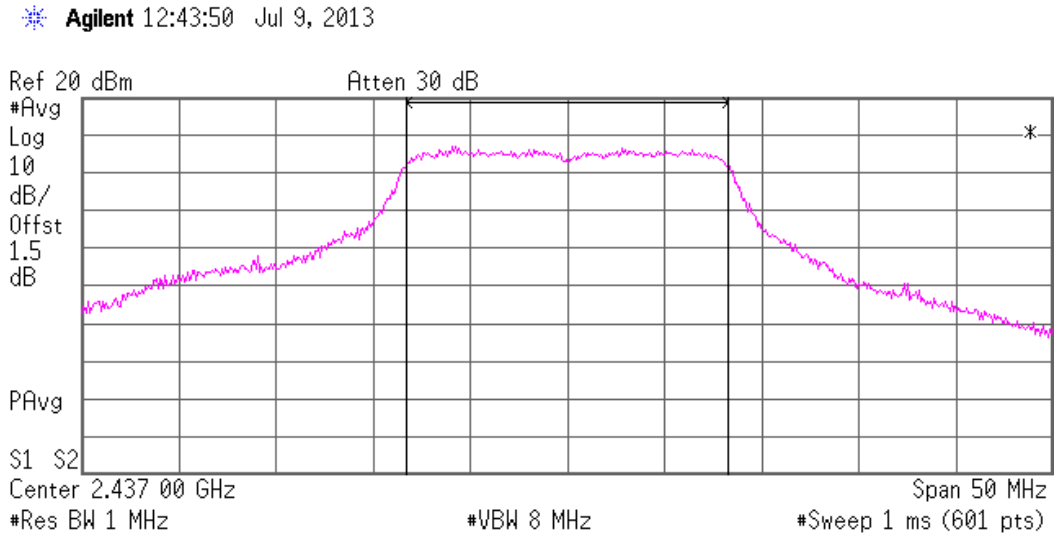
Channel Power

12.81 dBm /16.6000 MHz

Power Spectral Density

-59.39 dBm/Hz

Channel 6, 802.11g, 36Mbps



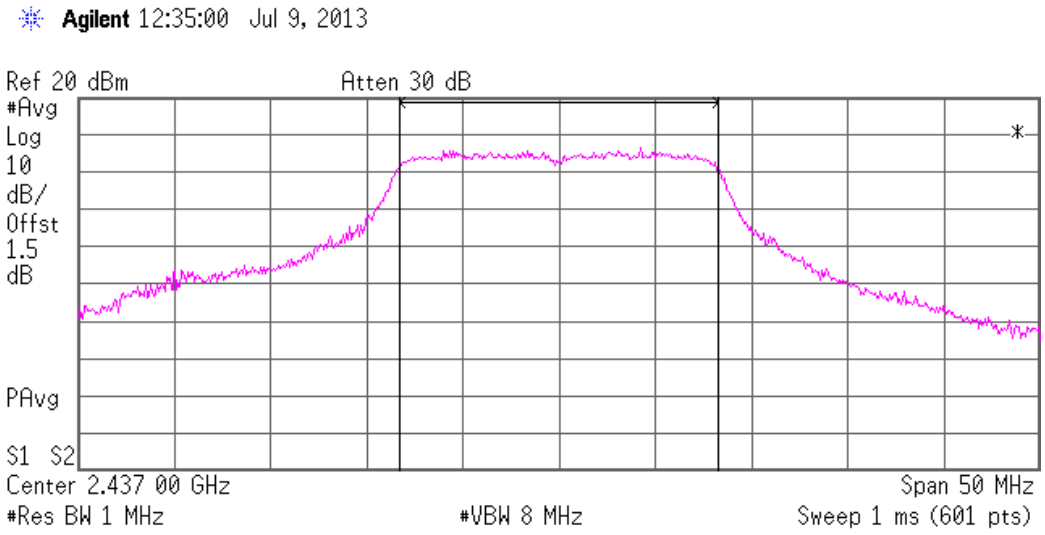
Channel Power

12.78 dBm /16.4700 MHz

Power Spectral Density

-59.39 dBm/Hz

Channel 6, 802.11g, 54Mbps



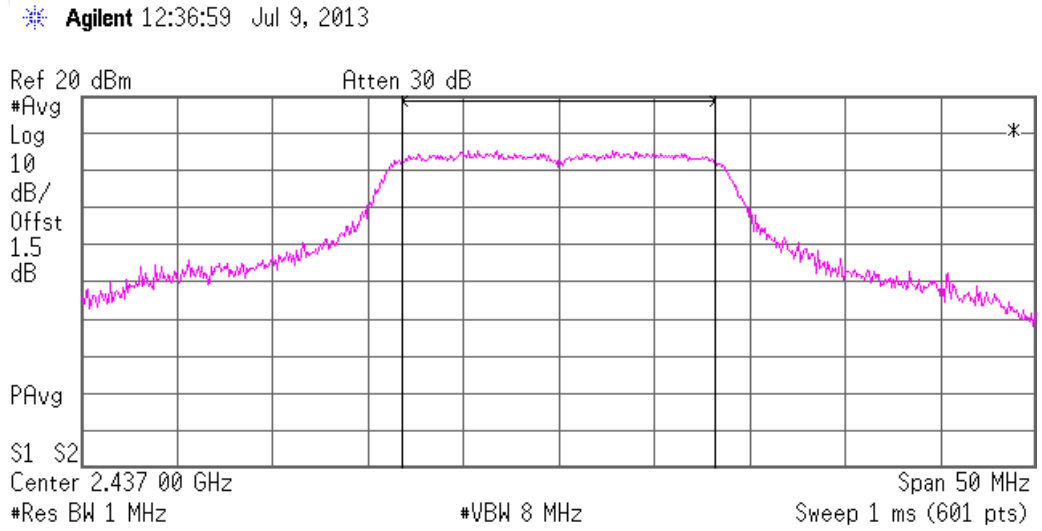
Channel Power

11.66 dBm /16.5000 MHz

Power Spectral Density

-60.52 dBm/Hz

Channel 6, 802.11n, 6.5Mbps



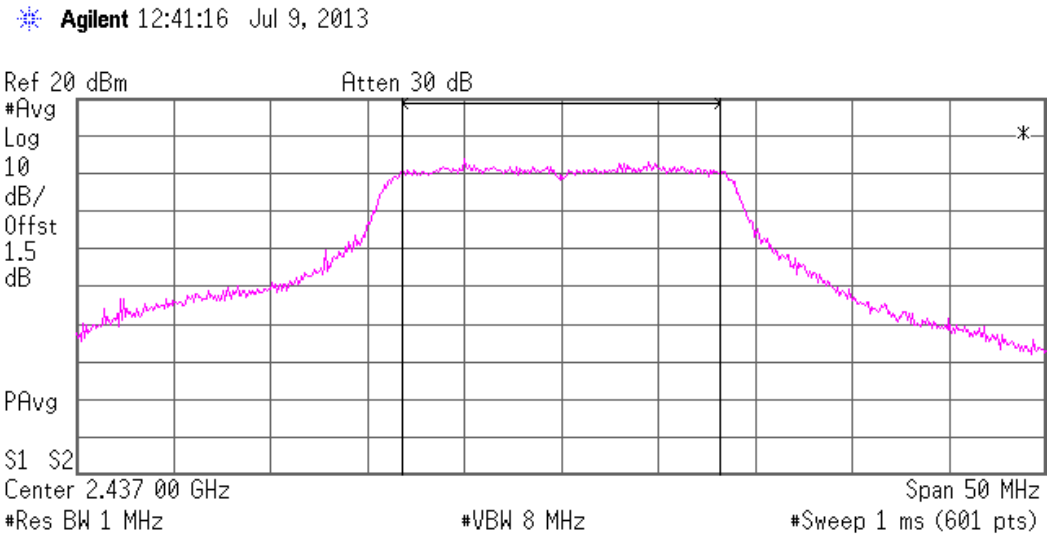
Channel Power

12.29 dBm /16.3300 MHz

Power Spectral Density

-59.84 dBm/Hz

Channel 6, 802.11n, 65Mbps



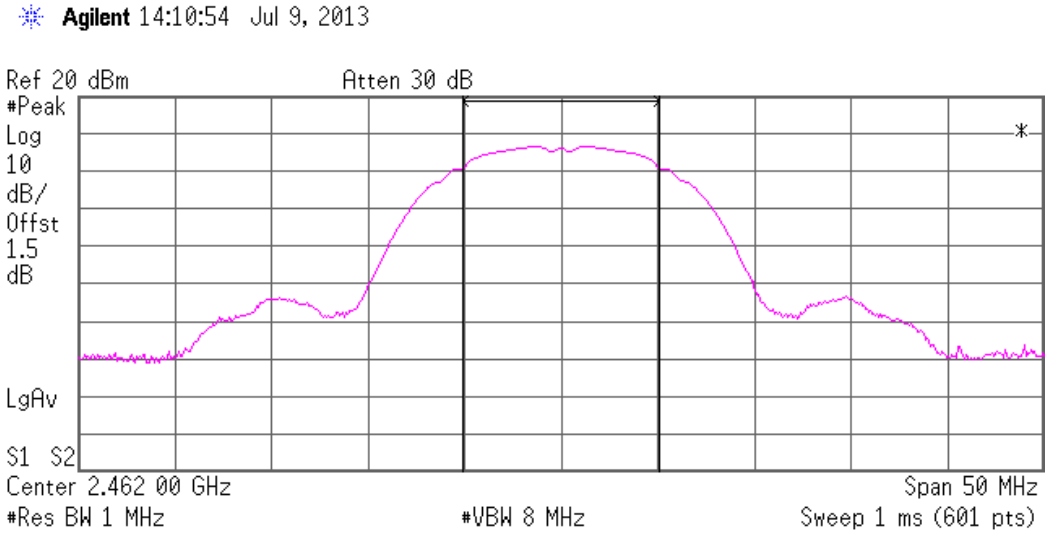
Channel Power

8.28 dBm /16.3300 MHz

Power Spectral Density

-63.85 dBm/Hz

Channel 11, 802.11b, 1Mbps



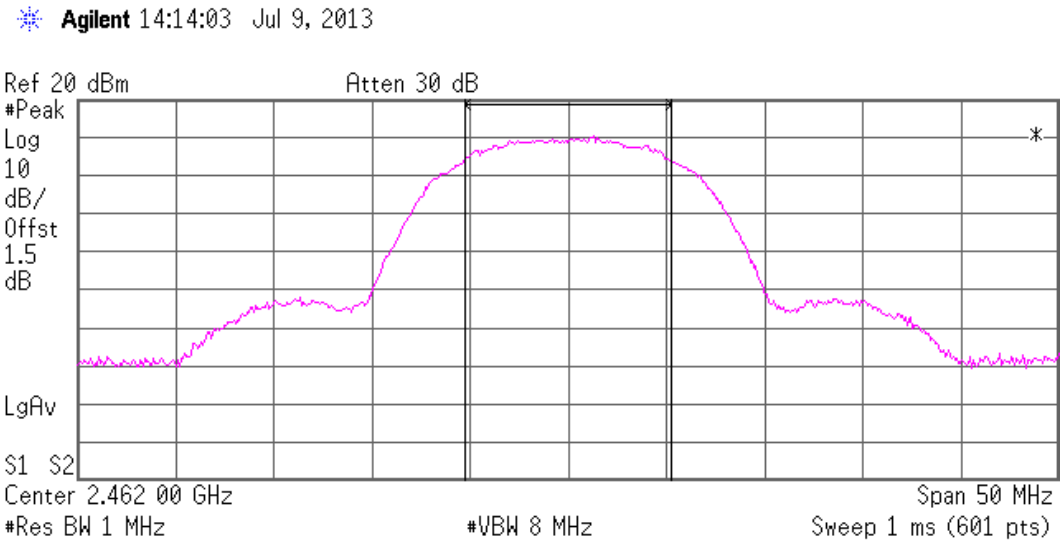
Channel Power

14.85 dBm /10.1300 MHz

Power Spectral Density

-55.21 dBm/Hz

Channel 11, 802.11b, 11Mbps



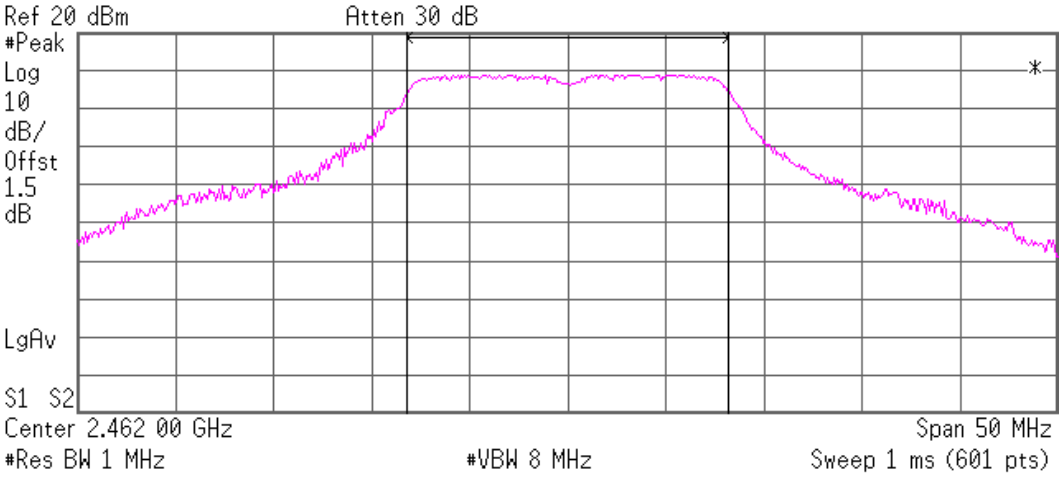
Channel Power

15.31 dBm /10.4300 MHz

Power Spectral Density

-54.87 dBm/Hz

Channel 11, 802.11g, 6Mbps



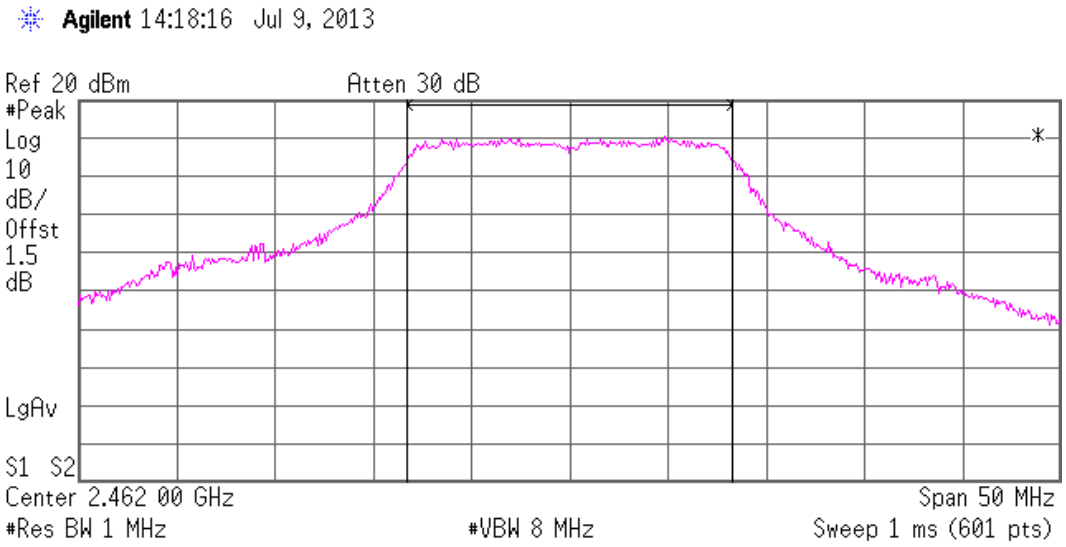
Channel Power

16.00 dBm /16.3700 MHz

Power Spectral Density

-56.14 dBm/Hz

Channel 11, 802.11g, 36Mbps



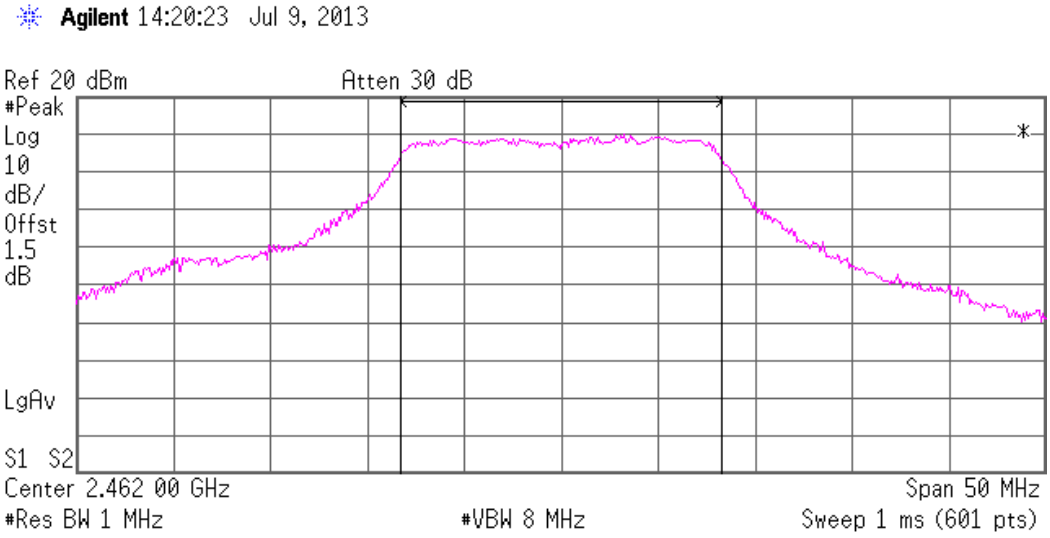
Channel Power

16.04 dBm /16.4700 MHz

Power Spectral Density

-56.13 dBm/Hz

Channel 11, 802.11g, 54Mbps



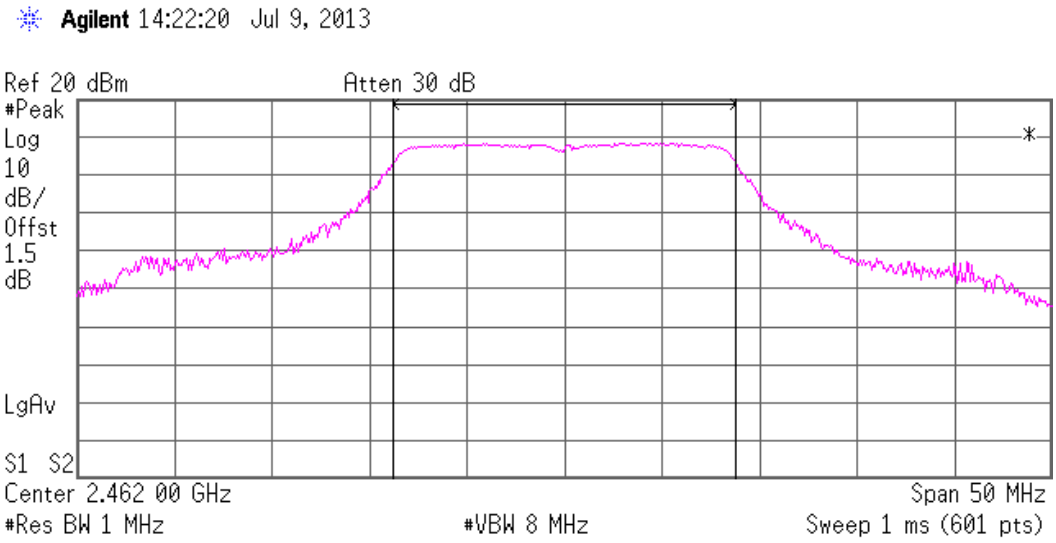
Channel Power

14.87 dBm /16.5000 MHz

Power Spectral Density

-57.30 dBm/Hz

Channel 11, 802.11n, 6.5Mbps



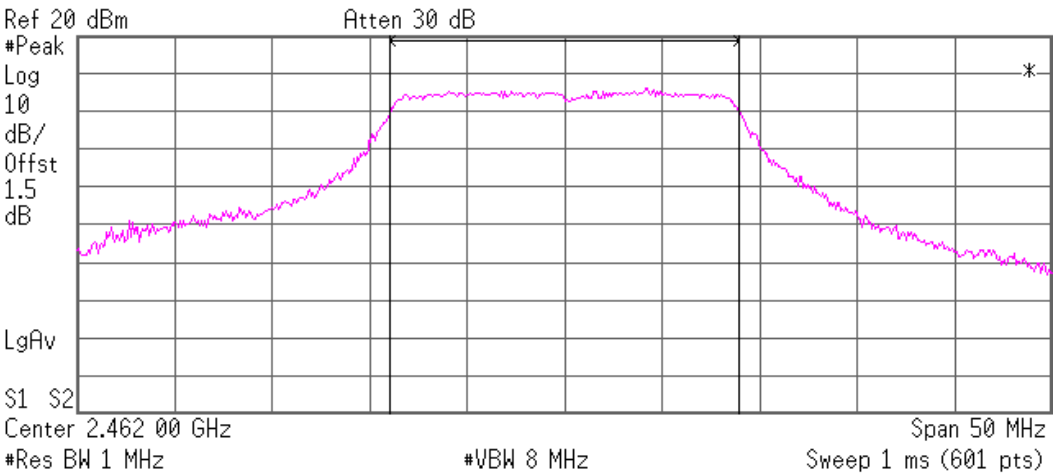
Channel Power

15.73 dBm /17.4700 MHz

Power Spectral Density

-56.69 dBm/Hz

Channel 11, 802.11n, 65Mbp



Channel Power

11.89 dBm /17.8000 MHz

Power Spectral Density

-60.61 dBm/Hz

Maximum power spectral density

FCC 15.247(e), IC RSS-210 A8.2(b)

Test summary

The requirements are: ■ - MET ☐ - NOT MET
Testing per FCC D01 DTS Meas Guidance v03, 10.2 Method PKPSD (peak PSD)
Maximum peak power spectral density is 3.72 dBm/100 kHz.

Test location

☐ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)
■ - Wild River Shield Room 2

Test equipment

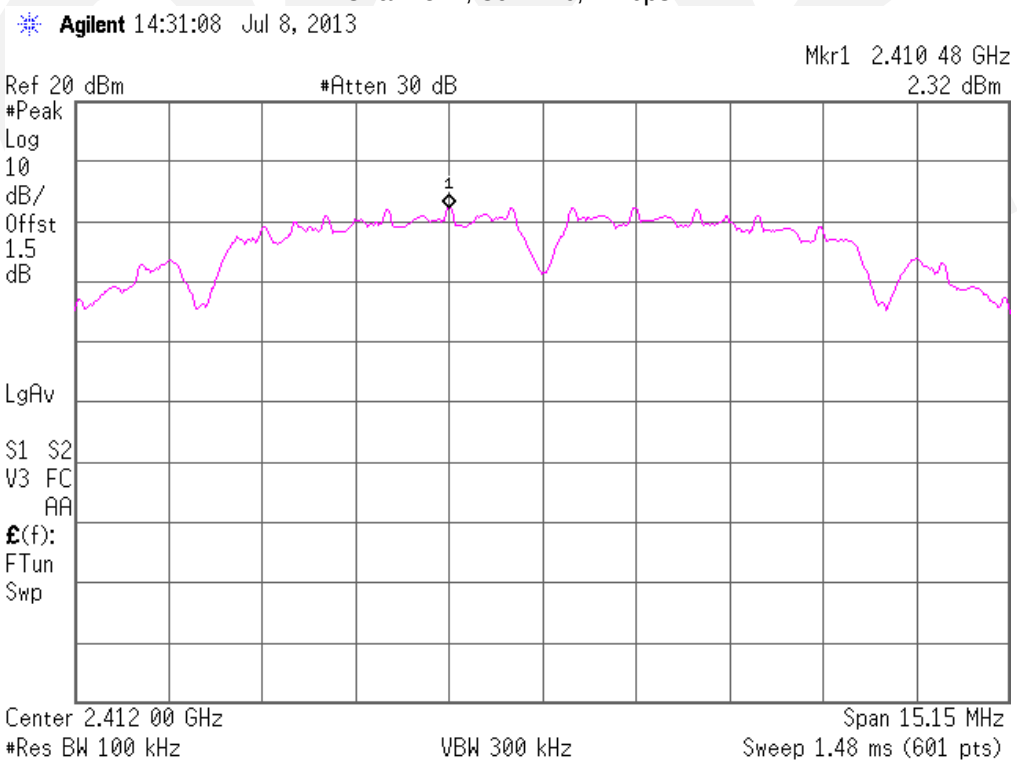
TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13

Test limit

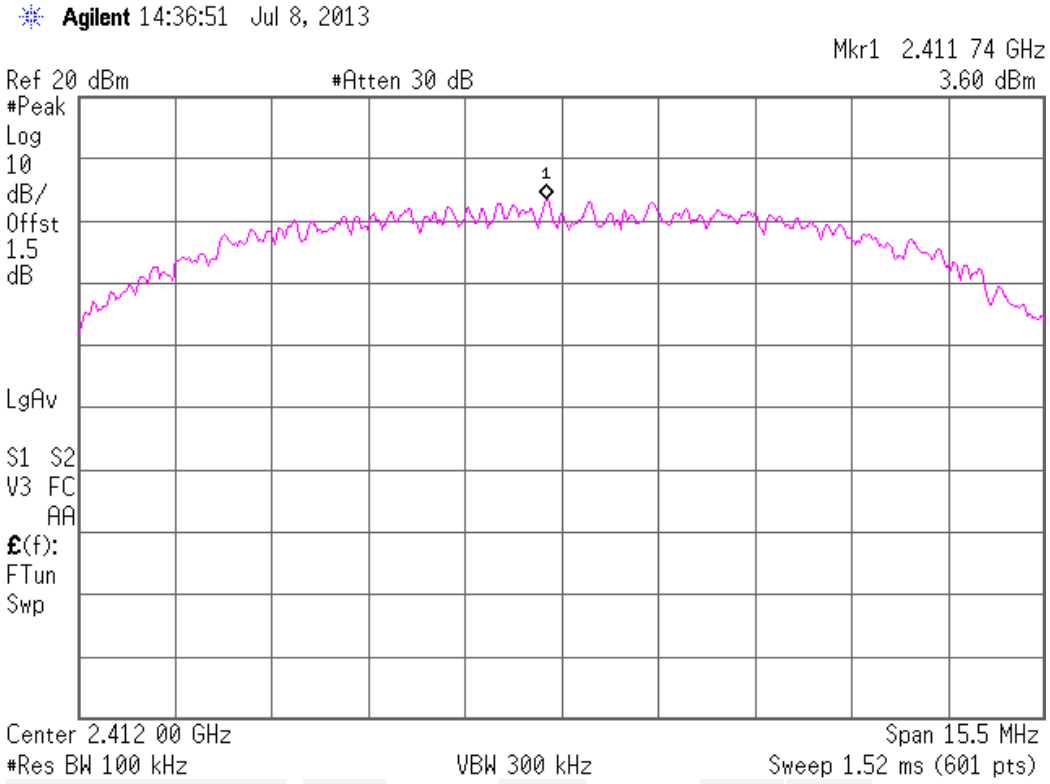
No greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test data

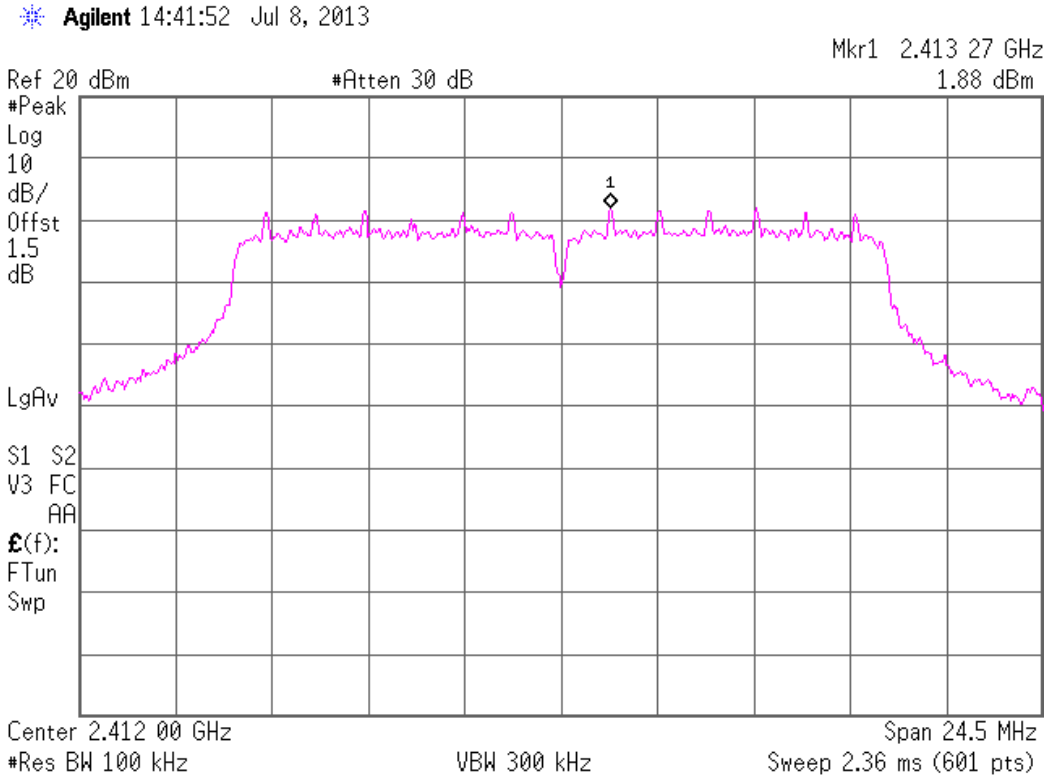
Channel 1, 802.11b, 1Mbps



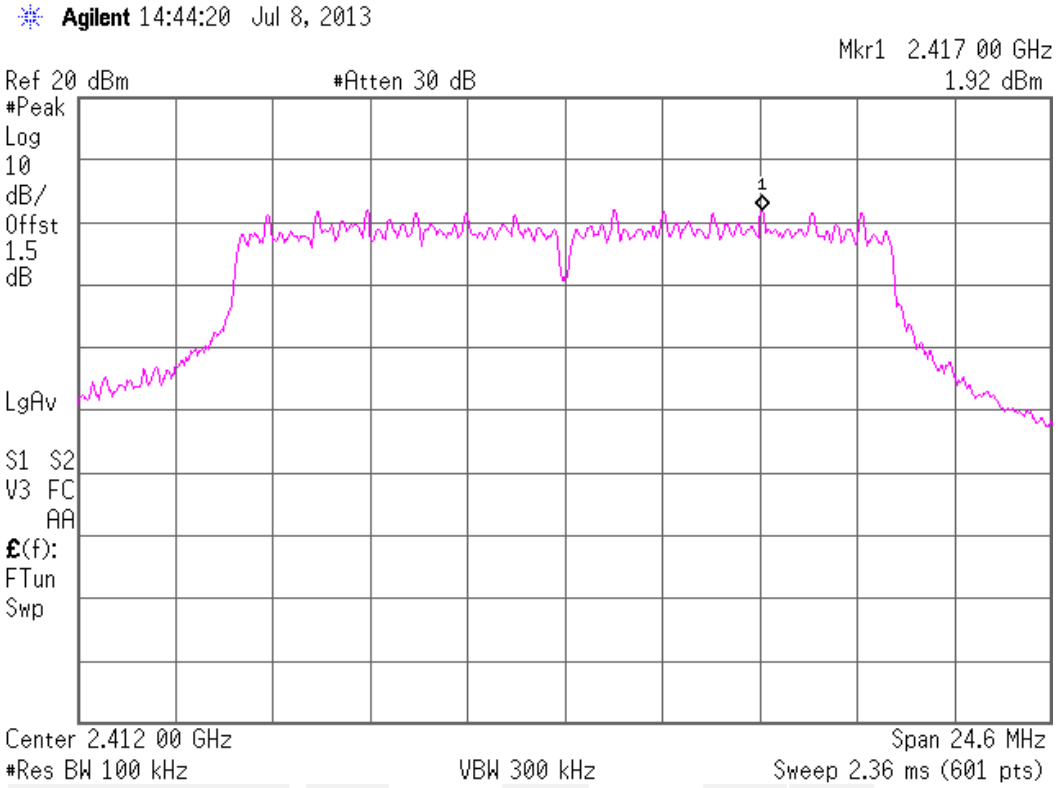
Channel 1, 802.11b, 11Mbps



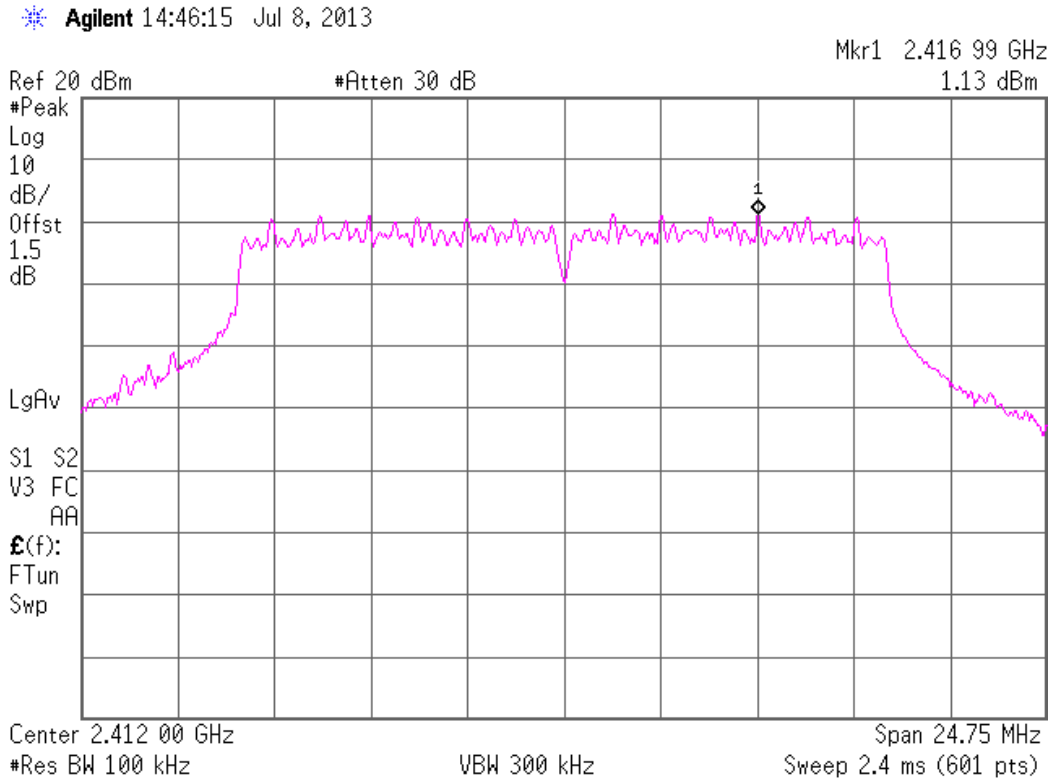
Channel 1, 802.11g, 6Mbps



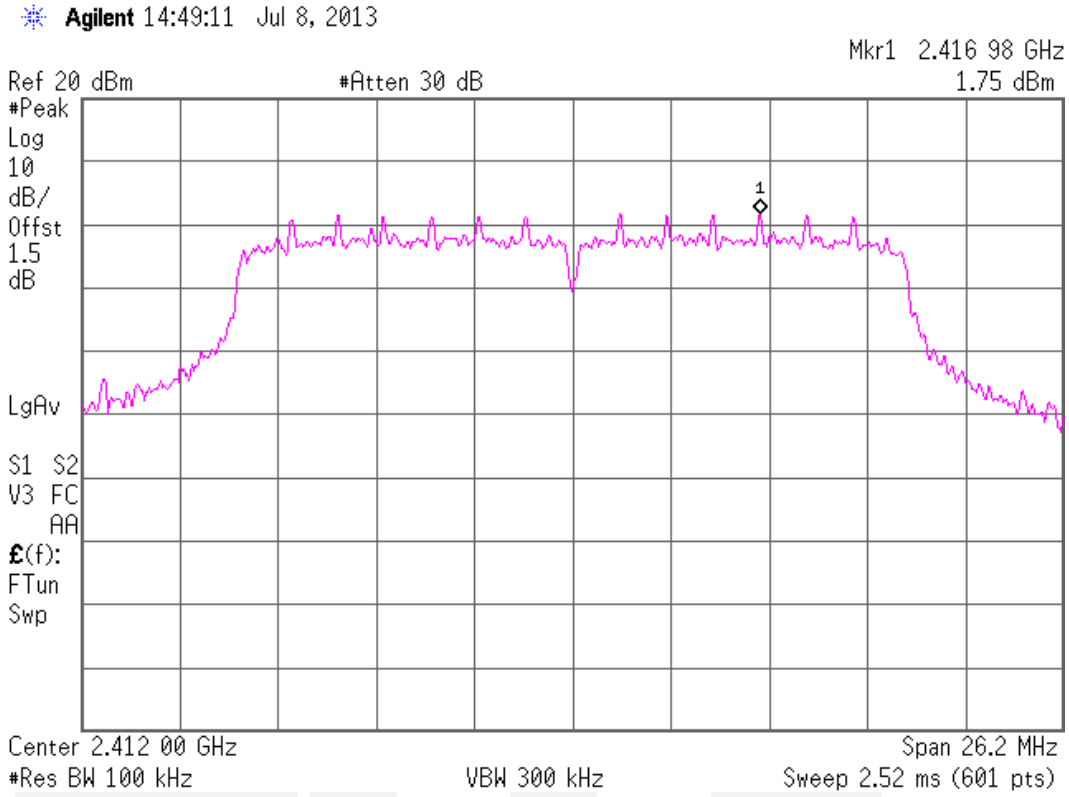
Channel 1, 802.11g, 36Mbps



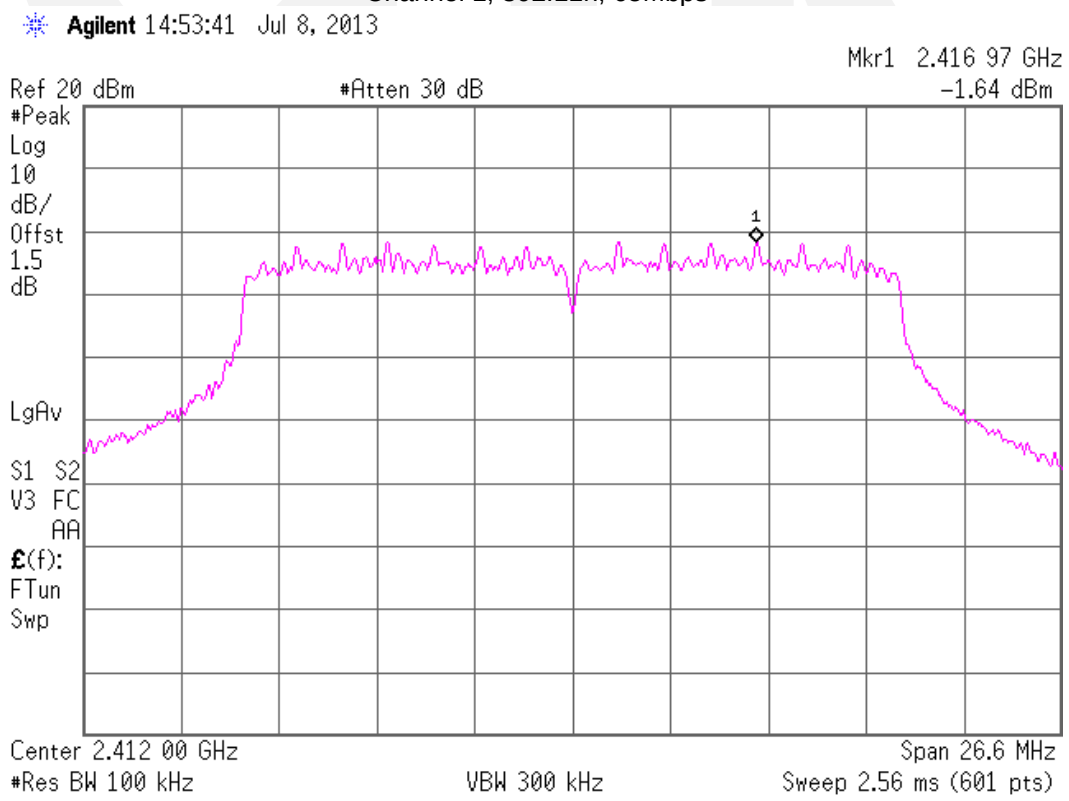
Channel 1, 802.11g, 54Mbps



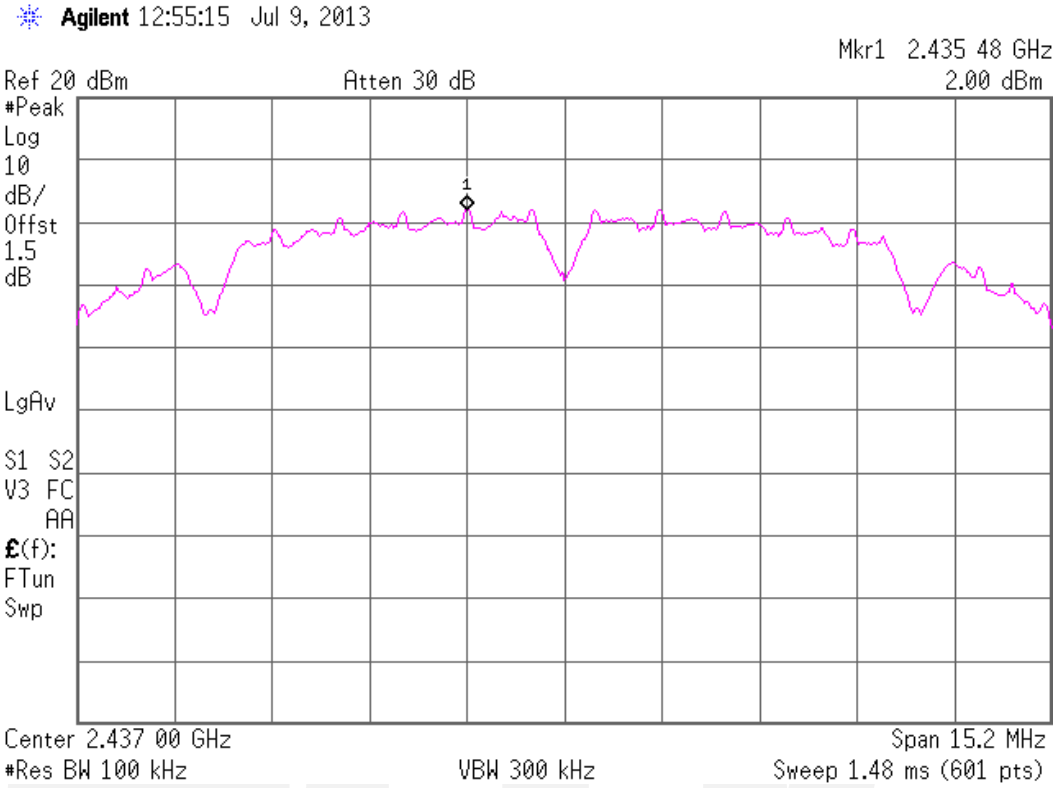
Channel 1, 802.11n, 6.5Mbps



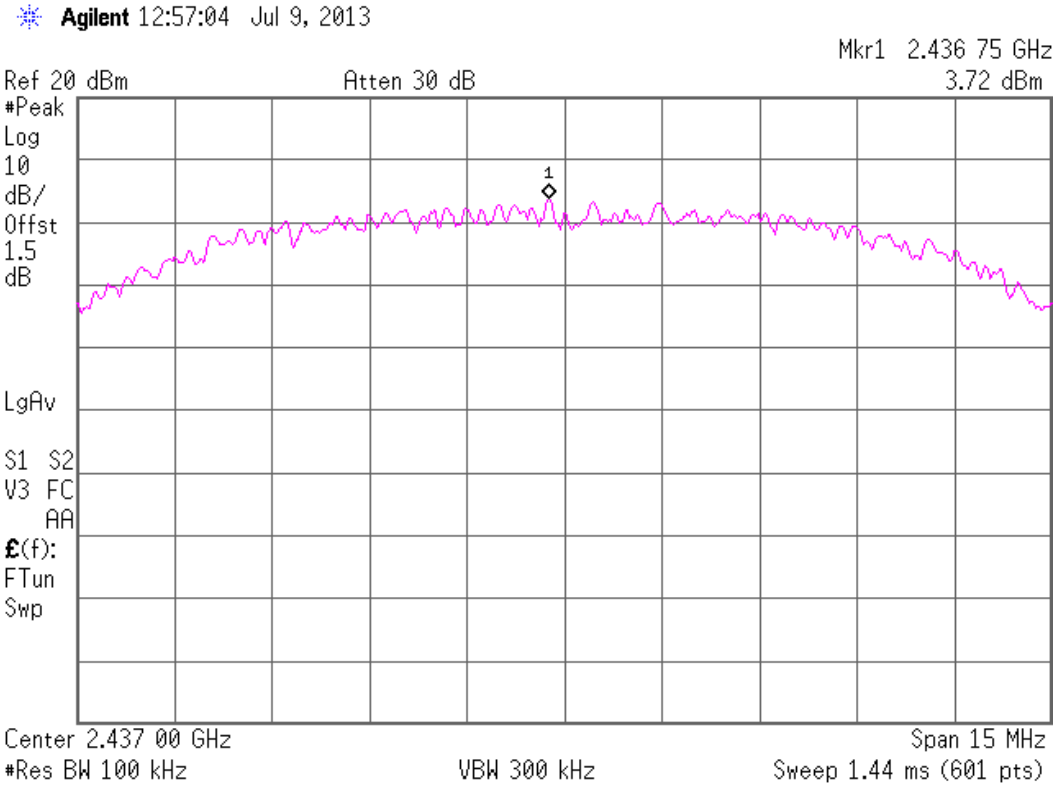
Channel 1, 802.11n, 65Mbps



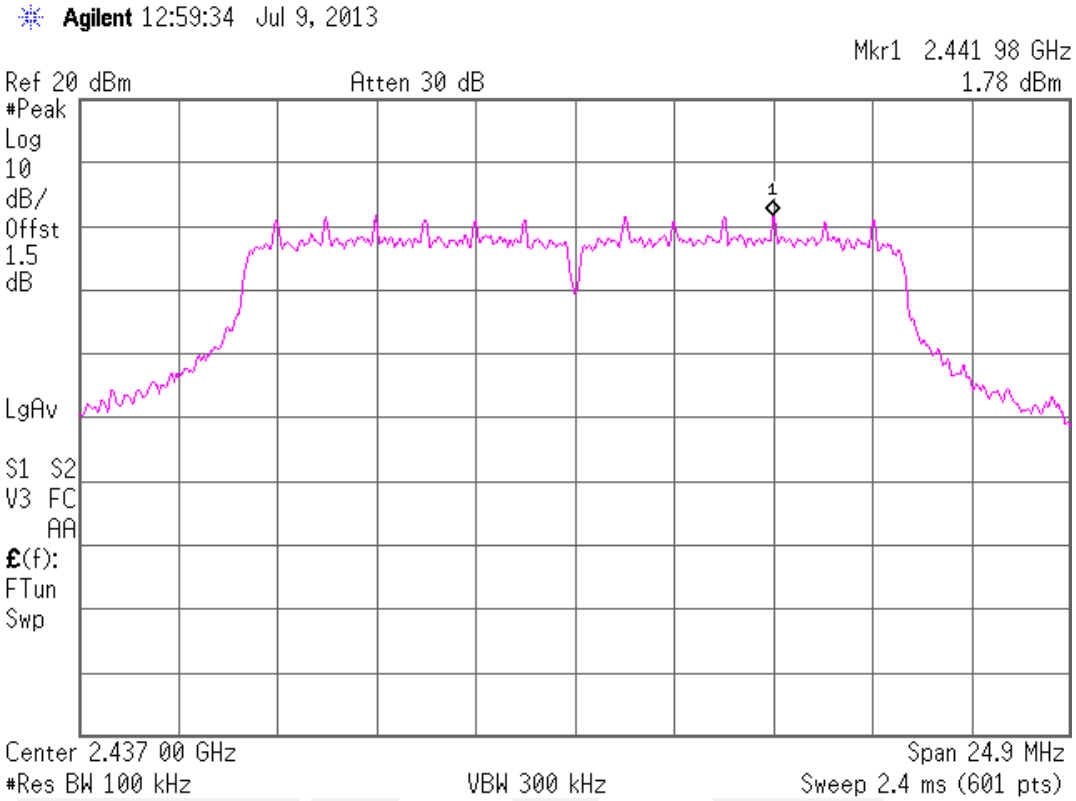
Channel 6, 802.11b, 1Mbps



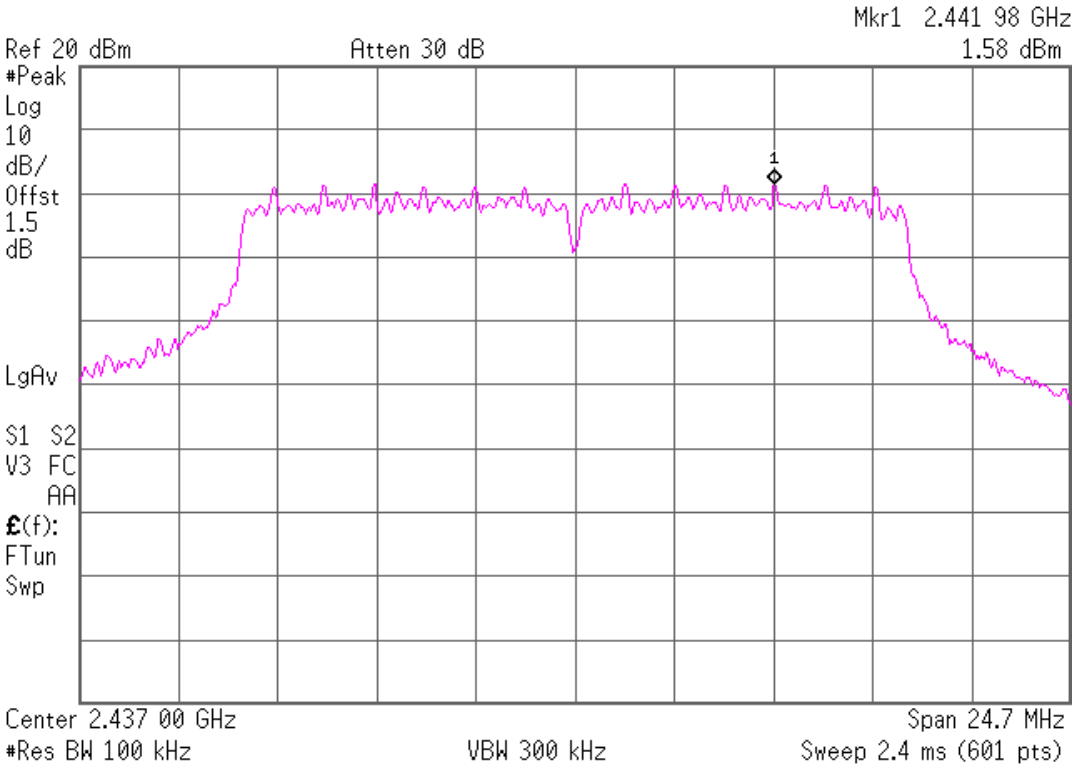
Channel 6, 802.11b, 11Mbps



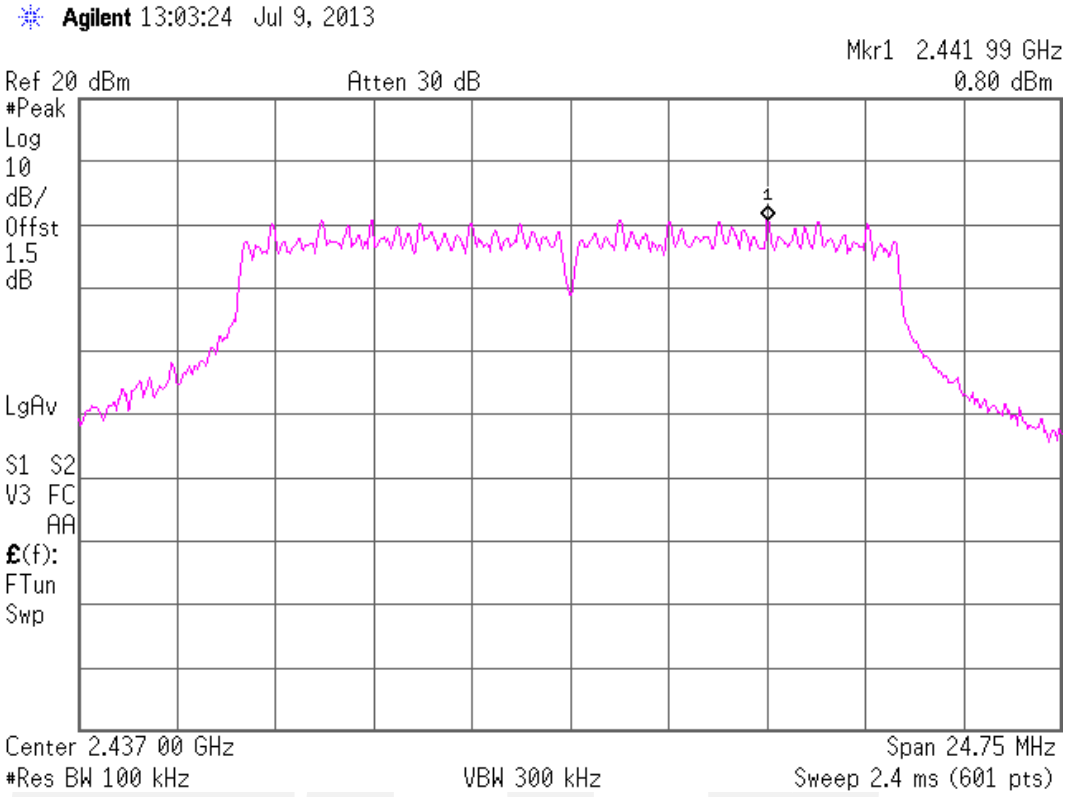
Channel 6, 802.11g, 6Mbps



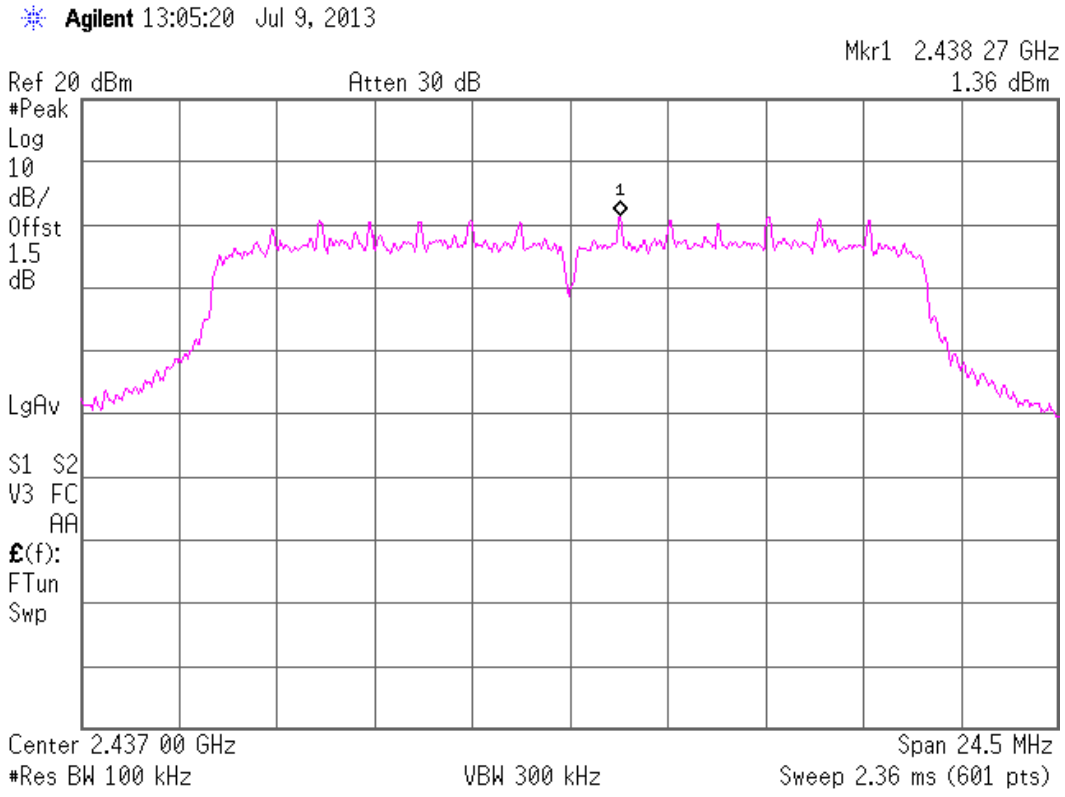
Channel 6, 802.11g, 36Mbps



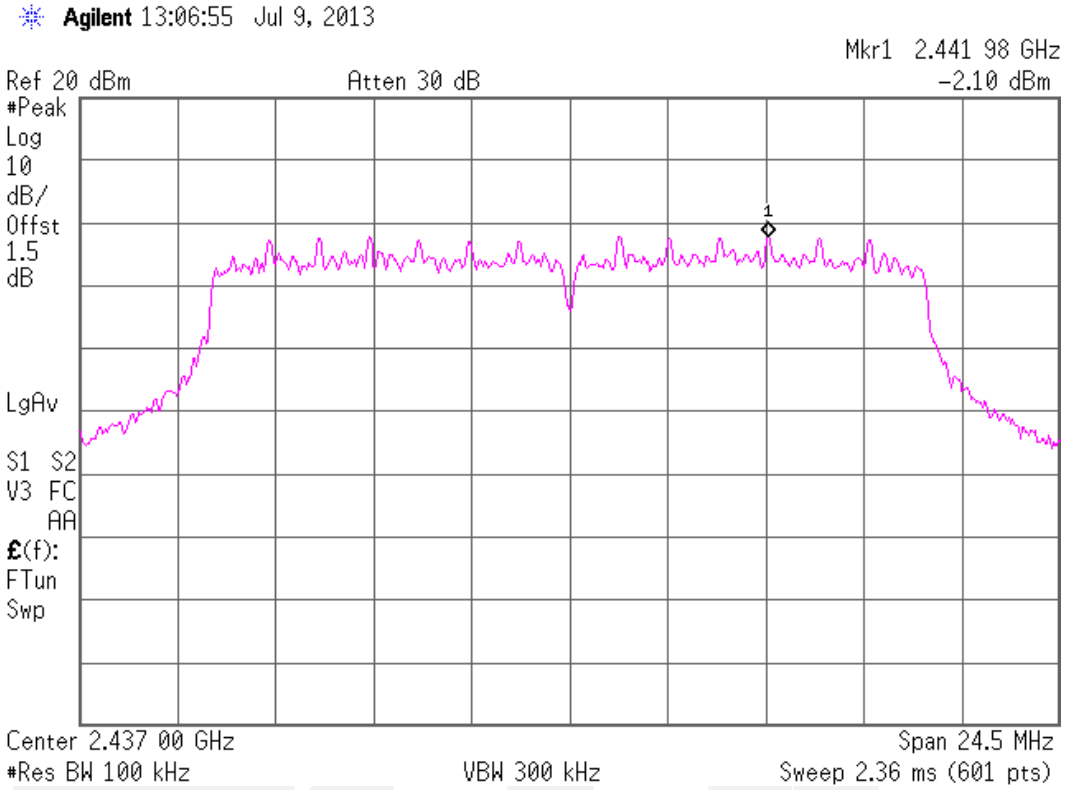
Channel 6, 802.11g, 54Mbps



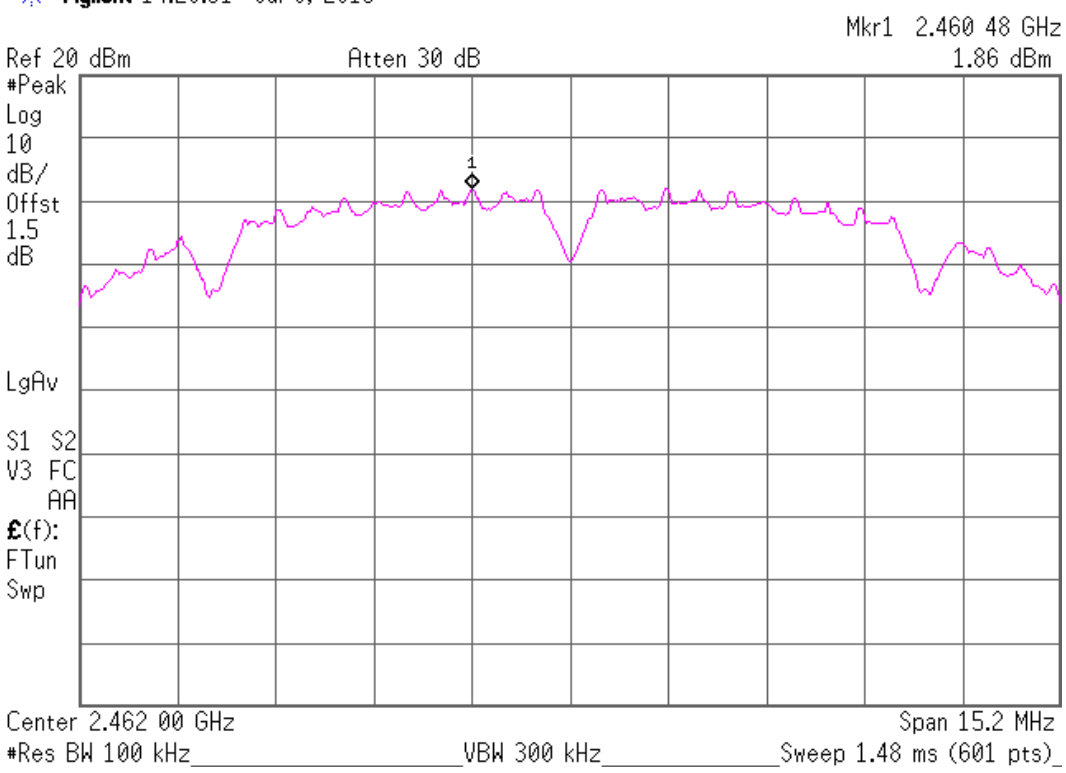
Channel 6, 802.11n, 6.5Mbps



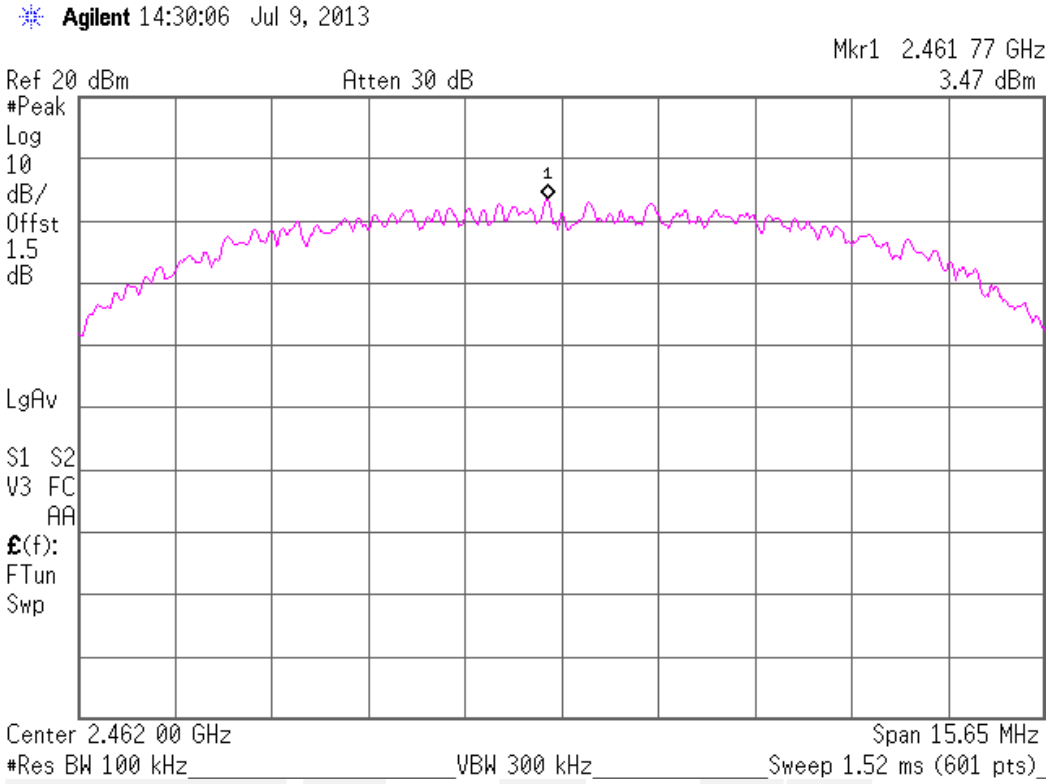
Channel 6, 802.11n, 65Mbps



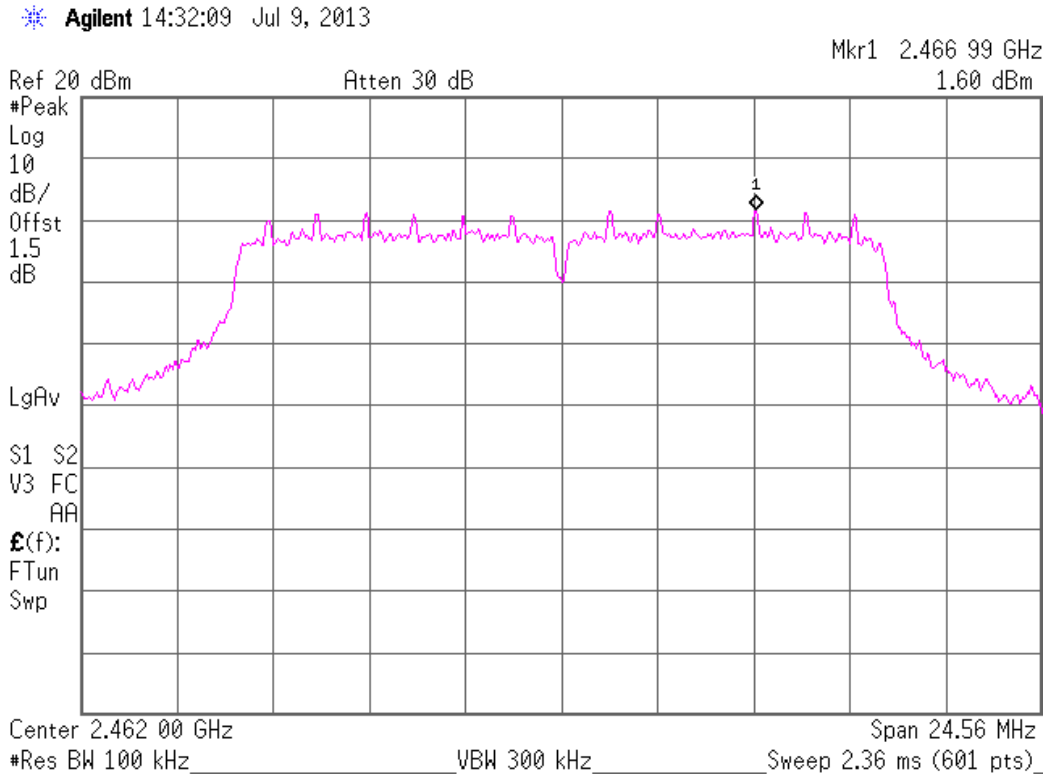
Channel 11, 802.11b, 1Mbps



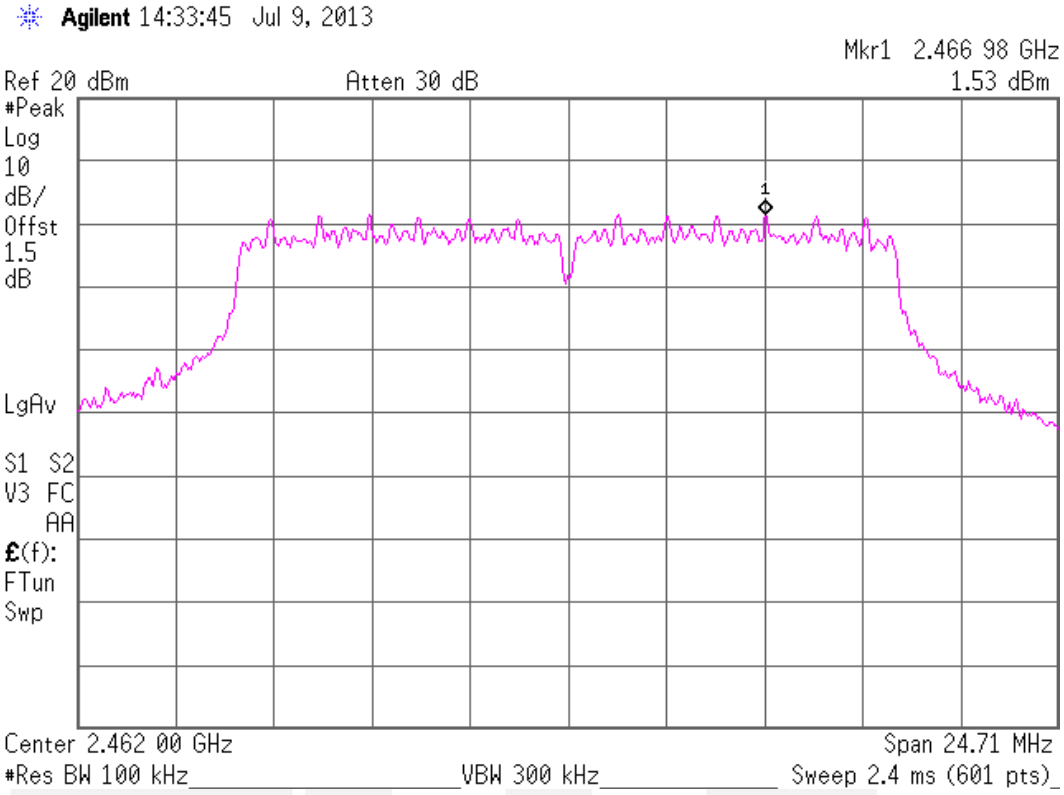
Channel 11, 802.11b, 11Mbps



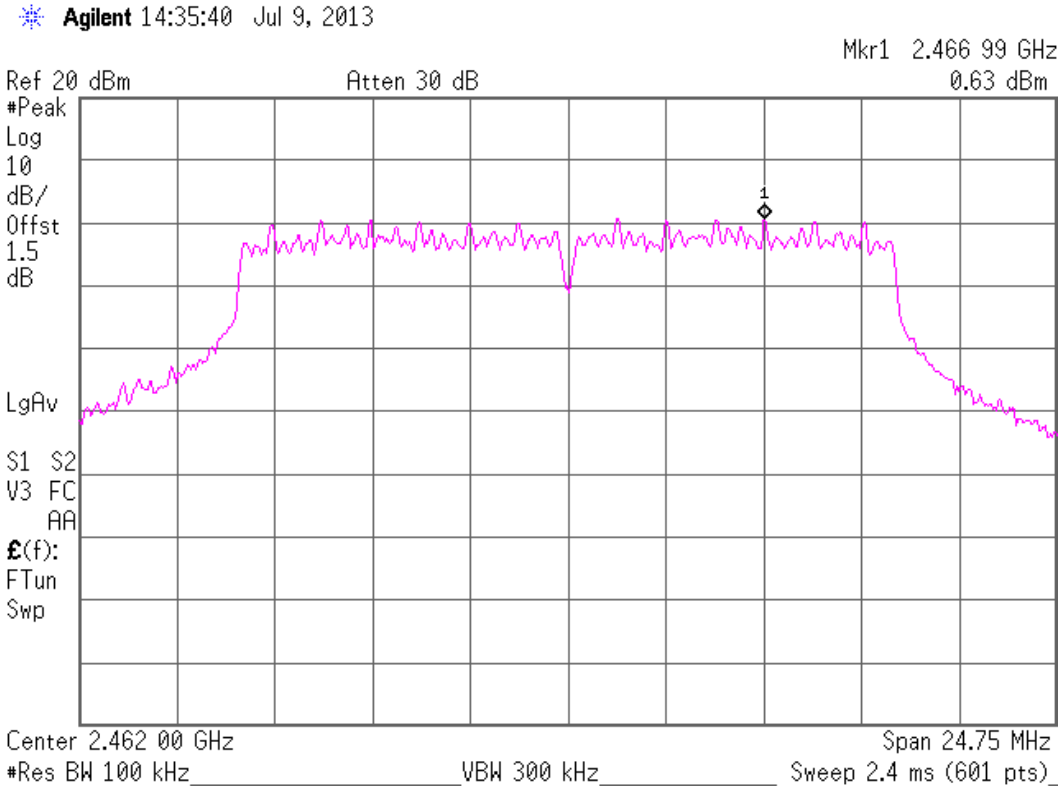
Channel 11, 802.11g, 6Mbps



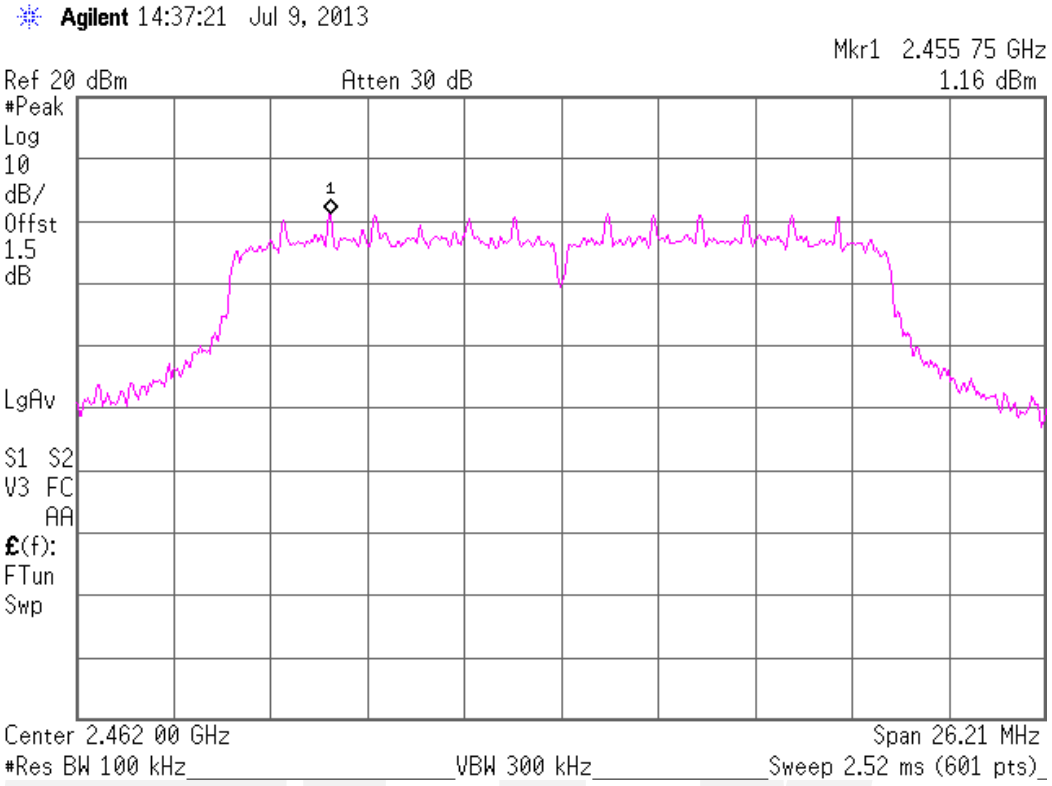
Channel 11, 802.11g, 36Mbps



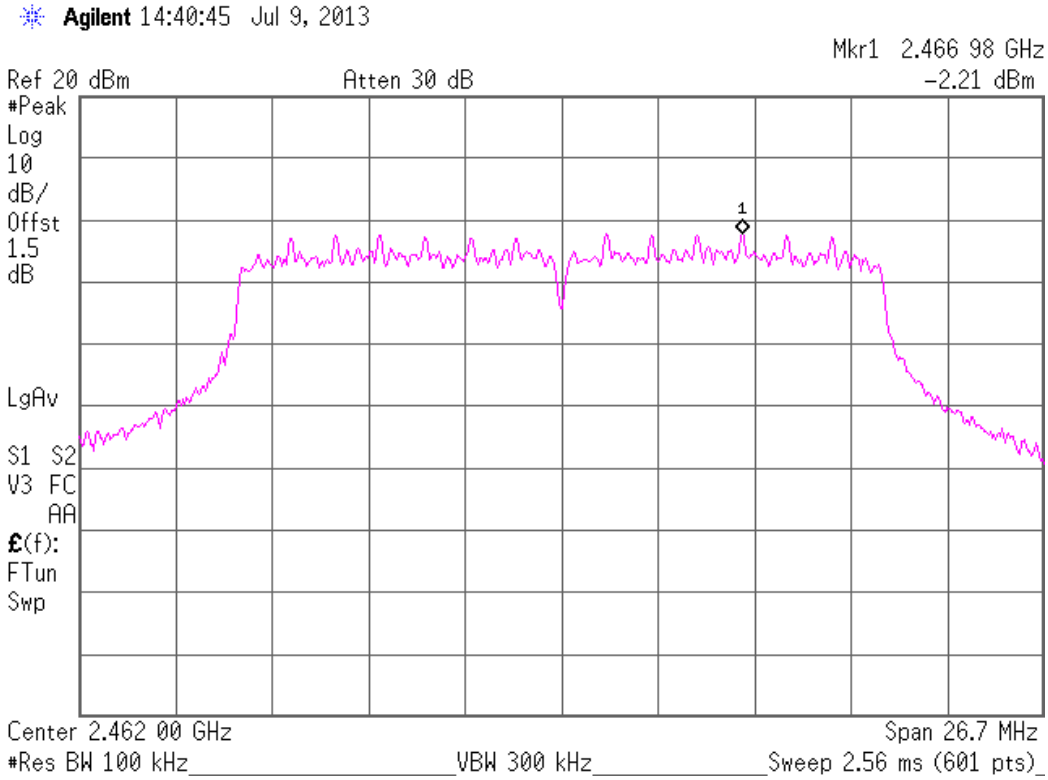
Channel 11, 802.11g, 54Mbps



Channel 11, 802.11n, 6.5Mbps



Channel 11, 802.11n, 65Mbp



Emissions in non-restricted frequency bands

FCC 15.247(d), IC RSS-210 A8.5

Test summary

The requirements are: ■ - MET ☐ - NOT MET
Testing per FCC D01 DTS Meas Guidance v03, 11.0 Emissions in non-restricted frequency bands
The channel with the maximum PSD level is 6, 802.11b, 11Mbps. Reference level is 3.72 dBm.
The maximum emission level is -52.72 dBm at 4.92 GHz
The minimum margin of compliance = 36.4 dB

Test location

☐ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)
■ - Wild River Shield Room 2

Test equipment

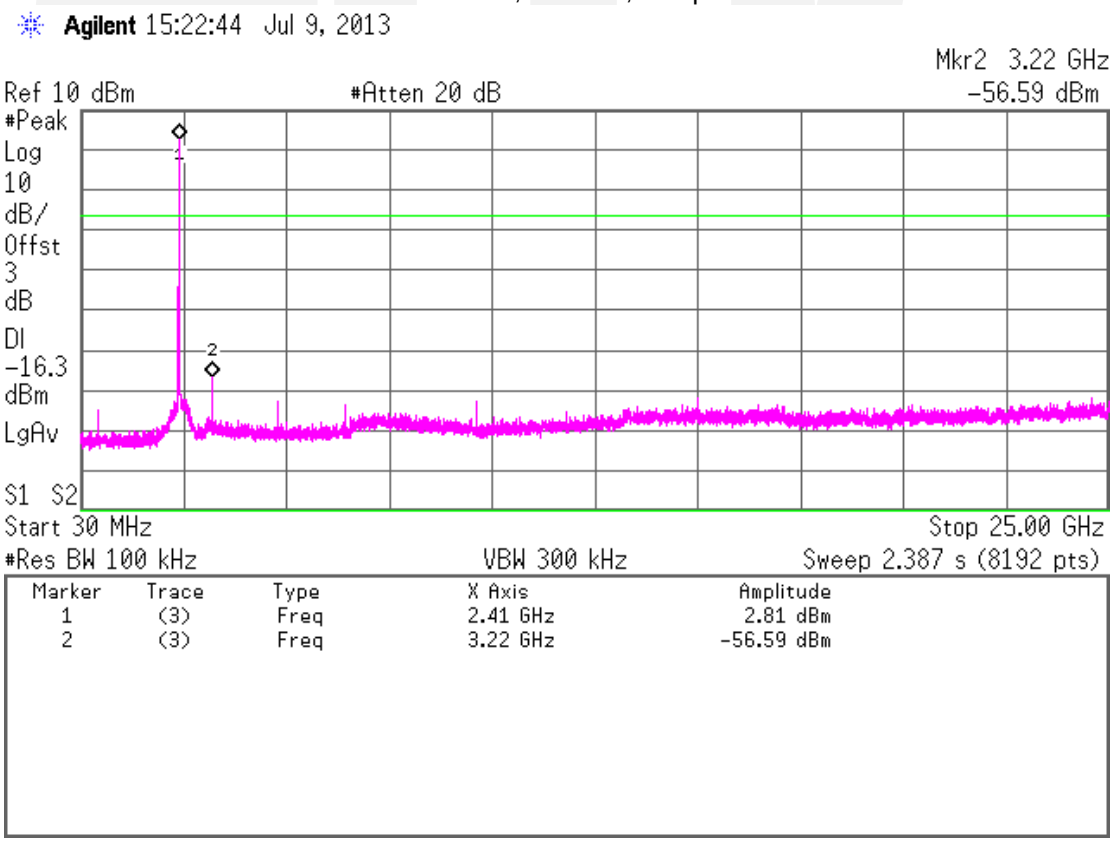
TUV ID	Model	Manufacturer	Description	Serial	Cal Due
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13

Test limit

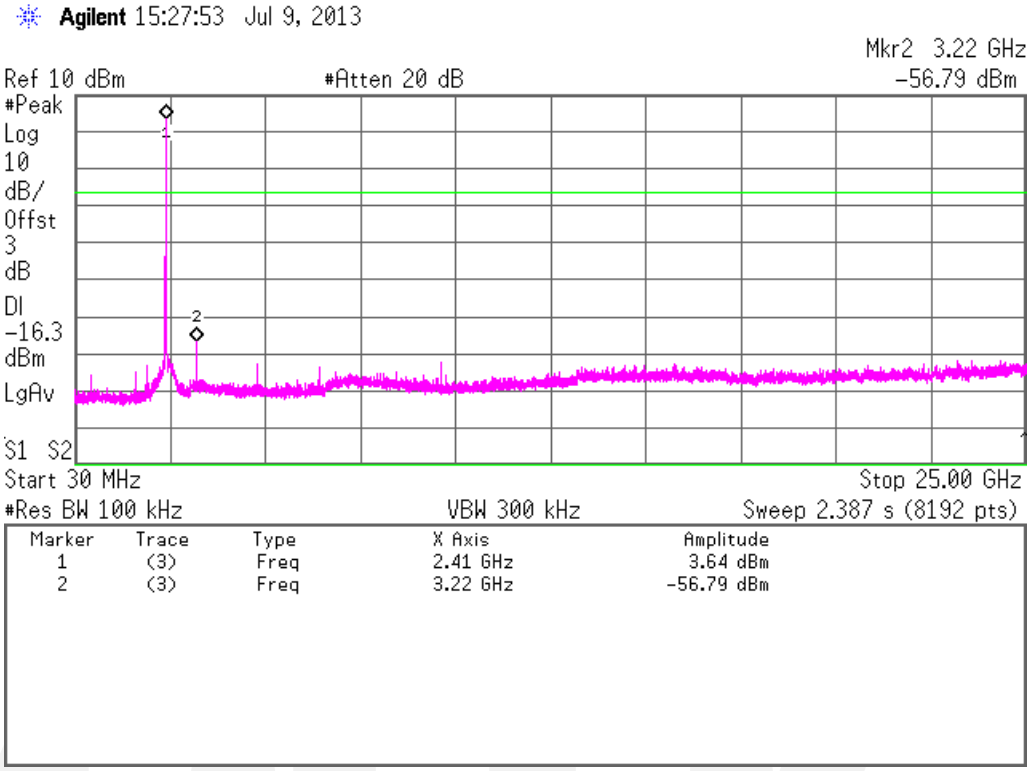
-20 dBc

Test data

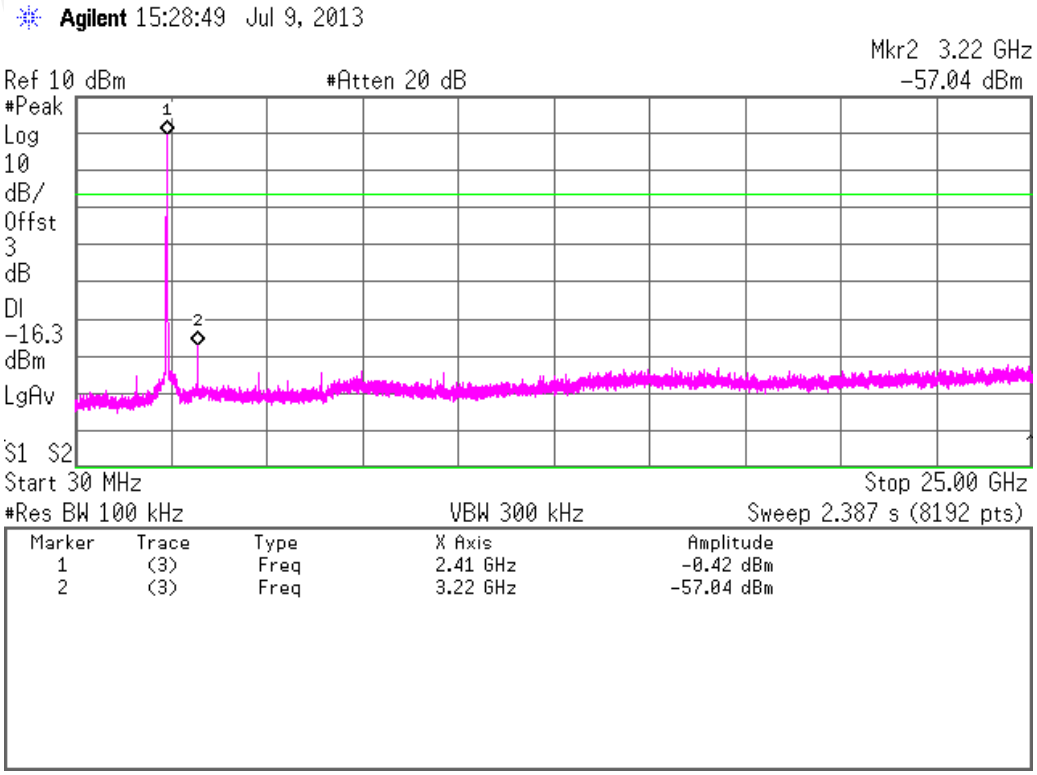
Channel 1, 802.11b, 1Mbps



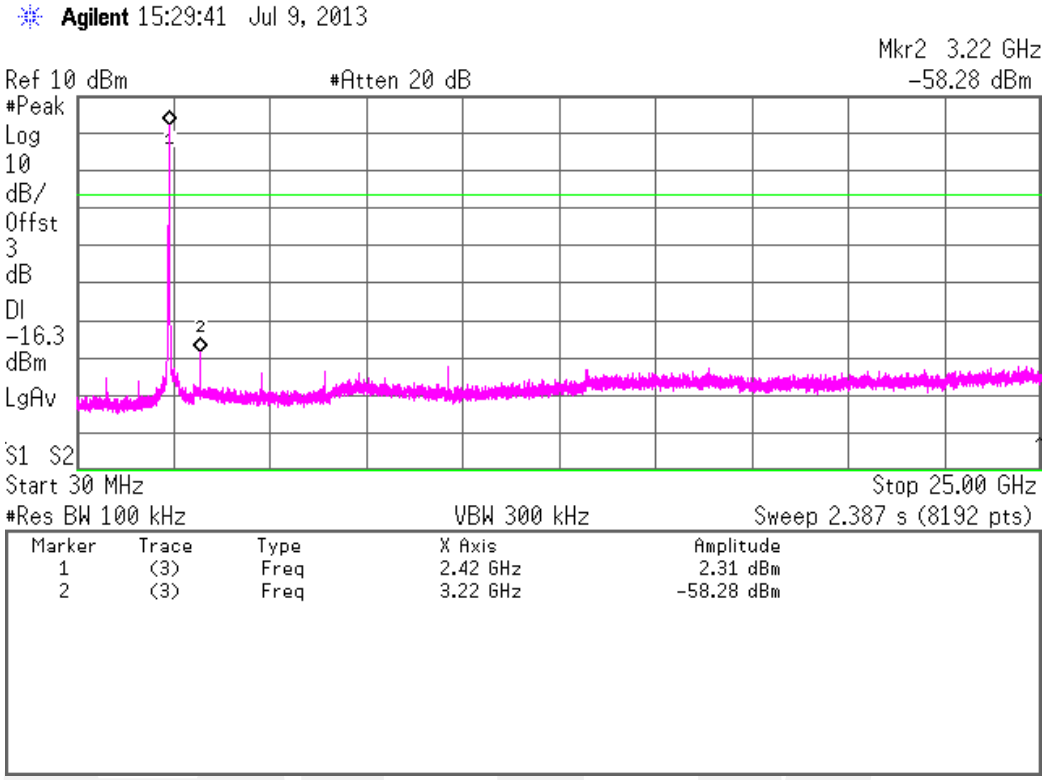
Channel 1, 802.11b, 11Mbps



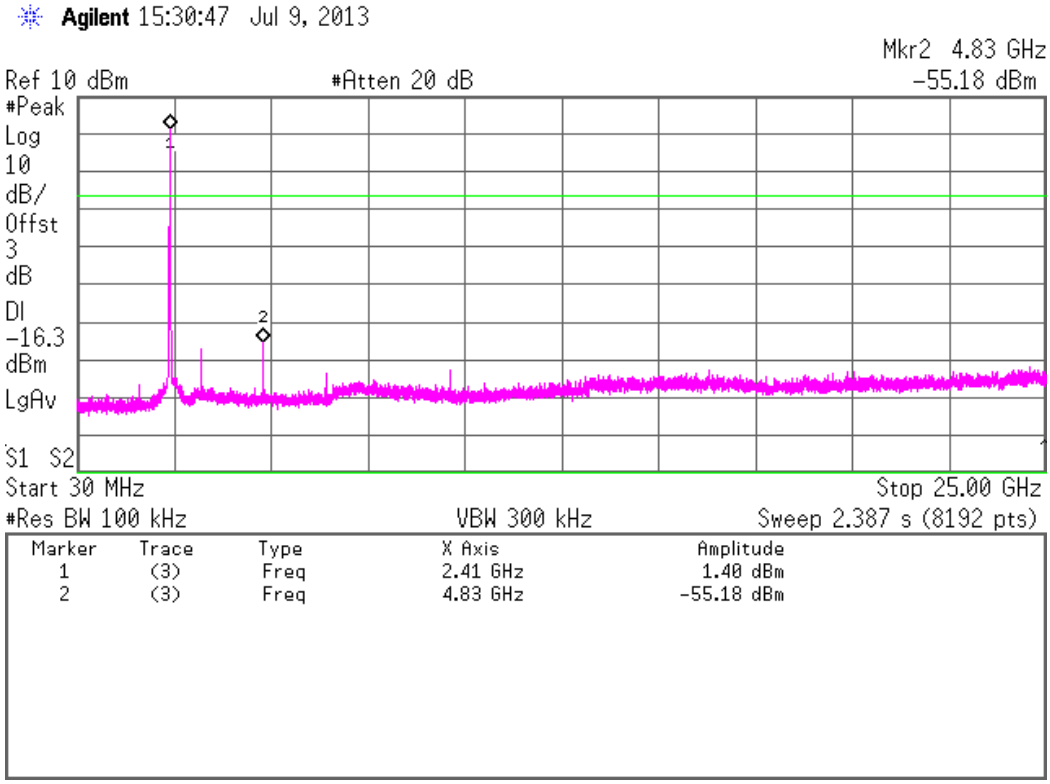
Channel 1, 802.11g, 6Mbps



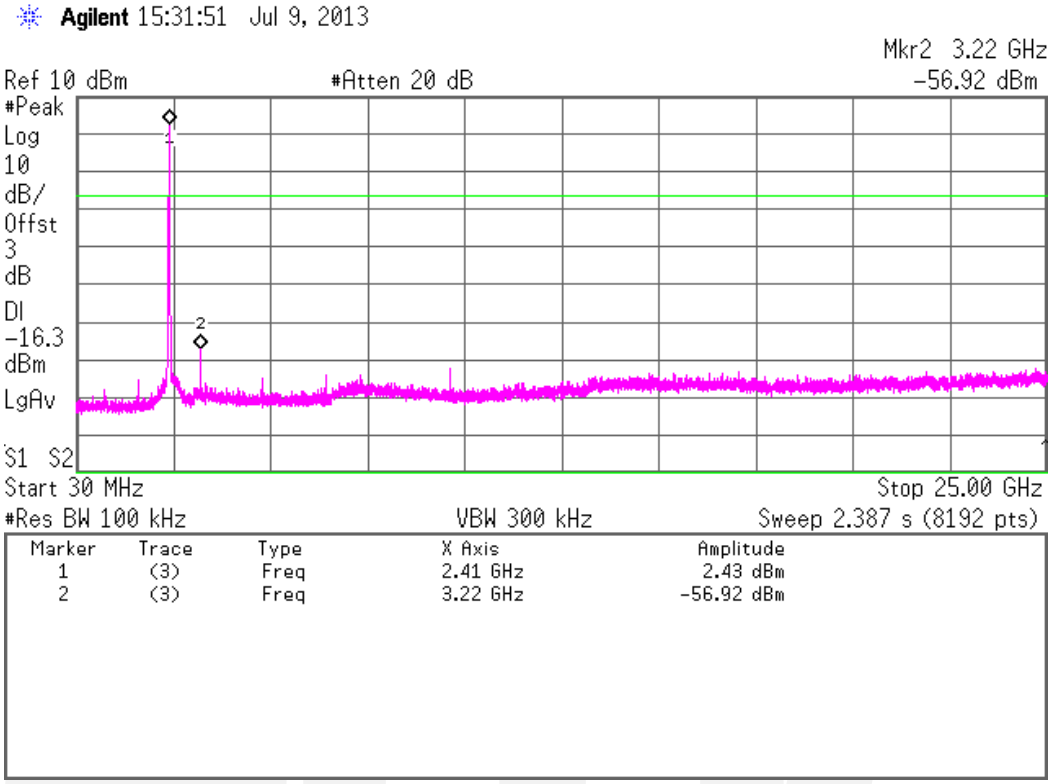
Channel 1, 802.11g, 36Mbps



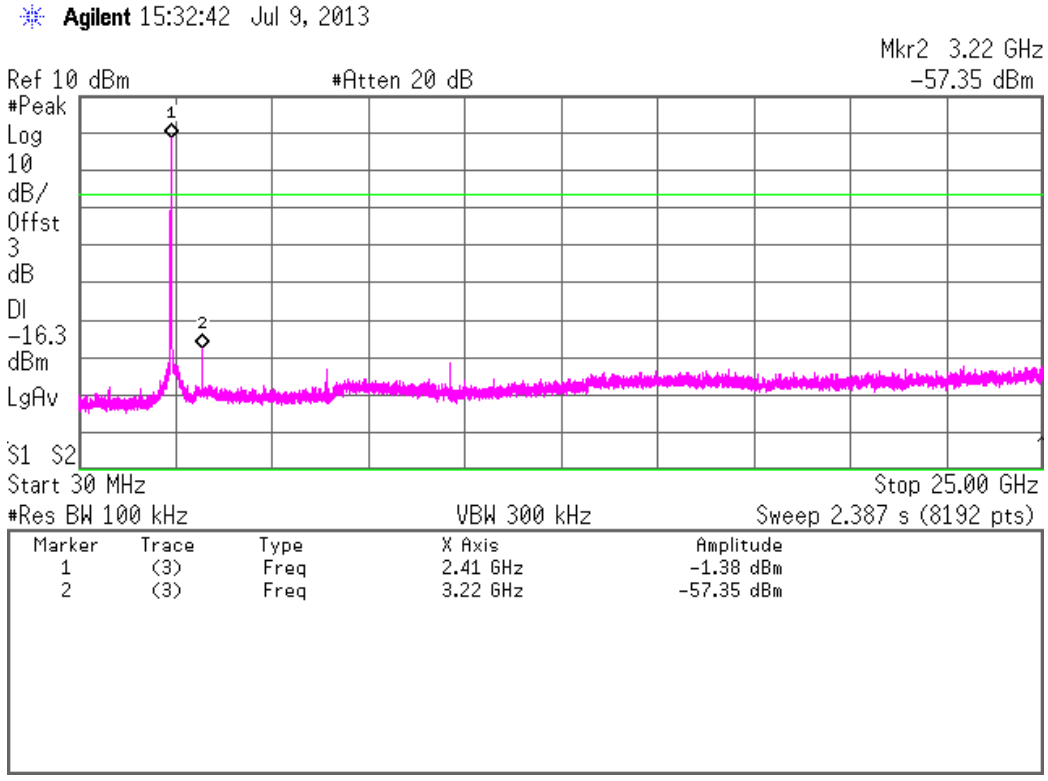
Channel 1, 802.11g, 54Mbps



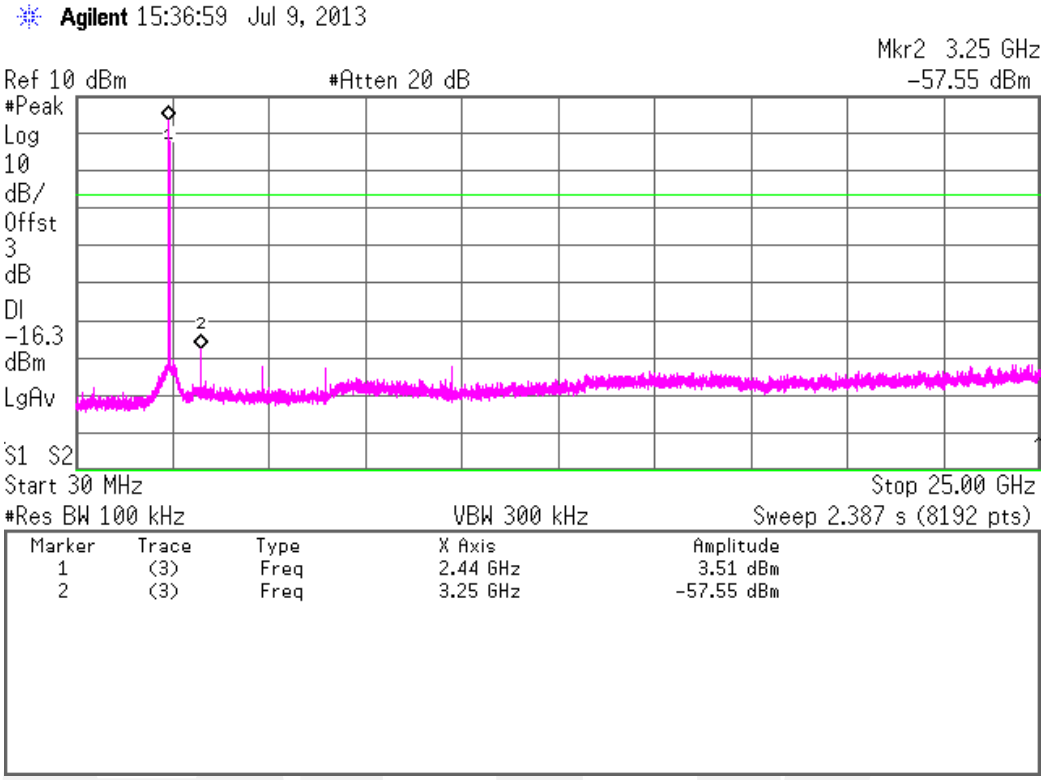
Channel 1, 802.11n, 6.5Mbps



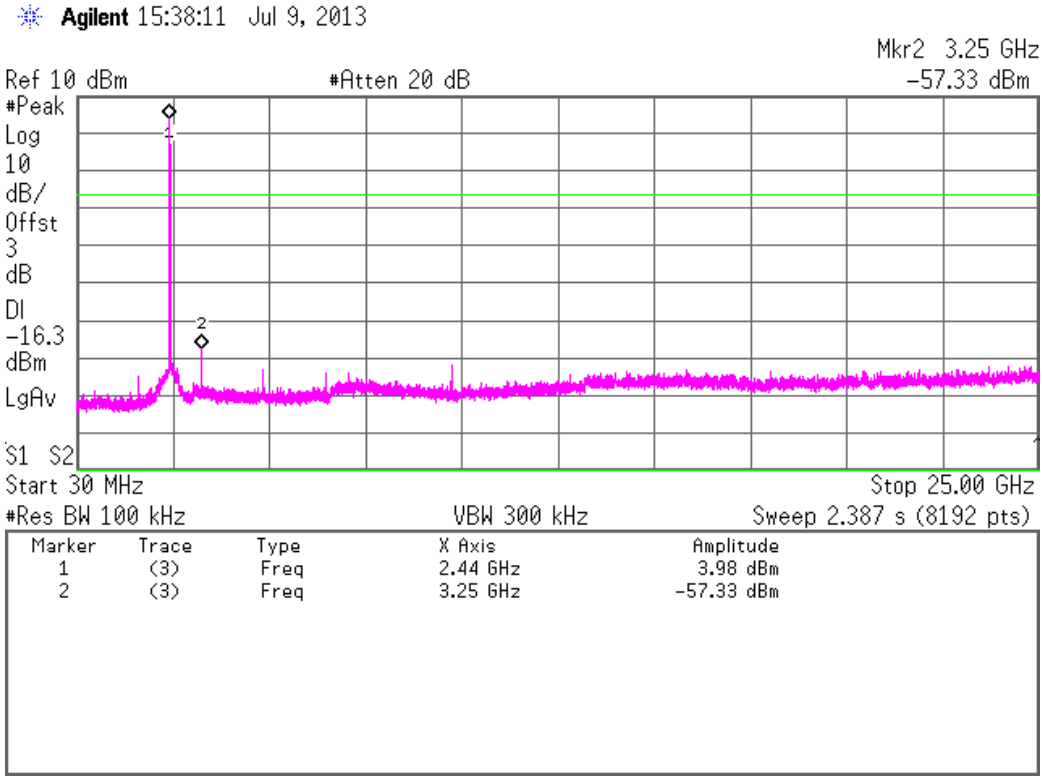
Channel 1, 802.11n, 65Mbps



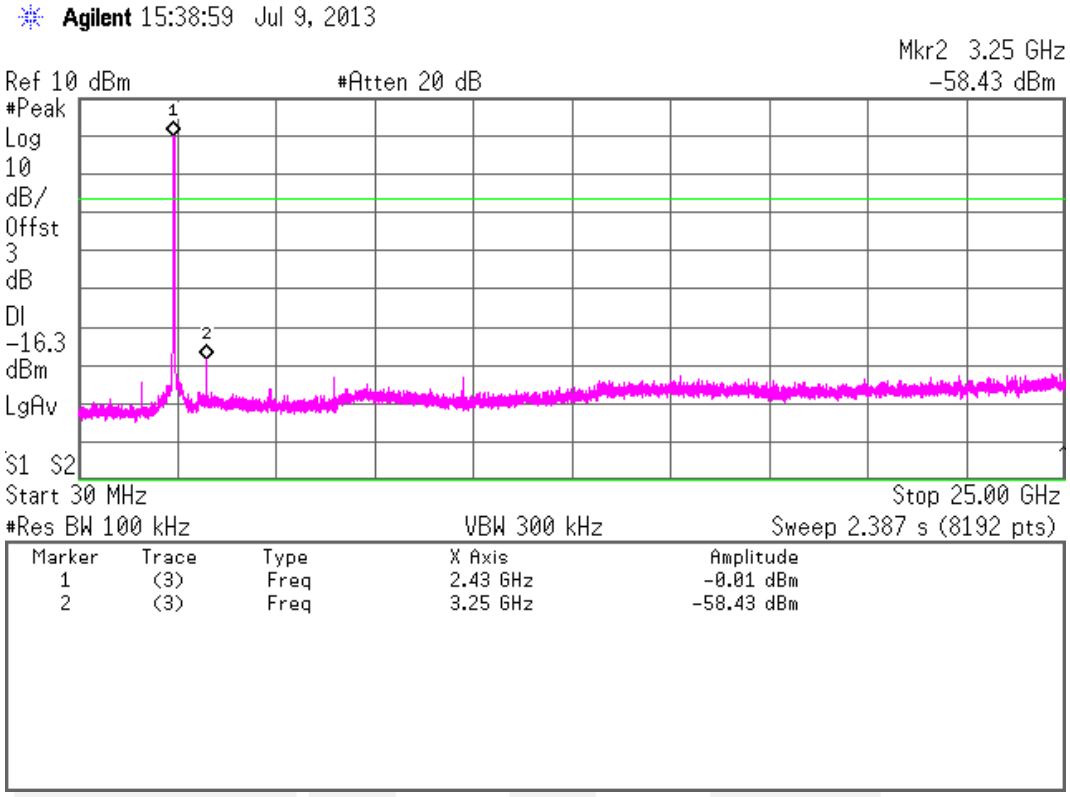
Channel 6, 802.11b, 1Mbps



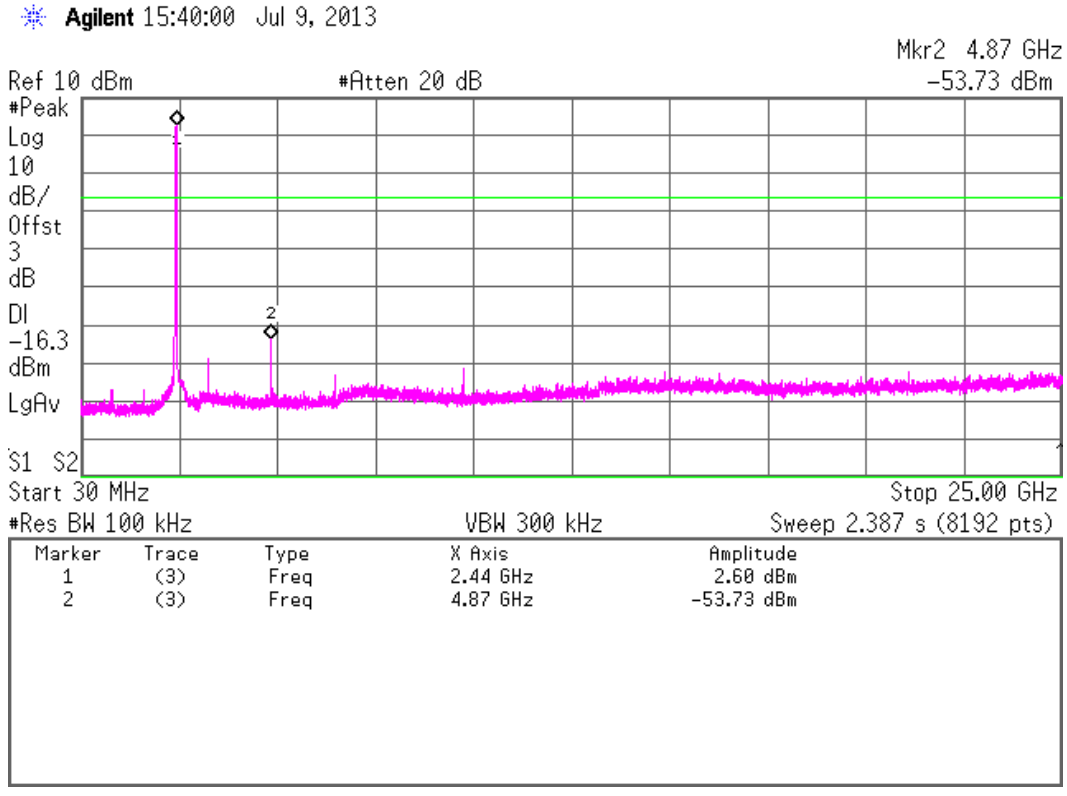
Channel 6, 802.11b, 11Mbps



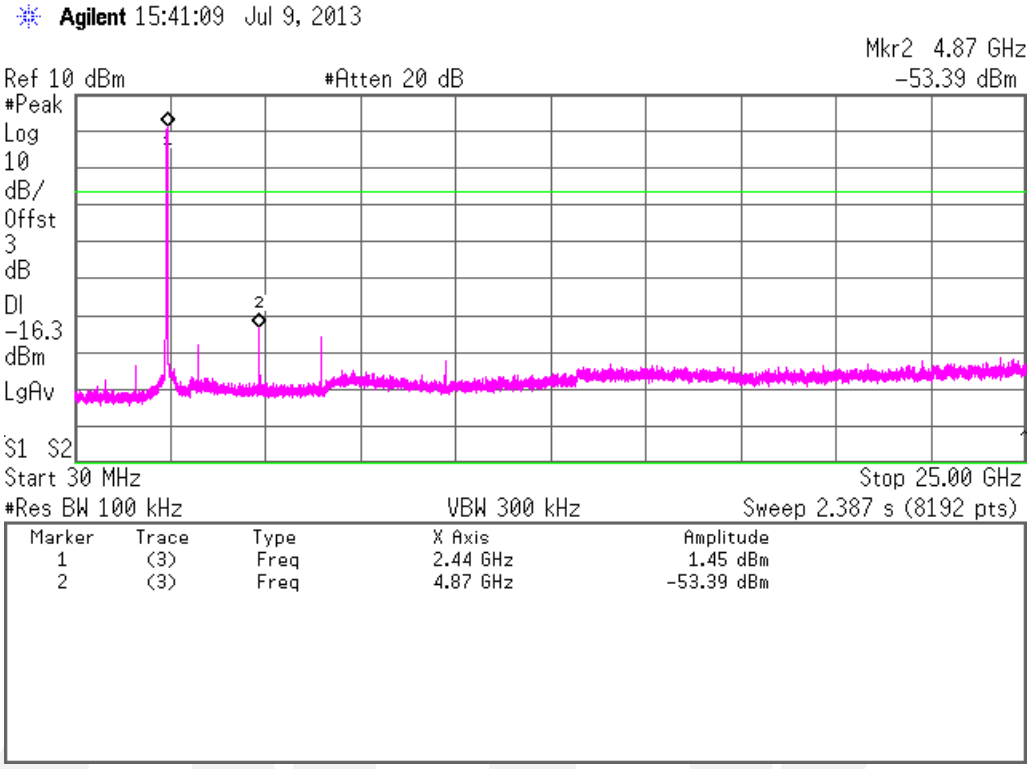
Channel 6, 802.11g, 6Mbps



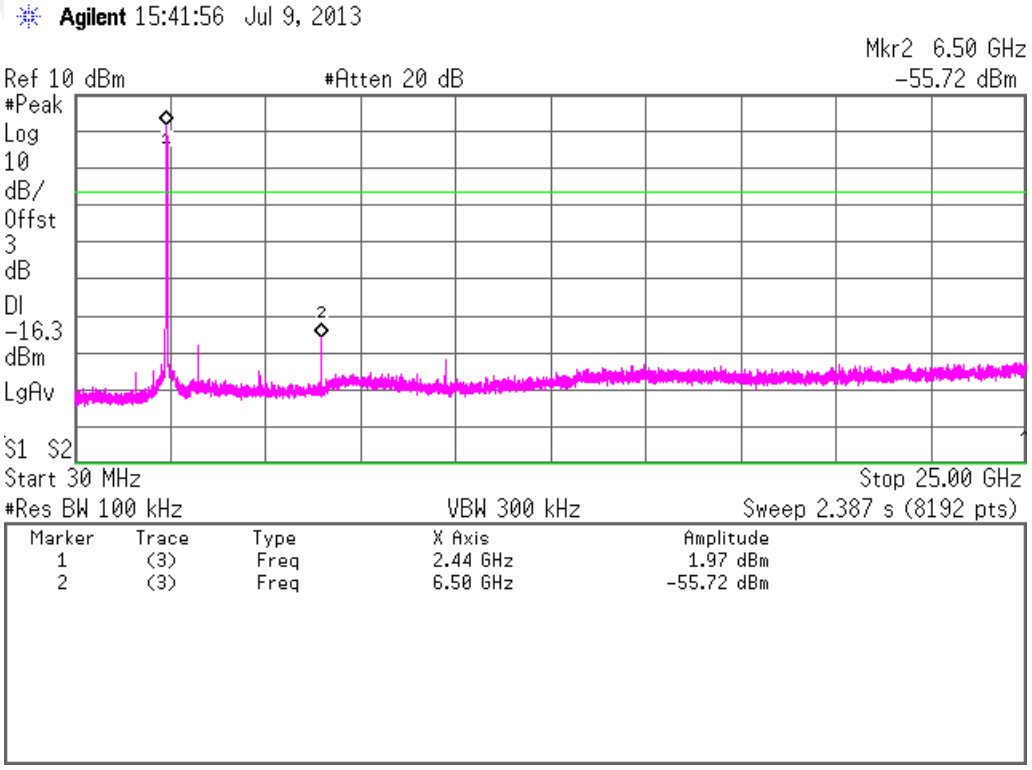
Channel 6, 802.11g, 36Mbps



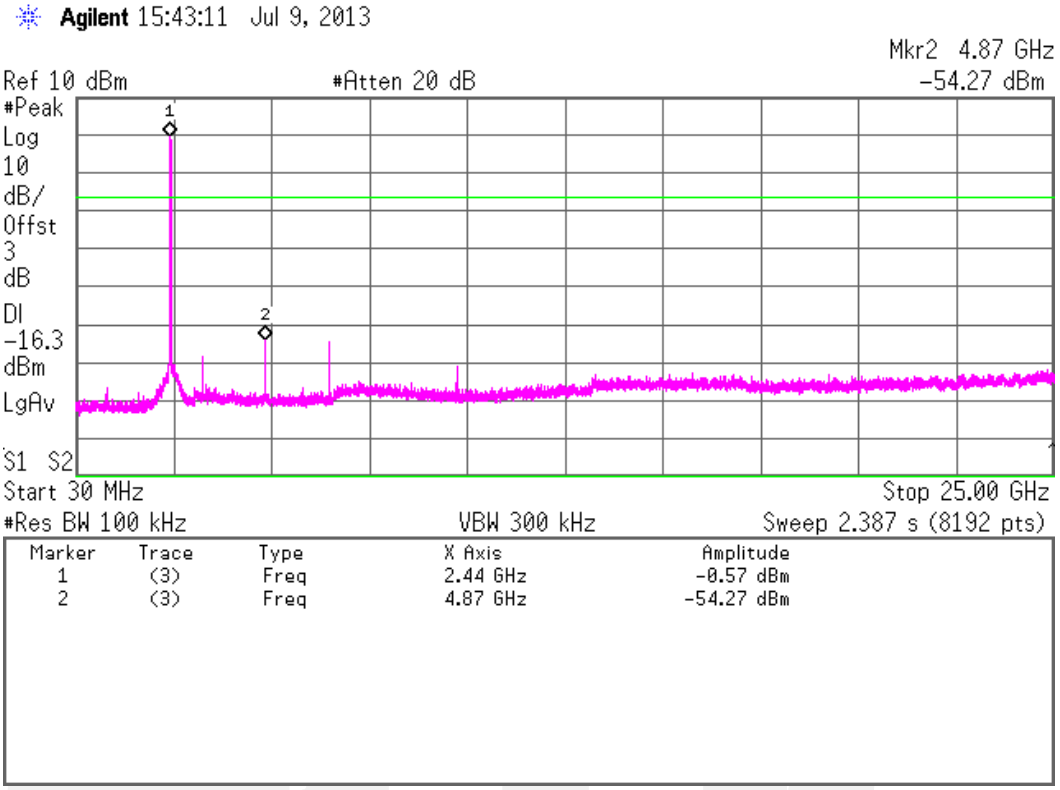
Channel 6, 802.11g, 54Mbps



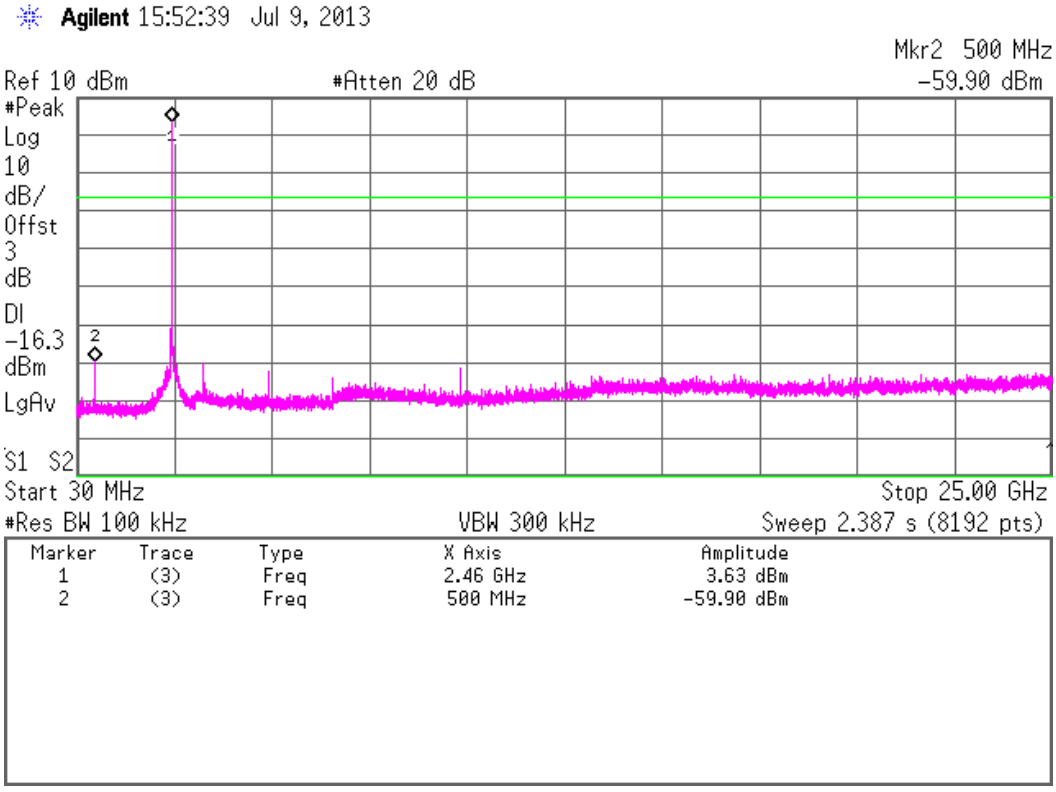
Channel 6, 802.11n, 6.5Mbps



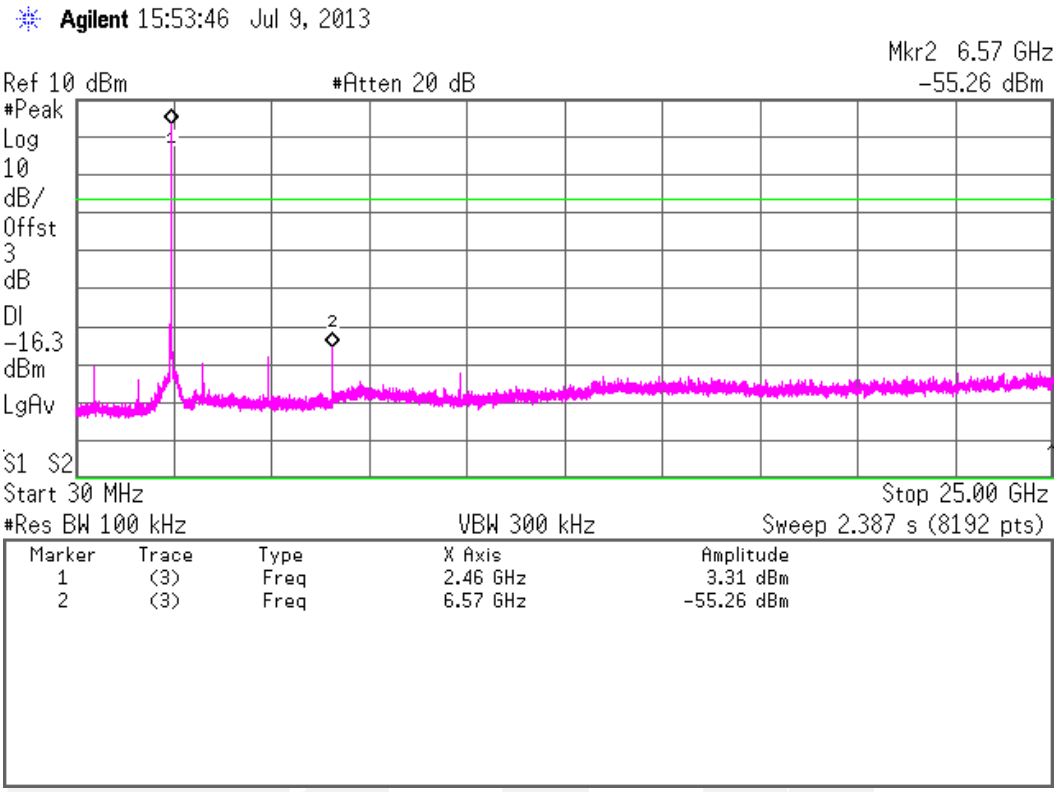
Channel 6, 802.11n, 65Mbps



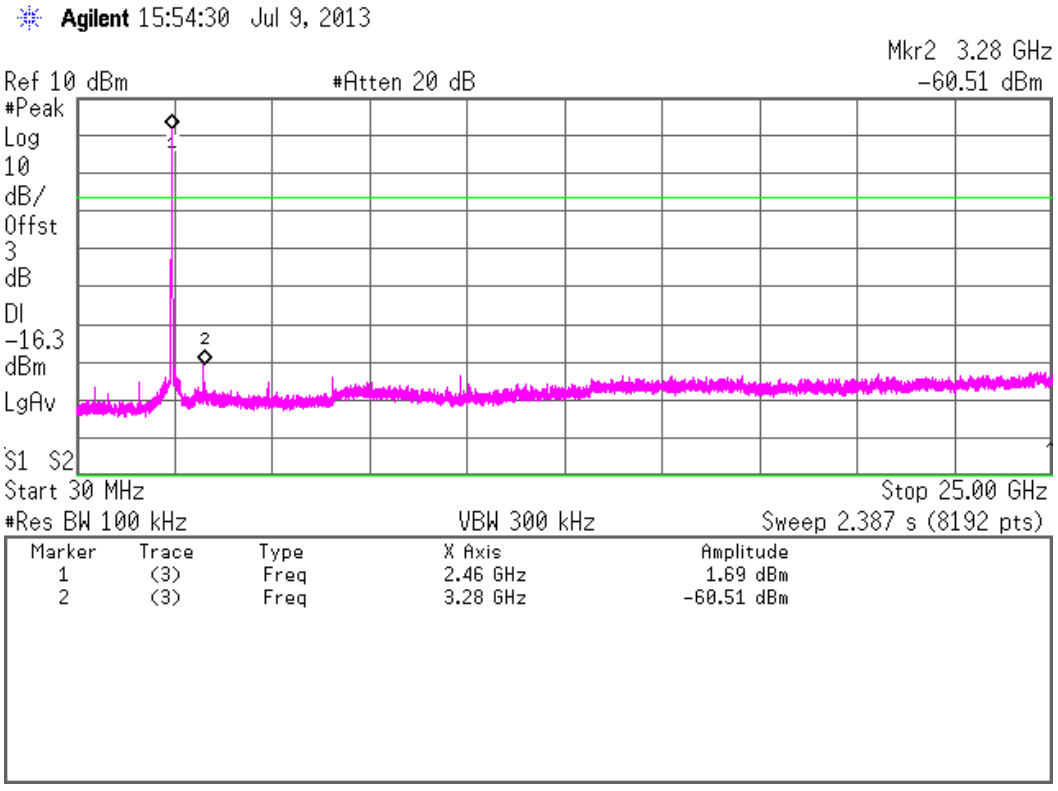
Channel 11, 802.11b, 1Mbps



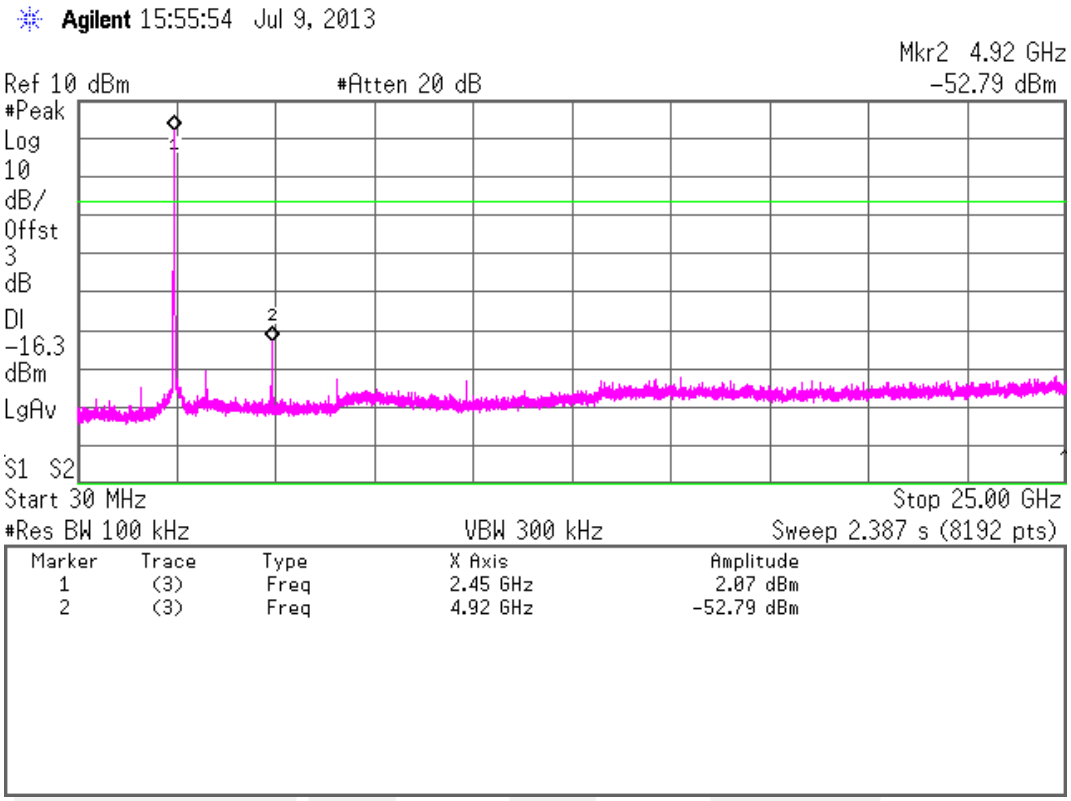
Channel 11, 802.11b, 11Mbps



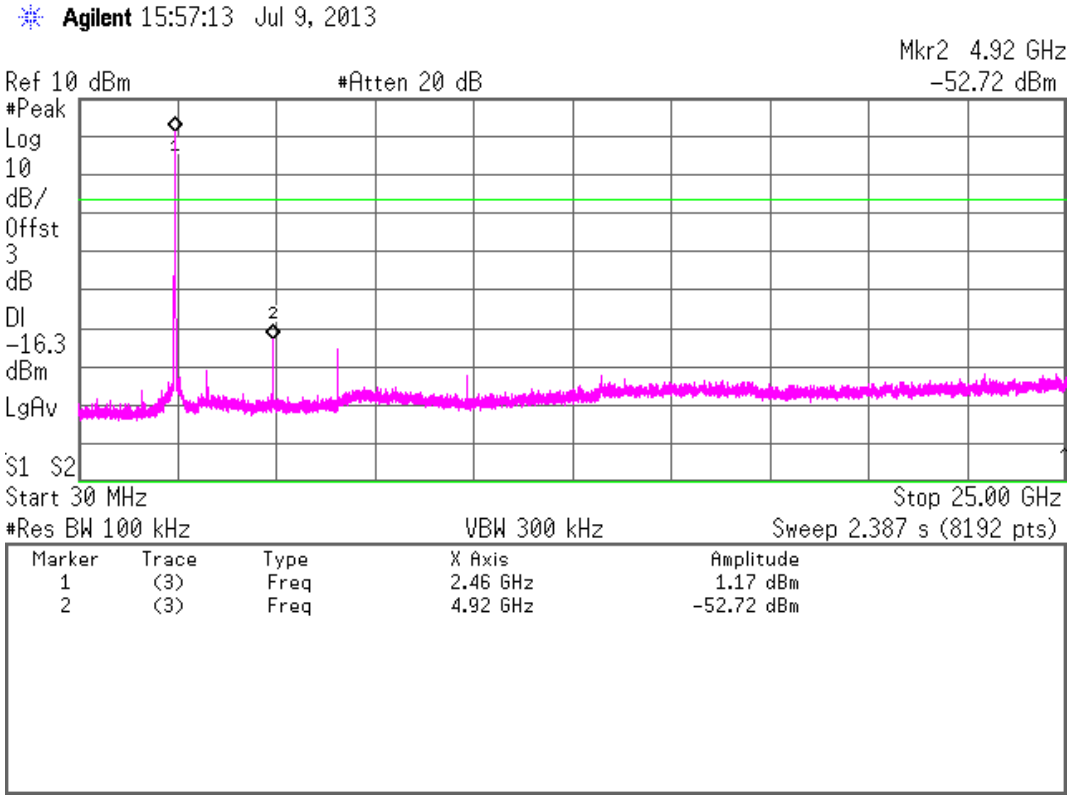
Channel 11, 802.11g, 6Mbps



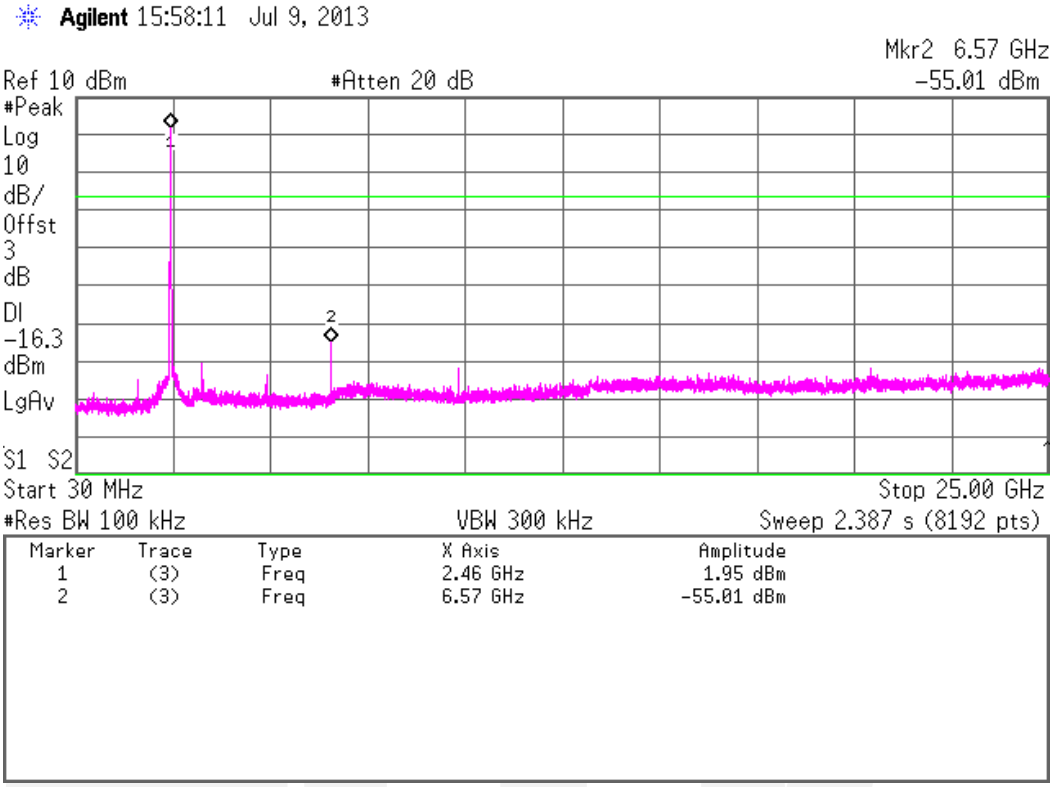
Channel 11, 802.11g, 36Mbps



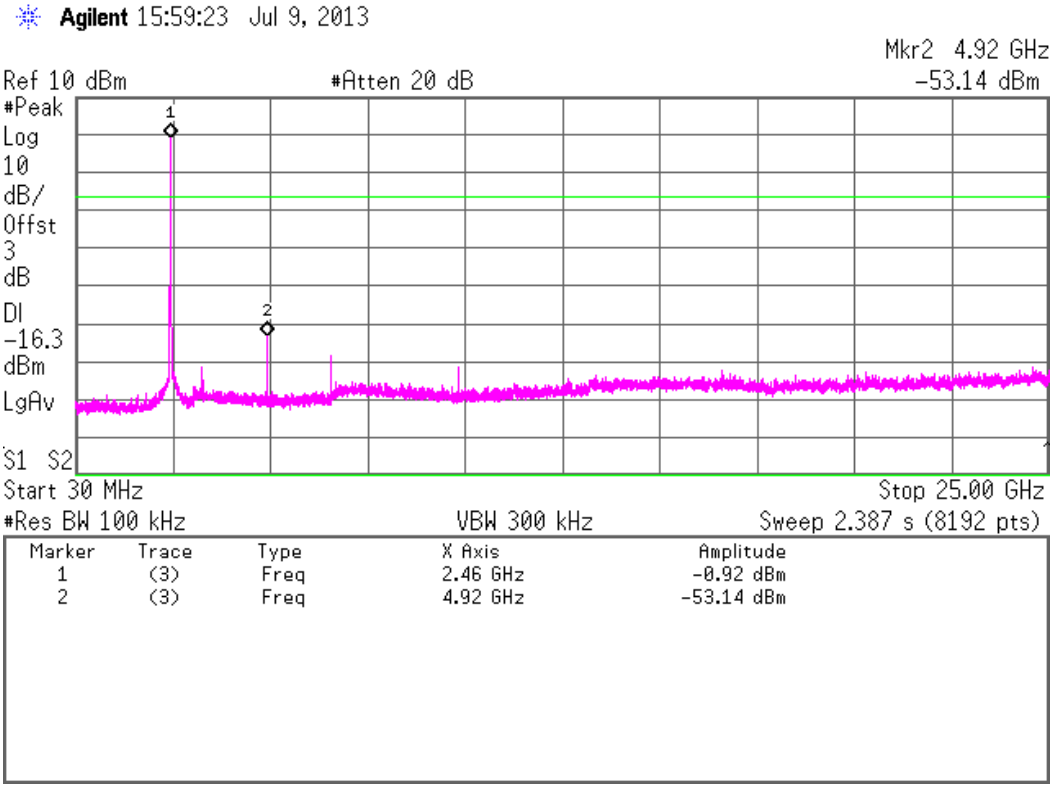
Channel 11, 802.11g, 54Mbps



Channel 11, 802.11n, 6.5Mbps



Channel 11, 802.11n, 65Mbp



Emissions in restricted frequency bands

FCC 15.209(d)

Test summary

The requirements are: ■ - MET ☐ - NOT MET
Testing per FCC D01 DTS Meas Guidance v03, 12.1 Radiated emission measurements
Minimum margin of compliance is 5.71 dB at 960.018 MHz

Test location

■ - Wild River Lab Large Test Site (Open Area Test Site)
■ - Oakwood Lab Medium Test Site (Open Area Test Site)
☐ - Wild River Lab Large Test Site Tech Area

Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
OWLE02074	3115	Electro-Mechanics	Ridge Guide Antenna	2504	07-Mar-14
WRLE03958	SL18B4020	Phase One Microwave	Preamplifier 1 – 18 GHz	0002	Code B 02-Jan-14
WRLE03997	EWT-14-0066	EWT	2.4 GHz Notch filter	E2	Code B 08-Jan-14
NBLE03196	8566B	Hewlett-Packard	Spectrum Analyzer	2240A01856	13-Jan-14
NBLE03195	85662A	Hewlett-Packard	Analyzer Display	2648A13518	13-Jan-14
OWLE02682	85650A	Hewlett-Packard	Quasi-Peak Adapter	2811A01127	19-Mar-14
WRLE03995	EM-6917B	Electro-Metrics	Biconicalog Periodic	151	17-Jun-14
OWLE02671	8447D	Hewlett-Packard	Preamplifier	2648A04942	Code B 07-Feb-14
WRLE03371	E4440A	Agilent	Spectrum Analyzer	MY43362222	06-Nov-13
OWLE03996	SAS-572	A.H. Systems	STD Gain Horn	183	Code Y
WRLE03978	SL26-3010	Phase One Microwave	Amplifier 18-26.5 GHz	0005	Code B 02-Jan-14
WRLE03997	EWT-14-0066	EWT	2.4 GHz Notch filter	E2	Code B 08-Jan-14
WRLE02003	F550B1	Acronetics	4-8 GHz Bandpass Filter	010	Code B 08-Jan-14
WRLE03933	F551B-1	Acronetics	8-12 GHz Bandpass Filter	010	Code B 08-Jan-14

Test limit (in restricted bands)

Frequncy (MHz)	Field strength (μV/meter)	Field strength (dBμV/meter)
30 - 88	100 – QP	40.0
88 - 216	150 – QP	43.5
216 - 960	200 – QP	46.0
960-1000	500 – QP	54.0
>1000	500 – AV 5000 – PK	54.0 74.0

Test data

30-1000 MHz

Measurement summary for limit1: FCC 15.247 <1GHz 3m (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC 15.247 <1GHz 3m
960.018 MHz	46.61 Qp	3.02 / 22.8 / 24.14 / 0.0	48.29	H / 1.44 / 212	-5.71
120.005 MHz	33.25 Qp	0.8 / 8.88 / 24.27 / 0.0	18.67	V / 1.00 / 90	-24.83
128.015 MHz	32.75 Qp	0.83 / 8.46 / 24.21 / 0.0	17.83	V / 1.00 / 0	-25.67

1-25 GHz

No significant emissions were detected within the restricted bands

Radiated restricted band edge

FCC 15.247(d) RSS-210 A8.5

Test summary

The requirements are: ■ - MET ☐ - NOT MET
Maximum average field strength of a bandedge emission is 50.34 dBuV/m at 3m at 2.39 GHz
Minimum margin of compliance is 3.66 dB
Maximum peak field strength of a bandedge emission is 68.14 dBuV/m at 3m at 2.39 GHz
Minimum margin of compliance is 5.86 dB

Test location

■ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)
☐ - Wild River Lab Large Test Site Tech Area

Test equipment

TUV ID	Model	Manufacturer	Description	Serial	Cal Due
OWLE02074	3115	Electro-Mechanics	Ridge Guide Antenna	2504	07-Mar-14
WRLE03958	SL18B4020	Phase One Microwave	Preamplifier 1 – 18 GHz	0002	Code B 02-Jan-14
WRLE03058	2	Inmet	20 dB Attenuator	18N20W-20dB	Code B 04-Feb-14
NBLE03196	8566B	Hewlett-Packard	Spectrum Analyzer	2240A01856	13-Jan-14
NBLE03195	85662A	Hewlett-Packard	Analyzer Display	2648A13518	13-Jan-14

Test limit

Frequency (GHz)	Field strength (μV/meter)	Field strength (dBμV/meter)
2.39 & 2.4835	500 – AV 5000 – PK	54.0 74.0

Test data

Measurement summary for limit1: FCC 15.247 >1G 3m pk (Pk)

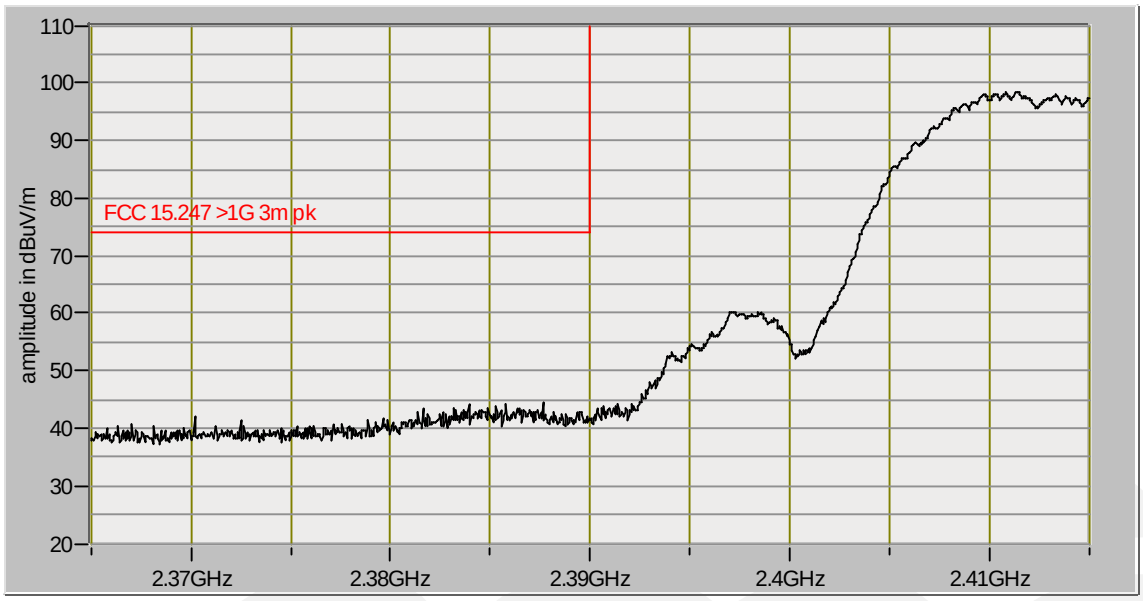
FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC 15.247 >1G 3m pk
2.39 GHz	83.1 Pk	5.78 / 28.15 / 48.89 / 0.0	68.14	V / 1.00 / 21	-5.86
2.4835 GHz	75.1 Pk	6.04 / 28.62 / 48.76 / 0.0	60.99	V / 1.00 / 16	-13.01

Measurement summary for limit2: FCC 15.247 >1G 3m av (Av)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA2 FCC 15.247 >1G 3m av
2.39 GHz	65.3 Av	5.78 / 28.15 / 48.89 / 0.0	50.34	V / 1.00 / 21	-3.66
2.4835 GHz	59.5 Av	6.04 / 28.62 / 48.76 / 0.0	45.39	V / 1.00 / 16	-8.61

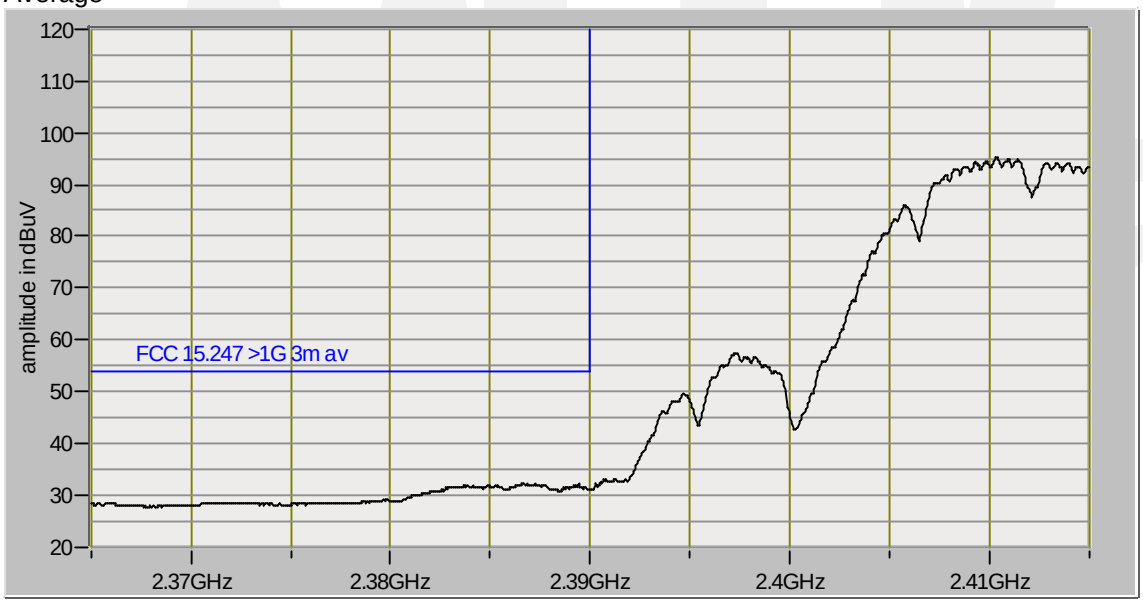
Band edge

802.11b, Ch 1, 1 Mbps
Peak



RBW 1 MHz VBW 1 MHz

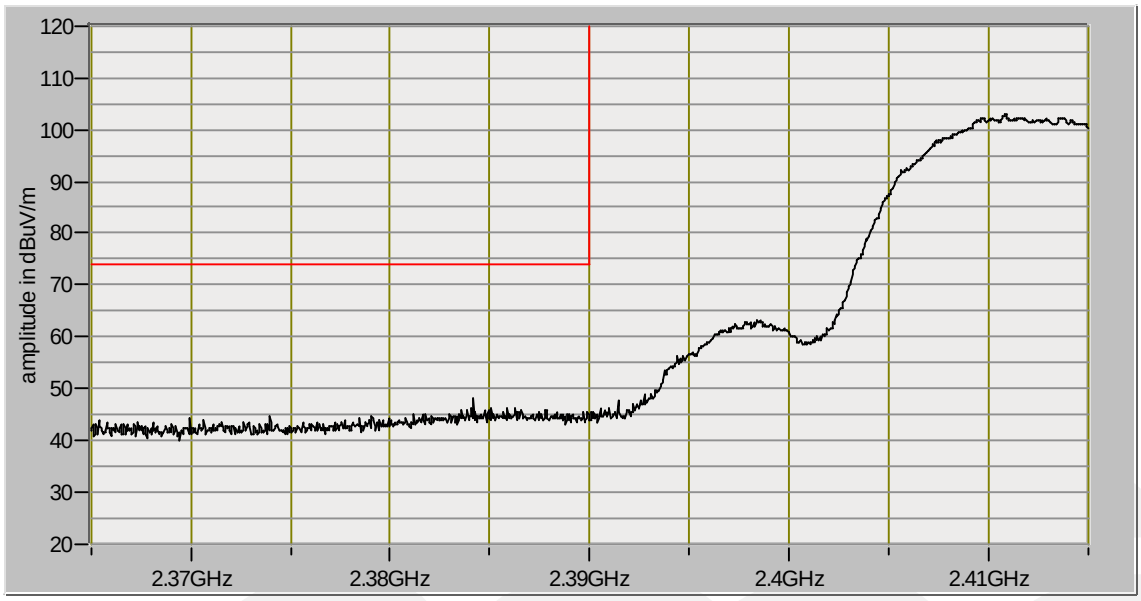
Average



RBW 1 MHz VBW 10 Hz

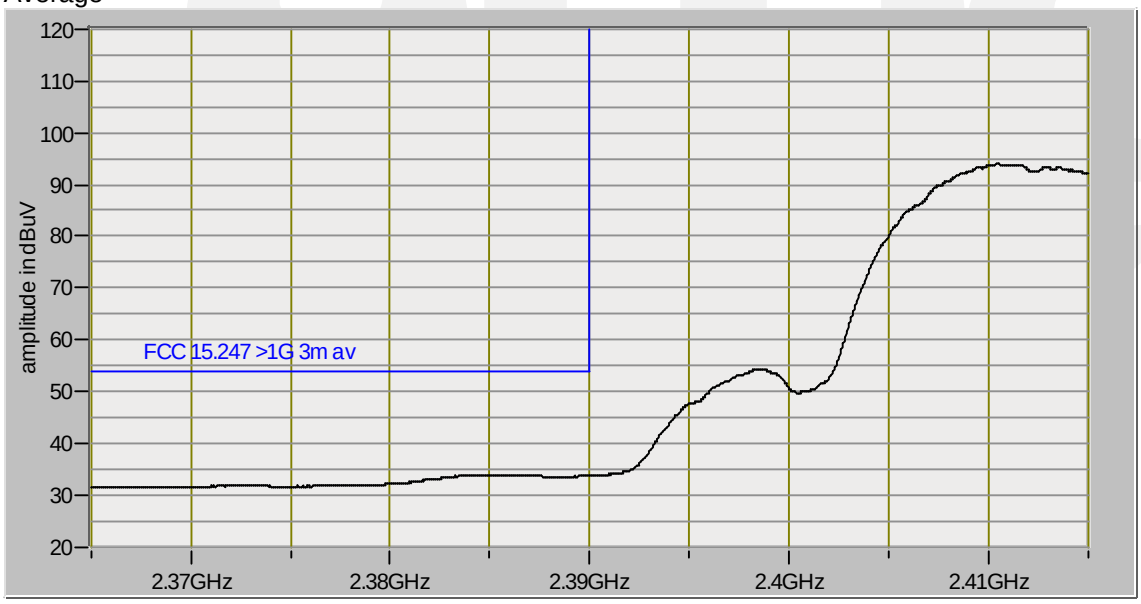
802.11b, Ch 1, 11 Mbps

Peak



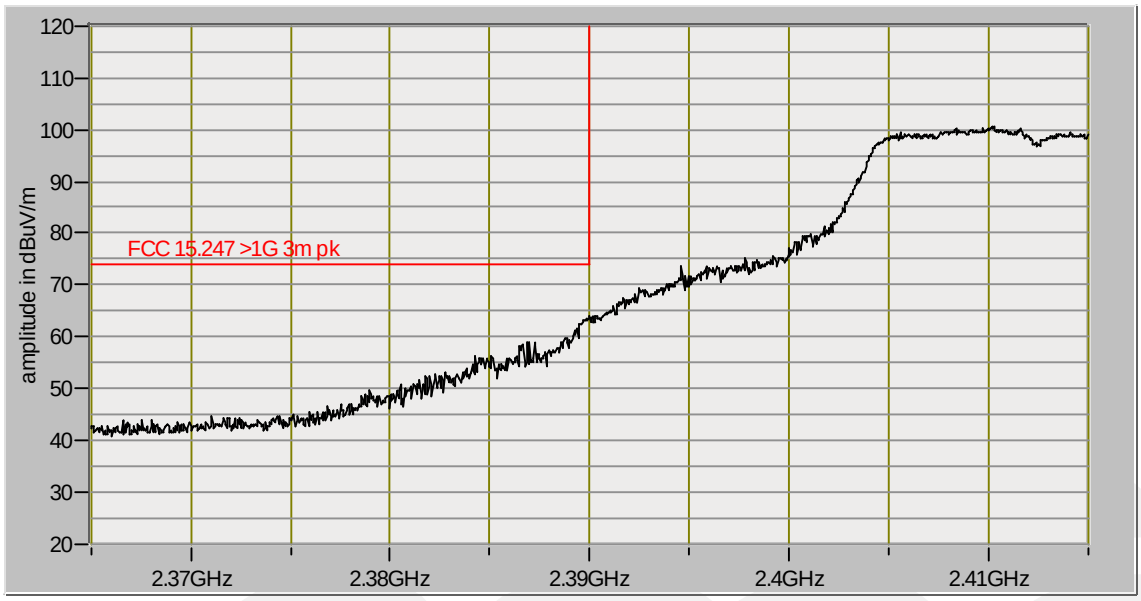
RBW 1 MHz VBW 1 MHz

Average



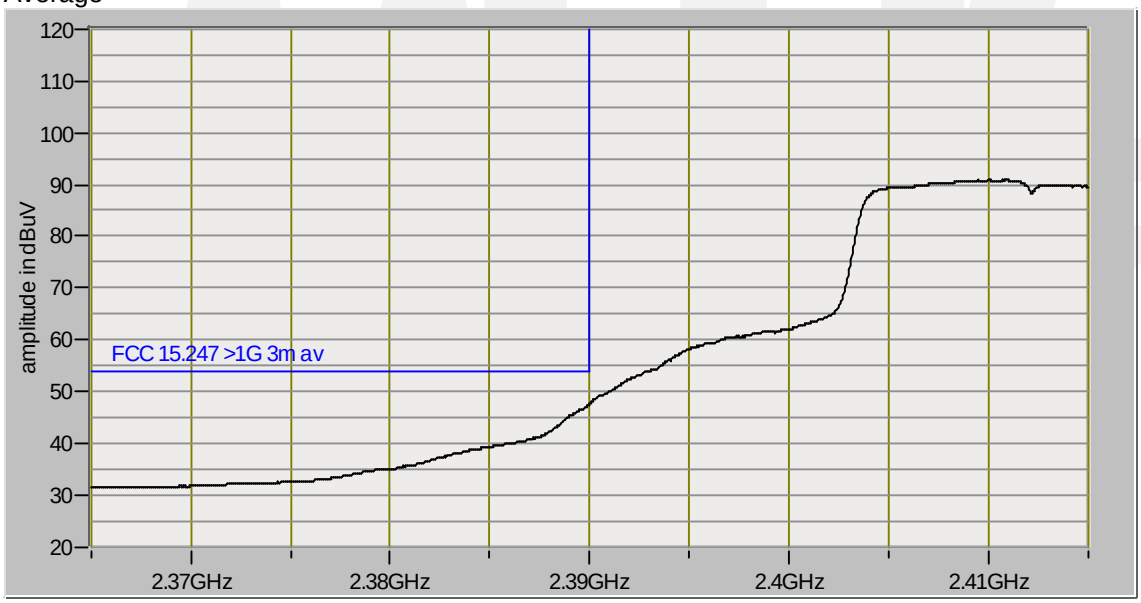
RBW 1 MHz VBW 10 Hz

802.11g, Ch 1, 6 Mbps
Peak



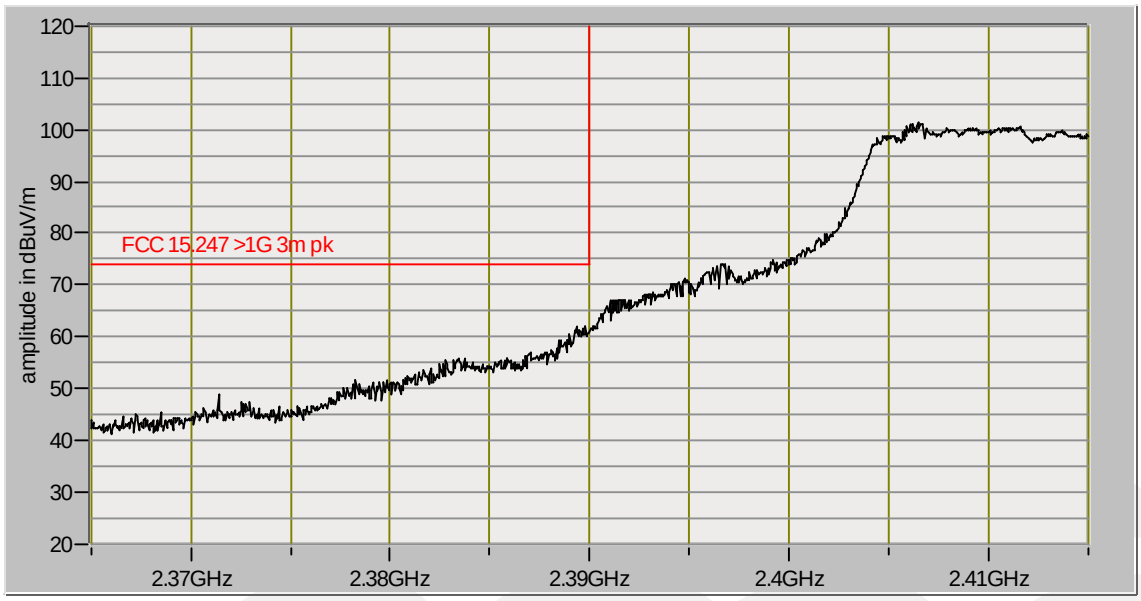
RBW 1 MHz VBW 1 MHz

Average



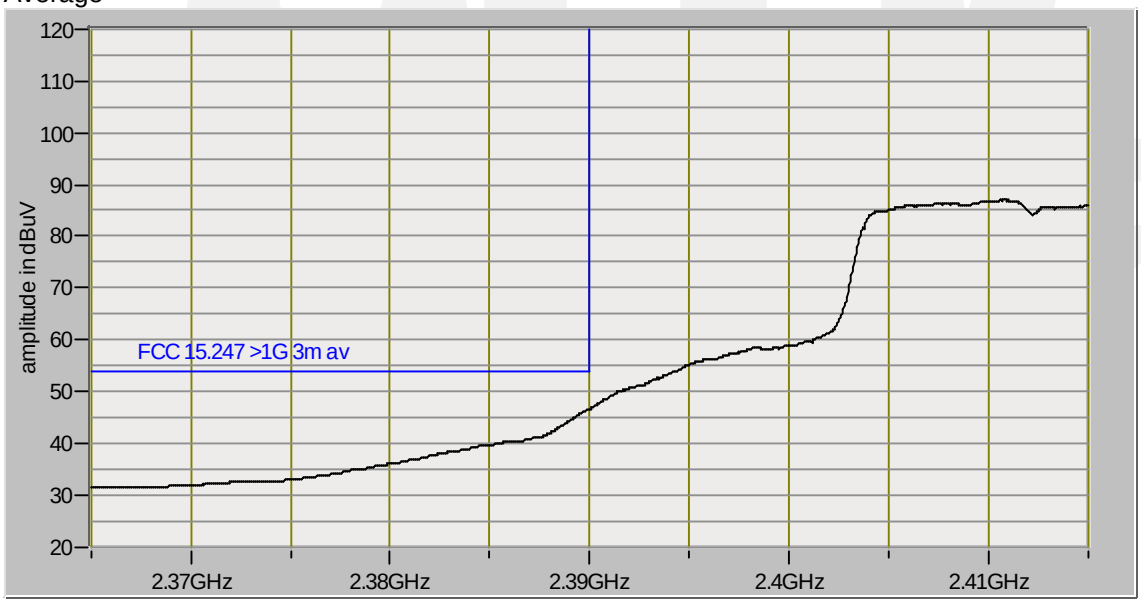
RBW 1 MHz VBW 10 Hz

802.11g, Ch 1, 36 Mbps
Peak



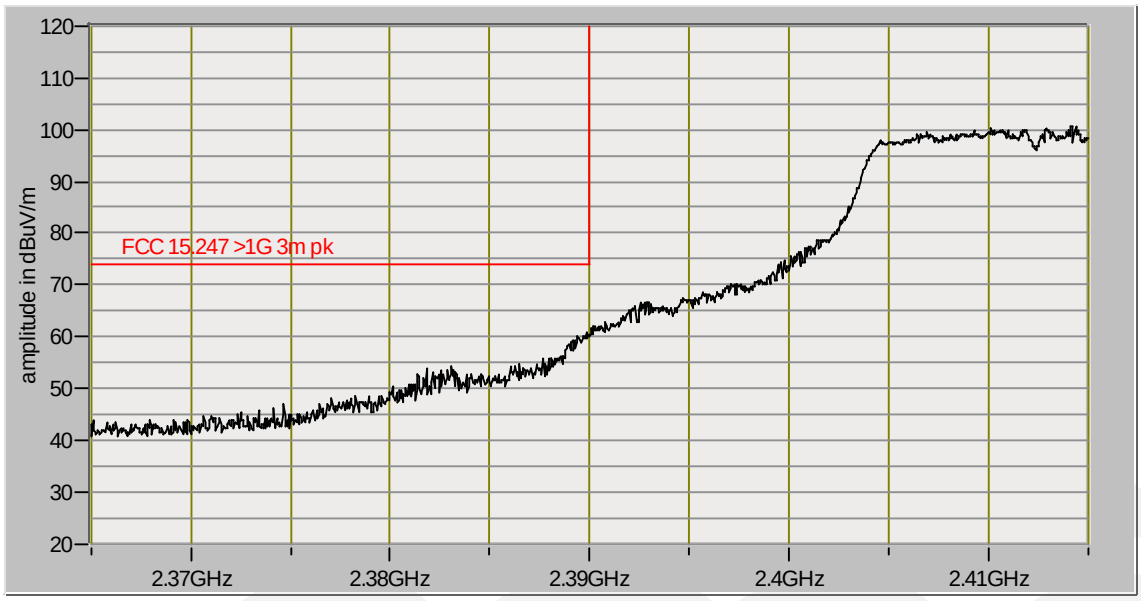
RBW 1 MHz VBW 1 MHz

Average



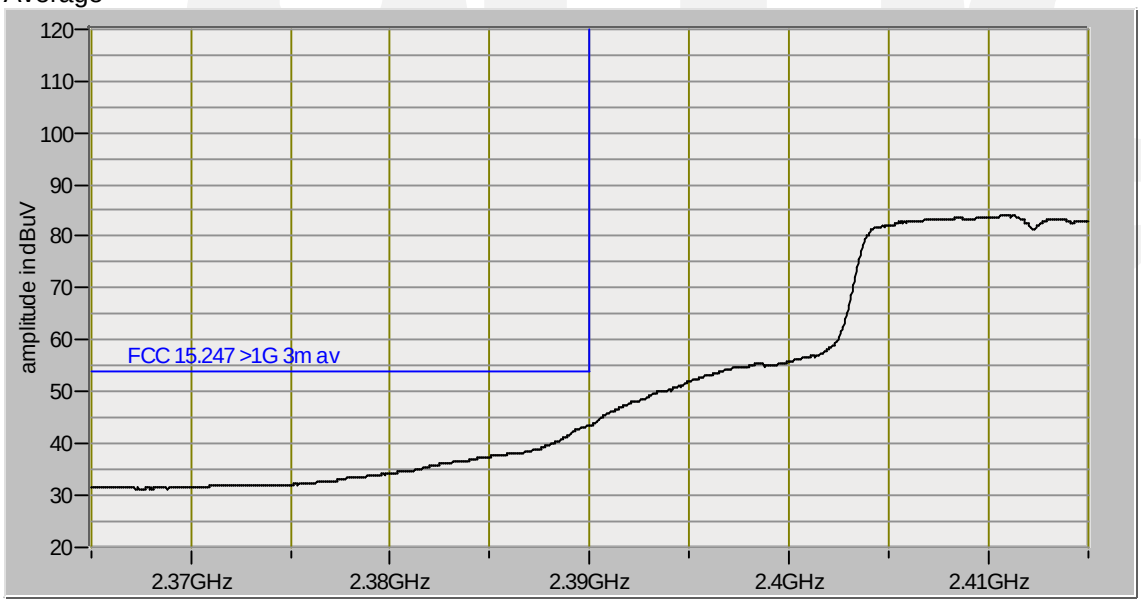
RBW 1 MHz VBW 10 Hz

802.11g, Ch 1, 54 Mbps
Peak



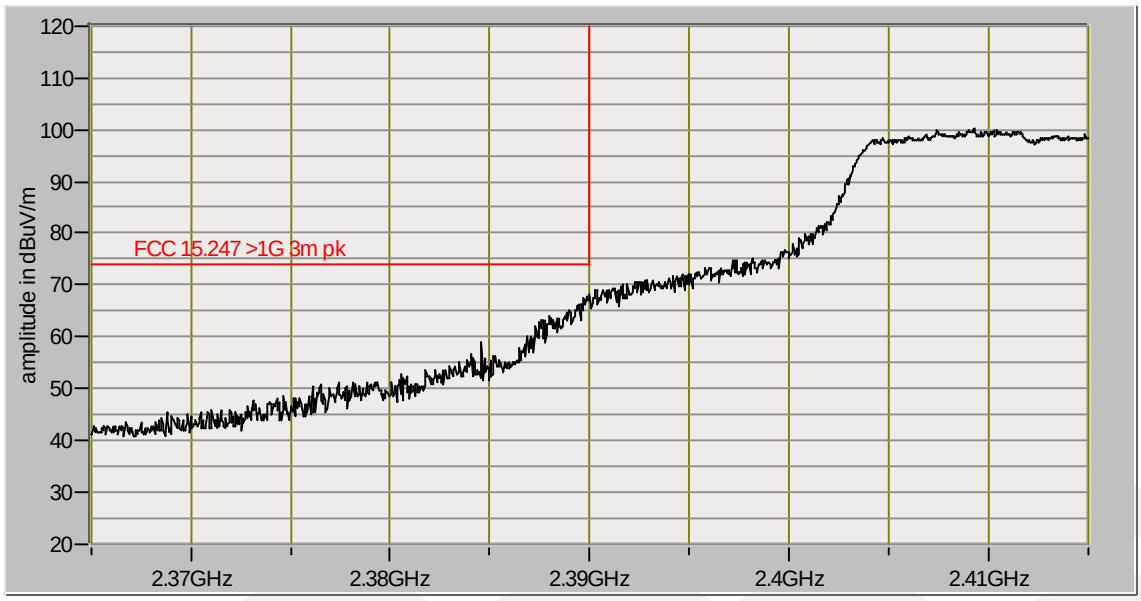
RBW 1 MHz VBW 1 MHz

Average



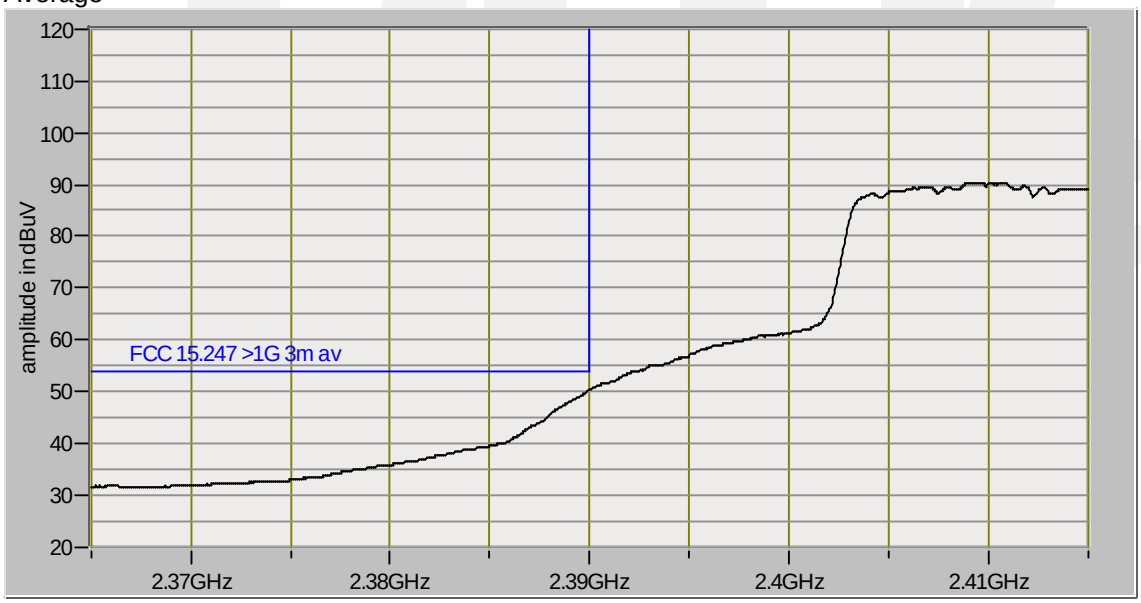
RBW 1 MHz VBW 10 Hz

802.11n, Ch 1, 6.5 Mbps
Peak



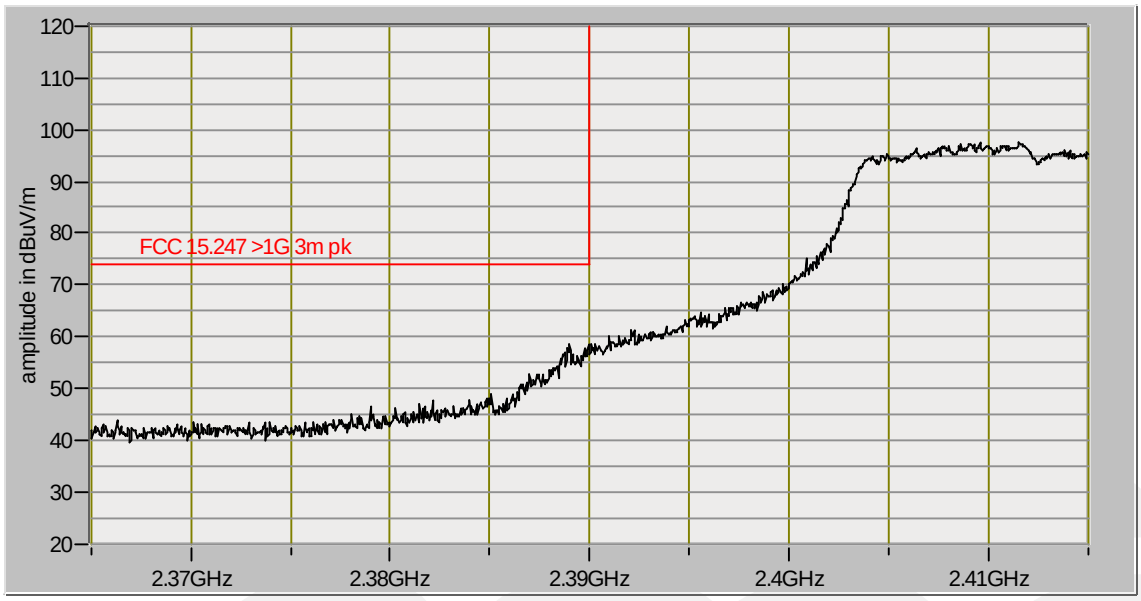
RBW 1 MHz VBW 1 MHz

Average



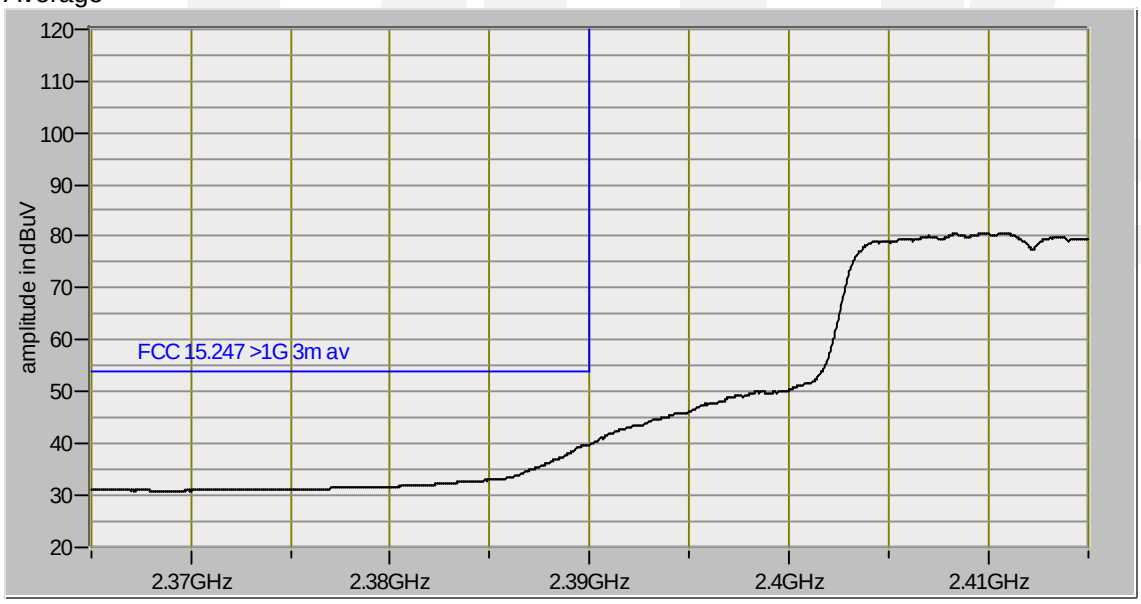
RBW 1 MHz VBW 10 Hz

802.11n, Ch 1, 65 Mbps
Peak



RBW 1 MHz VBW 1 MHz

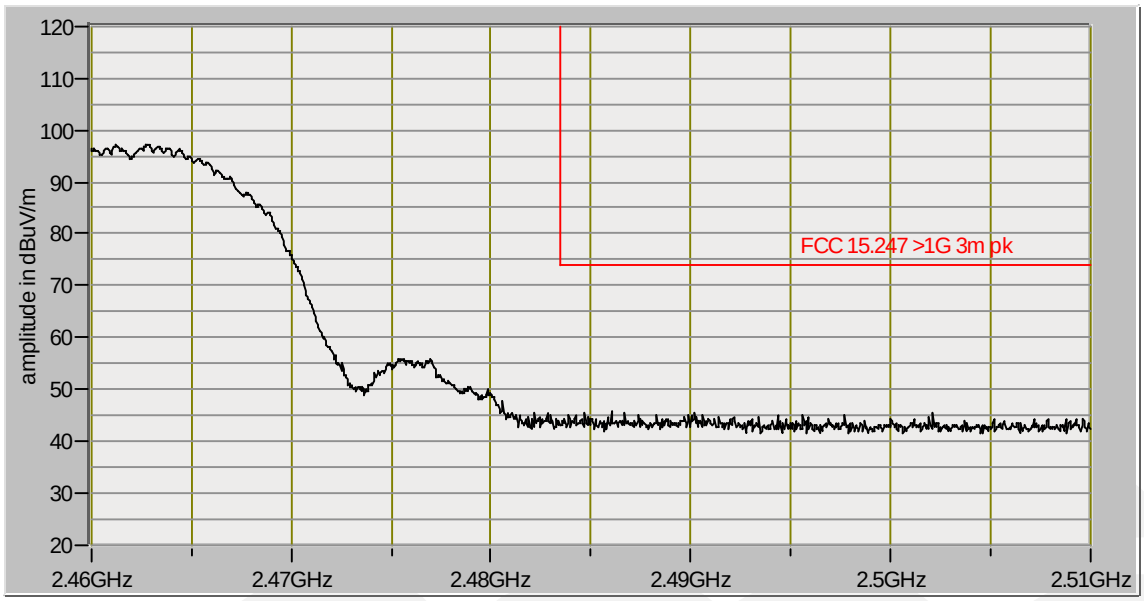
Average



RBW 1 MHz VBW 10 Hz

802.11b, Ch 11, 1 Mbps

Peak

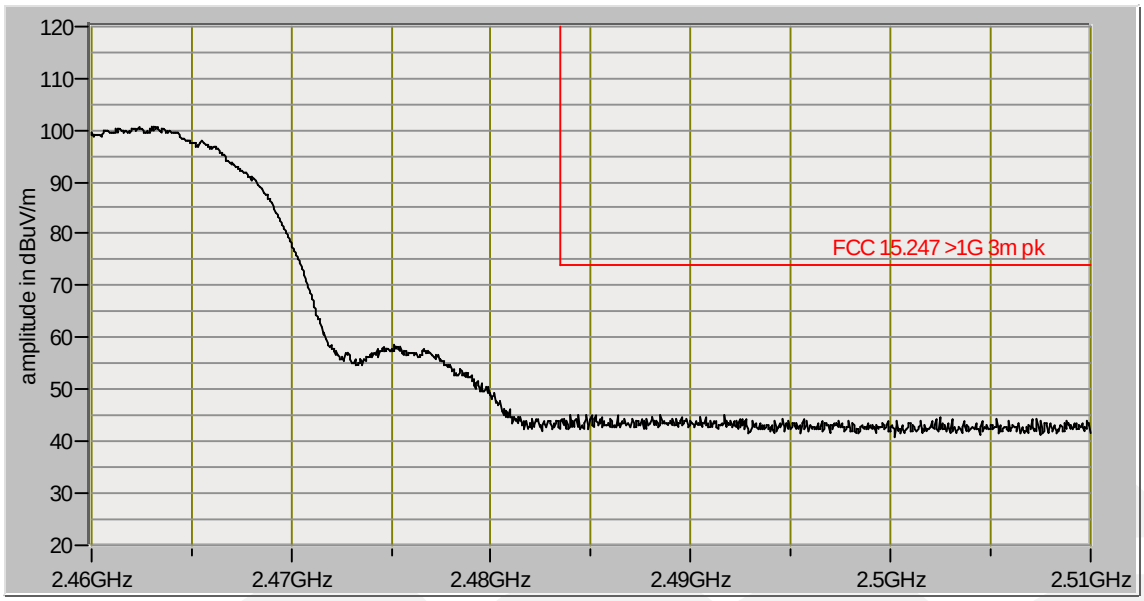


RBW 1 MHz VBW 1 MHz

Average

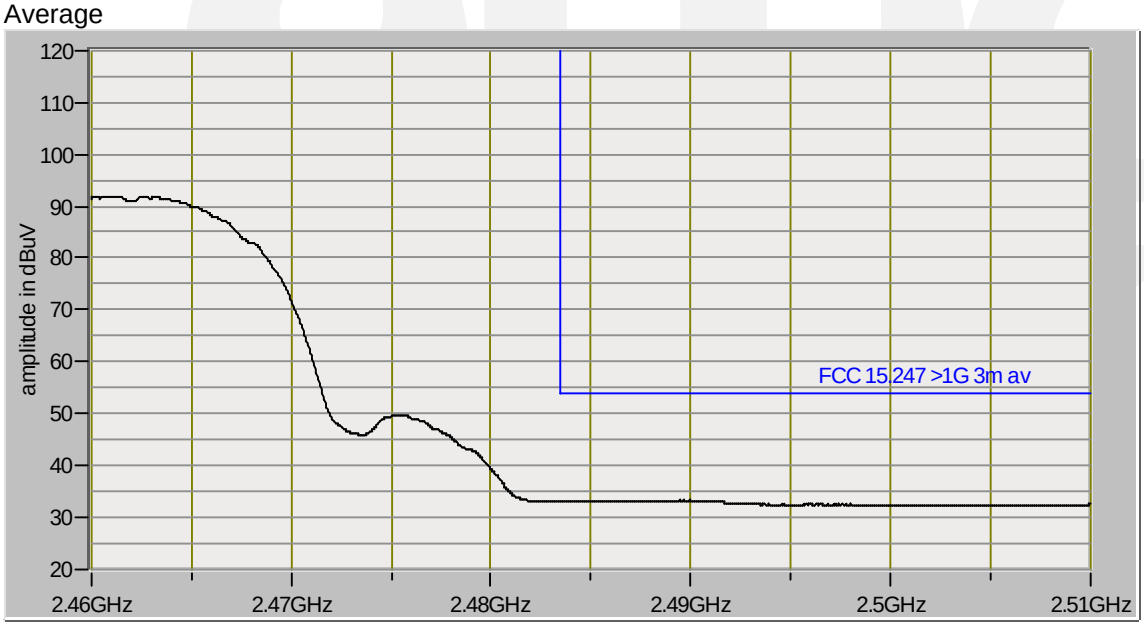
RBW 1 MHz VBW 10 Hz

802.11b, Ch 11, 11 Mbps
Peak



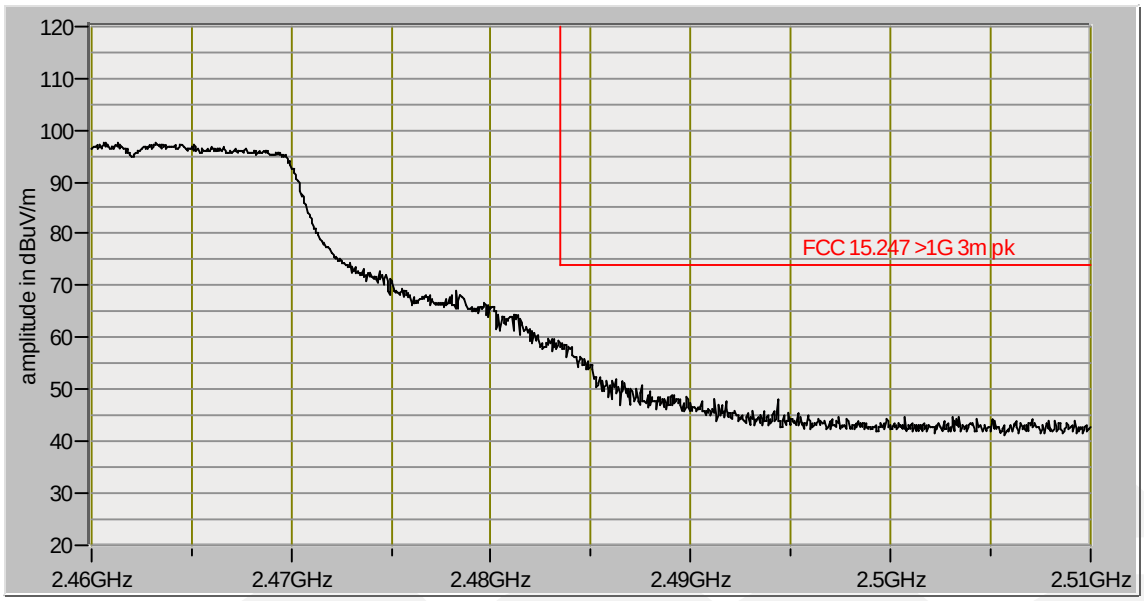
RBW 1 MHz VBW 1 MHz

Average



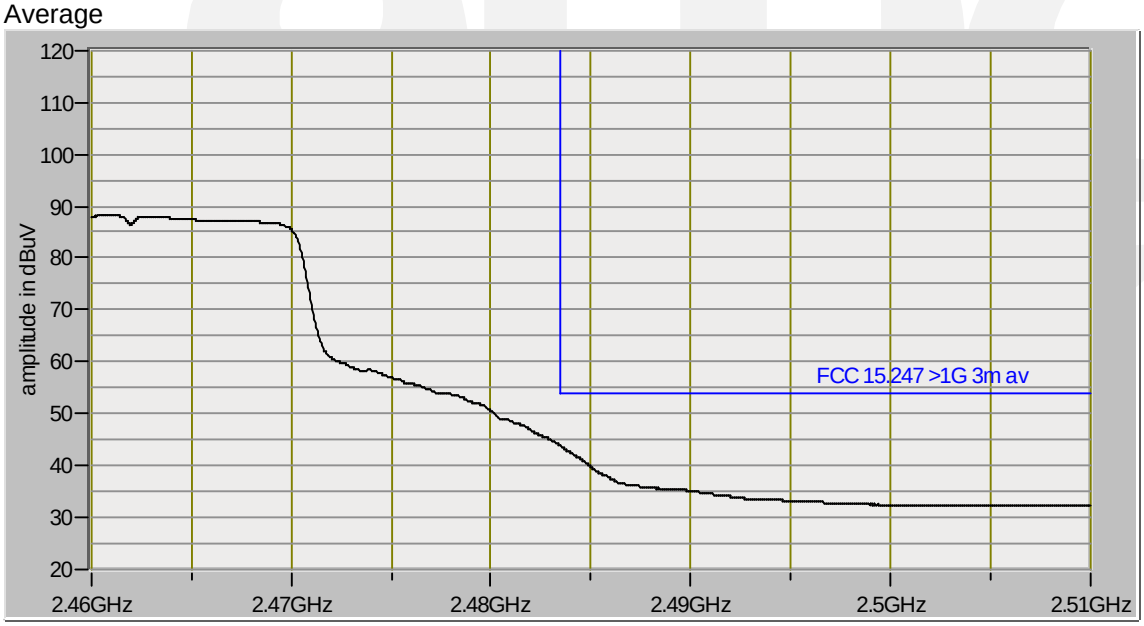
RBW 1 MHz VBW 10 Hz

802.11g, Ch 11, 6 Mbps
Peak



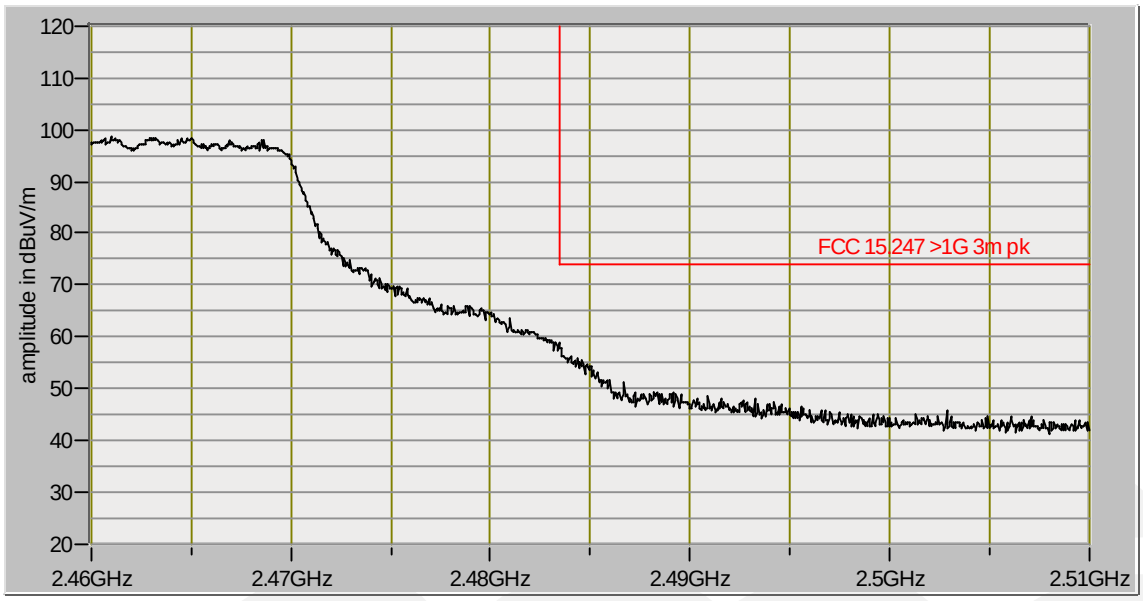
RBW 1 MHz VBW 1 MHz

Average



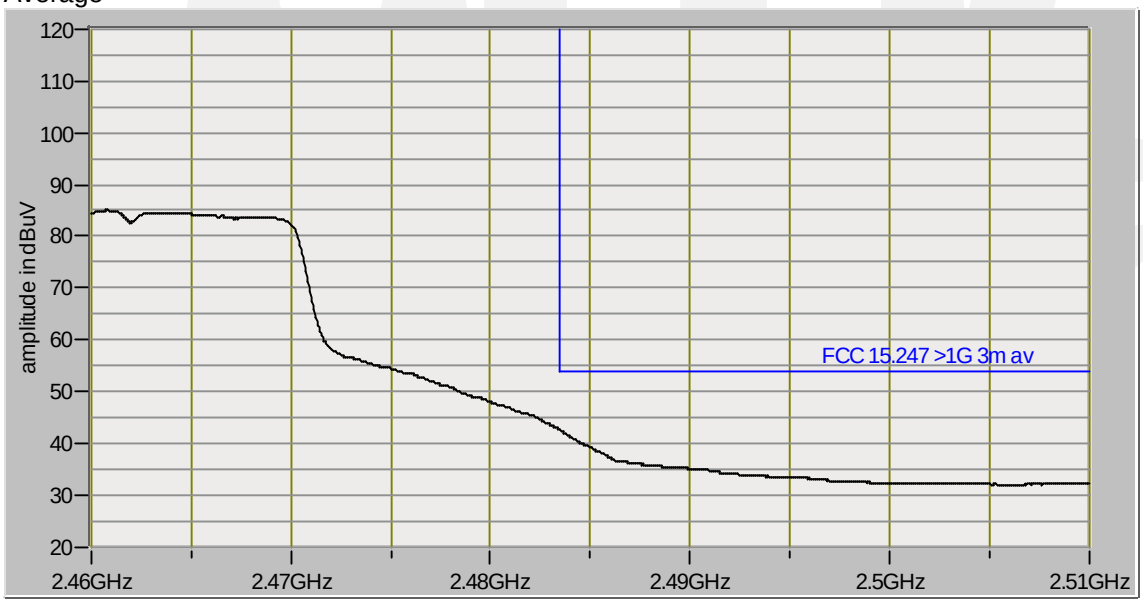
RBW 1 MHz VBW 10 Hz

802.11g, Ch 11, 36 Mbps
Peak



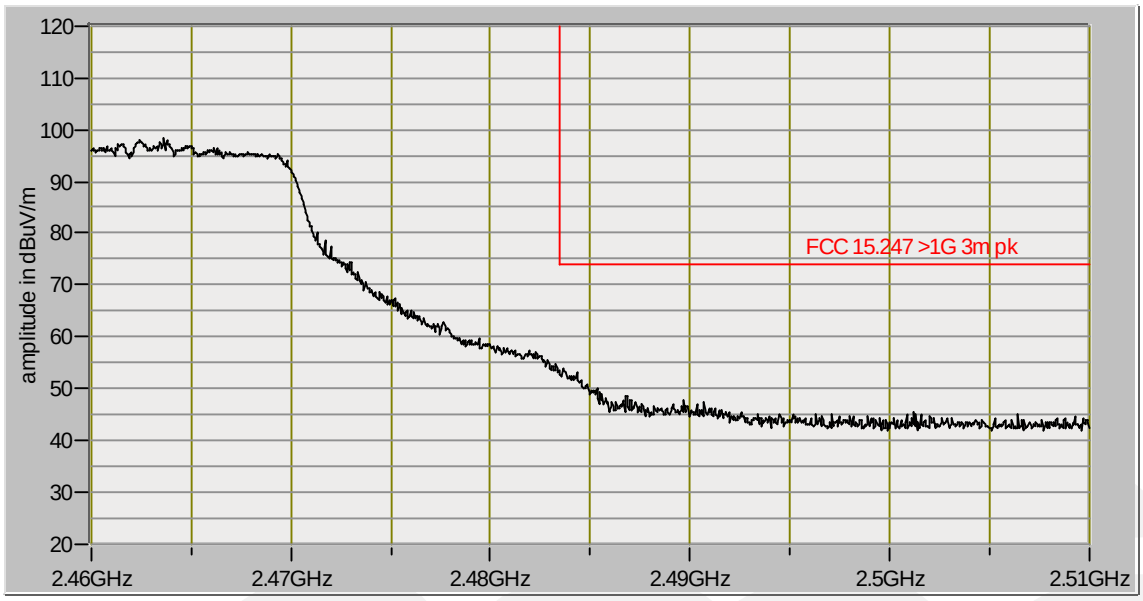
RBW 1 MHz VBW 1 MHz

Average



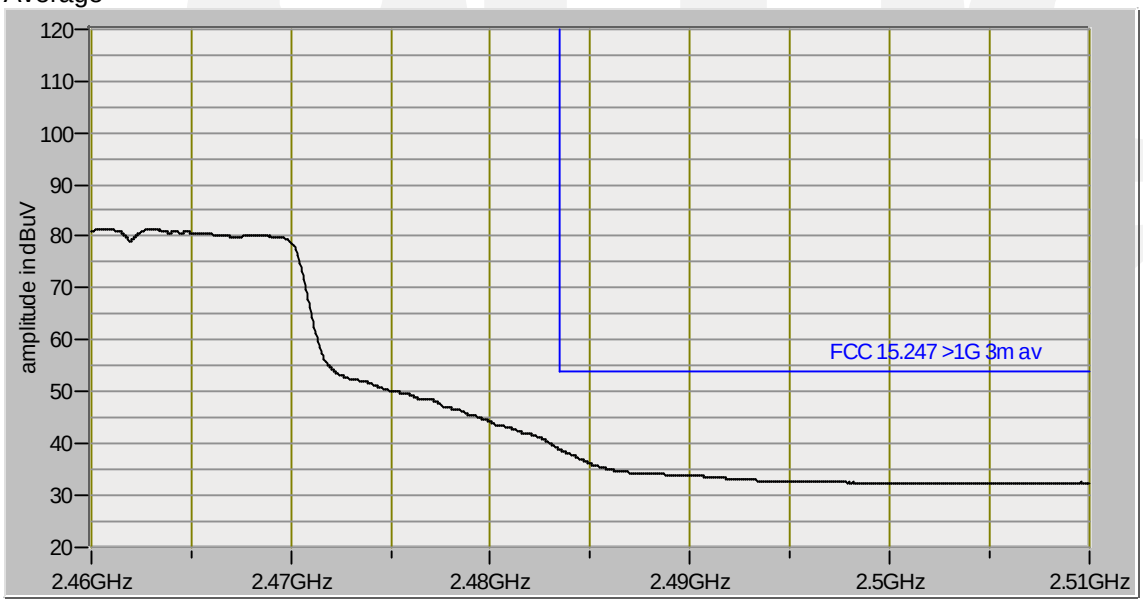
RBW 1 MHz VBW 10 Hz

802.11g, Ch 11, 54 Mbps
Peak



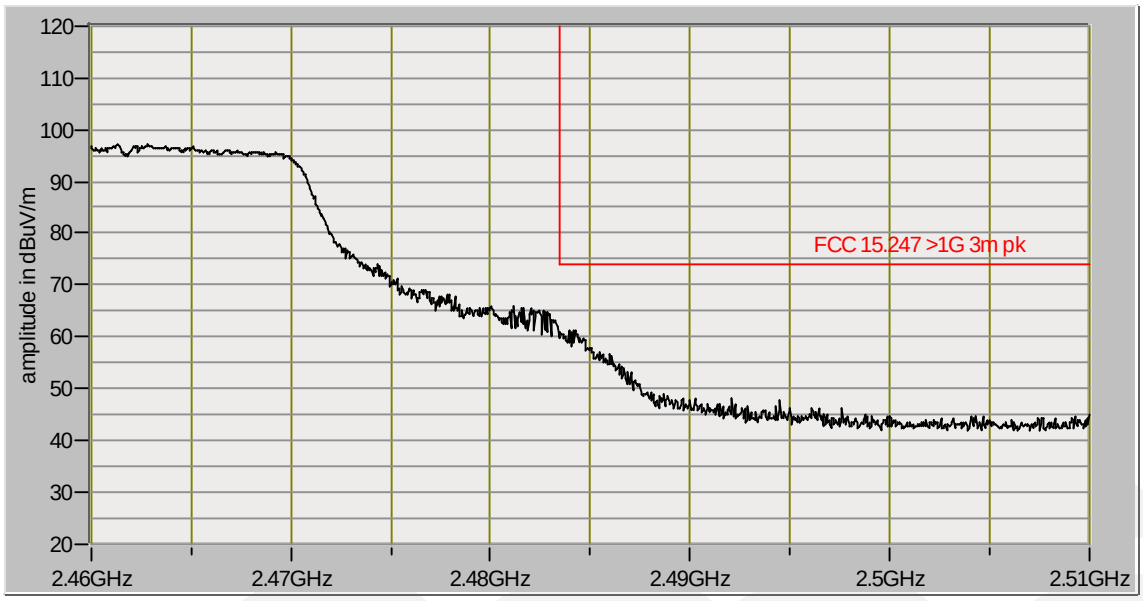
RBW 1 MHz VBW 1 MHz

Average



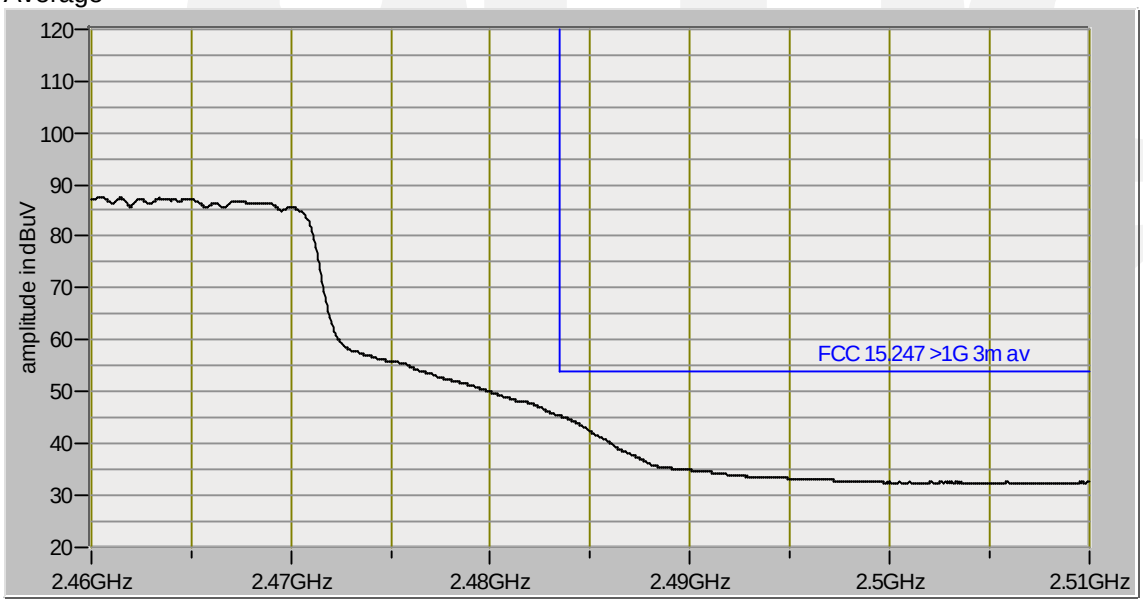
RBW 1 MHz VBW 10 Hz

802.11n, Ch 11, 6.5 Mbps
Peak



RBW 1 MHz VBW 1 MHz

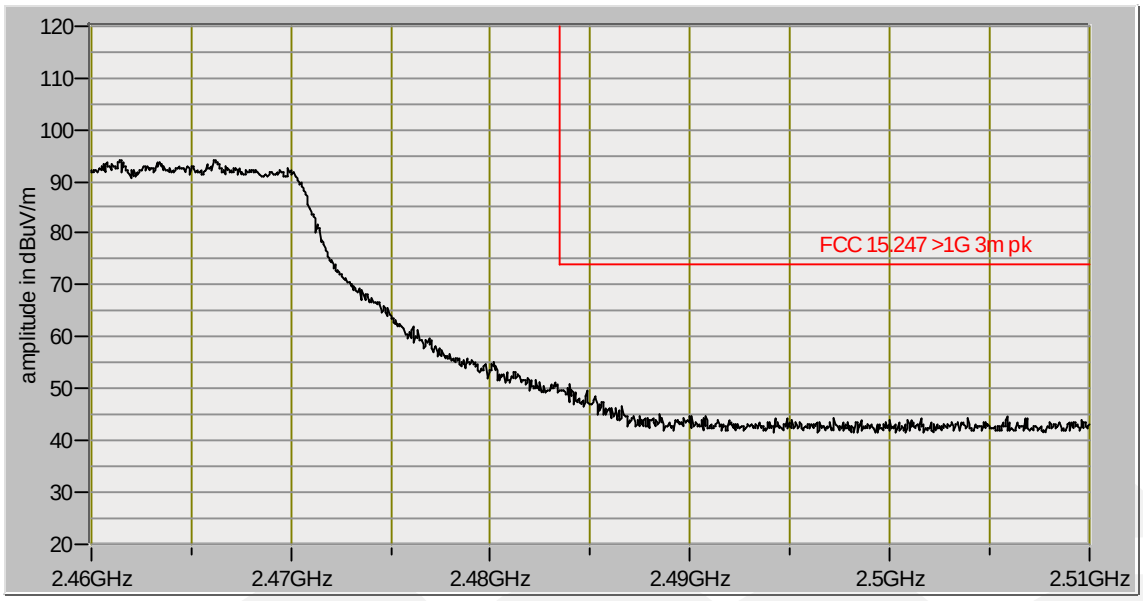
Average



RBW 1 MHz VBW 10 Hz

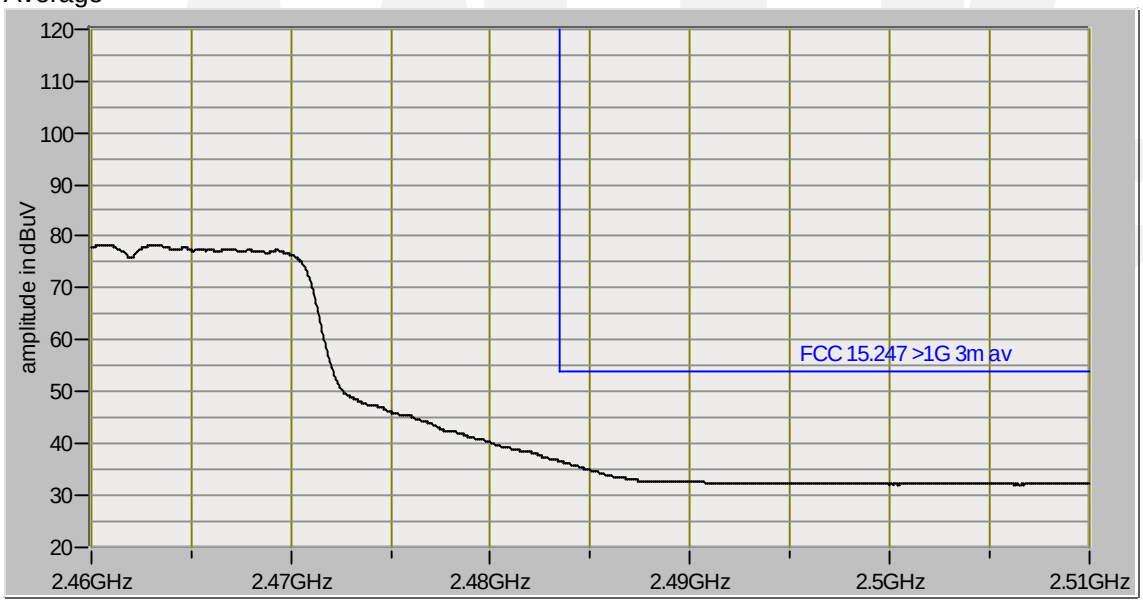
802.11n, Ch 11, 65 Mbps

Peak



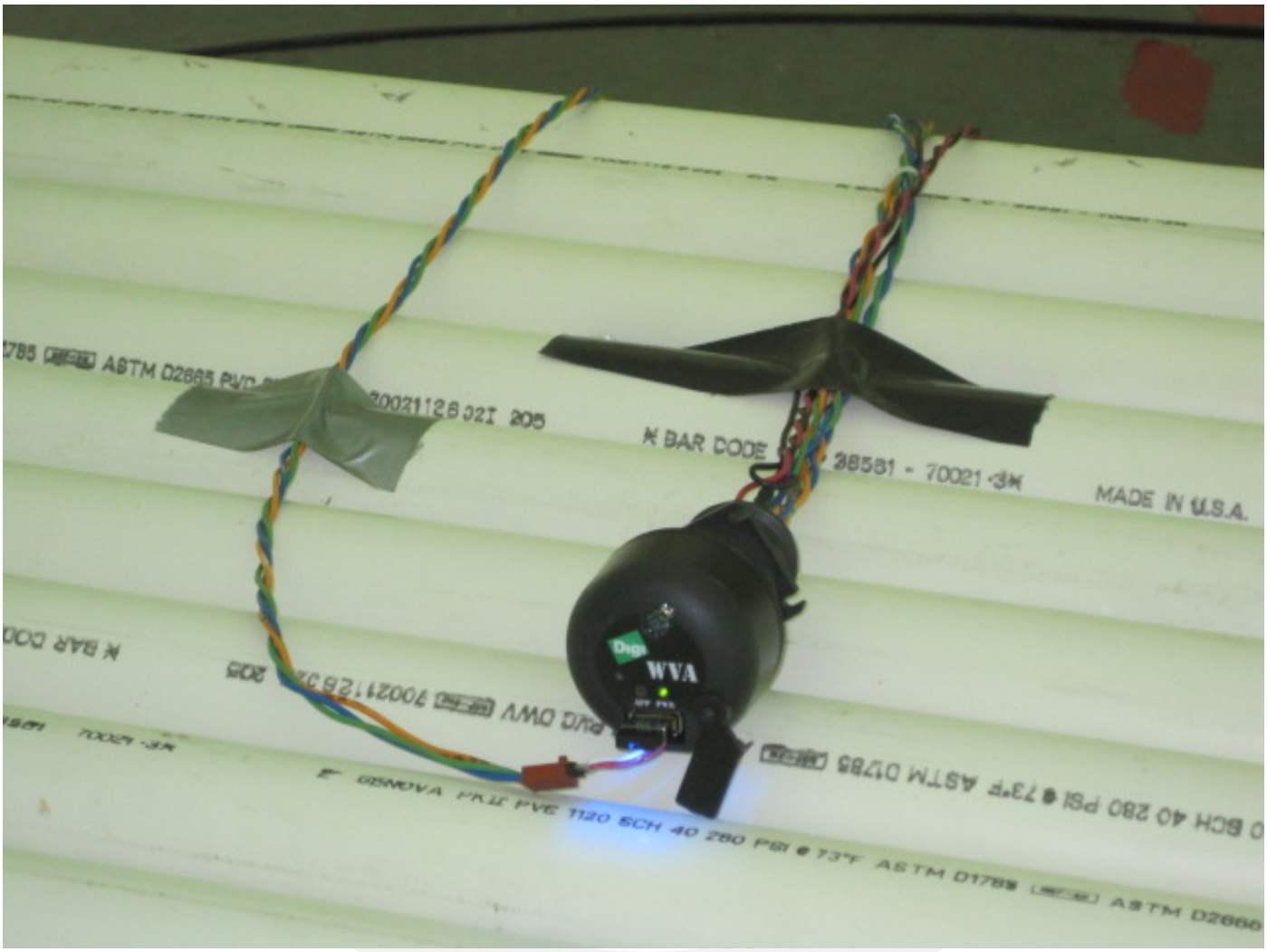
RBW 1 MHz VBW 1 MHz

Average



RBW 1 MHz VBW 10 Hz

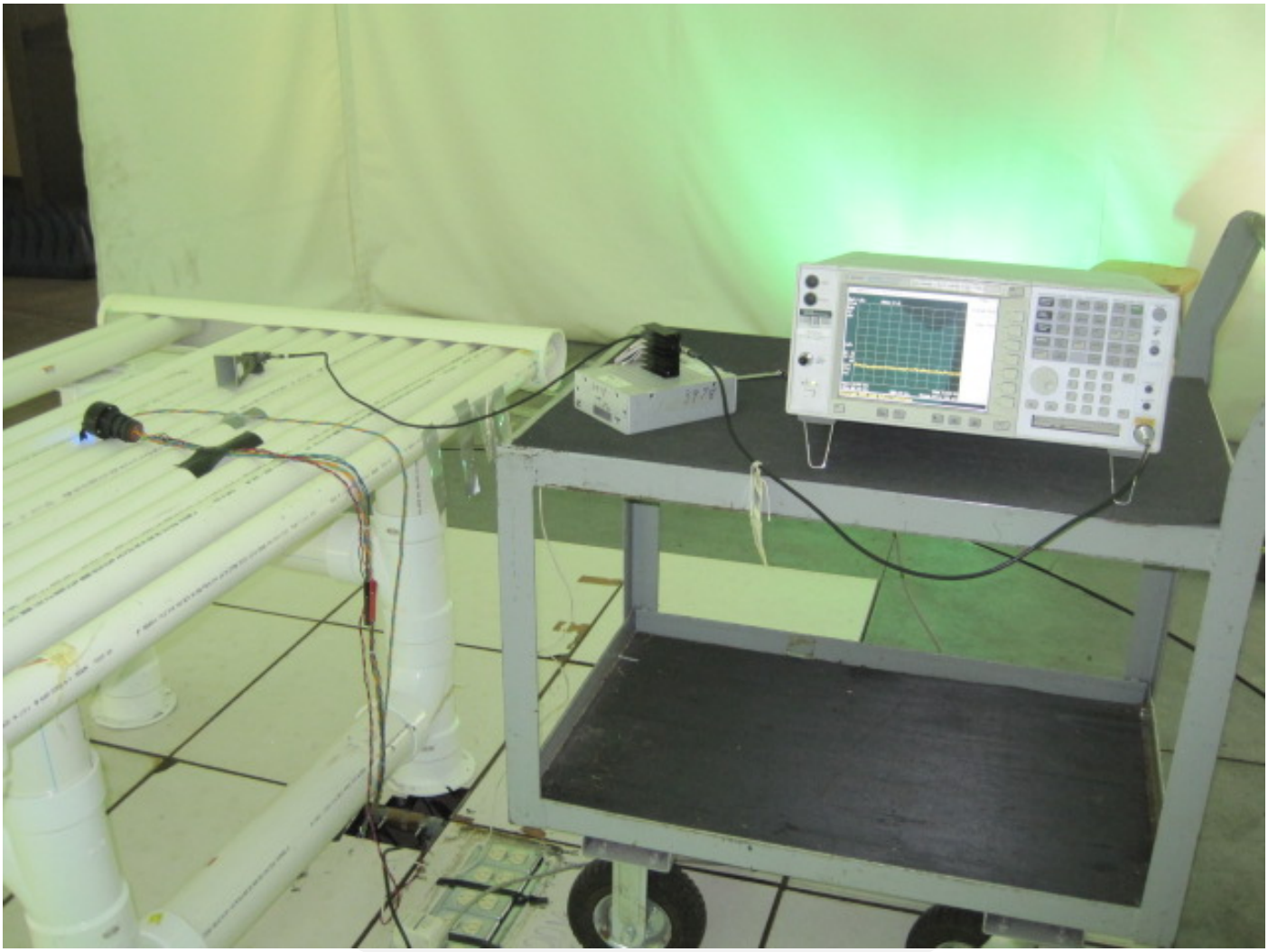
Test-setup photo(s):
Radiated measurements



Test-setup photo(s):
Radiated measurements

Test-setup photo(s):
Radiated measurements

Test-setup photo(s):
Radiated measurements



Test-setup photo(s):
Conducted measurements

Equipment Under Test (EUT) Test Operation Mode:

The device under test was operated under the following conditions during emissions testing:

☐ - Standby

☐ - Test program (H - Pattern)

☐ - Test program (color bar)

☐ - Test program (customer specific)

☐ - Practice operation

☐ - Normal Operating Mode

■ - Fundamental set on low, mid & high channels. Continuous on. Maximum power. 802.11b,g,n

Configuration of the device under test:

■ - See Constructional Data Form and Block Diagram in Appendix A

☐ - See Product Information Form in Appendix B

GENERAL REMARKS:

None

Modifications required to pass:

■ None
☐ As indicated on the data sheet(s)

Test Specification Deviations: Additions to or Exclusions from:

■ None
☐ As indicated in the Test Plan

SUMMARY:

The requirements according to the technical regulations are
■ - met and the equipment under test does fulfill the general approval requirements.
☐ - **not** met and the equipment under test does **not** fulfill the general approval requirements.

EUT Received Date:	08 July 2013
Condition of EUT:	Normal
Testing Start Date:	08 July 2013
Testing End Date:	28 August 2013

TÜV SÜD AMERICA INC

Tested by:

Greg Jakubowski
Senior EMC Technician

Approved by:

Joel T Schneider
Senior EMC Engineer

Appendix A

Constructional Data Form

Form

EMC Test Plan and Constructional Data Form

PLEASE COMPLETE THIS DOCUMENT IN FULL, ENTERING N/A IF THE FIELD IS NOT APPLICABLE. IF TESTING RESULTS IN MODIFICATIONS TO THE EQUIPMENT, PLEASE SUBMIT A REVISED TP/CDF INDICATING THOSE MODIFICATIONS.
NOTE: This information will be input into your test report as shown below. Press the F1 key at any time to get HELP for the current field selected.

Company:	Digi International		
Address:	11001 Bren Road East		
	Minnetonka MN 55343		
Contact:	Nathan Carlson	Position:	Lead Hardware Engineer
Phone:	952-912-3474	Fax:	
E-mail Address:	nathan.carlson@digi.com		

General Equipment Description -- ***NOTE: This information will be input into your test report as shown below.***

EUT Description	Truck vehicle data bus to WiFi adapter		
EUT Name	WiFi Vehicle Adapter		
Model No.:	50001817-02	Serial No.:	0001
Product Options:	Only one variant available		
Configurations to be tested:	Maximally populated product with all possible functions added and enabled		

Equipment Modification (*If applicable, indicate modifications since EUT was last tested. If modifications are made during this testing, submit revised TP/CDF after testing is complete.)*

Modifications since last test:	
Modifications made during test:	

Test Objective(s): ***Please indicate the tests to be performed, entering the applicable standard(s) where noted.***

☒ EMC Directive 2004/108/EC (EMC)	☒ FCC:	Class ☐ A ☒ B	Part 15
Std: EN55022, EN55024	☐ VCCI:	Class ☐ A ☐ B	
☐ Machinery Directive 89/392/EEC (EMC)	☐ BSMI:	Class ☐ A ☐ B	(Separate Report)
Std:	☐ Canada:	Class ☐ A ☐ B	
☐ Medical Device Directive 93/42/EEC (EMC)	☐ Australia:	Class ☐ A ☐ B	
Std:	☐ Other:		
☒ Vehicle Directive - 2004/104/EC (EMC)	☐ Ag Directive *2009/64/EC (EMC)		
☒ Other Vehicle Std: Cispr 25, ISO7637-2.-3, ISO11452-2,-4, sae1113/2, ISO10605			
☐ FDA Reviewers Guidance for Premarket Notification Submissions (EMC)			

Form

EMC Test Plan and Constructional Data Form

Third Party Certification (contact TÜV for quote), if applicable (*Signature on last page required).	
☐ Attestation of Compliance (AoC)*	☐ EMC Certification (used with Octagon Mark)*
☐ Statement of Compliance (SoC, previously CoC)* - All aspects of the essential requirements were assessed	
Protection Class (Req'd for AoC, SoC, EMC Cert. N/A for vehicles) ☐ Class I ☐ Class II ☐ Class III (Press **F1** when field is selected to show additional information on Protection Class.)	
☐ FCC / TCB Certification	☐ Taiwan Certification
☐ Industry Canada / FCB Certification	☐ Korean Certification
☒ e-Mark Certification	

Attendance

Test will be: ☒ Attended by the customer ☐ Unattended by the customer

Failure - *Complete this section if testing will not be attended by the customer.*

If a failure occurs, TÜV SÜD America should:

☐ Call contact listed above, if not available then stop testing. (After hrs phone): _____
☐ Continue testing to complete test series.
☐ Continue testing to define corrective action.
☐ Stop testing.

EUT Specifications and Requirements

Length: 2.15" Width: 2.15" Height: 2.1" Weight: 0.2 lbs.

Power Requirements

Regulations require testing to be performed at typical power ratings in the countries of intended use. (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)

Voltage: 12VDC (If battery powered, make sure battery life is sufficient to complete testing.)

# of Phases: N.A.

Current (Amps/phase(max)): 1A Current (Amps/phase(nominal)): 0.15A

Other _____

Other Special Requirements

Typical Installation and/or Operating Environment

(ie. Hospital, Small Business, Industrial/Factory, etc.)

EUT Power Cable

☐ Permanent OR ☒ Removable Length (in meters): 5
☐ Shielded OR ☒ Unshielded
☐ Not Applicable

Form

EMC Test Plan and Constructional Data Form

EUT Interface Ports and Cables

Type	Analog	Digital	During Test: Active	During Test: Passive	Qty	Shielding: Yes	Shielding: No	Shielding: Type	Termination	Connector Type	Port Termination	Length tested (in meters)	Removable	Permanent
EXAMPLE: *RS232*	☐	☒	☒	☐	*2*	☒	☐	*Foil over braid*	*Coaxial*	*Metallized 9-pin D-Sub*	*Characteristic Impedance*	*6*	☒	☐
CAN	☐	☒	☒	☐	2	☐	☒			Deutsch 9 pin	60 ohms	5	☒	☐
J1708	☐	☒	☒	☐	1	☐	☒			Deutsch 9 pin		5	☒	☐
USB	☐	☒	☒	☐	1	☒	☐	metal can	USB memory stick	USB A		0.02	☒	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐
	☐	☐	☐	☐		☐	☐						☐	☐

Form

EMC Test Plan and Constructional Data Form

EUT Software.

Revision Level: beta

Description: Special software test application that activates and queries all subsystems and reports back status

Equipment Under Test (EUT) Operating Modes to be Tested -- list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing. Consult with your TÜV Product Service Representative if additional assistance is required.

1. Normal operation - running immunity script in the EOS and also running python script. These scripts exercise all of the interfaces and peripherals - I2C bus accesses, memory accesses, J1708 and CAN/J1939 activity, WiFi searching for AP, power PIC functionality, Bluetooth functions, LED and beeper, RTC, accelerometer, RNG, USB.
2.
3.

Equipment Under Test (EUT) System Components -- List and describe all components which are part of the EUT. For FCC & Taiwan testing a minimum configuration is required. (ie. Mouse, Printer, Monitor, External Disk Drive, Motherboard, etc)

Description	Model #	Serial #	FCC ID #
WiFi Vehicle Adapter	50001817-02	0001	

Form

EMC Test Plan and Constructional Data Form

Support Equipment -- List and describe all support equipment which is not part of the EUT. (i.e. peripherals, simulators, etc) This information is required for FCC & Taiwan testing.

Description	*Model #*	*Serial #*	*FCC ID #*
Digi Can repeater box	55001444-01	001	
Digi USB to TTL Rs232	55001217-02	001	
Dell PC laptop	PP03L	10319260105	

Oscillator Frequencies

Manufacturer	*Frequency*	*Derived Frequency*	*Component # / Location*	*Description of Use*
Various	32.768 Khz	32.768 Khz	Y2/power board	RTC in Power PIC
Various	16 Mhz	16 Mhz	Y1/power board	Power PIC main clock
Various	24 Mhz	360 Mhz	Y1/processor board	IMX28 main clock
Various	32.768 Khz	32.768 Khz	Y2/processor board	Standalone I2C RTC
Atheros	?	2.4 Ghz	MOD1/RF board	WiFi tranciever

Power Supply

Manufacturer	*Model #*	*Serial #*	*Type*
			☐ Switched-mode: (Frequency) _____ ☐ Linear ☐ Other: _____
			☐ Switched-mode: (Frequency) _____ ☐ Linear ☐ Other: _____

Power Line Filters

Manufacturer	*Model #*	*Location in EUT*
Various, ferrite bead 0805	600ohm/2A	L3, L4

Form

EMC Test Plan and Constructional Data Form

Critical EMI Components (Capacitors, ferrites, etc.)				
Description	***Manufacturer***	***Part # or Value***	***Qty***	***Component # / Location***
Ferrite Bead 0805	Various	600 ohm 2A	3	L3,L4,L5 power board
CAN common mode choke	TDK	11uH	2	L1,L2 power board
Drum inductor 0.3x0.2	Various	22uH 1.5A	1	L6 power board
USB common mode choke	Wurth	120uH	1	L1 processor board

EMC Critical Detail -- Describe other EMC Design details used to reduce high frequency noise.

Full shield covering all of the IMX processor, flash, DDR ram, IMX power supply.

PLEASE ENTER NAMES BELOW (INSERT ELECTRONIC SIGNATURE IF POSSIBLE)

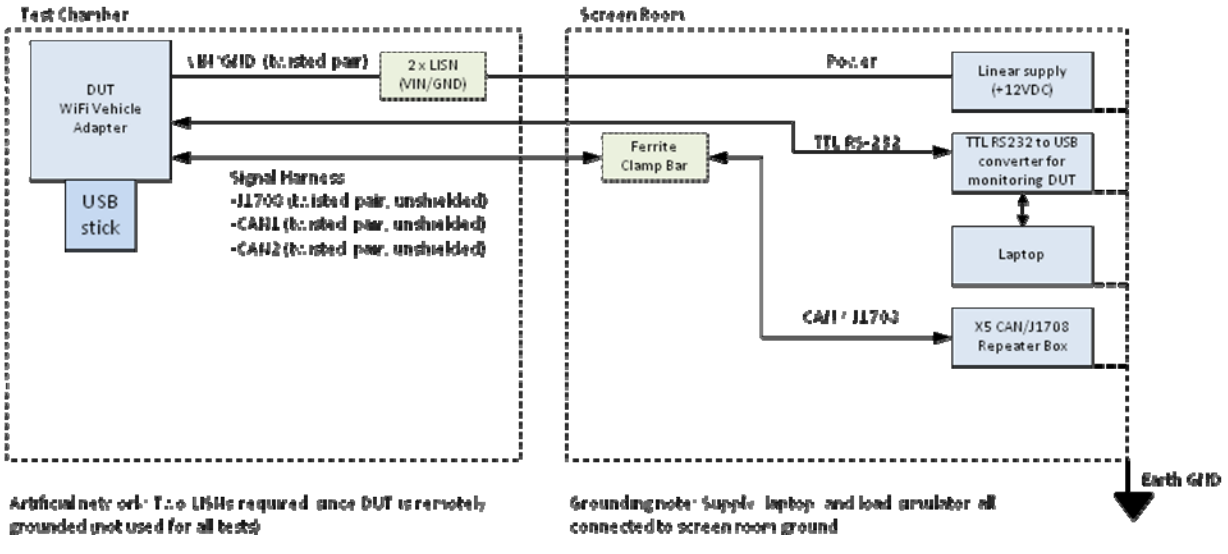
Authorization (Signature Required if a Third Party Certification is checked on pg 1)

Nathan Carlson	04-25-2013
Customer authorization to perform tests according to this test plan.	Date
Nathan Carlson	04-25-2013
Test Plan/CDF Prepared By (please print)	Date

Form

EMC Block Diagram Form

System Configuration Block Diagram -- Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, power cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside testing field.



Authorization Signatures

Nathan Carlson	04-26-2013
Customer authorization to perform tests according to this test plan.	Date
Nathan Carlson	04-26-2013
Test Plan/CDF Prepared By (please print)	Date

Appendix B

Measurement Protocol

MEASUREMENT PROTOCOL

GENERAL INFORMATION

Test Methodology

Emission testing is performed according to the procedures in ANSI C63.4-2009 and FCC D01 DTS Meas Guidance v03.

Measurement Uncertainty

The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. The test system has a measurement uncertainty of ±4.8 dB. The equipment comprising the test systems is calibrated on an annual basis.

Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

Conducted Emissions

Final measurement levels are determined by connecting the antenna port of the DUT to a spectrum analyzer input via coaxial adapters, high frequency coax, and attenuators as necessary. The loss created by the interconnect apparatus is offset by settings within the analyzer. Specific analyzer settings are determined by the procedures throughout this report.

Radiated Emissions

The spectrum analyzer uses a quasi-peak detector for frequencies up to and including 1 GHz. For measurements above 1 GHz, peak and average detectors are used. The bandwidths used are equal to or greater than 100 Hz from 9 kHz to 150 kHz, 9 kHz from 150 kHz to 30 MHz, 100 kHz from 30 MHz to 1000 MHz, and 1 MHz from 1 GHz to 40 GHz. Video bandwidths are at least three times greater than the IF bandwidth. Average measurements above 1 GHz are also achieved using a peak detector with 1 MHz RBW and 10 Hz VBW.

The final level, in dBμV/m, equals the reading from the spectrum analyzer (Level dBμV), adding the antenna correction factor and cable loss factor (Factor dB) to it, and subtracting the preamp gain (and duty cycle correction factor, if applicable). This result then has the limit subtracted from it to provide the Delta, which gives the tabular data as shown in the data. Intentional radiators are rotated through 3 orthogonal axes to determine the test position yielding the maximum emission levels.

Example:

FREQ (MHz)	LEVEL (dBuV)		CABLE (dB)	ANT (dB/m)	PREAMP (dB)	FINAL (dBuV/m)	POL	HGT (m)	AZ (deg)	DELTA1
60.80	42.5Qp	+	1.2	+ 10.9	- 25.5 =	29.1	V	1.0	0.0	-10.9

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Test Equipment

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated according to internal procedure.