Testing Tomorrow's Technology

Application

For

Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an Intentional Radiator per Part 15, Subpart C, paragraphs 15.207, 15.209 and 15.247

And

RSS-247 Issue 1 for Industry Canada

For the

Soneter, Inc.

SmartFlowH20 Model: UFMT-1000

FCC ID: 2AHFE-UFMT1000
IC: 21143-UFMT1000

UST Project: 16-0020
Issue Date: February 11, 2016

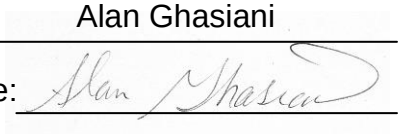
Total Pages in This Report: 150

3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com

I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: Alan Ghasiani

Name: 

Title: Compliance Engineer – President

Date February 11, 2016

NVLAP LAB CODE 200162-0

3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com

MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Soneter, Inc.

MODEL: UFMT-1000

FCC ID: 2AHFE-UFMT1000

IC: 21143-UFMT1000

DATE: February 11, 2016

This report concerns (check one): Original grant [X]
Class II change [ ]

Equipment type: 2412 - 2462 MHz Transmitter Module

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No X

If yes, defer until: _____N/A_____
date
agrees to notify the Commission by N/A
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

Table of Contents

List of Figures

Figures **Title** **Page**

List of Tables

Table **Title** **Page**

List of Attachments

Agency Agreement
Application Forms
Letter of Confidentiality
Equipment Label(s)
Block Diagram(s)
Schematic(s)
Test Configuration Photographs
Internal Photographs
External Photographs
Antenna Photographs
Theory of Operation
RF Exposure
User's Manual

1 General Information

1.1 Purpose of this Report

This report is prepared as a means of conveying test results and information concerning the suitability of this exact product for public distribution according to the FCC Rules and Regulations Part 15, Section 247 and IC RSS 247 Issue 1.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on November 24, 2015 and again on January 25, 2016 in good operating condition.

1.3 Product Description

The Equipment Under Test (EUT) is the Soneter, Inc. SmartFlowH20 Model UFMT-1000 water flow meter. The EUT is for use in tracking the flow of potable water. The meter is powered using a 6 VDC outlet connected power supply and communicates over WiFi. The product can non-invasively track the flow of water in a pipe.

Antenna Gain: 3.81 dBi (Inverted F)
Modulation: 802.11 b, g, n modes @ 11Mb/s, 54 Mb/s and 72.2 Mb/s
Maximum Output Power: +15.0 dBm (as rated)

1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.4:2009/2014, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2009/2014)*, *ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices* and per FCC KDB Publication number 558074 for Digital Transmission Systems Operating Under section 15.247. Also, FCC, KDB Publication No. 558074 v03r04 was used as a test procedure guide.

A list of EUT and Peripherals is found in Table 1 below. A block diagram of the tested system is shown in Figure 1. Test configuration photographs are provided in separate Appendices.

1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC. Its designation number is 186022. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1.

1.6 Related Submittals

The EUT is subject to the following FCC Authorizations:

a) Certification under section 15.247 as a transmitter.
b) Verification under 15.101 as a digital device and receiver.

The Verification requirement shares many common report elements with the Certification report. Therefore, though this report is mostly intended to provide data for the Certification process, the Verification authorization report (part 15.107 and 15.109) for the EUT is included herein.

Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER.	MODEL NUMBER	SERIAL NUMBER	FCC/IC ID:	CABLES P/D
Soneter, Inc.	UFMT-1000	Engineering Sample	2AHFE-UFMT1000 21143-UFMT1000	3 m UP
Power Adapter Shenzhen Frecom Electronics Co. LTD.	F05W-060060SPAU	Engineering Sample	None	3 m U P
Antenna See antenna details	--	--	--	--

U= Unshielded S= Shielded
P= Power D= Data

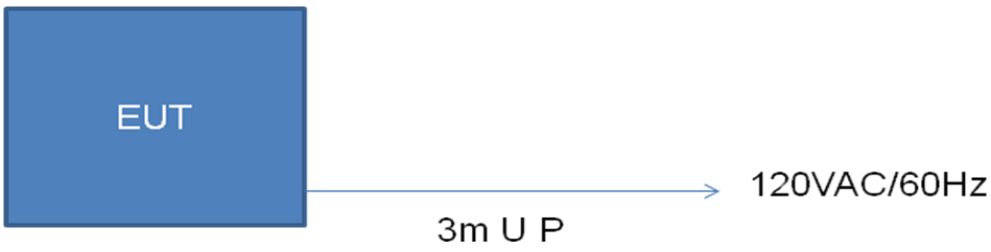


Figure 1. Block Diagram of Test Configuration

2 Tests and Measurements

2.1 Test Equipment

The table below lists test equipment used to evaluate this product. Model numbers, serial numbers, and calibration status are indicated.

Table 2. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8566B	HEWLETT-PACKARD	2747A05665	5/7/2015
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	1/17/2016
LOOP ANTENNA	SAS-200/562	A.H. Systems	142	9/28/2015 2 yr.
BICONICAL ANTENNA	3110B	EMCO	9306-1708	11/24/2014 2 yr.
LOG PERIODIC ANTENNA	3146	EMCO	9110-3236	11/19/2014 2 yr.
LOG PERIODIC ANTENNA	3146	EMCO	9305-3600	7/1/2014 2 yr.
HORN ANTENNA	SAS-571	A.H. Systems	605	8/25/2015 2 yr.
HORN ANTENNA	3115	EMCO	9107-3723	7/8/2014 2 yr.
HORN ANTENNA	3116	EMCO	9505-2255	1/27/2015 2 yr.
PRE-AMPLIFIER	11975A	HEWLETT-PACKARD	2517A00647	12/05/2014 Extended 90 days
HARMONIC MIXER	11970K	HEWLETT-PACKARD	2332A01241	Not Required
PRE-AMPLIFIER	8449B	HEWLETT-PACKARD	3008A00480	12/1/2015
PRE-AMPLIFIER	8477E	HEWLETT-PACKARD	1145A00307	12/3/2015
PRE-AMPLIFIER	8447D	HEWLETT-PACKARD	1937A02980	12/2/2015
LISN x 2	9247-50-TS-50-N	SOLAR ELECTRONICS	955824 and 955825	11/30/2015

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.2 Modifications to EUT Hardware

No physical modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements.

2.3 Number of Measurements for Intentional Radiators (15.31(m))

Measurements of intentional radiators or receivers shall be performed and reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in Table 3 below.

Table 3. Number of Test Frequencies for Intentional Radiators

Frequency Range over which the device operates	Number of Frequencies	Location in the Range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near the top 1 near the bottom
Greater than 10 MHz	3	1 near top 1 near middle 1 near bottom

Because the EUT operates at 2412 MHz to 2462 MHz, 3 test frequencies were used.

2.4 Frequency Range of Radiated Measurements (Part 15.33)

2.4.1 Intentional Radiator

The spectrum shall be investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 10^{th} harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

2.4.2 Unintentional Radiator

For the digital device, an unintentional radiator, the frequency range shall be 30 MHz to 1000 MHz, or to 5 times the highest internal clock frequency.

2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

The radiated and conducted emissions limits shown herein are based on the following:

2.5.1 Detector Function and Associated Bandwidth

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the Quasi-peak device are used.

2.5.2 Corresponding Peak and Average Requirements

Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

2.5.3 Pulsed Transmitter Averaging

When the radiated emissions limit is expressed as an average value, and the transmitter is pulsed, the measured field strength shall be determined by applying a Duty Cycle Correction Factor based upon dividing the total ON time during the first 100 ms period by 100 ms (or by the period if less than 100 ms). The duty cycle may be expressed logarithmically in dB.

NOTE: If the transmitter was programmed to transmit at >98% duty cycle, then, wherever applicable (where the detection mode was AVG) the duty cycle factor calculated will be applied.

2.6 EUT Antenna Requirements (CFR 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. Only the antenna(s) listed in Table 4 will be used with this module.

Table 4. Allowed Antenna(s)

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB_i	TYPE OF CONNECTOR
Antenna	Soneter Inc	Inverted F	Inverted F	3.81	PCB Trace

2.7 Restricted Bands of Operation (Part 15.205)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious emissions cannot exceed the limits of 15.209. Radiated harmonics and other spurious emissions are examined for this requirement; see the test data following.

2.8 Transmitter Duty Cycle (CFR 35 (c))

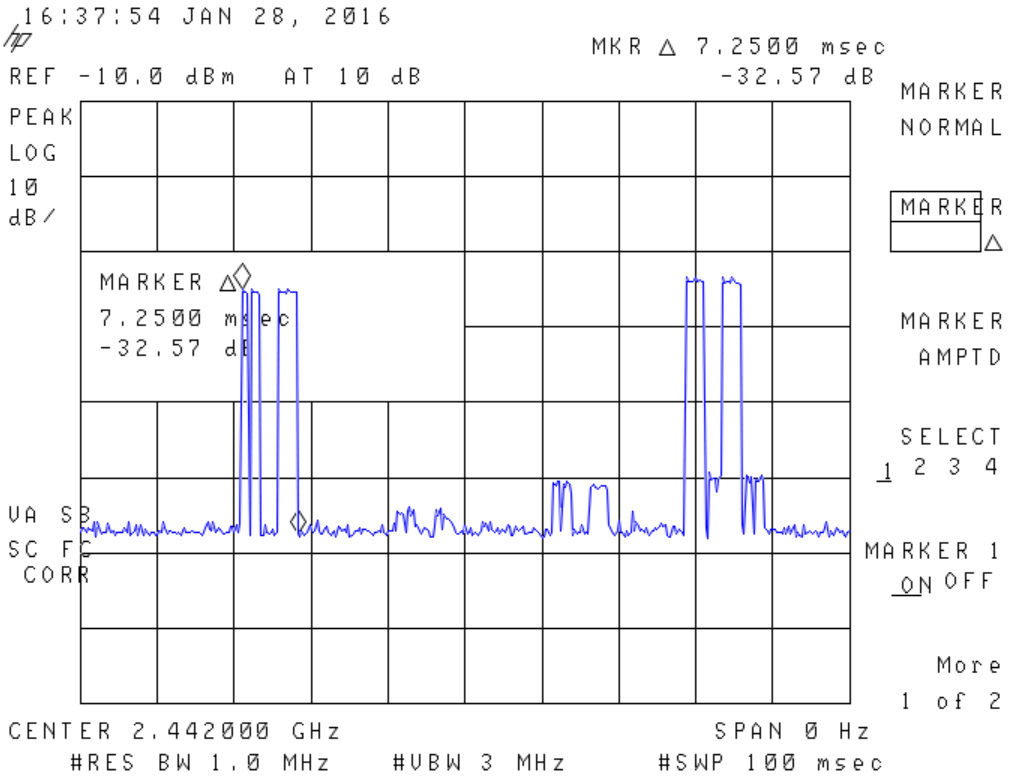


Figure 2. Duty Cycle 100ms Sweep

Time On (from Figure 2) = 7.25 ms (Transmitter Pulse Width)
Total Pulse Train = 7.25 ms x3= 21.75 ms (Pulse Train)

(21.75 ms Total Time On)/(100 ms Total Time) = 0.218 Numeric Duty Cycle
Duty Cycle = 20 Log (A/B) = -13.3 dB

NOTE: The transmitter was programmed to transmit at >98% duty cycle, therefore wherever applicable (where the detection mode was AVG), the duty cycle factor calculated above will be applied.

2.9 Intentional Radiator, Power Line Conducted Emissions (CFR 15.207)

The EUT is powered by 6 VDC through an AC/DC power adapter connected to the AC mains, power line conducted emissions testing was performed. Power line conducted emissions testing was performed to ensure that with the EUT in operation (exercising all transmitter functions), the complete system continues to meet the applicable requirements for CFR 15.207. See Section 15.16 of this test report for the test data.

2.10 Intentional Radiator, Spurious Emissions (CFR 15.209, 15.247(d)) (IC RSS 247, 5.4)

Radiated Spurious measurements: the EUT was placed into a continuous transmit mode of operation (>98% duty cycle) and tested per FCC KDB Publication 558074 v03r04 and ANSI C63.10:2013. A preliminary scan was performed on the EUT to find signal frequencies that were caused by the transmitter part of the device. To obtain worst case results, the EUT was tested in X, Y, and Z axes or in the orientation of normal operation if the device is designed to operate in a fixed position.

Radiated measurements were then conducted between the frequency range of 9 KHz (or lowest frequency used/generated by the device) up to the tenth harmonic of the device (no greater than 40 GHz). In the band below 30 MHz, a resolution bandwidth (RBW) of 9 kHz was used; emissions below 1 GHz were tested with a RBW of 120 KHz and emissions above 1 GHz were tested with a RBW of 1 MHz. All video bandwidth settings were at least three times the RBW value.

The EUT was investigated to CFR 15.209, General requirements for unwanted spurious emissions. The conducted spurious method as described below was use to investigate all other emissions emanating from the antenna port.

Conducted Spurious measurements: the EUT was put into a continuous-transmit mode of operation (>98% duty cycle) and tested per FCC KDB Publication 558074 D01 v03r04 for conducted out of band emissions emanating from the antenna port over the frequency range of 30 MHz to 25 GHz. A conducted scan was performed on the EUT to identify and record spurious signals that were related to the transmitter.

The results are displayed in the plots below. Radiated emissions per CFR 15.209 were performed to address the concerns of unwanted emissions that may radiate from the EUT cabinet, control circuits, or power leads. The results for this test can be found herein.

Note 1: The peak output power measured in any 100 KHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz.

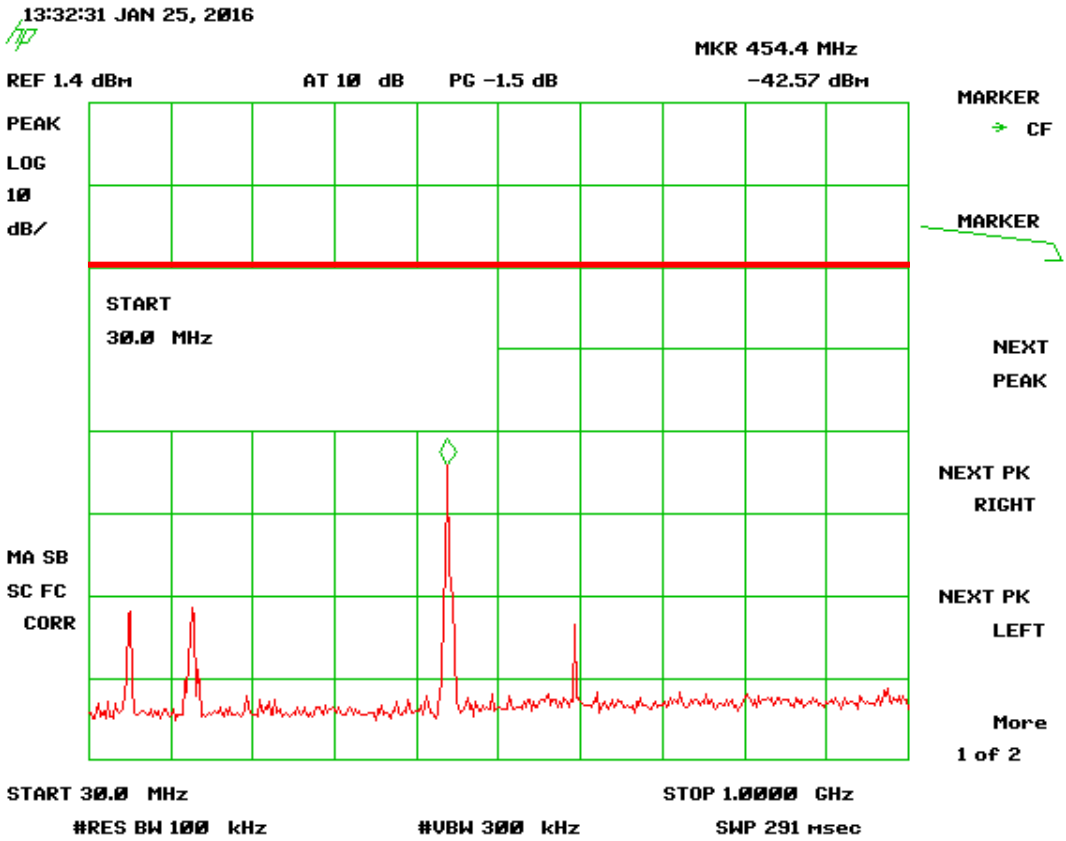


Figure 3. Antenna Conducted Emissions 802.11b Low, Part 1

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

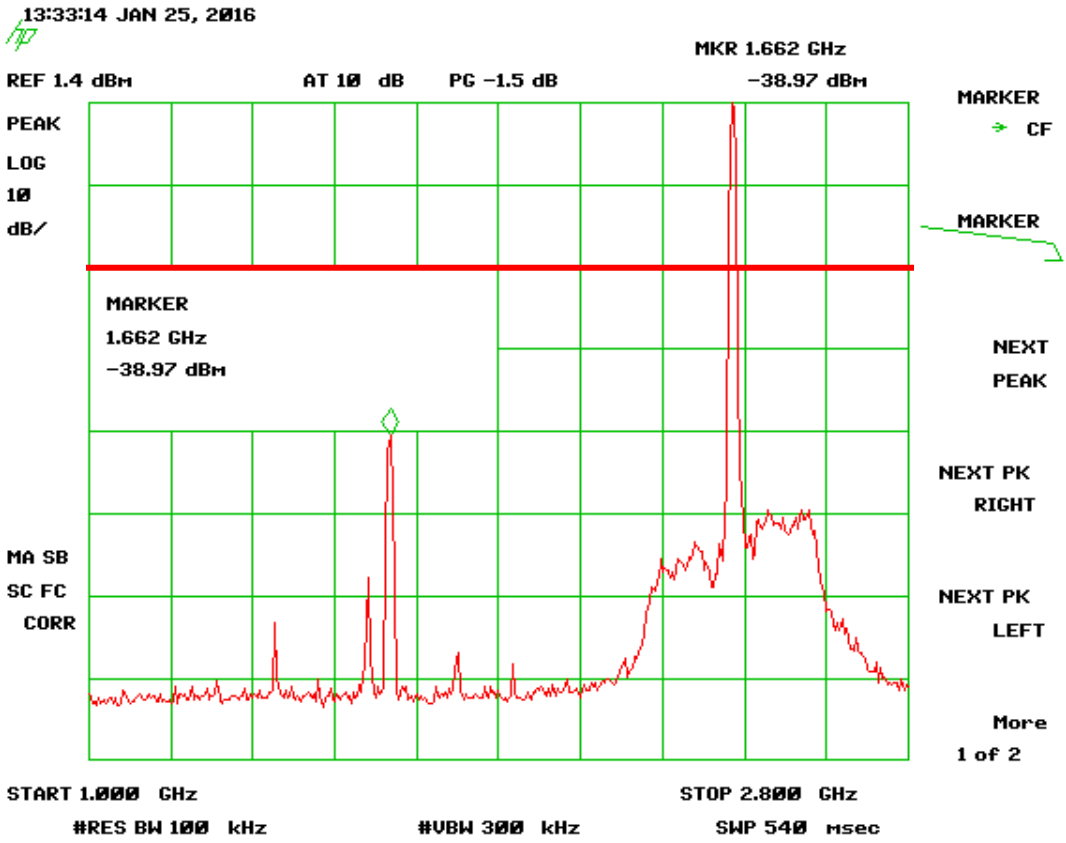


Figure 4. Antenna Conducted Emissions 802.11b Low, Part 2

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental. The large emission seen is the fundamental emission.

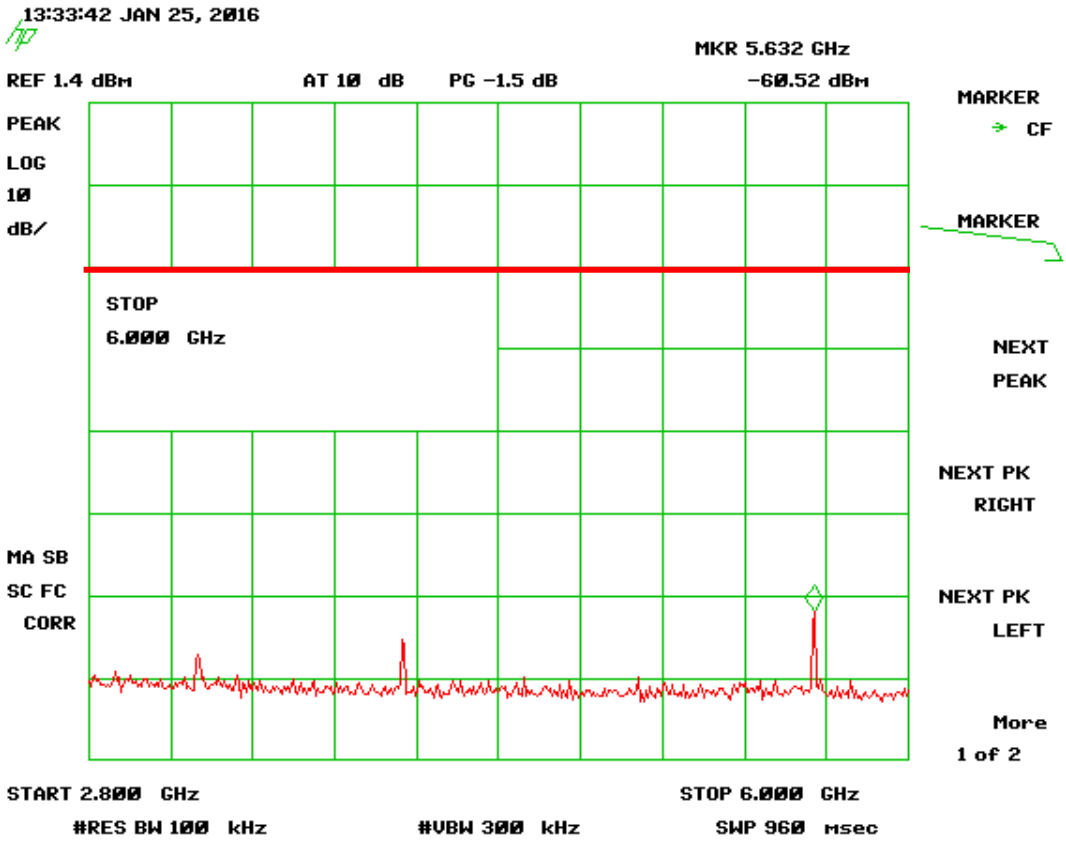


Figure 5. Antenna Conducted Emissions 802.11b Low, Part 3

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

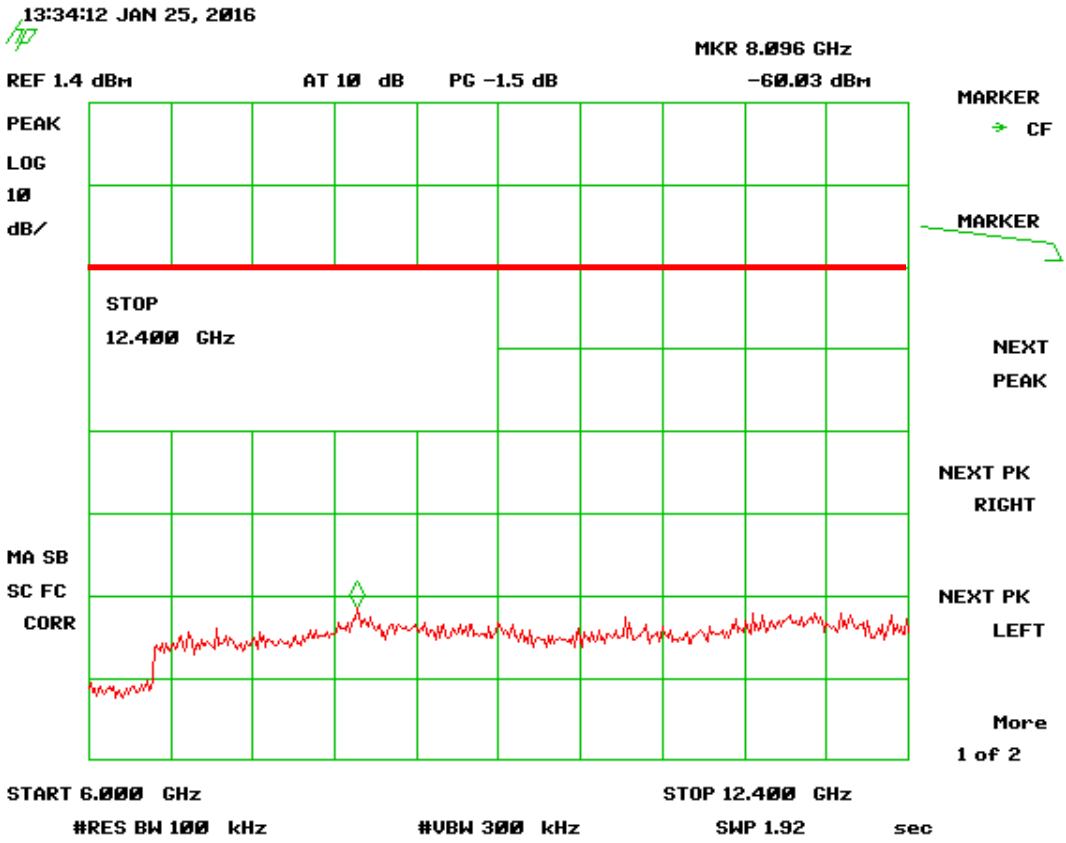


Figure 6. Antenna Conducted Emissions 802.11b Low, Part 4

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

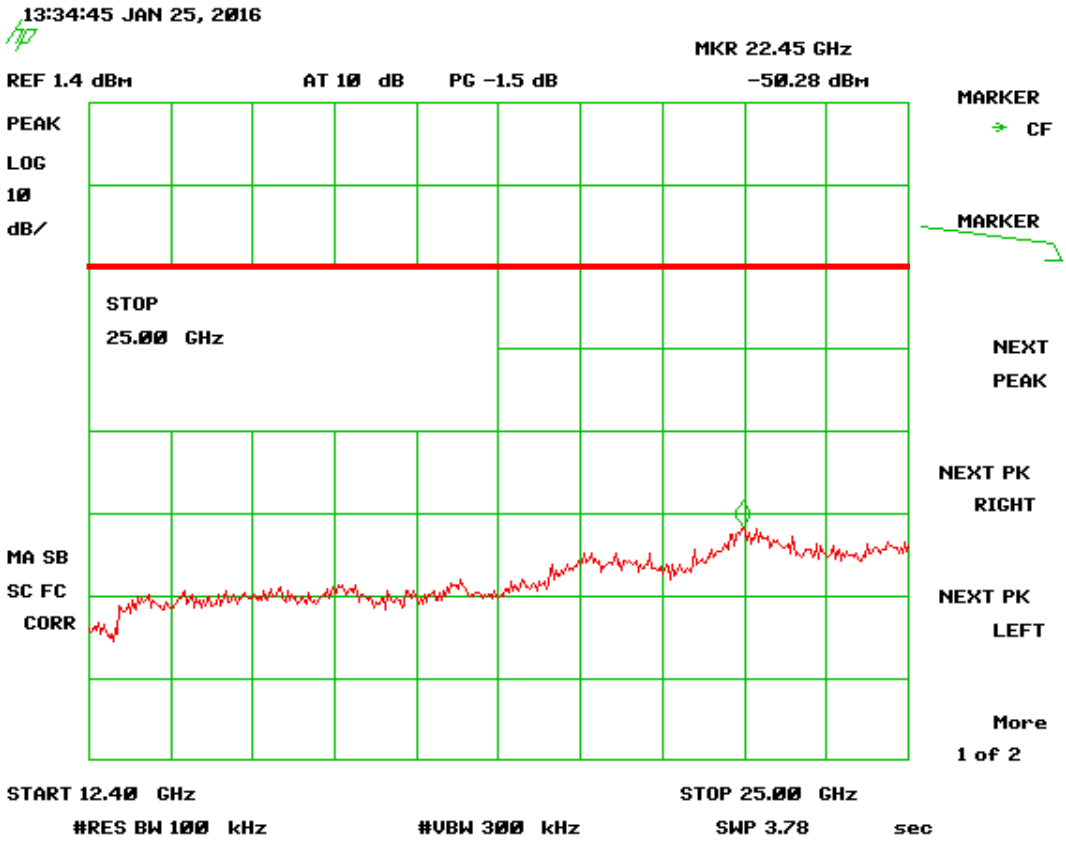


Figure 7. Antenna Conducted Emissions 802.11b Low, Part 5

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

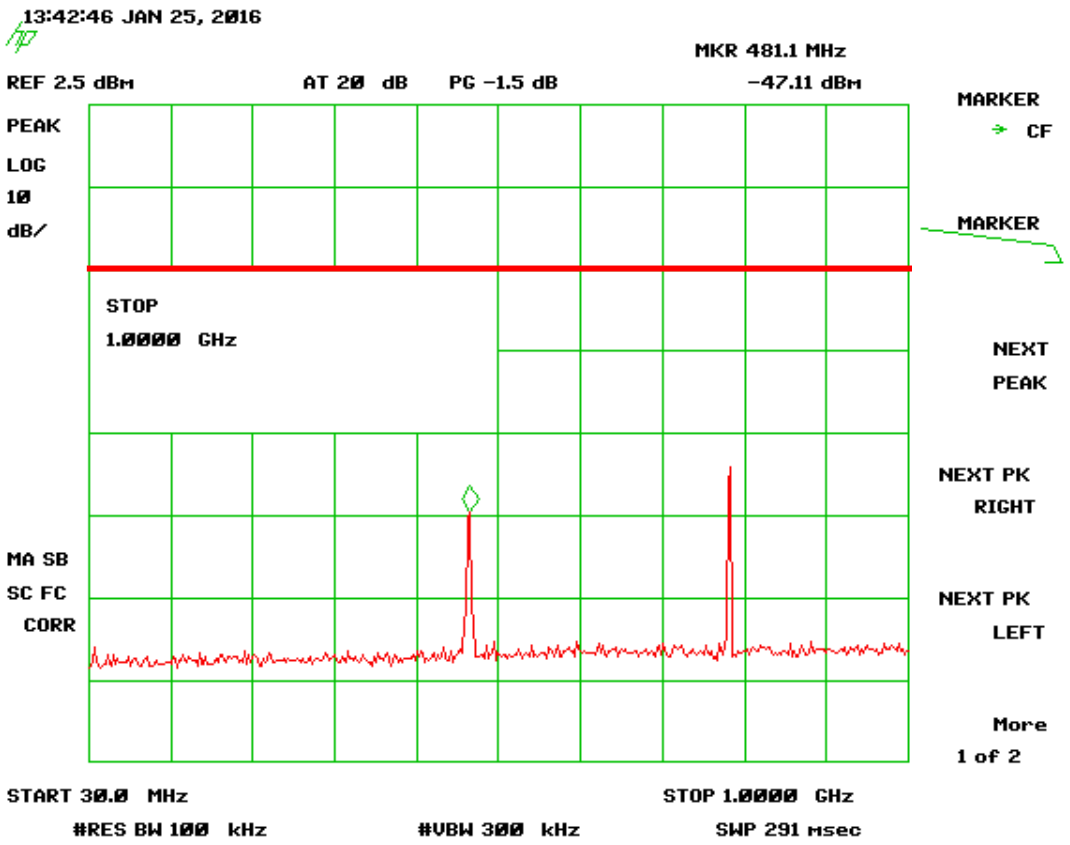


Figure 8. Antenna Conducted Emissions 802.11b Mid, Part 1

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

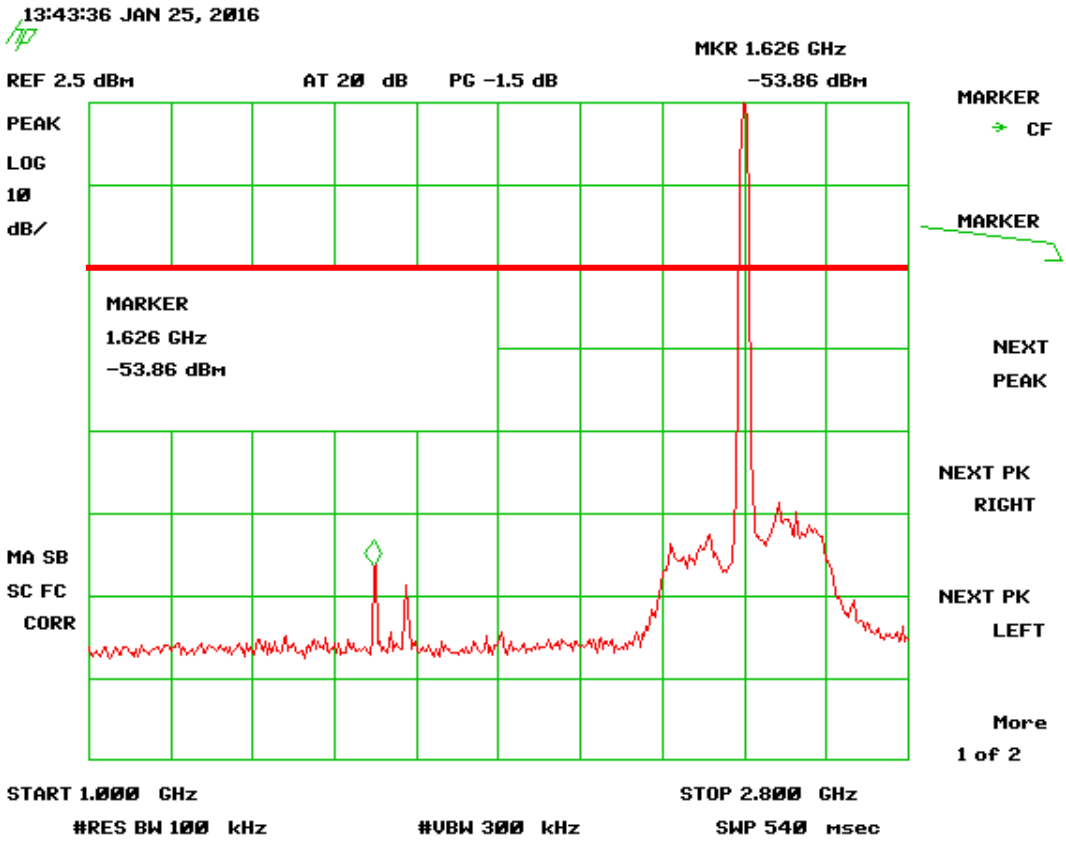


Figure 9. Antenna Conducted Emissions 802.11b Mid, Part 2

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental. The large emission seen is the fundamental emission.

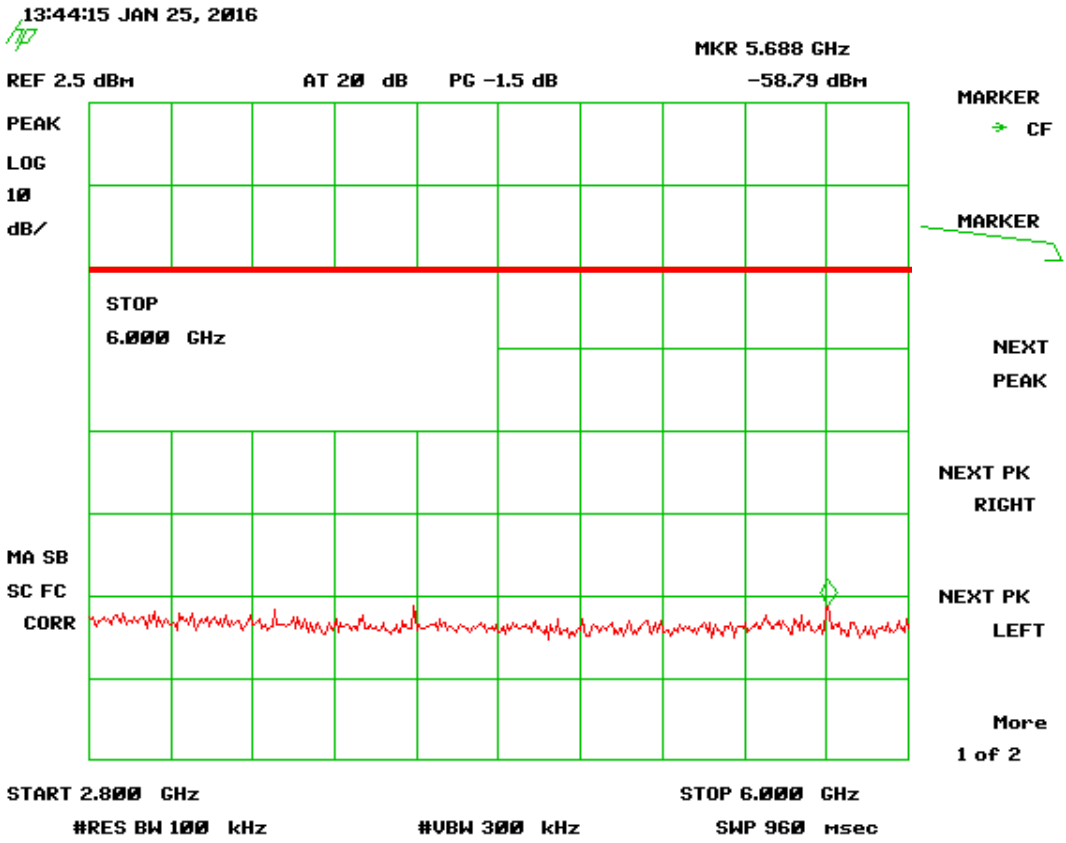


Figure 10. Antenna Conducted Emissions 802.11b Mid, Part 3

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

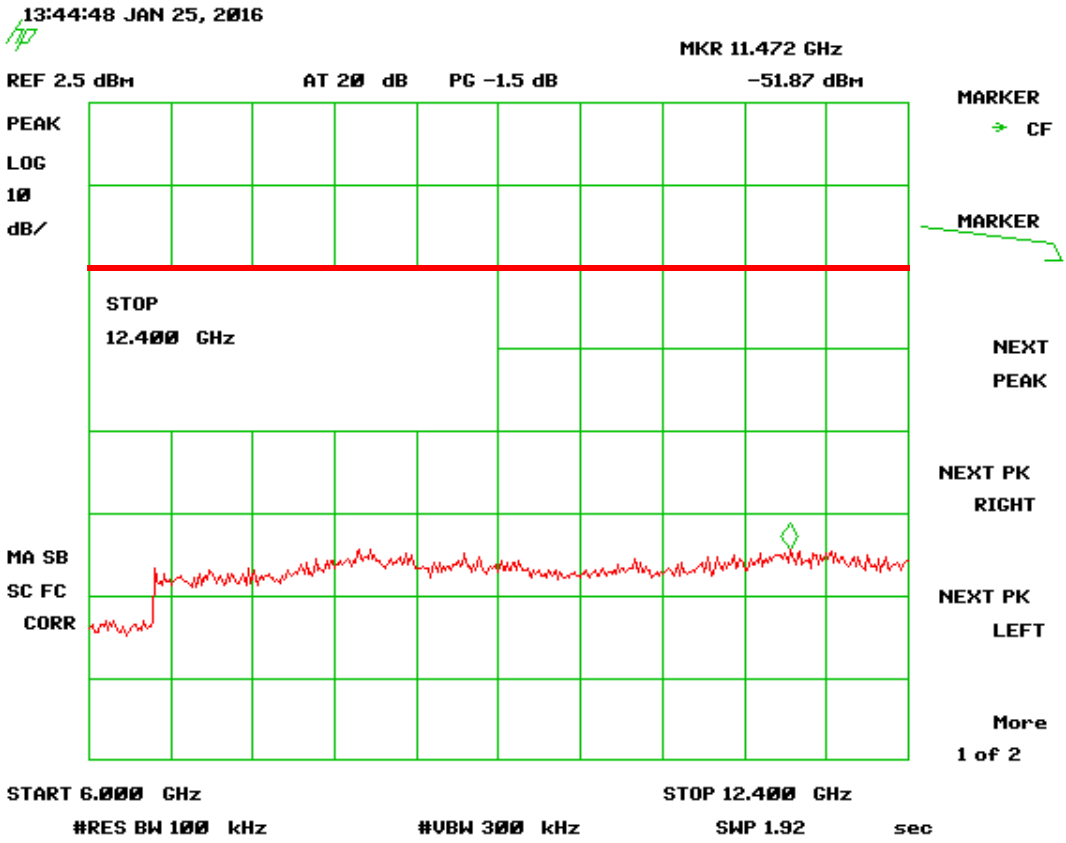


Figure 11. Antenna Conducted Emissions 802.11b Mid, Part 4

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

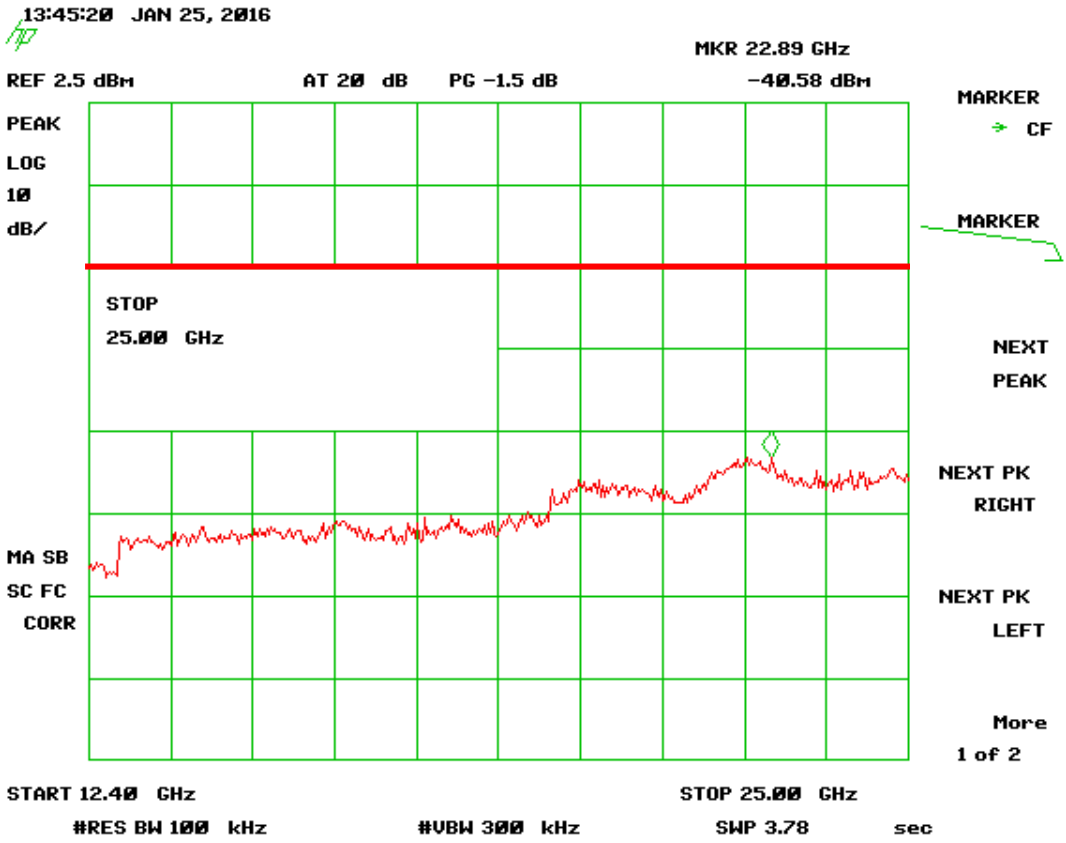


Figure 12. Antenna Conducted Emissions 802.11b Mid, Part 5

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

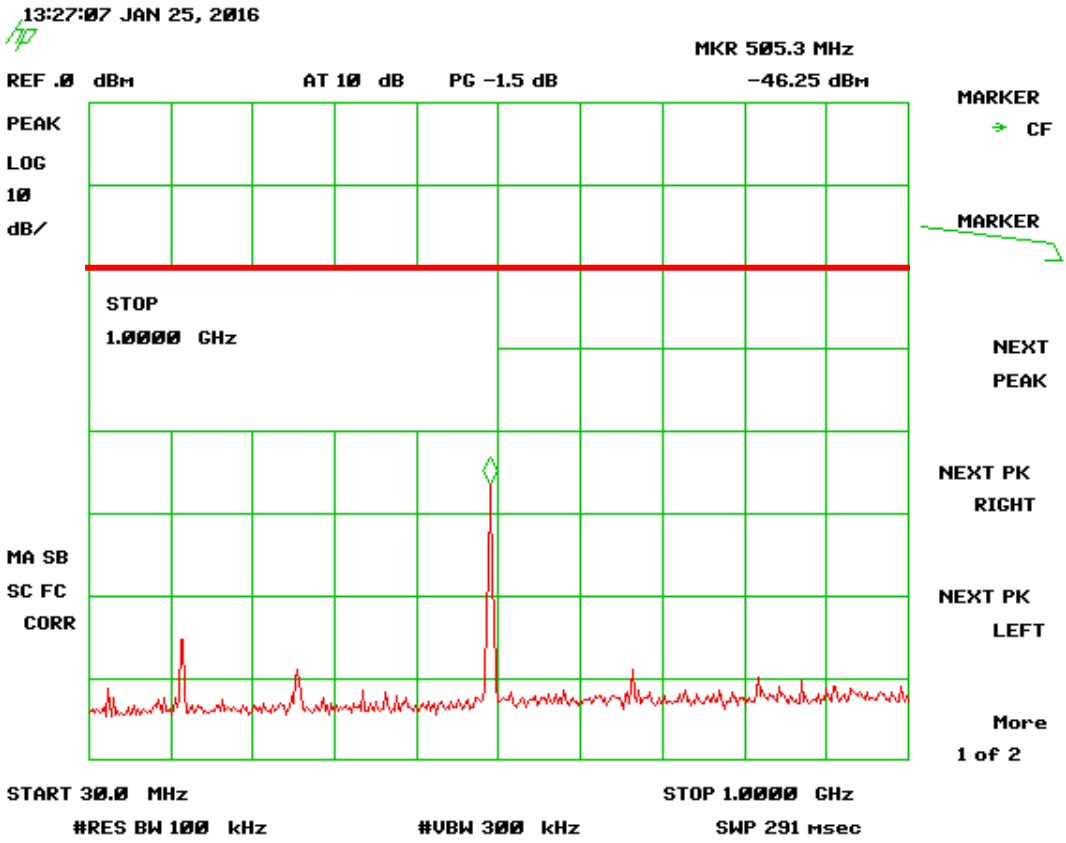


Figure 13. Antenna Conducted Emissions 802.11b High, Part 1

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

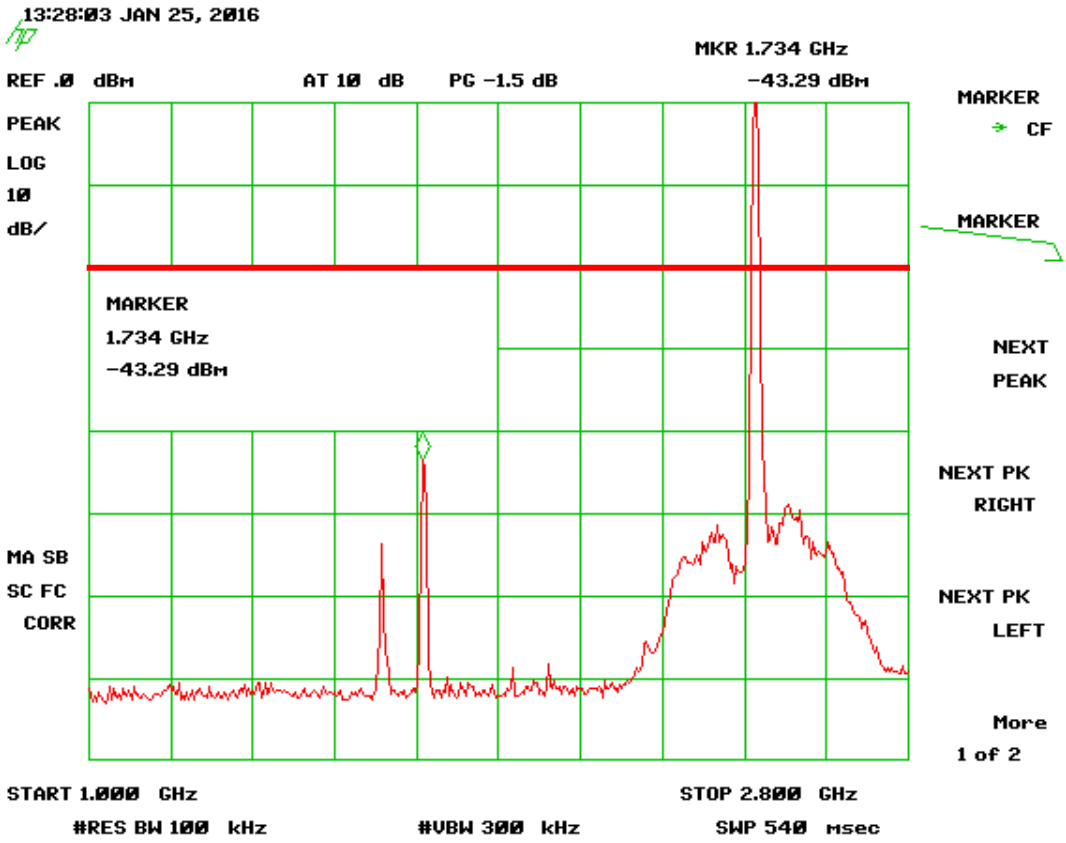


Figure 14. Antenna Conducted Emissions 802.11b High, Part 2

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental. The large emission seen is the fundamental emission.

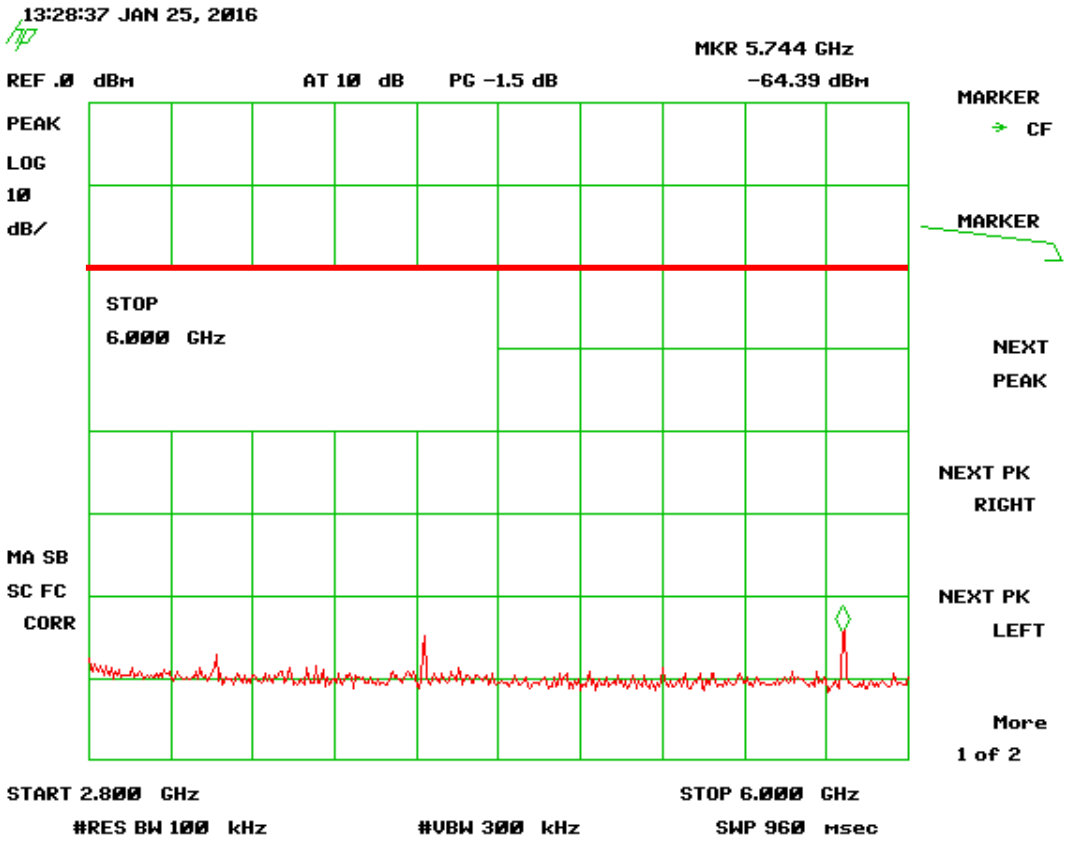


Figure 15. Antenna Conducted Emissions 802.11b High, Part 3

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

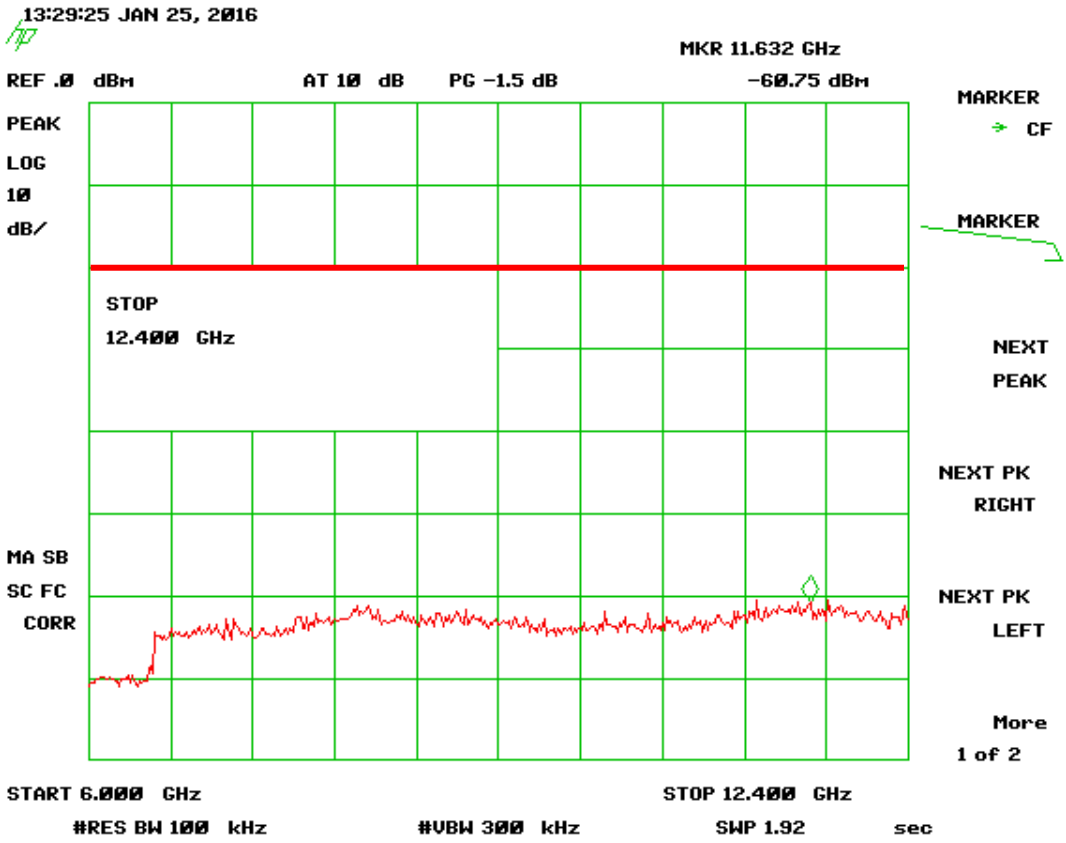


Figure 16. Antenna Conducted Emissions 802.11b High, Part 4

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

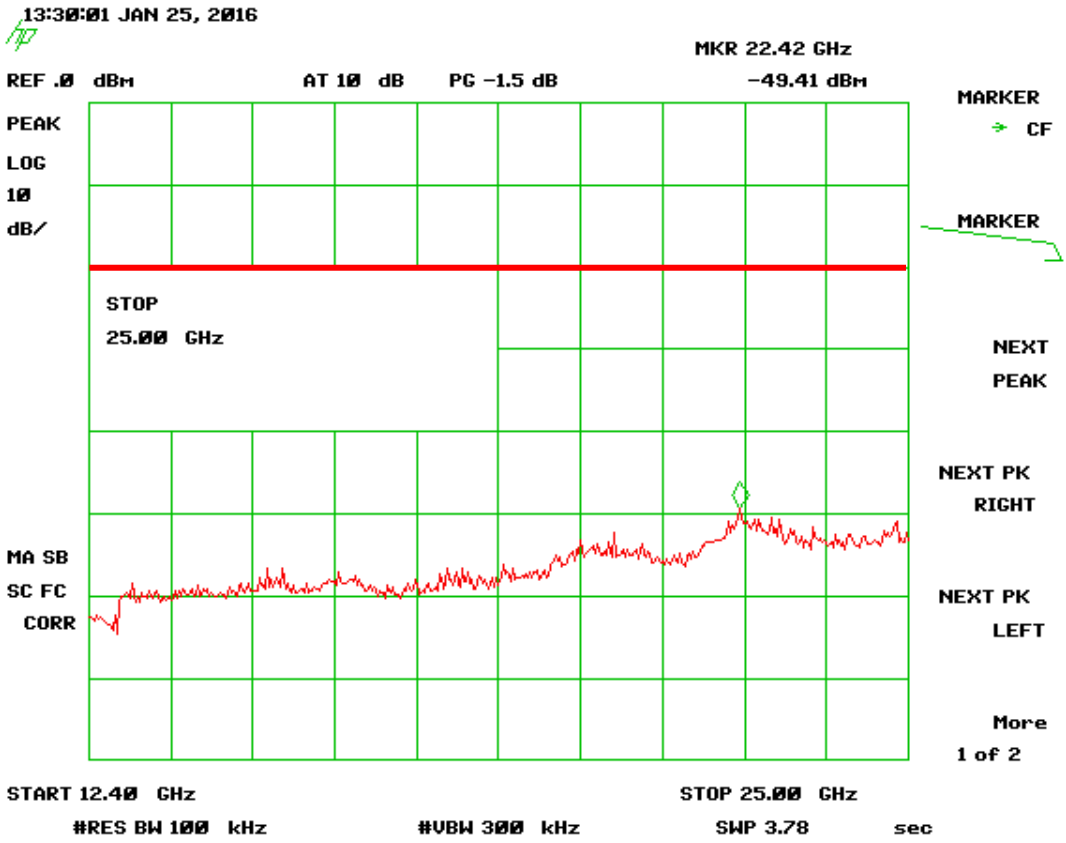


Figure 17. Antenna Conducted Emissions 802.11b High, Part 5

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

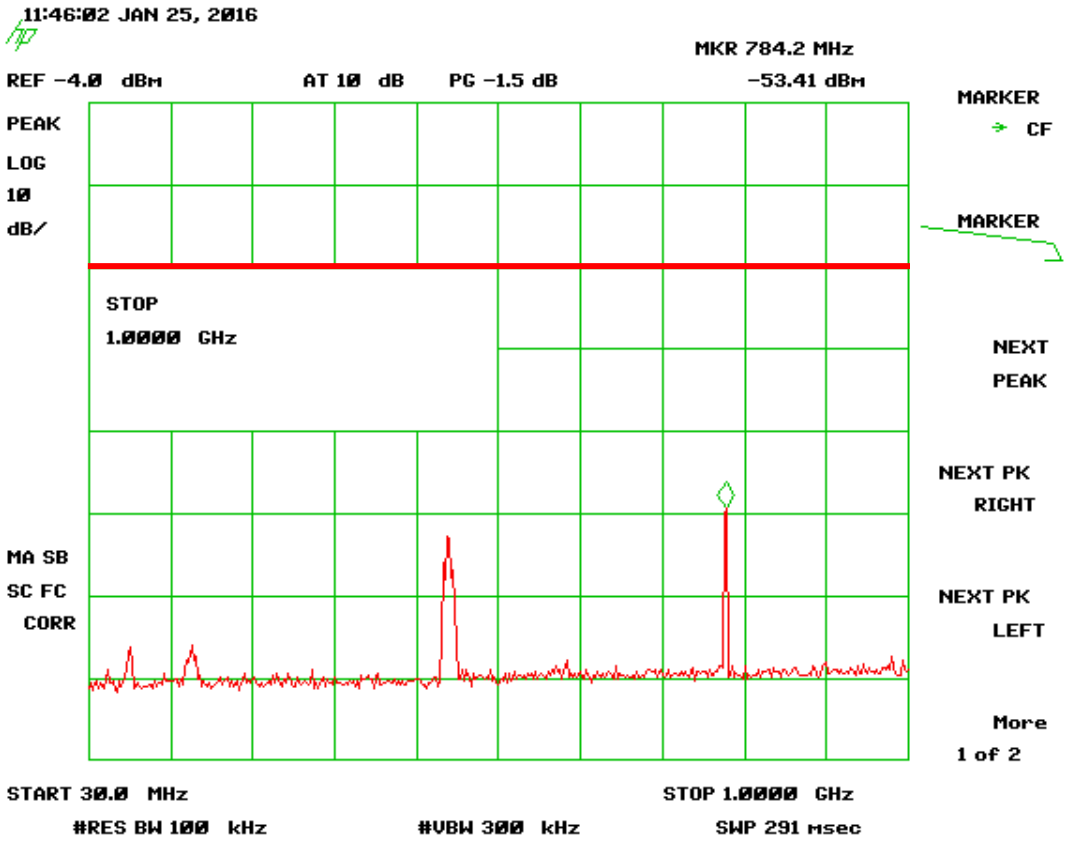


Figure 18. Antenna Conducted Emissions 802.11g Low, Part 1

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

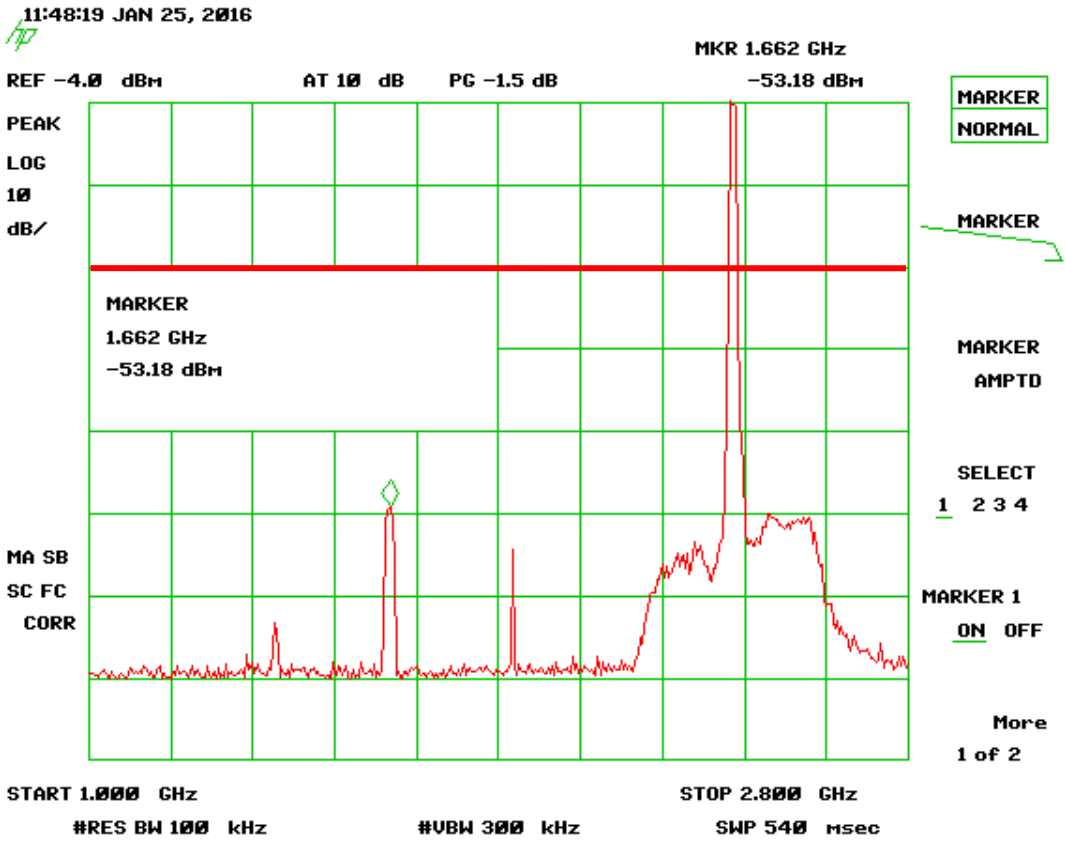


Figure 19. Antenna Conducted Emissions 802.11g Low, Part 2

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental. The large emission seen is the fundamental emission.

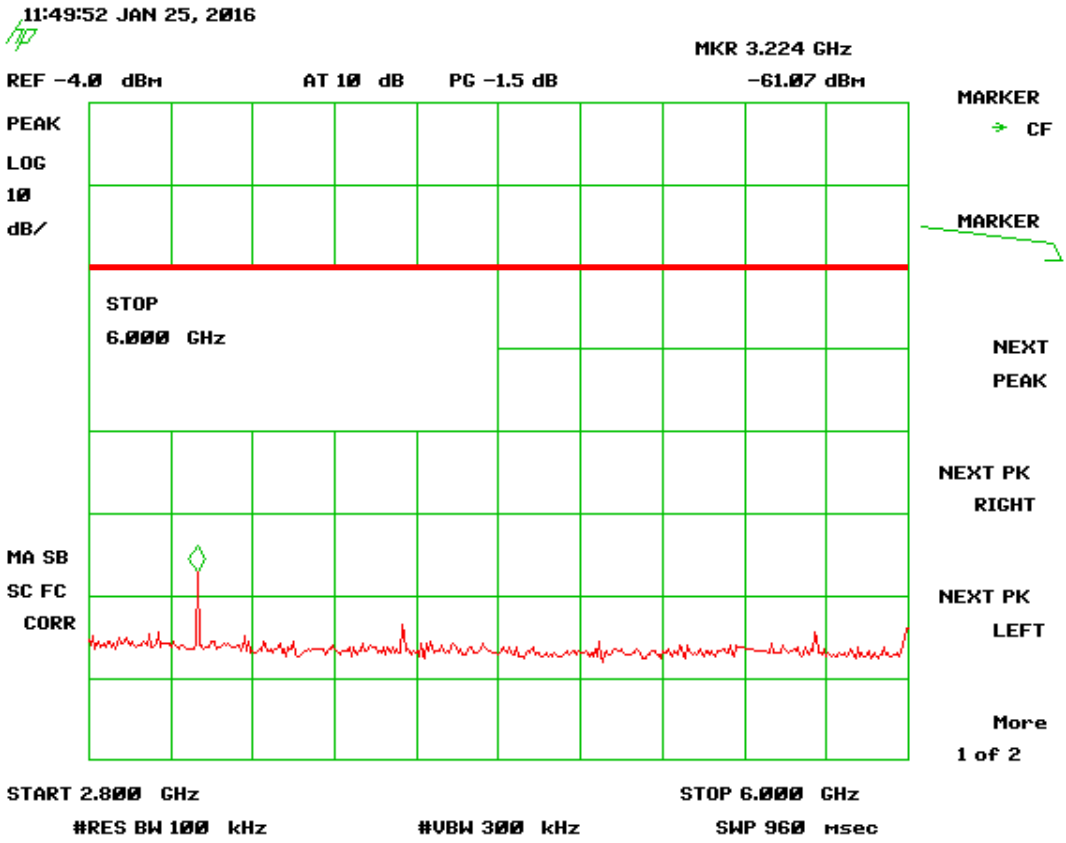


Figure 20. Antenna Conducted Emissions 802.11g Low, Part 3

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

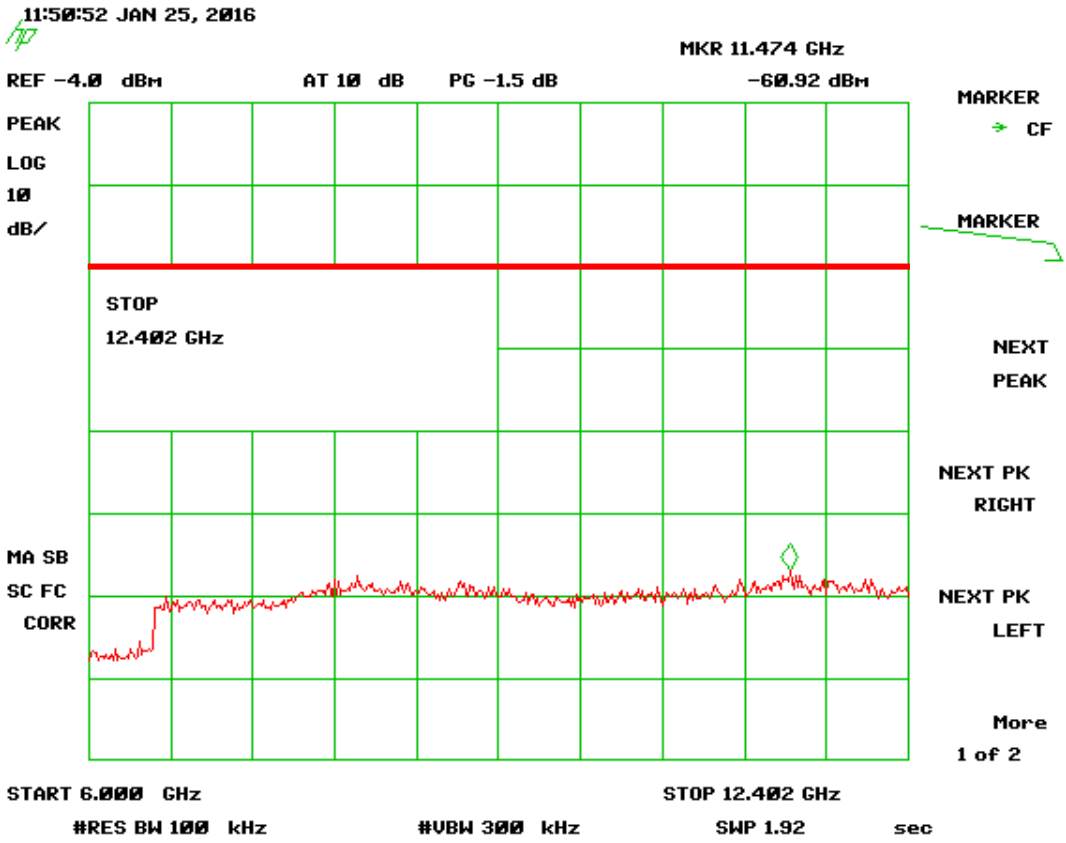


Figure 21. Antenna Conducted Emissions 802.11g Low, Part 4

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

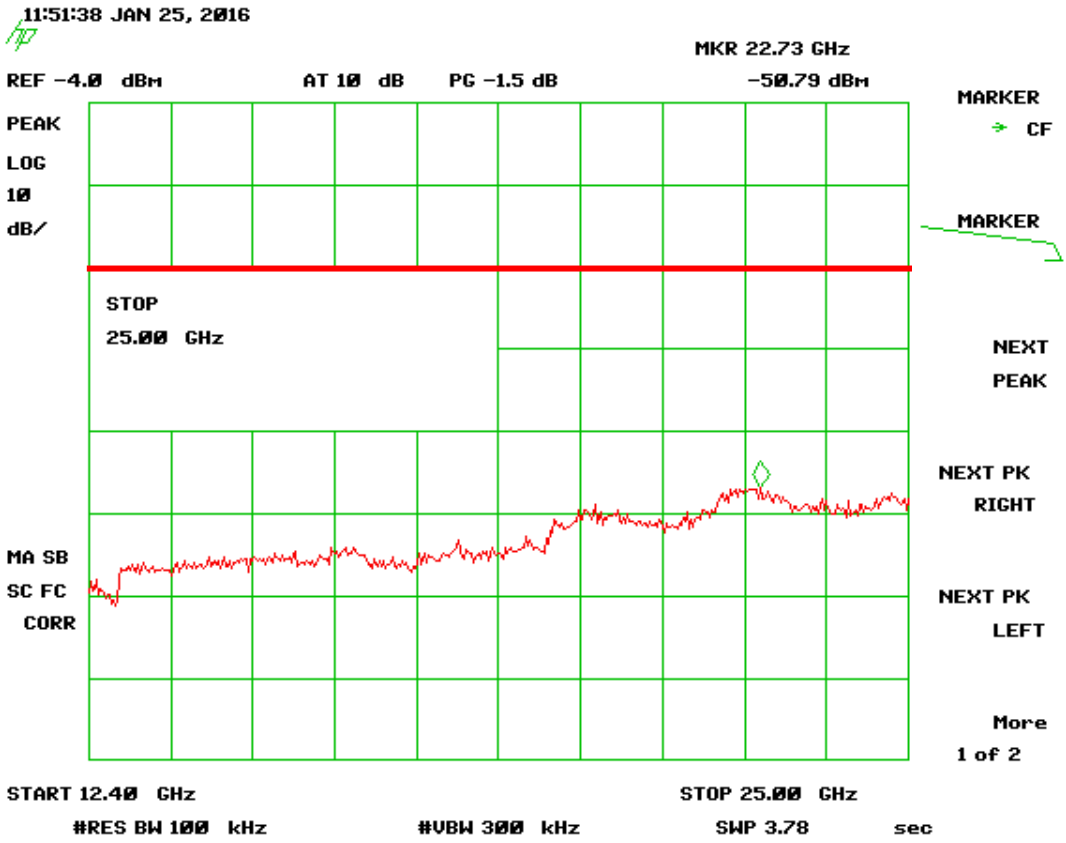


Figure 22. Antenna Conducted Emissions 802.11g Low, Part 5

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

.

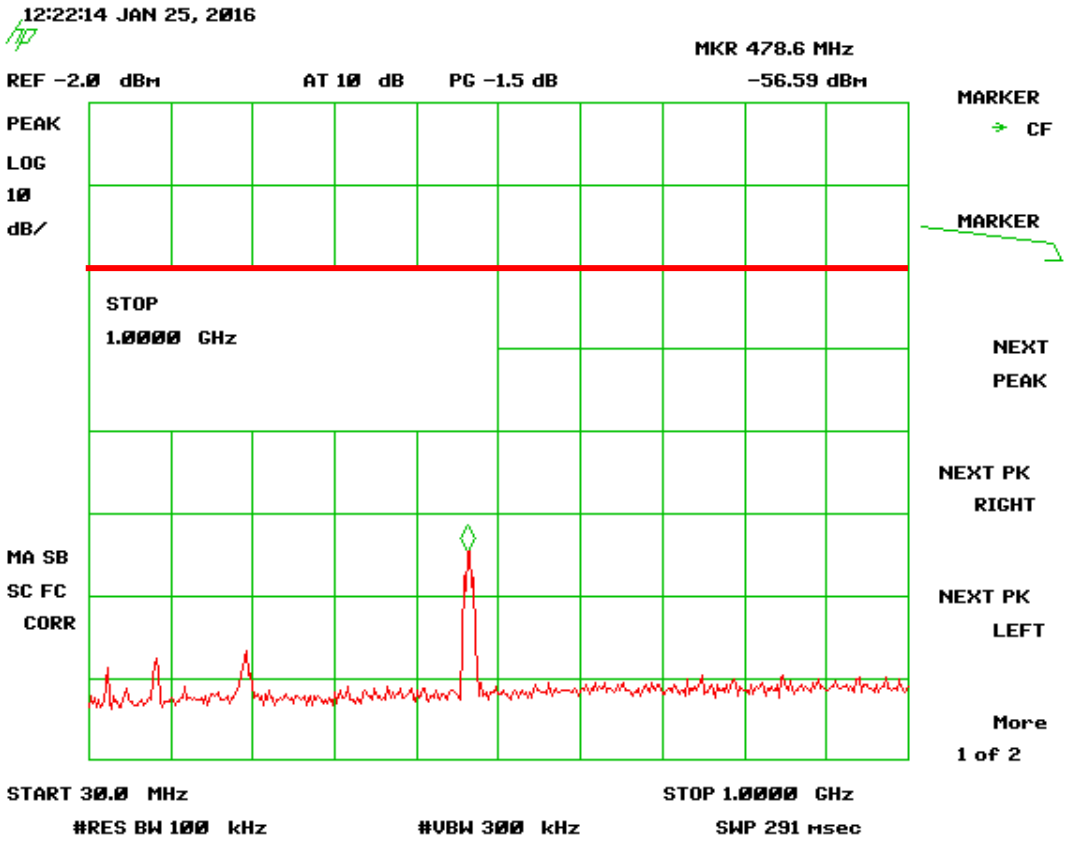


Figure 23. Antenna Conducted Emissions 802.11g Mid, Part 1

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

.

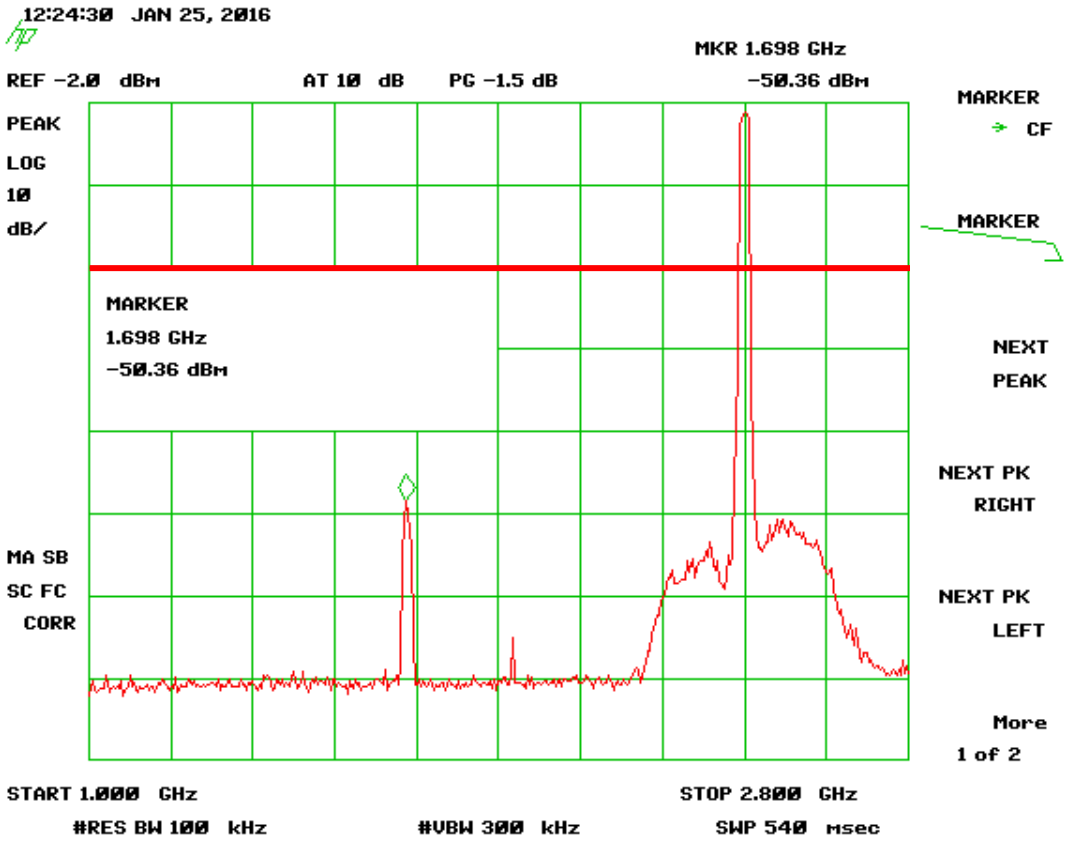


Figure 24. Antenna Conducted Emissions 802.11g Mid, Part 2

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental. The large emission seen is the fundamental emission.

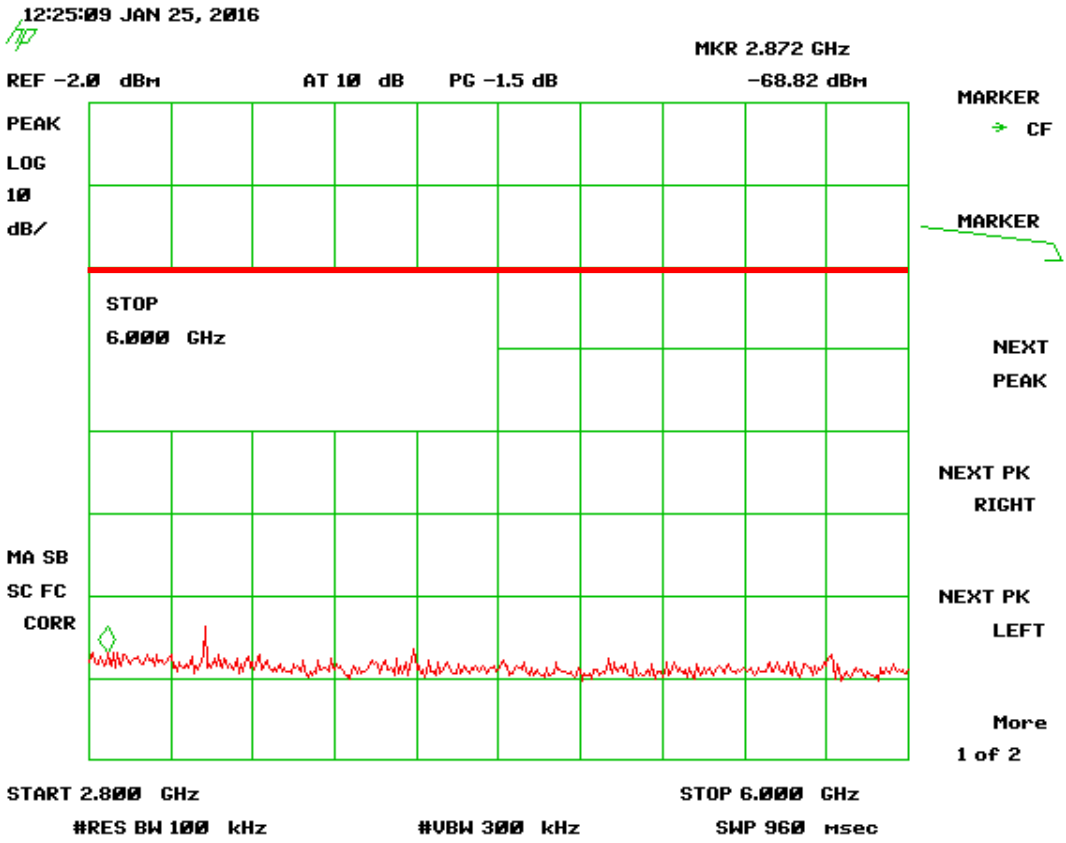


Figure 25. Antenna Conducted Emissions 802.11g Mid, Part 3

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

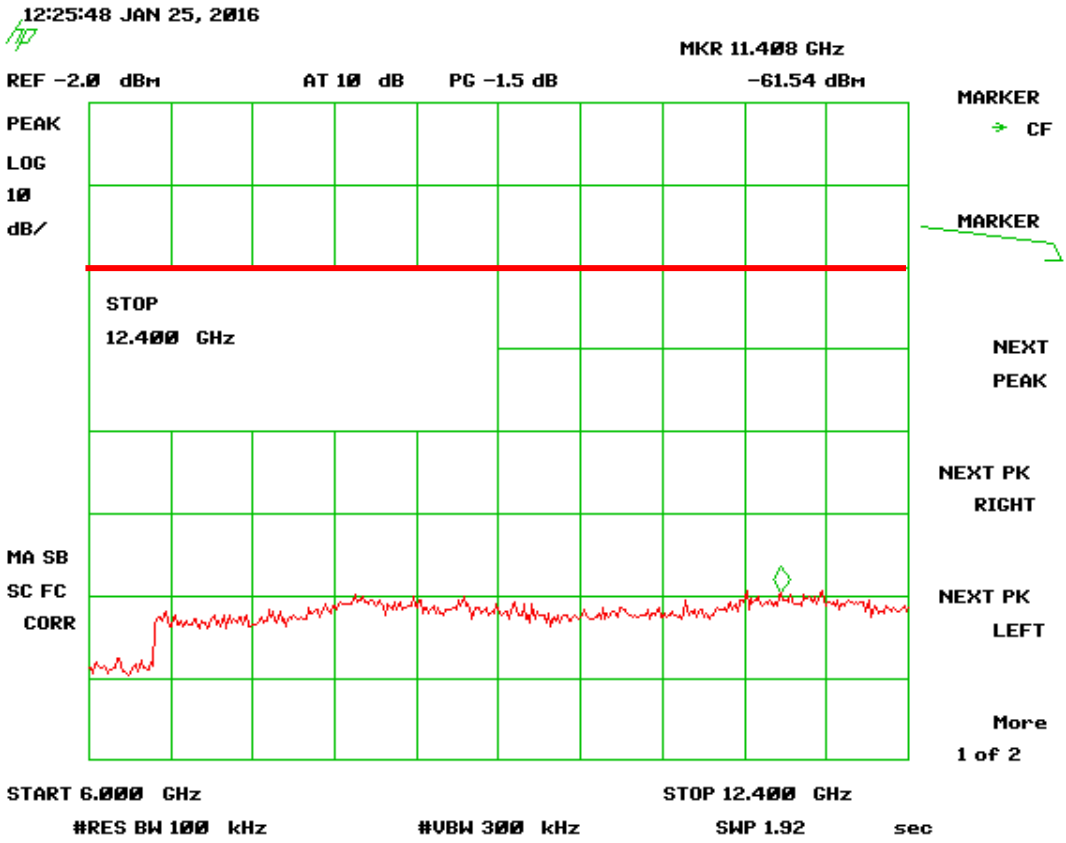


Figure 26. Antenna Conducted Emissions 802.11g Mid, Part 4

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

.

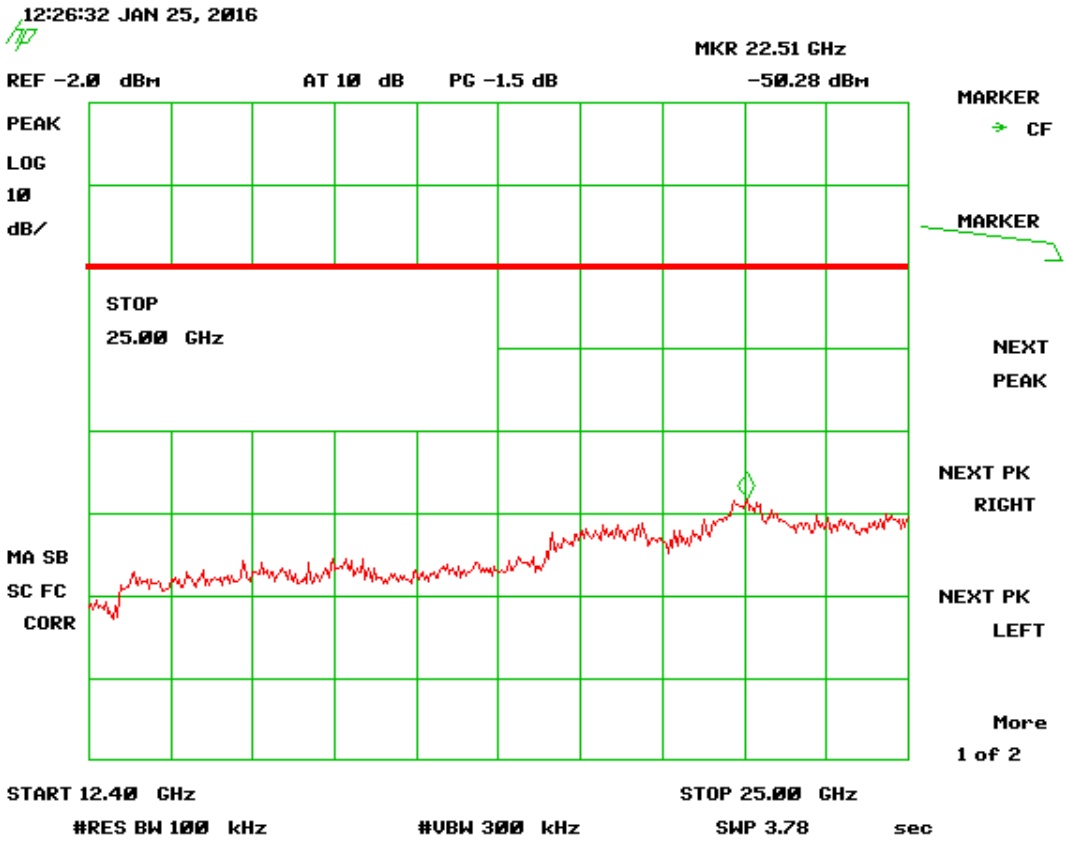


Figure 27. Antenna Conducted Emissions 802.11g Mid, Part 5

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

.

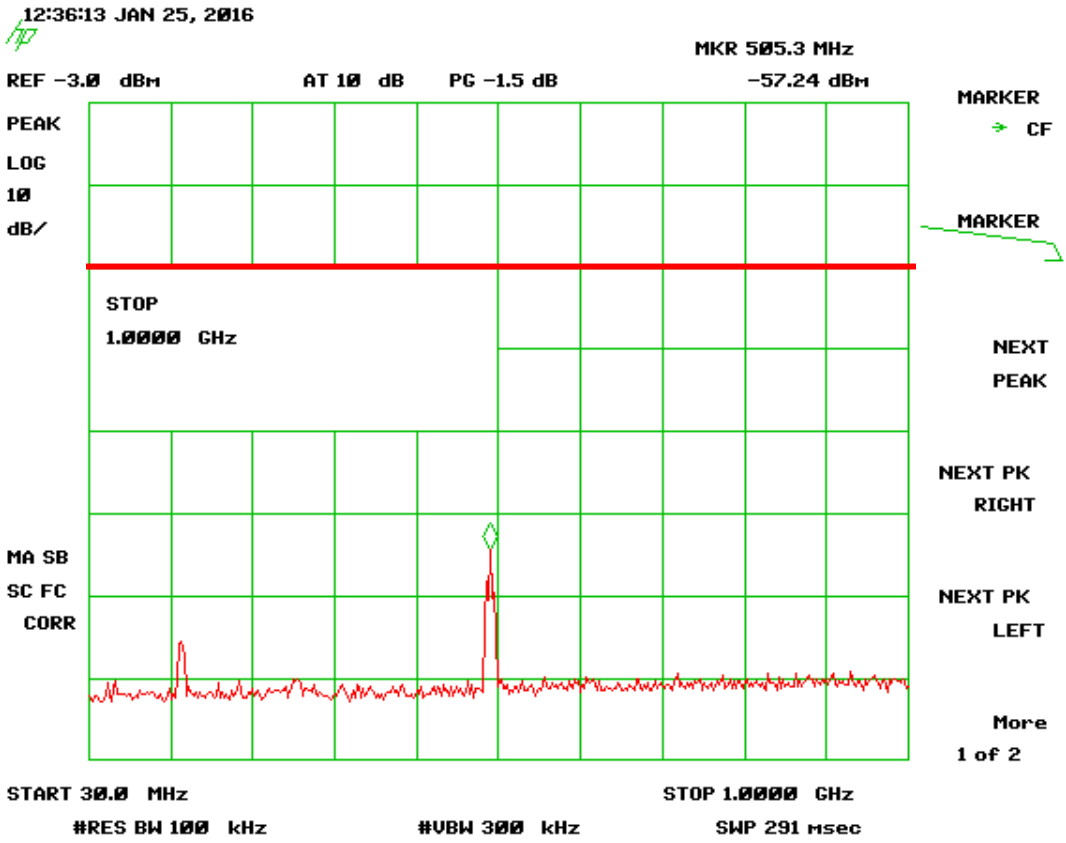


Figure 28. Antenna Conducted Emissions 802.11g High, Part 1

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

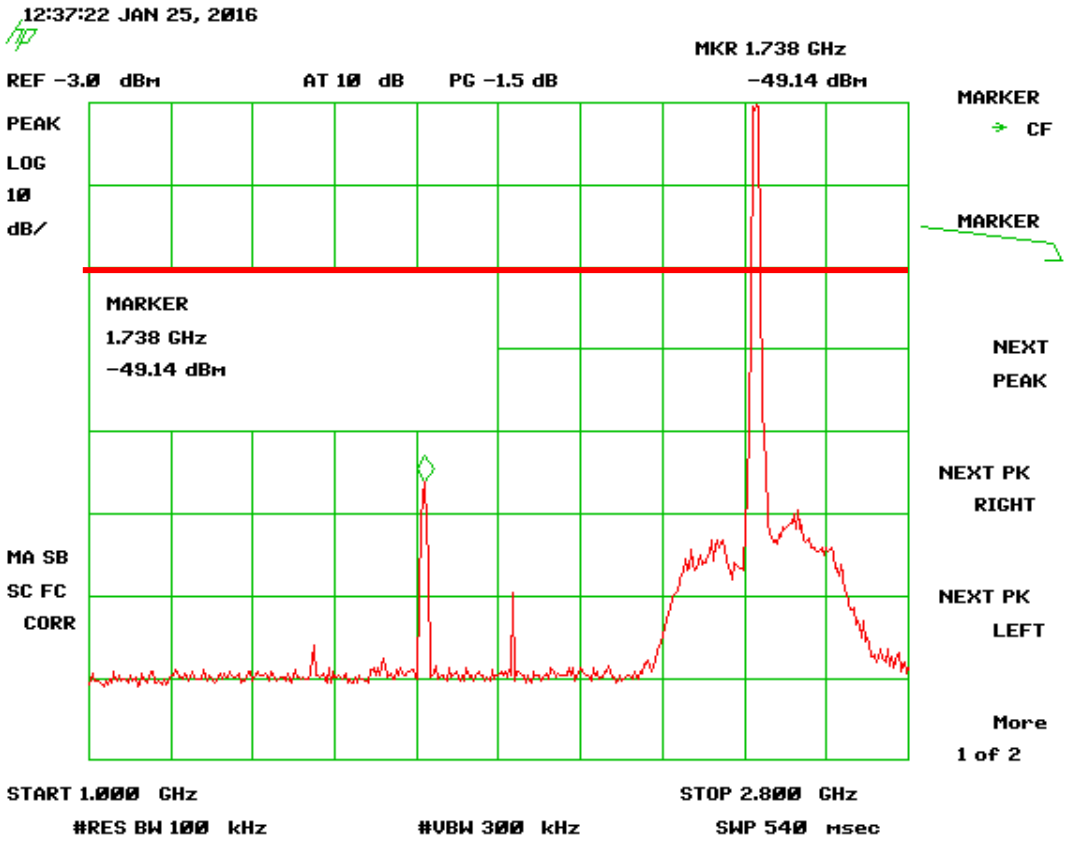


Figure 29. Antenna Conducted Emissions 802.11g High, Part 2

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental. The large emission seen is the fundamental emission.

.

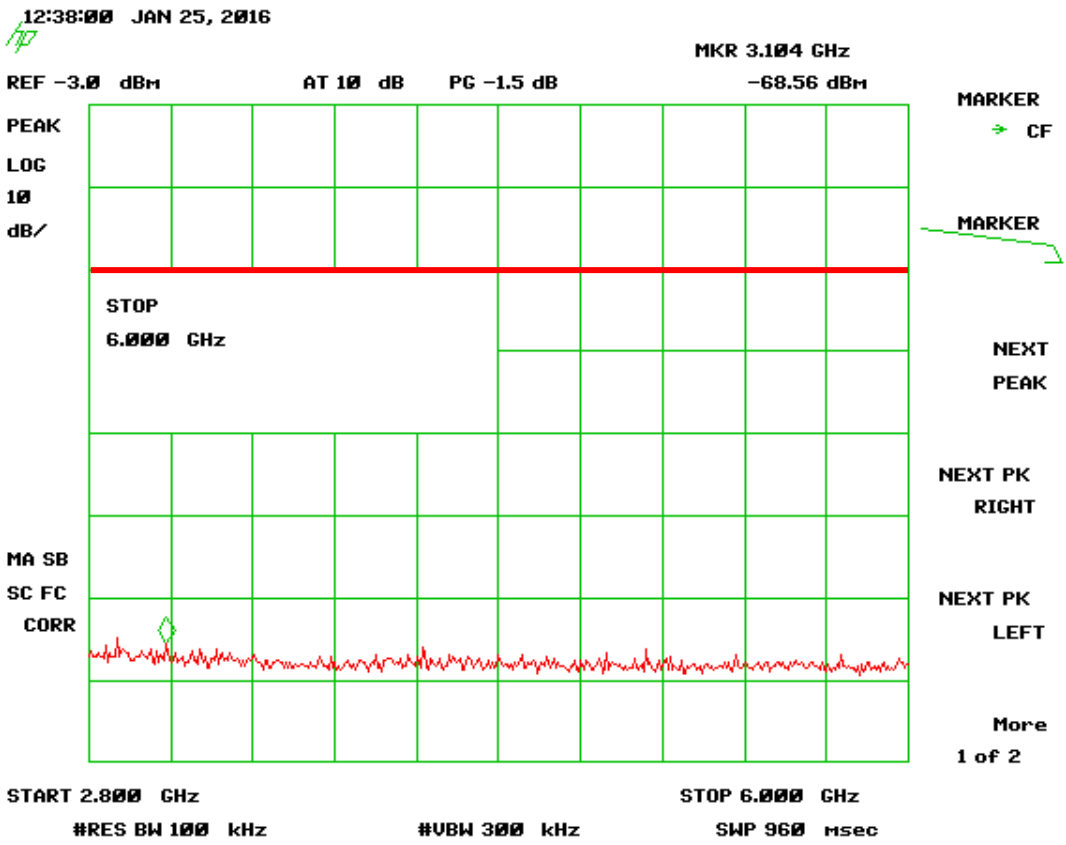


Figure 30. Antenna Conducted Emissions 802.11g High, Part 3

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

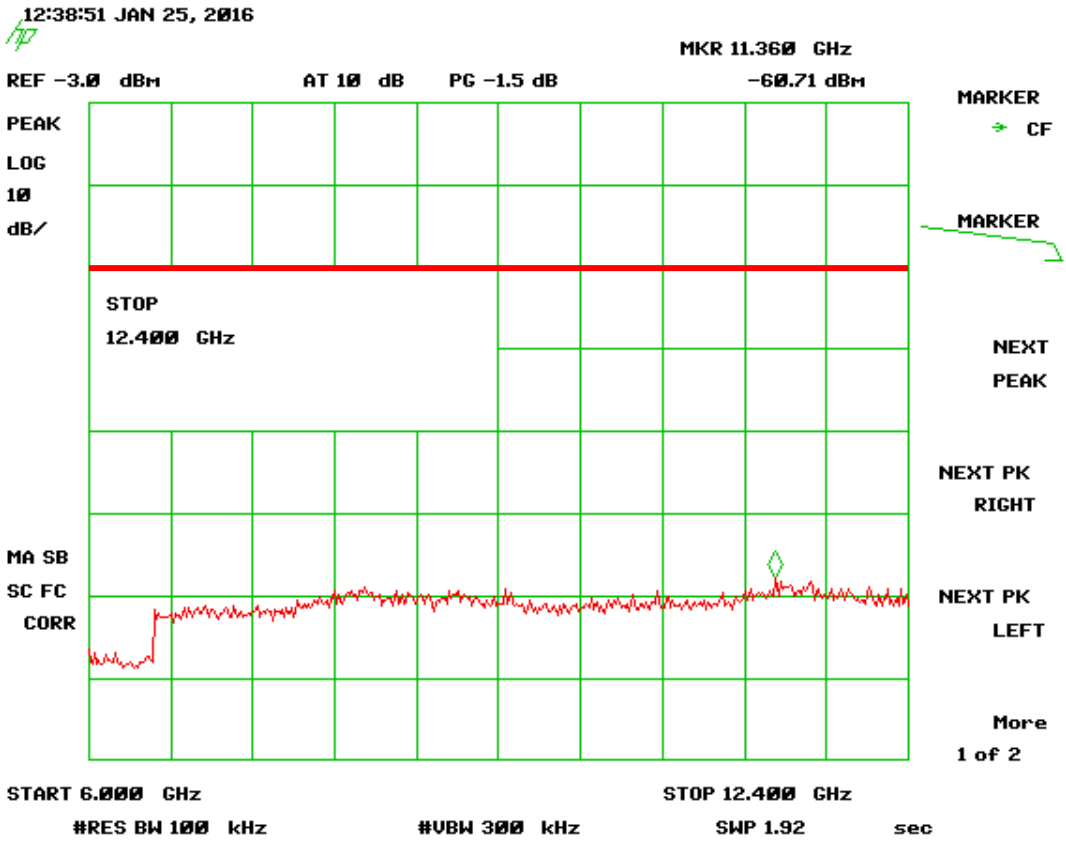


Figure 31. Antenna Conducted Emissions 802.11g High, Part 4

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental. The large emission seen is the fundamental emission.

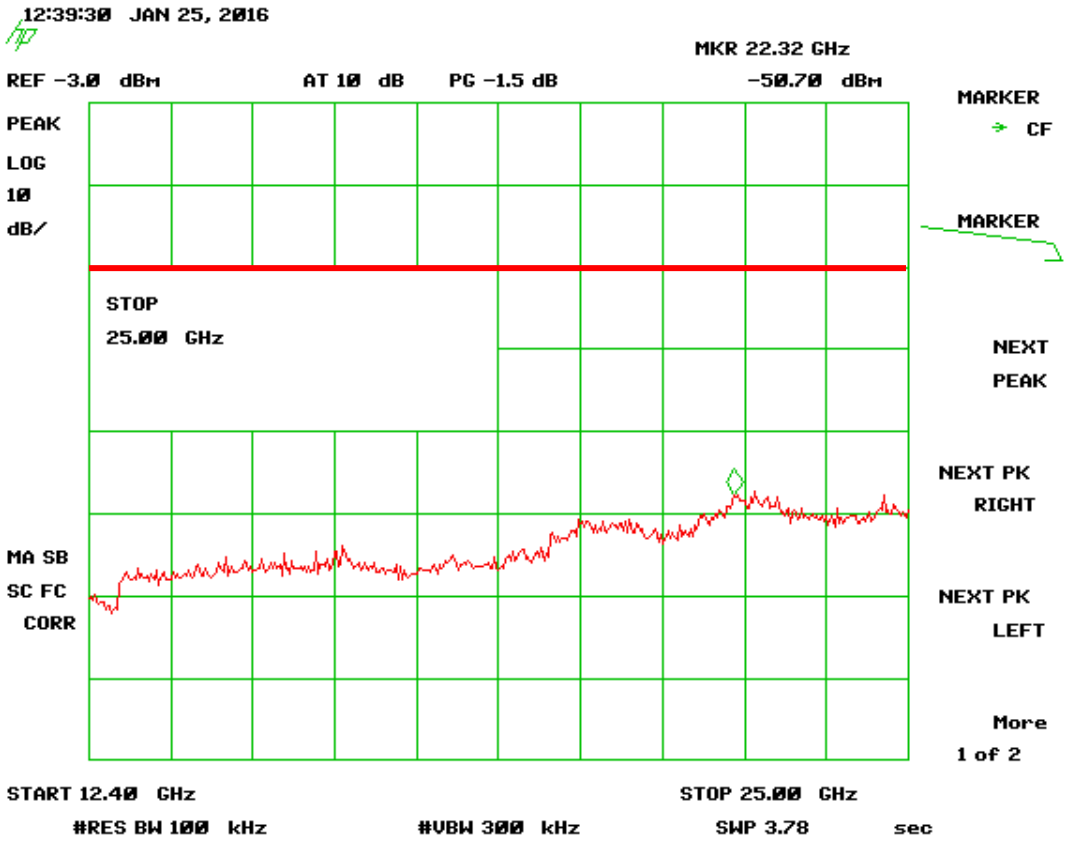


Figure 32. Antenna Conducted Emissions 802.11g High, Part 5

Note: Offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

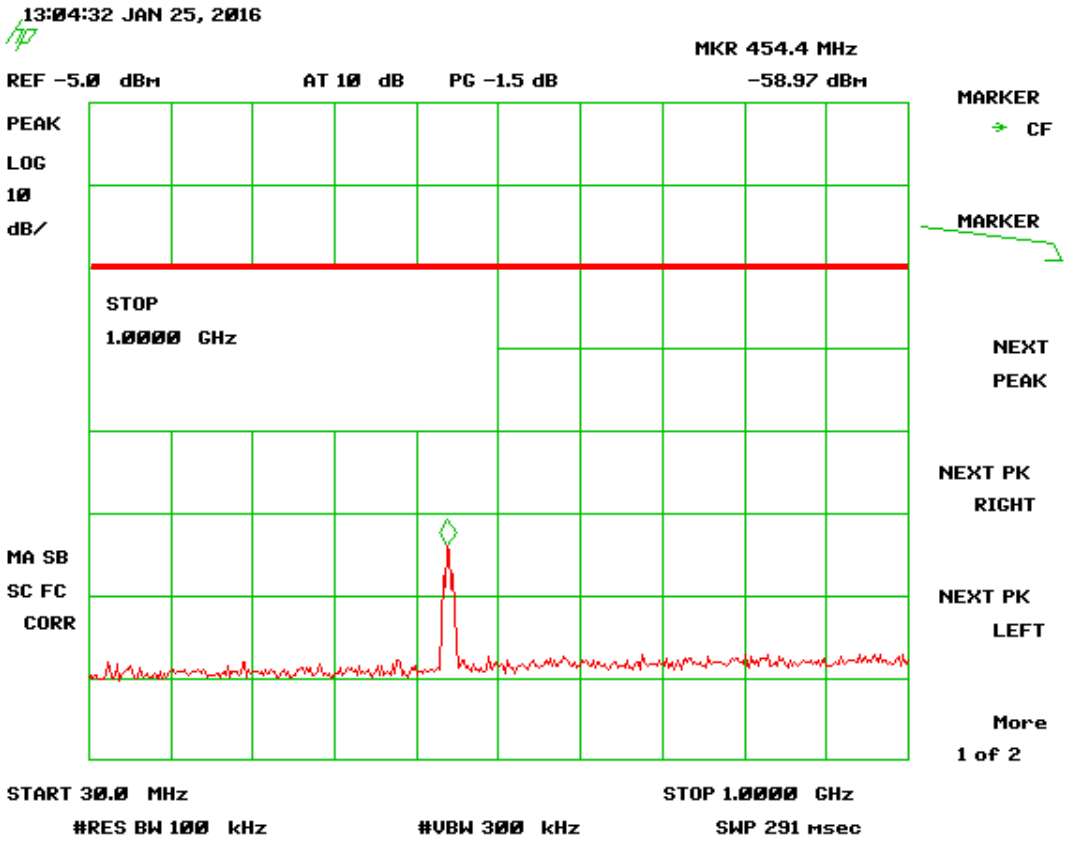


Figure 33. Antenna Conducted Emissions 802.11n Low, Part 1

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

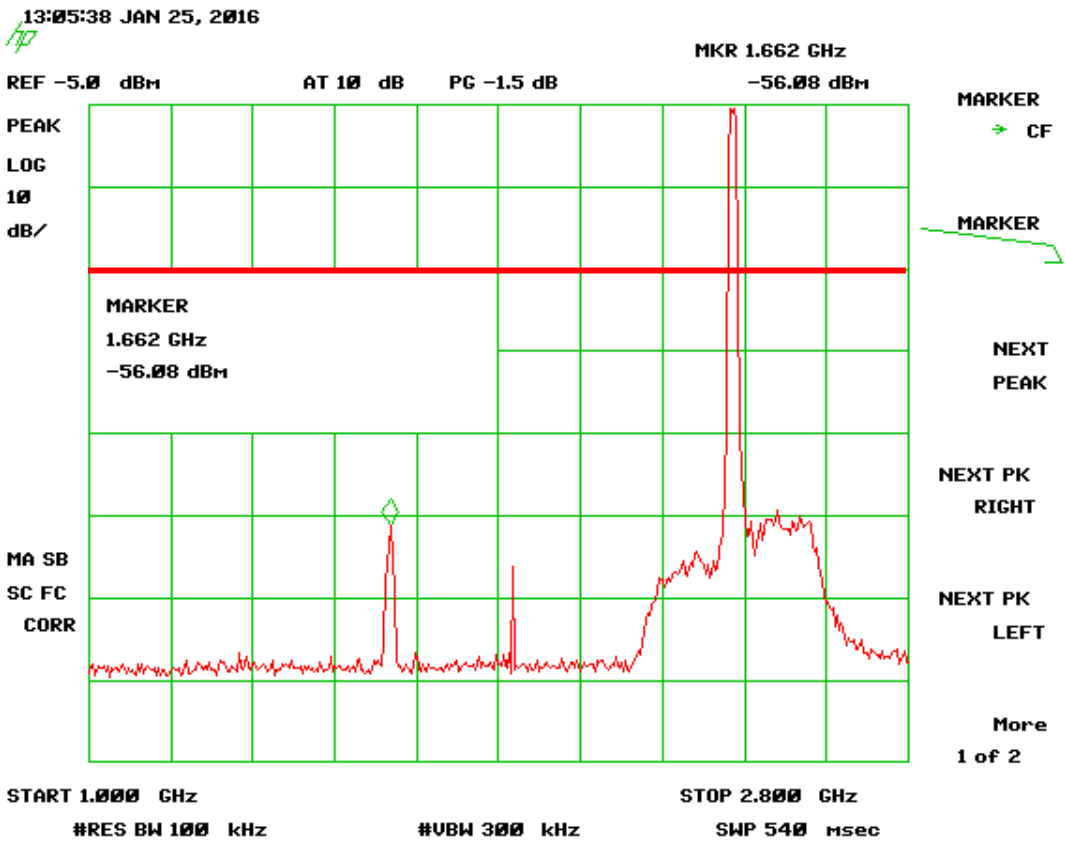


Figure 34. Antenna Conducted Emissions 802.11n Low, Part 2

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental. The large emission seen is the fundamental emission.

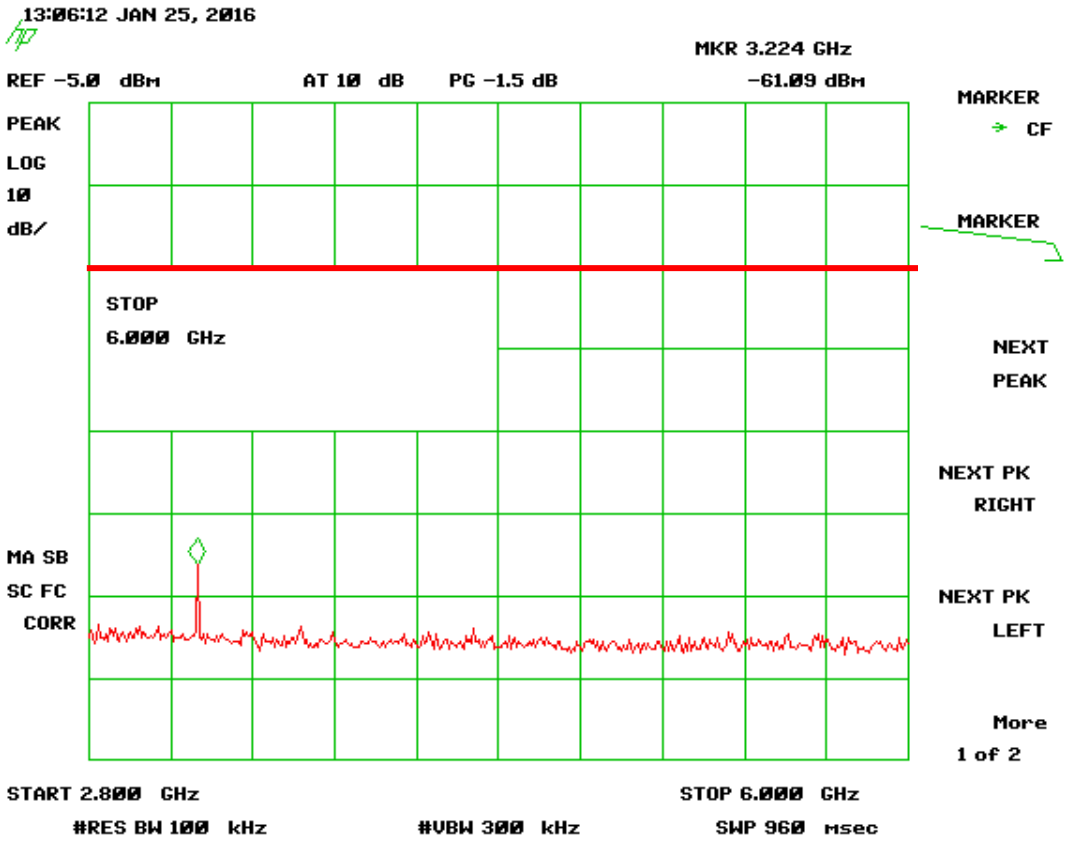


Figure 35. Antenna Conducted Emissions 802.11n Low, Part 3

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

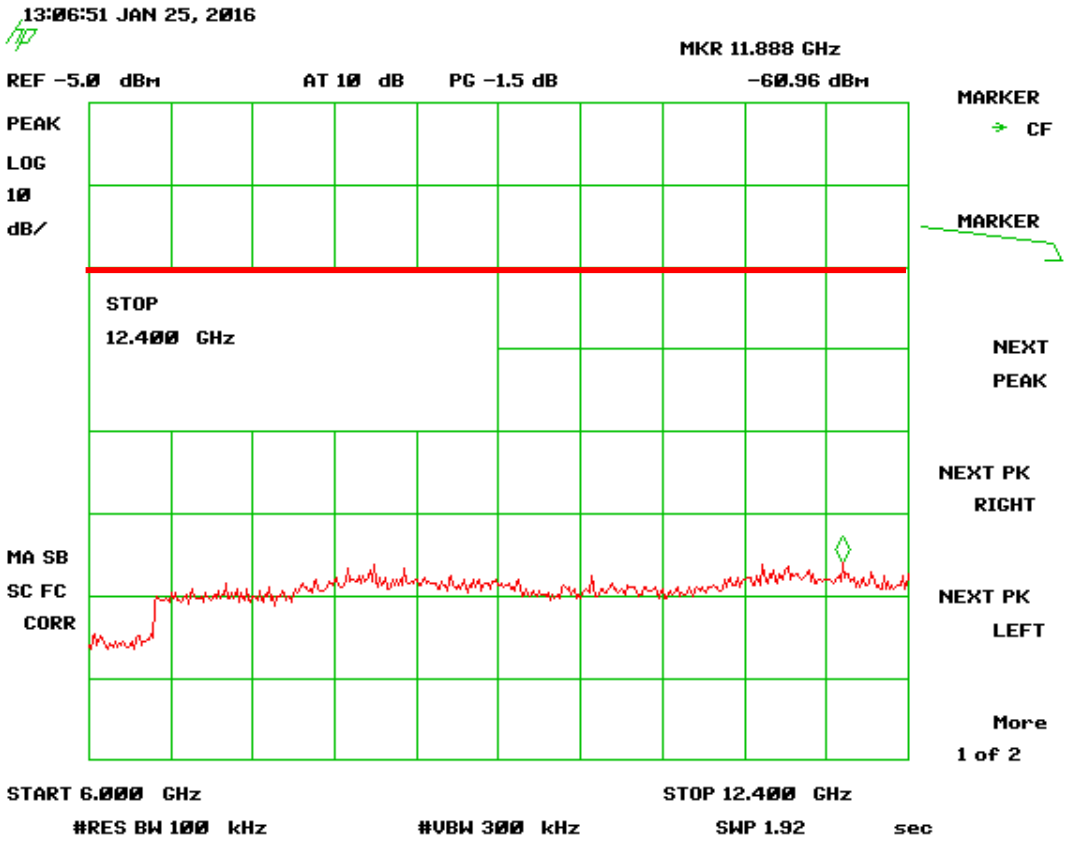


Figure 36. Antenna Conducted Emissions 802.11n Low, Part 4

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

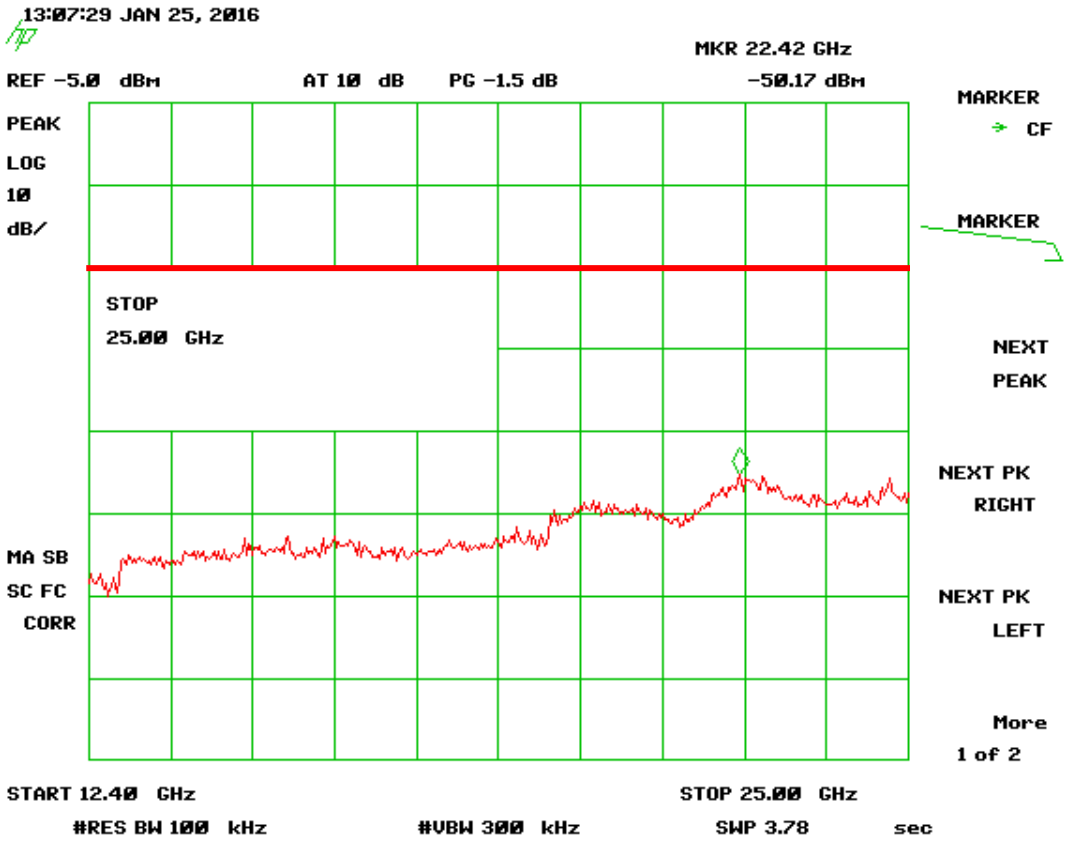


Figure 37. Antenna Conducted Emissions 802.11n Low, Part 5

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

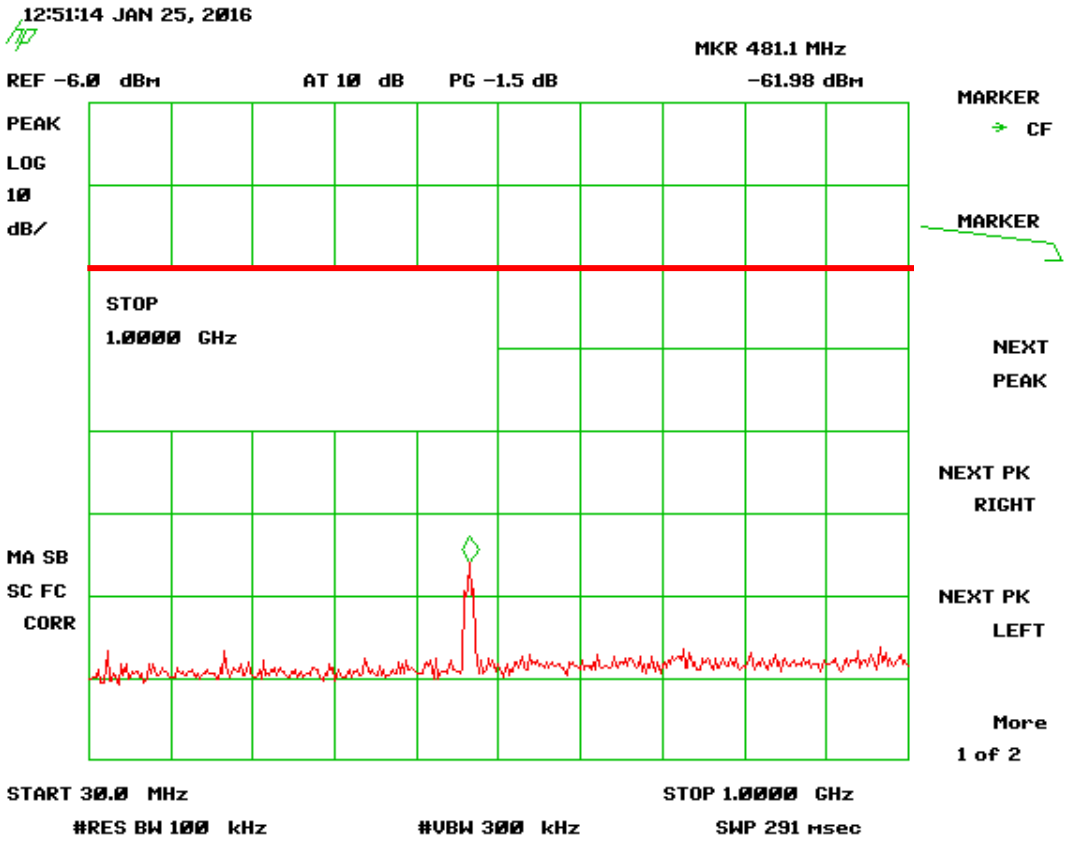


Figure 38. Antenna Conducted Emissions 802.11n Mid, Part 1

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

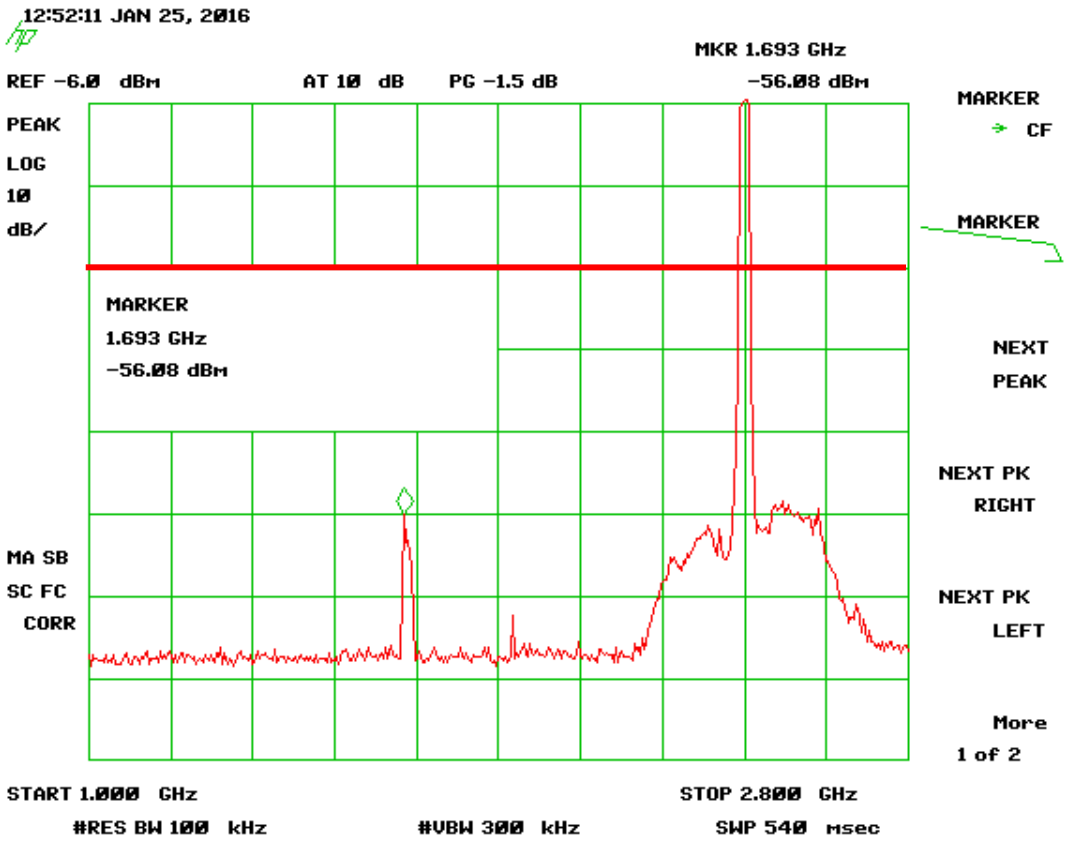


Figure 39. Antenna Conducted Emissions 802.11n Mid, Part 2

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental. The large emission seen is the fundamental emission.

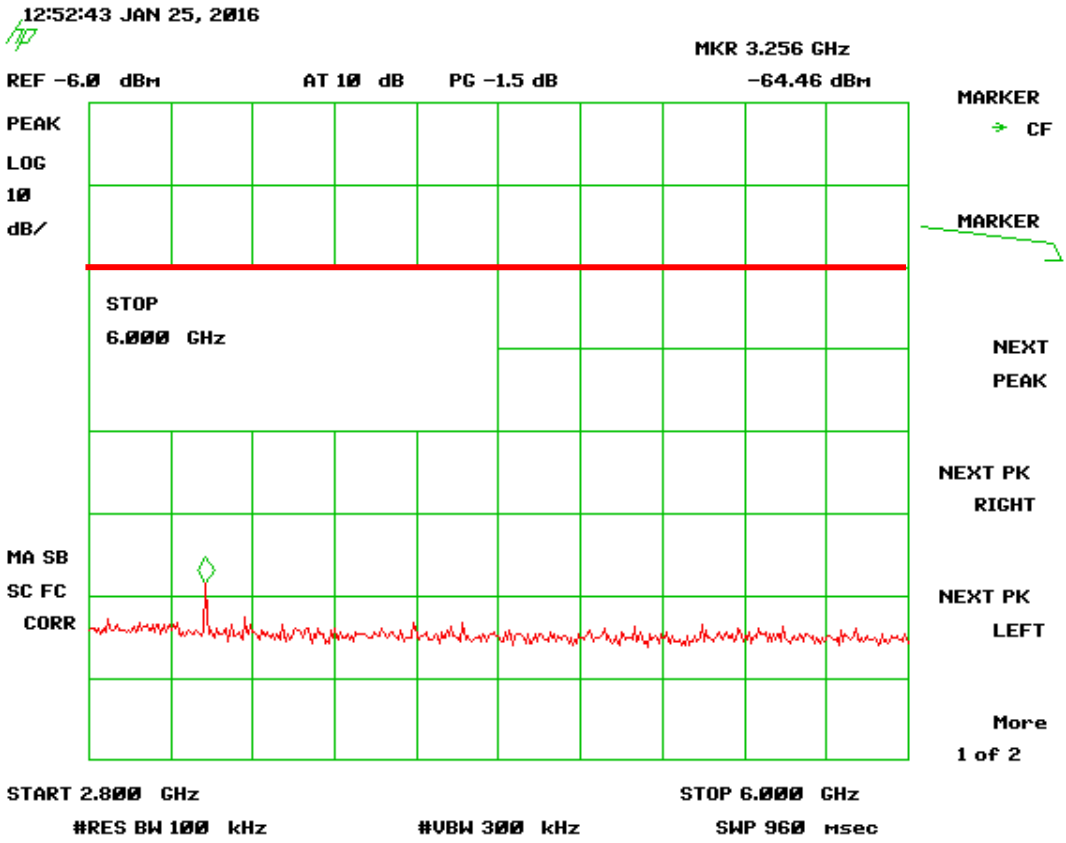


Figure 40. Antenna Conducted Emissions 802.11n Mid, Part 3

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

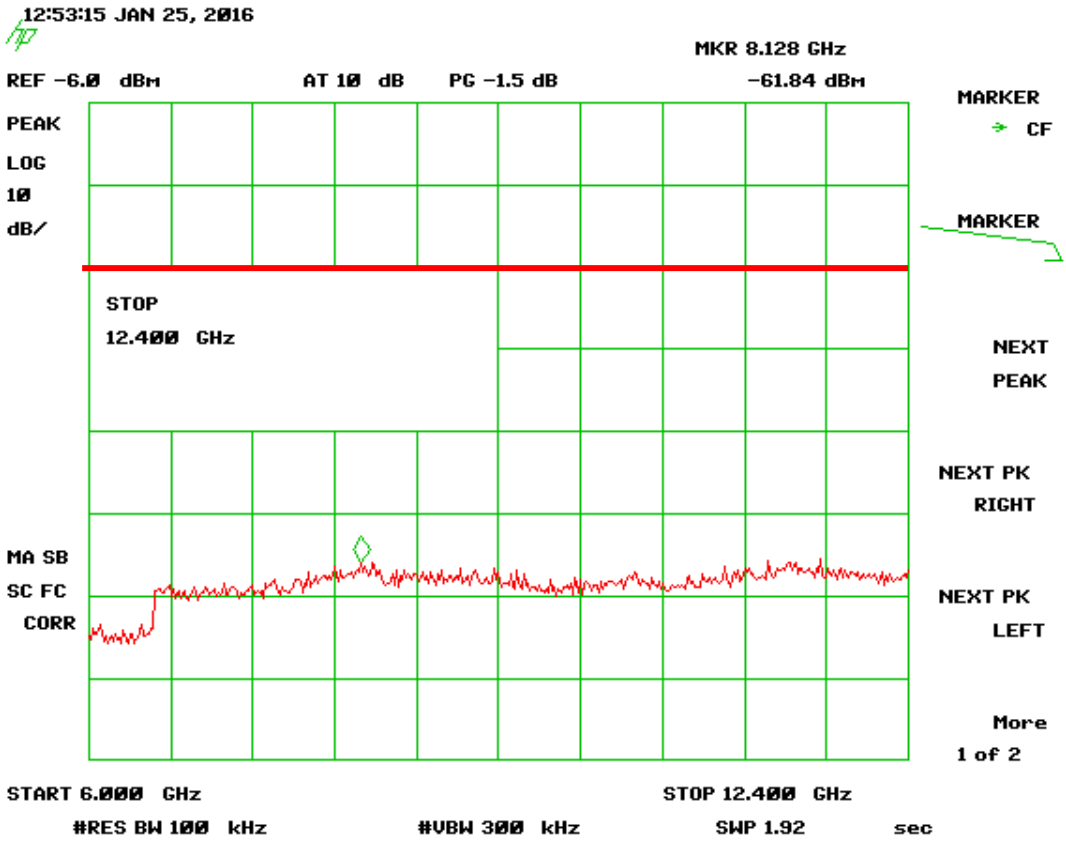


Figure 41. Antenna Conducted Emissions 802.11n Mid, Part 4

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

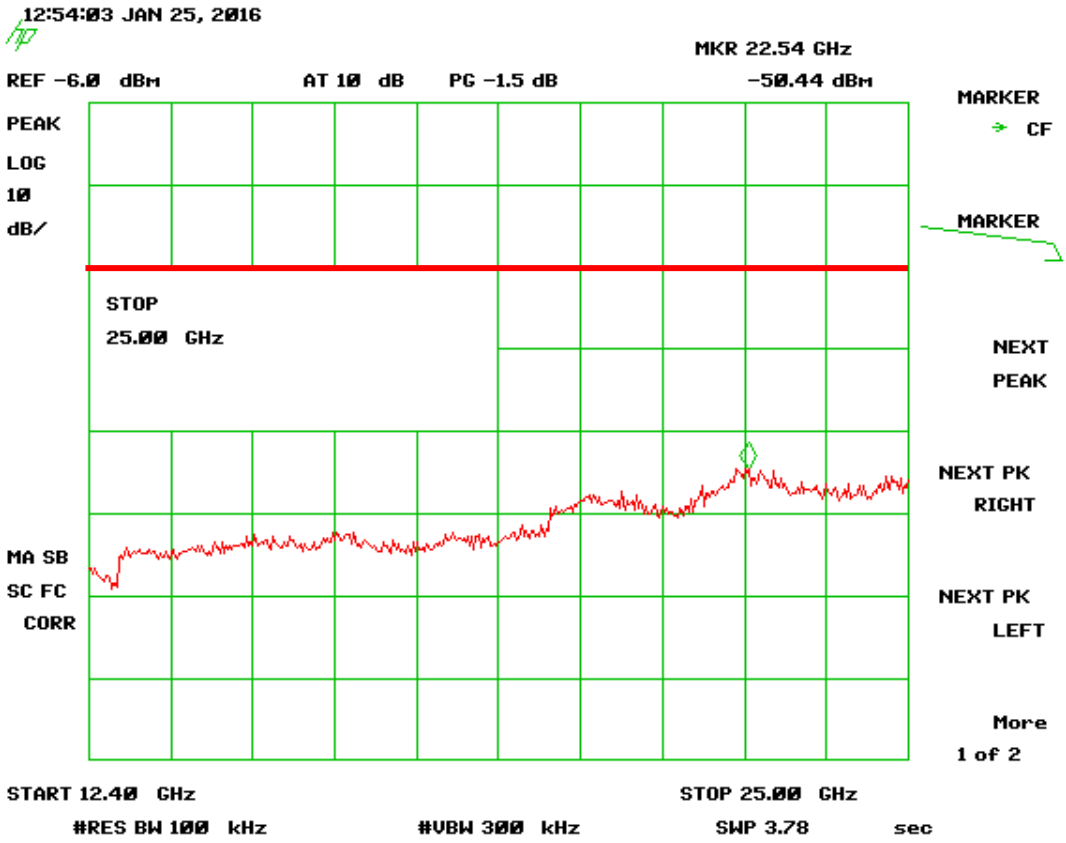


Figure 42. Antenna Conducted Emissions 802.11n Mid, Part 5

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

.

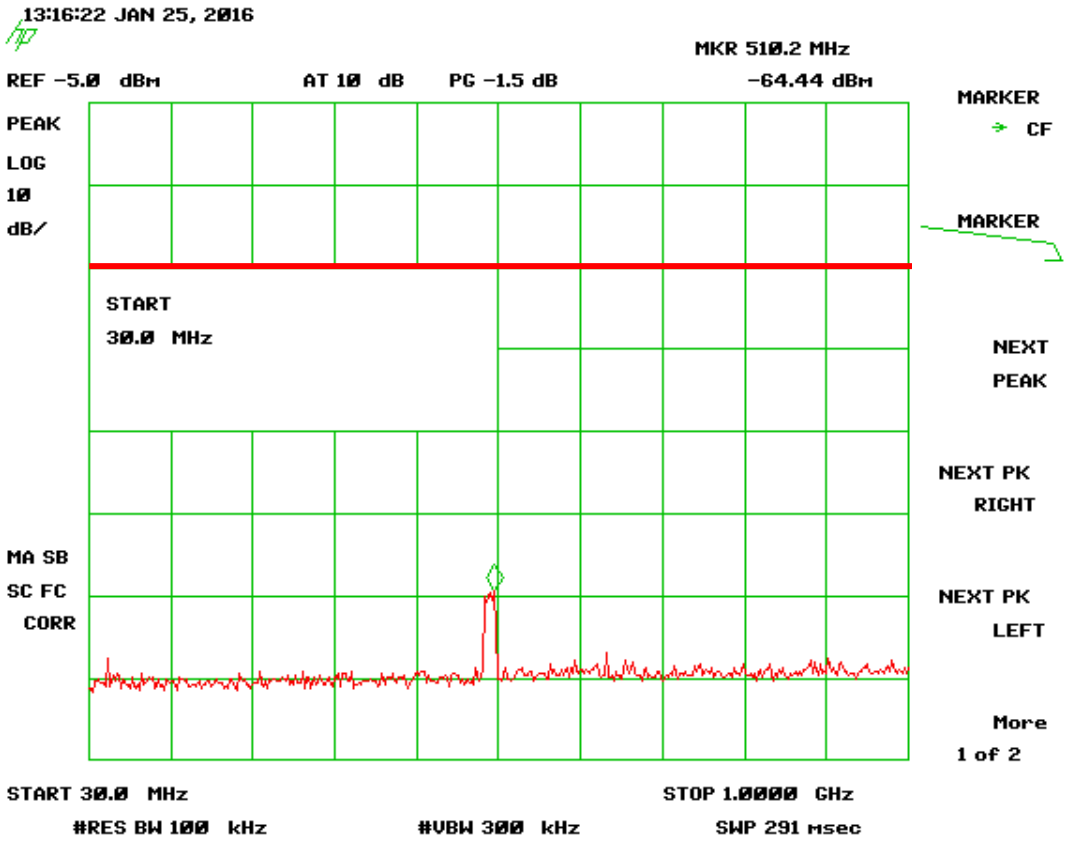


Figure 43. Antenna Conducted Emissions 802.11n High, Part 1

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

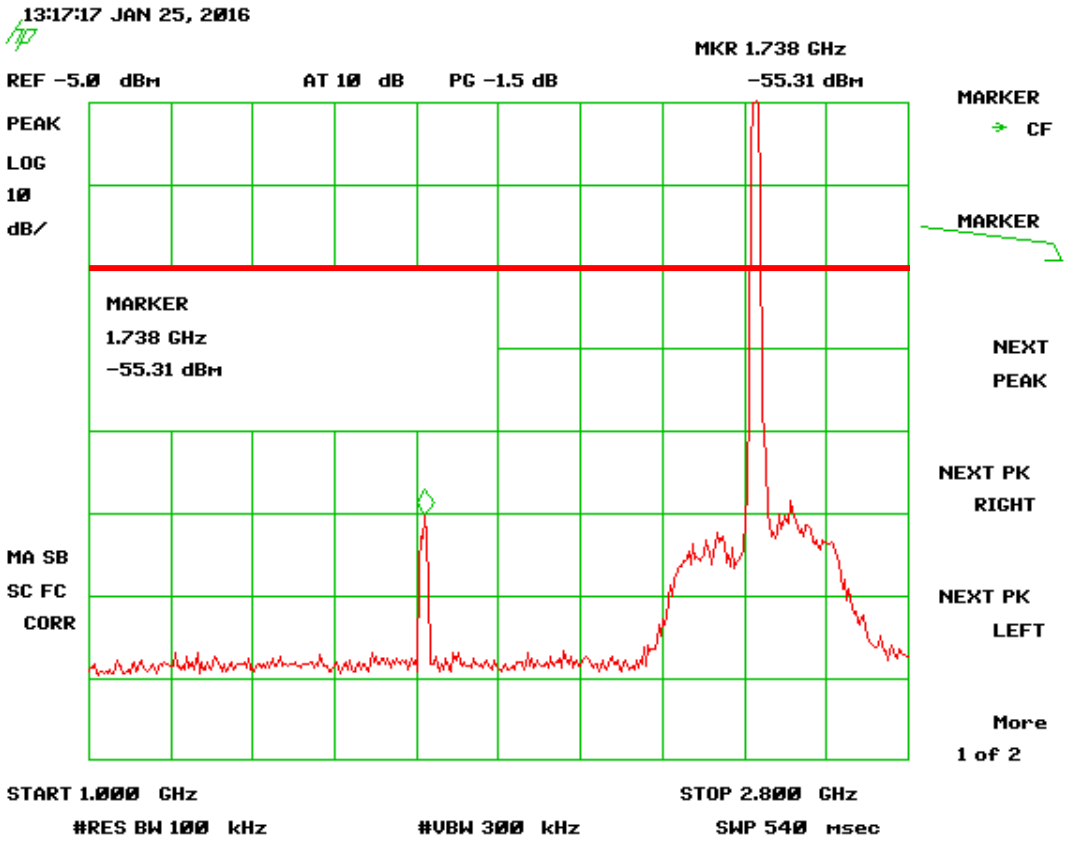


Figure 44. Antenna Conducted Emissions 802.11n High, Part 2

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental. The large emission seen is the fundamental emission.

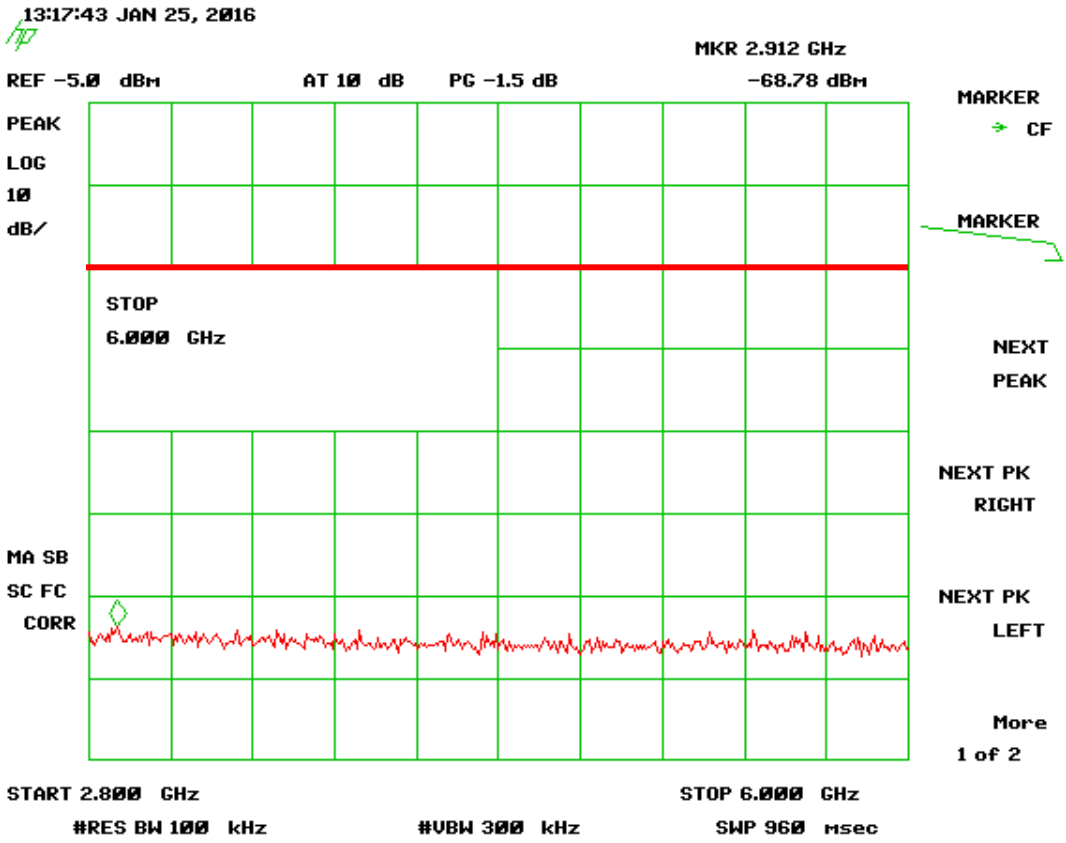


Figure 45. Antenna Conducted Emissions 802.11n High, Part 3

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

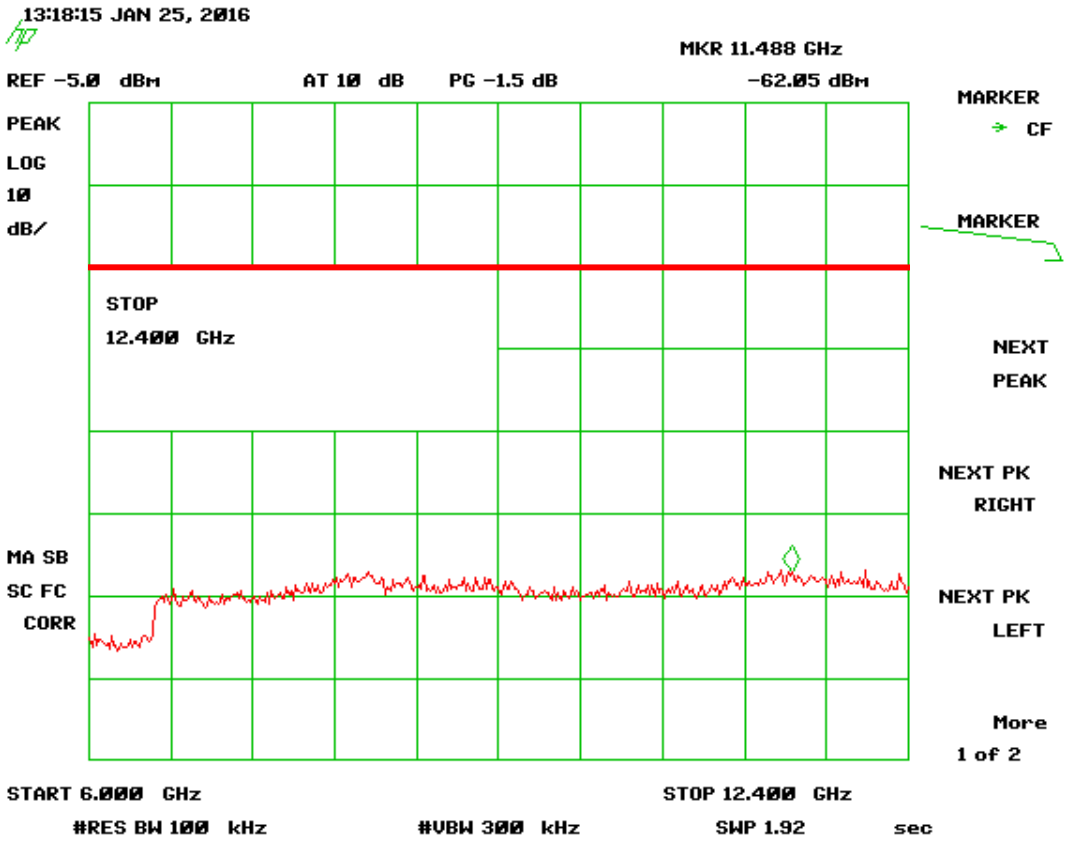


Figure 46. Antenna Conducted Emissions 802.11n High, Part 4

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

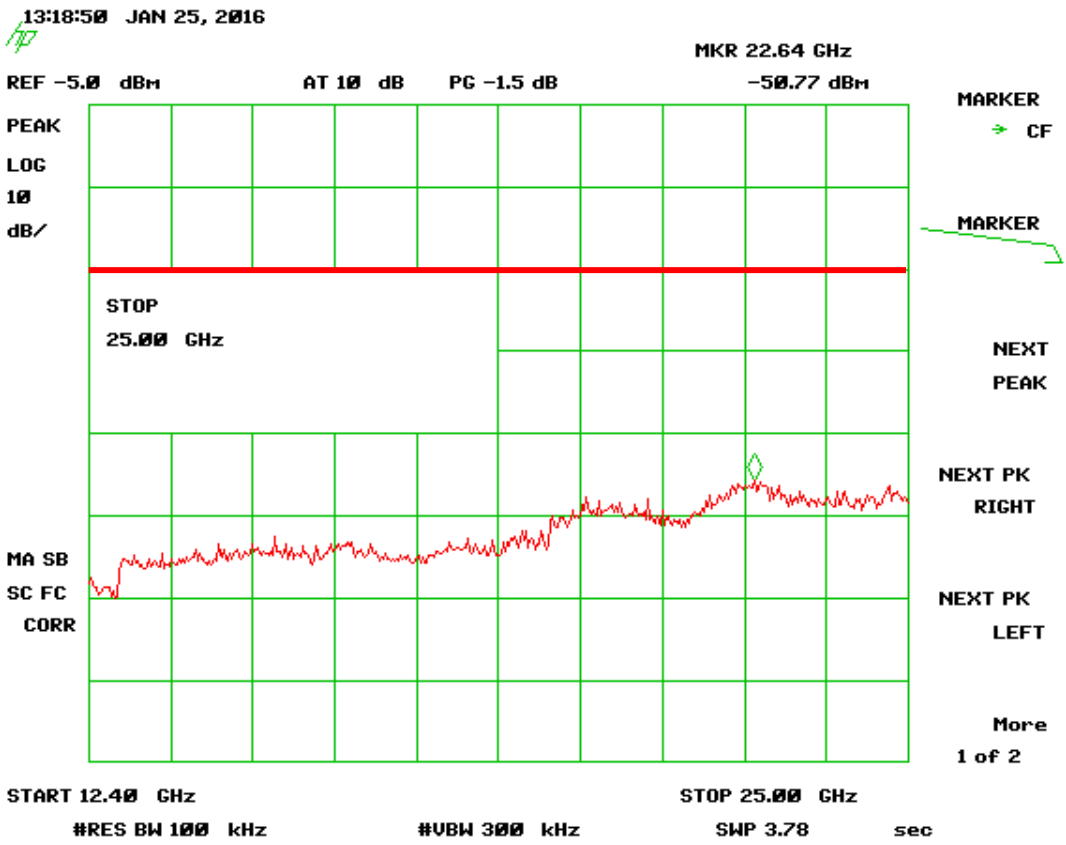


Figure 47. Antenna Conducted Emissions 802.11n High, Part 5

Note: PG offset is used to correct for cable loss and attenuator used. The red line is at least 20 dB down from the measured fundamental.

Table 5. Radiated Emissions 9 kHz to 30 MHz

Test: 15.209, 15.109				**Client:** Soneter, Inc			
Project: 16-0020				**Model:** UFMT-100			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector Mode**
All other detected emissions were 20 dB or more from the applicable limit.							

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculations: N/A

Test Date: January 25, 2016
Tested By
Signature: _____ Name: George Yang

Table 6. 802.11b Peak Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15, Para 15.209, 15.247(d)					**Client:** Soneter, Inc.			
Project: 16-0020					**Model:** UFMT-1000			
Frequency (MHz)	**Test Data (dBuV)**	**Factor (dB)**	**AF+CA -AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector Mode**
Low Channel								
2412.21	64.12	-	31.97	96.09	-	3.0m./HORZ	-	**PK**
4824.38	52.44	-8.50	2.09	46.03	74.0	1.0m./HORZ	28.0	**PK**
7235.88	49.45	-8.50	6.33	47.28	74.0	1.0m./HORZ	26.7	**PK**
9647.37	50.53	-8.50	4.16	46.19	74.0	1.0m./HORZ	27.8	**PK**
Mid Channel								
2437.28	66.23	-	31.97	98.20	-	3.0m./HORZ	-	**PK**
4874.00	53.67	-8.50	2.64	47.81	74.0	1.0m./HORZ	26.2	**PK**
7311.00	51.12	-8.50	6.50	49.12	74.0	1.0m./HORZ	24.9	**PK**
9737.50	49.64	-8.50	4.22	45.36	74.0	1.0m./HORZ	28.6	**PK**
High Channel								
2462.38	66.90	-	31.99	98.89	-	3.0m./HORZ	-	**PK**
4924.25	53.50	-8.50	2.79	47.79	74.0	1.0m./HORZ	26.2	**PK**
7386.13	50.42	-8.50	6.48	48.40	74.0	1.0m./HORZ	25.6	**PK**
9872.87	50.77	-8.50	4.83	47.10	74.0	1.0m./HORZ	26.9	**PK**

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Measurements taken at 1 meter were extrapolated to 3 meters using a factor of -9.5 dB. Band-pass filter used for all harmonic measurements, a factor of 1.0 dB was use to correct for the filter.
4. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4824.38 MHz:

Magnitude of Measured Frequency	52.44	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	2.09	dB/m
Additional Factor (see note 3)	-8.50	dB
Corrected Result	46.03	dBuV/m

Test Date: January 25, 2016
Tested By
Signature: _____ Name: George Yang

Table 7. 802.11b Average Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15, Para 15.209, 15.247(d)					**Client:** Soneter, Inc.			
Project: 16-0020					**Model:** UFMT-1000			
Frequency (MHz)	**Test Data (dBuV)**	**Factor (dB)**	**AF+CA -AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector Mode**
Low Channel								
2412.21	64.12	-13.30	31.97	82.79	-	3.0m./HORZ	-	**PK**
4824.38	52.44	-8.50	2.09	46.03	54.0	1.0m./HORZ	8.0	**PK**
7235.88	49.45	-8.50	6.33	47.28	54.0	1.0m./HORZ	6.7	**PK**
9647.37	50.53	-8.50	4.16	46.19	54.0	1.0m./HORZ	7.8	**PK**
Mid Channel								
2437.28	66.23	-13.30	31.97	84.90	-	3.0m./HORZ	-	**PK**
4874.00	53.67	-8.50	2.64	47.81	54.0	1.0m./HORZ	6.2	**PK**
7311.00	51.12	-8.50	6.50	49.12	54.0	1.0m./HORZ	4.9	**PK**
9737.50	49.64	-8.50	4.22	45.36	54.0	1.0m./HORZ	8.6	**PK**
High Channel								
2462.38	66.90	-13.30	31.99	85.59	-	3.0m./HORZ	-	**PK**
4924.25	53.50	-8.50	2.79	47.79	54.0	1.0m./HORZ	6.2	**PK**
7386.13	50.42	-8.50	6.48	48.40	54.0	1.0m./HORZ	5.6	**PK**
9872.87	50.77	-8.50	4.83	47.10	54.0	1.0m./HORZ	6.9	**PK**

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Measurements taken at 1 meter were extrapolated to 3 meters using a factor of -9.5 dB. Band-pass filter used for all harmonic measurements, a factor of 1.0 dB was use to correct for the filter.
4. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. For fundamental measurements the duty cycle factor was used to correct for AVG measurements. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.
5. The Duty cycle correction factor was applied to the Fundamental Emission, but not the Harmonic Emissions.

Sample Calculation at 4824.38 MHz:

Magnitude of Measured Frequency	52.44	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	2.09	dB/m
Additional Factor (see note 3)	-8.50	dB
Corrected Result	46.03	dBuV/m

Test Date: January 25, 2016
Tested By
Signature: _____ Name: George Yang

Table 8. 802.11g Peak Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15, Para 15.209, 15.247(d)					**Client:** Soneter, Inc.			
Project: 16-0020					**Model:** UFMT-1000			
Frequency (MHz)	**Test Data (dBuV)**	**Factor (dB)**	**AF+CA -AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector Mode**
Low Channel								
2416.63	62.13	-	31.97	94.10	-	3.0m./HORZ	-	**PK**
4820.75	47.46	-8.50	2.09	41.05	74.0	1.0m./HORZ	33.0	**PK**
Mid Channel								
2433.38	62.90	-	31.97	94.87	-	3.0m./HORZ	-	**PK**
4874.13	47.50	-8.50	2.64	41.64	74.0	1.0m./HORZ	32.4	**PK**
High Channel								
2468.00	62.28	-	31.99	94.27	-	3.0m./HORZ	-	**PK**
4925.75	46.25	-8.50	2.86	40.61	74.0	1.0m./HORZ	33.4	**PK**

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Measurements taken at 1 meter were extrapolated to 3 meters using a factor of -9.5 dB. Band-pass filter used for all harmonic measurements, a factor of 1.0 dB was use to correct for the filter.
4. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4820.75 MHz:

Magnitude of Measured Frequency	47.46	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	2.09	dB/m
Additional Factor (see note 3)	-8.50	dB
Corrected Result	41.05	dBuV/m

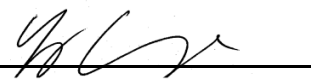
Test Date: January 25, 2016
Tested By
Signature:  Name: George Yang

Table 9. 802.11g Average Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15, Para 15.209, 15.247(d)					**Client:** Soneter, Inc.			
Project: 16-0020					**Model:** UFMT-1000			
Frequency (MHz)	**Test Data (dBuV)**	**Factor (dB)**	**AF+CA -AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector Mode**
Low Channel								
2416.63	62.13	-13.30	31.97	80.80	-	3.0m./HORZ	-	**PK**
4820.75	47.46	-8.50	2.09	41.05	54.0	1.0m./HORZ	13.0	**PK**
Mid Channel								
2433.38	62.90	-13.30	31.97	81.57	-	3.0m./HORZ	-	**PK**
4874.13	47.50	-8.50	2.64	41.64	54.0	1.0m./HORZ	12.4	**PK**
High Channel								
2468.00	62.28	-13.30	31.99	80.97	-	3.0m./HORZ	-	**PK**
4925.75	46.25	-8.50	2.86	40.61	54.0	1.0m./HORZ	13.4	**PK**

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Measurements taken at 1 meter were extrapolated to 3 meters using a factor of -9.5 dB. Band-pass filter used for all harmonic measurements, a factor of 1.0 dB was use to correct for the filter.
4. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. For fundamental measurements the duty cycle factor was used to correct for AVG measurements. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.
5. The Duty cycle correction factor was applied to the Fundamental Emission, but not the Harmonic Emissions.

Sample Calculation at 4820.75 MHz:

Magnitude of Measured Frequency	47.46	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	2.09	dB/m
Additional Factor (see note 3)	-8.50	dB
Corrected Result	41.05	dBuV/m

Test Date: January 25, 2016
Tested By
Signature: _____ Name: George Yang

Table 10. 802.11n Peak Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15, Para 15.209, 15.247(d)					**Client:** Soneter, Inc.			
Project: 16-0020					**Model:** UFMT-1000			
Frequency (MHz)	**Test Data (dBuV)**	**Factor (dB)**	**AF+CA -AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector Mode**
Low Channel								
2415.63	59.30	-	31.97	91.27	-	3.0m./HORZ	-	**PK**
4822.25	42.00	-8.50	2.09	35.59	74.0	1.0m./HORZ	38.4	**PK**
Mid Channel								
2430.75	61.45	-	31.97	93.42	-	3.0m./HORZ	-	**PK**
4869.60	46.30	-8.50	2.64	40.44	74.0	1.0m./HORZ	33.6	**PK**
High Channel								
2462.88	61.17	-	31.99	93.16	-	3.0m./HORZ	-	**PK**
4923.00	44.40	-8.50	2.79	38.69	74.0	1.0m./HORZ	35.3	**PK**

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Measurements taken at 1 meter were extrapolated to 3 meters using a factor of -9.5 dB. Band-pass filter used for all harmonic measurements, a factor of 1.0 dB was use to correct for the filter.
4. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 4822.25 MHz:

Magnitude of Measured Frequency	42.00	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	2.09	dB/m
Additional Factor (see note 3)	-8.50	dB
Corrected Result	35.59	dBuV/m

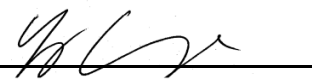
Test Date: January 25, 2016
Tested By
Signature:  Name: George Yang

Table 11. 802.11n Average Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15, Para 15.209, 15.247(d)					**Client:** Soneter, Inc.			
Project: 16-0020					**Model:** UFMT-1000			
Frequency (MHz)	**Test Data (dBuV)**	**Factor (dB)**	**AF+CA -AMP (dB/m)**	**Results (dBuV/m)**	**Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector Mode**
Low Channel								
2415.63	59.30	-13.30	31.97	77.97	-	3.0m./HORZ	-	**PK**
4822.25	42.00	-8.50	2.09	35.59	54.0	1.0m./HORZ	18.4	**PK**
Mid Channel								
2430.75	61.45	-13.30	31.97	80.12	-	3.0m./HORZ	-	**PK**
4869.60	46.30	-8.50	2.64	40.44	54.0	1.0m./HORZ	13.6	**PK**
High Channel								
2462.88	61.17	-13.30	31.99	79.86	-	3.0m./HORZ	-	**PK**
4923.00	44.40	-8.50	2.79	38.69	54.0	1.0m./HORZ	15.3	**PK**

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Measurements taken at 1 meter were extrapolated to 3 meters using a factor of -9.5 dB. Band-pass filter used for all harmonic measurements, a factor of 1.0 dB was use to correct for the filter.
4. The EUT was placed in three orthogonal positions, tested while broadcasting from each antenna, and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. For fundamental measurements the duty cycle factor was used to correct for AVG measurements. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.
5. The Duty cycle correction factor was applied to the Fundamental Emission, but not the Harmonic Emissions.

Sample Calculation at 4822.25 MHz:

Magnitude of Measured Frequency	42.00	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	2.09	dB/m
Additional Factor	-8.50	dB
Corrected Result	35.59	dBuV/m

Test Date: January 25, 2016
Tested By
Signature: Name: George Yang

2.11 Band Edge Measurements – (CFR 15.247 (d))

Band Edge measurements are made following the guidelines in FCC KDB Publication No. 558074 V03r04 and ANSI C63.10-2013 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation.

The measurements are performed to demonstrate compliance with the requirement of 15.247(d) that all emissions outside of the band edges be attenuated by at least 20 dB when compared to its highest in-band value (contained in a 100 kHz band).

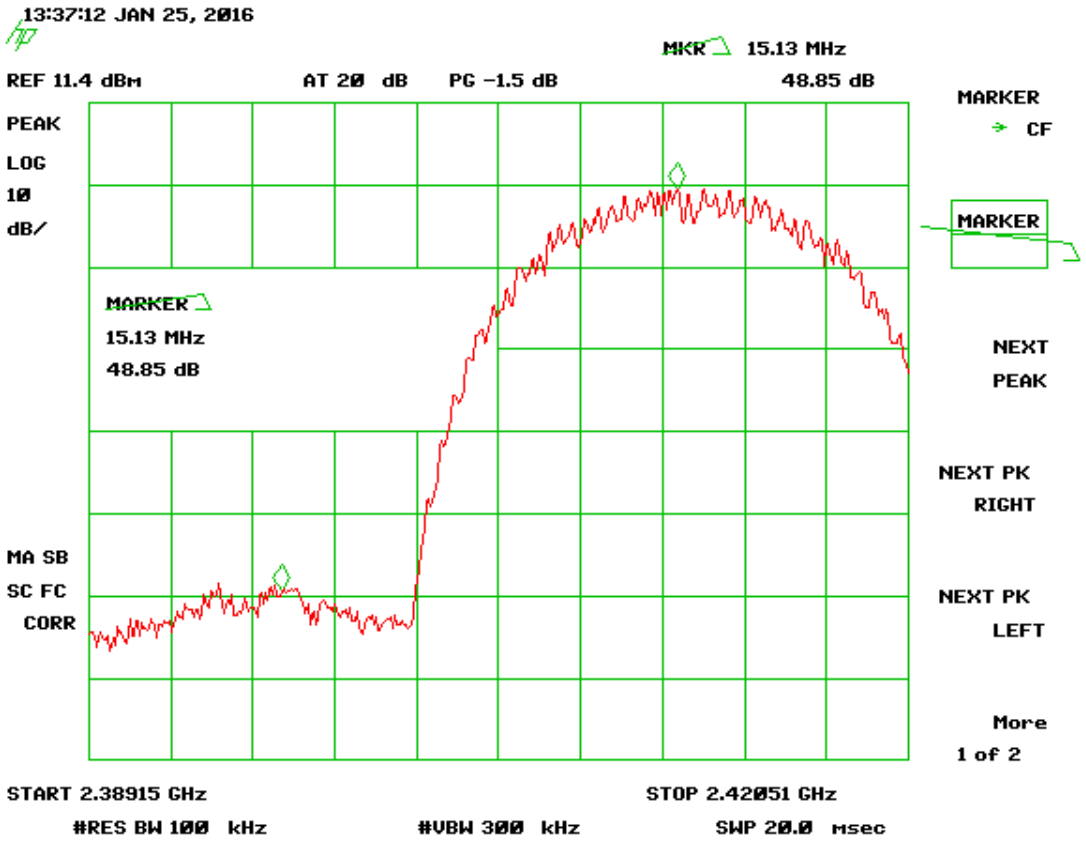


Figure 48. Band Edge Compliance, 802.11b Low Channel

Calculation of worst case lower band edge measurement:

Measured Delta (from Figure 48)	48.85	dB
Band Edge Limit	20.00	dB
Margin	28.85	dB

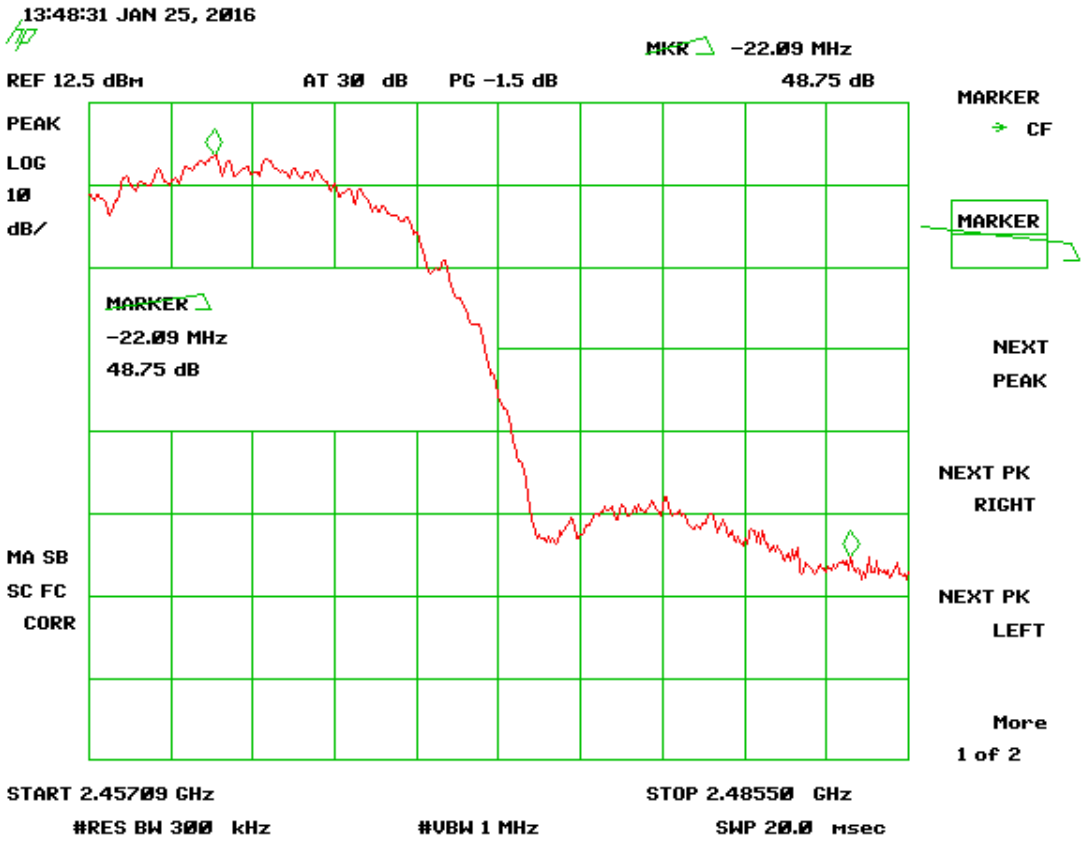


Figure 49. Band Edge Compliance, 802.11b High Channel

Calculation of worst case upper band edge measurement:

Measured Delta (From Figure 49)	48.75	dB
Band Edge Limit	20.00	dB
Margin	28.75	dB

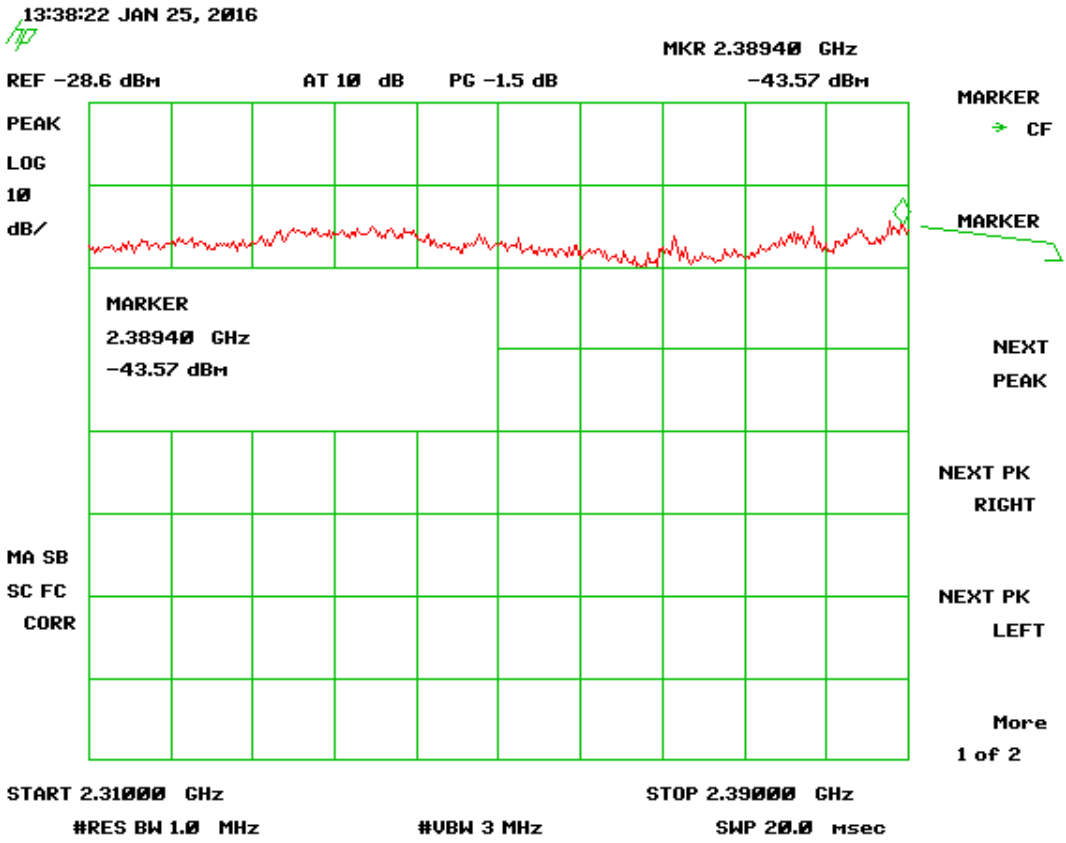


Figure 50. Radiated Restricted band 2310 MHz to 2390 MHz, 802.11b – Peak

Calculation of worst case restricted band 2310 MHz to 2390 MHz , 802.11b – Peak

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 50)	-43.57	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-39.76	dB

EIRP to Electric Field Strength conversion:

E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -39.76 – 20log (3) +104.8
=-39.76 – 9.54+104.8
= 55.50 dBuV/m at 3 meters

Margin Calculation:

Limit	74.00	dBuV/m
-Electric Field Strength (E)	55.50	dBuV/m
Margin	18.50	dB

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

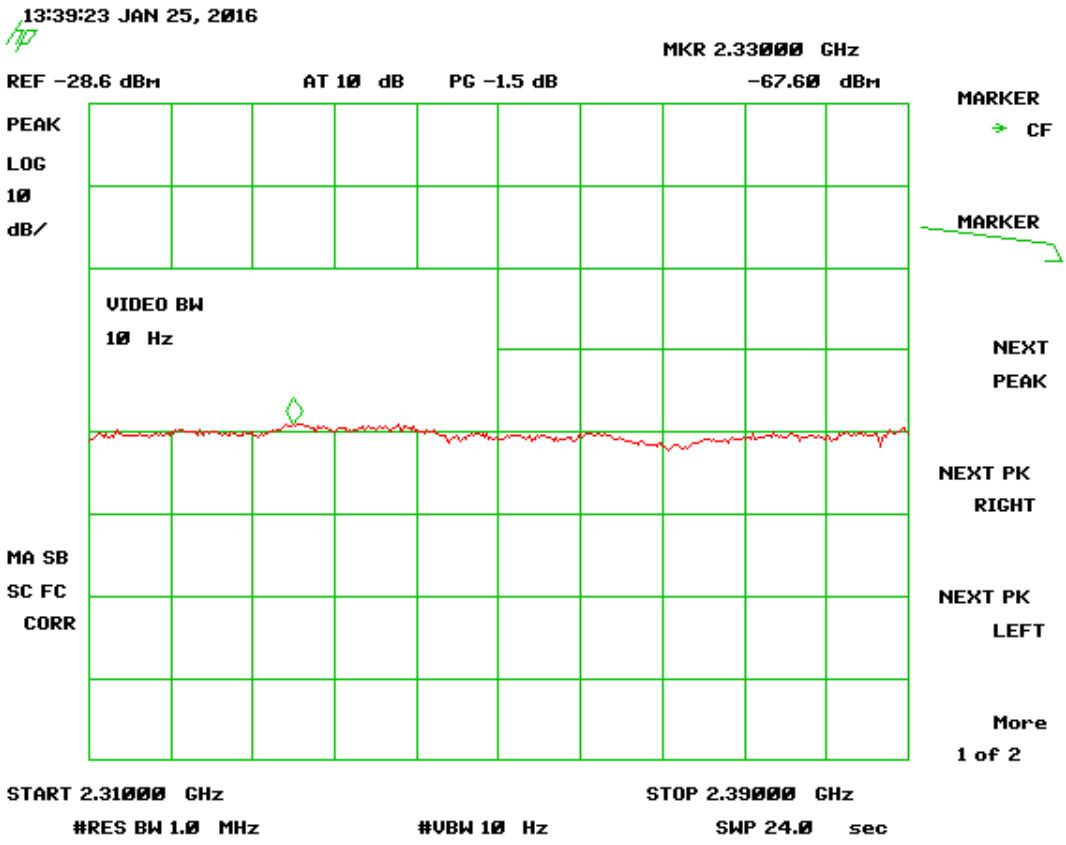


Figure 51. Radiated Restricted band 2310 MHz to 2390 MHz, 802.11b – Average

Calculation of worst case restricted band 2310 MHz to 2390 MHz , 802.11b – Average

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 51)	-67.60	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-63.79	dB

EIRP to Electric Field Strength conversion:

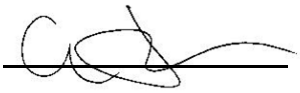
E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -63.79 – 20log (3) +104.8
=-63.79-9.54+104.8
= 31.47 dBuV/m at 3 meters

Margin Calculation:

Limit	54.00	dBuV/m
-Electric Field Strength (E)	31.47	dBuV/m
Margin	22.53	dB

Test Date: January 25, 2016
Tested By
Signature:  Name: Carrie Ingram

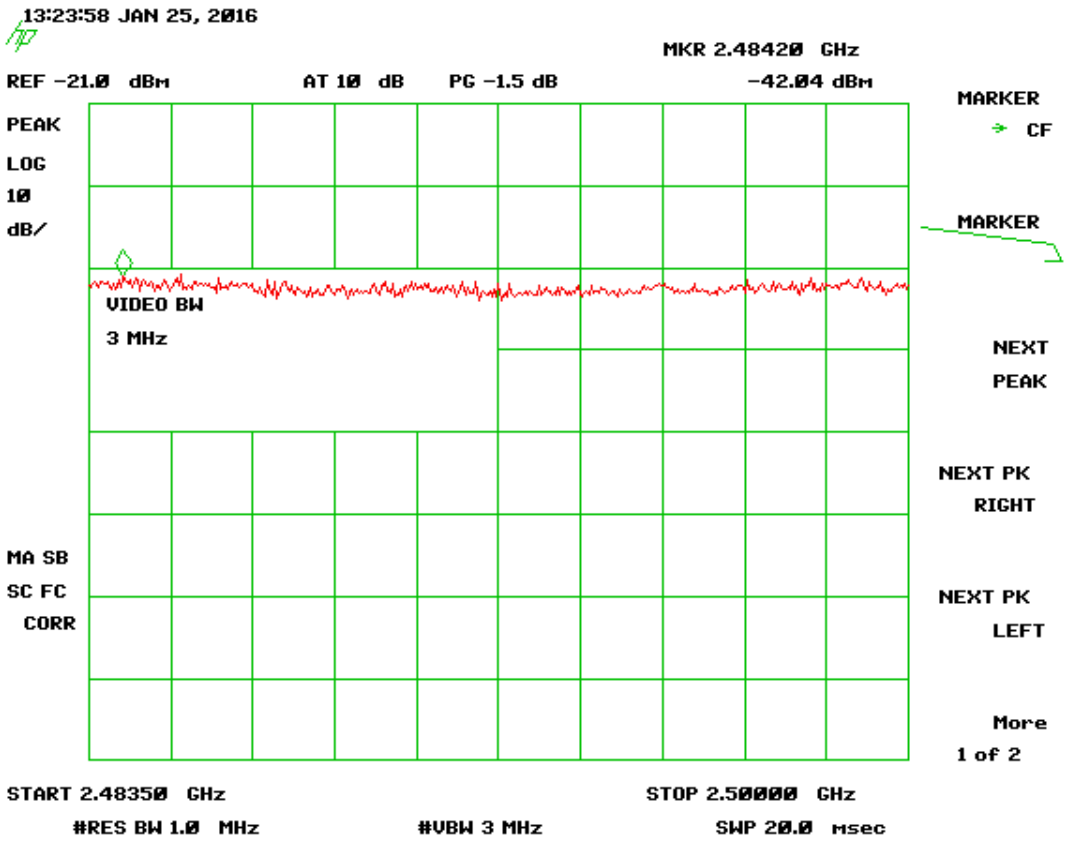


Figure 52. Radiated Restricted band 2483.5 MHz to 2500 MHz, 802.11b – Peak

Calculation of worst case restricted band 2483.5 MHz to 2500 MHz , 802.11b – Peak

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 52)	-42.04	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-38.23	dB

EIRP to Electric Field Strength conversion:

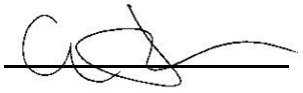
E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -38.23 – 20log (3) +104.8
=-38.23-9.54+104.8
= 57.03 dBuV/m at 3 meters

Margin Calculation:

Limit	74.00	dBuV/m
-Electric Field Strength (E)	57.03	dBuV/m
Margin	16.97	dB

Test Date: January 25, 2016
Tested By
Signature:  Name: Carrie Ingram

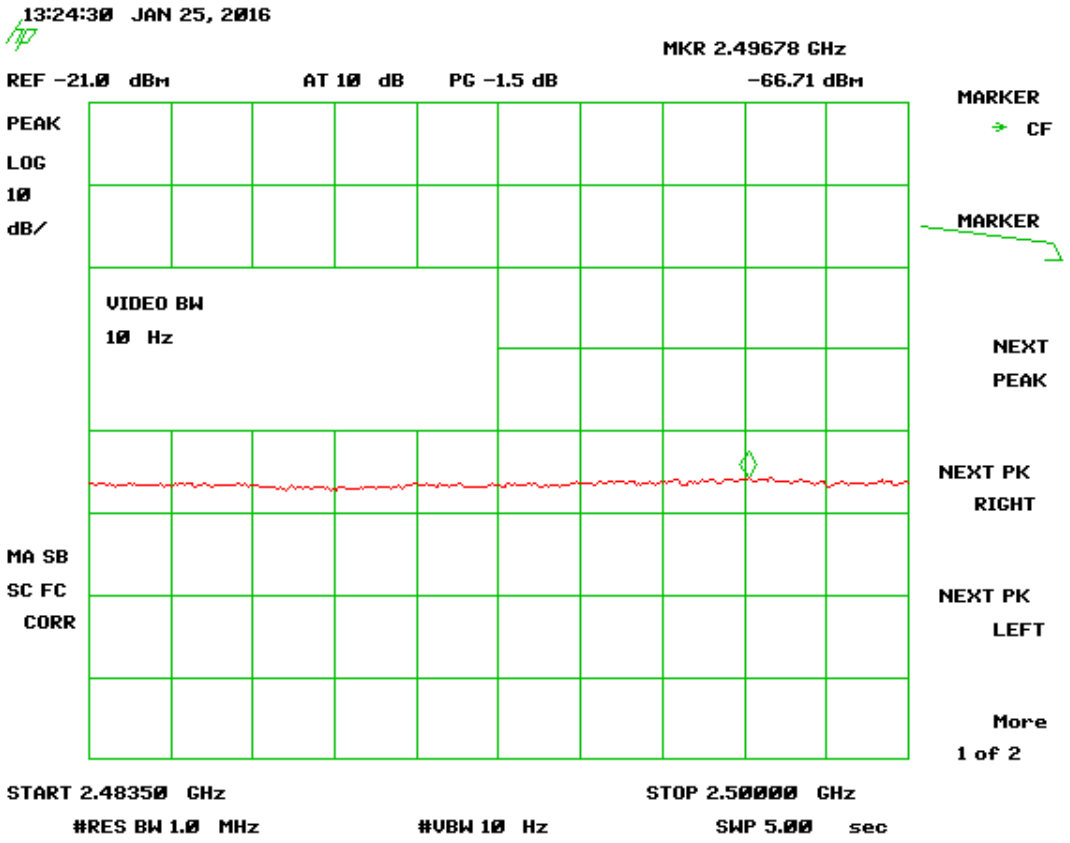


Figure 53. Radiated Restricted band 2483.5 MHz to 2500 MHz, 802.11b – Average

Calculation of worst case restricted band 2483.5 MHz to 2500 MHz , 802.11b – Average

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 53)	-66.71	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-62.90	dB

EIRP to Electric Field Strength conversion:

E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -62.90 – 20log (3) +104.8
=-62.90 – 9.54 +104.8
= 32.36 dBuV/m at 3 meters

Margin Calculation:

Limit	54.00	dBuV/m
-Electric Field Strength (E)	32.36	dBuV/m
Margin	21.64	dB

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

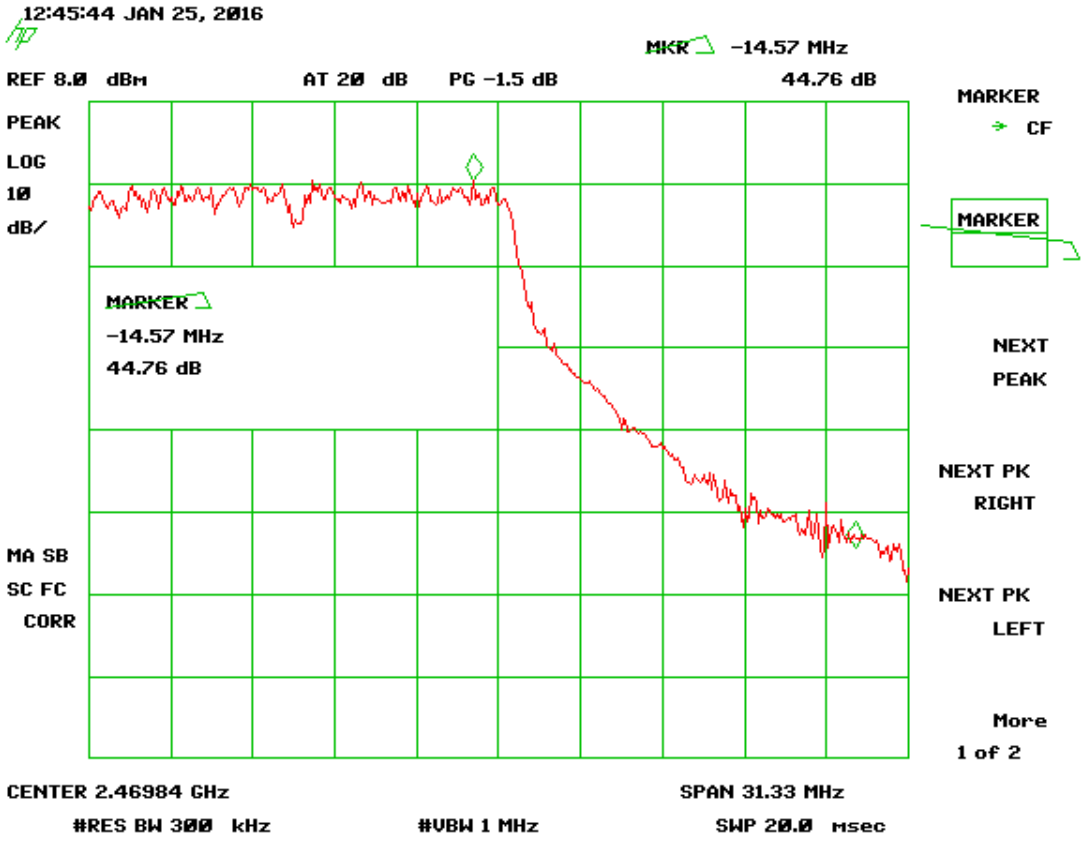


Figure 54. Band Edge Compliance, 802.11g High Channel

Calculation of worst case lower band edge measurement:

Measured Delta (from Figure 54)	44.76	dB
Band Edge Limit	20.00	dB
Margin	24.76	dB

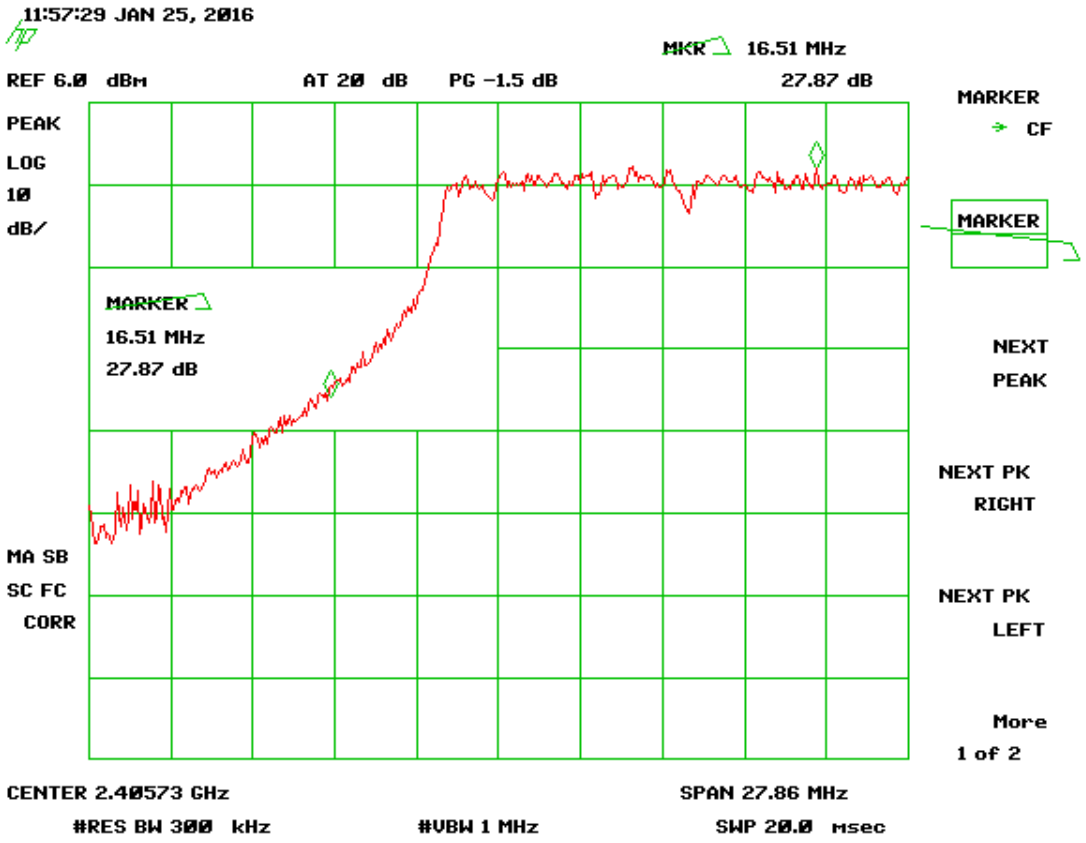


Figure 55. Band Edge Compliance, 802.11g Low Channel

Calculation of worst case upper band edge measurement:

Measured Delta (From Figure 55)	27.87	dB
Band Edge Limit	20.00	dB
Margin	7.87	dB

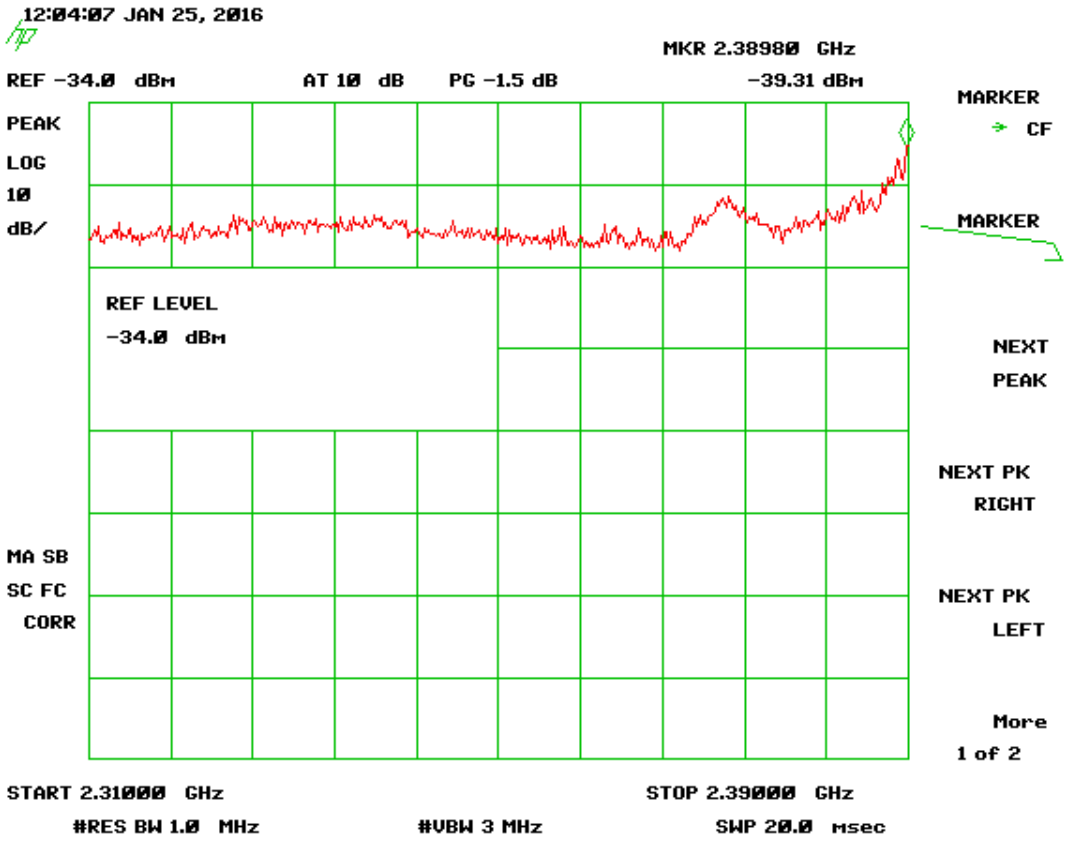


Figure 56. Radiated Restricted band 2310 MHz to 2390 MHz, 802.11g – Peak

Calculation of worst case restricted band 2310 MHz to 2390 MHz , 802.11g – Peak

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 56)	-39.31	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-35.50	dB

EIRP to Electric Field Strength conversion:

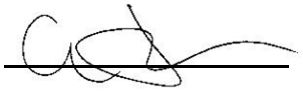
E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -35.50 – 20log (3) +104.8
=-35.50 – 9.54+104.8
= 59.76 dBuV/m at 3 meters

Margin Calculation:

Limit	74.00	dBuV/m
-Electric Field Strength (E)	59.76	dBuV/m
Margin	14.24	dB

Test Date: January 25, 2016
Tested By
Signature:  Name: Carrie Ingram

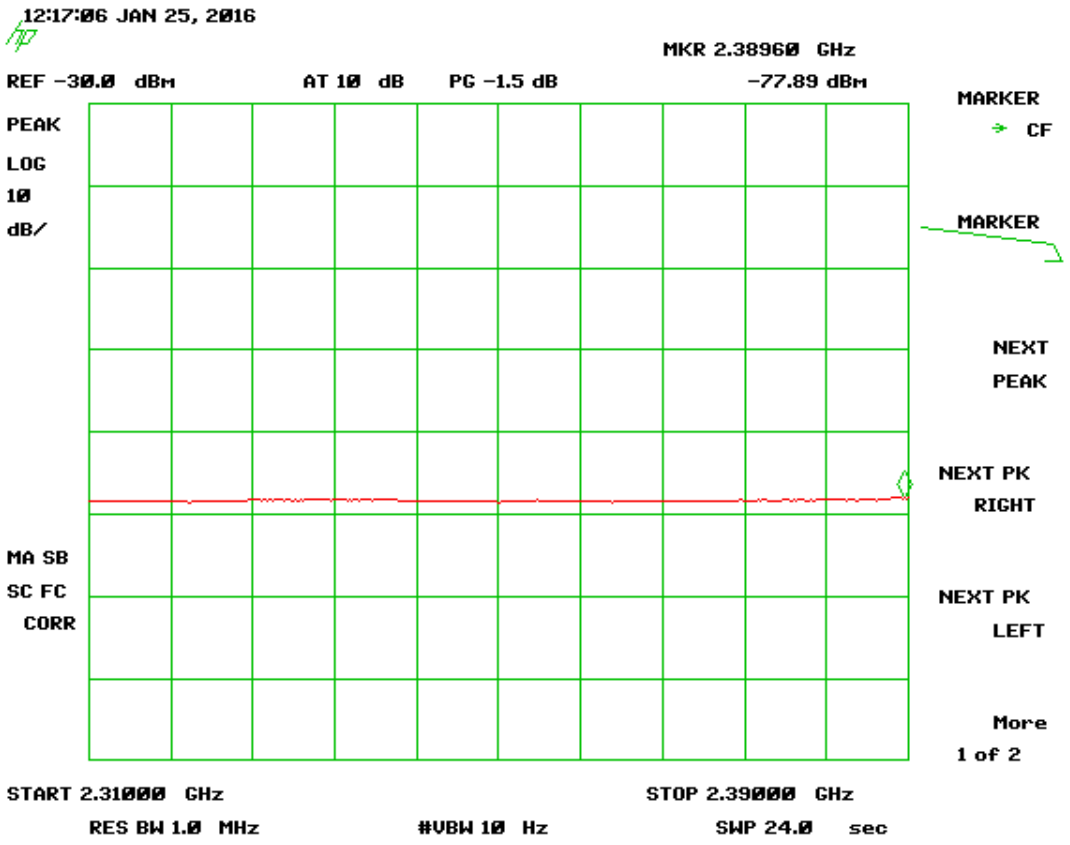


Figure 57. Radiated Restricted band 2310 MHz to 2390 MHz, 802.11g – Average

Calculation of worst case restricted band 2310 MHz to 2390 MHz , 802.11g – Average

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 57)	-77.89	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-74.08	dB

EIRP to Electric Field Strength conversion:

E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -74.08 – 20log (3) +104.8
=-74.08-9.54+104.8
= 21.18 dBuV/m at 3 meters

Margin Calculation:

Limit	54.00	dBuV/m
-Electric Field Strength (E)	21.18	dBuV/m
Margin	32.82	dB

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

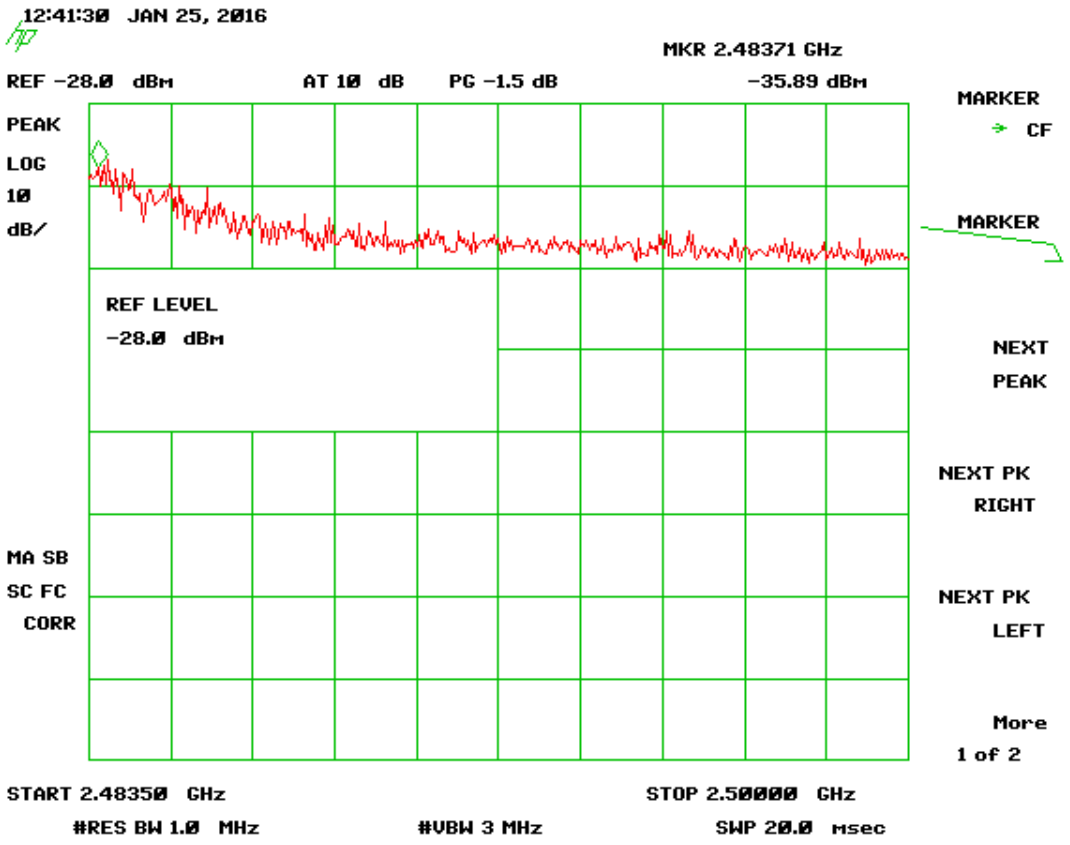


Figure 58. Radiated Restricted band 2483.5 MHz to 2500 MHz, 802.11g – Peak

Calculation of worst case restricted band 2483.5 MHz to 2500 MHz , 802.11g – Peak

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 58)	-35.89	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-32.08	dB

EIRP to Electric Field Strength conversion:

E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -32.08 – 20log (3) +104.8
=-32.08-9.54+104.8
= 63.18 dBuV/m at 3 meters

Margin Calculation:

Limit	74.00	dBuV/m
-Electric Field Strength (E)	63.18	dBuV/m
Margin	10.82	dB

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

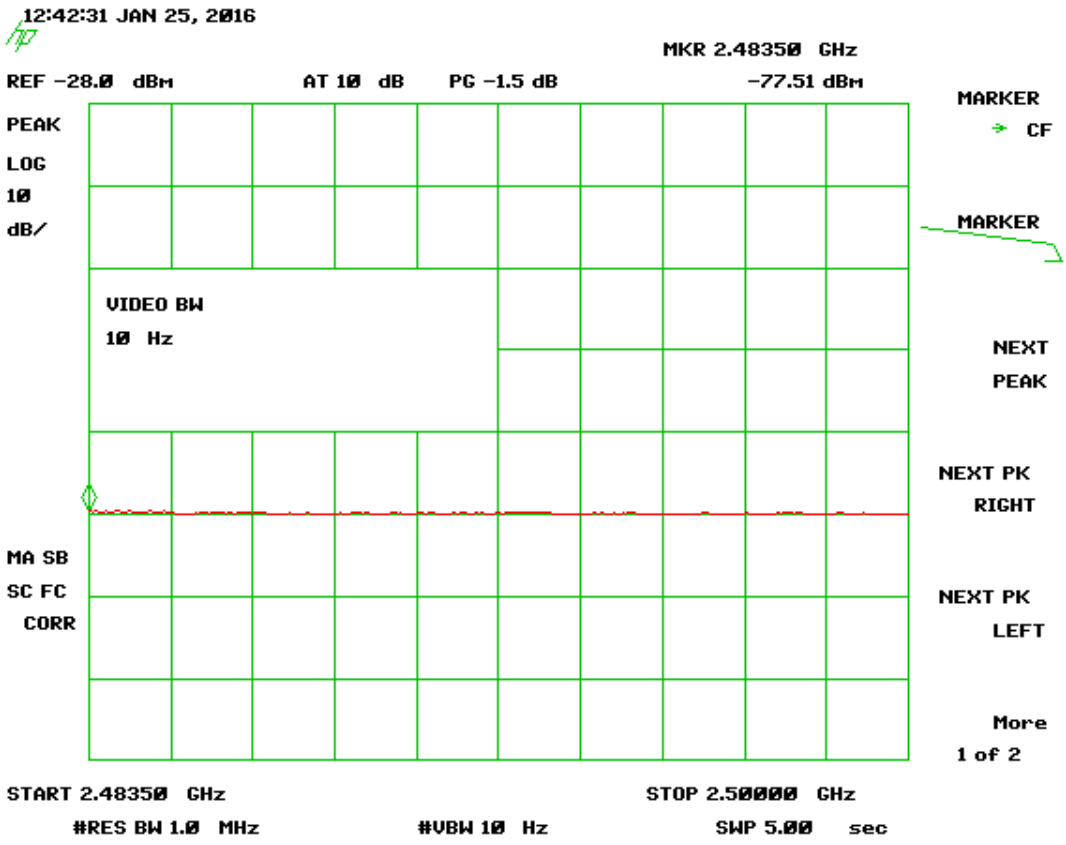


Figure 59. Radiated Restricted band 2483.5 MHz to 2500 MHz, 802.11g – Average

Calculation of worst case restricted band 2483.5 MHz to 2500 MHz , 802.11g – Average

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 59)	-77.51	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-73.70	dB

EIRP to Electric Field Strength conversion:

E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -73.70 – 20log (3) +104.8
=-73.70-9.54+104.8
= 21.56 dBuV/m at 3 meters

Margin Calculation:

Limit	54.00	dBuV/m
-Electric Field Strength (E)	21.56	dBuV/m
Margin	32.44	dB

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

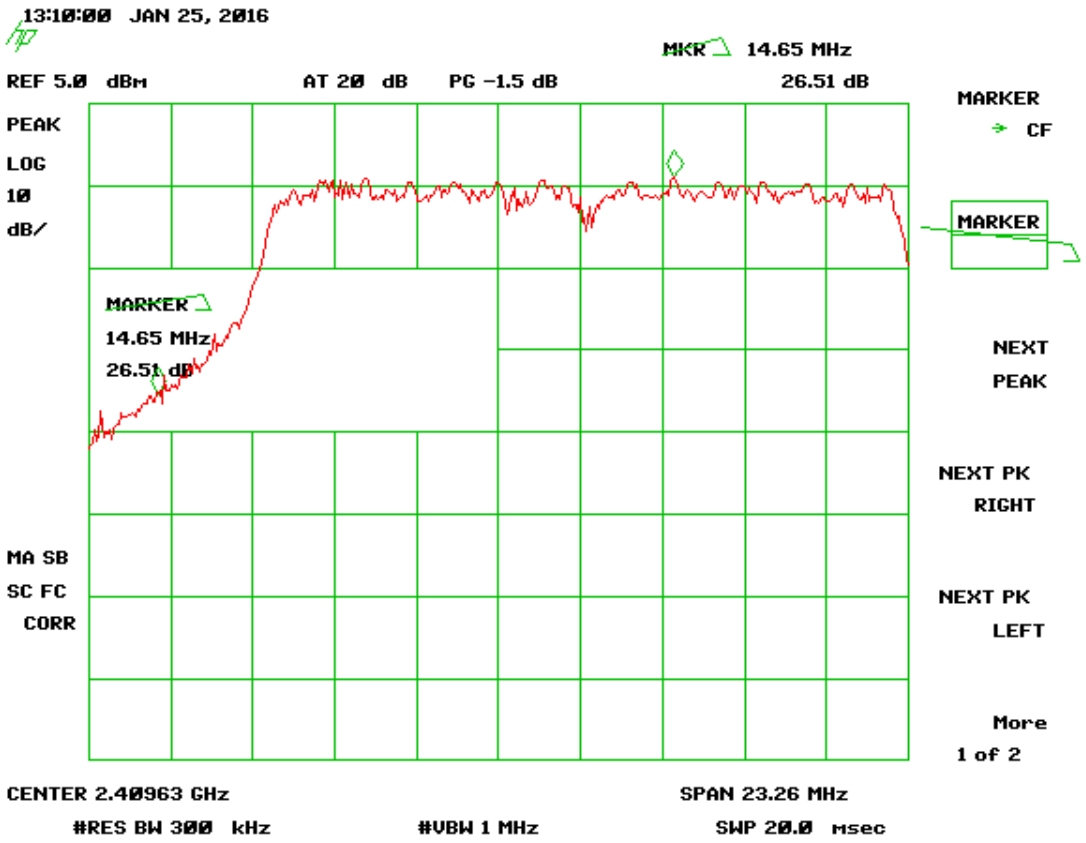


Figure 60. Band Edge Compliance, 802.11n Low Channel

Calculation of worst case lower band edge measurement:

Measured Delta (from Figure 60)	26.51	dB
Band Edge Limit	20.00	dB
Margin	6.51	dB

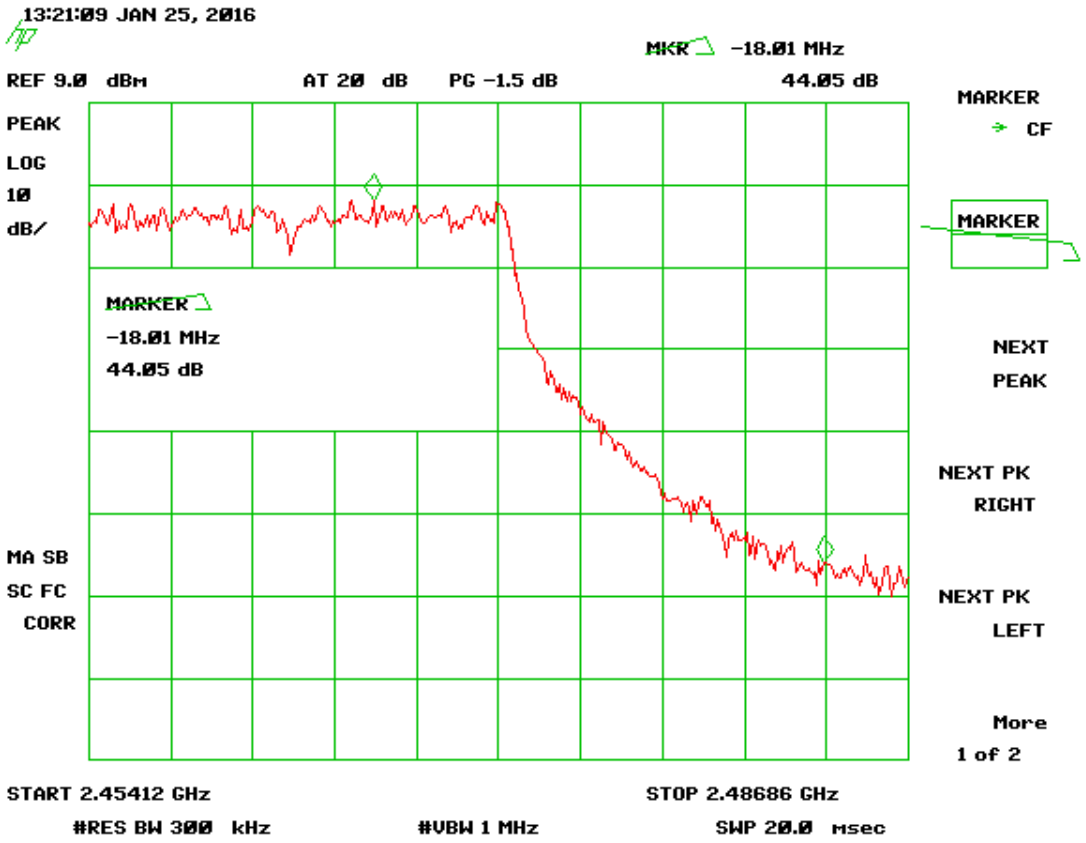


Figure 61. Band Edge Compliance, 802.11n High Channel

Calculation of worst case upper band edge measurement:

Measured Delta (From Figure 61)	44.05	dB
Band Edge Limit	20.00	dB
Margin	24.05	dB

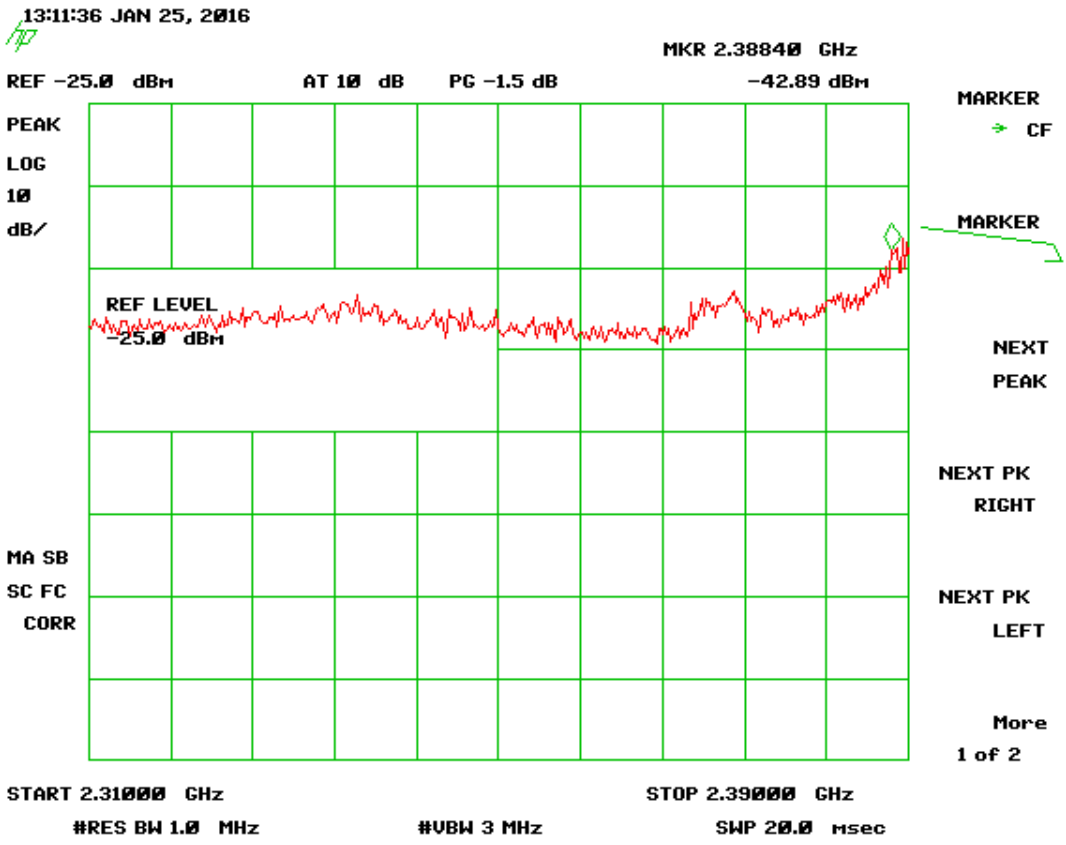


Figure 62. Radiated Restricted band 2310 MHz to 2390 MHz, 802.11n – Peak

Calculation of worst case restricted band 2310 MHz to 2390 MHz , 802.11n – Peak

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 62)	-42.89	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-39.08	dB

EIRP to Electric Field Strength conversion:

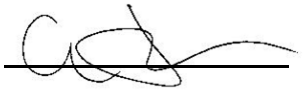
E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -39.08 – 20log (3) +104.8
=-39.08 – 9.54+104.8
= 56.18 dBuV/m at 3 meters

Margin Calculation:

Limit	74.00	dBuV/m
-Electric Field Strength (E)	56.18	dBuV/m
Margin	17.82	dB

Test Date: January 25, 2016
Tested By
Signature:  Name: Carrie Ingram

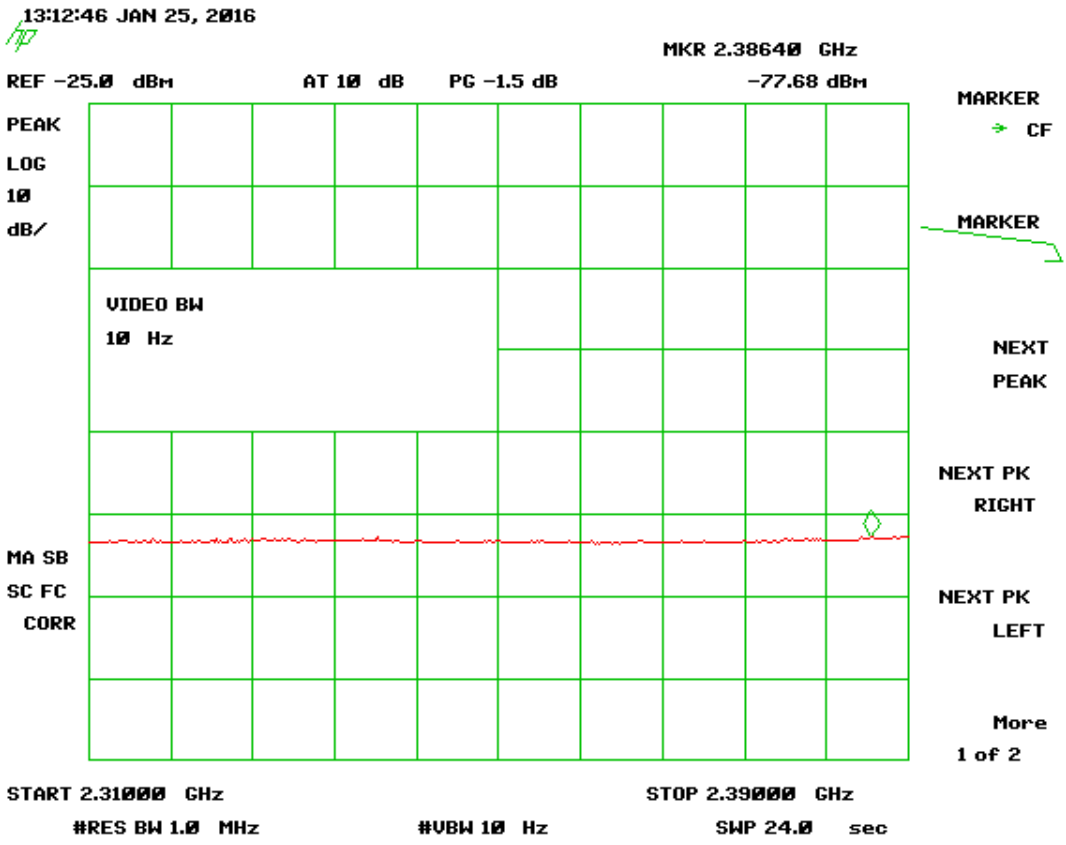


Figure 63. Radiated Restricted band 2310 MHz to 2390 MHz, 802.11n – Average

Calculation of worst case restricted band 2310 MHz to 2390 MHz , 802.11n – Average

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 63)	-77.68	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-73.87	dB

EIRP to Electric Field Strength conversion:

E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -73.87 – 20log (3) +104.8
=-73.87-9.54+104.8
= 21.39 dBuV/m at 3 meters

Margin Calculation:

Limit	54.00	dBuV/m
-Electric Field Strength (E)	21.39	dBuV/m
Margin	32.61	dB

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

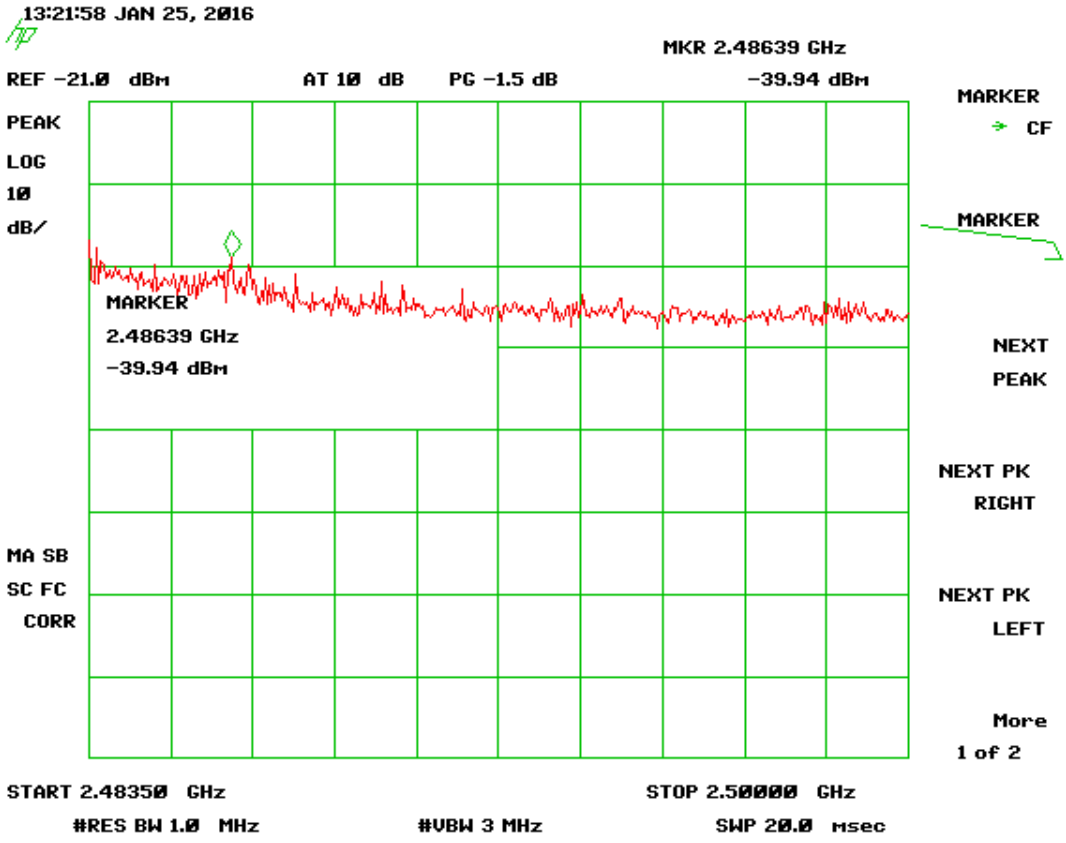


Figure 64. Radiated Restricted band 2483.5 MHz to 2500 MHz, 802.11n – Peak

Calculation of worst case restricted band 2483.5 MHz to 2500 MHz , 802.11n – Peak

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 64)	-39.94	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-36.13	dB

EIRP to Electric Field Strength conversion:

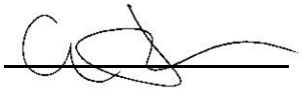
E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -36.13 – 20log (3) +104.8
=-36.13-9.54+104.8
= 59.13 dBuV/m at 3 meters

Margin Calculation:

Limit	74.00	dBuV/m
-Electric Field Strength (E)	59.13	dBuV/m
Margin	14.87	dB

Test Date: January 25, 2016
Tested By
Signature:  Name: Carrie Ingram

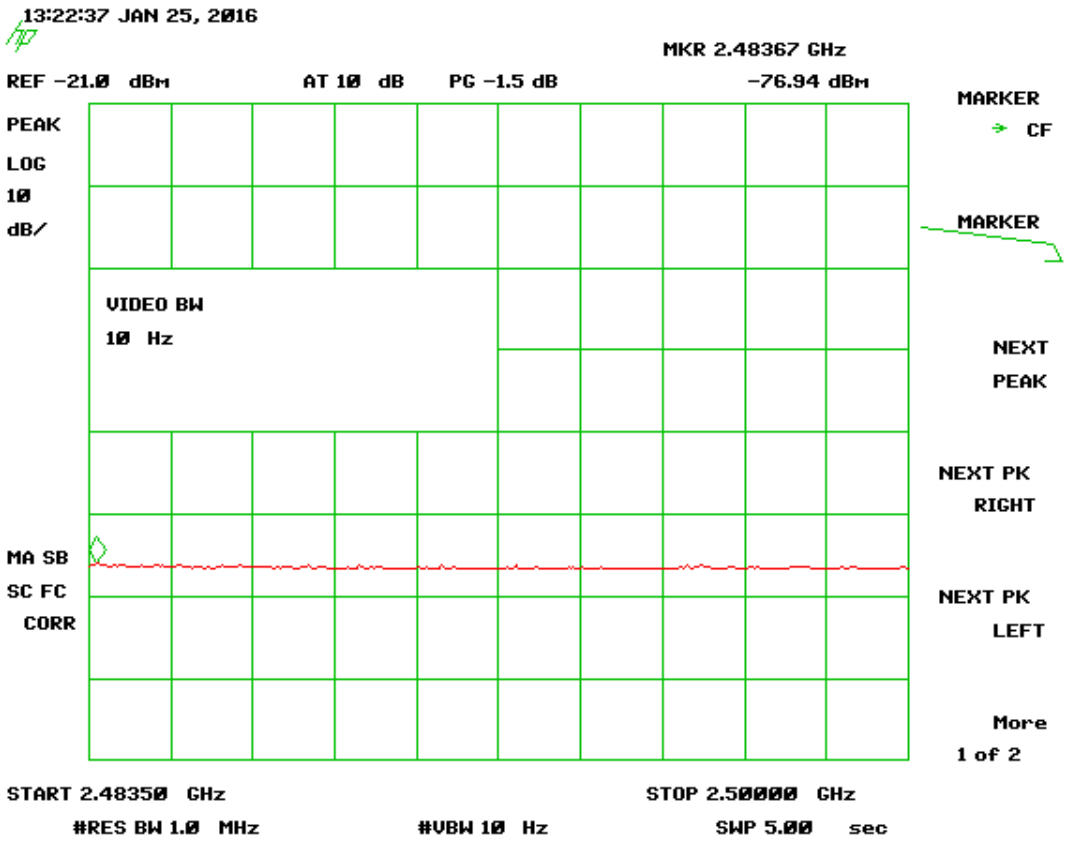


Figure 65. Radiated Restricted band 2483.5 MHz to 2500 MHz, 802.11n – Average

Calculation of worst case restricted band 2483.5 MHz to 2500 MHz , 802.11n – Average

Raw Data to EIRP Conversion:

EIRP= Raw Data + Antenna Gain + Ground Floor Reflection factor

Worst Case Restricted Band Emission (from Figure 65)	-76.94	dB
Maximum Antenna Gain (dBi)	3.81	dB
Ground floor reflection	0.00	dB
EIRP	-73.13	dB

EIRP to Electric Field Strength conversion:

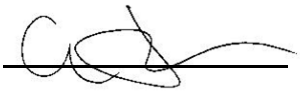
E = EIRP – 20log D + 104.8, where:

E = Electric field strength
D = specified measurement distance

E = -73.13 – 20log (3) +104.8
=-73.13-9.54+104.8
= 22.13 dBuV/m at 3 meters

Margin Calculation:

Limit	54.00	dBuV/m
-Electric Field Strength (E)	22.13	dBuV/m
Margin	31.87	dB

Test Date: January 25, 2016
Tested By
Signature:  Name: Carrie Ingram

2.12 Six (6) dB Bandwidth per CFR 15.247(a)(2),

The EUT antenna port was connected to a spectrum analyzer having a 50 Ω input impedance. Measurements were performed using the test procedure outlined in ANSI C63.10: 2013, paragraph 6.9.2, for a bandwidth of 6 dB. The RBW was set to > 1.0% of the OBW and the VBW ≥ RBW. The results of this test are given in the table below and Figures below.

Table 12. 802.11b Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)
2412	11.05	0.500
2442	11.10	0.500
2462	9.85	0.500

Table 13. 802.11g Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)
2412	16.51	0.500
2442	16.51	0.500
2462	16.51	0.500

Table 14. 802.11n Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)
2412	17.62	0.500
2442	17.62	0.500
2462	17.63	0.500

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

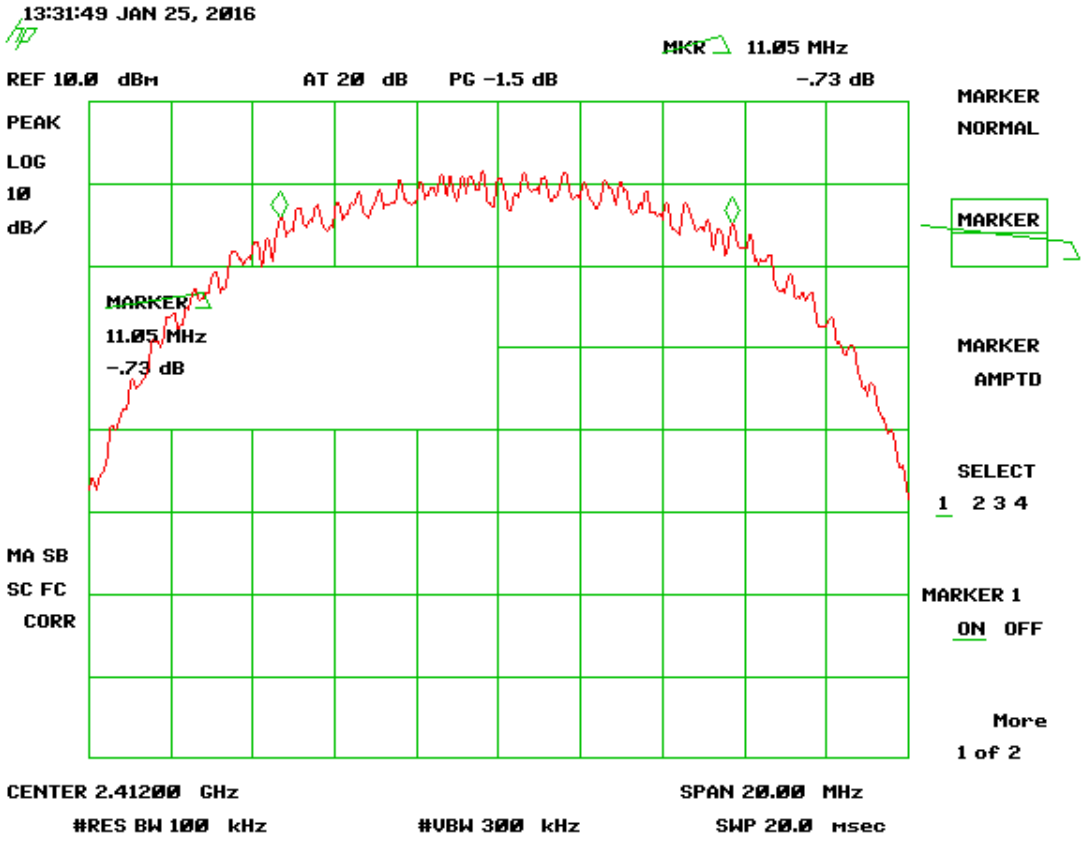


Figure 66. Six dB Bandwidth - 15.247 – 802.11b Low Channel

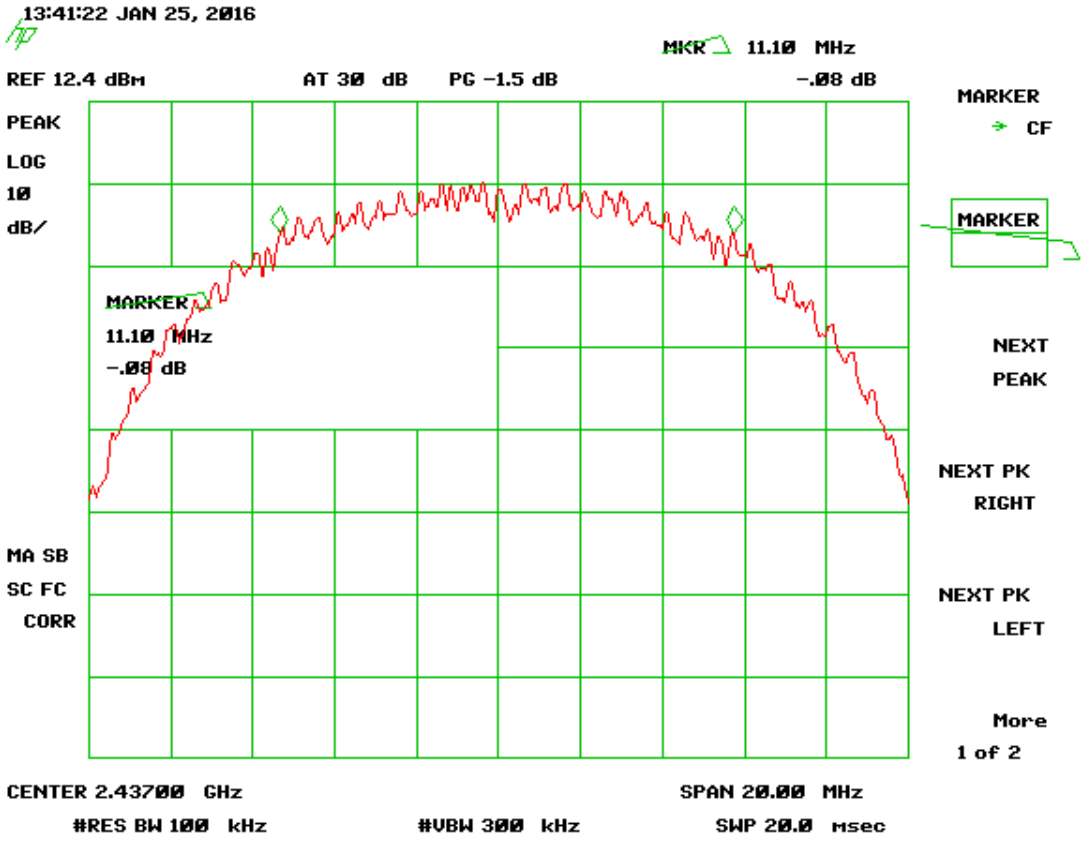


Figure 67. Six dB Bandwidth - 15.247 – 802.11b Mid Channel

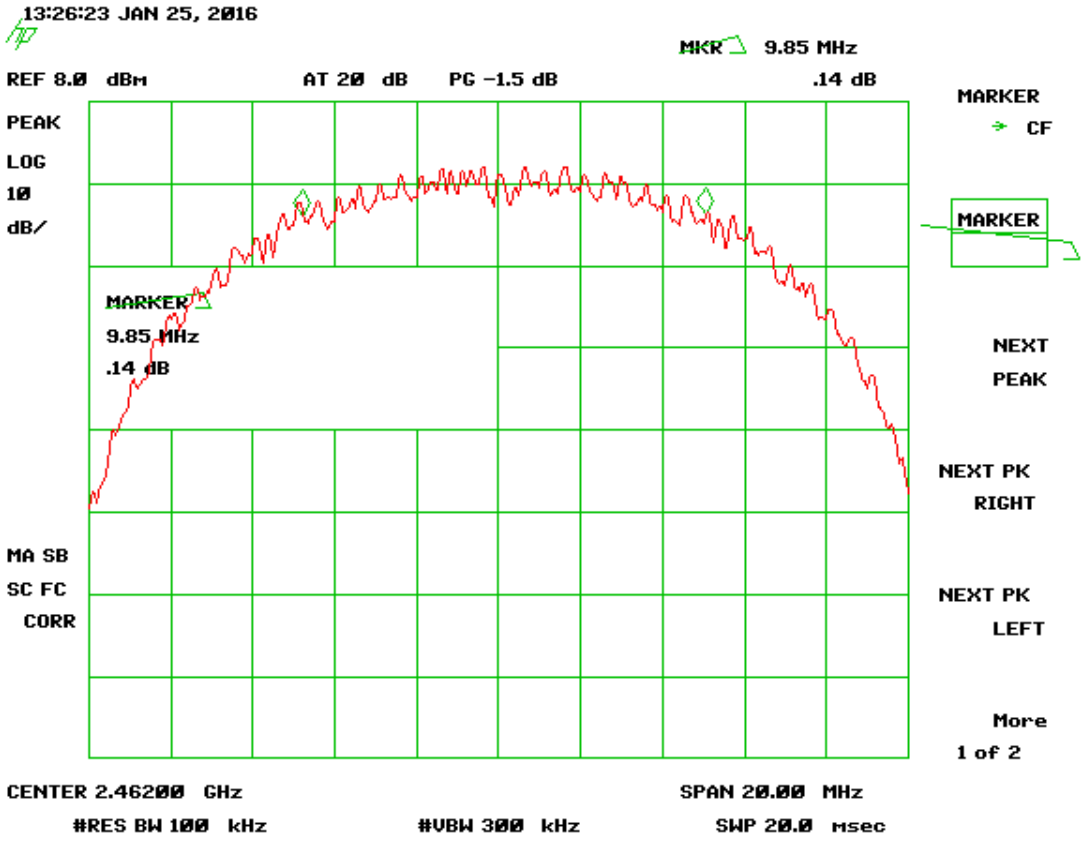


Figure 68. Six dB Bandwidth - 15.247 – 802.11b High Channel

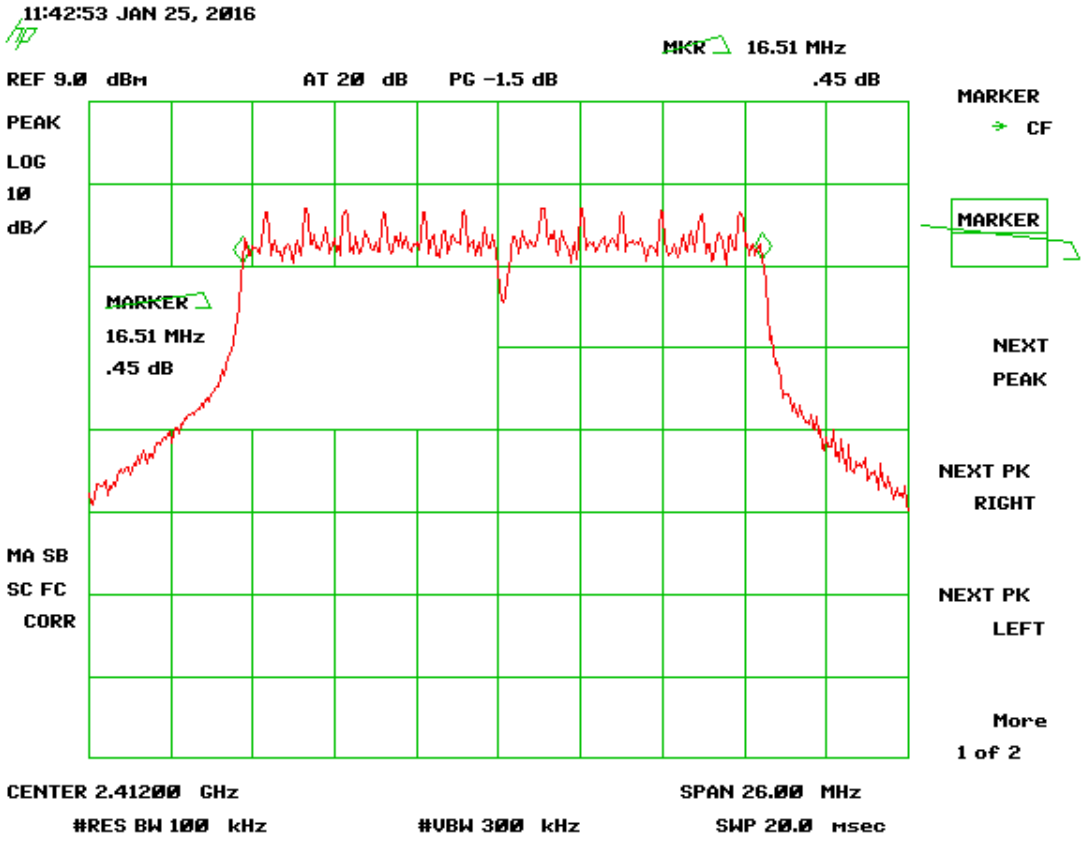


Figure 69. Six dB Bandwidth - 15.247 – 802.11g Low Channel

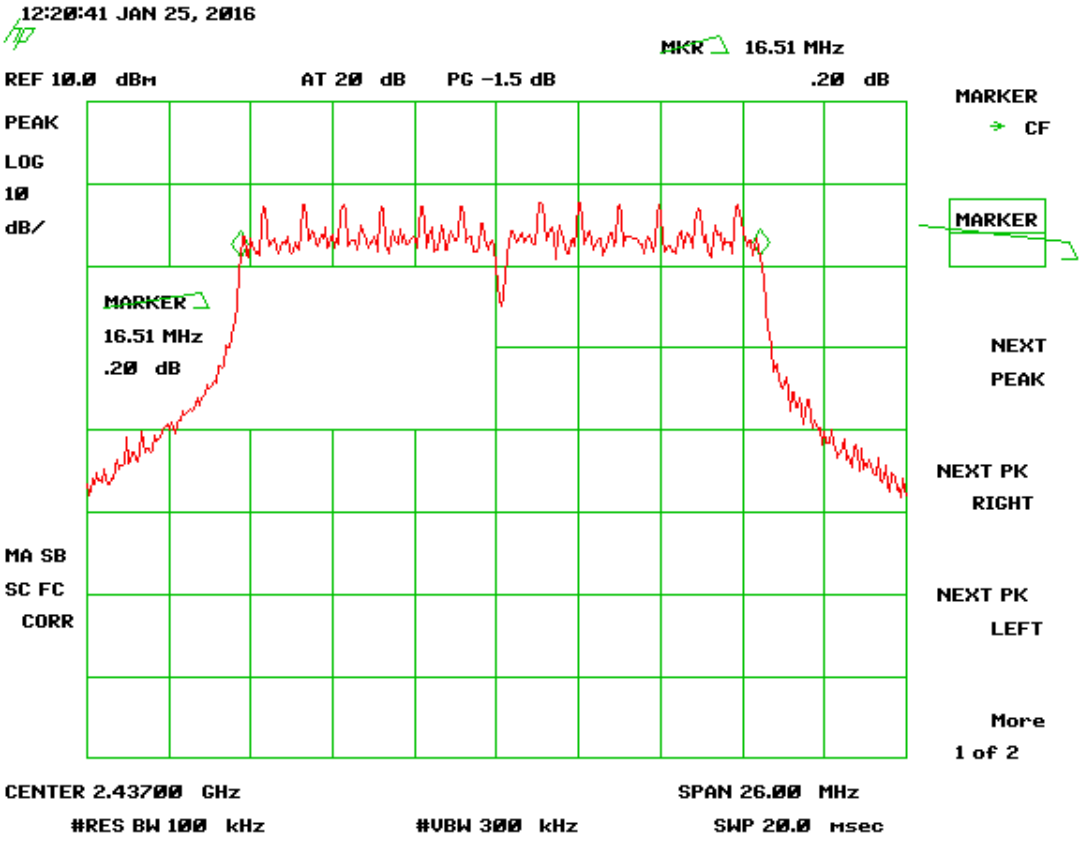


Figure 70. Six dB Bandwidth - 15.247 – 802.11g Mid Channel

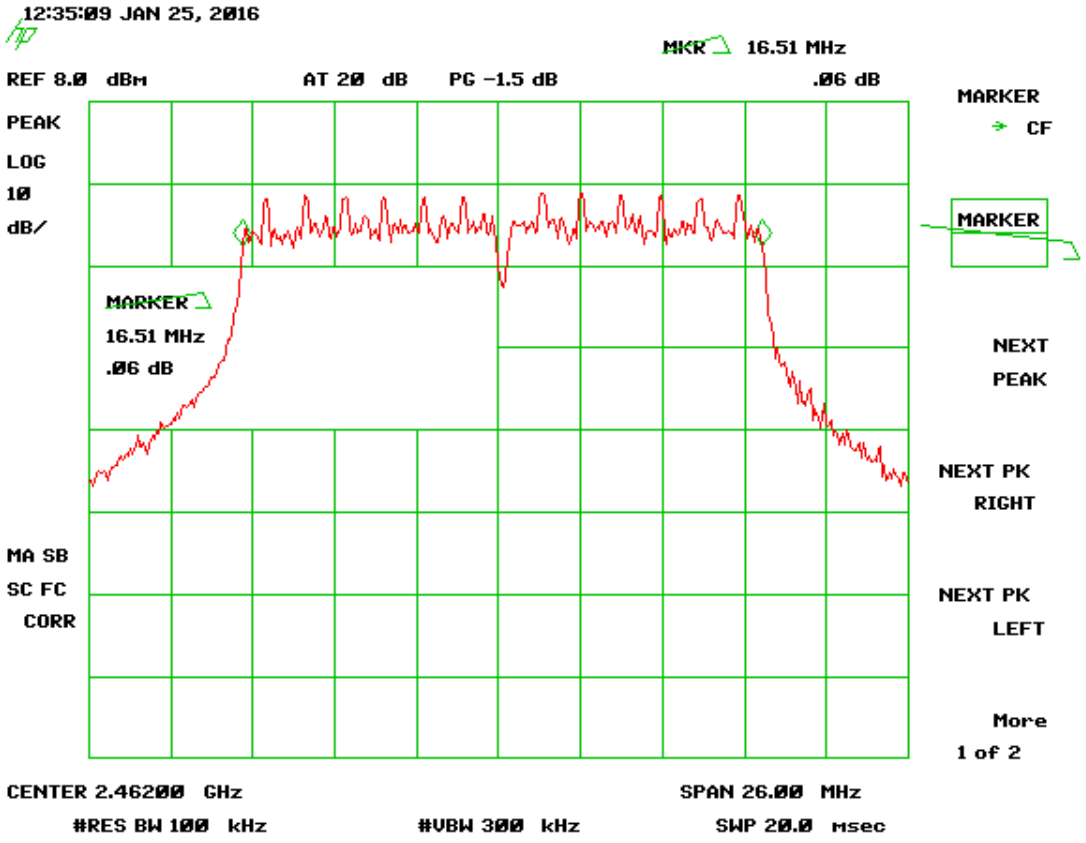


Figure 71. Six dB Bandwidth - 15.247 – 802.11g High Channel

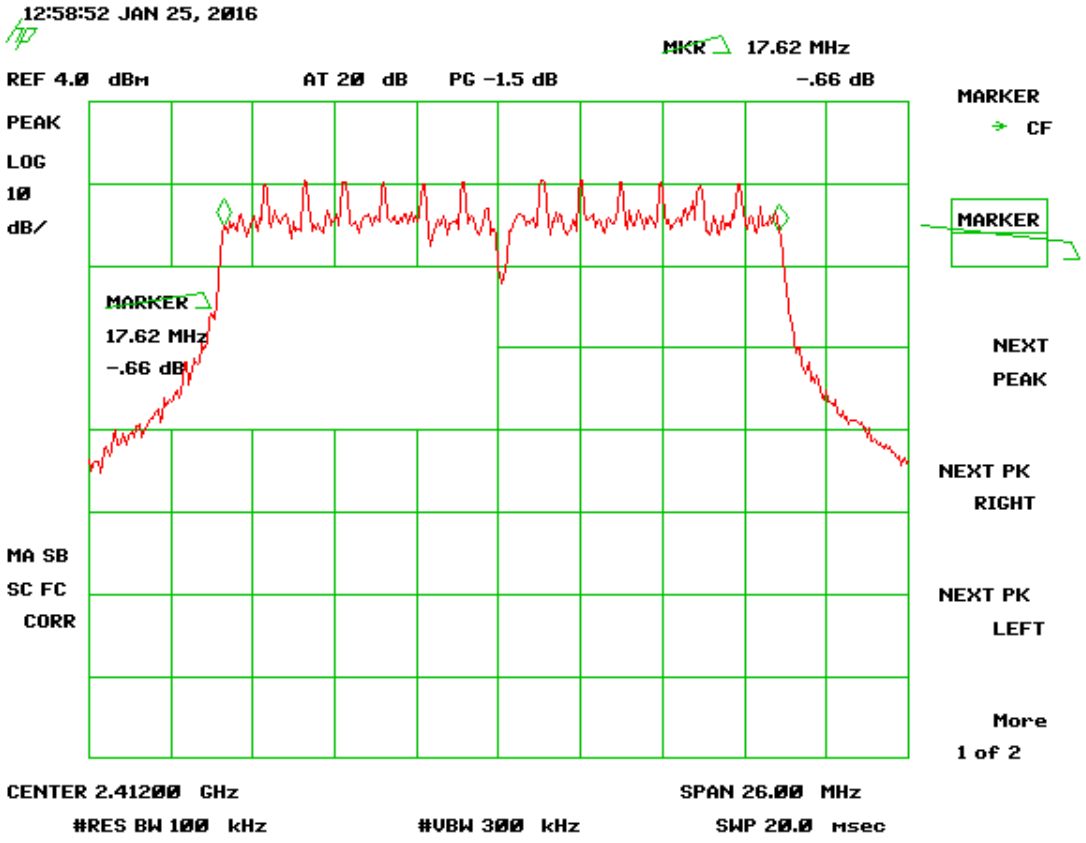


Figure 72. Six dB Bandwidth - 15.247 – 802.11n Low Channel

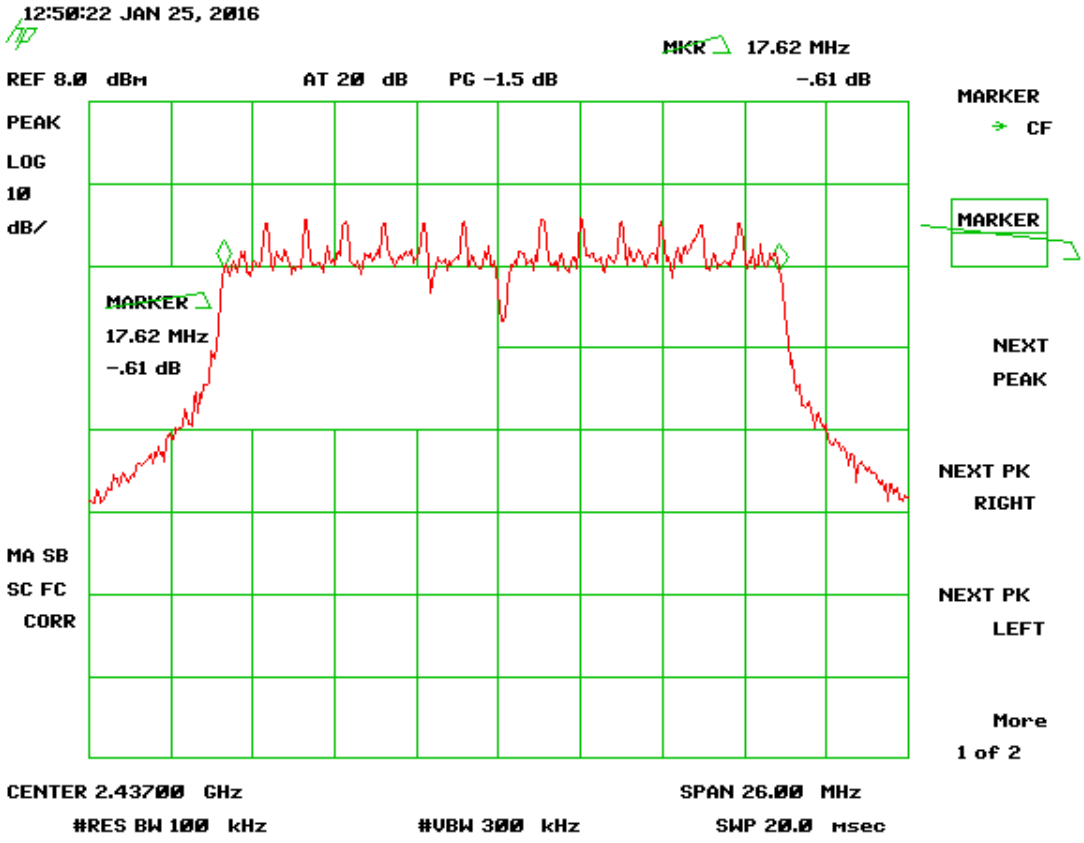


Figure 73. Six dB Bandwidth - 15.247 – 802.11n Mid Channel

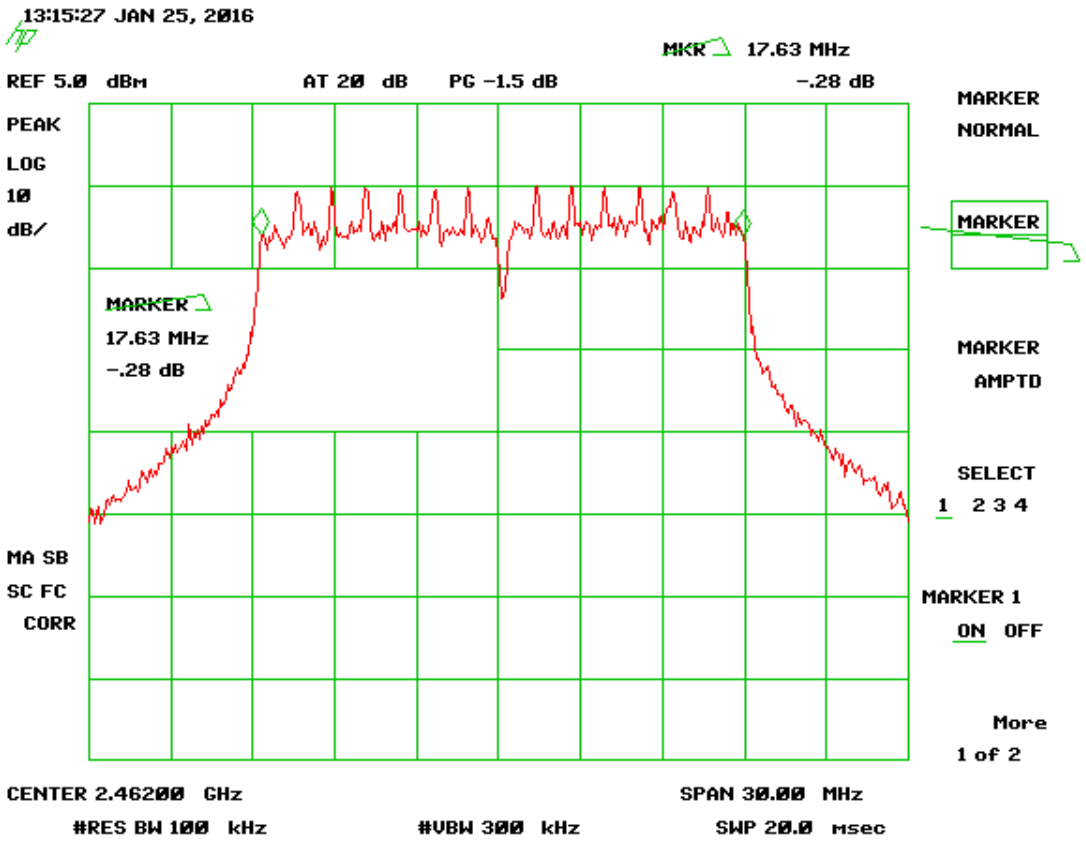


Figure 74. Six dB Bandwidth - 15.247 – 802.11n High Channel

2.13 99% Occupied Bandwidth (IC RSS Gen, 6.6)

These measurements were performed while the EUT was in a constant transmit mode. The test procedure in RSS Gen, section 6.6 was used. The RBW was set to 1% - 5% of the OBW and the VBW was set to 3 times the RBW. The results of this test are given in the Tables below. Screen shots of the measurements can be found in the Figures below.

Table 15. 802.11b 99% Occupied Bandwidth

Frequency (MHz)	99% Occupied Bandwidth (MHz)
2412	17.65
2442	17.95
2462	18.15

Table 16. 802.11g 99% Occupied Bandwidth

Frequency (MHz)	99% Occupied Bandwidth (MHz)
2412	19.57
2442	19.37
2462	19.31

Table 17. 802.11n 99% Occupied Bandwidth

Frequency (MHz)	99% Occupied Bandwidth (MHz)
2412	20.09
2442	20.35
2462	19.58

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

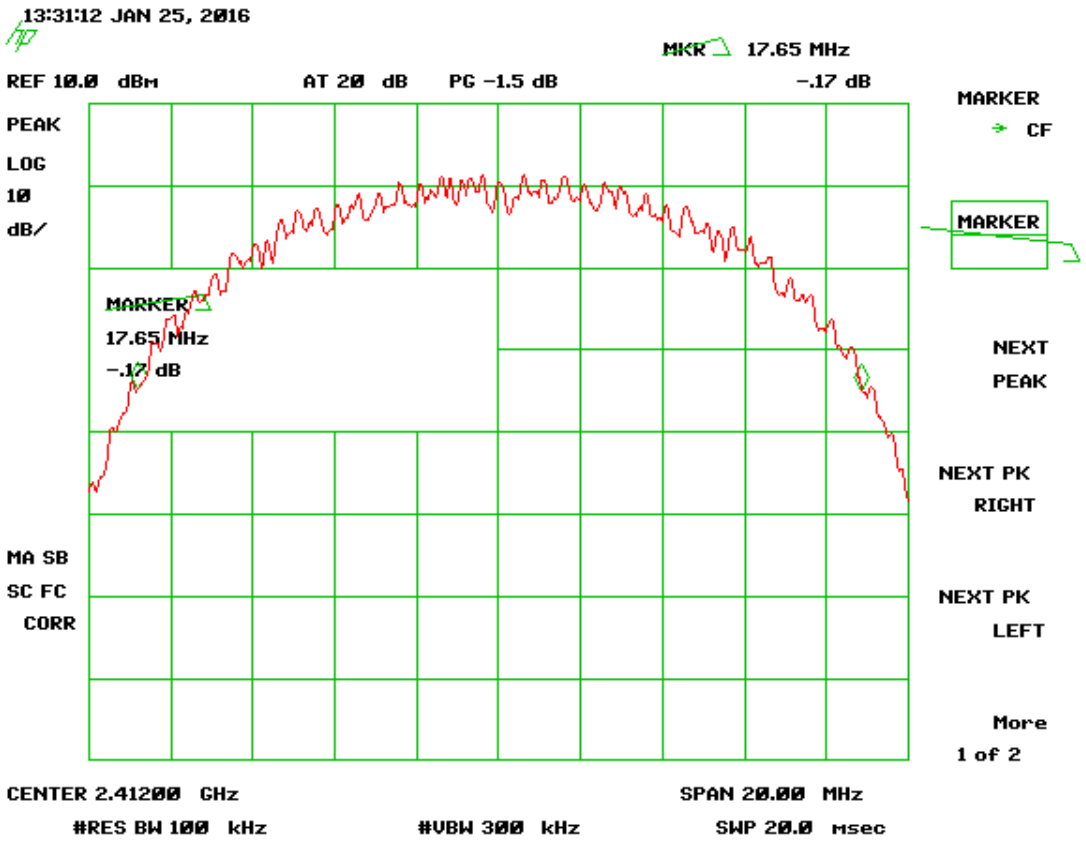


Figure 75. 99% Bandwidth 802.11b Low Channel

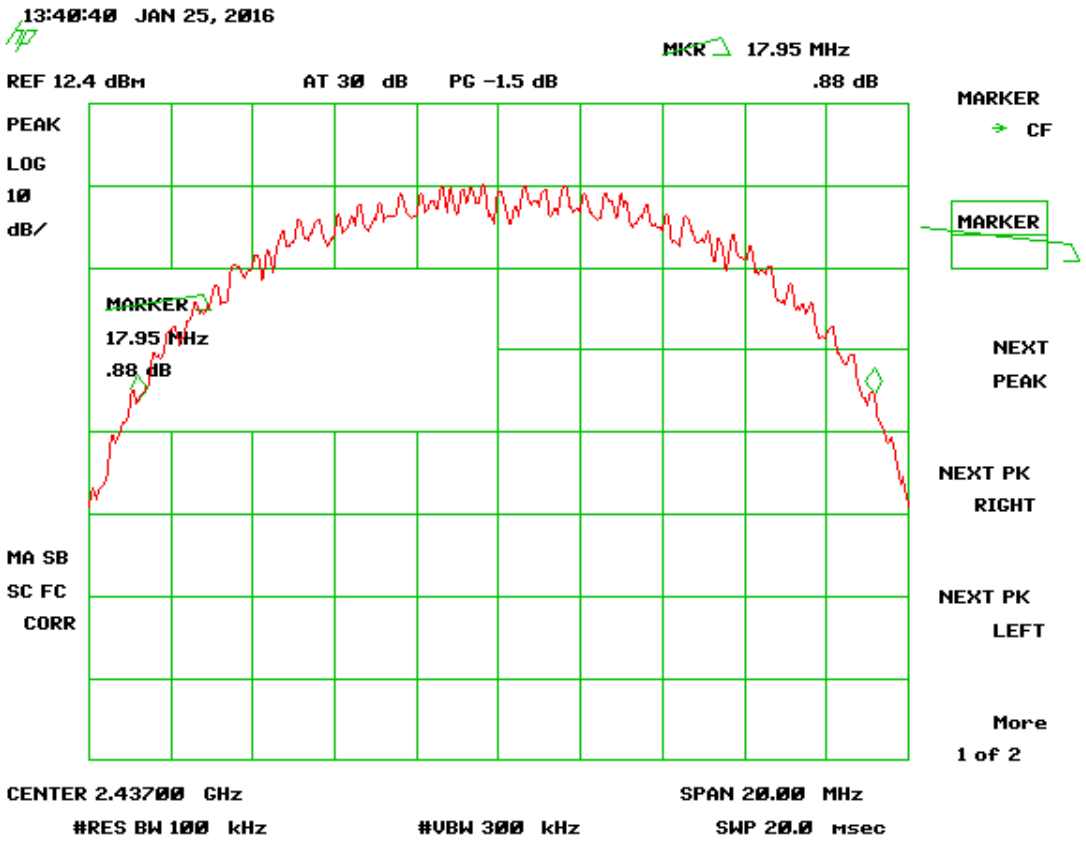


Figure 76. 99% Bandwidth 802.11b Mid Channel

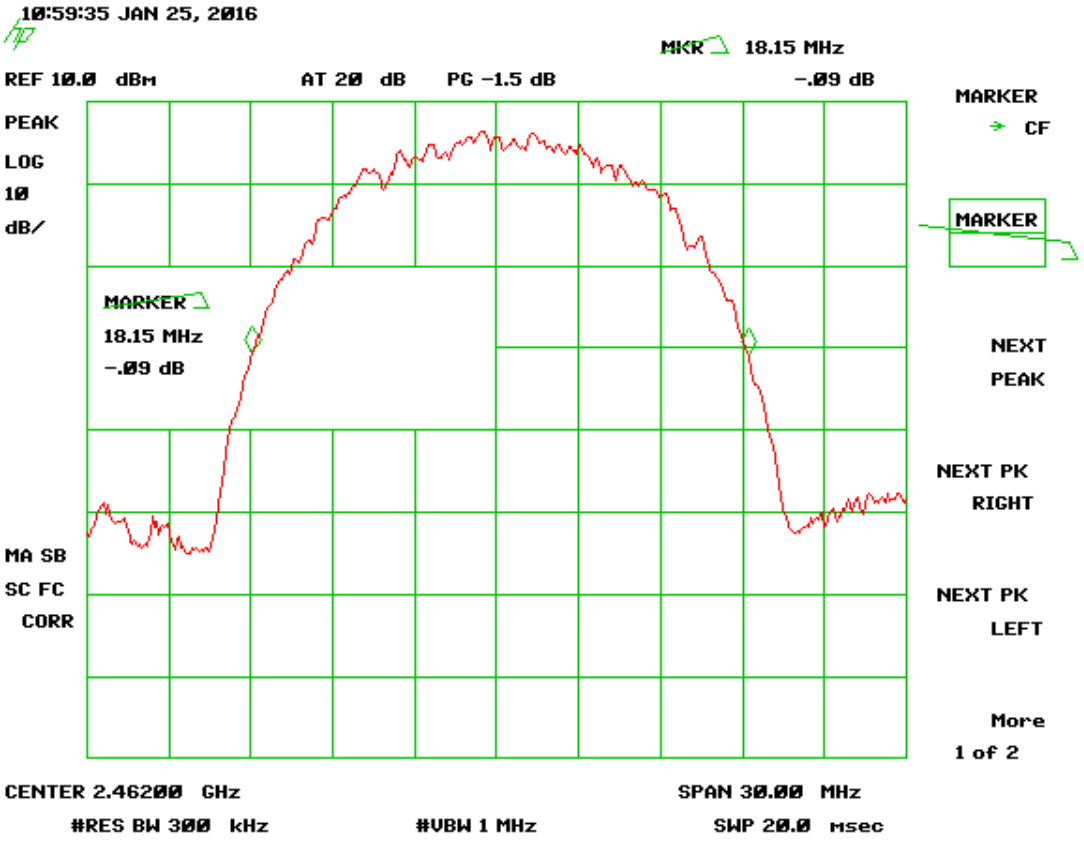


Figure 77. 99% Bandwidth 802.11b High Channel

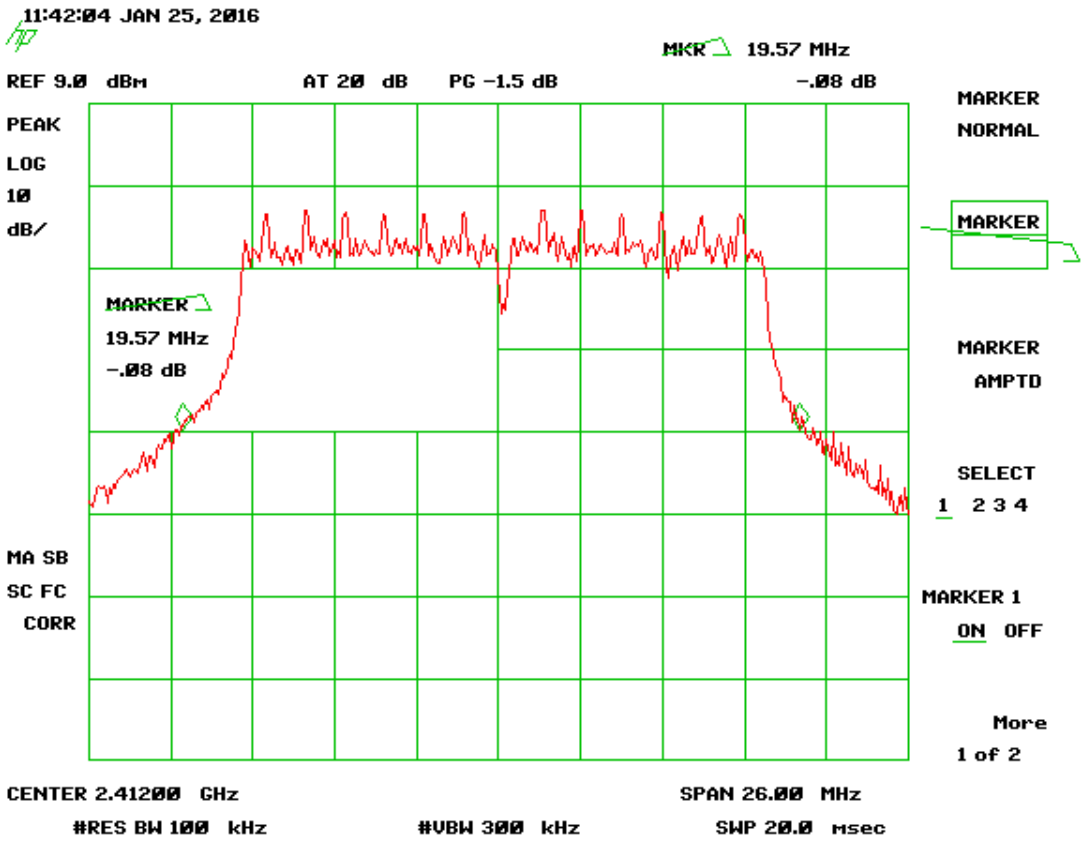


Figure 78. 99% Bandwidth 802.11g Low Channel

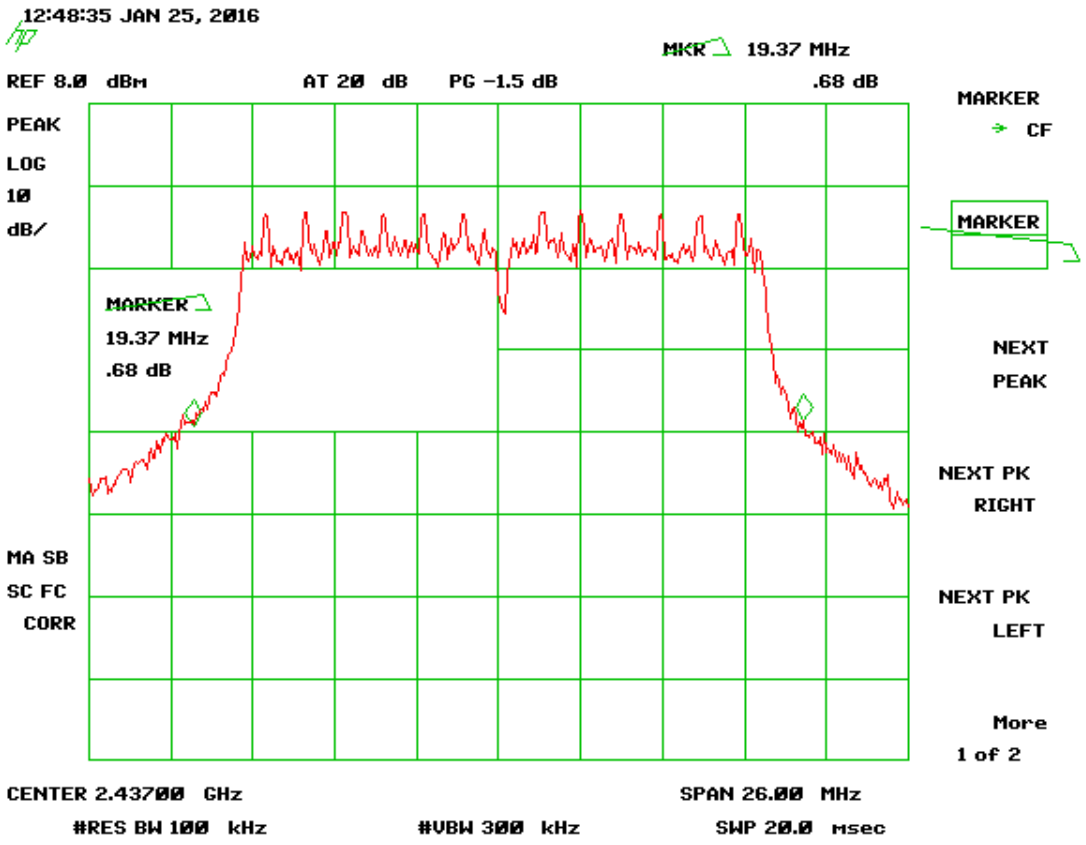


Figure 79. 99% Bandwidth 802.11g Mid Channel

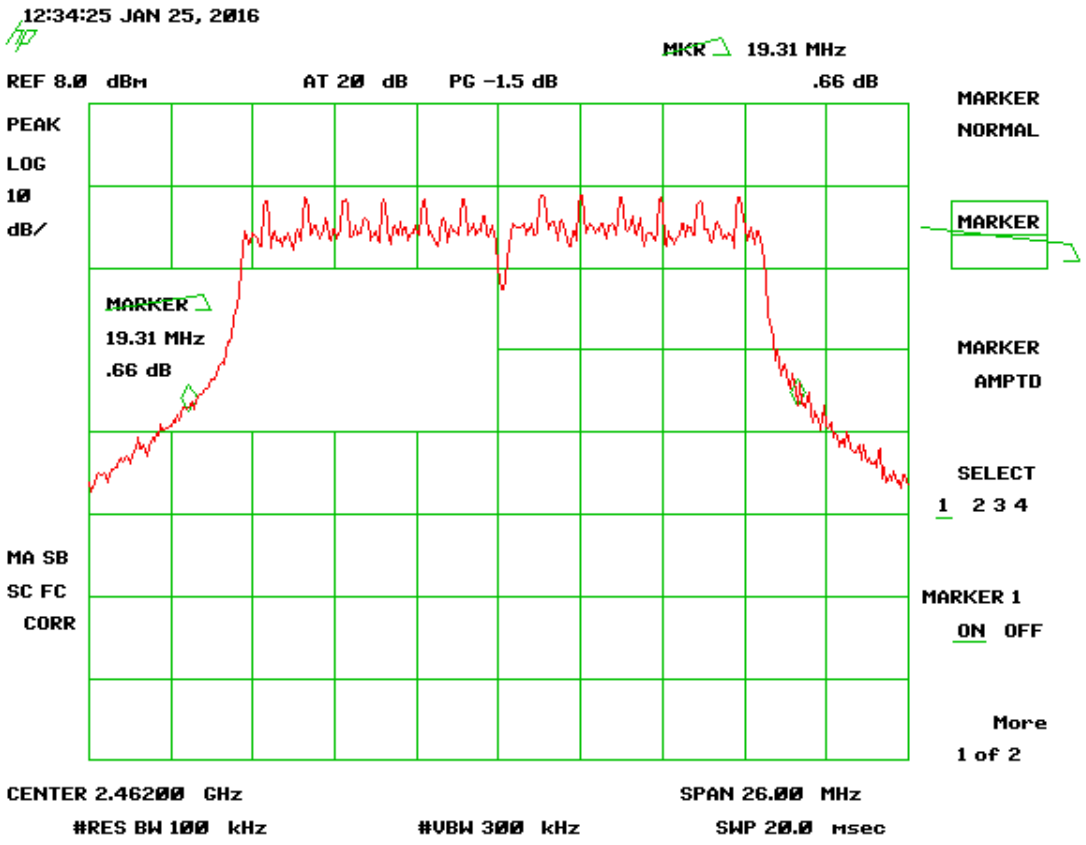


Figure 80. 99% Bandwidth 802.11g High Channel

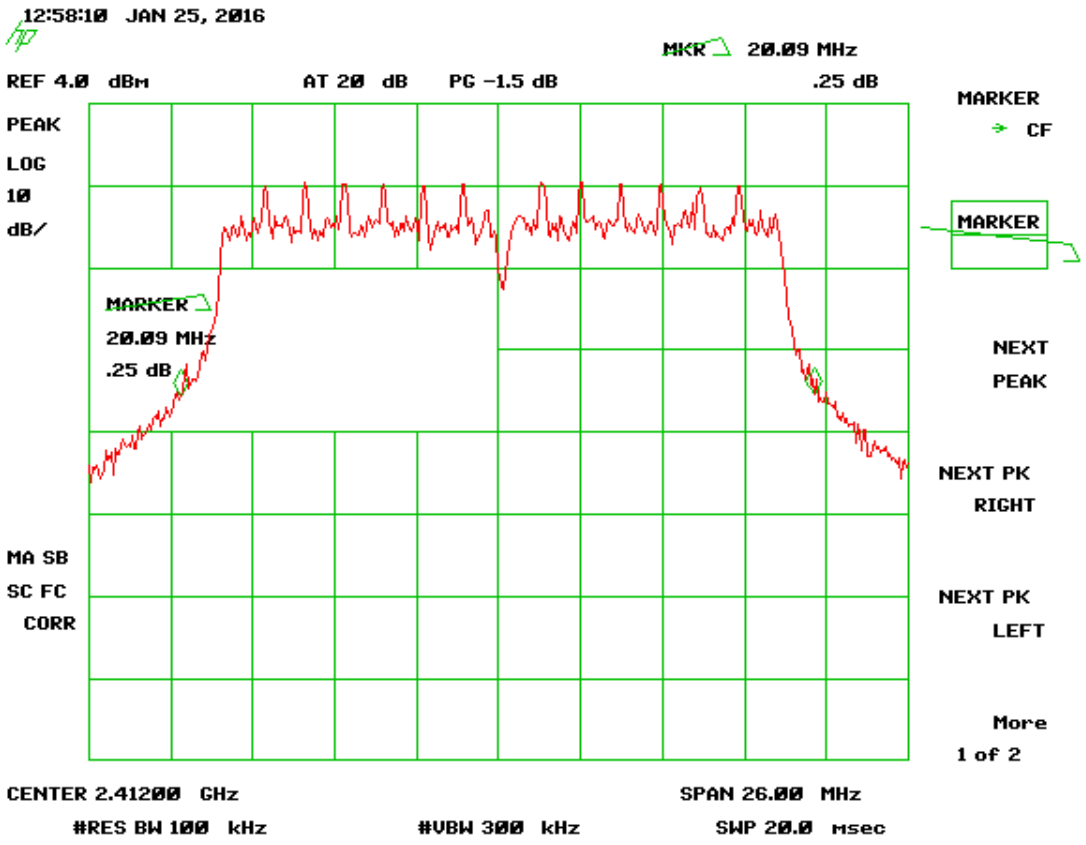


Figure 81. 99% Bandwidth 802.11n Low Channel

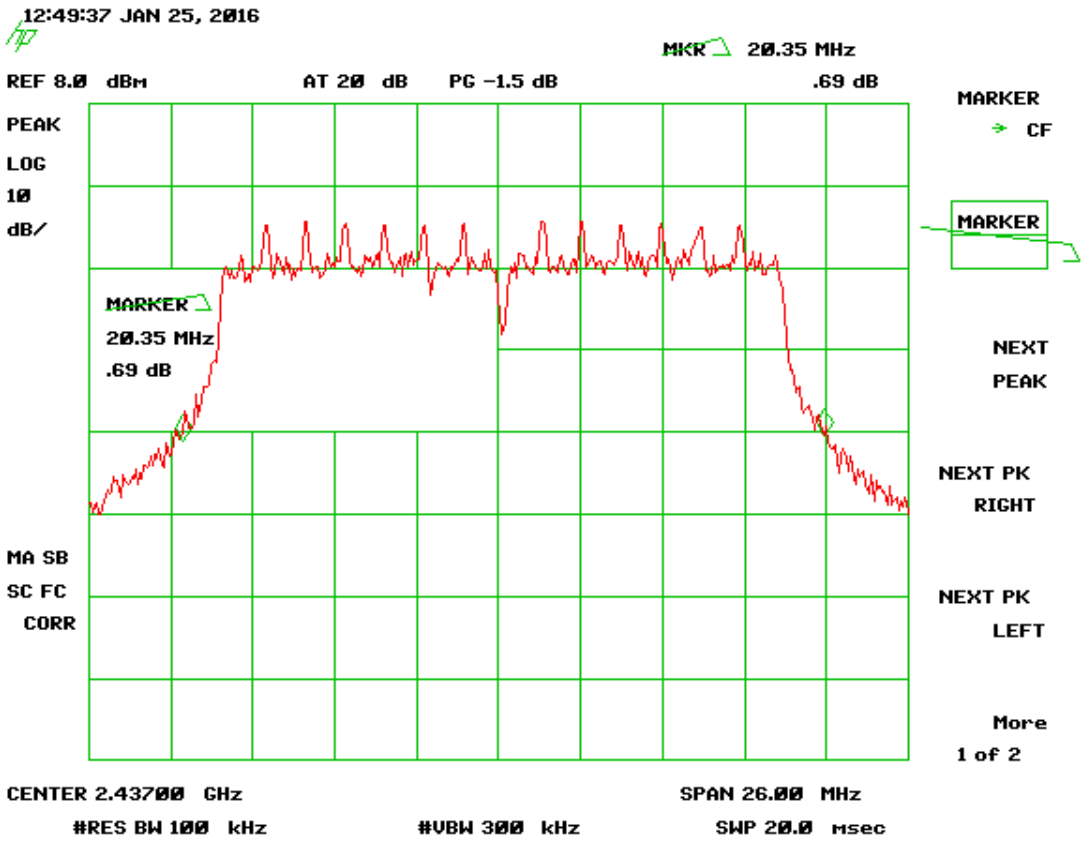


Figure 82. 99% Bandwidth 802.11n Mid Channel

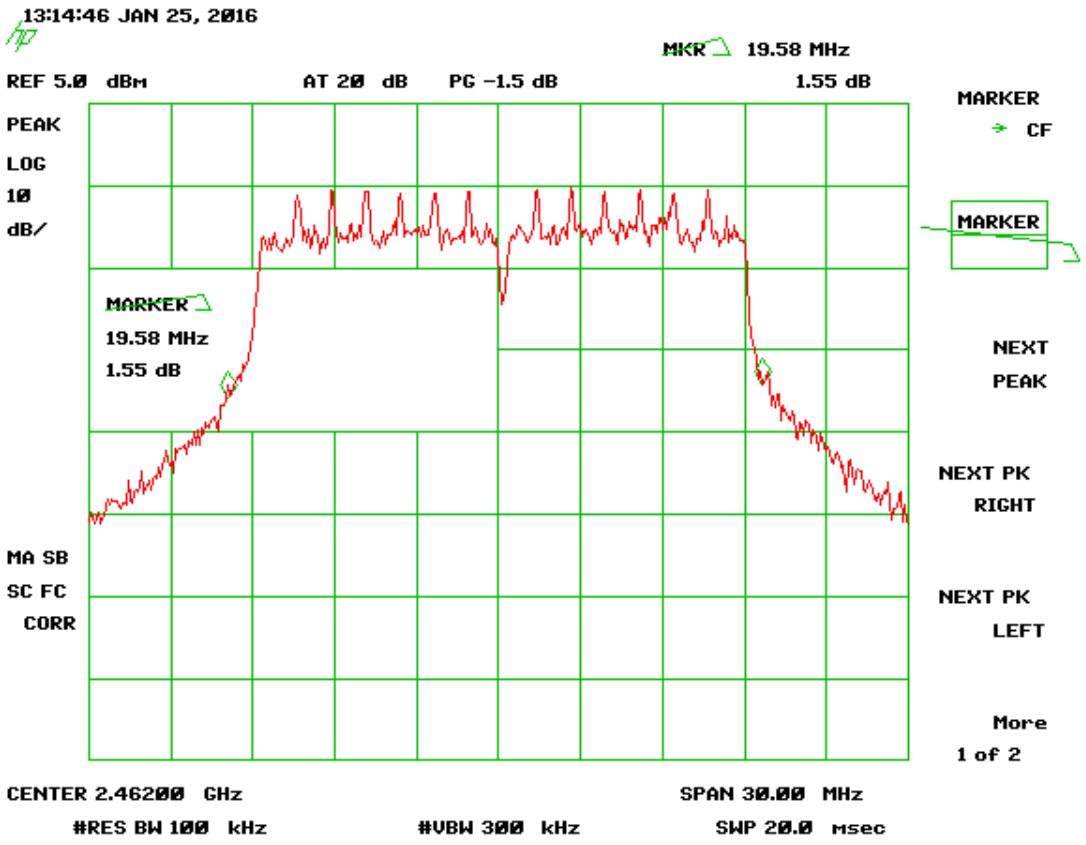


Figure 83. 99% Bandwidth 802.11n High Channel

2.14 Maximum Peak Conducted Output Power (CFR 15.247 (b) (3))

For this test, the transmitter was programmed to operate at a maximum output power across the bandwidth.

Peak power within the band 2.4 GHz to 2.4835 GHz was measured per FCC KDB Publication 558074 v03r04 as an Antenna Conducted test with a spectrum analyzer by connecting the spectrum analyzer directly, via a short RF cable, and attenuators to the antenna output terminals on the EUT. The spectrum analyzer and the antenna port both have an impedance of 50 Ω with the RBW set greater than the 6 dB bandwidth of the EUT, and the VBW ≥ RBW. Peak antenna conducted output power is tabulated in the table below.

Table 18. 802.11b Peak Conducted Output Power per Part 15.247 (b) (3)

Frequency of Fundamental (MHz)	Raw Test Data (dBm)	Output Power (mW)	FCC Limit (mW)
2412	13.70	23.44	1000
2442	15.34	34.20	1000
2462	15.46	35.16	1000

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

Table 19. 802.11g Peak Conducted Output Power per Part 15.247 (b) (3)

Frequency of Fundamental (MHz)	Raw Test Data dBm	Output Power (mW)	FCC Limit (mW)
2412	8.58	7.21	1000
2442	11.59	14.42	1000
2462	10.43	11.04	1000

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

Table 20. 802.11n Peak Conducted Output Power per Part 15.247 (b) (3)

Frequency of Fundamental (MHz)	Raw Test Data dBm	Output Power (mW)	FCC Limit (mW)
2412	6.19	4.16	1000
2442	9.35	8.61	1000
2462	7.40	5.50	1000

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

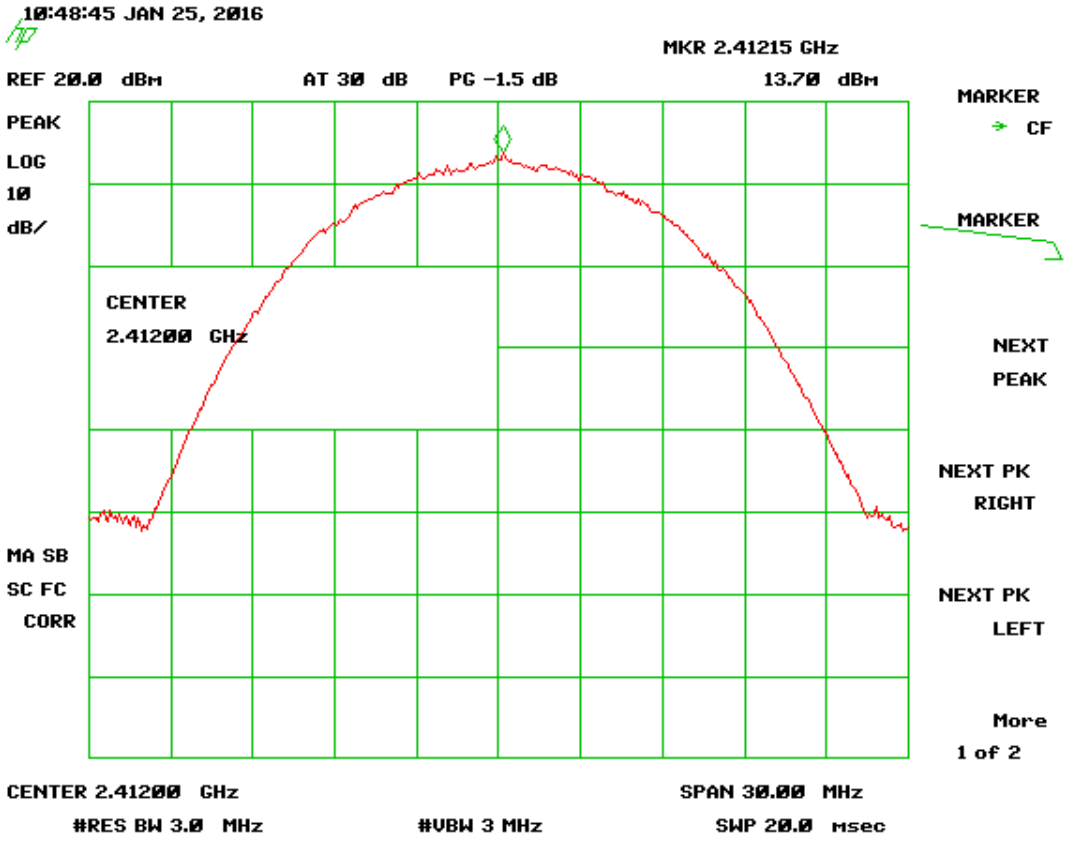


Figure 84. Peak Antenna Conducted Output Power, 802.11b Low Channel

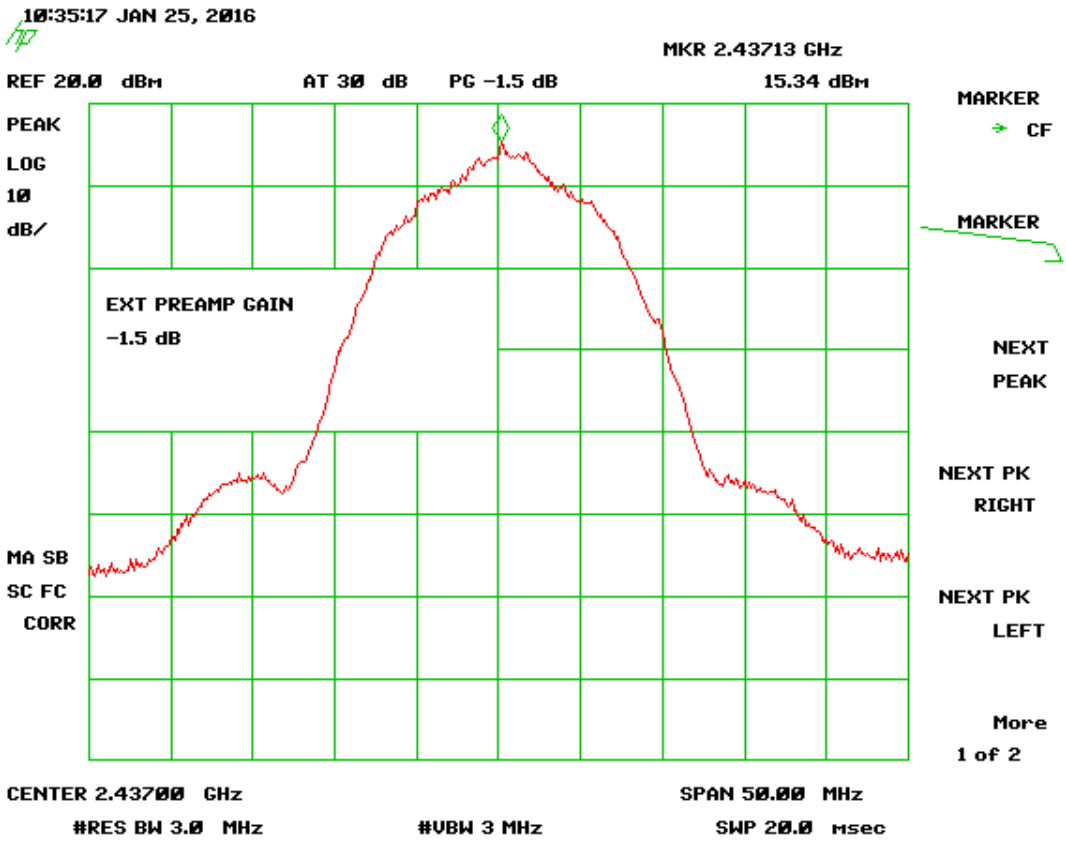


Figure 85. Peak Antenna Conducted Output Power, 802.11b Mid Channel

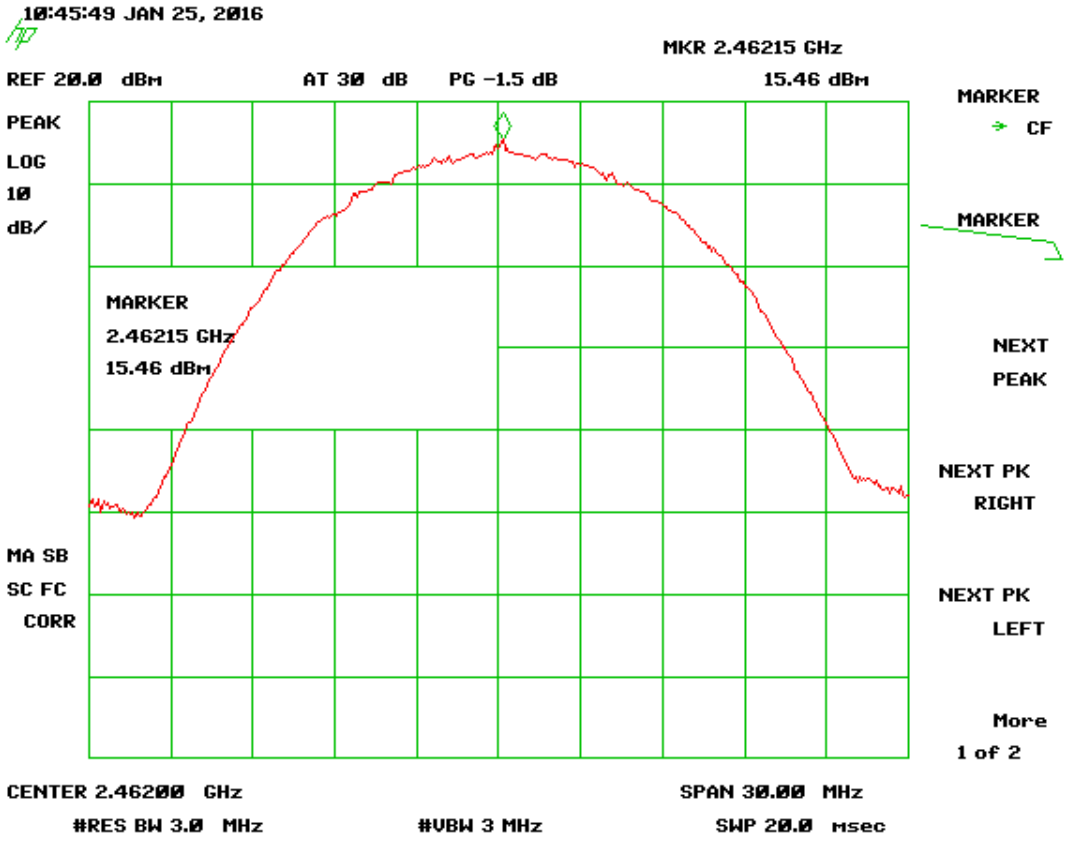


Figure 86. Peak Antenna Conducted Output Power, 802.11b High Channel

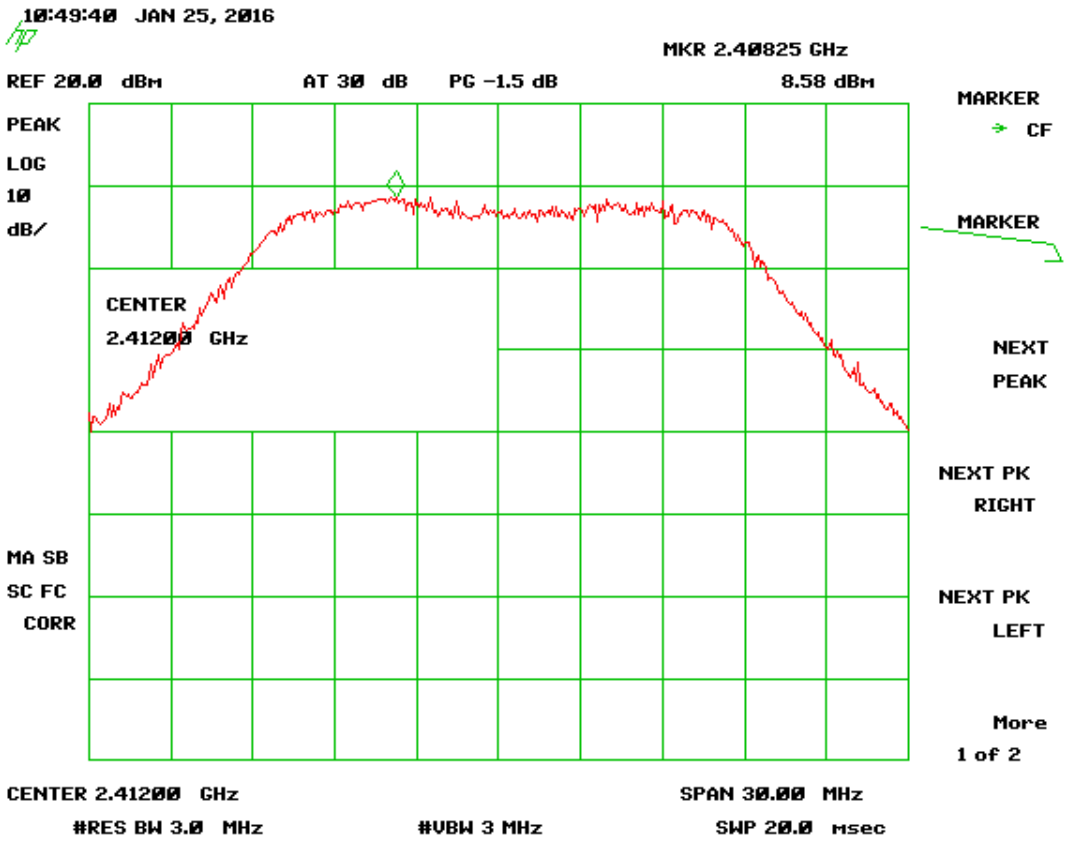


Figure 87. Peak Antenna Conducted Output Power, 802.11g Low Channel

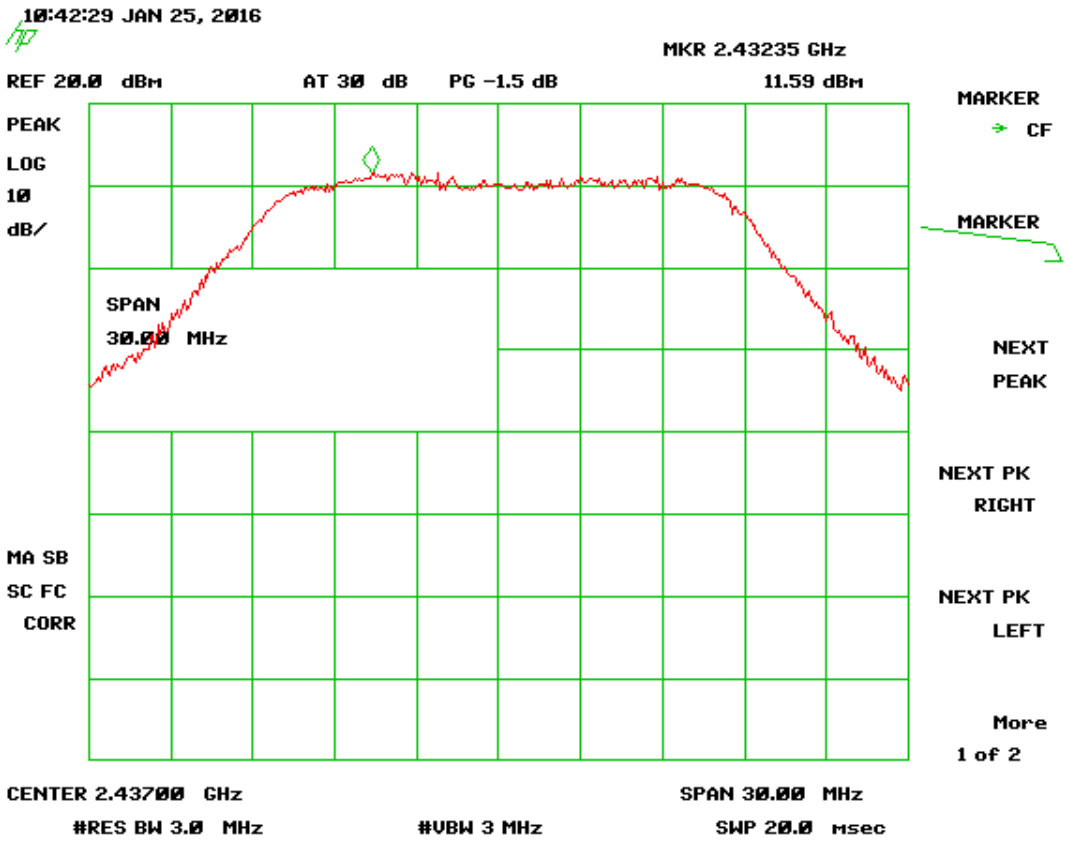


Figure 88. Peak Antenna Conducted Output Power, 802.11g Mid Channel

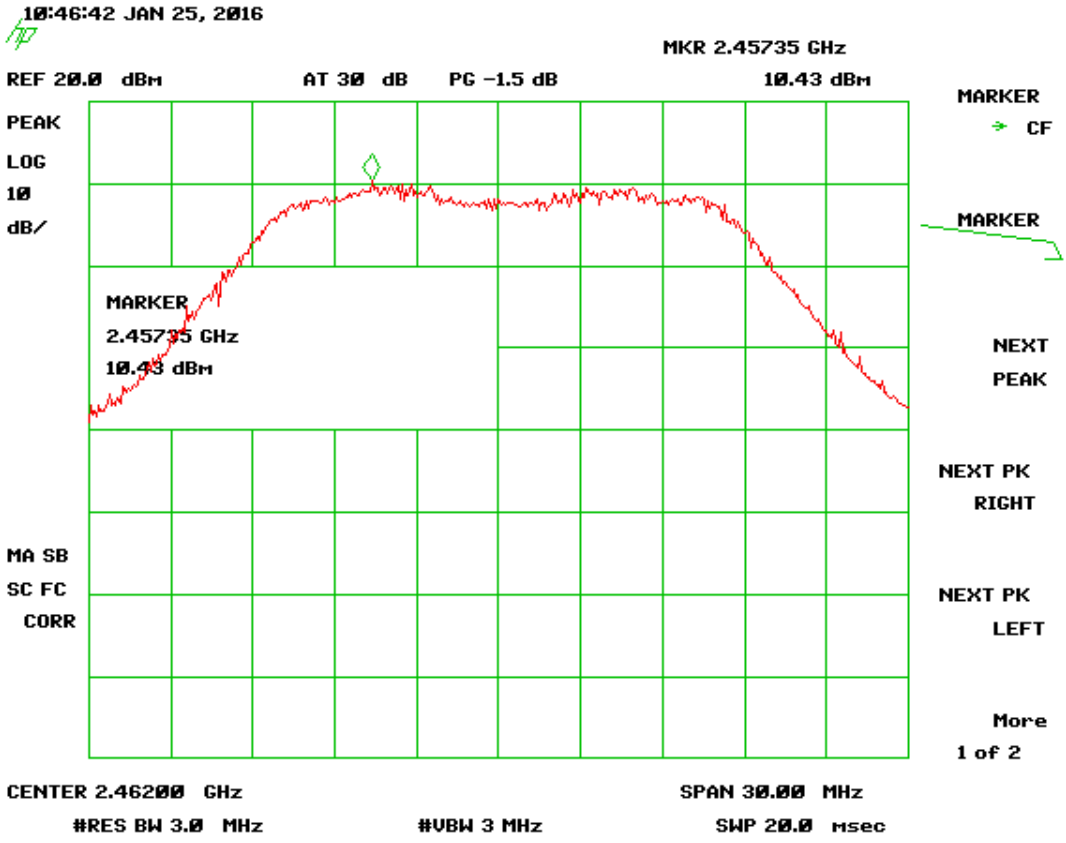


Figure 89. Peak Antenna Conducted Output Power, 802.11g High Channel

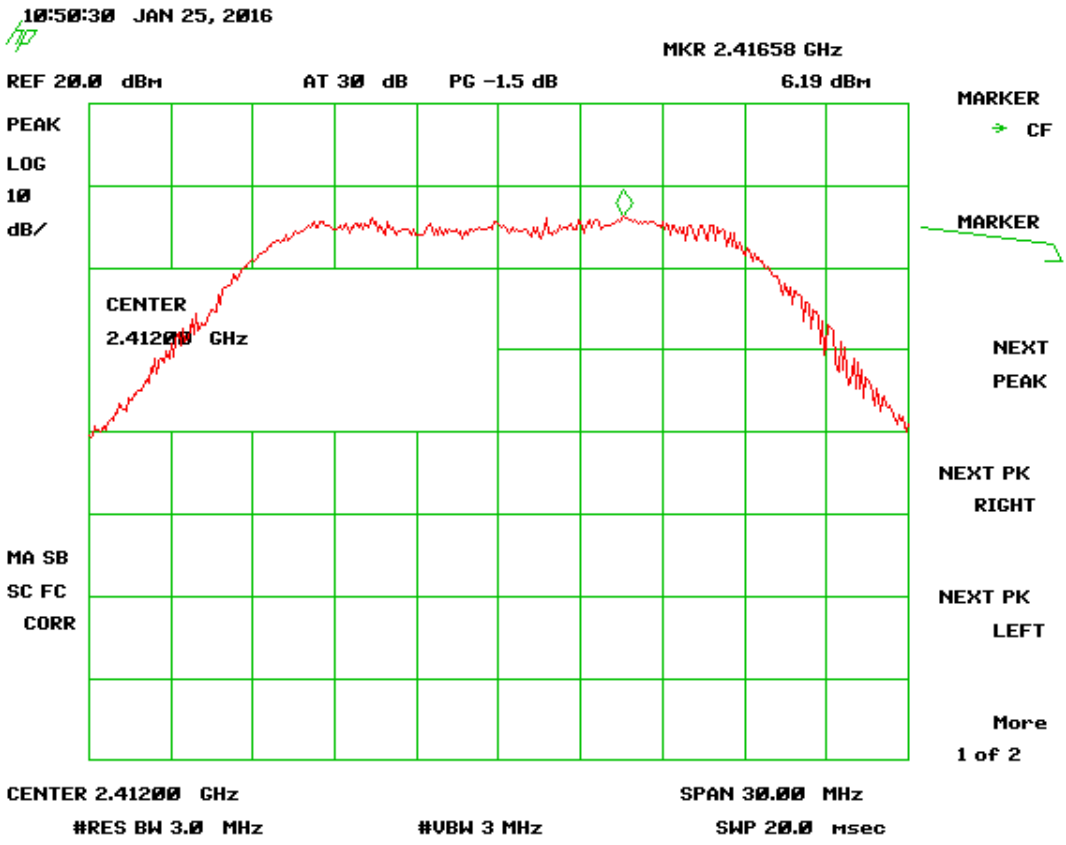


Figure 90. Peak Antenna Conducted Output Power, 802.11n Low Channel

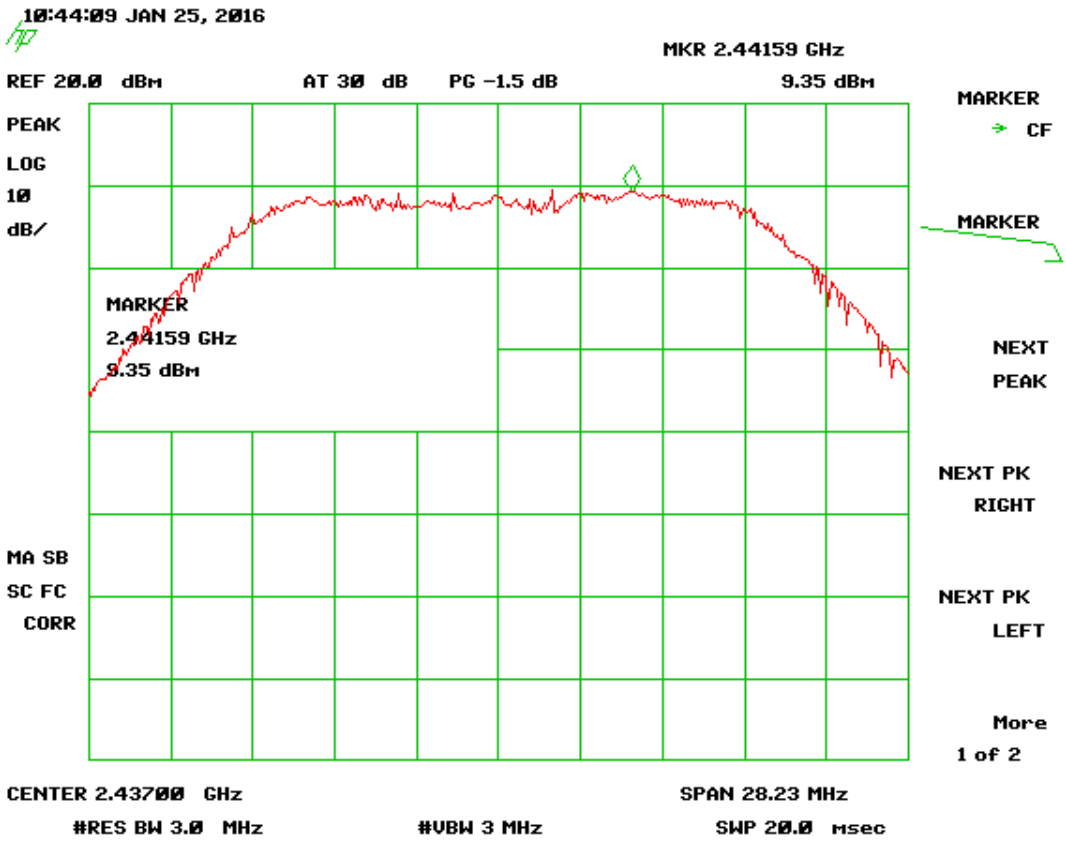


Figure 91. Peak Antenna Conducted Output Power, 802.11n Mid Channel

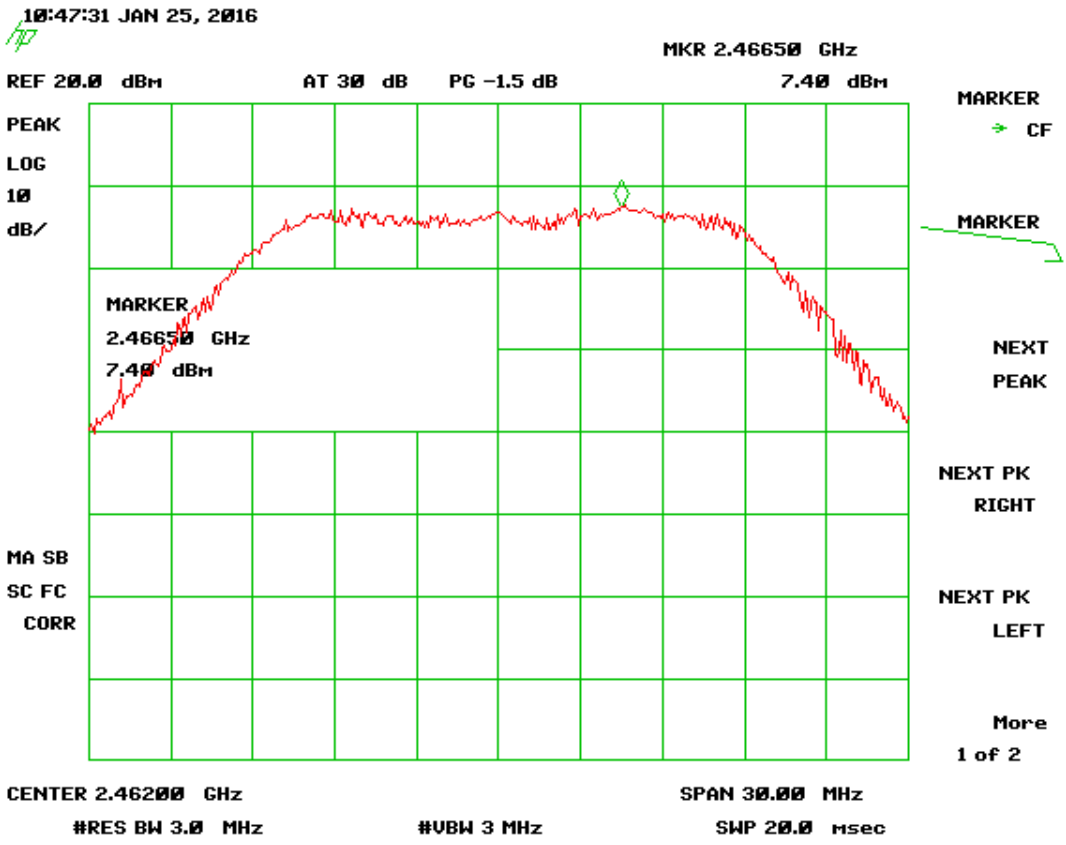


Figure 92. Peak Antenna Conducted Output Power, 802.11n High Channel

2.15 Power Spectral Density (CFR 15.247(e)) (IC RSS 210 A8.5)

The transmitter was placed into a continuous mode of operation at all applicable frequencies. The measurements were performed per the procedures of FCC KDB Procedure 558074 v03r04. The RBW was set to 3 kHz and the Video Bandwidth was set to ≥ RBW. The span was set to 1.5 times the OBW.

In accordance with 15.247 (e), the power spectral density shall be no greater than +8 dBm per any 3 kHz band.

The following results show that all are less than +8 dBm per 3 kHz band.

Table 21. 802.11b Power Spectral Density for Low, Mid and High Bands

Frequecy (MHz)	Test Data (dBm/ 3 kHz)	Limit (dBm/3 kHz)
2412	-12.52	8.0
2442	-11.53	8.0
2462	-11.43	8.0

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

Table 22. 802.11g Power Spectral Density for Low, Mid and High Bands

Frequecy (MHz)	Test Data (dBm/ 3 kHz)	Limit (dBm/3 kHz)
2412	-23.42	8.0
2442	-21.87	8.0
2462	-21.99	8.0

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

Table 23. 802.11n Power Spectral Density for Low, Mid and High Bands

Frequecy (MHz)	Test Data (dBm/ 3 kHz)	Limit (dBm/8 kHz)
2412	-24.69	8.0
2442	-22.80	8.0
2462	-22.22	8.0

Test Date: January 25, 2016
Tested By
Signature: _____ Name: Carrie Ingram

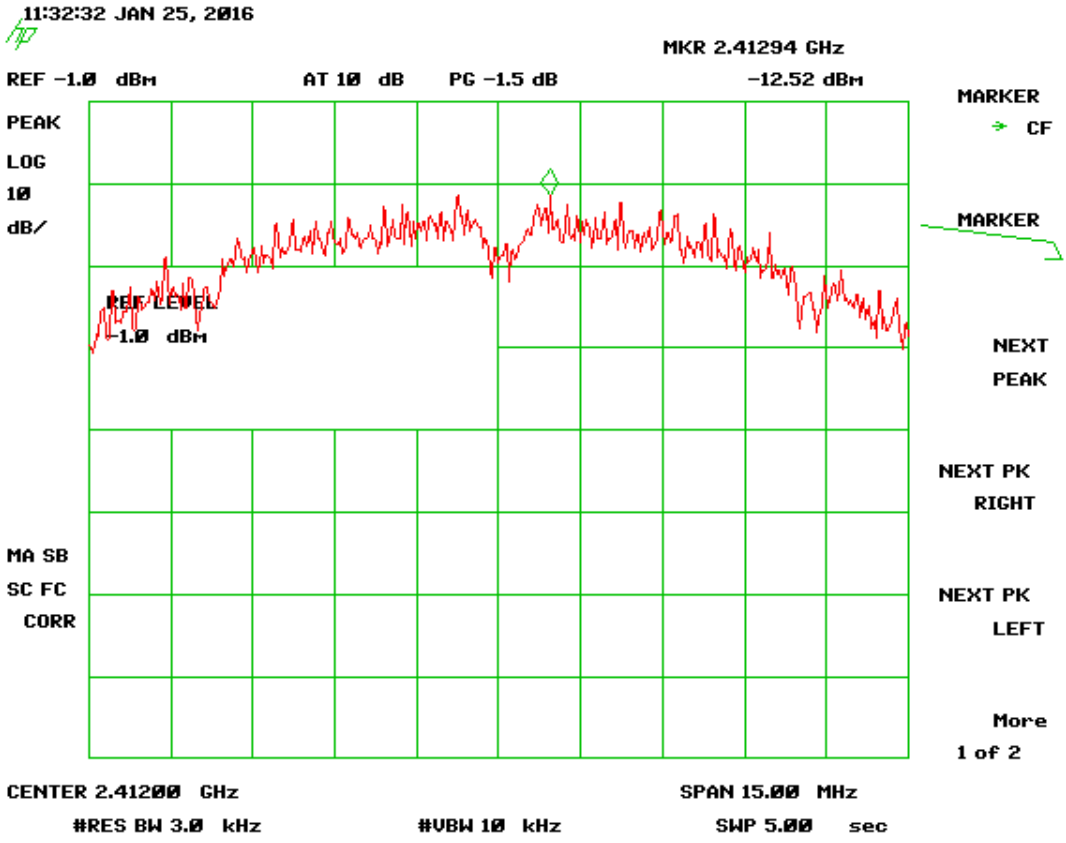


Figure 93. Peak Power Spectral Density, 802.11b Low Channel

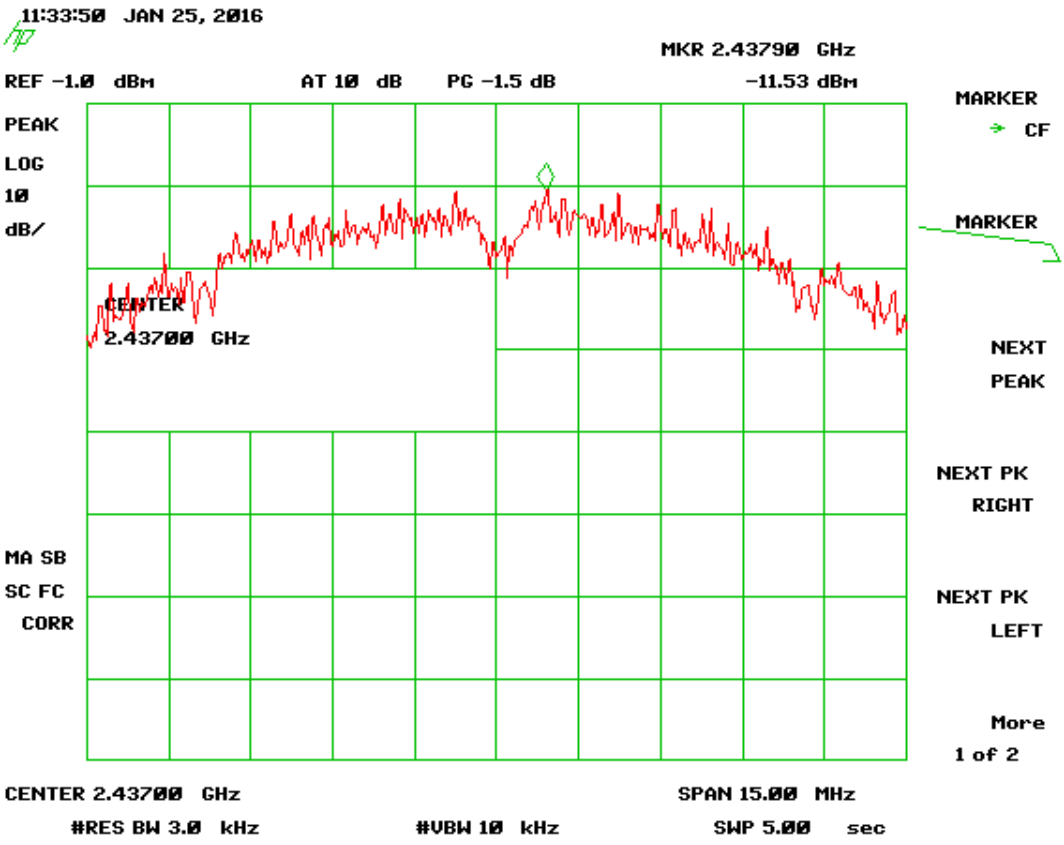


Figure 94. Peak Power Spectral Density, 802.11b Mid Channel

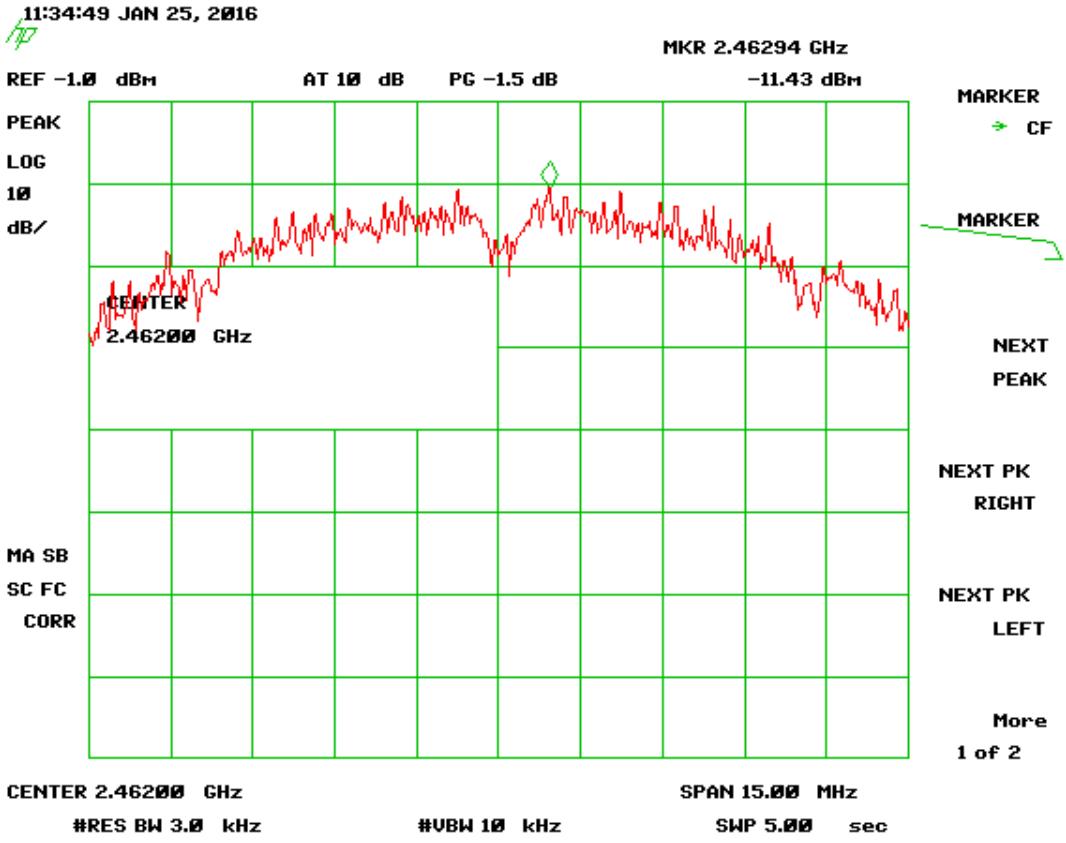


Figure 95. Peak Power Spectral Density, 802.11b High Channel

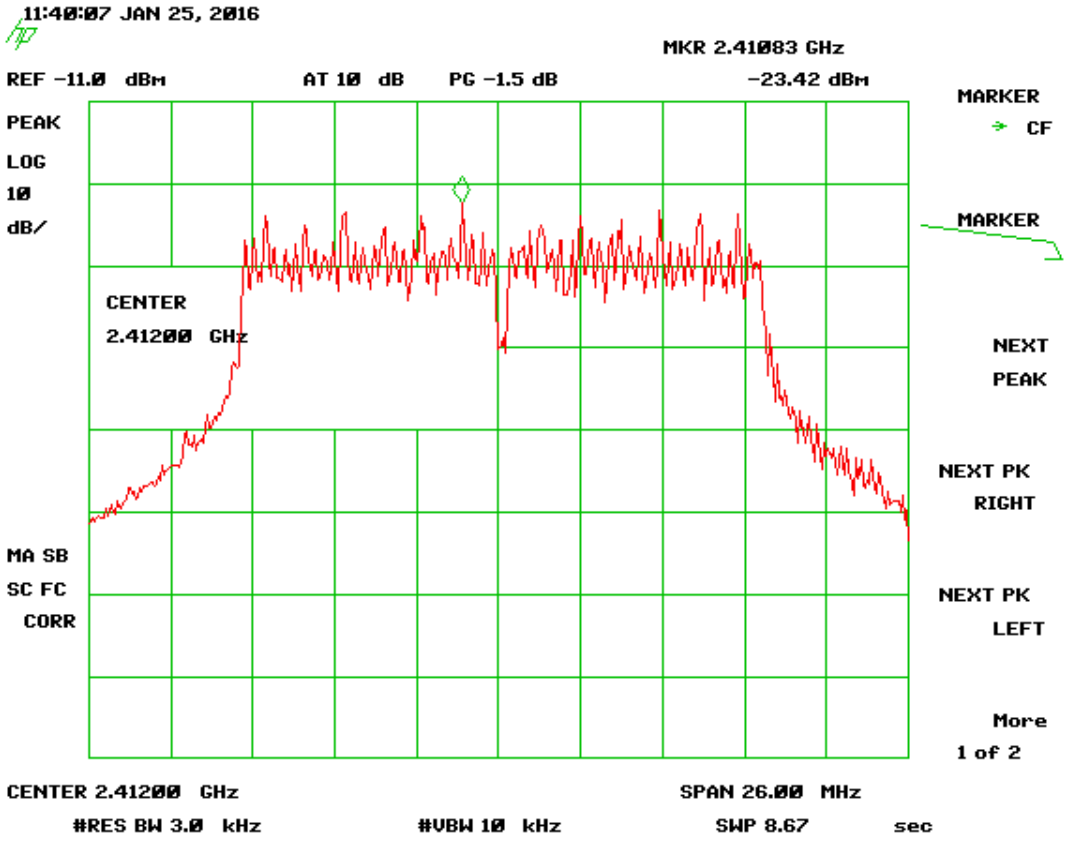


Figure 96. Peak Power Spectral Density, 802.11g Low Channel

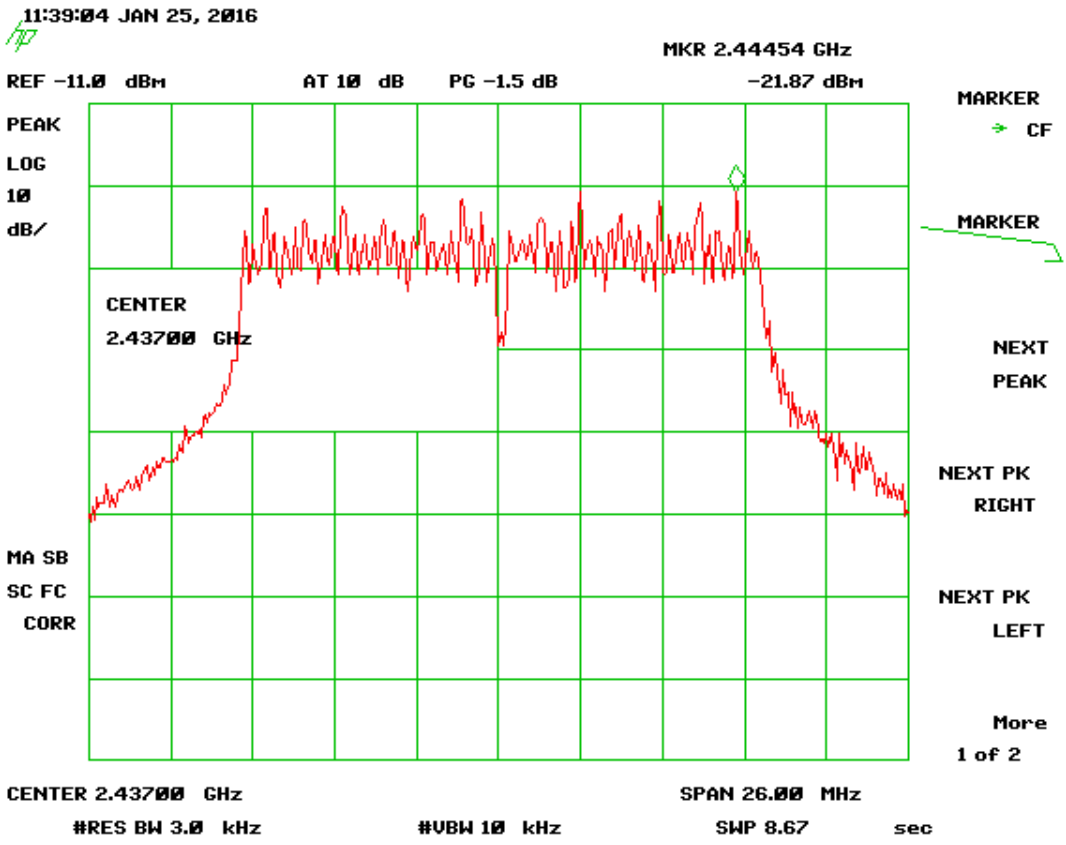


Figure 97. Peak Power Spectral Density, 802.11g Mid Channel

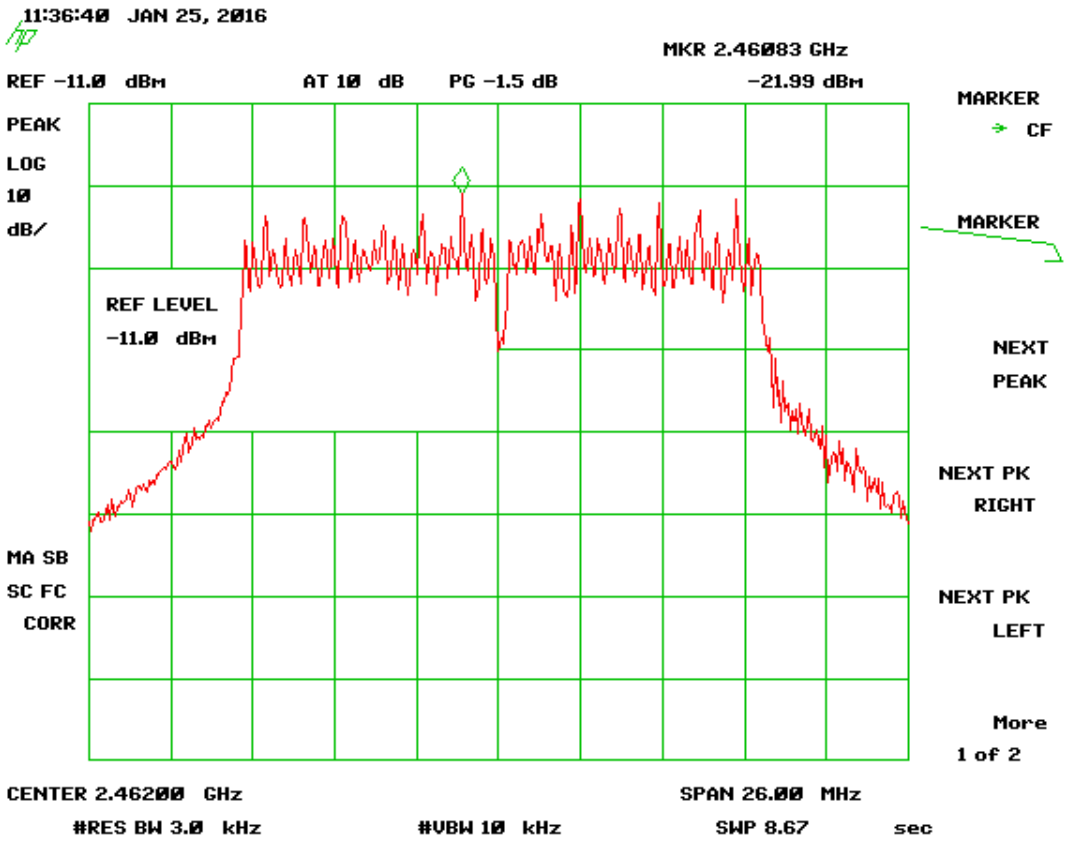


Figure 98. Peak Power Spectral Density, 802.11g High Channel

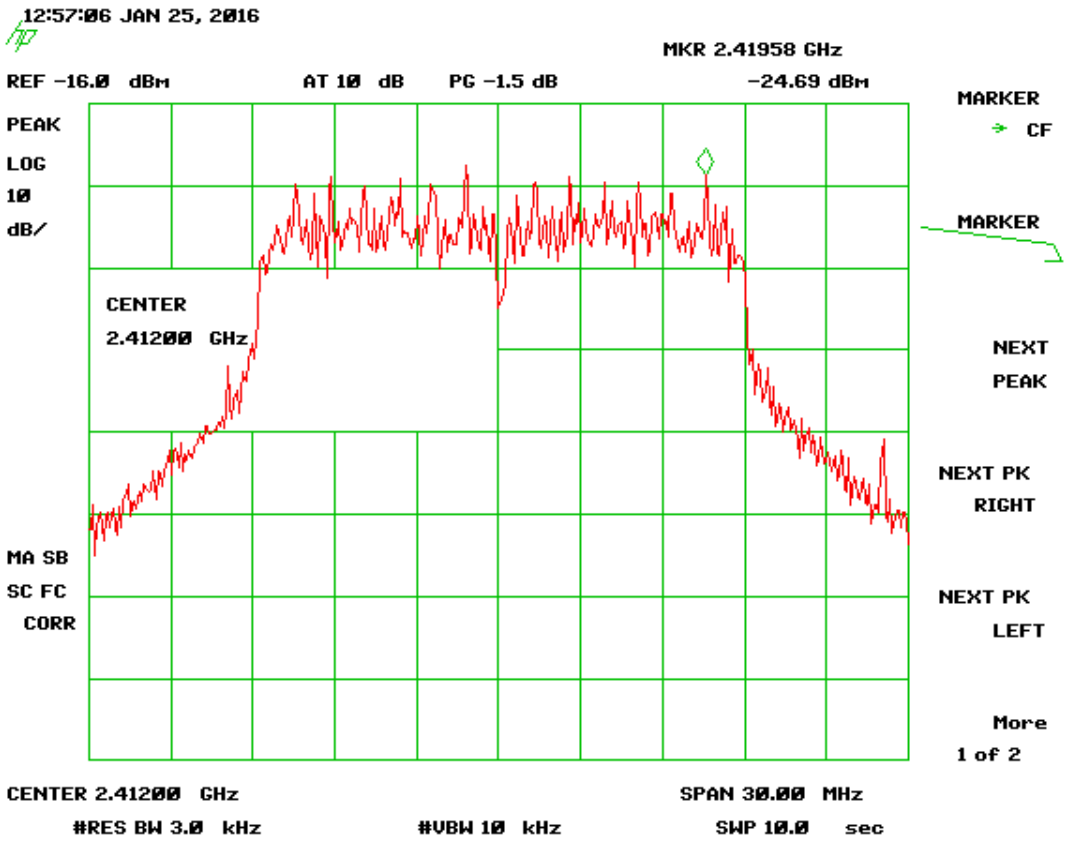


Figure 99. Peak Power Spectral Density, 802.11n Low Channel

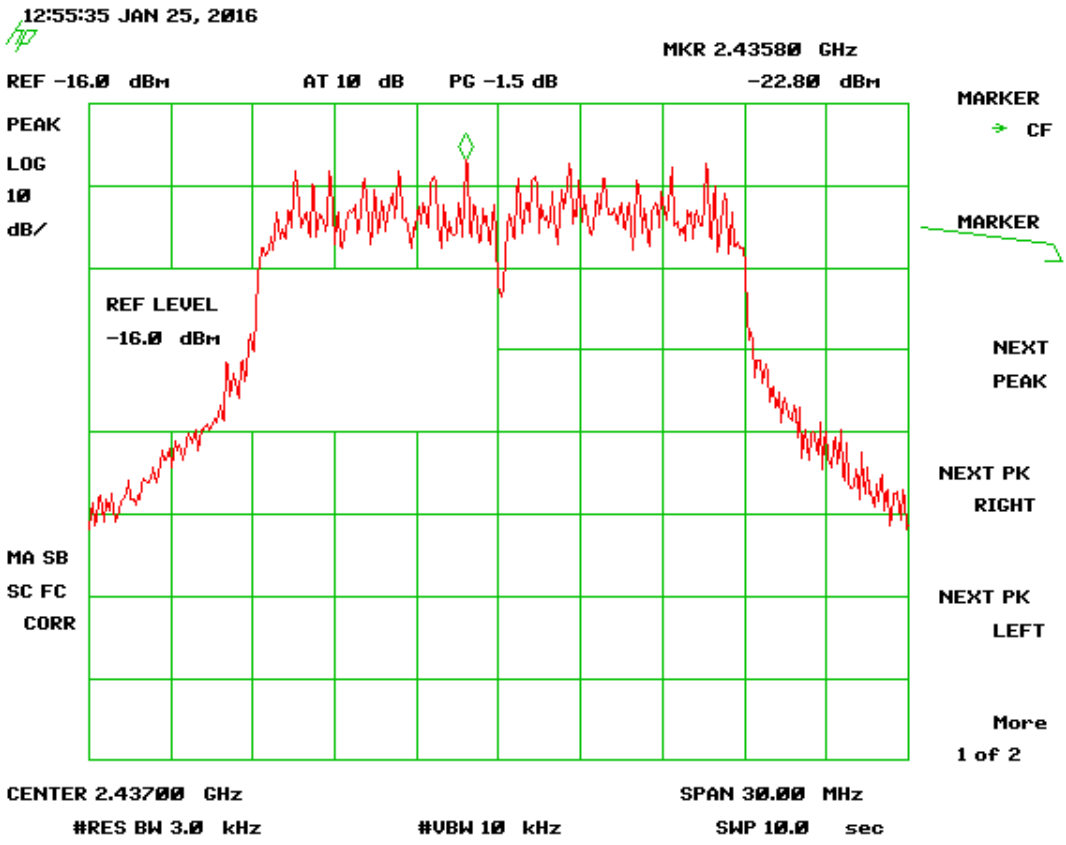


Figure 100. Peak Power Spectral Density, 802.11n Mid Channel

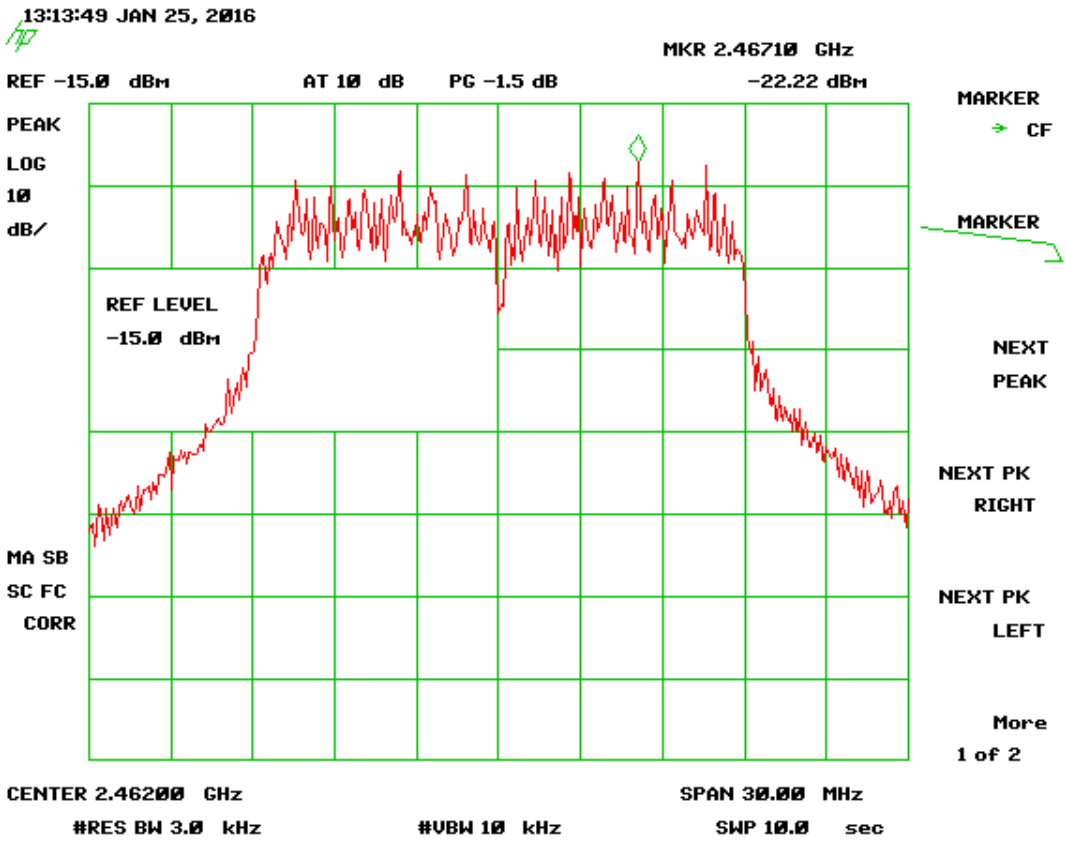


Figure 101. Peak Power Spectral Density, 802.11n High Channel

2.16 Unintentional Radiator, Powerline Emissions (CFR 15.107, 15.207)

The power line conducted voltage emission measurements have been carried out in accordance with CFR 15.107, per ANSI C63.4:2009, Paragraph 7, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmission.

The worst-case results for conducted emissions were determined to be produced when the EUT was operating under continuous transmission. The worst case measurement occurred on the Phase line at 0.15 MHz. The emission level was 4.1 dB from the applicable limit. All other emissions were at least 6.3 dB from the limit. Those results are given in the table following.

NOTE: The test data provided in this section is to support the Verification and co-location requirement for the digital apparatus and the radios within.

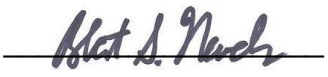
Table 24. Transmitter Power Line Conducted Emissions Test Data, Part 15.107, 15.207

150 KHz to 30 MHz with Class B Limits						
Test: Power Line Conducted Emissions				**Client:** Soneter, Inc.		
Project: 16-0020				**Model:** UFMT-1000		
Frequency (MHz)	**Test Data (dBuv)**	**LISN+CL-PA (dB)**	**Results (dBuV)**	**AVG Limits (dBuV)**	**Margin (dB)**	**Detector PK, QP, or AVG**
120 VAC, 60 Hz Phase						
0.15	61.10	0.54	61.64	65.8*	4.1	**PK**
0.15	38.80	0.54	39.34	55.8	16.4	**AVG**
0.54	46.30	0.32	46.62	56.0*	9.4	**PK**
0.54	32.50	0.32	32.82	46.0	13.2	**AVG**
1.68	32.30	0.30	32.60	46.0	13.4	**PK**
5.13	30.30	0.17	30.47	50.0	19.5	**PK**
16.90	30.70	0.29	30.99	50.0	19.0	**PK**
22.12	25.70	0.35	26.05	50.0	24.0	**PK**
120VAC, 60 Hz Neutral						
0.16	59.00	0.37	59.37	65.7*	6.3	**PK**
0.16	29.60	0.37	29.97	55.7	25.7	**AVG**
0.54	40.30	0.18	40.48	56.0*	15.5	**PK**
0.54	28.60	0.18	28.78	46.0	17.2	**AVG**
3.84	30.30	0.15	30.45	46.0	15.5	**PK**
5.30	29.10	0.17	29.27	50.0	20.7	**PK**
10.11	28.70	0.23	28.93	50.0	21.1	**PK**
20.94	25.60	0.33	25.93	50.0	24.1	**PK**

Note: * denotes QP Limits

SAMPLE CALCULATION at 0.15 MHz:

Magnitude of Measured Frequency	61.10	dBuV
+ Cable Loss+ LISN Loss	0.54	dB
=Corrected Result	61.64	dBuV
Limit	65.80	dBuV
-Corrected Result	61.64	dBuV
Margin	4.1	dB

Test Date: January 27, 2016
Tested By
Signature:  Name: Robert Nevels

2.17 Unintentional Radiator, Radiated Emissions (CFR 15.109,15.209)

Radiated emissions disturbance Measurements were performed with an instrument having both peak and quasi-peak detectors over the frequency range of 30 MHz to 10 times the highest frequency used or generated by the test unit. Measurements of the radiated emissions were made with the receiver antenna at a distance of 3 m from the boundary of the test unit.

The test antenna was varied from 1 m to 4 m in height while watching the analyzers' display for the maximum magnitude of the signal at the test frequency. The antenna polarization (horizontal or vertical) and test sample azimuth were varied during the measurements to find the maximum field strength readings to record.

The worst-case radiated emission was 8.6 dB below the limit at 289.00 MHz. This signal is found in the test tables below. All other radiated emissions were 9.2 dB or better below the limit.

NOTE: The test data provided in this section is to support the Verification and co-location requirement for the digital apparatus and the radios within. During this testing the radio were placed into normal operation mode.

Table 25. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109, 15.209), 30 MHz to 1000 MHz

30 MHz to 1000 MHz with Class B Limits							
Test: Radiated Emissions				**Client:** Soneter, Inc.			
Project: 16-0020				**Model:** UFMT-1000			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or QP**
71.24	49.22	-18.44	30.78	40.0	3m./VERT	9.2	**PK**
145.54	45.68	-12.96	32.72	43.5	3m./VERT	10.8	**PK**
120.92	44.51	-14.52	29.99	43.5	3m./VERT	13.5	**PK**
144.42	46.07	-13.47	32.60	43.5	3m./HORZ	10.9	**PK**
123.00	48.15	-14.90	33.25	43.5	3m./HORZ	10.3	**PK**
270.00	44.76	-10.19	34.57	46.0	3m./HORZ	11.4	**PK**
289.00	47.50	-10.11	37.39	46.0	3m./VERT	8.6	**PK**

Tested from 30 MHz to 1 GHz

SAMPLE CALCULATION at 71.24 MHz:

Magnitude of Measured Frequency	49.22	dBuV
+ Antenna Factor + Cable Loss – Amp Gain	-18.44	dB
=Corrected Result	30.78	dBuV
Limit	40.00	dBuV
-Corrected Result	30.78	dBuV
Margin	9.2	dB

Test Date: November 24, 2015

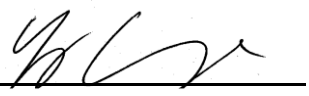
Tested By
Signature:  Name: George Yang

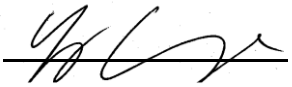
Table 26. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109, 15.209), Above 1 GHz

1 GHz to 13 GHz with Class B Limits							
Test: Radiated Emissions				**Client:** Soneter, Inc.			
Project: 16-0020				**Model:** UFMT-1000			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
1050.05	46.77	-9.33	37.44	54.0	3.0m./HORZ	16.6	**PK**
All other emissions were 20 dB or more below the limit.							

SAMPLE CALCULATION at 1050.05 MHz:

Magnitude of Measured Frequency	46.77	dBuV
+ Antenna Factor + Cable Loss – Amp Gain	-9.33	dB
=Corrected Result	37.44	dBuV
Limit	54.00	dBuV
-Corrected Result	37.44	dBuV
Margin	16.6	dB

Test Date: November 24, 2015

Signature:  Name: George Yang

2.18 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4. A coverage factor of k=2 was used to give a level of confidence of approximately 95%.

2.18.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.78 dB.

The data listed in this test report does have sufficient margin to negate the effects of uncertainty. Therefore, the EUT unconditionally meets this requirement.

2.18.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ± 5.39 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ± 5.18 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.21dB.

The data listed in this test report does have sufficient margin to negate the effects of uncertainty. Therefore, the EUT unconditionally meets this requirement.