

June 3, 2020

Viavi Solutions
20250 Century Blvd.
Germantown, MD 20874

Dear Jaryk Kuzel,

Enclosed is the EMC Wireless test report for compliance testing of the Viavi Solutions, OneAdvisor ONA-800A as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15.407, Subpart E (UNII 1).

Thank you for using the services of Eurofins E&E North America. If you have any questions regarding these results or if we can be of further service to you, please feel free to contact me.

Sincerely yours,
EUROFINS E&E NORTH AMERICA

A handwritten signature in cursive script that reads "Michelle Tawmging".

Michelle Tawmging
Documentation Department

Reference: (\\Viavi Solutions\\ WIR106969-FCC407 UNII 1)

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Electromagnetic Compatibility Criteria Test Report

for the

**Viavi Solutions
Model OneAdvisor ONA-800A**

Tested under
The FCC Certification Rules
contained in
Title 47 of the CFR
15.407 Subpart E

Report: WIR106969-FCC407 UNII 1

June 3, 2020

Prepared For:

**Viavi Solutions
20250 Century Blvd.
Germantown, MD 20874**

Prepared By:
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Tested under
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Title 47 of the CFR
15.407 Subpart E



Donald Salguero
Electromagnetic Compatibility Lab



Michelle Tawmging
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Parts 15B, 15.407, of the FCC Rules under normal use and maintenance.



Deepak Giri,
Manager, Wireless Lab

Report Status Sheet

| Revision | Report Date | Reason for Revision |
|----------|---------------|---------------------|
| Ø | June 3, 2020 | Initial Issue. |
| 1 | June 29, 2020 | TCB Comments |

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List of Terms and Abbreviations

| | |
|--------------------------|--|
| AC | Alternating Current |
| ACF | Antenna Correction Factor |
| Cal | Calibration |
| <i>d</i> | Measurement Distance |
| dB | Decibels |
| dB_μA | Decibels above one microamp |
| dB_μV | Decibels above one microvolt |
| dB_μA/m | Decibels above one microamp per meter |
| dB_μV/m | Decibels above one microvolt per meter |
| DC | Direct Current |
| E | Electric Field |
| DSL | Digital Subscriber Line |
| ESD | Electrostatic Discharge |
| EUT | Equipment Under Test |
| <i>f</i> | Frequency |
| FCC | Federal Communications Commission |
| GRP | Ground Reference Plane |
| H | Magnetic Field |
| HCP | Horizontal Coupling Plane |
| Hz | Hertz |
| IEC | International Electrotechnical Commission |
| kHz | Kilohertz |
| kPa | Kilopascal |
| kV | Kilovolt |
| LISN | Line Impedance Stabilization Network |
| MHz | Megahertz |
| μH | Microhenry |
| μ | Microfarad |
| μs | Microseconds |
| PRF | Pulse Repetition Frequency |
| RF | Radio Frequency |
| RMS | Root-Mean-Square |
| TWT | Traveling Wave Tube |
| V/m | Volts per meter |
| VCP | Vertical Coupling Plane |

Executive Summary

A. Purpose of Test

An EMC Wireless evaluation was performed to determine compliance of the Viavi Solutions OneAdvisor ONA-800A, with the requirements of Part 15, §15.407. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the OneAdvisor ONA-800A. Viavi Solutions should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the OneAdvisor ONA-800A, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.407, in accordance with Viavi Solutions, purchase order number 2941000132. All tests were conducted using measurement procedure ANSI C63.10-2013.

| FCC Reference | Description | Results |
|-------------------------|-----------------------|-----------|
| §15.407 (b)(1)& (6 - 7) | Undesirable Emissions | Compliant |

Figure 1: Executive Summary of EMC Part 15.407 Compliance Testing

Equipment Configuration

A. Overview

Eurofins MET Laboratories, Inc. was contracted by Viavi Solutions to perform testing on the OneAdvisor ONA-800A, under Viavi Solutions's purchase order number 2941000132.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Viavi Solutions OneAdvisor ONA-800A.

The results obtained relate only to the item(s) tested.

| | | |
|---------------------------------------|---|---|
| Model(s) Tested: | OneAdvisor ONA-800A | |
| Model(s) Covered: | OneAdvisor ONA-800A | |
| EUT Specifications: | Primary Power: 100-240VAC | |
| | FCC ID: WUW-SXPCEAC2 | |
| | Type of Modulations: | OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) |
| | Equipment Code: | NII |
| | Max. RF Output Power: | 0.08W |
| | EUT Frequency Ranges: | 5180-5240; 5190-5230; 5210 |
| Analysis: | The results obtained relate only to the item(s) tested. | |
| Environmental Test Conditions: | Temperature: 15-35° C | |
| | Relative Humidity: 30-60% | |
| | Barometric Pressure: 860-1060 mbar | |
| Type of Filing: | Other | |
| Evaluated by: | Donald Salguero | |
| Report Date(s): | June 3, 2020 | |

Figure 2: EUT Summary

B. References

| | |
|---|--|
| CFR 47, Part 15, Subpart E | Unlicensed National Information Infrastructure Devices (UNII) |
| ANSI C63.4:2014 | Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz |
| ISO/IEC 17025:2017 | General Requirements for the Competence of Testing and Calibration Laboratories |
| ANSI C63.10-2013 | American National Standard for Testing Unlicensed Wireless Devices |
| 789033 D02 General UNII Test Procedures New Rules v02r01 | Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E |

Figure 3: References

C. Test Site

All testing was performed at Eurofins MET Laboratories, Inc., 914 W. Patapsco Avenue, Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 3 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at Eurofins MET Laboratories.

Eurofins MET Laboratories Inc. (Eurofins E&E North America) is part of the Eurofins Electrical & Electronics (E&E) global compliance network.

D. Description of Test Sample

The OneAdvisor ONA-800A, Equipment Under Test (EUT) for the remainder of this document, is a portable handheld test platform that is used to test wireless telecommunications infrastructure. Different test capabilities are added through the use of attached expansion modules. The platform consists of the product mainframe ONA-800A-MF and its display ONA-800-DISPL.

The expansion modules listed below, tested with the platform in this report, are considered representative of all modules from their respective families. This particular combination of modules is intended to be used by telecommunications network installation and maintenance technicians at cellular antenna and base station sites.

CAA06MA – Cable and Antenna Analyzer (CAA) module

E41DWDMC - Optical Time Domain Reflectometer (OTDR) module

The ONA-800 supports both wired and wireless network connections for remote control and transfer of saved results and configurations.

Power is supplied by either the internal battery or the external AC/DC adapter.

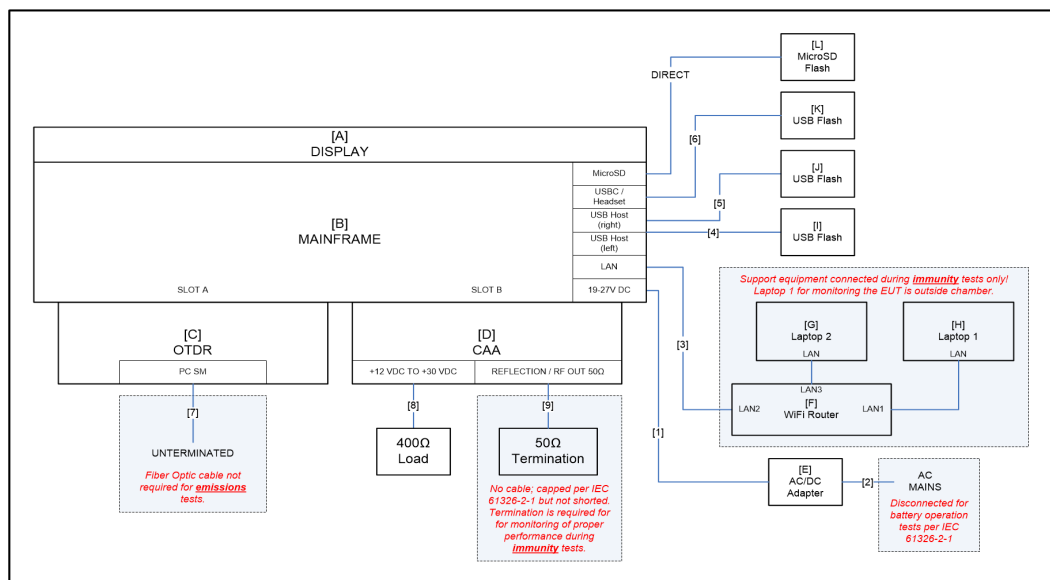


Figure 4: Block Diagram of Test Configuration

E. Equipment Configuration

The EUT was set up as outlined in Figure 4. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

| Ref. ID | Slot # | Name / Description | Model Number | Part Number | Serial Number | Rev. # |
|---------|--------|---|----------------|-------------------|----------------|--------|
| [A] | - | OneAdvisor ONA-800A Display | ONA-800A-DISPL | - | N/A | 000 |
| [B] | - | OneAdvisor ONA-800A Mainframe | ONA-800A-MF | - | WMSH0040300020 | 000 |
| [C] | A | METRO-ACCESS/PON 1310/1550/1625 NM PC OTDR MODULE | E41DWDMC-PC | - | 34193 | 000 |
| [D] | B | 6 GHz Cable and Antenna Analyzer Module | CAA06MA | 22130016-001 | JCFA0022 | 001 |
| [E] | - | AC/DC Adapter | ATS160TP190 | ATS160TP190Q15204 | N/A | N/A |

Figure 5: Equipment Configuration

F. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

| Ref. ID | Name / Description | Manufacturer | Model Number | *Customer Supplied Calibration Data |
|-----------|--------------------|--------------|--------------------|-------------------------------------|
| [F] | Wi-Fi Router | Netgear | AC1200 / R6220 | N/A |
| [G] | Laptop 2 | Lenovo | ThinkPad X1 Carbon | N/A |
| [H] | Laptop 1 | Dell | M4800 | N/A |
| [I, J, K] | USB Flash | SanDisk | SDCZ60-016G | N/A |
| [L] | MicroSD Flash | ATP | AF1GUDI | N/A |

Figure 6: Support Equipment

G. Ports and Cabling Information

| Ref. ID | Port name on EUT | Cable Description or reason for no cable | Qty | Length as tested (m) | Max Length (m) | Shielded? (Y/N) | Termination Box ID & Port Name |
|---------|-----------------------------|--|-----|----------------------|----------------|-----------------|--------------------------------|
| 1 | [B] 19-27V DC | 2 conductor, 16 AWG UL 2464 | 1 | 1.5 | 1.5 | N | [E] DC OUTPUT |
| 2 | [E] AC INPUT | 3 conductor, 18 AWG | 1 | 2.5 | 2.5 | N | AC MAINS |
| 3 | [B] LAN | CAT5/5e/6, UTP | 1 | 3 | 100 | N | [F] LAN2 |
| 4 | [B] USB Host (left) | USB A/A, STP | 1 | 3 | 5 | Y | [I] USB Flash |
| 5 | [B] USB Host (right) | USB A/A, STP | 1 | 3 | 5 | Y | [J] USB Flash |
| 6 | [B] USB C | USB C/A + USB A/A, STP | 1 | 3.15 | 5 | Y | [K] USB Flash |
| 7 | [C] PC SM | Optical fiber | 1 | ~3000 | N/A | N/A | Unterminated |
| 8 | [D] +12 VDC TO +30 VDC | RG-58 (3m) + RG-316 (0.25m) | 1 | 3.25 | >3m | Y | 400Ω Load |
| 9 | [D] REFLECTION / RF OUT 50Ω | Capped, no cable per IEC61326-2-1. Termination required for immunity measurement | 1 | 0m | >3m | Y | 50Ω Termination |

Figure 7: Ports and Cabling Information

H. Mode of Operation

The EUT will be running two simultaneous test applications during both emissions and immunity testing:

“Reflection Return Loss” test application running continuously on the CAA module

“OTDR EXPERT” test application in “Real Time” mode running continuously on the OTDR module

Additionally, the EUT will be running the following during immunity testing only:

Ethernet ping test running continuously between Laptop 2 and the EUT via the router

Wi-Fi ping test running continuously between Laptop 2 and the EUT via the router

I. Method of Monitoring EUT Operation

Each of the test applications below are monitored from outside the test chamber using a VNC client. Each test application is checked by switching focus between their respective tabs at the top of the display. Note: Stimulus must be applied when focus is on the CAA test application because it runs continuously only when selected.

For “Reflection Return Loss” test application running on CAA module:

1. In normal, error-free operation, the:

- Reflection Return Loss trace is continuously updated and remains similar to the initial reference waveform
- the Bias Voltage current measurement value is continuously updated and remains similar to the expected value

2. In continuously errored / broken state, the:

- Reflection Return Loss trace is not updating or becomes consistently dissimilar to the initial reference waveform
- the Bias Voltage current measurement value is not updating or is dissimilar to the expected value

For “OTDR EXPERT” test application running on CAA module:

1. In normal, error-free operation, the:

- OTDR trace is continuously updated and remains similar to the initial reference waveform

2. In continuously errored / broken state, the:

- OTDR trace is not updating or becomes consistently dissimilar to the initial reference waveform

Ethernet and Wi-Fi ping tests:

1. In normal, error-free operation, the:

- Lost packets during a single test are $\leq 10\%$.

2. In errored state, the:

- Lost packets during a single test are $> 10\%$.

Note regarding pass/fail criteria:

Note: Transient errors or measurement deviations do not constitute a failure per performance criteria B provided that performance returns to normal without user intervention after the immunity test stimulus is removed.

J. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

K. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Viavi Solutions upon completion of testing.

Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators**§15.407(b)(1) & (6 – 7) Undesirable Emissions**

| | |
|---------------------------|---|
| Test Requirements: | <p>§ 15.407(b)(1): For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.</p> <p>§ 15.407(b)(6): Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.</p> <p>§ 15.407(b)(7): The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.</p> |
| Test Procedure: | <p>The EUT was placed on a non-conducting stand on a turntable in a chamber. To find the maximum emission the EUT was set to transmit on low, mid, and high channels. Additionally, the turntable was rotated 360 degrees, the EUT was oriented through its three orthogonal axes, and the receive antenna height was varied in order to maximize emissions.</p> <p>For frequencies from 30 MHz to 1 GHz, measurements were first made using a peak detector with a 100 kHz resolution bandwidth. Emissions which exceeded the limits were re-measured using a quasi-peak detector with a 120 kHz resolution bandwidth.</p> <p>Above 1 GHz, measurements were made pursuant the method described in FCC KDB 789033 D02 General UNII Test Procedure New Rules v01. The equation, EIRP = E + 20 log D – 104.8 was used to convert field strength to EIRP (E = field strength (dBμV/m) and D = Reference measurement distance).</p> <p>For emissions above 1 GHz and in restricted bands, measurements of the field strength were made with a peak detector and an average detector and compared with the limits of 15.209.</p> <p>As an alternative, according to FCC KDB 789033 D02 General UNII Test Procedure New Rules v01, all emissions above 1 GHz that comply with the peak and average limits of 15.209 satisfy the requirements of unwanted emissions in 15.407.</p> |
| Test Results: | <p>For below 1 GHz, the EUT was compliant with the requirements of this section.</p> <p>For above 1 GHz, the EUT was compliant with the requirements of this section. Only noise was observed above 18GHz, noise level was below applicable limits by at least 6dB.</p> <p>EUT was setup for 2x2MIMO transmissions on all available modes.</p> |
| Test Engineer: | Donald Salguero |
| Test Date: | May 1, 2020 |

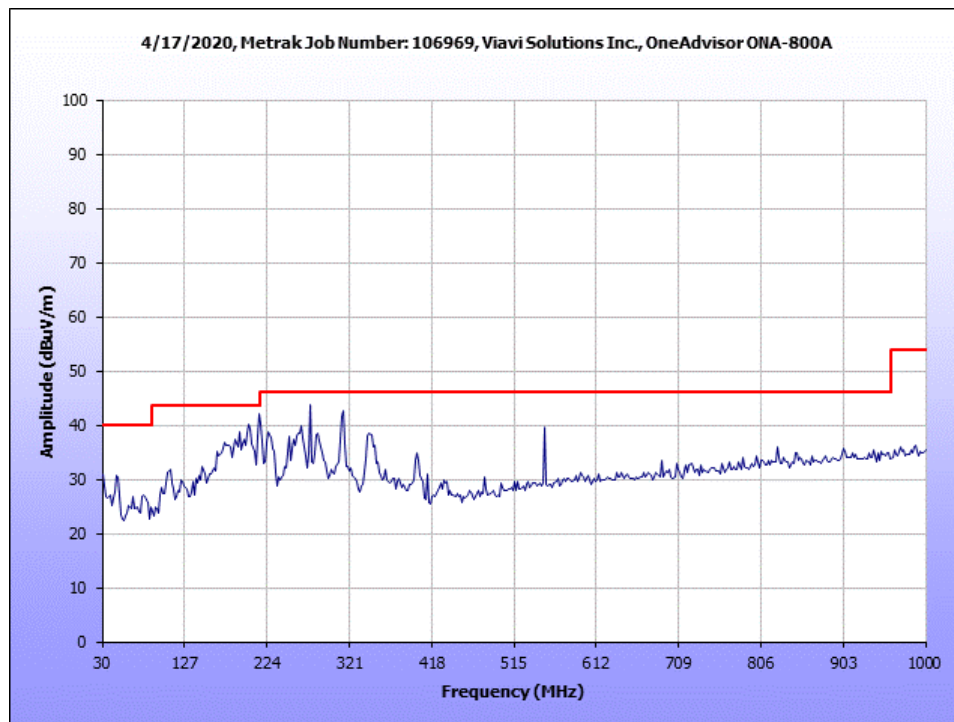


Figure 8: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 15.209 worst case - below 1GHz.

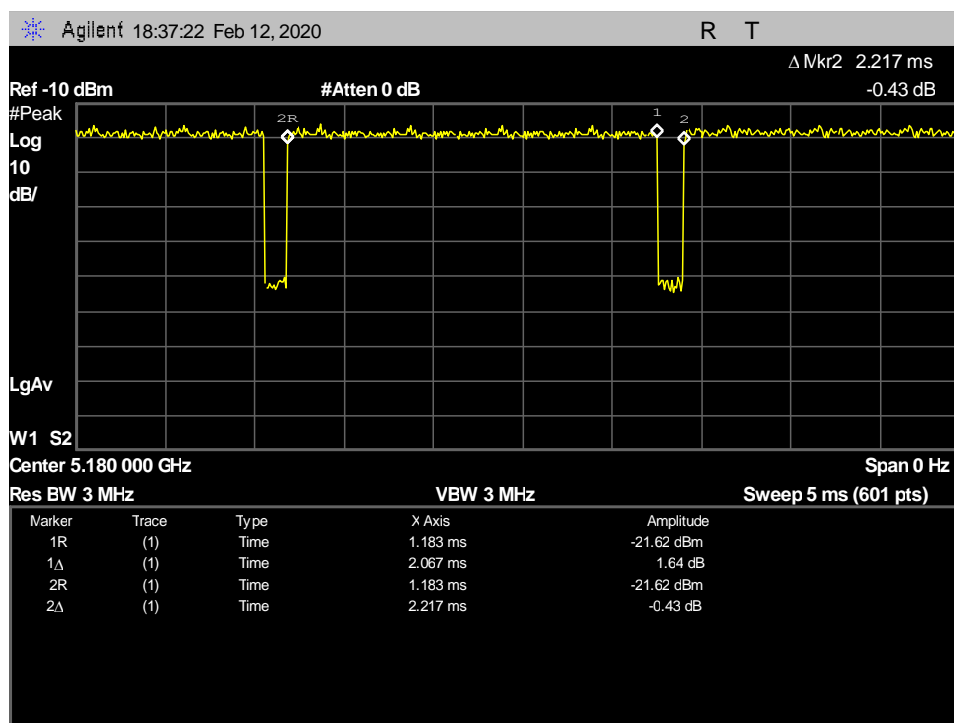


Figure 9: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11a Duty Cycle

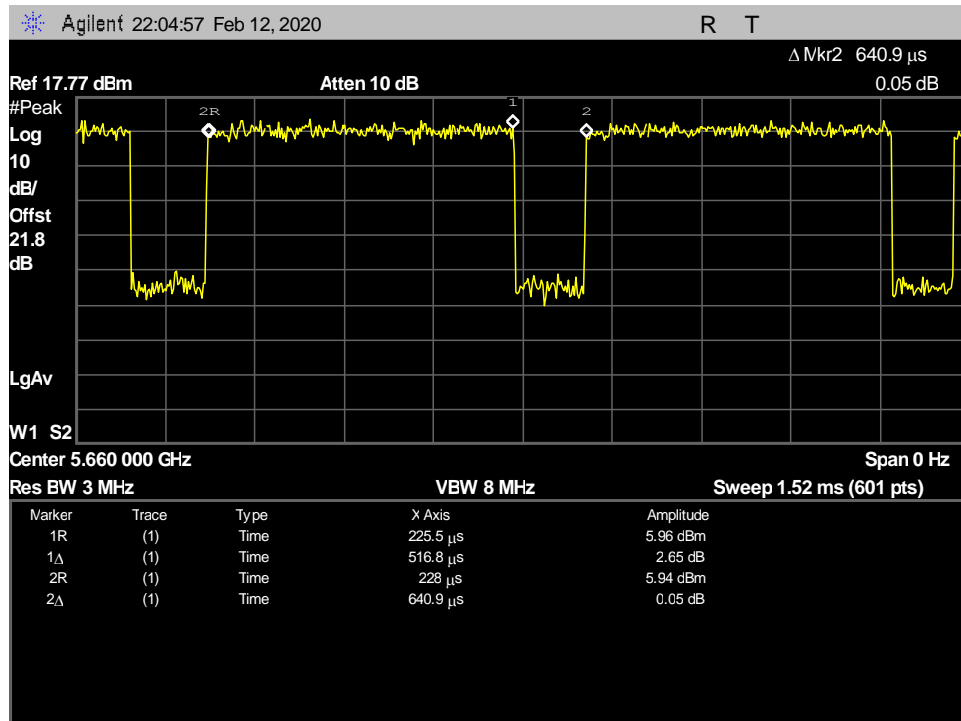


Figure 10: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac20 Duty Cycle

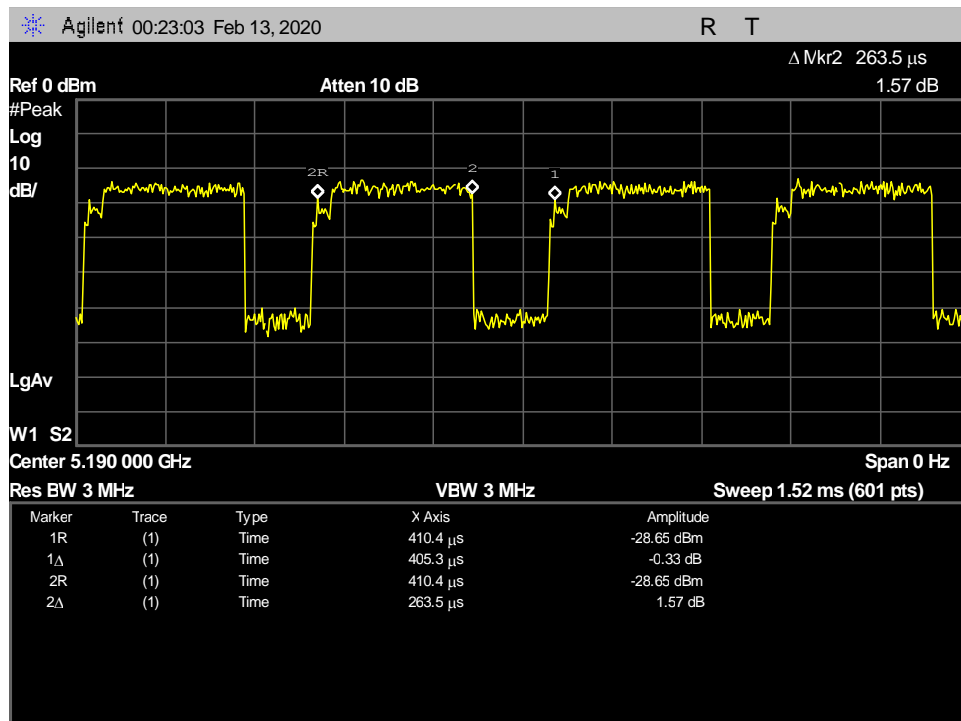


Figure 11: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac40 Duty Cycle

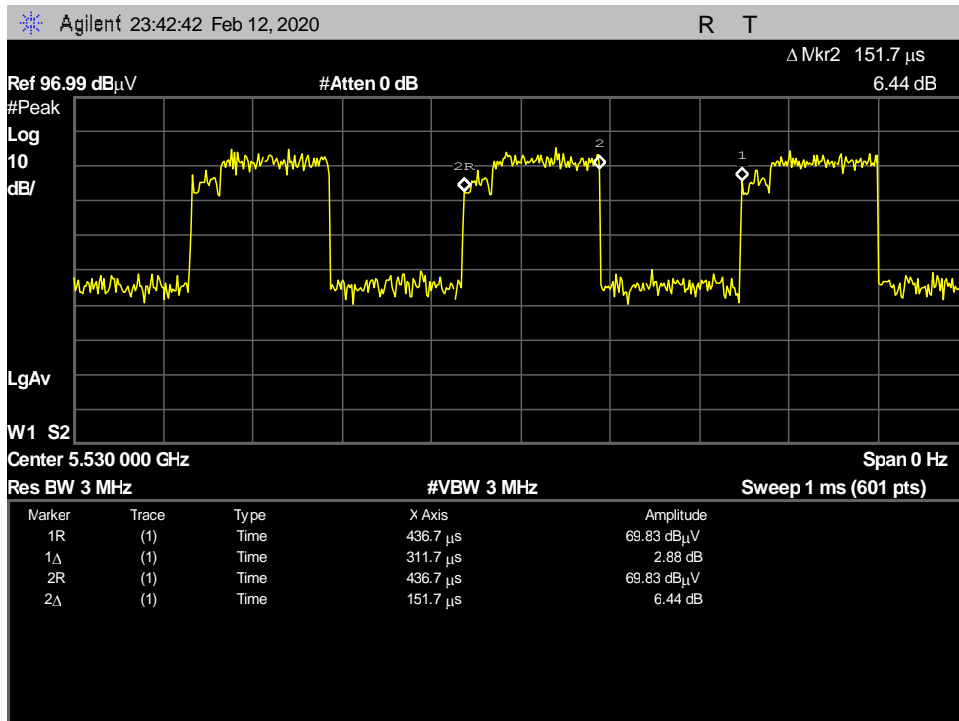


Figure 12: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac80 Duty Cycle

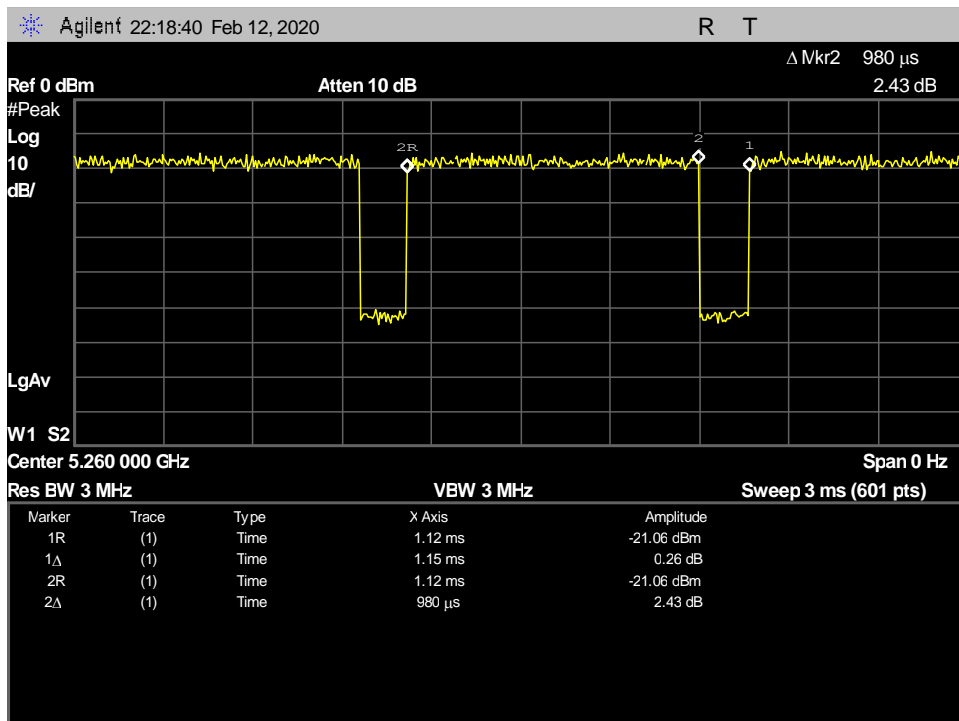


Figure 13: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11n20 Duty Cycle

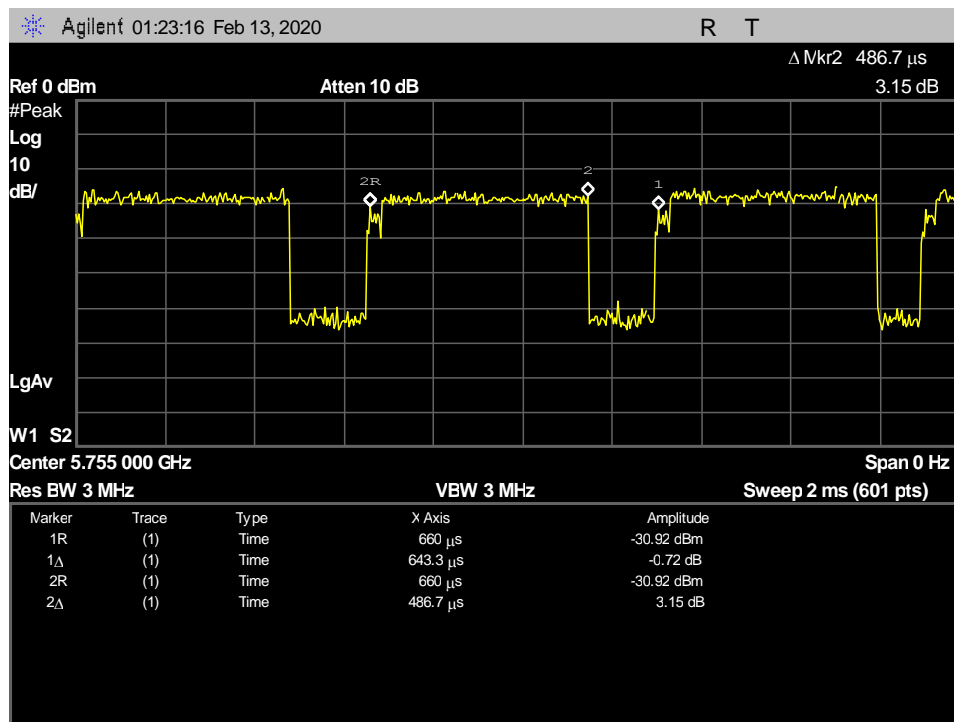


Figure 14: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11n40 Duty Cycle

| Mode | Period (ms) | 1/T (Hz) | VBW (kHz) |
|-------------|-------------|----------|-----------|
| 802.11a | 2.217 | 451 | 1 |
| 802.11ac 20 | 0.6409 | 1560 | 3 |
| 802.11ac 40 | 0.4053 | 2467 | 3 |
| 802.11ac 80 | 0.3117 | 3208 | 10 |
| 802.11n 20 | 1.15 | 870 | 1 |
| 802.11n 40 | 0.6433 | 1554 | 3 |

Figure 15: VBW values for Average Radiated Emissions Measurements

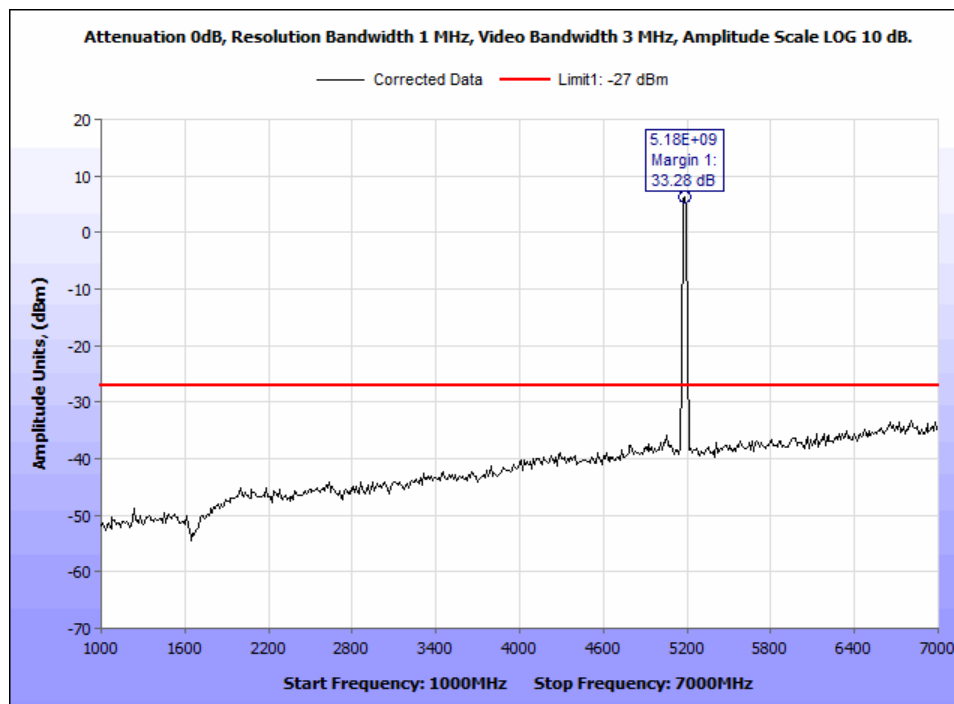


Figure 16: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11a 20M 5180M - 1-7GHz.

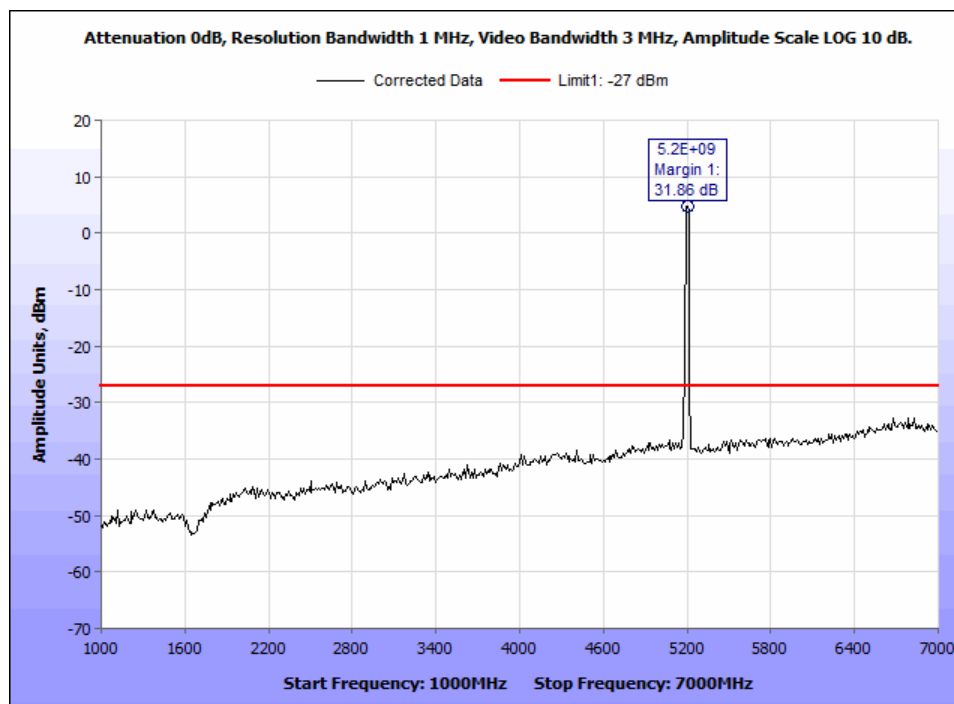


Figure 17: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11a 20M 5200M - 1-7GHz.

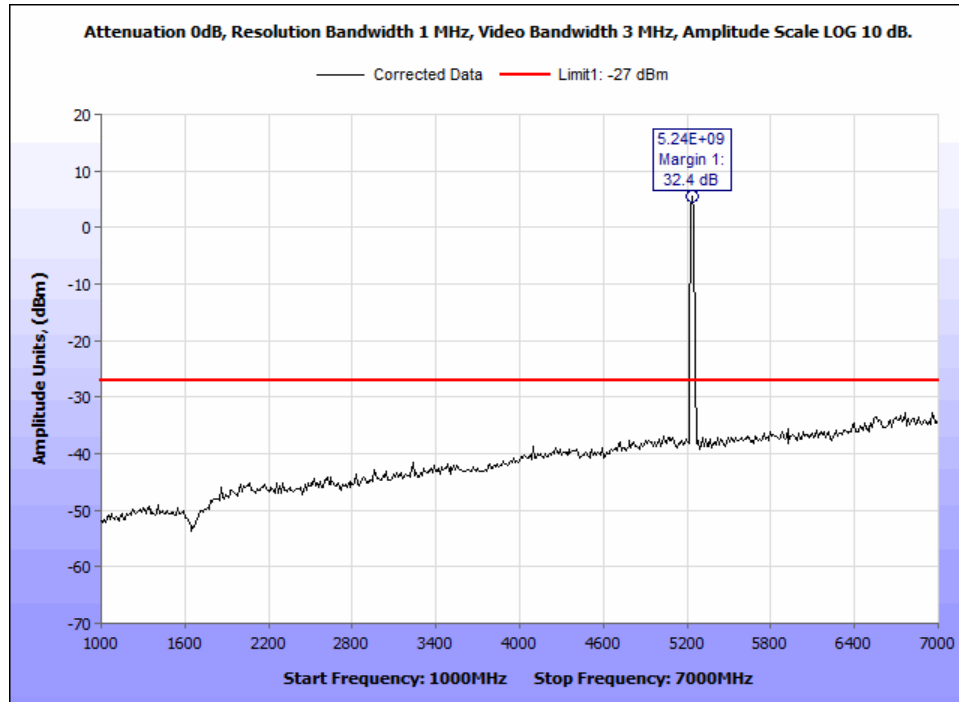


Figure 18: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11a 20M 5240M - 1-7GHz.

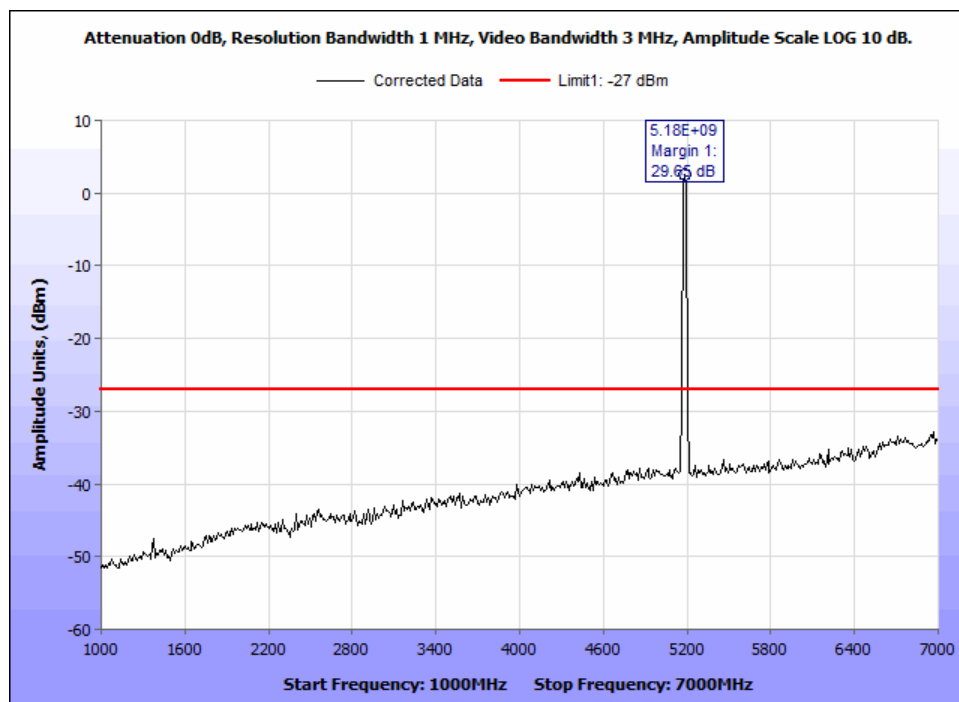


Figure 19: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11ac 20M 5180M - 1-7GHz.

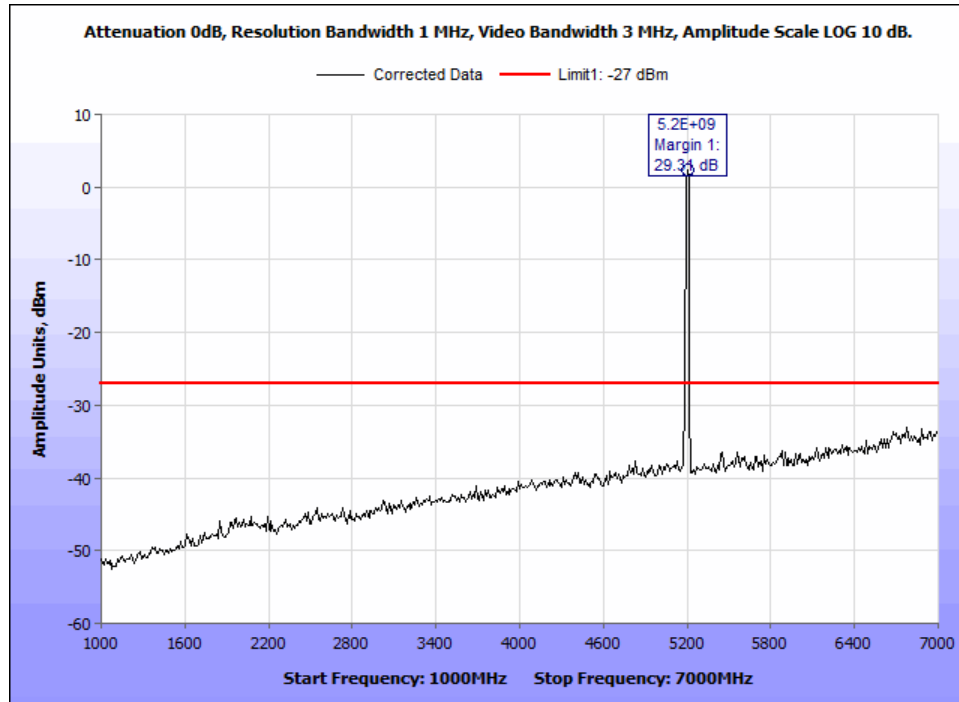


Figure 20: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11ac 20M 5200M - 1-7GHz.

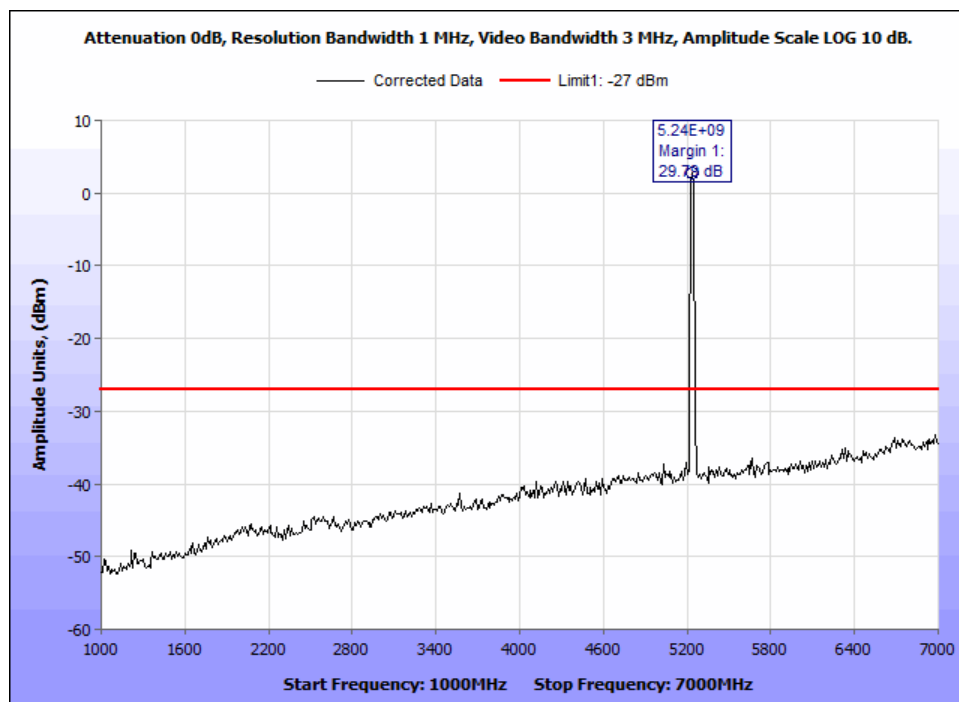


Figure 21: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11ac 20M 5240M - 1-7GHz.

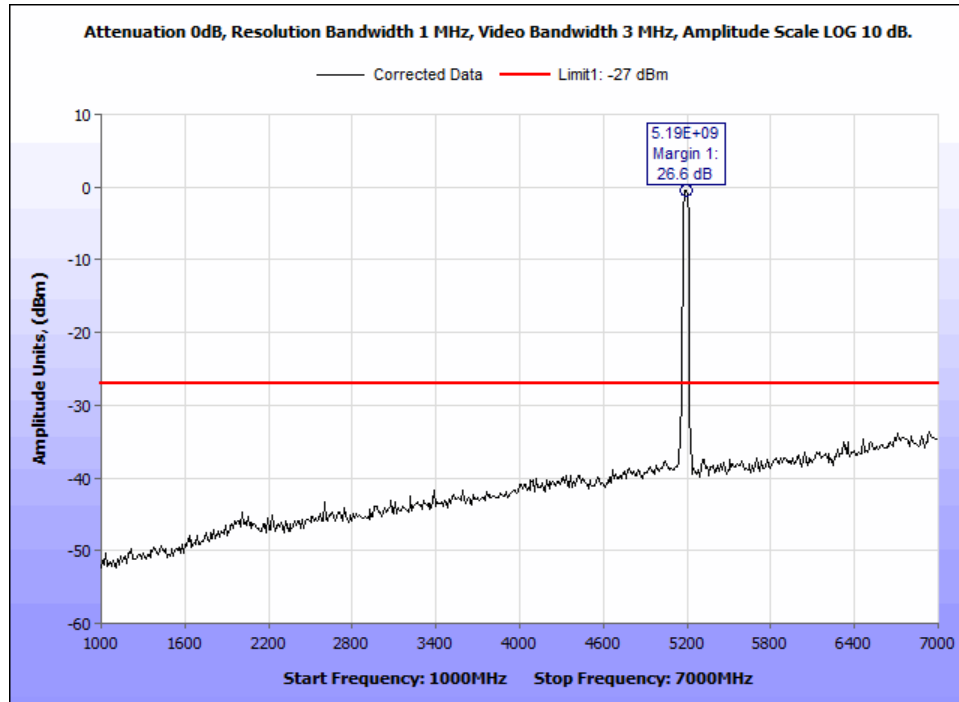


Figure 22: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11ac 40M 5190M - 1-7GHz.

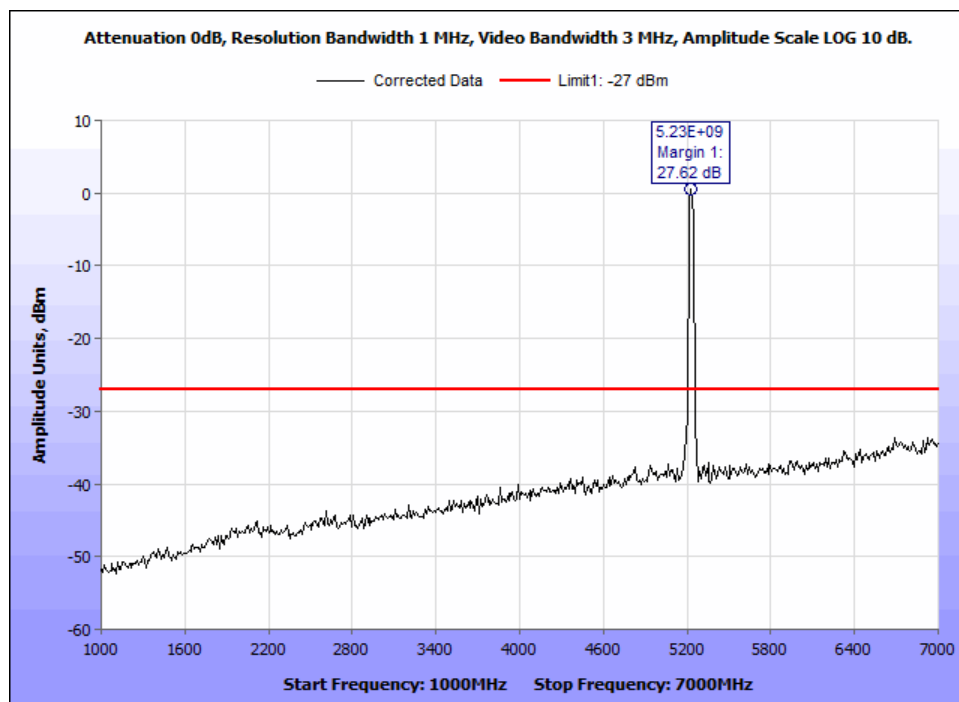


Figure 23: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11ac 40M 5230M - 1-7GHz.

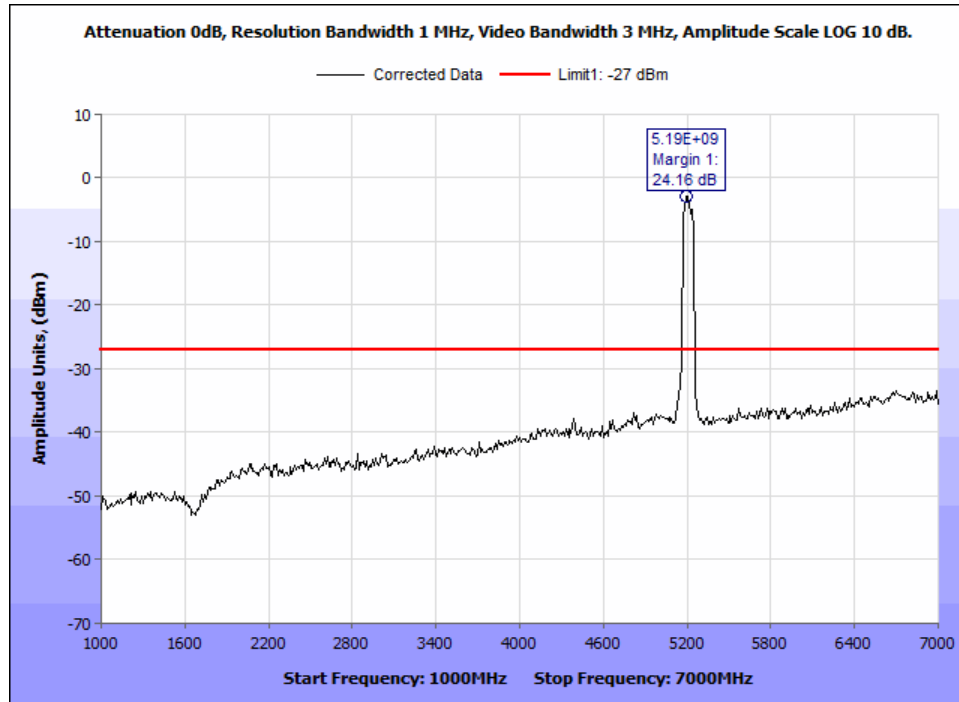


Figure 24: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11ac 80M 5210M - 1-7GHz.

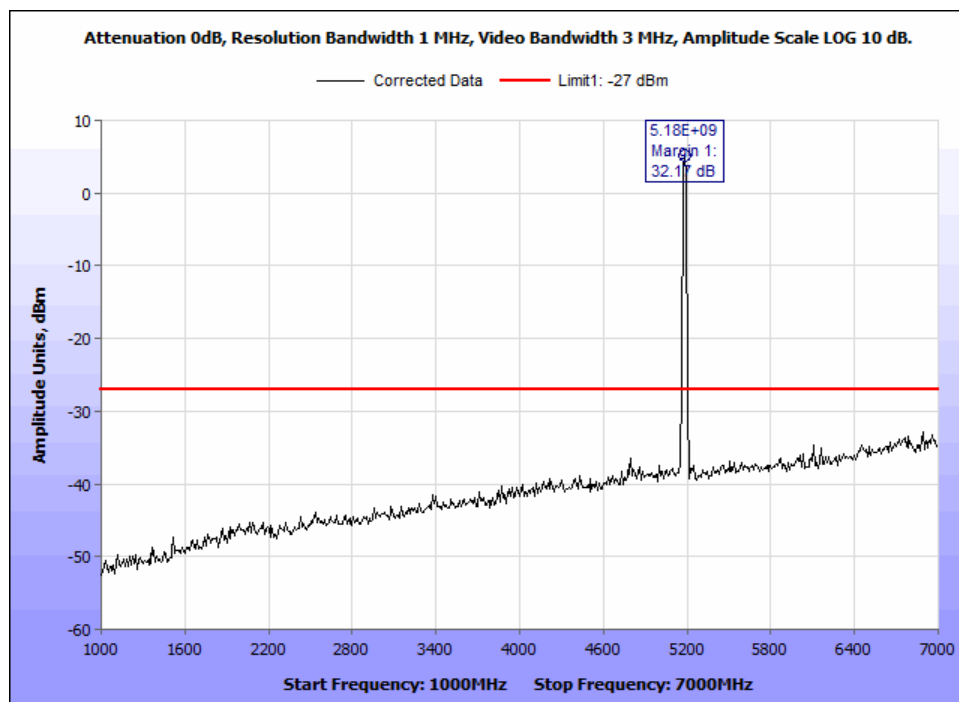


Figure 25: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11n 20M 5180M - 1-7GHz.

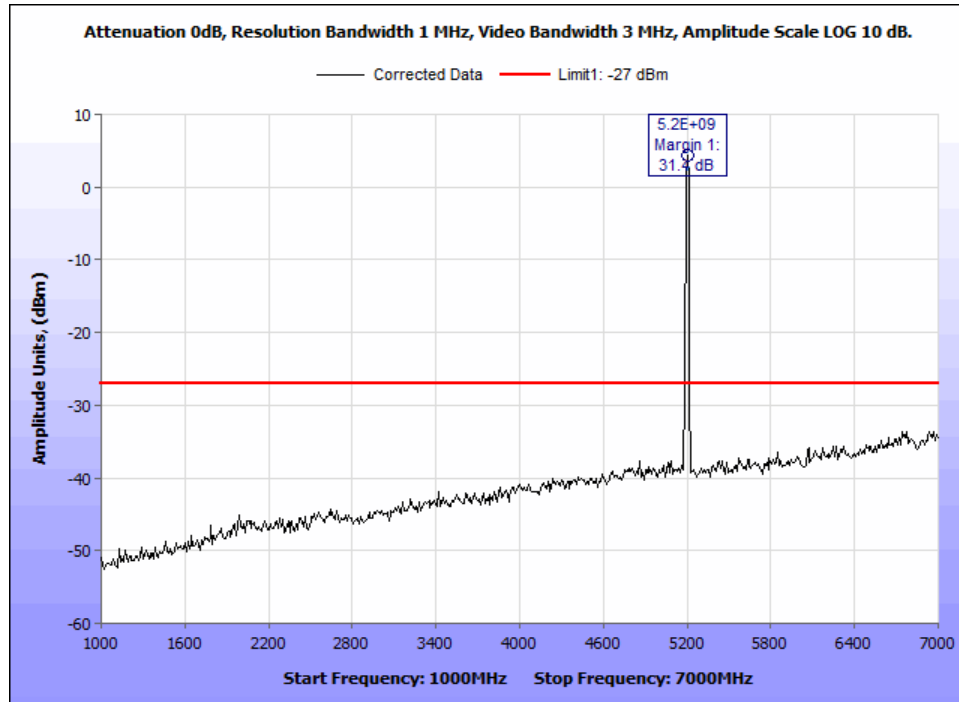


Figure 26: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11n 20M 5200M - 1-7GHz.

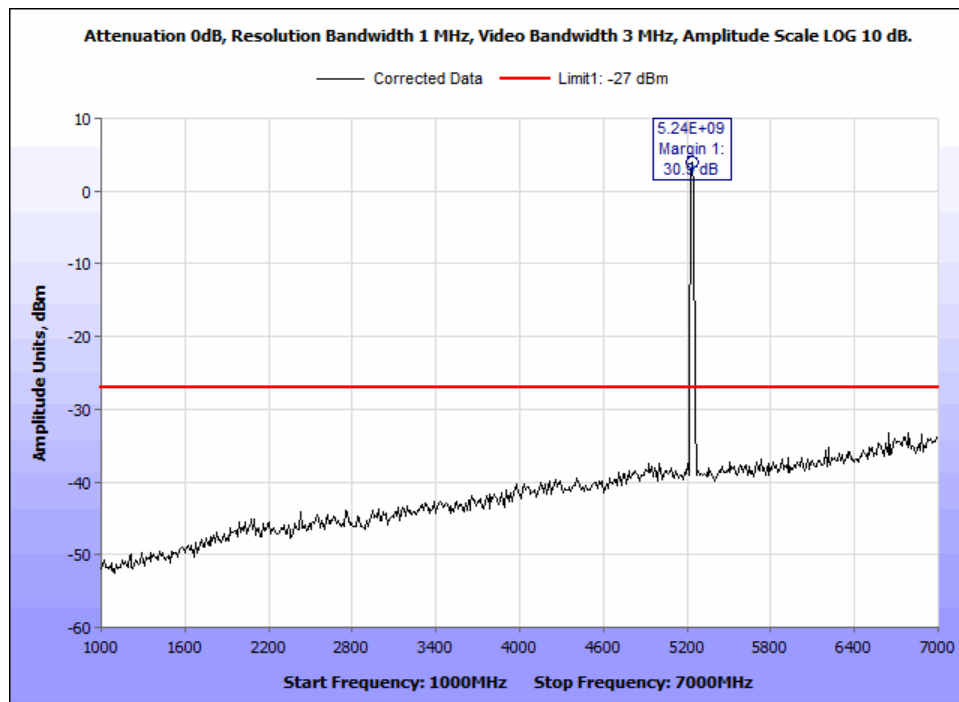


Figure 27: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11n 20M 5240M - 1-7GHz.

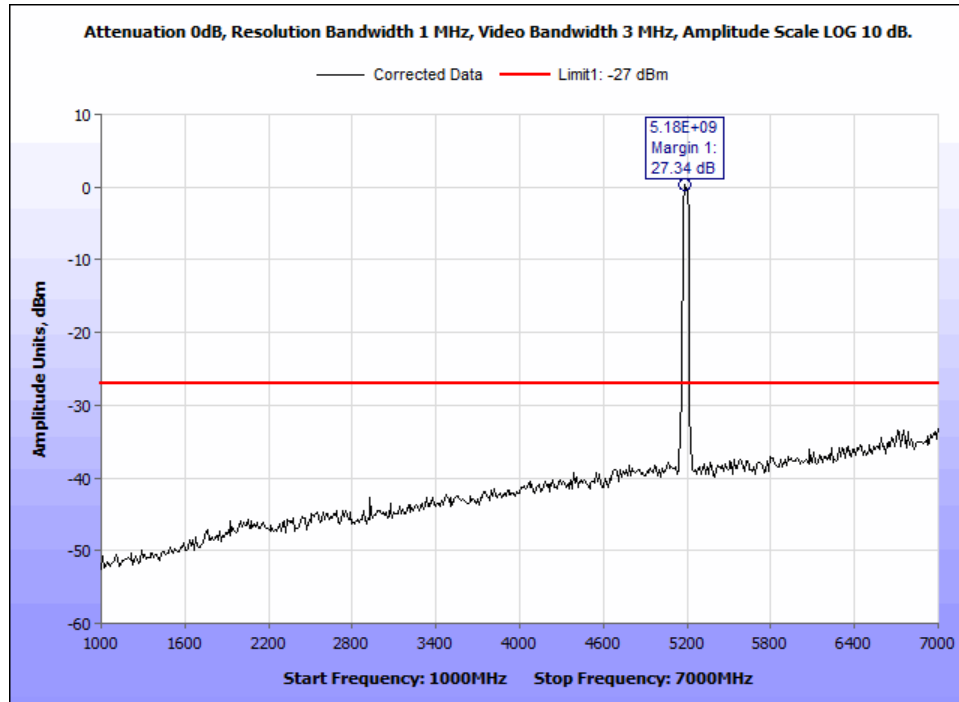


Figure 28: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11n 40M 5190M - 1-7GHz.

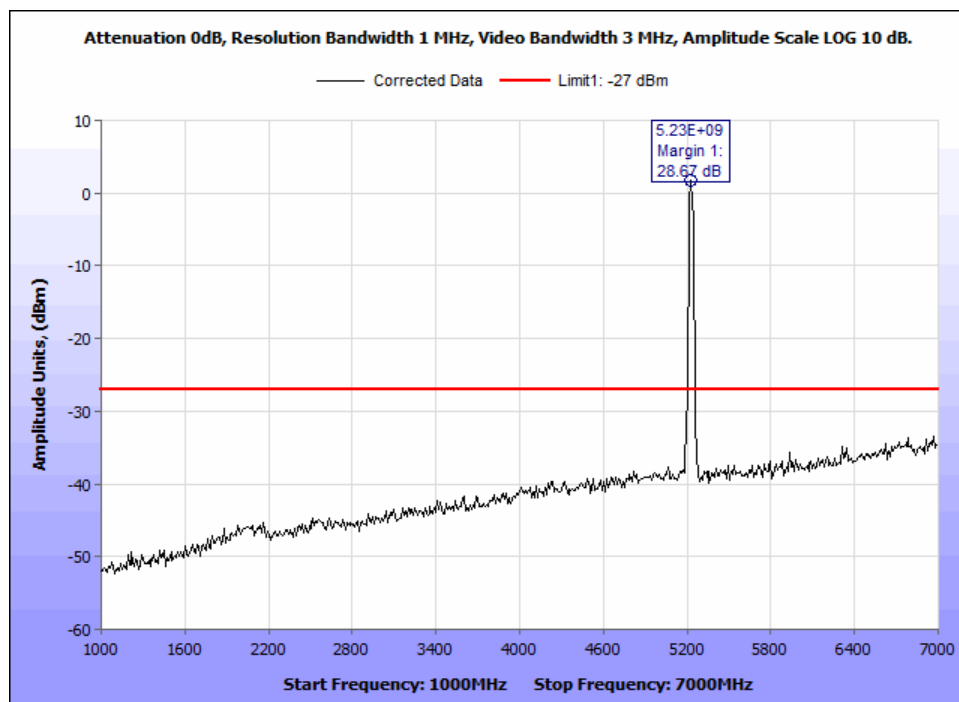


Figure 29: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm Radiated Emissions - 802.11n 40M 5230M - 1-7GHz.

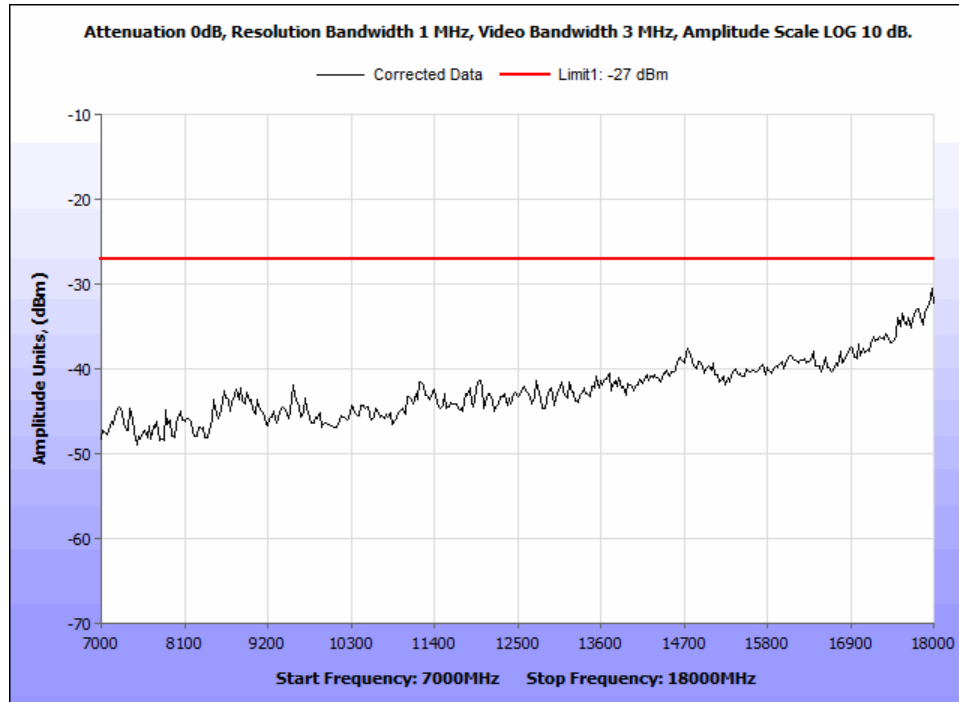


Figure 30: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm_15.407_worst case_Radiated Emissions_7-18GHz.

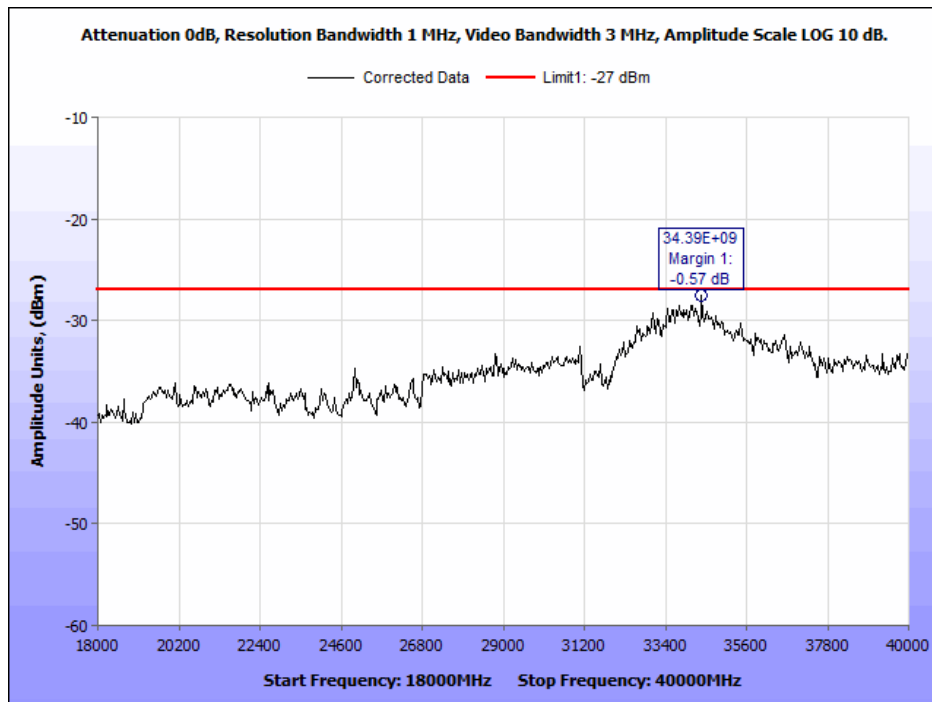


Figure 31: §15.407(b)(1) & (6 – 7) Undesirable Emissions, -27dBm_15.407_worst case_Radiated Emissions_18-40GHz.

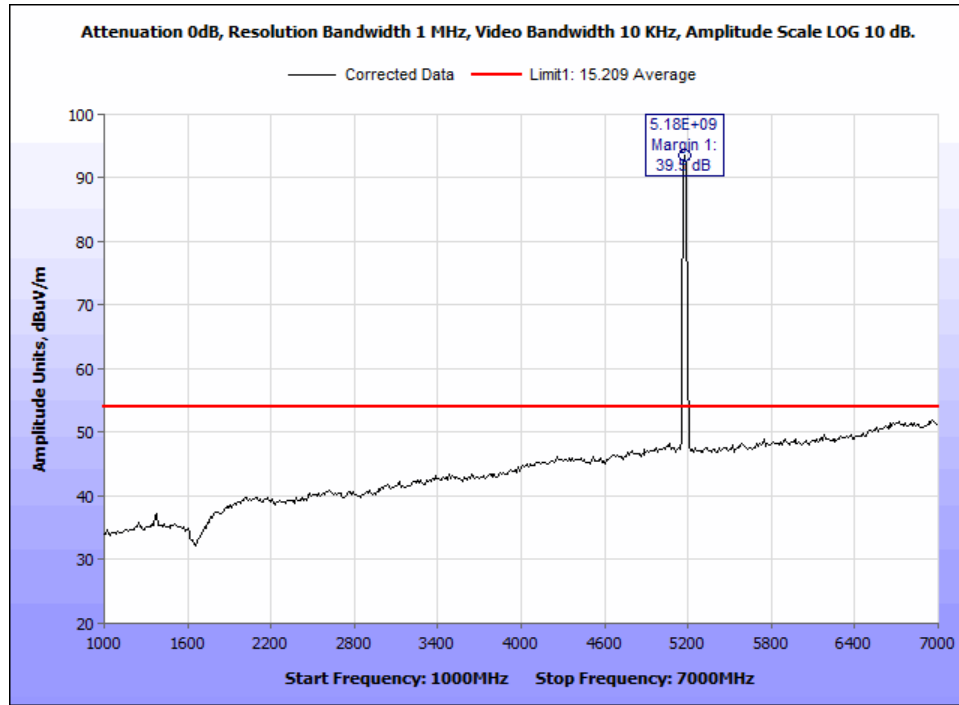


Figure 32: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11a 20M 5180M - 1-7GHz.

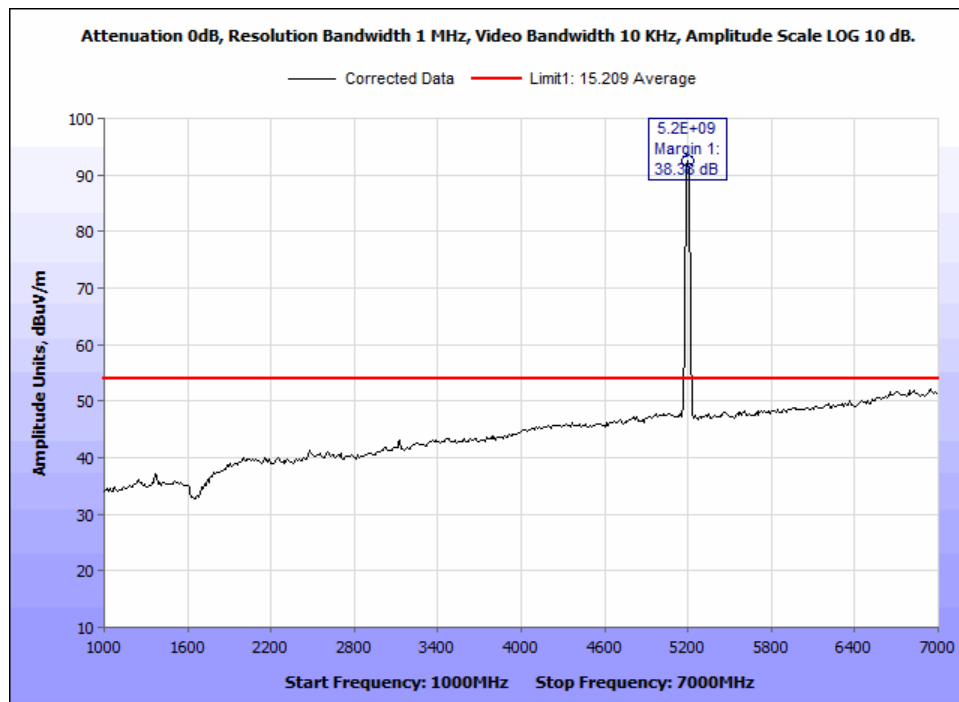


Figure 33: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11a 20M 5200M - 1-7GHz.

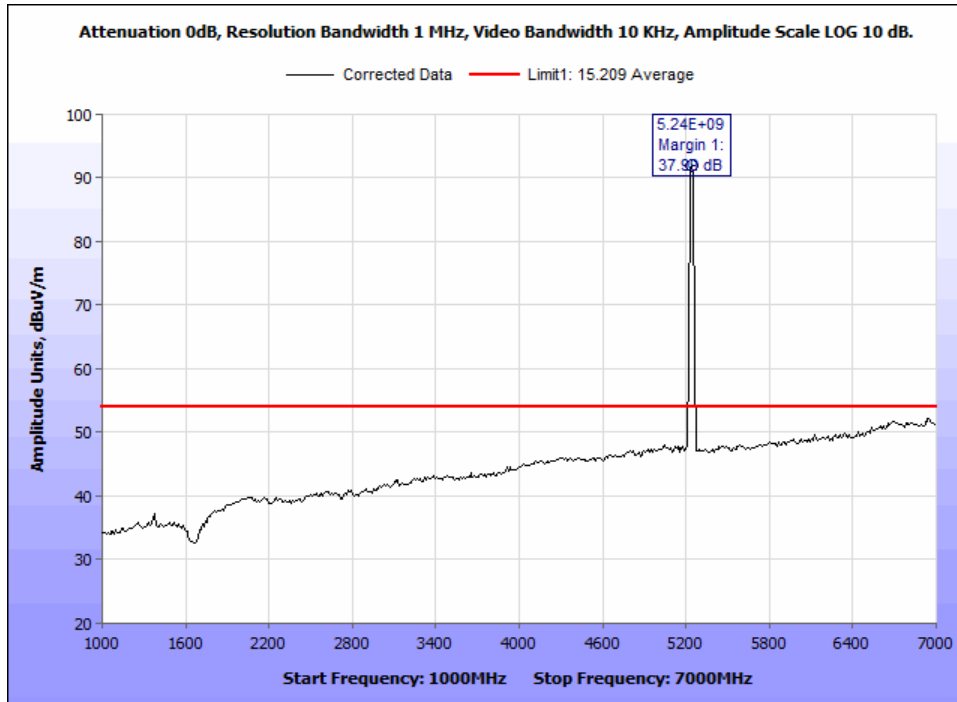
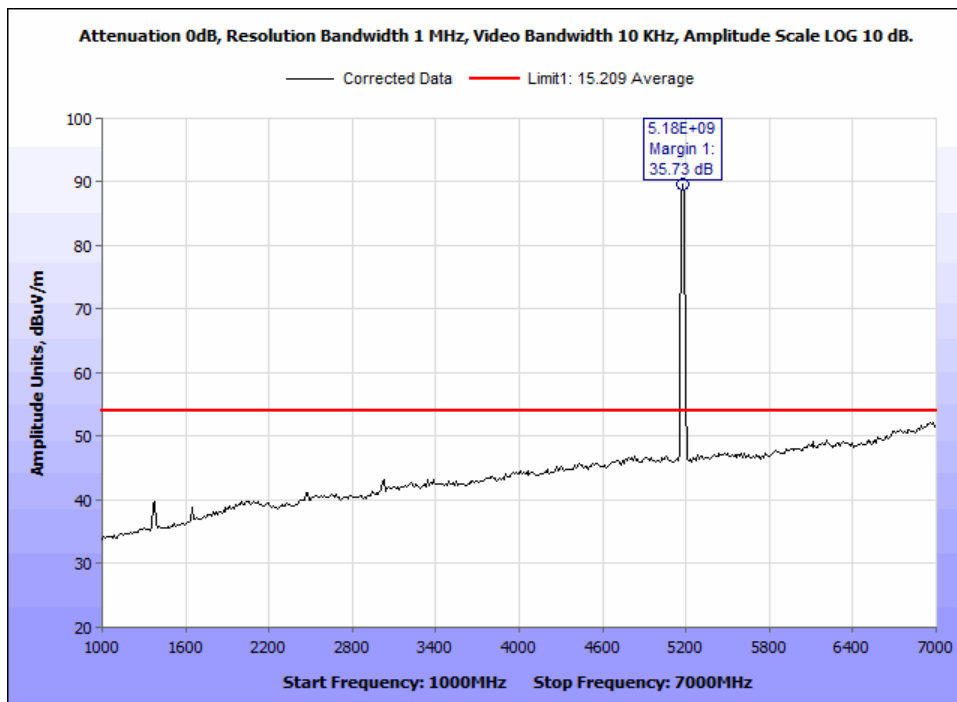
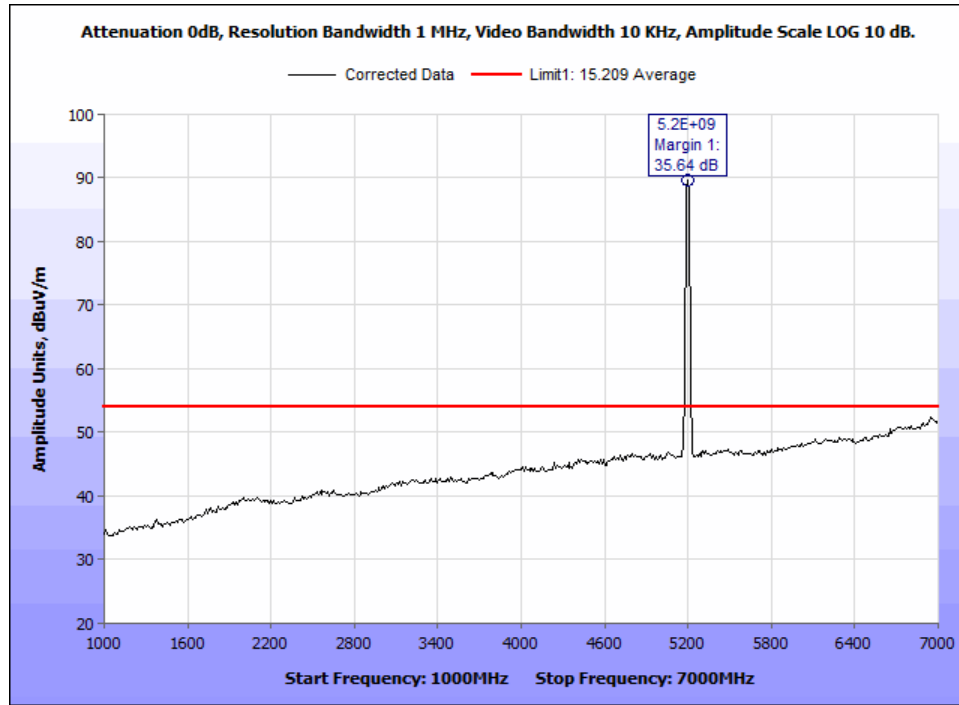


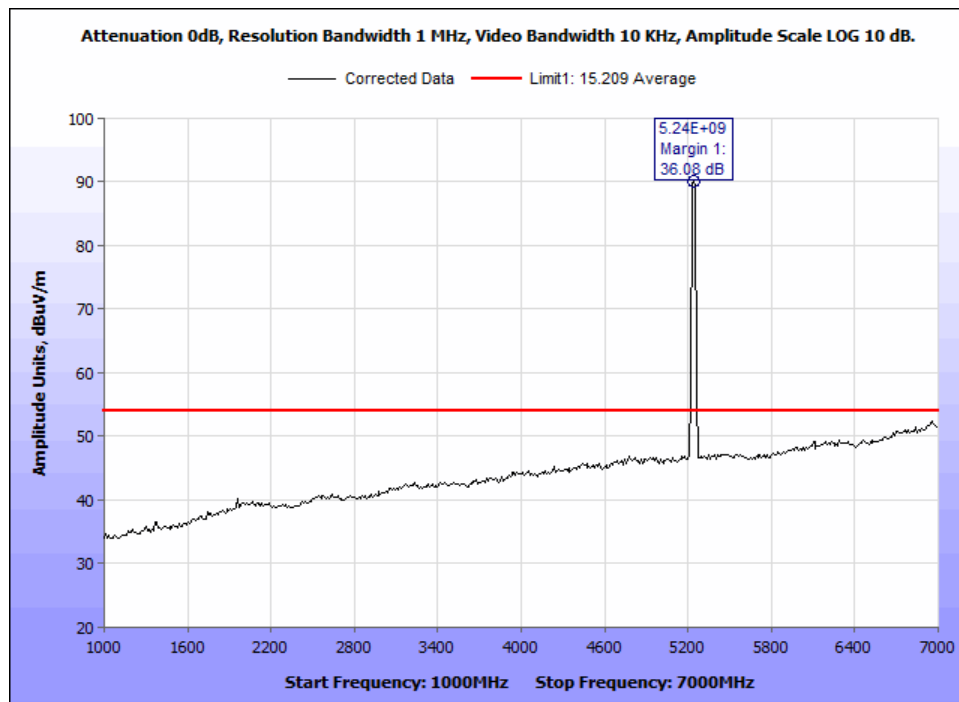
Figure 34: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11a 20M 5240M - 1-7GHz.



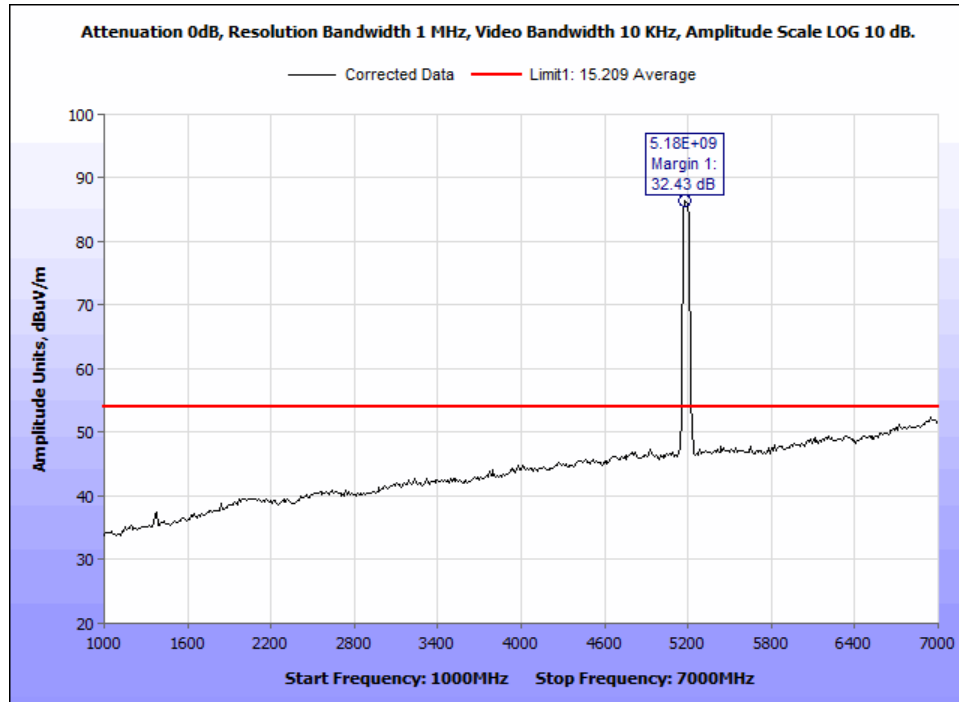
**Figure 35: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11ac 20M
5180M - 1-7GHz.**



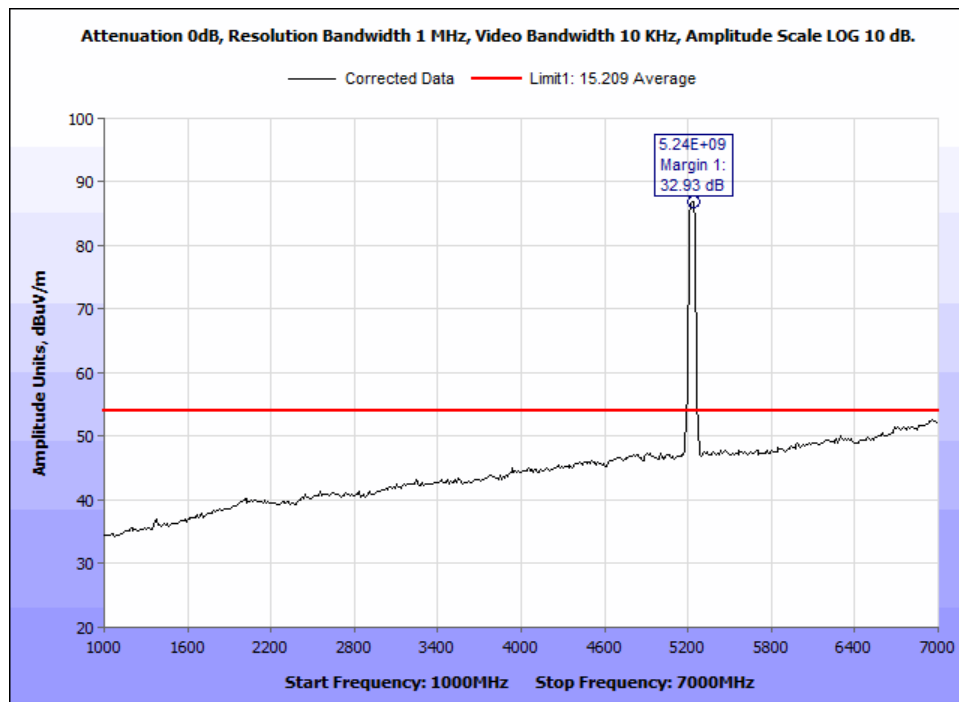
**Figure 36: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11ac 20M
5200M - 1-7GHz.**



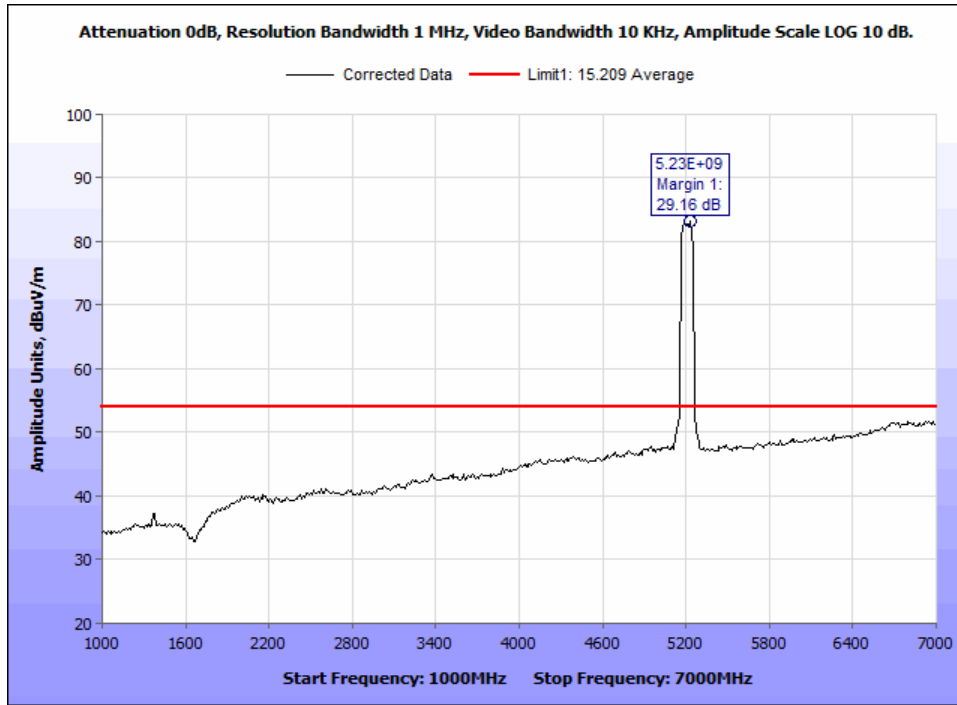
**Figure 37: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11ac 20M
5240M - 1.7GHz.**



**Figure 38: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11ac 40M
5190M - 1.7GHz.**



**Figure 39: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11ac 40M
5230M - 1-7GHz.**



**Figure 40: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11ac 80M
5210M - 1-7GHz.**

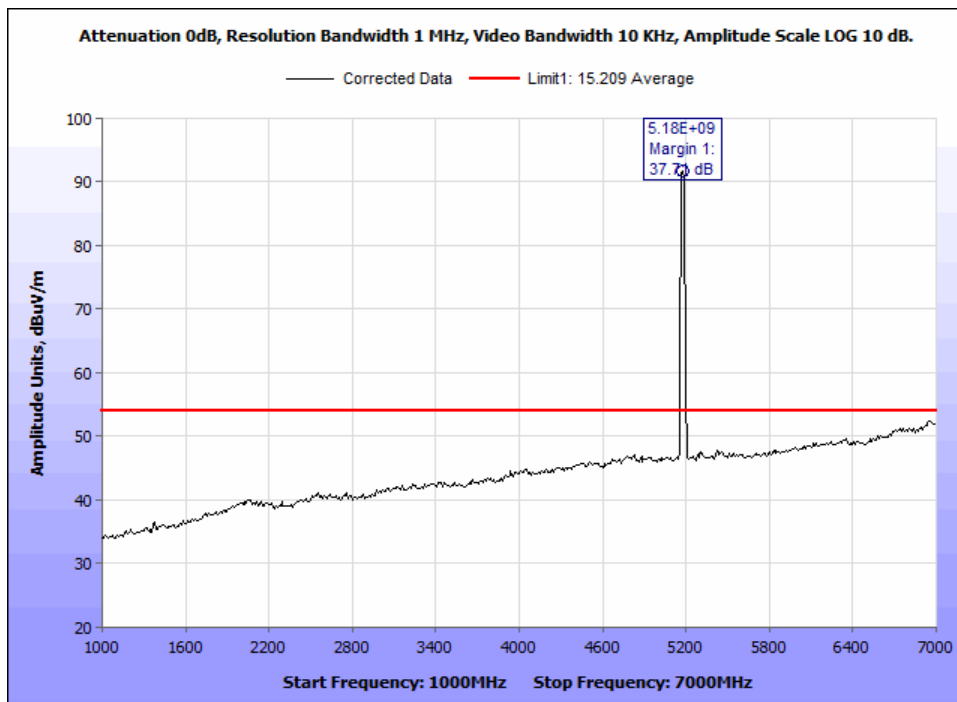


Figure 41: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11n 20M 5180M - 1-7GHz.

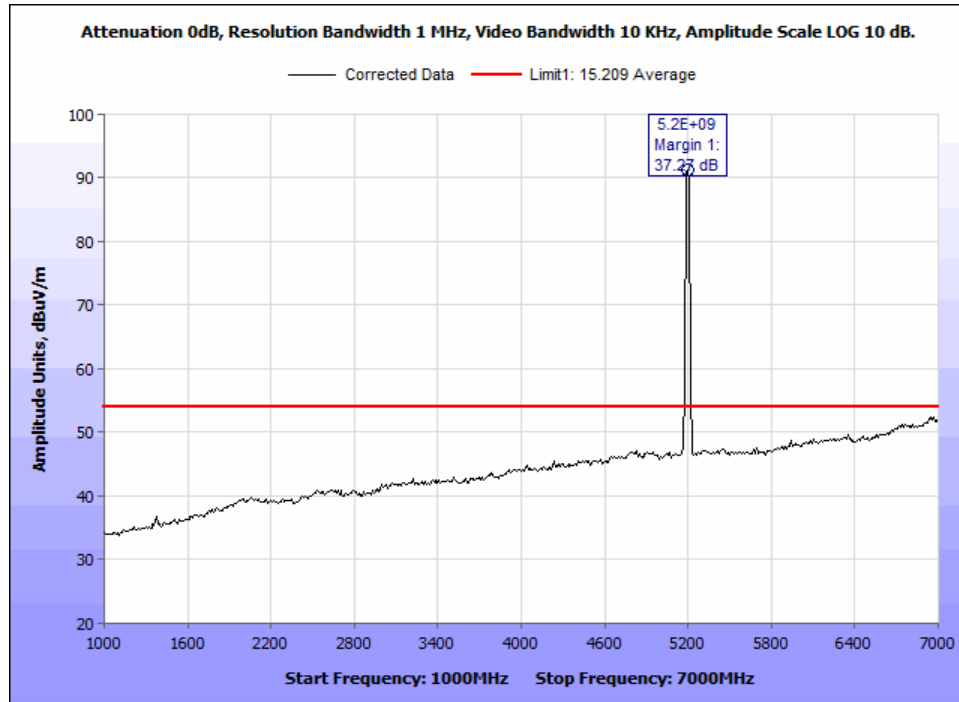


Figure 42: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11n 20M 5200M - 1-7GHz.

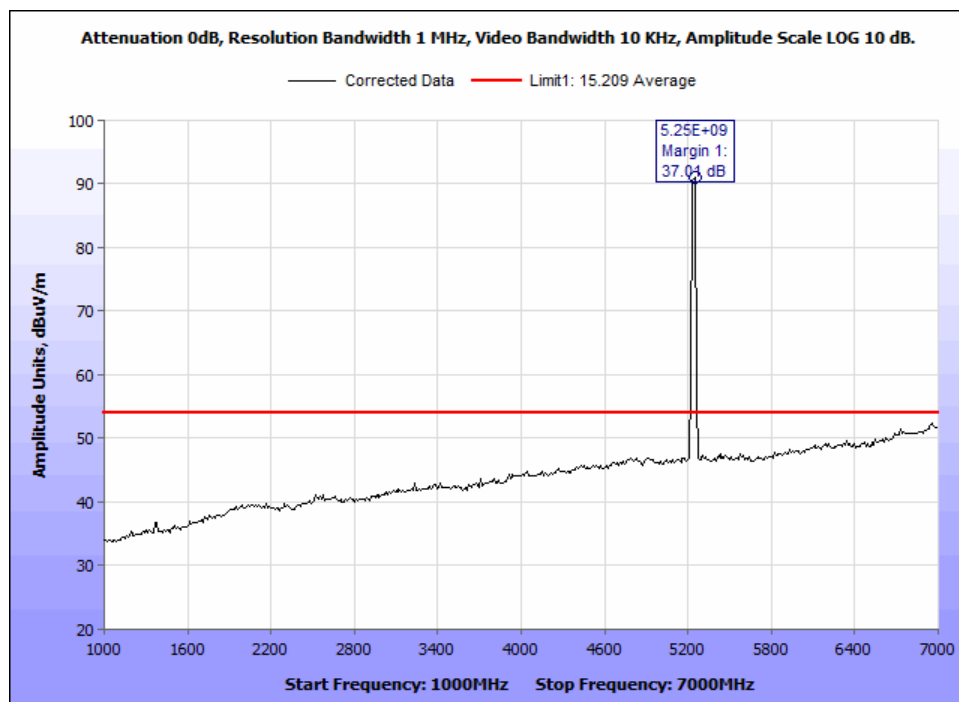


Figure 43: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11n 20M 5240M - 1-7GHz.

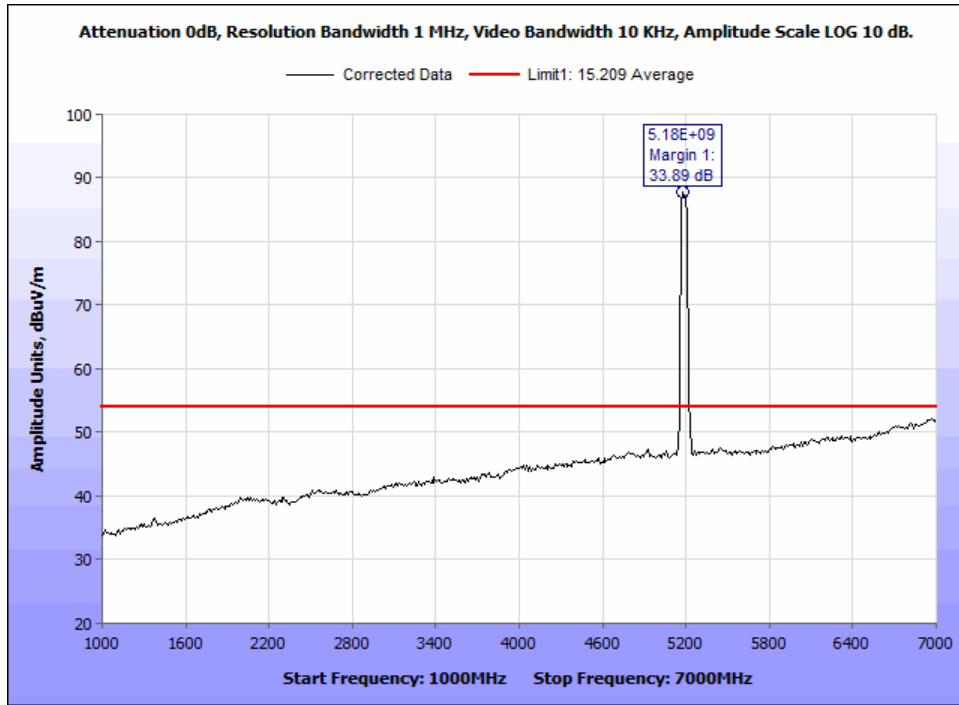


Figure 44: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11n 40M 5190M - 1-7GHz.

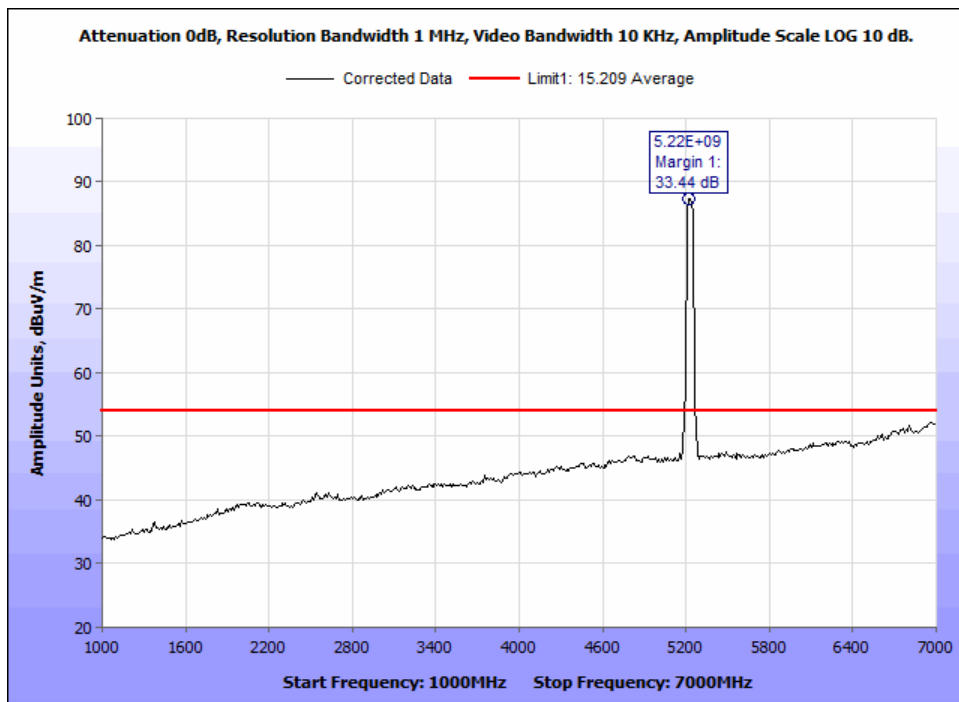


Figure 45: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Average Radiated Emissions - 802.11n 40M 5230M - 1-7GHz.

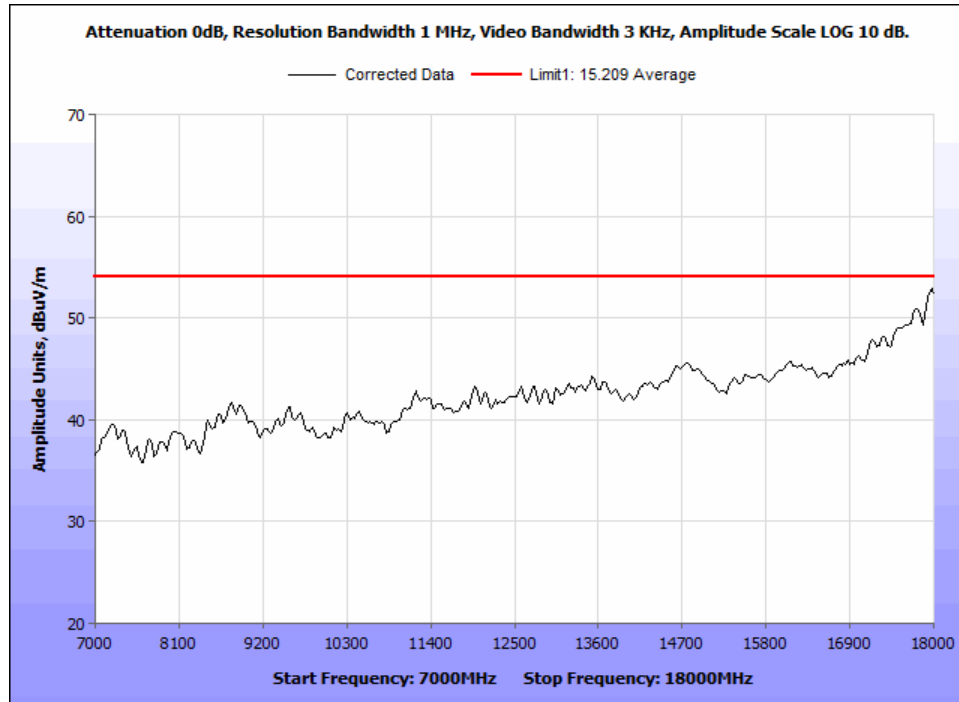


Figure 46: §15.407(b)(1) & (6 – 7) Undesirable Emissions, AVG_15.209_worst case_Radiated Emissions_7-18GHz.

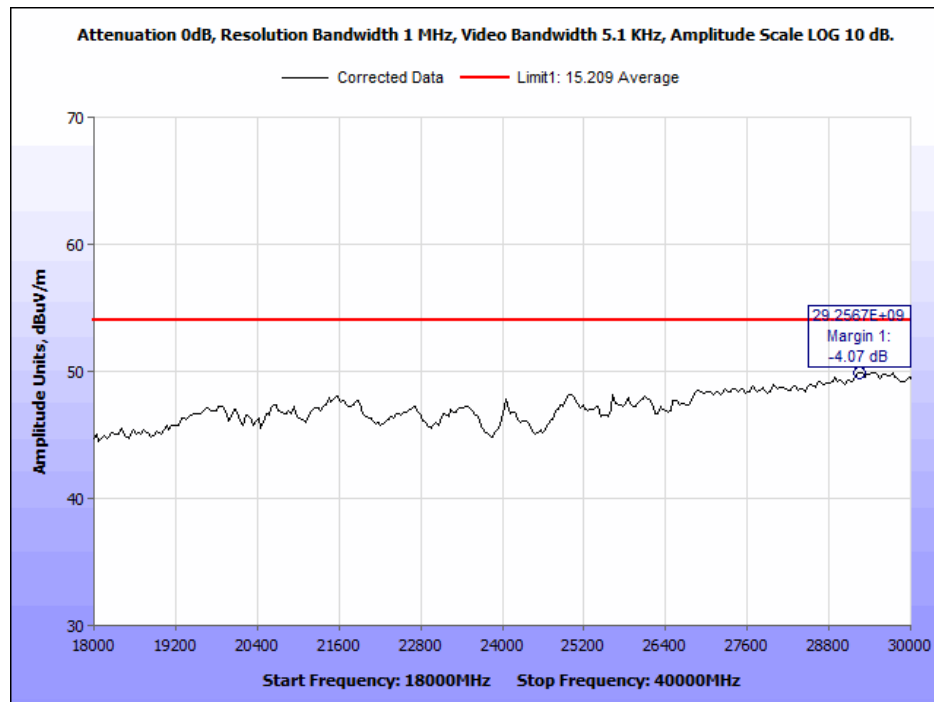


Figure 47: §15.407(b)(1) & (6 – 7) Undesirable Emissions, AVG_15.209_worst case_Radiated Emissions_18-30GHz.

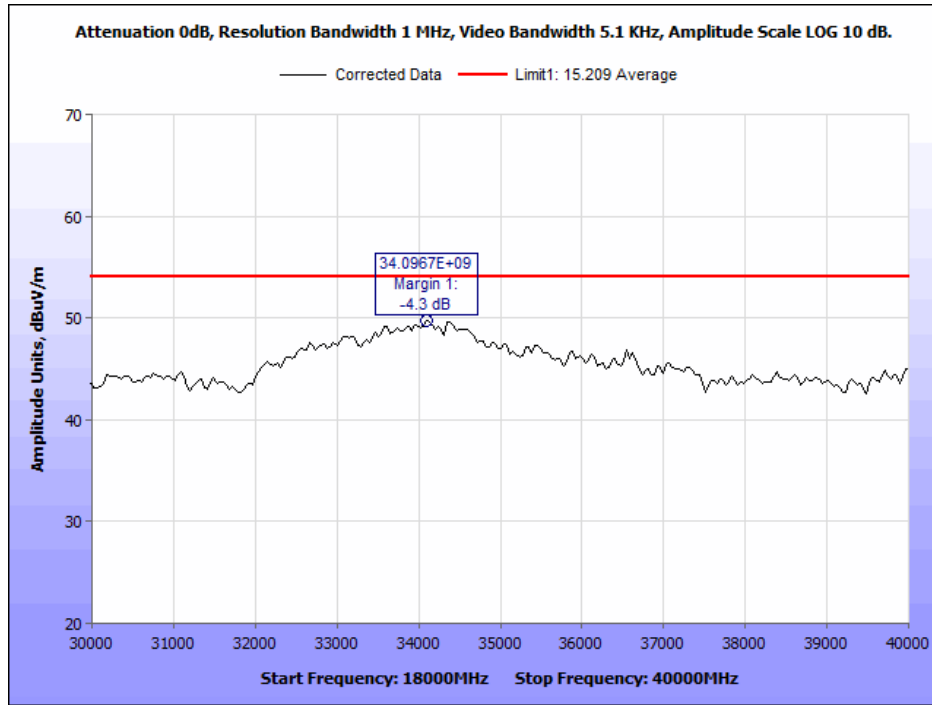


Figure 48: §15.407(b)(1) & (6 – 7) Undesirable Emissions, AVG_15.209_worst case_Radiated Emissions_30-40GHz.

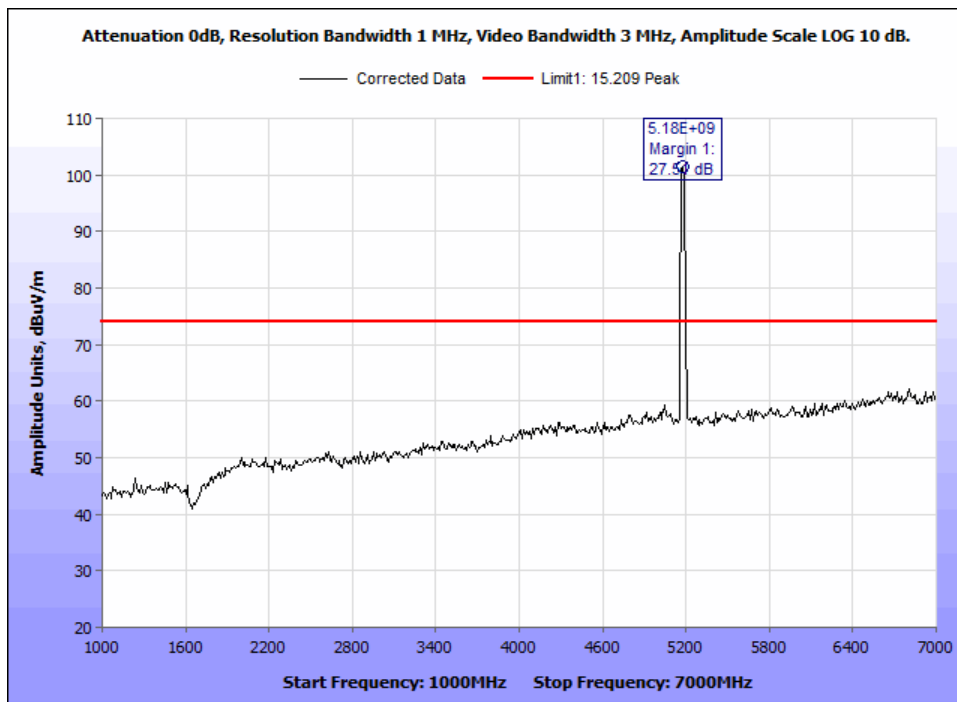


Figure 49: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11a 20M 5180M - 1-7GHz.

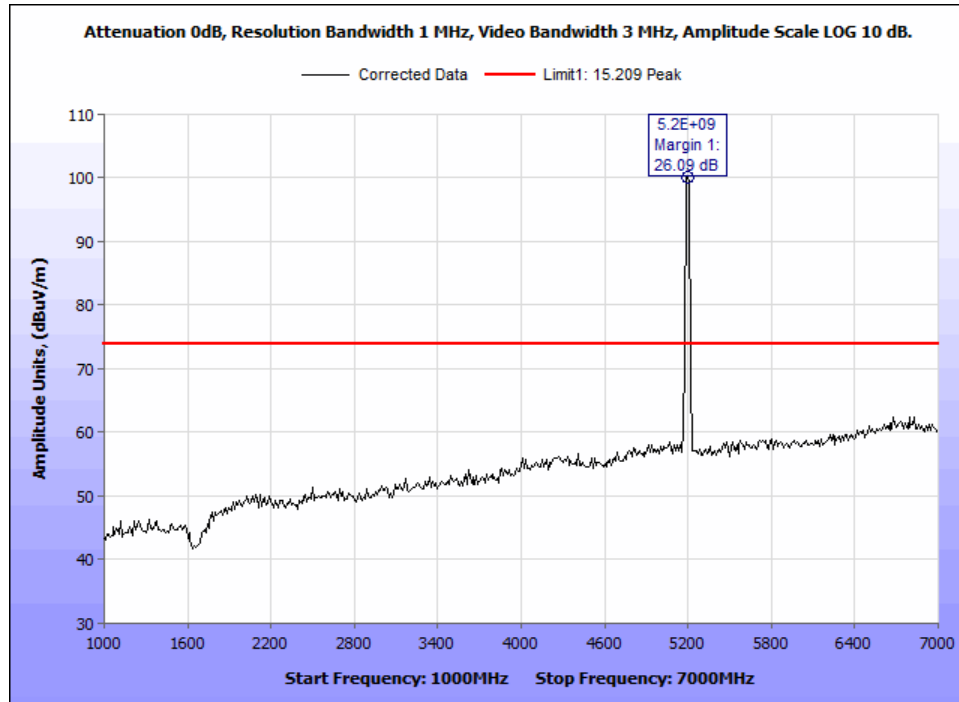


Figure 50: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11a 20M 5200M - 1-7GHz.

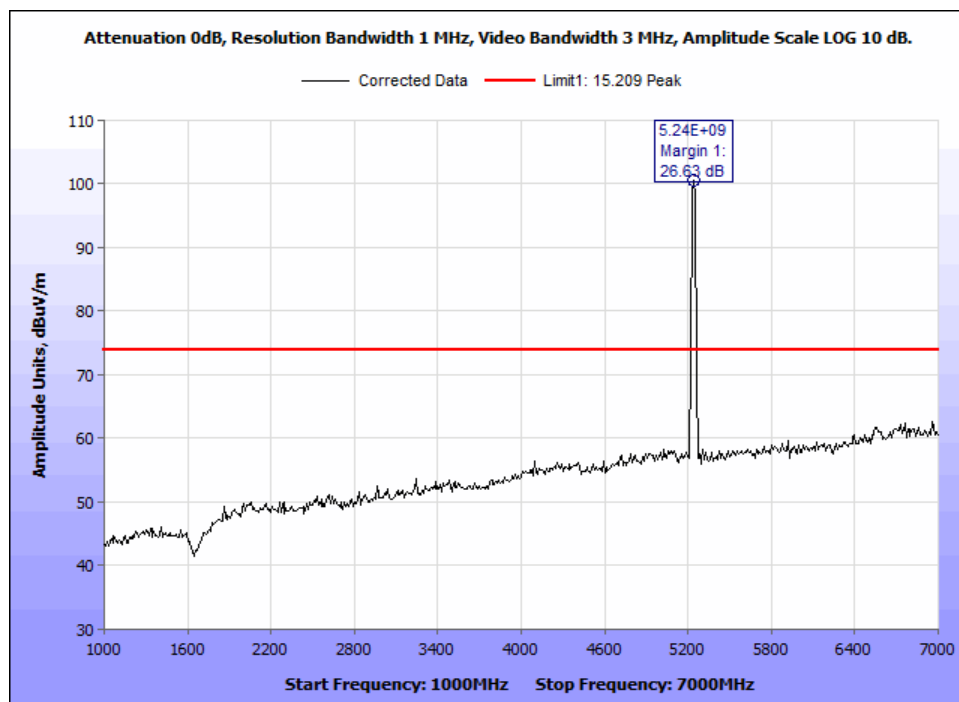


Figure 51: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11a 20M 5240M - 1-7GHz.

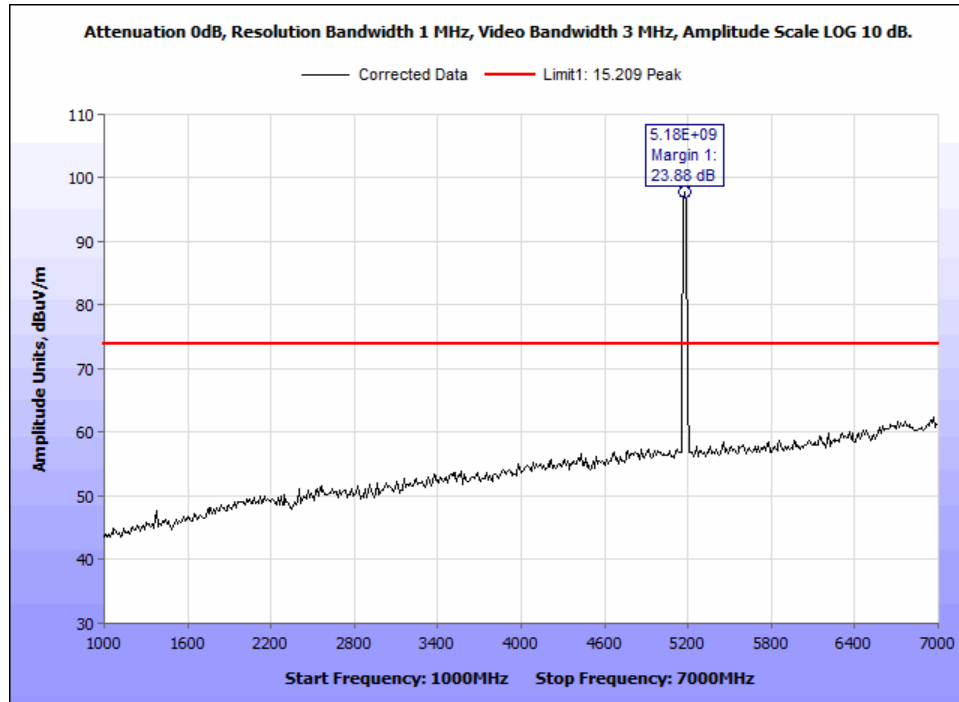


Figure 52: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11ac 20M 5180M - 1-7GHz.

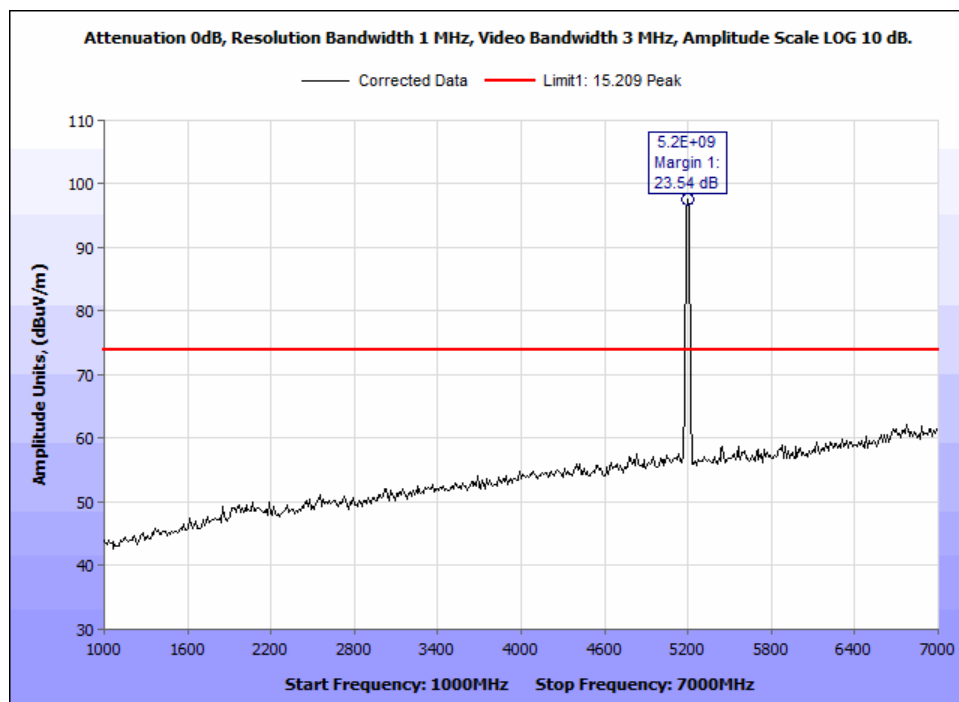


Figure 53: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11ac 20M 5200M - 1-7GHz.

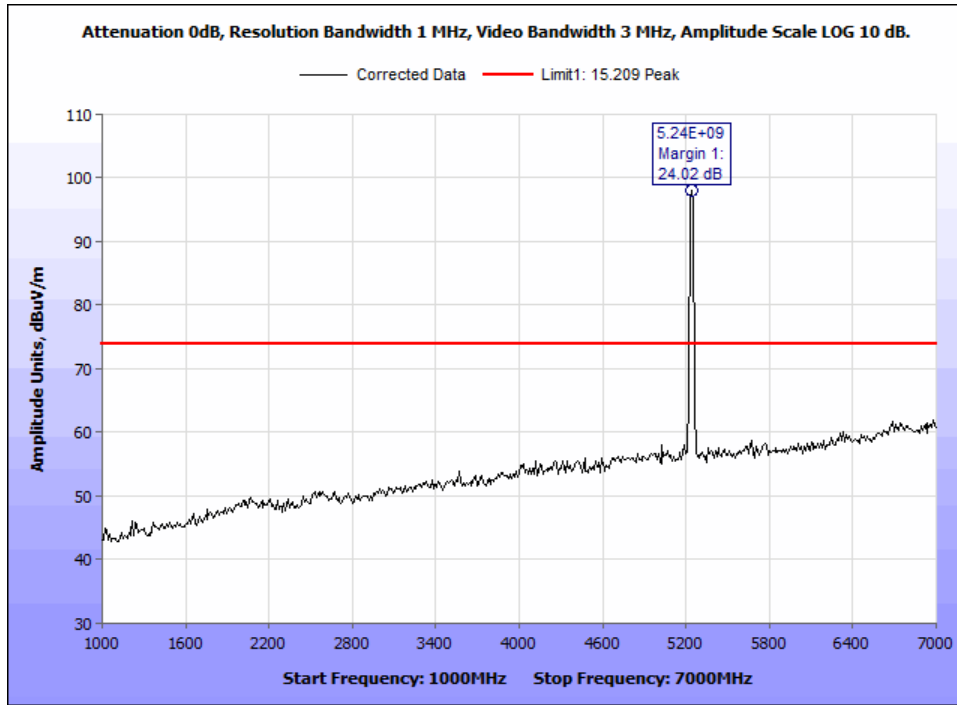


Figure 54: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11ac 20M 5240M - 1-7GHz.

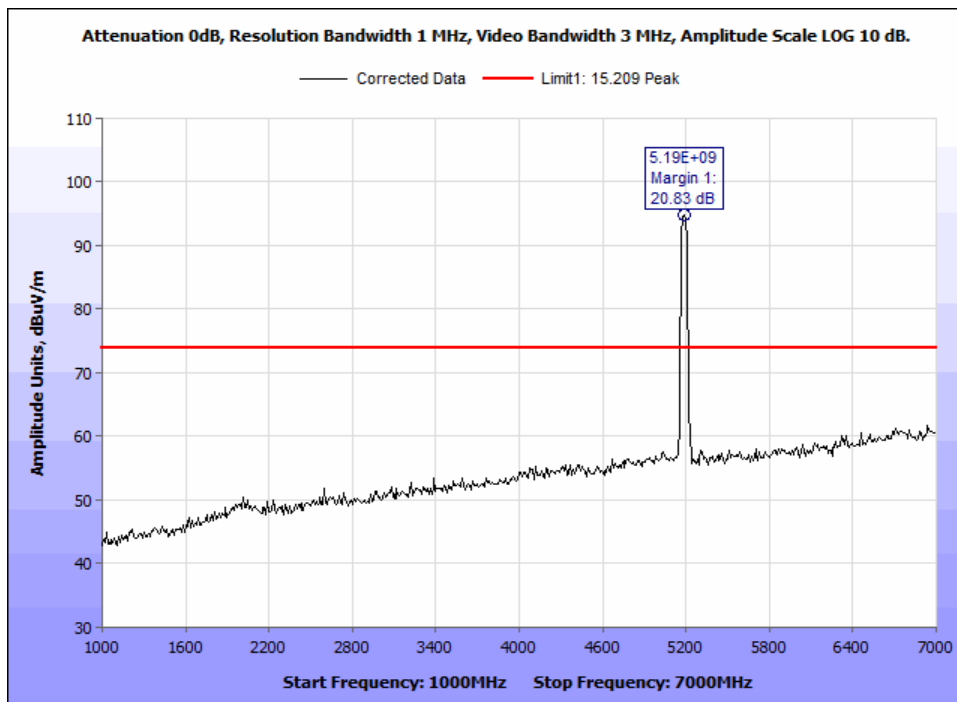


Figure 55: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11ac 40M 5190M - 1-7GHz.

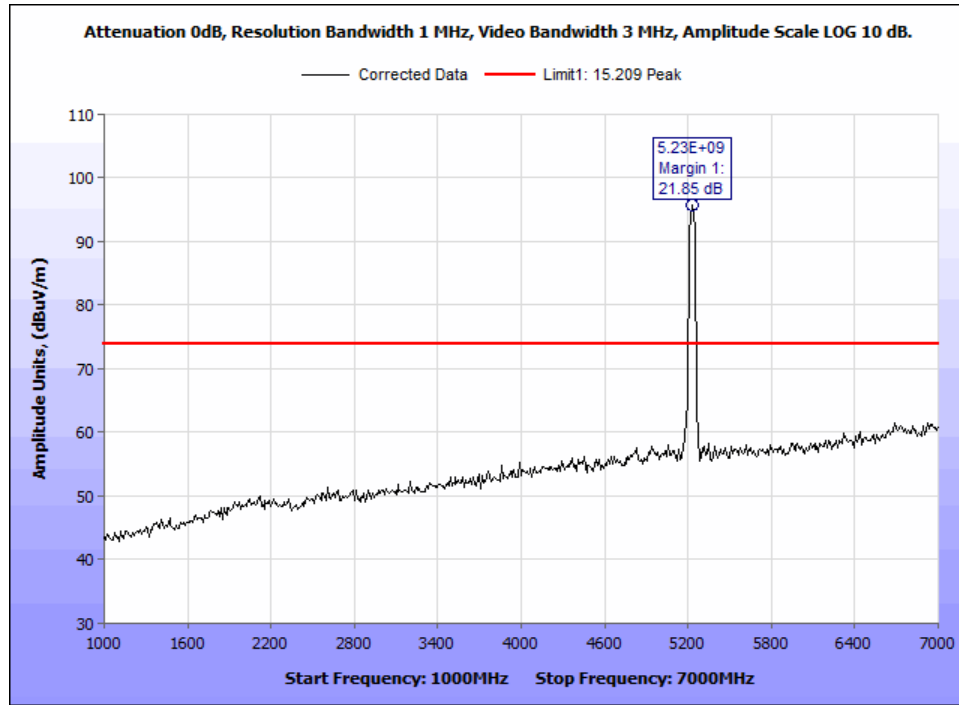


Figure 56: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11ac 40M 5230M - 1-7GHz.

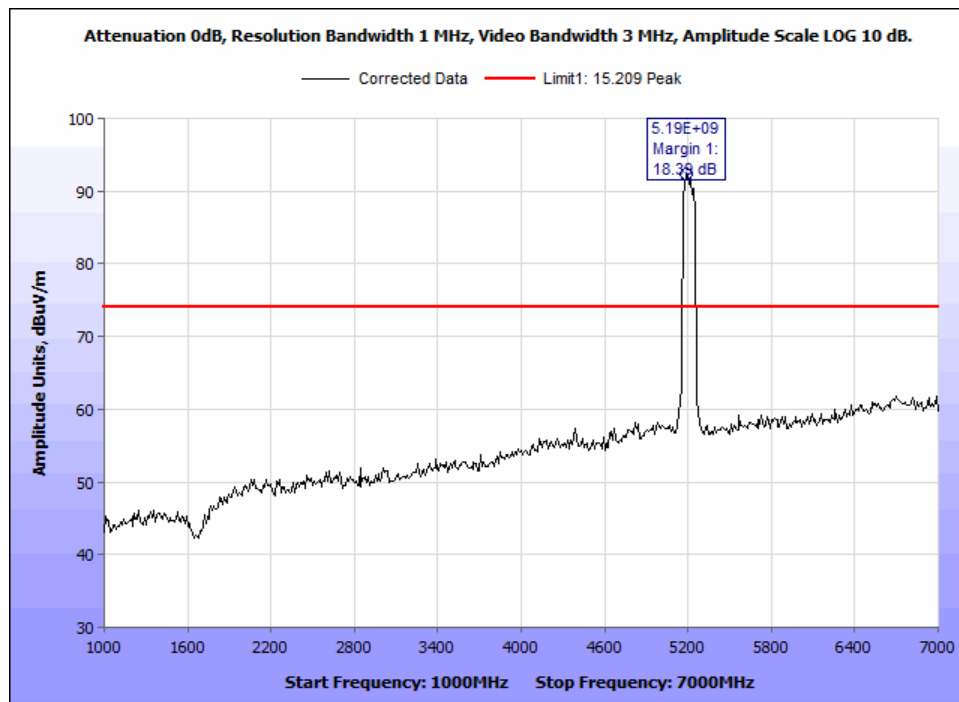


Figure 57: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11ac 80M 5210M - 1-7GHz.

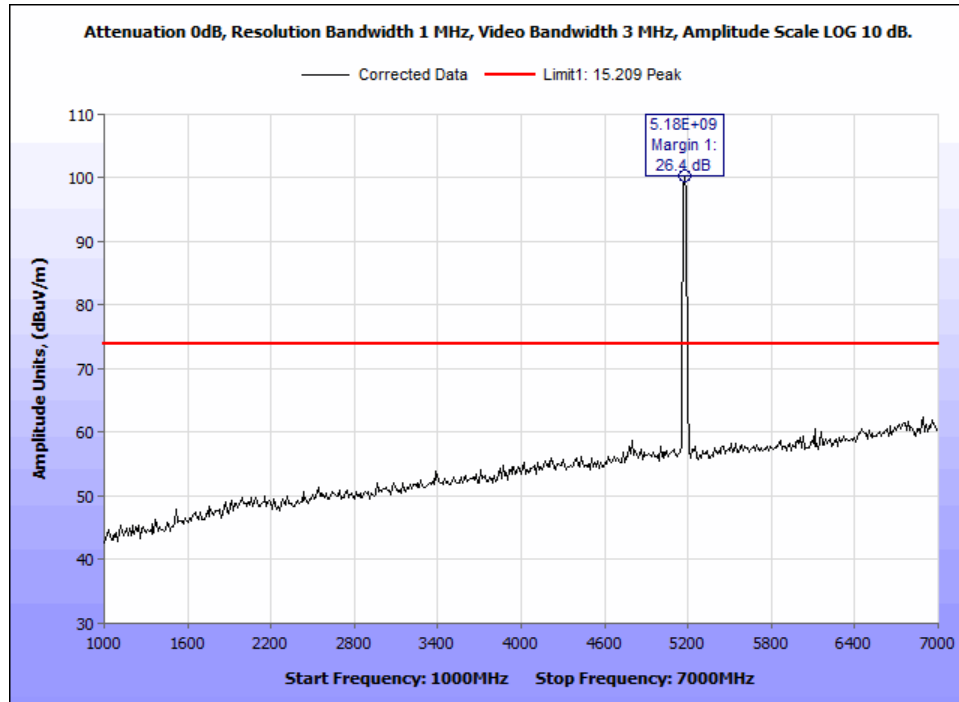


Figure 58: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11n 20M 5180M - 1-7GHz.

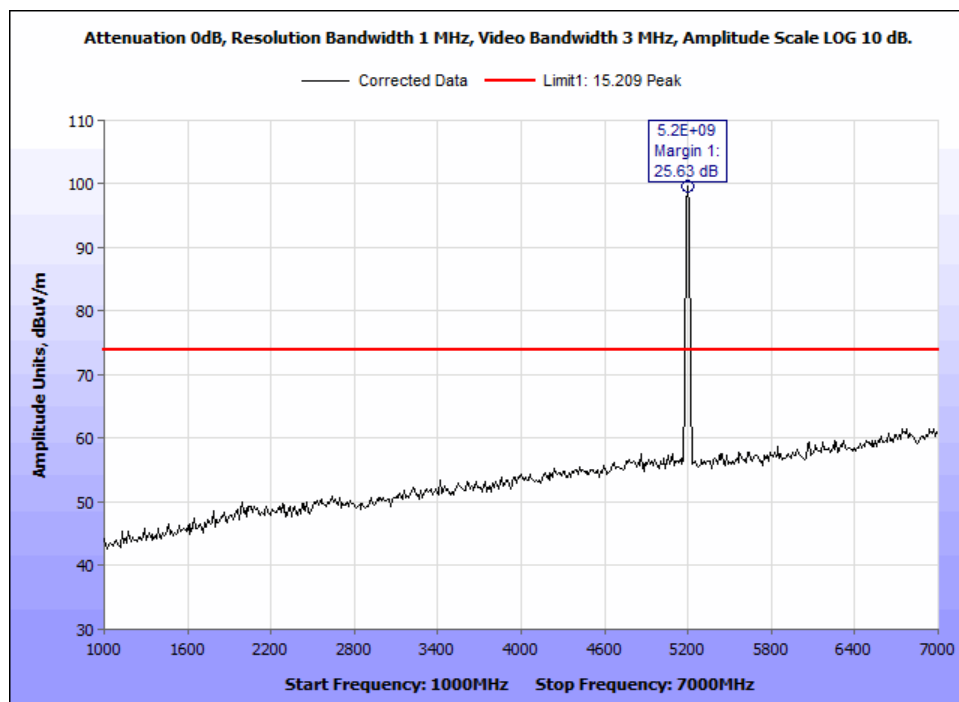


Figure 59: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11n 20M 5200M - 1-7GHz.

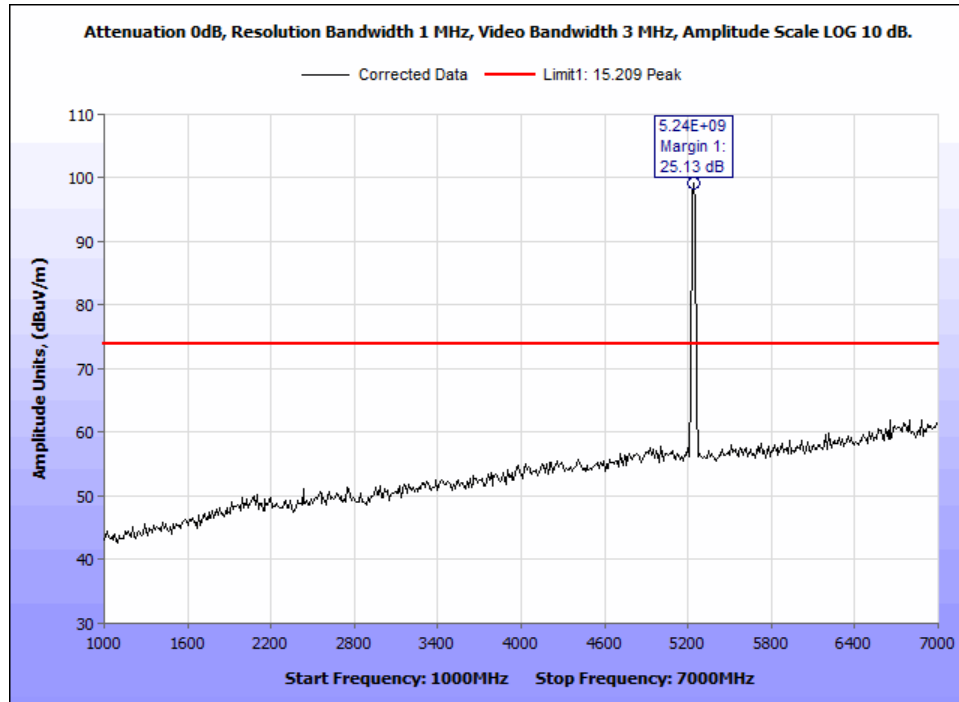


Figure 60: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11n 20M 5240M - 1-7GHz.

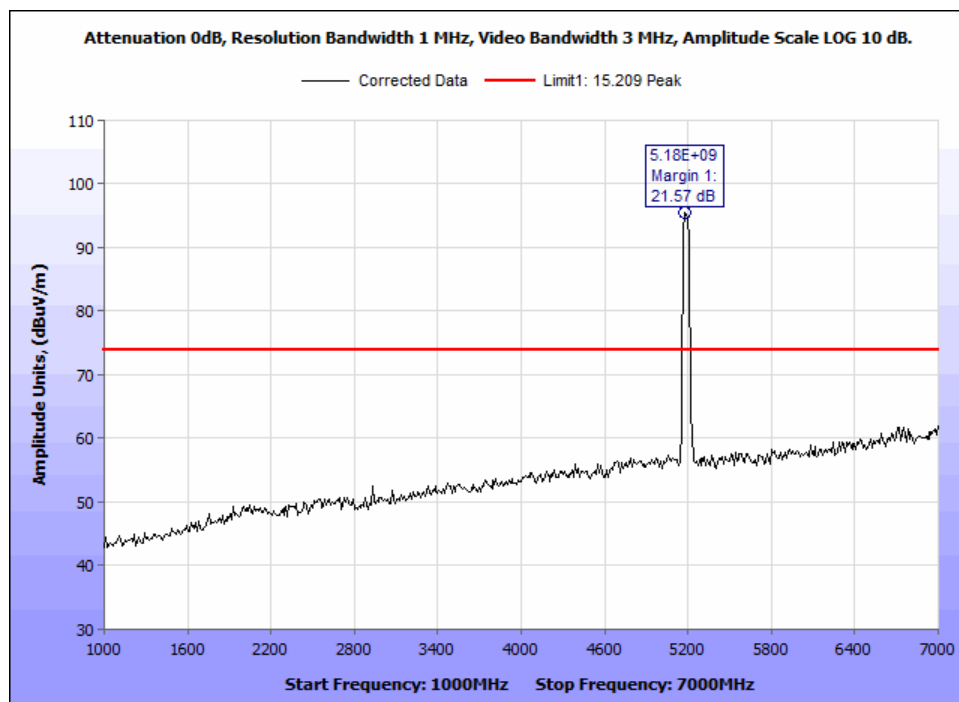


Figure 61: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11n 40M 5190M - 1-7GHz.

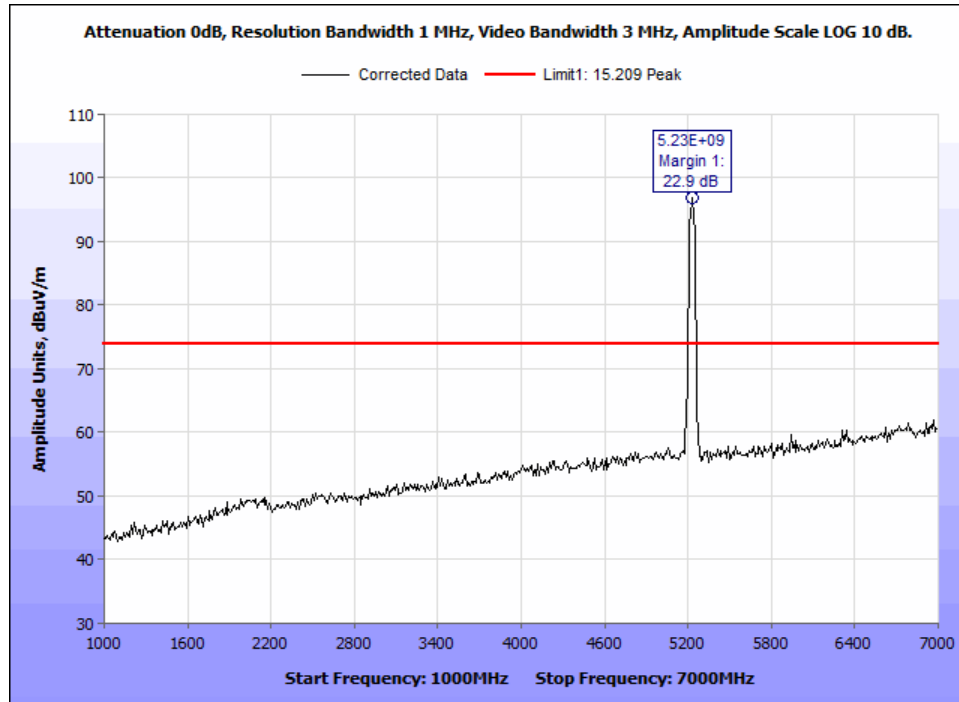


Figure 62: §15.407(b)(1) & (6 – 7) Undesirable Emissions, Peak Radiated Emissions - 802.11n 40M 5230M - 1-7GHz.

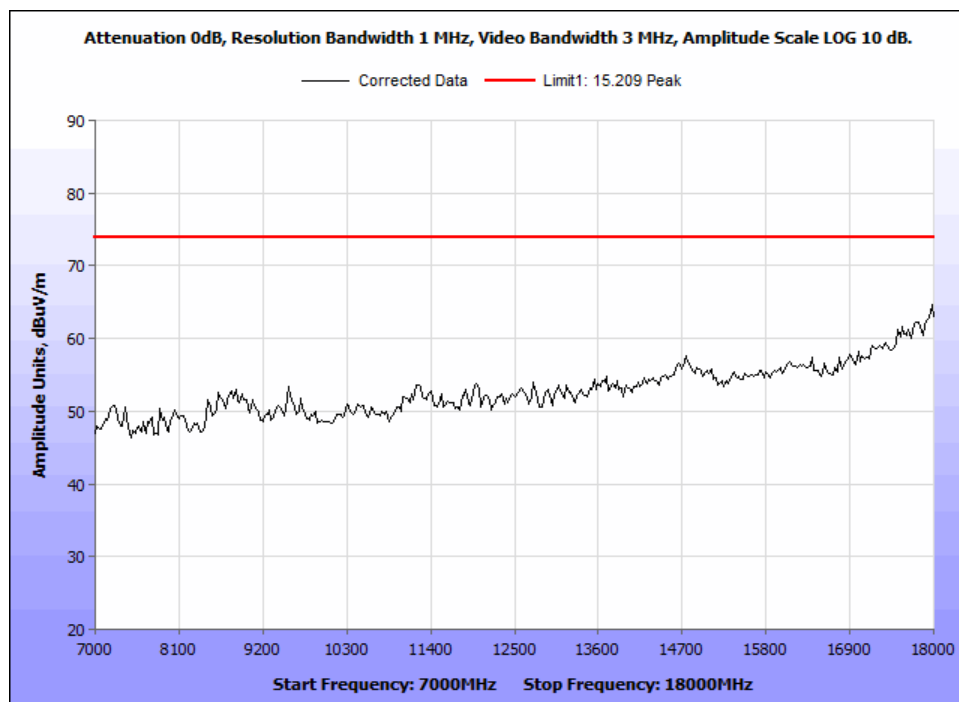


Figure 63: §15.407(b)(1) & (6 – 7) Undesirable Emissions, PK_15.209_worst case_Radiated Emissions_7-18GHz.

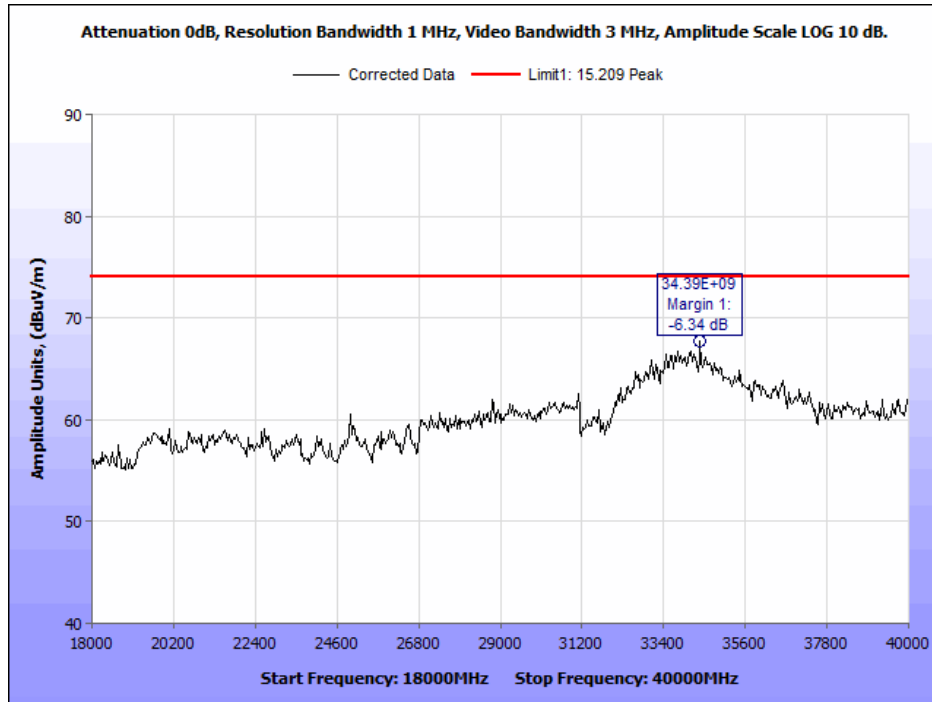


Figure 64: §15.407(b)(1) & (6 – 7) Undesirable Emissions, PK_15.209_worst case_Radiated Emissions_18-40GHz.

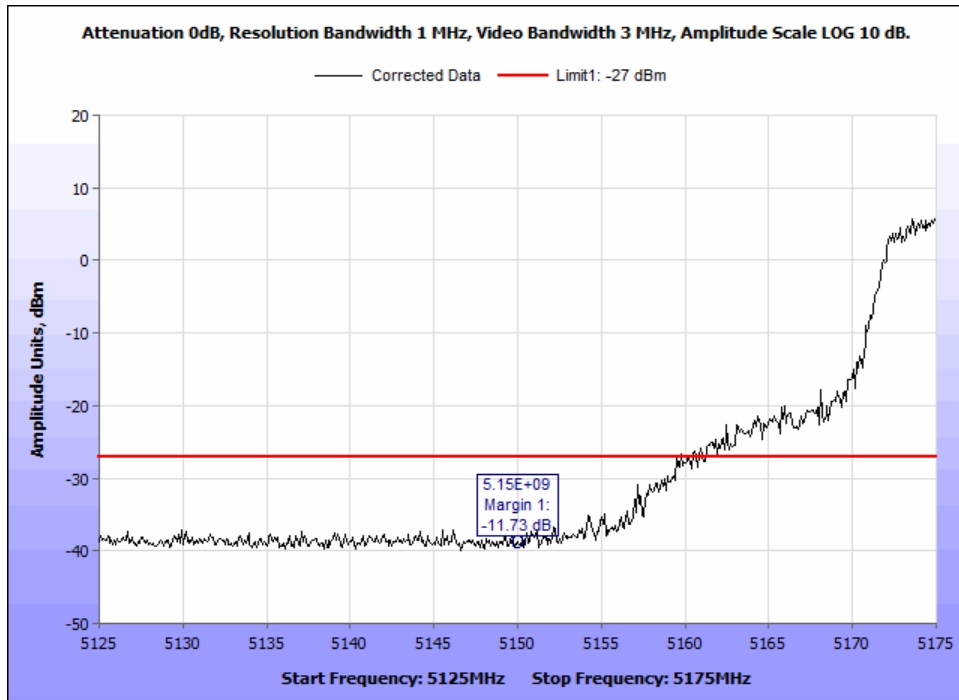


Figure 65: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11a -27dBm Radiated Bandedge @5150MHz - 20MHz 5180MHz.

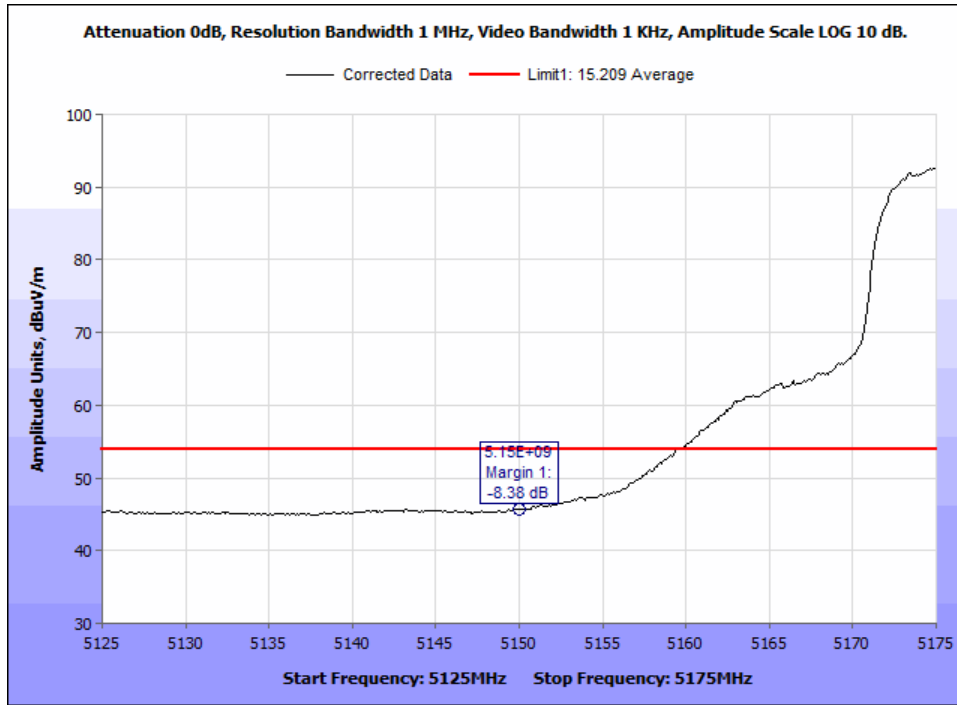


Figure 66: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11a Average Radiated Bandedge @5150MHz - 20MHz 5180MHz.

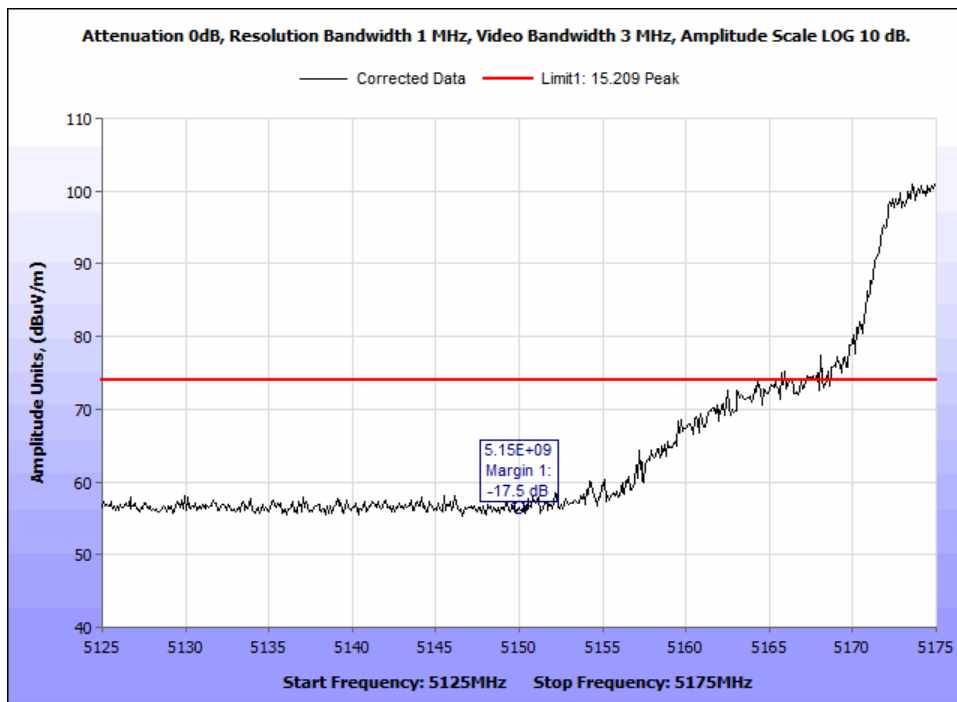


Figure 67: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11a Peak Radiated Bandedge @5150MHz - 20MHz 5180MHz.

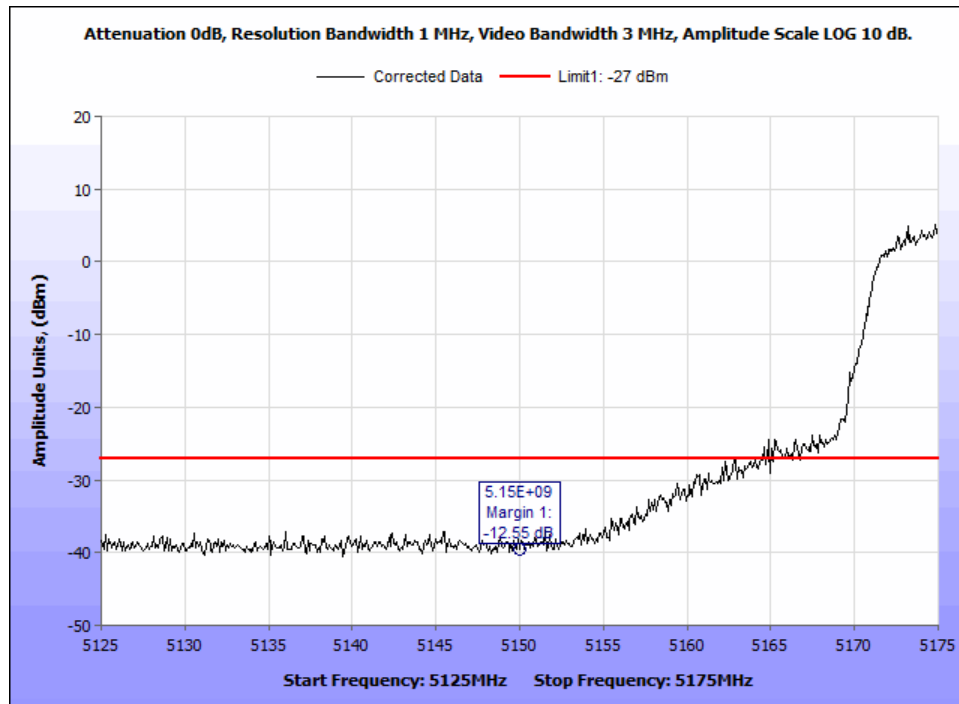


Figure 68: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac -27dBm Radiated Bandedge @5150MHz - 20MHz 5180MHz.

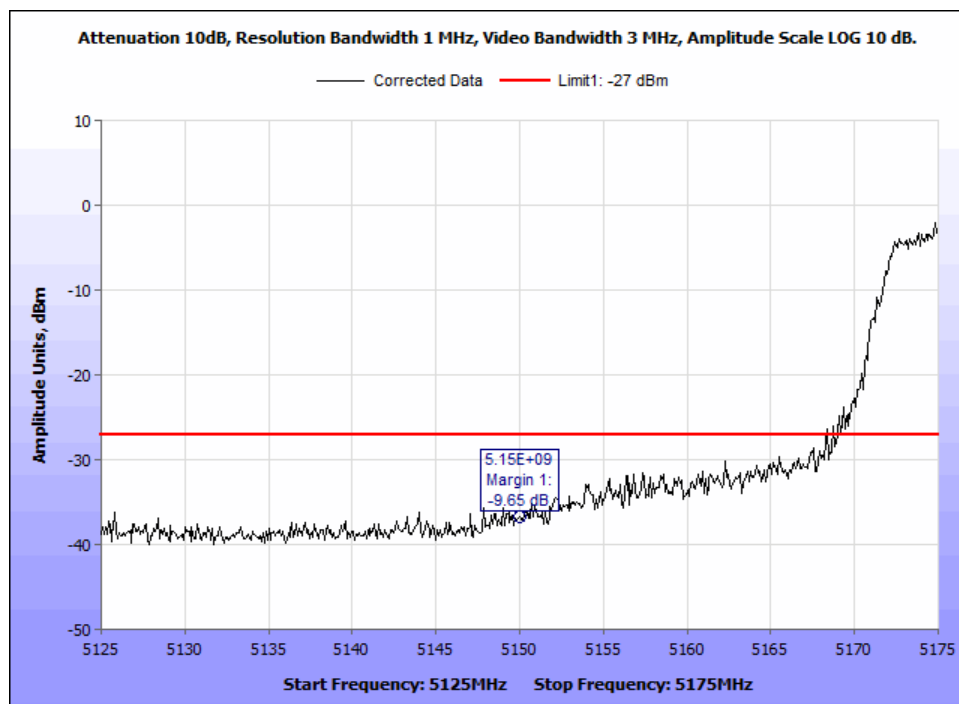


Figure 69: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac -27dBm Radiated Bandedge @5150MHz - 40MHz 5190MHz.

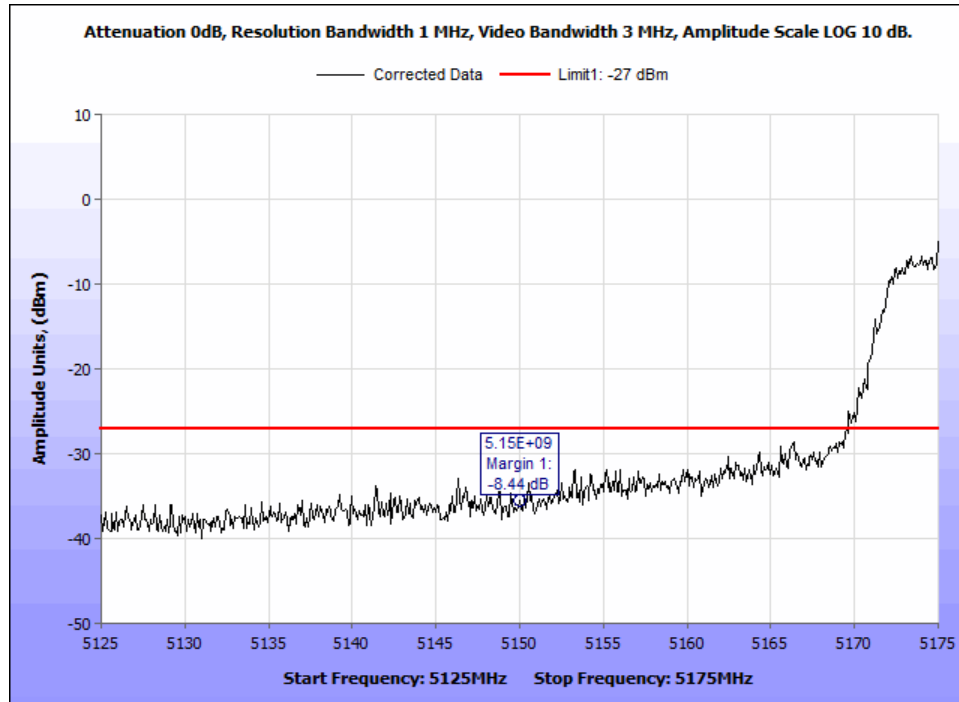


Figure 70: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac -27dBm Radiated Bandedge @5150MHz - 80MHz 5210MHz.

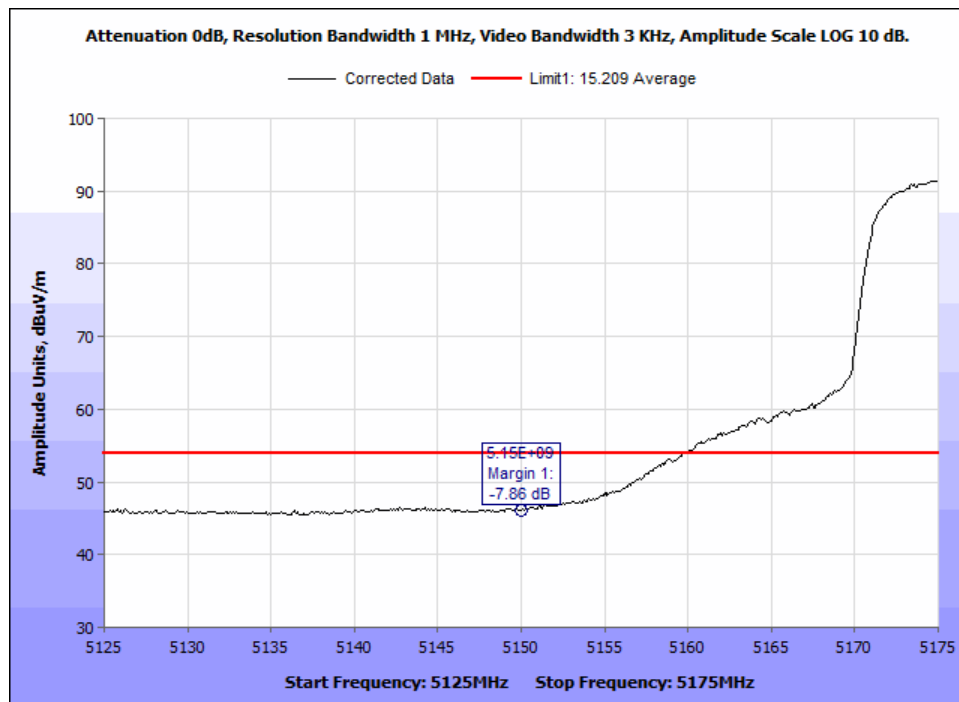


Figure 71: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac Average Radiated Bandedge @5150MHz - 20MHz 5180MHz.

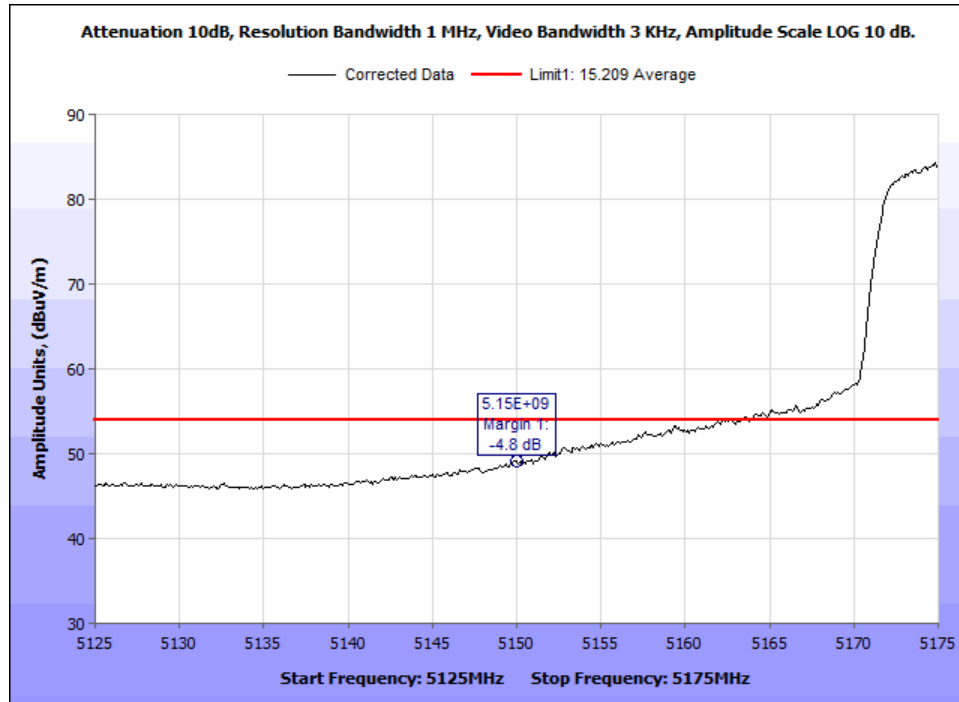


Figure 72: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac Average Radiated Bandedge @5150MHz - 40MHz 5190MHz.

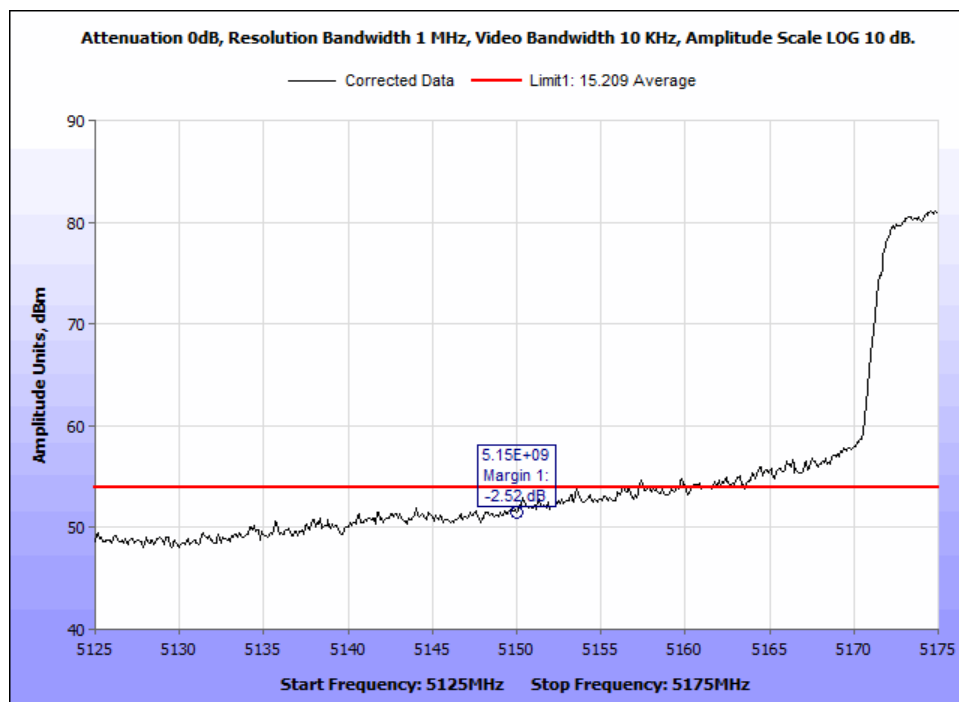


Figure 73: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac Average Radiated Bandedge @5150MHz - 80MHz 5210MHz.

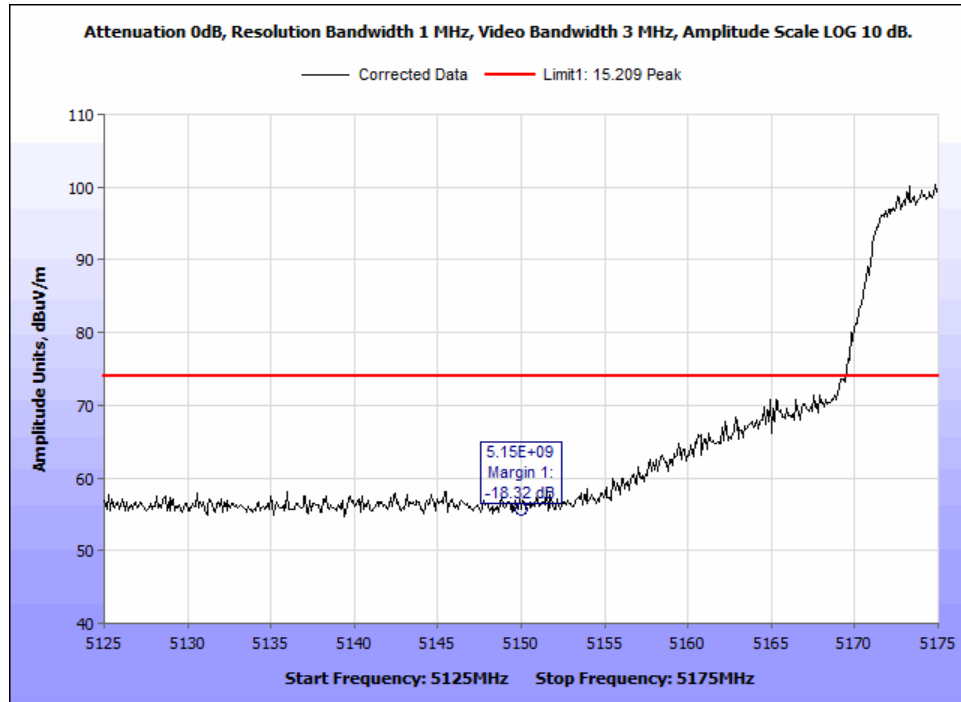


Figure 74: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac Peak Radiated Bandedge @5150MHz - 20MHz 5180MHz.

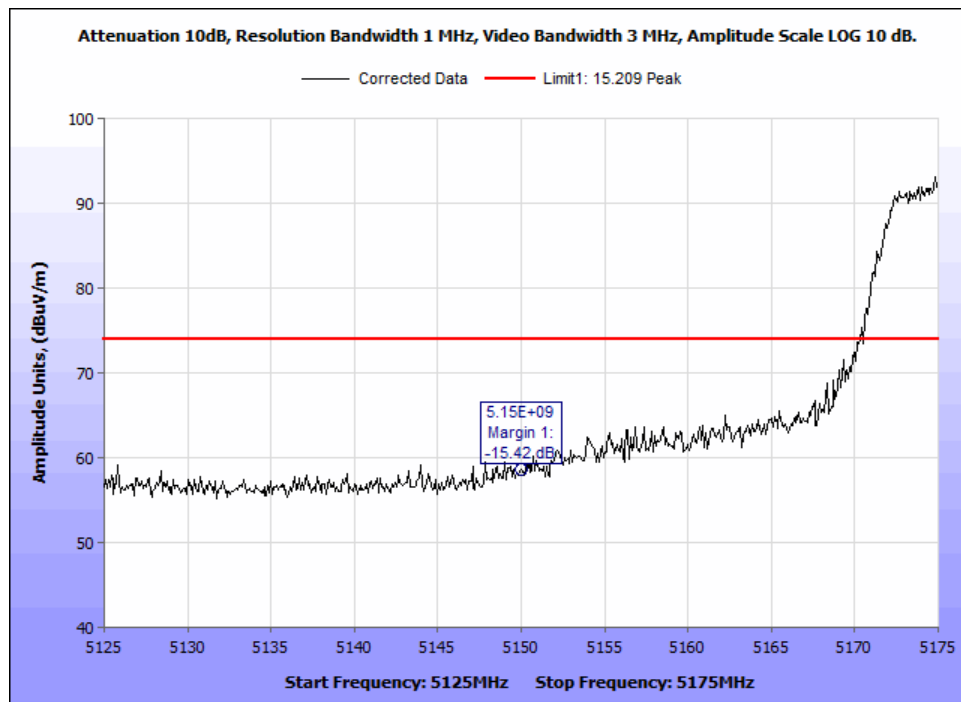


Figure 75: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac Peak Radiated Bandedge @5150MHz - 40MHz 5190MHz.

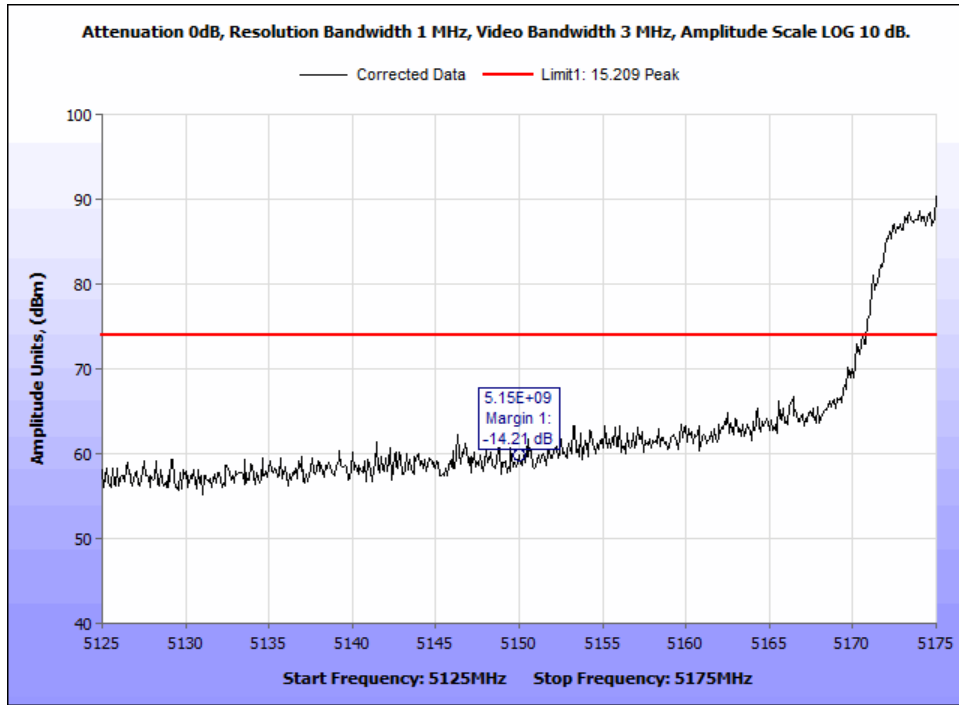


Figure 76: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11ac Peak Radiated Bandedge @5150MHz - 80MHz 5210MHz.

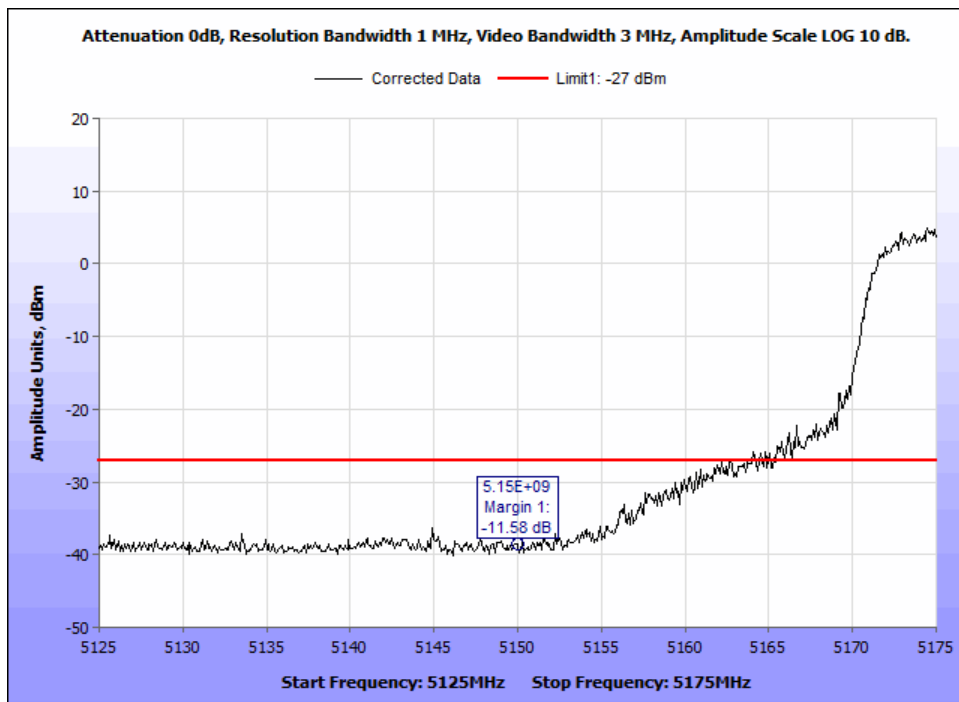


Figure 77: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11n -27dBm Radiated Bandedge @5150MHz - 20MHz 5180MHz.

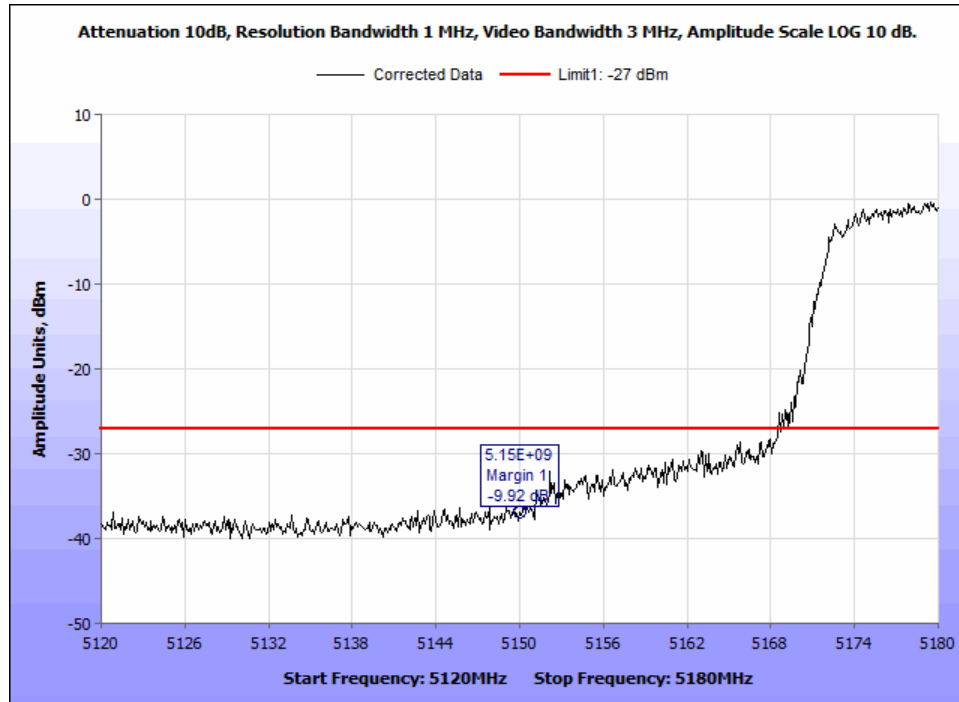


Figure 78: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11n -27dBm Radiated Bandedge @5150MHz - 40MHz 5190MHz.

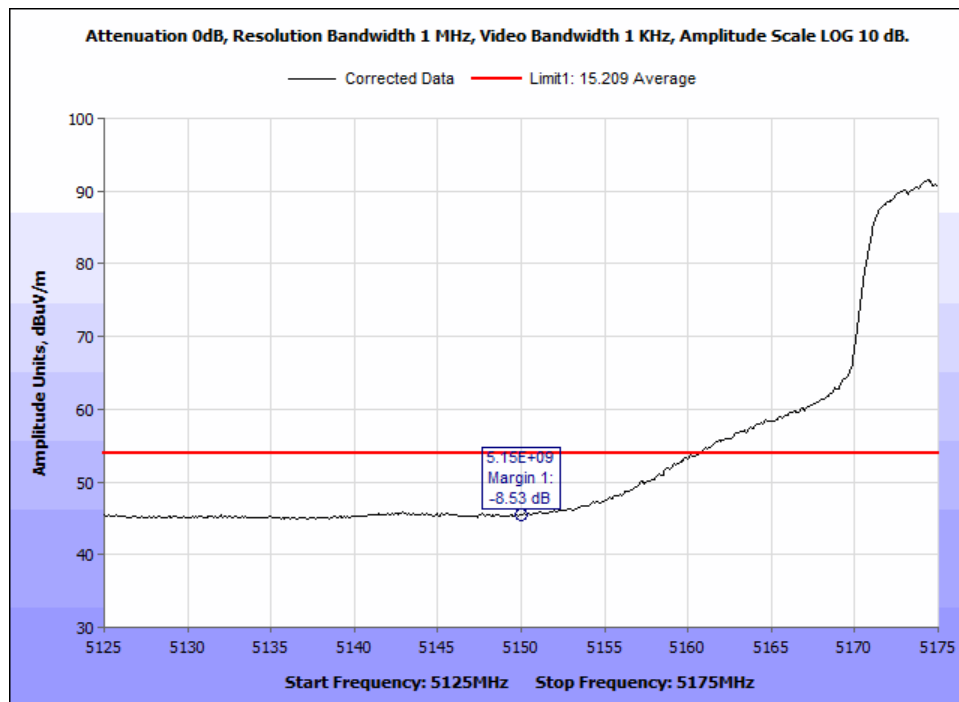


Figure 79: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11n Average Radiated Bandedge @5150MHz - 20MHz 5180MHz.

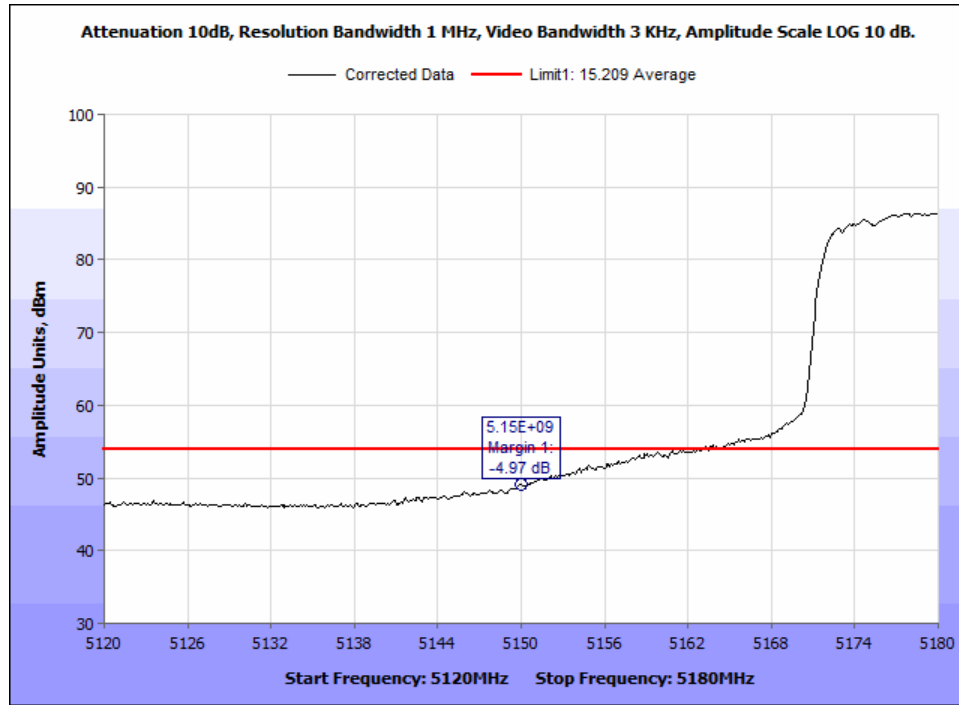


Figure 80: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11n Average Radiated Bandedge @5150MHz - 40MHz 5190MHz.

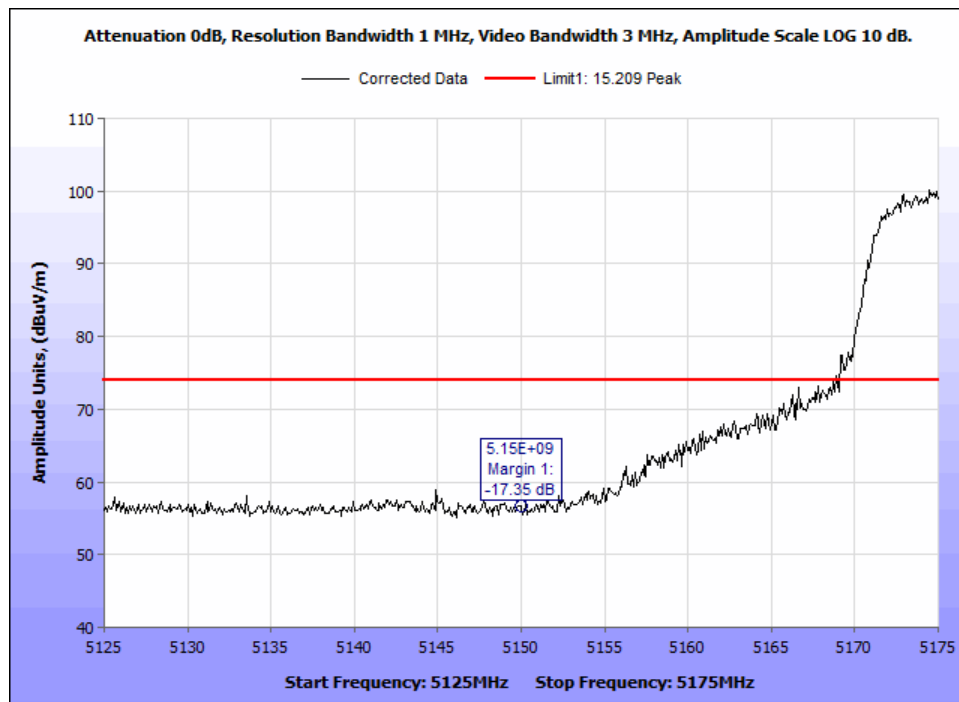


Figure 81: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11n Peak Radiated Bandedge @5150MHz - 20MHz 5180MHz.

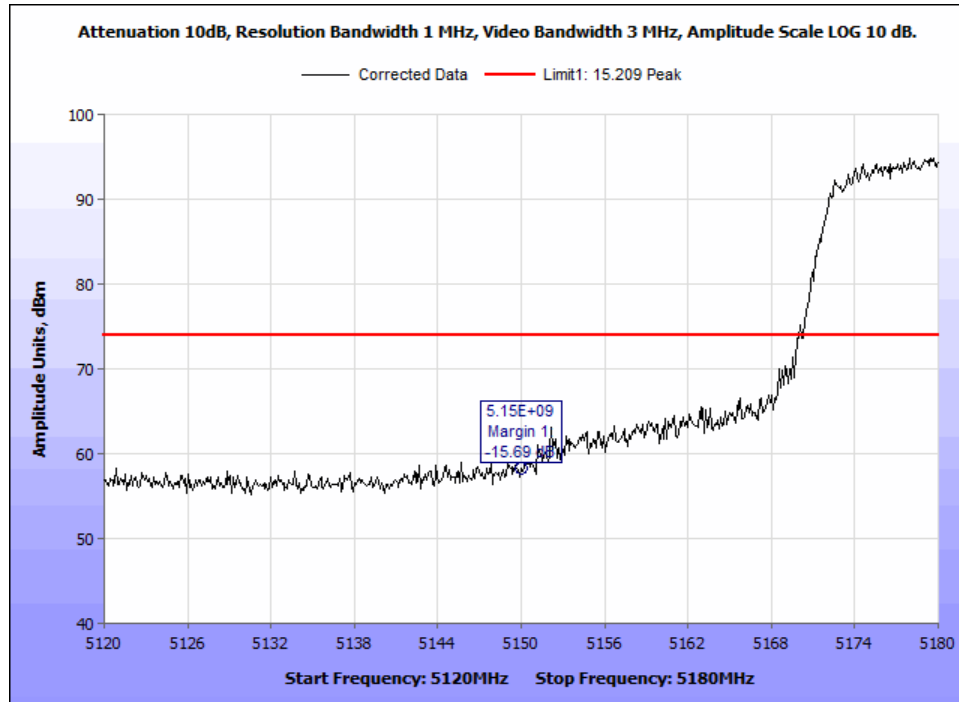


Figure 82: §15.407(b)(1) & (6 – 7) Undesirable Emissions, 802.11n Peak Radiated Bandedge @5150MHz - 40MHz 5190MHz.

Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

| ASSET # | EQUIPMENT | MANUFACTURER | MODEL | LAST CAL | CAL DUE |
|---------|-----------------------------------|-------------------------|-----------------------------|-----------------|-----------------|
| 1T4409 | EMI RECEIVER | ROHDE & SCHWARZ | ESIB7 | 1/4/2019 | 1/4/2021 |
| 1T4751 | ANTENNA - BILOG | SUNOL SCIENCES | JB6 | 5/2/2019 | 11/2/2020 |
| 1T4905 | HORN ANTENNA | COM-POWER | AH-118 | 5/7/2019 | 11/7/2020 |
| 1T4771 | PSA SPECTRUM ANALYZER | AGILENT TECHNOLOGIES | E4446A | 2/26/2020 | 8/26/2021 |
| 1T4300B | SEMI-ANECHOIC 3M CHAMBER SVSWR | EMC TEST SYSTEMS | NONE | 6/30/2019 | 12/30/2020 |
| 1T4300 | SEMI-ANECHOIC CHAMBER (NSA) | EMC TEST SYSTEMS | NONE | 6/30/2019 | 6/30/2020 |
| 1T8743 | PREAMPLIFIER | A.H. SYSTEMS, INC. | PAM-0118P | NOT REQUIRED | NOT REQUIRED |
| 1T4752 | PRE-AMPLIFIER | MITEQ | JS44- 18004000-35- 8P | FUNC VERIFY | |
| 1T4745 | ANTENNA, HORN | ETS-LINDGREN | 3116 | 11/27/2018 | 5/27/2020 |

Figure 83: Test Equipment List

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

Certification & User's Manual Information

Certification & User's Manual Information

L. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

- (a) The various types of radio communication transmitting devices described throughout this chapter.
- (b) *The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.*
- (c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.
- (d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

- (a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:
 - (1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or
 - (2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.
- (d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

- (e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:
- (i) *Compliance testing;*
 - (ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or
 - (v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.
- (e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.
- (f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

Certification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

- (a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.¹ *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.*
- (b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

- (a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.
- (b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

¹ In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

- (a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.
 - (1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.
 - (i) *If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.*
 - (ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.
 - (2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

Certification & User's Manual Information

Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) *In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:*

- (1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

- (2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

- (3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

- (4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.
- (5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

- (a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

- (b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.