

December 17, 2020

Antx/RemoteIQ  
3005 Glacier Pass Lane  
Cedar Park, TX 78613

Dear Alan Thomas,

Enclosed is the Wireless test report for compliance testing of the Antx/RemoteIQ, Messenger 3.0 -W as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15 Subpart C for Intentional Radiators.

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



Michelle Tawmging  
Documentation Department

Reference: (\Antx/RemoteIQ\WIRA108100-FCC247 Rev. 3)

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## **Electromagnetic Compatibility Criteria Test Report**

for the

**Antx/RemoteIQ  
Messenger 3.0 -W**

**Tested under**  
the FCC Certification Rules  
contained in  
15.247 Subpart C for Intentional Radiators

**Report: WIRA108100-FCC247 Rev. 3**

December 17, 2020

**Prepared For:**

**Antx/RemoteIQ  
3005 Glacier Pass Lane  
Cedar Park, TX 78613**

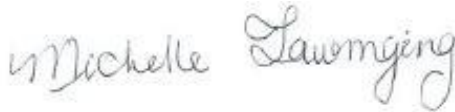
**Prepared By:**  
**Eurofins E&E North America**  
13501 McCallen Pass  
Austin, TX 78753

## **Electromagnetic Compatibility Criteria Test Report**

for the

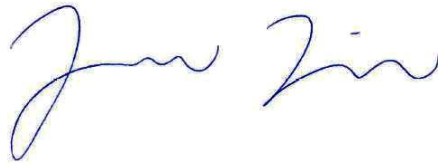
**Antx/RemoteIQ**  
**Messenger 3.0 -W**

**Tested under**  
the FCC Certification Rules  
contained in  
15.247 Subpart C for Intentional Radiators



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 the FCC Rules Part 15.247 under normal use and maintenance.



Jonathan Tavera,  
Project Engineer  
Manager, Electromagnetic Compatibility Lab

## Report Status Sheet

| Revision | Report Date        | Reason for Revision       |
|----------|--------------------|---------------------------|
| Ø        | September 11, 2020 | Initial Issue             |
| 1        | September 17, 2020 | Added FCC ID to Figure 2. |
| 2        | November 17, 2020  | TCB corrections.          |
| 3        | December 17, 2020  | TCB corrections.          |

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## List of Terms and Abbreviations

|                              |                                                      |
|------------------------------|------------------------------------------------------|
| <b>AC</b>                    | <b>Alternating Current</b>                           |
| <b>ACF</b>                   | <b>Antenna Correction Factor</b>                     |
| <b>Cal</b>                   | <b>Calibration</b>                                   |
| <b><i>d</i></b>              | <b>Measurement Distance</b>                          |
| <b>dB</b>                    | <b>Decibels</b>                                      |
| <b>dB<math>\mu</math>A</b>   | <b>Decibels above one <b>microamp</b></b>            |
| <b>dB<math>\mu</math>V</b>   | <b>Decibels above one <b>microvolt</b></b>           |
| <b>dB<math>\mu</math>A/m</b> | <b>Decibels above one <b>microamp per meter</b></b>  |
| <b>dB<math>\mu</math>V/m</b> | <b>Decibels above one <b>microvolt per meter</b></b> |
| <b>DC</b>                    | <b>Direct Current</b>                                |
| <b>E</b>                     | <b>Electric Field</b>                                |
| <b>DSL</b>                   | <b>Digital Subscriber Line</b>                       |
| <b>ESD</b>                   | <b>Electrostatic Discharge</b>                       |
| <b>EUT</b>                   | <b>Equipment Under Test</b>                          |
| <b><i>f</i></b>              | <b>Frequency</b>                                     |
| <b>FCC</b>                   | <b>Federal Communications Commission</b>             |
| <b>GRP</b>                   | <b>Ground Reference Plane</b>                        |
| <b>H</b>                     | <b>Magnetic Field</b>                                |
| <b>HCP</b>                   | <b>Horizontal Coupling Plane</b>                     |
| <b>Hz</b>                    | <b>Hertz</b>                                         |
| <b>IEC</b>                   | <b>International Electrotechnical Commission</b>     |
| <b>kHz</b>                   | <b>kilohertz</b>                                     |
| <b>kPa</b>                   | <b>kilopascal</b>                                    |
| <b>kV</b>                    | <b>kilovolt</b>                                      |
| <b>LISN</b>                  | <b>Line Impedance Stabilization Network</b>          |
| <b>MHz</b>                   | <b>Megahertz</b>                                     |
| <b><math>\mu</math>H</b>     | <b>microhenry</b>                                    |
| <b><math>\mu</math></b>      | <b>microfarad</b>                                    |
| <b><math>\mu</math>s</b>     | <b>microseconds</b>                                  |
| <b>NEBS</b>                  | <b>Network Equipment-Building System</b>             |
| <b>PRF</b>                   | <b>Pulse Repetition Frequency</b>                    |
| <b>RF</b>                    | <b>Radio Frequency</b>                               |
| <b>RMS</b>                   | <b>Root-Mean-Square</b>                              |
| <b>TWT</b>                   | <b>Traveling Wave Tube</b>                           |
| <b>V/m</b>                   | <b>Volts <b>per meter</b></b>                        |
| <b>VCP</b>                   | <b>Vertical Coupling Plane</b>                       |

## Executive Summary

## **A. Purpose of Test**

An EMC evaluation was performed to determine compliance of the Antx/RemoteIQ Messenger 3.0 -W, with the requirements of Part 15, §15.247. 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 Messenger 3.0 -W. Antx/RemoteIQ should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Messenger 3.0 -W, 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, §15.247, in accordance with Antx/RemoteIQ, quote number 9EXA0602R5. All tests were conducted using measurement procedure ANSI C63.10-2013.

| <b>FCC Reference<br/>47 CFR Part 15.247:2005</b>          | <b>Description</b>                              | <b>Compliance</b> |
|-----------------------------------------------------------|-------------------------------------------------|-------------------|
| Title 47 of the CFR, Part 15 §15.203                      | Antenna Requirement                             | Compliant         |
| Title 47 of the CFR, Part 15 §15.207(a)                   | Conducted Emission Limits                       | Compliant         |
| Title 47 of the CFR, Part 15 §15.247(a)(2)                | 6dB Occupied Bandwidth                          | Compliant         |
| Title 47 of the CFR, Part 15 §15.247(b)                   | Peak Power Output                               | Compliant         |
| Title 47 of the CFR, Part 15 §15.247(c)                   | Spurious Emissions in Non-restricted Bands      | Compliant         |
| Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205 | Radiated Spurious Emissions Requirements        | Compliant         |
| Title 47 of the CFR, Part 15; §15.247(e)                  | Peak Power Spectral Density                     | Compliant         |
| Title 47 of the CFR, Part 15 §15.247(i)                   | RF Human Exposure, Maximum Permissible Exposure | Compliant         |

**Figure 1: Executive Summary of EMC Part 15.247 Compliance Testing**

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

# Equipment Configuration

## A. Overview

Eurofins E&E North America was contracted by Antx/RemoteIQ to perform testing on the Messenger 3.0 - W, under Antx/RemoteIQ's quote number 9EXA0602R5,

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Antx/RemoteIQ, Messenger 3.0 -W.

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

|                                       |                                                         |                |
|---------------------------------------|---------------------------------------------------------|----------------|
| <b>Model(s) Tested:</b>               | Messenger 3.0 -W                                        |                |
| <b>Model(s) Covered:</b>              | Messenger 3.0 -W                                        |                |
| <b>EUT Specifications:</b>            | Primary Power: 8-36 VDC                                 |                |
|                                       | FCC ID: CN24102                                         |                |
|                                       | <b>Type of Modulations:</b>                             | GFSK           |
|                                       | <b>Equipment Code:</b>                                  | DTS            |
|                                       | <b>Peak RF Output Power:</b>                            | 5.71 dBm       |
|                                       | <b>EUT Frequency Ranges:</b>                            | 2402-2480 MHz  |
|                                       | <b>Transmit Speeds:</b>                                 | 1 Mbps, 2 Mbps |
|                                       | <b>Antenna Type:</b>                                    | Chip           |
|                                       | <b>Antenna Gain:</b>                                    | 0.5 dBi        |
|                                       | <b>Firmware Version:</b>                                | M3.0-V1.0.51   |
|                                       | <b>RF Power Setting as Tested:</b>                      | 4 dBm          |
| <b>Analysis:</b>                      | The results obtained relate only to the item(s) tested. |                |
| <b>Environmental Test Conditions:</b> | Temperature: 15-35° C                                   |                |
|                                       | Relative Humidity: 30-60%                               |                |
|                                       | Barometric Pressure: 860-1060 mbar                      |                |
| <b>Evaluated by:</b>                  | Jonathan Tavira, Donald Salguero                        |                |
| <b>Report Date(s):</b>                | December 17, 2020                                       |                |

Figure 2: EUT Summary Table

## B. References

|                                   |                                                                                                                                                                       |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CFR 47, Part 15, Subpart C</b> | Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies |
| <b>ANSI C63.4:2014</b>            | Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz                                |
| <b>ISO/IEC 17025:2005</b>         | General Requirements for the Competence of Testing and Calibration Laboratories                                                                                       |
| <b>ANSI C63.10-2013</b>           | American National Standard for Testing Unlicensed Wireless Devices                                                                                                    |
| <b>KDB 558074 v04</b>             | Guidance For Performing Compliance Measurements On Digital Transmission Systems (DTS) Operating Under Section 15.247                                                  |

Figure 3: References

## C. Test Site

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

All testing was performed at Eurofins E&E North America, 13501 McCallen Pass, Austin, TX 78753. 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 E&E North America.

## D. Measurement Uncertainty

| Test Method                                  | Typical Expanded Uncertainty | K | Confidence Level |
|----------------------------------------------|------------------------------|---|------------------|
| <b>RF Frequencies</b>                        | ±4.52 Hz                     | 2 | 95%              |
| <b>RF Power Conducted Emissions</b>          | ±2.32 dB                     | 2 | 95%              |
| <b>RF Power Conducted Spurious Emissions</b> | ±2.25 dB                     | 2 | 95%              |
| <b>RF Power Radiated Emissions</b>           | ±3.01 dB                     | 2 | 95%              |

Figure 4: Uncertainty Calculations Summary

## E. Description of Test Sample

The Messenger 3.0 -W, Equipment Under Test (EUT), is an industrial device for monitoring of physical IO data (analog/digital) as well as monitoring of data collected from serial RS485 or CAN bus connections.. In addition, bluetooth low energy is available for users to locally query the device for data values or change configuration parameters. The intended markets include (but not limited to) water/waste water utility, off-road heavy construction equipment, on-road semi-trucks, oil and gas, and standby power generators.

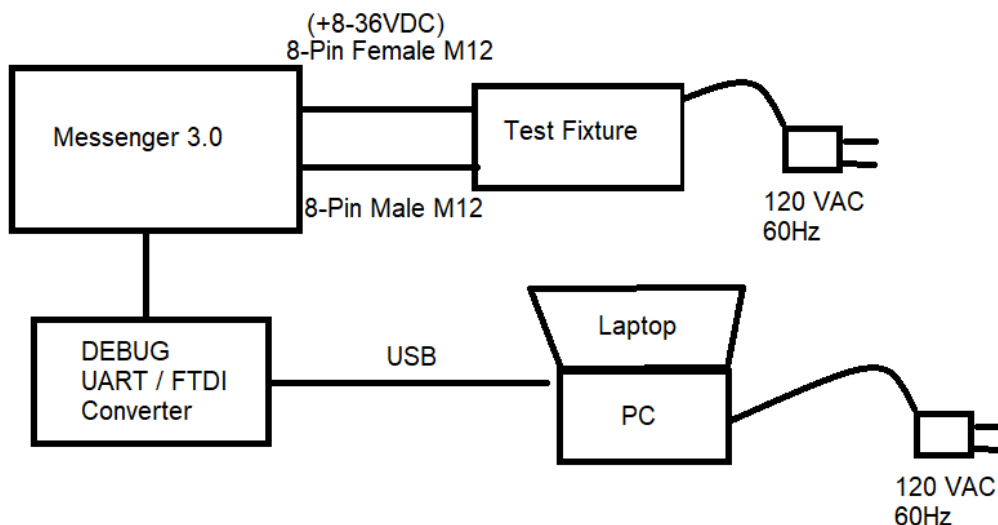


Figure 5: Block Diagram of Test Configuration

## F. Equipment Configuration

The EUT was set up as outlined in **Figure 5**. 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. # |
|---------|--------|---------------------------------------|--------------|-------------|---------------|--------|
| N/A     | N/A    | Messenger 3.0 (Conducted RF)          | 1950-0034    | N/A         | N/A           | 2      |
| N/A     | N/A    | Messenger 3.0 (Radiated RF)           | 1950-0034    | N/A         | N/A           | 2      |
| N/A     | N/A    | Test Fixture / Mean Well Power Supply | DRC-40A      | MW02        | N/A           | N/A    |

Figure 6: Equipment List

The firmware installed in the EUT during testing was M3.0-V1.0.51

## G. Support Equipment

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

| Ref. ID | Slot # | Name / Description                | Model Number     | Part Number    | Serial Number | Rev. # |
|---------|--------|-----------------------------------|------------------|----------------|---------------|--------|
| N/A     | N/A    | Lenovo ideapad Flex 4 / Laptop PC | 80SA             | N/A            | MP122ENL      | N/A    |
| N/A     | N/A    | Lenovo AC Adapter / Power Supply  | ADLX65CL<br>GU2A | 5A10K7874<br>5 | N/A           | N/A    |
| N/A     | N/A    | B&B Electronics / TTL Converter   | 232FPTTL         | N/A            | N/A           | N/A    |

Figure 7: Support Equipment

## H. 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 |
|---------|--------------------|------------------------------------------|-----|----------------------|----------------|-----------------|--------------------------------|
| N/A     | Debug / UART       | TTL Converter                            | 1   | 0.2                  | 0.2            | N               | Laptop PC                      |
| N/A     | Input Power        | 8-Pn Female M12                          | 1   | 0.5                  | 0.5            | N               | Test Fixture /AC Mains         |
| N/A     | Output Termination | 8-Pn Male M12                            | 1   | 0.5                  | 0.5            | N               | Test Fixture                   |

Figure 8: Ports and Cabling Information

## I. Mode of Operation

For RF bench level testing, the EUT was configured via Debug Terminal through TeraTerm. An ancillary UART converter established a COM Port connection with the configuration lap, via Serial connection.

Using a Command Line Interface (CLI), the EUT was place into a Radio Test mode, which provided a direct connection with the Noridc MCU of the BLE transmitter. All radio parameters such as; RF Channel,

Data rate, and RF Output Power were controlled through the CLI. The EUT was configured to operate with a constant modulated carrier (100% Duty Cycle), encoded with a pseudo random bit sequence on channels: 2402 MHz, 2440 MHz and 2480 MHz. The EUT was configured to transmit at the maximum output power of +4 dBm.

## J. Method of Monitoring EUT Operation

Successful programming via the CLI was confirmed if the EUT did not return an error. The Power indication LED remained green if the system was fully booted and functional.

**K. Modifications**

**a) Modifications to EUT**

A test sample was modified and fitted with a u.FL connector, so that conducted RF measurements could be performed.

**b) Modifications to Test Standard**

No modifications were made to the test standard.

**L. Disposition of EUT**

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

# Electromagnetic Compatibility Criteria for Intentional Radiators

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.203      Antenna Requirement

**Test Requirement:**      § 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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

- a.) Antenna must be permanently attached to the unit.
- b.) Antenna must use a unique type of connector to attach to the EUT.
- c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

**Test Results:**      The EUT was tested is **compliant** with § 15.203 Antenna Requirement. The Messenger 3.0 uses a PCB etched antenna that is permanently attached.

**Test Engineer:**      Jonathan Tavira

**Test Date:**      June 26, 2020

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.207(a) Conducted Emissions Limits

**Test Requirement(s):** § 15.207 (a): For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50  $\Omega$  line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency range (MHz) | § 15.207(a), Conducted Limit (dB $\mu$ V) |         |
|-----------------------|-------------------------------------------|---------|
|                       | Quasi-Peak                                | Average |
| * 0.15- 0.5           | 66 - 56                                   | 56 - 46 |
| 0.5 - 5               | 56                                        | 46      |
| 5 - 30                | 60                                        | 50      |

**Figure 9: Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)**

**Test Procedure:** The EUT was placed on a 0.8 m-high wooden table inside a screen room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50  $\Omega$ /50  $\mu$ H Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2014 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50  $\Omega$ /50  $\mu$ H LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

**Test Results:** The EUT was tested is **compliant** with § 15.207(a) Conducted Emissions Limits. Measured emissions were below applicable limits.

**Test Engineer:** Jonathan Tavira

**Test Date:** August 18, 2020

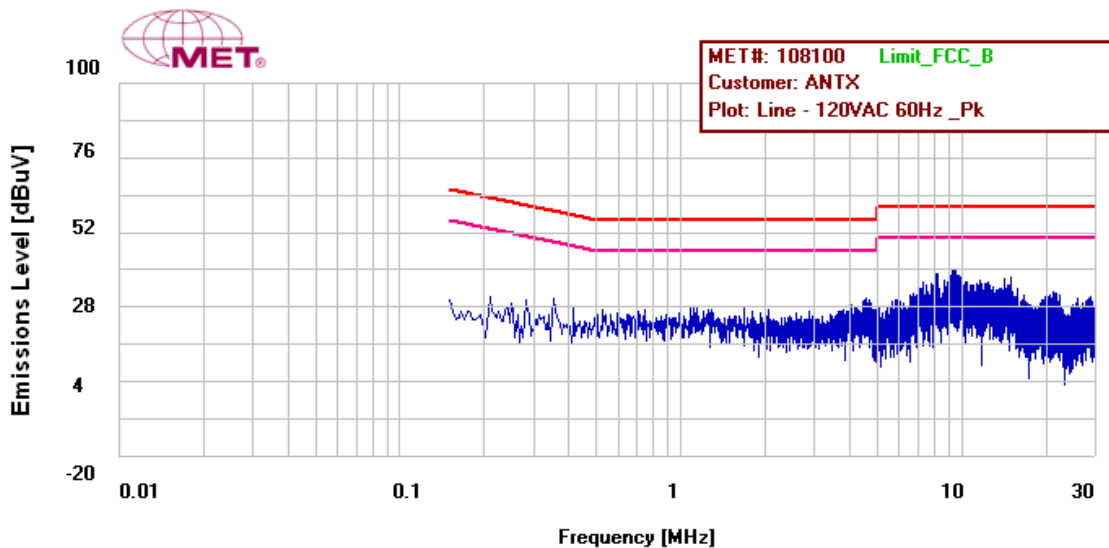
**Test Data**

| Meas. Location                                       | Meas. m  | Limit    | Pass/Fail |
|------------------------------------------------------|----------|----------|-----------|
| Bonding measurement from LISN ground to ground plane | 1.932 mΩ | < 2.5 mΩ | Pass      |

**Figure 10: § 15.207(a) Conducted Emissions Limits, Ground Plane Bonding Measurement**

| Line               | Freq (MHz) | QP Amplitude (dBμV) | QP Limit (dBμV) | Margin (dB) | Pass /Fail | Average Amplitude (dBμV) | Average Limit (dBμV) | Margin (dB) | Pass /Fail |
|--------------------|------------|---------------------|-----------------|-------------|------------|--------------------------|----------------------|-------------|------------|
| Line - 120VAC 60Hz | 0.210      | 29.23               | 63.213          | -33.983     | Pass       | 23.02                    | 53.213               | -30.193     | Pass       |
| Line - 120VAC 60Hz | 7.322      | 33.65               | 60              | -26.35      | Pass       | 28.95                    | 50                   | -21.05      | Pass       |
| Line - 120VAC 60Hz | 8.174      | 34.39               | 60              | -25.61      | Pass       | 28.15                    | 50                   | -21.85      | Pass       |
| Line - 120VAC 60Hz | 9.478      | 37.59               | 60              | -22.41      | Pass       | 31.67                    | 50                   | -18.33      | Pass       |
| Line - 120VAC 60Hz | 21.322     | 30.39               | 60              | -29.61      | Pass       | 28.31                    | 50                   | -21.69      | Pass       |
| Line - 120VAC 60Hz | 28.922     | 27.86               | 60              | -32.14      | Pass       | 25.11                    | 50                   | -24.89      | Pass       |

**Figure 11: § 15.207(a) Conducted Emissions Limits, Line, Test Results**



**Figure 12: § 15.207(a) Conducted Emissions Limits, Line, Peak Scan**

| Line                  | Freq (MHz) | QP Amplitude (dBμV) | QP Limit (dBμV) | Margin (dB) | Pass/Fail | Average Amplitude (dBμV) | Average Limit (dBμV) | Margin (dB) | Pass/Fail |
|-----------------------|------------|---------------------|-----------------|-------------|-----------|--------------------------|----------------------|-------------|-----------|
| Neutral - 120VAC 60Hz | 0.178      | 32.398              | 64.582          | -32.184     | Pass      | 25.12                    | 54.582               | -29.462     | Pass      |
| Neutral - 120VAC 60Hz | 4.658      | 27.42               | 56              | -28.58      | Pass      | 21.74                    | 46                   | -24.26      | Pass      |
| Neutral - 120VAC 60Hz | 8.002      | 36.33               | 60              | -23.67      | Pass      | 30.43                    | 50                   | -19.57      | Pass      |
| Neutral - 120VAC 60Hz | 9.098      | 31.61               | 60              | -28.39      | Pass      | 25.23                    | 50                   | -24.77      | Pass      |
| Neutral - 120VAC 60Hz | 20.802     | 31.7                | 60              | -28.3       | Pass      | 29.8                     | 50                   | -20.2       | Pass      |
| Neutral - 120VAC 60Hz | 28.238     | 31.01               | 60              | -28.99      | Pass      | 29.06                    | 50                   | -20.94      | Pass      |

Figure 13: § 15.207(a) Conducted Emissions Limits, Neutral, Test Results

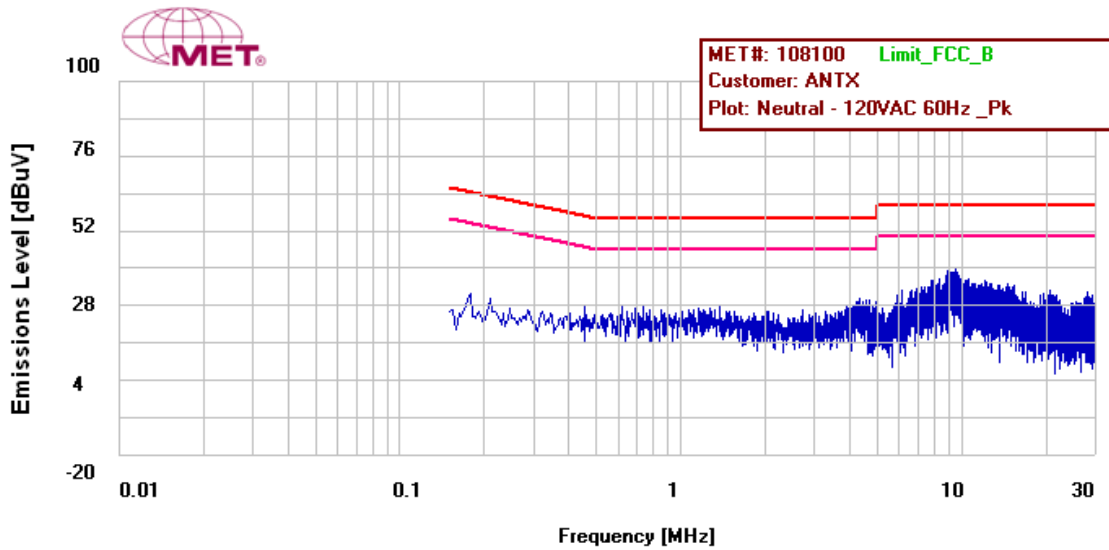


Figure 14: § 15.207(a) Conducted Emissions Limits, Neutral, Peak Scan

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(a)(2) 6 dB Bandwidth

**Test Requirements:** § 15.247(a)(2): Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

**Test Procedure:** The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW = 100kHz, VBW = 3\*RBW. The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels.



**Figure 15: Block Diagram, Occupied Bandwidth Test Setup**

**Test Results:** The EUT was tested is **compliant** with § 15.247(a)(2) 6 dB Bandwidth. No anomalies noted.

The 6 dB Bandwidth was determined from the plots on the following pages.

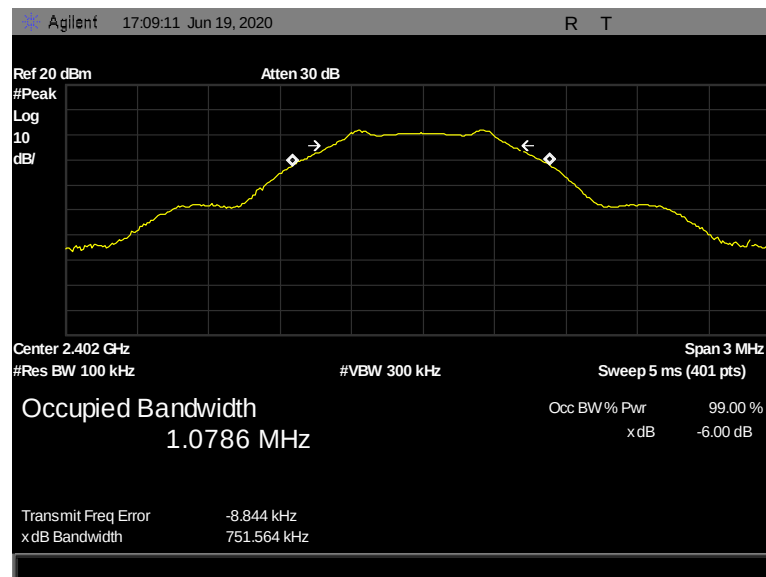
**Test Engineer:** Jonathan Tavira

**Test Date:** June 26, 2020

**Test Data**

| Mode   | Channel (MHz) | 6 dB Bandwidth (MHz) | Limit (MHz)  |
|--------|---------------|----------------------|--------------|
| 1 Mbps | 2402          | 0.755869             | $\geq 0.500$ |
| 1 Mbps | 2442          | 0.760138             | $\geq 0.500$ |
| 1 Mbps | 2480          | 0.764631             | $\geq 0.500$ |
| 2 Mbps | 2402          | 1.342000             | $\geq 0.500$ |
| 2 Mbps | 2442          | 1.348000             | $\geq 0.500$ |
| 2 Mbps | 2480          | 1.349000             | $\geq 0.500$ |

**Figure 16: § 15.247(a)(2) 6 dB Bandwidth, Test Results**



**Figure 17: § 15.247(a)(2) 6 dB Bandwidth, 2402 MHz, 1 Mbps**

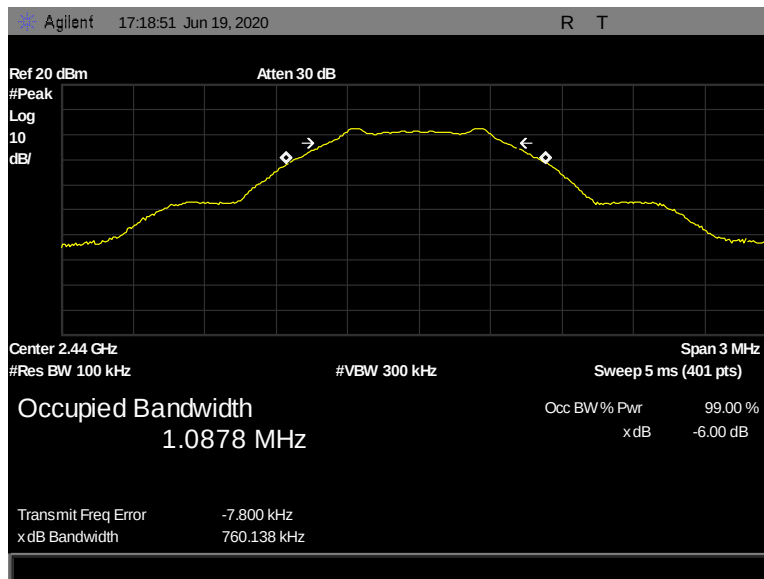


Figure 18: § 15.247(a)(2) 6 dB Bandwidth, 2440 MHz, 1 Mbps

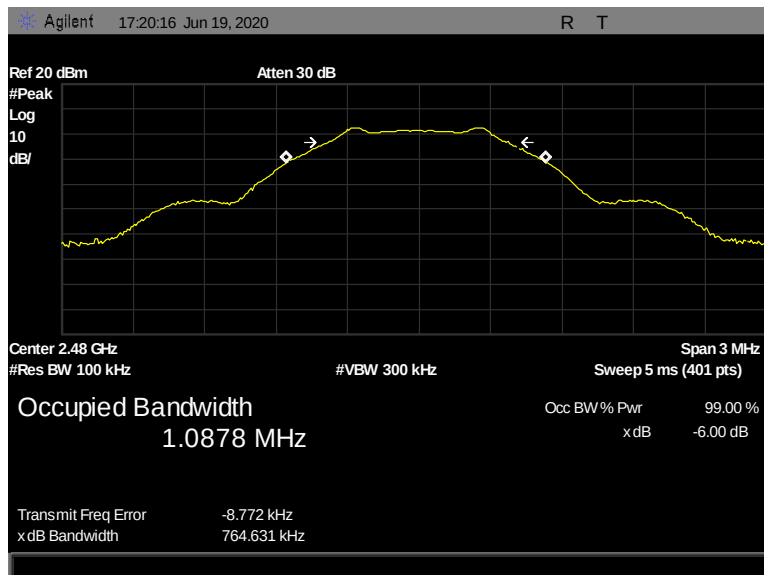


Figure 19: § 15.247(a)(2) 6 dB Bandwidth, 2480 MHz, 1 Mbps

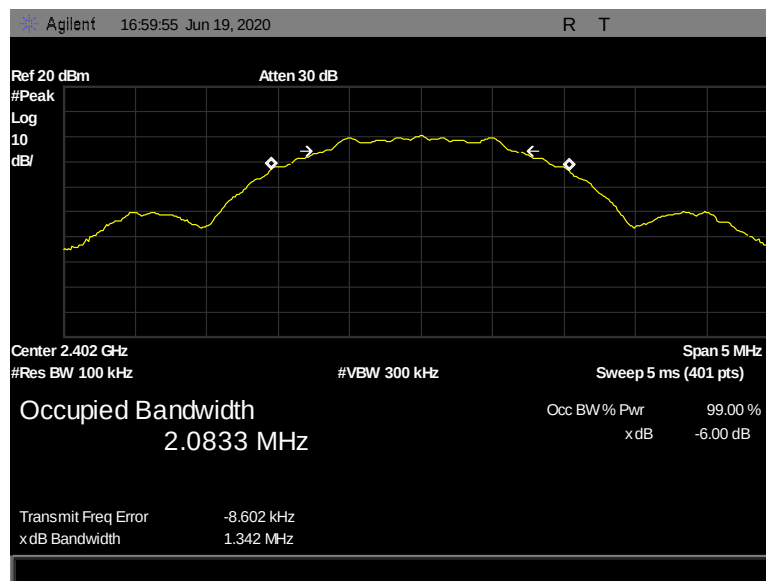


Figure 20: § 15.247(a)(2) 6 dB Bandwidth, 2402 MHz, 2 Mbps

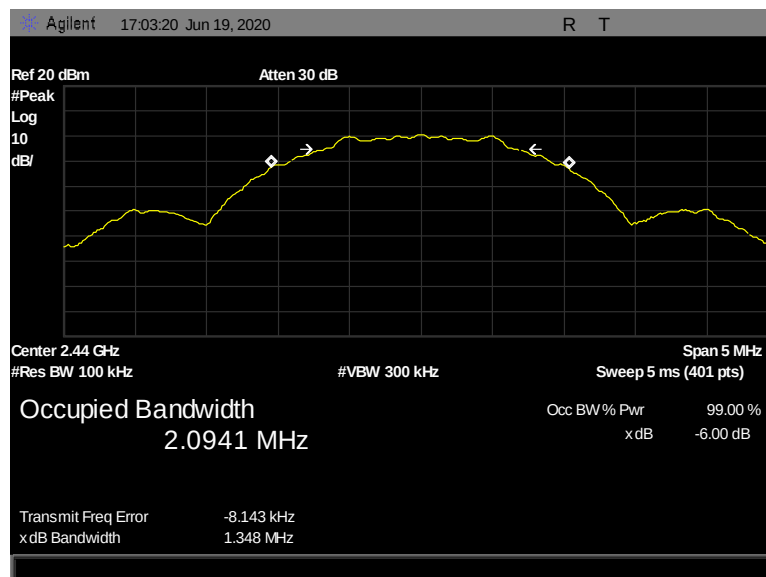


Figure 21: § 15.247(a)(2) 6 dB Bandwidth, 2440 MHz, 2 Mbps

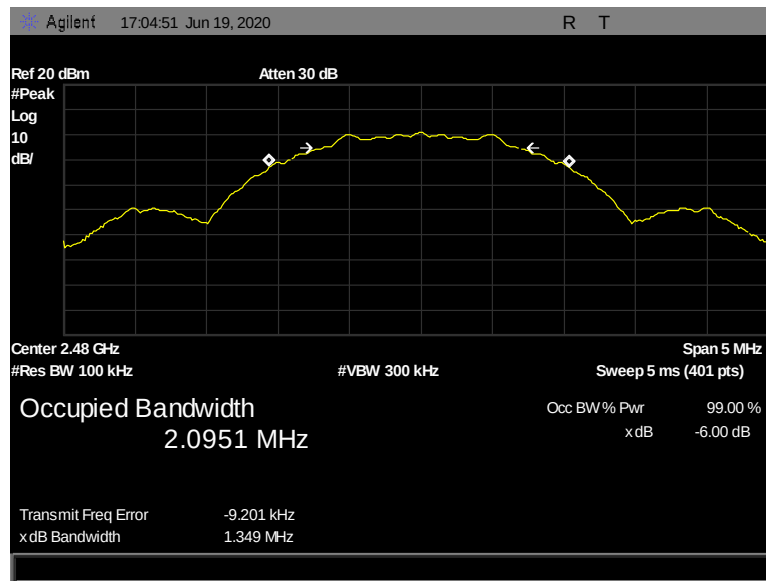


Figure 22: § 15.247(a)(2) 6 dB Bandwidth, 2480 MHz, 2 Mbps

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(b) Peak Power Output

**Test Requirements:** §15.247(b): The maximum peak output power of the intentional radiator shall not exceed the following:

| Digital Transmission Systems<br>(MHz) | Output Limit<br>(Watts) |
|---------------------------------------|-------------------------|
| 2400–2483.5                           | 1.000                   |

Figure 23: Output Power Requirements from §15.247(b)

§15.247(c): if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the 9, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**Test Procedure:** The EUT was configured to measure the low, mid and high channels of each band at the maximum power level. Measurements were performed in a conducted setup as shown in figure below.



Figure 24: Block Diagram, Peak Conducted Output Power Test Setup

**Test Results:** The EUT was tested is **compliant** with § 15.247(b) Peak Power Output. No anomalies noted.

**Test Engineer:** Jonathan Tavira

**Test Date:** June 26, 2020

## Test Data

| Mode   | Channel (MHz) | Peak Output Power (dBm) | Peak EIRP (dBm) |
|--------|---------------|-------------------------|-----------------|
| 1 Mbps | 2402          | 4.14                    | 4.64            |
| 1 Mbps | 2442          | 4.57                    | 5.07            |
| 1 Mbps | 2480          | 4.82                    | 5.32            |
| 2 Mbps | 2402          | 5.05                    | 5.55            |
| 2 Mbps | 2442          | 5.50                    | 6.00            |
| 2 Mbps | 2480          | 5.71                    | 6.21            |

Figure 25: § 15.247(b) Peak Power Output, Test Results

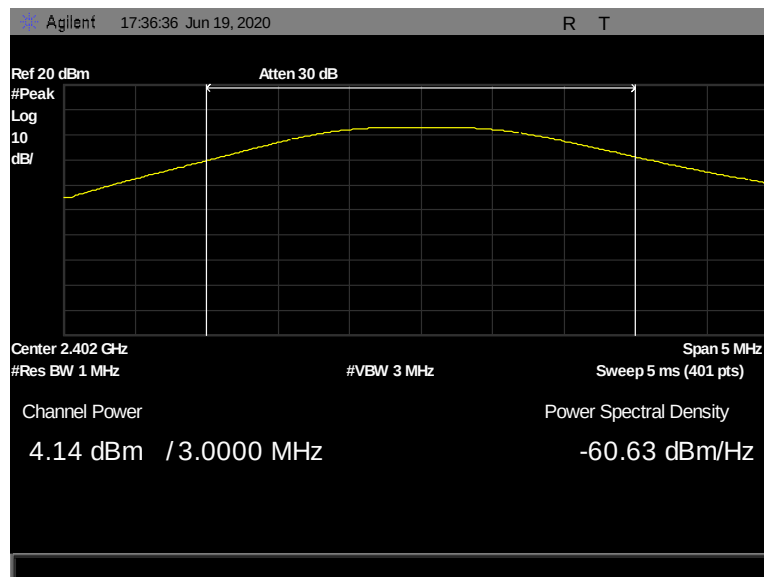


Figure 26: § 15.247(b) Peak Power Output, Peak Output Power, 2402 MHz, 1 Mbps

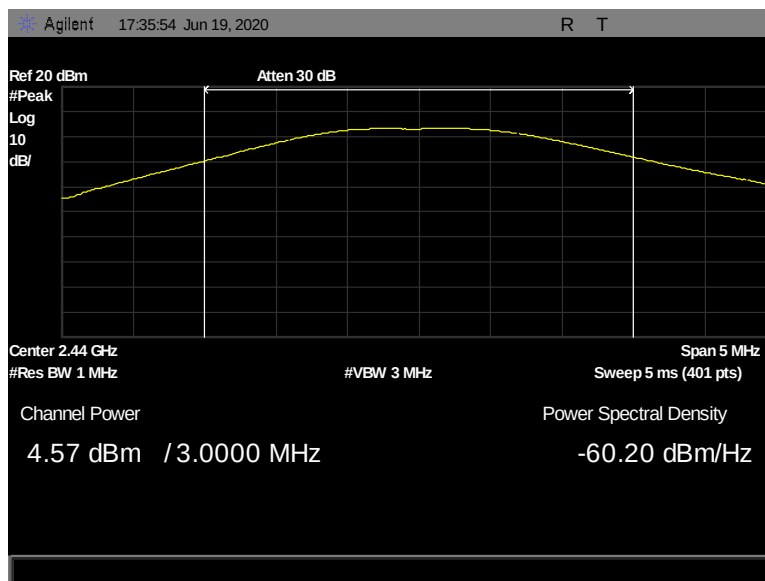


Figure 27: § 15.247(b) Peak Power Output, 2440 MHz, 1 Mbps

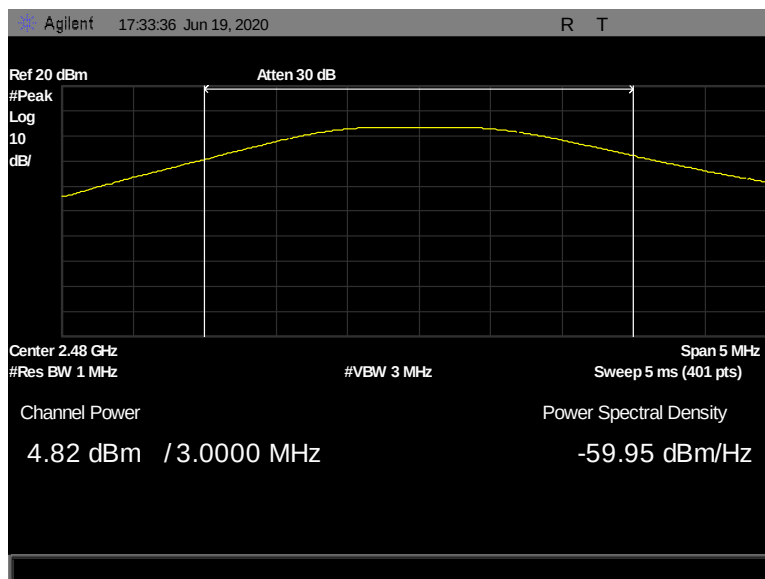


Figure 28: § 15.247(b) Peak Power Output, 2480 MHz, 1 Mbps

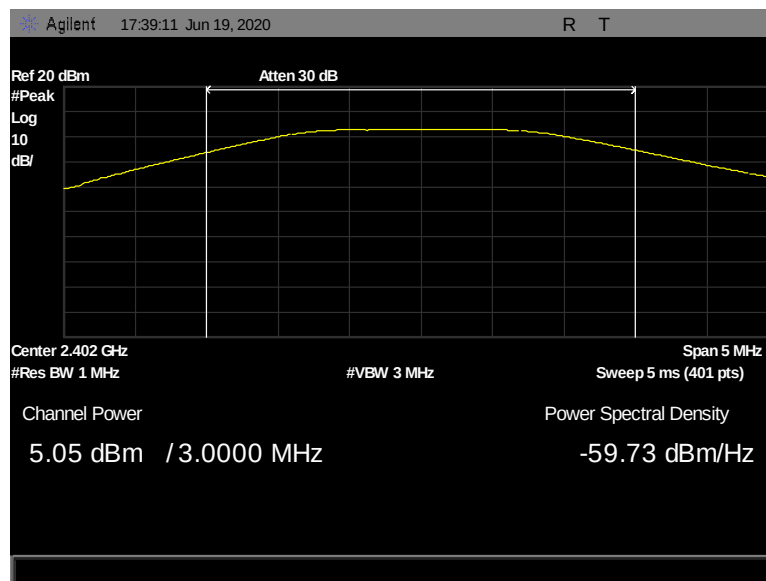


Figure 29: § 15.247(b) Peak Power Output, 2402 MHz, 2 Mbps

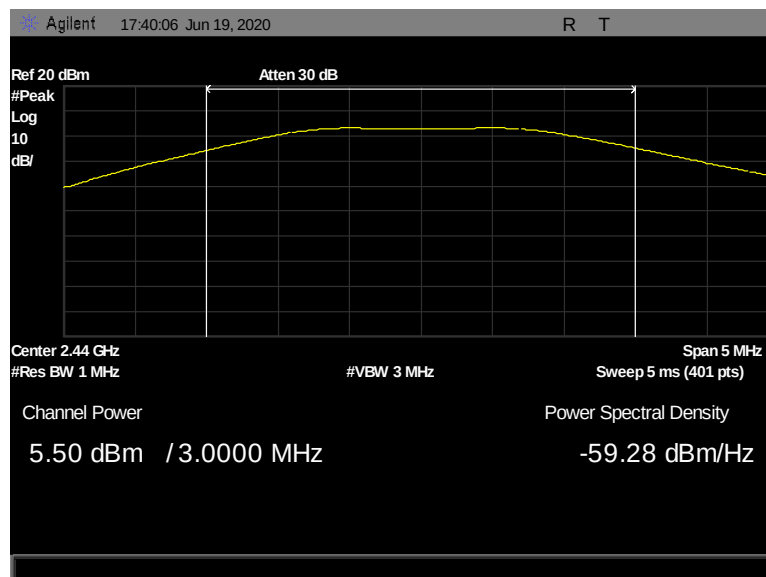


Figure 30: § 15.247(b) Peak Power Output, 2440 MHz, 2 Mbps

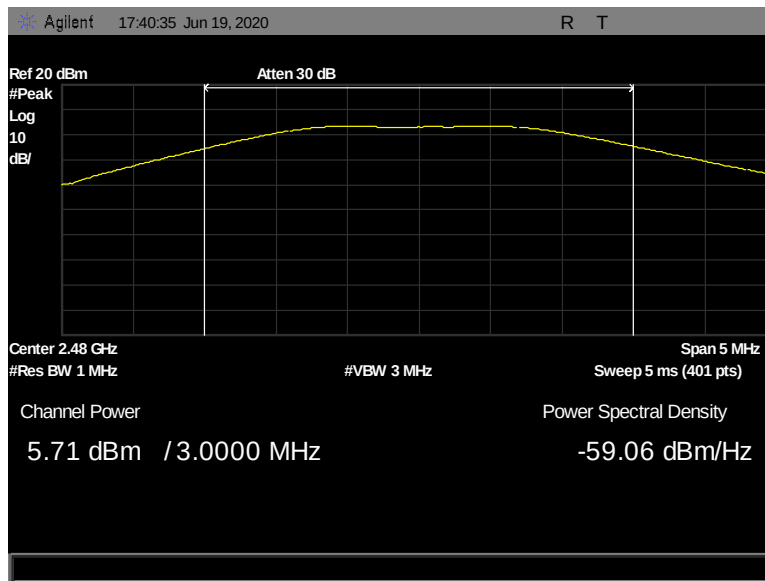


Figure 31: § 15.247(b) Peak Power Output, 2480 MHz, 2 Mbps

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.209 Radiated Spurious Emissions Requirements and Band Edge

**Test Requirements:** §15.247(d); §15.205: Emissions outside the frequency band.

**§15.205(a):** Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                           | MHz                 | MHz             | GHz              |
|-------------------------------|---------------------|-----------------|------------------|
| 0.090–0.110-----              | 16.42–16.423        | 399.9–410       | 4.5–5.15         |
| <sup>1</sup> 0.495–0.505----- | 16.69475–16.69525   | 608–614         | 5.35–5.46        |
| 2.1735–2.1905-----            | 16.80425–16.80475   | 960–1240        | 7.25–7.75        |
| 4.125–4.128-----              | 25.5–25.67          | 1300–1427       | 8.025–8.5        |
| 4.17725–4.17775-----          | 37.5–38.25          | 1435–1626.5     | 9.0–9.2          |
| 4.20725–4.20775-----          | 73–74.6             | 1645.5–1646.5   | 9.3–9.5          |
| 6.215–6.218-----              | 74.8–75.2           | 1660–1710       | 10.6–12.7        |
| 6.26775–6.26825-----          | 108–121.94          | 1718.8–1722.2   | 13.25–13.4       |
| 6.31175–6.31225-----          | 123–138             | 2200–2300       | 14.47–14.5       |
| 8.291–8.294-----              | 149.9–150.05        | 2310–2390       | 15.35–16.2       |
| 8.362–8.366-----              | 156.52475–156.52525 | 2483.5–2500     | 17.7–21.4        |
| 8.37625–8.38675-----          | 156.7–156.9         | 2655–2900       | 22.01–23.12      |
| 8.41425–8.41475-----          | 162.0125–167.17     | 3260–3267       | 23.6–24.0        |
| 12.29–12.293-----             | 167.72–173.2        | 3332–3339       | 31.2–31.8        |
| 12.51975–12.52025-----        | 240–285             | 3345.8–3358 36. | 43–36.5          |
| 12.57675–12.57725-----        | 322–335.4           | 3600–4400       | ( <sup>2</sup> ) |

**Figure 32: Restricted Bands of Operation**

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.

<sup>2</sup> Above 38.6

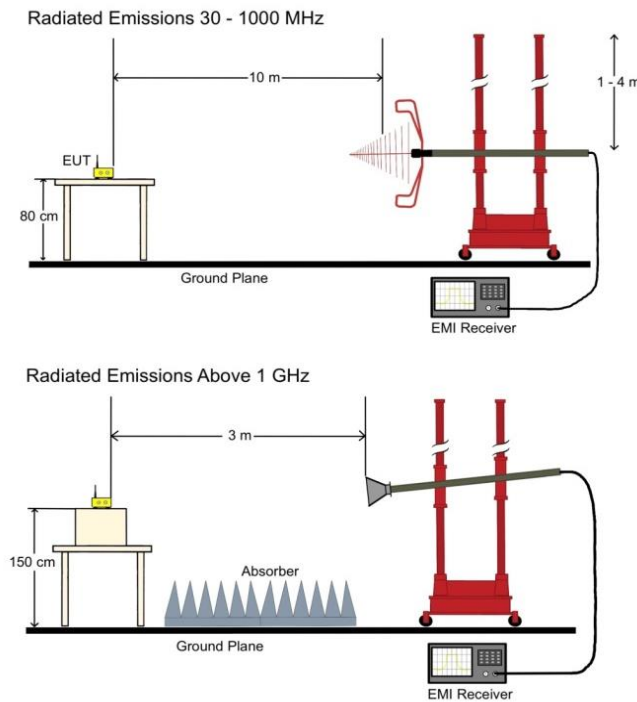
**Test Requirement(s):** § 15.209 (a): Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Figure 33:

| Frequency (MHz) | § 15.209(a), Radiated Emission Limits (dBμV) @ 3m |
|-----------------|---------------------------------------------------|
| 30 - 88         | 40.00                                             |
| 88 - 216        | 43.50                                             |
| 216 - 960       | 46.00                                             |
| Above 960       | 54.00                                             |

**Figure 33: Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)**

**Test Procedures:**

The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz. All peak emissions within 20 dB of the applicable limit were remeasured using either a quasi-peak or average detector as appropriate. During testing, it was determined that the 2 Mbps data rate produced the worst-case emission profile. The following test data reflects results when the EUT was operating at a rate of 2 Mbps.



**Figure 34: Radiated Emissions Test Setup**

**Test Results:**

The EUT was tested is **compliant** with § 15.209 Radiated Spurious Emissions Requirements and Band Edge. Measured emissions were below applicable limits.

**Test Engineer:**

Jonathan Tavira

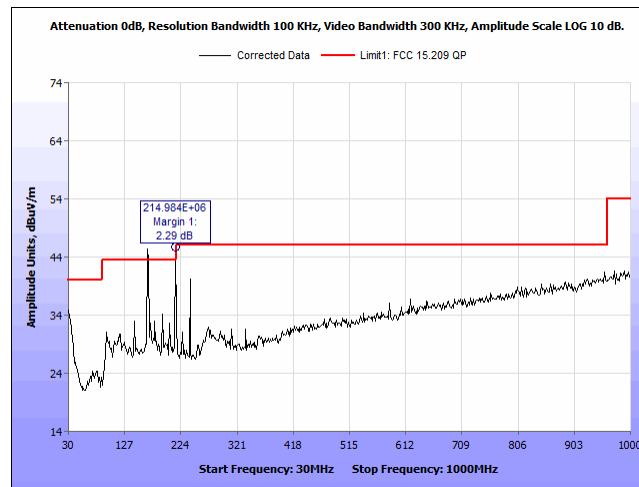
**Test Date:**

June 19, 2020

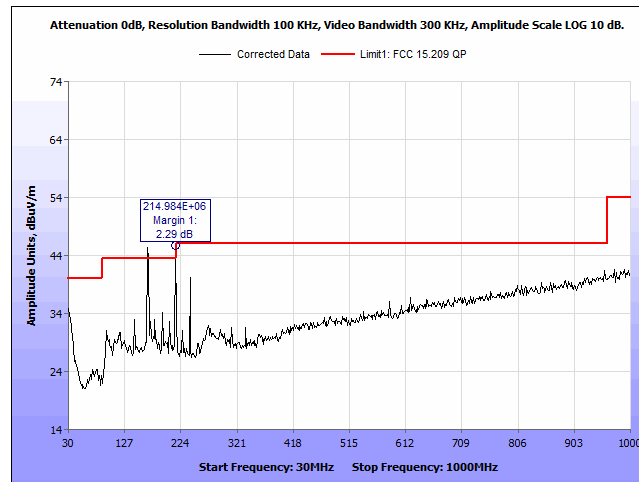
**Test Data**

| Frequency (MHz) | EUT Azimuth (Degrees)                                                                                                                                                        | Antenna Polarity (H/V) | Antenna HEIGHT (cm) | Uncorrected EMI Meter Reading (dBμV) | Antenna Correction Factor (dB/m) (+) | Distance Correction Factor (dB) (-) | Cable Loss/Pre-amp (dB) (+) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------|-------------|
| 214.984         | 230.70                                                                                                                                                                       | H                      | 335.60              | 36.25                                | 14.40                                | 10.46                               | -19.45                      | 41.66                        | 43.5           | -1.84       |
| 239.8558        | 217.90                                                                                                                                                                       | H                      | 294.20              | 38.55                                | 15.50                                | 10.46                               | -19.50                      | 45.01                        | 46.0           | -0.99       |
| 263.1731        | 126.80                                                                                                                                                                       | H                      | 325.80              | 36.49                                | 16.52                                | 10.46                               | -19.27                      | 44.2                         | 46.0           | -1.8        |
| 166.7949        | 8.30                                                                                                                                                                         | H                      | 315.60              | 28.79                                | 15.90                                | 10.46                               | -19.82                      | 35.33                        | 43.5           | -8.17       |
| 191.6666        | 230.40                                                                                                                                                                       | H                      | 303.70              | 39.87                                | 15.37                                | 10.46                               | -19.91                      | 45.79                        | 43.5           | *2.29       |
| 168.3494        | 0.90                                                                                                                                                                         | H                      | 339.10              | 28.88                                | 15.80                                | 10.46                               | -19.69                      | 35.45                        | 43.5           | -8.05       |
| Note            | Emissions that were measured above the limit are digital emissions from ancillary equipment (TTL Converter). These emissions are subject the class A requirements of 15.109. |                        |                     |                                      |                                      |                                     |                             |                              |                |             |

**Figure 35: § 15.209 Radiated Spurious Emissions, 30-1000 MHz, 2402 MHz, Quasi-Peak Results**



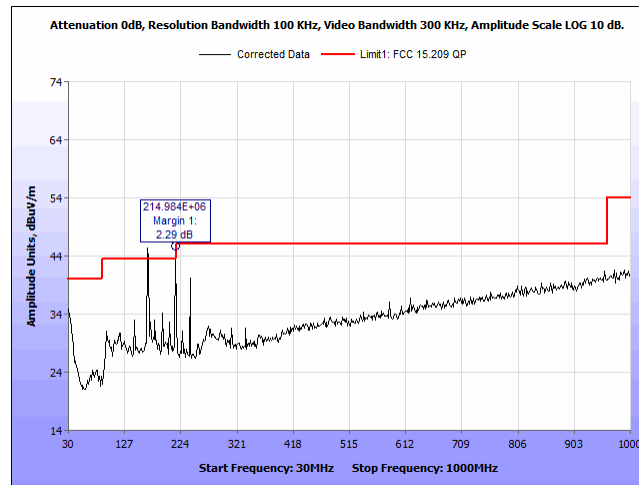
**Figure 36: § 15.209 Radiated Spurious Emissions, 30-1000 MHz, 2402 MHz, Horizontal, Peak Scan**



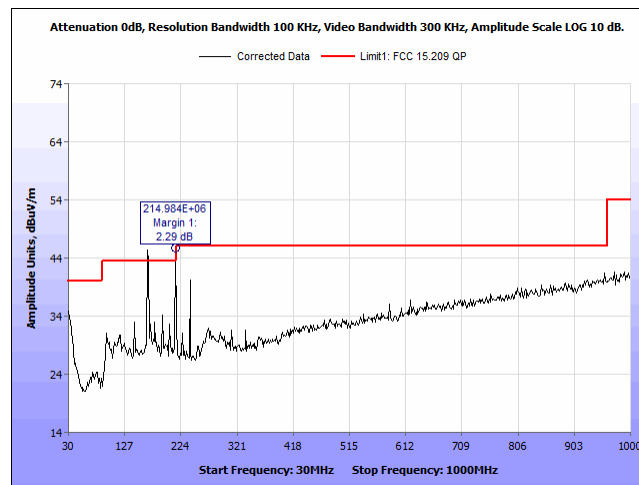
**Figure 37: § 15.209 Radiated Spurious Emissions, 30-1000 MHz, 2402 MHz, Vertical, Peak Scan**

| Frequency (MHz)                                                                                                                                                                   | EUT Azimuth (Degrees) | Antenna Polarity (H/V) | Antenna HEIGHT (cm) | Uncorrected EMI Meter Reading (dBµV) | Antenna Correction Factor (dB/m) (+) | Distance Correction Factor (dB) (-) | Cable Loss/Pre-amp (dB) (+) | Corrected Amplitude (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------|---------------------|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------|-------------|
| 166.7949                                                                                                                                                                          | 7.00                  | H                      | 315.80              | 28.79                                | 15.90                                | 10.46                               | -19.91                      | 35.24                        | 43.5           | -8.26       |
| 168.3494                                                                                                                                                                          | 0.00                  | H                      | 338.20              | 28.98                                | 15.80                                | 10.46                               | -19.69                      | 35.55                        | 43.5           | -7.95       |
| 191.6667                                                                                                                                                                          | 230.70                | H                      | 302.70              | 39.02                                | 15.37                                | 10.46                               | -19.82                      | 45.03                        | 43.5           | *1.53       |
| 214.984                                                                                                                                                                           | 231.20                | H                      | 331.70              | 40.88                                | 14.40                                | 10.46                               | -19.45                      | 46.29                        | 43.5           | *2.79       |
| 239.8558                                                                                                                                                                          | 219.40                | H                      | 296.30              | 41.56                                | 15.50                                | 10.46                               | -19.50                      | 48.02                        | 46.0           | *2.02       |
| 263.1731                                                                                                                                                                          | 127.10                | H                      | 323.90              | 39.87                                | 16.52                                | 10.46                               | -19.27                      | 47.58                        | 46.0           | *1.58       |
| Note: Emissions that were measured above the limit are digital emissions from ancillary equipment (TTL Converter). These emissions are subject the class A requirements of 15.109 |                       |                        |                     |                                      |                                      |                                     |                             |                              |                |             |

**Figure 38: § 15.209 Radiated Spurious Emissions, 30-1000 MHz, 2440 MHz, Quasi-Peak Results**



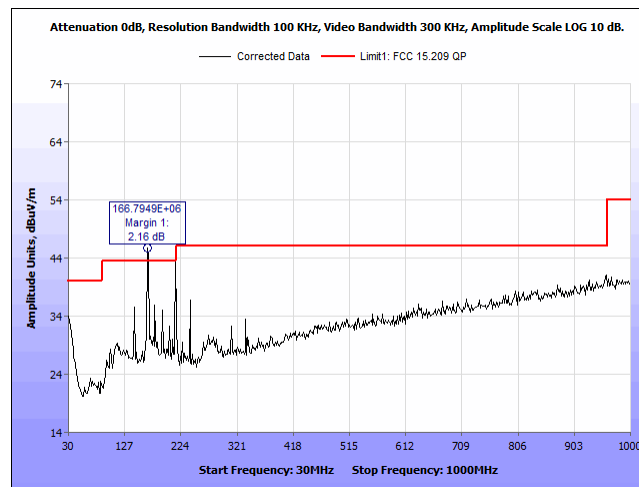
**Figure 39: § 15.209 Radiated Spurious Emissions, 30-1000 MHz, 2440 MHz, Horizontal, Peak Scan**



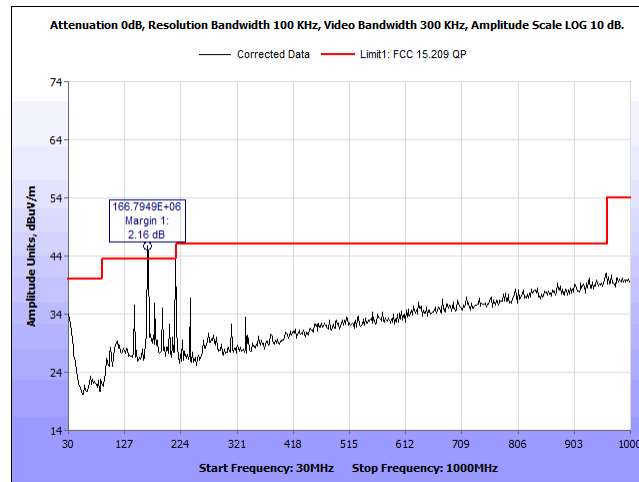
**Figure 40: § 15.209 Radiated Spurious Emissions, 30-1000 MHz, 2440 MHz, Vertical, Peak Scan**

| Frequency (MHz) | EUT Azimuth (Degrees)                                                                                                                                                        | Antenna Polarity (H/V) | Antenna HEIGHT (cm) | Uncorrected EMI Meter Reading (dBμV) | Antenna Correction Factor (dB/m) (+) | Distance Correction Factor (dB) (-) | Cable Loss/Pre-amp (dB) (+) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------|-------------|
| 214.984         | 231.10                                                                                                                                                                       | H                      | 329.80              | 40.88                                | 14.40                                | 10.46                               | -19.45                      | 46.29                        | 43.50          | *2.79       |
| 239.8558        | 218.80                                                                                                                                                                       | H                      | 291.20              | 34.65                                | 15.50                                | 10.46                               | -19.5                       | 41.11                        | 46.00          | -4.89       |
| 263.1731        | 127.40                                                                                                                                                                       | H                      | 326.00              | 27.55                                | 16.52                                | 10.46                               | -19.27                      | 35.26                        | 46.00          | -10.74      |
| 191.6667        | 229.80                                                                                                                                                                       | H                      | 308.50              | 35.62                                | 15.37                                | 10.46                               | -19.91                      | 41.54                        | 43.50          | -1.96       |
| 166.7949        | 4.60                                                                                                                                                                         | H                      | 313.80              | 40.93                                | 15.90                                | 10.46                               | -19.82                      | 46.47                        | 43.50          | *2.97       |
| 168.3494        | 0.00                                                                                                                                                                         | H                      | 338.50              | 37.65                                | 15.80                                | 10.46                               | -19.69                      | 44.22                        | 43.50          | *0.72       |
| Note            | Emissions that were measured above the limit are digital emissions from ancillary equipment (TTL Converter). These emissions are subject the class A requirements of 15.109. |                        |                     |                                      |                                      |                                     |                             |                              |                |             |

**Figure 41: § 15.209 Radiated Spurious Emissions, 30-1000 MHz, 2480 MHz, Quasi-Peak Results**



**Figure 42: § 15.209 Radiated Spurious Emissions, 30-1000 MHz, 2480 MHz, Horizontal, Peak Scan**



**Figure 43: § 15.209 Radiated Spurious Emissions, 30-1000 MHz, 2480 MHz, Vertical, Peak Scan**

| Frequency (GHz) | EUT Azimuth (Degrees) | Antenna Polarity (H/V) | Antenna HEIGHT (cm) | Uncorrected EMI Meter Reading (dBμV) | Antenna Correction Factor (dB/m) (+) | Distance Correction Factor (dB) (-) | Cable Loss/Pre-amp (dB) (+) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-----------------------|------------------------|---------------------|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------|-------------|
| 7.2115          | 181.20                | H                      | 186.90              | 42.10                                | 35.38                                | 0.00                                | -40.00                      | 37.48                        | 54             | -16.52      |
| 7.2115          | 180.90                | V                      | 184.20              | 39.56                                | 35.35                                | 0.00                                | -40.00                      | 34.91                        | 54             | -19.09      |
| 16.3381         | 270.30                | H                      | 210.00              | 36.99                                | 40.50                                | 0.00                                | -56.27                      | 36.32                        | 54             | -17.68      |
| 16.3654         | 269.90                | H                      | 210.00              | 36.94                                | 40.53                                | 0.00                                | -52.37                      | 36.38                        | 54             | -17.62      |
| 16.3926         | 269.90                | H                      | 210.00              | 36.84                                | 40.57                                | 0.00                                | -48.08                      | 36.38                        | 54             | -17.62      |
| 16.4199         | 271.00                | H                      | 210.00              | 36.18                                | 40.61                                | 0.00                                | -47.60                      | 35.81                        | 54             | -18.19      |

Figure 44: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2402 MHz, Average Results

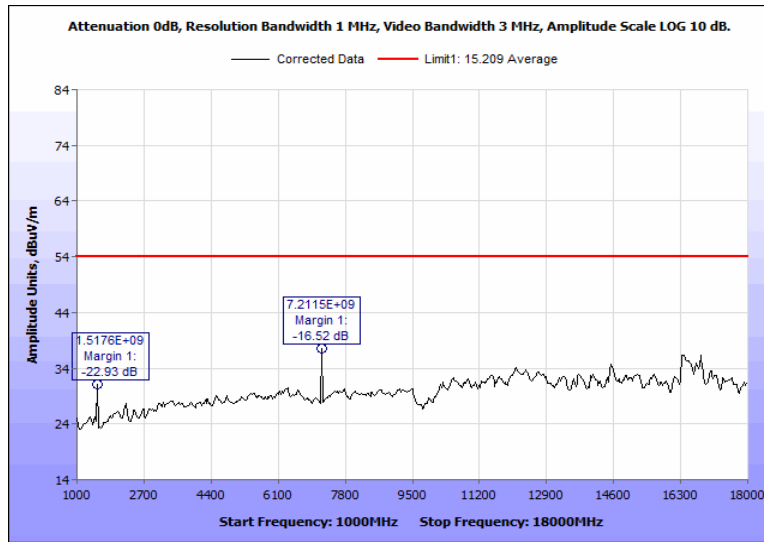


Figure 45: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2402 MHz, Average, Horizontal, Peak Scan

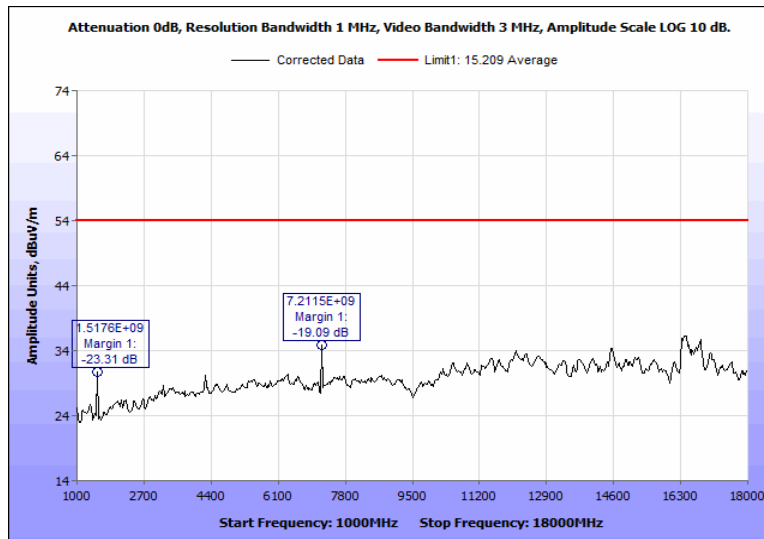


Figure 46: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2402 MHz, Average, Vertical, Peak Scan

| Frequency (GHz) | EUT Azimuth (Degrees) | Antenna Polarity (H/V) | Antenna HEIGHT (cm) | Uncorrected EMI Meter Reading (dBμV) | Antenna Correction Factor (dB/m) (+) | Distance Correction Factor (dB) (-) | Cable Loss/Pre-amp (dB) (+) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-----------------------|------------------------|---------------------|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------|-------------|
| 7.2115          | 181.20                | H                      | 186.90              | 61.22                                | 35.38                                | 0.00                                | -40.00                      | 56.6                         | 74             | -17.4       |
| 7.2115          | 180.90                | V                      | 184.20              | 59.77                                | 35.38                                | 0.00                                | -40.00                      | 55.16                        | 74             | -18.84      |

Figure 47: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2402 MHz, Peak Results

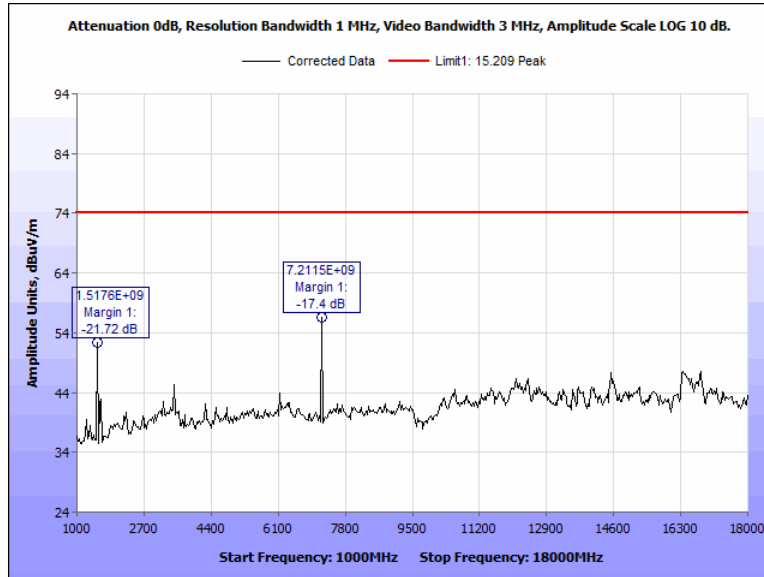


Figure 48: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2402 MHz, Peak, Vertical, Peak Scan

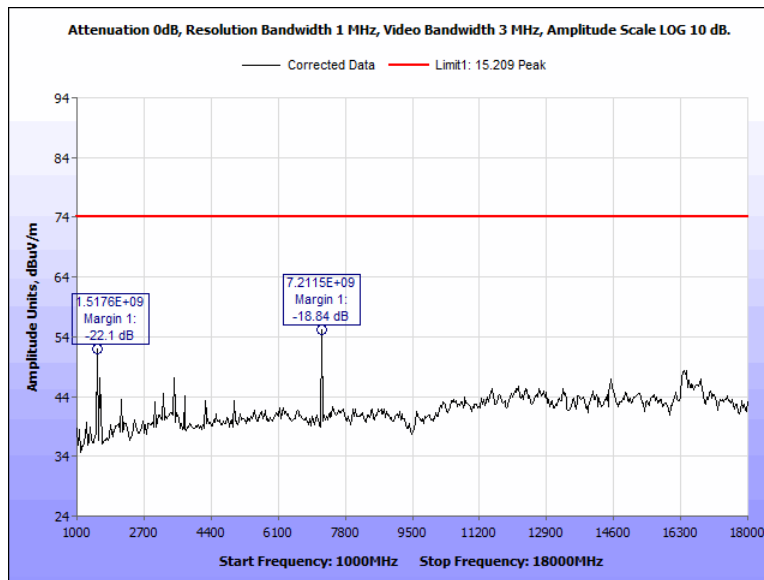


Figure 49: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2402 MHz, Peak, Vertical, Peak Scan

| Frequency (GHz) | EUT Azimuth (Degrees) | Antenna Polarity (H/V) | Antenna HEIGHT (cm) | Uncorrected EMI Meter Reading (dBμV) | Antenna Correction Factor (dB/m) (+) | Distance Correction Factor (dB) (-) | Cable Loss/Pre-amp (dB) (+) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-----------------------|------------------------|---------------------|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------|-------------|
| 7.3205          | 179.20                | H                      | 184.20              | 46.57                                | 35.38                                | 0.00                                | -39.93                      | 42.02                        | 54             | -11.98      |
| 7.3205          | 180.90                | V                      | 184.20              | 45.43                                | 35.39                                | 0.00                                | -39.93                      | 40.89                        | 54             | -13.11      |
| 14.5401         | 166.320               | H                      | 211.20              | 34.75                                | 39.01                                | 0.00                                | -39.19                      | 34.58                        | 54             | -19.42      |
| 16.3381         | 269.90                | H                      | 210.00              | 36.99                                | 40.50                                | 0.00                                | -41.16                      | 36.32                        | 54             | -17.68      |
| 16.3654         | 269.90                | H                      | 210.00              | 36.65                                | 40.53                                | 0.00                                | -41.10                      | 36.09                        | 54             | -17.91      |
| 16.3926         | 271.00                | H                      | 210.00              | 36.82                                | 40.57                                | 0.00                                | -41.03                      | 36.36                        | 54             | -17.64      |

Figure 50: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2440 MHz, Average Results

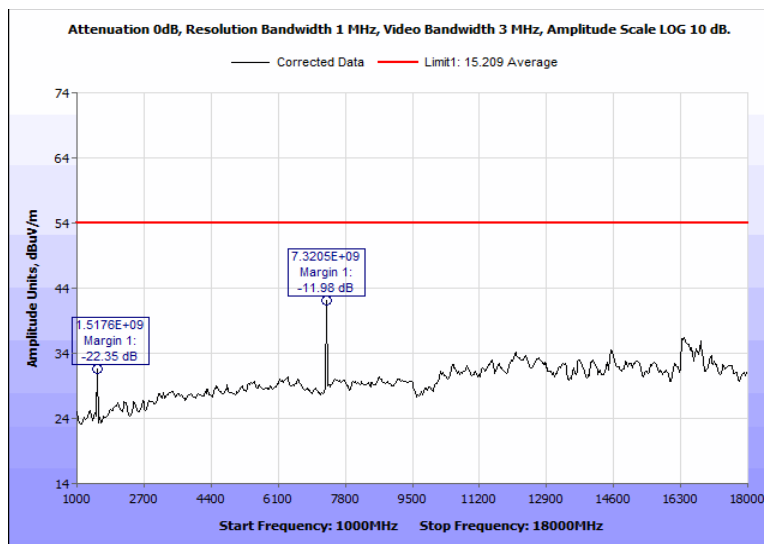


Figure 51: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2440 MHz, Average, Horizontal, Peak Scan

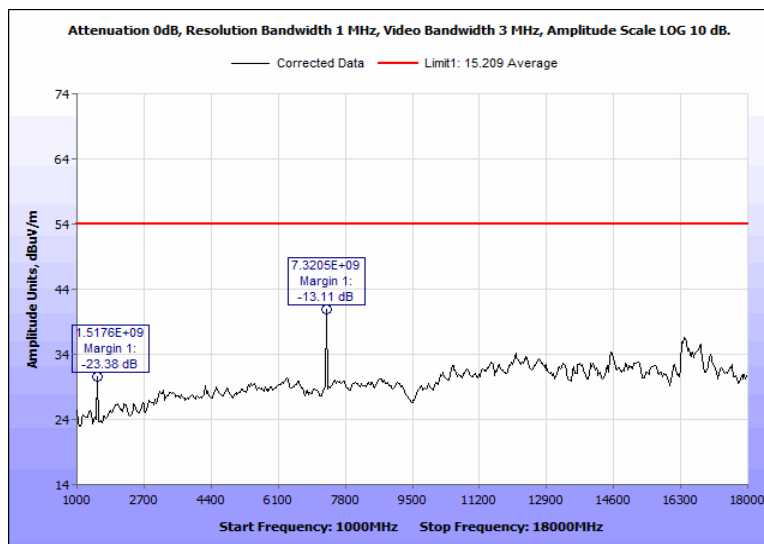


Figure 52: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2440 MHz, Average, Vertical, Peak Scan

| Frequency (MHz) | EUT Azimuth (Degrees) | Antenna Polarity (H/V) | Antenna HEIGHT (cm) | Uncorrected EMI Meter Reading (dBμV) | Antenna Correction Factor (dB/m) (+) | Distance Correction Factor (dB) (-) | Cable Loss/Pre-amp (dB) (+) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-----------------------|------------------------|---------------------|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------|-------------|
| 7.3205          | 179.20                | H                      | 184.20              | 65.87                                | 35.38                                | 0.00                                | -39.93                      | 61.33                        | 74             | -12.67      |
| 7.3205          | 180.90                | H                      | 184.20              | 54.48                                | 35.39                                | 0.00                                | -39.93                      | 59.12                        | 74             | -14.88      |

Figure 53: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2440 MHz, Peak Results

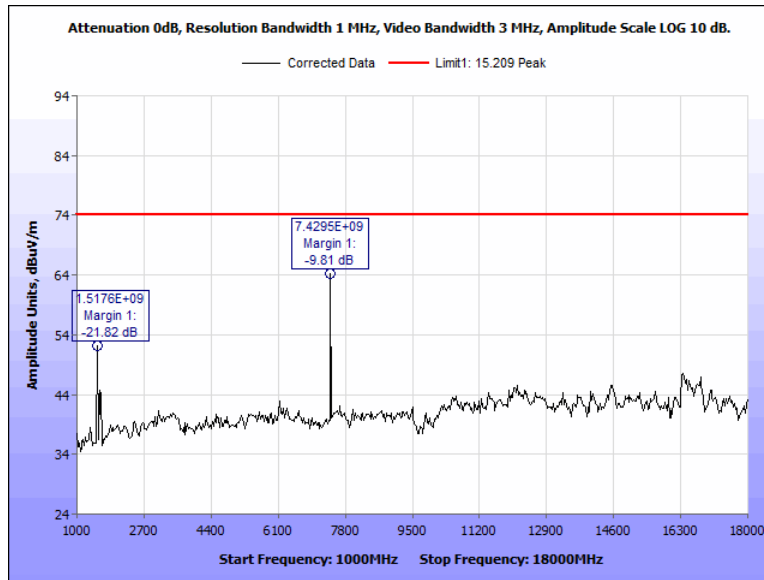


Figure 54: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2440 MHz, Peak, Vertical, Peak Scan

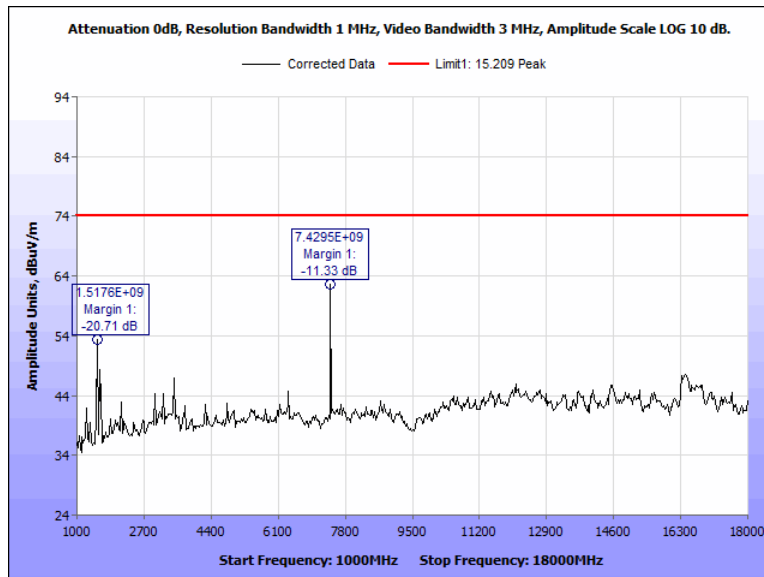


Figure 55: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2440 MHz, Peak, Vertical, Peak Scan

| Frequency (GHz) | EUT Azimuth (Degrees) | Antenna Polarity (H/V) | Antenna HEIGHT (cm) | Uncorrected EMI Meter Reading (dBμV) | Antenna Correction Factor (dB/m) (+) | Distance Correction Factor (dB) (-) | Cable Loss/Pre-amp (dB) (+) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-----------------------|------------------------|---------------------|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------|-------------|
| 7.4295          | 179.60                | H                      | 183.90              | 48.08                                | 35.38                                | 0.00                                | -39.55                      | 43.92                        | 54             | -10.08      |
| 7.4295          | 179.60                | V                      | 183.90              | 47.60                                | 35.38                                | 0.00                                | -39.55                      | 43.43                        | 54             | -10.57      |
| 16.3381         | 166.320               | H                      | 211.20              | 36.72                                | 40.5                                 | 0.00                                | -41.16                      | 36.05                        | 54             | -17.95      |
| 16.365          | 269.90                | H                      | 212.00              | 36.83                                | 40.53                                | 0.00                                | -41.1                       | 36.27                        | 54             | -17.73      |
| 16.3926         | 269.90                | H                      | 211.90              | 36.76                                | 40.57                                | 0.00                                | -41.03                      | 36.3                         | 54             | -17.7       |
| 16.4199         | 271.00                | H                      | 210.00              | 35.91                                | 40.61                                | 0.00                                | -40.99                      | 35.53                        | 54             | -18.47      |

Figure 56: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2480 MHz, Average Results

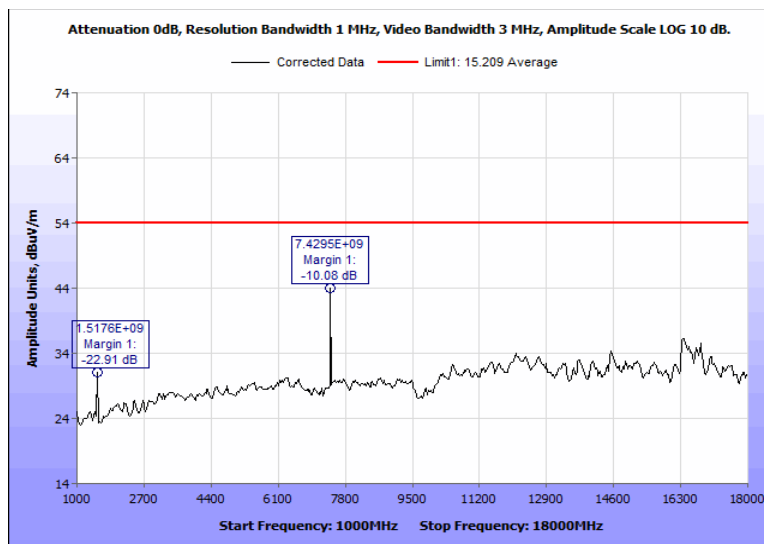


Figure 57: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2480 MHz, Average, Horizontal, Peak Scan

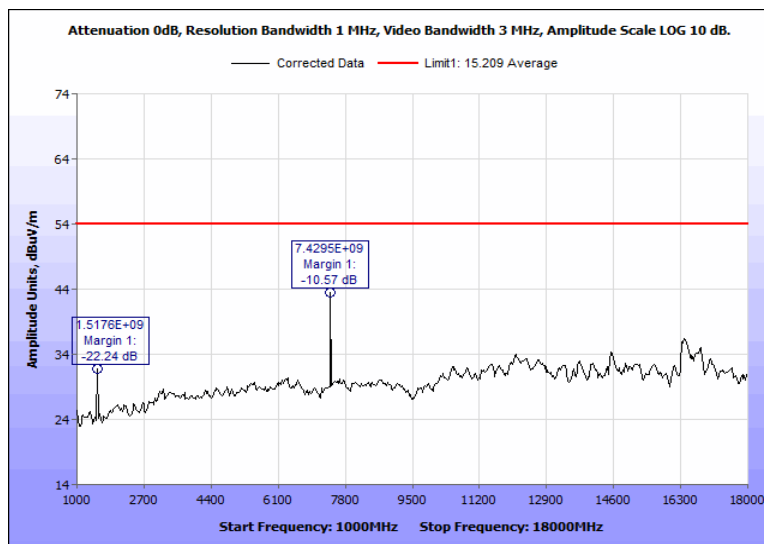


Figure 58: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2480 MHz, Average, Vertical, Peak Scan

| Frequency (GHz) | EUT Azimuth (Degrees) | Antenna Polarity (H/V) | Antenna HEIGHT (cm) | Uncorrected EMI Meter Reading (dBμV) | Antenna Correction Factor (dB/m) (+) | Distance Correction Factor (dB) (-) | Cable Loss/Pre-amp (dB) (+) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-----------------------|------------------------|---------------------|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------|-------------|
| 7.4295          | 179.20                | H                      | 184.20              | 68.36                                | 35.38                                | 0.00                                | -39.55                      | 64.19                        | 74             | -9.81       |
| 7.4295          | 179.20                | V                      | 184.20              | 66.84                                | 35.38                                | 0.00                                | -39.55                      | 62.67                        | 74             | -11.33      |

Figure 59: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2480 MHz, Peak Results

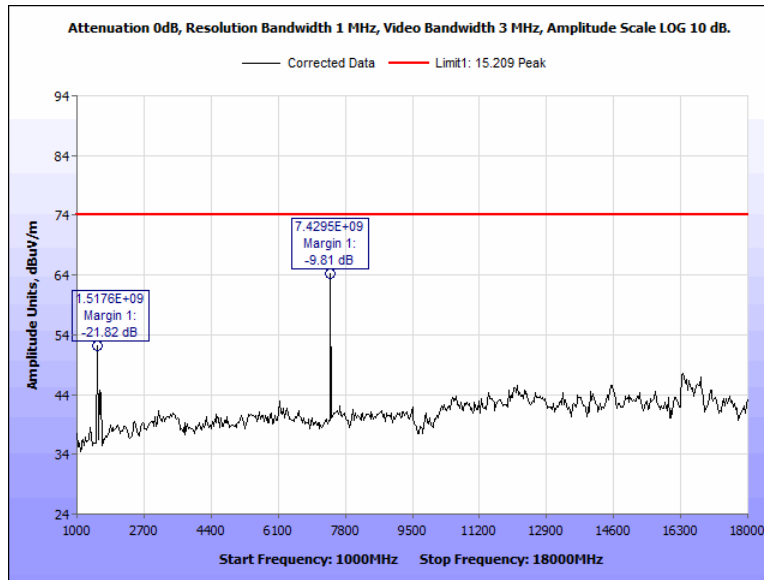


Figure 60: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2480 MHz, Peak, Vertical, Peak Scan

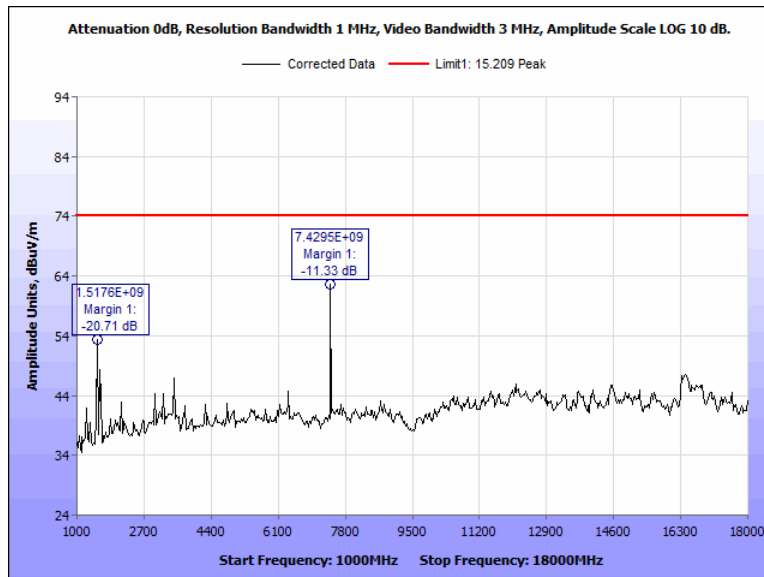


Figure 61: § 15.209 Radiated Spurious Emissions, 1-18 GHz, 2480 MHz, Peak, Vertical, Peak Scan

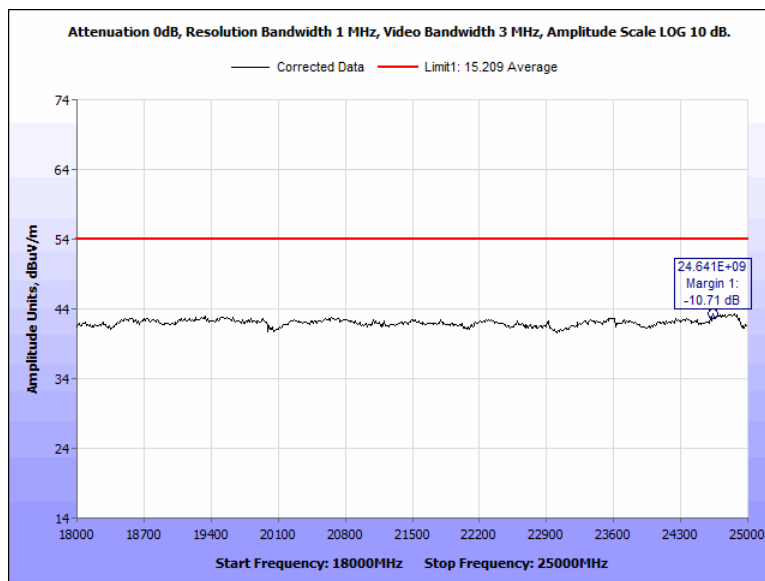


Figure 62: § 15.209 Radiated Spurious Emissions, 18-25 GHz, 2480 MHz, Average, Horizontal, Peak Scan

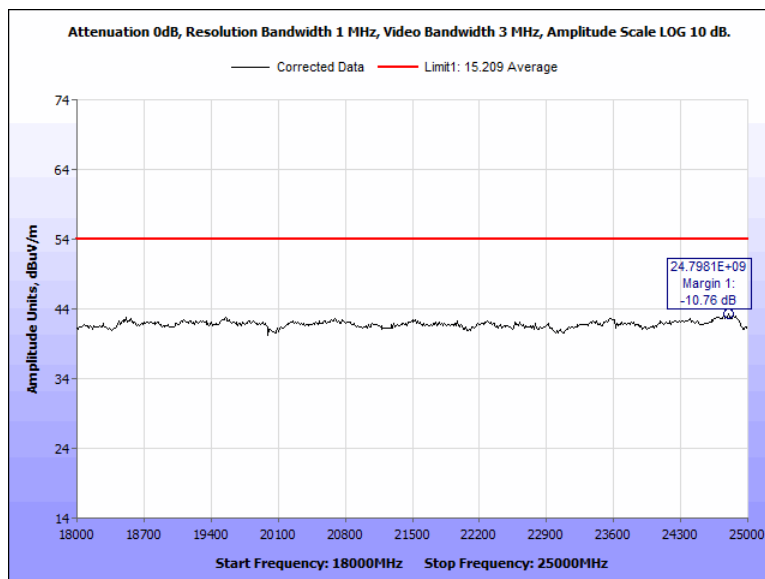


Figure 63: § 15.209 Radiated Spurious Emissions, 18-25 GHz, 2480 MHz, Average, Vertical, Peak Scan

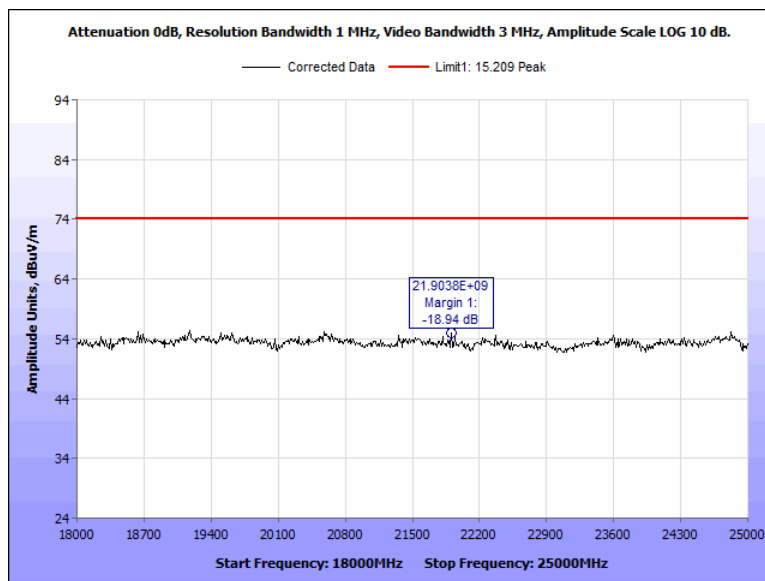


Figure 64: § 15.209 Radiated Spurious Emissions, 18-25 GHz, 2480 MHz, Peak, Vertical, Peak Scan

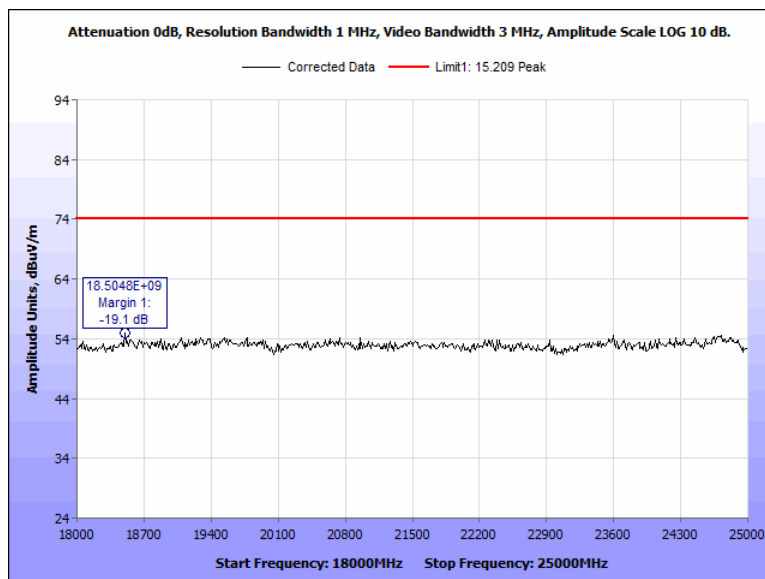


Figure 65: § 15.209 Radiated Spurious Emissions, 18-25 GHz, 2480 MHz, Peak, Vertical, Peak Scan

## Radiated Band Edge Measurements

### Test Procedures:

The transmitter was turned on. Measurements were performed of the low and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. During testing, it was determined that the 2 Mbps data rate produced the worst-case emission profile. The following test data reflects results when the EUT was operating at a rate of 2 Mbps.

### Test Data

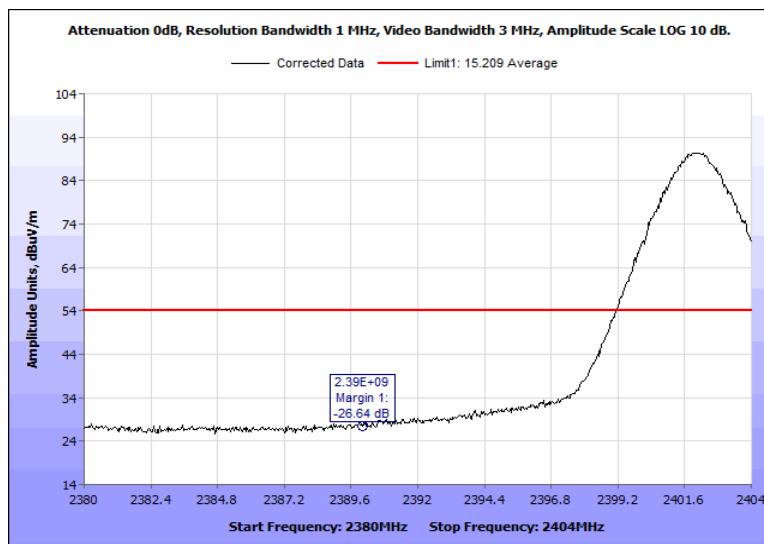
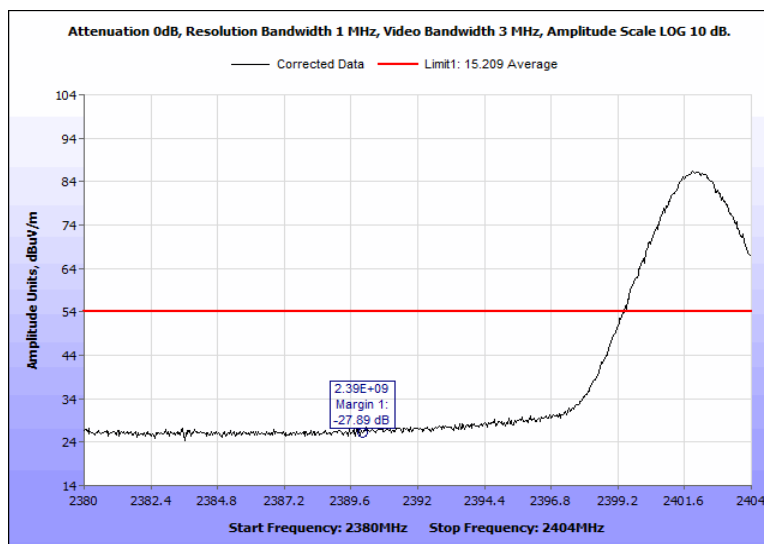
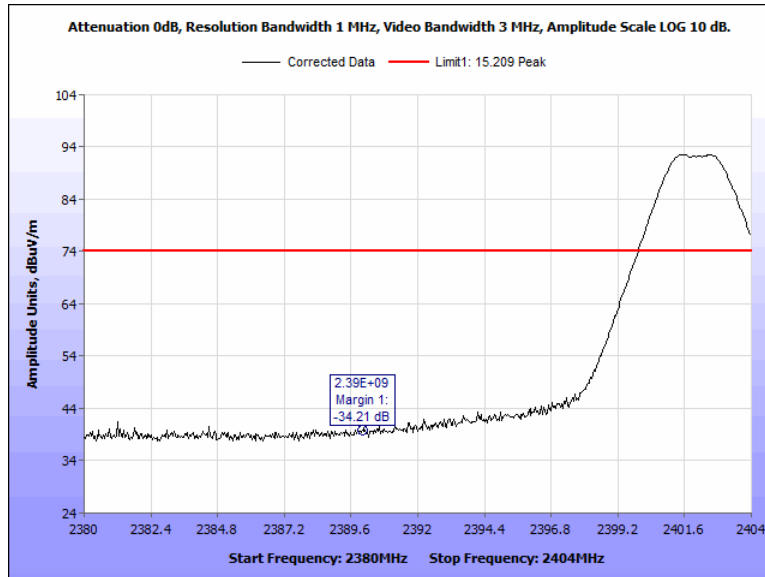


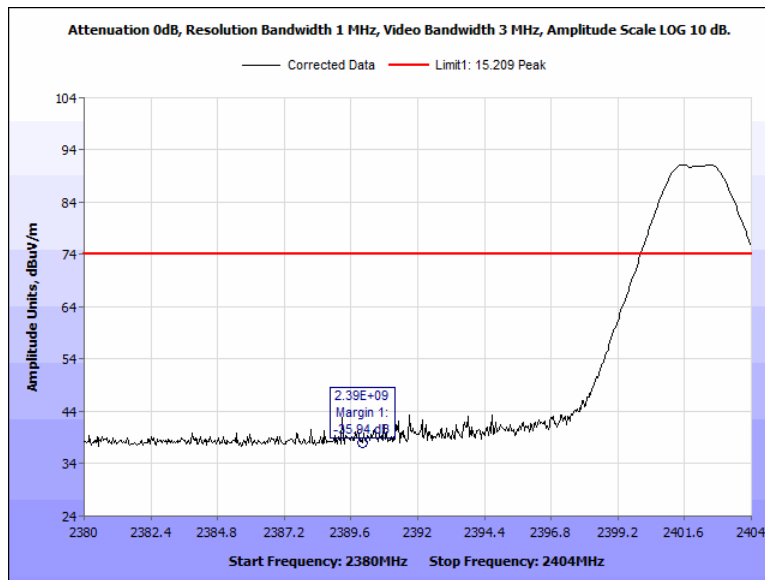
Figure 66: § 15.209 Radiated Spurious Emissions, Radiated Restricted Band Edge, 2402 MHz, Average, Horizontal



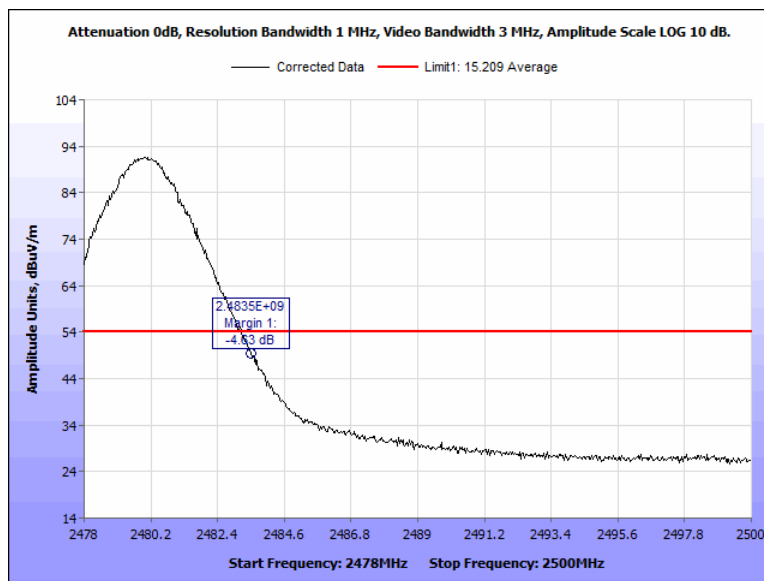
**Figure 67: § 15.209 Radiated Spurious Emissions, Radiated Restricted Band Edge, 2402 MHz, Average, Vertical**



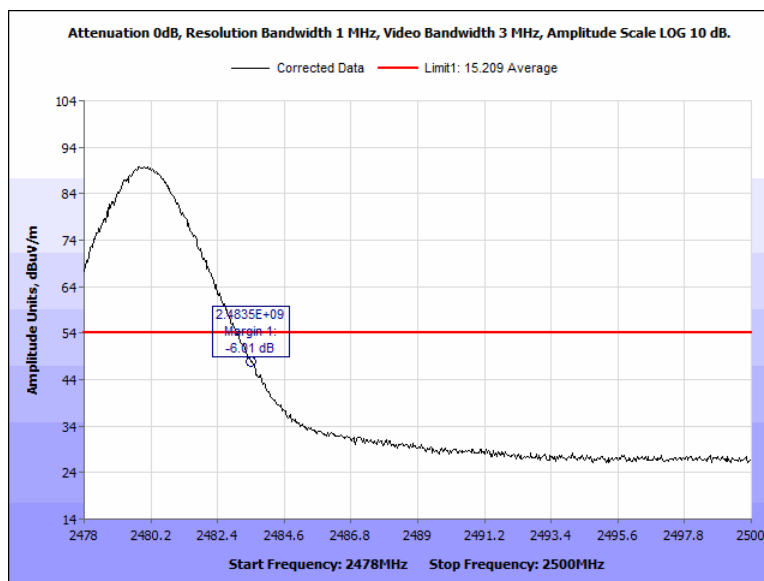
**Figure 68: § 15.209 Radiated Spurious Emissions, Radiated Restricted Band Edge, 2402 MHz, Peak, Horizontal**



**Figure 69: § 15.209 Radiated Spurious Emissions, Radiated Restricted Band Edge, 2402 MHz, Peak, Vertical**



**Figure 70: § 15.209 Radiated Spurious Emissions, Radiated Restricted Band Edge, 2480 MHz, Average, Horizontal**



**Figure 71: § 15.209 Radiated Spurious Emissions, Radiated Restricted Band Edge, 2480 MHz, Average, Vertical**

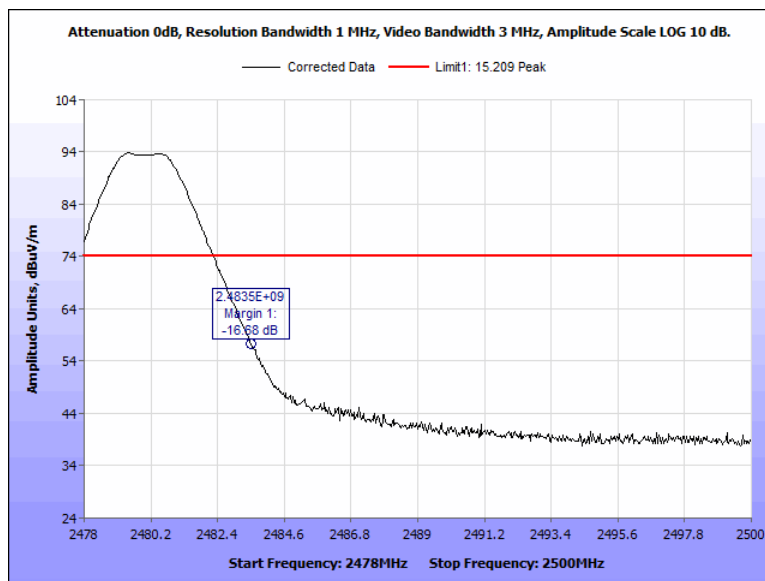


Figure 72: § 15.209 Radiated Spurious Emissions, Radiated Restricted Band Edge, 2480 MHz, Peak, Horizontal

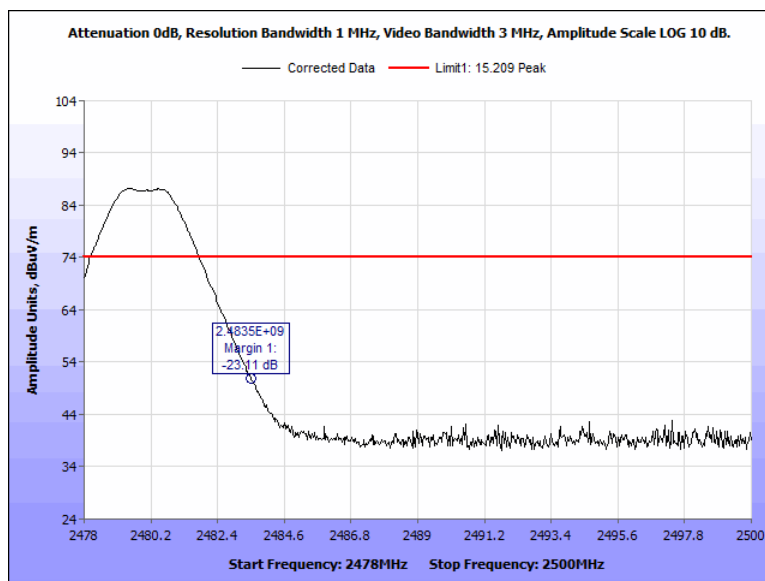


Figure 73: § 15.209 Radiated Spurious Emissions, Radiated Restricted Band Edge, 2480 MHz, Peak, Vertical

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(d) Spurious Emissions in Non-restricted Bands

**Test Requirement:**      **15.247(d)** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

**Test Procedure:**      For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10<sup>th</sup> harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Conducted measurements were performed. The plots were corrected for cable loss.



**Figure 74: Block Diagram, Conducted Spurious Emissions Test Setup**

**Test Results:**      The EUT was tested is **compliant** with § 15.247(d) Spurious Emissions in Non-restricted Bands. Measured emissions were below applicable limits.

**Test Engineer:**      Jonathan Tavira

**Test Date:**      June 26, 2020

Test Data

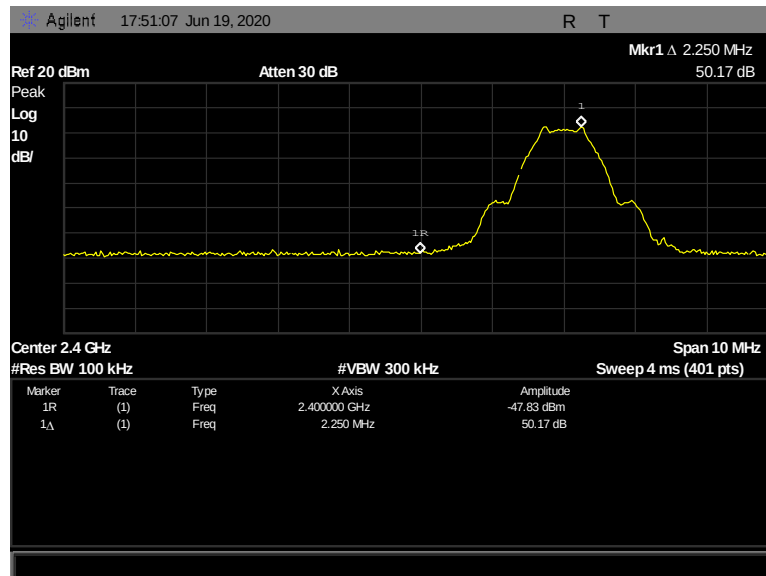


Figure 75: § 15.247(d) Spurious Emissions in Non-restricted Bands, 2402 MHz, 1 Mbps

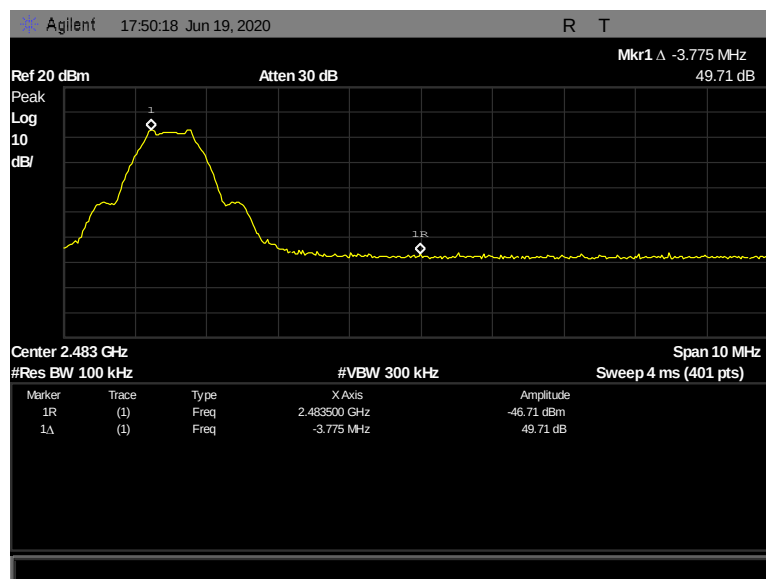


Figure 76: § 15.247(d) Spurious Emissions in Non-restricted Bands, 2480 MHz, 1 Mbps

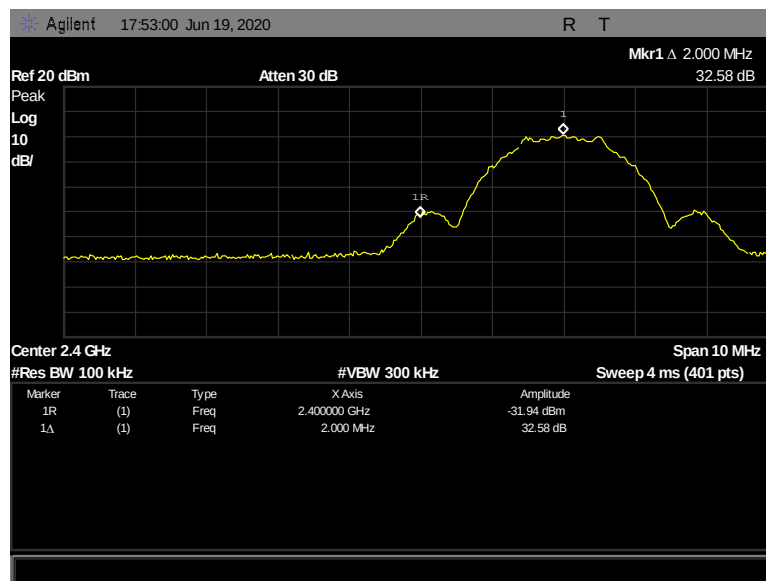


Figure 77: § 15.247(d) Spurious Emissions in Non-restricted Bands, 2402 MHz, 2 Mbps

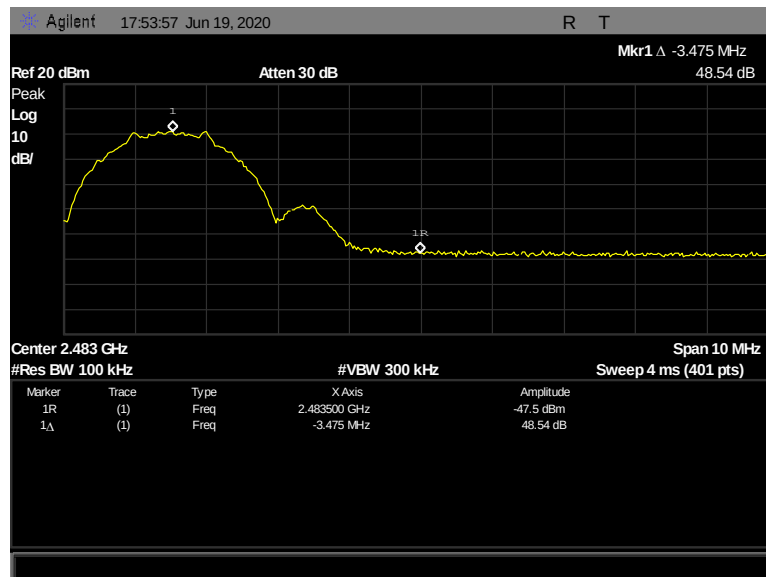


Figure 78: § 15.247(d) Spurious Emissions in Non-restricted Bands, 2480 MHz, 2 Mbps

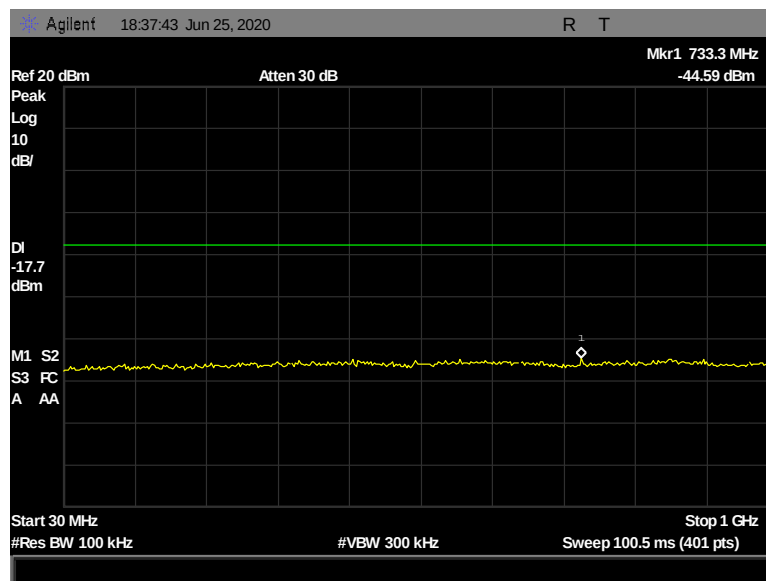


Figure 79: § 15.247(d) Spurious Emissions in Non-restricted Bands, 30-1000 MHz, 2402 MHz, 1 Mbps

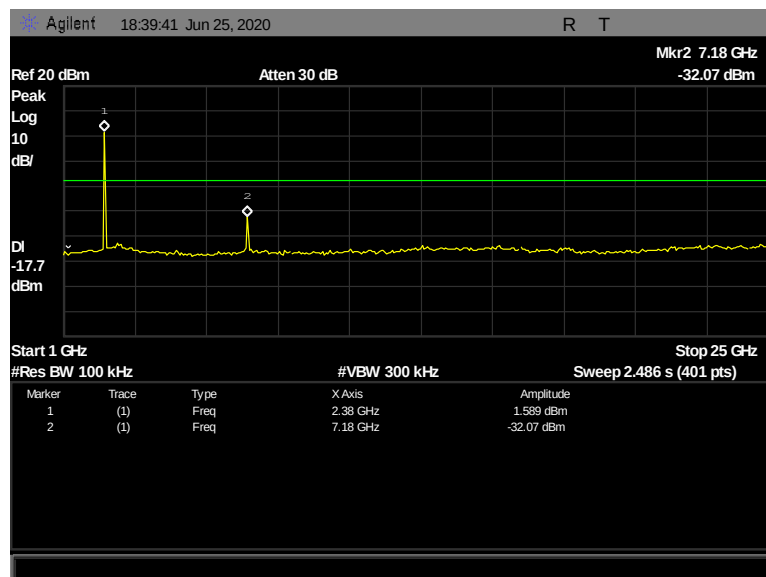


Figure 80: § 15.247(d) Spurious Emissions in Non-restricted Bands, 1-25 GHz, 2402 MHz, 1 Mbps

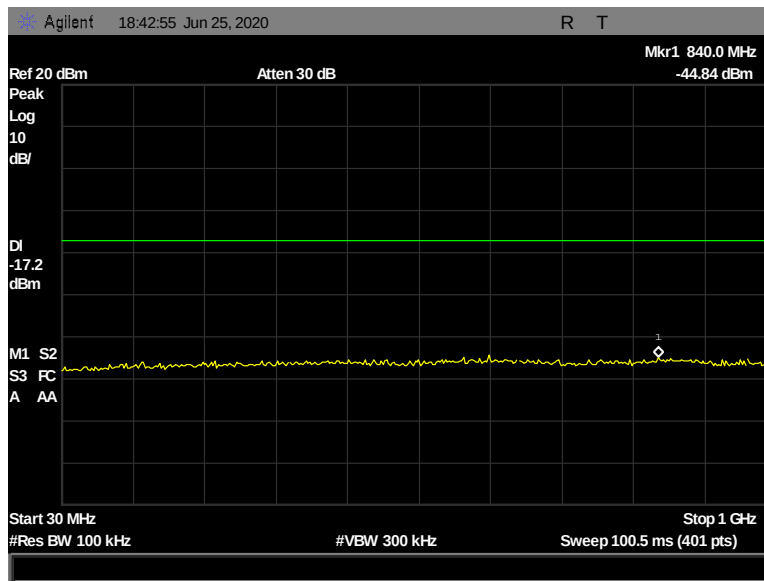


Figure 81: § 15.247(d) Spurious Emissions in Non-restricted Bands, 30-1000 MHz, 2440 MHz, 1 Mbps

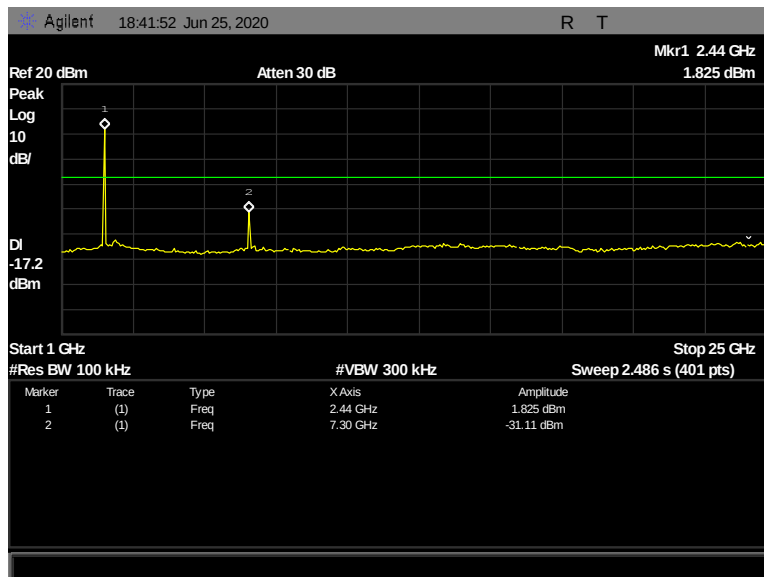


Figure 82: § 15.247(d) Spurious Emissions in Non-restricted Bands, 1-25 GHz, 2440 MHz, 1 Mbps

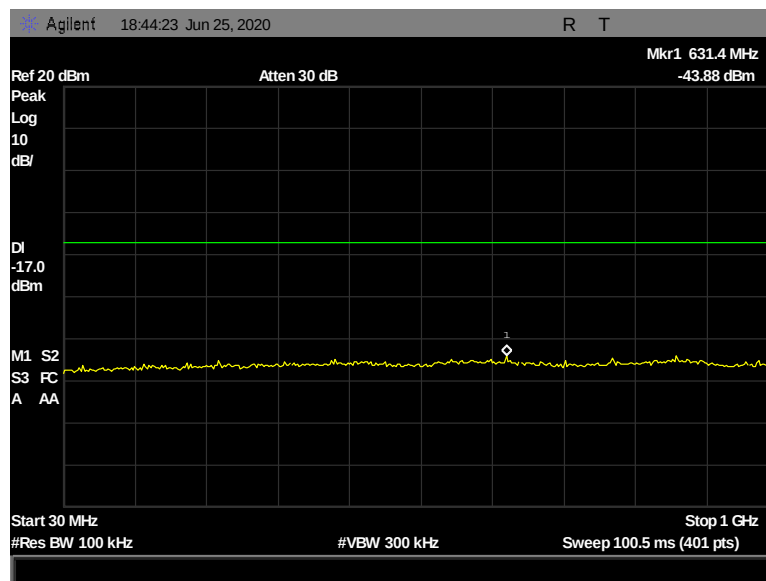


Figure 83: § 15.247(d) Spurious Emissions in Non-restricted Bands, 30-1000 MHz, 2480 MHz, 1 Mbps

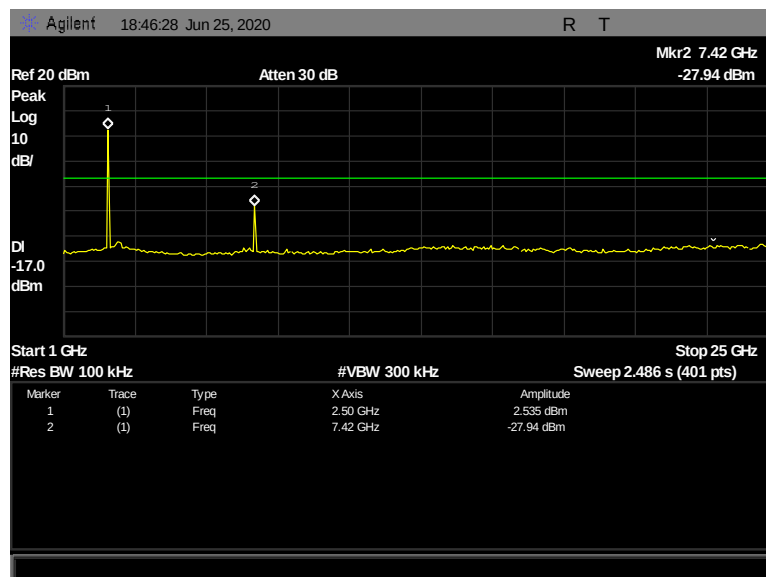


Figure 84: § 15.247(d) Spurious Emissions in Non-restricted Bands, 1-25 GHz, 2480 MHz, 1 Mbps

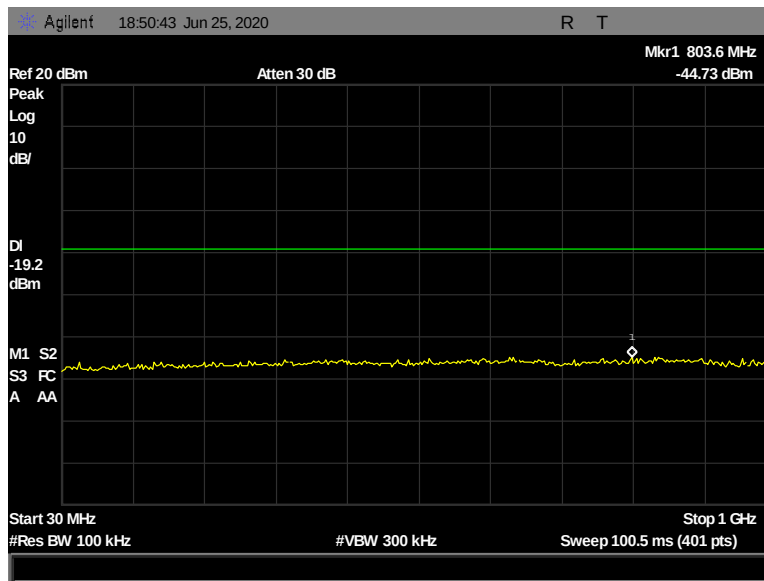


Figure 85: § 15.247(d) Spurious Emissions in Non-restricted Bands, 30-1000 MHz, 2402 MHz, 2 Mbps

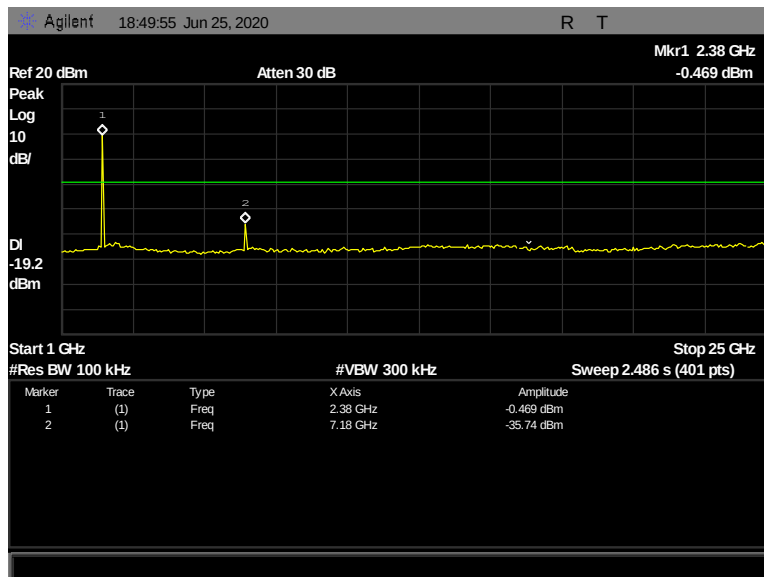


Figure 86: § 15.247(d) Spurious Emissions in Non-restricted Bands, 1-25 GHz, 2402 MHz, 2 Mbps

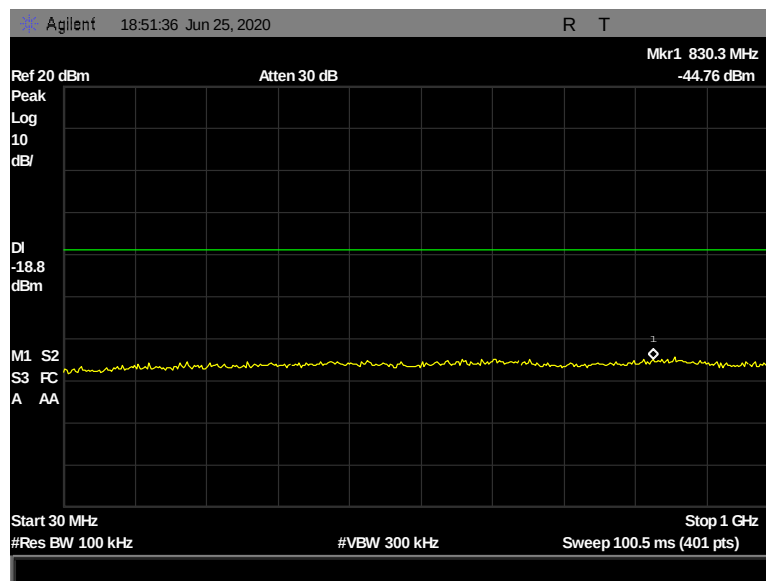


Figure 87: § 15.247(d) Spurious Emissions in Non-restricted Bands, 30-1000 MHz, 2440 MHz, 2 Mbps

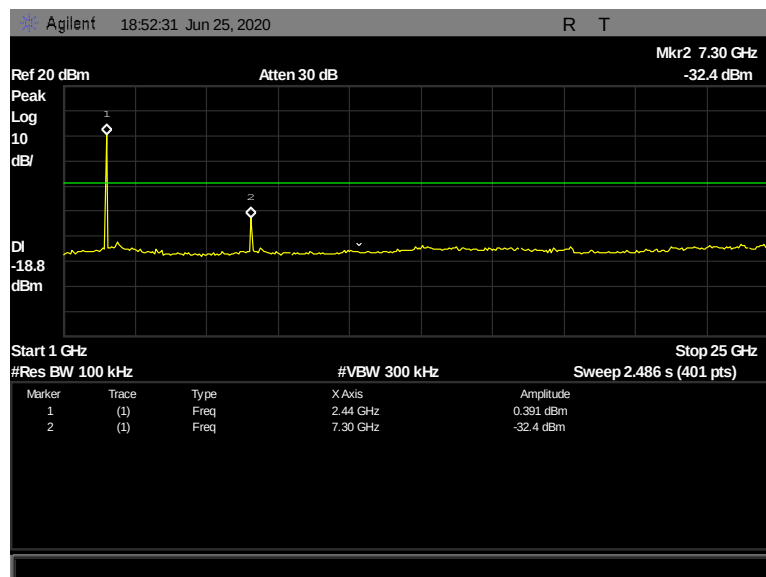


Figure 88: § 15.247(d) Spurious Emissions in Non-restricted Bands, 1-25 GHz, 2440 MHz, 2 Mbps

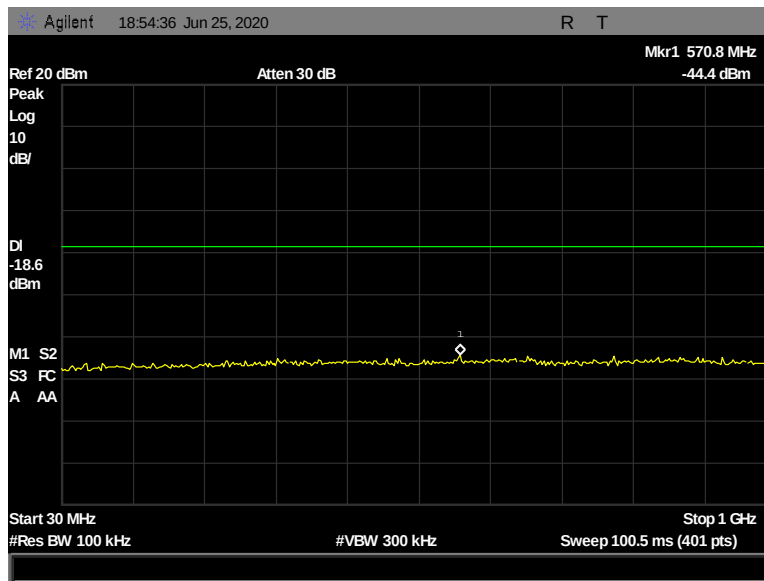


Figure 89: § 15.247(d) Spurious Emissions in Non-restricted Bands, 30-1000 MHz, 2480 MHz, 2 Mbps

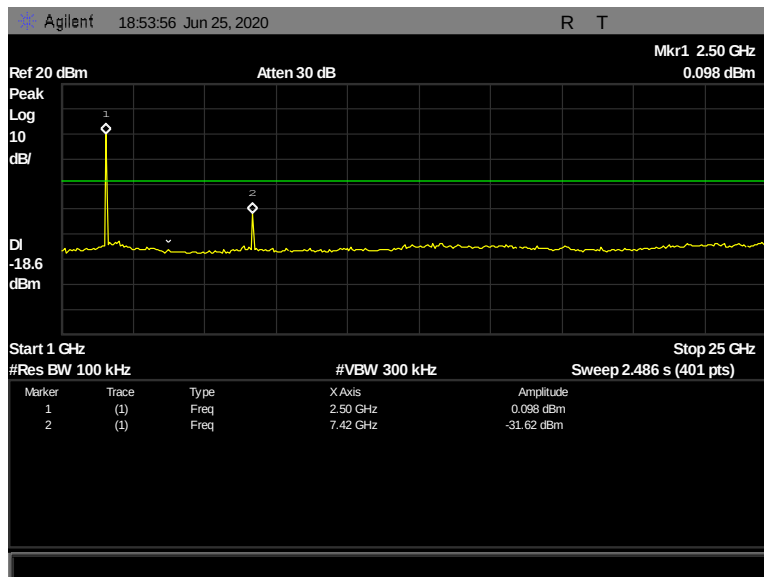


Figure 90: § 15.247(d) Spurious Emissions in Non-restricted Bands, 1-25 GHz, 2480 MHz, 2 Mbps

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(e) Peak Power Spectral Density

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

**Test Procedure:** The power level was set to the maximum level throughout each of the 100 sweeps of power averaging. The RBW was set to 100 kHz and a VBW set to 300 kHz or greater. The spectrum analyzer was set to an auto sweep time and a peak detector was used. Measurements were carried out at the low, mid and high channels.



Figure 91: Block Diagram, Power Spectral Density Test Setup

**Test Results:** The EUT was tested is **compliant** with § 15.247(e) Peak Power Spectral Density. No anomalies noted.

The peak power spectral density was determined from plots on the following page(s).

**Test Engineer:** Jonathan Tavira

**Test Date:** June 26, 2020

#### Test Data

| Mode   | Channel (MHz) | Power Density (dBm) | Power Density EIRP (dBm) |
|--------|---------------|---------------------|--------------------------|
| 1 Mbps | 2402          | 2.319               | 2.819                    |
| 1 Mbps | 2442          | 2.769               | 3.269                    |
| 1 Mbps | 2480          | 2.953               | 3.453                    |
| 2 Mbps | 2402          | 0.809               | 1.309                    |
| 2 Mbps | 2442          | 1.205               | 1.705                    |
| 2 Mbps | 2480          | 1.414               | 1.914                    |

Figure 92: § 15.247(e) Peak Power Spectral Density, Test Results

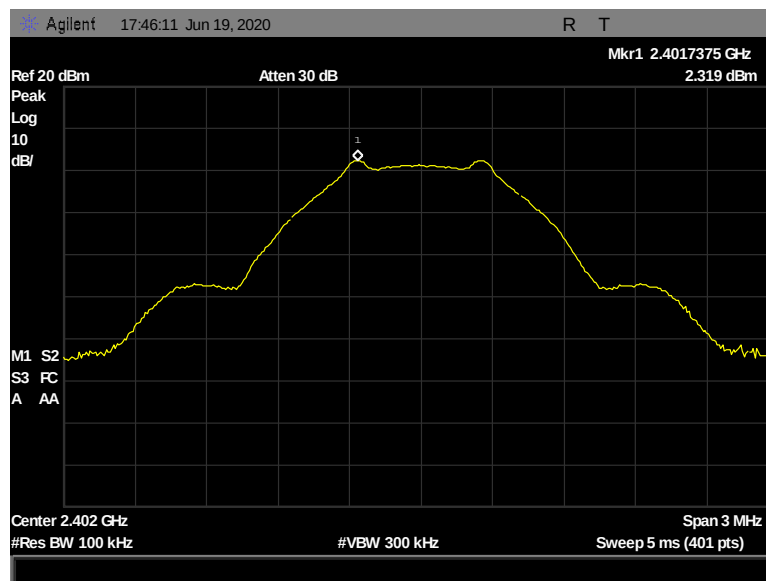


Figure 93: § 15.247(e) Peak Power Spectral Density, 2402 MHz, 1 Mbps

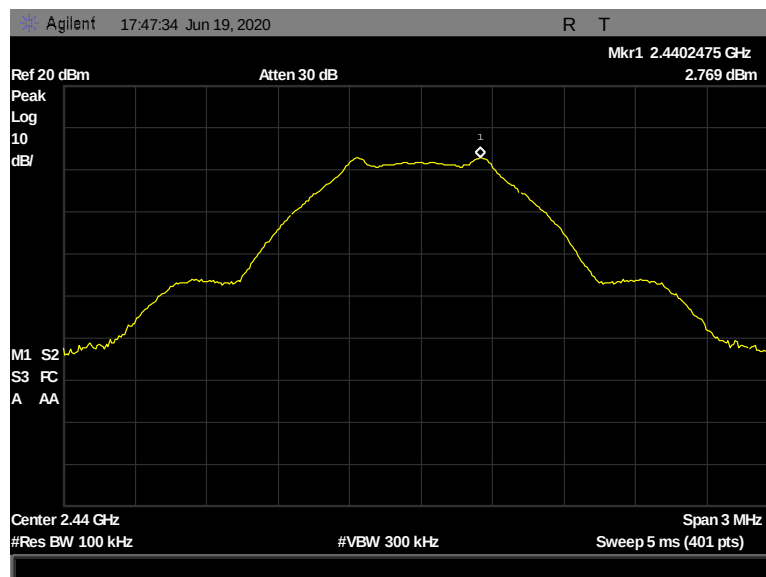


Figure 94: § 15.247(e) Peak Power Spectral Density, 2440 MHz, 1 Mbps

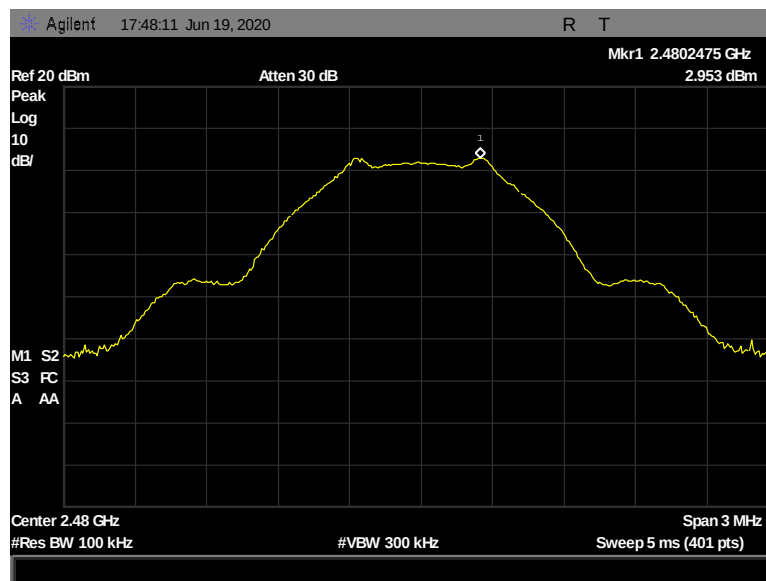


Figure 95: § 15.247(e) Peak Power Spectral Density, 2480 MHz, 1 Mbps

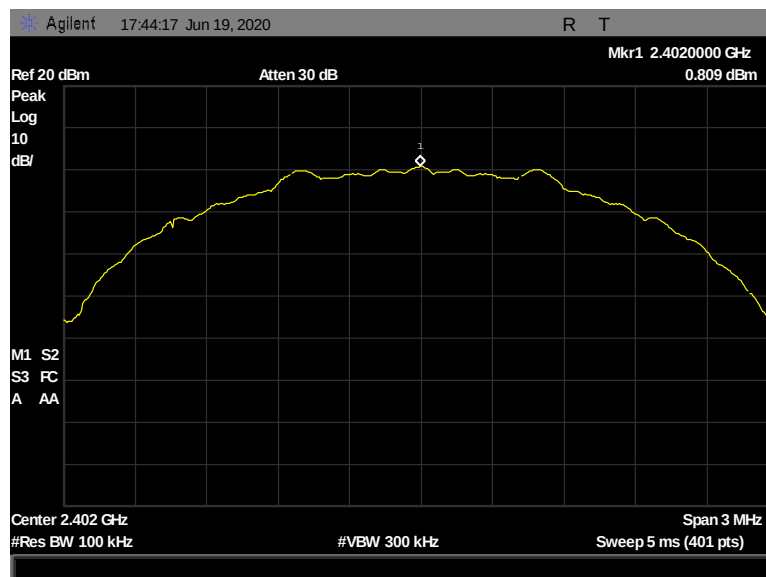


Figure 96: § 15.247(e) Peak Power Spectral Density, 2402 MHz, 2 Mbps

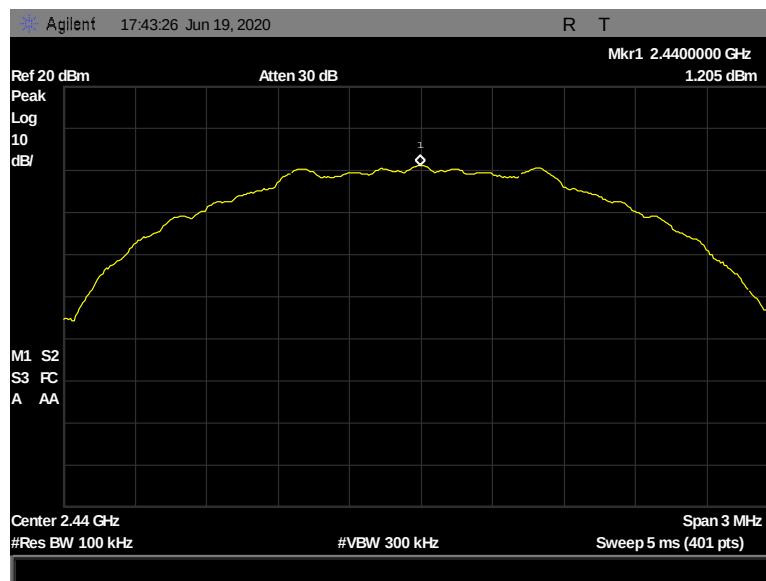


Figure 97: § 15.247(e) Peak Power Spectral Density, 2440 MHz, 2 Mbps

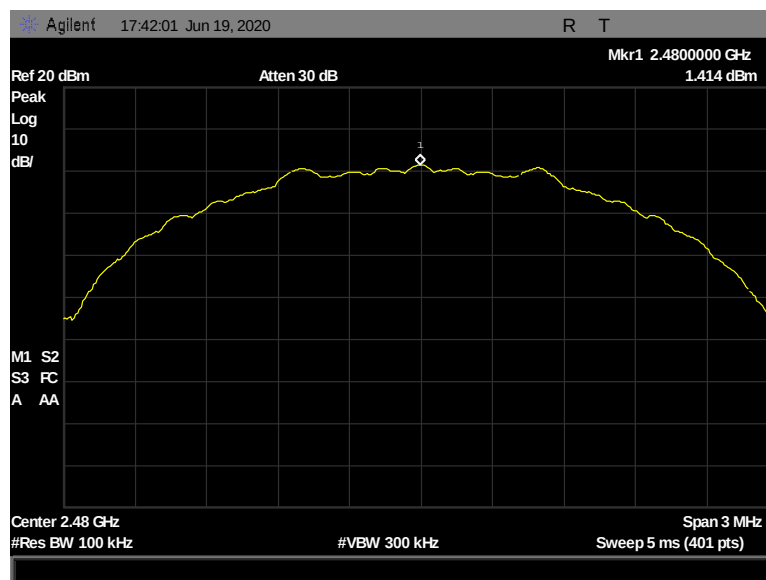


Figure 98: § 15.247(e) Peak Power Spectral Density, 2480 MHz, 2 Mbps

## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(i) RF Human Exposure

#### RF Exposure

##### Requirements:

**§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

#### RF Radiation

##### Exposure Limit:

**§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

MPE Limit: EUT's operating frequencies @ 2400-2483.5 MHz; **Limit for Uncontrolled exposure: 1 mW/cm<sup>2</sup> or 10 W/m<sup>2</sup>**

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where,

S = Power Density (mW/cm<sup>2</sup>)

P = Power Input to antenna (mW)

G = Antenna Gain (numeric value)

R = Distance (cm)

##### Test Results:

The EUT was tested is **compliant** with § 15.247(i) Maximum Permissible Exposure.

The safe distance where Power Density is less than the MPE Limit listed above was found to be 20 cm.

##### Test Engineer:

Donald Salguero

##### Test Date:

August 25, 2020

##### Test Data

| FCC             |                 |                |                 |                   |                                    |                             |         |               |        |
|-----------------|-----------------|----------------|-----------------|-------------------|------------------------------------|-----------------------------|---------|---------------|--------|
| Frequency (MHz) | Con. Pwr. (dBm) | Con. Pwr. (mW) | Ant. Gain (dBi) | Ant. Gain numeric | Pwr. Density (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) | Margin  | Distance (cm) | Result |
| 2480            | 5.71            | 3.724          | 0.5             | 1.122             | 0.00083                            | 1                           | 0.99917 | 20            | Pass   |

## Test Equipment

## Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2005.

| ASSET #   | EQUIPMENT                                                                                          | MANUFACTURER         | MODEL                  | LAST CAL DATE | CAL DUE DATE |
|-----------|----------------------------------------------------------------------------------------------------|----------------------|------------------------|---------------|--------------|
| 1A1044    | GENERATOR                                                                                          | COM-POWER CORP       | CG-520                 | SEE NOTE      | SEE NOTE     |
| 1A1099    | GENERATOR                                                                                          | COM-POWER CORP       | CG-51000               | SEE NOTE      | SEE NOTE     |
| 1A1079    | CONDUCTED COMB GENERATOR                                                                           | COM-POWER CORP       | CGC-255                | SEE NOTE      | SEE NOTE     |
| 1A1147    | BILOG ANTENNA (30 MHZ TO 1 GHZ)                                                                    | SUNOL SCIENCES CORP. | JB3                    | 06/05/2019    | 12/05/2020   |
| 1A1183    | DOUBLE RIDGE WAVE GUIDE HORN ANTENNA                                                               | ETS-LINDGREN         | 3117                   | 06/01/2020    | 06/01/2022   |
| 1A1180    | PRE-AMP                                                                                            | MITEQ                | AMF-7D-01001800-22-10P | SEE NOTE      | SEE NOTE     |
| 1A1161    | DOUBLE RIDGE WAVE GUIDE HORN ANTENNA                                                               | ETS-LINDGREN         | 3116C-PA               | 06/03/2020    | 06/03/2022   |
| 1A1161-PA | PREAMP ASSEMBLY (18GHZ – 40GHZ)                                                                    | ETS LINDGREN         | 3116C-PA               | SEE NOTE      | SEE NOTE     |
| 1A1088    | PRE-AMP                                                                                            | RHODE & SCHWARZ      | TS-PR1                 | SEE NOTE      | SEE NOTE     |
| 1A1073    | MULTI DEVICE CONTROLLER                                                                            | ETS LINDGREN         | 2090                   | SEE NOTE      | SEE NOTE     |
| 1A1195    | PREAMPLIFIER                                                                                       | A.H. SYSTEMS         | PAM-0018P              | SEE NOTE      | SEE NOTE     |
| 1A1074    | SYSTEM CAMERA CONTROLLER                                                                           | PANASONIC            | WV-CU101               | SEE NOTE      | SEE NOTE     |
| 1A1075    | SYSTEM CAMERA CONTROLLER                                                                           | PANASONIC            | WV-CU101               | SEE NOTE      | SEE NOTE     |
| 1A1080    | MULTI DEVICE CONTROLLER                                                                            | ETS LINDGREN         | 2090                   | SEE NOTE      | SEE NOTE     |
| 1A1176    | ACTIVE LOOP ANTENNA                                                                                | ETS-LINDGREN         | 6502                   | 06/02/2020    | 06/02/2021   |
| 1A1122    | LISN                                                                                               | TESEQ                | NNB 51                 | 09/25/2019    | 09/25/2020   |
| 1A1065    | EMI RECEIVER                                                                                       | ROHDE & SCHWARZ      | ESCI                   | 06/22/2020    | 06/22/2021   |
| 1A1149    | MILLIOHM METER                                                                                     | GW INSTRTEK          | GOM-802                | 06/10/2020    | 06/10/2021   |
| 1A1141    | SPECTRUM ANALYZER                                                                                  | AGILENT TECHNOLOGIES | E4407B                 | 08/06/2019    | 08/06/2020   |
| 1A1225    | ENVIRONMENTAL CHAMBER                                                                              | ASPEC                | EXP-2H/NEW             | 02/27/2020    | 02/27/2021   |
| 1A1119    | TEST AREA                                                                                          | CUSTOM MADE          | N/A                    | SEE NOTE      |              |
| 1A1177    | PULSE LIMITER / ATTENUATOR                                                                         | ROHDE & SCHWARZ      | ESH3Z2                 | 06/10/2020    | 06/10/2021   |
| 1A1083    | TEST RECEIVER                                                                                      | ROHDE & SCHWARZ      | ESU40                  | 10/10/2019    | 10/10/2020   |
| 1A1106    | 10 M CHAMBER (NSA)                                                                                 | ETS LINDGREN         | SEMI-ANECHOIC          | SEE NOTE      |              |
| NOTE      | Functionally tested equipment is verified using calibrated instrumentation at the time of testing. |                      |                        |               |              |

Figure 99: Test Equipment List

## **Certification & User's Manual Information**

## Certification & User's Manual Information

### M. 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.<sup>1</sup> *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.

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<sup>1</sup> 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**

### **1. 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.

## End of Report