

March 16, 2021

Neogen Corporation
620 Leshner Place
Lansing, Michigan 48912

Dear Mike Wilcox,

Enclosed is the EMC test report for compliance testing of the Neogen Corporation, AccuPoint Advanced 2 Sanitation Monitoring System, tested to the requirements of Title 47 of the CFR, Part 15.225, Subpart C for Certification as an Intentional Radiator.

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

Sincerely yours,
EUROFINS E&E NORTH AMERICA.

A handwritten signature in black ink, appearing to read "Jennifer Warnell".

Jennifer Warnell
Documentation Department

Reference: (\Neogen Corporation\WIR107592-FCC225 Rev. 2)

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

Electromagnetic Compatibility Criteria Test Report

for the

**Neogen Corporation
AccuPoint Advanced 2 Sanitation Monitoring System**

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

MET Report: WIR107592-FCC225 Rev. 2

March 16, 2021

Prepared For:

**Neogen Corporation
620 Leshar Place
Lansing, Michigan 48912**

Prepared By:
Eurofins E&E North America.
914 W. Patapsco Ave.
Baltimore, MD 21230

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15.225 Subpart C
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Donald Salguero, Project Engineer
Electromagnetic Compatibility Lab

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 15.225 under normal use and maintenance.



Steve Pitta,
Operations Director

Report Status Sheet

| Revision | Report Date | Reason for Revision |
|----------|-----------------|--|
| Ø | August 25, 2020 | Initial Issue. |
| 1 | August 25, 2020 | Changing recipient name on first page. |
| 2 | March 15, 2021 | Updates per TCB Comments |

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I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Neogen Corporation AccuPoint Advanced 2 Sanitation Monitoring System, with the requirements of Part 15, §15.225. 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 AccuPoint Advanced 2 Sanitation Monitoring System. Neogen Corporation should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the AccuPoint Advanced 2 Sanitation Monitoring System, 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, §15.225, in accordance with Neogen Corporation, purchase order number 152573. All tests were conducted using measurement procedure ANSI C63.10-2013.

| FCC Reference 47 CFR Part 15.225 | Description | Compliance |
|-------------------------------------|--|------------|
| Part 15 §15.203 | Antenna Requirement | Compliant |
| Part 15 §15.207(a) | Conducted Emission Limits | Compliant |
| Part 15 §15.215 | 20dB Occupied Bandwidth | Compliant |
| Part 15 §15.225(a) | Field Strength emissions within the band 13.553 – 13.567 MHz | Compliant |
| Part 15 §15.225(b) | Field Strength emissions within the band 13.410 – 13.553 MHz and 13.567 – 13.710 MHz | Compliant |
| Part 15 §15.225(c) | Field Strength emissions within the band 13.110 – 13.410 MHz and 13.710 – 14.010 MHz | Compliant |
| Part 15 §15.225(d) | Outside-Band Field Strength emissions per 15.209 - 13.110 – 14.010 MHz | Compliant |
| Part 15 §15.225(e) | Frequency Tolerance of the Carrier | Compliant |

Table 1. Executive Summary of EMC Part 15.225 Compliance Testing

II. Equipment Configuration

A. Overview

Eurofins E&E North America. was contracted by Neogen Corporation to perform testing on the AccuPoint Advanced 2 Sanitation Monitoring System, under Neogen Corporation's purchase order number 152573.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Neogen Corporation, AccuPoint Advanced 2 Sanitation Monitoring System.

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

| | | | |
|---------------------------------------|---|--------------|--|
| Model(s) Tested: | AccuPoint Advanced 2 Sanitation Monitoring System | | |
| Model(s) Covered: | AccuPoint Advanced 2 Sanitation Monitoring System | | |
| EUT Specifications: | Primary Power: 5V DC; rechargeable battery | | |
| | FCC ID: 2AWD5-9904 | | |
| | Type of Modulations: | NFCIP-1,2 | |
| | Equipment Code: | DXX | |
| | Peak Field Strength: | 11.82 dBuV/m | |
| | EUT Frequency Ranges: | 13.56 MHz | |
| Analysis: | The results obtained relate only to the item(s) tested. | | |
| Environmental Test Conditions: | Temperature: 15-35° C | | |
| | Relative Humidity: 30-60% | | |
| | Barometric Pressure: 860-1060 mbar | | |
| Evaluated by: | Donald Salguero | | |
| Report Date(s): | March 16, 2021 | | |

Table 2. EUT Summary Table

B. References

| | |
|-----------------------------------|---|
| CFR 47, Part 15, Subpart C | Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies |
| ANSI C63.4:2014 | Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz |
| ISO/IEC 17025:2017 | General Requirements for the Competence of Testing and Calibration Laboratories |
| ANSI C63.10-2013 | American National Standard for Testing Unlicensed Wireless Devices |

Table 3. References

C. Test Site

All testing was performed at Eurofins E&E North America., 914 W. Patapsco Ave., Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

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

D. Measurement Uncertainty

| Test Method | Typical Expanded Uncertainty | K | Confidence Level |
|---------------------------------------|------------------------------|---|------------------|
| RF Frequencies | ±4.52 Hz | 2 | 95% |
| RF Power Conducted Emissions | ±2.32 dB | 2 | 95% |
| RF Power Conducted Spurious Emissions | ±2.25 dB | 2 | 95% |
| RF Power Radiated Emissions | ±3.01 dB | 2 | 95% |
| Radiated Emissions, (30 MHz – 1 GHz) | ±3.45 | 2 | 95% |
| Radiated Emissions, (1 - 6 GHz) | ±6.29 | 2 | 95% |
| Conducted Emission | ±3.8 | 2 | 95% |
| CEV Telecom Port | ±2.8 | 2 | 95% |

Table 4. Uncertainty Calculations Summary

E. Description of Test Sample

The AccuPoint Advanced 2 Sanitation Monitoring System, Equipment Under Test (EUT), is a portable handheld device used to measure samples emitting extremely low light levels.

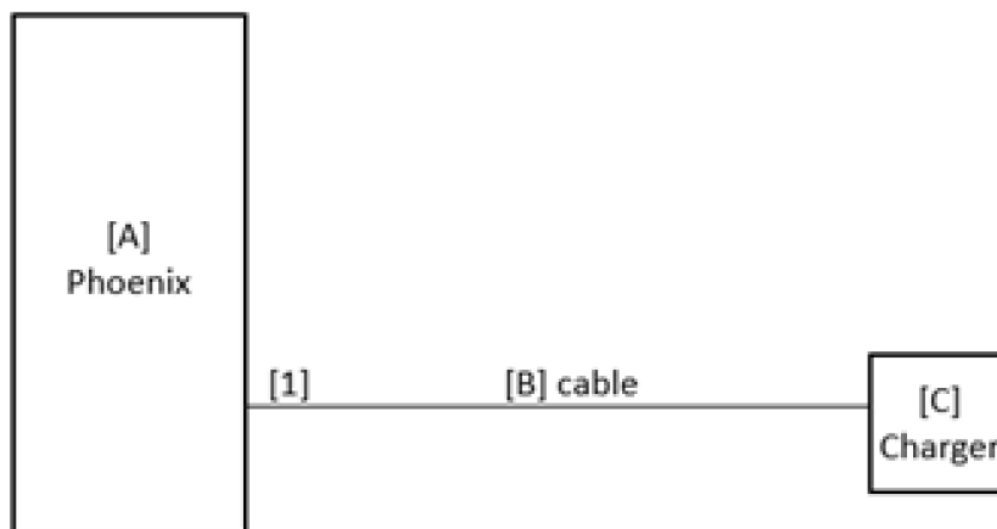


Figure 1. Block Diagram of Test Configuration

F. Equipment Configuration

The EUT was set up as outlined in Figure 1. All equipment incorporated as part of the EUT is included in the following list.

| Ref. ID | Name / Description | Model Number | Part Number | Serial Number | Revision |
|---------|--------------------|--------------|-------------|---------------|----------|
| -- | AccuPoint | 9904 | -- | -- | -- |

Table 5. Equipment Configuration

G. Support Equipment

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

| Ref. ID | Name / Description | Manufacturer | Model Number |
|---------|-------------------------------------|------------------|---------------------|
| -- | PC/laptop for host communications | -- | -- |
| -- | HID_UART.exe Windows application SW | -- | -- |
| -- | USB A-B micro cable | -- | -- |
| -- | USB charger | Mega Electronics | MWM012T-W050VU-5346 |

Table 6. Support Equipment

H. Ports and Cabling Information

| Ref. ID | Port Name on EUT | Cable Description | Qty. | Length (m) | Shielded (Y/N) | Termination Point |
|---------|------------------|--------------------------------|------|------------|----------------|-------------------|
| -- | Data | Micro USB 2.0 type B connector | 1 | 1 | 2 | No |
| -- | DC Input | Micro USB 2.0 type B connector | 1 | 1 | 2 | No |

Table 7. Ports and Cabling Information

I. Mode of Operation During Testing

Idle/WiFi Disabled – EUT is waiting for user input, RFID is occasionally pinged. WiFi is disabled. (factory reset) unit connected to USB, powered-on, waiting on home screen. Stress All – Wifi searching for AP, RFID pinging rapidly, cycling vibrator motor, random patterns to screen, backlight on full, optical LED on full for 1hr. Power supply fully stressed. (factory reset) unit connected to USB, send “stress all” command over USB serial. Send “unstress all” or cycle power to resume idle.

The test software used during testing was Trace Data Grabber version 11/24/08.

J. Modifications**a) Modifications to EUT**

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

K. Disposition of EUT

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

III. 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 was 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.

Results: The EUT was compliant with the requirement of §15.203. EUT uses a built-in antenna.

Test Engineer(s): Donald Salguero

Test Date(s): 04/01/2020

Manufacturer: Taoglas
Type: NFC Flex antenna
Gain: N/A
Pat No: FXR.08.52.0075X.A

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 μ H/50 Ω 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 μ V) | |
|--------------------------|---|---------|
| | Quasi-Peak | Average |
| * 0.15 - 0.5 | 66 - 56 | 56 - 46 |
| 0.5 - 5 | 56 | 46 |
| 5 - 30 | 60 | 50 |

Table 8. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Note: *Decreases with the logarithm of the frequency.

Test Procedure: The EUT was placed on a 0.8 m-high non-conducting table above a ground plane. 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 Ω /50 μ 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 C63.10-2013 "Procedures for Compliance Testing of Unlicensed Wireless Devices"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω /50 μ H LISN as the input transducer to an EMI receiver. For the purpose of this testing, the transmitter was turned on at full power during scans.

Test Results: The EUT was compliant with this requirement.

Test Engineer(s): Donald Salguero

Test Date(s): 06/09/2020

Conducted Emissions Voltage Test Setup

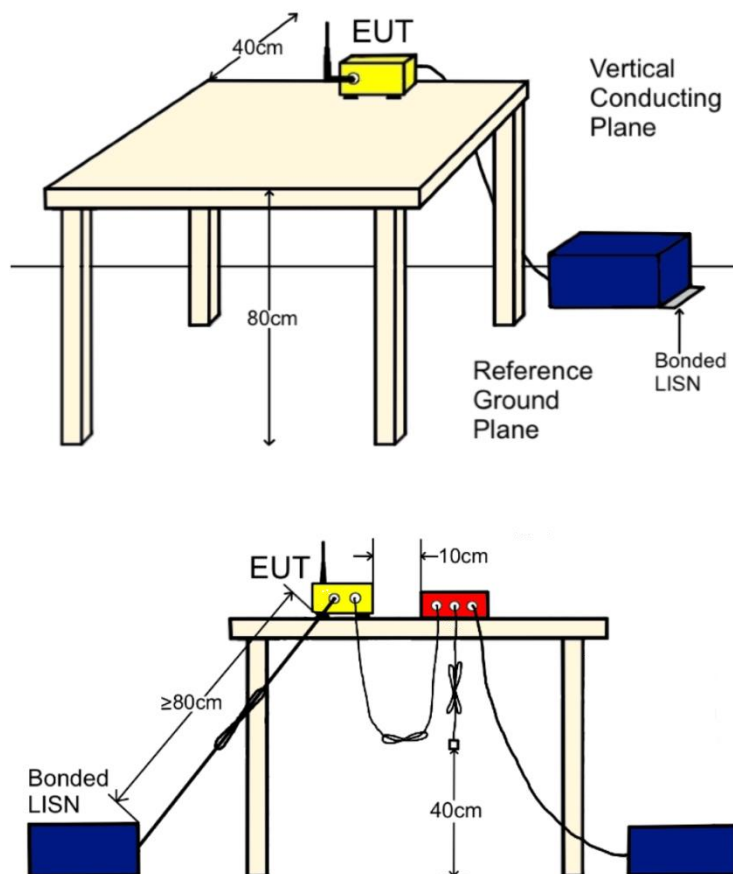


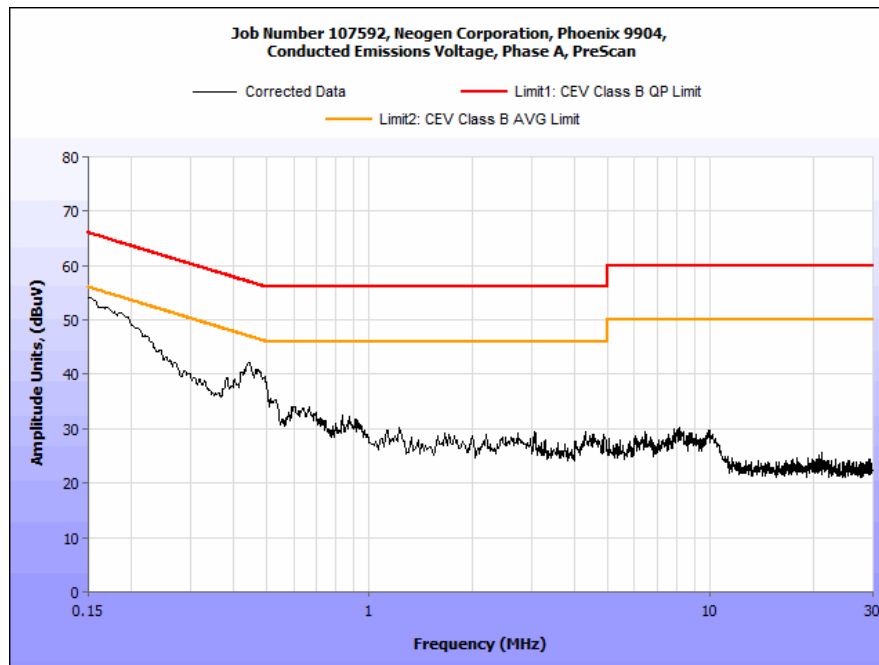
Figure 2. CEV Test Setup

| Freq. (MHz) | Uncorrected Meter Reading (dBµV) QP | Cable Loss (dB) | External Atten. (dB) | Corrected Meas. (dBµV) QP | Limit (dBµV) QP | Pass / Fail QP | Margin (dB) QP | Uncorrected Meter Reading (dBµV) Avg. | Cable Loss (dB) | External Atten. (dB) | Corrected Meas. (dBµV) AVG | Limit (dBµV) AVG | Pass / Fail AVG | Margin (dB) AVG |
|-------------|-------------------------------------|-----------------|----------------------|---------------------------|-----------------|----------------|----------------|---------------------------------------|-----------------|----------------------|----------------------------|------------------|-----------------|-----------------|
| 0.15 | 39.34 | 0 | 10 | 49.34 | 66 | PASS | -16.66 | 20.57 | 0 | 10 | 30.57 | 56 | PASS | -25.43 |
| 0.179 | 35.6 | 0 | 10 | 45.6 | 64.53 | PASS | -18.93 | 17.92 | 0 | 10 | 27.92 | 54.53 | PASS | -26.61 |
| 0.4398 | 26.85 | 0 | 10 | 36.85 | 57.07 | PASS | -20.22 | 14.71 | 0 | 10 | 24.71 | 47.07 | PASS | -22.36 |
| 0.475 | 25.44 | 0 | 10 | 35.44 | 56.43 | PASS | -20.99 | 12.54 | 0 | 10 | 22.54 | 46.43 | PASS | -23.89 |
| 0.5018 | 20.84 | 0 | 10 | 30.84 | 56 | PASS | -25.16 | 8.15 | 0 | 10 | 18.15 | 46 | PASS | -27.85 |
| 0.8501 | 15.27 | 0 | 10 | 25.27 | 56 | PASS | -30.73 | 5.73 | 0 | 10 | 15.73 | 46 | PASS | -30.27 |

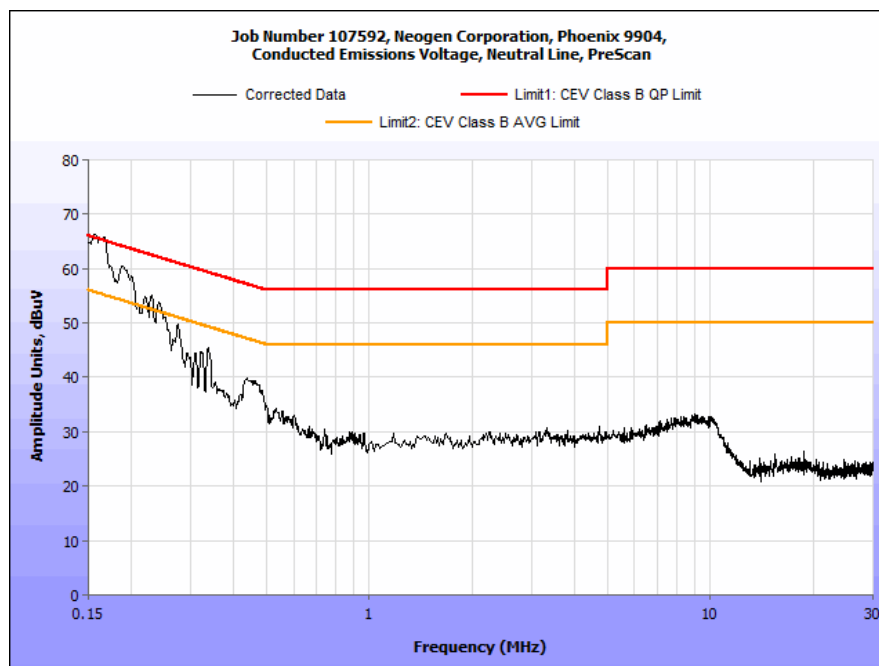
Table 9. Conducted Emissions, Test Results, Phase

| Freq. (MHz) | Uncorrected Meter Reading (dBµV) QP | Cable Loss (dB) | External Atten. (dB) | Corrected Meas. (dBµV) QP | Limit (dBµV) QP | Pass / Fail QP | Margin (dB) QP | Uncorrected Meter Reading (dBµV) Avg. | Cable Loss (dB) | External Atten. (dB) | Corrected Meas. (dBµV) AVG | Limit (dBµV) AVG | Pass / Fail AVG | Margin (dB) AVG |
|-------------|-------------------------------------|-----------------|----------------------|---------------------------|-----------------|----------------|----------------|---------------------------------------|-----------------|----------------------|----------------------------|------------------|-----------------|-----------------|
| 0.1526 | 43.36 | 0 | 10 | 53.36 | 65.86 | PASS | -12.5 | 23.88 | 0 | 10 | 33.88 | 55.86 | PASS | -21.98 |
| 0.1612 | 42.82 | 0 | 10 | 52.82 | 65.4 | PASS | -12.58 | 23.6 | 0 | 10 | 33.6 | 55.4 | PASS | -21.8 |
| 0.2002 | 37.63 | 0 | 10 | 47.63 | 63.6 | PASS | -15.97 | 20.07 | 0 | 10 | 30.07 | 53.6 | PASS | -23.53 |
| 0.2188 | 33.85 | 0 | 10 | 43.85 | 62.86 | PASS | -19.01 | 16.57 | 0 | 10 | 26.57 | 52.86 | PASS | -26.29 |
| 0.3024 | 25.94 | 0 | 10 | 35.94 | 60.18 | PASS | -24.24 | 11.3 | 0 | 10 | 21.3 | 50.18 | PASS | -28.88 |
| 0.4505 | 26.42 | 0 | 10 | 36.42 | 56.87 | PASS | -20.45 | 17.02 | 0 | 10 | 27.02 | 46.87 | PASS | -19.85 |

Table 10. Conducted Emissions, Test Results, Neutral



Plot 1. Conducted Emissions over AC mains_phase prescan



Plot 2. Conducted Emissions over AC mains_neutral prescan

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.215(c) 20 dB Occupied Bandwidth

Test Requirement(s): § 15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measure with the spectrum analyzer using an RBW approximately 1% of the total emission bandwidth. The 20 dB Bandwidth was measured and recorded.

Test Results: The EUT was compliant with this requirement.

Test Engineer(s): Donald Salguero

Test Date(s): 06/11/2020

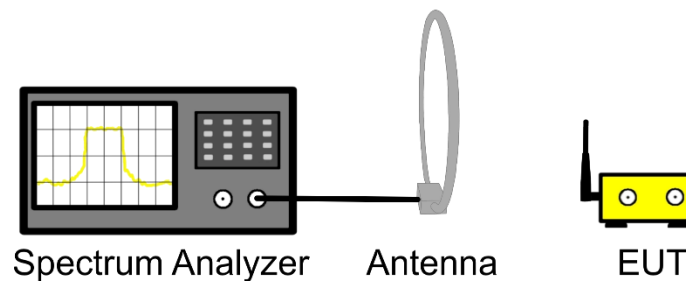
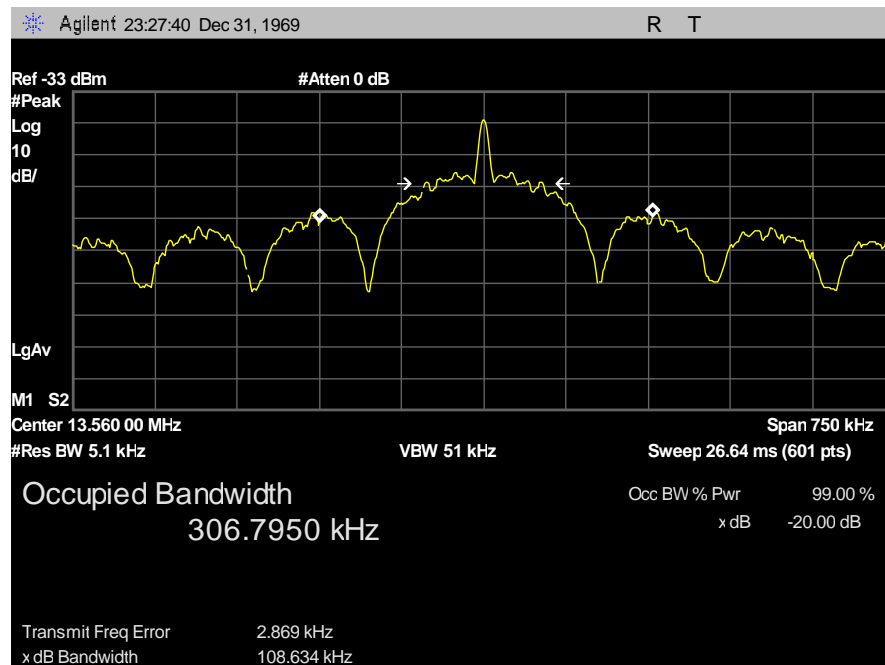


Figure 3. 20 dB Bandwidth Test Setup



Plot 3. 20dB BW - 13.56 MHZ

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(a) Spurious Emission Limits, within the band 13.553 – 13.567 MHz

Test Requirement(s): **15.225 (a)** The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

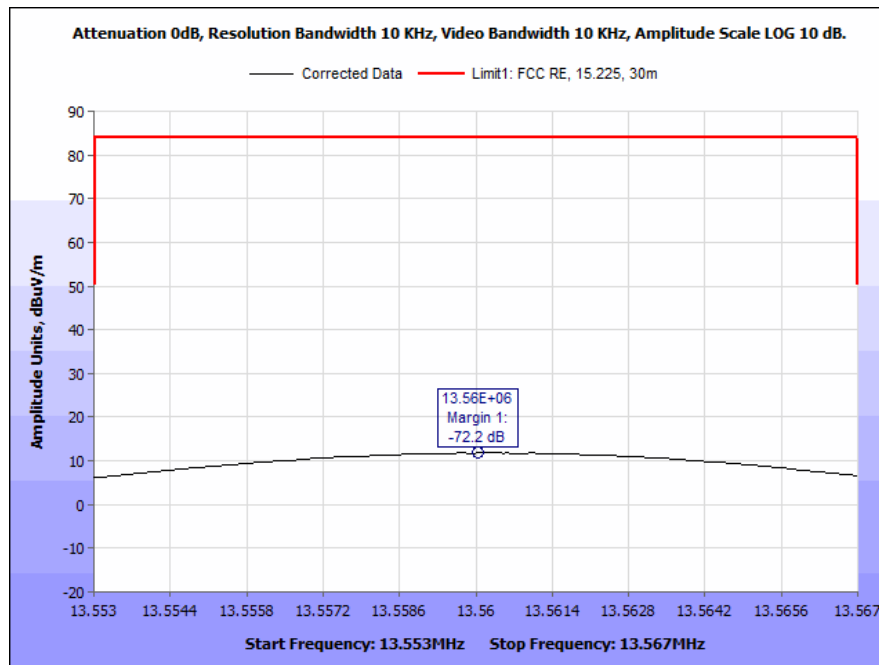
Test Procedure: The EUT was set to transmit and placed on a 0.8m-high non-conductive table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. The loop antenna was located 3 m from the EUT. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer RBW was set to 10 kHz and VBW was set to 30 kHz. A peak detector was used. The measurements were made at 3m and then extrapolated to 30m using the following correction factor.

$$40\log(3/30) = -40 \text{ dB}$$

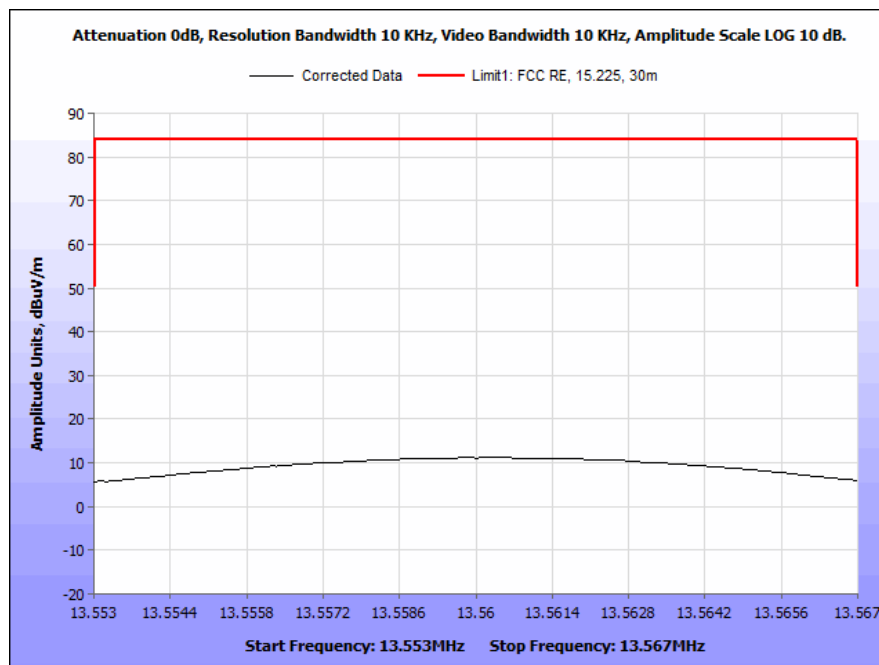
Test Results: The EUT was compliant with the requirements of §15.225(a).

Test Engineer(s): Donald Salguero

Test Date(s): 06/23/2020



Plot 4. Spurious Emissions Within the Band 13.553 – 13.567 MHz, fundamental emission_parallel



Plot 5. Spurious Emissions Within the Band 13.553 – 13.567 MHz, fundamental emission_perpendicular

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(b) Spurious Emission Limits, within the bands 13.410 – 13.553 MHz and 13.567 – 13.710 MHz

Test Requirement(s): **15.225 (b)** Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

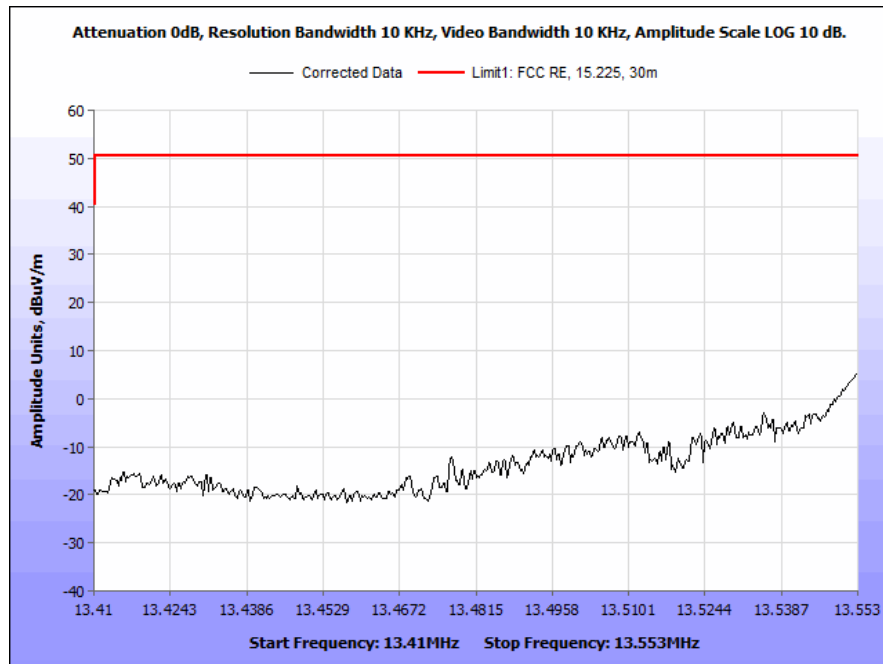
Test Procedures: The EUT was set to transmit and placed on a 0.8m-high wooden stand inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. The loop antenna was located 3 m from the EUT. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer RBW was set to 10 kHz and VBW was set to 30 kHz. A peak detector was used. The measurements were made at 3m and then extrapolated to 30m using the following correction factor.

$$40\log(3/30) = -40 \text{ dB}$$

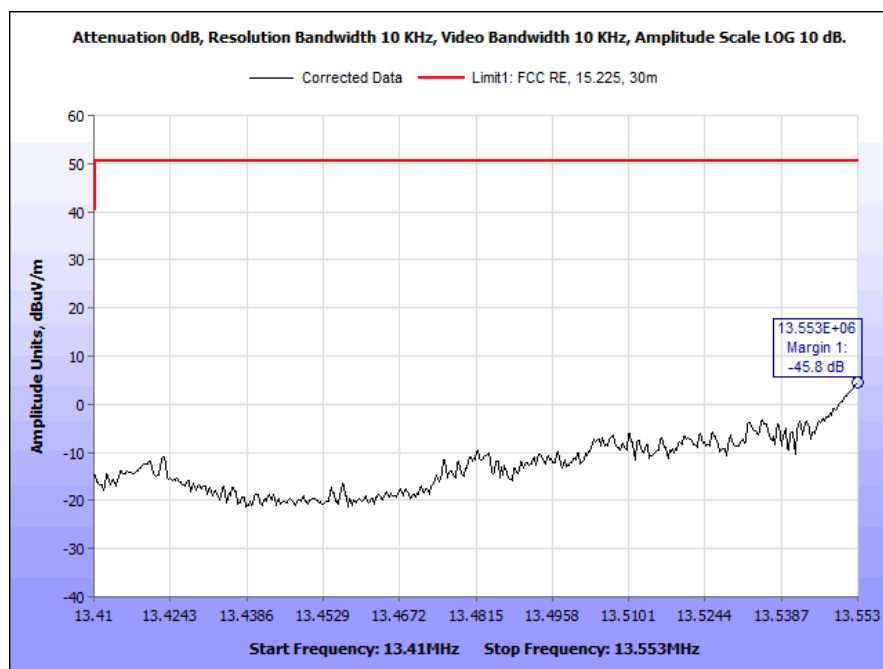
Test Results: The EUT was compliant with the requirements of § 15.225(b).

Test Engineer(s): Donald Salguero

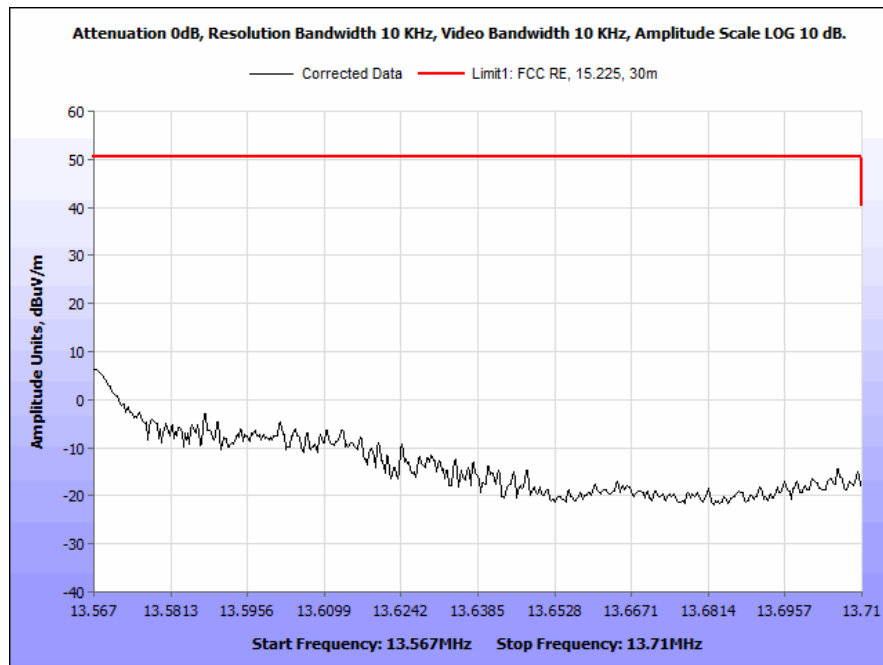
Test Date(s): 06/23/2020



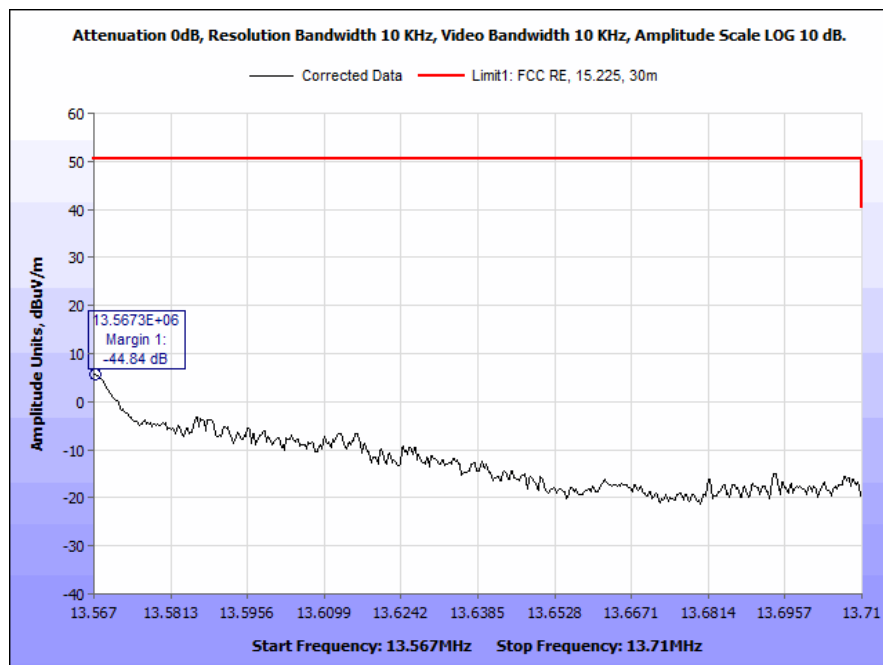
Plot 6. Radiated Emissions_13.41-13.553 MHz_parallel



Plot 7. Radiated Emissions_13.41-13.553 MHz_perpendicular



Plot 8. Radiated Emissions_13.567-13.71 MHz_parallel



Plot 9. Radiated Emissions_13.567-13.71 MHz_perpendicular

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(c) Spurious Emission Limits, within the bands 13.110 – 13.410 MHz and 13.710 – 14.010 MHz

Test Requirement(s): **15.225 (c)** Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

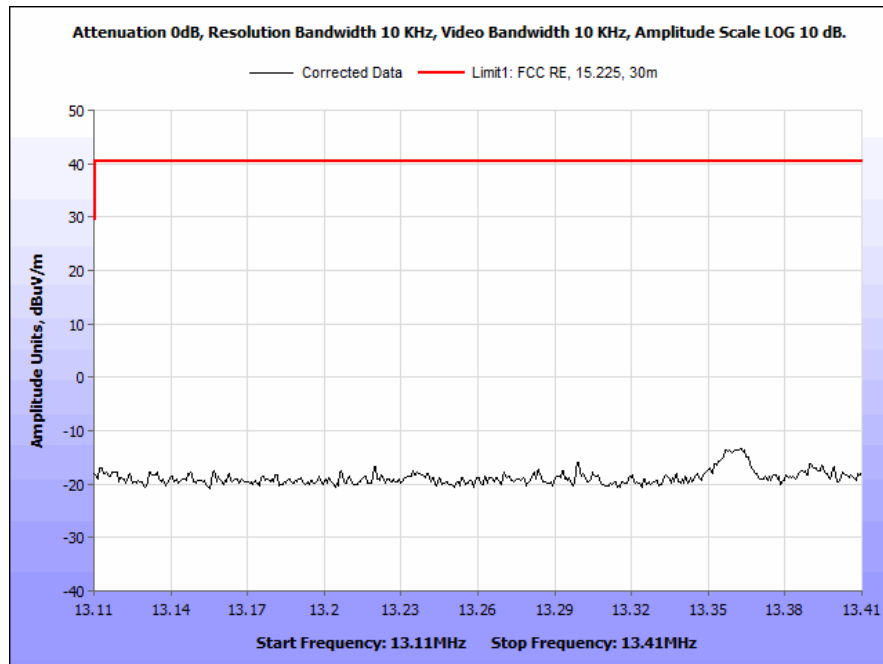
Test Procedures: The EUT was set to transmit and placed on a 0.8m-high wooden stand inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. The loop antenna was located 3 m from the EUT. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer RBW was set to 10 kHz and VBW was set to 30 kHz. A peak detector was used. The measurements were made at 3m and then extrapolated to 30m using the following correction factor.

$$40\log(3/30) = -40 \text{ dB}$$

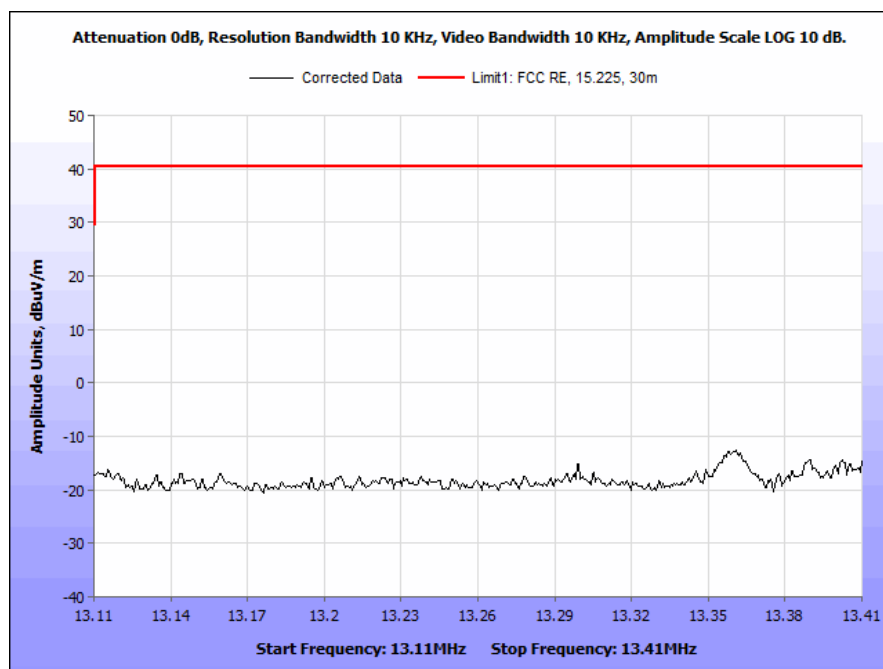
Test Results: The EUT was compliant with the requirements of §15.225(c).

Test Engineer(s): Donald Salguero

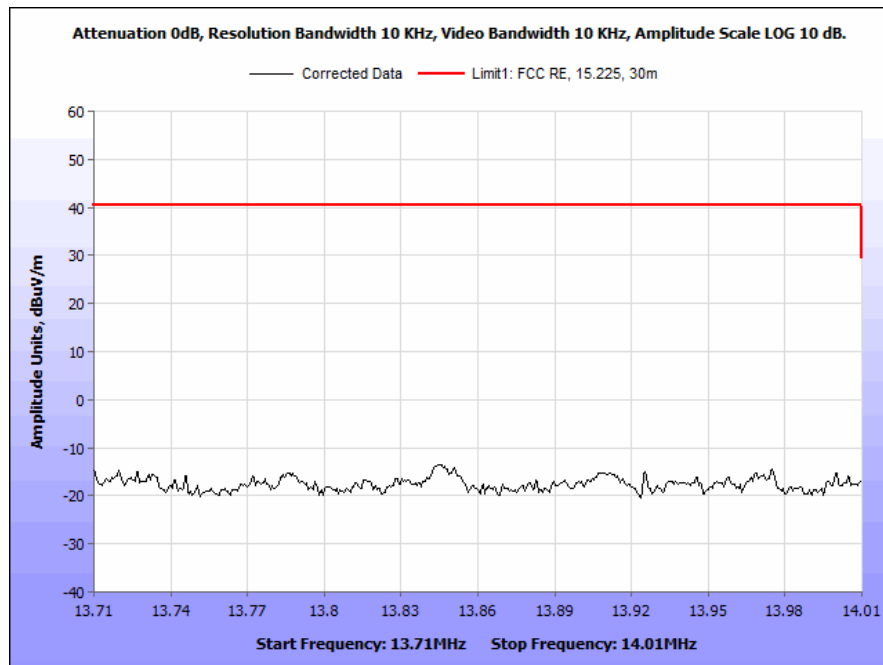
Test Date(s): 06/23/2020



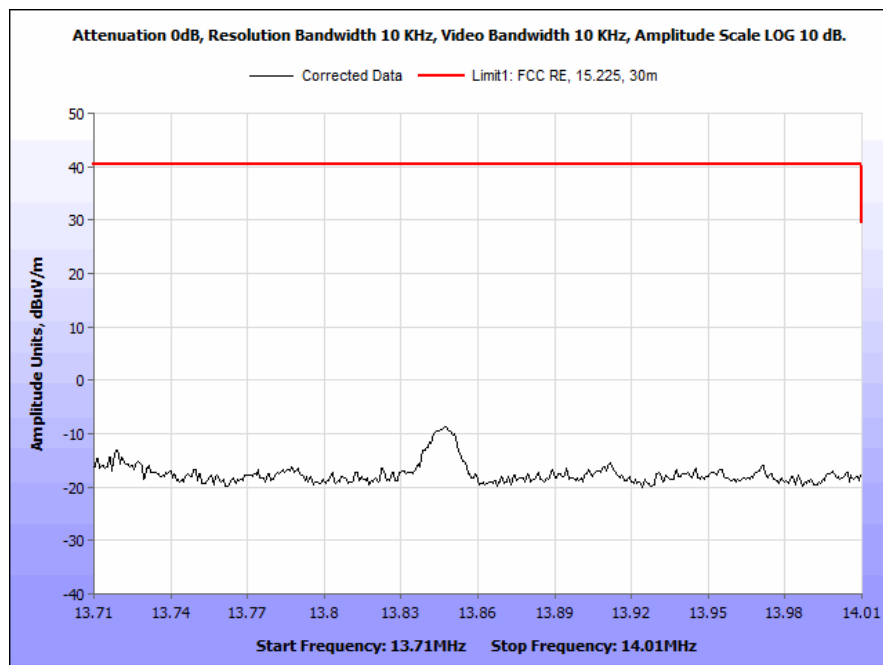
Plot 10. Radiated Emissions_13.11-13.41 MHz_parallel



Plot 11. Radiated Emissions_13.11-13.41 MHz_perpendicular



Plot 12. Radiated Emissions_13.71-14.01 MHz_parallel



Plot 13. Radiated Emissions_13.71-14.01 MHz_perpendicular

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(d) Spurious Emission Limits, outside the bands 13.110 – 14.010 MHz

Test Requirement(s): 15.225 (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

Test Procedures: The EUT was set to transmit and placed on a 0.8m-high wooden stand inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4: 2014 and ANSI C63.10: 2013 were used. For measurements below 30 MHz a loop antenna placed 3m away from the unit was used. For measurements above 30 MHz a biconalog antenna placed 10m away from the unit was used. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer RBW was set to 10 kHz and VBW was set to 30 kHz. Below 150 kHz, the RBW was set to 300 Hz and the VBW set to 1 kHz. A peak detector was used below 30 MHz and a Quasi-peak detector was used for measurements for above 30 MHz.

For measurements from 0.009-30MHz, they were made at 3m with the loop antenna then extrapolated to 30m or 300m using the following correction factors.

$$40\log(3/30) = -40 \text{ dB for measurements between 0.49-30 MHz}$$

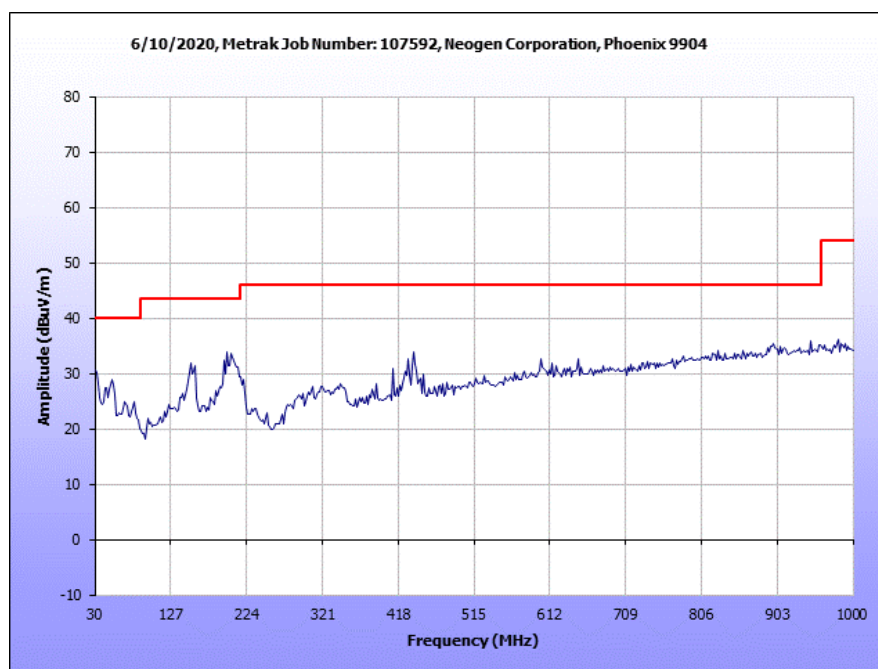
$$40\log(3/300) = -80 \text{ dB for measurements between 0.009-0.49 MHz}$$

The measurements from 30MHz – 1GHz were made at 3m with the biconilog antenna.

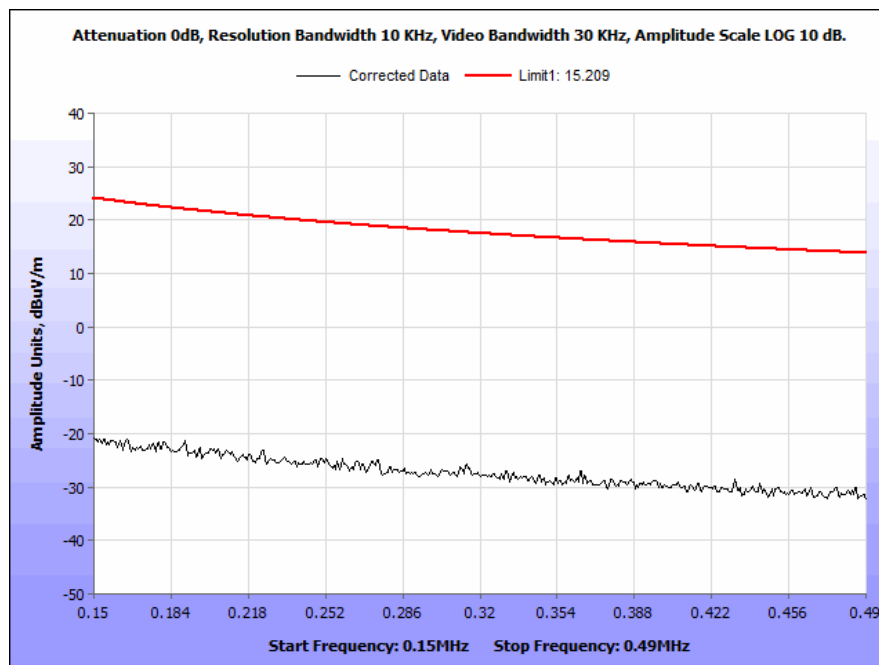
Test Results: The EUT was compliant with requirements of § 15.225 (d).

Test Engineer: Donald Salguero

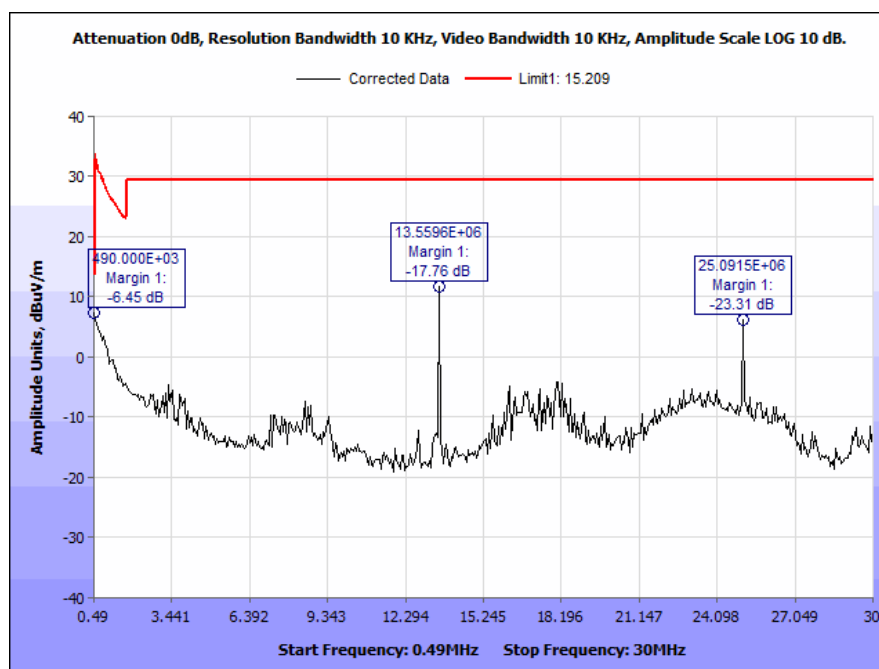
Test Date: 06/23/2020



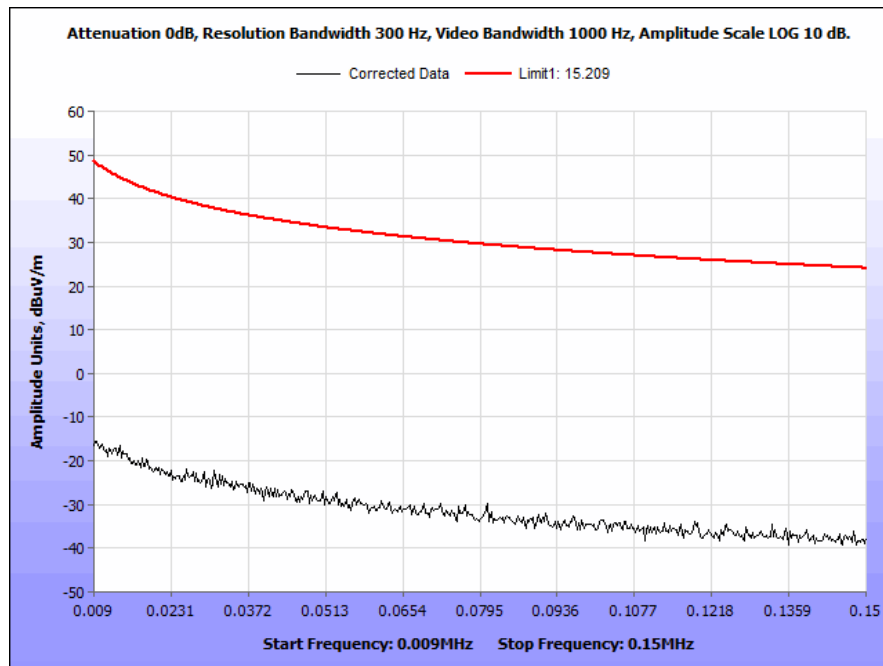
Plot 14. Radiated Emissions, 30-1000 MHz, Cumulative



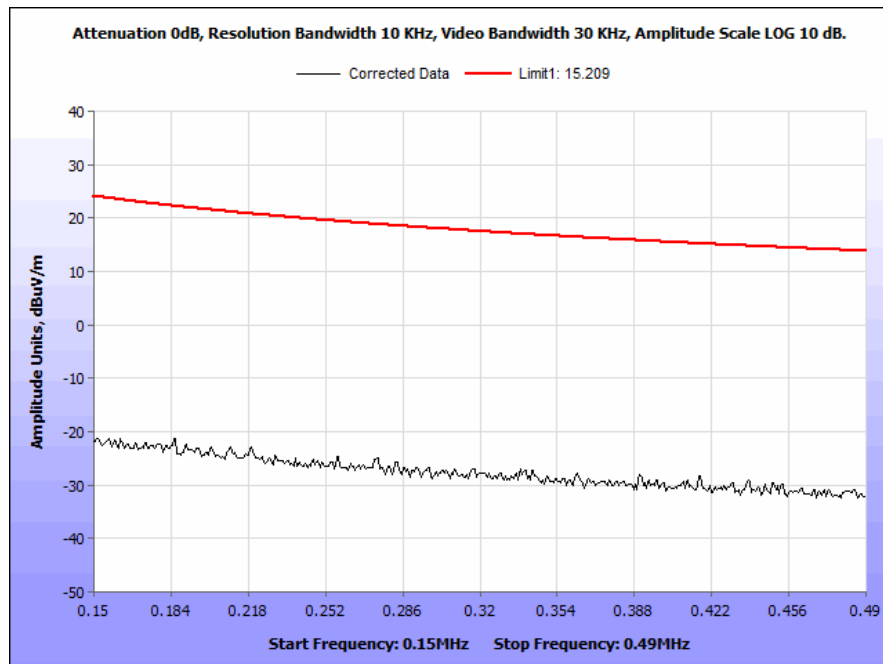
Plot 15. Radiated Emissions, perpendicular_150 - 490 kHz



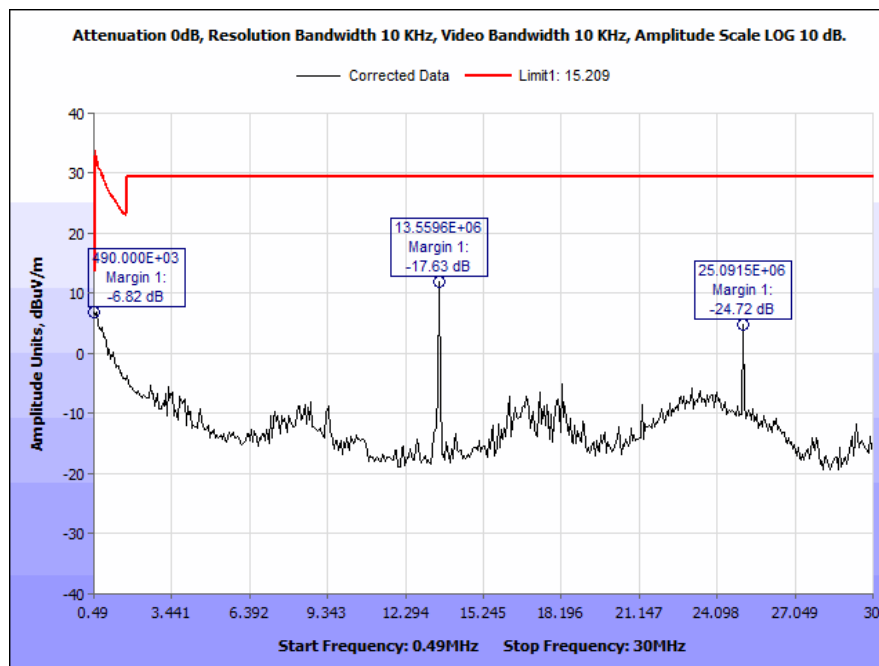
Plot 16. Radiated emissions_parallel_0.49 - 30 MHz



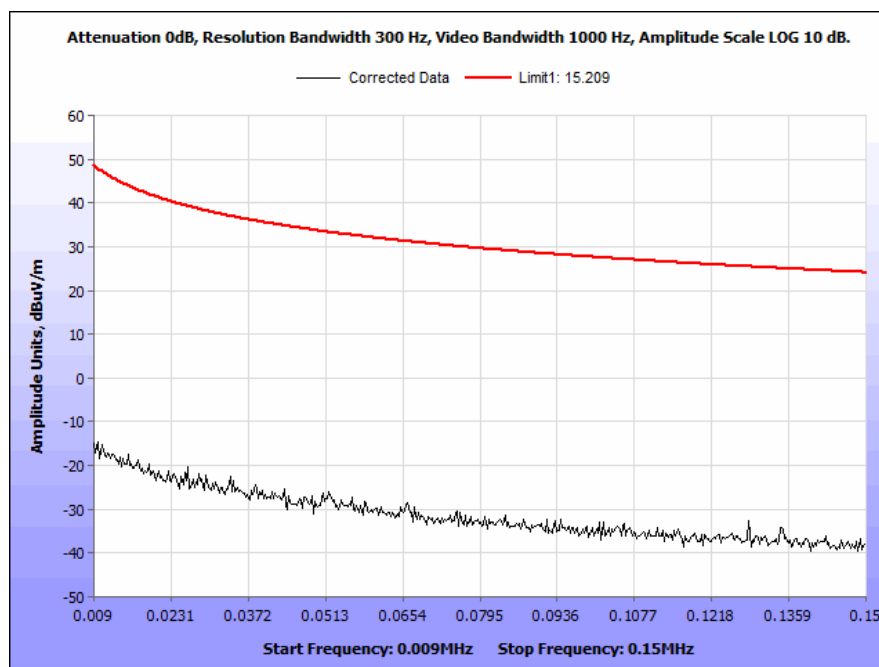
Plot 17 Spurious Emissions, Radiated emissions_parallel_9 - 150 kHz



Plot 18. Radiated emissions_parallel_150 - 490 kHz



Plot 19. Radiated emissions_perpendicular_0.49 - 30 MHz



Plot 20. Radiated emissions_perpendicular_9 - 150 kHz

Spurious Emissions Limits Test Setup

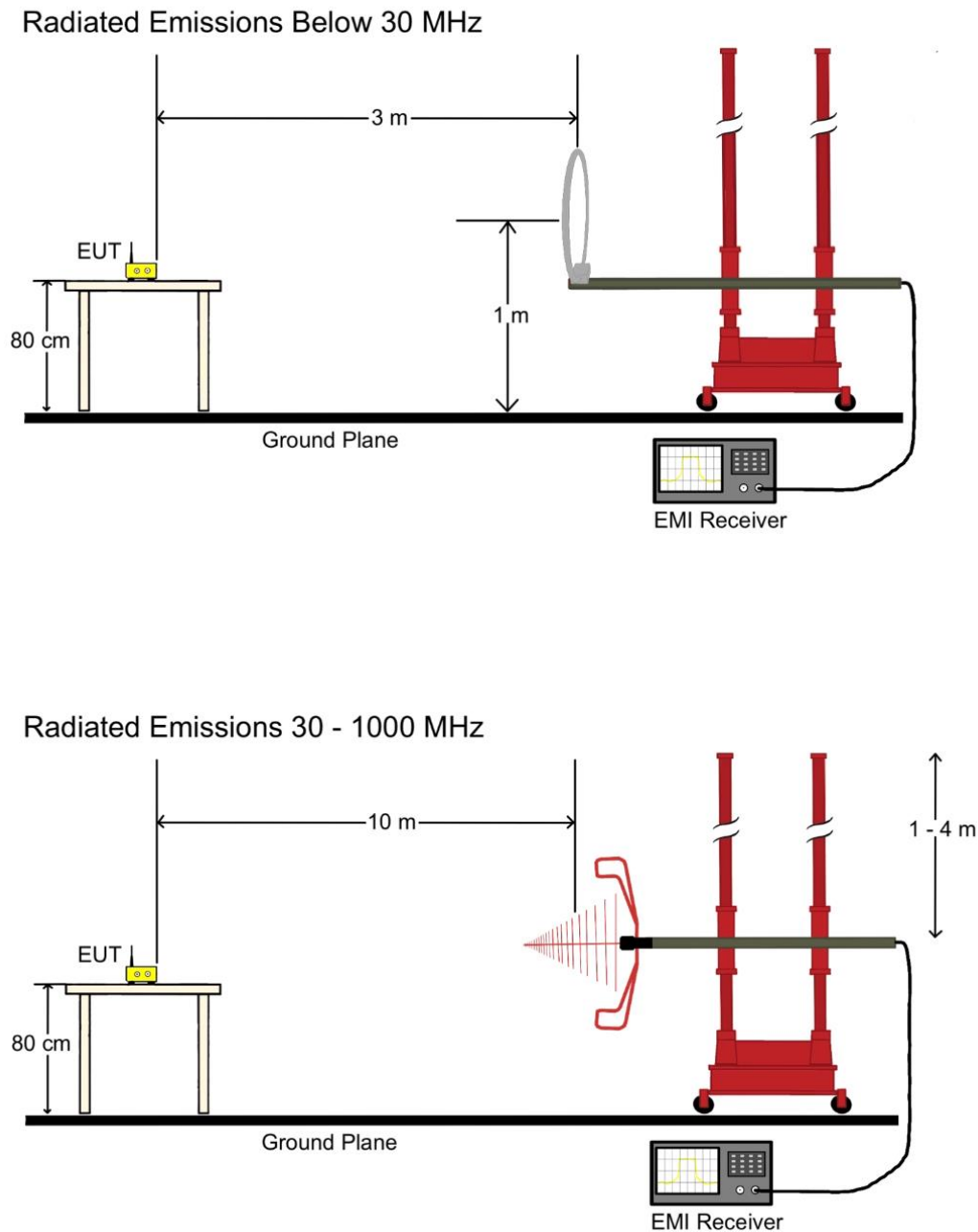


Figure 4. Radiated Emissions Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(e) Frequency Stability

Test Requirement(s): 15.225(e) The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Procedure: Measurements are in accordance with Part 2.1055. The EUT was placed in the Environmental Chamber and allowed to reach desired temperature. A spectrum analyzer was used to measure the frequency drift. The EUT was set to transmit in the operating frequency range. Frequency drift was investigated for the extreme temperatures and nominal temperature, until the unit is stabilized then recorded the reading in tabular format with the temperature range of -20° to 50°C.

Test Results: The EUT was found compliant with the frequency stability requirements of this section.

Test Engineer(s): Donald Salguero

Test Date(s): 06/12/2020

| Temperature | Measured Center Frequency | % |
|-------------|---------------------------|---------|
| 50 | 13.55999513 | 0.00062 |
| 40 | 13.56001091 | 0.0005 |
| 30 | 13.56004117 | 0.00028 |
| 20 | 13.56007885 | 0 |
| 10 | 13.56011375 | 0.00026 |
| 0 | 13.5601425 | 0.00047 |
| -10 | 13.56015723 | 0.00058 |
| -20 | 13.5601592 | 0.00059 |

Table 11. Frequency Stability, Test Results

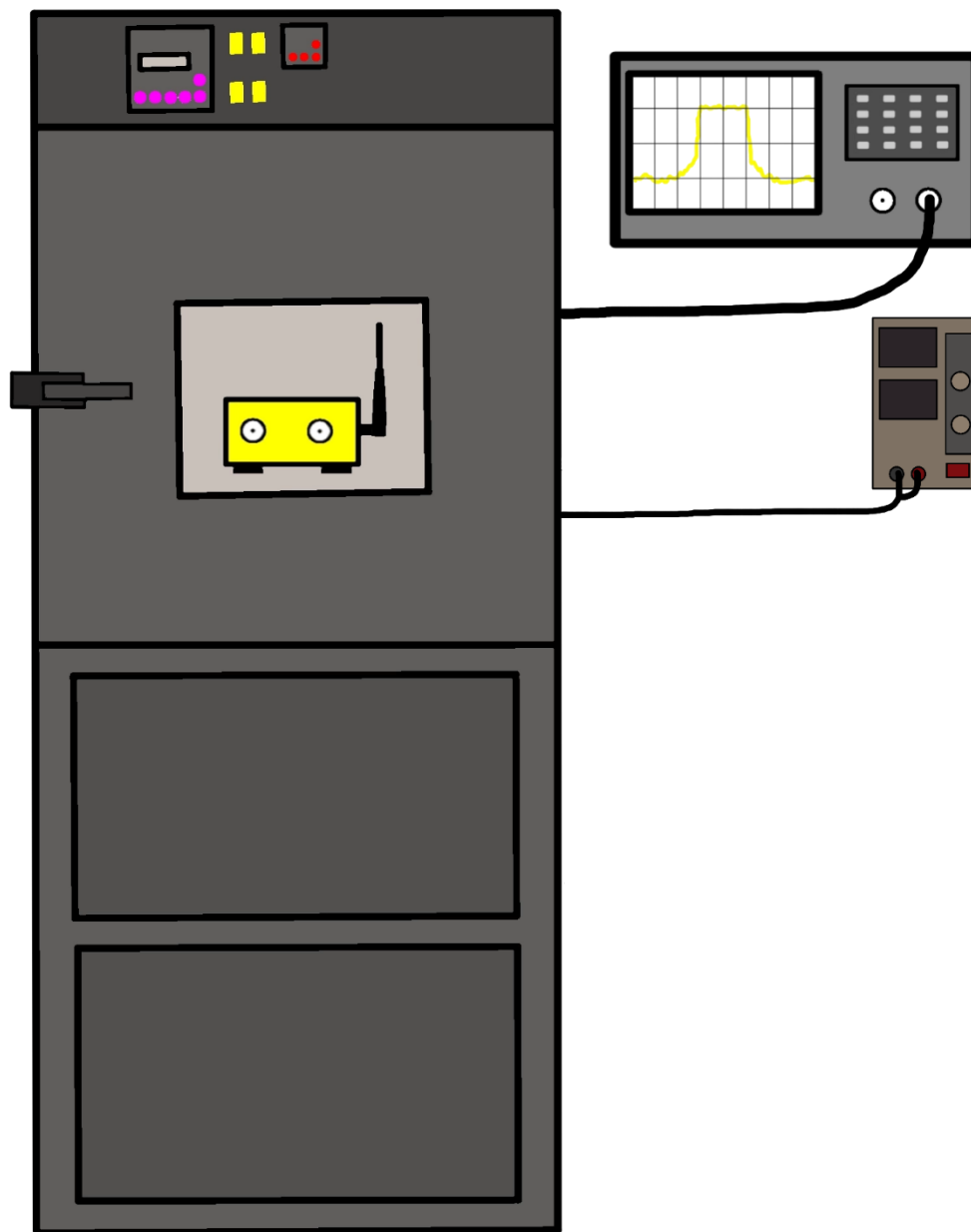


Figure 5. Temperature Stability Test Setup

IV. Test Equipment

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

| Asset | Equipment | Manufacturer | Model | Calibration Date | Calibration Due Date |
|--------|------------------------------|---------------------------|-----------|------------------|----------------------|
| 1T4565 | LISN (24 AMP) | SOLAR ELECTRONICS COMPANY | 925-5-BNC | 4/3/2019 | 10/3/2020 |
| 1T4771 | PSA SPECTRUM ANALYZER | AGILENT TECHNOLOGIES | E4446A | 2/26/2020 | 8/26/2021 |
| 1T7450 | TRANSIENT LIMITER | COM-POWER | LIT-153A | NOT REQUIRED | |
| 1T4504 | SHIELDED ROOM | UNIVERSAL SHIELDING CORP | N/A | NOT REQUIRED | |
| 1T4409 | EMI Receiver | Rohde & Schwarz | ESIB7 | 1/4/2019 | 1/4/2021 |
| 1T4751 | Antenna - Bilog | Sunol Sciences | JB6 | 5/2/2019 | 11/2/2020 |
| 1T9586 | Active Loop Antenna | ETS-Lindgren | 6502 | 10/30/2019 | 10/30/2020 |
| 2T8226 | Temperature/Humidity Chamber | ESPEC | EPX-4H | 1/12/2020 | 1/12/2021 |

Table 12. Test Equipment List

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

End of Report