NVLAP Lab Code 200087-0


# ROGERS LABS, INC.

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47CFR, PART 15C - Intentional Radiators
47CFR Paragraph 15.245 and
Industry Canada RSS-GEN Issue 5 and RSS-210 Issue 10

# Application For Grant of Certification

# Model / HVIN: VPR

24.075-24.175 GHz
Field disturbance sensors (FDS)

## FCC ID: OHRVPR
## IC: 6775A-VPR

# MS Sedco, Inc.

7898 Zionsville Road
Indianapolis, IN 46268

FCC Designation: US5305
ISED Registration: 3041A

Test Report Number: 230720

Test Date: July 20, 2023

Authorized Signatory: Scot D Rogers
Scot D. Rogers

## Revisions

Revision 1 Issued September 18, 2023

## Foreword

The following information is submitted for consideration in obtaining Grants of Certification for low power intentional radiator per 47CFR Paragraph 15.245, and Industry Canad Innovation, Science and Economic Development Canada (ISED) RSS-210 Issue 10, Annex F and RSS-GEN Issue 5, low power digital device transmitter operations in the 24.075-24.175 GHz frequency band.

Name of Applicant: MS Sedco, Inc.
7898 Zionsville Road
Indianapolis, IN 46268

HVIN: VPR

FCC ID: OHRVPR IC: 6775A-VPR

Operating Frequency Range: 24.075-24.175 GHz

| Frequency Band (GHz) | Peak Power (dBµV/m@3m) | Average power (dBµV/m@3m) | 99% OBW (MHz) |
|---|---|---|---|
| 24.075 - 24.175 | 113.0 | 112.8 | 169.87 |

## Opinion / Interpretation of Results

| Tests Performed | Margin (dB) | Results |
|---|---|---|
| Restricted Bands 47CFR 15.205, RSS-210 Issue 10 | -28.6 | Complies |
| AC Line Conducted 47CFR 15.207, RSS-GEN 8.8 | -27.5 | Complies |
| Radiated Emissions 47CFR 15.209, RSS-GEN 8.9 | -9.4 | Complies |
| Harmonic Emissions per 47CFR 15.245, RSS-210 Issue 10 | -28.6 | Complies |

## Equipment Tested

Model: VPR

| Equipment | Model / PN | Serial Number |
|---|---|---|
| EUT | VPR | 629003 |
| AC Transformer | Manufacturer | N/A |

Test results in this report relate only to the items tested.

Software Version: V081523

Integral PCB Patch Antenna

The design transmits pulses at center frequency and receives backscatter to determine motion in the field.

Test results in this report relate only to the items tested.

### *Equipment Function and Configuration*

The EUT is a fixed mounted field disturbance sensor. The design incorporates an authorized module (FCC ID: UXS-IPS280). The test sample was provided with an AC transformer to power the design for testing. The test system only required power to enable the transmitter function during testing. The test sample operated the transmitter at near 100% duty cycle while powered for testing purposes. The EUT was arranged as described by the manufacturer emulating typical use configuration for testing purposes. For testing purposes, the EUT received power from the provided external AC Transformer and was configured to operate in the manufacturer provided mode and duty cycle. As requested by the manufacturer and required by regulations, the equipment was evaluated for compliance using the available configurations with the worst-case data presented. This report documents the performed testing and results for the applicable configuration and product operation. Test results in this report relate only to the products described in this report.

### *Equipment Configuration*

## Application for Certification

(1) Manufacturer: MS Sedco, Inc.
7898 Zionsville Road
Indianapolis, IN 46268

(2) Identification: HVIN: VPR
FCC ID: OHRVPR IC: 6775A-VPR

(3) Instruction Book:

Refer to Exhibit for Instruction Manual.

(4) Description of Circuit Functions:

Refer to Exhibit of Operational Description.

(5) Block Diagram with Frequencies:

Refer to Exhibit of Operational Description.

(6) Report of Measurements:

Report of measurements follows in this Report.

(7) Photographs: Construction, Component Placement, etc.:

Refer to Exhibit for photographs of equipment.

(8) List of Peripheral Equipment Necessary for operation. The equipment operates from fixed 24Vac power provided from external AC transformer. The design provides relay contact interface option in the wiring harness for installation as presented in this filing. The EUT offers no other connection ports than those presented in this filing.

(9) Transition Provisions of 47CFR 15.37 are not requested.

(10) Not Applicable. The unit is not a scanning receiver.

(11) Not Applicable. The EUT does not operate in the 59 – 64 GHz frequency band.

(12) The equipment is not software defined and this section is not applicable.

(13) Applications for certification of U-NII devices in the 5.15-5.35 GHz and the 5.47-5.85 GHz bands must include a high-level operational description of the security procedures that control the radio frequency operating parameters and ensure that unauthorized modifications cannot be made. This requirement is not applicable to this device.

(14) Contain at least one drawing or photograph showing the test set-up for each of the required types of tests applicable to the device for which certification is requested. These drawings or photographs must show enough detail to confirm other information contained in the test report. Any photographs used must be focused originals without glare or dark spots and must clearly show the test configuration used. This information is provided in this report and Test Setup Exhibits provided with the application filing.

## Applicable Standards & Test Procedures

In accordance with the Title 47 of the Code of Federal Regulations (47CFR), dated July 20, 2023: Part 2, Subpart J, Paragraphs 2.907, 2.911, 2.913, 2.925, 2.926, 2.1031 through 2.1057, and applicable parts of paragraph 15, Part 15C Paragraph 15.245, Industry Canada RSS-210 Issue 10, Annex F, and RSS-GEN Issue 5 operation in the 24.075-24.175 GHz Frequency band. Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in ANSI C63.10-2013.

## Testing Procedures

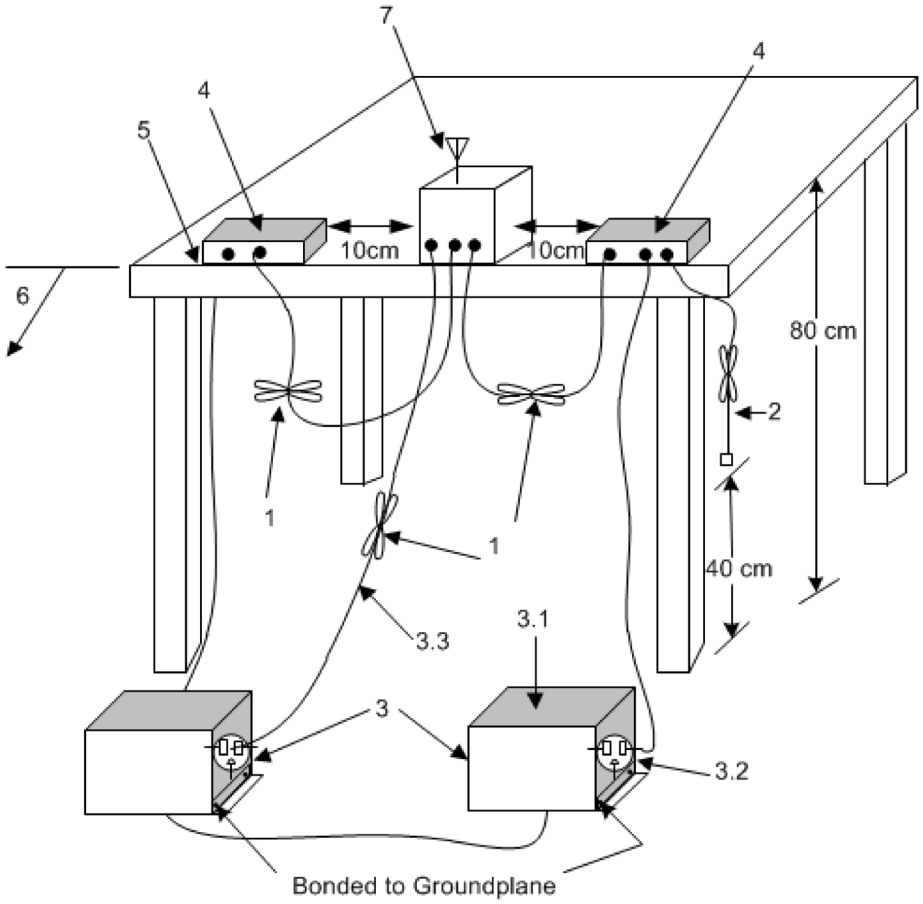
### *AC Line Conducted Emission Test Procedure*

Testing for the AC line-conducted emissions was performed as defined in ANSI C63.10-2013. The test setup, including the EUT, was arranged in the test configurations as presented during testing. The test configuration was placed on a 1 x 1.5-meter bench, 0.8 meters high located in a screen room. The power lines of the system were isolated from the power source using a standard LISN with a 50-µHy choke. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor internal to the LISN. The LISN was positioned on the floor beneath the wooden bench supporting the EUT. The power lines and cables were draped over the back edge of the table. Refer to diagram 1 showing typical test arrangement and photographs in exhibits for EUT placement used during testing.

### *Radiated Emission Test Procedure*

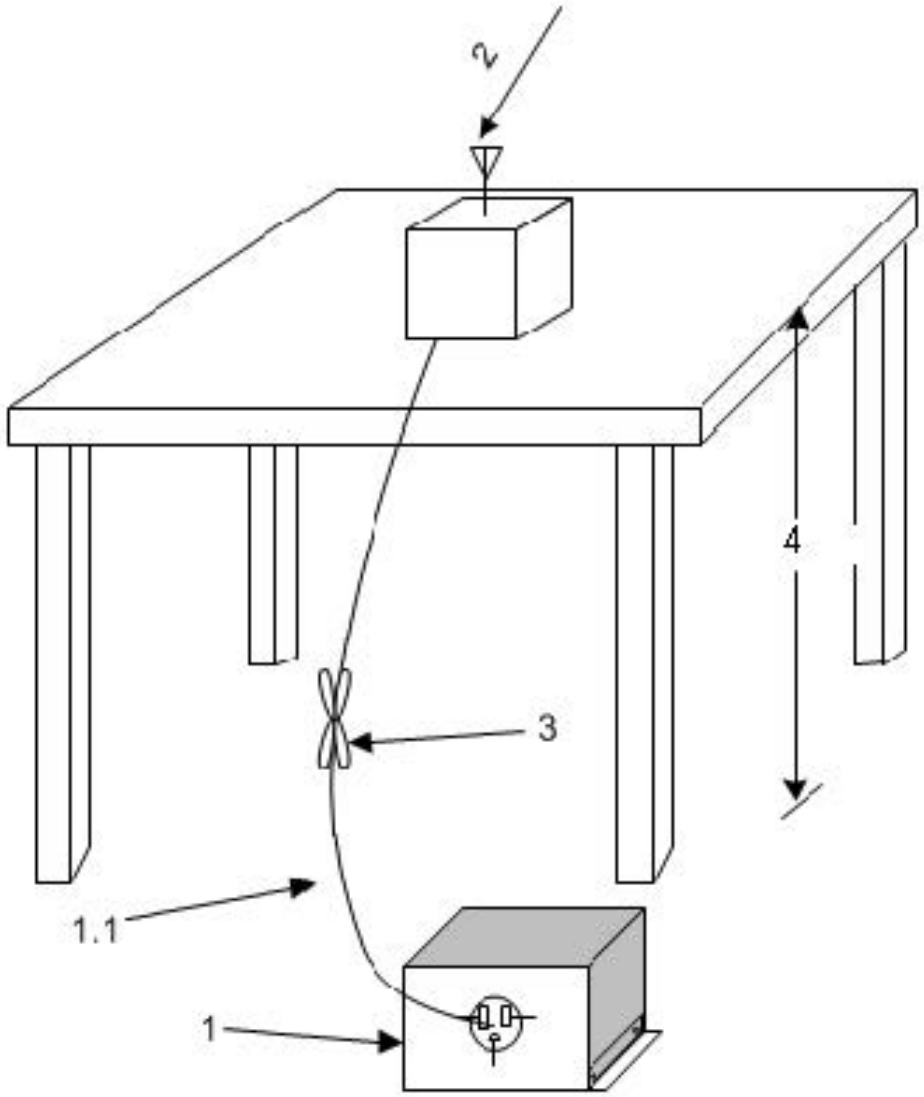
Radiated emissions testing was performed as required in 47CFR 15C, RSS-210 Issue 10 and specified in ANSI C63.10-2013. The EUT was placed on a rotating 0.9 x 1.2-meter platform, elevated as required above the ground plane at a distance of 3 meters from the FSM antenna. EMI energy was maximized by equipment placement permitting orientation in three orthogonal axes, raising, and lowering the FSM antenna, changing the antenna polarization, and by rotating the turntable. Each emission was maximized before data was taken and recorded. The frequency spectrum from 9 kHz to 40,000 MHz was searched for emissions during preliminary investigation. Refer to diagrams 2 and 3 showing typical test setup. Refer to photographs in the test setup.

**Diagram 1 Test arrangement for Conducted Emissions**




1—Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long see (see 6.2.3.2).
2—The I/O cables that are not connected to an accessory shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m (see 6.2.2).
3—EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω loads. LISN may be placed on top of, or immediately beneath, reference ground plane (see 6.2.2 and 6.2.3).
3.1—All other equipment powered from additional LISN(s).
3.2—A multiple outlet strip may be used for multiple power cords of non EUT equipment.
3.3—LISN at least 80 cm from nearest part of EUT chassis.
4—Non EUT components of EUT system being tested.
5—Rear of EUT, including peripherals, shall all be aligned and flush with edge of tabletop (see 6.2.3.2).
6—Edge of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane (see 6.2.2 for options).
7—Antenna can be integral or detachable. If detachable, then the antenna shall be attached for this test.

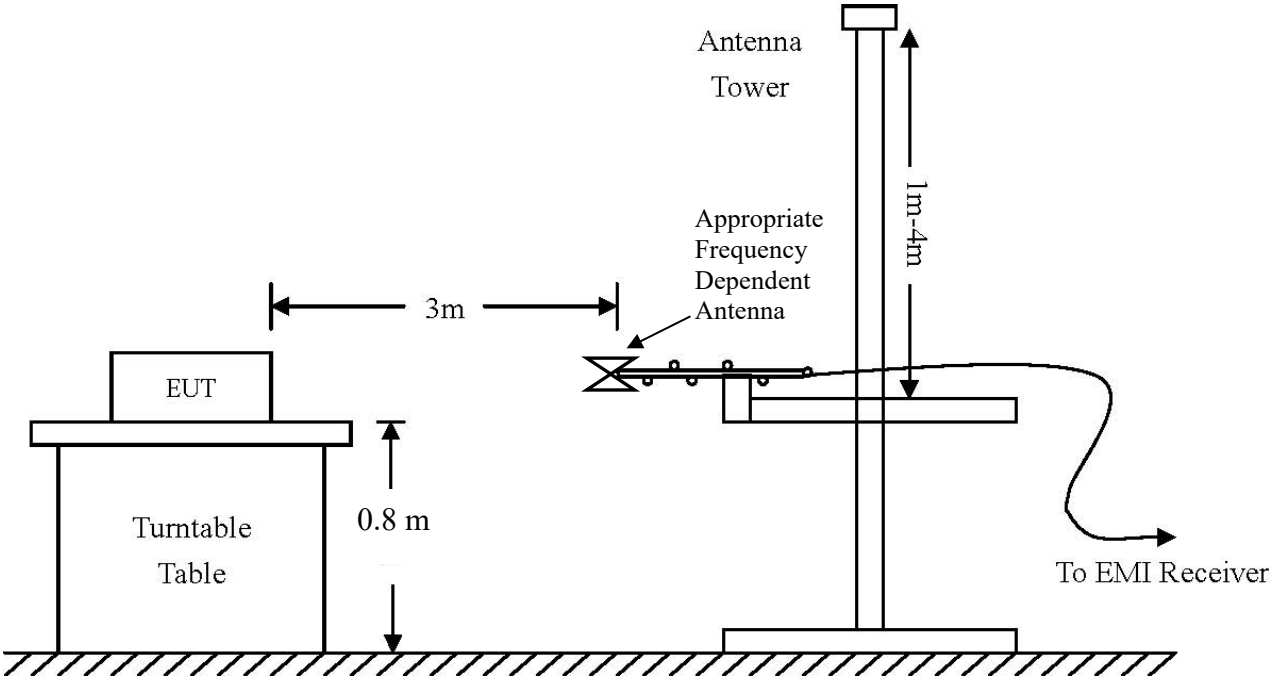
***Diagram 2 Test arrangement for radiated emissions of tabletop equipment.***



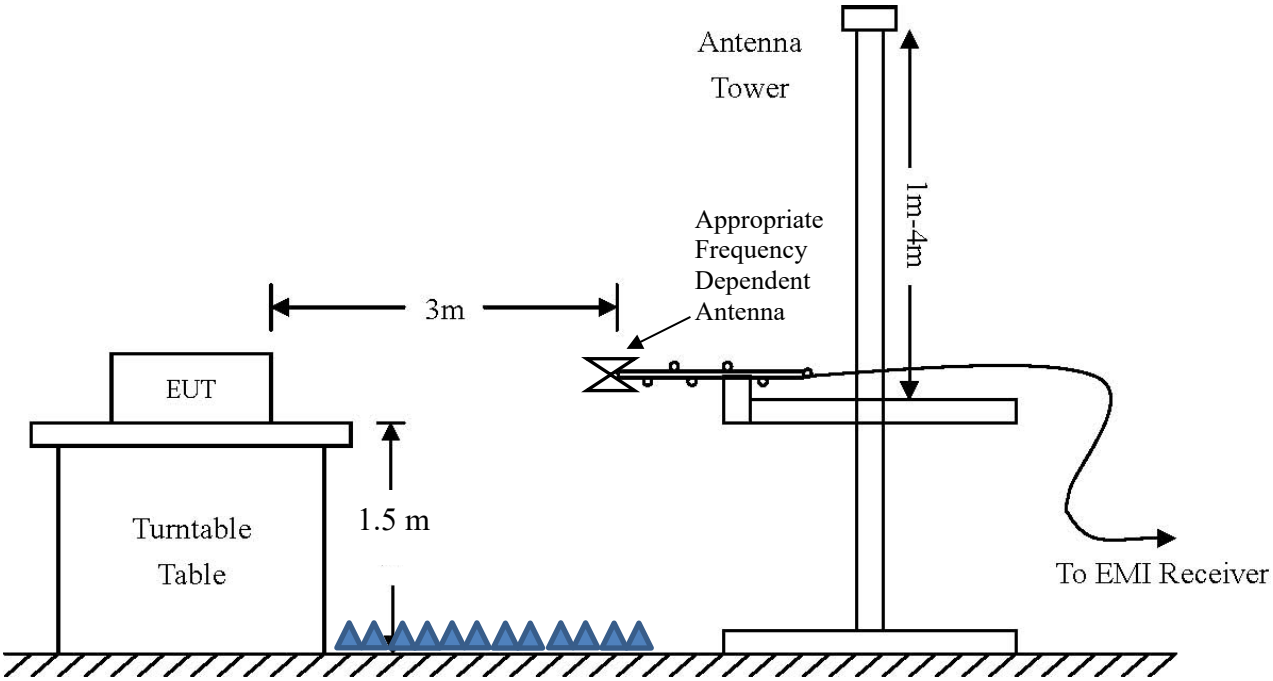

1—A LISN is optional for radiated measurements between 30 MHz and 1000 MHz but not allowed for measurements below 30 MHz and above 1000 MHz (see 6.3.1). If used, then connect EUT to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω loads. The LISN may be placed on top of, or immediately beneath, the reference ground plane (see 6.2.2 and 6.2.3.2).
1.1—LISN spaced at least 80 cm from the nearest part of the EUT chassis.
2—Antenna can be integral or detachable, depending on the EUT (see 6.3.1).
3—Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long (see 6.3.1).
4—For emission measurements at or below 1 GHz, the table height shall be 80 cm. For emission measurements above 1 GHz, the table height shall be 1.5 m for measurements, except as otherwise specified (see 6.3.1 and 6.6.3.1).

***Diagram 3 Test arrangement for radiated emissions tested on Open Area Test Site***

**Test arrangement for radiated emissions Below 1 GHz**




**Test arrangement for radiated emissions Above 1 GHz**



## Test Site Locations

| | |
|---|---|
| Conducted EMI | AC line conducted emissions testing performed in a shielded screen room located at Rogers Labs, Inc., 4405 West 259th Terrace, Louisburg, KS |
| Antenna port | Antenna port conducted emissions testing was performed in a shielded screen room located at Rogers Labs, Inc., 4405 West 259th Terrace, Louisburg, KS |
| Radiated EMI | The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 West 259th Terrace, Louisburg, KS |
| Registered Site information: | FCC Site: US5305, ISED: 3041A, CAB Identifier: US0096 |
| NVLAP Accreditation | Lab code 200087-0 |

## Units of Measurements

| | |
|---|---|
| Conducted EMI | Data presented in dBµV; dB referenced to one microvolt. |
| Antenna port Conducted | Data is in dBm; dB referenced to one milliwatt. |
| Radiated EMI | Data presented in dBµV/m; dB referenced to one microvolt per meter. |

Note: Radiated limit may be expressed for measurement in dBµV/m when the measurement is taken at a distance of 3 or 10 meters. Data taken for this report was taken at distance of 3 meters. Sample calculation demonstrates corrected field strength reading for Open Area Test Site using the measurement reading and correcting for receive antenna factor, cable losses, and amplifier gains.

Sample Calculation:

RFS = Radiated Field Strength, FSM = Field Strength Measured

A.F. = Receive antenna factor, Losses = attenuators/cable losses, Gain = amplification gains

RFS (dBµV/m @ 3m) = FSM (dBµV) + A.F. (dB/m) + Losses (dB) - Gain (dB)

## Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.1° C |
| Relative Humidity | 43% |
| Atmospheric Pressure | 1017.7 mb |

## Statement of Modifications and Deviations

No modifications to the EUT were required for the equipment to demonstrate compliance with the 47CFR Part 15C, 15.245, Industry Canada RSS-210 Issue 10, Annex F and RSS-GEN Issue 5 emission requirements. There were no deviations to the specifications.

## Intentional Radiators

The following information is submitted supporting compliance with the requirements of 47CFR, Subpart C, paragraph 15.245, Industry Canada RSS-210 Issue 10, and RSS-GEN Issue 5.

### *Antenna Requirements*

The EUT incorporates an integral antenna system. Production equipment offers no provision for connection to alternate antenna system. The antenna connection point complies with the unique antenna connection requirements. There are no deviations or exceptions to the specification.

### *Restricted Bands of Operation*

Spurious emissions falling in the restricted frequency bands of operation were measured at the OATS. The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were investigated at the OATS, using appropriate antennas or pyramidal horns, amplification stages, and a spectrum analyzer. Peak and average amplitudes of frequencies above 1000 MHz were compared to the required limits with worst-case data presented below. Test procedures of ANSI C63.10-2013 were used during testing. No other significant emission was observed which fell into the restricted bands of operation. Computed emission values take into account the received radiated field strength, receive antenna correction factor, amplifier gain stage, and test system cable losses.

**Table 1 Radiated Emissions in Restricted Frequency Bands Data**

| Frequency in MHz | Horizontal Peak (dBµV/m) | Horizontal Average (dBµV/m) | Vertical Peak (dBµV/m) | Vertical Average (dBµV/m) | Limit @ 3m (dBµV/m) | Horizontal Margin (dB) | Vertical Margin (dB) |
|---|---|---|---|---|---|---|---|
| 48,298.4 | 36.0 | 25.0 | 35.0 | 24.8 | 68.0 | -43.0 | -43.2 |
| 72,447.6 | 42.2 | 30.6 | 42.9 | 30.3 | 68.0 | -37.4 | -37.7 |
| 96,596.8 | 52.5 | 39.3 | 52.0 | 39.4 | 68.0 | -28.7 | -28.6 |

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

### *Summary of Results for Radiated Emissions in Restricted Bands*

The EUT demonstrated compliance with the radiated emissions requirements of 47CFR Part 15C and RSS-210 Issue 10 Intentional Radiator requirements. The EUT demonstrated a worst-case minimum margin of -28.6 dB below the emissions requirements in restricted frequency bands. Peak, Quasi-peak, and average amplitudes were checked for compliance with the regulations. Worst-case emissions are reported with other emissions found in the restricted frequency bands at least 20 dB below the requirements.

## *AC Line Conducted EMI Procedure*

The EUT was arranged in typical equipment configurations as offered by the manufacturer and presented above in equipment configuration. The EUT operates from Alternating (AC) Current power provided through transformer. Therefore, the AC Line conducted emissions testing was performed on the applicable AC powered configuration as described by the manufacturer for powering the EUT. Testing was performed with the EUT placed on a 1 x 1.5-meter bench 80 cm above the conducting ground plane, floor of a screen room. The bench was positioned 40 cm away from the wall of the screen room. The LISN was positioned on the floor of the screen room 80-cm from the rear of the EUT. Testing for the AC line-conducted emissions followed the procedures of ANSI C63.10. All power cords except the EUT were then powered from the second LISN. EMI was coupled to the spectrum analyzer through a 0.1 µF capacitor, internal to the LISN. Power line conducted emissions testing was carried out individually for each current carrying conductor of the EUT. The excess length of lead between the system and the LISN receptacle was folded back and forth to form a bundle not exceeding 40 cm in length. The screen room, conducting ground plane, analyzer, and LISN were bonded together to the protective earth ground. Preliminary testing was performed to identify the frequencies of each of the emissions, which demonstrated the highest amplitudes. The cables were repositioned to obtain maximum amplitude of measured EMI level. Once the worst-case configuration was identified, plots were made of the EMI from 0.15 MHz to 30 MHz and data recorded.

Refer to figures 1 and 2 for plots of the EUT – AC Line conducted emissions

**Figure 1 AC Line Conducted emissions Line L1**

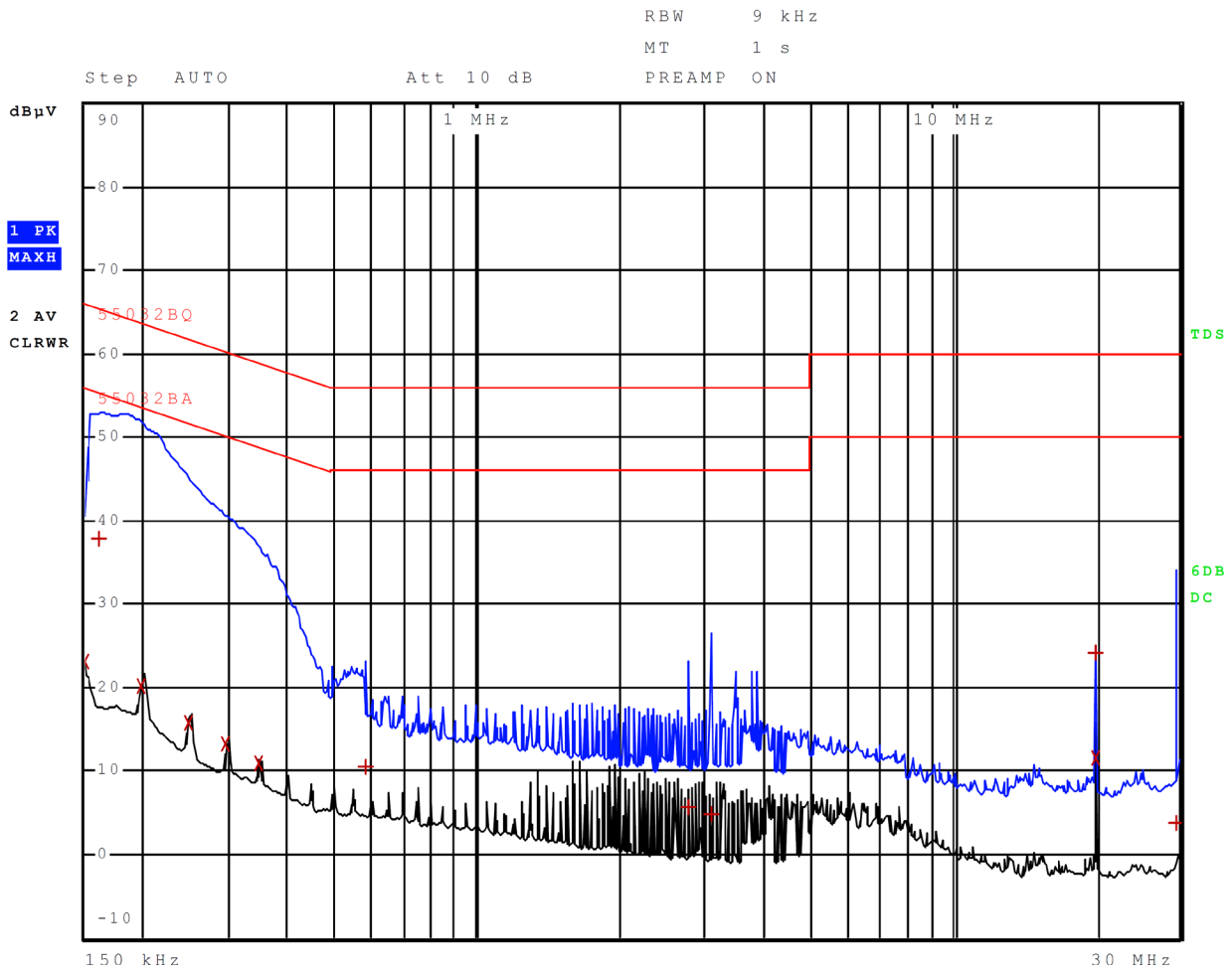


**Figure 2 AC Line Conducted emissions Line L2**

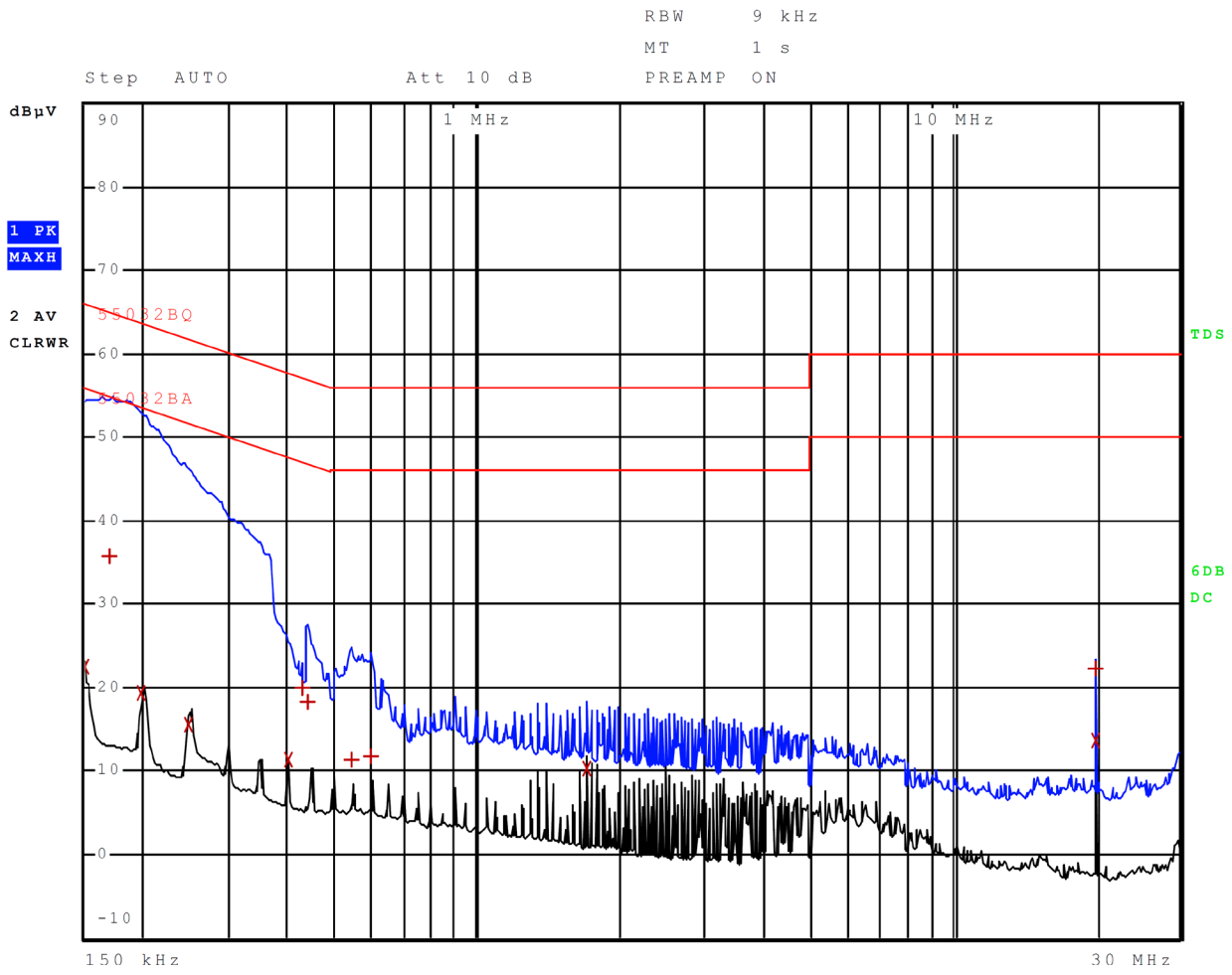


**Table 2 AC Line Conducted Emissions Data L1**

| Trace | Frequency | Level (dBµV) | Detector | Delta Limit/dB |
|---|---|---|---|---|
| 2 | 150.000000000 kHz | 22.99 | Average | -33.01 |
| 1 | 162.000000000 kHz | 37.78 | Quasi Peak | -27.58 |
| 2 | 198.000000000 kHz | 20.12 | Average | -33.57 |
| 2 | 250.000000000 kHz | 15.70 | Average | -36.05 |
| 2 | 298.000000000 kHz | 13.16 | Average | -37.14 |
| 2 | 346.000000000 kHz | 10.90 | Average | -38.16 |
| 1 | 578.000000000 kHz | 10.51 | Quasi Peak | -45.49 |
| 1 | 2.778000000 MHz | 5.60 | Quasi Peak | -50.40 |
| 1 | 3.106000000 MHz | 4.77 | Quasi Peak | -51.23 |
| 2 | 19.963900000 MHz | 11.44 | Average | -38.56 |
| 1 | 19.967900000 MHz | 24.14 | Quasi Peak | -35.86 |
| 1 | 29.483900000 MHz | 3.81 | Quasi Peak | -56.19 |

Other emissions present had amplitudes at least 20 dB below the limit.

**Table 3 AC Line Conducted Emissions Data L2**

| Trace | Frequency | Level (dBµV) | Detector | Delta Limit/dB |
|---|---|---|---|---|
| 2 | 150.000000000 kHz | 22.41 | Average | -33.59 |
| 1 | 170.000000000 kHz | 35.63 | Quasi Peak | -29.34 |
| 2 | 198.000000000 kHz | 19.30 | Average | -34.39 |
| 2 | 250.000000000 kHz | 15.63 | Average | -36.13 |
| 2 | 398.000000000 kHz | 11.29 | Average | -36.61 |
| 1 | 426.000000000 kHz | 20.04 | Quasi Peak | -37.29 |
| 1 | 438.000000000 kHz | 18.16 | Quasi Peak | -38.94 |
| 1 | 542.000000000 kHz | 11.27 | Quasi Peak | -44.73 |
| 1 | 594.000000000 kHz | 11.72 | Quasi Peak | -44.28 |
| 2 | 1.690000000 MHz | 10.34 | Average | -35.66 |
| 2 | 19.967900000 MHz | 13.60 | Average | -36.40 |
| 1 | 19.967900000 MHz | 22.29 | Quasi Peak | -37.71 |

Other emissions present had amplitudes at least 20 dB below the limit.

### *Summary of Results for AC Line Conducted Emissions Results*

The EUT demonstrated compliance with the AC Line Conducted Emissions requirements of 47CFR Part 15C, RSS-210 and other applicable emissions requirements. The worst-case configuration demonstrated a minimum margin of -27.5 dB below the requirement. Other emissions were present with amplitudes at least 20 dB below the limit and worst-case amplitudes recorded.

### *General Radiated Emissions Procedure*

The EUT was arranged in typical equipment configurations and operated through available modes during testing. Preliminary testing was performed in a screen room with the EUT positioned 1 meter from the FSM. Radiated emissions measurements were performed to identify the frequencies which produced the highest emissions. Each radiated emission was then maximized at the OATS location before final radiated measurements were performed. Final data was taken with the EUT located at the OATS at a distance of 3 meters between the EUT and the receiving antenna. The frequency spectrum from 9 kHz to 100,000 MHz was searched for general radiated emissions. Measured emission levels were maximized by EUT placement on the table, rotating the turntable through 360 degrees, varying the antenna height between 1 and 4 meters above the ground plane and changing antenna position between horizontal and vertical polarization. Antennas used were Loop from 9 kHz to 30 MHz, Broadband Biconical from 30 to 200 MHz, Biconilog from 30 to 1000 MHz, Log Periodic from 200 MHz to 1 GHz and or double Ridge or pyramidal horns and mixers above 1 GHz, notch filters and appropriate amplifiers and external mixers were utilized.

**Table 4 General Radiated Emissions Data**

| Frequency (MHz) | Horizontal Peak (dBµV/m) | Horizontal Quasi-Peak (dBµV/m) | Vertical Peak (dBµV/m) | Vertical Quasi-Peak (dBµV/m) | FCC/ISED Limit @ 3m (dBµV/m) | Horizontal Margin (dB) | Vertical Margin (dB) |
|---|---|---|---|---|---|---|---|
| 70.2 | 37.9 | 27.4 | 33.9 | 26.8 | 40.0 | -12.6 | -13.2 |
| 77.1 | 41.8 | 27.0 | 38.4 | 27.4 | 40.0 | -13.0 | -12.6 |
| 81.6 | 38.4 | 25.2 | 38.0 | 25.1 | 40.0 | -14.8 | -14.9 |
| 82.6 | 33.6 | 23.9 | 38.7 | 26.2 | 40.0 | -16.1 | -13.8 |
| 120.0 | 39.0 | 27.5 | 39.0 | 24.1 | 40.0 | -12.5 | -15.9 |
| 125.0 | 39.0 | 30.6 | 35.0 | 26.7 | 40.0 | -9.4 | -13.3 |
| 167.0 | 33.0 | 17.0 | 28.0 | 15.9 | 40.0 | -23.0 | -24.1 |
| 367.6 | 31.1 | 15.3 | 30.0 | 20.4 | 47.0 | -31.7 | -26.6 |
| 500.1 | 25.1 | 18.0 | 33.0 | 23.7 | 47.0 | -29.0 | -23.3 |
| 512.0 | 30.0 | 19.0 | 30.0 | 20.1 | 47.0 | -28.0 | -26.9 |
| 680.0 | 28.6 | 21.8 | 29.7 | 21.8 | 47.0 | -25.2 | -25.2 |

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

### *Summary of Results for General Radiated Emissions*

The EUT demonstrated compliance with the radiated emissions requirements of 47CFR Part 15C paragraph 15.209, RSS-210 Issue 10, and RSS-GEN Intentional Radiators. The EUT demonstrated a minimum margin of -9.4 dB below the requirements. Other emissions were present with amplitudes at least 20 dB below the Limits.

### *Operation in the Band 24.075–24.175 GHz*

The transmitter output power and emissions were measured on an Open Area Test Site @ 3 meters. The EUT was placed on a turntable elevated as required above the ground plane and at a distance of 3 meters from the FSM antenna. The peak and quasi-peak amplitude of frequencies below 1000 MHz were measured using a spectrum analyzer. The peak and average amplitude of frequencies above 1000 MHz were measured using a spectrum analyzer. The amplitude of each emission was then recorded from the analyzer display. Emissions radiated outside of the specified bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits, whichever is the lesser attenuation. The amplitude of each radiated emission was measured on the OATS at a distance of 3 meters from the FSM antenna testing was performed on sample representative of production with worst-case data provided. The amplitude of each radiated emission was maximized by equipment orientation and placement on the turn table, raising and lowering the FSM (Field Strength Measuring) antenna, changing the FSM antenna polarization, and by rotating the turntable. A Loop antenna was used for measuring emissions from 0.009 to 30 MHz, Biconilog Antenna for 30 to 1000 MHz, Double-Ridge, and/or Pyramidal Horn Antennas from 1 GHz to 40 GHz. Emissions were measured in dBµV/m @ 3 meters. External mixers were used to measure the harmonic emissions.

Refer to figures 3 through 5 showing plots taken of the 24.075-24.175 GHz transmitter operation.

**Figure 3 Plot of Transmitter Emissions Operation in 24.075-24.175 GHz**

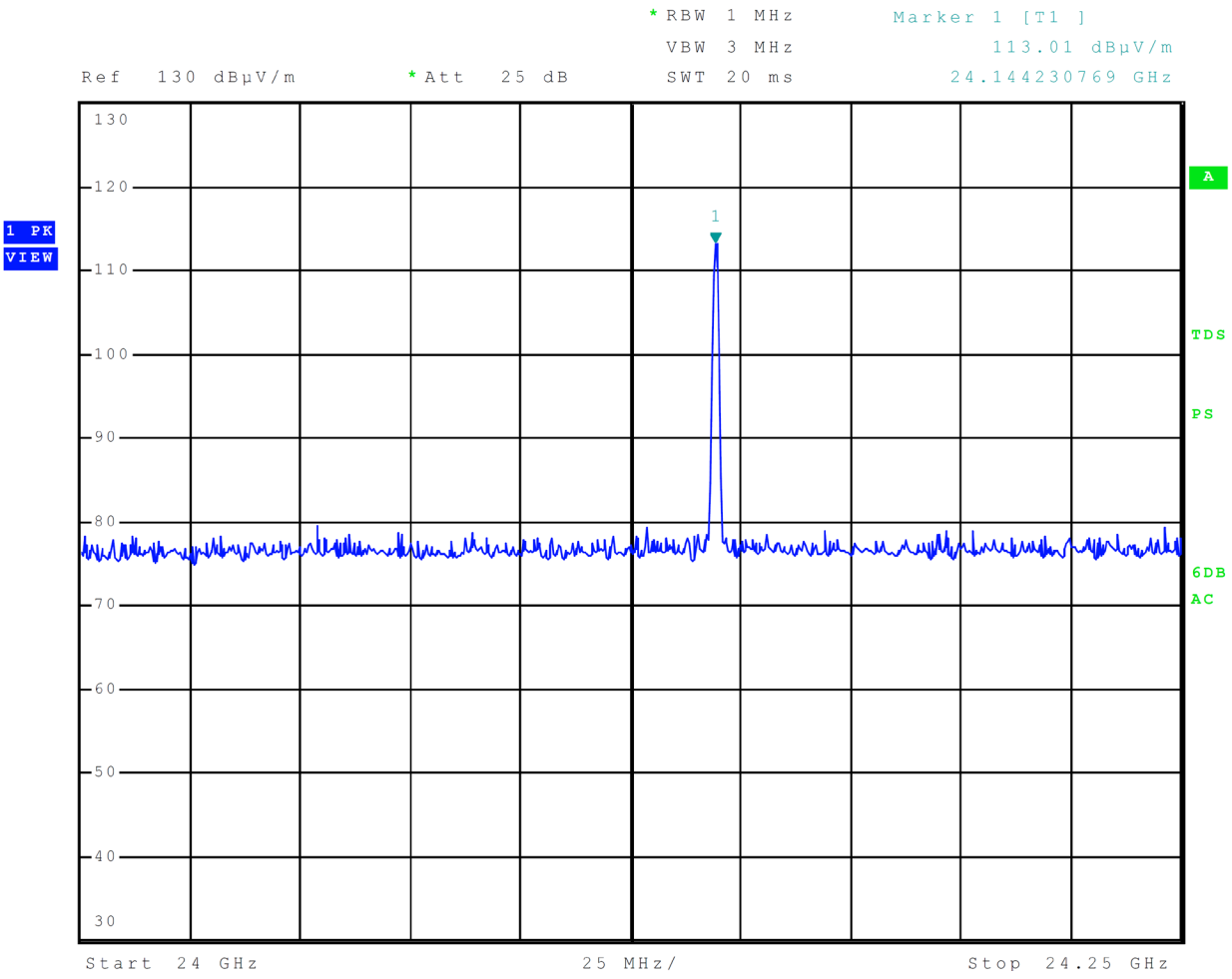


**Figure 4 Plot of Transmitter Emissions 99% Occupied Bandwidth**

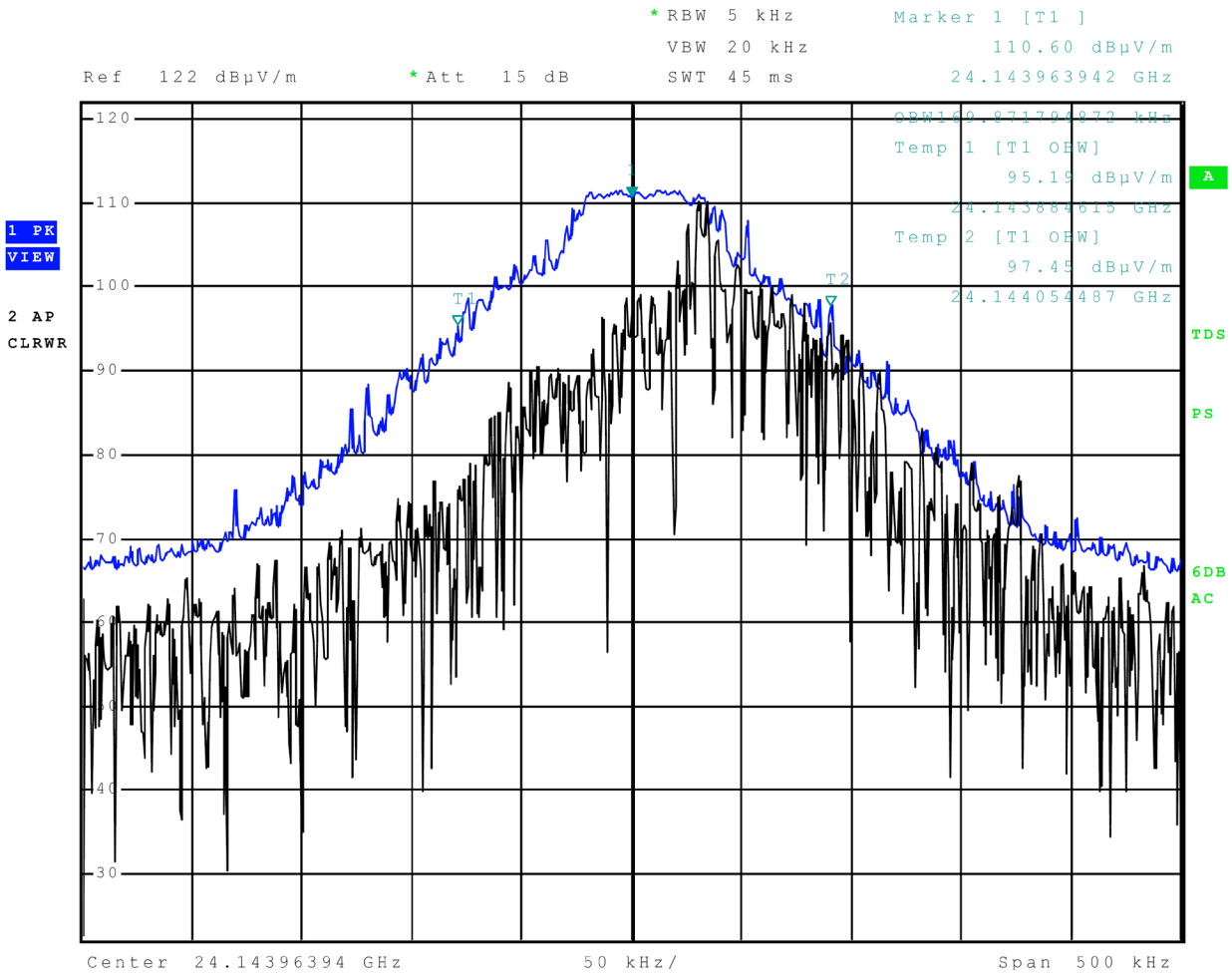
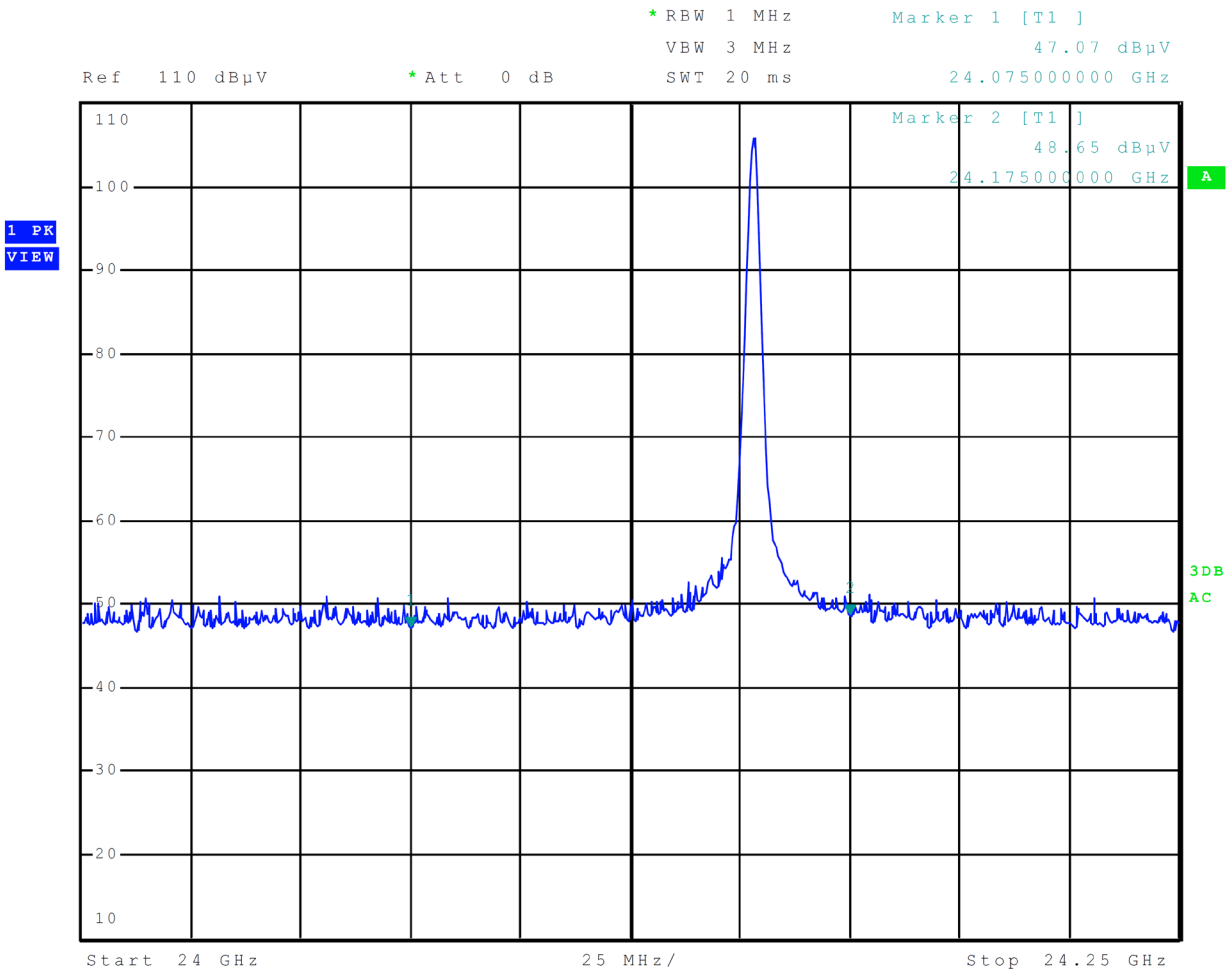


**Figure 5 Plot of Transmitter Emissions Out of Band**



### *Transmitter Emissions Data*

**Table 5 Transmitter Radiated Emissions**

| Frequency in MHz | Horizontal Peak (dBµV/m) | Horizontal Average (dBµV/m) | Vertical Peak (dBµV/m) | Vertical Average (dBµV/m) | Limit @ 3m (dBµV/m) | Horizontal Margin (dB) | Vertical Margin (dB) |
|---|---|---|---|---|---|---|---|
| 24,149.2 | 113.0 | 112.8 | 87.6 | 85.9 | 128.0 | -15.2 | -42.1 |
| 48,298.4 | 36.0 | 25.0 | 35.0 | 24.8 | 68.0 | -43.0 | -43.2 |
| 72,447.6 | 42.2 | 30.6 | 42.9 | 30.3 | 68.0 | -37.4 | -37.7 |
| 96,596.8 | 52.5 | 39.3 | 52.0 | 39.4 | 68.0 | -28.7 | -28.6 |

Other emissions present had amplitudes at least 20 dB below the limit. Peak and Quasi-Peak amplitude emissions are recorded for frequency range below 1000 MHz. Peak and Average amplitude emissions are recorded for frequency range above 1000 MHz.

### *Summary of Results for Transmitter Radiated Emissions of Intentional Radiator*

The EUT demonstrated compliance with the radiated emissions requirements of FCC 47CFR Part 15.245, Industry Canada RSS-210 Issue 10, and RSS-GEN Issue 5 Intentional Radiator regulations. The EUT worst-case test sample configuration demonstrated minimum average margin of -15.2 dB below the average emission limit for the fundamental. The EUT worst-case configuration demonstrated minimum radiated harmonic emission margin of -28.6 dB below the limit. No other radiated emissions were found in the restricted bands less than 20 dB below limits than those recorded in this report. Other emissions were present with amplitudes at least 20 dB below the limits.

## Annex

- Annex A Measurement Uncertainty Calculations
- Annex B Test Equipment
- Annex C Rogers Qualifications
- Annex D Rogers Labs Certificate of Accreditation

## *Annex A Measurement Uncertainty Calculations*

The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4. The results of measurement uncertainty calculations are recorded below. Component and process variability of production devices similar to those evaluated may result in additional deviations. The manufacturer has the sole responsibility of continued compliance.

| Measurement | Expanded Measurement Uncertainty $U_{(lab)}$ |
|---|---|
| 3 Meter Horizontal 0.009-1000 MHz Measurements | 4.16 |
| 3 Meter Vertical 0.009-1000 MHz Measurements | 4.33 |
| 3 Meter Measurements 1-18 GHz | 5.14 |
| 3 Meter Measurements 18-40 GHz | 5.16 |
| 10 Meter Horizontal Measurements 0.009-1000 MHz | 4.15 |
| 10 Meter Vertical Measurements 0.009-1000 MHz | 4.32 |
| AC Line Conducted | 1.75 |
| Antenna Port Conducted power | 1.17 |
| Frequency Stability | 1.00E-11 |
| Temperature | 1.6˚C |
| Humidity | 3% |

## *Annex B Test Equipment List*

| Equipment | Manufacturer | Model (SN) | Band | Cal Date(m/d/y) | Due |
|---|---|---|---|---|---|
| ☒ LISN | FCC | FCC-LISN-50-25-10(1PA) (160611) | .15-30MHz | 3/28/2023 | 3/28/2024 |
| ☒ LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08 | | | | 3/28/2023 | 3/28/2024 |
| ☒ Cable | Huber & Suhner Inc. | Sucoflex102ea(L10M)(303073) | 9kHz-40 GHz | 10/11/2022 | 10/11/2023 |
| ☐ Cable | Huber & Suhner Inc. | Sucoflex102ea(1.5M)(303069) | 9kHz-40 GHz | 10/11/2022 | 10/11/2023 |
| ☒ Cable | Huber & Suhner Inc. | Sucoflex102ea(1.5M)(303070) | 9kHz-40 GHz | 10/11/2022 | 10/11/2023 |
| ☒ Cable | Belden | RG-58 (L1-CAT3-11509) | 9kHz-30 MHz | 10/11/2022 | 10/11/2023 |
| ☐ Cable | Belden | RG-58 (L2-CAT3-11509) | 9kHz-30 MHz | 10/11/2022 | 10/11/2023 |
| ☒ Antenna | Com Power | AL-130 (121055) | .001-30 MHz | 10/11/2022 | 10/11/2023 |
| ☐ Antenna: | EMCO | 6509 | .001-30 MHz | 10/14/2020 | 10/11/2023 |
| ☐ Antenna | ARA | BCD-235-B (169) | 20-350MHz | 10/11/2022 | 10/11/2023 |
| ☒ Antenna | Sunol | JB-6 (A100709) | 30-1000 MHz | 10/11/2022 | 10/11/2023 |
| ☐ Antenna | ETS-Lindgren | 3147 (40582) | 200-1000MHz | 10/11/2022 | 10/11/2024 |
| ☒ Antenna | ETS-Lindgren | 3117 (200389) | 1-18 GHz | 3/28/2022 | 3/29/2024 |
| ☐ Antenna | Com Power | AH-118 (10110) | 1-18 GHz | 10/11/2022 | 10/11/2024 |
| ☒ Antenna | Com Power | AH-840 (101046) | 18-40 GHz | 3/27/2023 | 3/27/2025 |
| ☒ Analyzer | Rohde & Schwarz | ESU40 (100108) | 20Hz-40GHz | 6/26/2023 | 6/26/2024 |
| ☒ Analyzer | Rohde & Schwarz | ESW44 (101534) | 20Hz-44GHz | 1/25/2023 | 1/25/2024 |
| ☒ Analyzer | Rohde & Schwarz | FS-Z60, 90, 140, and 220 | 40GHz-220GHz | 12/22/2017 | 12/22/2027 |
| ☒ Amplifier | Com-Power | PA-010 (171003) | 100Hz-30MHz | 10/11/2022 | 10/11/2023 |
| ☒ Amplifier | Com-Power | CPPA-102 (01254) | 1-1000 MHz | 10/11/2022 | 10/11/2023 |
| ☒ Amplifier | Com-Power | PAM-118A (551014) | 0.5-18 GHz | 10/11/2022 | 10/11/2023 |
| ☒ Amplifier | Com-Power | PAM-840A (461328) | 18-40 GHz | 10/11/2022 | 10/11/2023 |
| ☐ Pwr Sensor | Rohde & Schwarz | NRP33T | 0.05-33 GHz | 8/31/2022 | 8/31/2023 |
| ☐ Power Meter | Agilent | N1911A with N1921A | 0.05-40 GHz | 3/28/2023 | 3/28/2025 |
| ☐ Generator | Rohde & Schwarz | SMB100A6 (100150) | 20Hz-6 GHz | 3/28/2023 | 3/28/2024 |
| ☐ Generator | Rohde & Schwarz | SMBV100A6 (260771) | 20Hz-6 GHz | 3/28/2023 | 3/28/2024 |
| ☐ RF Filter | Micro-Tronics | BRC50722 (009).9G notch | 30-18000 MHz | 3/28/2023 | 3/28/2025 |
| ☐ RF Filter | Micro-Tronics | HPM50114 (017)1.5G HPF | 30-18000 MHz | 3/28/2023 | 3/28/2025 |
| ☐ RF Filter | Micro-Tronics | HPM50117 (063) 3G HPF | 30-18000 MHz | 3/28/2023 | 3/28/2025 |
| ☐ RF Filter | Micro-Tronics | HPM50105 (059) 6G HPF | 30-18000 MHz | 3/28/2023 | 3/28/2025 |
| ☐ RF Filter | Micro-Tronics | BRM50702 (172) 2G notch | 30-18000 MHz | 3/28/2023 | 3/28/2025 |
| ☐ RF Filter | Micro-Tronics | BRC50703 (G102) 5G notch | 30-18000 MHz | 3/28/2023 | 3/28/2025 |
| ☐ RF Filter | Micro-Tronics | BRC50705 (024) 5G notch | 30-18000 MHz | 3/28/2023 | 3/28/2025 |
| ☐ Attenuator | Fairview | SA6NFNF100W-40 (1625) | 30-18000 MHz | 3/28/2023 | 3/28/2024 |
| ☐ Attenuator | Mini-Circuits | VAT-3W2+ (1436) | 30-6000 MHz | 3/28/2023 | 3/28/2024 |
| ☐ Attenuator | Mini-Circuits | VAT-3W2+ (1445) | 30-6000 MHz | 3/28/2023 | 3/28/2024 |
| ☐ Attenuator | Mini-Circuits | VAT-3W2+ (1735) | 30-6000 MHz | 3/28/2023 | 3/28/2024 |
| ☐ Attenuator | Mini-Circuits | VAT-6W2+ (1438) | 30-6000 MHz | 3/28/2023 | 3/28/2024 |
| ☐ Attenuator | Mini-Circuits | VAT-6W2+ (1736) | 30-6000 MHz | 3/28/2023 | 3/28/2024 |
| ☒ Weather station | Davis | 6312 (A81120N075) | | 10/11/2022 | 10/11/2023 |

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| List of Test Equipment | | | Calibration Date (m/d/y) | Due |
|---|---|---|---|---|
| ☐ Frequency Counter: Leader LDC-825 (8060153 | | | 3/28/2023 | 3/28/2025 |
| ☐ ISN: | Com-Power Model ISN T-8 | | 3/28/2023 | 3/28/2024 |
| ☐ LISN | Compliance Design | FCC-LISN-2.Mod.cd,(126) .15-30MHz | 10/11/2022 | 10/11/2024 |
| ☐ LISN: | Com-Power Model LI-220A | | 3/29/2023 | 3/29/2025 |
| ☐ LISN: | Com-Power Model LI-550C | | 10/11/2022 | 10/11/2024 |
| ☐ Cable | Huber & Suhner Inc. | Sucoflex102ea(1.5M)(303072) 9kHz-40 GHz | 10/11/2022 | 10/11/2023 |
| ☐ Cable | Huber & Suhner Inc. | Sucoflex102ea(L1M)(281183) 9kHz-40 GHz | 10/11/2022 | 10/11/2023 |
| ☐ Cable | Huber & Suhner Inc. | Sucoflex102ea(L4M)(281184) 9kHz-40 GHz | 10/11/2022 | 10/11/2023 |
| ☐ Cable | Huber & Suhner Inc. | Sucoflex102ea(L10M)(317546)9kHz-40 GHz | 10/11/2022 | 10/11/2023 |
| ☐ Cable | Time Microwave | 4M-750HF290-750 (4M) 9kHz-24 GHz | 10/11/2022 | 10/11/2023 |
| ☐ RF Filter | Micro-Tronics | BRC17663 (001) 9.3-9.5 notch 30-1800 MHz | 3/28/2023 | 3/28/2025 |
| ☐ RF Filter | Micro-Tronics | BRC19565 (001) 9.2-9.6 notch 30-1800 MHz | 3/28/2023 | 3/28/2025 |
| ☐ Analyzer | HP | 8562A (3051A05950) 9kHz-125GHz | 3/28/2023 | 3/28/2024 |
| ☐ Wave Form Generator Keysight | | 33512B (MY57400128) | 3/29/2022 | 3/29/2024 |
| ☐ Antenna: | Solar 9229-1 & 9230-1 | | 2/18/2023 | 2/18/2024 |
| ☐ CDN: | Com-Power Model CDN325E | | 10/11/2022 | 10/11/2024 |
| ☐ Oscilloscope Scope: Tektronix MDO 4104 | | | 2/18/2023 | 2/18/2024 |
| ☐ EMC Transient Generator HVT TR 3000 | | | 2/18/2023 | 2/18/2024 |
| ☐ AC Power Source (Ametech, California Instruments) | | | 2/18/2023 | 2/18/2024 |
| ☐ Field Intensity Meter: EFM-018 | | | 2/18/2023 | 2/18/2024 |
| ☐ ESD Simulator: MZ-15 | | | 2/18/2023 | 2/18/2024 |
| ☐ Injection Clamp Luthi Model EM101 | | | not required | |
| ☐ R.F. Power Amp ACS 230-50W | | | not required | |
| ☐ R.F. Power Amp EIN Model: A301 | | | not required | |
| ☐ R.F. Power Amp A.R. Model: 10W 1010M7 | | | not required | |
| ☐ R.F. Power Amp A.R. Model: 50U1000 | | | not required | |
| ☐ Temperature Chamber | | | not required | |
| ☒ Shielded Room | | | not required | |

## *Annex C Rogers Qualifications*

***Scot D. Rogers, Engineer***

**Rogers Labs, Inc.**

Mr. Rogers has over 37 years' experience in the field of electronics. Engineering experience includes six years in the automated controls industry and remaining years working with the design, development and testing of radio communications and electronic equipment.

Positions Held:

Systems Engineer: A/C Controls Mfg. Co., Inc.

Electrical Engineer: Rogers Consulting Labs, Inc.

Electrical Engineer: Rogers Labs, Inc. Current

Educational Background:

Bachelor of Science Degree in Electrical Engineering from Kansas State University

Bachelor of Science Degree in Business Administration Kansas State University

Several Specialized Training courses and seminars pertaining to Microprocessors and Software programming

NVLAP Lab Code 200087-0

## *Annex D Laboratory Certificate of Accreditation*

United States Department of Commerce
National Institute of Standards and Technology

# Certificate of Accreditation to ISO/IEC 17025:2017

**NVLAP LAB CODE: 200087-0**

**Rogers Labs, Inc.**
Louisburg, KS

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:*

**Electromagnetic Compatibility & Telecommunications**

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2023-03-16 through 2024-03-31
*Effective Dates*

*For the National Voluntary Laboratory Accreditation Program*