NVLAP Lab Code 200087-0

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47CFR, PART 15C - Intentional Radiators
47CFR Paragraph 15.249 and
Industry Canada RSS-GEN Issue 5 and RSS-210 Issue 11
Application For Grant of Certification

Model: A04664

2402-2480 MHz
Low Power Digital Transmitter (DXX)

FCC ID: IPH-04664
IC: 1792A-04664

Garmin International, Inc.

1200 East 151st Street
Olathe, KS 66062

Test Report Number: 241104
Test Date: November 4, 2024 – December 5, 2024

Authorized Signatory:

Patrick Powell
Rogers Labs, a division of The Compatibility Center LLC
FCC Designation: US5305
ISED Registration: 3041A

Revisions

Revision 1 Issued March 13, 2025

Executive Summary

License Exempt Digital Transmission System Intentional Radiator operating under Title 47 Code of Federal Regulations (47 CFR) Paragraph 15.249 and Industry Canada RSS-210 Issue 11 and RSS-GEN Issue 5, Low Power (DXX) Digital Device transmitter operations in the 2400 – 2483.5 MHz frequency band.

Name of Applicant: Garmin International, Inc.
1200 East 151st Street
Olathe, KS 66062

PMN: A04664
FCC ID: IPH-04664 IC: 1792A-04664
Operating Frequency Range: 2402-2480 MHz

A04664 was chosen for transmitter configuration testing and used for final measurements.

Operational communication mode 1

Mode	Peak Power (dBµV/m@3m)	Average power (dBµV/m@3m)	Limit@3m (dBuV/m)	Margin	99% OBW (kHz)
Mode 1, ANT (GFSK)	97.2	66.3	94.0	-27.7	986.3

This report addresses EUT Operations as Low Power Transmitter (DXX) using transmitter modulation mode 1. Note, the production device utilizes an integral antenna system with the 2.4 GHz non-user accessible providing 1.00 dBi gain.

Opinion / Interpretation of Results

Tests Performed	Margin (dB)	Results
Restricted Bands 47 CFR 15.205, RSS-210 8.1	-6.1	Complies
Conducted Emissions per 47CFR 15.207, RSS-GEN 8.8	-15.11	Complies
Radiated Emissions 47 CFR 15.209, RSS-GEN 8.9	-1.8	Complies
Harmonic Emissions per 47 CFR 15.249, RSS-210 B.10	-1.0	Complies

Equipment Tested

Model: A04664

Garmin International, Inc.

1200 East 151st Street

Olathe, KS 66062

Equipment	Model / PN	Serial Number
EUT #1 Radiated	A04664	8NN000083
EUT #2 Antenna Port Conducted	A04664	8NN000252
AC/DC Wall mount power supply	362-00118-00	N/A
USB-C to C Cable, USB 2.0 with TCO, 0.5m	320-01643-0A	N/A
Laptop Computer	Latitude 7480	EFSPSN2

Test results in this report relate only to the items tested. Worst-case configuration data recorded in this report.

The design may operate one transmitter chain at a time and is not capable of simultaneous transmission on more than one port.

Software (FVIN): 5.10 or higher; Antennas: ANT PIFA (1.00 dBi), BLE PIFA (1.17 dBi), 2.4 GHz WiFi PIFA (1.17 dBi), 5.1 GHz PIFA (0.05 dBi), 5.7 GHz PIFA (0.05 dBi)

Equipment Operational Modes

Mode	Transmitter Operation
mode 1	ANT (GFSK)
mode 2	BT BLE (GMSK)
mode 3	802.11b
mode 4	802.11g
mode 5	802.11n
mode 6	U-NII-1 802.11a
mode 7	U-NII-1 802.11n
mode 8	U-NII-1 802.11n40
mode 9	U-NII-1 802.11ac40
mode 10	U-NII-1 802.11ac80
mode 11	U-NII-3 802.11a
mode 12	U-NII-3 802.11n
mode 13	U-NII-3 802.11n40
mode 14	U-NII-3 802.11ac40
mode 15	U-NII-3 802.11ac80

Equipment Function

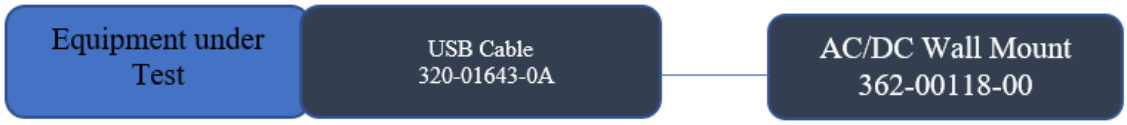
The EUT is a mobile mounted, digital recording device incorporating wireless data transfer. The device incorporates a camera sensor and associated circuitry to record images within the lens view angle. The design incorporates transmitter circuitry operating in the 2402-2480, 5150-5250, and 5725-5850 MHz frequency bands. The product operates from the internal battery or external direct current power provided over the USB-C port. Power is provided through compatible USB interface cable options and power sources. The design provides a Micro SD Card slot and USB-C interface port as presented below and wireless communications with compatible equipment. The EUT was arranged as described by the manufacturer emulating typical user configurations for testing purposes. The EUT offers no other interface connections other than those presented in the configuration options as described by the manufacturer and presented below. During testing, the test system was configured to operate in a manufacturer defined mode. As requested by the manufacturer, the equipment was tested for emissions compliance using the available configurations with the worst-case data presented. Test results in this report relate only to the products described in this report.

Equipment Configuration

1) EUT operating off internal battery

2) EUT connected to Computer USB port through cable assembly.

3) EUT connected to DC Through USB cable connected to AC/DC Wall mount power supply.



Applicable Standards

The following information is submitted in accordance with the eCFR Title 47 Code of Federal Regulations (47CFR), dated October 18, 2024: Part 2, Subpart J, Part 15C Paragraph 15.249, Industry Canada RSS-210 Issue 11, and RSS-GEN Issue 5. Test procedures used are the established Methods of Measurement of Radio-Noise Emissions as described in ANSI C63.10-2013. This report documents compliance with the EUT operations as Low Power Transmitter (DXX).

Equipment Testing Procedures

AC Line Conducted Emission Test Procedure

Testing for the AC line-conducted emissions were performed as required in CFR47 15B, RSS-GEN, and directed in ANSI C63.4-2014. 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 one showing typical test arrangement and photographs in the test setup exhibit for EUT placement used during testing.

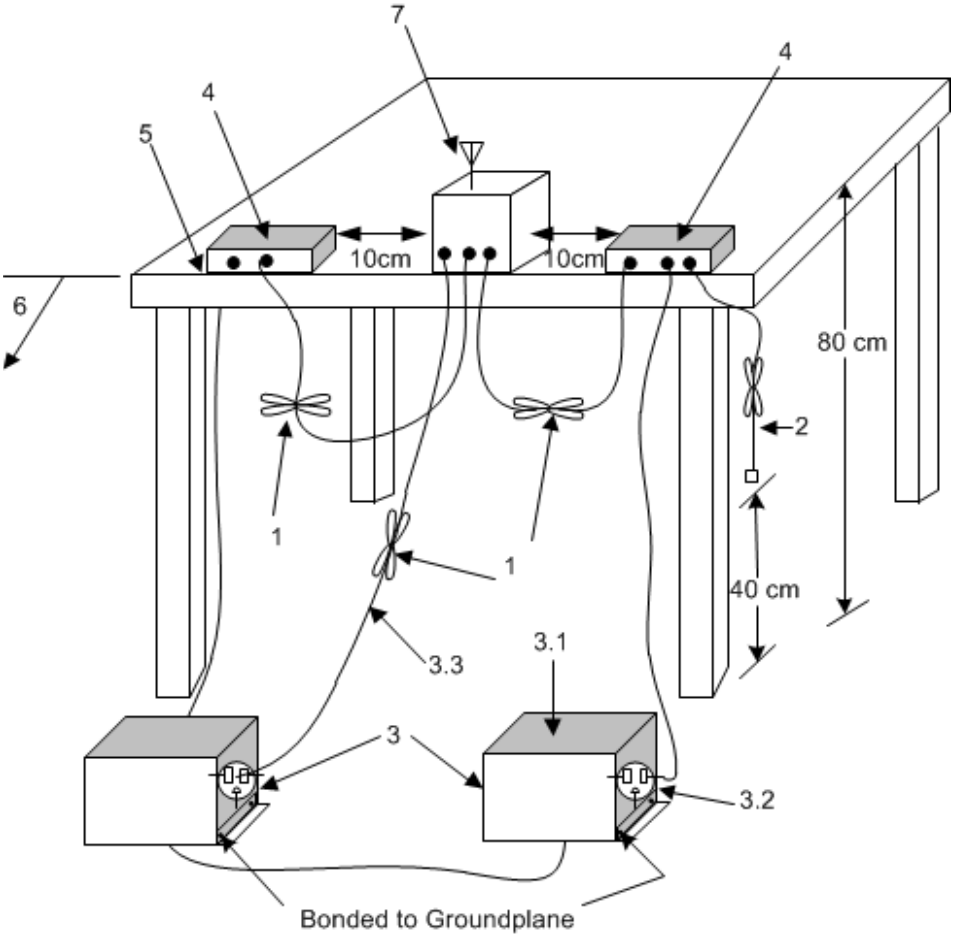
Radiated Emission Test Procedure

Radiated emissions testing was performed as required in 47 CFR 15C, RSS-210 Issue 11, 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 25,000 MHz was searched for emissions during preliminary investigation. Refer to diagrams one and two showing typical test setup. Refer to photographs in the test setup exhibits for specific EUT placement during testing.

Antenna Port Conducted Emission Test Procedure

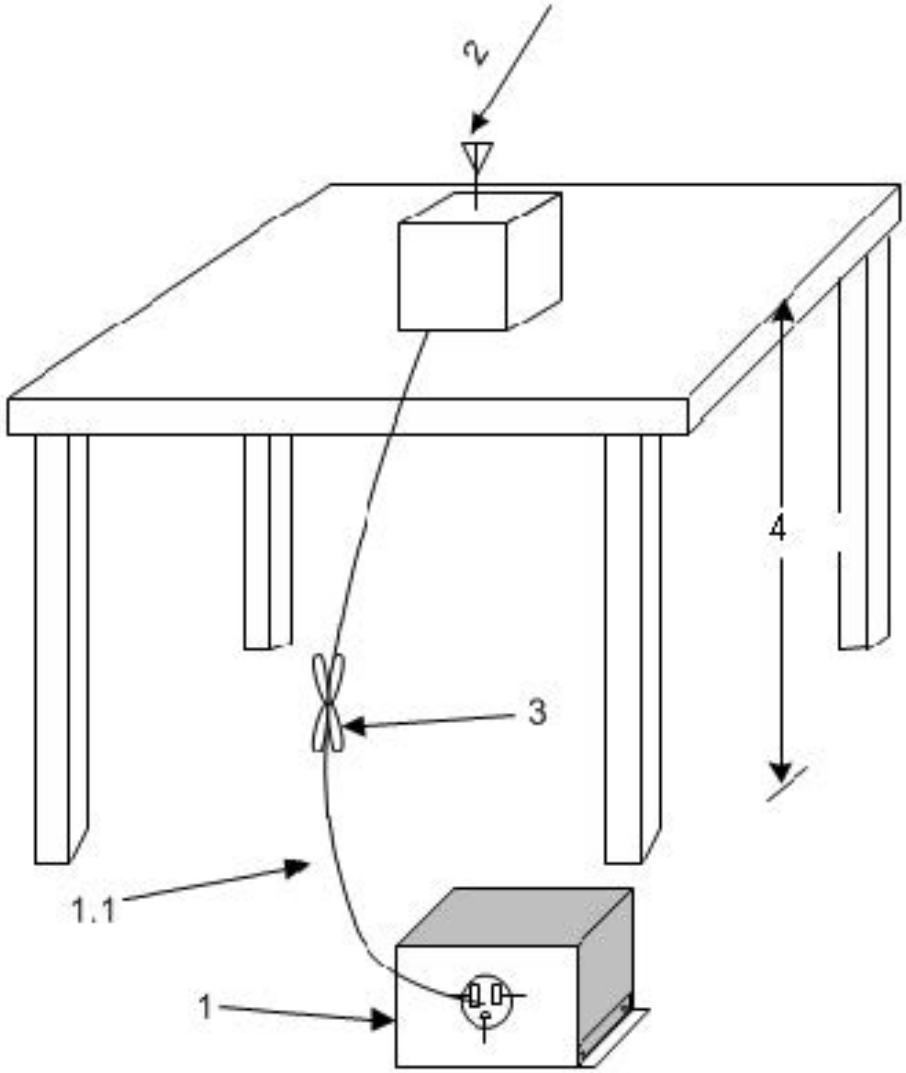
The EUT was assembled as required for operation placed on a benchtop. This configuration provided the ability to connect test equipment to the provided test antenna port Antenna Port conducted emissions testing was performed presented in the regulations and specified in ANSI C63.10-2013. Testing was completed on a laboratory bench in a shielded room. The active antenna port of the device was connected to appropriate attenuation and the spectrum analyzer. Refer to diagram three showing typical test arrangement and photographs in the test setup exhibits for specific EUT placement during testing.

Diagram 1 Test arrangement for power-line 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 6.2.3.1).
2. 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 can 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 Multiple-outlet strip can 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 rear of tabletop (see 6.2.3.1).
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 may be integral or detachable. If detachable, the antenna shall be attached for this test

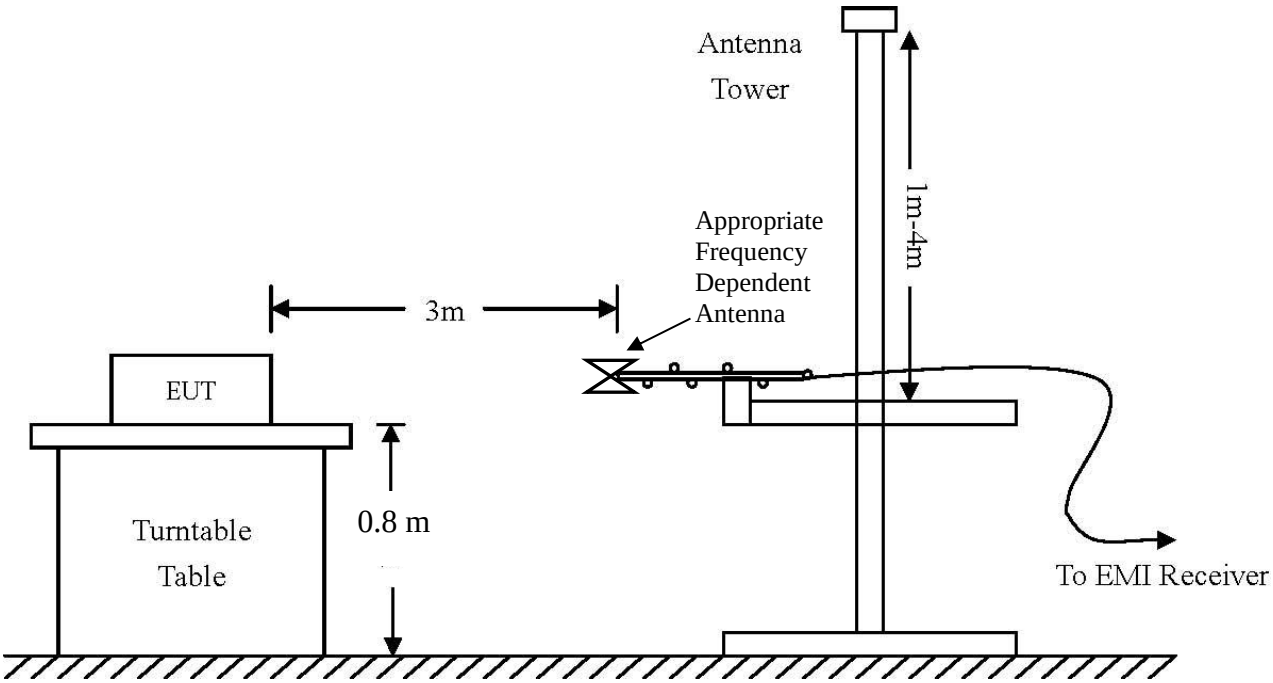
Diagram 2 Test arrangement for radiated emissions of tabletop equipment



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 in Semi-Anechoic Chamber (SAC) or Open Area Test Site (OATS)

Test arrangement for radiated emissions Below 1 GHz



Test arrangement for radiated emissions Above 1 GHz

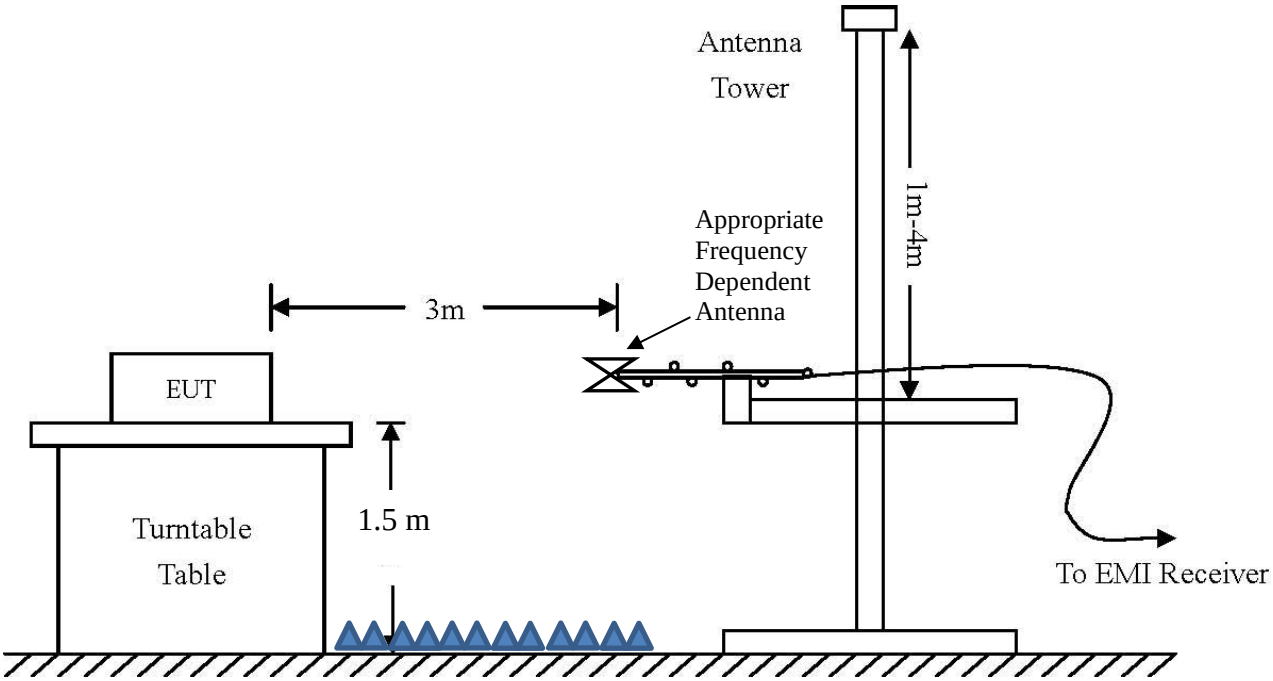
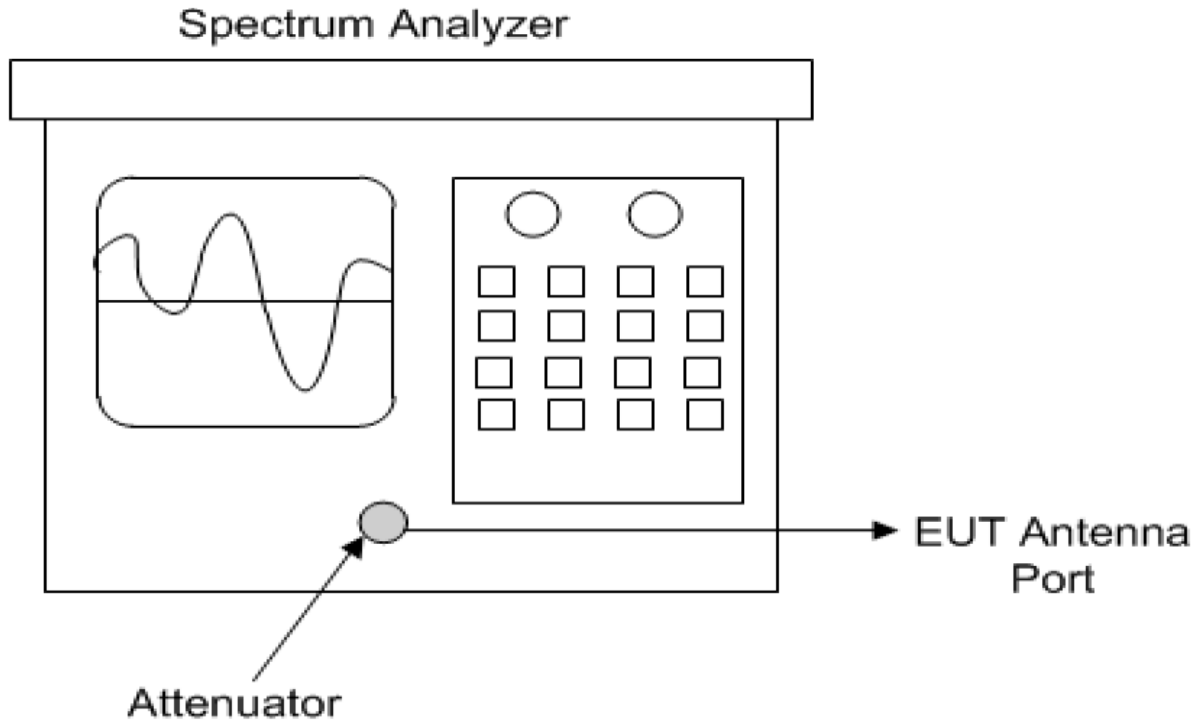


Diagram 4 Test arrangement for Antenna Port Conducted emissions



Test Site Locations

Conducted EMI	AC line conducted emissions testing performed in a shielded screen room located at Rogers Labs, a division of The Compatibility Center LLC, 7915 Nieman Rd., Lenexa, KS (or satellite location).
Antenna port	Antenna port conducted emissions testing was performed in a shielded screen room located at Rogers Labs, a division of The Compatibility Center LLC, 7915 Nieman Rd., Lenexa, KS (or satellite location).
Radiated EMI	The radiated emissions tests were performed at the 3 meters Semi-Anechoic Chamber (SAC) located at Rogers Labs, a division of The Compatibility Center LLC, 7915 Nieman Rd., Lenexa, KS or at the 3 meters Outdoor Area Test Site (OATS) in the satellite location.
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 Semi-Anechoic Chamber 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	20.0° C
Relative Humidity	49.0 %
Atmospheric Pressure	1018.3 mb

Statement of Modifications and Deviations

No modifications to the EUT were required for the equipment to demonstrate compliance with the 47 CFR Part 15C, Industry Canada RSS-210 Issue 11, 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 47 CFR, Subpart C, paragraph 15.249, Industry Canada RSS-210 Issue 11, and RSS-GEN Issue 5.

Per 47 CFR, Subpart A, paragraph 15.31, all testing was performed over three frequencies (1 near top, 1 near middle and 1 near bottom).

Antenna Requirements

The EUT incorporates integral non-user accessible systems. 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 in the 3 meters Semi-Anechoic Chamber (SAC). The EUT utilizes frequency, determining circuitry, which generates harmonics falling in the restricted bands. Emissions were investigated in the 3m SAC, using appropriate antennas or pyramidal horns, amplification stages, and receiver / 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 consider 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 Mode 1 ANT (GFSK)

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)
2390.0	51.3	37.8	51.7	37.9	54.0	-16.2	-16.1
2483.5	53.7	38.6	52.5	38.6	54.0	-15.4	-15.4
4804.0	55.6	37.9	54.0	37.4	54.0	-16.1	-16.6
4914.0	55.7	37.9	52.3	37.1	54.0	-16.1	-16.9
4960.0	51.2	36.8	52.7	37.0	54.0	-17.2	-17.0
7206.0	53.9	40.1	55.1	40.3	54.0	-13.9	-13.7
7371.0	54.2	40.5	54.2	40.4	54.0	-13.5	-13.6
7440.0	53.6	40.3	54.8	40.5	54.0	-13.7	-13.5
12010.0	60.0	46.5	60.6	46.5	54.0	-7.5	-7.5
12285.0	62.0	47.9	61.6	47.9	54.0	-6.1	-6.1
12400.0	61.5	47.7	61.8	47.7	54.0	-6.3	-6.3

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

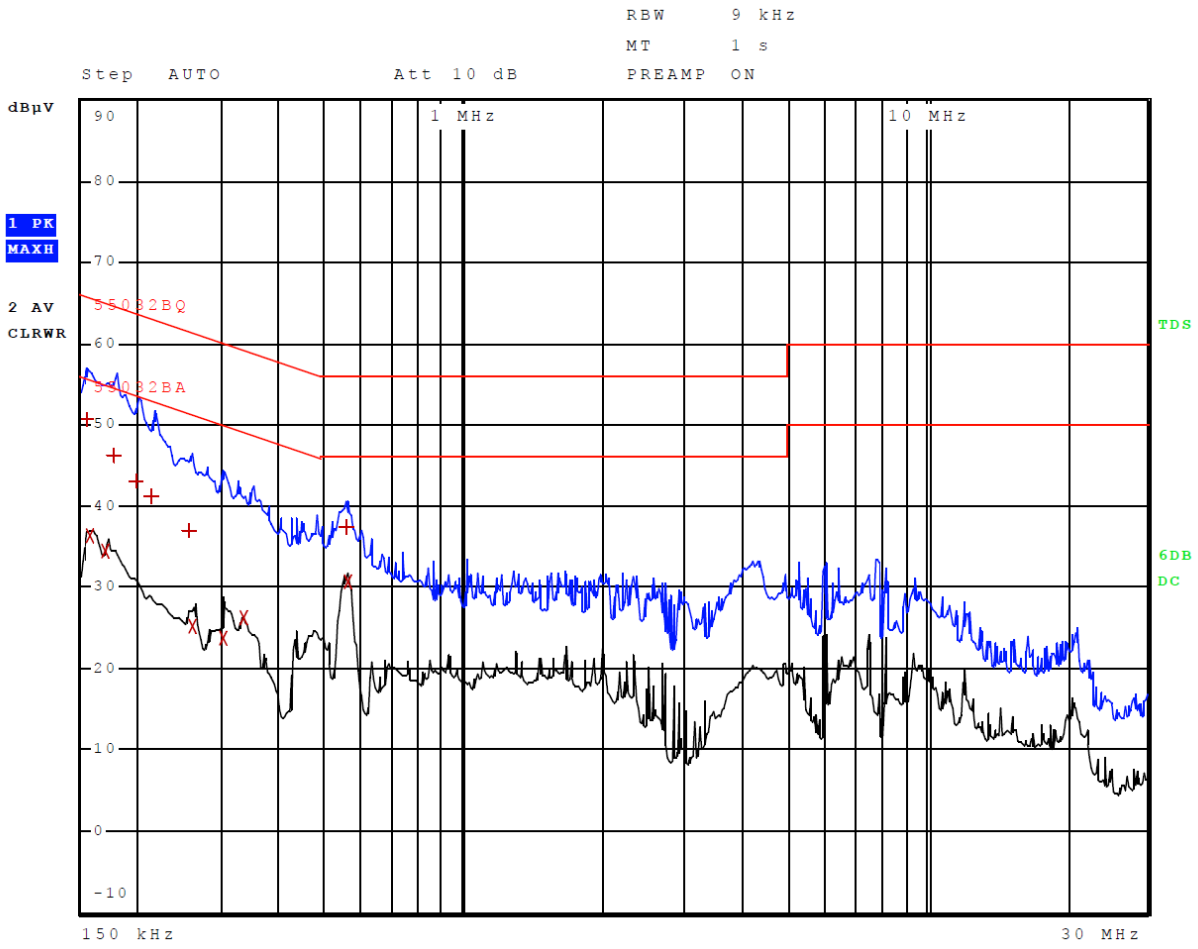
The EUT demonstrated compliance with the radiated emissions requirements of 47CFR Part 15C and RSS-210 Issue 11 Intentional Radiator requirements. The EUT demonstrated a worst-case minimum margin of -6.1 dB below the emissions requirements in restricted frequency bands. Peak, Quasi-peak, and average 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. AC Line Conducted emission 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 C63.10-2013. The EUT was configured as presented in the AC Line conducted configurations as directed by the manufacturer and presented above in equipment configuration. The AC adapter for the EUT was connected to the LISN for AC line-conducted emissions testing. A second LISN was positioned on the floor of the screen room 80-cm from the rear of the supporting equipment of the test configuration. 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.

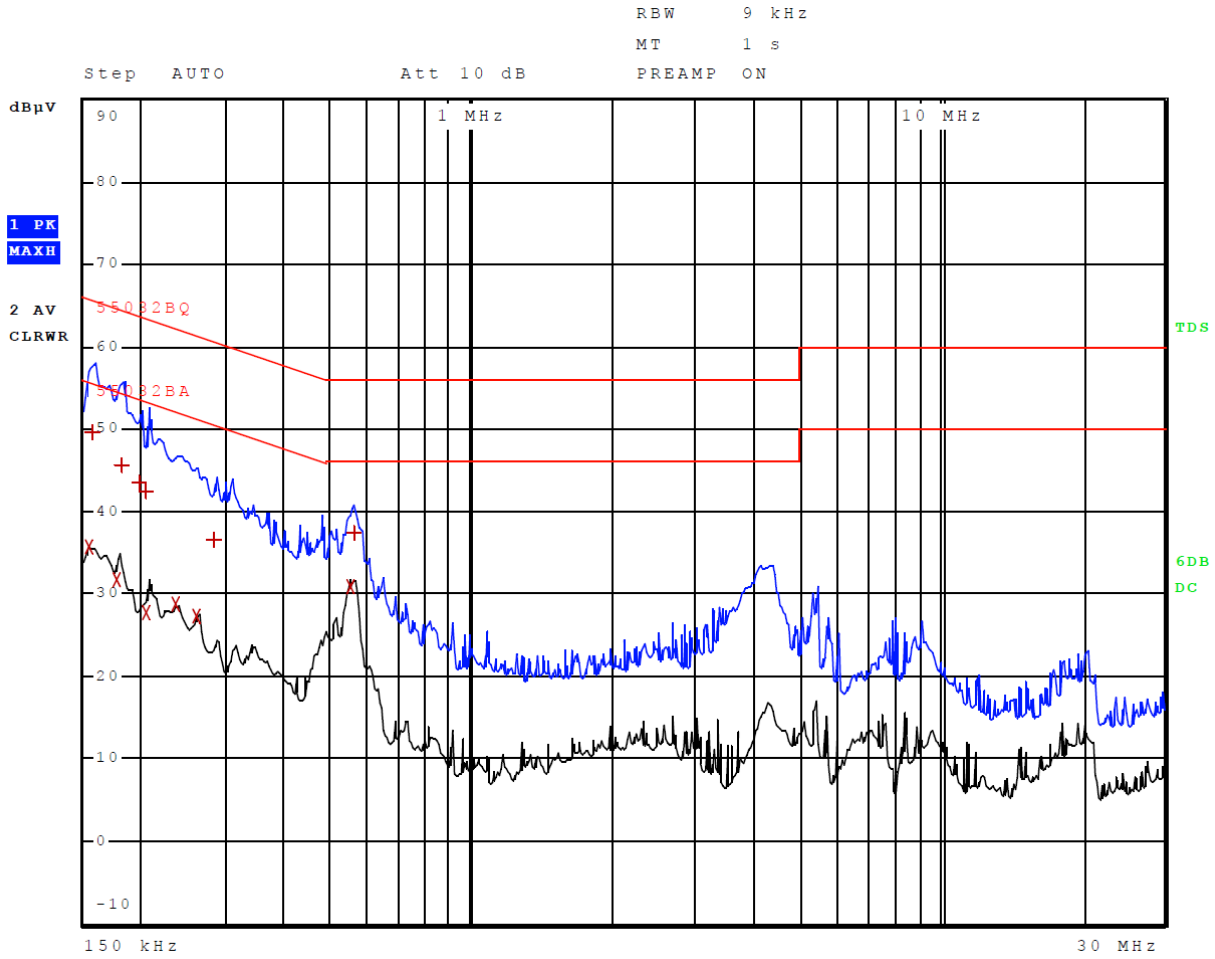
Refer to figure one and two for plots of the Configuration #2 EUT – USB Computer interface AC Line conducted emissions.

Figure 1 AC Line Conducted Emissions Data L1 (#2, EUT – Computer)



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

Figure 2 AC Line Conducted Emissions Data L2 (#2, EUT – Computer)



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

Table 2 AC Line Conducted Emissions Data L1 (#2, EUT – Computer)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
1	154.000000000 kHz	50.57	Quasi Peak	-15.21
2	158.000000000 kHz	36.35	Average	-19.22
2	170.000000000 kHz	34.36	Average	-20.60
1	178.000000000 kHz	46.27	Quasi Peak	-18.30
1	198.000000000 kHz	43.06	Quasi Peak	-20.63
1	214.000000000 kHz	41.19	Quasi Peak	-21.86
1	258.000000000 kHz	36.95	Quasi Peak	-24.55
2	262.000000000 kHz	25.23	Average	-26.14
2	302.000000000 kHz	23.81	Average	-26.38
2	334.000000000 kHz	26.15	Average	-23.20
1	554.000000000 kHz	37.33	Quasi Peak	-18.67
2	562.000000000 kHz	30.71	Average	-15.29

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

Table 3 AC Line Conducted Emissions Data L2 (#2, EUT – Computer)

Trace	Frequency	Level (dBµV)	Detector	Delta Limit/dB
2	154.000000000 kHz	35.70	Average	-20.08
1	158.000000000 kHz	49.52	Quasi Peak	-16.05
2	178.000000000 kHz	31.63	Average	-22.95
1	182.000000000 kHz	45.64	Quasi Peak	-18.75
1	198.000000000 kHz	43.47	Quasi Peak	-20.22
2	206.000000000 kHz	27.62	Average	-25.74
1	206.000000000 kHz	42.45	Quasi Peak	-20.92
2	238.000000000 kHz	28.74	Average	-23.42
2	262.000000000 kHz	27.27	Average	-24.10
1	286.000000000 kHz	36.56	Quasi Peak	-24.08
2	550.000000000 kHz	30.89	Average	-15.11
1	558.000000000 kHz	37.47	Quasi Peak	-18.53

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

Summary of Results for AC Line Conducted Emissions

The EUT demonstrated compliance with the AC Line Conducted Emissions requirements of 47CFR Part 15C and other applicable emissions requirements. The EUT configuration #2 demonstrated a minimum margin of -15.11 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 a manufacturer defined equipment configuration and operated with transmitter active 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 in the SAC before final radiated measurements were performed. Final data was taken with the EUT located in the SAC at 3 meters distance between the EUT and the receiving antenna. The frequency spectrum from 9 kHz to 25,000 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 – Worst Case (Horizontal Polarization)

Frequency (MHz)	Peak (dBµV/m)	Quasi-Peak (dBµV/m)	Limit @ 3m (dBµV/m)	Margin (dBm)
195.2	33.3	26.6	47	-13.5
240.1	27.0	22.8	47	-24.2
480.0	47.4	45.2	47	-1.8
531.0	34.5	26.9	47	-20.1
719.9	38.0	30.1	47	-16.9
960.0	44.0	35.2	47	-11.9

Figure 3 Plot of General Radiated Emissions – Horizontal Polarization

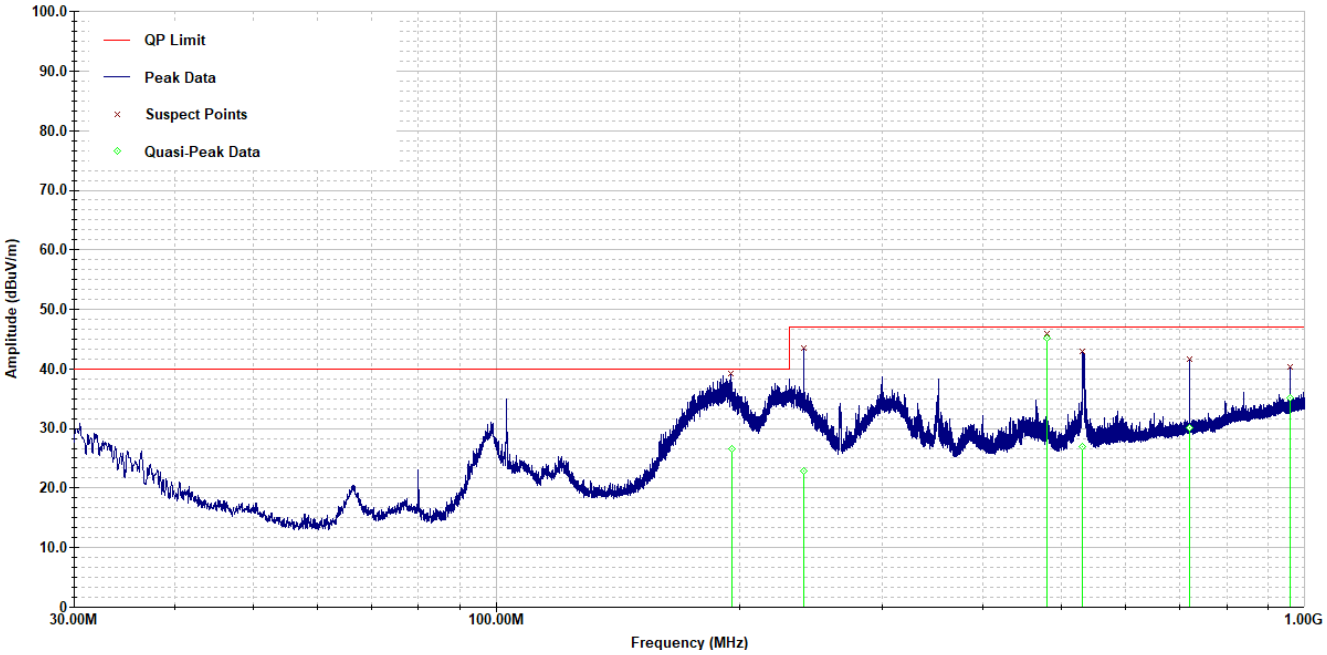
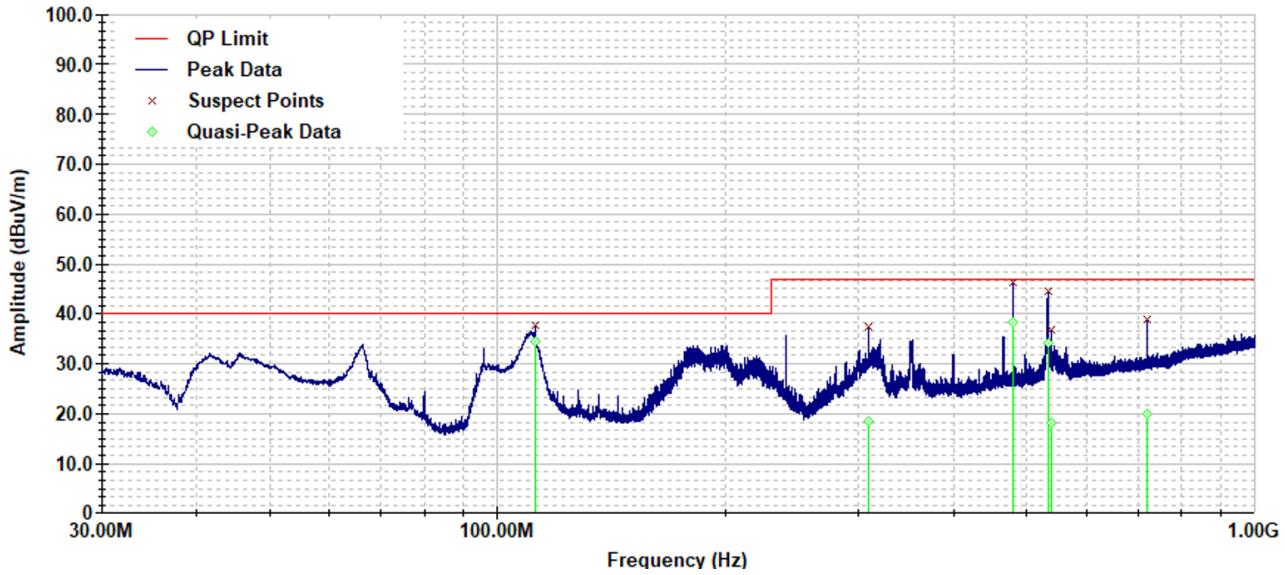


Table 5 General Radiated Emissions Data - Worst Case (Vertical Polarization)

Frequency (MHz)	Peak (dBµV/m)	Quasi-Peak (dBµV/m)	Limit @ 3m (dBµV/m)	Margin (dBm)
112.0	37.7	34.5	40	-5.5
308.5	26.0	18.4	47	-28.6
480.0	24.1	38.3	47	-8.7
532.9	27.3	34.1	47	-12.9
538.1	26.0	18.3	47	-28.7
720.0	27.7	20.0	47	-27.0

Figure 4 Plot of General Radiated Emissions – Vertical Polarization



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 11, and RSS-GEN Issue 5 Intentional Radiators. The EUT worst-case transmitter configuration demonstrated a minimum margin of -1.8 dB below the requirements. Other emissions were present with amplitudes at least 20 dB below the Limits.

Operation in the Band 2400 – 2483.5 MHz

The transmitter output power, harmonic, and general emissions were measured in the semi anechoic chamber (SAC) @ 3 meters. The amplitude of radiated emission was measured in the SAC at distance of 3 meters from the FSM antenna (radiated emission testing was performed on sample #1) representative of production equipment with integral antennas. 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. Antenna port emission plots were taken of transmitter performance for reference in this and other documentation using test sample #2. 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 25 GHz. Emissions were measured in dBµV/m @ 3 meters.

Refer to figures five through eight showing plots of mode 1 taken of the 2402-2480 MHz transmitter operation displaying compliance with the specifications.

Figure 5 Plot of Transmitter Emissions in 2402-2480 MHz Mode 1 ANT (GFSK)

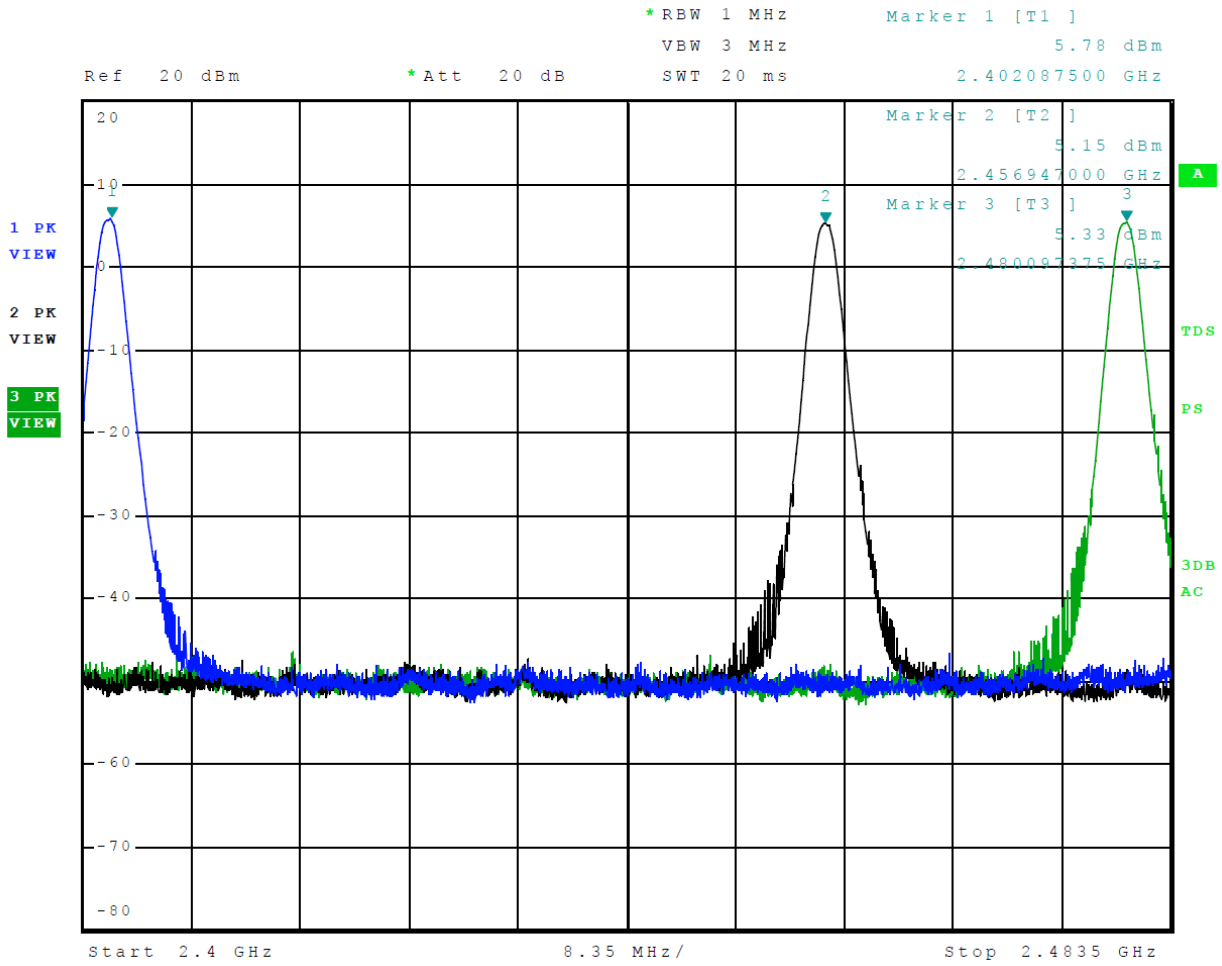


Figure 6 Plot of Transmitter Emissions Low Band Edge Mode 1 ANT (GFSK)

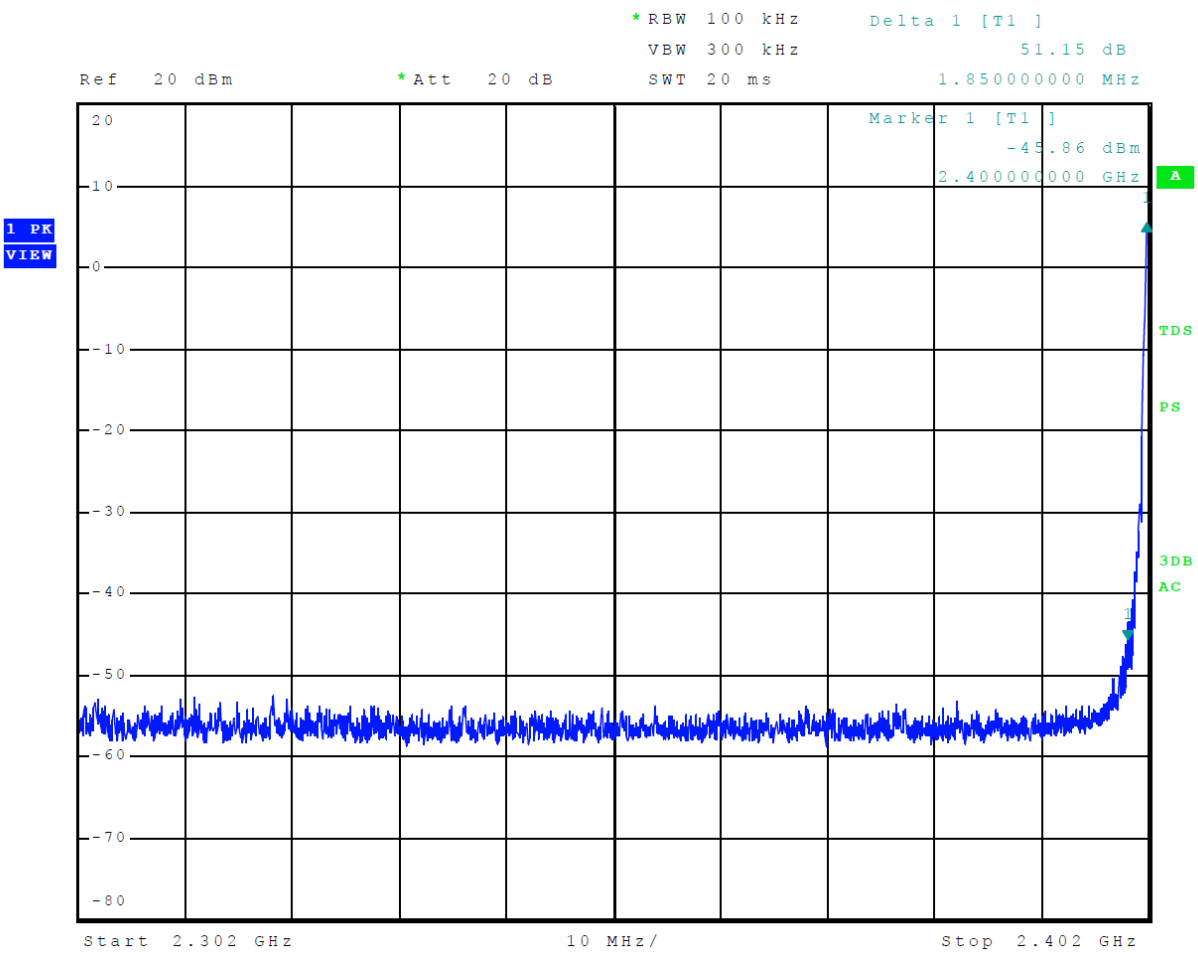


Figure 7 Plot of Transmitter Emissions High Band Edge Mode 1 ANT (GFSK)

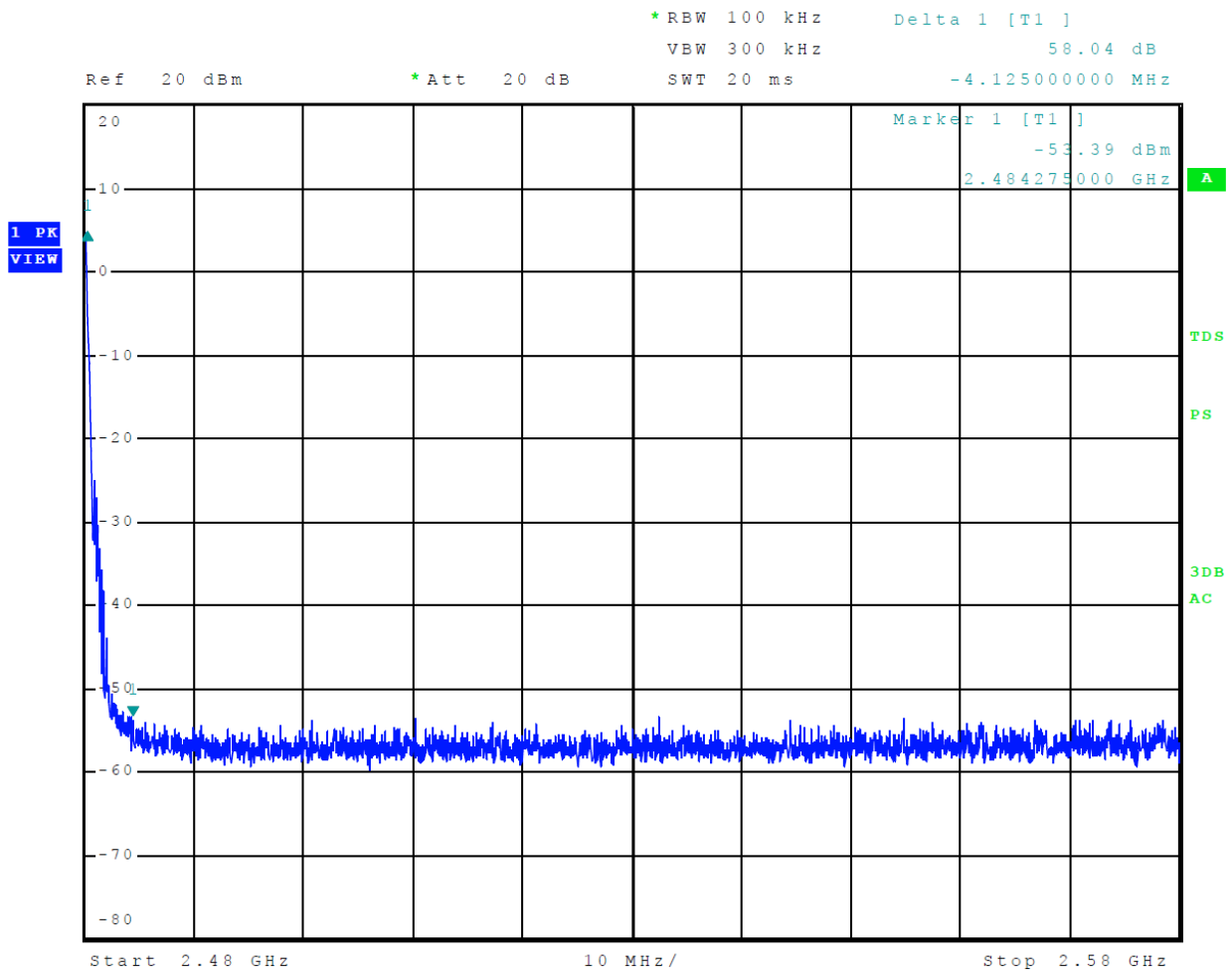
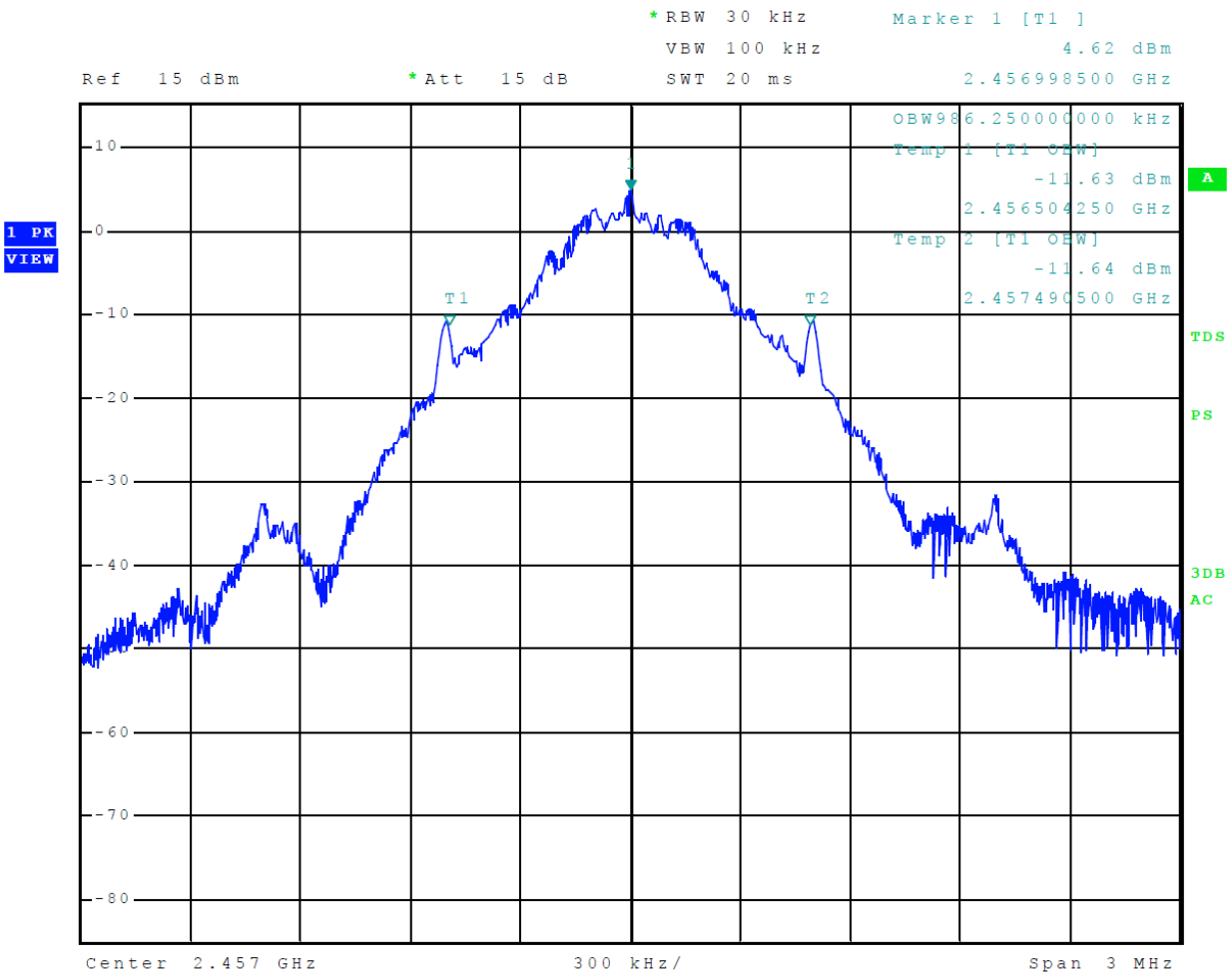


Figure 8 Plot of Transmitter 99% Occupied Bandwidth Mode 1 ANT (GFSK)



Transmitter Emissions Data

Table 6 Transmitter Radiated Emissions Mode 1 ANT (GFSK)

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)
2402.0	97.2	69.3	92.5	63.7	94.0	-24.7	-30.3
4804.0	55.6	37.9	54.0	37.4	54.0	-16.1	-16.6
7206.0	53.9	40.1	55.1	40.3	54.0	-13.9	-13.7
9608.0	57.5	43.8	57.8	43.4	54.0	-10.2	-10.6
12010.0	60.0	46.5	60.6	46.5	54.0	-7.5	-7.5
14412.0	62.0	47.5	61.0	47.5	54.0	-6.5	-6.5
16814.0	66.8	53.0	66.2	53.0	54.0	-1.0	-1.0
2457.0	98.3	70.3	92.8	64.9	94.0	-23.7	-29.1
4914.0	55.7	37.9	52.3	37.1	54.0	-16.1	-16.9
7371.0	54.2	40.5	54.2	40.4	54.0	-13.5	-13.6
9828.0	56.9	43.8	57.1	43.9	54.0	-10.2	-10.1
12285.0	62.0	47.9	61.6	47.9	54.0	-6.1	-6.1
14742.0	62.5	48.8	62.3	48.8	54.0	-5.2	-5.2
17199.0	65.0	52.0	65.3	51.9	54.0	-2.0	-2.1
2480.0	97.0	69.1	91.9	64.1	94.0	-24.9	-29.9
4960.0	51.2	36.8	52.7	37.0	54.0	-17.2	-17.0
7440.0	53.6	40.3	54.8	40.5	54.0	-13.7	-13.5
9920.0	57.6	44.4	57.7	44.5	54.0	-9.6	-9.5
12400.0	61.5	47.7	61.8	47.7	54.0	-6.3	-6.3
14880.0	62.2	48.7	62.6	48.6	54.0	-5.3	-5.4
17360.0	65.6	52.0	65.3	51.9	54.0	-2.0	-2.1

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 47CFR Part 15.249, Industry Canada RSS-210 Issue 11, and RSS-GEN Issue 5 Intentional Radiator regulations. The EUT worst-case test sample configuration demonstrated minimum average margin of -24.7 dB below the average emission limit for the fundamental. The EUT worst-case configuration demonstrated minimum radiated harmonic emission margin of -1.0 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 Laboratory 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. Result of measurement uncertainty calculations are recorded below. Component and process variability of production devices similar to those tested 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	5.46
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

Equipment	Manufacturer	Model (SN)	Band	Cal Date(m/d/y)	Due
☒ LISN	FCC	FCC-LISN-50-25-10(1PA) (160611)	.15-30MHz	3/25/2024	3/25/2025
☐ LISN: Fischer Custom Communications Model: FCC-LISN-50-16-2-08				3/25/2024	3/25/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(L10M)(303073)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303069)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303070)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Belden	RG-58 (L1-CAT3-11509)	9kHz-30 MHz	9/16/2024	9/16/2025
☐ Cable	Belden	RG-58 (L2-CAT3-11509)	9kHz-30 MHz	9/16/2024	9/16/2025
☒ Antenna	Com Power	AL-130 (121055)	.001-30 MHz	9/16/2024	9/16/2025
☐ Antenna:	EMCO	6509	.001-30 MHz	9/16/2024	9/16/2026
☒ Antenna	ARA	BCD-235-B (169)	20-350MHz	9/16/2024	9/16/2025
☒ Antenna	Sunol	JB-6 (A100709)	30-1000 MHz	9/16/2024	9/16/2025
☐ Antenna	ETS-Lindgren	3147 (40582)	200-1000MHz	9/16/2024	9/16/2026
☒ Antenna	ETS-Lindgren	3117 (200389)	1-18 GHz	3/25/2024	3/25/2026
☒ Antenna	Com Power	AH-118 (10110)	1-18 GHz	9/16/2024	9/16/2026
☒ Antenna	Com Power	AH-1840 (101046)	18-40 GHz	3/27/2023	3/27/2025
☒ Analyzer	Rohde & Schwarz	ESU40 (100108)	20Hz-40GHz	7/8/2024	7/8/2025
☒ Analyzer	Rohde & Schwarz	ESW44 (101534)	20Hz-44GHz	1/26/2024	1/26/2025
☐ 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	9/16/2024	9/16/2025
☐ Amplifier	Com-Power	CPPA-102 (01254)	1-1000 MHz	9/16/2024	9/16/2025
☒ Amplifier	Com-Power	PAM-118A (551014)	0.5-18 GHz	9/16/2024	9/16/2025
☒ Amplifier	Com-Power	PAM-840A (461328)	18-40 GHz	9/16/2024	9/16/2025
☒ Pwr Sensor	Rohde & Schwarz	NRP33T	0.05-33 GHz	9/26/2023	9/26/2025
☒ Power meter	Agilent	N1911A with N1921A	0.05-40 GHz	3/25/2024	3/25/2025
☒ Generator	Rohde & Schwarz	SMB100A6 (100150)	20Hz-6 GHz	3/25/2024	3/25/2025
☒ Generator	Rohde & Schwarz	SMBV100A6 (260771)	20Hz-6 GHz	3/25/2024	3/25/2025
☐ RF Filter	Micro-Tronics	BRC50722 (009).9G notch	30-18000 MHz	3/25/2024	3/25/2025
☐ RF Filter	Micro-Tronics	HPM50114 (017)1.5G HPF	30-18000 MHz	3/25/2024	3/25/2025
☐ RF Filter	Micro-Tronics	HPM50117 (063) 3G HPF	30-18000 MHz	3/25/2024	3/25/2025
☐ RF Filter	Micro-Tronics	HPM50105 (059) 6G HPF	30-18000 MHz	3/25/2024	3/25/2025
☒ RF Filter	Micro-Tronics	BRM50702 (172) 2G notch	30-18000 MHz	3/25/2024	3/25/2025
☒ RF Filter	Micro-Tronics	BRC50703 (G102) 5G notch	30-18000 MHz	3/25/2024	3/25/2025
☒ RF Filter	Micro-Tronics	BRC50705 (024) 5G notch	30-18000 MHz	3/25/2024	3/25/2025
☐ Attenuator	Fairview	SA6NFNF100W-40 (1625)	30-18000 MHz	3/25/2024	3/25/2025
☒ Attenuator	Mini-Circuits	VAT-3W2+ (1436)	30-6000 MHz	3/25/2024	3/25/2025
☒ Attenuator	Mini-Circuits	VAT-3W2+ (1445)	30-6000 MHz	3/25/2024	3/25/2025
☒ Attenuator	Mini-Circuits	VAT-3W2+ (1735)	30-6000 MHz	3/25/2024	3/25/2025
☒ Attenuator	Mini-Circuits	VAT-6W2+ (1438)	30-6000 MHz	3/25/2024	3/25/2025
☐ Attenuator	Mini-Circuits	VAT-6W2+ (1736)	30-6000 MHz	3/25/2024	3/25/2025

NVLAP Lab Code 200087-0

Equipment	Manufacturer	Model (SN)	Band	Cal Date(m/d/y)	Due
☐ Frequency Counter: Leader		LDC-825 (8060153)		3/28/2023	3/28/2025
☐ ISN	Com-Power	Model ISN T-8 (600111)		3/25/2024	3/25/2025
☐ LISN	Compliance Design	FCC-LISN-2.Mod.cd,(126)	.15-30MHz	9/16/2024	9/16/2025
☐ LISN:	Com-Power	Model LI-220A		9/16/2024	9/16/2026
☒ LISN:	Com-Power	Model LI-550C		9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(1.5M)(303072)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(L1M)(281183)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(L4M)(281184)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Huber & Suhner Inc.	Sucoflex102ea(L10M)(317546)	9kHz-40 GHz	9/16/2024	9/16/2025
☒ Cable	Time Microwave	4M-750HF290-750 (L4M)	9kHz-24 GHz	9/16/2024	9/16/2025
☒ Cable	Mini-Circuits	KBL-2M-LOW+ (23090329)	9kHz-40 GHz	3/25/2024	3/25/2025
☐ 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	3/25/2024	3/25/2025
☐ Wave Form Generator Keysight		33500B (MY57400128)		3/25/2024	3/25/2025
☐ Antenna:	Solar	9229-1 & 9230-1		2/10/2024	2/10/2025
☐ CDN:	Com-Power	Model CDN325E		10/11/2022	10/11/2024
☐ Oscilloscope Scope: Tektronix		MDO 4104		2/10/2024	2/10/2025
☐ EMC Transient Generator HVT		TR 3000		2/10/2024	2/10/2025
☐ AC Power Source (Ametech, California Instruments)				2/10/2024	2/10/2025
☒ Field Intensity Meter: EFM-018				2/10/2024	2/10/2025
☒ ESD Simulator: MZ-15				2/10/2024	2/10/2025
☒ Weather station Davis		6152 (A70927D44N)		7/11/2024	7/11/2025
☐ 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 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, a division of The Compatibility Center LLC
Lenexa, 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).

2024-03-18 through 2025-03-31
Effective Dates

For the National Voluntary Laboratory Accreditation Program