November 07, 2022

Xirgo Technologies, LLC
188 Camino Ruiz
Camarillo, CA

Dear Ed Gabrelian,

Enclosed is the EMC test report for compliance testing of the, Xirgo Technologies, LLC., Asset Tracking/ FLEET TPMS as tested to the requirements of the

- FCC Part 15 Subpart B
- Innovation, Science, and Economic Development (ISED) Canada ICES-003 Issue 7

Thank you for using the services of Eurofins Electrical and Electronic Testing NA, Inc. Please contact me if you have any questions regarding these results or if Eurofins E&E can be of further service to you.

Sincerely,

Gary Chou

Documentation Department
Eurofins Electrical and Electronic Testing NA, Inc.

Reference: EMCS121141-Xirgo-FCC-IC

A2LA ACCREDITED TESTINGCERT #0591.02

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	November 06, 2022	Initial Issue.

Table of Contents

1.0 Testing Summary

Test is compliant to the following specification(s).

- FCC Part 15 Subpart B
- Innovation, Science, and Economic Development (ISED) Canada ICES-003 Issue 7

Christopher Martin

Christopher Martin
Test Engineer, Wireless Laboratory

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated. 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.

Gary Chou

Gary Chou
Wireless Lab Manager, California

2.0 Overview

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing, XT4392.

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

Model(s) Tested:	XT4392
Equipment Emissions Class:	B

2.1 Test Site

All testing was performed at Eurofins Electrical and Electronic Testing NA, Inc., 3162 Belick St. Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology. Eurofins Electrical and Electronic Testing NA, Inc. has been accredited by the American Association for Laboratory Accreditation (A2LA) (Certificate #: 0591.02) in accordance with ISO/IEC 17025:2017.

2.2 Measurement Uncertainty

Measurement uncertainty calculated as per NIST Technical Note (TN) 1297 and ANSI / NCSL Z540-2, as equivalent to EN 55016-4-2 / IEC CISPR 16-4-2.

Test Method	Typical Expanded Uncertainty (dB)	K	Confidence Level
Radiated Emissions, (30 MHz – 1 GHz)	±3.24	2	95%
Radiated Emissions, (1 GHz – 6 GHz)	±3.92	2	95%
Conducted Emission Voltage	±2.44	2	95%
Conducted Emission Telecom	±3.53	2	95%

Measurement Uncertainty

2.4 Equipment Overview

Name of EUT/Model:	XT4392
Voltage:	8-32 Vdc
AC or DC:	DC
Voltage Frequency:	N/A
Number of Phases:	1
PN/ SN	-
EUT Arrangement:	Table Top
System with Multiple Chassis?	False
Highest Internal Frequency (MHz):	2480 MHz

EUT List

Ref. ID	Slot #	Name/Description	Model Number	Part Number	Serial Number	Rev. #
A		Asset Tracking/ FLEET TPMS	XT4392	-	-	N/A

Support Equipment

Ref. ID	Name/Description	Manufacturer	Model Number	Customer Supplied Calibration Data
A	-	-	N/A	N/A

2.5 Modifications to the EUT

No modifications were made to the EUT.

2.6 Modifications to the Standard

No modifications were made to the Test Standard.

2.7 Disposition of EUT

The test sample including all support equipment (if any), submitted to the Electromagnetic Compatibility Lab for testing was returned to Xirgo Technologies, LLC. upon completion of testing.

3.0 Electromagnetic Compatibility Emission Criteria

3.1 Limits for Conducted Disturbance at Mains Terminals

Test Method: ANSI 63.4:2014

Sample Calculation:

$$R_f - S = M$$

where:

R_f = Receiver Reading in dBuV
S = Specification Limit in dBuV
M = Margin to Specification in +/- dB

Test Requirement(s): The following standards specified below are covered in the scope of this section of the test report:

- FCC Part 15 Subpart B
- Innovation, Science, and Economic Development (ISED) Canada ICES-003 Issue 7

The EUT shall meet the Class B limits shown in the table below.

Frequency Range (MHz)	Class A Limits(dBµV)		Class B Limits (dBµV)	
	Quasi-Peak	Average	Quasi- Peak	Average
0.15 - 0.5	79	66	66 to 56	56 to 46
0.5 - 5	73	60	56	46
5 - 30	73	60	60	50
Note 1 – The lower limit shall apply at the transition frequencies. Note 2 – The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.				

Conducted Emissions - Limits

Test Procedure: The EUT was placed on a non-metallic table, 80 cm above the ground plane and 40 cm away from the vertical reference ground plane . The method of testing, test conditions, and test procedures of ANSI C63.4-2014 were used. The EUT was powered through a 50Ω/50µH LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. All peak emissions within 6 dB of the limit were re-measured using a quasi-peak and/or average detector as appropriate. Any measured frequency that exhibits a margin of compliance that is less than 3 dB below the specification limit is marked. Eurofins E&E recommends that every emission measured, has at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process. Photographs of test setup are presented below.

Test Software Used: BAT EMC.

Test Results:

Test Standard:	FCC Part 15 Subpart B Innovation, Science, and Economic Development (ISED) Canada ICES-003 Issue 7 Class B
Test Name	Conducted Emissions
Test Dates:	N/A
Laboratory	Eurofins Electrical and Electronic Testing NA, Inc.
Test Engineer:	N/A
Test Results:	Not Applicable
Additional Notes:	DC Powered

Conducted Emission Measurement

Limits of Conducted Emission Measurement :

The following standards specified below are covered in the scope of this section of the test report:

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

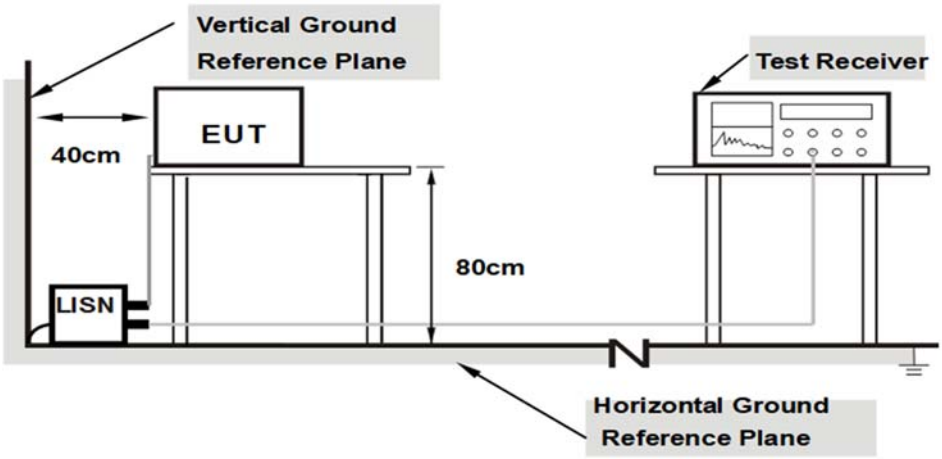
Conducted Emissions - Test Procedure

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency ranges from 150 kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

Conducted Emissions - Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo)

Test Results:

N/A

3.3 Radiated Emissions: Limits of Electromagnetic Radiation Disturbance

Test Method: ANSI C63.4-2014

Test Requirement(s): The following standards specified below are covered in the scope of this section of the test report:

- FCC Part 15 Subpart B
- Innovation, Science, and Economic Development (ISED) Canada ICES-003 Issue 7

§15.109 (a)/ ICES-003 3.2.2

Except for Class B digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field Strength (dBµV/m)
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	54.00

Test Procedure: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing, test conditions, and test procedures of ANSI C63.4-2014 were used. Any measured frequency that exhibits a margin of compliance that is less than 3 dB below the specification limit is marked. Eurofins E&E recommends that every emission measured, has at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process.

For emissions between 30 MHz and 1000 MHz, a biconilog antenna was located 3m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz resolution bandwidth.

For emission between 1 GHz and 18 GHz, a double ridged guide horn was located 3 m from the EUT on an adjustable mast. A pre-scan was performed and used to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied depending on the geometry of the EUT. In order to ensure maximized emissions, the horn antenna was positioned both vertically and laterally. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a peak and average detector with a 1 MHz resolution bandwidth.

Test Software Used: BAT EMC was used to perform this test.

Test Results:

Test Standard:	FCC Part 15 Subpart B Innovation, Science, and Economic Development (ISED) Canada ICES-003 Issue 7 Class B
Test Name	Radiated Emissions
Test Dates:	09/28/2022
Laboratory	Eurofins Electrical and Electronic Testing NA, Inc.
Test Engineer:	Christopher Martin
Test Results:	Pass
Additional Notes:	N/A

Test Data

EUT Test Condition		Measurement Detail	
Mode	Normal Operation	Frequency Range	30MHz-1GHz
Input Power	14 Vdc	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Antenna Polarity & Test Distance: Vertical At 3m			

Antenna Polarity & Test Distance: Vertical At 3m									
No.	Frequency (MHz)	Polarization	Level Peak[dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Pass/ Fail
1	182.374	Vertical	23.107	43.5	-20.393	1.1	335	-16.17	Pass
2	402.048	Vertical	11.907	46	-34.093	3.79	164	-8.65	Pass
3	550.832	Vertical	14.972	46	-31.028	2.06	6	-5.4	Pass

Table 1. Radiated Emissions, Test Results

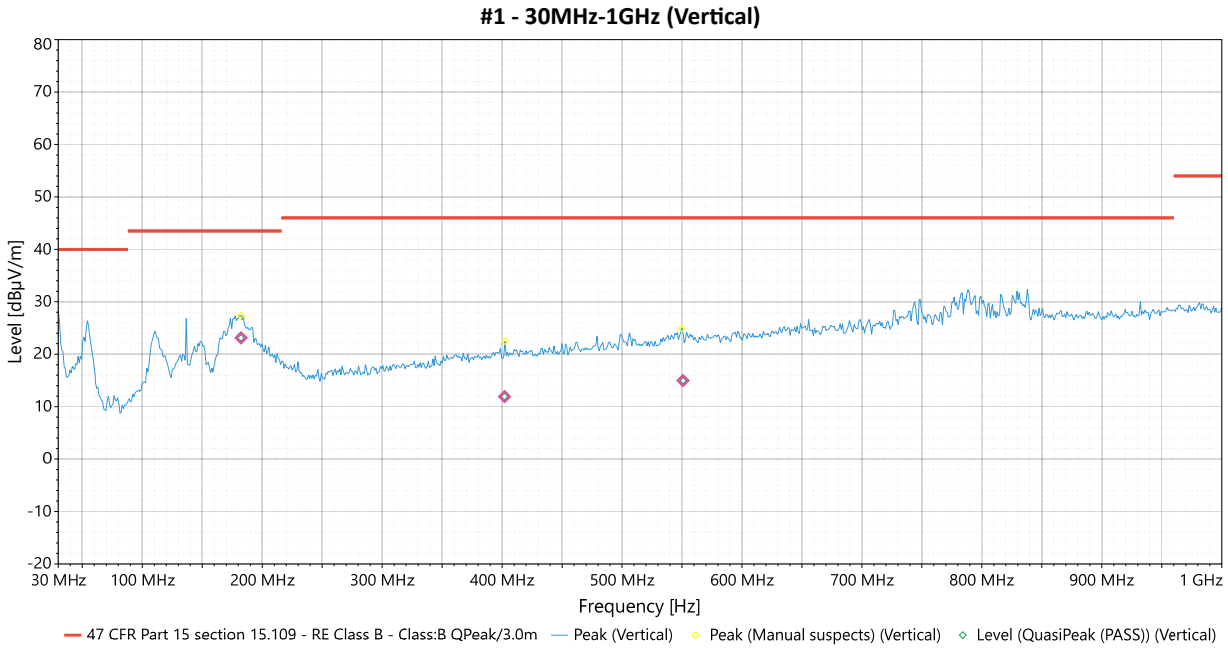


Figure 1. Radiated Emissions, Plot (Vertical)

EUT Test Condition		Measurement Detail	
Mode	Normal Operation	Frequency Range	30MHz-1GHz
Input Power	14 Vdc	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Antenna Polarity & Test Distance: Horizontal At 3m			

Antenna Polarity & Test Distance: Horizontal At 3m									
No.	Frequency (MHz)	Polarization	Level Peak[dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Pass/ Fail
1	152.304	Horizontal	14.377	43.5	-29.123	1.81	201	-15.91	Pass
2	320.018	Horizontal	14.009	46	-31.991	2.05	128	-11.14	Pass
3	594.442	Horizontal	15.081	46	-30.919	1.81	161	-5.57	Pass

Table 2. Radiated Emissions, Test Results

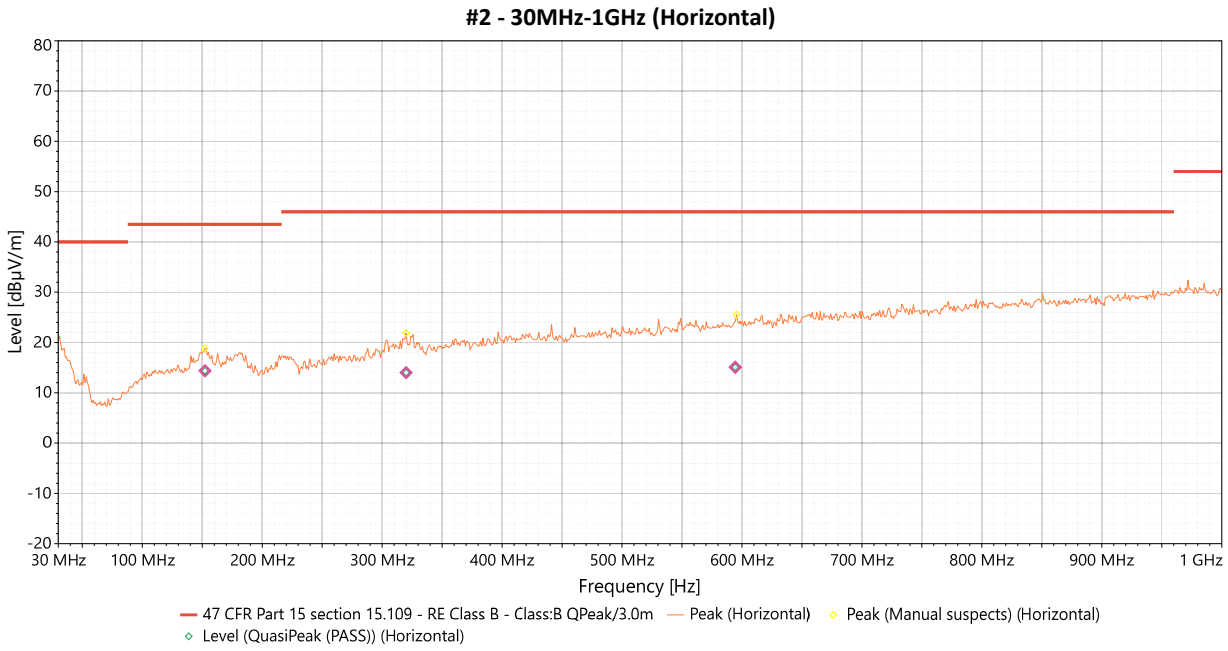


Figure 2. Radiated Emissions, Plot (Horizontal)

EUT Test Condition		Measurement Detail	
Mode	Normal Operation	Frequency Range	1GHz-13GHz
Input Power	14 Vdc	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Antenna Polarity & Test Distance: Vertical At 3m			

Antenna Polarity & Test Distance: Vertical at 3m										
No.	Frequency (MHz)	Source	Polarization	Level [dB(uV/m)]	Limit dB(uV/m)	Margin [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Pass/ Fail
1	2552.025	Peak	Vertical	42.254	74	-31.746	1.21	317	-0.24	Pass
2	2552.025	Average	Vertical	29.309	54	-24.691	1.21	317	-0.24	Pass
3	6431.406	Peak	Vertical	47.443	74	-26.557	1.74	172	2.28	Pass
4	6431.406	Average	Vertical	41.527	54	-12.473	1.74	172	2.28	Pass
5	16041.43	Peak	Vertical	51.016	74	-22.984	1.91	1	4.74	Pass
6	16041.43	Average	Vertical	38.318	54	-15.682	1.91	1	4.74	Pass

Table 3. Radiated Emissions, Test Results

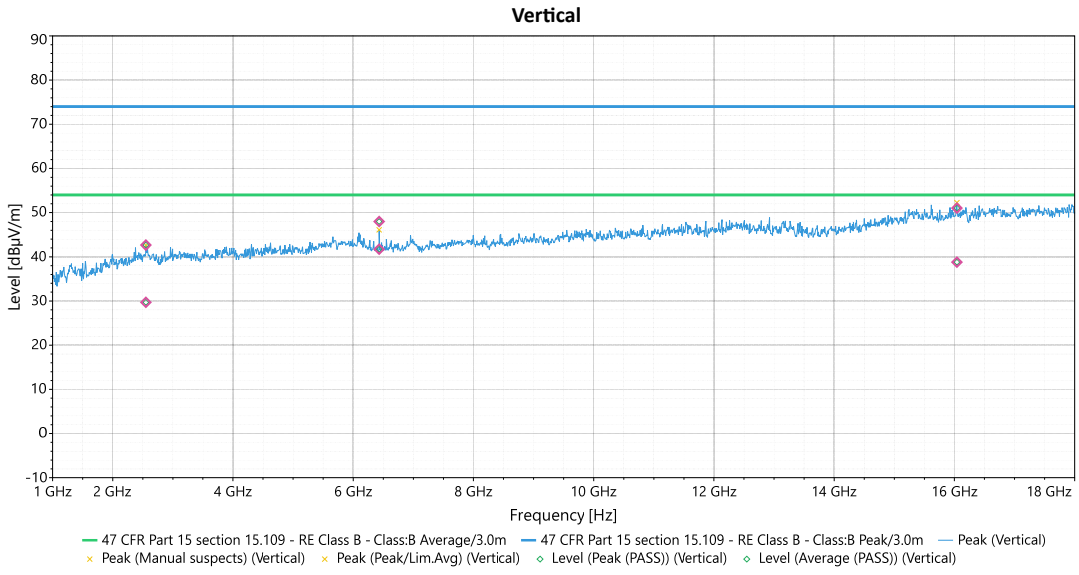


Figure 3. Radiated Emissions, Plot

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin agains

EUT Test Condition		Measurement Detail	
Mode	Normal Operation	Frequency Range	1GHz-13GHz
Input Power	14 Vdc	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Christopher Martin
Antenna Polarity & Test Distance: Horizontal At 3m			

Antenna Polarity & Test Distance: Vertical at 3m										
No.	Frequency (MHz)	Source	Polarization	Level [dB(uV/m)]	Limit dB(uV/m)	Margin [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Pass/ Fail
1	6431.43	Peak	Horizontal	44.412	74	-29.588	3.46	316	2.32	Pass
2	6431.43	Average	Horizontal	34.502	54	-19.498	3.46	316	2.32	Pass
3	10638.46	Peak	Horizontal	46.318	74	-27.682	4	316	2.88	Pass
4	10638.46	Average	Horizontal	34.254	54	-19.746	4	316	2.88	Pass
5	15026.27	Peak	Horizontal	50.316	74	-23.684	4	124	3.16	Pass
6	15026.27	Average	Horizontal	37.175	54	-16.825	4	124	3.16	Pass

Table 4. Radiated Emissions, Test Results

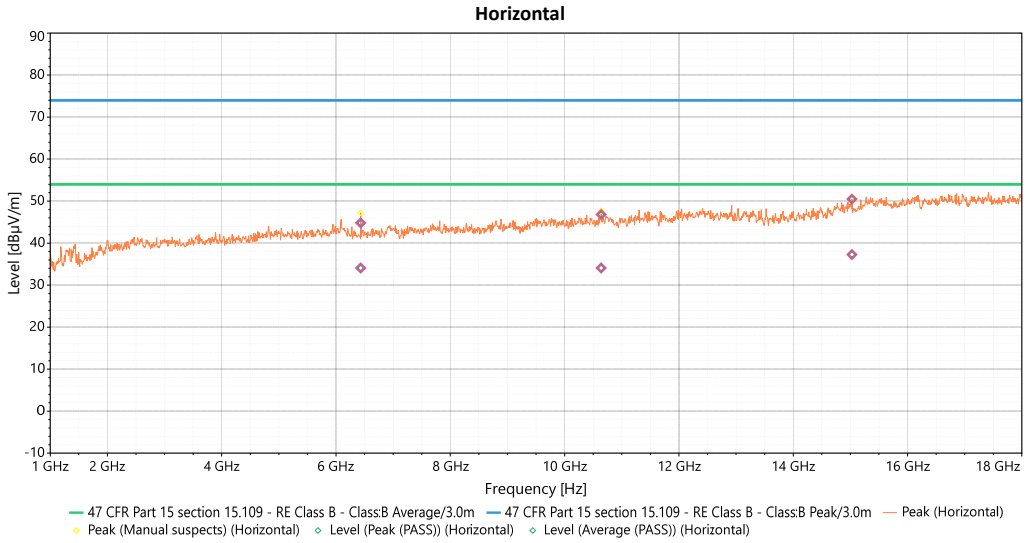
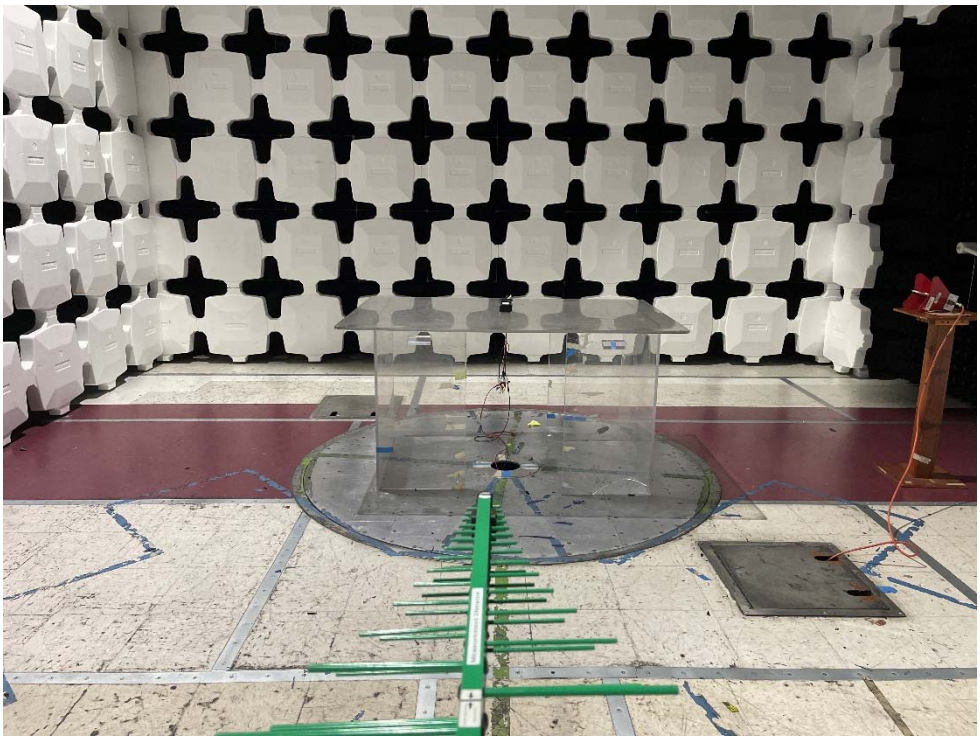
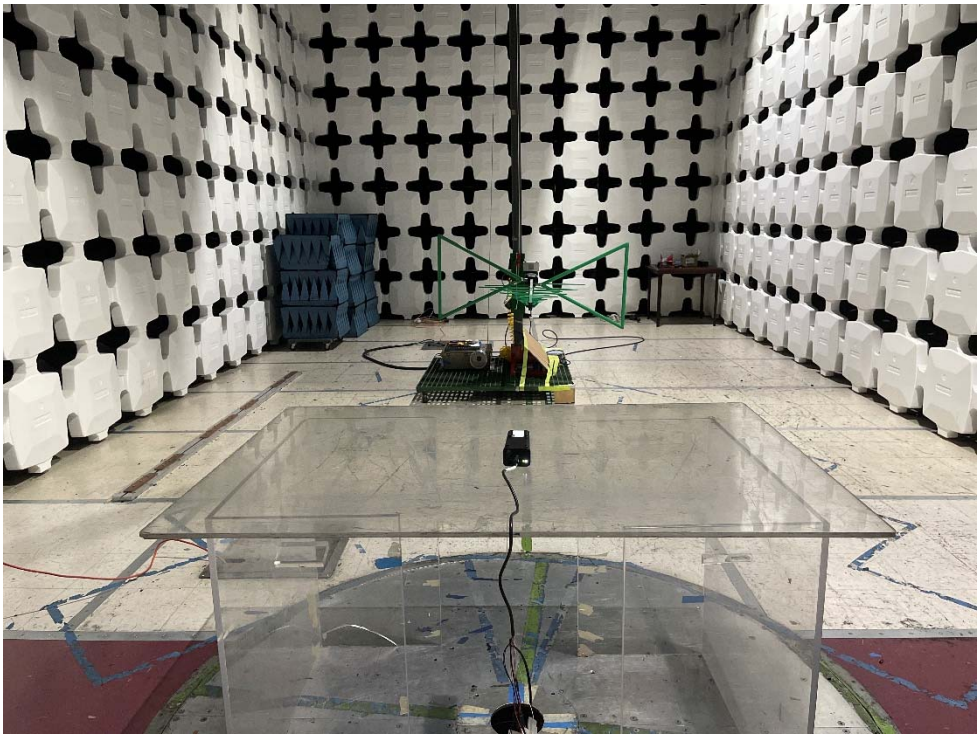


Figure 4. Radiated Emissions, Plot

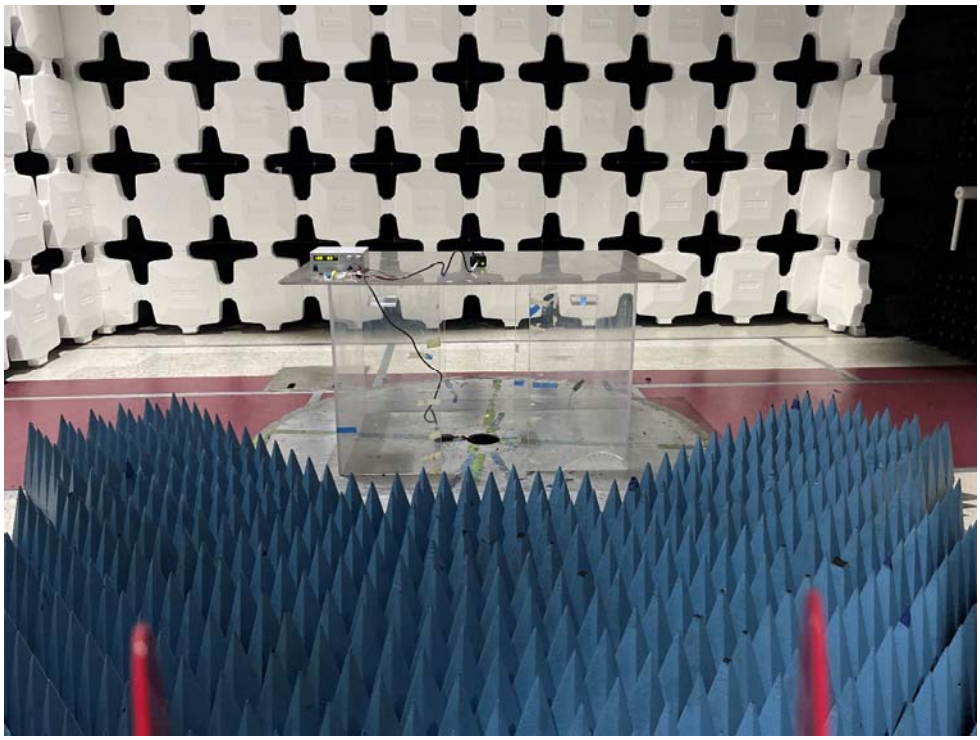
1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin agains



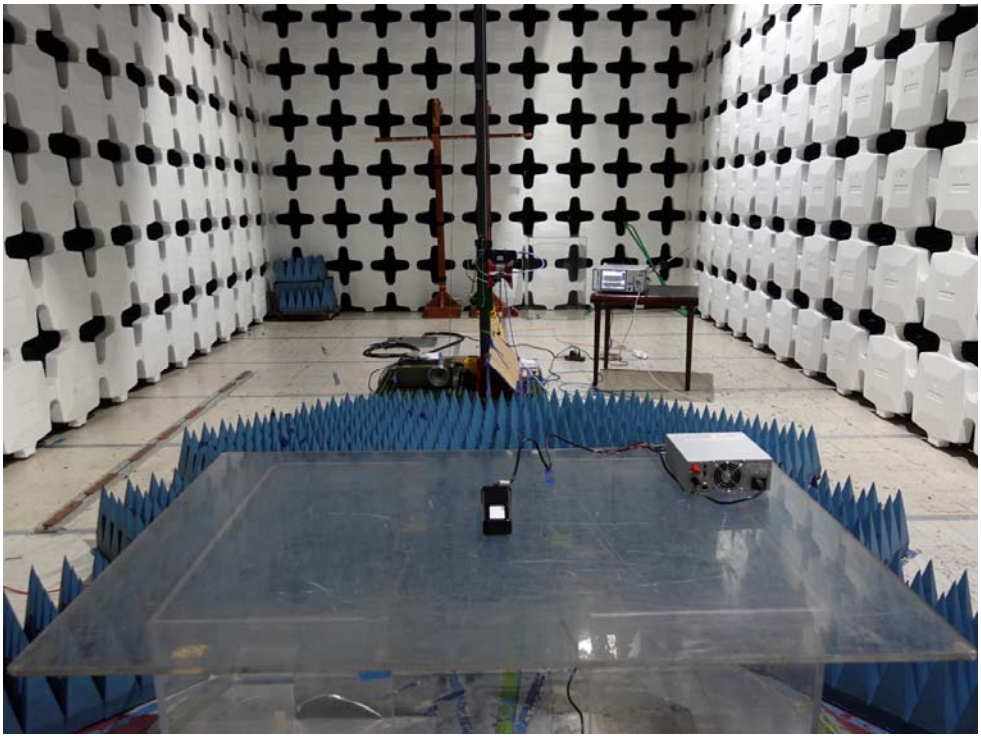
Radiated Emissions, Test Setup- Below 1GHz Front View



Radiated Emissions, Test Setup- Below 1GHz Rear View



. Radiated Emissions, Test Setup- Above 1GHz Front View



Radiated Emissions, Test Setup- Above 1GHz Rear View

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

Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2003	EMI Test Receiver	ROHDE & SCHWARZ	N9030B	10/08/2021	10/08/2022
1S2399	Turntable Controller	SUNOL SCIENCE	SC99V	Not Required	Not Required
1S2486	5 Meter Chamber Control Room	Panashield	5 Meter Control Room	Not Required	Not Required
1S2435	Horn Antenna	ETS-LINDGREN	3117	03/03/2021	03/09/2023
1S4802	Preamplifier	EMC Instrument	EMC118A45SE	Note 1	Note 1
1S2668	Preamplifier	Sonoma Instrument	310N	Note 1	Note 1
1S2600	Antenna	TESEQ GmbH	D-12623	05/ 11/ 2021	05/ 11/ 2023
Note 1: Verified by calibrated instrumentation at the time of testing					

Table 5. Radiated Emissions, Test Equipment

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

END OF REPORT