

Test Report

Prepared for: Sierzega Elektronik GmbH

Model: GRM-V22 Module

Serial Number: 35082

Project No: p2440003

Test Results: Pass

To

FCC Part 15B Class B
and
IC ICES-003 Issue 7 (October 2020) Class B

Date of Issue: June 5, 2024

On the behalf of the applicant:

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ISED Site Reg. #2044A-2

Reviewed / Authorized By:



Jeremiah Darden, Principal Engineer

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Test Results Summary

Test Date Range: May 23 - 31, 2024

Specification		Test Name	Pass, Fail, N/A	Comments
FCC	ICES			
FCC 15.107	ICES-003 Section 3	AC Powerline Conducted Emissions	Pass	
FCC 15.109	ICES-003 Section 3	Radiated Emissions	Pass	
Method Deviations/Additions: No				

Statements of conformity are reported as:

- Pass - the measured value is below the acceptance limit, *acceptance limit = test limit*.
- Fail - the measured value is above the acceptance limit, *acceptance limit = test limit*.

References/Methods	Description
ANSI C63.4-2014	Method and Measurements of Radio-Noise Emissions from low-Voltage Electrical and Electronic Equipment in the range 9kHz to 40GHz.
ISO/IEC 17025:2017	General requirements for the Competence of Testing and Calibrations Laboratories

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	June 5, 2024	Jeremiah Darden	Original Document

Current revision of the test report replaces any prior versions. Only the current version of the test report is valid.

EUT Description

Model:	GRM-V22 Module
Serial:	35082
Firmware:	V9.6
Software:	N/A
Description:	Module for monitoring Vehicle Traffic Speed on Roadways
Additional Information:	Highest Frequency Generated: Non Radio Frequency <1250 MHz (radio signals related to BLE, Cellular or Radar are addressed separately in other reports) Usage: Mounted in enclosures for table top or mounted on poles for outdoor use.
Receipt of Sample(s):	May 16, 2024
EUT Condition:	Visual Damage No State of Development Production/Production Equivalent

EUT PHOTO



Notifications

The applicant has been cautioned as to the following:

FCC

15.21 – Information to user

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) – Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in the part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in §2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Industry Canada

Products subject to Industry Canada ICES-003 must be labeled in English and/or French (based on the intended market and any other applicable provincial or federal regulations) as follows:

CAN ICES-003 (B)/NMB-003(B)

Note: These notices are specific to the methods and standards related to the testing within this report. Customers should also consider and review additional legal regulations for import/export documentation and labeling for the countries and geographies under consideration by the manufacturer.

Test and Measurement Data

Subpart 2.1033(b)

All tests and measurement data shown were performed in accordance with FCC Rule Parts: 15.107, 15.109 (Unintentional Radiators).

All tests and measurement data shown are deemed satisfactory evidence of compliance with Industry Canada Interference-Causing Equipment Standard ICES-003.

Standard Engineering Practices

Unless otherwise indicated, the procedures contained in ANSI C63.4-2014 were observed during testing.

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst case measurement.

Standard Test Conditions and Engineering Practices

Unless otherwise indicated in the specific measurement results, the ambient temperature was maintained within the range of 10° to 40°C (50° to 104°F) and the relative humidity levels were in the range of 10% to 90%.

Environmental Conditions		
Temperature (°C)	Humidity (%)	Barometric Pressure (mbar)
25.72 – 28.39	22.5 – 25.7	965.2 – 966.4

Test Setup and Modes of Operation

EUT Operation during Tests

EUT was connected to power and operated with the installed software for typical operation. 24GHz radio could not be turned off while still exercising primary functions. 24GHz Radio is on for all testing. EUT was powered by a 12VDC from a battery for Radiated Emissions. For conducted emissions a linear AC to DC power adapter was used.

EUT:

Qty	Description	Manufacturer	Model	S/N
1	Radar Module	Sierzega	GRM_V22	35082

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Linear AC to 12VDC adapter	TamuraGroup	835AS12100	None

Cables:

Qty	Description	Length (M)	Ferrites (Y/N)	Shielding Y/N	Shielded Hood Y/N	Termination / Connection
1	Power Cable	1.8	N	N	N	EUT to 12VDC

Software/Firmware:

Name	Description	Version	Installation Info
GRM	System firmware	9.6	Installed on EUT

Modifications to EUT(s) (Y/N): N

15.107 AC Powerline Conducted Emissions

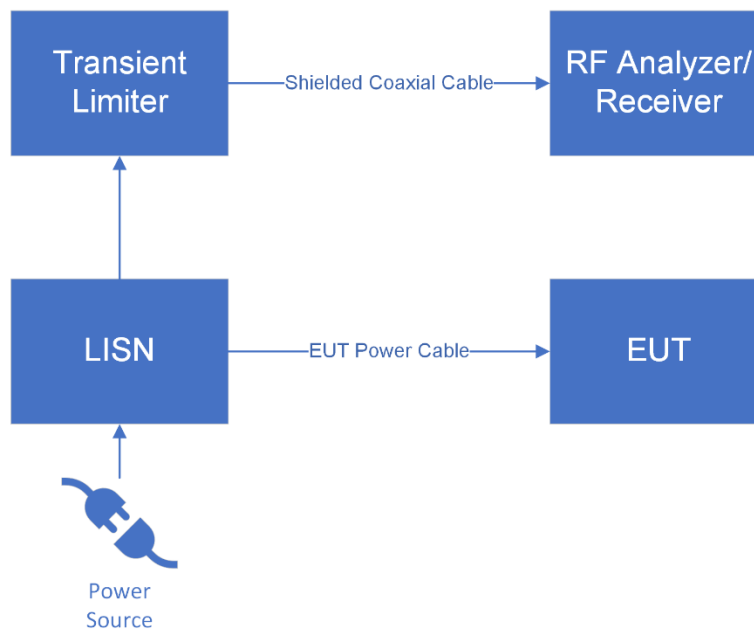
Engineer: Jeremiah Darden

Test Date: May 31, 2024

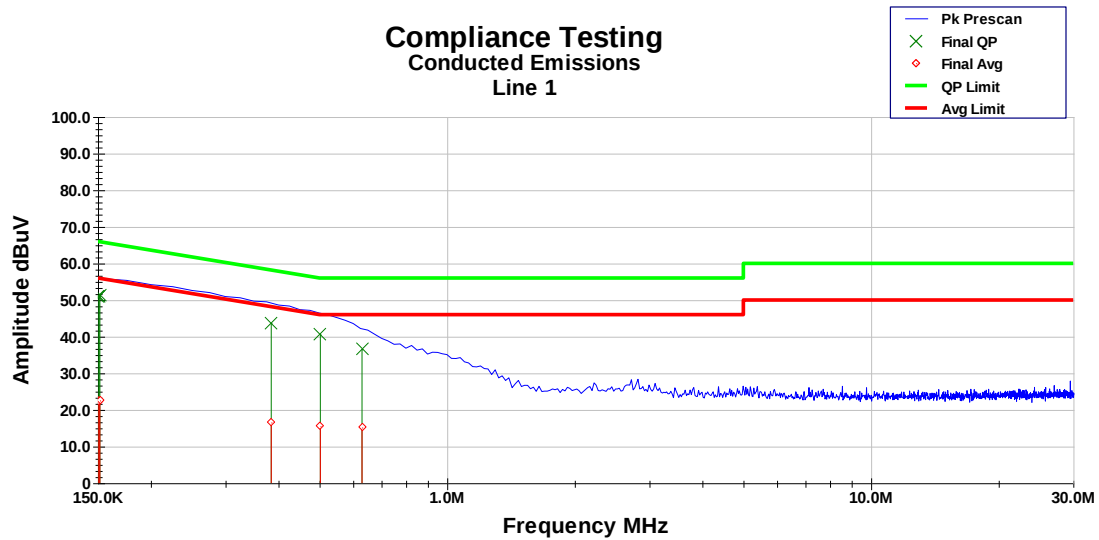
Test Procedure

The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

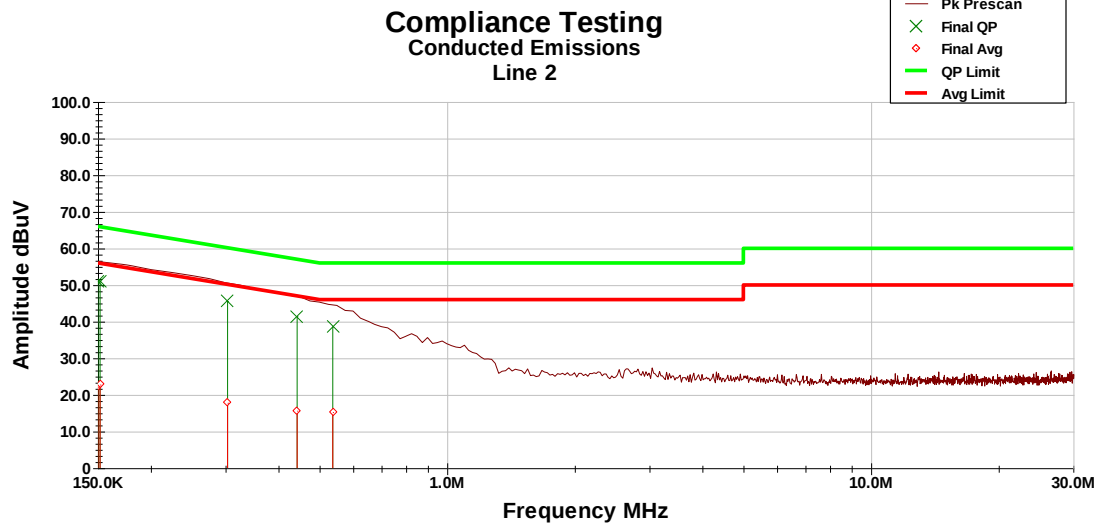
Basic Test Setup



AC Powerline Conducted Emissions. (120VAC/60Hz to 12VDC using non filtered linear power adapter)

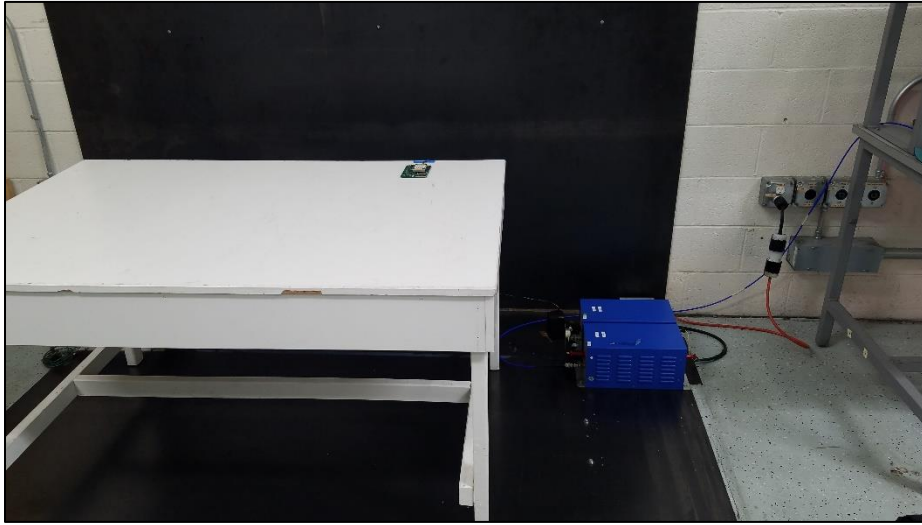


Frequency	Raw QP	Raw Avg	Path Loss	Final QP	Final Avg	QP Limit	QP Margin	Avg Limit	Avg Margin
-	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dB	dBuV	dB
150.19 KHz	41.20	12.70	9.90	51.10	22.60	66.00	-14.90	56.00	-33.40
151.06 KHz	41.30	12.40	9.90	51.10	22.30	66.00	-14.80	56.00	-33.70
151.63 KHz	41.30	12.70	9.90	51.20	22.60	66.00	-14.80	56.00	-33.40
384.63 KHz	33.70	6.50	10.10	43.70	16.60	59.30	-15.60	49.30	-32.70
502.38 KHz	30.50	5.40	10.10	40.60	15.50	56.00	-15.40	46.00	-30.50
629.75 KHz	26.50	5.10	10.10	36.60	15.20	56.00	-19.40	46.00	-30.80
Final = Raw + Path Loss									
Margin = Final - Limit									



Frequency	Raw QP	Raw Avg	Path Loss	Final QP	Final Avg	QP Limit	QP Margin	Avg Limit	Avg Margin
-	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dB	dBuV	dB
150.13 KHz	41.22	12.40	9.80	51.00	22.30	66.00	-15.00	56.00	-33.70
150.13 KHz	41.22	12.40	9.80	51.00	22.30	66.00	-15.00	56.00	-33.70
151.81 KHz	41.31	13.00	9.80	51.10	22.80	65.90	-14.80	55.90	-33.10
303.5 KHz	35.61	7.80	10.00	45.60	17.80	61.60	-16.00	51.60	-33.80
442.75 KHz	31.44	5.70	10.00	41.50	15.70	57.60	-16.20	47.60	-32.00
537.26 KHz	28.64	5.30	10.00	38.70	15.30	56.00	-17.30	46.00	-30.70
Final = Raw + Path Loss									
Margin = Final - Limit									

Conducted Emissions Test Setup Photo



15.109 Radiated Emissions

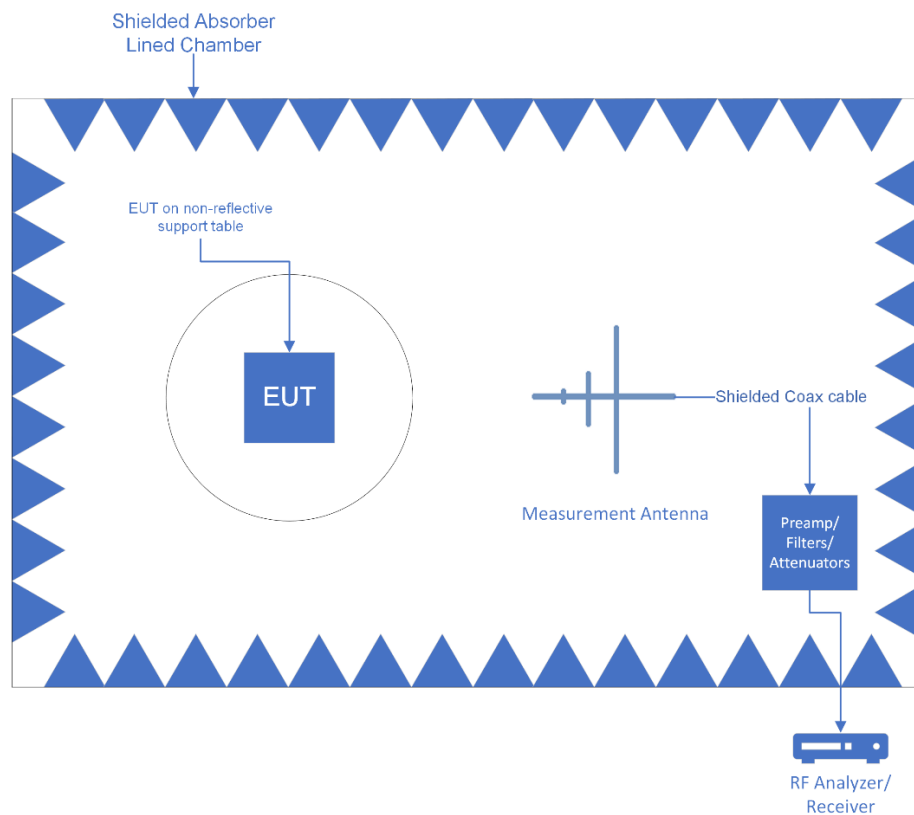
Engineer: Jeremiah Darden

Test Date: May 31, 2024

Test Procedure

The EUT was tested in a semi-anechoic chamber with the turntable set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360 degrees with the antennas in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure the signal levels were maximized. All emissions from 30 MHz to 13 GHz were examined.

Basic Test Setup



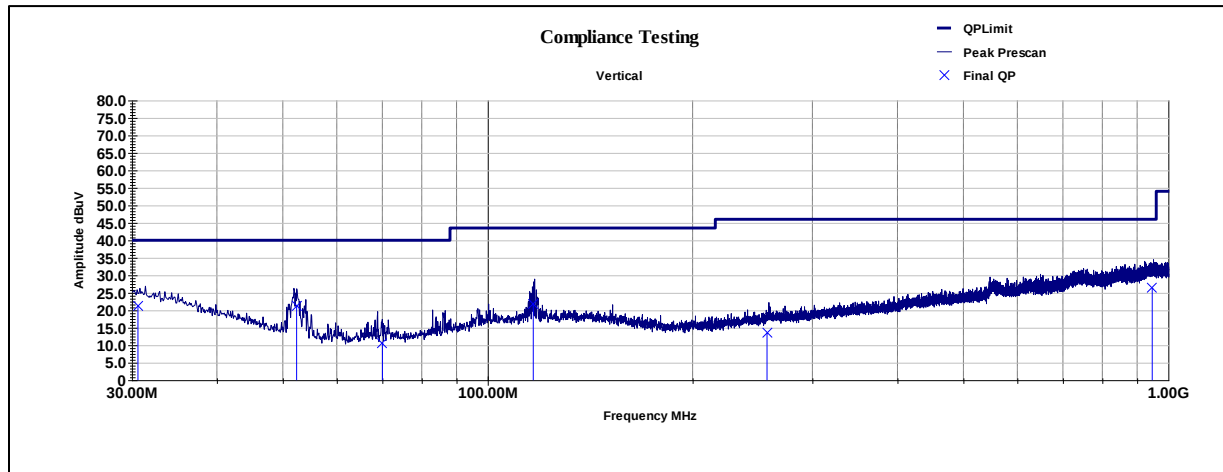
	Settings Below 1GHz	Settings Above 1GHz
RBW	120 kHz	1 MHz
VBW	300 kHz	3 MHz
Detector	Quasi Peak	Peak / Average

Sample Calculations

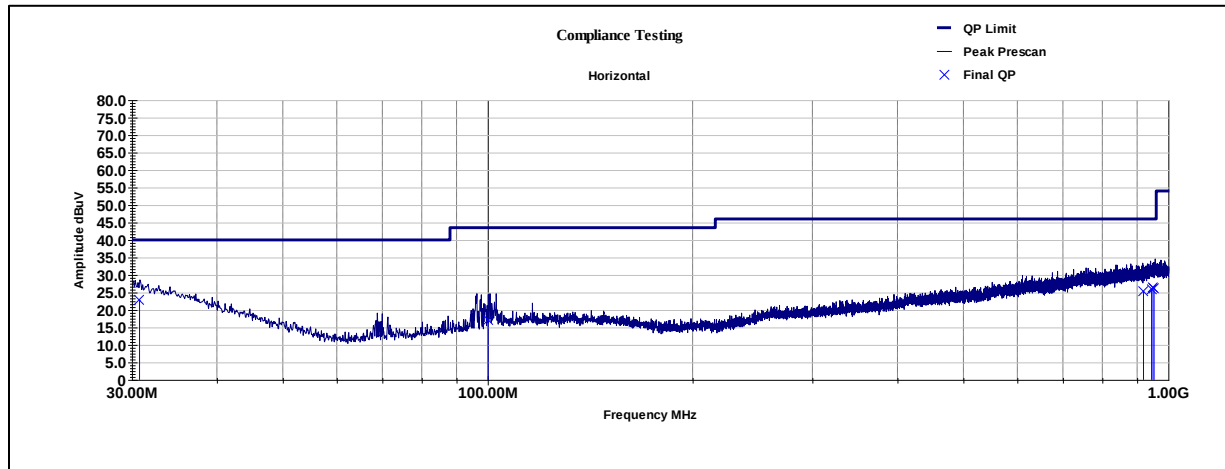
Corrected Value = Measured Value + Correction factor

Correction factor = Antenna Correction Factor + Cable loss + Preamp/Attenuator Factor

Radiated Emissions 30-1000MHz

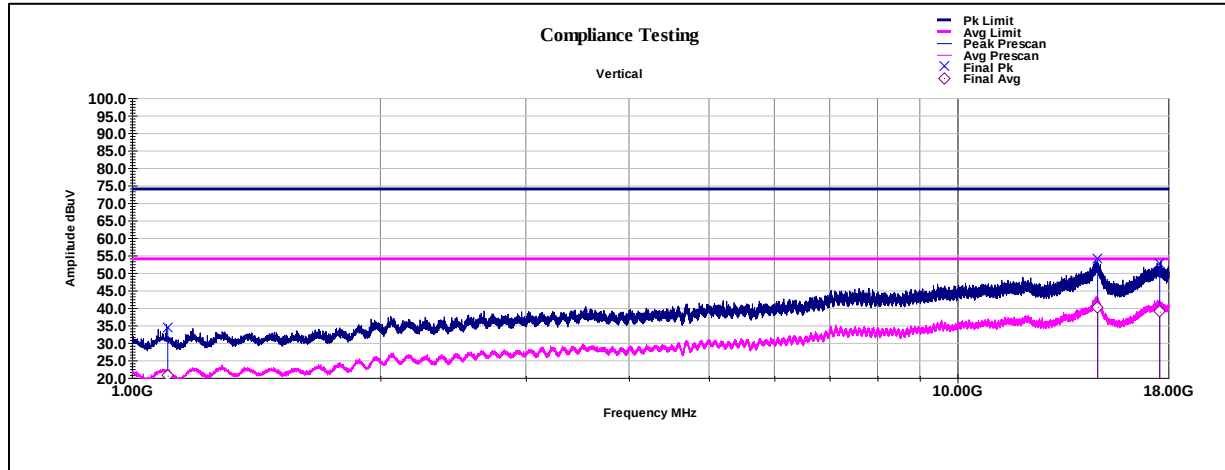


Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
30.621	173.00	393.00	38.40	-17.07	21.30	40.00	-18.70
52.38	41.00	100.00	49.32	-28.00	21.30	40.00	-18.70
70.028	228.00	167.00	38.67	-28.19	10.50	40.00	-29.50
116.646	205.00	105.00	44.52	-22.65	21.90	43.50	-21.60
257.208	30.00	351.00	34.61	-21.06	13.60	46.00	-32.40
946.91	253.00	389.00	33.46	-7.08	26.40	46.00	-19.60
Final = Raw + Path Loss							
Margin = Final - Limit							

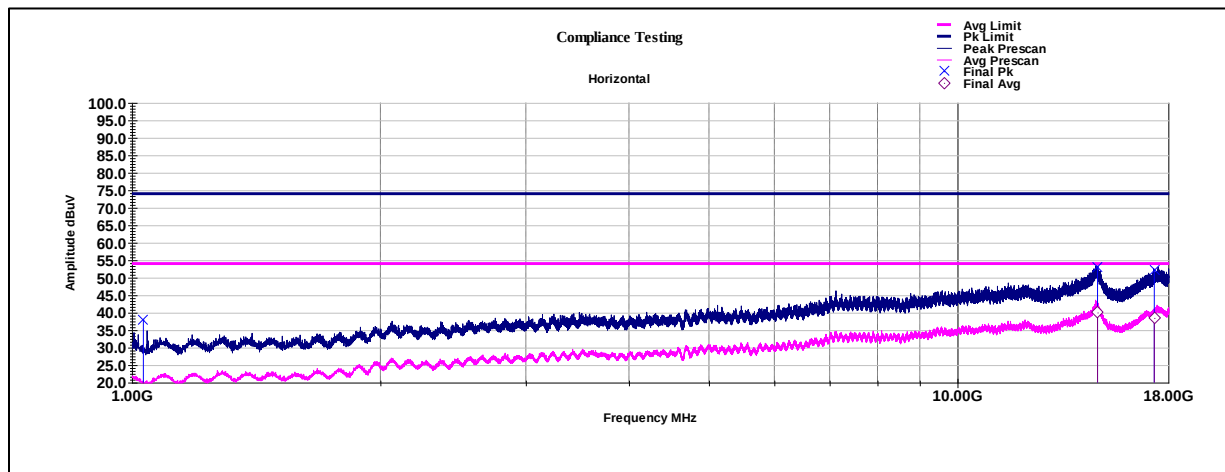


Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
30.787	308.00	400.00	38.46	-15.63	22.80	40.00	-17.20
100.098	119.00	246.00	41.77	-24.53	17.20	43.50	-26.30
919.579	145.00	343.00	33.43	-8.14	25.30	46.00	-20.70
945.012	142.00	113.00	33.23	-7.27	26.00	46.00	-20.00
949.367	315.00	325.00	33.55	-7.17	26.40	46.00	-19.60
952.98	211.00	356.00	33.33	-7.17	26.20	46.00	-19.80
Final = Raw + Path Loss							
Margin = Final - Limit							

Radiated Emissions Above 1000MHz



Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
GHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
1.10529225	77.00	311.00	53.06	39.17	-18.55	34.51	74.00	-39.49	20.62	54	-33.38
14.7802815	150.00	395.00	48.03	34.20	6.05	54.08	74.00	-19.92	40.25	54	-13.75
17.57390375	253.00	395.00	44.78	30.92	8.01	52.78	74.00	-21.22	38.93	54	-15.07
Final = Raw + Path Loss											
Margin = Final - Limit											

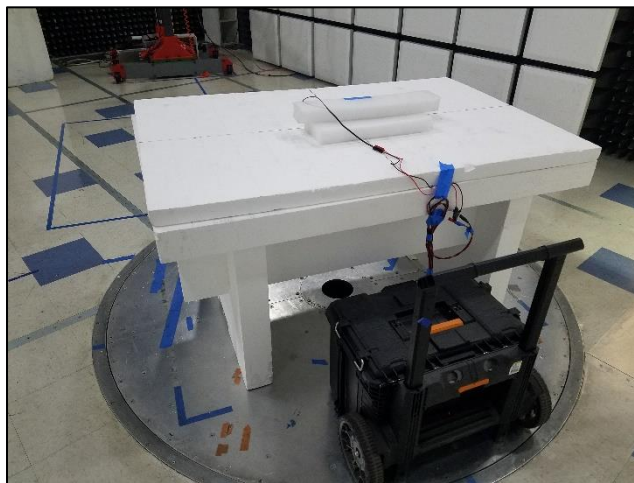


Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
GHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
1.03249675	79.00	314.00	56.83	37.19	-18.85	37.98	74.00	-36.02	18.34	54	-35.66
14.77466775	353.00	159.00	47.01	33.92	6.12	53.13	74.00	-20.87	40.03	54	-13.97
17.30830575	5.00	105.00	45.08	31.29	7.17	52.25	74.00	-21.75	38.46	54	-15.54
Final = Raw + Path Loss											
Margin = Final - Limit											

Radiated Emissions Test Setup Photos
30-1000MHz



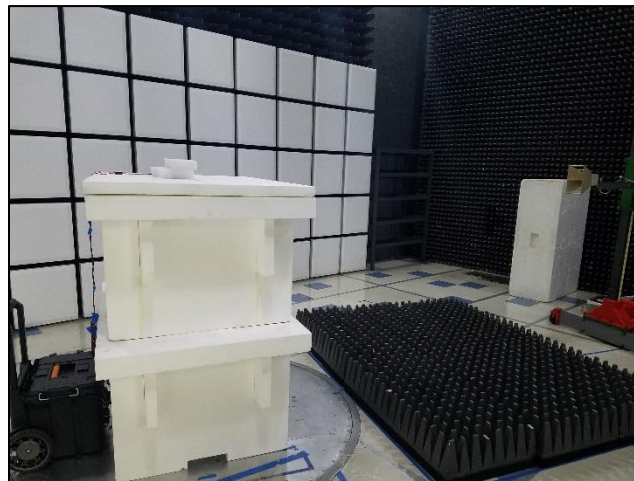
30-1000MHz



>1GHz



>1GHz



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Bilog Antenna 0.030-1.0GHz	Schaffner	CBL6111C	i00349	02/07/23	02/06/25
ultra wideband LNA 10MHz-45GHz	RF-Lambda USA	RLNA00M45GA	i00555	02/19/24	02/19/25
9kHz-44GHz CISPR comp. receiver	Keysight	N9038A	i00552	03/01/24	03/01/25
temperature/humidity/pressure probe	Omega Engineering, Inc.	iBTHX-W-5	i00629	01/25/23	01/24/25
temperature/humidity/pressure probe	Omega Engineering, Inc.	iBTHX-W	i00686	01/25/23	01/24/25
EMI Receiver	Hewlett Packard	85462A	i00033	6/21/23	6/21/24
Transient Limiter	Com-Power	LIT-153	i00123	Verified on: 4/30/24	
Voltmeter	Fluke	87-iii	i00319	5/8/23	5/8/24
AC Power Source	Behlman	BL 6000	i00362	N/A	
LISN	COM-Power	LI-125A	i00446	3/18/24	3/18/26
LISN	COM-Power	LI-125A	i00448	3/18/24	3/18/26
RF Amplifier 10MHz-50GHz, 40dB gain amp.	Eravant	SBB-0115034019-2F2F-E3	i00722	02/7/24	02/7/25
1-18GHz Horn Antenna	Antenna Research Assoc	DRG-118/A	i00271	08/11/22	08/10/24
Antenna, Horn 18-40GHz	EMCO	3116	i00085	03/14/23	03/13/25
Network analyzer	HP	8753D	i00505	11/03/23	11/02/24
Spectrum Analyzer 3Hz-13.2GHz	Agilent	E4445A	i00471	01/05/24	01/05/25

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

Measurement Uncertainty

Measurement Uncertainty for Compliance Testing is listed in the table below.

Measurement	U_{lab}
Radio Frequency	$\pm 3.3 \times 10^{-8}$
RF Power, conducted	± 1.5 dB
RF Power Density, conducted	± 1.0 dB
Conducted Emissions	± 1.8 dB

Measurement	U_{lab}
Radiated Emissions 9kHz-30MHz	$\pm 3.6 \text{ dB}$
Radiated Emissions 30MHz-1000MHz	$\pm 4.25 \text{ dB}$
Radiated Emissions – 1GHz-18GHz	$\pm 4.5 \text{ dB}$
Temperature	$\pm 1.5 \text{ deg C}$
Humidity	$\pm 4.3 \%$
DC voltage	$\pm 0.20 \text{ VDC}$
AC Voltage	$\pm 1.2 \text{ VAC}$

The reported expanded uncertainty $\pm U_{lab}(\text{dB})$ has been estimated at a 95% confidence level ($k=2$) U_{lab} is less than or equal to U_{EMC} therefore;

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit.
- Non-Compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

END OF TEST REPORT