

Test Report

Prepared for: Pix4D S.A.

Model: 324001

Name: viDoc RTK Rover for iPhone 12 Pro

Serial Number: 2100088

Contains FCC ID: 228B324001

Contains IC: 27729-324001

To

FCC Part 15.247 DTS

IC RSS-247 Issue 2

Date of Issue: 19 October 2021

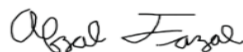
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Afzal Fazal
Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	12 October 2021	Afzal Fazal	Original Document
2.0	19 October 2021	Afzal Fazal	Added modulation and data rate

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



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Table of Contents

<u>Description</u>	<u>Page</u>
Standard Test Conditions and Engineering Practices	6
15.207 A/C Powerline Conducted Emissions	9
15.209 Radiated Emissions	12
Test Equipment Utilized.....	19
Measurement Uncertainty	20

The applicant has been cautioned as to the following

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 marked 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 this 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.

ANAB

Compliance Testing, LLC, has been 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 the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.



FCC Site Reg. #349717

IC Site Reg. #2044A-2

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 (%)
29.3	31.7

Note: The highest clock frequency generated from the device was at 2.48 GHz, therefore the device was tested up to 18 GHz per FCC 15.33 (b)(1).

EUT Description

Model: 324001

Description: viDoc RTK Rover for iPhone 12 Pro

Firmware: 0.2.1(9)

Serial Number: 2100088

Additional Information: The firmware was placed in a test mode of operation where a long press on the power button allowed us to place the unit in normal operation, or in continuous transmit on either low, mid, or high channel. A standard AC to USB charging adapter was used to charge the device during transmit.

EUT Operation during Tests

The EUT's battery was run down before the test and monitored to ensure that full charge was not reached during the test (charging circuits active). The device was tested in three orthogonal axis and on low, mid, and high channels. The worst-case data has been reported.

Transmitter Description

Protocol: Bluetooth Low Energy

Frequency Range: 2402 – 2480 MHz

Antenna Type: PCB Antenna

Antenna Gain: -0.39 dBi

Modulation: GFSK

Data Rate: 1 Mbps

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Power Adapter	Apple Inc.	A1692	FNT0303PD74PPM9AT

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	Charging cable	0.53	Y	Y	Y

Modifications:

none

Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.247(d), RSS-247 (5.1 & 5.2) 15.209(a), RSS-Gen (6.13 & 8.9) 15.205, RSS-Gen (8.10)	Radiated Spurious Emissions	Pass	
15.207, ISED-003	A/C Powerline Conducted Emissions	Pass	
15.109, RSS-Gen 7.1	Receiver Spurious Emission Limits	Pass	

Note:

Spectrum frequency from 9 kHz to 25GHz (tenth harmonic of fundamental frequency) was investigated, and no obvious emission were detected from 9 kHz to 30MHz and 18GHz to 25GHz, so below final test was performed with frequency range from 30MHz to 18GHz.

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	Description
CFR47, Part 15, Subpart B	Unintentional Radiators
CFR47, Part 15, Subpart C	Intentional Radiators
ANSI C63.10-2013	American National standard for testing Unlicensed Wireless Devices
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
KDB 558074 D01 v04	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under §15.247

15.207 A/C Powerline Conducted Emissions

Engineer: Afzal Fazal

Test Date: 9/15/2021

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. The test was performed per section 6.2 of C63.10:2013 "Standard test method for ac power-line conducted emissions from unlicensed wireless devices".

The Spectrum Analyzer was set to the following:

RBW = 9 kHz

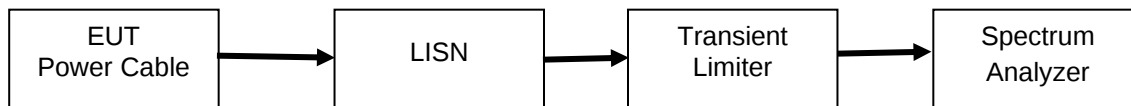
VBW $\geq 3 \times$ RBW

Sweep time = auto couple

Detector = Peak, Quasi-Peak, Average

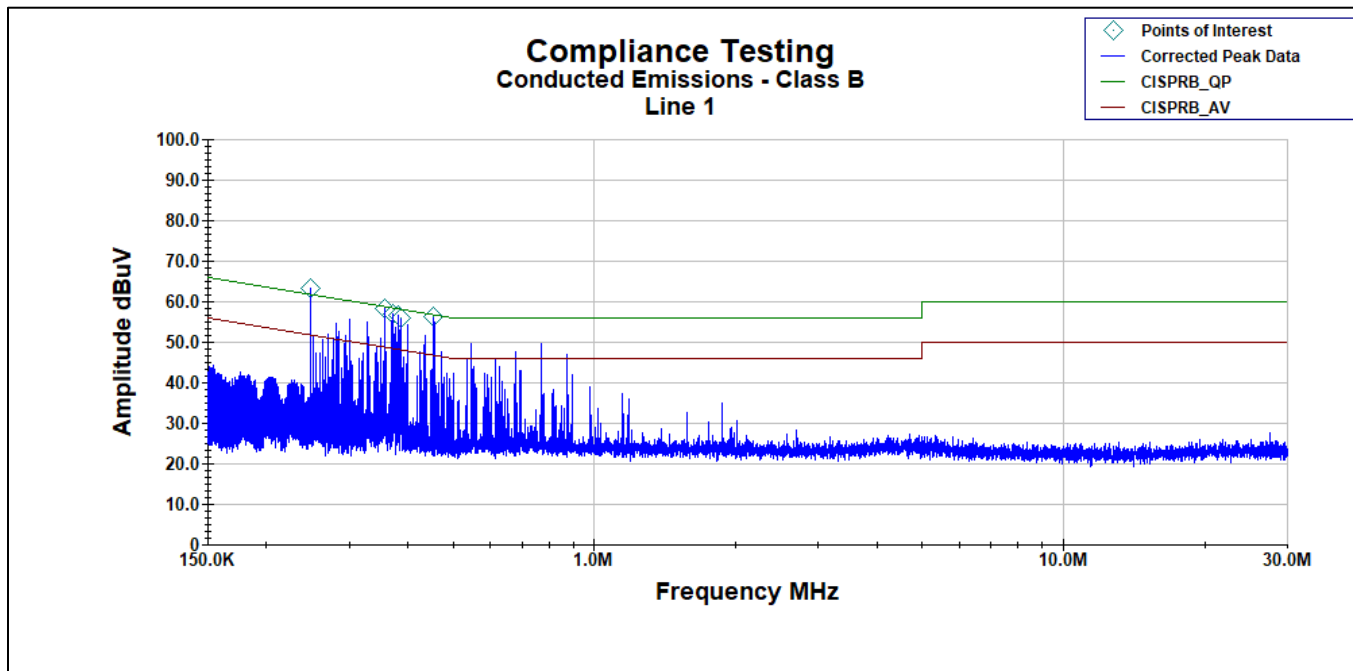
Trace Mode = max hold

Test Setup

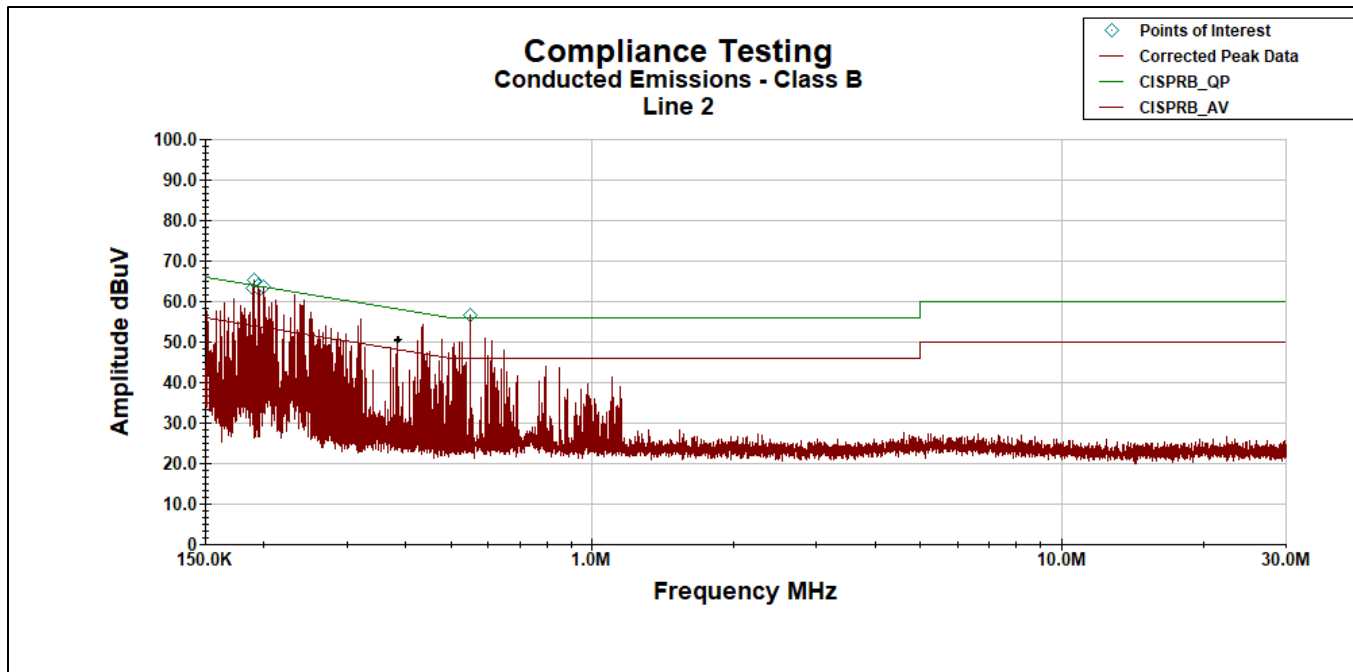


Conducted Emissions Test Results

Line 1 Peak Plot



Line 2 Peak Plot



Line 1 Neutral QP Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	Avg Margin (dB)
260.61 KHz	23.07	0.202	0.023	10.1	33.395	62.84	-29.445
351.74 KHz	16.37	0.149	0.028	10.1	26.647	60.236	-33.589
379.1 KHz	16.57	0.138	0.029	10.1	26.837	59.454	-32.617
380.52 KHz	15.8	0.138	0.029	10.1	26.067	59.414	-33.347
390.16 KHz	16.34	0.134	0.03	10.1	26.603	59.138	-32.535
445.7 KHz	12.27	0.121	0.03	10.1	22.521	57.551	-35.031

Line 1 Neutral Avg Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	Avg Margin (dB)
260.61 KHz	6.53	0.2	0.023	10.1	16.853	52.84	-35.987
351.74 KHz	6.15	0.15	0.028	10.1	16.427	50.236	-33.809
379.1 KHz	5.3	0.14	0.029	10.1	15.571	49.454	-33.884
380.52 KHz	5.79	0.14	0.029	10.1	16.06	49.414	-33.354
390.16 KHz	2.53	0.13	0.03	10.1	12.79	49.138	-36.348
445.7 KHz	3.39	0.12	0.03	10.1	13.638	47.551	-33.914

Line 2 Phase QP Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
175.37 KHz	41.45	0.34	0.02	10.1	51.914	65.275	-13.361
180.16 KHz	40.09	0.33	0.02	10.1	50.54	65.138	-14.599
188.38 KHz	44.24	0.3	0.02	10.1	54.665	64.903	-10.239
194.29 KHz	18.67	0.29	0.02	10.1	29.081	64.735	-35.653
198.4 KHz	38.79	0.28	0.02	10.1	49.193	64.617	-15.424
549.9 KHz	8.79	0.09	0.03	10.1	19.01	56	-36.99

Line 2 Phase Avg Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
175.37 KHz	18.07	0.34	0.02	10.1	28.534	55.275	-26.741
180.16 KHz	16.18	0.33	0.02	10.1	26.633	55.138	-28.505
188.38 KHz	20.32	0.3	0.02	10.1	30.748	54.903	-24.155
194.29 KHz	8.09	0.29	0.02	10.1	18.5	54.735	-36.235
198.4 KHz	13.24	0.28	0.02	10.1	23.647	54.617	-30.971
549.9 KHz	5.55	0.09	0.03	10.1	15.767	46	-30.233

15.209 Radiated Emissions

Engineer: Afzal Fazal

Test Date: 9/16-23/2021

Test Procedure

The EUT was tested in a semi-anechoic test chamber 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° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized. The test was performed per section 11.11 of C63.10:2013 "Emissions in nonrestricted frequency bands" and compared to limits of 15.209.

All emissions from 30 MHz to 1 GHz were examined.

Measured Level includes antenna and receiver cable correction factors.

Correction factors were input into the spectrum analyzer before recording "Measured Level".

RBW = 120 KHz

VBW = 300 KHz

Detector – Quasi Peak

All emissions above 1 GHz were examined.

Measured Level includes antenna and receiver cable correction factors.

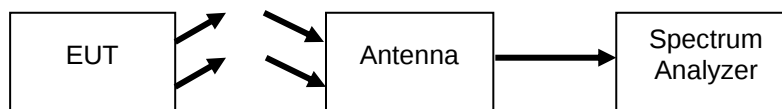
Correction factors were input into the spectrum analyzer before recording "Measured Level".

RBW = 1 MHz

VBW = 3 MHz

Detector – Average

Test Setup



Settings below 1 GHz

RBW = 120 KHz

VBW = 300 KHz

Detector – Quasi Peak

Settings above 1 GHz

RBW = 1 MHz

VBW = 3 MHz

Detector – Peak

Sample Calculations

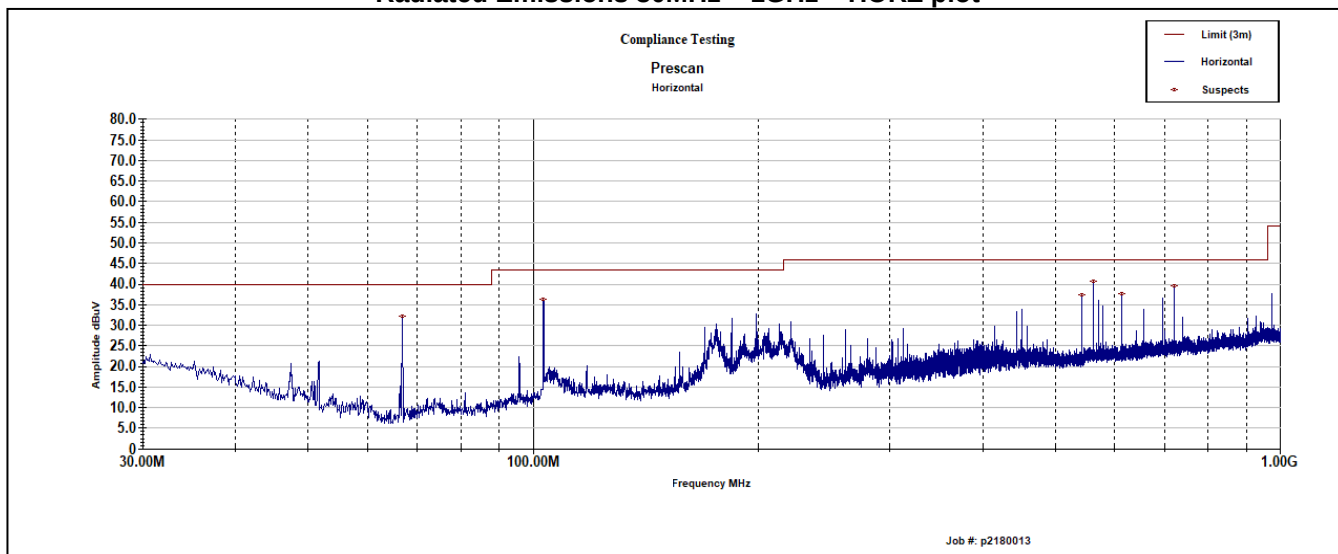
Corrected Value = Measured Value + Correction factor

Correction factor = ACF + Cable loss

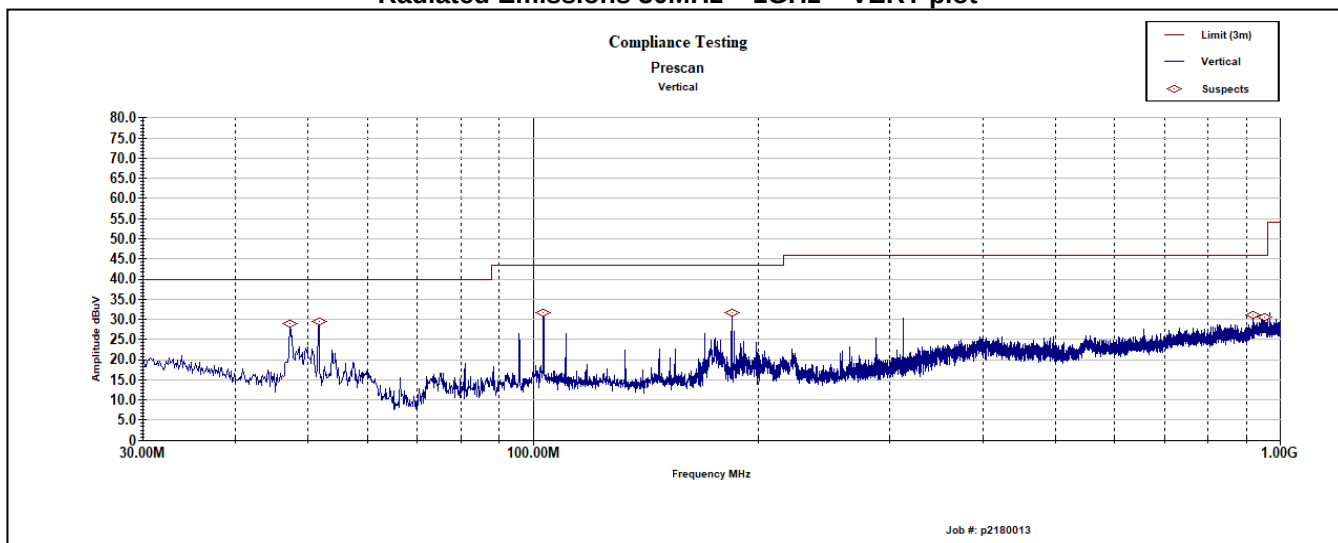
Radiated Emissions: 30MHz – 1GHz

Emission Frequency (MHz)	Measured Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Antenna Polarity (V/H)	Turntable Position (deg)	Detector (QP,PK,Avg)
47.78	31.84	40	-8.16	110	V	0	QP
51.610	29.47	40	-10.53	170	V	0	QP
103.220	23.55	43.5	-19.95	110	V	0	QP
184.310	24.73	43.5	-18.77	110	V	0	QP
551.470	21.74	46	-24.26	110	H	0	QP
738.410	22.58	46	-23.42	110	H	0	QP

Radiated Emissions 30MHz – 1GHz – HORZ plot



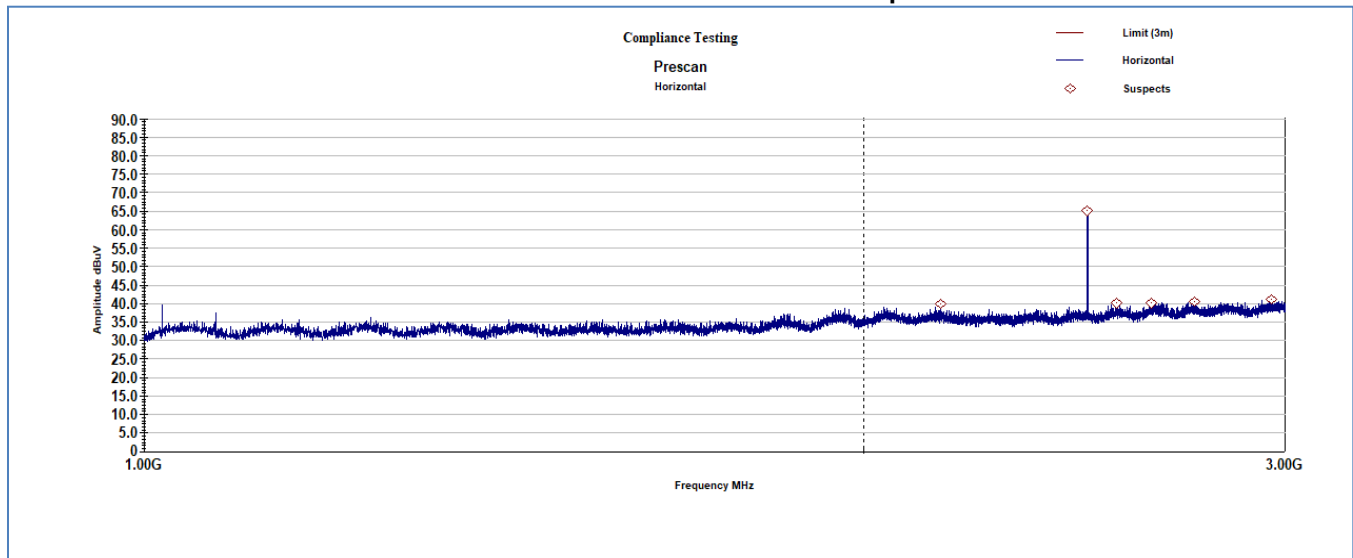
Radiated Emissions 30MHz – 1GHz – VERT plot



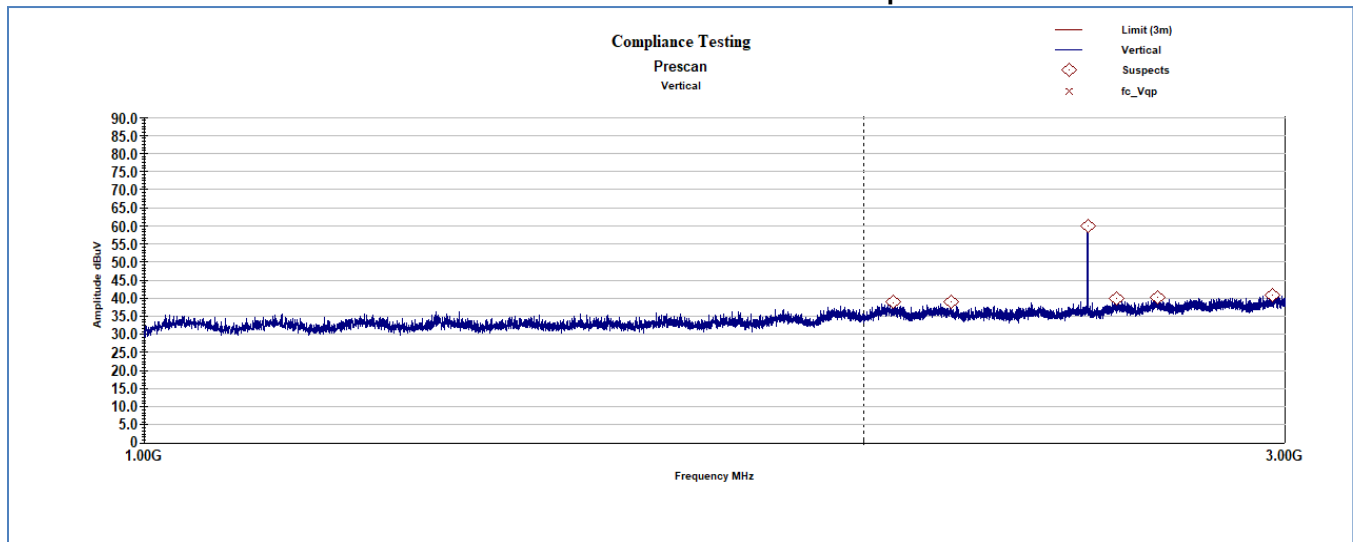
Radiated Emissions 1-18 GHz

Emission Frequency (MHz)	Measured Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Antenna Polarity (V/H)	Turntable Position (deg)	Detector (QP,PK,Avg)
2550.482	39.02	53.9	-14.88	150	V	0	AVG
2959.224	39.23	53.9	-14.67	150	H	0	AVG
2963.863	40.11	53.9	-13.79	150	V	0	AVG
14783.543	50.73	53.9	-3.17	150	V	0	AVG
14821.634	50.46	53.9	-3.44	150	H	0	AVG
17521.304	52.26	53.9	-1.64	150	H	0	AVG
17587.962	51.67	53.9	-2.23	150	V	0	AVG

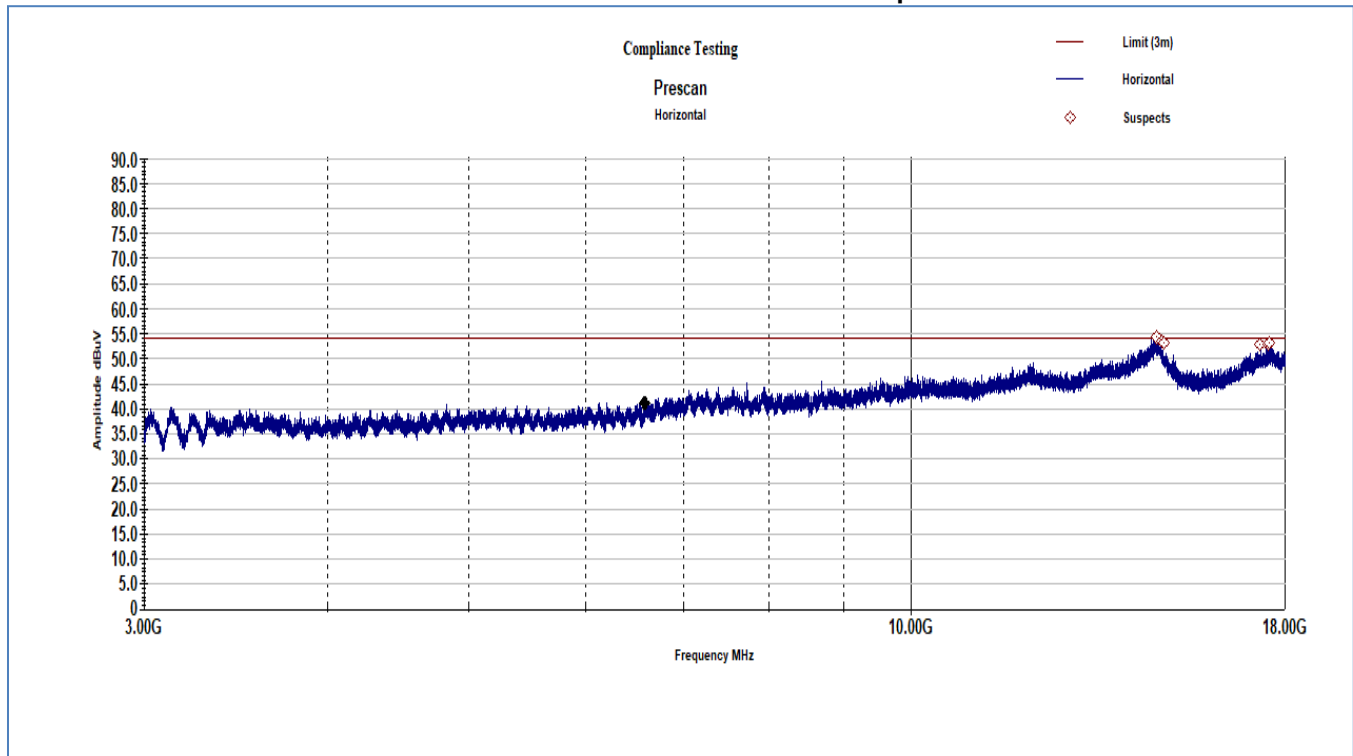
Radiated Emissions 1-3 GHz – HORZ plot



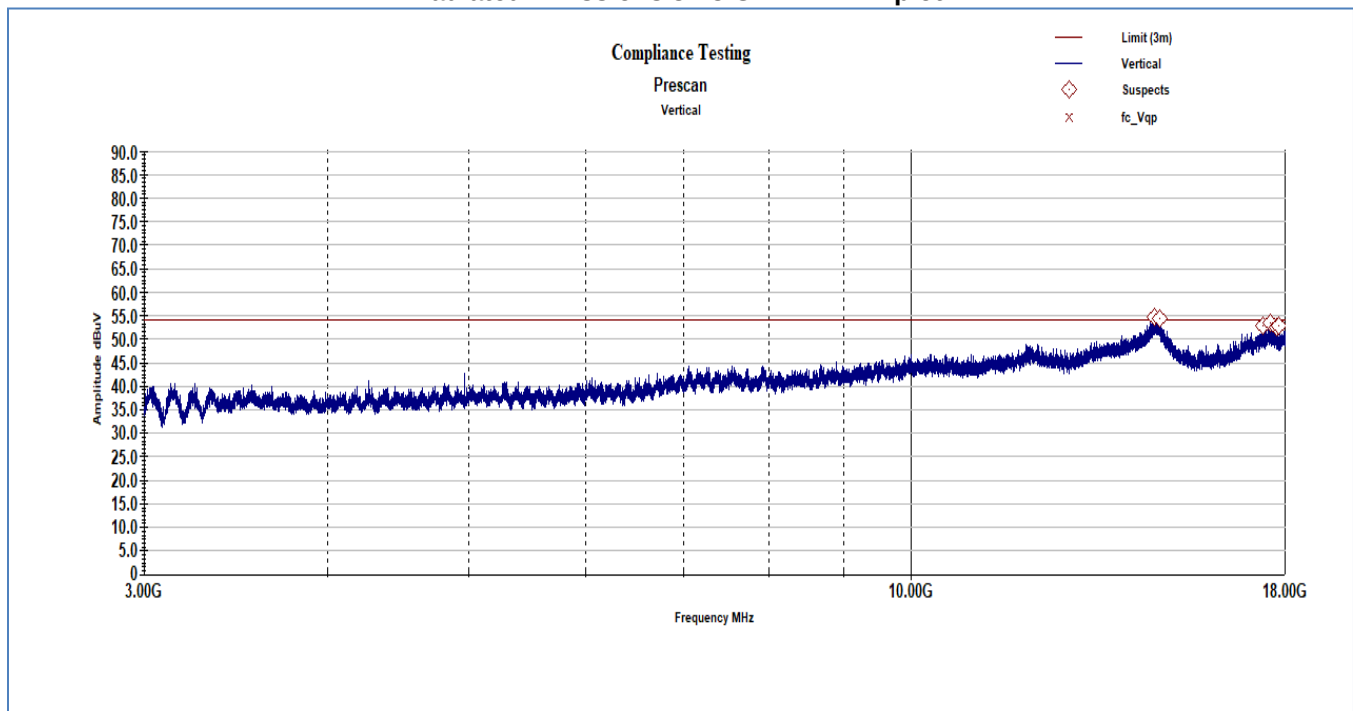
Radiated Emissions 1-3 GHz – VERT plot



Radiated Emissions 3-18 GHz – HORZ plot



Radiated Emissions 3-18 GHz – VERT plot

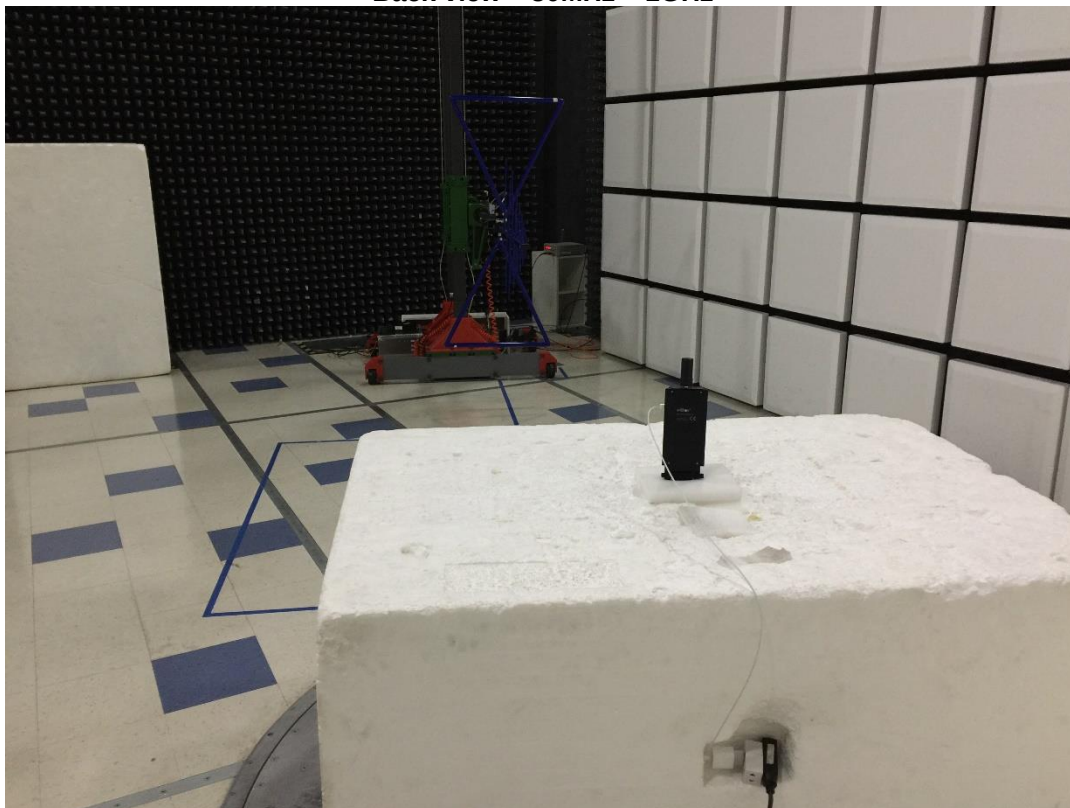


Radiated Emissions Test Setup Photos

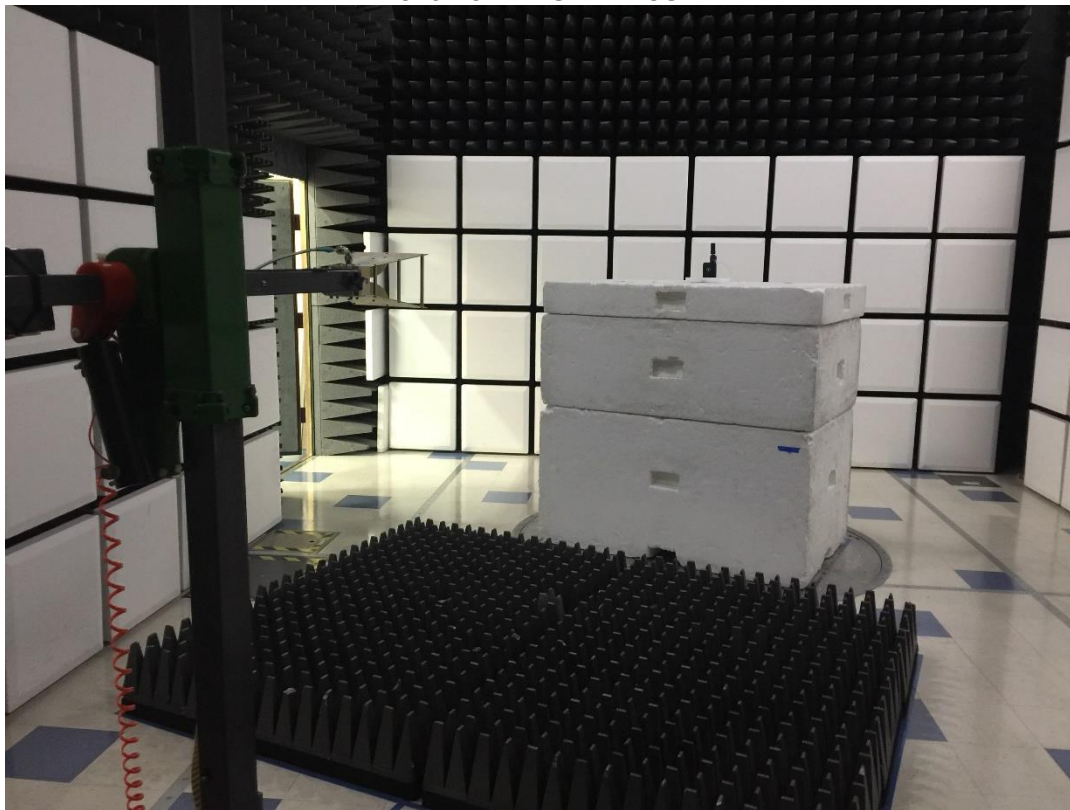
Front view – 30MHz – 1GHz



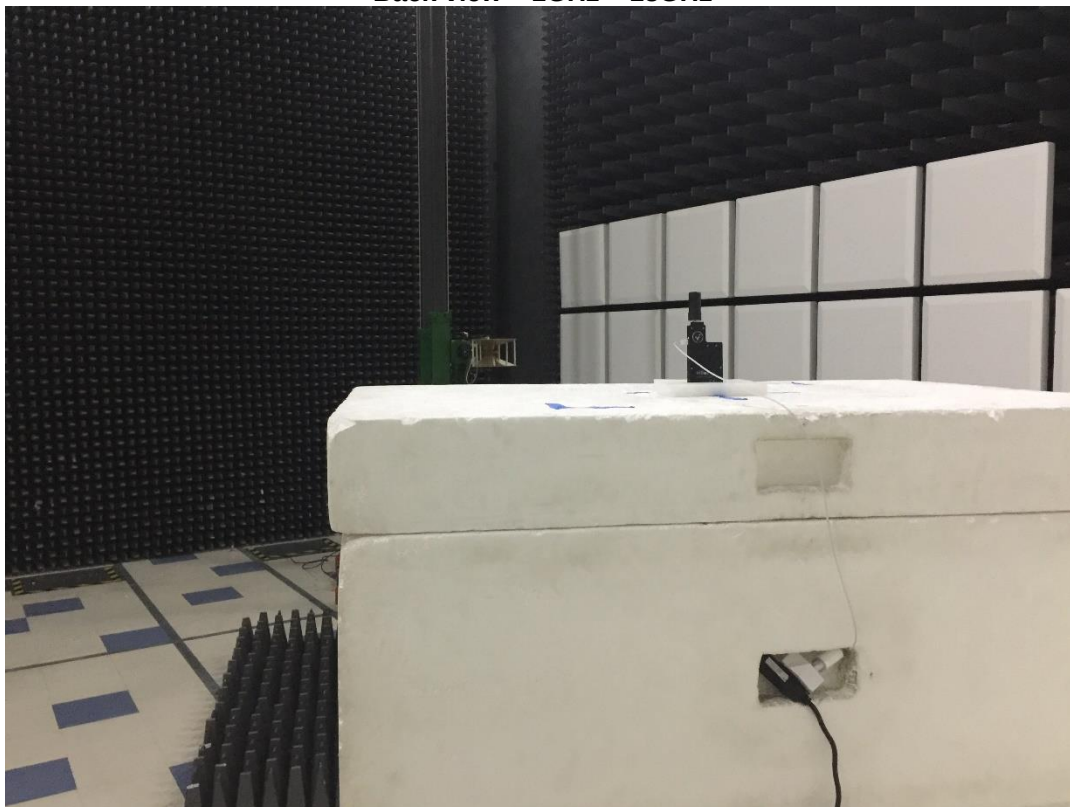
Back view – 30MHz – 1GHz



Front view – 1GHz – 18GHz

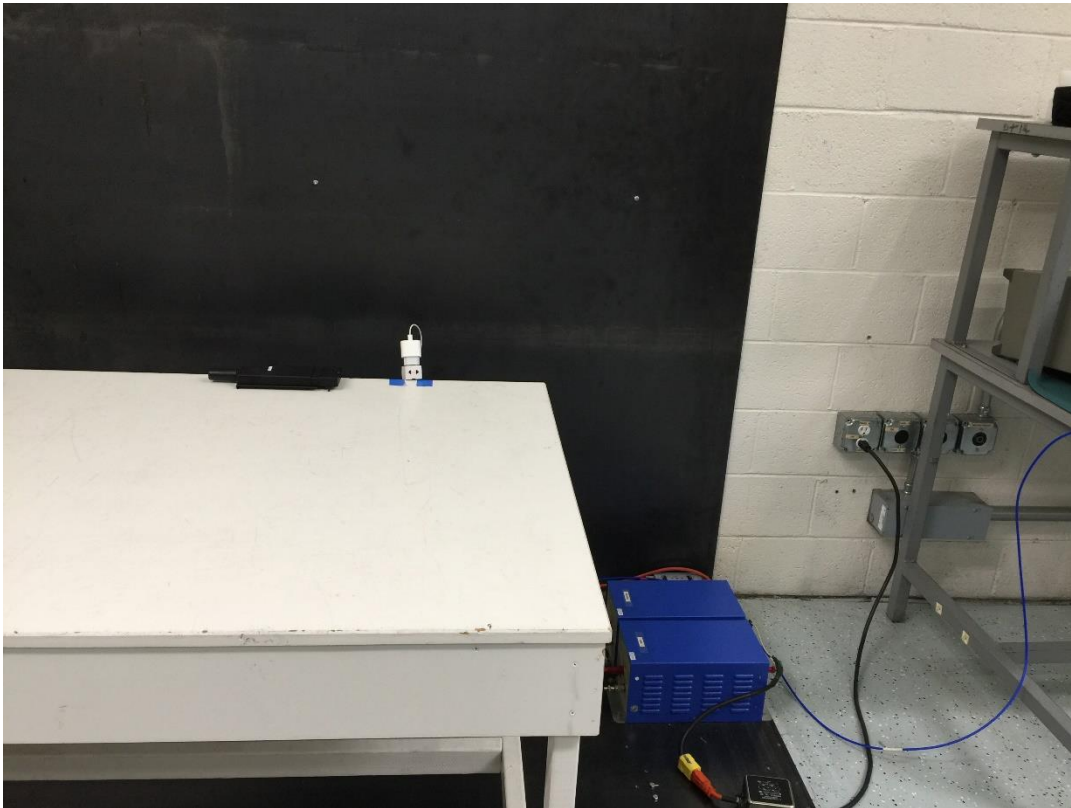


Back view – 1GHz – 18GHz

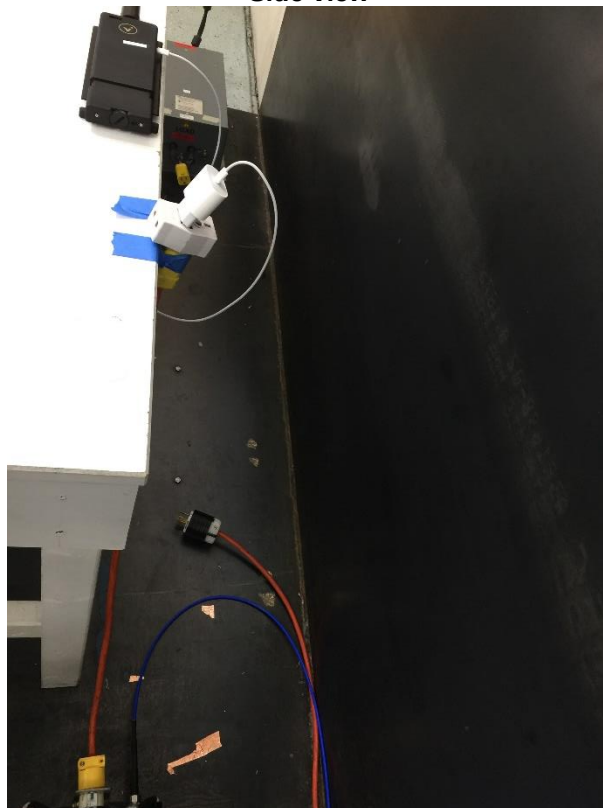


A/C Conducted Emissions Test Setup Photos

Front View



Side view



Test Equipment Utilized

FCC Part 15B

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Preamplifier	Eravant	S BB-0115034018-2F2F-E3	i00591	Verified on: 9/19/21	
Transient Limiter	Com-Power	LIT-153	i00123	Verified on: 9/15/21	
Bi-Log antenna	Chase	CBL6111C	i00267	8/28/20	8/28/22
Humidity / Temp Meter*	Newport	IBTHX-W-5	i00282	8/28/20	8/28/21*
EMI Analyzer	Agilent	E7405A	i00379	12/29/20	12/29/21
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	7/17/20	7/17/23
LISN	Com-Power	LI-125A	i00447	4/28/20	4/28/22
LISN	Com-Power	LI-125A	i00449	4/28/20	4/28/22

*Extended 30 days by the Lab Manager

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 Type	Measurement Unit	Frequency Range	Expanded Uncertainty
Conducted Emissions	dBuV	0.15 - 30 MHz	± 3.2 dB
Radiated Emissions	dBuV/m	30 - 1000 MHz	± 3.6 dB
Radiated Emissions	dBuV/m	1 - 6 GHz	± 3.9 dB
Radiated Emissions	dBuV/m	6 – 18 GHz	± 4.2 dB

The reported expanded uncertainty $\pm U_{lab}$ (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