

Intragrain Technologies Inc. **TEST REPORT**

SCOPE OF WORK

EMC TESTING – Fuel Lock, Model: 106304-B

REPORT NUMBER

104114272MPK-006

ISSUE DATE

September 27, 2021

REVISED DATE

November 04, 2021

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DOCUMENT CONTROL NUMBER

Non-Specific EMC Report Shell Rev. December 2017 MPK
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TEST REPORT

(FULL COMPLIANCE)

Report Number: 104114272MPK-006
Project Numbers: G104114272, G104123441

Report Issue Date: September 27, 2021
Revision Issue Date: November 04, 2021

Product Designation: Fuel Lock
Model Tested: 106304-B

Standards: FCC Part 15, Subpart B
ISED ICES-003 Issue 7

Class A

for

Intragrain Technologies Inc.

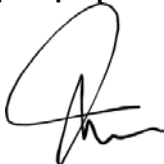
Test Performed by:

Intertek
1365 Adams Court
Menlo Park, CA 94025 USA

Test Authorized by:

Intragrain Technologies Inc.
118 Husum Road
RM of Sherwood, S4K 0A4 Canada

Report prepared by



John Nguyen / EMC Engineer

Report reviewed by



Krishna Vemuri / EMC Manager

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1. Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2. Executive Test Plan and Test Summary

Tests were performed to the following standards per FCC Part 15 Subpart B and ISED ICES-003 Issue 7:

Radiated Emissions

ANSI C63.4: 2014, Class A

AC Mains Conducted Emissions

ANSI C63.4: 2014, Class A

Test Plan

The EUT shall be tested according to the table below:

FCC Part 15 Subpart B, ICES-003 Emissions Test Requirements Proposed Tests			
Basic Standard	Test Specifications	Applicable Ports	Test Mode and Configuration
ANSI C63.4	Radiated Emission	-	120V 60Hz Normal Mode
ANSI C63.4	Conducted Emission	-	120V 60Hz Normal Mode

EXECUTIVE SUMMARY

FCC Part 15 Subpart B, ICES-003 Emissions Test Requirements Summary of Test Results			
Basic Standard	Test Specifications	Applicable Ports	Pass/Fail Comments
ANSI C63.4	Radiated Emission	-	Complies
ANSI C63.4	Conducted Emission	-	Complies

3. Client Information, Environmental Conditions, Performance Level**This EUT was tested at the request of:**

Client: Intragrain Technologies Inc.
 118 Husum Road
 RM of Sherwood, SK S4K0A4
 Canada

Contact: Grant Kerr
Email: grantkerr@intragrain.com

4. Description of Equipment Under Test and Variant Models

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Fuel Lock	Intragrain Technologies Inc.	106304-B	B07F3AF

Receive Date:	09/01/2021	Test Started:	09/02/2021
Received Condition:	Good	Test Completed:	09/15/2021
Type:	Production		

Description of Equipment Under Test (provided by client)
Device used for bulk fuel security and employee management.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
Fuel Lock			
120V	30A	60Hz	1

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	The EUT was in normal operation with cell radio module working continuously.

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	N/A

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

Not Applicable.

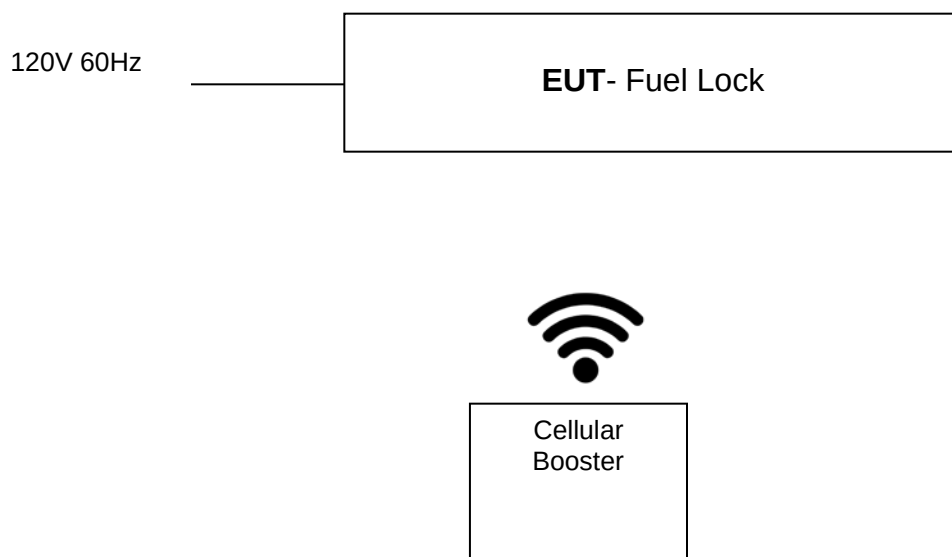
5. System Setup and Method

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Cellular Booster	HiBoost	F10G-5S-BTW	F10G5S2101271132

5.1 Method

Configuration as required by ANSI C63.4.

5.2 EUT Block Diagram



EUT Pictures



5.3 Justification

The EUT was configured in table-top configuration for testing, as specified by Intragrain Technologies Inc. The highest clock frequency is the Cell radio module. Therefore, for FCC 15 Subpart B, emissions were performed up to 26.5GHz.

Evaluation for spurious emissions of pre-certified radio module installed inside Host equipment was performed. Radio module FCC ID: XPY1EIQ24NN. See Appendix A for test data and setup photos.

5.4 Modifications Required for Compliance

No modifications were installed by Intertek to achieve compliance.

6. Radiated Emissions (ANSI C63.4)

6.1 Method

Tests are performed in accordance with ANSI C63.4.

TEST SITE: 10 m ALSE

10 m ALSE: The test facility is located at 1365 Adams Court, Menlo Park, California. The test site is a 10-meter semi-anechoic chamber. The site meets the characteristics of ANSI C63.4:2014. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote-controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

The A2LA certificate number for this site is 1755-01.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	U _{CISPR}
Radiated Emissions, 10m	30-200 MHz	4.9 dB	6.3 dB
Radiated Emissions, 10m	200-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-18 GHz	5.0 dB	5.2 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation:

The field strength is calculated by adding the Antenna Factor and Cable Factor, then subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength in dB μ V/m
RA = Receiver Amplitude (including preamplifier) in dB μ V
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV, the following was used:

$$UF = 10^{(NF/20)}$$

Where: UF = Net Reading in μ V
NF = Net Reading in dB μ V

Example:

FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0
UF = $10^{(32 \text{ dB}\mu\text{V}/20)} = 39.8 \mu\text{V/m}$

6.2 Test Equipment Used

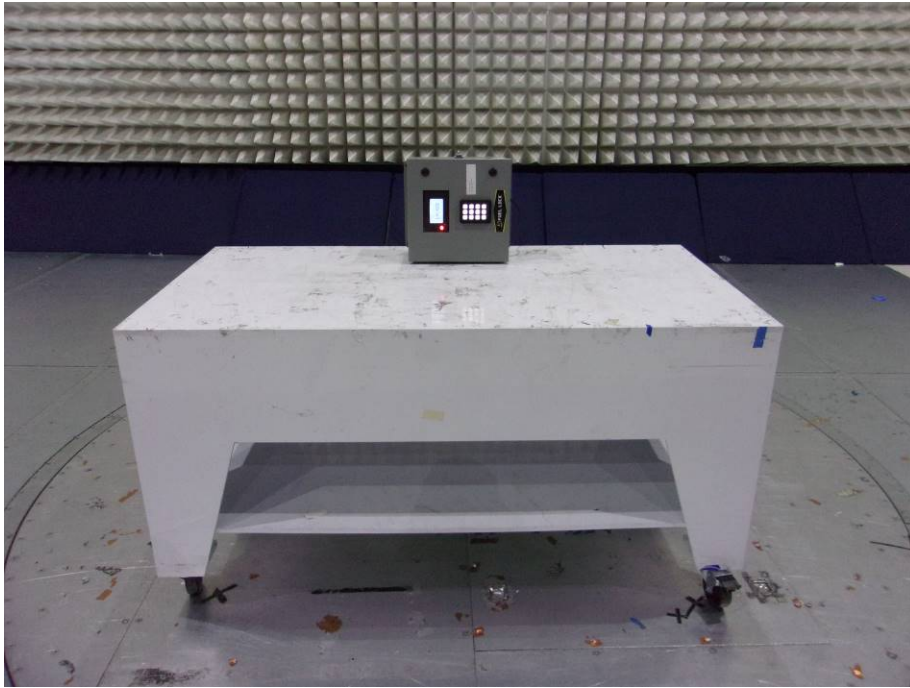
See Section 8.0 for specific equipment used for this test.

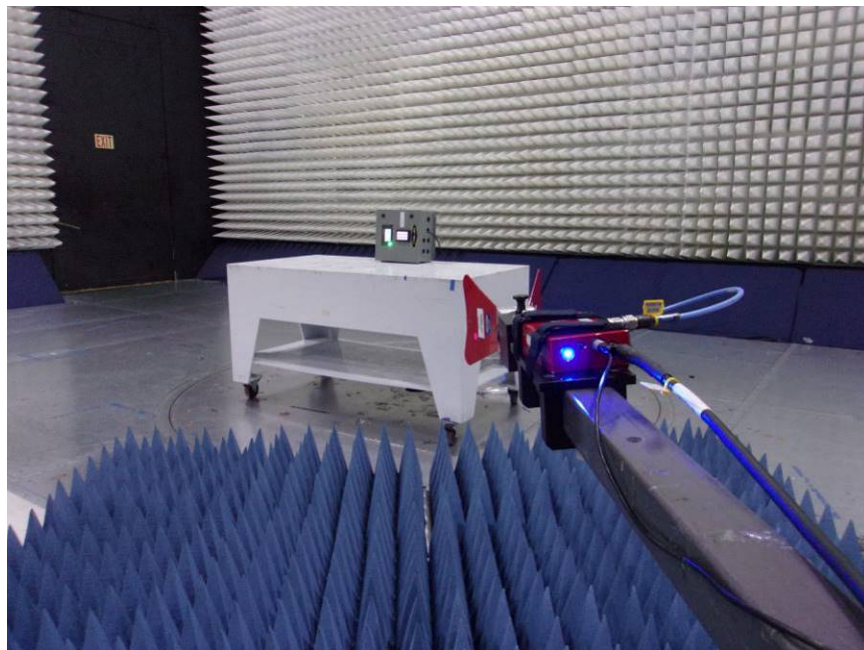
Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	3.20.0.14

6.3 Result

The sample tested was found to **comply**.

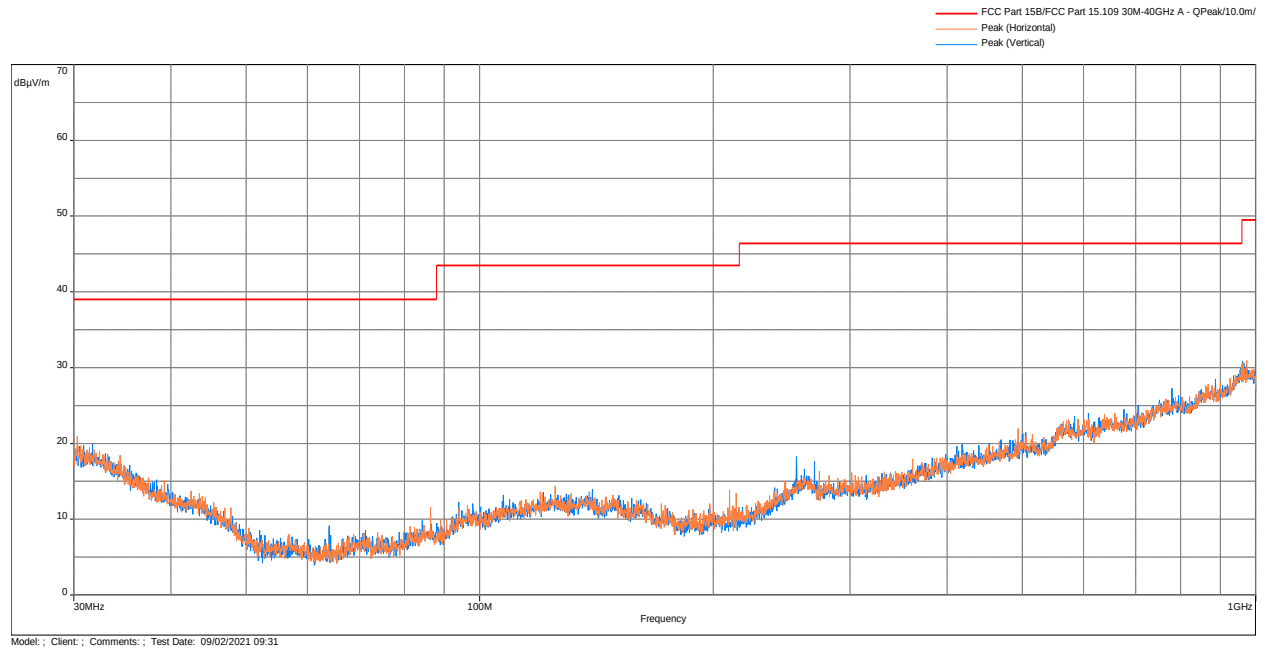
6.4 Setup Photograph



6.5 Plot/Data

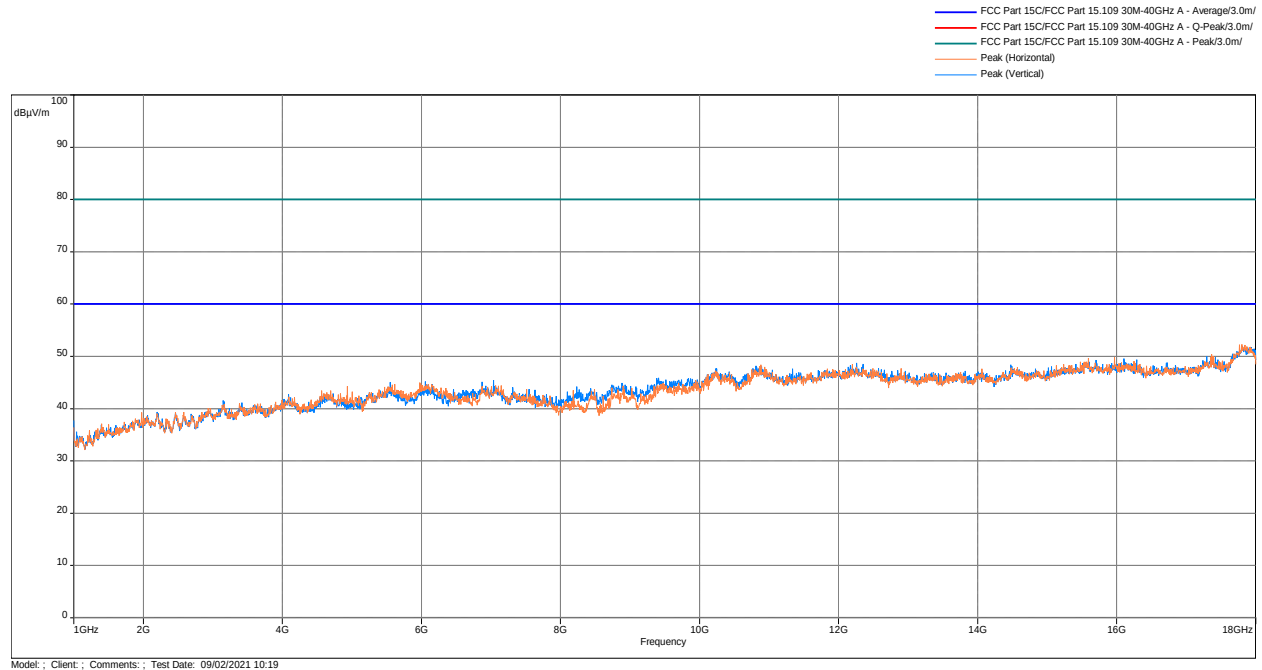
The EUT met the radiated disturbance requirements of FCC Part 15 Subpart B and ICES-003 for a Class A Device.

FCC Part 15 Subpart B and ICES-003 Radiated Disturbance 30MHz to 1GHz



Frequency (MHz)	Peak (dBμV/m)	Lim.Q-Peak (dBμV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
30.32333	21	39	-18.0	2.01	179.75	Horizontal	-8.57
31.71367	19.91	39	-19.09	3	198.25	Vertical	-9.24
34.42967	18.46	39	-20.54	1	0	Horizontal	-10.66
39.24733	15.11	39	-23.89	2.01	0	Horizontal	-13.09
940.636	29.05	46.4	-17.35	1	215.25	Horizontal	2.92
948.9457	29.07	46.4	-17.33	2	0.5	Vertical	3.55
949.851	29.14	46.4	-17.26	1	224.25	Vertical	3.56
951.015	28.74	46.4	-17.66	1	100.75	Horizontal	3.57
952.3407	28.95	46.4	-17.45	2.99	145	Horizontal	3.69
953.6663	29.7	46.4	-16.7	2.99	172.5	Horizontal	3.77
954.4747	29.62	46.4	-16.78	3	171.25	Vertical	3.82
955.8327	28.97	46.4	-17.43	2.01	302.5	Horizontal	3.83
956.8997	29.93	46.4	-16.47	2	294.75	Vertical	3.93
957.4817	30.01	46.4	-16.39	2	0.5	Vertical	3.95
959.4863	30.32	46.4	-16.08	2	66	Vertical	4.08
959.7773	30.54	46.4	-15.86	1	127	Horizontal	4.09

Radiated Disturbance, 1GHz-18GHz, Peak Detector vs Peak Limit and Avg Limit



Result: Complies by 15.86 dB

Note: Data includes of the worst-case configuration (the configuration which resulted in the highest emission levels).

Intertek

REPORT NUMBER: 104114272MPK-006

Issued: September 27, 2021

Test Personnel:	<u>Kenneth Roque</u>	Test Date:	<u>09/02/21</u>
Supervising/ Reviewing Engineer:		Limit Applied:	<u>Class A</u>
(Where Applicable)			
Product Standard:	<u>FCC Part 15 Subpart B, ICES-003</u>		
Input Voltage:	<u>120V 60Hz</u>		
Pretest Verification w/ Ambient Signals or		Ambient Temperature:	<u>24 °C</u>
BB Source:	<u>BB Source</u>	Relative Humidity:	<u>50 %</u>
		Atmospheric Pressure:	<u>30 in Hg</u>

Deviations, Additions, or Exclusions: None

7. Conducted Emissions (ANSI C63.4)

7.1 Method

Tests are performed in accordance with ANSI C63.4.

TEST SITE: 10 m ALSE

10 m ALSE: The test facility is located at 1365 Adams Court, Menlo Park, California. The test site is a 10-meter semi-anechoic chamber. The site meets the characteristics of ANSI C63.4:2014.

The A2LA certificate number for this site is 1755-01.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	U _{CISPR}
AC Line Conducted Emissions	150 kHz – 30 MHz	2.1 dB	3.4 dB

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation:

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where: NF = Net Reading in dB μ V
 RF = Reading from receiver in dB μ V
 LF = LISN or ISN Correction Factor in dB
 CF = Cable Correction Factor in dB
 AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV, the following was used:

$$UF = 10^{(NF/20)}$$

Where: UF = Net Reading in μ V
 NF = Net Reading in dB μ V

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$
$$UF = 10^{(49.1 \text{ dB}\mu\text{V}/20)} = 285.1 \mu\text{V/m}$$

7.2 Test Equipment Used

See Section 8.0 for specific equipment used for this test.

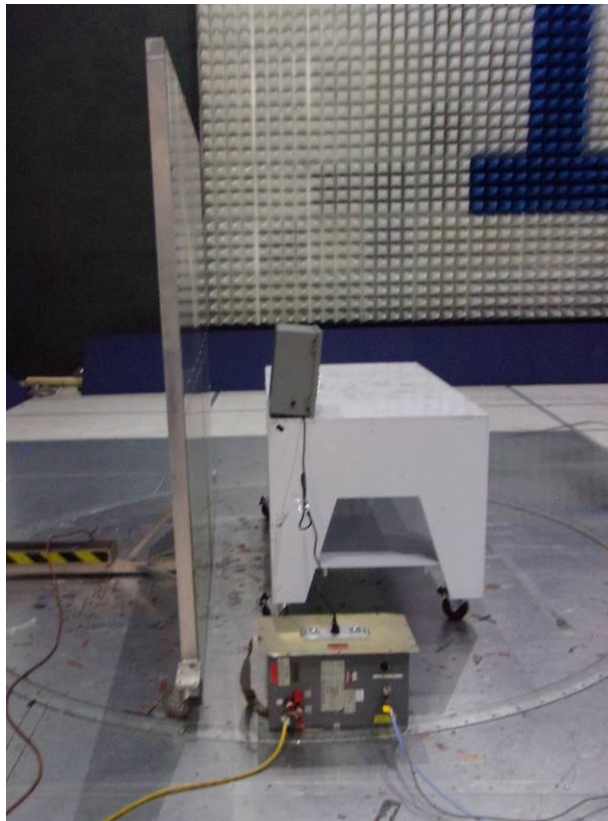
Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	3.20.0.14

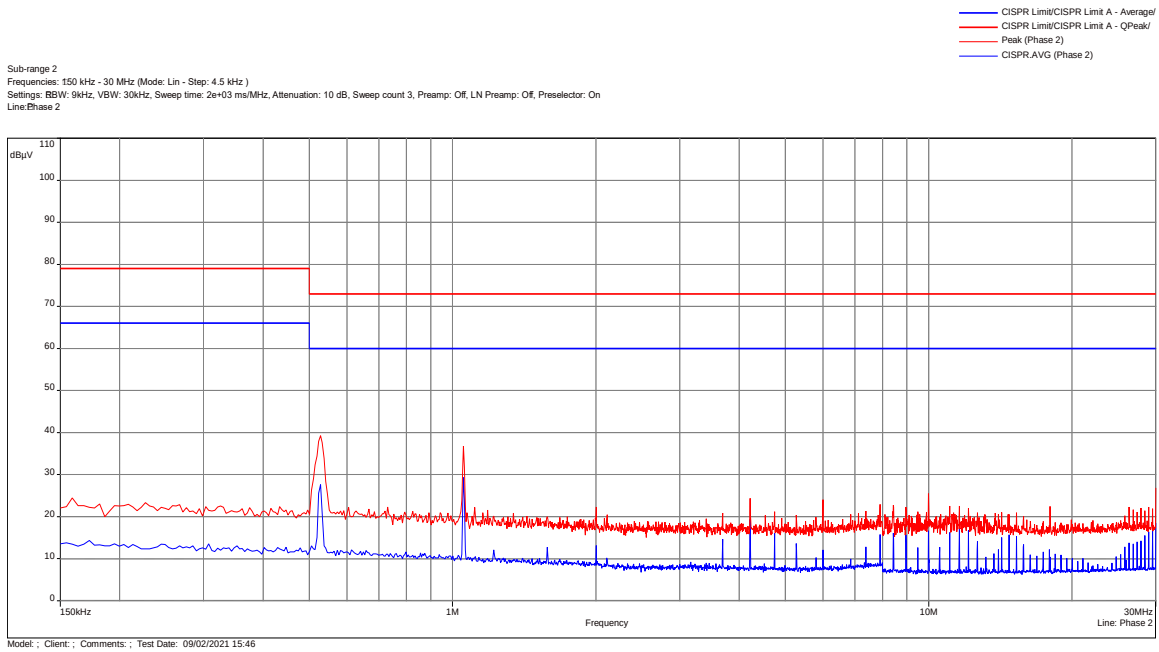
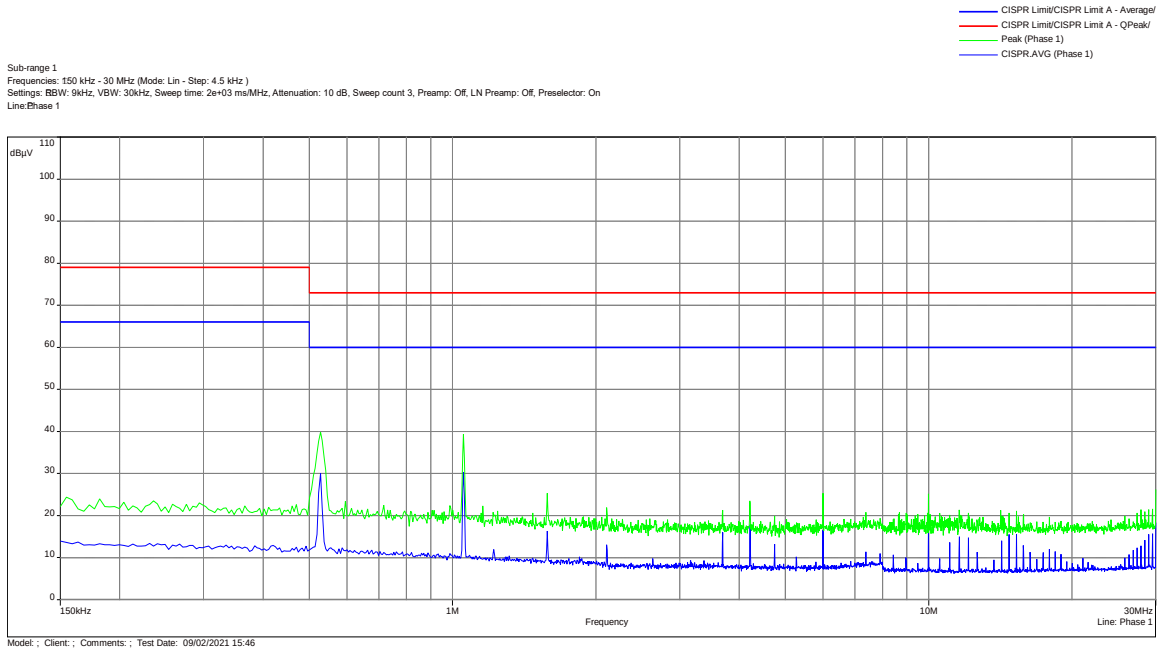
7.3 Result

The sample tested was found to **comply**.

7.4 Setup Photograph



7.5 Plot/Data



Peak/Lim.Q-Peak

Frequency (MHz)	Peak (dBμV)	Lim.Q-Peak (dBμV)	Margin (dB)	Line	Correction (dB)
0.1545	24.39	79	-54.61	Phase 1	10.95
0.159	24.44	79	-54.56	Phase 2	10.97
0.528	39.85	73	-33.15	Phase 1	10.96
0.528	39.31	73	-33.69	Phase 2	10.96
0.5955	23.44	73	-49.56	Phase 1	10.96
0.987	22.4	73	-50.6	Phase 1	11
1.0545	39.33	73	-33.67	Phase 1	10.99
1.0545	36.83	73	-36.17	Phase 2	10.99
1.113	22.2	73	-50.8	Phase 2	11
1.581	25.32	73	-47.68	Phase 1	11.04
2.004	22.3	73	-50.7	Phase 2	11.05
4.2135	23.53	73	-49.47	Phase 1	11.15
4.218	24.35	73	-48.65	Phase 2	11.15
4.749	21.17	73	-51.83	Phase 2	11.2
6	25.34	73	-47.66	Phase 1	11.22
6	24.09	73	-48.91	Phase 2	11.22
7.908	22.97	73	-50.03	Phase 2	11.29
8.4345	22.74	73	-50.26	Phase 2	11.3
9.996	25.49	73	-47.51	Phase 2	11.34
9.996	25.18	73	-47.82	Phase 1	11.34
11.598	22.54	73	-50.46	Phase 2	11.35
27.942	21.41	73	-51.59	Phase 1	11.48
28.995	21.45	73	-51.55	Phase 1	11.44
29.5215	21.59	73	-51.41	Phase 1	11.44
29.9985	26.2	73	-46.8	Phase 1	11.41
30	26.86	73	-46.14	Phase 2	11.41

CISPR.AVG/Lim.Avg

Frequency (MHz)	CISPR.AVG (dBμV)	Lim.Avg (dBμV)	Margin (dB)	Line	Correction (dB)
0.15	13.97	66	-52.03	Phase 1	10.96
0.1725	14.31	66	-51.69	Phase 2	10.98
0.528	30.01	60	-29.99	Phase 1	10.96
0.528	27.67	60	-32.33	Phase 2	10.96
1.0545	30.26	60	-29.74	Phase 1	10.99
1.0545	29.32	60	-30.68	Phase 2	10.99
1.581	16.3	60	-43.7	Phase 1	11.04
2.004	13.14	60	-46.86	Phase 2	11.05
3.6915	14.63	60	-45.37	Phase 2	11.11
3.6915	16.02	60	-43.98	Phase 1	11.11
4.218	19.35	60	-40.65	Phase 2	11.15
4.218	17.87	60	-42.13	Phase 1	11.15
4.7445	13.23	60	-46.77	Phase 1	11.2
4.7445	16.02	60	-43.98	Phase 2	11.2
6	16.58	60	-43.42	Phase 1	11.22
9.996	16.64	60	-43.36	Phase 2	11.34
9.996	17.37	60	-42.63	Phase 1	11.34
11.598	17.43	60	-42.57	Phase 2	11.35
12.1245	16.74	60	-43.26	Phase 2	11.36
14.7615	15.57	60	-44.43	Phase 1	11.37
15.288	15.65	60	-44.35	Phase 1	11.34
28.9995	16.44	60	-43.56	Phase 2	11.44
29.5215	15.73	60	-44.27	Phase 1	11.44
29.526	16.7	60	-43.3	Phase 2	11.44
29.9985	18.32	60	-41.68	Phase 1	11.41
30	18.47	60	-41.53	Phase 2	11.41

Result:	Complies by 29.74 dB
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Intertek

REPORT NUMBER: 104114272MPK-006

Issued: September 27, 2021

Test Personnel: Kenneth Roque
Supervising/
Reviewing Engineer:
(Where Applicable) _____
Product Standard: FCC Part 15 Subpart B, ICES-003
Input Voltage: 120V 60Hz
Pretest Verification w/
Ambient Signals or
BB Source: BB Source

Test Date: 09/02/21
Limit Applied: Class A
Ambient Temperature: 24 °C
Relative Humidity: 50 %
Atmospheric Pressure: 30 in Hg

Deviations, Additions, or Exclusions: None

8. List of Test Equipment**Emissions Test Equipment List**

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	03/09/22
Pre-amp	Sonoma	310N	ITS 01714	12	11/13/21
BI-Log Antenna	Teseq	CBL611D	ITS 01505	12	03/22/22
Active Horn Antenna	ETS-Lindgren	3117-PA	ITS 01365	12	04/20/22
LISN	FCC	FCC-LISN-50-50-M-H	ITS 00551	12	11/16/21
10m Chamber	Panashield	10m Semi-Anechoic Chamber	ITS 00984	36	07/29/23

9. Revision History

Revision Level	Date	Report Number	Prepared by	Reviewed by	Notes
1	September 27, 2021	104114272MPK-006	JN	KV	Original Issue
2	November 04, 2021	104114272MPK-006	JN	KV	Updated the equipment list in Section A2.

Appendix A- Evaluation for spurious emissions of pre-certified radio module installed inside the host equipment per KDB 996369 D04**A.1 Radiated Emissions (ANSI C63.26)****A.1.1 Method**

Tests are performed in accordance with ANSI C63.26, FCC Part 22 and FCC Part 24.

TEST SITE: 10 m ALSE

10 m ALSE: The test facility is located at 1365 Adams Court, Menlo Park, California. The test site is a 10-meter semi-anechoic chamber. The site meets the characteristics of ANSI C63.4:2014. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote-controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

The A2LA certificate number for this site is 1755-01.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisprr
Radiated Emissions, 10m	30-200 MHz	4.9 dB	6.3 dB
Radiated Emissions, 10m	200-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-18 GHz	5.0 dB	5.2 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

A.1.2 Test Equipment Used:

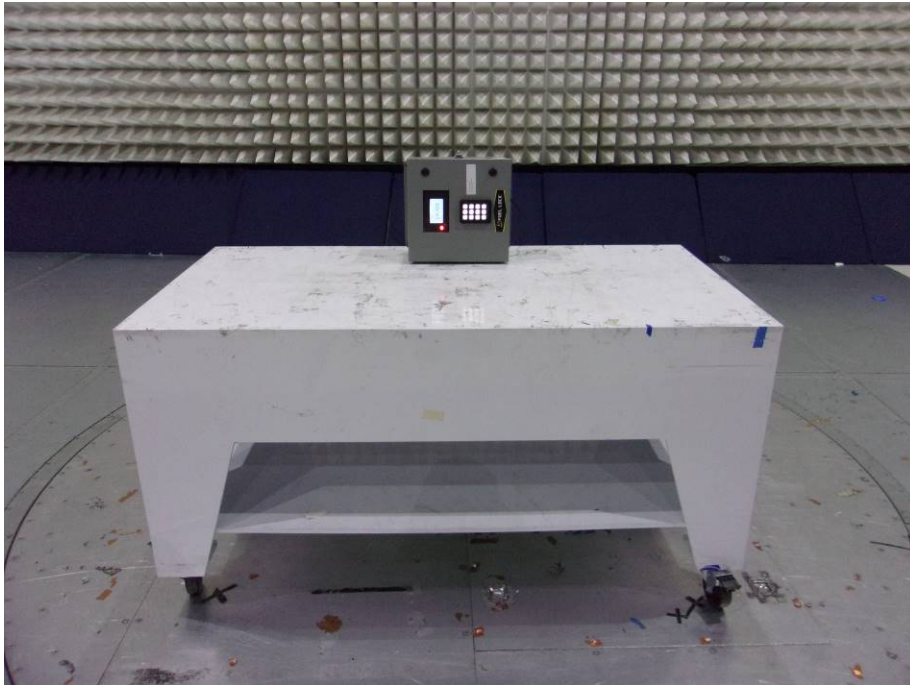
See Section A.2 for specific equipment used for this test

Software Utilized:

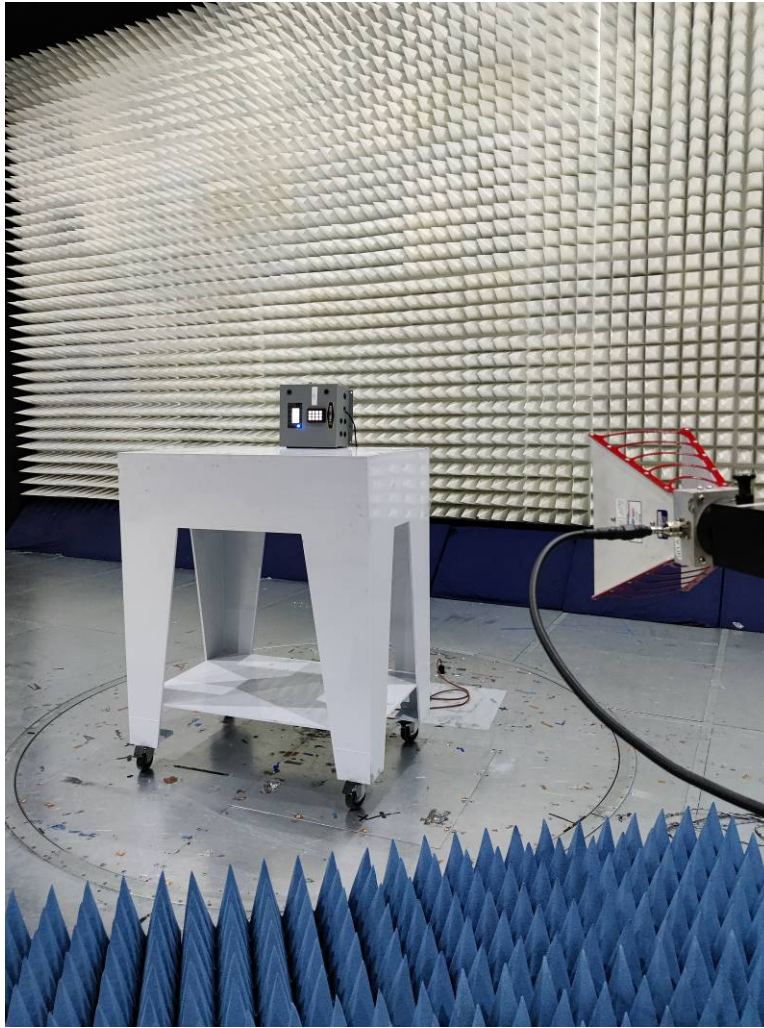
Name	Manufacturer	Version
BAT-EMC	NEXIO	3.20.0.14

A.1.3 Results:

The sample tested was found to **comply**.

A.1.4 Setup Photographs:

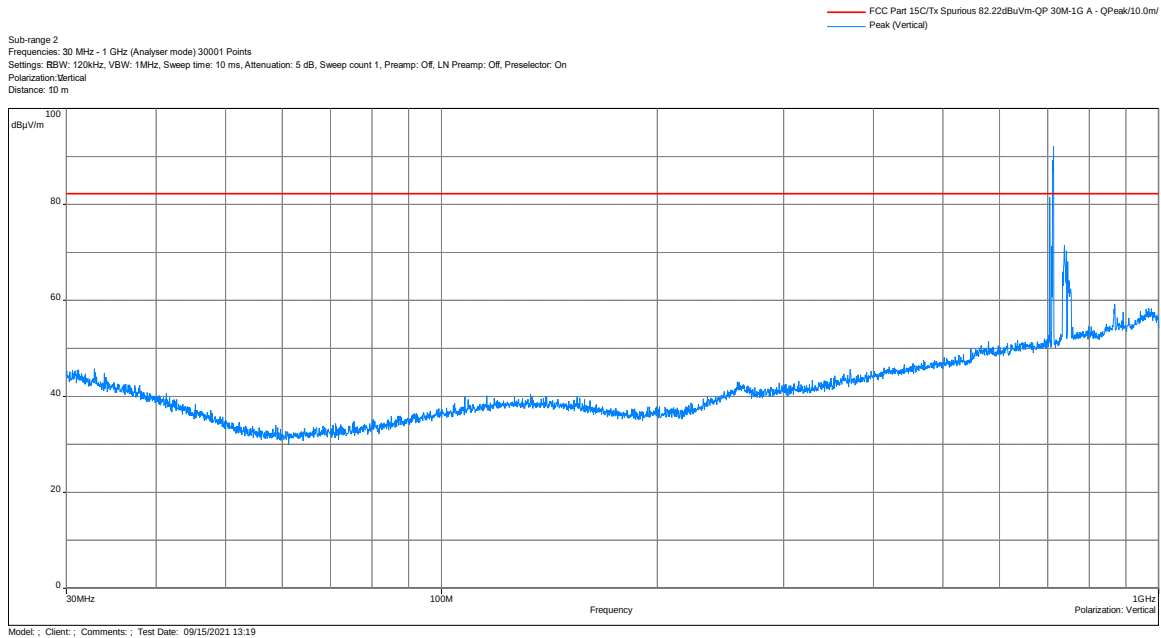
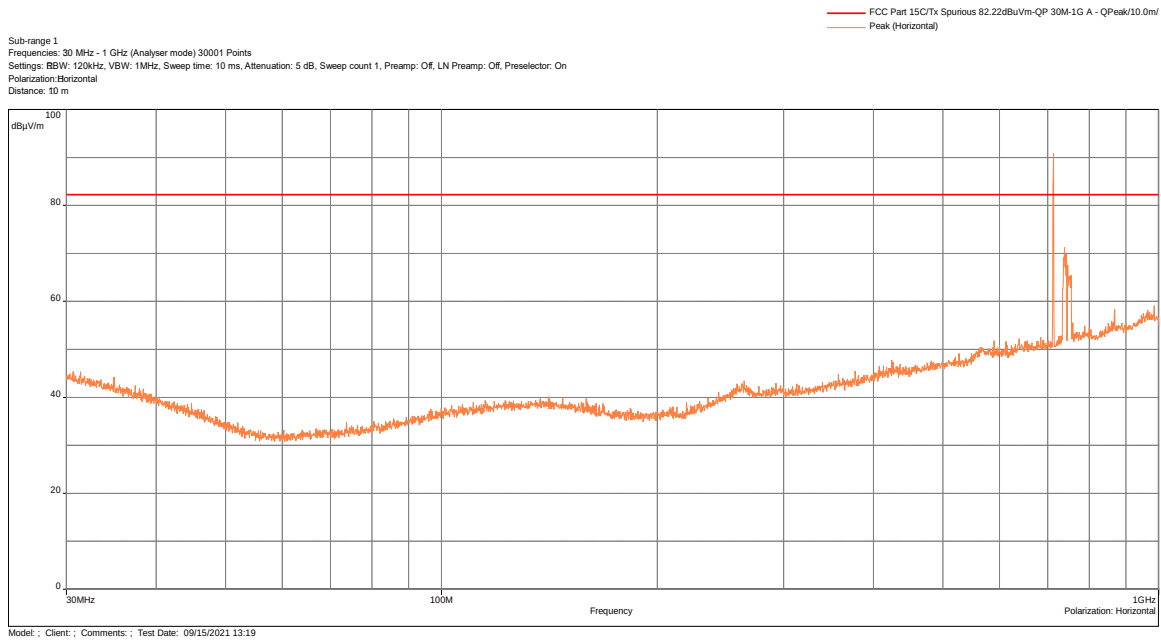
Electromagnetic Radiated Disturbance Setup Photograph



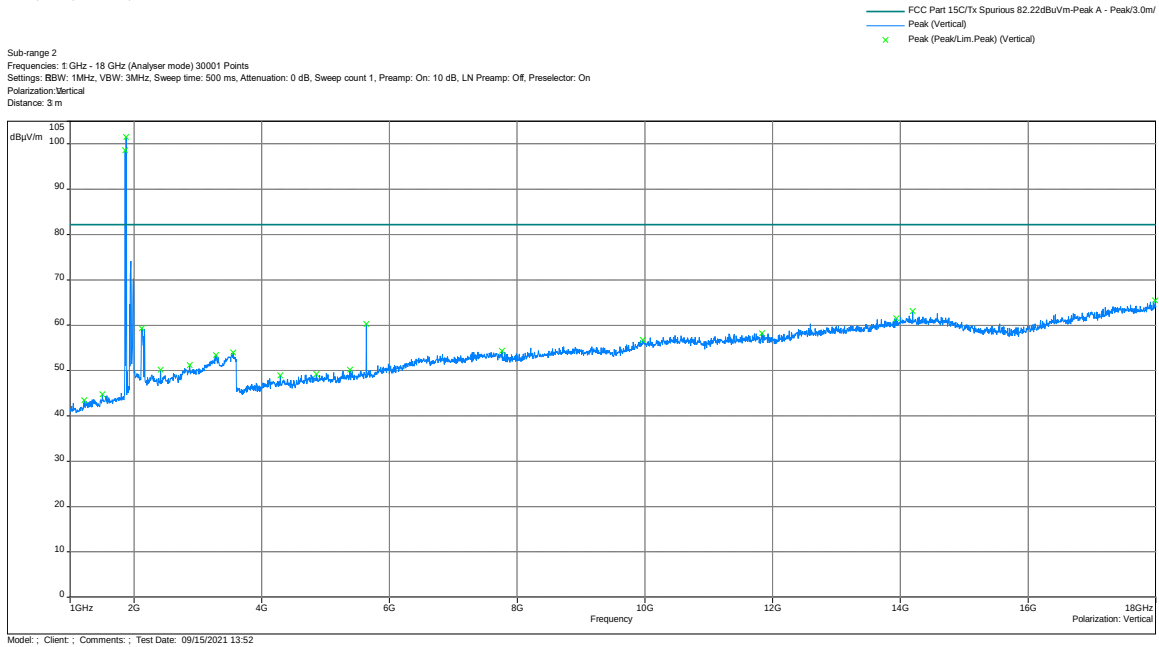
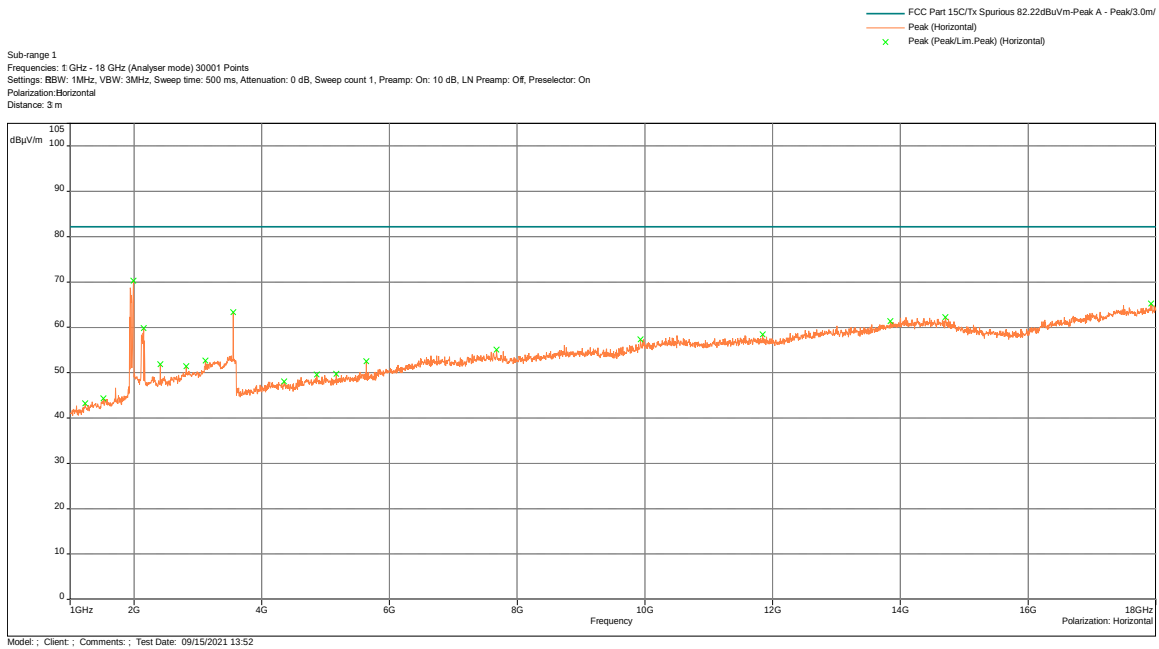
Electromagnetic Radiated Disturbance Setup Photograph

A.1.5 Plots/Data:

The EUT met the spurious radiated disturbance requirements of FCC Part 22 and FCC Part 24.

Spurious Radiated Emissions from 30MHz to 1GHz

Note: The emissions observed at 713 MHz are fundamental frequency of the cell radio for frequency band 701.5 – 713.5 MHz, and are not part of the scope for spurious emissions.

Spurious Radiated Emissions from 1GHz to 18GHz - Peak Detector

Note: The emissions observed at 1878 MHz are fundamental frequency of the cell radio for frequency band 1860 – 1900 MHz, and are not part of the scope for spurious emissions.

Radiated emission measurements were performed up to 26.5GHz. No Emissions were identified when scanned from 18 - 26.5 GHz

Test Personnel: John Nguyen
Supervising/Reviewing
Engineer:
(Where Applicable) Oliver Moyrong
Product Standard: FCC Part 22, FCC Part 24
Input Voltage: 120v 60Hz
Pretest Verification w/
Ambient Signals or
BB Source: BB Source

Test Date: 09/15/21

Limit Applied: NA

Ambient Temperature: 24 °C
Relative Humidity: 50 %
Atmospheric Pressure: 30 in Hg

Deviations, Additions, or Exclusions: None

A.2 List of Test Equipment**Emissions Test Equipment List**

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	03/09/2022
Passive Horn Antenna	ETS-Lindgren	3115	ITS 00982	12	05/13/2022
BI-Log Antenna	Teseq	CBL 6111D	ITS 01505	12	03/22/2022
Standard Gain Horn Antenna	EMCO	3160-09	ITS 00571	#	#
10 Meter Chamber	Panashield	10 Meter Semi-Anechoic Chamber	ITS 00984	36	07/29/2023
True RMS Multimeter	Fluke	287	ITS 01262	12	11/04/2021

Calibration not required.