

NorthEast Monitoring, Inc.

TEST REPORT

SCOPE OF WORK

EMC TESTING – Transceiver, Model: NEMP00539

REPORT NUMBER

105185424MPK-001

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October 24, 2022

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TEST REPORT (FULL COMPLIANCE)

Report Number: 105185424MPK-001
Project Number: G105185424

Report Issue Date: October 24, 2022

Product Designation: Transceiver
Model Tested: NEMP00539

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

Class: B

for

NorthEast Monitoring, Inc.

Tested by:
Intertek
1365 Adams Court
Menlo Park, CA 94025 USA

Client:
NorthEast Monitoring, Inc.
141 Parker Street, Suite 200
Maynard, MA 01754 USA

Report prepared by:



Kenneth Roque / EMC Project Engineer

Report reviewed by:



Anderson Soungpanya / EMC Team Leader

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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, ISED ICES-003 Issue 7:

Radiated Emissions

ANSI C63.4: 2014, Class B

AC Mains Conducted Emissions

ANSI C63.4: 2014, Class B

TEST PLAN

The EUT shall be tested according to the table below:

FCC Part 15 Subpart B, ICES-003 Proposed Tests for Emissions			
Basic Standard	Test Specifications	Applicable Ports	Test Mode and Configuration
ANSI C63.4	Radiated Emission	Enclosure	120 Vac 60 Hz, Battery Powered Normal Mode
ANSI C63.4	Conducted Emission	AC Power	120 Vac 60 Hz Normal Mode

EXECUTIVE SUMMARY

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

3. Client Information, Environmental Conditions, Performance Level

This EUT was tested at the request of:

Client: NorthEast Monitoring, Inc.
141 Parker Street, Suite 200
Maynard, MA 01754
United States of America

Contact: Sherry L. Steele
Telephone: 1 (978) 461-3992
Email: ssteele@nemon.com

4. Description of Equipment Under Test and Variant Models

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Gateway 2	NorthEast Monitoring, Inc.	NEMP00539	1693300009
PSU	GlobTek, Inc.	GTM86100-1005-W2	WR9HA2000USBCFMEDR6W

Received Date:	09/27/22	Test Started:	09/27/22
Received Condition:	Good	Test Completed:	10/06/22
Type:	Production		

Description of Equipment Under Test (Provided by Client)			
The gateway is a wireless gateway between NorthEast Monitoring's event recorders and FTP servers. It simply provides a bridge between the recorder and the cellular modem contained within the gateway, via the Bluetooth modules in the gateway and the recorder. It can be operated either on battery power or while plugged in via the USBC charging port.			

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
5 VDC (Battery)	1280 mA	N/A	N/A
100-240 VAC (PSU)	0.3 A	50/60 Hz	1

Operating Modes of the EUT	
No.	Description of EUT Exercising
1	Normal Mode (FCC part 15B): The Gateway 2 put into standby/receive mode with cellular and Bluetooth radio modules powered on. BLE Radio (appendix A): The EUT was placed into transmit mode using a test program provided by NorthEast Monitoring, Inc. Cellular Radio (appendix B): The EUT cellular radio is connected to a cellular network and data is continuously uploaded to an FTP server.

Software Used by the EUT	
No.	Description of EUT Exercising
1	Proprietary software.

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.

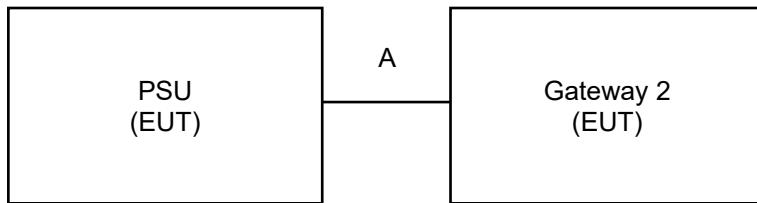
Not Applicable.

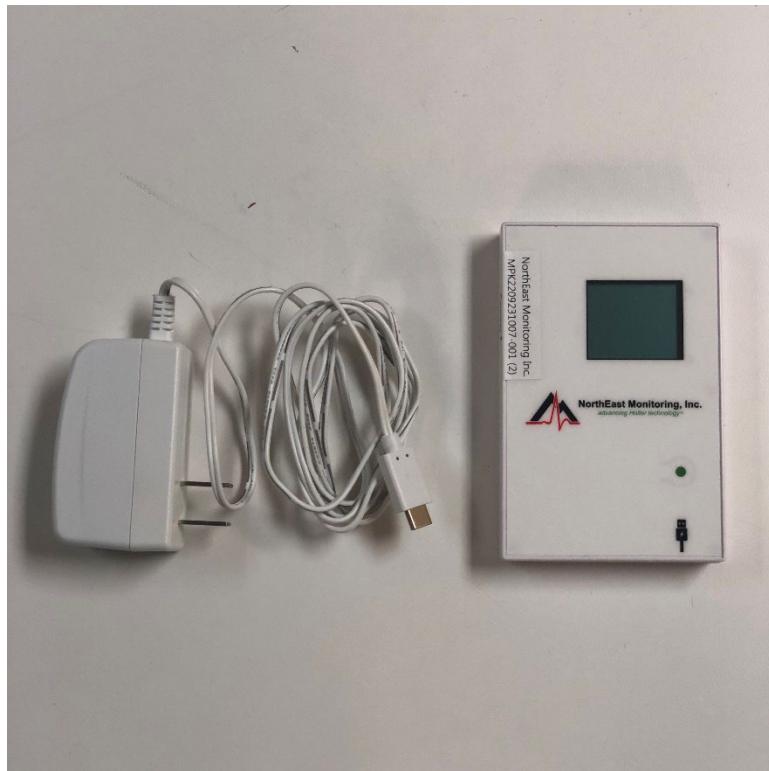
5. System Setup and Method

Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
A	AC Cord	1.5	No	No	N/A

5.1 Method

Configuration as required by ANSI C63.4.

5.2 EUT Block Diagram

5.3 EUT Picture**5.4 EUT Labels**

5.5 Justification

The EUT was configured in table-top configuration for testing, as specified by NorthEast Monitoring, Inc.

The highest clock frequency used was 2.48 GHz (BLE) as specified by NorthEast Monitoring, Inc. so Radiated Emissions were performed up to 18 GHz for FCC Part 15B.

5.6 Modifications Required for Compliance

No modifications were installed by Intertek Testing Services during compliance testing in order to bring the product into 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, 10 m	30 – 200 MHz	4.9 dB	6.3 dB
Radiated Emissions, 10 m	200 – 1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3 m	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.

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.

$$\begin{aligned} RA &= 52.0 \text{ dB}\mu\text{V} \\ AF &= 7.4 \text{ dB/m} \\ CF &= 1.6 \text{ dB} \\ AG &= 29.0 \text{ dB} \\ FS &= 32 \text{ dB}\mu\text{V/m} \end{aligned}$$

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:

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

6.2 Test Equipment Used

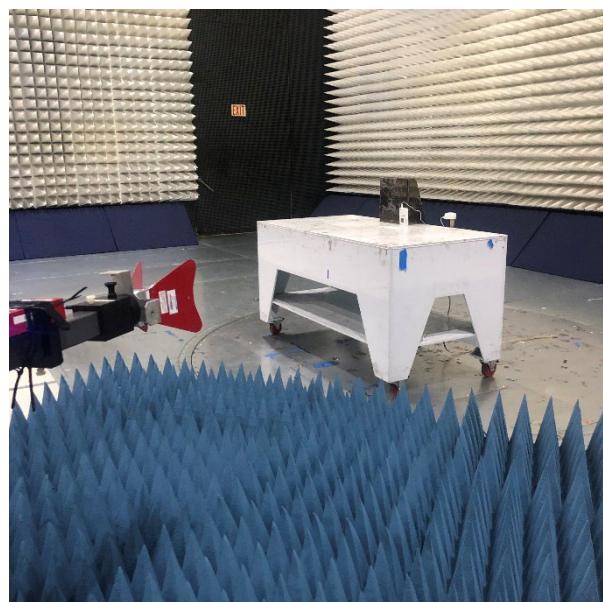
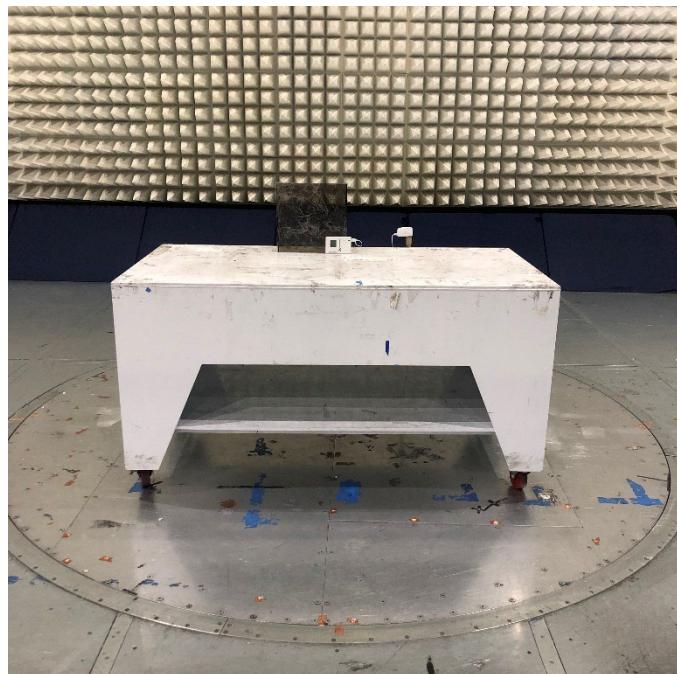
See Section 8.0 for specific equipment used for this test.

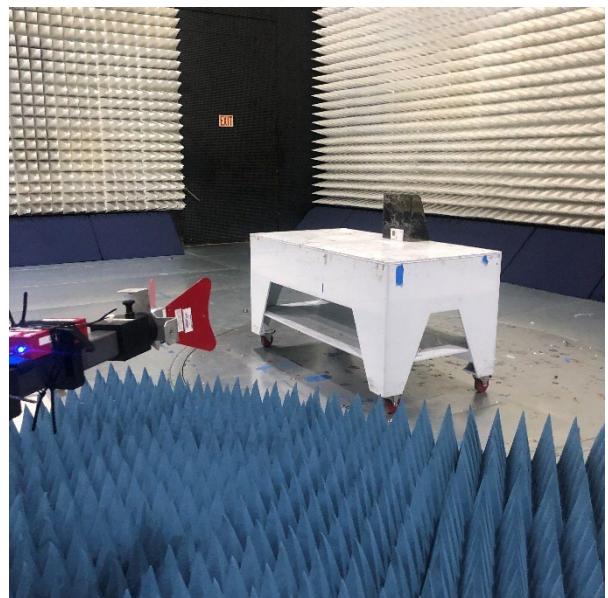
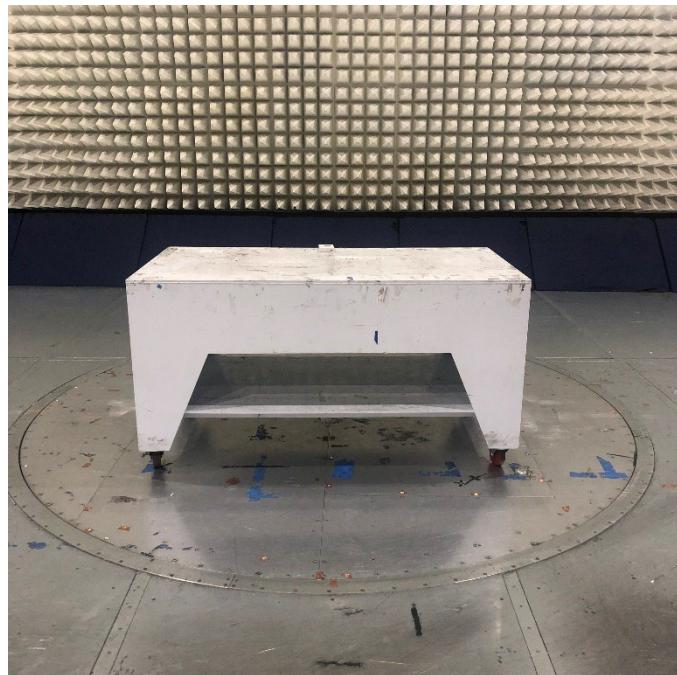
Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	3.20.0.23

6.3 Result

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

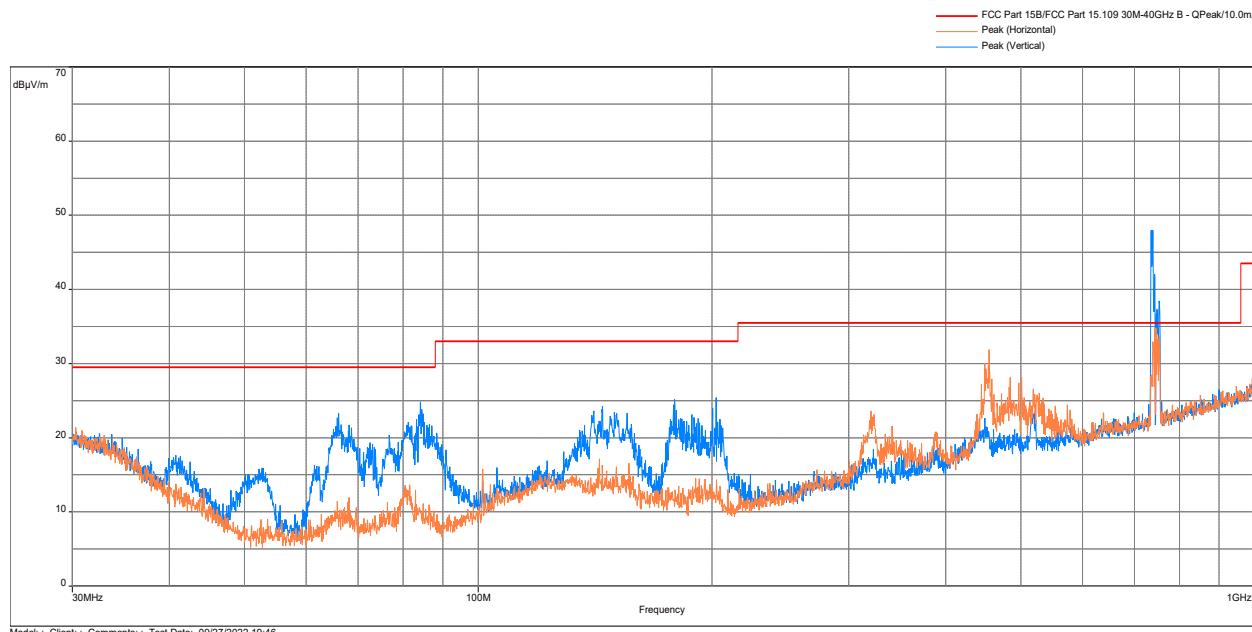
6.4 Setup Photograph**120 Vac 60 Hz**

Battery Powered

6.5 Plot/Data

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

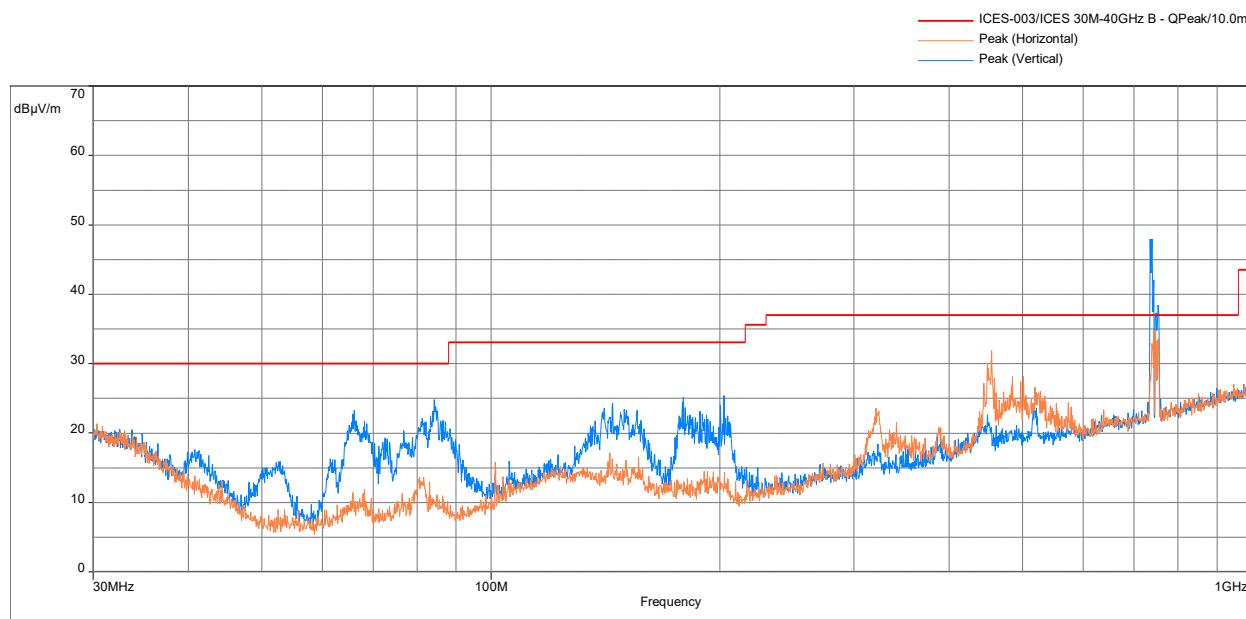
FCC Part 15 Subpart B 30MHz to 1GHz @ 120 Vac 60 Hz



Frequency (MHz)	Pk dB(μV/m)	Qp Limit dB(μV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
454.763	31.89	35.50	-3.61	302.25	2.00	Horizontal	40.04	-8.15
84.255	24.82	29.50	-4.68	189.75	1.00	Vertical	44.26	-19.44
449.072	30.10	35.50	-5.40	302.25	2.00	Horizontal	38.37	-8.27
66.084	23.29	29.50	-6.21	5.50	2.00	Vertical	42.26	-18.97
30.323	21.38	29.50	-8.12	0.00	1.00	Horizontal	27.78	-6.40
40.799	13.82	29.50	-15.68	162.50	3.00	Horizontal	27.78	-13.96

Note: The fundamental signal from the 700MHz cellular radio module was ON during testing.

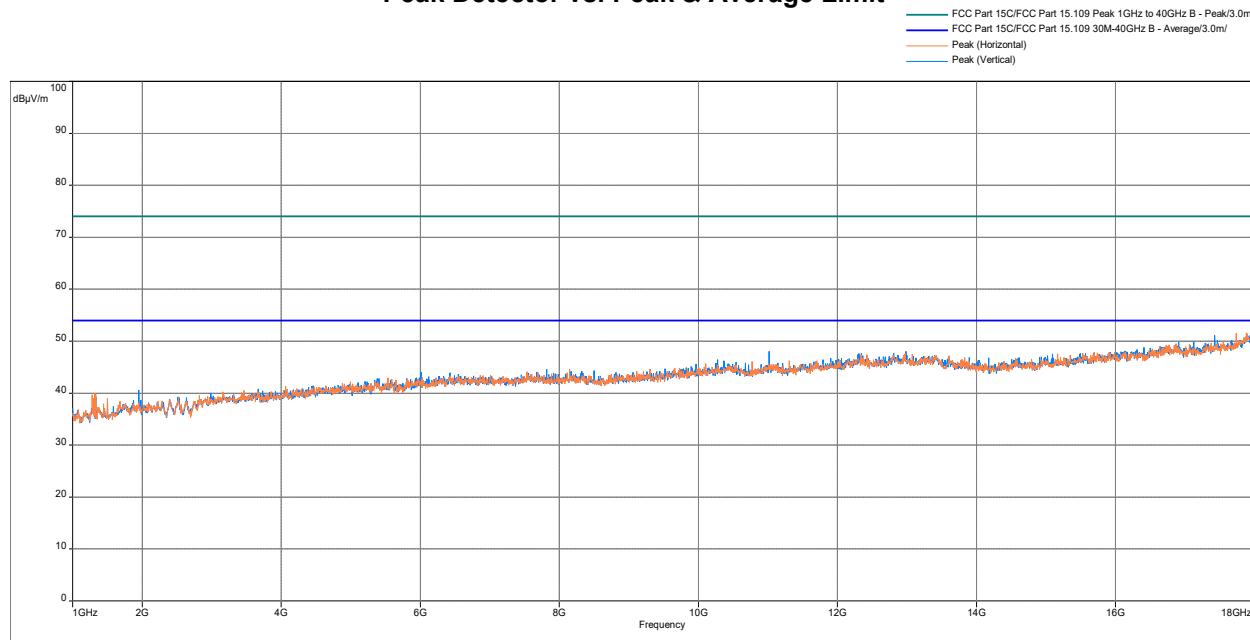
ISED ICES-003
30MHz to 1GHz @ 120 Vac 60 Hz



Frequency (MHz)	Pk dB(μV/m)	Qp Limit dB(μV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
454.763	31.89	37.00	-5.11	302.25	2.00	Horizontal	40.04	-8.15
84.255	24.82	30.00	-5.18	189.75	1.00	Vertical	44.26	-19.44
449.072	30.10	37.00	-6.90	302.25	2.00	Horizontal	38.37	-8.27
66.084	23.29	30.00	-6.71	5.50	2.00	Vertical	42.26	-18.97
30.323	21.38	30.00	-8.62	0.00	1.00	Horizontal	27.78	-6.40
40.799	13.82	30.00	-16.18	162.50	3.00	Horizontal	27.78	-13.96

Note: The fundamental signal from the 700MHz cellular radio module was ON during testing.

FCC Part 15 Subpart B, ISED ICES-003
1GHz to 18GHz @ 120 Vac 60 Hz
Peak Detector vs. Peak & Average Limit

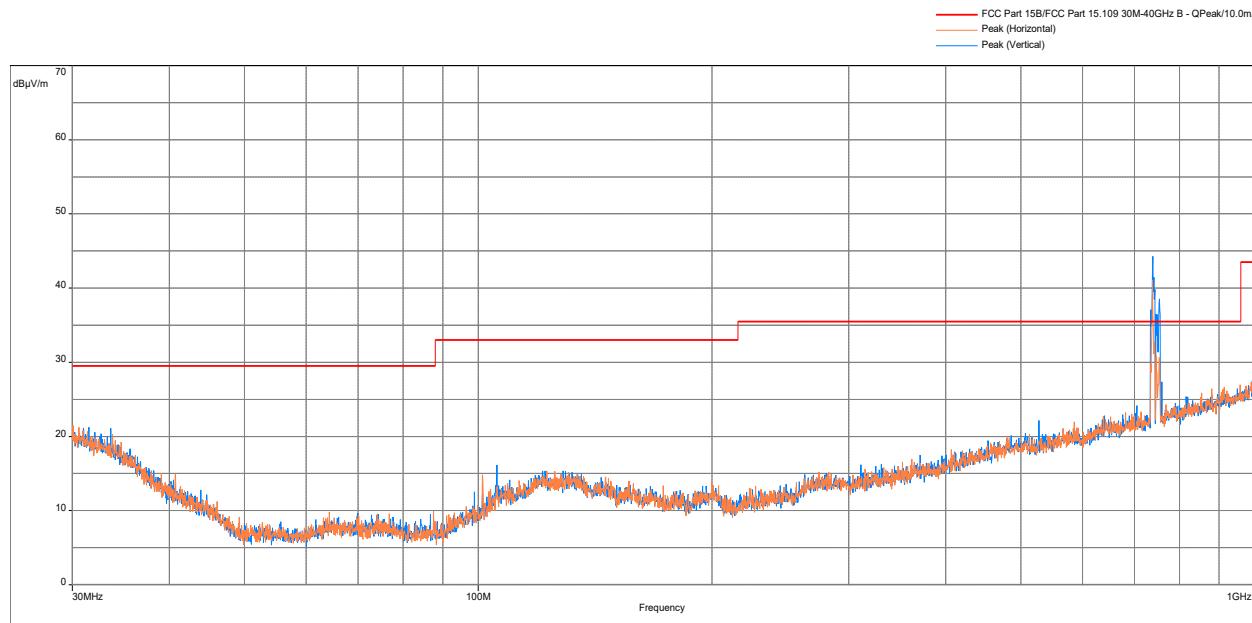


Result: **Complies** by 3.61 dB at 120 Vac 60 Hz

Note: Horizontal and Vertical orientations of the EUT were tested. Worst case data shown

Note: The measured result is below the specification limit by a margin less than the measurement uncertainty; it is not therefore possible to determine compliance at confidence level of 95%. However, the measured result indicates a higher probability that the product tested complies with the specification limit.

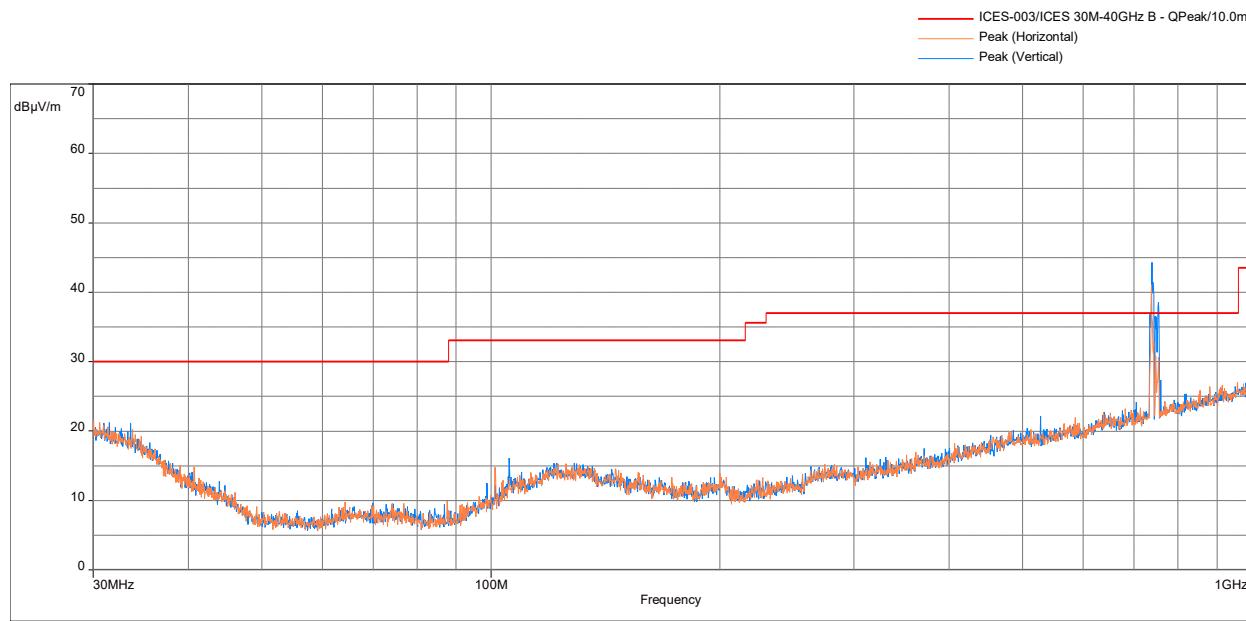
FCC Part 15 Subpart B
30MHz to 1GHz @ Battery Mode



Frequency (MHz)	Pk dB(μV/m)	Qp Limit dB(μV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
30.065	21.50	29.50	-8.00	277.75	3.00	Horizontal	27.73	-6.23
31.520	21.26	29.50	-8.24	172.00	1.00	Vertical	28.44	-7.18

Note: The fundamental signal from the 700MHz cellular radio module was ON during testing.

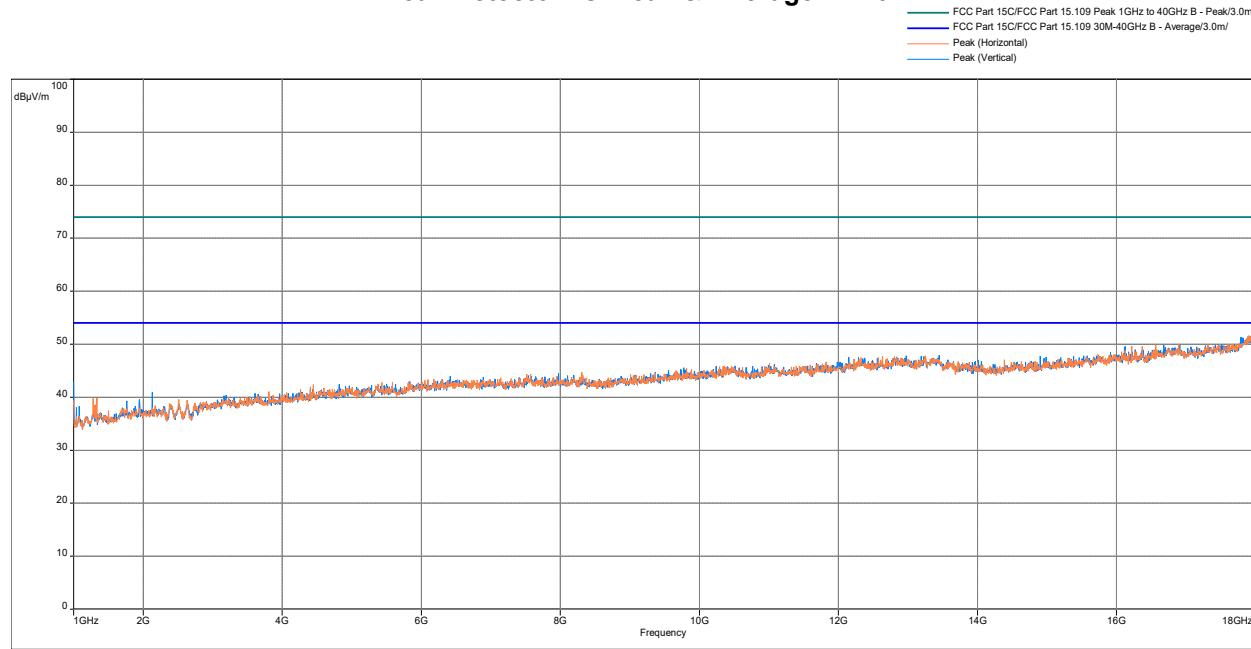
ISED ICES-003
30MHz to 1GHz @ Battery Mode



Frequency (MHz)	Pk dB(μV/m)	Qp Limit dB(μV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
30.065	21.50	30.00	-8.50	277.75	3.00	Horizontal	27.73	-6.23
31.520	21.26	30.00	-8.74	172.00	1.00	Vertical	28.44	-7.18

Note: The fundamental signal from the 700MHz cellular radio module was ON during testing.

FCC Part 15 Subpart B, ISED ICES-003
1GHz to 18GHz @ Battery Mode
Peak Detector vs. Peak & Average Limit



Result: **Complies** by 8.00 dB at Battery Mode

Note: Horizontal and Vertical orientations of the EUT were tested. Worst case data shown

Intertek

REPORT NUMBER: 105185424MPK-001

Issued: October 24, 2022

Test Personnel:	Kenneth Roque	Test Date:	09/27/22 – 10/06/22
Supervising/		Limit Applied:	ANSI C63.4
Reviewing Engineer:			
(Where Applicable)			
Product Standard:	FCC Part 15 Subpart B, ISED ICES-003,	Ambient Temperature:	23.33 °C
Input Voltage:	120Vac 60Hz & Battery Mode	Relative Humidity:	41.9 %
Pretest Verification w/		Atmospheric Pressure:	30 in Hg
Ambient Signals or			
BB Source:	BB Source		

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
Telecommunication Ports	150 kHz – 30 MHz	2.6 dB	5.0 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.

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:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V}/20)} = 285.1 \mu\text{V}/\text{m}$$

7.2 Test Equipment Used

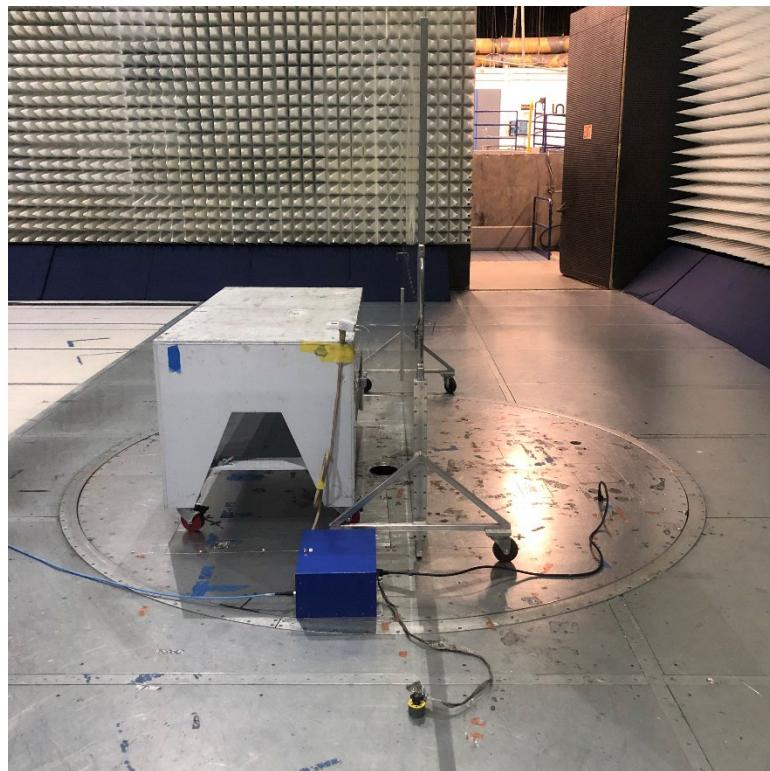
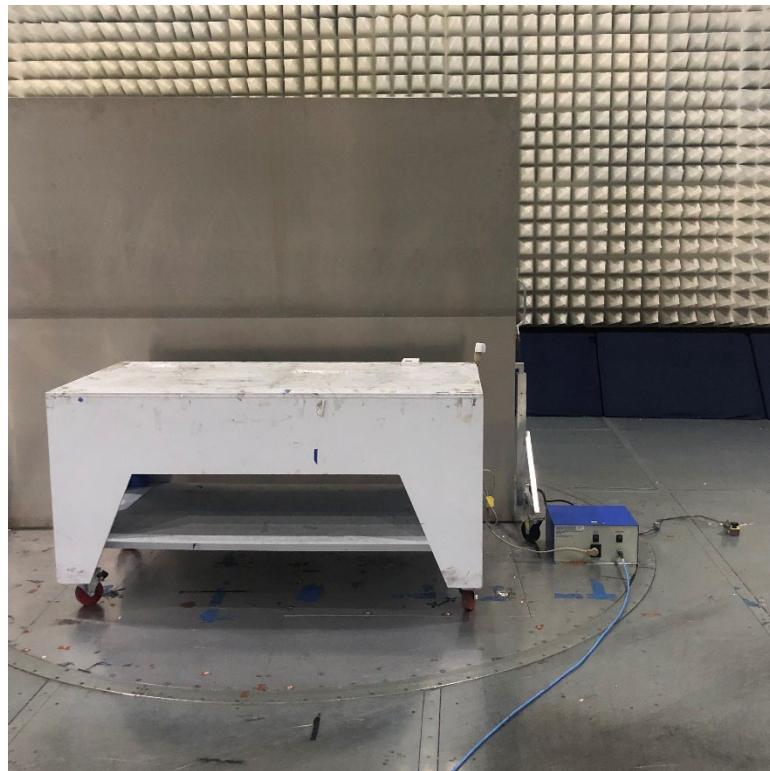
See Section 8.0 for specific equipment used for this test.

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	3.20.0.23

7.3 Result

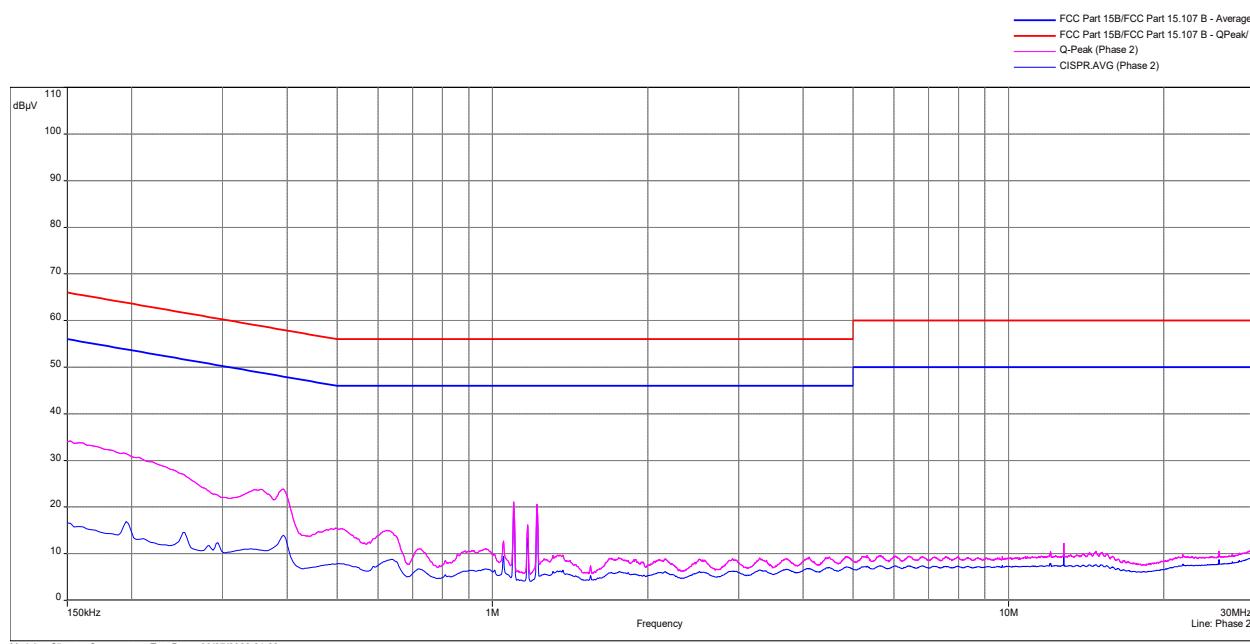
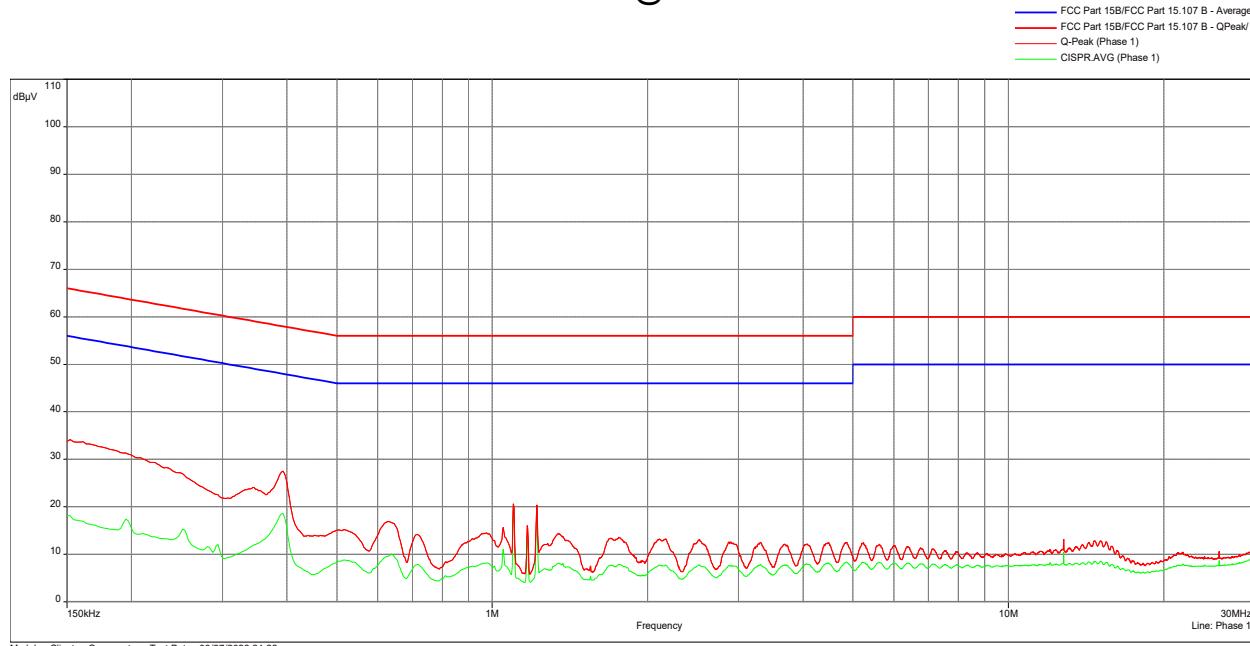
The sample tested was found to **comply**.

7.4 Setup Photograph

7.5 Plot/Data

The EUT met the conducted disturbance requirements of FCC Part 15 Subpart B, and ISED ICES-003 for a Class B device.

FCC Part 15 Subpart B, ISED ICES-003 150kHz – 30MHz @ 120 Vac 60 Hz



QPeak/Lim.Qpeak (16)

Frequency (MHz)	Level-QP (dB μ V)	Limit-QP (dB μ V)	Margin-QP (dB)	Line	Correction (dB)
0.3930	27.50	58.00	-30.50	Phase 1	10.84
0.1523	34.20	65.88	-31.67	Phase 2	11.35
0.1523	34.19	65.88	-31.69	Phase 1	11.32
1.0995	21.11	56.00	-34.89	Phase 2	10.83
1.0995	20.62	56.00	-35.38	Phase 1	10.78
1.2210	20.58	56.00	-35.42	Phase 2	10.83
1.2210	20.38	56.00	-35.62	Phase 1	10.78
0.6293	16.89	56.00	-39.11	Phase 1	10.79
1.1693	16.19	56.00	-39.81	Phase 2	10.83
1.1693	16.02	56.00	-39.98	Phase 1	10.78
1.0500	15.64	56.00	-40.36	Phase 1	10.78
0.5010	15.40	56.00	-40.60	Phase 2	10.85
0.5168	15.18	56.00	-40.82	Phase 1	10.80
1.0500	12.76	56.00	-43.24	Phase 2	10.83
12.7995	13.22	60.00	-46.78	Phase 1	11.14
12.7995	12.32	60.00	-47.68	Phase 2	11.23

CISPR AVG/Lim. Average (15)

Frequency (MHz)	Level-Av (dB μ V)	Limit-Av (dB μ V)	Margin-Av (dB)	Line	Correction (dB)
1.0995	19.84	46.00	-26.16	Phase 1	10.78
1.0995	19.42	46.00	-26.58	Phase 2	10.83
1.2210	18.63	46.00	-27.37	Phase 1	10.78
1.2210	18.61	46.00	-27.39	Phase 2	10.83
0.3908	18.56	48.05	-29.49	Phase 1	10.85
1.1693	13.47	46.00	-32.53	Phase 2	10.83
1.1693	13.43	46.00	-32.57	Phase 1	10.78
1.0500	11.12	46.00	-34.88	Phase 1	10.78
0.6383	10.07	46.00	-35.93	Phase 1	10.79
1.0500	9.50	46.00	-36.50	Phase 2	10.83
0.1950	16.87	53.82	-36.95	Phase 2	11.21
0.6383	8.80	46.00	-37.20	Phase 2	10.83
0.1500	18.17	56.00	-37.83	Phase 1	11.33
12.7995	10.45	50.00	-39.55	Phase 1	11.14
12.7995	10.04	50.00	-39.96	Phase 2	11.23

Result:	Complies by 26.16 dB at 120 Vac 60 Hz
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Intertek

REPORT NUMBER: 105185424MPK-001

Issued: October 24, 2022

Test Personnel:	Kenneth Roque	Test Date:	09/27/22
Supervising/			
Reviewing Engineer:		Limit Applied:	ANSI C63.4
(Where Applicable)			
Product Standard:	FCC Part 15 Subpart B,	Ambient Temperature:	23.17 °C
	ISED ICES-003,	Relative Humidity:	42.5 %
Input Voltage:	120Vac 60Hz	Atmospheric Pressure:	30 in Hg
Pretest Verification w/			
Ambient Signals or			
BB Source:	BB Source		

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	03/10/23
EMI Receiver	Rohde and Schwarz	ESR	ITS 01607	12	11/19/22
Pre-Amplifier	Sonoma Instrument	310	ITS 01713	12	02/17/23
Bi-Log Antenna	SunAR RF Motion	JB1	ITS 01577	12	02/10/23
Horn Antenna	ETS Lindgren	3117-PA	ITS 01325	12	10/26/22
LISN	Com-Power	LIN-120A	ITS 01400	12	12/14/22
10 Meter Chamber	Panashield	10 Meter Semi-Anechoic Chamber	ITS 00984	36	07/22/23

Calibration performed by ITS prior to the test, "#" = Calibration not required.

9. Revision History

Revision Level	Date	Report Number	Prepared by	Reviewed by	Notes
1	October 24, 2022	105185424MPK-001	KR	AS	Original Issue

Appendix A – Evaluation for Spurious Emissions of Pre-Certified Radio Module Installed Inside the Host Equipment per KDB 996369 D04 (BLE Radio Module)**A.1 Radiated Emissions (ANSI C63.10)****A.1.1 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, 10 m	30 – 200 MHz	4.9 dB	6.3 dB
Radiated Emissions, 10 m	200 – 1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3 m	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.

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.

$$\begin{aligned} RA &= 52.0 \text{ dB}\mu\text{V} \\ AF &= 7.4 \text{ dB/m} \\ CF &= 1.6 \text{ dB} \\ AG &= 29.0 \text{ dB} \\ FS &= 32 \text{ dB}\mu\text{V/m} \end{aligned}$$

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:

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

A.1.2 Test Equipment Used**Emissions Test Equipment List**

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	03/10/23
Pre-Amplifier	Sonoma Instrument	310	ITS 01713	12	02/17/23
Pre-Amplifier	MicroComp Nordic	MCNS-50-18004000-33-5P	ITS 01799	12	03/24/23
BI-Log Antenna	SunAR RF Motion	JB1	ITS 01577	12	02/10/23
Horn Antenna	ETS Lindgren	3117-PA	ITS 01325	12	10/26/22
Horn Antenna	EMCO	3160-09	ITS 00571	#	#
10 Meter Chamber	Panashield	10 Meter Semi-Anechoic Chamber	ITS 00984	36	07/22/23

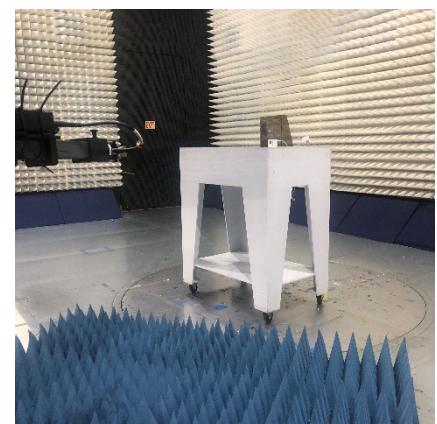
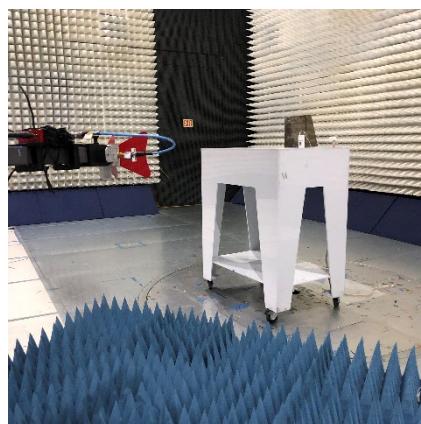
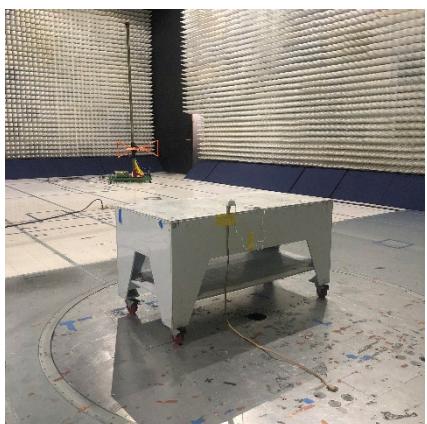
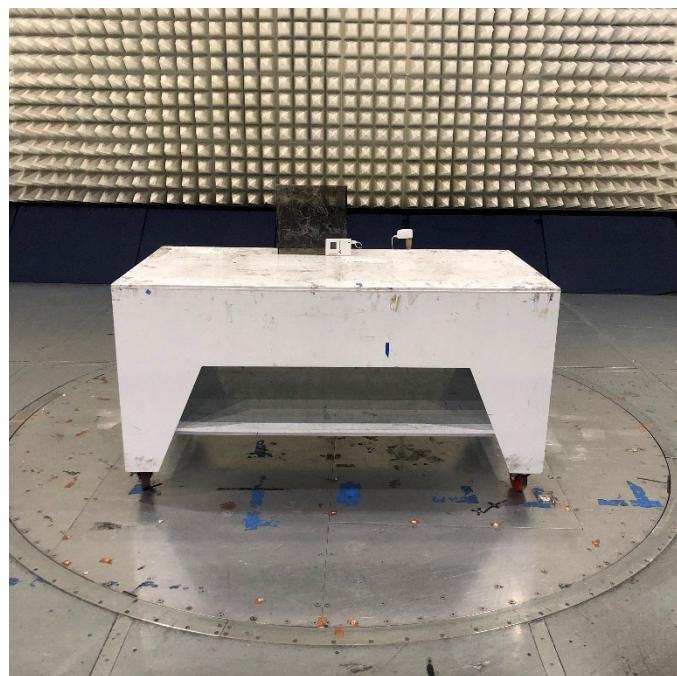
Calibration performed by ITS prior to the test, "#" = Calibration not required.

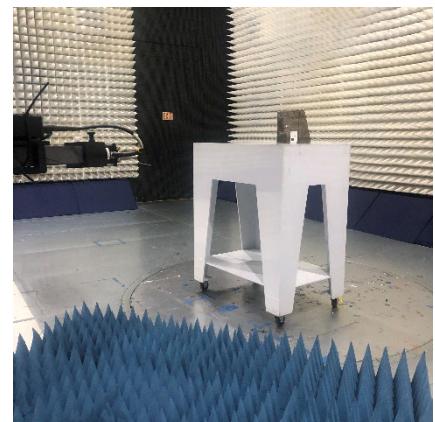
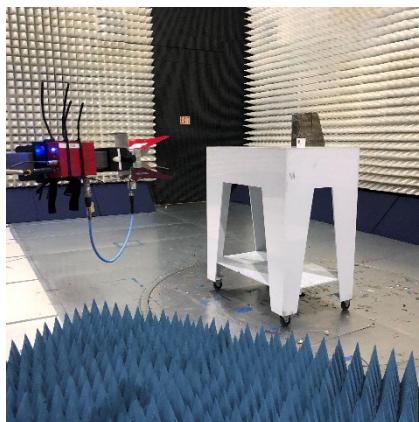
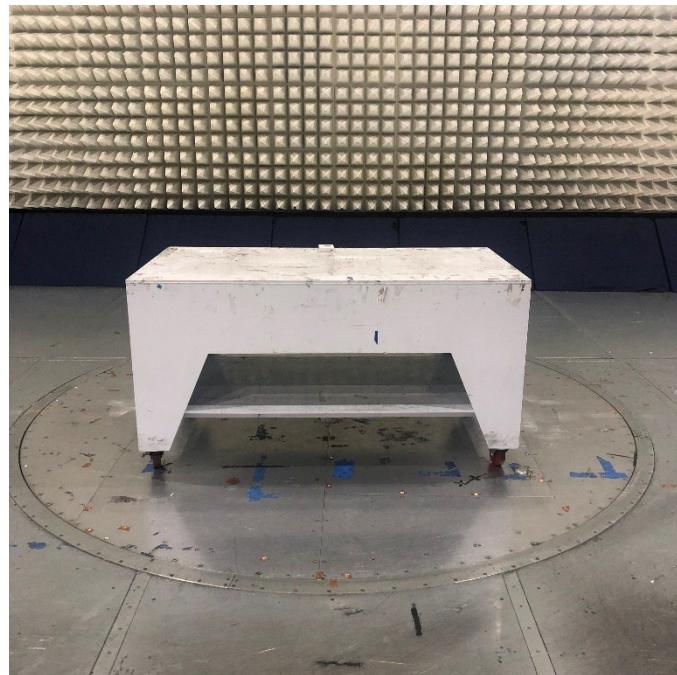
Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	3.20.0.23

A.1.3 Result

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

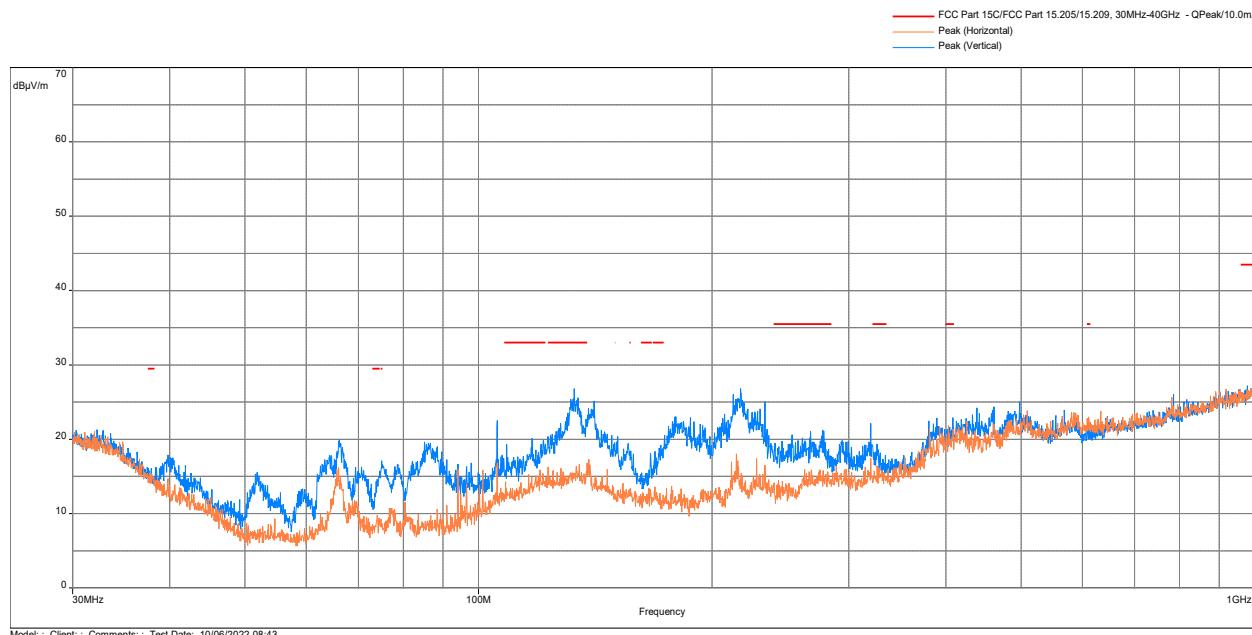
A.1.4 Setup Photograph**120 Vac 60 Hz**

Battery Powered

A.1.5 Plot/Data

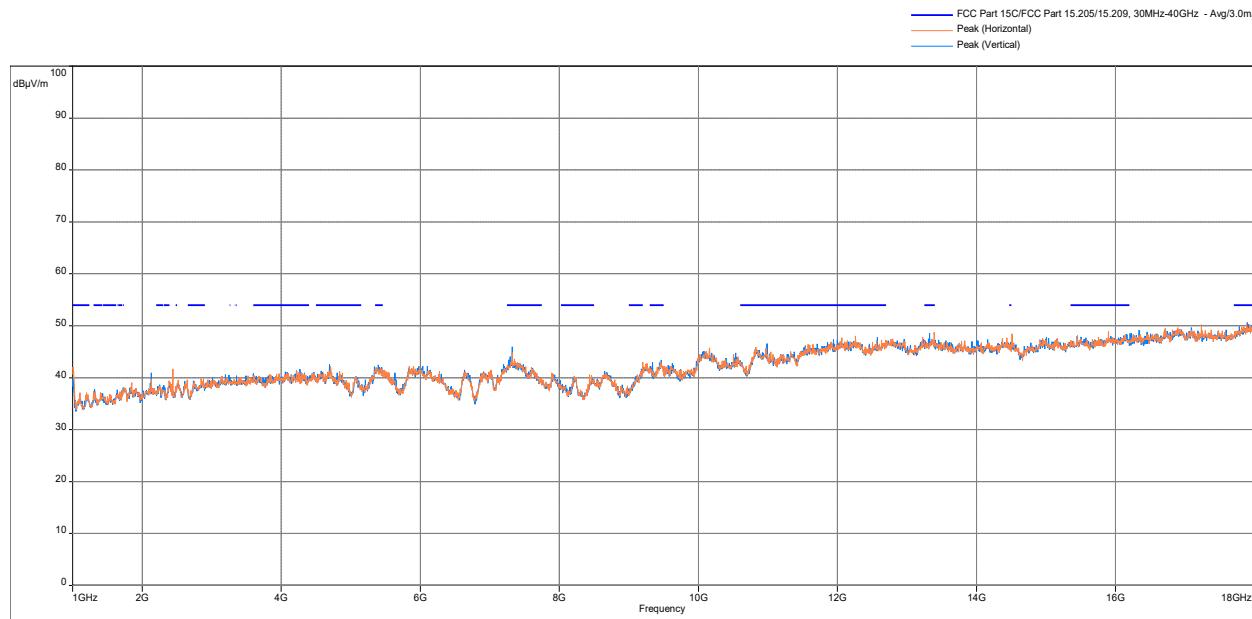
The EUT met the radiated disturbance requirements of FCC 47CFR PT 15.247.

**Radiated Spurious Emissions (2.4 GHz BLE)
30MHz to 1GHz @ 120 Vav 60 Hz**



Frequency (MHz)	Pk dB(μV/m)	Qp Limit dB(μV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
132.820	26.80	33.00	-6.20	346.00	2.00	Vertical	39.45	-12.65
135.407	23.72	33.00	-9.28	248.75	3.00	Vertical	36.51	-12.79
130.395	23.54	33.00	-9.46	226.50	2.00	Vertical	35.95	-12.41
75.040	17.12	29.50	-12.38	130.25	2.00	Vertical	35.83	-18.71
611.450	23.01	35.50	-12.49	146.75	4.00	Horizontal	28.79	-5.78
402.933	21.87	35.50	-13.63	103.00	2.00	Horizontal	31.61	-9.74
610.189	21.72	35.50	-13.78	94.75	3.00	Horizontal	27.58	-5.86
74.038	9.82	29.50	-19.68	41.50	2.00	Horizontal	28.53	-18.71

Radiated Spurious Emissions (2.4 GHz BLE)
1GHz to 18GHz @ 120 Vav 60 Hz
Peak Detector vs. Average Limit

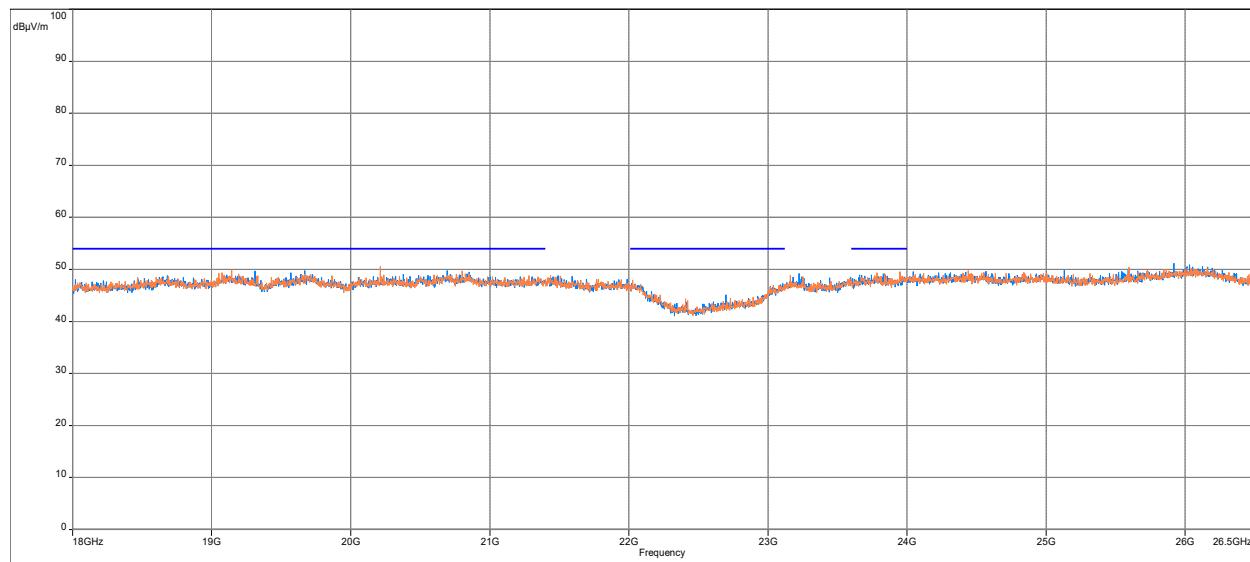


Model: Client: Comments: Test Date: 10/05/2022 08:03

Frequency (MHz)	Pk dB(μV/m)	Avg Limit dB(μV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
17896.87	50.62	54.00	-3.38	175.75	1.25	Vertical	42.36	8.26
17883.83	50.40	54.00	-3.60	154.75	3.25	Horizontal	42.23	8.17
13389.03	48.77	54.00	-5.23	266.50	3.25	Horizontal	45.42	3.35
13324.43	48.60	54.00	-5.40	138.50	1.25	Vertical	45.10	3.50

Radiated Spurious Emissions (2.4 GHz BLE)
18GHz to 26.5GHz @ 120 Vac 60 Hz
Peak Detector vs. Average Limit

— FCC Part 15C/FCC Part 15.205/15.209, 30MHz-40GHz - Average/3.0m
— Peak (Horizontal)
— Peak (Vertical)

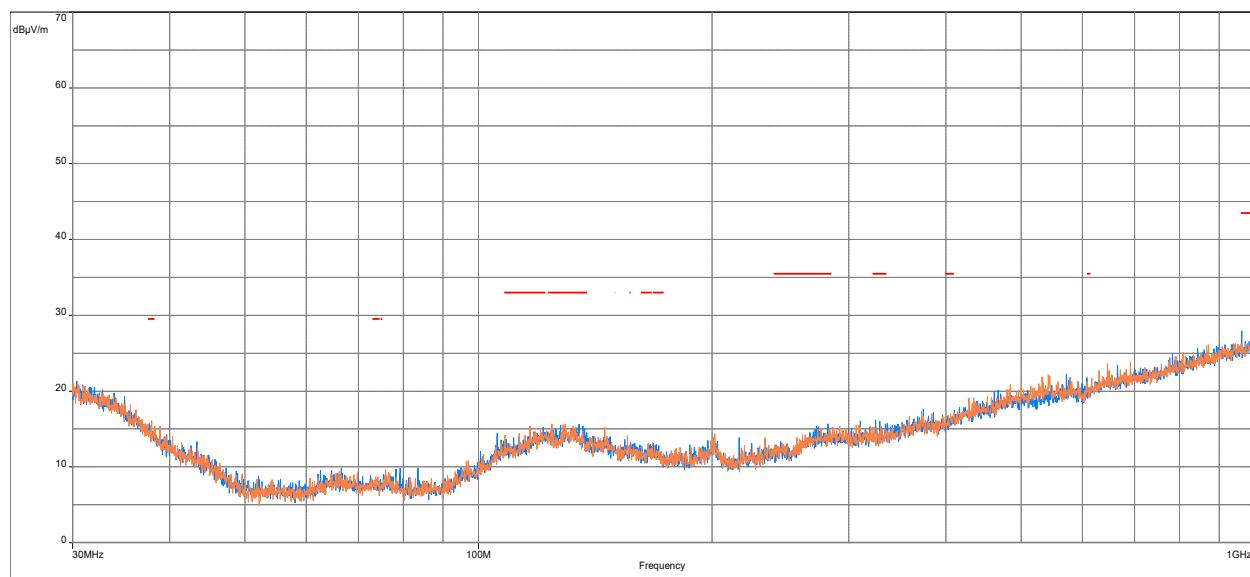


Frequency (MHz)	Pk dB(μV/m)	Avg Limit dB(μV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
20213.97	50.57	54.00	-3.43	238.75	1.25	Horizontal	54.87	-4.30
19670.53	49.82	54.00	-4.18	72.75	1.25	Vertical	54.02	-4.20

Result:	Complies by 3.38 dB at 120 Vac 60 Hz
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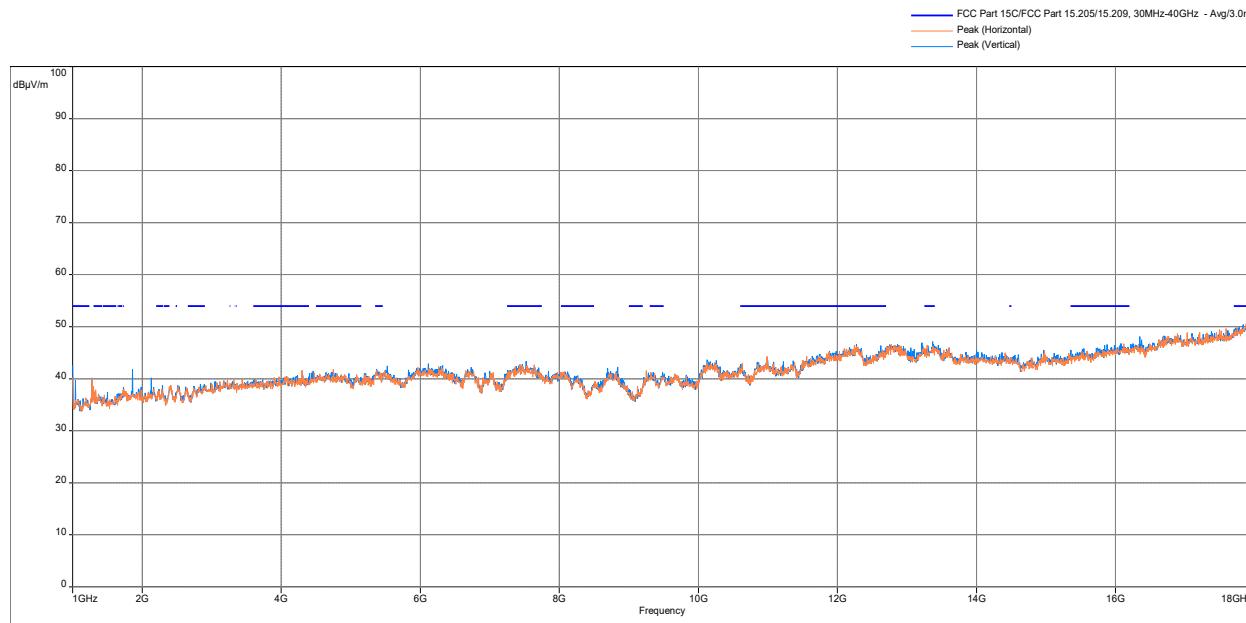
Radiated Spurious Emissions (2.4 GHz BLE)
30MHz to 1GHz @ Battery Mode

— FCC Part 15C/FCC Part 15.205/15.209, 30MHz-40GHz - QPeak/10.0m/
— Peak (Horizontal)
— Peak (Vertical)



Frequency (MHz)	Pk dB(µV/m)	Qp Limit dB(µV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
608.346	20.78	35.50	-14.72	39.25	2.00	Horizontal	26.73	-5.95
609.607	20.49	35.50	-15.01	233.00	4.00	Horizontal	26.37	-5.88

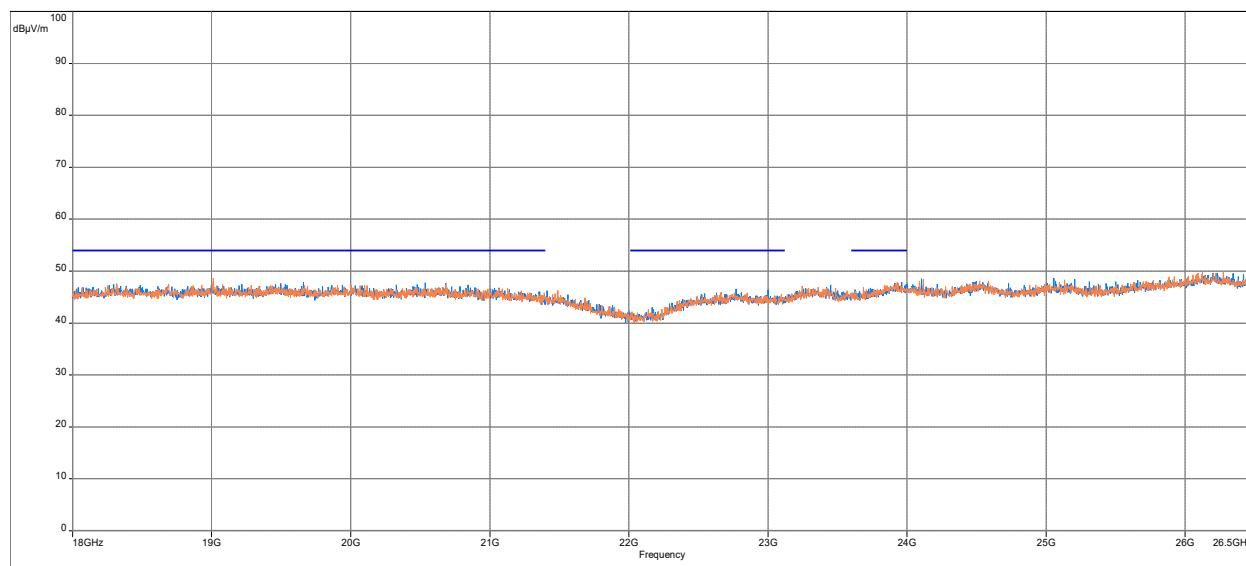
Radiated Spurious Emissions (2.4 GHz BLE)
1GHz to 18GHz @ Battery Mode
Peak Detector vs. Average Limit



Frequency (MHz)	Pk dB(μ V/m)	Avg Limit dB(μ V/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dB μ V)	Correction (dB)
17925.20	51.79	54.00	-2.21	278.00	1.25	Vertical	43.06	8.73
17998.87	50.96	54.00	-3.04	274.50	3.25	Horizontal	41.67	9.29

Radiated Spurious Emissions (2.4 GHz BLE)
18GHz to 26.5GHz @ Battery Mode
Peak Detector vs. Average Limit

— FCC Part 15C/FCC Part 15.205/15.209, 30MHz-40GHz - Average/3.0m
— Peak (Horizontal)
— Peak (Vertical)



Model: ; Client: ; Comments: ; Test Date: 10/03/2022 10:36

Frequency (MHz)	Pk dB(μV/m)	Avg Limit dB(μV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
19010.65	48.71	54.00	-5.29	3.24	75.75	Horizontal	52.23	-3.52
23961.62	47.93	54.00	-6.07	3.24	263.50	Vertical	48.78	-0.85

Result: Complies by 2.21 dB in Battery Mode.

Intertek

REPORT NUMBER: 105185424MPK-001

Issued: October 24, 2022

Test Personnel:	<u>Kenneth Roque</u>	Test Date:	<u>09/27/22 – 10/06/22</u>
Supervising/ Reviewing Engineer:		Limit Applied:	<u>ANSI C63.10</u>
(Where Applicable)			
Product Standard:	<u>FCC 47CFR PT 15.247</u>	Ambient Temperature:	<u>23.33 °C</u>
Input Voltage:	<u>120Vac 60Hz & Battery Mode</u>	Relative Humidity:	<u>41.9 %</u>
Pretest Verification w/ Ambient Signals or BB Source:	<u>BB Source</u>	Atmospheric Pressure:	<u>30 in Hg</u>

Deviations, Additions, or Exclusions: None

Appendix B – Evaluation for Spurious Emissions of Pre-Certified Radio Module Installed Inside the Host Equipment per KDB 996369 D04 (Cellular Radio Module)**B.1 Radiated Emissions (ANSI C63.26)****B.1.1 Method**

Tests are performed in accordance with ANSI C63.26 and FCC CFR 47 Part 22H & 24E.

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, 10 m	30 – 200 MHz	4.9 dB	6.3 dB
Radiated Emissions, 10 m	200 – 1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3 m	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.

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.

$$\begin{aligned} RA &= 52.0 \text{ dB}\mu\text{V} \\ AF &= 7.4 \text{ dB/m} \\ CF &= 1.6 \text{ dB} \\ AG &= 29.0 \text{ dB} \\ FS &= 32 \text{ dB}\mu\text{V/m} \end{aligned}$$

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:

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

B.1.2 Test Equipment Used**Emissions Test Equipment List**

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	03/10/23
Pre-Amplifier	Sonoma Instrument	310	ITS 01713	12	02/17/23
Bi-Log Antenna	SunAR RF Motion	JB1	ITS 01577	12	02/10/23
Horn Antenna	ETS Lindgren	3115	ITS 00982	12	05/11/23
10 Meter Chamber	Panashield	10 Meter Semi-Anechoic Chamber	ITS 00984	36	07/22/23

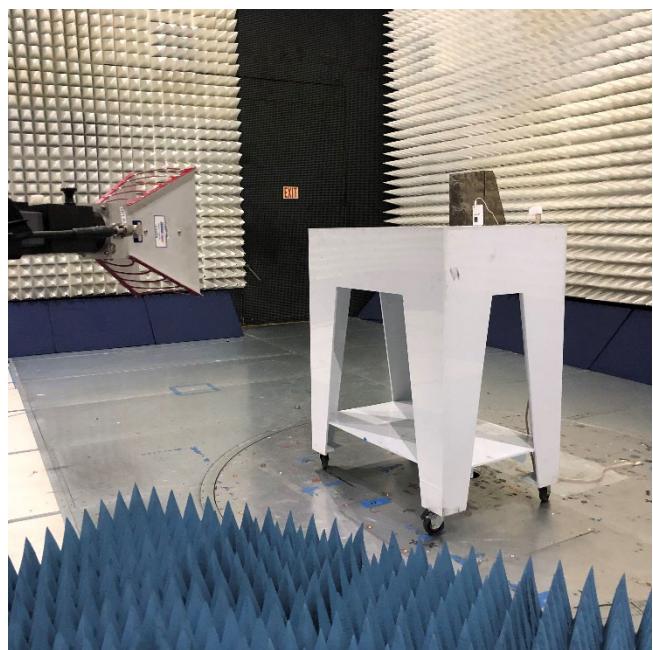
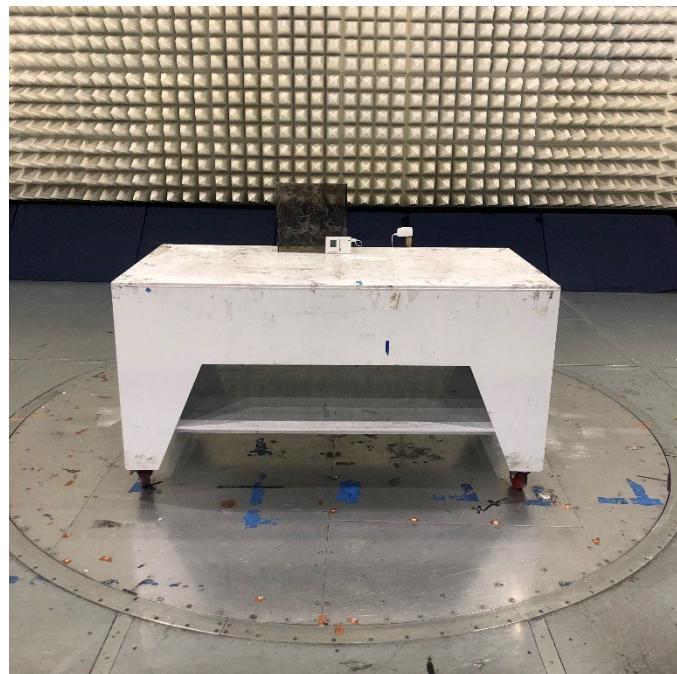
Calibration performed by ITS prior to the test, "#" = Calibration not required.

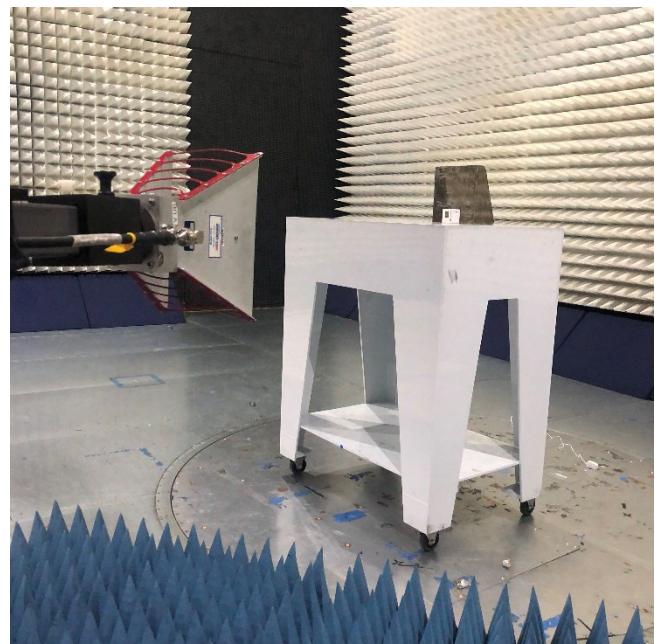
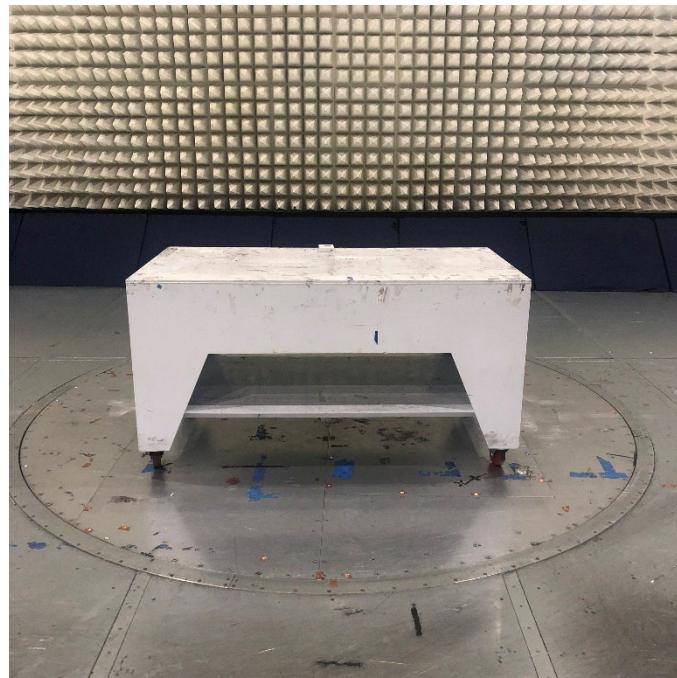
Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	3.20.0.23

B.1.3 Result

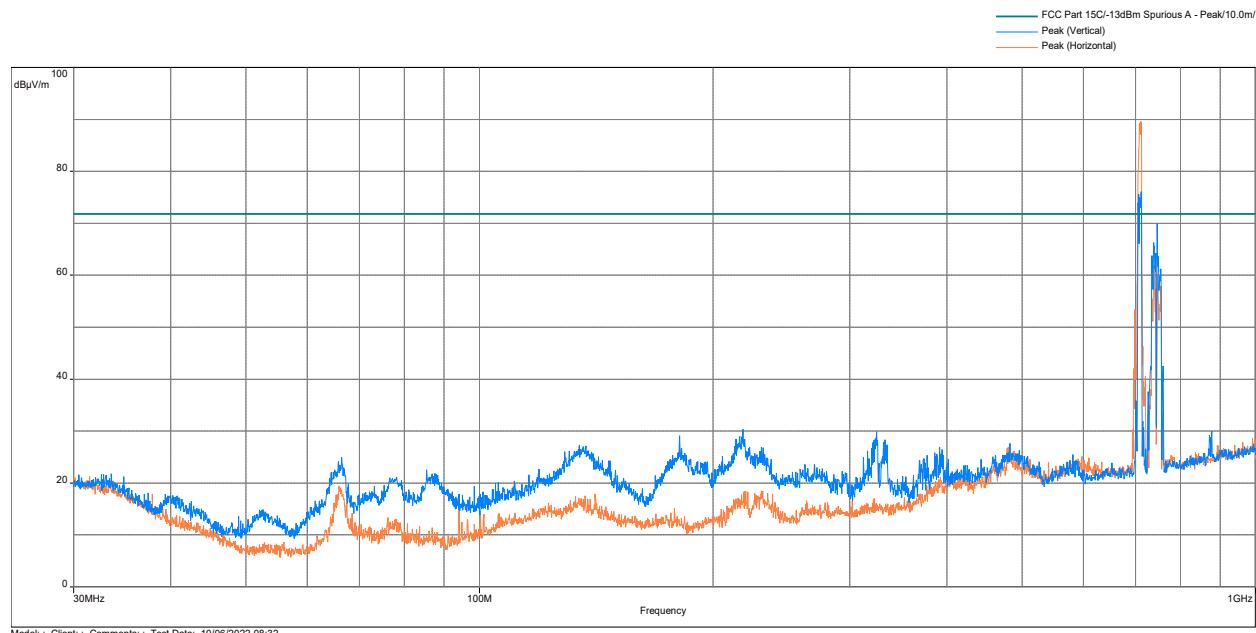
The sample tested was found to **comply**.

B.1.4 Setup Photograph**120 Vac 60 Hz**

Battery Powered

B.1.5 Plot/Data

The EUT met the radiated disturbance requirements of FCC CFR 47 Part 22H & 24E.

**Radiated Spurious Emissions (Cellular)
30MHz to 1GHz @ 120 Vav 60 Hz**

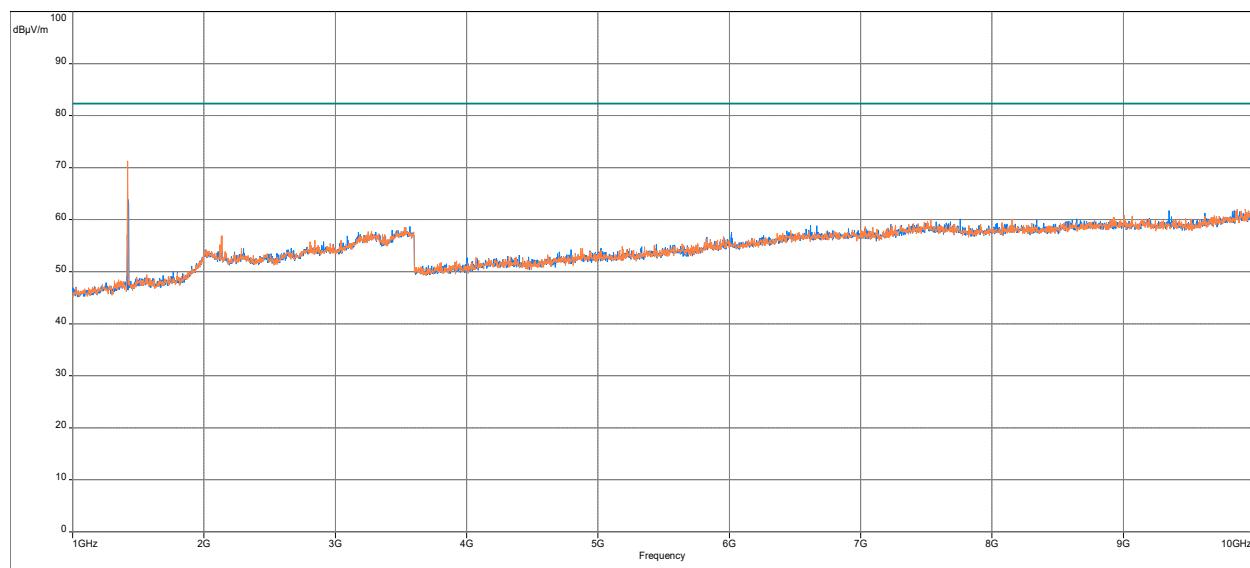
Note: The fundamental signal was on during testing.

Note: The limit was converted from a dBm value to a dB μ V/m value.

$$\text{Limit dB}(\mu\text{V}/\text{m}) = \text{Limit (dBm)} + 104.8 - 20 \cdot \log(D) = -13\text{dBm} + 104.8 - 20 \cdot \log(10) = 71.8\text{dB}\mu\text{V}/\text{m}$$

Radiated Spurious Emissions (Cellular)
1GHz to 18GHz @ 120 Vac 60 Hz

FCC Part 15C/-13dBm Spurious A - Peak/3.0m/
 Peak (Horizontal)
 Peak (Vertical)



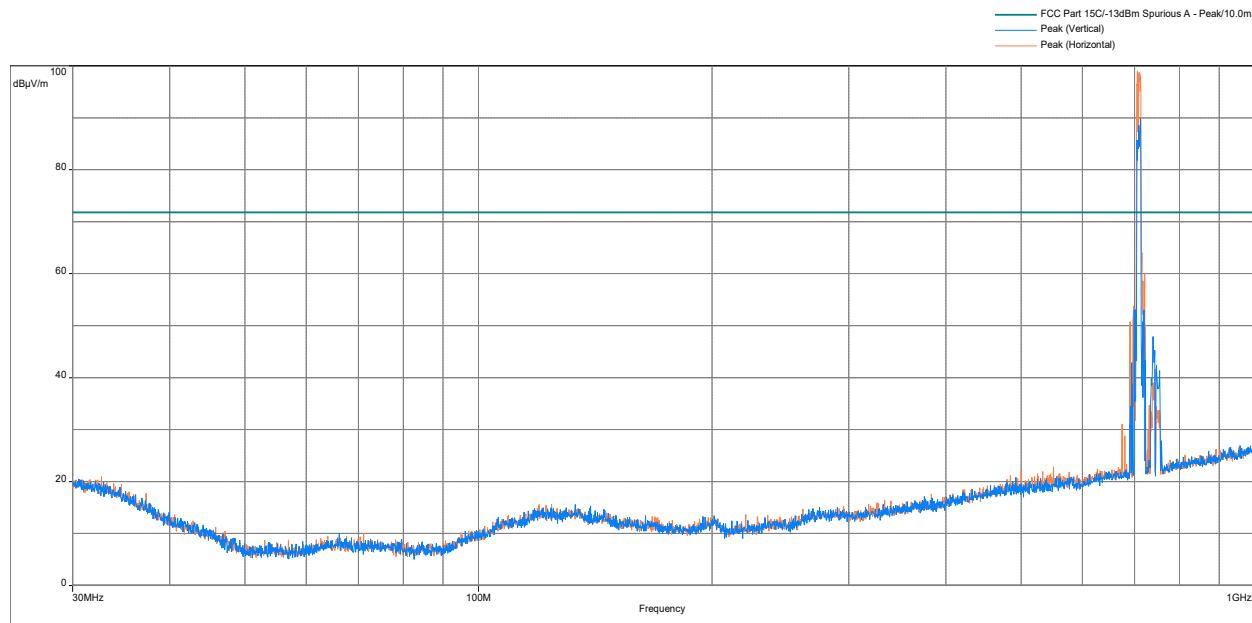
Model: Client: Comments: Test Date: 10/06/2022 13:16

Note: The limit was converted from a dBm value to a dB μ V/m value.

$$\text{Limit dB}(\mu\text{V}/\text{m}) = \text{Limit (dBm)} + 104.8 - 20 \cdot \log(D) = -13\text{dBm} + 104.8 - 20 \cdot \log(3) = 82.3\text{dB}\mu\text{V}/\text{m}$$

Frequency (MHz)	Pk dB(μ V/m)	Pk Limit dB(μ V/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dB μ V)	Correction (dB)
1418.50	71.29	82.30	-11.01	191.50	2.25	Horizontal	43.59	27.70
1424.80	63.84	82.30	-18.46	359.50	2.25	Vertical	36.11	27.73

Result:	Complies by 11.01 dB at 120 Vac 60 Hz
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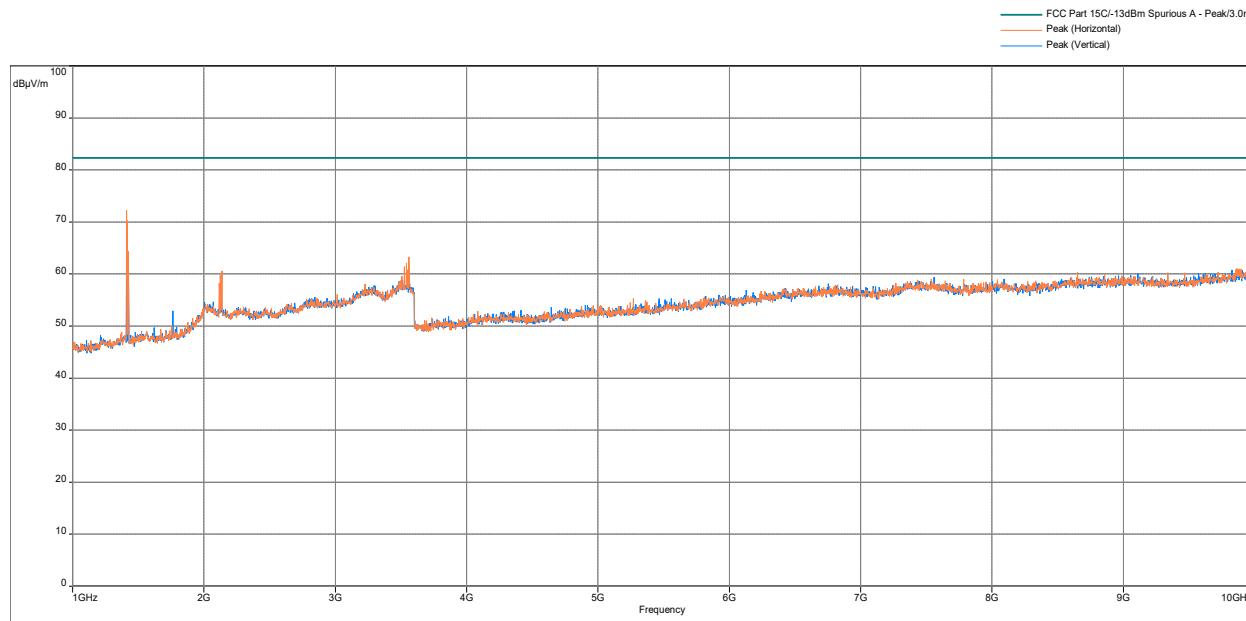
**Radiated Spurious Emissions (Cellular)
30MHz to 1GHz @ Battery Mode**

Note: The fundamental signal was on during testing.

Note: The limit was converted from a dBm value to a dB μ V/m value.

$$\text{Limit } \text{dB}(\mu\text{V/m}) = \text{Limit } (\text{dBm}) + 104.8 - 20 \cdot \log(D) = -13 \text{dBm} + 104.8 - 20 \cdot \log(10) = 71.8 \text{dB}\mu\text{V/m}$$

**Radiated Spurious Emissions (Cellular)
1GHz to 18GHz @ Battery Mode**



Model: ; Client: ; Comments: ; Test Date: 10/03/2022 10:13

Frequency (MHz)	Pk dB(μV/m)	P Limit dB(μV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
1410.70	72.25	82.30	-10.05	33.25	1.25	Horizontal	44.38	27.87
3559.60	63.33	82.30	-18.97	288.75	1.25	Horizontal	28.65	34.68
1410.70	62.04	82.30	-20.26	39.75	3.25	Vertical	34.17	27.87

Result:	Complies by 10.05 dB in Battery Mode
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Intertek

REPORT NUMBER: 105185424MPK-001

Issued: October 24, 2022

Test Personnel:	<u>Kenneth Roque</u>	Test Date:	<u>09/27/22 – 10/06/22</u>
Supervising/ Reviewing Engineer:		Limit Applied:	<u>ANSI C63.26</u>
(Where Applicable)			
Product Standard:	<u>FCC CFR 47 Part 22H & 24E</u>	Ambient Temperature:	<u>23.33 °C</u>
Input Voltage:	<u>120Vac 60Hz & Battery Mode</u>	Relative Humidity:	<u>41.9 %</u>
Pretest Verification w/ Ambient Signals or BB Source:	<u>BB Source</u>	Atmospheric Pressure:	<u>30 in Hg</u>

Deviations, Additions, or Exclusions: None

END OF REPORT