

# NorthEast Monitoring, Inc. **TEST REPORT**

**SCOPE OF WORK**

EMC TESTING – Transceiver, Model: NEMP00539

**REPORT NUMBER**

105185424MPK-001

**ISSUE DATE**

October 24, 2022

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Non-Specific EMC Report Shell Rev. December 2017 MPK  
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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<br>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<br>Normal Mode |
| ANSI C63.4  | Conducted Emission  | AC Power         | 120 Vac 60 Hz<br>Normal Mode                  |

## EXECUTIVE SUMMARY

| FCC Part 15 Subpart B, ICES-003<br>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 |

|                            |            |                        |          |
|----------------------------|------------|------------------------|----------|
| <b>Received Date:</b>      | 09/27/22   | <b>Test Started:</b>   | 09/27/22 |
| <b>Received Condition:</b> | Good       | <b>Test Completed:</b> | 10/06/22 |
| <b>Type:</b>               | 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.<br>BLE Radio (appendix A): The EUT was placed into transmit mode using a test program provided by NorthEast Monitoring, Inc.<br>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.

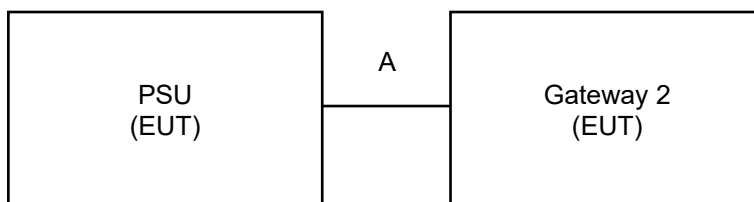
## 5. System Setup and Method

| 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.

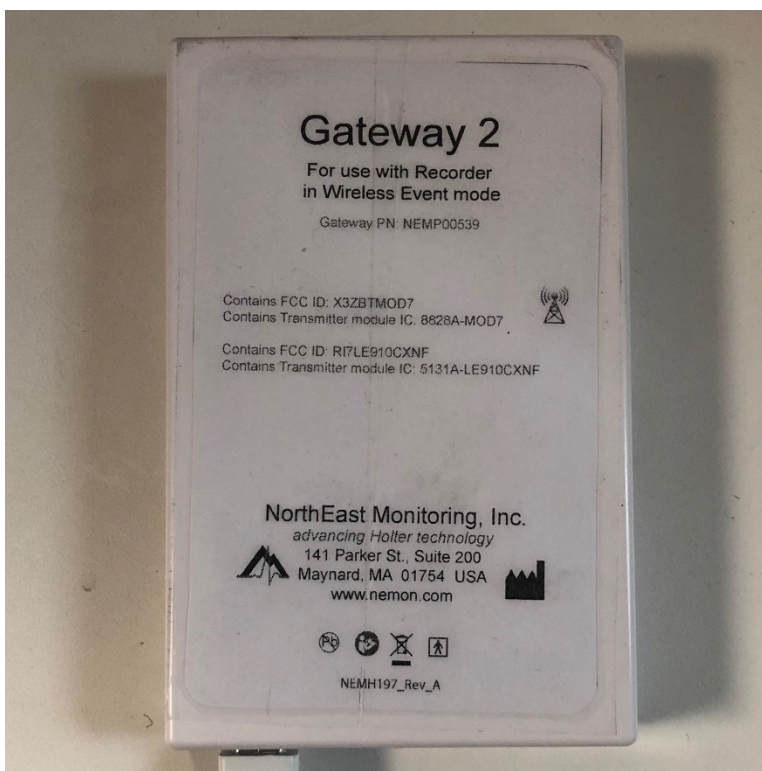
### 5.2 EUT Block Diagram



### 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 <sub>CISPR</sub> |
|--------------------------|-----------------|----------------------------|--------------------|
| 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 $\mu$ V/m  
RA = Receiver Amplitude (including preamplifier) in dB $\mu$ 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 $\mu$ 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 $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA = 52.0 dB $\mu$ V  
AF = 7.4 dB/m  
CF = 1.6 dB  
AG = 29.0 dB  
FS = 32 dB $\mu$ V/m

To convert from dB $\mu$ V to  $\mu$ V or mV, the following was used:

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

Where: UF = Net Reading in  $\mu$ V  
NF = Net Reading in dB $\mu$ 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:**

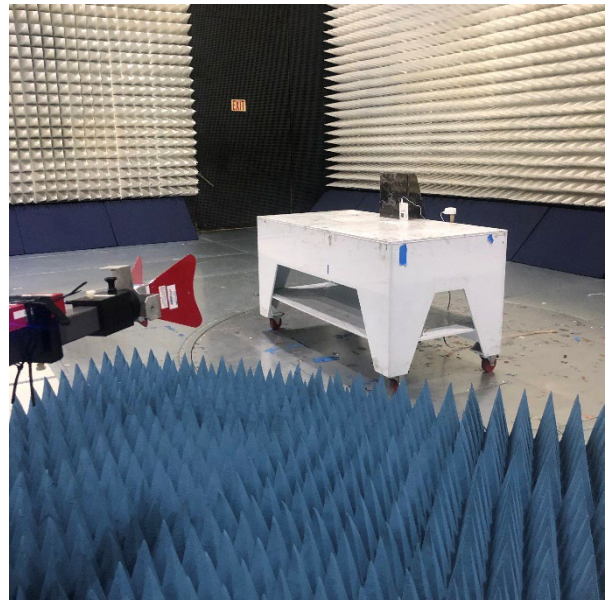
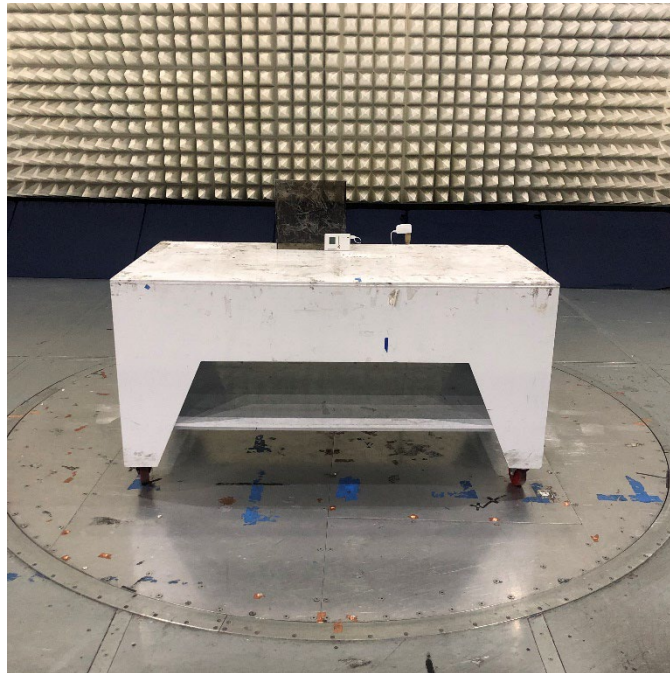
| Name    | Manufacturer | Version   |
|---------|--------------|-----------|
| BAT-EMC | NEXIO        | 3.20.0.23 |

**6.3 Result**

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

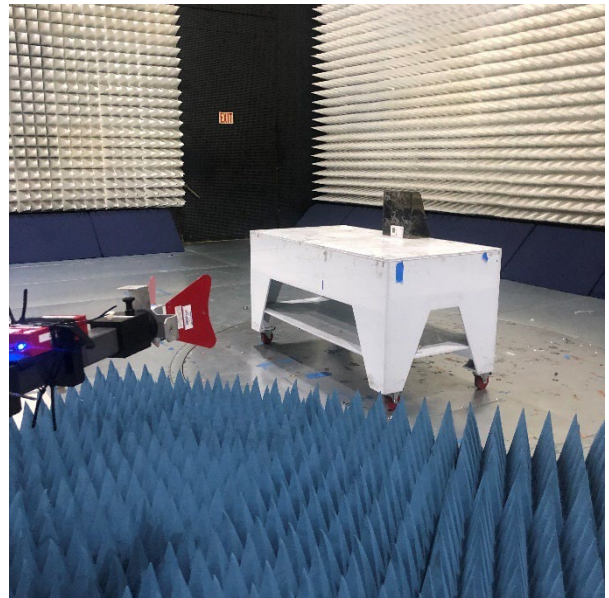
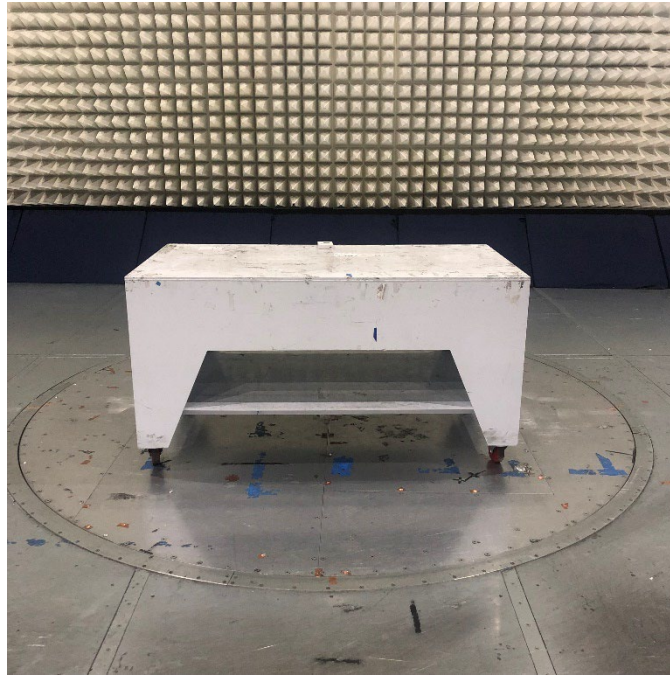
## 6.4 Setup Photograph

**120 Vac 60 Hz**





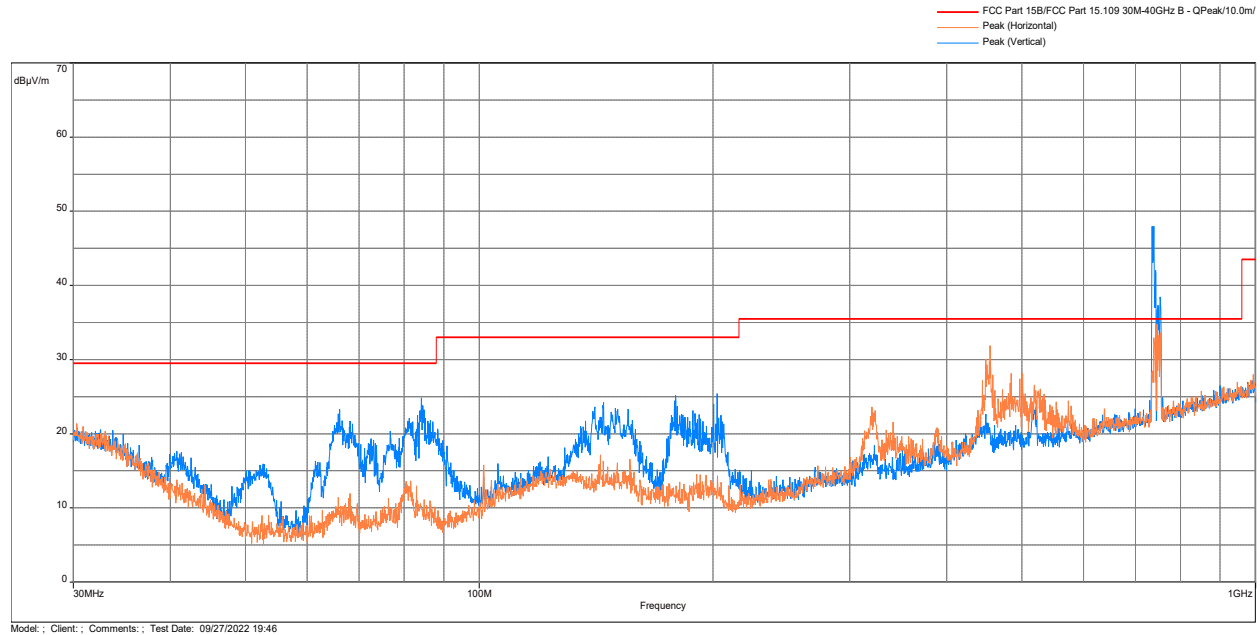
**Battery Powered**



## 6.5 Plot/Data

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

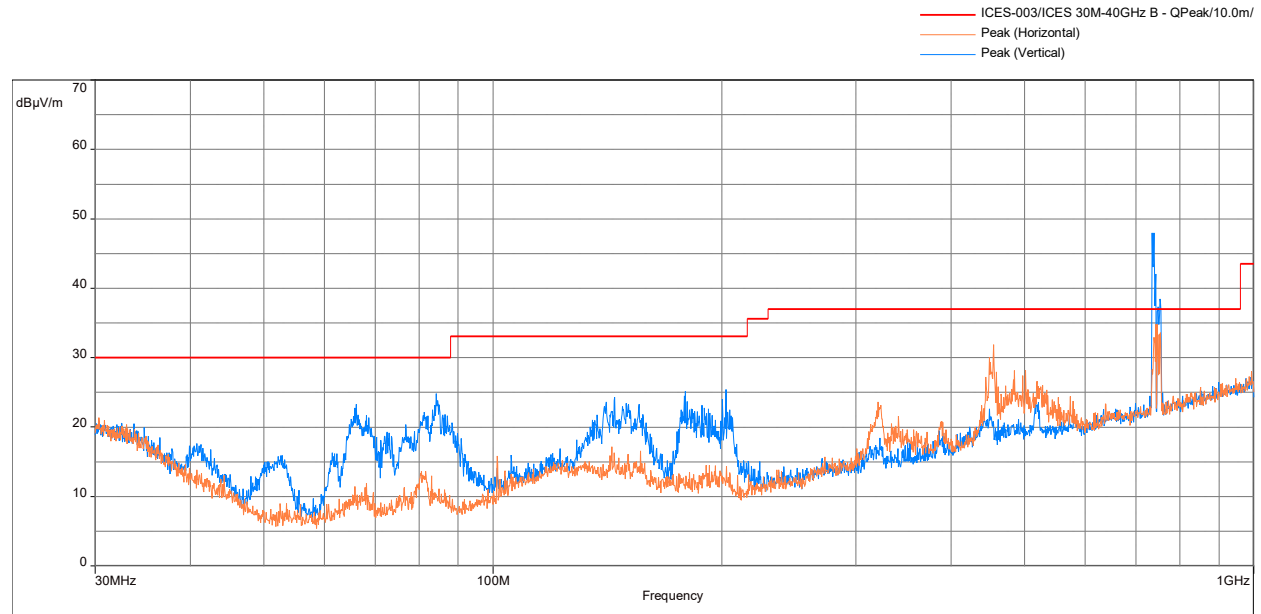
### FCC Part 15 Subpart B 30MHz to 1GHz @ 120 Vac 60 Hz



| 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**

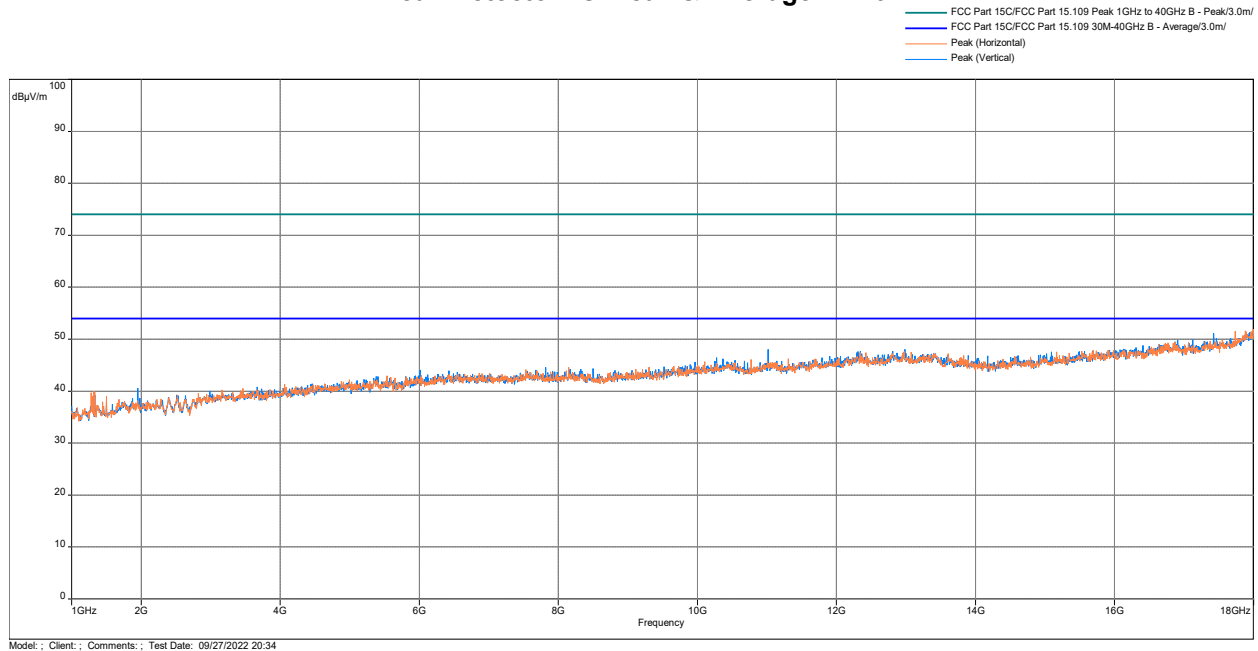


| Frequency (MHz) | Pk dB(μV/m) | Qp Limit dB(μV/m) | Margin (dB) | Azimuth (deg) | Height (m) | Polarity   | RA (dBuV) | Correction (dB) |
|-----------------|-------------|-------------------|-------------|---------------|------------|------------|-----------|-----------------|
| 454.763         | 31.89       | 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, ISSED ICES-003**  
**1GHz to 18GHz @ 120 Vac 60 Hz**  
**Peak Detector vs. Peak & Average Limit**

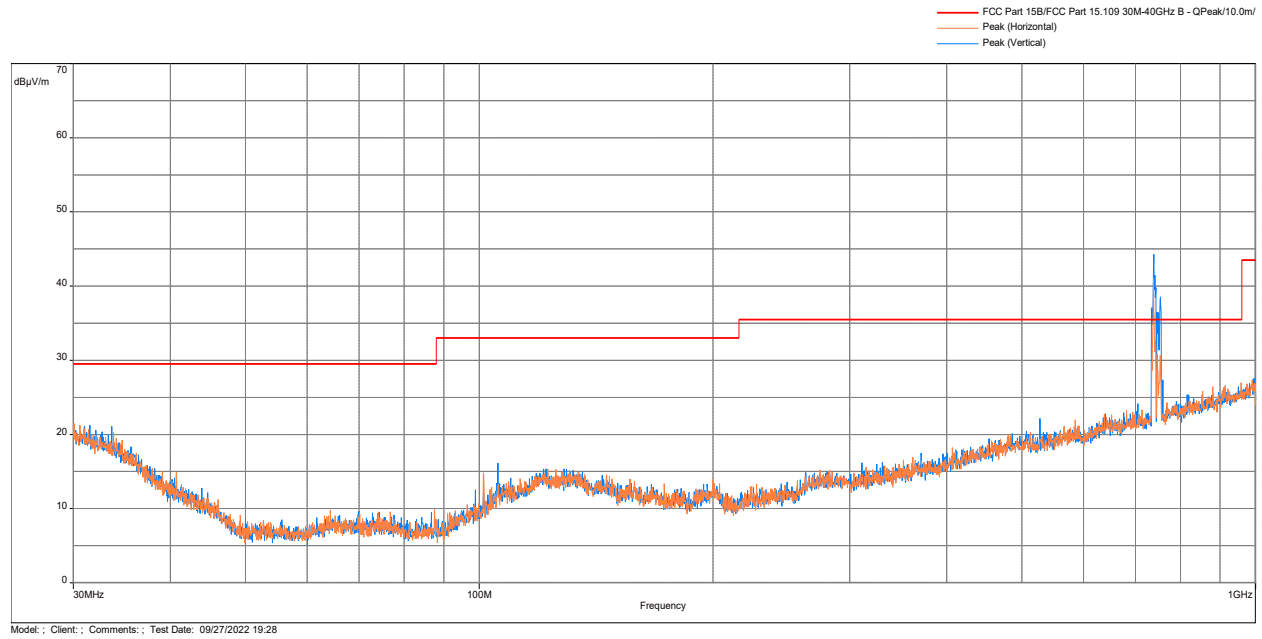


**Result:** **Complies by 3.61 dB at 120 Vac 60 Hz**

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

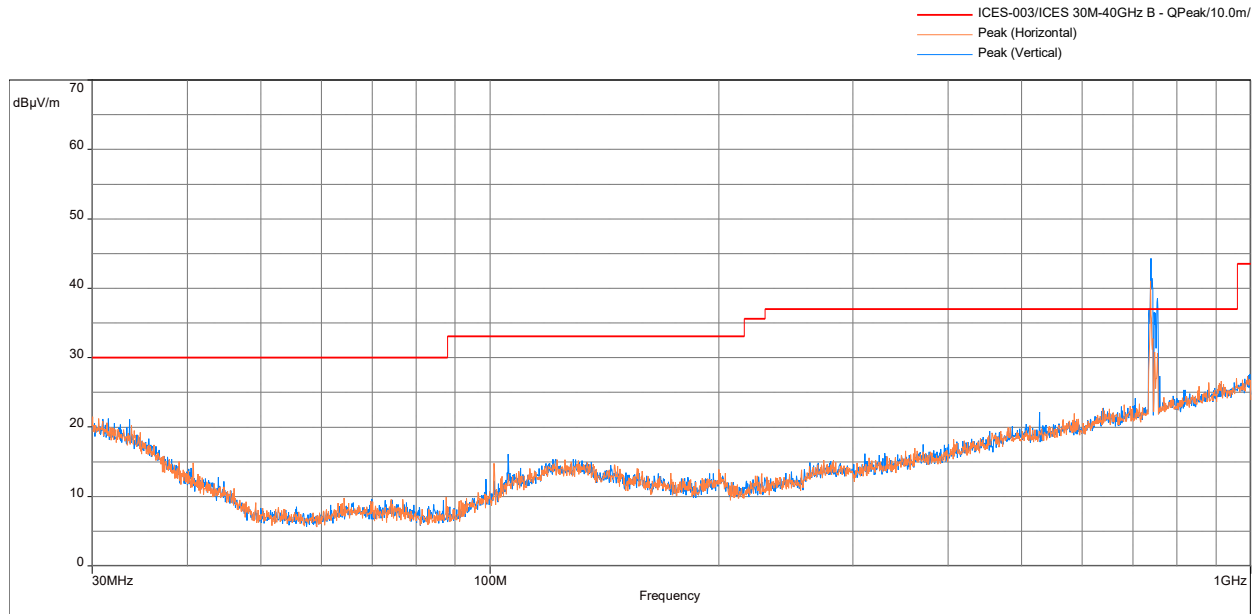
Note: The measured result is below the specification limit by a margin less than the measurement uncertainty; it is not therefore possible to determine compliance at confidence level of 95%. However, the measured result indicates a higher probability that the product tested complies with the specification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

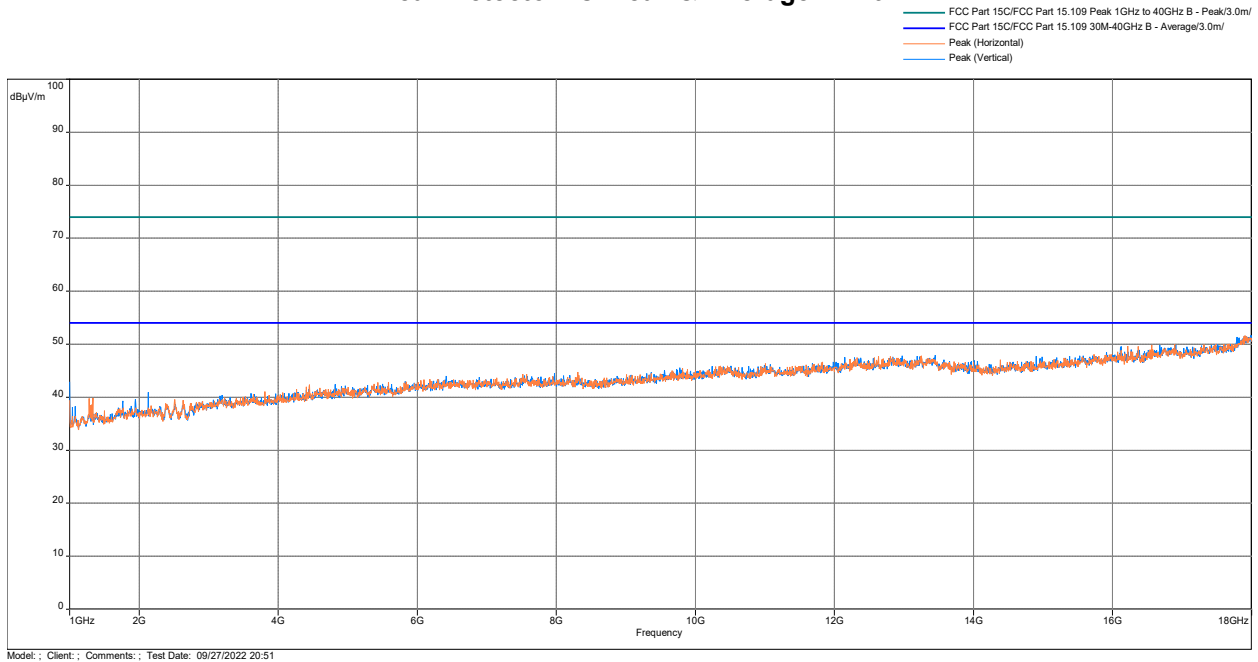
Note: The fundamental signal from the 700MHz cellular radio module was ON during testing.

**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, ISSED 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:   | <u>Kenneth Roque</u>                             | Test Date:            | <u>09/27/22 – 10/06/22</u> |
| Supervising/<br>Reviewing Engineer:<br>(Where Applicable)   | <u></u>  | Limit Applied:        | <u>ANSI C63.4</u>          |
| Product Standard:   | <u>FCC Part 15 Subpart B,<br/>ISED ICES-003,</u> |                       |                            |
| Input Voltage:  | <u>120Vac 60Hz &amp; Battery Mode</u>            |                       |                            |
| Pretest Verification w/<br>Ambient Signals or<br>BB Source: | <u>BB Source</u>                                 | Ambient Temperature:  | <u>23.33 °C</u>            |
|   |  | Relative Humidity:    | <u>41.9 %</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 <sub>CISPR</sub> |
|-----------------------------|------------------|----------------------------|--------------------|
| 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 $\mu$ V
- RF = Reading from receiver in dB $\mu$ 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 $\mu$ V to  $\mu$ V or mV, the following was used:

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

Where:

- UF = Net Reading in  $\mu$ V
- NF = Net Reading in dB $\mu$ V

### Example:

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

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

**7.2 Test Equipment Used**

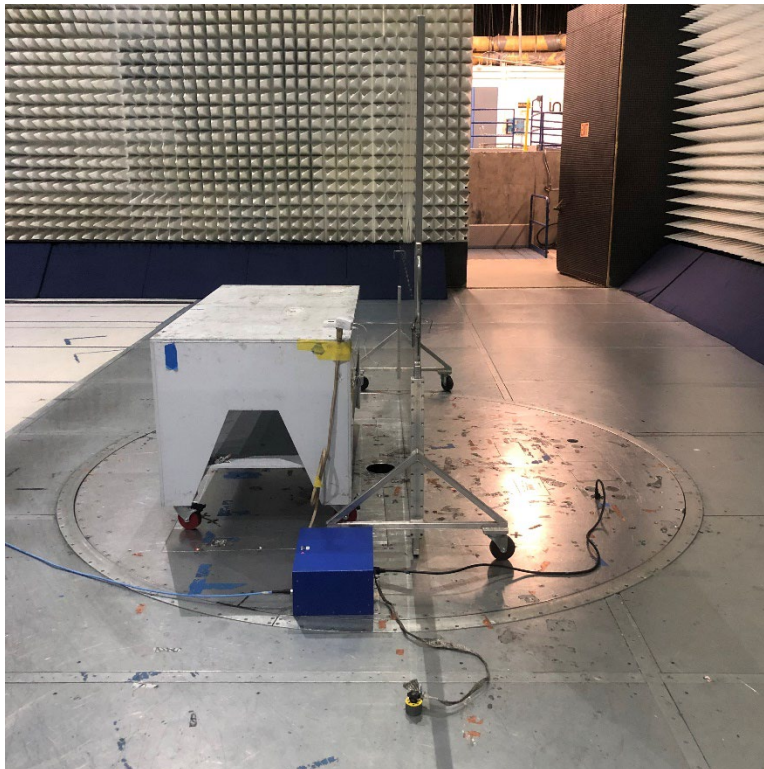
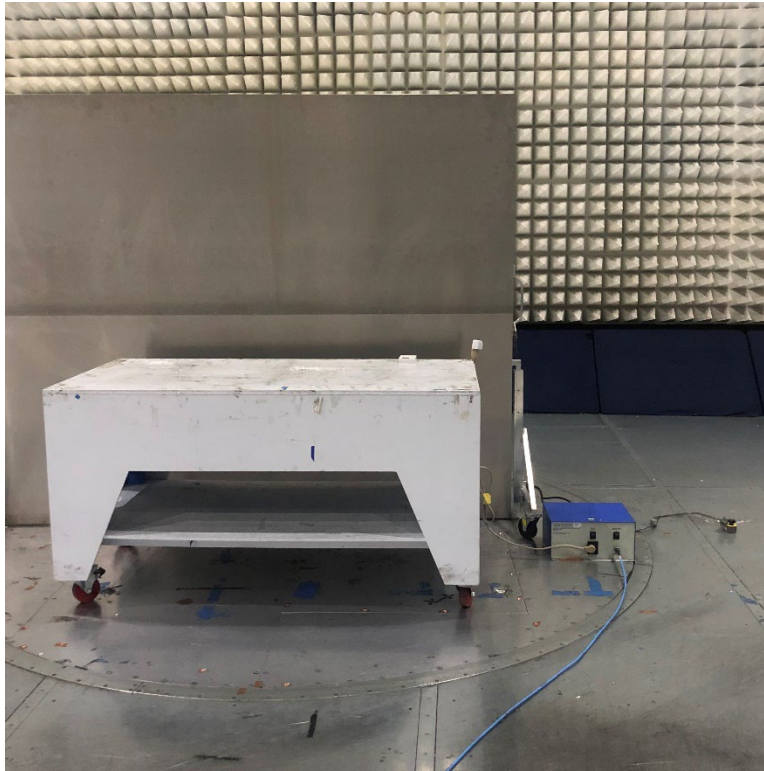
See Section 8.0 for specific equipment used for this test.

**Software Utilized:**

| Name    | Manufacturer | Version   |
|---------|--------------|-----------|
| BAT-EMC | NEXIO        | 3.20.0.23 |

**7.3 Result**

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

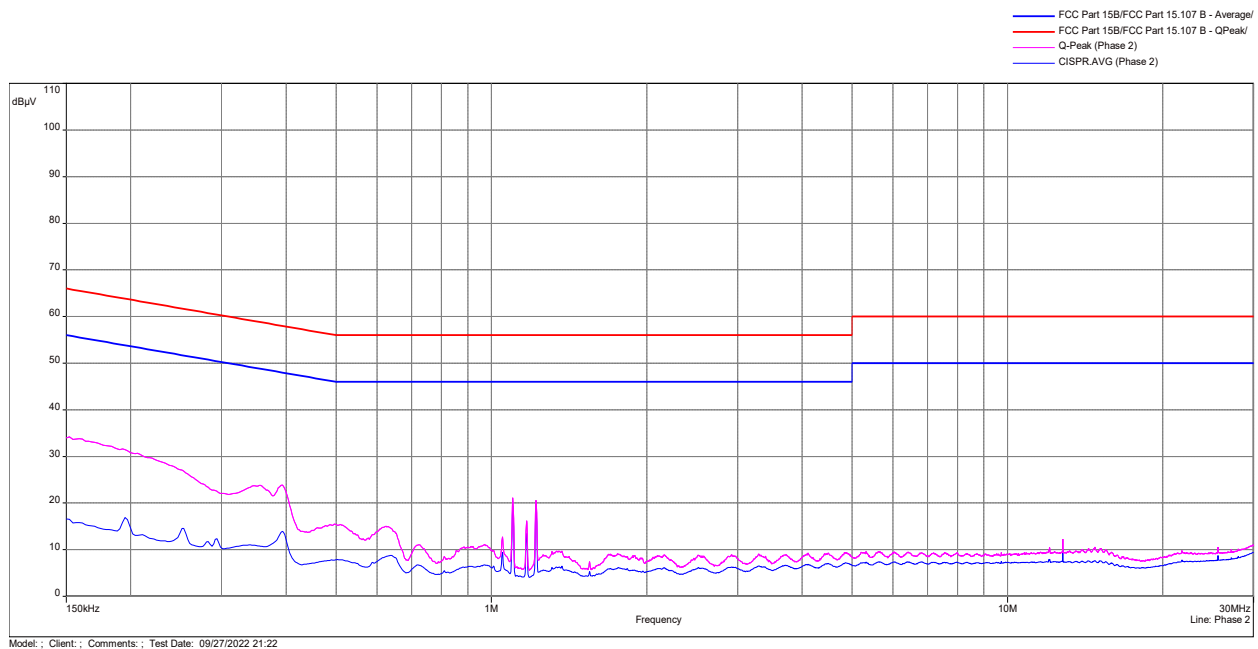
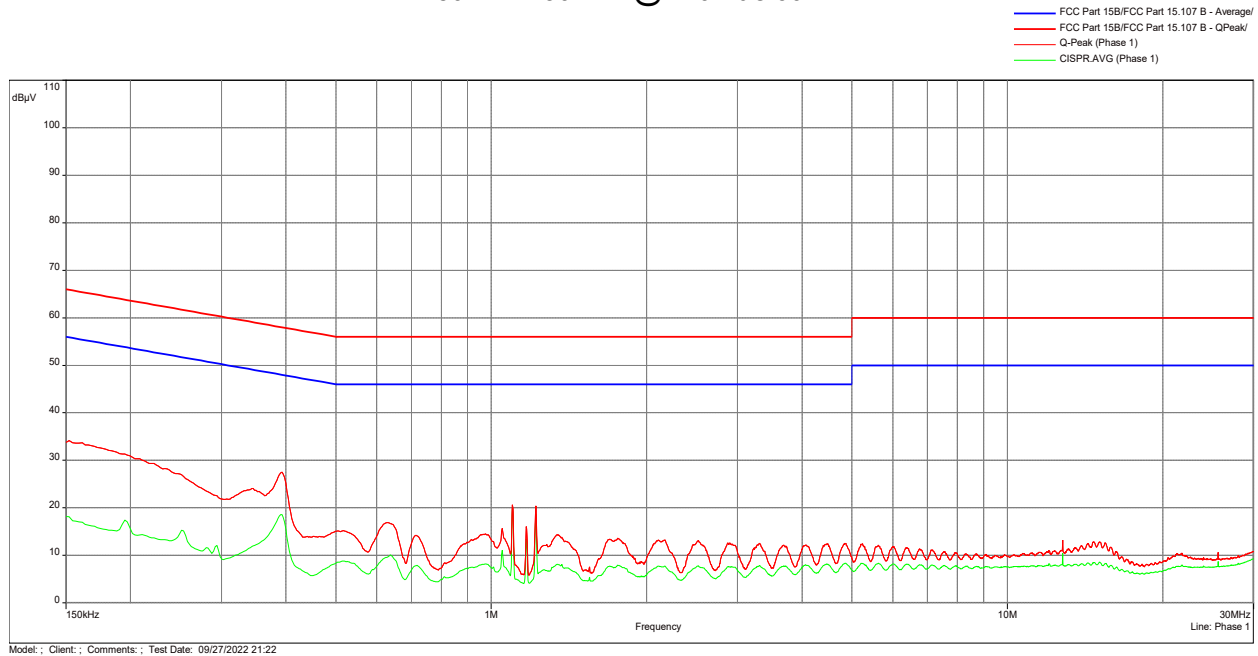
**7.4 Setup Photograph**



## 7.5 Plot/Data

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

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



**QPeak/Lim.Qpeak (16)**

| Frequency (MHz) | Level-QP (dBμV) | Limit-QP (dBμV) | 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 (dBμV) | Limit-Av (dBμV) | 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           |

|                |  |
|----------------|--|
| <b>Result:</b> | <b>Complies by 26.16 dB at 120 Vac 60 Hz</b> |
|----------------|--|

# Intertek

REPORT NUMBER: 105185424MPK-001

Issued: October 24, 2022

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

Deviations, Additions, or Exclusions: None

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

| <b>Equipment</b> | <b>Manufacturer</b> | <b>Model/Type</b>              | <b>Serial #</b> | <b>Cal Int</b> | <b>Cal Due</b> |
|------------------|---------------------|--------------------------------|-----------------|----------------|----------------|
| 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 <sub>CISPR</sub> |
|--------------------------|-----------------|----------------------------|--------------------|
| 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 $\mu$ V/m  
RA = Receiver Amplitude (including preamplifier) in dB $\mu$ 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 $\mu$ 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 $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA = 52.0 dB $\mu$ V  
AF = 7.4 dB/m  
CF = 1.6 dB  
AG = 29.0 dB  
FS = 32 dB $\mu$ V/m

To convert from dB $\mu$ V to  $\mu$ V or mV, the following was used:

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

Where: UF = Net Reading in  $\mu$ V  
NF = Net Reading in dB $\mu$ V

**Example:**

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

**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 |

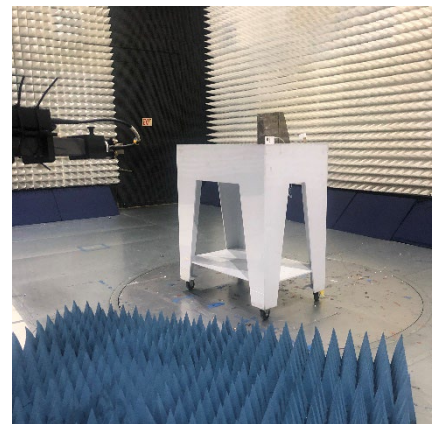
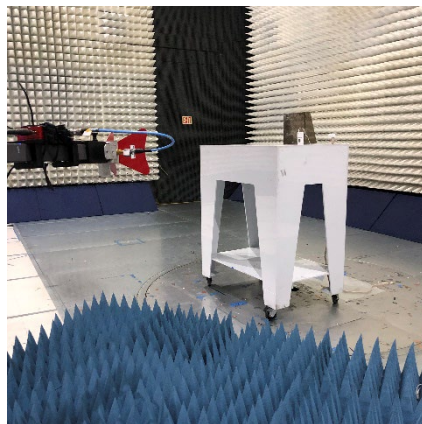
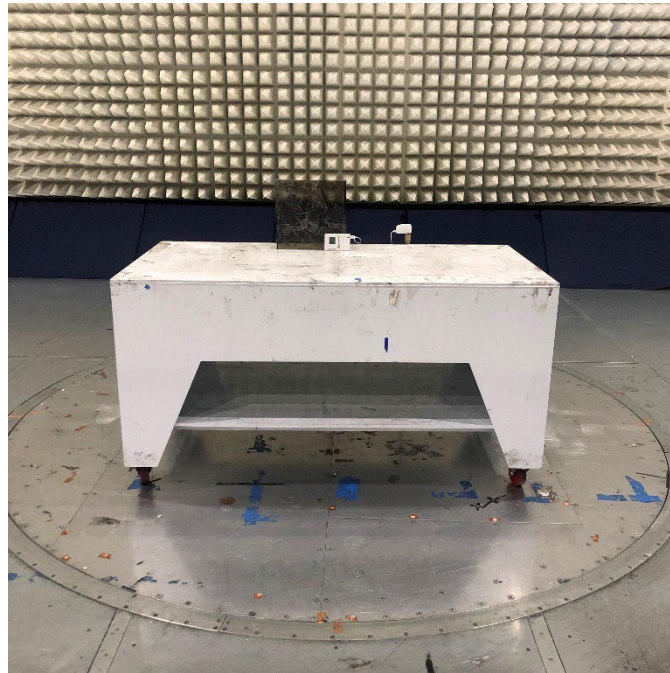
**A.1.3 Result**

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

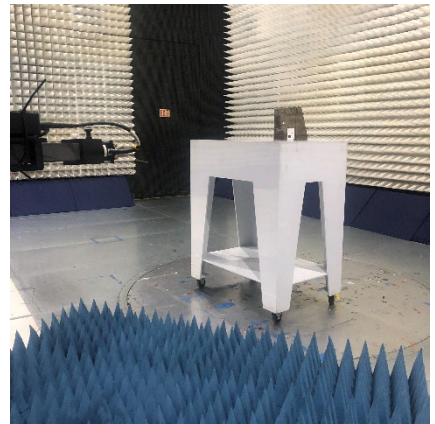
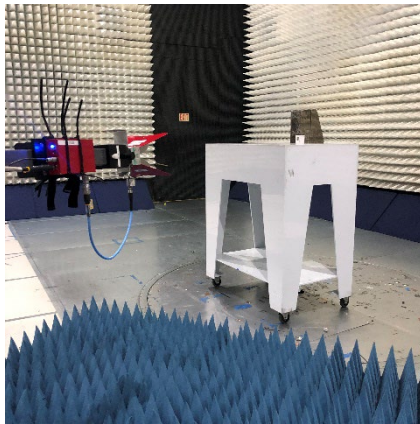
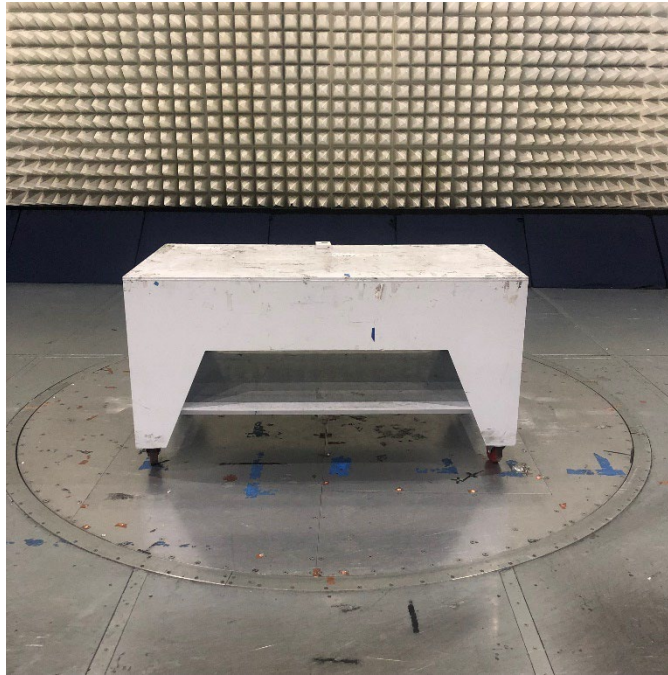


**A.1.4 Setup Photograph**

**120 Vac 60 Hz**



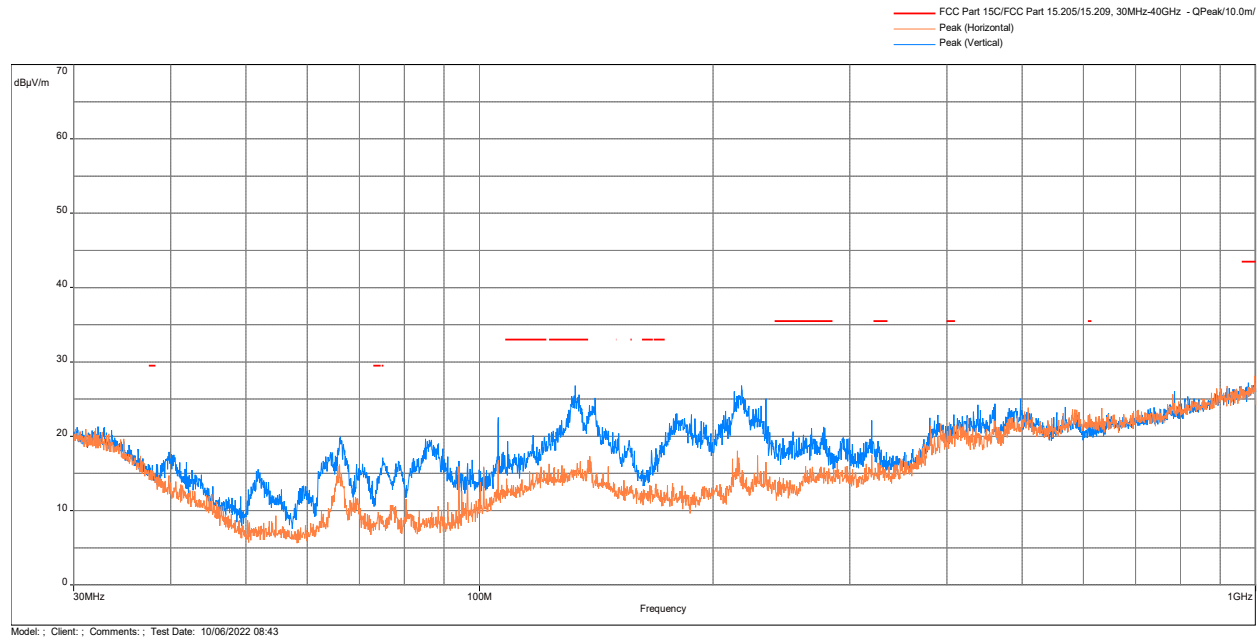
**Battery Powered**



**A.1.5 Plot/Data**

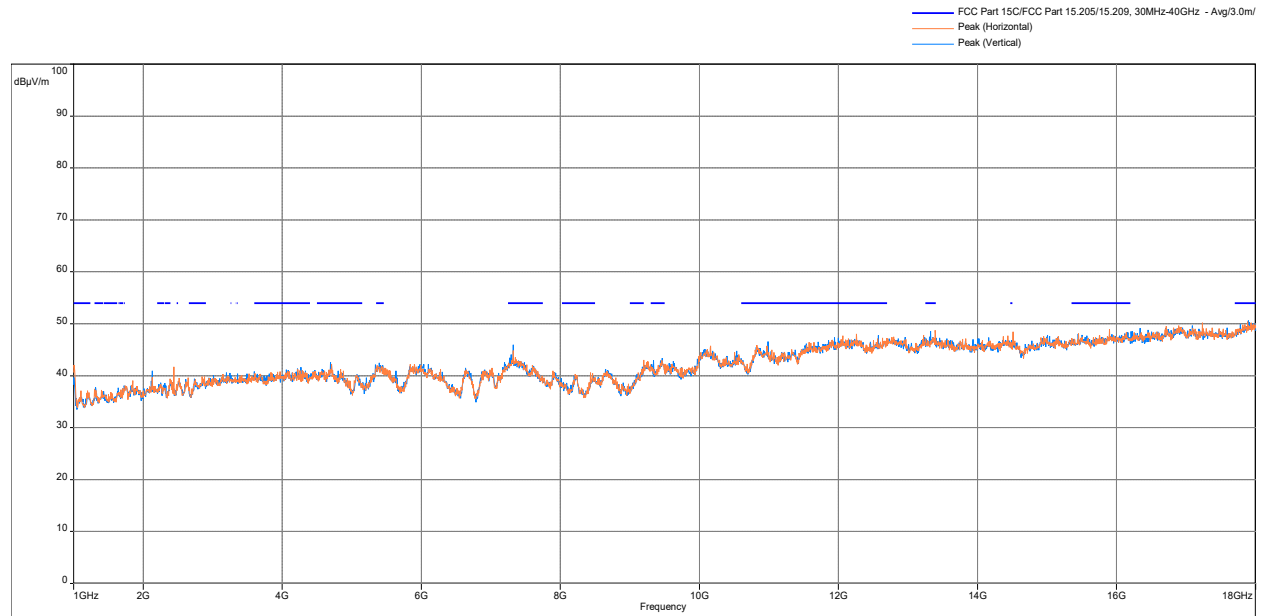
The EUT met the radiated disturbance requirements of FCC 47CFR PT 15.247.

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



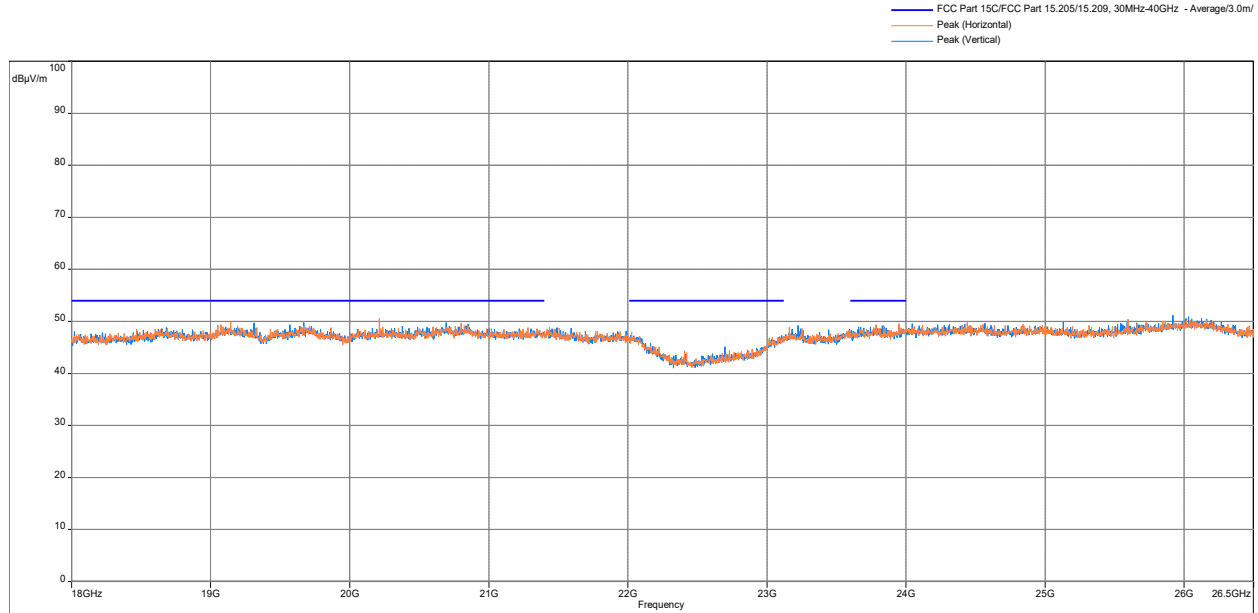
| Frequency (MHz) | Pk dB(μV/m) | Qp Limit dB(μV/m) | Margin (dB) | Azimuth (deg) | Height (m) | Polarity   | RA (dBuV) | Correction (dB) |
|-----------------|-------------|-------------------|-------------|---------------|------------|------------|-----------|-----------------|
| 132.820         | 26.80       | 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**



| 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 Vav 60 Hz  
Peak Detector vs. Average Limit**

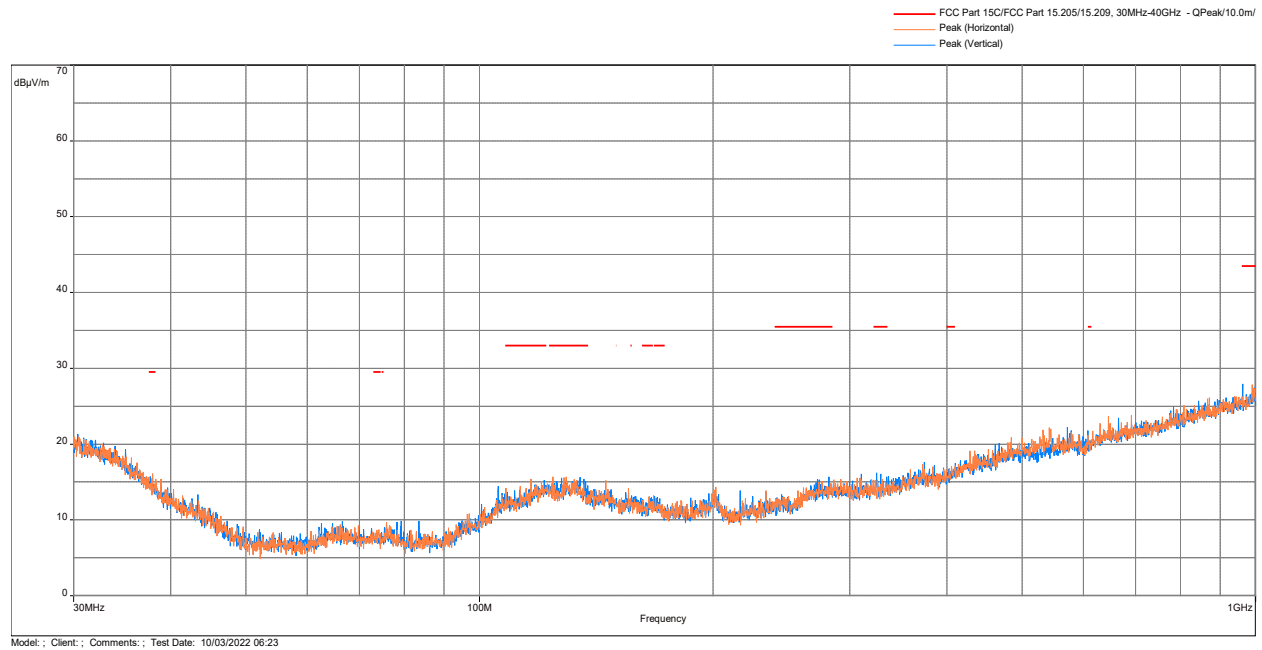


| Frequency (MHz) | Pk dB(μV/m) | Avg Limit dB(μV/m) | Margin (dB) | Azimuth (deg) | Height (m) | Polarity   | RA (dBuV) | Correction (dB) |
|-----------------|-------------|--------------------|-------------|---------------|------------|------------|-----------|-----------------|
| 20213.97        | 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

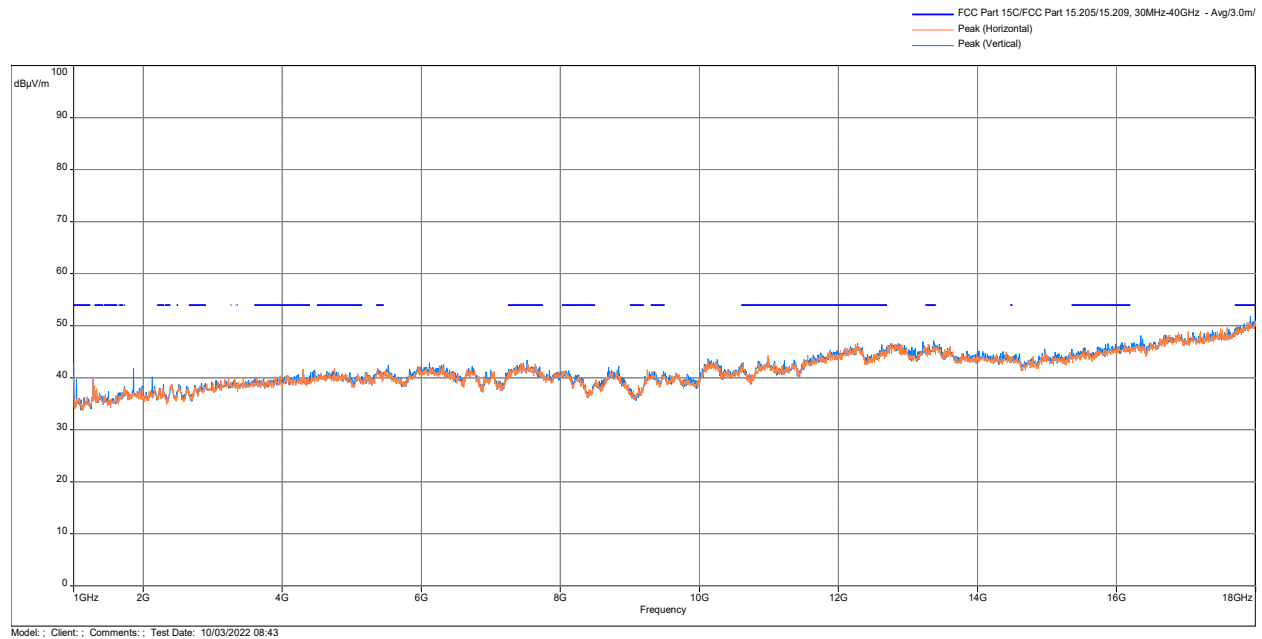


**Radiated Spurious Emissions (2.4 GHz BLE)  
30MHz to 1GHz @ Battery Mode**



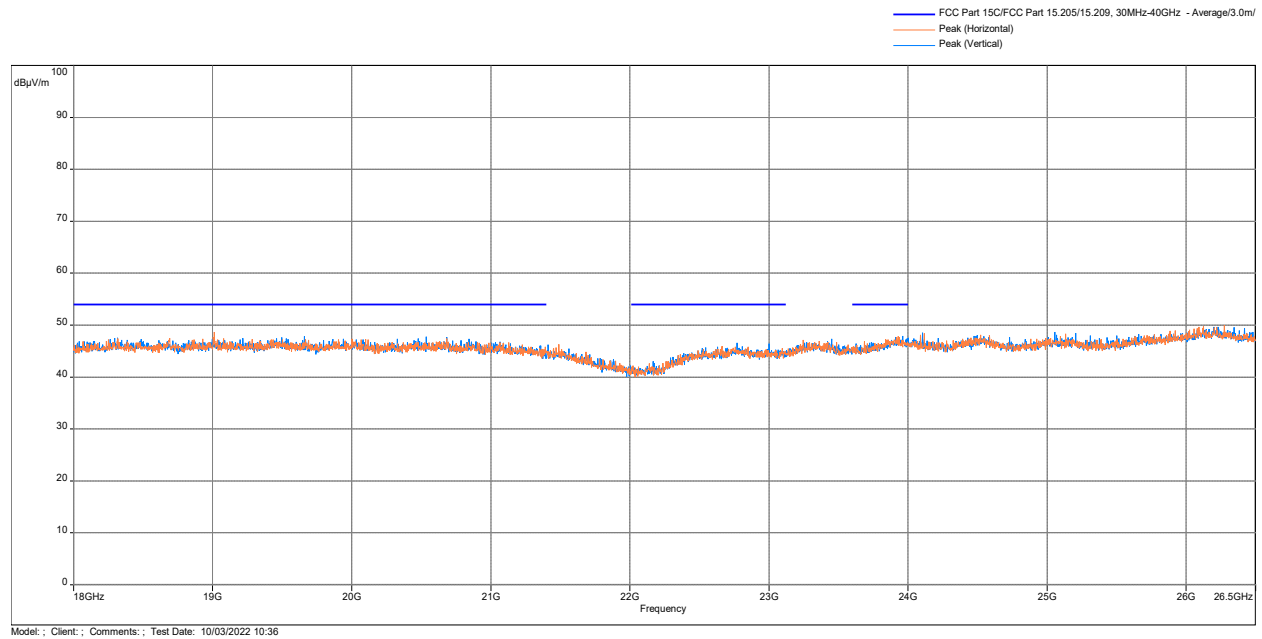
| Frequency (MHz) | Pk dB(μV/m) | Qp Limit dB(uV/m) | Margin (dB) | Azimuth (deg) | Height (m) | Polarity   | RA (dBuV) | Correction (dB) |
|-----------------|-------------|-------------------|-------------|---------------|------------|------------|-----------|-----------------|
| 608.346         | 20.78       | 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(μV/m) | Avg Limit dB(μV/m) | Margin (dB) | Azimuth (deg) | Height (m) | Polarity   | RA (dBuV) | 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**



| 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           |

|                |   |
|----------------|---|
| <b>Result:</b> | <b>Complies by 2.21 dB in Battery Mode.</b> |
|----------------|---|



# Intertek

REPORT NUMBER: 105185424MPK-001

Issued: October 24, 2022

Test Personnel: Kenneth Roque  
Supervising/  
Reviewing Engineer:  
(Where Applicable) \_\_\_\_\_  
Product Standard: FCC 47CFR PT 15.247  
Input Voltage: 120Vac 60Hz & Battery Mode  
Pretest Verification w/  
Ambient Signals or  
BB Source: BB Source

Test Date: 09/27/22 – 10/06/22  
Limit Applied: ANSI C63.10  
Ambient Temperature: 23.33 °C  
Relative Humidity: 41.9 %  
Atmospheric Pressure: 30 in Hg

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 <sub>CISPR</sub> |
|--------------------------|-----------------|----------------------------|--------------------|
| 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 $\mu$ V/m  
RA = Receiver Amplitude (including preamplifier) in dB $\mu$ 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 $\mu$ 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 $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA = 52.0 dB $\mu$ V  
AF = 7.4 dB/m  
CF = 1.6 dB  
AG = 29.0 dB  
FS = 32 dB $\mu$ V/m

To convert from dB $\mu$ V to  $\mu$ V or mV, the following was used:

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

Where: UF = Net Reading in  $\mu$ V  
NF = Net Reading in dB $\mu$ V

**Example:**

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

**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:**

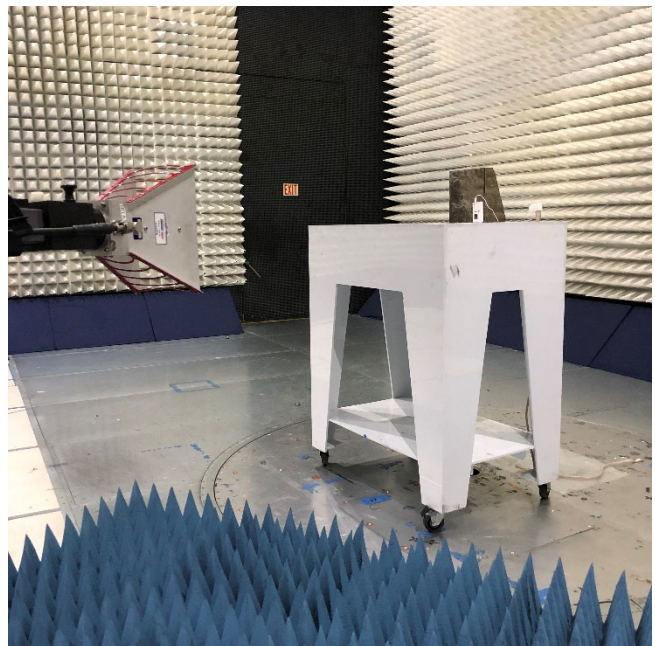
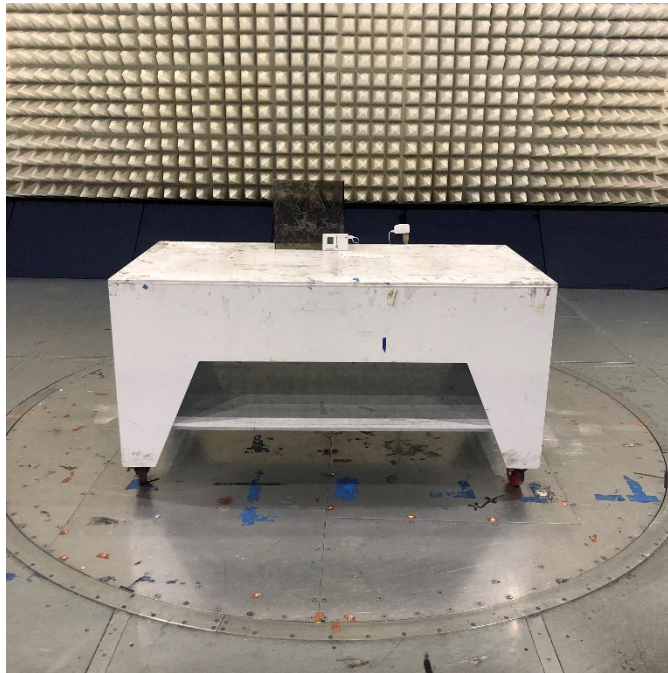
| Name    | Manufacturer | Version   |
|---------|--------------|-----------|
| BAT-EMC | NEXIO        | 3.20.0.23 |

**B.1.3 Result**

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

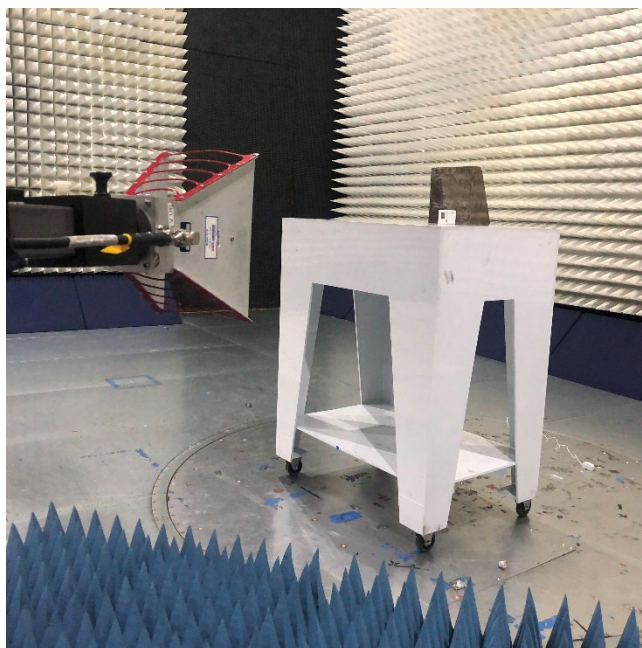
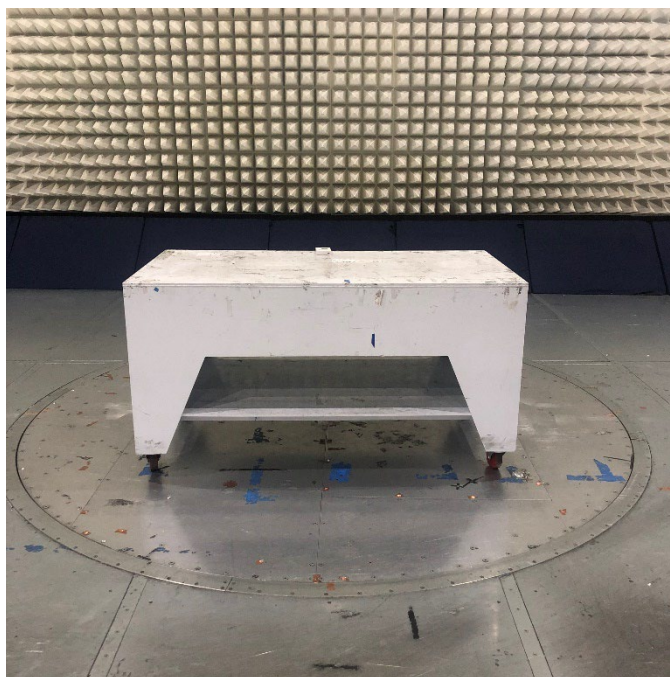
**B.1.4 Setup Photograph**

**120 Vac 60 Hz**





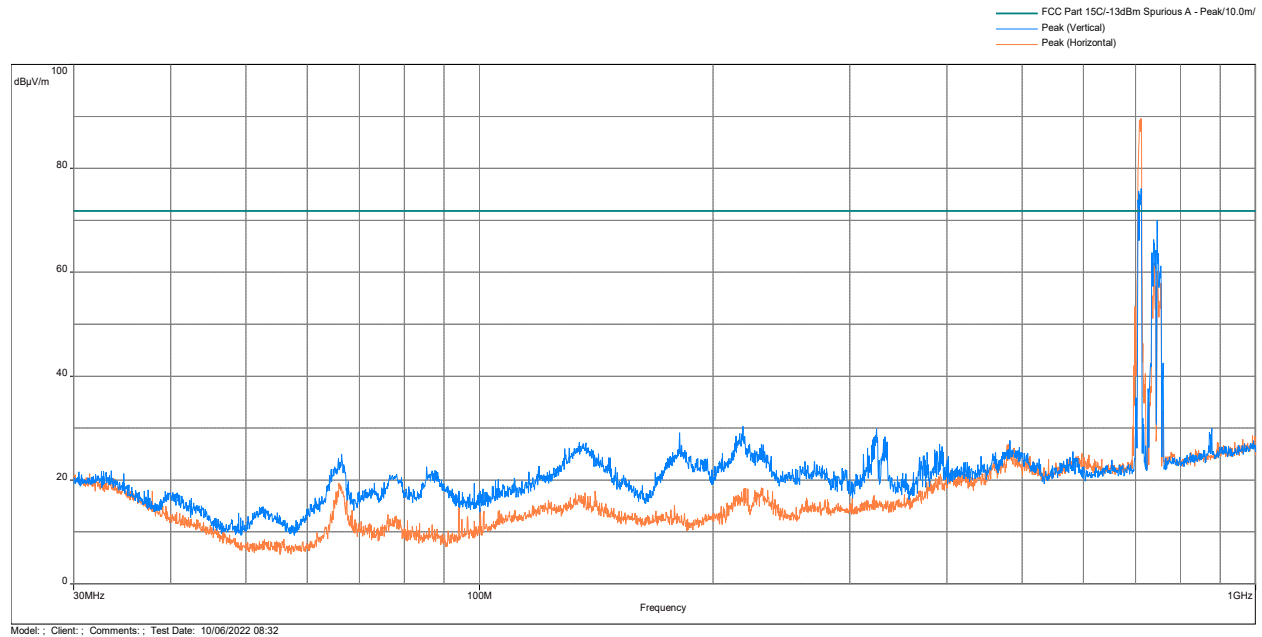
**Battery Powered**



### 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

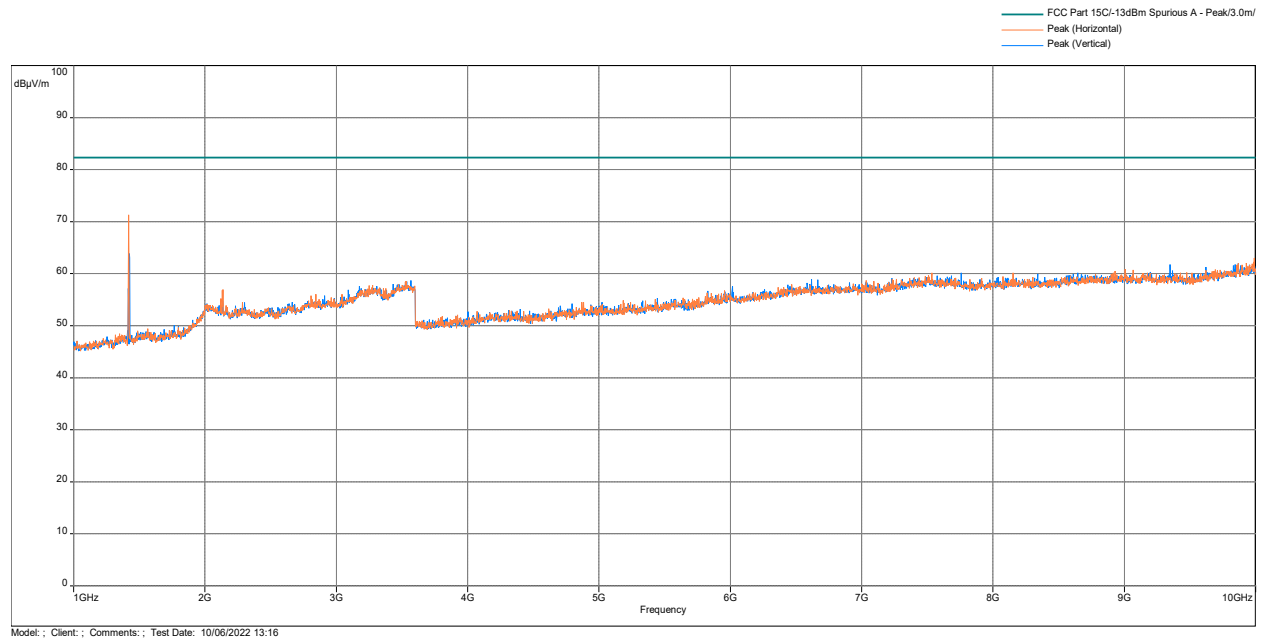


Note: The fundamental signal was on during testing.

Note: The limit was converted from a dBm value to a dBμV/m value.

Limit dB(μV/m)=Limit (dBm)+104.8-20\*log(D) = -13dBm+104.8-20\*log(10)=71.8dBμV/m

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



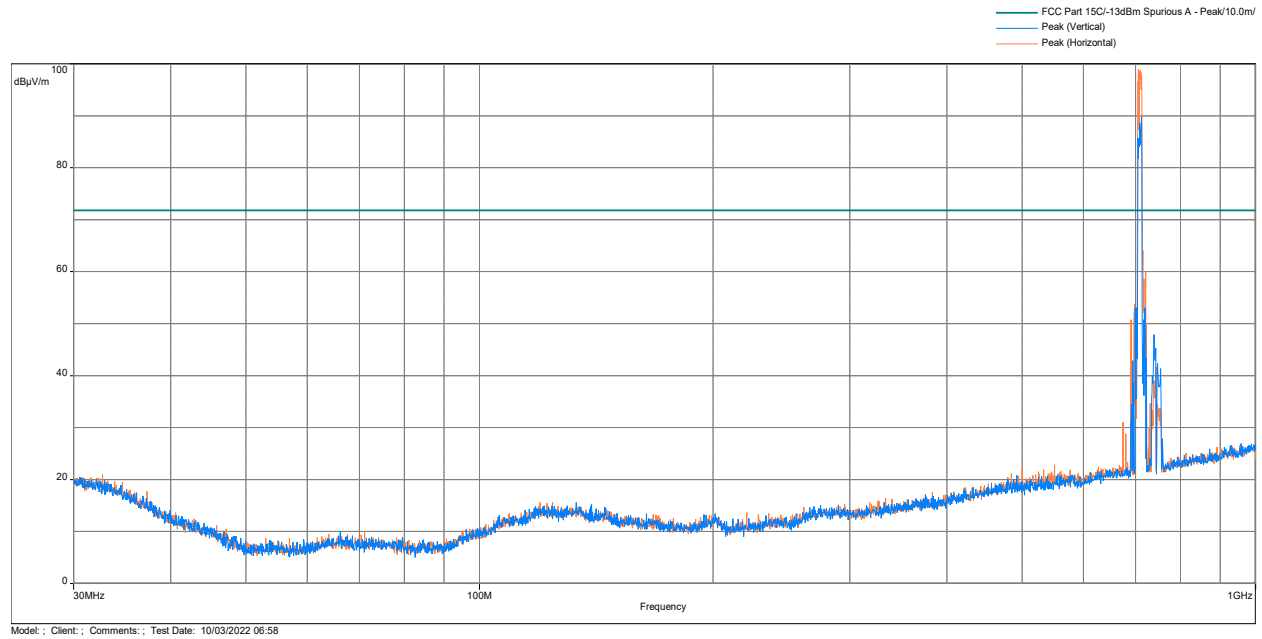
Note: The limit was converted from a dBm value to a dBμV/m value.  
 $\text{Limit dB}(\mu\text{V/m}) = \text{Limit (dBm)} + 104.8 - 20 \cdot \log(D) = -13\text{dBm} + 104.8 - 20 \cdot \log(3) = 82.3\text{dB}\mu\text{V/m}$

| Frequency (MHz) | Pk dB(μV/m) | Pk Limit dB(uV/m) | Margin (dB) | Azimuth (deg) | Height (m) | Polarity   | RA (dBuV) | 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           |

|                |  |
|----------------|--|
| <b>Result:</b> | <b>Complies by 11.01 dB at 120 Vac 60 Hz</b> |
|----------------|--|



**Radiated Spurious Emissions (Cellular)  
30MHz to 1GHz @ Battery Mode**

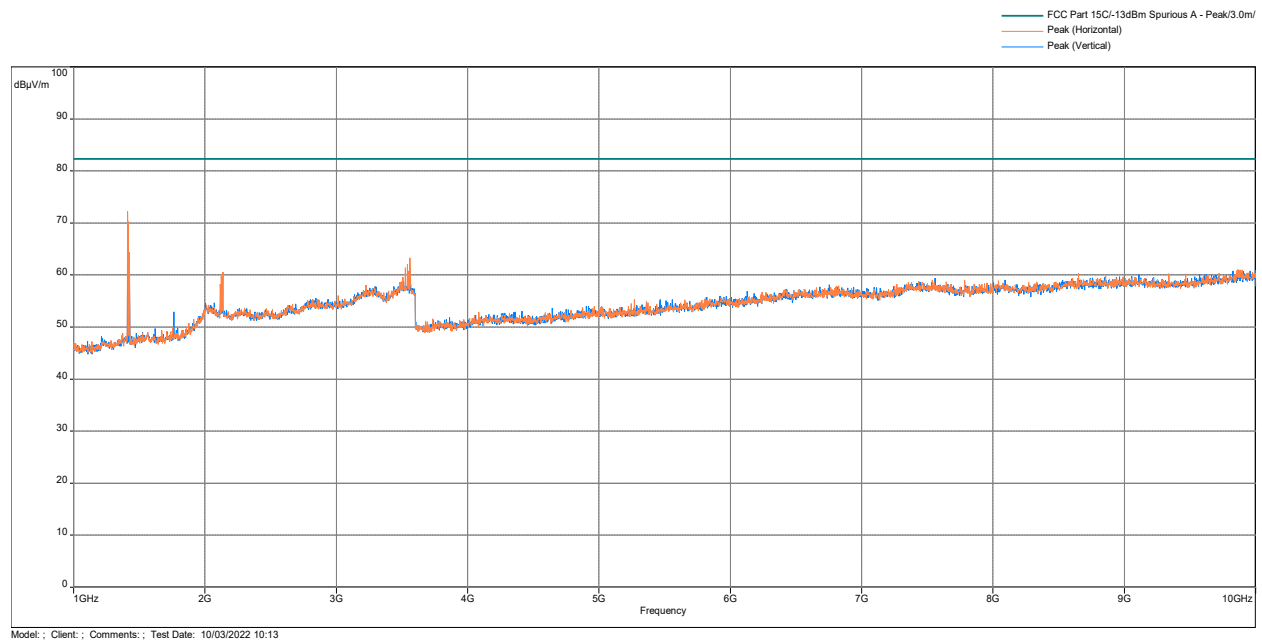


Note: The fundamental signal was on during testing.

Note: The limit was converted from a dBm value to a dBμV/m value.

Limit dB(μV/m)=Limit (dBm)+104.8-20\*log(D) = -13dBm+104.8-20\*log(10)=71.8dBμV/m

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



| 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           |

|                |   |
|----------------|---|
| <b>Result:</b> | <b>Complies by 10.05 dB in Battery Mode</b> |
|----------------|---|

# 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/<br>Reviewing Engineer:           |                                       | Limit Applied:        | <u>ANSI C63.26</u>         |
| (Where Applicable)                            |                                       |                       |                            |
| Product Standard:                             | <u>FCC CFR 47 Part 22H &amp; 24E</u>  |                       |                            |
| Input Voltage:                                | <u>120Vac 60Hz &amp; Battery Mode</u> |                       |                            |
| Pretest Verification w/<br>Ambient Signals or |                                       | Ambient Temperature:  | <u>23.33 °C</u>            |
| BB Source:                                    | <u>BB Source</u>                      | Relative Humidity:    | <u>41.9 %</u>              |
|   |                                       | Atmospheric Pressure: | <u>30 in Hg</u>            |

Deviations, Additions, or Exclusions: None

**END OF REPORT**