# FCC / ISED Test Report

**For:**
Visteon

**Model Number:**
BPCMFX

**Product Description:**
Battery Pack Control Module

**FCC ID:** NT8-BPCMFX

**IC:** 3043A-BPCMFX

**Applied Rules and Standards:**
FCC Part 15, Subpart B

ICES-003

**REPORT #:** EMC_VISTE_006_24001_FCC_15B_ICES_003_BPCMFX

**DATE:** 2024-11-08

**A2LA Accredited**

**IC recognized # 3462B**

***CETECOM* Inc.**
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*CETECOM* Inc. is a Delaware Corporation with Corporation number: 2905571

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# 1 Assessment

The following equipment (as further described in section 3 of this report) was evaluated against the applicable criteria specified in the Code of Federal Regulations Title 47 CFR Part 15B, and the relevant Canada standard ICES-003 Issue X

Radiated and conducted Emission tests are carried out to show that the EUT complies with FCC 15.107; FCC 15.109 (b) and ICES-003, §3.2.1; §3.2.2 limits for Class B device.

No deficiencies were ascertained.

| Company | Description | Model # |
|---|---|---|
| Visteon | Battery Pack Control Module | BPCMFX |

**Responsible for Testing Laboratory:**

| Date | Section | Name | Signature |
|---|---|---|---|
| 2024-11-08 | Compliance | Ilarina, Alvin (EMC Lab Manager) | Alvin ILARINA Digitally signed by Alvin ILARINA Date: 2024.11.08 10:38:33 -08'00' |

**Responsible for the Report:**

| Date | Section | Name | Signature |
|---|---|---|---|
| 2024-11-08 | Compliance | Huang, Guangcheng (EMC Test Engineer) | |

The test results of this test report relate exclusively to the test item specified in Section3.

# 2 Administrative Data

## 2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

| | |
|---|---|
| **Company Name:** | CETECOM Inc. |
| **Department:** | Compliance |
| **Street Address:** | 411 Dixon Landing Road |
| **City/Zip Code** | Milpitas, CA 95035 |
| **Country** | USA |
| **Telephone:** | +1 (408) 586 6200 |
| **Fax:** | +1 (408) 586 6299 |
| **EMC Lab Manager:** | Ilarina, Alvin |
| **Responsible Project Leader:** | Baskaran, Akanksha |

## 2.2 Identification of the Client

| | |
|---|---|
| **Applicant's Name:** | Visteon Corporation |
| **Street Address:** | One Village Center Drive |
| **City/Zip Code** | Van Buren Township, MI/48111 |
| **Country** | USA |

## 2.3 Identification of the Manufacturer

| | |
|---|---|
| **Manufacturer's Name:** | Same as Client |
| **Manufacturers Address:** | |
| **City/Zip Code** | |
| **Country** | |

# 3 Equipment under Test (EUT)

## 3.1 EUT Specifications

| | |
|---|---|
| **Model No:** | BPCMFX |
| **Marketing Name:** | Battery Pack Control Module |
| **HW Version:** | VPRE1F-12A650-MH |
| **SW Version:** | SWE201-28418-006F01 |
| **FCC ID:** | NT8-BPCMFX |
| **IC:** | 3043A-BPCMFX |
| **FWIN:** | 1.0 |
| **HVIN:** | BPCMFX |
| **PMN:** | Battery Pack Control Module |
| **Product Description:** | Battery Pack Control Module |
| **Power Supply / Rated operating Voltage Range:** | Min. 8 V, Nom 13.5 V, Max. 16 V powered by the vehicle battery power system |
| **Operating Temperature Range** | -40 °C to +85 °C |
| **Sample Revision** | Production |
| **EUT Dimensions** | 12.4 cm X 40.86 cm X 0+ 3.47 cm |
| Note: All information provided by the client. | |

## 3.2 Radio Specifications

| | |
|---|---|
| **Embedded Radio Technologies** | Integrating 2 ADI Proprietary Protocol:<br>1.- ADRF8951 chipset<br>2.- ADRF8951 chipset |
| **Frequency Range / number of channels:** | 1.- ADRF8951 chipset:<br>Low Power 2.4 GHz wBMS radio<br>Frequency Range: 2405 - 2480 MHz<br>Channels: 0-15<br><br>2.- ADRF8951 chipset:<br>Low Power 2.4 GHz wBMS radio<br>Frequency Range: 2405 - 2480 MHz<br>Channels: 0-15 |
| **Rated max. EIRP** | 1.- ADRF8951 chipset: 12 dBm<br>2.- ADRF8951 chipset: 12 dBm |
| **Tested radio technology** | Integrating 2 ADI Proprietary Protocol |
| **Antenna Type / Gain** | 1. Part No. 1001013<br>Product: 2.4 GHz<br>FR4 Antenna<br>2. Part No. 1001013<br>Product: 2.4 GHz<br>FR4 Antenna |
| **Modes of Operation** | 1.- ADRF8951 chipset:<br>Proprietary Protocol: 802.15.4<br>2400 MHz - 2483.5 MHz ISM Band<br>Modulation: GFSK<br>Nominal Channel Bandwitdth: 5 MHz<br>Duty Cycle: 27%<br>2.- ADRF8951 chipset:<br>Proprietary Protocol: 802.15.4<br>2400 MHz - 2483.5 MHz ISM Band<br>Modulation: GFSK<br>Nominal Channel Bandwitdth: 5 MHz<br>Duty Cycle: 27% |
| Note: All information provided by the client. | |

### 3.3 EUT Sample details

| EUT # | Serial Number | HW Version | SW Version | Notes/Comments |
|---|---|---|---|---|
| 1 | BPCMFX | VPRE1F-12A650-MH | SWE201-28418-006F01 | Unintentional radiated emissions |

### 3.4 Accessory Equipment (AE) details

| AE # | Type | Model | Manufacturer | S/N | Notes/Comments |
|---|---|---|---|---|---|
| 1 | AC/DC Adaptor | GST36U12-P1J | Mean Well | None | 13 V DC |
| 2 | USB-Dongle | PL2303TA | HiLetgo | NA | - |
| 3 | Harness cables | Power ON cables | NA | NA | - |

### 3.5 Test Sample Configuration

| Set-up # | EUT / AE used for set-up | Comments |
|---|---|---|
| 1 | EUT # 1+AE # 1+3 | - |

### 3.6 Mode of Operation details

| Mode of Operation | Description of Operating modes | Additional Information |
|---|---|---|
| Op. 1 | Idle | EUT in fully functional mode, while radio idle |

# 4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to evaluate the compliance of the EUT against the relevant requirements specified in the Code of Federal Regulations Title 47 CFR Part 15B and the relevant Canada standard ICES-003 Issue X

Radiated and conducted Emission tests are carried out to show that the EUT complies with FCC 15.107; FCC 15.109 (b) and ICES-003, §3.2.1; §3.2.2 limits for Class B device.

## 4.1 Date of Testing:

10/4/2024

## 4.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=2.

| Measurement System | | EMC Lab 1 | EMC Lab 2 |
|---|---|---|---|
| Conducted emissions (mains port) | 150 kHz – 30 MHz | 2.47 dB | N/A |
| Radiated emissions | 9 kHz – 30 MHz | 2.68 dB | 2.53 dB |
| | 30 – 100 MHz | 4.39 dB | 3.85 dB |
| | 100 MHz – 1 GHz | 5.65 dB | 5.24 dB |
| | 1 – 6 GHz | 5.0 dB | 4.88 dB |
| | 6 – 18 GHz | 4.76 dB | 4.58 dB |
| | 18 – 40 GHz | 4.65 dB | 4.61 dB |

RF conducted measurement ±0.5 dB

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3dB to the limit.

## 4.3 Environmental Conditions during Testing:

The following environmental conditions were maintained during testing:

- Ambient Temperature: 20-25°C
- Relative humidity: 40-60%

Deviating test conditions are indicated at individual test description where applicable.

## 4.4 Decision Rule:

Cetecom advanced follows ILAC G8:2019 chapter 4.2.1 (Simple Acceptance Rule).

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3. The measurement uncertainty is mentioned in this test report, See chapter 9, but is not taken into account – neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.

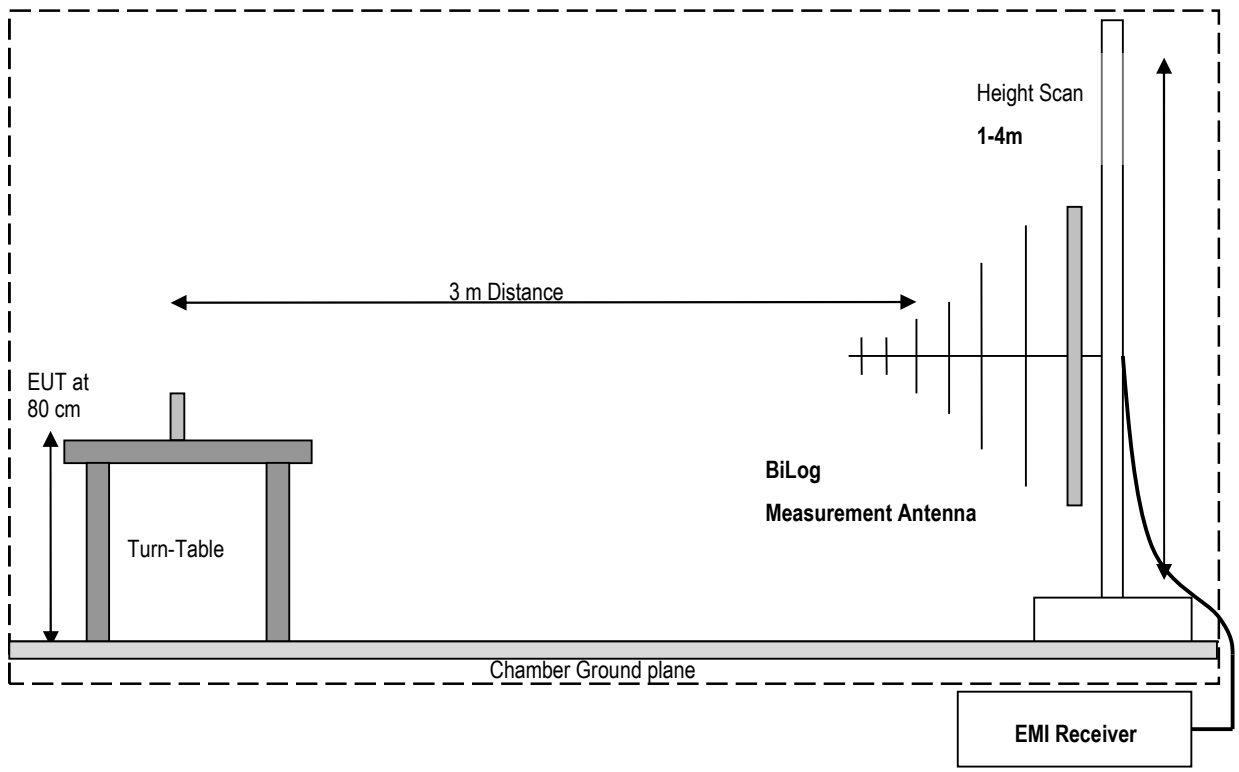
# 5 Measurement Procedures

Testing is performed according to the guidelines provided in ANSI C63.4-2014 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 30 MHz to 40 GHz

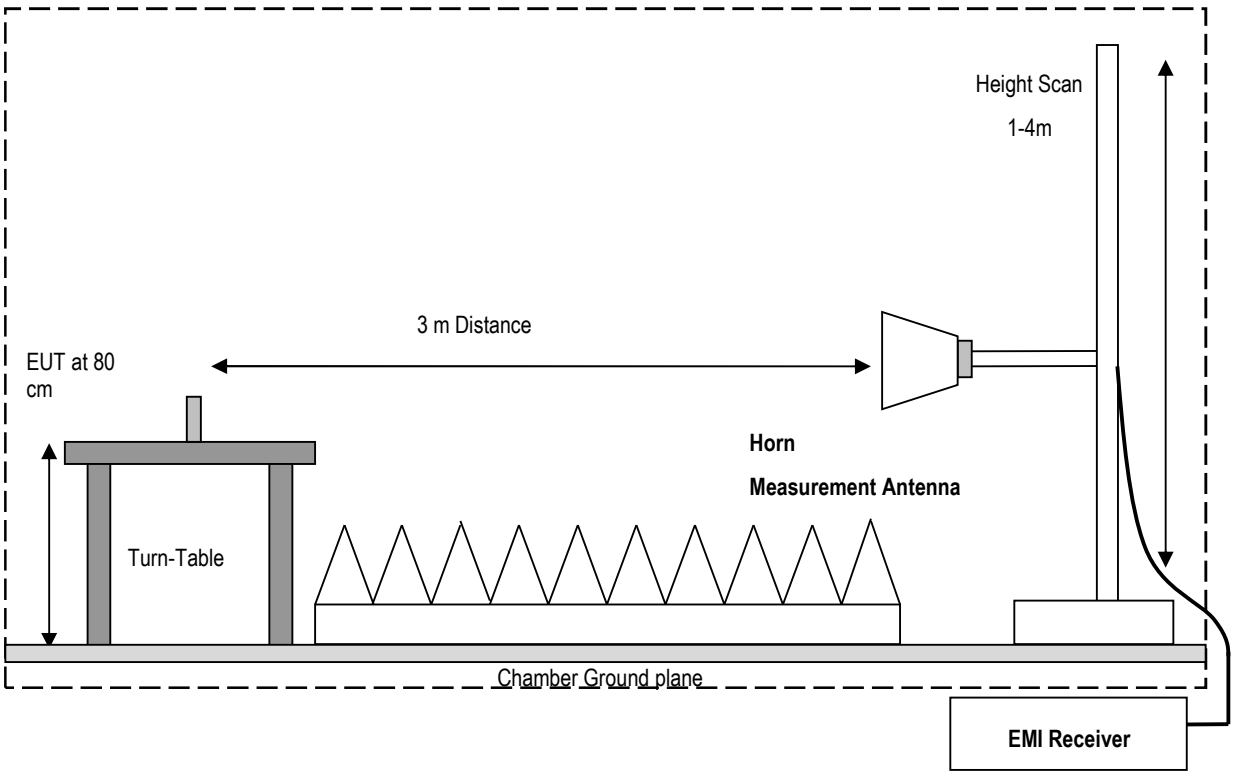
## 5.1 Radiated Measurement

- The exploratory measurement is accomplished by running a matrix of sweeps over the required frequency range with R&S Test-SW EMC32, 360º continuous measurement of the turntable, two orthogonal positions of the EUT and both antenna polarizations, at 1, 1.5, and 2 meters. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 6 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 3 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

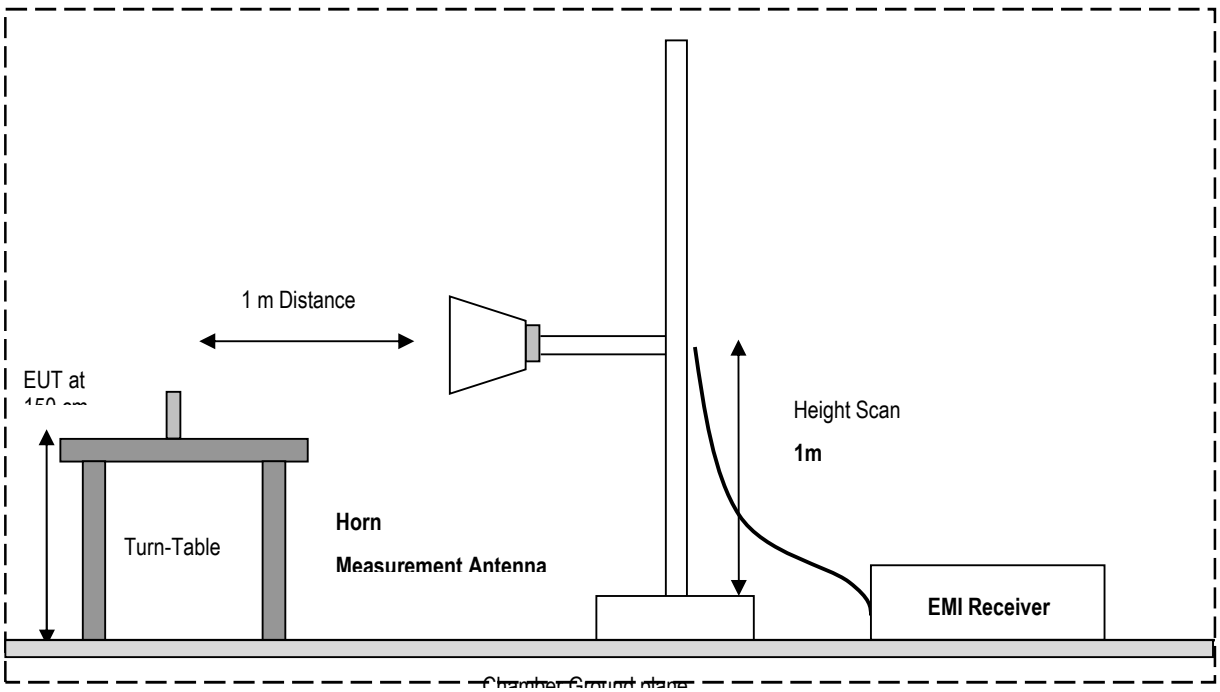
Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup 1GHz-18GHz Measurements




Radiated Emissions Test Setup 18GHz-40GHz Measurements



### 5.2 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

- Measured reading in dBµV
- Cable Loss between the receiving antenna and SA in dB and
- Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

FS (dBµV/m) = Measured Value on SA (dBµV) + Cable Loss (dB) + Antenna Factor (dB/m)

Example:

| Frequency (MHz) | Measured SA (dBµV) | Cable Loss (dB) | Antenna Factor Correction (dB) | Field Strength Result (dBµV/m) |
|---|---|---|---|---|
| 1000 | 80.5 | 3.5 | 14 | 98.0 |

# 6 Measurement Results Summary

| Test Specification | Test Case | Temperature and Voltage Conditions | Mode | Pass | NA | NP | Result |
|---|---|---|---|---|---|---|---|
| FCC §15.109<br>ICES-003, §3.2.2 | Radiated Emissions | Nominal | RX Mode | ☑ | ☐ | ☐ | Complies |
| FCC §15.107<br>ICES-003, §3.2.1 | Conducted Emissions | Nominal | RX Mode | ☐ | ☑ | ☐ | N/A |

Note 1: NA= Not Applicable; NP= Not Performed.

# 7 Test Result Data

## 7.1 Radiated Emissions Measurement according to CFR 47 Part 15.109 and ICES-003 3.2.2

| Spectrum Analyzer settings | | |
|---|---|---|
| **Sweep Frequency Range** | 30 MHz – 1 GHz | 1 GHz – 40 GHz |
| **Resolution Bandwidth** | 120 kHz | 1 MHz |
| **Detector (Exploratory Measurements)** | Peak | Peak, Average |
| **Detector (Final Measurements)** | Quasi-Peak | Peak, Average |
| **Trace Mode** | Max Hold | Max Hold |
| **Step Size** | 40 kHz | 800 kHz |
| **Measurement Time (Exploratory Measurements)** | 2 ms | 2 ms |
| **Measurement Time (Final Measurements)** | 100 ms | 100 ms |

### 7.1.1 Limits:

| Class A Limits | | |
|---|---|---|
| **Frequency of emission (MHz)** | **Field Strength @ 10 m (µV/m)** | **Field Strength @ 3 m (dBµV/m)** |
| 30-88 | 90 | 49.5 |
| 88-216 | 150 | 54 |
| 216-960 | 210 | 56.9 |
| Above 960 | 300 | 60 |

| Class B Limits | | |
|---|---|---|
| **Frequency of emission (MHz)** | **Field Strength @ 3 m (µV/m)** | **Field Strength @ 3 m (dBµV/m)** |
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

Note: For measurements below 1 GHz, the limits above use a quasi-peak detector. For measurements above 1 GHz, the limits above use an average detector.

### 7.1.2 Test Summary:

| Environmental Conditions | |
|---|---|
| Ambient Temperature: | 23.6° C |
| Relative Humidity: | 46.2% |
| Atmospheric Pressure: | 1011.5 mbar |

| Test Results | | | | | |
|---|---|---|---|---|---|
| **Plot #** | **EUT Set-Up #** | **EUT operating mode** | **Scan Frequency** | **Power Supply Input** | **Result** |
| 1 – 3 | 1 | Op. 1 | 30 MHz – 18 GHz | 13 V DC | Pass |

### 7.1.3 Measurement Plots:

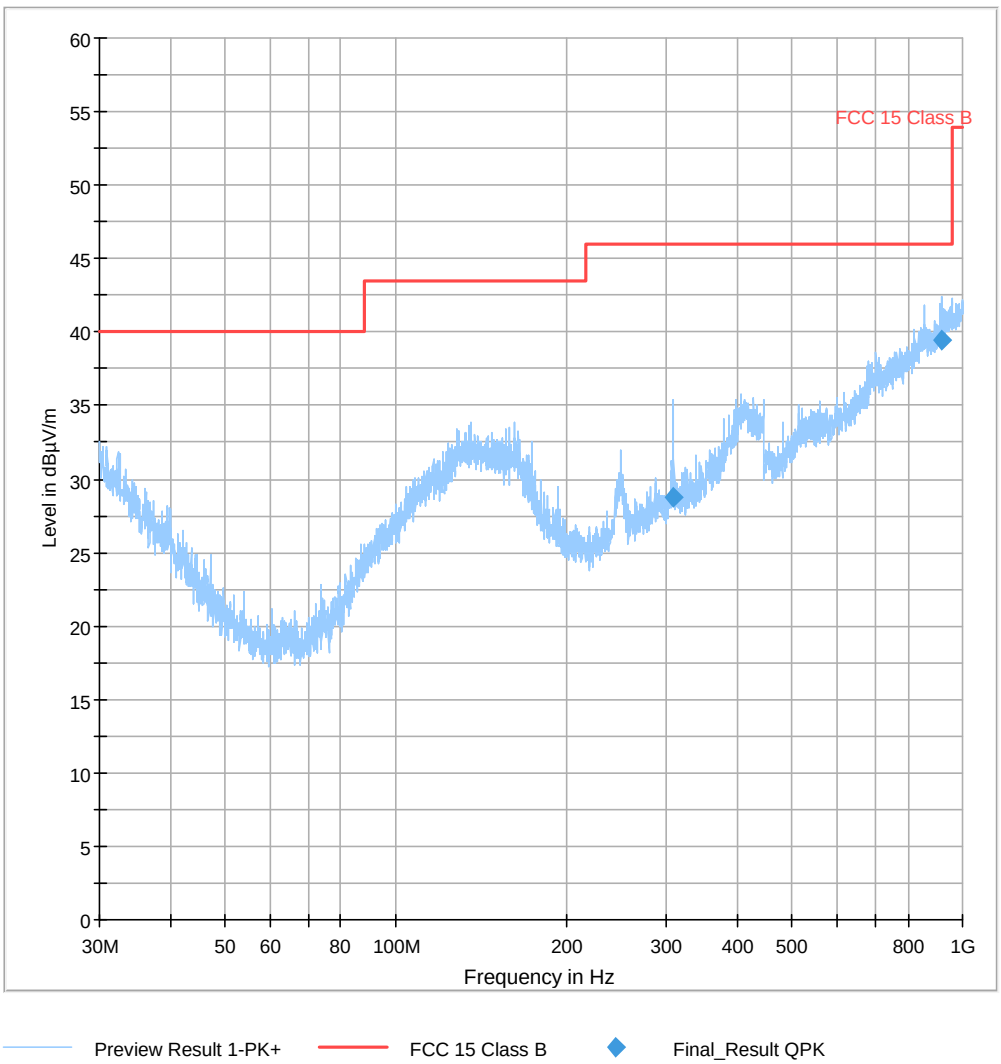
**Plot # 1**

**30 MHz – 1GHz**

## Final_Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Sig Path (dB) | Preamp (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 307.996 | 28.707 | 46.02 | 17.31 | 500.0 | 120.000 | 100.0 | H | 72.0 | 22.4 | 1.9 | 0.0 |
| 916.671 | 39.428 | 46.02 | 6.59 | 500.0 | 120.000 | 270.0 | H | 178.0 | 32.1 | 3.2 | 0.0 |

| Frequency (MHz) | Trd Corr. (dB/m) | Raw Rec (dBµV) |
|---|---|---|
| 307.996 | 20.5 | 6.3 |
| 916.671 | 28.9 | 7.3 |



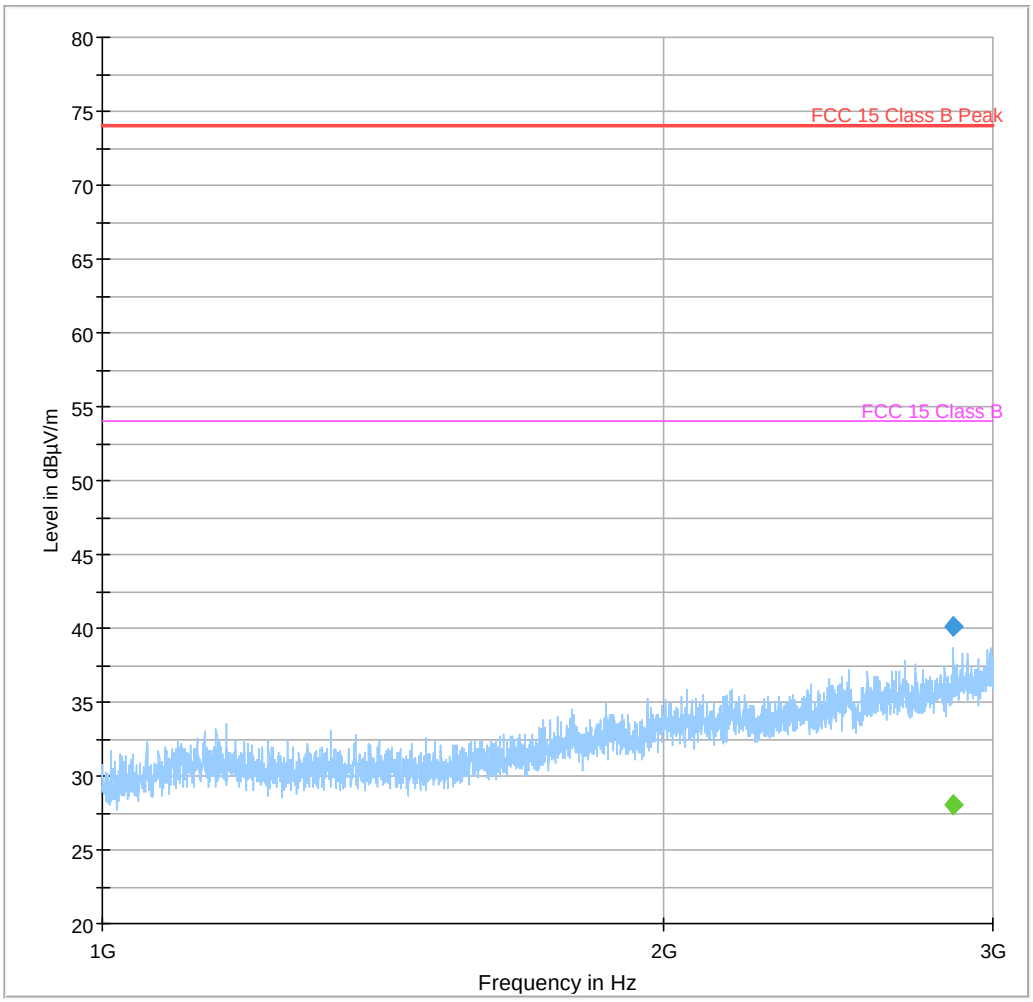
## Plot # 2

### 1 – 3GHz

## Final_Result

| Frequency (MHz) | MaxPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Sig Path (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2855.750 | --- | 28.095 | 53.98 | 25.88 | 500.0 | 1000.000 | 145.0 | H | 6.0 | 0.0 | -29.1 |
| 2855.750 | 40.125 | --- | 73.98 | 33.85 | 500.0 | 1000.000 | 145.0 | H | 6.0 | 0.0 | -29.1 |

| Frequency (MHz) | Preamp (dB) | Trd Corr. (dB/m) | Raw Rec (dBµV) |
|---|---|---|---|
| 2855.750 | 0.0 | 29.1 | 28.1 |
| 2855.750 | 0.0 | 29.1 | 40.1 |



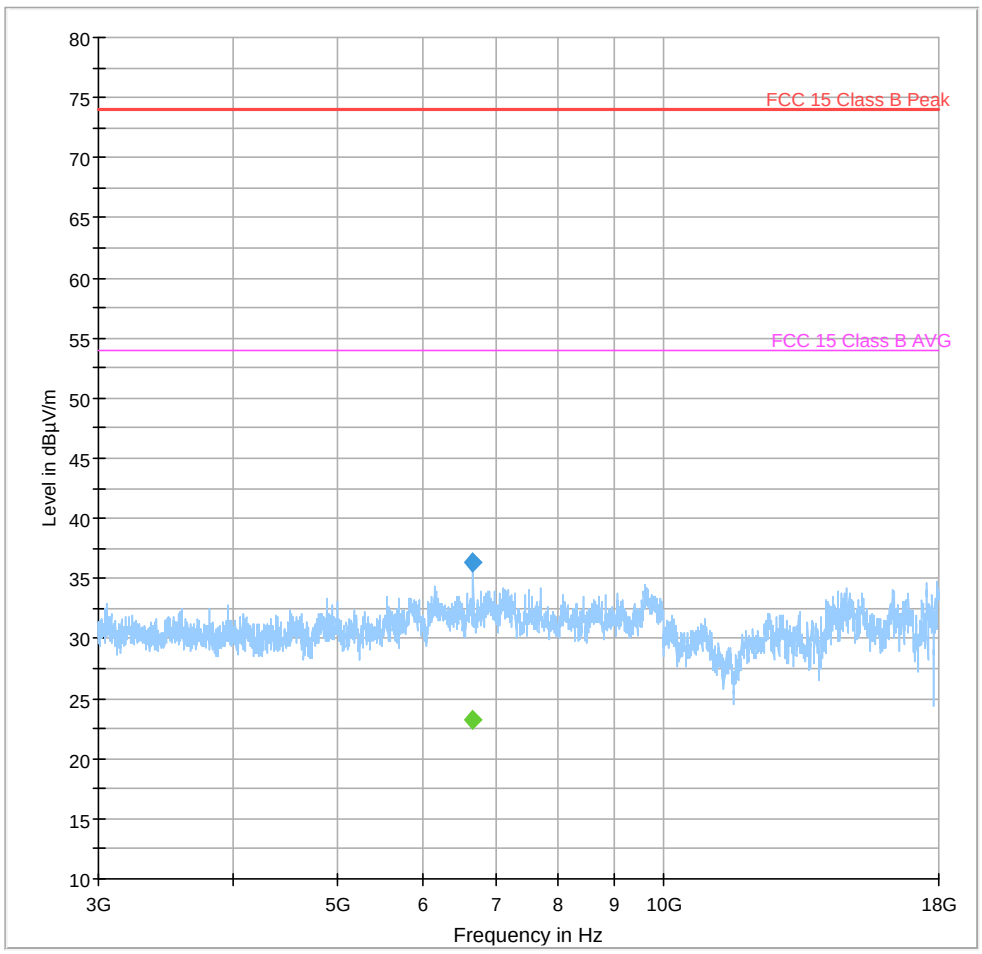
## Plot # 3

### 3 – 18GHz

## Final_Result

| Frequency (MHz) | MaxPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Sig Path (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6671.500 | --- | 23.209 | 53.98 | 30.77 | 500.0 | 1000.000 | 378.0 | V | 138.0 | -30.3 | -18.6 |
| 6671.500 | 36.370 | --- | 73.98 | 37.61 | 500.0 | 1000.000 | 378.0 | V | 138.0 | -30.3 | -18.6 |

| Frequency (MHz) | Preamp (dB) | Trd Corr. (dB/m) | Raw Rec (dBµV) |
|---|---|---|---|
| 6671.500 | -47.7 | 35.9 | 53.6 |
| 6671.500 | -47.7 | 35.9 | 66.7 |



## 8 Test Setup Photos

Setup photos are included in supporting file name: "EMC_VISTE_006_24001_FCC_15B_Setup_Photos.pdf"

## 9 Test Equipment And Ancillaries Used For Testing

### EMC Lab 2

| Equipment Type | Manufacturer | Model | Serial # | Calibration Cycle | Last Calibration Date |
|---|---|---|---|---|---|
| BILOG ANTENNA | A.H. SYSTEMS | BiLA2G | 569 | 3 Years | 10/30/2023 |
| HORN ANTENNA | EMCO | 3115 | 00035111 | 3 Years | 10/26/2023 |
| HORN ANTENNA | ETS LINDGREN | 3117-PA | 00167061 | 3 Years | 9/25/2023 |
| ESW.EMI TEST RECEIVER | ROHDE & SCHWARZ | ESW44 | 101715 | 3 Years | 10/24/2023 |
| DIGITAL THERMOMETER | Control Company | 4410,90080-03 | 230712972 | 3 Years | 10/18/2023 |
| Multimeter | Fluke | 115 | 56090717MV | 3 Years | 09/26/2023 |
| Software | EMC32 | Version 10.50.40 | - | - | - |

Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "N/A" for calibration status either do not specifically require calibration or is internally characterized before use.

## 10 Revision History

| Date | Report Name | Changes to report | Report prepared by |
|---|---|---|---|
| 2024-11-08 | EMC_VISTE_006_24001_FCC_15B_ICES_003_BPCMFX | Initial version | Huang, Guangcheng |

<<The End>>