



Test Report for Hanchett Entry Systems, Inc.
Report No. EW0235-4 Issue 5



TEST REPORT

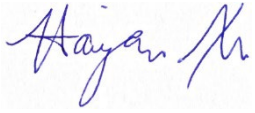
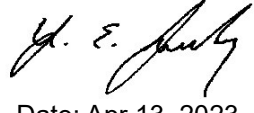
| | |
|-----------|---|
| Applicant | Hanchett Entry Systems, Inc. |
| Address | 10027 S. 51 st Street, Suite 102, Phoenix AZ 85044 |

| | |
|---|--------------------------------------|
| FCC ID | VC3-DR100V3 |
| ISED IC | 7160A-DR100V3 |
| Product Description | RFID Reader Module |
| PMN Model/HVIN FVIN HMN | DR100-V3 DR100-V3 N/A DR100 |
| Additional Models & Model Difference | N/A |
| Date of tests | Jul 19, 2022 to Jan 5, 2023 |
| FCC Test Firm DN Canada CABID | US1028 US0106 |

The tests have been carried out according to the requirements of the following standard:

- ☒ FCC Part 15, Subpart C, 15.247
- ☒ RSS-247 Issue 2

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

| | |
|---|--|
| Prepared by Haiyan Xu Wireless Engineer | Approved by Yunus Faziloglu Wireless Manager |
|  |  Date: Apr 13, 2023 |

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RELEASE CONTROL RECORD

| ISSUE NO. | REASON FOR CHANGE | DATE ISSUED | ISSUED BY | APPROVED BY |
|------------------|--|--------------------|------------------|--------------------|
| 1 | Original release | Jan 3, 2023 | HX | YF |
| 2 | Update output power rating (Section 3) Update peak power table and results (Section 4.4) Update PSD Test Procedure RBW to 10kHz (Section 4.5) Update conducted band edge data (Section 4.7) | Jan 6, 2023 | HX | YF |
| 3 | Include AC line conducted emissions data (Section 4.1) Include radiated spurious emissions data (Section 4.2) | Feb 21, 2023 | RMB | YF |
| 4 | To address TCB review comments: Power setting clarification added to Pg 6 Noise floor readings added to Pg 39, Pg 44 and Pg 49 | Mar 16, 2023 | RMB | YF |
| 5 | Updated EUT antenna gain in Section 3 | Apr 13, 2023 | RMB | YF |



1 SUMMARY OF TEST RESULTS

The EUT has been tested against the following requirements:

| APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247), RSS-247 | | | | |
|--|---|-----------------------------------|------------|--------|
| STANDARD SECTION | | TEST TYPE AND LIMIT | APPLICABLE | RESULT |
| 47CFR15 | RSS | | | |
| 15.207 | Gen 8.8 | AC Power Line Conducted Emissions | Y | Pass |
| 15.205 15.209 | 247 3.3 247 5.5 Gen 8.9 Gen 8.10 | Radiated Spurious Emissions | Y | Pass |
| 15.247(d) | 247 5.5 | Conducted Spurious Emissions | Y | Pass |
| 15.247(a)(2) | 247 5.2(a) | 6dB Bandwidth | Y | Pass |
| -- | Gen 6.7 | 99% Occupied Bandwidth | Y | Pass |
| 15.247(b)(3) | 247 5.4(d) | Conducted Output Power | Y | Pass |
| 15.247(e) | 247 5.2(b) | Power Spectral Density | Y | Pass |
| 15.203 | Gen 6.8 | Antenna Requirement | Y | Pass |



2 MEASUREMENT UNCERTAINTY

The listed uncertainties are the worst-case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results. Values for measurement uncertainty are calculated per ETSI TR 100 028 (2001).

| Measurement | Expanded Uncertainty k=2 | Maximum allowable uncertainty |
|---|--------------------------|-------------------------------|
| Radio frequency (@ 2.4GHz) | 3.23×10^{-8} | 1×10^{-7} |
| RF power, conducted | 0.40dB | 0.75dB |
| Maximum frequency deviation: Within 300Hz and 6kHz of audio frequency / Within 6kHz and 25kHz of audio frequency | 3.4% 0.3dB | 5% 3dB |
| Adjacent channel power | 1.9dB | 3dB |
| Conducted spurious emission of transmitter, valid up to 12.75GHz | 2.39dB | 3dB |
| Conducted emission of receivers | 1.3dB | 3dB |
| Radiated emission of transmitter, valid up to 26.5GHz | 3.9dB | 6dB |
| Radiated emission of transmitter, valid up to 80GHz | 3.3dB | 6dB |
| Radiated emission of receiver, valid up to 26.5GHz | 3.9dB | 6dB |
| Radiated emission of receiver, valid up to 80GHz | 3.3dB | 6dB |
| Humidity | 2.37% | 5% |
| Temperature | 0.7°C | 1.0°C |
| Time | 4.1% | 10% |
| RF Power Density, Conducted | 0.4dB | 3dB |
| DC and low frequency voltages | 1.3% | 3% |
| Voltage (AC, <10kHz) | 1.3% | 2% |
| Voltage (DC) | 0.62% | 1% |
| The above reflects a 95% confidence level | | |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.



3 GENERAL INFORMATION

General Description of EUT

| | |
|------------------------------|---|
| PRODUCT | RFID Reader Module |
| MODEL NO. | DR100-V3 |
| ADDITIONAL MODEL | N/A |
| FCC ID | VC3-DR100V3 |
| ISED IC | 7160A-DR100V3 |
| NOMINAL VOLTAGE | 3VDC |
| MODULATION TECHNOLOGY | Zigbee: DTS |
| DATA RATES | 250Kbps |
| OPERATING FREQUENCY | 2405-2480MHz |
| EUT Power Setting | Default (maximum). Same setting for all channels. |
| OUTPUT POWER | 2.19mW (Peak Conducted) |
| ANTENNA TYPE | Internal PCB surface mount antenna |
| ANTENNA GAIN | 2.9dBi gain |

This test report supports a "Limited Modular Approval" certification application for the RFID Reader Module (Model: DR100-V3) operating pursuant to:

CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2

This report contains test data for the Zigbee radio portion of this EUT.

The EUT is the RFID Reader Module (Model: DR100-V3). It communicates reading activity to a remote unit over the 2.4GHz band. It was tested inside the Aperio V3 Wireless Door Relay (Host Model: DR100). The RFID Reader Module (Model: DR100-V3) also contains a 125kHz RFID radio and a 13.56MHz RFID radio. The Zigbee radio of the module uses an internal PCB surface mount antenna. The Host Model DR100 operating voltage is 24VDC, and the RFID Reader Module (Model: DR100-V3) operating voltage is 3VDC.

In addition, DR100 host includes a previously certified Bluetooth Low Energy module with FCC ID: Y88-MBM1CC2640 and IC: 9504A-MBM1CC2640.

Lowest clock frequency in the device (used/generated): 32.768kHz

A support laptop was used to control the Zigbee transmitter. PuTTY (software) was used on this laptop to enable/disable transmitters and set transmission channels. The transmitter was set to operate in continuous transmit mode with modulation (duty-cycle > 98%). EUT was supplied with an "RFID



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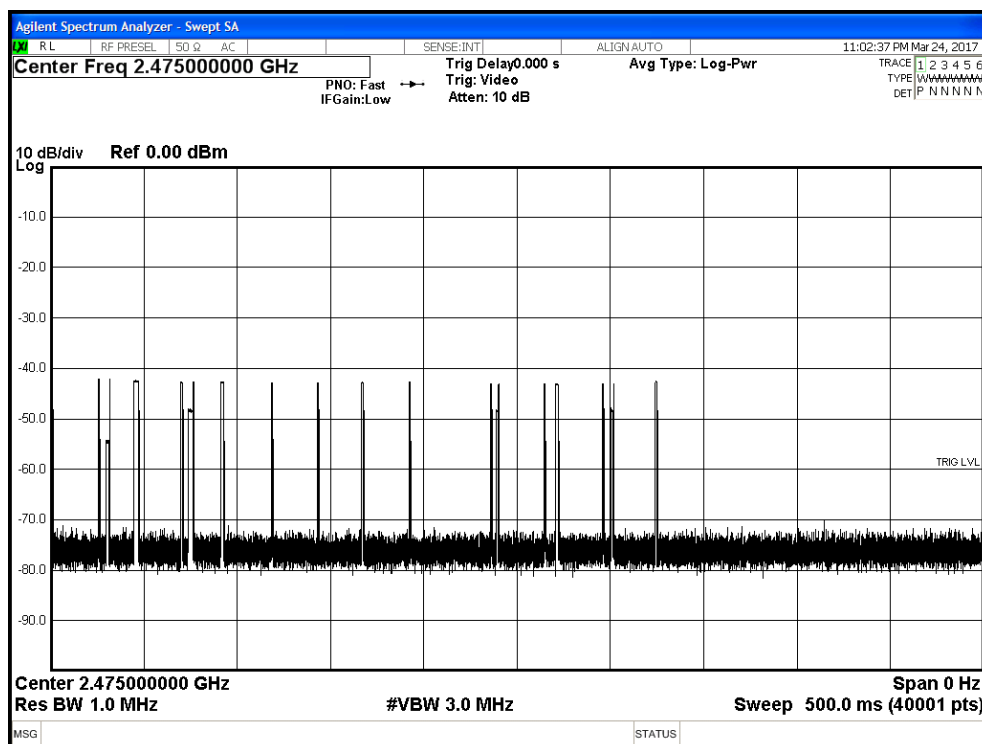
windmill" test fixture to present RFID tags to the EUT during unintentional emissions testing in order to simulate normal operation of periodic tag reading. This fixture was not exercised during radio testing.

Following bandwidths were used during emissions testing:

| Freq. (MHz) | RBW | VBW | Pre-scan | Final |
|-------------|--------|--------|----------|--|
| 0.009-0.15 | 200Hz | 1kHz | Peak | Quasi Peak |
| 0.15-30 | 9kHz | 30kHz | Peak | Quasi Peak |
| 30-1000 | 120kHz | 300kHz | Peak | Quasi Peak |
| >1000 | 1MHz | 3MHz | Peak | Peak Max Hold and RMS Power Avg Max Hold |

If peak measurements were below the applicable limit, QPk and RMS measurements were not performed.

For some harmonic emissions of Zigbee, average readings were calculated by applying operational duty-cycle correction factor to peak readings as permitted in 558074 D01 15.247 Meas Guidance v05r02 Section 11 Q3.A3.a). Client confirmed that operational duty-cycle of the Zigbee radio is same as the radio in FCC ID: VC3-R100V3 on file with the FCC. Following plot and calculation is an excerpt from test report ER0115-2 in that filing.



Software used to calculate duty-cycle over worst case 100ms window from trace data points of the plot above.

$$\text{Duty-Cycle} = 13.6\%$$

$$\text{DCCF} = 20 \cdot \log(13.6/100) = -17.3\text{dB}$$

We found that the product complied with the requirements above without modification. Test sample was received in good condition.



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Description of Test Modes

16 channels are provided for the Zigbee radio:

| Channel | FREQ. (MHz) | Channel | FREQ. (MHz) |
|---------|-------------|---------|-------------|
| 11 | 2405 | 19 | 2445 |
| 12 | 2410 | 20 | 2450 |
| 13 | 2415 | 21 | 2455 |
| 14 | 2420 | 22 | 2460 |
| 15 | 2425 | 23 | 2465 |
| 16 | 2430 | 24 | 2470 |
| 17 | 2435 | 25 | 2475 |
| 18 | 2440 | 26 | 2480 |

Configuration of System Under Test

Two samples were provided for testing, one for radiated measurements and another with an SMA connector for conducted antenna port measurements. Both samples were powered with a 24VDC power supply and had a temporary port for a serial to USB cable for connection to a support laptop for putting the radio in necessary test modes. EUT configuration modes are as follows:

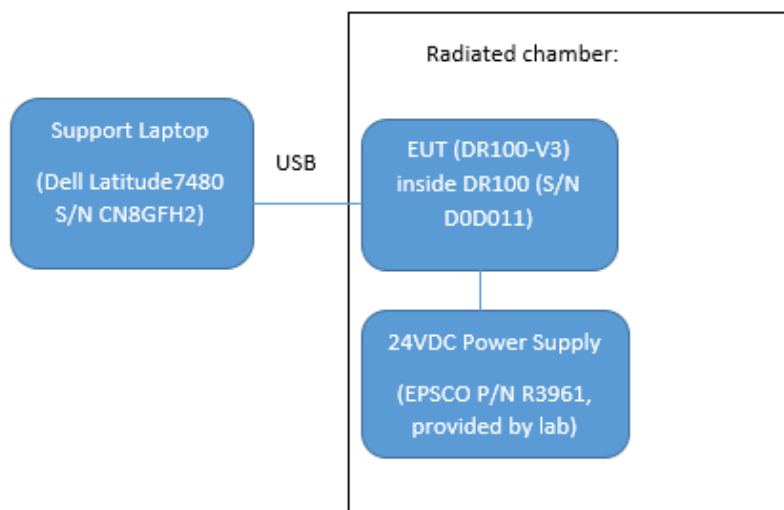
| TEST MODE | DESCRIPTION |
|-----------|--|
| A | Continuous transmission with modulation (Duty-cycle > 98%) |



Test Setup Block Diagrams

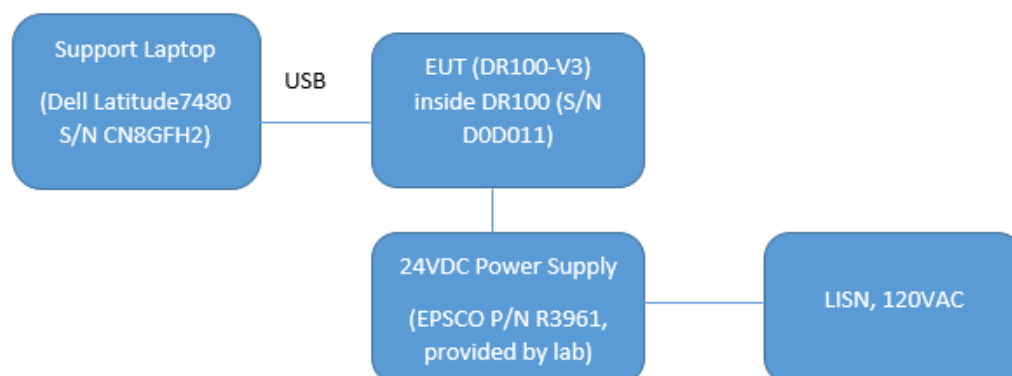
Radiated Emissions

Radiated setup



Power Line Conducted Emissions

Conducted Emissions



For antenna port test setup block diagrams, please see the corresponding sections of this report.



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Following channels/modes were selected for the applicable tests below.

| TEST | TEST MODE | AVAILABLE CHANNELS | TESTED CHANNEL | MODULATION TYPE | DATA RATE (Kbps) | Notes |
|--------|-----------|--------------------|----------------|-----------------|------------------|-------|
| PLCE | A | 11 to 26 | 19 | O-QPSK | 250 | -- |
| RSE<1G | A | 11 to 26 | 11,19,26 | O-QPSK | 250 | 1, 2 |
| RSE>1G | A | 11 to 26 | 11,19,26 | O-QPSK | 250 | 2 |
| RBE | A | 11 to 26 | 11,26 | O-QPSK | 250 | 2 |
| COP | A | 11 to 26 | 11,18,26 | O-QPSK | 250 | -- |
| PSD | A | 11 to 26 | 11,18,26 | O-QPSK | 250 | -- |
| CBE | A | 11 to 26 | 11,26 | O-QPSK | 250 | -- |
| 6DB | A | 11 to 26 | 11,18,26 | O-QPSK | 250 | -- |
| OBW | A | 11 to 26 | 11,18,26 | O-QPSK | 250 | -- |
| CSE | A | 11 to 26 | 11,18,26 | O-QPSK | 250 | -- |

Note 1: Testing below 30MHz was limited to 2 channels only since no emissions were detected in this range.

Note 2: Host was in normal installation (upright) position during testing.

PLCE: Power Line Conducted Emissions

RSE: Radiated Spurious Emissions

RBE: Radiated Bandedges

COP: Conducted Output Power

PSD: Power Spectral Density

CBE: Conducted Band-edge

6DB: 6dB Bandwidth

OBW: 99% Occupied Bandwidth

CSE: Conducted Spurious Emissions

Test Conditions:

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|----------------------------------|--|-------------|----------------------------------|
| Antenna Port Measurements | 23.2deg. C, 50.9%RH, 1018mbar 20.9deg. C, 54.7%RH, 1010mbar | 24VDC | RB: 11-30-2022 RB: 01-05-2023 |

Environmental conditions during radiated spurious emissions and power line conducted emissions tests can be found on the associated data tables.



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General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C, Section 15.247
RSS-247 Issue 2
558074 D01 15.247 Meas Guidance v05r02
ANSI C63.10-2013

Note: All tests performed and recorded per the standards above.

Support Equipment

| Support Equipment | Model # | Serial # |
|-------------------|--------------------|----------|
| Laptop | Dell Latitude 7480 | CN8GFH |
| DC Power Supply | EPSCO R3961 | N/A |
| DC Power Supply | Eventek KPS3010D | N/A |



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4 TEST RESULTS

4.1 CONDUCTED EMISSIONS MEASUREMENT

4.1.1 LIMITS OF CONDUCTED EMISSIONS MEASUREMENT

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dBμV) | |
|-----------------------------|------------------------|----------|
| | Quasi-peak | Average |
| 0.15 ~ 0.5 | 66 to 56 | 56 to 46 |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

NOTE: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.1.2 TEST INSTRUMENTS

Rev. 8/26/2022

| | | | | | | | | | |
|---|--------------|--------------|-------------------|---------------|---------|-----|-----------------|---------------|--|
| Spectrum Analyzers / Receivers /Preselectors | | | | | | | | | |
| Rental EXA Signal Analyzer(1118472) | Range | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on | |
| Rental EXA Signal Analyzer(1118473) | 9KHz-26.5GHz | N9010A-526;K | AT | MY51170010 | 1118472 | I | 10/27/2022 | 10/27/2021 | |
| | 9KHz-26.5GHz | N9010A-526;N | AT | MY51170076 | 1118473 | I | 8/5/2022 | 8/5/2021 | |
| LISNs/Measurement Probes | | | | | | | | | |
| LISN Asset 2092 | Range | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on | |
| | 9KHz-30MHz | NNLK 8121 | Schwarzbeck | NNLK 8121-662 | 2092 | I | 10/25/2022 | 10/25/2021 | |
| Conducted Test Sites (Mains / Telco) | | | | | | | | | |
| CEMI 1 | FCC Code | | VCCI Code | | | Cat | Calibration Due | Calibrated on | |
| CEMI 5 | 719150 | | A-0015 | | | III | NA | N/A | |
| | 719150 | | A-0015 | | | III | NA | N/A | |
| Meteorological Meters/Chambers | | | | | | | | | |
| Weather Clock (Pressure Only) | | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on | |
| Asset #2657 | | BA928 | Oregon Scientific | C3166-1 | 831 | I | 11/23/2022 | 11/23/2020 | |
| Asset #2657 | | 1235C97 | Control Company | 200435369 | 2657 | I | 8/18/2025 | 8/18/2022 | |
| | | 1235C97 | Control Company | 200435369 | 2657 | I | 8/23/2022 | 7/23/2020 | |
| Cables | | | | | | | | | |
| CEMI-02 | Range | | Mfr | | | Cat | Calibration Due | Calibrated on | |
| CEMI-15 | 9kHz - 2GHz | | C-S | | | II | 2/17/2023 | 2/17/2022 | |
| | 9kHz - 2GHz | | C-S | | | II | 2/17/2023 | 2/17/2022 | |
| Attenuators | | | | | | | | | |
| 20dB ATT(A#2506) | Range | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on | |
| 20dB ATT(A#2506) | 9kHz-2GHz | PE7014-20 | Pasternack | 2016 | 2506 | II | 8/3/2023 | 8/3/2022 | |
| | 9kHz-2GHz | PE7014-20 | Pasternack | 2016 | 2506 | II | 8/4/2022 | 8/4/2021 | |

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



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4.1.3 TEST PROCEDURES

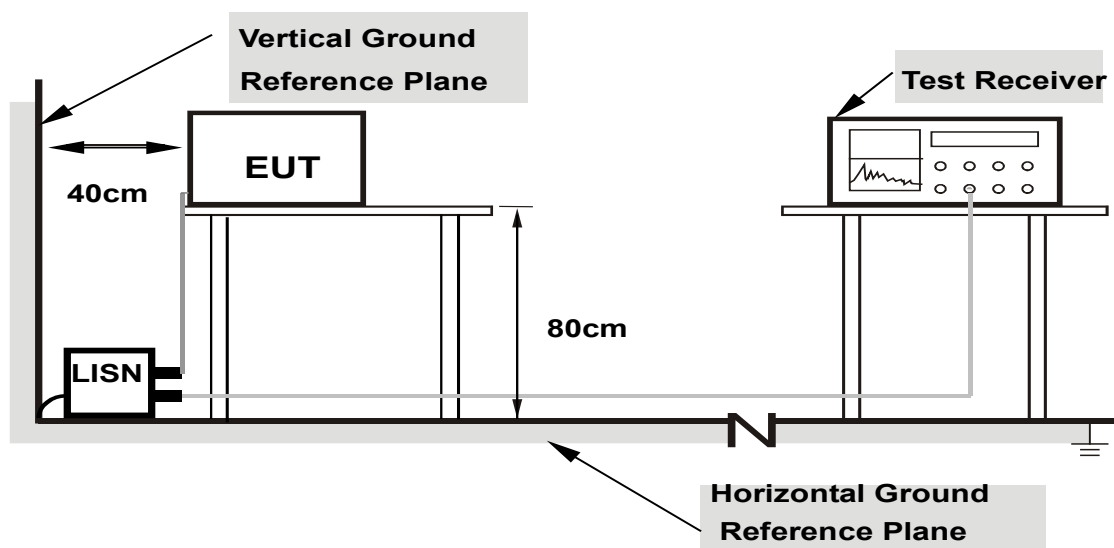
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded. RBW of 9kHz and VBW of 30kHz were used during measurement.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

4.1.5 TEST SETUP



- Note:** 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to Test Setup Photos exhibit.

4.1.6 EUT OPERATING CONDITIONS

- Turned on the power and connected all equipment.
- EUT was operated according to manufacturer's specifications.



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VERITAS

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4.1.7 TEST RESULTS

Bureau Veritas Consumer Product Services Inc.
Conducted Emissions per CISPR 16-2-1

Peak Detector Data

Notes:

EUT Line tested: 120VAC/60Hz; Line Phase

EUT Mode of Operation: AC Side of DC Supply

zb mid

Work Order # - W0235

EUT Power Input - 120VAC/ 60Hz

Test Site - CEMI-1

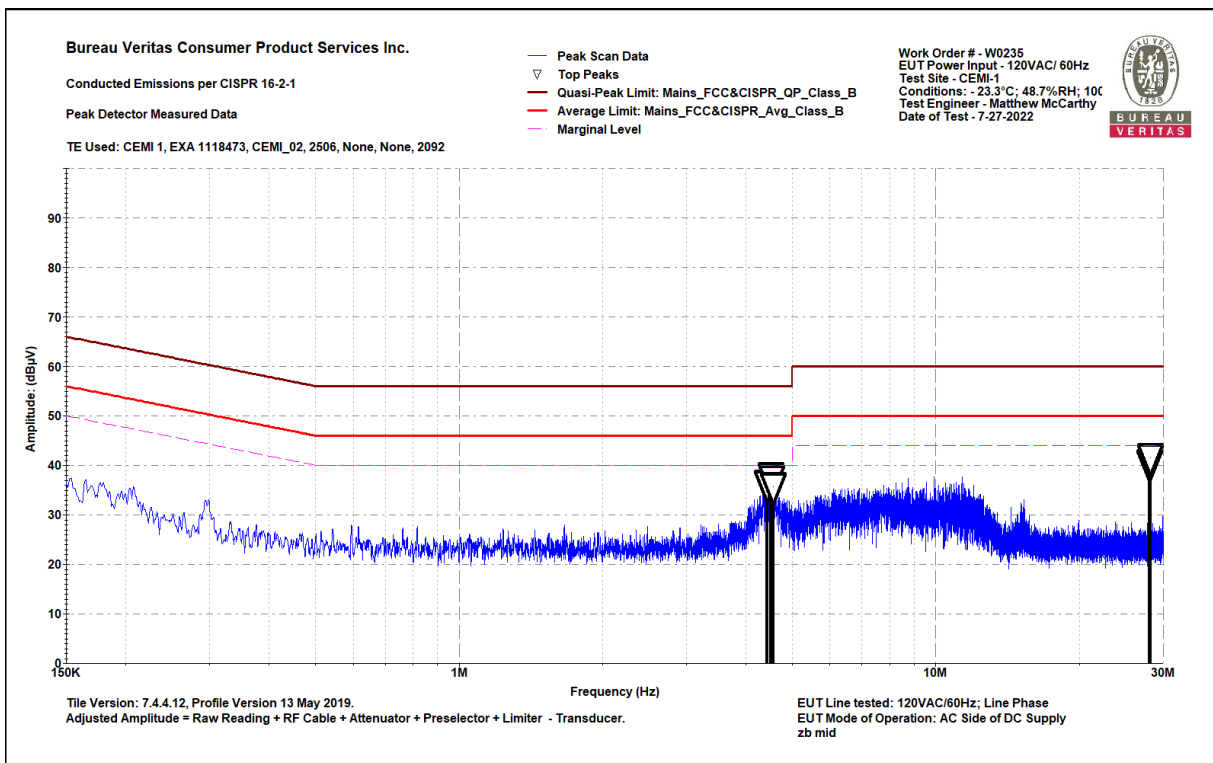
Conditions: - 23.3°C; 48.7%RH; 1006mBar

Test Engineer - Matthew McCarthy

Date of Test - 7-27-2022

| Frequency (MHz) | Raw Pk Reading (dBμV) | Correction Factor (dB) | Adjusted Pk Amplitude (dBμV) | QP Lim: Mains_FCC&CISPR_QP_Class_B (dBμV) | Margin to the QP Limit (dB) | Pk to QP Limit Results (Pass/Fail) | Worst Margin (QP Limit) (dB) | Av Lim: Mains_FCC&CISPR_Avg_Class_B (dBμV) | Margin to Avg Limit (dB) | Pk to Avg Limit Results (Pass/Fail) | Worst Margin (Avg Limit) (dB) |
|--------------------|--------------------------|---------------------------|------------------------------------|---|-----------------------------------|--|------------------------------------|--|--------------------------------|---|-------------------------------------|
| 4.434 | 15.6 | 20.4 | 36.1 | 56 | -19.9 | PASS | | 46 | -9.9 | PASS | |
| 4.505 | 17.2 | 20.4 | 37.7 | 56 | -18.3 | PASS | -18.3 | 46 | -8.3 | PASS | -8.3 |
| 4.533 | 16.8 | 20.4 | 37.2 | 56 | -18.8 | PASS | | 46 | -8.8 | PASS | |
| 4.56 | 15.2 | 20.4 | 35.7 | 56 | -20.3 | PASS | | 46 | -10.3 | PASS | |
| 28.041 | 19.5 | 20.7 | 40.2 | 60 | -19.8 | PASS | | 50 | -9.8 | PASS | |
| 28.134 | 20.7 | 20.7 | 41.5 | 60 | -18.5 | PASS | | 50 | -8.5 | PASS | |

Line PK



Line PK

Bureau Veritas Consumer Product
Services Inc.

One Distribution Center Circle, #1
Littleton, MA

Tel.: (978) 486-8880
Fax: (978) 486-8828



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Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5

Bureau Veritas Consumer Product Services Inc.

Conducted Emissions per CISPR 16-2-1

Peak Detector Data

Notes:

EUT Line tested: 120VAC/60Hz; Neutral Phase

EUT Mode of Operation: AC Side of DC Supply

zb mid

Work Order # - W0235

EUT Power Input - 120VAC/ 60Hz

Test Site - CEMI-1

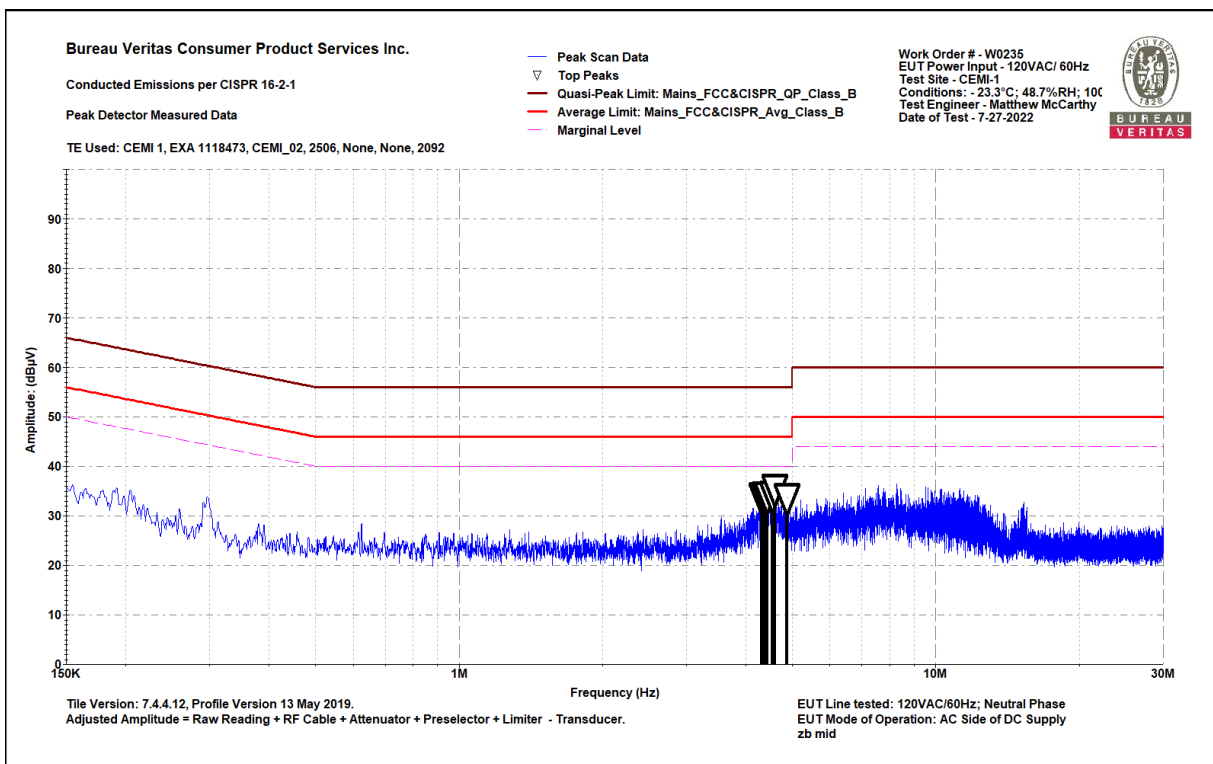
Conditions: - 23.3°C; 48.7%RH; 1006mBar

Test Engineer - Matthew McCarthy

Date of Test - 7-27-2022

| Frequency (MHz) | Raw Pk Reading (dBμV) | Correction Factor (dB) | Adjusted Pk Amplitude (dBμV) | QP Lim: Mains_FCC&CISPR_QP_Class_B (dBμV) | Margin to the QP Limit (dB) | Pk to QP Limit Results (Pass/Fail) | Worst Margin (QP Limit) (dB) | Av Lim: Mains_FCC&CISPR_Avg_Class_B (dBμV) | Margin to Avg Limit (dB) | Pk to Avg Limit Results (Pass/Fail) | Worst Margin (Avg Limit) (dB) |
|--------------------|--------------------------|---------------------------|------------------------------------|---|-----------------------------------|--|------------------------------------|--|--------------------------------|---|-------------------------------------|
| 4.311 | 13.4 | 20.4 | 33.8 | 56 | -22.2 | PASS | | 46 | -12.2 | PASS | |
| 4.379 | 13.6 | 20.4 | 34 | 56 | -22 | PASS | | 46 | -12 | PASS | |
| 4.425 | 13.5 | 20.4 | 33.9 | 56 | -22.1 | PASS | | 46 | -12.1 | PASS | |
| 4.547 | 13.7 | 20.4 | 34.1 | 56 | -21.9 | PASS | | 46 | -11.9 | PASS | |
| 4.599 | 15 | 20.4 | 35.5 | 56 | -20.5 | PASS | -20.5 | 46 | -10.5 | PASS | -10.5 |
| 4.877 | 13.3 | 20.4 | 33.7 | 56 | -22.3 | PASS | | 46 | -12.3 | PASS | |

Neutral PK



Neutral PK

Bureau Veritas Consumer Product
Services Inc.

One Distribution Center Circle, #1
Littleton, MA

Tel.: (978) 486-8880
Fax: (978) 486-8828



4.2 RADIATED EMISSIONS MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSIONS MEASUREMENT

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emissions limits specified in Section 15.209(a).

| FREQUENCIES (MHz) | FIELD STRENGTH (microvolts/meter) | MEASUREMENT DISTANCE (meters) |
|----------------------|--------------------------------------|----------------------------------|
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 |
| 1.705 ~ 30.0 | 30 | 30 |
| 30 ~ 88 | 100 | 3 |
| 88 ~ 216 | 150 | 3 |
| 216 ~ 960 | 200 | 3 |
| Above 960 | 500 | 3 |

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



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4.2.2 TEST INSTRUMENTS

Rev. 8/17/2022

| Spectrum Analyzers / Receivers / Preselectors | | | | | | | | | |
|--|----------------|---------------|-------------------|--------------|-------|-----|-------------------|---------------|--|
| | Range | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on | |
| Gold | 100Hz-26.5 GHz | E4407B | Agilent | MY45113816 | 1284 | I | 1/27/2023 | 1/27/2022 | |
| 2093 MXE EMI Receiver | 20Hz-26.5GHz | N9038A | Agilent | MY51210181 | 2093 | I | 3/7/2023 | 3/7/2022 | |
| Radiated Emissions Sites | | | | | | | | | |
| | FCC Code | IC Code | VCCI Code | Range | Asset | Cat | Calibration Due | Calibrated on | |
| EMI Chamber 2 | 719150 | 2762A-7 | A-0015 | 30-1000MHz | 1686 | I | 12/5/2022 | 12/5/2020 | |
| EMI Chamber 2 | 719150 | 2762A-7 | A-0015 | 1-18GHz | 1686 | I | 12/8/2022 | 12/8/2020 | |
| Preamps / Couplers Attenuators / Filters | | | | | | | | | |
| | Range | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on | |
| 8449B HF Preamp | 1-18GHz | 8449B | Agilent | 1149055 | | II | 11/10/2022 | 11/10/2021 | |
| 8447F Rental PA | 9KHz-1.3GHz | 84477F | HP | 3113A.05395 | | II | 10/18/2022 | 10/18/2021 | |
| 2116 BRF | 0.009-18000MHz | BRM50702 | Micro-Tronics | G226 | 2116 | II | 11/10/2022 | 11/10/2021 | |
| Antennas | | | | | | | | | |
| | Range | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on | |
| Red-Brown Bilog | 30-2000MHz | JB1 | Sunol | A0032406 | 1218 | I | 4/28/2023 | 4/28/2021 | |
| Blue Horn | 1-18Ghz | 3117 | ETS | 157647 | 1861 | I | 4/26/2023 | 4/26/2021 | |
| Small Loop | 10kHz-30MHz | PLA-130/A | ARA | 1024 | 755 | I | 8/25/2022 | 8/25/2020 | |
| Large Loop | 20Hz-5MHz | 6511 | EMCO | 9704-1154 | 67 | I | 8/21/2022 | 8/21/2020 | |
| HF (White) Horn | 18-26.5GHz | 801-WLM | Waveline | 758 | 758 | III | Verify before Use | date of test | |
| Meteorological Meters/Chambers | | | | | | | | | |
| | | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on | |
| Weather Clock (Pressure Only) | | BA928 | Oregon Scientific | C3166-1 | 831 | I | 11/23/2022 | 11/23/2020 | |
| Asset #2656 | | 1235C97 | Control Company | 200435359 | 2656 | I | 8/23/2022 | 7/23/2020 | |
| Cables | | | | | | | | | |
| | Range | | Mfr | | | Cat | Calibration Due | Calibrated on | |
| Asset #2474 | 9KHz-18GHz | | MegaPhase | | | II | 11/9/2022 | 11/9/2021 | |
| Asset #2610 | 9KHz-18GHz | | Pasternack | | | II | 3/16/2023 | 3/16/2022 | |
| Asset #2583 | 9KHz-18GHz | | Pasternack | | | II | 2/17/2023 | 2/17/2022 | |
| Asset #2323 | 1-26.5GHz | TM26-S1S1-120 | MEGAPHASE | 17139101 002 | | II | 9/10/2022 | 9/10/2021 | |

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



4.2.3 TEST PROCEDURES

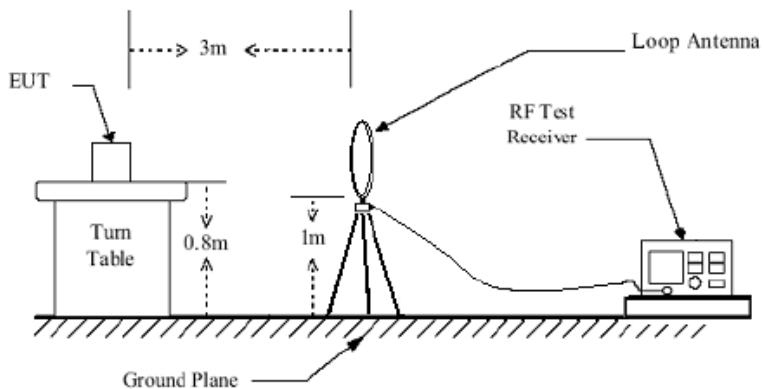
- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. In 9kHz-6GHz range, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the lowest point of the loop shall be 1m above the ground.
- g. In 6-18GHz range, the measurement distance was 1m. In 18-25GHz, the measurement distance was 0.1m.
- h. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, and was placed in its intended operating position. The turntable was rotated to maximize the emission level.

4.2.4 DEVIATION FROM TEST STANDARD

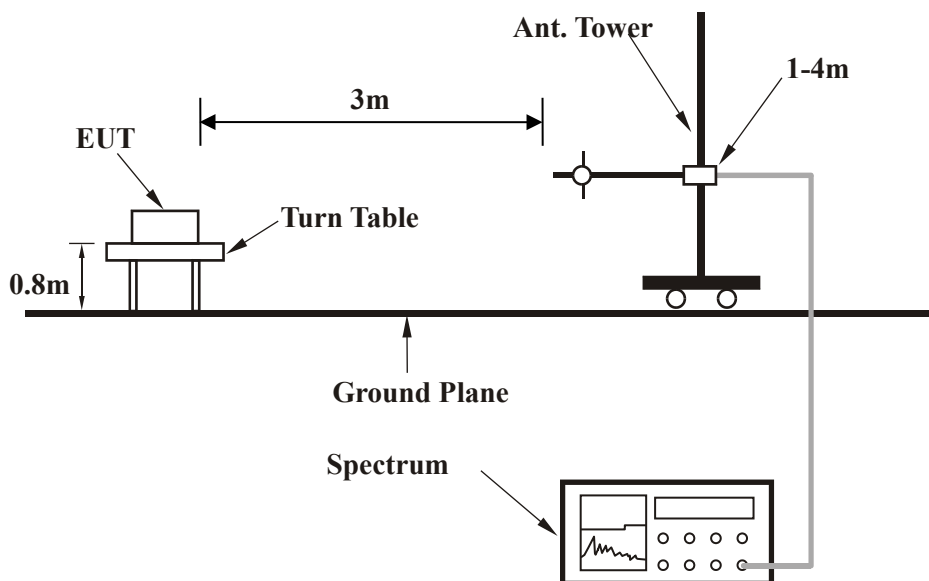
No deviation.

4.2.5 TEST SETUP

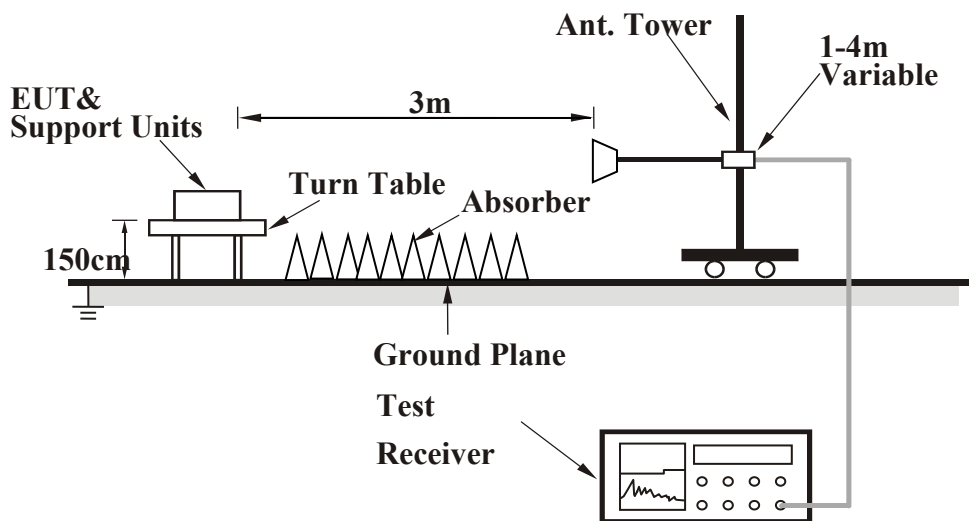
Below 30MHz test setup



Below 1GHz test setup



Above 1GHz test setup



Note: For the actual test configuration, please refer to the Test Setup Photos exhibit.

4.2.6 EUT OPERATING CONDITIONS

EUT was operated according to the manufacturer's specifications.



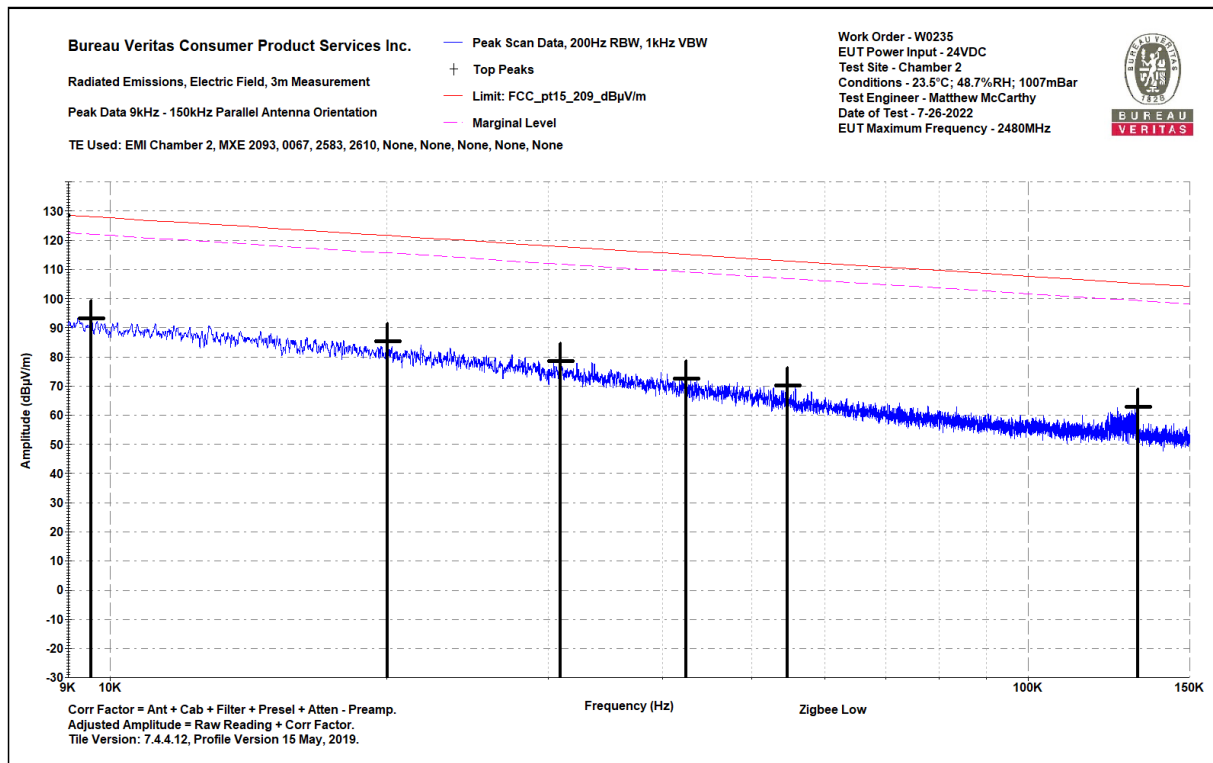
Test Report for Hanchett Entry Systems, Inc.
Report No. EW0235-4 Issue 5

4.2.7 TEST RESULTS

Emissions below 1GHz

Results for Zigbee 250Kbps O-QPSK Channel 11

No emissions within 10dB of the limit were identified in 9kHz-30MHz range. Only plots shown below.

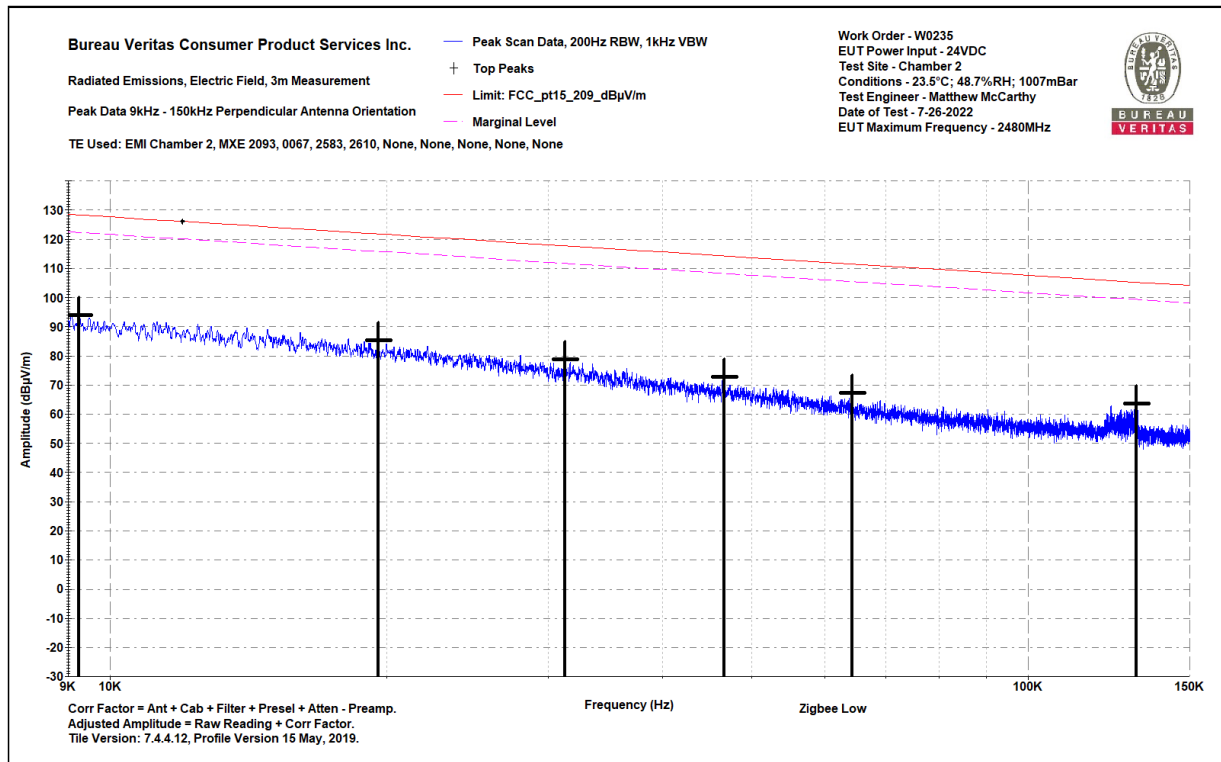


0.009-0.15MHz Parallel

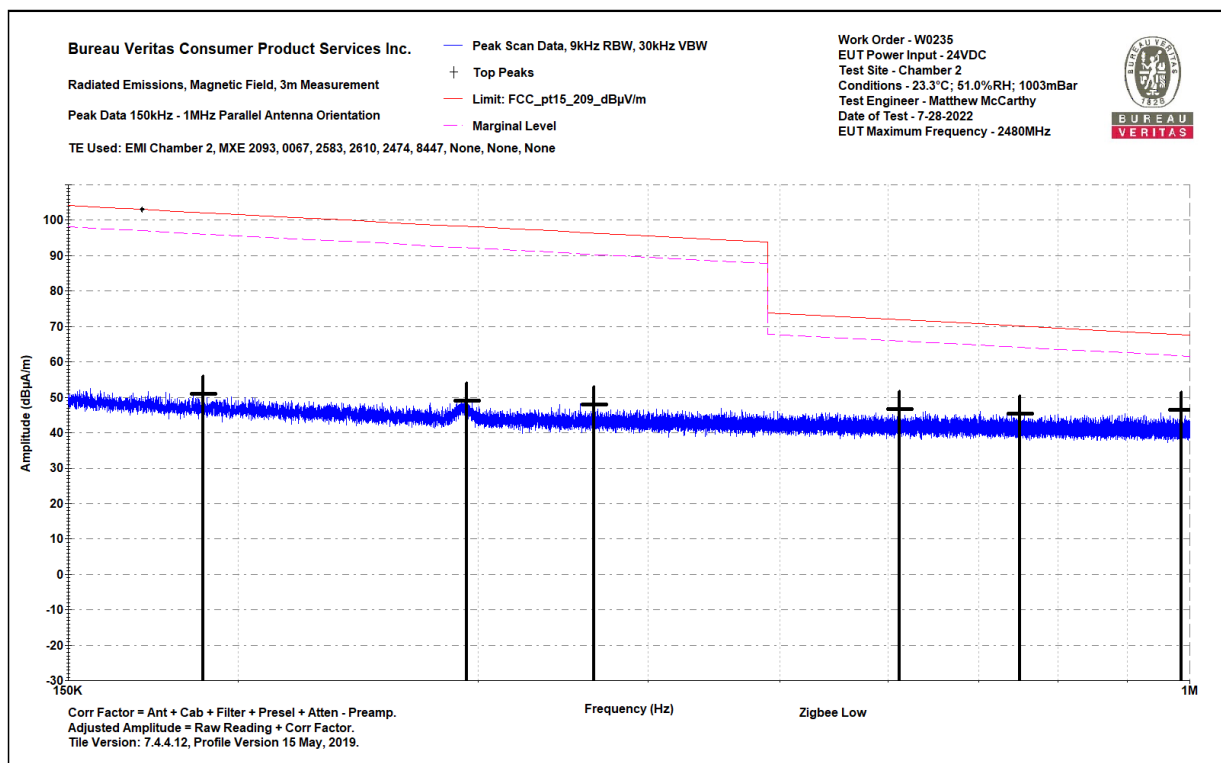


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0.009-0.15MHz Perpendicular



0.15-1MHz Parallel

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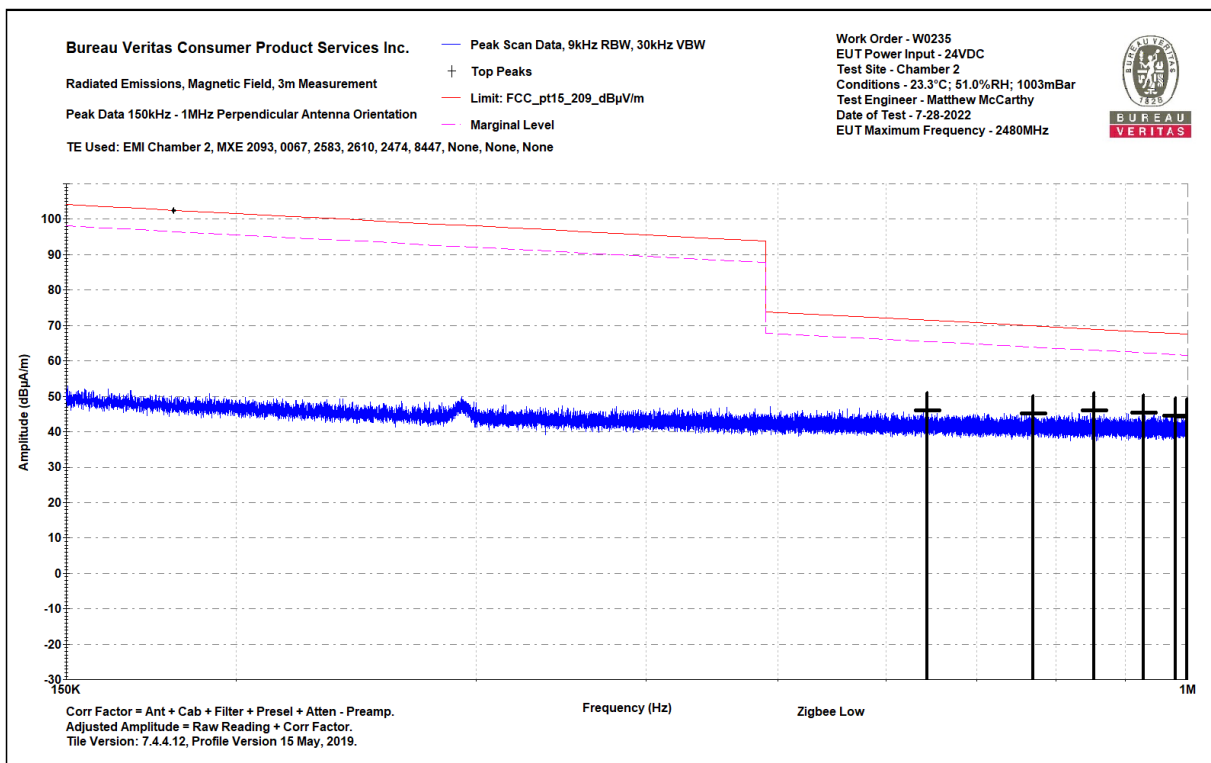
One Distribution Center Circle, #1
Littleton, MA

Tel.: (978) 486-8880
Fax: (978) 486-8828

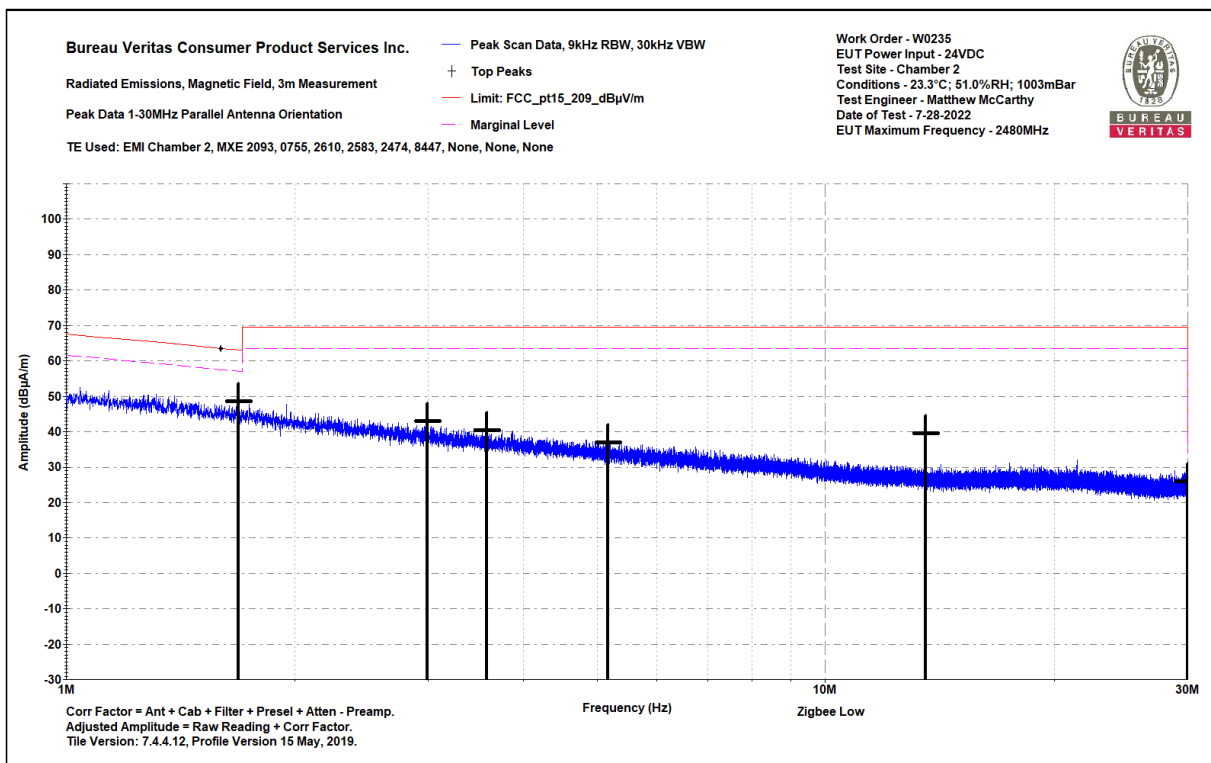


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Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5



0.15-1MHz Perpendicular



1-30MHz Parallel

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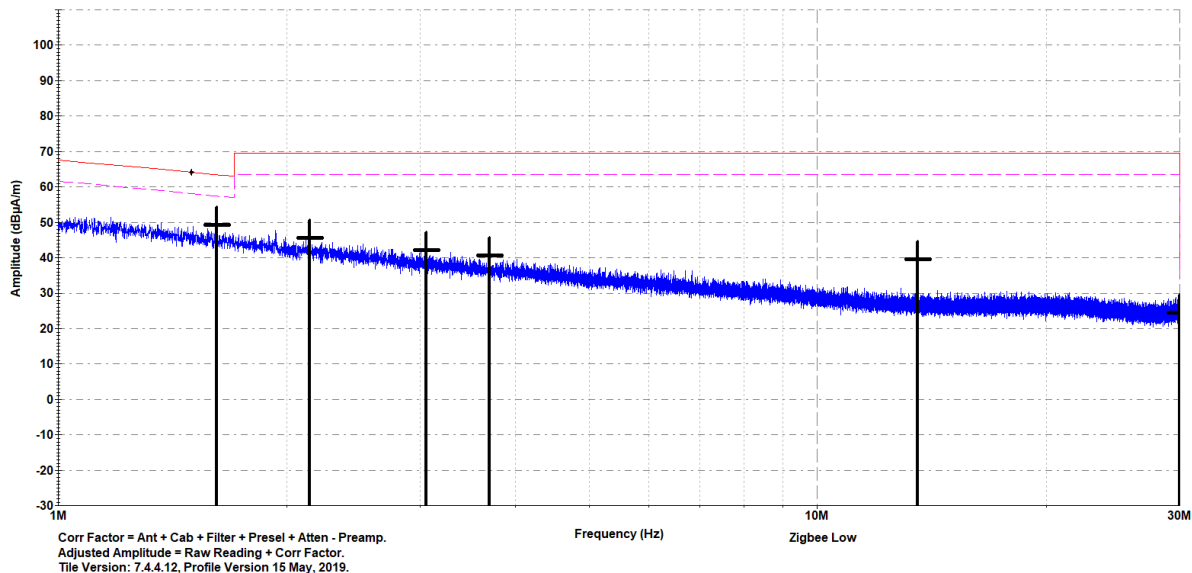
Radiated Emissions, Magnetic Field, 3m Measurement

Peak Data 1-30MHz Perpendicular Antenna Orientation

TE Used: EMI Chamber 2, MXE 2093, 0755, 2610, 2583, 2474, 8447, None, None, None

— Peak Scan Data, 9kHz RBW, 30kHz VBW
+ Top Peaks
— Limit: FCC_pt15_209_dBμV/m
— Marginal Level

Work Order - W0235
EUT Power Input - 24VDC
Test Site - Chamber 2
Conditions - 23.3°C; 51.0%RH; 1003mBar
Test Engineer - Matthew McCarthy
Date of Test - 7-28-2022
EUT Maximum Frequency - 2480MHz



1-30MHz Perpendicular

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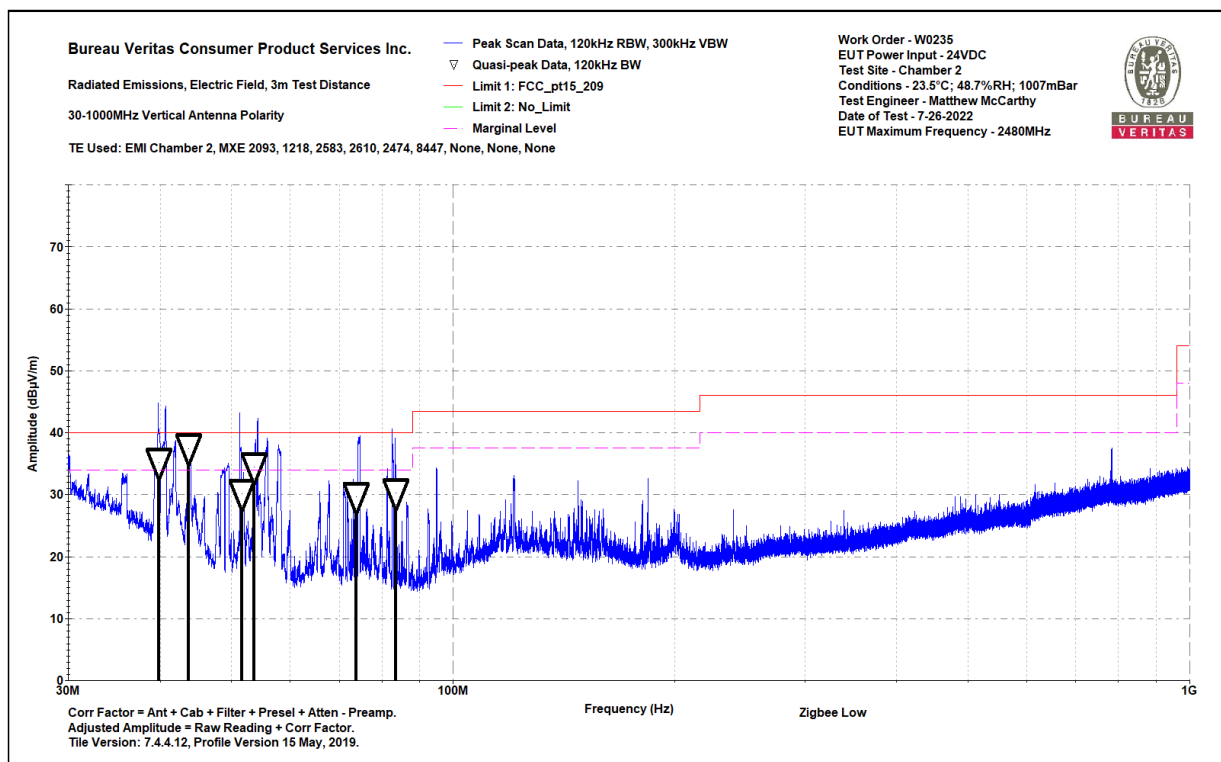
Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
30-1000MHz Vertical Data
Notes:
Zigbee Low
0

Work Order - W0235
EUT Power Input - 24VDC
Test Site - Chamber 2
Conditions - 23.5°C; 48.7%RH; 1007mBar
Test Engineer - Matthew McCarthy
Date of Test - 7-26-2022

| Frequency (MHz) | Raw QP Reading (dBµV) | Correction Factor (dB/m) | Adjusted QP Amplitude (dBµV/m) | Lim1: FCC_pt15_209 (dBµV/m) | Margin to Lim1 (dB) | Test Results Lim1 (Pass/Fail) | Worst Margin Lim1 (dB) | Lim2: No_Limit (dBµV/m) | Margin to Lim2 (dB) | Test Results Lim2 (Pass/Fail) | Worst Margin Lim2 (dB) | Antenna Height (cm) | EUT Azimuth (degrees) |
|-----------------|-----------------------|--------------------------|--------------------------------|-----------------------------|---------------------|-------------------------------|------------------------|-------------------------|---------------------|-------------------------------|------------------------|---------------------|-----------------------|
| 39.795 | 40.8 | -5.6 | 35.2 | 40 | -4.8 | PASS | | 200 | -164.8 | PASS | | 118 | 10 |
| 43.764 | 45.7 | -8.2 | 37.5 | 40 | -2.5 | PASS | -2.5 | 200 | -162.5 | PASS | -162.5 | 108 | 25 |
| 51.673 | 41.9 | -11.7 | 30.2 | 40 | -9.8 | PASS | | 200 | -169.8 | PASS | | 175 | 65 |
| 53.633 | 46.5 | -12.1 | 34.4 | 40 | -5.6 | PASS | | 200 | -165.6 | PASS | | 125 | 294 |
| 73.881 | 41.2 | -11.6 | 29.6 | 40 | -10.4 | PASS | | 200 | -170.4 | PASS | | 216 | 25 |
| 83.506 | 42.3 | -12.1 | 30.3 | 40 | -9.7 | PASS | | 200 | -169.7 | PASS | | 157 | 18 |

30-1000MHz Vertical



30-1000MHz Vertical



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Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5

Bureau Veritas Consumer Product Services Inc.

Radiated Emissions Electric Field 3m Distance

30-1000MHz Horizontal Data

Notes:

Zigbee Low

0

Work Order - W0235

EUT Power Input - 24VDC

Test Site - Chamber 2

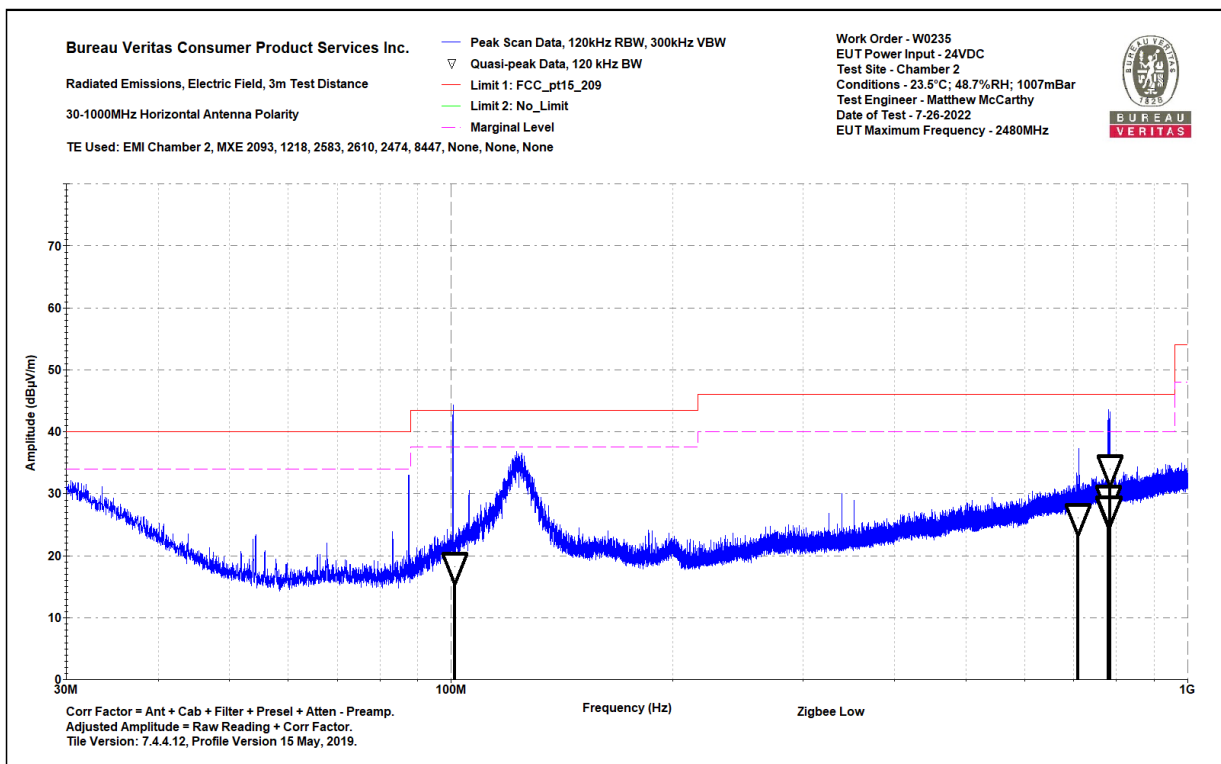
Conditions - 23.5°C; 48.7%RH; 1007mBar

Test Engineer - Matthew McCarthy

Date of Test - 7-26-2022

| Frequency (MHz) | Raw QP Reading (dBμV) | Correction Factor (dB/m) | Adjusted QP Amplitude (dBμV/m) | Lim1: FCC_pt15_20 9 (dBμV/m) | Margin to Lim1 (dB) | Test Results Lim1 (Pass/Fail) | Worst Margin Lim1 (dB) | Lim2: No_Limit (dBμV/m) | Margin to Lim2 (dB) | Test Results Lim2 (Pass/Fail) | Worst Margin Lim2 (dB) | Antenna Height (cm) | EUT Azimuth (degrees) |
|--------------------|-----------------------------|--------------------------------|--------------------------------------|---------------------------------------|---------------------------|-------------------------------------|------------------------------|-------------------------------|---------------------------|-------------------------------------|------------------------------|---------------------------|--------------------------|
| 101.212 | 27.3 | -9.1 | 18.2 | 43.5 | -25.3 | PASS | | 200 | -181.8 | PASS | | 223 | 296 |
| 709.925 | 24.2 | 2 | 26.1 | 46 | -19.9 | PASS | | 200 | -173.9 | PASS | | 225 | 69 |
| 779.726 | 25.6 | 3.4 | 29 | 46 | -17 | PASS | | 200 | -171 | PASS | | 110 | 45 |
| 779.958 | 23.8 | 3.4 | 27.3 | 46 | -18.7 | PASS | | 200 | -172.7 | PASS | | 104 | 20 |
| 782.301 | 24 | 3.4 | 27.4 | 46 | -18.6 | PASS | | 200 | -172.6 | PASS | | 193 | 32 |
| 785.381 | 30.6 | 3.3 | 33.9 | 46 | -12.1 | PASS | -12.1 | 200 | -166.1 | PASS | -166.1 | 147 | 296 |

30-1000MHz Horizontal



30-1000MHz Horizontal

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Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5

Results for Zigbee 250Kbps O-QPSK Channel 19

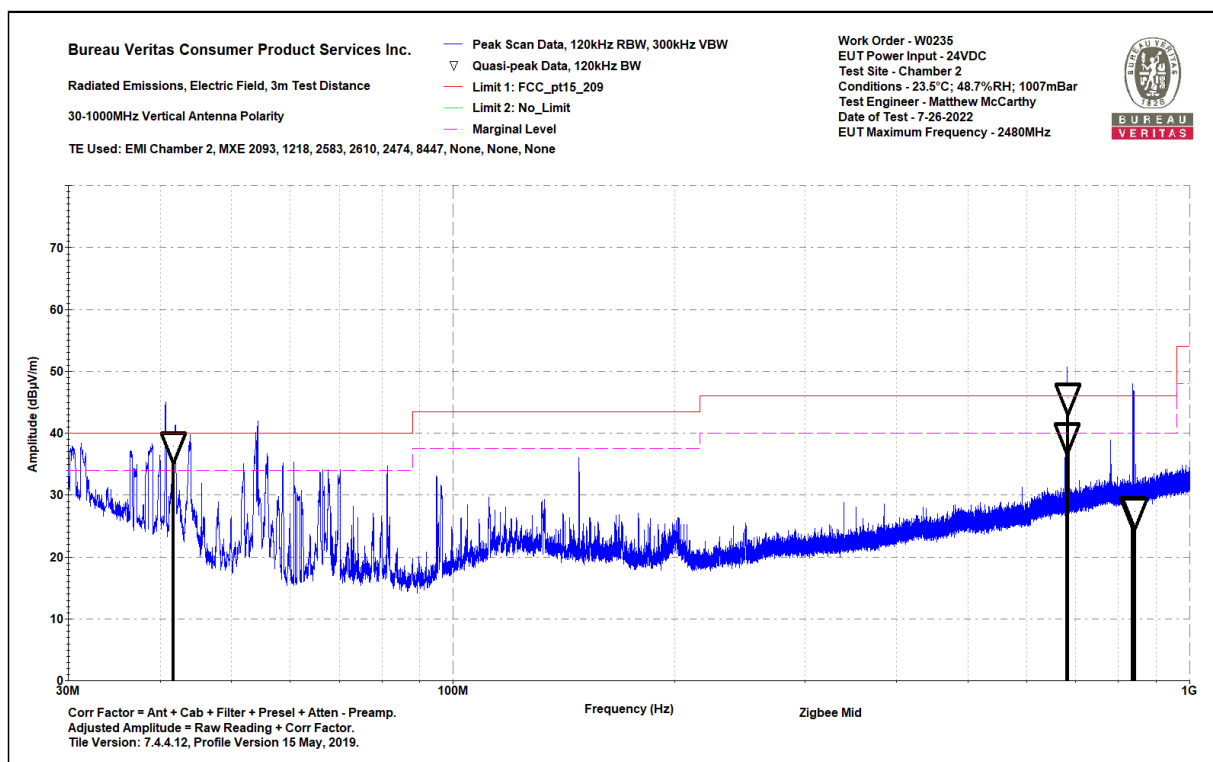
Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
30-1000MHz Vertical Data

Notes:
Zigbee Mid
0

Work Order - W0235
EUT Power Input - 24VDC
Test Site - Chamber 2
Conditions - 23.5°C; 48.7%RH; 1007mBar
Test Engineer - Matthew McCarthy
Date of Test - 7-26-2022

| Frequency (MHz) | Raw QP Reading (dBμV) | Correction Factor (dB/m) | Adjusted QP Amplitude (dBμV/m) | Lim1: FCC_pt15_20 9 (dBμV/m) | Margin to Lim1 (dB) | Test Results Lim1 (Pass/Fail) | Worst Margin Lim1 (dB) | Lim2: No_Limit (dBμV/m) | Margin to Lim2 (dB) | Test Results Lim2 (Pass/Fail) | Worst Margin Lim2 (dB) | Antenna Height (cm) | EUT Azimuth (degrees) |
|--------------------|-----------------------------|--------------------------------|--------------------------------------|---------------------------------------|---------------------------|-------------------------------------|------------------------------|-------------------------------|---------------------------|-------------------------------------|------------------------------|---------------------------|--------------------------|
| 41.673 | 44.8 | -6.9 | 37.9 | 40 | -2.1 | PASS | | 200 | -162.1 | PASS | | 113 | 245 |
| 681.612 | 38 | 1.4 | 39.4 | 46 | -6.6 | PASS | | 200 | -160.6 | PASS | | 136 | 25 |
| 682.978 | 44.5 | 1.4 | 45.8 | 46 | -0.2 | PASS | -0.2 | 200 | -154.2 | PASS | -154.2 | 214 | 13 |
| 836.264 | 23.5 | 3.8 | 27.4 | 46 | -18.6 | PASS | | 200 | -172.6 | PASS | | 131 | 86 |
| 839.474 | 23.5 | 3.8 | 27.3 | 46 | -18.7 | PASS | | 200 | -172.7 | PASS | | 149 | 155 |
| 841.729 | 23.5 | 3.8 | 27.3 | 46 | -18.7 | PASS | | 200 | -172.7 | PASS | | 141 | 178 |

30-1000MHz Vertical



30-1000MHz Vertical



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Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5

Bureau Veritas Consumer Product Services Inc.

Radiated Emissions Electric Field 3m Distance

30-1000MHz Horizontal Data

Notes:

Zigbee Mid

0

Work Order - W0235

EUT Power Input - 24VDC

Test Site - Chamber 2

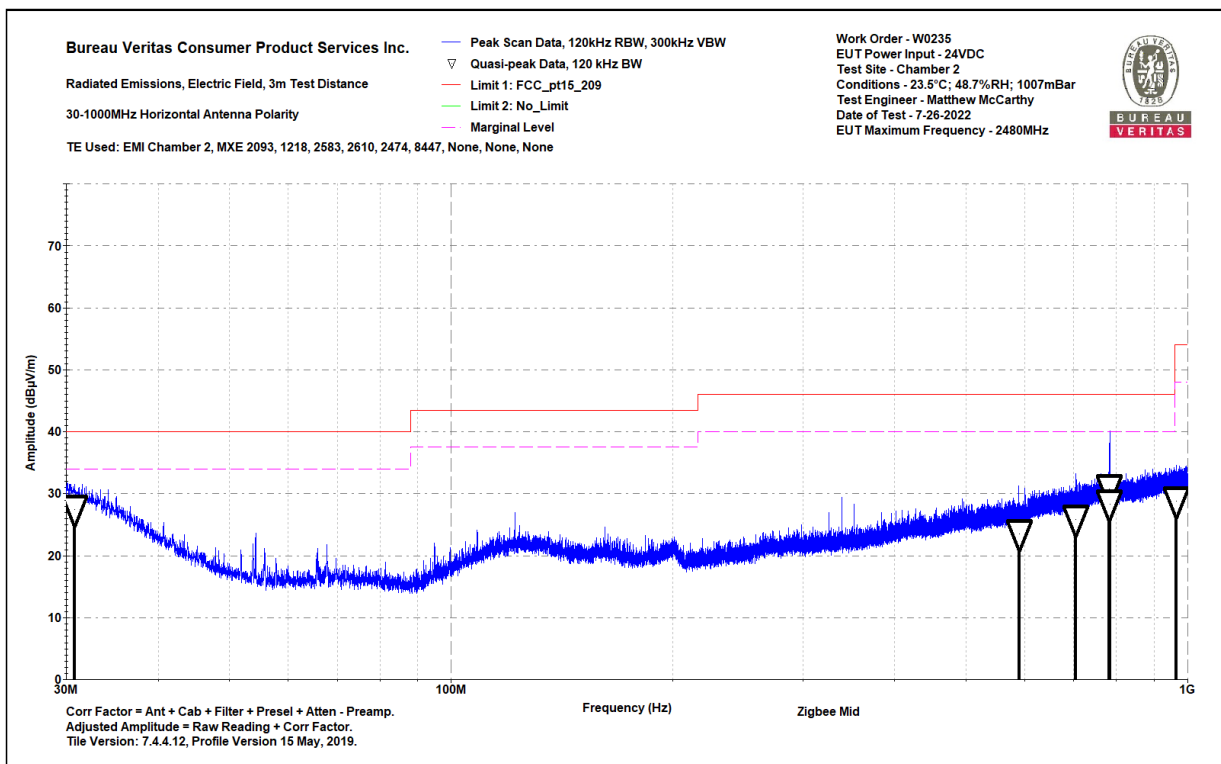
Conditions - 23.5°C; 48.7%RH; 1007mBar

Test Engineer - Matthew McCarthy

Date of Test - 7-26-2022

| Frequency (MHz) | Raw QP Reading (dBμV) | Correction Factor (dB/m) | Adjusted QP Amplitude (dBμV/m) | Lim1: FCC_pt15_209 (dBμV/m) | Margin to Lim1 (dB) | Test Results Lim1 (Pass/Fail) | Worst Margin Lim1 (dB) | Lim2: No_Limit (dBμV/m) | Margin to Lim2 (dB) | Test Results Lim2 (Pass/Fail) | Worst Margin Lim2 (dB) | Antenna Height (cm) | EUT Azimuth (degrees) |
|-----------------|-----------------------|--------------------------|--------------------------------|-----------------------------|---------------------|-------------------------------|------------------------|-------------------------|---------------------|-------------------------------|------------------------|---------------------|-----------------------|
| 30.796 | 26.1 | 1.3 | 27.5 | 40 | -12.5 | PASS | -12.5 | 200 | -172.5 | PASS | | 105 | 110 |
| 590.367 | 23.7 | -0.2 | 23.5 | 46 | -22.5 | PASS | | 200 | -176.5 | PASS | | 169 | 78 |
| 705.406 | 24.1 | 1.8 | 25.9 | 46 | -20.1 | PASS | | 200 | -174.1 | PASS | | 157 | 20 |
| 781.897 | 27.4 | 3.4 | 30.8 | 46 | -15.2 | PASS | | 200 | -169.2 | PASS | -169.2 | 112 | 155 |
| 783.501 | 25 | 3.3 | 28.3 | 46 | -17.7 | PASS | | 200 | -171.7 | PASS | | 108 | 202 |
| 964.122 | 23 | 5.8 | 28.8 | 54 | -25.2 | PASS | | 200 | -171.2 | PASS | | 168 | 25 |

30-1000MHz Horizontal



30-1000MHz Horizontal

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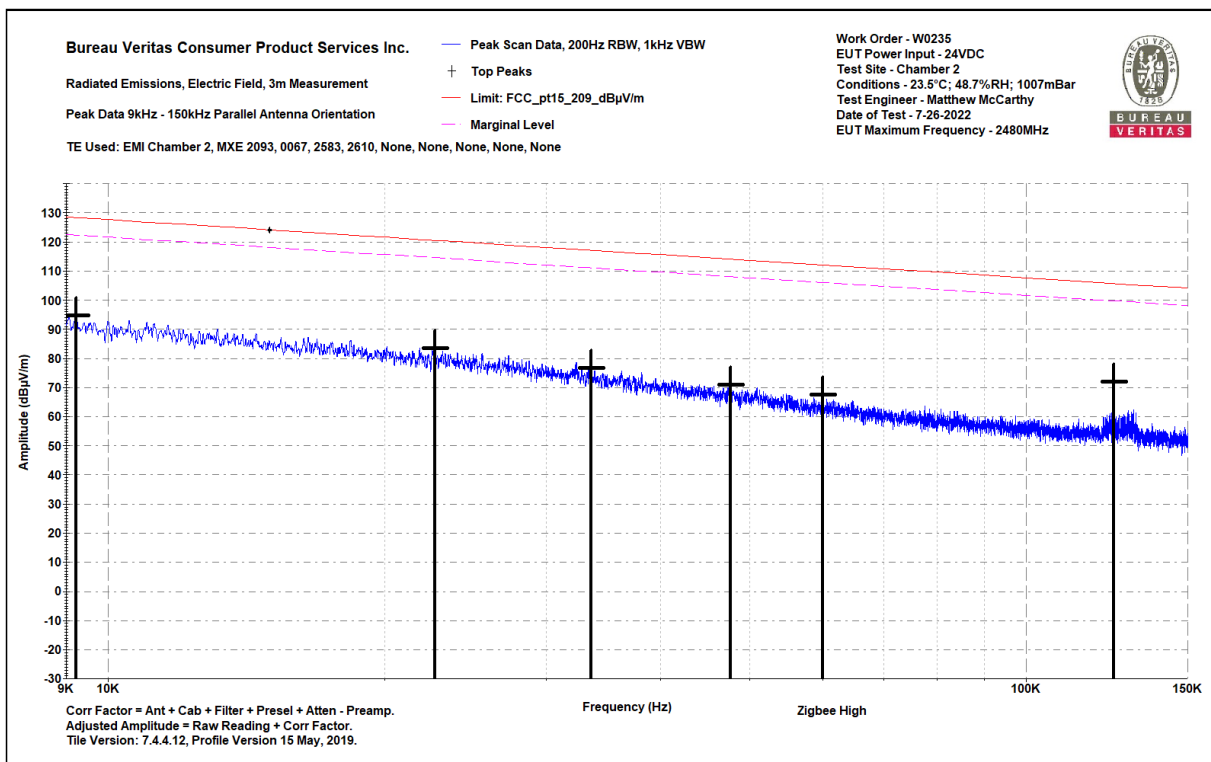


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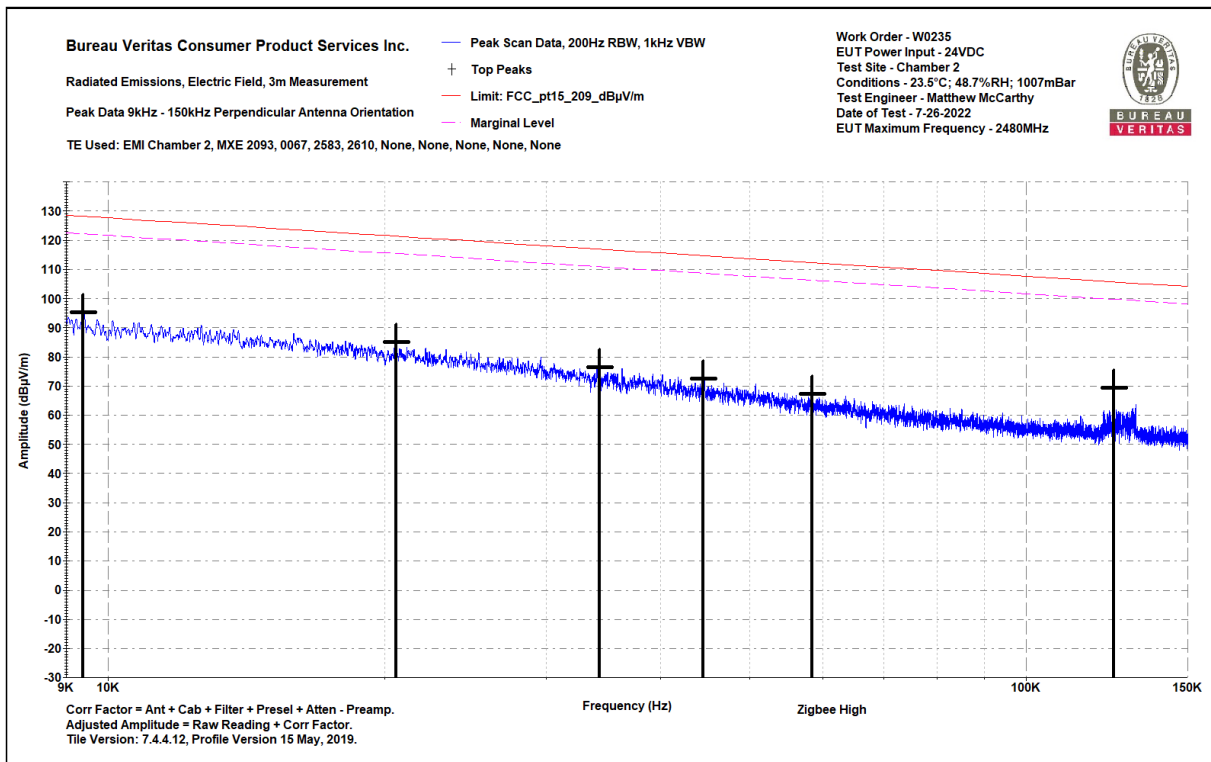
Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5

Results for Zigbee 250Kbps O-QPSK Channel 26

No emissions within 10dB of the limit were identified in 9kHz-30MHz range. Only plots shown below.



0.009-0.15MHz Parallel



0.009-0.15MHz Perpendicular

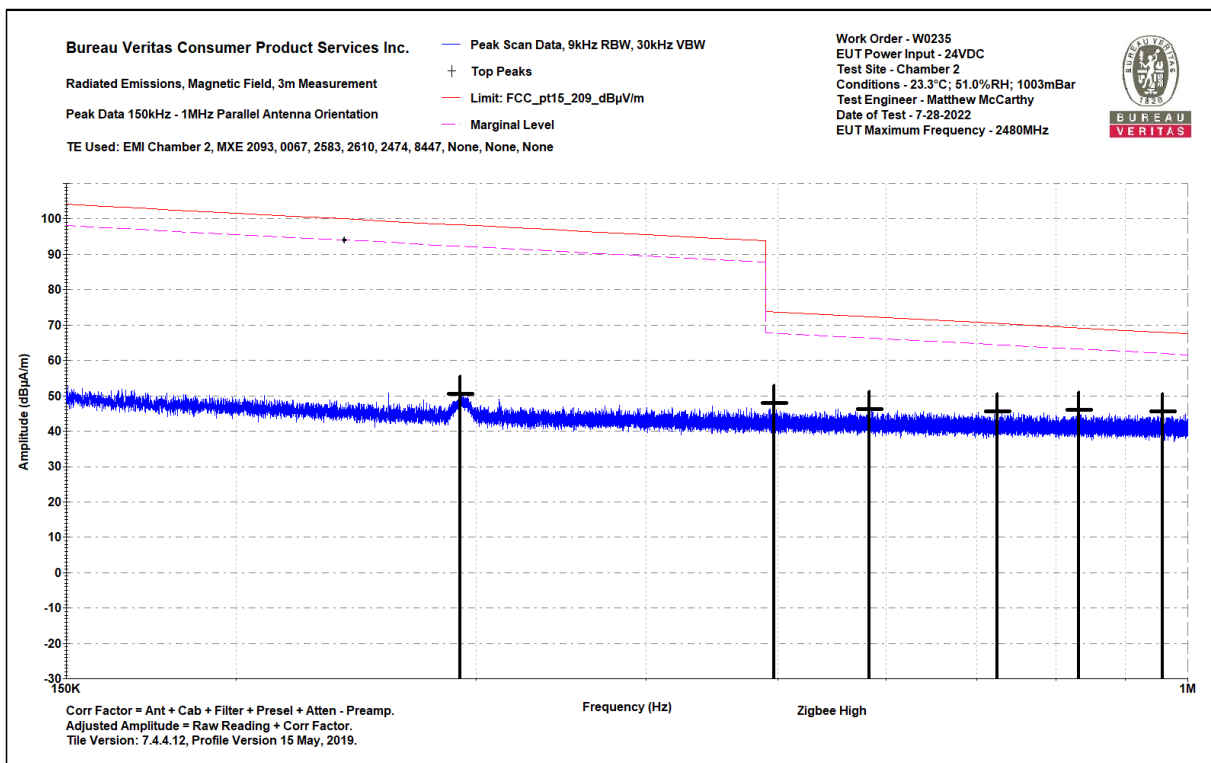
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Littleton, MA

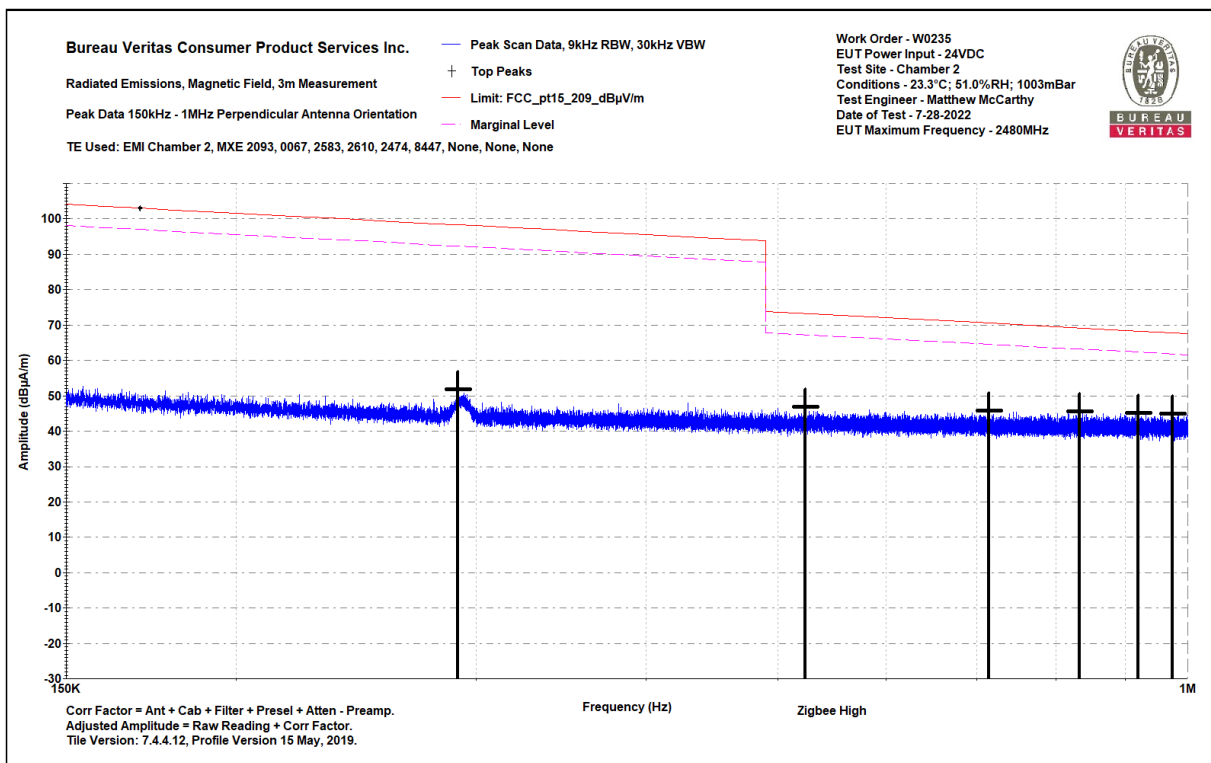
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Test Report for Hanchett Entry Systems, Inc.
Report No. EW0235-4 Issue 5



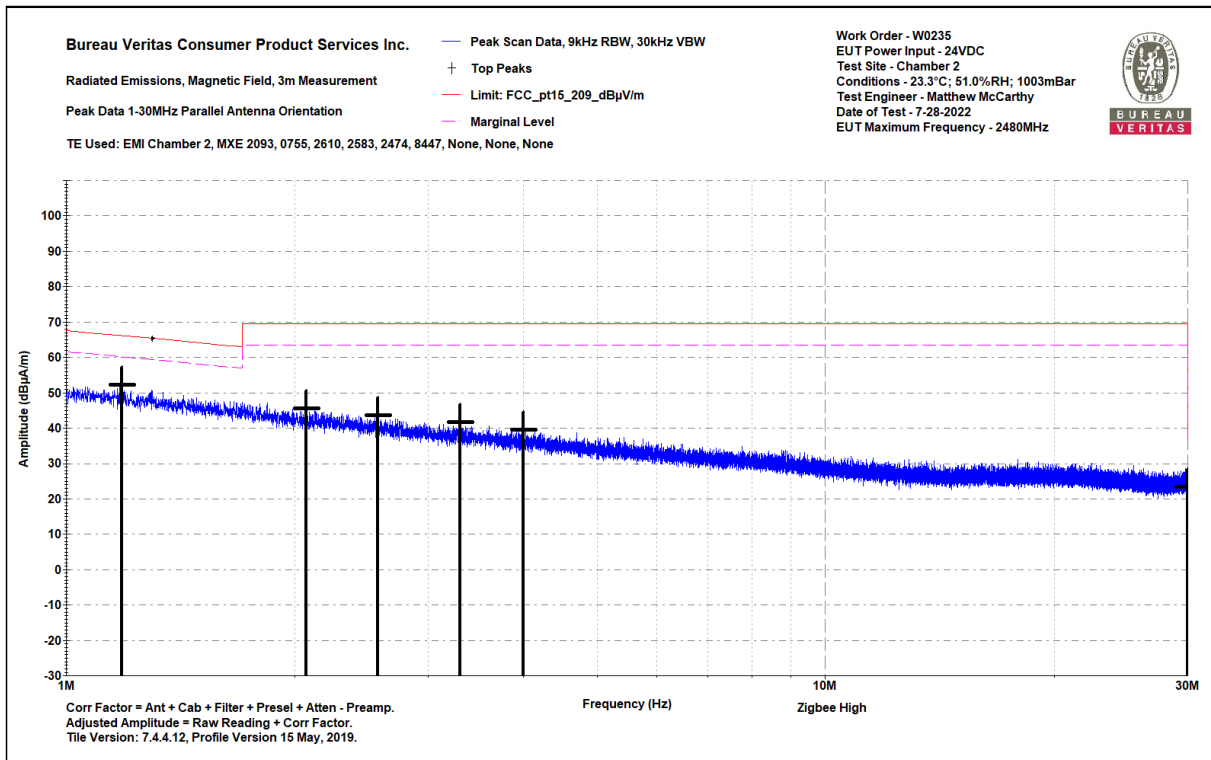
0.15-1MHz Parallel



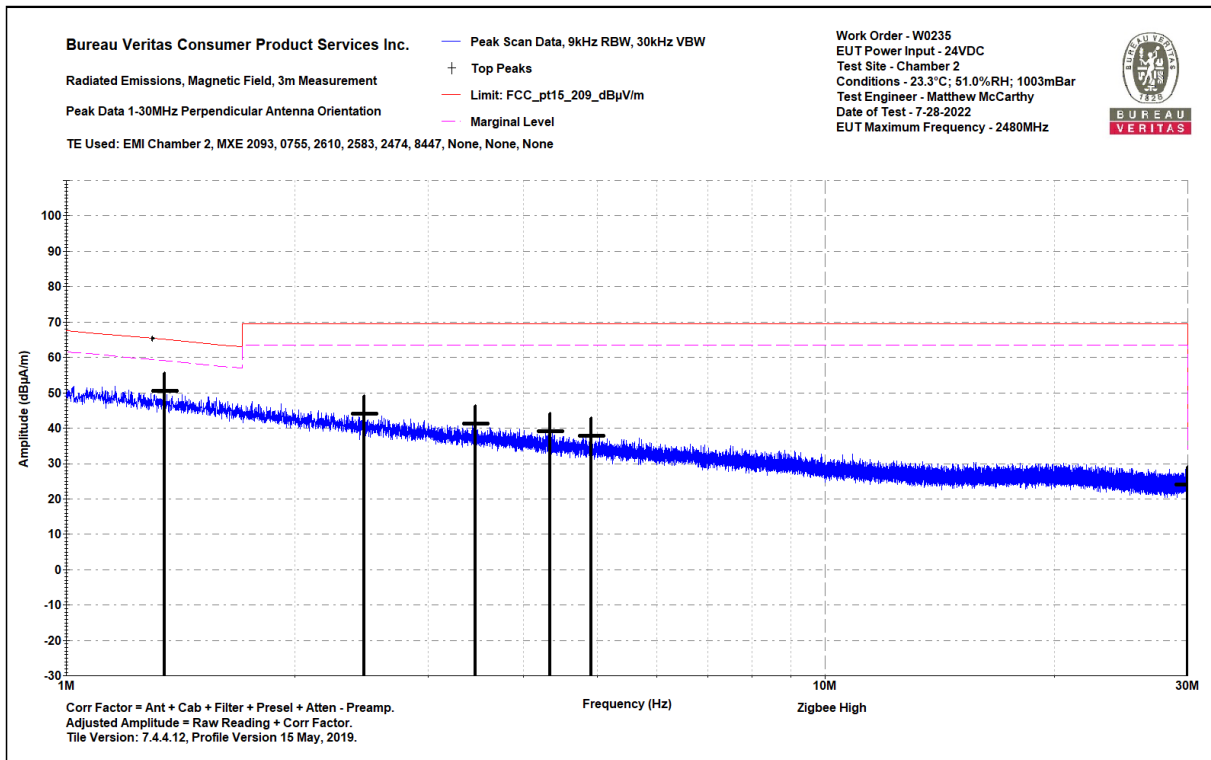
0.15-1MHz Perpendicular



Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5



1-30MHz Parallel



1-30MHz Perpendicular



Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5

Bureau Veritas Consumer Product Services Inc.

Radiated Emissions Electric Field 3m Distance

30-1000MHz Vertical Data

Notes:

Zigbee High

0

Work Order - W0235

EUT Power Input - 24VDC

Test Site - Chamber 2

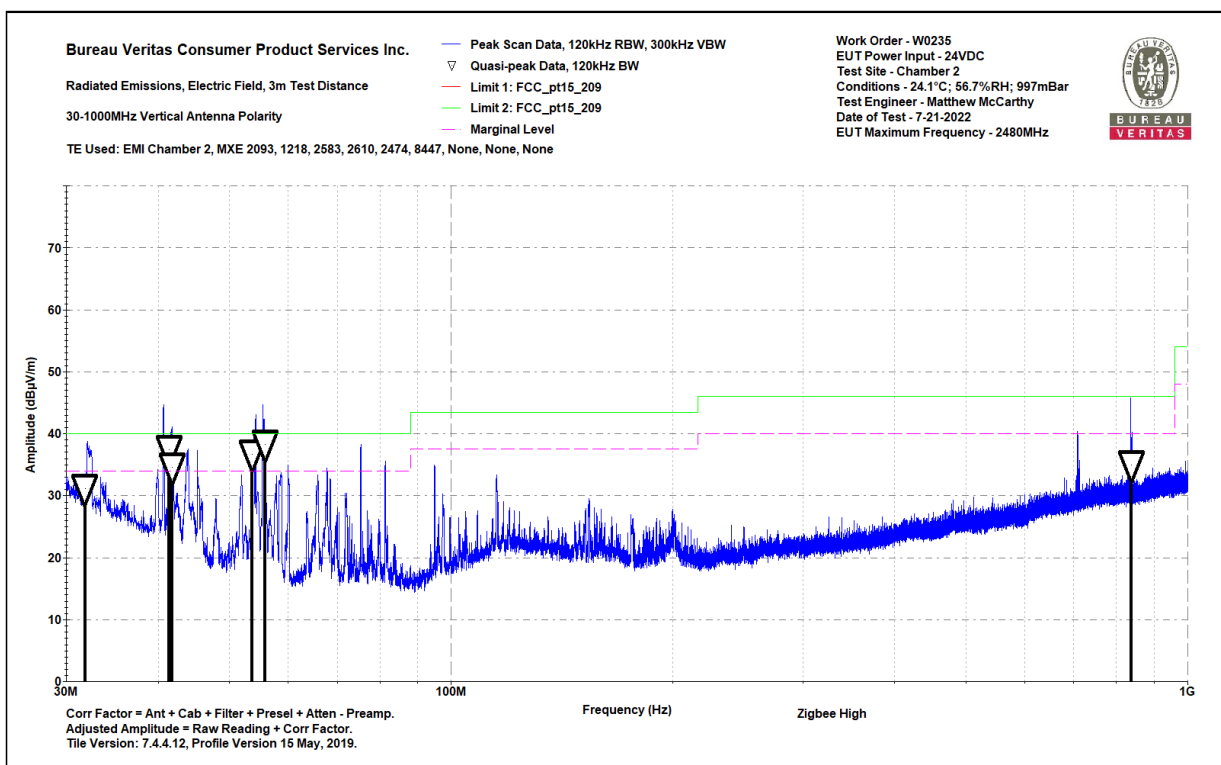
Conditions - 24.1°C; 56.7%RH; 997mBar

Test Engineer - Matthew McCarthy

Date of Test - 7-21-2022

| Frequency (MHz) | Raw QP Reading (dBμV) | Correction Factor (dB/m) | Adjusted QP Amplitude (dBμV/m) | Lim1: FCC_pt15_20 9 (dBμV/m) | Margin to Lim1 (dB) | Test Results Lim1 (Pass/Fail) | Worst Margin Lim1 (dB) | Lim2: FCC_pt15_20 9 (dBμV/m) | Margin to Lim2 (dB) | Test Results Lim2 (Pass/Fail) | Worst Margin Lim2 (dB) | Antenna Height (cm) | EUT Azimuth (degrees) |
|--------------------|-----------------------------|--------------------------------|--------------------------------------|---------------------------------------|---------------------------|-------------------------------------|------------------------------|---------------------------------------|---------------------------|-------------------------------------|------------------------------|---------------------------|--------------------------|
| 31.806 | 30.6 | 0.6 | 31.2 | 40 | -8.8 | PASS | | 40 | -8.8 | PASS | | 116 | 20 |
| 41.406 | 44.1 | -6.7 | 37.4 | 40 | -2.6 | PASS | | 40 | -2.6 | PASS | | 125 | 200 |
| 41.775 | 41.5 | -6.9 | 34.6 | 40 | -5.4 | PASS | | 40 | -5.4 | PASS | | 203 | 12 |
| 53.717 | 48.8 | -12.1 | 36.7 | 40 | -3.3 | PASS | | 40 | -3.3 | PASS | | 125 | 201 |
| 55.93 | 50.5 | -12.2 | 38.3 | 40 | -1.7 | PASS | -1.7 | 40 | -1.7 | PASS | -1.7 | 175 | 107 |
| 837.771 | 31.1 | 3.8 | 34.9 | 46 | -11.1 | PASS | | 46 | -11.1 | PASS | | 125 | 72 |

30-1000MHz Vertical



30-1000MHz Vertical



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Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5

Bureau Veritas Consumer Product Services Inc.

Radiated Emissions Electric Field 3m Distance

30-1000MHz Horizontal Data

Notes:

Zigbee High

0

Work Order - W0235

EUT Power Input - 24VDC

Test Site - Chamber 2

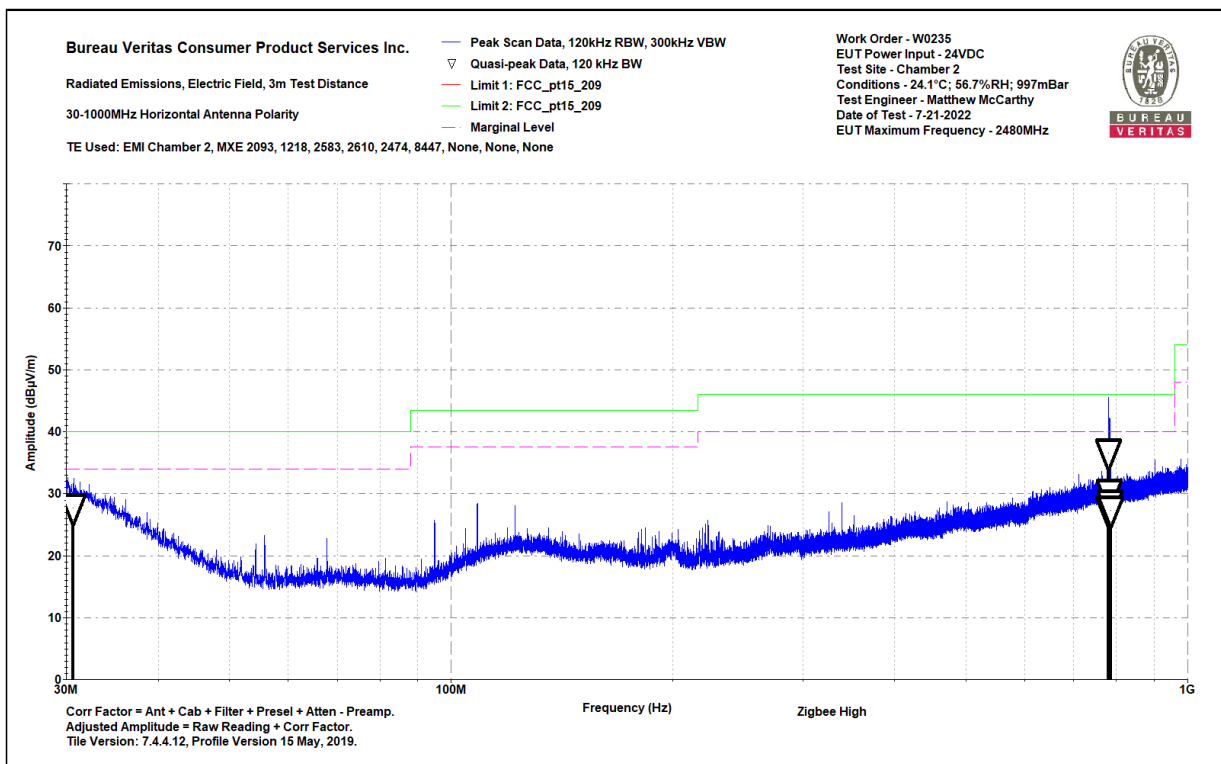
Conditions - 24.1°C; 56.7%RH; 997mBar

Test Engineer - Matthew McCarthy

Date of Test - 7-21-2022

| Frequency (MHz) | Raw QP Reading (dBμV) | Correction Factor (dB/m) | Adjusted QP Amplitude (dBμV/m) | Lim1: FCC_pt15_20 9 (dBμV/m) | Margin to Lim1 (dB) | Test Results Lim1 (Pass/Fail) | Worst Margin Lim1 (dB) | Lim2: FCC_pt15_20 9 (dBμV/m) | Margin to Lim2 (dB) | Test Results Lim2 (Pass/Fail) | Worst Margin Lim2 (dB) | Antenna Height (cm) | EUT Azimuth (degrees) |
|--------------------|-----------------------------|--------------------------------|--------------------------------------|---------------------------------------|---------------------------|-------------------------------------|------------------------------|---------------------------------------|---------------------------|-------------------------------------|------------------------------|---------------------------|--------------------------|
| 30.679 | 26.2 | 1.4 | 27.7 | 40 | -12.3 | PASS | | 40 | -12.3 | PASS | | 137 | 210 |
| 779.995 | 23.8 | 3.4 | 27.3 | 46 | -18.7 | PASS | | 46 | -18.7 | PASS | | 167 | 110 |
| 780.05 | 33.1 | 3.4 | 36.6 | 46 | -9.4 | PASS | -9.4 | 46 | -9.4 | PASS | -9.4 | 104 | 299 |
| 783.442 | 26.7 | 3.3 | 30 | 46 | -16 | PASS | | 46 | -16 | PASS | | 118 | 304 |
| 784.527 | 25.1 | 3.3 | 28.4 | 46 | -17.6 | PASS | | 46 | -17.6 | PASS | | 175 | 315 |
| 786.101 | 24 | 3.3 | 27.3 | 46 | -18.7 | PASS | | 46 | -18.7 | PASS | | 245 | 338 |

30-1000MHz Horizontal



30-1000MHz Horizontal

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Test Report for Hanchett Entry Systems, Inc. Report No. EW0235-4 Issue 5

Emissions above 1GHz

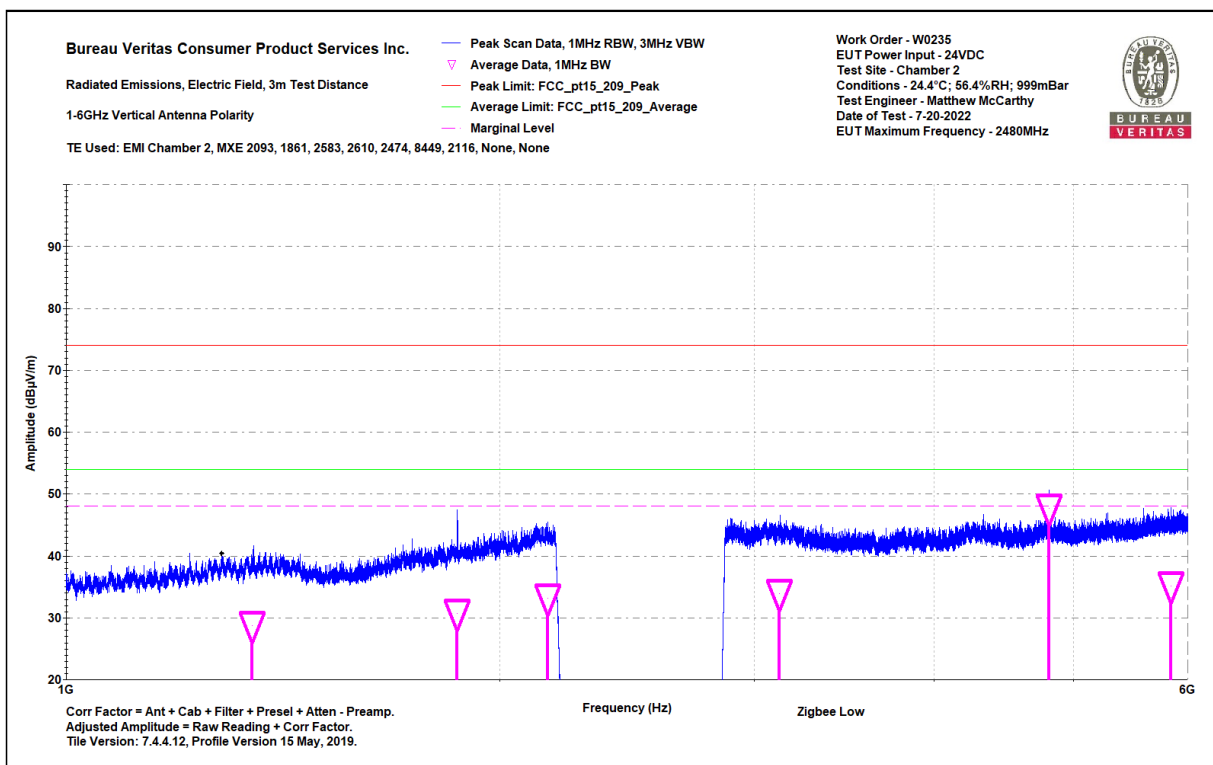
Results for Zigbee 250Kbps O-QPSK Channel 11

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 3m Distance
1-6GHz Vertical Data
Notes:
Zigbee Low
0

Work Order - W0235
EUT Power Input - 24VDC
Test Site - Chamber 2
Conditions - 24.4°C; 56.4%RH; 999mBar
Test Engineer - Matthew McCarthy
Date of Test - 7-20-2022

| Frequency (MHz) | Raw Peak Reading (dBμV) | Raw Avg Reading (dBμV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBμV/m) | Pk Lim: FCC_pt15_20_9_Peak (dBμV/m) | Peak Margin (dB) | Peak Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBμV/m) | Av Lim: FCC_pt15_20_9_Average (dBμV/m) | Avg Margin (dB) | Avg Results (Pass/Fail) | Worst Avg Margin (dB) | Antenna Height (cm) | EUT Azimuth (degrees) |
|-----------------|-------------------------|------------------------|--------------------------|----------------------------------|-------------------------------------|------------------|--------------------------|------------------------|---------------------------------|--|-----------------|-------------------------|-----------------------|---------------------|-----------------------|
| 1346.6 | 47 | 36.2 | -7.4 | 39.6 | 74 | -34.4 | PASS | | 28.7 | 54 | -25.3 | PASS | | 298 | 307 |
| 1868.1 | 44.7 | 34.8 | -4 | 40.6 | 74 | -33.4 | PASS | | 30.7 | 54 | -23.3 | PASS | | 294 | 61 |
| 2159.3 | 43.6 | 35 | -1.8 | 41.8 | 74 | -32.2 | PASS | | 33.2 | 54 | -20.8 | PASS | | 285 | 232 |
| 3125.2 | 42.7 | 34.4 | -0.4 | 42.3 | 74 | -31.7 | PASS | | 34 | 54 | -20 | PASS | | 125 | 288 |
| 4810 | 50.2 | 46.8 | 0.8 | 51 | 74 | -23 | PASS | -23 | 47.6 | 54 | -6.4 | PASS | -6.4 | 103 | 4 |
| 5843.5 | 43.1 | 32.9 | 2.2 | 45.3 | 74 | -28.7 | PASS | | 35.2 | 54 | -18.8 | PASS | | 209 | 118 |

1-6GHz Vertical



1-6GHz Vertical

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