# EMC TEST REPORT

NVLAP Lab Code 200033-0

**Standard(s):**

**47 CFR FCC Part 15.247**
**RSS 247, Issue 3, 2023**

**FCC ID:Y9ZFL61007WS7**
**IC:4406A-FL61007WS7**

**Product: 3M™ Peltor™ WS Adapter G3 Ground Mechanic (BR/EDR)**

**Model(s): FL61007-WS7**

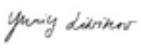
**Company Name:**
**3M Svenska AB**

**3M Division: PSD**

**Address:**
**Box 2341, Malmstensgatan 19**
**SE-33102 Värnamo, Sweden**

**Report Number: HRE202312453-2**
**Report Issue Date: September 16, 2024**

**Report Prepared by:**

**Signature:** 
**Yuriy Litvinov**
**Lead EMC Engineer**

**Tested by:**
**3M Hardgoods Regulatory Engineering Laboratory**
**410 E. Fillmore Avenue, Building 76**
**St. Paul, Minnesota 55107-1208, USA**

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## 1.0 Test Summary

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

| | Requirement – Test | Test Description | Result | Comments |
|---|---|---|---|---|
| 4.1 | FCC Part 15.247(a)(1)/ RSS-247(5.1(a)) | 20dB Bandwidth | **pass** | |
| 4.2 | FCC Part 15.247(b)(1)/ RSS-247(5.4(b)) | Maximum Peak Conducted Output Power | **pass** | |
| 4.3 | FCC Part 15.247(a)(1)/ RSS-247(5.1(c)) | Channel Separation | **pass** | |
| 4.4 | FCC Part 15.247(a)(1)/ RSS-247(5.1(d)) | Number of Channels | **pass** | |
| 4.5 | FCC Part 15.247(a)(1)/ RSS-247(5.1(4)) | Time of Occupancy | **pass** | |
| 4.6 | FCC Part 15.209 RSS-Gen, 8.9 | Radiated Emissions in restricted band | **pass** | |
| 4.7 | FCC Part 15.247(d)/ RSS-247(5.5) | Radiated Emissions in non-restricted band | **pass** | |
| 4.8 | FCC Part 15.247(d)(1)/ RSS-247(5.5) | Band-edge Emissions Measurements | **pass** | |
| 4.9 | FCC Part 15.207/ RSS-Gen (8.8) | Conducted Emissions | **pass** | |
| 4.10 | FCC Part 15.247(i)/ RSS 102 Issue 5 | RF Exposure Compliance | **pass** | |

| **Note:** | |
|---|---|

## 1.1 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements. The measurement uncertainty figures were calculated and correspond to a coverage factor of k=2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

| | |
|---|---|
| Radiated emissions 30MHz to 1000MHz | 4.9 dB |
| Radiated emissions 1GHz to 18GHz | 4.6 dB |
| Conducted emissions 150KHz to 30MHz (AMN) | 2.7 dB |
| Conducted emissions 150KHz to 30MHz (AAN) | 1.92 dB |
| RF frequency | $\pm 3 \times 10^{-8}$ |
| RF power, conducted | 1.4 dB |
| RF Power Spectral Density | 0.96 dB |

## 1.2 Test Facility

| | |
|---|---|
| **Test Facility Accreditations:** | ISO/IEC 17025:2017, NVLAP LAB CODE: 200033-0 |
| | FCC OET Designation Number: US5320 |
| | ISED CAB identifier: US0012 |
| | Chinese Taipei - (NCC) CAB identifier: US0012 |

## 2.0 Equipment Description

| 2.1 | Equipment Under Test | | | |
|---|---|---|---|---|
| **Description:** | WS Adapter is a Bluetooth host to be used for wireless communications on airplanes and around airports. | | | |
| **Model(s):** | FL61007-WS7 | | | |
| **Serial number:** | 1824111478 (conducted) and 1824111479 (radiated) | | | |
| **3M Division:** | Personal Safety | | | |
| **Modifications and Special Measures:** | none | | | |
| **Frequency Range:** | 2402.0-2480.0 MHz | | | |
| **Channel No.:** | 79 | | | |
| **Modulation Type:** | GFSK, π/4-DQPSK and 8DPSK | | | |
| **FCC Classification:** | Spread Spectrum Transmitter (DSS) | | | |
| **Output Power EIRP:** | 4dBm (2.5mW) | | | |
| **Antenna Type and Antenna Assembly Gain:** | ☐ External | ☒ Integral PCB Antenna | ☐ Dedicated | |
| | ☒ 1.35dBi | ☐ Declared by the Manufacturer | ☒ Measured | |
| **Test Deviations or Exclusions** | ☐ Yes | ☒ No | | |
| **Rated Power:** | **Voltage:** | ☐ 120VAC | ☐ 230VAC | ☒ 3.7VDC |
| | **Phase:** | ☐ 1ph | ☐ 3ph | ☒ Battery |
| | **Frequency:** | ☐ 50Hz | ☐ 60Hz | |
| | **Current:** | N/A | | |
| **Test Dates:** | 06/03-09/16/2024 | | | |
| **Received Date:** | 06/03/2024 | | | |
| **Received Conditions:** | ☐ Poor | ☒ Good | | |
| | ☒ Prototype | ☐ Production | | |

## 3.0 EUT Configuration

### 3.1 System Configuration

| No. | Product Type | Manufacturer | Model | Comments |
|---|---|---|---|---|
| 1 | WS Adapter | 3M | MRX21A1WS7 | EUT |
| 2 | Li-Io Battery | 3M | ACK081 | 3.7VDC/1800mAh |
| 3 | USB Charger | Apple | M1385 | Support Equipment |
| 4 | Headset | 3M | MT15H7AWSS6-111 | Support Equipment |

### 3.2 Input/Output Ports of EUT

| No. | Description | Type | Comments |
|---|---|---|---|
| 1 | Audio | Phone Plug | Media jack |
| 2 | | | |

### 3.3 Cables

| No. | Description | Type | Length | Shielding | Comments |
|---|---|---|---|---|---|
| 1 | Audio | 3 conductors audio | 30cm | Yes | |
| 2 | | | | | |

### 3.4 Measurement Arrangements of EUT

| | Intended Operational Arrangement(s) | Comments |
|---|---|---|
| ☒ | Table-top only | |
| ☐ | Floor-standing only | |
| ☐ | Floor-standing or table-top | |
| ☒ | Other | Body-worn |

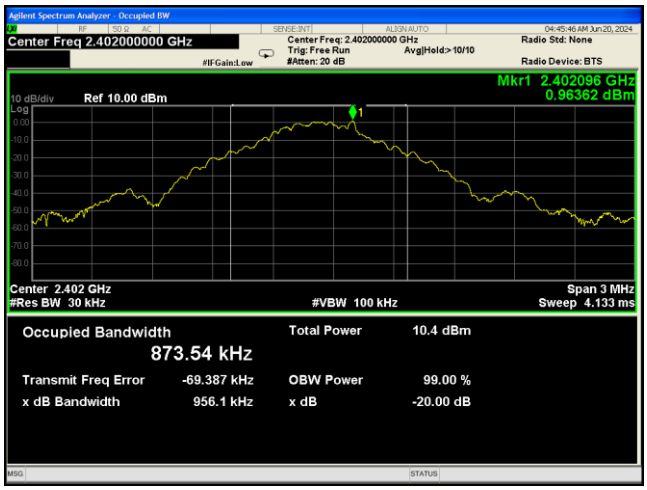
### 3.5 Exercising of EUT and Interfaces

| No. | Mode of Operation |
|---|---|
| 1 | Worst Case Bluetooth protocol BR (DH5)-1mbps and EDR (3-DH5)-3mbps |
| 2 | Transmitting at lowest, middle and highest channels of operation using modulated carrier at each operation mode according to applicable Bluetooth test protocol. |
| 3 | Device programming using Qualcomm Bluesuite WIN.3.3 software for continuous transmission of modulated carrier at maximum rated RF output power and Duty Cycle. |

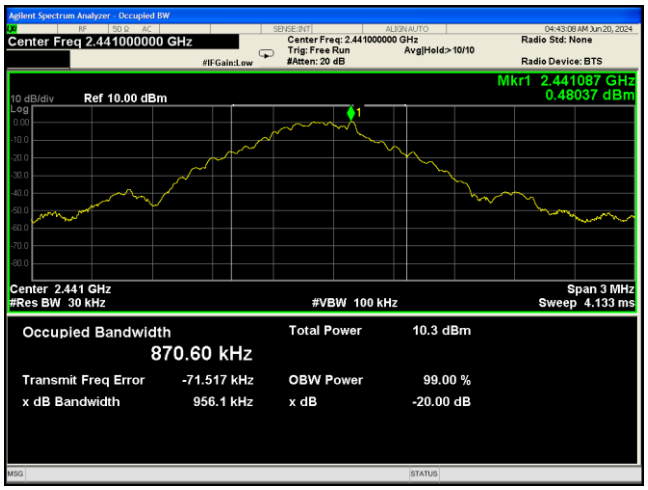
## 4.0 Test Conditions and Results

| **4.1** | **20dB Bandwidth** | |
|---|---|---|
| | Laboratory Ambient Temperature: | 23°C |
| | Relative Humidity: | 48% |
| | Atmospheric Pressure: | 1011 mbars |
| **Reference Standard(s):** | ☒ ANSI C63.10:2020, Section 11.8.2<br>☒ FCC Part 15.247/RSS 247<br>☒ KDB 558074 | **Measurement Point**<br>☒ Conducted<br>☐ Radiated |
| **Frequency Range:** | ☒ 2402.0-2480.0 MHz | RBW = 30KHz<br>VBW ≥ 3 x RBW |
| **Nominal Voltage:** | ☐ 120VAC ☒ 3.7VDC | |
| **Test Personnel:** | Yuriy Litvinov | **Date:** 06/20/2024 |

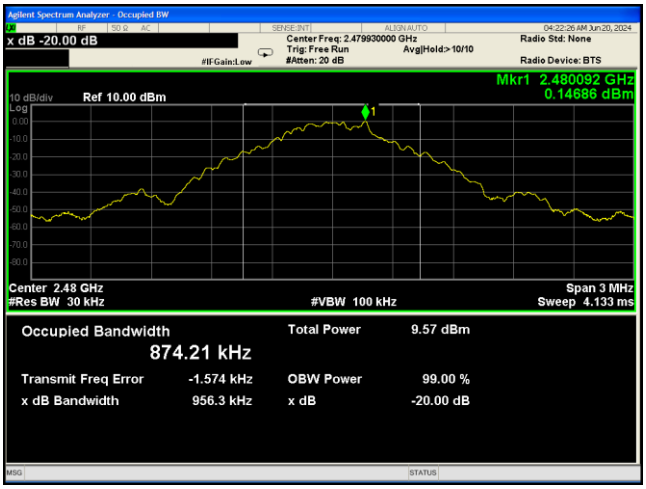
| Frequency (MHz) | Data Rate | Modulations | 99% Bandwidth (KHz) | 20dB Bandwidth (KHz) | Results |
|---|---|---|---|---|---|
| 2402 | 1 Mbps | GFSK | 837.5 | 956.1 | **pass** |
| 2441 | 1 Mbps | GFSK | 870.6 | 956.1 | **pass** |
| 2480 | 1 Mbps | GFSK | 874.2 | 956.3 | **pass** |
| 2402 | 3 Mbps | 8DPSK | 1188 | 1305 | **pass** |
| 2441 | 3 Mbps | 8DPSK | 1188 | 1306 | **pass** |
| 2480 | 3 Mbps | 8DPSK | 1187 | 1306 | **pass** |



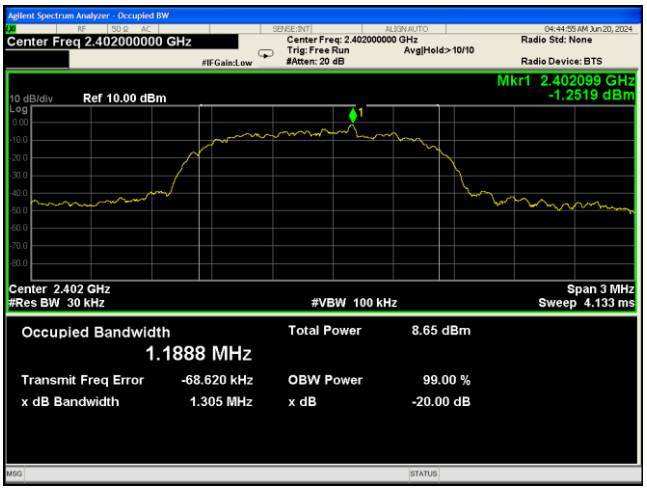

**OBW –Low Channel (1Mbps)**



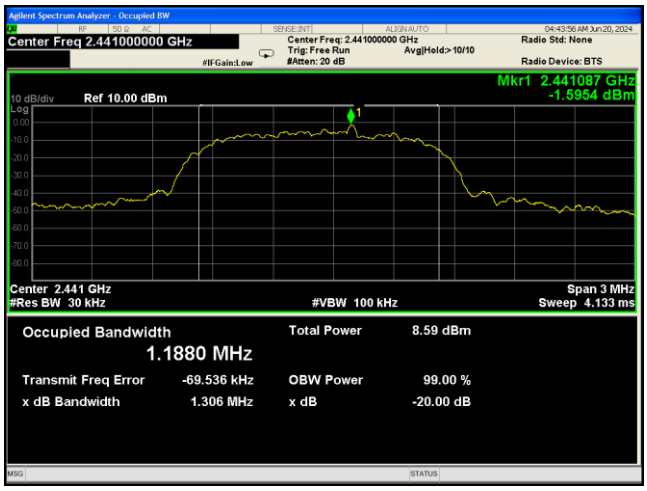

**OBW – Mid Channel (1Mbps)**



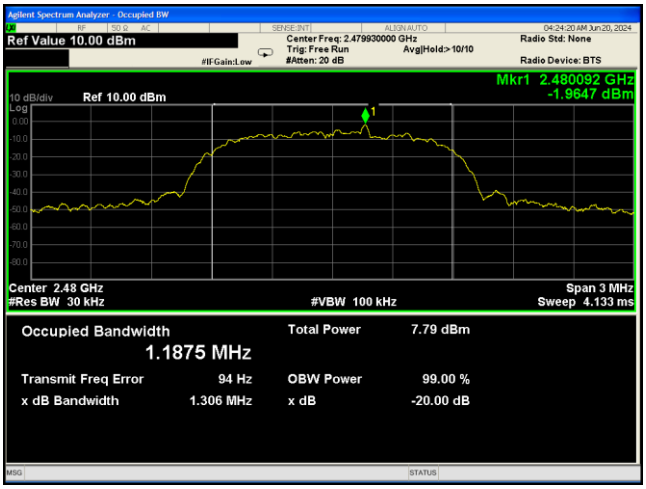

**OBW – High Channel (1Mbps)**




**OBW –Low Channel (3Mbps)**




**OBW – Mid Channel (3Mbps)**

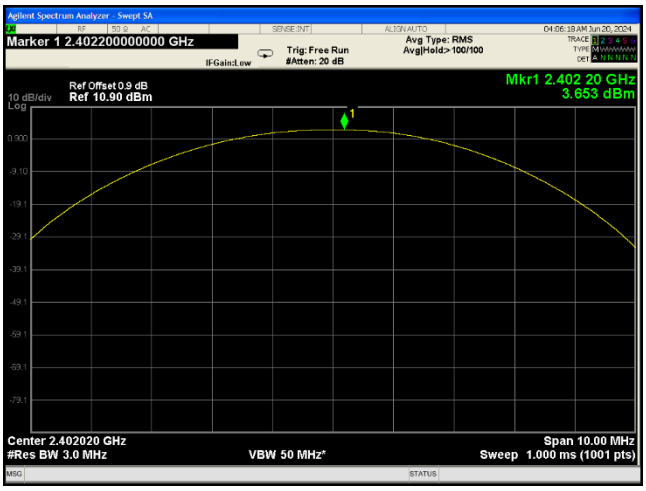



**OBW – High Channel (3Mbps)**

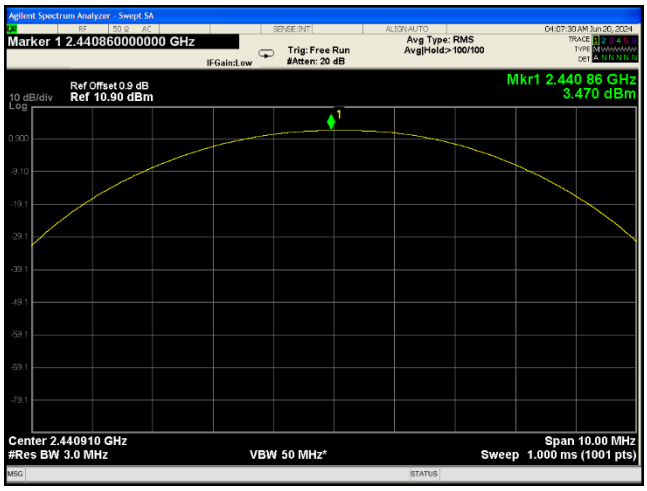
| **4.2** | **Maximum Output Power** | |
|---|---|---|
| **Method:** | Measurements was performed with CW carrier at the highest power level at which the transmitter is intended to operate. The analyzer offset was adjusted to compensate for the attenuator and other losses. | |
| | Laboratory Ambient Temperature: | 23°C |
| | Relative Humidity: | 48% |
| | Atmospheric Pressure: | 1011 mbars |
| **Reference Standard(s):** | ☒ ANSI C63.10:2020, Section 11.9<br>☒ FCC Part 15.247/RSS 247<br>☒ KDB 558074 | **Measurement Point**<br>☒ Conducted<br>☐ Radiated at 3 meters |
| **Frequency Range:** | ☒ 2402.0 – 2480.0 MHz | |
| **Antenna Gain:** | 1.35dBi | **Maximum RF Conducted Power:** |
| **Limit:** | 30 dBm | 4.0dBm |
| **Nominal Voltage:** | ☐ 120VAC ☒ 3.7VDC | |
| **Test Personnel:** | Yuriy Litvinov | **Date:** 06/20/2024 |

| **Note:** | EIRP (dBm) = Conducted Power (dBm) +Antenna Gain (dBi)= 4.0+1.35= 5.35dBm(3.4mW)<br>All modes of operation and data were investigated. The results shown represent the worst case. |
|---|---|

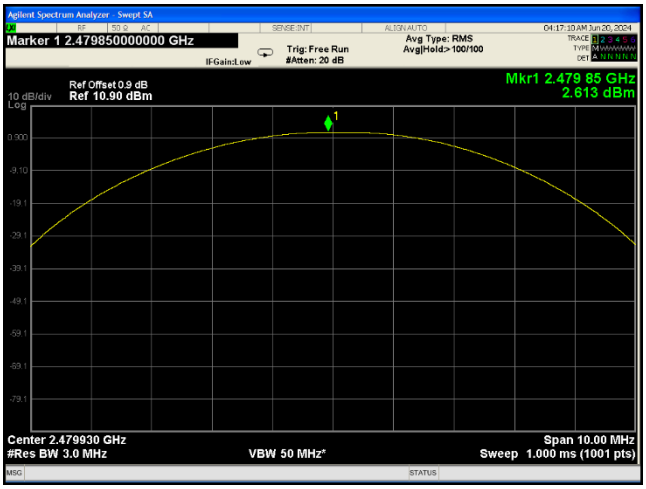
| Frequency (MHz) | Data Rate | Modulations | RMS Conducted Power (dBm) | Limit (dBm) | Results |
|---|---|---|---|---|---|
| 2402 | 1 Mbps | GFSK | 3.7 | 30 | **pass** |
| 2440 | 1 Mbps | GFSK | 3.5 | 30 | **pass** |
| 2480 | 1 Mbps | GFSK | 2.6 | 30 | **pass** |
| 2402 | 3 Mbps | 8DPSK | 4.0 | 30 | **pass** |
| 2440 | 3 Mbps | 8DPSK | 3.9 | 30 | **pass** |
| 2480 | 3 Mbps | 8DPSK | 3.0 | 30 | **pass** |



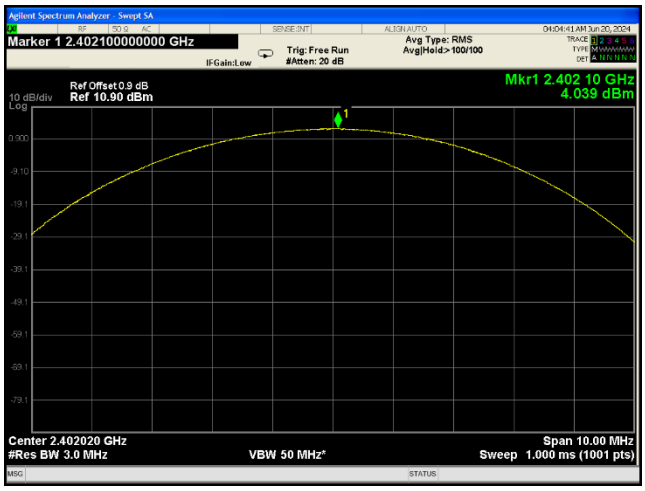

**RMS Power Low Channel (1Mbps)**



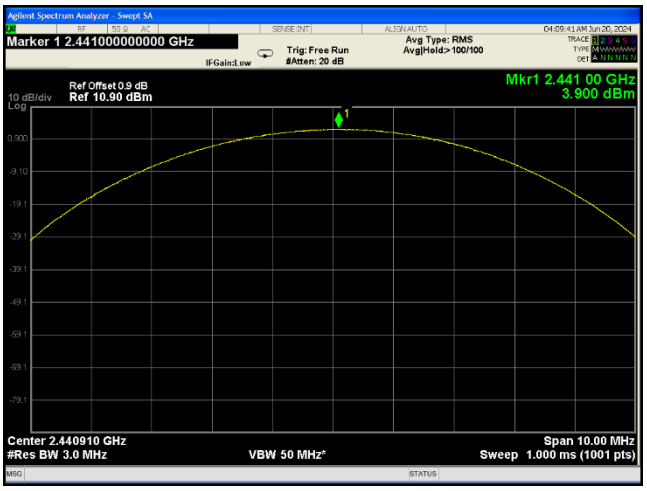

**RMS Power Mid Channel (1Mbps)**



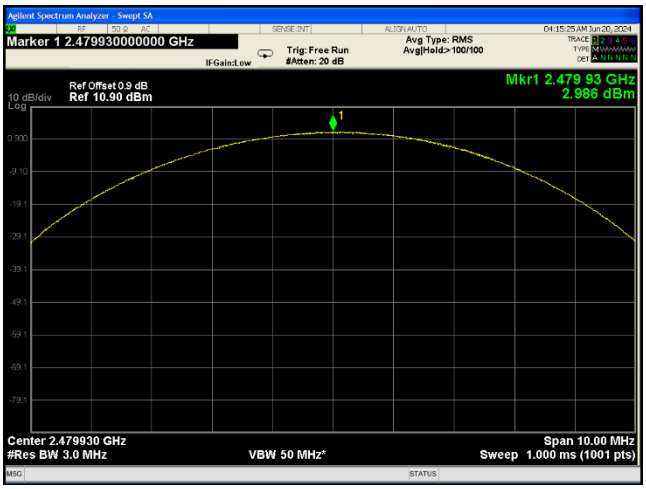

**RMS Power High Channel (1Mbps)**




**RMS Power Low Channel (3Mbps)**



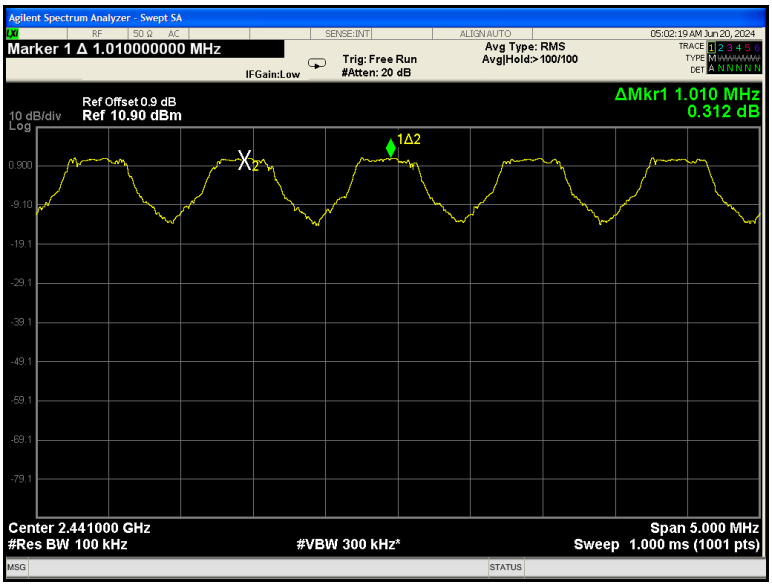

**RMS Power Mid Channel (3Mbps)**




**RMS Power High Channel (3Mbps)**

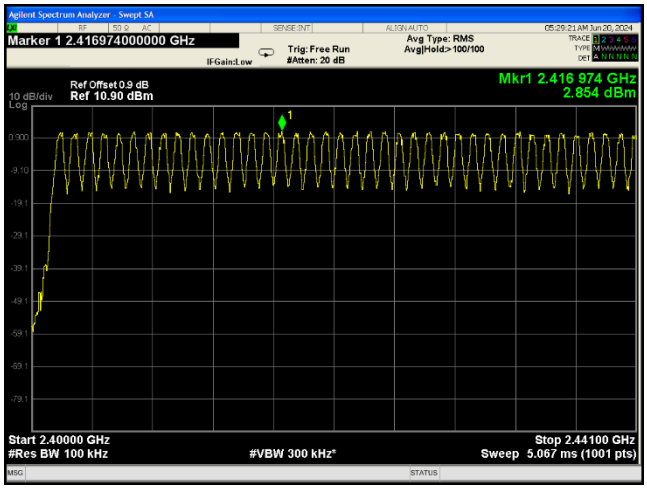
| **4.3** | **Carrier Frequency Separation** | |
|---|---|---|
| **Method:** | The measurements were made with transmitter set to transmit a continuously with hopping function enabled. | |
| | Laboratory Ambient Temperature: | 23°C |
| | Relative Humidity: | 48% |
| | Atmospheric Pressure: | 1011 mbars |
| **Reference Standard(s):** | ☒ ANSI C63.10:2020, Section 7.8<br>☒ FCC Part 15.247/RSS 247<br>☒ KDB 558074 | **Measurement Point**<br>☒ Conducted<br>☐ Radiated<br>☐ |
| **Frequency Range:** | ☒ 2402-2480MHz | |
| **Antenna Gain:** | ☒ 1.35dBi | **Result** |
| **Limit:** | ☐ >25KHz<br>☒ >2/3 the value of the 20dB Bandwidth<br>☐ | 1.010MHz |
| **Nominal Voltage:** | ☐ 230VAC ☒ 3.7VDC | |
| **Test Personnel:** | Yuriy Litvinov | **Date:** 06/20/2024 |

| **Note:** | The EUT complies with the minimum channel separation requirement when it is operating in 1x/EDR mode using 79 channels.<br>All modes of operation and data were investigated. The results shown represent the worst case. |
|---|---|

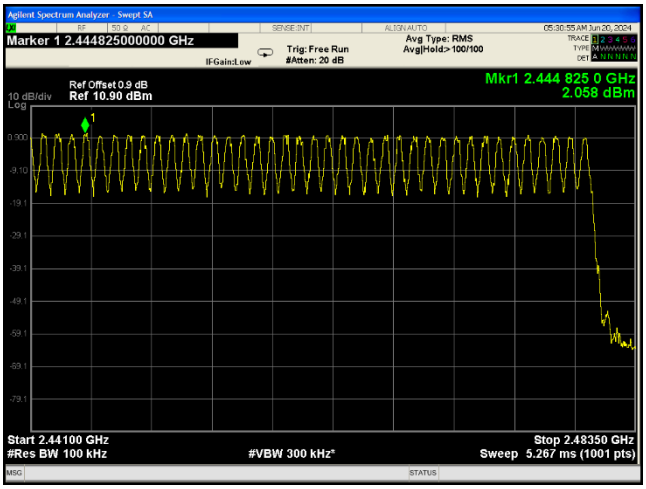


| **4.4** | **Number of Hopping Frequencies** | |
|---|---|---|
| **Method:** | The measurements were made with transmitter set to transmit a continuously with hopping function enabled. | |
| | Laboratory Ambient Temperature: | 23°C |
| | Relative Humidity: | 48% |
| | Atmospheric Pressure: | 1011 mbars |
| **Reference Standard(s):** | ☒ ANSI C63.10:2020, Section 7.8<br>☒ FCC Part 15.247/RSS 247<br>☒ KDB 558074 | **Measurement Point**<br>☒ Conducted<br>☐ Radiated |
| **Frequency Range:** | ☒ 2402.0 – 2480.0 MHz | |
| **Antenna Gain:** | 1.35dBi | **Result** |
| **Limit:** | ☒ >75 Hopping Channels | 79 |
| **Nominal Voltage:** | ☐ 120VAC ☒ 3.7VDC | |
| **Test Personnel:** | Yuriy Litvinov | **Date:** 06/20/2024 |

| **Note:** | The frequency spectrum was broken up into two subranges to clearly show all the hopping frequencies. |
|---|---|



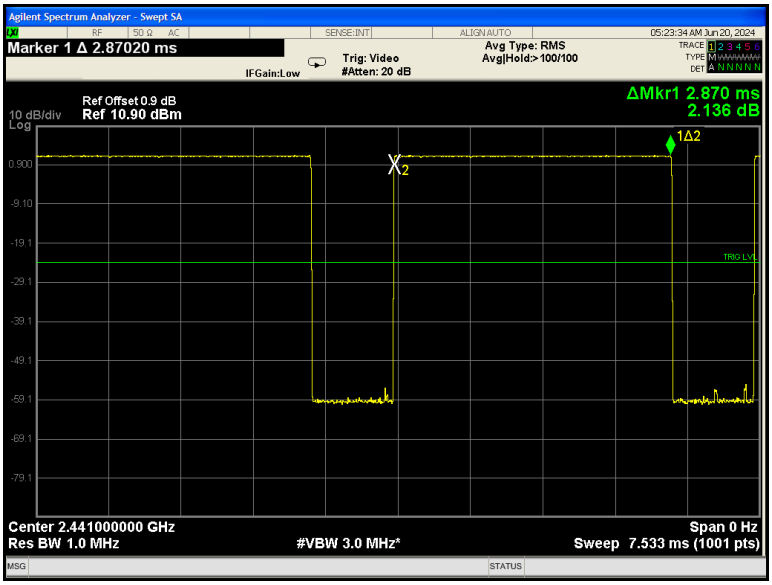

**Low End Spectrum**




**High End Spectrum**

| **4.5** | **Time of Occupancy** | |
|---|---|---|
| **Method:** | The measurements were made with transmitter set to transmit a continuously with hopping function enabled. | |
| | Laboratory Ambient Temperature: | 23°C |
| | Relative Humidity: | 48% |
| | Atmospheric Pressure: | 1011 mbars |
| **Reference Standard(s):** | ☒ ANSI C63.10:2020, Section 7.8<br>☒ FCC Part 15.247/RSS 247<br>☒ KDB 558074 | **Measurement Point**<br>☒ Conducted<br>☐ Radiated |
| **Frequency Range:** | ☒ 2402.0 – 2480.0 MHz | |
| **Antenna Gain:** | 1.35dBi | **Result** |
| **Limit (dwell time):** | ☒ <0.4 sec within a period of 0.4 sec x *N* hopping channels | 306ms/channel |
| **Nominal Voltage:** | ☐ 120VAC ☒ 3.7VDC | |
| **Test Personnel:** | Yuriy Litvinov | **Date:** 02/07/2024 |

| **Note:** | Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600hops/s. Since 1x/EDR use 5 transmit and 1 receive slot the actual hopping rate 1600/6=266.67 hops/slot.<br>○ 400ms x 79 channels=31.6 (Time of Occupancy).<br>○ Worst case BT has 266.67 hops/second 1x/(EDR modes DH5 operation).<br>○ 266.67/79 = 3.38 hops/second (#of hops/second on one channel).<br>○ 3.38 x 31.6=106.67 (#hops over a 31.6 second period).<br>○ 106.67x 2.87 /channel=306ms (worst case dwell time for one channel in 1x/EDR) |
|---|---|



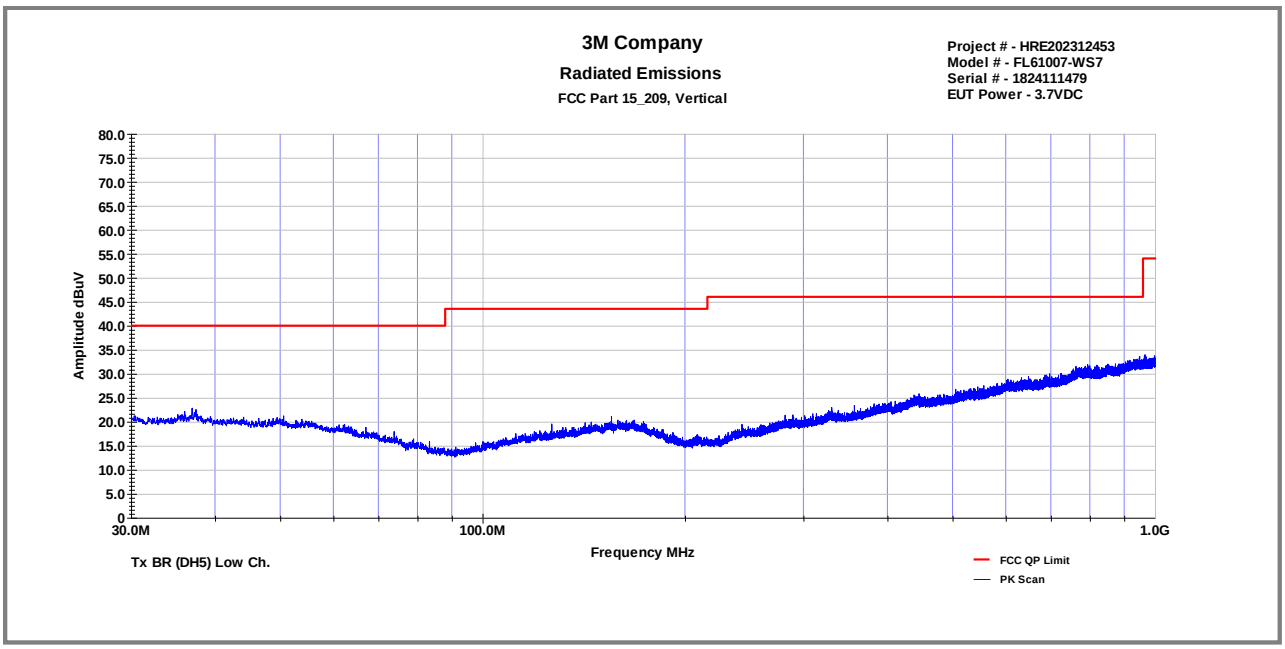
| **4.6** | **Radiated Emissions in restricted band** |
|---|---|
| **Method:** | Measurements were made in a 3-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4 standards.<br>EUT was rotated through three orthogonal axes to determine which attitude (orientation) and arrangement produces the highest emission relative to the limit; the attitude and device arrangement that produces the highest emission relative to the limit was used in making final radiated emission measurements. Spurious Radiated emissions measurements ware performed with external preamp and a high pass filter. Final measurements were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. |

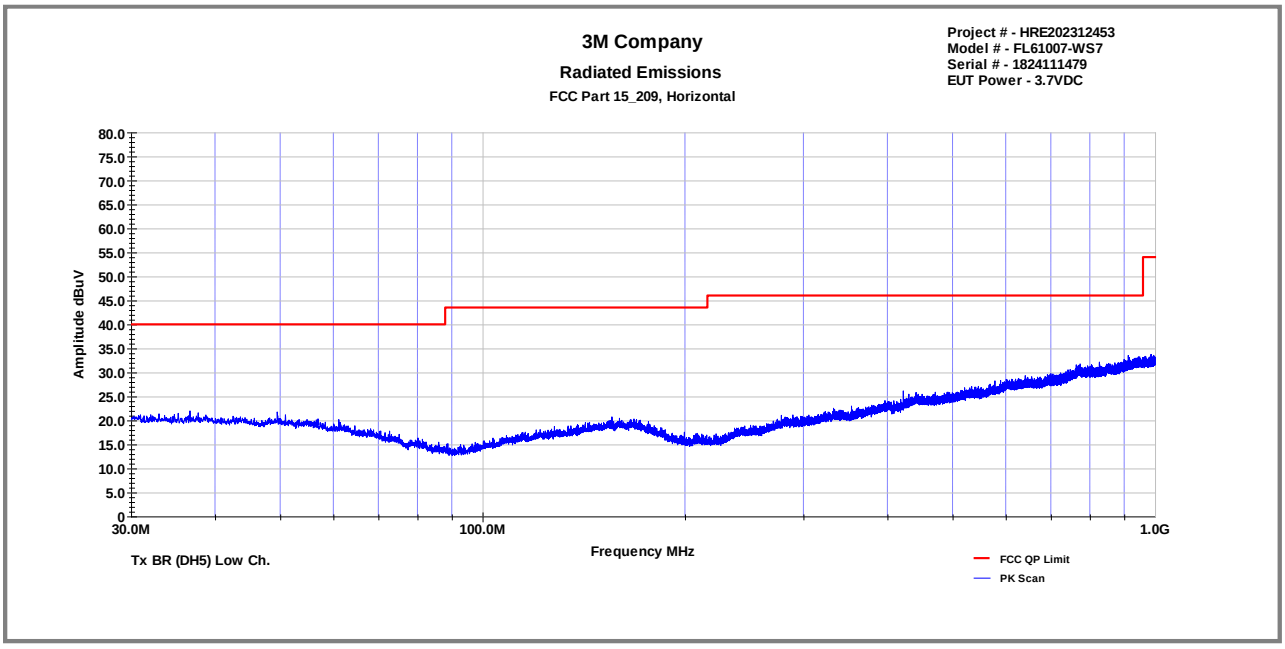
| | | |
|---|---|---|
| **Test Verification:** ☒ | Laboratory Ambient Temperature: | 23°C |
| | Relative Humidity: | 55% |
| | Atmospheric Pressure: | 1011 mbars |
| **Reference Standard(s):** | ☒ ANSI C63.10:2020, Section 11.12.1<br>☒ FCC Part 15.205/15.209/RSS Gen (8.9)<br>☒ KDB 558074 | **Measurement Distance**<br>☒ 3 Meters ☐ |
| **Frequency Range:** | ☒ 30 MHz to 1 GHz | RBW = 100KHz, VBW ≥ 3 x RBW |
| | ☒ 1 GHz to 25 GHz | RBW = 1MHz, VBW ≥ 3 x RBW |
| **Nominal Voltage:** | ☐ 120VAC ☒ 3.7VDC | |
| **Test Personnel:** | Keith Schwartz KS | **Date:** 06/19/2024 |

**Limits –15.209 and RSS Gen**

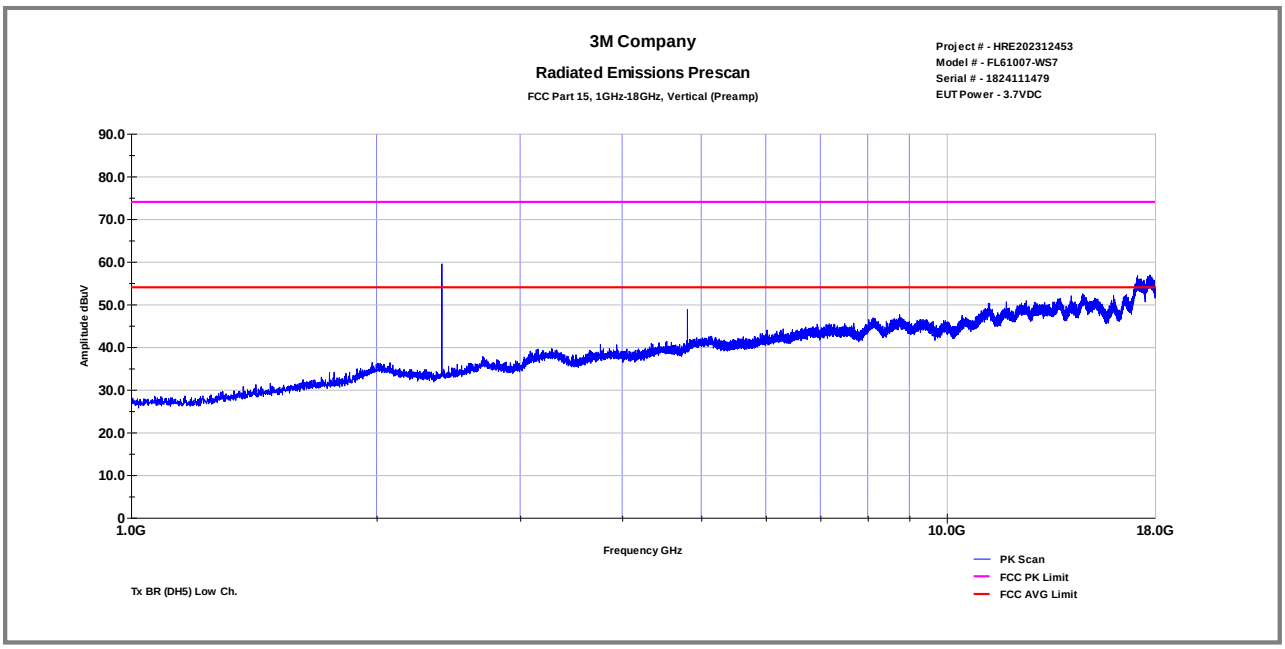
| Frequency (MHz) | Limit dB (µV/m) | | | | |
|---|---|---|---|---|---|
| | Quasi-Peak | Average | Peak | Distance | Results |
| 0.009-0.490 | | 2400/F(KHz) | | 300 | **N/A** |
| 0.490-1.705 | 24000/F(KHz) | | | 30 | **N/A** |
| 1.705-30 | 30 | | | 30 | **N/A** |
| 30 to 88 | 40 | | | 3 | **pass** |
| 88 to 216 | 43.5 | | | 3 | **pass** |
| 216 to 960 | 46 | | | 3 | **pass** |
| Above 960 | | 54 | 74 | 3 | **pass** |

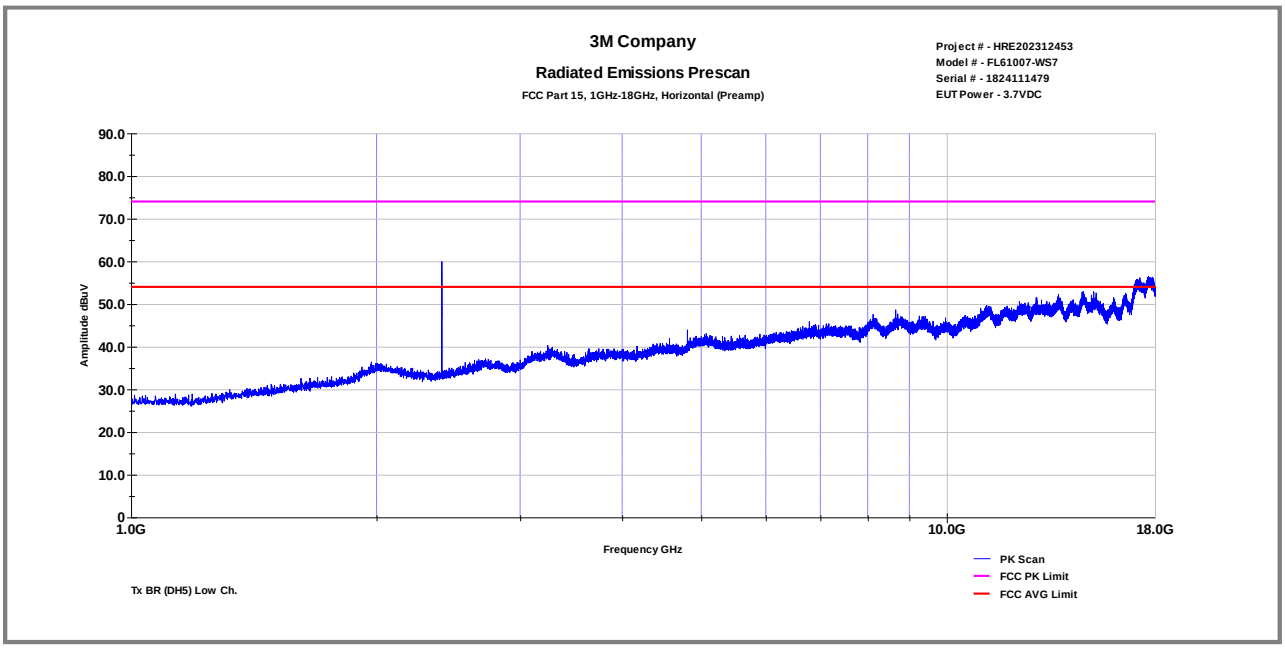
| **Modifications:** | |
|---|---|
| **Note:** | The lower limit applies at the transition frequency. An inverse proportionality factor of 20 dB per decade has been used to normalize the measured data to the specified distance for determining compliance.<br>All modes of operation and data were investigated. The results shown represent the worst case.<br>No radiated spurious emissions were detected above 18GHz<br>For emission in the restricted bands, the limit of 15.209 was used.<br>There are no emissions were detected in the 15.205 restricted band within 30dB below 15.209 limit adjacent or nearby to 2400-2483.5MHz frequency band during operation at the high channel. |



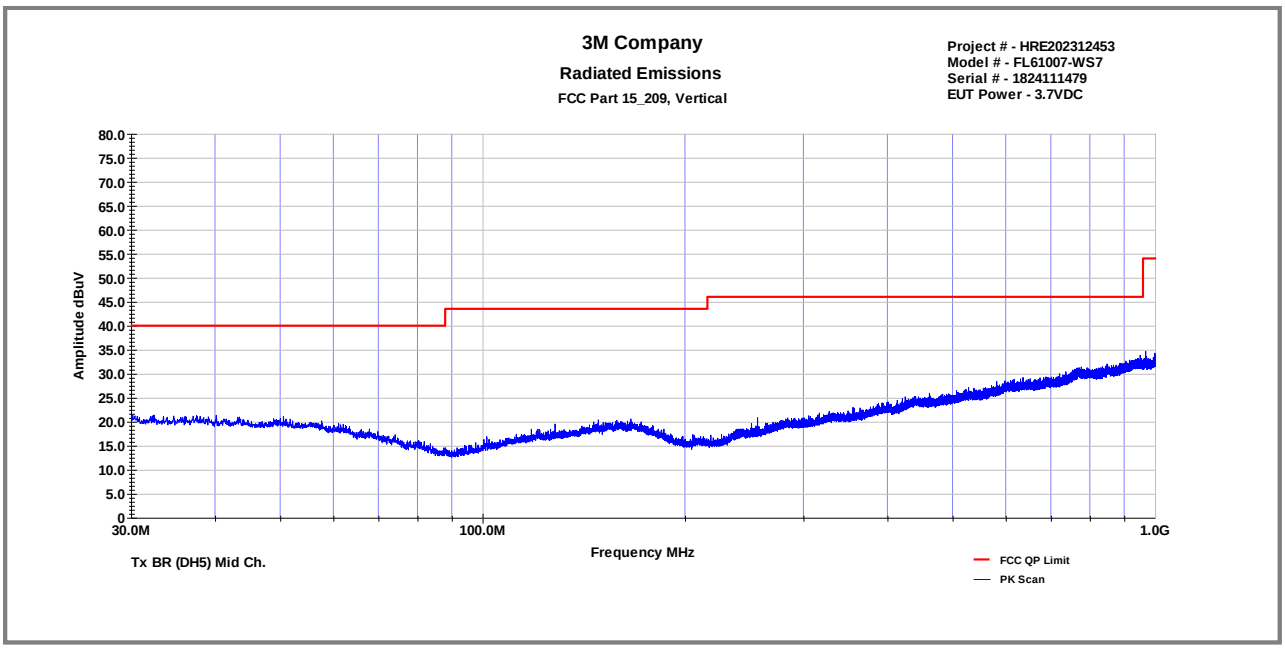



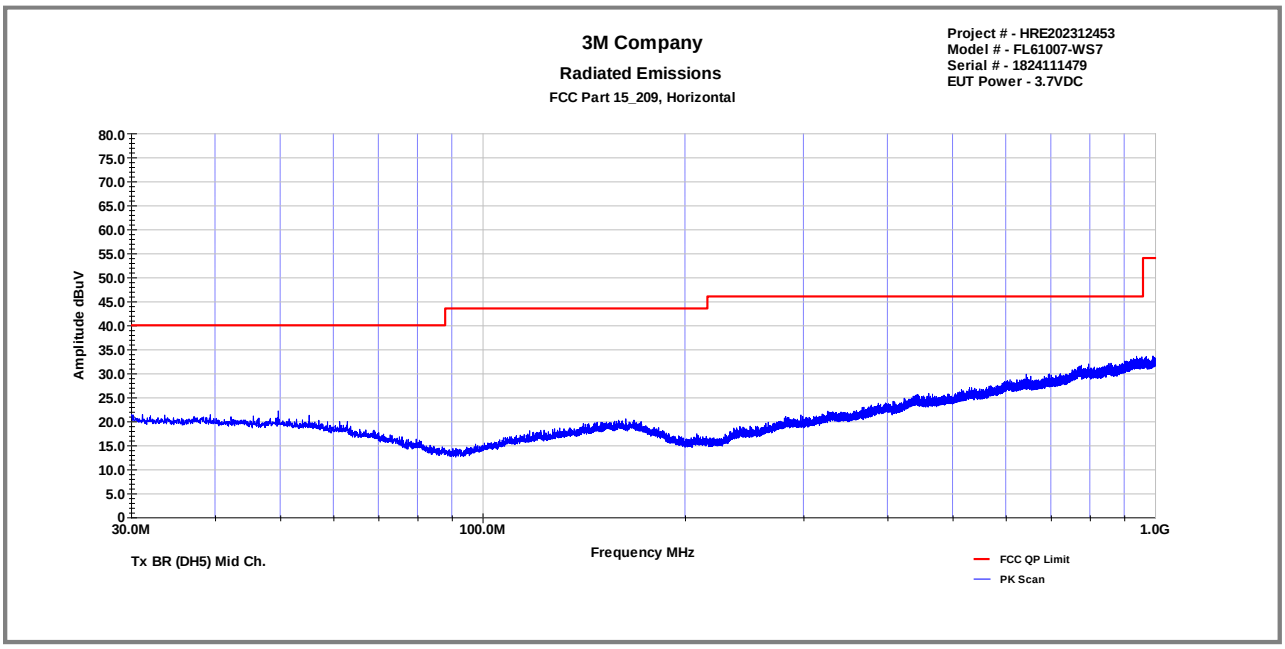

FCC Part 15.209 Radiated Emissions in restricted band – Low Channel (DH5)



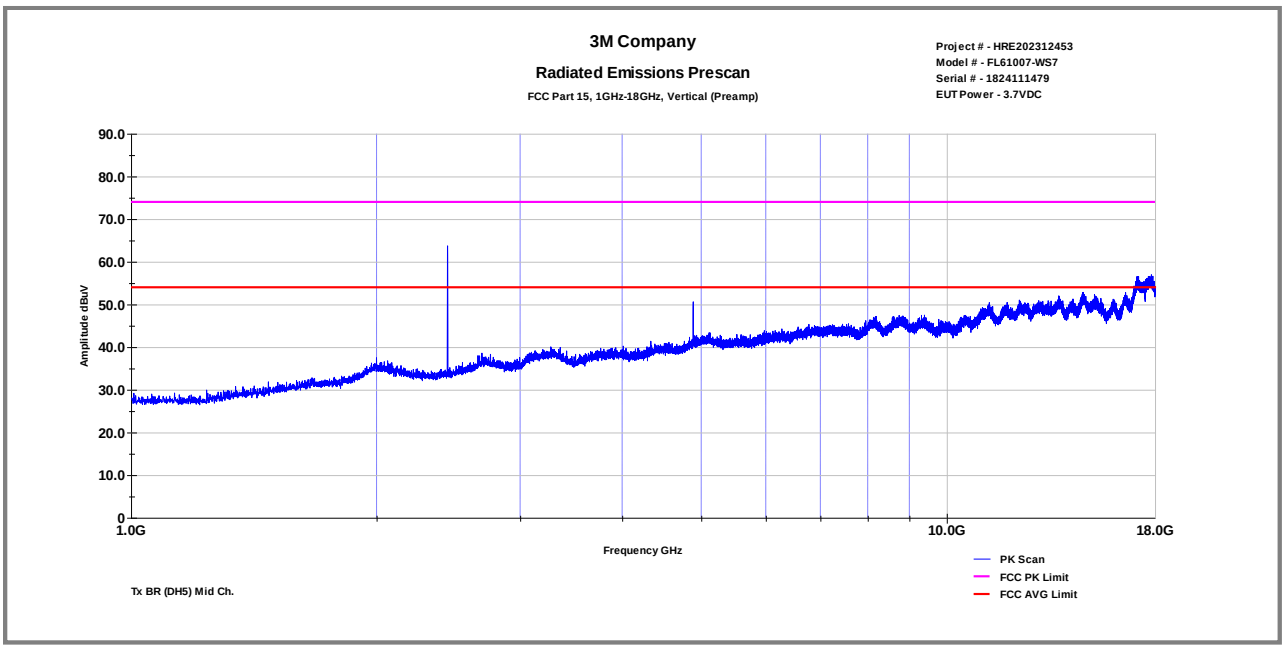



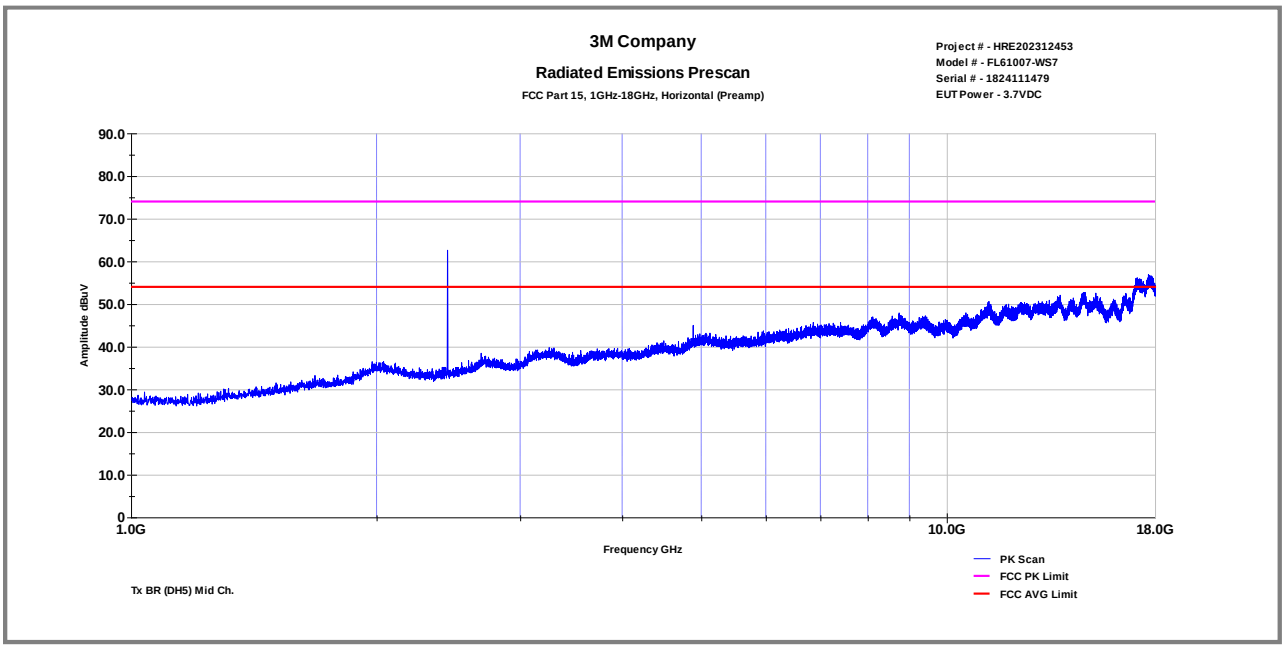

FCC Part 15.209 Radiated Emissions in restricted band – Low Channel (DH5)



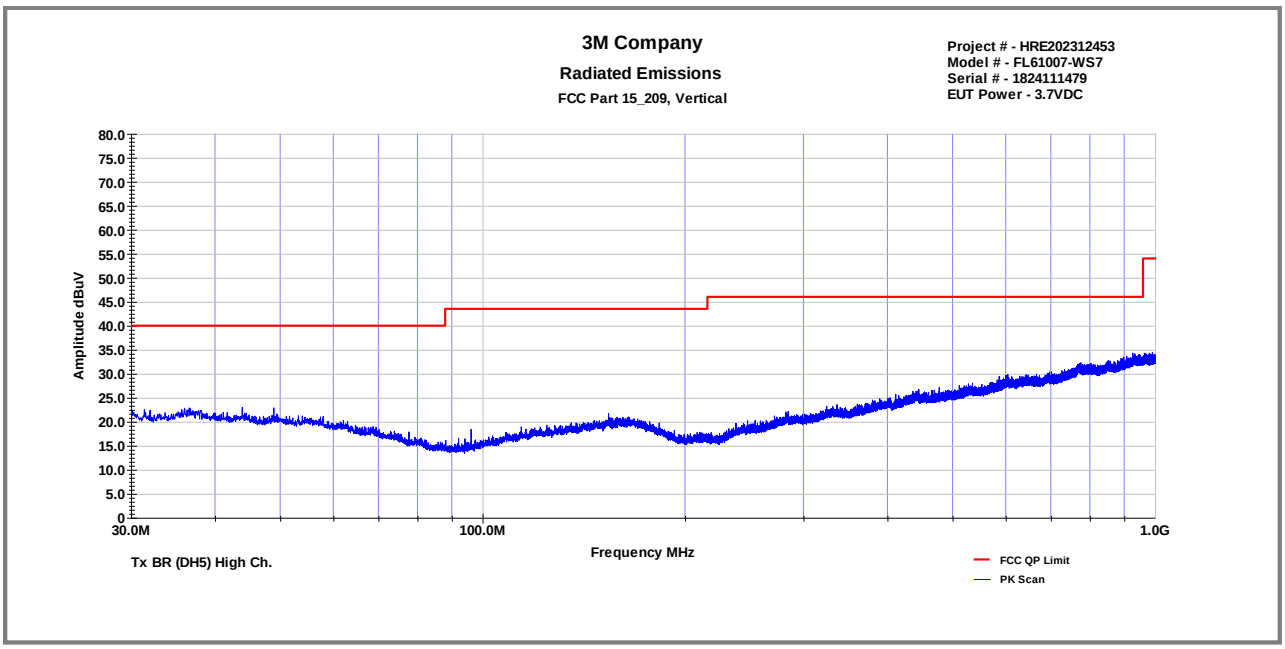



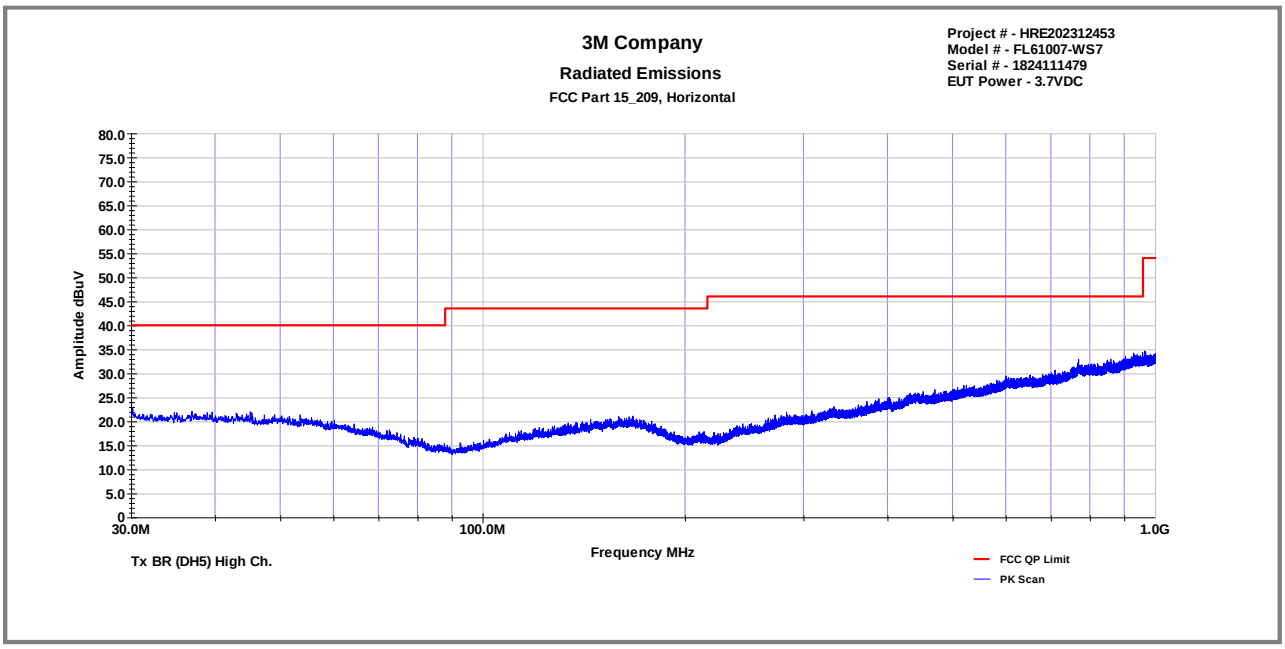

FCC Part 15.209 Radiated Emissions in restricted band – Mid Channel (DH5)



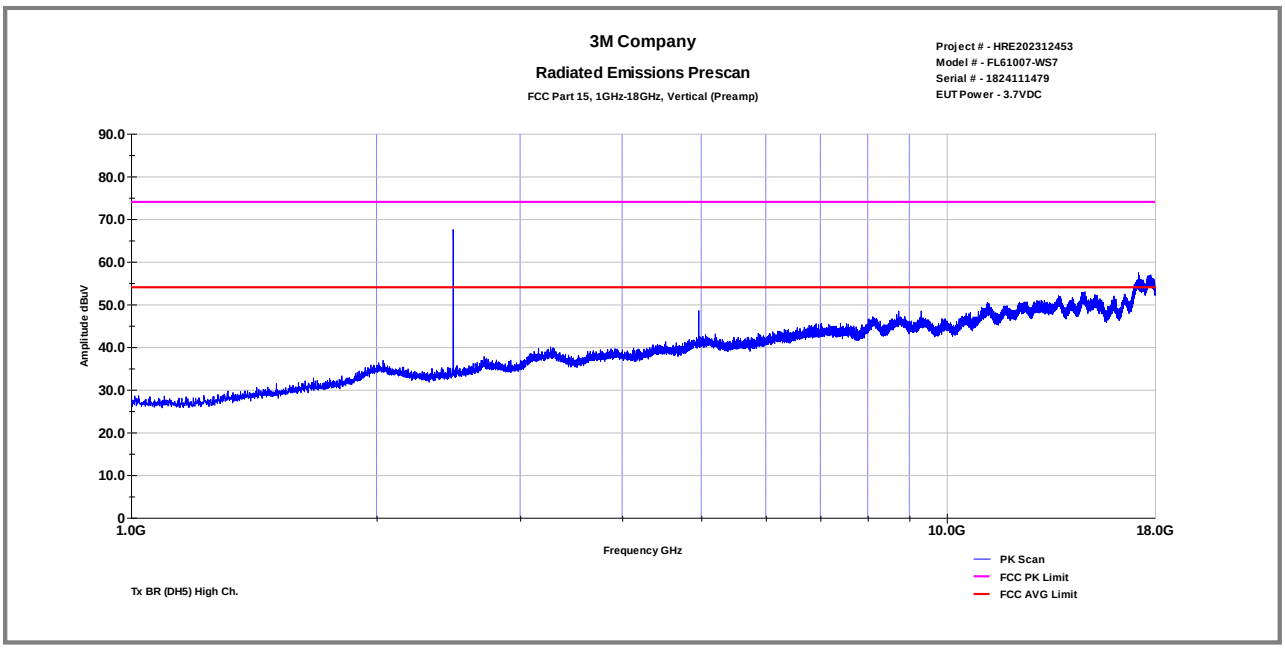



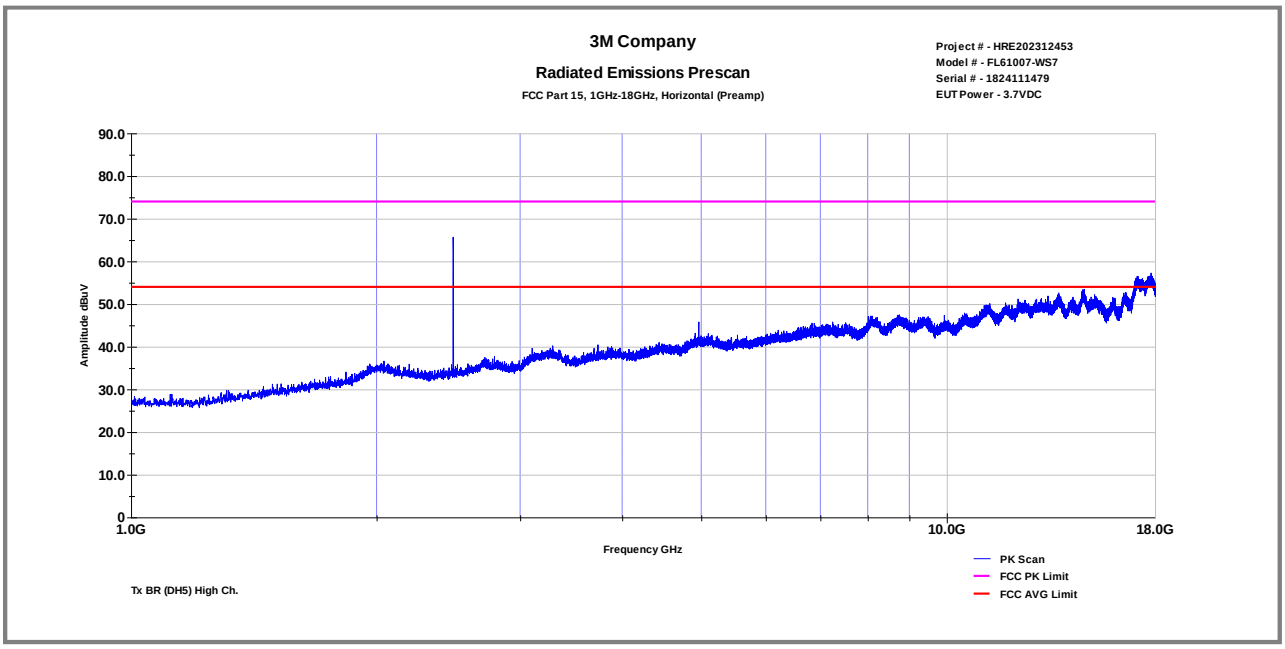

FCC Part 15.209 Radiated Emissions in restricted band – Mid Channel (DH5)




FCC Part 15.209 Radiated Emissions in restricted band – High Channel (DH5)




FCC Part 15.209 Radiated Emissions in restricted band – High Channel (DH5)

## Tables - Radiated Emissions in restricted band

| Frequency (MHz) | Pol. | QP Reading dBµV/m | Total CF dB | Net at 3 m dBµV/m | Limit (dBµV/m) | Margin dB |
|---|---|---|---|---|---|---|
| 37.07 | V | 3.7 | 17 | 20.8 | 40 | -19.2 |
| 50.03 | H | 2.5 | 18.3 | 20.8 | 40 | -19.2 |
| 125.69 | H | 2.1 | 16 | 18.1 | 43.5 | -25.4 |
| 154.79 | H | 2.1 | 18.2 | 20.3 | 43.5 | -23.2 |
| 421.31 | H | 2.9 | 21.7 | 24.6 | 46 | -21.4 |
| 793.11 | H | 3 | 28.6 | 31.7 | 46 | -14.3 |
| **Notes:** | Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB)<br>Low Channel-DH5 | | | | | |

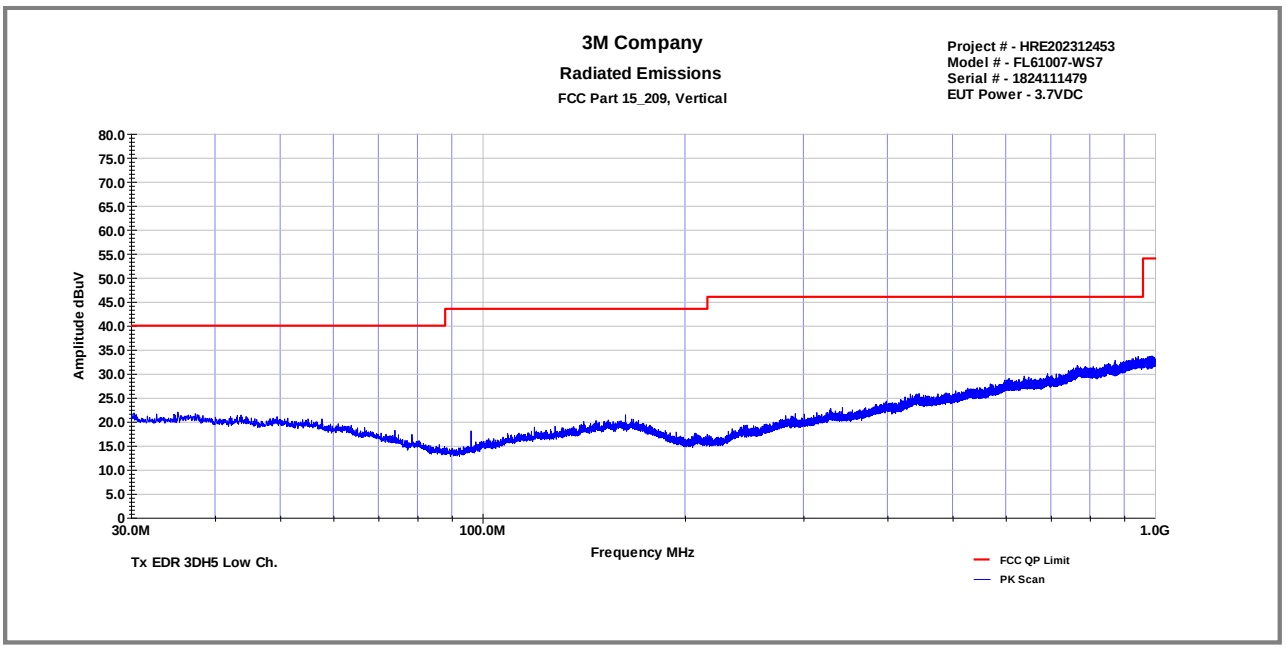
| Frequency (MHz) | Pol. | QP Reading dBµV/m | Total CF dB | Net at 3 m dBµV/m | Limit (dBµV/m) | Margin dB |
|---|---|---|---|---|---|---|
| 39.44 | V | 3.3 | 17.4 | 20.7 | 40 | -19.3 |
| 49.43 | H | 2.5 | 18.3 | 20.8 | 40 | -19.2 |
| 54.92 | H | 2.3 | 18.2 | 20.5 | 40 | -19.5 |
| 165.17 | H | 2.3 | 18.1 | 20.4 | 43.5 | -23.1 |
| 776.96 | H | 3.1 | 28.4 | 31.6 | 46 | -14.4 |
| 966.89 | H | 3.4 | 30.3 | 33.7 | 54 | -20.3 |
| **Notes:** | Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB)<br>Mid Channel-DH5 | | | | | |

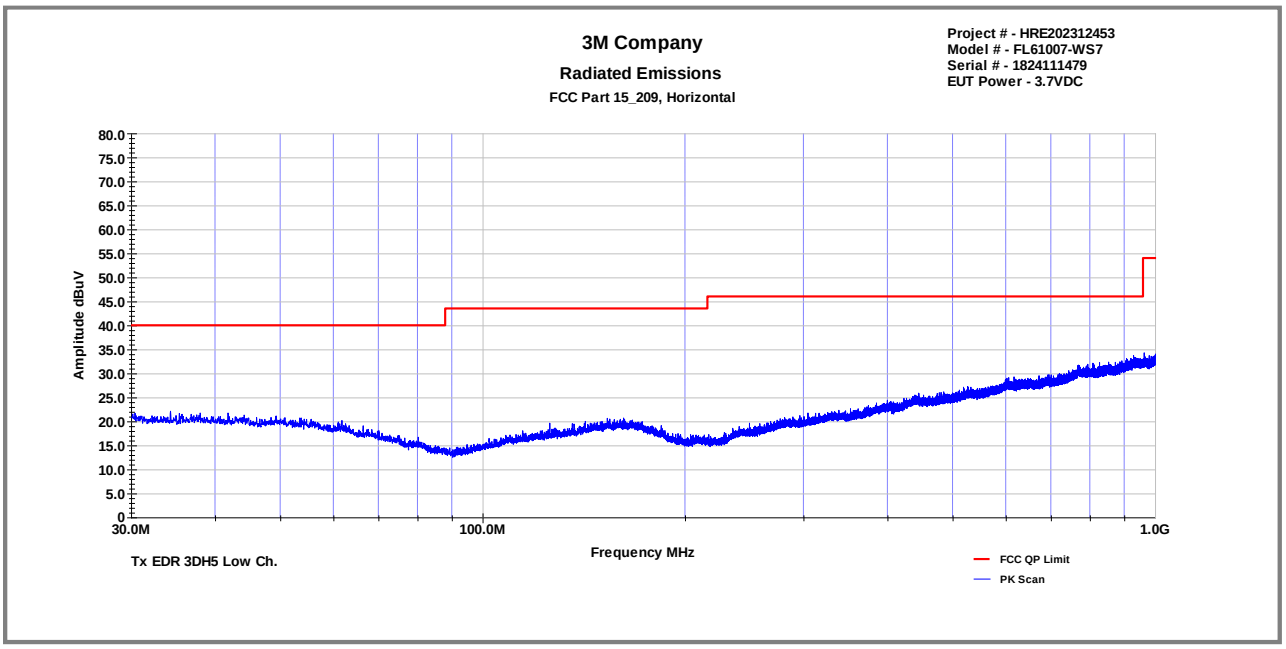
| Frequency (MHz) | Pol. | QP Reading dBµV/m | Total CF dB | Net at 3 m dBµV/m | Limit (dBµV/m) | Margin dB |
|---|---|---|---|---|---|---|
| 37.07 | H | 4.1 | 17 | 21.2 | 40 | -18.8 |
| 44.78 | V | 3.2 | 17.9 | 21.1 | 40 | -18.9 |
| 49.43 | H | 2.8 | 18.3 | 21.1 | 40 | -18.9 |
| 477.35 | V | 3 | 23 | 25.9 | 46 | -20.1 |
| 599.51 | V | 3.8 | 25.5 | 29.2 | 46 | -16.8 |
| 769.57 | H | 3.3 | 28.4 | 31.7 | 46 | -14.3 |
| **Notes:** | Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB)<br>High Channel-DH5 | | | | | |

| Pol | Frequency (MHz) | Peak dBµV/m | AVG dBµV/m | Total CF dB | Net Peak dBµV/m | Net AVG dBµV/m | PK Limit dBµV/m | AVE Limit dBµV/m | PK Margin dB | AVG Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| V | 3689.40 | 50.39 | 39.0 | -9.85 | 40.54 | 29.11 | 74.00 | 54.00 | -33.46 | -24.89 |
| H | 3689.40 | 49.85 | 39.0 | -9.85 | 40.00 | 29.13 | 74.00 | 54.00 | -34.00 | -24.87 |
| V | 4802.90 | 56.38 | 53.6 | -6.36 | 50.02 | 47.25 | 74.00 | 54.00 | -23.98 | -6.75 |
| H | 4802.90 | 53.03 | 47.1 | -6.36 | 46.67 | 40.72 | 74.00 | 54.00 | -27.33 | -13.28 |
| V | 8099.70 | 47.75 | 36.8 | 0.10 | -0.08 | 36.88 | 74.00 | 54.00 | -74.08 | -17.12 |
| H | 8099.70 | 48.85 | 36.8 | 0.10 | -0.08 | 36.94 | 74.00 | 54.00 | -74.08 | -17.06 |
| V | 9607.00 | 50.04 | 43.2 | -0.23 | -0.22 | 42.99 | 74.00 | 54.00 | -74.22 | -11.01 |
| H | 9607.00 | 50.22 | 43.7 | -0.23 | -0.22 | 43.49 | 74.00 | 54.00 | -74.22 | -10.51 |
| **Notes:** | | Net Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB)) | | | | | | | | |
| | | Low Channel-DH5 | | | | | | | | |

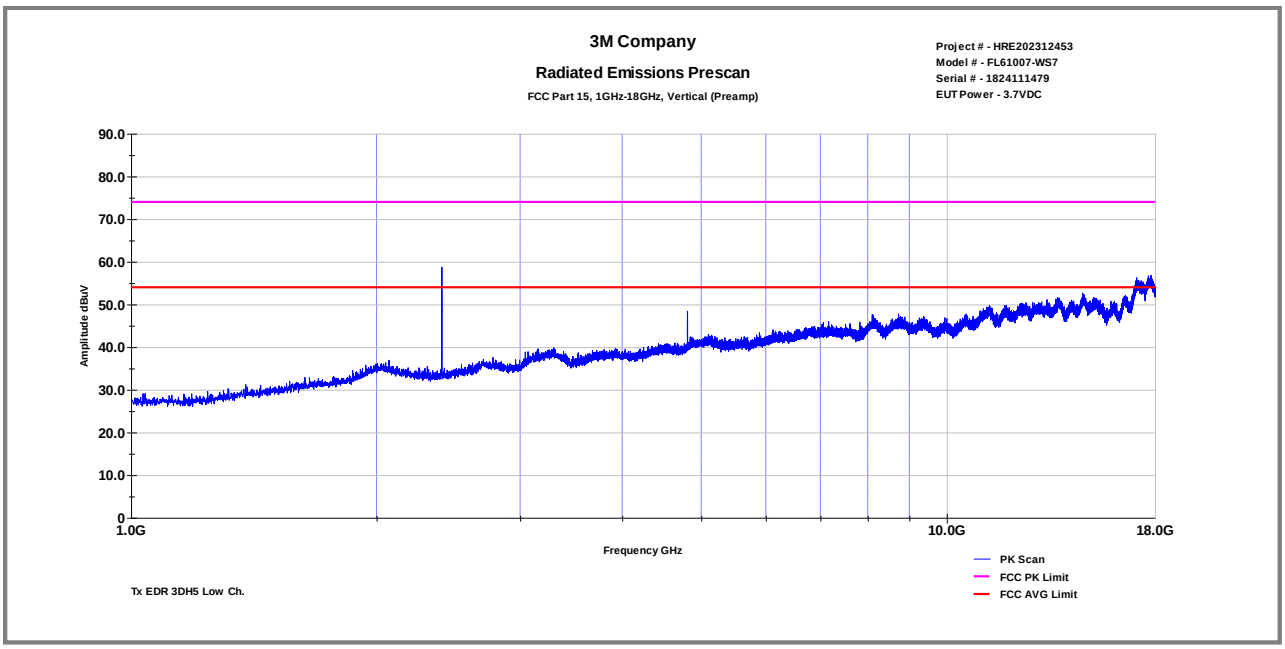
| Pol | Frequency (MHz) | Peak dBµV/m | AVG dBµV/m | Total CF dB | Net Peak dBµV/m | Net AVG dBµV/m | PK Limit dBµV/m | AVE Limit dBµV/m | PK Margin dB | AVG Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| V | 4882.00 | 56.70 | 52.8 | -5.30 | 51.40 | 47.54 | 74.00 | 54.00 | -22.60 | -6.46 |
| H | 4882.00 | 52.72 | 47.0 | -5.30 | 47.42 | 41.65 | 74.00 | 54.00 | -26.58 | -12.35 |
| V | 7322.60 | 49.59 | 40.2 | -2.01 | 47.58 | 38.17 | 74.00 | 54.00 | -26.42 | -15.83 |
| H | 7322.60 | 49.01 | 39.4 | -2.01 | 47.00 | 37.42 | 74.00 | 54.00 | -27.00 | -16.58 |
| V | 9763.50 | 49.81 | 41.3 | -0.16 | 49.65 | 41.11 | 74.00 | 54.00 | -24.35 | -12.89 |
| H | 9763.50 | 49.95 | 41.5 | -0.16 | 49.79 | 41.33 | 74.00 | 54.00 | -24.21 | -12.67 |
| **Notes:** | | Net Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB)) | | | | | | | | |
| | | Mid Channel-DH5 | | | | | | | | |

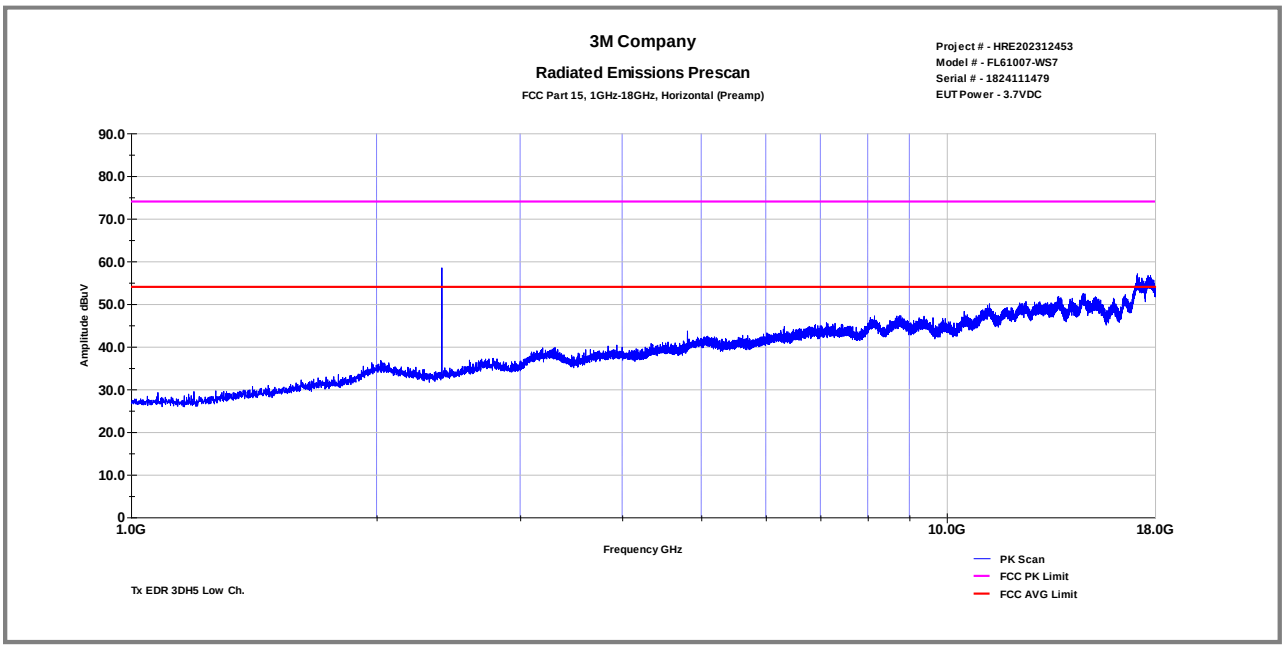
| Pol | Frequency (MHz) | Peak dBµV/m | AVG dBµV/m | Total CF dB | Net Peak dBµV/m | Net AVG dBµV/m | PK Limit dBµV/m | AVE Limit dBµV/m | PK Margin dB | AVG Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| V | 2705.90 | 51.66 | 40.0 | -12.21 | 39.45 | 27.81 | 74.00 | 54.00 | -34.55 | -26.19 |
| H | 2705.90 | 51.53 | 39.8 | -12.21 | 39.32 | 27.62 | 74.00 | 54.00 | -34.68 | -26.38 |
| V | 4959.30 | 55.65 | 51.5 | -5.17 | 50.48 | 46.34 | 74.00 | 54.00 | -23.52 | -7.66 |
| H | 4959.30 | 52.45 | 46.8 | -5.17 | 47.28 | 41.67 | 74.00 | 54.00 | -26.72 | -12.33 |
| V | 7439.40 | 50.21 | 41.6 | -1.69 | 48.52 | 39.95 | 74.00 | 54.00 | -25.48 | -14.05 |
| H | 7439.40 | 49.84 | 40.6 | -1.69 | 48.15 | 38.92 | 74.00 | 54.00 | -25.85 | -15.08 |
| V | 9919.30 | 49.87 | 40.3 | 0.35 | 50.22 | 40.61 | 74.00 | 54.00 | -23.78 | -13.39 |
| H | 9919.30 | 50.83 | 42.5 | 0.35 | 51.18 | 42.88 | 74.00 | 54.00 | -22.82 | -11.12 |
| **Notes:** | | Net AVG VBW>1/T=2KHz Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB)) | | | | | | | | |
| | | High Channel-DH5 | | | | | | | | |



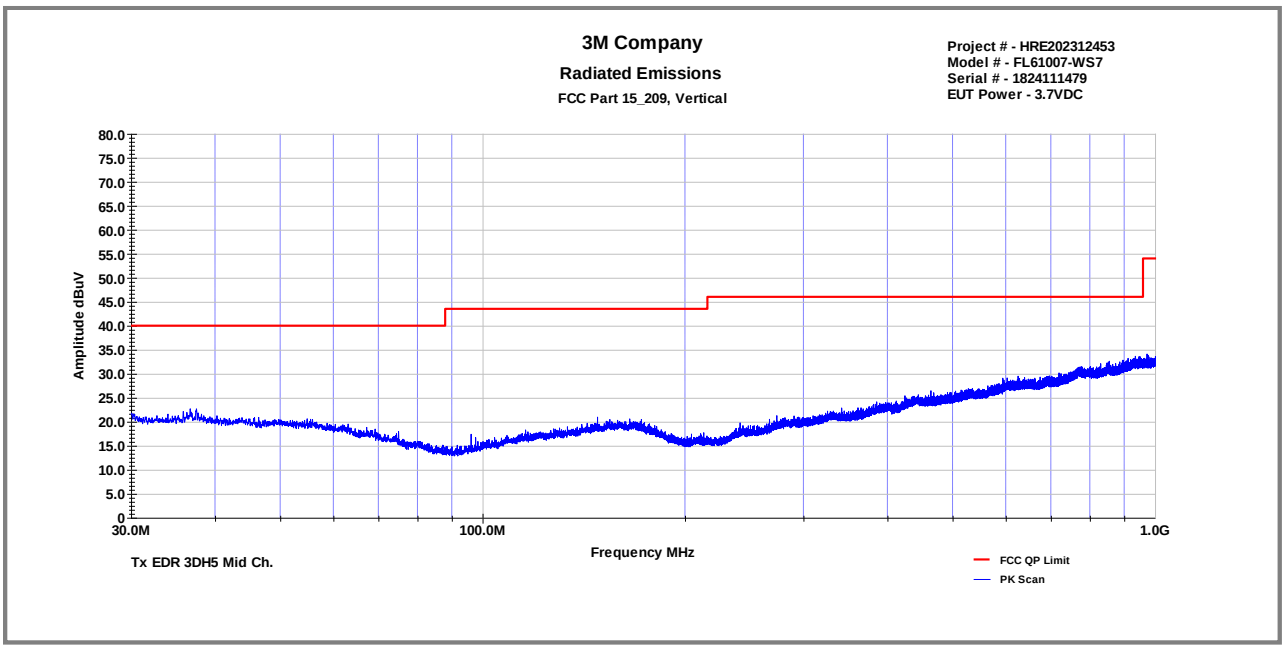



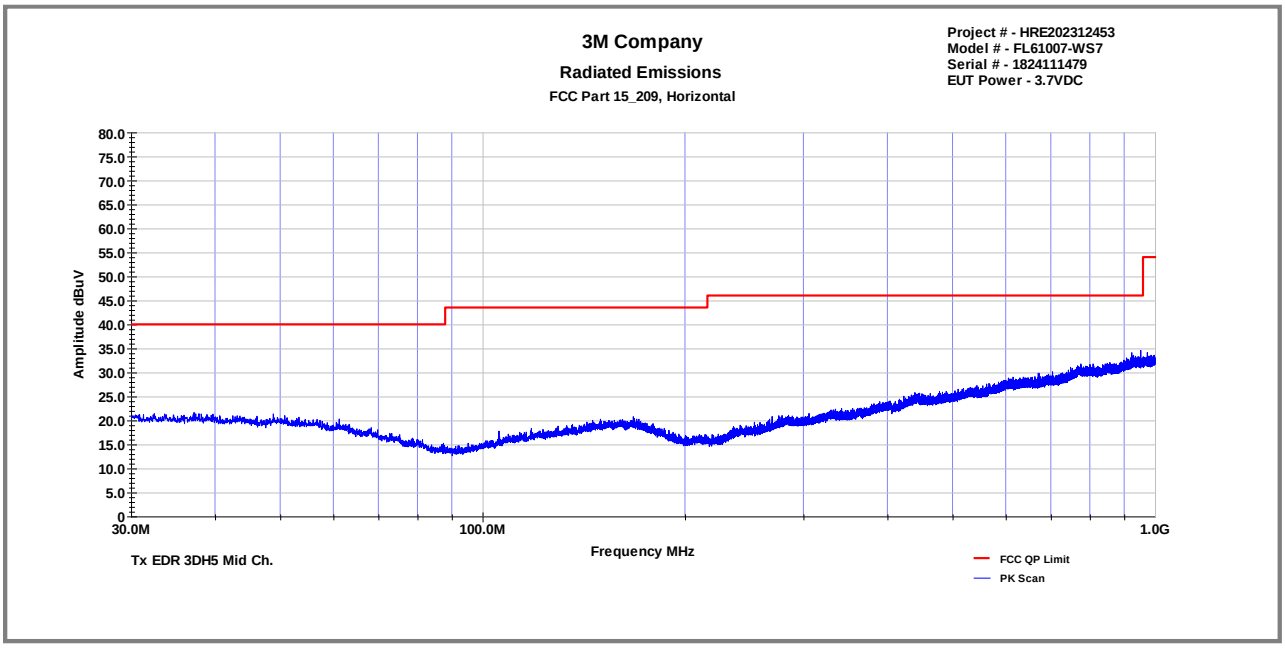

FCC Part 15.209 Radiated Emissions in restricted band – Low Channel (3-DH5)



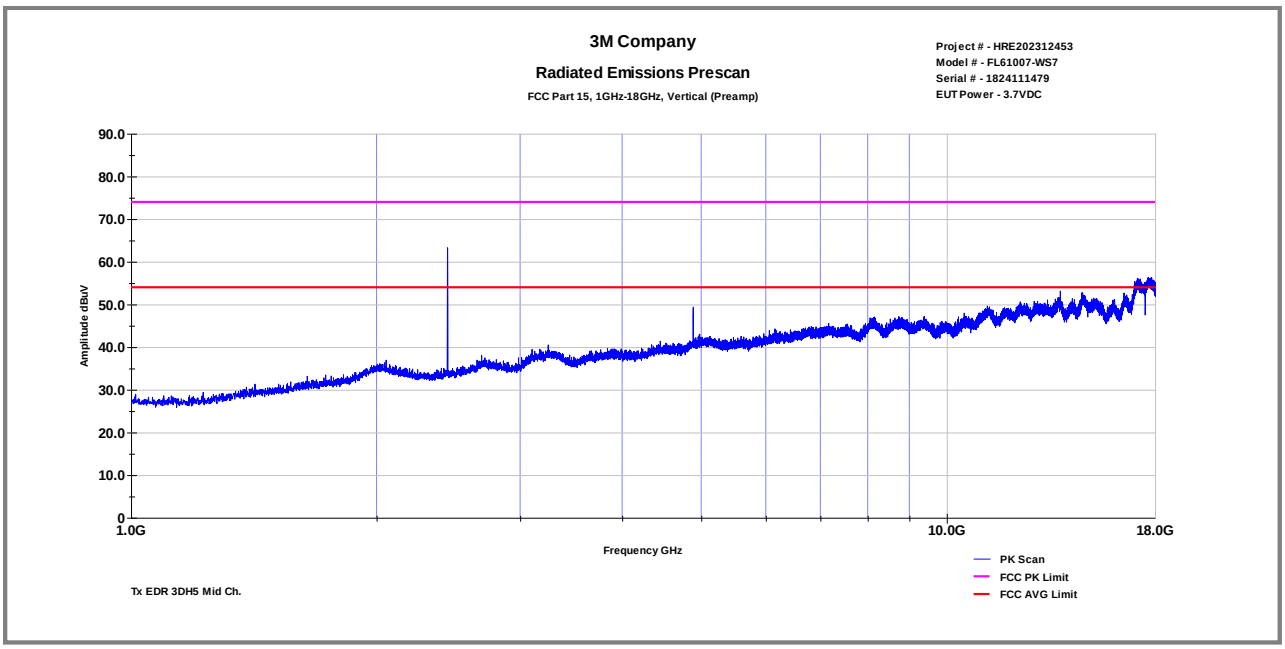



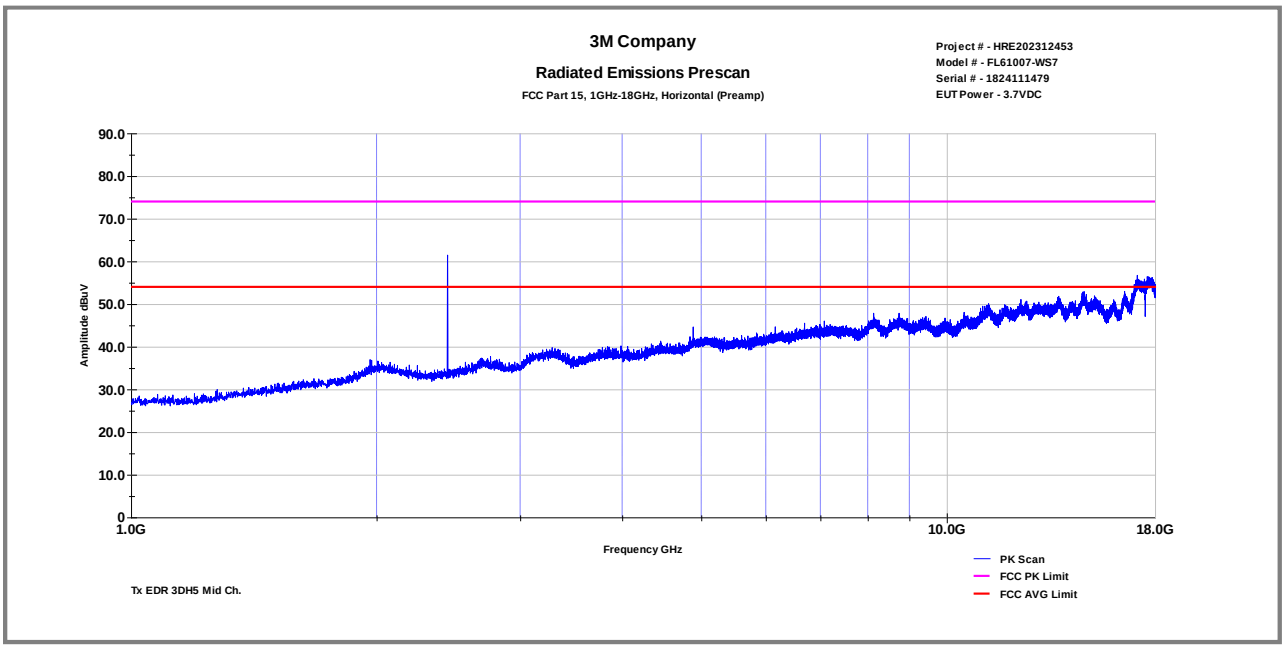

FCC Part 15.209 Radiated Emissions in restricted band – Low Channel (3-DH5)



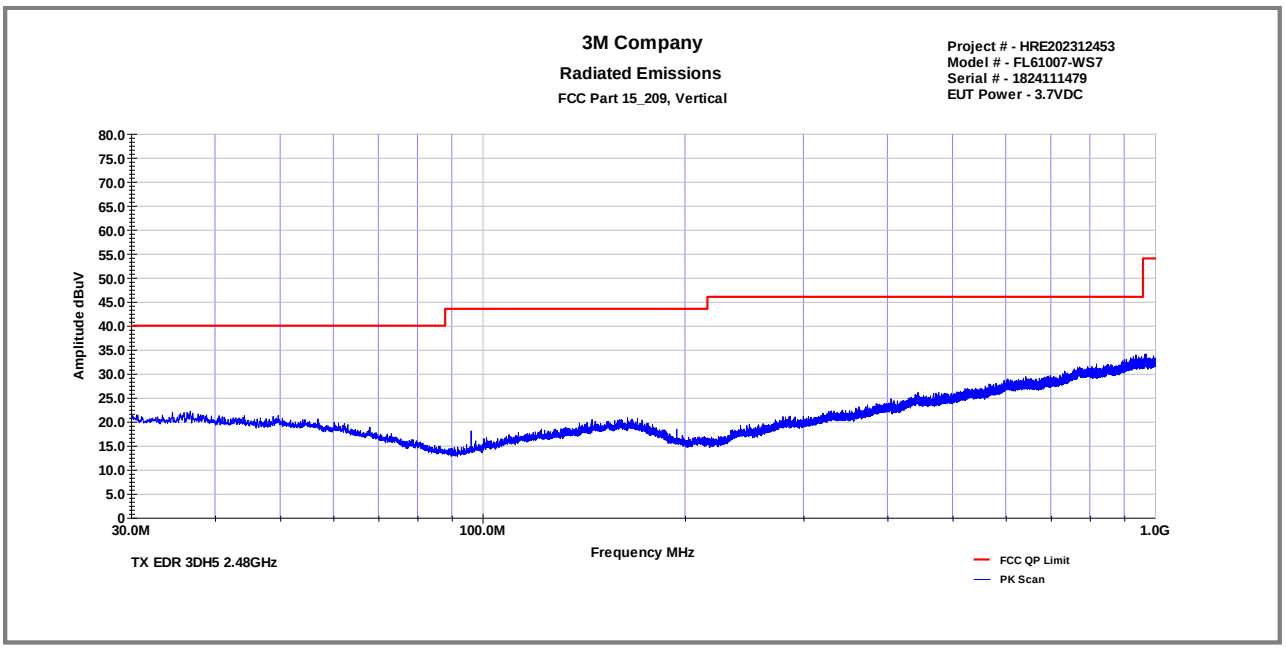



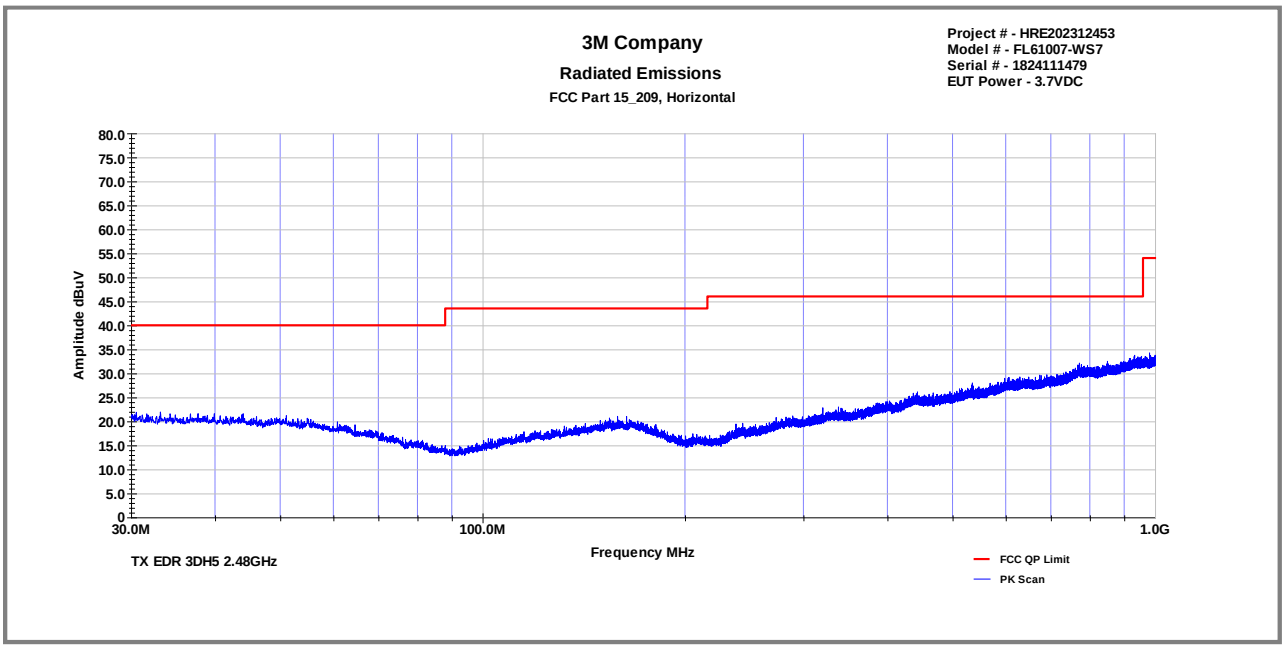

FCC Part 15.209 Radiated Emissions in restricted band – Mid Channel (3-DH5)



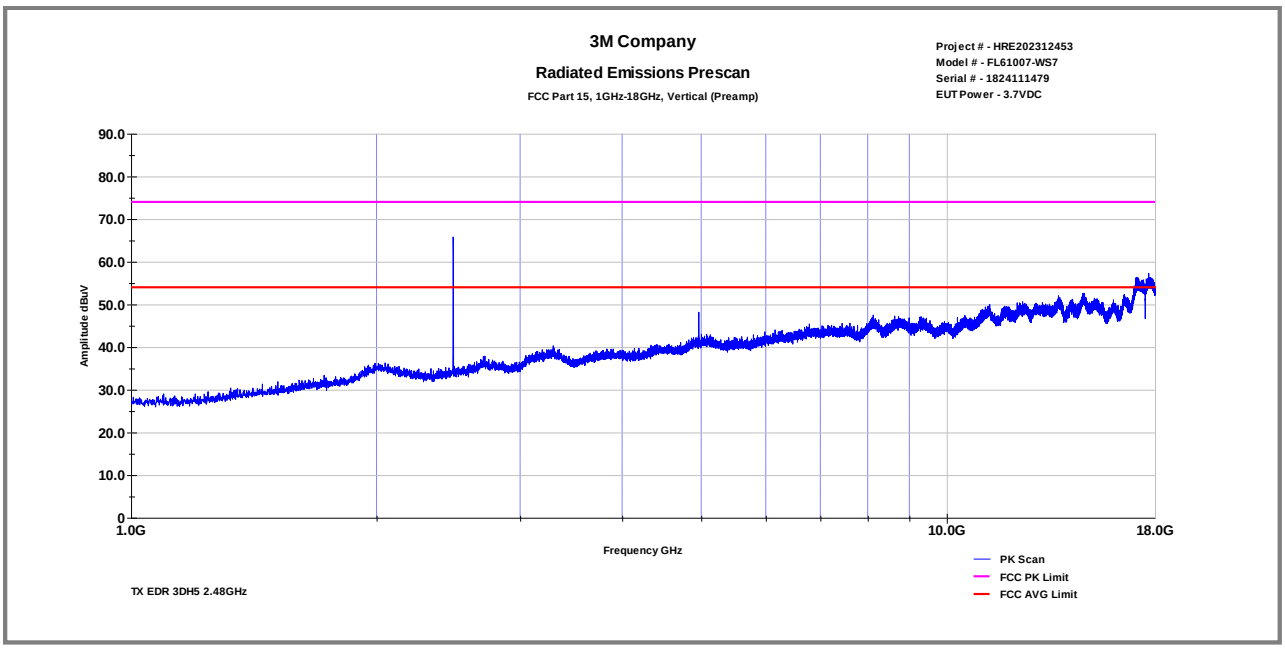



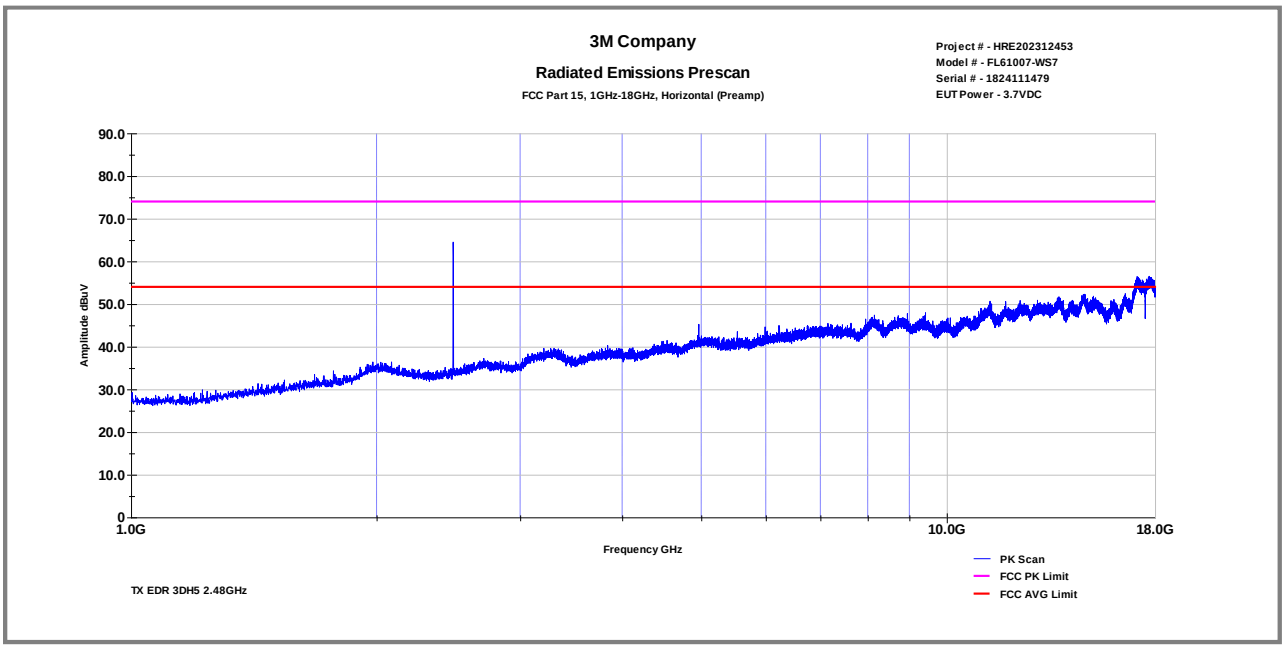

FCC Part 15.209 Radiated Emissions in restricted band – Mid Channel (3-DH5)




FCC Part 15.209 Radiated Emissions in restricted band –High Channel (3-DH5)




FCC Part 15.209 Radiated Emissions in restricted band –High Channel (3-DH5)

## Tables - Radiated Emissions in restricted band

| Frequency (MHz) | Pol. | QP Reading dBµV/m | Total CF dB | Net at 3 m dBµV/m | Limit (dBµV/m) | Margin dB |
|---|---|---|---|---|---|---|
| 33.44 | V | 4.4 | 16.5 | 20.9 | 40 | -19.1 |
| 48.41 | V | 2.8 | 18.2 | 21.1 | 40 | -18.9 |
| 96.35 | V | 2.6 | 13.1 | 15.8 | 43.5 | -27.7 |
| 161.9 | H | 2.5 | 18.2 | 20.7 | 43.5 | -22.8 |
| 825.14 | H | 3.1 | 28.7 | 31.8 | 46 | -14.2 |
| 906.23 | V | 3.8 | 29.6 | 33.4 | 46 | -12.6 |
| **Notes:** | Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB)<br>Low Channel-3DH5 | | | | | |

| Frequency (MHz) | Pol. | QP Reading dBµV/m | Total CF dB | Net at 3 m dBµV/m | Limit (dBµV/m) | Margin dB |
|---|---|---|---|---|---|---|
| 36.17 | H | 4 | 16.9 | 21 | 40 | -19 |
| 48.38 | H | 2.8 | 18.2 | 21.1 | 40 | -18.9 |
| 60.38 | H | 2.6 | 17.6 | 20.2 | 40 | -19.8 |
| 148.04 | H | 2.3 | 18.1 | 20.3 | 43.5 | -23.2 |
| 168.23 | H | 2.5 | 17.9 | 20.4 | 43.5 | -23.1 |
| 849.89 | H | 3.7 | 28.8 | 32.5 | 46 | -13.5 |
| **Notes:** | Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB)<br>Mid Channel-3DH5 | | | | | |

| Frequency (MHz) | Pol. | QP Reading dBµV/m | Total CF dB | Net at 3 m dBµV/m | Limit (dBµV/m) | Margin dB |
|---|---|---|---|---|---|---|
| 35.96 | H | 4 | 16.9 | 20.9 | 40 | -19.1 |
| 49.46 | H | 2.8 | 18.3 | 21 | 40 | -19 |
| 163.22 | H | 2.5 | 18.2 | 20.7 | 43.5 | -22.8 |
| 534.98 | H | 3.1 | 24.1 | 27.2 | 46 | -18.8 |
| 775.28 | H | 3.3 | 28.4 | 31.8 | 46 | -14.2 |
| 928.1 | H | 3.8 | 29.9 | 33.7 | 46 | -12.3 |
| **Notes:** | Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB)<br>Mid Channel-3DH5 | | | | | |

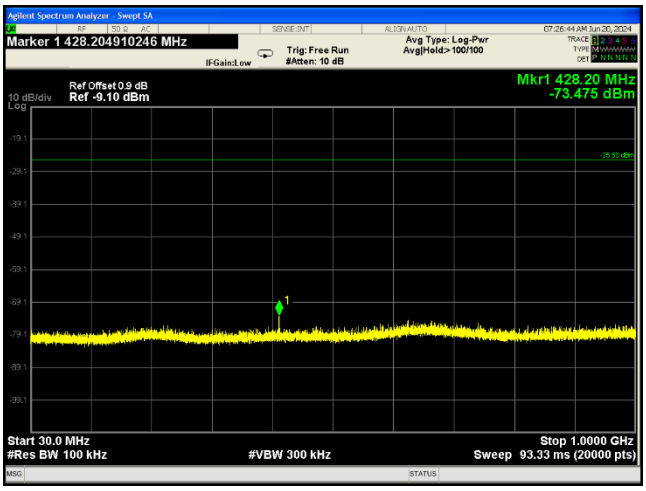
| Pol | Frequency (MHz) | Peak dBµV/m | AVG dBµV/m | Total CF dB | Net Peak dBµV/m | Net AVG dBµV/m | PK Limit dBµV/m | AVE Limit dBµV/m | PK Margin dB | AVG Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| V | 3689.40 | 50.00 | 39.0 | -9.85 | 40.15 | 29.17 | 74.00 | 54.00 | -33.85 | -24.83 |
| H | 3689.40 | 49.91 | 39.0 | -9.85 | 40.06 | 29.17 | 74.00 | 54.00 | -33.94 | -24.83 |
| V | 4803.75 | 56.45 | 52.6 | -6.36 | 50.09 | 46.28 | 74.00 | 54.00 | -23.91 | -7.72 |
| H | 4803.75 | 52.25 | 46.0 | -6.36 | 45.89 | 39.68 | 74.00 | 54.00 | -28.11 | -14.32 |
| V | 8099.70 | 48.41 | 36.8 | 0.10 | -0.08 | 36.94 | 74.00 | 54.00 | -74.08 | -17.06 |
| H | 8099.70 | 48.18 | 37.0 | 0.10 | -0.08 | 37.06 | 74.00 | 54.00 | -74.08 | -16.94 |
| V | 9608.00 | 50.13 | 40.3 | -0.23 | -0.22 | 40.02 | 74.00 | 54.00 | -74.22 | -13.98 |
| H | 9608.00 | 49.38 | 40.4 | -0.23 | -0.22 | 40.12 | 74.00 | 54.00 | -74.22 | -13.88 |
| **Notes:** | | Net Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB)) | | | | | | | | |
| | | Low Channel-3DH5 | | | | | | | | |

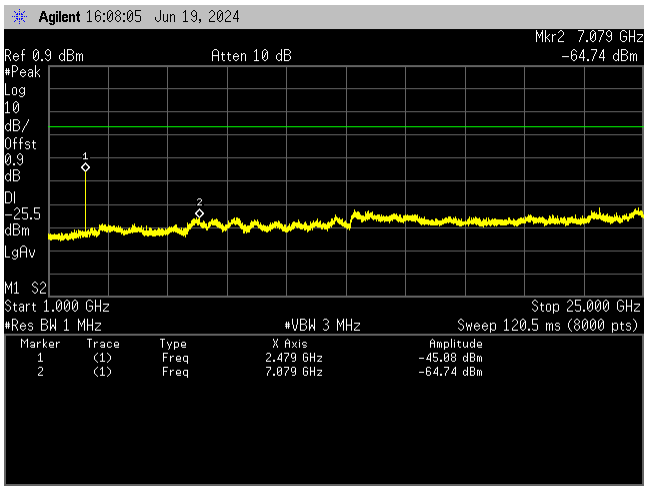
| Pol | Frequency (MHz) | Peak dBµV/m | AVG dBµV/m | Total CF dB | Net Peak dBµV/m | Net AVG dBµV/m | PK Limit dBµV/m | AVE Limit dBµV/m | PK Margin dB | AVG Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| V | 4881.55 | 55.89 | 51.9 | -5.30 | 50.59 | 46.56 | 74.00 | 54.00 | -23.41 | -7.44 |
| H | 4881.55 | 52.31 | 47.0 | -5.30 | 47.01 | 41.66 | 74.00 | 54.00 | -26.99 | -12.34 |
| V | 7322.00 | 49.49 | 39.2 | -2.01 | 47.48 | 37.23 | 74.00 | 54.00 | -26.52 | -16.77 |
| H | 7322.00 | 49.05 | 38.9 | -2.01 | 47.04 | 36.87 | 74.00 | 54.00 | -26.96 | -17.13 |
| V | 9763.50 | 49.23 | 39.0 | -0.16 | 49.07 | 38.84 | 74.00 | 54.00 | -24.93 | -15.16 |
| H | 9763.50 | 49.47 | 39.9 | -0.16 | 49.31 | 39.69 | 74.00 | 54.00 | -24.69 | -14.31 |
| **Notes:** | | Net Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB)) | | | | | | | | |
| | | Mid Channel-3DH5 | | | | | | | | |

| Pol | Frequency (MHz) | Peak dBµV/m | AVG dBµV/m | Total CF dB | Net Peak dBµV/m | Net AVG dBµV/m | PK Limit dBµV/m | AVE Limit dBµV/m | PK Margin dB | AVG Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| V | 2700.00 | 50.71 | 39.2 | -12.21 | 38.50 | 26.99 | 74.00 | 54.00 | -35.50 | -27.01 |
| H | 2700.00 | 50.89 | 39.7 | -12.21 | 38.68 | 27.49 | 74.00 | 54.00 | -35.32 | -26.51 |
| V | 4959.30 | 54.77 | 50.3 | -5.17 | 49.60 | 45.11 | 74.00 | 54.00 | -24.40 | -8.89 |
| H | 4959.30 | 52.11 | 46.0 | -5.17 | 46.94 | 40.83 | 74.00 | 54.00 | -27.06 | -13.17 |
| V | 7440.00 | 50.21 | 39.5 | -1.69 | 48.52 | 37.85 | 74.00 | 54.00 | -25.48 | -16.15 |
| H | 7440.00 | 49.61 | 40.3 | -1.69 | 47.92 | 38.65 | 74.00 | 54.00 | -26.08 | -15.35 |
| V | 9919.30 | 48.42 | 38.4 | 0.35 | 48.77 | 38.77 | 74.00 | 54.00 | -25.23 | -15.23 |
| H | 9919.30 | 49.25 | 39.3 | 0.35 | 49.60 | 39.64 | 74.00 | 54.00 | -24.40 | -14.36 |
| **Notes:** | | Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB)) | | | | | | | | |
| | | High Channel-3DH5 | | | | | | | | |

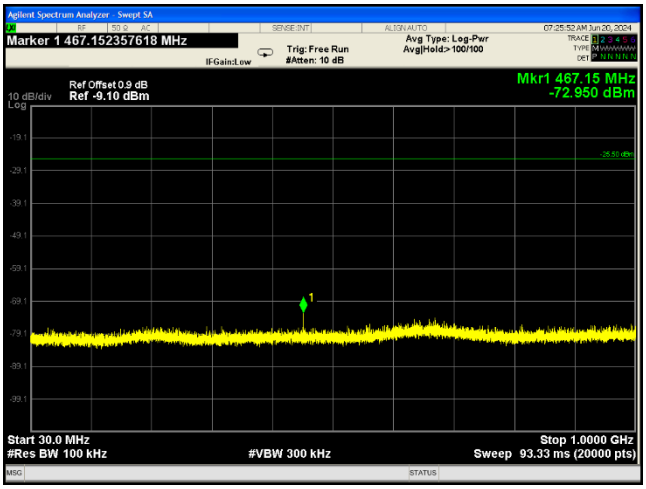
| 4.7 | **Radiated Emissions in non-restricted band** | |
|---|---|---|
| **Method:** | Antenna-port conducted measurements were used in addition to radiated measurements for determining compliance in the restricted frequency bands requirements using the proper antenna impedance matching. The measurements were made with transmitter set to transmit continuously low, medium and high channels. The notch filter was installed in the signal path to minimize the radiated power on the fundamental transmitting frequency in order to avoid saturation effect. Conducted out-of-band spurious emissions were investigated from 30MHz up to 25GHz to include 10th harmonic | |
| | Laboratory Ambient Temperature: | 23°C |
| | Relative Humidity: | 48% |
| | Atmospheric Pressure: | 1011 mbars |
| **Reference Standard(s):** | ☒ ANSI C63.10:2020, Section 11.11<br>☒ FCC Part 15.247/RSS Gen (8.9)<br>☒ KDB 558074 | **Measurement Point**<br>☒ Conducted<br>☐ Radiated |
| **Frequency Range:** | ☒ 2402.0-2480.0MHz | |
| **In-band power in 100KHz:** | ☒ 4.0dBm | **Results:** |
| **Limit:** | ☒ -26dBm (30dBc below in-band power) | >65dBc |
| **Nominal Voltage:** | ☐ 120VAC ☒ 3.7VDC | |
| **Test Personnel:** | Yuriy Litvinov | **Date:** 06/19/2024 |

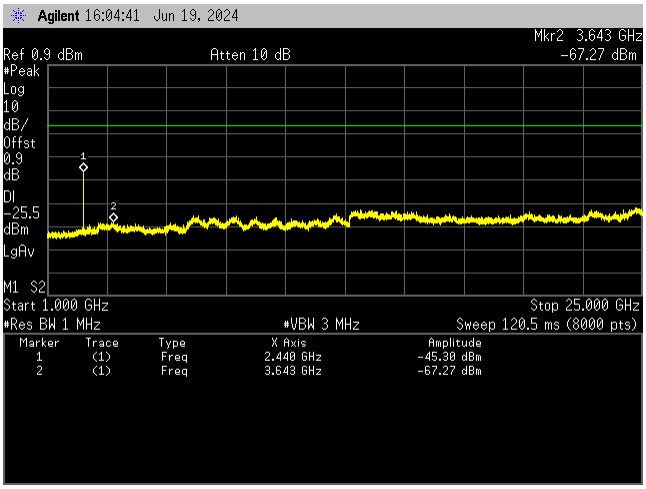
| **Note:** | Out-of -the band conducted spurious emissions were investigated for all data rates and the worst-case emissions were found with the EUT transmitting at 3mbps.<br>The display line shown on the plots is the limit at 20dB below the fundamental emissions measured in a 100KHz bandwidth. |
|---|---|



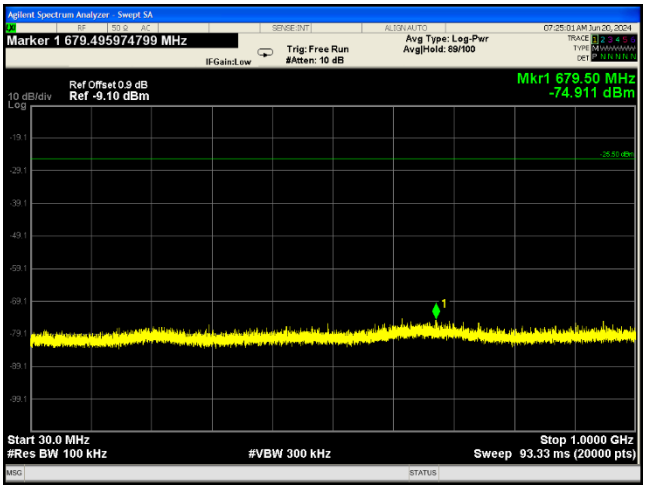



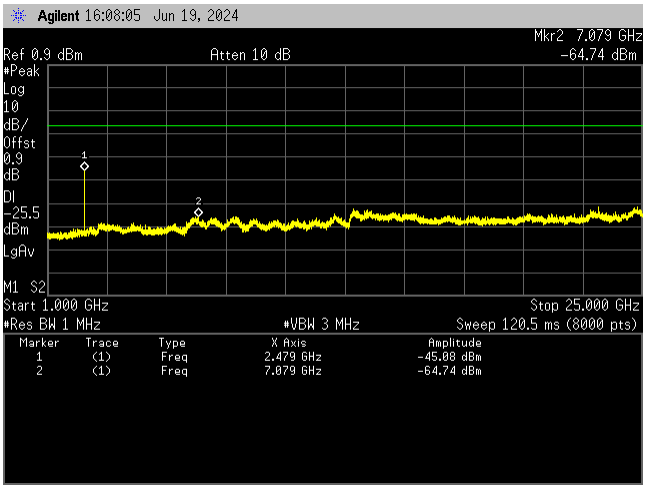

**Conducted Spurious - Low Channel (3-DH5)**




**Conducted Spurious – Mid Channel (3-DH5)**

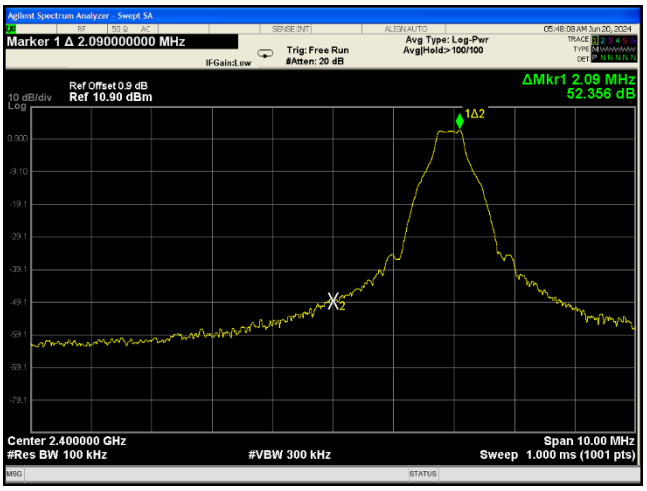


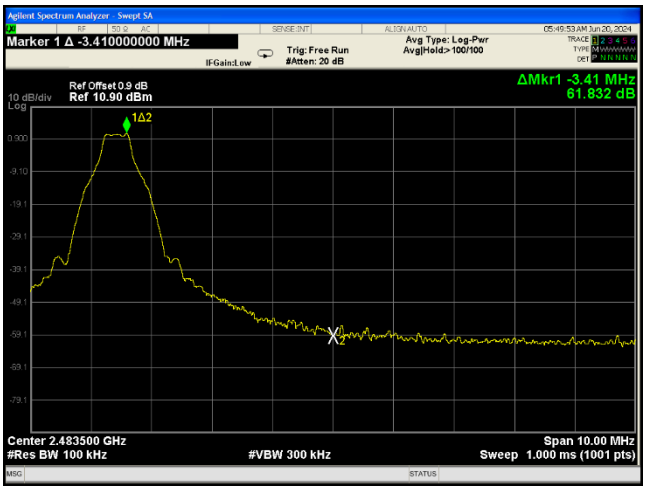

**Conducted Spurious – High Channel (3-DH5)**

| **4.8** | **Band-Edge Compliance** | |
|---|---|---|
| **Method:** | The measurements were made with transmitter set to transmit continuously with modulated signal at low and high channels. | |
| | Laboratory Ambient Temperature: | 23°C |
| | Relative Humidity: | 48% |
| | Atmospheric Pressure: | 1011 mbars |
| **Reference Standard(s):** | ☒ ANSI C63.10:2020, Section 6.10.4<br>☒ FCC Part 15.247/RSS 247<br>☒ KDB 558074 | **Measurement Point**<br>☒ Conducted<br>☐ Radiated |
| **Frequency Range:** | ☒ 2402.0-2480.0 MHz | |
| **In-band power in 100KHz:** | ☒ 4.0dBm | **Results** |
| **Limit:** | ☒ >30dBc | Low Ch., 2402 MHz > 52dBc<br>High Ch., 2480 MHz > 59dBc |
| **Nominal Voltage:** | ☐ 120VAC ☒ 3.7VDC | |
| **Test Personnel:** | Yuriy Litvinov | **Date:** 09/16/2024 |

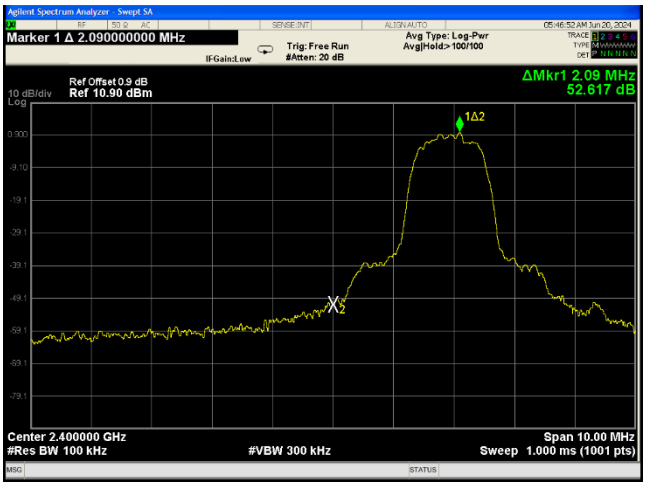
| **Note:** | Out-of-band conducted spurious emissions at the band edge were investigated for all data rates in hopping and no-hopping modes. |
|---|---|



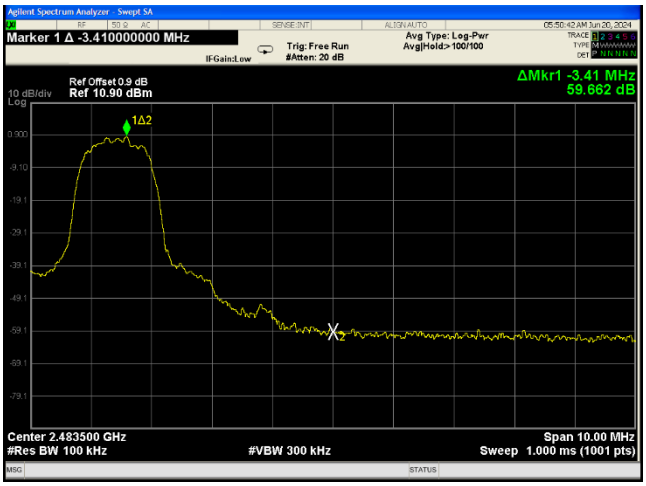

Band Edge – DH5 Low Channel
Center Freq. 2.400GHz
(BT with Hopping Disabled)



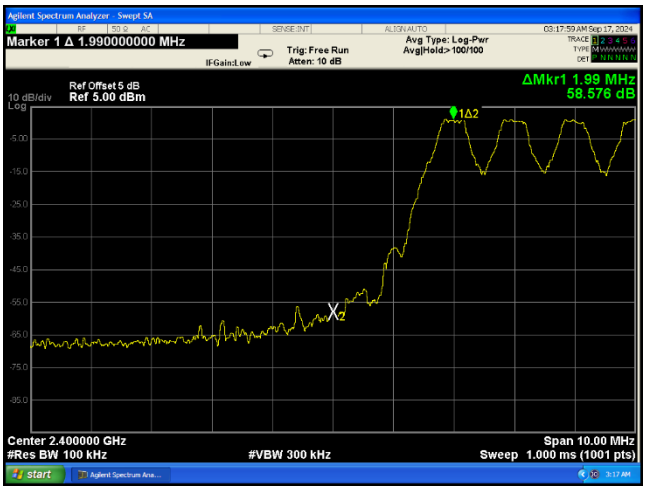

Band Edge – DH5 High Channel
Center Freq. 2.4835GHz
(BT with Hopping Disabled)



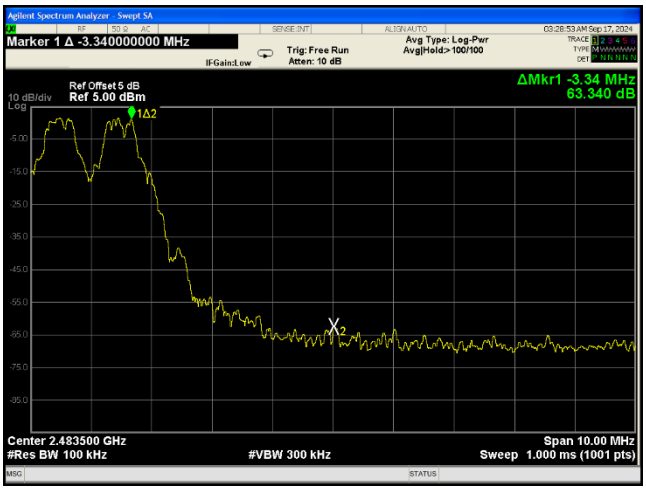

Band Edge – 3DH5 Low Channel
Center Freq. 2.400GHz
(BT with Hopping Disabled)



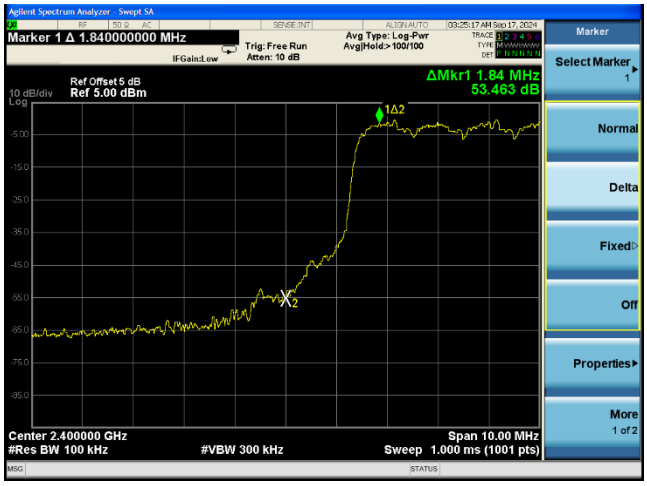

Band Edge – 3DH5 High Channel
Center Freq. 2.4835GHz
(BT with Hopping Disabled)



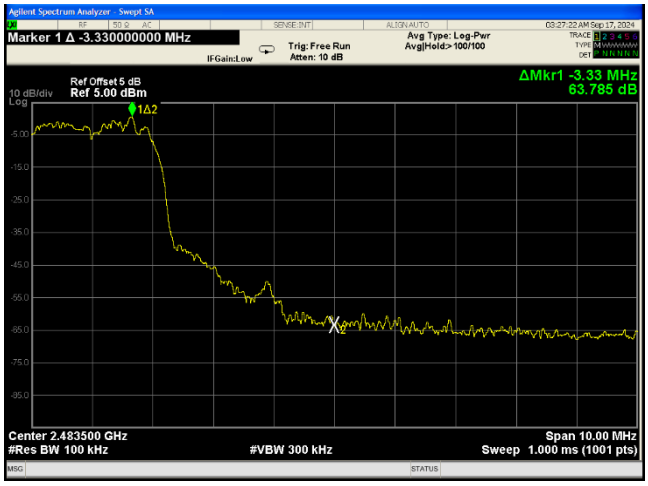

Band Edge – DH5 Low Channel
Center Freq. 2.400GHz
(BT with Hopping Enabled)




Band Edge – DH5 High Channel
Center Freq. 2.4835GHz
(BT with Hopping Enabled)




Band Edge – 3DH5 Low Channel
Center Freq. 2.400GHz
(BT with Hopping Enabled)




Band Edge – 3DH5 High Channel
Center Freq. 2.4835GHz
(BT with Hopping Enabled)

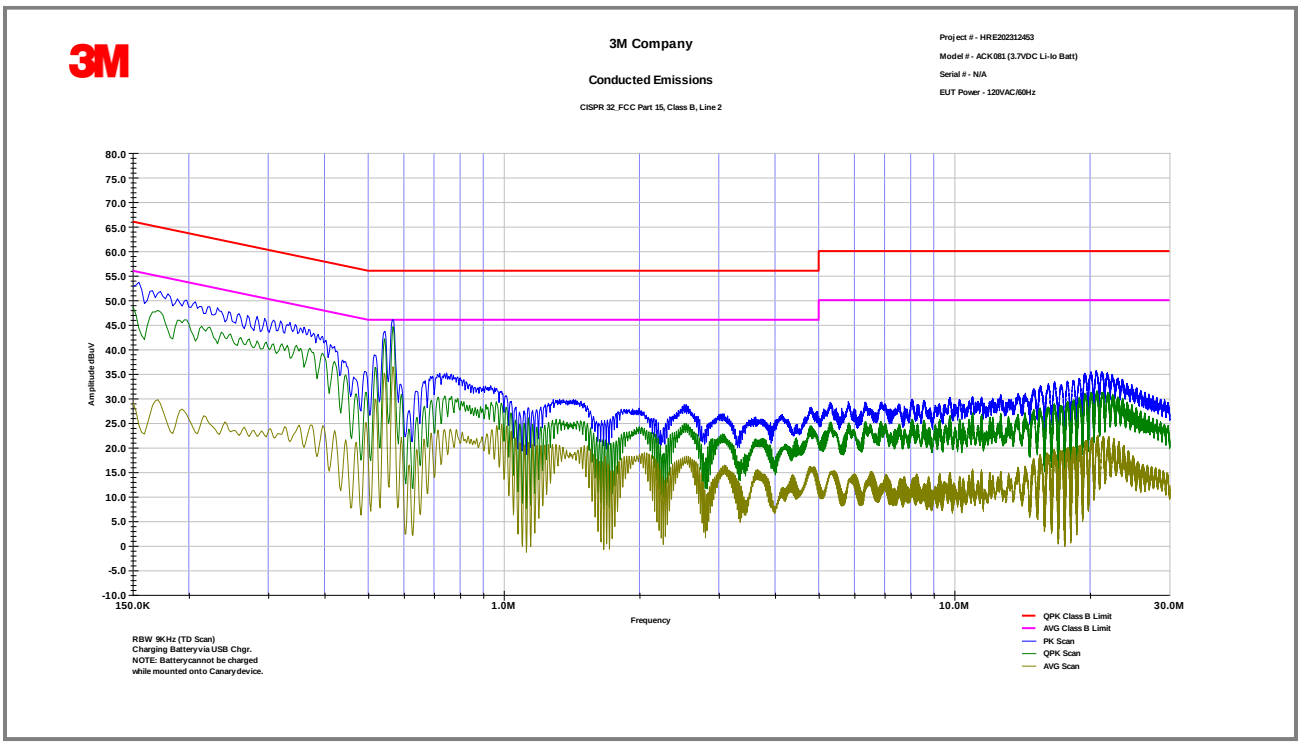
| **4.9** | **Conducted Emissions Data** |
|---|---|
| **Method:** | The AMN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN. |
| | All power was connected to the system through Artificial Mains Network (AMN). All tested telecommunications lines were connected to an Asymmetric Artificial Network (AAN) and conducted voltage measurements on telecommunications lines were made at the output of the ISN. Where an AAN was not appropriate or available measurements were made using a Capacitive Voltage Probe. |

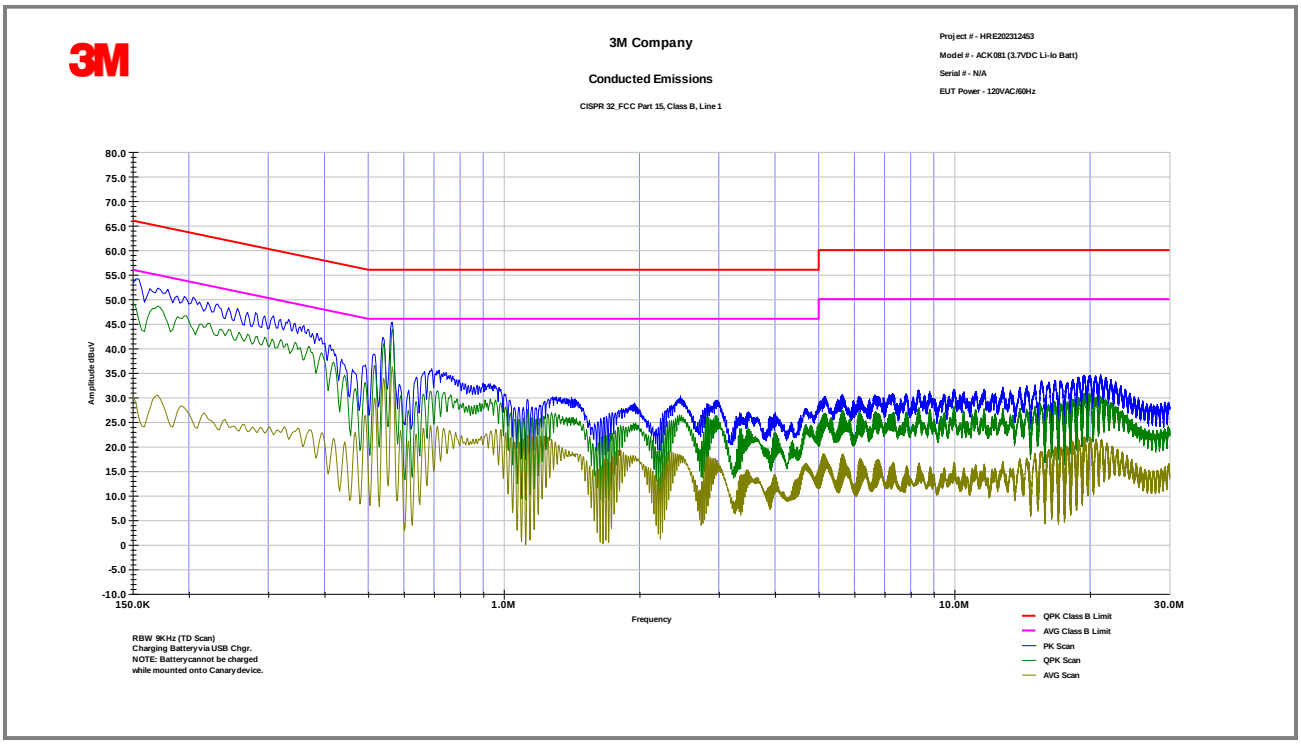
| | | |
|---|---|---|
| **Test Verification:** ☒ | Laboratory Ambient Temperature: | 23°C |
| | Relative Humidity: | 48% |
| | Atmospheric Pressure: | 1011 mbars |
| **Reference Standard(s):** | ☒ FCC 15.207/RSS Gen (8.8)<br>☒ ANSI C63.4:2014<br>☒ ANSI C63.10:2020 | **Measurement Point**<br>☒ Mains<br>☐ Telecommunication ports<br>☐ |
| **Nominal Voltage:** | ☒ 120VAC ☐ 230VAC ☐ VDC | |
| **Test Personnel:** | Keith Schwartz KS | **Date:** 06/03/2024 |

**Limits – Part 15.207/RSS Gen – AC Mains**

| Frequency (MHz) | Limit dB (µV) | | | |
|---|---|---|---|---|
| | Quasi-Peak | Average | Result | Comments |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 | **pass** | Time Domain Scan |
| 0.50 to 5 | 56 | 46 | **pass** | Time Domain Scan |
| 5 to 30 | 60 | 50 | **pass** | Time Domain Scan |

| | |
|---|---|
| **Modifications:** | |
| **Note:** | Battery can be charged when removed from WS Adapter. Test data is for reference only. |


3M Company
Conducted Emissions
CISPR 32_FCC Part 15, Class B, Line 2
Project # - HRE202312453
Model # - ACK081 (3.7VDC Li-Io Batt)
Serial # - N/A
EUT Power - 120VAC/60Hz
Amplitude dBuV
Frequency
150.0K
1.0M
10.0M
30.0M
QPK Class B Limit
AVG Class B Limit
PK Scan
QPK Scan
AVG Scan
RBW 9KHz (TD Scan)
Charging Batteryvia USB Chgr.
NOTE: Batterycannot be charged
while mounted onto Canarydevice.


3M Company
Conducted Emissions
CISPR 32_FCC Part 15, Class B, Line 1
Project # - HRE202312453
Model # - ACK081 (3.7VDC Li-Io Batt)
Serial # - N/A
EUT Power - 120VAC/60Hz
Amplitude dBuV
Frequency
150.0K
1.0M
10.0M
30.0M
QPK Class B Limit
AVG Class B Limit
PK Scan
QPK Scan
AVG Scan
RBW 9KHz (TD Scan)
Charging Batteryvia USB Chgr.
NOTE: Batterycannot be charged
while mounted onto Canarydevice.

| 4.8 | RF Exposure Evaluation | |
|---|---|---|
| **Reference Standard(s):** | ☒ KDB 447498 RF Exposure Guidance v06<br>☐ KDB 447498 Interim RF Exposure Guidance v01<br>☒ RSS 102, Issue 5<br>☐ | ☐ MPE<br>☐ SAR Evaluation<br>☒ SAR Test Exclusion |
| **Frequency Range(s):** | ☒ 2402-2480.0MHz<br>☐ | |
| | | |
| **Antenna Separation Distance:** | >8mm | |
| **RF Exposure Conditions:** | Portable (Body-worn) | |
| **2.4GHz Antenna Gain:** | 1.35dBi | |
| **BR/EDR the source-based output power:** | 2.5mW(4.0dBm)*0.7(FHSS worst case duty cycle)= 1.8mW(2.6dBm) | |
| **BR/EDR EIRP/ERP output power:** | **EIRP**=2.6dBm + 1.35dBi=3.95dBm, **ERP**=3.95dBm - 2.15dB=1.8dBm(1.5mW) | |
| | | |
| **LE/QHS the source-based output power:** | 2.8mW(4.5dBm)*0.85(worst case duty cycle)=2.4mW(3.8dBm) | |
| **LE/QHS EIRP/ERP output power:** | **EIRP**=3.8dBm + 1.35Bi=5.15dBm, **ERP**=5.15dBm - 2.15dB= 3.0dBm(2mW) | |
| **The SAR Exclusion Threshold Level** | | |
| **FCC Part 2.1093** | 10mW<5mm @2.45GHz | |
| **RSS 102, Issue 5** | 4mW<5mm @2.45GHz | |
| | | |

| **Note:** | |
|---|---|

| 5.0 | Test Equipment | | | | |
|---|---|---|---|---|---|
| **Test Equipment Used** | | | | | |
| **Description** | **Manufacturer** | **Model** | **Identifier** | **Last Cal. Date** | **Check** |
| Biconilog Antenna | Schwarzbeck | VULB 9168 | 9168-1070 | 10/20/2023 | ☒ |
| Horn Antenna | A.H. Systems | SAS 571 | 1010 | 10/20/2023 | ☒ |
| Loop Antenna | A.H. Systems | EHA-51B | 1213E | 10/20/2023 | ☐ |
| EMI Receiver | Rohde & Schwarz | ESW26 | 101412 | 10/20/2023 | ☒ |
| Signal Analyzer | Agilent | N9000A | MY53031040 | 10/20/2023 | ☒ |
| EMI Receiver | Agilent | E4448A | 1530975 | 10/20/2023 | ☒ |
| LISN | TESEQ | NNB51 | 1130 | 10/20/2023 | ☒ |
| Coaxial Cable | Insulated Wire | 2803 | CBL2039 | 10/20/2023 | ☒ |
| EMC Software | ETS-Lindgren | TILE 7 | | N/A | ☒ |
| **Equipment Calibration Interval:** | | ☒ 12 months | | ☐ 24 months | |

| 6.0 | Report revision history | | |
|---|---|---|---|
| **Revision Level** | **Date** | **Report Number** | **Notes** |
| 0 | 09/16/2024 | HRE202312543-2 | Original Issue |
| | | | |
| | | | |