EMC TEST REPORT

NVLAP Lab Code 200033-0

Standard(s):

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

FCC ID:Y9ZMRX21A1WS7
IC:4406A-MRX21A1WS7

Product: WS™ ALERT™ XPV Headset (EDR)

Model(s): MRX21A1WS7-NA

Company Name:
3M Svenska AB

3M Division: PSD

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

Report Number: HRE202303408-5
Report Issue Date: September 13, 2024

Report Prepared by:

Signature: Yuriy Litvinov
Yuriy Litvinov
Lead EMC Engineer

Tested by:
3M Company, Hardgoods Regulatory Engineering Laboratory
410 East 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 ALERT XPV Headset helps protect against hazardous noise, has Bluetooth wireless communication, noise-cancelling boom microphone, and level-dependent function for ambient listening.			
Model(s):	MRX21A1WS7-NA			
Serial number:	128837-2			
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:	7.5dBm (5.6mW), (4.8dBm Conducted RF Power)			
Antenna Type and Antenna Assembly Gain:	☐ External	☒ Integral PCB Antenna	☐ Dedicated	
	☒ 2.7dBi	☐ Declared by the Manufacturer	☒ Measured	
Test Deviations or Exclusions	☐ Yes	☒ No		
Rated Power:	**Voltage:**	☒ 120VAC	☐ 230VAC	☒ 3VDC
	Phase:	☒ 1ph	☐ 3ph	☒ USB-C
	Frequency:	☐ 50Hz	☒ 60Hz	
	Current:	N/A		
Test Dates:	02/05-02/13/2024			
Received Date:	01/15/2024			
Received Conditions:	☐ Poor	☒ Good		
	☒ Prototype	☐ Production		

3.0 EUT Configuration

3.1 System Configuration

No.	Product Type	Manufacturer	Model	Comments
1	EUT	3M	MRX21A1WS7	
2	USB Charger	Apple	M1385	Support Equipment
3	Programming interface	Qualcomm	TRBI200	Support Equipment

3.2 Input/Output Ports of EUT

No.	Description	Type	Comments
1	DC Power	USB-C	
2			

3.3 Cables

No.	Description	Type	Length	Shielding	Comments
1	USB-C	USB 2.0	1m	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

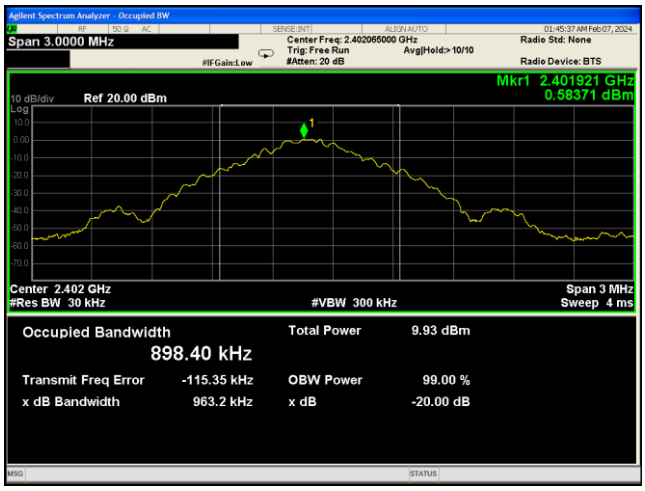
3.5 Exercising of EUT and Interfaces

No.	Mode of Operation
1	Transmitting at lowest (0), middle (19) and highest (39) channels of operation with unmodulated CW carrier
2	Continuous transmission of modulated signal at lowest (0), middle (19) and highest (39) channels
3	Device programming using Qualcomm Bluesuit WIN.3.3 software for continuous transmission of modulated carrier at maximum rated RF output power and Duty Cycle.

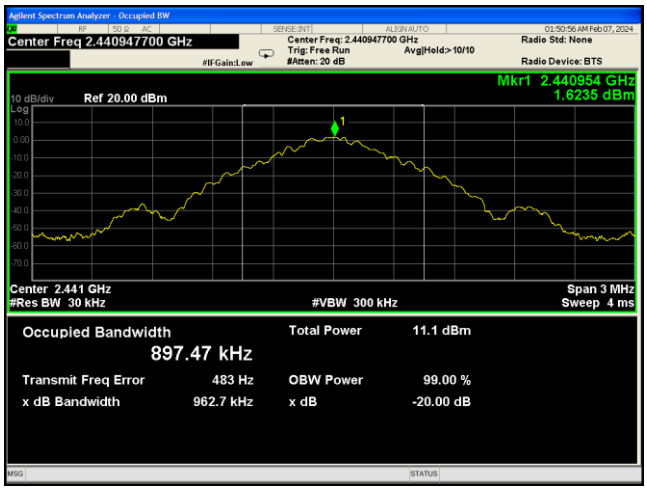
4.0 Test Conditions and Results

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 ☒ FCC Part 15.247/RSS 247 ☒ KDB 558074	**Measurement Point** ☒ Conducted ☐ Radiated
Frequency Range:	☒ 2402.0-2480.0 MHz	RBW = 30KHz VBW ≥ 3 x RBW
Nominal Voltage:	☐ 120VAC ☒ 3.0VDC	
Test Personnel:	Yuriy Litvinov	**Date:** 02/06/2024

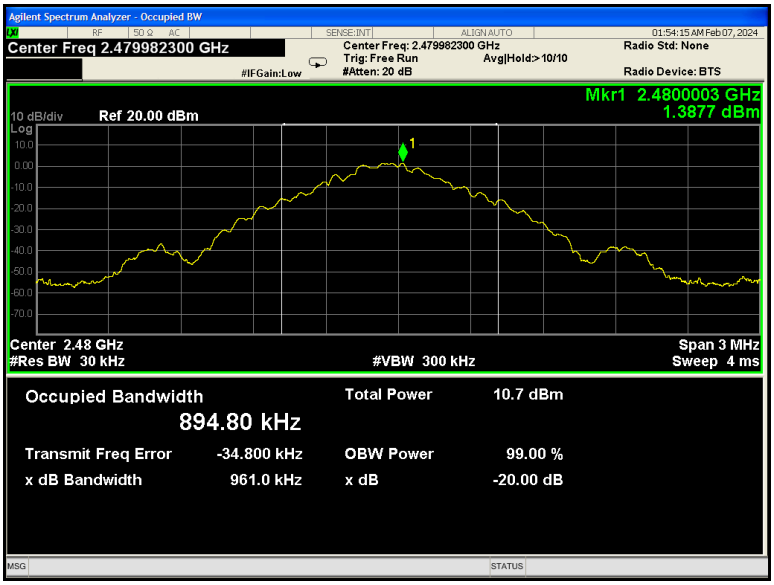
Frequency (MHz)	Data Rate	Modulations	99% Bandwidth (KHz)	20dB Bandwidth (KHz)	Results
2402	1 Mbps	GFSK	898.4	983.2	**pass**
2441	1 Mbps	GFSK	897.4	962.7	**pass**
2480	1 Mbps	GFSK	894.8	961.0	**pass**
2402	2 Mbps	π/4-DQPSK	1212	1371	**pass**
2441	2 Mbps	π/4-DQPSK	1199	1364	**pass**
2480	2 Mbps	π/4-DQPSK	1205	1367	**pass**
2402	3 Mbps	8DPSK	1216	1357	**pass**
2441	3 Mbps	8DPSK	1204	1352	**pass**
2480	3 Mbps	8DPSK	1210	1353	**pass**



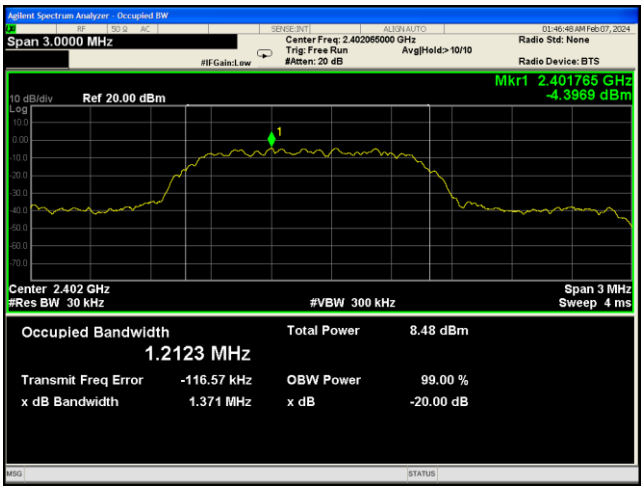
OBW –Low Channel (1Mbps)



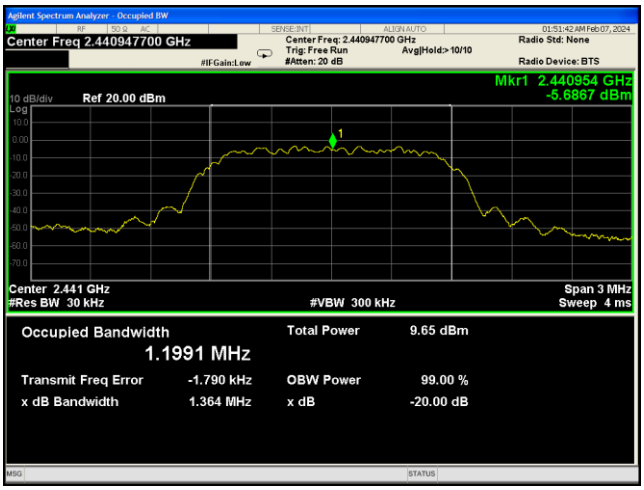
OBW – Mid Channel (1Mbps)



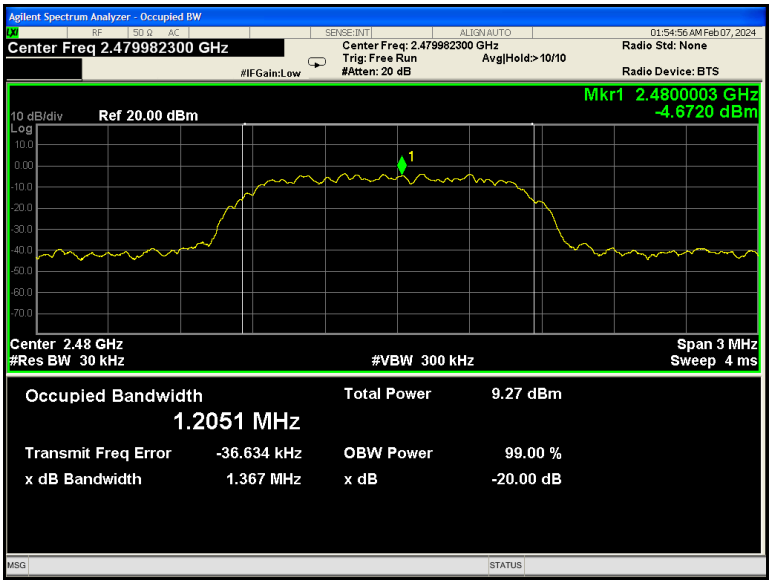
OBW – High Channel (1Mbps)



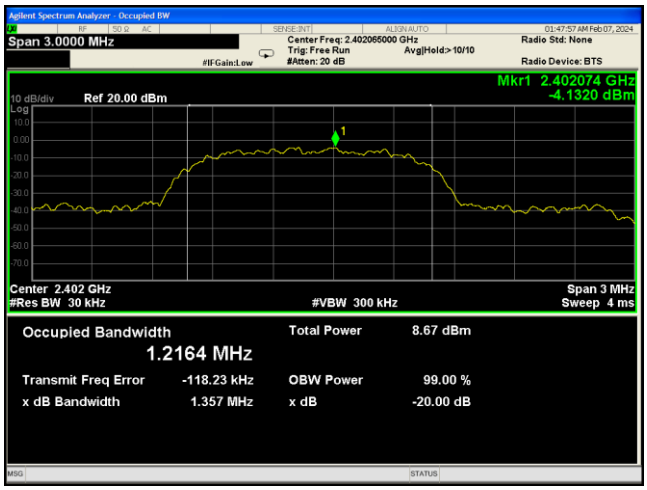
OBW –Low Channel (2Mbps)



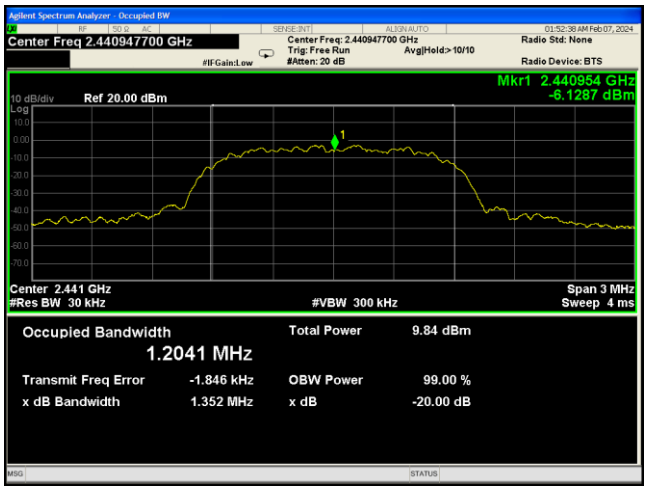
OBW – Mid Channel (2Mbps)



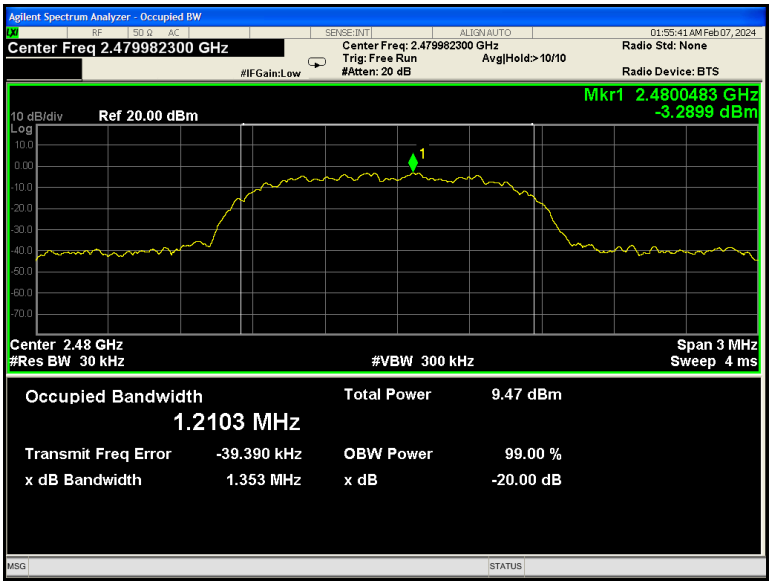
OBW – High Channel (2Mbps)



OBW –Low Channel (3Mbps)



OBW – Mid Channel (3Mbps)

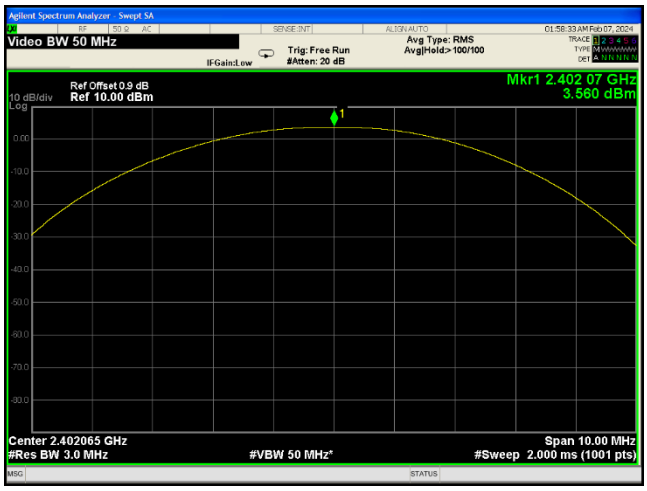


OBW – High Channel (3Mbps)

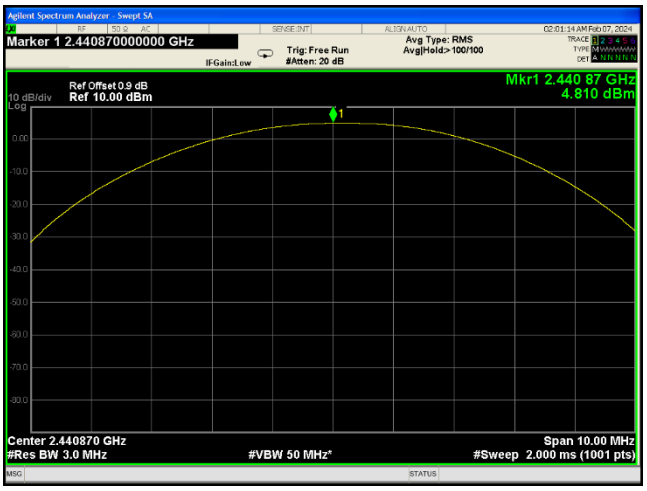
4.2	**Maximum Output Power**	
Method:	Measurements was performed with CW carrier at the highest power level at which the transmitter is intended to operate. The analyzer offset was adjusted to compensate for the attenuator and other losses.	
	Laboratory Ambient Temperature:	23°C
	Relative Humidity:	48%
	Atmospheric Pressure:	1011 mbars
Reference Standard(s):	☒ ANSI C63.10:2020, Section 11.9 ☒ FCC Part 15.247/RSS 247 ☒ KDB 558074	**Measurement Point** ☒ Conducted ☐ Radiated at 3 meters
Frequency Range:	☒ 2402.0 – 2480.0 MHz	
Antenna Gain:	2.7dBi	**Maximum Power (EIRP):**
Limit:	30 dBm	7.5dBm (5.6mW)
Nominal Voltage:	☐ 120VAC ☒ 3.0VDC	
Test Personnel:	Yuriy Litvinov	**Date:** 02/06/2024

Note:	EIRP (dBm) = Conducted Power (dBm) +Antenna Gain (dBi)= 4.8+2.7= 7.5 dBm. All modes of operation and data were investigated. The results shown represent the worst case.

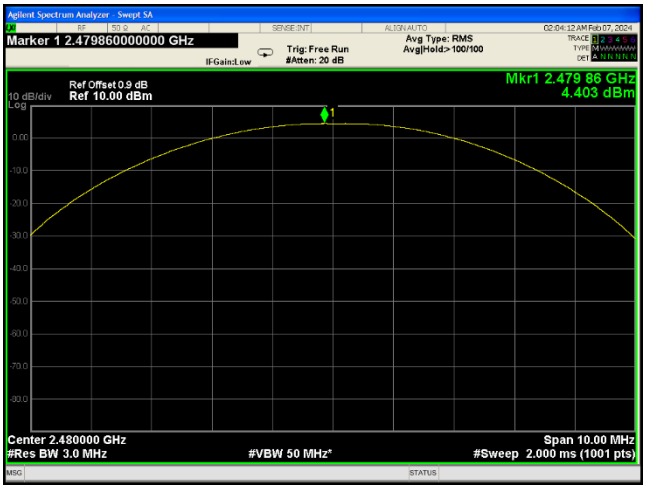
Frequency (MHz)	Data Rate	Modulations	RMS Conducted Power (dBm)	Limit (dBm)	Results
2402	1 Mbps	GFSK	3.6	30	**pass**
2440	1 Mbps	GFSK	4.8	30	**pass**
2480	1 Mbps	GFSK	4.4	30	**pass**
2402	2 Mbps	π/4-DQPSK	3.1	30	**pass**
2440	2 Mbps	π/4-DQPSK	4.4	30	**pass**
2480	2 Mbps	π/4-DQPSK	4.0	30	**pass**
2402	3 Mbps	8DPSK	3.2	30	**pass**
2440	3 Mbps	8DPSK	4.5	30	**pass**
2480	3 Mbps	8DPSK	4.0	30	**pass**



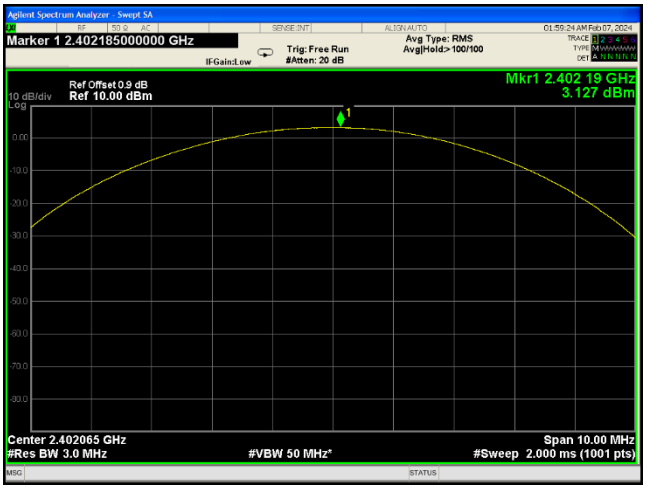
Peak Power Low Channel (1Mbps)



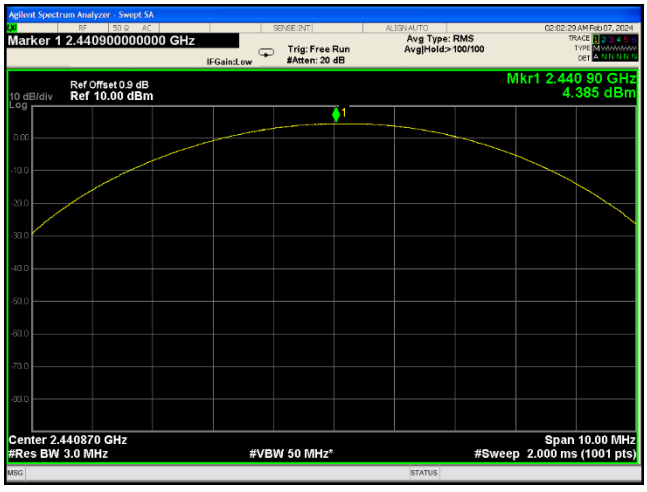
Peak Power Mid Channel (1Mbps)



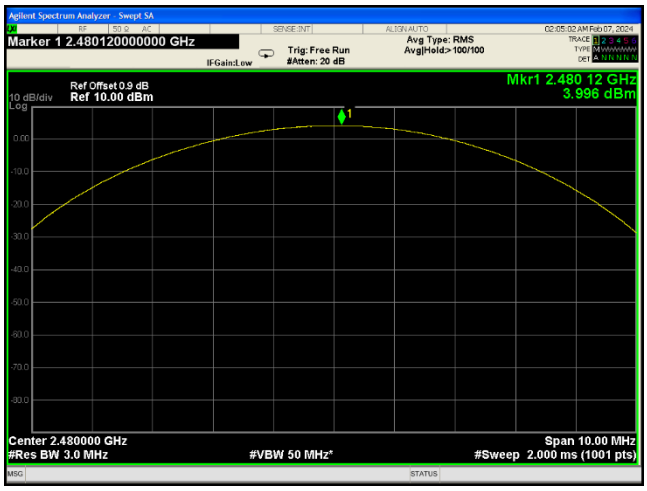
Peak Power High Channel (1Mbps)



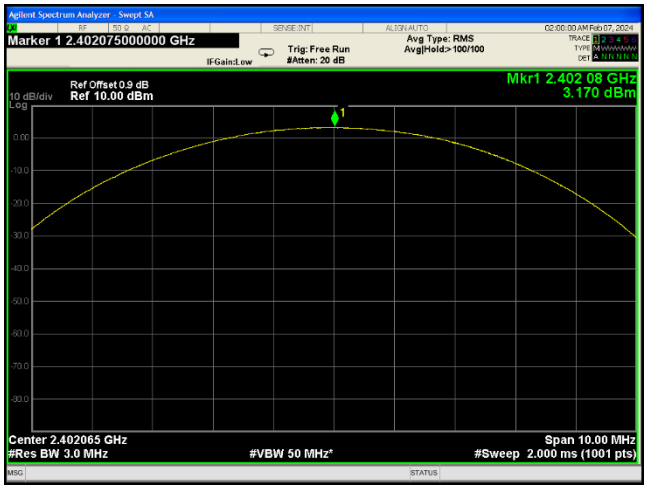
Peak Power Low Channel (2Mbps)



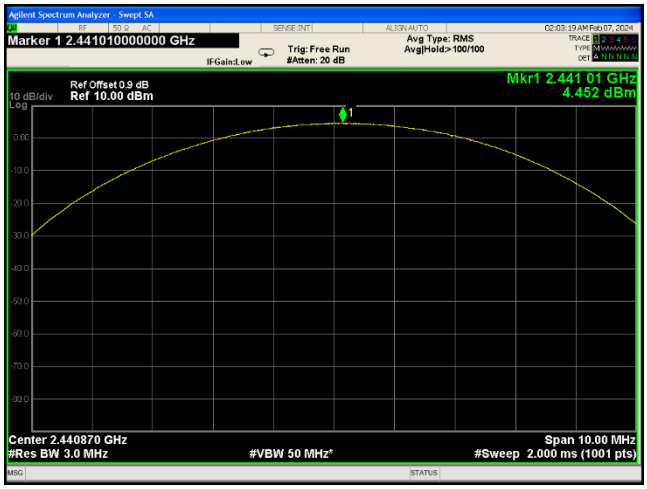
Peak Power Mid Channel (2Mbps)



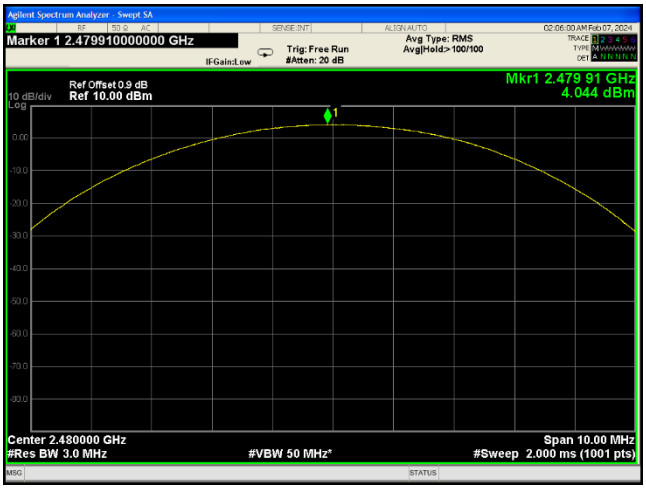
Peak Power High Channel (2Mbps)



Peak Power Low Channel (3Mbps)



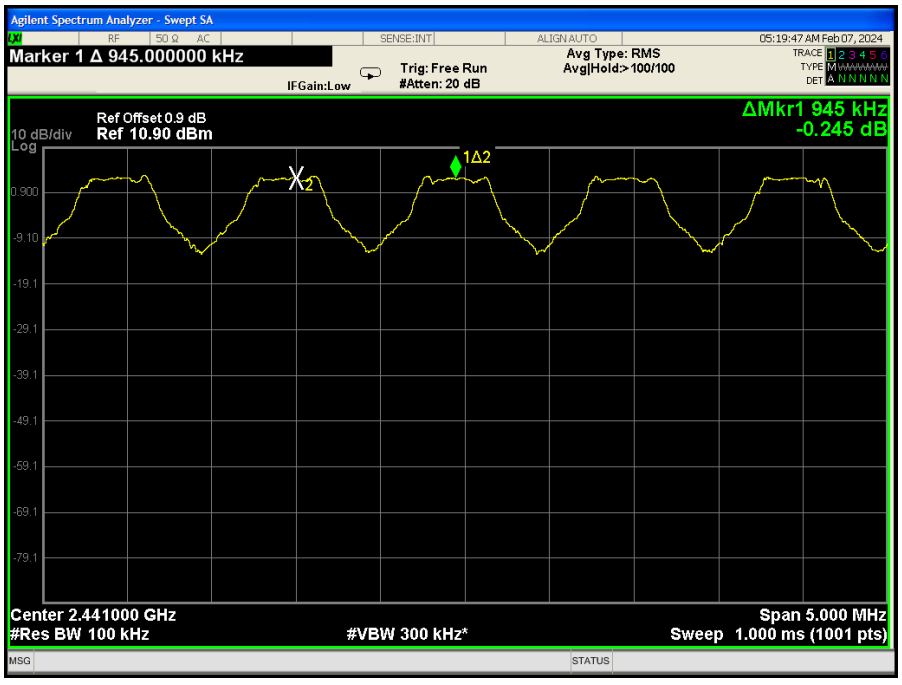
Peak Power Mid Channel (3Mbps)



Peak Power High Channel (3Mbps)

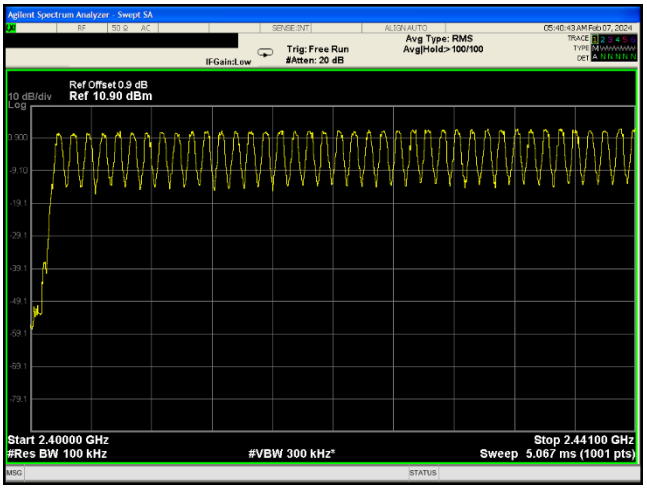
4.3	**Carrier Frequency Separation**	
Method:	The measurements were made with transmitter set to transmit a continuously with hopping function enabled.	
	Laboratory Ambient Temperature:	23°C
	Relative Humidity:	48%
	Atmospheric Pressure:	1011 mbars
Reference Standard(s):	☒ ANSI C63.10:2020, Section 7.8 ☒ FCC Part 15.247/RSS 247 ☒ KDB 558074	**Measurement Point** ☒ Conducted ☐ Radiated ☐
Frequency Range:	☒ 2402-2480MHz	
Antenna Gain:	☒ 2.7dBi	**Result**
Limit:	☐ >25KHz ☒ >2/3 the value of the 20dB Bandwidth ☐	0.945MHz
Nominal Voltage:	☐ 230VAC ☒ 3.0VDC	
Test Personnel:	Yuriy Litvinov	**Date:** 02/07/2024

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

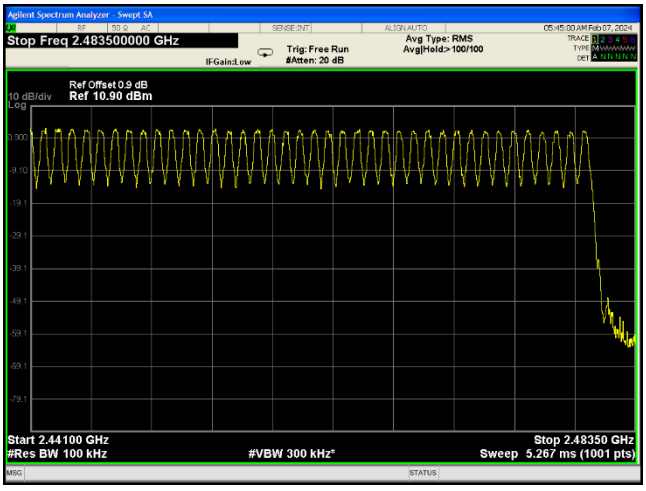


4.4	**Number of Hopping Frequencies**	
Method:	The measurements were made with transmitter set to transmit a continuously with hopping function enabled.	
	Laboratory Ambient Temperature:	23°C
	Relative Humidity:	48%
	Atmospheric Pressure:	1011 mbars
Reference Standard(s):	☒ ANSI C63.10:2020, Section 7.8 ☒ FCC Part 15.247/RSS 247 ☒ KDB 558074	**Measurement Point** ☒ Conducted ☐ Radiated
Frequency Range:	☒ 2402.0 – 2480.0 MHz	
Antenna Gain:	2.3dBi	**Result**
Limit:	☒ >75 Hopping Channels	79
Nominal Voltage:	☐ 120VAC ☒ 3.0VDC	
Test Personnel:	Yuriy Litvinov	**Date:** 02/07/2024

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



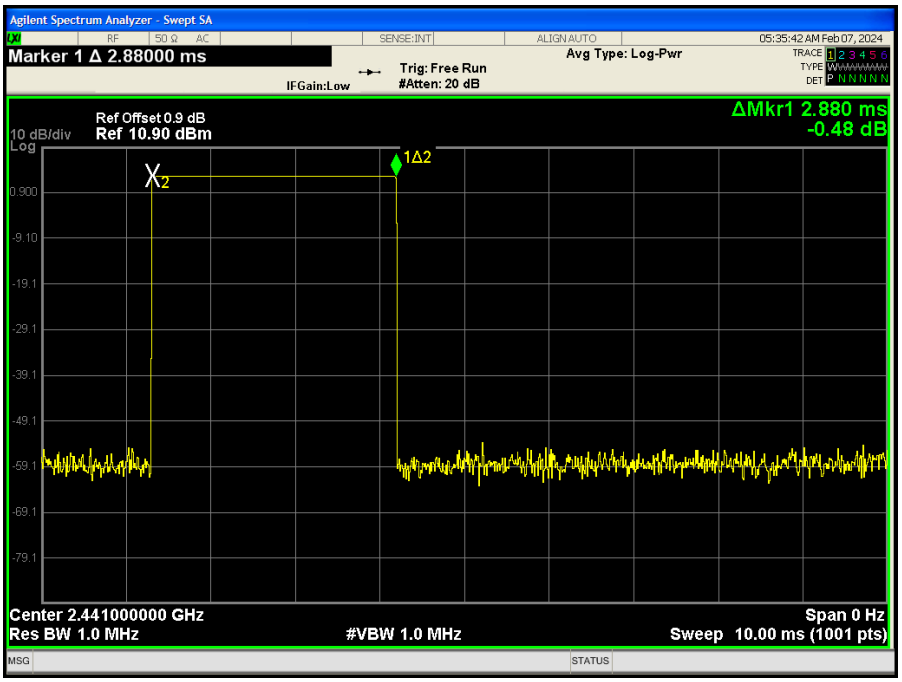
Low End Spectrum



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 ☒ FCC Part 15.247/RSS 247 ☒ KDB 558074	**Measurement Point** ☒ Conducted ☐ Radiated
Frequency Range:	☒ 2402.0 – 2480.0 MHz	
Antenna Gain:	2.7dBi	**Result**
Limit (dwell time):	☒ <0.4 sec within a period of 0.4 sec x *N* hopping channels	307ms/channel
Nominal Voltage:	☐ 120VAC ☒ 3.0VDC	
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. ○ 400ms x 79 channels=31.6 (Time of Occupancy). ○ Worst case BT has 266.67 hops/second 1x/(EDR modes DH5 operation). ○ 266.67/79 = 3.38 hops/second (#of hops/second on one channel). ○ 3.38 x 31.6=106.67 (#hops over a 31.6 second period). ○ 106.67x 2.88 /channel=307.2ms (worst case dwell time for one channel in 1x/EDR)



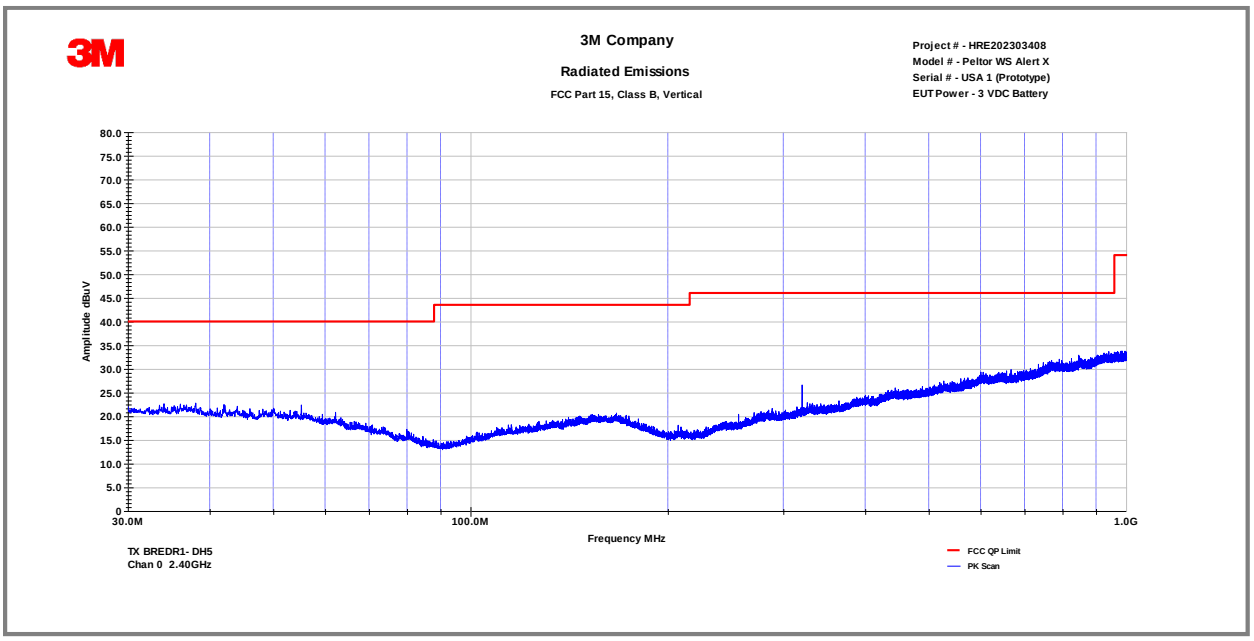
4.6	**Radiated Emissions in restricted band**
Method:	Measurements were made in a 3-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4 standards. EUT was rotated through three orthogonal axes to determine which attitude (orientation) and arrangement produces the highest emission relative 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.

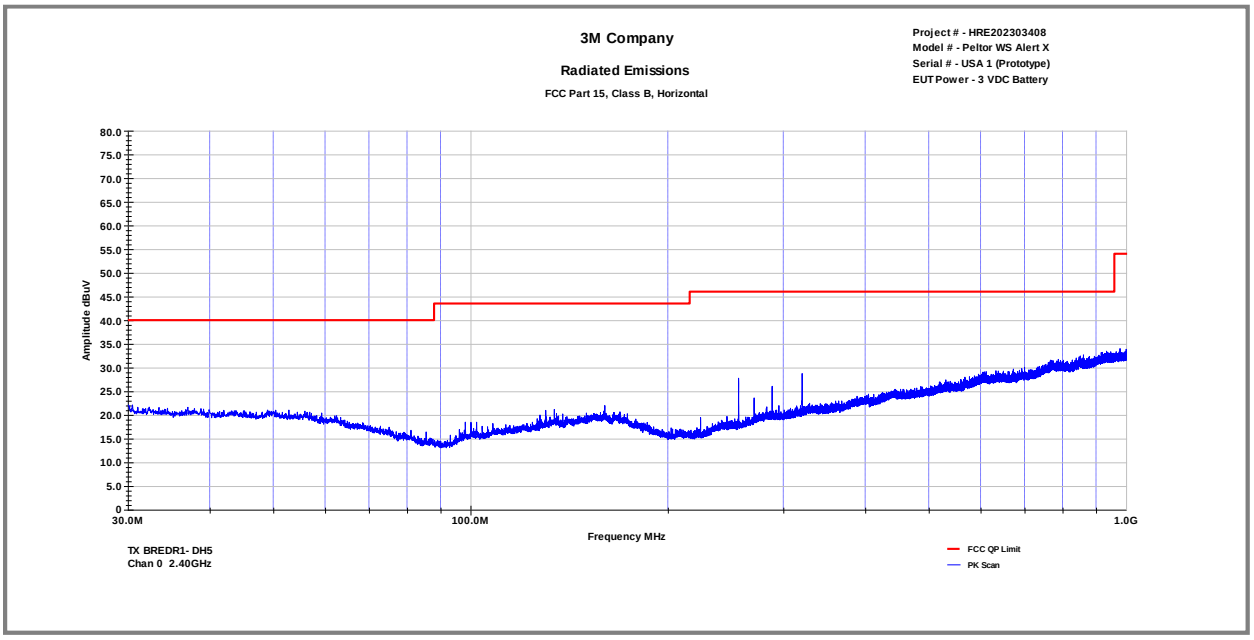
Test Verification: ☒	Laboratory Ambient Temperature:	23°C
	Relative Humidity:	55%
	Atmospheric Pressure:	1011 mbars
Reference Standard(s):	☒ ANSI C63.10:2020, Section 11.12.1 ☒ FCC Part 15.205/15.209/RSS Gen (8.9) ☒ KDB 558074	**Measurement Distance** ☒ 3 Meters ☐
Frequency Range:	☒ 30 MHz to 1 GHz	RBW = 100KHz, VBW ≥ 3 x RBW
	☒ 1 GHz to 25 GHz	RBW = 1MHz, VBW ≥ 3 x RBW
Nominal Voltage:	☐ 120VAC ☒ 3.0VDC	
Test Personnel:	Keith Schwartz KS	**Date:** 02/09/2024

Limits –15.209 and RSS Gen

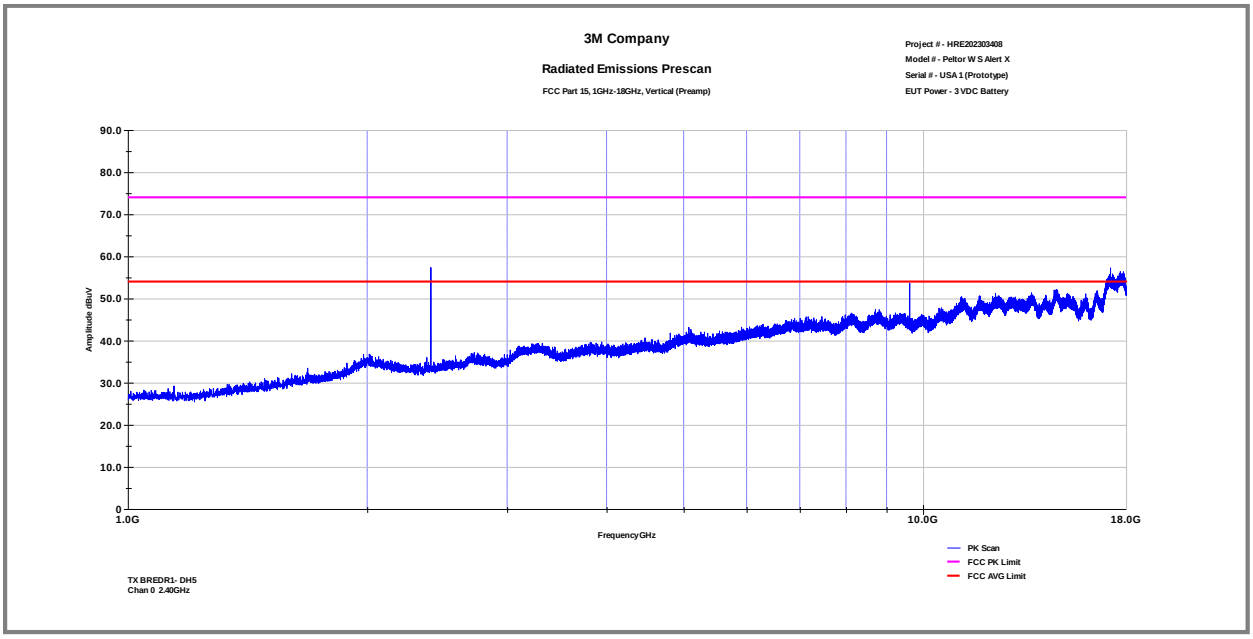
Frequency (MHz)	Limit dB (µV/m)				
	Quasi-Peak	Average	Peak	Distance	Results
0.009-0.490		2400/F(KHz)		300	**N/A**
0.490-1.705	24000/F(KHz)			30	**N/A**
1.705-30	30			30	**N/A**
30 to 88	40			3	**pass**
88 to 216	43.5			3	**pass**
216 to 960	46			3	**pass**
Above 960		54	74	3	**pass**

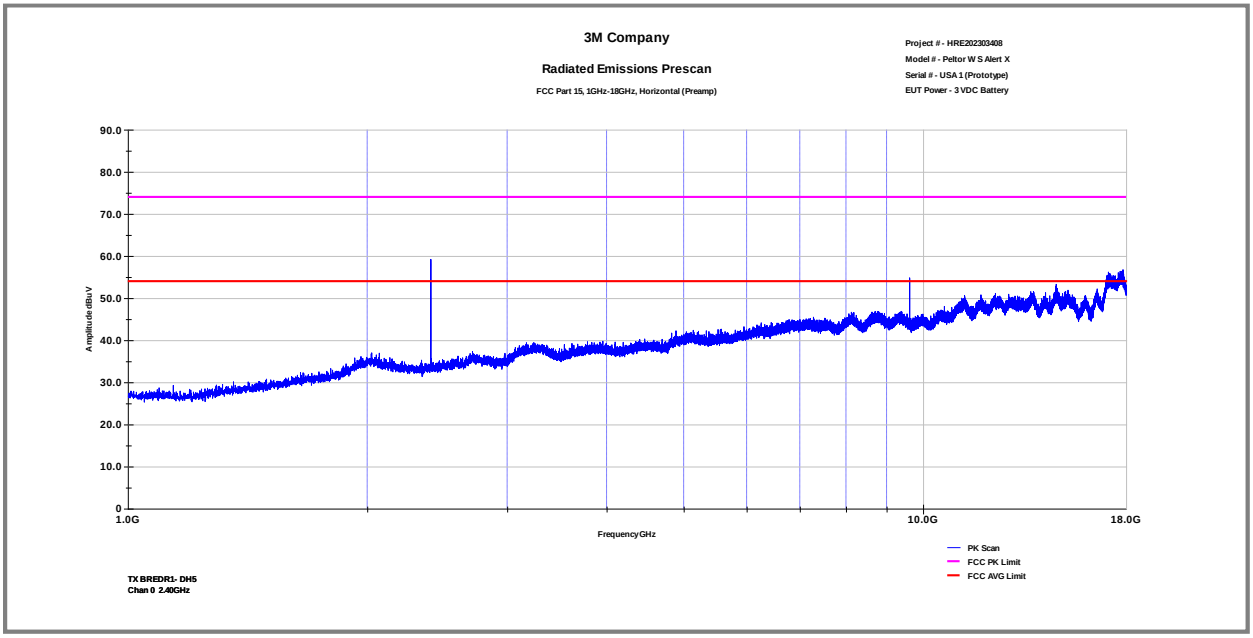
Modifications:	
Note:	The lower limit applies at the transition frequency. An inverse proportionality factor of 20 dB per decade has been used to normalize the measured data to the specified distance for determining compliance. All modes of operation and data were investigated. The results shown represent the worst case. No radiated spurious emissions were detected above 18GHz. 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.



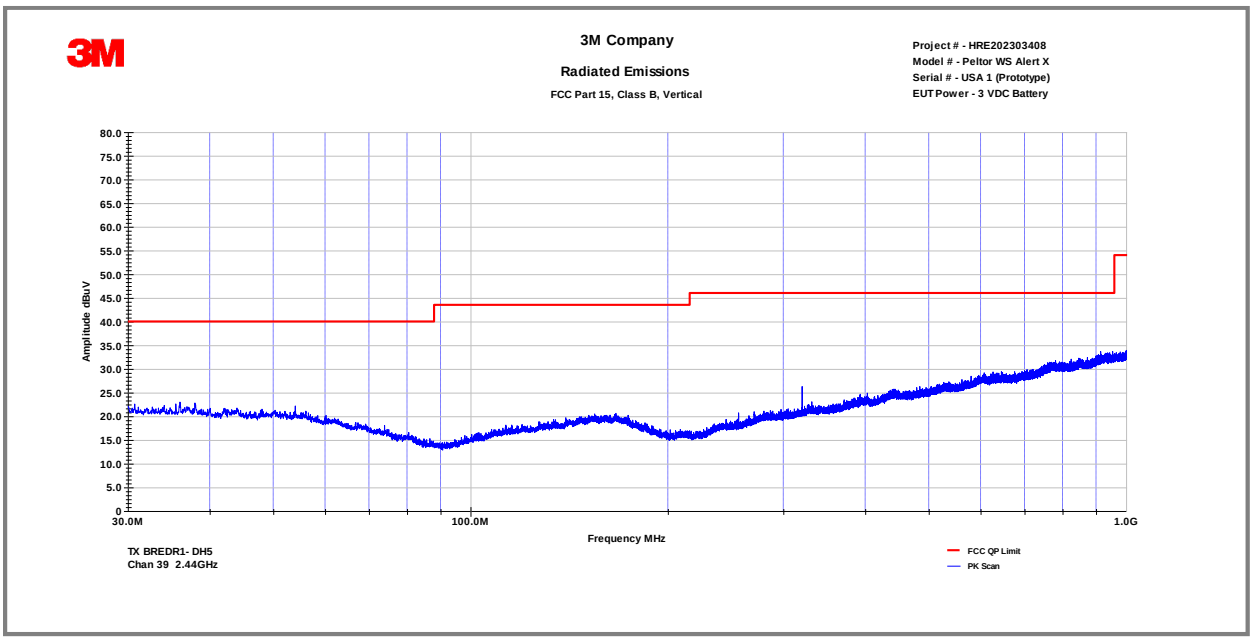


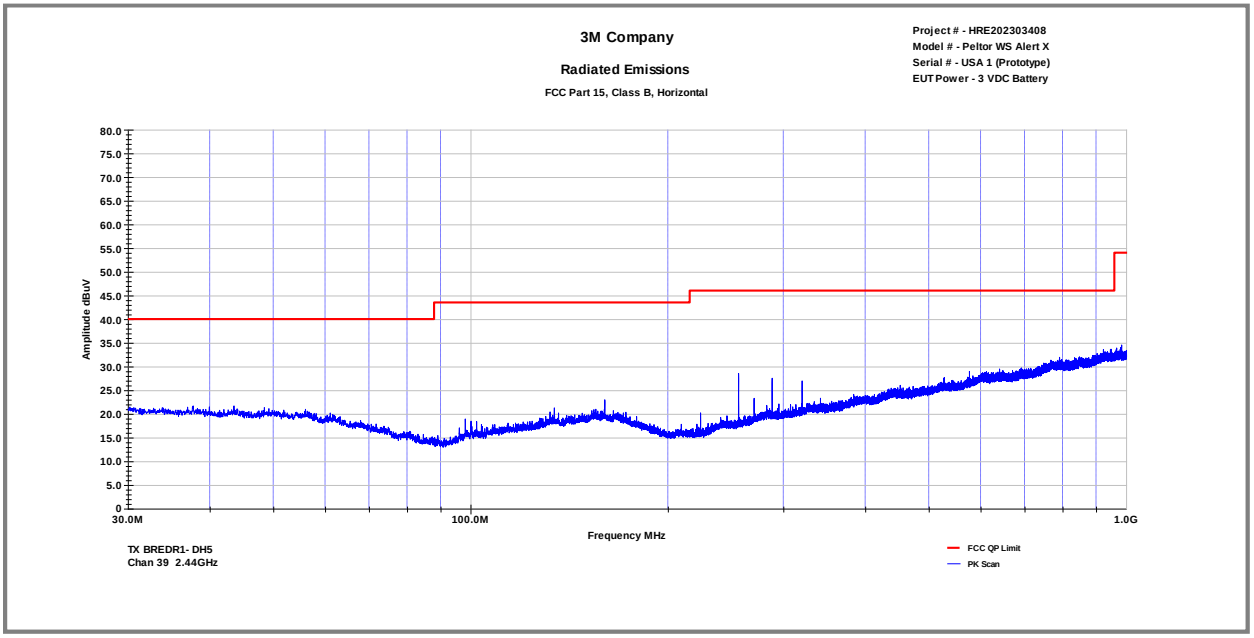
FCC Part 15.209 Radiated Emissions in restricted band – Low Channel (DH5)



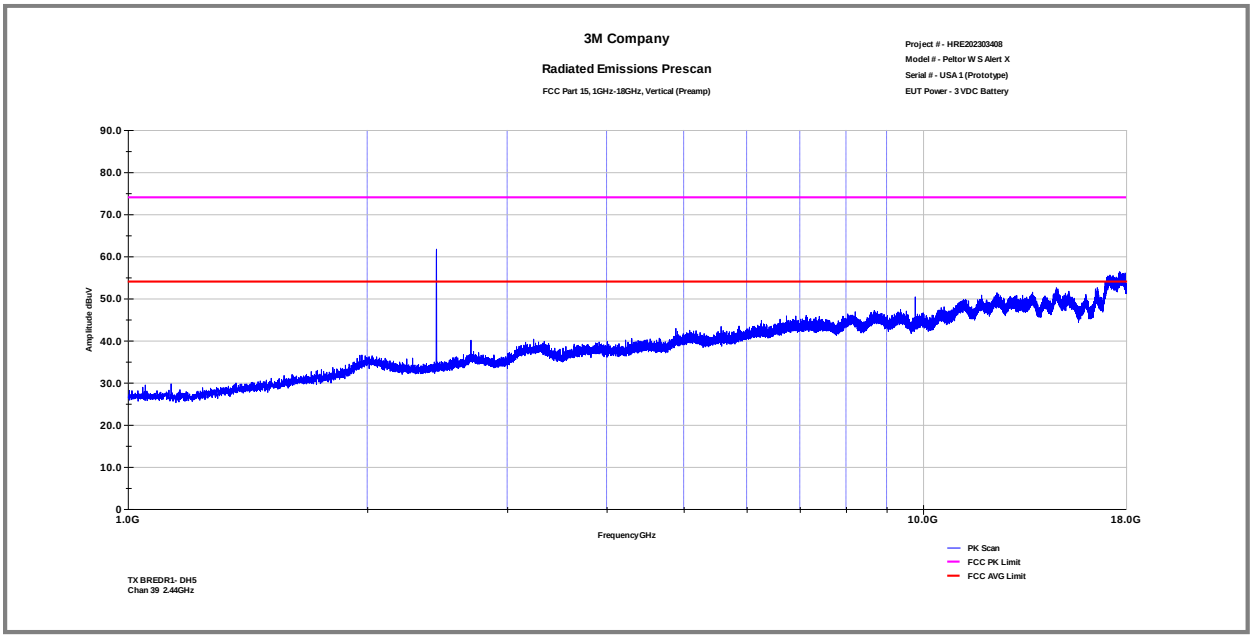


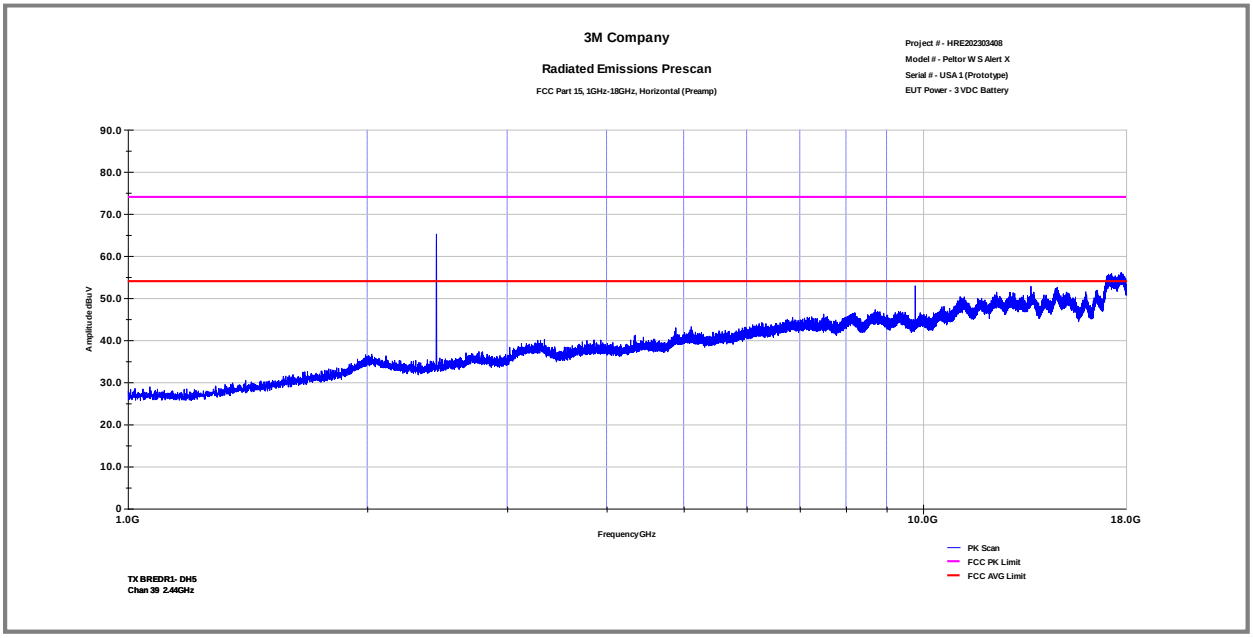
FCC Part 15.209 Radiated Emissions in restricted band – Low Channel (DH5)



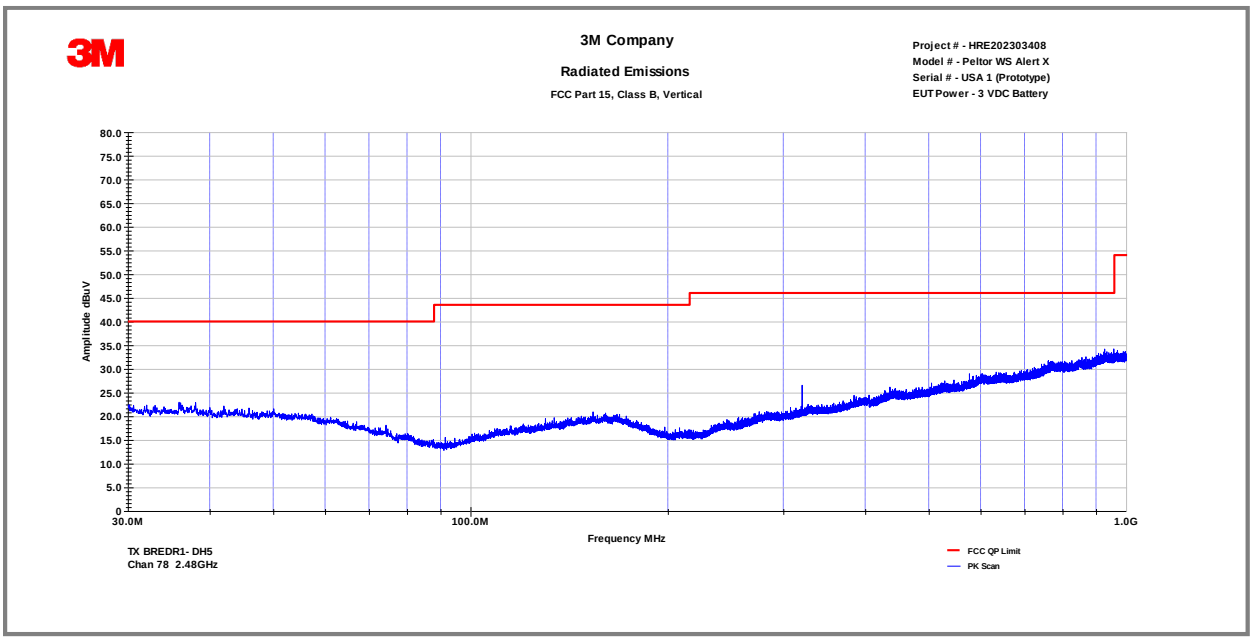


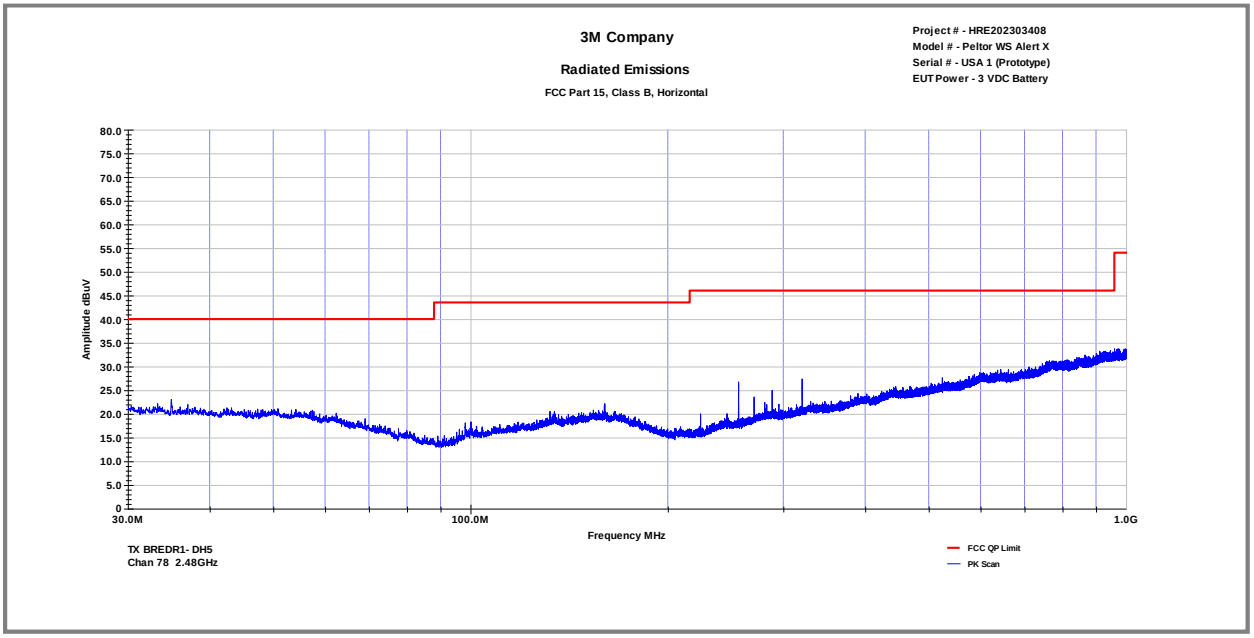
FCC Part 15.209 Radiated Emissions in restricted band – Mid Channel (DH5)



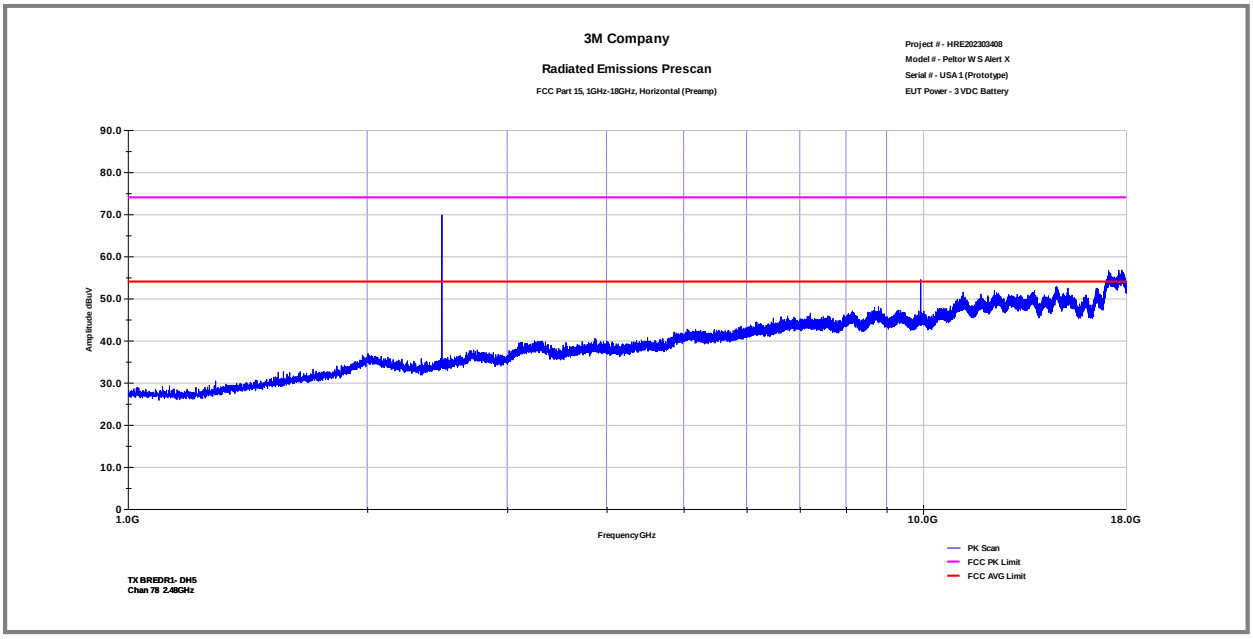


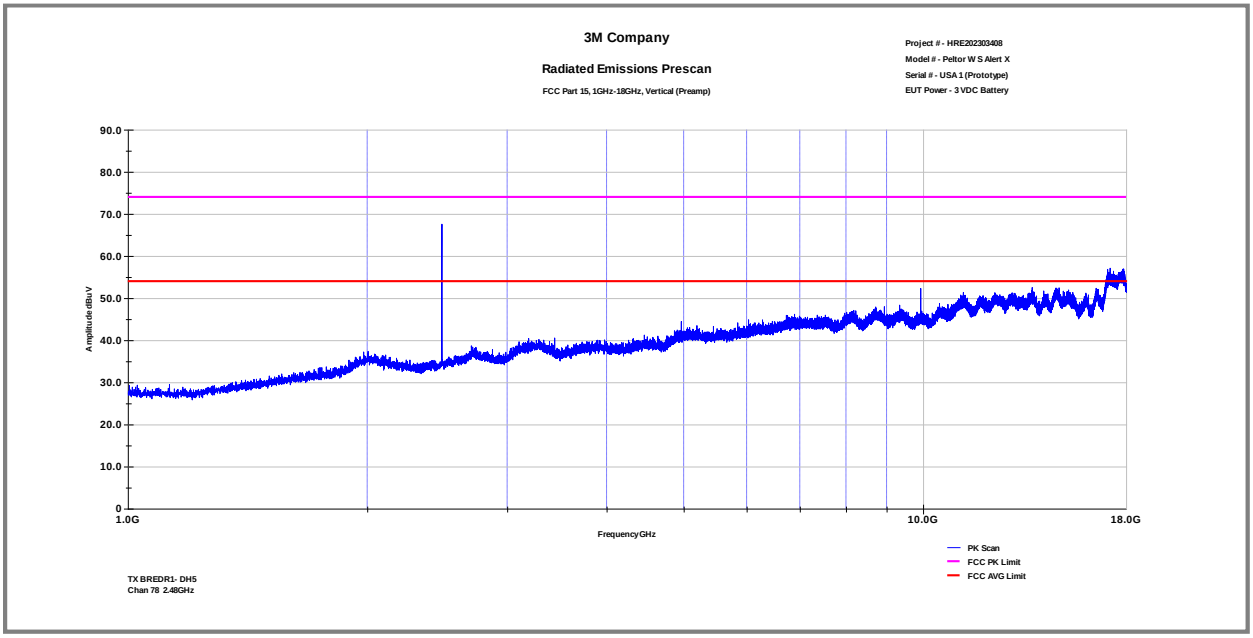
FCC Part 15.209 Radiated Emissions in restricted band – Mid Channel (DH5)





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
37.22	H	3.6	17.2	20.9	40	-19.1
54.44	H	2.2	18.2	20.4	40	-19.6
159.89	H	2.2	18.2	20.4	43.5	-23.1
256.37	H	1.7	17	18.6	46	-27.4
319.01	H	2.1	19.3	21.4	46	-24.6
845.24	H	3.3	28.8	32.1	46	-13.9
Notes:	Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB) Low Channel-DH5					

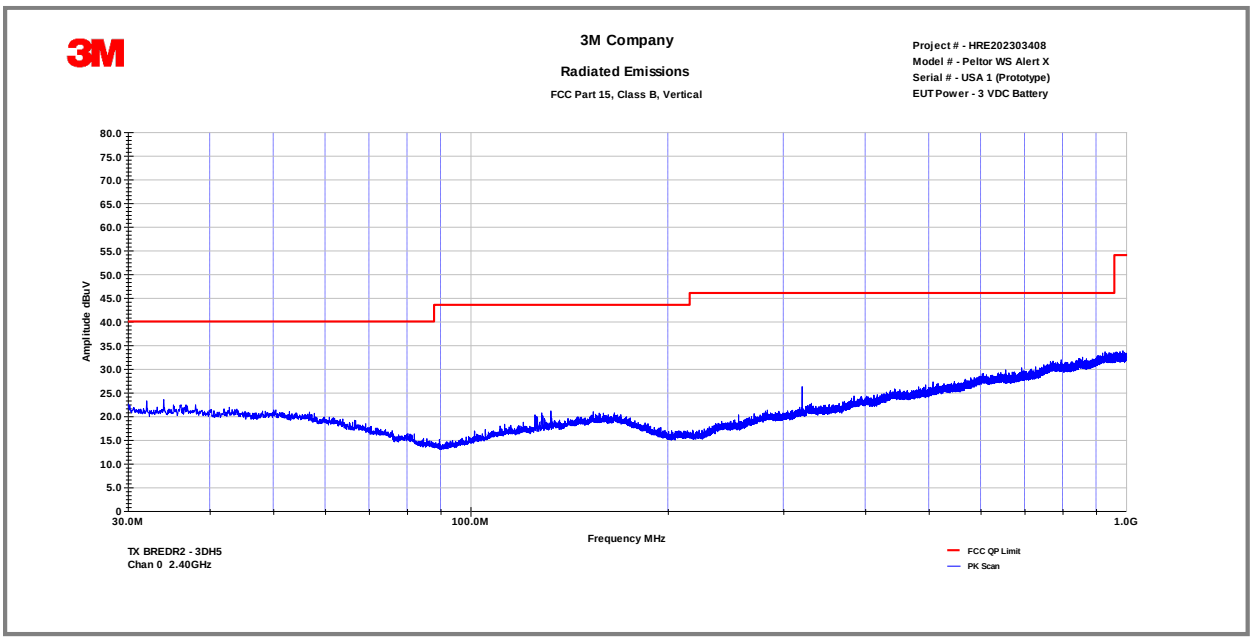
Frequency (MHz)	Pol.	QP Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m	Limit (dBµV/m)	Margin dB
36.74	H	3.7	17.2	20.8	40	-19.2
160.99	H	2.2	18.2	20.4	43.5	-23.1
255.65	H	1.6	16.9	18.5	46	-27.5
287.18	H	2	18.4	20.4	46	-25.6
320.06	V	2.1	19.4	21.6	46	-24.4
576.44	H	2.8	24.8	27.6	46	-18.4
Notes:	Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB) Mid Channel-DH5					

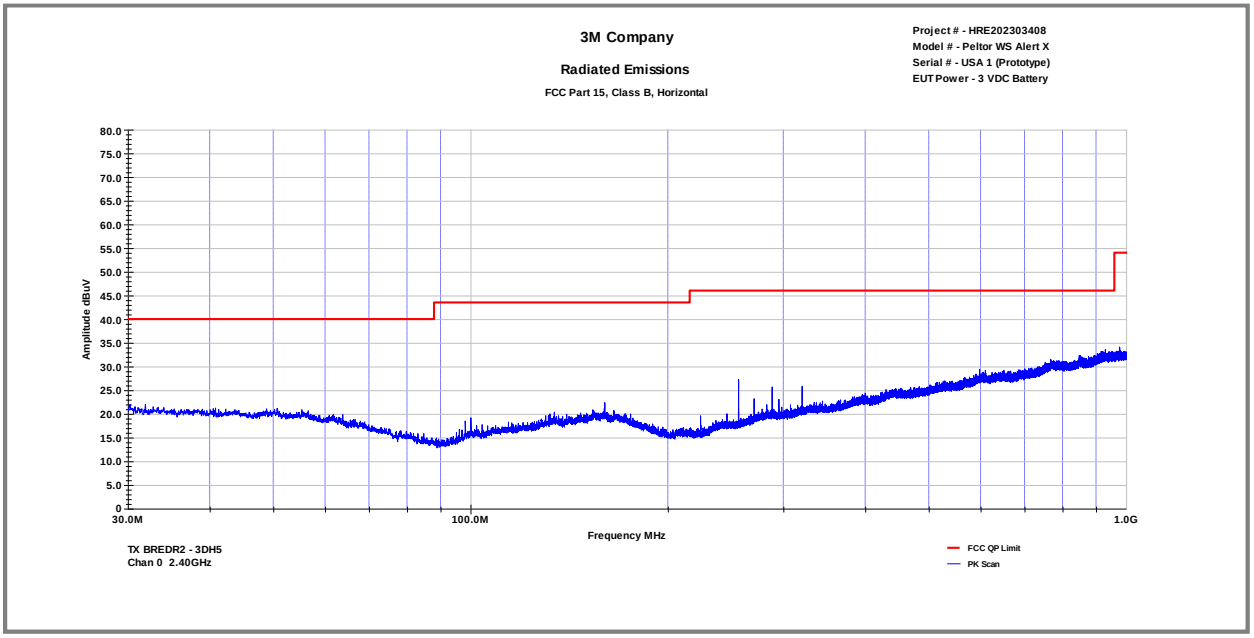
Frequency (MHz)	Pol.	QP Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m	Limit (dBµV/m)	Margin dB
34.22	H	3.9	16.8	20.7	40	-19.3
37.4	H	3.4	17.2	20.7	40	-19.3
159.47	H	2.2	18.2	20.4	43.5	-23.1
255.23	H	1.6	16.9	18.5	46	-27.5
288.74	H	1.8	18.4	20.2	46	-25.8
320.21	H	2.1	19.4	21.5	46	-24.5
Notes:	Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB) High Channel-DH5					

Pol	Frequency (MHz)	Peak dBµV/m	AVG dBµV/m	Total CF dB	Net Peak dBµV/m	Net AVE dBµV/m	PK Limit dBµV/m	AVE Limit dBµV/m	PK Margin dB	AVG Margin dB
V	3689.40	50.18	38.9	-9.85	40.33	29.09	74.00	54.00	-33.67	-24.91
H	3689.40	50.60	38.9	-9.85	40.75	29.09	74.00	54.00	-33.25	-24.91
V	4803.50	50.62	41.6	-6.36	44.26	35.24	74.00	54.00	-29.74	-18.76
H	4803.50	49.26	39.9	-6.36	42.90	33.55	74.00	54.00	-31.10	-20.45
V	8099.70	47.72	36.5	0.10	47.82	36.60	74.00	54.00	-26.18	-17.40
H	8099.70	47.88	36.6	0.10	47.98	36.74	74.00	54.00	-26.02	-17.26
V	9607.00	55.02	50.0	-0.23	54.79	49.72	74.00	54.00	-19.21	-4.28
H	9607.00	56.91	52.4	-0.23	56.68	52.15	74.00	54.00	-17.32	-1.85
Notes:		Net Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB))								
		Low Channel-DH5								

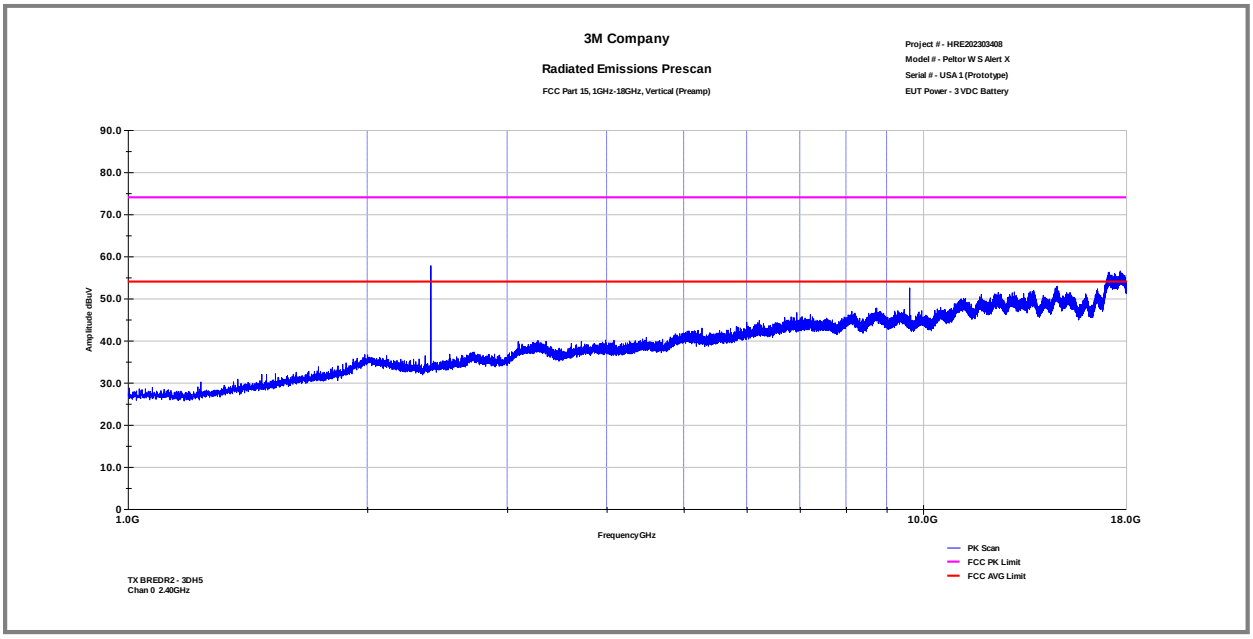
Pol	Frequency (MHz)	Peak dBµV/m	AVG dBµV/m	Total CF dB	Net Peak dBµV/m	Net AVE dBµV/m	PK Limit dBµV/m	AVE Limit dBµV/m	PK Margin dB	AVG Margin dB
V	4880.00	51.42	44.2	-5.30	46.12	38.85	74.00	54.00	-27.88	-15.15
H	4880.00	50.16	42.0	-5.30	44.86	36.67	74.00	54.00	-29.14	-17.33
V	7320.00	48.91	38.5	-2.01	46.90	36.47	74.00	54.00	-27.10	-17.53
H	7320.00	49.04	38.9	-2.01	47.03	36.92	74.00	54.00	-26.97	-17.08
V	9763.50	52.65	46.7	-0.16	52.49	46.55	74.00	54.00	-21.51	-7.45
H	9763.50	53.63	48.0	-0.16	53.47	47.79	74.00	54.00	-20.53	-6.21
Notes:		Net Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB))								
		Mid Channel-DH5								

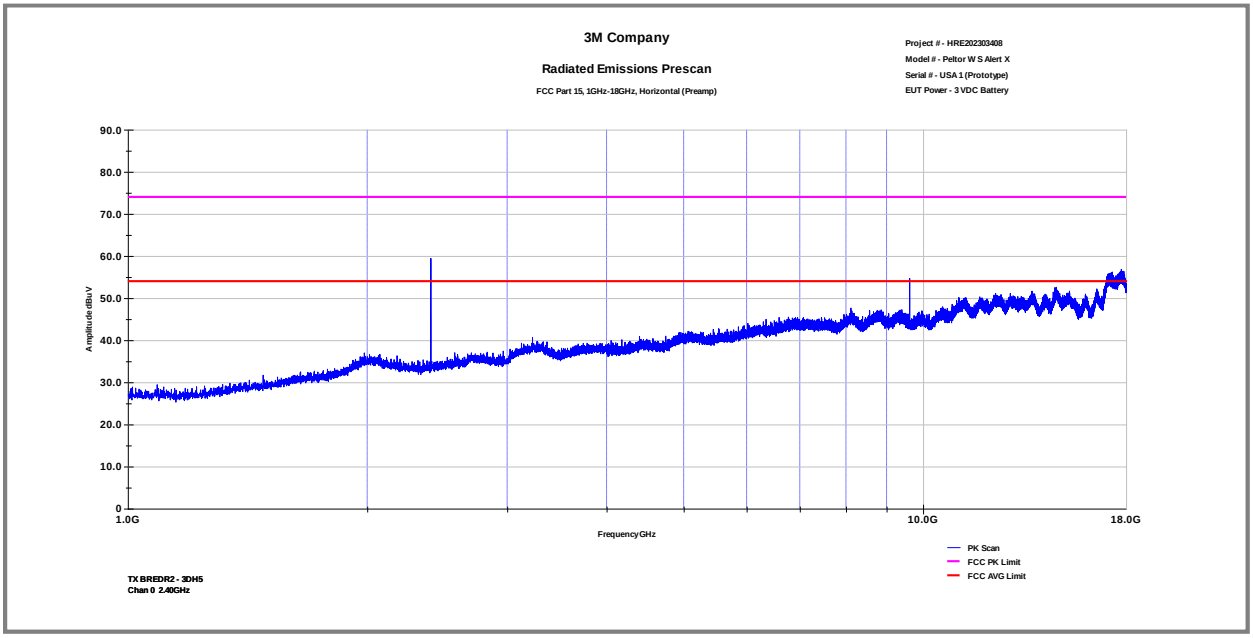
Pol	Frequency (MHz)	Peak dBµV/m	AVG dBµV/m	Total CF dB	Net Peak dBµV/m	Net AVE dBµV/m	PK Limit dBµV/m	AVE Limit dBµV/m	PK Margin dB	AVG Margin dB
V	2700.00	52.19	42.3	-12.21	39.98	30.10	74.00	54.00	-34.02	-23.90
H	2700.00	52.50	42.5	-12.21	40.29	30.24	74.00	54.00	-33.71	-23.76
V	4959.30	51.81	45.0	-5.17	46.64	39.81	74.00	54.00	-27.36	-14.19
H	4959.30	49.55	39.7	-5.17	44.38	34.56	74.00	54.00	-29.62	-19.44
V	7439.40	49.67	40.1	-1.69	47.98	38.41	74.00	54.00	-26.02	-15.59
H	7439.40	49.67	40.1	-1.69	47.98	38.36	74.00	54.00	-26.02	-15.64
V	9919.30	53.08	46.2	0.35	53.43	46.57	74.00	54.00	-20.57	-7.43
H	9919.30	55.48	50.6	0.35	55.83	50.99	74.00	54.00	-18.17	-3.01
Notes:		Net AVG VBW>1/T=2KHz Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB))								
		High Channel-DH5								



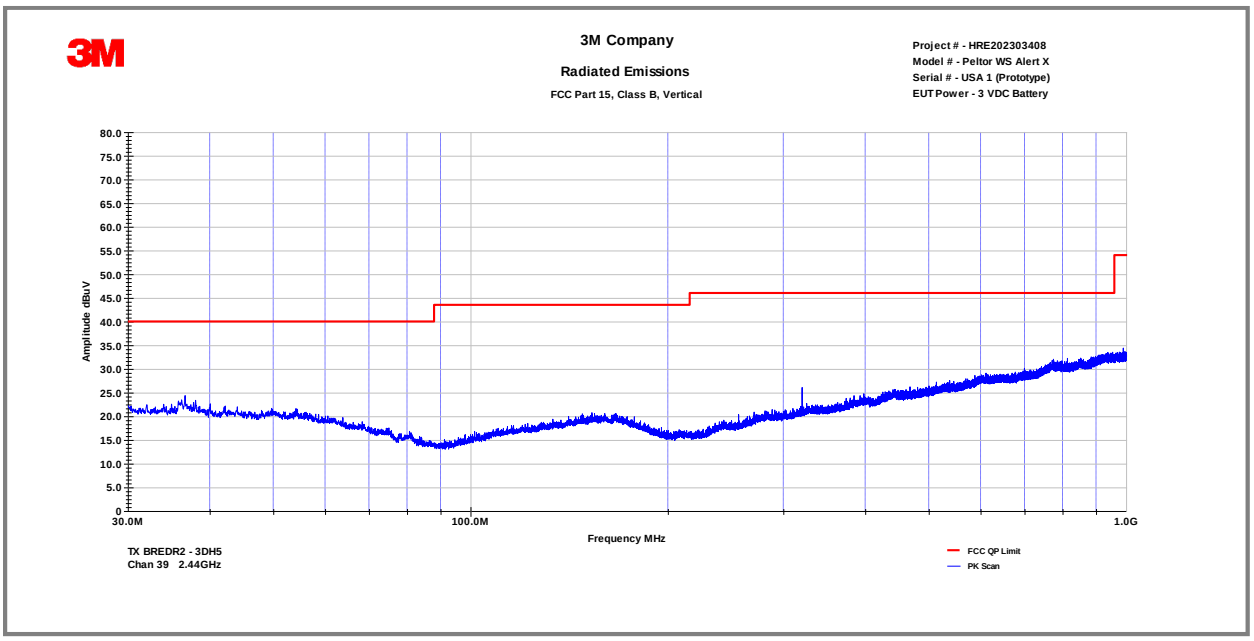


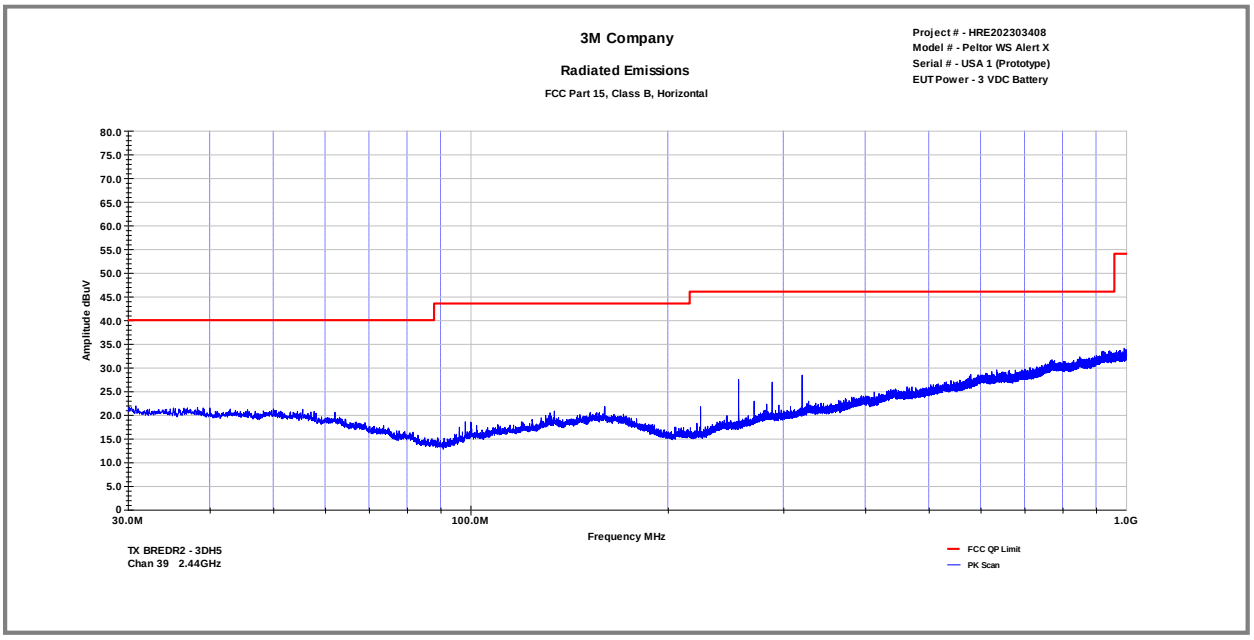
FCC Part 15.209 Radiated Emissions in restricted band – Low Channel (3-DH5)



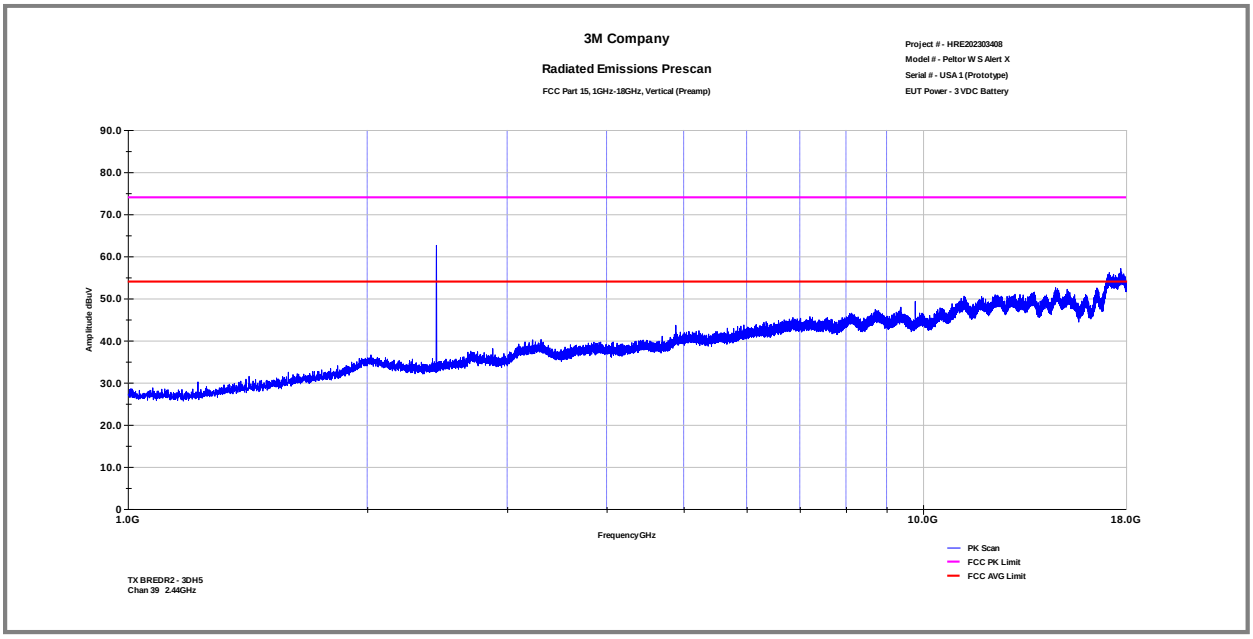


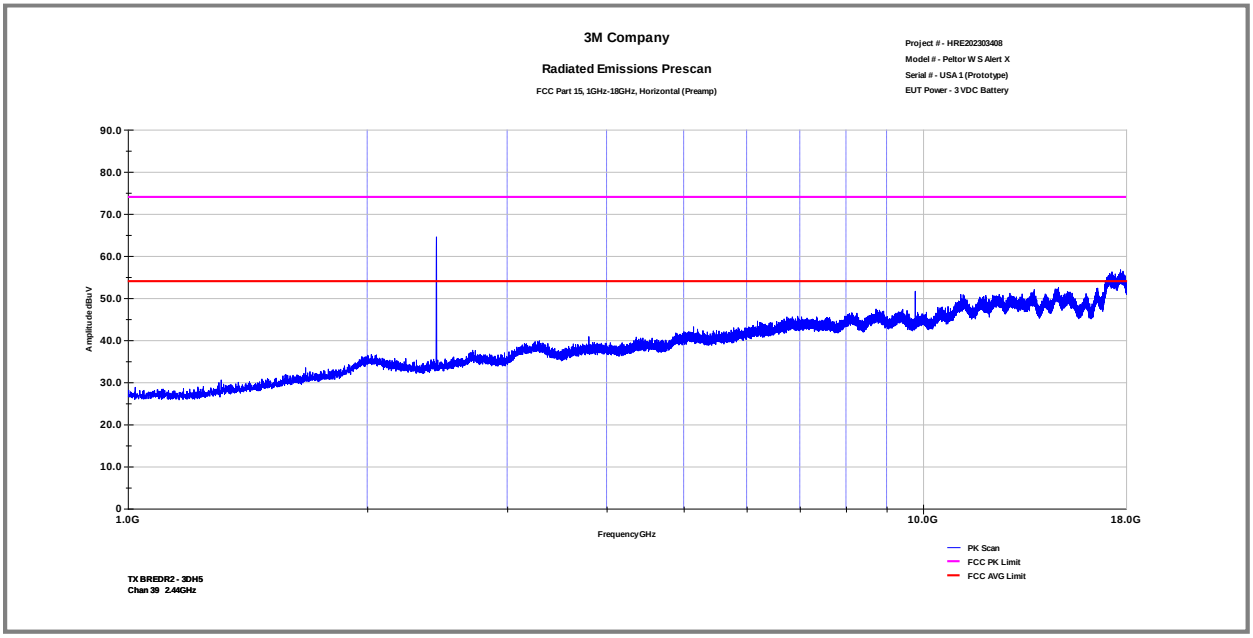
FCC Part 15.209 Radiated Emissions in restricted band – Low Channel (3-DH5)



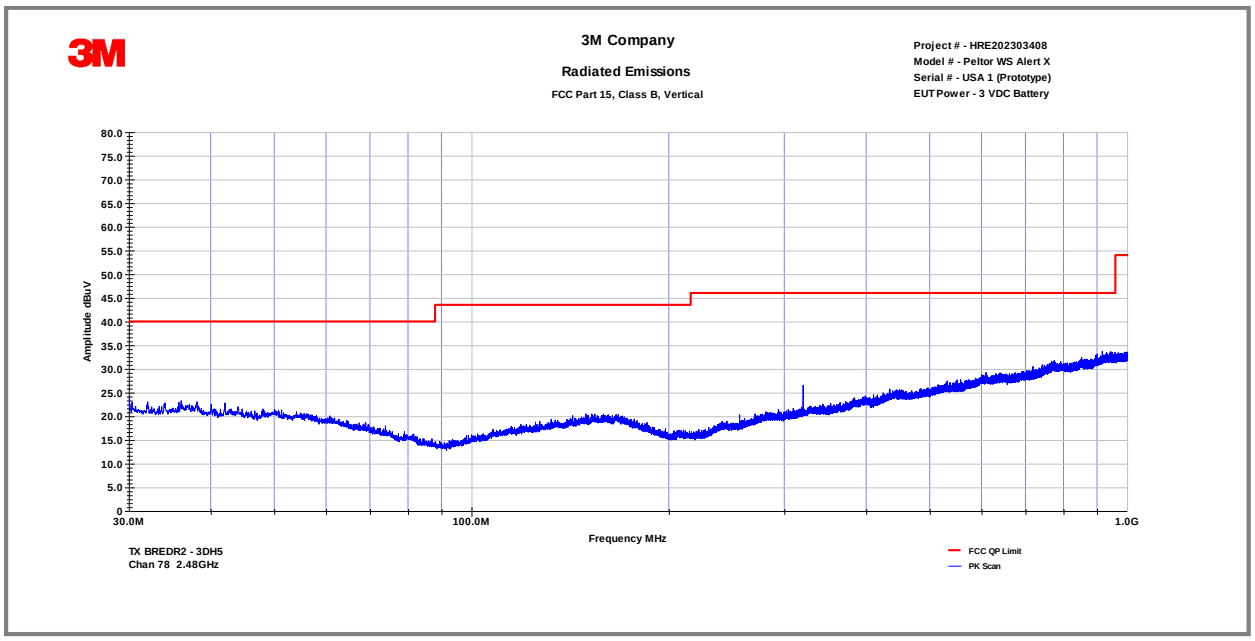


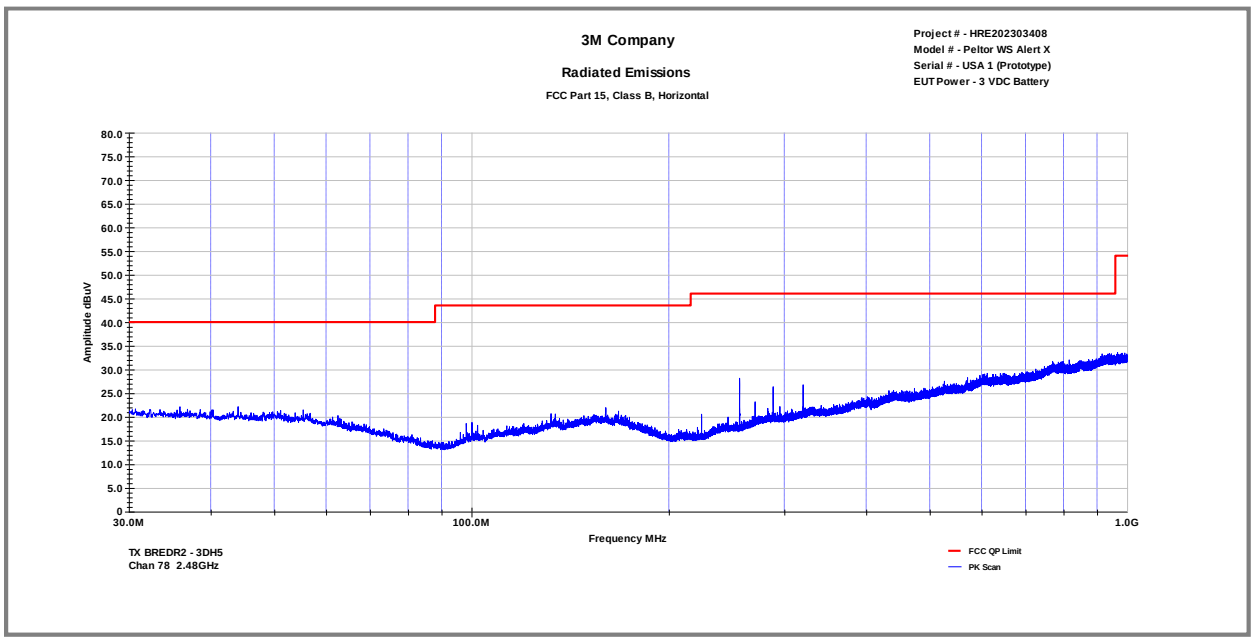
FCC Part 15.209 Radiated Emissions in restricted band – Mid Channel (3-DH5)



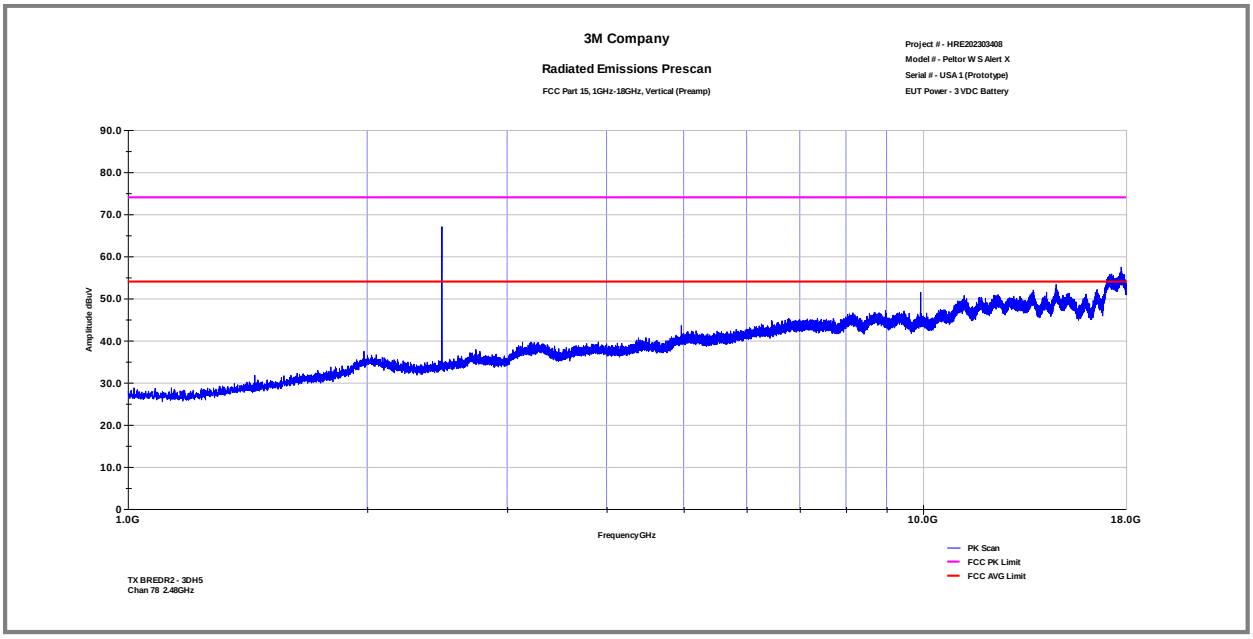


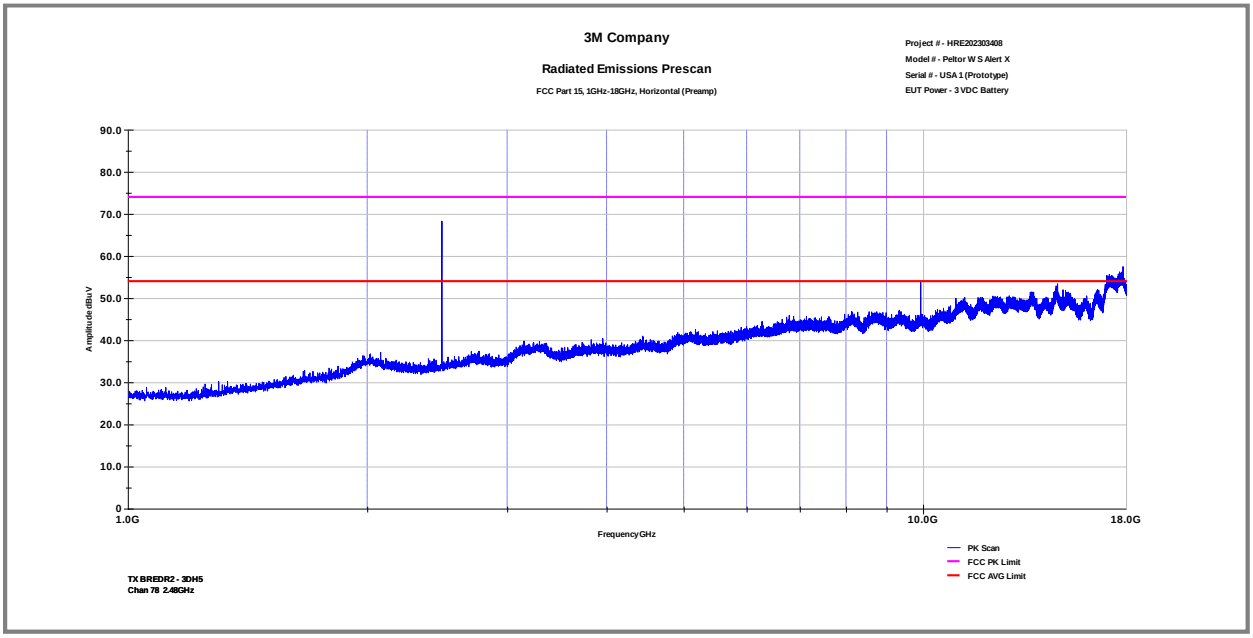
FCC Part 15.209 Radiated Emissions in restricted band – Mid Channel (3-DH5)





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
32.99	V	3.9	16.7	20.7	40	-19.3
99.98	H	3	13.5	16.5	43.5	-27
132.22	H	2	16.6	18.6	43.5	-24.9
255.71	H	1.6	16.9	18.5	46	-27.5
288.23	V	1.8	18.4	20.2	46	-25.8
319.13	H	2	19.3	21.3	46	-24.7
Notes:	Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB) Low Channel-3DH5					

Frequency (MHz)	Pol.	QP Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m	Limit (dBµV/m)	Margin dB
36.11	H	3.7	17	20.7	40	-19.3
160.94	H	2.2	18.2	20.5	43.5	-23
224.39	H	1.8	14.8	16.7	46	-29.3
256.04	H	1.7	16.9	18.6	46	-27.4
288.92	H	1.9	18.4	20.3	46	-25.7
320.09	H	2.1	19.4	21.5	46	-24.5
Notes:	Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB) Mid Channel-3DH5					

Frequency (MHz)	Pol.	QP Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m	Limit (dBµV/m)	Margin dB
35.33	H	3.8	17	20.7	40	-19.3
159.5	V	2.2	18.2	20.4	43.5	-23.1
255.41	H	1.6	16.9	18.5	46	-27.5
287.96	H	2	18.4	20.4	46	-25.6
320.27	V	2.1	19.4	21.5	46	-24.5
770.84	H	3.1	28.4	31.5	46	-14.5
Notes:	Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB) Mid Channel-3DH5					

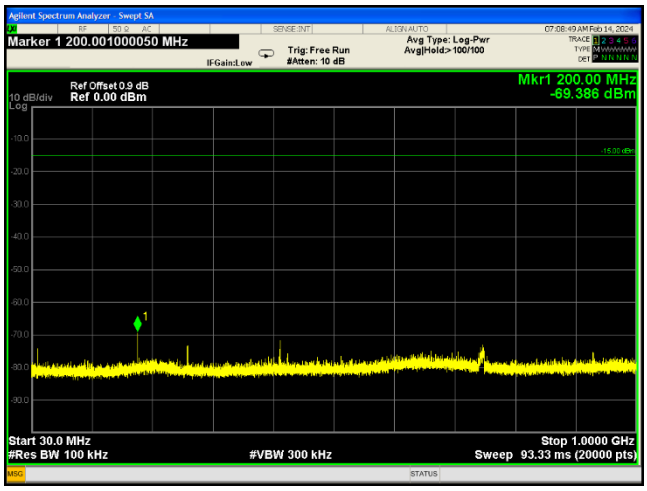
Pol	Frequency (MHz)	Peak dBµV/m	AVG dBµV/m	Total CF dB	Net Peak dBµV/m	Net AVE dBµV/m	PK Limit dBµV/m	AVE Limit dBµV/m	PK Margin dB	AVG Margin dB
V	3689.40	50.67	39.1	-9.85	40.82	29.28	74.00	54.00	-33.18	-24.72
H	3689.40	49.67	39.2	-9.85	39.82	29.30	74.00	54.00	-34.18	-24.70
V	4803.50	50.60	41.9	-6.36	44.24	35.52	74.00	54.00	-29.76	-18.48
H	4803.50	50.49	39.7	-6.36	44.13	33.30	74.00	54.00	-29.87	-20.70
V	8099.70	47.39	36.4	0.10	47.49	36.46	74.00	54.00	-26.51	-17.54
H	8099.70	47.93	36.4	0.10	48.03	36.51	74.00	54.00	-25.97	-17.49
V	9608.00	54.84	48.4	-0.23	54.61	48.21	74.00	54.00	-19.39	-5.79
H	9608.00	57.25	51.3	-0.23	57.02	51.10	74.00	54.00	-16.98	-2.90
Notes:		Net Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB))								
		Low Channel-3DH5								

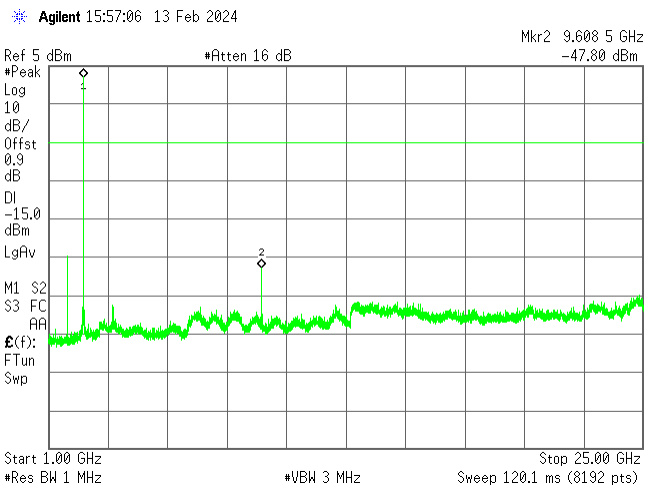
Pol	Frequency (MHz)	Peak dBµV/m	AVG dBµV/m	Total CF dB	Net Peak dBµV/m	Net AVE dBµV/m	PK Limit dBµV/m	AVE Limit dBµV/m	PK Margin dB	AVG Margin dB
V	4880.90	50.92	42.4	-5.30	45.62	37.14	74.00	54.00	-28.38	-16.86
H	4880.90	49.85	40.28	-5.30	44.55	-5.30	74.00	54.00	-29.45	-19.02
V	7320.00	48.25	37.1	-2.01	46.24	35.09	74.00	54.00	-27.76	-18.91
H	7320.00	48.30	37.2	-2.01	46.29	35.15	74.00	54.00	-27.71	-18.85
V	9763.50	52.12	44.6	-0.16	51.96	44.44	74.00	54.00	-22.04	-9.56
H	9763.50	53.84	47.1	-0.16	53.68	46.91	74.00	54.00	-20.32	-7.09
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 AVE dBµV/m	PK Limit dBµV/m	AVE Limit dBµV/m	PK Margin dB	AVG Margin dB
V	2700.00	51.81	41.5	-12.21	39.60	29.27	74.00	54.00	-34.40	-24.73
H	2700.00	51.83	41.1	-12.21	39.62	28.84	74.00	54.00	-34.38	-25.16
V	4959.30	51.82	44.0	-5.17	46.65	38.82	74.00	54.00	-27.35	-15.18
H	4959.30	49.42	39.5	-5.17	44.25	34.30	74.00	54.00	-29.75	-19.70
V	7439.40	49.49	39.0	-1.69	47.80	37.35	74.00	54.00	-26.20	-16.65
H	7439.40	49.12	38.9	-1.69	47.43	37.24	74.00	54.00	-26.57	-16.76
V	9919.30	49.22	39.1	0.35	49.57	39.41	74.00	54.00	-24.43	-14.59
H	9919.30	49.27	38.9	0.35	49.62	39.21	74.00	54.00	-24.38	-14.79
Notes:		Reading (dBuV) = Reading (dBµV) + (Antenna with amp CF(dB)+Cable CF(dB))								
		High Channel-3DH5								

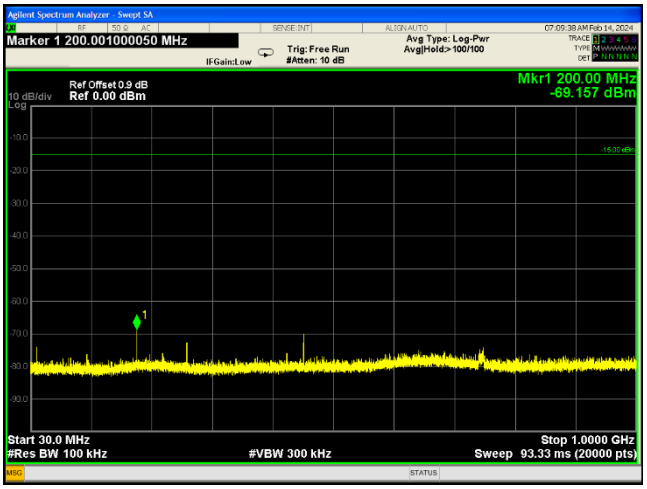
4.7	**Radiated Emissions in non-restricted band**	
Method:	Conducted out-of-band spurious emissions were investigated from 30MHz up to 25GHz to include 10th harmonic. The measurements were made with transmitter set to transmit continuously at low, medium and high channels.	
	Laboratory Ambient Temperature:	23°C
	Relative Humidity:	48%
	Atmospheric Pressure:	1011 mbars
Reference Standard(s):	☒ ANSI C63.10:2020, Section 11.11 ☒ FCC Part 15.247/RSS Gen (8.9) ☒ KDB 558074	**Measurement Point** ☒ Conducted ☐ Radiated
Frequency Range:	☒ 2402.0-2480.0MHz	
In-band power in 100KHz:	☒ 4.8dBm	**Results:**
Limit:	☒ -25.2dBm (30dBc below in-band power)	>37dBc
Nominal Voltage:	☐ 120VAC ☒ 3.0VDC	
Test Personnel:	Yuriy Litvinov	**Date:** 02/13/2024

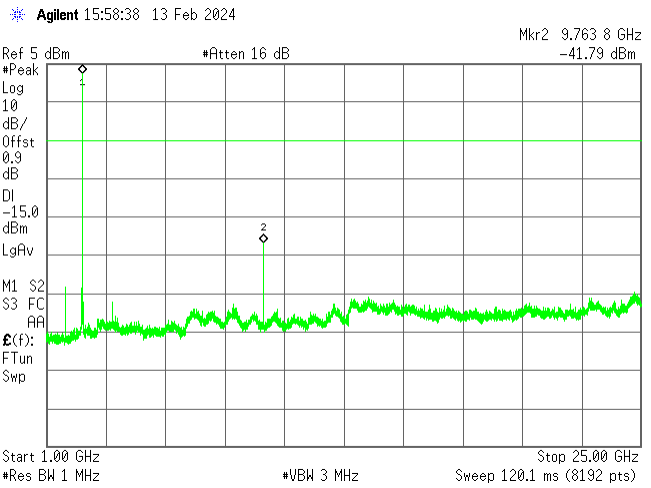
Note:	Out-of -the band conducted spurious emissions were investigated for all data rates and the worst-case emissions were found with the EUT transmitting at 3mbps..



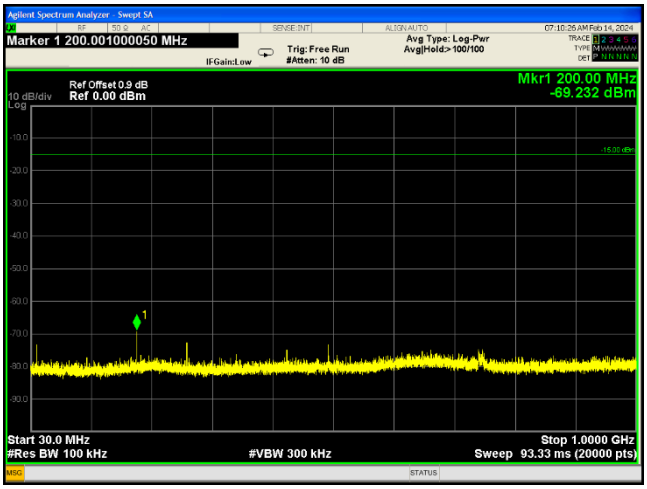


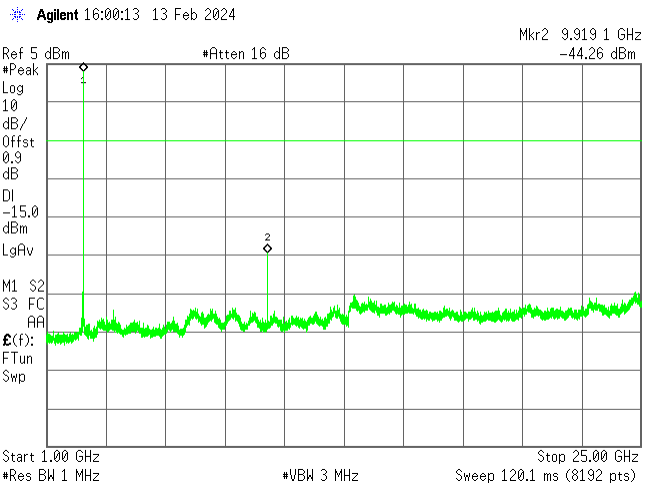
Conducted Spurious - Low Channel (3-DH5)





Conducted Spurious – Mid Channel (3-DH5)

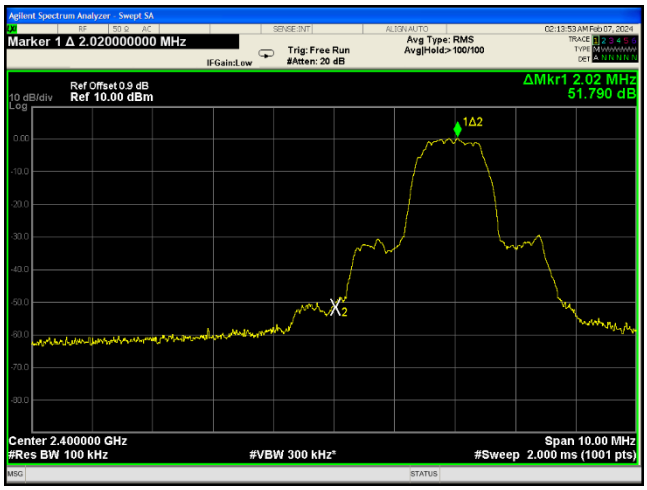




Conducted Spurious – High Channel (3-DH5)

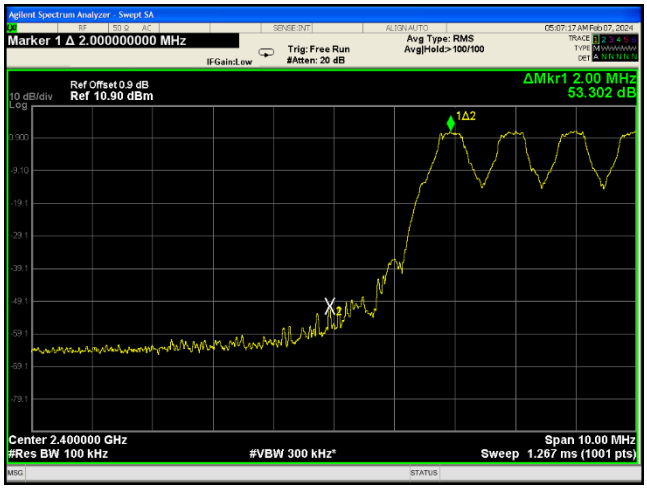
4.8	**Band-Edge Compliance**	
Method:	The measurements were made with transmitter set to transmit continuously with modulated signal at low and high channels.	
	Laboratory Ambient Temperature:	23°C
	Relative Humidity:	48%
	Atmospheric Pressure:	1011 mbars
Reference Standard(s):	☒ ANSI C63.10:2020, Section 6.10.4 ☒ FCC Part 15.247/RSS 247 ☒ KDB 558074	**Measurement Point** ☒ Conducted ☐ Radiated
Frequency Range:	☒ 2402.0-2480.0 MHz	**Results**
Limit:	☒ >30dBc	Low Ch., 2402 MHz > 51dBc High Ch., 2480 MHz > 59dBc
Nominal Voltage:	☐ 120VAC ☒ 3.0VDC	
Test Personnel:	Yuriy Litvinov	**Date:** 02/07/2024

Note:	Out-of-band conducted spurious emissions at the band edge were investigated for all data rates in hopping and no-hopping modes. The worst-case emissions were found with the EUT transmitting at 3mbps. Plots of the worst-case emissions are shown below.

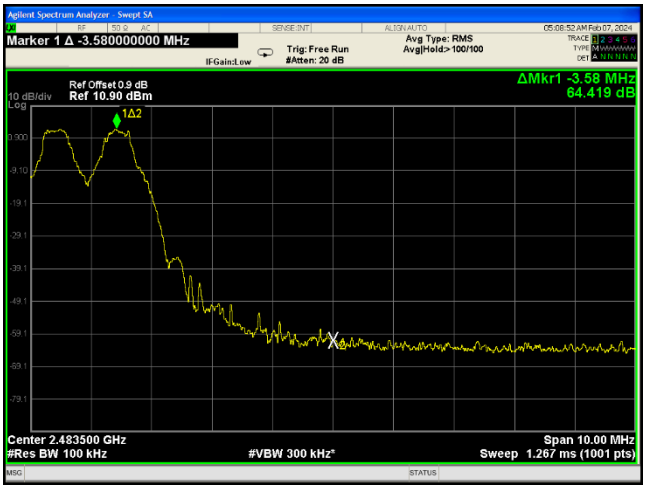


Band Edge - Low Channel
Hopping Disabled
Center Freq. 2.400GHz

Band Edge - High Channel
Hopping Disabled
Center Freq. 2.4835GHz



Band Edge - Low Channel
Hopping Enabled
Center Freq. 2.400GHz



Band Edge - High Channel
Hopping Enabled
Center Freq. 2.4835GHz

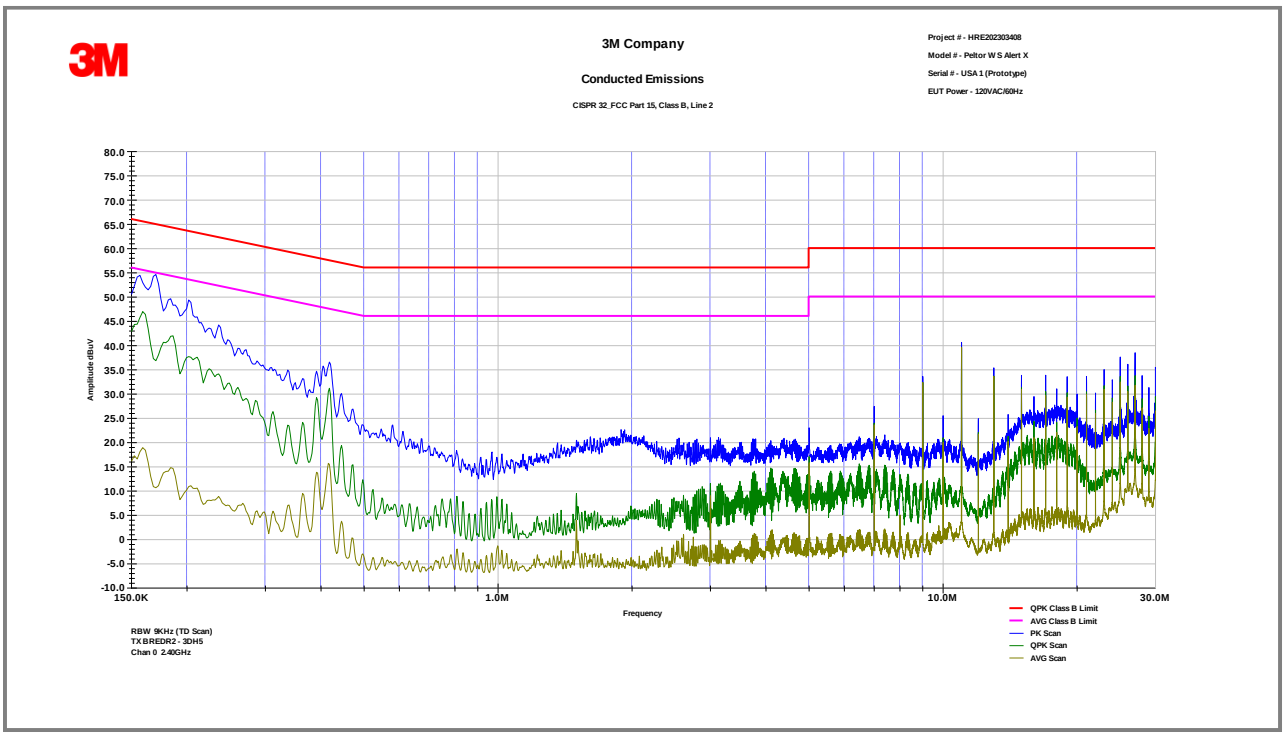
4.9	**Conducted Emissions Data**
Method:	The AMN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the AMN. 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.

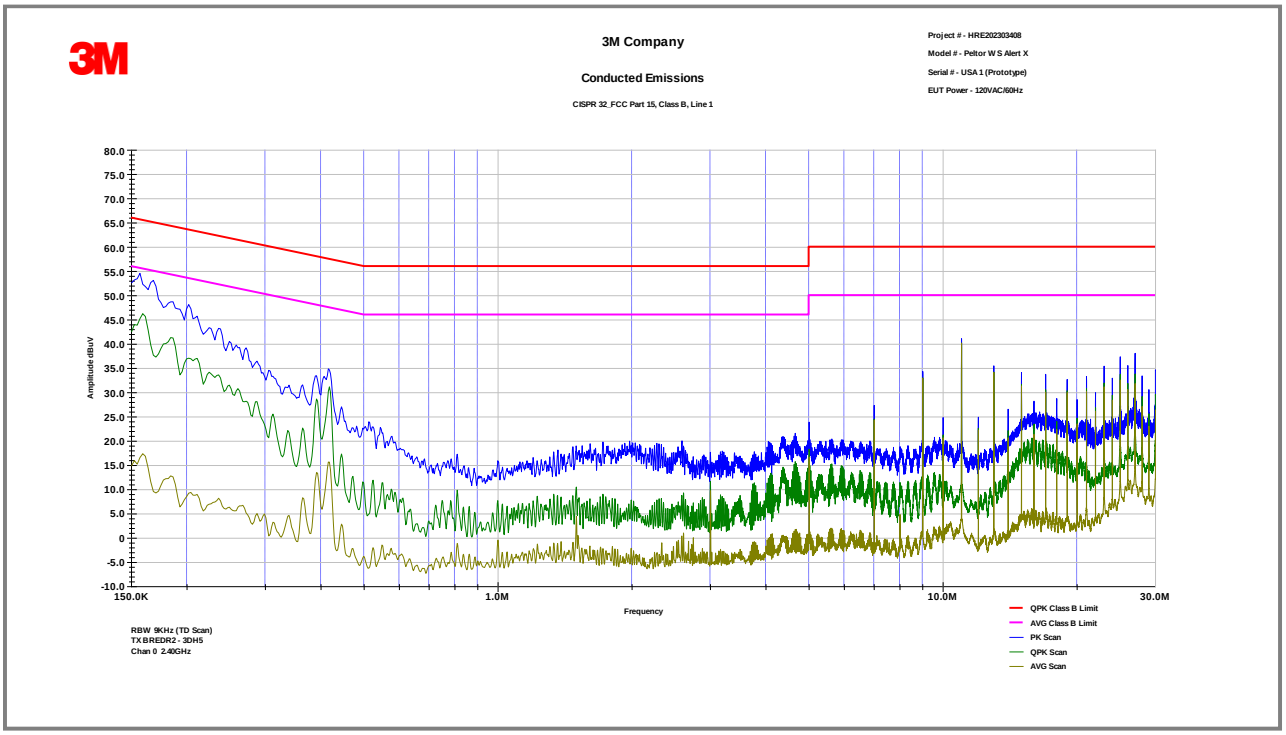
Test Verification: ☒	Laboratory Ambient Temperature:	23°C
	Relative Humidity:	48%
	Atmospheric Pressure:	1011 mbars
Reference Standard(s):	☒ FCC 15.207/RSS Gen (8.8) ☒ ANSI C63.4:2014 ☒ ANSI C63.10:2020	**Measurement Point** ☒ Mains ☐ Telecommunication ports ☐
Nominal Voltage:	☒ 120VAC ☐ 230VAC ☐ 3.0VDC	
Test Personnel:	Keith Schwartz KS	**Date:** 02/08/2024

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:	


3M Company
Conducted Emissions
CISPR 32_FCC Part 15, Class B, Line 2
Project # - HRE202303408
Model # - Peltor W S Alert X
Serial # - USA 1 (Prototype)
EUT Power - 120VAC/60Hz
Amplitude dBuV
Frequency
150.0K
1.0M
10.0M
30.0M
RBW 9KHz (TD Scan)
TX:BREDR2 - 3DH5
Chan 0 2.40GHz
QPK Class B Limit
AVG Class B Limit
PK Scan
QPK Scan
AVG Scan


3M Company
Conducted Emissions
CISPR 32_FCC Part 15, Class B, Line 1
Project # - HRE202303408
Model # - Peltor W S Alert X
Serial # - USA 1 (Prototype)
EUT Power - 120VAC/60Hz
Amplitude dBuV
Frequency
150.0K
1.0M
10.0M
30.0M
RBW 9KHz (TD Scan)
TX:BREDR2 - 3DH5
Chan 0 2.40GHz
QPK Class B Limit
AVG Class B Limit
PK Scan
QPK Scan
AVG Scan

4.8	RF Exposure Evaluation	
Reference Standard(s):	☒ KDB 447498 RF Exposure Guidance v06 ☐ KDB 447498 Interim RF Exposure Guidance v01 ☒ RSS 102, Issue 5 ☐	☐ MPE ☐ SAR Evaluation ☒ SAR Test Exclusion
Frequency Range(s):	☐ 911-918.5MHz ☒ 2402-2480.0MHz ☐	

Antenna Separation Distance:	>40mm
RF Exposure Conditions:	Portable (Body-worn)
2.4GHz Antenna Gain:	2.7dBi
BT EDR the source-based conducted output power:	3.0mW(4.8dBm)*0.7(FHSS worst case duty cycle)= 2.1mW(3.2dBm)
BT EDR EIRP/ERP output power:	**EIRP**=3.2dBm + 2.7dBi=5.9dBm, **ERP**=5.9dBm - 2.15dB=3.75dBm(2.4mW)
BLE the source-based conducted output power:	1.3mW(1dBm)*0.85(worst case duty cycle)=1.1mW(0.4dBm)
BLE EIRP/ERP output power:	**EIRP**=0.4dBm + 2.7dBi=3.1dBm, **ERP**=3.1dBm - 2.15dB= 0.95dBm(1.2mW)
The SAR Exclusion Threshold Level	
FCC Part 2.1093	77mW<40mm @2.45GHz
RSS 102, Issue 5	173mW>40mm @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	09/12/2024	HRE202303408-5	Original Issue