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Midmark Corporation
TEST REPORT

SCOPE OF WORK
EMC TESTING – WIRELESS HAND CONTROL

REPORT NUMBER
105489075LEX-001.1bb

ISSUE DATE
7/17/2024

REVISE DATE
5/19/2025

PAGES
37

DOCUMENT CONTROL NUMBER
Non-Specific EMC Report Shell Rev. December 2017

EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 105489075LEX-001.1bb
Project Number: G105489075

Report Issue Date: 7/17/2024
Report Revise Date: 5/19/2025

Model(s) Tested: Wireless Hand Control
029-4020-01

Standards: Title 47 CFR Part 15.247
RSS-247 Issue 3
RSS-Gen Issue 5

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Dr.
Lexington, KY 40510
USA

Client:
Midmark Corporation
60 Vista Dr.
Versailles, OH 45342
USA

Report prepared by

Brian Lackey, Team Leader

Report reviewed by

Michael Carlson, Project Engineer

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
6	Radiated Spurious Emissions (FCC Part 15.247(d), RSS-247 Issue 3 § 5.5)	Pass
7	Output Power and Power Spectral Density (FCC Part 15.247(b)(3), FCC Part 15.247(e), RSS-247 Issue 3 §§ 5.2(b), 5.4(d))	Pass
8	Occupied Bandwidth (FCC Part 15.247, RSS-247 Issue 3 § 5.2(a))	Pass
9	Antenna Requirement (FCC Part 15.203, RSS-Gen Issue 5 § 6.8)	Pass

3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Midmark Corporation
Address:	60 Vista Dr. Versailles, OH 45342 USA
Contact:	Nick Stammen
Email:	nstammen@midmark.com
Manufacturer Information	
Manufacturer Name:	Midmark Corporation
Manufacturer Address:	60 Vista Dr. Versailles, OH 45342 USA

4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	Wireless Hand Control
Model Numbers	029-4020-01
Serial Number	Unit 1
Receive Date	9/28/2023
Test Start Date	9/28/2023
Test End Date	9/29/2023
Device Received Condition	Good
Test Sample Type	Production
Hardware Version	015-2084-02
Rated Voltage	3VDC, 2xAA batteries
Frequency Band(s)	2400 – 2483.5MHz
Test Channel(s)	2405MHz, 2445MHz, 2475MHz
Maximum Antenna Gain (dBi)[1]	-2.69 dBi
Description of Equipment Under Test (provided by client)	
The wireless hand control allows the user to energize the motor(s) of the chair/table to move the orientation of the chair/table.	

4.1 Variant Models:

There were no variant models covered by this evaluation.

[1] Values were taken from ezurio report “Midmark Controllers 2024-03-25.xlsx” provided by the client. Deviations from these values may affect compliance. Intertek does not make any claims of compliance for values other than those shown.

5 System Setup and Method

5.1 Method:

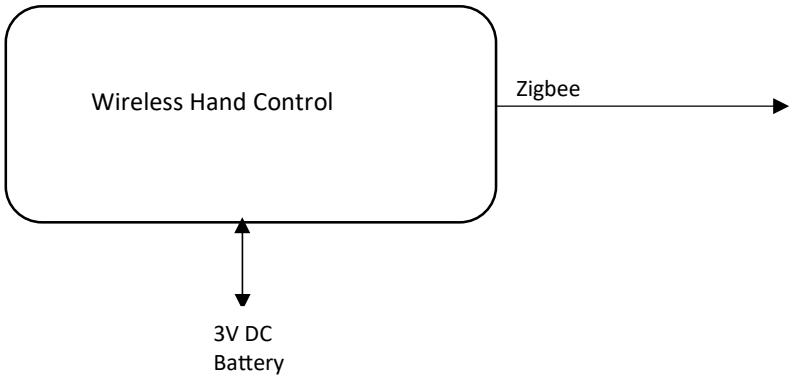
Configuration as required by ANSI C63.10:2020

No.	Descriptions of EUT Exercising
1	Transmitting a Zigbee signal on low, middle, or high channel at greater than 98% duty cycle.

Cables					
Qty	Description	Length (m)	Shielding	Ferrites	Termination
-	-	-	-	-	-

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
-	-	-	-

5.2 EUT Block Diagram:



6 Transmitter Spurious Emissions & Band Edge

6.1 Test Limits

FCC Part 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

RSS-247 Issue 3 § 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

6.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.12.1 Radiated emission measurements.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	U_{CISPR}
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	5.5 dB

As shown in the table above our radiated emissions U_{Lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

6.3 Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

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

6.4 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	8258	Rohde & Schwarz	ESW44	9/19/2023	9/19/2024
Magnetic Loop Antenna	2366	ETS	6502	8/28/2023	8/28/2024
Bilog Antenna (30MHz-1GHz)	7085	SunAR	JB6	3/7/2023	3/7/2024
Horn Antenna (1-18GHz)	3780	ETS	3117	8/8/2023	8/8/2024
Horn Antenna (18-40GHz)	3779	ETS	3116c	8/23/2023	8/23/2024
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
30M-1G 3m Signal Path without Preamplifier	3339, 2592, 8188, 8185	-	-	1/12/2023	1/12/2024
1-18GHz Signal Path with Preamplifier	3074, 3918, 2588, 2593, 8188, 8185	-	-	1/12/2023	1/12/2024
18-40GHz Signal Path with Preamplifier	7020, 3921, 7021	-	-	1/12/2023	1/12/2024

6.5 Software Utilized

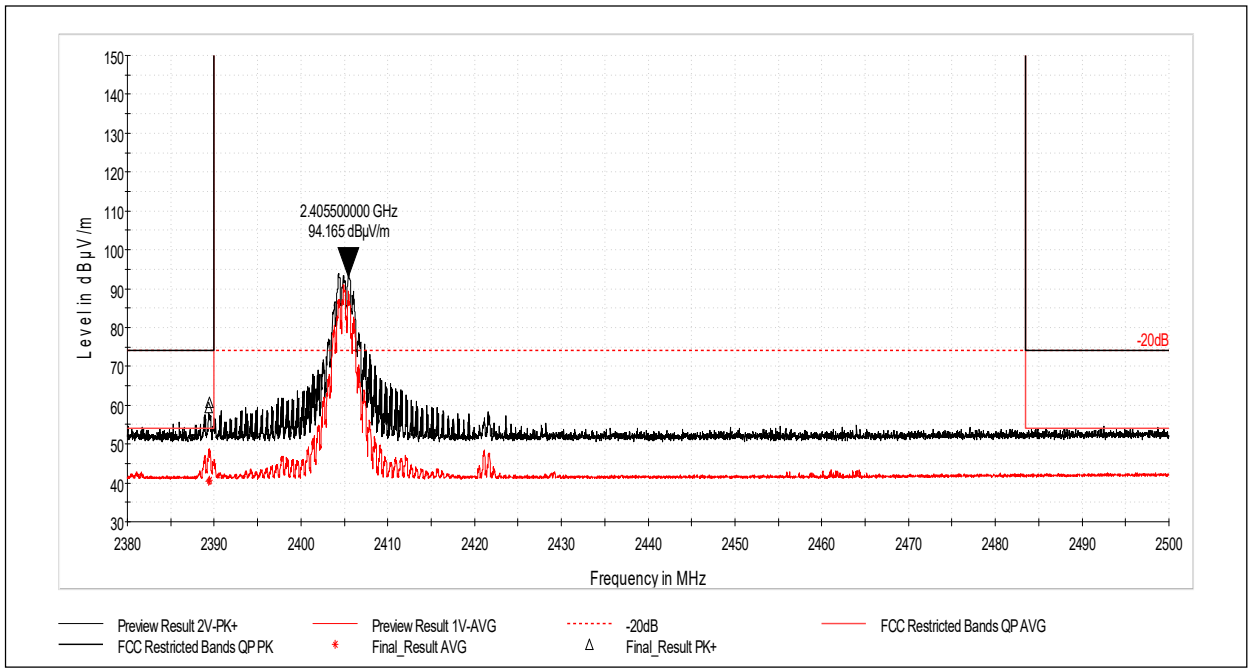
Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 10.60.20

6.6 Test Results

The sample tested was found to be **compliant**. The data presented represents the worst-case emissions with the device positioned in three orthogonal positions.

6.7 Test Data: Radiated Band Edge

6.7.1 2405 MHz



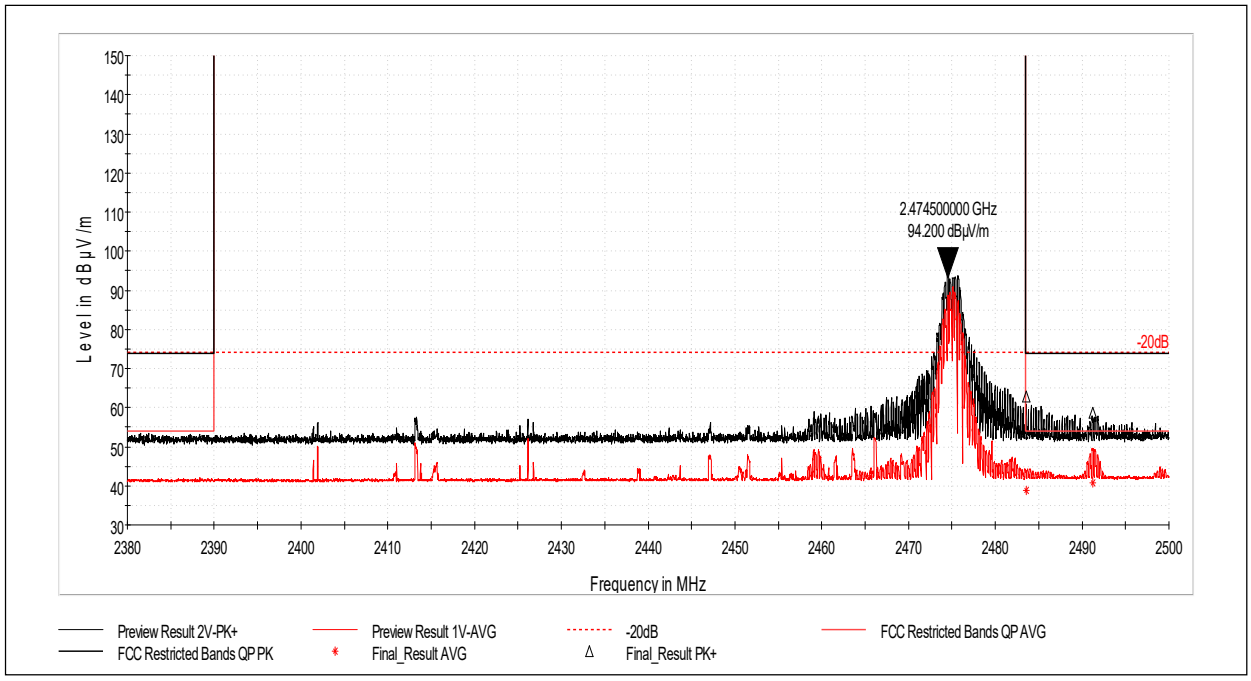
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.392	59.51	73.98	14.47	120.0	V	156.0	40.0
2389.438	60.76	73.98	13.22	121.0	V	162.0	40.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.392	40.31	53.98	13.67	120.0	V	156.0	40.0
2389.438	40.80	53.98	13.18	121.0	V	162.0	40.0

Test Personnel:	Brian Lackey	Test Date:	9/28/2023
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Product Standard:	FCC Part 15.247 RSS-247 Issue 3	Ambient Temperature:	22.0°C
Input Voltage:	3VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

Deviations, Additions, or Exclusions: None

6.7.2 2475 MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.523	62.71	73.98	11.27	127.0	V	88.0	40.5
2491.254	58.62	73.98	15.36	129.0	V	80.0	40.5

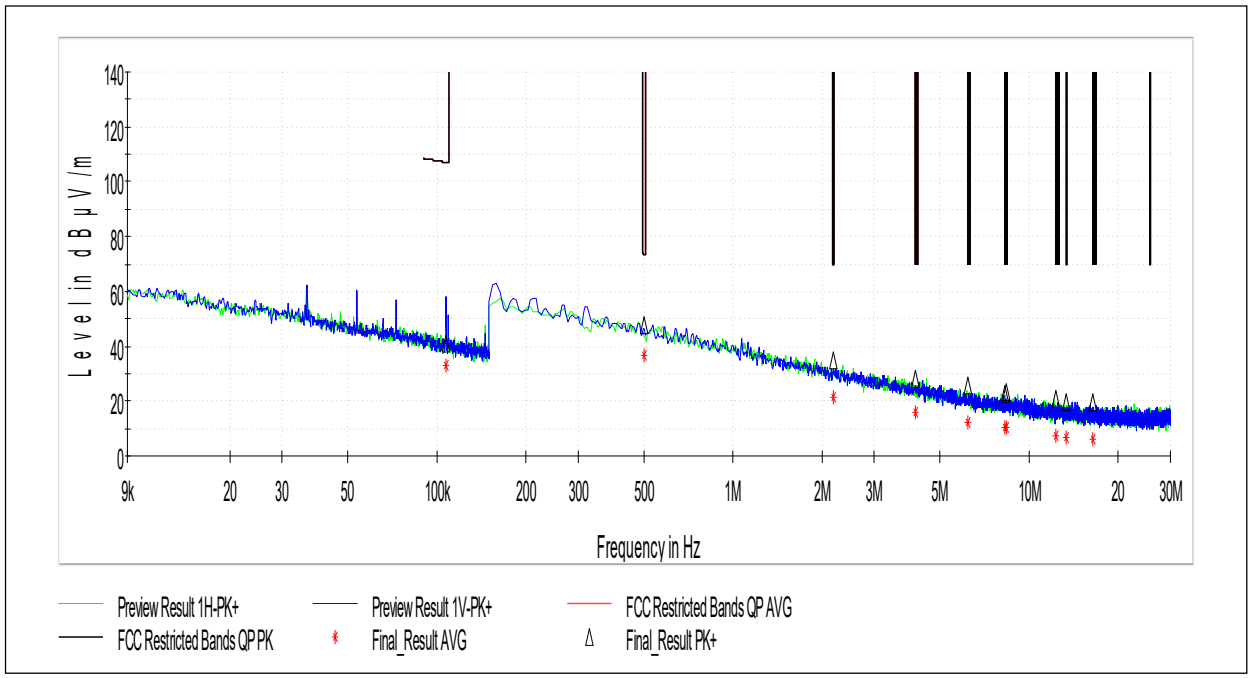
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.523	38.90	53.98	15.08	127.0	V	88.0	40.5
2491.254	40.63	53.98	13.35	129.0	V	80.0	40.5

Test Personnel:	Brian Lackey	Test Date:	9/28/2023
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Product Standard:	FCC Part 15.247 RSS-247 Issue 3	Ambient Temperature:	22.0°C
Input Voltage:	3VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

Deviations, Additions, or Exclusions: None

6.8 Test Data: Radiated Spurious Emissions

6.8.1 Radiated Spurious Emissions, 2445MHz, 9KHz-30MHz:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB/m)
0.107	41.08	107.01	65.94	0.200	215.0	12.9
0.501	47.71	73.61	25.90	9.000	100.0	12.6
2.187	34.71	69.54	34.83	9.000	166.0	12.4
4.127	27.96	69.54	41.58	9.000	263.0	12.2
6.217	25.37	69.54	44.17	9.000	92.0	11.9
8.293	22.38	69.54	47.17	9.000	16.0	11.7
8.385	23.38	69.54	46.17	9.000	118.0	11.7
12.292	20.79	69.54	48.75	9.000	24.0	11.6
13.363	19.86	69.54	49.68	9.000	0.0	11.6
16.423	19.61	69.54	49.93	9.000	166.0	11.4

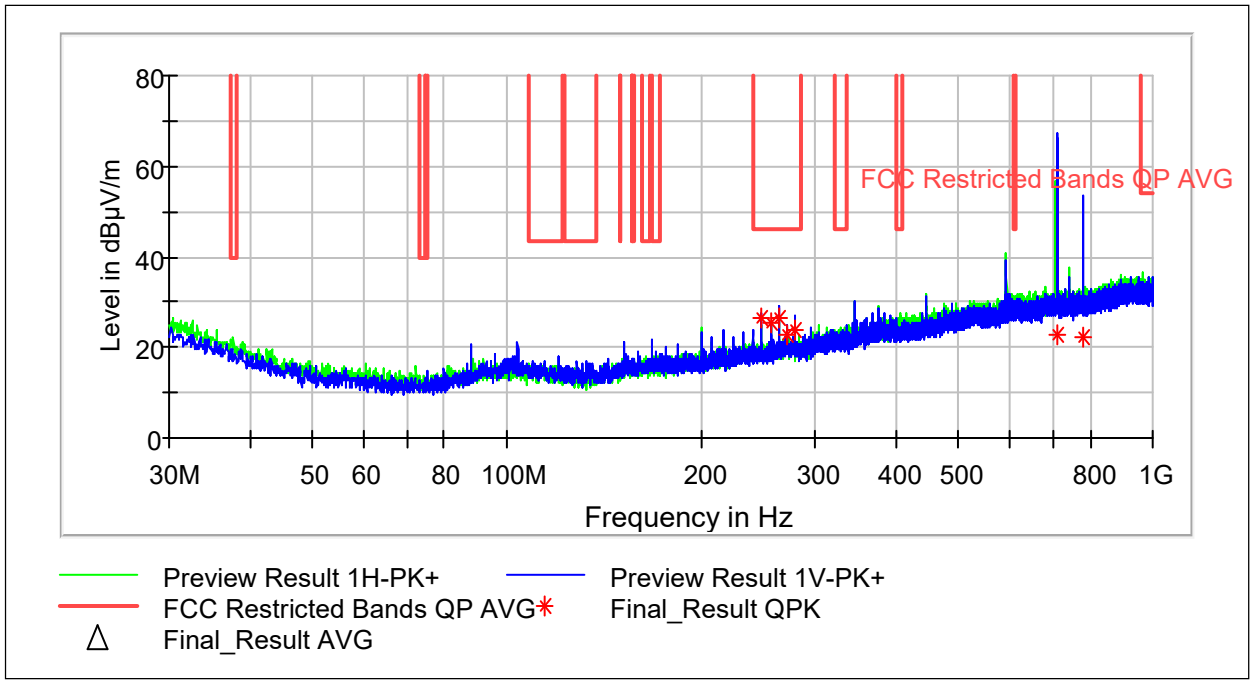
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB/m)
0.107	33.02	107.01	74.00	0.200	215.0	12.9
0.501	36.53	73.61	37.07	9.000	100.0	12.6
2.187	21.68	69.54	47.86	9.000	166.0	12.4
4.127	16.15	69.54	53.39	9.000	263.0	12.2
6.217	12.35	69.54	57.19	9.000	92.0	11.9
8.293	10.14	69.54	59.40	9.000	16.0	11.7
8.385	10.22	69.54	59.32	9.000	118.0	11.7
12.292	7.52	69.54	62.03	9.000	24.0	11.6
13.363	6.92	69.54	62.62	9.000	0.0	11.6
16.423	5.89	69.54	63.65	9.000	166.0	11.4

Test Personnel:	Brian Lackey	Test Date:	9/29/2023
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Product Standard:	FCC Part 15.247 RSS-247 Issue 3	Ambient Temperature:	21.9°C
Input Voltage:	3VDC	Relative Humidity:	62.6%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

Deviations, Additions, or Exclusions: None

Note: Testing represents the worst case of low, middle, and high channels.

6.8.2 Radiated Spurious Emissions, 2445MHz, 30MHz-1GHz:



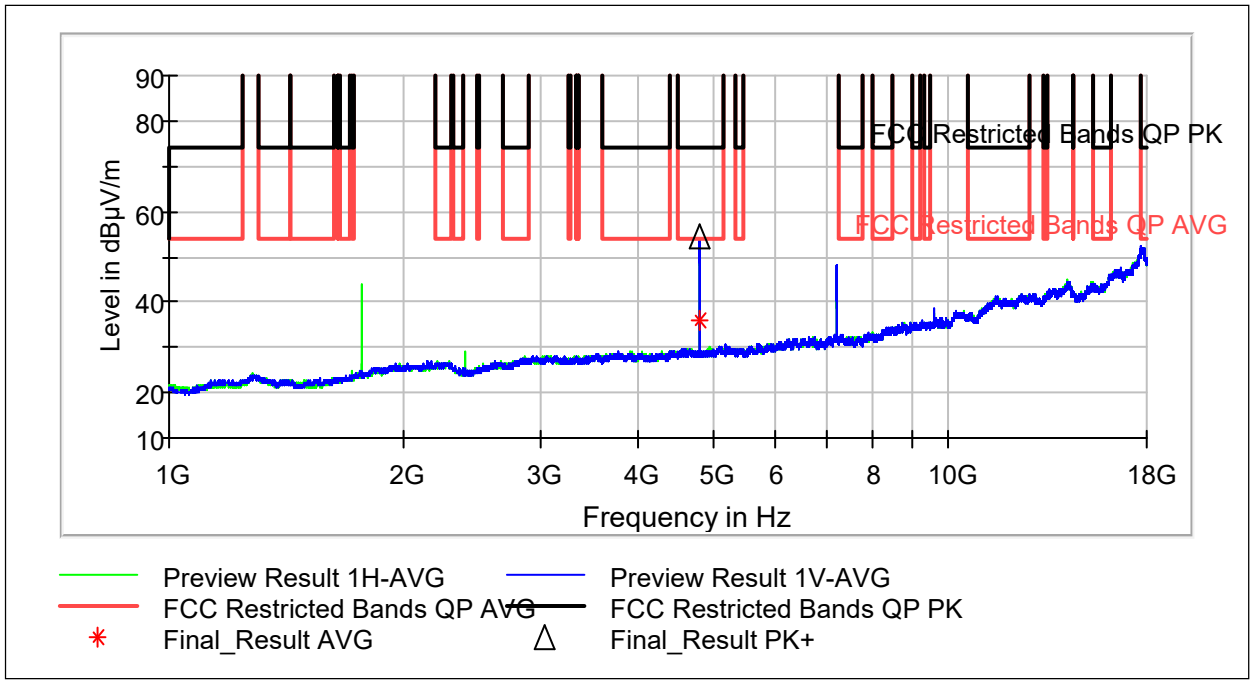
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
247.981	26.66	46.02	19.36	100.0	V	7.0	19.9
256.010	25.40	46.02	20.62	100.0	V	0.0	20.1
263.986	26.38	46.02	19.65	100.0	V	0.0	20.2
272.015	22.66	46.02	23.36	149.0	V	0.0	20.8
279.991	23.80	46.02	22.22	151.0	V	0.0	20.7
711.964	22.75	-	-	285.0	V	241.0	30.0
778.463	22.38	-	-	342.0	V	48.0	30.2

Test Personnel:	Brian Lackey	Test Date:	9/28/2023
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Product Standard:	FCC Part 15.247 RSS-247 Issue 3	Ambient Temperature:	22.0°C
Input Voltage:	3VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

Deviations, Additions, or Exclusions: signals observed at 711.964MHz and 778.463MHz were transients not observed during final measurement.

Note: Testing represents the worst case of low, middle, and high channels.

6.8.3 Radiated Spurious Emissions, 2405MHz, 1GHz-18GHz:



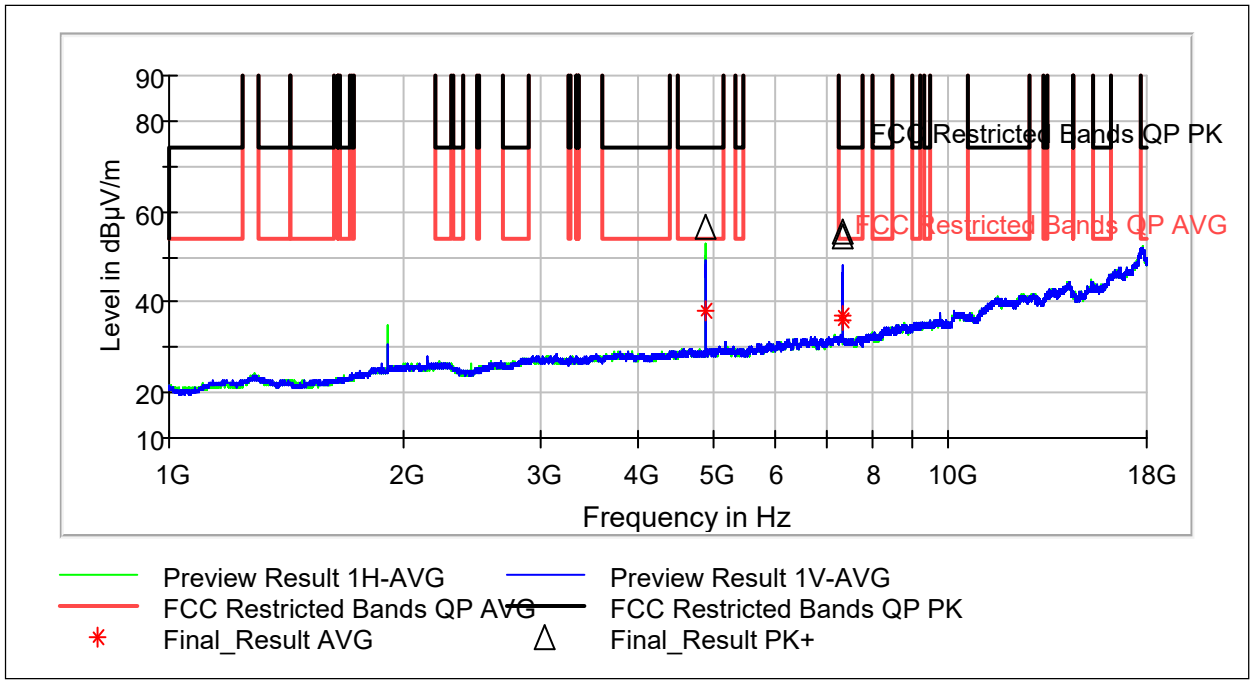
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4811.000	54.54	73.98	19.44	266.0	V	22.0	10.3

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4811.000	36.14	53.98	17.84	266.0	V	22.0	10.3

Test Personnel:	Brian Lackey	Test Date:	9/28/2023
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Product Standard:	FCC Part 15.247 RSS-247 Issue 3	Ambient Temperature:	22.0°C
Input Voltage:	3VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

Deviations, Additions, or Exclusions: None

6.8.4 Radiated Spurious Emissions, 2445MHz 1GHz-18GHz:



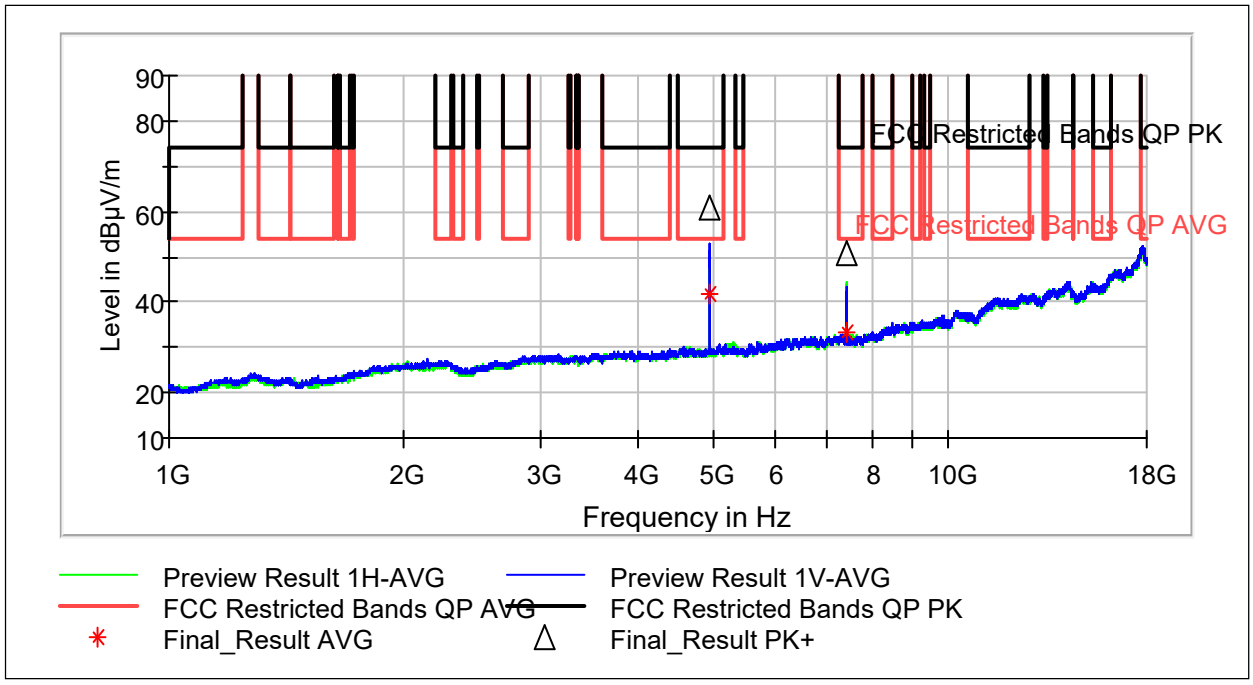
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4891.000	56.65	73.98	17.33	254.0	H	314.0	10.3
7333.500	54.58	73.98	19.40	198.0	V	0.0	14.9
7336.500	55.36	73.98	18.62	199.0	V	0.0	15.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4891.000	37.95	53.98	16.03	254.0	H	314.0	10.3
7333.500	36.11	53.98	17.87	198.0	V	0.0	14.9
7336.500	36.96	53.98	17.02	199.0	V	0.0	15.0

Test Personnel:	Brian Lackey	Test Date:	9/28/2023
Supervising/Reviewing Engineer:		Limit Applied:	FCC Part 15.209 in Restricted Bands from FCC Part 15.205
(Where Applicable)	NA		
Product Standard:	FCC Part 15.247 RSS-247 Issue 3	Ambient Temperature:	22.0°C
Input Voltage:	3VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

Deviations, Additions, or Exclusions: None

6.8.5 Radiated Spurious Emissions, 2475MHz, 1GHz-18GHz:



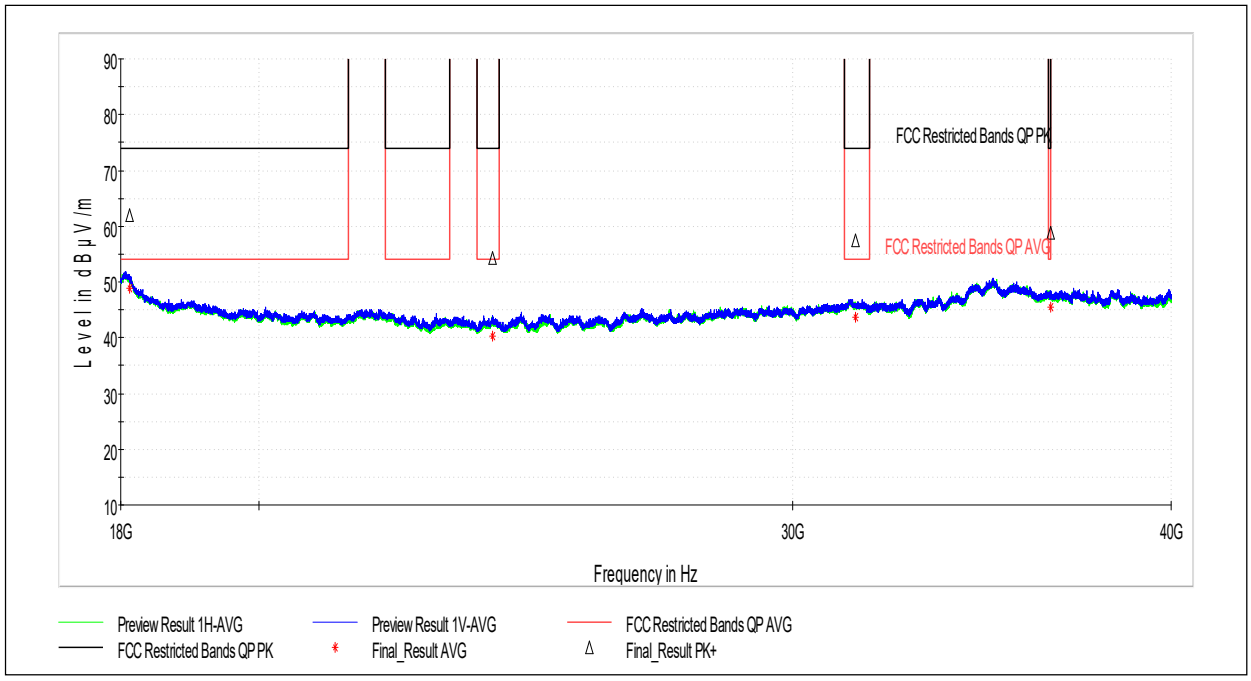
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4951.000	60.96	73.98	13.02	277.0	V	301.0	10.1
7426.500	50.84	73.98	23.14	256.0	H	0.0	13.9

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4951.000	42.00	53.98	11.98	277.0	V	301.0	10.1
7426.500	33.50	53.98	20.48	256.0	H	0.0	13.9

Test Personnel:	Brian Lackey	Test Date:	9/28/2023
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Product Standard:	FCC Part 15.247 RSS-247 Issue 3	Ambient Temperature:	22.0°C
Input Voltage:	3VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

Deviations, Additions, or Exclusions: None

6.8.6 Radiated Spurious Emissions, 2445MHz, 18GHz-40GHz:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18117.000	62.09	73.98	11.89	410.0	V	268.0	30.5
23882.000	54.38	73.98	19.60	381.0	V	312.0	13.3
31464.000	57.52	73.98	16.46	410.0	H	0.0	19.7
36508.000	58.87	1000.00	941.13	410.0	V	67.0	21.4

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18117.000	48.92	53.98	5.06	410.0	V	268.0	30.5
23882.000	40.34	53.98	13.64	381.0	V	312.0	13.3
31464.000	43.76	53.98	10.22	410.0	H	0.0	19.7
36508.000	45.56	1000.00	954.44	410.0	V	67.0	21.4

Test Personnel:	Brian Lackey	Test Date:	9/28/2023
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Product Standard:	FCC Part 15.247 RSS-247 Issue 3	Ambient Temperature:	22.0°C
Input Voltage:	3VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

Deviations, Additions, or Exclusions: None

Note: Testing represents the worst case of low, middle, and high channels.

7 Output Power and Peak Power Spectral Density

7.1 Test Limits

FCC Part 15.247(b)(3):

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

FCC Part 15.247(e):

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

RSS-247 Issue 3 § 5.4(d):

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

RSS-247 Issue 3 § 5.2(b):

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

7.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.9.1.1

7.3 Measurement Uncertainty

Description	Expanded Uncertainty (k=2)
Signal Chain Calibration	1.2

No measurement correction based on measurement uncertainty is performed.

7.4 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	8258	Rohde & Schwarz	ESW44	9/19/2023	9/19/2024
Horn Antenna (1-18GHz)	3780	ETS	3117	8/8/2023	8/8/2024
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
1-18GHz Signal Path without Preamplifier	3074, 2588, 2593, 8188, 8185	-	-	1/12/2023	1/12/2024

7.5 Test Results

The device was found to be **compliant**. The peak output power was less than 1W and the EIRP was less than 4W. Per ANSI C63.10:2020 § 11.10.1:

> Where the measured power (peak conducted output power or maximum conducted output power) complies with the regulatory requirement for the PSD, then measurement of the PSD is not required, provided that the PSD level is reported as being equal to the measured output power.

7.6 Test Conditions

Test Personnel:	Brian Lackey	Test Date:	9/28/2023
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209 in Restricted Bands from FCC Part 15.205
Product Standard:	FCC Part 15.247 RSS-247 Issue 3	Ambient Temperature:	22.0°C
Input Voltage:	3VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

Deviations, Additions, or Exclusions: None

7.7 Test Data

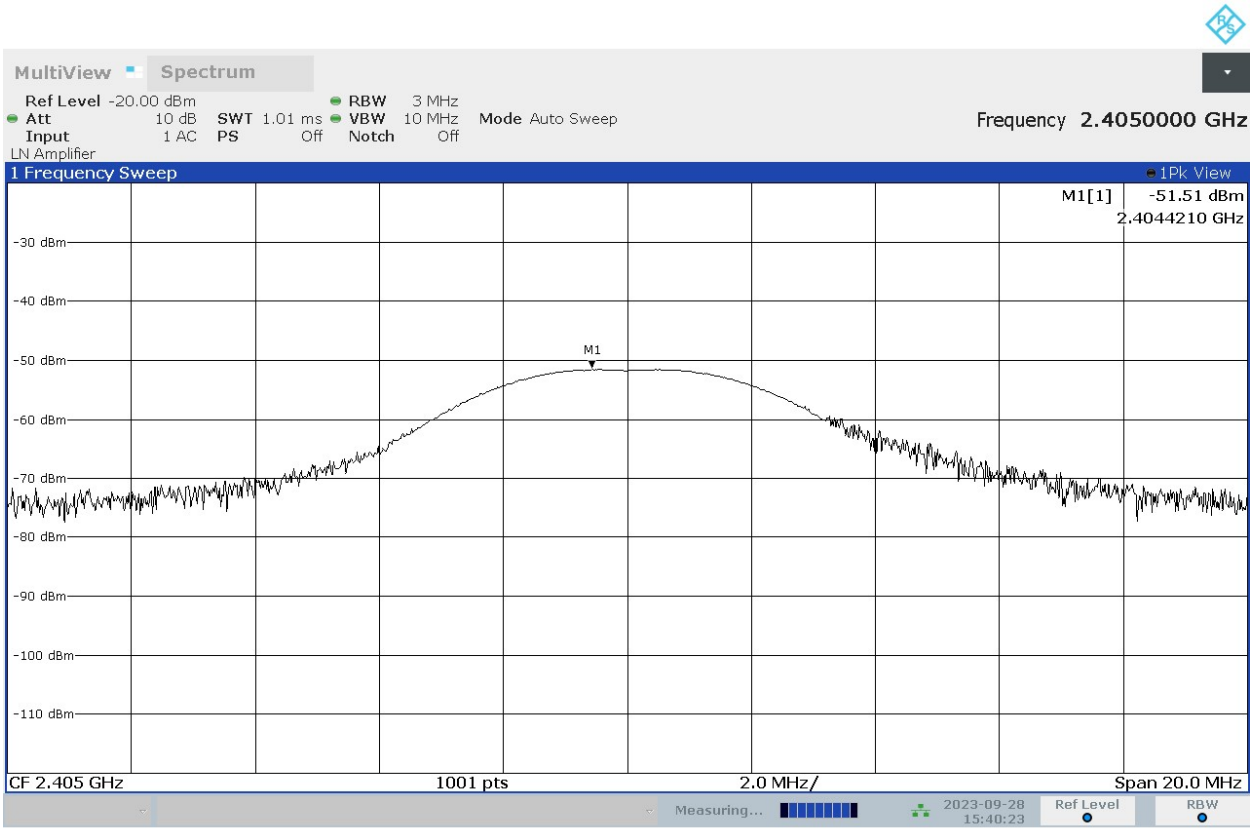
Frequency (MHz)	Receiver Reading (dBm)	Receiver Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	E Field (dBuV/m)	EIRP (dBm)
2405	-51.51	55.48	32.5	8.0	95.98	0.75
2445	-52.04	54.95	32.5	8.0	95.45	0.22
2475	-52.88	54.11	32.5	8.0	94.61	-0.62

Frequency (MHz)	EIRP (dBm)	Antenna Gain (dBi)	Conducted Output Power / PSD (dBm)
2405	0.75	-2.69	3.44

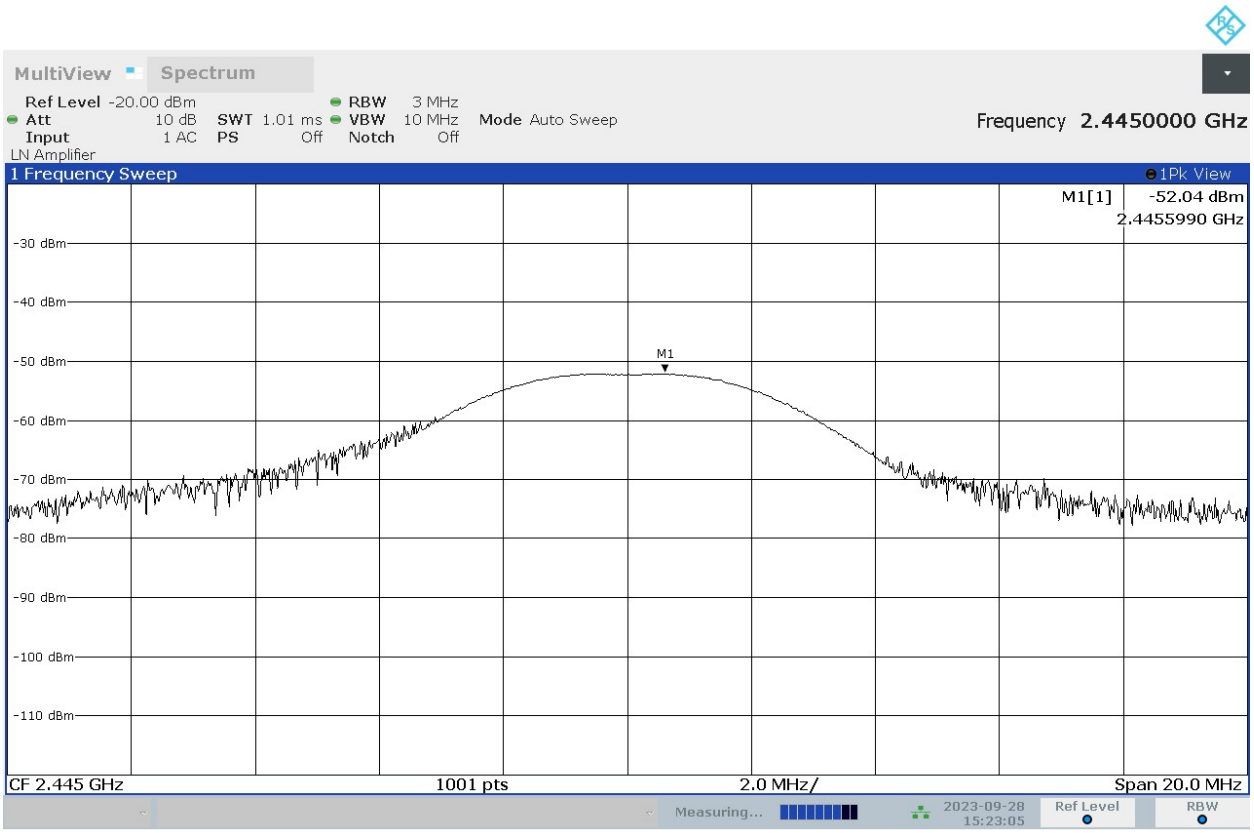
2445	0.22	-3.92	4.14
2475	-0.62	-4.63	5.25

7.8 Spectrum Plots

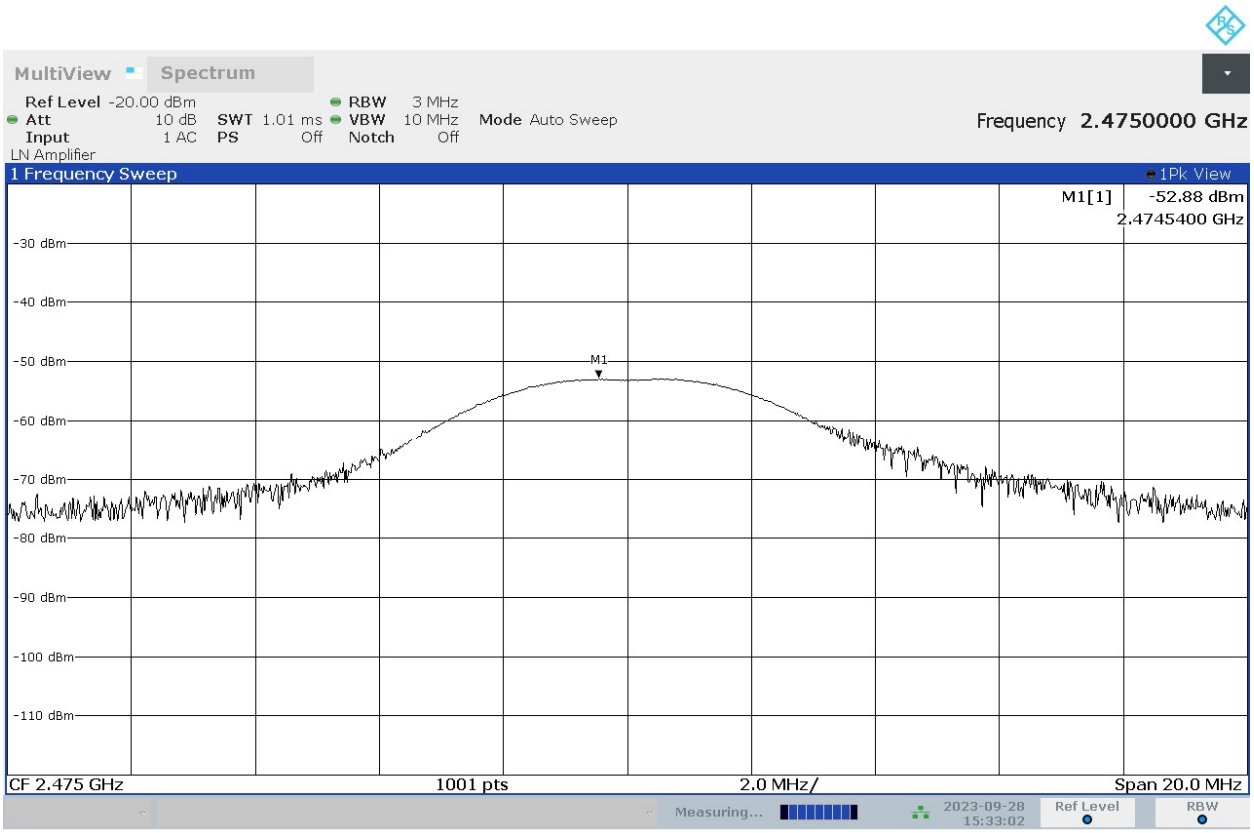
7.8.1 2405 MHz



7.8.1 2445 MHz


MultiView
Spectrum
Ref Level -20.00 dBm
RBW 3 MHz
Att 10 dB
SWT 1.01 ms
VBW 10 MHz
Mode Auto Sweep
Input 1 AC
PS Off
Notch Off
Frequency 2.4450000 GHz
LN Amplifier
1 Frequency Sweep
1Pk View
M1[1] -52.04 dBm
2.4455990 GHz
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
-100 dBm
-110 dBm
M1
CF 2.445 GHz
1001 pts
2.0 MHz/
Span 20.0 MHz
Measuring...
2023-09-28
15:23:05
Ref Level
RBW
03:23:06 PM 09/28/2023

7.8.2 2475 MHz



03:33:03 PM 09/28/2023

8 Occupied Bandwidth

8.1 Test Limits

FCC Part 15.247(a)(2):

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

RSS-247 Issue 3 § 5.2(a):

The minimum 6 dB bandwidth shall be 500 kHz.

8.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.8.1.

8.3 Measurement Uncertainty

Description	Expanded Uncertainty (k=2)
Signal Chain Calibration	1.2

No measurement correction based on measurement uncertainty is performed.

8.4 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	8258	Rohde & Schwarz	ESW44	9/19/2023	9/19/2024
Horn Antenna (1-18GHz)	3780	ETS	3117	8/8/2023	8/8/2024
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
1-18GHz Signal Path without Preamplifier	3074, 2588, 2593, 8188, 8185	-	-	1/12/2023	1/12/2024

8.5 Test Results

The device was found to be **compliant**. The 6dB bandwidth was at least 500kHz.

8.6 Test Conditions

Test Personnel:	Brian Lackey	Test Date:	9/29/2023
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	From FCC Part 15.247(b)(3), RSS-247 Issue 3 § 5.4(d)
Product Standard:	FCC Part 15.247 RSS-247 Issue 3	Ambient Temperature:	21.9°C
Input Voltage:	3VDC	Relative Humidity:	62.6%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

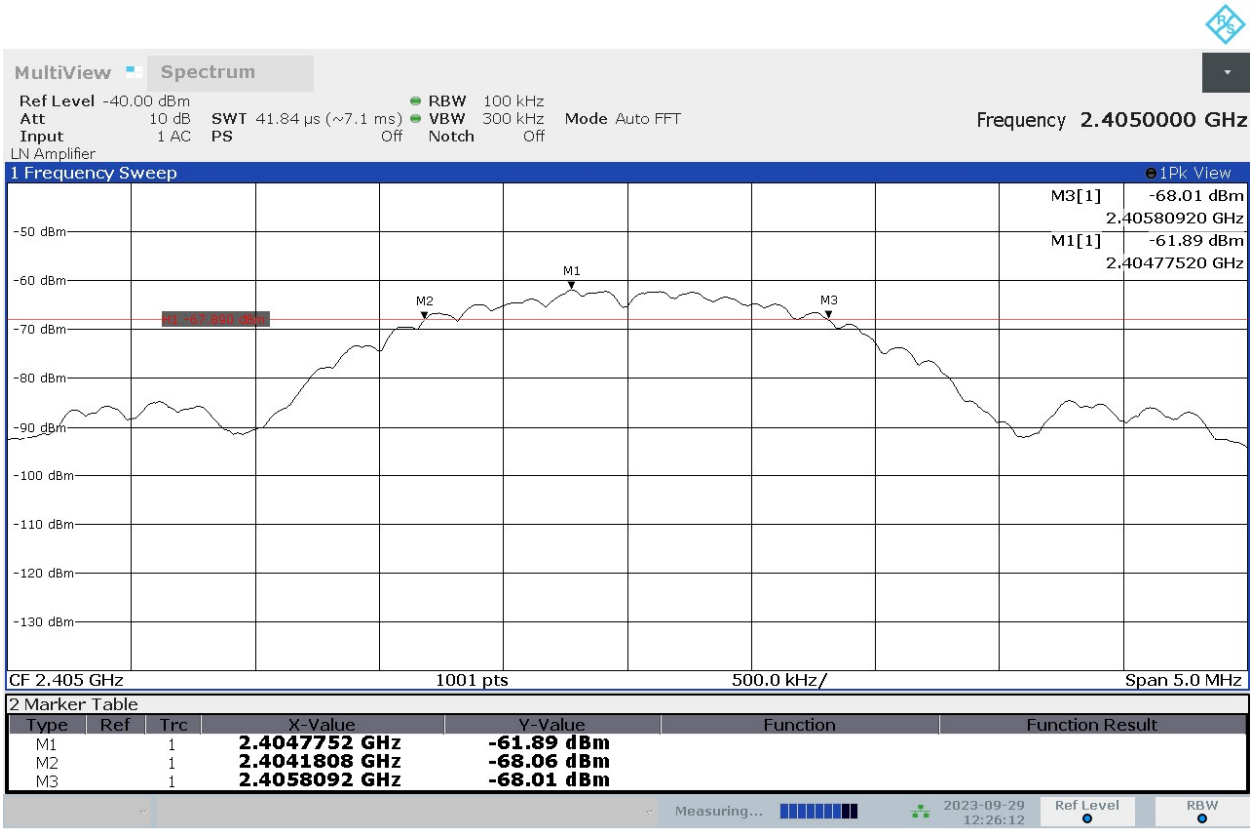
Deviations, Additions, or Exclusions: None

8.7 Test Data

Frequency (MHz)	6dB BW (kHz)	20dB BW (kHz)	99% BW (kHz)
2405	1628	2608	2553
2445	1608	2578	2623
2475	1623	2578	2577

8.8 Spectrum Plots

8.8.1 2405MHz 6dB BW



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M3 – M2 = 2405.8092 MHz – 2404.1808 MHz = 1.628 MHz = 1628 kHz

8.8.2 2405MHz 20dB BW

12:28:03 PM 09/29/2023

8.8.3 2405MHz 99% BW

12:28:36 PM 09/29/2023

8.8.4 2445MHz 6dB BW

12:32:09 PM 09/29/2023

8.8.5 2445MHz 20dB BW

12:30:50 PM 09/29/2023

8.8.6 2445MHz 99% BW

12:30:25 PM 09/29/2023

8.8.7 2475MHz 6dB BW

12:34:16 PM 09/29/2023

M3 – M2 = 2475.8142 MHz – 2474.1908 MHz = 1.623 MHz = 1623 kHz

8.8.8 2475MHz 20dB BW

12:36:28 PM 09/29/2023

8.8.9 2475MHz 99% BW

12:36:08 PM 09/29/2023

10 Antenna Requirement

10.1 Test Limits

FCC Part 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

RSS-Gen Issue 5 § 6.8:

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

10.2 Test Results

The device was found to be **compliant**. The device has an internal, permanently affixed antenna.

11 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	7/17/2024	105489075LEX-001bb	BL	MC	Original Issue
1	5/19/2025	105489075LEX-001.1bb	BL	MC	Added measurement uncertainty values, sample calculations, and duty cycle.