Report on the Testing of the

Mitsubishi Electric US
PAC-USWHS002-WF-2

In accordance with:
FCC 47 CFR part 15.247
ISED RSS-247 Issue 2, February 2017

Prepared for: MuRata Electronics North America
2200 Lake Park Drive
Smyrna, Georgia 30080 USA

America

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Kirby Munroe	**Wireless / EMC Technical and Certification Manager, NA** **TUV SUD America Inc.**	**Authorized Signatory**	5/1/2023

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FCC Accreditation Designation Number US1233
FCC Test Site Registration Number 967699
Innovation, Science, and Economic Development Canada Lab Code 23932

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with the standards listed above.

A2LA Cert. No. 2955.09

ACCREDITATION
Our A2LA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our A2LA Accreditation.

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www.tuv-sud-america.com

Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Table 1.1-1 – Modification Record

Issue	Description of Change	Date of Issue
0	First Issue	2/2/2023
1	Second Issue	5/1/2023

1.2 Introduction

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations Section 15.247 and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein.

Applicant	Rodney Olson
Applicant Company	Mitsubishi Electric US
Manufacturer	Murata Electronics North America
Applicant's Email Address	ROlson@hvac.mea.com
Model Name/Number	PAC-USWHS002-WF-2
Serial Number	N/A
FCC ID	2AIGWFB004
ISED Certification Number	30119-WFB004
Hardware Version(s)	3
Software Version(s)	3
Number of Samples Tested	2
Test Specification/Issue/Date	US Code of Federal REgulation (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2022 ISED Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017.
Order Number	72185560
Date of Receipt of EUT	12/12/2022
Start of Test	12/12/2022
Finish of Test	1/5/2023

Related Document(s)	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Device. FCC OET KDB 558074 D01 15.247 Meas Guidance v05r02: Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of the FCC Rules, April 2, 2019 US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2022. ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5, Amendment 1 (March 2019), Amendment 2 (February 2021)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC Part 15.247 and ISED Canada's RSS-247 is shown below.

Table 1.3-1: Test Result Summary

Test Parameter	Test Plan (Yes/No)	Test Result	FCC 47 CFR Rule Part	ISED Canada's RSS	Test Report Page No
Antenna Requirement	Yes	Pass	15.203, 15.204	-------	11
6 dB Bandwidth	Yes	Pass	15.247(a)(2)	RSS-247 5.2(a)	19
99% Bandwidth	Yes	Pass	-------	RSS-GEN 6.7	19
Fundamental Emission Output Power	Yes	Pass	15.247(b)(3)	RSS-247 5.4(d)	17
Band-Edge Compliance of RF Conducted Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	39
RF Conducted Spurious Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	43
Radiated Spurious Emissions into Restricted Frequency Bands	Yes	Pass	15.205, 15.209	RSS-GEN 8.9, 8.10	47
Power Spectral Density	Yes	Pass	15.247(e)	RSS-247 5.2(b)	31
AC Power Line Conducted Emissions	Yes	Pass	15.207	RSS-GEN 8.8	12

1.4 Product Information

1.4.1 Technical Description

The PAC-USWHS002-WF-3 WIFI-BLE adapter is the third generation in its series. It wirelessly monitors and controls a MEUS HVAC unit via WIFI link. This device communicates wirelessly using either 802.11b/g/n WIFI mode or Bluetooth Smart (i.e. BLE) mode

Table 1.4-1 – Wireless Technical Information

Detail	Description
FCC ID	2AIGWFB004
ISED Canada Certification Number	30119-WFB004
Transceiver Model Name / Numbers	PAC-USWHS002-WF-2
Frequency Range (MHz)	2412 – 2462 MHz
Modulation Format	IEEE 802.11 b: DSSS (DBPSK / DQPSK / CCK) 802.11 g/n (HT20): OFDM (BPSK / DQPSK / 16-QAM / 64-QAM)
Number of Channels	11
Data Rates	1,2,5.5,11,6,9,12,18,24,36,48,54,6.5,13,19.5,26,39,52,58.5,65, 72(WIFI) Mbps
Operating voltage	5VAC, 12 VAC
Antenna Type / Gain:	PCB Trace / 3.3 dBi

A full description and detailed product specification details are available from the manufacturer.

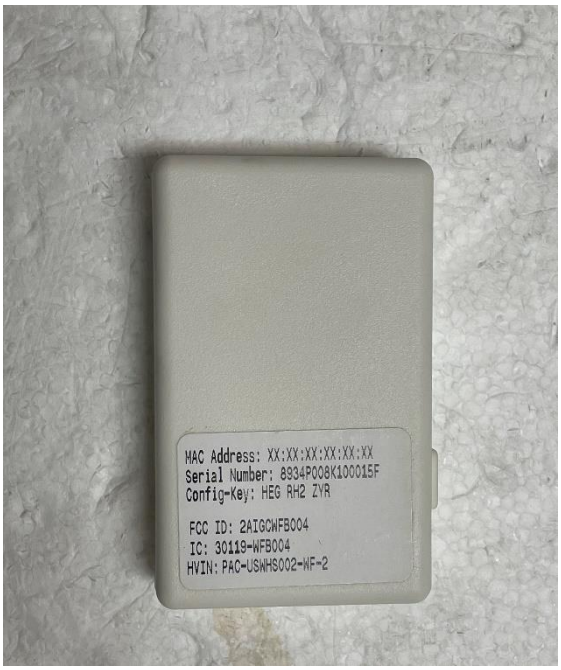


Photo 1.4.1-1 – Front view of Radiated EUT

Photo 1.4.1-2 – Front view of Radiated EUT

Photo 1.4.1-3 – Front view of Conducted EUT

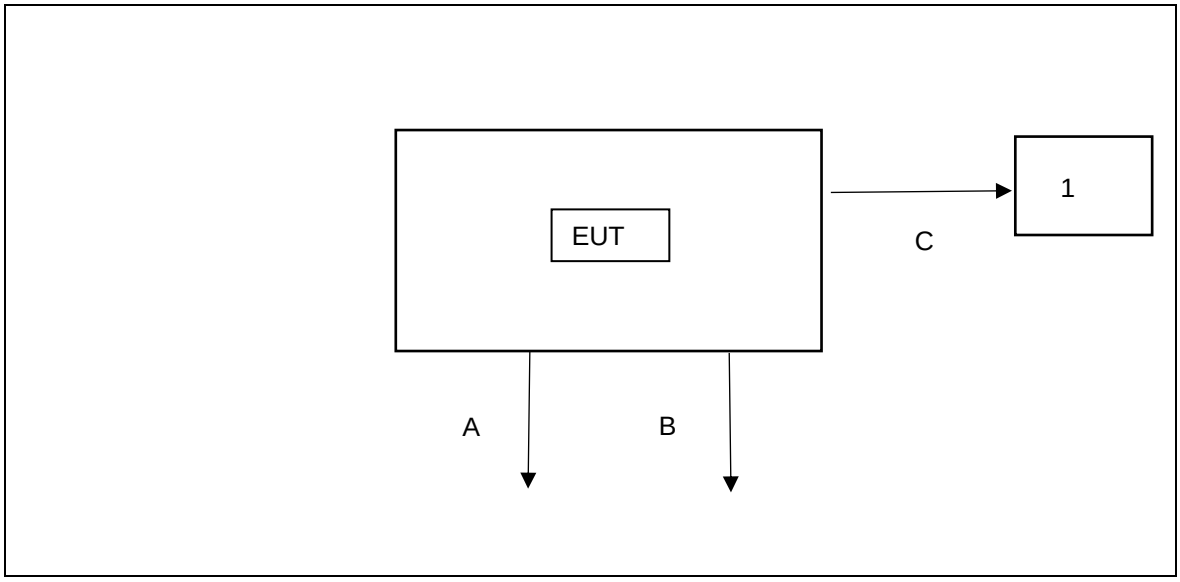


Figure 1.4.1-5 – Test Setup Block Diagram

Table 1.4.1-1 – Cable Descriptions

Item	Cable/Port	Description
A	DC Power supply	12VDC power supply to EUT
B	Power supply Wall adapter	5VAC Wall adapter
C	USB programming cable	Used for BLE radio configuration

Table 1.4.1-2 – Support Equipment Descriptions

Item	Make/Model	Description
1	ThinkPad	Laptop for configuration

1.4.2 Modes of Operation

Module provides 1 mode of operation using BLE classifications as outlined below.

Mode of Operation	Frequency Range (MHz)	Number of Channels	Data Rates Supported	Classification
1	2412 - 2462	11	1-11 Mbps	Wi-Fi 802.11 b
2	2412 - 2462	11	6-54 Mbps	Wi-Fi 802.11 g
3	2412 - 2462	11	6.5-72 Mbps	Wi-Fi 802.11 n20

1.4.3 Monitoring of Performance

For radiated emissions, the EUT was evaluated in three orthogonal orientations. The worst-case orientation was set to Z-plane. See test setup photos for more information. The EUT was programmed to generate a continuously modulated signal on each channel evaluated.

For RF Conducted measurements, the EUT (standalone module) was connected to the test equipment with a temporary antenna port to SMA connector.

Power setting during test: 17dBm for b mode
13dBm for g mode
12 dBm for n20 mode

Worst case data rate setting during test: 11 for b mode
6 for g mode
52 (MCS5) for n20 mode

1.5 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.6 EUT Modification Record

The table below details modifications made to the EUT during the test program. The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Date Modification Fitted
0	Initial State	
1	Updated test setup pictures with host enclosure, HVIN Number & IC ID	4/24/2023

The equipment was tested as provided without any modifications.

1.7 Test Location

TÜV SÜD conducted the following tests at our Alpharetta, GA test laboratory.

Test Name	Name of Engineer(s)	Accreditation
Antenna Requirement	Divya Adusumilli	A2LA
AC Power Line Conducted Emissions	Divya Adusumilli	A2LA
Fundamental Emission Output Power	Divya Adusumilli	A2LA
6dB / 99% Bandwidth	Divya Adusumilli	A2LA
Band-Edge Compliance of RF Conducted Emissions	Divya Adusumilli	A2LA
RF Conducted Spurious Emissions	Divya Adusumilli	A2LA
Radiated Spurious Emissions into Restricted Frequency Bands	Bhagyashree Chaudhary	A2LA
Power Spectral Density	Divya Adusumilli	A2LA

Office address:
TÜV SÜD America
5945 Cabot Parkway, Suite 100
Alpharetta, GA 30005, USA

2 Test Details

2.1 Antenna Requirement

2.1.1 Specification Reference

FCC Section: 15.203, 15.204

2.1.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “1”, as noted in §1.6.

2.1.3 Date of Observation

12/12/2022

2.1.4 Test Method

N/A

2.1.5 Environmental Conditions

N/A

2.1.6 Test Results

The EUT utilizes the PCB trace antenna with 3.3 dBi which is internal to the enclosure and affixed to the PCB, therefore satisfying the requirements of Section 15.203.

2.2 Power Line Conducted Emissions

2.2.1 Specification Reference

FCC Section: 15.207
ISED Canada: RSS-Gen 8.8

2.2.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “1”, as noted in §1.6.

2.2.3 Date of Test

1/5/2023

2.2.4 Test Method

ANSI C63.10 section 6 was the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer’s resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Corrected Reading - Applicable Limit

2.2.5 Environmental Conditions

The EUT was evaluated within the temperature, humidity and pressure range of the EUT as specified by the standard. The laboratory shall have an ambient temperature range of 15°C to 35°C, relative humidity range of 30% to 60% and atmospheric pressure range of 86 kPa to 106 kPa.

Ambient Temperature	24 °C
Relative Humidity	43 %
Atmospheric Pressure	982.1 mbar

2.2.6 Test Results

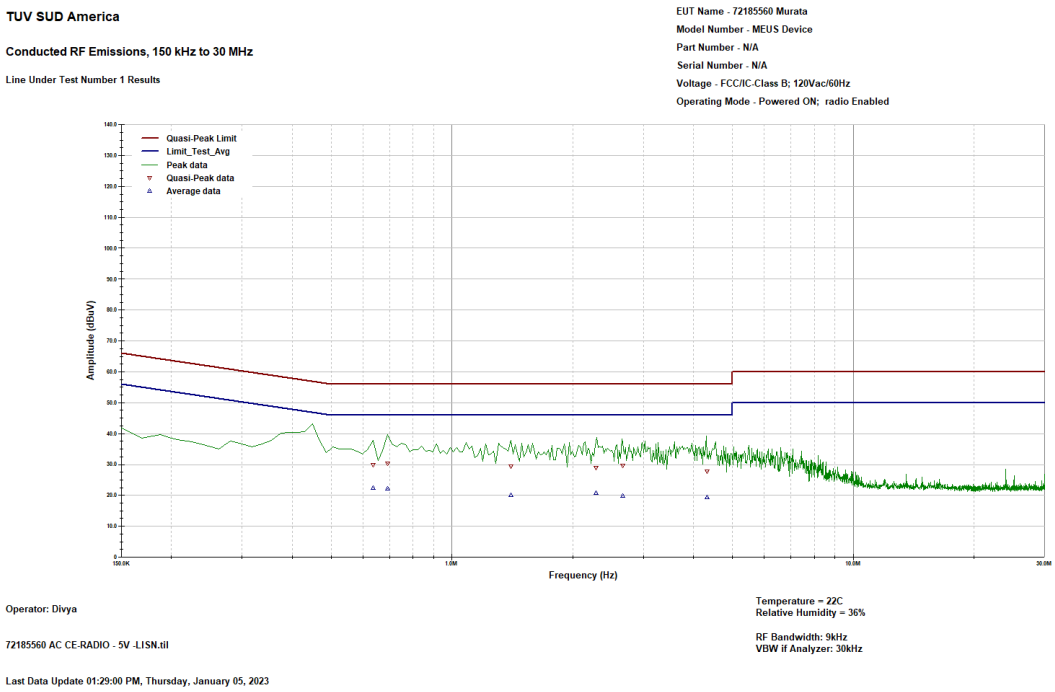


Figure 2.2.6-1 – Graphical Results – AC Mains L1 Plot – 5V adapter

Table 2.2.6-1 – Conducted Emissions Results on the AC Power Port (L1) - 5V adapter

Frequency (MHz)	Avg Limit	Avg Level Corr	Avg Level	Corr Fact.	Avg Margin	Result
0.63	46	22.5	12.8	9.658	-23.5	PASS
0.69	46	22.2	12.5	9.661	-23.8	PASS
1.4	46	20	10.3	9.704	-26	PASS
2.29	46	20.8	11	9.781	-25.2	PASS
2.67	46	19.8	10	9.79	-26.2	PASS
4.32	46	19.4	9.6	9.78	-26.6	PASS

Frequency (MHz)	QP Limit	QP Level Corr	QP Level	Corr Fact.	QP Margin	Result
0.63	56	29.9	20.2	9.658	-26.1	PASS
0.69	56	30.3	20.6	9.661	-25.7	PASS
1.4	56	29.5	19.8	9.704	-26.5	PASS
2.29	56	28.9	19.2	9.781	-27.1	PASS
2.67	56	29.6	19.8	9.79	-26.4	PASS
4.32	56	27.8	18	9.78	-28.2	PASS

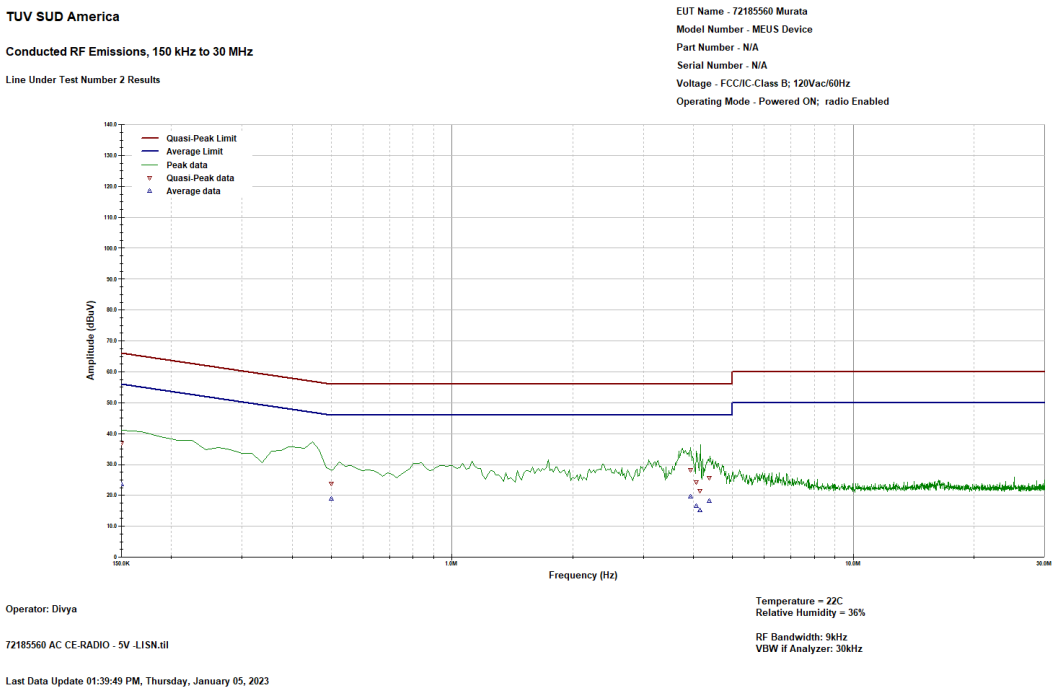


Figure 2.2.6-2 – Graphical Results – AC Mains N Plot – 5V adapter

Table 2.2.6-2 – Conducted Emissions Results on the AC Power Port (N) - 5V adapter

Frequency (MHz)	Avg Limit	Avg Level Corr	Avg Level	Corr Fact.	Avg Margin	Result
0.15	56	23.4	13.8	9.675	-32.6	PASS
0.5	46	18.9	9.3	9.63	-27.1	PASS
3.93	46	19.5	9.7	9.8	-26.5	PASS
4.06	46	16.6	6.8	9.8	-29.4	PASS
4.15	46	15.1	5.3	9.8	-30.9	PASS
4.38	46	18.1	8.3	9.8	-27.9	PASS

Frequency (MHz)	QP Limit	QP Level Corr	QP Level	Corr Fact.	QP Margin	Result
0.15	66	36.9	27.2	9.675	-29.1	PASS
0.5	56	23.9	14.3	9.63	-32.1	PASS
3.93	56	28.3	18.5	9.8	-27.7	PASS
4.06	56	24.1	14.3	9.8	-31.9	PASS
4.15	56	21.5	11.7	9.8	-34.5	PASS
4.38	56	25.6	15.8	9.8	-30.4	PASS

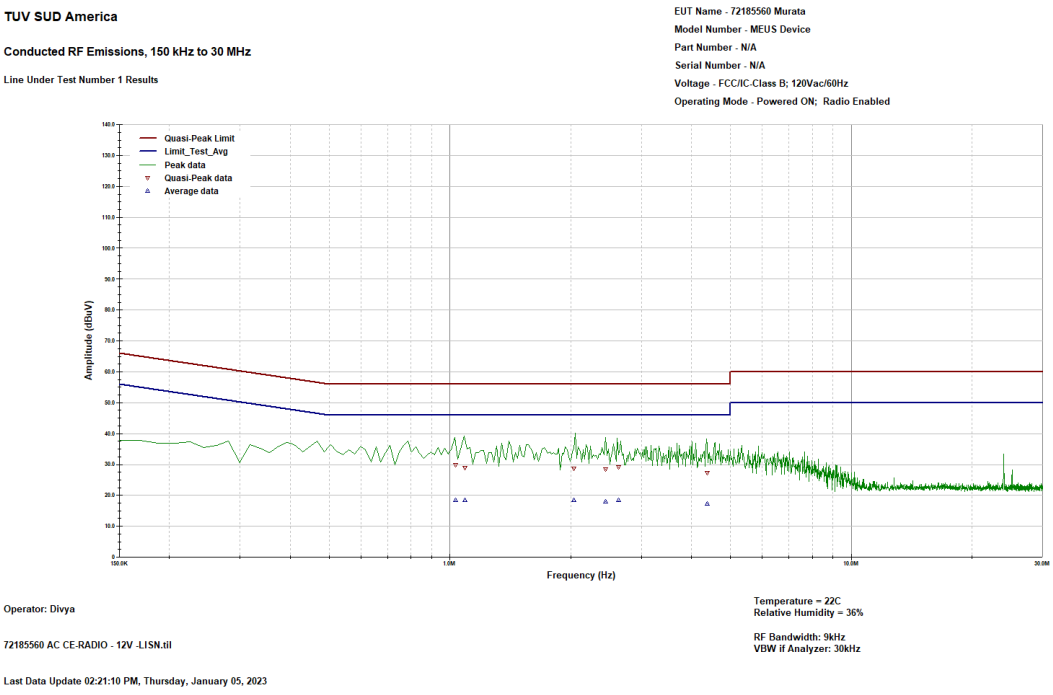


Figure 2.2.6-3 – Graphical Results – AC Mains L1 Plot – 12V adapter

Table 2.2.6-3 – Conducted Emissions Results on the AC Power Port (L1) – 12V adapter

Frequency (MHz)	Avg Limit	Avg Level Corr	Avg Level	Corr Fact.	Avg Margin	Result
1.03	46	18.4	8.8	9.682	-27.6	PASS
1.09	46	18.4	8.8	9.685	-27.6	PASS
2.04	46	18.4	8.6	9.771	-27.6	PASS
2.44	46	17.9	8.1	9.788	-28.1	PASS
2.63	46	18.3	8.5	9.79	-27.7	PASS
4.38	46	17.2	7.4	9.78	-28.8	PASS

Frequency (MHz)	QP Limit	QP Level Corr	QP Level	Corr Fact.	QP Margin	Result
1.03	56	29.9	20.2	9.682	-26.1	PASS
1.09	56	29	19.3	9.685	-27	PASS
2.04	56	28.8	19	9.771	-27.2	PASS
2.44	56	28.4	18.6	9.788	-27.6	PASS
2.63	56	29.1	19.3	9.79	-26.9	PASS
4.38	56	27.3	17.5	9.78	-28.7	PASS

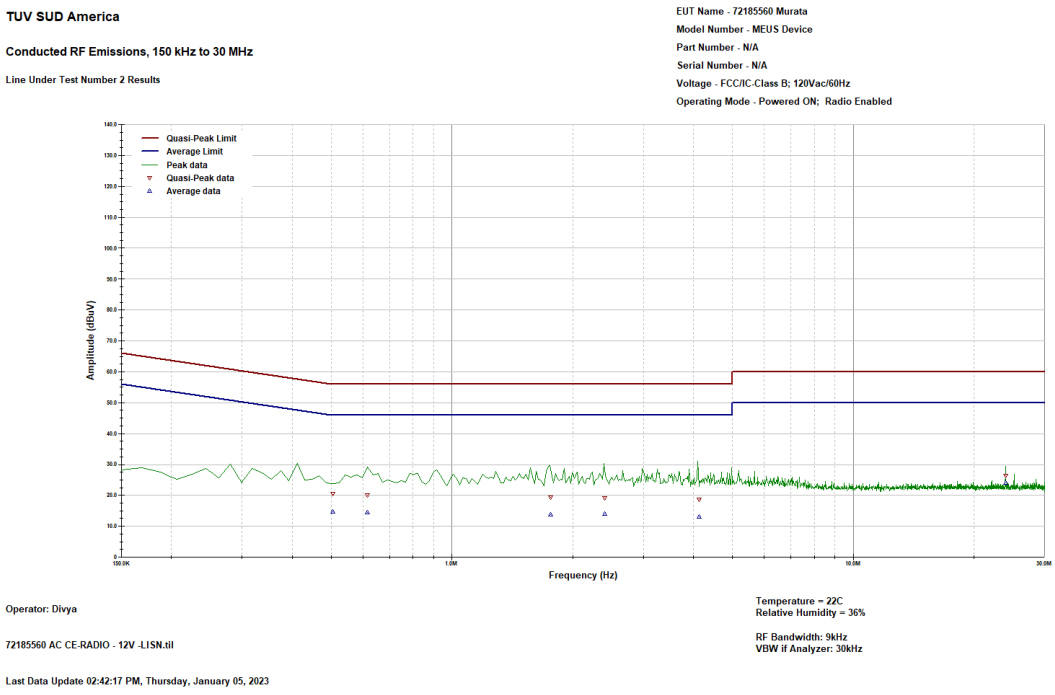


Figure 2.2.6-4 – Graphical Results – AC Mains N Plot – 12V adapter

Table 2.2.6-4 – Conducted Emissions Results on the AC Power Port (N) – 12V adapter

Frequency (MHz)	Avg Limit	Avg Level Corr	Avg Level	Corr Fact.	Avg Margin	Result
0.5	46	14.6	5	9.63	-31.4	PASS
0.62	46	14.5	4.8	9.637	-31.5	PASS
1.76	46	13.7	4	9.741	-32.3	PASS
2.4	46	13.9	4.1	9.768	-32.1	PASS
4.13	46	13.2	3.4	9.8	-32.8	PASS
24	50	24.1	14	10.09	-25.9	PASS

Frequency (MHz)	QP Limit	QP Level Corr	QP Level	Corr Fact.	QP Margin	Result
0.5	56	20.4	10.8	9.63	-35.6	PASS
0.62	56	20	10.3	9.637	-36	PASS
1.76	56	19.4	9.6	9.741	-36.6	PASS
2.4	56	19.2	9.4	9.768	-36.8	PASS
4.13	56	18.8	9	9.8	-37.2	PASS
24	60	26.4	16.3	10.09	-33.6	PASS

2.3 Fundamental Emission Output Power

2.3.1 Specification Reference

FCC Sections: 15.247(b)(3)
ISED Canada: RSS-247 5.4(d)

2.3.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.3.3 Date of Test

12/12/2022

2.3.4 Test Method

The maximum peak conducted output power may be measured using a broadband peak RF power meter with ANSI C63.10 Subclause 11.9.1.3. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

2.3.5 Environmental Conditions

The EUT was evaluated within the temperature, humidity and pressure range of the EUT as specified by the standard. The laboratory shall have an ambient temperature range of 15°C to 35°C, relative humidity range of 30% to 60% and atmospheric pressure range of 86 kPa to 106 kPa.

Ambient Temperature	24 °C
Relative Humidity	43 %
Atmospheric Pressure	982.1 mbar

2.3.6 Test Results

Test Summary: EUT was set to transmit mode.

Test Results: Pass

See data below for detailed results.

Table 2.3.6-1: RF Output Power – 802.11b

Frequency (MHz)	Peak Output Power (dBm)
2412	21.81
2437	20.13
2462	20.12

Table 2.3.6-2: RF Output Power – 802.11g

Frequency (MHz)	Peak Output Power (dBm)
2412	24.25
2437	24.16
2462	24.21

Table 2.3.6-3: RF Output Power – 802.11n (HT20)

Frequency (MHz)	Peak Output Power (dBm)
2412	23.69
2437	23.46
2462	23.61

2.4 6dB / 99% Bandwidth

2.4.1 Specification Reference

FCC Sections: 15.247(a)(2)
ISED Canada: RSS-247 5.2(a), RSS-GEN 6.7

2.4.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.4.3 Date of Test

12/12/2022

2.4.4 Test Method

The 6dB bandwidth was measured in accordance with the ANSI C63.10 Section 11.8. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 3 times the RBW. The trace was set to max hold with a peak detector active. The marker-delta function of the spectrum analyzer was utilized to determine the 6 dB bandwidth of the emission.

The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The resolution bandwidth was set to 1% to 5% of the occupied bandwidth. The video bandwidth was set to 3 times the resolution bandwidth. A peak detector was used.

2.4.5 Environmental Conditions

The EUT was evaluated within the temperature, humidity and pressure range of the EUT as specified by the standard. The laboratory shall have an ambient temperature range of 15°C to 35°C, relative humidity range of 30% to 60% and atmospheric pressure range of 86 kPa to 106 kPa.

Ambient Temperature	24 °C
Relative Humidity	43 %
Atmospheric Pressure	982.1 mbar

2.4.6 Test Results

Test Summary: EUT was set to transmit mode.

Test Results: Pass

See data below for detailed results.

Table 2.4.6-1: 6dB / 99% Bandwidth – 802.11b

Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2412	6.250	12.200
2437	6.250	12.300
2462	6.200	12.200

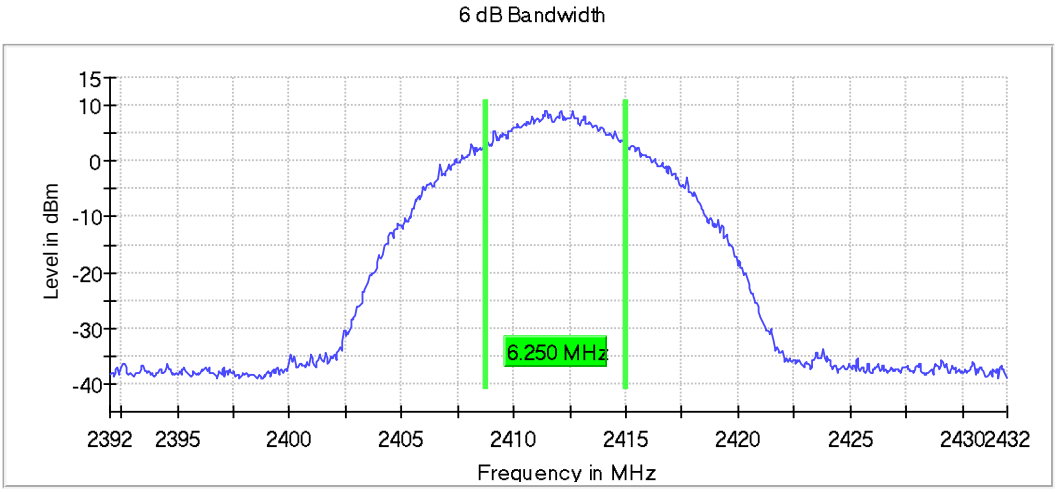


Figure 2.4.6-1: 6 dB BW - LCH

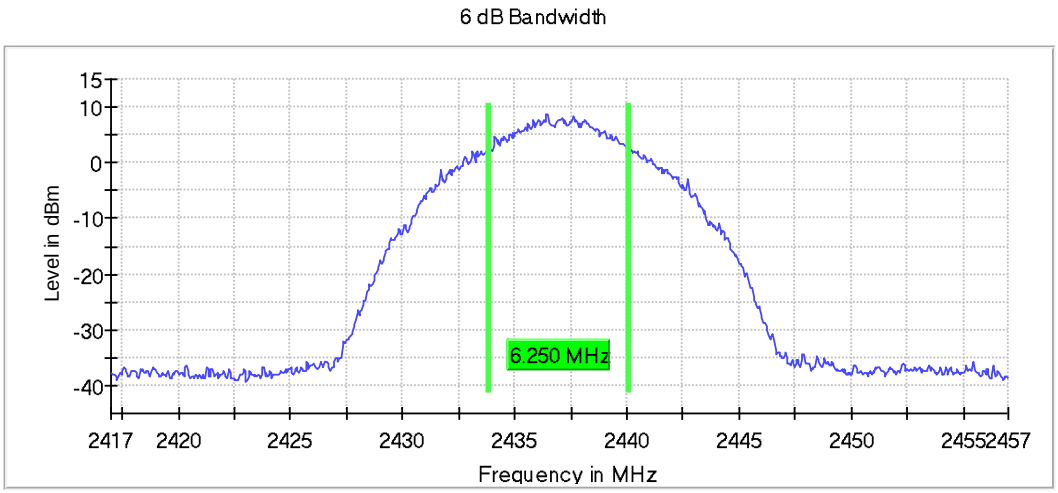


Figure 2.4.6-2: 6 dB BW - MCH

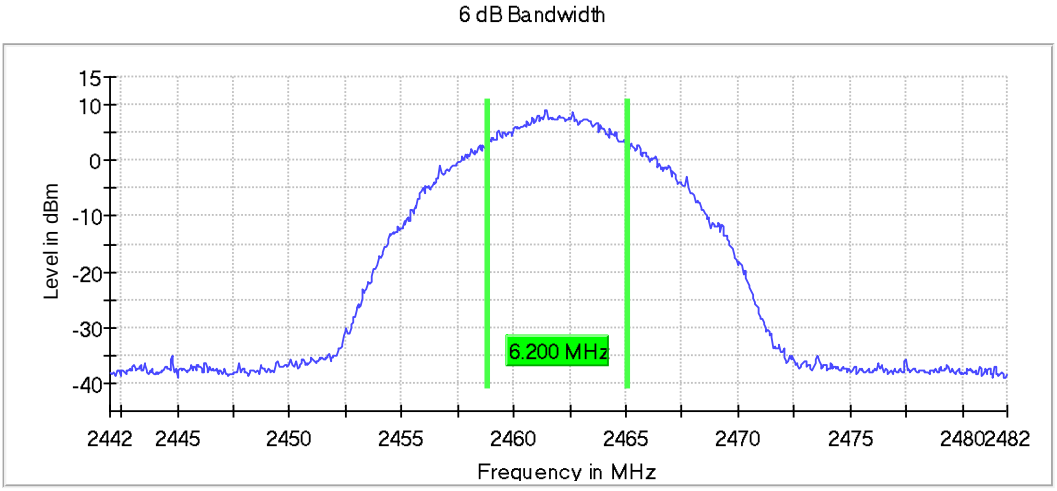


Figure 2.4.6-3: 6 dB BW - HCH

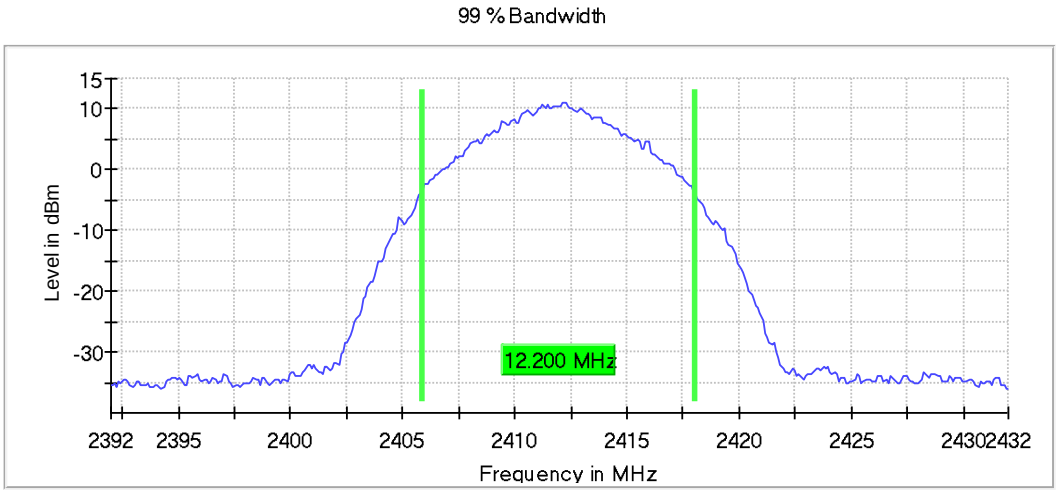


Figure 2.4.6-4: 99% BW - LCH

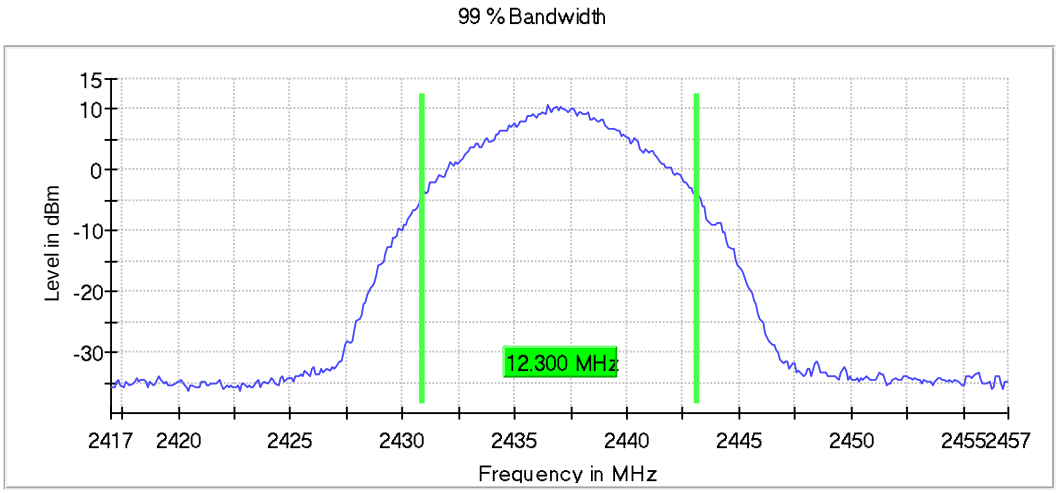


Figure 2.4.6-5: 99% BW - MCH

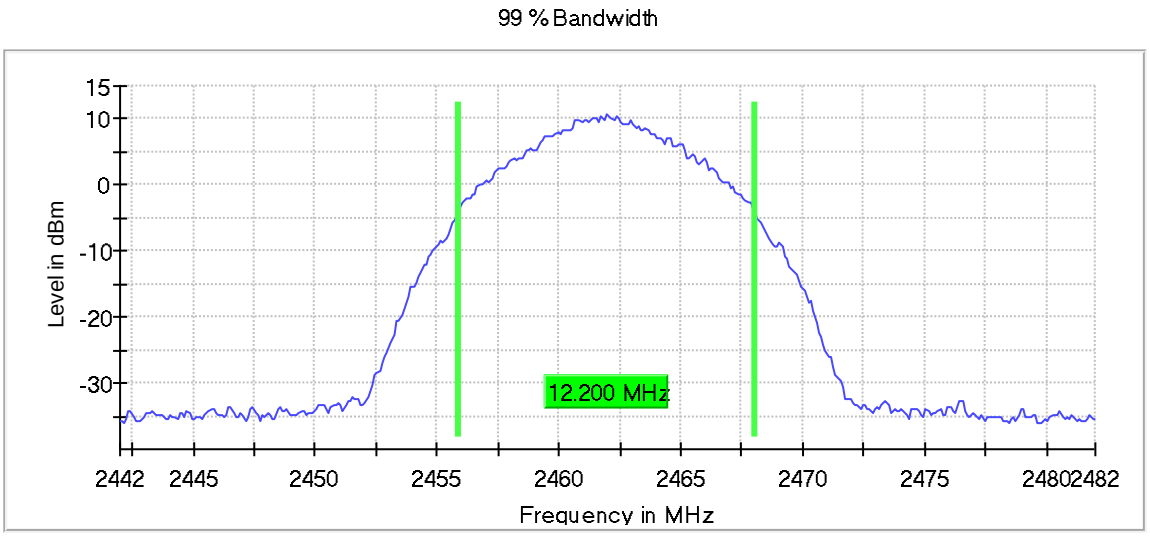


Figure 2.4.6-6: 99% BW - HCH

Table 2.4.6-2: 6dB / 99% Bandwidth – 802.11g

Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2412	15.200	16.400
2437	15.200	16.300
2462	15.200	16.300

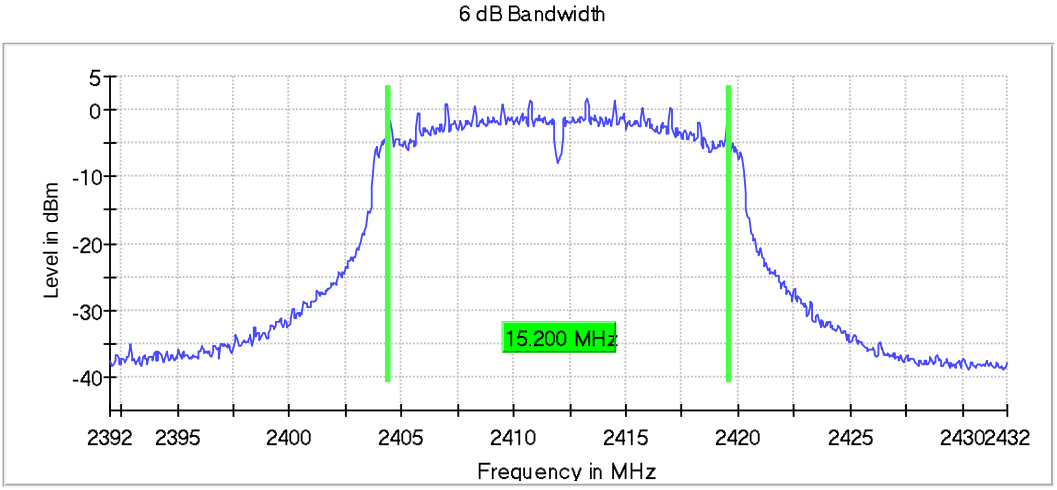


Figure 2.4.6-7: 6 dB BW - LCH

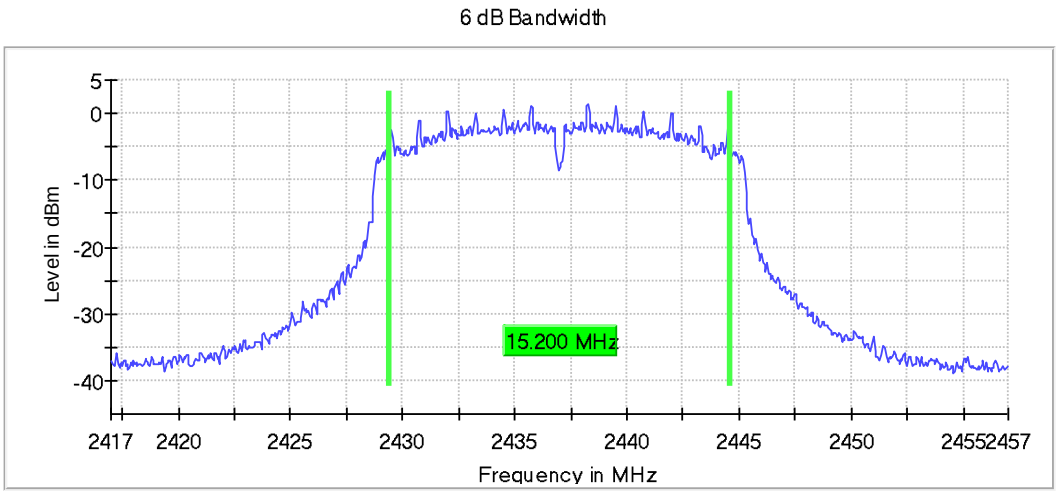


Figure 2.4.6-8: 6 dB BW - MCH

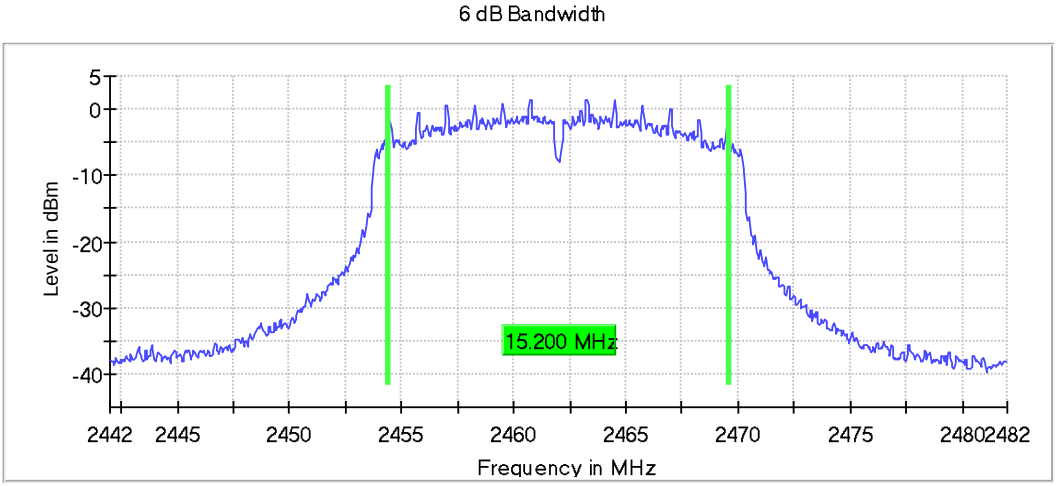


Figure 2.4.6-9: 6 dB BW - HCH

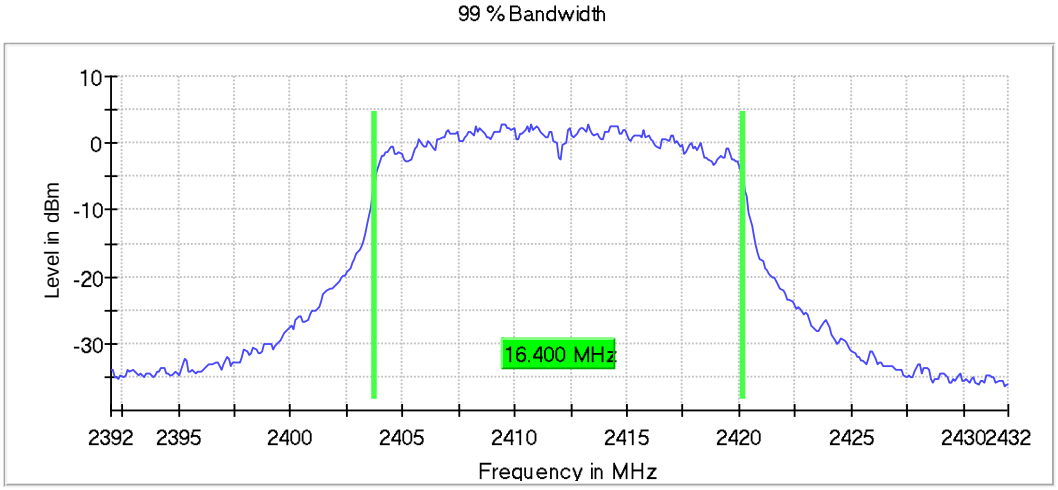


Figure 2.4.6-10: 99% BW - LCH

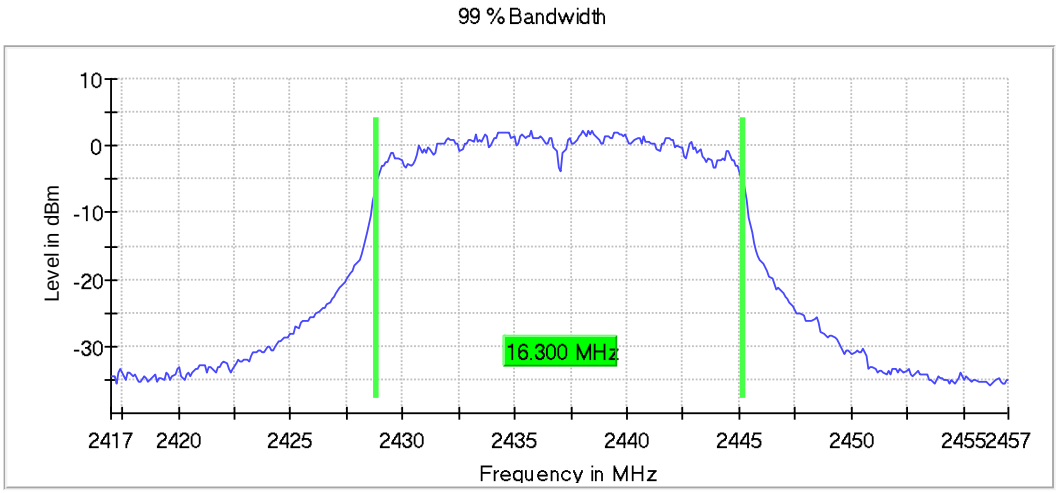


Figure 2.4.6-11: 99% BW - MCH

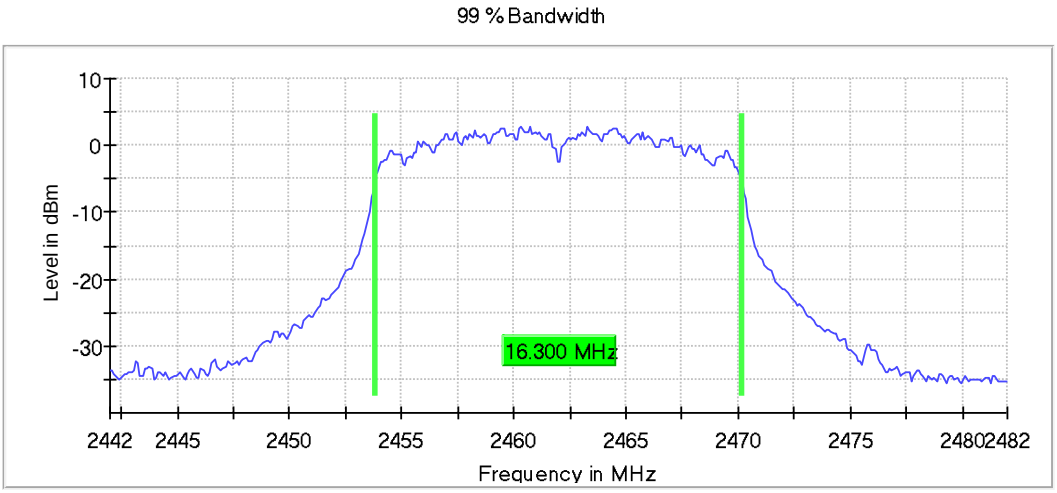


Figure 2.4.6-12: 99% BW - HCH

Table 2.4.6-3: 6dB / 99% Bandwidth – 802.11n20 (HT20)

Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2412	16.350	17.600
2437	17.000	17.500
2462	16.750	17.500

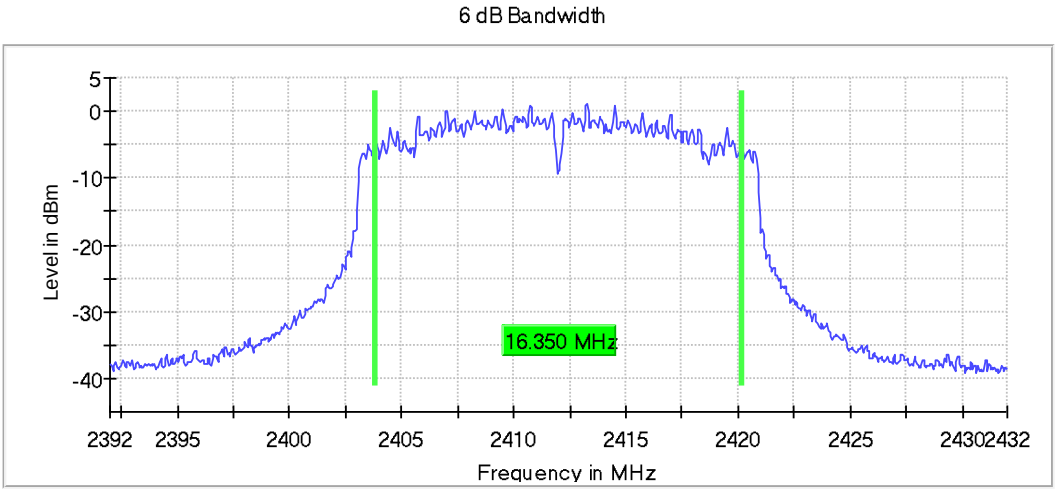


Figure 2.4.6-13: 6 dB BW - LCH

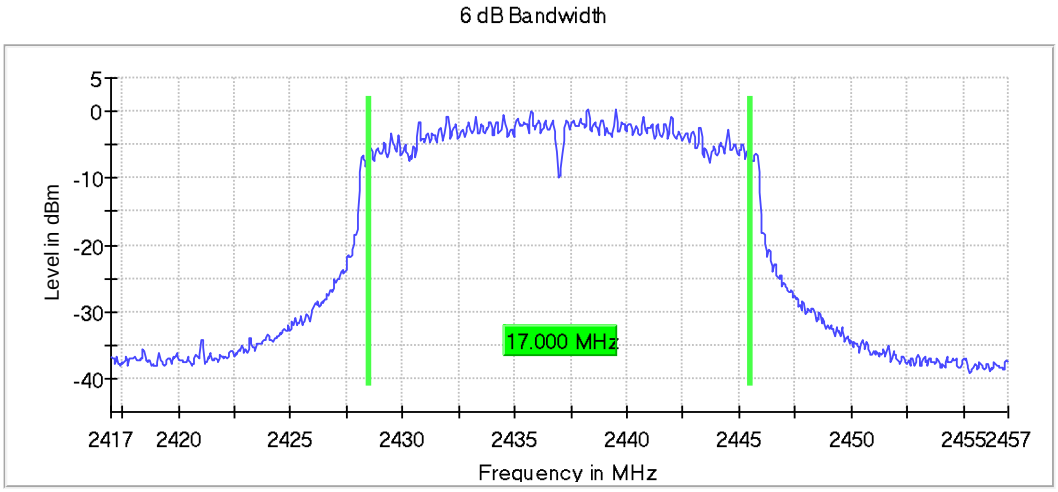


Figure 2.4.6-14: 6 dB BW - MCH

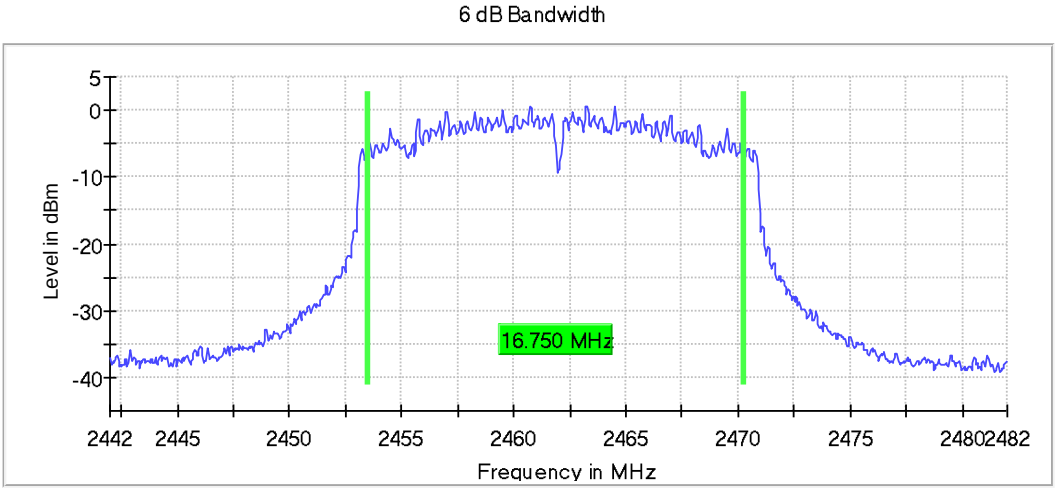


Figure 2.4.6-15: 6 dB BW - HCH

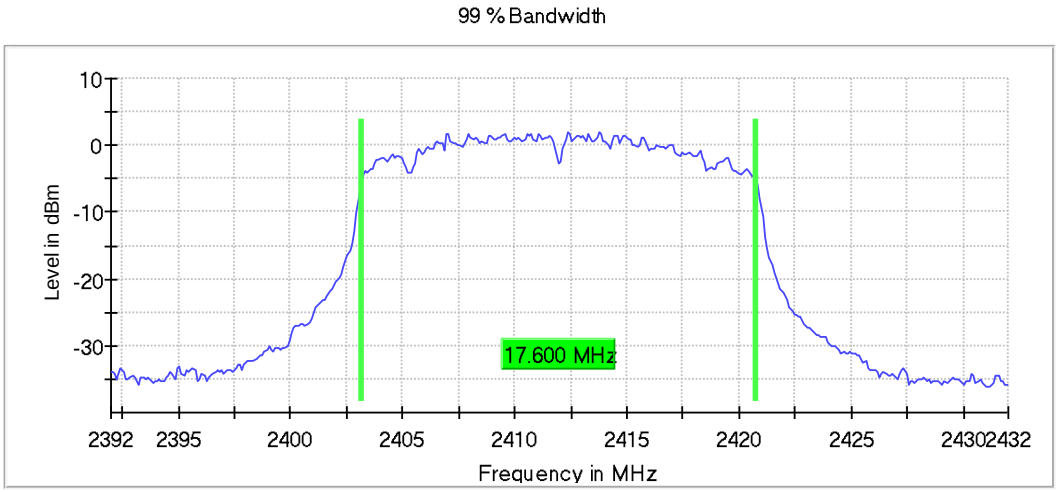


Figure 2.4.6-16: 99% BW - LCH

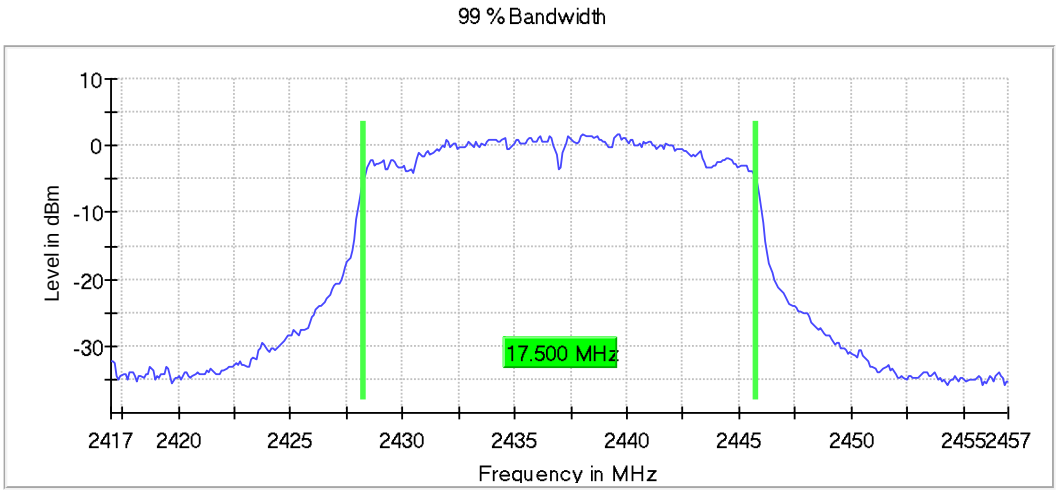


Figure 2.4.6-17: 99% BW - MCH

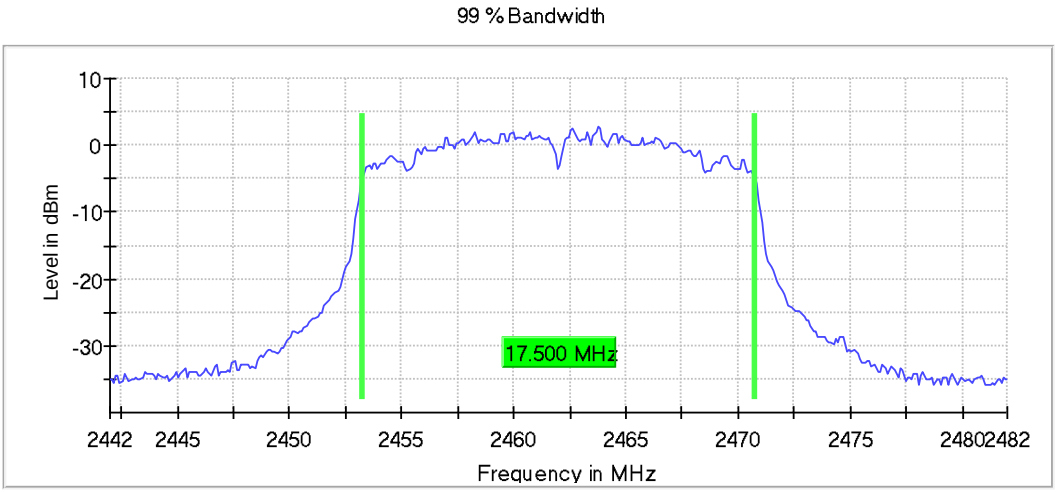


Figure 2.4.6-18: 99% BW - HCH

Table 2.4.6-4: Sample Measurement Setting (6dB BW)

Setting	Instrument Value	Target Value
Start Frequency	2.39200 GHz	2.39200 GHz
Stop Frequency	2.43200 GHz	2.43200 GHz
Span	40.000 MHz	40.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
Sweep Points	800	~ 800
Sweep time	56.836 µs	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Max Peak	Max Peak
Sweep Count	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweep type	FFT	AUTO
Preamp	off	off
Stable mode	Trace	Trace
Stable value	0.50 dB	0.50 dB
Run	55 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.38 dB	0.50 dB

Table 2.4.6-5: Sample Measurement Setting (99% BW)

Setting	Instrument Value	Target Value
Start Frequency	2.39200 GHz	2.39200 GHz
Stop Frequency	2.43200 GHz	2.43200 GHz
Span	40.000 MHz	40.000 MHz
RBW	200.000 kHz	>= 200.000 kHz
VBW	1.000 MHz	>= 600.000 kHz
Sweep Points	400	~ 400
Sweep time	28.477 µs	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Max Peak	Max Peak
Sweep Count	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweep type	FFT	AUTO
Preamp	off	off
Stable mode	Trace	Trace
Stable value	0.30 dB	0.30 dB
Run	48 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.15 dB	0.30 dB

2.5 Maximum Power Spectral Density in the Fundamental Emission

2.5.1 Specification Reference

FCC Sections: 15.247(e)
ISED Canada: RSS-247 5.2(b)

2.5.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.5.3 Date of Test

12/12/2022

2.5.4 Test Method

The power spectral density was measured in accordance with the ANSI C63.10 Section 11.10.2 The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to 300 kHz. Span was set to 1.5 times the channel bandwidth. The trace was set to max hold with the peak detector active.

2.5.5 Environmental Conditions

The EUT was evaluated within the temperature, humidity and pressure range of the EUT as specified by the standard. The laboratory shall have an ambient temperature range of 15°C to 35°C, relative humidity range of 30% to 60% and atmospheric pressure range of 86 kPa to 106 kPa.

Ambient Temperature	24 °C
Relative Humidity	43 %
Atmospheric Pressure	982.1 mbar

2.5.6 Test Results

Test Summary: EUT was set to transmit mode.

Test Results: Pass

See data below for detailed results.

Table 2.5.6-1: RF Power Spectral Density – 802.11b

Frequency (MHz)	PSD (dBm)
2412	-4.990
2437	-5.102
2462	-5.072

Figure 2.5.6-1: PSD – LCH

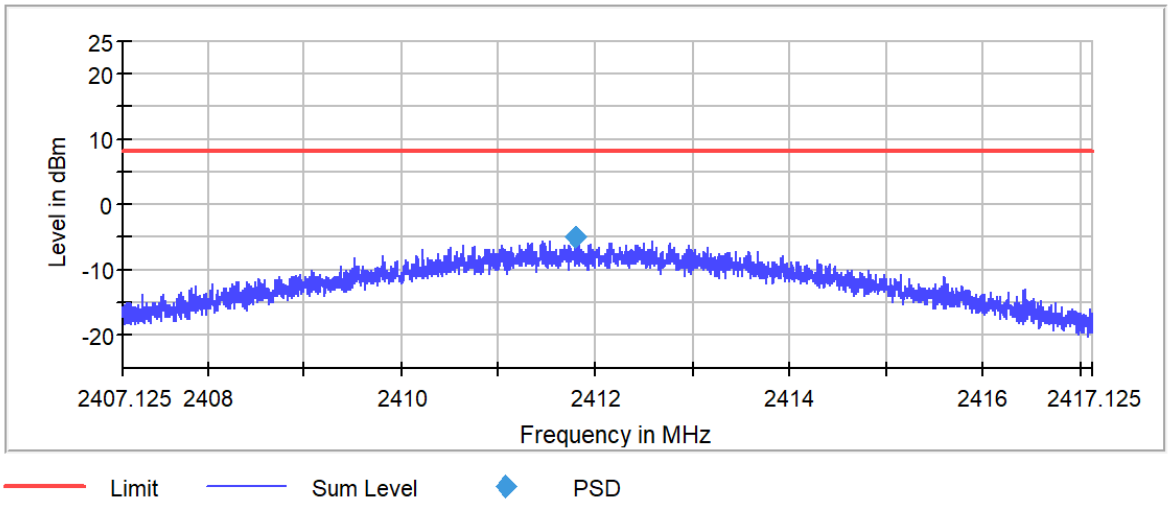


Figure 2.5.6-1: PSD – LCH

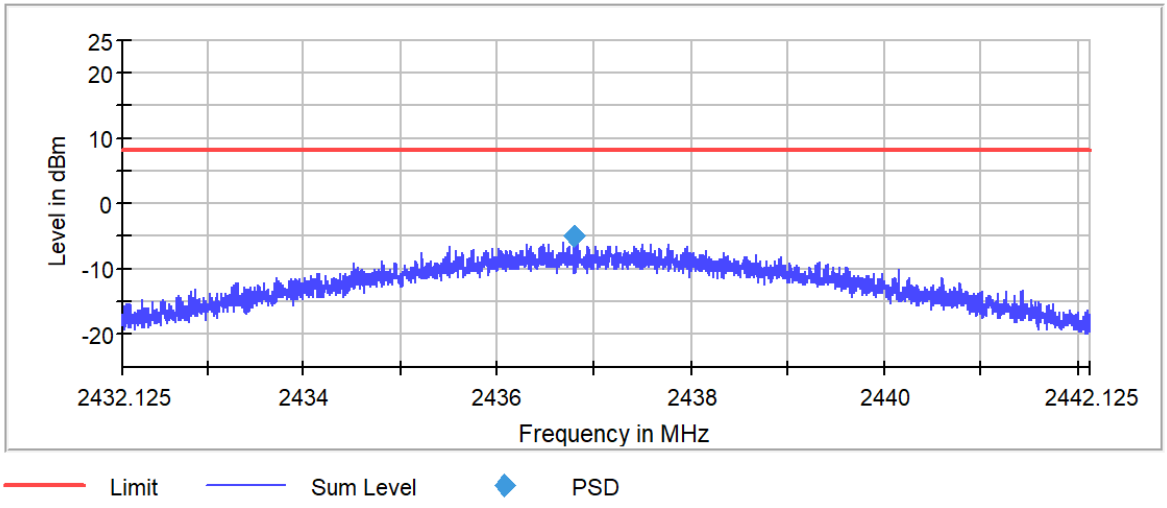


Figure 2.5.6-2: PSD – MCH

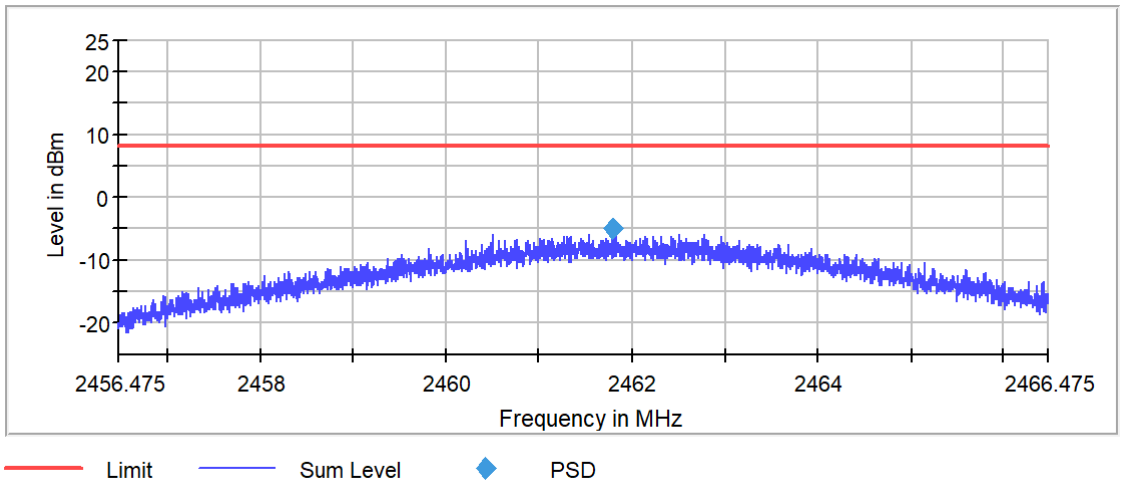


Figure 2.5.6-3: PSD – HCH

Table 2.5.6-2: RF Power Spectral Density – 802.11g

Frequency (MHz)	PSD (dBm)
2412	1.773
2437	1.220
2462	1.672

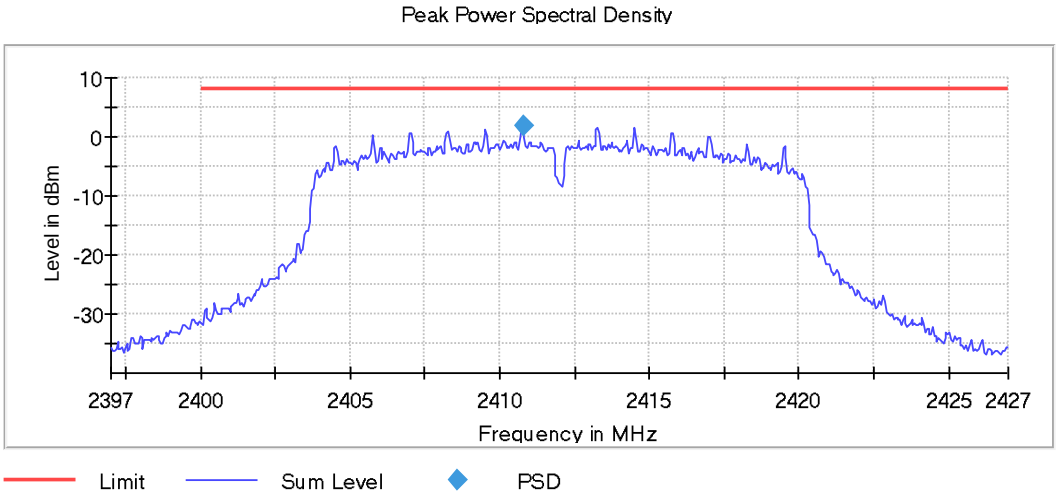


Figure 2.5.6-4: PSD – LCH

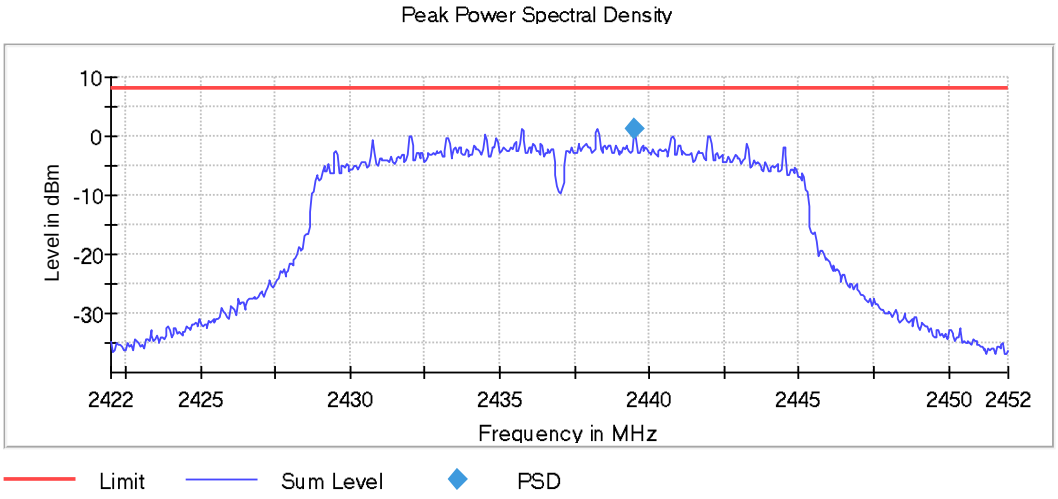


Figure 2.5.6-5: PSD – MCH

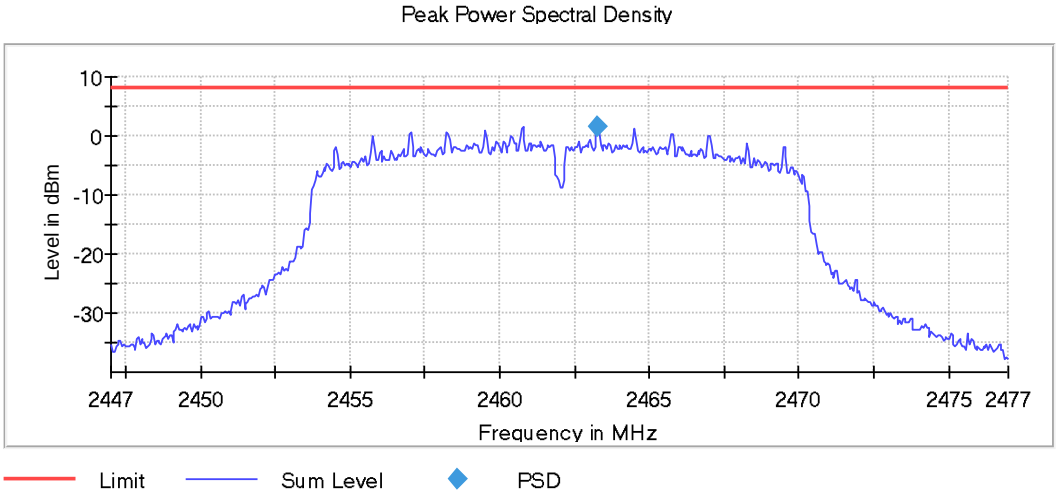


Figure 2.5.6-6: PSD – HCH

Table 2.5.6-3: RF Power Spectral Density – 802.11n20 (HT20)

Frequency (MHz)	PSD (dBm)
2412	0.623
2437	0.173
2462	0.769

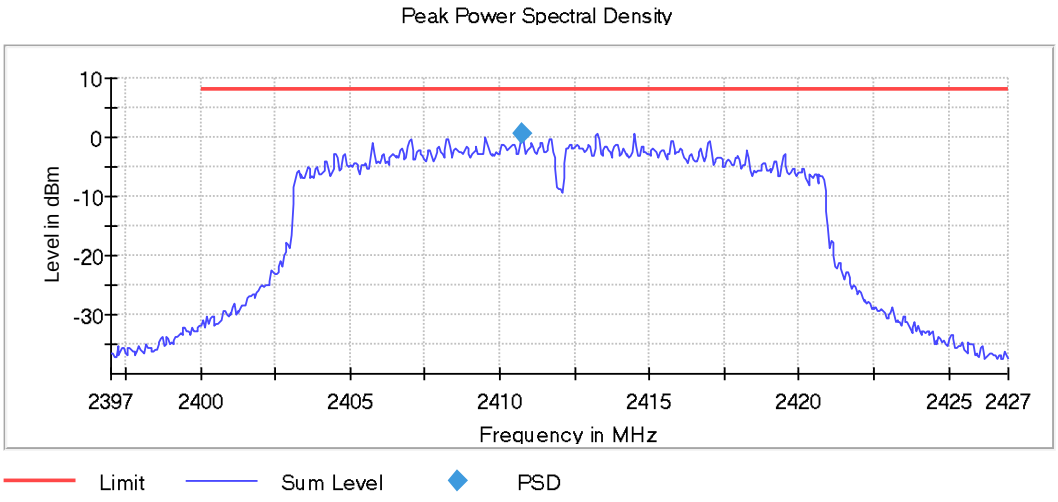


Figure 2.5.6-7: PSD – LCH

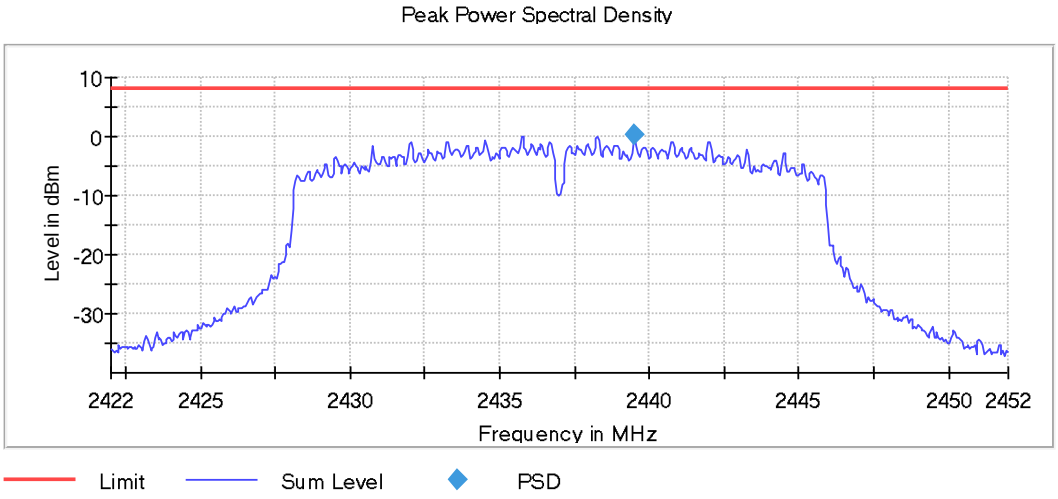


Figure 2.5.6-8: PSD – MCH

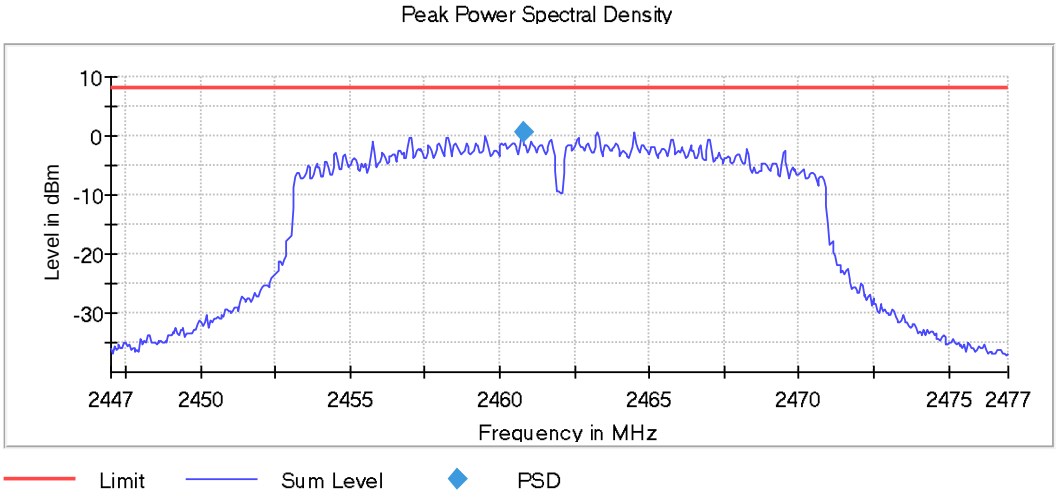


Figure 2.5.6-9: PSD – HCH

Table 2.5.6-4: Sample Measurement Settings (PSD)

Setting	Instrument Value	Target Value
Start Frequency	2.39700 GHz	2.39700 GHz
Stop Frequency	2.42700 GHz	2.42700 GHz
Span	30.000 MHz	30.000 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
Sweep Points	600	~ 600
Sweep time	1.040 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Max Peak	Max Peak
Sweep Count	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweep type	Sweep	Sweep
Preamp	off	off
Stable mode	Trace	Trace
Stable value	0.50 dB	0.50 dB
Run	55 / max. 150	max. 150
Stable	2 / 2	2
Max Stable Difference	0.05 dB	0.50 dB

Table 2.5.6-5: Sample Measurement Settings (PSD) 2nd Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.40713 GHz	2.40713 GHz
Stop Frequency	2.41713 GHz	2.41713 GHz
Span	10.000 MHz	10.000 MHz
RBW	3.000 kHz	<= 3.000 kHz
VBW	10.000 kHz	>= 9.000 kHz
Sweep Points	6667	~ 6667
Sweep time	112.000 ms	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	Max Peak	Max Peak
Sweep Count	10	10
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweep type	Sweep	Sweep
Preamp	off	off
Stable mode	Trace	Trace
Stable value	0.50 dB	0.50 dB
Run	99 / max. 150	max. 150
Stable	1 / 1	1
Max Stable Difference	0.49 dB	0.50 dB

2.6 Band-Edge Compliance of RF Conducted Emissions

2.6.1 Specification Reference

FCC Sections: 15.247(d)
ISED Canada: RSS-247 5.5

2.6.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.6.3 Date of Test

12/12/2022

2.6.4 Test Method

The unwanted emissions into non-restricted bands were measured conducted in accordance with ANSI C63.10 Section 11.11. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 300 kHz. The resulting spectrum analyzer peak level was used to determine the reference level with respect to the 20 dBc limit at the band edges.

2.6.5 Environmental Conditions

The EUT was evaluated within the temperature, humidity and pressure range of the EUT as specified by the standard. The laboratory shall have an ambient temperature range of 15°C to 35°C, relative humidity range of 30% to 60% and atmospheric pressure range of 86 kPa to 106 kPa.

Ambient Temperature	24 °C
Relative Humidity	43 %
Atmospheric Pressure	982.1 mbar

2.6.6 Test Results

Test Summary: EUT was set to transmit mode.

Test Results: Pass

See data below for detailed results.

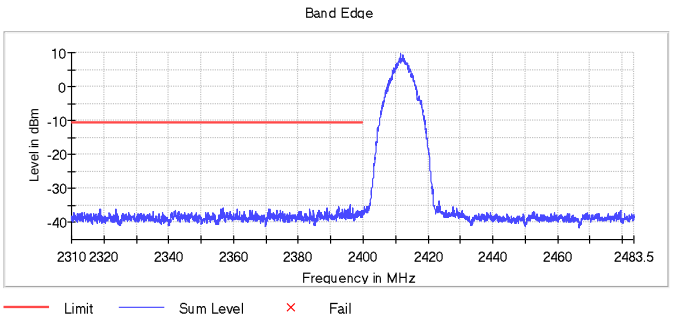


Figure 2.6.6-1: Lower Band-edge – 802.11b

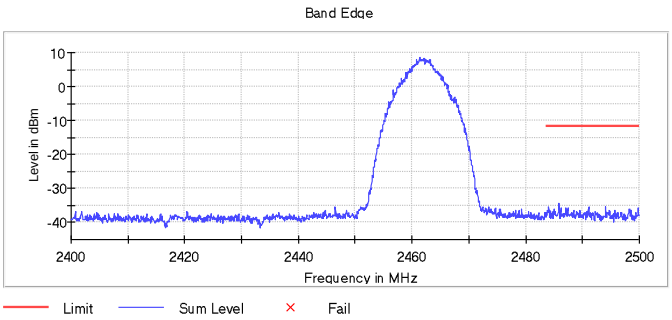


Figure 2.6.6-2: Upper Band-edge – 802.11b

Table 2.6.6-1: Lower Band-edge- Low Channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2395.925000	-34.7	24.3	-10.5	PASS
2395.875000	-34.8	24.3	-10.5	PASS
2392.325000	-35.5	25.0	-10.5	PASS
2395.975000	-35.5	25.0	-10.5	PASS
2356.725000	-35.6	25.1	-10.5	PASS
2356.775000	-35.7	25.2	-10.5	PASS
2388.875000	-35.7	25.2	-10.5	PASS
2392.275000	-35.8	25.3	-10.5	PASS
2392.475000	-35.8	25.3	-10.5	PASS
2396.825000	-35.8	25.3	-10.5	PASS
2396.775000	-35.9	25.4	-10.5	PASS
2393.675000	-35.9	25.4	-10.5	PASS
2394.275000	-35.9	25.4	-10.5	PASS
2370.875000	-35.9	25.4	-10.5	PASS
2356.025000	-36.0	25.5	-10.5	PASS

Table 2.6.6-2: Upper Band-edge – High Channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2485.875000	-34.3	22.8	-11.5	PASS
2485.825000	-34.7	23.2	-11.5	PASS
2485.925000	-35.1	23.5	-11.5	PASS
2484.025000	-35.3	23.8	-11.5	PASS
2491.075000	-35.4	23.9	-11.5	PASS
2484.075000	-35.5	23.9	-11.5	PASS
2494.075000	-35.5	24.0	-11.5	PASS
2491.125000	-35.5	24.0	-11.5	PASS
2499.825000	-35.6	24.1	-11.5	PASS
2487.075000	-35.7	24.1	-11.5	PASS
2499.775000	-35.8	24.3	-11.5	PASS
2486.225000	-35.8	24.3	-11.5	PASS
2487.025000	-35.8	24.3	-11.5	PASS
2487.475000	-35.9	24.3	-11.5	PASS
2498.225000	-35.9	24.4	-11.5	PASS

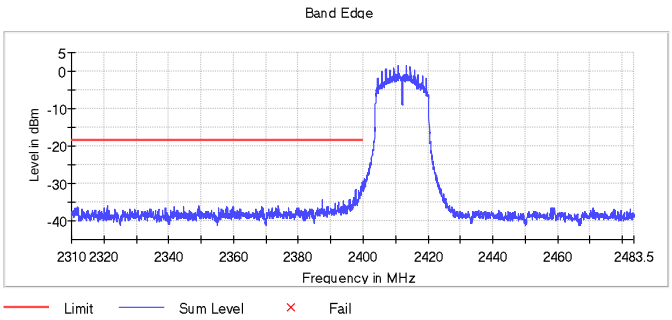


Figure 2.6.6-3: Lower Band-edge – 802.11g

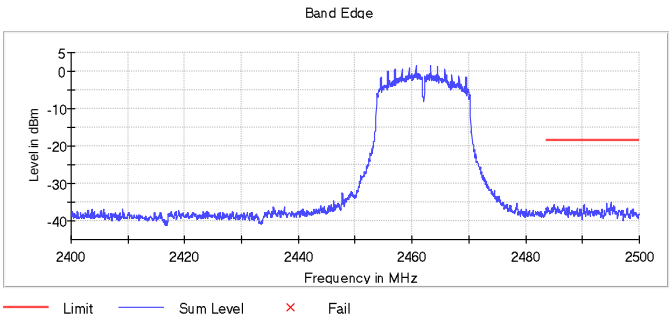


Figure 2.6.6-4: Upper Band-edge – 802.11g

Table 2.6.6-3: Lower Band-edge- Low Channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-29.4	10.9	-18.5	PASS
2399.775000	-29.7	11.3	-18.5	PASS
2399.725000	-29.8	11.3	-18.5	PASS
2399.475000	-30.5	12.1	-18.5	PASS
2399.825000	-30.9	12.4	-18.5	PASS
2399.425000	-31.0	12.5	-18.5	PASS
2399.625000	-31.1	12.6	-18.5	PASS
2399.275000	-31.1	12.6	-18.5	PASS
2399.525000	-31.1	12.7	-18.5	PASS
2399.325000	-31.4	12.9	-18.5	PASS
2399.675000	-31.6	13.2	-18.5	PASS
2399.925000	-31.6	13.2	-18.5	PASS
2397.675000	-31.7	13.2	-18.5	PASS
2399.575000	-31.8	13.3	-18.5	PASS
2399.225000	-31.8	13.3	-18.5	PASS

Table 2.6.6-4: Upper Band-edge – High Channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2494.975000	-34.9	16.5	-18.4	PASS
2495.025000	-35.1	16.7	-18.4	PASS
2494.225000	-35.3	16.9	-18.4	PASS
2494.275000	-35.4	17.0	-18.4	PASS
2484.925000	-35.5	17.2	-18.4	PASS
2490.275000	-35.6	17.2	-18.4	PASS
2486.725000	-35.8	17.4	-18.4	PASS
2484.975000	-35.8	17.4	-18.4	PASS
2486.675000	-35.9	17.5	-18.4	PASS
2495.425000	-35.9	17.6	-18.4	PASS
2490.225000	-36.1	17.7	-18.4	PASS
2485.625000	-36.1	17.7	-18.4	PASS
2483.875000	-36.1	17.8	-18.4	PASS
2487.575000	-36.2	17.8	-18.4	PASS
2485.675000	-36.2	17.8	-18.4	PASS

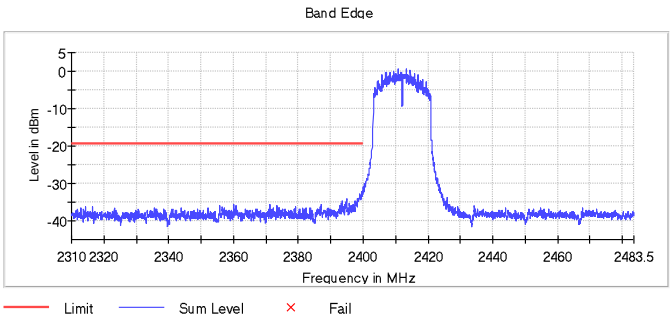


Figure 2.6.6-5: Lower Band-edge – 802.11n20 (HT20)

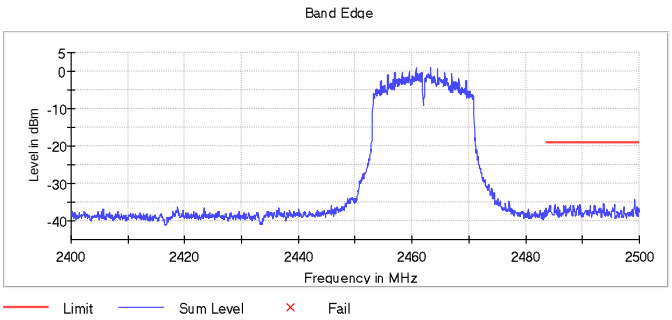


Figure 2.6.6-6: Upper Band-edge – 802.11n20 (HT20)

Table 2.6.6-5: Lower Band-edge- Low Channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-31.6	12.2	-19.4	PASS
2399.875000	-32.0	12.6	-19.4	PASS
2399.925000	-32.2	12.8	-19.4	PASS
2399.675000	-32.3	12.9	-19.4	PASS
2399.525000	-32.3	13.0	-19.4	PASS
2399.475000	-32.6	13.3	-19.4	PASS
2399.825000	-32.9	13.5	-19.4	PASS
2398.925000	-33.0	13.6	-19.4	PASS
2398.975000	-33.0	13.7	-19.4	PASS
2399.625000	-33.1	13.7	-19.4	PASS
2399.775000	-33.1	13.7	-19.4	PASS
2399.725000	-33.2	13.9	-19.4	PASS
2398.875000	-33.2	13.9	-19.4	PASS
2399.575000	-33.3	14.0	-19.4	PASS
2399.425000	-33.3	14.0	-19.4	PASS

Table 2.6.6-6: Upper Band-edge – High Channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2499.225000	-34.5	15.3	-19.1	PASS
2499.175000	-34.5	15.4	-19.1	PASS
2493.725000	-35.3	16.2	-19.1	PASS
2493.775000	-35.6	16.4	-19.1	PASS
2495.625000	-35.7	16.5	-19.1	PASS
2489.625000	-35.7	16.5	-19.1	PASS
2485.125000	-35.7	16.6	-19.1	PASS
2499.275000	-35.8	16.6	-19.1	PASS
2495.675000	-35.8	16.6	-19.1	PASS
2486.975000	-35.8	16.7	-19.1	PASS
2489.575000	-35.8	16.7	-19.1	PASS
2486.675000	-35.8	16.7	-19.1	PASS
2489.175000	-35.9	16.7	-19.1	PASS
2492.075000	-35.9	16.7	-19.1	PASS
2487.875000	-35.9	16.8	-19.1	PASS

2.7 RF Conducted Spurious Emissions

2.7.1 Specification Reference

FCC Sections: 15.247(d)
ISED Canada: RSS-247 5.5

2.7.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.7.3 Date of Test

12/12/2022

2.7.4 Test Method

The unwanted emissions into non-restricted bands were measured conducted in accordance with ANSI C63.10 Section 11.11. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 300 kHz. The resulting spectrum analyzer peak level was used to determine the reference level with respect to the 20 dBc limit at the band edges. The spectrum span was then adjusted for the measurement of spurious emissions from 30MHz to 26GHz, 10 times the highest fundamental frequency.

2.7.5 Environmental Conditions

The EUT was evaluated within the temperature, humidity and pressure range of the EUT as specified by the standard. The laboratory shall have an ambient temperature range of 15°C to 35°C, relative humidity range of 30% to 60% and atmospheric pressure range of 86 kPa to 106 kPa.

Ambient Temperature	24 °C
Relative Humidity	43 %
Atmospheric Pressure	982.1 mbar

2.7.6 Test Results

Test Summary: EUT was set to transmit mode.

Test Results: Pass

See data below for detailed results.

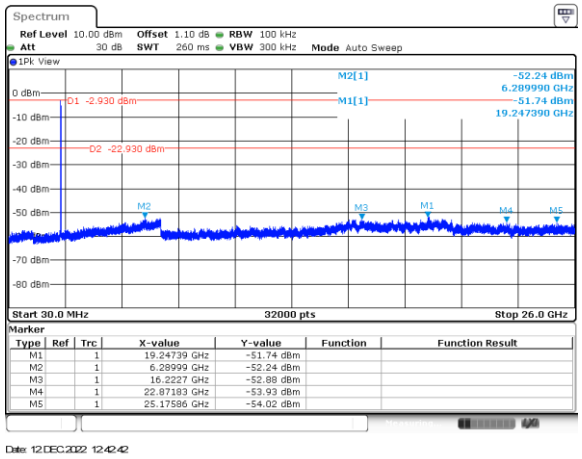


Figure 2.7.6-1: 30MHz – 26GHz – LCH – 802.11b

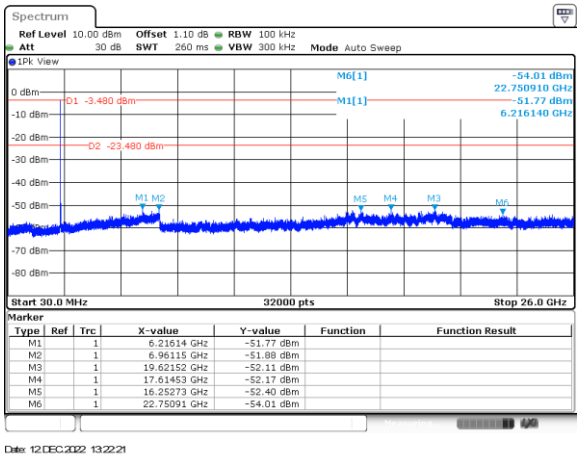


Figure 2.7.6-2: 30MHz – 26GHz – MCH – 802.11b

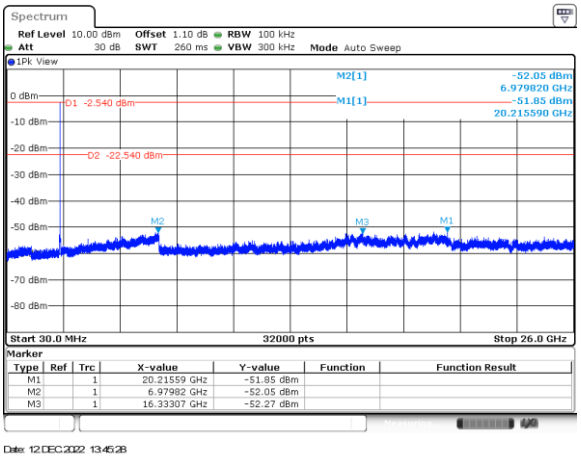


Figure 2.7.6-3: 30MHz – 26GHz – HCH – 802.11b

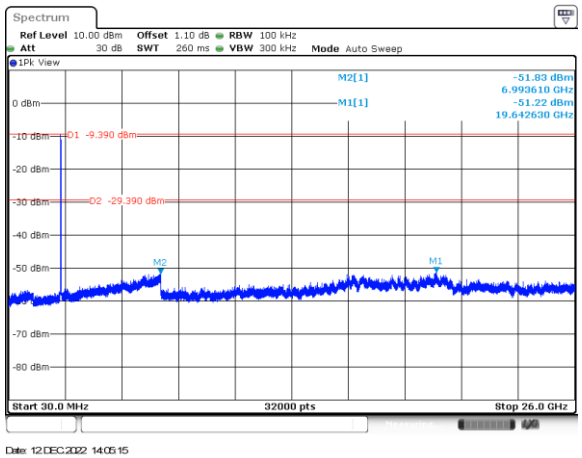


Figure 2.7.6-4: 30MHz – 26GHz – LCH – 802.11g

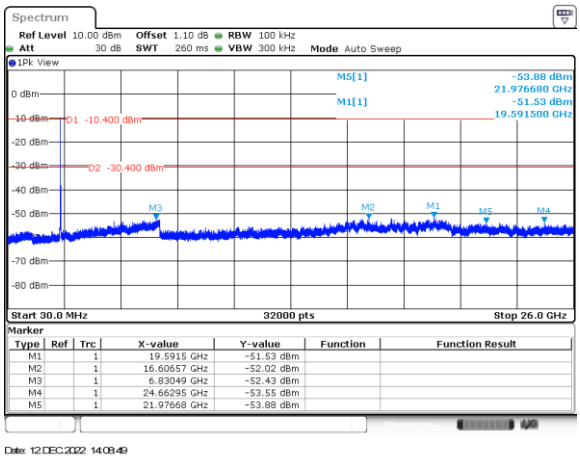


Figure 2.7.6-5: 30MHz – 26GHz – MCH – 802.11g

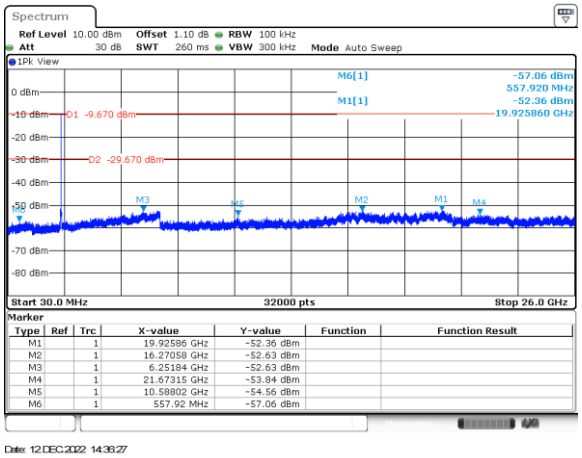
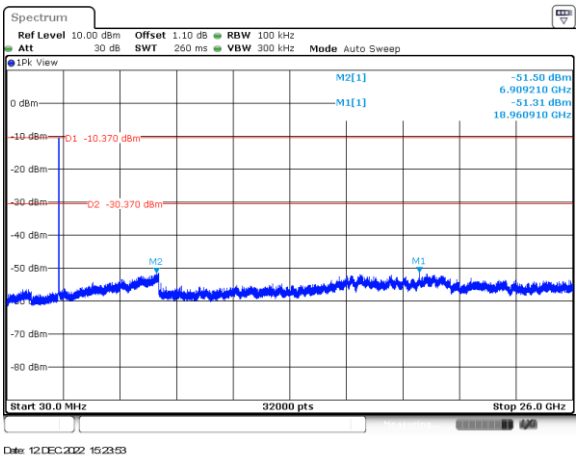


Figure 2.7.6-6: 30MHz – 26GHz – HCH – 802.11g



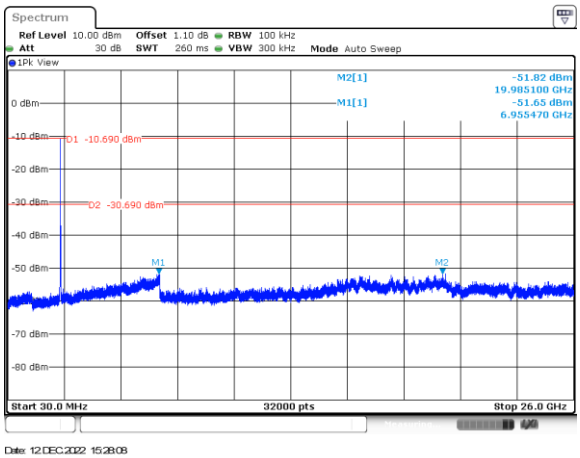


Figure 2.7.6-7: 30MHz – 26GHz – LCH – 802.11n20 (HT20) **Figure 2.7.6-8: 30MHz – 26GHz – MCH – 802.11n20 (HT20)**

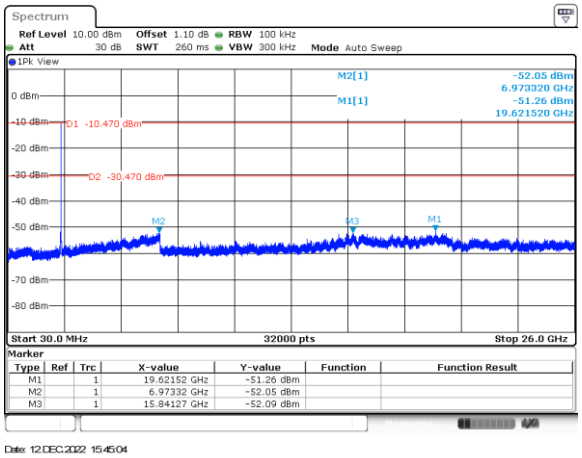


Figure 2.7.6-9: 30MHz – 26GHz – HCH – 802.11n20 (HT20)

2.8 Radiated Spurious Emissions into Restricted Frequency Bands

2.8.1 Specification Reference

FCC Sections: 15.205, 15.209.
ISED Canada RSS – Gen 8.9/8.10

2.8.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “1”, as noted in §1.6.

2.8.3 Date of Test

12/13/2022 to 12/19/2022

2.8.4 Test Method

Radiated emissions tests were made over the frequency range of 9 kHz to 26 GHz, 10 times the highest fundamental frequency of 2.4 GHz. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in Section 15.209.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 150 kHz, quasi-peak measurements were made using a resolution bandwidth RBW of 300 Hz and a video bandwidth VBW of 1 kHz and frequencies between 150 kHz and 30MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 10 kHz and a video bandwidth VBW of 30 kHz. For frequencies between 30 MHz and 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 100 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak and average measurements were made with RBW of 1 MHz and VBW of 3 MHz

2.8.5 Environmental Conditions

The EUT was evaluated within the temperature, humidity and pressure range of the EUT as specified by the standard. The laboratory shall have an ambient temperature range of 15°C to 35°C, relative humidity range of 30% to 60% and atmospheric pressure range of 86 kPa to 106 kPa.

Ambient Temperature	24 °C
Relative Humidity	43 %
Atmospheric Pressure	982.1 mbar

2.8.6 Test Results

Test Summary: EUT was set to transmit mode.

Test Results: Pass

See data below for detailed results.

Table 2.8.6-1: Radiated Spurious Emissions Tabulated Data 802.11b

Frequency	Peak Value	QP/Avg Value	Peak Limit	QP/Avg Limit	Peak Margin	QP/Avg Margin	Polarity	Peak Limit Results	QP/Avg Limit Results
MHz	dBµV/m	dBµV/m	dBµV/m	Limit_Avg	dB	dB	H/V	Pass/Fail	Pass/Fail
LCH - 2412 MHz									
12059.75	47.239	33.65	74	54	-26.76	-20.35	H	Pass	Pass
14472.175	48.851	34.97	74	54	-25.15	-19.03	H	Pass	Pass
12059.825	47.243	33.581	74	54	-26.76	-20.42	V	Pass	Pass
14472.2	49.789	34.982	74	54	-24.21	-19.02	V	Pass	Pass
19295.9	52.199	38.298	74	54	-21.8	-15.7	H	Pass	Pass
19296.2	52.297	38.304	74	54	-21.7	-15.7	V	Pass	Pass
MCH – 2437 MHz									
4874.25	46.566	31.858	74	54	-27.43	-22.14	H	Pass	Pass
7310.75	50.816	35.518	74	54	-23.18	-18.48	H	Pass	Pass
4874.175	45.988	31.905	74	54	-28.01	-22.09	V	Pass	Pass
7311.2	49.142	35.052	74	54	-24.86	-18.95	V	Pass	Pass
12185.25	49.298	34.352	74	54	-24.7	-19.65	H	Pass	Pass
12185.025	48.485	34.335	74	54	-25.51	-19.67	V	Pass	Pass
19495.925	52.976	38.592	74	54	-21.02	-15.41	H	Pass	Pass
19495.75	53.138	38.606	74	54	-20.86	-15.39	V	Pass	Pass
HCH – 2462 MHz									
4924.075	48.772	34.629	74	54	-25.23	-19.37	H	Pass	Pass
7384.55	53.468	39.852	74	54	-20.53	-14.15	H	Pass	Pass
4923.825	46.941	32.476	74	54	-27.06	-21.52	V	Pass	Pass
7386.2	48.483	34.027	74	54	-25.52	-19.97	V	Pass	Pass
12309.875	47.93	34.078	74	54	-26.07	-19.92	H	Pass	Pass
12309.775	48.609	34.159	74	54	-25.39	-19.84	V	Pass	Pass
19696.025	52.936	39.098	74	54	-21.06	-14.9	H	Pass	Pass
22158.125	57.019	43.16	74	54	-16.98	-10.84	H	Pass	Pass
19695.775	52.681	39.107	74	54	-21.32	-14.89	V	Pass	Pass
22157.775	56.82	43.207	74	54	-17.18	-10.79	V	Pass	Pass

Table 2.8.6-2: Radiated Spurious Emissions Tabulated Data 802.11g

Frequency	Peak Value	QP/Avg Value	Peak Limit	QP/Avg Limit	Peak Margin	QP/Avg Margin	Polarity	Peak Limit Results	QP/Avg Limit Results
MHz	dBµV/m	dBµV/m	dBµV/m	Limit_Avg	dB	dB	H/V	Pass/Fail	Pass/Fail
LCH - 2412 MHz									
4823.925	46.053	31.904	74	54	-27.95	-22.1	H	Pass	Pass
4823.8	46.346	31.916	74	54	-27.65	-22.08	V	Pass	Pass
12060.125	47.491	33.71	74	54	-26.51	-20.29	H	Pass	Pass
14472.225	49.57	34.919	74	54	-24.43	-19.08	H	Pass	Pass
12060.175	48.087	33.665	74	54	-25.91	-20.33	V	Pass	Pass
14472.225	50.275	34.908	74	54	-23.73	-19.09	V	Pass	Pass
19295.85	52.036	38.284	74	54	-21.96	-15.72	H	Pass	Pass
19295.8	52.964	38.362	74	54	-21.04	-15.64	V	Pass	Pass
MCH – 2437 MHz									
4874.05	46.21	31.893	74	54	-27.79	-22.11	H	Pass	Pass
7310.85	48.553	34.043	74	54	-25.45	-19.96	H	Pass	Pass
4874.225	46.583	31.844	74	54	-27.42	-22.16	V	Pass	Pass
7310.975	49.453	34.739	74	54	-24.55	-19.26	V	Pass	Pass
12185.025	48.465	34.307	74	54	-25.53	-19.69	H	Pass	Pass
12184.75	48.532	34.297	74	54	-25.47	-19.7	V	Pass	Pass
19496	52.326	38.584	74	54	-21.67	-15.42	H	Pass	Pass
19496	52.404	38.557	74	54	-21.6	-15.44	V	Pass	Pass
HCH – 2462 MHz									
271.871	----	26.859	----	46	----	-19.14	V	----	Pass
4924.25	48.418	32.548	74	54	-25.58	-21.45	H	Pass	Pass
7385.75	50.619	36.02	74	54	-23.38	-17.98	H	Pass	Pass
4924.025	46.847	32.463	74	54	-27.15	-21.54	V	Pass	Pass
7385.75	47.881	33.569	74	54	-26.12	-20.43	V	Pass	Pass
12309.8	48.962	34.104	74	54	-25.04	-19.9	H	Pass	Pass
12309.9	48.241	34.213	74	54	-25.76	-19.79	V	Pass	Pass
19695.925	52.739	39.092	74	54	-21.26	-14.91	H	Pass	Pass
22157.95	57.335	43.188	74	54	-16.66	-10.81	H	Pass	Pass
19695.9	53.178	39.097	74	54	-20.82	-14.9	V	Pass	Pass
22158.225	57.05	43.18	74	54	-16.95	-10.82	V	Pass	Pass

Table 2.8.6-3: Radiated Spurious Emissions Tabulated Data 802.11n20(HT20)

Frequency	Peak Value	QP/Avg Value	Peak Limit	QP/Avg Limit	Peak Margin	QP/Avg Margin	Polarity	Peak Limit Results	QP/Avg Limit Results
MHz	dBµV/m	dBµV/m	dBµV/m	Limit_Avg	dB	dB	H/V	Pass/Fail	Pass/Fail
LCH - 2412 MHz									
267.556	----	29.844	----	46	----	-16.16	H	----	Pass
4823.75	45.624	31.514	74	54	-28.38	-22.49	H	Pass	Pass
4824.125	47.116	31.507	74	54	-26.88	-22.49	V	Pass	Pass
12059.75	47.679	33.718	74	54	-26.32	-20.28	H	Pass	Pass
14472.15	48.485	34.916	74	54	-25.52	-19.08	H	Pass	Pass
12059.975	47.344	33.65	74	54	-26.66	-20.35	V	Pass	Pass
14472.075	48.845	34.96	74	54	-25.16	-19.04	V	Pass	Pass
19296	52.505	38.354	74	54	-21.5	-15.65	H	Pass	Pass
19296.15	53.211	38.345	74	54	-20.79	-15.65	V	Pass	Pass
MCH – 2437 MHz									
4873.95	46.166	31.615	74	54	-27.83	-22.38	H	Pass	Pass
7311.1	49.28	35.09	74	54	-24.72	-18.91	H	Pass	Pass
4874.075	45.78	31.664	74	54	-28.22	-22.34	V	Pass	Pass
7311.05	48.324	34.605	74	54	-25.68	-19.4	V	Pass	Pass
12185.25	48.952	34.319	74	54	-25.05	-19.68	H	Pass	Pass
12185	48.893	34.28	74	54	-25.11	-19.72	V	Pass	Pass
19496	52.539	38.616	74	54	-21.46	-15.38	H	Pass	Pass
19495.8	52.354	38.665	74	54	-21.65	-15.33	V	Pass	Pass
HCH – 2462 MHz									
4924.025	47.109	32.223	74	54	-26.89	-21.78	H	Pass	Pass
7385.975	49.681	35.831	74	54	-24.32	-18.17	H	Pass	Pass
4924.15	46.647	32.153	74	54	-27.35	-21.85	V	Pass	Pass
7386.025	47.905	34.883	74	54	-26.09	-19.12	V	Pass	Pass
12310.05	48.117	34.064	74	54	-25.88	-19.94	H	Pass	Pass
12309.9	47.791	34.226	74	54	-26.21	-19.77	V	Pass	Pass
19695.8	53.698	39.229	74	54	-20.3	-14.77	H	Pass	Pass
22158.025	57.04	43.311	74	54	-16.96	-10.69	H	Pass	Pass
19695.925	54.046	39.247	74	54	-19.95	-14.75	V	Pass	Pass
22157.95	57.483	43.368	74	54	-16.52	-10.63	V	Pass	Pass

Table 2.8.6-4: Radiated Band-Edge Tabulated Data – 802.11b

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
LCH										
2390	62.20	50.70	H	-2.04	60.16	48.66	74.0	54.0	13.8	5.3
2390	52.10	39.00	V	-2.04	50.06	36.96	74.0	54.0	23.9	17.0
HCH										
2483.5	62.60	50.10	H	-1.78	60.82	48.32	74.0	54.0	13.2	5.7
2483.5	53.90	39.30	V	-1.78	52.12	37.52	74.0	54.0	21.9	16.5

Table 2.8.6-5: Radiated Band-Edge Tabulated Data – 802.11g

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
LCH										
2390	69.10	52.70	H	-2.04	67.06	50.66	74.0	54.0	6.9	3.3
2390	61.70	43.90	V	-2.04	59.66	41.86	74.0	54.0	14.3	12.1
HCH										
2483.5	71.70	53.20	H	-1.78	69.92	51.42	74.0	54.0	4.1	2.6
2483.5	64.00	46.40	V	-1.78	62.22	44.62	74.0	54.0	11.8	9.4

Table 2.8.6-6: Radiated Band-Edge Tabulated Data – 802.11n20

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
LCH										
2390	68.52	51.30	H	-2.04	66.48	49.26	74.0	54.0	7.5	4.7
2390	61.70	43.40	V	-2.04	59.66	41.36	74.0	54.0	14.3	12.6
HCH										
2483.5	68.30	51.10	H	-1.78	66.52	49.32	74.0	54.0	7.5	4.7
2483.5	59.30	42.00	V	-1.78	57.52	40.22	74.0	54.0	16.5	13.8

Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: 71.70+ -1.78 = 69.92dBµV/m
Margin: 74dBµV/m –69.92dBµV/m = 4.1dB

Example Calculation: Average

Corrected Level: 53.20+ -1.78 – 0 = 51.42dBµV
Margin: 54dBµV – 51.42dBµV = 2.6dB

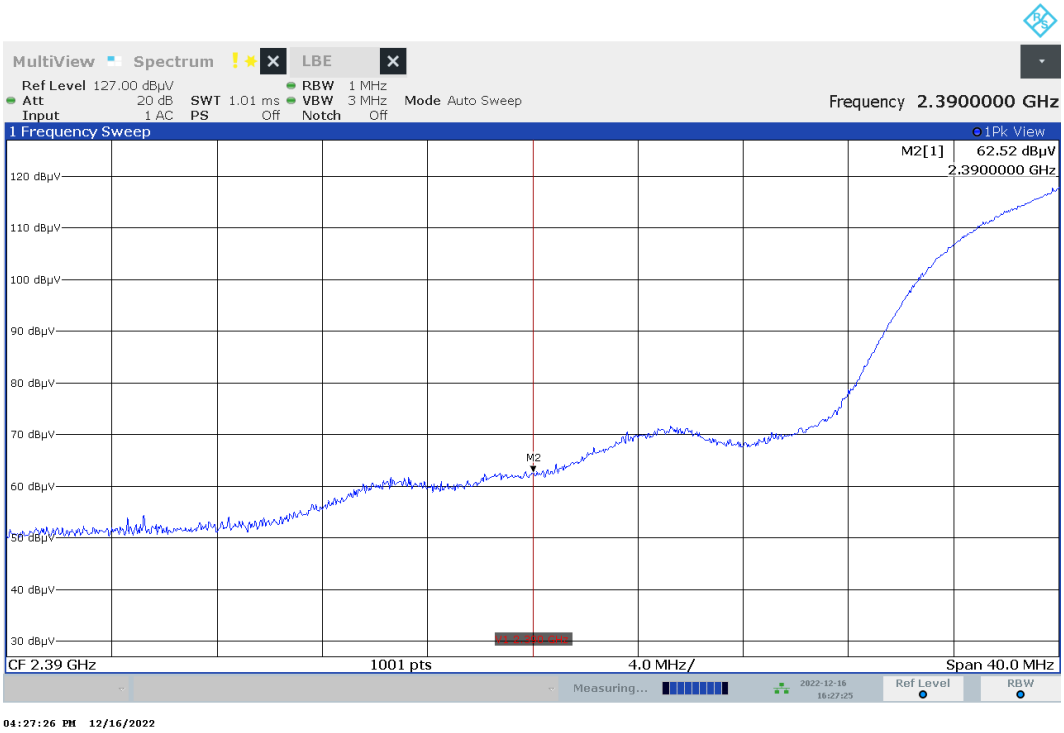


Figure 2.8.6-1: Reference plot Radiated Lower Band-edge – LCH – 802.11b

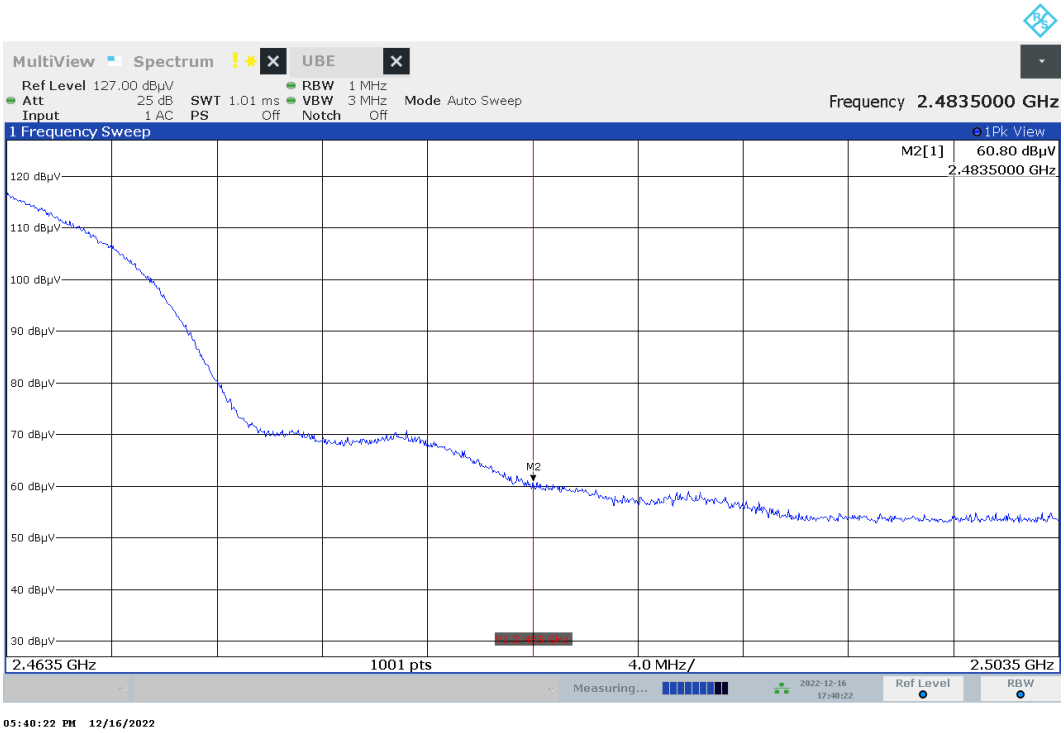


Figure 2.8.6-2: Reference plot Radiated Upper Band-edge – HCH – 802.11b

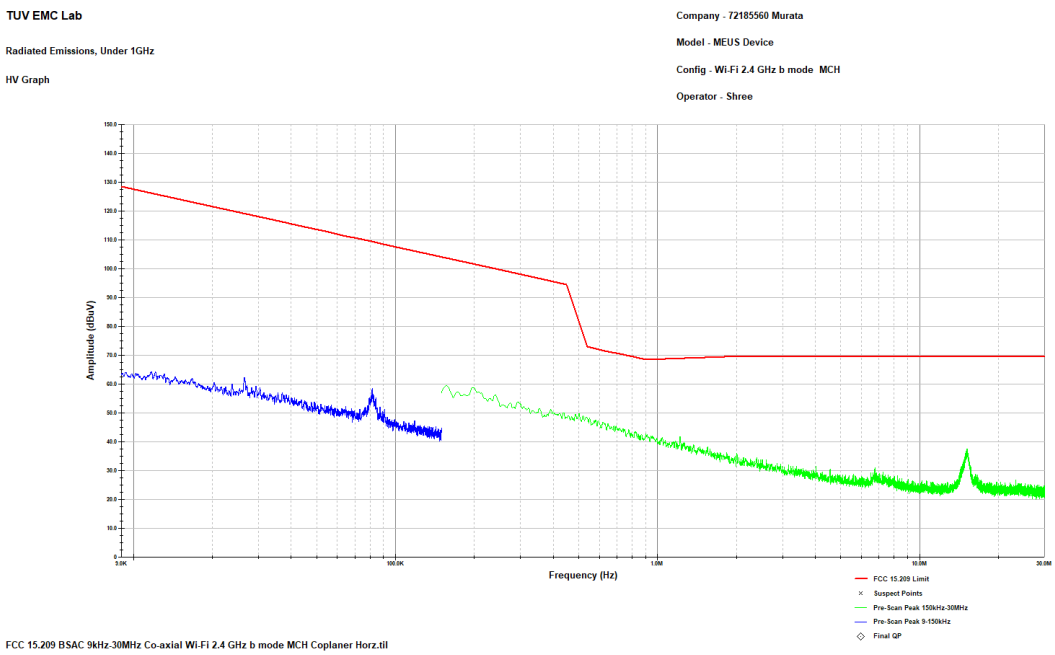


Figure 2.8.6-3: Reference plot for Radiated Spurious Emissions – 9 kHz – 30 MHz – MCH – 802.11b
Note: Emissions above the noise floor are ambient not associated with the EUT.

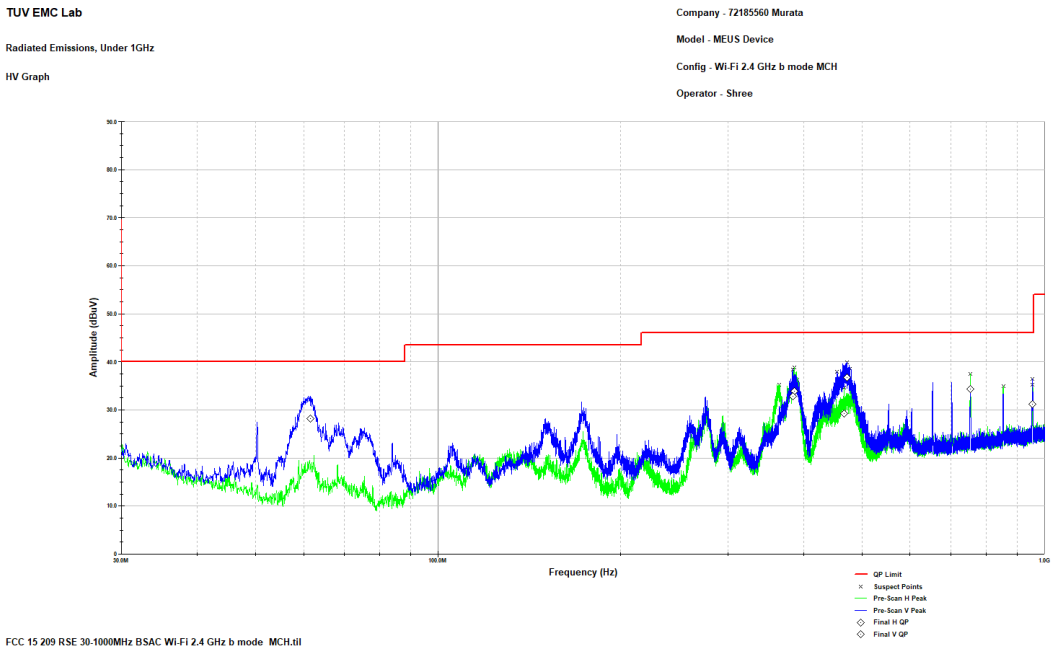


Figure 2.8.6-4: Reference plot for Radiated Spurious Emissions – 30 MHz – 1 GHz – MCH – 802.11b

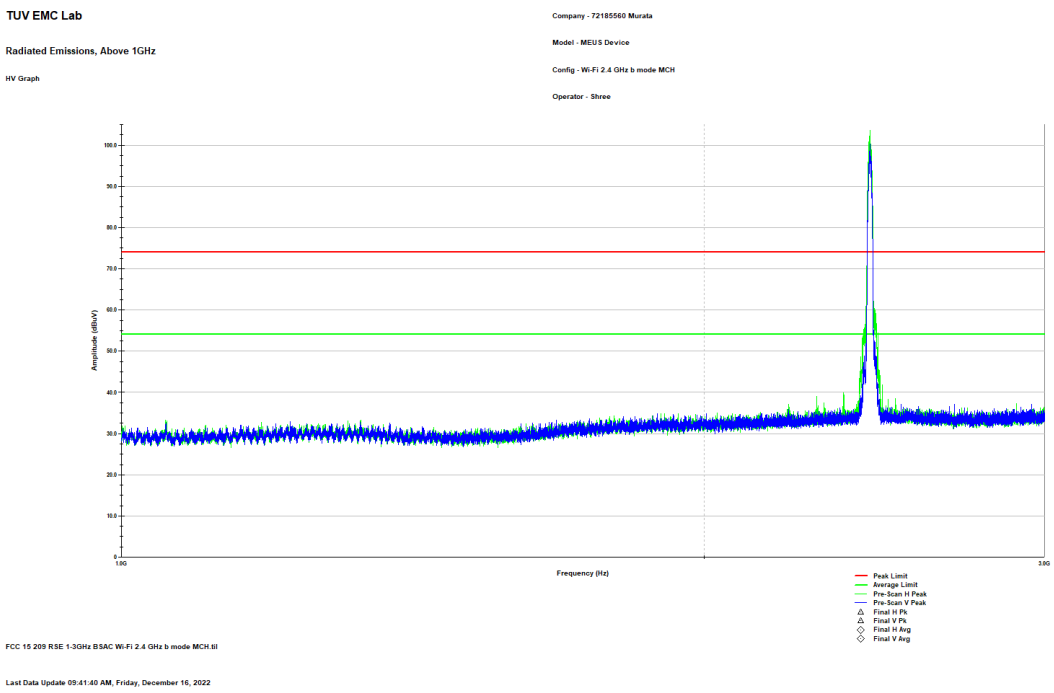


Figure 2.8.6-5: Reference plot for Radiated Spurious Emissions – 1 GHz – 3 GHz – MCH – 802.11b
Note: Emission above limit is fundamental frequency.

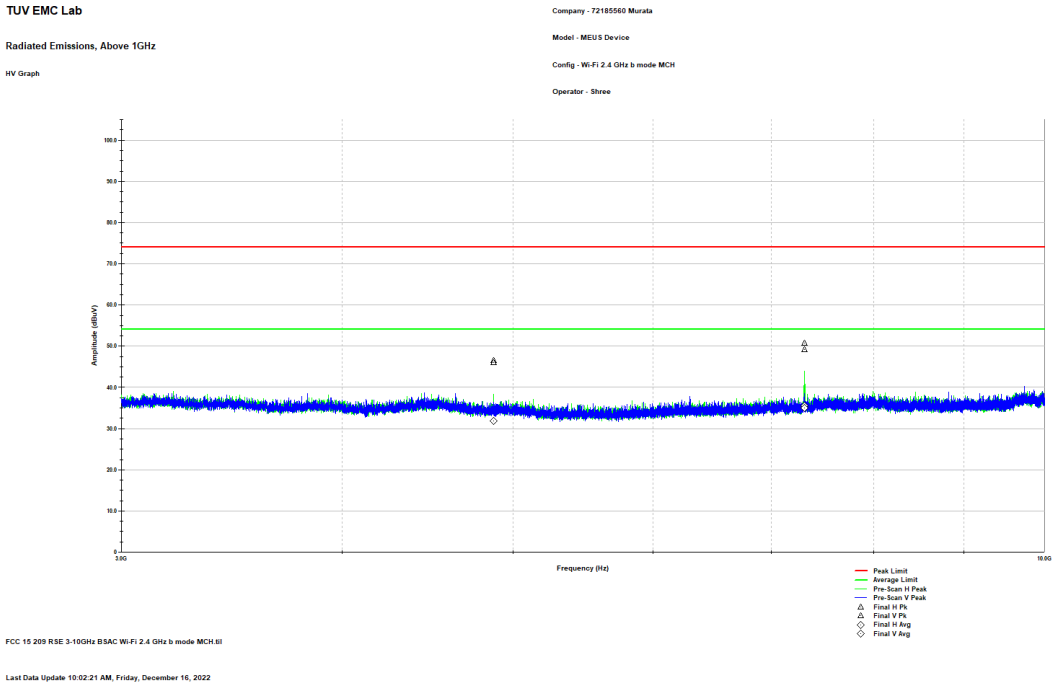


Figure 2.8.6-6: Reference plot for Radiated Spurious Emissions – 3 GHz – 10 GHz – MCH – 802.11b

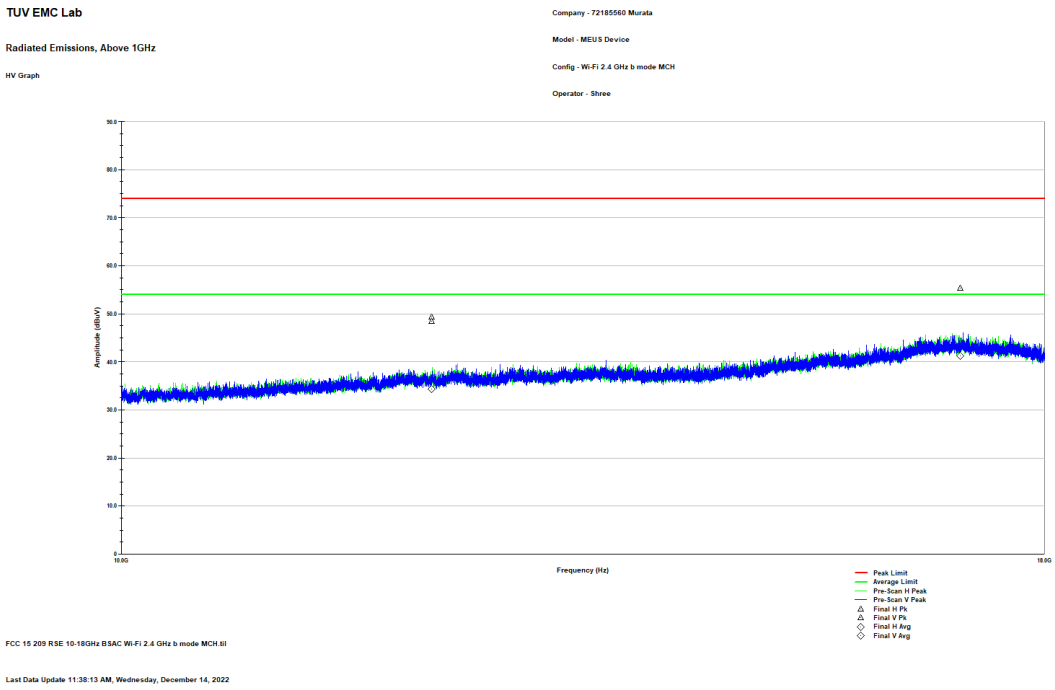


Figure 2.8.6-7: Reference plot for Radiated Spurious Emissions – 10 GHz – 18 GHz – MCH – 802.11b

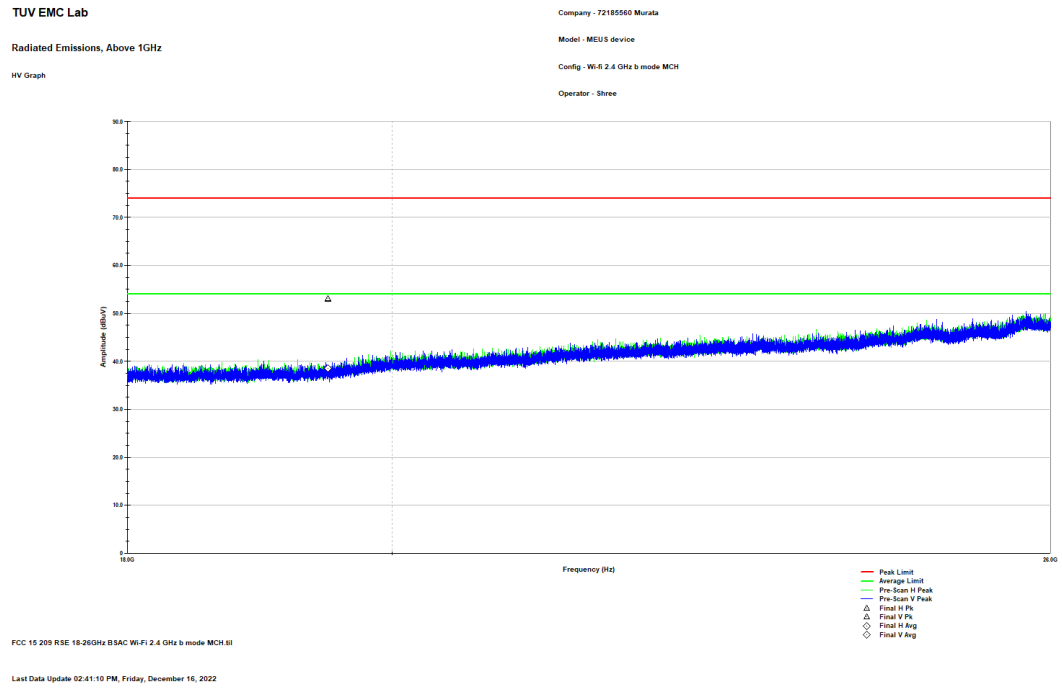


Figure 2.8.6-8: Reference plot for Radiated Spurious Emissions – 18 GHz – 26 GHz – MCH - 802.11b

2.9 Test Equipment Used

Table 2.9-1 –Equipment List

Asset ID	Manufacturer	Model	Equipment Type	Serial Number	Last Calibration Date	Calibration Due Date
853	Teseq	CBL6112D	BiLog Antenna	51616	7/15/2021	7/15/2023
884	ETS Lindgren (EMCO)	3117	DOUBLE-RIDGED GUIDE ANTENNA	240106	5/6/2021	5/6/2023
334	Rohde & Schwarz	3160-09	HF Antenna 18-26.5 GHz	45576	4/25/2022	5/25/2024
889	Com Power	PAM 103	Pre-amplifier	18020215	9/27/2022	9/27/2023
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	6/22/2021	6/22/2023
882	Rohde & Schwarz	ESW44	ESW44 EMI TEST RECEIVER	101961	7/14/2022	7/14/2023
22	Teledyne Storm Microwave	90-195-456	BSAC Cable	N/A	10/7/2022	10/7/2023
20	Teledyne Storm Microwave	R-90-195-036	BSAC Cable	N/A	7/12/2022	7/12/2023
21	Teledyne Storm Microwave	R-90-195-072	BSAC Cable	N/A	7/12/2022	7/12/2023
335	Suhner Sucoflex	SF-102A	RF Cable	882/2A	6/21/2022	6/21/2023
345	Suhner Sucoflex	102A	RF Cable	1077/2A	6/21/2022	6/21/2023
432	Microwave Circuits	H3G020G4	High pass Filter	264066	6/9/2022	6/9/2023
827	Rohde & Schwarz	RF Cable set	TS8997 Rack cable set	N/A	12/20/2021	12/20/2022
622	Rohde & Schwarz	FSV40 (v3.40)	FSV Signal Analyzer 10Hz to 40GHz	101338	10/05/2022	10/05/2023
872	HP	E7402A	EMI Receiver	US40240258	6/21/2022	6/21/2023
871	ACS	n/a	Conducted EMI Cable	871	4/1/2022	4/1/2023
3010	Rohde & Schwarz	ENV216	Two-Line V-Network	3010	6/22/2022	6/22/2023

N/A – Not Applicable

3 Diagram of Test Set-ups

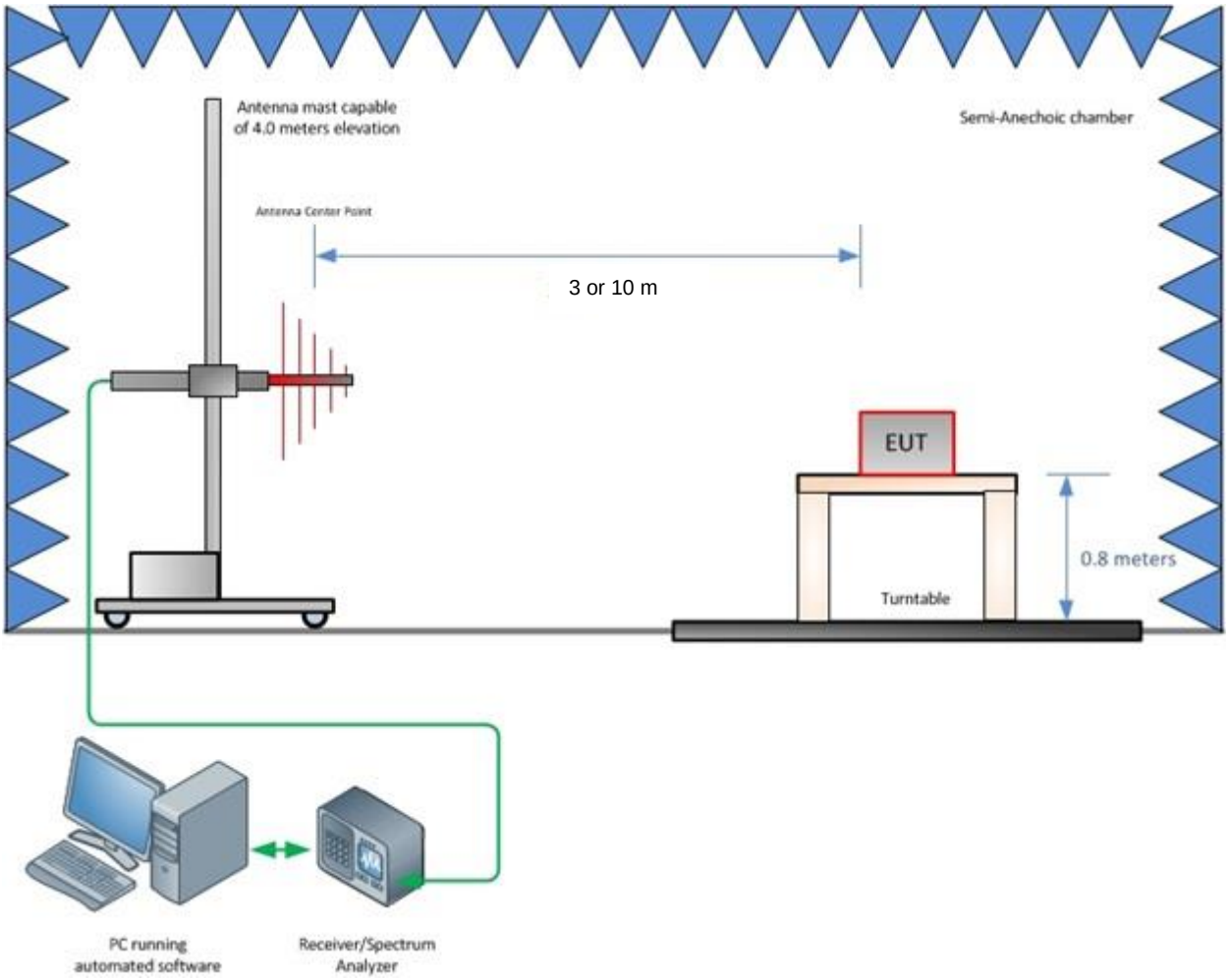


Figure 3-1 – Radiated Emissions Test Setup up to 1 GHz

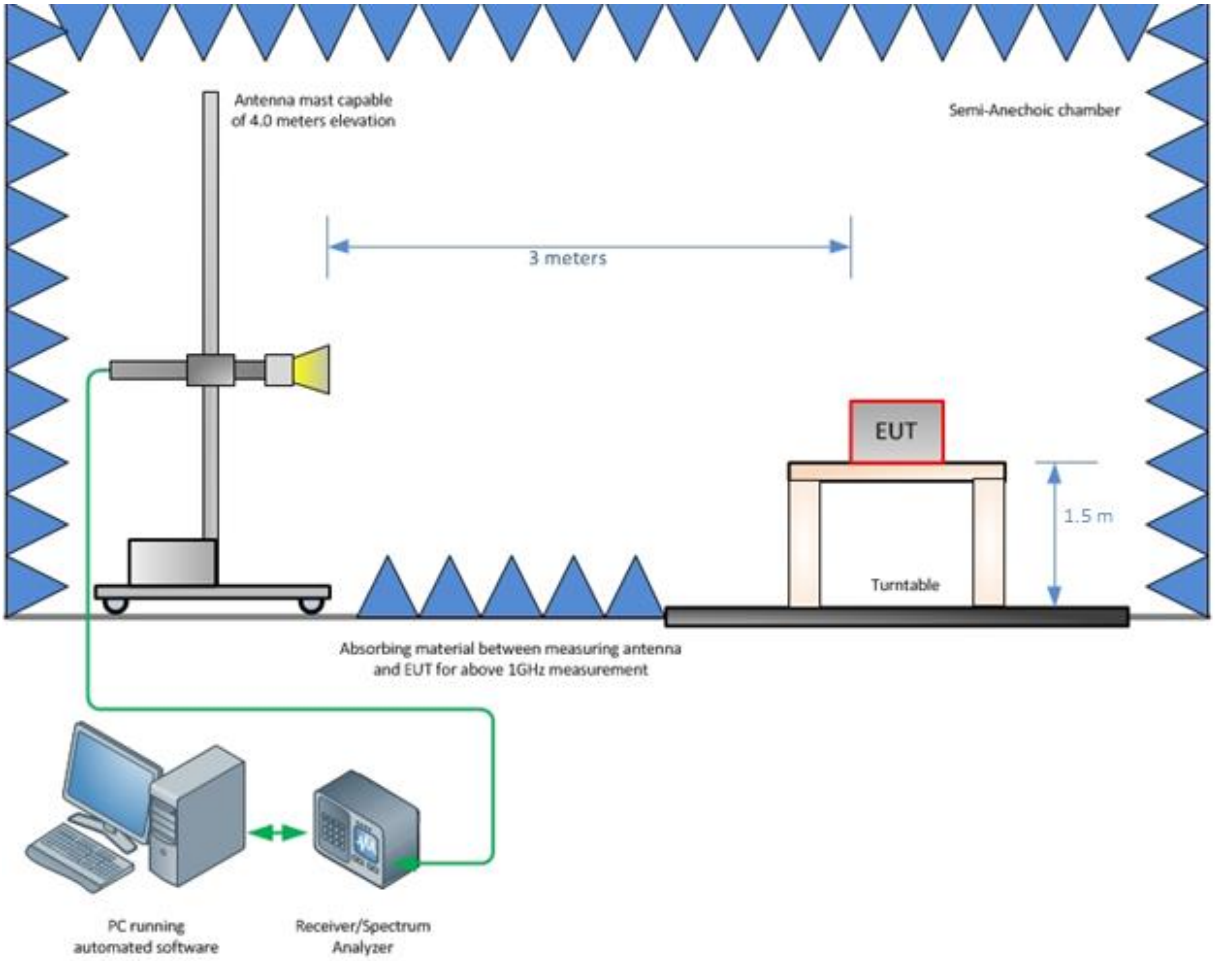


Figure 3-2 – Radiated Emissions Test Setup above 1 GHz

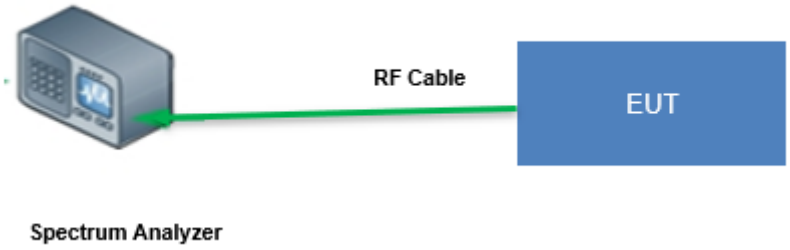


Figure 3-3 – Conducted Test Setup: Antenna Port measurement

4 Accreditation, Disclaimers and Copyright

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STATEMENT OF MEASUREMENT UNCERTAINTY – Emissions

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

Table 4-1: Estimation of Measurement Uncertainty

Parameter	U_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 0.349 dB
Power Spectral Density	± 0.372 dB
Antenna Port Conducted Emissions	± 1.264 dB
Radiated Emissions ≤ 1 GHz	± 5.814 dB
Radiated Emissions > 1 GHz	± 4.318 dB
Temperature	± 0.860 °C
Radio Frequency	± 2.832 x 10^{-8}
AC Power Line Conducted Emissions	± 3.360 dB

TEST EQUIPMENT

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated to meet test method standard requirements and/or manufacturer's specifications