

Report on the Testing of the Cooper Lighting Solutions WaveLinx Pro R3 Sensor

In accordance with:
FCC 47 CFR part 15.247
ISED RSS-247 Issue 3, August 2023

Prepared for: Cooper Lighting Solutions
1121 Highway 74 South
Peachtree City, GA - 30269



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Thierry Jean-Charles	Senior Engineer TUV SUD America Inc.	Authorized Signatory	6/17/2025

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD America, Inc. document control rules.

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.



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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	6/17/2025

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	Khaled Salah
Manufacturer	Cooper Lighting Solutions
Applicant's Email Address	Khaled.salah@cooperlighting.com
Model Name	WaveLinx Pro R3 Sensor Integrated Emergency WaveLinx Pro R3 Sensor
Model Number	WPS-R3 WEM-WPS-R3
Serial Number	N/A
FCC ID	2AKCY-42296706111
ISED Certification Number	4706A-42296706111
Hardware Version(s)	EP1
Software Version(s)	Railtest_mg24_1536k_with_switch_data_rate_support
Number of Samples Tested	1
Test Specification/Issue/Date	US Code of Federal REGulation (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2025 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 3, August 2023.
Order Number	721009025
Date of Receipt of EUT	4/2/2025
Start of Test	4/2/2025



Finish of Test

5/21/2025

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, 2025.

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	-----	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)	15
Band-Edge Compliance of RF Conducted Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	28
RF Conducted Spurious Emissions	Yes	Pass	15.247(d)	RSS-247 5.5	31
Radiated Spurious Emissions into Restricted Frequency Bands	Yes	Pass	15.205, 15.209	RSS-GEN 8.9, 8.10	33
Power Spectral Density	Yes	Pass	15.247(e)	RSS-247 5.2(b)	24
AC Power Line Conducted Emissions	Yes	Pass	15.207	RSS-GEN 8.8	12

1.4 Product Information

1.4.1 Technical Description

The Equipment Under Test (EUT) is a WaveLinx Lightning-Contel Sensor Module. The module supports Zigbee radio.

Table 1.4.1-1 – Wireless Technical Information

Detail	Description
FCC ID	2AKCY-42296706111
IC ID	4706A-42296706111
Transceiver Model name	WaveLinx Pro R3 Sensor Integrated Emergency WaveLinx Pro R3 Sensor
Transceiver Model number	WPS-R3 WEM-WPS-R3
Frequency Range (MHz)	2405 – 2480 MHz
Modulation Format	OQPSK
Number of Channels	16
Channel Bandwidth	~ 2MHz
Data Rates	250 kbps
Operating voltage	120VAC / 60Hz
Antenna Type / Gain:	Surface-mounted antenna (SMD) / 2.6 dBi

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



Photo 1.4.1-1 – Front view of the EUT



Photo 1.4.1-2 – Rear view of the EUT



Photo 1.4.1-3 – Front view of the Module



Photo 1.4.1-4 – Rear view of the Module

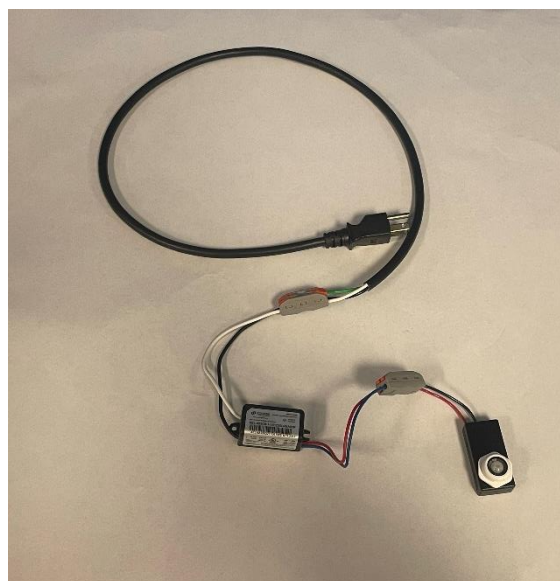


Photo 1.4.1-5 – Test Set up of EUT

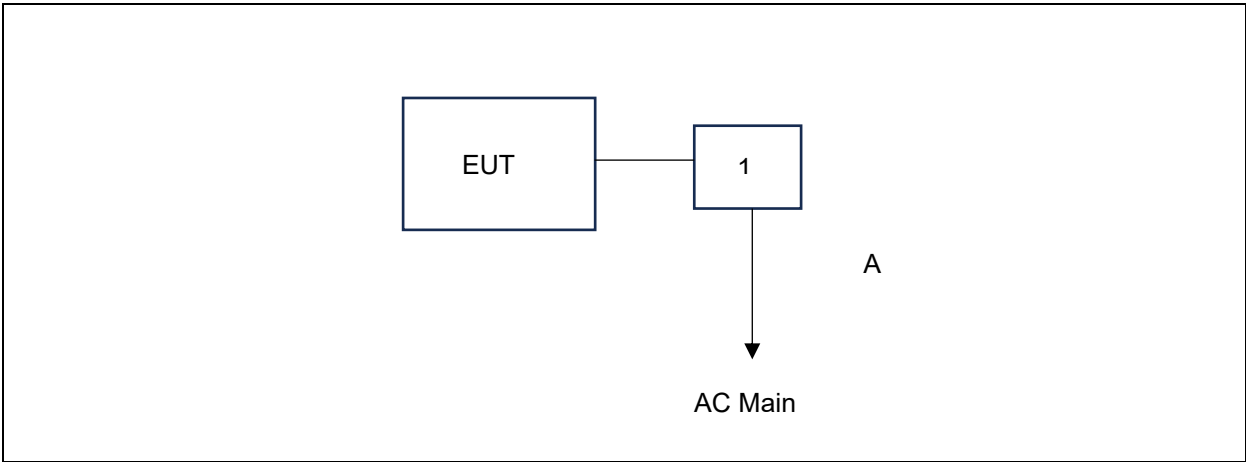


Figure 1.4.1-4: Test Setup Block Diagram

Table 1.4.1-2 – Cable Descriptions

Item	Cable/Port	Length	Shield
A	AC Power cable	1.2 m	No

Table 1.4.1-2 – Support Equipment Descriptions

Item	Make/Model	Description
1	Cooper Lighting solutions	3W Constant voltage LED driver



1.4.2 Modes of Operation

WaveLinX Pro R3 Sensor provides 1 mode of operation using Zigbee classifications as outlined below.

Mode of Operation	Frequency Range (MHz)	Number of Channels	Stack / Mode	Data Rates Supported	Classification
1	2405 – 2483.5	16	OQPSK	250 kbps	Zigbee

1.4.3 Monitoring of Performance

For radiated emissions, the EUT was evaluated in three orthogonal orientations. The worst-case orientation was the Z-orientation. 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: 10 dBm for 2405 MHz, 2440 MHz, and 2475 MHz
0 dBm for 2480 MHz

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	Modification Fitted By	Date Modification Fitted
0	Initial State		

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 "0", as noted in §1.6.

2.1.1 Date of Observation

4/2/2025

2.1.2 Test Method

N/A

2.1.3 Environmental Conditions

N/A

2.1.4 Test Results

The EUT utilizes a Surface-mounted antenna (SMD) with gain of 2.6 dBi for 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 "0", as noted in §1.6.

2.2.3 Date of Test

4/17/2025

2.2.4 Test Method

ANSI C63.10 section 6.2 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	21.3 °C
Relative Humidity	49 %
Atmospheric Pressure	981.1 mbar



2.2.6 Test Results

FCC Part 15.207

Conducted RF Emissions, 150 kHz to 30 MHz

Line Under Test Number 1 Results

EUT Name - 721007025 Cooper

Model Number - R3

Part Number - N/A

Serial Number - N/A

Voltage - Test

Operating Mode - Powered on, Zigbee 2405 MHz

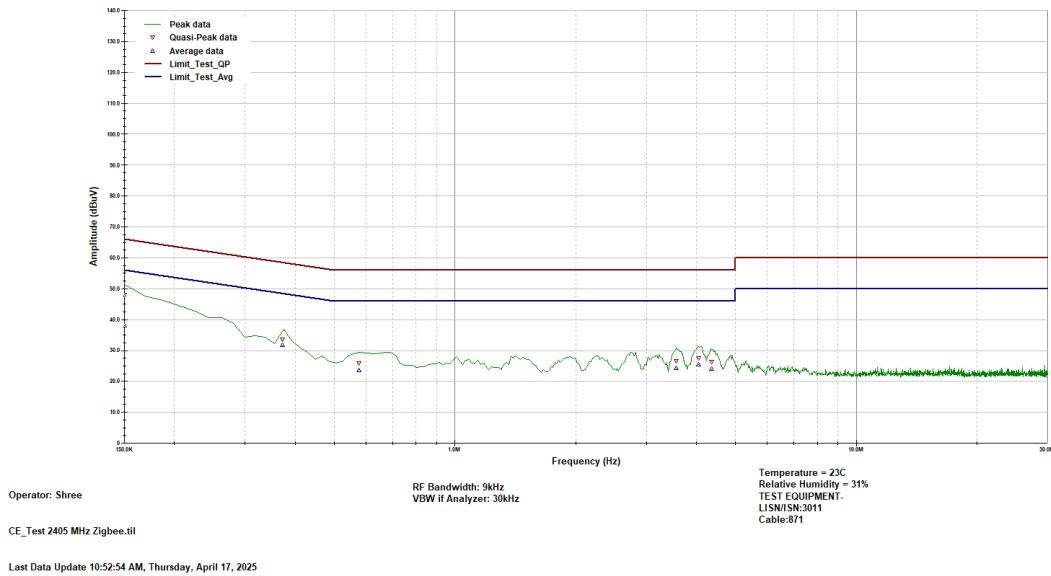


Figure 2.2.6-1: Conducted Emission Plot – Line 1

Table 2.2.6-1: Conducted EMI Results-Avg – Line 1

Frequency (MHz)	Avg Limit (dBμV)	Avg Level Corr (dBμV)	Avg Level (dBμV)	Corr Fact. (dB)	Avg Margin (dB)	Result
0.15	56	38	28.4	9.624	-18	PASS
0.37	49.7	31.6	22	9.633	-18	PASS
0.58	46	23.5	13.9	9.646	-22.5	PASS
3.56	46	24.4	14.6	9.73	-21.6	PASS
4.04	46	25.3	15.6	9.743	-20.7	PASS
4.35	46	23.9	14.2	9.746	-22.1	PASS

Table 2.2.6-2: Conducted EMI Results-QP – Line 1

Frequency (MHz)	Avg Limit (dBμV)	Avg Level Corr (dBμV)	Avg Level (dBμV)	Corr Fact. (dB)	Avg Margin (dB)	Result
0.15	66	47.9	38.3	9.624	-18.1	PASS
0.37	59.7	33.5	23.8	9.633	-26.2	PASS
0.58	56	26	16.3	9.646	-30	PASS
3.56	56	26.6	16.9	9.73	-29.4	PASS
4.04	56	27.5	17.8	9.743	-28.5	PASS
4.35	56	26.3	16.5	9.746	-29.7	PASS



FCC Part 15.207

Conducted RF Emissions, 150 kHz to 30 MHz

Line Under Test Number 2 Results

EUT Name - 721007025 Cooper

Model Number - R3

Part Number - N/A

Serial Number - N/A

Voltage - Test

Operating Mode - Powered on, Zigbee 2405 MHz

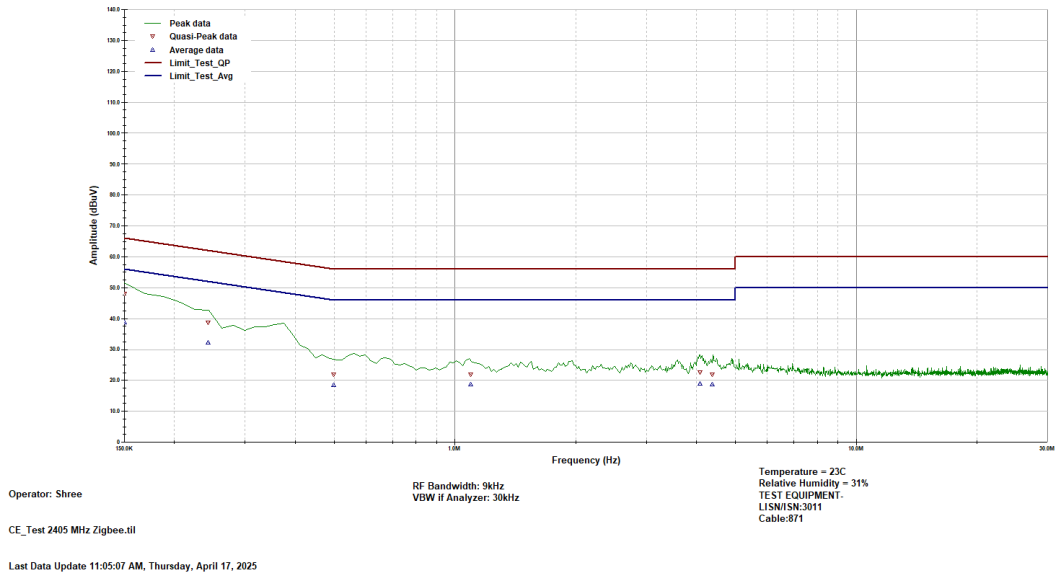


Figure 2.2.6-2: Conducted Emission Plot – Nuetral

Table 2.2.6-3: Conducted EMI Results-Avg – Line 2

Frequency (MHz)	Avg Limit (dBμV)	Avg Level Corr (dBμV)	Avg Level (dBμV)	Corr Fact. (dB)	Avg Margin (dB)	Result
0.15	56	38.7	29	9.622	-17.3	PASS
0.24	53.4	32.2	22.6	9.62	-21.1	PASS
0.5	46.1	18.4	8.7	9.623	-27.7	PASS
1.09	46	18.7	9	9.648	-27.3	PASS
4.09	46	18.9	9.2	9.725	-27.1	PASS
4.38	46	18.7	9	9.734	-27.3	PASS

Table 2.2.6-4: Conducted EMI Results-QP – Line 2

Frequency (MHz)	Avg Limit (dBμV)	Avg Level Corr (dBμV)	Avg Level (dBμV)	Corr Fact. (dB)	Avg Margin (dB)	Result
0.15	66	47.9	38.3	9.622	-18.1	PASS
0.24	63.4	38.7	29	9.62	-24.7	PASS
0.5	56.1	22	12.4	9.623	-34.1	PASS
1.09	56	22	12.3	9.648	-34	PASS
4.09	56	22.5	12.8	9.725	-33.5	PASS
4.38	56	21.9	12.2	9.734	-34.1	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

5/21/2025

2.3.4 Test Method

The maximum peak conducted output power was measured in accordance with ANSI C63.10 Subclause 11.9.1.1 utilizing the RBW $\geq$ DTS Bandwidth method. The RF output of the equipment under test was directly connected to the input of the analyzer applying suitable attenuation.

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	22.1 °C
Relative Humidity	48.7 %
Atmospheric Pressure	981.1 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

Frequency [MHz]	Peak Output Power (dBm)	Data Rate
2405	10.9	250 kbps
2440	10.8	250 kbps
2475	11.1	250 kbps
2480	0.8	250 kbps

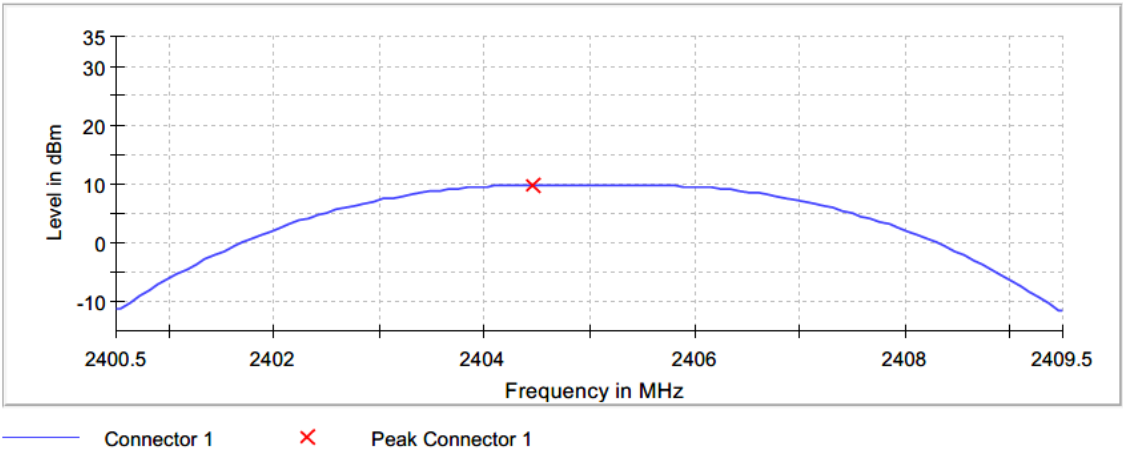


Figure 2.3.6-1: Output Power - LCH – 2405 MHz

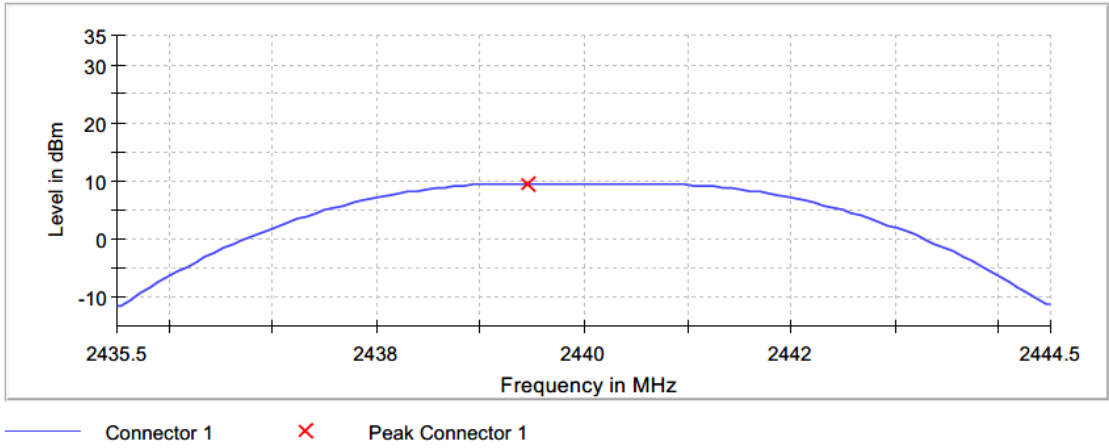


Figure 2.3.6-2: Output Power - MCH – 2440 MHz

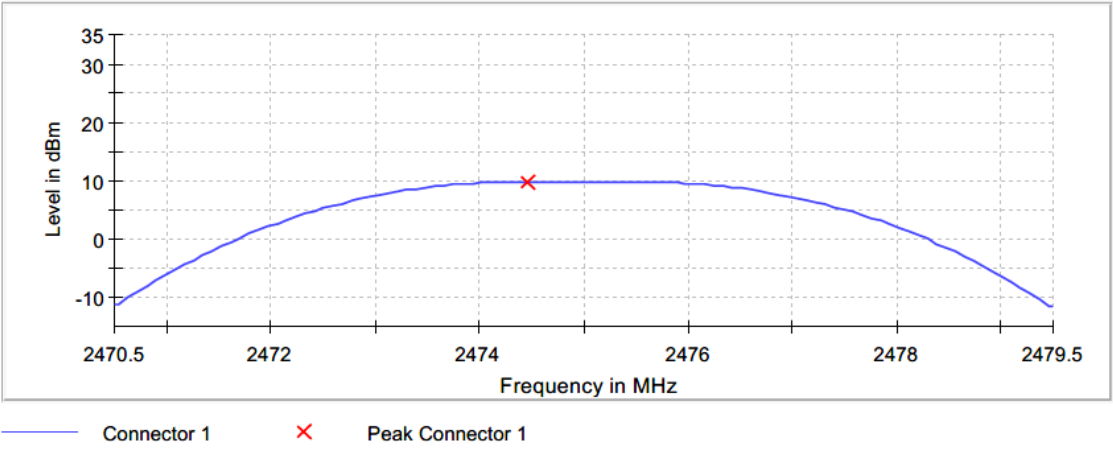


Figure 2.3.6-3: Output Power - HCH – 2475 MHz

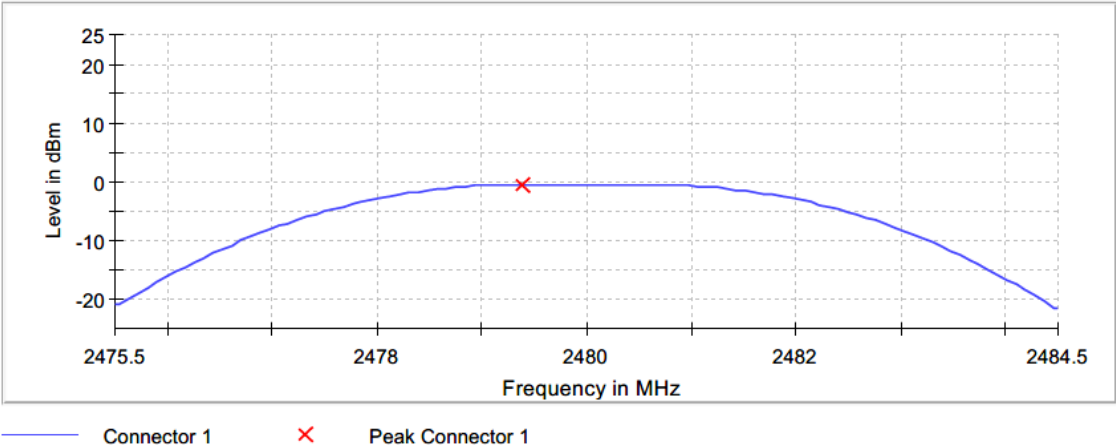


Figure 2.3.6-4: Output Power - HCH – 2480 MHz

**Table 2.3.6-2: Sample Measurement Settings**

Setting	Instrument Value	Target Value
Start Frequency	2.40200 GHz	2.40200 GHz
Stop Frequency	2.40800 GHz	2.40800 GHz
Span	6.000 MHz	6.000 MHz
RBW	2.000 MHz	≥ 1.743 MHz
VBW	10.000 MHz	≥ 6.000 MHz
Sweep Points	101	~ 101
Sweep time	1.000 ms	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
Sweep Count	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweep type	FFT	AUTO
Preamplifier	off	off
Stable mode	Trace	Trace
Stable value	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.09 dB	0.50 dB



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

4/2/2025

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	22.1 °C
Relative Humidity	48.7 %
Atmospheric Pressure	981.1 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

Frequency [MHz]	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Data Rate
2405	1.743	2.220	250 kbps
2440	1.743	2.230	250 kbps
2475	1.743	2.230	250 kbps
2480	1.743	2.230	250 kbps

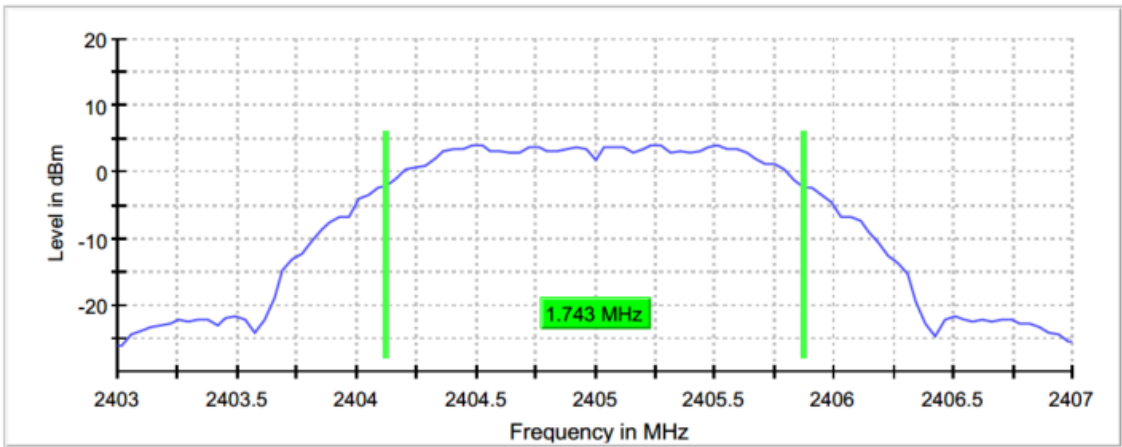


Figure 2.4.6-1: 6 dB BW - LCH – 2405 MHz

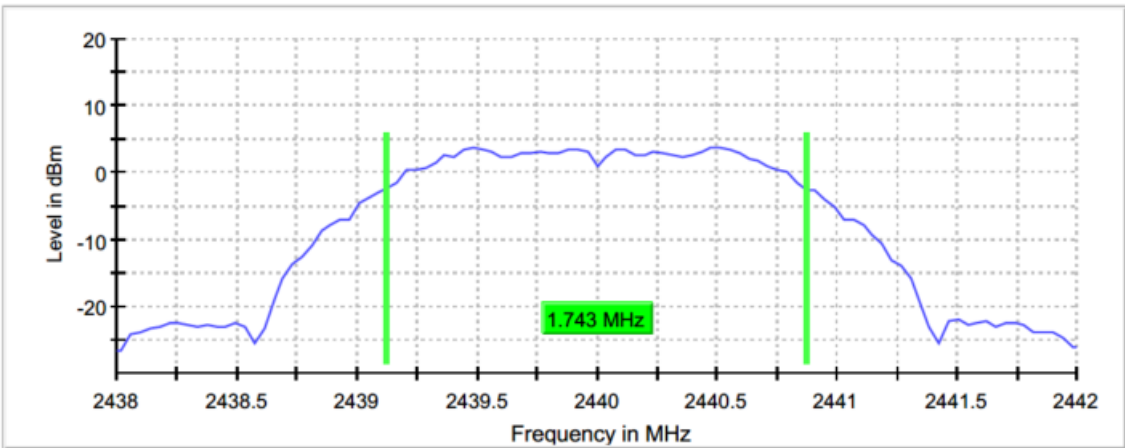


Figure 2.4.6-2: 6 dB BW - MCH – 2440 MHz

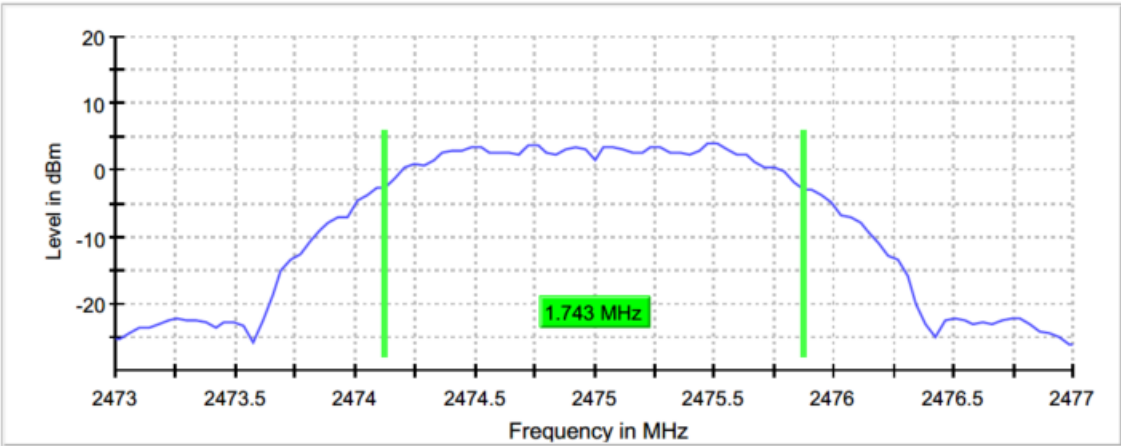


Figure 2.4.6-3: 6 dB BW - HCH – 2475 MHz

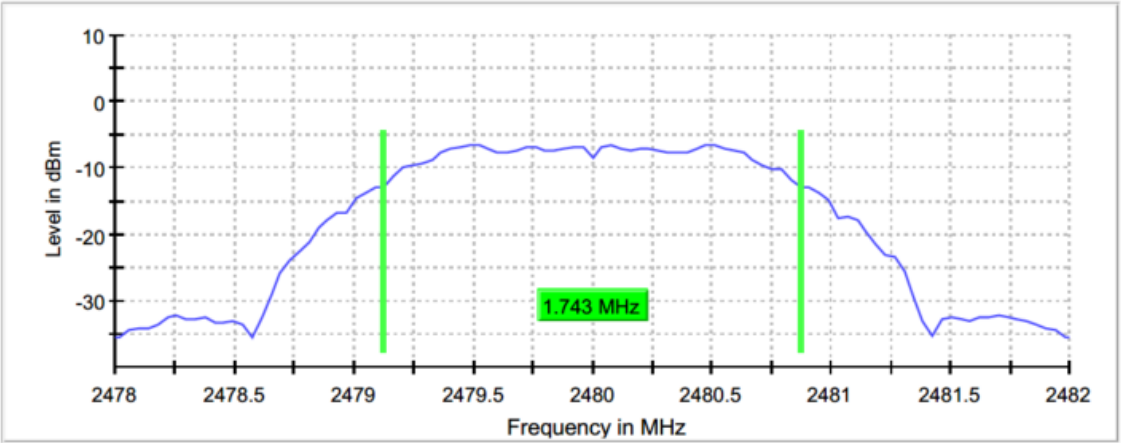


Figure 2.4.6-4: 6 dB BW - HCH – 2480 MHz

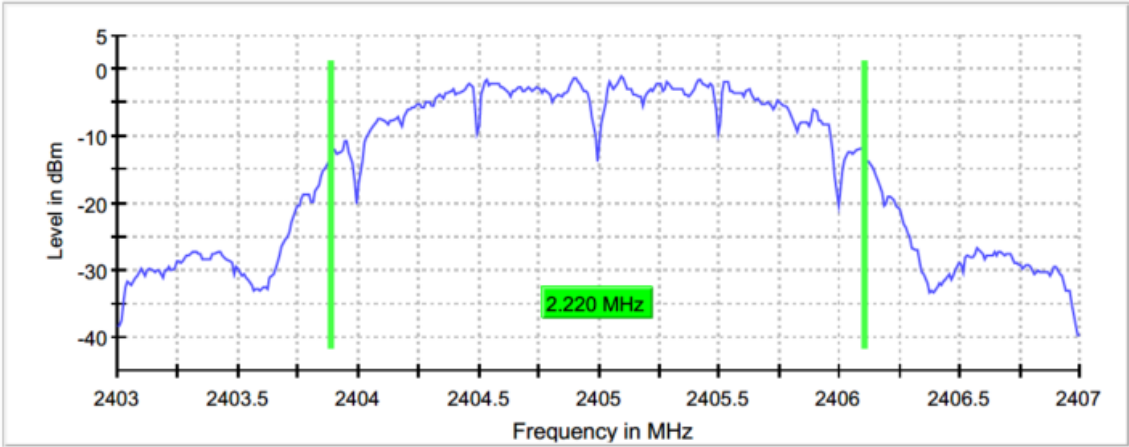


Figure 2.4.6-5: 99% BW - LCH – 2405 MHz

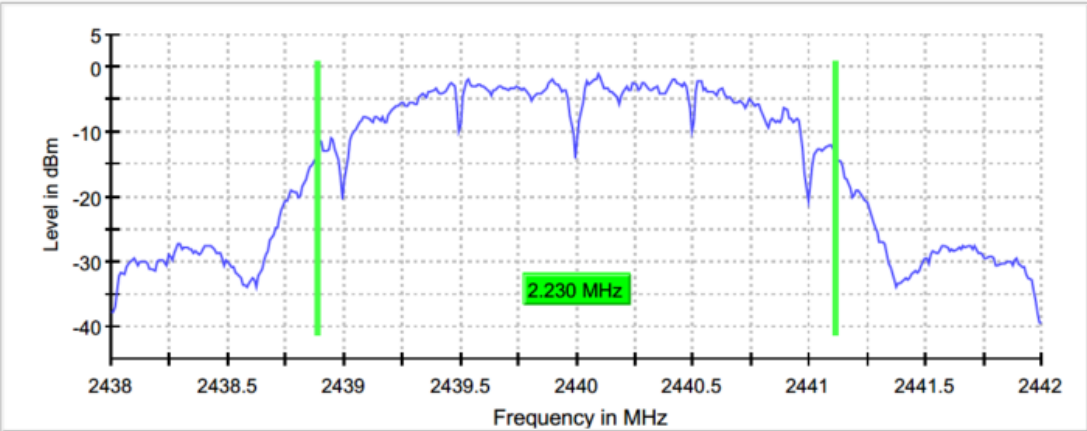


Figure 2.4.6-6: 99% BW - MCH – 2440 MHz

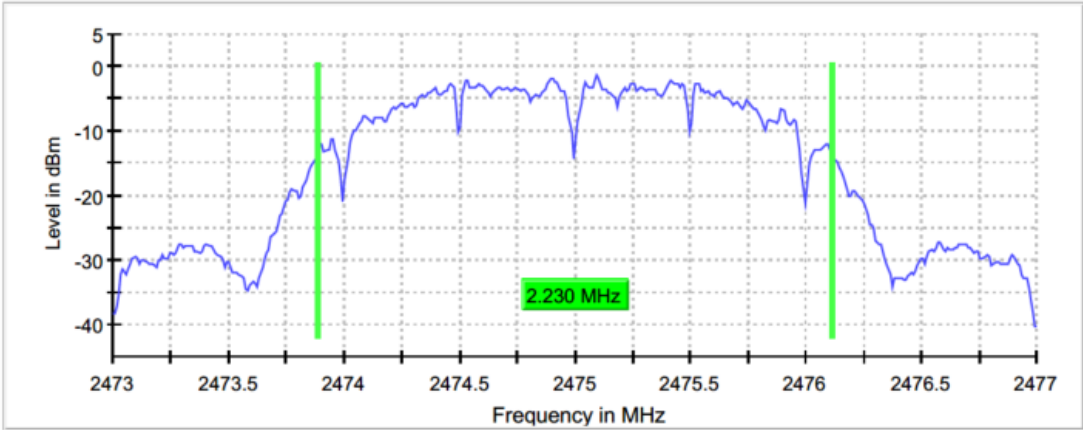


Figure 2.4.6-7: 99% BW - HCH - 2475 MHz

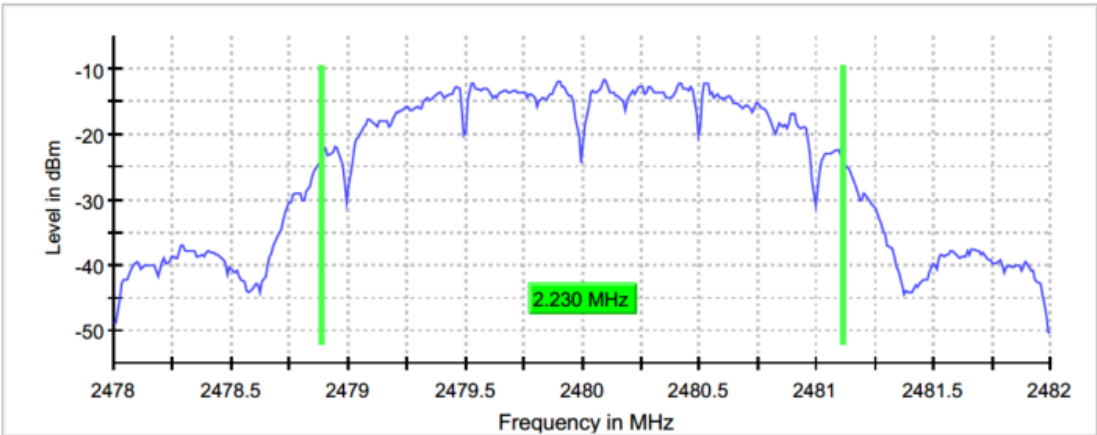


Figure 2.4.6-8: 99% BW - HCH – 2480 MHz

**Table 2.4.6-2: Sample Measurement Setting (6dB BW)**

Setting	Instrument Value	Target Value
Start Frequency	2.40300 GHz	2.40300 GHz
Stop Frequency	2.40700 GHz	2.40700 GHz
Span	4.000 MHz	4.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
Sweep Points	101	~ 80
Sweep time	41.830 μ s	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
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	19 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.06 dB	0.50 dB

Table 2.4.6-3: Sample Measurement Setting (99% BW)

Setting	Instrument Value	Target Value
Start Frequency	2.40300 GHz	2.40300 GHz
Stop Frequency	2.40700 GHz	2.40700 GHz
Span	4.000 MHz	4.000 MHz
RBW	20.000 kHz	>= 20.000 kHz
VBW	100.000 kHz	>= 60.000 kHz
Sweep Points	400	~ 400
Sweep time	210 μ s	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
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	20 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.03 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

4/2/2025

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 10 kHz. The Video Bandwidth (VBW) was set to 30 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	22.1 °C
Relative Humidity	48.7 %
Atmospheric Pressure	981.1 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

Frequency [MHz]	PSD (dBm)	Data Rate
2405	-2.483	250 kbps
2440	-2.816	250 kbps
2475	-3.339	250 kbps
2480	-13.146	250 kbps

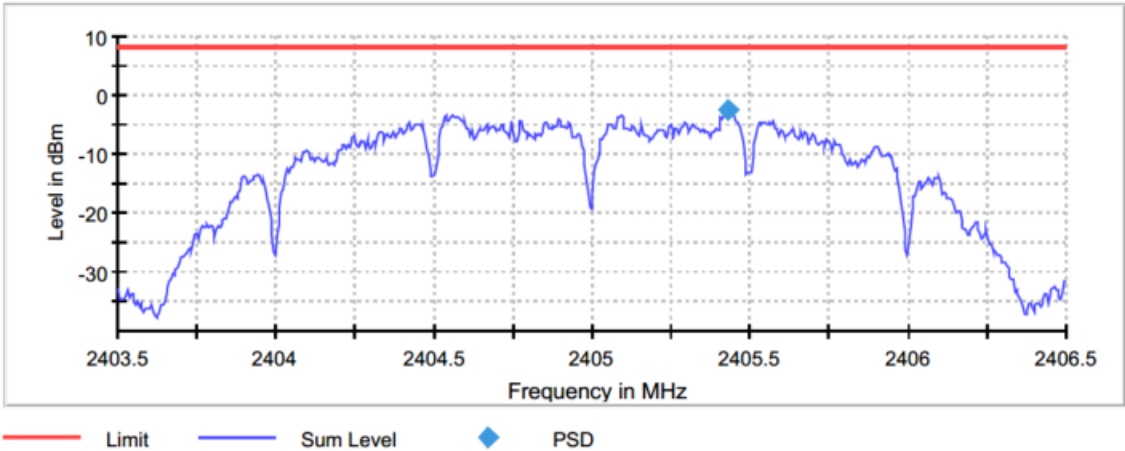


Figure 2.5.6-1: PSD – LCH – 2405 MHz

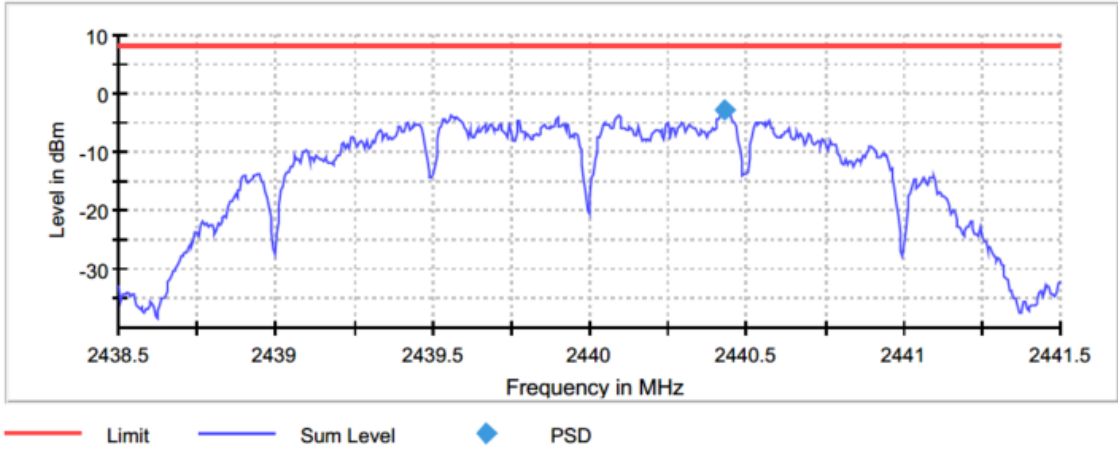


Figure 2.5.6-2: PSD – MCH – 2440 MHz

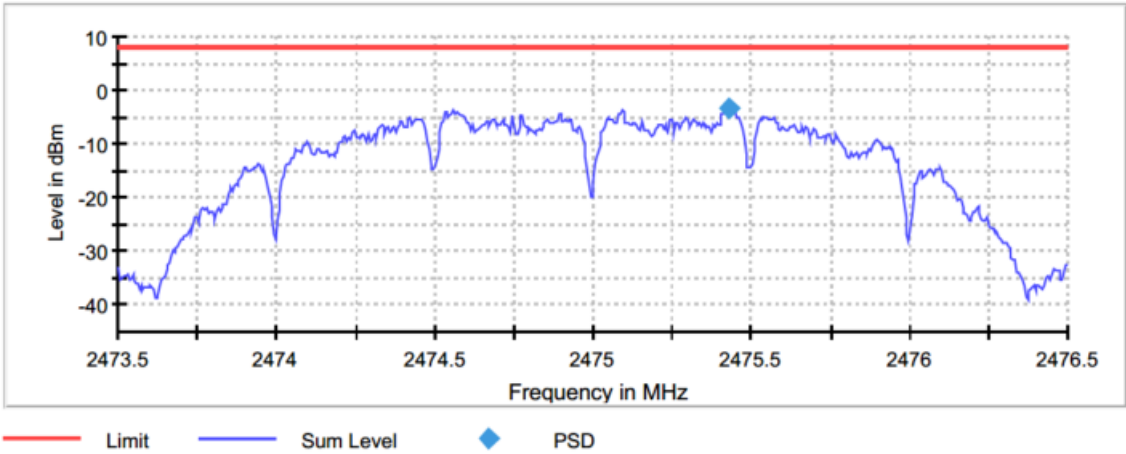


Figure 2.5.6-3: PSD – HCH – 2475 MHz

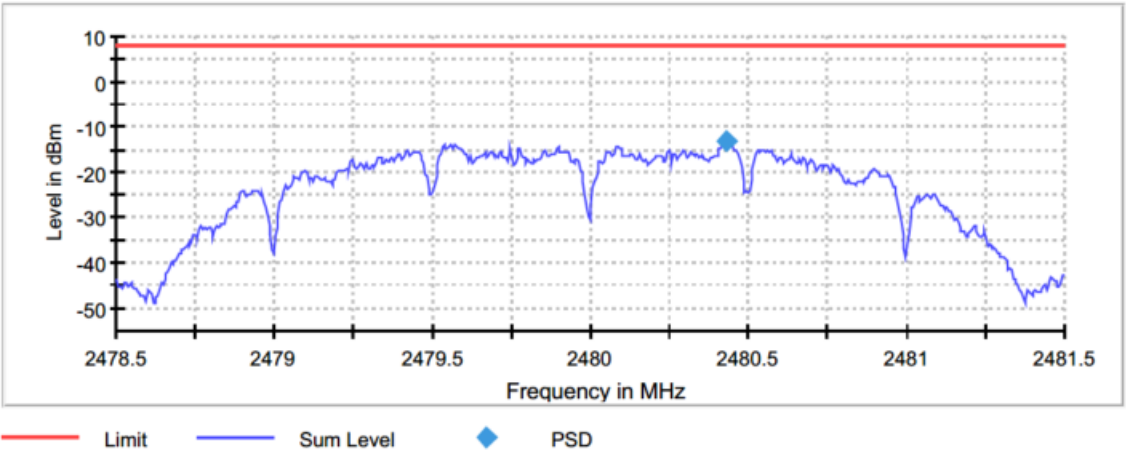


Figure 2.5.6-4: PSD – HCH – 2480 MHz

**Table 2.5.6-2: Sample Measurement Settings (PSD)**

Setting	Instrument Value	Target Value
Start Frequency	2.40350 GHz	2.40350 GHz
Stop Frequency	2.40650 GHz	2.40650 GHz
Span	3.000 MHz	3.000 MHz
RBW	10.000 kHz	<= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
Sweep Points	600	~ 600
Sweep time	3.000 ms	AUTO
Reference Level	0.000 dBm	10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
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	13 / max. 150	max. 150
Stable	2 / 2	2
Max Stable Difference	0.47 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

4/2/2025

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	22.1 °C
Relative Humidity	48.7 %
Atmospheric Pressure	981.1 mbar

2.6.6 Test Results

Test Summary: EUT was set to transmit mode.

Test Results: Pass

See data below for detailed results.

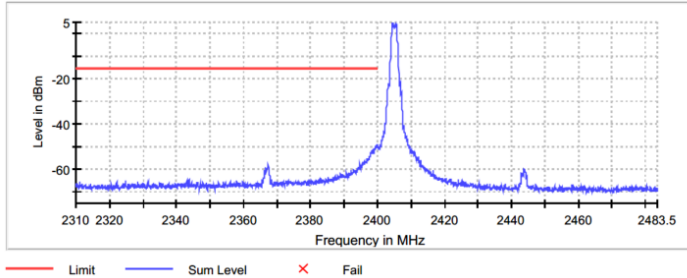


Figure 2.6.6-1: Lower Band-edge – 2405 MHz

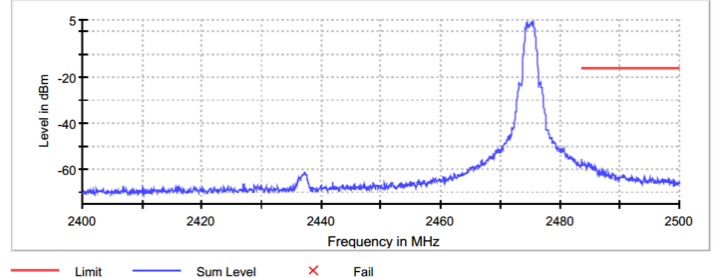


Figure 2.6.6-2: Upper Band-edge – 2475 MHz

Table 2.6.6-1: Lower Band-edge- Low Channel – 2405 MHz

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-49.0	33.5	-15.5	PASS
2399.575000	-49.3	33.8	-15.5	PASS
2399.875000	-49.4	33.9	-15.5	PASS
2399.625000	-49.5	34.0	-15.5	PASS
2399.475000	-49.6	34.1	-15.5	PASS
2399.925000	-49.6	34.1	-15.5	PASS
2399.525000	-49.7	34.2	-15.5	PASS
2399.825000	-49.9	34.4	-15.5	PASS
2399.375000	-50.1	34.7	-15.5	PASS
2399.425000	-50.2	34.7	-15.5	PASS
2399.675000	-50.3	34.8	-15.5	PASS
2399.775000	-50.3	34.8	-15.5	PASS
2399.725000	-50.4	34.9	-15.5	PASS
2399.175000	-50.6	35.1	-15.5	PASS
2399.125000	-50.8	35.3	-15.5	PASS

Table 2.6.6-2: Upper Band-edge – High Channel – 2475 MHz

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.625000	-55.4	39.5	-15.8	PASS
2483.575000	-55.6	39.8	-15.8	PASS
2483.725000	-56.8	41.0	-15.8	PASS
2483.675000	-57.0	41.1	-15.8	PASS
2484.825000	-57.1	41.2	-15.8	PASS
2483.525000	-57.1	41.2	-15.8	PASS
2484.875000	-57.3	41.5	-15.8	PASS
2483.825000	-57.4	41.6	-15.8	PASS
2485.225000	-57.5	41.6	-15.8	PASS
2483.875000	-57.5	41.7	-15.8	PASS
2484.225000	-57.5	41.7	-15.8	PASS
2484.025000	-57.7	41.9	-15.8	PASS
2484.275000	-57.7	41.9	-15.8	PASS
2483.925000	-57.8	41.9	-15.8	PASS
2484.575000	-57.8	41.9	-15.8	PASS

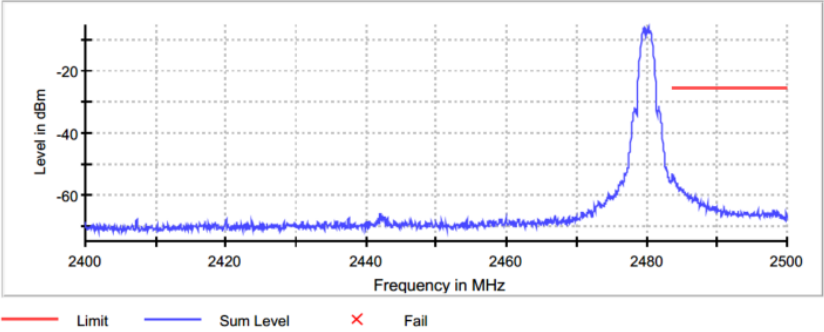


Figure 2.6.6-3: Upper Band-edge – 2480MHz

Table 2.6.6-3: Upper Band-edge- 2480 MHz

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.525000	-53.0	27.3	-25.7	PASS
2483.625000	-53.4	27.7	-25.7	PASS
2483.575000	-53.6	27.9	-25.7	PASS
2483.775000	-53.6	27.9	-25.7	PASS
2483.725000	-54.0	28.3	-25.7	PASS
2483.825000	-54.5	28.8	-25.7	PASS
2483.925000	-54.8	29.1	-25.7	PASS
2483.975000	-55.0	29.3	-25.7	PASS
2483.675000	-55.0	29.3	-25.7	PASS
2483.875000	-55.4	29.7	-25.7	PASS
2484.075000	-55.5	29.8	-25.7	PASS
2484.025000	-56.0	30.3	-25.7	PASS
2484.425000	-56.1	30.5	-25.7	PASS
2484.125000	-56.5	30.8	-25.7	PASS
2484.175000	-56.7	31.0	-25.7	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

4/2/2025

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	22.1 °C
Relative Humidity	48.7 %
Atmospheric Pressure	981.1 mbar

2.7.6 Test Results

Test Summary: EUT was set to transmit mode.

Test Results: Pass

See data below for detailed results.

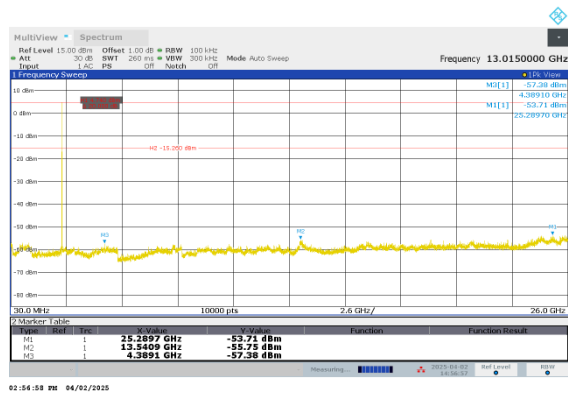


Figure 2.7.6-1: 30MHz – 26GHz – LCH – 2405 MHz

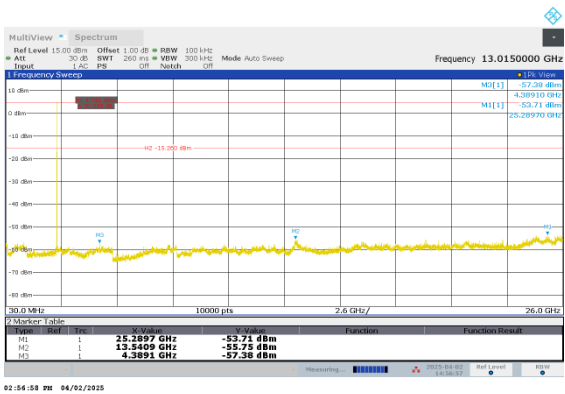


Figure 2.7.6-2: 30MHz – 26GHz – MCH – 2440 MHz

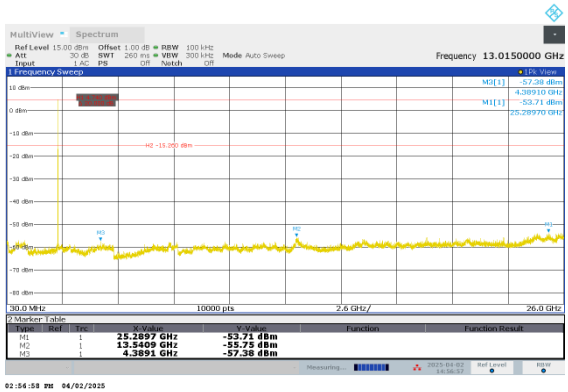


Figure 2.7.6-3: 30MHz – 26GHz – HCH – 2475 MHz

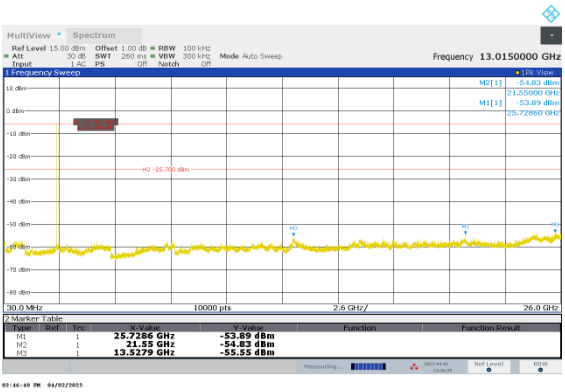


Figure 2.7.6-4: 30MHz – 26GHz – HCH – 2480 MHz



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 “0”, as noted in §1.6.

2.8.3 Date of Test

04/15/2025 to 04/18/2025

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 200 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 9 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 120 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	21.2 °C
Relative Humidity	49 %
Atmospheric Pressure	981 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

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	dBμV/m	dB	dB	H/V	Pass/Fail	Pass/Fail
LCH - 2405 MHz									
130.883	-----	16.607	-----	43.5	-----	26.89	H	-----	PASS
7216.65	54.983	41.893	74	54	19.02	12.107	H	PASS	PASS
4811	52.212	40.152	74	54	21.79	13.848	V	PASS	PASS
7213.45	56.129	44.716	74	54	17.87	9.284	V	PASS	PASS
MCH - 2440 MHz									
131.197	-----	16.115	-----	43.5	-----	27.385	H	-----	PASS
131.459	-----	15.181	-----	43.5	-----	28.319	V	-----	PASS
7321.775	53.305	39.97	74	54	20.69	14.03	H	PASS	PASS
4881	50.513	37.531	74	54	23.49	16.469	V	PASS	PASS
7318.475	55.503	43.429	74	54	18.5	10.571	V	PASS	PASS
HCH - 2475 MHz									
130.978	-----	16.596	-----	43.5	-----	26.904	H	-----	PASS
271.991	-----	21.214	-----	46	-----	24.786	V	-----	PASS
7423.35	53.713	40.376	74	54	20.29	13.624	H	PASS	PASS
7426.65	54.251	41.956	74	54	19.75	12.044	V	PASS	PASS
HCH - 2480 MHz									
130.227	-----	16.461	-----	43.5	-----	27.039	H	-----	PASS
132.046	-----	14.909	-----	43.5	-----	28.591	V	-----	PASS
271.975	-----	11.245	-----	46	-----	34.755	V	-----	PASS



Table 2.8.6-2: Radiated Band Edge Tabulated Data

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	dBμV/m	dB	dB	H/V	Pass/Fail	Pass/Fail
LCH - 2405 MHz									
2389.8	44.818	30.188	74	54	29.18	23.812	H	PASS	PASS
2389.825	44.716	29.804	74	54	29.28	24.196	V	PASS	PASS
HCH - 2475 MHz									
2483.7	50.199	34.713	74	54	23.8	19.287	H	PASS	PASS
2483.475	49.344	33.92	74	54	24.66	20.08	V	PASS	PASS
HCH - 2480 MHz									
2483.425	56.615	40.314	74	54	17.39	13.686	H	PASS	PASS
2483.25	56.293	39.88	74	54	17.71	14.12	V	PASS	PASS

Sample Calculation:

$$R_C = R_U + CF_T$$

Where:

- CF_T = Total Correction Factor (AF+CA+AG)+DC ((Duty cycle applies to 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 (LCH - Band edge)Corrected Level: $47.722 + -2.904 = 44.818\text{dB}\mu\text{V/m}$ Margin: $74\text{dB}\mu\text{V/m} - 44.818\text{dB}\mu\text{V/m} = 29.18\text{dB}$ **Example Calculation: Average**Corrected Level: $33.092 + -2.904 + 0 = 30.188\text{dB}\mu\text{V}$ Margin: $54\text{dB}\mu\text{V} - 30.188\text{dB}\mu\text{V} = 23.812\text{dB}$

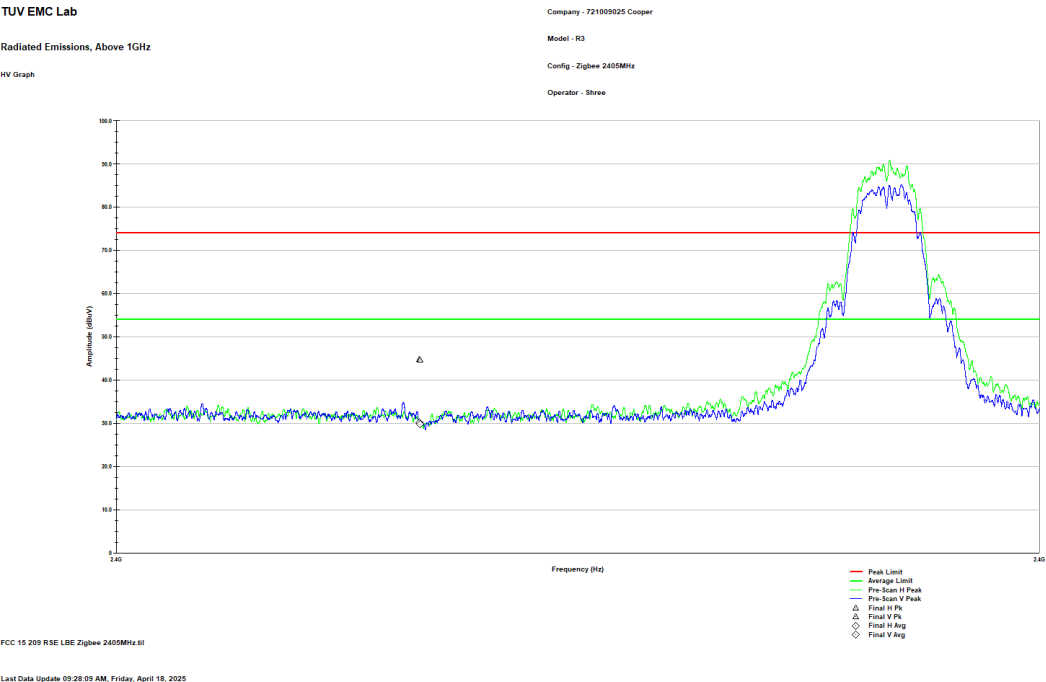


Figure 2.8.6-1: Radiated Lower Band-edge – LCH – 2405 MHz

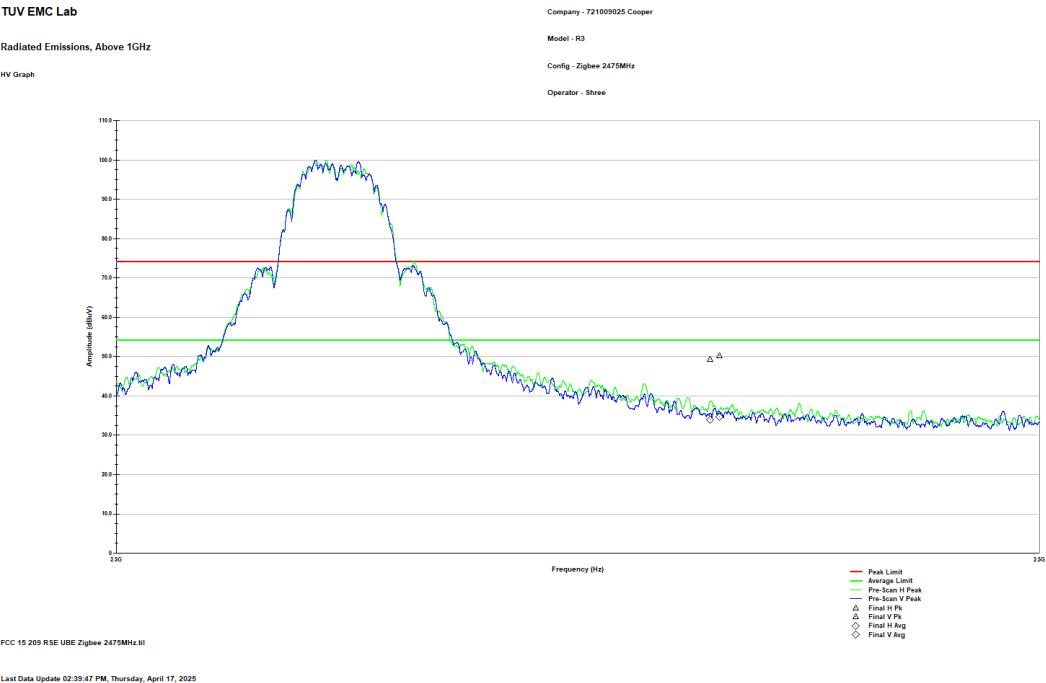


Figure 2.8.6-2: Radiated Upper Band-edge – HCH - 2475 MHz

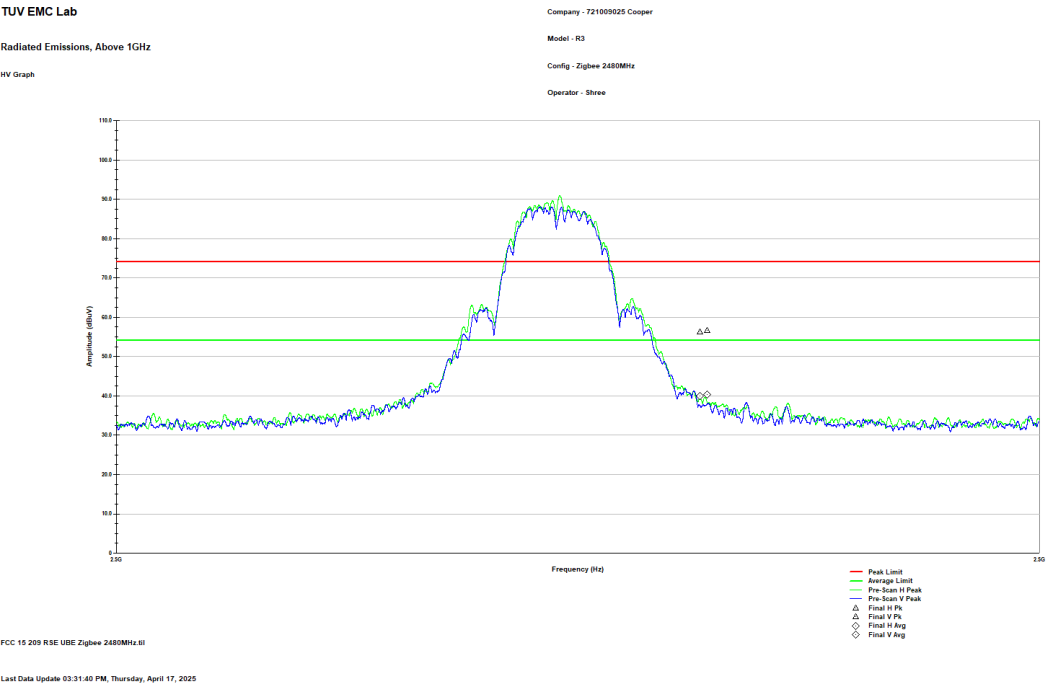


Figure 2.8.6-3: Radiated Upper Band-edge – HCH - 2480 MHz

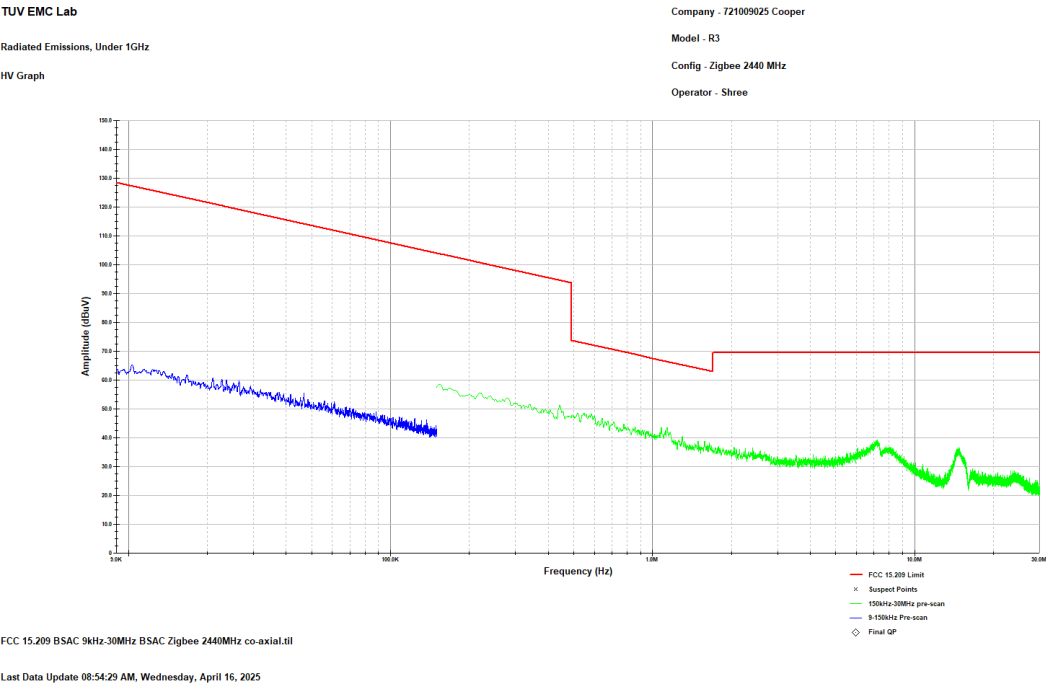


Figure 2.8.6-4: Reference plot for Radiated Spurious Emissions – 9 kHz – 30 MHz – Co-axial



TUV EMC Lab

Radiated Emissions, Under 1GHz

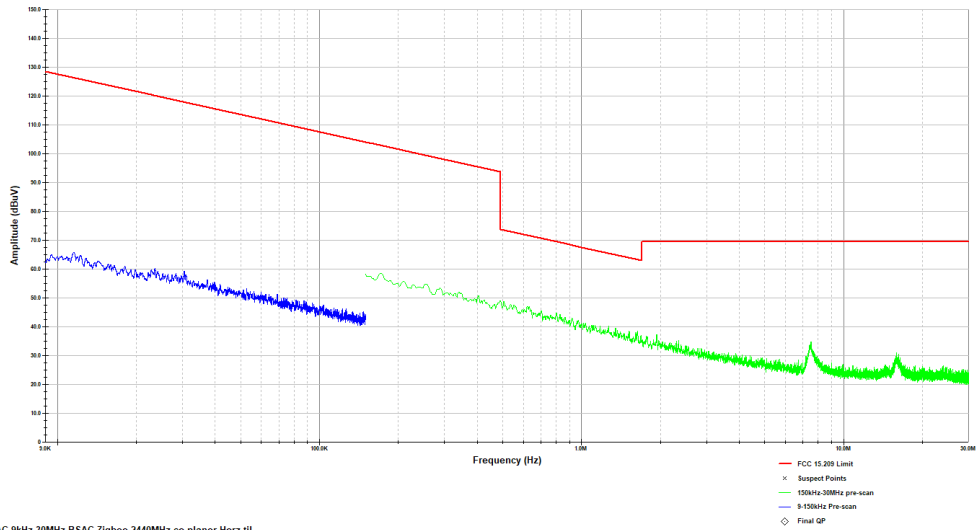
HV Graph

Company - 721009025 Cooper

Model - R3

Config - Zigbee 2440 MHz

Operator - Shree



FCC 15.209 BSAC 9kHz-30MHz BSAC Zigbee 2440MHz co-planar Horiz.tif

Last Data Update 09:01:01 AM, Wednesday, April 16, 2025

Figure 2.8.6-5: Reference plot for Radiated Spurious Emissions – 9 kHz – 30 MHz – Co-planar Horizontal

TUV EMC Lab

Radiated Emissions, Under 1GHz

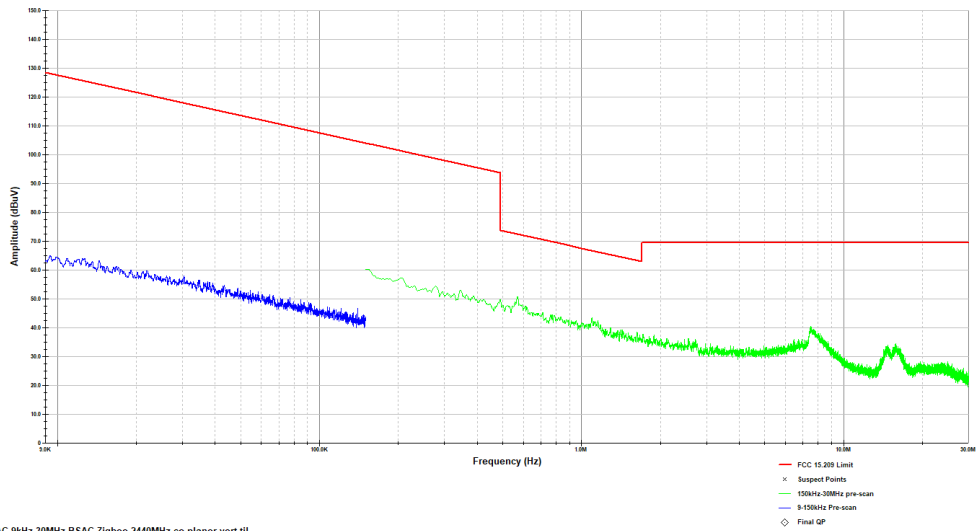
HV Graph

Company - 721009025 Cooper

Model - R3

Config - Zigbee 2440 MHz

Operator - Shree



FCC 15.209 BSAC 9kHz-30MHz BSAC Zigbee 2440MHz co-planar vert.tif

Last Data Update 08:57:44 AM, Wednesday, April 16, 2025

Figure 2.8.6-6: Reference plot for Radiated Spurious Emissions – 9 kHz – 30 MHz – Co-planar Vertical

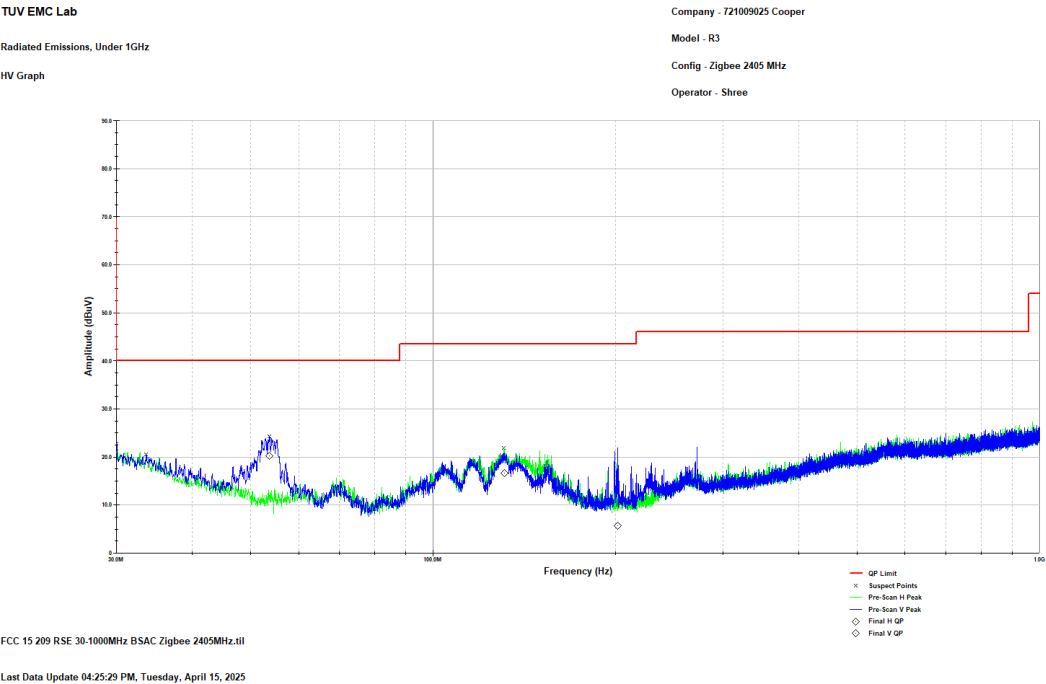


Figure 2.8.6-7: Reference plot for Radiated Spurious Emissions – 30 MHz – 1 GHz
Note: Frequencies that fall under restricted band are only evaluated and reported.

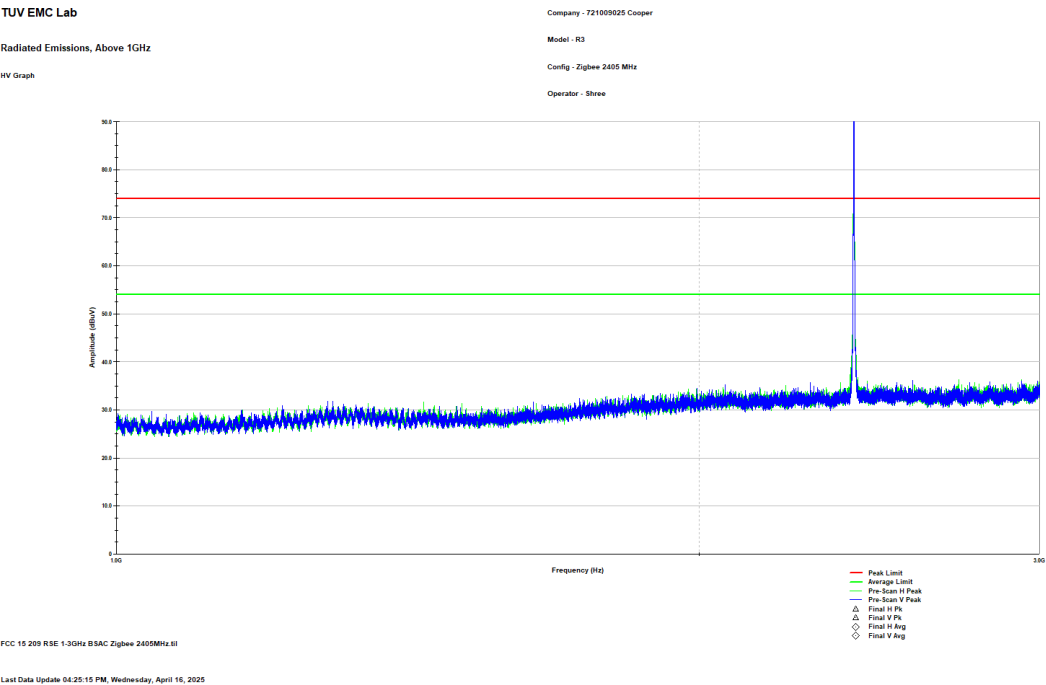


Figure 2.8.6-8: Reference plot for Radiated Spurious Emissions – 1 GHz – 3 GHz
Note: Emission above the limit line is the Fundamental Frequency.

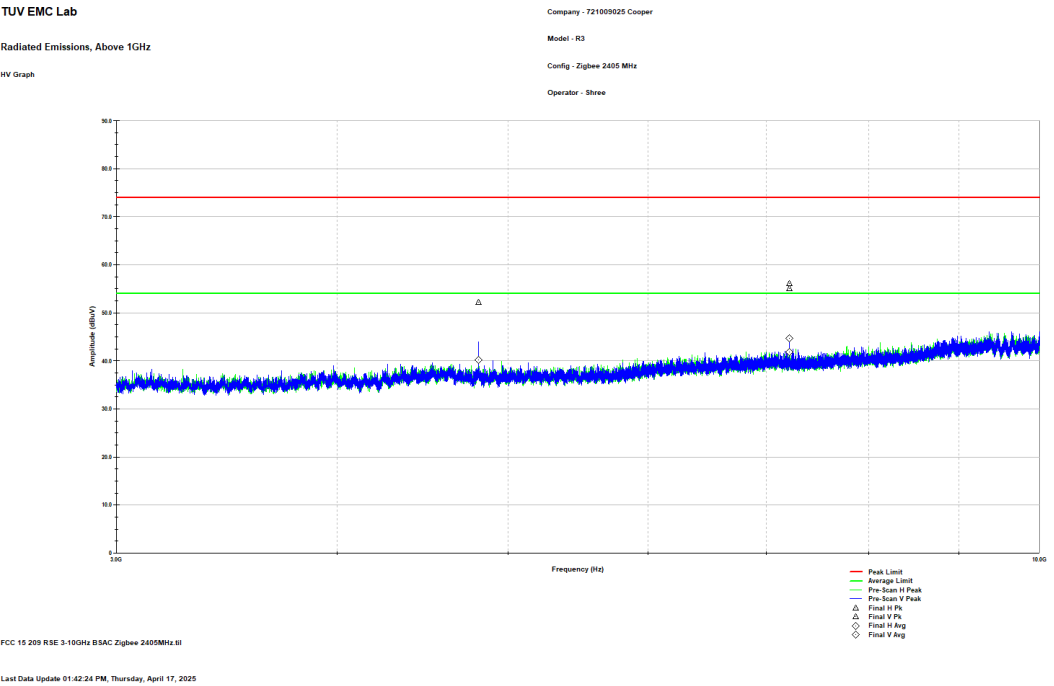


Figure 2.8.6-9: Reference plot for Radiated Spurious Emissions – 3 GHz – 10 GHz

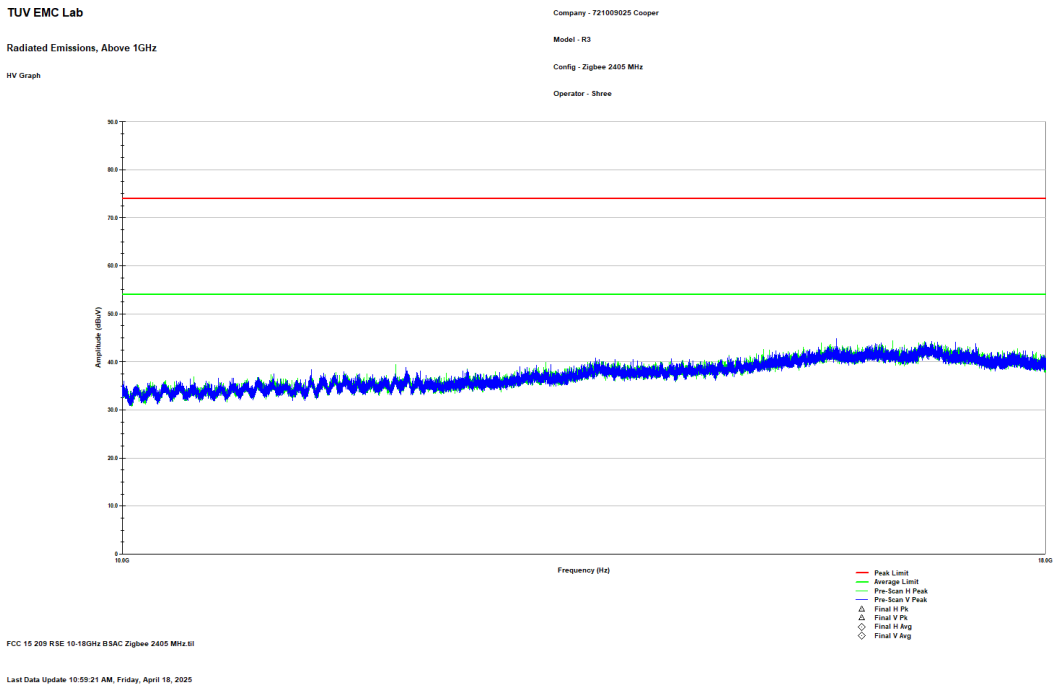


Figure 2.8.6-10: Reference plot for Radiated Spurious Emissions – 10 GHz – 18 GHz

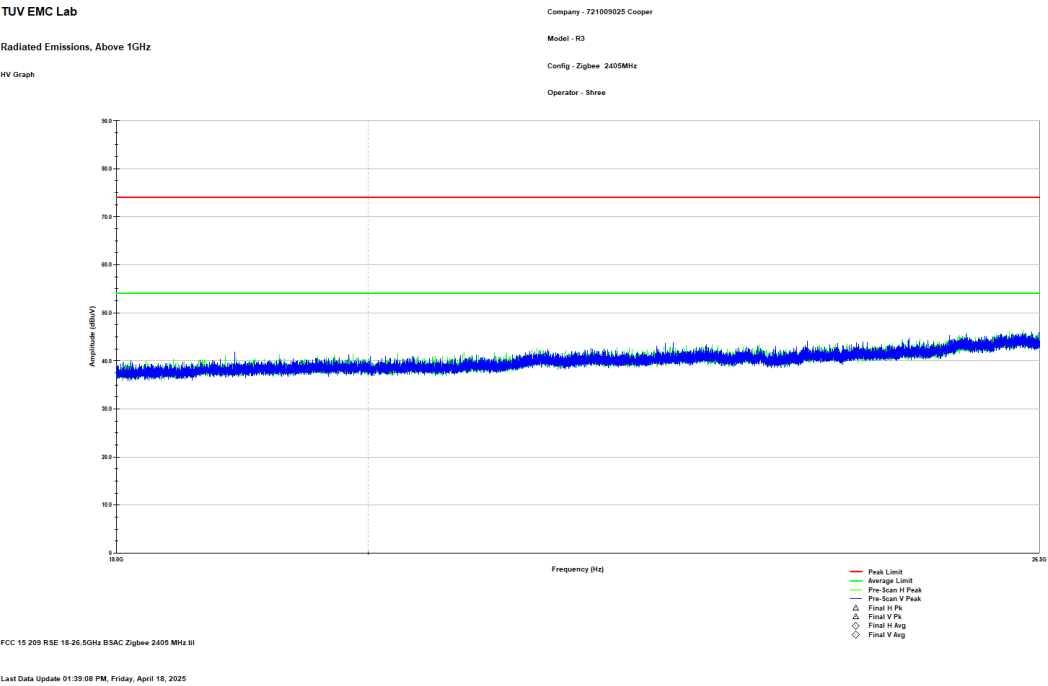


Figure 2.8.6-11: Reference plot for Radiated Spurious Emissions – 18 GHz – 26.5 GHz



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
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	06/20/2023	06/20/2025
853	Teseq	CBL6112D	BiLog Antenna	51616	7/26/2023	7/26/2025
884	ETS Lindgren (EMCO)	3117	DOUBLE-RIDGED GUIDE ANTENNA	240106	5/16/2023	5/16/2025
AEMC0889	Com Power	PAM 103	Pre-amplifier	18020215	09/30/2024	09/30/2025
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	06/18/2024	06/18/2026
882	Rohde & Schwarz	ESW44	ESW44 EMI TEST RECEIVER	101961	6/18/2024	6/18/2025
22	Teledyne Storm Microwave	90-195-456	BSAC Cable	N/A	07/15/2024	07/15/2025
20	Teledyne Storm Microwave	R-90-195-036	BSAC Cable	N/A	07/15/2024	07/15/2025
21	Teledyne Storm Microwave	R-90-195-072	BSAC Cable	N/A	07/15/2024	07/15/2025
432	Microwave Circuits	H3G020G4	High pass filter	264066	5/31/2024	5/31/2025
3010	Rohde & Schwarz	ENV216	Two-Line V-Network	3010	06/18/2024	06/18/2025
871	ACS	n/a	Conducted EMI Cable	871	3/22/2025	3/22/2026
872	HP	E7402A	EMI Receiver	US40240258	6/20/2024	6/20/2025
334	Rohde & Schwarz	3160-09	HF 18 -26.5 GHz antenna	49404	06/23/2024	06/23/2026
335	Suhner	SF-102A	Cable (40GHZ)	882/2A	06/18/2024	06/18/2025
345	Suhner Sucoflex	102A	Cable 42(GHZ)	1077/2A	06/18/2024	06/18/2025
827	Rohde & Schwarz	RF Cable set	TS8997 Rack cable set	N/A	01/13/2025	01/13/2026
622	Rohde & Schwarz	FSV40 (v3.40)	FSV Signal Analyzer 10Hz to 40GHz	101338	04/02/2025	04/02/2026
144	Omega	RH411	Temp / Humidity Meter	H0103373	02/06/2025	02/06/2027
N/A	Rohde & Schwarz	WMS32	Test Software Version 11.30.00	N/A	N/A	N/A
AEMC3144	ETS Lindgren	TILE!	Test Software Version 7.7.2.4	00232063	N/A	N/A

N/A – Not Applicable

3 Diagram of Test Set-ups

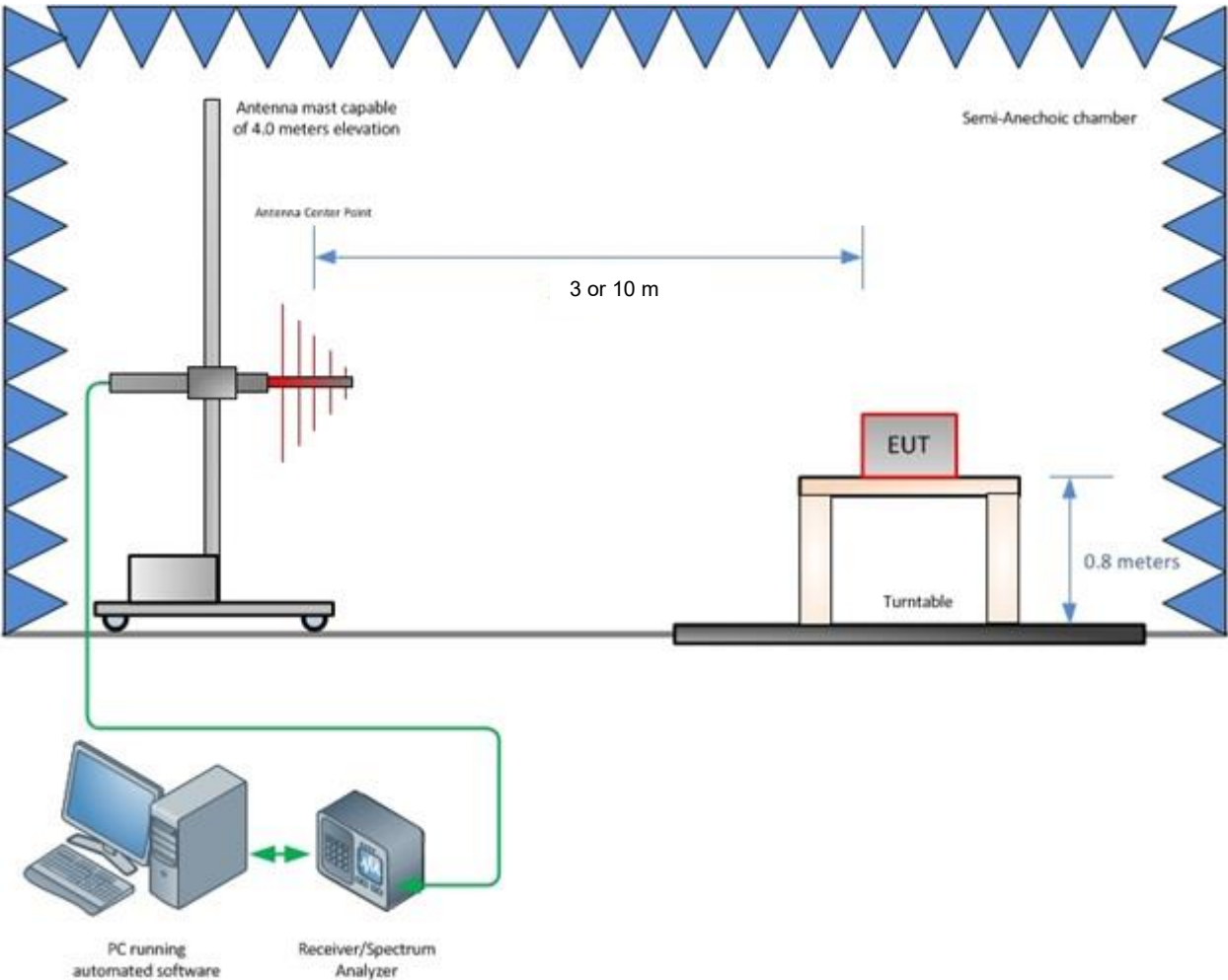


Figure 3-1 – Radiated Emissions Test Setup up to 1 GHz

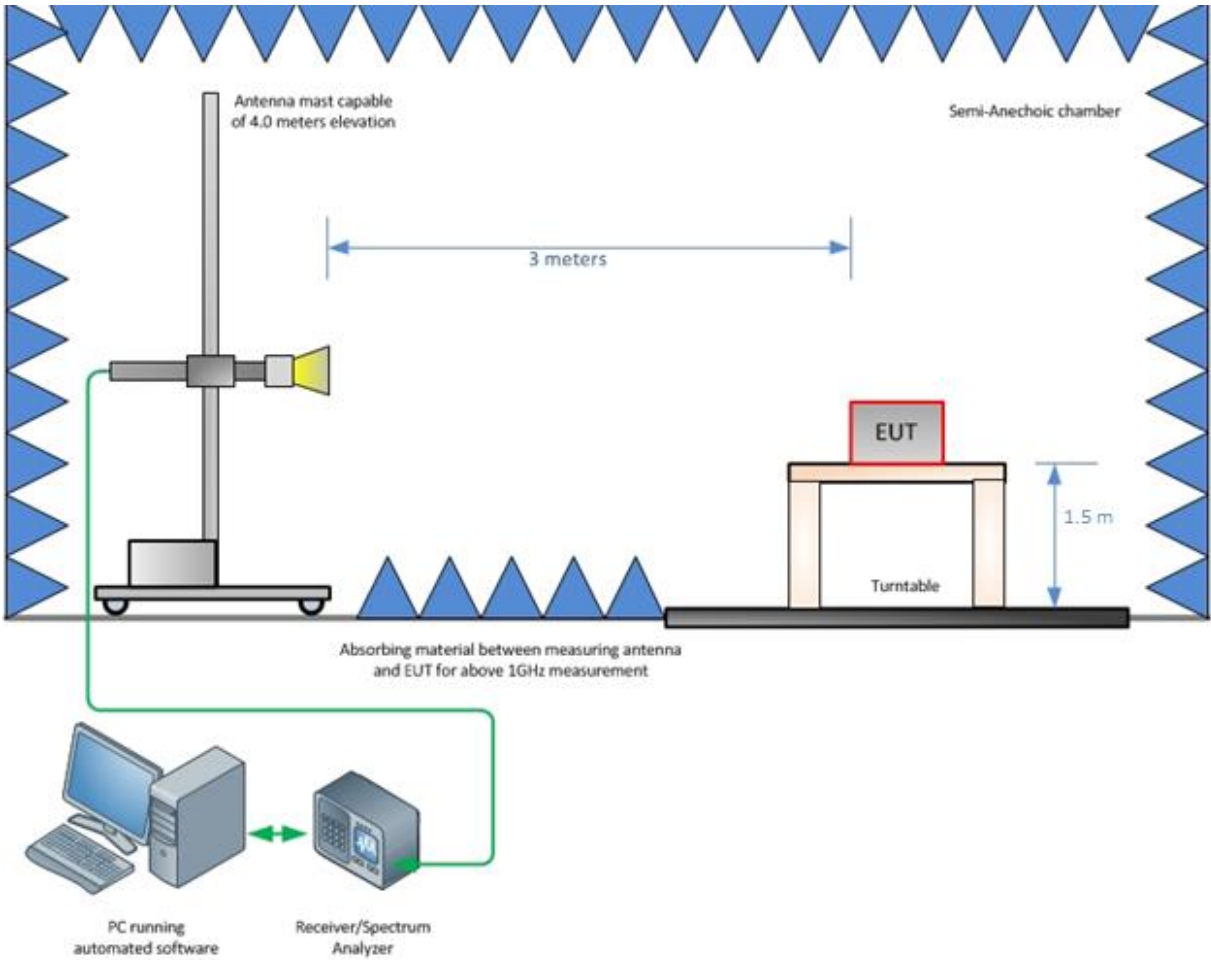


Figure 3-2 – Radiated Emissions Test Setup above 1 GHz

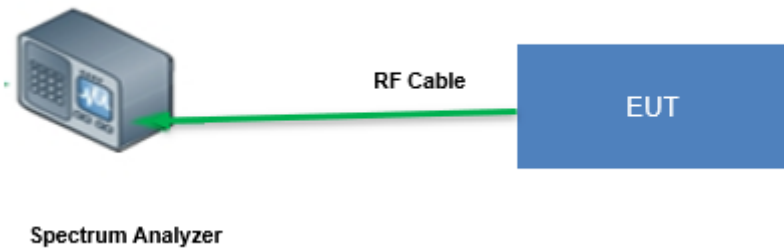


Figure 3-3 – Conducted Test Setup: Antenna Port measurement

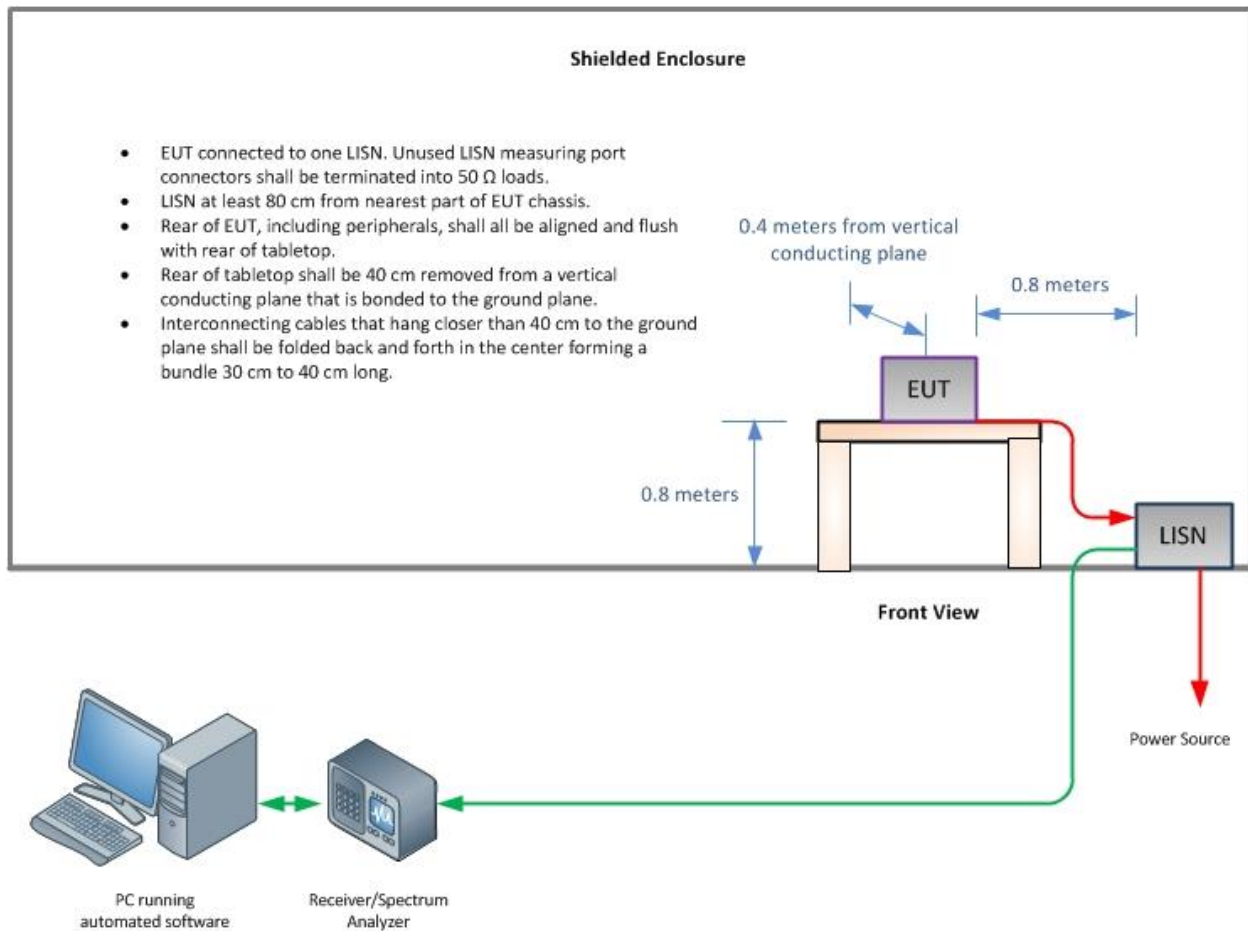


Figure 3-4 – Conducted Emissions Test Setup



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	$\pm 0.009 \%$
RF Conducted Output Power	$\pm 0.349 \text{ dB}$
Power Spectral Density	$\pm 0.372 \text{ dB}$
Antenna Port Conducted Emissions	$\pm 1.264 \text{ dB}$
Radiated Emissions $\leq 1 \text{ GHz}$	$\pm 5.99 \text{ dB}$
Radiated Emissions $> 1 \text{ GHz}$	$\pm 4.99 \text{ dB}$
Temperature	$\pm 0.860 \text{ }^{\circ}\text{C}$
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions 9 – 150 kHz	$\pm 3.69 \text{ dB}$
AC Power Line Conducted Emissions 150 kHz – 30 MHz	$\pm 3.28 \text{ dB}$



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