

# Report on the Testing of the Cooper Lighting LLC Insight's Ceiling Sensor

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

Prepared for: Cooper Lighting LLC  
NAFSC-1030, PO BOX 818044  
Cleveland, OH 44181-8044 USA



America

**Add value.  
Inspire trust.**

## COMMERCIAL-IN-CONFIDENCE

Document Number: AT72179470.2C0

### SIGNATURE

| NAME             | JOB TITLE                                        | RESPONSIBLE FOR      | ISSUE DATE |
|------------------|--------------------------------------------------|----------------------|------------|
| Divya Adusumilli | Senior Wireless Engineer<br>TUV SUD America Inc. | Authorized Signatory | 6/9/2022   |

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.



A2LA Cert. No. 2955.09

#### DISCLAIMER AND COPYRIGHT

This non-binding report has been prepared by TÜV SÜD America with all reasonable skill and care. The document is confidential to the potential Client and TÜV SÜD America. No part of this document may be reproduced without the prior written approval of TÜV SÜD America.  
© TÜV SÜD.

#### ACCREDITATION

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

TÜV SÜD America  
5945 Cabot Parkway, Suite 100  
Alpharetta, GA 3005

Phone: 678-341-5900  
[www.tuv-sud-america.com](http://www.tuv-sud-america.com)

TÜV SÜD

TÜV®



## Contents

|          |                                                                  |           |
|----------|------------------------------------------------------------------|-----------|
| <b>1</b> | <b>Report Summary .....</b>                                      | <b>3</b>  |
| 1.1      | Report Modification Record.....                                  | 3         |
| 1.2      | Introduction.....                                                | 3         |
| 1.3      | Brief Summary of Results .....                                   | 5         |
| 1.4      | Product Information .....                                        | 6         |
| 1.5      | Deviations from the Standard.....                                | 9         |
| 1.6      | EUT Modification Record .....                                    | 9         |
| 1.7      | Test Location .....                                              | 10        |
| <b>2</b> | <b>Test Details .....</b>                                        | <b>11</b> |
| 2.1      | Antenna Requirement .....                                        | 11        |
| 2.2      | Power Line Conducted Emissions .....                             | 12        |
| 2.3      | Fundamental Emission Output Power.....                           | 15        |
| 2.4      | 6dB / 99% Bandwidth .....                                        | 18        |
| 2.5      | Maximum Power Spectral Density in the Fundamental Emission ..... | 24        |
| 2.6      | Band-Edge Compliance of RF Conducted Emissions .....             | 27        |
| 2.7      | RF Conducted Spurious Emissions .....                            | 30        |
| 2.8      | Radiated Spurious Emissions into Restricted Frequency Bands..... | 32        |
| 2.9      | Test Equipment Used.....                                         | 44        |
| <b>3</b> | <b>Diagram of Test Set-ups.....</b>                              | <b>45</b> |
| <b>4</b> | <b>Accreditation, Disclaimers and Copyright.....</b>             | <b>47</b> |



# 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           | 6/9/2022      |

## 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                     | Simi Kaur                                                                                                                                                                                                                                                                                                                                            |
| Manufacturer                  | Cooper Lighting LLC                                                                                                                                                                                                                                                                                                                                  |
| Applicant's Email Address     | simi.kaur@cooperlighting.com                                                                                                                                                                                                                                                                                                                         |
| Model Name                    | Insights Ceiling Sensor                                                                                                                                                                                                                                                                                                                              |
| Model Number                  | ECS-Z-M05-LV                                                                                                                                                                                                                                                                                                                                         |
| Serial Number                 | 2214000368 0725-000026-002 (Radiated sample)<br>2215000417 0725-000026-002 (Conducted sample)                                                                                                                                                                                                                                                        |
| FCC ID                        | 2AKCY-0580000038                                                                                                                                                                                                                                                                                                                                     |
| ISED Certification Number     | 4706A-0580000038                                                                                                                                                                                                                                                                                                                                     |
| Hardware Version(s)           | 0725-000052-00 (Upper PCBA)<br>0725-000053-00 (Lower PCBA)                                                                                                                                                                                                                                                                                           |
| Software Version(s)           | 4090-000214-00                                                                                                                                                                                                                                                                                                                                       |
| Number of Samples Tested      | 2                                                                                                                                                                                                                                                                                                                                                    |
| Test Specification/Issue/Date | US Code of Federal REGulation (CFR): Title 47, Part 15,<br>Subpart C: Radio Frequency Devices, Intentional<br>Radiators, 2021<br>ISED Canada Radio Standards Specification: RSS-247 –<br>Digital Transmission Systems (DTSs), Frequency Hopping<br>Systems (FHSs) and License-Exempt Local Area Network<br>(LE-LAN) Devices, Issue 2, February 2017. |
| Order Number                  | 72179470                                                                                                                                                                                                                                                                                                                                             |
| Date of Receipt of EUT        | 4/28/2022                                                                                                                                                                                                                                                                                                                                            |
| Start of Test                 | 4/28/2022                                                                                                                                                                                                                                                                                                                                            |



Finish of Test

5/17/2022

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, 2021.

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)    | 18                  |
| 99% Bandwidth                                               | Yes                | Pass        | -----                | RSS-GEN 6.7       | 18                  |
| 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       | 27                  |
| RF Conducted Spurious Emissions                             | Yes                | Pass        | 15.247(d)            | RSS-247 5.5       | 30                  |
| Radiated Spurious Emissions into Restricted Frequency Bands | Yes                | Pass        | 15.205, 15.209       | RSS-GEN 8.9, 8.10 | 32                  |
| 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

Insights Ceiling Sensor which consists of camera, PIR, daylight, LED and IR sensor. Sensors communicate via Zigbee (U601) and has 2<sup>nd</sup> radio for BLE (U602)

**Table 1.4-1 – Wireless Technical Information**

| Detail                | Description                       |
|-----------------------|-----------------------------------|
| FCC ID                | 2AKCY-0580000038                  |
| IC ID                 | 4706A-0580000038                  |
| Transceiver Model #   | ECS-Z-M05-LV                      |
| Frequency Range (MHz) | 2405 – 2480 MHz                   |
| Modulation Format     | OQPSK                             |
| Number of Channels    | 16                                |
| Channel Spacing       | 5 MHz                             |
| Data Rates            | 250 kbps                          |
| Operating voltage     | 24 VDC                            |
| Antenna Type / Gain:  | Isolated Magnetic Dipole / 2.6dBi |

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

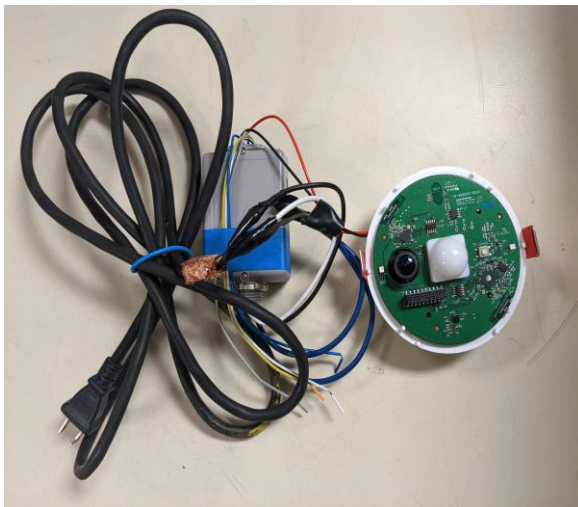


**Photo 1.4.1-1 – Front view of the conducted EUT**

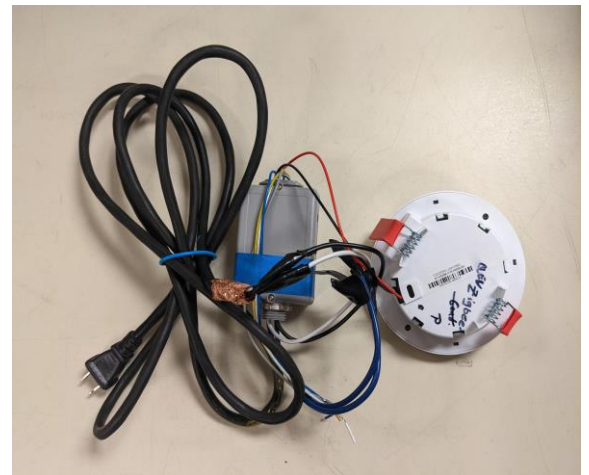


**Photo 1.4.1-2 – Back view of the conducted EUT**

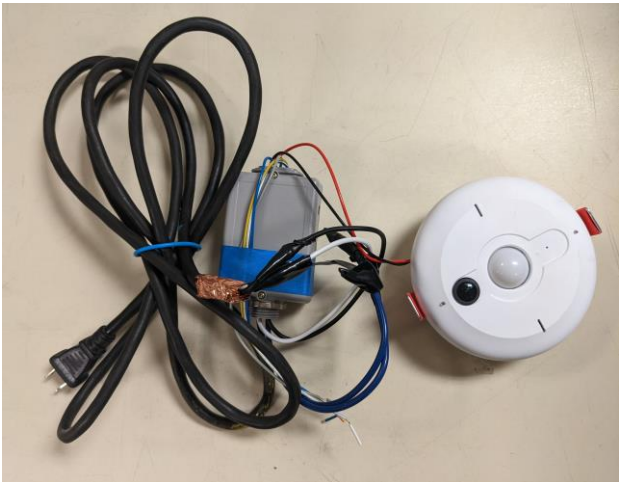


Photo 1.4.1-3 – Front view of the Radiated EUT

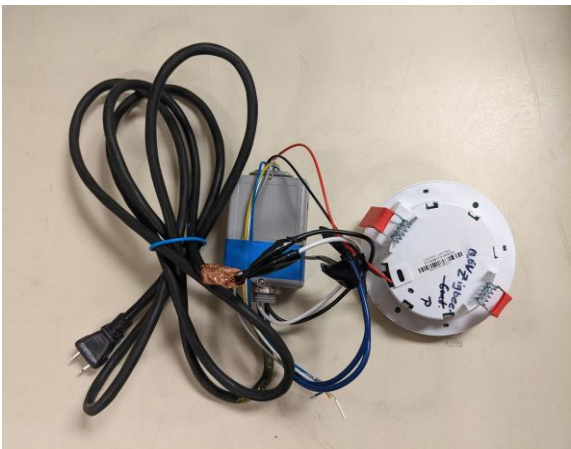


Photo 1.4.1-4 – Back view of the Radiated EUT

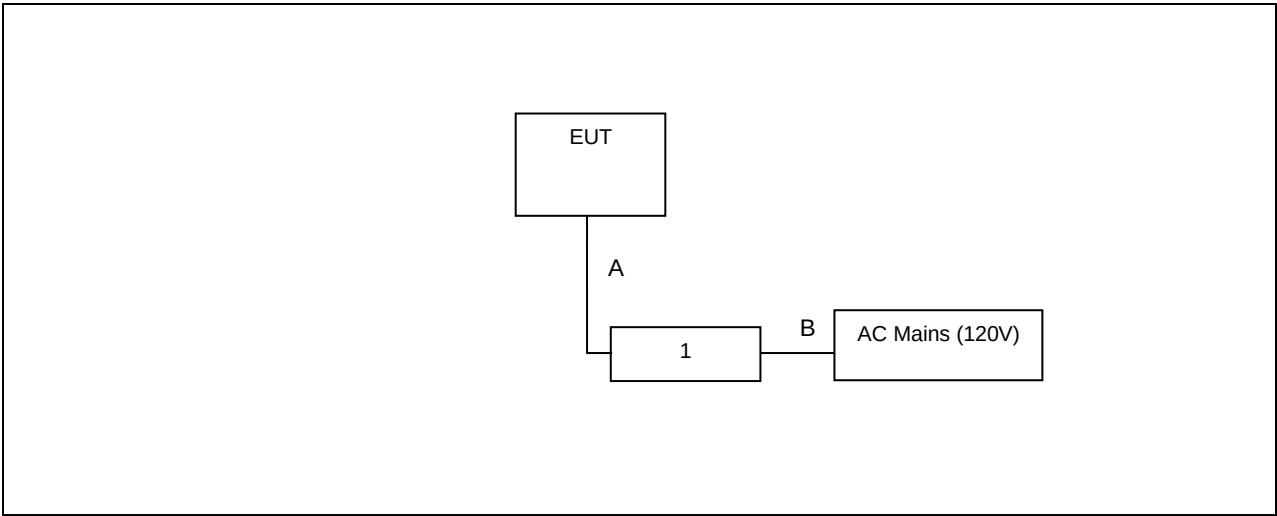


Figure 1.4.1-5: Test Setup Block Diagram

Table 1.4.1-2 – Cable Descriptions

| Item | Cable/Port     | Length | Shield |
|------|----------------|--------|--------|
| A    | DC Power cable | 20 cm  | No     |
| B    | AC Power Cord  | 100 cm | No     |



**Table 1.4.1-3 – Support Equipment Descriptions**

| Item | Make/Model                  | Description                        |
|------|-----------------------------|------------------------------------|
| 1    | EATON / SP20-RD4 SWITCHPACK | LED Electronic Driver Power Supply |



### 1.4.2 Modes of Operation

ECS-Z-M05-LV model provides 1 modes of operation using BLE classifications as outlined below.

| Mode of Operation | Frequency Range (MHz) | Number of Channels | Stack / Mode | Data Rates Supported | Classification |
|-------------------|-----------------------|--------------------|--------------|----------------------|----------------|
| 1                 | 2405 – 2480           | 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 X-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: CH 11 (2405 MHz) – CH 25 (2475 MHz) – 12.5 dBm  
CH 26 (2480MHz) – 0dBm

### 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 | Paul Villarreal     | 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.

#### 2.1.3 Date of Test

4/29/2022

#### 2.1.4 Test Method

N/A

#### 2.1.5 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  | 22.3 °C    |
| Relative Humidity    | 53.8 %     |
| Atmospheric Pressure | 972.2 mbar |

#### 2.1.6 Test Results

The EUT utilizes Isolated Magnetic Dipole antenna with gain of 2.6 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 “0”, as noted in §1.6.

### 2.2.3 Date of Test

4/29/2022

### 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    22.3 °C  
Relative Humidity        53.8 %  
Atmospheric Pressure    972.2 mbar

### 2.2.6 Test Results

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

| Frequency (MHz) | Avg Limit | Avg Level Corrected | Avg Level | Correction Fact. | Avg Margin | Result |
|-----------------|-----------|---------------------|-----------|------------------|------------|--------|
| 0.58            | 60        | 36.3                | 26.7      | 9.655            | 23.7       | PASS   |
| 0.71            | 60        | 22.3                | 12.7      | 9.663            | 37.7       | PASS   |
| 0.8             | 60        | 21.9                | 12.2      | 9.668            | 38.1       | PASS   |
| 1.77            | 60        | 23.8                | 14        | 9.742            | 36.2       | PASS   |
| 1.9             | 60        | 23.3                | 13.5      | 9.758            | 36.7       | PASS   |
| 2.23            | 60        | 19.7                | 9.9       | 9.779            | 40.3       | PASS   |

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

| Frequency (MHz) | QP Limit | QP Level Corrected | QP Level | Correction Fact. | QP Margin | Result |
|-----------------|----------|--------------------|----------|------------------|-----------|--------|
| 0.58            | 73       | 39.7               | 30.1     | 9.655            | 33.3      | PASS   |
| 0.71            | 73       | 29.9               | 20.3     | 9.663            | 43.1      | PASS   |
| 0.8             | 73       | 29.6               | 19.9     | 9.668            | 43.4      | PASS   |
| 1.77            | 73       | 29.7               | 20       | 9.742            | 43.3      | PASS   |
| 1.9             | 73       | 29.3               | 19.5     | 9.758            | 43.7      | PASS   |
| 2.23            | 73       | 27.8               | 18       | 9.779            | 45.2      | PASS   |

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

| Frequency (MHz) | Avg Limit | Avg Level Corrected | Avg Level | Correction Fact. | Avg Margin | Result |
|-----------------|-----------|---------------------|-----------|------------------|------------|--------|
| 0.5             | 60        | 27.8                | 18.2      | 9.63             | 32.2       | PASS   |
| 0.5             | 60        | 27.8                | 18.2      | 9.63             | 32.2       | PASS   |
| 0.58            | 60        | 38.6                | 28.9      | 9.635            | 21.4       | PASS   |
| 0.87            | 60        | 22.3                | 12.6      | 9.652            | 37.7       | PASS   |
| 1.08            | 60        | 25                  | 15.3      | 9.669            | 35         | PASS   |
| 1.8             | 60        | 24.8                | 15.1      | 9.744            | 35.2       | PASS   |

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

| Frequency (MHz) | QP Limit | QP Level Corrected | QP Level | Correction Fact. | QP Margin | Result |
|-----------------|----------|--------------------|----------|------------------|-----------|--------|
| 0.5             | 73       | 31.7               | 22.1     | 9.63             | 41.3      | PASS   |
| 0.5             | 73       | 31.7               | 22       | 9.63             | 41.3      | PASS   |
| 0.58            | 73       | 41.9               | 32.3     | 9.635            | 31.1      | PASS   |
| 0.87            | 73       | 26                 | 16.3     | 9.652            | 47        | PASS   |
| 1.08            | 73       | 28.1               | 18.4     | 9.669            | 44.9      | PASS   |
| 1.8             | 73       | 28                 | 18.2     | 9.744            | 45        | PASS   |

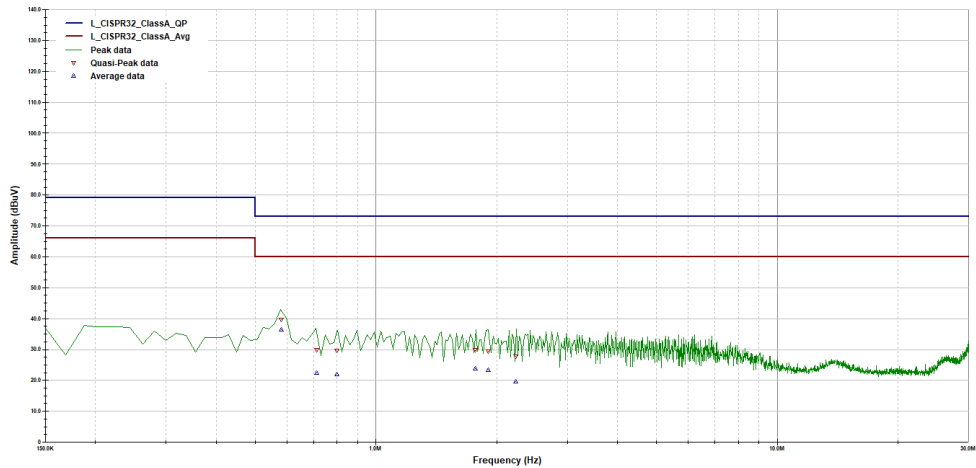


CISPR 32-2012, Class A

Conducted RF Emissions, 150 kHz to 30 MHz

Line Under Test Number 1 Results

EUT Name - 72179470 - Cooper Lighting  
Model Number - Insights Ceiling Sensor & ECS-ZM05-LV  
Part Number -  
Serial Number -  
Voltage - Class A; 120 V / 60 Hz  
Operating Mode - Powered on



Operator: Sam K

Temperature ~ 22C  
Relative Humidity ~ 43%  
RF Bandwidth: 9kHz  
VBW if Analyzer: 30kHz

AC Mains Class A.ttl

Last Data Update 02:45:10 PM, Friday, April 29, 2022

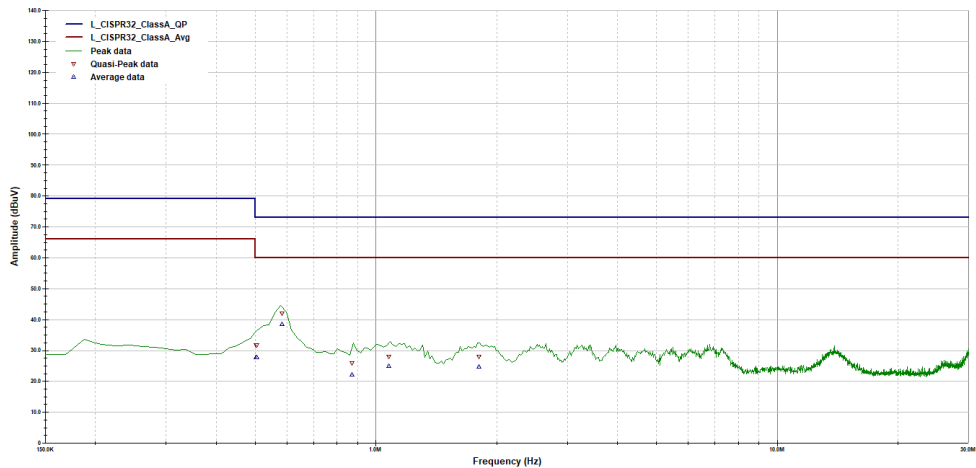
Figure 2.2.6-1: Conducted Emission Plot – Line 1

CISPR 32-2012, Class A

Conducted RF Emissions, 150 kHz to 30 MHz

Line Under Test Number 2 Results

EUT Name - 72179470 - Cooper Lighting  
Model Number - Insights Ceiling Sensor & ECS-ZM05-LV  
Part Number -  
Serial Number -  
Voltage - Class A; 120 V / 60 Hz  
Operating Mode - Powered on



Operator: Sam K

Temperature ~ 22C  
Relative Humidity ~ 43%  
RF Bandwidth: 9kHz  
VBW if Analyzer: 30kHz

AC Mains Class A.ttl

Last Data Update 02:53:52 PM, Friday, April 29, 2022

Figure 2.2.6-2: Conducted Emission Plot – Nuetral



## **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**

4/28/2022

### **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  | 22.3 °C    |
| Relative Humidity    | 53.8 %     |
| Atmospheric Pressure | 972.2 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            | 12.3                    | 250 kbps  |
| 2440            | 11.8                    | 250 kbps  |
| 2475            | 11.4                    | 250 kbps  |
| 2480            | -0.8                    | 250 kbps  |

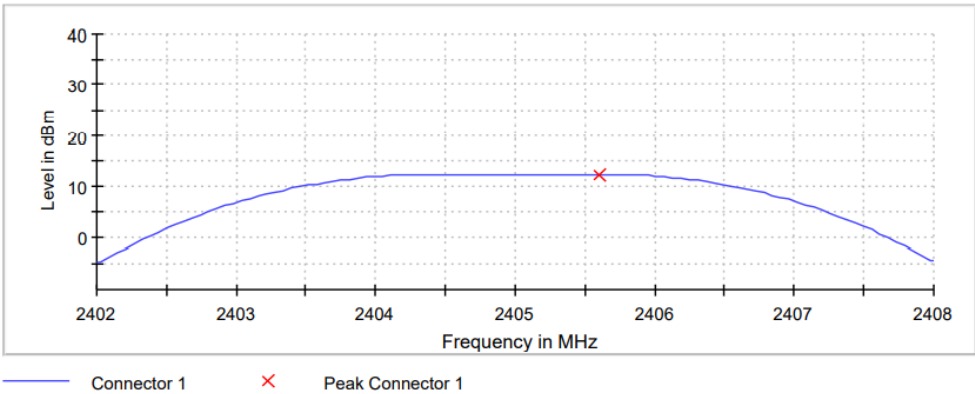


Figure 2.3.6-1: Output Power - LCH

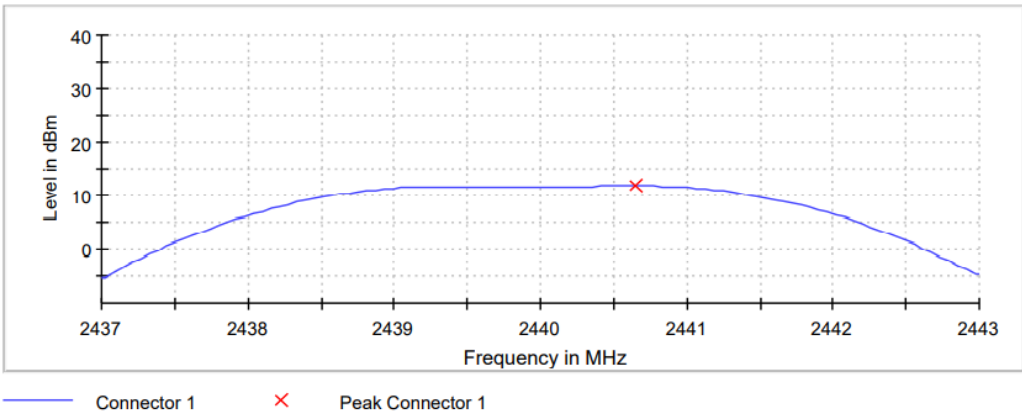


Figure 2.3.6-2: Output Power - MCH

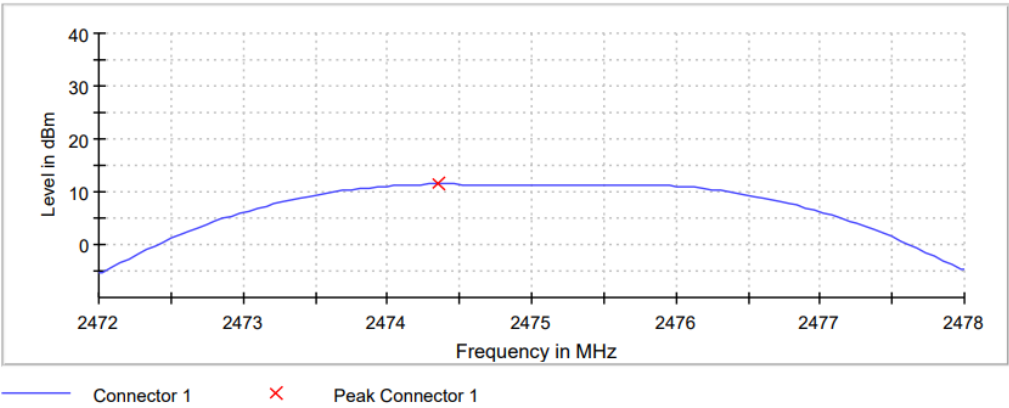


Figure 2.3.6-3: Output Power - HCH – 2475MHz

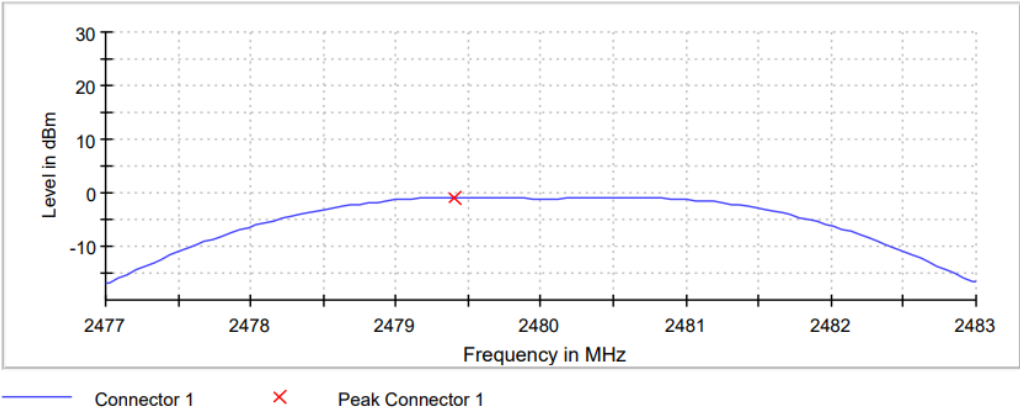


Figure 2.3.6-4: Output Power - HCH – 2480MHz

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        | >= 1.782 MHz |
| VBW                   | 10.000 MHz       | >= 6.000 MHz |
| Sweep Points          | 101              | ~ 101        |
| Sweep time            | 1953.450 ns      | 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                   | 4 / max. 150     | max. 150     |
| Stable                | 3 / 3            | 3            |
| Max Stable Difference | 0.08 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**

4/28/2022

### **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  $\geq 3$  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  | 22.3 °C    |
| Relative Humidity    | 53.8 %     |
| Atmospheric Pressure | 972.2 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            | 1.782               | 2.220               | 250 kbps  |
| 2440            | 1.782               | 2.220               | 250 kbps  |
| 2475            | 1.782               | 2.220               | 250 kbps  |
| 2480            | 1.782               | 2.220               | 250 kbps  |

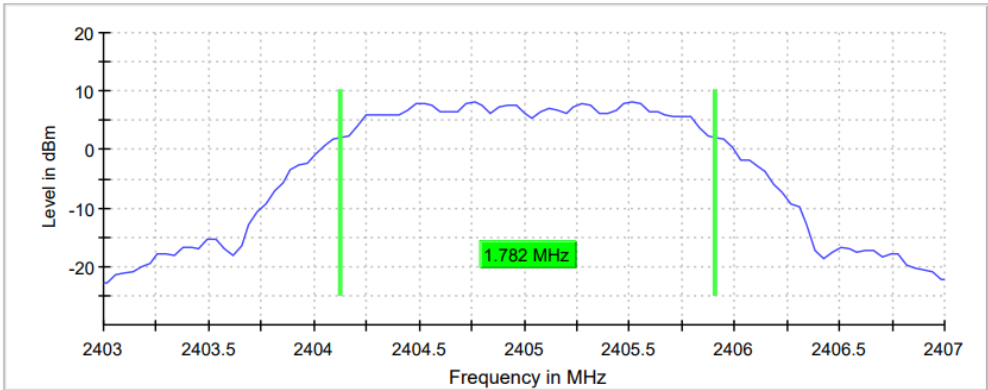


Figure 2.4.6-1: 6 dB BW - LCH

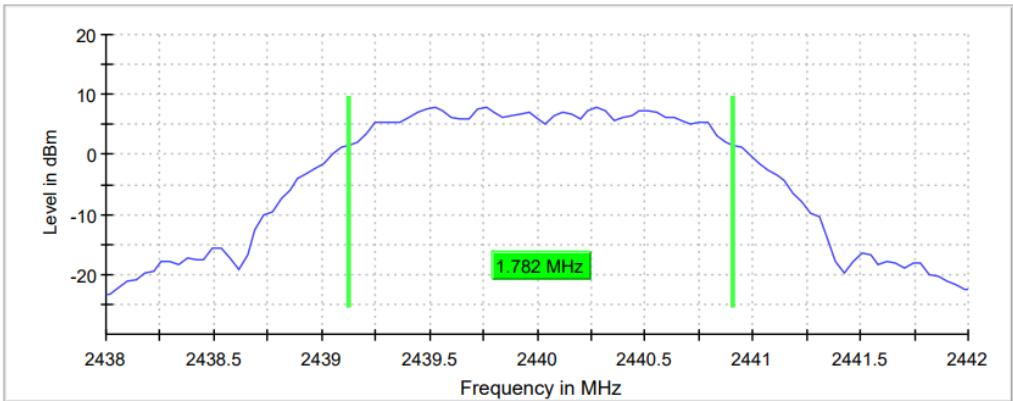


Figure 2.4.6-2: 6 dB BW - MCH

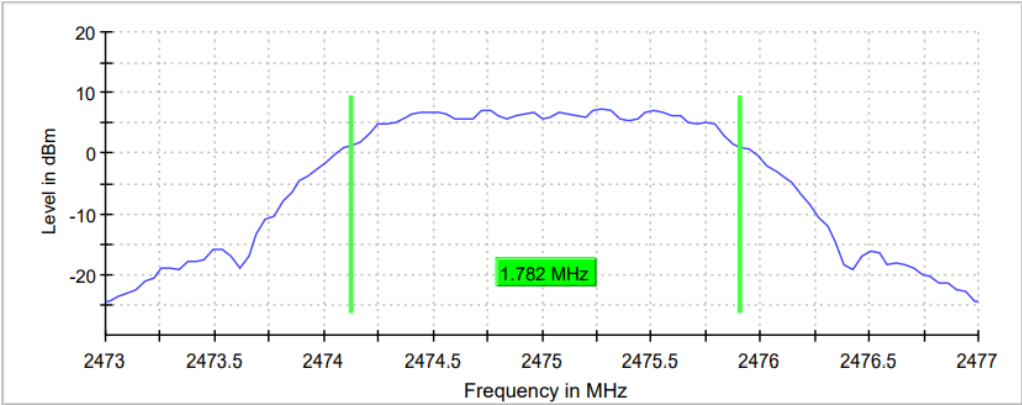


Figure 2.4.6-3: 6 dB BW - HCH – 2475MHz

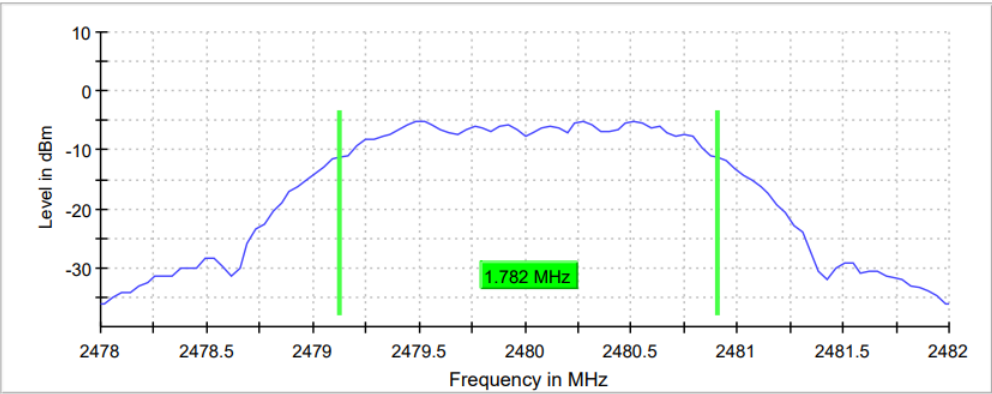


Figure 2.4.6-4: 6 dB BW - HCH – 2480MHz

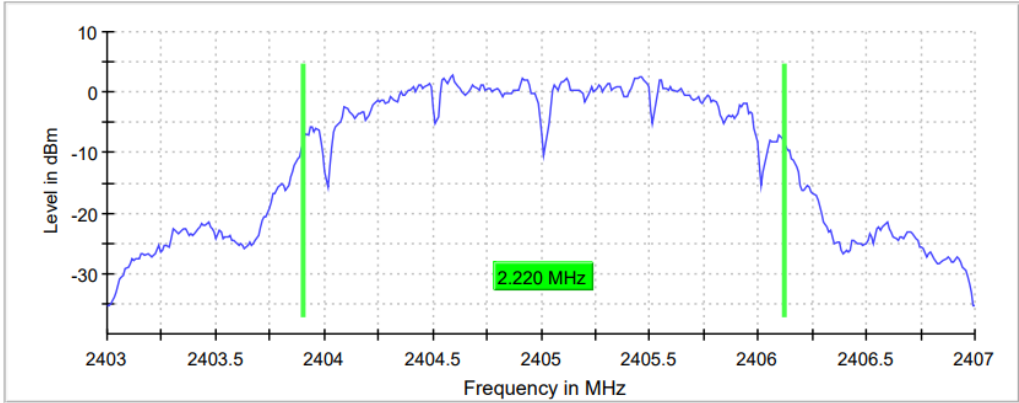


Figure 2.4.6-5: 99% BW - LCH

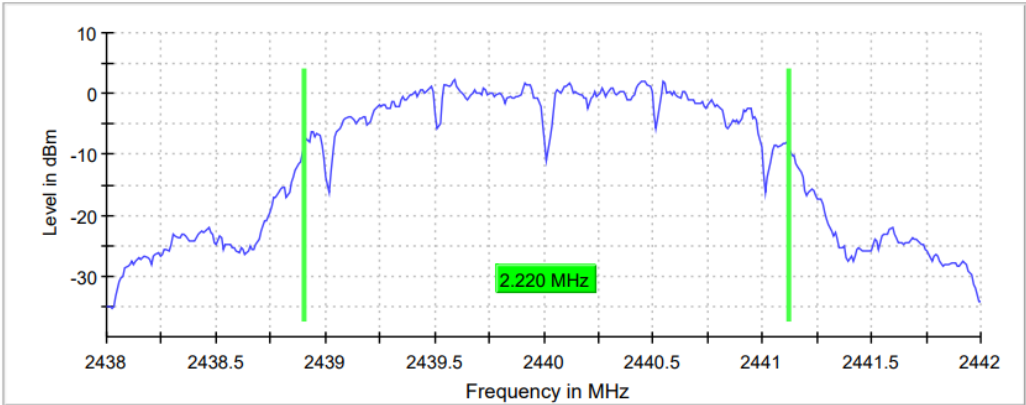


Figure 2.4.6-6: 99% BW - MCH

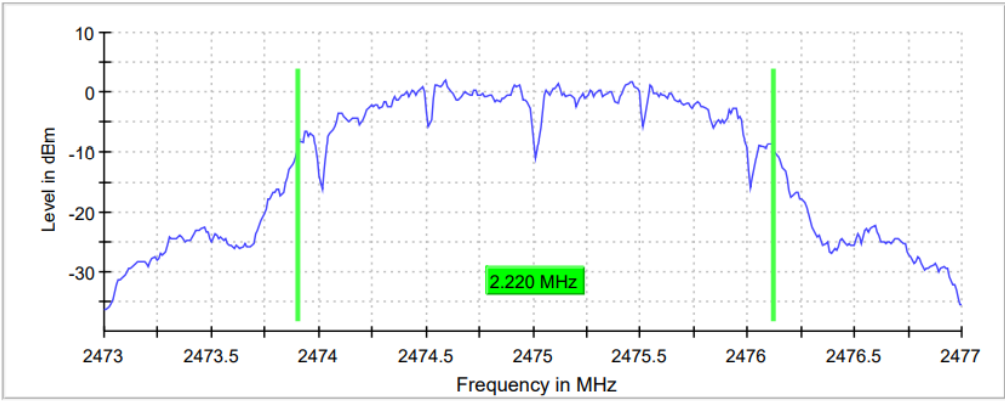


Figure 2.4.6-7: 99% BW - HCH – 2475 MHz

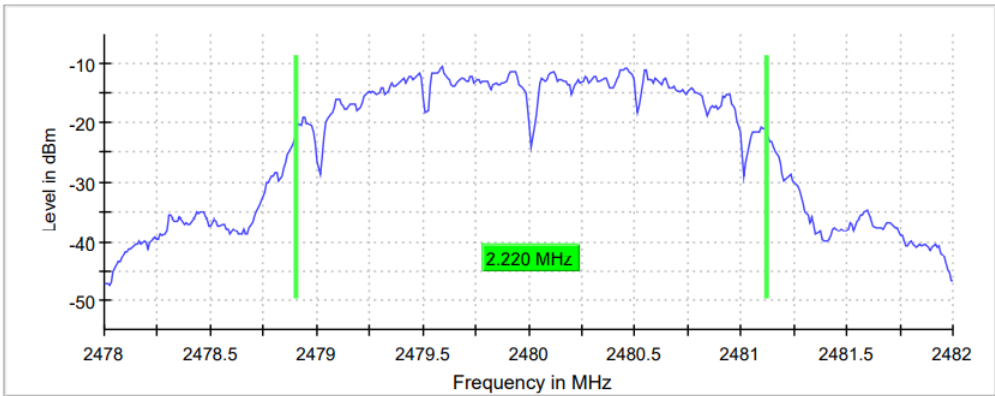


Figure 2.4.6-8: 99% BW - HCH – 2480 MHz

**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            | 18.938 $\mu$ s   | AUTO          |
| Reference Level       | 10.000 dBm       | 10.000 dBm    |
| Attenuation           | 30.000 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                   | 16 / max. 150    | max. 150      |
| Stable                | 5 / 5            | 5             |
| Max Stable Difference | 0.21 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       | $\geq 20.000$ kHz |
| VBW                   | 100.000 kHz      | $\geq 60.000$ kHz |
| Sweep Points          | 400              | ~ 400             |
| Sweep time            | 94.824 $\mu$ s   | AUTO              |
| Reference Level       | 10.000 dBm       | 10.000 dBm        |
| Attenuation           | 30.000 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                   | 18 / max. 150    | max. 150          |
| Stable                | 3 / 3            | 3                 |
| Max Stable Difference | 0.16 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**

4/28/2022

### **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 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  | 22.3 °C    |
| Relative Humidity    | 53.8 %     |
| Atmospheric Pressure | 972.2 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<br>[MHz] | PSD (dBm) | Data Rate |
|--------------------|-----------|-----------|
| 2405               | 1.247     | 250 kbps  |
| 2440               | 0.767     | 250 kbps  |
| 2475               | 0.456     | 250 kbps  |
| 2480               | -12.139   | 250 kbps  |

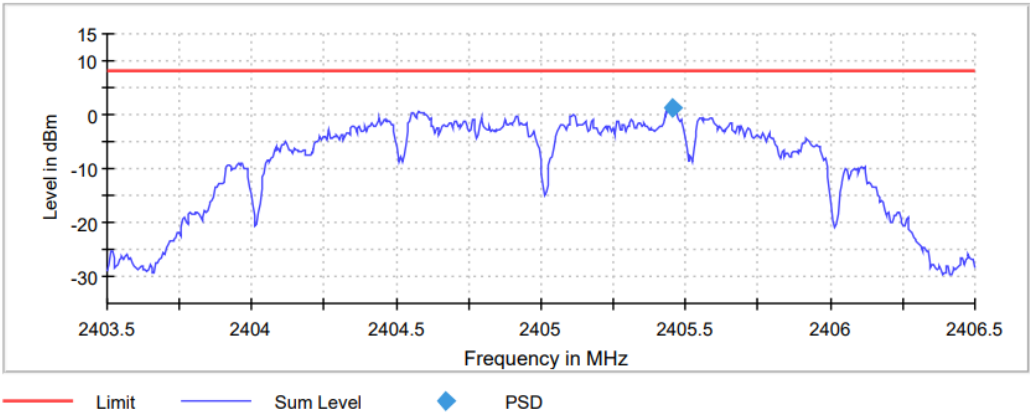


Figure 2.5.6-1: PSD – LCH

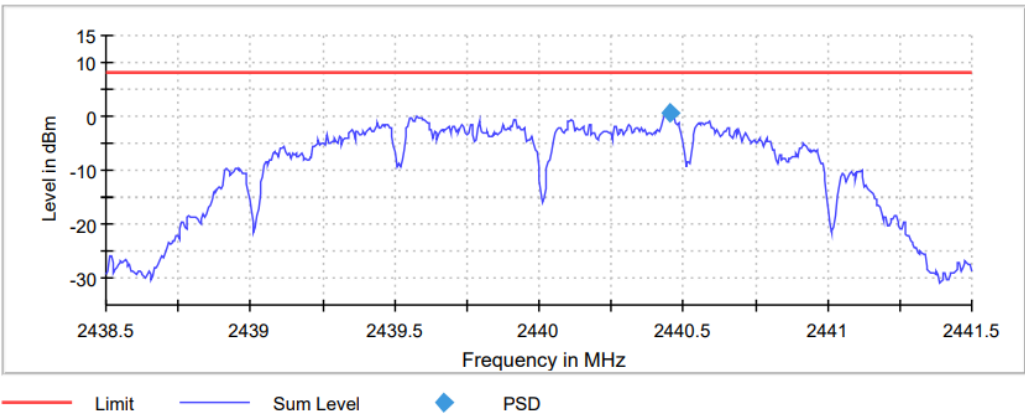


Figure 2.5.6-2: PSD – MCH

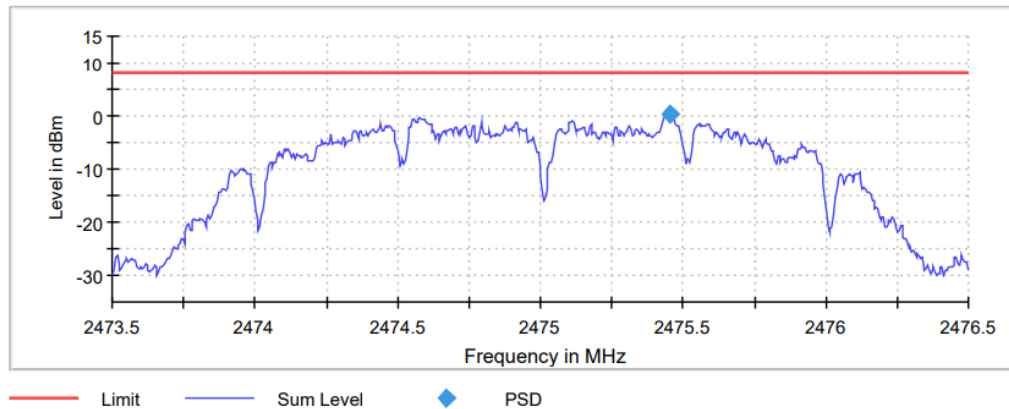


Figure 2.5.6-3: PSD – HCH -2475 MHz

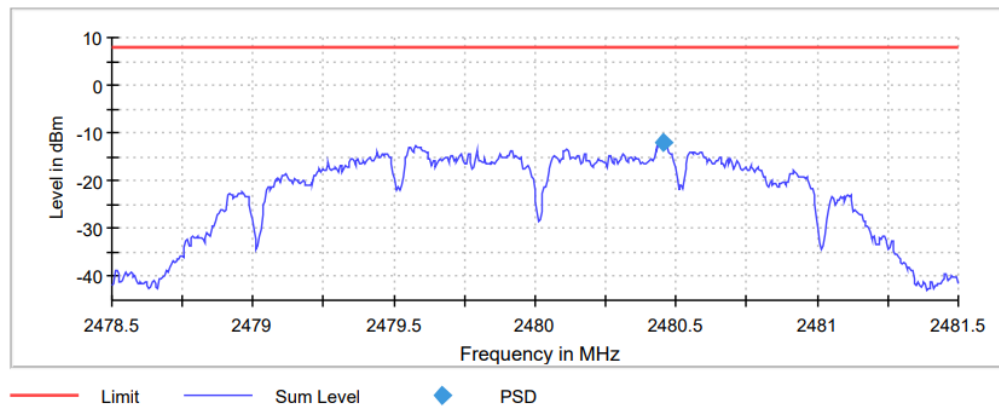


Figure 2.5.6-4: PSD – HCH -2480 MHz

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       | $\leq 10.000$ kHz |
| VBW                   | 30.000 kHz       | $\geq 30.000$ kHz |
| Sweep Points          | 600              | ~ 600             |
| Sweep time            | 3.000 ms         | AUTO              |
| Reference Level       | 10.000 dBm       | 10.000 dBm        |
| Attenuation           | 30.000 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                   | 11 / max. 150    | max. 150          |
| Stable                | 2 / 2            | 2                 |
| Max Stable Difference | 0.22 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**

4/28/2022

### **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  $\geq 300$  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. 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  | 22.3 °C    |
| Relative Humidity    | 53.8 %     |
| Atmospheric Pressure | 972.2 mbar |

### **2.6.5 Test Results**

**Test Summary: EUT was set to transmit mode.**

**Test Results: Pass**

See data below for detailed results.

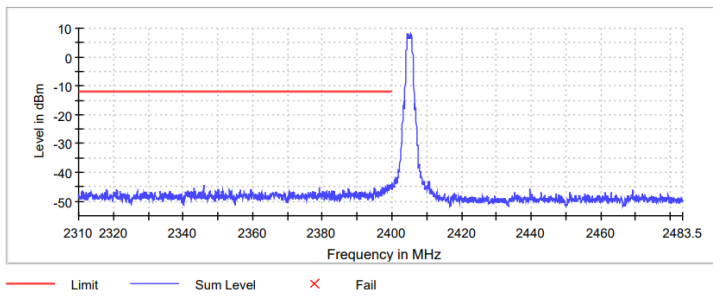


Figure 2.6.6-1: Lower Band-edge

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

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) | Result |
|-----------------|-------------|-------------|-------------|--------|
| 2399.875000     | -43.5       | 31.7        | -11.8       | PASS   |
| 2399.925000     | -44.0       | 32.2        | -11.8       | PASS   |
| 2399.625000     | -44.0       | 32.2        | -11.8       | PASS   |
| 2399.975000     | -44.2       | 32.4        | -11.8       | PASS   |
| 2399.675000     | -44.2       | 32.4        | -11.8       | PASS   |
| 2398.725000     | -44.2       | 32.4        | -11.8       | PASS   |
| 2399.325000     | -44.3       | 32.5        | -11.8       | PASS   |
| 2399.825000     | -44.3       | 32.5        | -11.8       | PASS   |
| 2398.775000     | -44.4       | 32.6        | -11.8       | PASS   |
| 2399.275000     | -44.5       | 32.6        | -11.8       | PASS   |
| 2345.875000     | -44.6       | 32.8        | -11.8       | PASS   |
| 2399.725000     | -44.7       | 32.8        | -11.8       | PASS   |
| 2345.825000     | -44.8       | 33.0        | -11.8       | PASS   |
| 2399.375000     | -44.9       | 33.1        | -11.8       | PASS   |
| 2398.925000     | -44.9       | 33.1        | -11.8       | PASS   |

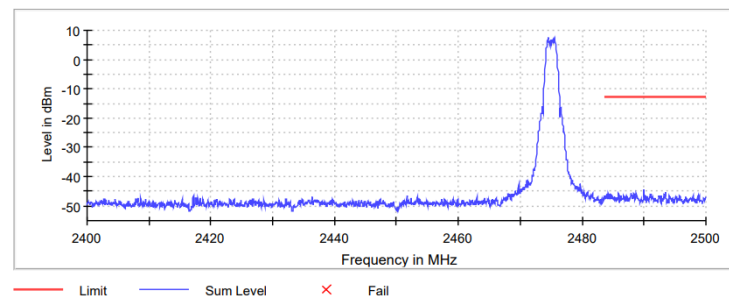


Figure 2.6.6-2: Upper Band-edge – 2475MHz

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

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) | Result |
|-----------------|-------------|-------------|-------------|--------|
| 2489.975000     | -44.4       | 31.8        | -12.6       | PASS   |
| 2489.925000     | -44.6       | 32.0        | -12.6       | PASS   |
| 2493.425000     | -45.1       | 32.5        | -12.6       | PASS   |
| 2493.475000     | -45.3       | 32.7        | -12.6       | PASS   |
| 2484.225000     | -45.6       | 33.0        | -12.6       | PASS   |
| 2485.925000     | -45.6       | 33.0        | -12.6       | PASS   |
| 2490.025000     | -45.6       | 33.0        | -12.6       | PASS   |
| 2484.275000     | -45.7       | 33.1        | -12.6       | PASS   |
| 2488.725000     | -45.7       | 33.1        | -12.6       | PASS   |
| 2488.775000     | -45.7       | 33.1        | -12.6       | PASS   |
| 2485.875000     | -45.8       | 33.2        | -12.6       | PASS   |
| 2488.375000     | -45.8       | 33.2        | -12.6       | PASS   |
| 2487.875000     | -45.9       | 33.2        | -12.6       | PASS   |
| 2484.075000     | -45.9       | 33.3        | -12.6       | PASS   |
| 2488.325000     | -45.9       | 33.3        | -12.6       | PASS   |

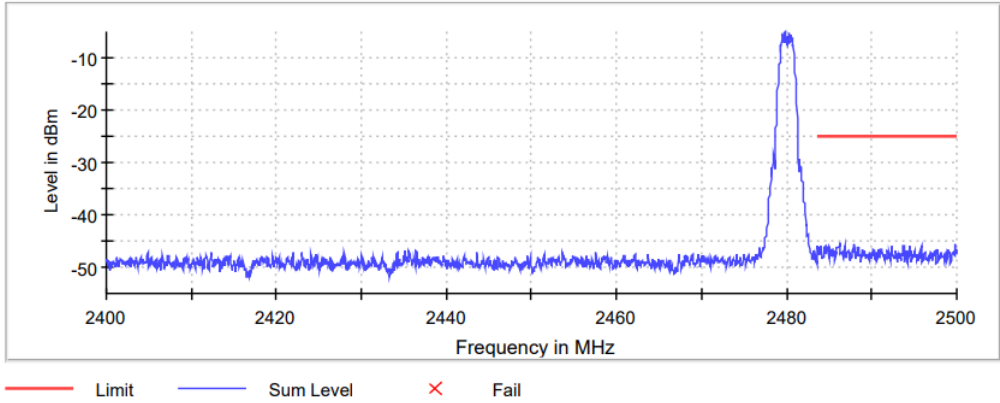


Figure 2.6.6-3: Upper Band-edge – 2480MHz

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

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) | Result |
|-----------------|-------------|-------------|-------------|--------|
| 2486.225000     | -45.2       | 20.0        | -25.1       | PASS   |
| 2499.825000     | -45.5       | 20.4        | -25.1       | PASS   |
| 2499.775000     | -45.6       | 20.5        | -25.1       | PASS   |
| 2487.925000     | -45.7       | 20.5        | -25.1       | PASS   |
| 2487.975000     | -45.8       | 20.6        | -25.1       | PASS   |
| 2486.825000     | -45.8       | 20.7        | -25.1       | PASS   |
| 2486.275000     | -45.8       | 20.7        | -25.1       | PASS   |
| 2492.425000     | -45.9       | 20.7        | -25.1       | PASS   |
| 2495.825000     | -45.9       | 20.8        | -25.1       | PASS   |
| 2483.625000     | -45.9       | 20.8        | -25.1       | PASS   |
| 2486.775000     | -45.9       | 20.8        | -25.1       | PASS   |
| 2484.525000     | -45.9       | 20.8        | -25.1       | PASS   |
| 2493.775000     | -46.0       | 20.8        | -25.1       | PASS   |
| 2495.875000     | -46.0       | 20.8        | -25.1       | PASS   |
| 2494.425000     | -46.0       | 20.9        | -25.1       | 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**

4/28/2022

### **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  $\geq 300$  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  | 22.3 °C    |
| Relative Humidity    | 53.8 %     |
| Atmospheric Pressure | 972.2 mbar |

### **2.7.6 Test Results**

**Test Summary: EUT was set to transmit mode.**

**Test Results: Pass**

See data below for detailed results.

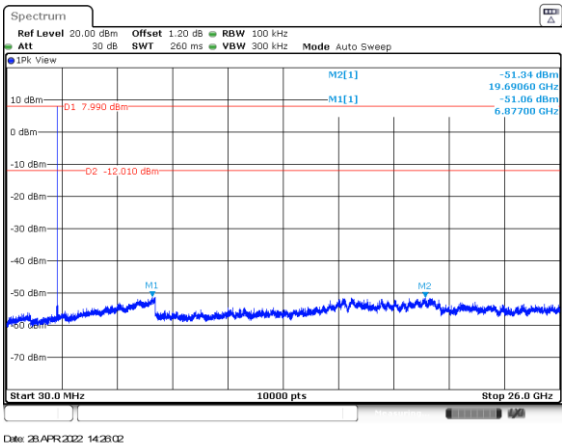


Figure 2.7.6-1: 30MHz – 26GHz – LCH

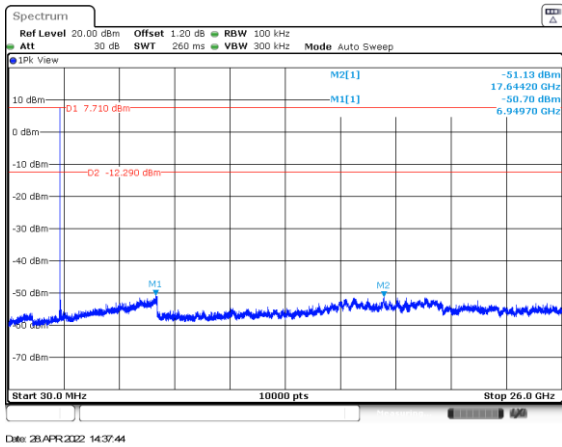


Figure 2.7.6-2: 30MHz – 26GHz – MCH

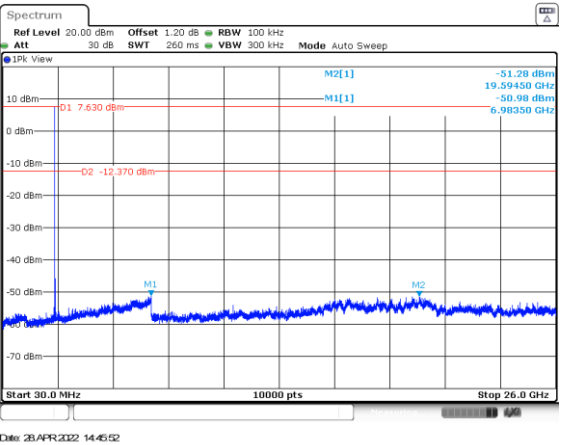


Figure 2.7.6-3: 30MHz – 26GHz – HCH – 2475MHz

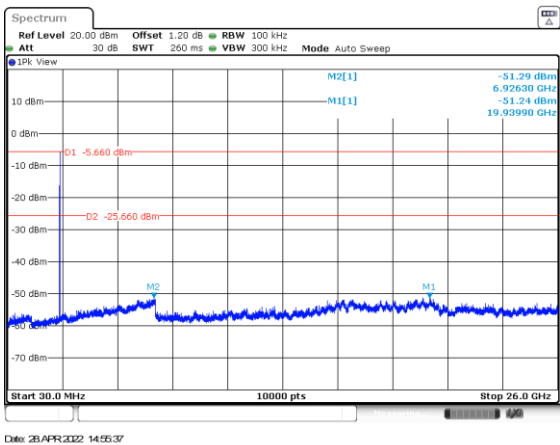


Figure 2.7.6-4: 30MHz – 26GHz – HCH – 2480MHz



## **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**

4/28/2022 to 5/17/2022

### **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  | 22.3 °C    |
| Relative Humidity    | 53.8 %     |
| Atmospheric Pressure | 972.2 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<br>(MHz) | Level<br>(dBuV) |         | Antenna<br>Polarity<br>(H/V) | Limit<br>(dBuV/m) |         | Margin<br>(dB) |         |
|--------------------|-----------------|---------|------------------------------|-------------------|---------|----------------|---------|
|                    | pk              | Qpk/Avg |                              | pk                | Qpk/Avg | pk             | Qpk/Avg |
| LCH - 2405 MHz     |                 |         |                              |                   |         |                |         |
| 329.053            | ----            | 30.577  | H                            | ----              | 46      | ----           | 15.42   |
| 2367.35            | 51.945          | 40.072  | H                            | 74                | 54      | 22.055         | 13.93   |
| 2441.1             | 47.458          | 33.256  | H                            | 74                | 54      | 26.542         | 20.74   |
| 2479.925           | 52.302          | 33.163  | H                            | 74                | 54      | 21.698         | 20.84   |
| 5218.5             | 59.076          | 37.01   | H                            | 74                | 54      | 14.92          | 16.99   |
| 5785.125           | 64.703          | 38.386  | H                            | 74                | 54      | 9.30           | 15.61   |
| 9871.625           | 59.405          | 44.973  | H                            | 74                | 54      | 14.60          | 9.03    |
| 12024.75           | 51.941          | 38.365  | H                            | 74                | 54      | 22.06          | 15.64   |
| 25804.125          | 64.087          | 50.347  | H                            | 74                | 54      | 9.91           | 3.65    |
| 116.039            | ----            | 30.054  | V                            | ----              | 43.5    | ----           | 13.45   |
| 2331.325           | 47.674          | 33.202  | V                            | 74                | 54      | 26.33          | 20.80   |
| 2480.025           | 50.748          | 33.121  | V                            | 74                | 54      | 23.25          | 20.88   |
| 2583.575           | 48.884          | 33.35   | V                            | 74                | 54      | 25.12          | 20.65   |
| 4809.05            | 52.464          | 39.719  | V                            | 74                | 54      | 21.54          | 14.28   |
| 5218.675           | 56.054          | 37.081  | V                            | 74                | 54      | 17.95          | 16.92   |
| 5785.8             | 64.679          | 38.485  | V                            | 74                | 54      | 9.32           | 15.52   |
| 9994.775           | 58.346          | 44.575  | V                            | 74                | 54      | 15.65          | 9.43    |
| 12025.05           | 52.276          | 38.413  | V                            | 74                | 54      | 21.72          | 15.59   |
| 25866.475          | 64.804          | 50.465  | V                            | 74                | 54      | 9.20           | 3.54    |
| MCH - 2440 MHz     |                 |         |                              |                   |         |                |         |
| 2402.375           | 49.529          | 36.478  | H                            | 74                | 54      | 24.47          | 17.52   |
| 2479.55            | 47.595          | 33.518  | H                            | 74                | 54      | 26.41          | 20.48   |
| 5237.375           | 50.905          | 36.791  | H                            | 74                | 54      | 23.10          | 17.21   |
| 5746.9             | 52.566          | 37.908  | H                            | 74                | 54      | 21.43          | 16.09   |
| 9756.5             | 58.983          | 45.142  | H                            | 74                | 54      | 15.02          | 8.86    |
| 12200.2            | 52.155          | 38.32   | H                            | 74                | 54      | 21.85          | 15.68   |
| 25792.375          | 63.784          | 50.324  | H                            | 74                | 54      | 10.22          | 3.68    |
| 116.184            | ----            | 31.069  | V                            | ----              | 43.5    | ----           | 12.43   |
| 2377.85            | 47.217          | 32.704  | V                            | 74                | 54      | 26.78          | 21.30   |
| 2417.85            | 47.664          | 32.818  | V                            | 74                | 54      | 26.34          | 21.18   |
| 2480.15            | 47.218          | 33.138  | V                            | 74                | 54      | 26.78          | 20.86   |
| 4881.025           | 52.615          | 39.171  | V                            | 74                | 54      | 21.39          | 14.83   |
| 5223.675           | 62.115          | 37.111  | V                            | 74                | 54      | 11.89          | 16.89   |
| 5786.1             | 59.001          | 40.621  | V                            | 74                | 54      | 15.00          | 13.38   |



|                       |        |        |   |      |      |       |       |
|-----------------------|--------|--------|---|------|------|-------|-------|
| 9740.25               | 58.887 | 45.01  | V | 74   | 54   | 15.11 | 8.99  |
| 12200.1               | 51.488 | 38.298 | V | 74   | 54   | 22.51 | 15.70 |
| 25790.3               | 64.872 | 50.313 | V | 74   | 54   | 9.13  | 3.69  |
| <b>HCH - 2475 MHz</b> |        |        |   |      |      |       |       |
| 327.089               | ----   | 30.952 | H | ---- | 46   | ----  | 15.05 |
| 1229.875              | 43.364 | 29.468 | H | 74   | 54   | 30.64 | 24.53 |
| 2426.35               | 52.171 | 32.956 | H | 74   | 54   | 21.83 | 21.04 |
| 2437.1                | 50.812 | 38.937 | H | 74   | 54   | 23.19 | 15.06 |
| 5218.6                | 55.569 | 36.843 | H | 74   | 54   | 18.43 | 17.16 |
| 5785.725              | 63.553 | 38.426 | H | 74   | 54   | 10.45 | 15.57 |
| 9827                  | 58.04  | 44.457 | H | 74   | 54   | 15.96 | 9.54  |
| 12375.125             | 52.38  | 38.214 | H | 74   | 54   | 21.62 | 15.79 |
| 25956.575             | 64.319 | 50.497 | H | 74   | 54   | 9.68  | 3.50  |
| 116.669               | ----   | 30.094 | V | ---- | 43.5 | ----  | 13.41 |
| 1356.85               | 43.703 | 29.948 | V | 74   | 54   | 30.30 | 24.05 |
| 1703.325              | 45.188 | 30.486 | V | 74   | 54   | 28.81 | 23.51 |
| 2401.75               | 55.8   | 33.196 | V | 74   | 54   | 18.20 | 20.80 |
| 2425.85               | 48.849 | 32.916 | V | 74   | 54   | 25.15 | 21.08 |
| 4949.025              | 53.939 | 41.301 | V | 74   | 54   | 20.06 | 12.70 |
| 5223.35               | 60.881 | 37.098 | V | 74   | 54   | 13.12 | 16.90 |
| 5785.55               | 63.429 | 39.466 | V | 74   | 54   | 10.57 | 14.53 |
| 5792.55               | 58.112 | 38.227 | V | 74   | 54   | 15.89 | 15.77 |
| 9797.525              | 58.361 | 44.266 | V | 74   | 54   | 15.64 | 9.73  |
| 12375.125             | 52.579 | 38.375 | V | 74   | 54   | 21.42 | 15.63 |
| 25827.5               | 63.848 | 50.366 | V | 74   | 54   | 10.15 | 3.63  |
| <b>HCH - 2480 MHz</b> |        |        |   |      |      |       |       |
| 325.003               | ----   | 30.823 | H | ---- | 46   | ----  | 15.18 |
| 2401.85               | 52.895 | 33.077 | H | 74   | 54   | 21.11 | 20.92 |
| 2425.75               | 54.008 | 33.023 | H | 74   | 54   | 19.99 | 20.98 |
| 2446.1                | 47.096 | 32.936 | H | 74   | 54   | 26.90 | 21.06 |
| 5223.375              | 59.618 | 37.009 | H | 74   | 54   | 14.38 | 16.99 |
| 5805.5                | 52.302 | 38.241 | H | 74   | 54   | 21.70 | 15.76 |
| 9725.675              | 58.268 | 44.667 | H | 74   | 54   | 15.73 | 9.33  |
| 12400.025             | 52.566 | 38.48  | H | 74   | 54   | 21.43 | 15.52 |
| 25888.175             | 64.278 | 50.527 | H | 74   | 54   | 9.72  | 3.47  |
| 116.136               | ----   | 30.682 | V | ---- | 43.5 | ----  | 12.82 |
| 2418.65               | 46.75  | 32.808 | V | 74   | 54   | 27.25 | 21.19 |
| 2442.95               | 47.185 | 33.141 | V | 74   | 54   | 26.82 | 20.86 |
| 5222.975              | 60.803 | 37.025 | V | 74   | 54   | 13.20 | 16.98 |
| 5808.9                | 52.158 | 38.144 | V | 74   | 54   | 21.84 | 15.86 |



|           |        |        |   |    |    |       |       |
|-----------|--------|--------|---|----|----|-------|-------|
| 9732.8    | 58.376 | 44.81  | V | 74 | 54 | 15.62 | 9.19  |
| 12400.175 | 52.31  | 38.432 | V | 74 | 54 | 21.69 | 15.57 |
| 25919.55  | 64.083 | 50.562 | V | 74 | 54 | 9.92  | 3.44  |

Table 2.8.6-2: Radiated Band-Edge Tabulated Data

| Frequency<br>(MHz)         | Level<br>(dBuV) |         | Antenna<br>Polarity<br>(H/V) | Correction<br>Factors<br>(dB) | Corrected Level<br>(dBuV/m) |         | Limit<br>(dBuV/m) |         | Margin<br>(dB) |         |
|----------------------------|-----------------|---------|------------------------------|-------------------------------|-----------------------------|---------|-------------------|---------|----------------|---------|
|                            | pk              | Qpk/Avg |                              |                               | pk                          | Qpk/Avg | pk                | Qpk/Avg | pk             | Qpk/Avg |
| 2405 MHz - Lower Band Edge |                 |         |                              |                               |                             |         |                   |         |                |         |
| 2390                       | 47.30           | 34.10   | H                            | 0.08                          | 47.38                       | 34.18   | 74.0              | 54.0    | 26.6           | 19.8    |
| 2475 MHz - Upper Band Edge |                 |         |                              |                               |                             |         |                   |         |                |         |
| 2483.5                     | 56.00           | 41.60   | H                            | 0.36                          | 56.36                       | 41.96   | 74.0              | 54.0    | 17.6           | 12.0    |
| 2480 MHz - Upper Band Edge |                 |         |                              |                               |                             |         |                   |         |                |         |
| 2483.5                     | 57.40           | 43.40   | H                            | 0.36                          | 57.76                       | 43.76   | 74.0              | 54.0    | 16.2           | 10.2    |

Note: Only Worst-Case Polarization was evaluated and reported.

### 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:  $57.40 + 0.36 = 57.76 \text{ dB}\mu\text{V/m}$

Margin:  $74 \text{ dB}\mu\text{V/m} - 57.76 \text{ dB}\mu\text{V/m} = 16.2 \text{ dB}$

### Example Calculation: Average

Corrected Level:  $43.40 + 0.36 - 0 = 43.76 \text{ dB}\mu\text{V}$

Margin:  $54 \text{ dB}\mu\text{V} - 43.76 \text{ dB}\mu\text{V} = 10.2 \text{ dB}$

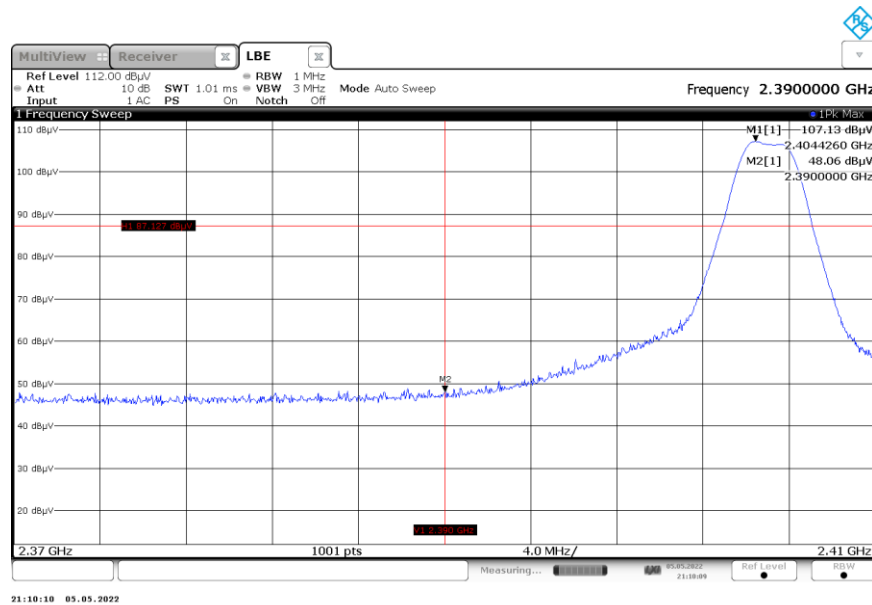


Figure 2.8.6-1: Reference plot Radiated Lower Band-edge – LCH

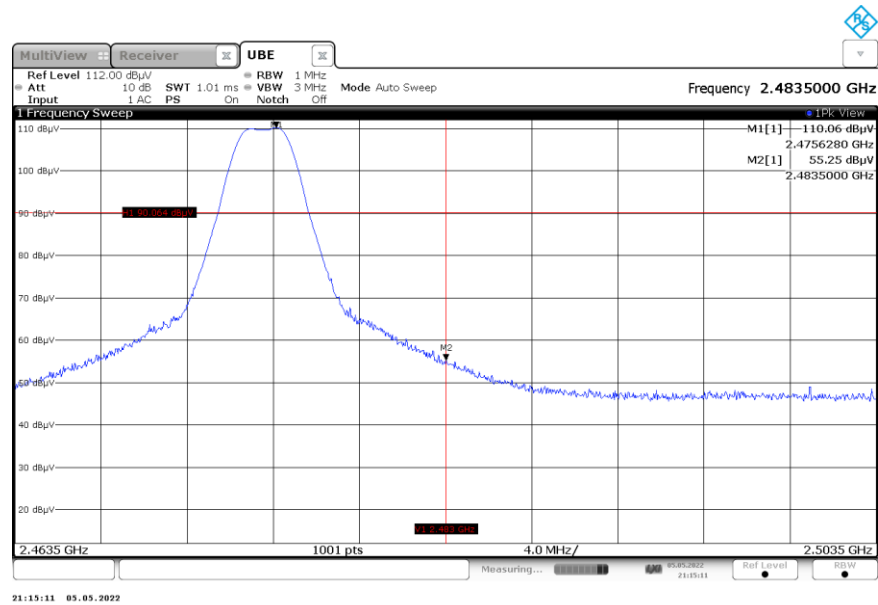


Figure 2.8.6-2: Reference plot Radiated Upper Band-edge – HCH – 2475MHz

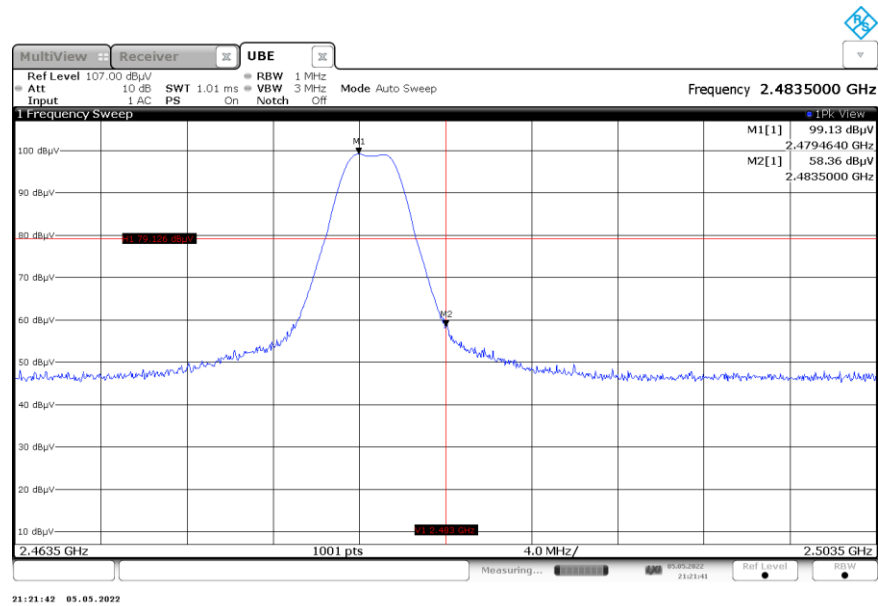


Figure 2.8.6-3: Reference plot Radiated Upper Band-edge – HCH – 2480MHz

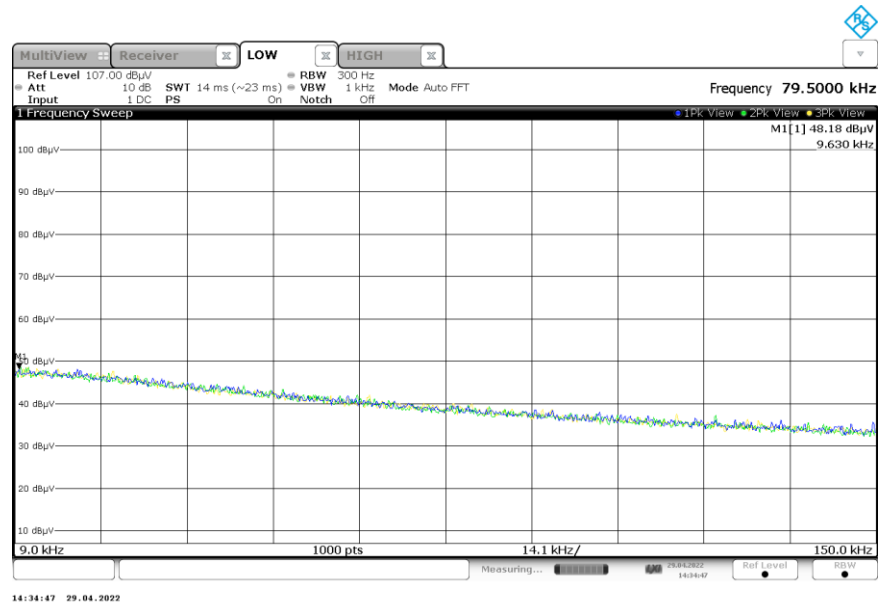


Figure 2.8.6-4: Reference plot for Radiated Spurious Emissions – 9 kHz – 150 kHz

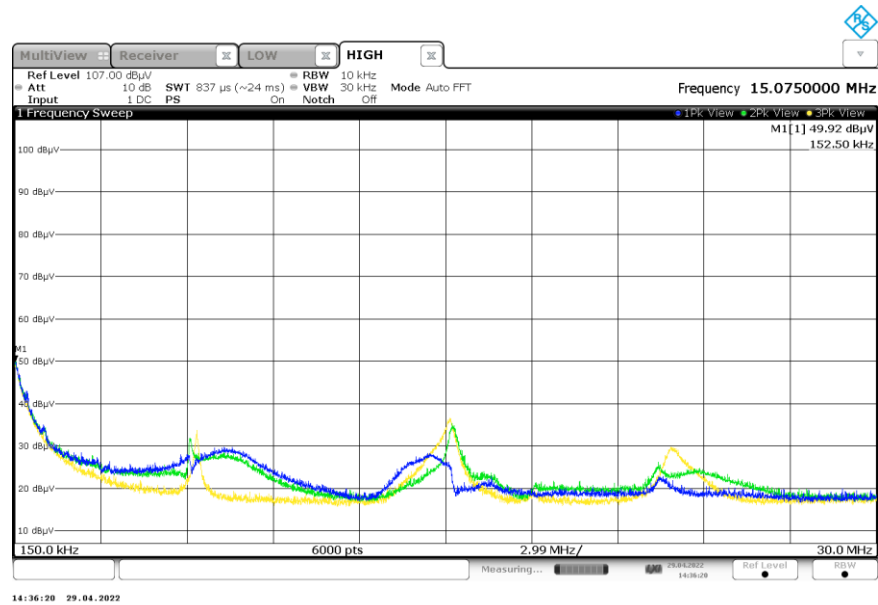


Figure 2.8.6-5: Reference plot for Radiated Spurious Emissions– 150 kHz – 30MHz  
Note: Emissions above the noise floor are ambient not associated with the EUT.

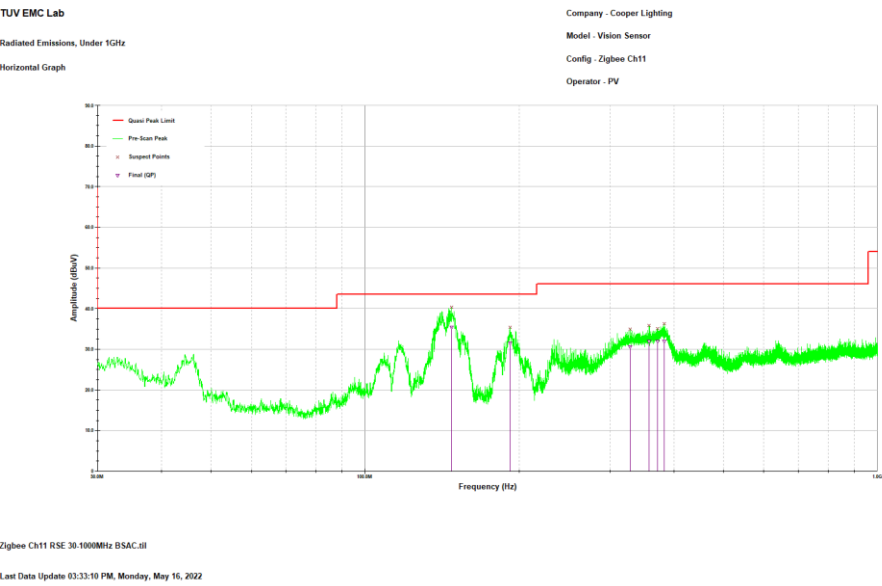


**Figure 2.8.6-6: Reference plot for Radiated Spurious Emissions – 30 MHz – 1 GHz – H Polarity**  
Note: Frequencies that falls under restricted band are only evaluated and reported.

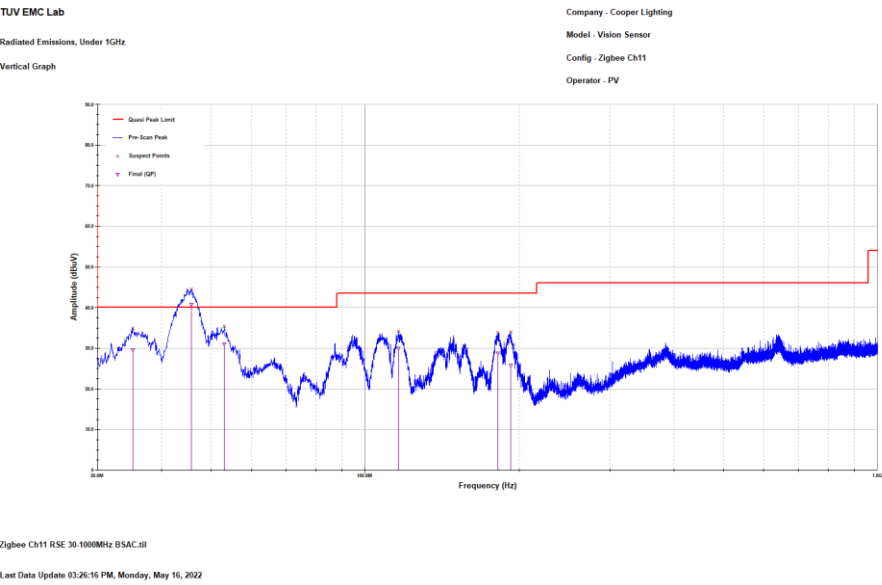


**Figure 2.8.6-7: Reference plot for Radiated Spurious Emissions – 30 MHz – 1 GHz – V Polarity**  
Note: Frequencies that falls under restricted band are only evaluated and reported.  
Emission above the limit line is ambient noise not associated with the radio of the EUT.

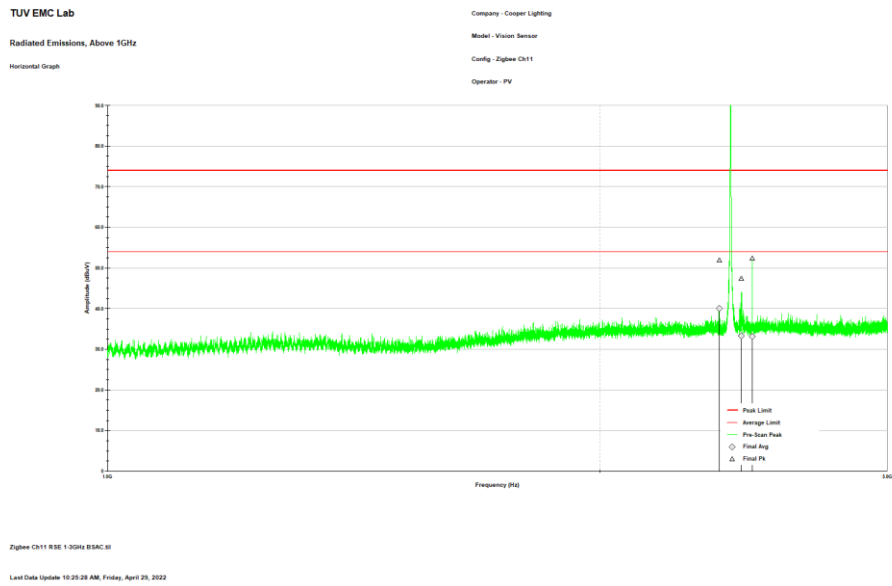


Figure 2.8.6-8: Reference plot for Radiated Spurious Emissions – 1 GHz – 3 GHz – H Polarity

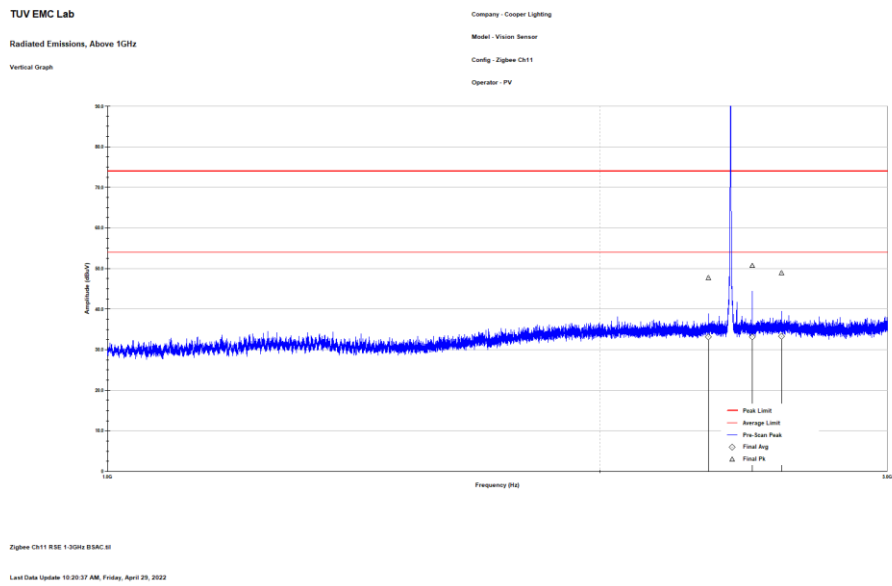


Figure 2.8.6-9: Reference plot for Radiated Spurious Emissions – 1 GHz – 3 GHz – V Polarity

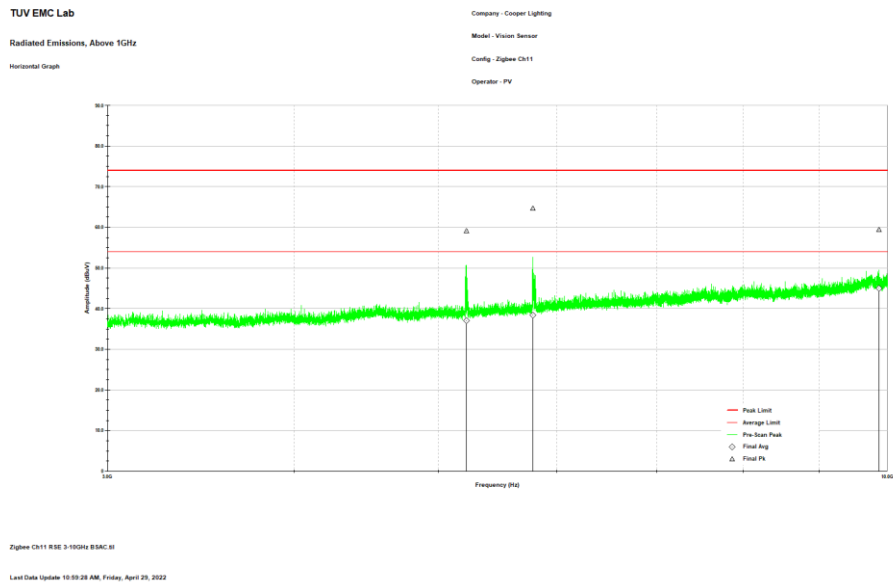


Figure 2.8.6-10: Reference plot for Radiated Spurious Emissions – 3 GHz – 10 GHz – H Polarity

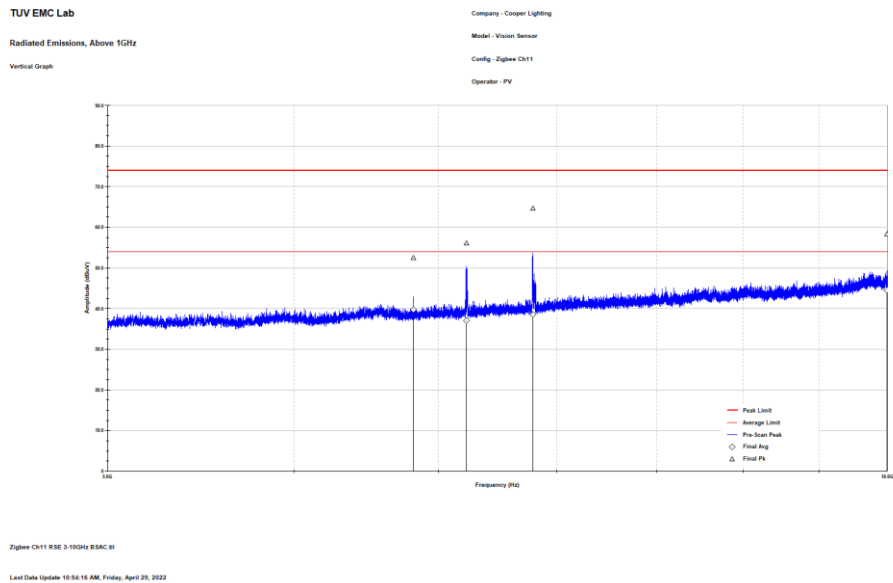


Figure 2.8.6-11: Reference plot for Radiated Spurious Emissions – 3 GHz – 10 GHz – V Polarity

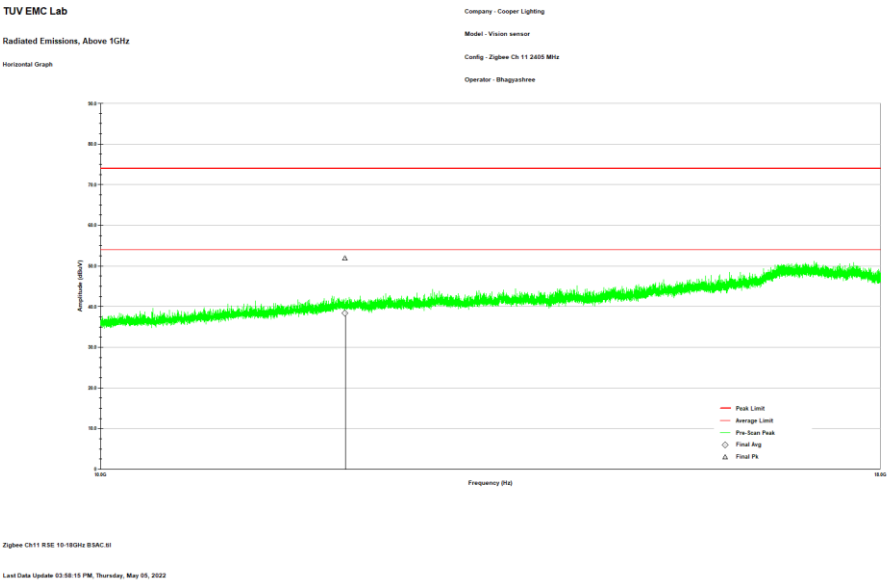


Figure 2.8.6-12: Reference plot for Radiated Spurious Emissions – 10 GHz – 18 GHz – H Polarity

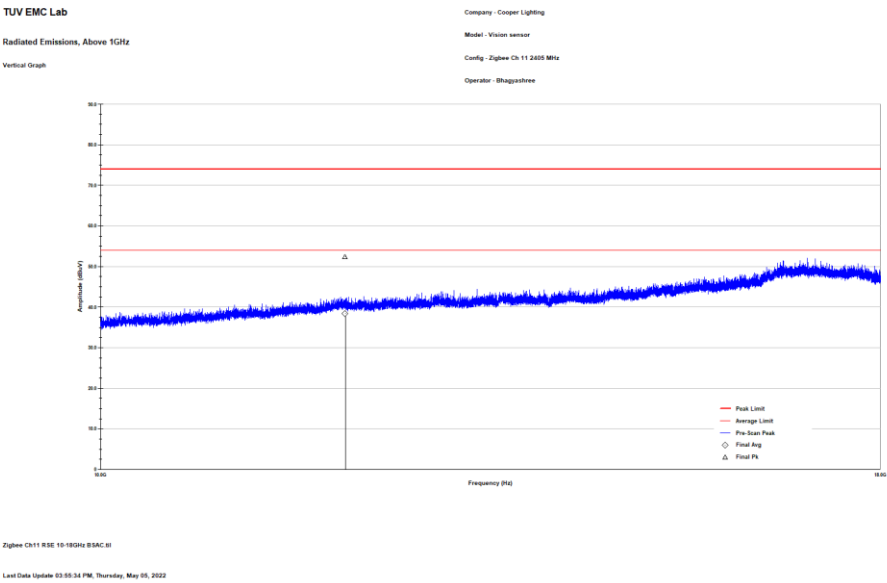


Figure 2.8.6-13: Reference plot for Radiated Spurious Emissions – 10 GHz – 18 GHz – V polarity

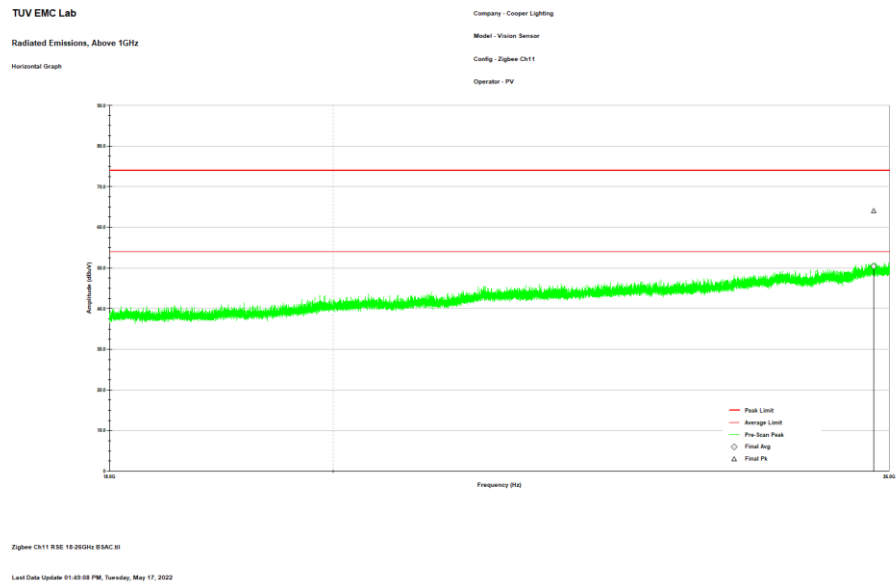


Figure 2.8.6-14: Reference plot for Radiated Spurious Emissions – 18 GHz – 26 GHz – H Polarity

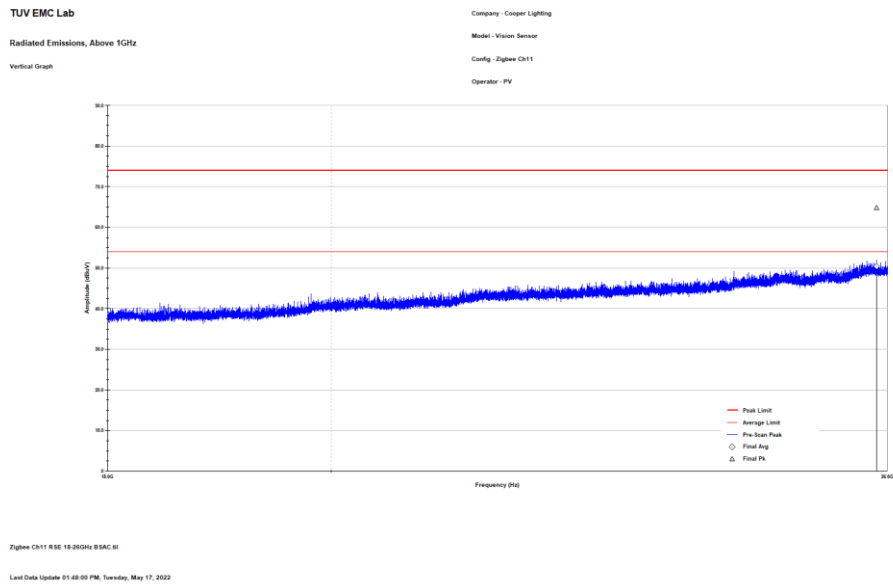


Figure 2.8.6-15: Reference plot for Radiated Spurious Emissions – 18 GHz – 26 GHz – V Polarity



## 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<br>10kHz-30MHz      | 9407-2877     | 6/8/2021              | 6/8/2023             |
| AEMC0884 | ETS Lindgren               | 3117          | Double ridged horn<br>antenna           | 240106        | 5/6/2021              | 5/6/2022             |
| DEMC3161 | Ametek CTS<br>Germany GmbH | CBL 6112D     | Bilog Antenna; Attenuator               | 51323         | 3/19/2021             | 3/19/2023            |
| 213      | TEC                        | PA 102        | Amplifier                               | 44927         | 7/30/2021             | 7/30/2022            |
| 338      | Hewlett Packard            | 8449B         | High Frequency Pre-Amp                  | 3008A01111    | 6/22/2021             | 6/22/2023            |
| 882      | Rohde & Schwarz            | ESW44         | Test Receiver                           | 111961        | 6/24/2021             | 6/24/2022            |
| 836      | ETS Lindgren               | SAC Cable Set | SAC Cable Set includes<br>620, 837, 838 | N/A           | 5/11/2021             | 7/11/2022            |
| 335      | Suhner                     | SF-102A       | Cable (40GHz)                           | 882/2A        | 6/24/2021             | 6/24/2022            |
| 345      | Suhner Sucoflex            | 102A          | Cable (42GHz)                           | 1077/2A       | 6/24/2021             | 6/24/2022            |
| 334      | Rohde & Schwarz            | 3160-09       | HF 18-26.5GHz Antenna                   | 49404         | 4/25/2020             | 4/25/2022            |
| 334      | Rohde & Schwarz            | 3160-09       | HF 18-26.5GHz Antenna                   | 49404         | 4/25/2022             | 5/25/2024            |
| 432      | Microwave Circuits         | H3G020G4      | High pass Filter                        | 264066        | 6/9/2021              | 6/9/2022             |
| 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<br>10Hz to 40GHz    | 101338        | 9/22/2021             | 9/22/2022            |
| 267      | Hewlett Packard            | N1911A        | Power Meter                             | MY45100129    | 7/27/2021             | 7/27/2023            |
| 3010     | Rohde & Schwarz            | ENV216        | Two-Line V-Network                      | 3010          | 6/23/2021             | 6/23/2022            |
| 872      | Agilent                    | E7402A        | EMC Spectrum Analyzer                   | US40240258    | 6/22/2021             | 6/22/2022            |
| 871      | Belden                     | RF Cable      | RF Cable (CE Cable)                     | 871           | 4/1/2022              | 4/1/2023             |
| 144      | Omega                      | RH411         | Temp / Humidity Meter                   | H0103373      | 12/16/2020            | 12/16/2022           |

**N/A – Not Applicable**

### 3 Diagram of Test Set-ups

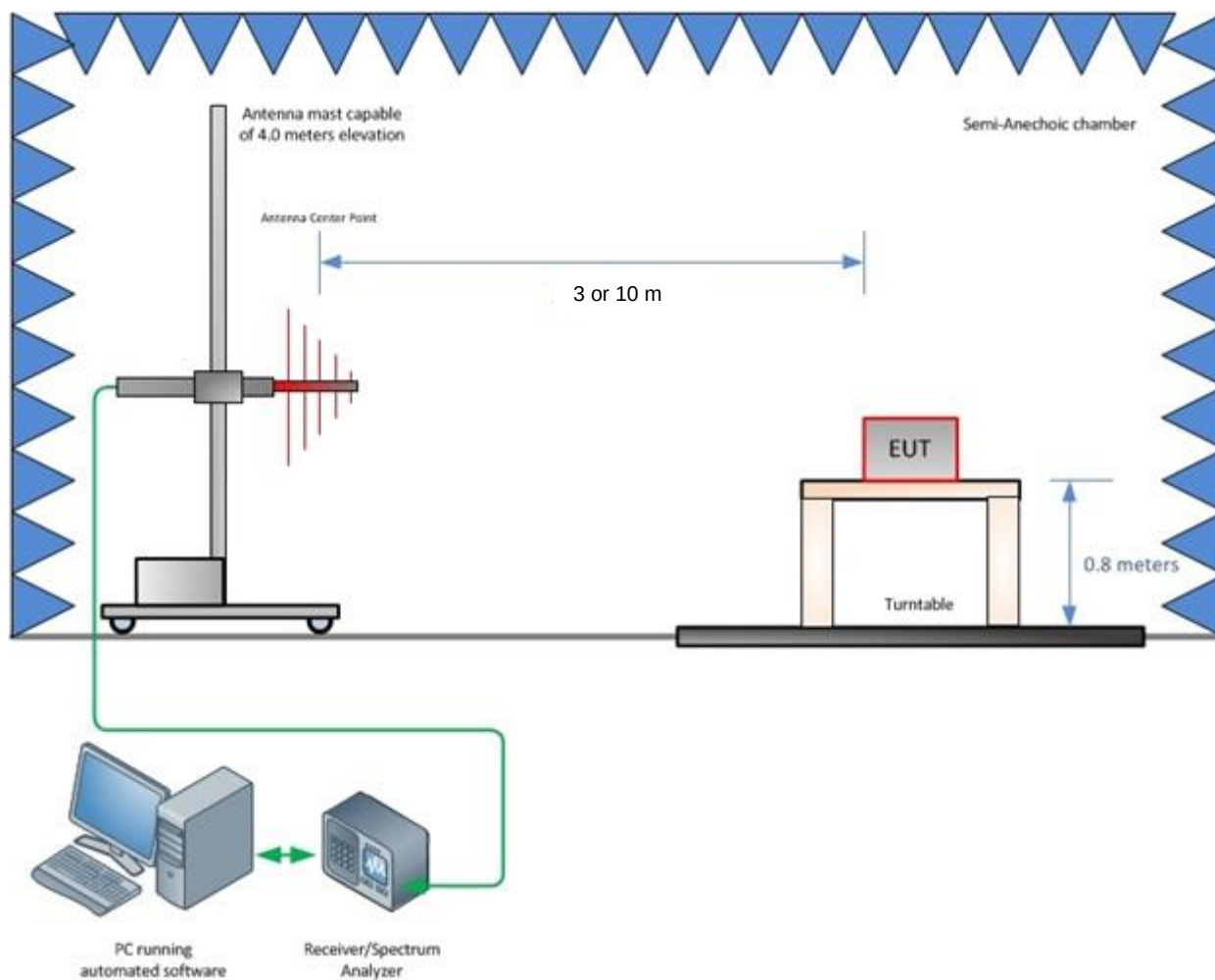


Figure 3-1 – Radiated Emissions Test Setup up to 1 GHz

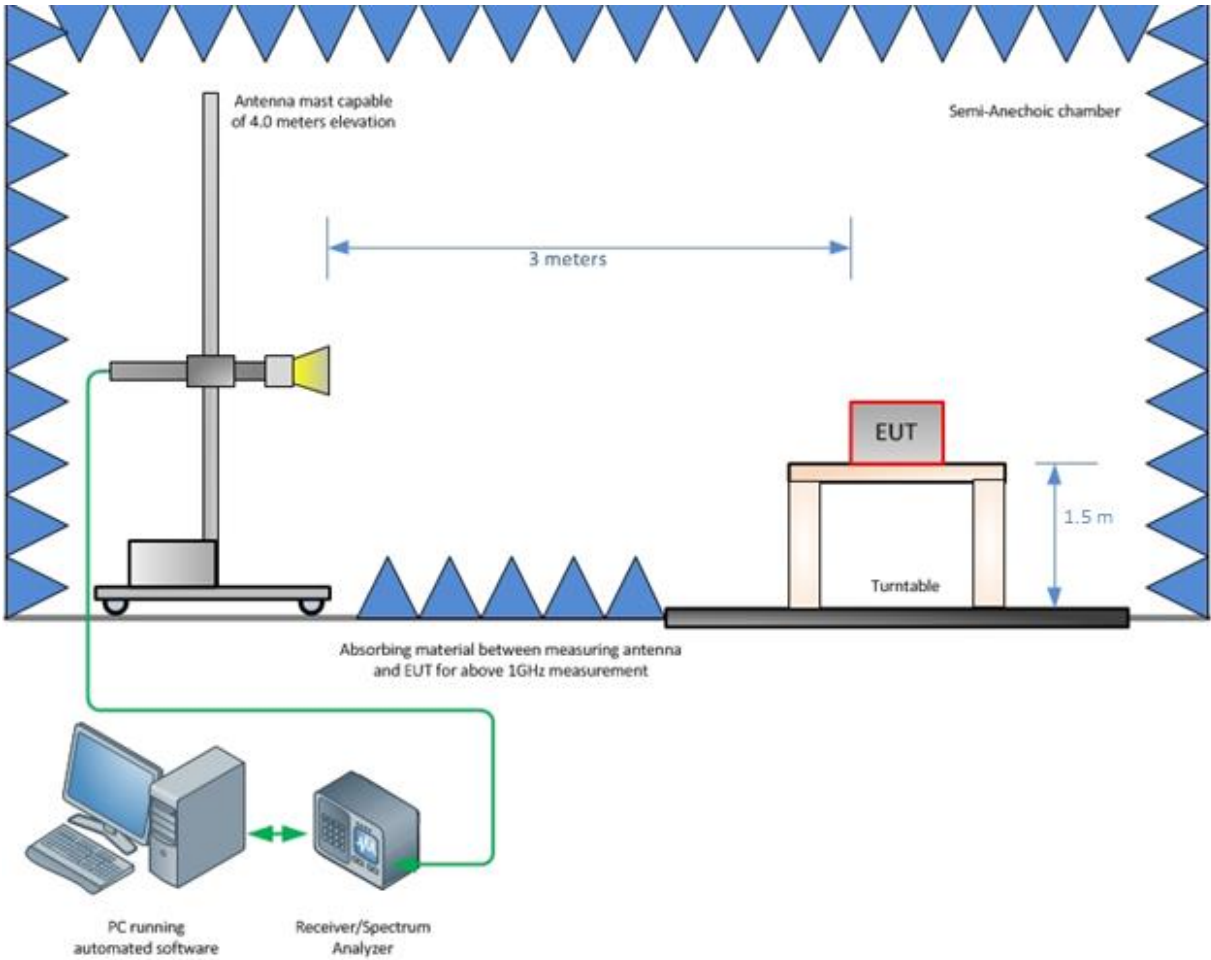


Figure 3-2 – Radiated Emissions Test Setup above 1 GHz

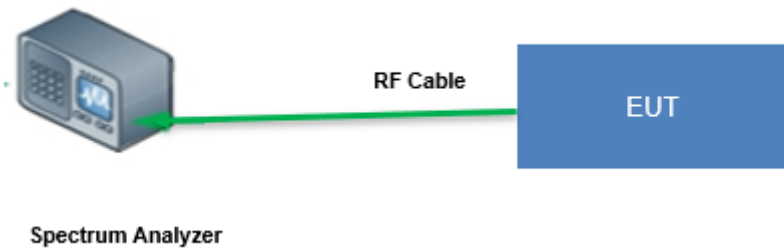


Figure 3-3 – Conducted Test Setup: Antenna Port measurement



## 4 Accreditation, Disclaimers and Copyright

TÜV SÜD America Inc.'s reports apply only to the specific sample tested under stated test conditions. It is the manufacturer's responsibility to assure the continued compliance of production units of this model. TÜV SÜD America, Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD America, Inc.'s issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and TÜV SÜD America, Inc., extracts from the test report shall not be reproduced, except in full without TÜV SÜD America, Inc.'s written approval.

This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the federal government.

### STATEMENT OF MEASUREMENT UNCERTAINTY – Emissions

The expanded laboratory measurement uncertainty figures ( $U_{\text{Lab}}$ ) 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                               | $U_{\text{lab}}$                     |
|-----------------------------------------|--------------------------------------|
| 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 $\leq 1 \text{ GHz}$ | $\pm 5.814 \text{ dB}$               |
| Radiated Emissions $> 1 \text{ GHz}$    | $\pm 4.318 \text{ dB}$               |
| Temperature                             | $\pm 0.860 \text{ }^{\circ}\text{C}$ |
| Radio Frequency                         | $\pm 2.832 \times 10^{-8}$           |
| AC Power Line Conducted Emissions       | $\pm 3.360 \text{ dB}$               |

### 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