

# Report on the Testing of the Mueller MS-H4\_Radio-V2

In accordance with:  
FCC 47 CFR part 15.247  
ISED RSS-247 Issue 4, July 2025

Prepared for: Mueller Systems, LLC  
1200 Abernathy Rd  
Atlanta, GA 30328



America

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A handwritten signature in black ink, appearing to be "Bhagyashree Chaudhary".

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Bhagyashree Chaudhary	Wireless Engineer TUV SUD America Inc.	Authorized Signatory	9/4/2025

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.



A2LA Cert. No. 2955.09

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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	4/22/2022
1	Second Issue	8/14/2025
2	Third Issue – Updated antenna gain information	9/4/2025

## 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 to support a permissive change of 900 MHz radio module when integrated in to host device.

Applicant	David Wentzler
Manufacturer	Mueller Systems, LLC
Applicant's Email Address	<a href="mailto:Dwentzler@muellerwp.com">Dwentzler@muellerwp.com</a>
Model Name/Number(s)	MS-H4_Radio-V2
Serial Number(s)	N/A
Module FCC ID	SM6-LMXR
Module ISED Certification Number	9235A-LMXR
Hardware Version(s)	N/A
Software Version(s)	N/A
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 4, July 2025.
Order Number	72176786
Date of Receipt of EUT	3/7/2022



Start of Test	4/14/2022
Finish of Test	4/18/2022
Related Document(s)	<p>ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Device.</p> <p>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</p> <p>US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2025.</p> <p>ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5, Amendment 1 (March 2019), Amendment 2 (February 2021)</p>



### 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	-----	10
Carrier Frequency Separation	No	Not Tested	15.247(a)(1)	RSS-247 5.1(b)	-----
Number of Hopping Channels	No	Not Tested	15.247(a)(1)(i)	RSS-247 5.1(c)	-----
Channel Dwell Time (FHSS / Hybrid)	No	Not Tested	15.247(a)(1)(i) 15.247(f)	RSS-247 5.1(c) RSS-247 5.3(a)	-----
20 dB Bandwidth	No	Not Tested	15.247(a)(1)(i)	RSS-247 5.1(c)	-----
99% Bandwidth	No	Not Tested	-----	RSS-GEN 6.7	-----
Peak Output Power	Yes	Pass	15.247(b)(2)	RSS-247 5.4(a)	11
Band-Edge Compliance of RF Conducted Emissions	No	Not Tested	15.247(d)	RSS-247 5.5	-----
RF Conducted Spurious Emissions	No	Not Tested	15.247(d)	RSS-247 5.5	-----
Radiated Spurious Emissions into Restricted Frequency Bands	Yes	Pass	15.205, 15.209	RSS-GEN 8.9, 8.10	13
Power Spectral Density (Hybrid)	No	Not Tested	15.247(e)	RSS-247 5.2(b)	-----
Power Line Conducted Emissions	No	Not Tested	15.207	RSS-GEN 8.8	-----
Duty Cycle	No	-----			-----

## 1.4 Product Information

### 1.4.1 Technical Description

MS-H4\_RADIO-V2 is a Node installation tool that operates between a smart device using BT module and the 900 MHz modem in the Node.

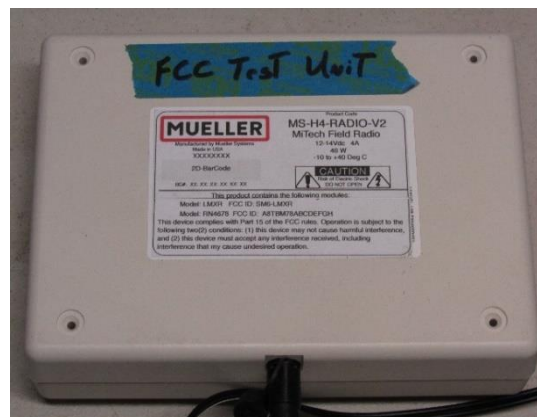
**Table 1.4.1-1 – Wireless Technical Information**

Detail	Description
900MHz Module FCC ID	SM6-LMXR
900MHz Module IC ID	9235A-LMXR
Host Transceiver Model #	MS-H4_RADIO-V2
Modulation Format	FHSS, DSSS
Antenna Type / Description:	PCB Trace Antenna / 4.8 dBi

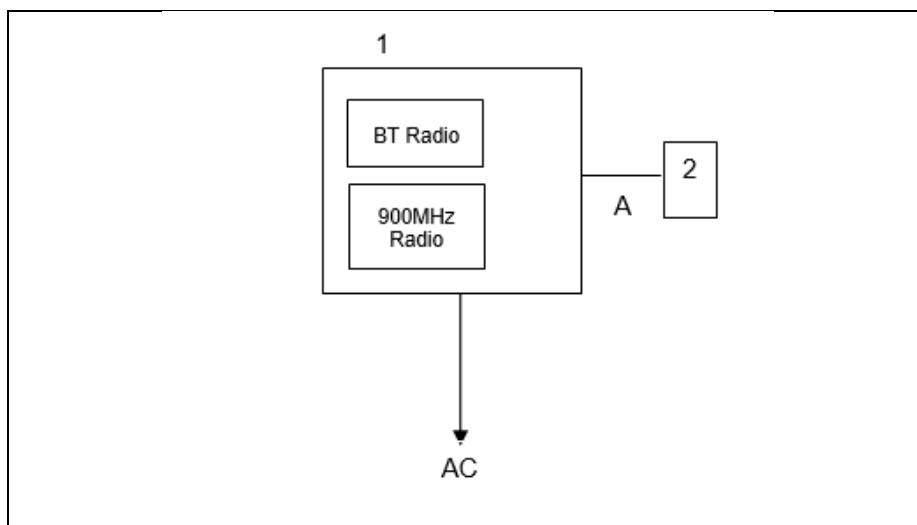
A full description and detailed product specification details are available from the manufacturer.



**Figure 1.4.1-1 –Front view of the EUT**



**Figure 1.4.1-2 – Back view of the EUT**

**Figure 1.4.1-3 – Test Setup Block Diagram****Table 1.4.1-2 – Cable Descriptions**

Item	Cable/Port	Description
A	USB Cable	Programming Cable

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

Item	Make/Model	Description
1	MS-H4_Radio-V2	MiTech Field Radio
2	Lenovo	Laptop used for configuring wireless module



#### 1.4.2 Modes of Operation

This test report documents the compliance of 900 MHz FHSS mode of operation on all 3 channels.

Mode of Operation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Stack / Mode	Data Rates Supported (kbps)
1	912.3100 – 927.012	50	300	FHSS / DSSS	2604bps, 4557bps

#### 1.4.3 Monitoring of Performance

For radiated emissions, the EUT was evaluated in an orientation of typical use. See test setup photos for more information. The EUT was programmed to generate a continuously modulated signal on each channel evaluated.

For RF Conducted peak power measurements, the EUT was connected to the test equipment with an MMCX to SMA connector. The EUT was programmed to generate a continuously modulated signal.

Test case	Modulation / Data rate	Tested Frequency (MHz)
Peak output power	FHSS / 4557bps	912.3100 – 919.511 – 927.012
Radiated spurious emissions	FHSS / 4577bps	912.3100 – 919.511 – 927.012

Power setting during test: GFSK: Default EUT Setting

#### 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
Peak Output Power	Divya Adusumilli	A2LA
Radiated Spurious Emissions into Restricted Frequency Bands	Bhagyashree Chaudhary	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

#### 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

4/14/2022

#### 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 module utilizes a PCB Trace antenna with 4.8 dBi gain. Therefore, satisfying the requirements of Section 15.203.



## **2.2 Peak Output Power**

### **2.2.1 Specification Reference**

FCC Sections: 15.247(b)(2)  
ISED Canada: RSS-247 5.4(a)

### **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**

4/18/2022

### **2.2.4 Test Method**

The maximum conducted peak output power was measured in accordance with ANSI C63.10 Subclause 7.8.5 Method PKPM (Peak Power meter). The RF output port of the EUT was directly connected to the input of a peak power meter. The resulting peak value was recorded.

### **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**

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

**Test Results:** Pass

See data below for detailed results.

**Table 2.2.6-1: RF Output Power - FHSS**

<b>Frequency [MHz]</b>	<b>Peak Output Power (dBm)</b>	<b>Data Rate (bps)</b>
912.31	26	4557
919.511	26	4557
927.012	26	4557



## **2.3 Radiated Spurious Emissions into Restricted Frequency Bands**

### **2.3.1 Specification Reference**

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

### **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**

04/14/2022 to 04/18/2022

### **2.3.4 Test Method**

Radiated emissions tests were made over the frequency range of 9 kHz to 10 GHz, 10 times the highest fundamental frequency of 900 MHz. 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.

### **2.3.5 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: Radiated Spurious Emissions Tabulated Data – LCH**

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg		pk	Qpk/Avg	pk	Qpk/Avg
LCH							
33.731	-----	19.502	H	-----	40.000	-----	20.500
71.465	-----	15.771	H	-----	40.000	-----	24.230
133.816	-----	13.526	H	-----	43.500	-----	29.970
173.462	-----	20.686	H	-----	43.500	-----	22.810
265.659	-----	21.491	H	-----	46.000	-----	24.510
656.255	-----	19.699	H	-----	46.000	-----	26.300
2736.825	51.266	42.321	H	74.000	54.000	22.730	11.680
3649.125	50.286	38.415	H	74.000	54.000	23.710	15.590
4561.800	52.124	40.055	H	74.000	54.000	21.880	13.940
6386.245	54.837	40.179	H	74.000	54.000	19.160	13.820
7298.730	54.256	40.149	H	74.000	54.000	19.740	13.850
30.922	-----	25.558	V	-----	40.000	-----	14.440
46.102	-----	22.271	V	-----	40.000	-----	17.730
74.475	-----	19.876	V	-----	40.000	-----	20.120
172.638	-----	25.898	V	-----	43.500	-----	17.600
264.012	-----	23.189	V	-----	46.000	-----	22.810
840.581	-----	25.288	V	-----	46.000	-----	20.710
1120.775	40.718	26.027	V	74.000	54.000	33.280	27.970
2736.500	51.366	39.501	V	74.000	54.000	22.630	14.500
4561.600	50.516	37.252	V	74.000	54.000	23.480	16.750
6386.550	54.831	41.022	V	74.000	54.000	19.170	12.980
7298.580	53.738	40.104	V	74.000	54.000	20.260	13.900
8210.680	55.465	41.453	V	74.000	54.000	18.540	12.550
9123.075	58.377	44.320	V	74.000	54.000	15.620	9.680



Table 2.3.6-2: Radiated Spurious Emissions Tabulated Data - MCH

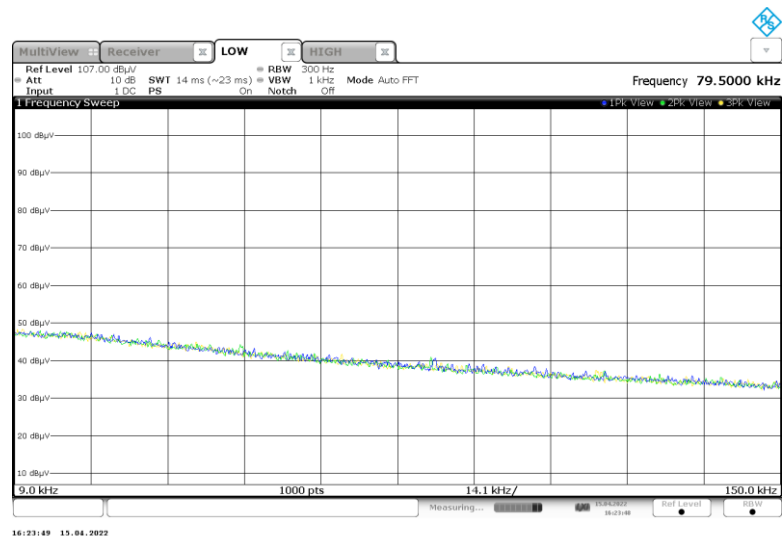
Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg		pk	Qpk/Avg	pk	Qpk/Avg
MCH							
31.943	-----	19.003	H	-----	40.000	-----	21.000
99.718	-----	10.705	H	-----	43.500	-----	32.790
172.612	-----	19.775	H	-----	43.500	-----	23.720
264.837	-----	21.882	H	-----	46.000	-----	24.120
580.861	-----	15.537	H	-----	46.000	-----	30.460
753.864	-----	17.619	H	-----	46.000	-----	28.380
1339.950	43.421	29.393	H	74.000	54.000	30.580	24.610
2758.175	50.419	39.103	H	74.000	54.000	23.580	14.900
3677.825	49.492	37.439	H	74.000	54.000	24.510	16.560
5790.975	59.111	38.009	H	74.000	54.000	14.890	15.990
7425.550	54.407	40.406	H	74.000	54.000	19.590	13.590
9847.350	58.083	44.319	H	74.000	54.000	15.920	9.680
31.000	-----	24.141	V	-----	40.000	-----	15.860
41.155	-----	21.317	V	-----	40.000	-----	18.680
71.564	-----	21.598	V	-----	40.000	-----	18.400
172.347	-----	23.032	V	-----	43.500	-----	20.470
281.230	-----	23.111	V	-----	46.000	-----	22.890
554.625	-----	14.999	V	-----	46.000	-----	31.000
1268.065	43.136	28.688	V	74.000	54.000	30.860	25.310
1340.850	43.717	28.666	V	74.000	54.000	30.280	25.330
2758.575	53.609	45.240	V	74.000	54.000	20.390	8.760
4597.550	50.218	39.066	V	74.000	54.000	23.780	14.930
5783.775	59.101	37.881	V	74.000	54.000	14.900	16.120
6436.175	54.792	41.173	V	74.000	54.000	19.210	12.830



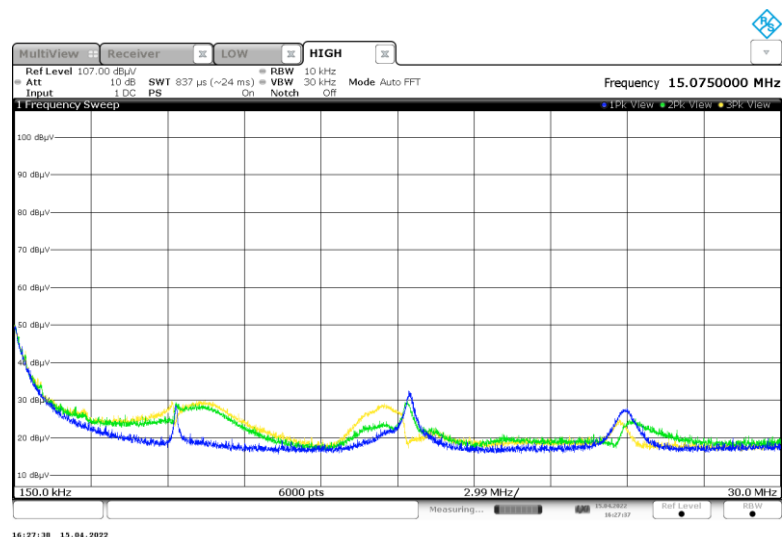
Table 2.3.6-3: Radiated Spurious Emissions Tabulated Data – HCH

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg		pk	Qpk/Avg	pk	Qpk/Avg
HCH							
32.666	-----	19.903	H	-----	40.000	-----	20.100
72.339	-----	13.212	H	-----	40.000	-----	26.790
173.732	-----	23.580	H	-----	43.500	-----	19.920
265.637	-----	21.160	H	-----	46.000	-----	24.840
546.086	-----	14.808	H	-----	46.000	-----	31.190
1165.175	42.630	28.500	H	74.000	54.000	31.370	25.500
1261.525	42.908	28.985	H	74.000	54.000	31.090	25.020
2780.900	50.815	41.175	H	74.000	54.000	23.190	12.830
3708.550	49.821	34.754	H	74.000	54.000	24.180	19.250
4635.050	52.080	41.013	H	74.000	54.000	21.920	12.990
9705.350	59.314	45.180	H	74.000	54.000	14.690	8.820
31.261	-----	27.396	V	-----	40.000	-----	12.600
41.834	-----	25.918	V	-----	40.000	-----	14.080
72.195	-----	23.218	V	-----	40.000	-----	16.780
172.833	-----	21.336	V	-----	43.500	-----	22.160
281.182	-----	19.343	V	-----	46.000	-----	26.660
702.841	-----	15.370	V	-----	46.000	-----	30.630
1212.875	43.130	27.873	V	74.000	54.000	30.870	26.130
1422.600	43.037	28.335	V	74.000	54.000	30.960	25.670
2781.175	51.566	41.635	V	74.000	54.000	22.430	12.360
3707.850	49.977	36.287	V	74.000	54.000	24.020	17.710
4634.975	51.827	40.250	V	74.000	54.000	22.170	13.750
9600.100	58.732	44.915	V	74.000	54.000	15.270	9.080





**Figure 1: Reference plot for Radiated Spurious Emissions – 9 kHz – 150 kHz – H & V Polarity-LCH**



**Figure 2: Reference plot for Radiated Spurious Emissions– 150 kHz – 30MHz - H & V Polarity-LCH**

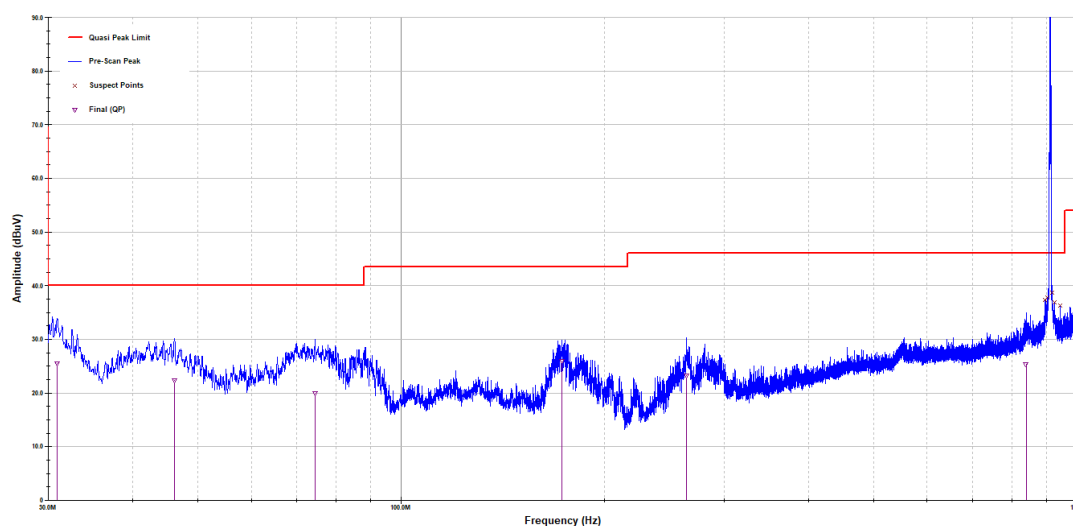
Note: Emissions above the noise floor are ambient and not associated with the EUT.



FCC 15 209 RSE 30-1000MHz BSAC :2022-03-11-LCH.tif

Last Data Update 03:25:19 PM, Thursday, April 14, 2022

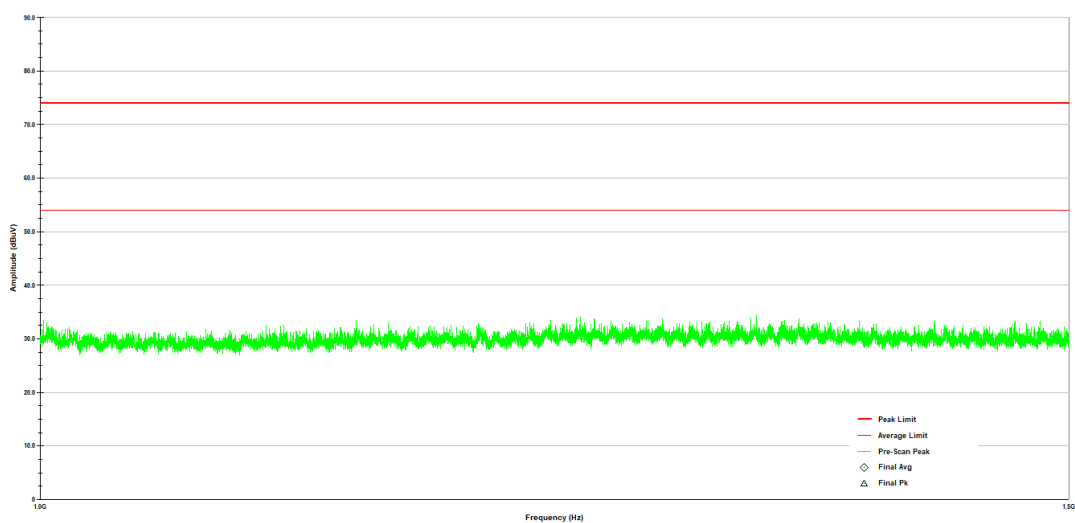
**Figure 3: Reference Plot for Radiated Spurious Emissions – 30 MHz – 1 GHz – H Polarity-LCH**  
Note: Peak above the limit line is fundamental frequency.



FCC 15 209 RSE 30-1000MHz BSAC :2022-03-11-LCH.tif

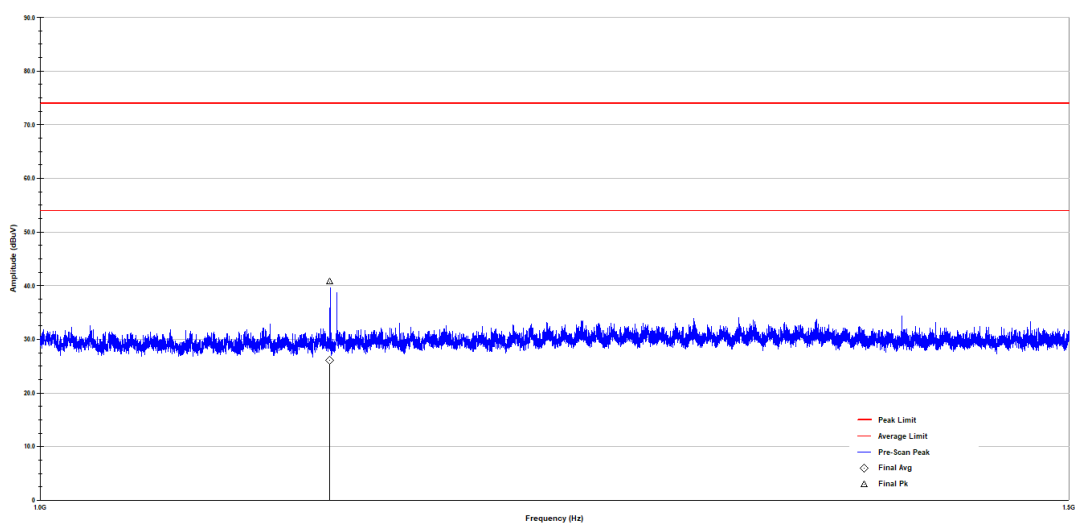
Last Data Update 03:18:02 PM, Thursday, April 14, 2022

**Figure 4: Reference Plot for Radiated Spurious Emissions – 30 MHz – 1 GHz – V Polarity- LCH**  
Note: Peak above the limit line is fundamental frequency.



FCC 15 209 RSE 1-1.5GHz BSAC :2022-03-11-LCH.BI

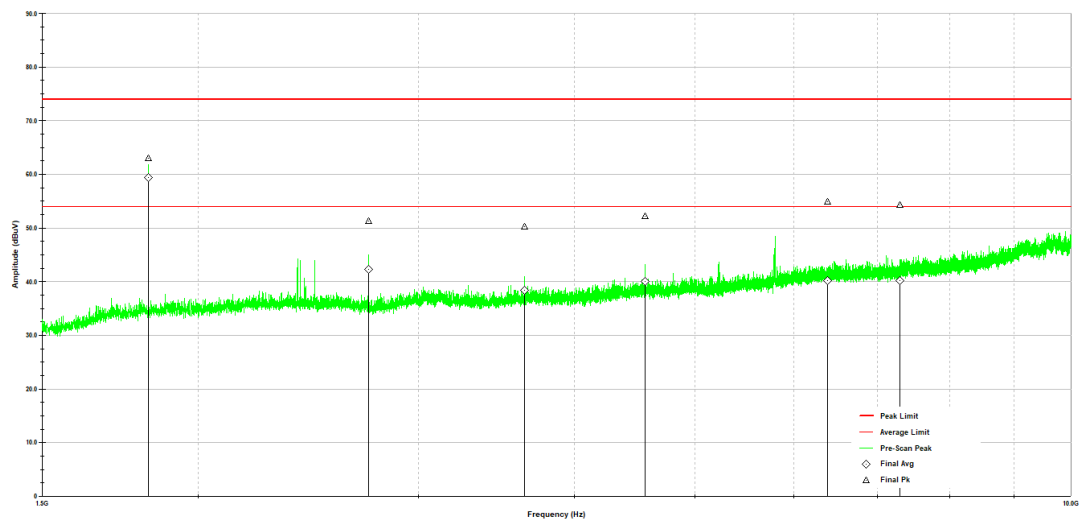
Last Data Update 10:59:10 AM, Friday, April 15, 2022

**Figure 5: Reference plot for Radiated Spurious Emissions – 1 GHz – 1.5 GHz – H Polarity - LCH**

FCC 15 209 RSE 1-1.5GHz BSAC :2022-03-11-LCH.BI

Last Data Update 10:59:01 AM, Friday, April 15, 2022

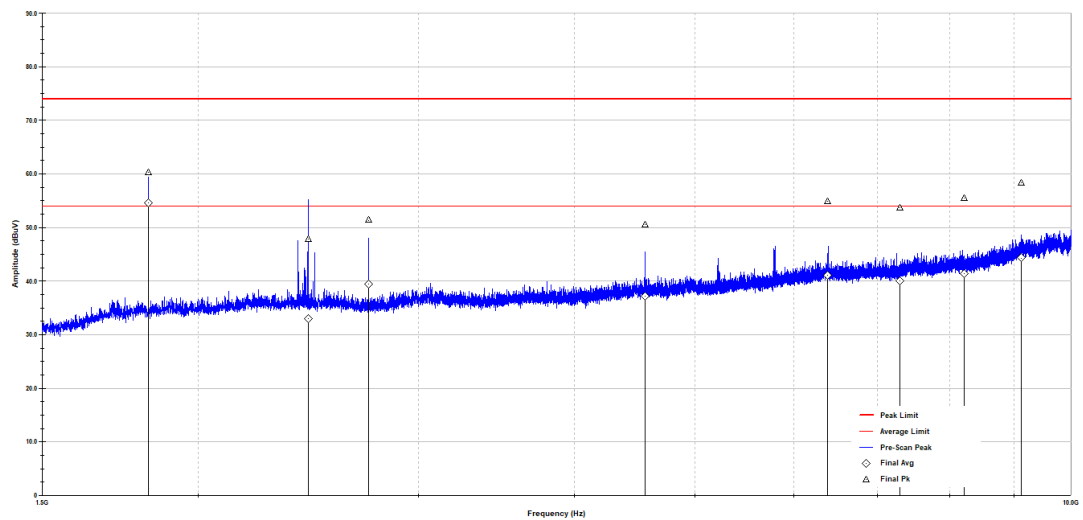
**Figure 6: Reference plot for Radiated Spurious Emissions – 1 GHz – 1.5 GHz – V Polarity – LCH**



FCC 15 209 RSE 1.5-10GHz BSAC v2022-03-11 LCH.BI

Last Data Update 11:42:26 AM, Friday, April 15, 2022

**Figure 7: Reference plot for Radiated Spurious Emissions – 1.5 GHz – 10 GHz – H Polarity – LCH**  
Note: Radiated spurious with in restricted bands only were evaluated.



FCC 15 209 RSE 1.5-10GHz BSAC v2022-03-11 LCH.BI

Last Data Update 11:30:25 AM, Friday, April 15, 2022

**Figure 8: Reference plot for Radiated Spurious Emissions – 1.5 GHz – 10 GHz – V Polarity – LCH**  
Note: Radiated spurious with in restricted bands only were evaluated.



## 2.4 Test Equipment Used

**Table 2.4-1 –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	06/08/2021	06/08/2023
3161	Ametek CTS Germany GmbH	CBL 6112D	BiLog Antenna	51323	03/19/2021	03/19/2023
884	ETS Lindgren (EMCO)	3117	DOUBLE-RIDGED GUIDE ANTENNA	00240106	05/06/2021	05/06/2022
213	TEC	PA 102	Amplifier	44927	07/30/2021	07/30/2022
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	06/22/2021	06/22/2023
882	Rohde & Schwarz	ESW44	ESW44 EMI TEST RECEIVER	101961	06/24/2021	06/24/2022
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	05/11/2021	05/11/2022
331	Microwave Circuits	H1G513G1	Microwave Bandpass Filter	31417	06/09/2021	06/09/2022
622	Rohde & Schwarz	FSV40 (v3.40)	FSV Signal Analyzer 10Hz to 40GHz	101338	09/22/2021	09/22/2022
267	Hewlett Packard	N1911A	Power Meter	MY45100129	07/27/2021	07/27/2023

**N/A – Not Applicable**

### 3 Diagram of Test Set-ups

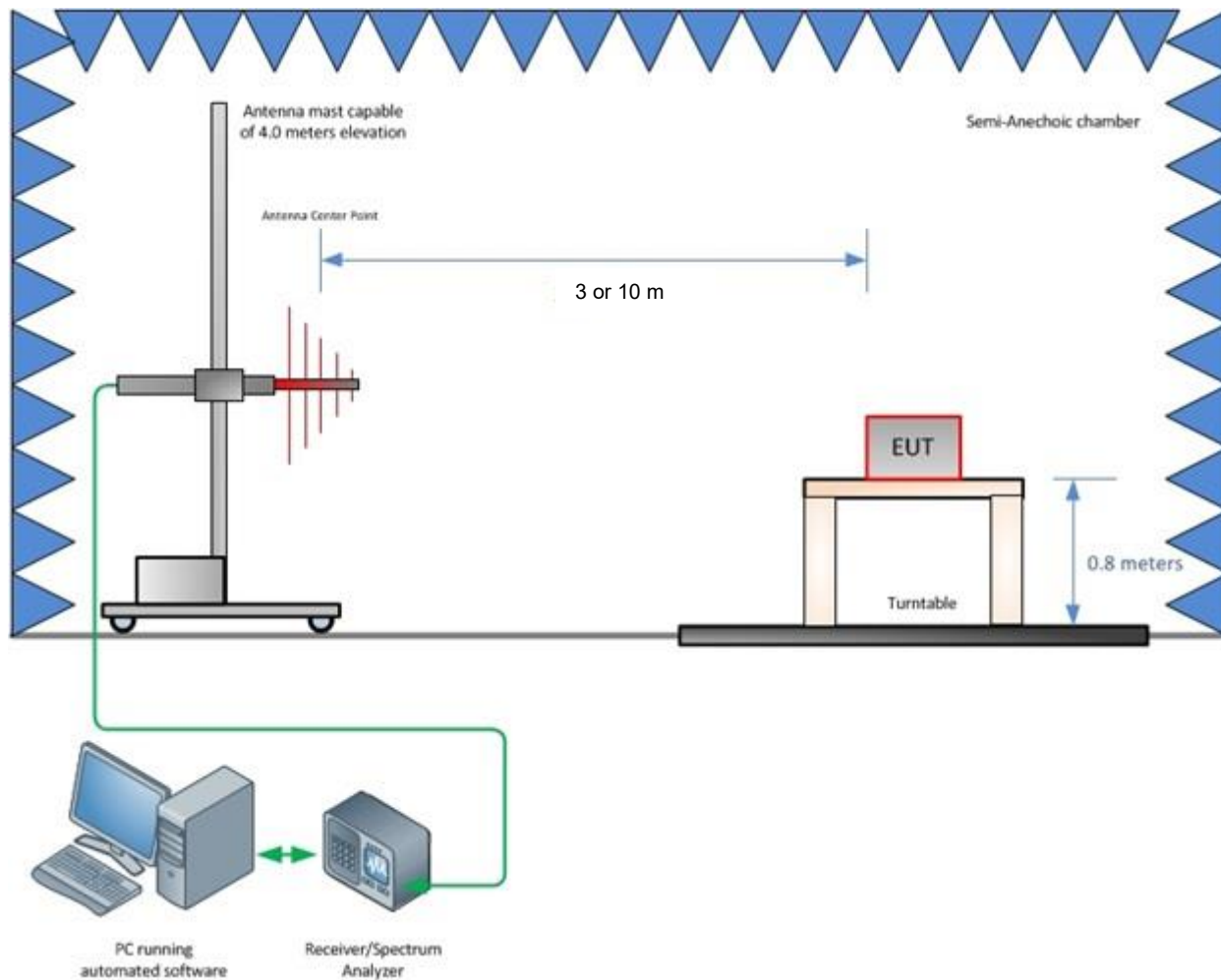
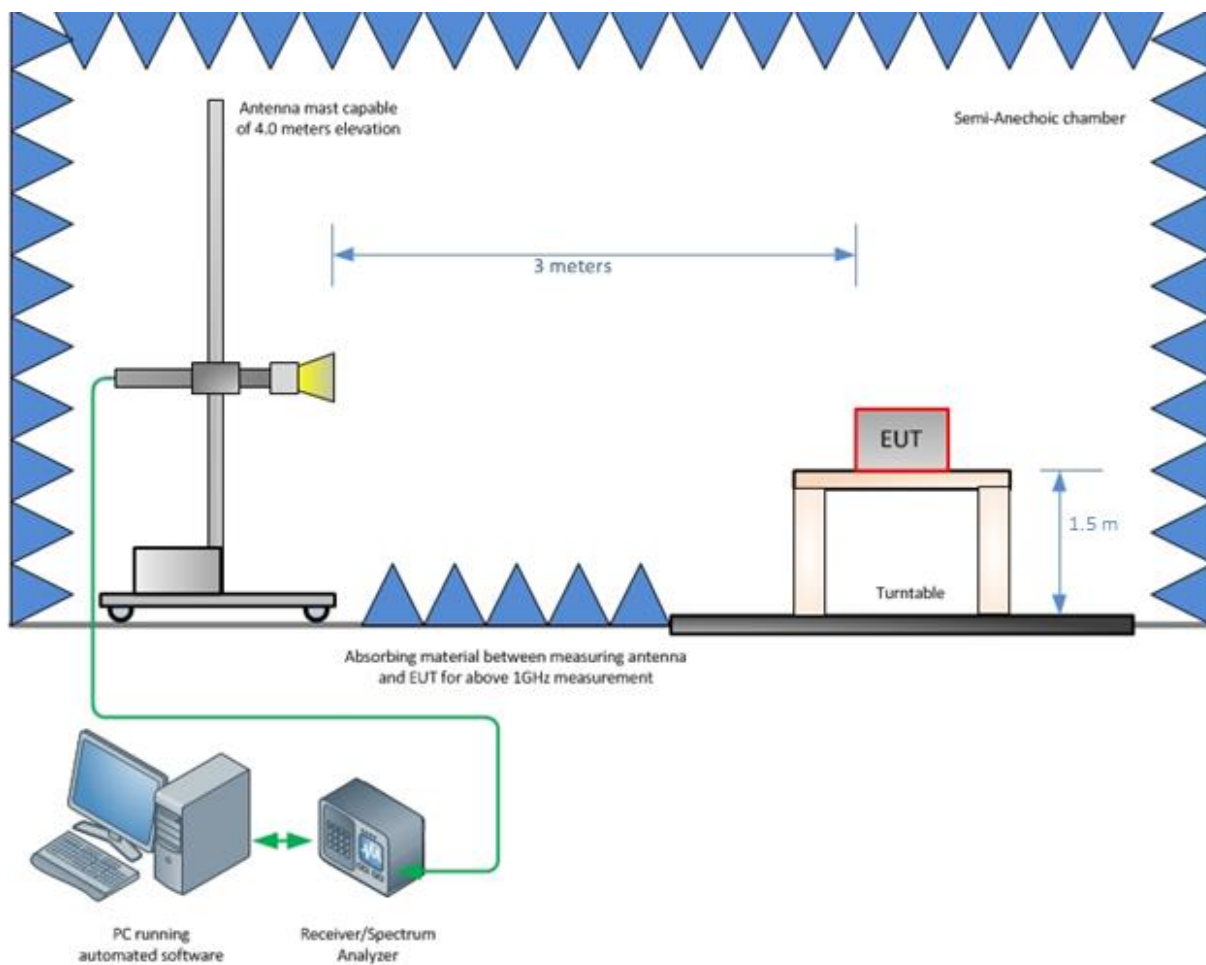
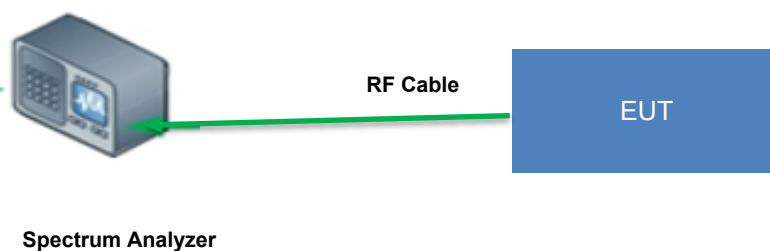


Figure 3-1 – Radiated Emissions Test Setup up to 1 GHz



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



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



## 4 Accreditation, Disclaimers and Copyright

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### STATEMENT OF MEASUREMENT UNCERTAINTY

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	$U_{\text{lab}}$
RF Conducted Output Power	$\pm 0.349$ dB
Radiated Emissions $\leq 1$ GHz	$\pm 5.814$ dB
Radiated Emissions $> 1$ GHz	$\pm 4.318$ dB
Temperature	$\pm 0.860$ °C
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	$\pm 3.360$ dB

### TEST EQUIPMENT

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