

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
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Atlanta, GA 30328



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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

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

EXECUTIVE SUMMARY

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



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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	Dwentzler@muellerwp.com
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)

ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Device.

FCC OET KDB 558074 D01 15.247 Meas Guidance v05r02: Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of the FCC Rules, April 2, 2019

US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2025.

ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5, Amendment 1 (March 2019), Amendment 2 (February 2021)



1.3 Brief Summary of Results

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

Table 1.3-1: Test Result Summary

Test Parameter	Test Plan (Yes/No)	Test Result	FCC 47 CFR Rule Part	ISED Canada's RSS	Test Report Page No
Antenna Requirement	Yes	Pass	15.203	-----	10
6 dB Bandwidth	No	Not Tested	15.247(a)(2)	RSS-247 5.2(a)	-----
99% Bandwidth	No	Not Tested	-----	RSS-GEN 6.7	-----
Avg Output Power	Yes	Pass	15.247(b)(3)	RSS-247 5.4(d)	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	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	DTS / 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

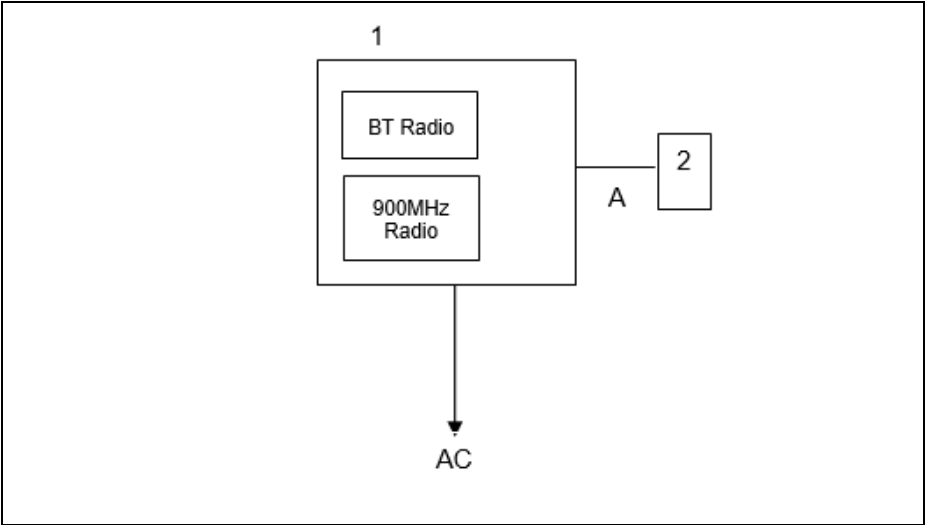


Figure 1.4.1-3 – Test Setup Block Diagram

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 DTS 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	903.649 – 915.725	24	525	DTS / DSSS	10416.7bps

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)
Avg output power	DTS / 10416.7bps	903.649 – 909.950 – 915.725
Radiated spurious emissions	DTS / 10416.7bps	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 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
Avg 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 Average Output Power

2.2.1 Specification Reference

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

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

12/21/2021

2.2.4 Test Method

The Average conducted output power was measured in accordance with ANSI C63.10 Subclause 11.9.2.3.1 Method AVGPM (Average Power Meter). The RF output port of the EUT was directly connected to the input of an Average power meter. The resulting average 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

Frequency [MHz]	Average Output Power (dBm)	Data Rate (bps)
903.649	25.35	10416
909.95	24.42	10416
915.725	24.6	10416



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							
31.671	-----	19.218	H	-----	40.000	-----	20.780
67.563	-----	10.063	H	-----	40.000	-----	29.940
140.189	-----	15.862	H	-----	43.500	-----	27.640
185.688	-----	19.989	H	-----	43.500	-----	23.510
264.476	-----	20.110	H	-----	46.000	-----	25.890
549.069	-----	16.386	H	-----	46.000	-----	29.610
1254.175	43.543	29.459	H	74.000	54.000	30.460	24.540
2425.575	67.218	34.228	H	74.000	54.000	6.780	19.770
6432.600	52.773	39.255	H	74.000	54.000	21.230	14.750
30.534	-----	29.130	V	-----	40.000	-----	10.870
45.763	-----	23.988	V	-----	40.000	-----	16.010
79.082	-----	24.007	V	-----	40.000	-----	15.990
176.906	-----	24.204	V	-----	43.500	-----	19.300
256.447	-----	22.650	V	-----	46.000	-----	23.350
848.971	-----	20.831	V	-----	46.000	-----	25.170
1301.025	44.210	29.315	V	74.000	54.000	29.790	24.680
2710.225	47.109	34.686	V	74.000	54.000	26.890	19.310
6325.125	53.168	39.643	V	74.000	54.000	20.830	14.360
9142.750	58.391	44.386	V	74.000	54.000	15.610	9.610

**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							
34.319	-----	18.519	H	-----	40.000	-----	21.480
71.058	-----	12.192	H	-----	40.000	-----	27.810
137.479	-----	16.150	H	-----	43.500	-----	27.350
175.357	-----	21.364	H	-----	43.500	-----	22.140
265.033	-----	21.928	H	-----	46.000	-----	24.070
555.354	-----	15.943	H	-----	46.000	-----	30.060
1348.525	44.200	29.769	H	74.000	54.000	29.800	24.230
2729.775	50.427	35.472	H	74.000	54.000	23.570	18.530
3639.775	48.584	35.055	H	74.000	54.000	25.420	18.940
4548.740	49.870	35.931	H	74.000	54.000	24.130	18.070
5461.275	52.091	37.320	H	74.000	54.000	21.910	16.680
31.067	-----	29.549	V	-----	40.000	-----	10.450
45.132	-----	23.446	V	-----	40.000	-----	16.550
78.112	-----	24.548	V	-----	40.000	-----	15.450
177.000	-----	25.788	V	-----	43.500	-----	17.710
371.537	-----	18.927	V	-----	46.000	-----	27.070
738.391	-----	17.211	V	-----	46.000	-----	28.790
1189.800	43.507	28.561	V	74.000	54.000	30.490	25.440
2729.625	52.952	37.128	V	74.000	54.000	21.050	16.870
3640.050	49.145	34.927	V	74.000	54.000	24.850	19.070
4549.850	50.506	35.899	V	74.000	54.000	23.490	18.100
9682.475	59.224	45.372	V	74.000	54.000	14.780	8.630

**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						
31.646	-----	18.978	H	-----	40.000	-----	21.020
75.080	-----	12.218	H	-----	40.000	-----	27.780
129.157	-----	15.091	H	-----	43.500	-----	28.410
184.181	-----	20.656	H	-----	43.500	-----	22.840
265.104	-----	18.109	H	-----	46.000	-----	27.890
975.775	-----	21.875	H	-----	54.000	-----	32.130
1348.525	44.200	29.769	H	74.000	54.000	29.800	24.230
2747.500	51.550	35.713	H	74.000	54.000	22.450	18.290
3662.900	48.498	35.175	H	74.000	54.000	25.500	18.830
4578.000	50.111	36.258	H	74.000	54.000	23.890	17.740
5747.525	60.661	37.916	H	74.000	54.000	13.340	16.080
30.534	-----	28.109	V	-----	40.000	-----	11.890
39.069	-----	23.162	V	-----	40.000	-----	16.840
71.564	-----	23.929	V	-----	40.000	-----	16.070
189.468	-----	22.770	V	-----	43.500	-----	20.730
261.345	-----	20.848	V	-----	46.000	-----	25.150
844.606	-----	25.049	V	-----	46.000	-----	20.950
1189.800	43.507	28.561	V	74.000	54.000	30.490	25.440
2747.175	48.800	34.210	V	74.000	54.000	25.200	19.790
4561.450	50.164	35.698	V	74.000	54.000	23.840	18.300
6411.425	53.339	39.340	V	74.000	54.000	20.660	14.660
7298.630	53.447	39.776	V	74.000	54.000	20.550	14.220

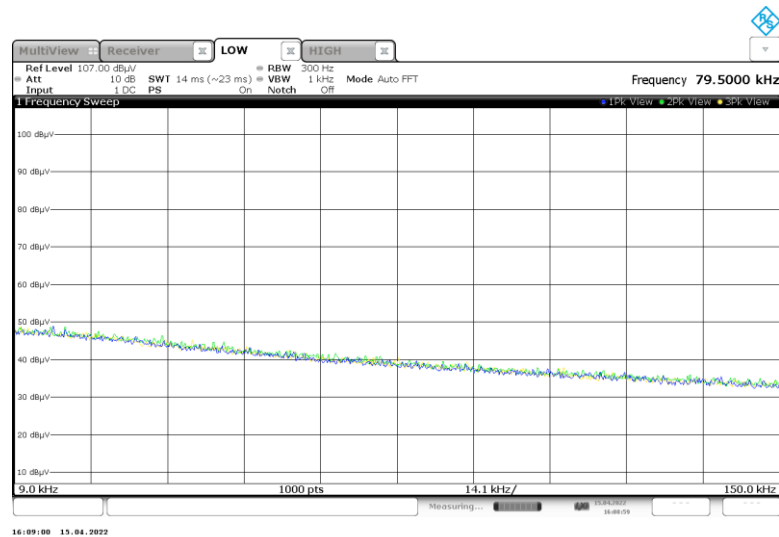


Figure 1: Reference plot for Radiated Spurious Emissions – 9 kHz – 150 kHz – H & V Polarity-LCH

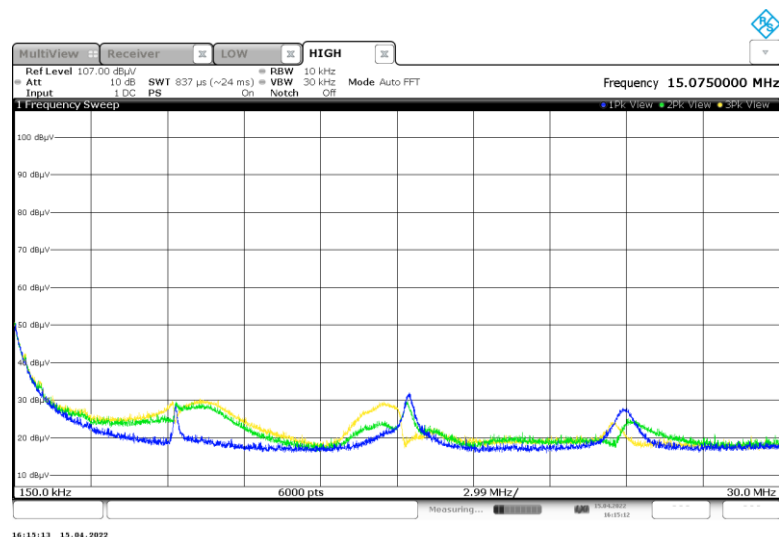
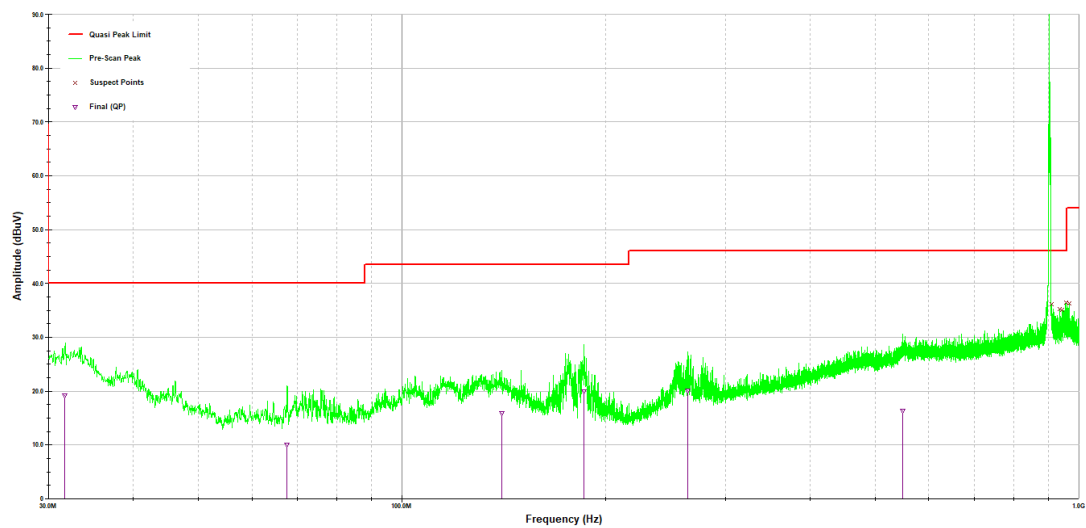


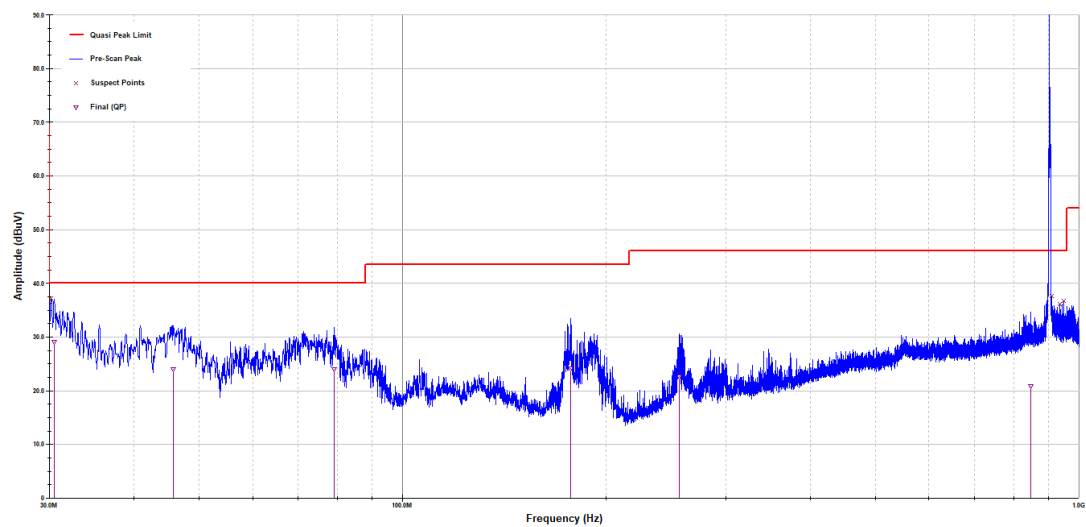
Figure 2: Reference plot for Radiated Spurious Emissions– 150 kHz – 30MHz - H & V Polarity-LCH
Note: Emissions above the noise floor are ambient and not associated with the EUT.



FCC 15 209 RSE 30-1000MHz BSAC (2022-03-11-LCH.ttl)

Last Data Update 08:39:45 AM, Friday, April 15, 2022

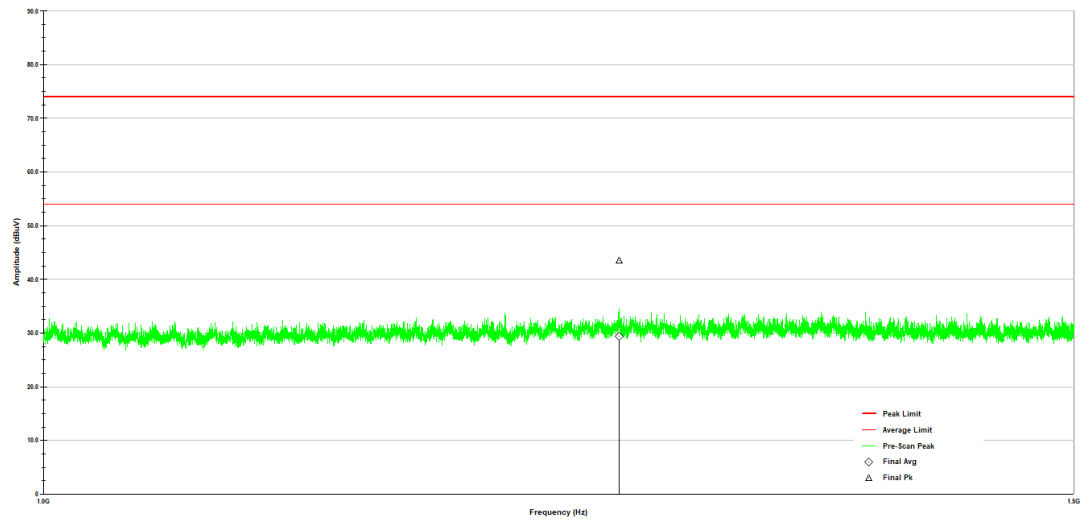
Figure 3: Reference Plot for Radiated Spurious Emissions – 30 MHz – 1 GHz – H Polarity-LCH
Note: Peak above the limit line is fundamental frequency.



FCC 15 209 RSE 30-1000MHz BSAC (2022-03-11-LCH.ttl)

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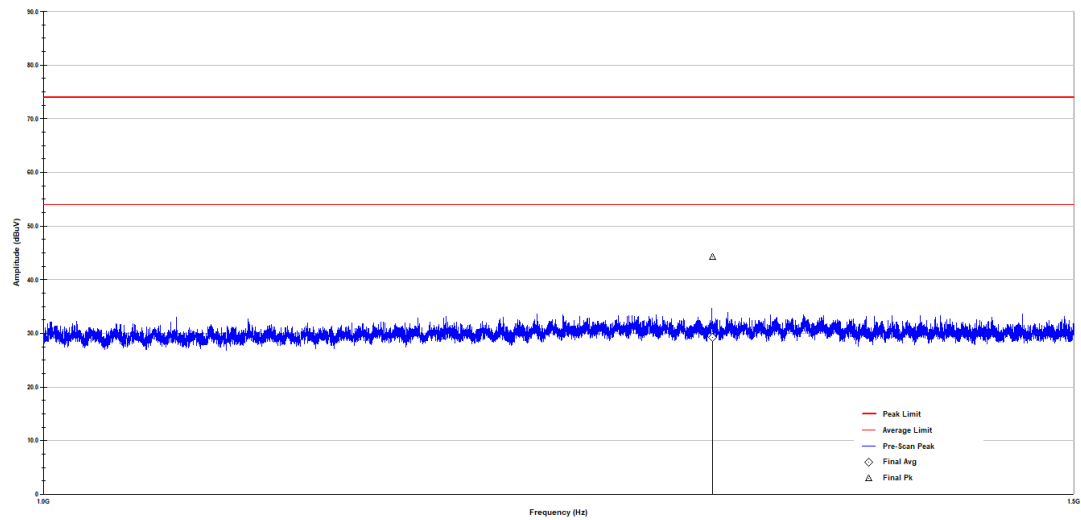
Figure 4: Reference Plot for Radiated Spurious Emissions – 30 MHz – 1 GHz – V Polarity- LCH
Note: Peak above the limit line is fundamental frequency.



FCC 15 209 RSE 1-1.5GHz BSAC v2022-03-11-LCH.BI

Last Data Update 03:40:21 PM, Friday, April 15, 2022

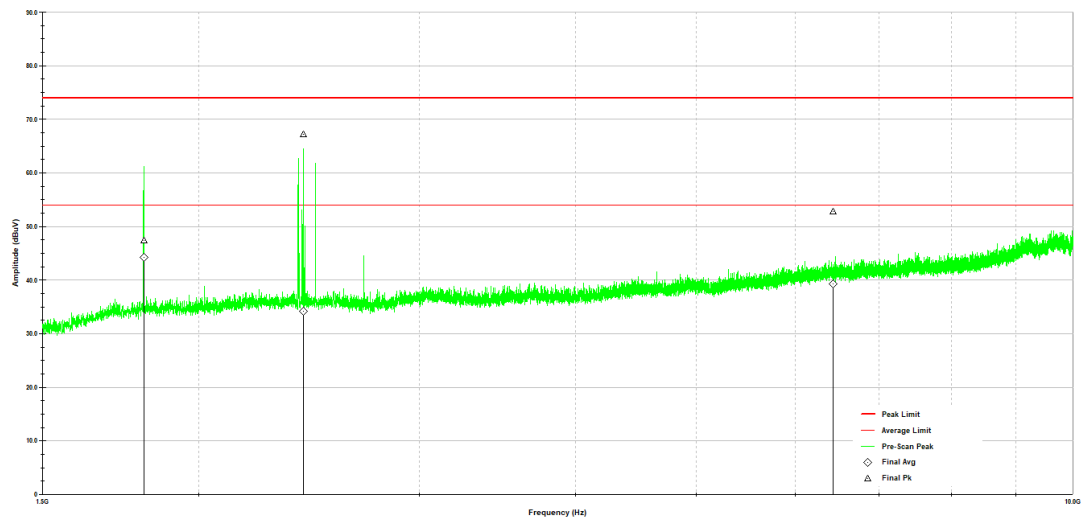
Figure 5: Reference plot for Radiated Spurious Emissions – 1 GHz – 1.5 GHz – H Polarity - LCH



FCC 15 209 RSE 1-1.5GHz BSAC v2022-03-11-LCH.BI

Last Data Update 03:38:42 PM, Friday, April 15, 2022

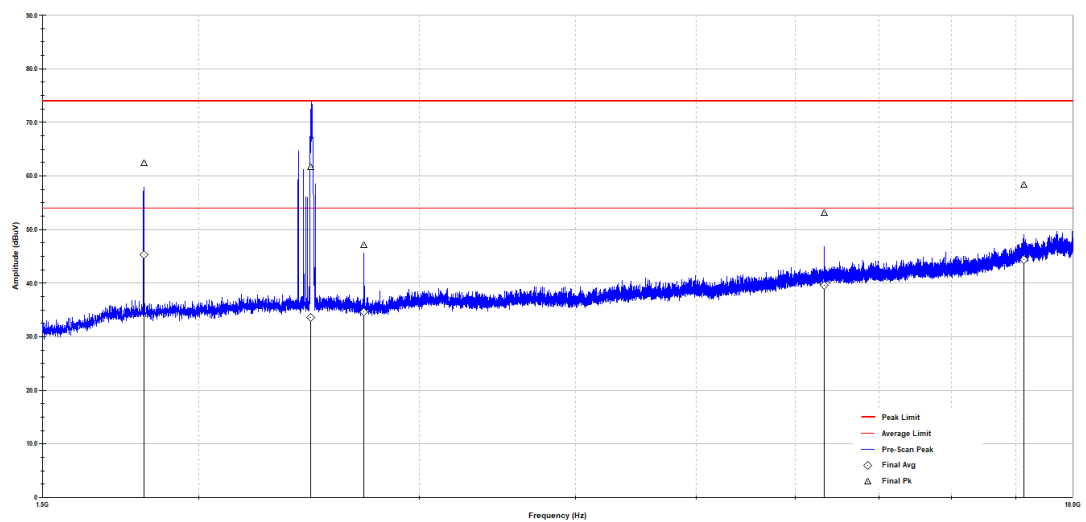
Figure 6: Reference plot for Radiated Spurious Emissions – 1 GHz – 1.5 GHz – V Polarity - LCH



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

Last Data Update 03:27:25 PM, Friday, April 15, 2022

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



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

Last Data Update 03:21:00 PM, Friday, April 15, 2022

Figure 8: Reference plot for Radiated Spurious Emissions – 1.5 GHz – 10 GHz – V Polarity – LCH
Note: Radiated spurious emissions 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

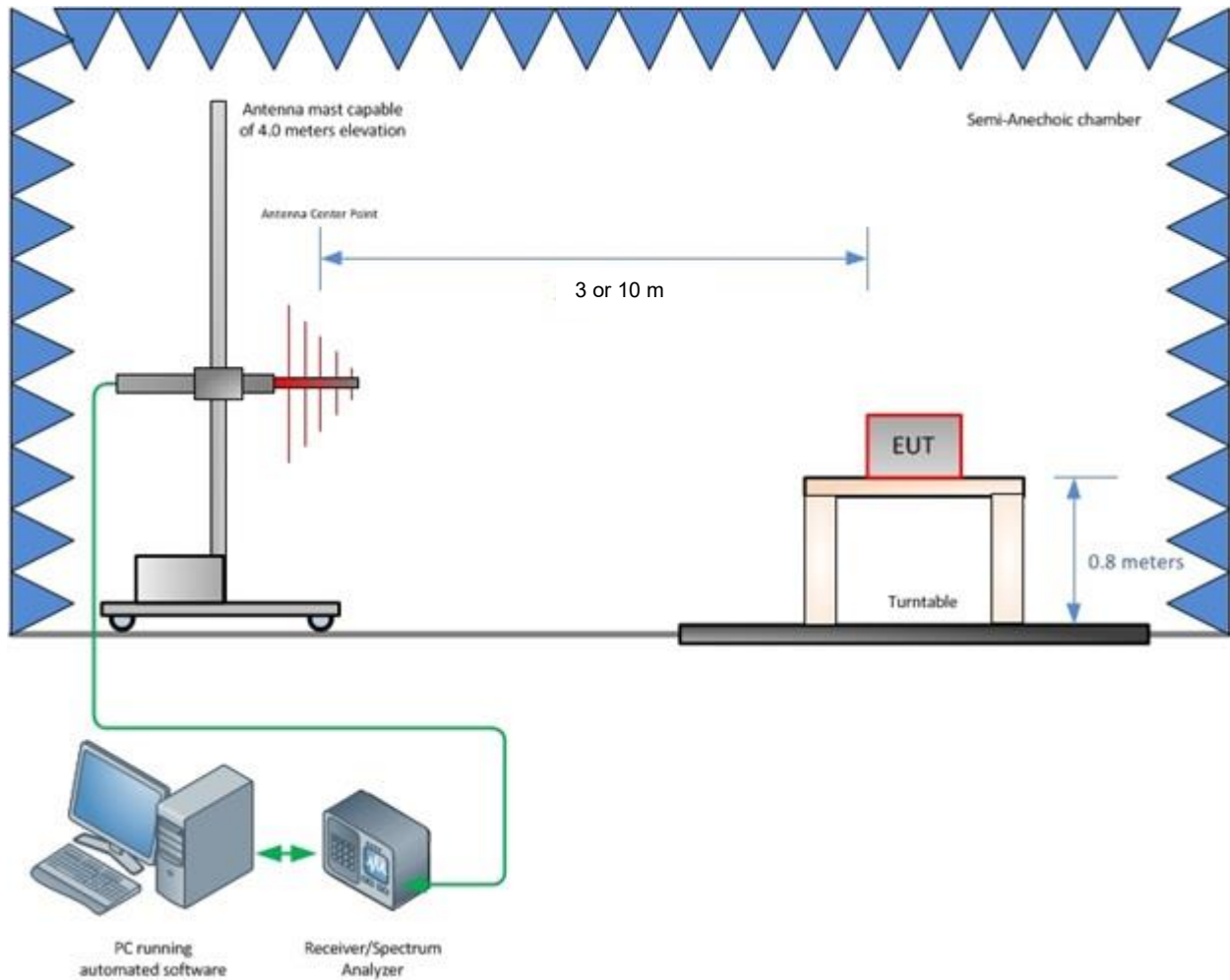


Figure 3-1 – Radiated Emissions Test Setup up to 1 GHz

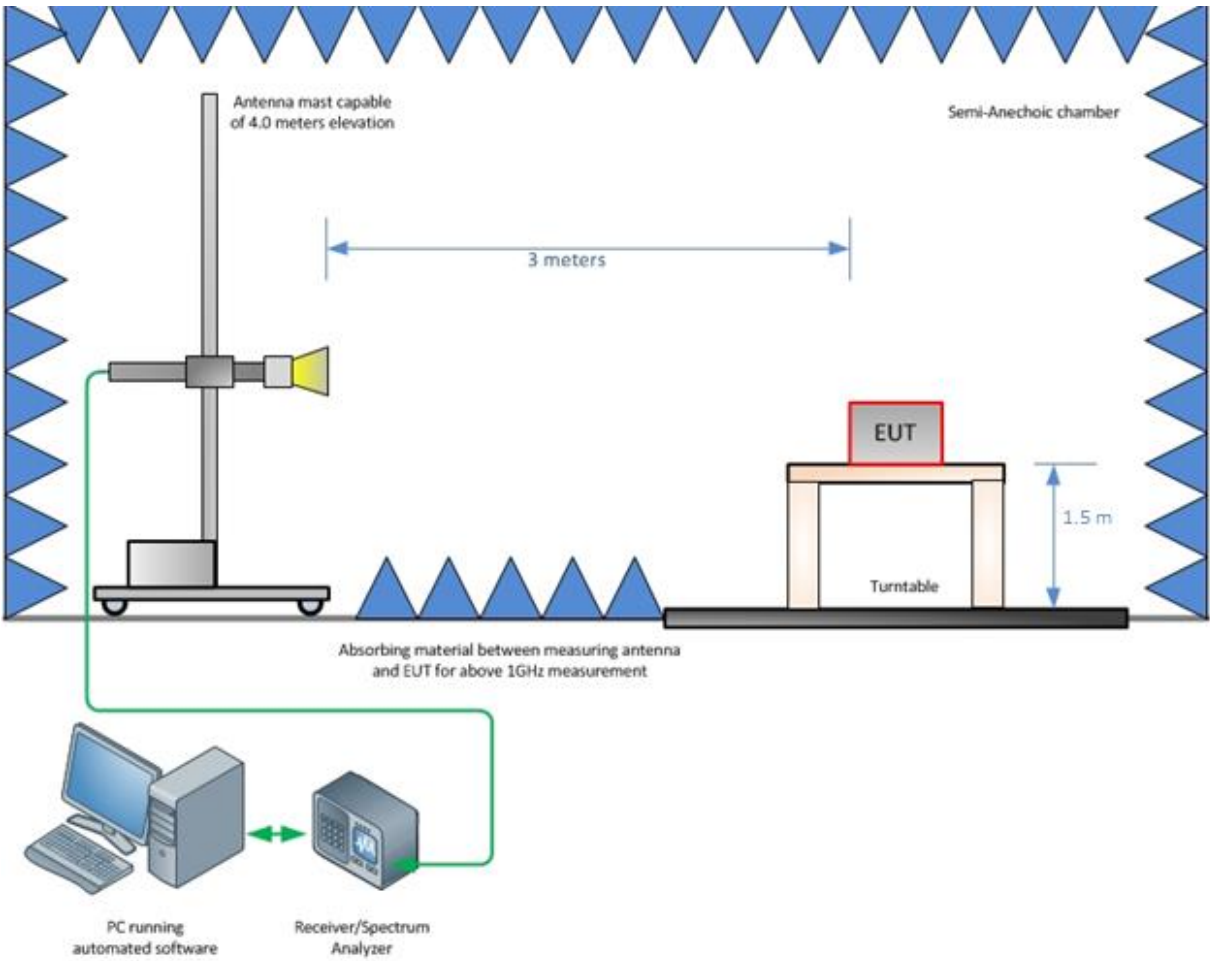


Figure 3-2 – Radiated Emissions Test Setup above 1 GHz

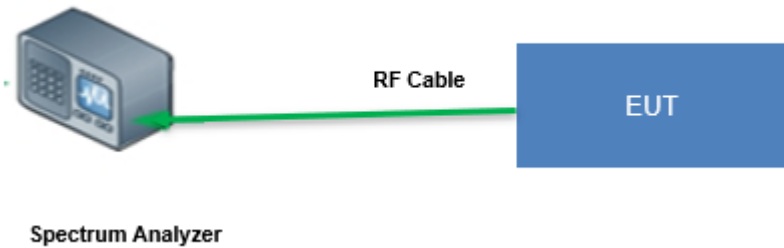


Figure 3-3 – Conducted Test Setup: Antenna Port measurement



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STATEMENT OF MEASUREMENT UNCERTAINTY – Emissions

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

Table 4-1: Estimation of Measurement Uncertainty

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

TEST EQUIPMENT

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