

Report on the Testing of the

Consumer Safety Technology, LLC

Keepr HHB

FCC ID: 2BEEUKH-P500

In accordance with:
FCC 47 CFR Part 15.247
FCC 47 CFR Part 15.207

Prepared for: Consumer Safety Technology, LLC
11305 Aurora Ave.
Des Moines, IA 50322

COMMERCIAL-IN-CONFIDENCE

Document Number: NC72194987.1 | Issue: 1



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Brad A Reasoner	EMC Technical Lead	Authorized Signatory	11 March 2024

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FCC Accreditation Designation Number US1148 New Brighton, MN Test Laboratory	Innovation, Science, and Economic Development Canada Accreditation Site Number 4512A New Brighton, MN Test Laboratory
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EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with the standards listed above and the tests shown in Table 1.3.1 of this report.



A2LA Cert. No. 2955.11

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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
1	First Issue	11 March 2024

1.2 Introduction

Manufacturer	Consumer Safety Technology, LLC
Applicant's Email Address	legal@intoxalock.com
Model Number(s)	KH-P500
Serial Number(s)	01473
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15.247 FCC 47 CFR Part 15.207
Order Number	72194987
Date of Receipt of EUT	06 December 2023
Start of Test	12 December 2023
Finish of Test	22 December 2023
Related Document(s)	KDB 558074 D01 ANSI C63.10 2013



1.3 Scope of Testing

To perform certification testing to confirm that the wireless device(s) meet the requirements of the applicable standards and guidance documents (KDB 558074 D01).

1.4 Summary of Results

A summary of the tests carried out in accordance with the specifications shown below.

Table 1.4-1 – Summary of Results

Section	Specification Clause		Test Description	Accreditation	Base Standard
2.1	15.203	RSS-GEN	Antenna Requirements	A2LA	FCC Sub Part C 15.203
2.2	15.247(b)(2)	RSS-247 (5.2a)	6dB / 99% Bandwidth	A2LA	ANSI C63.10:2013
2.3	15.247(b)(3)	RSS-247 (5.4d)	Peak Conducted Output Power	A2LA	ANSI C63.10:2013
2.4	15.247(e)	RSS-247 (5.2b)	Power Spectral Density	A2LA	ANSI C63.10:2013
2.5	15.247(d)	RSS-247 (5.5)	Conducted Spurious Emissions	A2LA	ANSI C63.10:2013
2.6	15.247(d)	RSS-247 (5.5)	Conducted Band-Edge	A2LA	ANSI C63.10:2013
2.7	15.107	RSS-GEN	Conducted Emissions 15.107	A2LA	ANSI C63.4:2014
2.8	15.207	RSS-GEN	Conducted Emissions 15.207	A2LA	ANSI C63.10:2013
2.9	15.247(d)	RSS-GEN	Radiated Spurious Emissions	A2LA	ANSI C63.10:2013
2.10	15.205	RSS-GEN	Radiated Restricted Bands of Emissions	A2LA	ANSI C63.10:2013

**Table 1.4-2 – Test Accreditation**

Test Name	Name of Tester(s)	Results / Comments
Antenna Requirements	Sean Sellergren	Pass
6dB / 99% Bandwidth	Sean Sellergren	Pass
Peak Conducted Output Power	Sean Sellergren	Pass
Power Spectral Density	Sean Sellergren	Pass
Conducted Spurious Emissions	Sean Sellergren	Pass
Conducted Band-Edge	Sean Sellergren	Pass
Conducted Emissions 15.107	Sean Sellergren	Pass
Conducted Emissions 15.207	Sean Sellergren	Pass
Radiated Spurious Emissions	Sean Sellergren	Pass
Radiated Restricted Bands of Emissions	Sean Sellergren	Pass



1.5 Product Information

1.5.1 Technical Description

The Equipment Under Test (EUT): Breathalyzer device with a BLE 5.4 transmitter.

Table 1.5-1 – Wireless Module Technical Information

Detail	Description
FCC ID	2BEEUKH-P500
Transceiver Model #	KH-P500
Operating Frequency	2402 – 2480MHz
Modulation Format	GFSK
Data Rate	1Mbps & 2Mbps
Antenna Type / Gain:	PCB / -10.69dBi

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

**Table 1.5-2 – Cable Descriptions**

Cable/Port	Description
N/A	N/A

Table 1.5-3 – Support Equipment Descriptions

Description
Laptop with programming software

1.5.2 Modes of Operation

Table 1.5-4 – Test Frequencies & Modes of Operation

Channel	Frequency (MHz)	Mode(s)
Low End	2402	1Mbps & 2Mbps
Middle	2440	1Mbps & 2Mbps
High End	2480	1Mbps & 2Mbps

1.6 Deviations from the Standard

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

1.7 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.

Table 1.7-1 – Modification Record

Modification State	Description of Modification fitted to EUT	Modification Fitted By	Date Modification Fitted
0	Initial State		

1.8 Test Location

TÜV SÜD conducted the following tests at our New Brighton, MN Test Laboratory.
Office address:

TÜV SÜD America
141 14th Street NW
New Brighton, MN 55112 USA



2 Test Details

2.1 Antenna Requirements

2.1.1 Specification Reference

FCC 47 CFR Part 15 Subpart C, 15.203
RSS-GEN Issue 5

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 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Note: Above statement is taken from FCC Part 15 Subpart C §15.203

Table 2.1-1 – Antenna Used In EUT

Antenna Type	Model	Antenna Gain
PCB	KH-P500	-10.69



2.2 6dB / 99% Bandwidth

2.2.1 Specification Reference

FCC 47 CFR Part 15.247(a)(2)
RSS-247 5.2(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

12 December 2023

2.2.4 Test Method

The 6dB bandwidth was measured in accordance with the FCC KDB 558074 D01 15.247 Meas Guidance. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz and the Video Bandwidth (VBW) was set to ≥ 3 times the RBW. The trace was set to max hold using a peak detector. The marker-delta function of the spectrum analyzer was utilized to determine the 6dB bandwidth of the emission.

The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth value. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The RBW to 1-5% of the occupied bandwidth and the VBW set to ≥ 3 times the RBW.

2.2.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.



2.2.6 Test Results

Table 2.2-1 – 6dB / 99% Bandwidth Results – 1Mbps

Frequency (MHz)	6dB Bandwidth (kHz)	99% Bandwidth (MHz)
2402	664.30	1.039
2440	669.30	1.040
2480	664.30	1.039

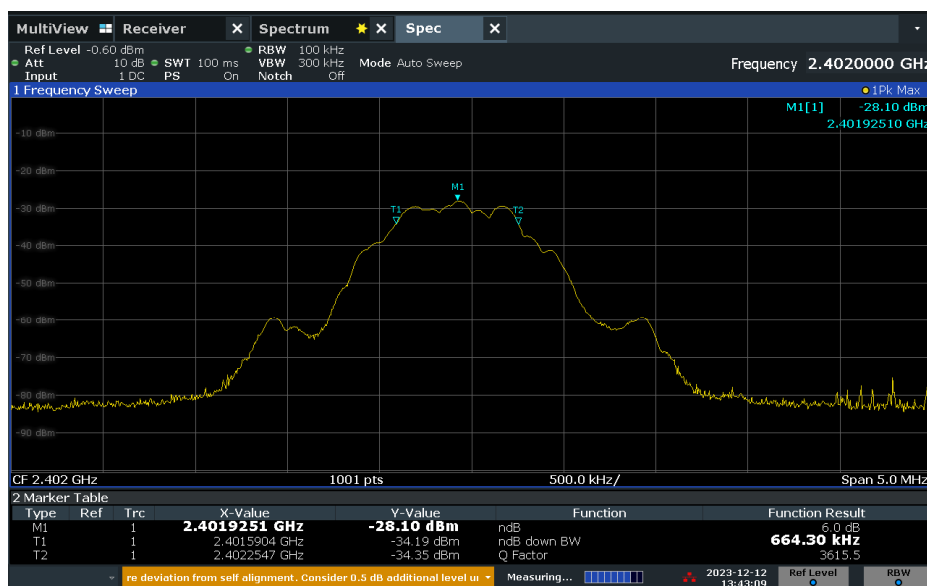
Table 2.2-2 – 6dB / 99% Bandwidth Results – 2Mbps

Frequency (MHz)	6dB Bandwidth (kHz)	99% Bandwidth (MHz)
2402	959.00	2.087
2440	959.00	2.088
2480	949.00	2.086

Test Summary: The 6dB DTS BW is greater than the required 500kHz per 15.247(a)(2). The EUT operated as intended before, during, and after testing.

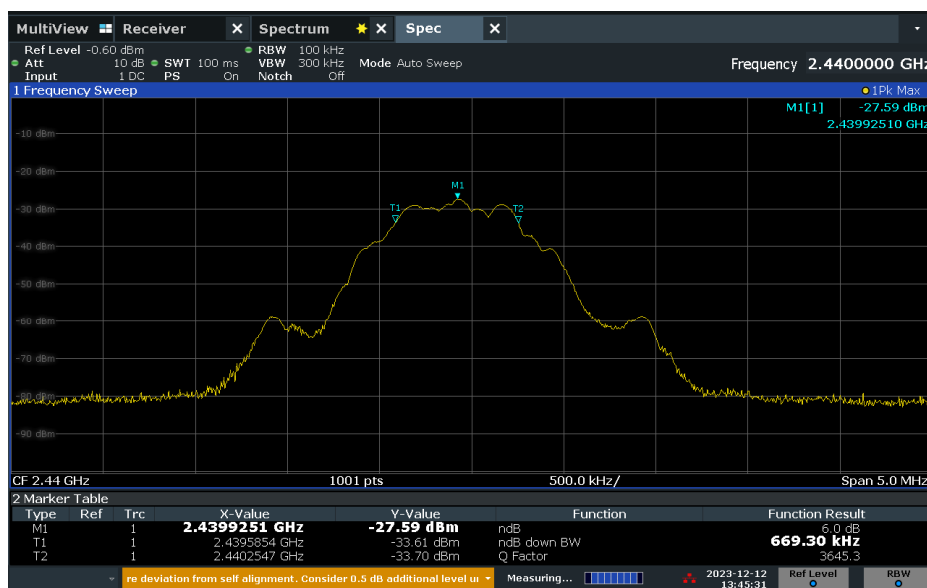
Test Result: Pass

See data below for detailed results.



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Figure 2-1 – 6dB Bandwidth – Low Channel – 1Mps

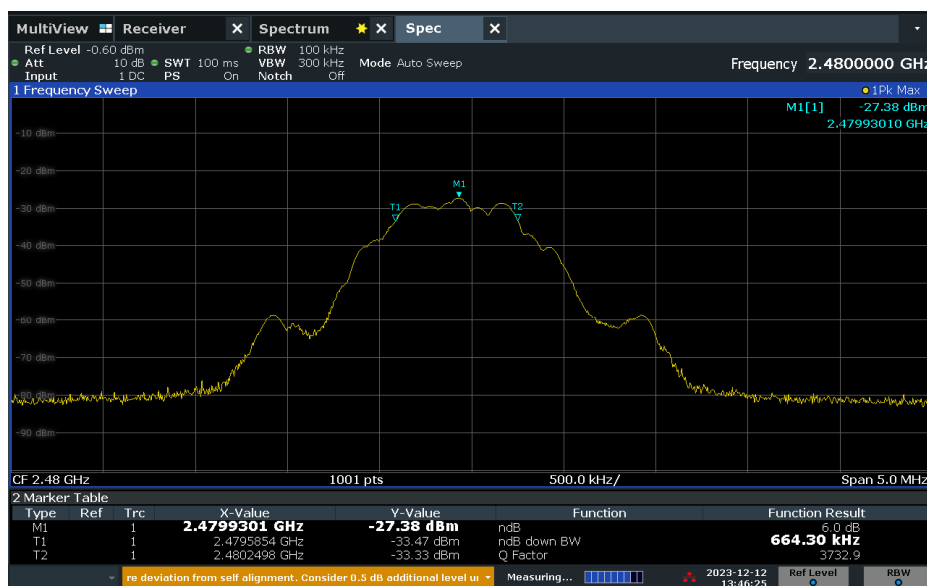


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Figure 2-2 – 6dB Bandwidth – Middle Channel – 1Mps

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Figure 2-3 – 6dB Bandwidth – High Channel – 1Mps



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Figure 2-4 – 6dB Bandwidth – Low Channel – 2Mps

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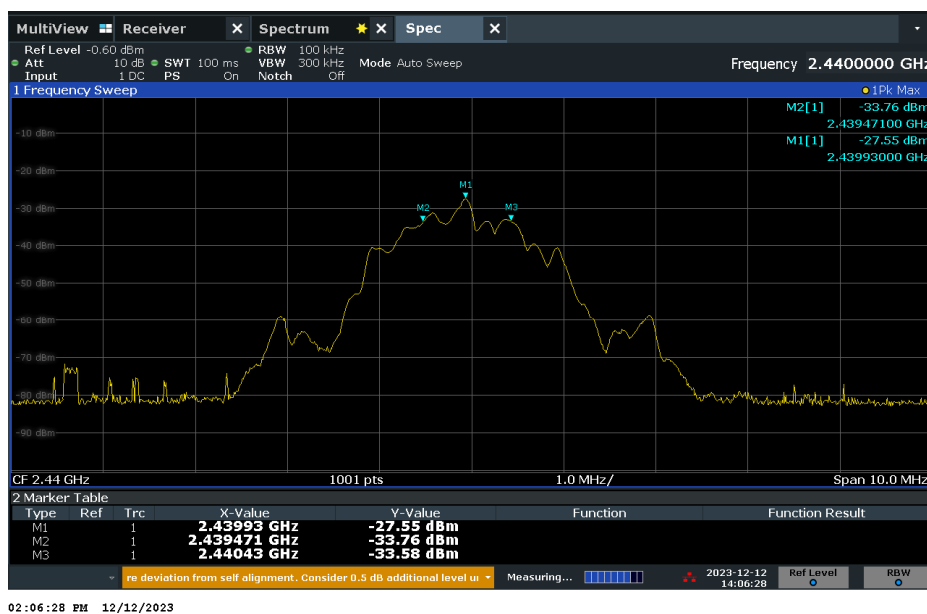


Figure 2-5 – 6dB Bandwidth – Middle Channel – 2Mbps

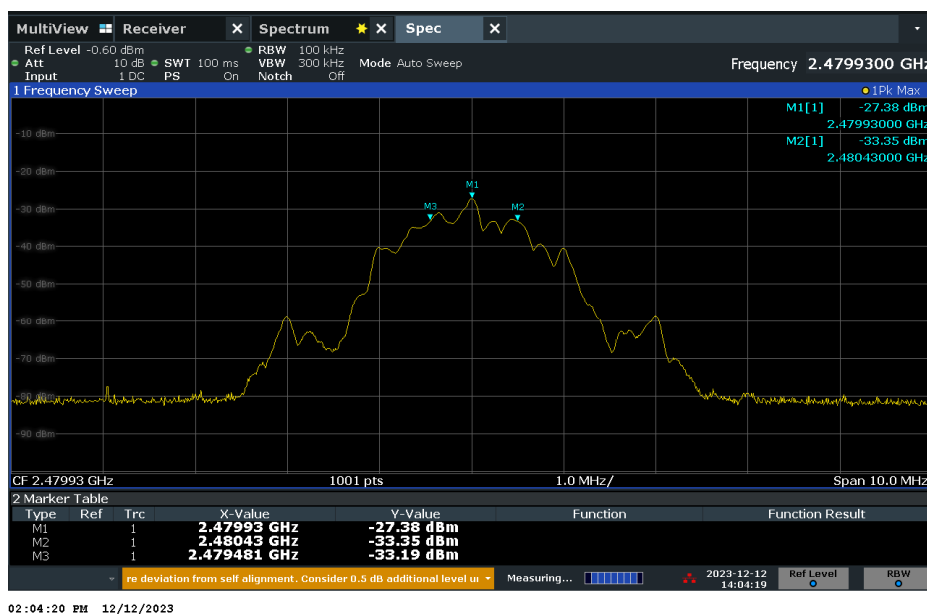


Figure 2-6 – 6dB Bandwidth – High Channel – 2Mbps

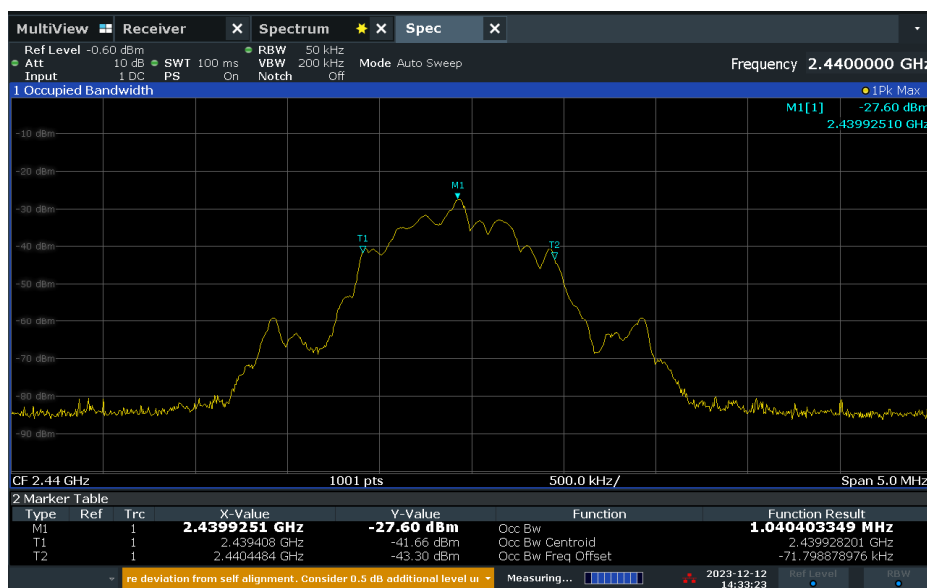
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Figure 2-7 – 99% Bandwidth – Low Channel – 1Mps



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Figure 2-8 – 99% Bandwidth – Middle Channel – 1Mps

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Figure 2-9 – 99% Bandwidth – High Channel – 1Mps



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Figure 2-10 – 99% Bandwidth – Low Channel – 2Mps

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Figure 2-11 – 99% Bandwidth – Middle Channel – 2Mps



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Figure 2-12 – 99% Bandwidth – High Channel – 2Mps

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2.2.7 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.

Test Area: CSAC1

Table 2.2-3 – Conducted Emissions Test Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
WRLE11396	Meca	Attenuator, 20 dB	603-20-1F18	11396	B	02/26/2023	02/26/2024
NBLE11754	Rohde & Schwarz	Receiver, 1 Hz-44 GHz	ESW44	103037	G	10/02/2023	10/02/2024

Cal Code G = Calibration performed by an accredited outside source.

Cal Code B = Calibration verification performed internally.

Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.



2.3 Peak Conducted Output Power

2.3.1 Specification Reference

FCC 47 CFR Part 15.247(b)(3)
RSS-247 5.2(d)

2.3.2 Equipment Under Test and Modification State

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

2.3.3 Date of Test

12 December 2023

2.3.4 Test Method

The maximum peak conducted output power was measured in accordance with the FCC KDB 558074 D01 15.247 Meas Guidance utilizing the RBW ≥ DTS Bandwidth method. The RF output of the EUT was directly connected to the input of the spectrum analyzer along with a suitable external attenuator.

Maximum conducted output limit is equal to 1 Watt (30dBm).

2.3.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.



2.3.6 Test Results

Table 2.3-1 – Peak Conducted Output Power Results – 1Mps

Frequency (MHz)	Measured Output Power (dBm)	Output Power Limit (dBm)	Output Power Margin (dB)
2402	-7.37	30	-37.37
2440	-6.91	30	-36.91
2480	-6.62	30	-36.62

Table 2.3-2 – Peak Conducted Output Power Results – 2Mps

Frequency (MHz)	Measured Output Power (dBm)	Output Power Limit (dBm)	Output Power Margin (dB)
2402	-7.39	30	-37.39
2440	-6.95	30	-36.95
2480	-6.61	30	-36.61

Note: Peak level calculation: Final Peak level = analyzer level + correction factor.

Test Summary: The EUT operated as intended before, during, and after testing.

Test Result: Pass

See data below for detailed results.



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Figure 2-13 – Peak Conducted Output Power – Low Channel – 1Mps



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Figure 2-14 – Peak Conducted Output Power – Middle Channel – 1Mps

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Figure 2-15 – Peak Conducted Output Power – High Channel – 1Mbps



Figure 2-16 – Peak Conducted Output Power – Low Channel – 2Mbps

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Figure 2-17 – Peak Conducted Output Power – Middle Channel – 2Mps



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Figure 2-18 – Peak Conducted Output Power – High Channel – 1Mps

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2.3.7 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.

Test Area: CSAC1

Table 2.3-3 – Conducted Emissions Test Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
WRLE11396	Meca	Attenuator, 20 dB	603-20-1F18	11396	B	02/26/2023	02/26/2024
NBLE11754	Rohde & Schwarz	Receiver, 1 Hz-44 GHz	ESW44	103037	G	10/02/2023	10/02/2024

Cal Code G = Calibration performed by an accredited outside source.

Cal Code B = Calibration verification performed internally.

Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.



2.4 Power Spectral Density

2.4.1 Specification Reference

FCC 47 CFR Part 15.247(e)
RSS-247 5.2(b)

2.4.2 Equipment Under Test and Modification State

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

2.4.3 Date of Test

12 December 2023

2.4.4 Test Method

The maximum peak conducted output power was measured in accordance with the FCC KDB 558074 D01 15.247 Meas Guidance utilizing the PKPSD (peak PSD) method. The RF output of the EUT was directly connected to the input of the spectrum analyzer along with a suitable external attenuator. The RBW of the spectrum analyzer was set to 50kHz and the VBW was set to ≥ 3 times the RBW. The spectrum analyzer was set to max hold using the peak detector.

Power Spectral Density limit is equal to 8dBm.

2.4.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.



2.4.6 Test Results

Table 2.4-1 – Peak Conducted Output Power Results – 1Mps

Frequency (MHz)	Measured PSD Level (dBm)	PSD Limit (dBm)	Margin (dBm)
2402	-7.38	8	-15.38
2440	-6.88	8	-14.88
2480	-6.68	8	-14.68

Table 2.4-2 – Peak Conducted Output Power Results – 2Mps

Frequency (MHz)	Measured PSD Level (dBm)	PSD Limit (dBm)	Margin (dBm)
2402	-7.49	8	-15.49
2440	-6.91	8	-14.91
2480	-6.67	8	-14.67

Note: Peak level calculation: Final Peak level = analyzer level + correction factor.

Test Summary: The EUT operated as intended before, during, and after testing.

Test Result: Pass

See data below for detailed results.



Figure 2-19 – Peak Conducted Output Power – Low Channel – 1Mps



Figure 2-20 – Peak Conducted Output Power – Middle Channel – 1Mps

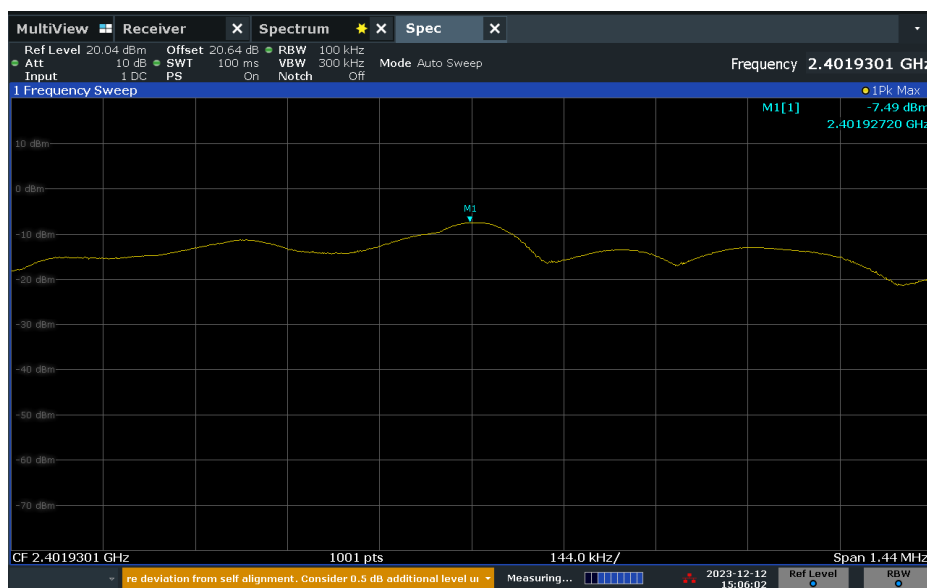
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Figure 2-21 – Peak Conducted Output Power – High Channel – 1Mbps

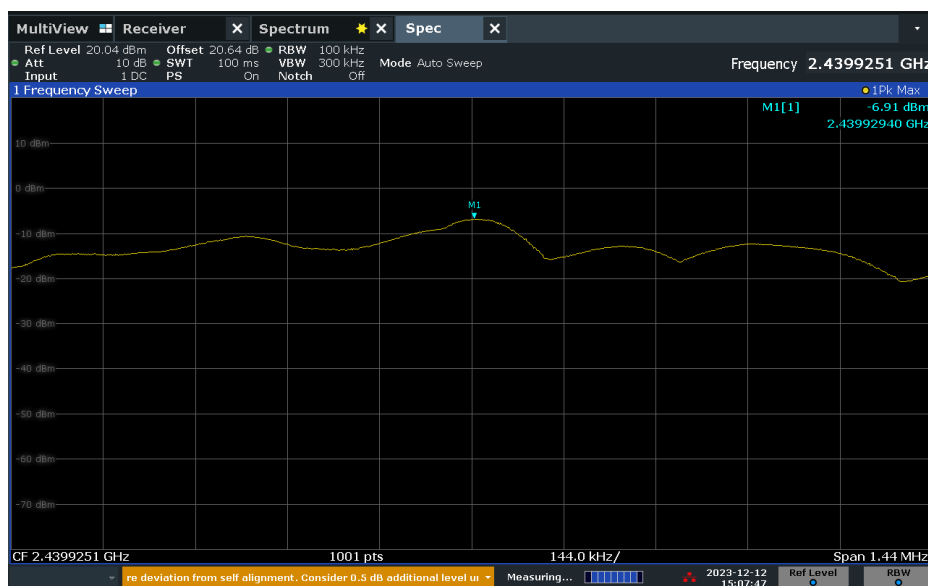


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Figure 2-22 – Peak Conducted Output Power – Low Channel – 2Mbps

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Figure 2-23 – Peak Conducted Output Power – Middle Channel – 2Mps



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Figure 2-24 – Peak Conducted Output Power – High Channel – 2Mps

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2.4.7 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.
Test Area: STS

Table 2.4-3 – Conducted Emissions Test Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
WRLE11396	Meca	Attenuator, 20 dB	603-20-1F18	11396	B	02/26/2023	02/26/2024
NBLE11754	Rohde & Schwarz	Receiver, 1 Hz-44 GHz	ESW44	103037	G	10/02/2023	10/02/2024

Cal Code G = Calibration performed by an accredited outside source.

Cal Code B = Calibration verification performed internally.

Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.



2.5 Conducted Spurious Emissions

2.5.1 Specification Reference

FCC 47 CFR Part 15.247(d)
RSS-247 5.2(5.5)

2.5.2 Equipment Under Test and Modification State

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

2.5.3 Date of Test

12 December 2023

2.5.4 Test Method

The maximum peak conducted output power was measured in accordance with the FCC KDB 558074 D01 15.247 Meas Guidance. The RF output of the EUT was directly connected to the input of the spectrum analyzer along with a suitable external attenuator. The RBW of the spectrum analyzer was set to 100kHz and the VBW was set to ≥ 3 times the RBW. The spectrum analyzer span was set to cover the entire frequency range of 30MHz to 25GHz (5 times the highest intentional radiator) and the trace was set to max hold using the peak detector.

The limit used for the entire frequency range is 20 dBc (20 dB lower than the maximum in-band peak PSD level, which was determined in Section 2.4 of this report).

2.5.5 Environmental Conditions

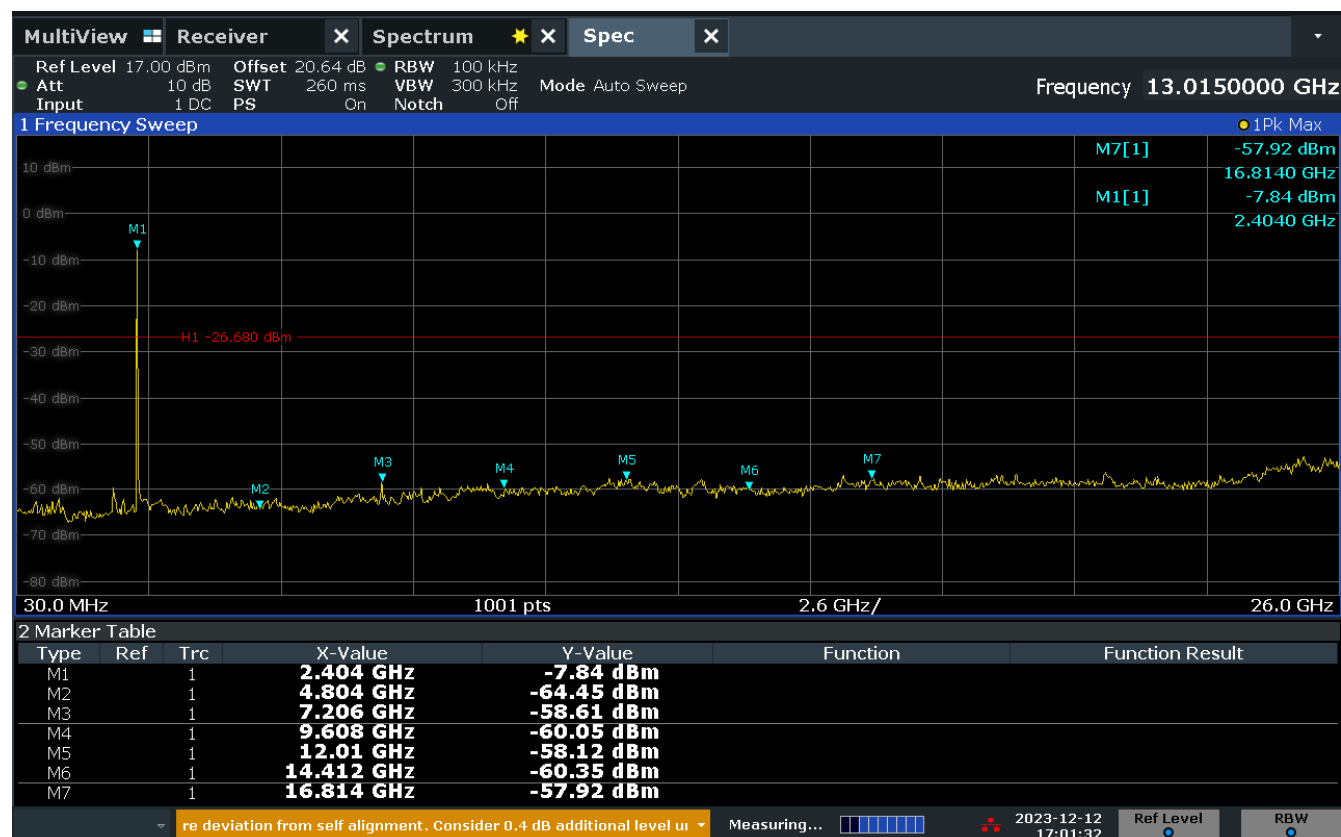
The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.

2.5.6 Test Results

Test Summary: The EUT operated as intended before, during, and after testing.

Test Result: Pass

See data below for detailed results.



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Figure 2-25 – Conducted Spurious Emissions 30 MHz – 25GHz – Low Channel – 1Mps

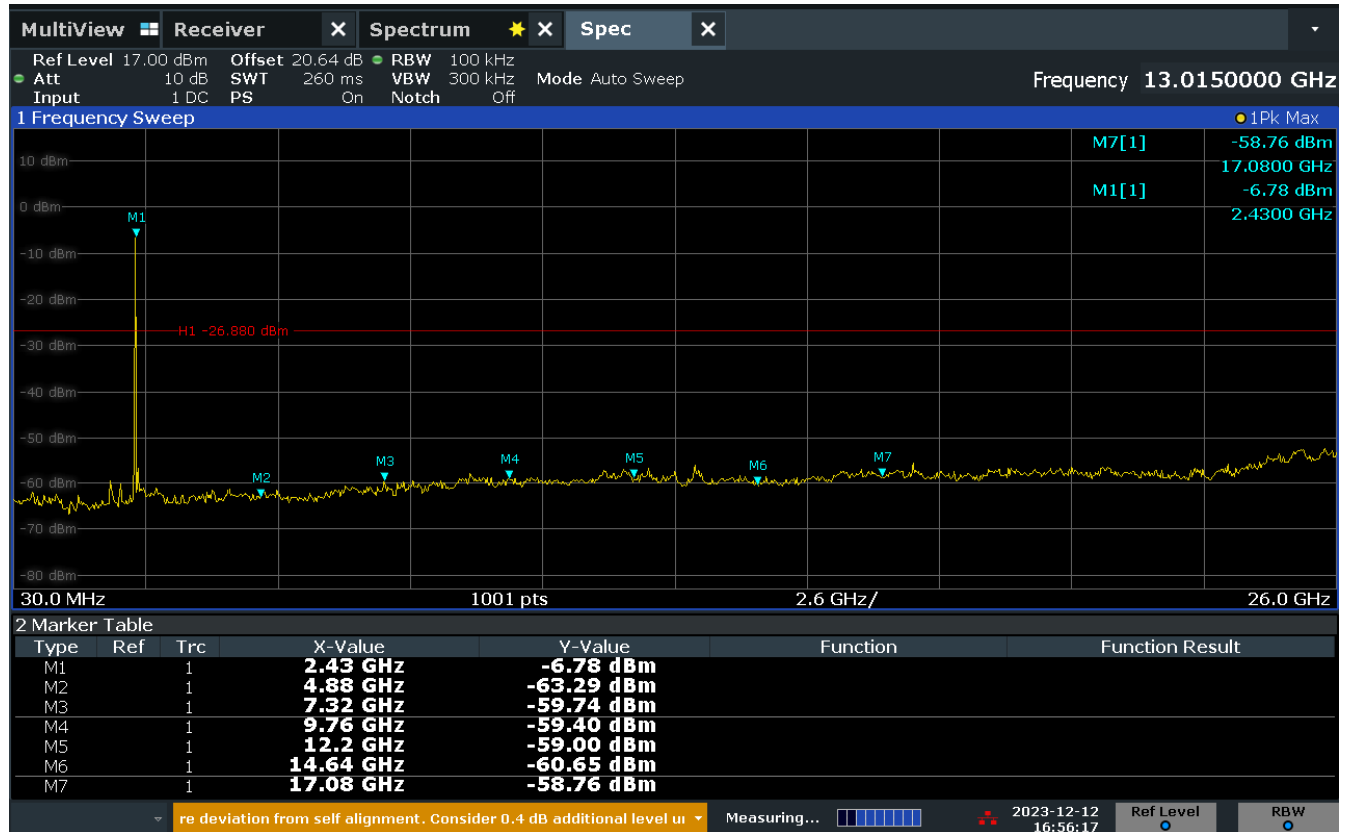
Table 2.5-1 – Conducted Spurious Emissions 30 MHz – 25GHz Results – 1Mps

Frequency (MHz)	Measured Level (dBm)	20 dBc Limit (dBm)	Margin (dBm)
4804.00	-64.45	-26.68	-37.77
7206.00	-58.61	-26.68	-31.93
9608.00	-60.05	-26.68	-33.37
12010.00	-58.12	-26.68	-31.44
14412.00	-60.35	-26.68	-33.67
16814.00	-57.92	-26.68	-31.24

Note: 20dBc limit is based on PSD value measured in Section 2.4 of this report.

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Figure 2-26 – Conducted Spurious Emissions 30 MHz – 25GHz – Mid Channel – 1Mps

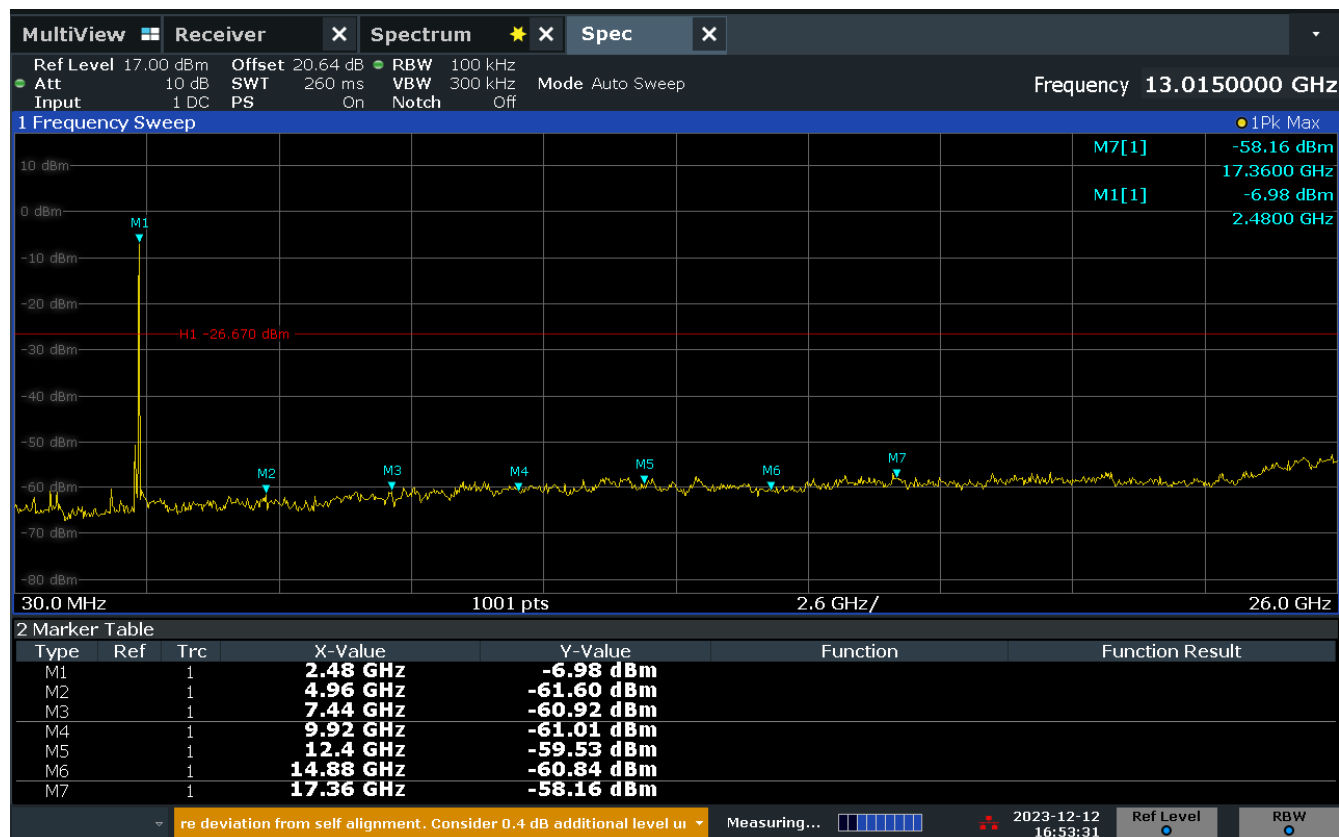
Table 2.5-2 – Conducted Spurious Emissions 30 MHz – 25GHz Results – 1Mps

Frequency (MHz)	Measured Level (dBm)	20 dBc Limit (dBm)	Margin (dBm)
4880.00	-63.29	-26.88	-36.41
7320.00	-59.74	-26.88	-32.86
9760.00	-59.40	-26.88	-32.52
12200.00	-59.00	-26.88	-32.12
14640.00	-60.65	-26.88	-33.77
17080.00	-58.76	-26.88	-31.88

Note: 20dBc limit is based on PSD value measured in Section 2.4 of this report.

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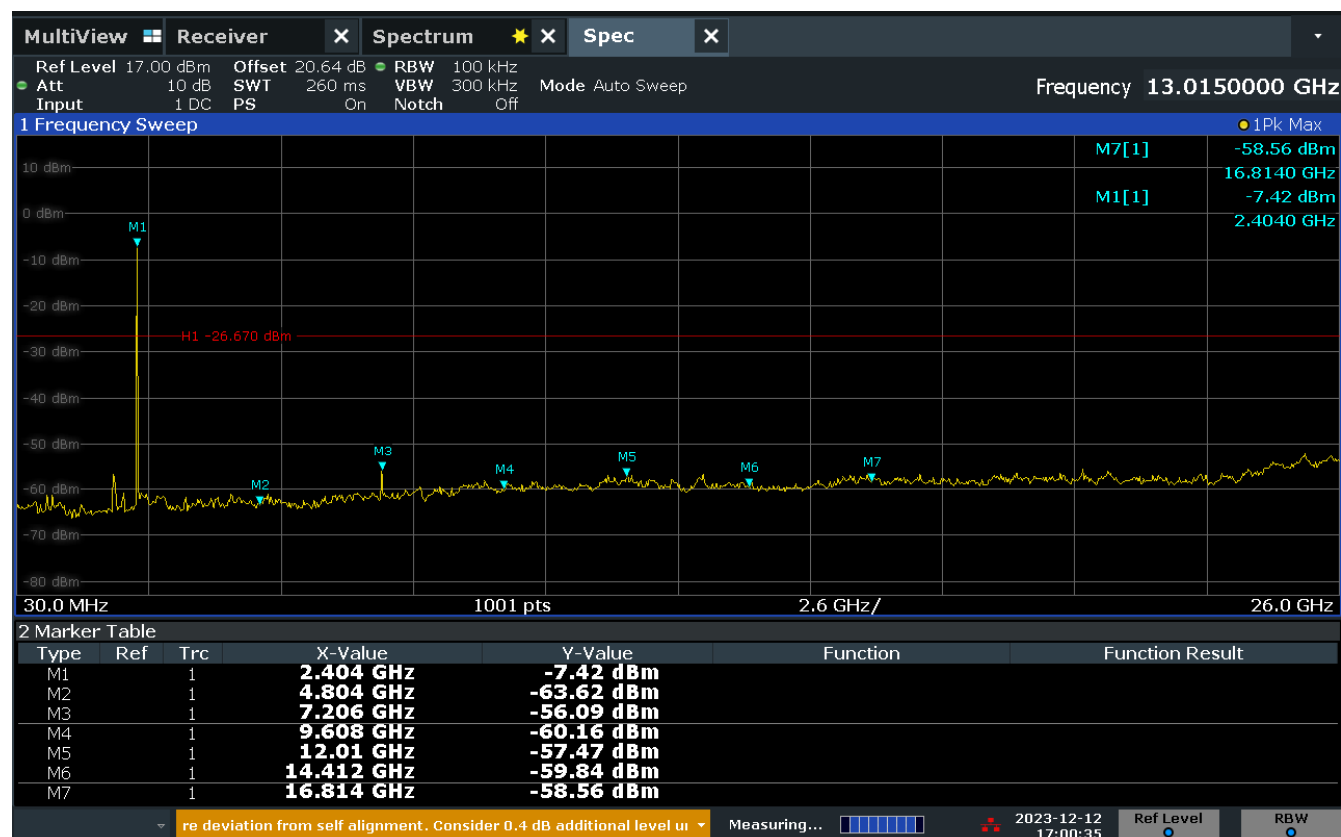
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Figure 2-27 – Conducted Spurious Emissions 30 MHz – 25GHz – High Channel – 1Mps

Table 2.5-3 – Conducted Spurious Emissions 30 MHz – 25GHz Results – 1Mps

Frequency (MHz)	Measured Level (dBm)	20 dBc Limit (dBm)	Margin (dBm)
4960.00	-61.60	-26.67	-34.93
7440.00	-60.92	-26.67	-34.25
9920.00	-61.01	-26.67	-34.34
12400.00	-59.53	-26.67	-32.86
14880.00	-60.84	-26.67	-34.17
17360.00	-58.16	-26.67	-31.49

Note: 20dBc limit is based on PSD value measured in Section 2.4 of this report.



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Figure 2-28 – Conducted Spurious Emissions 30 MHz – 25GHz – Low Channel – 2Mps

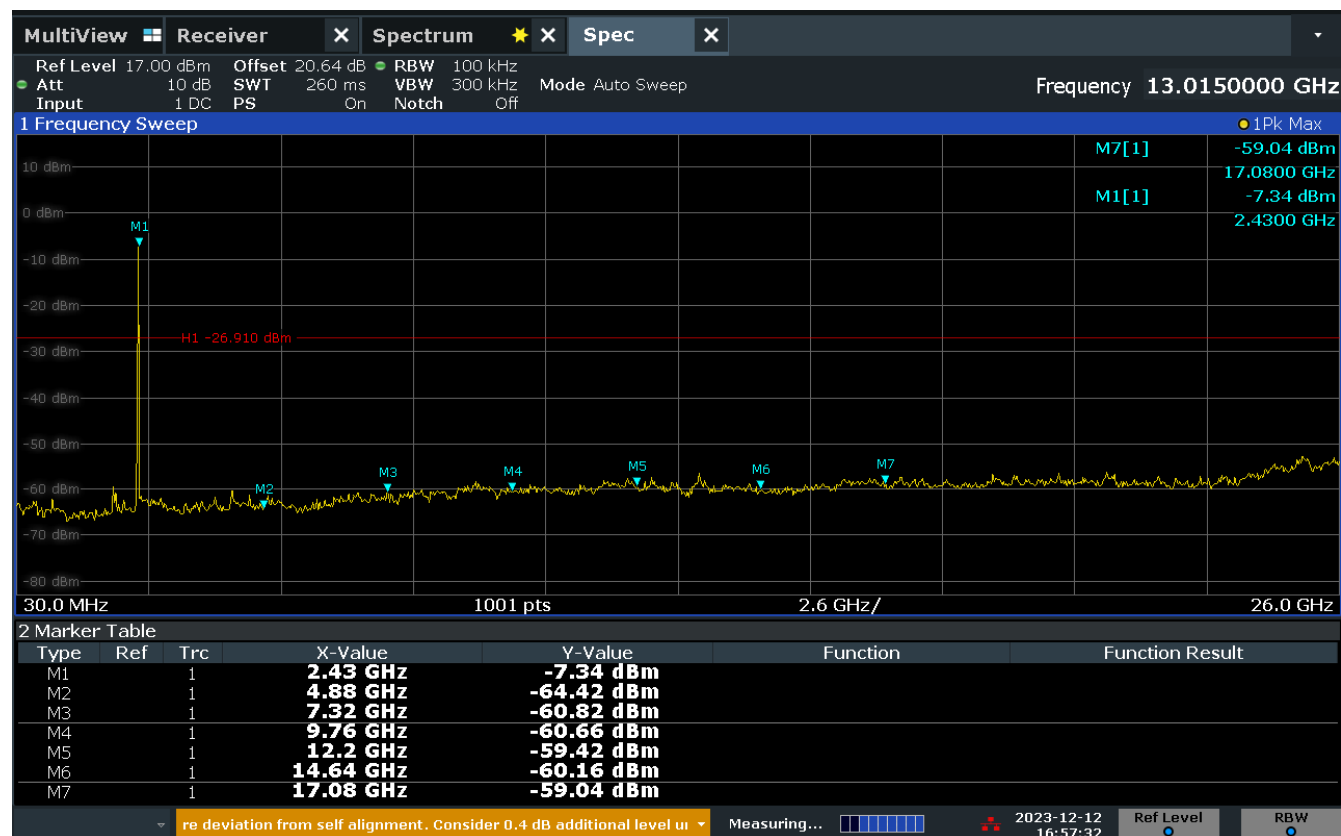
Table 2.5-4 – Conducted Spurious Emissions 30 MHz – 25GHz Results – 2Mps

Frequency (MHz)	Measured Level (dBm)	20 dBc Limit (dBm)	Margin (dBm)
4804.00	-63.62	-26.67	-36.95
7206.00	-56.09	-26.67	-29.42
9608.00	-60.16	-26.67	-33.49
12010.00	-57.47	-26.67	-30.8
14412.00	-59.84	-26.67	-33.17
16814.00	-58.56	-26.67	-31.89

Note: 20dBc limit is based on PSD value measured in Section 2.4 of this report.

TÜV SÜD America Inc
 141 14th Street NW
 New Brighton, MN 55112

Phone: 651-631-2487
www.tuv-sud-america.com



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Figure 2-29 – Conducted Spurious Emissions 30 MHz – 25GHz – Mid Channel – 2Mps

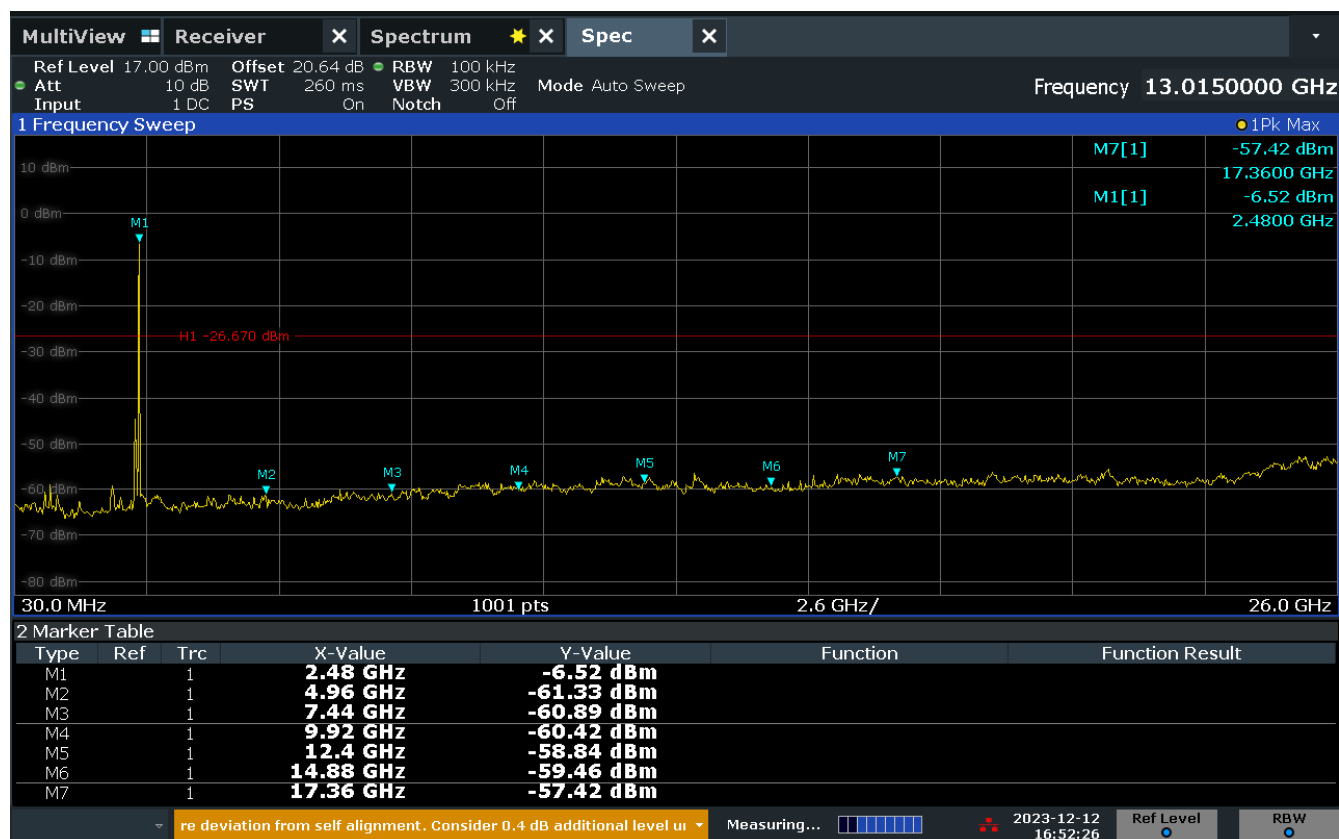
Table 2.5-5 – Conducted Spurious Emissions 30 MHz – 25GHz Results – 2Mps

Frequency (MHz)	Measured Level (dBm)	20 dBc Limit (dBm)	Margin (dBm)
4880.00	-64.42	-26.91	-37.51
7320.00	-60.82	-26.91	-33.91
9760.00	-60.66	-26.91	-33.75
12200.00	-59.42	-26.91	-32.51
14640.00	-60.16	-26.91	-33.25
17080.00	-59.04	-26.91	-32.13

Note: 20dBc limit is based on PSD value measured in Section 2.4 of this report.

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Figure 2-30 – Conducted Spurious Emissions 30 MHz – 25GHz – High Channel – 2Mps

Table 2.5-6 – Conducted Spurious Emissions 30 MHz – 25GHz Results – 2Mps

Frequency (MHz)	Measured Level (dBm)	20 dBc Limit (dBm)	Margin (dBm)
4960.00	-61.33	-26.67	-34.66
7440.00	-60.33	-26.67	-33.66
9920.00	-60.42	-26.67	-33.75
12400.00	-58.84	-26.67	-32.17
14880.00	-59.46	-26.67	-32.79
17360.00	-57.42	-26.67	-30.75

Note: 20dBc limit is based on uncorrected PSD value measured in Section 2.4 of this report.



2.5.7 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.

Test Area: CSAC1

Table 2.5-7 – Conducted Emissions Test Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
WRLE11396	Meca	Attenuator, 20 dB	603-20-1F18	11396	B	02/26/2023	02/26/2024
NBLE11754	Rohde & Schwarz	Receiver, 1 Hz-44 GHz	ESW44	103037	G	10/02/2023	10/02/2024

Cal Code G = Calibration performed by an accredited outside source.

Cal Code B = Calibration verification performed internally.

Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.



2.6 Conducted Band-Edge

2.6.1 Specification Reference

FCC 47 CFR Part 15.247(d)
RSS-247 5.2(5.5)

2.6.2 Equipment Under Test and Modification State

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

2.6.3 Date of Test

12 December 2024

2.6.4 Test Method

The maximum peak conducted output power was measured in accordance with the FCC KDB 558074 D01 15.247 Meas Guidance. The RF output of the EUT was directly connected to the input of the spectrum analyzer along with a suitable external attenuator. The RBW of the spectrum analyzer was set to 100kHz and the VBW was set to ≥ 3 times the RBW. The spectrum analyzer to max hold using the peak detector and then again using an average detector.

The limit used for the 2400 – 2483.5 MHz band-edges is 20 dBc (20 dB lower than the maximum in-band peak PSD level, which was determined in Section 2.4 of this report).

2.6.5 Environmental Conditions

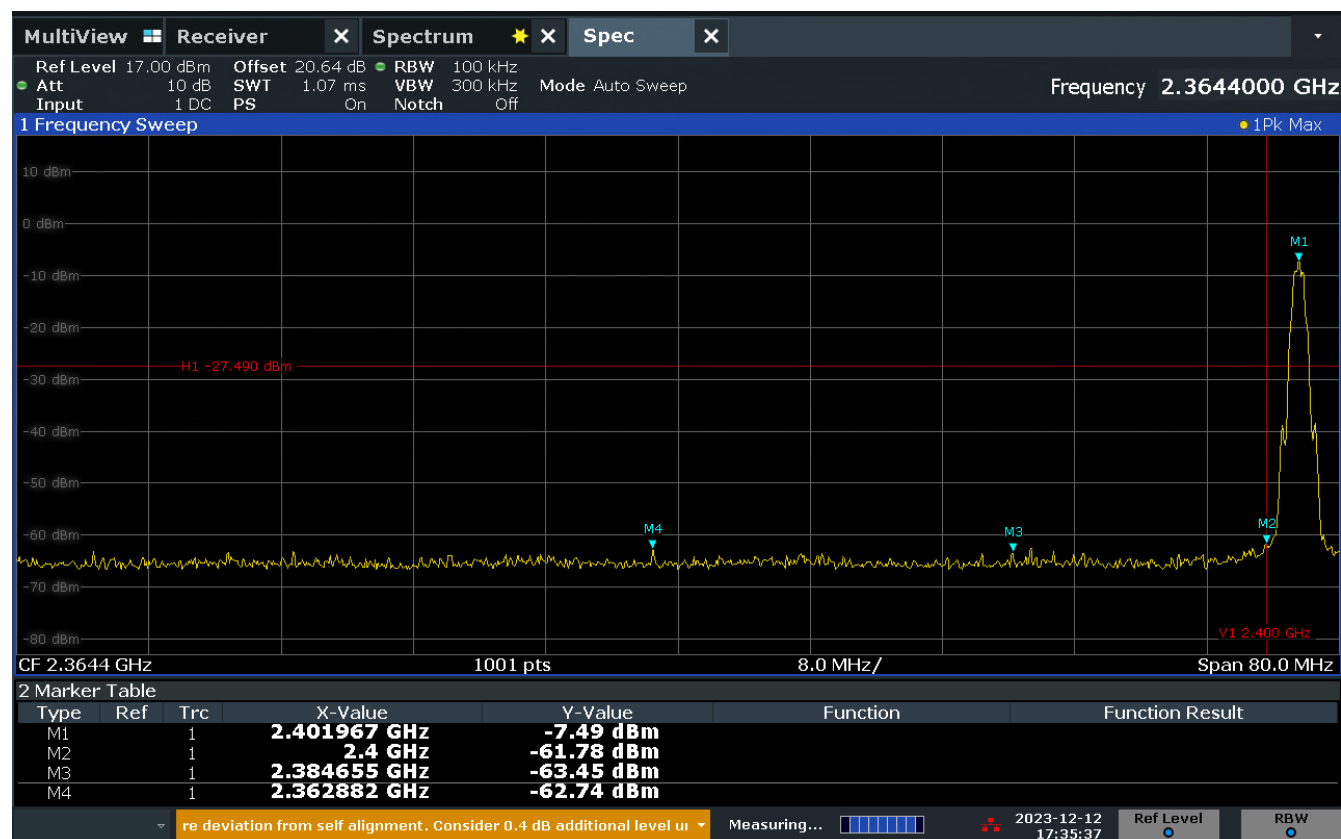
The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.

2.6.6 Test Results

Test Summary: The EUT operated as intended before, during, and after testing.

Test Result: Pass

See data below for detailed results.



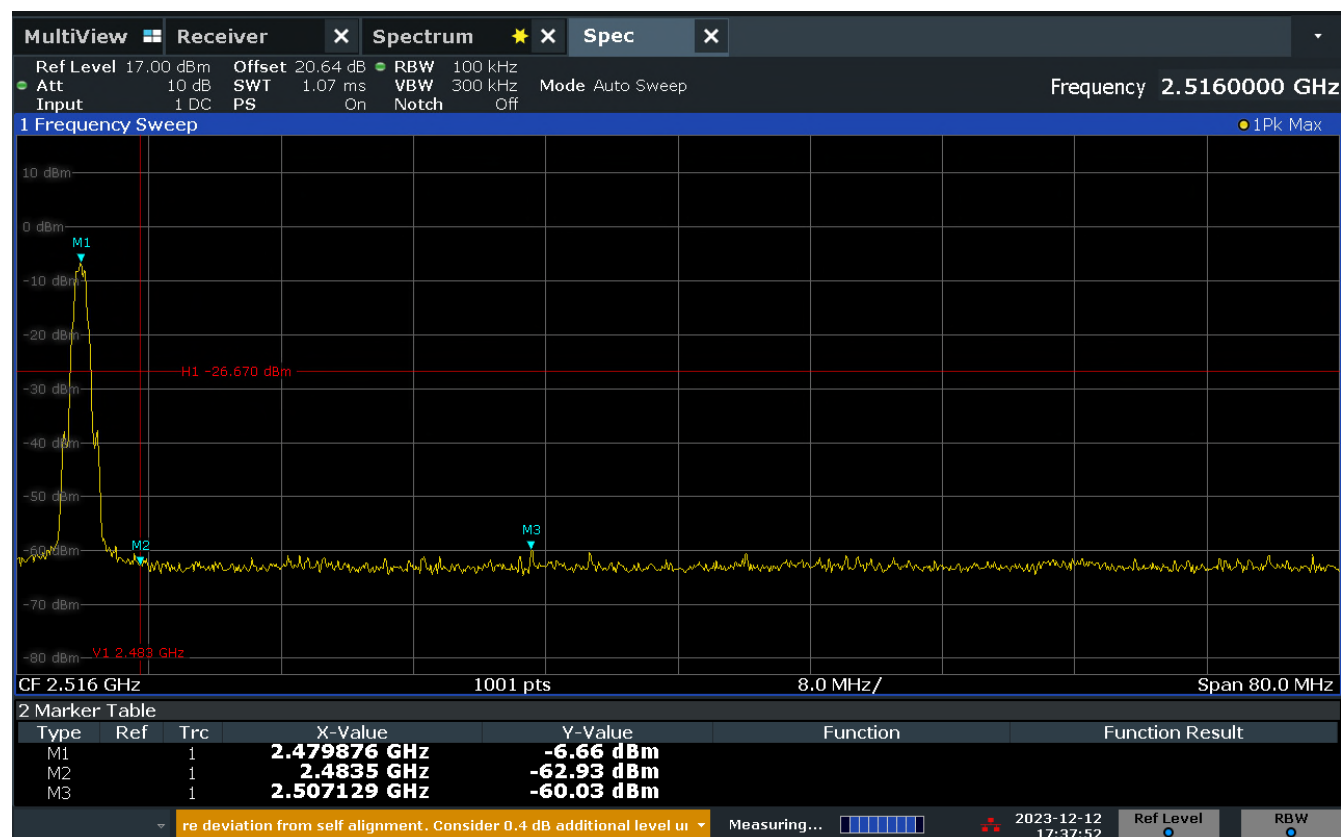
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Figure 2-31 – Conducted Band-Edge – Low Channel – 1Mps

Table 2.6-1 – Conducted Band-Edge Results – 1Mps

Frequency (MHz)	Measured Level (dBm)	20 dBc Limit (dBm)	Margin (dBm)
2400	-61.78	-27.49	-34.29
2384.65	-63.45	-27.49	-35.96
2362.82	-62.74	-27.49	-35.25

Note: 20dBc limit is based on uncorrected PSD value measured in Section 2.4 of this report.



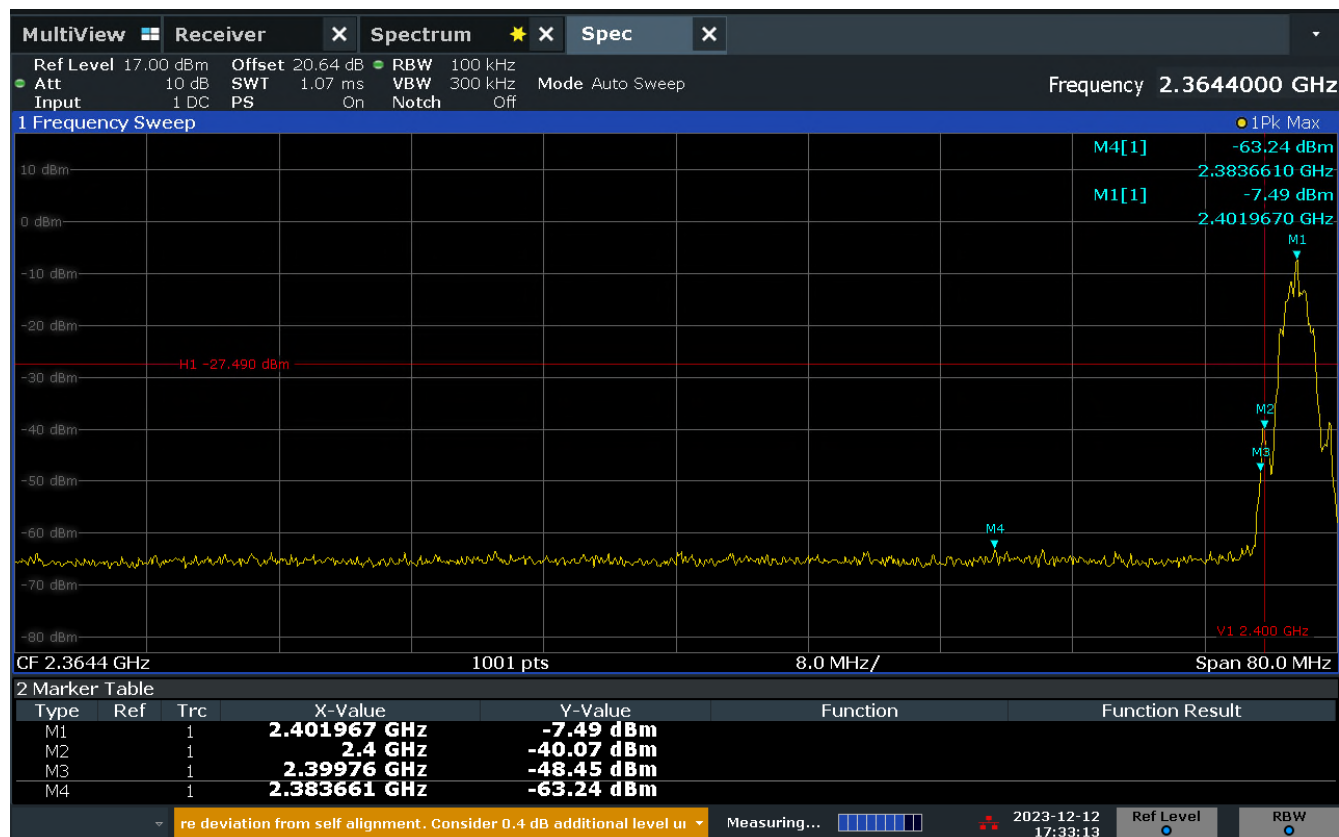
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Figure 2-32 – Conducted Band-Edge – High Channel – 1Mps

Table 2.6-2 – Conducted Band-Edge Results – 1Mps

Frequency (MHz)	Measured Level (dBm)	20 dBc Limit (dBm)	Margin (dBm)
2483.5	-62.93	-26.67	-36.26
2507.12	-60.03	-26.67	-33.36

Note: 20dBc limit is based on uncorrected PSD value measured in Section 2.4 of this report.



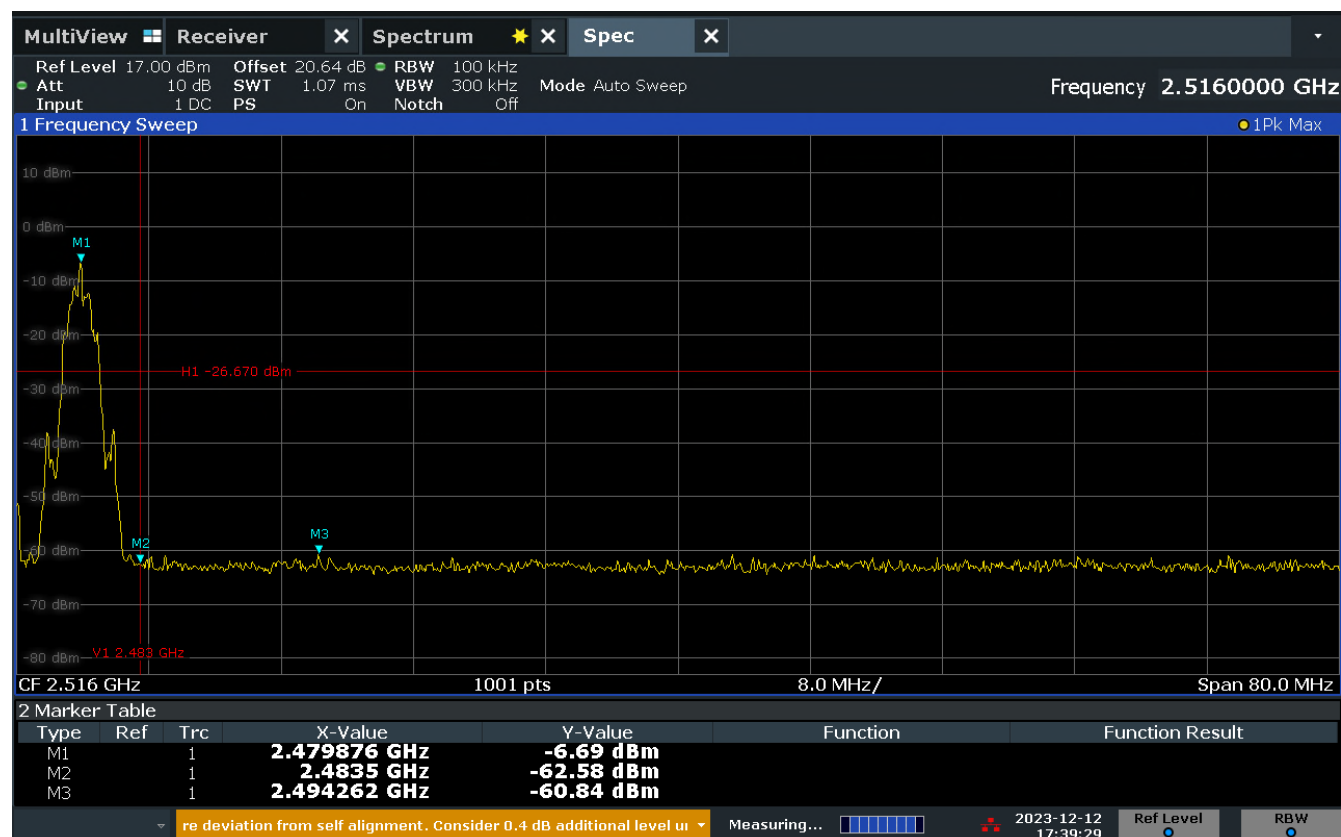
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Figure 2-33 – Conducted Band-Edge – Low Channel – 2Mps

Table 2.6-3 – Conducted Band-Edge Results – 2Mps

Frequency (MHz)	Measured Level (dBm)	20 dBc Limit (dBm)	Margin (dBm)
2400.00	-40.07	-27.49	-12.58
2399.76	-48.45	-27.49	-20.96
2383.66	-63.24	-27.49	-35.75

Note: 20dBc limit is based on uncorrected PSD value measured in Section 2.4 of this report.



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Figure 2-34 – Conducted Band-Edge – High Channel – 2Mps

Table 2.6-4 – Conducted Band-Edge Results – 2Mps

Frequency (MHz)	Measured Level (dBm)	20 dBc Limit (dBm)	Margin (dBm)
2483.50	-62.58	-26.67	-35.91
2494.26	-60.84	-26.67	-34.17

Note: 20dBc limit is based on uncorrected PSD value measured in Section 2.4 of this report.



2.6.7 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.

Test Area: CSAC1

Table 2.6-5 – Conducted Emissions Test Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
WRLE11396	Meca	Attenuator, 20 dB	603-20-1F18	11396	B	02/26/2023	02/26/2024
NBLE11754	Rohde & Schwarz	Receiver, 1 Hz-44 GHz	ESW44	103037	G	10/02/2023	10/02/2024

Cal Code G = Calibration performed by an accredited outside source.

Cal Code B = Calibration verification performed internally.

Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.



2.7 Conducted Emissions 15.207

2.7.1 Specification Reference

FCC 47 CFR Part 15 Subpart C, 15.207
RSS-GEN Issue 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

22 December 2023

2.7.4 Test Method

The EUT was placed on a non-conductive table 0.8 m above a reference ground plane and 0.4 m away from a vertical coupling plane.

All power was connected to the EUT through an Artificial Mains Network (AMN). Conducted emissions measurements on mains lines were made at the output of the AMN. The AMN was placed 0.8m from the boundary of the EUT and bonded to the reference ground plane.

2.7.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.

2.7.6 Additional Observations

Measurements were performed using BAT-EMC (v2022.0.27.0) automated software. The reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.



2.7.7 Sample Computation (Conducted Emission)

Measuring equipment raw measurement (dB μ V) @ 150 kHz			30.0
Correction Factor (dB)	TEMC00002 – LISN	0.03	10.53
	Cable 1	10.50	
Reported Quasi-peak Final Measurement (dB μ V) @ 150 kHz			40.53

2.7.8 Test Results

Test Summary: The EUT was tested with a representative AC-DC power converter as the EUT does not possess its own. EUT operated as intended before, during, and after testing.

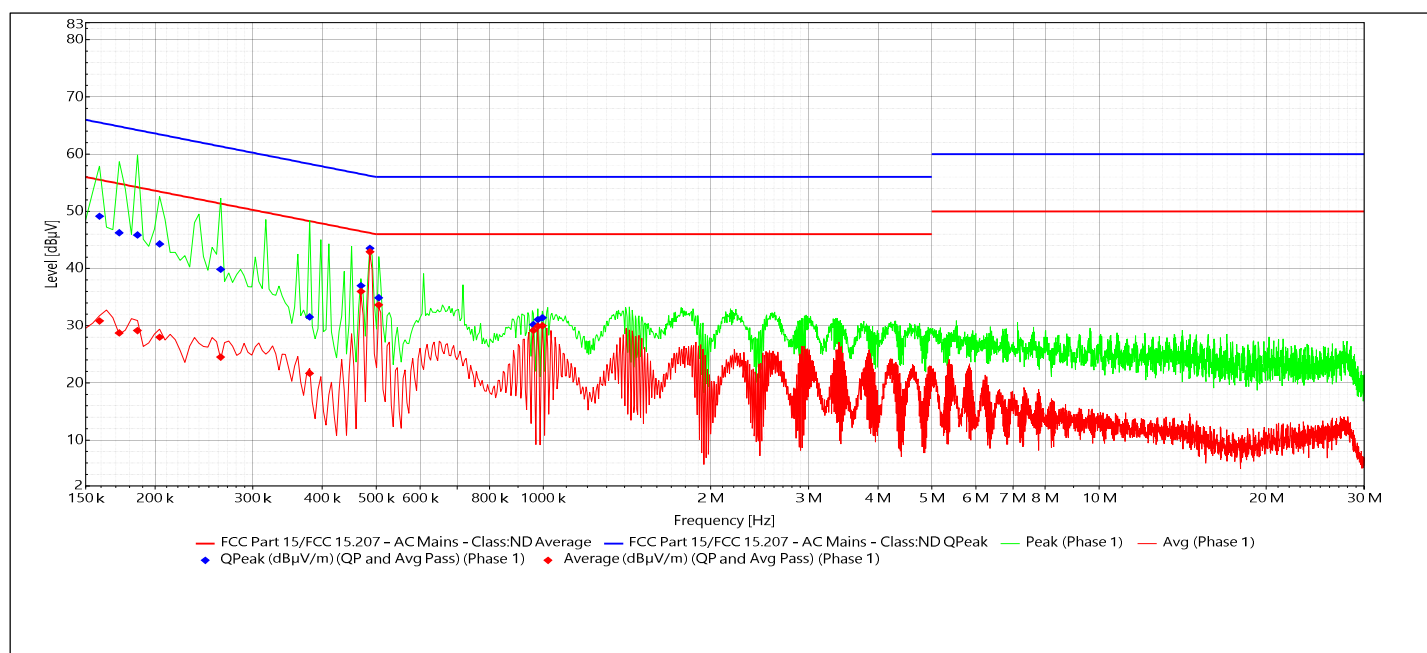
Test Result: Pass

See data below for detailed results.



150kHz - 30MHz - low channel - Line 1 – 1Mbps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	L1	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains
Test Date: 12/22/2023
Test Results: Pass

Test Notes: Low Channel 2402 MHz 1 Mps

Figure 2-35 – Graphical Results – AC Mains L1 Plot – Low Channel 2402MHz – 1Mbps

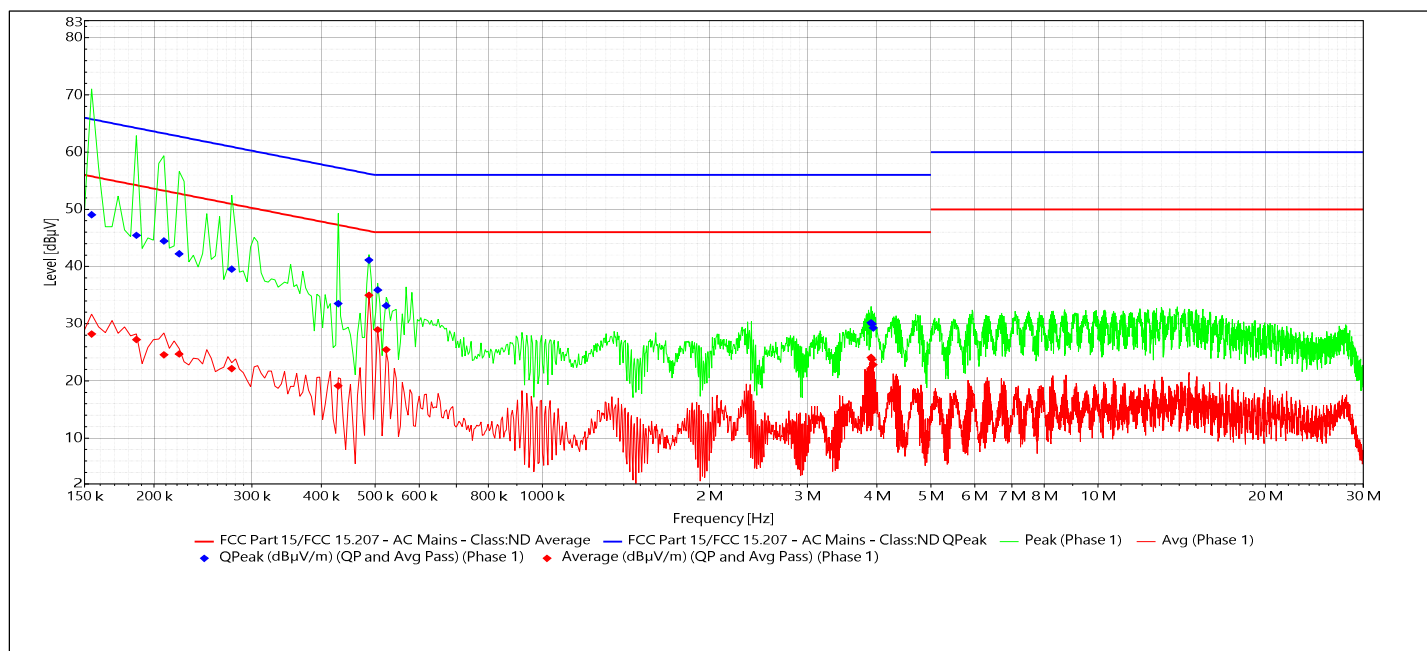
**Table 2.7-1 – Conducted Emissions Results on the AC Power Port (L1) – Low Channel 2402MHz – 1Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.159	30.82	55.52	-24.69	49.14	65.52	-16.38	Pass
0.173	28.74	54.84	-26.10	46.24	64.84	-18.60	Pass
0.186	29.16	54.21	-25.06	45.86	64.21	-18.36	Pass
0.204	27.99	53.45	-25.46	44.30	63.45	-19.15	Pass
0.263	24.51	51.35	-26.84	39.85	61.35	-21.50	Pass
0.380	21.68	48.29	-26.61	31.53	58.29	-26.76	Pass
0.470	35.99	46.52	-10.53	37.00	56.52	-19.52	Pass
0.488	42.92	46.21	-3.29	43.54	56.21	-12.67	Pass
0.506	33.62	46.00	-12.38	34.89	56.00	-21.11	Pass
0.960	29.19	46.00	-16.81	30.18	56.00	-25.82	Pass
0.978	29.91	46.00	-16.09	31.07	56.00	-24.93	Pass
0.996	29.99	46.00	-16.01	31.38	56.00	-24.62	Pass



150kHz - 30MHz - low channel – Line 2 – 1Mps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	N	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains
Test Date: 12/22/2023
Test Results: Pass

Test Notes: Low Channel 2402 MHz 1Mps

Figure 2-36 – Graphical Results – AC Mains L2 Plot – Low Channel 2402MHz – 1Mps

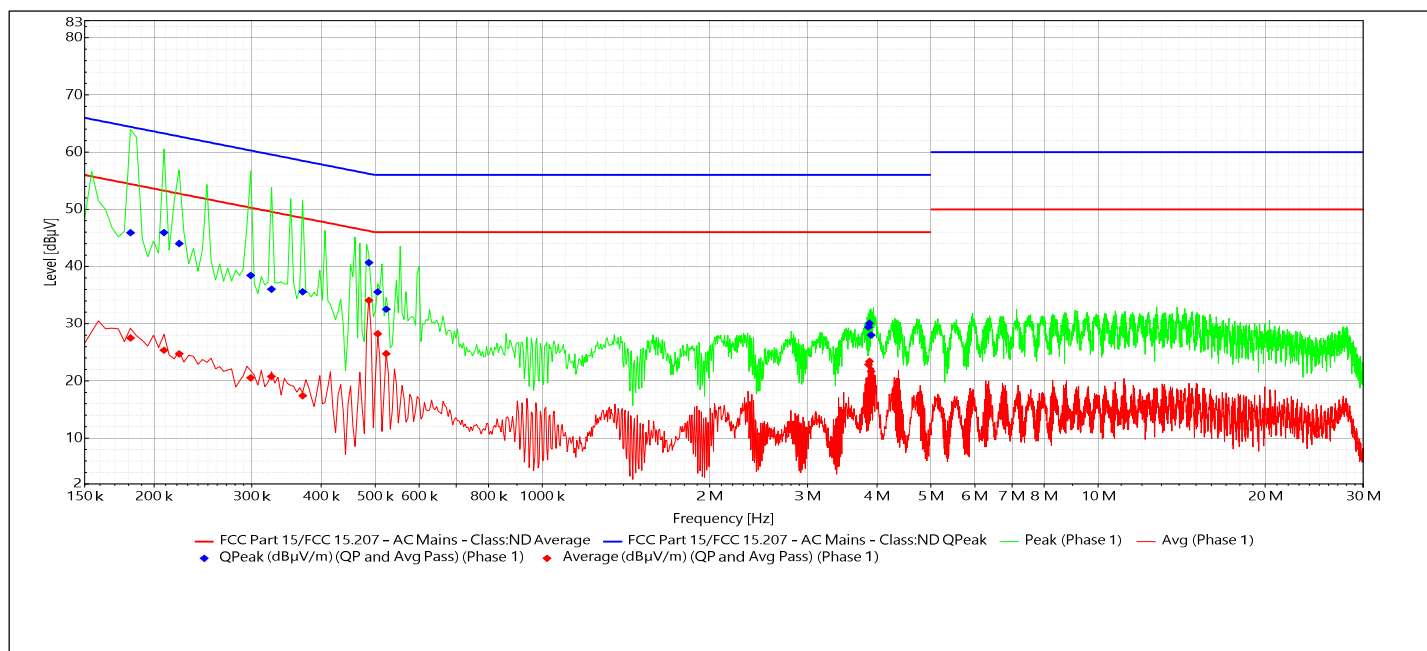
**Table 2.7-2 – Conducted Emissions Results on the AC Power Port (L2) – Low Channel 2402MHz – 1Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.155	28.19	55.75	-27.57	49.04	65.75	-16.72	Pass
0.186	27.23	54.21	-26.98	45.45	64.21	-18.76	Pass
0.209	24.57	53.26	-28.70	44.45	63.26	-18.82	Pass
0.222	24.71	52.74	-28.03	42.21	62.74	-20.54	Pass
0.276	22.16	50.94	-28.78	39.54	60.94	-21.40	Pass
0.429	19.13	47.27	-28.14	33.52	57.27	-23.75	Pass
0.488	34.96	46.21	-11.25	41.13	56.21	-15.08	Pass
0.506	28.94	46.00	-17.06	35.90	56.00	-20.10	Pass
0.524	25.46	46.00	-20.54	33.15	56.00	-22.85	Pass
3.903	24.08	46.00	-21.92	30.15	56.00	-25.85	Pass
3.921	23.74	46.00	-22.26	29.95	56.00	-26.05	Pass
3.939	22.82	46.00	-23.18	29.27	56.00	-26.73	Pass



150kHz - 30MHz - low channel 2Mps - Line 1

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	L1	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains **Test Date:** 12/22/2023 **Test Results:** Pass

Test Notes: Low Channel 2402 MHz 2Mps

Figure 2-37 – Graphical Results – AC Mains L1 Plot – Low Channel 2402MHz – 2Mps

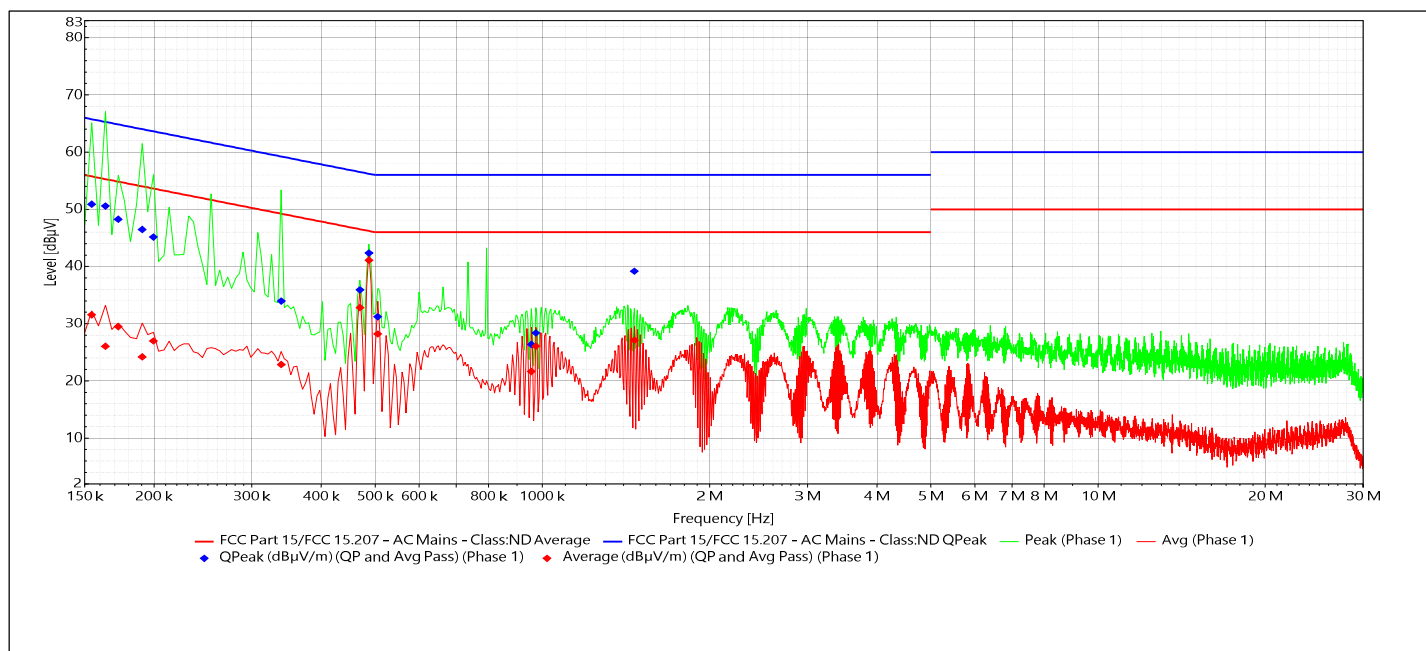
**Table 2.7-3 – Conducted Emissions Results on the AC Power Port (L2) – Low Channel 2402MHz – 2Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.182	27.50	54.42	-26.92	45.91	64.42	-18.51	Pass
0.209	25.36	53.26	-27.90	45.94	63.26	-17.32	Pass
0.222	24.72	52.74	-28.02	44.01	62.74	-18.73	Pass
0.299	20.54	50.28	-29.75	38.43	60.28	-21.85	Pass
0.326	20.75	49.57	-28.81	36.02	59.57	-23.55	Pass
0.371	17.39	48.49	-31.10	35.58	58.49	-22.91	Pass
0.488	34.08	46.21	-12.13	40.68	56.21	-15.53	Pass
0.506	28.23	46.00	-17.77	35.56	56.00	-20.44	Pass
0.524	24.75	46.00	-21.25	32.52	56.00	-23.48	Pass
3.863	22.85	46.00	-23.15	29.40	56.00	-26.60	Pass
3.881	23.42	46.00	-22.58	30.07	56.00	-25.93	Pass
3.903	21.64	46.00	-24.36	28.00	56.00	-28.00	Pass



150kHz - 30MHz - low channel – Line 2 – 2Mps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	N	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains
Test Date: 12/22/2023
Test Results: Pass

Test Notes: Low Channel 2402 MHz 2Mps

Figure 2-38 – Graphical Results – AC Mains L2 Plot – Low Channel 2402MHz – 2Mps

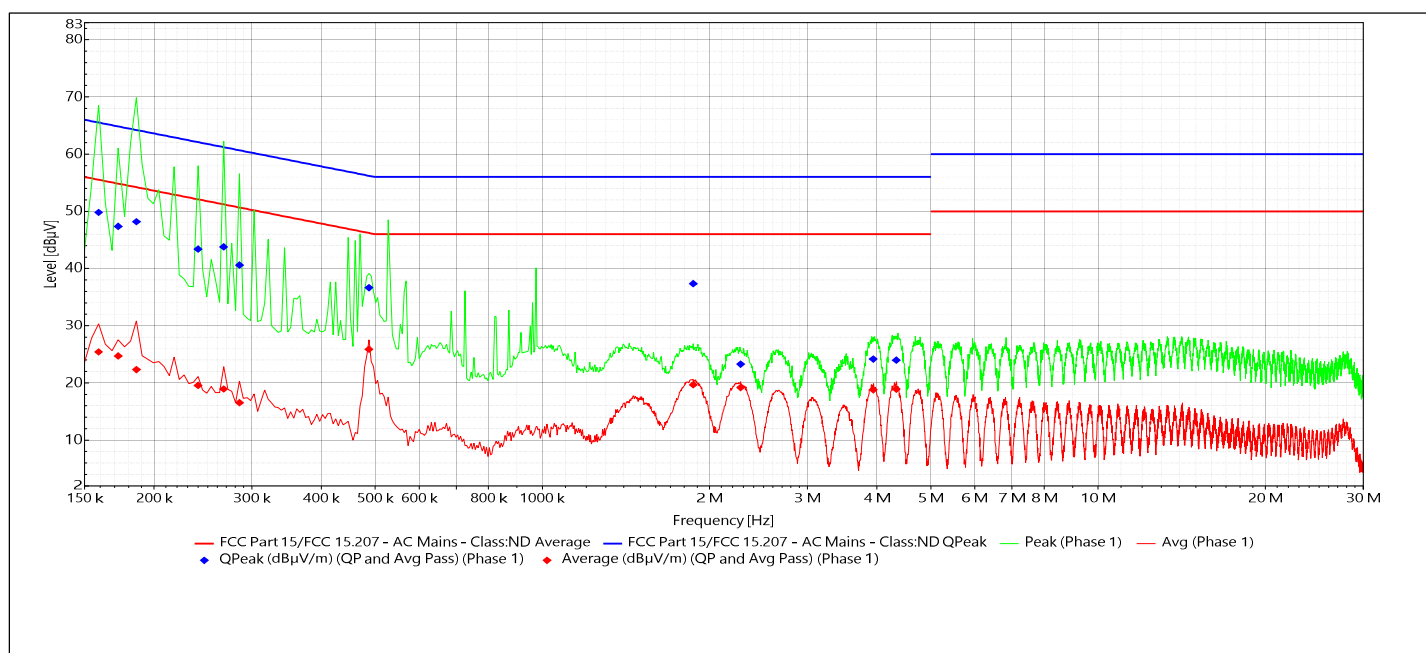
**Table 2.7-4 – Conducted Emissions Results on the AC Power Port (L2) – Low Channel 2402MHz – 2Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.155	31.56	55.75	-24.20	50.89	65.75	-14.86	Pass
0.164	26.05	55.28	-29.23	50.57	65.28	-14.72	Pass
0.173	29.48	54.84	-25.36	48.27	64.84	-16.57	Pass
0.191	24.20	54.01	-29.82	46.48	64.01	-17.54	Pass
0.200	26.98	53.63	-26.65	45.14	63.63	-18.49	Pass
0.339	22.86	49.23	-26.37	33.95	59.23	-25.27	Pass
0.470	32.82	46.52	-13.70	35.93	56.52	-20.60	Pass
0.488	41.11	46.21	-5.10	42.35	56.21	-13.86	Pass
0.506	28.21	46.00	-17.79	31.23	56.00	-24.77	Pass
0.956	21.65	46.00	-24.35	26.39	56.00	-29.61	Pass
0.974	26.08	46.00	-19.92	28.38	56.00	-27.62	Pass
1.464	27.10	46.00	-18.90	39.18	56.00	-16.82	Pass



150kHz - 30MHz - mid channel – Line 1 – 1Mbps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	L1	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains
Test Date: 12/22/2023
Test Results: Pass

Test Notes: Middle Channel 2440 MHz 1Mbps

Figure 2-39 – Graphical Results – AC Mains L1 Plot – Mid Channel 2440MHz – 1Mbps

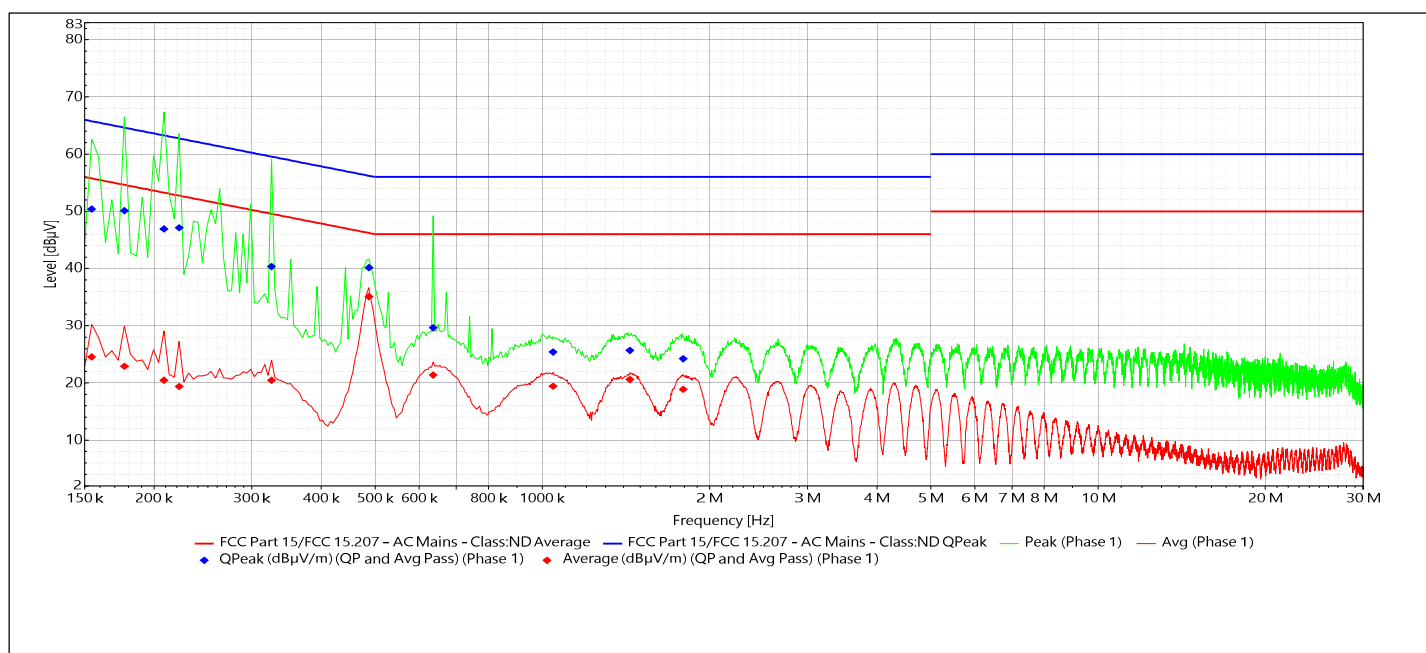
**Table 2.7-5 – Conducted Emissions Results on the AC Power Port (L1) – Mid Channel 2440MHz – 1Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.159	25.42	55.52	-30.10	49.81	65.52	-15.71	Pass
0.173	24.70	54.84	-30.14	47.36	64.84	-17.48	Pass
0.186	22.32	54.21	-31.89	48.19	64.21	-16.02	Pass
0.240	19.56	52.10	-32.53	43.39	62.10	-18.70	Pass
0.267	18.93	51.21	-32.28	43.79	61.21	-17.42	Pass
0.285	16.54	50.67	-34.13	40.59	60.67	-20.07	Pass
0.488	25.89	46.21	-20.32	36.65	56.21	-19.56	Pass
1.869	19.67	46.00	-26.33	37.36	56.00	-18.64	Pass
2.274	19.20	46.00	-26.80	23.27	56.00	-32.73	Pass
3.939	18.80	46.00	-27.20	24.16	56.00	-31.84	Pass
4.335	18.90	46.00	-27.10	23.97	56.00	-32.03	Pass



150kHz - 30MHz - mid channel – Line 2 – 1Mps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	N	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains **Test Date:** 12/22/2023 **Test Results:** Pass

Test Notes: Middle Channel 2440 MHz 1Mps

Figure 2-40 – Graphical Results – AC Mains L2 Plot – Mid Channel 2440MHz – 1Mps

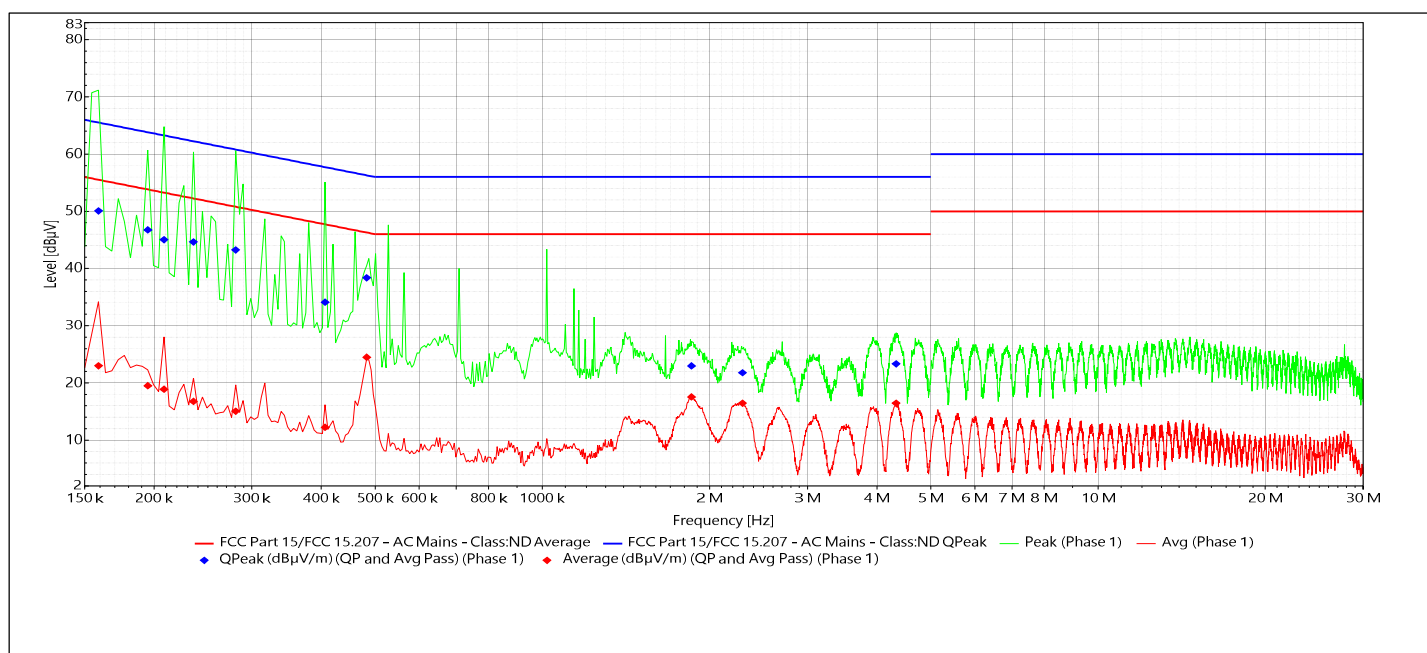
**Table 2.7-6 – Conducted Emissions Results on the AC Power Port (L2) – Mid Channel 2440MHz – 1Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.155	24.53	55.75	-31.23	50.39	65.75	-15.36	Pass
0.177	22.90	54.63	-31.72	50.11	64.63	-14.51	Pass
0.209	20.46	53.26	-32.80	46.91	63.26	-16.36	Pass
0.222	19.37	52.74	-33.38	47.13	62.74	-15.61	Pass
0.326	20.45	49.57	-29.12	40.33	59.57	-19.24	Pass
0.488	35.07	46.21	-11.14	40.15	56.21	-16.06	Pass
0.636	21.38	46.00	-24.62	29.66	56.00	-26.34	Pass
1.046	19.43	46.00	-26.57	25.41	56.00	-30.59	Pass
1.437	20.59	46.00	-25.41	25.69	56.00	-30.31	Pass
1.793	18.87	46.00	-27.13	24.23	56.00	-31.77	Pass



150kHz - 30MHz - mid channel – Line 1 – 2Mps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	L1	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains
Test Date: 12/22/2023
Test Results: Pass

Test Notes: Middle Channel 2440 MHz 2Mps

Figure 2-41 – Graphical Results – AC Mains L1 Plot – Mid Channel 2440MHz – 2Mps

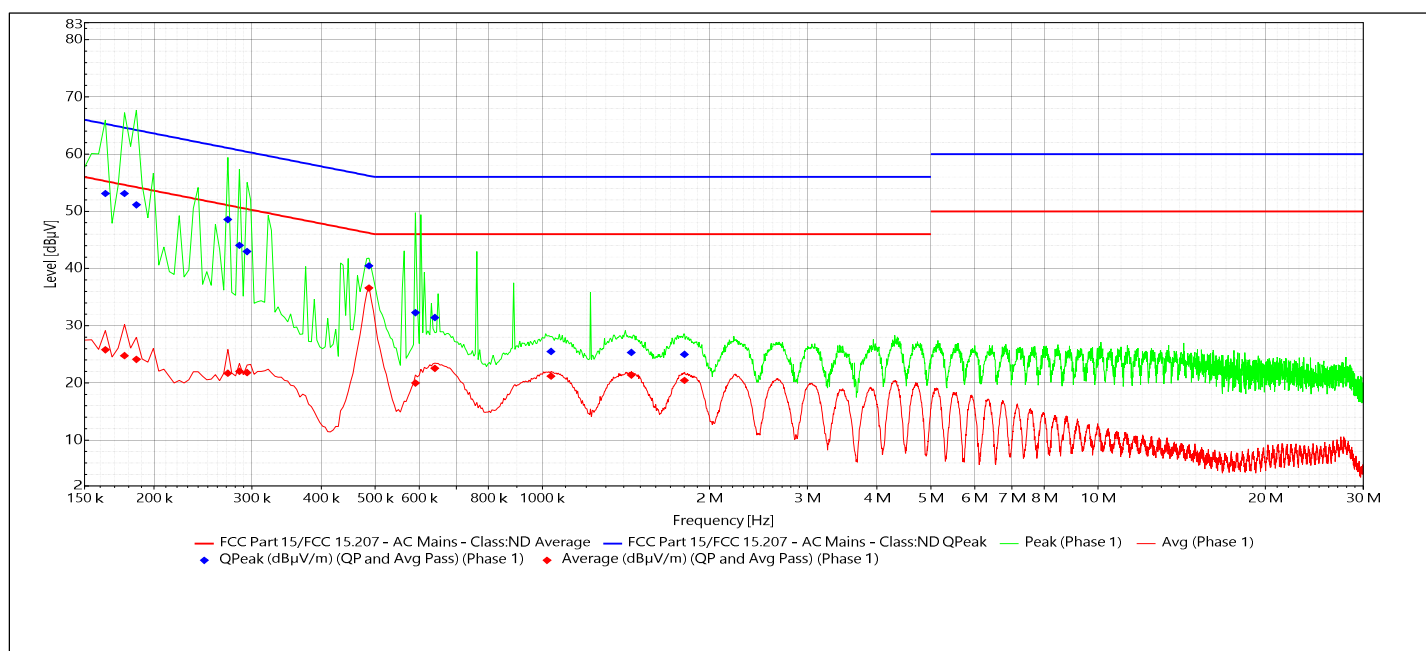
**Table 2.7-7 – Conducted Emissions Results on the AC Power Port (L1) – Mid Channel 2440MHz – 2Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.159	23.00	55.52	-32.52	50.08	65.52	-15.43	Pass
0.195	19.51	53.82	-34.31	46.75	63.82	-17.07	Pass
0.209	18.88	53.26	-34.38	45.05	63.26	-18.21	Pass
0.236	16.75	52.25	-35.50	44.65	62.25	-17.60	Pass
0.281	15.06	50.80	-35.74	43.26	60.80	-17.54	Pass
0.407	12.22	47.72	-35.50	34.11	57.72	-23.61	Pass
0.483	24.48	46.29	-21.81	38.39	56.29	-17.90	Pass
1.856	17.55	46.00	-28.45	22.98	56.00	-33.02	Pass
2.292	16.44	46.00	-29.56	21.78	56.00	-34.22	Pass
4.331	16.45	46.00	-29.55	23.32	56.00	-32.68	Pass



150kHz - 30MHz - mid channel – Line 2 – 2Mps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	N	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains
Test Date: 12/22/2023
Test Results: Pass

Test Notes: Middle Channel 2440 MHz 2Mps

Figure 2-42 – Graphical Results – AC Mains L2 Plot – Mid Channel 2440MHz – 2Mps

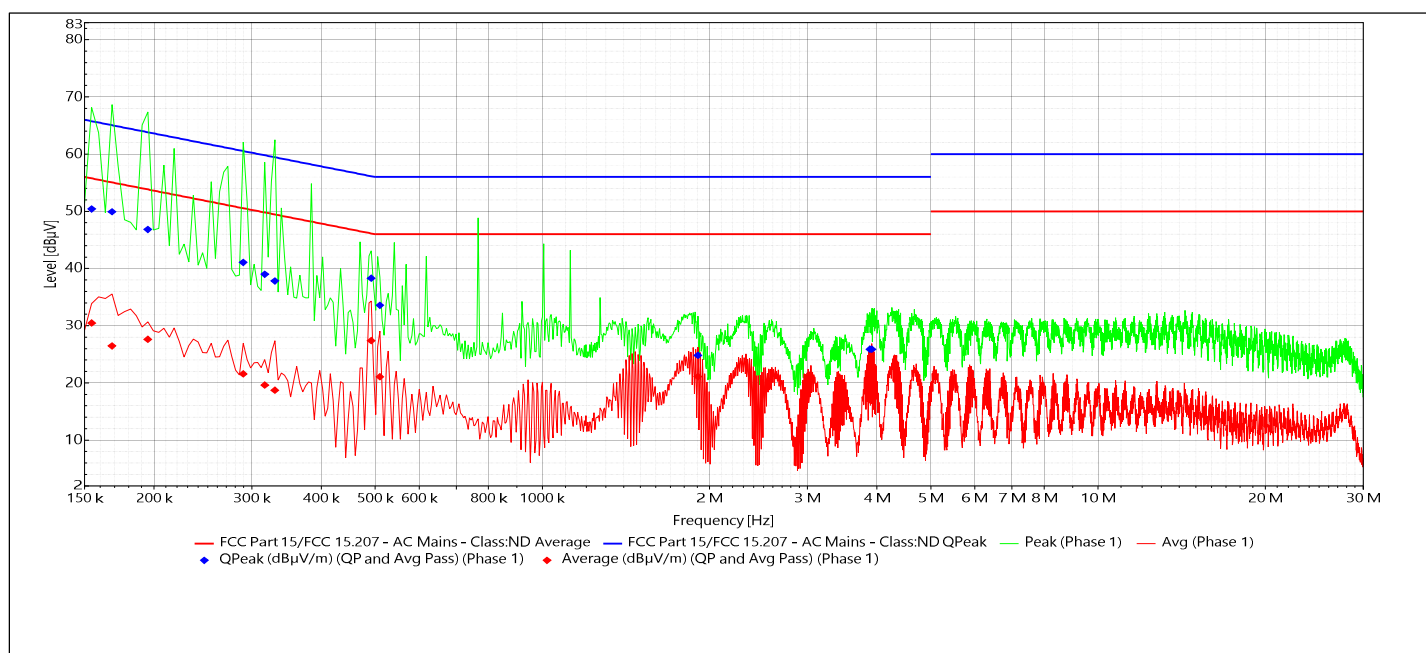
**Table 2.7-8 – Conducted Emissions Results on the AC Power Port (L2) – Mid Channel 2440MHz – 2Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.164	25.80	55.28	-29.49	53.11	65.28	-12.18	Pass
0.177	24.75	54.63	-29.88	53.11	64.63	-11.51	Pass
0.186	24.12	54.21	-30.09	51.15	64.21	-13.06	Pass
0.272	21.69	51.07	-29.38	48.57	61.07	-12.50	Pass
0.285	22.03	50.67	-28.64	44.05	60.67	-16.62	Pass
0.294	21.79	50.41	-28.62	42.97	60.41	-17.44	Pass
0.488	36.58	46.21	-9.63	40.47	56.21	-15.74	Pass
0.591	19.98	46.00	-26.02	32.28	56.00	-23.72	Pass
0.641	22.54	46.00	-23.46	31.41	56.00	-24.59	Pass
1.037	21.17	46.00	-24.83	25.49	56.00	-30.51	Pass
1.446	21.36	46.00	-24.64	25.33	56.00	-30.67	Pass
1.802	20.44	46.00	-25.56	24.98	56.00	-31.02	Pass



150kHz - 30MHz - High channel – Line 1 – 1Mbps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	L1	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains
Test Date: 12/22/2023
Test Results: Pass

Test Notes: High Channel 2480 MHz 1Mbps

Figure 2-43 – Graphical Results – AC Mains L1 Plot – High Channel 2480MHz – 1Mbps

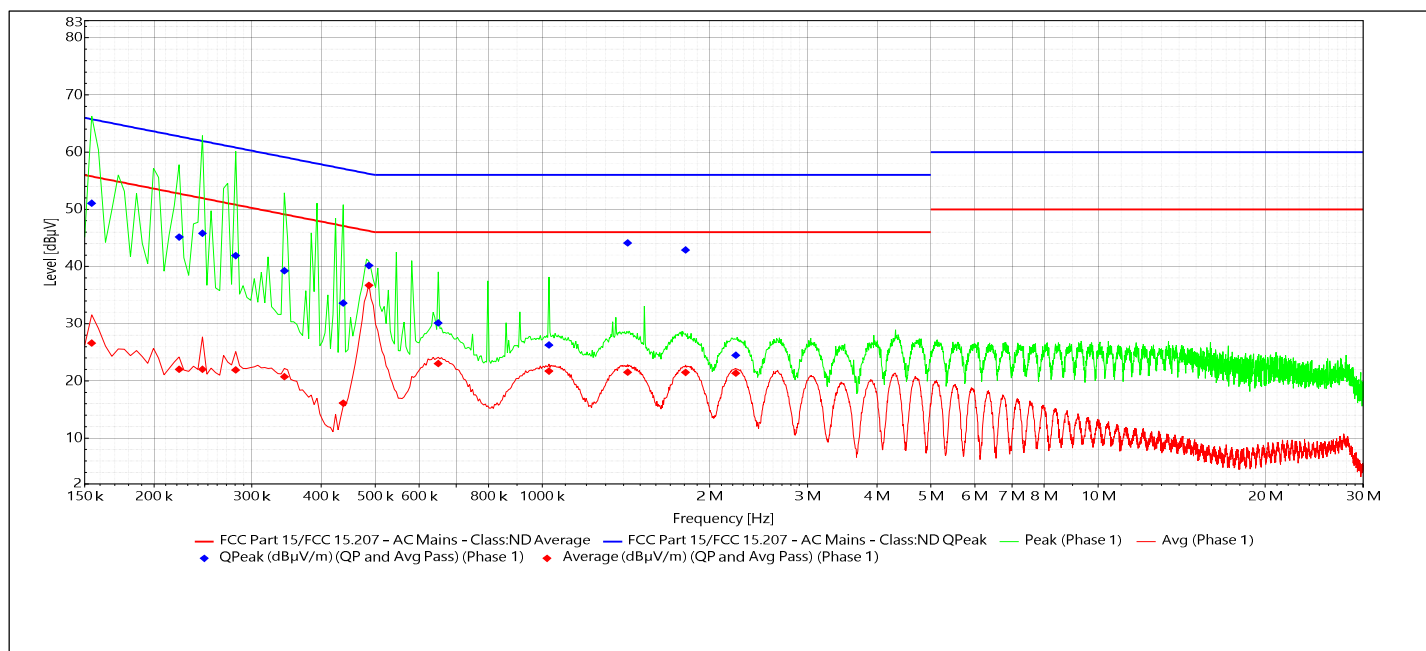
**Table 2.7-9 – Conducted Emissions Results on the AC Power Port (L1) – High Channel 2480MHz – 1Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.155	30.48	55.75	-25.27	50.41	65.75	-15.34	Pass
0.168	26.46	55.06	-28.60	49.92	65.06	-15.14	Pass
0.195	27.61	53.82	-26.21	46.84	63.82	-16.98	Pass
0.290	21.57	50.54	-28.97	41.06	60.54	-19.48	Pass
0.317	19.62	49.80	-30.18	39.00	59.80	-20.80	Pass
0.330	18.73	49.45	-30.72	37.81	59.45	-21.65	Pass
0.492	27.39	46.13	-18.74	38.31	56.13	-17.82	Pass
0.510	21.06	46.00	-24.94	33.56	56.00	-22.44	Pass
1.905	21.10	46.00	-24.90	24.82	56.00	-31.18	Pass
3.885	20.70	46.00	-25.30	25.88	56.00	-30.12	Pass
3.917	20.79	46.00	-25.21	25.89	56.00	-30.11	Pass



150kHz - 30MHz - High channel – Line 2 – 1Mps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	N	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains
Test Date: 12/22/2023
Test Results: Pass

Test Notes: High Channel 2480 MHz 1Mps

Figure 2-44 – Graphical Results – AC Mains L2 Plot – High Channel 2480MHz – 1Mps

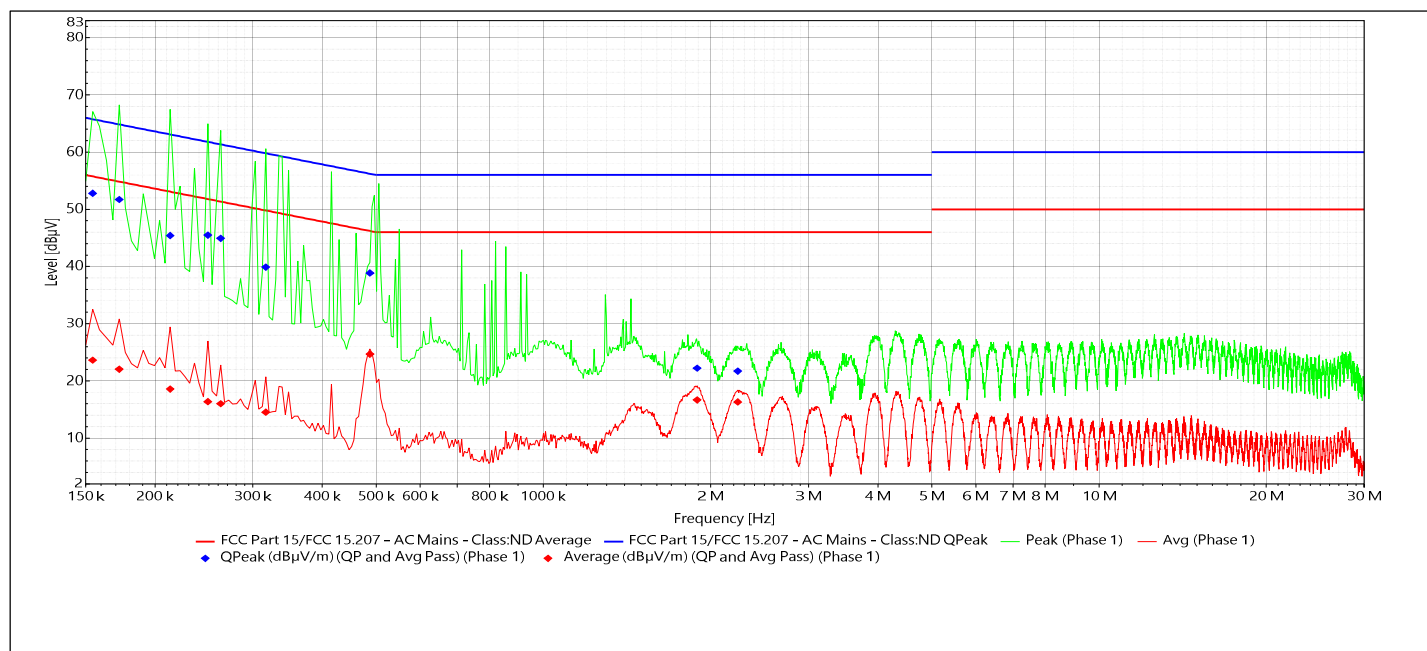
**Table 2.7-10 – Conducted Emissions Results on the AC Power Port (L2) – High Channel 2480MHz – 1Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.155	26.60	55.75	-29.16	51.07	65.75	-14.69	Pass
0.222	22.01	52.74	-30.73	45.16	62.74	-17.58	Pass
0.245	22.02	51.94	-29.92	45.81	61.94	-16.13	Pass
0.281	21.91	50.80	-28.89	41.91	60.80	-18.89	Pass
0.344	20.73	49.12	-28.39	39.26	59.12	-19.86	Pass
0.438	16.12	47.10	-30.98	33.61	57.10	-23.49	Pass
0.488	36.70	46.21	-9.51	40.17	56.21	-16.04	Pass
0.650	23.02	46.00	-22.98	30.14	56.00	-25.86	Pass
1.028	21.71	46.00	-24.29	26.27	56.00	-29.73	Pass
1.424	21.51	46.00	-24.49	44.12	56.00	-11.88	Pass
1.811	21.48	46.00	-24.52	42.90	56.00	-13.10	Pass
2.229	21.35	46.00	-24.65	24.49	56.00	-31.51	Pass



150kHz - 30MHz - High channel- Line 1 - 2Mps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	L1	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains
Test Date: 12/22/2023
Test Results: Pass

Test Notes: High Channel 2480 MHz 2Mps

Figure 2-45 – Graphical Results – AC Mains L1 Plot – High Channel 2480MHz – 2Mps

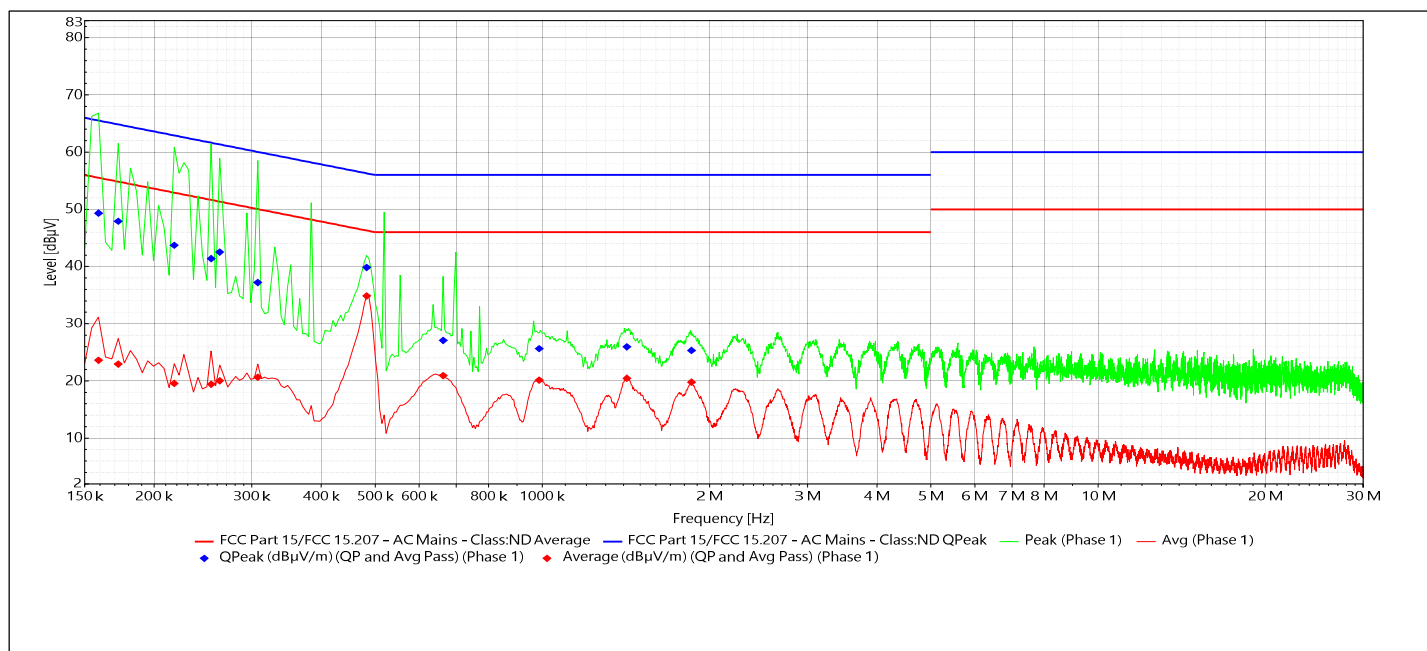
**Table 2.7-11 – Conducted Emissions Results on the AC Power Port (L1) – High Channel 2480MHz – 2Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.155	23.63	55.75	-32.12	52.79	65.75	-12.96	Pass
0.173	22.04	54.84	-32.80	51.71	64.84	-13.13	Pass
0.213	18.57	53.09	-34.51	45.40	63.09	-17.68	Pass
0.249	16.37	51.79	-35.42	45.49	61.79	-16.30	Pass
0.263	16.02	51.35	-35.34	44.92	61.35	-16.43	Pass
0.317	14.52	49.80	-35.28	39.89	59.80	-19.91	Pass
0.488	24.67	46.21	-21.54	38.86	56.21	-17.35	Pass
1.892	16.67	46.00	-29.33	22.23	56.00	-33.77	Pass
2.238	16.31	46.00	-29.69	21.71	56.00	-34.29	Pass



150kHz - 30MHz - High channel – Line 2 – 2Mps

Frequency Range	Line Tested	RBW	Step Size	Sweep Time
150 kHz - 30 MHz	N	9 kHz	4.5 kHz	5 s/MHz



Limit: FCC Part 15/FCC 15.207 - AC Mains
Test Date: 12/22/2023
Test Results: Pass

Test Notes: High Channel 2480 MHz 2Mps

Figure 2-46 – Graphical Results – AC Mains L2 Plot – High Channel 2480MHz – 2Mps

**Table 2.7-12 – Conducted Emissions Results on the AC Power Port (L2) – High Channel 2480MHz – 2Mps**

Frequency (MHz)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)	QPeak (dBuV)	QPeak Limit (dBuV)	QPeak Margin (dB)	Result
0.159	23.60	55.52	-31.92	49.32	65.52	-16.20	Pass
0.173	22.94	54.84	-31.90	47.91	64.84	-16.93	Pass
0.218	19.55	52.91	-33.36	43.71	62.91	-19.20	Pass
0.254	19.41	51.64	-32.23	41.38	61.64	-20.26	Pass
0.263	20.04	51.35	-31.32	42.53	61.35	-18.82	Pass
0.308	20.65	50.04	-29.39	37.21	60.04	-22.83	Pass
0.483	34.86	46.29	-11.43	39.84	56.29	-16.45	Pass
0.663	20.93	46.00	-25.07	27.09	56.00	-28.91	Pass
0.987	20.14	46.00	-25.86	25.64	56.00	-30.36	Pass
1.419	20.46	46.00	-25.54	25.97	56.00	-30.03	Pass
1.856	19.77	46.00	-26.23	25.31	56.00	-30.69	Pass



2.7.9 Test Location and Test Equipment Used

The tests were carried out in New Brighton, MN.

Test Area: CSAC1

Table 2.7-13 – Conducted Emissions Test Equipment List

Device #	Manufacturer	Description	Model	Serial #	Cal Code	Cal Date	Cal Due
NBLE10465	Weinschel	Attenuator, 20 dB	34-20-34	BR2600	B	01/02/2023	01/02/2024
WRLE10942	Fischer Custom Comm.	LISN	FCC-LISN-50-25-2-10	120306	G	08/30/2023	08/30/2025
NBLE11592	Rohde & Schwarz	Receiver, 10 Hz-7 GHz	ESR7 (SAP 21006090)	101771	G	03/06/2023	03/06/2024

Cal Code G = Calibration performed by an accredited outside source.

Cal Code B = Calibration verification performed internally.

Cal Code Y = Passive Device, or Calibration not required when used with other calibrated equipment.



2.8 Radiated Spurious Emissions

2.8.1 Specification Reference

FCC 47 CFR Part 15 Subpart C, 15.247
RSS-GEN Issue 5

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

18 - 20 December 2023

2.8.4 Test Method

The EUT was set up in a semi-anechoic chamber on a remotely controlled turntable and placed on a non-conductive table 0.8 m above a reference ground plane for 30-1000 MHz and 1.5m above the ground plane for above 1 GHz.

For 30-1000 MHz a pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarization using a peak detector; measurements were taken at a 3m distance.

For above 1 GHz a pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarization using peak and average detectors; measurements were taken at a 3m distance.

For all frequency ranges the final readings were maximized by adjusting the antenna height, polarization and turntable azimuth, in accordance with the specification. For below 1 GHz final measurements were taken with a quasi-peak detector and above 1 GHz final measurements were re-measured with peak and average detectors.

The EUT was assessed against the limits specified in FCC 47 CFR Part 15C §15.209.

2.8.5 Environmental Conditions

The EUT was evaluated within the climatic range of the EUT as specified by the manufacturer. When the manufacturer does not specify climatic parameters for the EUT, all tests are performed within the ambient climatic conditions of the laboratory.



2.8.6 Additional Observations

The highest frequency to which the DUT was measured in accordance with §15.33(a)(1).

Automated measurements used BAT-EMC (v2022.0.27.0) software. Measurements were done at a 3m distance. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.8.7 Sample Computation (Radiated Emissions)

Measuring equipment raw measurement (dBμV/m) @ 30 MHz			20.0
Correction Factor (dB)	Cable 2	0.24	18.94
	TEM00011 (antenna)	18.70	
Reported Quasi-peak Final Measurement (dBμV/m) @ 30 MHz			38.94

2.8.8 Test Results

Test Summary: Measurements between 1-18 GHz were taken with a 2.4 GHz notch filter in front of the pre-amp to prevent overloading. EUT operated as intended before, during, and after testing.

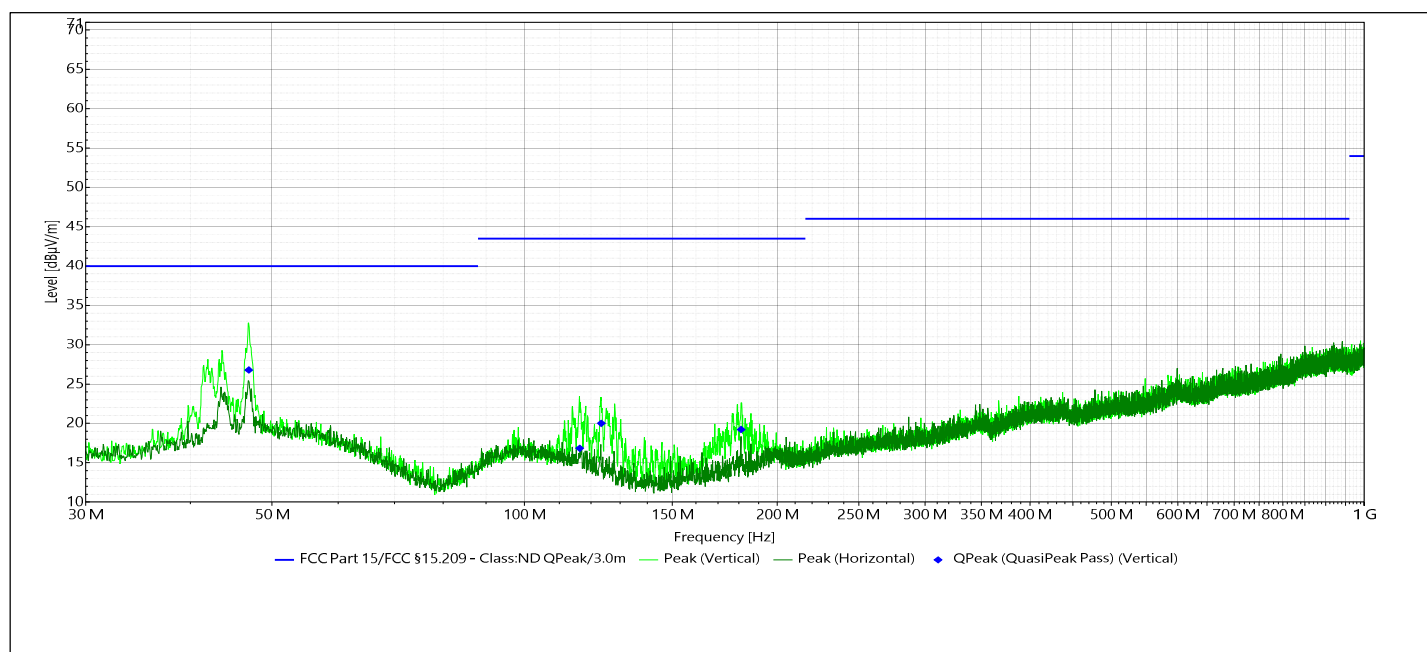
Test Result: Pass

See data below for detailed results.



Spurious Emissions 30M-1GHz - low channel 1MPs

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
30 MHz - 1 GHz	3m	Vertical	100 kHz	18001 Pts	Auto
30 MHz - 1 GHz	3m	Horizontal	100 kHz	18001 Pts	Auto



Limit: FCC Part 15/FCC §15.209
Test Date: 12/19/2023
Test Results: Pass

Test Notes: low Channel 2402MHz, 1Mps

Figure 2-47 – RE Spurious Emissions 30-1000 MHz – Low Channel – 1Mps

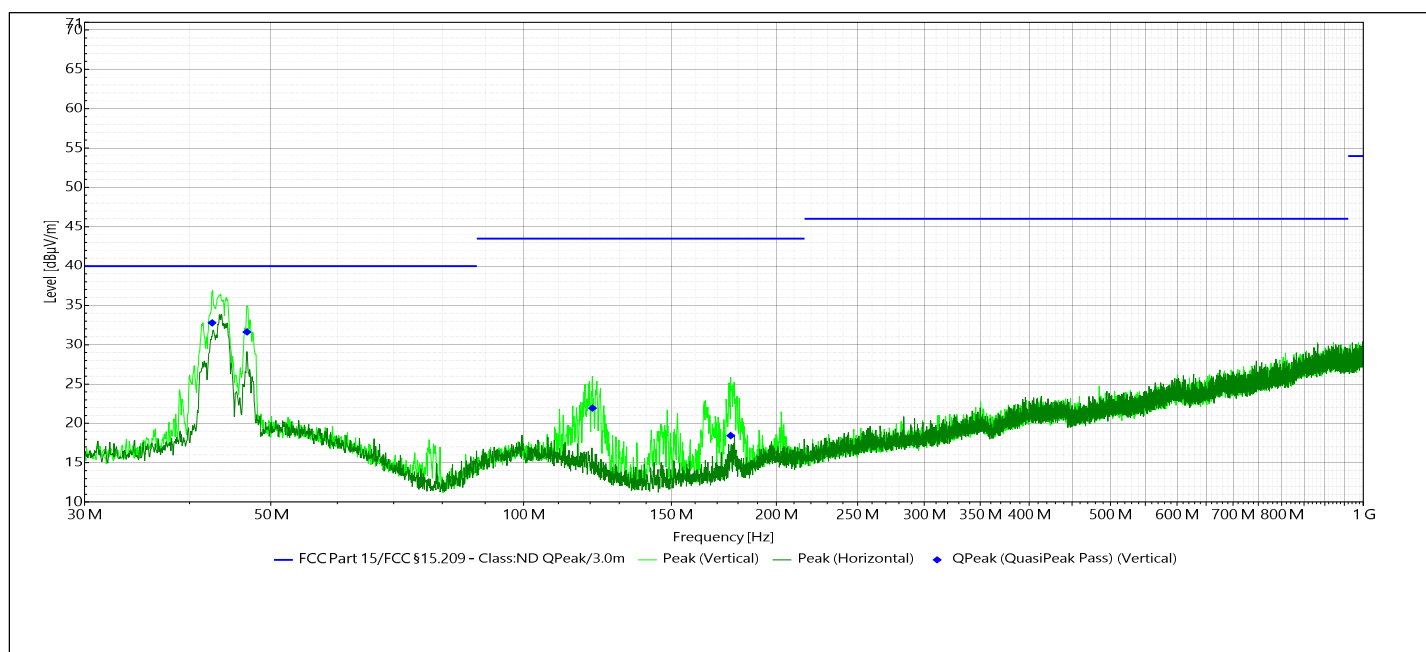
**Table 2.8-1 – RE Spurious Emissions 30-1000 MHz – Low Channel – 1MPs**

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
46.947	26.78	40.00	-13.22	179.00	1.12	Vertical	Pass
116.320	16.84	43.50	-26.66	249.00	1.33	Vertical	Pass
123.419	20.00	43.50	-23.50	153.00	1.12	Vertical	Pass
181.101	19.22	43.50	-24.28	54.00	1.00	Vertical	Pass



Spurious Emissions 30M-1GHz - low channel 2Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
30 MHz - 1 GHz	3m	Vertical	100 kHz	18001 Pts	Auto
30 MHz - 1 GHz	3m	Horizontal	100 kHz	18001 Pts	Auto



Limit: FCC Part 15/FCC §15.209
Test Date: 12/20/2023
Test Results: Pass

Test Notes: low Channel 2402MHz, 2Mps

Figure 2-48 – RE Spurious Emissions 30-1000 MHz – Low Channel – 2Mps

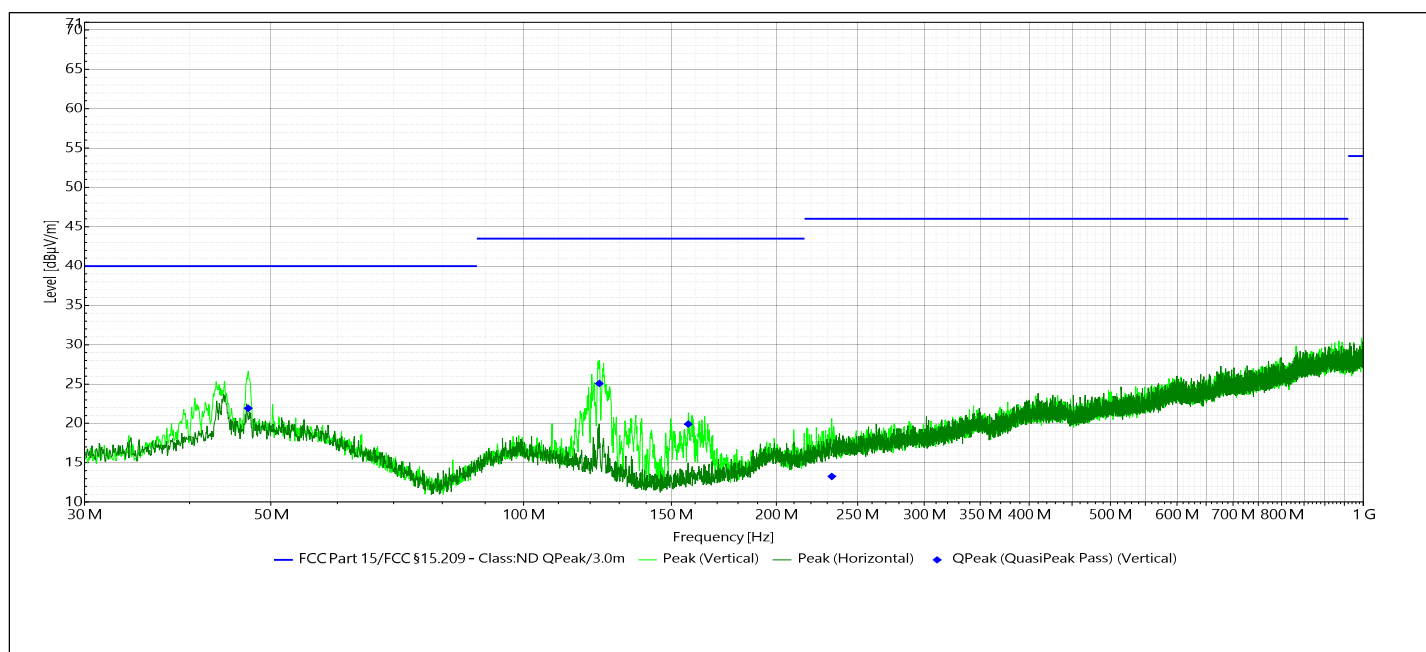
**Table 2.8-2 – RE Spurious Emissions 30-1000 MHz – Low Channel – 2MPs**

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
42.575	32.78	40.00	-7.22	151.00	2.20	Vertical	Pass
46.836	31.62	40.00	-8.38	221.00	1.00	Vertical	Pass
120.782	21.94	43.50	-21.56	209.00	1.12	Vertical	Pass
176.484	18.45	43.50	-25.05	320.00	1.00	Vertical	Pass



Spurious Emissions 30M-1GHz - Mid channel 1Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
30 MHz - 1 GHz	3m	Vertical	100 kHz	18001 Pts	Auto
30 MHz - 1 GHz	3m	Horizontal	100 kHz	18001 Pts	Auto



Limit: FCC Part 15/FCC §15.209
Test Date: 12/19/2023
Test Results: Pass

Test Notes: Mid Channel 2440MHz, 1Mps

Figure 2-49 – RE Spurious Emissions 30-1000 MHz – Mid Channel – 1Mps

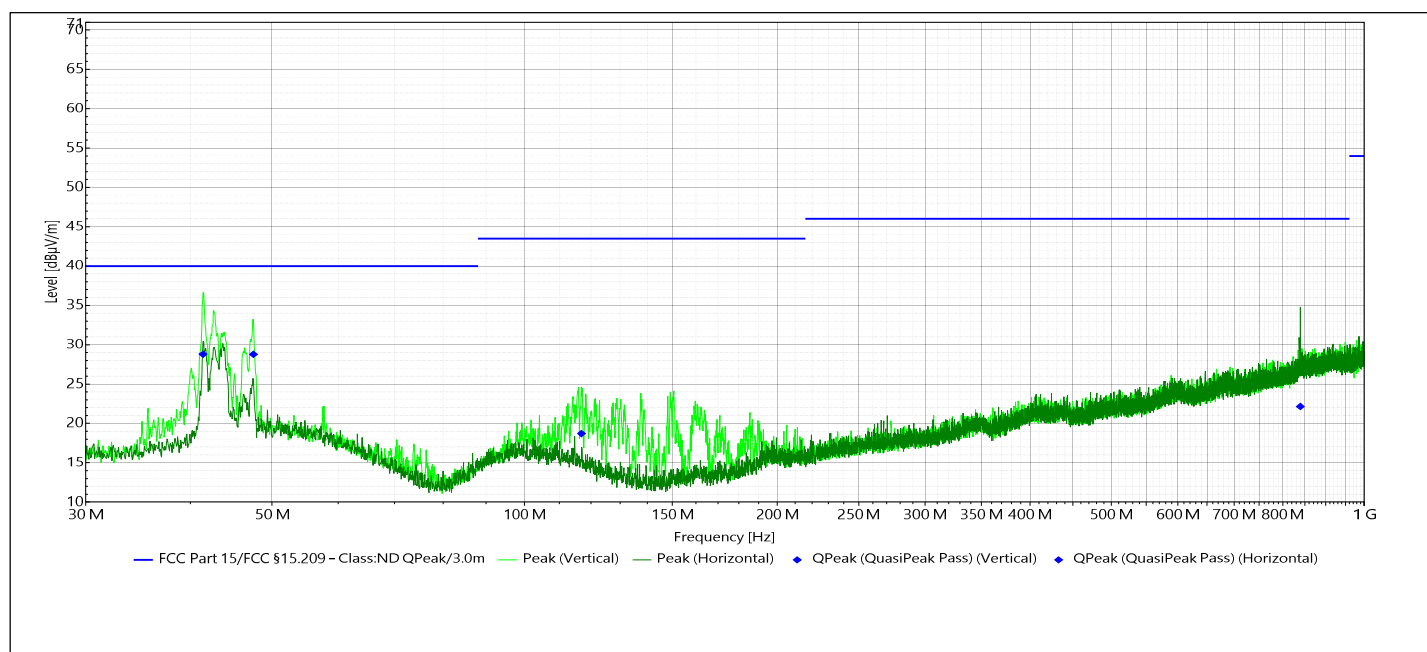
**Table 2.8-3 – RE Spurious Emissions 30-1000 MHz – Mid Channel – 1MPs**

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
47.000	21.91	40.00	-18.09	179.00	1.00	Vertical	Pass
123.070	25.08	43.50	-18.42	332.00	1.12	Vertical	Pass
157.128	19.90	43.50	-23.60	0.00	1.00	Vertical	Pass
232.841	13.25	46.00	-32.75	346.00	1.77	Vertical	Pass



Spurious Emissions 30M-1GHz - Mid channel 2Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
30 MHz - 1 GHz	3m	Vertical	100 kHz	18001 Pts	Auto
30 MHz - 1 GHz	3m	Horizontal	100 kHz	18001 Pts	Auto



Limit: FCC Part 15/FCC §15.209
Test Date: 12/20/2023
Test Results: Pass

Test Notes: Mid Channel 2440MHz, 2Mps

Figure 2-50 – RE Spurious Emissions 30-1000 MHz – Mid Channel – 2Mps

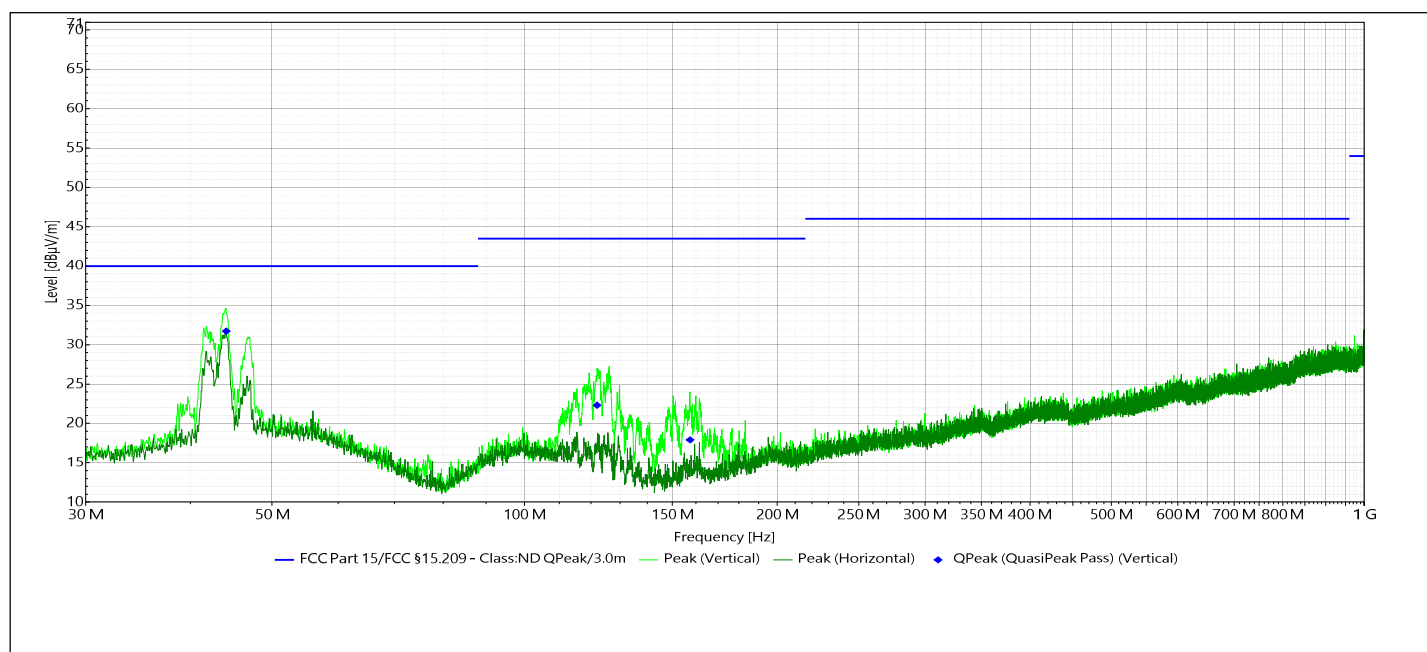
**Table 2.8-4 – RE Spurious Emissions 30-1000 MHz – Mid Channel – 2MPs**

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
41.402	28.79	40.00	-11.21	221.00	1.00	Vertical	Pass
47.549	28.78	40.00	-11.22	250.00	1.00	Vertical	Pass
116.909	18.71	43.50	-24.79	195.00	1.00	Vertical	Pass
839.311	22.14	46.00	-23.86	84.00	2.19	Horizontal	Pass



Spurious Emissions 30M-1GHz - High channel 1Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
30 MHz - 1 GHz	3m	Vertical	100 kHz	18001 Pts	Auto
30 MHz - 1 GHz	3m	Horizontal	100 kHz	18001 Pts	Auto



Limit: FCC Part 15/FCC §15.209
Test Date: 12/20/2023
Test Results: Pass

Test Notes: High Channel 2480MHz, 1Mps

Figure 2-51 – RE Spurious Emissions 30-1000 MHz – High Channel – 1Mps

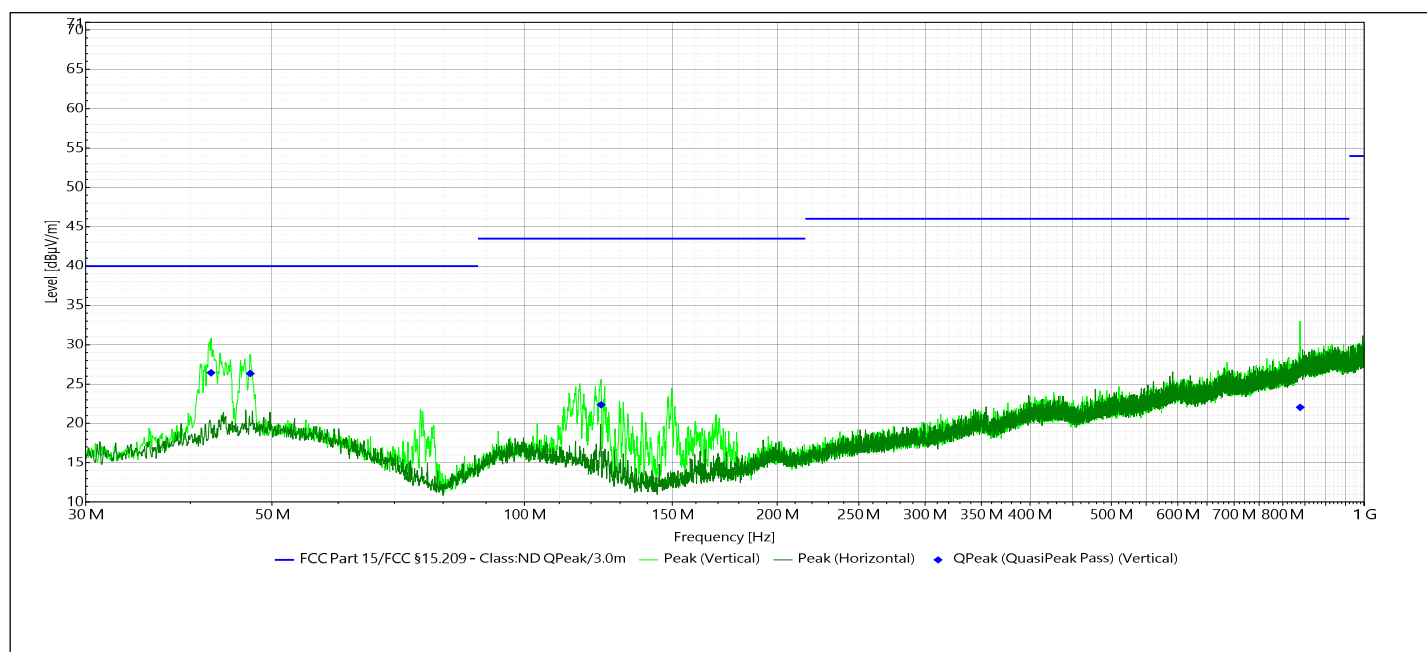
**Table 2.8-5 – RE Spurious Emissions 30-1000 MHz – High Channel – 1MPs**

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
44.131	31.72	40.00	-8.28	68.00	1.00	Vertical	Pass
121.996	22.31	43.50	-21.19	207.00	1.00	Vertical	Pass
157.447	17.90	43.50	-25.60	181.00	1.00	Vertical	Pass



Spurious Emissions 30M-1GHz - High channel 2Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
30 MHz - 1 GHz	3m	Vertical	100 kHz	18001 Pts	Auto
30 MHz - 1 GHz	3m	Horizontal	100 kHz	18001 Pts	Auto



Limit: FCC Part 15/FCC §15.209
Test Date: 12/20/2023
Test Results: Pass

Test Notes: High Channel 2480MHz, 2Mps

Figure 2-52 – RE Spurious Emissions 30-1000 MHz – High Channel – 2Mps

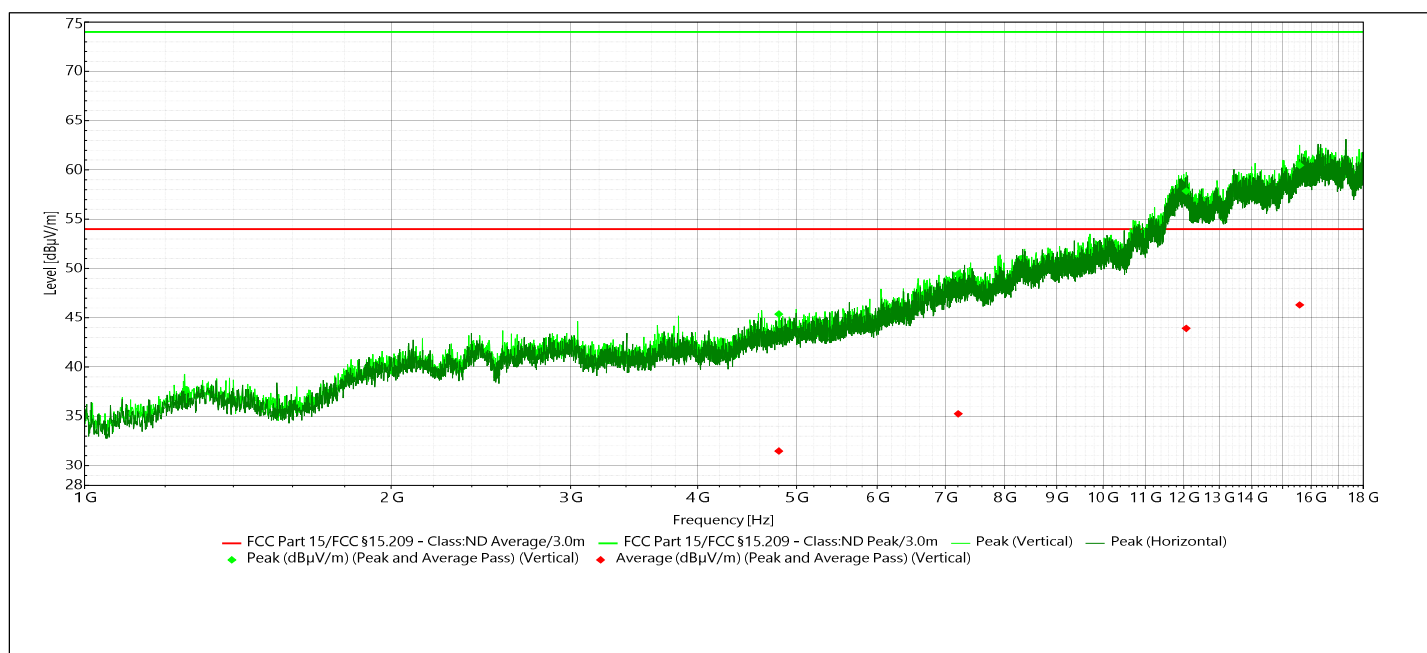
**Table 2.8-6 – RE Spurious Emissions 30-1000 MHz – High Channel – 2MPs**

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
42.319	26.43	40.00	-13.57	235.00	1.12	Vertical	Pass
47.135	26.33	40.00	-13.67	223.00	1.00	Vertical	Pass
123.345	22.37	43.50	-21.13	278.00	1.00	Vertical	Pass
839.171	22.04	46.00	-23.96	264.00	2.62	Vertical	Pass



Spurious Emissions 1 - 18GHz - low channel 1Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
1 GHz - 18 GHz	3m	Vertical	1 MHz	18001 Pts	Auto
1 GHz - 18 GHz	3m	Horizontal	1 MHz	18001 Pts	Auto



Limit: FCC Part 15/FCC §15.209
Test Date: 12/18/2023
Test Results: Pass

Test Notes: Low Channel 2402MHz, 1Mps

Figure 2-53 – RE Spurious Emissions 1-18 GHz – Low Channel – 1Mps

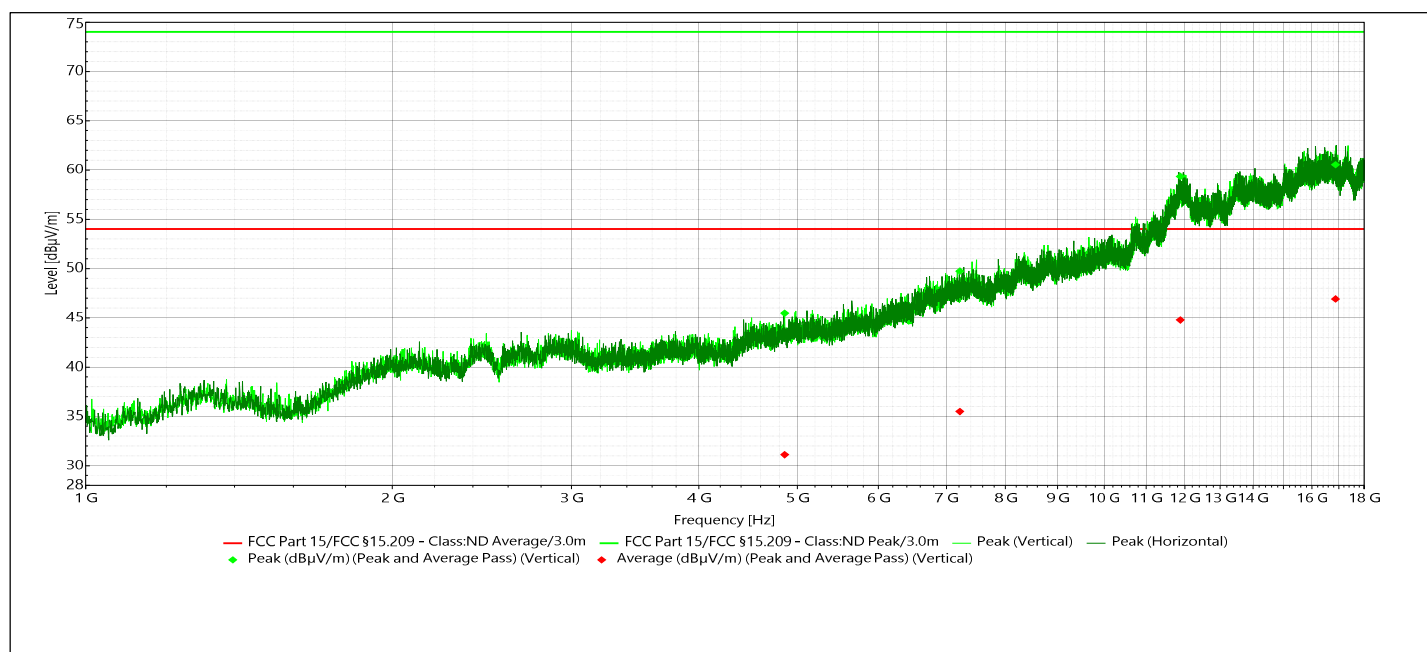
**Table 2.8-7 – RE Spurious Emissions 1-18 GHz – Low Channel – 1Mps**

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
4804.222	45.37	74.00	-28.63	31.47	54.00	-22.53	266.00	4.00	Vertical	Pass
7205.944	49.44	74.00	-24.56	35.25	54.00	-18.75	94.00	4.00	Vertical	Pass
12067.000	57.85	74.00	-16.15	43.92	54.00	-10.08	266.00	1.00	Vertical	Pass
15594.500	60.47	74.00	-13.53	46.30	54.00	-7.70	360.00	4.00	Vertical	Pass



Spurious Emissions 1 - 18GHz - low channel 2Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
1 GHz - 18 GHz	3m	Vertical	1 MHz	18001 Pts	Auto
1 GHz - 18 GHz	3m	Horizontal	1 MHz	18001 Pts	Auto



Limit: FCC Part 15/FCC §15.209
Test Date: 12/18/2023
Test Results: Pass

Test Notes: Low Channel 2402MHz, 2Mps

Figure 2-54 – RE Spurious Emissions 1-18 GHz – Low Channel – 2Mps

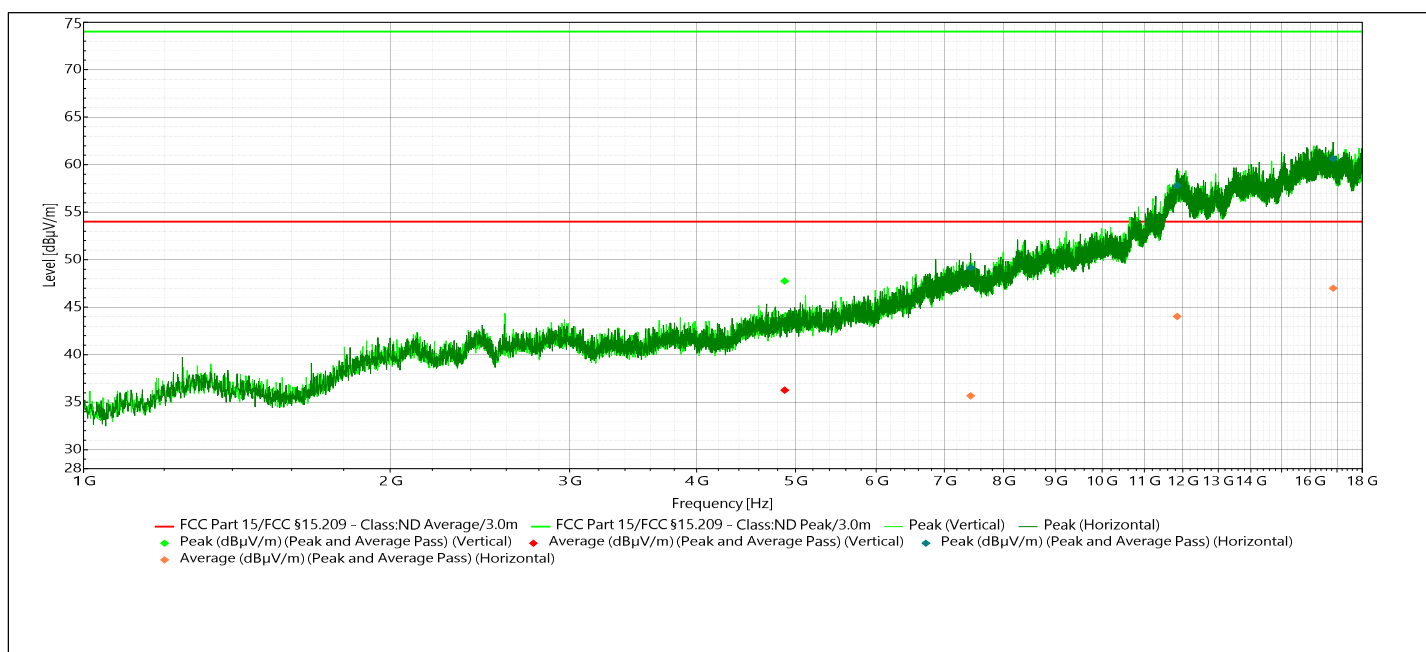
**Table 2.8-8 – RE Spurious Emissions 1-18 GHz – Low Channel – 2Mps**

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
4856.167	45.47	74.00	-28.53	31.12	54.00	-22.88	360.00	4.00	Vertical	Pass
7217.278	49.74	74.00	-24.26	35.50	54.00	-18.50	0.00	1.00	Vertical	Pass
11879.056	59.35	74.00	-14.65	44.78	54.00	-9.22	132.00	4.00	Vertical	Pass
16868.556	60.54	74.00	-13.46	46.91	54.00	-7.09	267.00	4.00	Vertical	Pass



Spurious Emissions 1 - 18GHz - mid channel 1Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
1 GHz - 18 GHz	3m	Vertical	1 MHz	18001 Pts	Auto
1 GHz - 18 GHz	3m	Horizontal	1 MHz	18001 Pts	Auto



Limit: FCC Part 15/FCC §15.209
Test Date: 12/18/2023
Test Results: Pass

Test Notes: Mid Channel 2440MHz, 1Mps

Figure 2-55 – RE Spurious Emissions 1-18 GHz – Mid Channel – 1Mps

**Table 2.8-9 – RE Spurious Emissions 1-18 GHz – Mid Channel – 1Mps**

Frequency (MHz)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Azimuth (°)	Height (m)	Polarity	Result
4879.778	47.75	74.00	-26.25	36.26	54.00	-17.74	266.00	4.00	Vertical	Pass
7428.833	49.16	74.00	-24.84	35.68	54.00	-18.32	93.00	4.00	Horizontal	Pass
11848.833	57.79	74.00	-16.21	44.03	54.00	-9.97	132.00	1.00	Horizontal	Pass
16859.111	60.64	74.00	-13.36	47.00	54.00	-7.00	360.00	4.00	Horizontal	Pass

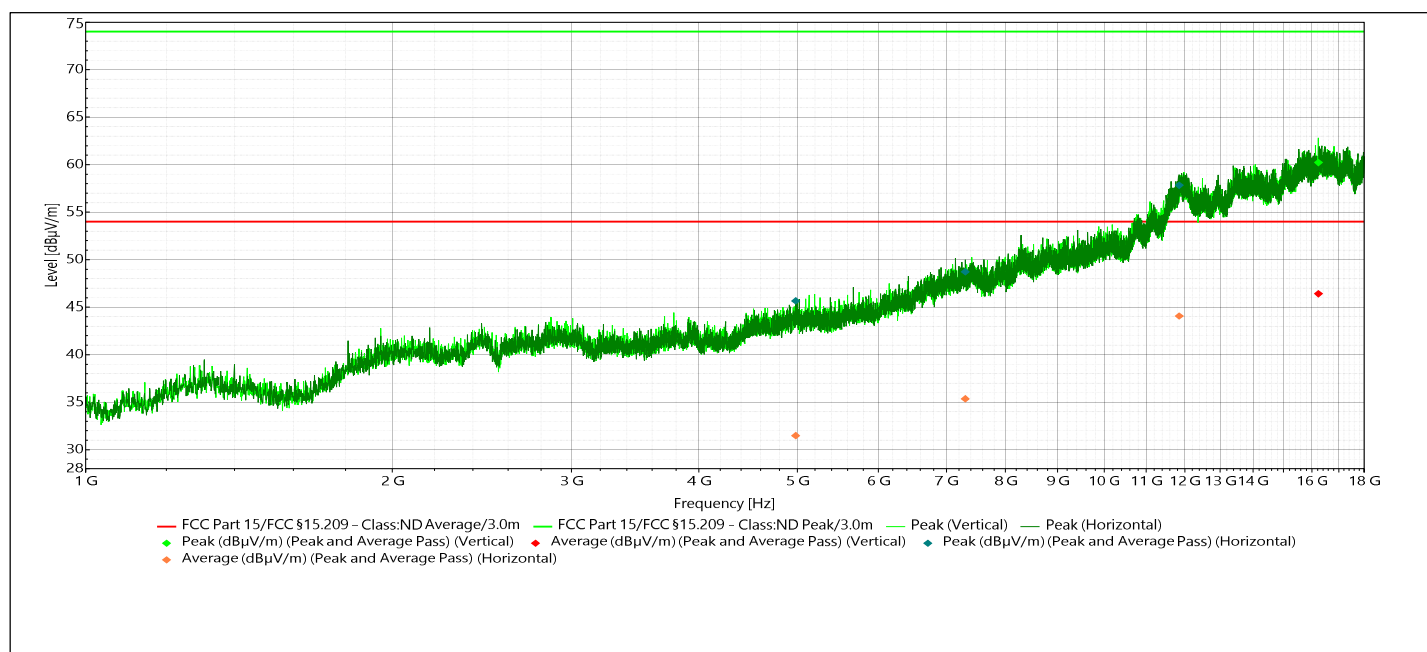
TÜV SÜD America Inc
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Spurious Emissions 1 - 18GHz - mid channel 2Mps

Frequency Range	Antenna Distance	Antenna Polarization	RBW	Step Size	Sweep Time
1 GHz - 18 GHz	3m	Vertical	1 MHz	18001 Pts	Auto
1 GHz - 18 GHz	3m	Horizontal	1 MHz	18001 Pts	Auto



Limit: FCC Part 15/FCC §15.209
Test Date: 12/18/2023
Test Results: Pass

Test Notes: Middle Channel 2440MHz, 2Mps

Figure 2-56 – RE Spurious Emissions 1-18 GHz – Mid Channel – 2Mps