FCC and ISED Test Report

Apple Inc
Model: A2442

In accordance with FCC 47 CFR Part 15C and ISED RSS-GEN
(2.4 GHz Bluetooth, 2.4 GHz WLAN and 5 GHz WLAN)

Add value.
Inspire trust.

Prepared for: Apple Inc
One Apple Park Way
Cupertino
California
95014
USA

FCC ID: BCGA2442 IC: 579C-A2442

COMMERCIAL-IN-CONFIDENCE

Document 75952057-13 Issue 01

Jensen Adams
Digitally signed by Jensen Adams
Date: 2021.09.17 12:04:22 +01'00'

SIGNATURE			
Jensen Adams			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Jensen Adams	Manager – Technical Solutions	Authorised Signatory	17 September 2021

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

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C and ISED RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Matthew Dawkins	17 September 2021	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

ISED Accreditation
12669A Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2020 and ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021) for the tests detailed in section 1.3.

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ACCREDITATION

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation. Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

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Contents

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.

Issue	Description of Change	Date of Issue
1	First Issue	17-September-2021

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2442
Serial Number(s)	NL6F4J0K4D
Hardware Version(s)	REV1.0
Software Version(s)	21A290
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2020 ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number Date	0540218229 22-April-2021
Date of Receipt of EUT	16-July-2021
Start of Test	23-July-2021
Finish of Test	23-July-2021
Name of Engineer(s)	Matthew Dawkins
Related Document(s)	ANSI C63.10 (2020)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C and ISED RSS-GEN is shown below.

Section	Specification Clause		Test Description	Result	Comments/Base Standard
	Part 15C	RSS-GEN			
Configuration and Mode: 2.4 GHz WLAN					
2.1	15.207	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2020)
Configuration and Mode: 5 GHz WLAN					
2.1	15.207	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2020)
Configuration and Mode: 2.4 GHz Bluetooth					
2.1	15.207	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2020)

Table 2

1.4 Product Information

1.4.1 Technical Description

The Equipment under test (EUT) was a laptop computer with Bluetooth, Bluetooth Low Energy and 802.11 a/b/g/n/ac/ax capabilities in the 2.4 GHz and 5 GHz bands.

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 programme.

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
Model: A2442, Serial Number: NL6F4J0K4D			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.7 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz WLAN		
AC Power Line Conducted Emissions	Matthew Dawkins	UKAS
Configuration and Mode: 2.4 GHz Bluetooth - FHSS		
AC Power Line Conducted Emissions	Matthew Dawkins	UKAS
Configuration and Mode: 5 GHz WLAN		
AC Power Line Conducted Emissions	Matthew Dawkins	UKAS

Table 4

Office Address:

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 AC Power Line Conducted Emissions

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.207
ISED RSS-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

A2442, S/N: NL6F4J0K4D - Modification State 0

2.1.3 Date of Test

23-July-2021

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.2.

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

All power was connected to the EUT through an Artificial Mains Network (AMN).

Conducted disturbance voltage measurements on mains lines were made at the output of the AMN.

2.1.5 Environmental Conditions

Ambient Temperature	21.0 °C
Relative Humidity	66.3 %

2.1.6 Test Results

2.4 GHz WLAN

Applied supply voltage: 120 V AC
Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.150	27.5	56.0	-28.6	CISPR Avg
0.150	47.5	66.0	-18.5	Q-Peak
0.167	26.1	55.1	-29.0	CISPR Avg
0.167	44.1	65.1	-21.0	Q-Peak
0.176	22.0	54.6	-32.6	CISPR Avg
0.176	42.3	64.6	-22.3	Q-Peak
0.182	23.1	54.4	-31.3	CISPR Avg
0.182	43.0	64.4	-21.4	Q-Peak
0.188	43.0	64.1	-21.1	Q-Peak
0.188	23.6	54.1	-30.5	CISPR Avg
0.211	20.9	53.2	-32.3	CISPR Avg
0.211	40.4	63.2	-22.9	Q-Peak
0.219	20.5	52.9	-32.4	CISPR Avg
0.219	39.5	62.9	-23.4	Q-Peak
0.235	36.9	62.3	-25.4	Q-Peak
0.235	20.0	52.3	-32.3	CISPR Avg

Table 5 - Live Line Emissions Results

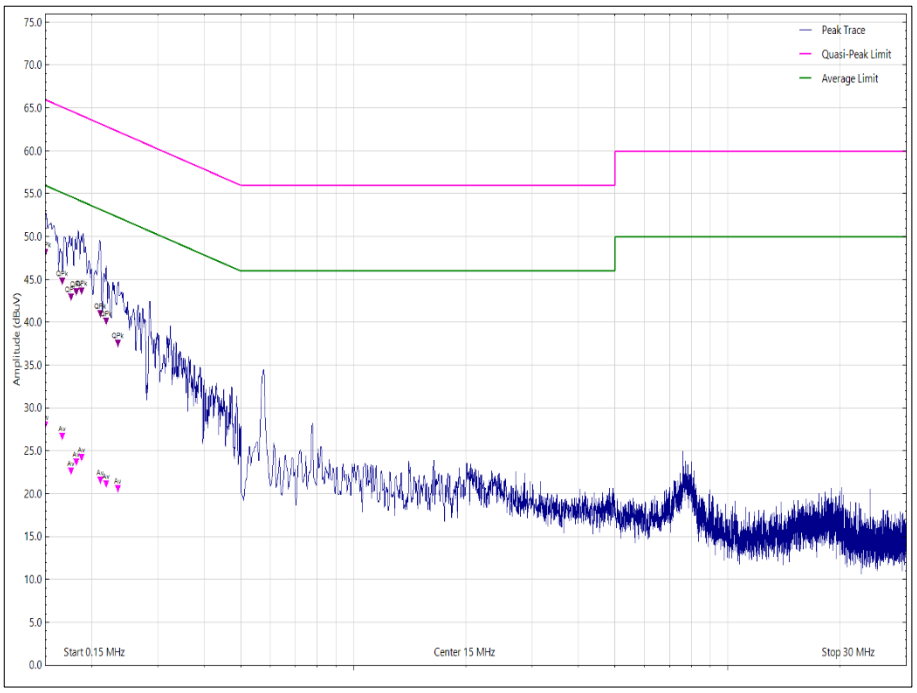

Figure 1 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.151	47.7	66.0	-18.3	Q-Peak
0.151	27.1	56.0	-28.9	CISPR Avg
0.154	47.1	65.8	-18.7	Q-Peak
0.154	25.9	55.8	-29.9	CISPR Avg
0.159	45.2	65.5	-20.3	Q-Peak
0.159	26.2	55.5	-29.3	CISPR Avg
0.166	43.3	65.2	-21.9	Q-Peak
0.166	26.1	55.2	-29.1	CISPR Avg
0.174	43.2	64.8	-21.6	Q-Peak
0.174	23.5	54.8	-31.3	CISPR Avg
0.185	42.6	64.2	-21.6	Q-Peak
0.185	23.0	54.2	-31.3	CISPR Avg
0.189	23.1	54.1	-31.0	CISPR Avg
0.189	42.5	64.1	-21.6	Q-Peak
0.219	20.4	52.9	-32.5	CISPR Avg
0.219	39.7	62.9	-23.2	Q-Peak
0.228	38.0	62.5	-24.5	Q-Peak
0.228	20.2	52.5	-32.3	CISPR Avg

Table 6 - Neutral Line Emissions Results

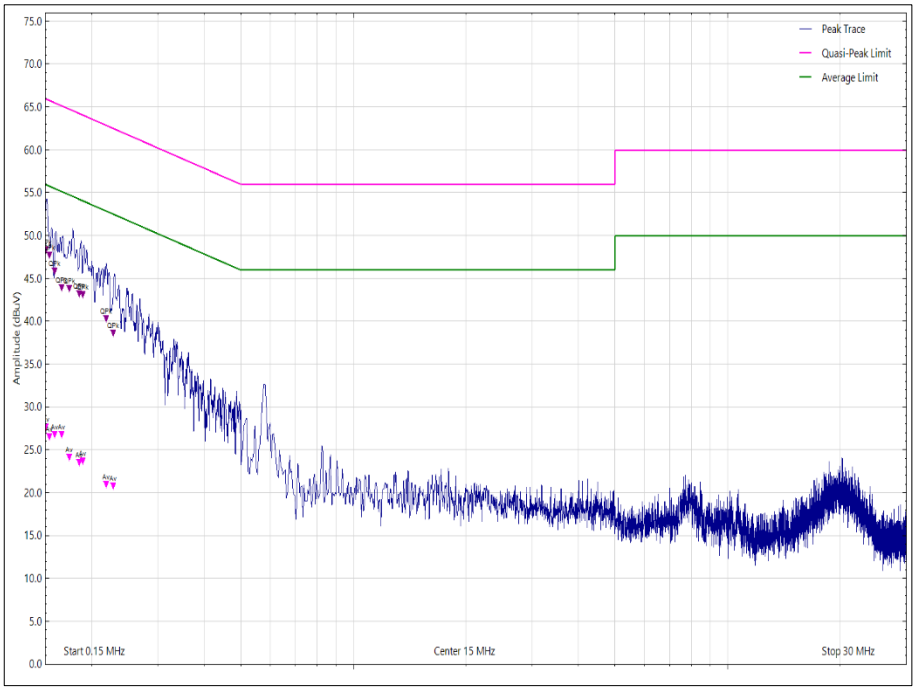

Figure 2 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz Bluetooth - FHSS

Applied supply voltage: 120 V AC
Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.152	47.7	65.9	-18.2	Q-Peak
0.152	28.0	55.9	-27.9	CISPR Avg
0.159	46.0	65.5	-19.5	Q-Peak
0.159	26.1	55.5	-29.5	CISPR Avg
0.164	43.2	65.3	-22.1	Q-Peak
0.164	27.0	55.3	-28.3	CISPR Avg
0.180	43.8	64.5	-20.7	Q-Peak
0.180	23.5	54.5	-31.0	CISPR Avg
0.191	43.2	64.0	-20.8	Q-Peak
0.191	24.0	54.0	-30.0	CISPR Avg
0.192	43.0	63.9	-21.0	Q-Peak
0.192	23.1	53.9	-30.8	CISPR Avg
0.214	39.5	63.1	-23.6	Q-Peak
0.214	20.6	53.1	-32.5	CISPR Avg
0.220	39.1	62.8	-23.8	Q-Peak
0.220	20.5	52.8	-32.3	CISPR Avg
0.225	38.3	62.6	-24.3	Q-Peak
0.225	20.7	52.6	-31.9	CISPR Avg

Table 7 - Live Line Emissions Results

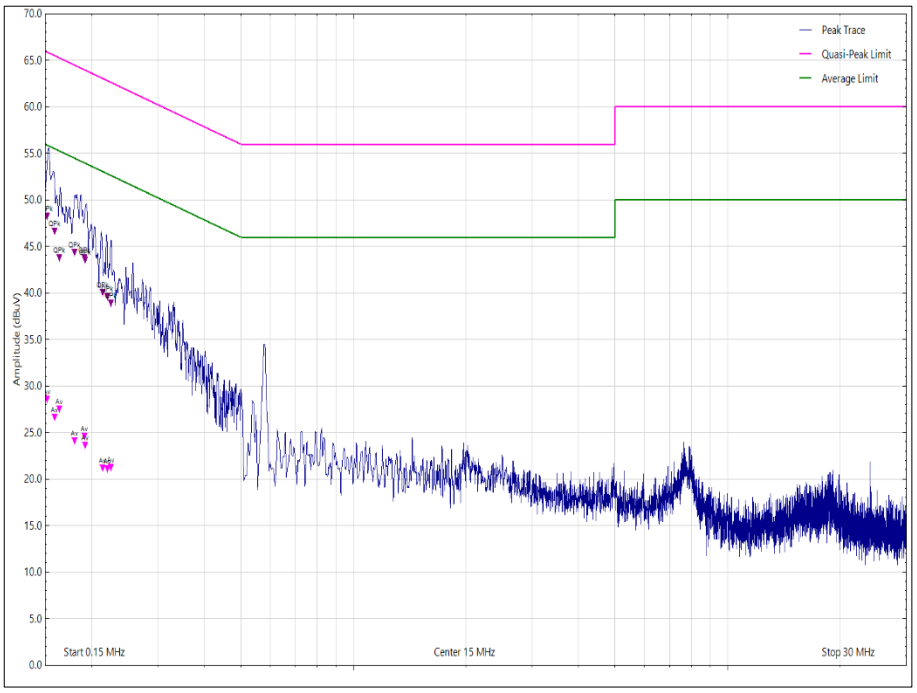

Figure 3 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.158	46.3	65.6	-19.3	Q-Peak
0.158	25.9	55.6	-29.7	CISPR Avg
0.175	22.6	54.7	-32.1	CISPR Avg
0.175	42.5	64.7	-22.2	Q-Peak
0.190	23.1	54.0	-30.9	CISPR Avg
0.190	43.2	64.0	-20.8	Q-Peak
0.229	39.5	62.5	-23.0	Q-Peak
0.229	20.2	52.5	-32.3	CISPR Avg
0.253	36.3	61.6	-25.3	Q-Peak
0.253	18.4	51.6	-33.2	CISPR Avg
0.262	35.7	61.4	-25.7	Q-Peak
0.262	18.1	51.4	-33.3	CISPR Avg

Table 8 - Neutral Line Emissions Results

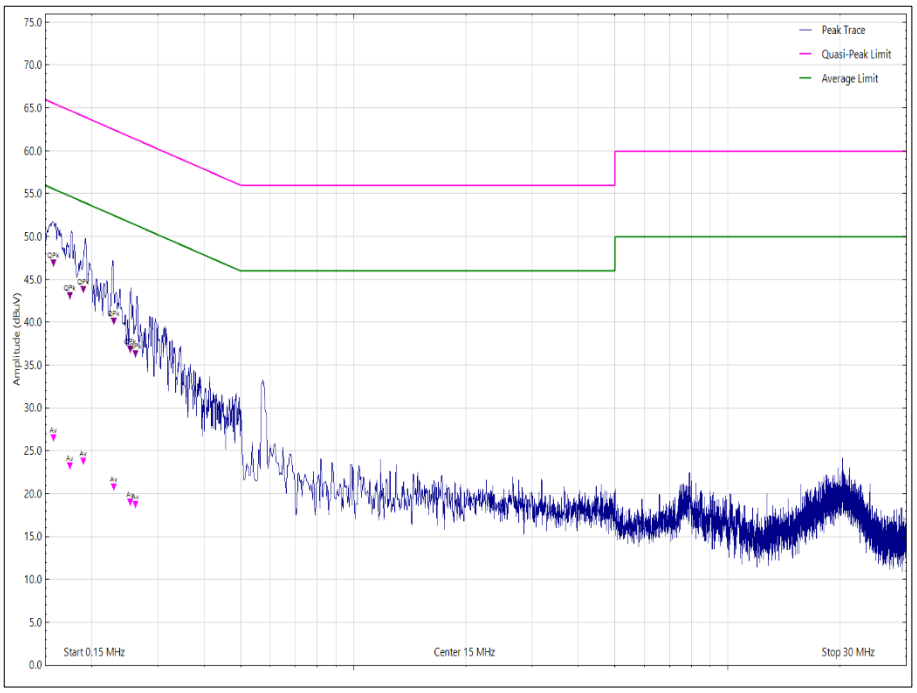

Figure 4 - Neutral Line - 150 kHz to 30 MHz

5 GHz WLAN

Applied supply voltage: 120 V AC
Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.153	47.7	65.8	-18.1	Q-Peak
0.153	26.9	55.8	-28.9	CISPR Avg
0.173	42.4	64.8	-22.4	Q-Peak
0.173	22.7	54.8	-32.2	CISPR Avg
0.177	43.3	64.6	-21.3	Q-Peak
0.177	23.6	54.6	-31.1	CISPR Avg
0.186	23.0	54.2	-31.2	CISPR Avg
0.186	42.5	64.2	-21.7	Q-Peak
0.191	23.4	54.0	-30.6	CISPR Avg
0.191	43.0	64.0	-21.0	Q-Peak
0.208	21.1	53.3	-32.2	CISPR Avg
0.208	42.0	63.3	-21.4	Q-Peak
0.216	21.2	53.0	-31.8	CISPR Avg
0.216	40.0	63.0	-23.0	Q-Peak
0.228	21.1	52.5	-31.4	CISPR Avg
0.228	38.4	62.5	-24.1	Q-Peak
0.243	36.4	62.0	-25.6	Q-Peak
0.243	18.3	52.0	-33.8	CISPR Avg

Table 9 - Live Line Emissions Results

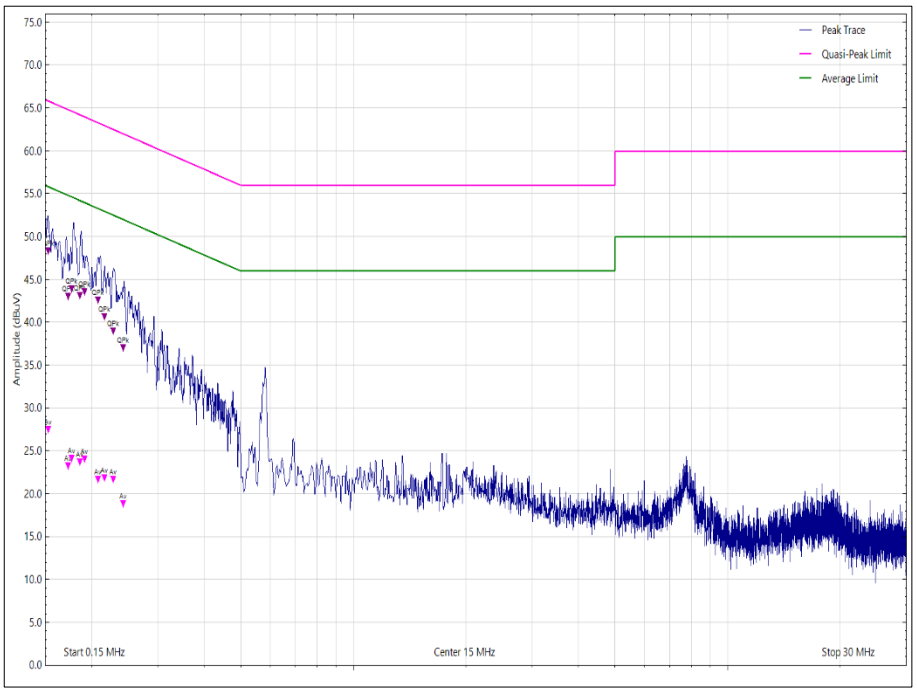

Figure 5 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.154	26.9	55.8	-28.9	CISPR Avg
0.154	47.0	65.8	-18.9	Q-Peak
0.167	42.9	65.1	-22.2	Q-Peak
0.167	26.0	55.1	-29.2	CISPR Avg
0.178	23.7	54.6	-30.9	CISPR Avg
0.178	43.9	64.6	-20.7	Q-Peak
0.209	21.7	53.3	-31.6	CISPR Avg
0.209	41.3	63.3	-22.1	Q-Peak
0.211	21.2	53.2	-32.1	CISPR Avg
0.211	40.6	63.2	-22.6	Q-Peak
0.216	21.0	53.0	-32.1	CISPR Avg
0.216	40.4	63.0	-22.7	Q-Peak
0.233	18.8	52.3	-33.5	CISPR Avg
0.233	37.4	62.3	-24.9	Q-Peak
0.263	35.3	61.3	-26.0	Q-Peak
0.263	18.6	51.3	-32.7	CISPR Avg

Table 10 - Neutral Line Emissions Results

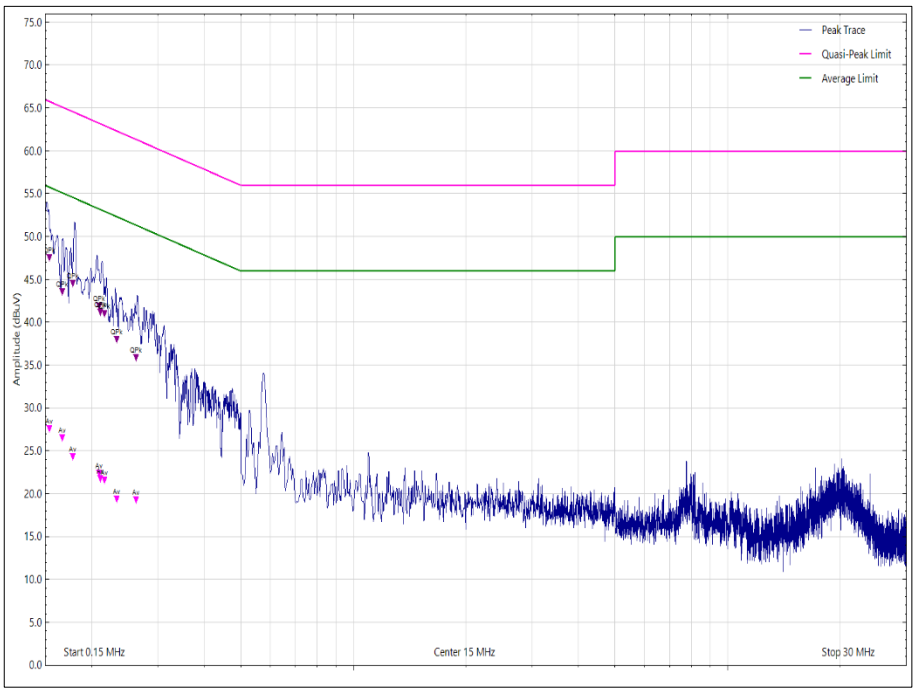

Figure 6 - Neutral Line - 150 kHz to 30 MHz

FCC 47 CFR Part 15, Limit Clause 15.207 and ISED RSS-GEN, Limit Clause 8.8

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	CISPR Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

Table 11

*Decreases with the logarithm of the frequency.

2.1.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
3m Semi Anechoic Chamber	MVG	EMC-3	5621	36	11-Aug-2023
EmX Emissions Software	TUV SUD	V2.1.11	5125	-	Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	18-Mar-2022
Transient Limiter	Hewlett Packard	11947A	2378	12	12-Oct-2021
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5428	12	15-Oct-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5473	12	01-Apr-2022
Cable Assembly - 18GHz 8m	Junkosha	MWX221-08000NMSNMS/B	5732	6	05-Aug-2021
LISN	Rohde & Schwarz	ESH3-Z5	1390	12	28-Jan-2022

Table 12

3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
AC Power Line Conducted Emissions	150 kHz to 30 MHz, LISN, ± 3.7 dB

Table 13

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.