

FCC and ISED Test Report

Apple Inc
Model: A2615

In accordance with FCC 47 CFR Part 15C, ISED
RSS-247 and ISED RSS-GEN
(2.4 GHz Bluetooth, 2.4 GHz WLAN and 5 GHz
WLAN)

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



Add value.
Inspire trust.

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SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andy Lawson	Chief Engineer, EMC	Authorised Signatory	27 January 2022

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, ISED RSS-247 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	Connor Lee	27 January 2022	

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, ISED RSS-247: Issue 2 (02-2017) and ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021) for the tests detailed in section 1.3.



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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.

Issue	Description of Change	Date of Issue
1	First Issue	27 January 2022

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2615
Serial Number(s)	F7F93XV4L7
Hardware Version(s)	REV1.0
Software Version(s)	21D20
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2020 ISED RSS-247: Issue 2 (02-2017) ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number	0540220896
Date	25-May-2021
Date of Receipt of EUT	09-November-2021
Start of Test	10-December-2021
Finish of Test	10-December-2021
Name of Engineer(s)	Connor Lee
Related Document(s)	ANSI C63.10: 2013



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 2.4 GHz WLAN						
2.1	15.207	3.1	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10: 2013
Configuration and Mode: 2.4 GHz Bluetooth - FHSS						
2.1	15.207	3.1	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10: 2013
Configuration and Mode: 5 GHz WLAN						
2.1	15.207	3.1	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10: 2013

Table 2



1.4 Product Information

1.4.1 Technical Description

The Equipment under test (EUT) was a desktop 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: A2615, Serial Number: F7F93XV4L7			
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	Connor Lee	UKAS
Configuration and Mode: 2.4 GHz Bluetooth - FHSS		
AC Power Line Conducted Emissions	Connor Lee	UKAS
Configuration and Mode: 5 GHz WLAN		
AC Power Line Conducted Emissions	Connor Lee	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-247, Clause 3.1
ISED RSS-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

A2615, S/N: F7F93XV4L7 - Modification State 0

2.1.3 Date of Test

10-December-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 Example Calculation

Quasi-Peak level (dBμV) = Receiver level (dBμV) + Correction Factor (dB)
Margin (dB) = Quasi-Peak level (dBμV) - Limit (dBμV)

CISPR Average level (dBμV) = Receiver level (dBμV) + Correction Factor (dB)
Margin (dB) = CISPR Average level (dBμV) - Limit (dBμV)

2.1.6 Example Test Setup Diagram

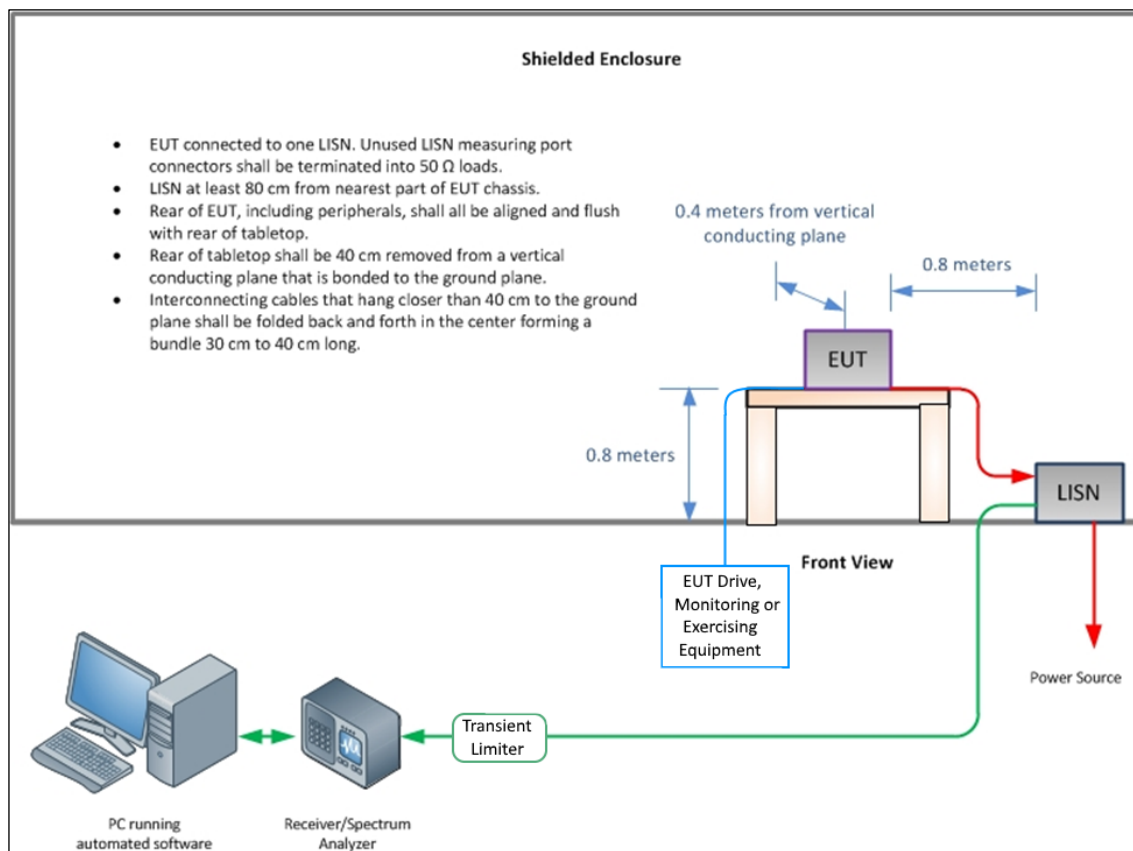


Figure 1 - Conducted Emissions

2.1.7 Environmental Conditions

Ambient Temperature	20.3 °C
Relative Humidity	32.6 %

2.1.8 Test Results

2.4 GHz WLAN

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.151	40.7	65.9	-25.2	Q-Peak
0.151	32.5	55.9	-23.4	CISPR Avg
0.435	35.5	57.2	-21.7	Q-Peak
0.435	30.0	47.2	-17.2	CISPR Avg

Table 5 - Live Line Emissions Results

No other final measurements were made as all other peak emissions above the measurement system noise floor during the pre-scan were greater than 6 dB below the CISPR Average test limit.

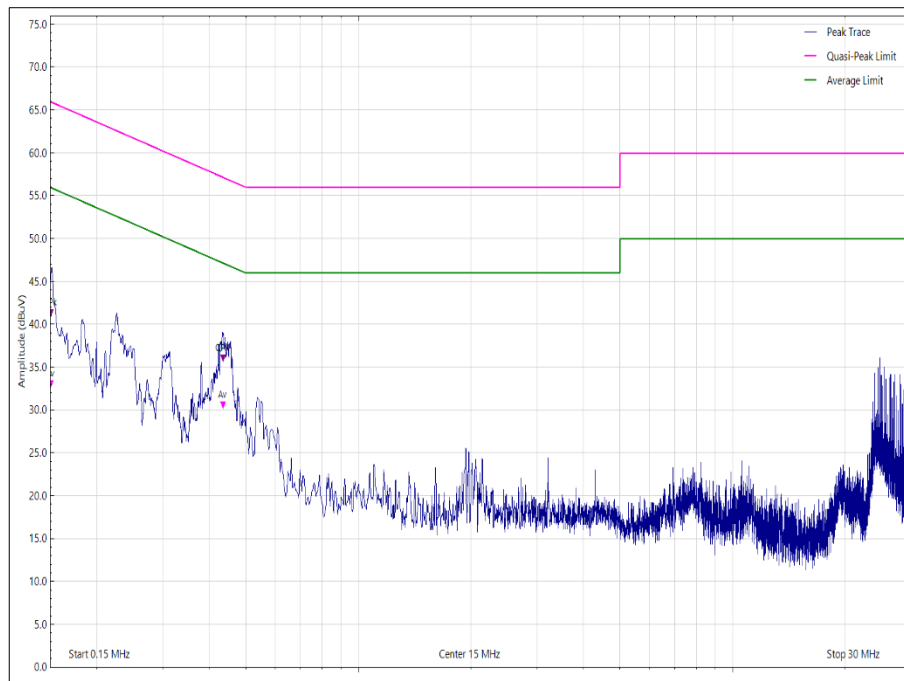


Figure 1 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.176	35.0	64.7	-29.7	Q-Peak
0.176	26.9	54.7	-27.8	CISPR Avg
0.222	38.6	62.7	-24.1	Q-Peak
0.222	30.0	52.7	-22.8	CISPR Avg
0.435	35.0	57.2	-22.2	Q-Peak
0.435	29.7	47.2	-17.5	CISPR Avg

Table 6 - Neutral Line Emissions Results

No other final measurements were made as all other peak emissions above the measurement system noise floor during the pre-scan were greater than 6 dB below the CISPR Average test limit.

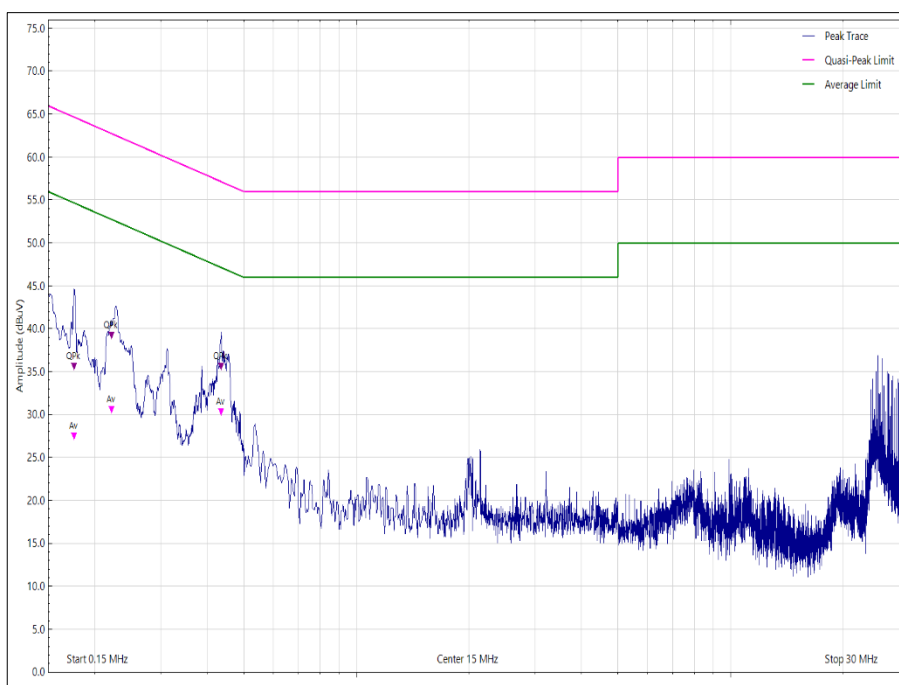


Figure 2 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz Bluetooth - FHSS

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.151	40.0	65.9	-25.9	Q-Peak
0.151	31.8	55.9	-24.1	CISPR Avg
0.225	37.2	62.6	-25.4	Q-Peak
0.225	29.7	52.6	-23.0	CISPR Avg
0.429	33.8	57.3	-23.5	Q-Peak
0.429	27.8	47.3	-19.5	CISPR Avg
0.452	34.1	56.8	-22.7	Q-Peak
0.452	29.2	46.8	-17.6	CISPR Avg

Table 7 - Live Line Emissions Results

No other final measurements were made as all other peak emissions above the measurement system noise floor during the pre-scan were greater than 6 dB below the CISPR Average test limit.

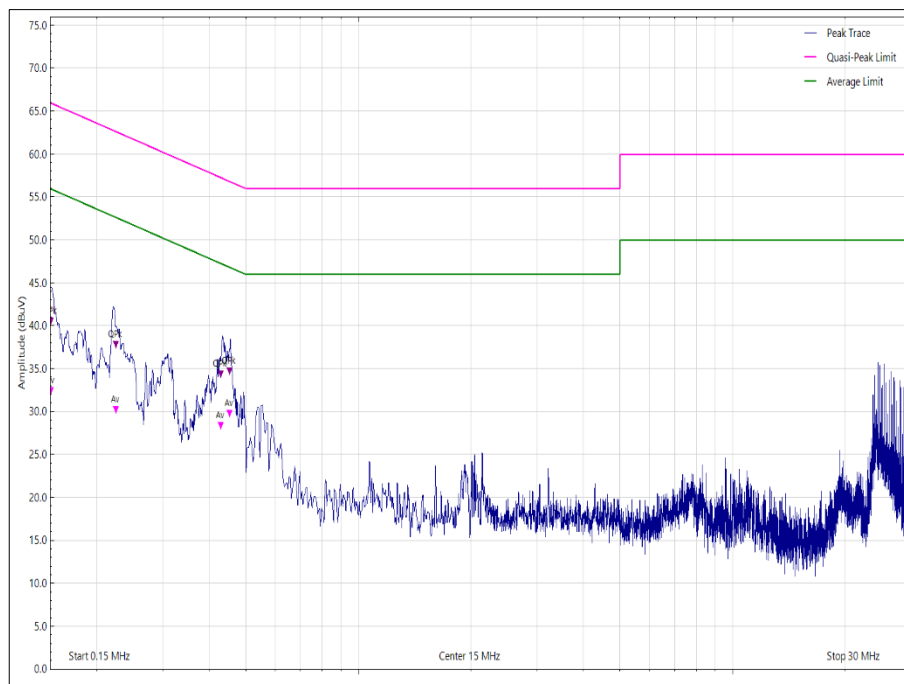


Figure 4 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.174	34.7	64.8	-30.1	Q-Peak
0.174	26.6	54.8	-28.2	CISPR Avg
0.436	35.1	57.1	-22.0	Q-Peak
0.436	29.7	47.1	-17.5	CISPR Avg

Table 8 - Neutral Line Emissions Results

No other final measurements were made as all other peak emissions above the measurement system noise floor during the pre-scan were greater than 6 dB below the CISPR Average test limit.

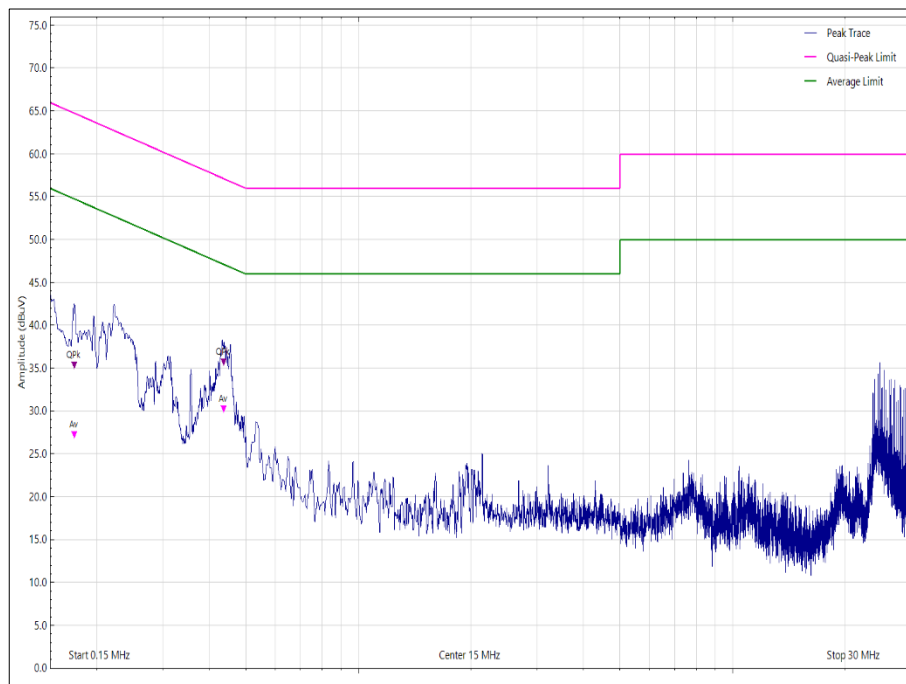


Figure 5 - Neutral Line - 150 kHz to 30 MHz

5 GHz WLAN

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.150	40.4	66.0	-25.6	Q-Peak
0.150	32.7	56.0	-23.3	CISPR Avg
0.433	35.5	57.2	-21.7	Q-Peak
0.433	29.7	47.2	-17.5	CISPR Avg

Table 9 - Live Line Emissions Results

No other final measurements were made as all other peak emissions above the measurement system noise floor during the pre-scan were greater than 6 dB below the CISPR Average test limit.

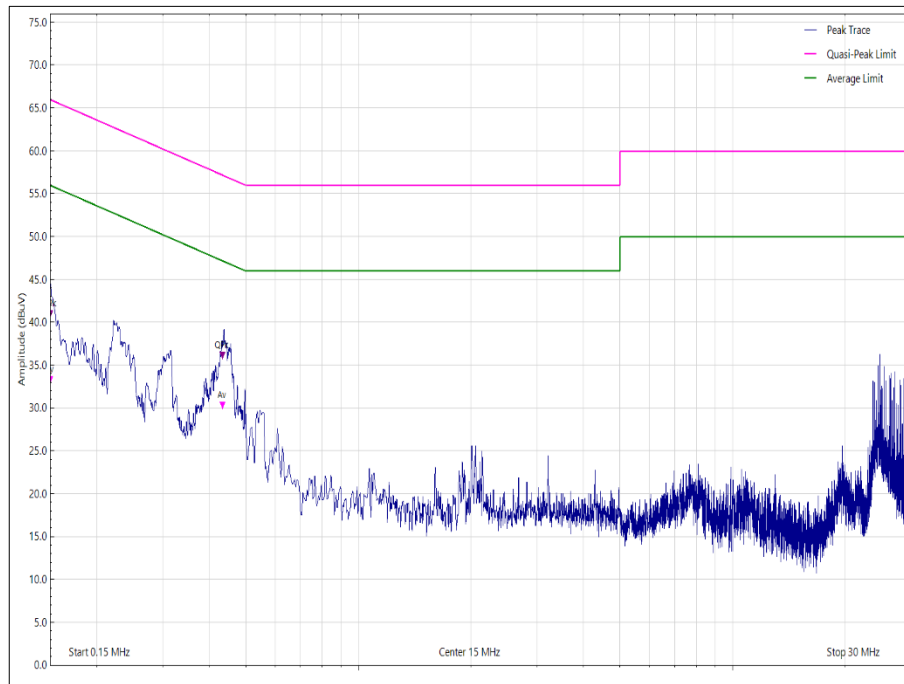


Figure 7 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.151	41.5	65.9	-24.4	Q-Peak
0.151	32.4	55.9	-23.5	CISPR Avg
0.227	38.8	62.5	-23.8	Q-Peak
0.227	31.4	52.5	-21.1	CISPR Avg
0.420	30.8	57.4	-26.6	Q-Peak
0.420	24.5	47.4	-22.9	CISPR Avg
0.454	34.2	56.8	-22.6	Q-Peak
0.454	29.5	46.8	-17.3	CISPR Avg

Table 10 - Neutral Line Emissions Results

No other final measurements were made as all other peak emissions above the measurement system noise floor during the pre-scan were greater than 6 dB below the CISPR Average test limit.

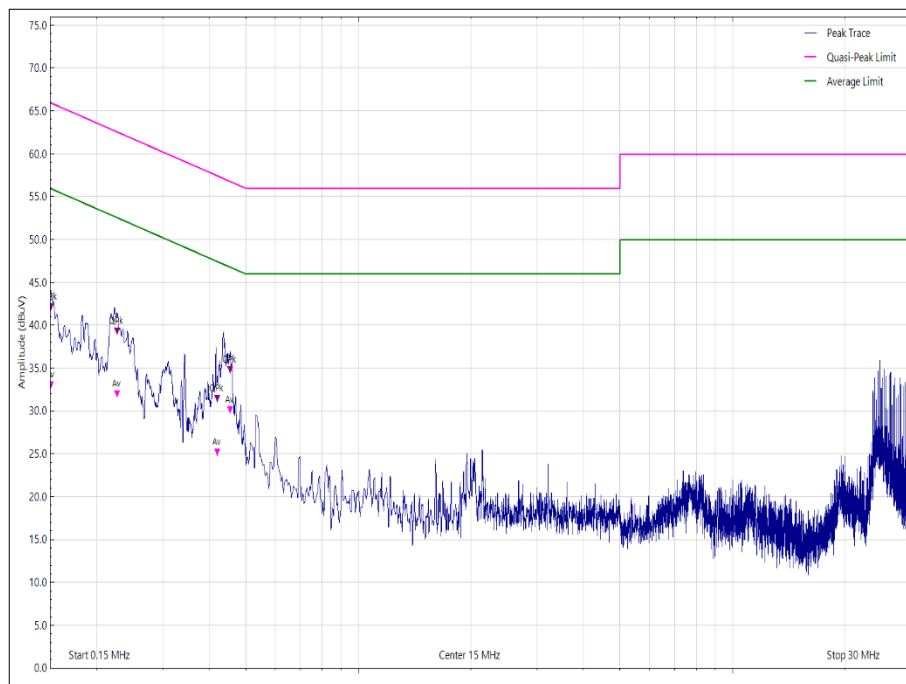


Figure 8 - Neutral Line - 150 kHz to 30 MHz

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.



2.1.9 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
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023
Emissions Software	TUV SUD	EmX V2.1.11	5125	-	Software
Test Receiver	Rohde & Schwarz	ESU40	3506	12	18-Mar-2022
Transient Limiter	Hewlett Packard	11947A	2377	12	01-Mar-2022
Cable (K-Type to K-Type, 2 m)	Scott Cables	KPS-1501-2000-KPS	4526	6	06-Mar-2022
Cable (N-Type to N-Type, 8 m)	Teledyne	PR90-088-8MTR	5450	6	08-Mar-2022
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 – Accuracy Method

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. (Procedure 2). The measurement results are directly compared with the test limit to determine conformance with the requirements of the standard.

Risk: The uncertainty of measurement about the measured result is negligible with regard to the final pass/fail decision. The measurement result can be directly compared with the test limit to determine conformance with the requirement (compare IEC Guide 115). The level of risk to falsely accept and falsely reject items is further described in ILAC-G8.