FCC and ISED Test Report

Apple Inc
Model: A2686

In accordance with FCC 47 CFR Part 15C and ISED RSS-247 and ISED RSS-GEN (2.4 GHz Bluetooth, 2.4 GHz WLAN, 5 GHz WLAN and 6 GHz WLAN)

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

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FCC ID: BCGA2686 IC: 579C-A2686

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Document 75954423-18 Issue 01

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AJ Lawson.			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Andrew Lawson	Chief Engineer, EMC	Authorised Signatory	10 November 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 and 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	James Cumming	10 November 2022	
Testing	Connor Lee	10 November 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, ISED RSS-247 and ISED RSS-GEN: 2020, Issue 2 (02-2017) and Issue 5 (04-2018) + A2 (02-2021) for the tests detailed in section 1.3.

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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	10 November 2022

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2686
Serial Number(s)	WX9C36FFWC and C2VHNP3C35
Hardware Version(s)	REV 1.0
Software Version(s)	22A271
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN: 2020, Issue 2 (02-2017) and Issue 5 (04-2018) + A2 (02-2021)
Order Number Date	0540246998 30-March-2022
Date of Receipt of EUT	05-April-2022
Start of Test	15-June-2022
Finish of Test	03-November-2022
Name of Engineer(s)	James Cumming and Connor Lee
Related Document(s)	ANSI C63.10 (2020) 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 and ISED RSS-247 and ISED RSS-GEN is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: 2.4 GHz WLAN				
2.1	15.207, 3.1 and 8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2020) ANSI C63.10 (2013)
Configuration and Mode: 2.4 GHz Bluetooth				
2.1	15.207, 3.1 and 8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2020) ANSI C63.10 (2013)
Configuration and Mode: 5 GHz WLAN				
2.1	15.207, 3.1 and 8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2020) ANSI C63.10 (2013)
Configuration and Mode: 6 GHz WLAN				
2.1	15.207, 3.1 and 8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2020) ANSI C63.10 (2013)

Table 2

1.4 Product Information

1.4.1 Technical Description

The Equipment under test (EUT) was an Apple desktop computer with Bluetooth® and IEEE 802.11 a/b/g/n/ac/ax Wi-Fi in the 2.4GHz, 5GHz and 6GHz 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: A2686, Serial Number: WX9C36FFWC			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2686, Serial Number: C2VHNP3C35			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.7 Test Location

TÜV SÜD conducted the following tests at our Octagon House Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 2.4 GHz WLAN		
AC Power Line Conducted Emissions	James Cumming	UKAS
Configuration and Mode: 2.4 GHz Bluetooth		
AC Power Line Conducted Emissions	James Cumming	UKAS
Configuration and Mode: 5 GHz WLAN		
AC Power Line Conducted Emissions	James Cumming	UKAS
Configuration and Mode: 6 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, ISED RSS-247 and ISED RSS-GEN, Clause 15.207, 3.1 and 8.8

2.1.2 Equipment Under Test and Modification State

A2686, S/N: WX9C36FFWC - Modification State 0
A2686, S/N: C2VHNP3C35 - Modification State 0

2.1.3 Date of Test

15-June-2022 to 03-November-2022

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	18.4 - 22.0 °C
Relative Humidity	50.0 - 58.1 %

2.1.6 Test Results

2.4 GHz WLAN

Applied supply voltage: 115 V AC
Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.367	34.6	58.6	-24.0	Q-Peak
0.367	32.8	48.6	-15.8	CISPR Avg
0.402	33.4	57.8	-24.4	Q-Peak
0.402	23.1	47.8	-24.7	CISPR Avg
0.407	26.8	47.7	-20.9	CISPR Avg
0.407	34.3	57.7	-23.4	Q-Peak
0.412	35.9	57.6	-21.7	Q-Peak
0.412	32.9	47.6	-14.7	CISPR Avg
0.457	34.8	56.8	-22.0	Q-Peak
0.457	26.6	46.8	-20.2	CISPR Avg
0.469	31.4	56.5	-25.1	Q-Peak
0.469	21.7	46.5	-24.8	CISPR Avg
0.594	39.8	56.0	-16.2	Q-Peak
0.594	37.1	46.0	-8.9	CISPR Avg
0.733	33.9	46.0	-12.1	CISPR Avg
0.733	37.1	56.0	-18.9	Q-Peak
0.821	31.8	46.0	-14.2	CISPR Avg
0.821	38.0	56.0	-18.0	Q-Peak
21.420	33.1	50.0	-16.9	CISPR Avg
21.420	39.0	60.0	-21.0	Q-Peak
23.247	38.6	50.0	-11.4	CISPR Avg
23.247	44.6	60.0	-15.4	Q-Peak
25.090	44.9	60.0	-15.1	Q-Peak
25.090	39.7	50.0	-10.3	CISPR Avg
28.217	32.2	50.0	-17.8	CISPR Avg
28.217	38.3	60.0	-21.7	Q-Peak

Table 5 - Live Line Emissions Results

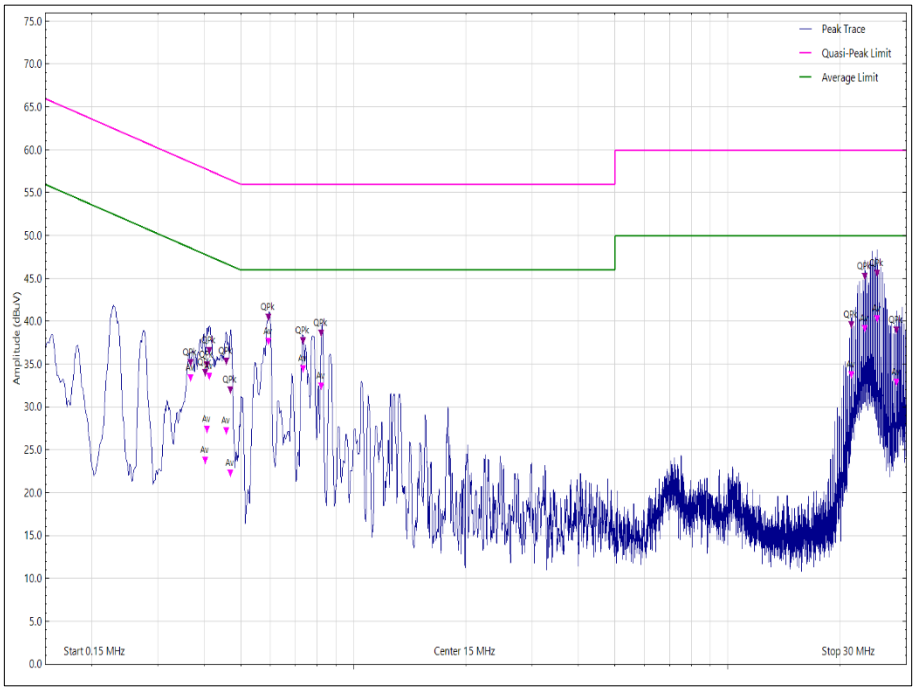

Figure 1 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.230	36.5	52.5	-16.0	CISPR Avg
0.230	40.7	62.5	-21.8	Q-Peak
0.393	27.0	48.0	-21.0	CISPR Avg
0.393	33.8	58.0	-24.2	Q-Peak
0.410	30.5	47.7	-17.2	CISPR Avg
0.410	35.6	57.7	-22.1	Q-Peak
0.426	19.1	47.3	-28.2	CISPR Avg
0.426	31.4	57.3	-25.9	Q-Peak
0.451	21.7	46.9	-25.2	CISPR Avg
0.451	33.9	56.9	-23.0	Q-Peak
0.462	26.9	46.7	-19.8	CISPR Avg
0.462	36.0	56.7	-20.7	Q-Peak
0.594	39.7	56.0	-16.3	Q-Peak
0.594	37.0	46.0	-9.0	CISPR Avg
0.733	33.7	46.0	-12.3	CISPR Avg
0.733	37.3	56.0	-18.7	Q-Peak
0.818	27.2	46.0	-18.8	CISPR Avg
0.818	36.7	56.0	-19.3	Q-Peak
23.206	32.3	60.0	-27.7	Q-Peak
23.206	25.1	50.0	-24.9	CISPR Avg
25.077	38.9	50.0	-11.1	CISPR Avg
25.077	44.0	60.0	-16.0	Q-Peak
26.378	33.9	50.0	-16.1	CISPR Avg
26.378	40.0	60.0	-20.0	Q-Peak
28.991	36.8	60.0	-23.2	Q-Peak
28.991	31.0	50.0	-19.0	CISPR Avg

Table 6 - Neutral Line Emissions Results

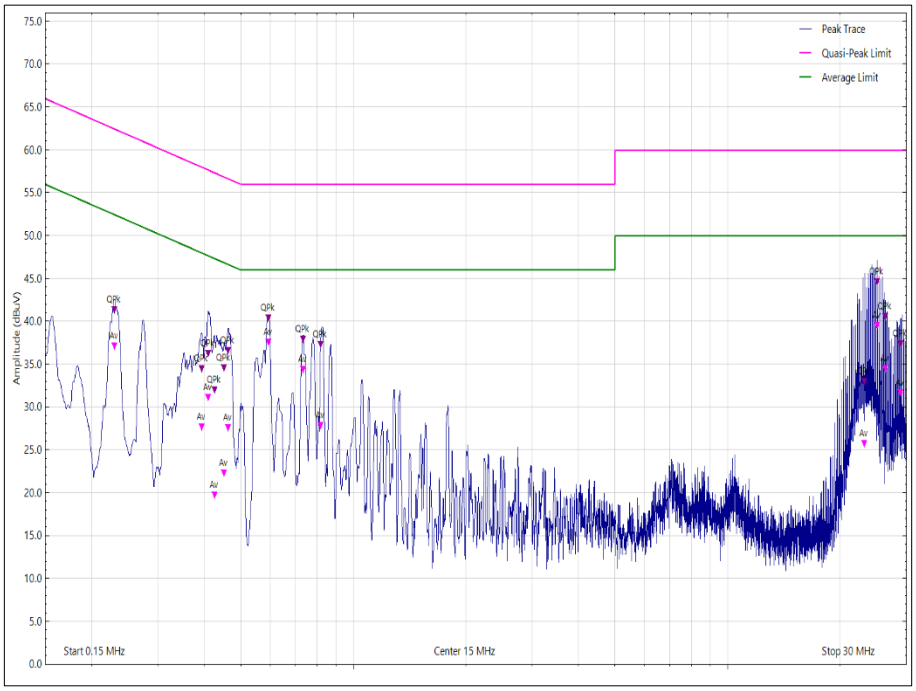

Figure 2 - Neutral Line - 150 kHz to 30 MHz

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 7

*Decreases with the logarithm of the frequency.

2.4 GHz Bluetooth

Applied supply voltage: 115 V AC
Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.234	38.6	62.3	-23.7	Q-Peak
0.234	34.8	52.3	-17.5	CISPR Avg
0.277	37.2	60.9	-23.7	Q-Peak
0.277	35.1	50.9	-15.8	CISPR Avg
0.414	33.5	57.6	-24.1	Q-Peak
0.414	24.7	47.6	-22.9	CISPR Avg
0.596	31.9	46.0	-14.1	CISPR Avg
0.596	39.1	56.0	-16.9	Q-Peak
0.819	36.4	56.0	-19.6	Q-Peak
0.819	28.8	46.0	-17.2	CISPR Avg
24.769	45.9	60.0	-14.1	Q-Peak
24.769	39.3	50.0	-10.7	CISPR Avg

Table 8 - Live Line Emissions Results

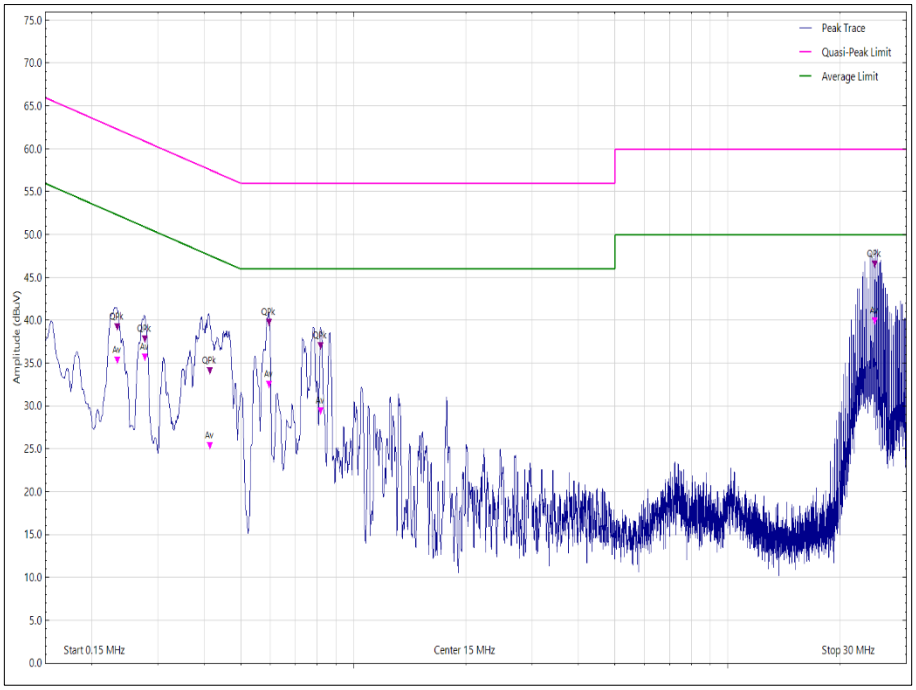

Figure 3 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.233	35.0	52.3	-17.3	CISPR Avg
0.233	39.4	62.3	-22.9	Q-Peak
0.274	36.9	51.0	-14.1	CISPR Avg
0.274	38.2	61.0	-22.8	Q-Peak
0.416	22.5	47.5	-25.0	CISPR Avg
0.416	31.7	57.5	-25.8	Q-Peak
0.590	36.2	46.0	-9.8	CISPR Avg
0.590	39.1	56.0	-16.9	Q-Peak
0.783	33.2	46.0	-12.8	CISPR Avg
0.783	37.8	56.0	-18.2	Q-Peak
23.981	38.3	50.0	-11.7	CISPR Avg
23.981	44.7	60.0	-15.3	Q-Peak

Table 9 - Neutral Line Emissions Results

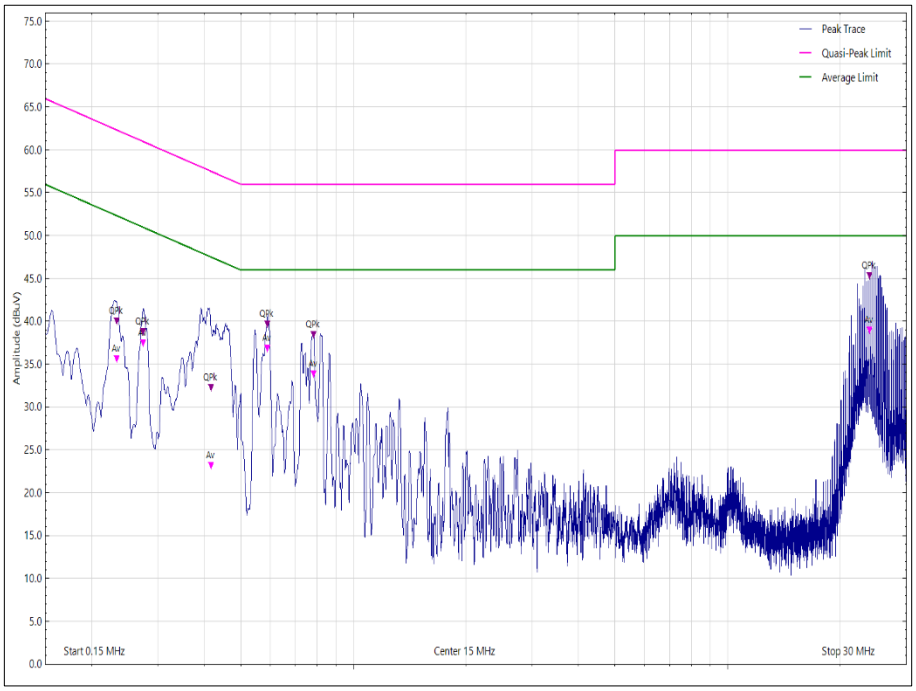

Figure 4 - Neutral Line - 150 kHz to 30 MHz

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 10

*Decreases with the logarithm of the frequency.

5 GHz WLAN

Applied supply voltage: 115 V AC
Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.231	39.3	62.4	-23.1	Q-Peak
0.231	35.4	52.4	-17.0	CISPR Avg
0.274	38.1	61.0	-22.9	Q-Peak
0.274	36.8	51.0	-14.2	CISPR Avg
0.393	35.9	58.0	-22.1	Q-Peak
0.393	30.2	48.0	-17.8	CISPR Avg
0.590	39.2	56.0	-16.8	Q-Peak
0.590	36.2	46.0	-9.8	CISPR Avg
0.821	37.8	56.0	-18.2	Q-Peak
0.821	32.0	46.0	-14.0	CISPR Avg
24.273	46.6	60.0	-13.4	Q-Peak
24.273	42.9	50.0	-7.1	CISPR Avg

Table 11 - Live Line Emissions Results

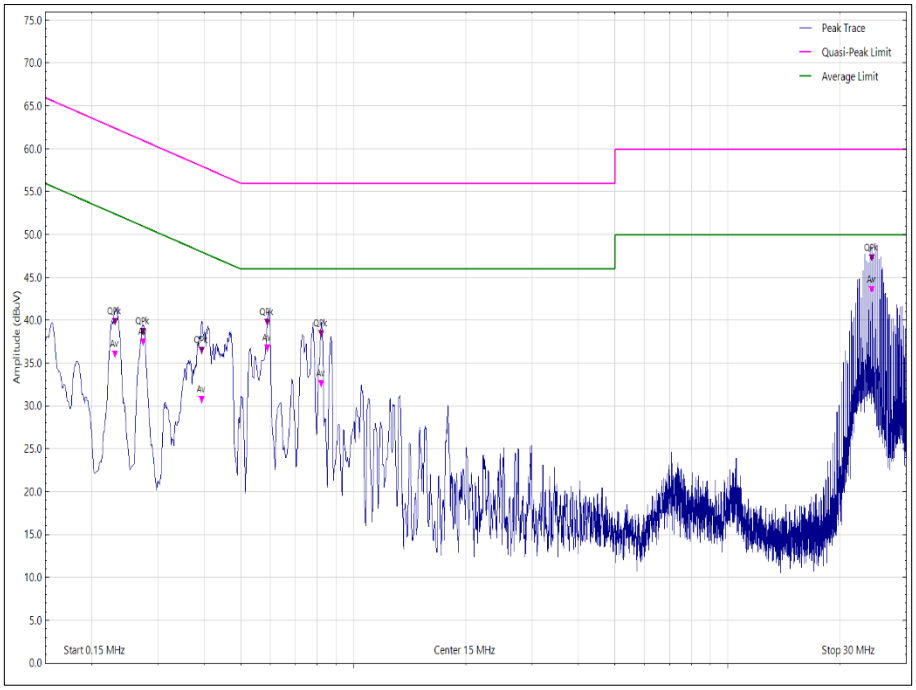

Figure 5 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.234	39.5	62.3	-22.8	Q-Peak
0.234	35.1	52.3	-17.2	CISPR Avg
0.274	36.6	51.0	-14.4	CISPR Avg
0.274	37.9	61.0	-23.1	Q-Peak
0.411	31.1	47.6	-16.5	CISPR Avg
0.411	35.6	57.6	-22.0	Q-Peak
0.595	36.5	46.0	-9.5	CISPR Avg
0.595	39.9	56.0	-16.1	Q-Peak
0.822	33.0	46.0	-13.0	CISPR Avg
0.822	37.6	56.0	-18.4	Q-Peak
24.019	42.0	50.0	-8.0	CISPR Avg
24.019	45.5	60.0	-14.5	Q-Peak

Table 12 - Neutral Line Emissions Results

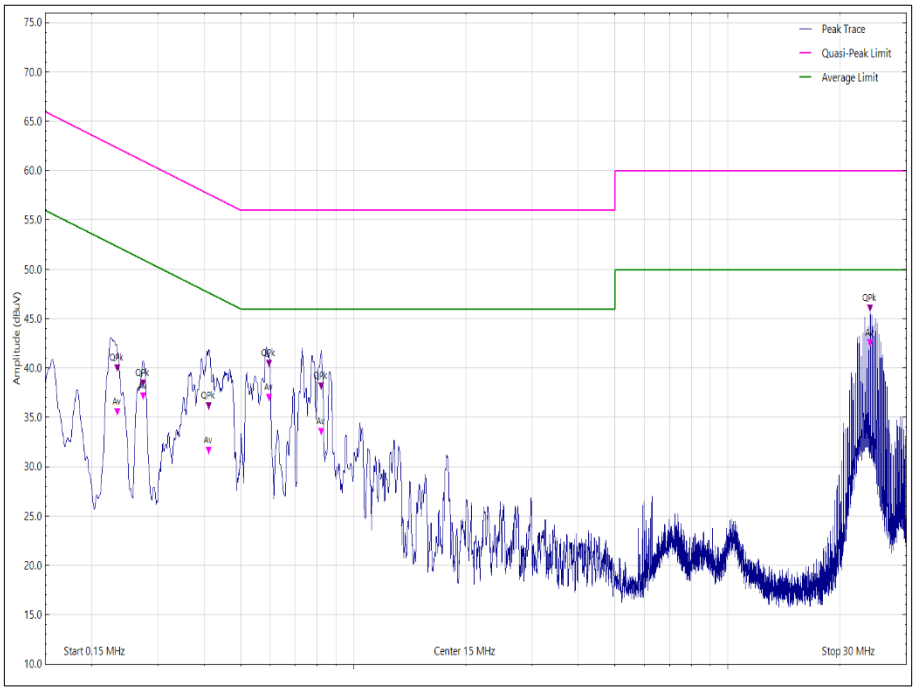

Figure 6 - Neutral Line - 150 kHz to 30 MHz

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 13

*Decreases with the logarithm of the frequency.

6 GHz WLAN

Applied supply voltage: 115 V
Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.469	35.68	56.50	-20.82	Q-Peak
0.469	26.25	46.50	-20.25	CISPR Avg
0.594	30.22	46.00	-15.78	CISPR Avg
0.594	39.34	56.00	-16.66	Q-Peak
0.786	30.81	46.00	-15.19	CISPR Avg
0.786	38.37	56.00	-17.63	Q-Peak
21.664	40.89	60.00	-19.11	Q-Peak
21.664	39.60	50.00	-10.40	CISPR Avg

Table 14 - Live Line Emissions Results

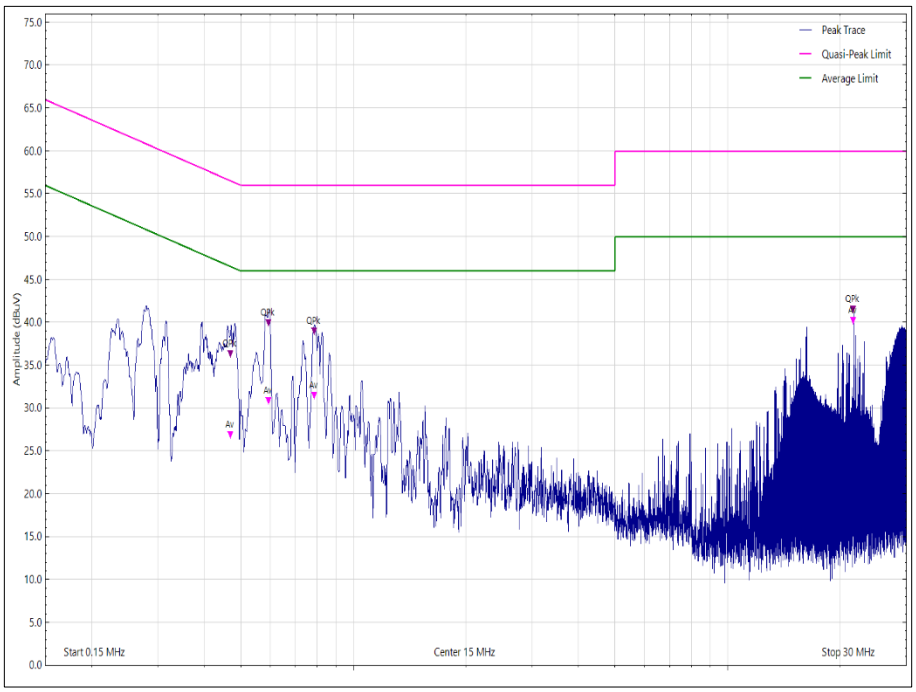

Figure 7 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.277	39.49	50.90	-11.41	CISPR Avg
0.277	40.77	60.90	-20.13	Q-Peak
0.411	27.00	47.60	-20.60	CISPR Avg
0.411	34.14	57.60	-23.46	Q-Peak
0.473	36.36	56.50	-20.14	Q-Peak
0.473	26.43	46.50	-20.07	CISPR Avg
0.593	39.32	56.00	-16.68	Q-Peak
0.593	30.66	46.00	-15.34	CISPR Avg
0.790	39.76	56.00	-16.24	Q-Peak
0.790	34.16	46.00	-11.84	CISPR Avg
21.664	40.42	60.00	-19.58	Q-Peak
21.664	39.26	50.00	-10.74	CISPR Avg

Table 15 - Neutral Line Emissions Results

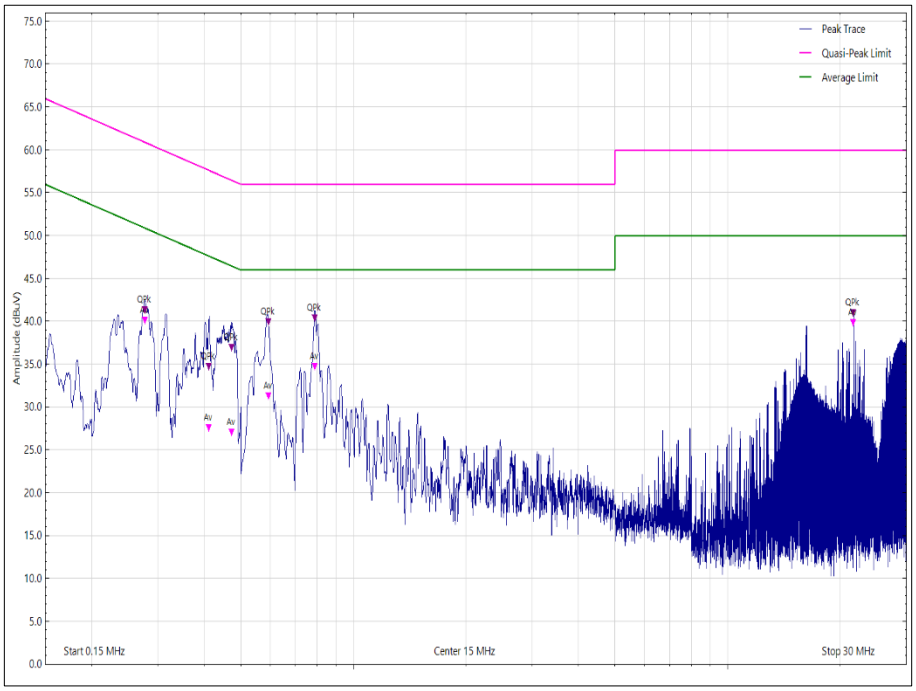

Figure 8 - Neutral Line - 150 kHz to 30 MHz

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 16

*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
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023
Emissions Software	TUV SUD	EmX V3.1.4	5125	-	N/A - Software
Test Receiver	Rohde & Schwarz	ESU40	3506	12	25-Mar-2023
Transient Limiter	Hewlett Packard	11947A	2377	12	28-Feb-2023
Cable (SMA to SMA, 2 m)	Rhophase	3PS-1801A-2000-3PS	4113	12	27-Jan-2023
Cable (N to N 8m)	Scott Cables	FSB800-NMNM-08.00M	6054	6	23-Dec-2022
LISN (CISPR 16, Single Phase)	Rohde & Schwarz	ESH3-Z5	1390	12	31-Jan-2023

Table 17

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
LISN (CISPR 16, Single Phase)	Chase	MN 2050	336	12	04-Jul-2023*
Load (50ohm, 12W)	Micronde	R404620	355	12	29-Jun-2023*
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5472	12	25-Mar-2023

Table 18

*Equipment was only employed in support of testing, during its valid calibration period.

4 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 19

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.