FCC and ISED Test Report

Apple Inc
Model: A2780

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

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

FCC ID: BCGA2780 IC: 579C-A2780

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TUV SUD Digitally signed by TUV SUD Date: 2022.11.15 10:46:38 Z

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Document 75955429-18 Issue 01

SIGNATURE			
AJ Lawson.			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Andrew Lawson	Chief Engineer	Authorised Signatory	15 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, 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
Report Generation	Hollie Marshall	15 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: 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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ACCREDITATION

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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	15 November 2022

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2780
Serial Number(s)	G22LH9VX36 and C2VJKD20WX
Hardware Version(s)	REV 1.0
Software Version(s)	22A8353 and 22A8375
Number of Samples Tested	2
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	0540246998
Start of Test	07-November-2022
Finish of Test	10-November-2022
Name of Engineer(s)	James Cumming and Connor Lee
Related Document(s)	ANSI C63.10 (2013) 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, ISED RSS-247 and ISED RSS-GEN is shown below.

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

Table 2

1.4 Product Information

1.4.1 Technical Description

The equipment under test was an Apple laptop computer with Bluetooth® and IEEE 802.11 a/b/g/n/ac/ax Wi-Fi capabilities 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: A2780, Serial Number: G22LH9VX36			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2780, Serial Number: C2VJKD20WX			
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	Connor Lee	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	Connor Lee	UKAS
Configuration and Mode: 6 GHz WLAN		
AC Power Line Conducted Emissions	Connor Lee	UKAS
Configuration and Mode: 5 GHz Narrow Band		
AC Power Line Conducted Emissions	James Cumming	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

A2780, S/N: G22LH9VX36 - Modification State 0
A2780, S/N: C2VJKD20WX - Modification State 0

2.1.3 Date of Test

07-November-2022 to 10-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 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 Test Setup Diagram

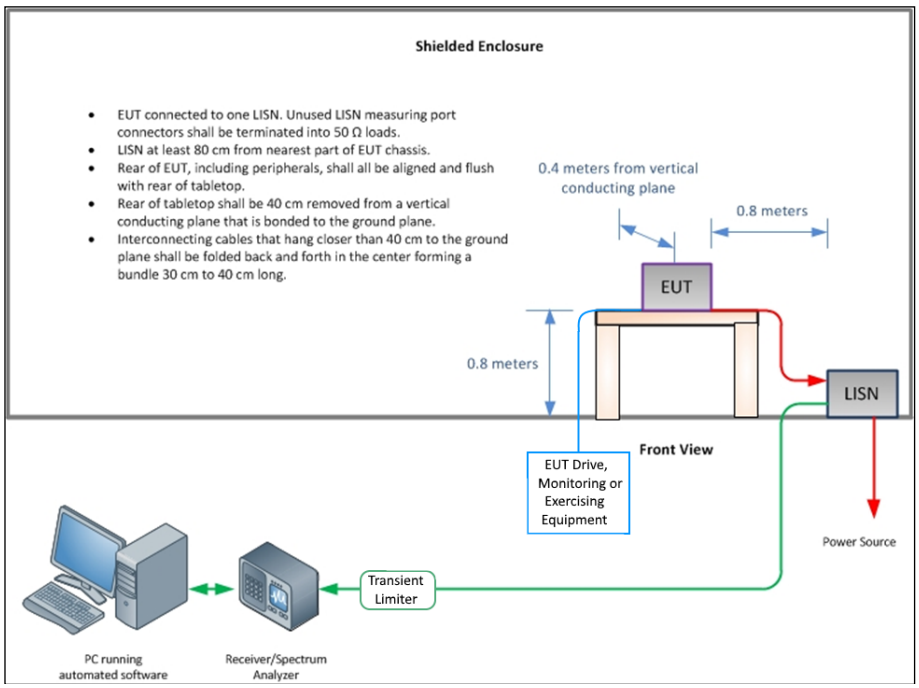

Figure 1 - Conducted Emissions

2.1.7 Environmental Conditions

Ambient Temperature	18.9 - 20.4 °C
Relative Humidity	53.5 - 67.2 %

2.1.8 Test Results

2.4 GHz WLAN

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.155	43.39	65.70	-22.31	Q-Peak
0.155	39.57	55.70	-16.13	CISPR Avg
0.482	32.08	56.30	-24.22	Q-Peak
0.482	19.60	46.30	-26.70	CISPR Avg
4.228	37.11	56.00	-18.89	Q-Peak
4.228	20.82	46.00	-25.18	CISPR Avg
6.861	38.89	60.00	-21.11	Q-Peak
6.861	25.25	50.00	-24.75	CISPR Avg

Table 5 - Live Line Emissions Results

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

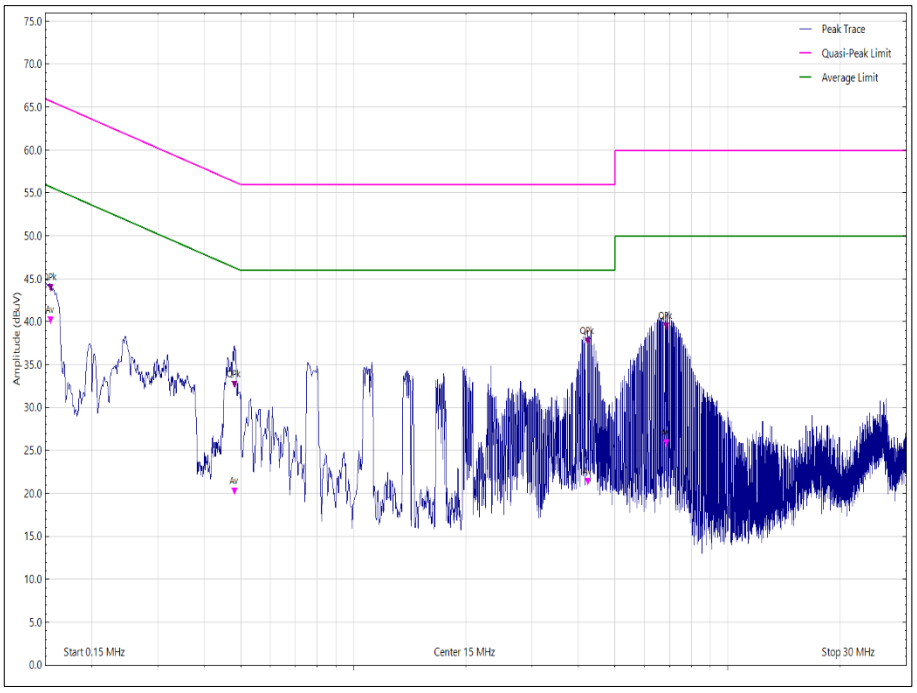

Figure 2 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.159	39.23	65.50	-26.27	Q-Peak
0.159	32.79	55.50	-22.71	CISPR Avg
0.477	32.04	56.40	-24.36	Q-Peak
0.477	23.08	46.40	-23.32	CISPR Avg
4.308	36.67	56.00	-19.33	Q-Peak
4.308	23.07	46.00	-22.93	CISPR Avg
6.817	41.29	60.00	-18.71	Q-Peak
6.817	27.06	50.00	-22.94	CISPR Avg

Table 6 - Neutral Line Emissions Results

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

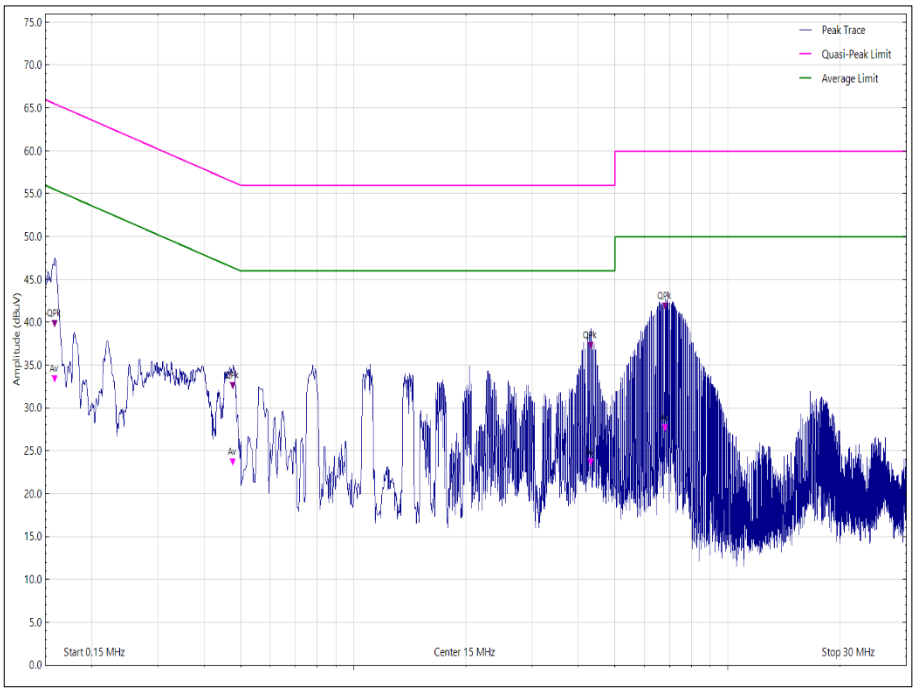

Figure 3 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz Bluetooth

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
*				

Table 7 - Live Line Emissions Results

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

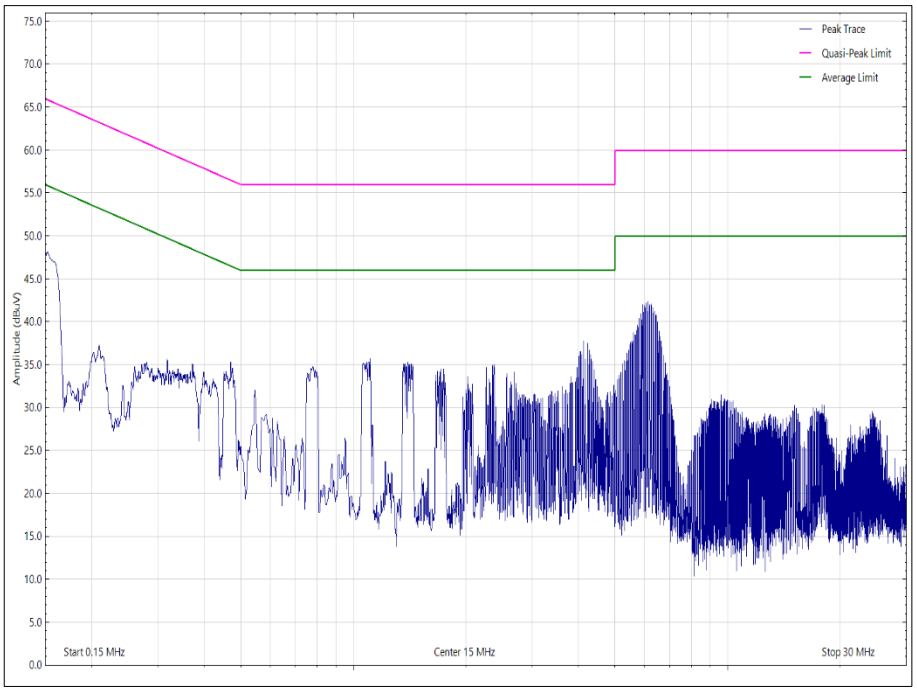

Figure 4 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
6.177	43.26	60.00	-16.74	Q-Peak
6.177	28.92	50.00	-21.08	CISPR Avg

Table 8 - Neutral Line Emissions Results

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

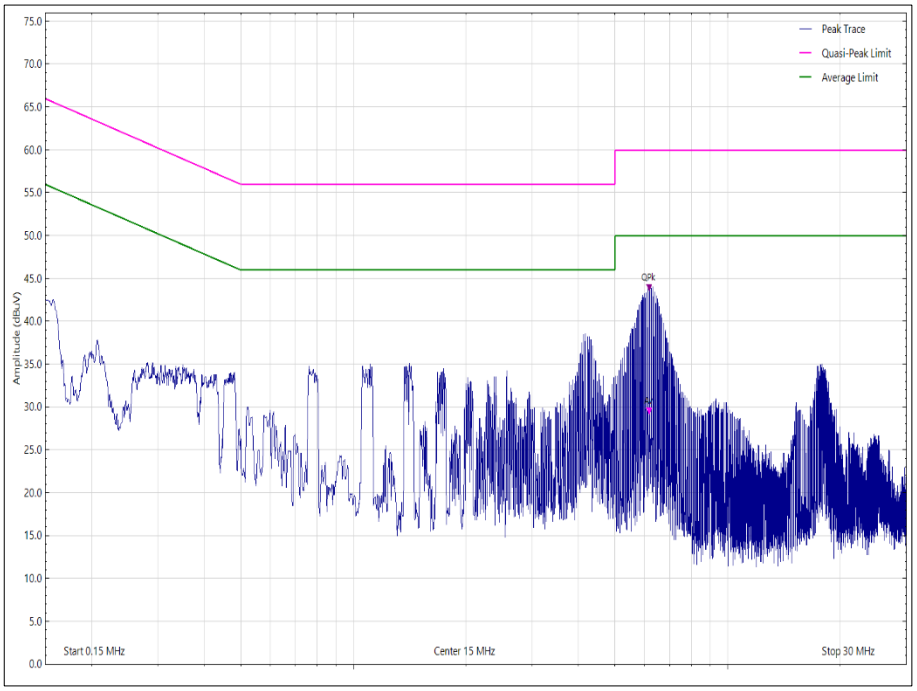

Figure 5 - Neutral Line - 150 kHz to 30 MHz

5 GHz WLAN

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.154	44.32	65.80	-21.48	Q-Peak
0.154	40.20	55.80	-15.60	CISPR Avg
0.454	33.09	56.80	-23.71	Q-Peak
0.454	23.81	46.80	-22.99	CISPR Avg
4.161	37.63	56.00	-18.37	Q-Peak
4.161	20.78	46.00	-25.22	CISPR Avg
6.883	38.48	60.00	-21.52	Q-Peak
6.883	20.58	50.00	-29.42	CISPR Avg

Table 9 - Live Line Emissions Results

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

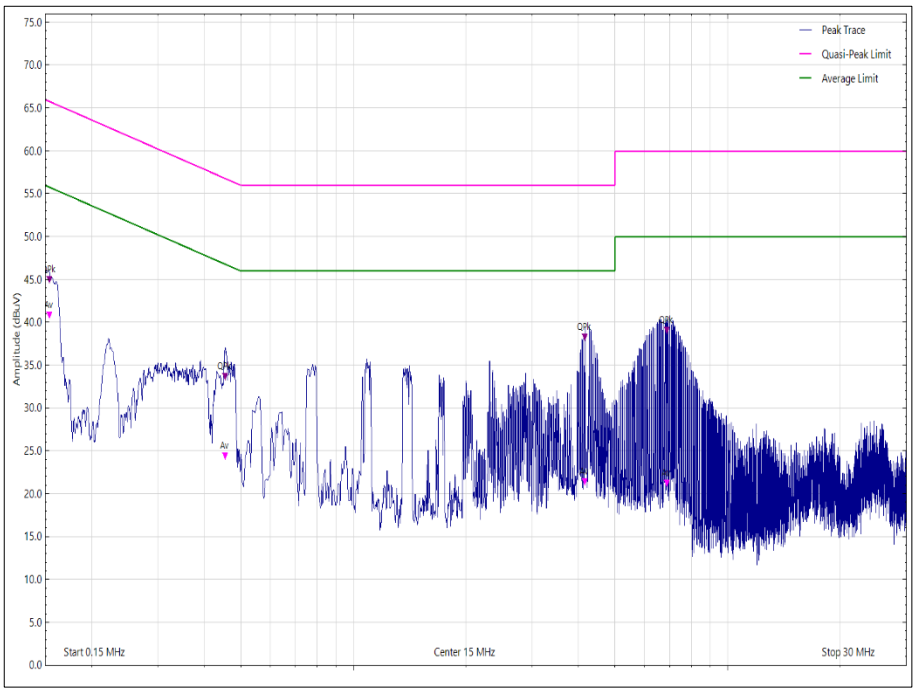

Figure 6 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.157	37.79	65.60	-27.81	Q-Peak
0.157	33.44	55.60	-22.16	CISPR Avg
0.454	33.12	56.80	-23.68	Q-Peak
0.454	24.08	46.80	-22.72	CISPR Avg
4.228	37.24	56.00	-18.76	Q-Peak
4.228	20.28	46.00	-25.72	CISPR Avg
6.884	40.93	60.00	-19.07	Q-Peak
6.884	22.42	50.00	-27.58	CISPR Avg

Table 10 - Neutral Line Emissions Results

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

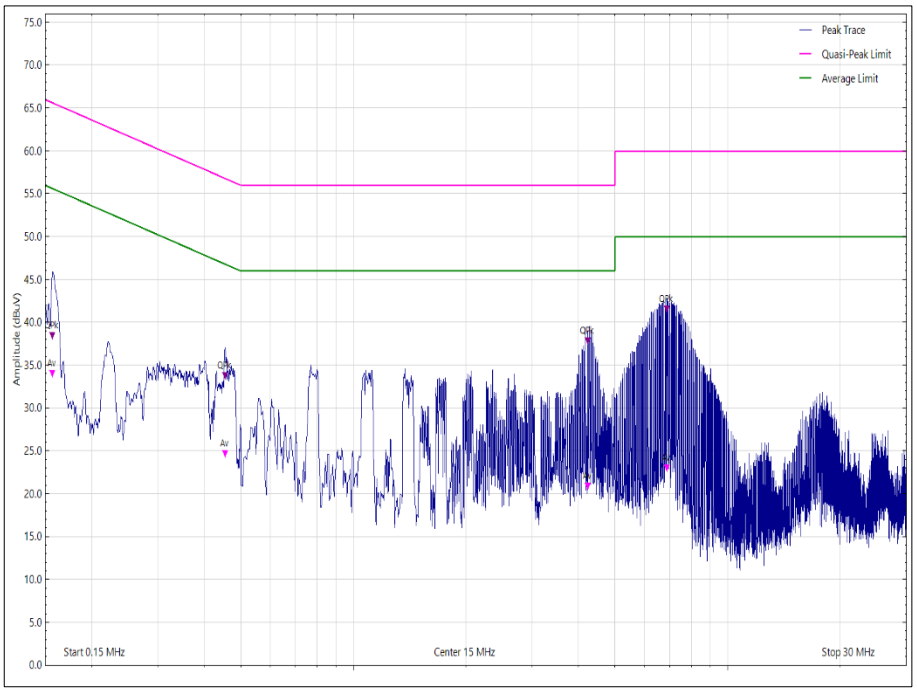

Figure 7 - Neutral Line - 150 kHz to 30 MHz

6 GHz WLAN

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.157	43.77	65.60	-21.83	Q-Peak
0.157	38.81	55.60	-16.79	CISPR Avg
0.480	33.74	56.30	-22.56	Q-Peak
0.480	24.14	46.30	-22.16	CISPR Avg
4.270	38.16	56.00	-17.84	Q-Peak
4.270	24.24	46.00	-21.76	CISPR Avg
6.885	38.85	60.00	-21.15	Q-Peak
6.885	20.65	50.00	-29.35	CISPR Avg

Table 11 - Live Line Emissions Results

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

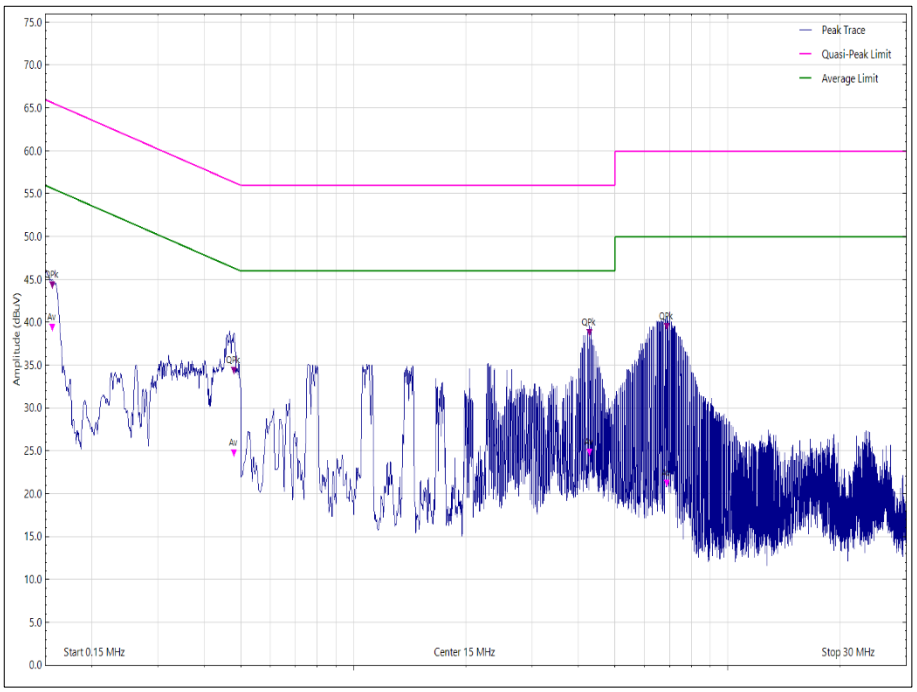

Figure 8 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.472	33.80	56.50	-22.70	Q-Peak
0.472	25.85	46.50	-20.65	CISPR Avg
4.230	36.99	56.00	-19.01	Q-Peak
4.230	19.83	46.00	-26.17	CISPR Avg
6.884	40.83	60.00	-19.17	Q-Peak
6.884	22.19	50.00	-27.81	CISPR Avg

Table 12 - Neutral Line Emissions Results

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

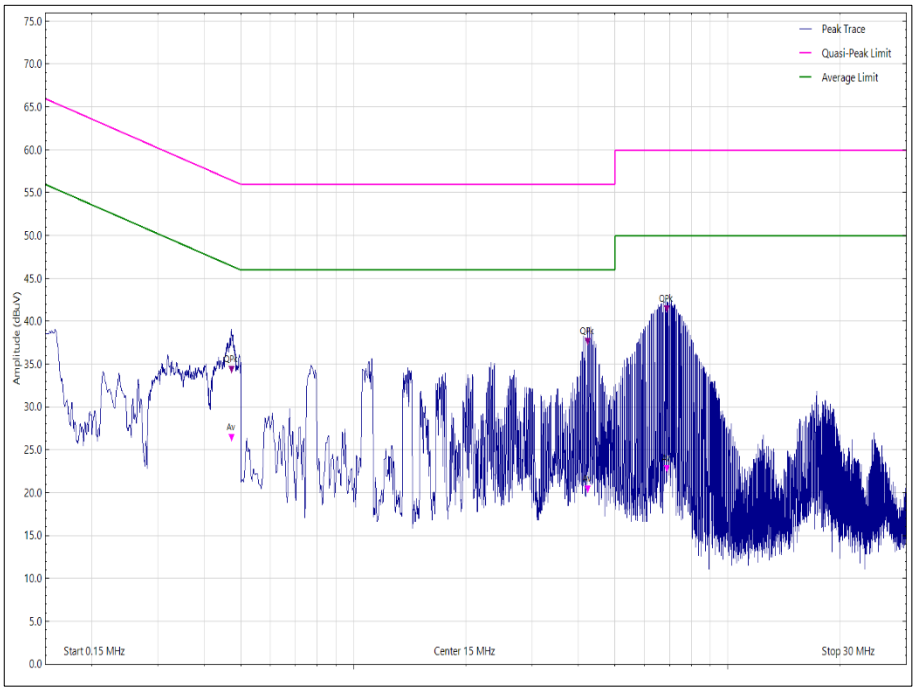

Figure 9 - Neutral Line - 150 kHz to 30 MHz

5GHz Narrow Band

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
*				

Table 13 - Live Line Emissions Results

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

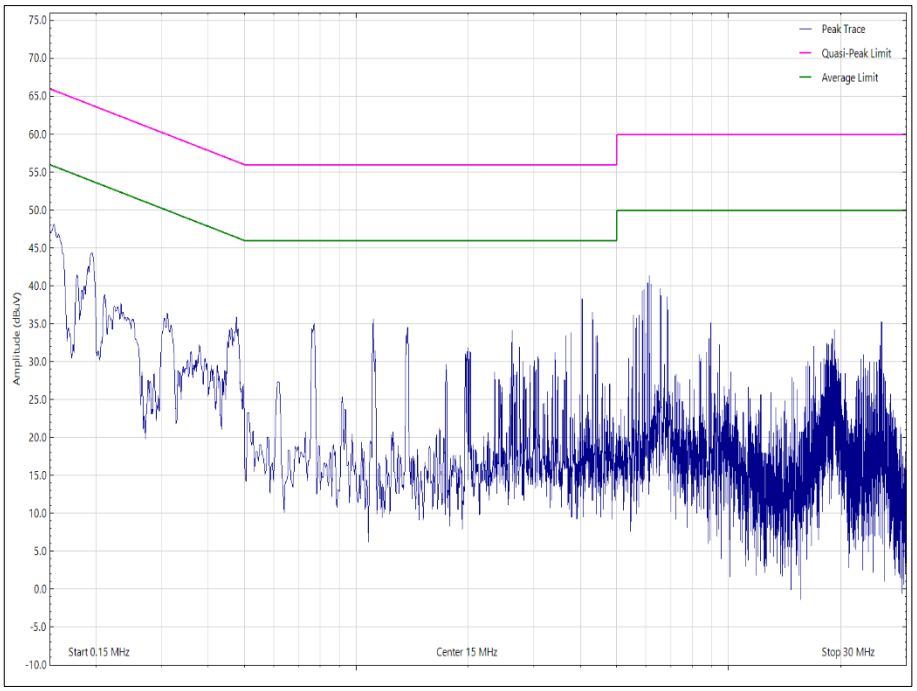

Figure 10 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
*				

Table 14 - Neutral Line Emissions Results

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

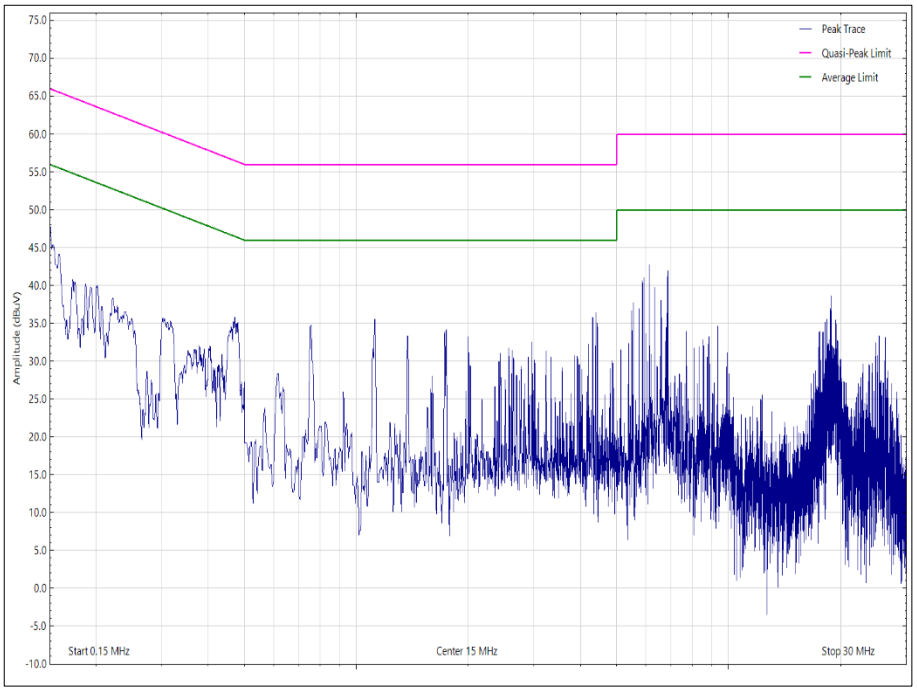

Figure 11 - Neutral Line - 150 kHz to 30 MHz

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 15

*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 V3.1.4	5125	-	Software
Test Receiver	Rohde & Schwarz	ESU40	3506	12	25-Mar-2023
Transient Limiter	Hewlett Packard	11947A	2377	12	28-Feb-2023
Load (50ohm, 30W)	Weinschel	50T-054-201	5468	12	02-Mar-2023
Cable (SMA to SMA, 2 m)	Rhophase	3PS-1801A-2000-3PS	4113	12	27-Jan-2023
Cable (N-Type to N-Type, 8 m)	Scott Cables	FSB800-NMNM-08.00M	6054	6	23-Dec-2022
LISN (CISPR 16, Single Phase)	Chase	MN 2050	336	12	04-Jul-2023
LISN (CISPR 16, Single Phase)	Rohde & Schwarz	ESH3-Z5	1390	12	31-Jan-2023

Table 16

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 17

Measurement Uncertainty Decision Rule – Accuracy Method

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2021, Clause 4.4.3 (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.