

FCC and ISED Test Report

Apple Inc
Model: A2816

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



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FCC ID: BCGA2816

IC: 579C-A2816

COMMERCIAL-IN-CONFIDENCE

Document 75954420-09 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andrew Lawson	Chief Engineer, EMC	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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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)	A2816
Serial Number(s)	LWPX9T56K4 and CL9N0XNWVH
Hardware Version(s)	REV 1.0
Software Version(s)	22A8375 and 22A8353
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	27-October-2022
Finish of Test	07-November-2022
Name of Engineer(s)	James Cumming
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 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: A2816, Serial Number: CL9N0XNWVH			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2816, Serial Number: LWPX9T56K4			
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	James Cumming	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

A2816, S/N: LWPX9T56K4 - Modification State 0
A2816, S/N: CL9N0XNWVH - Modification State 0

2.1.3 Date of Test

27-October-2022 to 07-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

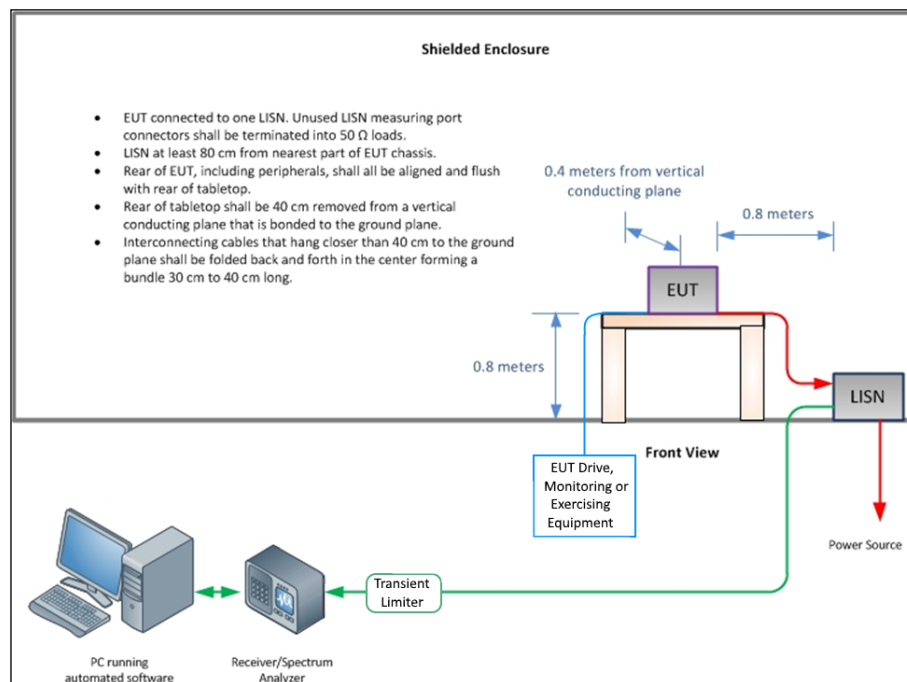


Figure 1 - Conducted Emissions

2.1.7 Environmental Conditions

Ambient Temperature	18.6 - 20.9 °C
Relative Humidity	68.6 - 72.8 %

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	Angle (°)	Height (cm)	Polarisation
0.159	30.76	65.50	-34.74	Q-Peak	0	100	Horizontal
0.159	19.74	55.50	-35.76	CISPR Avg	0	100	Horizontal
0.232	36.37	62.40	-26.03	Q-Peak	0	100	Horizontal
0.232	24.69	52.40	-27.71	CISPR Avg	0	100	Horizontal
0.253	38.88	61.70	-22.82	Q-Peak	0	100	Horizontal
0.253	28.49	51.70	-23.21	CISPR Avg	0	100	Horizontal
0.522	34.75	56.00	-21.25	Q-Peak	0	100	Horizontal
0.522	23.35	46.00	-22.65	CISPR Avg	0	100	Horizontal
0.817	31.55	56.00	-24.45	Q-Peak	0	100	Horizontal
0.817	18.64	46.00	-27.36	CISPR Avg	0	100	Horizontal
0.947	29.29	56.00	-26.71	Q-Peak	0	100	Horizontal
0.947	19.49	46.00	-26.51	CISPR Avg	0	100	Horizontal

Table 5 - Live Line Emissions Results

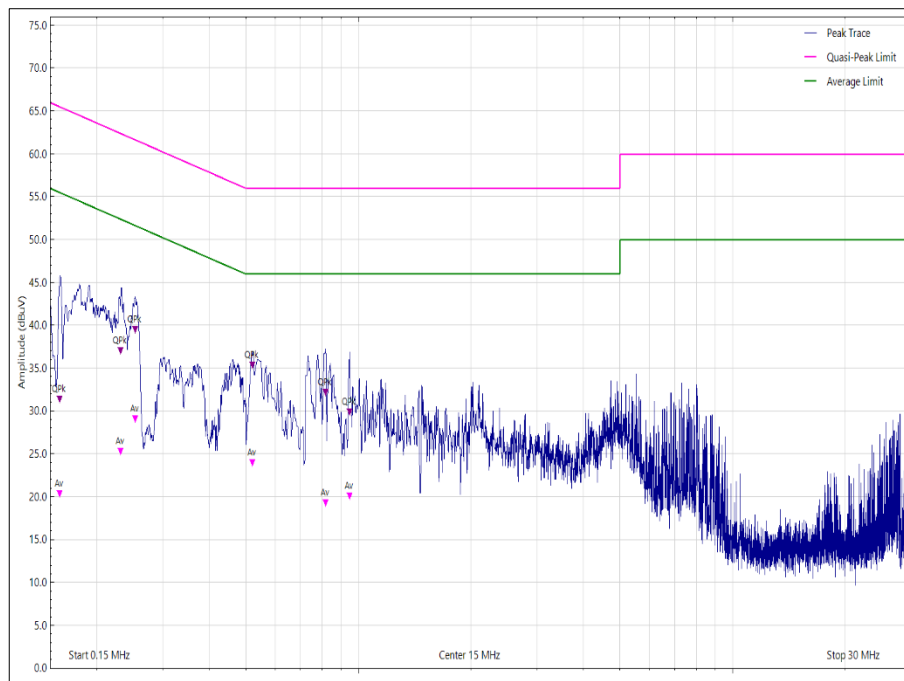


Figure 2 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
0.151	48.76	66.00	-17.24	Q-Peak	0	100	Horizontal
0.151	22.47	56.00	-33.53	CISPR Avg	0	100	Horizontal
0.185	39.72	64.20	-24.48	Q-Peak	0	100	Horizontal
0.185	29.60	54.20	-24.60	CISPR Avg	0	100	Horizontal
0.254	39.37	61.60	-22.23	Q-Peak	0	100	Horizontal
0.254	29.20	51.60	-22.40	CISPR Avg	0	100	Horizontal
0.479	30.47	56.40	-25.93	Q-Peak	0	100	Horizontal
0.479	19.78	46.40	-26.62	CISPR Avg	0	100	Horizontal
0.548	36.61	56.00	-19.39	Q-Peak	0	100	Horizontal
0.548	21.54	46.00	-24.46	CISPR Avg	0	100	Horizontal
0.742	32.71	56.00	-23.29	Q-Peak	0	100	Horizontal
0.742	21.27	46.00	-24.73	CISPR Avg	0	100	Horizontal

Table 6 - Neutral Line Emissions Results

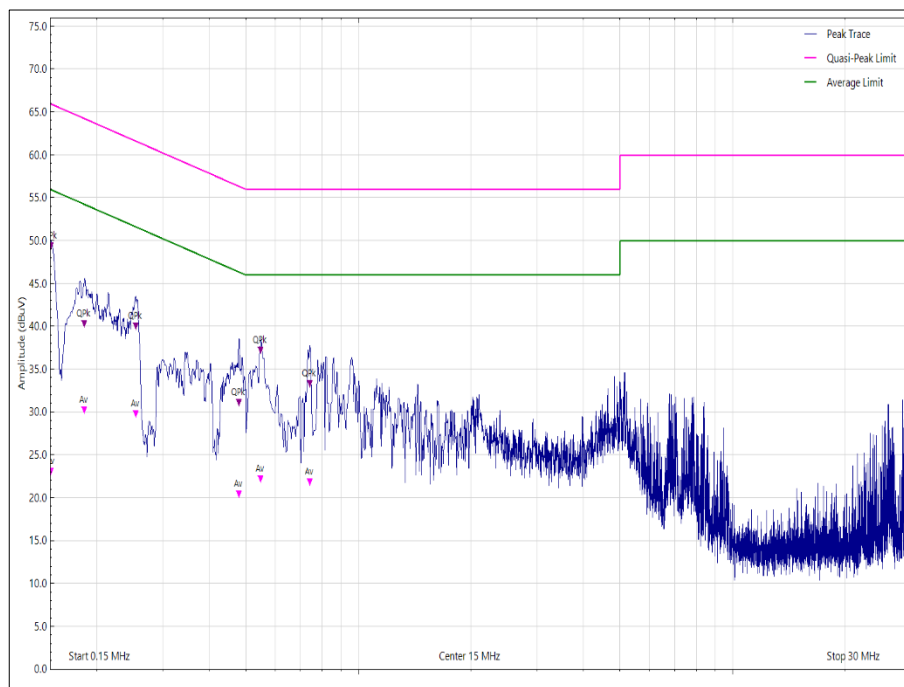


Figure 3 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz Bluetooth

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

Frequency (MHz)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
0.152	33.55	65.90	-32.35	Q-Peak	0	100	Horizontal
0.152	21.25	55.90	-34.65	CISPR Avg	0	100	Horizontal
0.167	35.00	65.10	-30.10	Q-Peak	0	100	Horizontal
0.167	24.06	55.10	-31.04	CISPR Avg	0	100	Horizontal
0.254	39.08	61.60	-22.52	Q-Peak	0	100	Horizontal
0.254	28.82	51.60	-22.78	CISPR Avg	0	100	Horizontal
0.549	32.73	56.00	-23.27	Q-Peak	0	100	Horizontal
0.549	21.09	46.00	-24.91	CISPR Avg	0	100	Horizontal
0.742	32.70	56.00	-23.30	Q-Peak	0	100	Horizontal
0.742	20.92	46.00	-25.08	CISPR Avg	0	100	Horizontal
1.144	28.70	56.00	-27.30	Q-Peak	0	100	Horizontal
1.144	18.20	46.00	-27.80	CISPR Avg	0	100	Horizontal

Table 7 - Live Line Emissions Results

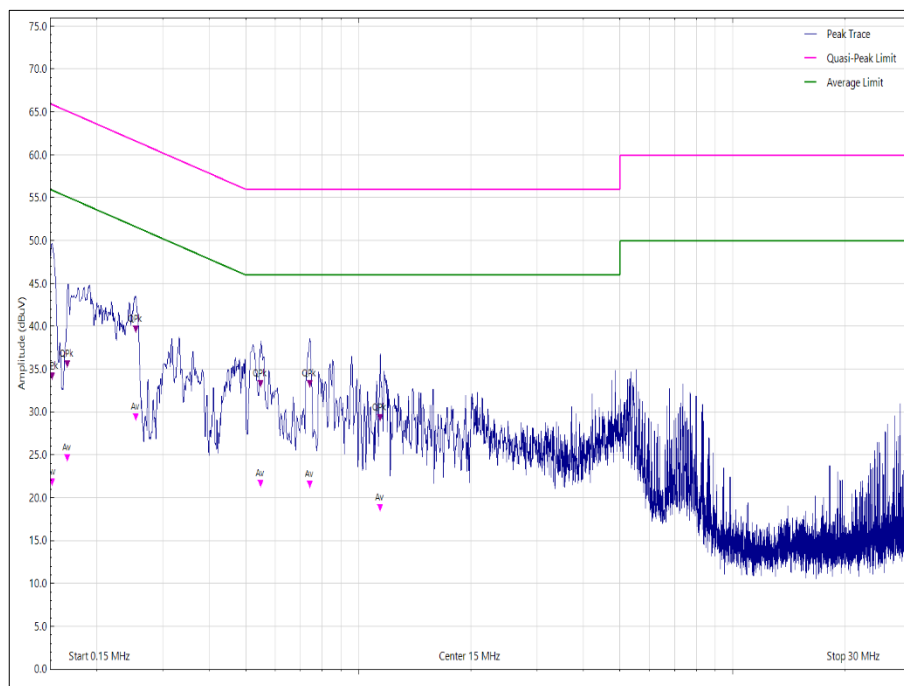


Figure 4 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
0.552	33.00	56.00	-23.00	Q-Peak	0	100	Horizontal
0.552	21.78	46.00	-24.22	CISPR Avg	0	100	Horizontal
0.746	31.42	56.00	-24.58	Q-Peak	0	100	Horizontal
0.746	20.36	46.00	-25.64	CISPR Avg	0	100	Horizontal

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.

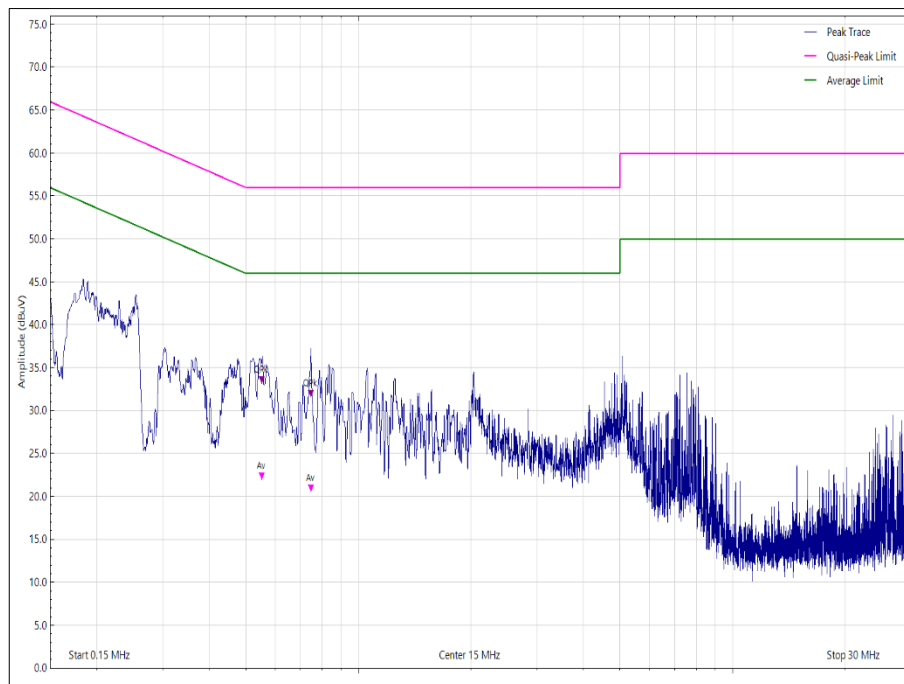


Figure 5 - Neutral Line - 150 kHz to 30 MHz

5 GHz WLAN

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
0.151	48.14	66.00	-17.86	Q-Peak	0	100	Horizontal
0.151	45.71	56.00	-10.29	CISPR Avg	0	100	Horizontal
0.190	39.46	64.00	-24.54	Q-Peak	0	100	Horizontal
0.190	29.91	54.00	-24.09	CISPR Avg	0	100	Horizontal
0.232	35.89	62.40	-26.51	Q-Peak	0	100	Horizontal
0.232	24.64	52.40	-27.76	CISPR Avg	0	100	Horizontal
0.254	39.12	61.60	-22.48	Q-Peak	0	100	Horizontal
0.254	28.94	51.60	-22.66	CISPR Avg	0	100	Horizontal
0.463	31.10	56.60	-25.50	Q-Peak	0	100	Horizontal
0.463	19.36	46.60	-27.24	CISPR Avg	0	100	Horizontal
0.604	34.13	56.00	-21.87	Q-Peak	0	100	Horizontal
0.604	27.93	46.00	-18.07	CISPR Avg	0	100	Horizontal
0.835	32.23	56.00	-23.77	Q-Peak	0	100	Horizontal
0.835	23.75	46.00	-22.25	CISPR Avg	0	100	Horizontal

Table 9 - Live Line Emissions Results

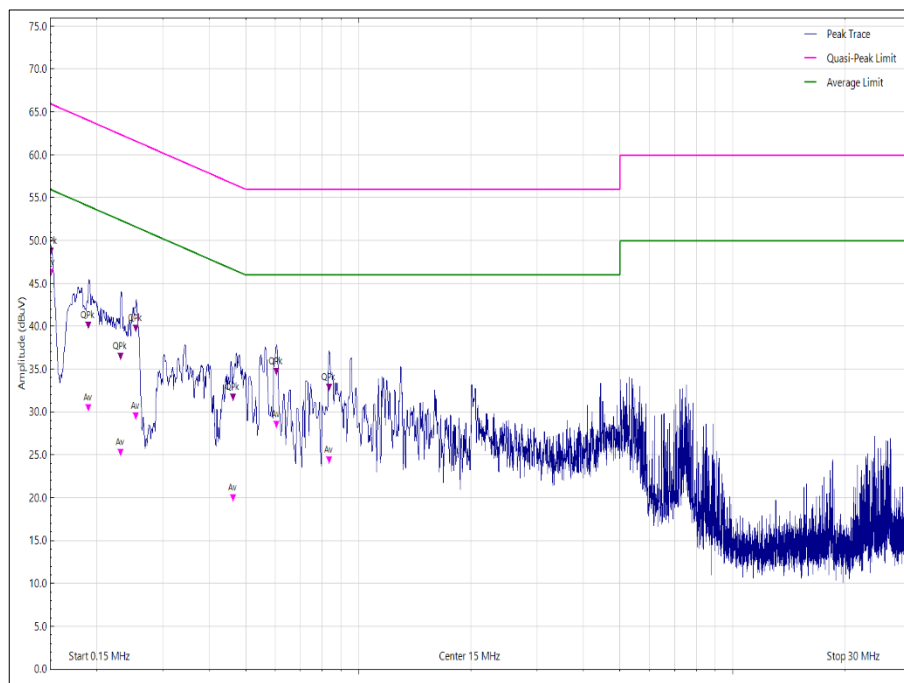


Figure 6 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
0.151	48.95	65.90	-16.95	Q-Peak	0	100	Horizontal
0.151	45.64	55.90	-10.26	CISPR Avg	0	100	Horizontal
0.189	39.60	64.10	-24.50	Q-Peak	0	100	Horizontal
0.189	29.63	54.10	-24.47	CISPR Avg	0	100	Horizontal
0.252	38.76	61.70	-22.94	Q-Peak	0	100	Horizontal
0.252	28.09	51.70	-23.61	CISPR Avg	0	100	Horizontal
0.473	30.70	56.50	-25.80	Q-Peak	0	100	Horizontal
0.473	19.40	46.50	-27.10	CISPR Avg	0	100	Horizontal
0.567	33.39	56.00	-22.61	Q-Peak	0	100	Horizontal
0.567	22.88	46.00	-23.12	CISPR Avg	0	100	Horizontal
0.736	34.82	56.00	-21.18	Q-Peak	0	100	Horizontal
0.736	21.14	46.00	-24.86	CISPR Avg	0	100	Horizontal

Table 10 - Neutral Line Emissions Results

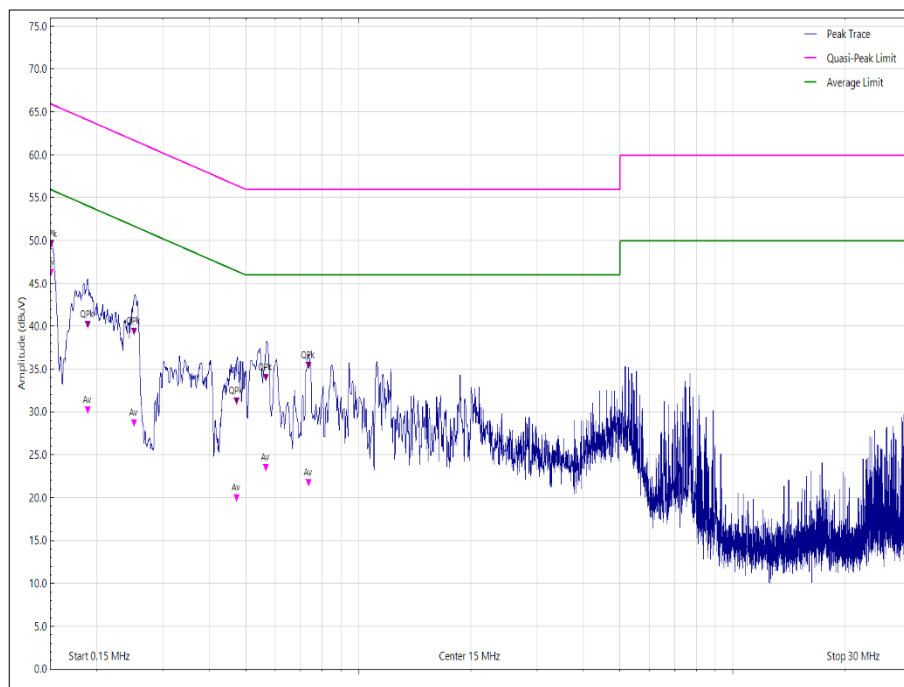


Figure 7 - Neutral Line - 150 kHz to 30 MHz

6 GHz WLAN

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

Frequency (MHz)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector
0.151	48.53	65.90	-17.37	Q-Peak
0.151	48.60	55.90	-7.30	CISPR Avg
0.162	32.77	65.40	-32.63	Q-Peak
0.162	20.63	55.40	-34.77	CISPR Avg
0.168	36.81	65.10	-28.29	Q-Peak
0.168	24.13	55.10	-30.97	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.

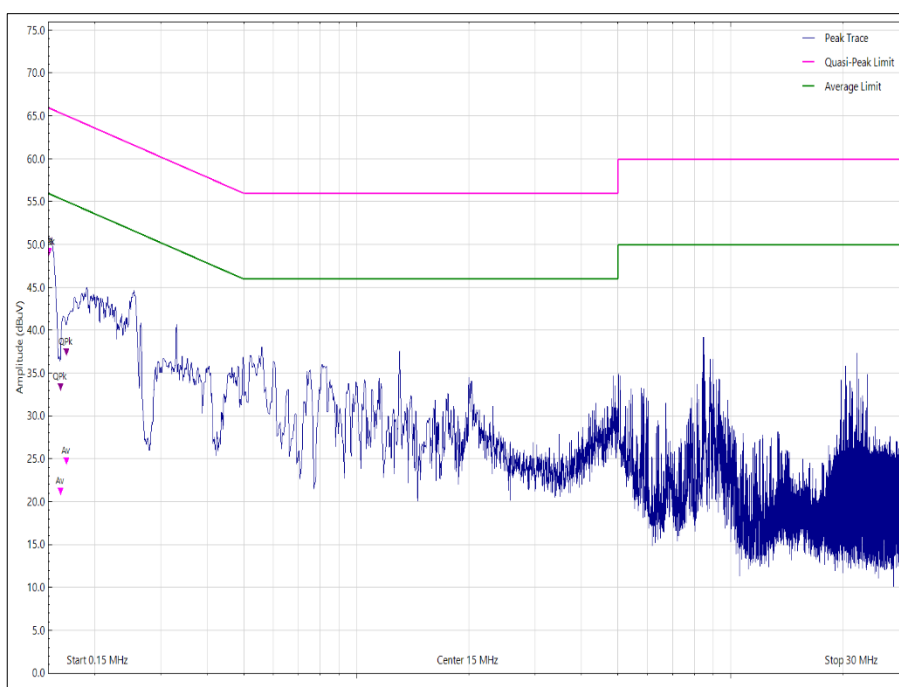


Figure 8 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector
0.152	49.27	65.90	-16.63	Q-Peak
0.152	48.23	55.90	-7.67	CISPR Avg
0.163	33.92	65.30	-31.38	Q-Peak
0.163	21.14	55.30	-34.16	CISPR Avg
0.254	40.72	61.60	-20.88	Q-Peak
0.254	30.47	51.60	-21.13	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.

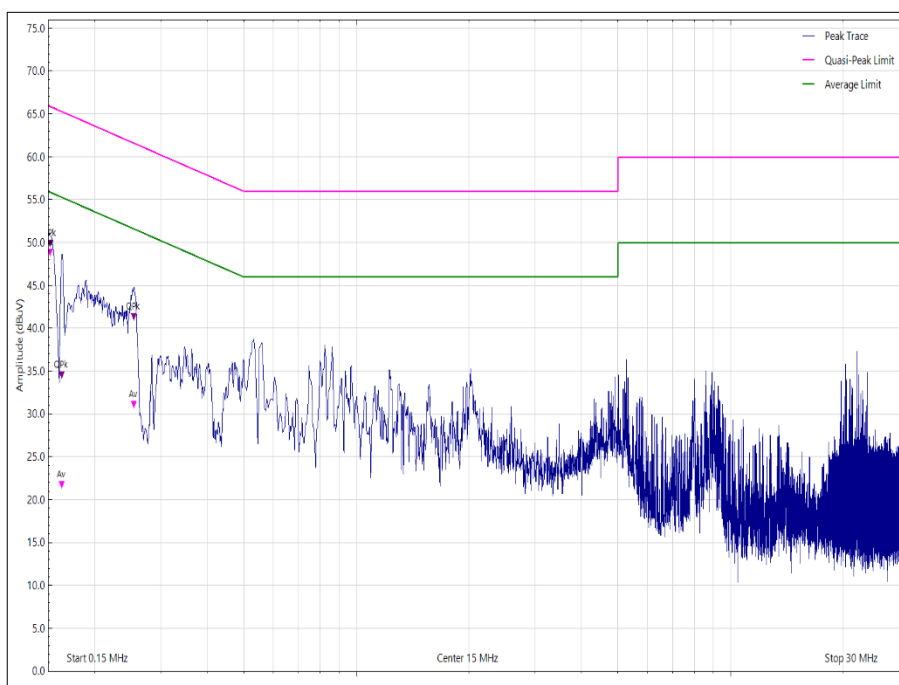


Figure 9 - Neutral Line - 150 kHz to 30 MHz

5 GHz Narrow Band

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

Frequency (MHz)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
0.151	49.00	65.90	-16.90	Q-Peak	0	100	Horizontal
0.151	47.28	55.90	-8.62	CISPR Avg	0	100	Horizontal
0.195	40.66	63.80	-23.14	Q-Peak	0	100	Horizontal
0.195	37.31	53.80	-16.49	CISPR Avg	0	100	Horizontal
0.252	27.29	61.70	-34.41	Q-Peak	0	100	Horizontal
0.252	25.09	51.70	-26.61	CISPR Avg	0	100	Horizontal
0.398	34.55	57.90	-23.35	Q-Peak	0	100	Horizontal
0.398	32.10	47.90	-15.80	CISPR Avg	0	100	Horizontal
0.489	36.87	56.20	-19.33	Q-Peak	0	100	Horizontal
0.489	25.75	46.20	-20.45	CISPR Avg	0	100	Horizontal
0.544	37.18	56.00	-18.82	Q-Peak	0	100	Horizontal
0.544	32.46	46.00	-13.54	CISPR Avg	0	100	Horizontal

Table 13 - Live Line Emissions Results

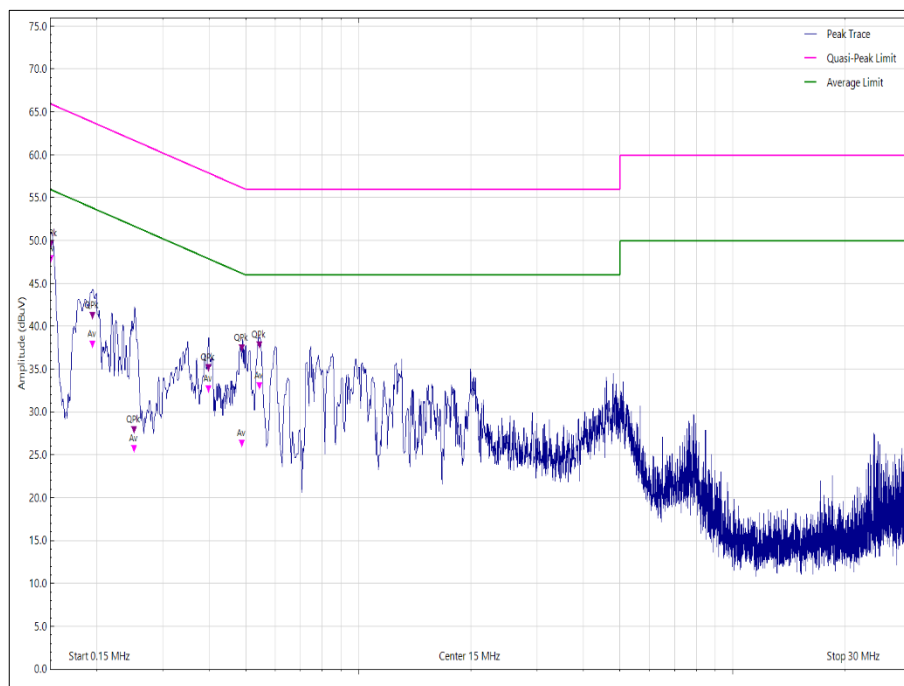


Figure 10 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
0.150	49.17	66.00	-16.83	Q-Peak	0	100	Horizontal
0.150	47.46	56.00	-8.54	CISPR Avg	0	100	Horizontal
0.183	42.24	64.30	-22.06	Q-Peak	0	100	Horizontal
0.183	35.10	54.30	-19.20	CISPR Avg	0	100	Horizontal
0.474	34.06	56.40	-22.34	Q-Peak	0	100	Horizontal
0.474	22.58	46.40	-23.82	CISPR Avg	0	100	Horizontal
0.504	37.74	56.00	-18.26	Q-Peak	0	100	Horizontal
0.504	32.13	46.00	-13.87	CISPR Avg	0	100	Horizontal
0.724	34.54	56.00	-21.46	Q-Peak	0	100	Horizontal
0.724	25.03	46.00	-20.97	CISPR Avg	0	100	Horizontal
0.965	34.23	56.00	-21.77	Q-Peak	0	100	Horizontal
0.965	27.40	46.00	-18.60	CISPR Avg	0	100	Horizontal

Table 14 - Neutral Line Emissions Results

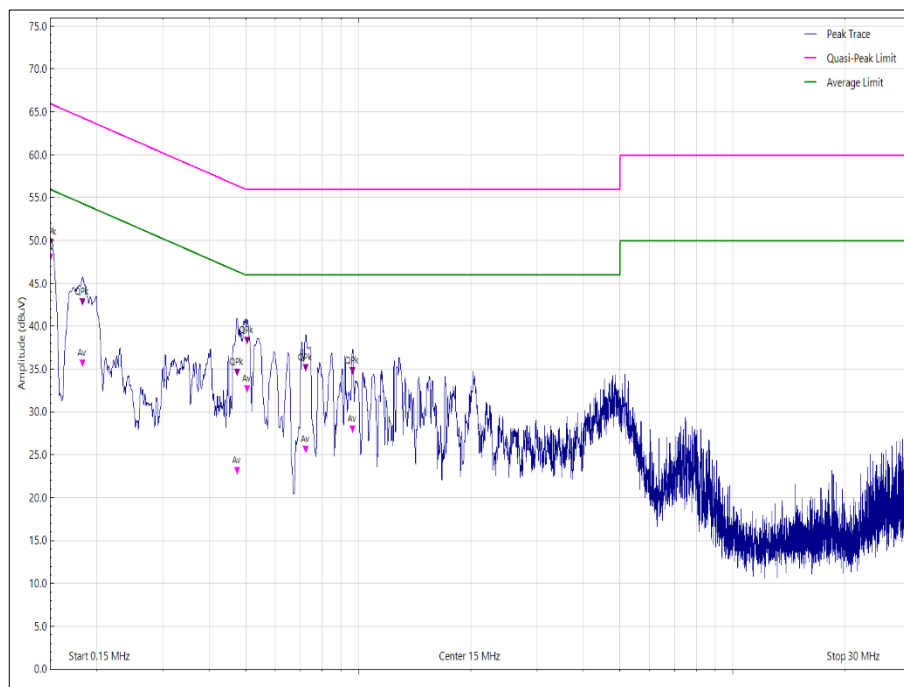


Figure 11 - Neutral Line - 150 kHz to 30 MHz



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.