

FCC and ISED Test Report

Apple Inc
Model: A2787

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: BCGA2787

IC: 579C-A2787

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Document 75955427-11 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andrew Lawson	Chief Engineer	Authorised Signatory	20-February-2023

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	Lauren Walters	20-February-2023	

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: 2021, ISED RSS-247: Issue 2 (02-2017) and ISED RSS-GEN: and 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	20-February-2023

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2787
Serial Number(s)	WDQCYW4692
Hardware Version(s)	REV 1.0
Software Version(s)	22E164 (Until 16-January-2023) 22E202 (After 16-January-2023)
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2021 ISED RSS-247: Issue 2 (02-2017) ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number	0540246998
Start of Test	06-January-2023
Finish of Test	23-January-2023
Name of Engineer(s)	James Cumming and Jonas Ayipah
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, 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 (2020) ANSI C63.10 (2013)
Configuration and Mode: 2.4 GHz Bluetooth						
2.1	15.207	3.1	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	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	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2020) ANSI C63.10 (2013)
Configuration and Mode: NarrowBand						
2.1	15.207	3.1	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 was a rack mounted Apple computer with Bluetooth® and IEEE 802.11 a/b/g/n/ac/ax Wi-Fi capabilities in the 2.4 GHz, 5 GHz and 6 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: A2787, Serial Number: WDQCYW4692			
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	Jonas Ayipah	UKAS
Configuration and Mode: NarrowBand		
AC Power Line Conducted Emissions	Jonas Ayipah	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

A2787, S/N: WDQCYW4692 - Modification State 0

2.1.3 Date of Test

06-January-2023 to 23-January-2023

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 0.8 m above a reference ground plane and 0.4 m 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 (dB μ V) = Receiver level (dB μ V) + Correction Factor (dB)
Margin (dB) = Quasi-Peak level (dB μ V) - Limit (dB μ V)

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

2.1.6 Example Test Setup Diagram

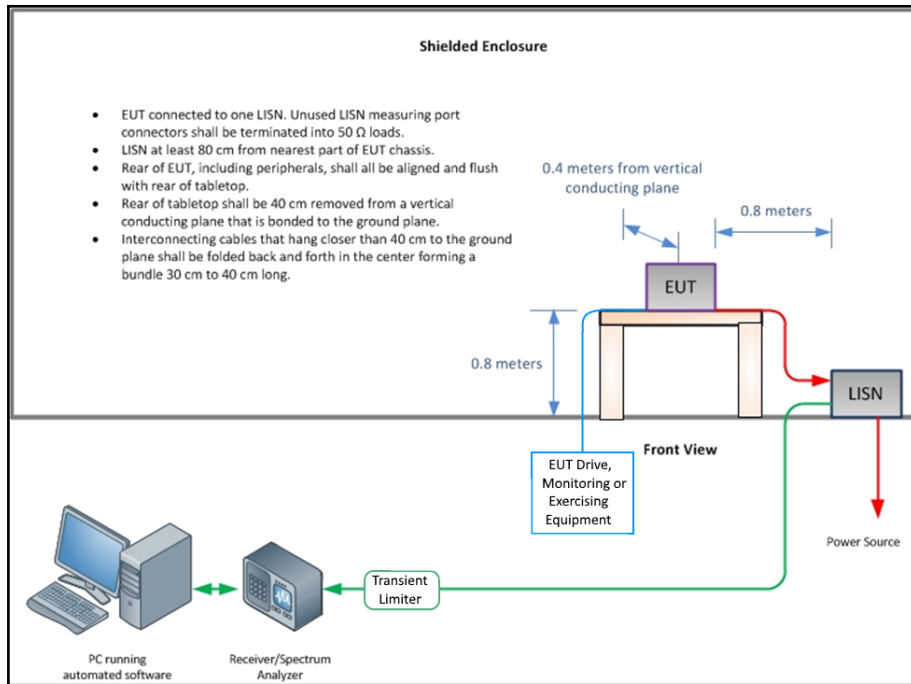


Figure 1 - Conducted Emissions

2.1.7 Environmental Conditions

Ambient Temperature	18.0 - 22.0 °C
Relative Humidity	26.0 - 51.3 %



2.1.8 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
*				

Table 5 - 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.

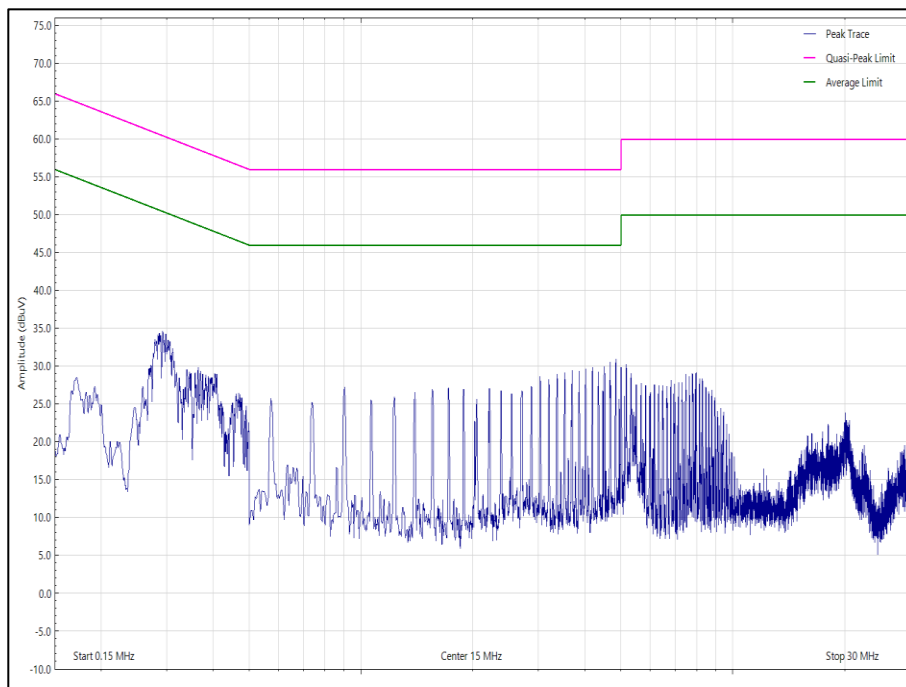


Figure 2 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.294	36.21	60.40	-24.19	Q-Peak
0.294	16.97	50.40	-33.43	CISPR Avg
4.509	37.63	56.00	-18.37	Q-Peak
4.509	25.86	46.00	-20.14	CISPR Avg
4.666	36.90	56.00	-19.10	Q-Peak
4.666	24.93	46.00	-21.07	CISPR Avg
4.836	37.93	56.00	-18.07	Q-Peak
4.836	25.80	46.00	-20.20	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.

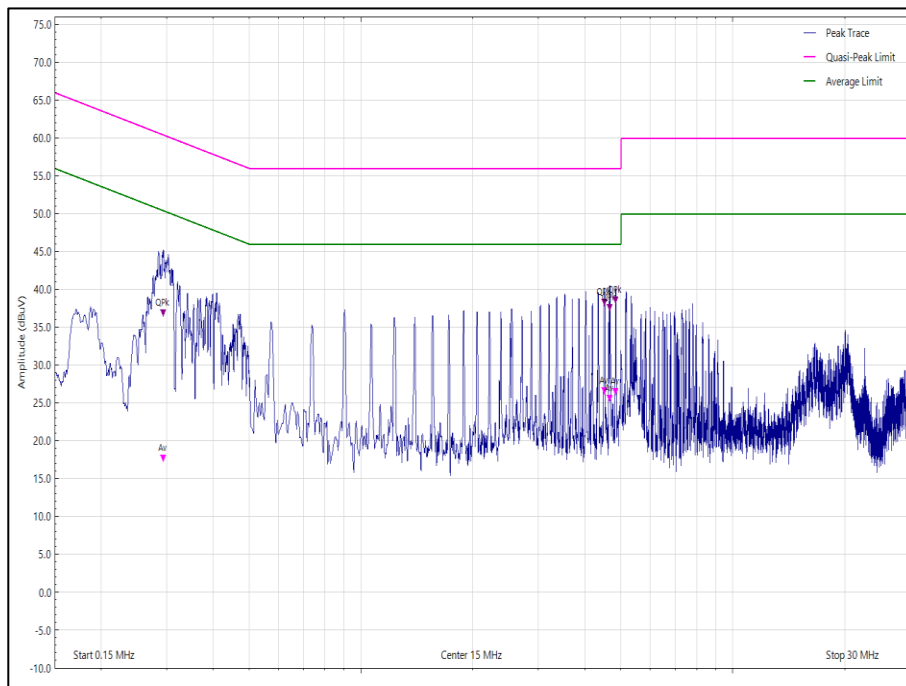


Figure 3 - Neutral Line - 150 kHz to 30 MHz



2.4 GHz Bluetooth

Applied supply voltage: 115 V AC
 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.

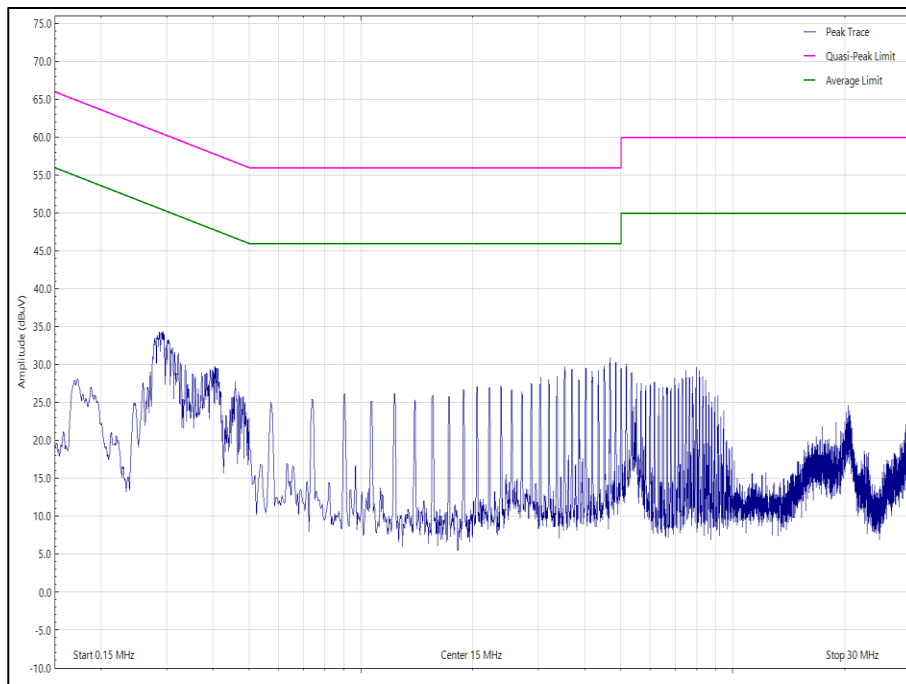


Figure 4 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.293	36.23	60.40	-24.17	Q-Peak
0.293	16.94	50.40	-33.46	CISPR Avg
3.522	36.88	56.00	-19.12	Q-Peak
3.522	25.88	46.00	-20.12	CISPR Avg
4.505	36.81	56.00	-19.19	Q-Peak
4.505	24.86	46.00	-21.14	CISPR Avg
4.845	37.44	56.00	-18.56	Q-Peak
4.845	25.27	46.00	-20.73	CISPR Avg
5.001	37.68	60.00	-22.32	Q-Peak
5.001	26.27	50.00	-23.73	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.

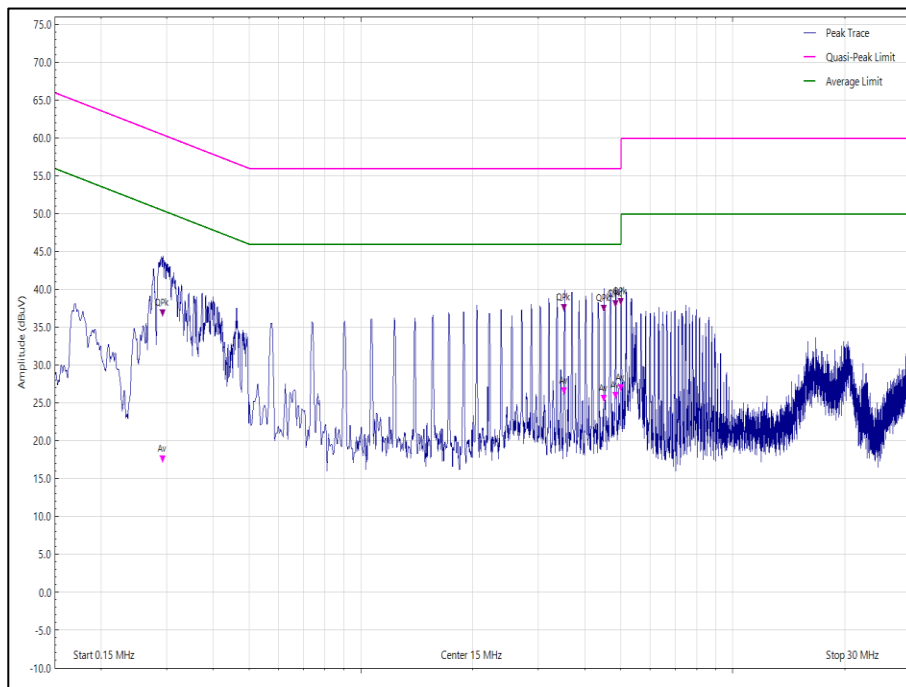


Figure 5 - Neutral Line - 150 kHz to 30 MHz



5 GHz WLAN

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

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

Table 9 - 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.

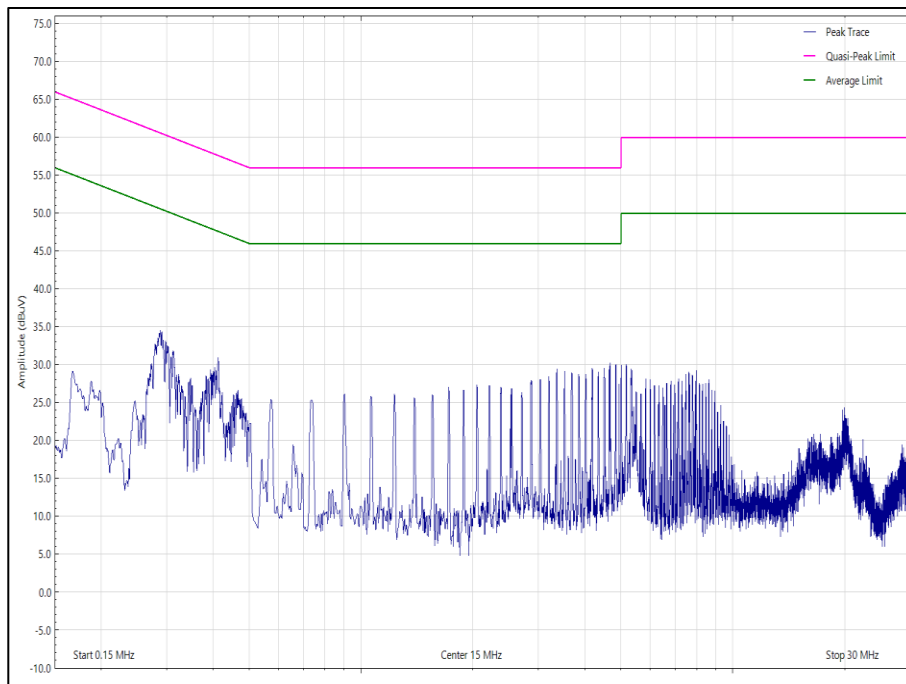


Figure 6 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.295	36.07	60.40	-24.33	Q-Peak
0.295	17.02	50.40	-33.38	CISPR Avg
4.822	33.22	56.00	-22.78	Q-Peak
4.822	21.13	46.00	-24.87	CISPR Avg
5.005	37.51	60.00	-22.49	Q-Peak
5.005	26.34	50.00	-23.66	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.

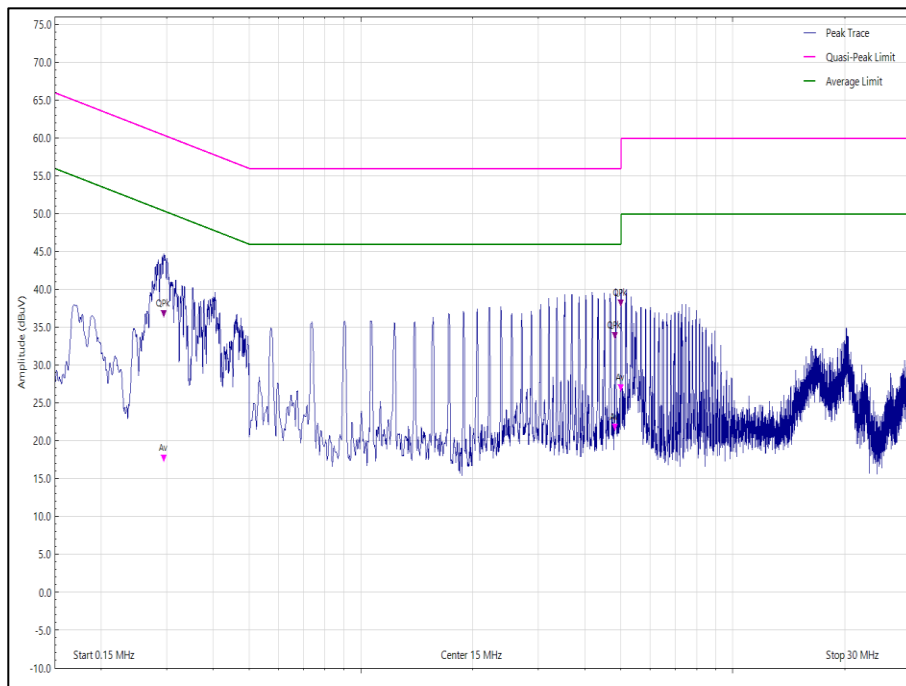


Figure 7 - Neutral Line - 150 kHz to 30 MHz



6 GHz WLAN

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
4.012	36.82	56.00	-19.18	Q-Peak
4.012	24.33	46.00	-21.67	CISPR Avg
4.666	37.44	56.00	-18.56	Q-Peak
4.666	24.63	46.00	-21.37	CISPR Avg
13.359	43.32	60.00	-16.68	Q-Peak
13.359	41.08	50.00	-8.92	CISPR Avg
21.930	42.97	60.00	-17.03	Q-Peak
21.930	37.03	50.00	-12.97	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.

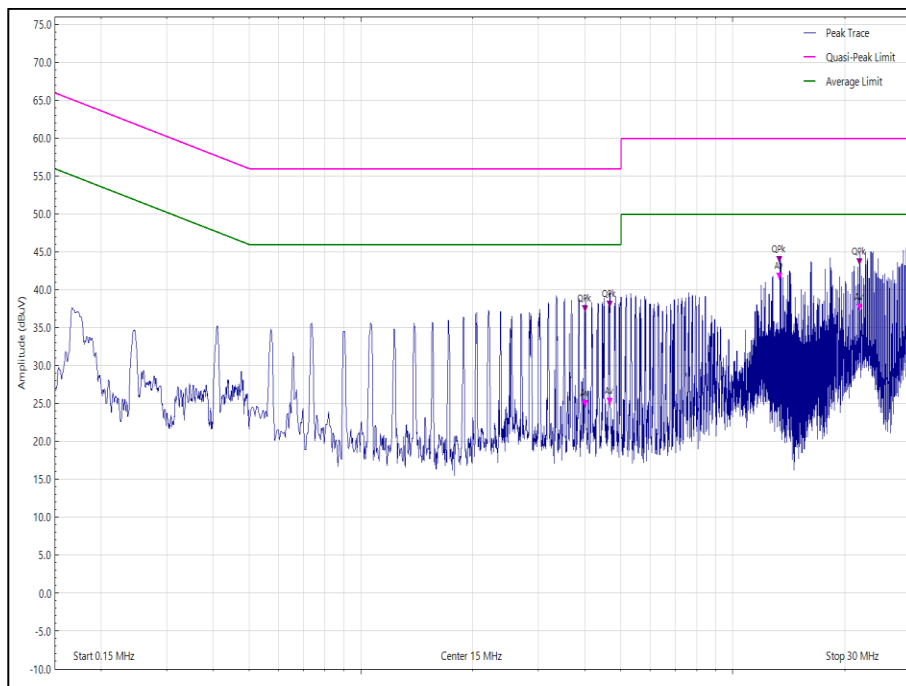


Figure 8 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
3.515	36.94	56.00	-19.06	Q-Peak
3.515	25.98	46.00	-20.02	CISPR Avg
4.669	37.72	56.00	-18.28	Q-Peak
4.669	25.30	46.00	-20.70	CISPR Avg
12.808	41.36	60.00	-18.64	Q-Peak
12.808	38.95	50.00	-11.05	CISPR Avg
13.358	43.42	60.00	-16.58	Q-Peak
13.358	41.20	50.00	-8.80	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.

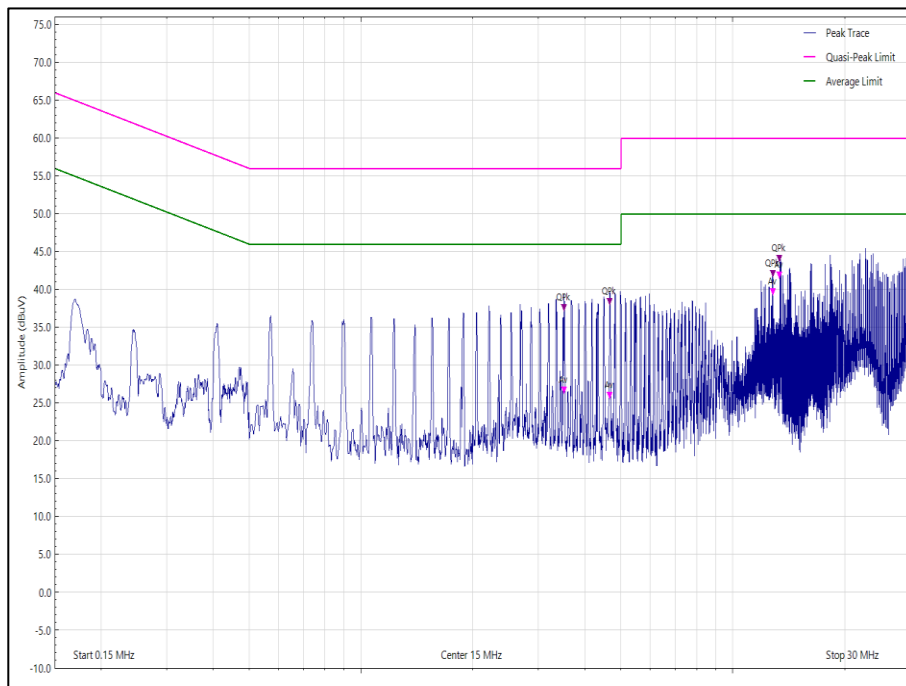


Figure 9 - Neutral Line - 150 kHz to 30 MHz

NarrowBand

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
2.033	32.53	56.00	-23.47	Q-Peak
2.033	17.71	46.00	-28.29	CISPR Avg
2.653	30.67	56.00	-25.33	Q-Peak
2.653	15.74	46.00	-30.26	CISPR Avg
3.341	33.55	56.00	-22.45	Q-Peak
3.341	17.24	46.00	-28.76	CISPR Avg
4.666	36.48	56.00	-19.52	Q-Peak
4.666	19.67	46.00	-26.33	CISPR Avg
21.930	42.91	60.00	-17.09	Q-Peak
21.930	37.15	50.00	-12.85	CISPR Avg
24.553	41.42	60.00	-18.58	Q-Peak
24.553	33.99	50.00	-16.01	CISPR Avg
27.929	40.66	60.00	-19.34	Q-Peak
27.929	33.80	50.00	-16.20	CISPR Avg

Table 13 - Live Line Emissions Results

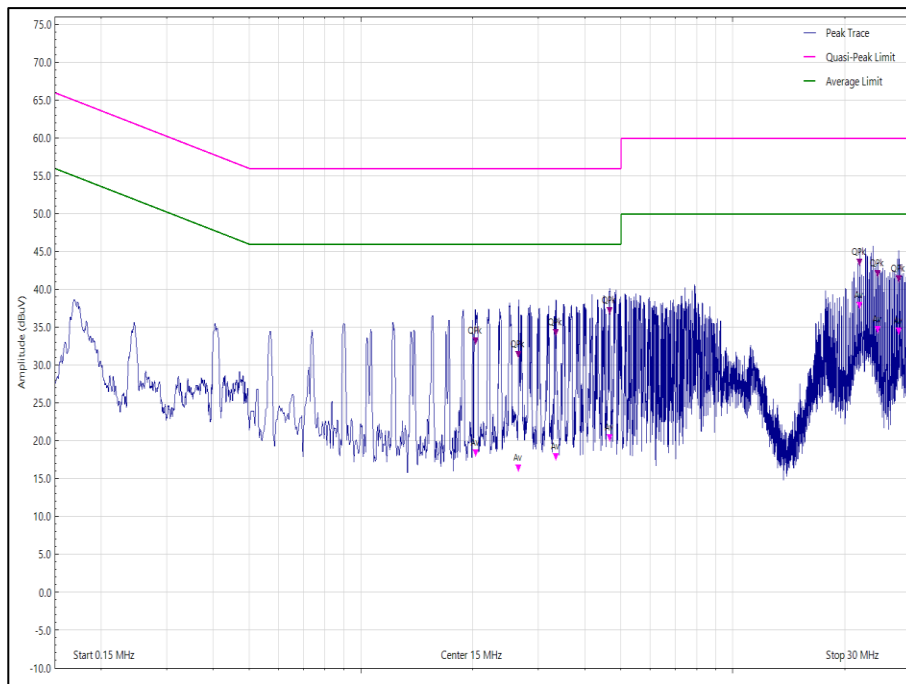


Figure 10 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
2.846	32.90	56.00	-23.10	Q-Peak
2.846	17.85	46.00	-28.15	CISPR Avg
3.535	31.41	56.00	-24.59	Q-Peak
3.535	16.75	46.00	-29.25	CISPR Avg
4.527	30.75	56.00	-25.25	Q-Peak
4.527	16.31	46.00	-29.69	CISPR Avg
21.927	42.79	60.00	-17.21	Q-Peak
21.927	37.27	50.00	-12.73	CISPR Avg
23.741	42.75	60.00	-17.25	Q-Peak
23.741	35.91	50.00	-14.09	CISPR Avg
27.930	41.52	60.00	-18.48	Q-Peak
27.930	35.11	50.00	-14.89	CISPR Avg
29.754	42.13	60.00	-17.87	Q-Peak
29.754	34.96	50.00	-15.04	CISPR Avg

Table 14 - Neutral Line Emissions Results

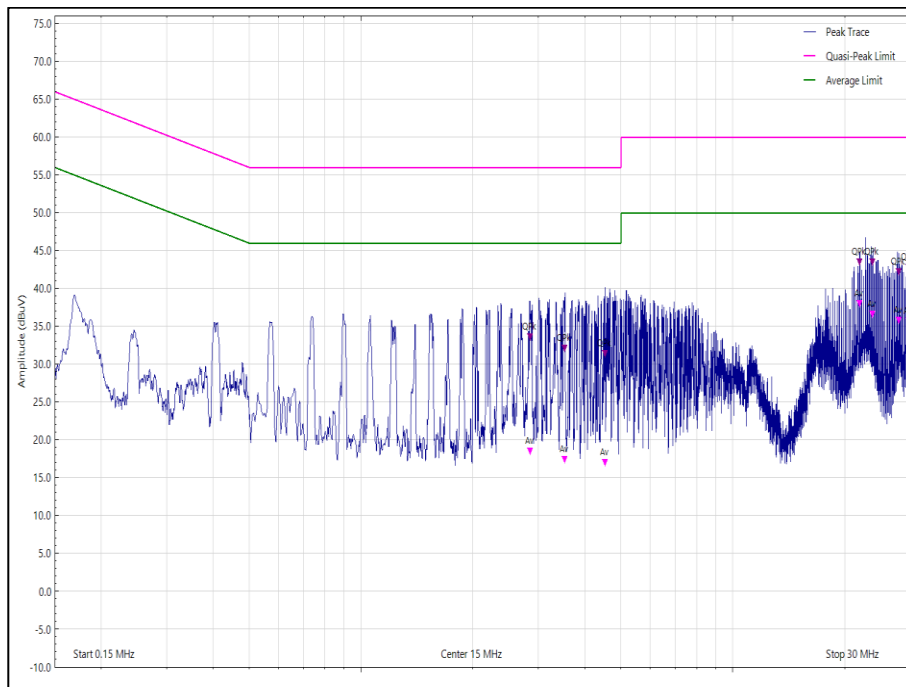


Figure 11 – Neutral Line - 150 kHz to 30 MHz



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

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	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 V3.1.10	5125	-	Software
Test Receiver	Rohde & Schwarz	ESU40	3506	12	25-Mar-2023
Transient Limiter	Hewlett Packard	11947A	2378	12	25-Oct-2023
Termination (50ohm)	Meca	405-1	369	12	23-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)	Teledyne	PR90-088-8MTR	5450	6	23-Apr-2023
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 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Thermo-hygro-Barometer	PCE Instruments	PCE-THB-40	5472	12	25-Mar-2023

Table 17



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 18

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.