

FCC and ISED Test Report

Apple Inc
Model: A2786

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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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 TUV SUD 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: 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)	A2786
Serial Number(s)	W6163XN7D4
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	11-December-2022
Finish of Test	24-January-2023
Name of Engineer(s)	Matthew Dawkins 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 tower configuration 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: A2786, Serial Number: W6163XN7D4			
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	Matthew Dawkins	UKAS
Configuration and Mode: 2.4 GHz Bluetooth		
AC Power Line Conducted Emissions	Matthew Dawkins	UKAS
Configuration and Mode: 5 GHz WLAN		
AC Power Line Conducted Emissions	Matthew Dawkins	UKAS
Configuration and Mode: 6 GHz WLAN		
AC Power Line Conducted Emissions	Matthew Dawkins	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

A2786, S/N: W6163XN7D4 - Modification State 0

2.1.3 Date of Test

11-December-2022 to 24-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 0.8m 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

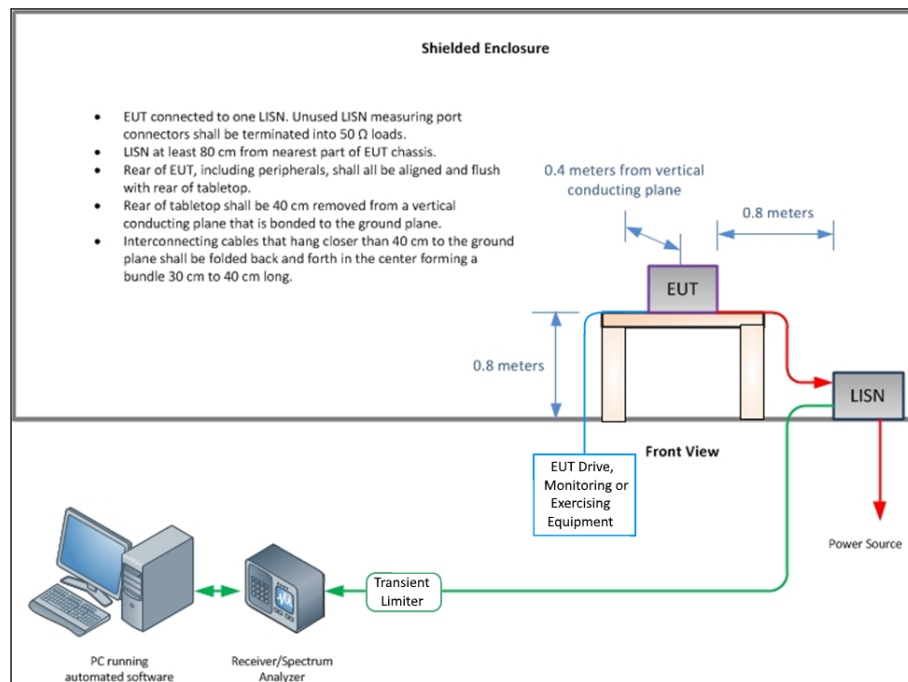


Figure 1 - Conducted Emissions

2.1.7 Environmental Conditions

Ambient Temperature	20.0 - 22.0 °C
Relative Humidity	34.4 - 39.0 %

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
0.401	33.48	57.80	-24.32	Q-Peak
0.401	24.94	47.80	-22.86	CISPR Avg
1.041	26.07	46.00	-19.93	CISPR Avg
1.041	34.40	56.00	-21.60	Q-Peak
1.680	23.68	46.00	-22.32	CISPR Avg
1.680	33.26	56.00	-22.74	Q-Peak
3.445	24.33	46.00	-21.67	CISPR Avg
3.445	36.35	56.00	-19.65	Q-Peak
5.055	25.07	50.00	-24.93	CISPR Avg
5.055	37.79	60.00	-22.21	Q-Peak
7.946	25.58	50.00	-24.42	CISPR Avg
7.946	36.61	60.00	-23.39	Q-Peak
23.814	45.24	60.00	-14.76	Q-Peak
23.814	39.36	50.00	-10.64	CISPR Avg

Table 5 - Live Line Emissions Results

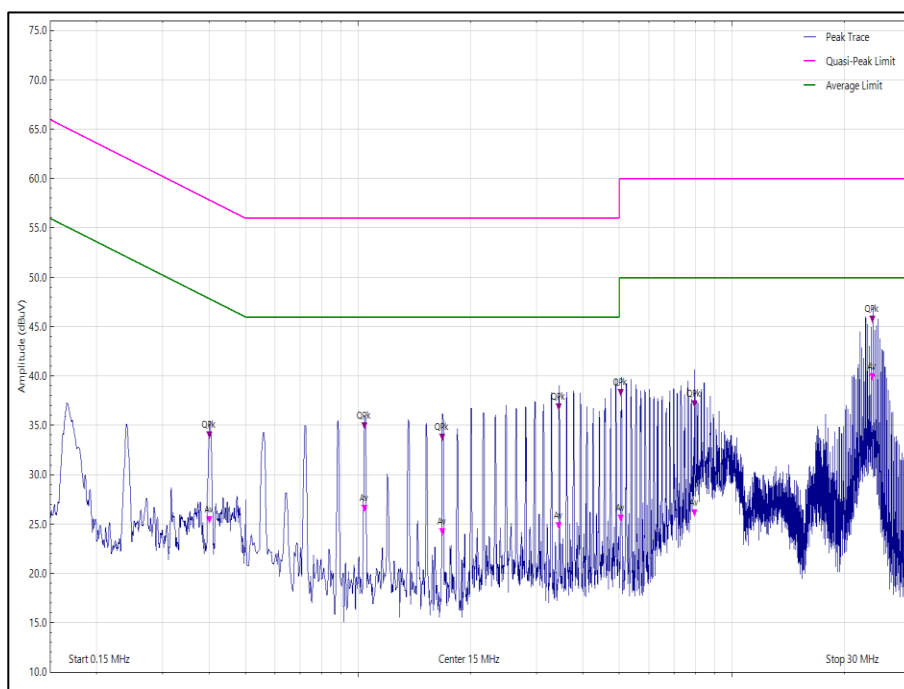


Figure 2 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.402	33.53	57.80	-24.27	Q-Peak
0.402	26.21	47.80	-21.59	CISPR Avg
1.041	35.09	56.00	-20.91	Q-Peak
1.041	28.75	46.00	-17.25	CISPR Avg
1.845	35.35	56.00	-20.65	Q-Peak
1.845	27.16	46.00	-18.84	CISPR Avg
3.607	36.75	56.00	-19.25	Q-Peak
3.607	25.89	46.00	-20.11	CISPR Avg
5.211	25.35	50.00	-24.65	CISPR Avg
5.211	37.50	60.00	-22.50	Q-Peak
7.455	34.96	60.00	-25.04	Q-Peak
7.455	23.28	50.00	-26.72	CISPR Avg
23.805	39.36	50.00	-10.64	CISPR Avg
23.805	45.19	60.00	-14.81	Q-Peak

Table 6 - Neutral Line Emissions Results

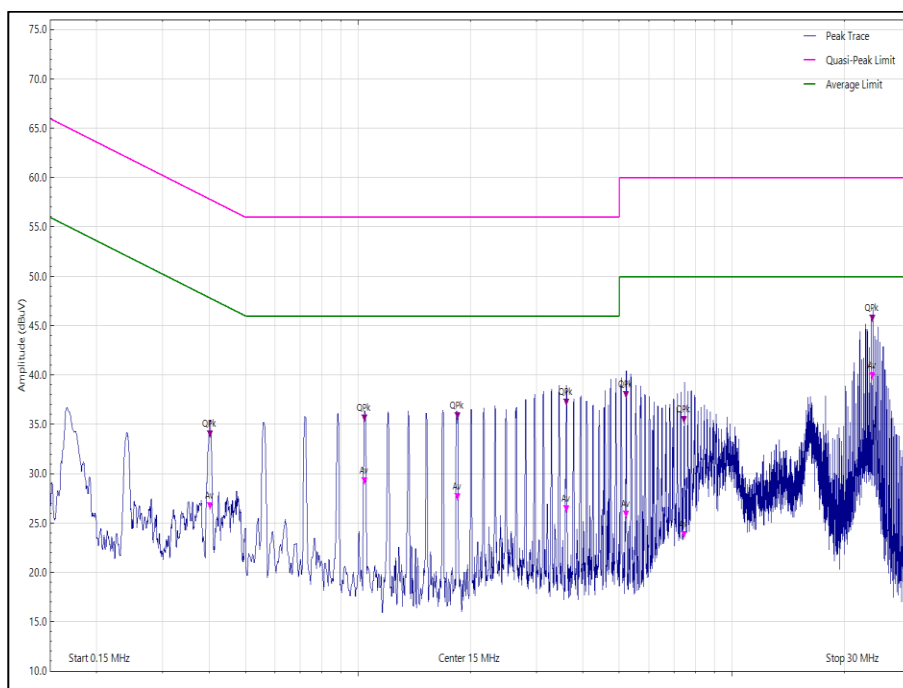


Figure 3 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz Bluetooth

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.401	24.96	47.80	-22.84	CISPR Avg
0.401	33.44	57.80	-24.36	Q-Peak
1.202	26.49	46.00	-19.51	CISPR Avg
1.202	34.38	56.00	-21.62	Q-Peak
1.689	25.07	46.00	-20.93	CISPR Avg
1.689	34.09	56.00	-21.91	Q-Peak
2.806	35.15	56.00	-20.85	Q-Peak
2.806	24.97	46.00	-21.03	CISPR Avg
3.611	25.58	46.00	-20.42	CISPR Avg
3.611	36.80	56.00	-19.20	Q-Peak
4.890	22.85	46.00	-23.15	CISPR Avg
4.890	35.70	56.00	-20.30	Q-Peak
22.768	40.74	60.00	-19.26	Q-Peak
22.768	33.89	50.00	-16.11	CISPR Avg

Table 7 - Live Line Emissions Results

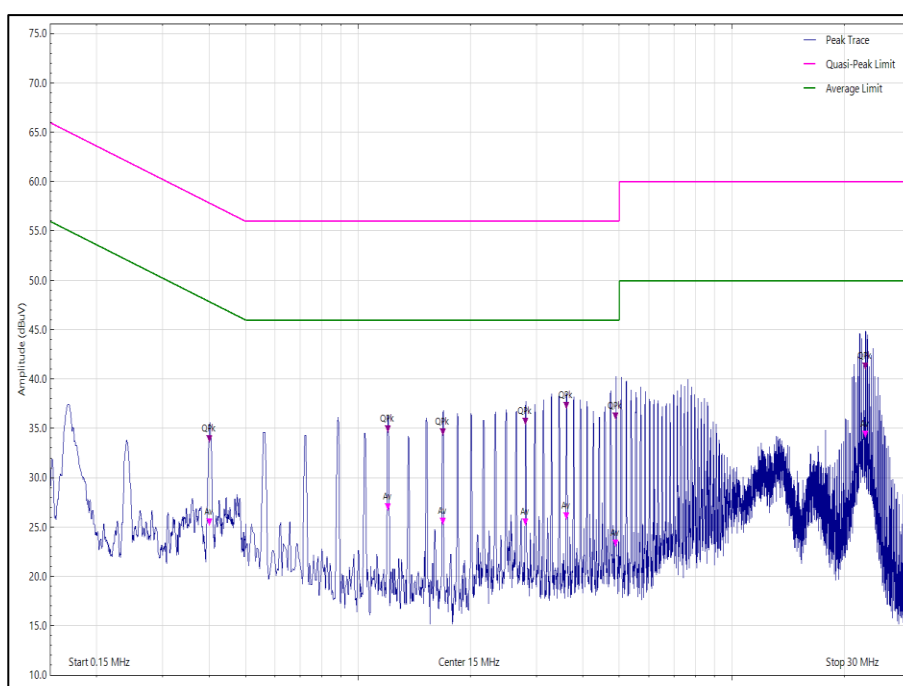


Figure 4 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.401	33.74	57.80	-24.06	Q-Peak
0.401	26.45	47.80	-21.35	CISPR Avg
1.041	34.71	56.00	-21.29	Q-Peak
1.041	28.60	46.00	-17.40	CISPR Avg
1.685	35.51	56.00	-20.49	Q-Peak
1.685	27.47	46.00	-18.53	CISPR Avg
2.489	26.11	46.00	-19.89	CISPR Avg
2.489	35.31	56.00	-20.69	Q-Peak
3.450	37.18	56.00	-18.82	Q-Peak
3.450	26.85	46.00	-19.15	CISPR Avg
4.898	37.69	56.00	-18.31	Q-Peak
4.898	25.94	46.00	-20.06	CISPR Avg
21.991	32.45	50.00	-17.55	CISPR Avg
21.991	40.19	60.00	-19.81	Q-Peak

Table 8 - Neutral Line Emissions Results

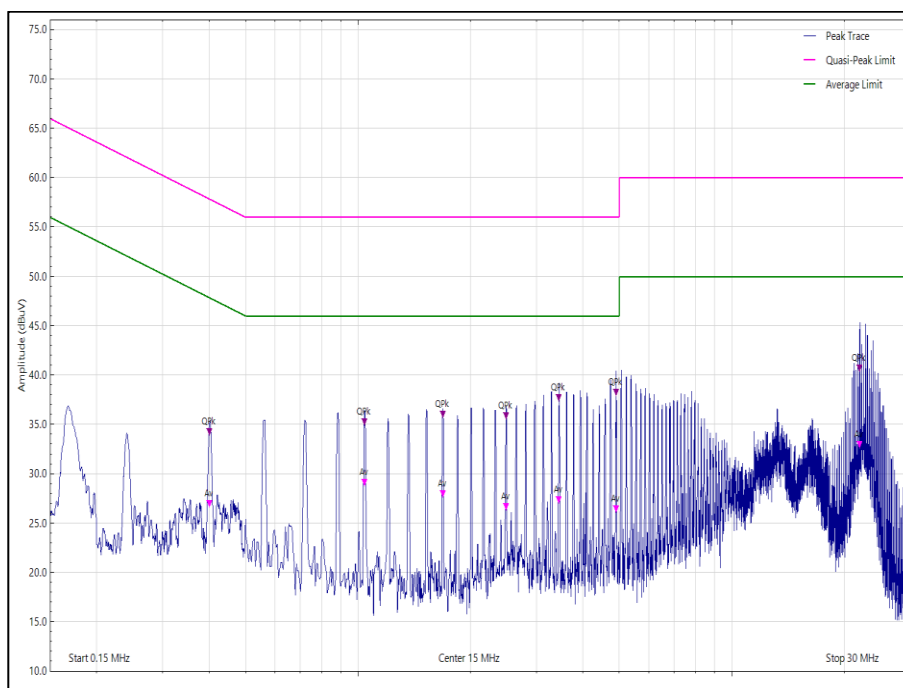


Figure 5 - Neutral Line - 150 kHz to 30 MHz

5 GHz WLAN

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.402	33.44	57.80	-24.36	Q-Peak
0.402	24.90	47.80	-22.90	CISPR Avg
1.041	34.19	56.00	-21.81	Q-Peak
1.041	25.83	46.00	-20.17	CISPR Avg
2.006	34.65	56.00	-21.35	Q-Peak
2.006	25.82	46.00	-20.18	CISPR Avg
3.289	36.35	56.00	-19.65	Q-Peak
3.289	25.53	46.00	-20.47	CISPR Avg
4.898	24.98	46.00	-21.02	CISPR Avg
4.898	37.61	56.00	-18.39	Q-Peak
7.629	36.67	60.00	-23.33	Q-Peak
7.629	24.00	50.00	-26.00	CISPR Avg
23.814	40.15	60.00	-19.85	Q-Peak
23.814	33.82	50.00	-16.18	CISPR Avg

Table 9 - Live Line Emissions Results

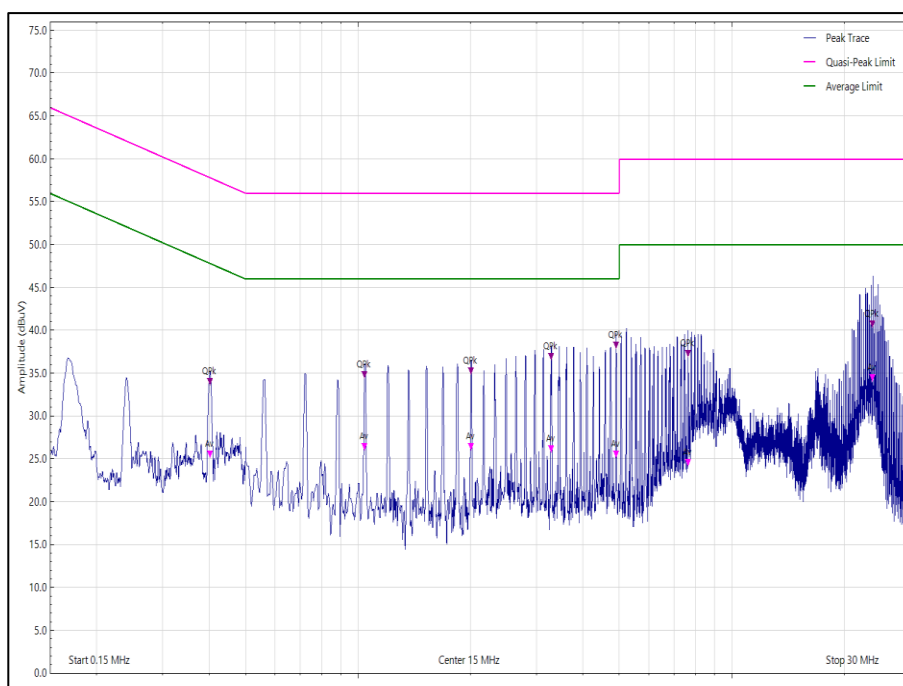


Figure 6 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.401	33.68	57.80	-24.12	Q-Peak
0.401	26.41	47.80	-21.39	CISPR Avg
1.041	28.55	46.00	-17.45	CISPR Avg
1.041	34.93	56.00	-21.07	Q-Peak
1.363	27.80	46.00	-18.20	CISPR Avg
1.363	35.13	56.00	-20.87	Q-Peak
1.685	27.48	46.00	-18.52	CISPR Avg
1.685	35.48	56.00	-20.52	Q-Peak
3.450	26.65	46.00	-19.35	CISPR Avg
3.450	37.12	56.00	-18.88	Q-Peak
4.903	24.88	46.00	-21.12	CISPR Avg
4.903	36.84	56.00	-19.16	Q-Peak
23.800	37.13	50.00	-12.87	CISPR Avg
23.800	43.85	60.00	-16.15	Q-Peak

Table 10 - Neutral Line Emissions Results

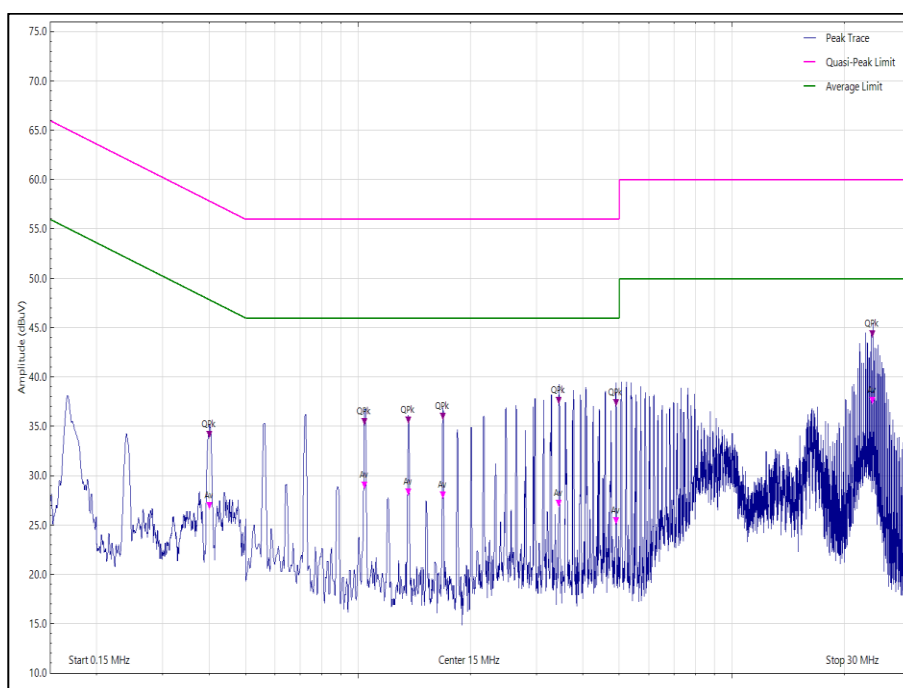


Figure 7 - Neutral Line - 150 kHz to 30 MHz

6 GHz WLAN

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.402	33.37	57.80	-24.43	Q-Peak
0.402	24.81	47.80	-22.99	CISPR Avg
1.845	34.95	56.00	-21.05	Q-Peak
1.845	26.36	46.00	-19.64	CISPR Avg
2.329	35.06	56.00	-20.94	Q-Peak
2.329	25.74	46.00	-20.26	CISPR Avg
3.455	26.06	46.00	-19.94	CISPR Avg
3.455	36.89	56.00	-19.11	Q-Peak
4.898	37.67	56.00	-18.33	Q-Peak
4.898	25.21	46.00	-20.79	CISPR Avg
7.468	36.89	60.00	-23.11	Q-Peak
7.468	23.66	50.00	-26.34	CISPR Avg
20.935	36.82	50.00	-13.18	CISPR Avg
20.935	43.29	60.00	-16.71	Q-Peak

Table 11 - Live Line Emissions Results

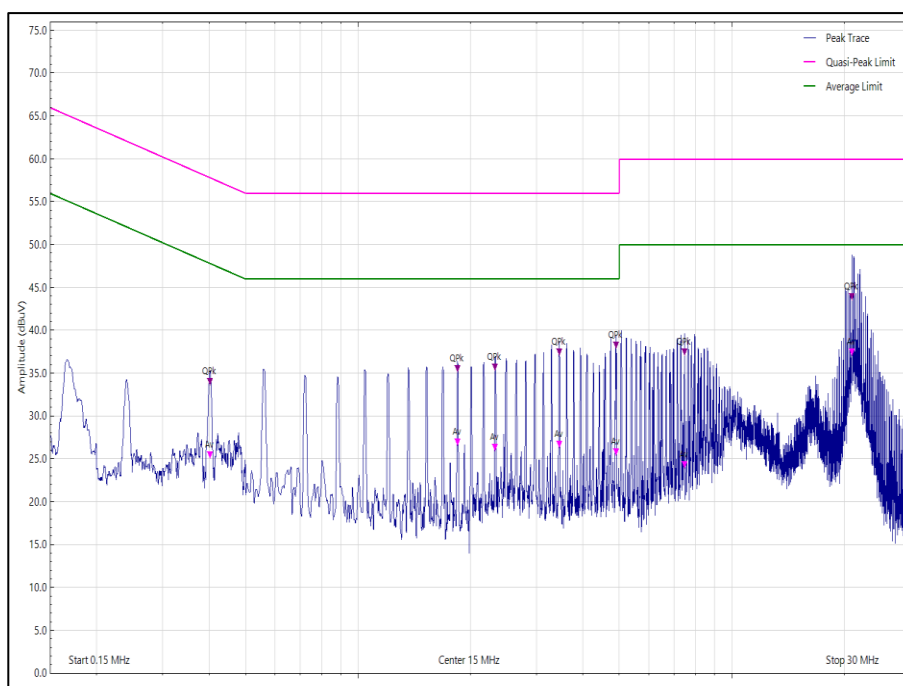


Figure 8 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.402	26.41	47.80	-21.39	CISPR Avg
0.402	33.72	57.80	-24.08	Q-Peak
1.045	35.20	56.00	-20.80	Q-Peak
1.045	28.35	46.00	-17.65	CISPR Avg
1.689	25.37	46.00	-20.63	CISPR Avg
1.689	34.57	56.00	-21.43	Q-Peak
2.328	35.32	56.00	-20.68	Q-Peak
2.328	26.47	46.00	-19.53	CISPR Avg
3.293	26.59	46.00	-19.41	CISPR Avg
3.293	36.75	56.00	-19.25	Q-Peak
4.889	23.99	46.00	-22.01	CISPR Avg
4.889	35.95	56.00	-20.05	Q-Peak
21.173	47.29	60.00	-12.71	Q-Peak
21.173	42.29	50.00	-7.71	CISPR Avg
21.973	45.53	60.00	-14.47	Q-Peak
21.973	38.47	50.00	-11.53	CISPR Avg

Table 12 - Neutral Line Emissions Results

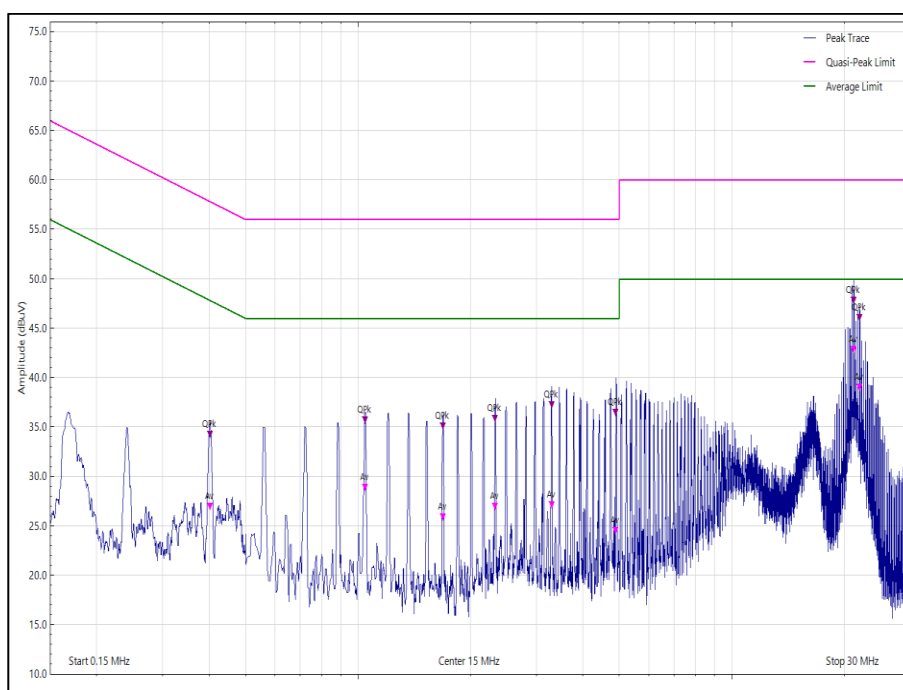


Figure 9 - Neutral Line - 150 kHz to 30 MHz

NarrowBand

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
22.747	49.92	60.00	-10.08	Q-Peak
22.747	43.68	50.00	-6.32	CISPR Avg
23.802	54.35	60.00	-5.65	Q-Peak
23.802	46.54	50.00	-3.46	CISPR Avg
24.079	47.51	60.00	-12.49	Q-Peak
24.079	37.11	50.00	-12.89	CISPR Avg
24.835	44.04	60.00	-15.96	Q-Peak
24.835	39.19	50.00	-10.81	CISPR Avg

Table 13 - 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.

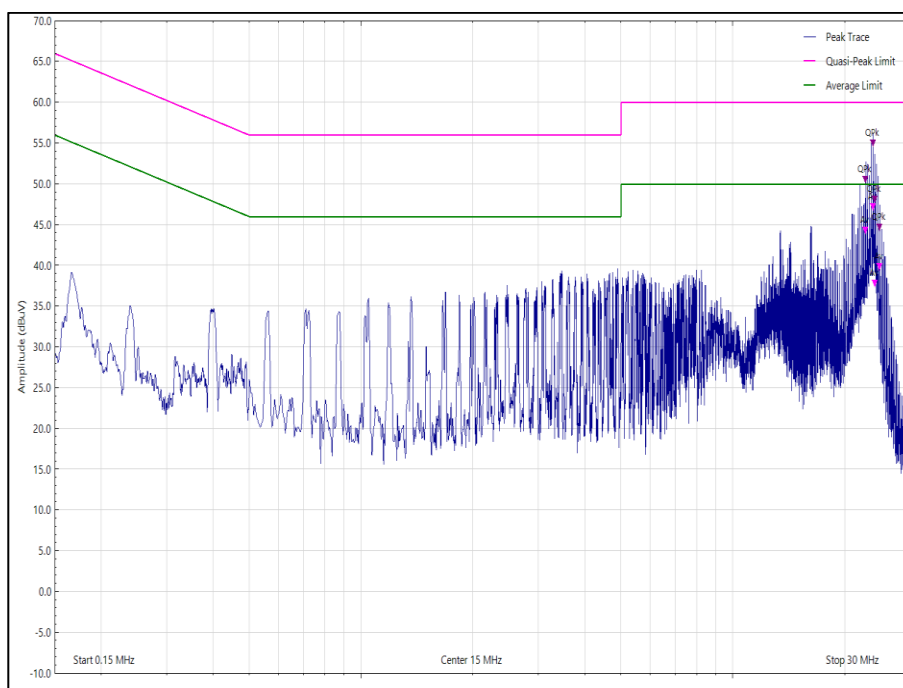


Figure 10 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
3.285	33.78	56.00	-22.22	Q-Peak
3.285	19.92	46.00	-26.08	CISPR Avg
4.540	33.18	56.00	-22.82	Q-Peak
4.540	17.23	46.00	-28.77	CISPR Avg
13.420	42.63	60.00	-17.37	Q-Peak
13.420	39.67	50.00	-10.33	CISPR Avg
16.207	33.69	60.00	-26.31	Q-Peak
16.207	27.64	50.00	-22.36	CISPR Avg
23.743	53.49	60.00	-6.51	Q-Peak
23.743	48.01	50.00	-1.99	CISPR Avg

Table 14 - 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.

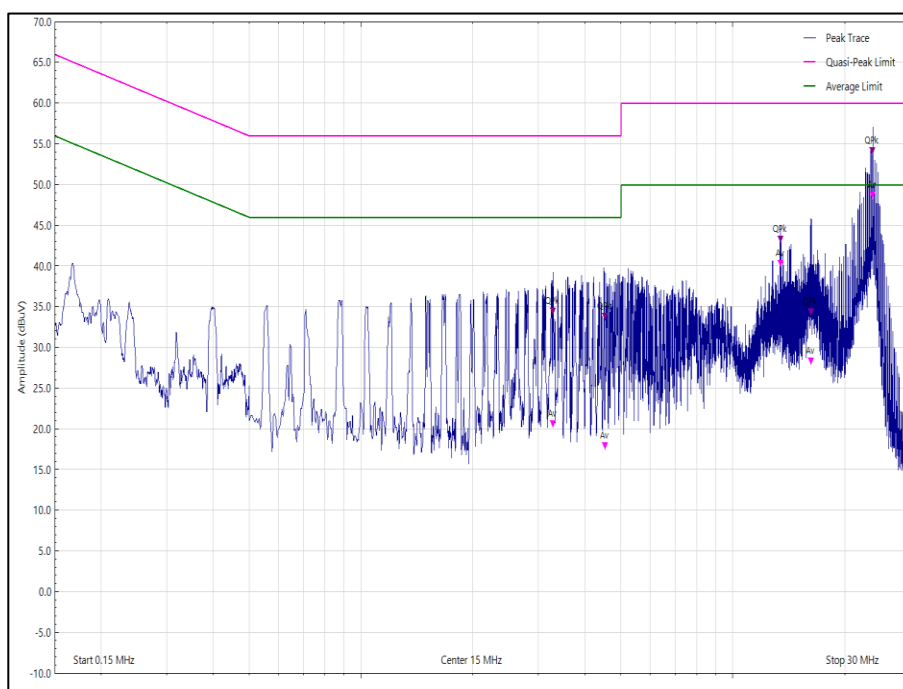


Figure 11 - Neutral Line - 150 kHz to 30 MHz



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.