

FCC and ISED Test Report

Apple Inc
Model: A2874

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

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

FCC ID: BCGA2874

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COMMERCIAL-IN-CONFIDENCE

Document 75957630-28 Issue 01

SIGNATURE

A. Lawson

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andrew Lawson	Chief Engineer, EMC	Authorised Signatory	11 May 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 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	Callum Pennells	11 May 2023	<i>C Pennells</i>
Testing	James Cumming	11 May 2023	<i>James Cumming</i>

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: 2021, Issue 2 (02-2017) 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	11 May 2023

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2874
Serial Number(s)	QXR0632C3V and VR4V14K45Q
Hardware Version(s)	REV 1.0
Software Version(s)	22E217 and 22E202
Number of Samples Tested	2
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)
Start of Test	22-February-2023
Finish of Test	02-May-2023
Name of Engineer(s)	Callum Pennells and James Cumming
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
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: AC Powered - 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: AC Powered - 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: AC Powered - 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: AC Powered - 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: AC Powered - Thread						
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: AC Powered – 5 GHz 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 (EUT) was an Apple desktop computer with Bluetooth® Low Energy, Thread and IEEE 802.11 a/b/g/n/ac/ax Wi-Fi capabilities in the 2.4 GHz, 5 GHz and 6 GHz bands.

1.4.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Configuration and Mode: AC Powered – All Modes				
AC Power	2 m	Mains power to the EUT's AC/DC adapter.	AC/DC adapter with proprietary connector to EUT.	No
Ethernet	3 m	Network	Cat 6 twisted pair	No
Audio Output	2 m	Audio Output	3.5 mm Minijack	No
USB-1	2 m	Data	USB Type -C	No
USB-2	2 m	Data	USB Type -C	No

Table 3

1.4.3 Test Configuration

Configuration	Description
AC Powered	<p>The EUT was powered from a 120 V 60 Hz AC mains supply.</p> <p>The following connections were made to the EUT:</p> <p>A set of headphones was used to terminate the EUT's 3.5 mm audio jack port.</p> <p>A USB-A to USB-C adapter and USB mouse were used to terminate the EUT's USB-1 port.</p> <p>A USB keyboard was used to terminate the EUT's USB-2 port.</p> <p>An ethernet switch and a router was used to terminate the ethernet port located on the EUT's power adapter.</p>

Table 4

1.4.4 Modes of Operation

Mode	Description
2.4 GHz Bluetooth	The EUT was connected to a R&S CMW 500 test set.
2.4 GHz WLAN	The EUT was continuously pinging to the IP Address of a Wi-Fi router.
5 GHz WLAN	The EUT was continuously pinging to the IP Address of a Wi-Fi router.
6 GHz WLAN	The EUT was continuously pinging to the IP Address of a Wi-Fi router.
Thread	The EUT was placed in a link with another customer provided sample.
Narrowband	The EUT was placed in a link with another customer provided sample.

Table 5



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: A2874, Serial Number: VR4V14K45Q			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2874, Serial Number: QXR0632C3V			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 6

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 Bluetooth		
AC Power Line Conducted Emissions	Callum Pennells	UKAS
Configuration and Mode: 2.4 GHz WLAN		
AC Power Line Conducted Emissions	Callum Pennells	UKAS
Configuration and Mode: 5 GHz WLAN		
AC Power Line Conducted Emissions	Callum Pennells	UKAS
Configuration and Mode: 6 GHz WLAN		
AC Power Line Conducted Emissions	James Cumming	UKAS
Configuration and Mode: 5 GHz Narrowband		
AC Power Line Conducted Emissions	James Cumming	UKAS
Configuration and Mode: Thread		
AC Power Line Conducted Emissions	James Cumming	UKAS

Table 7

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

A2874, S/N: QXR0632C3V - Modification State 0
A2874, S/N: VR4V14K45Q - Modification State 0

2.1.3 Date of Test

22-February-2023 to 02-May-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 Environmental Conditions

Ambient Temperature	19.8 - 23.8 °C
Relative Humidity	35.0 - 45.7 %

2.1.6 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)

2.1.7 Example Test Setup Diagram

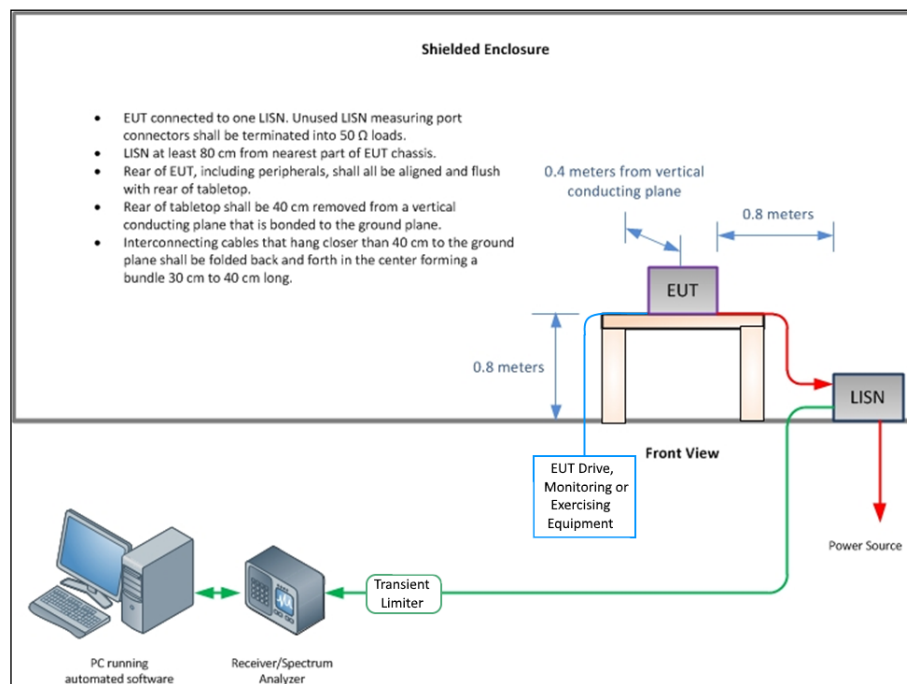


Figure 1 - Conducted Emissions

2.1.8 Test Results

AC Powered - 2.4 GHz Bluetooth

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.195	46.33	63.80	-17.47	Q-Peak
0.195	42.63	53.80	-11.17	CISPR Avg
0.217	45.61	62.90	-17.29	Q-Peak
0.217	41.46	52.90	-11.44	CISPR Avg

Table 8 - 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.

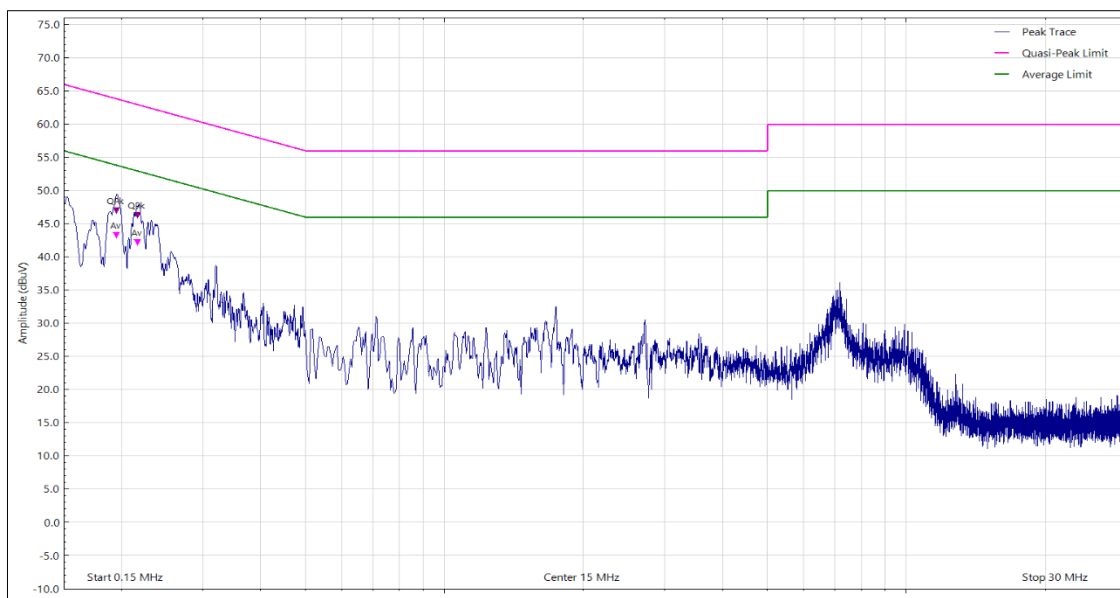


Figure 2 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector
0.198	44.45	63.70	-19.25	Q-Peak
0.198	38.45	53.70	-15.25	CISPR Avg
0.215	44.57	63.00	-18.43	Q-Peak
0.215	40.28	53.00	-12.72	CISPR Avg
0.221	43.40	62.80	-19.40	Q-Peak
0.221	36.03	52.80	-16.77	CISPR Avg

Table 9 - 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.

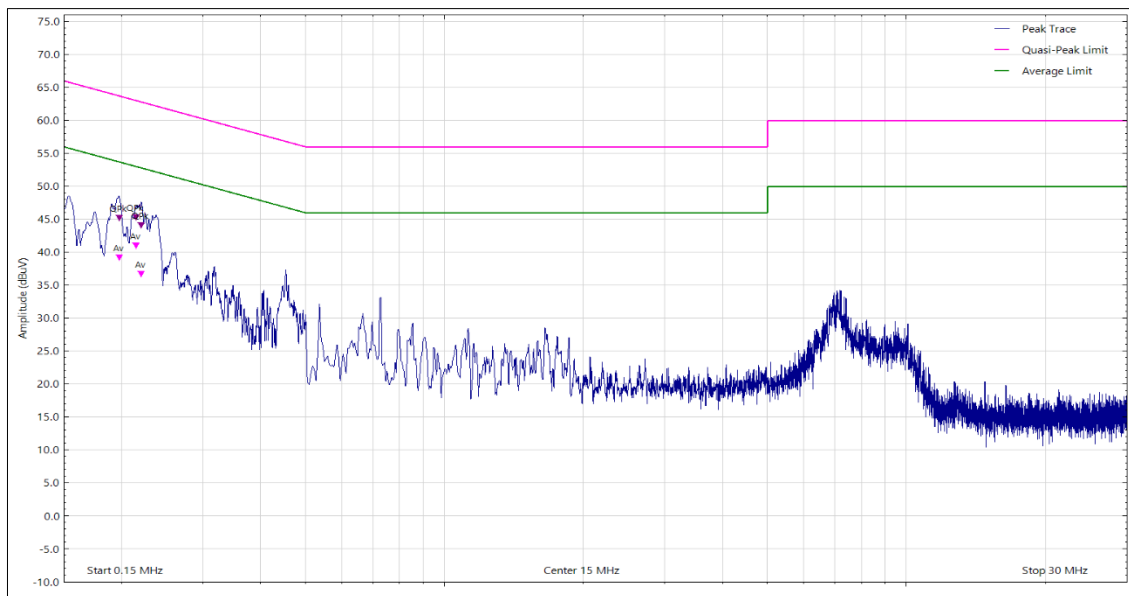


Figure 3 - Neutral Line - 150 kHz to 30 MHz

AC Powered - 2.4 GHz WLAN

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

Frequency (MHz)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector
0.192	46.40	63.90	-17.50	Q-Peak
0.192	42.88	53.90	-11.02	CISPR Avg
0.196	45.70	63.80	-18.10	Q-Peak
0.196	39.88	53.80	-13.92	CISPR Avg
0.212	43.84	63.10	-19.26	Q-Peak
0.212	40.29	53.10	-12.81	CISPR Avg
0.217	45.66	62.90	-17.24	Q-Peak
0.217	41.20	52.90	-11.70	CISPR Avg

Table 10 - 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.

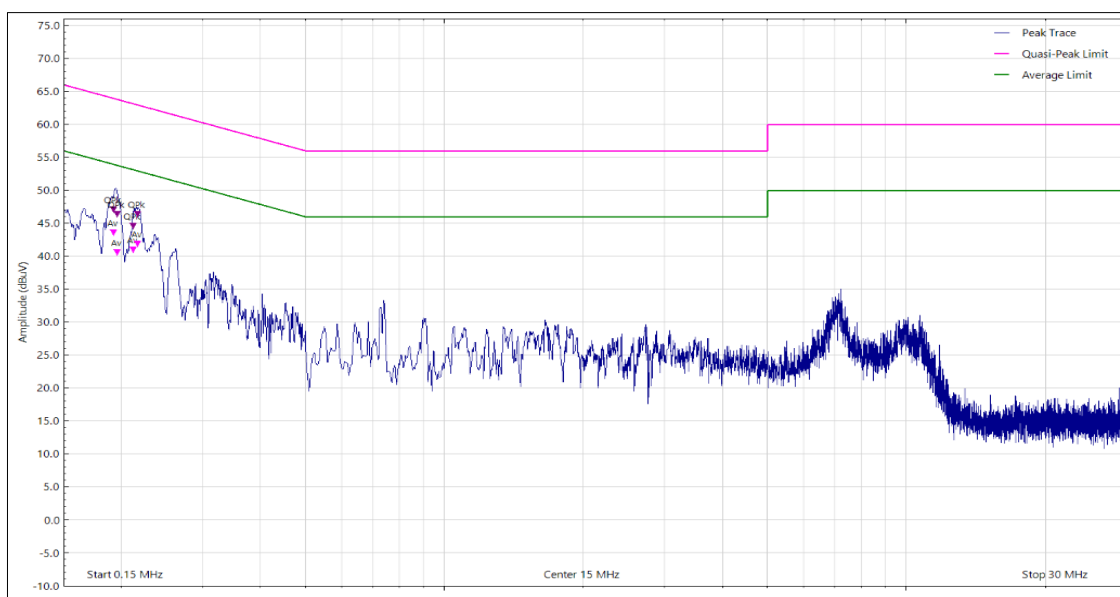


Figure 4 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector
0.193	45.23	63.90	-18.67	Q-Peak
0.193	41.37	53.90	-12.53	CISPR Avg
0.194	45.34	63.90	-18.56	Q-Peak
0.194	40.62	53.90	-13.28	CISPR Avg
0.214	45.42	63.00	-17.58	Q-Peak
0.214	40.17	53.00	-12.83	CISPR Avg

Table 11 - 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.

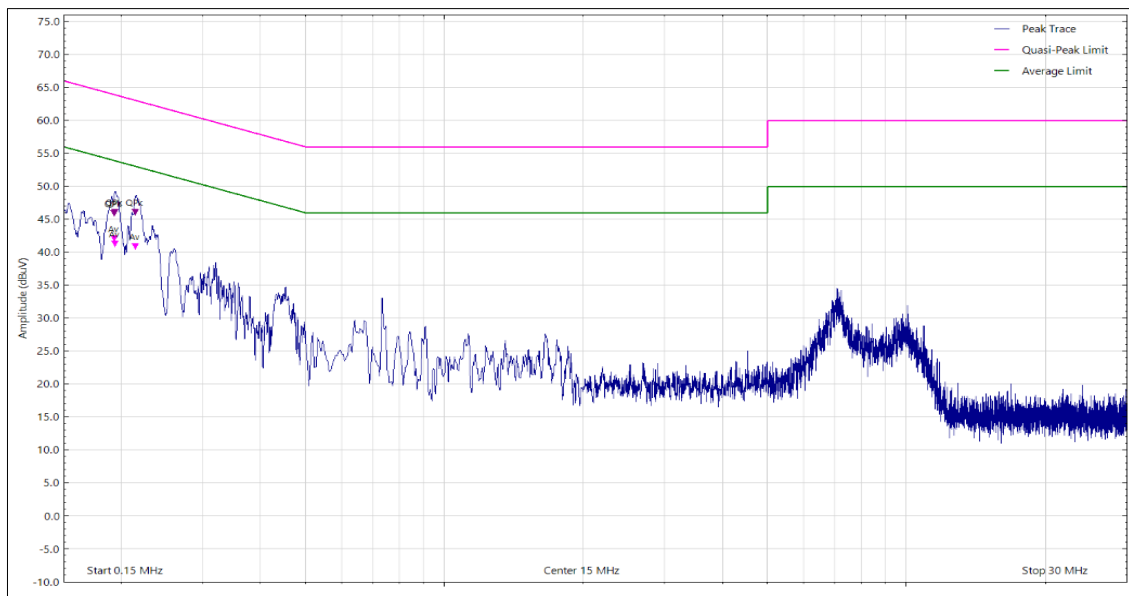


Figure 5 - Neutral Line - 150 kHz to 30 MHz

AC Powered - 5 GHz WLAN

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

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.191	45.73	64.00	-18.27	Q-Peak
0.191	42.62	54.00	-11.38	CISPR Avg
0.194	46.34	63.90	-17.56	Q-Peak
0.194	42.58	53.90	-11.32	CISPR Avg
0.197	45.35	63.70	-18.35	Q-Peak
0.197	39.19	53.70	-14.51	CISPR Avg
0.213	44.27	63.10	-18.83	Q-Peak
0.213	40.50	53.10	-12.60	CISPR Avg
0.217	45.58	62.90	-17.32	Q-Peak
0.217	41.19	52.90	-11.71	CISPR Avg

Table 12 - 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.

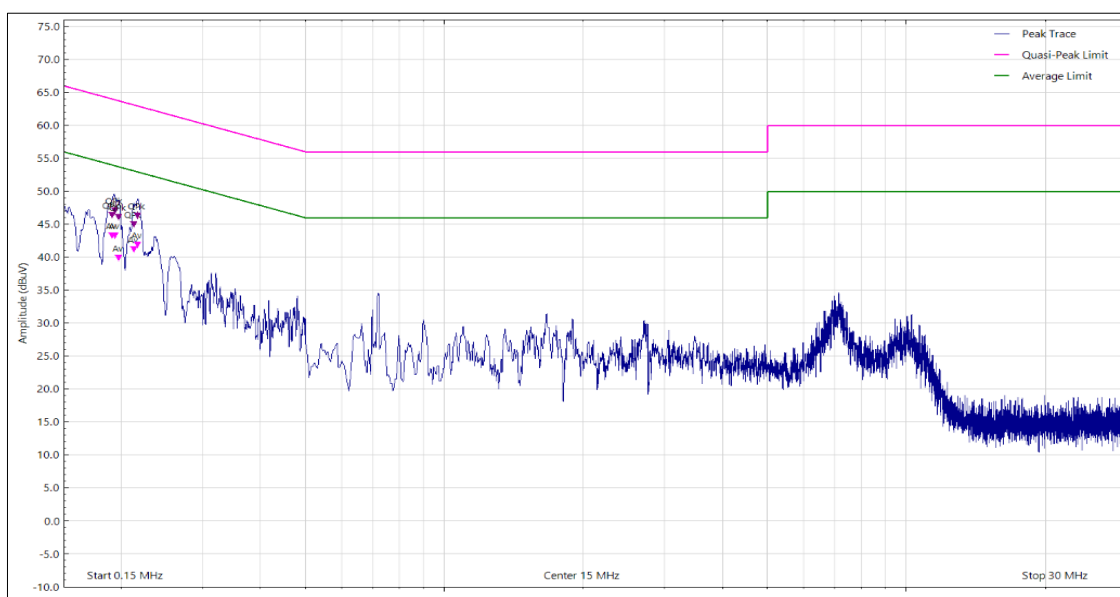


Figure 6 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector
0.195	45.34	63.80	-18.46	Q-Peak
0.195	40.42	53.80	-13.38	CISPR Avg
0.213	45.32	63.10	-17.78	Q-Peak
0.213	39.77	53.10	-13.33	CISPR Avg
0.219	44.30	62.80	-18.50	Q-Peak
0.219	36.82	52.80	-15.98	CISPR Avg

Table 13 - 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.

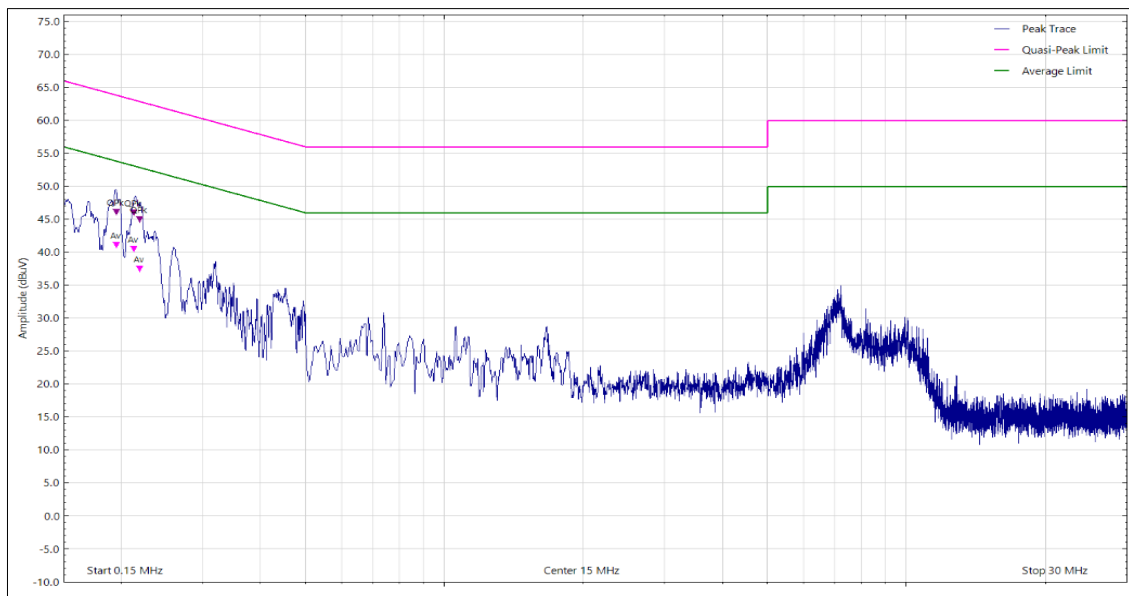


Figure 7 - Neutral Line - 150 kHz to 30 MHz



AC Powered - 6 GHz WLAN

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

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

Table 14 - Live Line Emissions Results

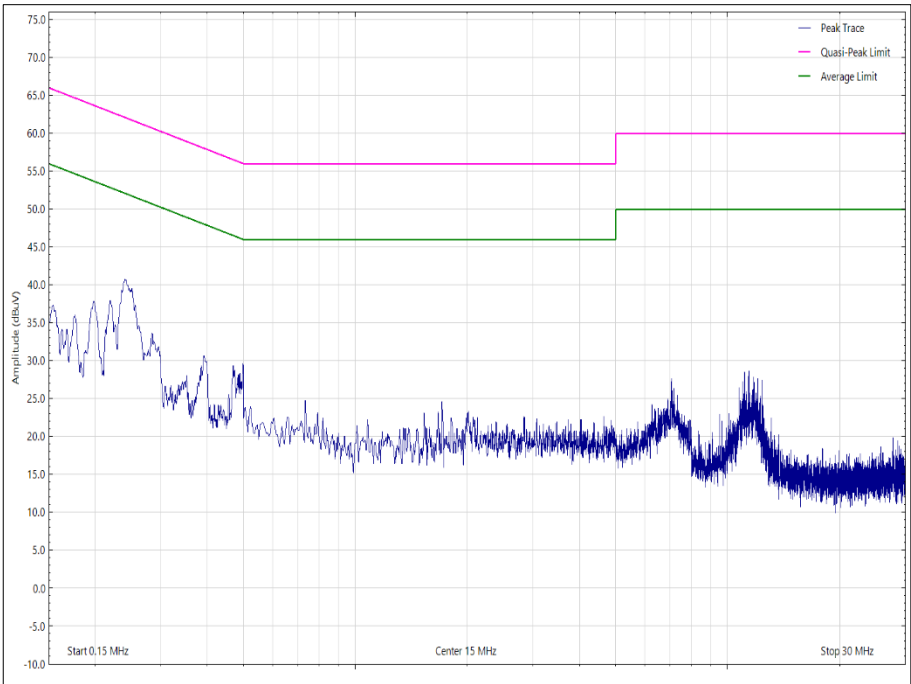


Figure 8 - Live Line - 150 kHz to 30 MHz



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

Table 15 - 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.

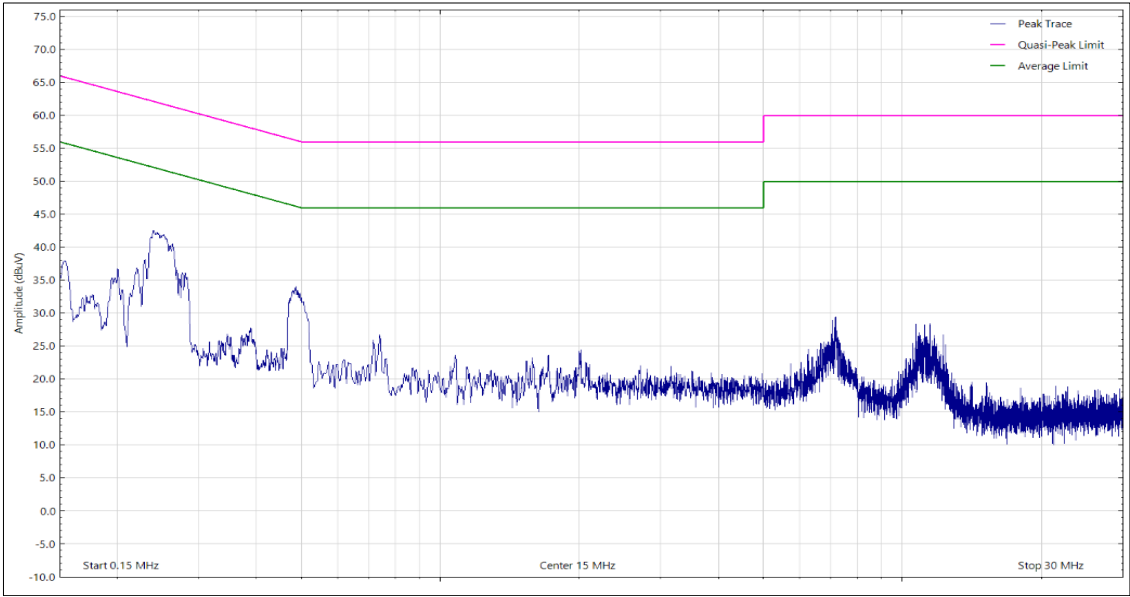


Figure 9 - Neutral Line - 150 kHz to 30 MHz

AC Powered – 5 GHz Narrowband

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

Frequency (MHz)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector
0.159	43.36	65.50	-22.14	Q-Peak
0.159	34.66	55.50	-20.84	CISPR Avg
0.187	43.06	64.20	-21.14	Q-Peak
0.187	38.64	54.20	-15.56	CISPR Avg
0.250	37.54	61.80	-24.26	Q-Peak
0.250	34.21	51.80	-17.59	CISPR Avg

Table 16 - 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.

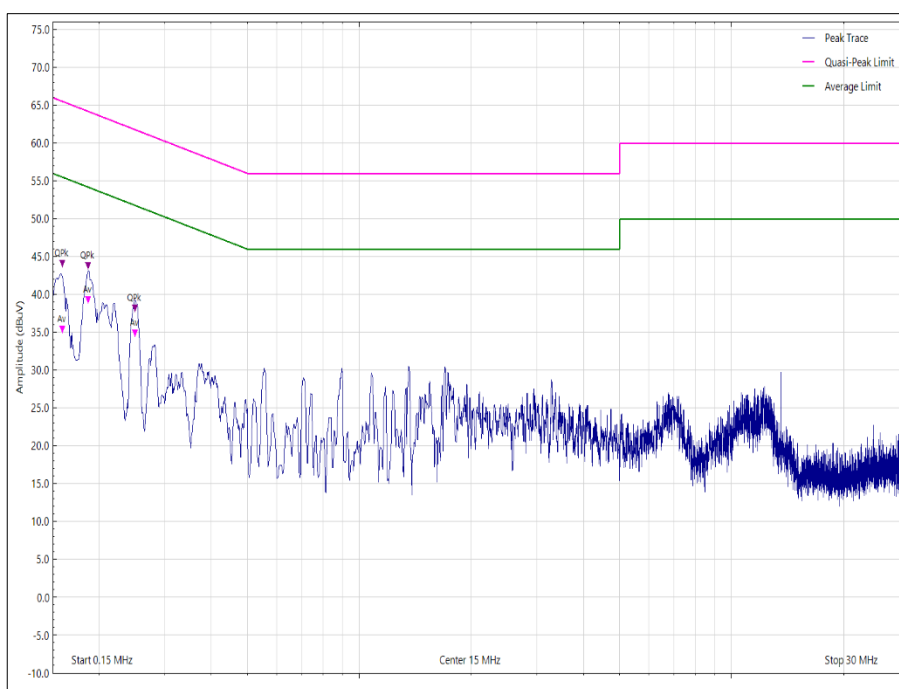


Figure 10 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector
0.156	42.92	65.70	-22.78	Q-Peak
0.156	36.60	55.70	-19.10	CISPR Avg
0.169	31.39	65.00	-33.61	Q-Peak
0.169	15.13	55.00	-39.87	CISPR Avg
0.190	39.50	64.00	-24.50	Q-Peak
0.190	31.89	54.00	-22.11	CISPR Avg
0.219	39.28	62.90	-23.62	Q-Peak
0.219	30.23	52.90	-22.67	CISPR Avg
0.246	37.79	61.90	-24.11	Q-Peak
0.246	32.43	51.90	-19.47	CISPR Avg

Table 17 - 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.

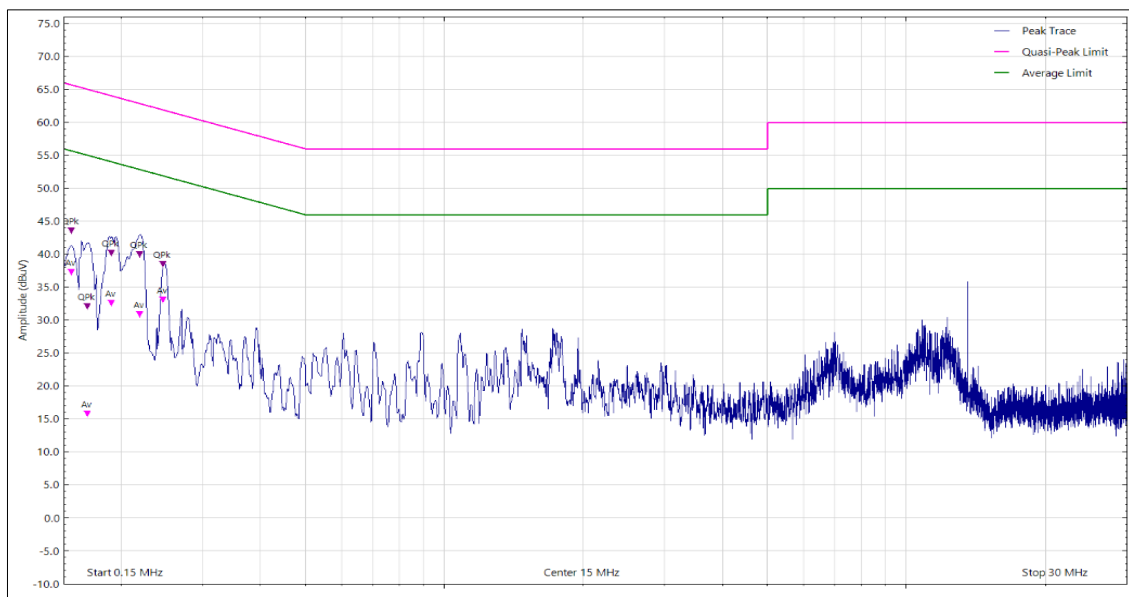


Figure 11 - Neutral Line - 150 kHz to 30 MHz

AC Powered - Thread

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

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

Table 18 - 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.

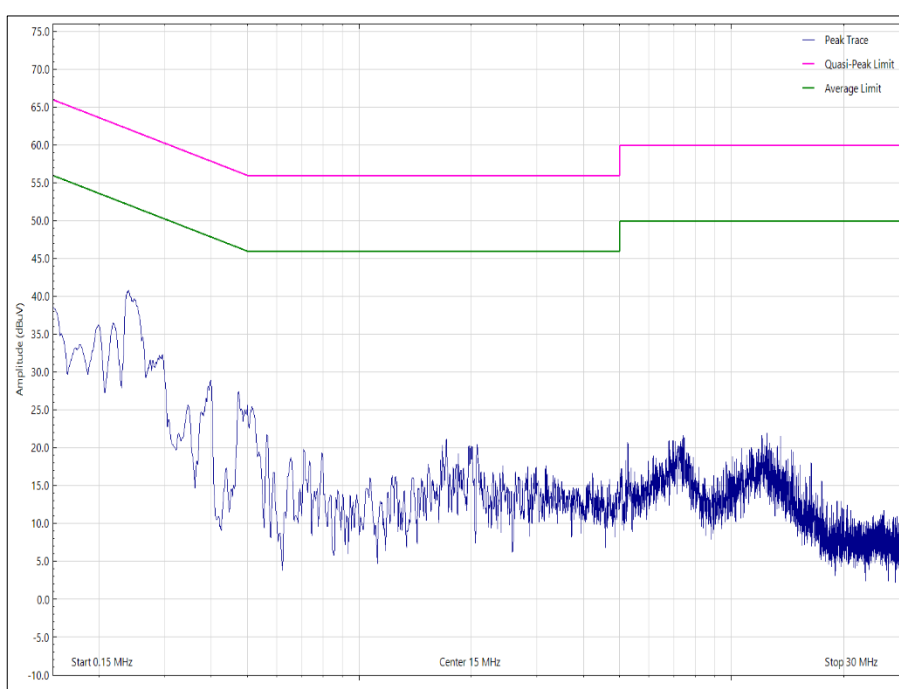


Figure 12 - Live Line - 150 kHz to 30 MHz

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

Table 19 - 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.

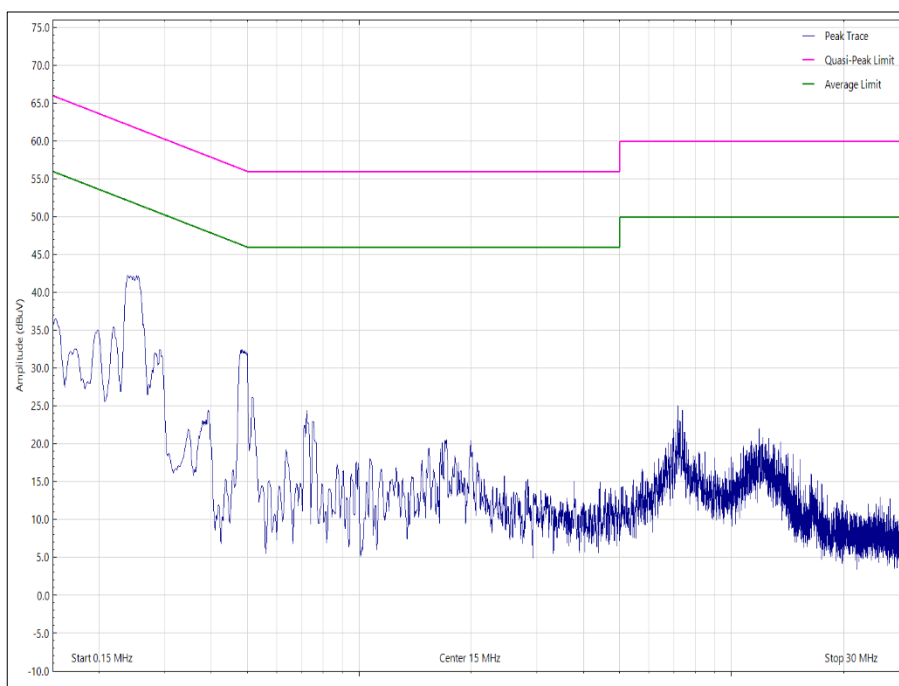


Figure 13 - Neutral Line - 150 kHz to 30 MHz

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

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	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 20

*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 and EMC Chamber 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023
Screened Room (1)	Rainford	Rainford	1541	12	01-Jul-2023
Emissions Software	TUV SUD	EmX V3.1.11	5125	-	N/A - Software
Test Receiver	Rohde & Schwarz	ESU40	3506	12	25-Mar-2023*
Test Receiver	Rohde & Schwarz	ESW44	5382	12	01-Jun-2023
Test Receiver	Rohde & Schwarz	ESW44	5808	12	14-Mar-2024*
Transient Limiter	Hewlett Packard	11947A	1032	12	21-Dec-2023
Transient Limiter	Hewlett Packard	11947A	2378	12	25-Oct-2023
Cable (N(m)-N(m), 5 m)	Teledyne	PR90-088-5MTR	5206	12	04-Aug-2023
Cable (N(m)-N(m), 8 m)	Teledyne	PR90-088-8MTR	5450	6	23-Apr-2023*
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5511	12	14-Apr-2023*
Cable (SMA to N-Type, 2 m)	Junkosha	MWX241/B	5817	6	04-Aug-2023
Cable (N to N 8m)	Junkosha	MWX221-08000NMSNMS/B	6320	12	04-Feb-2024
LISN (CISPR 16, Three Phase)	Rohde & Schwarz	ESH2-Z5	16	12	24-Aug-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	02-Feb-2024

Table 21

*Test equipment was in date for calibration on the date that it was used for testing.



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
wireless network dual band router	NETGEAR	WNDR3300	3828	-	TU
Power Supply	TTI	EX355R	5574	-	TU
Comb Generator	Schaffner	RSG1000	3034	-	TU
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5478	12	21-Apr-2024
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5605	12	06-Oct-2023
DRG	EMCO	3115	793	12	16-Oct-2023
Spectrum Analyser	Agilent technologies	E7405A	1410	12	10-Nov-2023
Cable	Teledyne	PR90-088-8MRT	5451	6	23-Aug-2023

Table 22

TU – Traceability Unscheduled



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 23

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.