

FCC and ISEC Test Report

Apple Inc
Model: A2169

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

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



FCC ID: BCGA2169

IC: 579C-A2169

COMMERCIAL-IN-CONFIDENCE

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SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andy Lawson	Senior Engineer	Authorised Signatory	12 January 2021

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-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Matthew Smart	12 January 2021	

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: 2019 and ISED RSS-GEN: and Issue 5 (04-2018) + A1 (03-2019) 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	12 January 2021

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2169
Serial Number(s)	C07CM05WQ4TG
Hardware Version(s)	REV 1.0
Software Version(s)	18J42710o
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2019 ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019)
Order Number	0540188556
Date	07-April-2020
Date of Receipt of EUT	01-June-2020
Start of Test	11-November-2020
Finish of Test	11-November-2020
Name of Engineer(s)	Matthew Smart
Related Document(s)	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 ISSED RSS-GEN is shown below.

Section	Specification Clause		Test Description	Result	Comments/Base Standard
	Part 15C	RSS-GEN			
Configuration and Mode: 5 GHz WLAN					
2.1	15.207	8.8	AC Power Line Conducted Emissions	Pass	
Configuration and Mode: 2.4 GHz WLAN					
2.1	15.207	8.8	AC Power Line Conducted Emissions	Pass	
Configuration and Mode: 2.4 GHz Bluetooth					
2.1	15.207	8.8	AC Power Line Conducted Emissions	Pass	
Configuration and Mode: 2.4 GHz Thread					
2.1	15.207	8.8	AC Power Line Conducted Emissions	Pass	

Table 2



1.4 Product Information

1.4.1 Technical Description

The Equipment under test (EUT) was an Apple TV Set Top Box with Bluetooth, Bluetooth Low Energy, Thread and 802.11 a/b/g/n/ac/ax capabilities in the 2.4 GHz and 5 GHz bands.

1.4.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
AC Power Port Live Line	1.5 m	Mains Power	AC Mains	No
AC Power Port Neutral Line	1.5 m	Mains Power	AC Mains	No
Signal 1	< 10 m	Data	Ethernet RJ45	Yes
Signal 2	< 3 m	Data	HDMI	Yes

Table 3

1.4.3 Test Configuration

Configuration	Description
120 V AC Powered	The EUT was powered from a 120 V 60 Hz AC power supply. Connected to the EUT were an HDMI cable which was loaded with a monitor and an Ethernet cable which was connected to a support MAC. The support MAC was employed to enable the device to transmit on each of the supported technologies at maximum power.

Table 4

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: A2169, Serial Number: C07CM05WQ4TG			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 5



1.7 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 5 GHz WLAN		
AC Power Line Conducted Emissions	Matthew Smart	UKAS
Configuration and Mode: 2.4 GHz WLAN		
AC Power Line Conducted Emissions	Matthew Smart	UKAS
Configuration and Mode: 2.4 GHz Bluetooth		
AC Power Line Conducted Emissions	Matthew Smart	UKAS
Configuration and Mode: 2.4 GHz Thread		
AC Power Line Conducted Emissions	Matthew Smart	UKAS

Table 6

Office Address:

Octagon House
Concorde Way
Segensworth North
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-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

A2169, S/N: C07CM05WQ4TG - Modification State 0

2.1.3 Date of Test

11-November-2020

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. A vertical coupling plane was placed 0.4 m from the EUT boundary.

A Line Impedance Stabilisation Network (LISN) was directly bonded to the ground-plane. The EUT was located so that the distance between the boundary of the EUT and the closest surface of the LISN was 0.8 m.

Interconnecting cables that hanged closer than 0.4 m to the ground plane were folded back and forth in the centre forming a bundle 0.3 m to 0.4 m long.

Input and output cables were terminated with equipment or loads representative of real usage conditions.

The EUT was configured to give the highest level of emissions within reason of a typical installation as described by the manufacturer.

Exploratory ac powerline conducted emission measurements were made as described in ANSI 6.2.4 for each mode of operation and for each ac power current-carrying conductor.

A minimum of six final measurements were then ensured, covering the highest emissions relative to the limit across the range of modes.

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

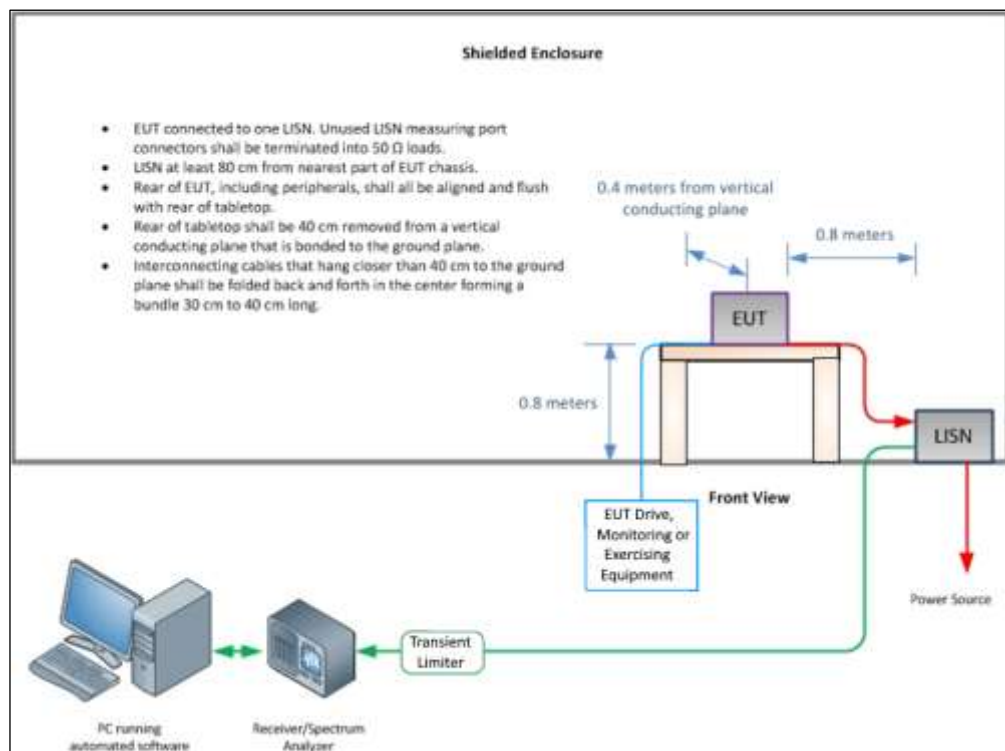


Figure 1 - Conducted Disturbance - Example Test Setup.

2.1.7 Environmental Conditions

Ambient Temperature	20.3 °C
Relative Humidity	53.7 %

2.1.8 Test Results

5 GHz WLAN

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.153	46.9	65.8	-18.9	37.8	55.8	-18.0
0.759	36.1	56.0	-19.9	27.3	46.0	-18.7
0.768	36.7	56.0	-19.3	27.3	46.0	-18.7
0.777	36.9	56.0	-19.1	27.8	46.0	-18.2
0.786	36.6	56.0	-19.4	28.6	46.0	-17.4
0.789	36.1	56.0	-19.9	28.2	46.0	-17.8

Table 7 - Live Line Emissions Results

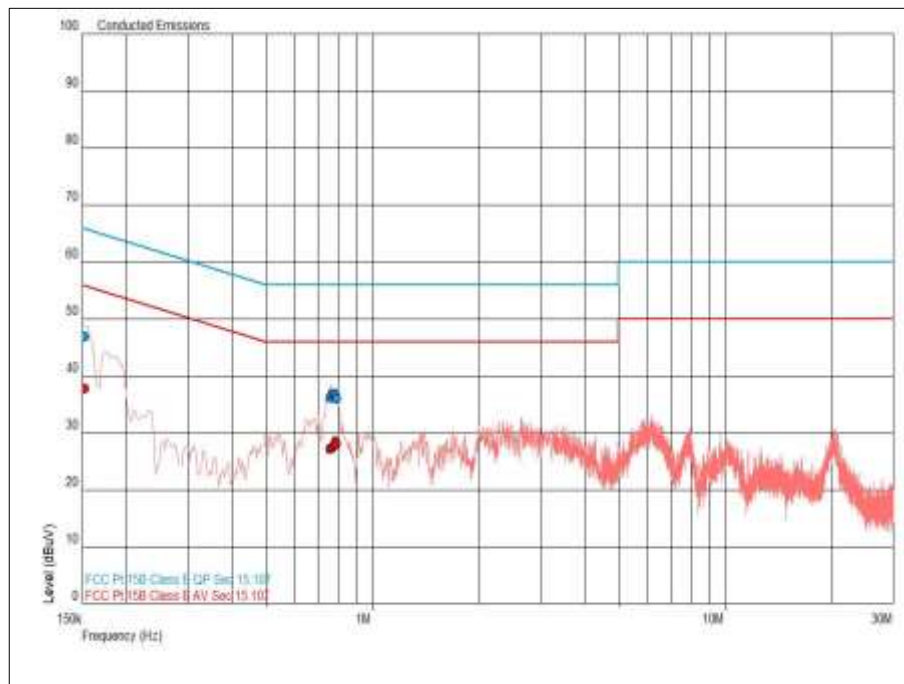


Figure 2 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.750	36.7	56.0	-19.3	28.3	46.0	-17.7
0.783	37.5	56.0	-18.5	29.3	46.0	-16.7
0.785	37.3	56.0	-18.7	29.0	46.0	-17.0

Table 8 - Neutral Line Emissions Results

No other final measurements were made as all other peak emissions seen were greater than 10 dB below the CISPR Average test limit.

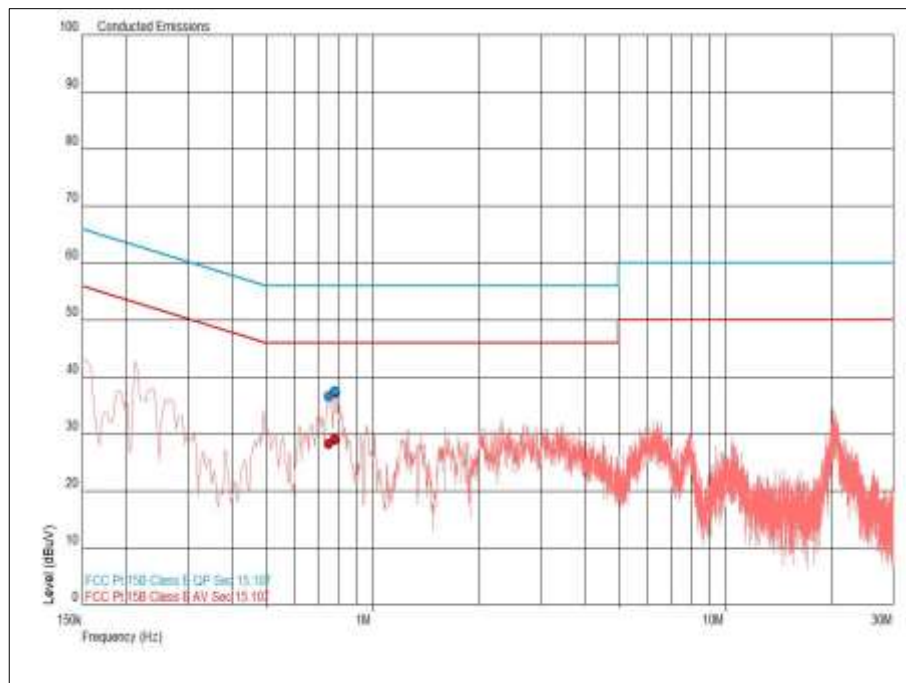


Figure 3 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz WLAN

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.153	49.6	65.8	-16.2	38.4	55.8	-17.4
0.768	36.5	56.0	-19.5	27.8	46.0	-18.2
0.774	36.9	56.0	-19.1	28.9	46.0	-17.1
0.789	35.6	56.0	-20.4	26.8	46.0	-19.2

Table 9 - Live Line Emissions Results

No other final measurements were made as all other peak emissions seen were greater than 10 dB below the CISPR Average test limit.

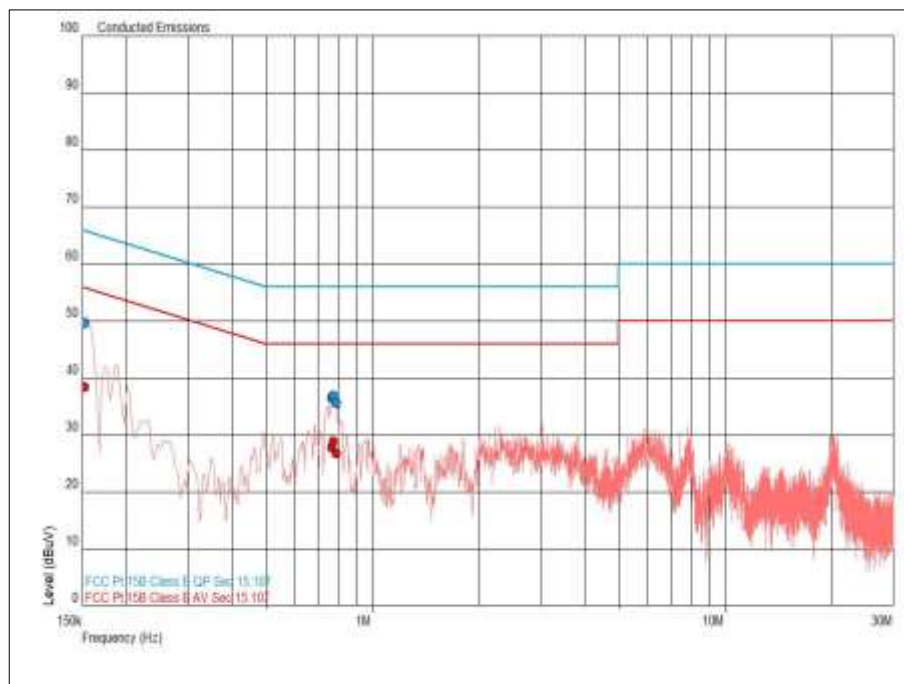


Figure 4 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.153	50.6	65.8	-15.3	37.4	55.8	-18.5
0.165	39.3	65.2	-25.9	22.8	55.2	-32.4
0.747	36.3	56.0	-19.7	28.0	46.0	-18.0
0.765	36.9	56.0	-19.1	27.6	46.0	-18.4
0.792	36.3	56.0	-19.7	27.4	46.0	-18.6

Table 10 - Neutral Line Emissions Results

No other final measurements were made as all other peak emissions seen were greater than 10 dB below the CISPR Average test limit.

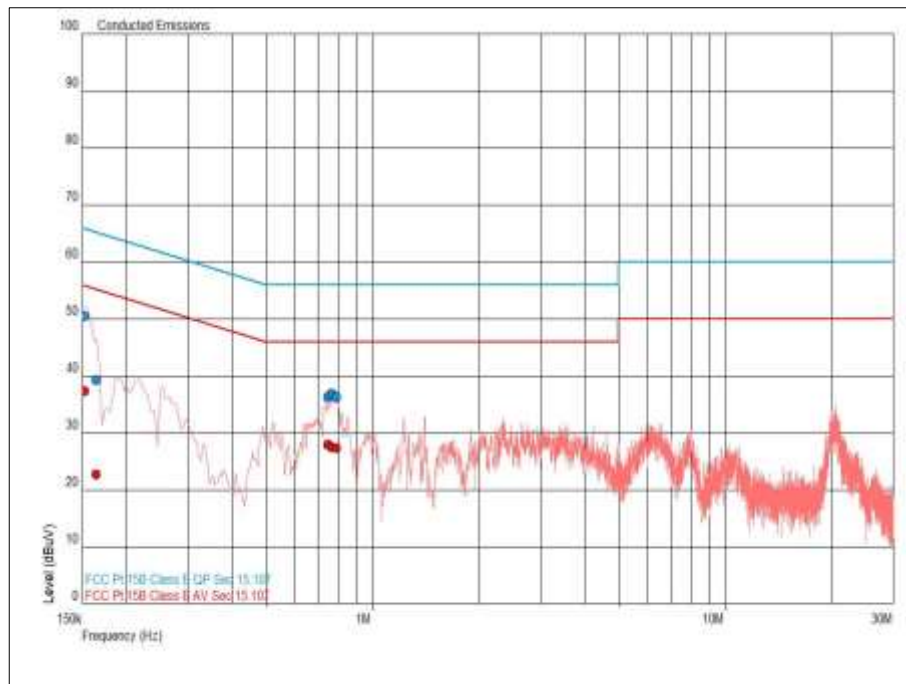


Figure 5 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz Bluetooth

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.756	36.2	56.0	-19.8	26.3	46.0	-19.7
0.768	38.4	56.0	-17.6	28.7	46.0	-17.3
0.780	38.4	56.0	-17.6	29.9	46.0	-16.1

Table 11 – Live Line Emissions Results

No other final measurements were made as all other peak emissions seen were greater than 10 dB below the CISPR Average test limit.

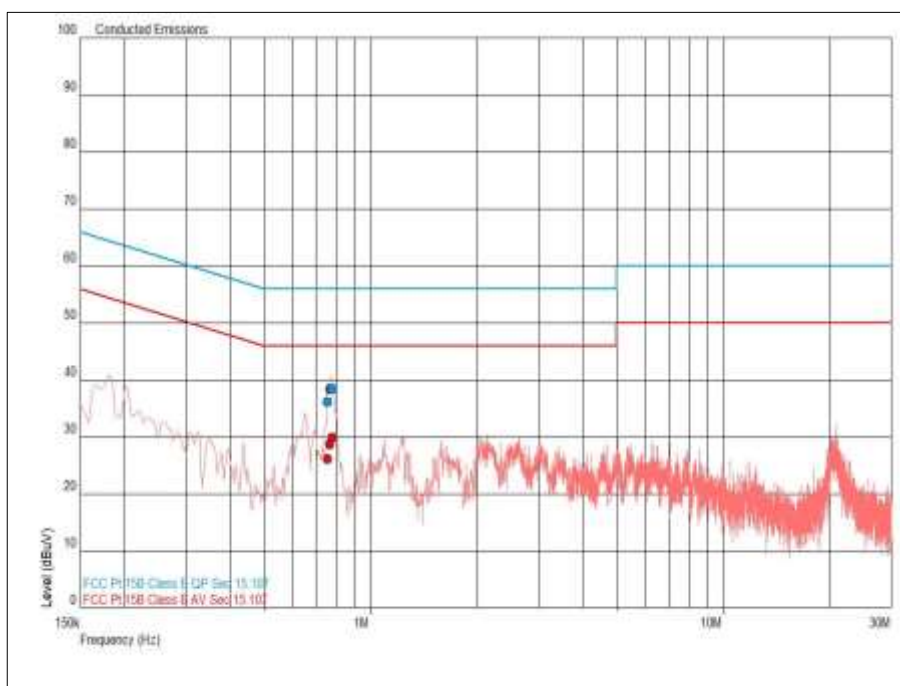


Figure 6 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.777	38.8	56.0	-17.2	30.6	46.0	-15.4

Table 12 – Neutral Line Emissions Results

No other final measurements were made as all other peak emissions seen were greater than 10 dB below the CISPR Average test limit.

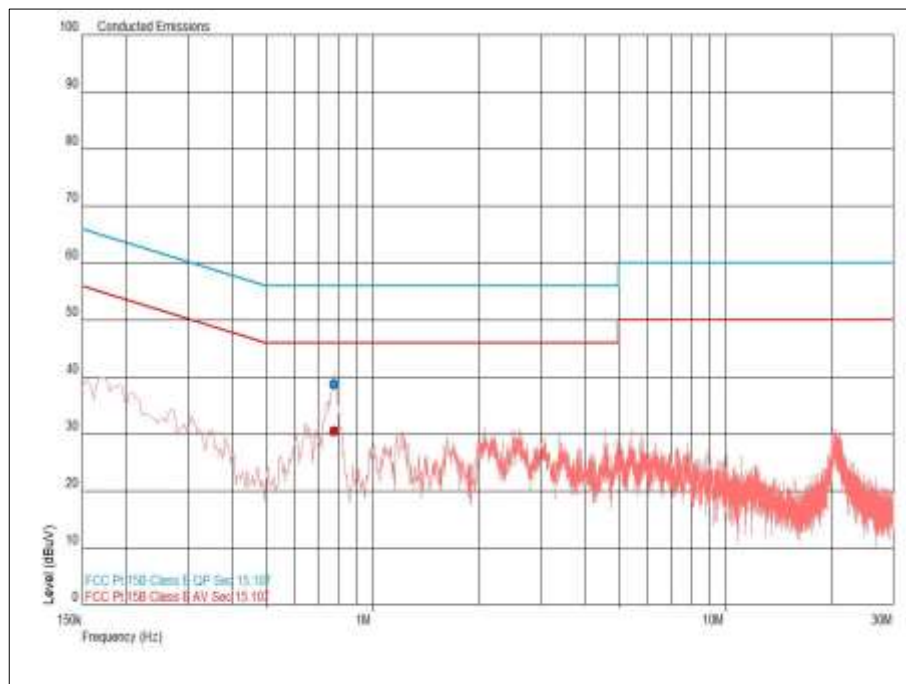


Figure 7 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz Thread

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.759	35.9	56.0	-20.1	24.8	46.0	-21.2
0.777	37.8	56.0	-18.2	27.5	46.0	-18.5

Table 13 – Live Line Emissions Results

No other final measurements were made as all other peak emissions seen were greater than 10 dB below the CISPR Average test limit.

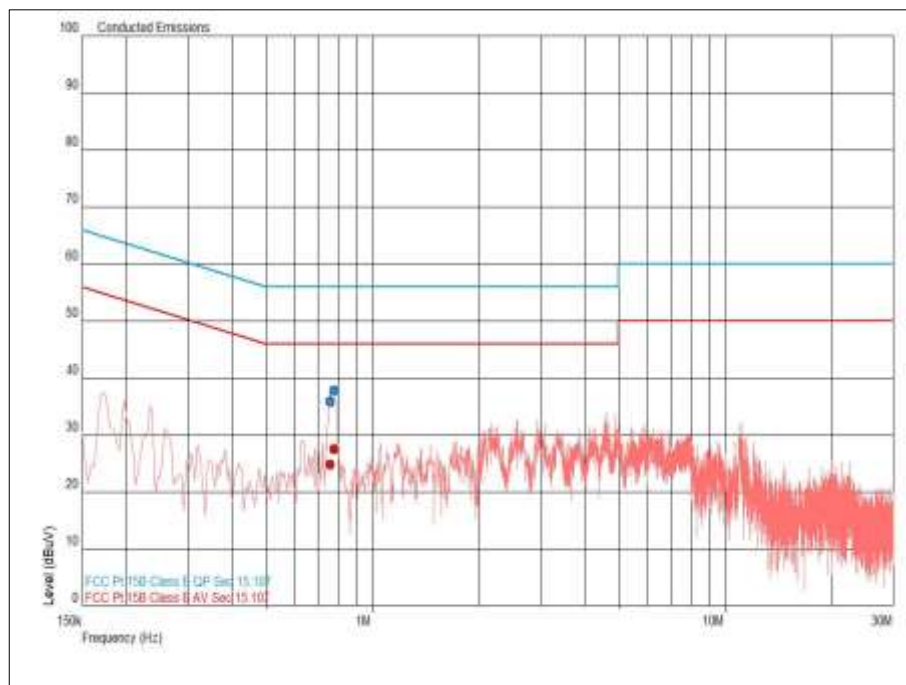


Figure 8 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	Quasi-Peak Level (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.774	38.6	56.0	-17.4	27.3	46.0	-18.7
0.783	37.2	56.0	-18.8	26.4	46.0	-19.6

Table 14 – Neutral Line Emissions Results

No other final measurements were made as all other peak emissions seen were greater than 10 dB below the CISPR Average test limit.

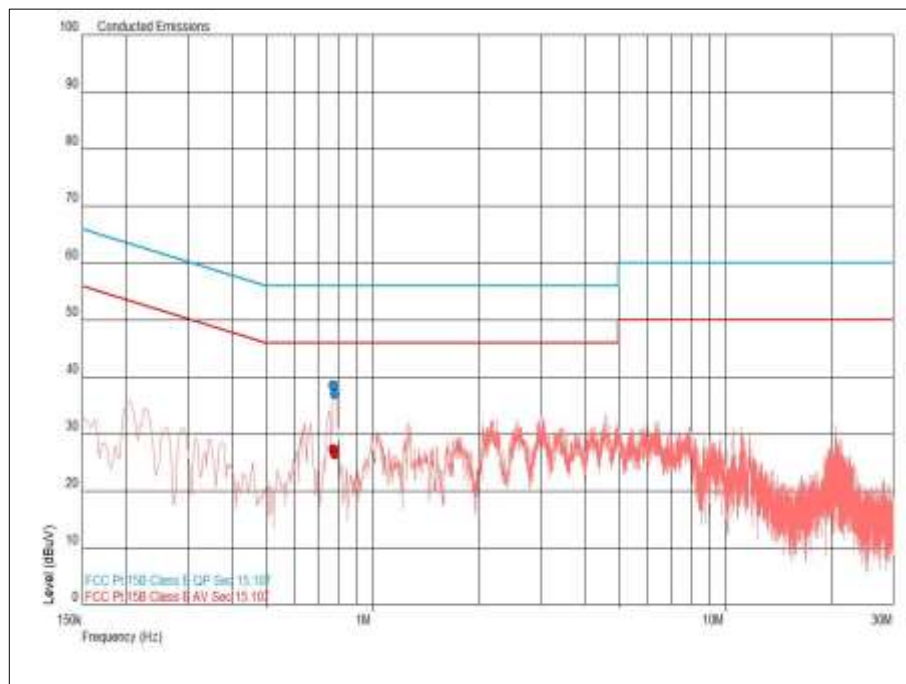


Figure 9 - Neutral Line - 150 kHz to 30 MHz

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	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 Due
3 m Semi Anechoic Chamber	MVG	EMC-3	5621	36	11-Aug-2023
Compliance 5 Emissions	Teseq	V5.26.51	3275	-	Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	03-Jan-2021
Transient Limiter	Hewlett Packard	11947A	2377	12	26-Feb-2021
Cable (18 GHz)	Rosenberger	LU7-071-2000	5106	12	09-Dec-2020
8m N Type Cable	Junkosha	MWX221-08000NMSNMS/B	5519	12	24-Mar-2021
LISN	Rohde & Schwarz	ESH3-Z5	1390	12	27-Jan-2021

Table 16



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Power Supply Unit	Farnell	LT30-2	2045	-	TU
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5604	12	08-Sep-2021

Table 17

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 18

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.