

FCC and ISEDC Test Report

Apple Inc
Model: A2289

In accordance with FCC 47 CFR Part 15C and
ISED RSS-GEN

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

FCC ID: BCGA2289

IC: 579C-A2289



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Document 75947591-14 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andy Lawson	Senior Engineer	Authorised Signatory	12 February 2020

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

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Connor Lee	12 February 2020	

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: 2018 and ISEDC RSS-GEN: 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 February 2020

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2289
Serial Number(s)	C02ZG007P0C9
Hardware Version(s)	Rev1.0
Software Version(s)	19D2013
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2018 ISED RSS-GEN: 2018, Issue 5 (04-2018) + A1 (03-2019)
Order Number	PTP
Date	26-November-2019
Date of Receipt of EUT	27-November-2019
Start of Test	07-February-2020
Finish of Test	07-February-2020
Name of Engineer(s)	Connor Lee
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 ISED RSS-GEN is shown below.

Section	Specification Clause		Test Description	Result	Comments/Base Standard
	Part 15C	RSS-GEN			
Configuration and Mode: 2.4 GHz Bluetooth - BR/EDR ePA					
2.1	15.207	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
Configuration and Mode: 2.4 GHz WLAN					
2.1	15.207	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
Configuration and Mode: 5.0 GHz WLAN					
2.1	15.207	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)

Table 2



1.4 Product Information

1.4.1 Technical Description

The Equipment Under Test (EUT) was a laptop computer with Bluetooth, Bluetooth Low Energy and 802.11 a/b/g/n/ac capabilities in the 2.4 GHz and 5.0 GHz bands.

The EUT was tested whilst being powered from a USB power adapter, model A1947.

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: A2289, Serial Number: C02ZG007P0C9			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

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: 2.4 GHz Bluetooth - BR/EDR ePA		
AC Power Line Conducted Emissions	Connor Lee	UKAS
Configuration and Mode: 2.4 GHz WLAN		
AC Power Line Conducted Emissions	Connor Lee	UKAS
Configuration and Mode: 5.0 GHz WLAN		
AC Power Line Conducted Emissions	Connor Lee	UKAS

Table 4

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

A2289, S/N: C02ZG007P0C9 - Modification State 0

2.1.3 Date of Test

07-February-2020

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.2.

2.1.5 Environmental Conditions

Ambient Temperature	18.4 °C
Relative Humidity	35.0 %

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

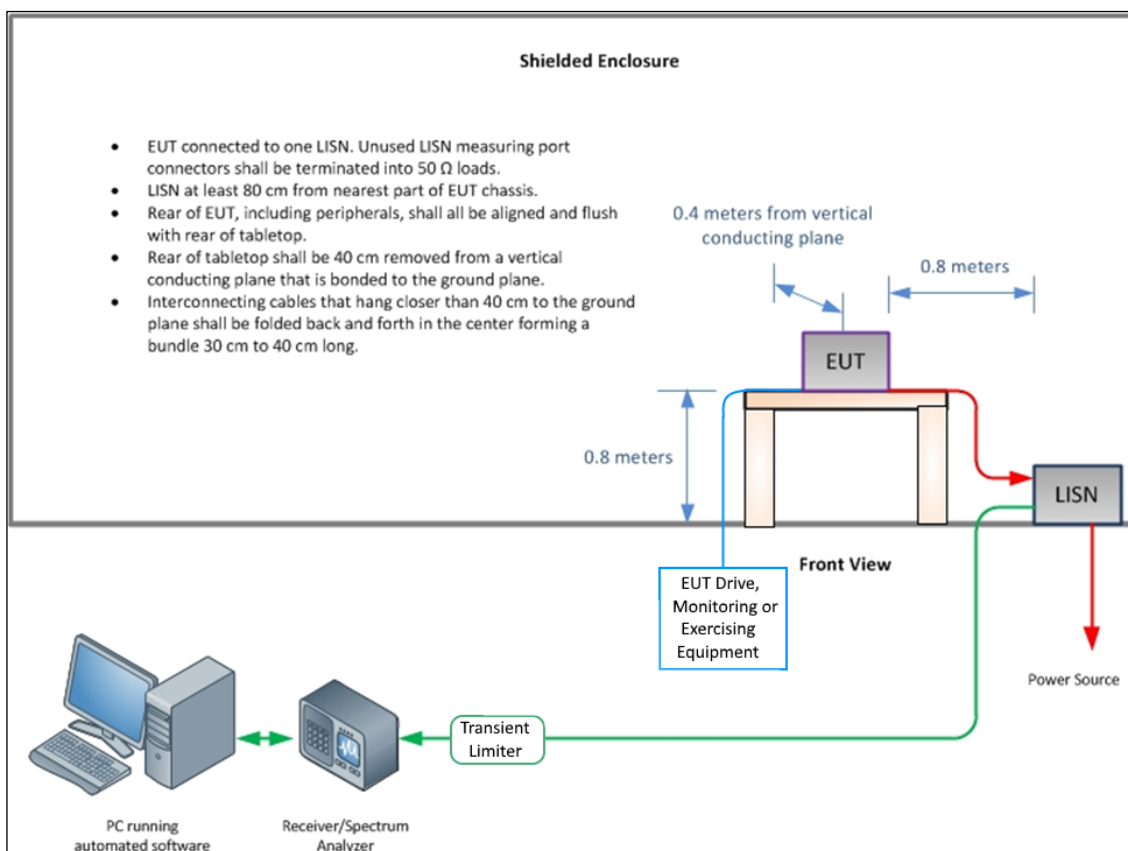


Figure 1 - Conducted Disturbance Example Test Setup

2.1.8 Test Results

2.4 GHz Bluetooth - BR/EDR ePA

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

Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.314	31.5	59.9	-28.4	16.0	49.9	-33.9
0.610	35.4	56.0	-20.6	29.2	46.0	-16.8

Table 5 - Live Line Emissions Results

No other emissions were measured as all other peak emissions seen were greater than 6 dB below the CISPR Average test limit.

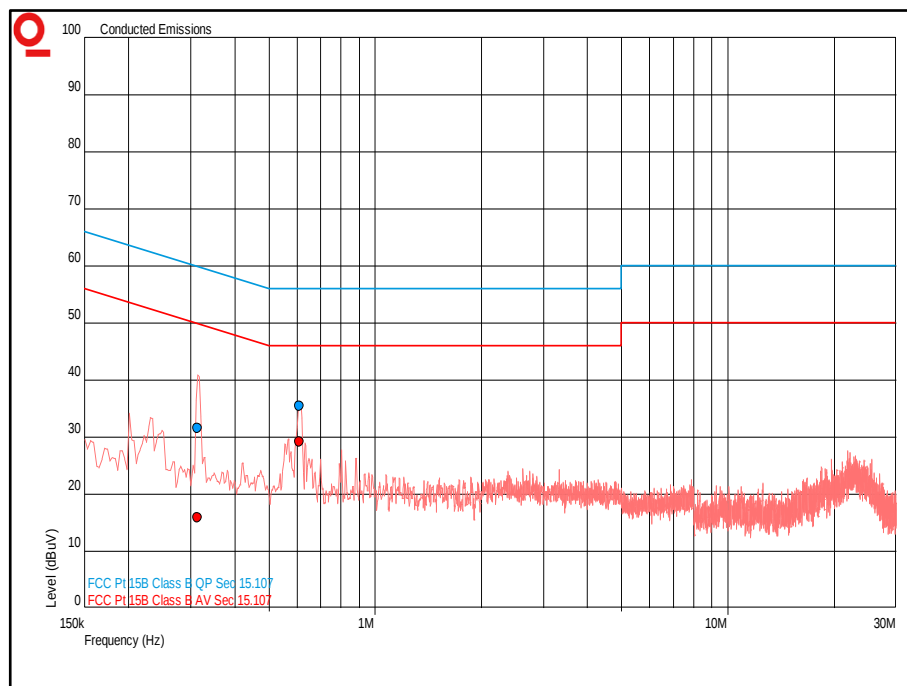


Figure 2 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.186	47.8	64.2	-16.4	29.5	54.2	-24.7
0.207	43.2	63.3	-20.1	12.8	53.3	-40.5
0.237	38.3	62.2	-24.0	11.6	52.2	-40.7
0.278	20.3	60.9	-40.5	11.2	50.9	-39.6
0.317	18.1	59.8	-41.7	10.7	49.8	-39.1
0.332	17.4	59.4	-42.0	10.5	49.4	-38.9
0.613	15.5	56.0	-40.5	9.7	46.0	-36.3
2.935	13.3	56.0	-42.7	7.5	46.0	-38.5

Table 6 - Neutral Line Emissions Results

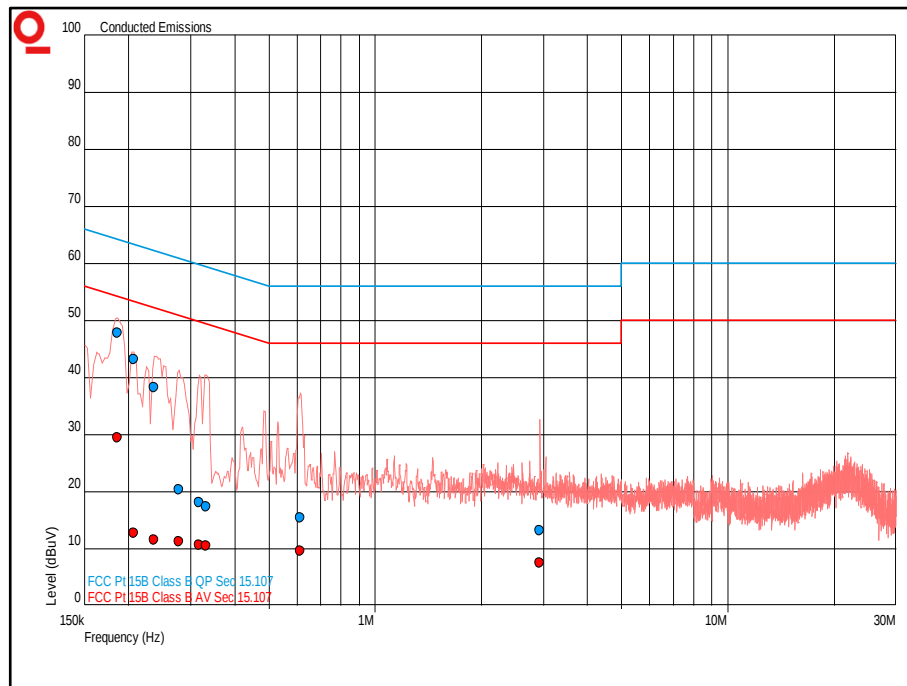


Figure 3 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz WLAN

Applied supply voltage: 120 V AC

Applied supply frequency: 50 Hz

Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.153	38.1	65.8	-27.8	19.9	55.8	-35.9
0.189	33.5	64.1	-30.5	14.1	54.1	-40.0
0.210	24.6	63.2	-38.6	14.1	53.2	-39.2
0.249	28.8	61.8	-33.0	13.0	51.8	-38.9
0.278	26.2	60.9	-34.7	12.1	50.9	-38.7
0.374	20.0	58.4	-38.4	10.9	48.4	-37.5
2.153	14.0	56.0	-42.0	8.2	46.0	-37.8

Table 7 - Live Line Emissions Results

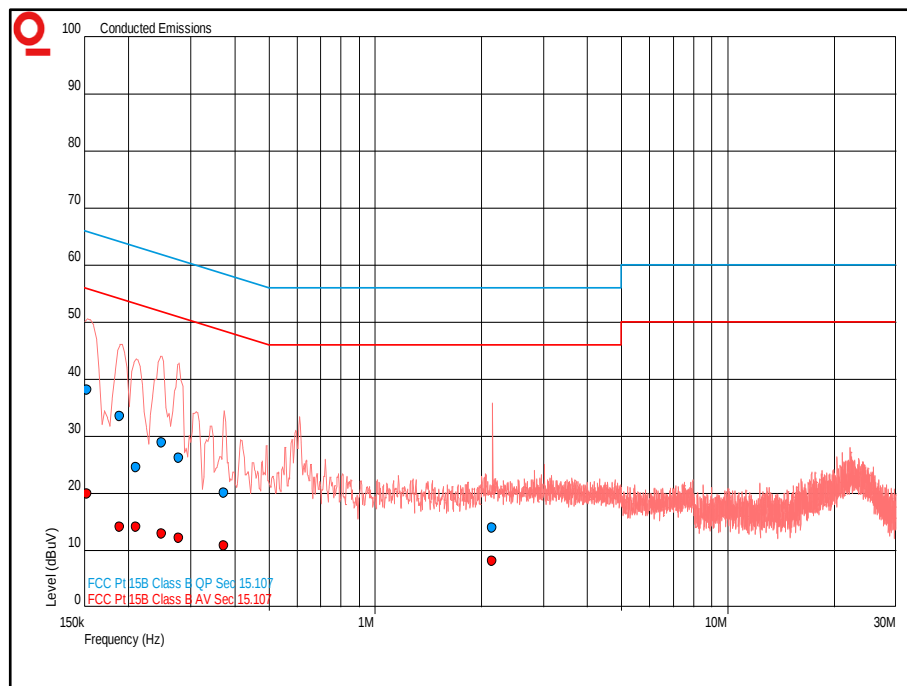


Figure 4 - Live Line - 150 kHz to 30 MHz



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR Average Level (dBµV)	CISPR Average Limit (dBµV)	CISPR Average Margin (dB)
0.192	45.1	64.0	-18.9	25.3	54.0	-28.9
0.219	43.6	62.9	-19.3	23.6	52.9	-29.3
0.257	37.0	61.5	-24.5	12.4	51.5	-39.1
0.290	24.2	60.5	-36.3	11.7	50.5	-38.8
0.607	16.0	56.0	-40.0	10.0	46.0	-36.0
2.174	13.5	56.0	-42.5	7.9	46.0	-38.1

Table 8 - Neutral Line Emissions Results

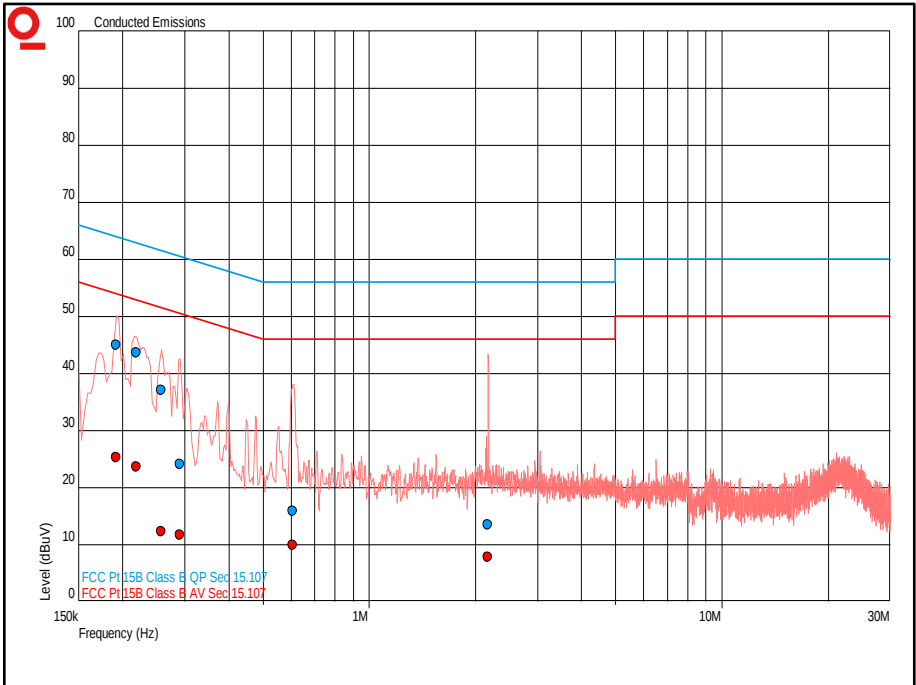


Figure 5 - Neutral Line - 150 kHz to 30 MHz

5.0 GHz WLAN

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dB)	CISPR Average Level (dBμV)	CISPR Average Limit (dBμV)	CISPR Average Margin (dB)
0.150	49.2	66.0	-16.8	29.6	56.0	-26.4
0.174	44.1	64.8	-20.7	25.4	54.8	-29.4
0.186	44.0	64.2	-20.2	25.2	54.2	-29.1
0.231	40.3	62.4	-22.1	11.8	52.4	-40.6
0.263	19.6	61.3	-41.7	11.1	51.3	-40.2
0.308	18.2	60.0	-41.8	10.7	50.0	-39.3
0.344	17.1	59.1	-42.0	10.4	49.1	-38.7
0.607	15.4	56.0	-40.6	9.6	46.0	-36.4
2.183	13.3	56.0	-42.7	7.4	46.0	-38.6

Table 9 - Live Line Emissions Results

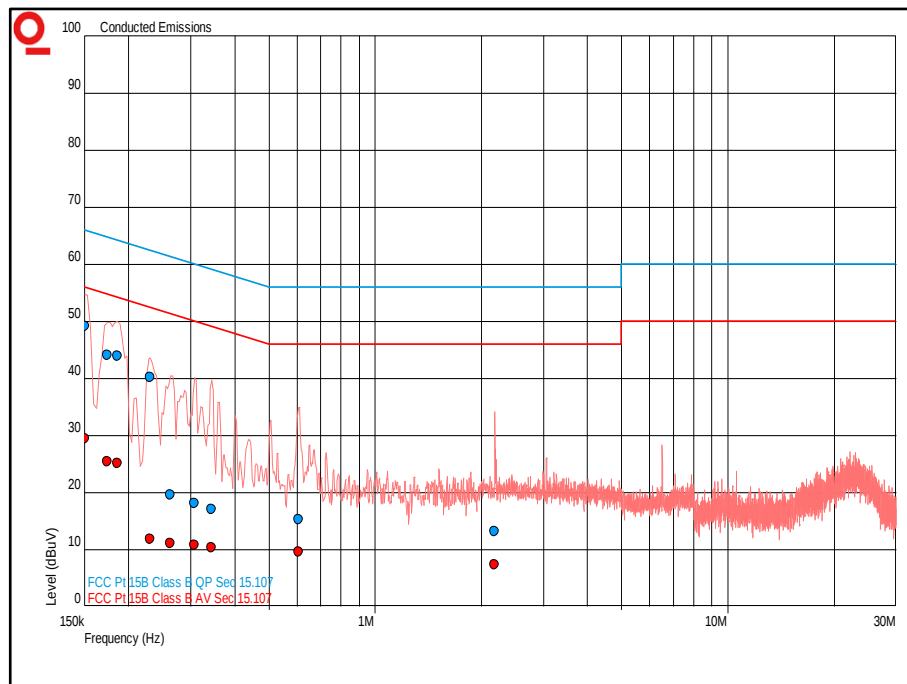


Figure 6 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	QP Level (dB μ V)	QP Limit (dB μ V)	QP Margin (dB)	CISPR Average Level (dB μ V)	CISPR Average Limit (dB μ V)	CISPR Average Margin (dB)
0.189	52.0	64.1	-12.1	32.7	54.1	-21.4
0.204	48.5	63.5	-15.0	32.2	53.5	-21.3
0.251	37.4	61.7	-24.3	20.3	51.7	-31.4
0.302	39.2	60.2	-20.9	24.5	50.2	-25.7
0.326	32.8	59.5	-26.7	20.0	49.5	-29.6
0.371	28.0	58.5	-30.5	14.1	48.5	-34.3

Table 10 - Neutral Line Emissions Results

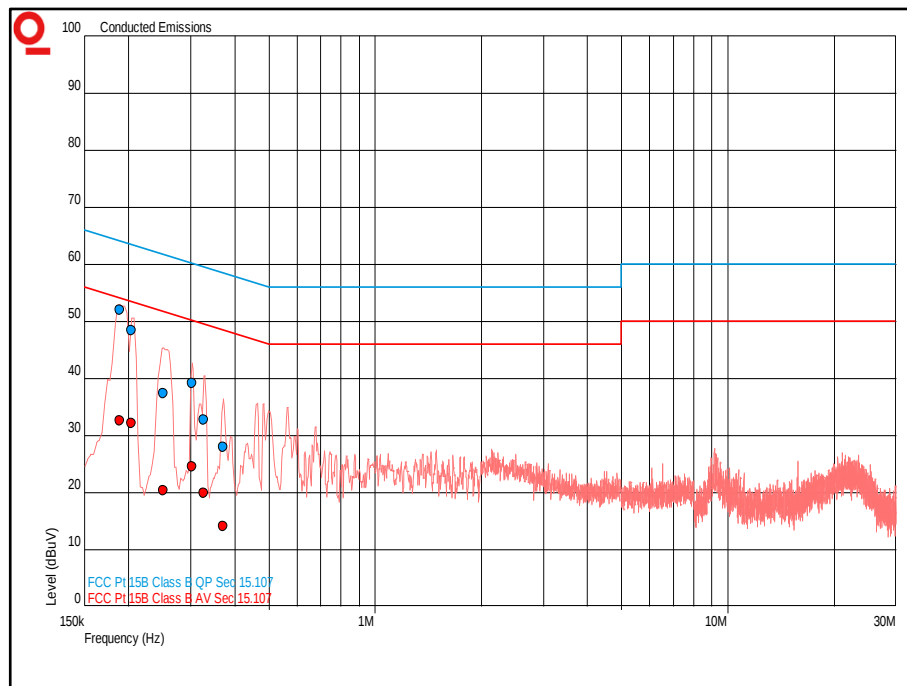


Figure 7 - Neutral Line - 150 kHz to 30 MHz



FCC 47 CFR Part 15, Limit Clause 15.207 and Industry Canada 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 11

*Decreases with the logarithm of the frequency.

2.1.9 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
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-2020
LISN	Rohde & Schwarz	ESH3-Z5	1390	12	27-Jan-2021
2 Meter Cable	Teledyne	PR90-088-2MTR	5196	12	06-Oct-2020
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020

Table 12



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 13

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.