Report on the FCC and ISED Testing of the:

Apple Inc
Model: A2141

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

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

Add value.
Inspire trust.

FCC ID: BCGA2141 IC: 579C-A2141

COMMERCIAL-IN-CONFIDENCE

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SIGNATURE			
A3 Lawson.			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Andy Lawson	Senior EMC Engineer	Authorised Signatory	30 October 2019

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	Matthew Smart	30 October 2019	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation
IC12669A 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 and ISEDC RSS-GEN: Issue 5 A1 (2019-03) for the tests detailed in section 1.3.

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ACCREDITATION
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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	30 October 2019

Table 1

1.2 Introduction

Applicant	Apple Inc.
Manufacturer	Apple Inc.
Model Number(s)	A2141
Serial Number(s)	C02YT00GL51N
Hardware Version(s)	Rev 1.0
Software Version(s)	19A497
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2018 ISEDC RSS-GEN: Issue 5 A1 (2019-03)
Start of Test	25-October-2019
Finish of Test	25-October-2019
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 ISEDC RSS-GEN is shown below.

Section	Specification Clause		Test Description	Result	Comments/Base Standard
	Part 15C	RSS-GEN			
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
Configuration and Mode: Bluetooth BR					
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/a/ac capabilities in the 2.4 GHz and 5.0 GHz bands.

1.4.2 EUT Configuration and Rationale for Conducted Spurious Emissions

The EUT was powered and charging from 120 V, 60 Hz via its USB type C power adaptor.

The device's internal battery was discharged prior to testing.

The display setting on the device was set to maximum brightness, and the device was configured to ensure that the display remained active throughout testing.

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: A2141: Serial Number: C02YT00GL51N			
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: Bluetooth - BR/EDR		
AC Power Line Conducted Emissions	Matthew Smart	UKAS
Configuration and Mode: 5GHz WLAN		
AC Power Line Conducted Emissions	Matthew Smart	UKAS
Configuration and Mode: 2.4GHz WLAN		
AC Power Line Conducted Emissions	Matthew Smart	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
ISEDC RSS-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

A2141, S/N: C02YT00GL51N - Modification State 0

2.1.3 Date of Test

25-October-2019

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.

The AMN was placed 0.8m from the boundary of the EUT and bonded to the reference ground plane.

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

2.1.5 Environmental Conditions

Ambient Temperature	21.0 °C
Relative Humidity	45.0 %

2.1.6 Specification Limits

FCC 47 CFR Part 15, Limit Clause 15.207 and ISEDC 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 5

*Decreases with the logarithm of the frequency.

2.1.7 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) = Quasi-Peak level (dBµV) - Limit (dBµV)

2.1.8 Example Test Setup Diagram

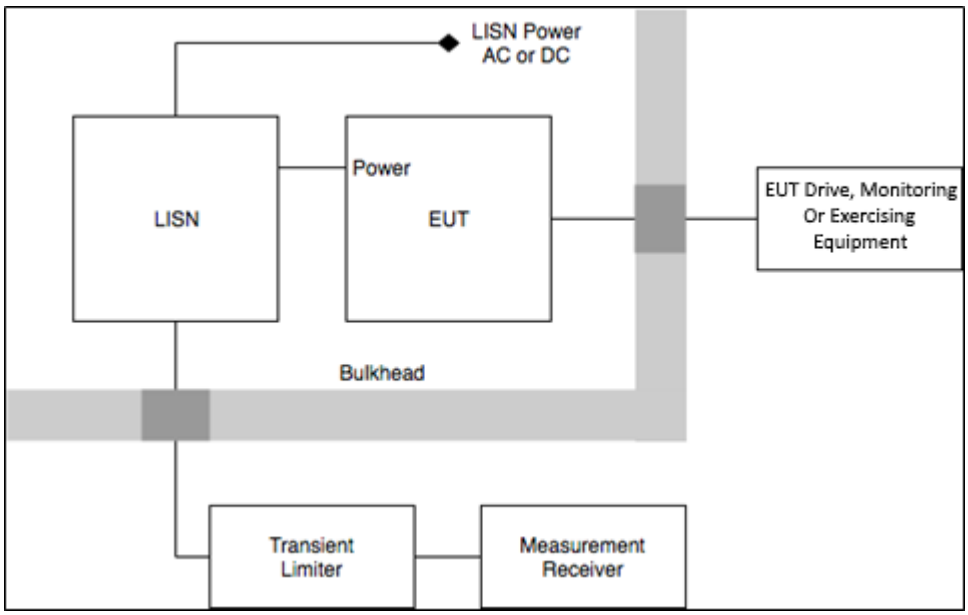

Figure 1 - Example Test Setup

2.1.9 Test Results

Bluetooth - BR/EDR

Applied supply Voltage: 60 Hz
Applied supply frequency: 120 Vac

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR AV Level (dBµV)	CISPR AV Limit (dBµV)	CISPR AV Margin (dB)
0.177	51.7	64.6	-12.9	32.0	54.6	-22.6
0.201	43.6	63.6	-19.9	36.2	53.6	-17.4

Table 6 - Live Line Emissions Results

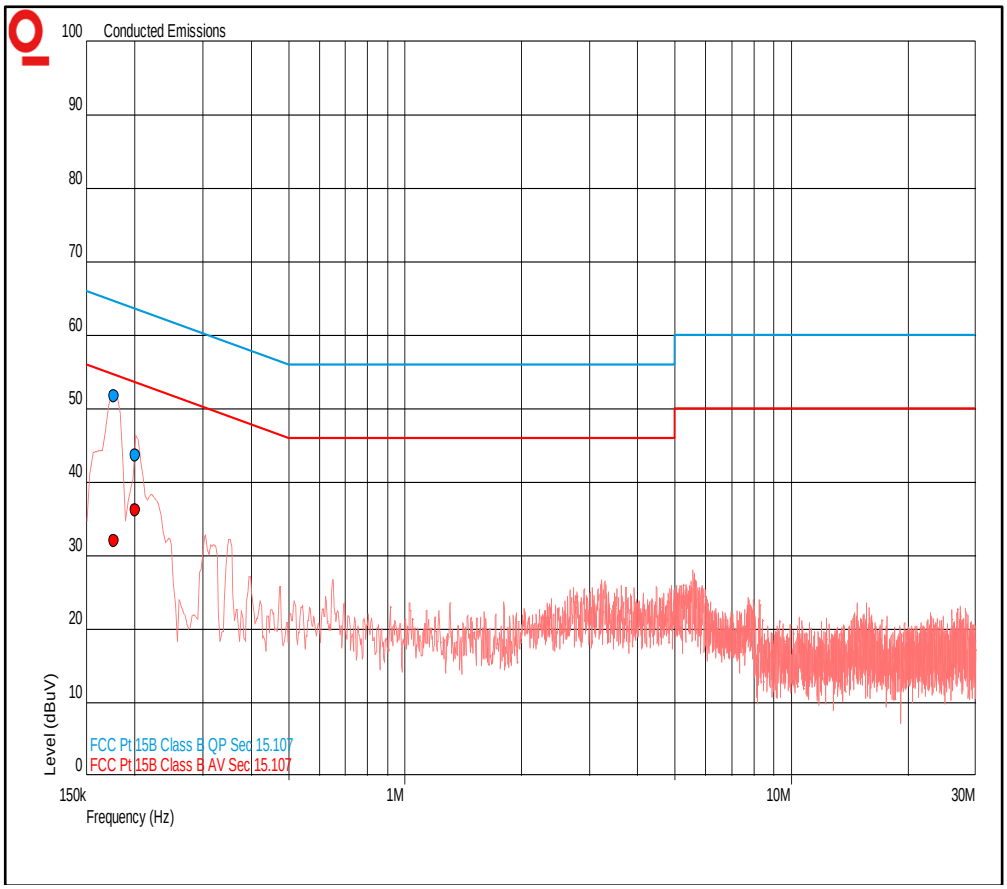

Figure 2 - Live Line - 150 kHz to 30 MHz

Applied supply Voltage: 60 Hz
Applied supply frequency: 120 Vac

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR AV Level (dBµV)	CISPR AV Limit (dBµV)	CISPR AV Margin (dB)
0.159	56.2	65.5	-9.3	35.5	55.5	-20.0

Table 7 - Neutral Line Emissions Results

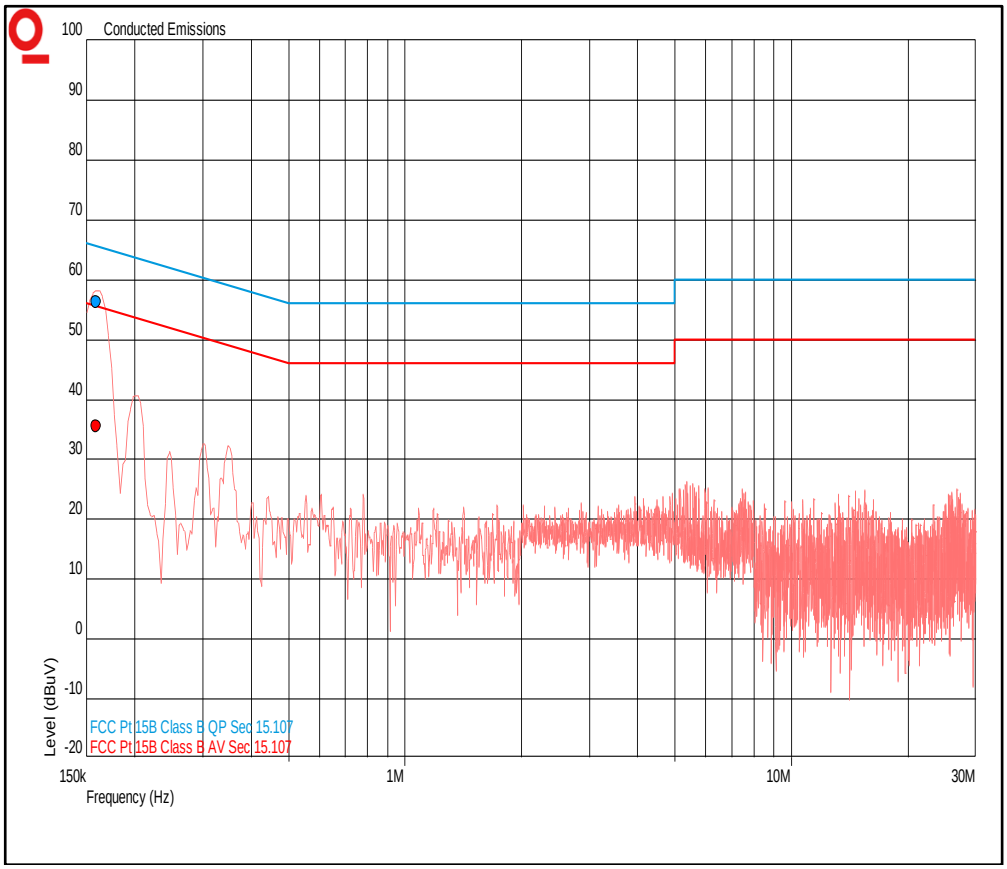

Figure 3 - Neutral Line - 150 kHz to 30 MHz

5.0 GHz WLAN

Applied supply Voltage: 60 Hz
Applied supply frequency: 120 Vac

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR AV Level (dBµV)	CISPR AV Limit (dBµV)	CISPR AV Margin (dB)
0.177	51.6	64.6	-13.1	30.2	54.6	-24.5
0.207	46.2	63.3	-17.1	30.5	53.3	-22.8

Table 8 - Live Line Emissions Results

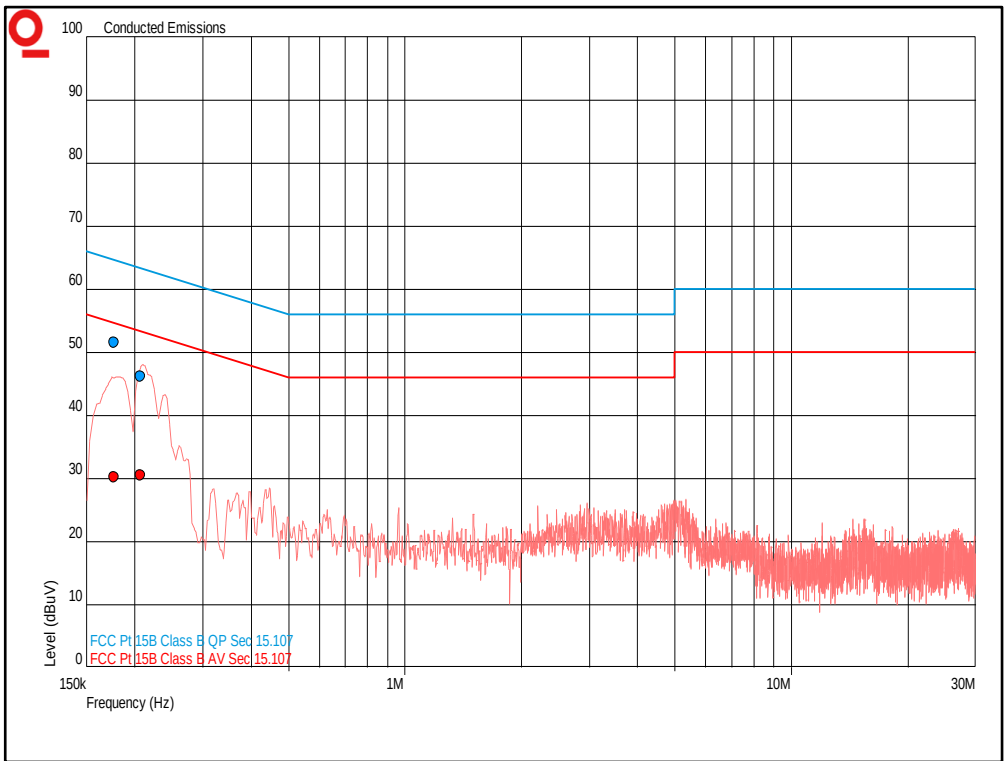

Figure 4 - Live Line - 150 kHz to 30 MHz

Applied supply Voltage: 60 Hz
Applied supply frequency: 120 Vac

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR AV Level (dBµV)	CISPR AV Limit (dBµV)	CISPR AV Margin (dB)
0.174	52.2	64.8	-12.5	30.6	54.8	-24.2
0.201	47.3	63.6	-16.3	30.3	53.6	-23.3

Table 9 - Neutral Line Emissions Results

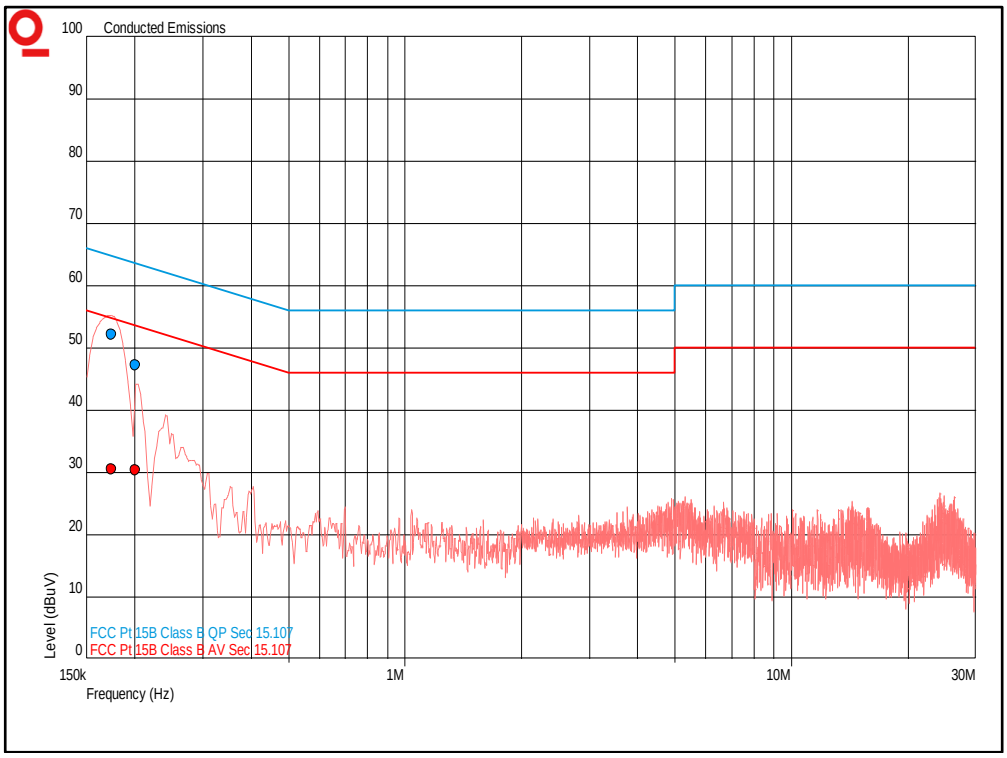

Figure 5 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz WLAN

Applied supply Voltage: 60 Hz
Applied supply frequency: 120 Vac

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR AV Level (dBµV)	CISPR AV Limit (dBµV)	CISPR AV Margin (dB)
0.153	57.7	65.8	-8.1	35.0	55.8	-20.8
0.171	52.9	64.9	-12.0	32.3	54.9	-22.6
0.207	39.1	63.3	-24.2	22.2	53.3	-31.1

Table 10 - Live Line Emissions Results

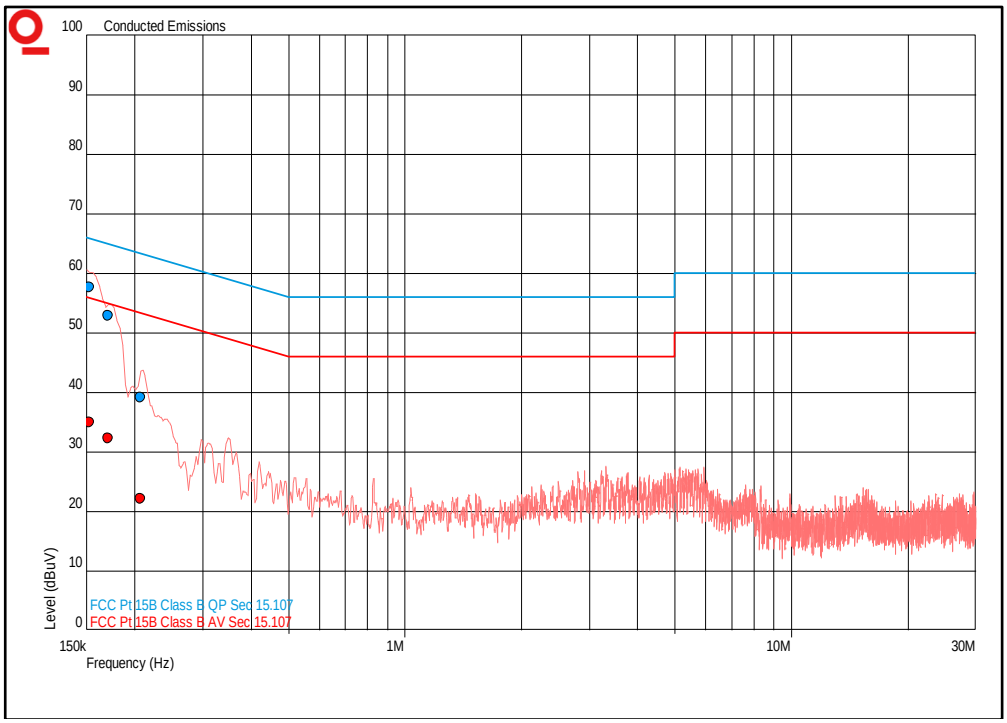

Figure 6 - Live Line - 150 kHz to 30 MHz

Applied supply Voltage: 60 Hz
Applied supply frequency: 120 Vac

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR AV Level (dBµV)	CISPR AV Limit (dBµV)	CISPR AV Margin (dB)
0.151	58.6	66.0	-7.3	35.5	56.0	-20.5
0.158	56.6	65.0	-9.0	34.0	55.6	-21.6
0.201	46.9	63.6	-16.7	30.2	53.6	-23.4

Table 11 - Neutral Line Emissions Results

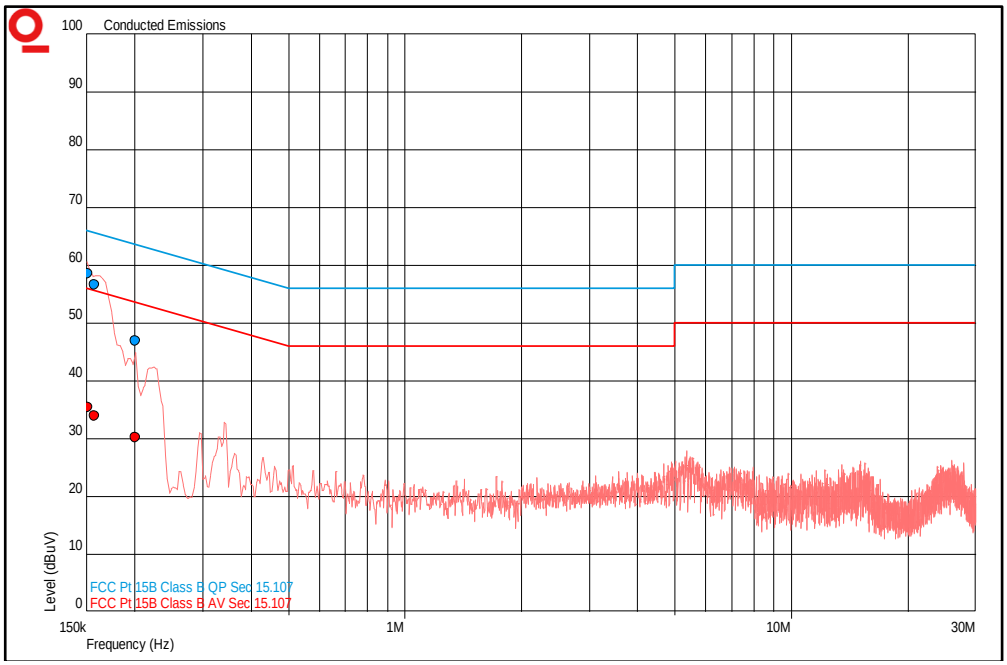

Figure 7 - Neutral Line - 150 kHz to 30 MHz

2.1.10 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	17-Dec-2019
Transient Limiter	Hewlett Packard	11947A	2377	12	26-Feb-2020
LISN	Rohde & Schwarz	ESH3-Z5	1390	12	20-Nov-2019
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5213	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