

FCC and ISED Test Report

Apple Inc
Model: A2338



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

Add value.
Inspire trust.

Prepared for: Apple Inc
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FCC ID: BGCA2338 IC: 579C-A2338

COMMERCIAL-IN-CONFIDENCE

Document 75948987-13 Issue 01

SIGNATURE			
NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andy Lawson	Senior Engineer	Authorised Signatory	07 October 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 ISED 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	07 October 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: 2019 and ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) for the tests detailed in section 1.3.

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Contents

1	Report Summary	2
1.1	Report Modification Record.....	2
1.2	Introduction.....	2
1.3	Brief Summary of Results	3
1.4	Product Information	4
1.5	Deviations from the Standard.....	4
1.6	EUT Modification Record	4
1.7	Test Location.....	4
2	Test Details	5
2.1	AC Power Line Conducted Emissions	5
3	Test Equipment Information	14
3.1	General Test Equipment Used.....	14
4	Incident Reports	15
5	Measurement Uncertainty	16

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	07 October 2020

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2338
Serial Number(s)	C02CX02HQC36
Hardware Version(s)	REV 1.0
Software Version(s)	20A2352
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	0540201117
Date	05-May-2020
Date of Receipt of EUT	24-August-2020
Start of Test	05-September-2020
Finish of Test	05-September-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: 5 GHz WLAN					
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: 2.4 GHz Bluetooth					
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/ax capabilities in the 2.4 GHz and 5 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: A2338, Serial Number: C02CX02HQC36			
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: 5 GHz WLAN		
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: 2.4 GHz Bluetooth		
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

A2338, S/N: C02CX02HQC36 - Modification State 0

2.1.3 Date of Test

05-September-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.

2.1.5 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)

2.1.6 Example Test Setup Diagram

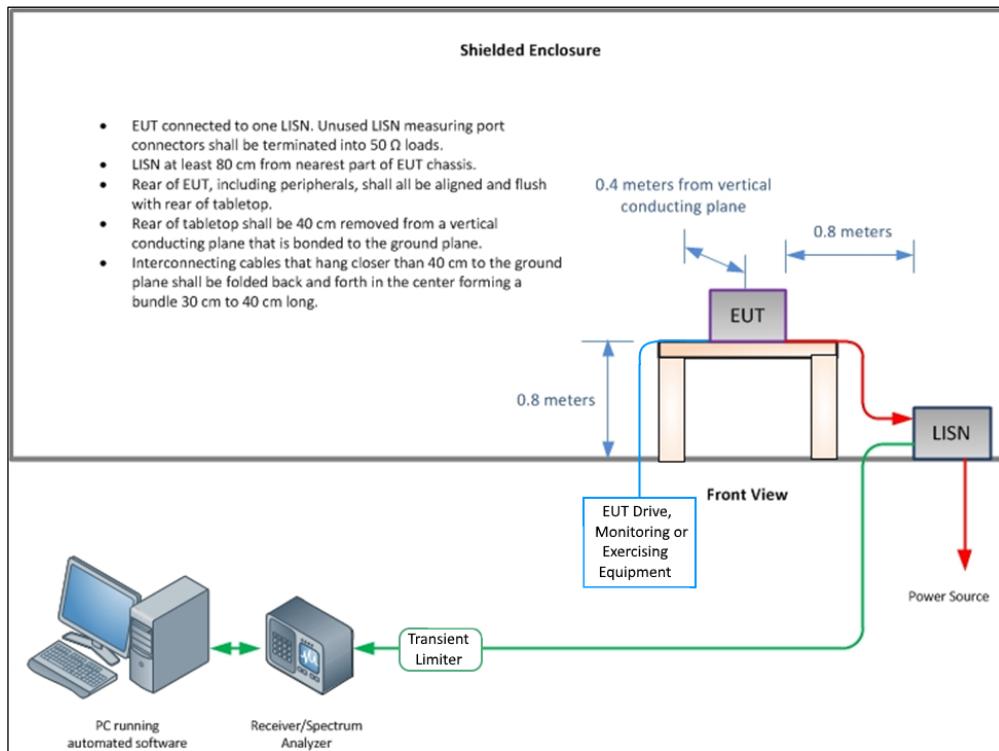


Figure 1 - Conducted Disturbance - Example Test Setup.

2.1.7 Environmental Conditions

Ambient Temperature 19.2 °C
Relative Humidity 51.8 %

2.1.8 Test Results

5 GHz WLAN

Applied supply voltage: 120 V AC

Applied supply frequency: 60 Hz

Frequency (MHz)	Quasi-Peak Level (dB μ V)	Quasi-Peak Limit (dB μ V)	Quasi-Peak Margin (dB)	CISPR Average Level (dB μ V)	CISPR Average Limit (dB μ V)	CISPR Average Margin (dB)
0.156	48.8	65.7	-16.8	28.3	55.7	-27.4
0.183	46.1	64.4	-18.2	26.5	54.4	-27.9
0.228	40.9	62.5	-21.7	22.0	52.5	-30.6
0.335	32.3	59.3	-27.0	17.3	49.3	-32.0
0.365	30.8	58.6	-27.9	16.7	48.6	-31.9
0.398	29.4	57.9	-28.5	17.5	47.9	-30.4
0.466	26.5	56.6	-30.1	15.3	46.6	-31.3

Table 5 - Live Line Emissions Results

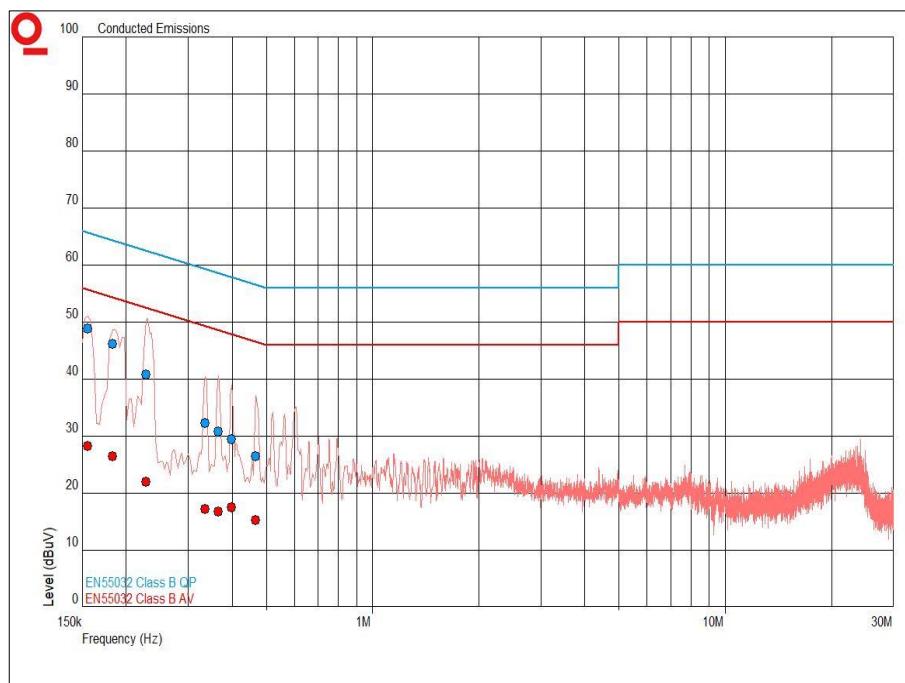


Figure 2 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Quasi-Peak Level (dB μ V)	Quasi-Peak Limit (dB μ V)	Quasi-Peak Margin (dB)	CISPR Average Level (dB μ V)	CISPR Average Limit (dB μ V)	CISPR Average Margin (dB)
0.165	45.4	65.2	-19.8	25.5	55.2	-29.7
0.192	42.6	64.0	-21.4	24.8	54.0	-29.1
0.237	37.5	62.2	-24.7	19.1	52.2	-33.1
0.306	31.6	60.1	-28.5	15.3	50.1	-34.8
0.329	30.1	59.5	-29.4	15.1	49.5	-34.3
0.350	31.6	59.0	-27.4	15.6	49.0	-33.3

Table 6 - Neutral Line Emissions Results

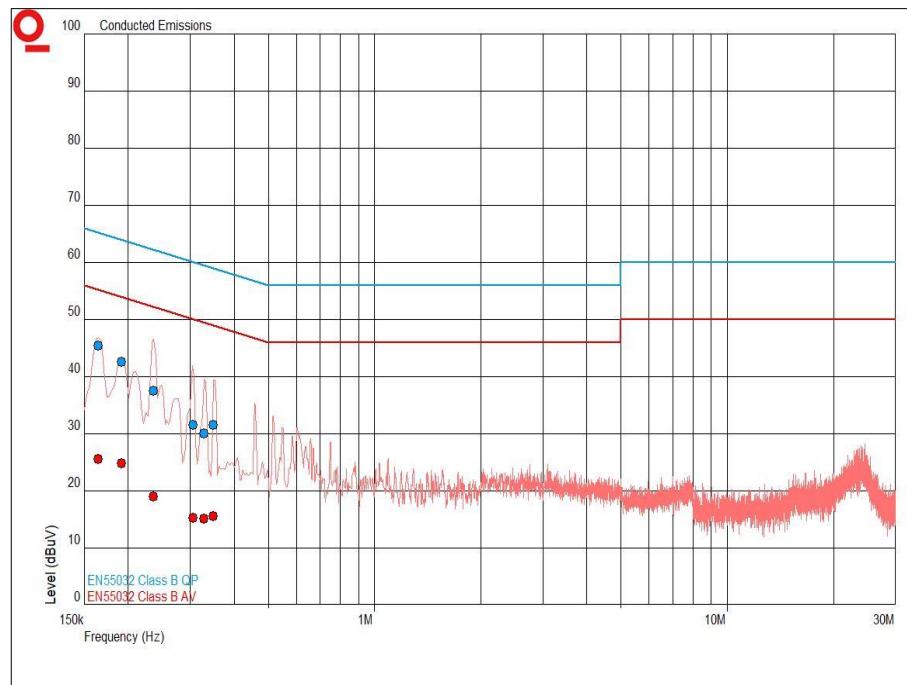


Figure 3 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz WLAN

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

Frequency (MHz)	Quasi-Peak Level (dB μ V)	Quasi-Peak Limit (dB μ V)	Quasi-Peak Margin (dB)	CISPR Average Level (dB μ V)	CISPR Average Limit (dB μ V)	CISPR Average Margin (dB)
0.162	45.5	65.4	-19.9	25.6	55.4	-29.8
0.281	37.6	60.8	-23.2	22.0	50.8	-28.7
0.365	31.1	58.6	-27.5	16.7	48.6	-31.9

Table 7 - Live Line Emissions Results

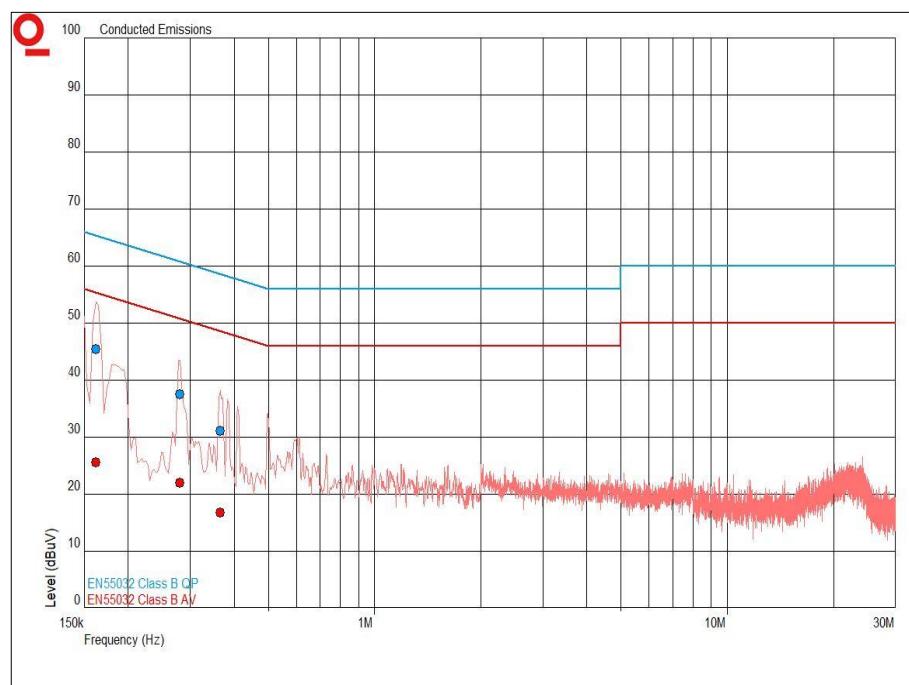


Figure 4 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Quasi-Peak Level (dB μ V)	Quasi-Peak Limit (dB μ V)	Quasi-Peak Margin (dB)	CISPR Average Level (dB μ V)	CISPR Average Limit (dB μ V)	CISPR Average Margin (dB)
0.156	48.6	65.7	-17.1	28.9	55.7	-26.7
0.174	46.2	64.8	-18.6	23.8	54.8	-31.0
0.240	40.5	62.1	-21.6	22.4	52.1	-29.7
0.278	38.1	60.9	-22.7	20.2	50.9	-30.7
0.332	32.7	59.4	-26.7	17.5	49.4	-31.9
0.416	28.8	57.5	-28.7	18.2	47.5	-29.4
0.434	27.8	57.2	-29.4	14.0	47.2	-33.2
0.604	32.5	56.0	-23.5	27.1	46.0	-18.9

Table 8 - Neutral Line Emissions Results

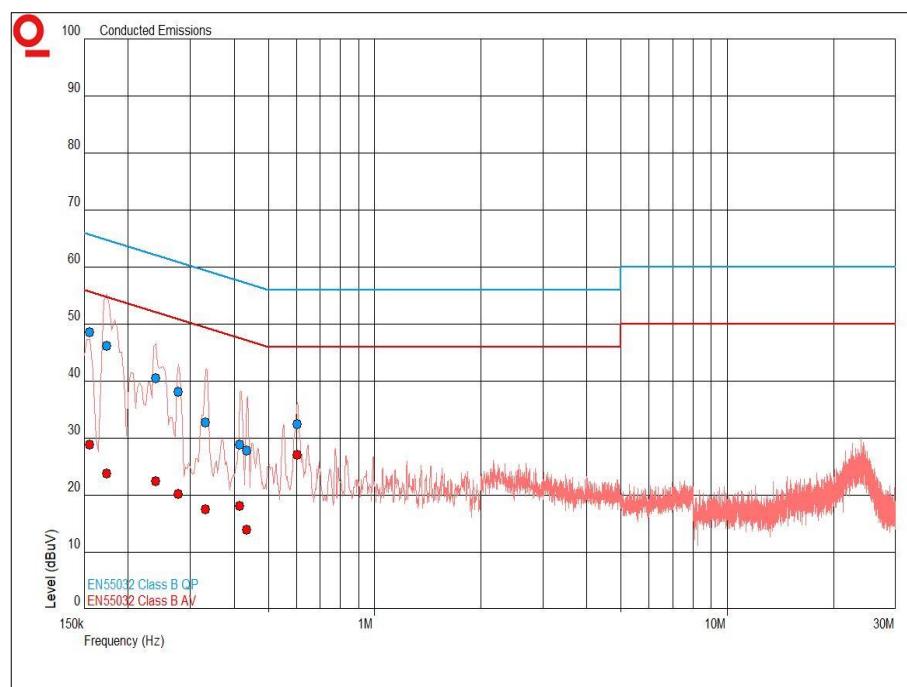


Figure 5 - Neutral Line - 150 kHz to 30 MHz

2.4 GHz Bluetooth

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

Frequency (MHz)	Quasi-Peak Level (dB μ V)	Quasi-Peak Limit (dB μ V)	Quasi-Peak Margin (dB)	CISPR Average Level (dB μ V)	CISPR Average Limit (dB μ V)	CISPR Average Margin (dB)
0.165	46.9	65.2	-18.3	23.9	55.2	-31.3
0.183	46.1	64.4	-18.2	26.4	54.4	-27.9
0.243	39.9	62.0	-22.1	21.7	52.0	-30.3
0.347	31.6	59.0	-27.5	16.8	49.0	-32.2
0.407	28.8	57.7	-28.9	15.3	47.7	-32.4

Table 9 - Live Line Emissions Results

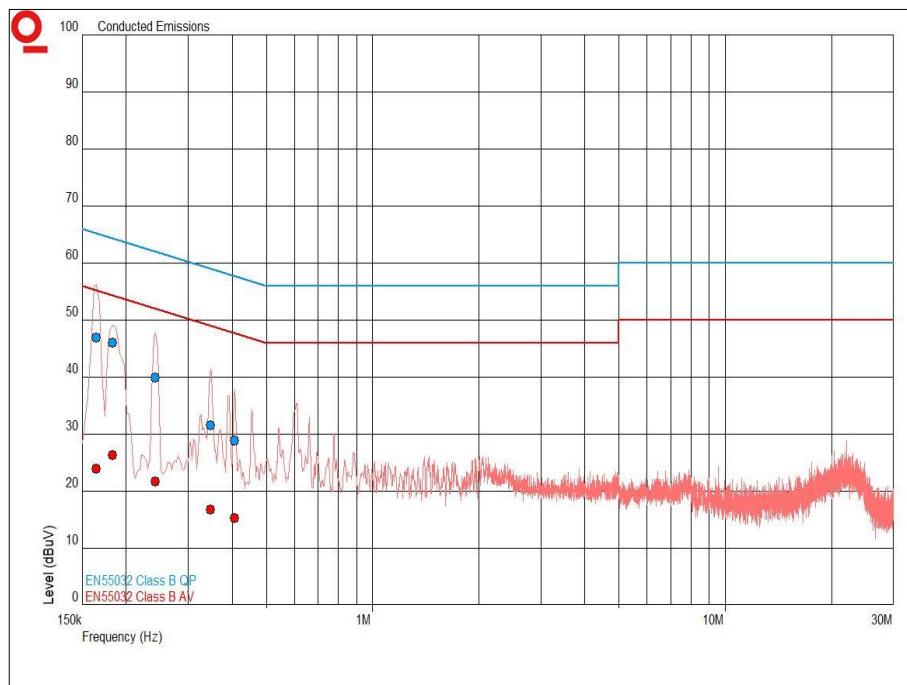


Figure 6 - Live Line - 150 kHz to 30 MHz

Frequency (MHz)	Quasi-Peak Level (dB μ V)	Quasi-Peak Limit (dB μ V)	Quasi-Peak Margin (dB)	CISPR Average Level (dB μ V)	CISPR Average Limit (dB μ V)	CISPR Average Margin (dB)
0.165	47.2	65.2	-18.0	29.2	55.2	-26.0
0.189	46.3	64.1	-17.8	31.9	54.1	-22.2
0.225	40.6	62.6	-22.0	25.4	52.6	-27.2
0.254	38.5	61.6	-23.1	24.5	51.6	-27.1
0.332	33.0	59.4	-26.4	21.1	49.4	-28.3
0.407	29.1	57.7	-28.6	18.1	47.7	-29.7
0.454	27.3	56.8	-29.5	17.3	46.8	-29.5

Table 10 - Neutral Line Emissions Results

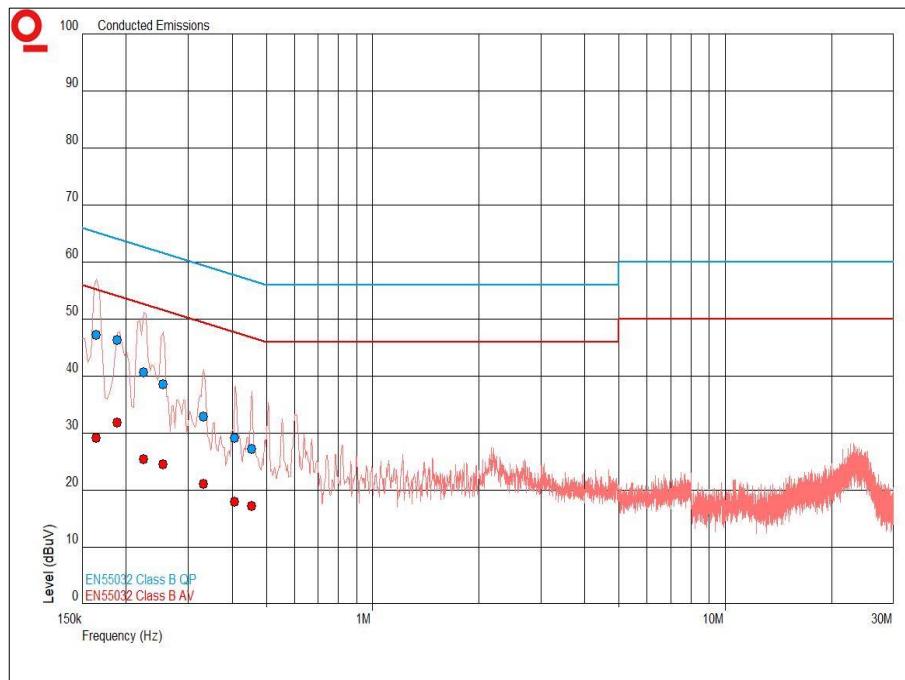


Figure 7 - Neutral Line - 150 kHz to 30 MHz

FCC 47 CFR Part 15, Limit Clause 15.207 and 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 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	Screened Room	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	15	12	02-Oct-2020
Cable (Rx, Nm-Nm, 2m)	Scott Cables	SLU18-NMNM-02.00M	4485	12	06-Mar-2021
8 m N-Type Cable	Junkosha	MWX221-08000NMSNMS/B	5520	12	24-Mar-2021
LISN	Rohde & Schwarz	ESH3-Z5	1390	12	27-Jan-2021

Table 12



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Multimeter	Iso-tech	IDM 101	2118	12	07-Feb-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5473	12	16-Mar-2021

Table 13



4 Incident Reports

No incidents reports were raised.

5 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 14

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.