

FCC and ISED Test Report

Apple Inc
Model: A2438

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

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



FCC ID: BCGA2438

IC: 579C-A2438

COMMERCIAL-IN-CONFIDENCE

Document 75948887-13 Issue 02

SIGNATURE

| NAME | JOB TITLE | RESPONSIBLE FOR | ISSUE DATE |
|----------|-----------------|----------------------|------------------|
| A Lawson | Senior Engineer | Authorised Signatory | 25 February 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 | Connor Lee | 25 February 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: Issue 5 (04-2018) + A1 (03-2019) 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 | 10 February 2021 |
| 2 | Correction to Model number of PSU | 25 February 2021 |

Table 1

1.2 Introduction

| | |
|-------------------------------|---|
| Applicant | Apple Inc |
| Manufacturer | Apple Inc |
| Model Number(s) | A2438 |
| Serial Number(s) | C02DM00Q087X |
| Hardware Version(s) | REV 1.0 |
| Software Version(s) | 20W430340t |
| Number of Samples Tested | 2 |
| 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 | 10-December-2020 and 11-December-2020 |
| Start of Test | 03-January-2021 |
| Finish of Test | 03-January-2021 |
| 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 desktop 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 were applicable from the test standard at the time of test.

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: A2438, Serial Number: C02DM00Q087X | | | |
| 0 | As supplied by the customer | Not Applicable | Not Applicable |
| Model: A2290, Serial Number: C4H034600ZPPL2D6W | | | |
| 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

A2438, S/N: C02DM00Q087X - Modification State 0
A2290, S/N: C4H034600ZPPL2D6W - Modification State 0

2.1.3 Date of Test

03-January-2021

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 | 18.7 °C |
| Relative Humidity | 34.6 % |



2.1.6 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) |
|-----------------|-------------------------|-------------------------|------------------------|----------------------------|----------------------------|---------------------------|
| 0.171 | 39.8 | 64.9 | -25.1 | 27.1 | 54.9 | -27.8 |
| 0.192 | 41.4 | 64.0 | -22.5 | 36.4 | 54.0 | -17.5 |
| 0.213 | 41.8 | 63.1 | -21.3 | 36.0 | 53.1 | -17.1 |
| 0.237 | 43.0 | 62.2 | -19.2 | 35.2 | 52.2 | -17.1 |
| 13.553 | 33.7 | 60.0 | -26.3 | 26.2 | 50.0 | -23.8 |

Table 5 - 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 10 dB below the CISPR Average test limit.

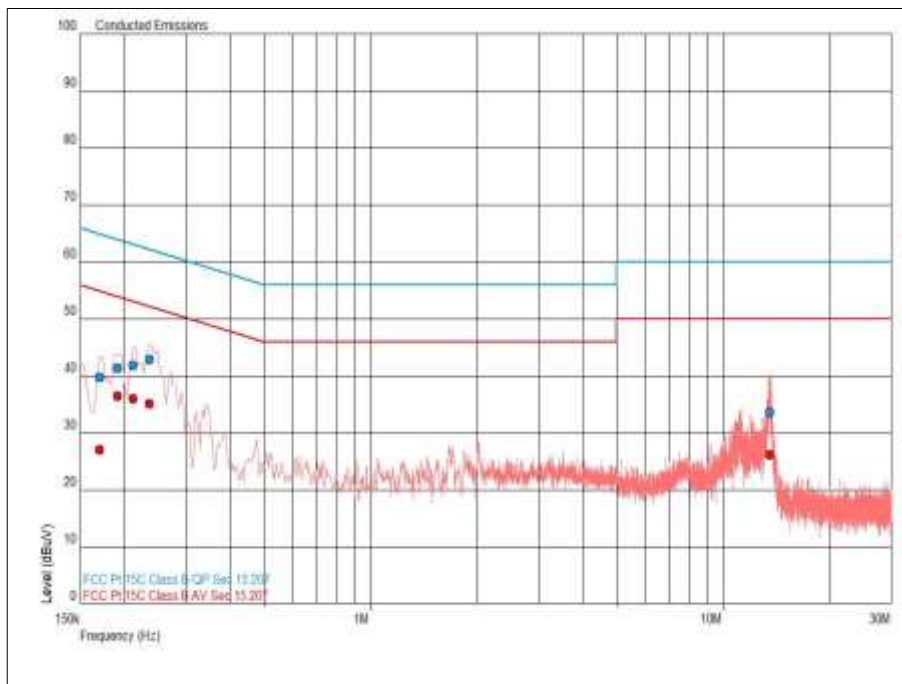


Figure 1 - Live Line - 150 kHz to 30 MHz



| 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) |
|-----------------|-------------------------|-------------------------|------------------------|----------------------------|----------------------------|---------------------------|
| 0.234 | 43.1 | 62.3 | -19.2 | 33.1 | 52.3 | -19.2 |
| 0.249 | 43.1 | 61.8 | -18.7 | 26.9 | 51.8 | -24.9 |
| 13.436 | 33.8 | 60.0 | -26.2 | 26.0 | 50.0 | -24.0 |

Table 6 - 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 10 dB below the CISPR Average test limit.

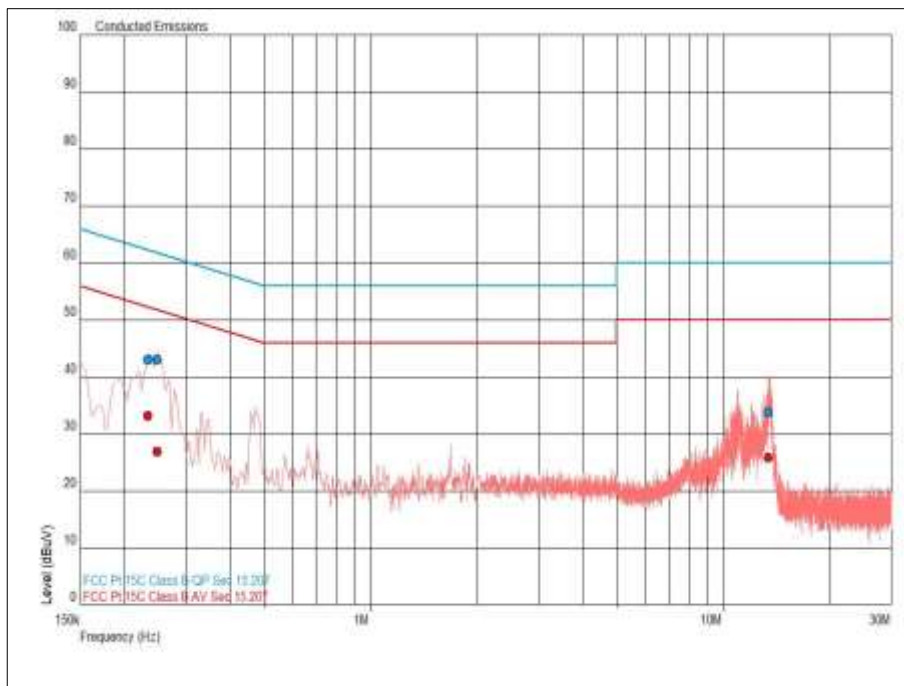


Figure 2 - Neutral Line - 150 kHz to 30 MHz



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) |
|-----------------|-------------------------|-------------------------|------------------------|----------------------------|----------------------------|---------------------------|
| 0.216 | 44.3 | 63.0 | -18.7 | 37.8 | 53.0 | -15.2 |
| 0.249 | 41.7 | 61.8 | -20.1 | 27.6 | 51.8 | -24.2 |
| 13.520 | 38.2 | 60.0 | -21.8 | 34.0 | 50.0 | -16.0 |

Table 7 - 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 10 dB below the CISPR Average test limit.

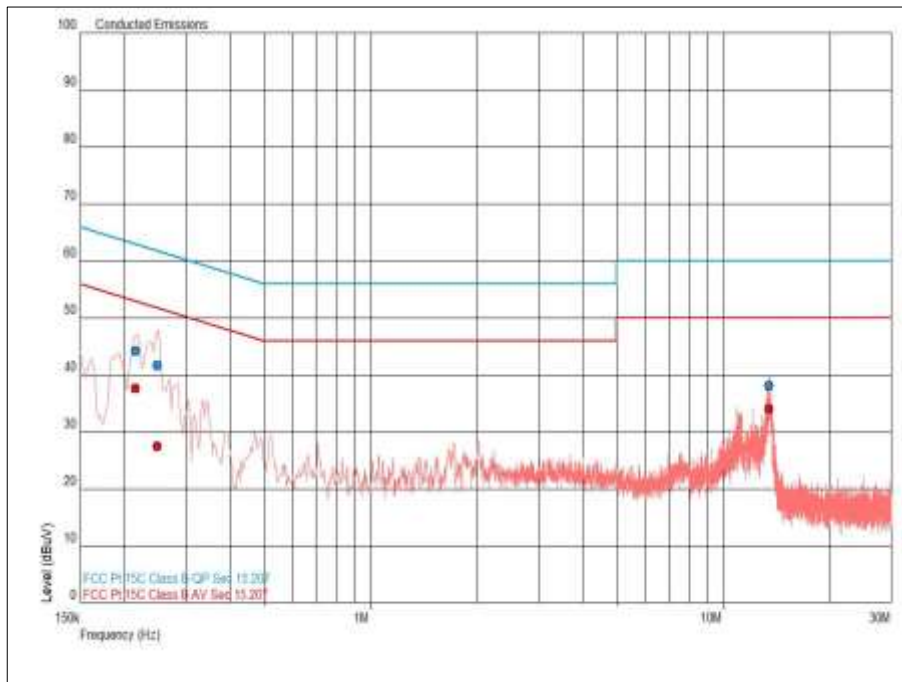


Figure 3 - Live Line - 150 kHz to 30 MHz



| 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) |
|-----------------|-------------------------|-------------------------|------------------------|----------------------------|----------------------------|---------------------------|
| 0.237 | 43.6 | 62.2 | -18.6 | 34.2 | 52.2 | -18.0 |
| 0.254 | 42.6 | 61.6 | -19.0 | 30.8 | 51.6 | -20.9 |
| 13.526 | 35.5 | 60.0 | -24.5 | 28.3 | 50.0 | -21.7 |

Table 8 - 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 10 dB below the CISPR Average test limit.

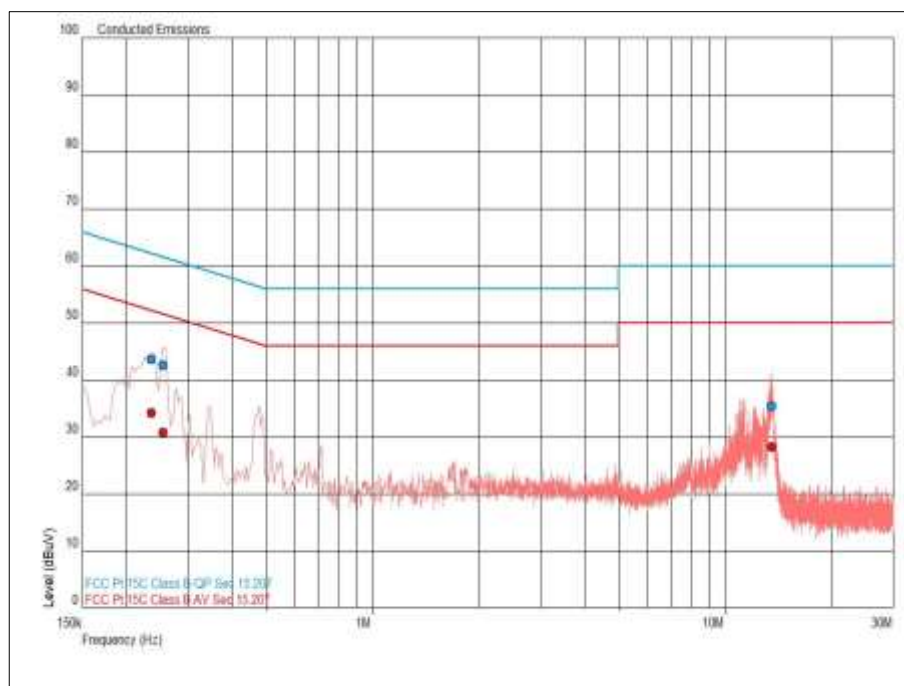


Figure 4 - Neutral Line - 150 kHz to 30 MHz



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) |
|-----------------|-------------------------|-------------------------|------------------------|----------------------------|----------------------------|---------------------------|
| 0.171 | 40.8 | 64.9 | -24.1 | 27.5 | 54.9 | -27.4 |
| 0.192 | 41.8 | 64.0 | -22.1 | 35.7 | 54.0 | -18.2 |
| 0.216 | 43.9 | 63.0 | -19.1 | 36.8 | 53.0 | -16.2 |
| 0.251 | 41.4 | 61.7 | -20.3 | 28.9 | 51.7 | -22.8 |
| 13.517 | 36.5 | 60.0 | -23.5 | 32.5 | 50.0 | -17.5 |

Table 9 - 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 10 dB below the CISPR Average test limit.

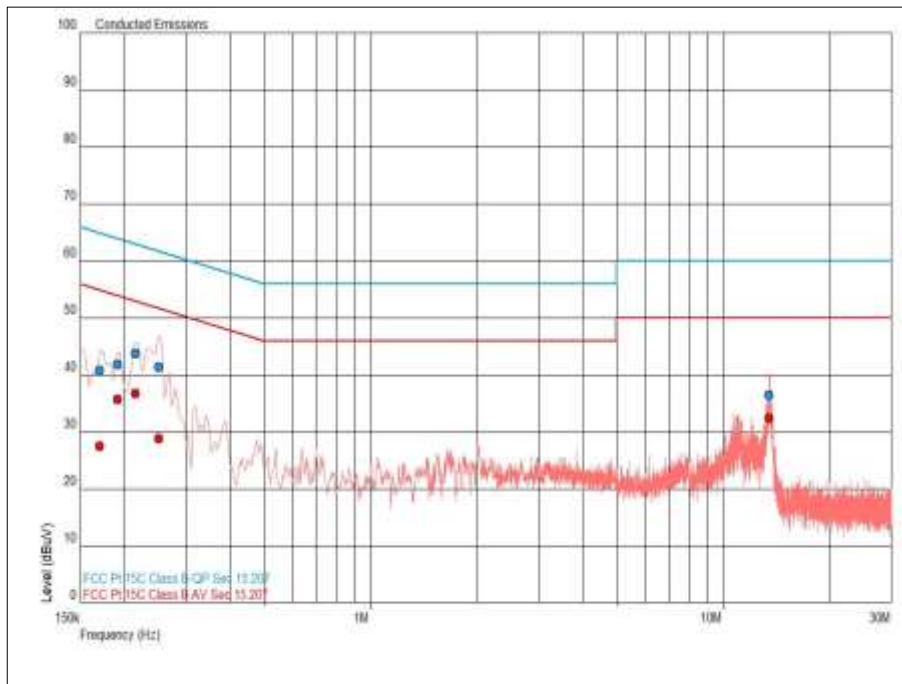


Figure 5 - Live Line - 150 kHz to 30 MHz



| 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) |
|-----------------|-------------------------|-------------------------|------------------------|----------------------------|----------------------------|---------------------------|
| 0.219 | 43.1 | 62.9 | -19.8 | 33.9 | 52.9 | -19.0 |
| 0.240 | 42.7 | 62.1 | -19.4 | 32.1 | 52.1 | -20.0 |
| 13.499 | 34.1 | 60.0 | -25.9 | 26.8 | 50.0 | -23.2 |

Table 10 - 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 10 dB below the CISPR Average test limit.

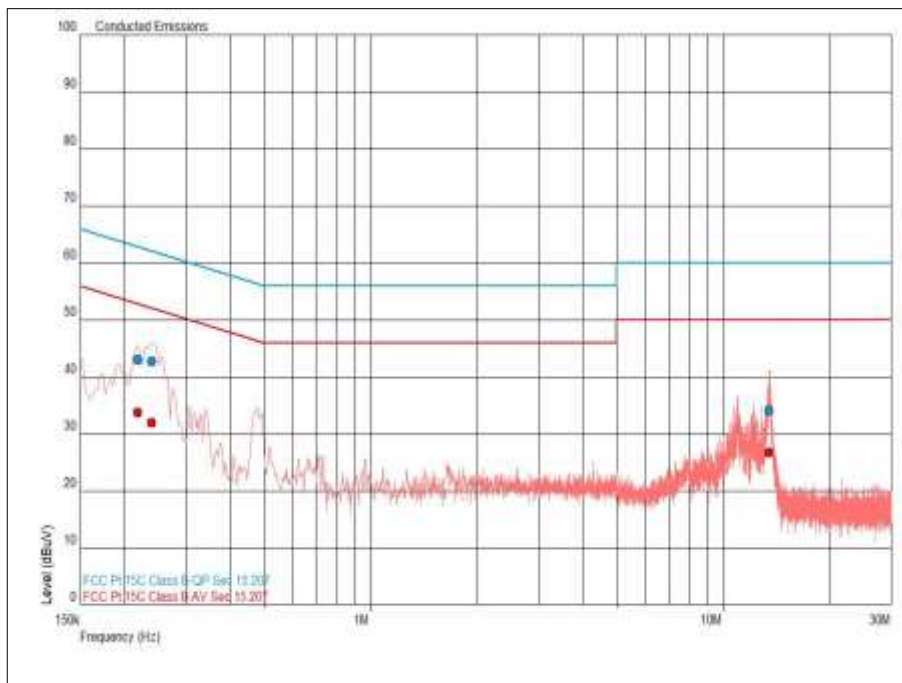


Figure 6 - Neutral Line - 150 kHz to 30 MHz

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 11

*Decreases with the logarithm of the frequency.



2.1.7 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 | - | N/A - Software |
| EMI Test Receiver | Rohde & Schwarz | ESU40 | 3506 | 12 | 14-Jan-2022 |
| Transient Limiter | Hewlett Packard | 11947A | 2377 | 12 | 26-Feb-2021 |
| Transient Limiter | Hewlett Packard | 11947A | 2378 | 12 | 12-Oct-2021 |
| 2 Meter Cable | Teledyne | PR90-088-2MTR | 5200 | 12 | 03-Sep-2021 |
| Cable (18GHz) | Junkosha | MWX221-04000NMSNMS/B | 5262 | 12 | 22-Jul-2021 |
| 8m N Type Cable | Junkosha | MWX221-08000NMSNMS/B | 5519 | 12 | 24-Mar-2021 |
| 8m N-Type Cable | Junkosha | MWX221-08000NMSNMS/B | 5520 | 12 | 24-Mar-2021 |
| 3 Phase Artificial Mains Network (LISN) | Rohde & Schwarz | ESH2-Z5 | 16 | 12 | 17-Apr-2021 |
| LISN | Rohde & Schwarz | ESH3-Z5 | 1390 | 12 | 27-Jan-2021 |
| Multimeter | Iso-tech | IDM101 | 2424 | 12 | 14-Dec-2021 |
| Thermo-Hygro-Barometer | PCE Instruments | PCE-THB 40 | 5604 | 12 | 08-Sep-2021 |

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.