

FCC and ISED Test Report

Apple Inc
Model: A2918

In accordance with FCC 47 CFR Part 15B, ICES-003 and ISED RSS-GEN
(2.4 GHz Bluetooth, 2.4 GHz Bluetooth Low Energy, 2.4 GHz WLAN, 5 GHz WLAN, Thread and 6 GHz WLAN)

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



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SIGNATURE

A. Lawson

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andrew Lawson	Chief Engineer, EMC	Authorised Signatory	10 May 2023

Signatures in this approval box have checked this document in line with the requirements of TUV SUD 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 15B, ICES-003 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	Callum Pennells	10 May 2023	<i>C Pennells</i>

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 15B: 2021, ICES-003: Issue 7: 2020 and ISED RSS-GEN: Issue 5 and A2 (2021-02) 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	10-May-2023

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2918
Serial Number(s)	DX2L73NQNJ
Hardware Version(s)	REV 1.0
Software Version(s)	22F15
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B: 2021 ICES-003: Issue 7: 2020 ISED RSS-GEN: Issue 5 and A2 (2021-02)
Start of Test	30-March-2023
Finish of Test	31-March-2023
Name of Engineer(s)	Callum Pennells
Related Document(s)	ANSI C63.4: 2014



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15B, ICES-003 and ISED RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15B	ICES-003	RSS-GEN			
Configuration and Mode: AC Powered - Transmitter Idle						
2.1	15.107	3.1	8.8	Conducted Disturbance at Mains Terminals	Pass	ANSI C63.4: 2014
2.2	15.109	3.2	7.1	Radiated Disturbance	Pass	ANSI C63.4: 2014

Table 2

1.4 Product Information

1.4.1 Technical Description

The equipment under test (EUT) was a portable laptop computer.

1.4.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Configuration and Mode: AC Powered - Transmitter Idle				
AC Power Port	2 m	Power	3 Core	No
Audio Output	2 m	Audio Output	3.5 mm Jack	No
Type-C	2 m	Data	USB Type - C	No
Type-C	2 m	Data	USB Type - C	No

Table 3

1.4.3 Test Configuration

Configuration	Description
AC Powered	The EUT was powered from a 120 V 60 Hz AC supply. A set of headphones was used to terminate the EUT's 3.5 mm audio jack port. A supplied support keyboard and cable were used to terminate the USB-C port on the left. A supplied support mouse and cable were used to terminate the USB-C Port on the right. A monitor was used to terminate the HDMI port.

Table 4

1.4.4 Modes of Operation

Mode	Description
Transmitter Idle	The EUT's intentional transmitters were turned Off. The EUT was configured to display video on the EUT screen, whilst playing audio through the headphones. The display was set to maximum brightness and sleep mode was disabled

Table 5

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: A2918, Serial Number: DX2L73NQNJ			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 6

1.7 Test Location

TÜV SÜD conducted the following tests at our Octagon House Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: AC Powered - Transmitter Idle		
Conducted Disturbance at Mains Terminals	Callum Pennells	UKAS
Radiated Disturbance	Callum Pennells	UKAS

Table 7

Office Address:

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire
PO15 5RL
United Kingdom



2 Test Details

2.1 Conducted Disturbance at Mains Terminals

2.1.1 Specification Reference

FCC 47 CFR Part 15B Clause 15.107
ICES-003 Clause 3.1
ISED RSS-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

A2918, S/N: DX2L73NQNJ - Modification State 0

2.1.3 Date of Test

30-March-2023

2.1.4 Test Method

The EUT was setup according to ANSI C63.4, clause 5.2.

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 (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

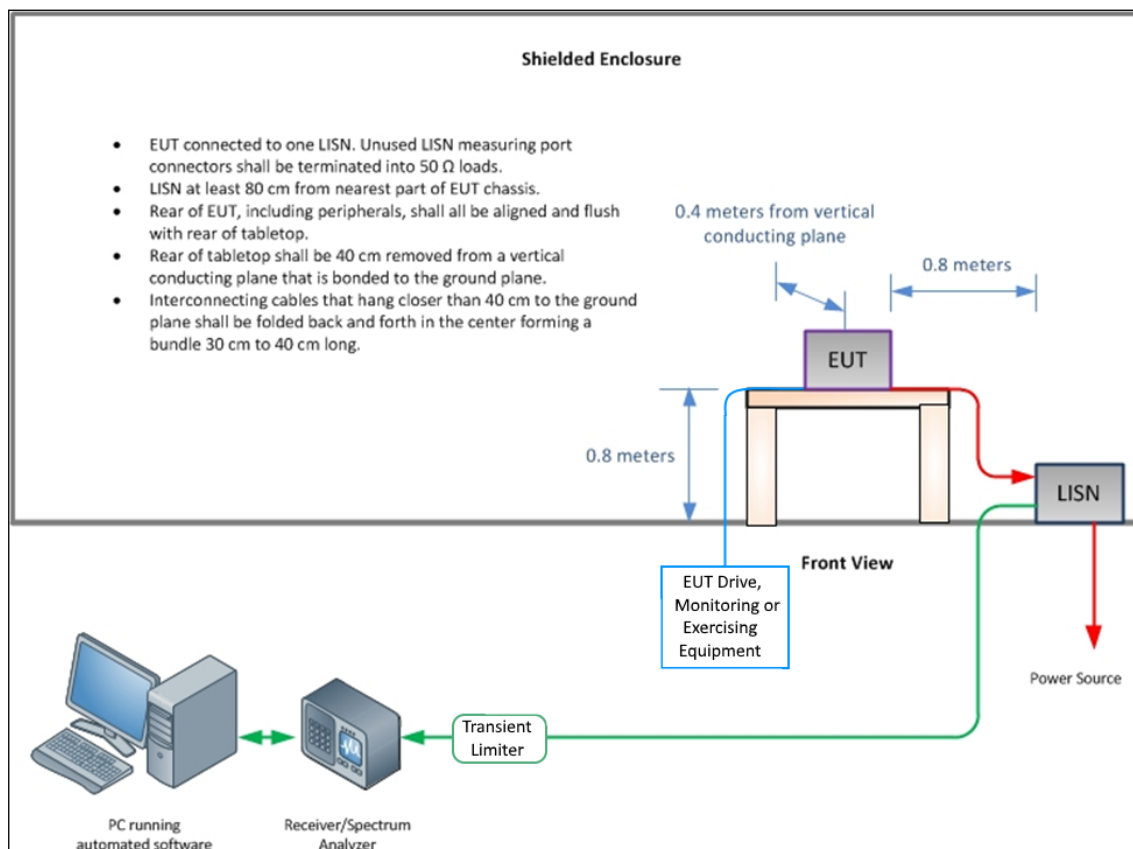


Figure 1 - Conducted Disturbance

2.1.7 Environmental Conditions

Ambient Temperature 20.9 °C
Relative Humidity 41.2 %
Atmospheric Pressure 1004.0 mbar

2.1.8 Specification Limits

Required Specification Limits - Class B			
Line Under Test	Frequency Range (MHz)	Quasi-Peak Test Limit (dB μ V)	CISPR Average Test Limit (dB μ V)
AC Power Port	0.15 to 0.5	66 to 56 ⁽¹⁾	56 to 46 ⁽¹⁾
	0.5 to 5	56	46
	5 to 30	60	50
Supplementary information: Note 1. Decreases with the logarithm of the frequency.			

Table 8

2.1.9 Test Results

Results for Configuration and Mode: AC Powered - Transmitter Idle.

This test was performed to the requirements of the Class B limits.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

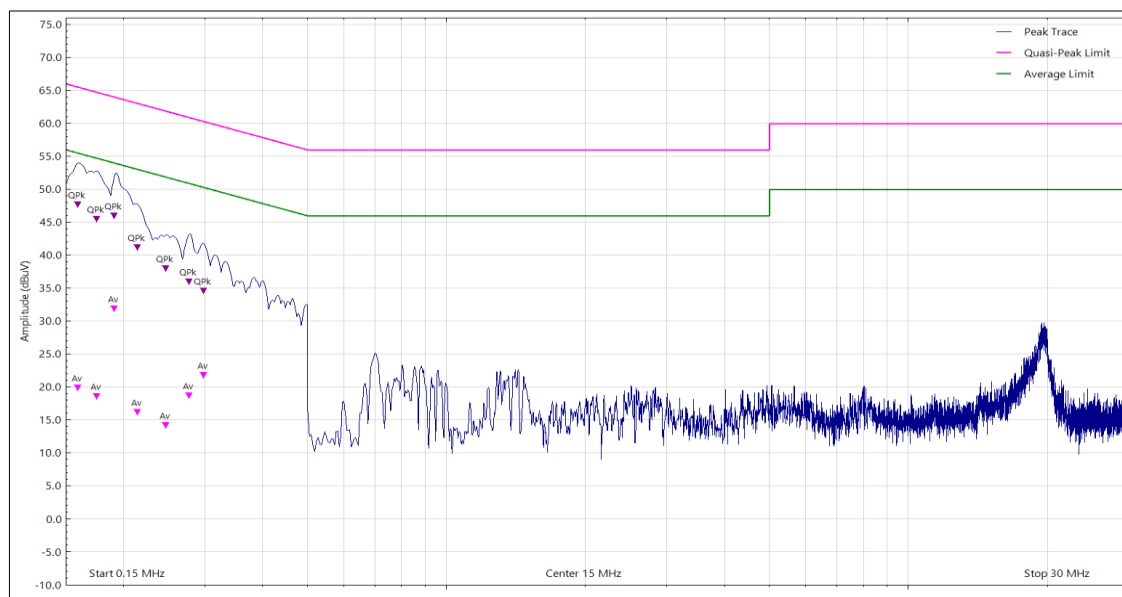


Figure 2 - Graphical Results - AC Power Neutral Line

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
0.159	46.95	65.50	-18.55	Q-Peak	0	100	Horizontal
0.159	19.21	55.50	-36.29	CISPR Avg	0	100	Horizontal
0.175	44.78	64.70	-19.92	Q-Peak	0	100	Horizontal
0.175	17.89	54.70	-36.81	CISPR Avg	0	100	Horizontal
0.191	31.16	54.00	-22.84	CISPR Avg	0	100	Horizontal
0.191	45.33	64.00	-18.67	Q-Peak	0	100	Horizontal
0.214	40.52	63.00	-22.48	Q-Peak	0	100	Horizontal
0.214	15.48	53.00	-37.52	CISPR Avg	0	100	Horizontal
0.247	37.28	61.80	-24.52	Q-Peak	0	100	Horizontal
0.247	13.55	51.80	-38.25	CISPR Avg	0	100	Horizontal
0.277	18.03	50.90	-32.87	CISPR Avg	0	100	Horizontal
0.277	35.30	60.90	-25.60	Q-Peak	0	100	Horizontal
0.298	21.12	50.30	-29.18	CISPR Avg	0	100	Horizontal
0.298	33.87	60.30	-26.43	Q-Peak	0	100	Horizontal

Table 9

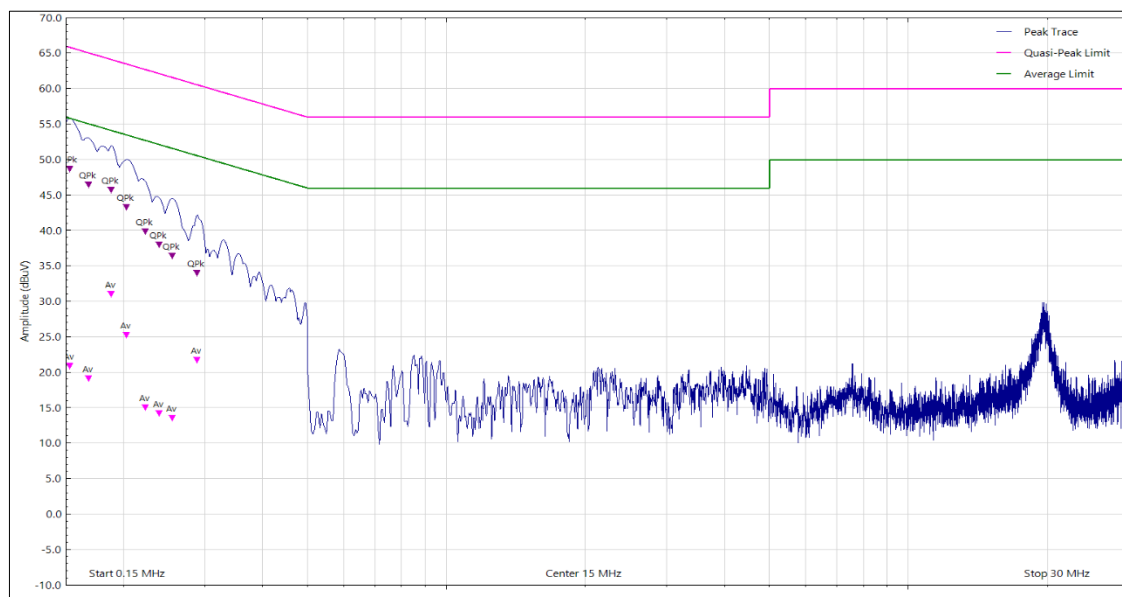


Figure 3 - Graphical Results - AC Power Live Line

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
0.153	48.00	65.80	-17.80	Q-Peak	0	100	Horizontal
0.153	20.25	55.80	-35.55	CISPR Avg	0	100	Horizontal
0.168	45.82	65.00	-19.18	Q-Peak	0	100	Horizontal
0.168	18.52	55.00	-36.48	CISPR Avg	0	100	Horizontal
0.188	45.05	64.10	-19.05	Q-Peak	0	100	Horizontal
0.188	30.34	54.10	-23.76	CISPR Avg	0	100	Horizontal
0.203	24.63	53.50	-28.87	CISPR Avg	0	100	Horizontal
0.203	42.61	63.50	-20.89	Q-Peak	0	100	Horizontal
0.223	14.39	52.70	-38.31	CISPR Avg	0	100	Horizontal
0.223	39.16	62.70	-23.54	Q-Peak	0	100	Horizontal
0.239	13.60	52.10	-38.50	CISPR Avg	0	100	Horizontal
0.239	37.35	62.10	-24.75	Q-Peak	0	100	Horizontal
0.255	35.73	61.60	-25.87	Q-Peak	0	100	Horizontal
0.255	12.94	51.60	-38.66	CISPR Avg	0	100	Horizontal
0.289	33.34	60.60	-27.26	Q-Peak	0	100	Horizontal
0.289	21.12	50.60	-29.48	CISPR Avg	0	100	Horizontal

Table 10



2.1.10 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 Expires
Screened Room (1)	Rainford	Rainford	1541	12	01-Jul-2023
Emissions Software	TUV SUD	EmX V3.1.11	5125	-	Software
Test Receiver	Rohde & Schwarz	ESW44	5379	12	01-Aug-2023
Transient Limiter	Hewlett Packard	11947A	2378	12	25-Oct-2023
Cable (N(m)-N(m), 5 m)	Teledyne	PR90-088-5MTR	5206	12	04-Aug-2023
LISN (CISPR 16, Single Phase)	Chase	MN 2050	336	12	04-Jul-2023
LISN (CISPR 16, Single Phase)	Rohde & Schwarz	ESH3-Z5	1390	12	02-Feb-2024

Table 11

2.2 Radiated Disturbance

2.2.1 Specification Reference

FCC 47 CFR Part 15B, Clause 15.109
ICES-003, Clause 3.2
ISED RSS-GEN, Clause 7.1

2.2.2 Equipment Under Test and Modification State

A2918, S/N: DX2L73NQNJ - Modification State 0

2.2.3 Date of Test

31-March-2023

2.2.4 Test Method

The EUT was set up on a non-conductive table 0.8 m above a reference ground plane within a semi-anechoic chamber on a remotely controlled turntable.

A pre-scan of the EUT emissions profile using a peak detector was made at a 3 m antenna distance whilst varying the antenna-to-EUT azimuth and polarisation.

For an EUT which could reasonably be used in multiple planes, pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

Using a list of the highest emissions detected during the pre-scan along with their bearing and associated antenna polarisation, the EUT was then formally measured using a Quasi-Peak, Peak or CISPR Average detector as appropriate.

The readings were maximised by adjusting the antenna height, polarisation and turntable azimuth, in accordance with the specification.

2.2.5 Example Calculation

Below 1 GHz:

Quasi-Peak level (dB μ V/m) = Receiver level (dB μ V) + Correction Factor (dB/m)
Margin (dB) = Quasi-Peak level (dB μ V/m) - Limit (dB μ V/m)

Above 1 GHz:

CISPR Average level (dB μ V/m) = Receiver level (dB μ V) + Correction Factor (dB/m)
Margin (dB) = CISPR Average level (dB μ V/m) - Limit (dB μ V/m)

Peak level (dB μ V/m) = Receiver level (dB μ V) + Correction Factor (dB/m)
Margin (dB) = Peak level (dB μ V/m) - Limit (dB μ V/m)

2.2.9 Test Results

Results for Configuration and Mode: AC Powered - Transmitter Idle.

This test was performed to the requirements of the Class B limits.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Highest frequency generated or used within the EUT: 7125 MHz

Which necessitates an upper frequency test limit of: 36 GHz

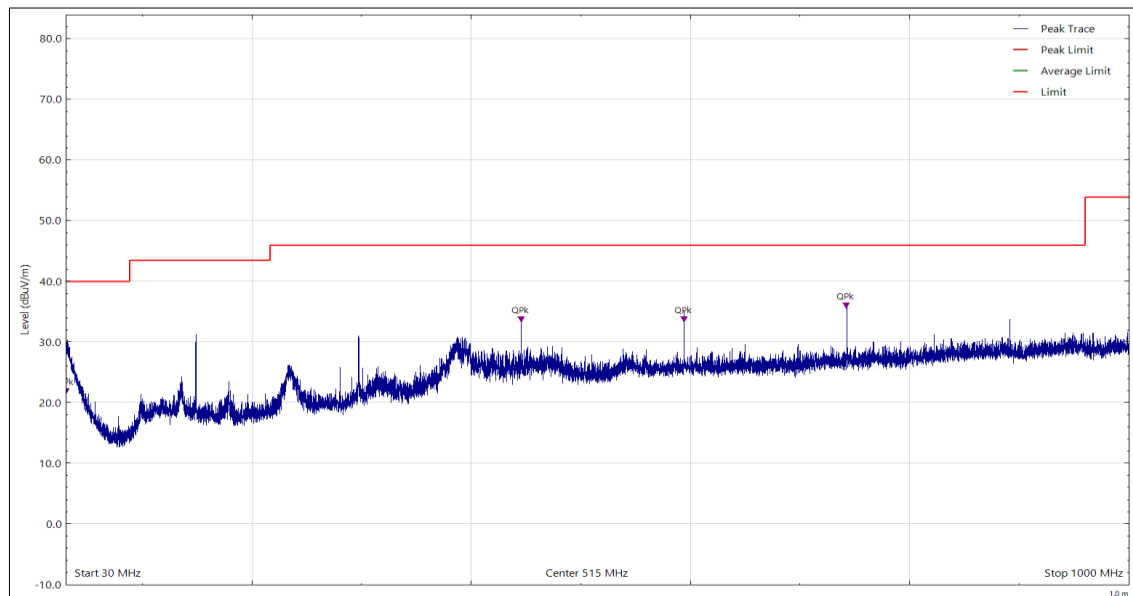


Figure 5 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
30.601	21.18	40.00	-18.82	Q-Peak	360	110	Horizontal
445.492	33.01	46.00	-12.99	Q-Peak	339	100	Horizontal
594.004	33.02	46.00	-12.98	Q-Peak	84	229	Horizontal
742.513	35.25	46.00	-10.75	Q-Peak	199	103	Horizontal

Table 13

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 test limit.

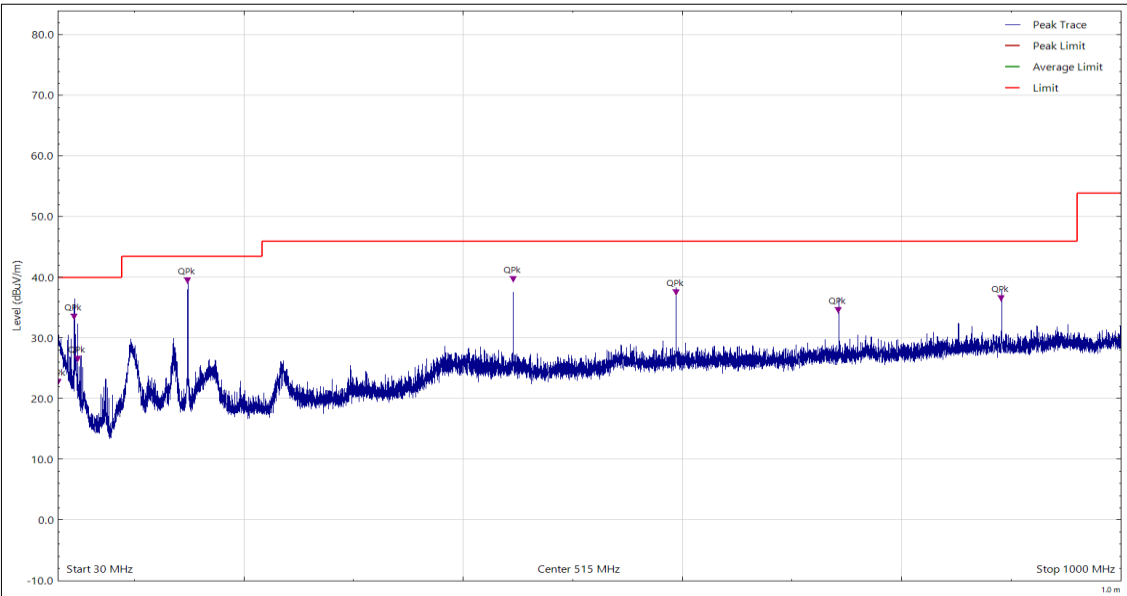


Figure 6 - 30 MHz to 1 GHz, Quasi-Peak, Vertical

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
30.207	22.00	40.00	-18.00	Q-Peak	337	100	Vertical
44.999	32.75	40.00	-7.25	Q-Peak	217	100	Vertical
47.999	25.83	40.00	-14.17	Q-Peak	350	105	Vertical
148.495	38.74	43.50	-4.76	Q-Peak	156	100	Vertical
445.494	38.96	46.00	-7.04	Q-Peak	154	109	Vertical
593.995	36.78	46.00	-9.22	Q-Peak	183	100	Vertical
742.495	33.86	46.00	-12.14	Q-Peak	216	100	Vertical
891.014	35.82	46.00	-10.18	Q-Peak	147	100	Vertical

Table 14

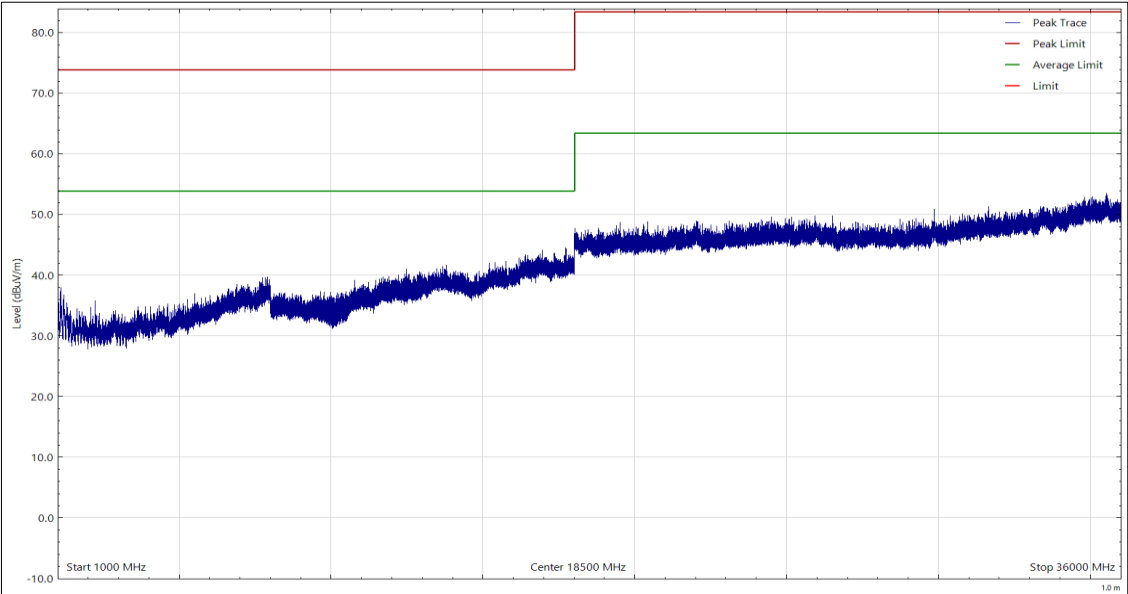


Figure 7 - 1 GHz to 36 GHz, Peak and CISPR Average, Horizontal

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
*							

Table 15

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.

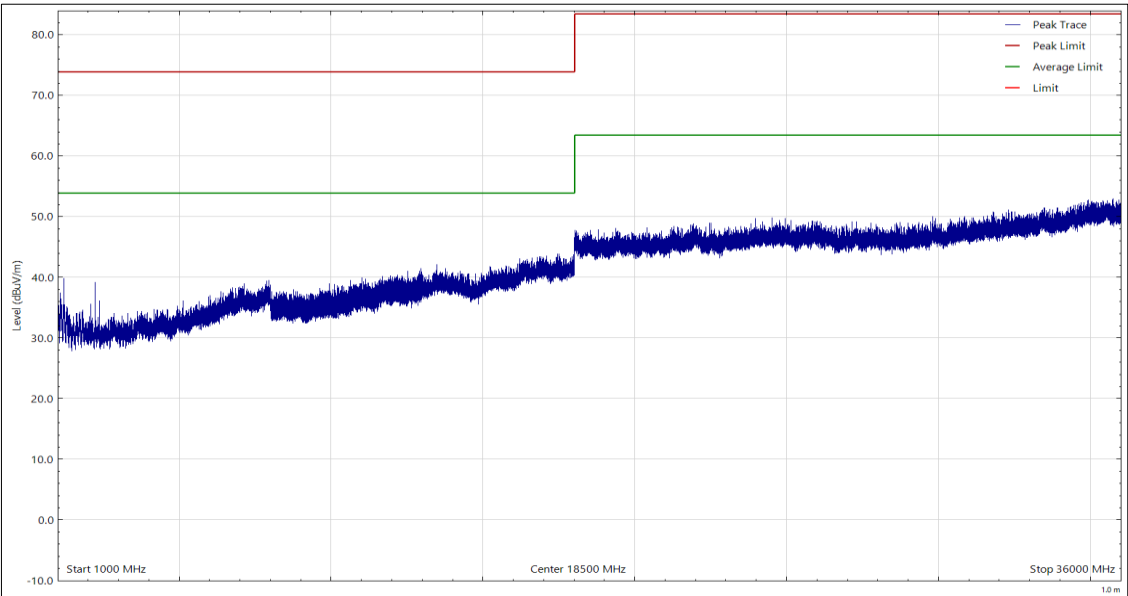


Figure 8 - 1 GHz to 36 GHz, Peak and CISPR Average, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Angle (°)	Height (cm)	Polarisation	Orientation
*							

Table 16

*No final measurements were made as all peak emissions seen above the measurement system noise floor during the pre-scan were greater than 10 dB below the test limit.



2.2.10 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 Expires
Screened Room (12)	MVG	EMC-3	5621	36	11-Aug-2023
Emissions Software	TUV SUD	EmX V3.1.11	5125	-	Software
Test Receiver	Rohde & Schwarz	ESU40	3506	12	30-Mar-2024
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Cable (N(m)-N(m), 8 m)	Teledyne	PR90-088-8MTR	5450	6	23-Apr-2023
Cable (SMA to N-Type, 2 m)	Junkosha	MWX241/B	5817	6	04-Aug-2023
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5511	12	14-Apr-2023
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5512	12	14-Apr-2023
Pre-Amplifier (1 GHz to 18 GHz)	Schwarzbeck	BBV 9718 C	5350	12	20-Oct-2023
Pre-Amplifier (8 GHz to 18 GHz)	Phase One	PS04-0086	1533	12	20-Feb-2024
Pre-Amplifier (18 GHz to 40 GHz)	Narda	NARDA DB02-0447	237	12	21-Oct-2023
Antenna (Bilog with attenuator, 30 MHz to 3 GHz)	Schaffner	CBL6143	287	24	02-Dec-2024
Antenna (DRG, 1 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	5611	12	16-Oct-2023
Antenna (DRG, 7.5 GHz to 18 GHz)	Schwarzbeck	HWRD750	5348	12	16-Oct-2023
Antenna (DRG, 18 GHz to 40 GHz)	Link Microtek Ltd	AM180HA-K-TU2	230	24	23-Sep-2024

Table 17

TU - Traceability Unscheduled



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5474	12	21-Apr-2023

Table 18



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
Conducted Disturbance at Mains Terminals	150 kHz to 30 MHz, LISN, ± 3.7 dB
Radiated Disturbance	30 MHz to 1 GHz, Bilog Antenna, ± 5.2 dB 1 GHz to 40 GHz, Horn Antenna, ± 6.3 dB

Table 19

Worst case error for both Time and Frequency measurement 12 parts in 10^6 .

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2021, Clause 4.4.3 (Procedure 2). The measurement results are directly compared with the test limit to determine conformance with the requirements of the standard.

Risk: The uncertainty of measurement about the measured result is negligible with regard to the final pass/fail decision. The measurement result can be directly compared with the test limit to determine conformance with the requirement (compare IEC Guide 115). The level of risk to falsely accept and falsely reject items is further described in ILAC-G8.