FCC and ISED Test Report

Apple Inc
Model: A3241

In accordance with FCC 47 CFR Part 15B, ICES-003 and ISED RSS-GEN

TUV SUD Limited Digitally signed by TUV SUD Limited Date: 2024.11.18 16:10:52 Z

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FCC ID: BCGA3241 IC: 579C-A3241

COMMERCIAL-IN-CONFIDENCE

Document 75962766-35 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Connor Lee	Senior Engineer	Authorised Signatory	18 November 2024

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 15B and 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	18 November 2024	

FCC Accreditation
492497/UK2010 Octagon House, Fareham Test Laboratory

ISED Accreditation
12669A/UK0003 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, ICES-003 and ISED RSS-GEN: 2023, Issue 7: 2020 and Issue 5 and A2 (2021-02) for the tests detailed in section 1.3.

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Contents

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	18-November-2024

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
EUT/Sample Identification	Refer to section 1.6
Test Specification/Issue/Date	FCC 47 CFR Part 15B, ICES-003 and ISED RSS-GEN: 2023, Issue 7: 2020 and Issue 5 and A2 (2021-02)
Start of Test	24-October-2024
Finish of Test	30-October-2024
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
Configuration and Mode: AC Powered - Transmitter Idle				
2.1	15.107, 3.1 and 8.8	Conducted Disturbance at Mains Terminals	Pass	ANSI C63.4: 2014
2.2	15.109, 3.2 and 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	AC to DC power adapter with USB-C output.	No
AC Power Port	2 m	Power	3 Pin Power Cable	No
USB 1 Port	1 m	Data	USB Type C	No
USB 2 Port	1 m	Data	USB Type C	No
Audio Jack Port	1 m	Data	Audio Jack 3.5mm	No

Table 3

1.4.3 Test Configuration

Configuration	Description
AC Powered	The EUT was powered from a 120 V 60 Hz AC supply via an AC to DC power adapter with USB-C output. PSU model: A2164 The Audio Jack Port was unterminated. A mouse was used to terminate the USB 1 Port. A keyboard was used to terminate the USB 2 Port.

Table 4

1.4.4 Modes of Operation

Mode	Description
Transmitter Idle	The EUT was powered with all internal transmitters disabled.

Table 5

1.5 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.6 Identification of the EUT

The table below details identification of the EUT(s) that have been used to carry out the testing within this report.

Model: A3241		
Serial Number	Hardware Version	Software Version
KJJKFX1X6V	REV1.0	24C62

Table 6

1.7 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: A3241, Serial Number: KJJKFX1X6V			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 7

1.8 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 8

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, ICES-003 and ISED RSS-GEN, Clause 15.107, 3.1 and 8.8

2.1.2 Equipment Under Test and Modification State

A3241, S/N: KJJKFX1X6V - Modification State 0

2.1.3 Date of Test

28-October-2024 to 29-October-2024

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.

A Peak detector pre-scan of the EUT emissions profile was measured across the appropriate frequency range.

Where all pre-scan peak emissions measured were greater than 20 dB below the CISPR Average test limit, no final measurements were made in accordance with ANSI C63.4.

Where any pre-scan peak emissions were within 20 dB of the CISPR Average test limit, the six highest pre-scan emissions seen across the frequency range were measured for at least 15 seconds using a Peak, Quasi-Peak or CISPR Average detector as appropriate to the test limit being measured against.

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

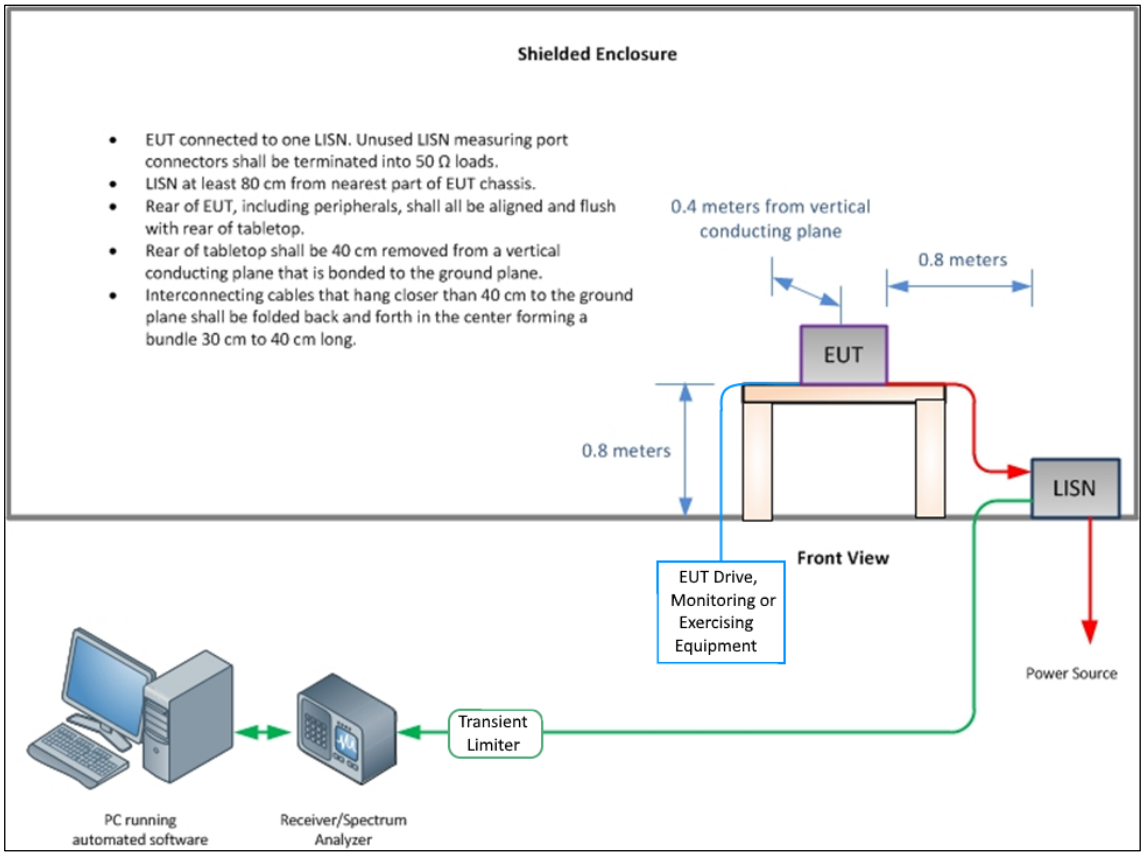

Figure 1 - Conducted Disturbance

2.1.7 Environmental Conditions

Ambient Temperature	21.0 – 21.7 °C
Relative Humidity	57.9 - 59.2 %
Atmospheric Pressure	1013.0 - 1015.0 mbar

2.1.8 Specification Limits

Required Specification Limits - Class B			
Line Under Test	Frequency Range (MHz)	Quasi-Peak Test Limit (dBµV)	CISPR Average Test Limit (dBµV)
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 9

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.

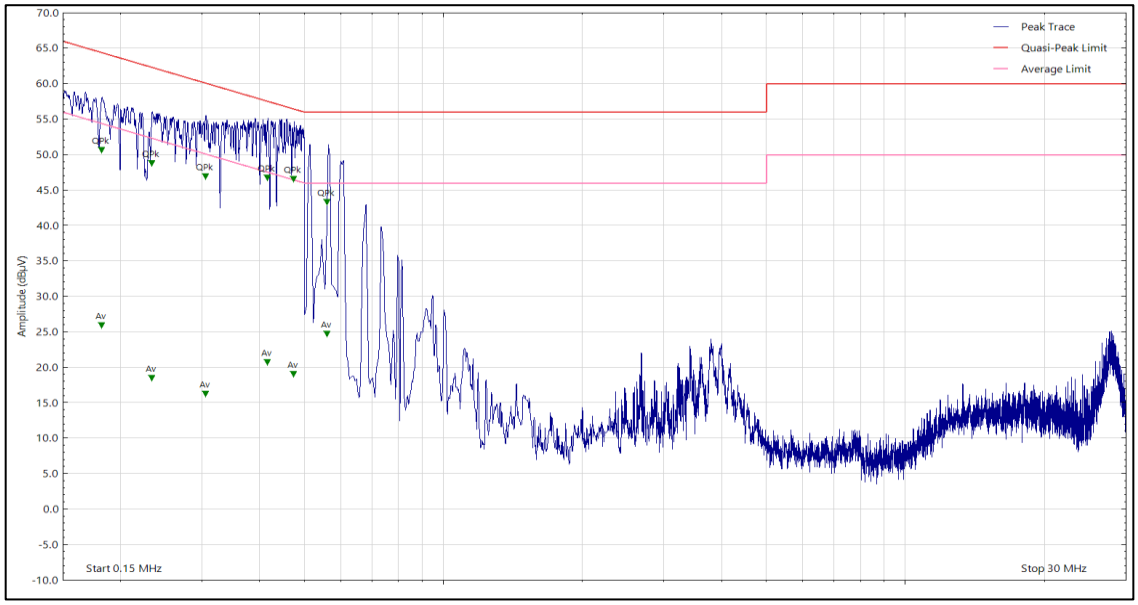

Figure 2 - Graphical Results – AC Power Port Live Line

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.182	49.95	64.40	-14.45	Q-Peak
0.182	25.23	54.40	-29.17	CISPR Avg
0.234	48.15	62.30	-14.15	Q-Peak
0.234	17.86	52.30	-34.44	CISPR Avg
0.306	46.27	60.10	-13.83	Q-Peak
0.306	15.61	50.10	-34.49	CISPR Avg
0.416	20.09	47.50	-27.41	CISPR Avg
0.416	46.11	57.50	-11.39	Q-Peak
0.474	45.93	56.40	-10.47	Q-Peak
0.474	18.38	46.40	-28.02	CISPR Avg
0.561	24.03	46.00	-21.97	CISPR Avg
0.561	42.63	56.00	-13.37	Q-Peak

Table 10

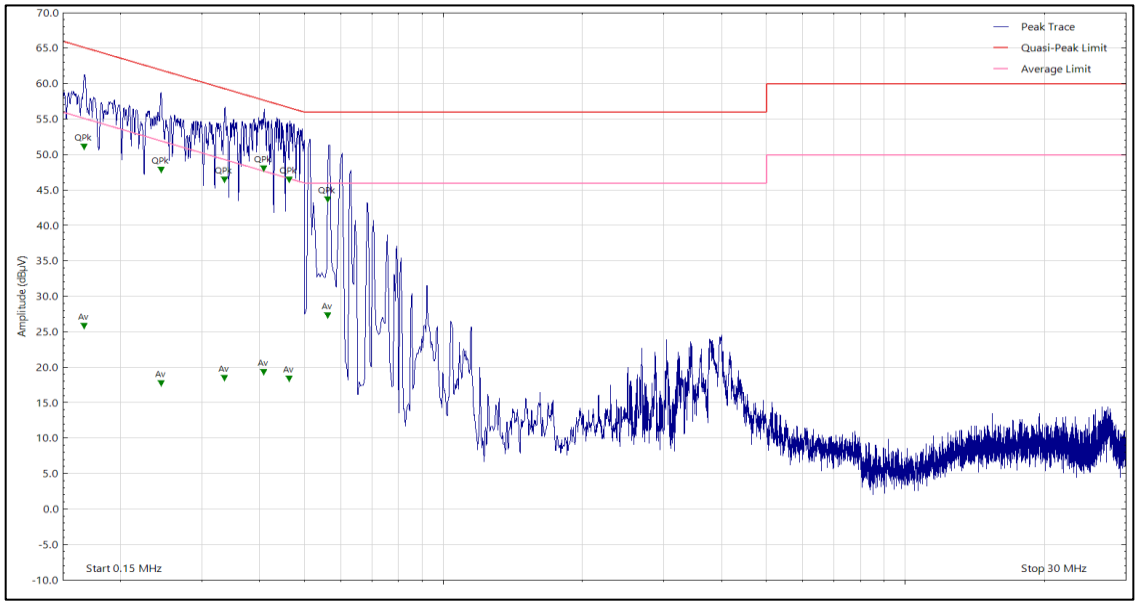

Figure 3 - Graphical Results – AC Power Port Neutral Line

Frequency (MHz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
0.167	25.16	55.10	-29.94	CISPR Avg
0.167	50.42	65.10	-14.68	Q-Peak
0.245	17.04	51.90	-34.86	CISPR Avg
0.245	47.22	61.90	-14.68	Q-Peak
0.336	17.87	49.30	-31.43	CISPR Avg
0.336	45.80	59.30	-13.50	Q-Peak
0.409	18.66	47.70	-29.04	CISPR Avg
0.409	47.41	57.70	-10.29	Q-Peak
0.463	17.76	46.60	-28.84	CISPR Avg
0.463	45.84	56.60	-10.76	Q-Peak
0.562	43.02	56.00	-12.98	Q-Peak
0.562	26.65	46.00	-19.35	CISPR Avg

Table 11

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
3m Semi-Anechoic Chamber	MVG	EMC Chamber 12	5621	36	07-Aug-2026
Emissions Software	TUV SUD	EmX V3.4.2	5125	-	Software
Test Receiver	Rohde & Schwarz	ESU40	3506	12	17-Apr-2025
Transient Limiter	Hewlett Packard	11947A	1032	12	02-Jan-2025
Cable (N-Type to N-Type, 2 m)	Junkosha	MWX221-02000AMSAMS/B	5729	6	02-Feb-2025
Cable (N-Type to N-Type, 8 m)	Junkosha	MWX221-08000NMSNMS/B	6321	12	04-Feb-2025
LISN (CISPR 16, Single Phase)	Rohde & Schwarz	ESH3-Z5	1390	12	01-Feb-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5478	12	13-May-2025

Table 12

2.2 Radiated Disturbance

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

A3241, S/N: KJJKFX1X6V - Modification State 0

2.2.3 Date of Test

24-October-2024 to 30-October-2024

2.2.4 Test Method

The EUT was set up in a semi-anechoic chamber in the centre of a remotely controlled turntable and placed on a non-conductive table 0.8 m above a reference ground plane.

A Peak detector pre-scan of the EUT emissions profile was measured across the appropriate frequency range while varying the antenna-to-EUT azimuth and polarisation. Measurements were made using a 3 m distance between the declared antenna measurement point and the EUT.

Where all pre-scan peak emissions measured were greater than 20 dB below the test limit, no final measurements were made in accordance with ANSI C63.4.

Where any pre-scan peak emissions were within 20 dB of the test limit, the six highest pre-scan peak emissions seen across the frequency range were maximised by adjusting antenna height, polarisation and angle and then measured for at least 15 seconds using a Peak, Quasi-Peak or CISPR Average detector as appropriate to the test limit being measured against.

2.2.5 Example Calculation

Below 1 GHz:

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

Above 1 GHz:

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

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

2.2.6 Example Test Setup Diagram

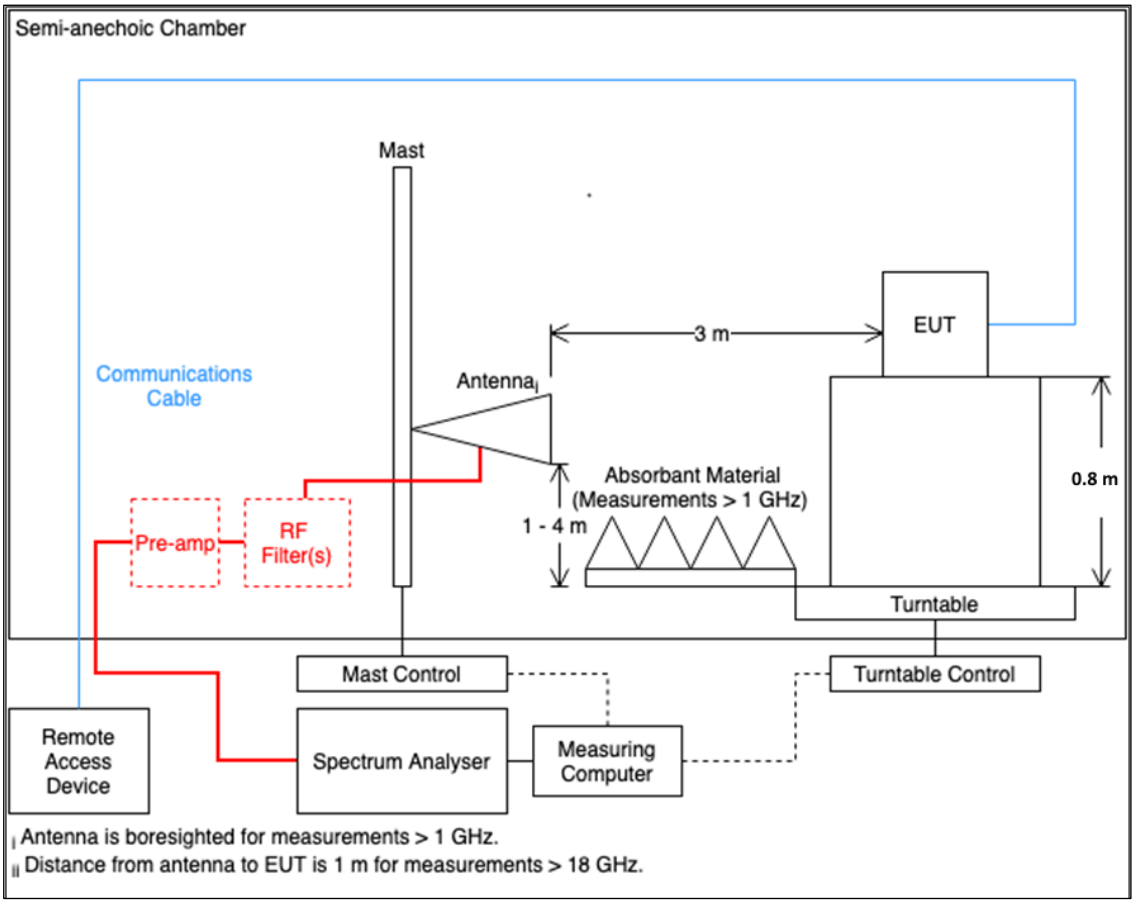

Figure 4 - Radiated Disturbance Example Test Setup

2.2.7 Environmental Conditions

Ambient Temperature	20.9 – 22.5°C
Relative Humidity	53.0 – 58.1 %
Atmospheric Pressure	1013.0 - 1020.0 mbar

2.2.8 Specification Limits

Required Specification Limits, Field Strength - Class B Test Limit at a 3 m Measurement Distance		
Frequency Range (MHz)	Test Limit (µV/m)	Test Limit (dBµV/m)
30 to 88	100	40.0
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0
Supplementary information: Note 1. A Quasi-peak detector is to be used for measurements below 1 GHz. Note 2. A CISPR Average detector is to be used for measurements above 1 GHz. Note 3. The Peak test limit above 1 GHz is 20 dB higher than the CISPR Average test limit.		

Table 13

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.

The EUT has a highest internally generated frequency of: 6 GHz
Which necessitates an upper frequency test limit of: 30 GHz (Tested to 40 GHz).

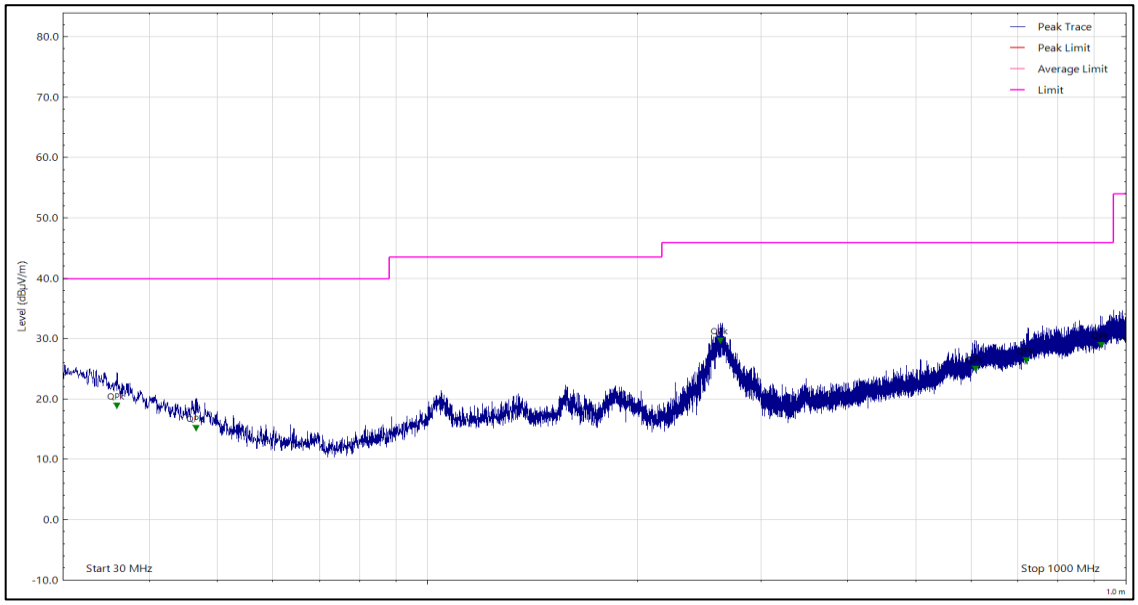

Figure 5 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
35.868	18.15	40.00	-21.85	Q-Peak	331	172	Horizontal
46.586	14.45	40.00	-25.55	Q-Peak	287	203	Horizontal
262.441	28.92	46.00	-17.08	Q-Peak	201	101	Horizontal
609.485	24.28	46.00	-21.72	Q-Peak	332	100	Horizontal
720.856	25.65	46.00	-20.35	Q-Peak	226	282	Horizontal
921.741	28.17	46.00	-17.83	Q-Peak	360	100	Horizontal

Table 14

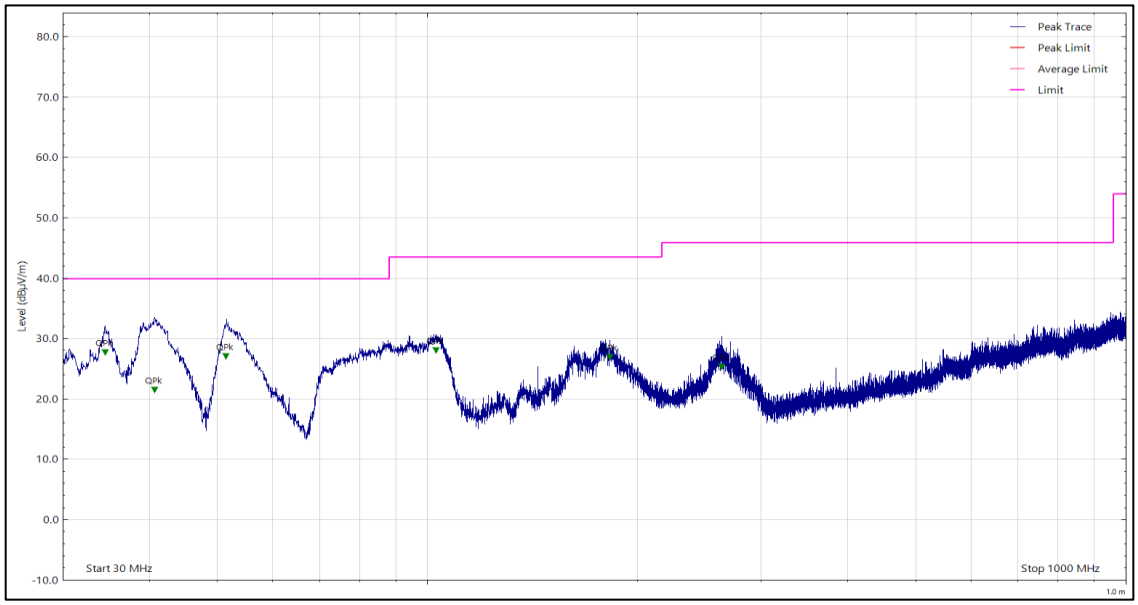

Figure 6 - 30 MHz to 1 GHz, Quasi-Peak, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
34.491	27.01	40.00	-12.99	Q-Peak	298	100	Vertical
40.598	20.70	40.00	-19.30	Q-Peak	358	105	Vertical
51.436	26.34	40.00	-13.66	Q-Peak	57	105	Vertical
102.750	27.26	43.50	-16.24	Q-Peak	74	100	Vertical
182.206	26.19	43.50	-17.31	Q-Peak	287	100	Vertical
263.758	24.51	46.00	-21.49	Q-Peak	12	100	Vertical

Table 15

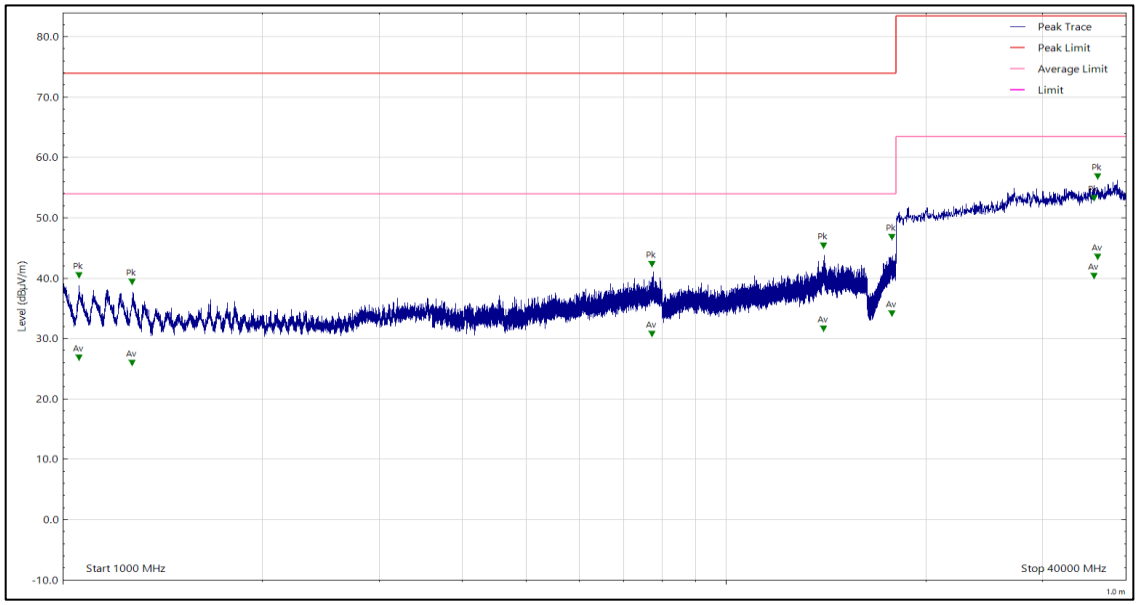

Figure 7 - 1 GHz to 40 GHz, Peak and CISPR Average, Horizontal

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
1058.000	39.71	74.00	-34.29	Peak	244	250	Horizontal
1058.000	26.06	54.00	-27.94	CISPR Avg	244	250	Horizontal
1273.000	38.66	74.00	-35.34	Peak	83	100	Horizontal
1273.000	25.22	54.00	-28.78	CISPR Avg	83	100	Horizontal
7729.500	41.56	74.00	-32.44	Peak	256	100	Horizontal
7729.500	30.06	54.00	-23.94	CISPR Avg	256	100	Horizontal
14033.500	30.92	54.00	-23.08	CISPR Avg	32	100	Horizontal
14033.500	44.65	74.00	-29.35	Peak	32	100	Horizontal
17774.500	46.05	74.00	-27.95	Peak	220	243	Horizontal
17774.500	33.36	54.00	-20.64	CISPR Avg	220	243	Horizontal
35842.000	52.51	83.50	-30.99	Peak	318	100	Horizontal
35842.000	39.60	63.50	-23.90	CISPR Avg	318	100	Horizontal
36260.000	56.10	83.50	-27.40	Peak	39	100	Horizontal
36260.000	42.80	63.50	-20.70	CISPR Avg	39	100	Horizontal

Table 16

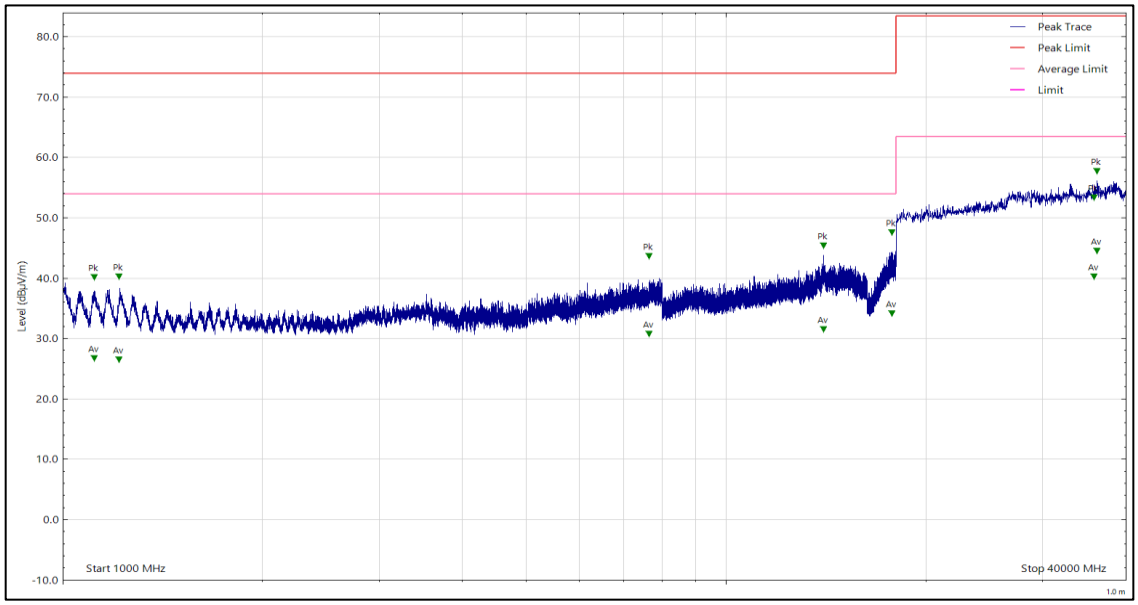

Figure 8 - 1 GHz to 40 GHz, Peak and CISPR Average, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
1116.000	39.45	74.00	-34.55	Peak	308	100	Vertical
1116.000	26.00	54.00	-28.00	CISPR Avg	308	100	Vertical
1217.500	39.49	74.00	-34.51	Peak	356	346	Vertical
1217.500	25.72	54.00	-28.28	CISPR Avg	356	346	Vertical
7652.500	42.91	74.00	-31.09	Peak	53	340	Vertical
7652.500	30.04	54.00	-23.96	CISPR Avg	53	340	Vertical
14013.500	44.64	74.00	-29.36	Peak	274	176	Vertical
14013.500	30.79	54.00	-23.21	CISPR Avg	274	176	Vertical
17771.000	46.82	74.00	-27.18	Peak	0	104	Vertical
17771.000	33.38	54.00	-20.62	CISPR Avg	0	104	Vertical
35864.000	52.66	83.50	-30.84	Peak	61	100	Vertical
35864.000	39.56	63.50	-23.94	CISPR Avg	61	100	Vertical
36172.000	56.96	83.50	-26.54	Peak	95	100	Vertical
36172.000	43.73	63.50	-19.77	CISPR Avg	95	100	Vertical

Table 17

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
3m Semi-Anechoic Chamber	MVG	EMC Chamber 12	5621	36	07-Aug-2026
Emissions Software	TUV SUD	EmX V3.4.2	5125	-	Software
Test Receiver	Rohde & Schwarz	ESU40	3506	12	17-Apr-2025
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Cable (N-Type to N-Type, 2 m)	Junkosha	MWX221-02000AMSAMS/B	5729	6	02-Feb-2025
Cable (K-Type to K-Type, 2 m)	Junkosha	MWX241/B	5909	12	18-Feb-2025
Cable (N-Type to N-Type, 8 m)	Junkosha	MWX221-08000NMSNMS/B	6321	12	04-Feb-2025
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	01-Feb-2025
Pre-Amplifier (1 GHz to 18 GHz)	Schwarzbeck	BBV 9718 C	5350	12	01-Dec-2024
Pre-Amplifier (8 GHz to 18 GHz)	Phase One	PS04-0086	1533	12	26-Feb-2025
Pre-Amplifier (18 GHz to 40 GHz)	Phase One	PSO4-0087	1534	12	16-Aug-2025
Antenna (DRG, 18 GHz to 40 GHz)	Link Microtek Ltd	AM180HA-K-TU2	230	24	08-Oct-2026
Antenna (Bi-Log, 30 MHz to 1 GHz)	Teseq	CBL6111D	5615	24	15-Mar-2025
Antenna (DRG 1-10.5GHz)	Schwarzbeck	BBHA9120B	4848	12	14-Jul-2025
Antenna (DRG, 7.5 GHz to 18 GHz)	Schwarzbeck	HWRD750	5348	12	13-Oct-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5478	12	13-May-2025

Table 18

TU - Traceability Unscheduled

3 Incident Reports

No incidents reports were raised.

4 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, SAC, ±5.2 dB 1 GHz to 6 GHz, Horn Antenna, SAC, ±5.1 dB 6 GHz to 18 GHz, Horn Antenna, SAC, ±4.9 dB 18 GHz to 40 GHz, Horn Antenna, SAC, ±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.