FCC and ISED Test Report

Apple Inc
Model: A2330

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

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

FCC ID: BCGA2330 IC: 579C-A2330

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Document 75948763-08 Issue 01

SIGNATURE			
AJ Lawson.			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Andy Lawson	Senior Engineer	Authorised Signatory	10 June 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 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	Connor Lee	10 June 2020	
Testing	Mohammad Malik	10 June 2020	
Testing	Jaiyanth Balendrarajah	10 June 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 15B: 2019, ICES-003: 2016 ISED RSS-GEN: 2019 and Issue 5 and A1 (2019-03) 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 June 2020

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2330
Serial Number(s)	C07CG03NPW8V and C07CG081PW8X
Hardware Version(s)	REV1.0
Software Version(s)	20A2236b
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15B: 2019 ICES-003: 2016 ISEDC RSS-GEN: Issue 5 and A1 (2019-03)
Order Number Date	0540201015 07-April-2020
Date of Receipt of EUT	08-April-2020 and 28-April-2020
Start of Test	24-April-2020
Finish of Test	02-May-2020
Name of Engineer(s)	Mohammad Malik, Jaiyanth Balendrarajah and Connor Lee
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: 120 V AC Powered - Transmitters Idle						
2.1	15.107	6.1	8.8	Conducted Disturbance at Mains Terminals	Pass	ANSI C63.4: 2014
2.2	15.109	6.2	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 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.

1.4.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Configuration and Mode: 120 V AC Powered - Transmitters Idle				
AC Power Port Live	<1 m	230 V AC power Supply	Live	No
Ethernet Port	>3 m	Data	Multi Core Cable	No
AC Power Port Neutral	<1 m	230 V AC power Supply	Neutral	No

Table 3

1.4.3 Test Configuration

Configuration	Description
120 V AC Powered	The EUT was powered from a 120 V AC mains supply. A set of headphones was connected to the auxiliary port. Each USB type A port was loaded with a mouse or keyboard. The HDMI port was connected through a D-link box and the ethernet cable was connected to ethernet port which was used to remote connect to the EUT.

Table 4

1.4.4 Modes of Operation

Mode	Description
Transmitters Idle	All transmitters within the EUT were not transmitting.

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: A2330, Serial Number: C07CG081PW8X			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: A2330, Serial Number: C07CG03NPW8V			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 6

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: 120 V AC Powered - Transmitters Idle		
Conducted Disturbance at Mains Terminals	Connor Lee	UKAS
Radiated Disturbance	Mohammad Malik and Jaiyanth Balendrarajah	UKAS

Table 7

Office Address:

Octagon House
Concorde Way
Segensworth North
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
ISED RSS-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

A2330, S/N: C07CG03NPW8V - Modification State 0

2.1.3 Date of Test

02-May-2020

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

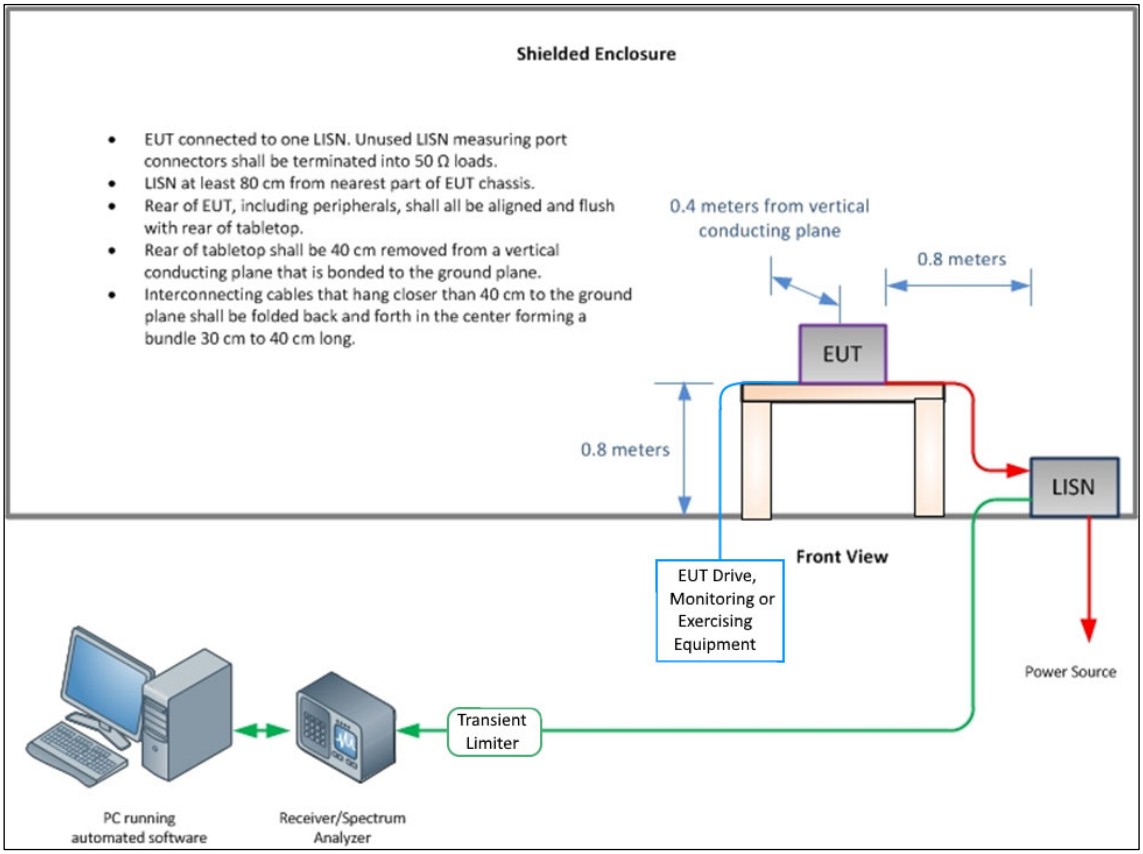

Figure 1 - Conducted Disturbance Example Test Setup

2.1.7 Environmental Conditions

Ambient Temperature	20.1 °C
Relative Humidity	45.7 %

2.1.8 Specification Limits

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

Table 8

2.1.9 Test Results

Results for Configuration and Mode: 120 V AC Powered - Transmitters Idle.

The test was performed in accordance with the Class B limits.

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

Detailed results are shown below.

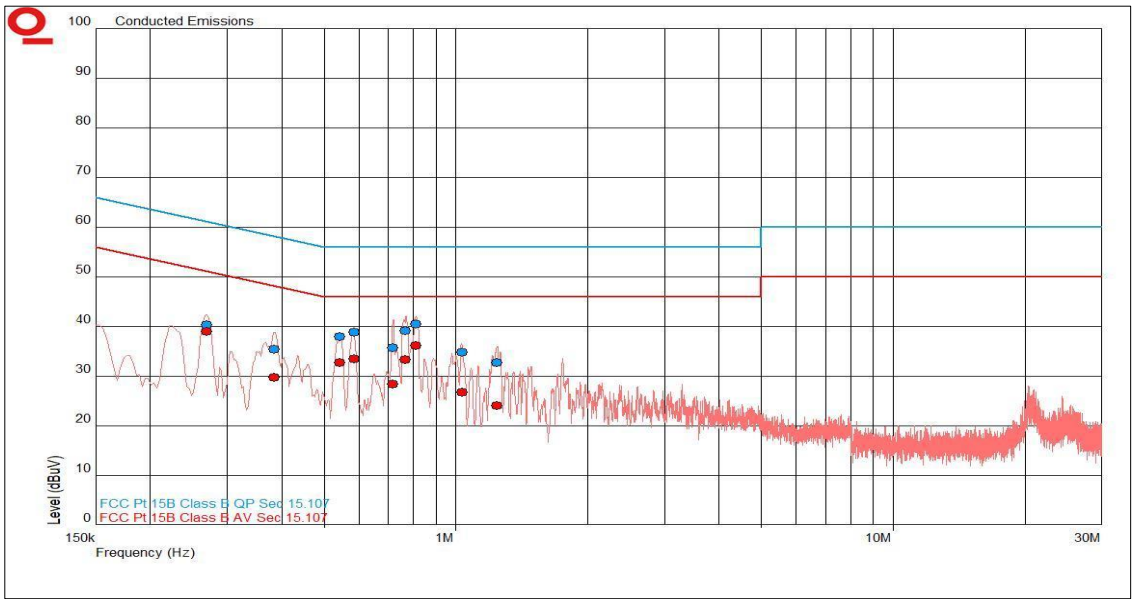

Figure 2 - Graphical Results - AC Power Port Live

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR Average Level (dBµV)	CISPR Average Limit (dBµV)	CISPR Average Margin (dB)
0.269	40.3	61.1	-20.8	39.0	51.1	-12.1
0.385	35.4	58.2	-22.8	29.8	48.2	-18.4
0.544	38.0	56.0	-18.0	32.7	46.0	-13.3
0.585	38.9	56.0	-17.1	33.5	46.0	-12.5
0.718	35.8	56.0	-20.2	28.4	46.0	-17.6
0.767	39.2	56.0	-16.8	33.4	46.0	-12.6
0.810	40.5	56.0	-15.5	36.1	46.0	-9.9
1.032	34.9	56.0	-21.1	26.8	46.0	-19.2
1.244	32.7	56.0	-23.3	24.1	46.0	-21.9

Table 9

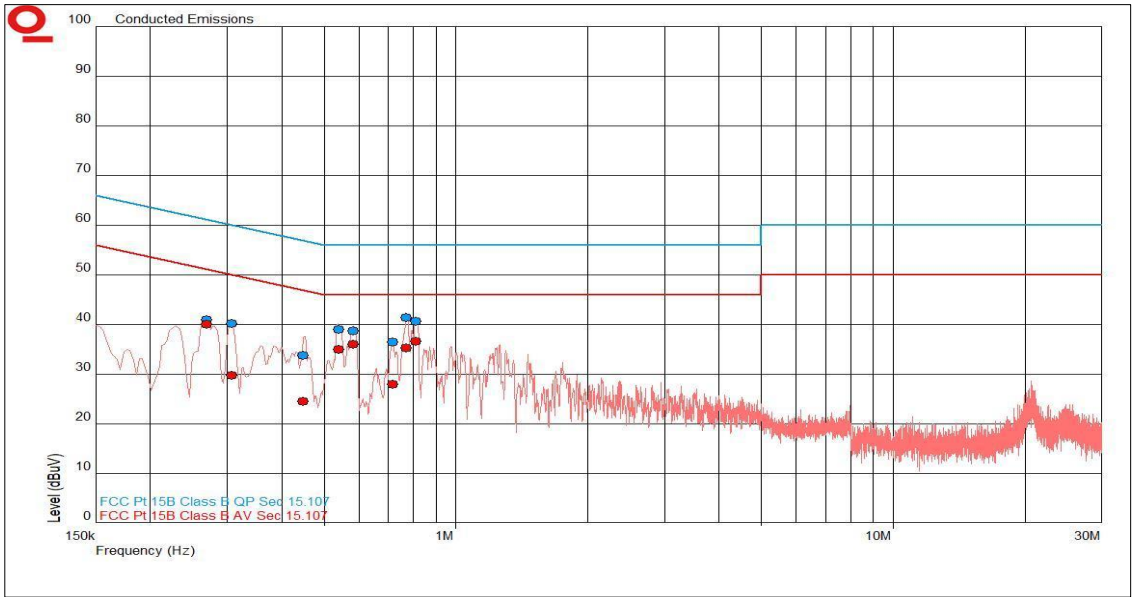

Figure 3 - Graphical Results - AC Power Port Neutral

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR Average Level (dBµV)	CISPR Average Limit (dBµV)	CISPR Average Margin (dB)
0.269	41.0	61.1	-20.1	40.1	51.1	-11.0
0.308	40.2	60.0	-19.9	29.7	50.0	-20.3
0.449	33.8	56.9	-23.1	24.5	46.9	-22.4
0.540	39.0	56.0	-17.0	35.0	46.0	-11.0
0.583	38.8	56.0	-17.2	36.0	46.0	-10.0
0.718	36.5	56.0	-19.5	28.0	46.0	-18.0
0.770	41.4	56.0	-14.6	35.3	46.0	-10.7
0.810	40.7	56.0	-15.3	36.7	46.0	-9.3

Table 10

Figure 4 - Test Setup

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	03-Jan-2021
Transient Limiter	Hewlett Packard	11947A	15	12	02-Oct-2020
3 phase LISN	Rohde & Schwarz	ESH2-Z5	323	12	21-Jan-2021
8 Meter RF Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
8 Meter RF Cable	Teledyne	PRO-088-8MTR	5462	6	06-Sep-2020

Table 11

2.2 Radiated Disturbance

2.2.1 Specification Reference

FCC 47 CFR Part 15B, Clause 15.109
ISEDC RSS-GEN, Clause 7.1

2.2.2 Equipment Under Test and Modification State

A2330, S/N: C07CG081PW8X - Modification State 0

2.2.3 Date of Test

24-April-2020

2.2.4 Test Method

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

A pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth, and antenna-to-EUT polarisation using a peak detector.

Measurements below 18GHz were taken at a 3m distance and measurements above 18GHz were taken at 1m distance.

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

The readings were maximized 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 (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

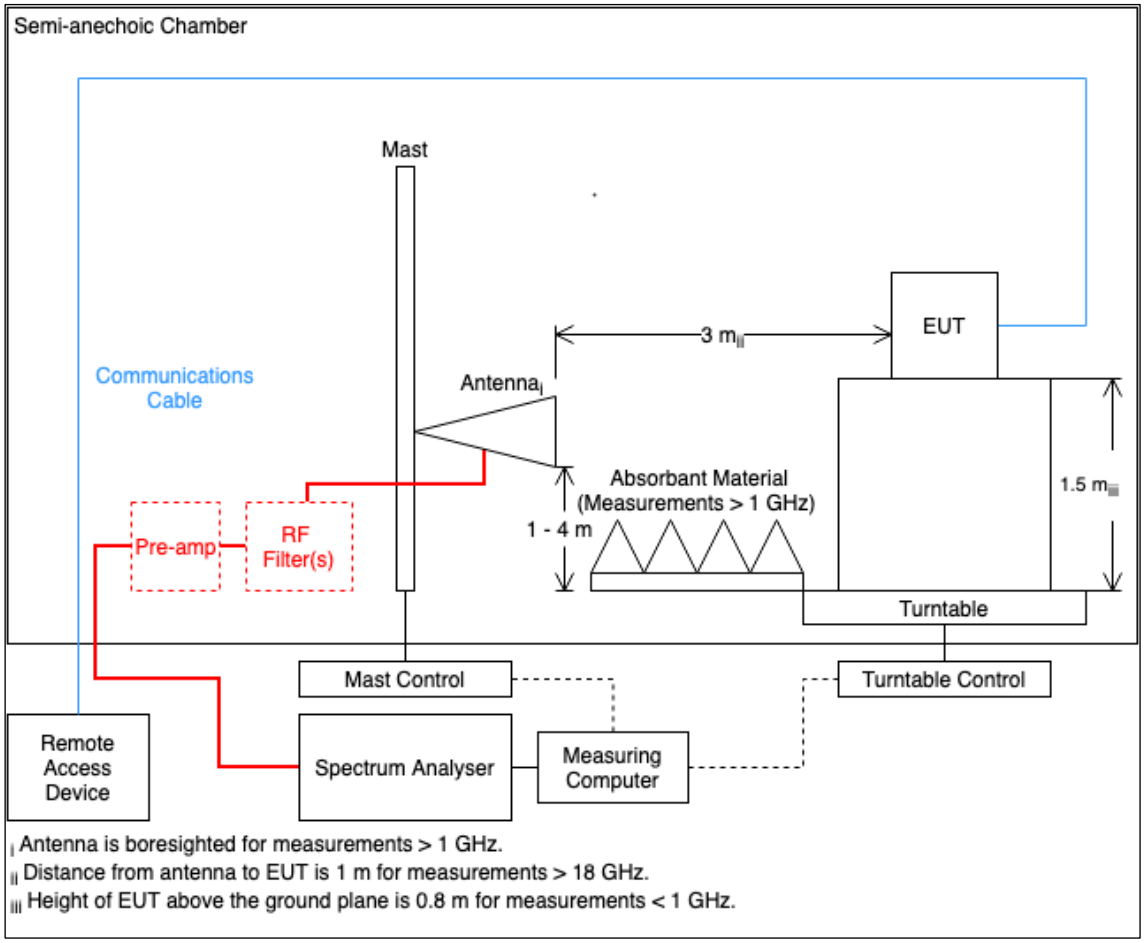

Figure 5

2.2.7 Environmental Conditions

Ambient Temperature	21.1 °C
Relative Humidity	37.7 %

2.2.8 Specification Limits

Required Specification Limits, Field Strength (Class B @ 3 m)		
Frequency Range (MHz)	(µV/m)	(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: Quasi-peak detector to be used for measurements below 1 GHz CISPR Average detector to be used for measurements above 1 GHz Peak test limit above 1 GHz is 20 dB higher than the CISPR Average test limit.		

Table 12

2.2.9 Test Results

Results for Configuration and Mode: 120 V AC Powered - Transmitters Idle.

The test was performed in accordance with 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: 5.825 GHz
Which necessitates an upper frequency test limit of: 30.000 GHz

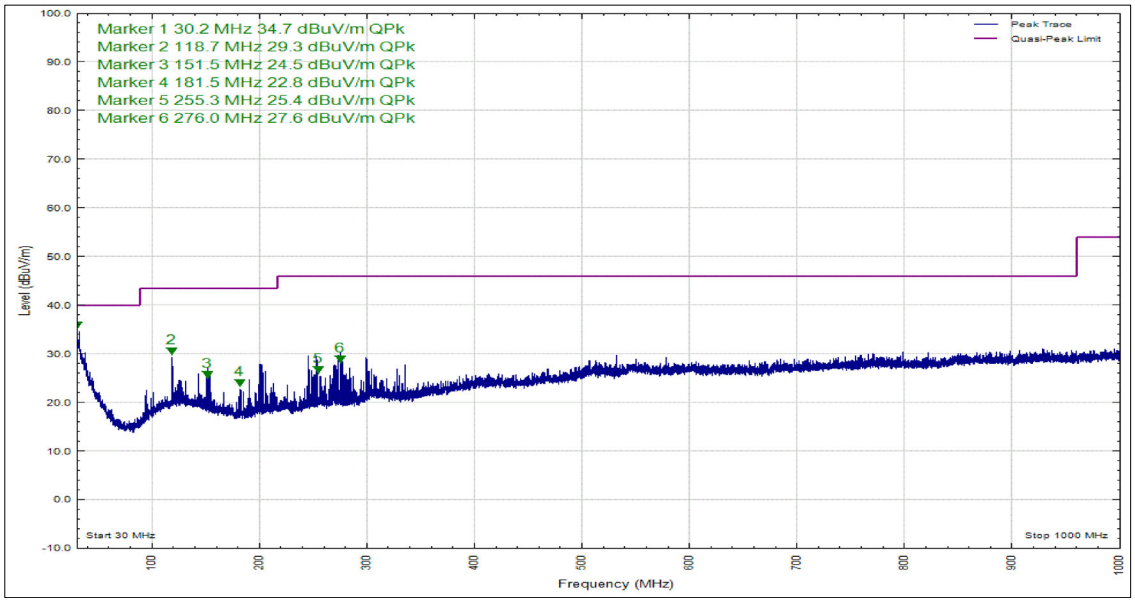

Figure 6 - 30 MHz to 1 GHz, Quasi-Peak, Horizontal

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
30.239	34.7	40.0	-5.3	Q-Peak	172	376	Horizontal	-
118.700	29.3	43.5	-14.2	Q-Peak	164	263	Horizontal	-
151.516	24.5	43.5	-19.0	Q-Peak	190	186	Horizontal	-
181.508	22.8	43.5	-20.8	Q-Peak	128	107	Horizontal	-
255.251	25.4	46.0	-20.6	Q-Peak	240	108	Horizontal	-
275.978	27.6	46.0	-18.4	Q-Peak	217	110	Horizontal	-

Table 13

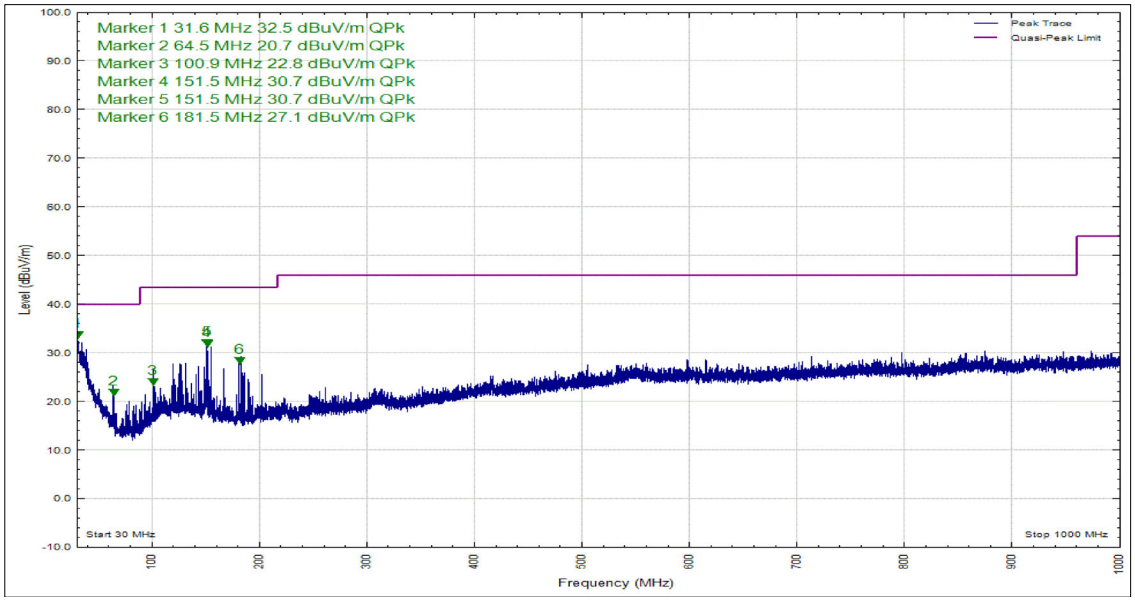

Figure 7 - 30 MHz to 1 GHz, Quasi-Peak, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
31.577	32.5	40.0	-7.5	Q-Peak	169	366	Vertical	-
64.498	20.7	40.0	-19.3	Q-Peak	269	107	Vertical	-
100.915	22.8	43.5	-20.7	Q-Peak	0	104	Vertical	-
151.481	30.7	43.5	-12.8	Q-Peak	149	103	Vertical	-
151.495	30.7	43.5	-12.8	Q-Peak	116	101	Vertical	-
181.507	27.1	43.5	-16.4	Q-Peak	165	107	Vertical	-

Table 14

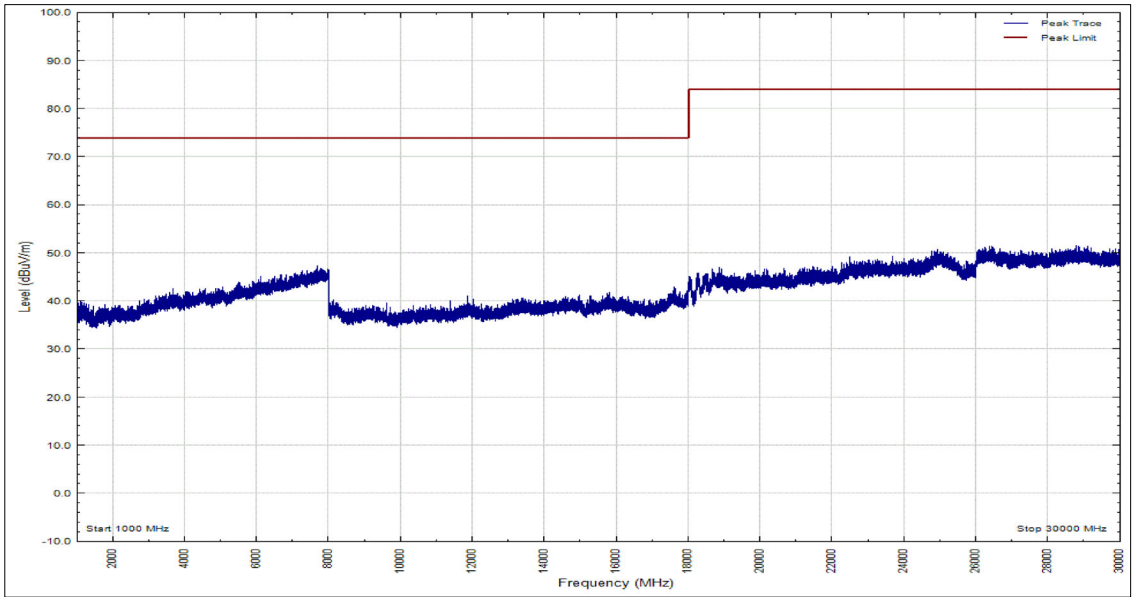

Figure 8 - 1 GHz to 30 GHz, Peak, Horizontal

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

Table 15

*No final measurements were made as all peak emissions seen were greater than 10 dB below the test limit.

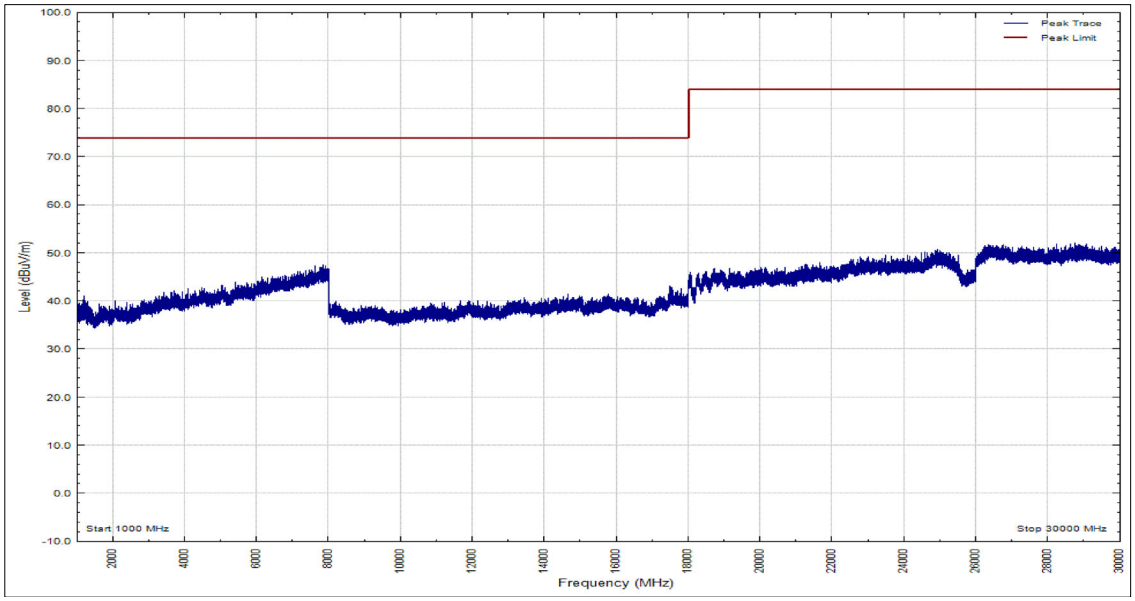

Figure 9 - 1 GHz to 30 GHz, Peak, Vertical

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

Table 16

*No final measurements were made as all peak emissions seen were greater than 10 dB below the test limit.

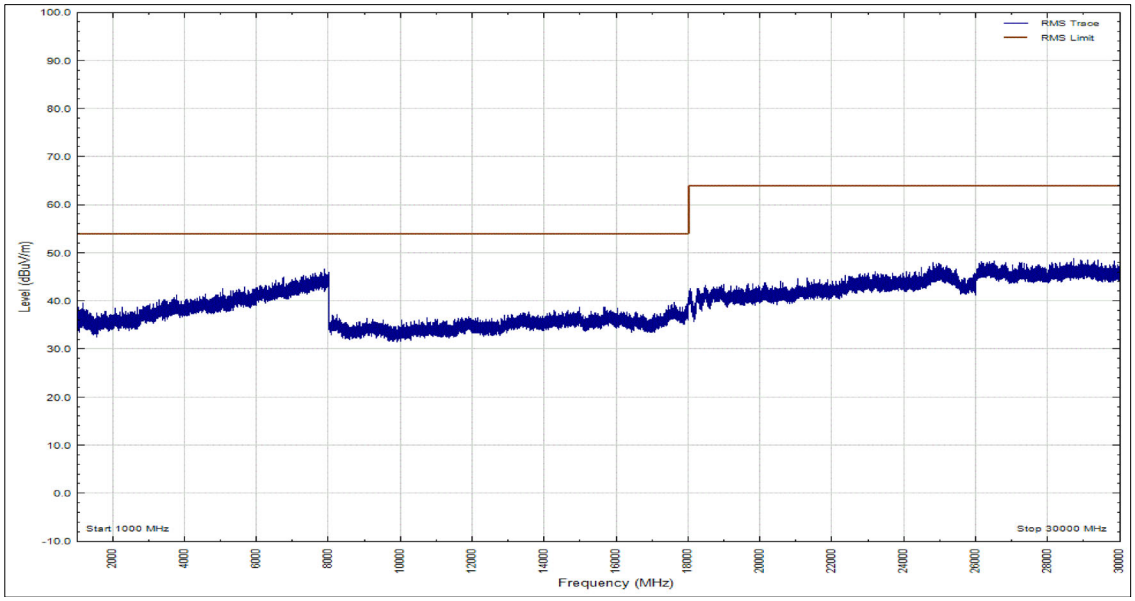

Figure 10 - 1 GHz to 30 GHz, CISPR Average, Horizontal

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

Table 17

*No final measurements were made as all peak emissions seen were greater than 10 dB below the test limit.

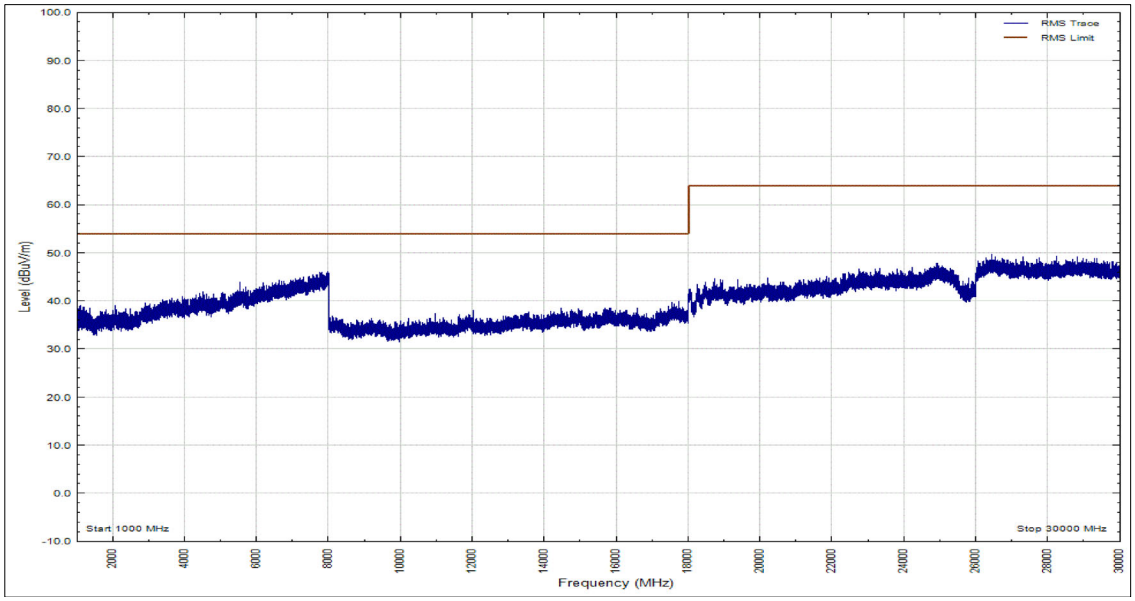

Figure 11 - 1 GHz to 30 GHz, CISPR Average, Vertical

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

Table 18

*No final measurements were made as all peak emissions seen were greater than 10 dB below the test limit.

2.2.10 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room (11)	Rainford	Rainford	5136	36	01-Nov-2021
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	28-Nov-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	08-Oct-2020
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
4dB Attenuator	Pasternack	PE7047-4	4935	24	30-Sep-2021
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	15-May-2020
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	30-Sep-2021
Pre-Amplifier	Phase One	PS04-0086	1533	12	04-Aug-2020
Preamplifier (30dB 18-40GHz)	Schwarzbeck	BBV 9721	5218	12	09-Jul-2020
Preamplifier (30dB 1GHz to 18GHz)	Schwarzbeck	BBV 9718 C	5261	12	07-Apr-2021
8 - 18 GHz preamp	Wright Technologies	PS06-0061/PS06-0060	4971	6	23-Jan-2021
Antenna (DRG Horn 7.5-18GHz)	Schwarzbeck	HWRD750	5348	12	04-Sep-2020
Preamplifier (30dB 1GHz to 18GHz)	Schwarzbeck	BBV 9718 C	5350	12	21-Aug-2020
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	10-Mar-2021
DRG Horn Antenna (7.5-18GHz)	Schwarzbeck	HWRD750	5216	12	10-Mar-2021
Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	5217	12	09-Jul-2020
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	28-Apr-2021
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	10-Mar-2021
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3695	12	11-Jun-2020
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	07-Aug-2020
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5092	12	06-Dec-2020

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Cable (18 GHz)	Rosenberger	LU7-071-1000	5099	12	06-Oct-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5102	12	06-Oct-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5103	12	06-Oct-2020

Table 19

TU - Traceability Unscheduled

3 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 20

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: 2007, clause 4.4.3 and 4.5.1.