

Report on the FCC and IC Testing of: Apple Inc. Model A1993

In accordance with FCC 47 CFR Part 15B and ICES-003

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

FCC ID: BCGA1993

IC: 579C-A1993



Product Service

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SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andy Lawson	Senior Engineer	Authorised Signatory	08 October 2018

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service 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. The sample tested was found to comply with the requirements defined in the applied rules.

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Graeme Lawler	Test Engineer	Testing	08 October 2018

FCC Accreditation

90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation

IC2932B-1 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: 2017 and ICES-003: 2016 for the tests detailed in section 1.3.



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Contents

1 Report Summary2

1.1 Report Modification Record.....2

1.2 Introduction.....2

1.3 Brief Summary of Results3

1.4 Product Information4

1.5 Deviations from the Standard.....4

1.6 EUT Modification Record4

1.7 Test Location.....4

2 Test Details5

2.1 Conducted Disturbance at Mains Terminals5

2.2 Radiated Disturbance.....9

3 Measurement Uncertainty16



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	02 October 2018
2	Second Issue – FCCID and ICID updated	08 October 2018

Table 1

1.2 Introduction

Applicant	Apple Inc.
Manufacturer	Apple Inc.
Model Number(s)	A1993
Serial Number(s)	C07WT00HK2V0
Hardware Version(s)	EVT
Software Version(s)	18B2034
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15B: 2017 ICES-003: 2016
Order Number	0540058293
Date	18-May-2018
Date of Receipt of EUT	20-June-2018
Start of Test	31-July-2018
Finish of Test	06-August-2018
Name of Engineer(s)	Graeme Lawler
Related Document(s)	ANSI C63.4: 2014



Product Service

1.3 Brief Summary of Results

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

Section	Specification Clause		Test Description	Result	Comments/Base Standard
	Part 15B	ICES-003			
Configuration and Mode: Idle					
2.1	15.107	6.1	Conducted Disturbance at Mains Terminals	Pass	ANSI C63.4: 2014
2.2	15.109	6.2	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 b/g/n/ac capabilities in the 2.4 GHz and 5.0 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
Serial Number: C07WT00HK2V0			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.7 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Idle		
Conducted Disturbance at Mains Terminals	Graeme Lawler	UKAS
Radiated Disturbance	Graeme Lawler	UKAS

Table 4

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
ICES-003, Clause 6.1

2.1.2 Equipment Under Test and Modification State

A1993, S/N: C07WT00HK2V0 - Modification State 0

2.1.3 Date of Test

06-August-2018

2.1.4 Test Method

The EUT was placed on a non-conductive table 0.8m above a reference ground plane and 0.4m away from a vertical coupling plane

All power was connected to the EUT through an Artificial Mains Network (AMN). Conducted disturbance voltage measurements on mains lines were made at the output of the AMN. The AMN was placed 0.8m from the boundary of the EUT and bonded to the reference ground plane.

2.1.5 Environmental Conditions

Ambient Temperature	19.7 °C
Relative Humidity	53.8 %

2.1.6 Test Results

Results for Configuration and Mode: Idle.

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

Detailed results are shown below.

Line Under Test: Live Line

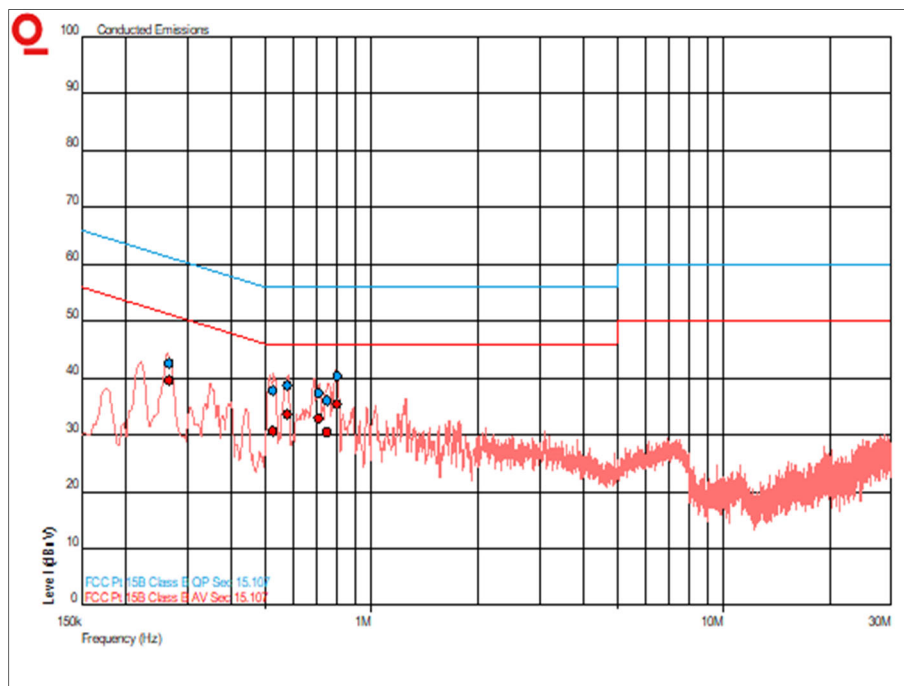


Figure 1 - Graphical Results - Live Line

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	CISPR AV Level (dBuV)	CISPR AV Limit (dBuV)	CISPR AV Margin (dBuV)
0.265	42.7	61.3	-18.6	39.7	51.3	-11.6
0.524	37.9	56.0	-18.1	30.7	46.0	-15.3
0.577	38.7	56.0	-17.3	33.7	46.0	-12.3
0.708	37.4	56.0	-18.6	32.8	46.0	-13.2
0.749	36.0	56.0	-20.0	30.5	46.0	-15.5
0.797	40.3	56.0	-15.7	35.4	46.0	-10.6

Table 5

Line Under Test: Neutral Line

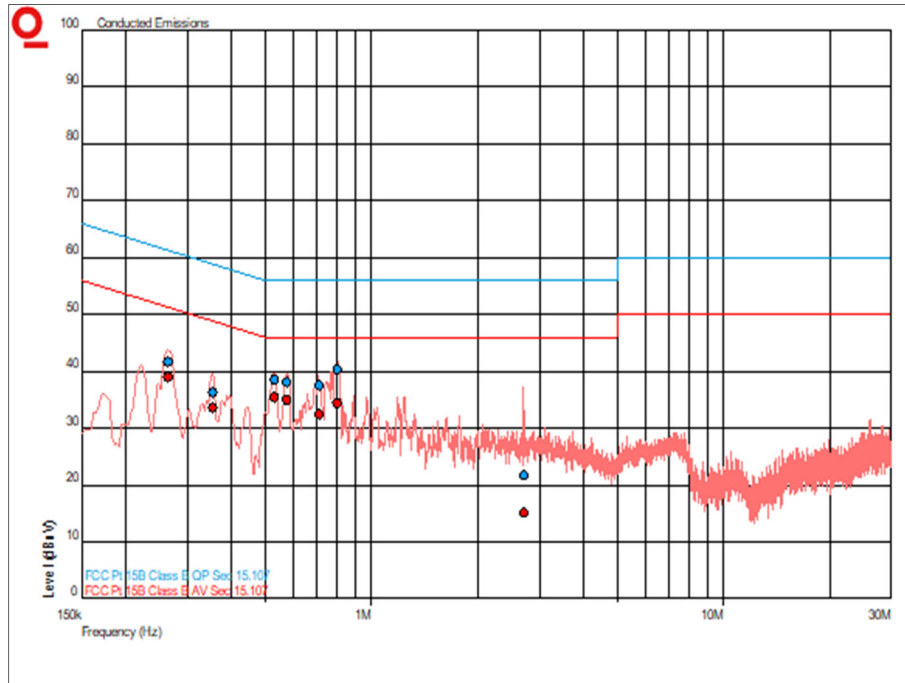


Figure 2 - Graphical Results - Neutral Line

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	CISPR AV Level (dBuV)	CISPR AV Limit (dBuV)	CISPR AV Margin (dBuV)
0.265	41.7	61.3	-19.6	39.1	51.3	-12.2
0.354	36.4	58.9	-22.5	33.7	48.9	-15.2
0.529	38.5	56.0	-17.5	35.5	46.0	-10.5
0.575	38.2	56.0	-17.8	34.9	46.0	-11.1
0.709	37.6	56.0	-18.4	32.5	46.0	-13.5
0.799	40.4	56.0	-15.6	34.4	46.0	-11.6
2.718	21.7	56.0	-34.3	15.1	46.0	-30.9

Table 6



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	3274	-	Software
Single Phase LISN	Rohde & Schwarz	ESH3-Z5	1674	12	4-Apr-2019
Transient Limiter	Hewlett Packard	11947A	2377	12	23-Feb-2019
Multimeter	Iso-tech	IDM101	2419	12	23-Nov-2018
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
Hygrometer	Rotronic	HP21	4989	12	26-Apr-2019

Table 7



2.2 Radiated Disturbance

2.2.1 Specification Reference

FCC 47 CFR Part 15B, Clause 15.109
ICES-003, Clause 6.2

2.2.2 Equipment Under Test and Modification State

A1993, S/N: C07WT00HK2V0 - Modification State 0

2.2.3 Date of Test

31-July-2018

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 were taken at a 3m distance. Using the pre-scan list of the highest emissions detected, their bearing and associated antenna polarisation, the EUT was then formally 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 Environmental Conditions

Ambient Temperature	20.2 °C
Relative Humidity	56.8 %

2.2.6 Test Results

Results for Configuration and Mode: Idle.

Detailed results are shown below.

Highest frequency generated or used within the EUT: 5.9GHz
Which necessitates an upper frequency test limit of: 30GHz



Frequency Range of Test: 30 MHz to 1 GHz

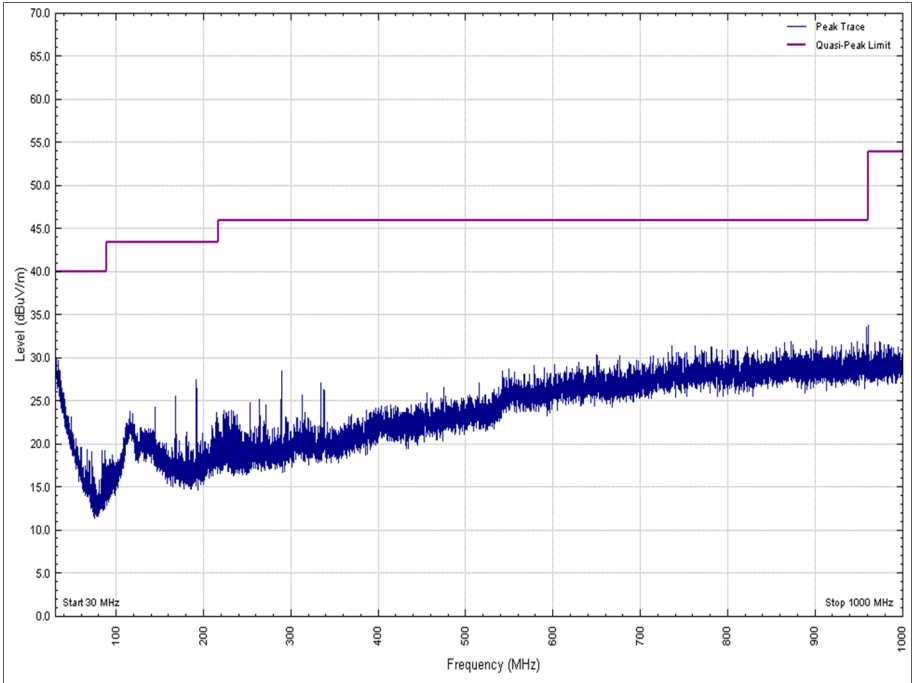


Figure 3 - Graphical Results - 30 MHz to 1 GHz - Horizontal Polarity

No emissions were detected within 10 dB of the limit.

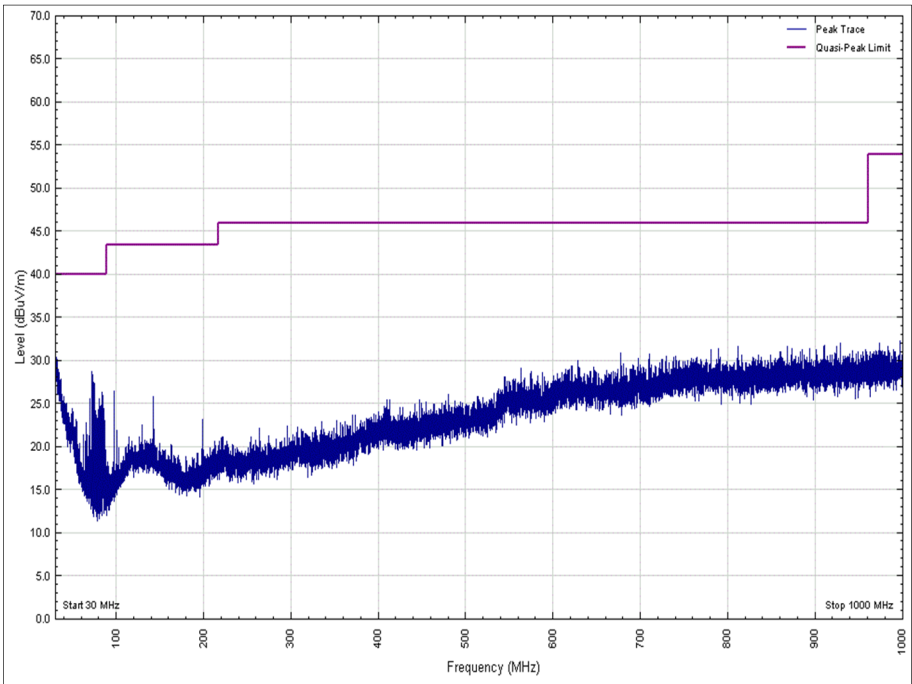


Figure 4 - Graphical Results - 30 MHz to 1 GHz - Vertical Polarity

No emissions were detected within 10 dB of the limit.



Frequency Range of Test: 1 GHz to 18 GHz

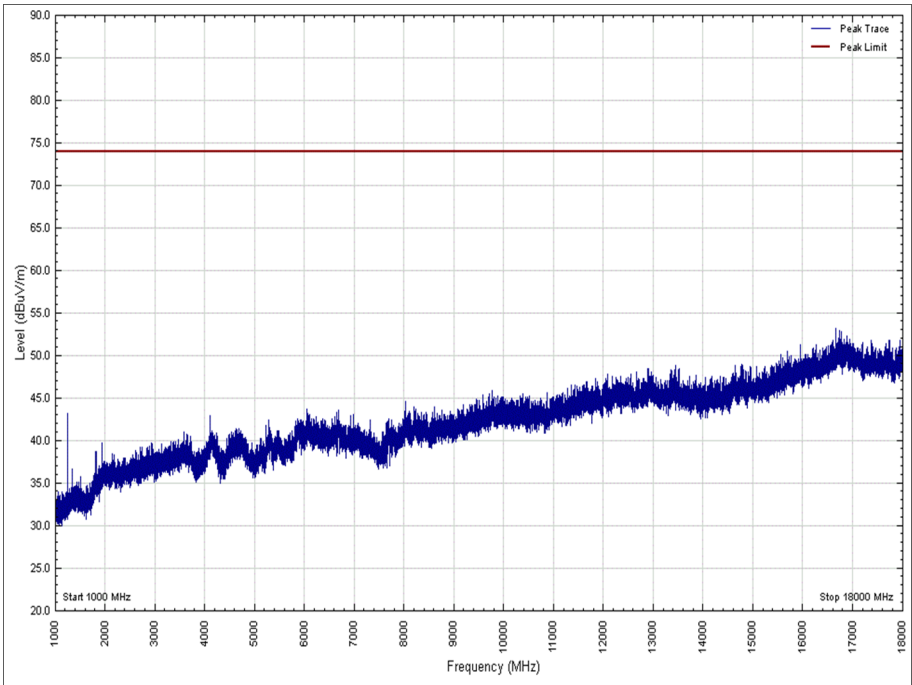


Figure 5 - Graphical Results, 1 GHz to 18 GHz, Peak - Horizontal Polarity

No emissions were detected within 10 dB of the limit.

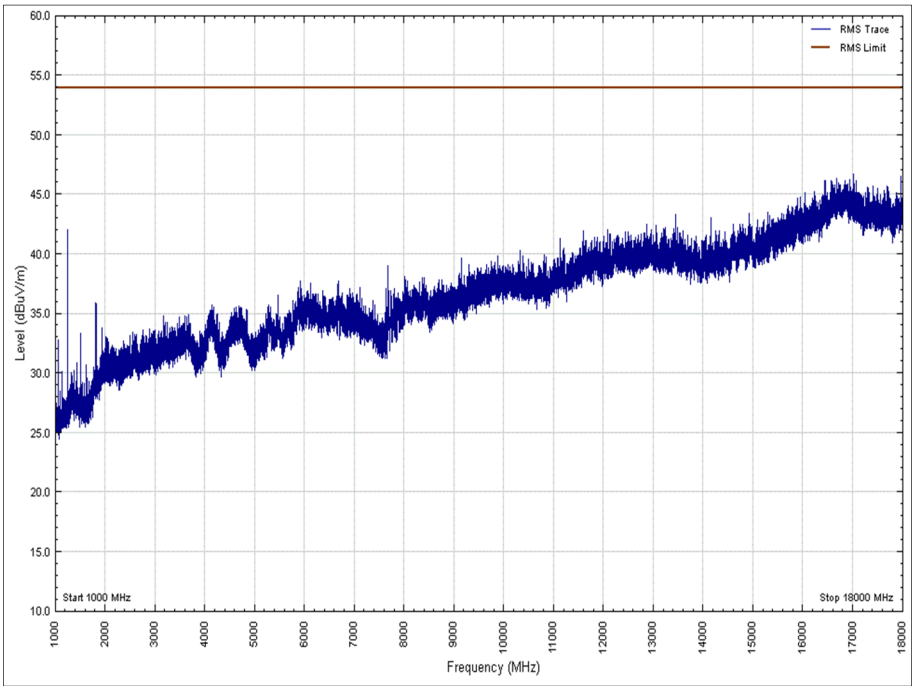


Figure 6 - Graphical Results, 1 GHz to 18 GHz, RMS - Horizontal Polarity

No emissions were detected within 10 dB of the limit.

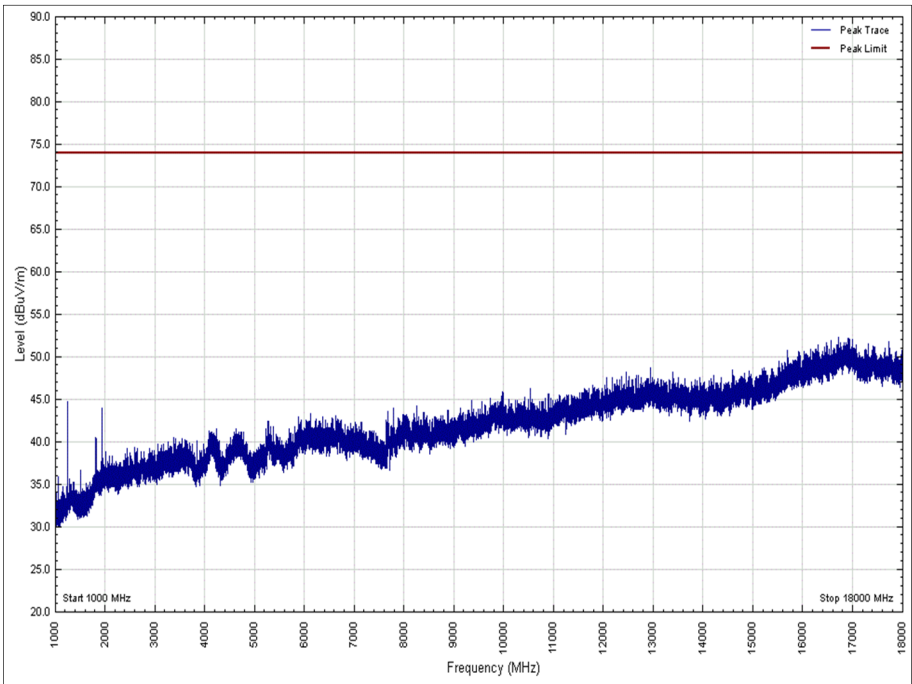


Figure 7 - Graphical Results, 1 GHz to 18 GHz, Peak - Vertical Polarity

No emissions were detected within 10 dB of the limit.

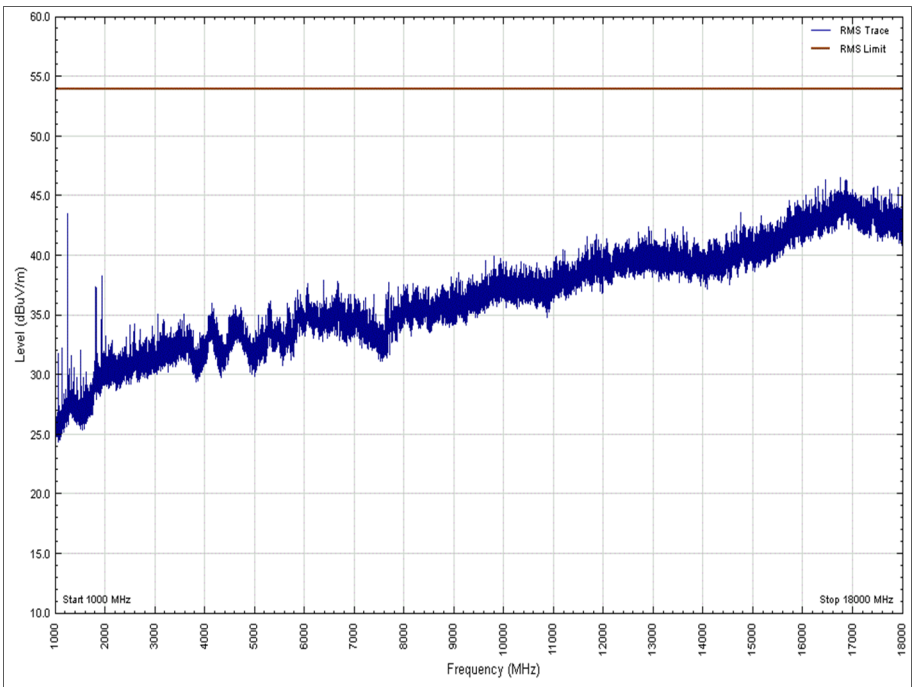


Figure 8 - Graphical Results, 1 GHz to 18 GHz, RMS - Vertical Polarity

No emissions were detected within 10 dB of the limit.



Frequency Range of Test: 18 GHz to 30 GHz

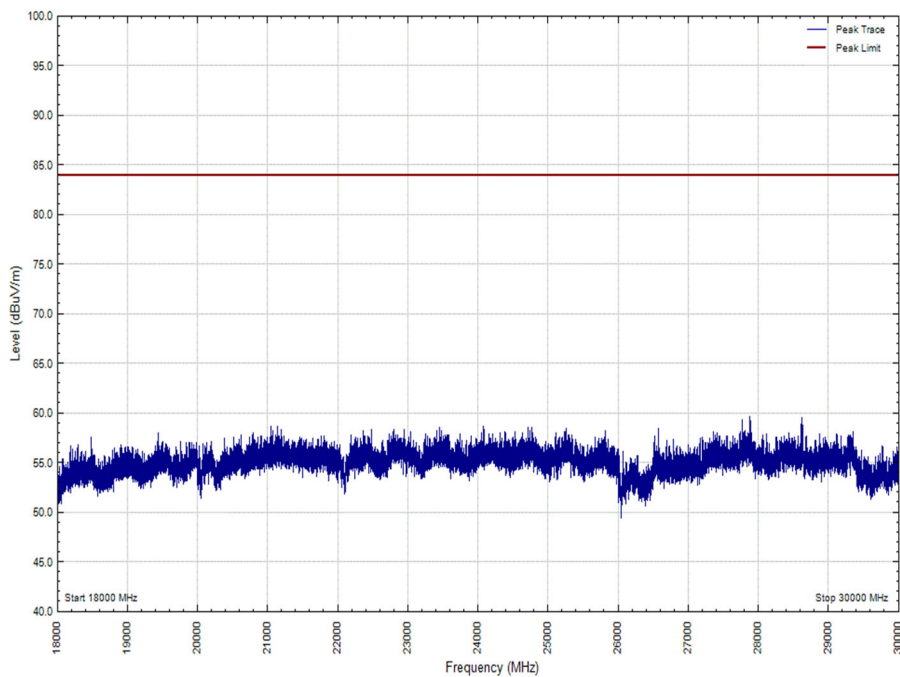


Figure 9 - Graphical Results, 18 GHz to 30 GHz, Peak - Horizontal Polarity

No emissions were detected within 10 dB of the limit.

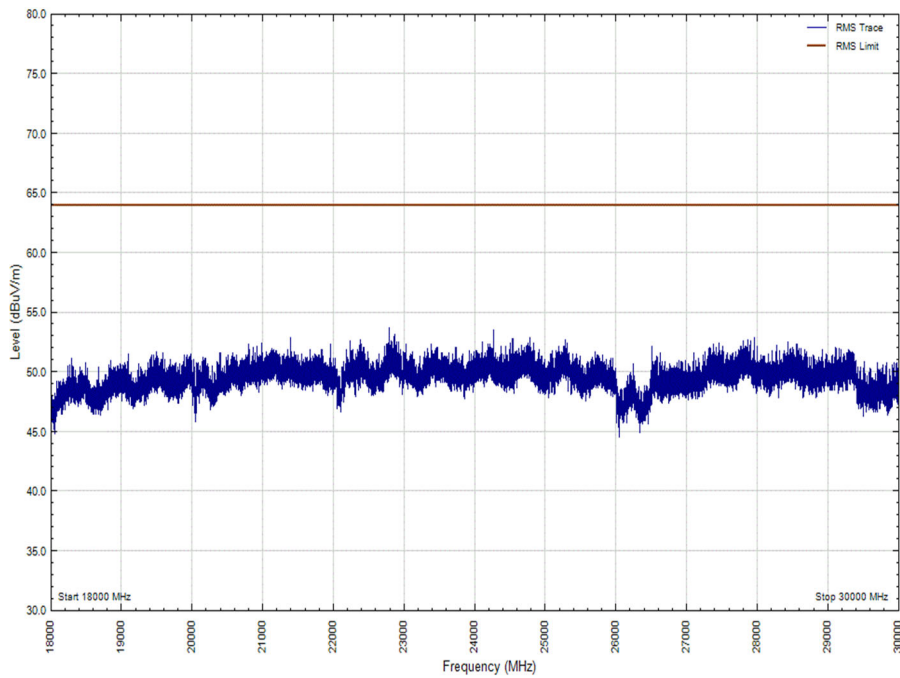


Figure 10 - Graphical Results, 18 GHz to 30 GHz, RMS - Horizontal Polarity

No emissions were detected within 10 dB of the limit.

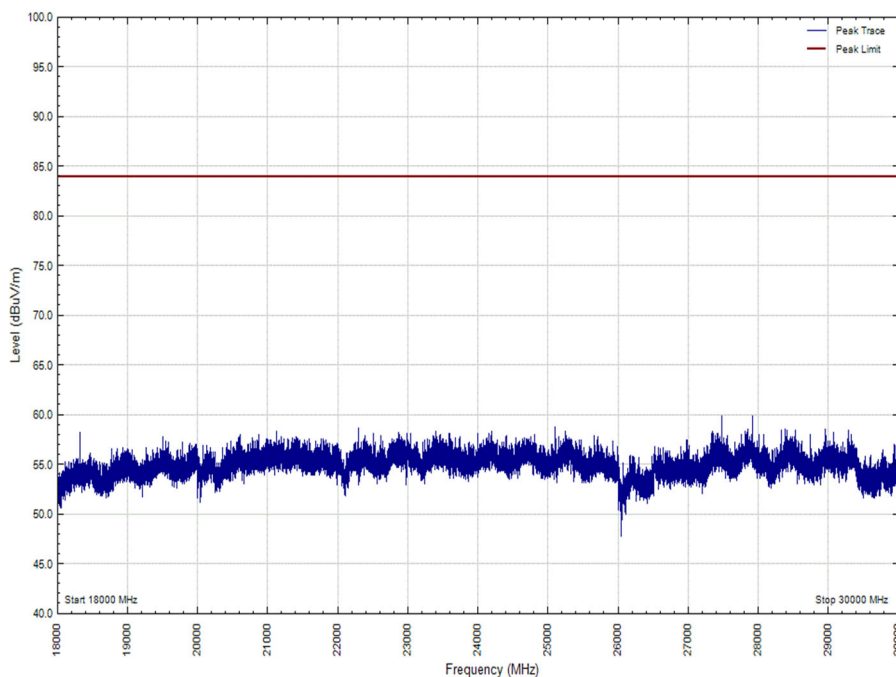


Figure 11 - Graphical Results, 18 GHz to 30 GHz, Peak - Vertical Polarity

No emissions were detected within 10 dB of the limit.

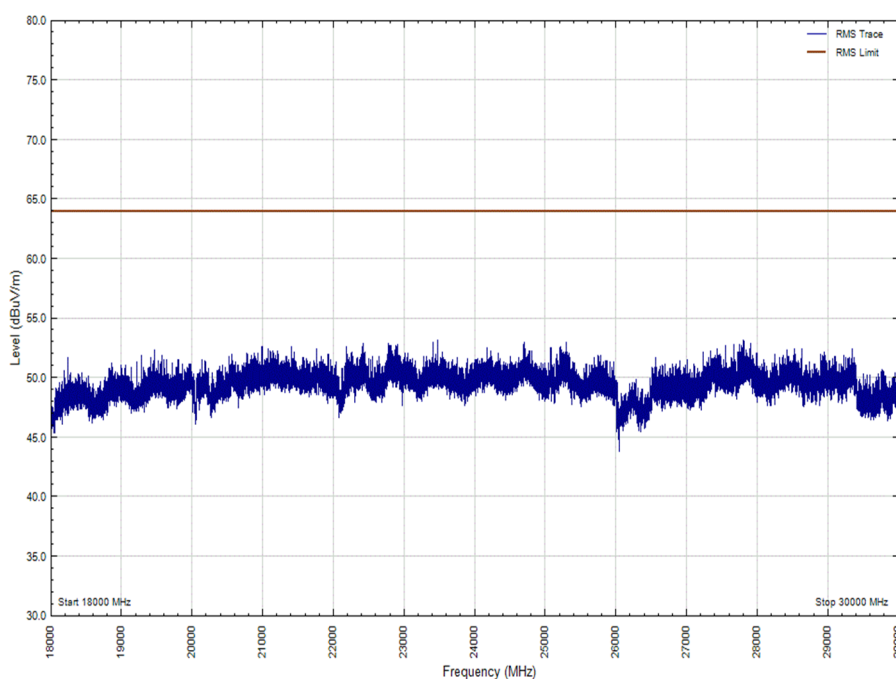


Figure 12 - Graphical Results, 18 GHz to 30 GHz, RMS - Vertical Polarity

No emissions were detected within 10 dB of the limit.



2.2.7 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
EmX Software	TUV SUD Product Service	V1.3.14	N/A	-	Software
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Multimeter	Iso-tech	IDM101	2419	12	23-Nov-2018
Antenna (Bilog)	Chase	CBL6143	2904	24	8-Aug-2019
Comb Generator	Schaffner	RSG1000	3034	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	18-Oct-2018
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	31-Aug-2018
Cable (Rx, SMAM-SMAM 0.5m)	Scott Cables	SLSL18-SMSM-00.50M	4528	6	15-Aug-2018
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	1-Mar-2019
Mast Controller	Maturo GmbH	NCD	4810	-	TU
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	4811	-	TU
9m N type RF cable	Rosenberger	2303-0 9.0m PNm	4827	6	4-Jan-2019
4dB Attenuator	Pasternack	PE7047-4	4935	12	28-Nov-2018

Table 8

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 9