Report on the FCC and IC Testing of: Apple Inc. Model: A1932

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

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

Product Service

Choose certainty.
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FCC ID: BCGA1932 IC: 579C-A1932

COMMERCIAL-IN-CONFIDENCE

Document Number: 75942371-09 | Issue: 01

SIGNATURE			
AJ Lawson.			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Andy Lawson	Senior EMC Engineer	Authorised Signatory	16 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**
Colin Mckean	Senior EMC Engineer	Testing	16 October 2018
Nandini Mathivanan	Engineer	Testing	16 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 and ICES-003: 2017 and 2016.

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Product Service

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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	16 October 2018

Table 1

1.2 Introduction

Applicant	Apple Inc.
Manufacturer	Apple Inc.
Model Number(s)	A1932
Serial Number(s)	C02X5003L3J0 & C02X500GL3FY
Hardware Version(s)	EVT2
Software Version(s)	18B2034
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15B: 2017 ICES-003: 2016
Order Number Date	0540166213 06-April-2018
Date of Receipt of EUT	23-August 2018
Start of Test	17-September 2018
Finish of Test	25-September 2018
Name of Engineer(s)	Colin McKean & Nandini Mathivanan
Related Document(s)	ANSI C63.4: 2014

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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

Product Service

1.4 Product Information

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Laptop 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: C02X5003L3J0			
0	As supplied by the customer	Not Applicable	Not Applicable
Serial Number: C02X500GL3FY			
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 Mode		
Conducted Disturbance at Mains Terminals	Colin Mckean	UKAS
Radiated Disturbance	Nandini Mathivanan	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

Product Service

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

A1932, S/N: C02X500GL3FY - Modification State 0

2.1.3 Date of Test

25-September-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	22.0 °C
Relative Humidity	54.0 %

2.1.6 Test Results

Results for Configuration and Mode: Idle.

This testing was carried out to the Class B test limits.

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

Detailed results are shown below.

Line Under Test: Live Line

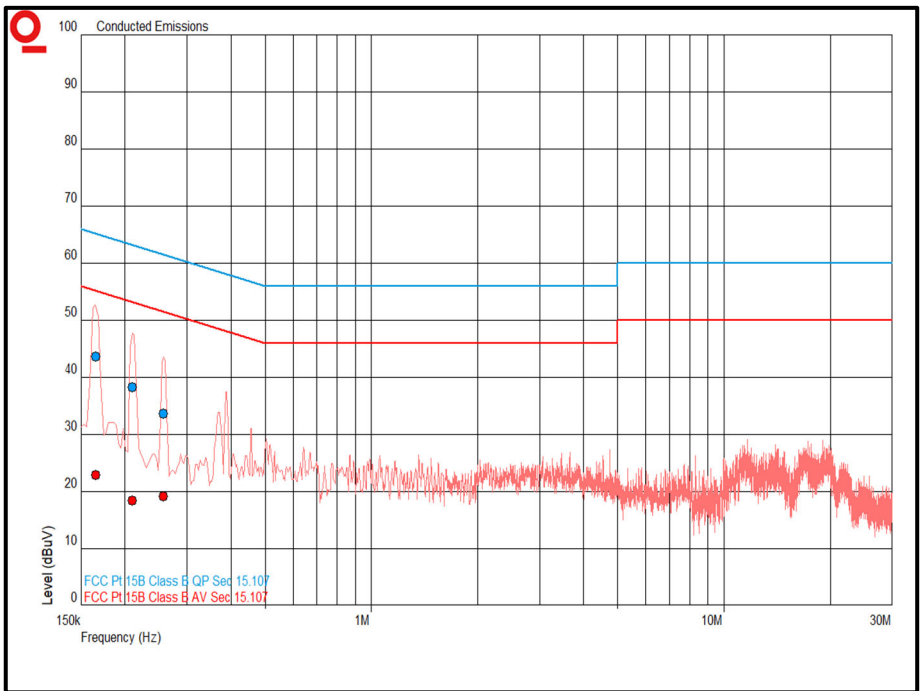

Figure 1 - Graphical Results - Live Line

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR AV Level (dBµV)	CISPR AV Limit (dBµV)	CISPR AV Margin (dB)
0.165	43.7	65.2	-21.5	22.9	55.2	-32.3
0.210	38.2	63.2	-25.0	18.5	53.2	-34.8
0.258	33.7	61.5	-27.8	19.1	51.5	-32.4

Table 5

Line Under Test: Neutral Line

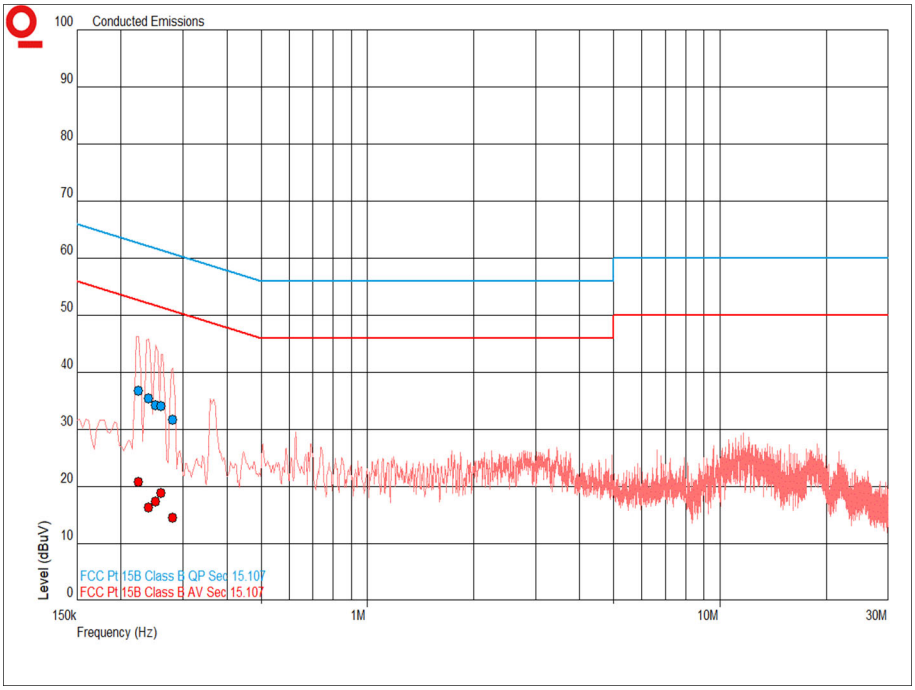

Figure 2 - Graphical Results - Neutral Line

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	CISPR AV Level (dBµV)	CISPR AV Limit (dBµV)	CISPR AV Margin (dB)
0.225	36.8	62.6	-25.9	20.8	52.6	-31.8
0.240	35.4	62.1	-26.7	16.4	52.1	-35.7
0.251	34.2	61.7	-27.5	17.3	51.7	-34.4
0.260	34.1	61.4	-27.3	18.9	51.4	-32.5
0.281	31.8	60.8	-29.0	14.6	50.8	-36.2

Table 6

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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
Transient Limiter	Hewlett Packard	11947A	15	12	26-Jul-2019
3 phase LISN	Rohde & Schwarz	ESH2-Z5	323	12	9-Apr-2019
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	22-Nov-2018

Table 7

Product Service

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

A1932, S/N: C02X500GL3FY - Modification State 0

2.2.3 Date of Test

17-September-2018 to 25-September-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 < 18GHz were taken at a 3m distance, and measurements > 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 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	21.8 °C
Relative Humidity	51.8 %

2.2.6 Test Results

Results for Configuration and Mode: Idle.

This testing was carried out to the Class B test limits.

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

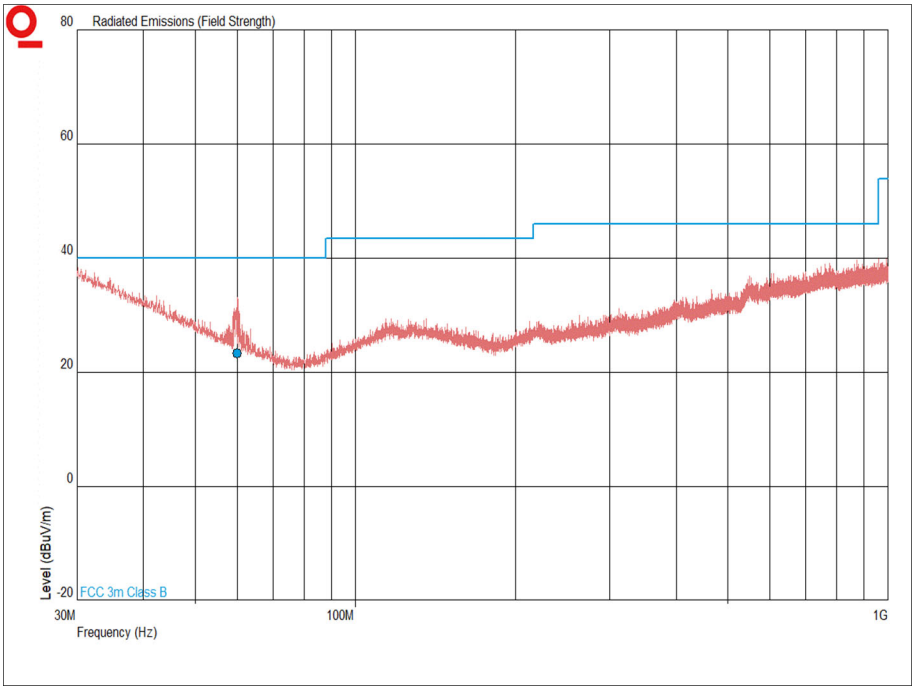

Figure 3 - Graphical Results - 30 MHz to 1 GHz – Horizontal/Vertical Polarity

Frequency (MHz)	QP Level (dBµV/m)	QP Limit (dBµV/m)	QP Margin (dB)	Angle(Deg)	Height(m)	Polarity
60.069	23.4	40.0	-16.6	39	1.00	Vertical

Table 8 – 30 MHz to 1 GHz – Radiated Emissions Results

Note: No other emissions were detected within 10 dB of the limit

Frequency Range of Test: 1 GHz to 30 GHz

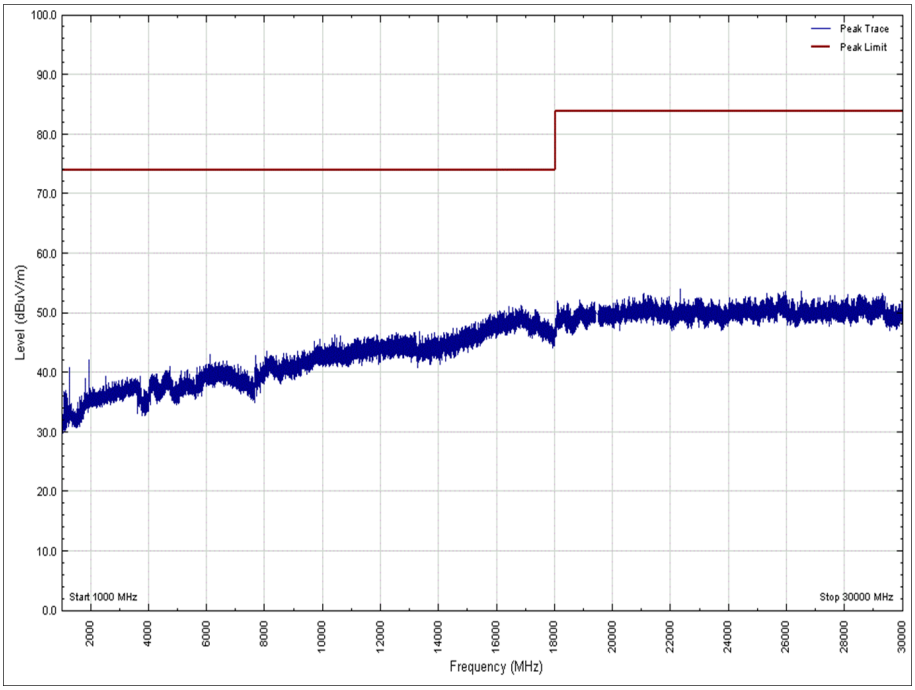

Figure 4 - Graphical Results 1 GHz to 30 GHz – Horizontal Polarity (Peak)

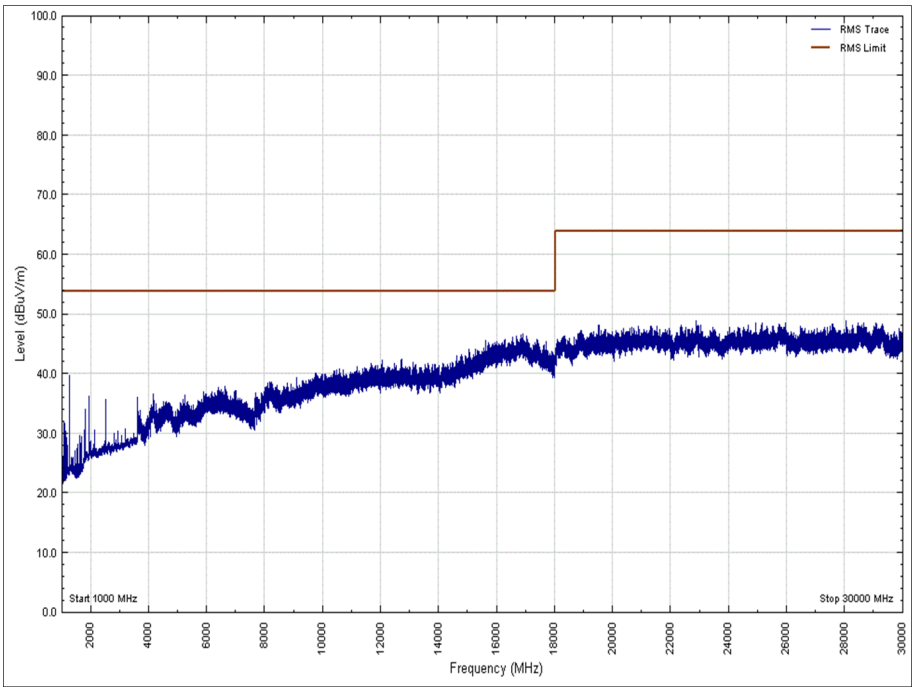

Figure 5 - Graphical Results 1 GHz to 30 GHz – Horizontal Polarity (Average)

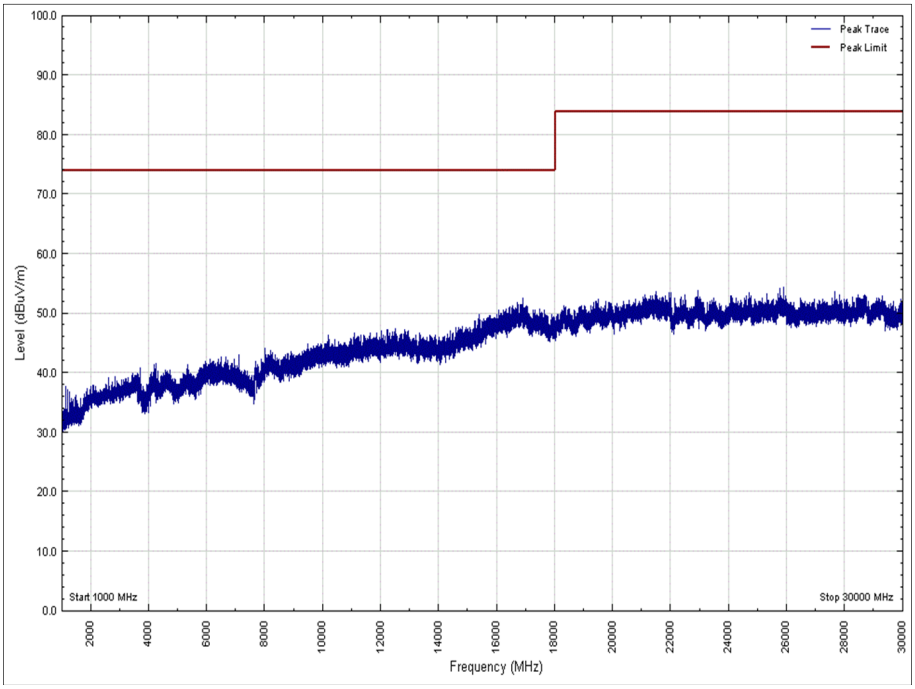

Figure 6 - Graphical Results 1 GHz to 30 GHz – Vertical Polarity (Peak)

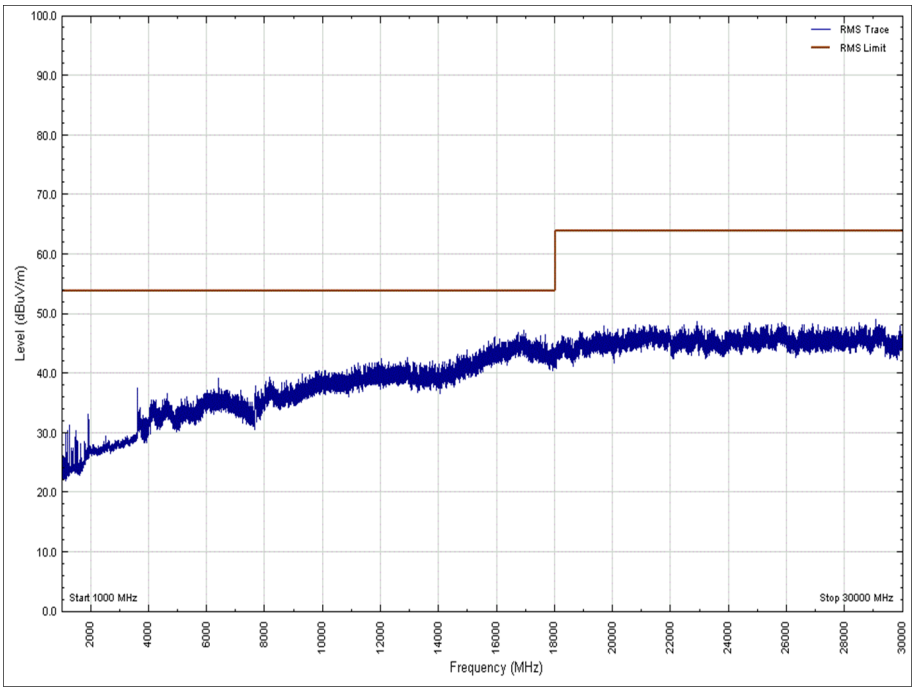

Figure 7 - Graphical Results 1 GHz to 30 GHz – Vertical Polarity (Average)

Frequency (GHz)	*Result (dBµV/m)*		*Limit (dBµV/m)*		*Margin (dB)*	
	Peak	*Average*	*Peak*	*Average*	*Peak*	*Average*
*						

Table 9 – 1 GHz to 30GHz - Radiated Emissions Results

*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
Pre-Amplifier	Phase One	PS04-0086	1533	12	12-Jan-2019
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	8-Aug-2019
Compliance 5 Emissions	Teseq	V5.26.51	3275	-	Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	Maturo Gmbh	NCD	3917	-	TU
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	18-Oct-2018
EMI Receiver	Keysight Technologies	N9038A MXE	4628	12	04-Jul-2019
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	12-Feb-2019
Cable (up to 40GHz)	Rosenberger	LU1-001-2000	5020	-	O/P Mon

Table 10

TU – Traceability Unscheduled

Product Service

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 11