



TEST REPORT

Test Report No. : UL-EMC-RP13559945JD19B V2.0

Manufacturer : Apple Inc.
Type of Equipment : Information Technology Equipment (ITE)
Model No. / HVIN : A2449
PMN : Apple Magic Keyboard with Touch ID
FCC ID : BCGA2449
ISED Canada Certification No. : 579C-A2449
Test Standard : 47CFR15.107, 47CFR15.109 and ICES-003 Issue 6 January 2016
Test Result : Complied

Version 2.0 supersedes all previous versions

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above standards.
4. The test results in this report are traceable to the national or international standards.

Date of issue:

07 April 2021

Checked by:

Adam Brown
Test Engineer

Company Signatory:

Matthew Owen
Operations Leader



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1. CUSTOMER DETAILS

Company Name:	Apple Inc.
Address:	1 Apple Park Way Cupertino CA 95014 USA
Contact Name:	Stuart Thomas

2. SUMMARY OF TESTING

2.1. Test Specification

1.	Reference:	47CFR15.107 and 47CFR15.109
	Title:	Code of Federal Regulations - Title 47 (Telecommunication): Part 15 (Radio Frequency Devices) - Subpart B (Unintentional Radiators) – Sections 15.107 and 15.109 October 1, 2020 Edition (including all applicable amendments up to November 13 2020)
2.	Reference:	ICES-003 Issue 6 January 2016
	Title:	Information Technology Equipment (Including Digital Apparatus) – Limits and Methods of Measurement
Site Registration:		FCC: 621311 / UK2011 ISED Canada: 20903 / UK0001

2.2. Summary of Test Results

FCC Reference	IC Reference	Measurement Type	Result
15.107	6.1	Conducted Emissions (AC Mains Input / Output Ports)	Complied
15.109	6.2	Radiated Emissions (Enclosure)	Complied

2.3. Location of Testing

All the measurements described in this report were performed at the premises of UL International (UK) Ltd, Unit 1 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire RG24 8AH.

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above, nor from the requirements defined in the basic standards called up within it.

3. EQUIPMENT UNDER TEST (EUT)

3.1. Description of EUT

The EUT was Bluetooth Keyboard.

3.2. Identification of Equipment under Test (EUT)

ID#	Description	Brand Name	Model No	Serial No
E1	Bluetooth Keyboard	Apple	A2449	F0T0417006N0JH302

3.3. Port Identification

Port	Description	Possible Length (m)	Type	Connector
P1.1	Enclosure	Not applicable	Enclosure	Not applicable
P1.2	Lightning	< 3	Signal / DC Power	Lightning

3.4. Operating Modes

Mode Reference	Definition
Charging	The EUT was charging from the Mains using an AC to DC Power Adapter but not Bluetooth connection was established. The EUT was left to go into a power saving state.

3.5. Configuration and Peripherals

Description:	Please refer to <i>section 9. Test Configuration Drawing</i> for schematic drawing(s) of the test configuration(s) employed in the course of testing.
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3.6. Modifications

No modifications were made to the EUT during the course of testing.

3.7. Additional Information Related to Testing

Equipment Category:	Information Technology Equipment (ITE)
Intended Operating Environment:	Residential / Commercial
Intended Installation:	Table Top
Cycle Time:	Less than 1 second
Power Supply Requirement(s):	5.1 V DC from AC to DC Power Adapter powered from 120 VAC, 60 Hz. 3.8 VDC Internal Battery
Weight:	241 g
Dimensions:	(279 x 114 x 11) mm
Hardware Version Number:	REV1.0
Software Version Number:	0xF125
FCC ID Number:	BCGA2449
ISED Number	579C-A2449
Highest Internally Generated Operating Frequency:	2480 MHz

4. SUPPORT EQUIPMENT

4.1. Identification of Support Equipment

Description	Manufacturer	Model No	Serial No
AC to DC Power Adapter	Apple	A2344	C3D0336AP4EPDYNAD
USB-C to USB-A Adapter	Apple	A1632	None Stated

4.2. Interconnecting Cables

Cable Type	Shielded	Length (m)	Ferrite	Connection 1	Connection 2
Lightning	Yes	1.0	No	EUT	USB-C to USB-A Adapter
USB 3	Yes	0.1	No	USB-C to USB-A Adapter	AC to DC Power Adapter
Direct Connection				AC to DC Power Adapter	AC Supply

5. MEASUREMENT UNCERTAINTY AND DECISION RULE

5.1. Overview

No measurement can ever be perfect and those imperfections give rise to error. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement regarding the uncertainty of approximation.

Note that compliance is determined solely upon the results of compliance measurements and does not take into account measurement uncertainties. The measurement uncertainty values quoted in this report are for information only as they do not influence the associated test results.

5.2. Method of calculation

The methods used to calculate the uncertainties included within this test report are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the United Kingdom Accreditation Service (UKAS) is followed.

5.3. Equipment Accuracy and Decision Rule

Measurement system instrumentation with an accuracy specification meeting the accuracy specification limits or that has an uncertainty within prescribed limits detailed in the specification or standard shall be used. When providing a statement of conformity to a technical specification or standard, unless inherent in the requested technical specification or standard, the decision rule applied shall be the Accuracy Method (as defined in IEC Guide 115) in determining compliance. The measurement result is considered in conformance with the requirement criteria if it is within the prescribed limit.

6. MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS

6.1. General Comments

6.1.1. This section contains the test result sheets for the measurements listed in Section 2.2.

Summary of Test Results (above).

6.1.2. The measurement uncertainties stated in the test result sheets were calculated in accordance with documented best practice and represent a confidence level of 95%. Where only confidence level is given, it has been demonstrated that the relevant items of test equipment used meet the specified requirements in the standard with at least this level of confidence.

6.1.3. Please refer to Section 5. **Measurement Uncertainty** on page 8 for details of our treatment of measurement uncertainty.

RADIATED EMISSIONS - TEST RESULTS

This test is covered by the scope of UL International (UK) Ltd's UKAS Accreditation under ISO/IEC 17025:2017.

GENERAL INFORMATION

JOB NUMBER:	13559945JD19	TEST SITE ID:	Site 51
EUT:	A2449	TEMPERATURE:	21 °C to 22 °C
TEST ENGINEER:	Nigel Clift	RELATIVE HUMIDITY:	49 % to 50 %
DATE OF TEST:	17 Nov 2020	ATMOSPHERIC PRESSURE:	1021mb to 1021 mb
FIELD TYPE:	Electric Field	MEASUREMENT DISTANCE:	3 Metres
UNCERTAINTY:	< 1 GHz: ± 3.91 dB > 1 GHz: ± 3.45 dB	EQUIPMENT CLASS:	Class B
MEASUREMENT UNITS:	dBµV/m	TEST ENVIRONMENT:	Test Site

TEST SPECIFICATION DETAILS

The EUT has been configured and tested in accordance with the methods and procedures detailed within the following basic standard:

REFERENCE:	ANSI C63.4:2014
TITLE:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

COMMENTS

○ Measurements were performed in a semi-anechoic chamber, at distances of 3 metres (30 MHz to 6 GHz) and 1 metre (6 GHz to 18 GHz). The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable.

Below 1 GHz, maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Above 1 GHz, the orientation of the EUT emanating the highest emission levels was determined using exploratory measurements with an antenna and spectrum analyser prior to the formal measurements. For the final test, emissions the EUT was rotated whilst positioned in the previously determined worst case orientation only.

○ The recorded disturbance level (field strength) was calculated from the level indicated by the measuring receiver, adjusted by a correction factor (CF in dB), calculated using the formula:

$$CF (dB) = CAtt (dB) + AF (dB/m) - PGain (dB)$$

Where:

CAtt (dB): Conducted Path Attenuation (Cables + Attenuators)

AF (dB/m): Antenna Factor

PGain (dB): External Preamplifier Gain

DEVIATIONS FROM TEST SPECIFICATION

There were no deviations from the test configuration and measurement arrangements defined in the test specification (identified above).

EUT RELATED

OPERATING MODE:	Normal Operation
FUNCTION(S) MONITORED:	Not Applicable

MEASUREMENT RESULTS

No.	Frequency (MHz)	Polarisation	Detector	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Graph No.	Result
1	37.667	Horizontal	Quasi-Peak	12.2	40.0	27.8	GPH\13559945JD19\001	Complied
2	49.725	Vertical	Quasi-Peak	14.0	40.0	26.0	GPH\13559945JD19\001	Complied
3	99.835	Horizontal	Quasi-Peak	12.2	43.5	31.3	GPH\13559945JD19\001	Complied
4	156.403	Vertical	Quasi-Peak	14.6	43.5	28.9	GPH\13559945JD19\001	Complied
5	226.364	Horizontal	Quasi-Peak	12.8	46.0	33.2	GPH\13559945JD19\001	Complied
6	330.298	Horizontal	Quasi-Peak	15.1	46.0	30.9	GPH\13559945JD19\001	Complied
7	478.022	Horizontal	Quasi-Peak	18.1	46.0	27.9	GPH\13559945JD19\001	Complied

MEASUREMENT RESULTS

No.	Frequency (MHz)	Polarisation	Detector	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Graph No.	Result
8	672.196	Vertical	Quasi-Peak	22.4	46.0	23.6	GPH\13559945JD19\001	Complied
9	958.038	Vertical	Quasi-Peak	26.8	46.0	19.2	GPH\13559945JD19\001	Complied
10	2057.652	Horizontal	Peak	42.6	74.0	31.4	GPH\13559945JD19\002	Complied
11	2058.831	Horizontal	CISPR Average	29.2	54.0	24.8	GPH\13559945JD19\002	Complied
12	4585.519	Horizontal	Peak	47.8	74.0	26.2	GPH\13559945JD19\003	Complied
13	4603.588	Vertical	CISPR Average	34.4	54.0	19.6	GPH\13559945JD19\003	Complied
14	9540.303	Vertical	CISPR Average	41.0	54.0	13.0	GPH\13559945JD19\004	Complied
15	9540.390	Horizontal	Peak	54.7	74.0	19.3	GPH\13559945JD19\004	Complied
16	11456.824	Horizontal	Peak	54.9	74.0	19.1	GPH\13559945JD19\005	Complied
17	11475.720	Horizontal	CISPR Average	41.1	54.0	12.9	GPH\13559945JD19\005	Complied

TEST EQUIPMENT USED

UL ID	INSTRUMENT DESCRIPTION	MODEL NUMBER	CALIBRATION DUE	INTERVAL
K0031	3m Semi-Anechoic Chamber 2	N/A	11 Feb 2021	12
M2048	Thermo-Hygrometer	608-H1	28 Sep 2021	12
M1590	26.5 GHz Test Receiver	ESU26	04 Mar 2021	12
C1768	1 metre N-male to N-male RF cable	SA90-195-1MTR	02 Jul 2021	12
A3149	10 MHz to 1.3 GHz Low Noise Pre-Amplifier	LNA - 1330	14 Aug 2021	12
A3157	3 dB Attenuator	1812 BW-N3 W5	13 Aug 2021	12
C1830	2 metre N-male to N-male RF cable	Sucoflex 104A	13 Aug 2021	12
C1823	15 metre N-male to N-male RF cable	Sucoflex 104A	14 Aug 2021	12
C1871	8 metre N-male to N-male RF cable	Sucoflex 104A	15 Apr 2021	12
A3047	5 dB Attenuator	BW-N5W5+	Calibrated as part of system	N/A
A2959	Trilog Broadband Antenna	VULB 9163	06 Feb 2021	12
C1832	1 metre N-male to N-male RF cable	Sucoflex 104A	13 Aug 2021	12
A2949	500 MHz to 18 GHz Pre-amplifier	PAM-118A	02 Mar 2021	12
A3076	3 dB Attenuator	1812 BW-N3 W5+	09 Jul 2021	12
C1801	2 metre N-male to N-male RF cable	SA90-195-2MTR	02 Mar 2021	12
C1807	2 metre N-male to N-male RF cable	SA90-195-2MTR	27 May 2021	12
C1676	1 metre N-male to N-male RF cable	SA90-195-1MTR	27 May 2021	12
A512	Double ridged Horn	3115	05 Nov 2021	12

CONDUCTED EMISSIONS - TEST RESULTS

This test is covered by the scope of UL International (UK) Ltd's UKAS Accreditation under ISO/IEC 17025:2017.

GENERAL INFORMATION

JOB NUMBER:	13559945JD19	TEST SITE ID:	Site 56
EUT:	A2449	TEMPERATURE:	22 °C To 22 °C
TEST ENGINEER:	Adam Brown	RELATIVE HUMIDITY:	45 % To 45 %
DATE OF TEST:	18 Nov 2020	ATMOSPHERIC PRESSURE:	1018 mb To 1018 mb
UNCERTAINTY:	± 1.96 dB	EQUIPMENT CLASS:	Class B
EUT CATEGORY:	Not Applicable	MEASUREMENT METHOD:	LISN (AC)
PORT UNDER TEST:	AC Power Input	EUT SUPPLY VOLTAGE:	120 VAC / 60 Hz

TEST SPECIFICATION DETAILS

The EUT has been configured and tested in accordance with the methods and procedures detailed within the following basic standard:

REFERENCE:	ANSI C63.4:2014
TITLE:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

COMMENTS

○ The recorded disturbance level (voltage) was calculated from the level indicated by the measuring receiver, adjusted by a correction factor (CF in dB), calculated using the formula:

$$CF (dB) = CAtt (dB) + PLAtt (dB) + VDF (dB)$$

Where:

CAtt (dB): Conducted Path Attenuation (Cables + Attenuators)

PLAtt (dB): Pulse Limiter Attenuation

VDF (dB): Voltage Division Factor of LISN

DEVIATIONS FROM TEST SPECIFICATION

There were no deviations from the test configuration and measurement arrangements defined in the test specification (identified above).

EUT RELATED

OPERATING MODE:	Charging
FUNCTION(S) MONITORED:	Not Applicable

MEASUREMENT RESULTS

No.	Frequency (MHz)	Line	Detector	Level (dBμV)	Limit (dBμV)	Margin (dB)	Graph No.	Result
1	0.152	Live	CISPR Average	17.7	55.9	38.2	GPH\13559945JD19\006	Complied
2	0.395	Live	CISPR Average	14.6	48.0	33.4	GPH\13559945JD19\006	Complied
3	0.431	Live	CISPR Average	15.4	47.2	31.9	GPH\13559945JD19\006	Complied
4	0.744	Live	CISPR Average	14.0	46.0	32.0	GPH\13559945JD19\006	Complied
5	13.560	Live	CISPR Average	15.7	50.0	34.3	GPH\13559945JD19\006	Complied
6	16.235	Live	CISPR Average	18.4	50.0	31.6	GPH\13559945JD19\006	Complied
7	29.193	Live	CISPR Average	19.5	50.0	30.5	GPH\13559945JD19\006	Complied
8	0.159	Live	Quasi-Peak	22.6	65.5	42.9	GPH\13559945JD19\006	Complied
9	0.395	Live	Quasi-Peak	17.2	58.0	40.8	GPH\13559945JD19\006	Complied
10	0.431	Live	Quasi-Peak	18.0	57.2	39.3	GPH\13559945JD19\006	Complied
11	0.744	Live	Quasi-Peak	17.9	56.0	38.1	GPH\13559945JD19\006	Complied
12	13.562	Live	Quasi-Peak	17.6	60.0	42.4	GPH\13559945JD19\006	Complied
13	16.240	Live	Quasi-Peak	20.4	60.0	39.6	GPH\13559945JD19\006	Complied

MEASUREMENT RESULTS

No.	Frequency (MHz)	Line	Detector	Level (dBµV)	Limit (dBµV)	Margin (dB)	Graph No.	Result
14	29.191	Live	Quasi-Peak	22.5	60.0	37.5	GPH\13559945JD19\006	Complied
15	0.152	Neutral	CISPR Average	17.6	55.9	38.3	GPH\13559945JD19\007	Complied
16	0.200	Neutral	CISPR Average	17.9	53.6	35.8	GPH\13559945JD19\007	Complied
17	0.431	Neutral	CISPR Average	17.1	47.2	30.1	GPH\13559945JD19\007	Complied
18	0.987	Neutral	CISPR Average	14.1	46.0	31.9	GPH\13559945JD19\007	Complied
19	16.193	Neutral	CISPR Average	15.0	50.0	35.0	GPH\13559945JD19\007	Complied
20	28.952	Neutral	CISPR Average	18.7	50.0	31.3	GPH\13559945JD19\007	Complied
21	0.155	Neutral	Quasi-Peak	22.7	65.8	43.1	GPH\13559945JD19\007	Complied
22	0.159	Neutral	Quasi-Peak	22.7	65.5	42.8	GPH\13559945JD19\007	Complied
23	0.431	Neutral	Quasi-Peak	19.2	57.2	38.0	GPH\13559945JD19\007	Complied
24	0.987	Neutral	Quasi-Peak	16.3	56.0	39.7	GPH\13559945JD19\007	Complied
25	16.215	Neutral	Quasi-Peak	18.7	60.0	41.3	GPH\13559945JD19\007	Complied
26	29.193	Neutral	Quasi-Peak	21.3	60.0	38.7	GPH\13559945JD19\007	Complied

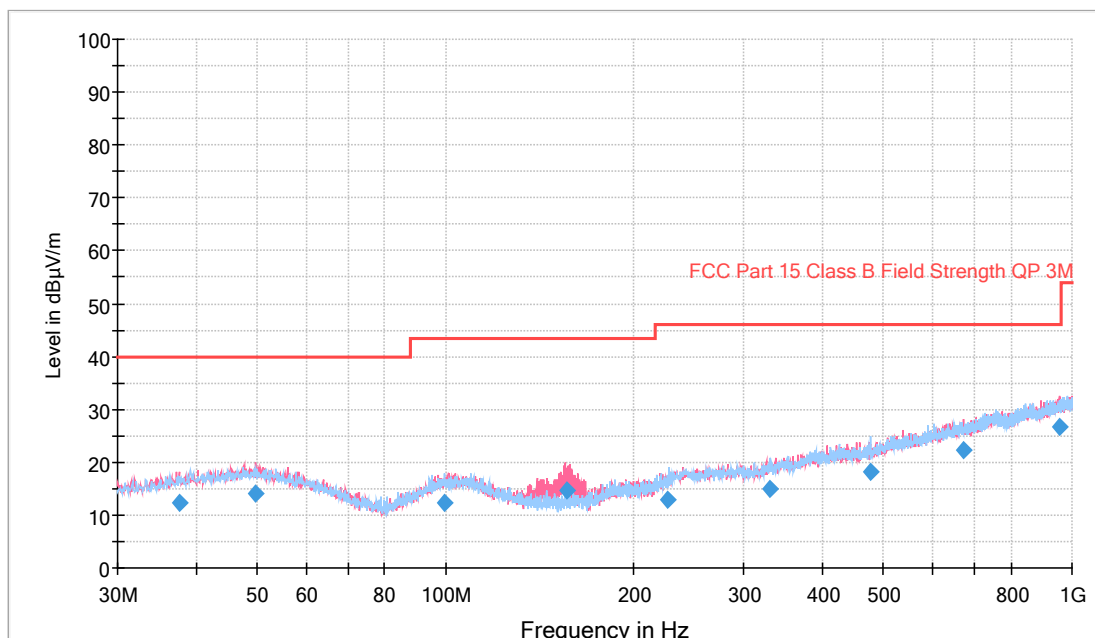
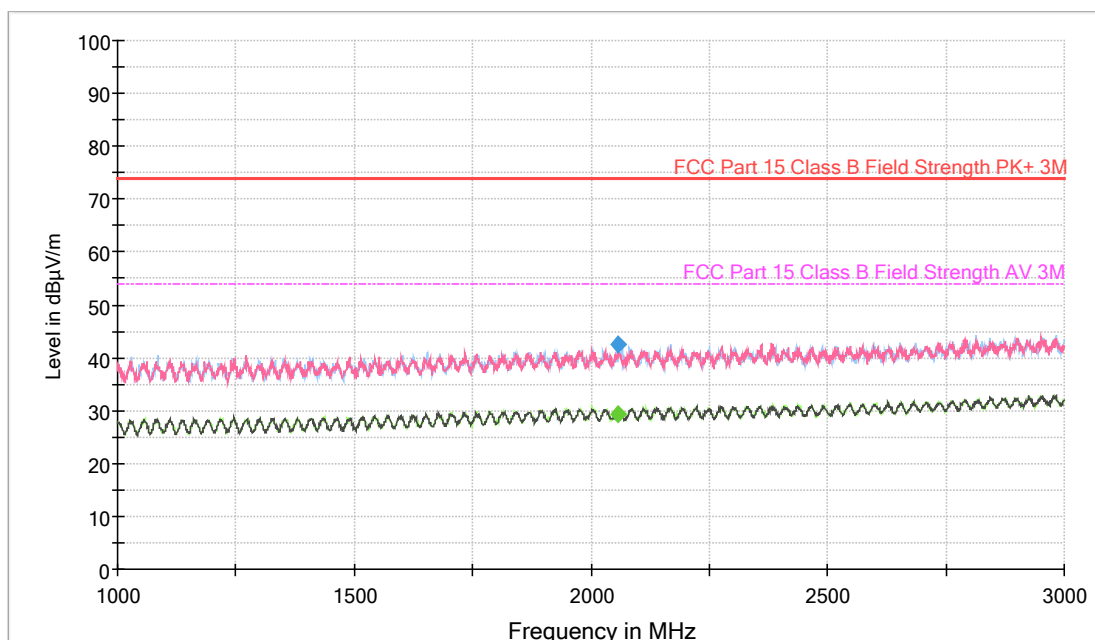
TEST EQUIPMENT USED

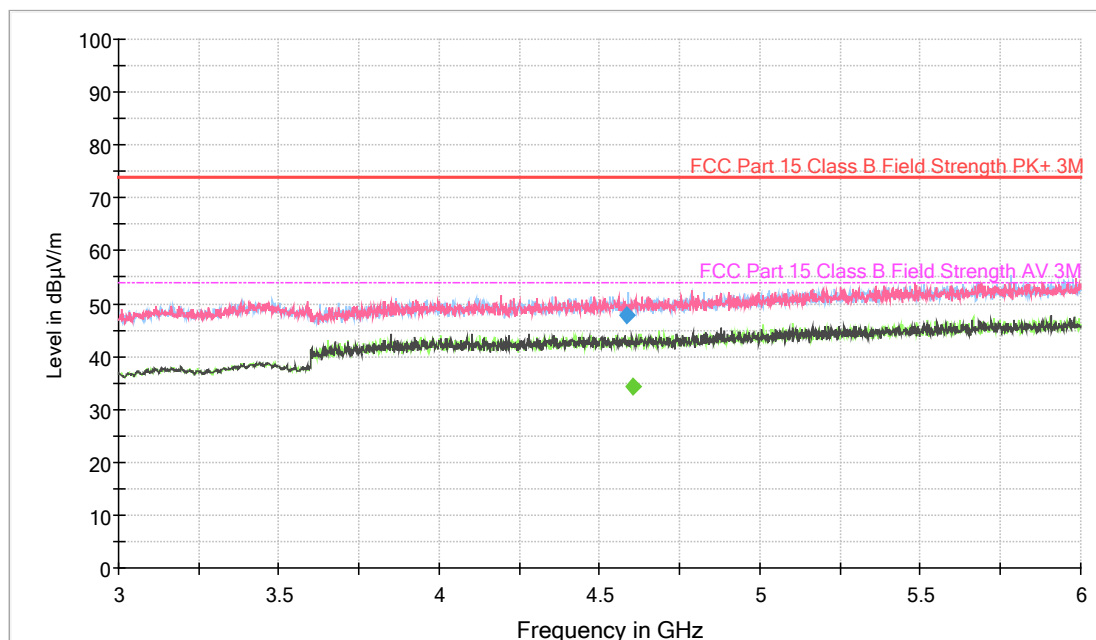
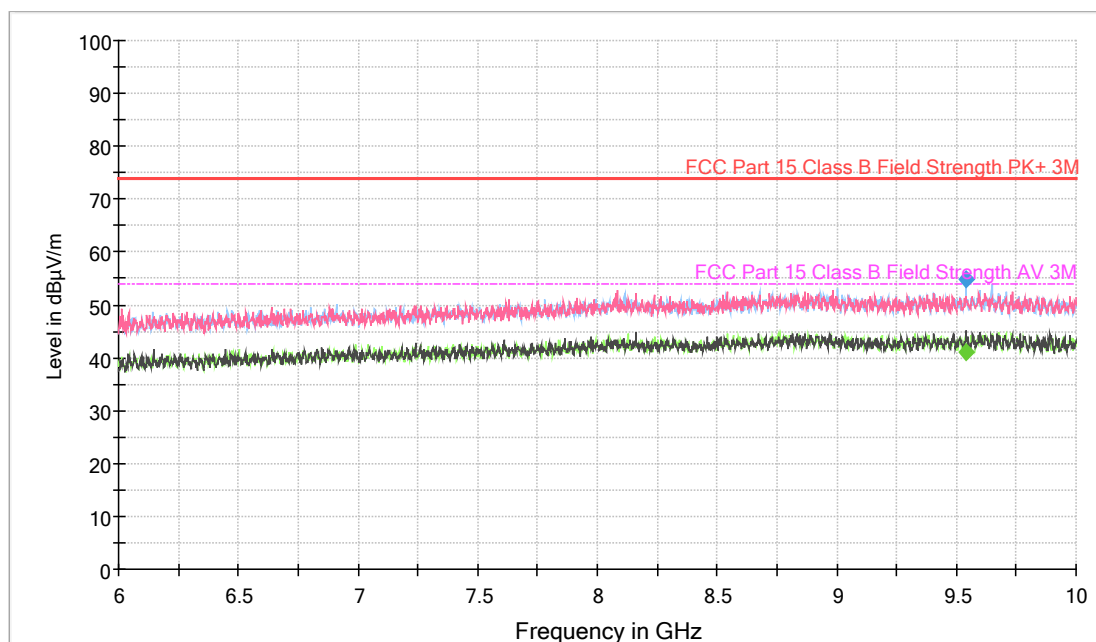
UL ID	INSTRUMENT DESCRIPTION	MODEL NUMBER	CALIBRATION DUE	INTERVAL
K0036	Conducted Emissions / Immunity Test Laboratory 2	N/A	Calibration not required	N/A
M2012	Thermo-Hygrometer	608-H1	06 Dec 2020	12
N0613	Site 56 Test PC	Motherboard Asus Z97-P	Calibration not required	N/A
M2051	3.6 GHz EMI Test Receiver	ESR3	14 Oct 2021	12
A1828	N-Type Pulse Limiter	ESH3-Z2	03 Nov 2021	12
C1619	Type N - Coaxial Cable	Sucoflex 104A	03 Nov 2021	12
A2086	2 Line LISN	ENV216 (3560.6550.13)	26 Feb 2021	12
M524	300V 4800VA 1ph Harmonics/Flicker Test system	6843A	Calibrated before use	N/A

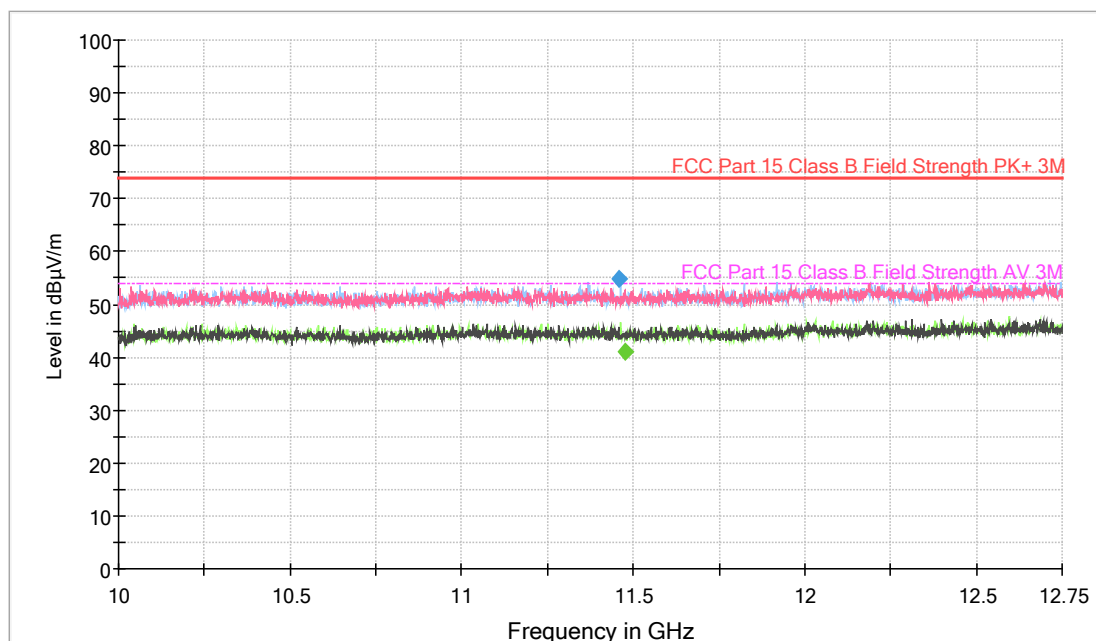
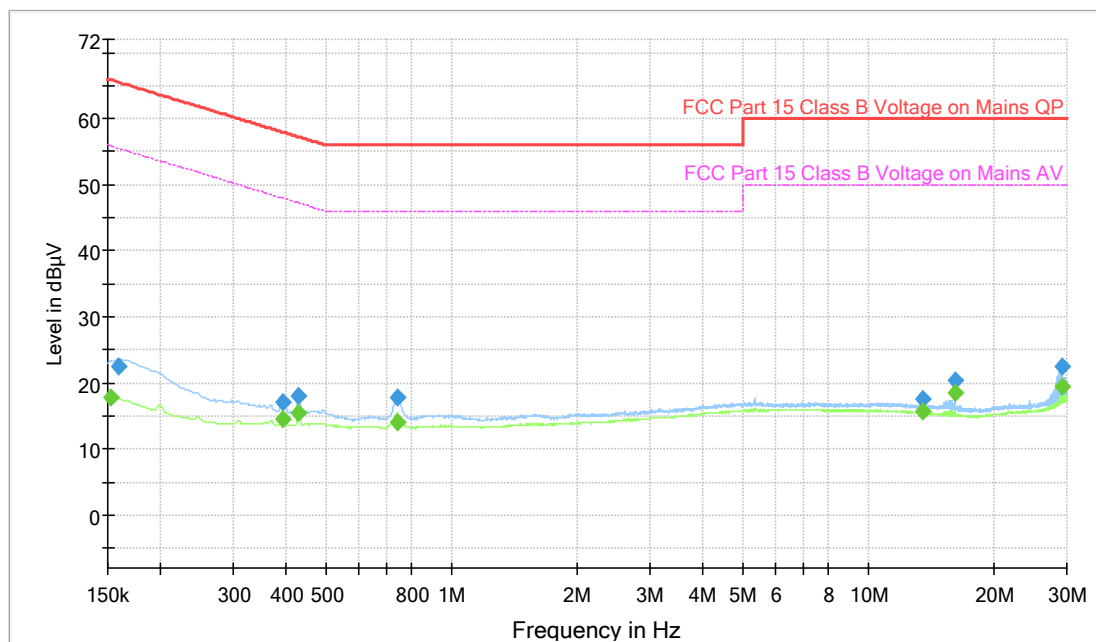
7. GRAPHICAL TEST RESULTS

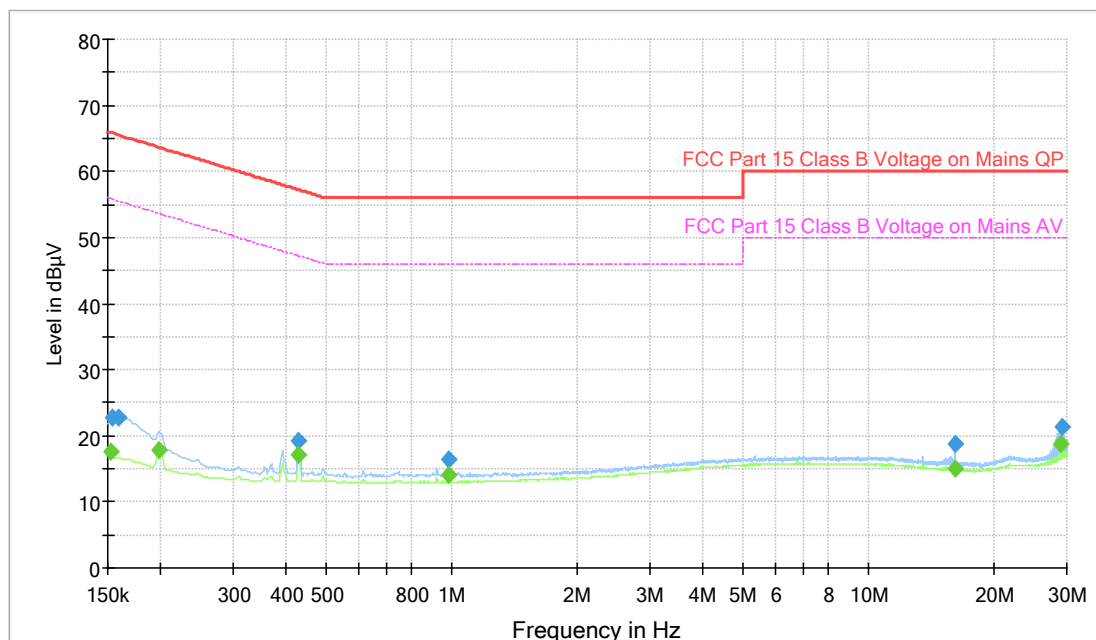
7.1. This section contains the graphical results for the measurements listed in Section **2.2. Summary of Test Results** (above).

Graph Reference Number	Title
GPH\13559945JD19\001	Radiated Emissions (30 MHz to 1 GHz)
GPH\13559945JD19\002	Radiated Emissions (1 GHz to 3 GHz)
GPH\13559945JD19\003	Radiated Emissions (3 GHz to 6 GHz)
GPH\13559945JD19\004	Radiated Emissions (6 GHz to 10 GHz)
GPH\13559945JD19\005	Radiated Emissions (10 GHz to 12.75 GHz)
GPH\13559945JD19\006	Conducted Emissions (150 kHz to 30 MHz) Live
GPH\13559945JD19\007	Conducted Emissions (150 kHz to 30 MHz) Neutral

GPH\13559945JD19\001 - Radiated Emissions (30 MHz to 1 GHz)**GPH\13559945JD19\002 - Radiated Emissions (1 GHz to 3 GHz)**

GPH\13559945JD19\003 - Radiated Emissions (3 GHz to 6 GHz)**GPH\13559945JD19\004 - Radiated Emissions (6 GHz to 10 GHz)**

GPH\13559945JD19\005 - Radiated Emissions (10 GHz to 12.75 GHz)**GPH\13559945JD19\006 – Conducted Emissions (150 kHz to 30 MHz) Live**

GPH\13559945JD19\007 – Conducted Emissions (150 kHz to 30 MHz) Neutral

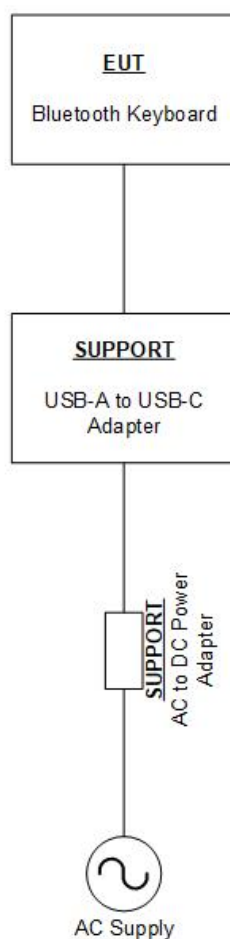
8. TEST CONFIGURATION DRAWING

8.1. This section contains the Test Configuration Drawings for the measurements listed in Section 7: Measurements, Examinations and Derived Results.

Test Configuration Reference Number	Title
DRG\13559945JD19\001	Schematic Diagram of the EUT, Support Equipment and Interconnecting Cables Used During Testing

DRG\13559945JD19\001 - Schematic Diagram of the EUT, Support Equipment and Interconnecting Cables Used During Testing

Configuration of EUT and Local Support Equipment



Configuration of Remote Support Equipment

9. REPORT REVISION HISTORY

9.1. This section contains the report revision history.

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version.
2.0	1, 6	Cover, 3.7	Removed "-" from FCC ID.