



TEST REPORT

Test Report No. : UL-RPT-RP13727985JD05A

Customer : Apple Inc.
Model No. / HVIN : A2540
PMN : Siri Remote
FCC ID : BCGA2540
ISED Certification No. : 579C-A2540
Technology : *Bluetooth* – Low Energy
Test Standard(s) : FCC Parts 15.207, 15.209(a) & 15.247
Innovation, Science and Economic Development Canada
RSS-247 Issue 2 February 2017
RSS-Gen Issue 5 February 2021
Test Laboratory : UL International (UK) Ltd, Basingstoke, Hampshire, RG24 8AH,
United Kingdom

1. This test report shall not be reproduced except in full, without the written approval of UL International (UK) Ltd.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0.

Date of Issue: 02 April 2021

Checked by: 
Sarah Williams
RF Operations Leader, Radio Laboratory

Company Signatory: 
Ben Mercer
Lead Project Engineer, Radio Laboratory



5772

The *Bluetooth*® word mark and logos are owned by the *Bluetooth* SIG, Inc. and any use of such marks by UL International (UK) Ltd is under licence. Other trademarks and trade names are those of their respective owners.

UL International (UK) LTD

Unit 1-3 Horizon, Kingsland Business Park, Wade Road, Basingstoke, Hampshire, RG24 8AH, UK
Telephone: +44 (0)1256 312000
Facsimile: +44 (0)1256 312001

Customer Information

Company Name:	Apple Inc.
Address:	One Apple Park Way Cupertino, California 95014 U.S.A.
Contact Name:	Stuart Thomas

Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	02/04/2021	Initial Version	Sarah Williams

Table of Contents

Customer Information.....	2
Report Revision History	2
Table of Contents.....	3
1. Attestation of Test Results	4
1.1. Description of EUT	4
1.2. General Information	4
1.3. Summary of Test Results	5
1.4. Deviations from the Test Specification	5
2. Summary of Testing.....	6
2.1. Facilities and Accreditation	6
2.2. Methods and Procedures	6
2.3. Calibration and Uncertainty	7
2.4. Test and Measurement Equipment	8
3. Equipment Under Test (EUT)	10
3.1. Identification of Equipment Under Test (EUT)	10
3.2. Modifications Incorporated in the EUT	10
3.3. Additional Information Related to Testing	11
3.4. Description of Available Antennas	11
3.5. Description of Test Setup	12
4. Antenna Port Test Results	17
4.1. Transmitter Duty Cycle	17
4.2. Transmitter 99% Occupied Bandwidth	18
4.3. Transmitter Minimum 6 dB Bandwidth	20
4.4. Transmitter Maximum Peak Output Power	22
5. Radiated Test Results.....	25
5.1. Transmitter Radiated Emissions <1 GHz	25
5.2. Transmitter Radiated Emissions >1 GHz	27
5.3. Transmitter Band Edge Radiated Emissions	30
6. AC Power Line Conducted Emissions Test Results.....	33
6.1. Transmitter AC Conducted Spurious Emissions	33

1. Attestation of Test Results

1.1. Description of EUT

The equipment under test was a *Bluetooth* Low Energy remote control for an Apple TV.

1.2. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 15.247
Specification Reference:	47CFR15.207 & 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Sections 15.207 & 15.209
Specification Reference:	RSS-Gen Issue 5 February 2021
Specification Title:	General Requirements for Compliance of Radio Apparatus
Specification Reference:	RSS-247 Issue 2 February 2017
Specification Title:	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Site Registration:	FCC: 621311, ISEDC: 20903
FCC Lab. Designation No.:	UK2011
ISEDC CABID:	UK0001
Location of Testing:	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, G24 8AH, United Kingdom
Test Dates:	26 March 2021 to 31 March 2021

1.3. Summary of Test Results

FCC Reference (47CFR)	ISED Canada Reference	Measurement	Result
Part 15.35(c)	RSS-Gen 8.2	Transmitter Duty Cycle	Note 1
N/A	RSS-Gen 6.7	Transmitter 99% Occupied Bandwidth	Complied
Part 15.247(a)(2)	RSS-Gen 6.7 / RSS-247 5.2(a)	Transmitter Minimum 6 dB Bandwidth	Complied
Part 15.247(b)(3)	RSS-Gen 6.12 / RSS-247 5.4(d)	Transmitter Maximum Peak Output Power	Complied
Part 15.247(e)	RSS-247 5.4(b)	Transmitter Power Spectral Density	Note 2
Part 15.247(d) & 15.209(a)	RSS-Gen 6.13 / RSS-247 5.5	Transmitter Band Edge Conducted Emissions	Complied
Part 15.247(d) & 15.209(a)	RSS-Gen 6.13 / RSS-247 5.5	Transmitter Radiated Emissions	Complied
Part 15.207	RSS-Gen 8.8	Transmitter AC Conducted Emissions	Complied

Note(s):

1. The measurement was performed to assist in the calculation of the level of the emissions. The EUT cannot transmit continuously and sweep triggering/signal gating cannot be implemented.
2. In accordance with ANSI C63.10 Section 11.10.1, PSD measurements are not required if the maximum conducted output power is less than the PSD limit of 8 dBm / 3 kHz. The PSD level is therefore deemed to be equal to the measured output power.

1.4. 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.

2. Summary of Testing

2.1. Facilities and Accreditation

The test site and measurement facilities used to collect data are located at Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom. The following table identifies which facilities were utilised for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

Site 1	X
Site 2	-
Site 17	X

UL International (UK) Ltd is accredited by the United Kingdom Accreditation Service (UKAS). UKAS is one of the signatories to the International Laboratory Accreditation Co-operation (ILAC) Arrangement for the mutual recognition of test reports. The tests reported herein have been performed in accordance with its terms of accreditation.

2.2. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
Title:	Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules
Reference:	KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions

2.3. Calibration and Uncertainty

Measuring Instrument Calibration

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

Measurement Uncertainty & Decision Rule

Overview

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. 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 of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

Decision Rule

The decision rule applied is based upon the accuracy method criteria. The measurement uncertainty is met and the result is considered in conformance with the requirement criteria if the observed value is within the prescribed limit.

Measurement Uncertainty

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Duty Cycle	2.4 GHz to 2.4835 GHz	95%	±1.14 %
99% Occupied Bandwidth	2.4 GHz to 2.4835 GHz	95%	±3.92 %
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±4.59 %
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	±5.32 dB
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±3.30 dB
Radiated Spurious Emissions	1 GHz to 25 GHz	95%	±2.94 dB
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±1.96 dB

The methods used to calculate the above uncertainties 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 appropriate accreditation body is followed.

2.4. Test and Measurement Equipment

Test Equipment Used for Transmitter Conducted Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2002	Thermohygrometer	Testo	608-H1	45041825	10 Dec 2021	12
A3118	Attenuator	AtlanTecRF	AN18-10	237378#2	Calibrated before use	-
M2018	Signal Analyser	Rohde & Schwarz	FSV7	102699	01 Oct 2021	12
G0615	Signal Generator	Rohde & Schwarz	SMBV100A	260473	19 Mar 2023	36

Test Equipment Used for Transmitter Radiated Emissions Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Oct 2021	12
M2003	Thermohygrometer	Testo	608-H1	45046641	10 Dec 2021	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	07 Dec 2021	12
A2889	Antenna	Schwarzbeck	BBHA 9210 B	00653	23 Oct 2021	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	01 Feb 2022	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	01 Feb 2022	12
A2948	Pre-Amplifier	Com-Power	PAM-118A	551087	21 Oct 2021	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	06 Feb 2022	12
A3142	Pre-Amplifier	Schwarzbeck	BBV9718B	00020	21 Oct 2021	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	26 Oct 2021	12
A2951	Pre-Amplifier	Com-Power	PAM-103	441141	25 Jan 2022	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	28 Oct 2021	12
A2893	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-021	28 Oct 2021	12
A490	Antenna	Chase	CBL6111A	1590	07 Jun 2021	12
A3036	Low Pass Filter	AtlanTecRF	AFL-02000	15062902848	01 Feb 2022	12
M2040	Thermohygrometer	Testo	608-H1	45124934	07 Jan 2021	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Oct 2021	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	24 Apr 2021	12
A3198	Magnetic Loop Antenna	ETS-Lindgren	6502	00221887	01 Apr 2021	12

Test and Measurement Equipment (continued)**Test Equipment Used for Transmitter Band Edge Radiated Emissions Tests**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Oct 2021	12
M2003	Thermohygrometer	Testo	608-H1	45046641	10 Dec 2021	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	07 Dec 2021	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	21 Oct 2021	12
A2889	Antenna	Schwarzbeck	BBHA 9210 B	00653	23 Oct 2021	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	01 Feb 2022	12

Test Equipment Used for Transmitter AC Conducted Spurious Emissions:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2037	Thermohygrometer	Testo	608-H1	45124925	09 Dec 2021	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	03 Aug 2021	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	14 Dec 2021	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	07 Apr 2021	12

Test Measurement Software/Firmware Used:

Name	Version	Release Date
Rohde & Schwarz EMC32	6.30.0	2018

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Apple
Model Name or Number / HVIN:	A2540
PMN:	Siri Remote
Test Sample Serial Number:	C08FF25K15J6 (<i>Conducted sample #1</i>)
Hardware Version:	REV 1.0
Software Version:	0031
FCC ID:	BCGA2540
ISED Canada Certification Number:	IC: 579C-A2540

Brand Name:	Apple
Model Name or Number / HVIN:	A2540
PMN:	Siri Remote
Test Sample Serial Number:	C08FF29K15J6 (<i>Radiated sample #1</i>)
Hardware Version:	REV 1.0
Software Version:	0031
FCC ID:	BCGA2540
ISED Canada Certification Number:	IC: 579C-A2540

Brand Name:	Apple
Model Name or Number / HVIN:	A2540
PMN:	Siri Remote
Test Sample Serial Number:	C08FF28H15J6 (<i>Radiated sample #2</i>)
Hardware Version:	REV 1.0
Software Version:	0031
FCC ID:	BCGA2540
ISED Canada Certification Number:	IC: 579C-A2540

3.2. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.3. Additional Information Related to Testing

Technology Tested:	Bluetooth Low Energy (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rate:	1 Mbps		
Power Supply Requirement(s):	Nominal	3.8 VDC	
Maximum Conducted Output Power:	7.1 dBm		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	37	2402
	Middle	17	2440
	Top	39	2480

3.4. Description of Available Antennas

The radio utilizes an integrated antenna, with the following maximum gain:

Frequency (MHz)	Antenna Gain (dBi)
2402	-7.9
2442	-4.5
2480	-4.9

3.5. Description of Test Setup

Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Test Laptop
Brand Name:	Apple
Model Name or Number:	MacBook Pro
Serial Number:	C02Q81N5G3QD

Description:	USB Diagnostic Cable
Brand Name:	Apple
Model Name or Number:	Kanzi
Serial Number:	325D6D

Description:	AC to DC USB Power Adaptor
Brand Name:	Apple
Model Name or Number:	A1696
Serial Number:	Not marked or stated

Description:	USB-C Cable
Brand Name:	Apple
Model Name or Number:	A2344
Serial Number:	Not marked or stated

Description:	Test Laptop
Brand Name:	Apple
Model Name or Number:	MacBook Pro
Serial Number:	C02S21YFG8WQ

Description:	USB Diagnostic Cable
Brand Name:	Apple
Model Name or Number:	Kanzi
Serial Number:	31EFAD

Operating Modes

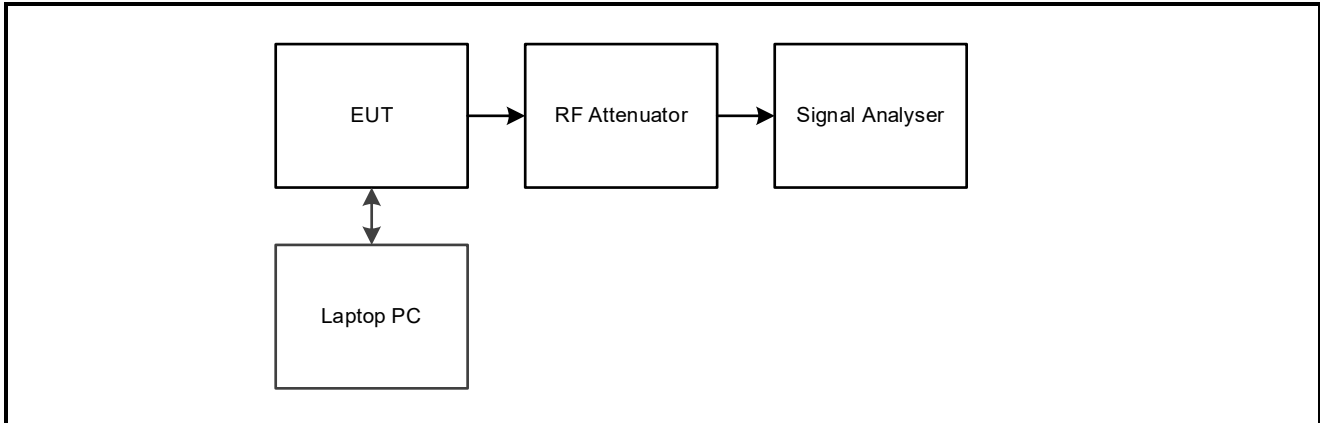
The EUT was tested in the following operating mode(s):

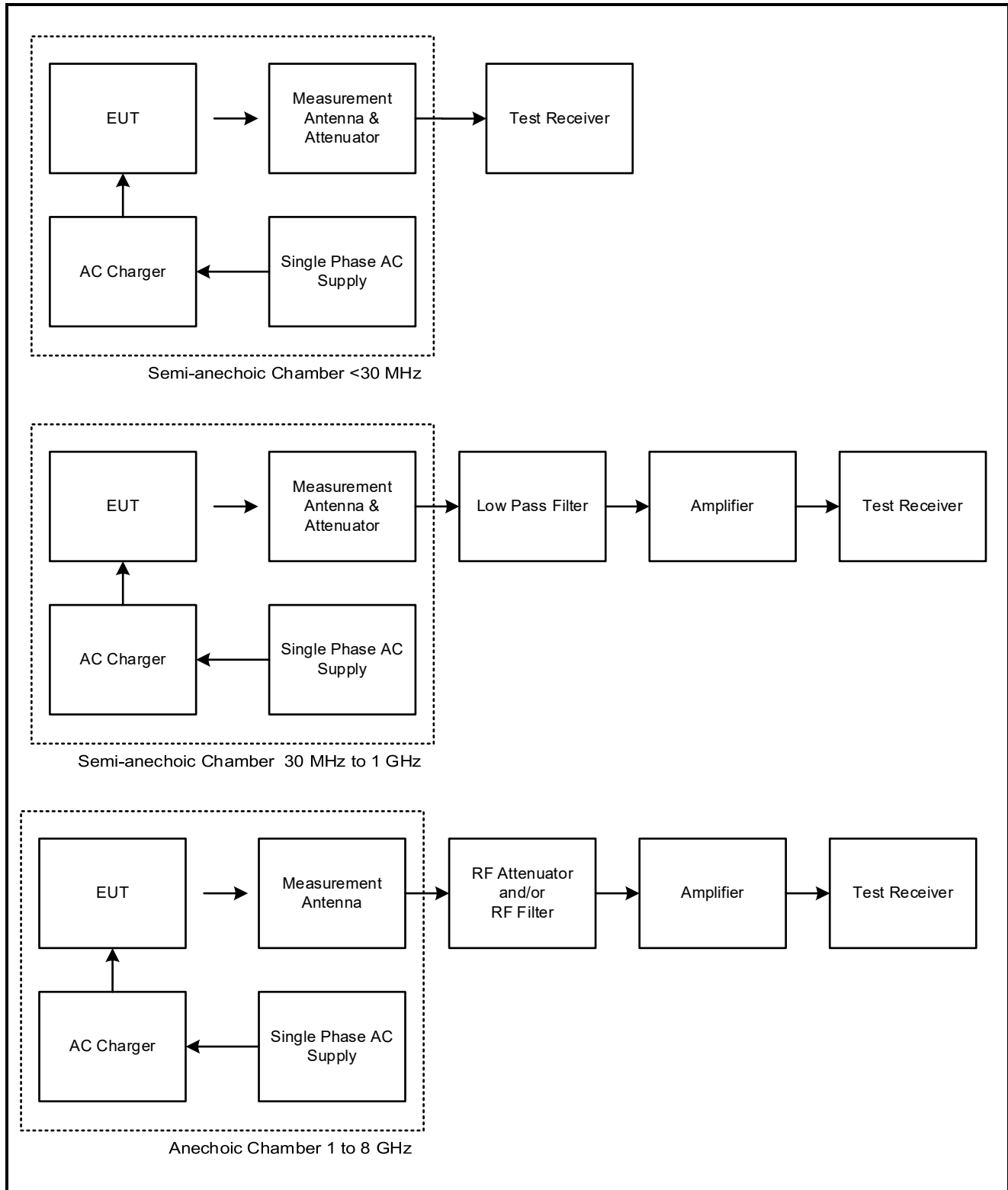
- Transmitting at maximum power in *Bluetooth* LE mode with modulation, maximum possible data length available and Pseudorandom Bit Sequence 9.

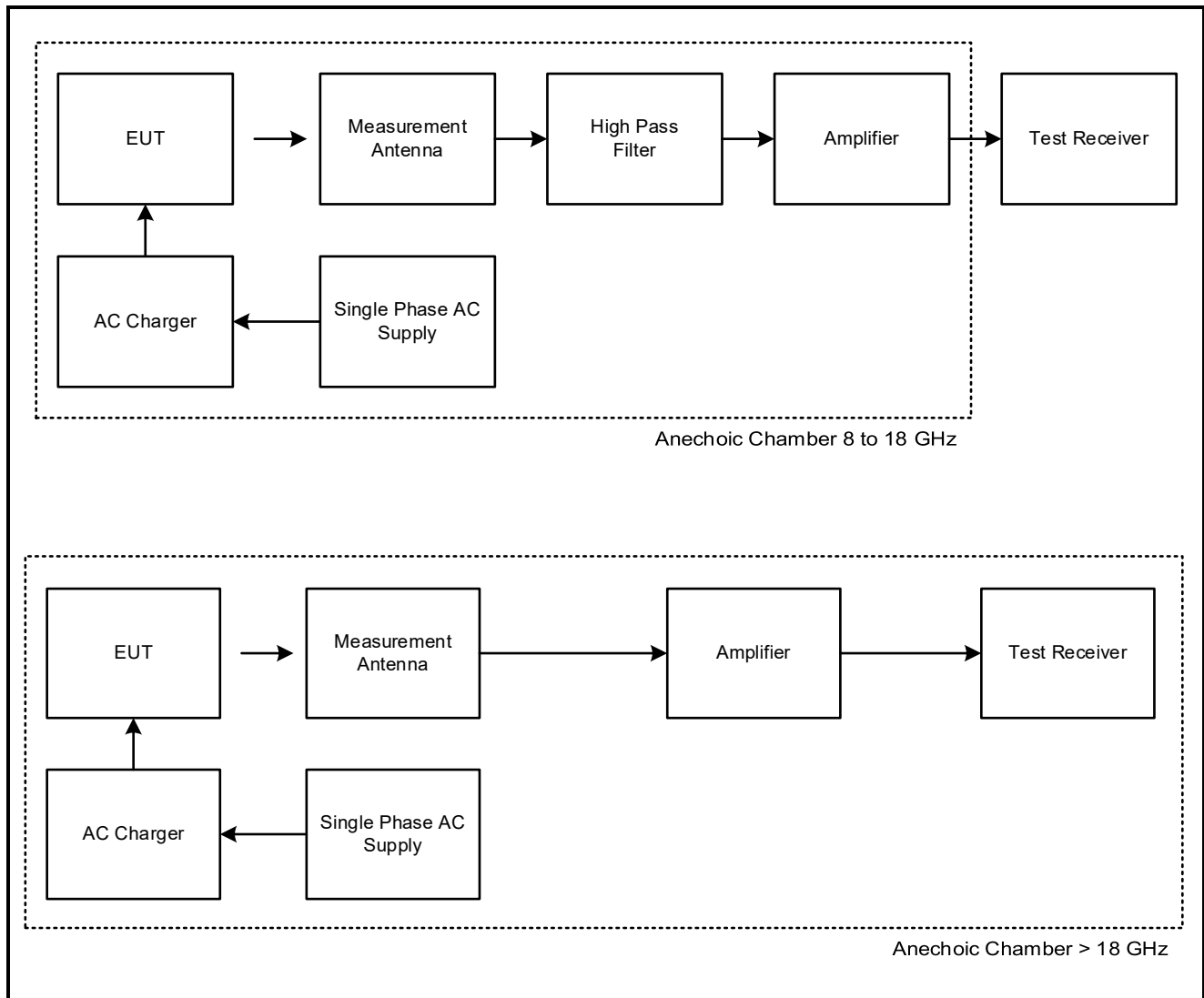
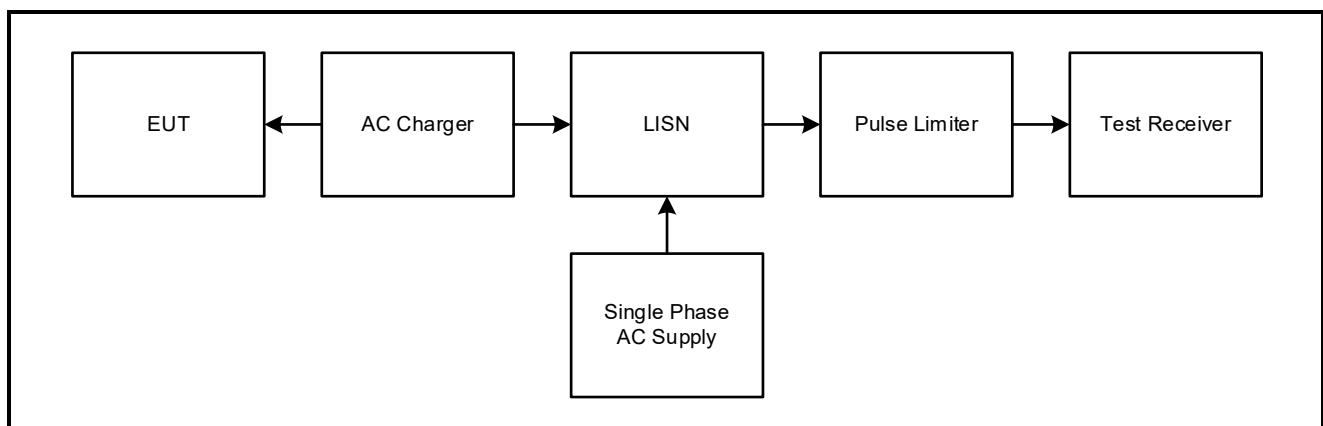
Configuration and Peripherals

The EUT was tested in the following configuration(s):

- Controlled in test mode using a set of commands entered into a terminal application on the test laptop supplied by the customer. The commands were used to enable a continuous transmission and to select the test channels as required. The customer supplied a document containing the setup instructions 'EUT_BT_SOP.docx'.
- The EUT was powered from the USB diagnostic cable connected to the test laptop for conducted tests.
- Transmitter radiated spurious emissions tests were performed with the EUT in the worst case position with the AC Charger connected to the EUT.

Test Setup Diagrams**Conducted Tests:****Test Setup for Transmitter Conducted Tests**

Test Setup Diagrams (continued)**Radiated Tests:****Test Setup for Transmitter Radiated Emissions**

Test Setup Diagrams (continued)**Test Setup for Transmitter Radiated Emissions (continued)****Test Setup for Transmitter AC Conducted Emissions**

4. Antenna Port Test Results

4.1. Transmitter Duty Cycle

Test Summary:

Test Engineer:	Chanthu Thevarajah	Test Date:	30 March 2021
Test Sample Serial Number:	C08FF25K15J6		

FCC Reference:	Part 15.35(c)
ISED Canada Reference:	RSS-Gen 8.2
Test Method Used:	FCC KDB 558074 Section 6 referencing ANSI C63.10 Section 11.6

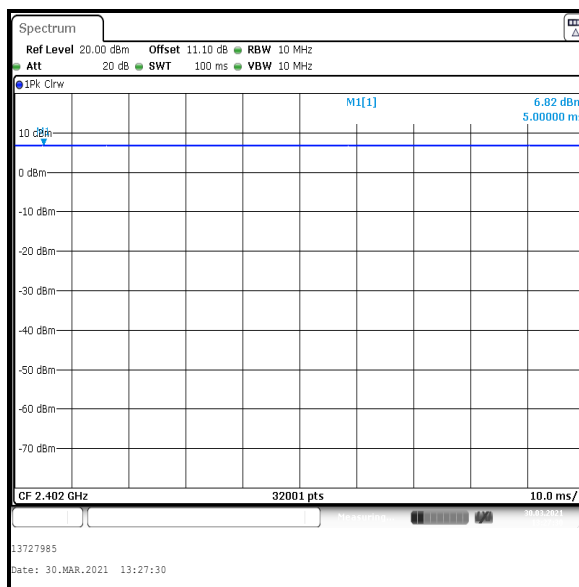
Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	35

Note(s):

- The duty cycle was measured and found to be greater than 98%. No duty cycle correction is required to assist with calculating the average emission levels.

Results:



4.2. Transmitter 99% Occupied Bandwidth

Test Summary:

Test Engineer:	Chanthu Thevarajah	Test Date:	26 March 2021
Test Sample Serial Number:	C08FF25K15J6		

FCC Reference:	N/A
ISED Canada Reference:	RSS-Gen 6.7
Test Method Used:	RSS-Gen 6.7 and Notes below

Environmental Conditions:

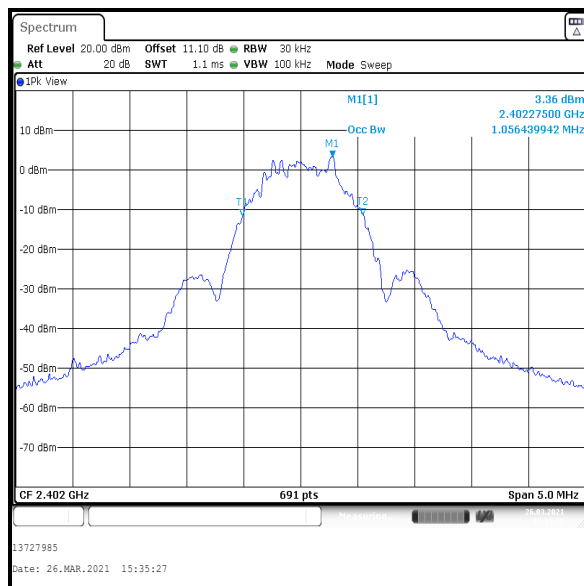
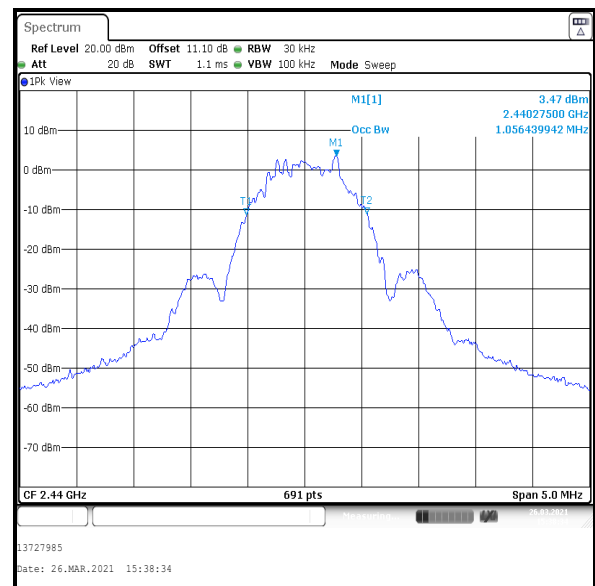
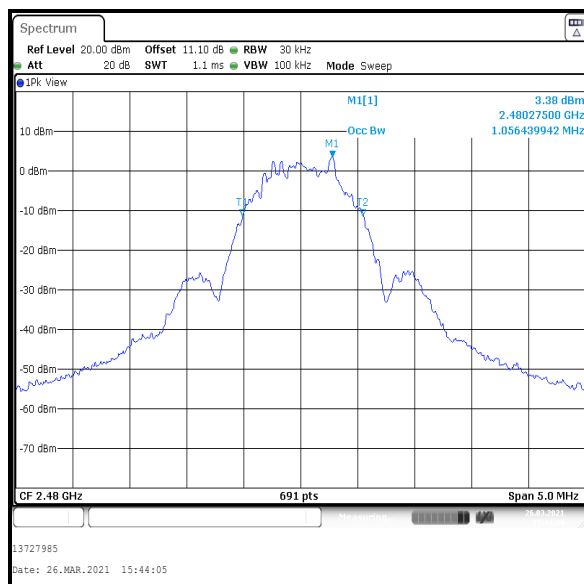
Temperature (°C):	22
Relative Humidity (%):	39

Note(s):

1. The 99% emission bandwidth was measured using the signal analyser occupied bandwidth function. The resolution bandwidth was set in the range of 1% to 5% of the occupied bandwidth and the video bandwidth set to 3 times the resolution bandwidth. The span was set to capture all products of the modulation process including emission skirts.
2. The signal analyser resolution bandwidth was set to 30 kHz and video bandwidth 100 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 5 MHz. The signal analyser function set the measurements to be made at 99% of the emission bandwidth. The results are given in the tables below.
3. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Transmitter 99% Occupied Bandwidth (continued)**Results:**

Channel	99% Occupied Bandwidth (kHz)
Bottom	1056.440
Middle	1056.440
Top	1056.440

**Bottom Channel****Middle Channel****Top Channel**

4.3. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Chanthu Thevarajah	Test Date:	26 March 2021
Test Sample Serial Number:	C08FF25K15J6		

FCC Reference:	Part 15.247(a)(2)
ISED Canada Reference:	RSS-Gen 6.7 / RSS-247 5.2(a)
Test Method Used:	FCC KDB 558074 Section 8.2 referencing ANSI C63.10 Section 11.8.1

Environmental Conditions:

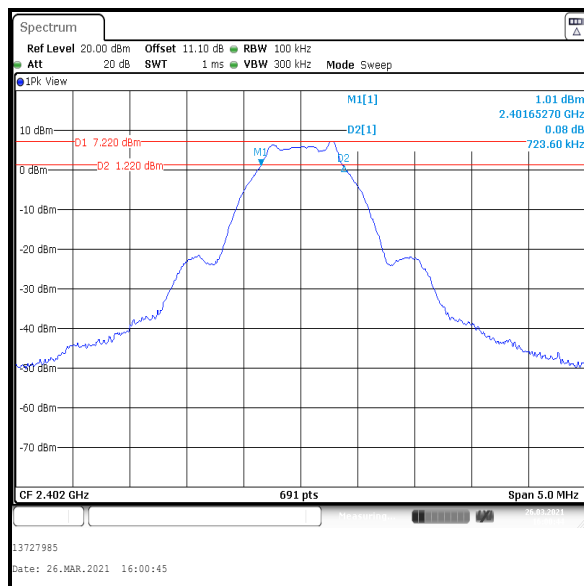
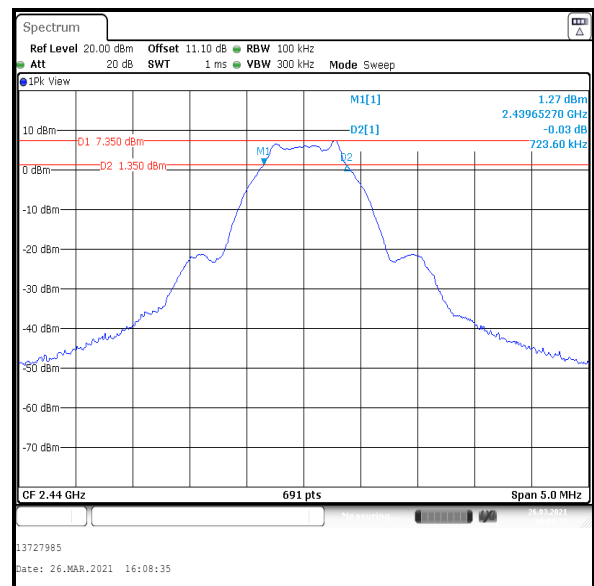
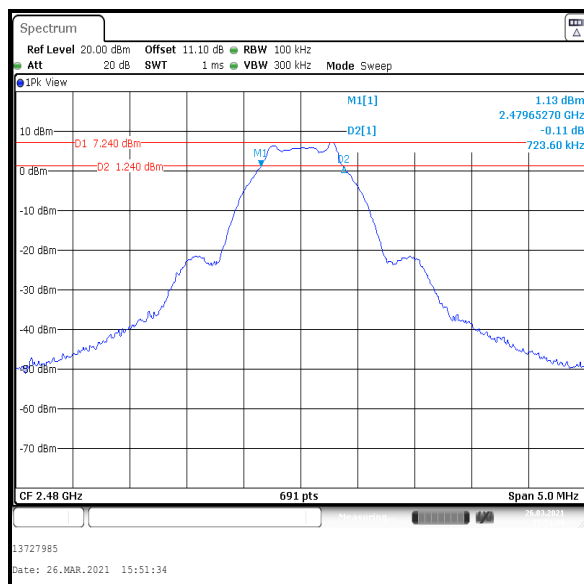
Temperature (°C):	22
Relative Humidity (%):	39

Note(s):

1. 6 dB DTS bandwidth tests were performed using a signal analyser in accordance with ANSI C63.10 Section 11.8.1 Option 1 measurement procedure. The signal analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Transmitter Minimum 6 dB Bandwidth (continued)**Results:**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	723.600	≥500	223.600	Complied
Middle	723.600	≥500	223.600	Complied
Top	723.600	≥500	223.600	Complied

**Bottom Channel****Middle Channel****Top Channel**

4.4. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Chanthu Thevarajah	Test Date:	29 March 2021
Test Sample Serial Number:	C08FF25K15J6		

FCC Reference:	Part 15.247(b)(3)
ISED Canada Reference:	RSS-Gen 6.12 / RSS-247 5.4(d)
Test Method Used:	FCC KDB 558074 Section 8.3.1.1 referencing ANSI C63.10 Section 11.9.1.1 and Notes below

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	38

Note(s):

1. Conducted power tests were performed using a signal analyser in accordance with ANSI C63.10 Section 11.9.1.1 with the RBW $\geq$ DTS bandwidth procedure.
2. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth of 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 3 MHz. A marker was placed at the peak of the signal and the results recorded in the tables below.
3. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.
4. The conducted power was added to the declared antenna gain to obtain the EIRP.

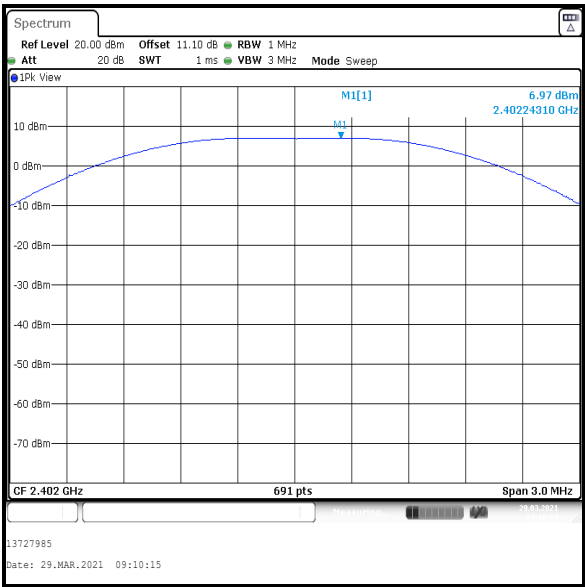
Transmitter Maximum Peak Output Power (continued)**Results:**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	7.0	30.0	23.0	Complied
Middle	7.1	30.0	22.9	Complied
Top	7.0	30.0	23.0	Complied

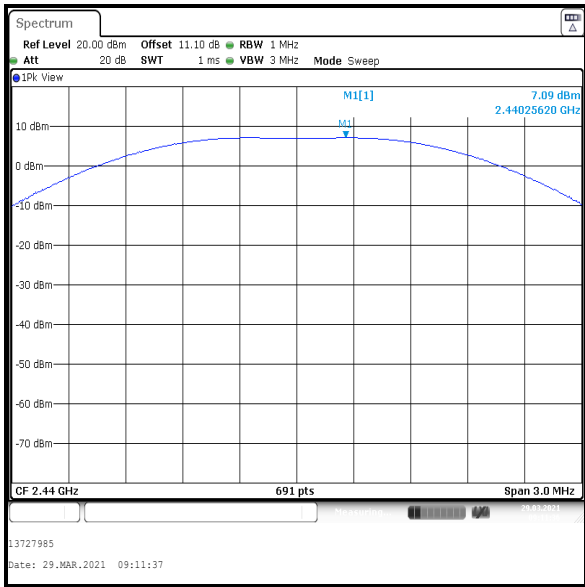
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	7.0	-7.9	-0.9	36.0	36.9	Complied
Middle	7.1	-4.5	2.6	36.0	33.4	Complied
Top	7.0	-4.9	2.1	36.0	33.9	Complied

Transmitter Maximum Peak Output Power (continued)

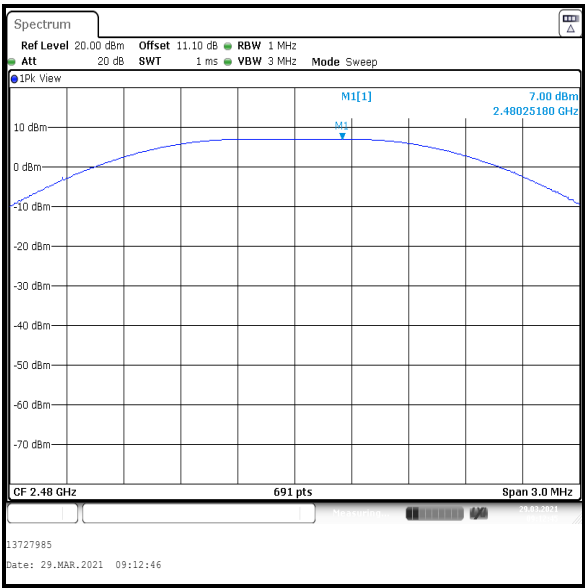
Results:



Bottom Channel



Middle Channel



Top Channel

5. Radiated Test Results

5.1. Transmitter Radiated Emissions <1 GHz

Test Summary:

Test Engineers:	Mark Perry & Nick Tye	Test Dates:	27 March 2021 & 31 March 2021
Test Sample Serial Number:	C08FF28H15J6		

FCC Reference:	Parts 15.247(d) & 15.209(a)
ISED Canada Reference:	RSS-Gen 6.13 & 8.9 / RSS-247 5.5
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	9 kHz to 1000 MHz

Environmental Conditions:

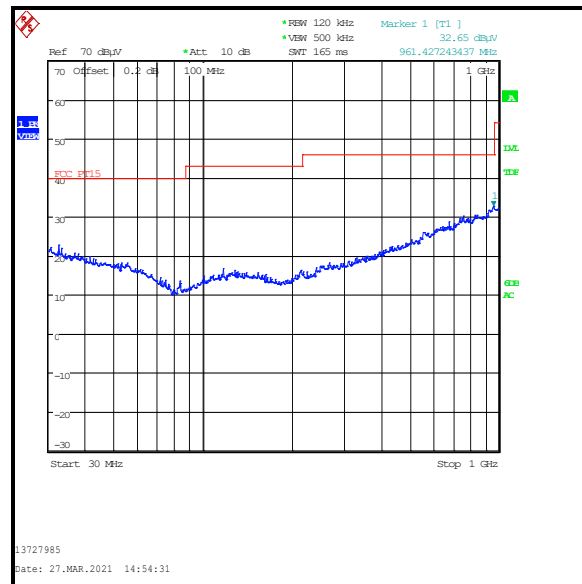
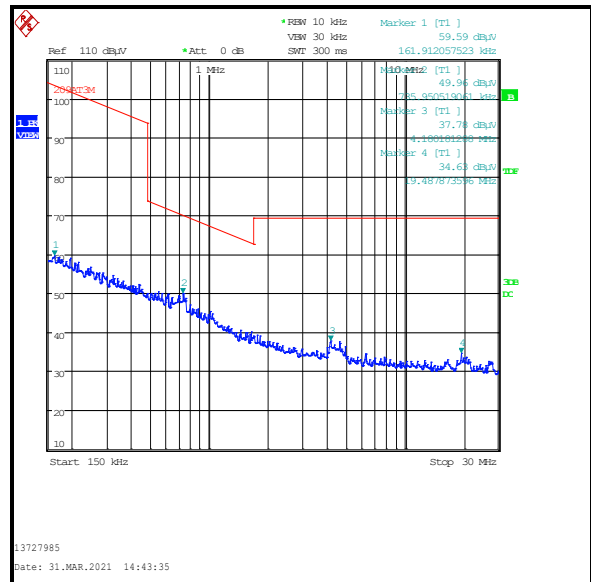
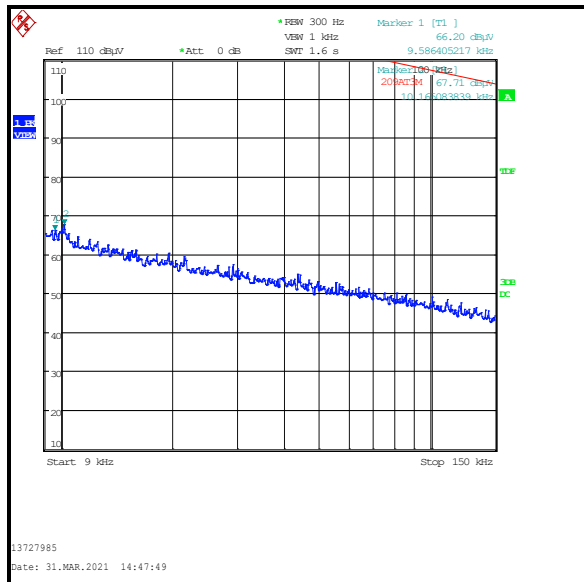
Temperature (°C):	22 to 25
Relative Humidity (%):	30 to 38

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below.
3. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
4. Pre-scans were performed and markers placed on the highest measured levels. The test receiver was configured as follows: For 9 kHz to 150 kHz, the resolution bandwidth was set to 300 Hz and video bandwidth 1 kHz. A peak detector was used and trace mode was Max Hold. For 150 kHz to 30 MHz, the resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz, trace mode was Max Hold. For 30 MHz to 1 GHz, the resolution bandwidth was set to 120 kHz and video bandwidth 500 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.

Transmitter Radiated Emissions (continued)**Results: Peak / Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
961.427	Vertical	32.7	54.0	21.3	Complied



5.2. Transmitter Radiated Emissions >1 GHz

Test Summary:

Test Engineer:	Mark Perry	Test Date:	27 March 2021
Test Sample Serial Number:	C08FF28H15J6		

FCC Reference:	Parts 15.247(d) & 15.209(a)
ISED Canada Reference:	RSS-Gen 6.13 & 8.9 / RSS-247 5.5
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 6.3, 6.6, 11.11 & 11.12
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	23 to 24
Relative Humidity (%):	30 to 32

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
3. The emission shown on the 1 GHz to 3 GHz plot is the EUT fundamental.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT.
5. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
6. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. Peak and average measurements were performed with their own appropriate detectors during the pre-scan measurements.

Transmitter Radiated Emissions (continued)**Results: Middle Channel / Peak**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7319.356	Horizontal	52.4	74.0	21.6	Complied

Results: Middle Channel / Average

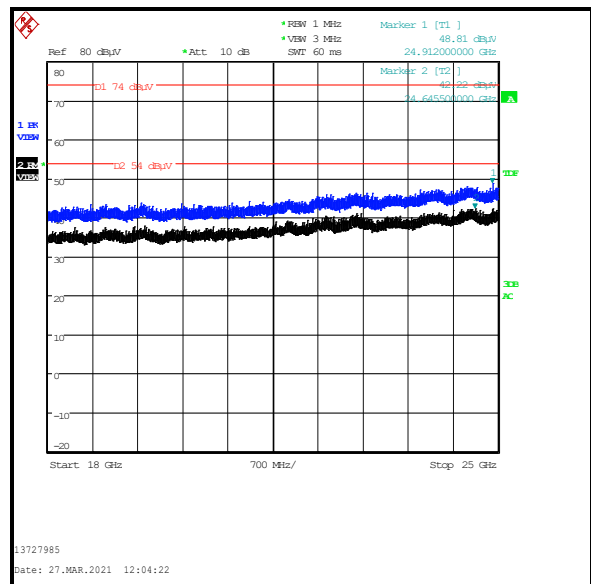
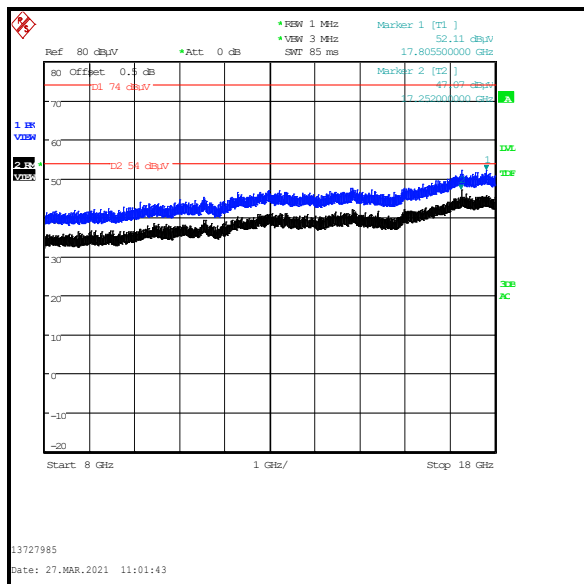
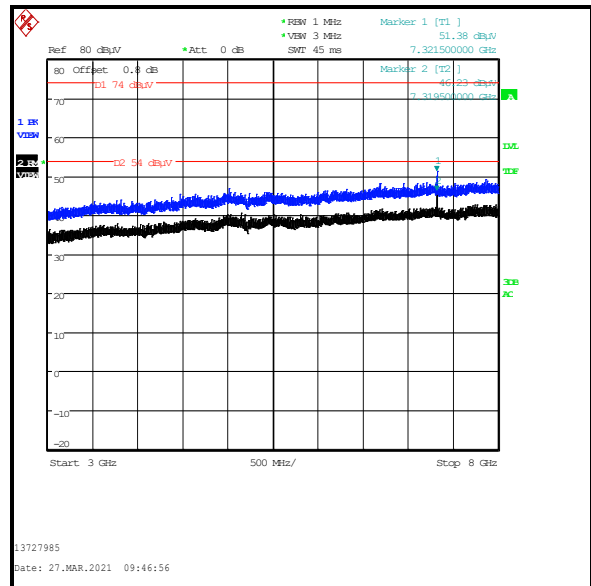
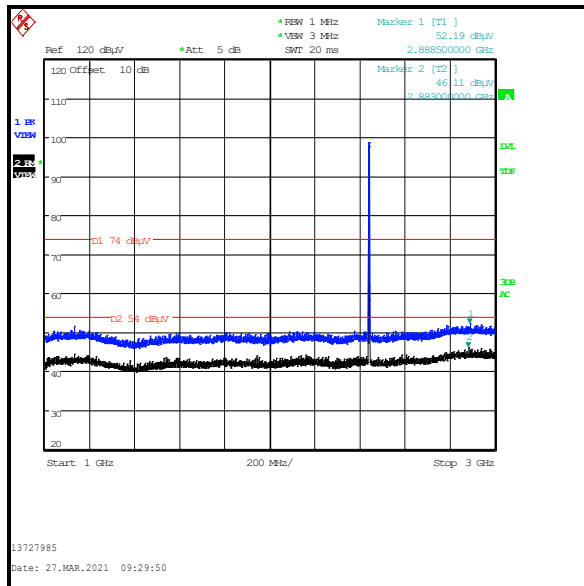
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7319.194	Horizontal	49.4	54.0	4.6	Complied

Results: Top Channel / Peak

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7439.348	Horizontal	52.9	74.0	21.1	Complied

Results: Top Channel / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7440.782	Horizontal	49.6	54.0	4.4	Complied

Transmitter Radiated Emissions (continued)

Note: The above plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.3. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Mark Perry	Test Dates:	26 March 2021 & 27 March 2021
Test Sample Serial Number:	C08FF29K15J6		

FCC Reference:	Parts 15.247(d) & 15.209(a)
ISED Canada Reference:	RSS-Gen 6.13 / RSS-247 5.5
Test Method Used:	KDB 558074 Section 8.7 referencing ANSI C63.10 Sections 11.11, 11.12 & 11.13

Environmental Conditions:

Temperature (°C):	23 to 26
Relative Humidity (%):	32 to 33

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. As the lower band edge is adjacent to a non-restricted band, only peak measurements are required. In accordance with ANSI C63.10 Section 11.11.1, the test method in Section 11.11.3 was followed: the test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. As the maximum peak conducted output power was measured using a peak detector in accordance with ANSI C63.10 Section 11.9.1.1 an out-of-band limit line was placed 20 dB (ANSI C63.10 Section 11.11.1(a)) below the peak level. A marker was placed on the band edge spot frequencies. Marker frequency and levels were recorded.
3. As the upper band edge is adjacent to a restricted band, both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. An RMS detector was used, sweep time was set to auto and trace mode was trace averaging over 300 sweeps. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
4. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with peak and RMS detectors respectively. Markers were placed on the highest point on each trace.
5. * -20 dBc limit.

Transmitter Band Edge Radiated Emissions (continued)**Results: Peak**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2399.760	Horizontal	45.6	76.6*	31.0	Complied
2400.0	Horizontal	45.5	76.6*	31.1	Complied
2483.5	Horizontal	56.9	74.0	17.1	Complied

Results: Average

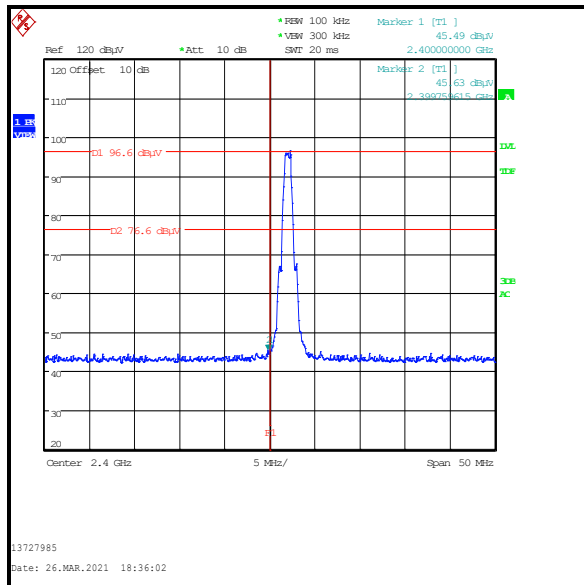
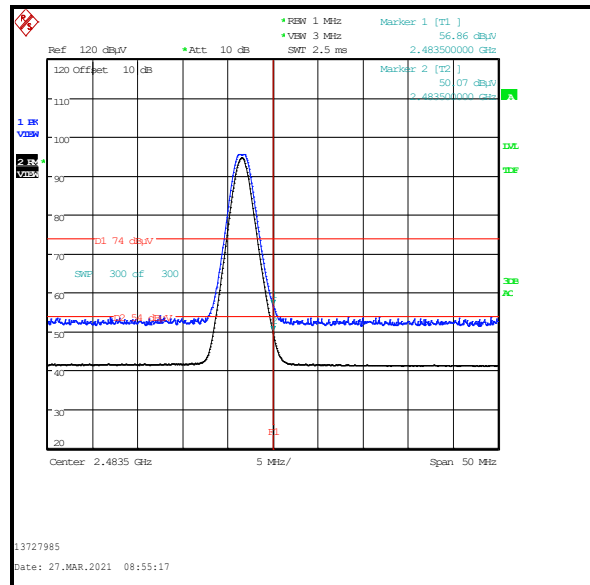
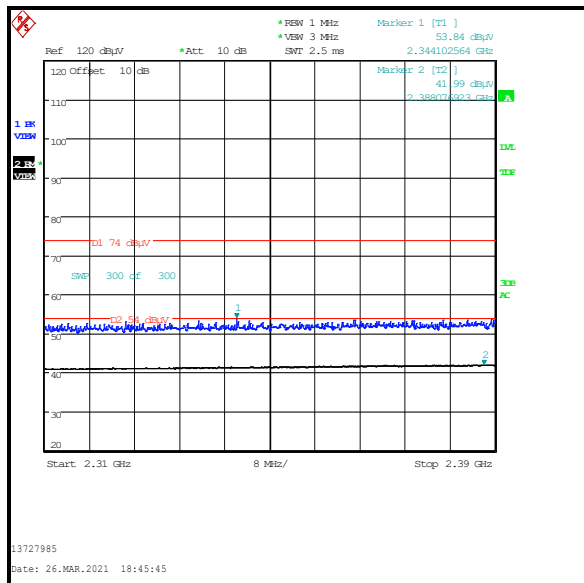
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	50.1	54.0	3.9	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2344.103	Horizontal	53.8	74.0	20.2	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2388.077	Horizontal	42.0	54.0	12.0	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results:****Lower Band Edge****Upper Band Edge****2310 MHz to 2390 MHz Restricted Band**

6. AC Power Line Conducted Emissions Test Results

6.1. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineers:	Andrew Edwards & Max Passell	Test Date:	31 March 2021
Test Sample Serial Number:	C08FF29K15J6		

FCC Reference:	Part 15.207
ISED Canada Reference:	RSS-Gen 8.8
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	40

Note(s):

1. The EUT was plugged into a USB cable which is connected to an AC charger. The AC charger was connected to 120 VAC 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the power supply.
3. A pulse limiter was fitted between the LISN and the test receiver.
4. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.164	Live	20.1	65.3	45.2	Complied
0.245	Live	18.5	61.9	43.4	Complied
0.330	Live	15.0	59.5	44.5	Complied
4.169	Live	13.4	56.0	42.6	Complied
4.781	Live	14.4	56.0	41.6	Complied
25.058	Live	23.3	60.0	36.7	Complied

Results: Live / Average / 120 VAC 60 Hz

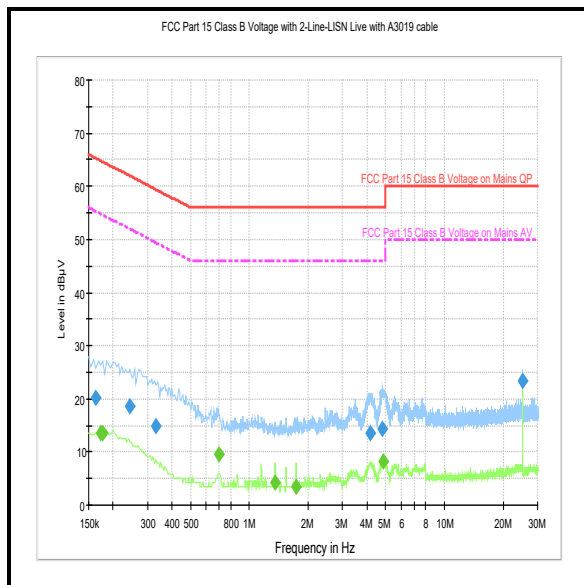
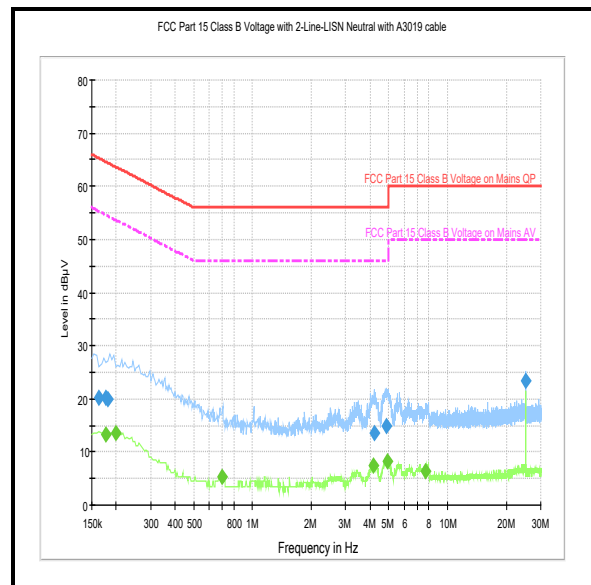
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.173	Live	13.5	54.8	41.3	Complied
0.177	Live	13.5	54.6	41.1	Complied
0.699	Live	9.4	46.0	36.6	Complied
1.352	Live	4.3	46.0	41.7	Complied
1.739	Live	3.4	46.0	42.6	Complied
4.835	Live	8.1	46.0	37.9	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.164	Neutral	20.1	65.3	45.2	Complied
0.177	Neutral	20.2	64.6	44.4	Complied
0.182	Neutral	19.9	64.4	44.5	Complied
4.196	Neutral	13.4	56.0	42.6	Complied
4.853	Neutral	15.0	56.0	41.0	Complied
25.058	Neutral	23.3	60.0	36.7	Complied

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.177	Neutral	13.3	54.6	41.3	Complied
0.200	Neutral	13.6	53.6	40.0	Complied
0.695	Neutral	5.3	46.0	40.7	Complied
4.173	Neutral	7.4	46.0	38.6	Complied
4.907	Neutral	8.1	46.0	37.9	Complied
7.715	Neutral	6.3	50.0	43.7	Complied

Transmitter AC Conducted Spurious Emissions (continued)**Results: 120 VAC 60 Hz****Live****Neutral**

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.155	Live	18.9	65.8	46.9	Complied
0.182	Live	18.9	64.4	45.5	Complied
3.282	Live	12.5	56.0	43.5	Complied
4.520	Live	19.2	56.0	36.8	Complied
5.699	Live	16.0	60.0	44.0	Complied
25.058	Live	23.0	60.0	37.0	Complied

Results: Live / Average / 240 VAC 60 Hz

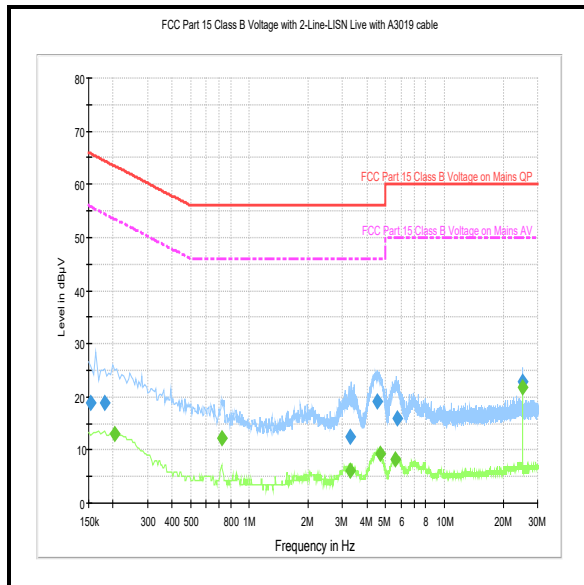
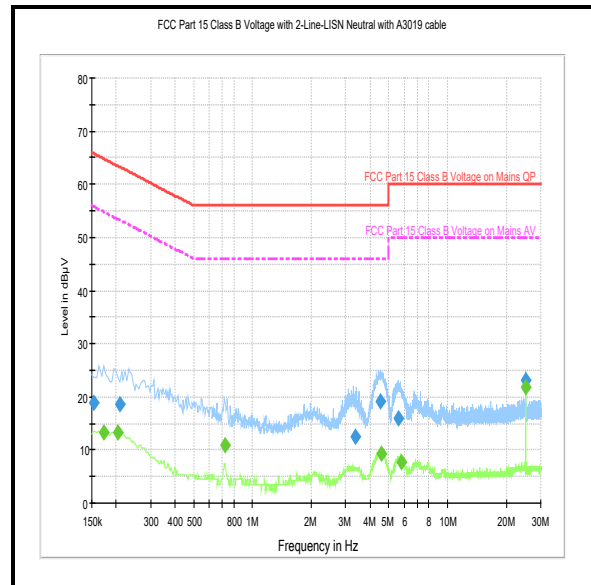
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.204	Live	13.0	53.4	40.4	Complied
0.726	Live	12.3	46.0	33.7	Complied
3.305	Live	6.1	46.0	39.9	Complied
4.664	Live	9.2	46.0	36.8	Complied
5.622	Live	8.2	50.0	41.8	Complied
25.058	Live	21.7	50.0	28.3	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.155	Neutral	19.0	65.8	46.8	Complied
0.209	Neutral	18.7	63.3	44.6	Complied
3.345	Neutral	12.4	56.0	43.6	Complied
4.533	Neutral	19.2	56.0	36.8	Complied
5.591	Neutral	16.0	60.0	44.0	Complied
25.058	Neutral	23.0	60.0	37.0	Complied

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.173	Neutral	13.3	54.8	41.5	Complied
0.204	Neutral	13.4	53.4	40.0	Complied
0.722	Neutral	10.9	46.0	35.1	Complied
4.565	Neutral	9.2	46.0	36.8	Complied
5.775	Neutral	7.6	50.0	42.4	Complied
25.058	Neutral	21.8	50.0	28.2	Complied

Transmitter AC Conducted Spurious Emissions (continued)**Results: 240 VAC 60 Hz****Live****Neutral**

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

--- END OF REPORT ---