



TEST REPORT

Test Report No. : UL-RPT-RP11838557JD09A V2.0

Customer : Apple Inc.
Model No. : A1862
FCC ID : BCGA1862
Technology : *Bluetooth* – Low Energy
Test Standard(s) : FCC Parts 15.207, 15.209(a) & 15.247

Test Laboratory : UL VS LTD, Basingstoke, Hampshire, RG24 8AH, United Kingdom

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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 2.0 supersedes all previous versions.

Date of Issue: 01 December 2017

Checked by:

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Customer Information

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Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	17/11/2017	Initial Version	Sarah Williams
2.0	01/12/2017	AC Conducted Emissions results added, Sections 1.2, 1.3, 2.2, 2.3, 2.4 updated	Sarah Williams

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1. Attestation of Test Results

1.1. Description of EUT

The Apple iMac Pro is a desktop computer, with 27-inch Retina display, storage media, multimedia functions, IEEE 802.11a/b/g/n/ac radio and Bluetooth radio.

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 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Sections 15.207 and 15.209
Test Dates:	19 August 2017 to 30 November 2017

1.3. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	Complied
Part 15.35(c)	Transmitter Duty Cycle	Note 1
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	Complied
Part 15.247(e)	Transmitter Power Spectral Density	Note 2
Part 15.247(d)/15.209(a)	Transmitter Radiated Emissions	Complied
Part 15.247(d)/15.209(a)	Transmitter Band Edge Radiated Emissions	Complied
Part 15.207	Transmitter AC Conducted Emissions	Complied

Note(s):

1. The measurement was performed to assist in the calculation of the level of average radiated emissions at the upper band edge.
2. In accordance with FCC KDB 558074 Section 10.1, PSD is 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 total output power.
3. There are two vendors of the WiFi/*Bluetooth* radio modules, Vendor 1 and Vendor 2.

The WiFi/*Bluetooth* radio modules have the same mechanical outline (i.e. the same packaging dimension and pin layout), use the same on-board antenna matching circuit, have an identical antenna structure and are built and tested to conform to the same specification and to operate within the same tolerances.

Baseline testing was performed on the two vendors to determine the worst case.

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	
Site 2	
Site 17	X

UL VS LTD is accredited by UKAS. 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 DTS Meas Guidance v04 April 5, 2017
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247
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

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 measured (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.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

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 %
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	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 25 GHz	95%	±2.94 dB
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 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)
M2005	Thermohygrometer	Testo	608-H1	45046700	22 Feb 2018	12
M1804	Signal Generator	Rohde & Schwarz	SMP22	100026	03 Feb 2018	24
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	22 Nov 2017	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	11 Apr 2018	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	15 Apr 2018	24
A2520	Attenuator	AtlanTecRF	AN18-20	832797#1	Calibrated before use	-

Test Equipment Used for Transmitter Radiated Emissions Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Feb 2018	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	14 Apr 2018	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	13 Apr 2018	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	11 Apr 2018	12
A2891	Preamplifier	Schwarzbeck	BBV 9718	9718-306	11 Apr 2018	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	11 Apr 2018	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	11 Apr 2018	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	11 Apr 2018	12
A2893	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-021	11 Apr 2018	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	25 Apr 2018	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	03 Mar 2018	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	06 Mar 2018	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	160190001	06 Mar 2018	12
A2131	Low Pass Filter	AtlanTecRF	AFL-02000	JFB1004-002	27 Feb 2018	12

Test Equipment Used for Transmitter Band Edge Radiated Emissions Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Feb 2018	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	14 Apr 2018	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	13 Apr 2018	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	11 Apr 2018	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	03 Mar 2018	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	11 Apr 2018	12

Test and Measurement Equipment (continued)**Test Equipment Used for Transmitter AC Conducted Spurious Emissions:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2013	Thermohygrometer	Testo	608-H1	45046424	20 Jun 2018	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	09 Aug 2018	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	09 May 2018	12
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	08 Dec 2017	12
A2953	Power Supply	Tacima	SC 5467	Not stated	Calibrated before use	-
M1229	Multimeter	Fluke	179	87640015	12 May 2018	12

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Apple
Model Name or Number:	A1862
Test Sample Serial Number:	C02V4003J61N <i>(Conducted Sample #1)</i>
Hardware Version:	EVT
Software Version:	17B2022
BT BB Version:	v250
FCC ID:	BCGA1862

Brand Name:	Apple
Model Name or Number:	A1862
Test Sample Serial Number:	C02V4002J61N <i>(Conducted & Radiated Sample)</i>
Hardware Version:	EVT
Software Version:	17B2022
BT BB Version:	v250
FCC ID:	BCGA1862

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: LE	1 Mbps		
Data Rate: LE2M	2 Mbps		
Power Supply Requirement(s):	Nominal	120 VAC 60 Hz	
Maximum Conducted Output Power:	3.6 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 Range (MHz)	Antenna Gain (dBi)
2400-2480	6.0

3.5. Description of Test Setup

Support Equipment

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

Description:	USB-C VGA Multiport Adaptor
Brand Name:	Apple
Model Name or Number:	MJ1L2ZM/A
Serial Number:	Not marked or stated

Description:	USB Keyboard
Brand Name:	Apple
Model Name or Number:	A1243
Serial Number:	DG7515613M4DPQWA2

Description:	USB Keyboard
Brand Name:	Apple
Model Name or Number:	A1243
Serial Number:	DG763550FGGGV6GAP

Description:	USB Mouse
Brand Name:	Apple
Model Name or Number:	A1152
Serial Number:	CC2446203JDNYPAN

Description:	USB Mouse
Brand Name:	Apple
Model Name or Number:	A1152
Serial Number:	CC2650501N3GW86AL

Description:	PHF
Brand Name:	Apple
Model Name or Number:	Apple EarPods
Serial Number:	Not marked or stated

Support Equipment (continued)

Description:	Ethernet cable. Length 2.0 metres
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	5 port Ethernet switch
Brand Name:	Netgear
Model Name or Number:	GS605 v3
Serial Number:	1YG19430021A1

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.
- Transmitting at maximum power in *Bluetooth* LE2M mode with modulation, maximum possible data length available and Pseudorandom Bit Sequence 9.

Configuration and Peripherals

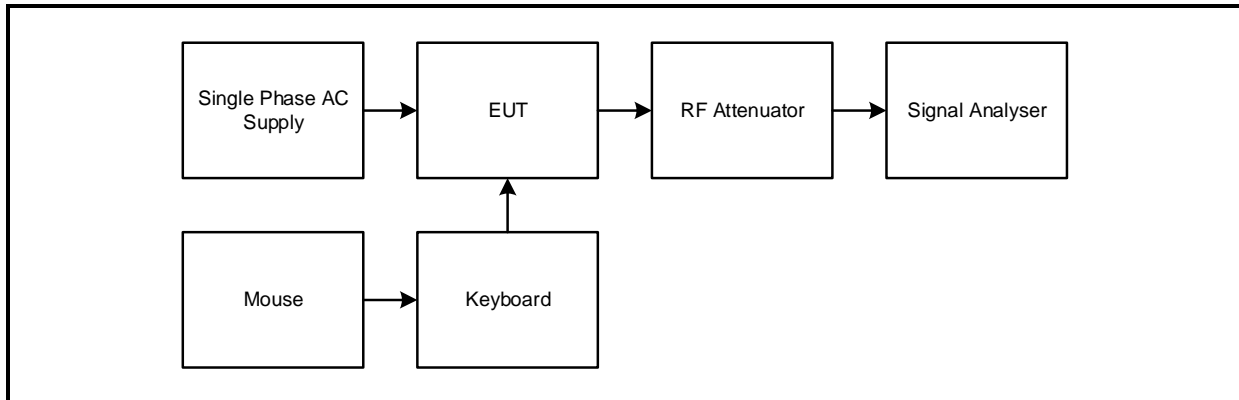
The EUT was tested in the following configuration(s):

- Controlled in test mode using a software application on the EUT. The application was 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_v1.4.pdf'.
- The EUT was powered from a 120 VAC 60 Hz single phase mains supply.
- All active ports were terminated using the appropriate termination.
- The radiated sample was converted to a conducted sample by disconnecting the internal antenna and replacing with a cable and RF connector in its place.

Test Setup Diagrams

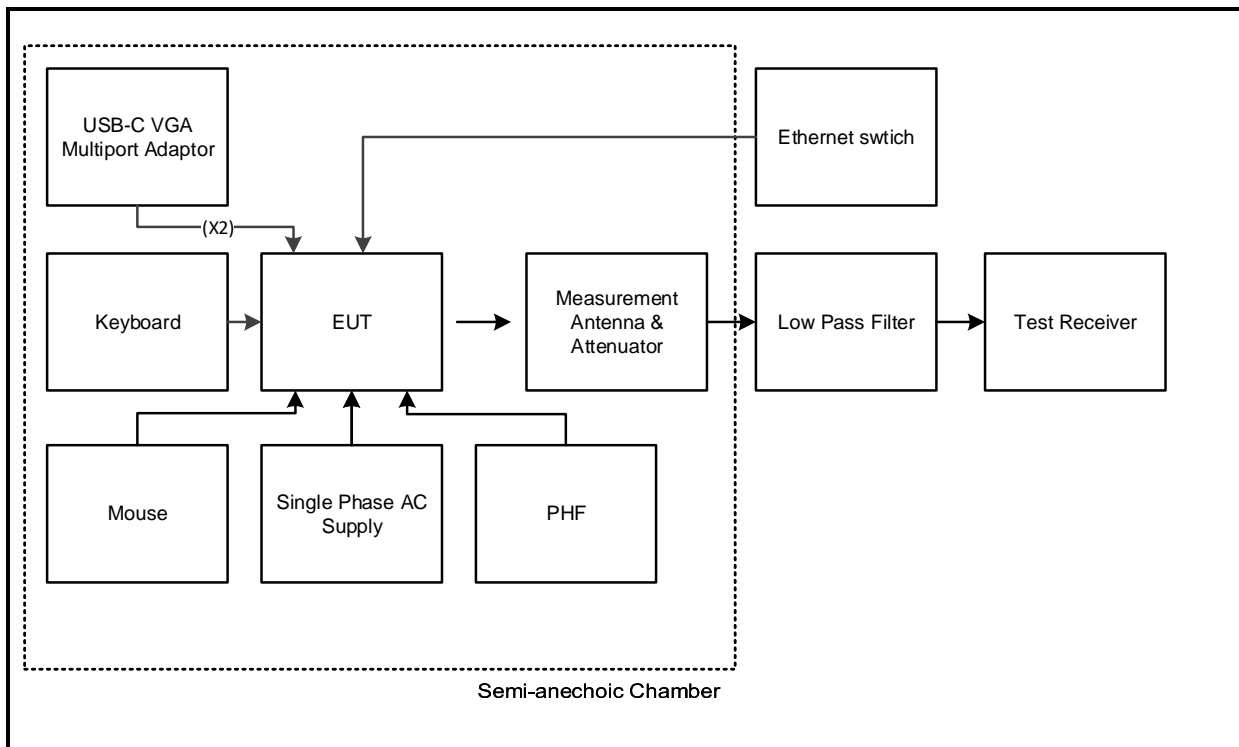
Conducted Tests:

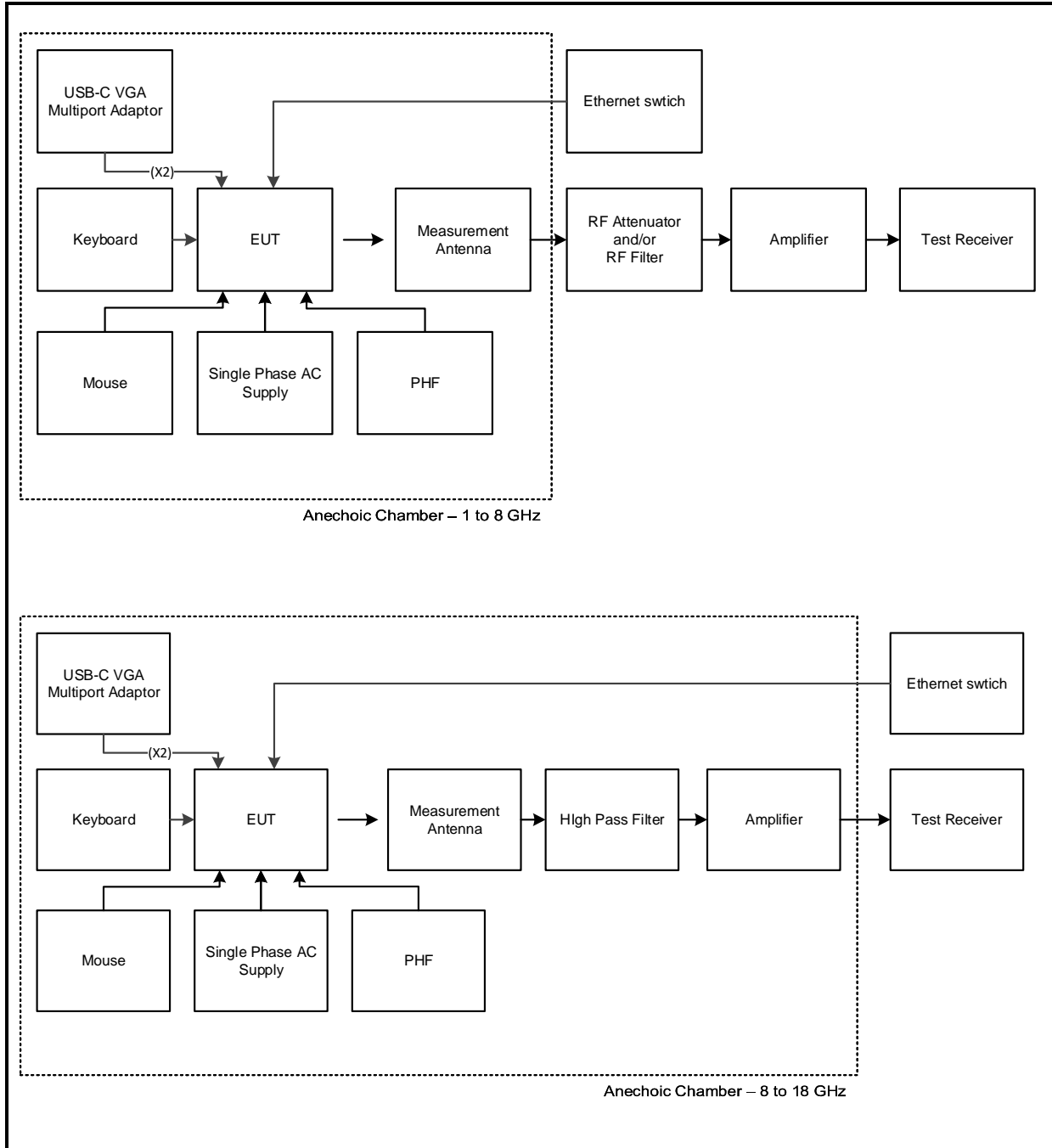
Test Setup for Transmitter Minimum 6 dB Bandwidth, Duty Cycle & Maximum Peak Output Power

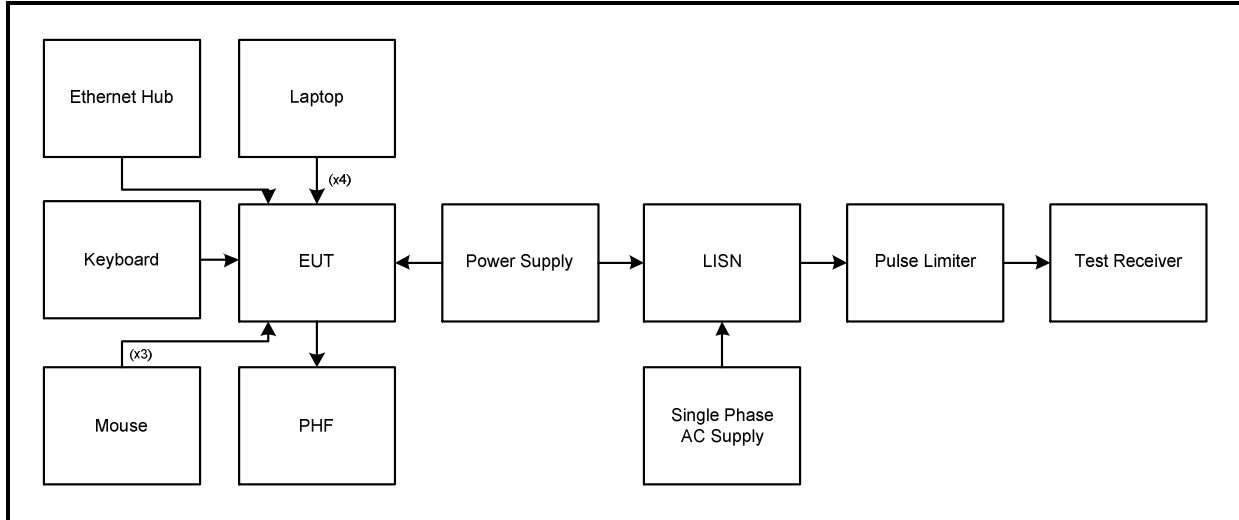


Radiated Tests:

Test Setup for Transmitter Radiated Emissions





Test Setup for Transmitter AC Conducted Spurious Emissions

4. Antenna Port Test Results

4.1. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	17 October 2017
Test Sample Serial Number:	C02V4003J61N		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	FCC KDB 558074 Section 8.1 Option 1

Environmental Conditions:

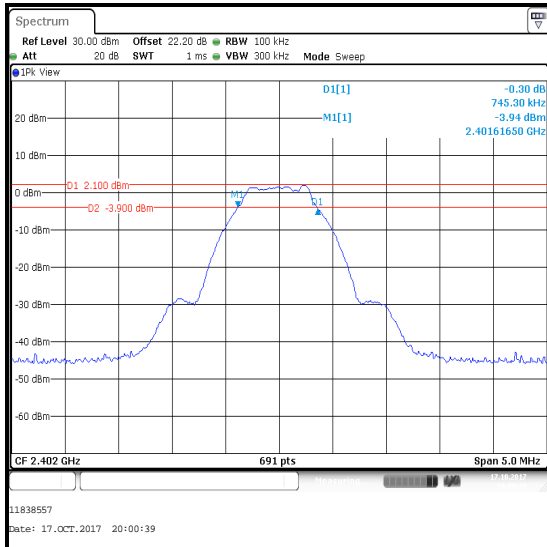
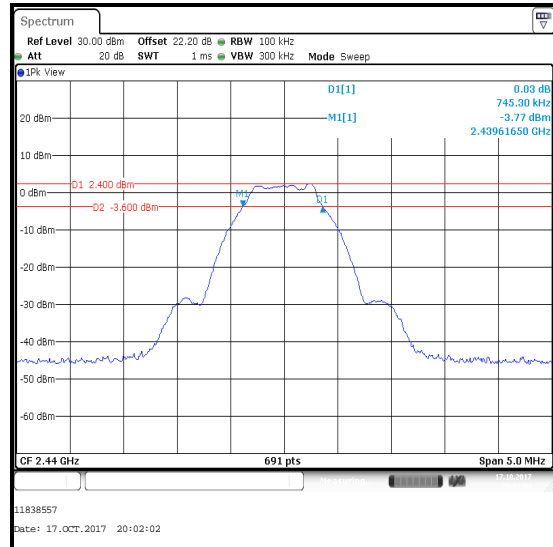
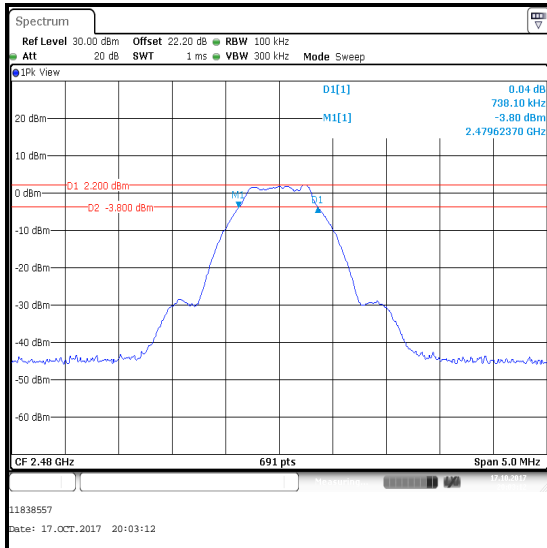
Temperature (°C):	26
Relative Humidity (%):	46

Note(s):

1. 6 dB DTS bandwidth tests were performed using a signal analyser in accordance with FCC KDB 558074 Section 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.

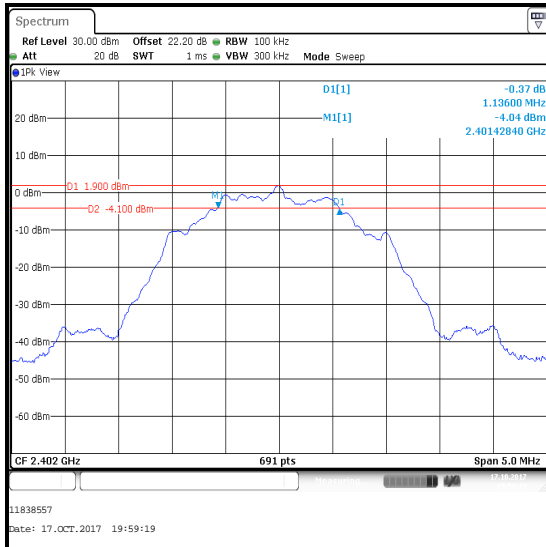
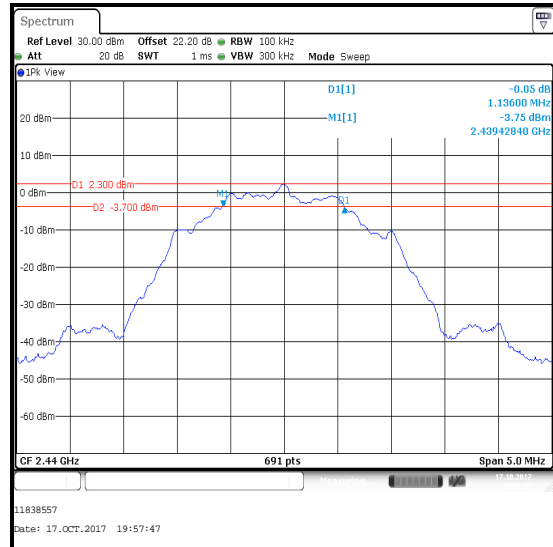
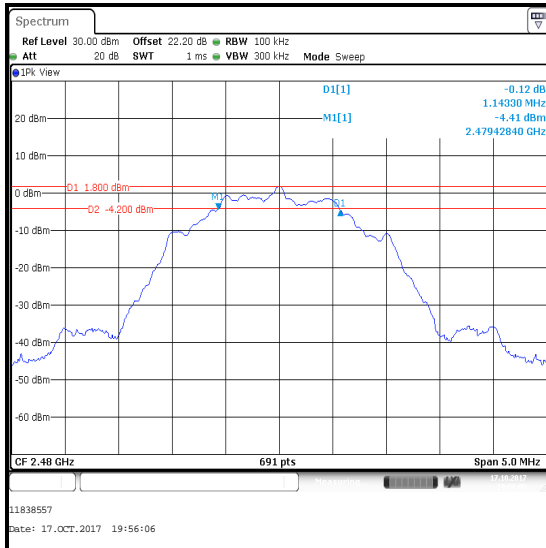
Transmitter Minimum 6 dB Bandwidth (continued)**Results: LE**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	745.300	≥500	245.300	Complied
Middle	745.300	≥500	245.300	Complied
Top	738.100	≥500	238.100	Complied

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

Transmitter Minimum 6 dB Bandwidth (continued)**Results: LE2M**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	1136.000	≥500	636.000	Complied
Middle	1136.000	≥500	636.000	Complied
Top	1143.300	≥500	643.300	Complied

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

4.2. Transmitter Duty Cycle**Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	13 October 2017
Test Sample Serial Number:	C02V4002J61N		

FCC Reference:	Part 15.35(c)
Test Method Used:	FCC KDB 558074 Section 6.0

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	45

Note(s):

- In order to assist with the determination of the average level of spurious emissions field strength in LE2M mode, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a signal analyser in the time domain and calculated by using the following calculation:

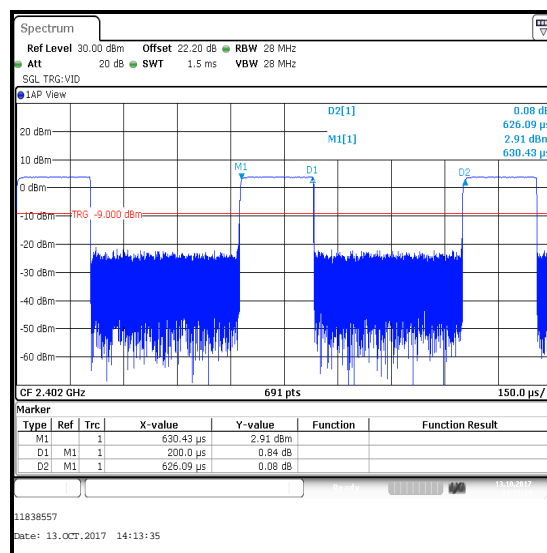
$$10 \log (1 / (\text{On Time} / [\text{Period or } 100 \text{ ms whichever is the lesser}])).$$

$$\text{LE2M duty cycle } 10 \log (1 / (0.200 / 0.626)) = 5.0 \text{ dB}$$

- The LE mode duty cycle was measured and found to be greater than 98%. No duty cycle correction is required.

Results: LE2M

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
0.200	0.626	5.0



4.3. Transmitter Maximum Peak Output Power**Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	17 October 2017
Test Sample Serial Number:	C02V4003J61N		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 9.1.1 and Notes below

Environmental Conditions:

Temperature (°C):	26
Relative Humidity (%):	41

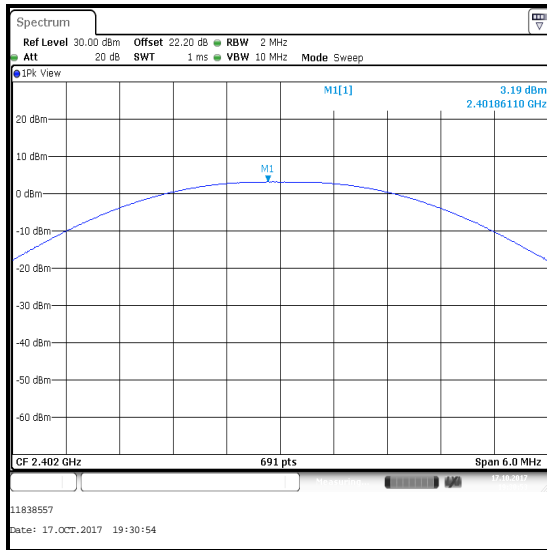
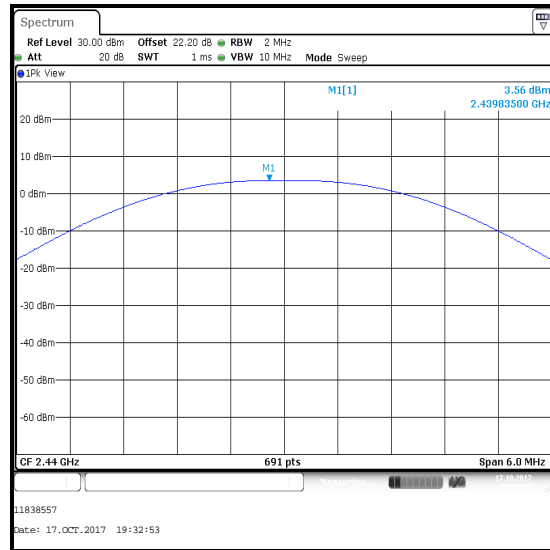
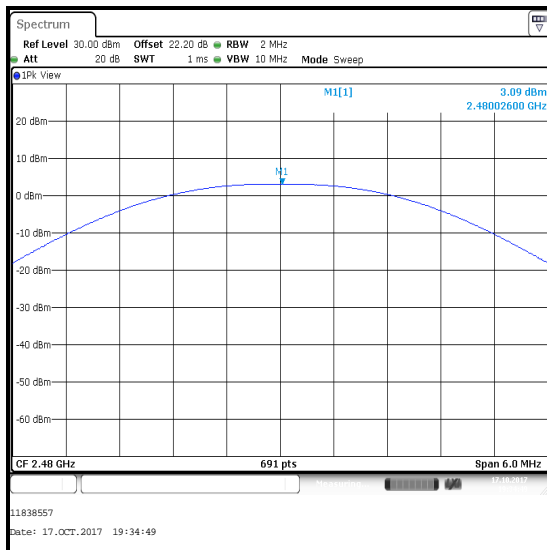
Note(s):

1. Conducted power tests were performed using a signal analyser in accordance with FCC KDB 558074 Section 9.1.1 with the RBW > *DTS bandwidth* procedure.
2. The signal analyser resolution bandwidth was set to 2 MHz and video bandwidth of 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 6 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: LE**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	3.2	30.0	26.8	Complied
Middle	3.6	30.0	26.4	Complied
Top	3.1	30.0	26.9	Complied

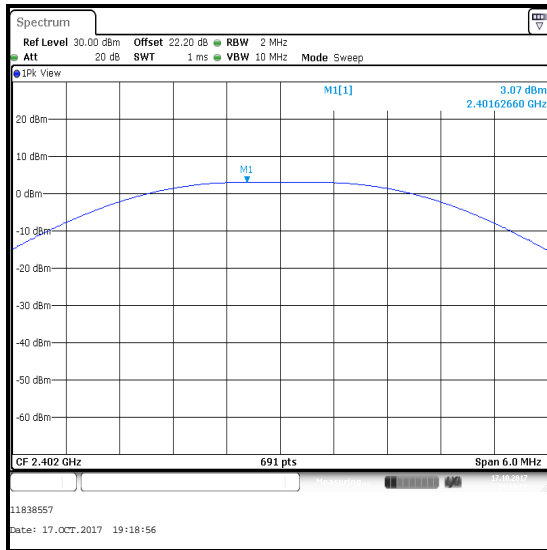
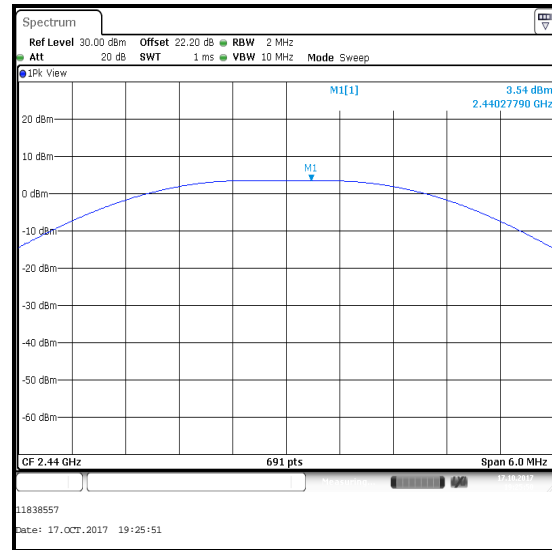
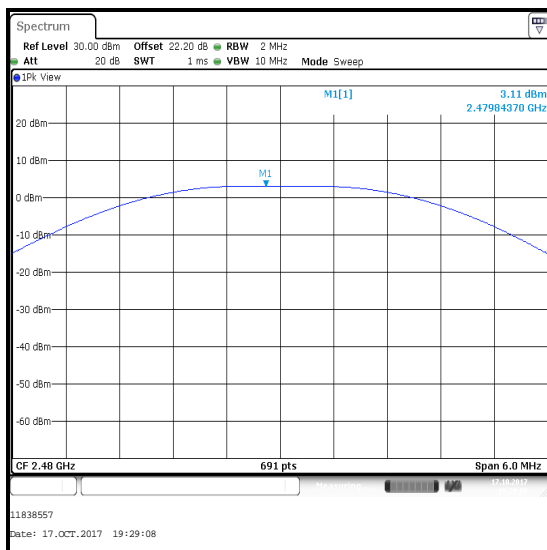
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	3.2	6.0	9.2	36.0	26.8	Complied
Middle	3.6	6.0	9.6	36.0	26.4	Complied
Top	3.1	6.0	9.1	36.0	26.9	Complied

Transmitter Maximum Peak Output Power (continued)**Results: LE****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Peak Output Power (continued)**Results: LE2M**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	3.1	30.0	26.9	Complied
Middle	3.5	30.0	26.5	Complied
Top	3.1	30.0	26.9	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	3.1	6.0	9.1	36.0	26.9	Complied
Middle	3.5	6.0	9.5	36.0	26.5	Complied
Top	3.1	6.0	9.1	36.0	26.9	Complied

Transmitter Maximum Peak Output Power (continued)**Results: LE2M****Bottom Channel****Middle Channel****Top Channel**

5. Radiated Test Results

5.1. Transmitter Radiated Emissions <1 GHz

Test Summary:

Test Engineer:	Mark Perry	Test Date:	01 September 2017
Test Sample Serial Number:	C02V4002J61N		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

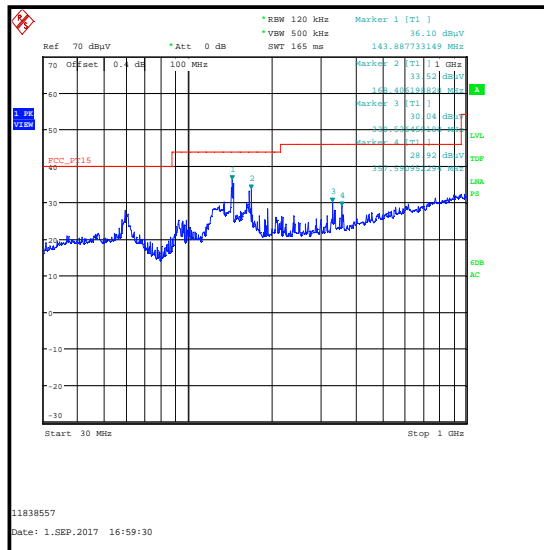
Temperature (°C):	23
Relative Humidity (%):	44

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. 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 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.
5. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span big enough to see the whole emission.

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

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
168.566	Horizontal	33.8	43.5	9.7	Complied



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

5.2. Transmitter Radiated Emissions >1 GHz**Test Summary:**

Test Engineer:	Stuart Martin	Test Dates:	20 August 2017 & 26 August 2017
Test Sample Serial Number:	C02V4002J61N		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 11 & 12 referencing ANSI C63.10 Sections 6.3 and 6.6
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	21 to 25
Relative Humidity (%):	47 to 50

Note(s):

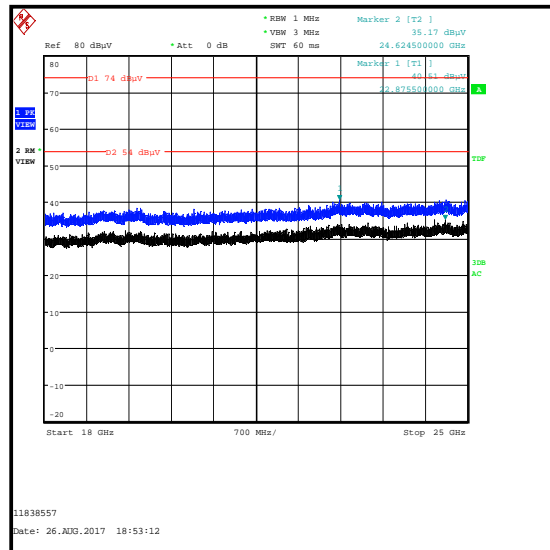
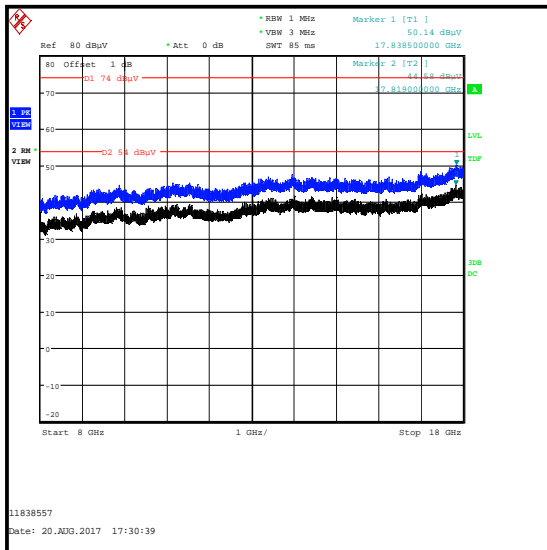
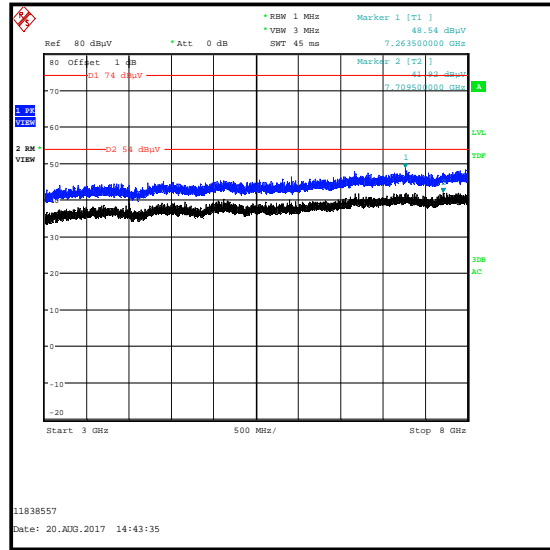
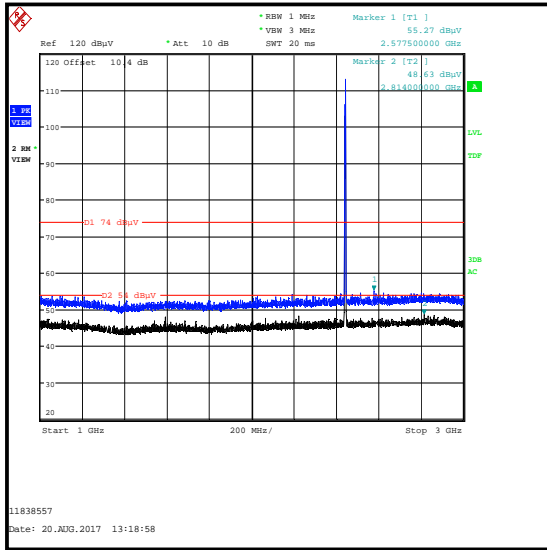
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The emission shown on the 1 GHz to 3 GHz plot is the EUT fundamental.
3. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak and average noise floor readings of the measuring receiver were recorded as shown in the tables below.
4. Pre-scans above 1 GHz were performed in 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. 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.

Results: Peak / Middle Channel / LE

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2577.500	Vertical	55.3	74.0	18.7	Complied

Results: Average / Middle Channel / LE

Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2814.000	Vertical	48.6	54.0	5.4	Complied

Transmitter Radiated Emissions (continued)

5.3. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Stuart Martin	Test Dates:	19 August 2017 to 08 October 2017
Test Sample Serial Number:	C02V4002J61N		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	KDB 558074 Sections 11, 12 & Notes below

Environmental Conditions:

Temperature (°C):	21 to 23
Relative Humidity (%):	47 to 49

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The maximum peak conducted output power was previously measured. In accordance with FCC KDB 558074 Section 11.1(a), the lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
3. As the lower band edge is adjacent to a non-restricted band, only peak measurements are required. In accordance with FCC KDB 558074 Section 11.1, the test method in Section 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 an peak detector in accordance with FCC KDB 558074 Section 9.1.1 an out-of-band limit line was placed 20 dB (FCC KDB 558074 Section 11.1(a)) below the peak level. A marker was placed on the band edge spot frequencies. Marker frequency and levels were recorded.
4. 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.
5. 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.
6. * -20 dBc limit.
7. **As the EUT had a duty cycle <98% the duty cycle correction factor has been applied to the LE2M upper band edge average result. The corrected level is shown below:

$$\begin{aligned} \text{Upper Band Average result} + \text{duty cycle} &= \text{Corrected band edge level} \\ \text{Corrected band edge level at 2483.5 MHz} &: 40.9 + 5.0 = 45.9 \text{ dB}\mu\text{V/m} \end{aligned}$$

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

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.000	Vertical	50.8	90.6*	39.8	Complied
2483.500	Vertical	55.7	74.0	18.3	Complied
2483.981	Vertical	56.3	74.0	17.7	Complied

Results: Average / LE

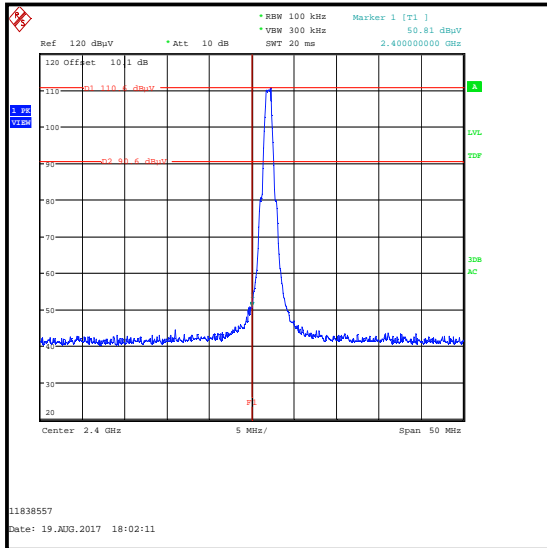
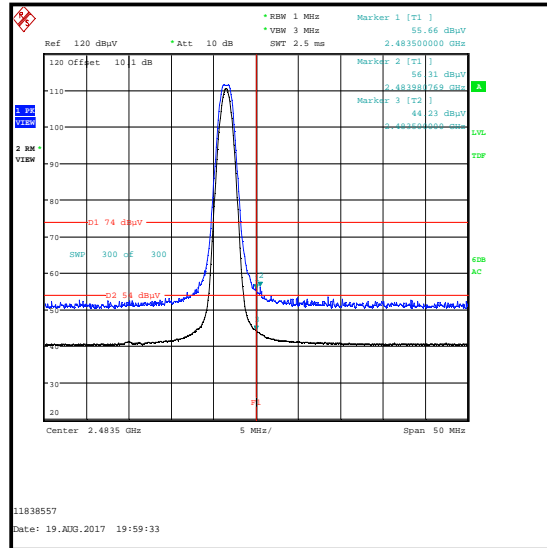
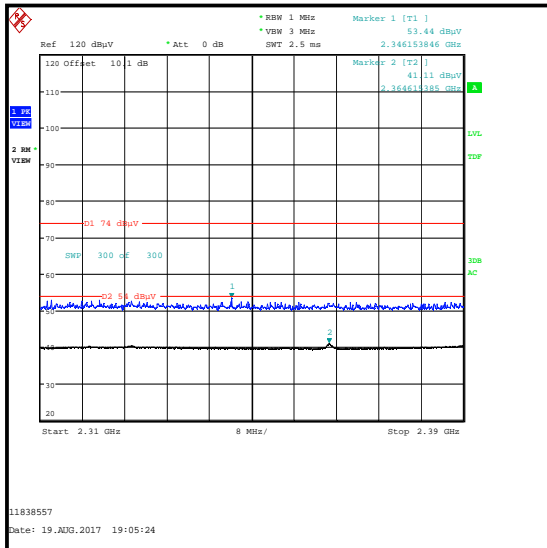
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.500	Vertical	44.2	54.0	9.8	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak / LE

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2346.154	Vertical	53.4	74.0	20.6	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average / LE

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2364.615	Vertical	41.1	54.0	12.9	Complied

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

Transmitter Band Edge Radiated Emissions (continued)**Results: Peak / LE2M**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.000	Vertical	62.6	81.3*	18.7	Complied
2483.500	Vertical	52.2	74.0	22.8	Complied
2506.978	Vertical	53.4	74.0	20.6	Complied

Results: Average / LE2M

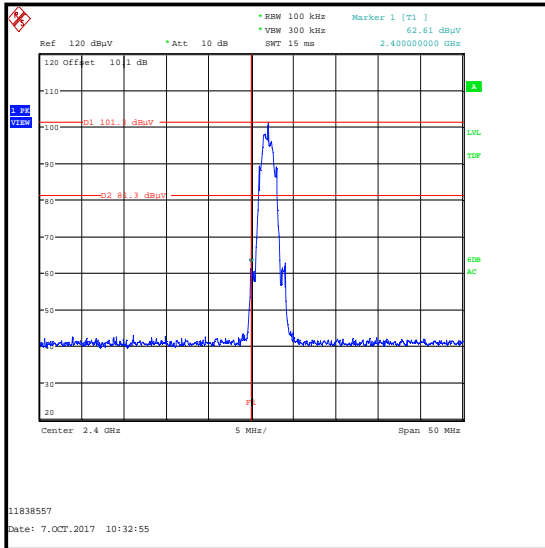
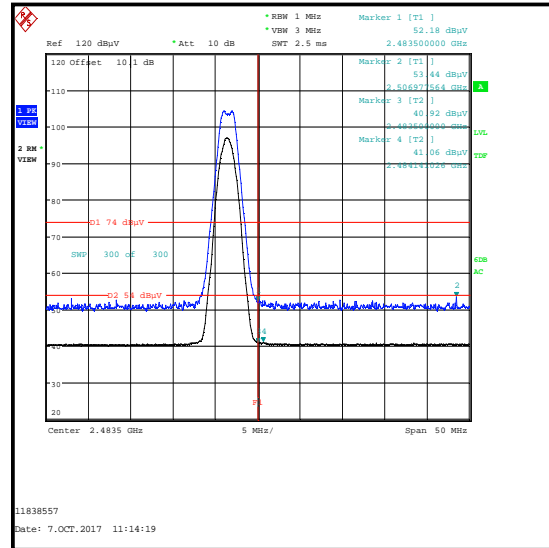
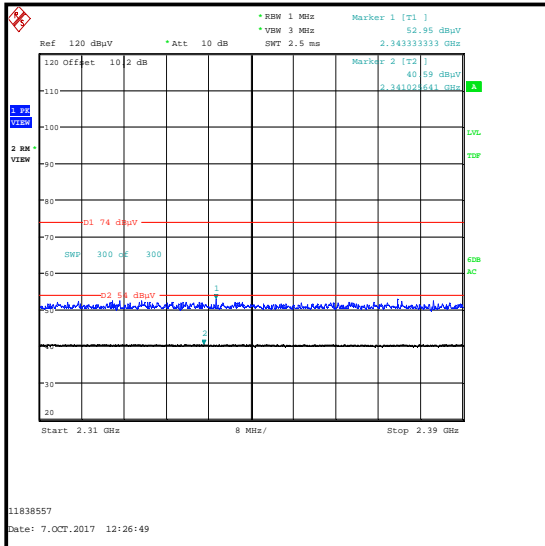
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Duty cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.500	Vertical	40.9**	5.0	45.9	54.0	8.1	Complied
2484.141	Vertical	41.1**	5.0	46.1	54.0	7.9	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak / LE2M

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2343.333	Vertical	53.0	74.0	21.0	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average / LE2M

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2341.026	Vertical	40.6	54.0	13.4	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results: LE2M****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 Engineer:	Doug Freegard	Test Date:	30 November 2017
Test Sample Serial Number:	C02V4002J61N		

FCC Reference:	Part 15.207
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	32

Note(s):

1. The EUT was connected to a 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.
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 (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Live	54.1	65.5	11.4	Complied
0.236	Live	43.6	62.3	18.7	Complied
0.398	Live	32.0	57.9	25.9	Complied
0.560	Live	28.0	56.0	28.0	Complied
11.243	Live	35.4	60.0	24.6	Complied
11.994	Live	28.7	60.0	31.3	Complied

Results: Live / Average / 120 VAC 60 Hz

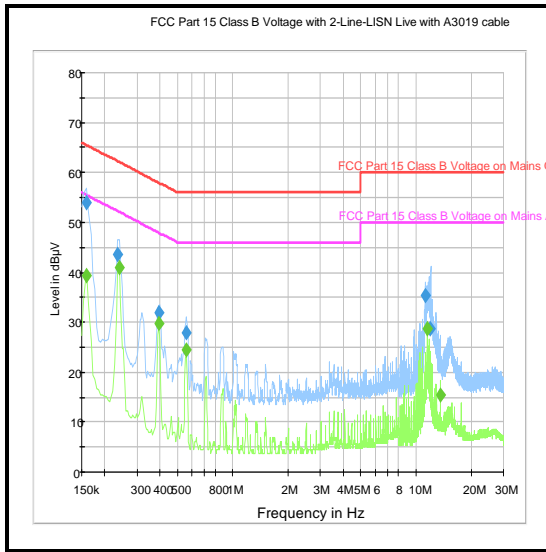
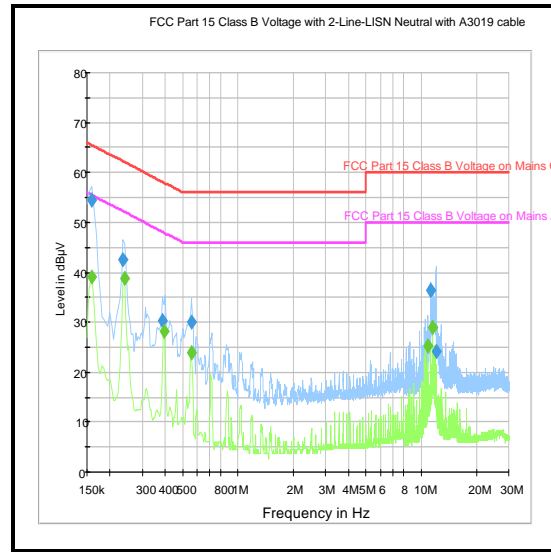
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Live	39.4	55.5	16.1	Complied
0.240	Live	40.9	52.1	11.2	Complied
0.398	Live	29.7	47.9	18.2	Complied
0.555	Live	24.4	46.0	21.6	Complied
11.549	Live	28.7	50.0	21.3	Complied
13.560	Live	15.5	50.0	34.5	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Neutral	54.5	65.5	11.0	Complied
0.236	Neutral	42.6	62.3	19.7	Complied
0.389	Neutral	30.4	58.1	27.7	Complied
0.555	Neutral	30.1	56.0	25.9	Complied
11.243	Neutral	36.4	60.0	23.6	Complied
11.999	Neutral	24.2	60.0	35.8	Complied

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Neutral	39.2	55.5	16.3	Complied
0.240	Neutral	38.8	52.1	13.3	Complied
0.398	Neutral	28.2	47.9	19.7	Complied
0.555	Neutral	24.0	46.0	22.0	Complied
10.838	Neutral	25.2	50.0	24.8	Complied
11.549	Neutral	28.9	50.0	21.1	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 (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Live	55.4	65.5	10.1	Complied
0.240	Live	44.0	62.1	18.1	Complied
0.398	Live	31.8	57.9	26.1	Complied
0.555	Live	27.8	56.0	28.2	Complied
11.243	Live	35.9	60.0	24.1	Complied
11.999	Live	28.5	60.0	31.5	Complied

Results: Live / Average / 240 VAC 60 Hz

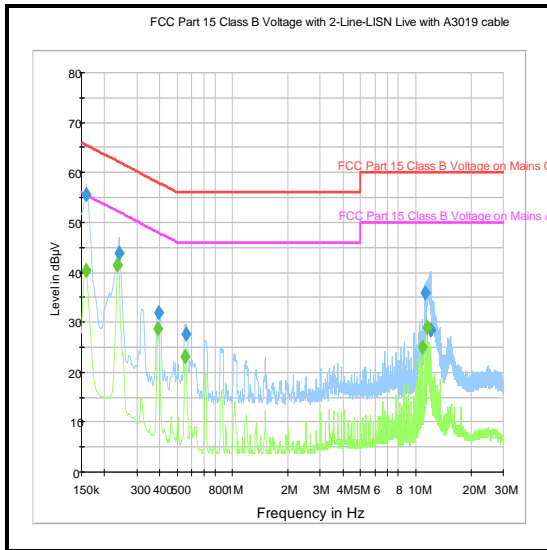
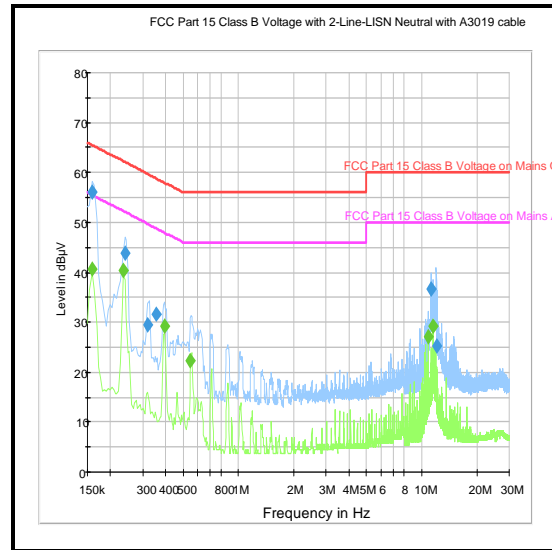
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Live	40.3	55.5	15.2	Complied
0.236	Live	41.3	52.3	11.0	Complied
0.393	Live	28.8	48.0	19.2	Complied
0.551	Live	23.2	46.0	22.8	Complied
10.838	Live	24.9	50.0	25.1	Complied
11.549	Live	28.9	50.0	21.1	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Neutral	56.1	65.5	9.4	Complied
0.240	Neutral	43.9	62.1	18.2	Complied
0.321	Neutral	29.5	59.7	30.2	Complied
0.357	Neutral	31.5	58.8	27.3	Complied
11.270	Neutral	36.6	60.0	23.4	Complied
11.999	Neutral	25.3	60.0	34.7	Complied

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.159	Neutral	40.8	55.5	14.7	Complied
0.236	Neutral	40.3	52.3	12.0	Complied
0.398	Neutral	29.2	47.9	18.7	Complied
0.542	Neutral	22.2	46.0	23.8	Complied
10.838	Neutral	27.2	50.0	22.8	Complied
11.549	Neutral	29.3	50.0	20.7	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 ---