



TEST REPORT

Test Report No. : UL-RPT-RP12173937JD10E V2.0

Customer : Apple Inc.
Model No. : A1989
FCC ID : BCGA1989
Technology : WLAN
Test Standard(s) : FCC Parts 15.209(a) & 15.407

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: 20 June 2018

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Customer Information

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Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	20/06/2018	Initial Version	Sarah Williams
2.0	20/06/2018	Section 3.5 updated	Sarah Williams

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1. Attestation of Test Results

1.1. Description of EUT

The equipment under test was a Laptop Computer with WLAN and *Bluetooth*.

1.2. General Information

Specification Reference:	47CFR15.407 and 47CFR15.403
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart E (Unlicensed National Information Infrastructure Devices) – Sections 15.403 and 15.407
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.209
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	18 February 2018 to 09 May 2018

1.3. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.35(c)	Transmitter Duty Cycle	Note 1
Part 15.403(i)	Transmitter 26 dB Emission Bandwidth	Complied
Part 15.407(e)	Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band)	Complied
Part 15.407(e)	Transmitter Minimum 6 dB Bandwidth (Channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz)	Complied
Part 15.407(a)(1)(iv)	Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band)	Complied
Part 15.407(a)(2)	Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands)	Complied
Part 15.407(a)(2)	Transmitter Maximum Conducted Output Power (Channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz)	Complied
Part 15.407(a)(3)	Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band)	Complied
Part 15.407(a)(1)(iv)	Transmitter Maximum Power Spectral Density (5.15-5.25 GHz band)	Complied
Part 15.407(a)(2)	Transmitter Maximum Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands)	Complied
Part 15.407(a)(2)	Transmitter Maximum Power Spectral Density (Channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz)	Complied
Part 15.407(a)(3)	Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band)	Complied
Part 15.407(b)/15.209(a)	Transmitter Out of Band Radiated Emissions	Complied
Part 15.407(b)/15.209(a)	Transmitter Band Edge Radiated Emissions	Complied
Part 15.407(g)	Transmitter Frequency Stability (Temperature & Voltage Variation)	Note 2
Part 15.407(h)(1)	Transmitter Power Control	Note 3

Note(s):

1. The measurement was performed to assist in the calculation of the level of average output power, power spectral density and emissions as the EUT employs pulsed operation.
2. Frequency stability is better than 20 ppm which ensures that the signal remains in the allocated bands under all operational conditions stated in the user manual.
3. Transmit Power Control was not tested as the maximum EIRP is less than 500 mW (27 dBm).
4. 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 specifications 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 789033 D02 General U-NII Test Procedures New Rules v02r01 December 14, 2017
Title:	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices (Part 15, Subpart E)

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	5.15 GHz to 5.850 GHz	95%	±1.14 %
26 dB Emission Bandwidth	5.15 GHz to 5.850 GHz	95%	±4.59 %
Minimum 6 dB Emission Bandwidth	5.15 GHz to 5.850 GHz	95%	±4.59 %
Maximum Conducted Output Power	5.15 GHz to 5.850 GHz	95%	±1.13 dB
Maximum Power Spectral Density	5.15 GHz to 5.850 GHz	95%	±1.13 dB
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±4.65 dB
Radiated Spurious Emissions	1 GHz to 40 GHz	95%	±2.94 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)
M2004	Thermohygrometer	Testo	608-H1	45046425	26 Feb 2019	12
A3028	Attenuator	Broadwave Technologies	351-311-006	#2	Calibrated before use	-
A3029	Attenuator	Broadwave Technologies	351-311-006	#3	Calibrated before use	-
A3030	Attenuator	Broadwave Technologies	351-311-006	#4	Calibrated before use	-
A3004	RF Switch	Pickering Interfaces	64-102-002	XZ363230	Calibrated before use	-
M2018	Signal Analyser	Rohde & Schwarz	FSV7	102699	23 Jun 2018	12
G0607	Signal Generator	Rohde & Schwarz	SMU200A	100943	10 May 2019	36

Test Equipment Used for Transmitter Radiated Emissions

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	27 Feb 2019	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	20 Feb 2019	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	18 Apr 2019	12
A2863	Pre Amplifier	Agilent	8449B	3008A02100	19 Feb 2019	12
A2891	Pre Amplifier	Schwarzbeck	BBV 9718	9718-306	20 Feb 2019	12
A2893	Pre Amplifier	Schwarzbeck	BBV 9721	9721-021	26 Apr 2019	12
A490	Antenna	Chase	CBL6111A	1590	03 Apr 2019	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	19 Feb 2019	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	19 Feb 2019	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	21 Feb 2019	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	21 Feb 2019	12
A2148	Attenuator	AtlanTecRF	AN18-06	090202-06	03 Apr 2019	12
A2915	Low Pass Filter	AtlanTecRF	AFL-04000	2156	22 Feb 2019	12
A3014	High Pass Filter	AtlanTecRF	AFH-06000	17042400007	22 Feb 2019	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	22 Feb 2019	12

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	27 Feb 2019	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	20 Feb 2019	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	18 Apr 2019	12
A2863	Pre Amplifier	Agilent	8449B	3008A02100	19 Feb 2019	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	19 Feb 2019	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	21 Feb 2019	12

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Apple
Model Name or Number:	A1989
Test Sample Serial Number:	C02VR00RJH93 (<i>Radiated sample #1</i>)
Hardware Version:	EVT
Software Version:	17G2014
FCC ID:	BCGA1989

Brand Name:	Apple
Model Name or Number:	A1989
Test Sample Serial Number:	C02VQ00GJKHY (<i>Radiated sample #2</i>)
Hardware Version:	EVT
Software Version:	17G2014
FCC ID:	BCGA1989

Brand Name:	Apple
Model Name or Number:	A1989
Test Sample Serial Number:	C02W6002JH95 (<i>Radiated sample #3</i>)
Hardware Version:	EVT
Software Version:	17G2014
FCC ID:	BCGA1989

Brand Name:	Apple
Model Name or Number:	A1989
Test Sample Serial Number:	C02VQ00SJKHY (<i>Conducted sample</i>)
Hardware Version:	EVT
Software Version:	17G2014
FCC ID:	BCGA1989

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:	WLAN (IEEE 802.11a,n,ac) / U-NII	
Type of Unit:	Transceiver	
Modulation:	BPSK, QPSK, 16QAM, 64QAM & 256QAM	
Data rates:	802.11a	6, 9, 12, 18, 24, 36 ,48 & 54 Mbps
	802.11n HT20	MCS0 to MCS7 (SISO)
	802.11n HT40	MCS0 to MCS7 (SISO)
	802.11ac VHT20	MCS0 to MCS8 (SISO)
	802.11ac VHT40	MCS0 to MCS9 (SISO)
	802.11ac VHT80	MCS0 to MCS9 (SISO)
Power Supply Requirement(s):	Nominal	3.8 VDC via 120 VAC 60 Hz AC/DC adapter
Maximum Conducted Output Power:	20 MHz	21.6 dBm
	40 MHz	21.7 dBm
	80 MHz	21.9 dBm

Additional Information Related to Testing (continued)

Channel Spacing:	20 MHz		
Transmit Frequency Band:	5150 MHz to 5250 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	36	5180
	Middle	40	5200
	Top	48	5240
Transmit Frequency Band:	5250 MHz to 5350 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	52	5260
	Middle	56	5280
	Top	64	5320
Transmit Frequency Band:	5470 MHz to 5725 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	100	5500
	Middle	116	5580
	Top	140	5700
Transmit Frequency Band:	Channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz		
Transmit Channel Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Single	144	5720
Transmit Frequency Band:	5725 MHz to 5850 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	149	5745
	Middle	157	5785
	Top	165	5825

Additional Information Related to Testing (continued)

Channel Spacing:	40 MHz		
Transmit Frequency Band:	5150 MHz to 5250 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	38	5190
	Top	46	5230
Transmit Frequency Band:	5250 MHz to 5350 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	54	5270
	Top	62	5310
Transmit Frequency Band:	5470 MHz to 5725 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	102	5510
	Middle	118	5590
	Top	134	5670
Transmit Frequency Band:	Channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz		
Transmit Channel Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Single	142	5710
Transmit Frequency Band:	5725 MHz to 5850 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	151	5755
	Top	159	5795

Additional Information Related to Testing (continued)

Channel Spacing:	80 MHz		
Transmit Frequency Band:	5150 MHz to 5250 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Single	42	5210
Transmit Frequency Band:	5250 MHz to 5350 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Single	58	5290
Transmit Frequency Band:	5470 MHz to 5725 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	106	5530
	Top	122	5610
Transmit Frequency Band:	Channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz		
Transmit Channel Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Single	138	5690
Transmit Frequency Band:	5725 MHz to 5850 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Single	155	5775

3.4. Description of Available Antennas

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

Frequency Range (MHz)	Antenna Gain (dBi)
5150 to 5250	5.5
5250 to 5350	6.3
5470 to 5725	5.0
5725 to 5850	4.5

3.5. Description of Test Setup

Support Equipment

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

Brand Name:	Not marked or stated
Description:	Type C USB Cable. Length 2.0 metres
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Brand Name:	Apple
Description:	USB-C Power Adapter
Model Name or Number:	A1947
Serial Number:	Not marked or stated

Brand Name:	Apple
Description:	USB-C to Ethernet Adapter
Model Name or Number:	A1632
Serial Number:	Not marked or stated

Brand Name:	Belkin
Description:	USB-C Adapter
Model Name or Number:	F2CU040
Serial Number:	Not marked or stated

Brand Name:	Apple
Description:	USB-C Power Adapter
Model Name or Number:	A1718
Serial Number:	Not marked or stated

Brand Name:	Apple
Description:	PHF (Personal Hands Free)
Model Name or Number:	Apple EarPods
Serial Number:	Not marked or stated

Brand Name:	Not marked or stated
Description:	Type A USB Cable. Length 3.0 metres.
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Support Equipment (continued)

Brand Name:	Belkin
Description:	4 Port USB Hub
Model Name or Number:	F5U404-BLK
Serial Number:	Not marked or stated

Operating Modes

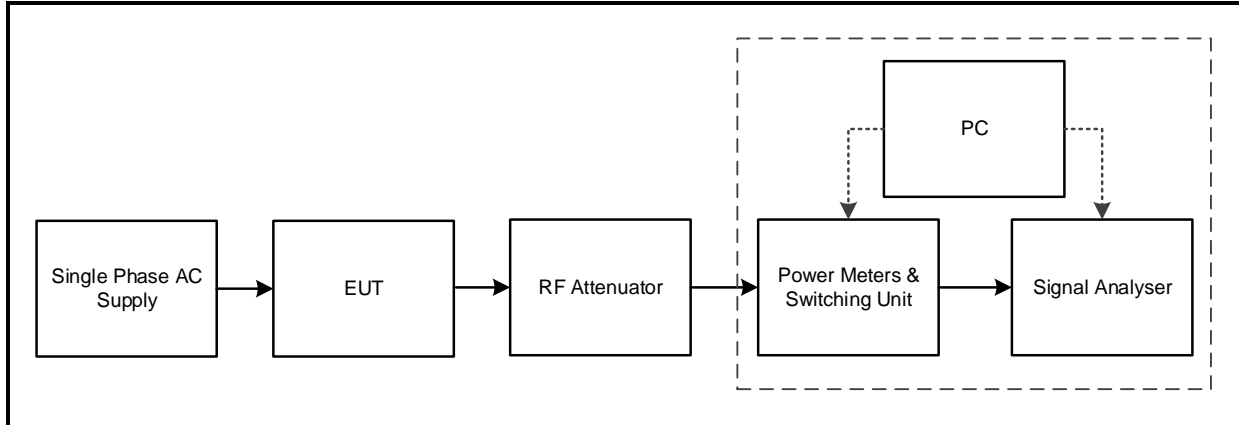
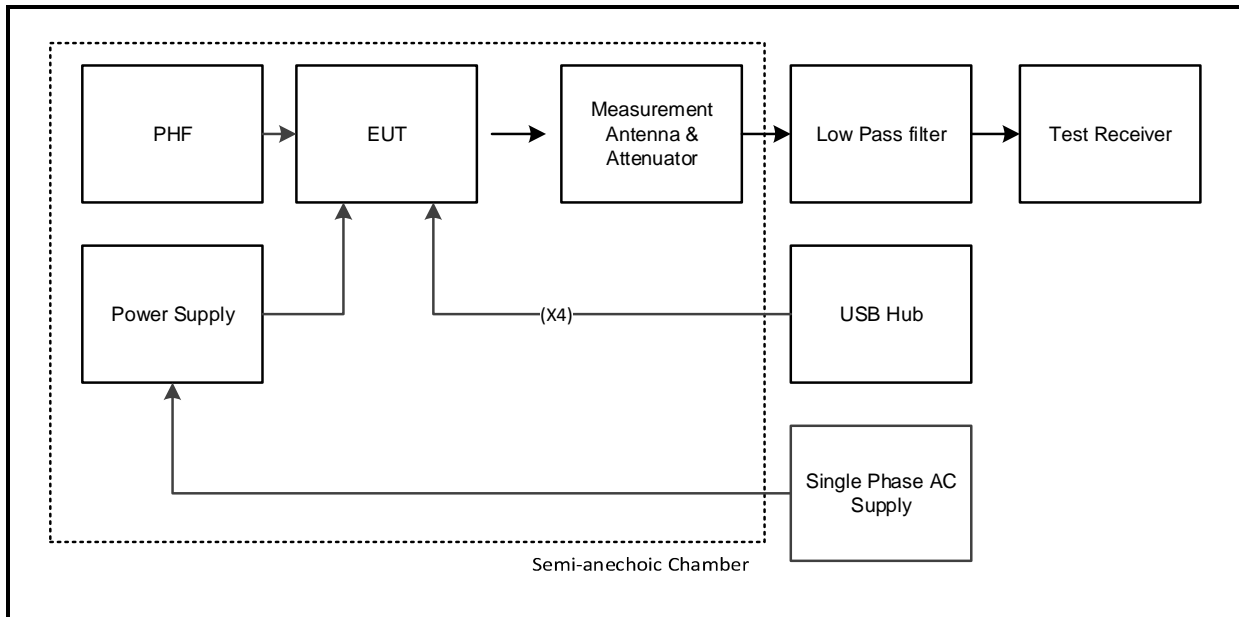
The EUT was tested in the following operating mode(s):

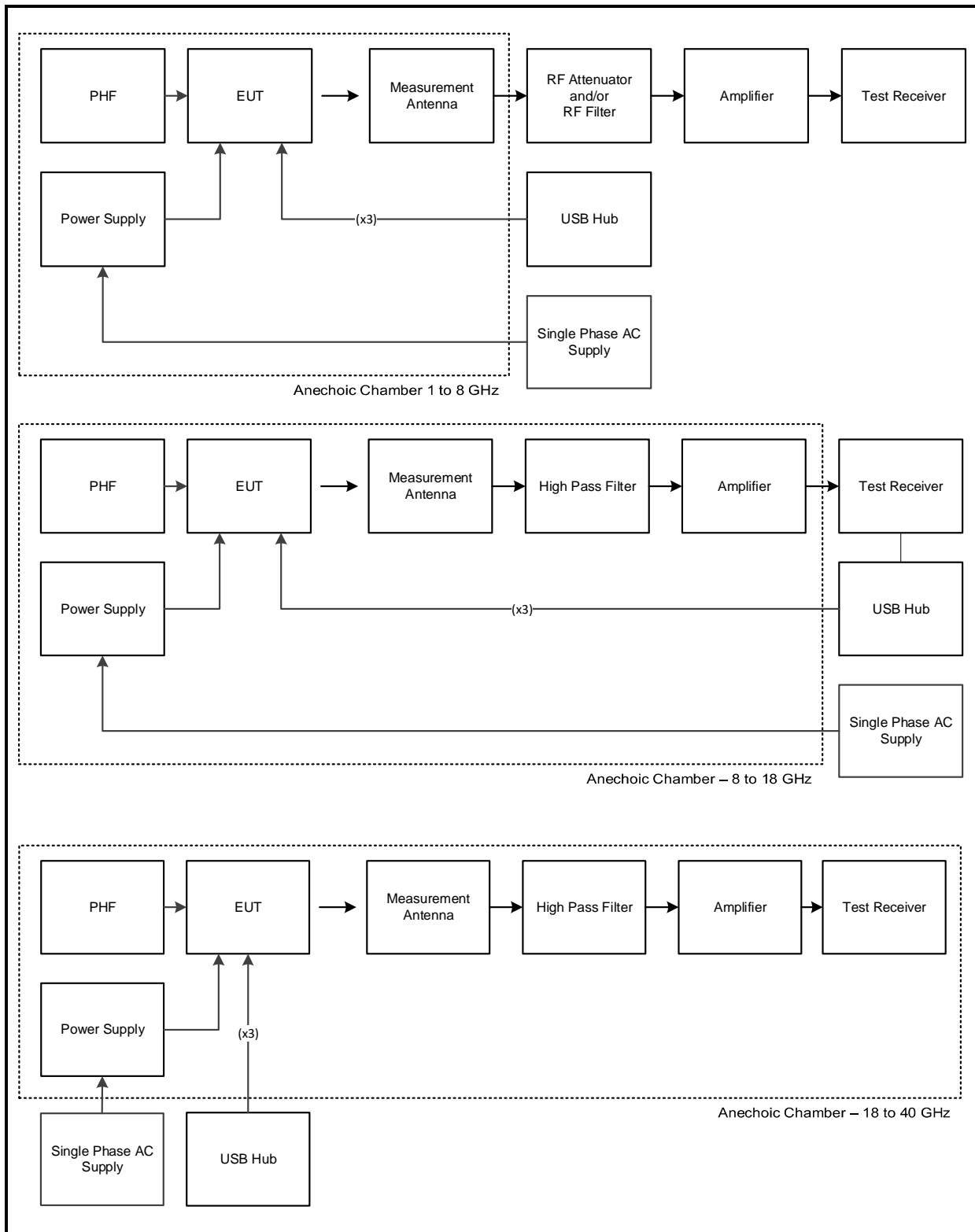
- Continuously transmitting with a modulated carrier at maximum power on the bottom, middle and top channels as required using the supported data rates/modulation types.

Configuration and Peripherals

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

- Controlled in test mode using a software application on the EUT supplied by the customer. The application was used to enable a continuous transmission and to select the test channels as required. The customer supplied scripts 'EUT_EVT_wlan_setup_v1.sh' to control the EUT.
- The customer requested the following data rates to be used for all measurements:
 - 802.11a SISO – BPSK / 6 Mbps / Port WF3
 - 802.11n HT20 / SISO – BPSK / MCS0 / Port WF3
 - 802.11n HT40 / SISO – BPSK / MCS0 / Port WF3
 - 802.11ac VHT80 / SISO – BPSK / MCS0 / Port WF3
- Transmitter spurious emissions were performed with the EUT transmitting in an 802.11a / 6 Mbps / SISO configuration. This was found to be the worst case with regards to emissions after preliminary investigations and, as this mode emits the highest transmit power spectral density, it was deemed to be the worst case.
- Transmitter radiated spurious emissions tests were performed with the AC Charger and PHF connected to the EUT. The USB ports were terminated to a USB hub which was placed outside the chamber.
- The EUT was powered from a 120 VAC 60 Hz single phase mains supply.

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

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

4. Antenna Port Test Results

4.1. Transmitter Duty Cycle

Test Summary:

Test Engineer:	Max Passell	Test Date:	24 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.35(c)
Test Method Used:	KDB 789033 D02 Section II.B.2.b)

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	43

Note(s):

1. In order to assist with the determination of the average level of fundamental and spurious emissions field strength, 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 spectrum analyser in the time domain and calculated by using the following calculation:

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

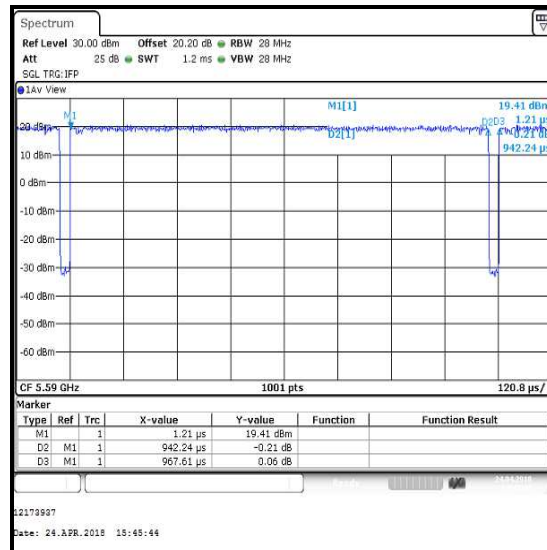
$$802.11n \text{ HT40} / \text{SISO} / \text{MCS0 duty cycle: } 10 \log (1 / (942.2 / 967.6)) = 0.1$$

$$802.11ac \text{ VHT80} / \text{SISO} / \text{MCS0x1 duty cycle: } 10 \log (1 / (458.9 / 483.0)) = 0.2$$

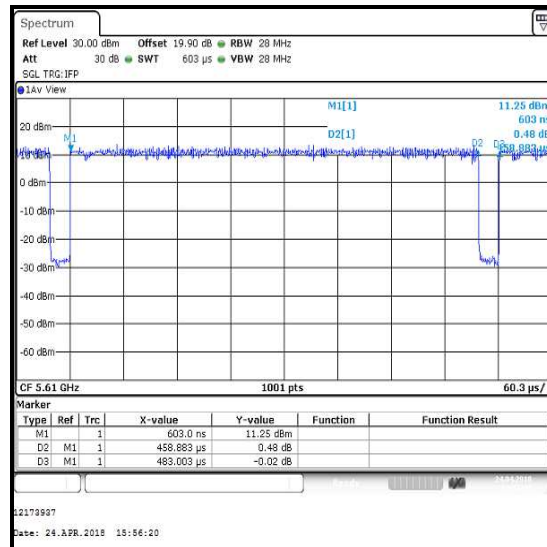
2. Plots below are for data rates with a duty cycle less than 98%. Results for all other modes having a duty cycle >98% are archived on the UL VS LTD IT server and available for inspection if required.
3. The signal analyser was connected to the RF port on the EUT using an RF switch, suitable attenuation and RF cables. An RF level offset was entered on the signal analyser to compensate for the loss of the switch, attenuators and RF cables.

Transmitter Duty Cycle (continued)**Results: 802.11n / 40 MHz / SISO / MCS0**

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
0.9422	0.9676	0.1

**Results: 802.11ac / 80 MHz / SISO / MCS0x1**

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
0.4589	0.4830	0.2



4.2. Transmitter 26 dB Emission Bandwidth**Test Summary:**

Test Engineer:	Max Passell	Test Dates:	24 April 2018 & 26 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.403(i)
Test Method Used:	KDB 789033 D02 Section II.C.1.

Environmental Conditions:

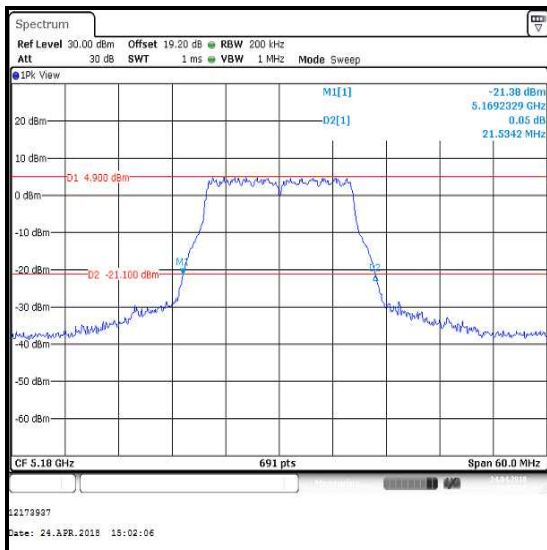
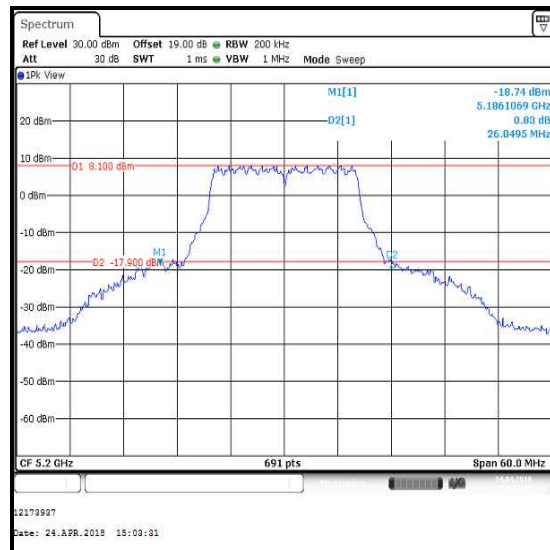
Temperatures (°C):	23 to 24
Relative Humidity (%):	38 to 43

Note(s):

1. Measurements were performed on data rates detailed in Section 3.5 on the relevant channels.
2. The signal analyser's resolution bandwidth was set to approximately 1% of the measured 26 dB emission bandwidth.
3. The signal analyser was connected to the RF port on the EUT using an RF switch, suitable attenuation and RF cables. An RF level offset was entered on the signal analyser to compensate for the loss of the switch, attenuators and RF cables.
4. For channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz, emission bandwidth measurements were performed twice. Measurements of the entire 26 dB emission bandwidth that is contained on both U-NII-2C and U-NII-3 bands, were used for power measurements. Measurements on the emission's portion that is contained only within the U-NII-2C band, were used to calculate the conducted power limit on U-NII-2C tests. These are labelled as 'Reference plots'.

Transmitter 26 dB Emission Bandwidth (5.15-5.25 GHz band) (continued)**4.2.1. 5.15-5.25 GHz band****Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5180	21.534
Middle	5200	26.050
Top	5240	33.343

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

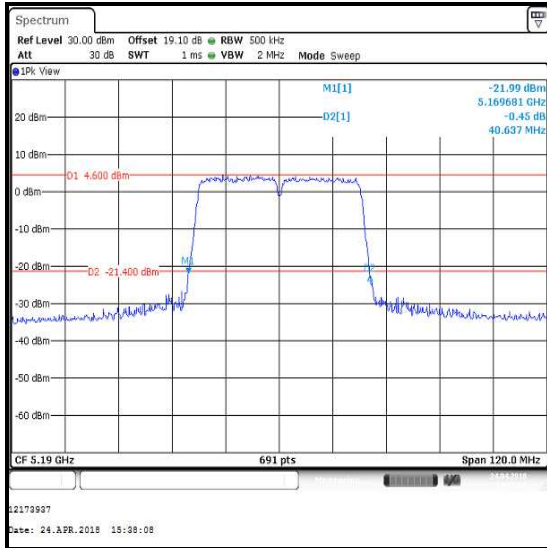
Transmitter 26 dB Emission Bandwidth (5.15-5.25 GHz band) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5180	21.881
Middle	5200	29.088
Top	5240	33.951

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

Transmitter 26 dB Emission Bandwidth (5.15-5.25 GHz band) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5190	40.637
Top	5230	75.021

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

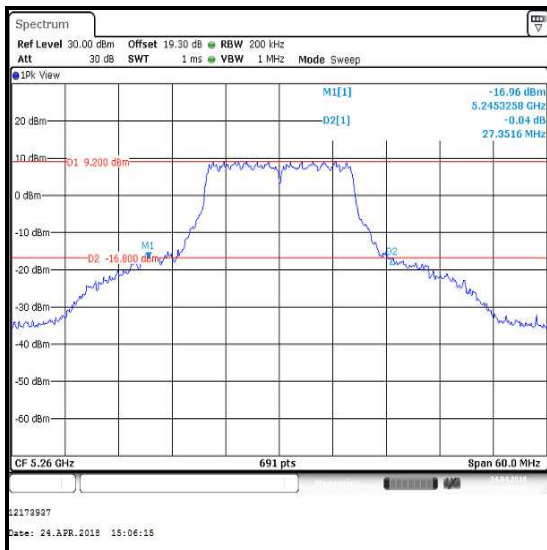
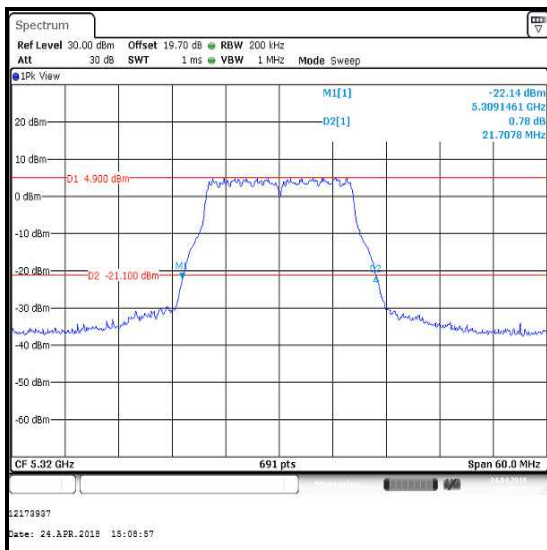
Transmitter 26 dB Emission Bandwidth (5.15-5.25 GHz band) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0x1 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5210	82.663

**Single Channel**

Transmitter 26 dB Emission Bandwidth (5.25-5.35 GHz band) (continued)**4.2.2. 5.25-5.35 GHz band****Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5260	27.352
Middle	5280	27.091
Top	5320	21.708

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

Transmitter 26 dB Emission Bandwidth (5.25-5.35 GHz band) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5260	31.086
Middle	5280	29.609
Top	5320	22.055

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

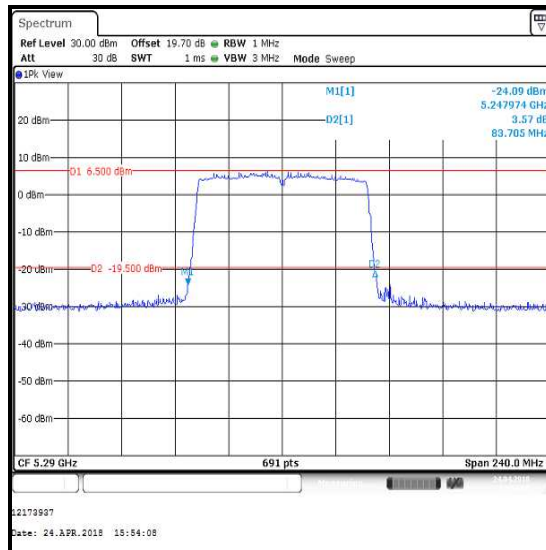
Transmitter 26 dB Emission Bandwidth (5.25-5.35 GHz band) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5270	68.249
Top	5310	40.637

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

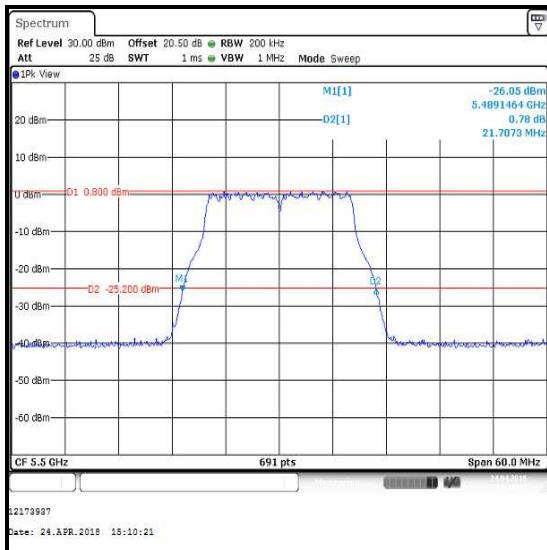
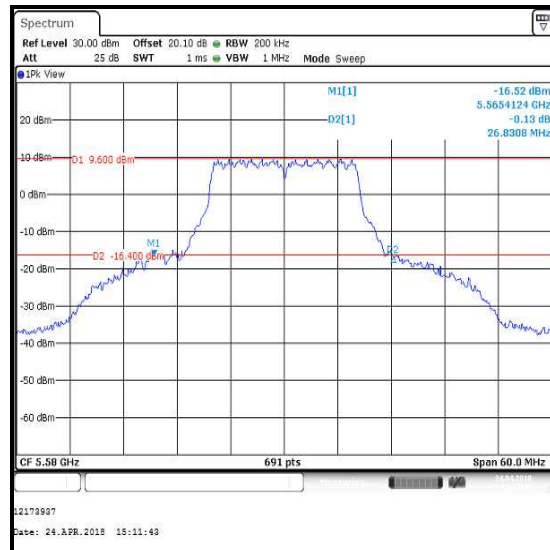
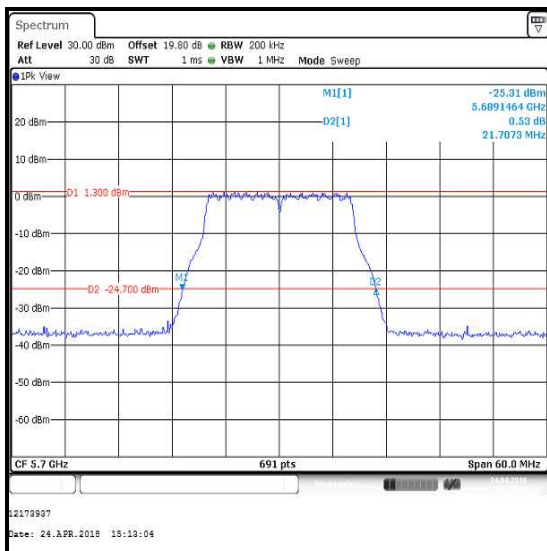
Transmitter 26 dB Emission Bandwidth (5.25-5.35 GHz band) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0x1 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5290	83.705

**Single Channel**

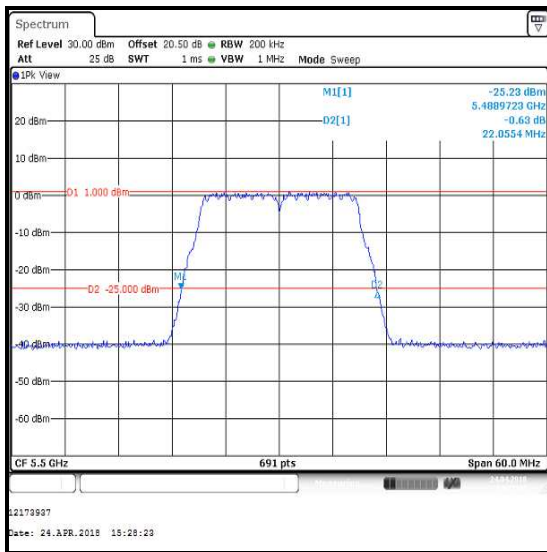
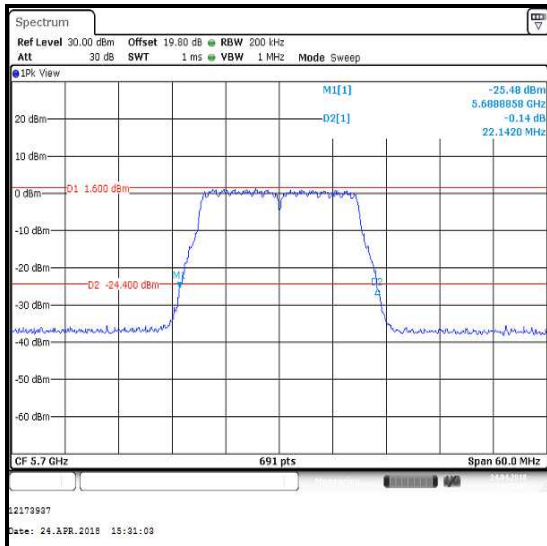
Transmitter 26 dB Emission Bandwidth (5.47-5.725 GHz band) (continued)**4.2.3. 5.47-5.725 GHz band****Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5500	21.707
Middle	5580	26.831
Top	5700	21.707

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

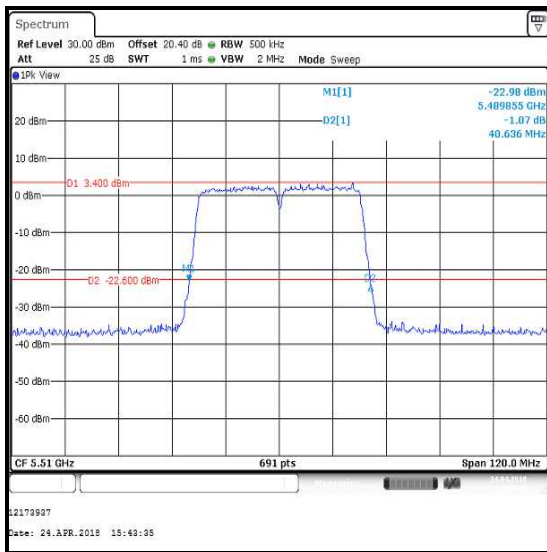
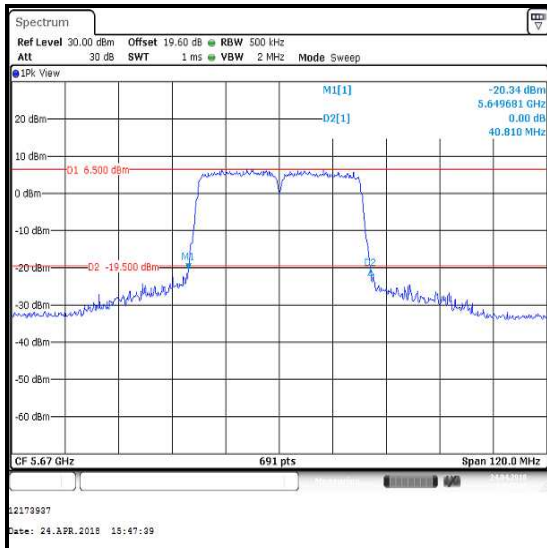
Transmitter 26 dB Emission Bandwidth (5.47-5.725 GHz band) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5500	22.055
Middle	5580	30.999
Top	5700	22.142

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

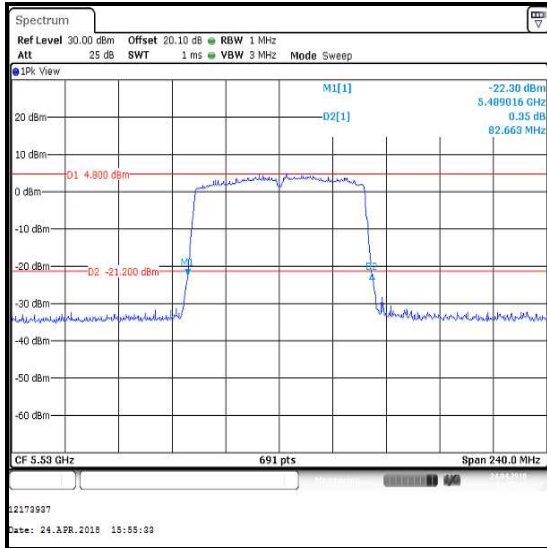
Transmitter 26 dB Emission Bandwidth (5.47-5.725 GHz band) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5510	40.636
Middle	5590	85.962
Top	5670	40.810

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

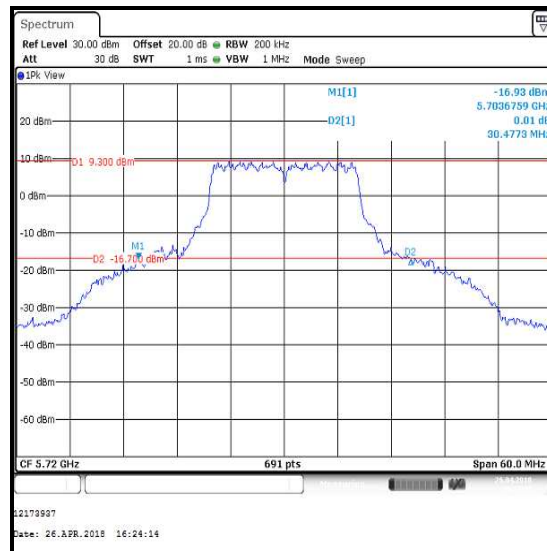
Transmitter 26 dB Emission Bandwidth (5.47-5.725 GHz band) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0x1 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5530	82.663
Top	5610	83.705

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

Transmitter 26 dB Emission Bandwidth (Straddle Channels) (continued)**4.2.4. Channels that straddle the U-NII-2C and U-NII-3 bands****Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5720	30.477



Single Channel

Results: Reference Plots / 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3

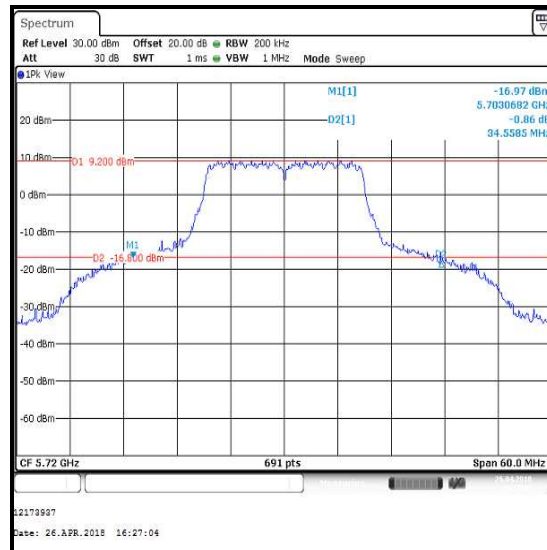
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5720	21.324



Single Channel

Transmitter 26 dB Emission Bandwidth (Straddle Channels) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

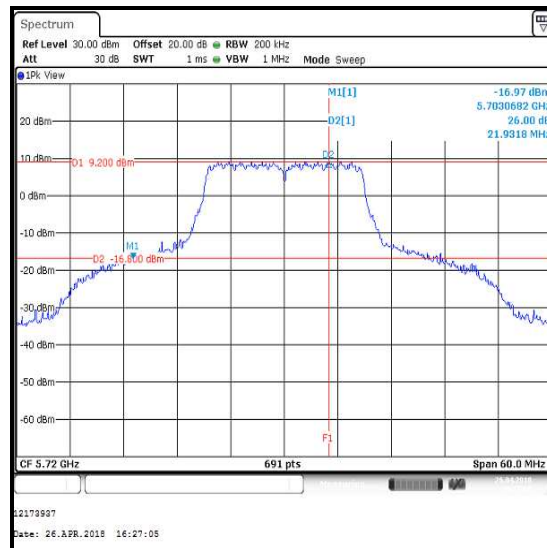
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5720	34.559



Single Channel

Results: Reference Plots / 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3

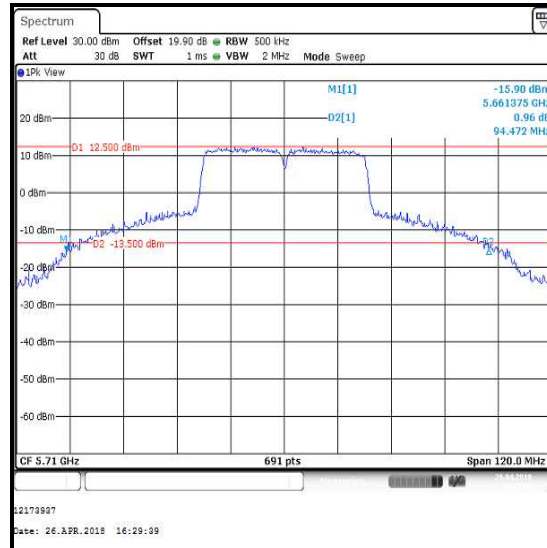
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5720	21.932



Single Channel

Transmitter 26 dB Emission Bandwidth (Straddle Channels) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

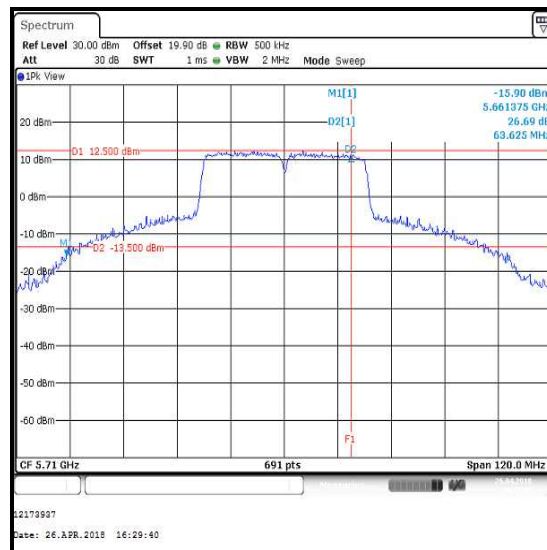
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5710	94.472



Single Channel

Results: Reference Plots / 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3

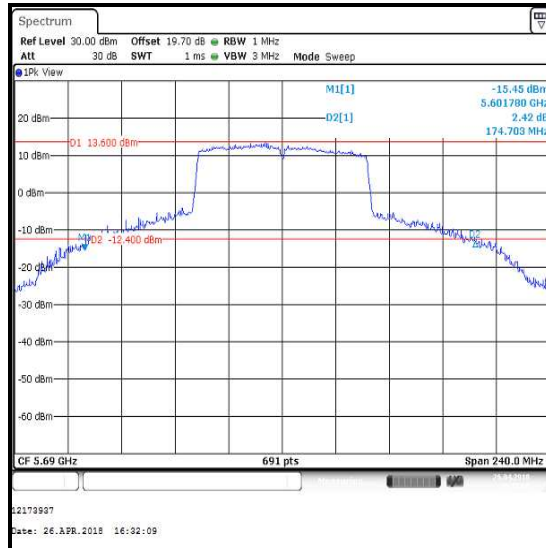
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5710	63.625



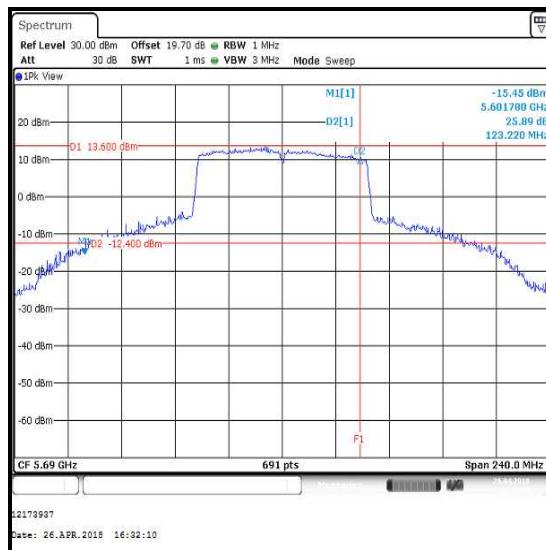
Single Channel

Transmitter 26 dB Emission Bandwidth (Straddle Channels) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0x1 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5690	174.703

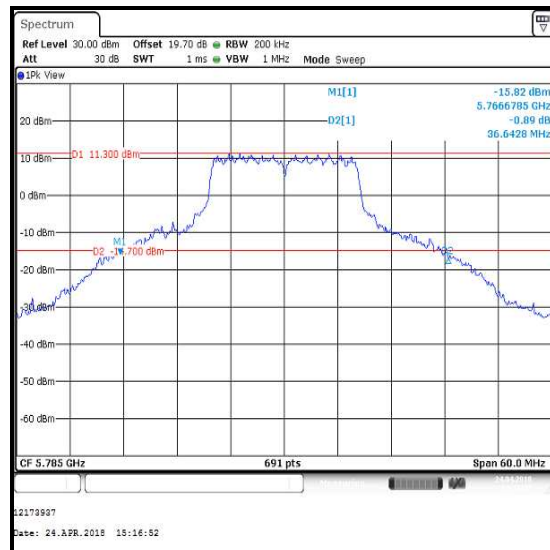
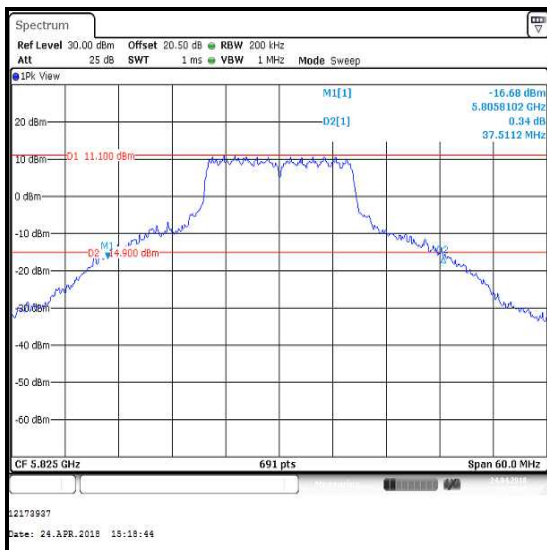
**Single Channel****Results: Reference Plots / 802.11ac / 80 MHz / SISO / BPSK / MCS0x1 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5690	123.220

**Single Channel**

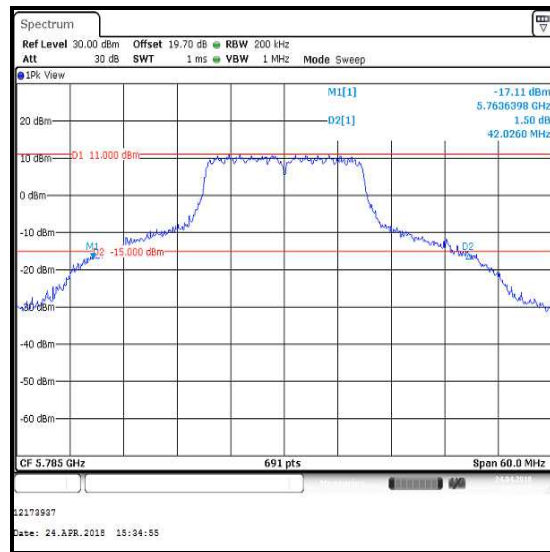
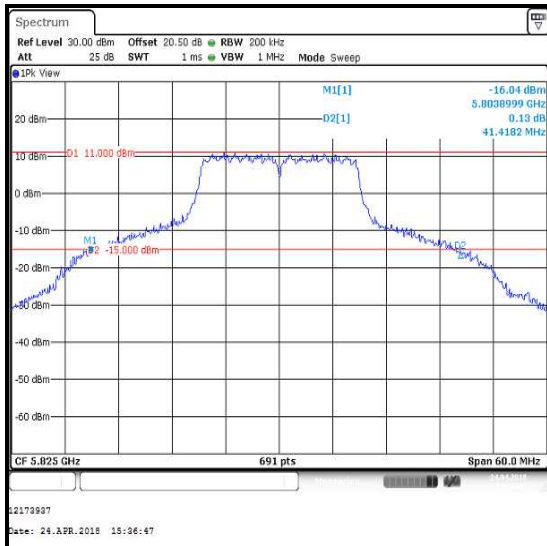
Transmitter 26 dB Emission Bandwidth (5.725-5.85 GHz band) (continued)**4.2.5. 5.725-5.85 GHz band****Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	38.466
Middle	5785	36.643
Top	5825	37.511

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

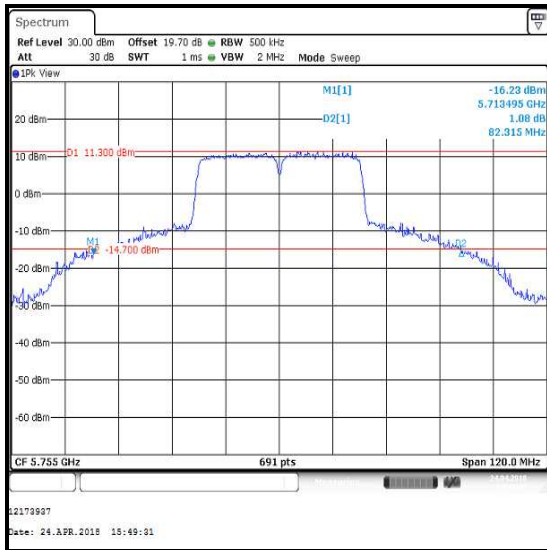
Transmitter 26 dB Emission Bandwidth (5.725-5.85 GHz band) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	41.852
Middle	5785	42.026
Top	5825	41.418

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

Transmitter 26 dB Emission Bandwidth (5.725-5.85 GHz band) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5755	82.315
Top	5795	87.351

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

Transmitter 26 dB Emission Bandwidth (5.725-5.85 GHz band) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5775	97.945

**Single Channel**

4.3. Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band)**Test Summary:**

Test Engineer:	Max Passell	Test Dates:	24 April 2018 & 26 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(e)
Test Method Used:	KDB 789033 D02 Section II.C.2.

Environmental Conditions:

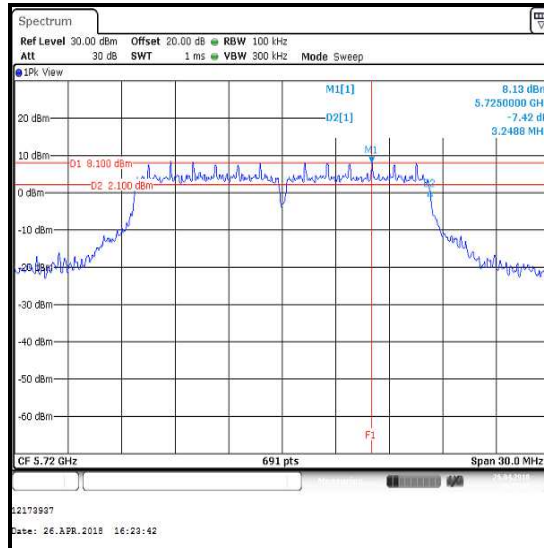
Temperature (°C):	23 to 24
Relative Humidity (%):	38 to 43

Note(s):

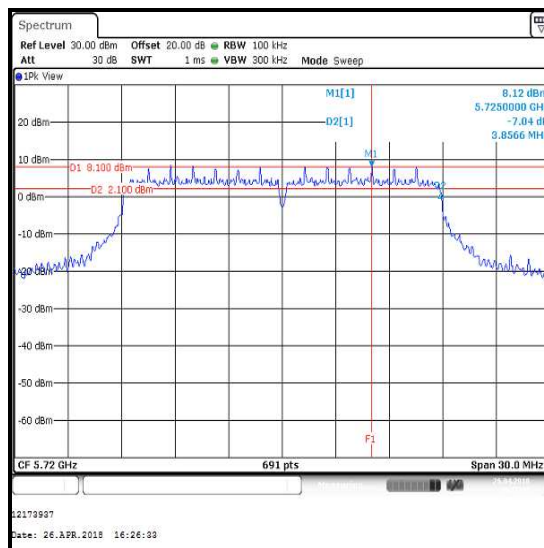
1. Measurements were performed on data rates detailed in Section 3.5 on the relevant channels.
2. For channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz, measurements were performed on the portion of the emission that is contained within the U-NII-3 band.
3. The signal analyser was connected to the RF port on the EUT using an RF switch, suitable attenuation and RF cables. An RF level offset was entered on the signal analyser to compensate for the loss of the switch, attenuators and RF cables.

Transmitter Minimum 6 dB Bandwidth (Straddle Channels) (continued)**4.3.1. Channels that straddle the U-NII-2C and the U-NII-3 bands at 5.725 GHz****Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	3249	≥500	2749	Complied

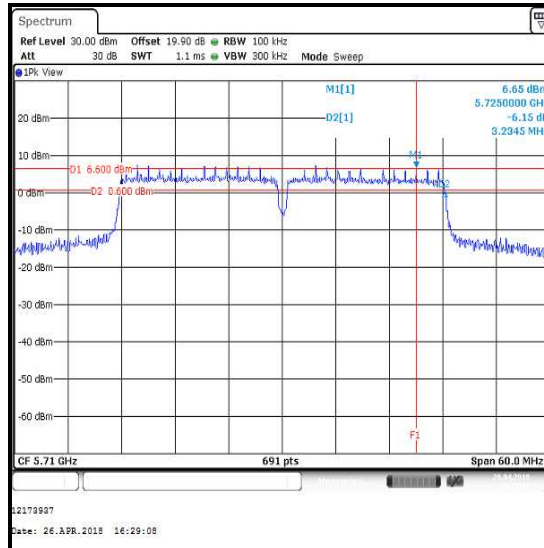
**Single Channel****Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	3857	≥500	3357	Complied

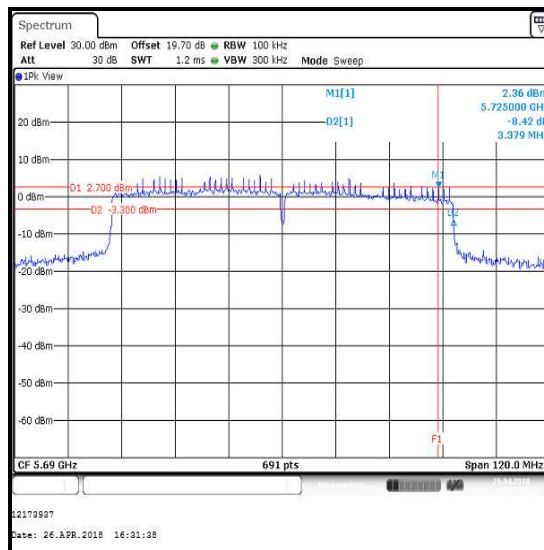
**Single Channel**

Transmitter Minimum 6 dB Bandwidth (Straddle Channels) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	3235	≥500	2735	Complied

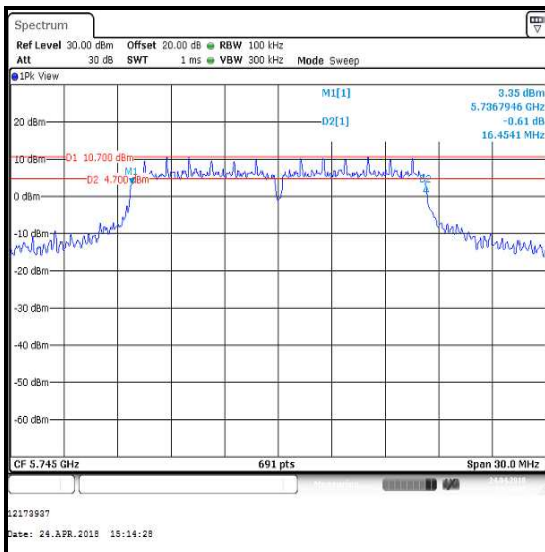
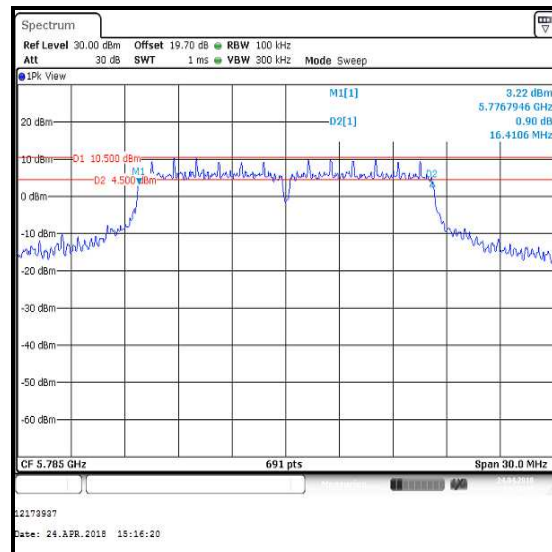
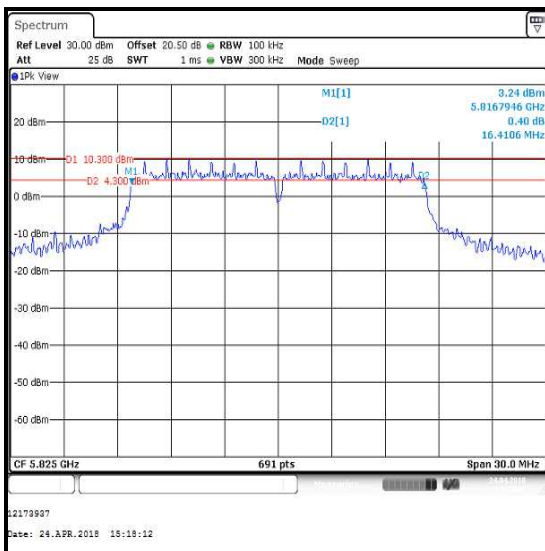
**Single Channel****Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	3379	≥500	2879	Complied

**Single Channel**

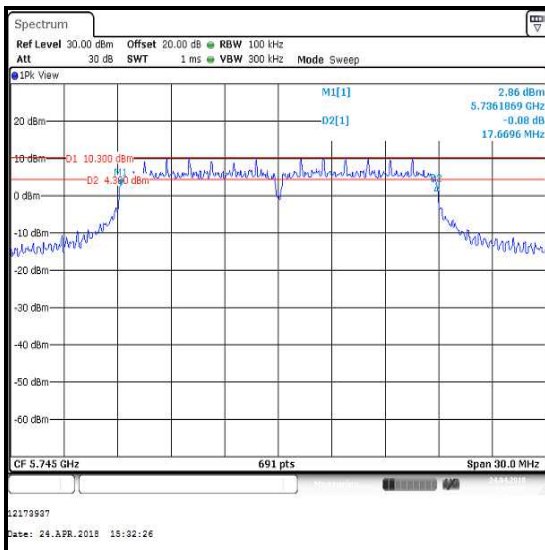
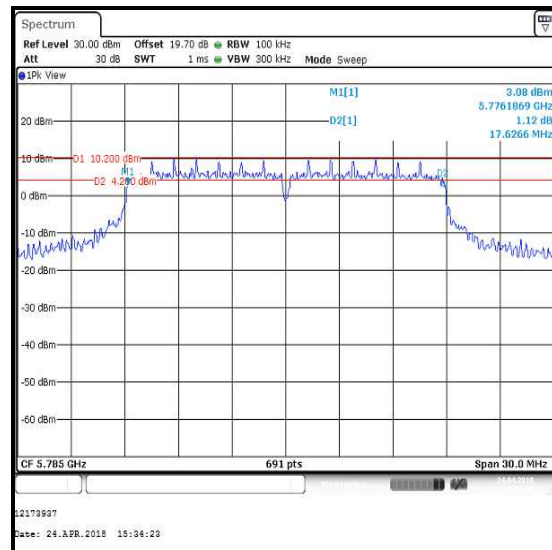
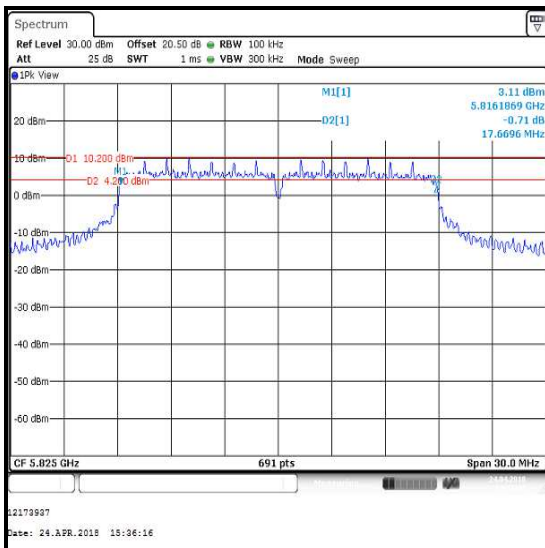
Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band) (continued)**4.3.2. 5.725-5.85 GHz band****Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16454	≥500	15954	Complied
Middle	16411	≥500	15911	Complied
Top	16411	≥500	15911	Complied

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

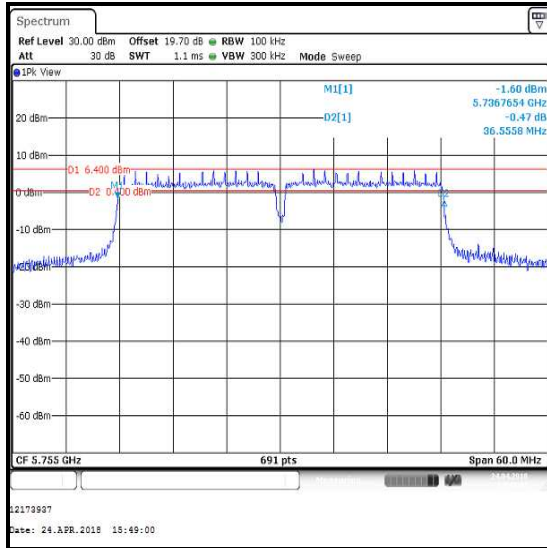
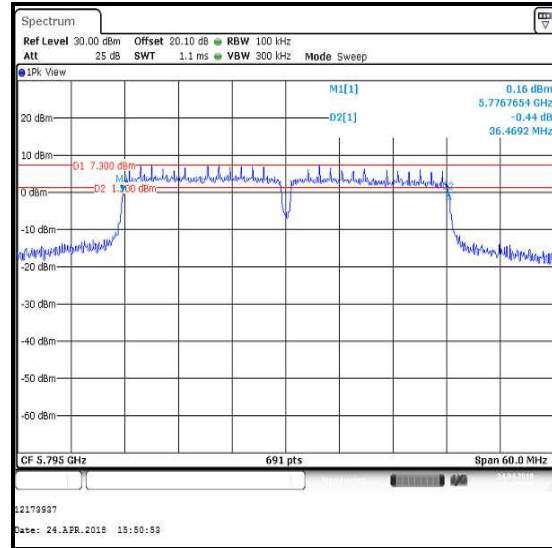
Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17670	≥500	17170	Complied
Middle	17627	≥500	17127	Complied
Top	17670	≥500	17170	Complied

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

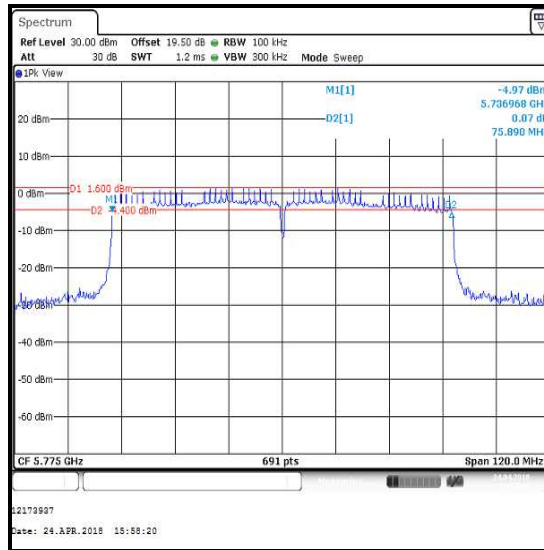
Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	36556	≥500	36056	Complied
Top	36469	≥500	35969	Complied

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

Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	75890	≥500	75390	Complied

**Single Channel**

4.4. Transmitter Maximum Conducted Output Power

4.4.1. 5.15-5.25 GHz band

Test Summary:

Test Engineer:	Max Passell	Test Date:	24 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(a)(1)(iv)
Test Method Used:	KDB 789033 D02 Section II.E.2.b) and II.E.2.d)

Environmental Conditions:

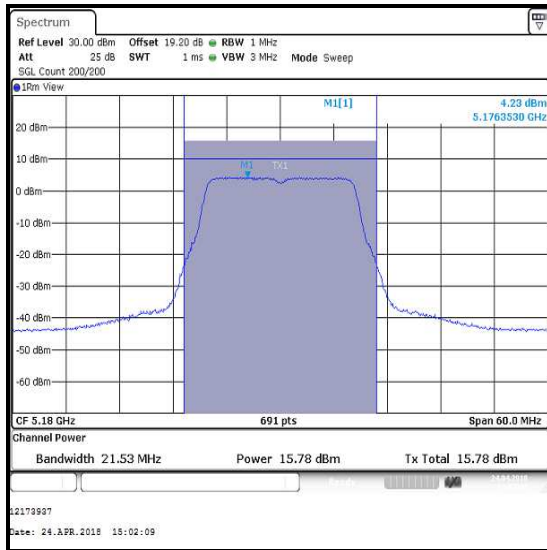
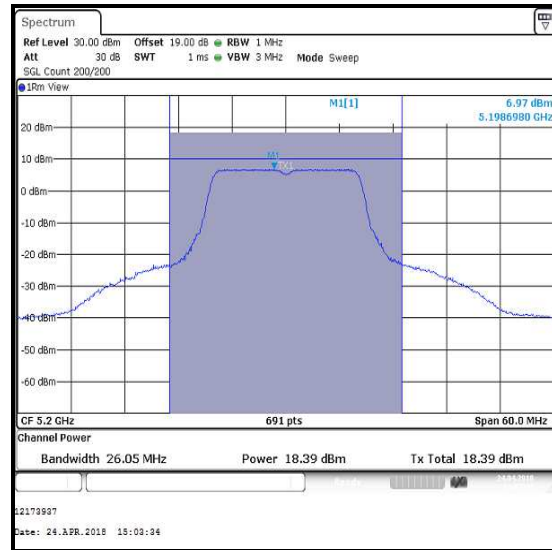
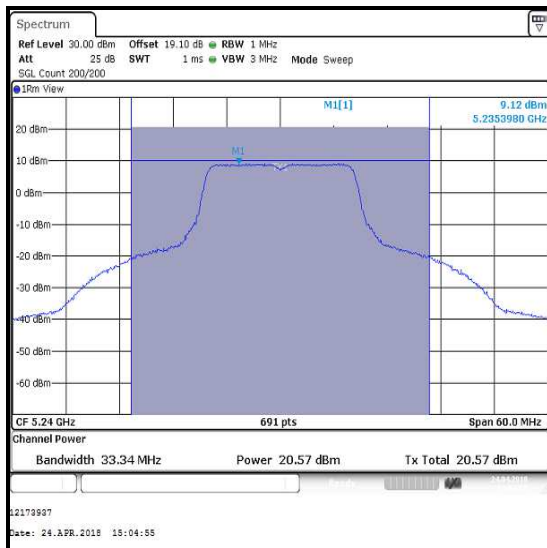
Temperature (°C):	24
Relative Humidity (%):	43

Note(s):

1. For conducted power tests where the duty cycle is >98%, the measurements were performed using a signal analyser in accordance with FCC KDB 789033 II.E.2.b) Method SA-1. Where the duty cycle is <98%, the measurements were performed in accordance with FCC KDB 789033 II.E.2.d) Method SA-2. The signal analyser's integration function was used to integrate across the 26 dB emission bandwidth. The resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. An RMS detector was used and sweep time was set to auto and 200 traces performed. The span was set to encompass the entire 26 dB emission bandwidth. The channel power results are recorded in the tables below.
2. Measurements were performed using configurations detailed in Section 3.5 of this test report on the relevant channels.
3. For data rates where the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 4.1 was added to the measured power in order to compute the average power during the actual transmission time.
4. For all modes of operation, the antenna gain is < 6 dBi.
5. For details on antenna gains refer to Section 3.4 of this test report.
6. The signal analyser was connected to the RF port on the EUT using an RF switch, 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.
7. The Part 15.407(a)(1)(iv) limit shall not exceed 250 mW (24.0 dBm).

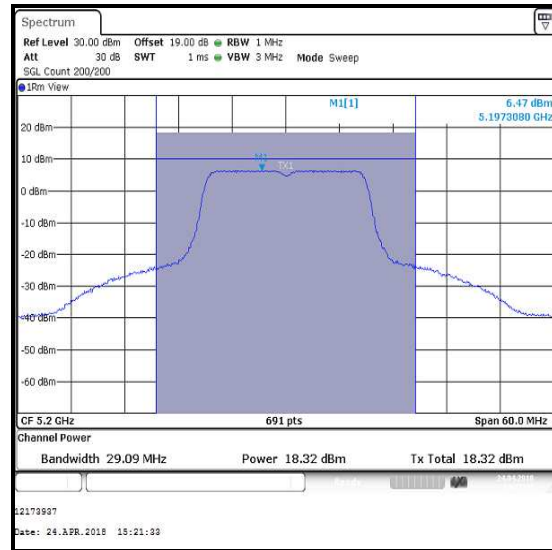
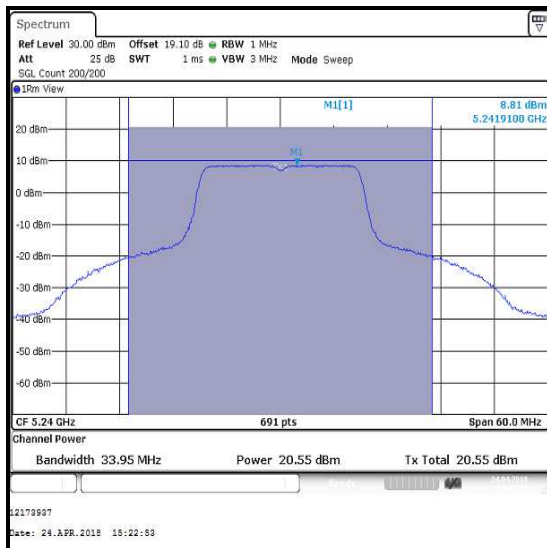
Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	15.8	24.0	8.2	Complied
Middle	5200	18.4	24.0	5.6	Complied
Top	5240	20.6	24.0	3.4	Complied

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

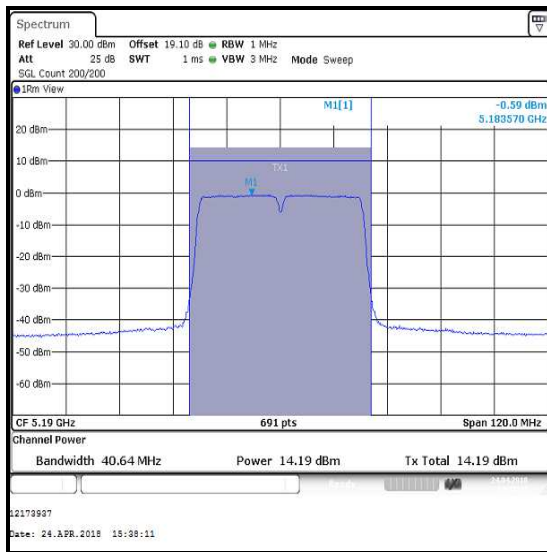
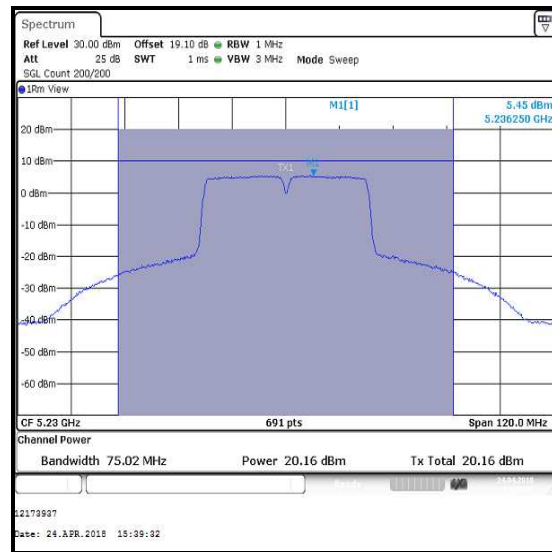
Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	15.9	24.0	8.1	Complied
Middle	5200	18.3	24.0	5.7	Complied
Top	5240	20.6	24.0	3.4	Complied

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

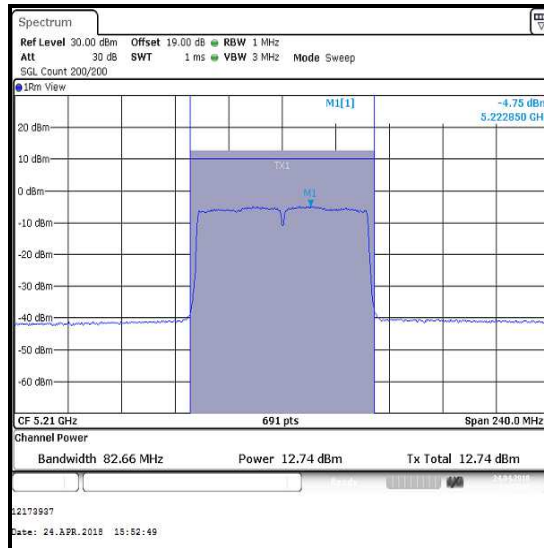
Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5190	14.2	0.1	14.3	24.0	9.7	Complied
Top	5230	20.2	0.1	20.3	24.0	3.7	Complied

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

Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5210	12.7	0.2	12.9	24.0	11.1	Complied

**Single Channel**

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band)**4.4.2. 5.25-5.35 GHz band****Test Summary:**

Test Engineer:	Max Passell	Test Date:	24 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(a)(2)
Test Method Used:	KDB 789033 D02 Section II.E.2.b) and II.E.2.d)

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	43

Note(s):

- For conducted power tests where the duty cycle is >98%, the measurements were performed using a signal analyser in accordance with FCC KDB 789033 II.E.2.b) Method SA-1. Where the duty cycle is <98%, the measurements were performed in accordance with FCC KDB 789033 II.E.2.d) Method SA-2. The signal analyser's integration function was used to integrate across the 26 dB emission bandwidth. The resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. An RMS detector was used and sweep time was set to auto and 200 traces performed. The span was set to encompass the entire 26 dB emission bandwidth. The channel power results are recorded in the tables below.
- Measurements were performed using configurations detailed in Section 3.5 of this test report on the relevant channels.
- For data rates where the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 4.1 was added to the measured power in order to compute the average power during the actual transmission time.
- The FCC Part 15.407(a)(2) limit is the lesser of 250 mW (24.0 dBm) or 11 dBm + 10 log₁₀ B, where B is the previously measured 26 dB emission bandwidth in MHz. For U-NII-2A band, the 26 dB EBW is greater than 20 MHz.

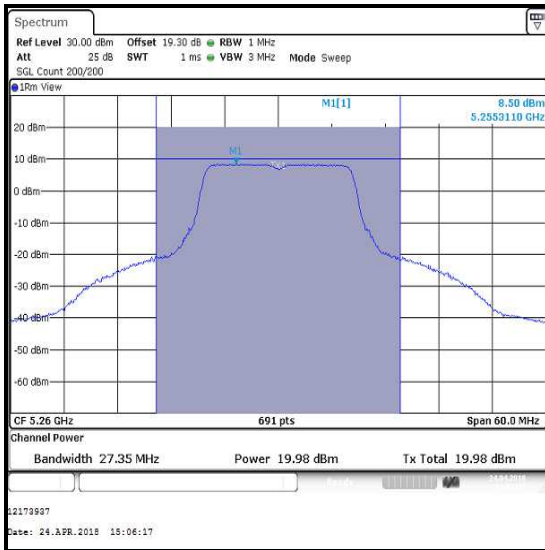
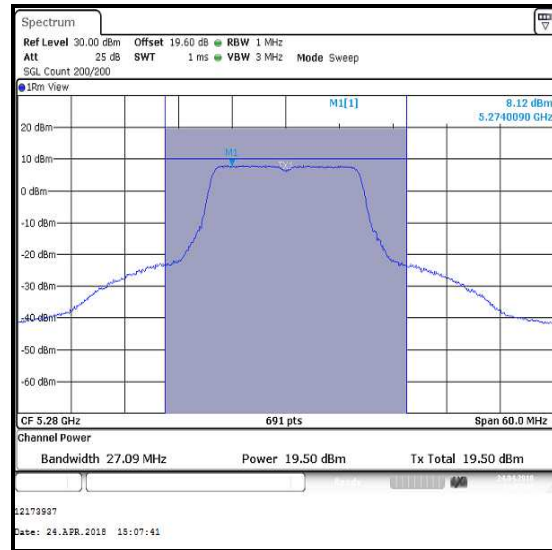
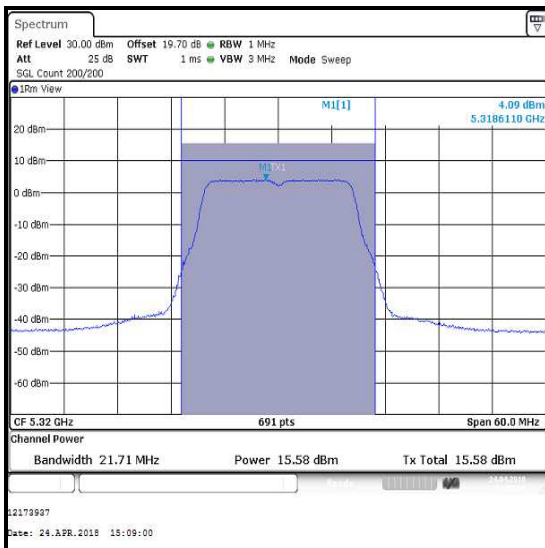
$$\begin{aligned}
 &\text{For } B > 20 \text{ MHz} \rightarrow \\
 &\rightarrow \log_{10} B > \log_{10} 20 \rightarrow \\
 &\rightarrow 10 \log_{10} B > 10 \log_{10} 20 \rightarrow \\
 &\rightarrow 11 + 10 \log_{10} B > 11 + 10 \log_{10} 20 \rightarrow \\
 &\rightarrow 11 + 10 \log_{10} B > 24.0 \text{ dBm}
 \end{aligned}$$

Therefore for measured emission bandwidths greater than 20 MHz, the lesser of the two limits is the fixed limit of 250 mW (24.0 dBm).

- The EUT has an antenna gain of 6.3 dBi. In accordance with Part 15.407(a)(2), the limit has been reduced by the amount in dB the antenna gain exceeds 6 dBi. Therefore the limit of 24.0 dBm has been reduced to 23.7 dBm.
- For details on antenna gains refer to Section 3.4 of this test report.
- The signal analyser was connected to the RF port on the EUT using an RF switch, 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.

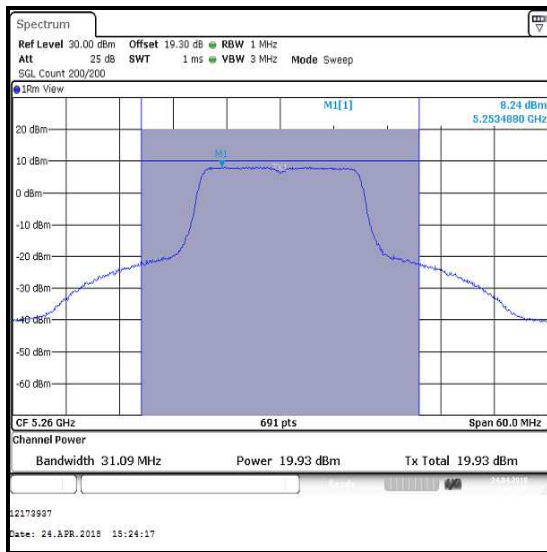
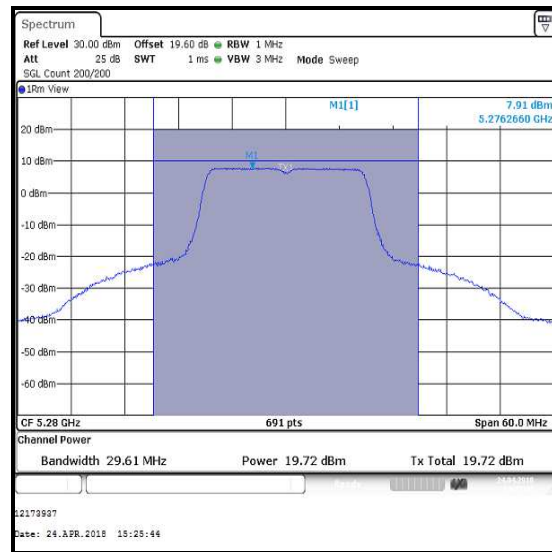
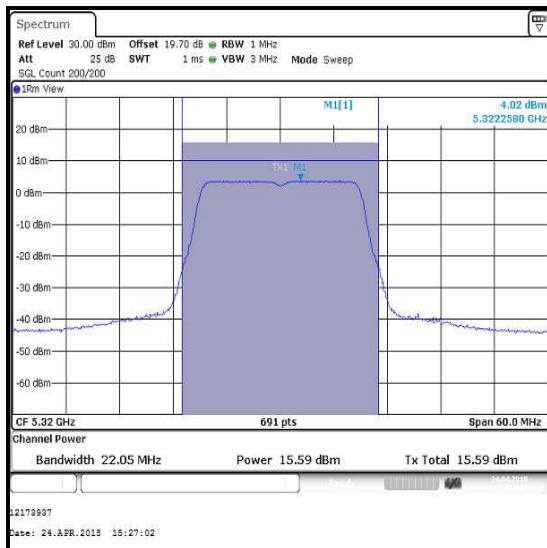
Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)**Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5260	20.0	23.7	3.7	Complied
Middle	5280	19.5	23.7	4.2	Complied
Top	5320	15.6	23.7	8.1	Complied

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

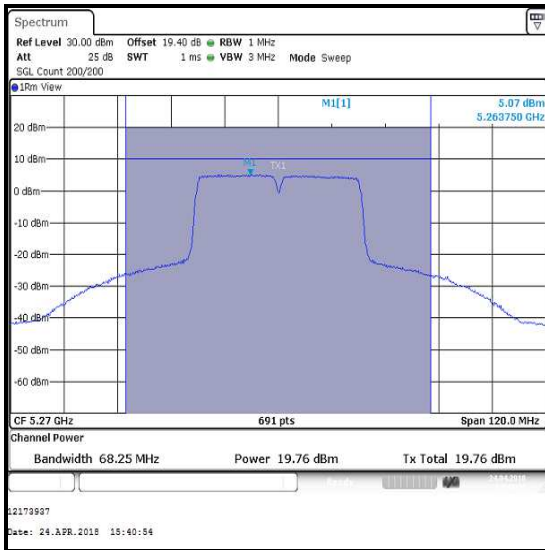
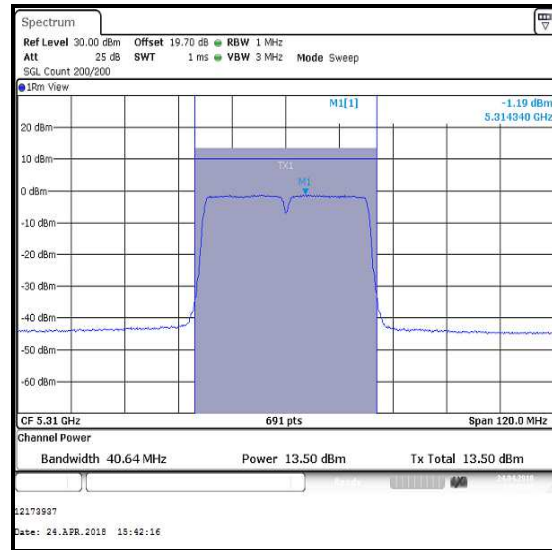
Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5260	19.9	23.7	3.8	Complied
Middle	5280	19.7	23.7	4.0	Complied
Top	5320	15.6	23.7	8.1	Complied

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

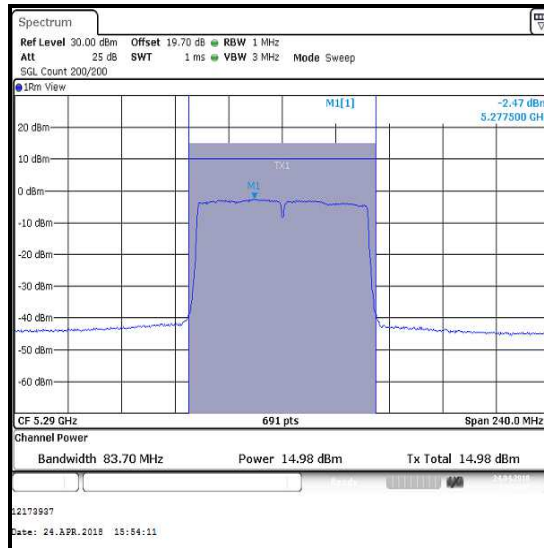
Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5270	19.8	0.1	19.9	23.7	3.8	Complied
Top	5310	13.5	0.1	13.6	23.7	10.1	Complied

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

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0x1 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5290	15.0	0.2	15.2	23.7	8.5	Complied

**Single Channel**

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band)**4.4.3. 5.47-5.725 GHz band****Test Summary:**

Test Engineer:	Max Passell	Test Date:	24 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(a)(2)
Test Method Used:	KDB 789033 D02 Section II.E.2.b) and II.E.2.d)

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	43

Note(s):

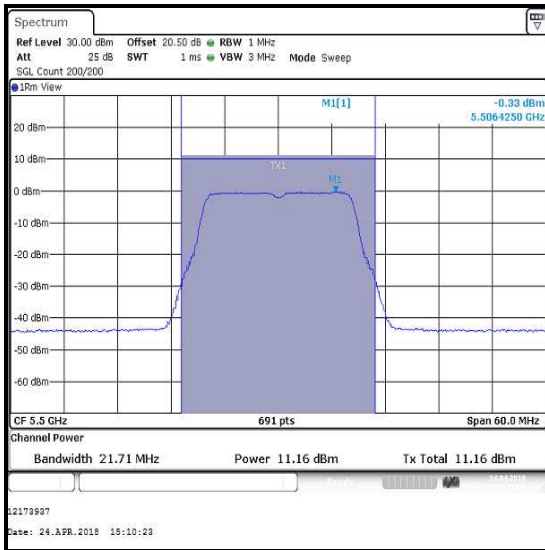
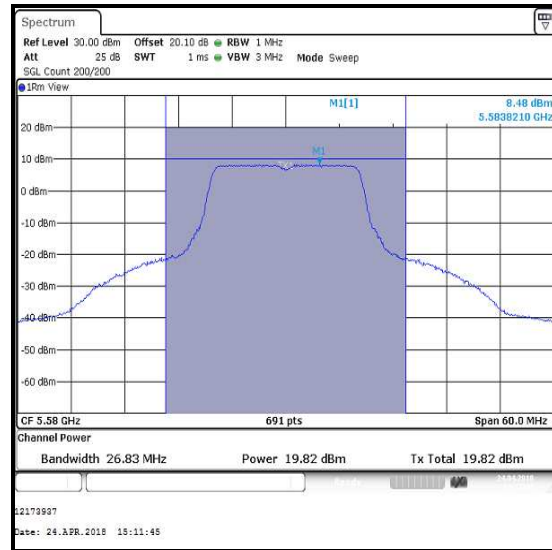
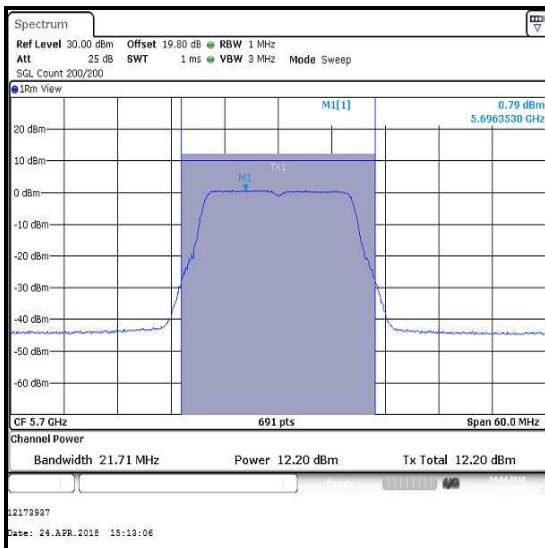
- For conducted power tests where the duty cycle is >98%, the measurements were performed using a signal analyser in accordance with FCC KDB 789033 II.E.2.b) Method SA-1. Where the duty cycle is <98%, the measurements were performed in accordance with FCC KDB 789033 II.E.2.d) Method SA-2. The signal analyser's integration function was used to integrate across the 26 dB emission bandwidth. The resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. An RMS detector was used and sweep time was set to auto and 200 traces performed. The span was set to encompass the entire 26 dB emission bandwidth. The channel power results are recorded in the tables below.
- Measurements were performed using configurations detailed in Section 3.5 of this test report on the relevant channels.
- For data rates where the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 4.1 was added to the measured power in order to compute the average power during the actual transmission time.
- For all modes of operation, the antenna gain is < 6 dBi.
- For details on antenna gains refer to Section 3.4 of this test report.
- The signal analyser was connected to the RF port on the EUT using an RF switch, 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.
- The FCC Part 15.407(a)(2) limit is the lesser of 250 mW (24.0 dBm) or 11 dBm + 10 log₁₀ B, where B is the previously measured 26 dB emission bandwidth in MHz. For U-NII-2C band, the 26 dB EBW is greater than 20 MHz.

$$\begin{aligned}
 &\text{For } B > 20 \text{ MHz} \rightarrow \\
 &\rightarrow \log_{10} B > \log_{10} 20 \rightarrow \\
 &\rightarrow 10 \log_{10} B > 10 \log_{10} 20 \rightarrow \\
 &\rightarrow 11 + 10 \log_{10} B > 11 + 10 \log_{10} 20 \rightarrow \\
 &\rightarrow 11 + 10 \log_{10} B > 24.0 \text{ dBm}
 \end{aligned}$$

Therefore for measured emission bandwidths greater than 20 MHz, the lesser of the two limits is the fixed limit of 250 mW (24.0 dBm). This was applied to the results.

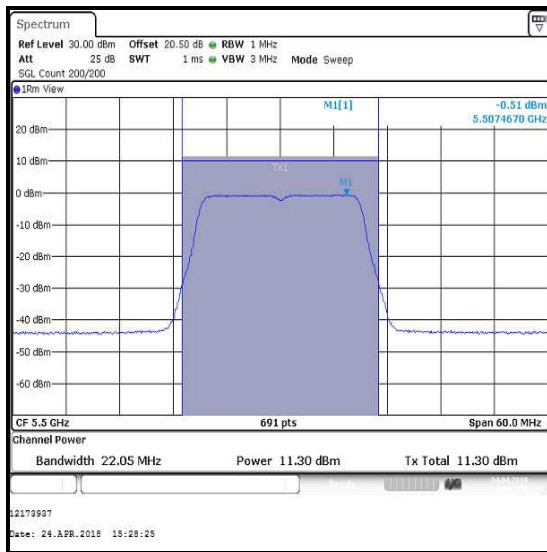
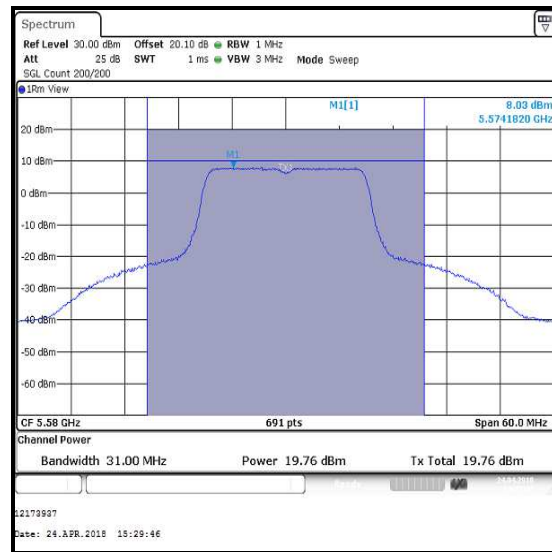
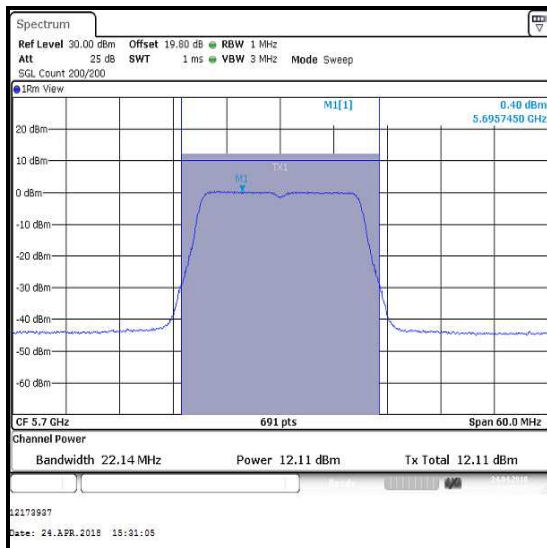
Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)**Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5500	11.2	24.0	12.8	Complied
Middle	5580	19.8	24.0	4.2	Complied
Top	5700	12.2	24.0	11.8	Complied

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

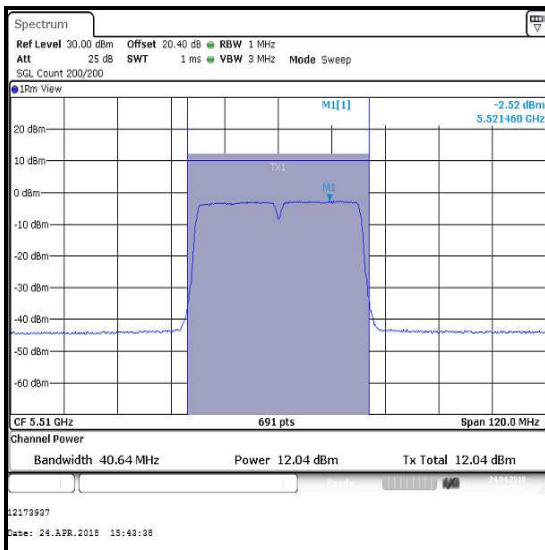
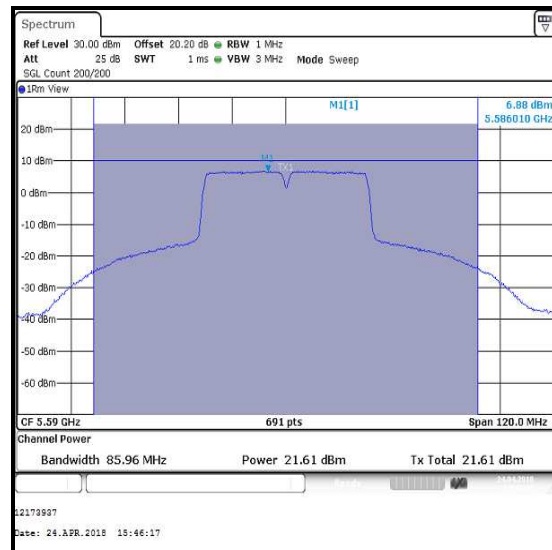
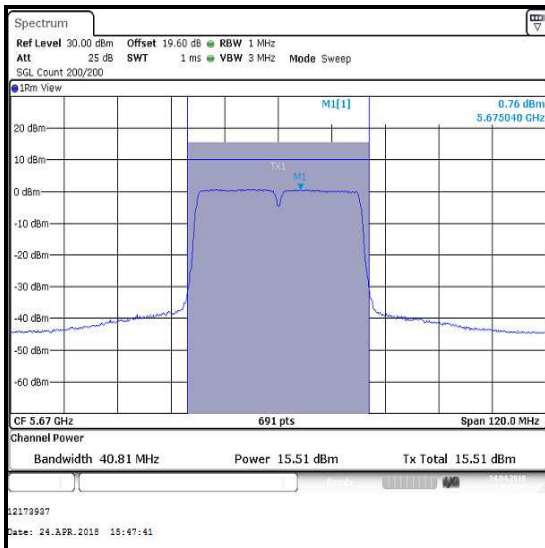
Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5500	11.3	24.0	12.7	Complied
Middle	5580	19.8	24.0	4.2	Complied
Top	5700	12.1	24.0	11.9	Complied

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

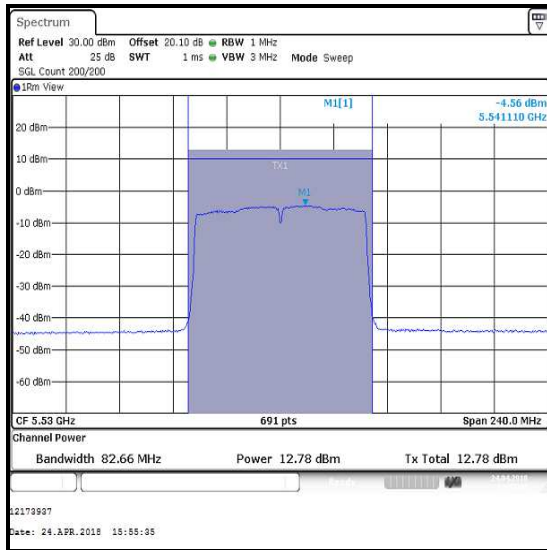
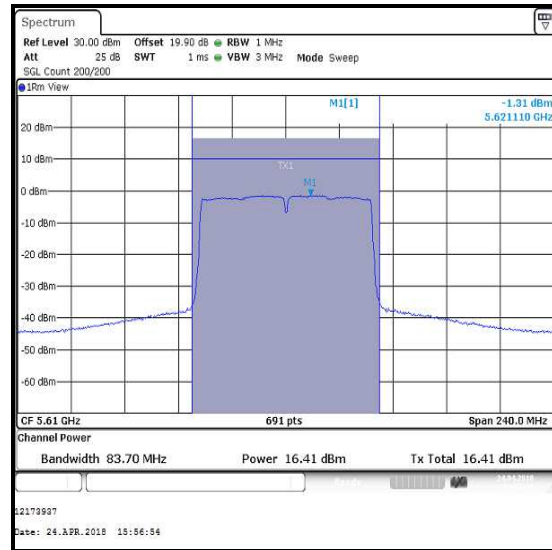
Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5510	12.0	0.1	12.1	24.0	11.9	Complied
Middle	5590	21.6	0.1	21.7	24.0	2.3	Complied
Top	5670	15.5	0.1	15.6	24.0	8.4	Complied

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

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0x1 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5530	12.8	0.2	13.0	24.0	11.0	Complied
Top	5610	16.4	0.2	16.6	24.0	7.4	Complied

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

Transmitter Maximum Conducted Output Power (Straddle Channels)**4.4.4. Channels that straddle the U-NII-2C and U-NII-3 bands****Test Summary:**

Test Engineer:	Max Passell	Test Date:	26 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(a)(2)
Test Method Used:	KDB 789033 D02 Section II.E.2.b) and II.E.2.d)

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	38

Note(s):

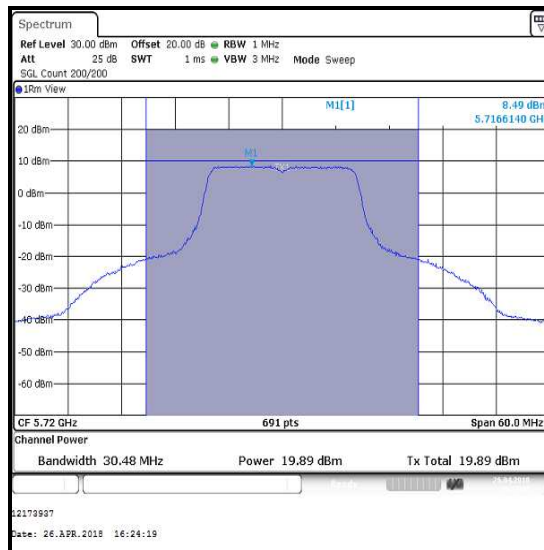
- Channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz need to meet requirements of both U-NII bands. Due to maximum conducted power limit being more stringent on U-NII-2C, compliance is shown against the limits of U-NII-2C. By default, the EUT also complies on U-NII-3.
- For conducted power tests where the duty cycle is >98%, the measurements were performed using a signal analyser in accordance with FCC KDB 789033 II.E.2.b) Method SA-1. Where the duty cycle is <98%, the measurements were performed in accordance with FCC KDB 789033 II.E.2.d) Method SA-2. The signal analyser's integration function was used to integrate across the 26 dB emission bandwidth. The resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. An RMS detector was used and sweep time was set to auto and 200 traces performed. The span was set to encompass the entire 26 dB emission bandwidth. The channel power results are recorded in the tables below.
- Measurements were performed using configurations detailed in Section 3.5 of this test report on the relevant channels.
- For data rates where the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 4.1 was added to the measured power in order to compute the average power during the actual transmission time.
- For all modes of operation, the antenna gain is < 6 dBi.
- For details on antenna gains refer to Section 3.4 of this test report.
- The signal analyser was connected to the RF port on the EUT using an RF switch, 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.
- The FCC Part 15.407(a)(2) limit is the lesser of 250 mW (24.0 dBm) or 11 dBm + 10 log₁₀ B, where B is the previously measured 26 dB emission bandwidth in MHz. The 26 dB EBW is greater than 20 MHz.

$$\begin{aligned}
 &\text{For } B > 20 \text{ MHz} \rightarrow \\
 &\rightarrow \log_{10} B > \log_{10} 20 \rightarrow \\
 &\rightarrow 10 \log_{10} B > 10 \log_{10} 20 \rightarrow \\
 &\rightarrow 11 + 10 \log_{10} B > 11 + 10 \log_{10} 20 \rightarrow \\
 &\rightarrow 11 + 10 \log_{10} B > 24.0 \text{ dBm}
 \end{aligned}$$

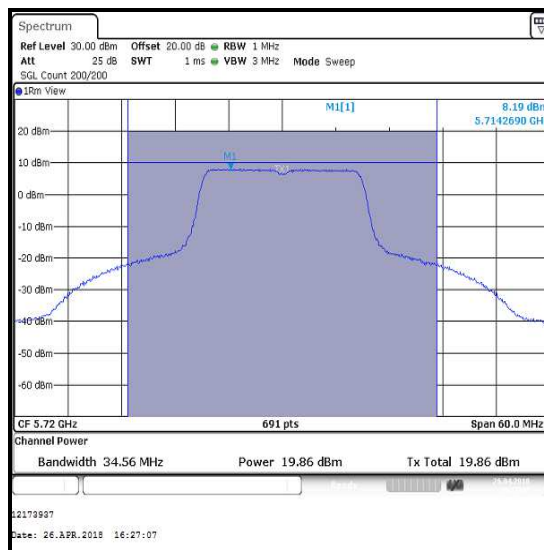
Therefore for measured emission bandwidths greater than 20 MHz, the lesser of the two limits is the fixed limit of 250 mW (24.0 dBm). This was applied to the results.

Transmitter Maximum Conducted Output Power (Straddle Channels) (continued)**Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5720	19.9	24.0	4.1	Complied

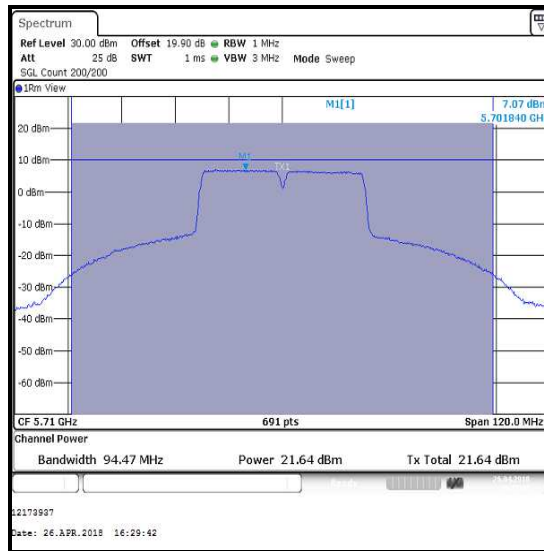
**Single Channel****Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5720	19.9	24.0	4.1	Complied

**Single Channel**

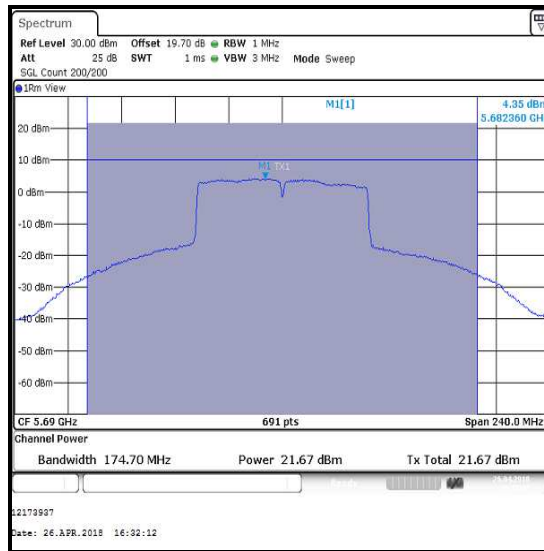
Transmitter Maximum Conducted Output Power (Straddle Channels) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5710	21.6	0.1	21.7	24.0	2.3	Complied

**Single Channel**

Transmitter Maximum Conducted Output Power (Straddle Channels) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5690	21.7	0.2	21.9	24.0	2.1	Complied

**Single Channel**

Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band)**4.4.5. 5.725-5.85 GHz band****Test Summary:**

Test Engineer:	Max Passell	Test Date:	24 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(a)(3)
Test Method Used:	KDB 789033 D02 Section II.E.2.b) and II.E.2.d)

Environmental Conditions:

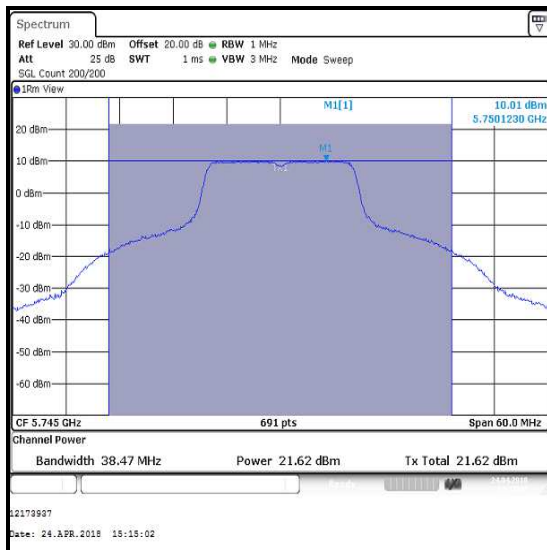
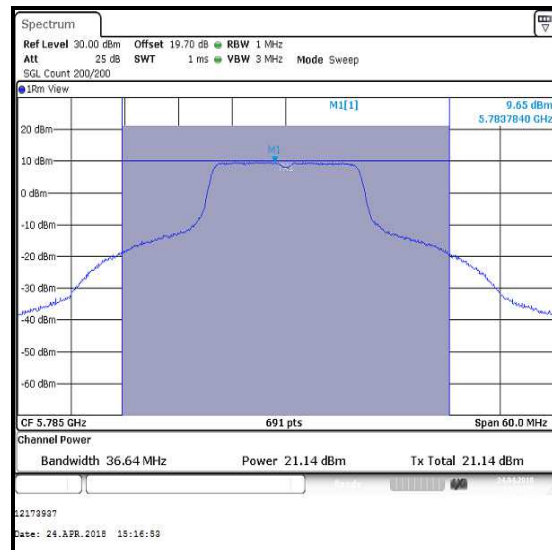
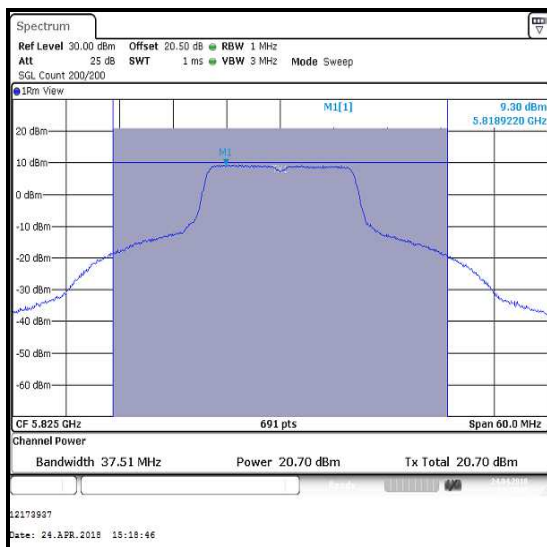
Temperature (°C):	24
Relative Humidity (%):	43

Note(s):

1. For conducted power tests where the duty cycle is >98%, the measurements were performed using a signal analyser in accordance with FCC KDB 789033 II.E.2.b) Method SA-1. Where the duty cycle is <98%, the measurements were performed in accordance with FCC KDB 789033 II.E.2.d) Method SA-2. The signal analyser's integration function was used to integrate across the 26 dB emission bandwidth. The resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. An RMS detector was used and sweep time was set to auto and 200 traces performed. The span was set to encompass the entire 26 dB emission bandwidth. The channel power results are recorded in the tables below.
2. Measurements were performed using configurations detailed in Section 3.5 of this test report on the relevant channels.
3. For data rates where the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 4.1 was added to the measured power in order to compute the average power during the actual transmission time.
4. For all modes of operation, the antenna gain is < 6 dBi.
5. For details on antenna gains refer to Section 3.4 of this test report.
6. The signal analyser was connected to the RF port on the EUT using an RF switch, 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.
7. The FCC Part 15.407(a)(3) limit shall not exceed 1 W (30.0 dBm).

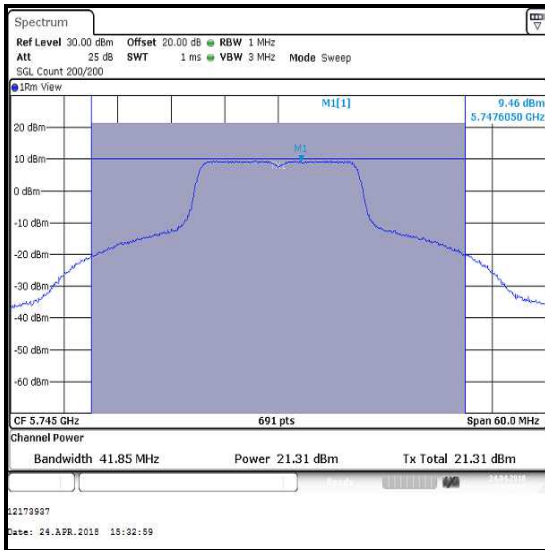
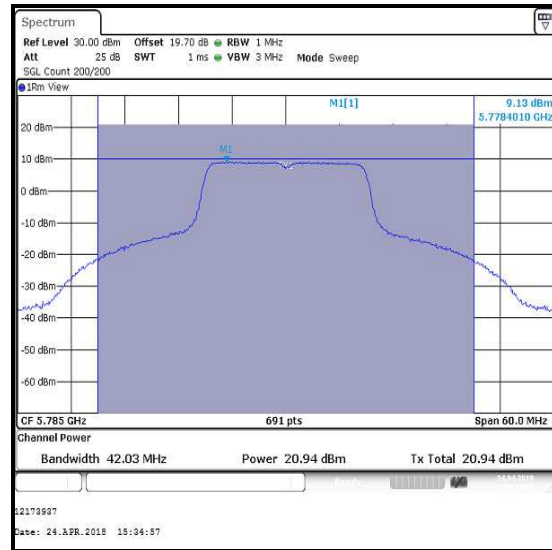
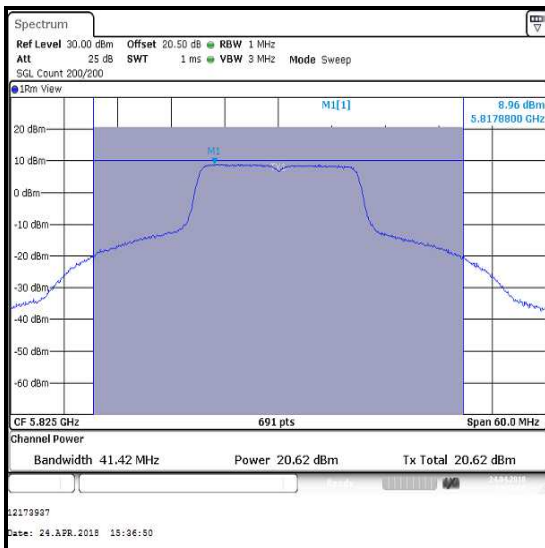
Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5745	21.6	30.0	8.4	Complied
Middle	5785	21.1	30.0	8.9	Complied
Top	5825	20.7	30.0	9.3	Complied

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

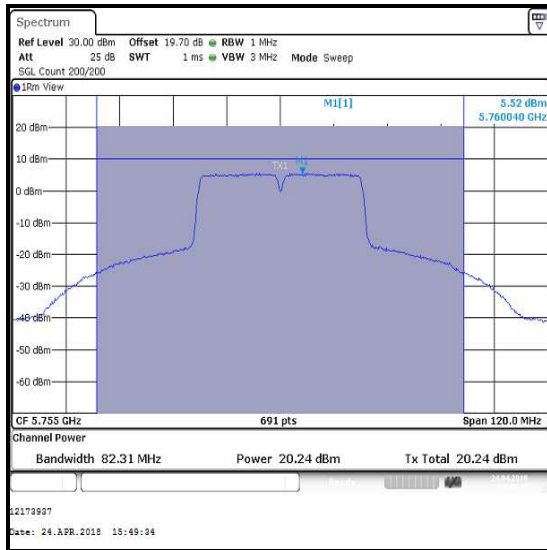
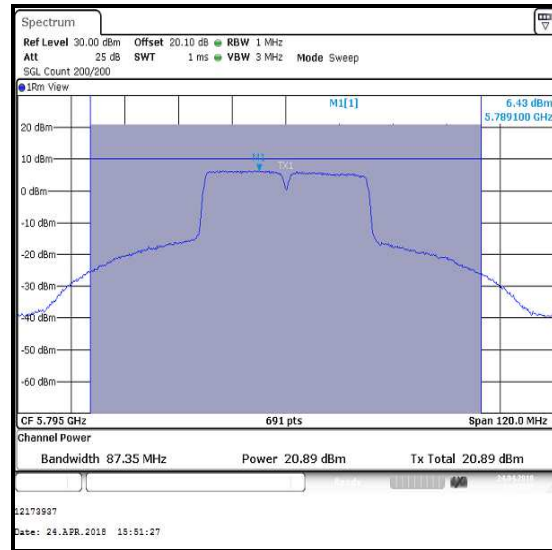
Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5745	21.3	30.0	8.7	Complied
Middle	5785	20.9	30.0	9.1	Complied
Top	5825	20.6	30.0	9.4	Complied

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

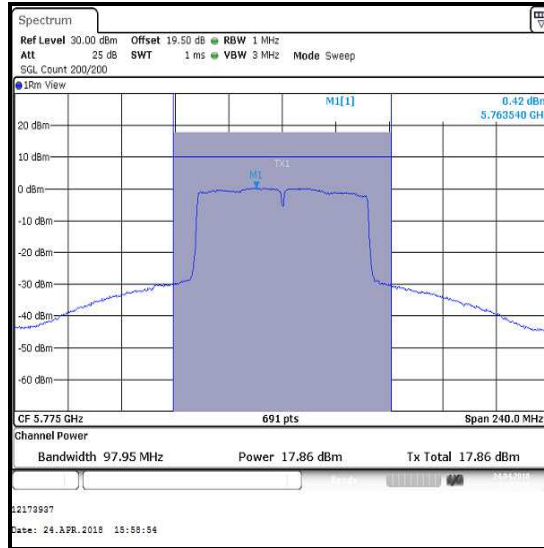
Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5755	20.2	0.1	20.3	30.0	9.7	Complied
Top	5795	20.9	0.1	21.0	30.0	9.0	Complied

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

Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0 / Port WF3**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5775	17.9	0.2	18.1	30.0	11.9	Complied

**Single Channel**

4.5. Transmitter Maximum Power Spectral Density

4.5.1. 5.15-5.25 GHz band

Test Summary:

Test Engineer:	Max Passell	Test Date:	24 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(a)(1)(iv)
Test Method Used:	KDB 789033 D02 Section II.F. referencing II.E.2.b) and II.E.2.d)

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	43

Note(s):

1. Transmitter Maximum Power Spectral Density tests in all bands were performed using a signal analyser in accordance with KDB 789033 II. F referencing II.E.2.b) Method SA-1 and II.E.2.d) Method SA-2.
2. Measurements were performed using configurations detailed in Section 3.5 of this test report on the relevant channels.
3. For data rates where the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 4.1 was added to the measured maximum power spectral density in order to compute the average maximum power spectral density during the actual transmission time.
4. FCC Part 15.407(a)(1)(iv) limit for PSD is <11 dBm/MHz.
5. For all modes of operation, the antenna gain is < 6 dBi.
6. For details on antenna gains refer to Section 3.4 of this test report.
7. The signal analyser was connected to the RF port on the EUT using an RF switch, 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.
8. As the power spectral density test uses the same test method as the output power test, before the power is integrated across the 26 dB bandwidth, the conducted power spectral density plots are located in the conducted output power section 4.4 of this test report. The peak spectral density was measured by placing a marker on the peak of the signal and the results entered in the tables below.

Transmitter Maximum Power Spectral Density (5.15-5.25 GHz band) (continued)**Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5180	4.2	11.0	6.8	Complied
Middle	5200	7.0	11.0	4.0	Complied
Top	5240	9.1	11.0	1.9	Complied

Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5180	4.1	11.0	6.9	Complied
Middle	5200	6.5	11.0	4.5	Complied
Top	5240	8.8	11.0	2.2	Complied

Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5190	-0.6	0.1	-0.5	11.0	11.5	Complied
Top	5230	5.5	0.1	5.6	11.0	5.4	Complied

Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0x1 / Port WF3

Channel	Frequency (MHz)	PSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Single	5210	-4.7	0.2	-4.5	11.0	15.5	Complied

Transmitter Maximum Power Spectral Density (5.25-5.35 GHz band)**4.5.2. 5.25-5.35 GHz band****Test Summary:**

Test Engineer:	Max Passell	Test Date:	24 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(a)(2)
Test Method Used:	KDB 789033 D02 Section II.F. referencing II.E.2.b) and II.E.2.d)

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	43

Note(s):

1. Transmitter Maximum Power Spectral Density tests in all bands were performed using a signal analyser in accordance with KDB 789033 II. F referencing II.E.2.b) Method SA-1 and II.E.2.d) Method SA-2.
2. Measurements were performed using configurations detailed in Section 3.5 of this test report on the relevant channels.
3. For data rates where the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 4.1 was added to the measured maximum power spectral density in order to compute the average maximum power spectral density during the actual transmission time.
4. FCC Part 15.407(a)(2) limit for PSD in the 5.25-5.35 GHz band is <11 dBm/MHz.
5. The EUT has an antenna gain of 6.3 dBi. In accordance with Part 15.407(a)(2), the limit has been reduced by the amount in dB the antenna gain exceeds 6 dBi. Therefore the limit of 11.0 dBm has been reduced to 10.7 dBm.
6. For details on antenna gains refer to Section 3.4 of this test report.
7. The signal analyser was connected to the RF port on the EUT using an RF switch, 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.
8. As the power spectral density test uses the same test method as the output power test, before the power is integrated across the 26 dB bandwidth, the conducted power spectral density plots are located in the conducted output power section 4.4 of this test report. The peak spectral density was measured by placing a marker on the peak of the signal and the results entered in the tables below.

Transmitter Maximum Power Spectral Density (5.25-5.35 GHz band) (continued)**Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5260	8.5	10.7	2.2	Complied
Middle	5280	8.1	10.7	2.6	Complied
Top	5320	4.1	10.7	6.6	Complied

Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5260	8.2	10.7	2.5	Complied
Middle	5280	7.9	10.7	2.8	Complied
Top	5320	4.0	10.7	6.7	Complied

Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5270	5.1	0.1	5.2	10.7	5.5	Complied
Top	5310	-1.2	0.1	-1.1	10.7	11.8	Complied

Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0x1 / Port WF3

Channel	Frequency (MHz)	PSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Single	5290	-2.5	0.2	-2.3	10.7	13.0	Complied

Transmitter Maximum Power Spectral Density (5.47-5.725 GHz band)**4.5.3. 5.47-5.725 GHz band****Test Summary:**

Test Engineer:	Max Passell	Test Date:	24 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(a)(2)
Test Method Used:	KDB 789033 D02 Section II.F. referencing II.E.2.b) and II.E.2.d)

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	43

Note(s):

1. Transmitter Maximum Power Spectral Density tests in all bands were performed using a signal analyser in accordance with KDB 789033 II. F referencing II.E.2.b) Method SA-1 and II.E.2.d) Method SA-2.
2. Measurements were performed using configurations detailed in Section 3.5 of this test report on the relevant channels.
3. For data rates where the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 4.1 was added to the measured maximum power spectral density in order to compute the average maximum power spectral density during the actual transmission time.
4. FCC Part 15.407(a)(2) limit for PSD in the 5.47-5.725 GHz band is <11 dBm/MHz.
5. For all modes of operation, the antenna gain is < 6 dBi.
6. For details on antenna gains refer to Section 3.4 of this test report.
7. The signal analyser was connected to the RF port on the EUT using an RF switch, 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.
8. As the power spectral density test uses the same test method as the output power test, before the power is integrated across the 26 dB bandwidth, the conducted power spectral density plots are located in the conducted output power section 4.4 of this test report. The peak spectral density was measured by placing a marker on the peak of the signal and the results entered in the tables below.

Transmitter Maximum Power Spectral Density (5.47-5.725 GHz band) (continued)**Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Bottom	5500	-0.3	11.0	11.3	Complied
Middle	5580	8.5	11.0	2.5	Complied
Top	5700	0.8	11.0	10.2	Complied

Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Bottom	5500	-0.5	11.0	11.5	Complied
Middle	5580	8.0	11.0	3.0	Complied
Top	5700	0.4	11.0	10.6	Complied

Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Bottom	5510	-2.5	0.1	-2.4	11.0	13.4	Complied
Middle	5590	6.9	0.1	7.0	11.0	4.0	Complied
Top	5670	0.8	0.1	0.9	11.0	10.1	Complied

Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Bottom	5530	-4.6	0.2	-4.4	11.0	15.4	Complied
Top	5610	-1.3	0.2	-1.1	11.0	12.1	Complied

Transmitter Maximum Power Spectral Density (Straddle channels)**4.5.4. Channels that straddle the U-NII-2C and U-NII-3 bands****Test Summary:**

Test Engineer:	Max Passell	Test Date:	26 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(a)(2)
Test Method Used:	KDB 789033 D02 Section II.F. referencing II.E.2.b) and II.E.2.d)

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	38

Note(s):

1. Channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz, need to meet requirements of both U-NII bands. Due to maximum power spectral density limit being more stringent on U-NII-2C, compliance is shown against the limits of U-NII-2C. By default the EUT also complied on U-NII-3.
2. Transmitter Maximum Power Spectral Density tests in all bands were performed using a signal analyser in accordance with KDB 789033 II. F referencing II.E.2.b) Method SA-1 and II.E.2.d) Method SA-2.
3. Measurements were performed using configurations detailed in Section 3.5 of this test report on the relevant channels.
4. For data rates where the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 4.1 was added to the measured maximum power spectral density in order to compute the average maximum power spectral density during the actual transmission time.
5. FCC Part 15.407(a)(2) limit for PPSD in the 5.47-5.725 GHz band is <11 dBm/MHz.
6. For all modes of operation, the antenna gain is < 6 dBi.
7. For details on antenna gains refer to Section 3.4 of this test report.
8. The signal analyser was connected to the RF port on the EUT using an RF switch, 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.
9. As the power spectral density test uses the same test method as the output power test, before the power is integrated across the 26 dB bandwidth, the conducted power spectral density plots are located in the conducted output power section 4.4 of this test report. The peak spectral density was measured by placing a marker on the peak of the signal and the results entered in the tables below.

Transmitter Maximum Power Spectral Density (Straddle channels) (continued)**Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Single	5720	8.5	11.0	2.5	Complied

Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Single	5720	8.2	11.0	2.8	Complied

Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Single	5710	7.1	0.1	7.2	11.0	3.8	Complied

Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Single	5690	4.4	0.2	4.6	11.0	6.4	Complied

Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band)**4.5.5. 5.725-5.85 GHz band****Test Summary:**

Test Engineer:	Max Passell	Test Date:	24 April 2018
Test Sample Serial Number:	C02VQ00SJKHY		

FCC Reference:	Part 15.407(a)(3)
Test Method Used:	KDB 789033 D02 Section II.F. referencing II.E.2.b) and II.E.2.d)

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	43

Note(s):

1. Transmitter Maximum Power Spectral Density tests in all bands were performed using a signal analyser in accordance with KDB 789033 II. F referencing II.E.2.b) Method SA-1 and II.E.2.d) Method SA-2.
2. Measurements were performed using configurations detailed in Section 3.5 of this test report on the relevant channels.
3. For data rates where the EUT was transmitting at <98% duty cycle, the calculated duty cycle in Section 4.1 was added to the measured maximum power spectral density in order to compute the average maximum power spectral density during the actual transmission time.
4. FCC Part 15.407(a)(3) limit for PPSD in the 5.725-5.85 GHz operating band is <30 dBm/500 kHz.
5. In accordance with ANSI C63.10 Section 4.1.4.1, use of bandwidths greater than those specified can produce higher readings. Compliance against the applicable limits is shown using a 1 MHz resolution bandwidth. This was deemed worst case.
6. For all modes of operation, the antenna gain is < 6 dBi.
7. For details on antenna gains refer to Section 3.4 of this test report.
8. The signal analyser was connected to the RF port on the EUT using an RF switch, 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.
9. As the power spectral density test uses the same test method as the output power test, before the power is integrated across the 26 dB bandwidth, the conducted power spectral density plots are located in the conducted output power section 4.4 of this test report. The peak spectral density was measured by placing a marker on the peak of the signal and the results entered in the tables below.

Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band) (continued)**Results: 802.11a / 20 MHz / SISO / BPSK / 6 Mbps / Port WF3**

Channel	Frequency (MHz)	PSD (dBm / 1 MHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5745	10.0	30.0	20.0	Complied
Middle	5785	9.7	30.0	20.3	Complied
Top	5825	9.3	30.0	20.7	Complied

Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm / 1 MHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5745	9.5	30.0	20.5	Complied
Middle	5785	9.1	30.0	20.9	Complied
Top	5825	9.0	30.0	21.0	Complied

Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Port WF3

Channel	Frequency (MHz)	PSD (dBm / 1 MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm / 1 MHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5755	5.5	0.1	5.6	30.0	24.4	Complied
Top	5795	6.4	0.1	6.5	30.0	23.5	Complied

Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0x1 / Port WF3

Channel	Frequency (MHz)	PSD (dBm / 1 MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm / 1 MHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Single	5775	0.4	0.2	0.6	30.0	29.4	Complied

5. Radiated Test Results

5.1. Transmitter Out of Band Radiated Emissions <1 GHz

Test Summary:

Test Engineer:	Alan Withers	Test Date:	02 May 2018
Test Sample Serial Number:	C02VR00RJH93		

FCC Reference:	Parts 15.407(b)(2),(6),(7) & 15.209(a)
Test Method Used:	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.5
Frequency Range:	30 MHz to 1000 MHz

Environmental Conditions:

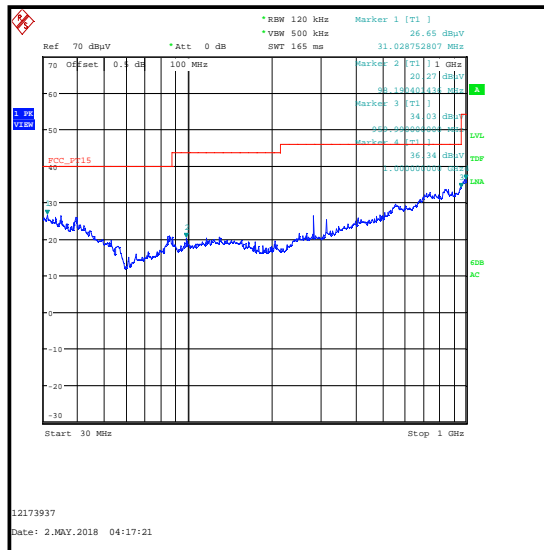
Temperature (°C):	23
Relative Humidity (%):	37

Note(s):

1. The final measured value, for the given emission in the field strength result tables, incorporates the calibrated antenna factor and cable loss.
2. Pre-scans were performed with the EUT transmitting in the band 5.725 to 5.85 GHz band with a configuration of 802.11a / 6 Mbps on middle channel in this band as it produced the highest power spectral density and was therefore deemed worst case. An inquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest power spectral density and all final measurements should be performed on any emissions seen in each band.
3. All emissions shown on the pre-scan plots were investigated and found to be ambient, or >20 dB below the applicable limit or below the measurement system noise floor. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
4. 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.
5. 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. The sweep time was set to auto. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.

Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Results: Peak / Middle Channel / 802.11a / 6 Mbps**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1000.000	Vertical	36.3	54.0	17.7	Complied



5.2. Transmitter Out of Band Radiated Emissions >1 GHz**5.2.1. 5.15-5.25 GHz band****Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation)****Test Summary:**

Test Engineers:	Andrew Edwards & John Ferdinand	Test Dates:	02 May 2018 to 09 May 2018
Test Sample Serial Number:	C02VR00RJH93		

FCC Reference:	Part 15.407(b)(1),(7) & 15.209(a)
Test Method Used:	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.6
Frequency Range:	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	21 to 22
Relative Humidity (%):	41 to 46

Note(s):

1. FCC Part 15.407(b)(1) states for transmitters operating in the band 5.15 to 5.25 GHz: all emissions outside of the 5.15 to 5.35 GHz band will not exceed -27 dBm/MHz. Part(b)(7) states the provisions of 15.205 apply e.g. restricted bands of operation.
2. In accordance with ANSI C63.10-2013 Section 6.5.4, emissions more than 20 dB below the limit do not need to be reported
3. Pre-scans were performed with the EUT transmitting in the band 5.725 to 5.85 GHz band with a data rate of 802.11a / 6 Mbps on middle channel in this band as it produced the highest output power and was therefore deemed worst case. An inquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest output power and all final measurements should be performed on any emissions seen in each band.
4. All emissions shown on the pre-scan plots were investigated and found to be ambient, or 20 dB below the applicable limit or below the measurement system noise floor. Therefore the highest peak and average noise floor readings of the measuring receiver were recorded in the 5.725-5.85 GHz results section of this report.
5. Appropriate RF filters and attenuators were used during pre-scans and final measurements. Insertion losses were entered on the spectrum analyser as RF levels offsets.
6. Measurements 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 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.

5.2.2. 5.25-5.35 GHz band**Transmitter Out of Band Radiated Emissions (5.25-5.35 GHz band operation)****Test Summary:**

Test Engineers:	Andrew Edwards & John Ferdinand	Test Dates:	02 May 2018 to 09 May 2018
Test Sample Serial Number:	C02VR00RJH93		

FCC Reference:	Part 15.407(b)(2),(7) & 15.209(a)
Test Method Used:	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.6
Frequency Range:	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	21 to 22
Relative Humidity (%):	41 to 46

Note(s):

1. FCC Part 15.407(b)(2) states for transmitters operating in the band 5.25 to 5.35 GHz: all emissions outside of the 5.15-5.35 GHz band will not exceed -27 dBm/MHz. Part(b)(7) states the provisions of 15.205 apply e.g. restricted bands of operation.
2. In accordance with ANSI C63.10-2013 Section 6.5.4, emissions more than 20 dB below the limit do not need to be reported.
3. Pre-scans were performed with the EUT transmitting in the band 5.725 to 5.85 GHz band with a data rate of 802.11a / 6 Mbps on middle channel in this band as it produced the highest power output power and was therefore deemed worst case. An inquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest output power and all final measurements should be performed on any emissions seen in each band.
4. All emissions shown on the pre-scan plots were investigated and found to be ambient, or >20 dB below the applicable limit or below the measurement system noise floor. Therefore the highest peak and average noise floor readings of the measuring receiver were recorded in the 5.725-5.85 GHz results section of this report.
5. Appropriate RF filters and attenuators were used during pre-scans and final measurements. Insertion losses were entered on the spectrum analyser as RF levels offsets.
6. Measurements 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 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.

5.2.3. 5.47-5.725 GHz band**Transmitter Out of Band Radiated Emissions (5.47-5.725 GHz band operation)****Test Summary:**

Test Engineers:	Andrew Edwards & John Ferdinand	Test Dates:	02 May 2018 to 09 May 2018
Test Sample Serial Number:	C02VR00RJH93		

FCC Reference:	Part 15.407(b)(3),(7) & 15.209(a)
Test Method Used:	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.6
Frequency Range:	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	21 to 22
Relative Humidity (%):	41 to 46

Note(s):

1. FCC Part 15.407(b)(3) states for transmitters operating in the band 5.47 to 5.725 GHz: all emissions outside of the band will not exceed -27 dBm/MHz. Part(b)(7) states the provisions of 15.205 apply e.g. restricted bands of operation.
2. In accordance with ANSI C63.10-2013 Section 6.5.4, emissions more than 20 dB below the limit do not need to be reported.
3. Pre-scans were performed with the EUT transmitting in the band 5.725 to 5.85 GHz band with a data rate of 802.11a / 6 Mbps on middle channel in this band as it produced the highest power output power and was therefore deemed worst case. An inquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest output power and all final measurements should be performed on any emissions seen in each band.
4. All emissions shown on the pre-scan plots were investigated and found to be ambient, or >20 dB below the applicable limit or below the measurement system noise floor. Therefore the highest peak and average noise floor readings of the measuring receiver were recorded in the 5.725-5.85 GHz results section of this report.
5. Appropriate RF filters and attenuators were used during pre-scans and final measurements. Insertion losses were entered on the spectrum analyser as RF levels offsets.
6. Measurements 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 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.

5.2.4. Channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz**Transmitter Out of Band Radiated Emissions (Channels that straddle the U-NII-2C and U-NII-3 bands at 5725 MHz)****Test Summary:**

Test Engineers:	Andrew Edwards & John Ferdinand	Test Dates:	02 May 2018 to 09 May 2018
Test Sample Serial Number:	C02VR00RJH93		

FCC Reference:	Part 15.407(b)(3),(4)(i),(7) & 15.209(a)
Test Method Used:	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.6
Frequency Range:	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	21 to 22
Relative Humidity (%):	41 to 46

Note(s):

1. FCC Part 15.407(b)(3) states for transmitters operating in the band 5.47 to 5.725 GHz: all emissions outside of the band will not exceed -27 dBm/MHz. Part(b)(7) states the provisions of 15.205 apply e.g. restricted bands of operation.
2. FCC Part 15.407(b)(4)(i) states for transmitters operating in the band 5.725 to 5.85 GHz: all emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
3. In accordance with ANSI C63.10-2013 Section 6.5.4, emissions more than 20 dB below the limit do not need to be reported.
4. Pre-scans were performed with the EUT transmitting in the band 5.725 to 5.85 GHz band with a data rate of 802.11a / 6 Mbps on middle channel in this band as it produced the highest power output power and was therefore deemed worst case. An inquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest output power and all final measurements should be performed on any emissions seen in each band.
5. All emissions shown on the pre-scan plots were investigated and found to be ambient, or >20 dB below the applicable limit or below the measurement system noise floor. Therefore the highest peak and average noise floor readings of the measuring receiver were recorded in the 5.725-5.85 GHz results section of this report.
6. Appropriate RF filters and attenuators were used during pre-scans and final measurements. Insertion losses were entered on the spectrum analyser as RF levels offsets.
7. Measurements 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 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.

5.2.5. 5.725-5.85 GHz band**Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation)****Test Summary:**

Test Engineers:	Andrew Edwards & John Ferdinand	Test Dates:	02 May 2018 to 09 May 2018
Test Sample Serial Number:	C02VR00RJH93		

FCC Reference:	Part 15.407(b)(4)(i),(7) & 15.209(a)
Test Method Used:	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.6
Frequency Range:	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	21 to 24
Relative Humidity (%):	41 to 46

Note(s):

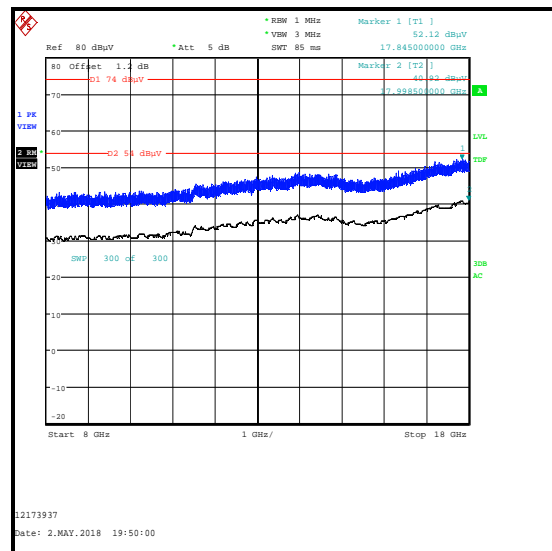
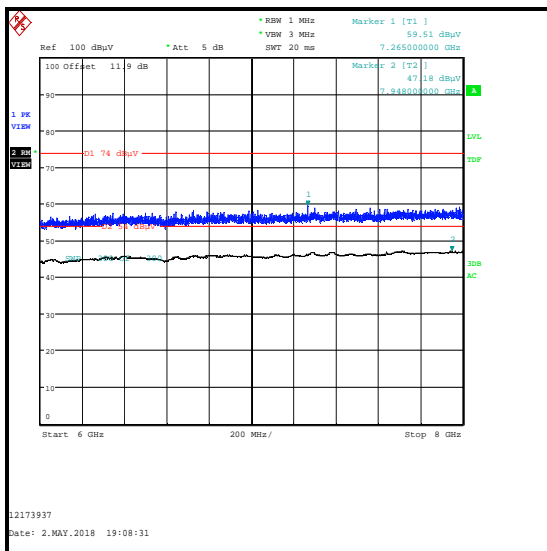
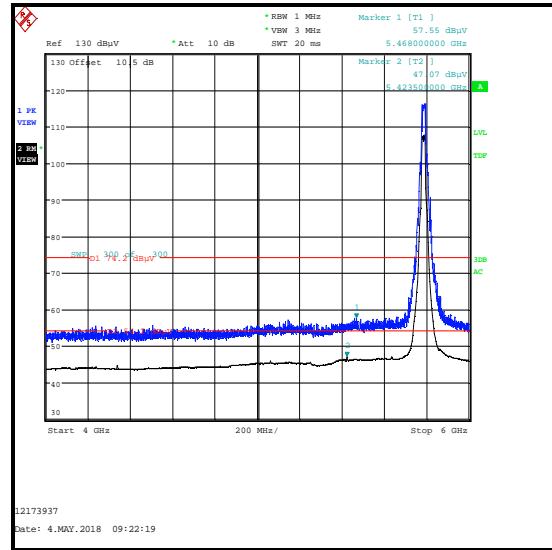
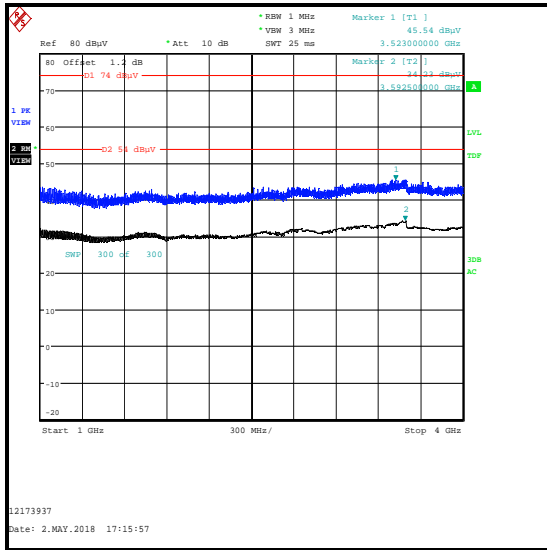
1. FCC Part 15.407(b)(4)(i) states for transmitters operating in the band 5.725 to 5.85 GHz: all emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. Part(b)(7) states the provisions of 15.205 apply e.g. restricted bands of operation.
2. Pre-scans were performed with the EUT transmitting in the band 5.725 to 5.85 GHz band with a data rate of 802.11a / 6 Mbps on middle channel in this band as it produced the highest power output power and was therefore deemed worst case. An inquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest output power and all final measurements should be performed on any emissions seen in each band.
3. The final measured value, for the given emission in the field strength result tables, incorporates the calibrated antenna factor and cable loss.
4. Appropriate RF filters and attenuators were used during pre-scans and final measurements. Insertion losses were entered on the spectrum analyser as RF levels offsets.
5. All emissions shown on the pre-scan plots were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor. Therefore the highest peak and average noise floor readings of the measuring receiver were recorded.
6. The emission shown on the 4 GHz to 6 GHz plot is the EUT fundamental.
7. Measurements were performed across the two restricted bands closest to the bands of operation with the EUT transmitting on the bottom channel in the 5.15 to 5.25 GHz band and top channel in the 5.25 to 5.35 GHz range. Plots are included in this section of the test report. Peak and average measurements were made.
8. Measurements 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 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.

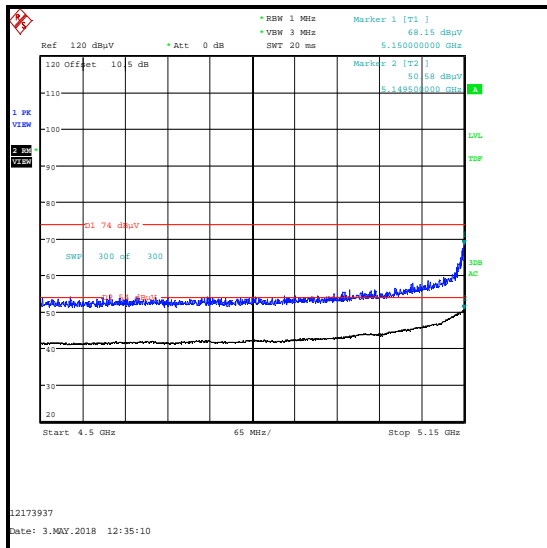
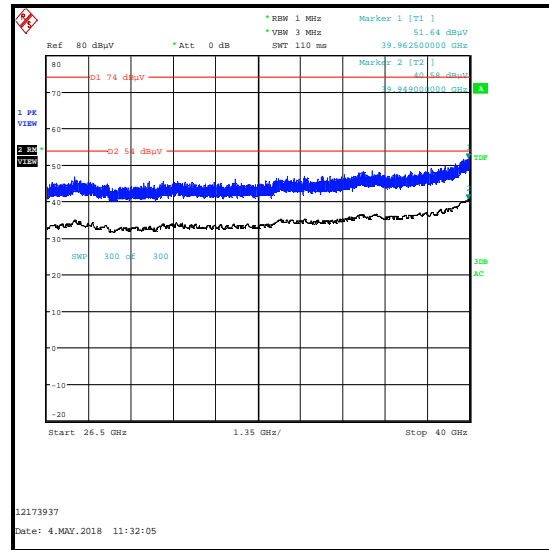
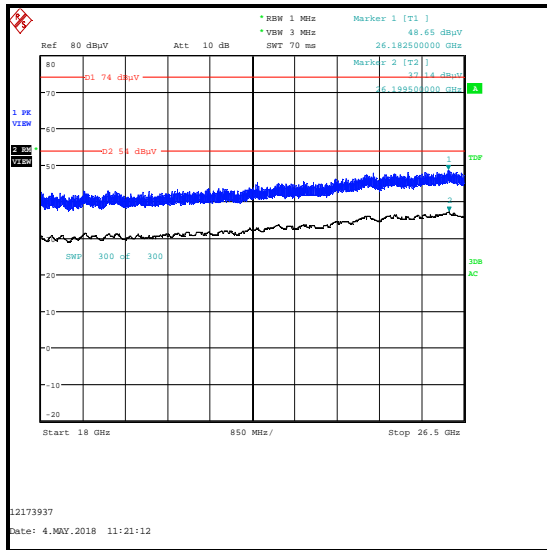
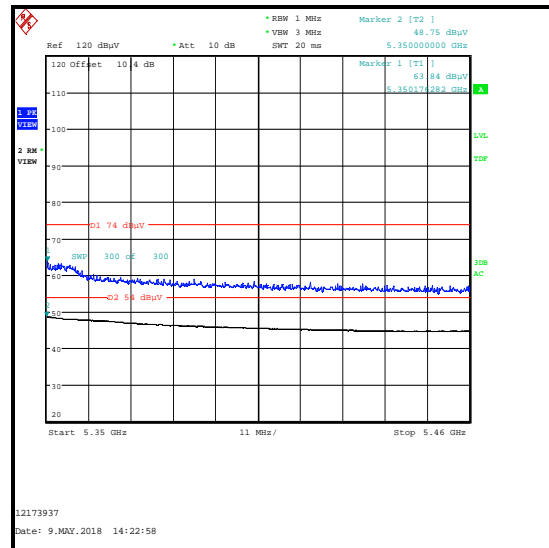
Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Results: Field Strength / Peak**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7265.000	Vertical	59.5	74.0	14.5	Complied

Results: Field Strength / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7948.000	Vertical	47.2	54.0	6.8	Complied

Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)

Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Restricted Band 4.5 GHz to 5.15 GHz****Restricted Band 5.35 GHz to 5.46 GHz**

5.3. Transmitter Band Edge Radiated Emissions

5.3.1. 5.15-5.25 GHz band

Test Summary:

Test Engineers:	John Ferdinand & Stuart Martin	Test Dates:	18 February 2018 & 22 February 2018
Test Sample Serial Number:	C02VQ00GJKHY		

FCC Reference:	Parts 15.407(b)(1),(7), 15.205 & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10 & KDB 789033 II.G.

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	39 to 42

Note(s):

- The following modes were tested:
 - 802.11a SISO – BPSK / 6 Mbps / Port WF3
 - 802.11n HT20 / SISO – BPSK / MCS0 / Port WF3
 - 802.11n HT40 / SISO – BPSK / MCS0 / Port WF3
 - 802.11ac VHT80 / SISO – BPSK / MCS0 / Port WF3
- Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
- For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. However, there are restricted bands of operation below the lower band edge at 4.5-5.15 GHz and also above the upper band edge at 5.35-5.46 GHz therefore the provisions of FCC Part 15.205 apply. Tests were performed in these restricted bands of operation, the results are included in the transmitter 5.725-5.85 GHz band radiated spurious emission section of this test report.
- Field strength measurements using peak and average detectors were performed in the restricted bands below 5.15 GHz and above 5.35 GHz. Field strength and EIRP results were found to be compliant with the restricted band limits and Part 15.407 out-of-band limits.
- For all average measurements in this section, 300 sweeps were used. This satisfies the requirement for the minimum number of sweep points, as stated in KDB 789033 Section II.G.6.c) Method AD (vi).
- In accordance with KDB 789033 Section II.G.6.c) Method AD (vii), for average measurements, data rates where the EUT was transmitting <98% duty cycle, the duty cycle correction factor calculated in section 4.1 was added to the measured result.

Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Results: 802.11a / 20 MHz / BPSK / 6 Mbps****Results: Lower Band Edge / Peak**

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5148.590	67.4	74.0	6.6	Complied
5150	66.9	74.0	7.1	Complied

Results: Upper Band Edge / Peak

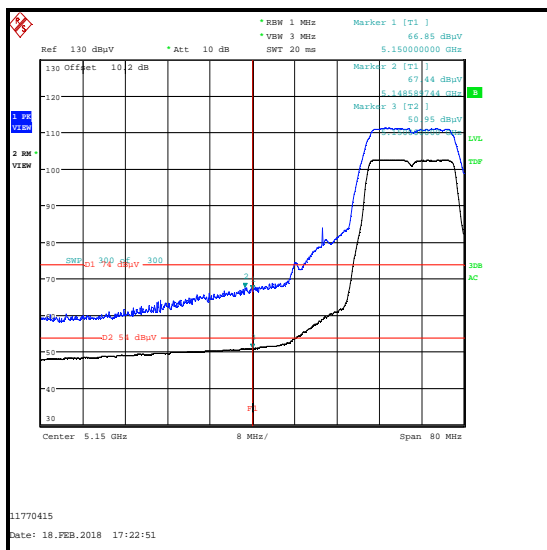
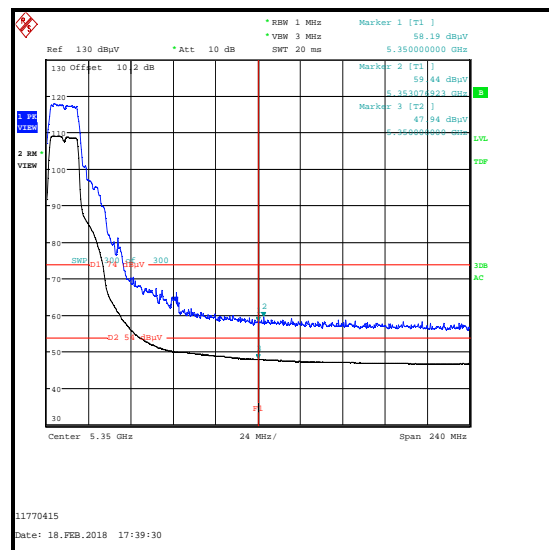
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5350	58.2	74.0	15.8	Complied
5353.077	59.4	74.0	14.6	Complied

Results: Lower Band Edge / Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5150	51.0	54.0	3.0	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5350	47.9	54.0	6.1	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0****Results: Lower Band Edge / Peak**

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5148.974	67.3	74.0	6.7	Complied
5150	66.6	74.0	7.4	Complied

Results: Upper Band Edge / Peak

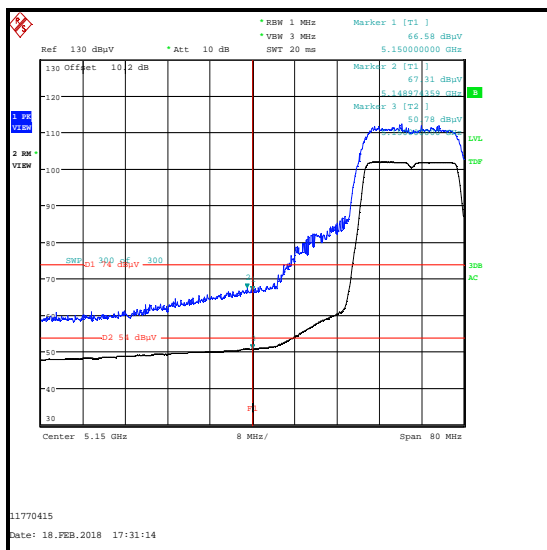
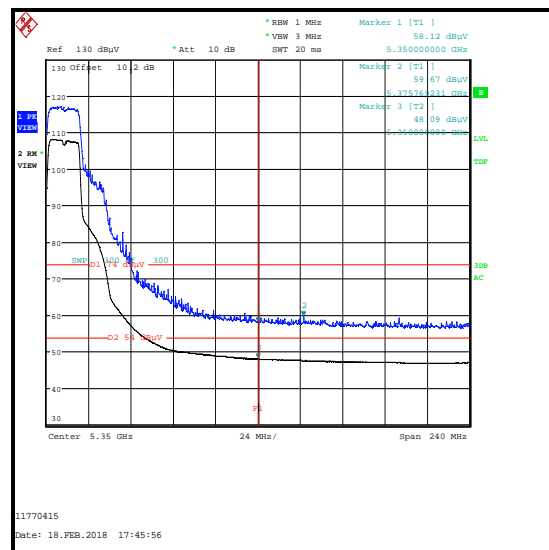
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5350	58.1	74.0	15.9	Complied
5375.769	59.7	74.0	14.3	Complied

Results: Lower Band Edge / Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5150	50.8	54.0	3.2	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5350	48.1	54.0	5.9	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0****Results: Lower Band Edge / Peak**

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5149.423	70.0	74.0	4.0	Complied
5150	69.1	74.0	4.9	Complied

Results: Upper Band Edge / Peak

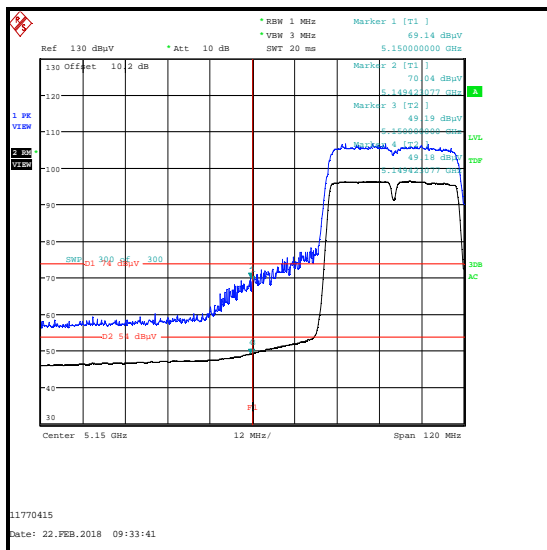
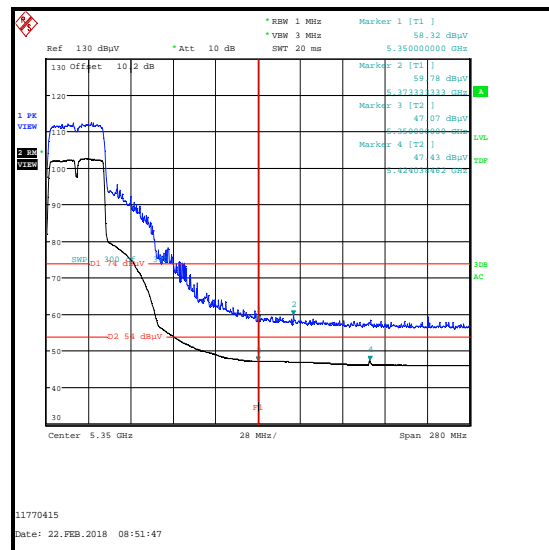
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5350	58.3	74.0	15.7	Complied
5373.333	59.8	74.0	14.2	Complied

Results: Lower Band Edge / Average

Frequency (MHz)	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5150	49.2	0.1	49.3	54.0	4.7	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5350	47.1	0.1	47.2	54.0	6.8	Complied
5424.038	47.4	0.1	47.5	54.0	6.5	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0****Results: Lower Band Edge / Peak**

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5148.718	64.7	74.0	9.3	Complied
5150	64.0	74.0	10.0	Complied

Results: Upper Band Edge / Peak

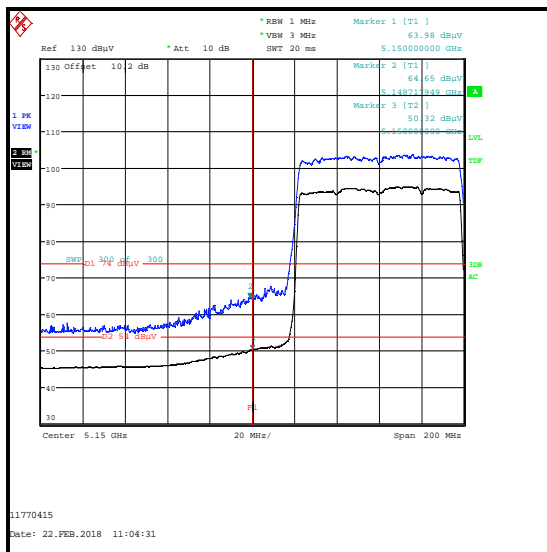
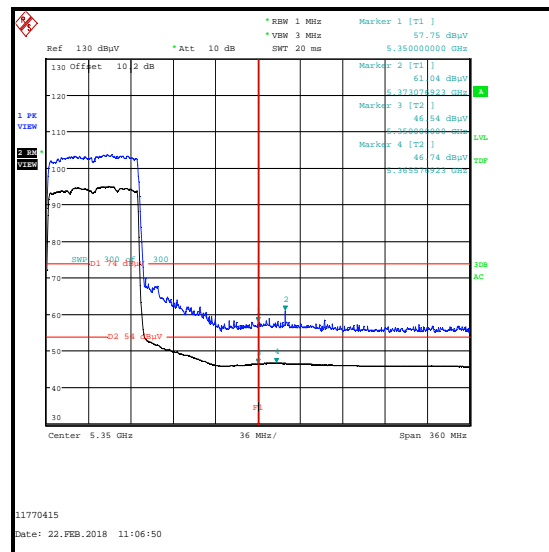
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5350	57.8	74.0	16.2	Complied
5373.077	61.0	74.0	13.0	Complied

Results: Lower Band Edge / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	50.3	0.2	50.5	54.0	3.5	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5350	46.5	0.2	46.7	54.0	7.3	Complied
5365.579	46.7	0.2	46.9	54.0	7.1	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band)**5.3.2. 5.25-5.35 GHz band****Test Summary:**

Test Engineers:	John Ferdinand & Stuart Martin	Test Dates:	18 February 2018 & 22 February 2018
Test Sample Serial Number:	C02VQ00GJKHY		

FCC Reference:	Parts 15.407(b)(2),(7), 15.205 & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10 & KDB 789033 II.G.

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	39 to 42

Note(s):

- The following modes were tested:
 - 802.11a SISO – BPSK / 6 Mbps / Port WF3
 - 802.11n HT20 / SISO – BPSK / MCS0 / Port WF3
 - 802.11n HT40 / SISO – BPSK / MCS0 / Port WF3
 - 802.11ac VHT80 / SISO – BPSK / MCS0 / Port WF3
- Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
- For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. However, there are restricted bands of operation below the lower band edge at 4.5-5.15 GHz and also above the upper band edge at 5.35-5.46 GHz therefore the provisions of FCC Part 15.205 apply. Tests were performed in these restricted bands of operation with the EUT transmitting on the bottom and top channels within 5.25-5.35 GHz band, the results are included in the transmitter 5.725-5.85 GHz band radiated spurious emissions section of this test report.
- Field strength measurements using peak and average detectors were performed in the restricted bands below 5.15 GHz and above 5.35 GHz. Field strength and EIRP results were found to be compliant with the restricted band limits and Part 15.407 out-of-band limits.
- For all average measurements in this section, 300 sweeps were used. This satisfies the requirement for the minimum number of sweep points, as stated in KDB 789033 Section II.G.6.c) Method AD (vi).
- In accordance with KDB 789033 Section II.G.6.c) Method AD (vii), for average measurements, data rates where the EUT was transmitting <98% duty cycle, the duty cycle correction factor calculated in section 4.1 was added to the measured result.

Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)**Results: 802.11a / 20 MHz / BPSK / 6 Mbps****Results: Lower Band Edge / Peak**

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5146.923	59.4	74.0	14.6	Complied
5150	57.7	74.0	16.3	Complied

Results: Upper Band Edge / Peak

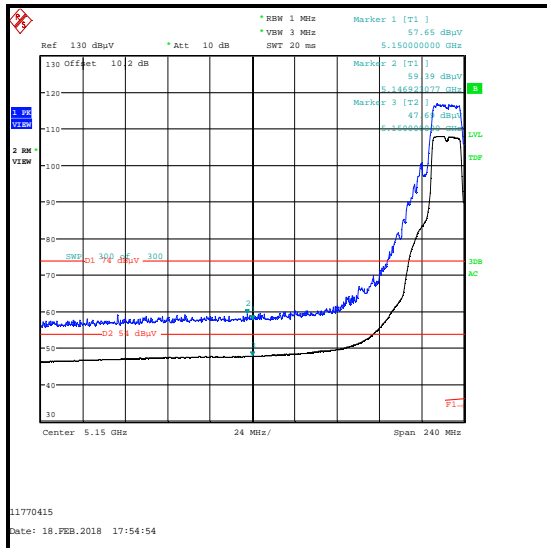
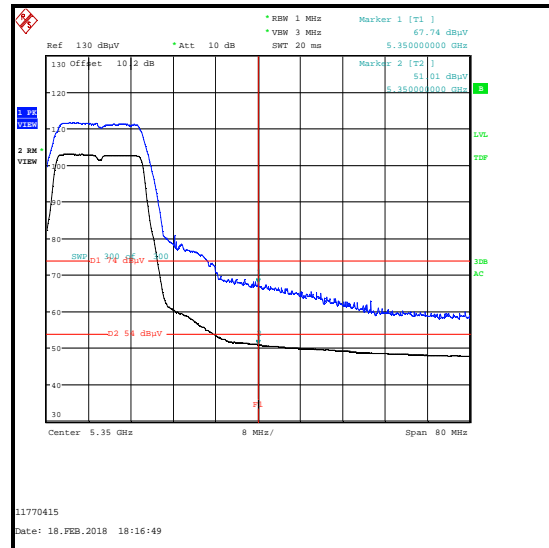
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5350	67.7	74.0	6.3	Complied

Results: Lower Band Edge / Average

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	47.7	54.0	6.3	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5350	51.0	54.0	3.0	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0****Results: Lower Band Edge / Peak**

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5120.385	59.9	74.0	14.1	Complied
5150	58.9	74.0	15.1	Complied

Results: Upper Band Edge / Peak

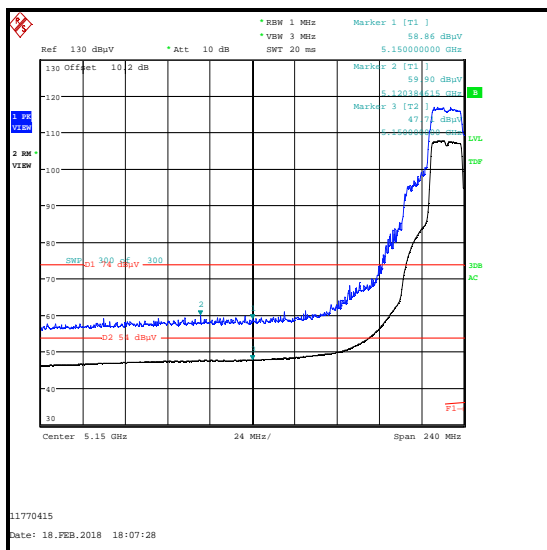
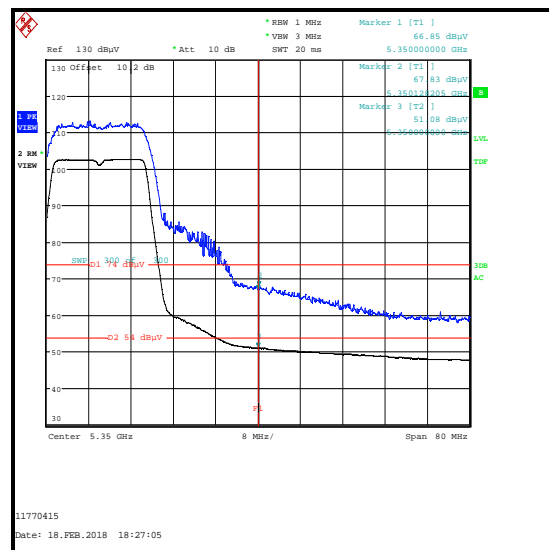
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5350	66.9	74.0	7.1	Complied
5350.126	67.8	74.0	6.2	Complied

Results: Lower Band Edge / Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5150	47.7	54.0	6.3	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5350	51.1	54.0	2.9	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0****Results: Lower Band Edge / Peak**

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5142.372	58.6	74.0	15.4	Complied
5150	57.5	74.0	16.5	Complied

Results: Upper Band Edge / Peak

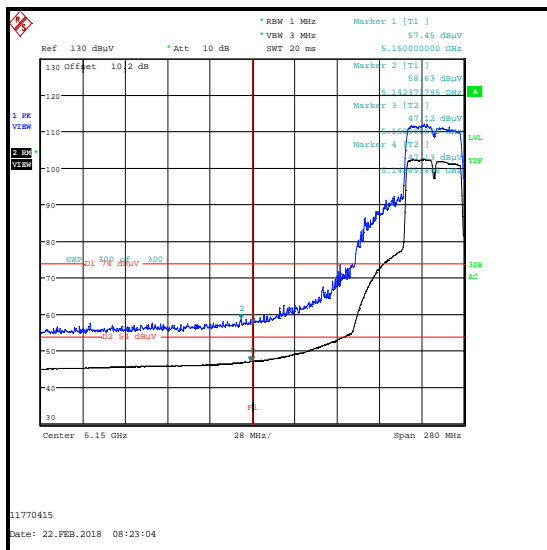
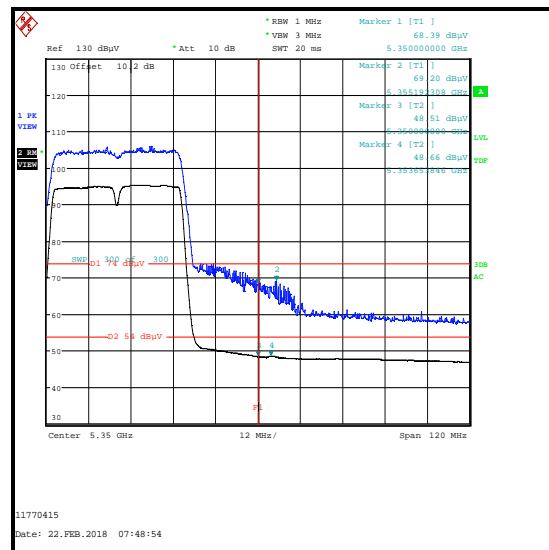
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5350	68.4	74.0	5.6	Complied
5355.192	69.2	74.0	4.8	Complied

Results: Lower Band Edge / Average

Frequency (MHz)	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5150	47.1	0.1	47.2	54.0	6.8	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5350	48.5	0.1	48.6	54.0	5.4	Complied
5353.658	48.7	0.1	48.8	54.0	5.2	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0****Results: Lower Band Edge / Peak**

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5144.231	59.5	74.0	14.5	Complied
5150	58.3	74.0	15.7	Complied

Results: Upper Band Edge / Peak

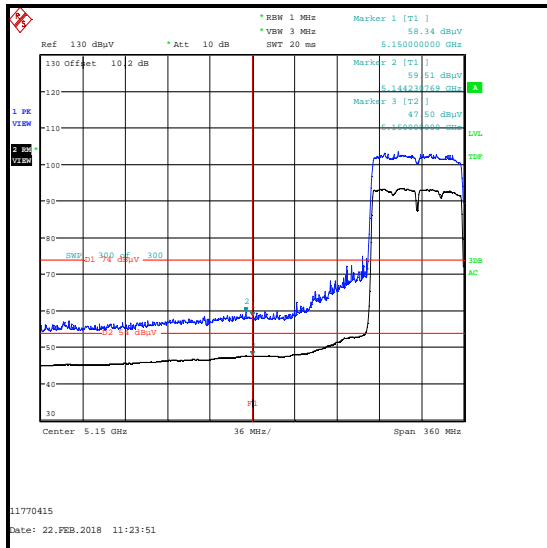
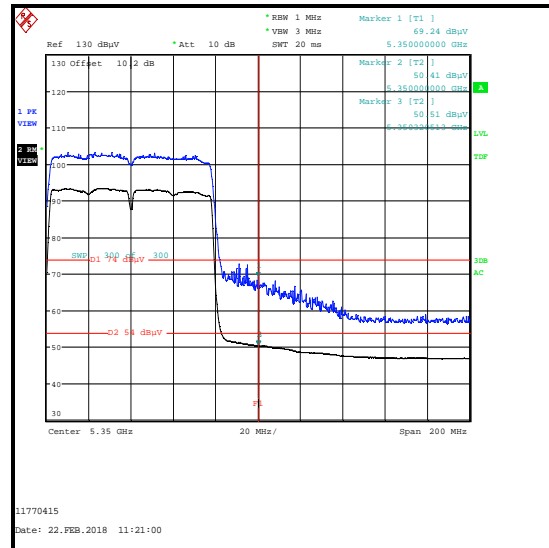
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5350	69.2	74.0	4.8	Complied

Results: Lower Band Edge / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	47.5	0.2	47.7	54.0	6.3	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5350	50.4	0.2	50.6	54.0	3.4	Complied
5350.321	50.5	0.2	50.7	54.0	3.3	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band)**5.3.3. 5.47-5.725 GHz band****Test Summary:**

Test Engineers:	John Ferdinand & Andrew Edwards	Test Dates:	18 February 2018 to 08 May 2018
Test Sample Serial Numbers:	C02VQ00GJKHY & C02W6002JH95		

FCC Reference:	Parts 15.407(b)(3),(7), 15.205 & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10 & KDB 789033 II.G.

Environmental Conditions:

Temperature (°C):	22 to 24
Relative Humidity (%):	38 to 45

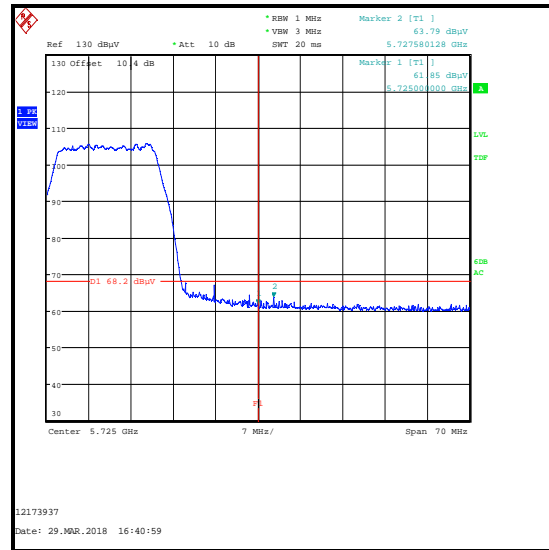
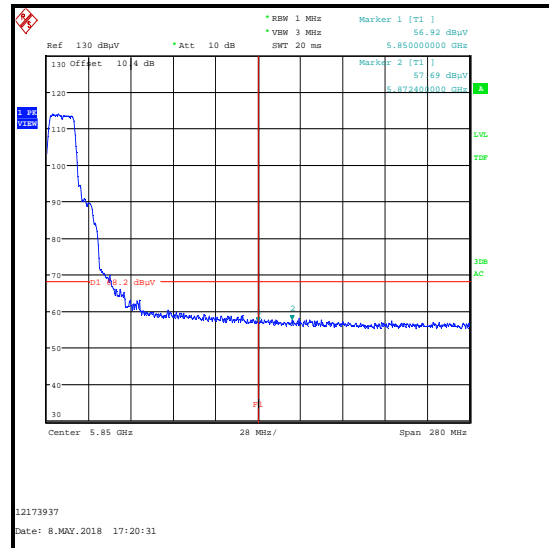
Note(s):

- The following modes were tested:
 - 802.11a SISO – BPSK / 6 Mbps / Port WF3
 - 802.11n HT20 / SISO – BPSK / MCS0 / Port WF3
 - 802.11n HT40 / SISO – BPSK / MCS0 / Port WF3
 - 802.11ac VHT80 / SISO – BPSK / MCS0 / Port WF3
- Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
- For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz. However, there are restricted bands of operation below the lower band edge at 4.5-5.15 GHz and also at 5.35-5.46 GHz therefore the provisions of FCC Part 15.205 apply. Tests were performed in these restricted bands of operation with the EUT transmitting on the bottom and top channels within 5.47-5.725 GHz band, the results are included in the transmitter 5.725-5.85 GHz band radiated spurious emissions section of this test report.
- For completeness, results are also shown as EIRP in dBm and also as field strength in dBμV/m. Measured field strength was converted to EIRP in accordance with KDB 789033 II.G.2.c(iii) using a conversion factor of 95.2.
- As straddle channels overlap the upper band edge at 5725 MHz, additional testing was performed in accordance with KDB 778093 III. B.2.b(iii) which requires compliance of overlapping channels to an unwanted emission level of -27 dBm/MHz at 5850 MHz instead of 5725 MHz. The EUT was configured to transmit on the straddle channels and the emission levels at 5850 MHz were recorded. A marker was placed on the band edge spot frequency and a second marker placed on the highest emission level in the adjacent non-restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)**Results: 802.11a / 20 MHz / BPSK / 6 Mbps / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5469.872	-31.9	-27.0	4.9	Complied
5470	-32.4	-27.0	5.4	Complied
5725	-33.3	-27.0	6.3	Complied
5727.580	-31.4	-27.0	4.4	Complied
5850	-38.3	-27.0	11.3	Complied
5872.400	-37.5	-27.0	10.5	Complied

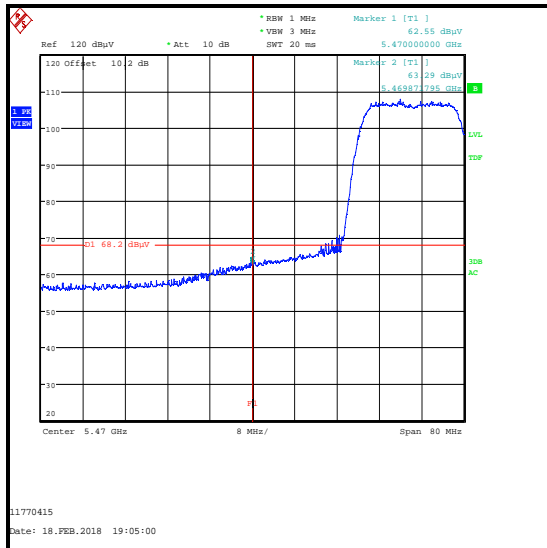
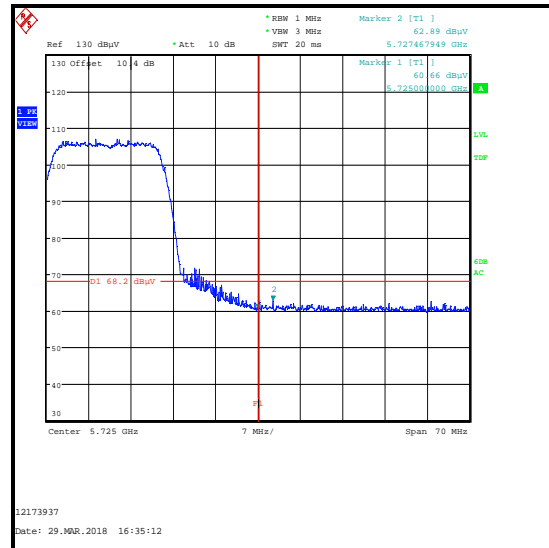
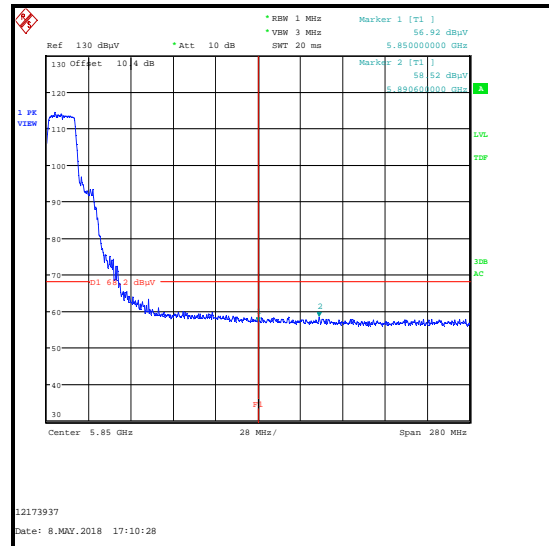
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5469.872	63.3	68.2	4.9	Complied
5470	62.8	68.2	5.4	Complied
5725	61.9	68.2	6.3	Complied
5727.580	63.8	68.2	4.4	Complied
5850	56.9	68.2	11.3	Complied
5872.400	57.7	68.2	10.5	Complied

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)**Results: 802.11a / 20 MHz / BPSK / 6 Mbps****Lower Band Edge****Upper Band Edge****Straddle Channel emission level at 5850 MHz**

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5469.872	-31.9	-27.0	4.9	Complied
5470	-32.6	-27.0	5.6	Complied
5725	-34.5	-27.0	7.5	Complied
5727.468	-32.3	-27.0	5.3	Complied
5850	-38.3	-27.0	11.3	Complied
5890.600	-36.7	-27.0	9.7	Complied

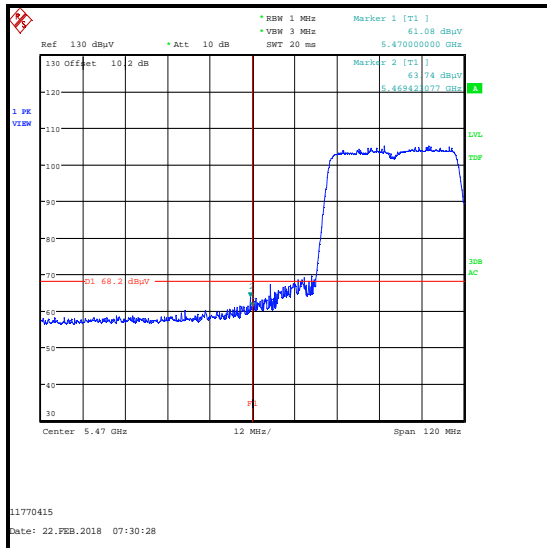
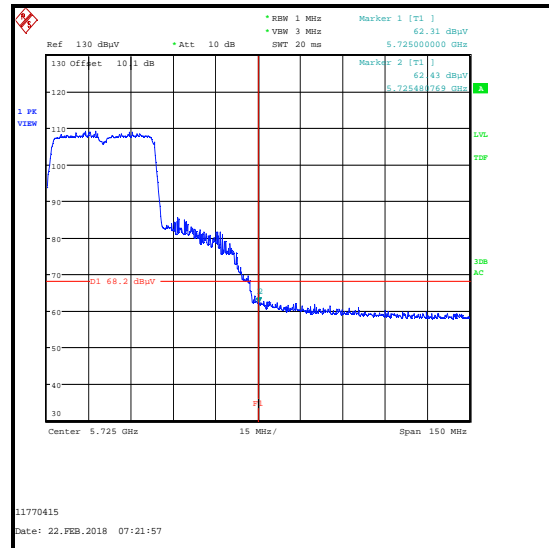
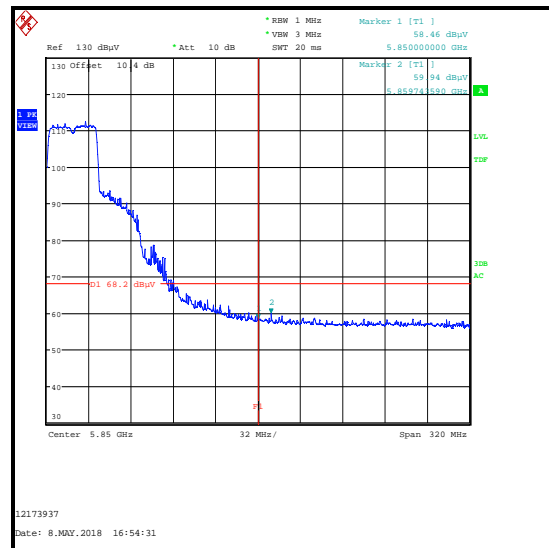
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5469.872	63.3	68.2	4.9	Complied
5470	62.6	68.2	5.6	Complied
5725	60.7	68.2	7.5	Complied
5727.468	62.9	68.2	5.3	Complied
5850	56.9	68.2	11.3	Complied
5890.600	58.5	68.2	9.7	Complied

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0****Lower Band Edge****Upper Band Edge****Straddle Channel emission level at 5850 MHz**

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5469.423	-31.5	-27.0	4.5	Complied
5470	-34.1	-27.0	7.1	Complied
5725	-32.9	-27.0	5.9	Complied
5725.481	-32.8	-27.0	5.8	Complied
5850	-36.7	-27.0	9.7	Complied
5859.744	-35.3	-27.0	8.3	Complied

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5469.423	63.7	68.2	4.5	Complied
5470	61.1	68.2	7.1	Complied
5725	62.3	68.2	5.9	Complied
5725.481	62.4	68.2	5.8	Complied
5850	58.5	68.2	9.7	Complied
5859.744	59.9	68.2	8.3	Complied

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0****Lower Band Edge****Upper Band Edge****Straddle Channel emission level at 5850 MHz**

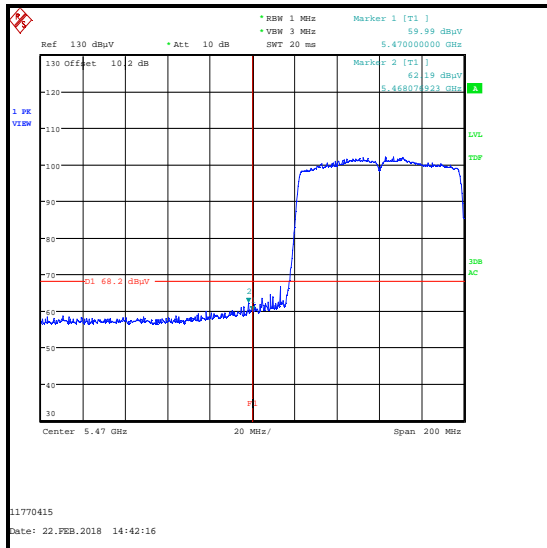
Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5468.077	-33.0	-27.0	6.0	Complied
5470	-35.2	-27.0	8.2	Complied
5725	-33.2	-27.0	6.2	Complied
5736.426	-32.6	-27.0	5.6	Complied
5850	-33.6	-27.0	6.6	Complied
5859.000	-31.0	-27.0	4.0	Complied

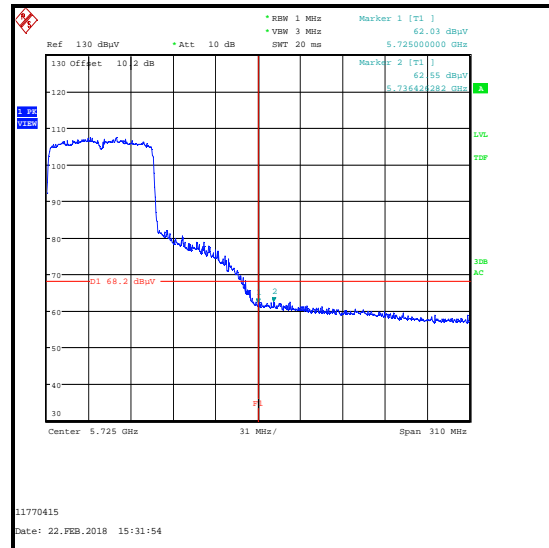
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5468.077	62.2	68.2	6.0	Complied
5470	60.0	68.2	8.2	Complied
5725	62.0	68.2	6.2	Complied
5736.426	62.6	68.2	5.6	Complied
5850	61.6	68.2	6.6	Complied
5859.000	64.2	68.2	4.0	Complied

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)

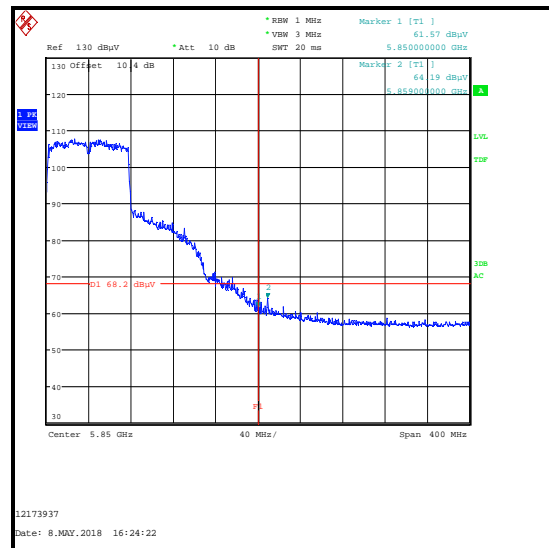
Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0



Lower Band Edge



Upper Band Edge



Straddle Channel emission level at 5850 MHz

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band)**5.3.4. 5.725-5.85 GHz band****Test Summary:**

Test Engineers:	Andrew Edwards & John Ferdinand	Test Dates:	18 February 2018 to 26 February 2018
Test Sample Serial Number:	C02VQ00GJKHY		

FCC Reference:	Parts 15.407(b)(4)(i),(7), 15.205 & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10 & KDB 789033 II.G.

Environmental Conditions:

Temperature (°C):	21 to 24
Relative Humidity (%):	39 to 43

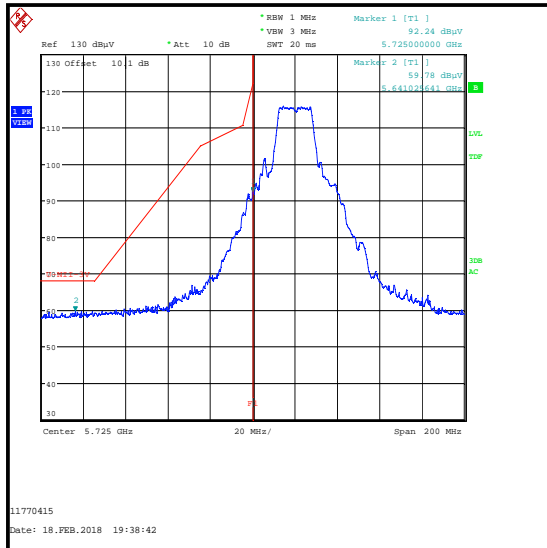
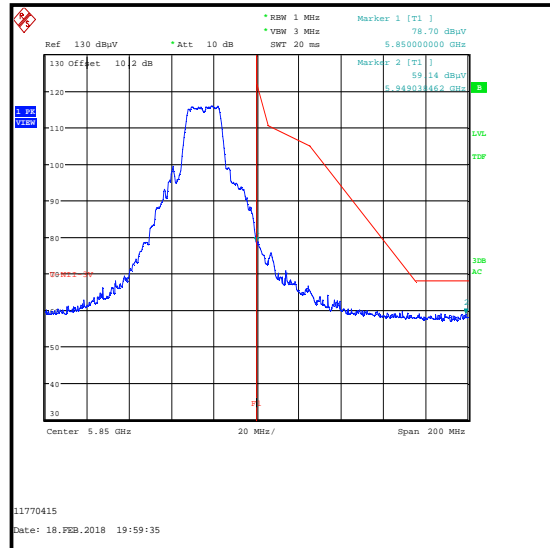
Note(s):

- The following modes were tested:
 - 802.11a SISO – BPSK / 6 Mbps / Port WF3
 - 802.11n HT20 / SISO – BPSK / MCS0 / Port WF3
 - 802.11n HT40 / SISO – BPSK / MCS0 / Port WF3
 - 802.11ac VHT80 / SISO – BPSK / MCS0 / Port WF3
- Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
- For completeness, results are also shown as EIRP in dBm and also as field strength in dBμV/m. Measured field strength was converted to EIRP in accordance with KDB 789033 G.2.c)(iii) using a conversion factor of 95.2.

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Results: 802.11a / 20 MHz / BPSK / 6 Mbps / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5641.026	-35.4	-27.0	8.4	Complied
5725	-3.0	27.0	30.0	Complied
5850	-16.5	27.0	43.5	Complied
5949.036	-36.1	-27.0	9.1	Complied

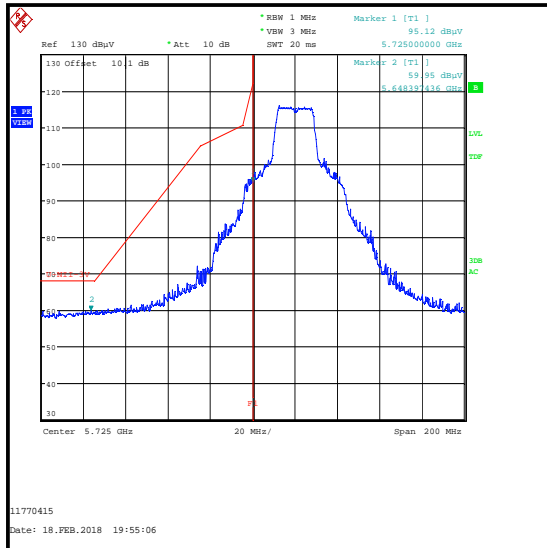
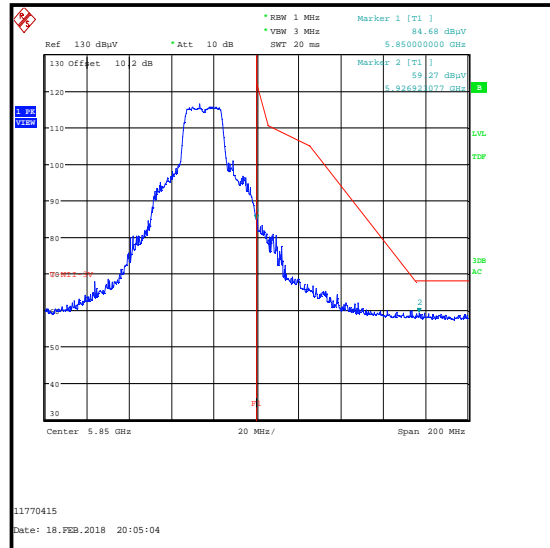
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5641.026	59.8	68.2	8.4	Complied
5725	92.2	122.2	30.0	Complied
5850	78.7	122.2	43.5	Complied
5949.036	59.1	68.2	9.1	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5648.397	-35.2	-27.0	8.2	Complied
5725	-0.1	27.0	27.1	Complied
5850	-10.5	27.0	37.5	Complied
5926.923	-35.9	-27.0	8.9	Complied

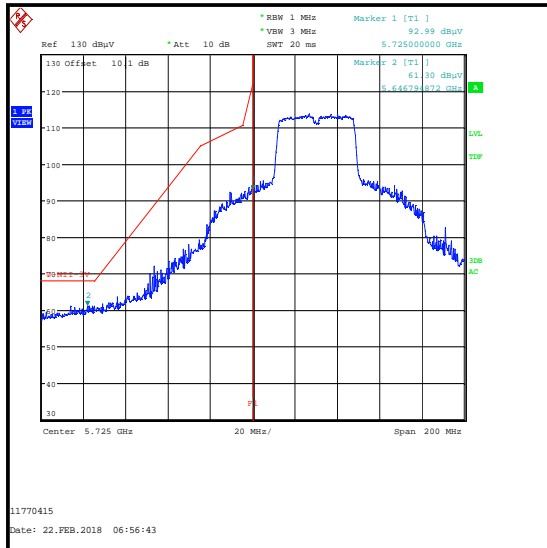
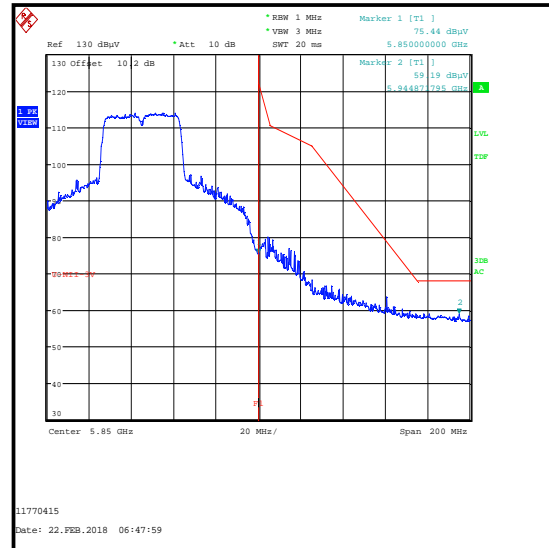
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5648.397	60.0	68.2	8.2	Complied
5725	95.1	122.2	27.1	Complied
5850	84.7	122.2	37.5	Complied
5926.923	59.3	68.2	8.9	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5646.795	-33.9	-27.0	6.9	Complied
5725	-2.2	27.0	29.2	Complied
5850	-19.8	27.0	46.8	Complied
5944.872	-36.0	-27.0	9.0	Complied

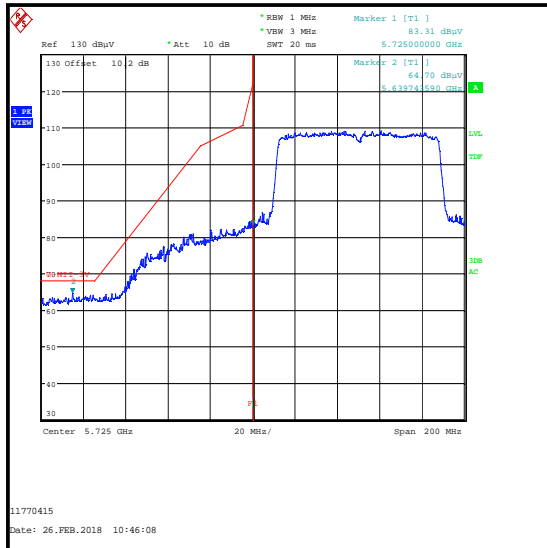
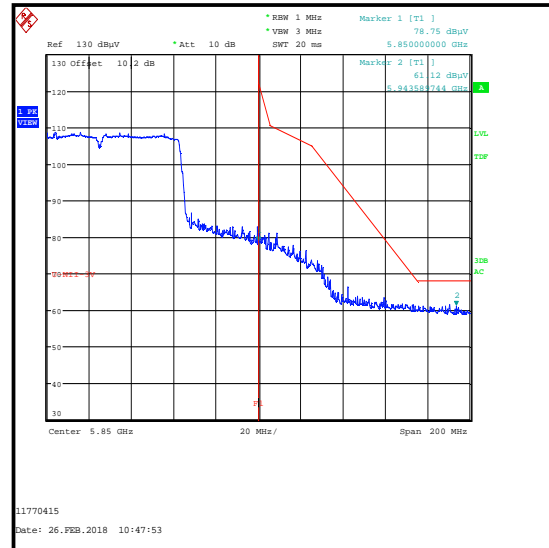
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5646.795	61.3	68.2	6.9	Complied
5725	93.0	122.2	29.2	Complied
5850	75.4	122.2	46.8	Complied
5944.872	59.2	68.2	9.0	Complied

**Lower Band Edge****Upper Band Edge**

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Results: 802.11ac / 80 MHz / SISO / BPSK / MCS0 / Peak**

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5639.744	-30.5	-27.0	3.5	Complied
5725	-11.9	27.0	38.9	Complied
5850	-16.4	27.0	43.4	Complied
5943.590	-34.1	-27.0	7.1	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5639.744	64.7	68.2	3.5	Complied
5725	83.3	122.2	38.9	Complied
5850	78.8	122.2	43.4	Complied
5943.590	61.1	68.2	7.1	Complied

**Lower Band Edge****Upper Band Edge****--- END OF REPORT ---**