



# TEST REPORT

**Test Report No. :** UL-RPT-RP13337971-1616A V2.0

**Customer** : Raspberry Pi (Trading) Ltd  
**Model No.** : RPI-RM0  
**FCC ID** : 2ABCB-RPIRM0  
**Technology** : WLAN  
**Test Standard(s)** : FCC Parts 15.403(i), 15.407(a)(1)(iv), 15.407(a)(2), 15.407(a)(3), 15.407(e), 15.407(g) & 15.407(h)(1)  
**Test Laboratory** : UL International (UK) Ltd, Basingstoke, Hampshire, RG24 8AH, United Kingdom

1. This test report shall not be reproduced except in full, without the written approval of UL International (UK) Ltd.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

**Date of Issue:** 20 October 2020

**Checked by:**

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RF Operations Leader, Radio Laboratory

**Company Signatory:**

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## **Customer Information**

<b>Company Name:</b>	Raspberry Pi (Trading) Ltd
<b>Address:</b>	Maurice Wilkes Building Cowley Road Cambridge CB4 0DS United Kingdom

## **Report Revision History**

<b>Version Number</b>	<b>Issue Date</b>	<b>Revision Details</b>	<b>Revised By</b>
1.0	02/07/2020	Initial Version	Sarah Williams
2.0	20/10/2020	Re-test with new Q values	Sarah Williams

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## **1. Attestation of Test Results**

### **1.1. Description of EUT**

The equipment under test was a *Bluetooth* and WiFi radio module.

### **1.2. General Information**

<b>Specification Reference:</b>	47CFR15.407 and 47CFR15.403
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart E (Unlicensed National Information Infrastructure Devices) – Sections 15.403 and 15.407
<b>Site Registration:</b>	621311
<b>Location of Testing:</b>	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
<b>Test Date:</b>	19 October 2020

### **1.3. Summary of Test Results**

<b>FCC Reference (47CFR)</b>	<b>Measurement</b>	<b>Result</b>
Part 15.35(c)	Transmitter Duty Cycle	Note 1
Part 15.403(i)	Transmitter 26 dB Emission Bandwidth	✔
Part 15.407(e)	Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band)	✔
Part 15.407(a)(1)(iv)	Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band)	✔
Part 15.407(a)(2)	Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands)	✔
Part 15.407(a)(3)	Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band)	✔
Part 15.407(a)(1)(iv)	Transmitter Maximum Power Spectral Density (5.15-5.25 GHz band)	✔
Part 15.407(a)(2)	Transmitter Maximum Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands)	✔
Part 15.407(a)(3)	Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band)	✔
Part 15.407(g)	Transmitter Frequency Stability (Temperature & Voltage Variation)	Note 2
Part 15.407(h)(1)	Transmitter Power Control	Note 3
<b>Key to Results</b>		
✔ = Complied    ✘ = Did not comply		

#### **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).

### **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.

UL International (UK) Ltd is accredited by UKAS. The tests reported herein have been performed in accordance with its terms of accreditation.

### **2.2. Methods and Procedures**

<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	KDB 789033 D02 General U-NII Test Procedures New Rules v02r01 December 14, 2017
<b>Title:</b>	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”.

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
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

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**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M2004	Thermohygrometer	Testo	608-H1	45046425	05 Jan 2021	12
M2036	Signal Analyser	Rohde & Schwarz	FSV30	101791	18 May 2021	12
M2022	Power Sensor	Boonton	55006	9968	20 Jan 2021	12
A3027	Attenuator	Broadwave Technologies Inc.	351-311-006	#1	Calibrated before use	-
A3004	RF Switch	Pickering Interfaces	64-102-002	XZ363230	Calibrated before use	-
A3180	Attenuator	Pasternack	PE7047-3	Not stated	Calibrated before use	-
G0614	Signal Generator	Rohde & Schwarz	SMB100A	260473	19 May 2023	36
A3005	Replay Test Rack	N/A	N/A	N/A	Calibration not required	-

### **Test Measurement Software/Firmware Used**

<b>Name</b>	<b>Version</b>	<b>Release Date</b>
UL VS LTD Replay	20190208	08 February 2019



### **3. Equipment Under Test (EUT)**

#### **3.1. Identification of Equipment Under Test (EUT)**

<b>Brand Name:</b>	Raspberry Pi
<b>Model Name or Number:</b>	RPI-RM0
<b>Test Sample Serial Number:</b>	3157589 ( <i>Conducted sample #1</i> )
<b>Hardware Version:</b>	V1.0
<b>Software Version:</b>	V1.0
<b>FCC ID:</b>	2ABCB-RPIRM0

#### **3.2. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

#### **3.3. Additional Information Related to Testing**

<b>Technology Tested:</b>	WLAN (IEEE 802.11a,n,ac) / U-NII	
<b>Type of Unit:</b>	Transceiver	
<b>Modulation:</b>	BPSK, QPSK, 16QAM, 64QAM & 256QAM	
<b>Data rates:</b>	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)
<b>Power Supply Requirement(s):</b>	Nominal	5.0 VDC
<b>Maximum Conducted Output Power:</b>	20 MHz	16.9 dBm
	40 MHz	18.2 dBm
	80 MHz	17.8 dBm

**Additional Information Related to Testing (continued)**

<b>Channel Spacing:</b>	20 MHz		
<b>Transmit Frequency Band:</b>	5150 MHz to 5250 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	36	5180
	Middle	40	5200
	Top	48	5240
<b>Transmit Frequency Band:</b>	5250 MHz to 5350 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	52	5260
	Middle	56	5280
	Top	64	5320
<b>Transmit Frequency Band:</b>	5470 MHz to 5725 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	100	5500
	Middle	116	5580
	Top	140	5700
<b>Transmit Frequency Band:</b>	5725 MHz to 5850 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	149	5745
	Middle	157	5785
	Top	165	5825

**Additional Information Related to Testing (continued)**

<b>Channel Spacing:</b>	40 MHz		
<b>Transmit Frequency Band:</b>	5150 MHz to 5250 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	38	5190
	Top	46	5230
<b>Transmit Frequency Band:</b>	5250 MHz to 5350 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	54	5270
	Top	62	5310
<b>Transmit Frequency Band:</b>	5470 MHz to 5725 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	102	5510
	Middle	110	5550
	Top	134	5670
<b>Transmit Frequency Band:</b>	5725 MHz to 5850 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	151	5755
	Top	159	5795

**Additional Information Related to Testing (continued)**

<b>Channel Spacing:</b>	80 MHz		
<b>Transmit Frequency Band:</b>	5150 MHz to 5250 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Single	42	5210
<b>Transmit Frequency Band:</b>	5250 MHz to 5350 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Single	58	5290
<b>Transmit Frequency Band:</b>	5470 MHz to 5725 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	106	5530
	Top	122	5610
<b>Transmit Frequency Band:</b>	5725 MHz to 5850 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Single	155	5775

**3.4. Description of Available Antennas**

The table below lists the internal niche antenna and the external antenna available.

<b>Manufacturer</b>	<b>Type</b>	<b>Frequency Range (MHz)</b>	<b>Antenna Gain (dBi)</b>
ProAnt	Internal	5150 to 5850	2.5
Raspberry Pi	External	5150 to 5850	2.0

### **3.5. Description of Test Setup**

#### **Support Equipment**

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

<b>Description:</b>	Pi4 board used as test jig
<b>Brand Name:</b>	Raspberry Pi4
<b>Model Name or Number:</b>	Pi4
<b>Serial Number:</b>	10000000ae575e0

<b>Description:</b>	Micro SD Card with OS image
<b>Brand Name:</b>	SanDisk
<b>Model Name or Number:</b>	16 GB card
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	USB Mouse
<b>Brand Name:</b>	Raspberry Pi
<b>Model Name or Number:</b>	RPI-MOUSE
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	USB Keyboard
<b>Brand Name:</b>	Raspberry Pi
<b>Model Name or Number:</b>	RPI-KYB
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Power Supply. 100-230 VAC Input / 5 VDC Output
<b>Brand Name:</b>	Belkin
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	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):

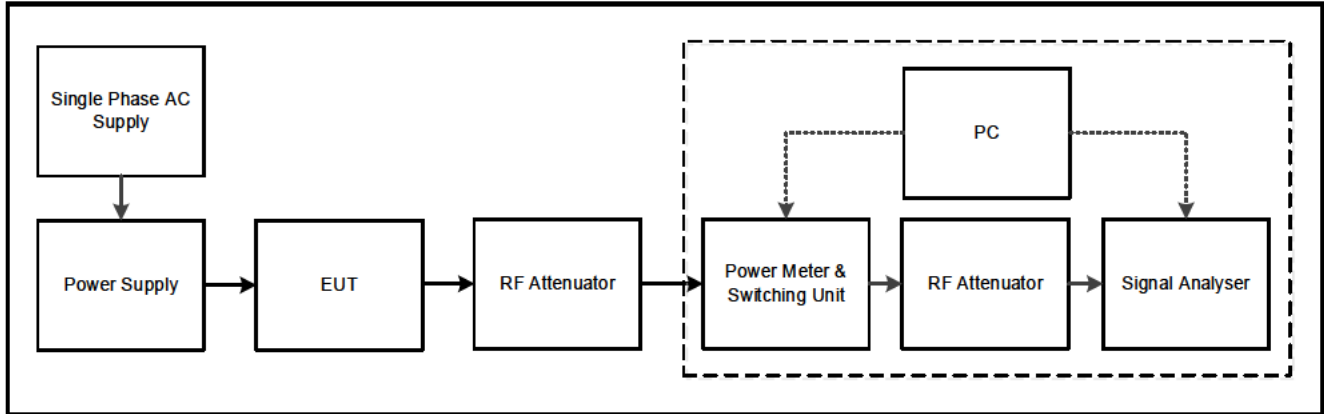
- The customer supplied 'wl' chipset commands. Test commands were provided in the wlan\_testing.sh file located on the /home/pi drive of the EUT. The test commands were entered into the automated test system and used to configure the EUT to enable a continuous transmission and to select the test channels, data rates and modulation schemes as required.
- The customer declared the following data rates to be used for all measurements as.
  - 802.11a - BPSK / 6 Mbps
  - 802.11n HT20 - BPSK / MCS0
  - 802.11n HT40 - BPSK / MCS0
  - 802.11ac VHT80 - BPSK / MCS0
- RF cables and attenuators connecting the test equipment to the EUT were calibrated before use and the calibration data incorporated into the conducted measurement results.
- The EUT was powered via the Pi4 test jig which was powered from an AC/DC switch mode power supply.



**Test Setup Diagrams**

**Conducted Tests:**

**Test Setup for Transmitter Conducted Tests**





## **4. Antenna Port Test Results**

### **4.1. Transmitter Duty Cycle**

#### **Test Summary:**

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	42

#### **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:

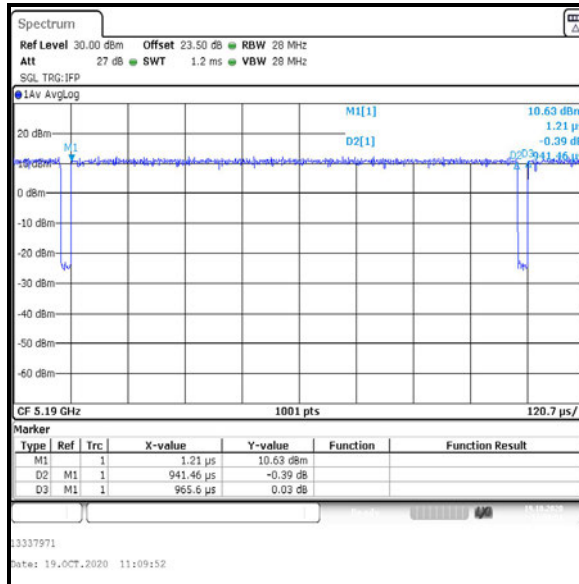
$$10 \log 1 / (\text{On Time} / [\text{Period or } 100\text{ms whichever is the lesser}]).$$

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 International (UK) Ltd IT server and available for inspection if required.

**Transmitter Duty Cycle (continued)**

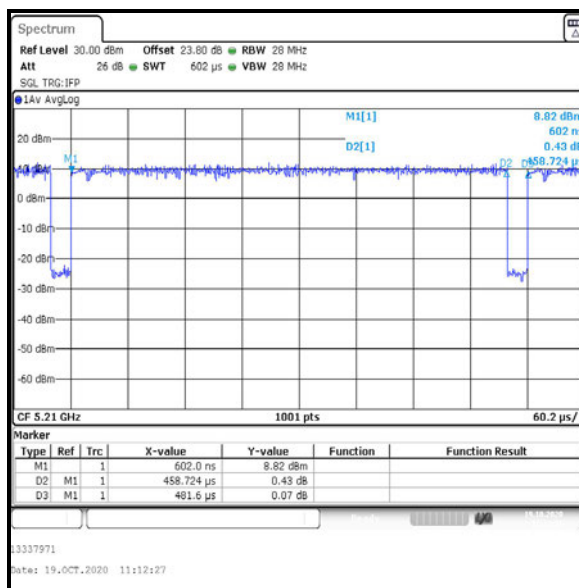
**Results: 802.11n / 40 MHz / MCS0**

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.941	0.966	0.1



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

Pulse Duration (ms)	Period (ms)	Duty Cycle Correction Factor (dB)
0.459	0.482	0.2



## **4.2. Transmitter 26 dB Emission Bandwidth**

### **Test Summary:**

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

### **Environmental Conditions:**

<b>Temperatures (°C):</b>	24
<b>Relative Humidity (%):</b>	42

### **Note(s):**

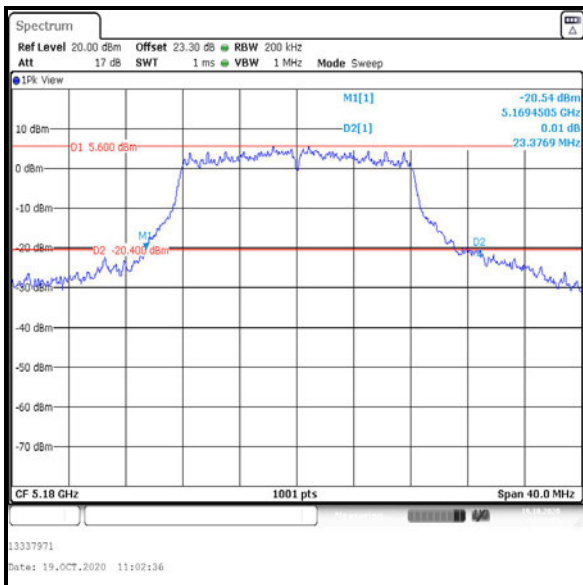
1. Measurements were performed in accordance with KDB 789033 Section II.C.1 Emission Bandwidth (EBW) test procedure on the relevant channels in all supported operating bands.
2. The signal analyser's resolution bandwidth was set to approximately 1% of the measured 26 dB emission bandwidth.
3. The signal 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.

**Transmitter 26 dB Emission Bandwidth (5.15-5.25 GHz band) (continued)**

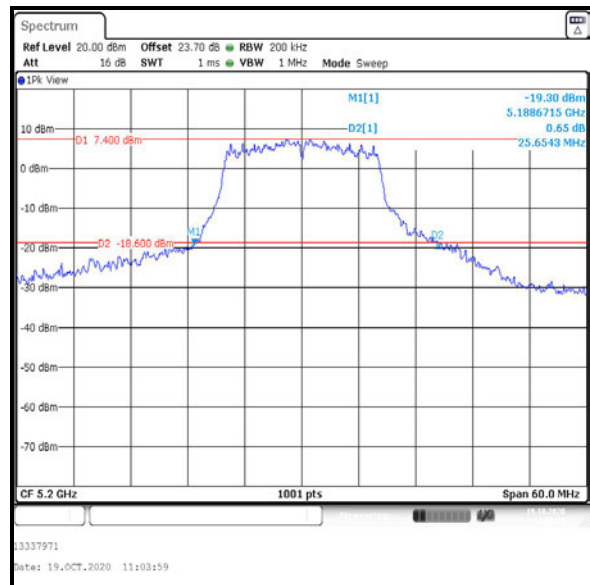
**4.2.1. 5.15-5.25 GHz band**

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps**

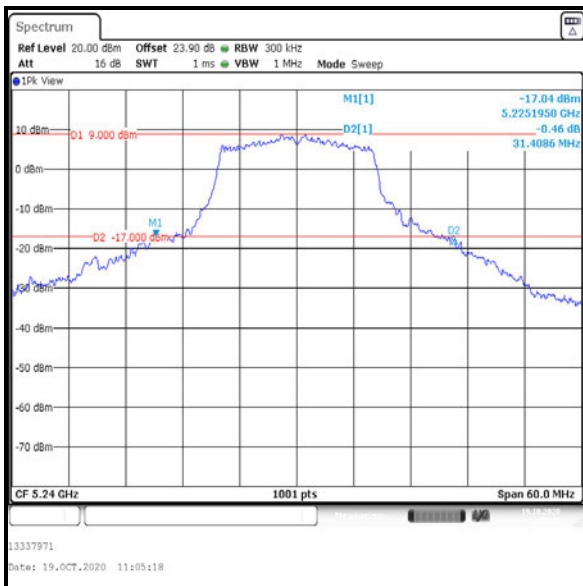
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5180	23.377
Middle	5200	25.654
Top	5240	31.409



**Bottom Channel**



**Middle Channel**

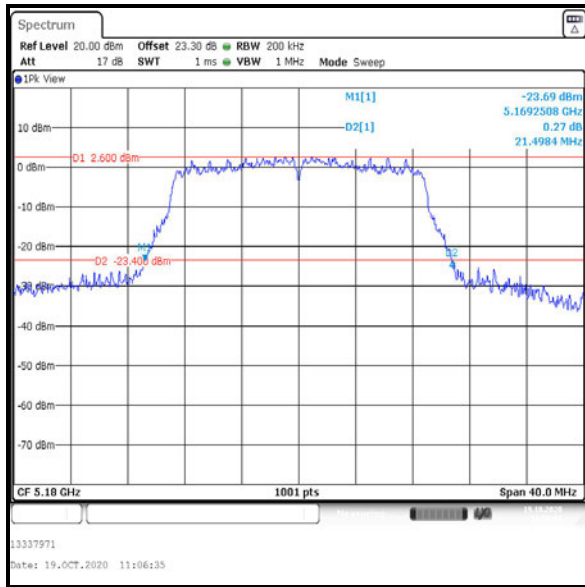


**Top Channel**

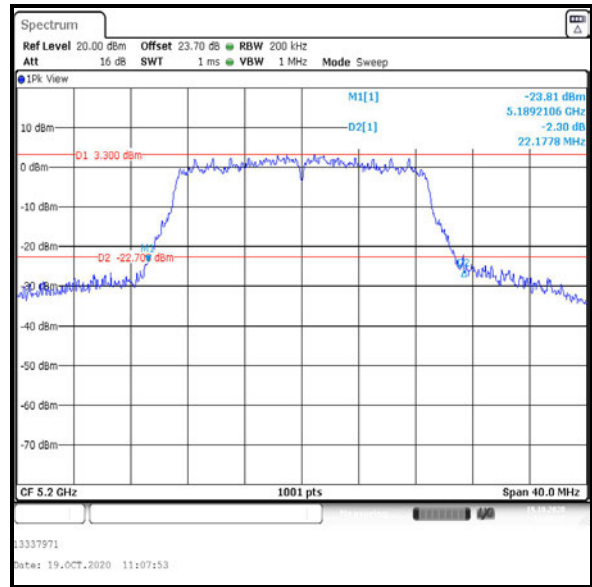
**Transmitter 26 dB Emission Bandwidth (5.15-5.25 GHz band) (continued)**

**Results: 802.11n / 20 MHz / BPSK / MCS0**

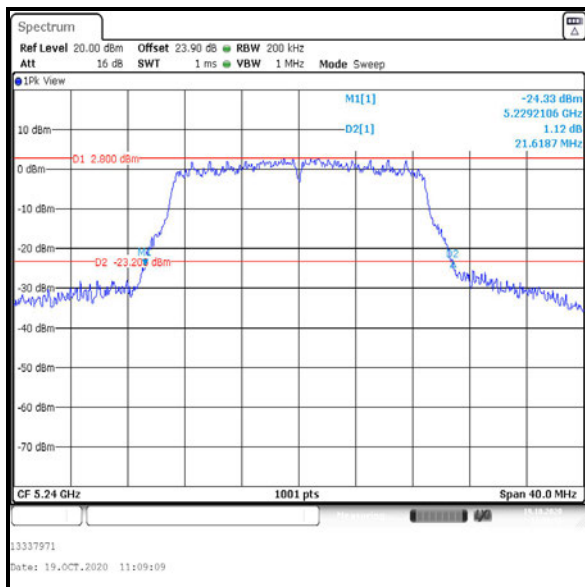
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5180	21.498
Middle	5200	22.178
Top	5240	21.619



**Bottom Channel**



**Middle Channel**

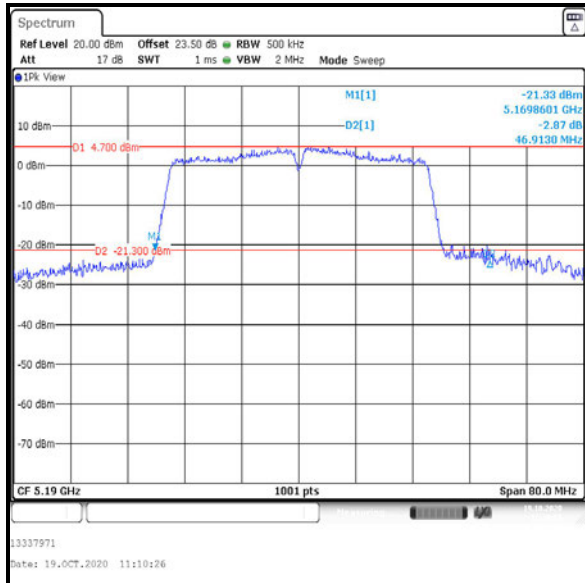


**Top Channel**

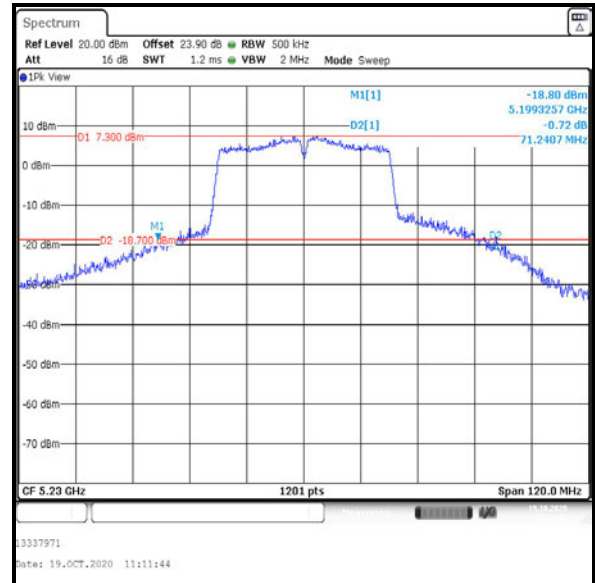
**Transmitter 26 dB Emission Bandwidth (5.15-5.25 GHz band) (continued)**

**Results: 802.11n / 40 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5190	46.913
Top	5230	71.241



**Bottom Channel**

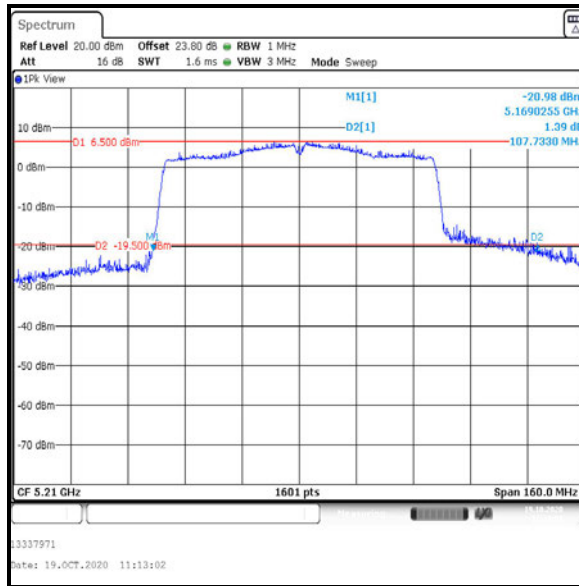


**Top Channel**

**Transmitter 26 dB Emission Bandwidth (5.15-5.25 GHz band) (continued)**

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

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5210	107.733



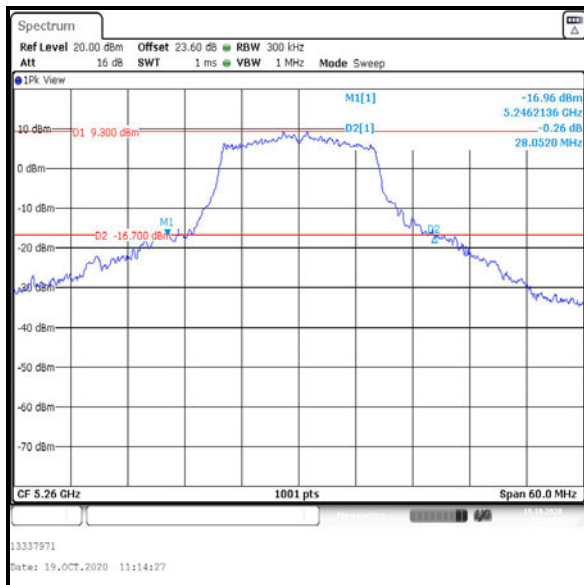
Single Channel

**Transmitter 26 dB Emission Bandwidth (5.25-5.35 GHz band) (continued)**

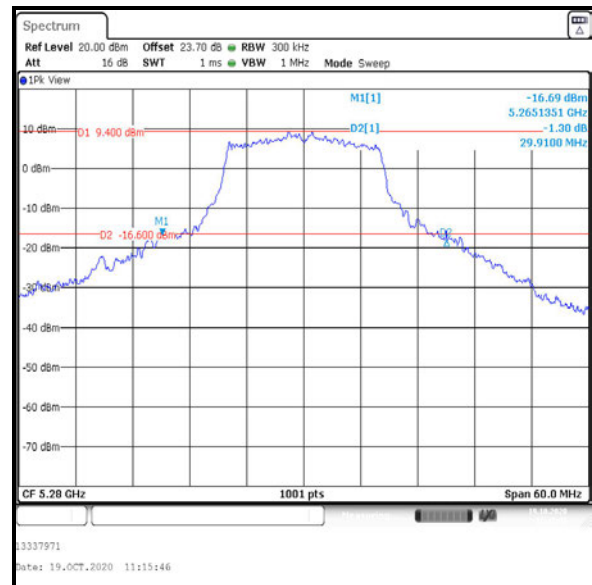
**4.2.2. 5.25-5.35 GHz band**

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps**

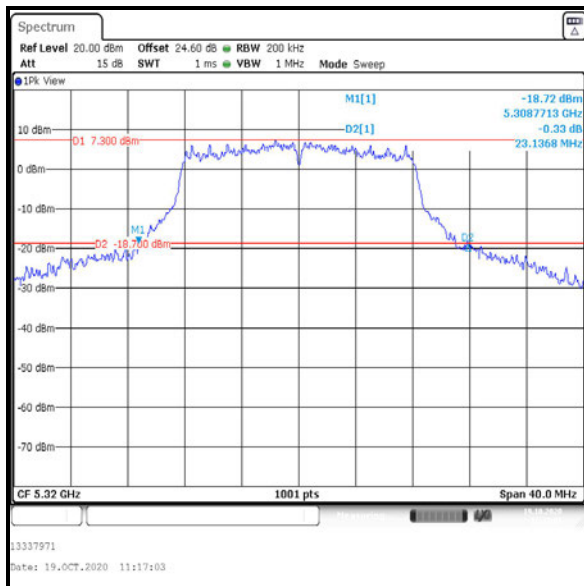
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5260	28.052
Middle	5280	29.910
Top	5320	23.137



**Bottom Channel**



**Middle Channel**



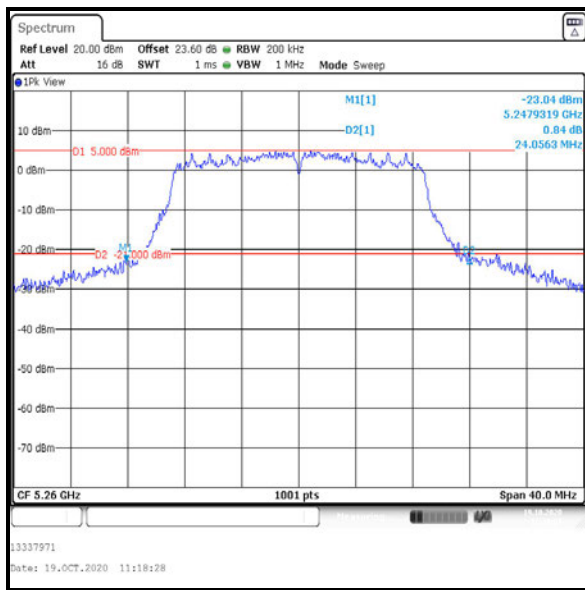
**Top Channel**



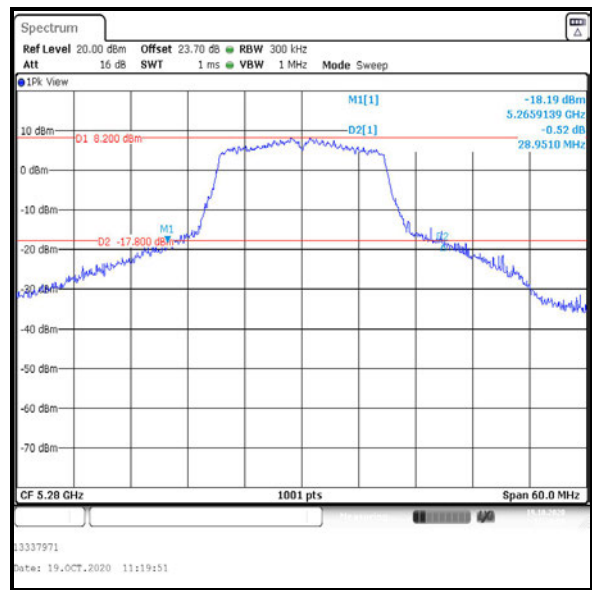
**Transmitter 26 dB Emission Bandwidth (5.25-5.35 GHz band) (continued)**

**Results: 802.11n / 20 MHz / BPSK / MCS0**

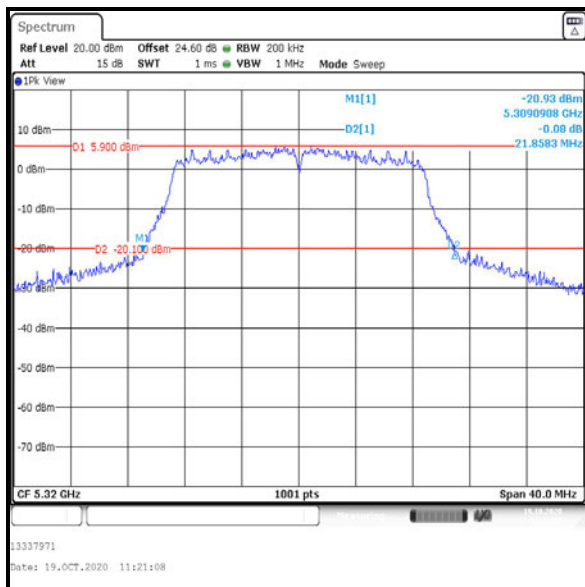
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5260	24.056
Middle	5280	28.951
Top	5320	21.858



**Bottom Channel**



**Middle Channel**

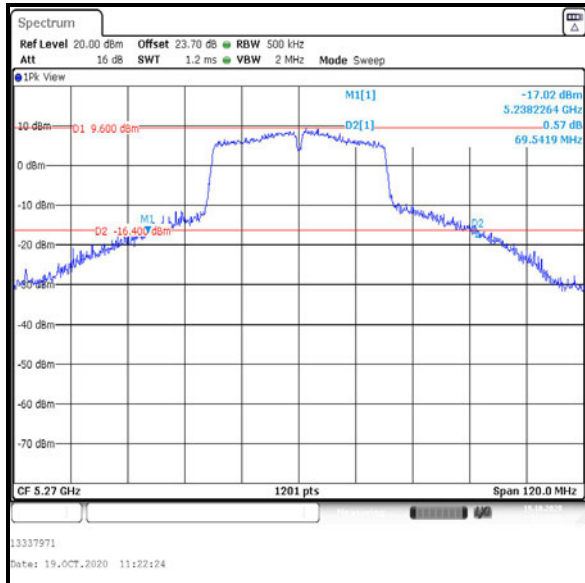


**Top Channel**

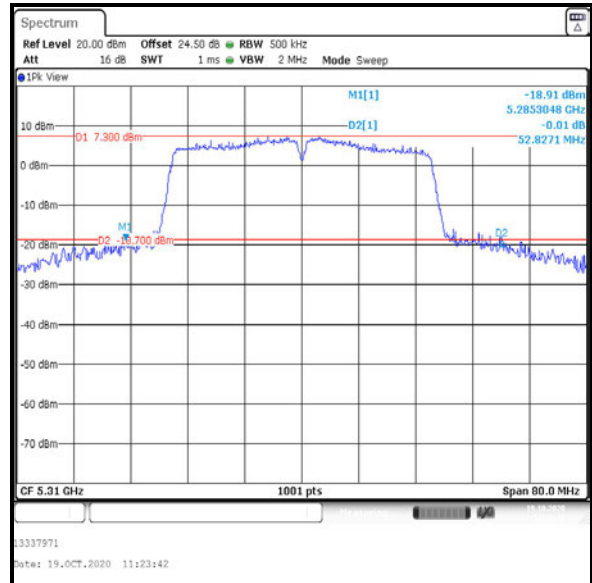
**Transmitter 26 dB Emission Bandwidth (5.25-5.35 GHz band) (continued)**

**Results: 802.11n / 40 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5270	69.542
Top	5310	52.827



Bottom Channel

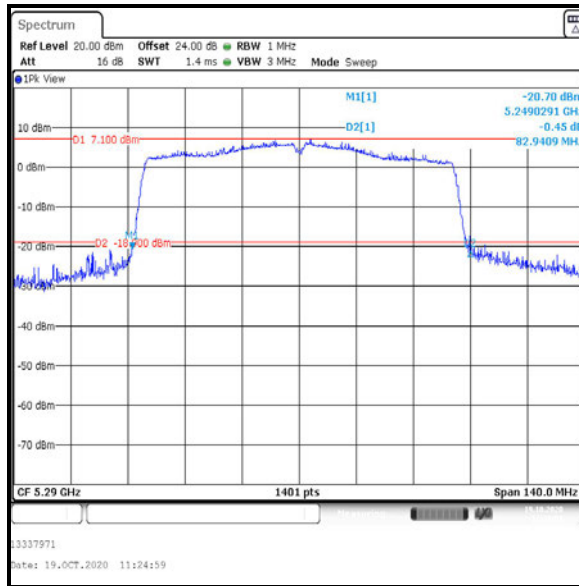


Top Channel

**Transmitter 26 dB Emission Bandwidth (5.25-5.35 GHz band) (continued)**

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

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5290	82.941



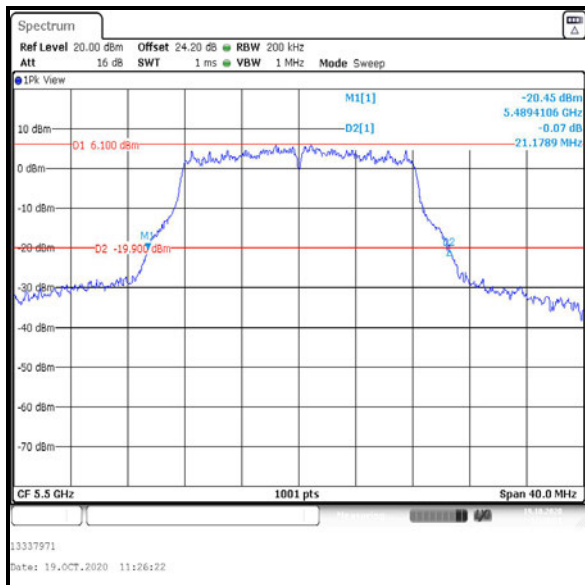
**Single Channel**

**Transmitter 26 dB Emission Bandwidth (5.47-5.725 GHz band) (continued)**

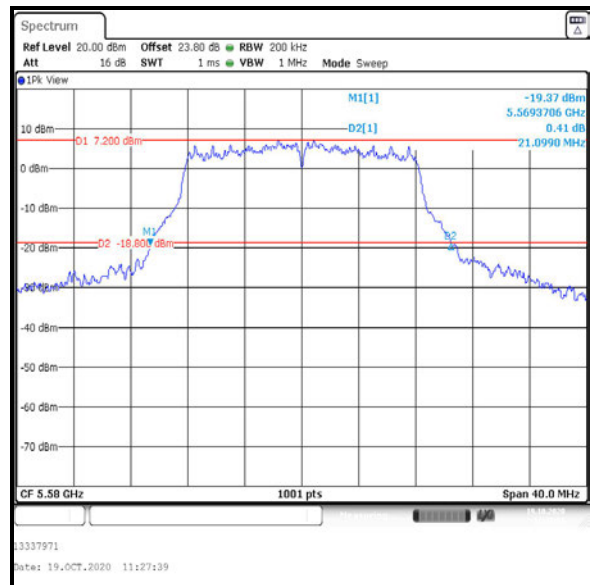
**4.2.3. 5.47-5.725 GHz band**

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps**

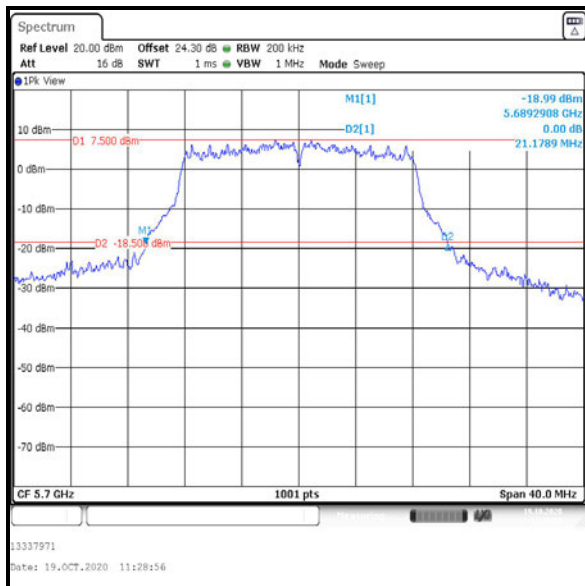
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5500	21.179
Middle	5580	21.099
Top	5700	21.179



**Bottom Channel**



**Middle Channel**

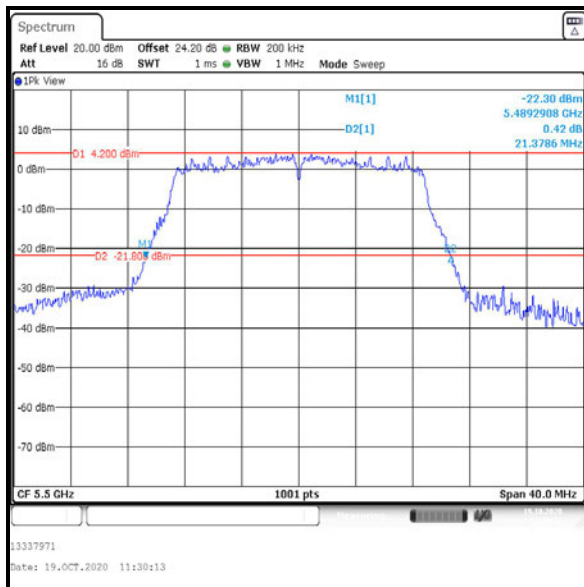


**Top Channel**

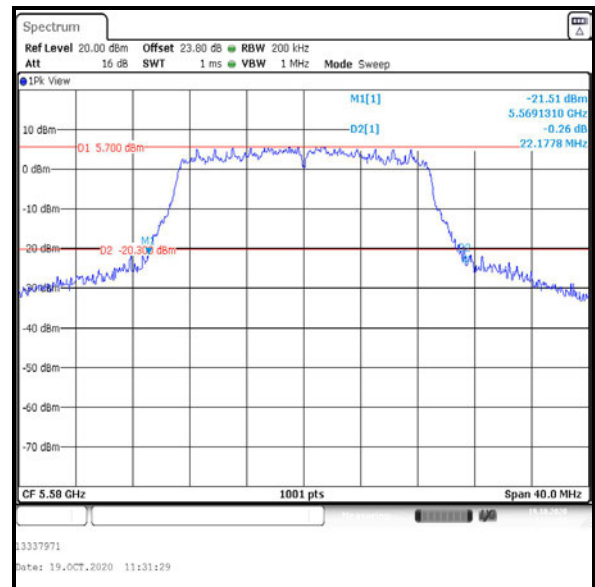
**Transmitter 26 dB Emission Bandwidth (5.47-5.725 GHz band) (continued)**

**Results: 802.11n / 20 MHz / BPSK / MCS0**

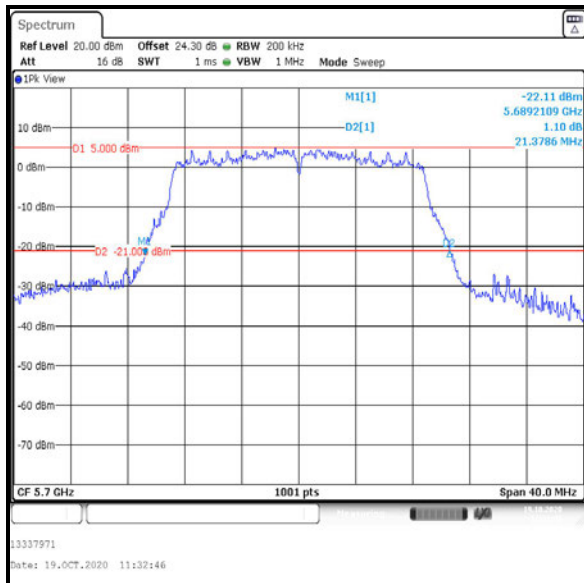
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5500	21.379
Middle	5580	22.178
Top	5700	21.379



Bottom Channel



Middle Channel

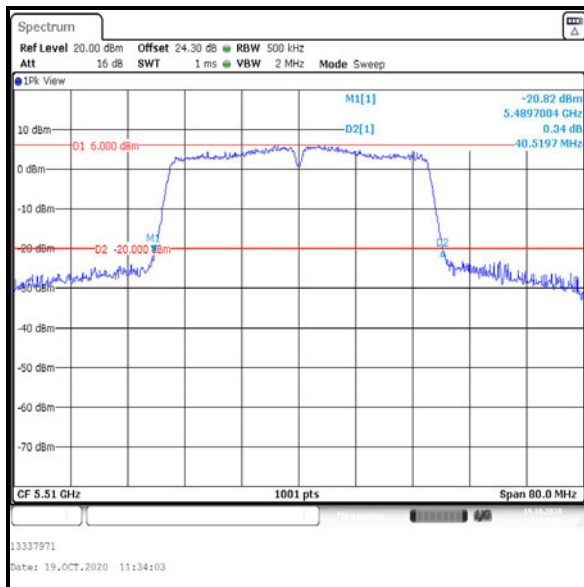


Top Channel

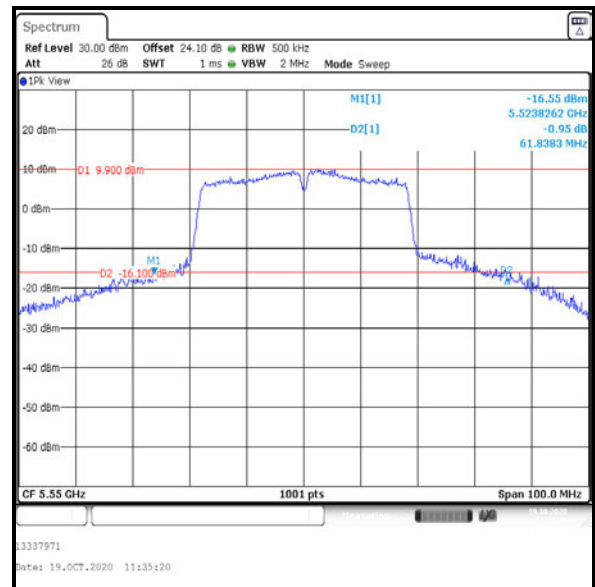
**Transmitter 26 dB Emission Bandwidth (5.47-5.725 GHz band) (continued)**

**Results: 802.11n / 40 MHz / BPSK / MCS0**

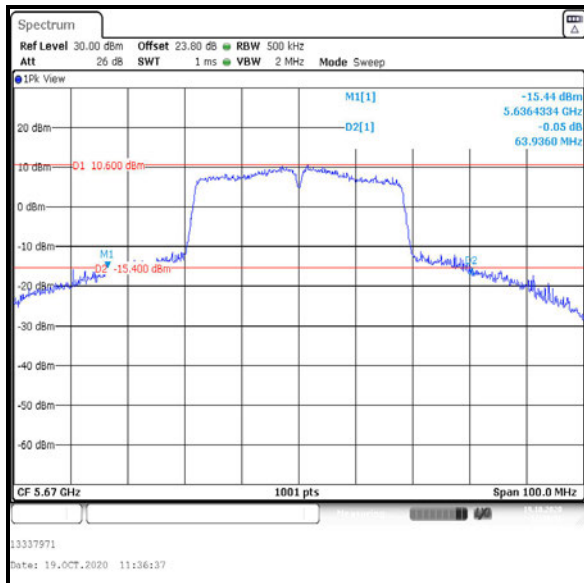
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5510	40.520
Middle	5590	61.838
Top	5670	63.936



**Bottom Channel**



**Middle Channel**

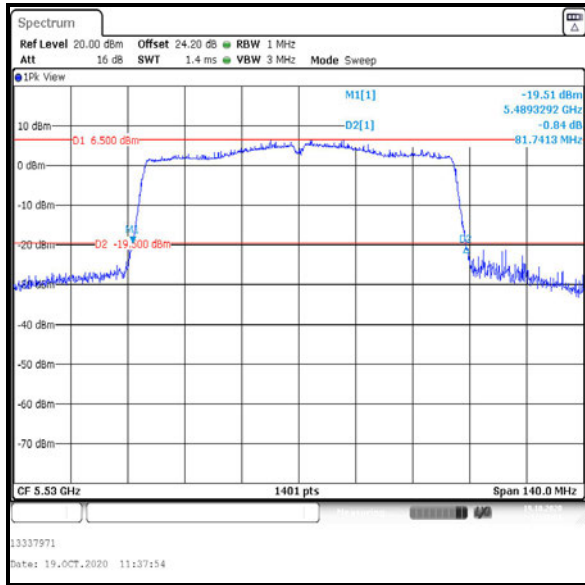


**Top Channel**

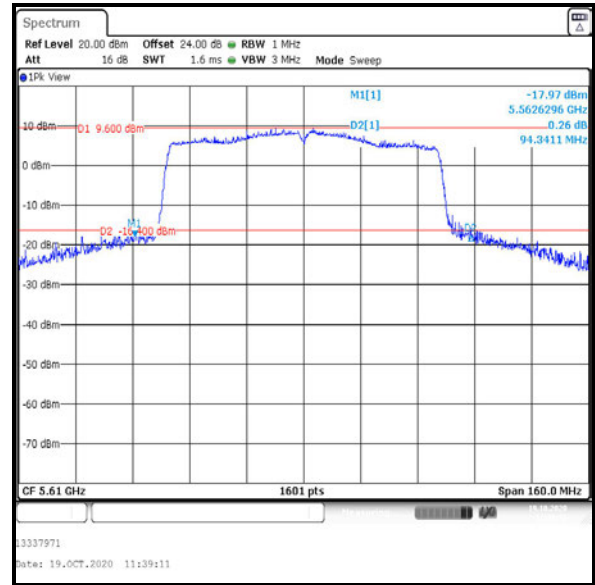
**Transmitter 26 dB Emission Bandwidth (5.47-5.725 GHz band) (continued)**

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

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5530	81.741
Top	5610	94.341



Bottom Channel



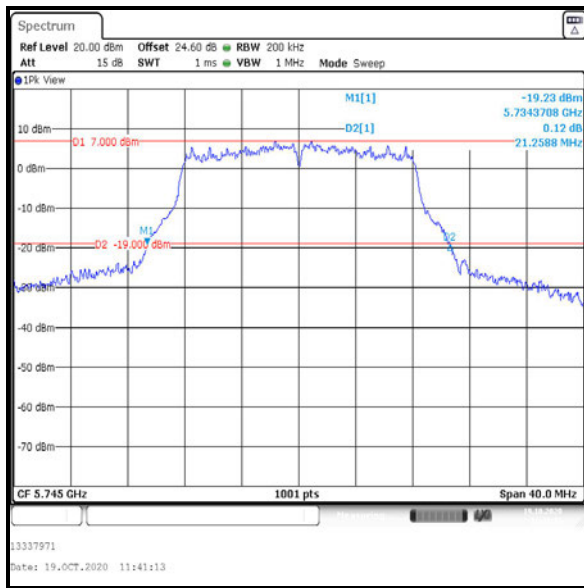
Top Channel

**Transmitter 26 dB Emission Bandwidth (5.725-5.85 GHz band) (continued)**

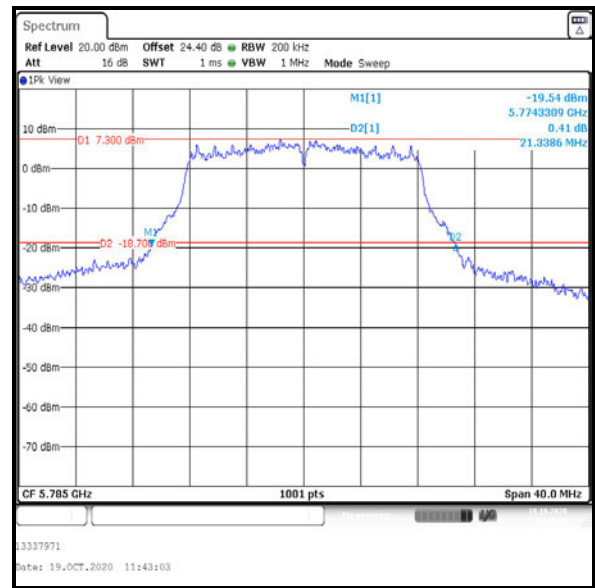
**4.2.4. 5.725-5.85 GHz band**

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps**

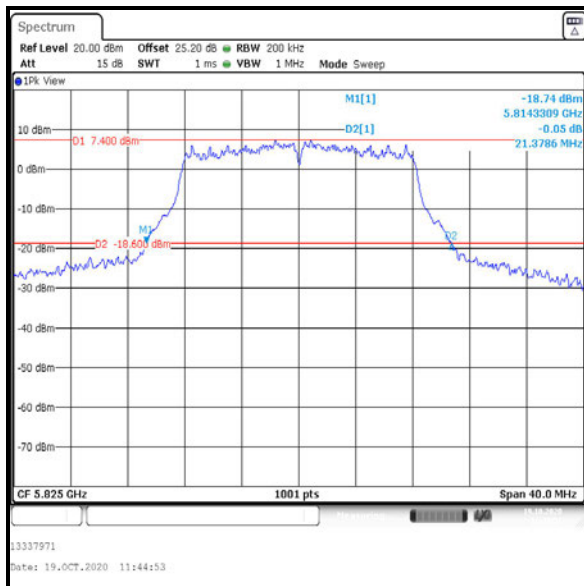
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	21.259
Middle	5785	21.339
Top	5825	21.379



**Bottom Channel**



**Middle Channel**



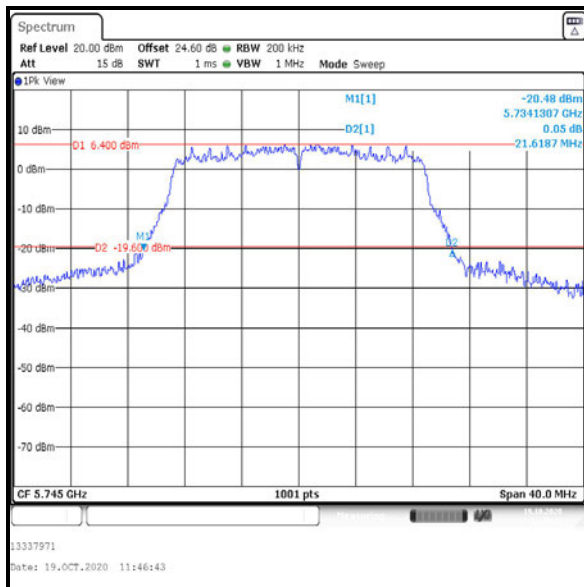
**Top Channel**



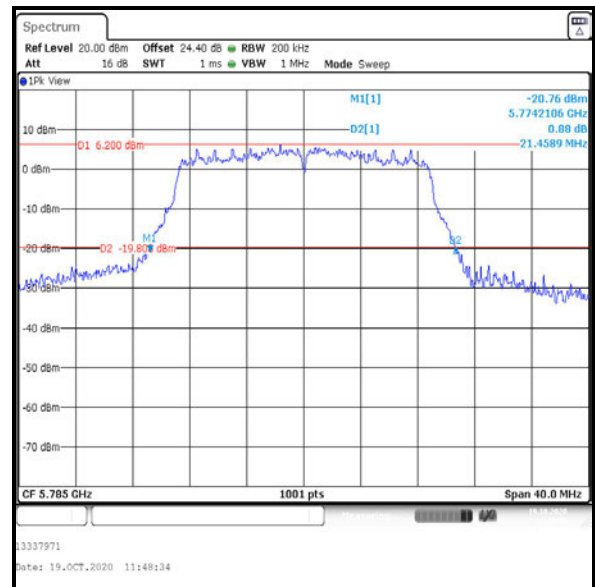
**Transmitter 26 dB Emission Bandwidth (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 20 MHz / BPSK / MCS0**

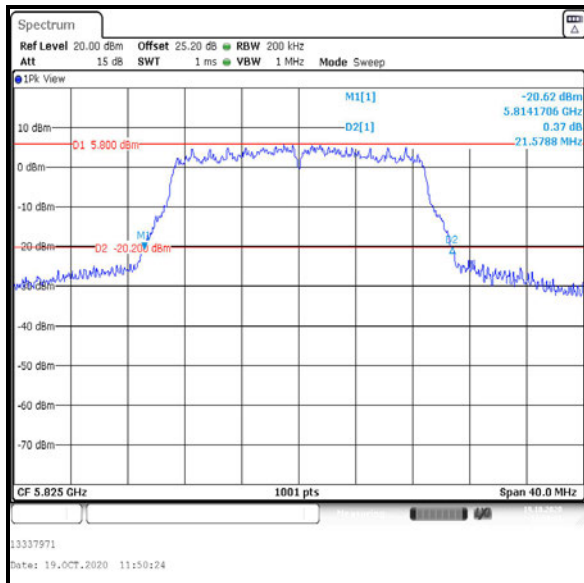
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	21.619
Middle	5785	21.459
Top	5825	21.579



**Bottom Channel**



**Middle Channel**

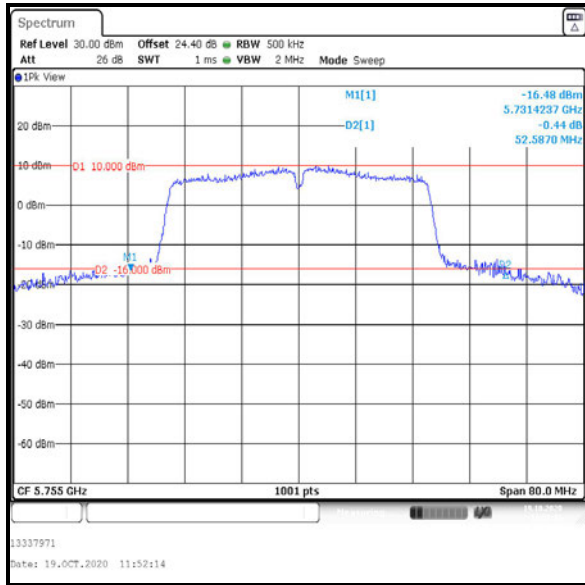


**Top Channel**

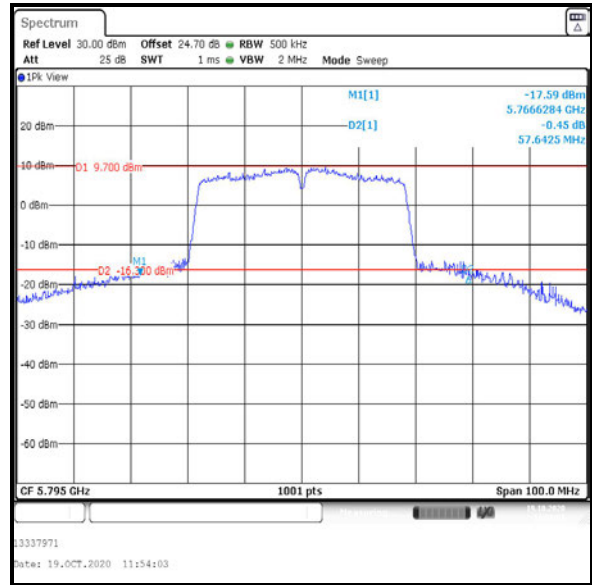
**Transmitter 26 dB Emission Bandwidth (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 40 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5755	52.587
Top	5795	57.643



**Bottom Channel**

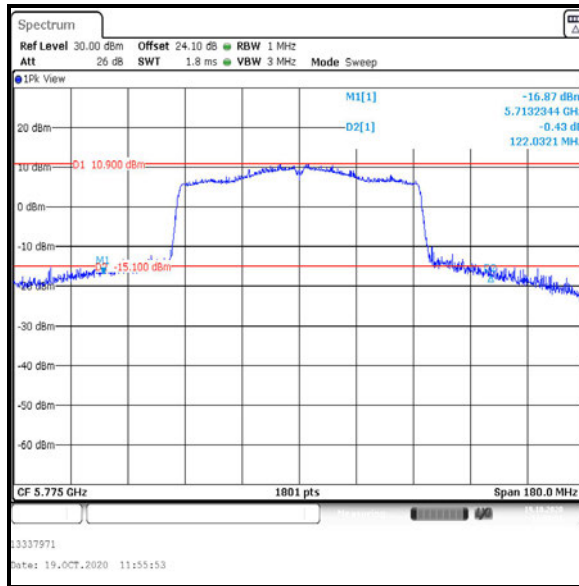


**Top Channel**

**Transmitter 26 dB Emission Bandwidth (5.725-5.85 GHz band) (continued)**

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

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5775	122.032



Single Channel

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

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	42

**Note(s):**

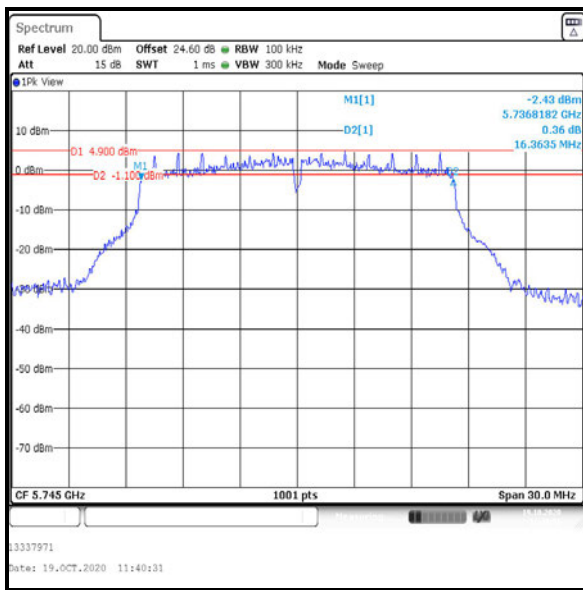
1. Measurements were performed in accordance with KDB 789033 Section II.C.2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz measurement procedure on the relevant channels in all supported operating bands.
2. The signal analyser was connected to the RF port on the EUT using an RF switch, suitable 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 (5.725-5.85 GHz band) (continued)**

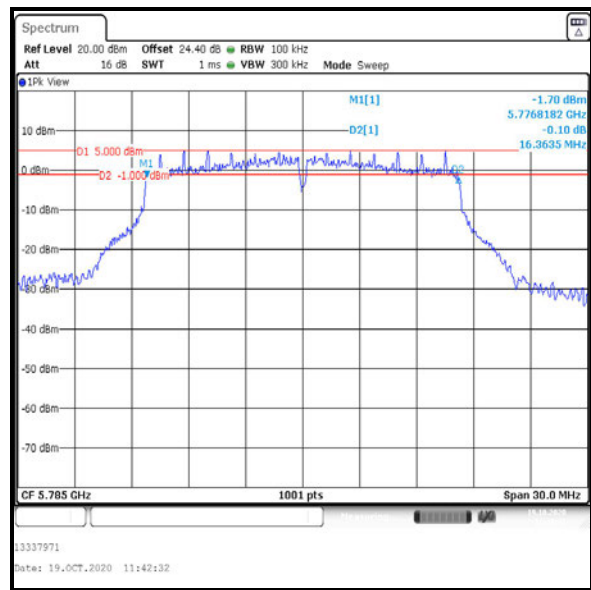
**4.3.1. 5.725-5.85 GHz band**

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps**

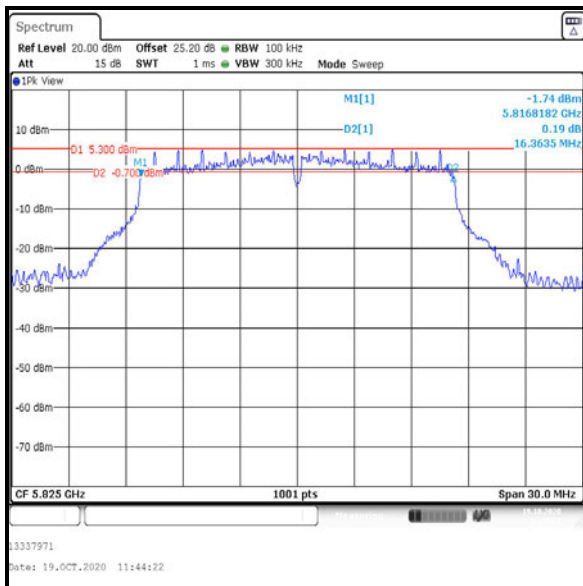
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16364	≥500	15864	Complied
Middle	16364	≥500	15864	Complied
Top	16364	≥500	15864	Complied



Bottom Channel



Middle Channel

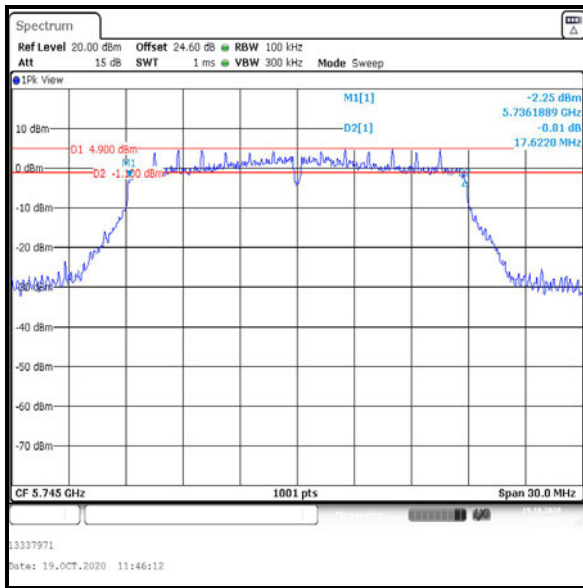


Top Channel

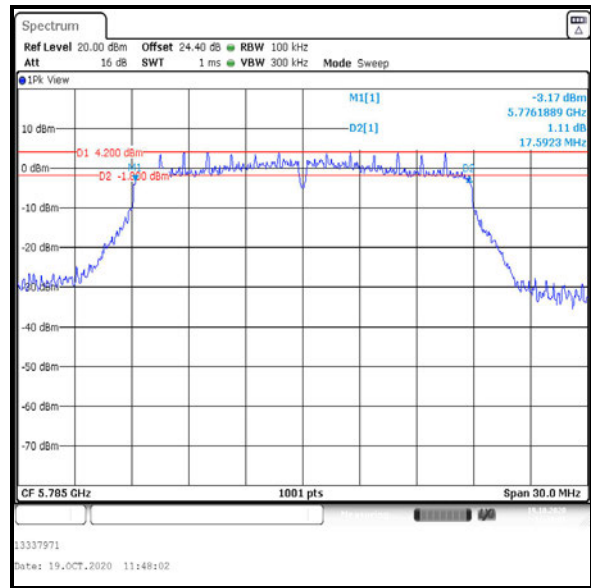
**Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 20 MHz / BPSK / MCS0**

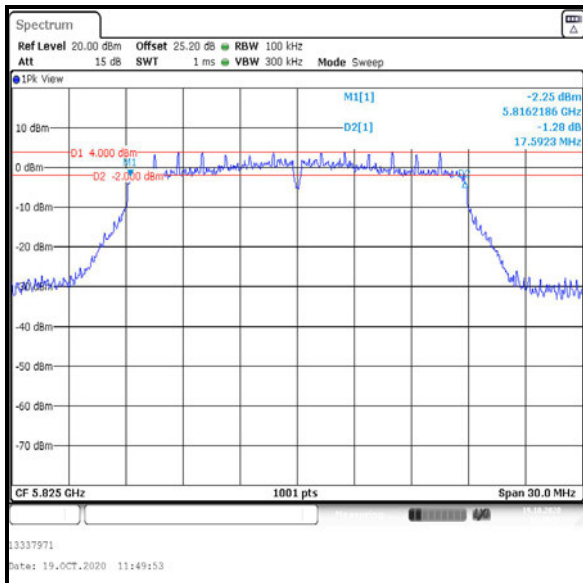
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17622	≥500	17122	Complied
Middle	17592	≥500	17092	Complied
Top	17592	≥500	17092	Complied



Bottom Channel



Middle Channel

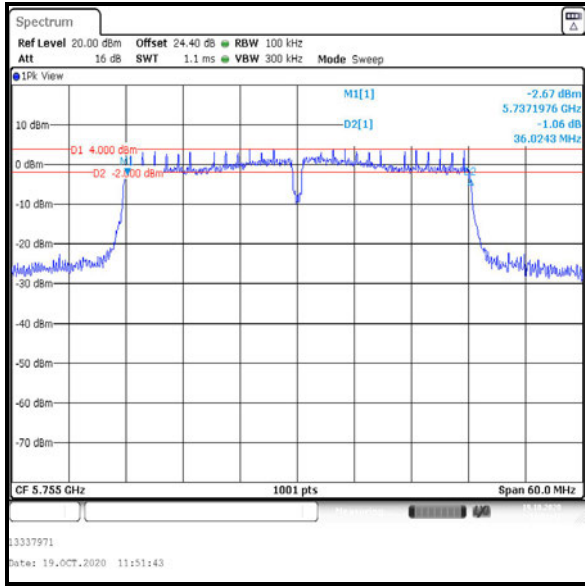


Top Channel

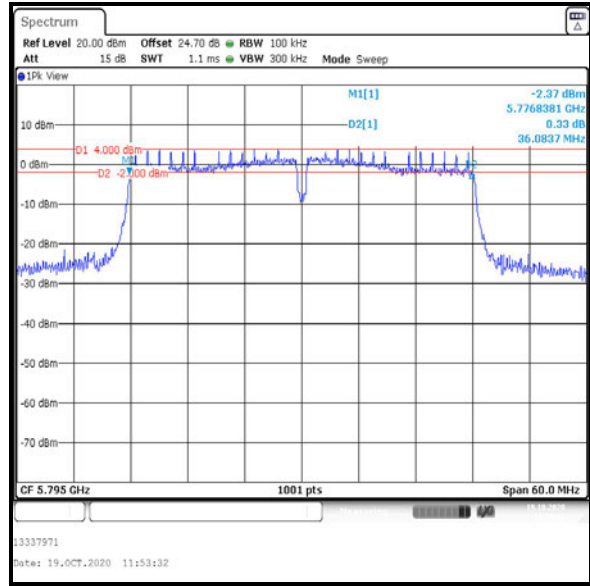
**Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 40 MHz / BPSK / MCS0**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	36024	≥500	35524	Complied
Top	36084	≥500	35584	Complied



Bottom Channel

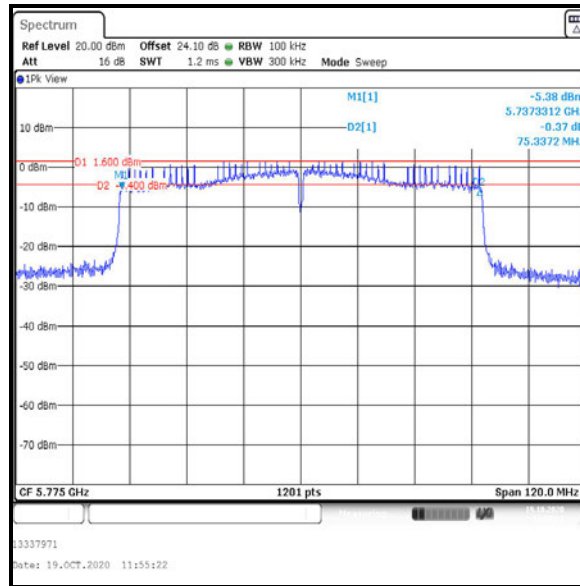


Top Channel

**Transmitter Minimum 6 dB Bandwidth (5.725-5.85 GHz band) (continued)**

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

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	75337	≥500	74837	Complied



Single Channel



#### **4.4. Transmitter Maximum Conducted Output Power**

##### **4.4.1. 5.15-5.25 GHz band**

##### **Test Summary:**

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

##### **Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	42

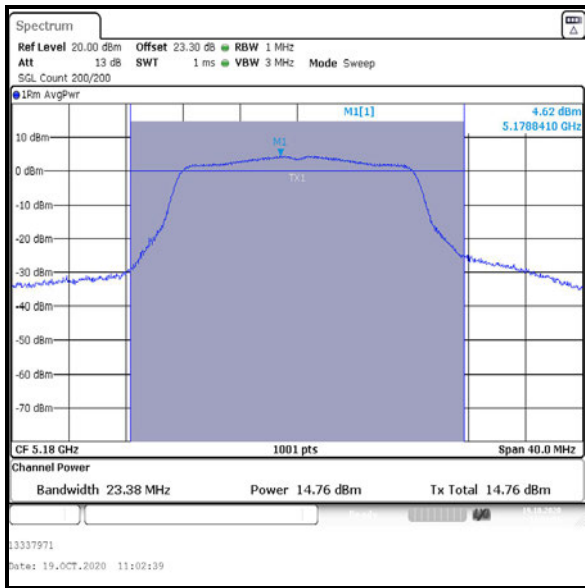
##### **Note(s):**

1. For conducted power tests where the duty cycle is >98%, the measurements were performed using a signal analyser in accordance with KDB 789033 II.E.2.b) Method SA-1. Where the duty cycle is <98%, the measurements were performed in accordance with 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. 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.
3. The Part 15.407(a)(1)(iv) limit shall not exceed 250 mW (24.0 dBm).
4. For all modes of operation, the antenna gain is < 6 dBi.
5. 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.

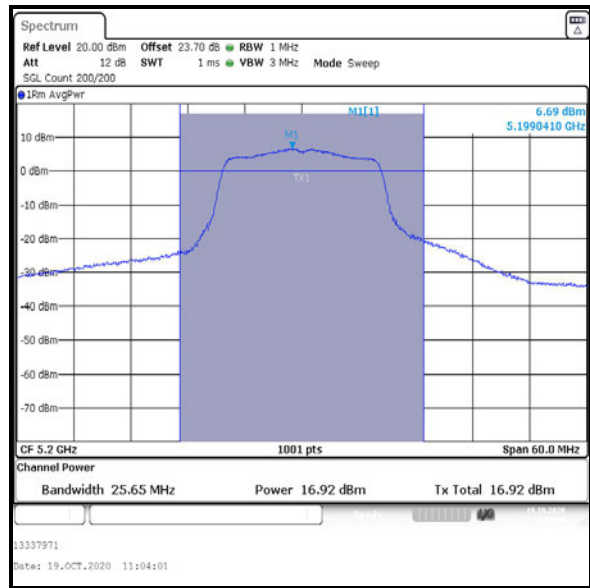
**Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps**

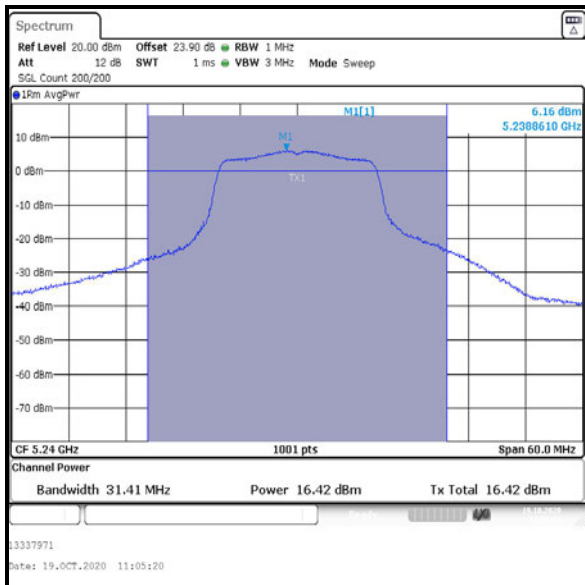
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	14.8	24.0	9.2	Complied
Middle	5200	16.9	24.0	7.1	Complied
Top	5240	16.4	24.0	7.6	Complied



**Bottom Channel**



**Middle Channel**

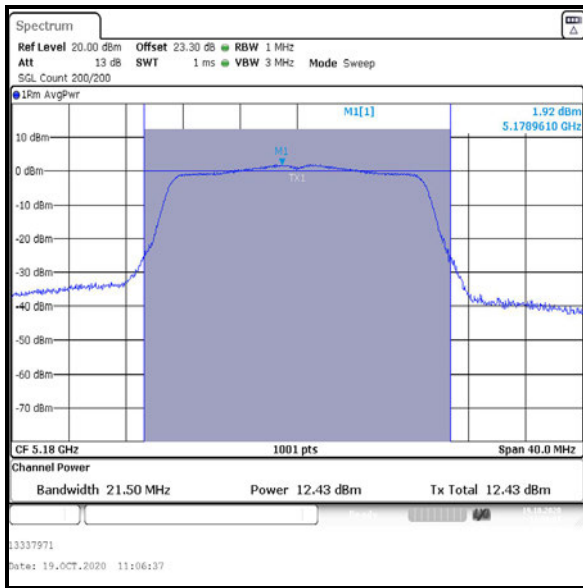


**Top Channel**

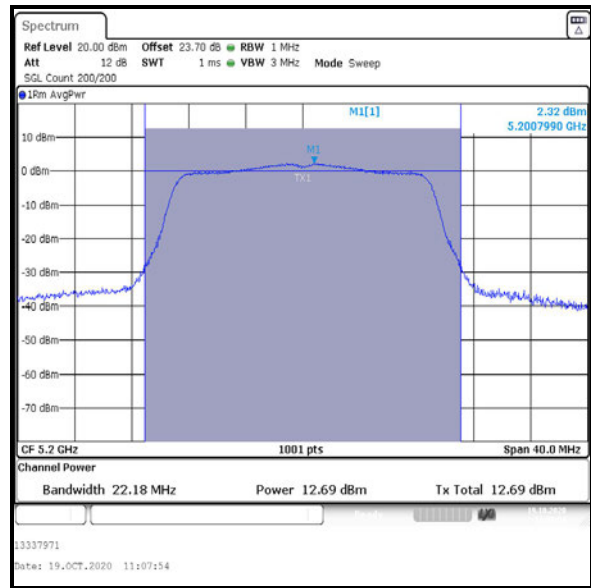
**Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**

**Results: 802.11n / 20 MHz / BPSK / MCS0**

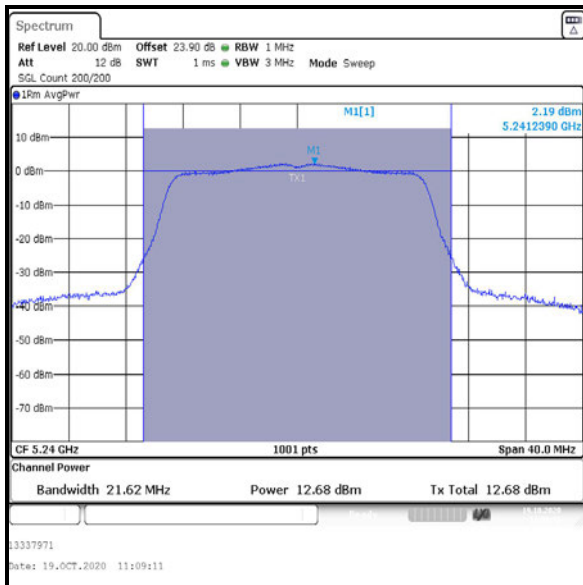
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	12.4	24.0	11.6	Complied
Middle	5200	12.7	24.0	11.3	Complied
Top	5240	12.7	24.0	11.3	Complied



**Bottom Channel**



**Middle Channel**

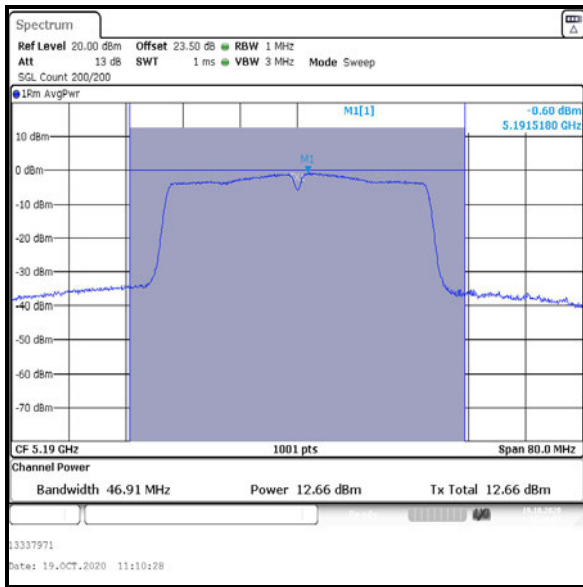


**Top Channel**

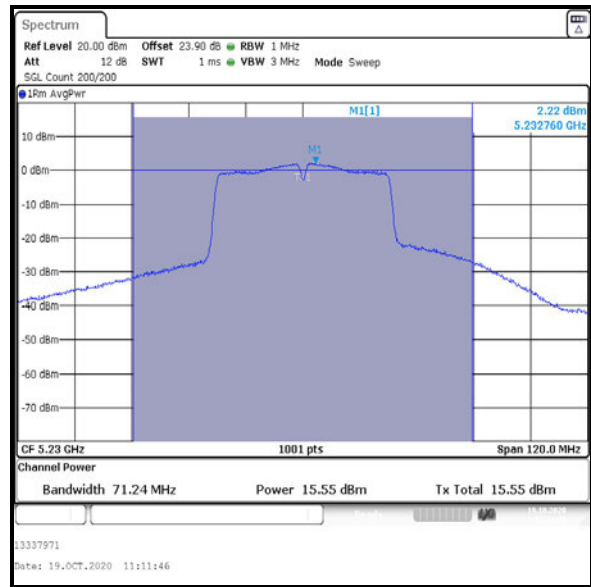
**Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**

**Results: 802.11n / 40 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5190	12.7	0.1	12.8	24.0	11.2	Complied
Top	5230	15.6	0.1	15.7	24.0	8.3	Complied



Bottom Channel

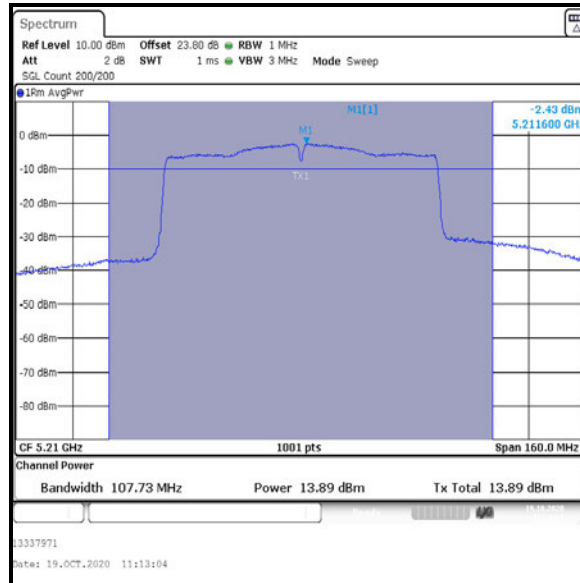


Top Channel

**Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (continued)**

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

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5210	13.9	0.2	14.1	24.0	9.9	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:**

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	42

**Note(s):**

- For conducted power tests where the duty cycle is >98%, the measurements were performed using a signal analyser in accordance with KDB 789033 II.E.2.b) Method SA-1. Where the duty cycle is <98%, the measurements were performed in accordance with 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.
- 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 log<sub>10</sub> 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.

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

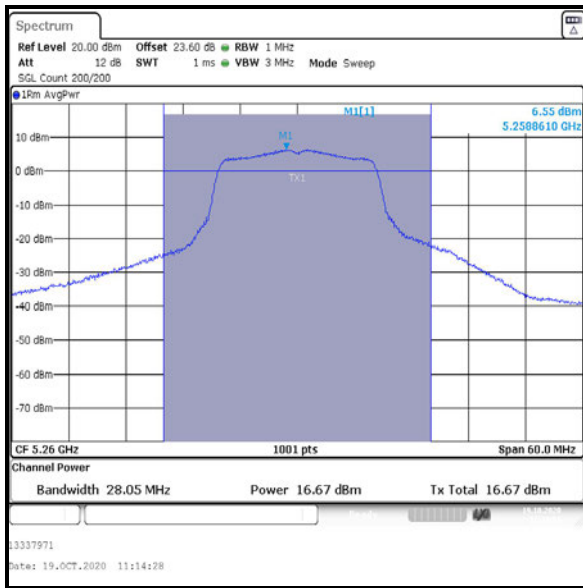
Therefore for measured emission bandwidths greater than 20 MHz, the lesser of the two limits is the fixed limit of 250 mW (24.0 dBm). This was applied to the results.

- For all modes of operation, the antenna gain is < 6 dBi.
- 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.

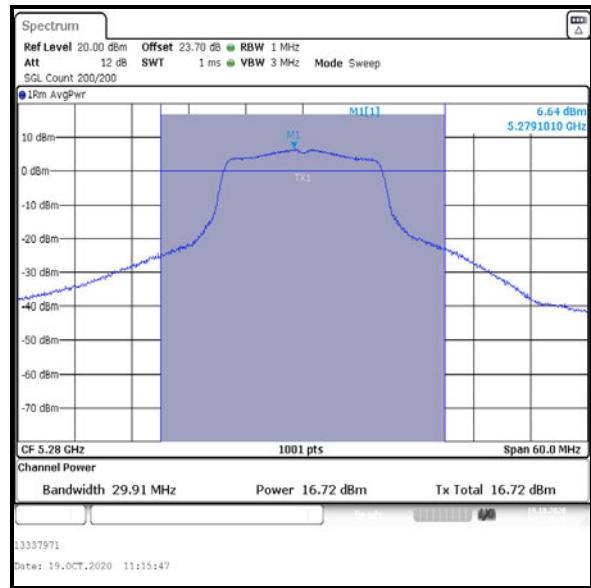
**Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)**

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps**

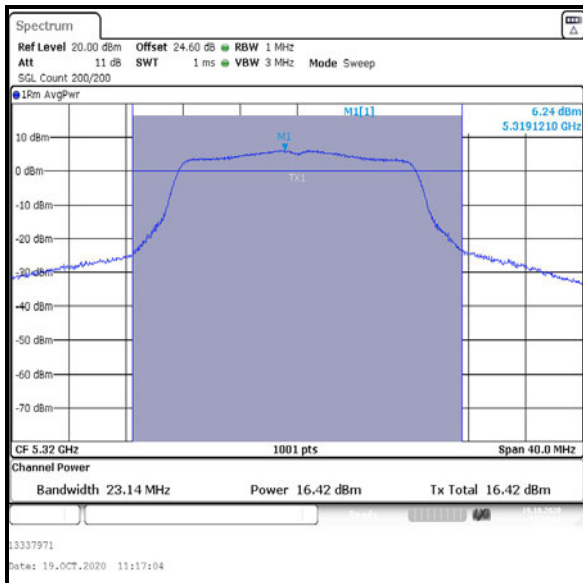
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5260	16.7	24.0	7.3	Complied
Middle	5280	16.7	24.0	7.3	Complied
Top	5320	16.4	24.0	7.6	Complied



**Bottom Channel**



**Middle Channel**

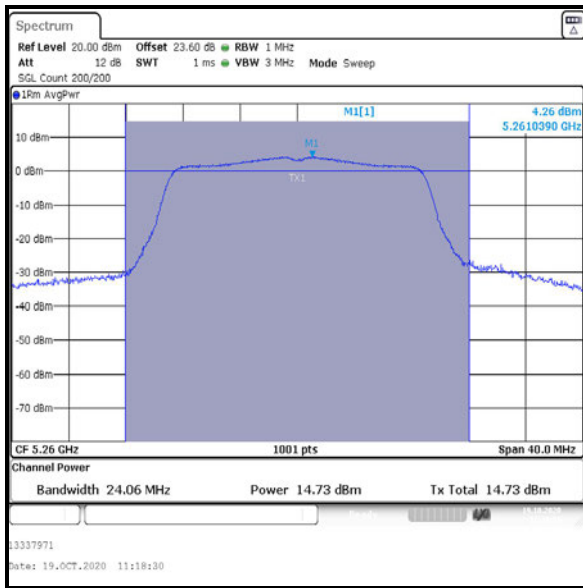


**Top Channel**

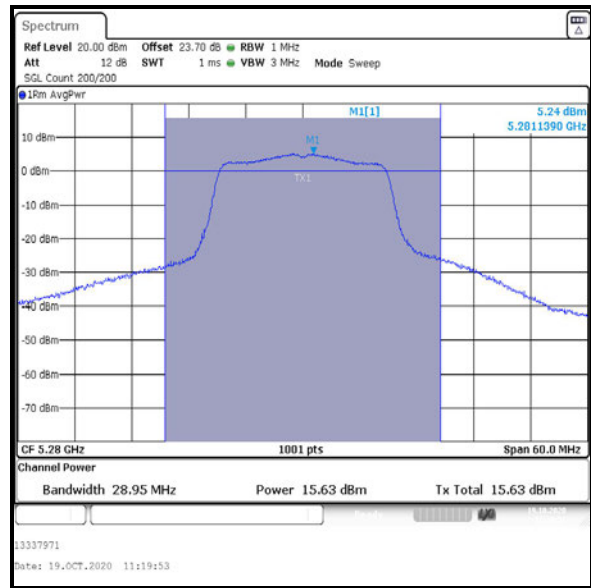
**Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)**

**Results: 802.11n / 20 MHz / BPSK / MCS0**

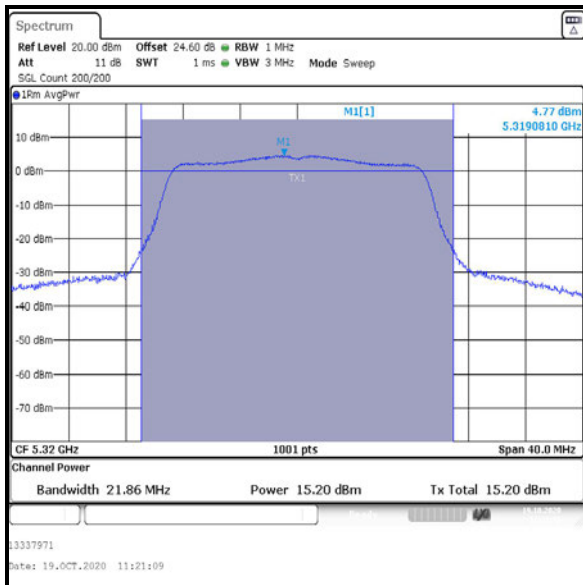
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5260	14.7	24.0	9.3	Complied
Middle	5280	15.6	24.0	8.4	Complied
Top	5320	15.2	24.0	8.8	Complied



**Bottom Channel**



**Middle Channel**



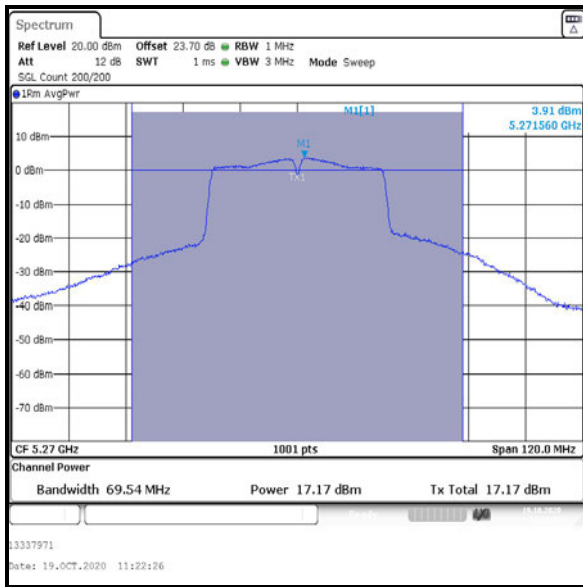
**Top Channel**



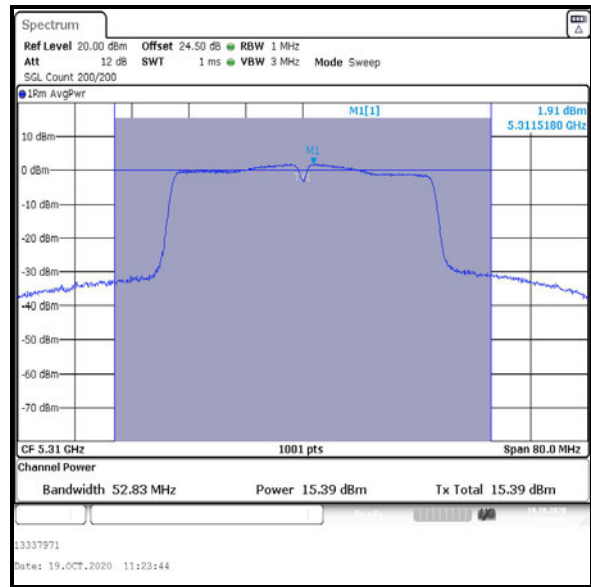
**Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)**

**Results: 802.11n / 40 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5270	17.2	0.1	17.3	24.0	6.7	Complied
Top	5310	15.4	0.1	15.5	24.0	8.5	Complied



Bottom Channel

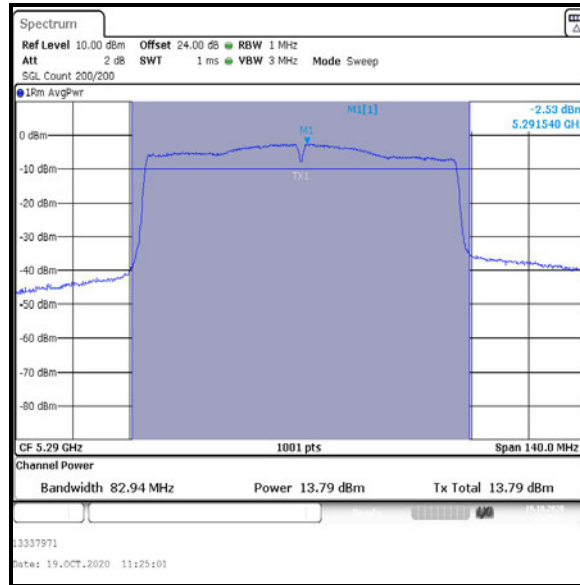


Top Channel

**Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)**

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

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5290	13.8	0.2	14.0	24.0	10.0	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:**

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	42

**Note(s):**

- For conducted power tests where the duty cycle is >98%, the measurements were performed using a signal analyser in accordance with KDB 789033 II.E.2.b) Method SA-1. Where the duty cycle is <98%, the measurements were performed in accordance with 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.
- 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 log<sub>10</sub> 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.

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

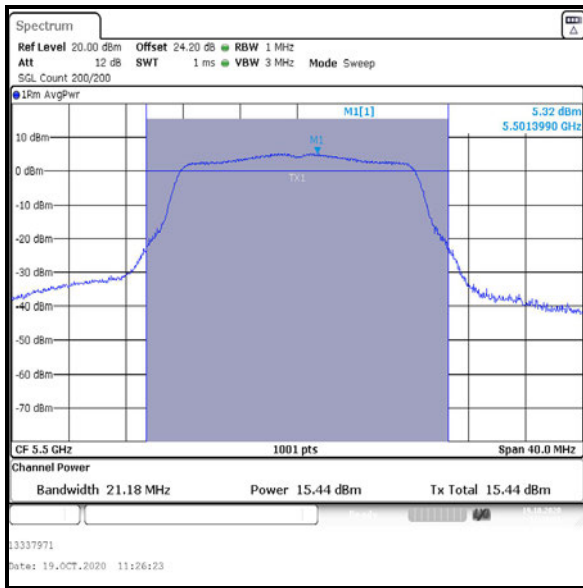
Therefore for measured emission bandwidths greater than 20 MHz, the lesser of the two limits is the fixed limit of 250 mW (24.0 dBm). This was applied to the results.

- For all modes of operation, the antenna gain is < 6 dBi.
- 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.

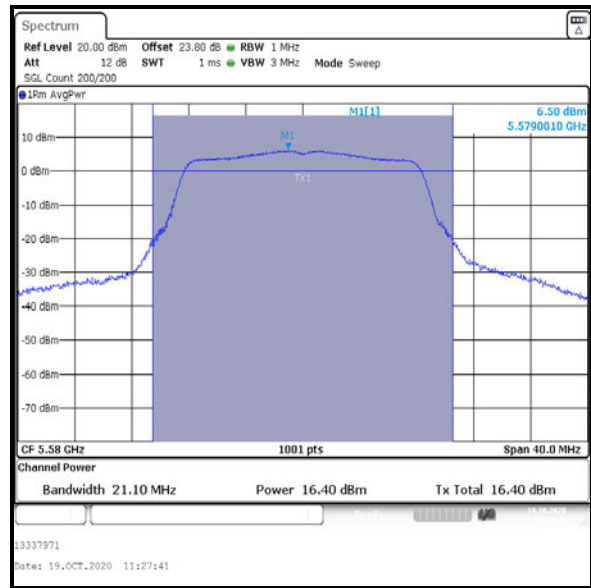
**Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)**

**Results: 802.11a / 20 MHz / 6 Mbps**

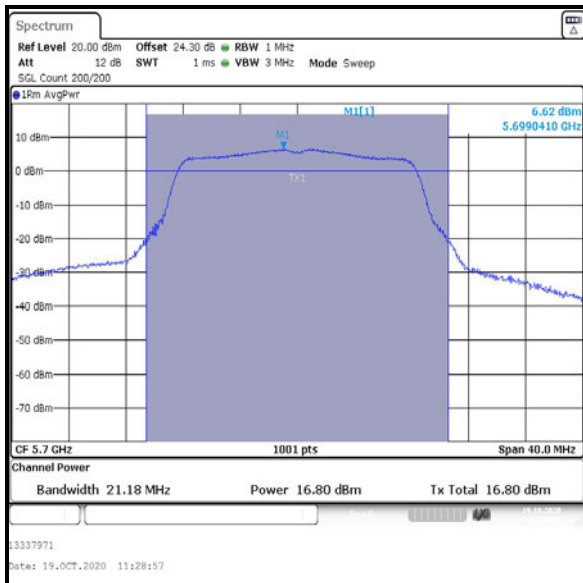
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5500	15.4	24.0	8.6	Complied
Middle	5580	16.4	24.0	7.6	Complied
Top	5700	16.8	24.0	7.2	Complied



**Bottom Channel**



**Middle Channel**

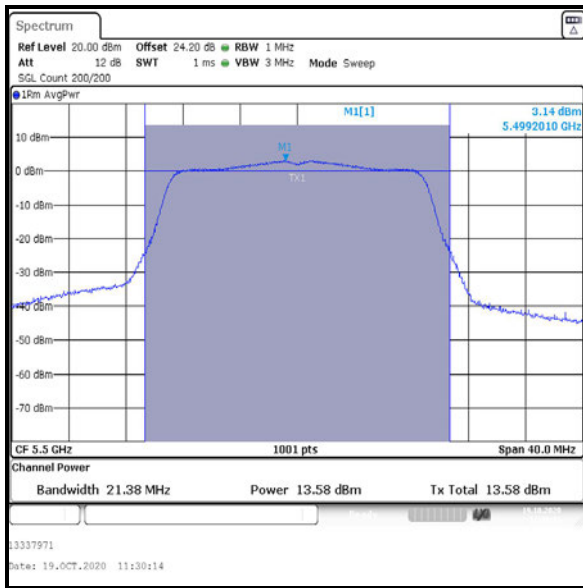


**Top Channel**

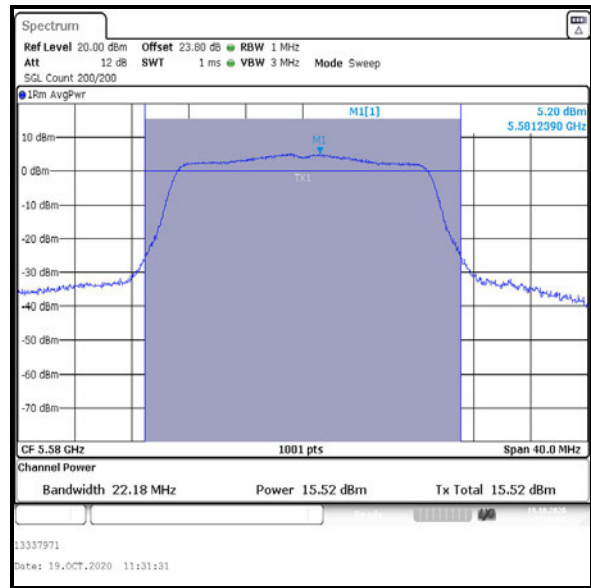
**Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)**

**Results: 802.11n / 20 MHz / BPSK / MCS0**

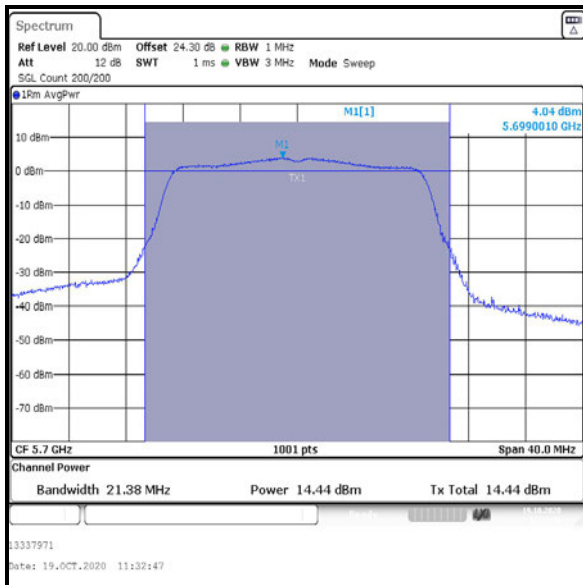
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5500	13.6	24.0	10.4	Complied
Middle	5580	15.5	24.0	8.5	Complied
Top	5700	14.4	24.0	9.6	Complied



**Bottom Channel**



**Middle Channel**

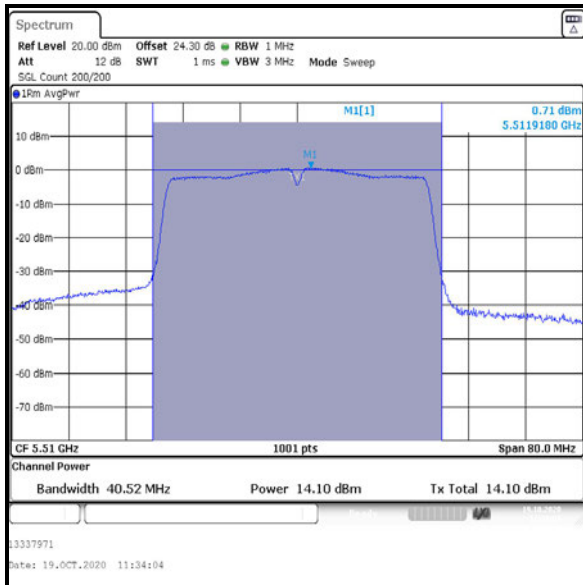


**Top Channel**

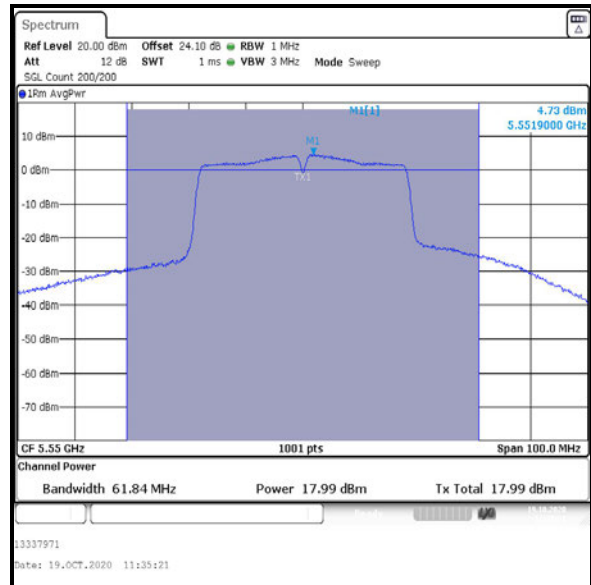
**Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)**

**Results: 802.11n / 40 MHz / BPSK / MCS0**

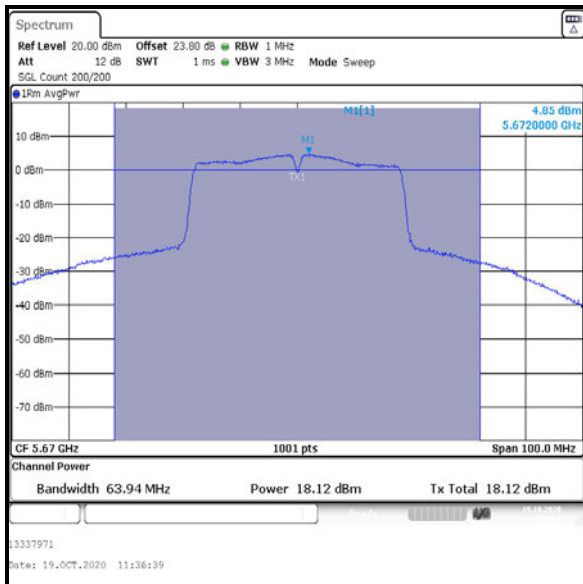
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5510	14.1	0.1	14.2	24.0	9.8	Complied
Middle	5550	18.0	0.1	18.1	24.0	5.9	Complied
Top	5670	18.1	0.1	18.2	24.0	5.8	Complied



**Bottom Channel**



**Middle Channel**

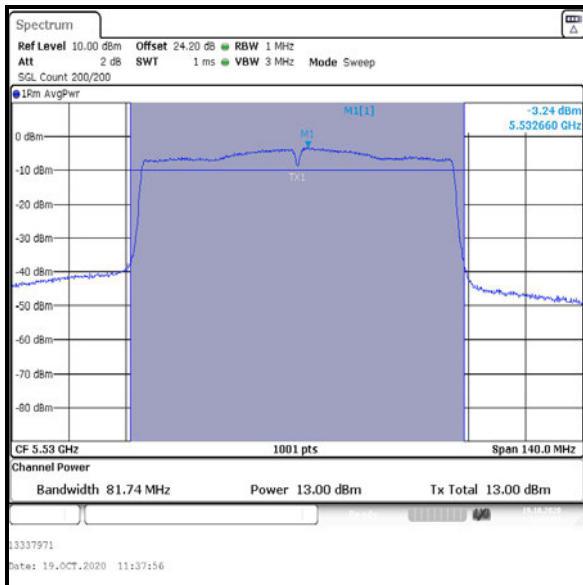


**Top Channel**

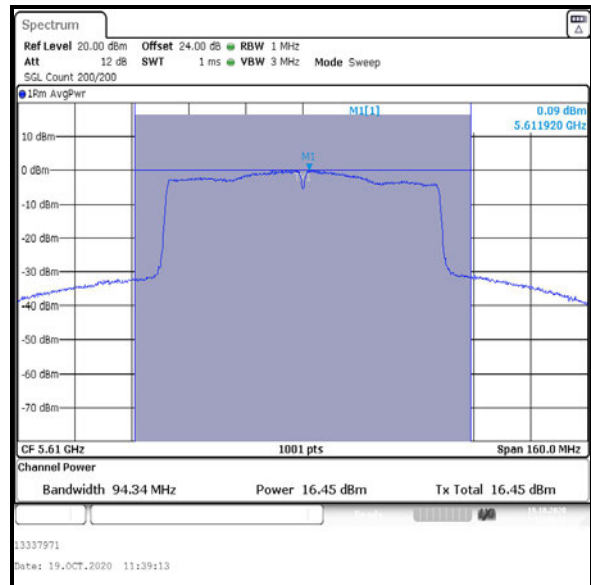
**Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)**

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

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5530	13.0	0.2	13.2	24.0	10.8	Complied
Top	5610	16.5	0.2	16.7	24.0	7.3	Complied



Bottom Channel



Top Channel

**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band)****4.4.4. 5.725-5.85 GHz band****Test Summary:**

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	42

**Note(s):**

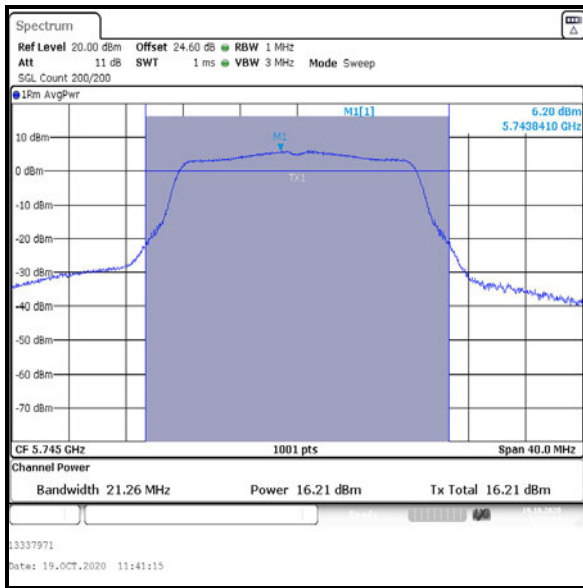
1. For conducted power tests where the duty cycle is >98%, the measurements were performed using a signal analyser in accordance with KDB 789033 II.E.2.b) Method SA-1. Where the duty cycle is <98%, the measurements were performed in accordance with KDB 789033 II.E.2.d) Method SA-2. The signal analyser's 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. 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.
3. The FCC Part 15.407(a)(3) limit shall not exceed 1 W (30.0 dBm).
4. For all modes of operation, the antenna gain is < 6 dBi.
5. 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.



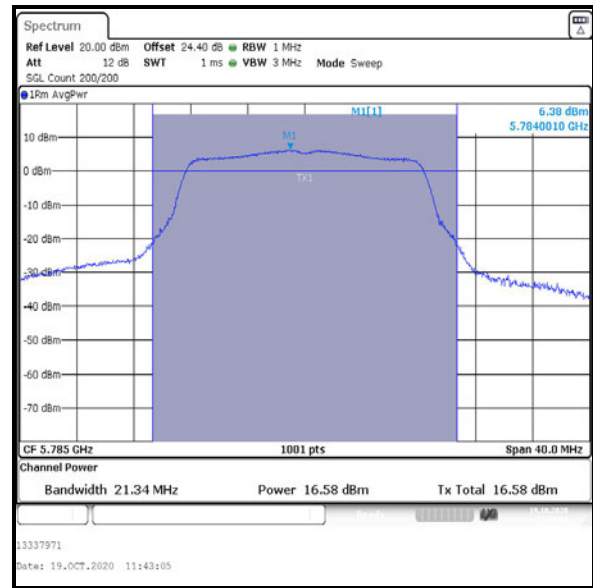
**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

**Results: 802.11a / 20 MHz / BPSK / 6 Mbps**

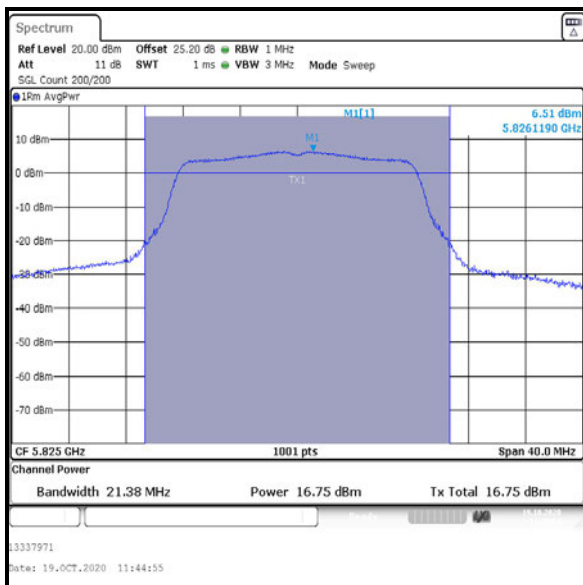
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5745	16.2	30.0	13.8	Complied
Middle	5785	16.6	30.0	13.4	Complied
Top	5825	16.8	30.0	13.2	Complied



**Bottom Channel**



**Middle Channel**

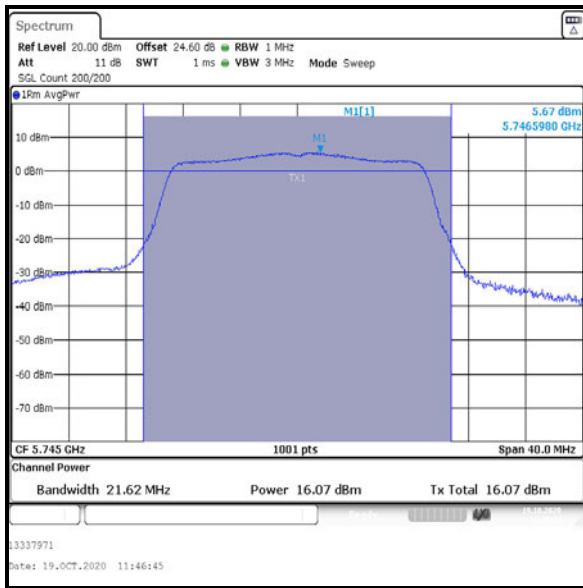


**Top Channel**

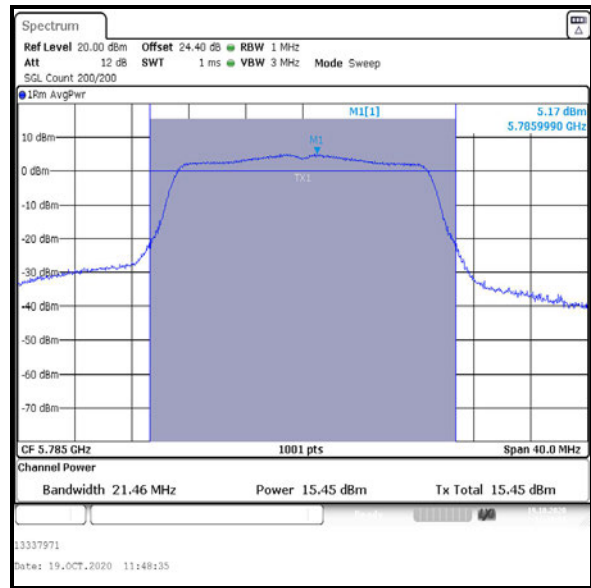
**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 20 MHz / BPSK / MCS0**

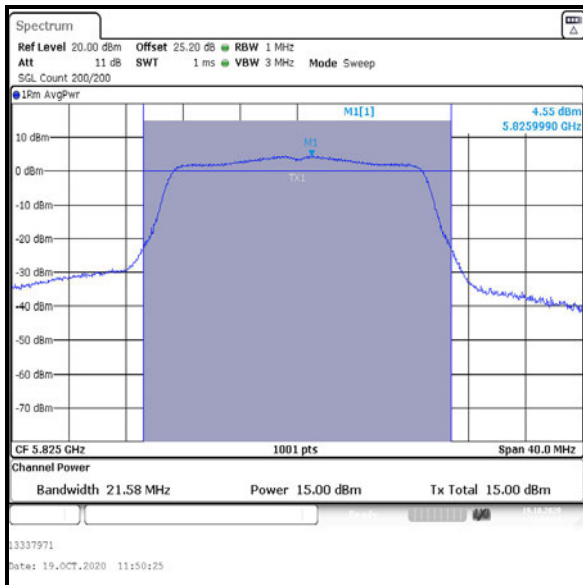
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5745	16.1	30.0	13.9	Complied
Middle	5785	15.5	30.0	14.5	Complied
Top	5825	15.0	30.0	15.0	Complied



**Bottom Channel**



**Middle Channel**

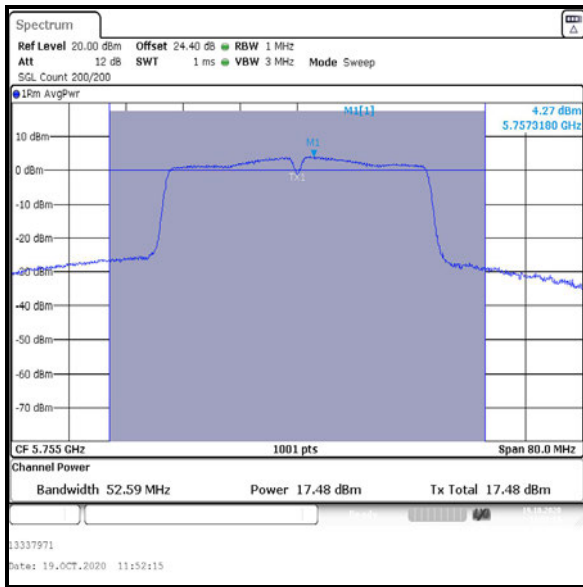


**Top Channel**

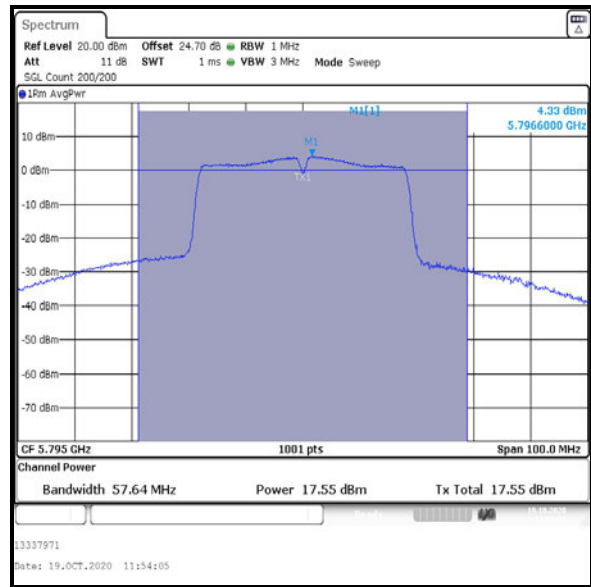
**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

**Results: 802.11n / 40 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5755	17.5	0.1	17.6	30.0	12.4	Complied
Top	5795	17.6	0.1	17.7	30.0	12.3	Complied



**Bottom Channel**

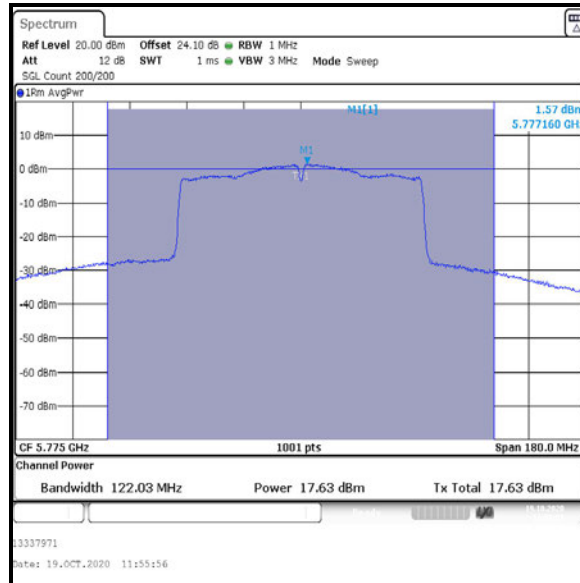


**Top Channel**

**Transmitter Maximum Conducted Output Power (5.725-5.85 GHz band) (continued)**

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

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Single	5775	17.6	0.2	17.8	30.0	12.2	Complied



**Single Channel**

## **4.5. Transmitter Maximum Power Spectral Density**

### **4.5.1. 5.15-5.25 GHz band**

#### **Test Summary:**

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	42

#### **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 where the duty cycle is >98% and II.E.2.d) Method SA-2 where the duty cycle was <98%.
2. 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.
3. FCC Part 15.407(a)(1)(iv) limit for PSD is <11 dBm/MHz.
4. For all modes of operation, the antenna gain is < 6 dBi.
5. 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.
6. 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 / BPSK / 6 Mbps**

Channel	Frequency (MHz)	PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5180	4.6	11.0	6.4	Complied
Middle	5200	6.7	11.0	4.3	Complied
Top	5240	6.2	11.0	4.8	Complied

**Results: 802.11n / 20 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5180	1.9	11.0	9.1	Complied
Middle	5200	2.3	11.0	8.7	Complied
Top	5240	2.2	11.0	8.8	Complied

**Results: 802.11n / 40 MHz / BPSK / MCS0**

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	2.2	0.1	2.3	11.0	8.7	Complied

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

Channel	Frequency (MHz)	PSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Single	5210	-2.4	0.2	-2.2	11.0	13.2	Complied

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

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	42

**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 where the duty cycle is >98% and II.E.2.d) Method SA-2 where the duty cycle was <98%.
2. 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.
3. FCC Part 15.407(a)(2) limit for PSD in the 5.25-5.35 GHz band is <11 dBm/MHz.
4. For all modes of operation, the antenna gain is < 6 dBi.
5. 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.
6. 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 / BPSK / 6 Mbps**

Channel	Frequency (MHz)	PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5260	6.6	11.0	4.4	Complied
Middle	5280	6.6	11.0	4.4	Complied
Top	5320	6.2	11.0	4.8	Complied

**Results: 802.11n / 20 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5260	4.3	11.0	6.7	Complied
Middle	5280	5.2	11.0	5.8	Complied
Top	5320	4.8	11.0	6.2	Complied

**Results: 802.11n / 40 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	PSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5270	3.9	0.1	4.0	11.0	7.0	Complied
Top	5310	1.9	0.1	2.0	11.0	9.0	Complied

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

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	11.0	13.3	Complied



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

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	42

**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 where the duty cycle is >98% and II.E.2.d) Method SA-2 where the duty cycle was <98%.
2. 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.
3. FCC Part 15.407(a)(2) limit for PSD in the 5.47-5.725 GHz band is <11 dBm/MHz.
4. For all modes of operation, the antenna gain is < 6 dBi.
5. 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.
6. 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 / BPSK / 6 Mbps**

Channel	Frequency (MHz)	PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Bottom	5500	5.3	11.0	5.7	Complied
Middle	5580	6.5	11.0	4.5	Complied
Top	5700	6.6	11.0	4.4	Complied

**Results: 802.11n / 20 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Bottom	5500	3.1	11.0	7.9	Complied
Middle	5580	5.2	11.0	5.8	Complied
Top	5700	4.0	11.0	7.0	Complied

**Results: 802.11n / 40 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	PSD (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Bottom	5510	0.7	0.1	0.8	11.0	10.2	Complied
Middle	5590	4.7	0.1	4.8	11.0	6.2	Complied
Top	5670	4.9	0.1	5.0	11.0	6.0	Complied

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

Channel	Frequency (MHz)	PSD (dBm/MHz)	Duty cycle correction factor (dB)	Corrected PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Result
Bottom	5530	-3.2	0.2	-3.0	11.0	14.0	Complied
Top	5610	0.1	0.2	0.3	11.0	10.7	Complied

**Transmitter Maximum Power Spectral Density (5.725-5.85 GHz band)****4.5.4. 5.725-5.85 GHz band****Test Summary:**

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	19 October 2020
<b>Test Sample Serial Number:</b>	3157589		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	42

**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 where the duty cycle is >98% and II.E.2.d) Method SA-2 where the duty cycle was <98%.
2. 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.
3. FCC Part 15.407(a)(3) limit for PPSD in the 5.725-5.85 GHz operating band is <30 dBm/500 kHz.
4. 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.
5. For all modes of operation, the antenna gain is < 6 dBi.
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. 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 / BPSK / 6 Mbps**

Channel	Frequency (MHz)	PSD (dBm / 1 MHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5745	6.2	30.0	23.8	Complied
Middle	5785	6.4	30.0	23.6	Complied
Top	5825	6.5	30.0	23.5	Complied

**Results: 802.11n / 20 MHz / BPSK / MCS0**

Channel	Frequency (MHz)	PSD (dBm / 1 MHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5745	5.7	30.0	24.3	Complied
Middle	5785	5.2	30.0	24.8	Complied
Top	5825	4.6	30.0	25.4	Complied

**Results: 802.11n / 40 MHz / BPSK / MCS0**

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	4.3	0.1	4.4	30.0	25.6	Complied
Top	5795	4.3	0.1	4.4	30.0	25.6	Complied

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

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	1.6	0.2	1.8	30.0	28.2	Complied

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