TEST REPORT

Test Report No. : UL-RPT-RP-11909763-3316-FCC-UNII3

Applicant	:	SIEMENS AG
Model No.	:	MPCIE-R1-ABGNAC-U4
FCC ID	:	LYHRAPACV1
Technology	:	WLAN 5 GHz
Test Standard(s)	:	FCC Parts 15.207, 15.209(a) & 15.407

For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. Test Report Version 1.0
5. Result of the tested sample: **PASS**

Prepared by: Krume, Ivanov
Title: Laboratory Engineer
Date: 12 February 2020

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 12 February 2020

Deutsche Akkreditierungsstelle
D-PL-19381-02-00

This laboratory is accredited by DAkkS.
The tests reported herein have been performed in accordance with its' terms of accreditation.

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1.Customer Information

1.1.Applicant Information

Company Name:	SIEMENS AG
Company Address:	Östliche Rheinbrückenstr. 50, 76187 Karlsruhe, Germany
Contact Person:	Dr. Malgorzata Janson
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1.2.Manufacturer Information

Company Name:	SIEMENS AG
Company Address:	76181 Karlsruhe, Germany
Contact Person:	Mr. Kilian Löser
Contact E-Mail Address:	kilian.loeser@siemens.com
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2. Summary of Testing

2.1. General Information

Applied Standards

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:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Test Firm Registration:	399704

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany

Date information

Order Date:	26 September 2017
EUT arrived:	26 January 2018
Test Dates:	13 February 2019 to 06 February 2020
EUT returned:	-/-

2.2. Summary of Test Results

Clause	Measurement (5.725-5.85 GHz band)	Complied	Did not comply	Not performed	Not applicable
Part 15.207	Transmitter AC Conducted Emissions	☒	☐	☐	☐
Part 15.403(i)	Transmitter 26 dB Emission Bandwidth	☒	☐	☐	☐
Part 15.407(e)	Transmitter Minimum 6 dB Bandwidth	☒	☐	☐	☐
Part 15.35(c)	Transmitter Duty Cycle	☒	☐	☐	☐
Part 15.407(a)(3)	Transmitter Maximum Conducted Output Power	☒	☐	☐	☐
Part 15.407(a)(3)	Transmitter Peak Power Spectral Density	☒	☐	☐	☐
Part 15.407(b)/15.209(a)	Transmitter Out of Band Radiated Emissions	☒	☐	☐	☐
Part 15.407(b)/15.209(a)	Transmitter Band Edge Radiated Emissions	☒	☐	☐	☐
Part 15.407(g)	Transmitter Frequency Stability(Note 1) (Temperature & Voltage Variation)	☐	☐	☒	☐
Part 15.407(h)(1)	Transmitter Power Control	☐	☐	☐	☒

Note:

1. As per applicant's user manual 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.

2.3. 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
Reference:	KDB 662911 D01 Multiple Transmitter Output v02r01 October 31, 2013
Title:	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
Reference:	KDB 174176 D01 Line Conducted FAQ v01r01June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	SIEMENS
Model Name or Number:	MPCIE-R1-ABGNAC-U4
Model Type:	A5E36528526
Serial/ Fixed IP Number:	192.168.0.80 (Radiated Test Sample)
Hardware Version Number:	1
Software Version Number:	T01.00.00
FCC ID :	LYHRAPACV1

Brand Name:	SIEMENS
Model Name or Number:	MPCIE-R1-ABGNAC-U4
Model Type:	A5E36528526
Serial/ Fixed IP Number:	192.168.0.60 (Conducted Test Sample)
Hardware Version Number:	1
Software Version Number:	T01.00.00
FCC ID:	LYHRAPACV1

3.2. Description of EUT

The equipment under test was a 4 X 4 MIMO radio module supporting WLAN 2.4 GHz & WLAN 5 GHz technologies.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	WLAN (IEEE 802.11a,n, ac)		
Type of Unit:	Transceiver		
Test Evaluation Board Power Supply Requirement(s):	Nominal	24.0 V DC	
	Minimum	16.8 V DC	
	Maximum	31.2 V DC	
EUT Power Supply Requirement(s):	Power Range	3.3 V DC ± 5 %	520 mA
	Power Range	5.0 V DC ± 5 %	700 mA
Temperature Requirement(s):	Nominal	23 °C	
Relative Humidity	30 %		
Supported Modulation Types:	BPSK, QPSK, 16QAM, 64QAM, 256QAM		
Supported Data rates:	802.11a	6, 9, 12, 18, 24, 36 ,48 & 54 Mbit/s (SISO or MIMO)	
	802.11n HT20	MCS0 to MCS7 (1 spatial stream) MCS8 to MCS15 (2 spatial streams) MCS16 to MCS23 (3 spatial streams) MCS24 to MCS31 (4 spatial streams)	
	802.11n HT40	MCS0 to MCS7 (1 spatial stream) MCS8 to MCS15 (2 spatial streams) MCS16 to MCS23 (3 spatial streams) MCS24 to MCS31 (4 spatial streams)	
	802.11ac HT20	MCS0 to MCS8 (up to 4 spatial streams)	
	802.11ac HT40	MCS0 to MCS9 (up to 4 spatial streams)	
	802.11ac HT80	MCS0 to MCS9 (up to 4 spatial streams)	
Antenna Gains:	Refer section 3.5 Antenna Information		
Maximum Conducted Output Power:	20 MHz	24.3 dBm	
	40 MHz	21.2 dBm	
	80 MHz	18.0 dBm	
Transceiver Frequency Band:	5725 MHz to 5850 MHz [U-NII-3 Band]		
Nominal Channel Bandwidth	20 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	149	5745
	Bottom +1	153	5765
	Middle	157	5785
	Top -1	161	5805
	Top	165	5825
Nominal Channel Bandwidth	40 MHz		
Transmit Channels Tested:	Bottom	151	5755
	Top	159	5795
Nominal Channel Bandwidth	80 MHz		
Transmit Channels Tested:	Single	155	5755

3.5. Antenna Information

Antenna types with highest antenna gains amongst their supported radiation patterns were used for the EUT testing:

Antenna Group:	8 dBi Antenna Group
Antenna Radiation Type:	Omni Directional
Antenna Model Number:	ANT795-6MN
Antenna Gain:	8 dBi @ 5 GHz
Antenna Beamwidth:	150°
Antenna Connector Type:	N
Manufacturer Article Number:	6GK5795-6MN10-0AA6
Batch Number:	1000744236

Antenna Group:	9 dBi Antenna Group
Antenna Radiation Type:	Sector
Antenna Model Number:	ANT795-6DC
Antenna Gain:	9 dBi @ 5 GHz
Antenna Beamwidth:	55°H / 55°V
Antenna Connector Type:	N
Manufacturer Article Number:	6GK5795-6DC00-0AA0
Batch Number:	006.707039

Antenna Group:	23 dBi Antenna Group
Antenna Radiation Type:	Directed
Antenna Model Number:	ANT793-8DK
Antenna Gain:	23 dBi @ 5 GHz
Antenna Cable Loss:	8.8 dB @ 5 GHz
Effective Antenna Gain:	14.2 dBi @ 5 GHz
Antenna Beamwidth:	9° H / 9° V
Antenna Connector Type:	N
Manufacturer Article Number:	6GK5793-8DK00-0AA0
Batch Number:	02 722467

3.6. Support Equipment

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

A. Support Equipment (In-house)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Laptop	Lenovo	L560	MP-16X73B 16/11
2	Lab DC Power Supply	Conrad Electronic	PS-2403D	Not stated
3	Lab Voltage Rectifier Power Supply	Spitzenberger Spies	PAS 5000	A2464 00/2 0200

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	DC Power Supply Cable (Length: 2 m | Quantity: 2 Pcs)	--	Standard 2 wire cable	--
2	M12- RJ45 Ethernet Cable (Length: 2 m | Quantity: 2 Pcs)	SIEMENS	LEONI L INDUSTRIAL ETHERNET FLEXIBLE 6XV1870-2E	--
3	N-N Connector Antenna Cable (Length: 10 m | Quantity: 4 Pcs)	SIEMENS Simatic Net Antenna Cable	6XV1875-5AN10 J39	--
4	Test Evaluation Board (Quantity: 2 Pcs)	SIEMENS	A5E36374290-AE GTW 18 94V-0	--
5	UMCC- N Connector Cable (Length: 0.25 m | Quantity: 4 Pcs)	SIEMENS	--	--
6	N Connector-50 Ω Terminations (Quantity: 4 Pcs)	SIEMENS	--	--
7	SIMATIC PS 307 Power Supply (Input: AC 120 /230 V | 2.3 /1.2 A | 50-60 Hz) (Output: DC 24 V| 5 A) | (Quantity: 1 Pcs)	SIEMENS	6ES7307-1EA01-0AA0	YSU/HO 165357

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

☒ **Continuously transmitting modulated carrier with combination of**

- **Maximum Power Settings** [refer section 4.3]
- **Test Channels** [refer section 3.4]
- **Worst Case* SISO and MIMO modes :**
  - 802.11a: 6 Mbit/s / SISO Mode
  - 802.11n HT20: MCS0 / SISO Mode
  - 802.11n HT40: MCS0 / SISO Mode
  - 802.11ac HT20: MCS0 / SISO Mode
  - 802.11ac HT40: MCS0 / SISO Mode
  - 802.11ac HT80: MCS0 / SISO Mode
  - 802.11a: 6 Mbit/s / MIMO Modes
  - 802.11n HT20: MCS0 / MIMO Modes
  - 802.11n HT40: MCS0 / MIMO Modes
  - 802.11ac HT20: MCS0 / MIMO Modes
  - 802.11ac HT40: MCS0 / MIMO Modes
  - 802.11ac HT80: MCS0 / MIMO Modes

*Multiple supported modulation schemes, nominal channel bandwidths and SISO/MIMO configurations were initially investigated to determine the above mentioned worst case data rates.

4.2. Configuration and Peripherals

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

- **EUT Power Supply:**

o For AC Conducted measurement EUT(the radio module) was mounted on Test Evaluation Board. Using Siemens SIMATIC PS 307 Power Supply, 24 V DC was supplied to this board; which in turn supplying 3.3 V DC to EUT.

o For all conducted measurements EUT(the radio module) was mounted on Test Evaluation Board. Using Lab DC Power Supply 24 V DC was supplied to this board; which in turn supplying 3.3 V DC to EUT.

o For all radiated measurements EUT(the radio module) was mounted on Test Evaluation Board. Using Lab Voltage Rectifier Power Supply 24 V DC was supplied to this board; which in turn supplying 3.3 V DC to EUT.

- **Test Mode Activation:**

o For continuous transmit tests the EUT was controlled using the chipset manufacturers 'cli' console over tera-term and putty. This was run from within the terminal application on the EUT. The application was used to enable continuous transmission mode and to select the test channels, data rates and modulation schemes as required.

- **Worst Case Mode Determination:**

o Multiple supported modulation schemes, nominal channel bandwidths and SISO+MIMO Modes configurations were initially investigated to determine worst case modes.

o The data rates that produced worst case results for each 802.11 mode (a/n/ac) were then used for measurements presented in this report.

- **Conducted Measurements:**

o RF Output Power, Power Spectral Density measured separetly on each Port with all supported SISO & MIMO Port combinations.

o For Occupied Channel Bandwidth & Duty Cycles were computed with worst case SISO mode; as they found to be independent of number of transmitter chains used.

o Conducted sourious emissions measurements were performed with SISIO Mode; as this port was found to have the worst case in terms of power settings amongst all supported possible SISO & MIMO Port combinations.

- **AC Conducted Emissions Measurements:**

o AC conducted tests were performed with all listed Antenna Groups with MIMO Port 1+2+3+4, employing maximum possible Antennas.

o The Toyo EMI Software EP5/CE Ver 4.0.1. was used for these measurements.

- **Radiated Band Edge Measurements:**

o Radiated Band edge emissions were performed with Antenna types listed in section 3.5 with all possible MIMO Port combinations.

o Radiated Band edge emissions were performed with the EUT & Antennas in the orientation simulating the worst case spurious emissions.

- **Raidated Cabinet Emission Measurements:**

o Transmitter cabinet radiated emissions were performed by terminating EUT's all 4-MIMO Ports with 50 Ω (proper impedance matching) and with maximum supported power settings amongst all supported SISO & MIMO Port combinations as well as amongst listed Antenna types.

o EMC32 V10.1.0 Software & Toyo EP5/RE Ver 4.0.1 were used for these measurements.

- **Applicable to all Tests:**

o All the supplied antennas listed in section 3.5 have been tested with power settings in section 4.3.

o During testing unused EUT ports were terminated as listed in section 4.3.

4.3. Used Power Settings & Port Terminations

The EUT was configured with following GUI Power Settings (PWL) & test channels for 8 dBi Antenna configurations.

5725 MHz to 5850 MHz [U-NII-3 Band]								
8 dBi Antenna Group								
SISO Port 1 (Note 1)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	26	N/T**	26	N/T**	26	151	159	80 MHz
n-mode : MCS0	26	N/T**	26	N/T**	26	26	26	155
ac-mode: MCS0	26	N/T**	26	N/T**	26	26	26	26
Note 1: Unused Ports 2,3 & 4 Terminatd with 50 Ω								
MIMO Port 1+2 (Note 2)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	26	N/T**	26	N/T**	26	151	159	80 MHz
n-mode : MCS0	26	N/T**	26	N/T**	26	26	26	155
ac-mode: MCS0	26	N/T**	26	N/T**	26	26	26	26
Note 2: Unused Ports 3 & 4 Terminatd with 50 Ω								
MIMO Port 1+2+3 (Note 3)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	23	26	26	26	23	151	159	80 MHz
n-mode : MCS0	23	26	26	26	23	23	23	155
ac-mode: MCS0	23	26	26	26	23	23	23	23
Note 3: Unused Port 4 Terminatd with 50 Ω								
MIMO Port 1+2+3+4 (Note 4)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	21	24	24	24	21	151	159	80 MHz
n-mode : MCS0	21	24	24	24	21	21	21	155
ac-mode: MCS0	21	24	24	24	21	21	21	21
Note 4: None of the Port was Terminatd with 50 Ω								
N/T** : CH153 not tested as it has same PWL as that of CH149 | CH161 not tested as it has same PWL as that of CH165								

The EUT was configured with following GUI Power Settings (PWL) & test channels for 9 dBi Antenna configurations.

5725 MHz to 5850 MHz [U-NII-3 Band]								
9 dBi Antenna Group								
SISO Port 1 (Note 1)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	16	26	26	26	16	151	159	80 MHz
n-mode : MCS0	16	26	26	26	16	16	16	155
ac-mode: MCS0	16	26	26	26	16	16	16	16
Note 1: Unused Ports 2,3 & 4 Terminatd with 50 Ω								
MIMO Port 1+2 (Note 2)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	21	26	26	26	21	151	159	80 MHz
n-mode : MCS0	21	26	26	26	21	21	21	155
ac-mode: MCS0	21	26	26	26	21	21	21	21
Note 2: Unused Ports 3 & 4 Terminatd with 50 Ω								
MIMO Port 1+2+3 (Note 3)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	17	22	22	22	17	151	159	80 MHz
n-mode : MCS0	17	22	22	22	17	17	17	155
ac-mode: MCS0	17	22	22	22	17	17	17	17
Note 3: Unused Port 4 Terminatd with 50 Ω								
MIMO Port 1+2+3+4 (Note 4)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	16	21	21	21	16	151	159	80 MHz
n-mode : MCS0	16	21	21	21	16	16	16	155
ac-mode: MCS0	16	21	21	21	16	16	16	16
Note 4: None of the Port was Terminatd with 50 Ω								

The EUT was configured with following GUI Power Settings (PWL) & test channels for 23 dBi Antenna configurations.

5725 MHz to 5850 MHz [U-NII-3 Band]								
23 dBi Antenna Group								
SISO Port 1 (Note 1)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	11	26	26	26	11	151	159	80 MHz
n-mode : MCS0	11	26	26	26	11	26	26	155
ac-mode: MCS0	11	26	26	26	11	26	26	11
Note 1: Unused Ports 2,3 & 4 Terminatd with 50 Ω								
MIMO Port 1+2 (Note 2)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	14	19	19	19	14	151	159	80 MHz
n-mode : MCS0	14	19	19	19	14	19	19	155
ac-mode: MCS0	14	19	19	19	14	19	19	14
Note 2: Unused Ports 3 & 4 Terminatd with 50 Ω								
MIMO Port 1+2+3 (Note 3)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	12	17	17	17	12	151	159	80 MHz
n-mode : MCS0	12	17	17	17	12	12	12	155
ac-mode: MCS0	12	17	17	17	12	12	12	12
Note 3: Unused Port 4 Terminatd with 50 Ω								
MIMO Port 1+2+3+4 (Note 4)								
Nominal Channel Bandwidth	20 MHz							
Test Channel	149	153	157	161	165	40 MHz		
a-mode: 6 Mbit	11	16	16	16	11	151	159	80 MHz
n-mode : MCS0	11	16	16	16	11	11	11	155
ac-mode: MCS0	11	16	16	16	11	16	11	11
Note 4: None of the Port was Terminatd with 50 Ω								

4.4. Used RF Cables

For radiated band edge & AC conducted emission measurements performed with Antennas, EUT ports were connected with following RF cables to the different antenna type.
For further details refer Section 3. B.

Antenna Group Type	EUT to Antennas Cable Details			
	SISO Mode Port 1	MIMO Mode Port 1+2	MIMO Mode Port 1+2+3	MIMO Mode Port 1+2+3+4
8 dBi Antenna Group	UMCC- N Connector Cables			
9 dBi Antenna Group	UMCC- N Connector Cables			
23 dBi Antenna Group	N-N Connector Antenna Cables*			
*As per applicant's declaration 23 dBi Antenna Group radiated tests have been carried out with N-N Connector Antenna Cable (10 m) having maximum loss of 8.8 dB @ 5 GHz bands. An RF level offset was entered in GUI settings to compensate the loss of those N-N Connector Antenna Cable.				

For radiated cabinet emissions measurements performed without Antennas, EUT ports were connected to 50 Ω terminations with following RF cables.
For further details refer Section 3. B.

Antenna Group Type	EUT to 50 Ω Terminations Cable Details
	MIMO Mode Port 1+2+3+4
8 dBi Antenna Group	UMCC- N Connector Cables
9 dBi Antenna Group	UMCC- N Connector Cables
23 dBi Antenna Group	UMCC- N Connector Cables

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 6 *Measurement Uncertainty* for details.

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

5.2. Test Results

5.2.1. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Krume Ivanov, Bernd Woerl & Vladmir Eppel	**Test Dates:**	20 May 2019 to 23 September 2019
Test Sample Serial Number:	192.168.0.80		
Test Site Identification	SR 7/8		

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

Environmental Conditions:

Temperature (°C):	23 to 28
Relative Humidity (%):	34 to 41

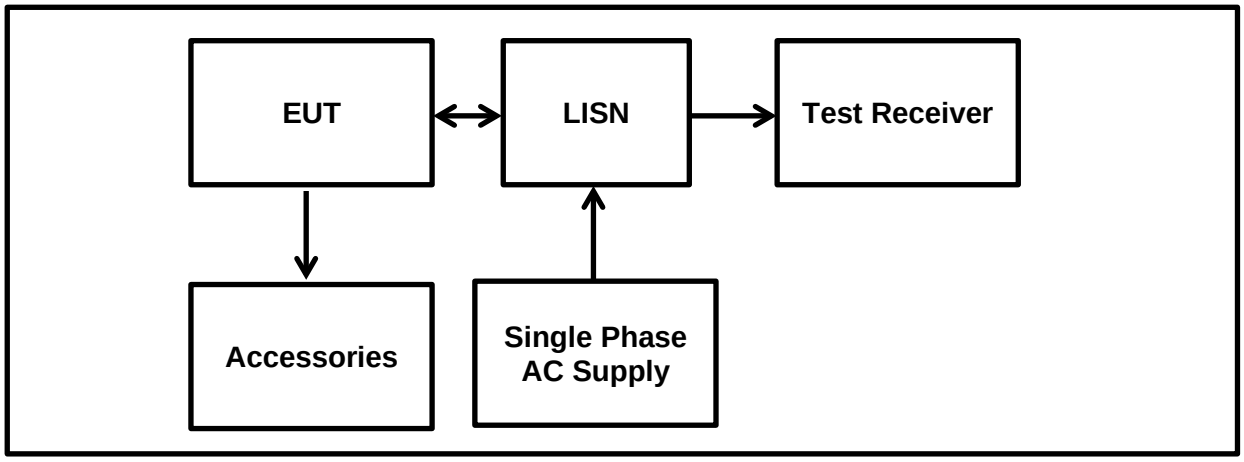
Settings of the Instrument

Detector	Quasi Peak/ Average Peak

Notes:

1. Measurement software used: Toyo EMI Software; CE measurement software EP5/CE Ver 4.0.1.
2. The EUT was powered by supplying 24 V DC via SIEMENS SIMATIC PS 307 Power Supply.
3. In accordance with FCC KDB 174176 Q4; SIEMENS SIMATIC PS 307 Power Supply was connected to 120 VAC 60 Hz single phase supply via a LISN.
4. The HEWLETT PACKARD E3620A Power Supply was connected to 240 VAC 60 Hz single phase supply via a LISN.
5. AC conducted tests were performed with :
    - each type of listed Antenna Groups.
    - maximum power setting (PWL) amongst all supported SISO & MIMO modes
    - MIMO Port 1+2+3+4 employing maximum possible Antennas
6. The EUT was configured in following test modes :
    - 8 dBi Antenna Group: MIMO Port 1+2+3+4 | n Mode | B.W. 20 MHz | PWL 26 | CH 157
    - 9 dBi Antenna Group: MIMO Port 1+2+3+4 | n Mode | B.W. 20 MHz | PWL 26 | CH 157
    - 23 dBi Antenna Group: MIMO Port 1+2+3+4 | n Mode | B.W. 20 MHz | PWL 26 | CH 149
7. Measurements were performed in shielded room (SR7/ 8 Asset Number 1603671). The EUT was placed at a height of 80 cm above the reference ground plane and in a distance of 40 cm from the vertical ground plane at the edge of the table.
8. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
9. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
10. The final measured value, for the given emission, in the table below incorporates the cable loss. Calculation: Level = test receiver reading + path loss (cable attenuation + correction LISN).

Transmitter AC Conducted Spurious Emissions (continued)
Test setup:



Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/8 dBi Antenna Group

Results: Live (L1) / Quasi Peak / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
0.17255	Live (L1)	35.0	9.9	44.9	64.8	19.9	Complied
0.19709	Live (L1)	29.6	9.9	39.5	63.7	24.2	Complied
0.22966	Live (L1)	31.4	9.9	41.3	62.5	21.2	Complied
0.27174	Live (L1)	27.0	9.8	36.8	61.1	24.3	Complied
0.37996	Live (L1)	24.4	9.9	34.3	58.3	24.0	Complied
3.55912	Live (L1)	23.9	9.9	33.8	56.0	22.2	Complied

Results: Live (L1) / Average / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading AV [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
0.17255	Live (L1)	27.5	9.9	37.4	54.8	17.4	Complied
0.19709	Live (L1)	16.6	9.9	26.5	53.7	27.2	Complied
0.22966	Live (L1)	25.2	9.9	35.1	52.5	17.4	Complied
0.27174	Live (L1)	13.8	9.8	23.6	51.1	27.5	Complied
0.37996	Live (L1)	10.1	9.9	20.0	48.3	28.3	Complied
3.55912	Live (L1)	9.6	9.9	19.5	46.0	26.5	Complied

Result: **Pass**

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/8 dBi Antenna Group

Results: Neutral (N) / Quasi Peak / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
0.16052	Neutral (N)	31.7	9.9	41.6	65.4	23.8	Complied
0.19259	Neutral (N)	29.8	9.9	39.7	63.9	24.2	Complied
0.21864	Neutral (N)	28.7	9.9	38.6	62.9	24.3	Complied
0.27375	Neutral (N)	26.6	9.8	36.4	61.0	24.6	Complied
0.42305	Neutral (N)	21.9	9.9	31.8	57.4	25.6	Complied
3.67535	Neutral (N)	25.3	9.9	35.2	56.0	20.8	Complied

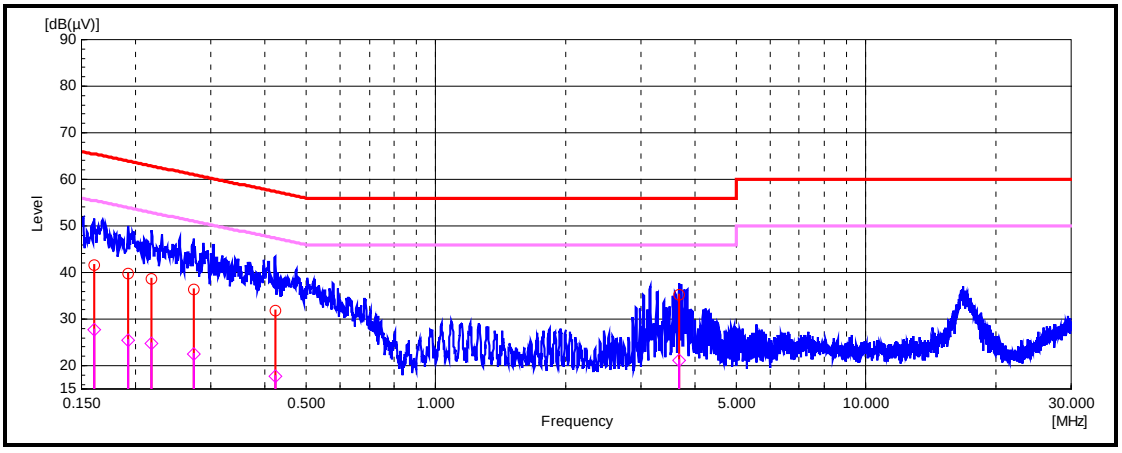
Results: Neutral (N) / Average / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading AV [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
0.16052	Neutral (N)	17.7	9.9	27.6	55.4	27.8	Complied
0.19259	Neutral (N)	15.6	9.9	25.5	53.9	28.4	Complied
0.21864	Neutral (N)	14.8	9.9	24.7	52.9	28.2	Complied
0.27375	Neutral (N)	12.6	9.8	22.4	51.0	28.6	Complied
0.42305	Neutral (N)	7.9	9.9	17.8	47.4	29.6	Complied
3.67535	Neutral (N)	11.2	9.9	21.1	46.0	24.9	Complied

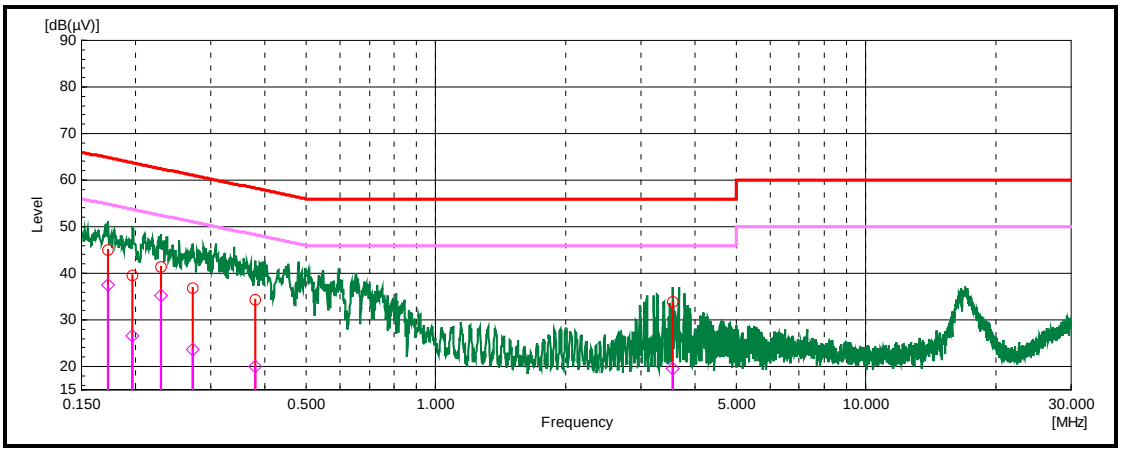
Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/8 dBi Antenna Group

Plot: Live and Neutral Line



Neutral(N)



Live(L1)

Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

Transmitter AC Conducted Spurious Emissions (continued) :
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/8 dBi Antenna Group

Results: Live (L1) / Quasi Peak / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
0.17543	Live (L1)	6.9	9.9	16.8	64.7	47.9	Complied
0.4885	Live (L1)	-1	9.9	8.9	56.2	47.3	Complied
0.68934	Live (L1)	-2	10	8	56	48	Complied
10.48357	Live (L1)	20.7	10	30.7	60	29.3	Complied
13.98061	Live (L1)	21.4	10.1	31.5	60	28.5	Complied
14.98722	Live (L1)	20.8	10.1	30.9	60	29.1	Complied

Results: Live (L1) / Average / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
0.17543	Live (L1)	2.7	9.9	12.6	54.7	42.1	Complied
0.4885	Live (L1)	-4.7	9.9	5.2	46.2	41	Complied
0.68934	Live (L1)	-6.5	10	3.5	46	42.5	Complied
10.48357	Live (L1)	18.2	10	28.2	50	21.8	Complied
13.98061	Live (L1)	18.5	10.1	28.6	50	21.4	Complied
14.98722	Live (L1)	19.4	10.1	29.5	50	20.5	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/8 dBi Antenna Group

Results: Neutral (N) / Quasi Peak / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
12.2277	Neutral (N)	17.8	10	27.8	60	32.2	Complied
14.66879	Neutral (N)	16.4	10.1	26.5	60	33.5	Complied
15.30806	Neutral (N)	18	10.1	28.1	60	31.9	Complied
15.72711	Neutral (N)	19.2	10.1	29.3	60	30.7	Complied
16.90015	Neutral (N)	16.2	10.1	26.3	60	33.7	Complied
19.21525	Neutral (N)	16.2	10.1	26.3	60	33.7	Complied

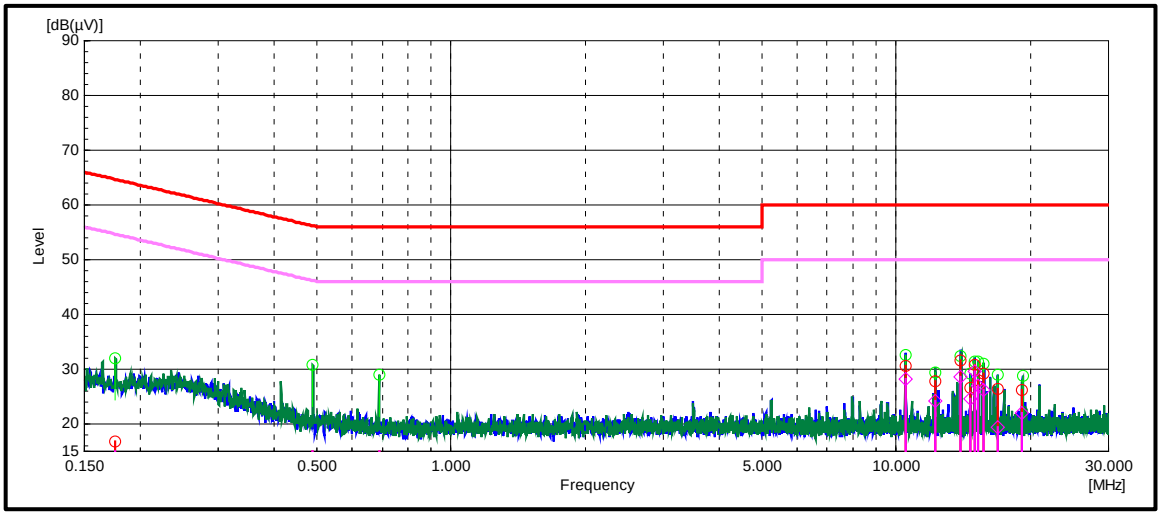
Results: Neutral (N) / Average / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
12.2277	Neutral (N)	14.2	10	24.2	50	25.8	Complied
14.66879	Neutral (N)	14.5	10.1	24.6	50	25.4	Complied
15.30806	Neutral (N)	17	10.1	27.1	50	22.9	Complied
15.72711	Neutral (N)	16.1	10.1	26.2	50	23.8	Complied
16.90015	Neutral (N)	9.4	10.1	19.5	50	30.5	Complied
19.21525	Neutral (N)	11.9	10.1	22	50	28	Complied

Result: **Pass**

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/8 dBi Antenna Group

Plot: Live and Neutral Line



Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

Transmitter AC Conducted Spurious Emissions (continued) :
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/9 dBi Antenna Group

Results: Live (L1) / Quasi Peak / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
0.17255	Live (L1)	34.0	9.9	43.9	64.8	20.9	Complied
0.23116	Live (L1)	29.7	9.9	39.6	62.4	22.8	Complied
0.28327	Live (L1)	27.0	9.8	36.8	60.7	23.9	Complied
0.32735	Live (L1)	24.6	9.8	34.4	59.5	25.1	Complied
3.21443	Live (L1)	22.5	9.9	32.4	56.0	23.6	Complied
18.75551	Live (L1)	24.7	10.1	34.8	60.0	25.2	Complied

Results: Live (L1) / Average / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading AV [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
0.17255	Live (L1)	26.4	9.9	36.3	54.8	18.5	Complied
0.23116	Live (L1)	23.4	9.9	33.3	52.4	19.1	Complied
0.28327	Live (L1)	20.1	9.8	29.9	50.7	20.8	Complied
0.32735	Live (L1)	13.1	9.8	22.9	49.5	26.6	Complied
3.21443	Live (L1)	9.2	9.9	19.1	46.0	26.9	Complied
18.75551	Live (L1)	20.1	10.1	30.2	50.0	19.8	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/9 dBi Antenna Group

Results: Neutral (N) / Quasi Peak / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
0.16854	Neutral (N)	30.2	9.9	40.1	65.0	24.9	Complied
0.23918	Neutral (N)	26.8	9.9	36.7	62.1	25.4	Complied
0.28878	Neutral (N)	25.2	9.8	35.0	60.6	25.6	Complied
0.39248	Neutral (N)	22.1	9.9	32.0	58.0	26.0	Complied
3.1503	Neutral (N)	19.9	9.9	29.8	56.0	26.2	Complied
18.75551	Neutral (N)	25.9	10.1	36.0	60.0	24.0	Complied

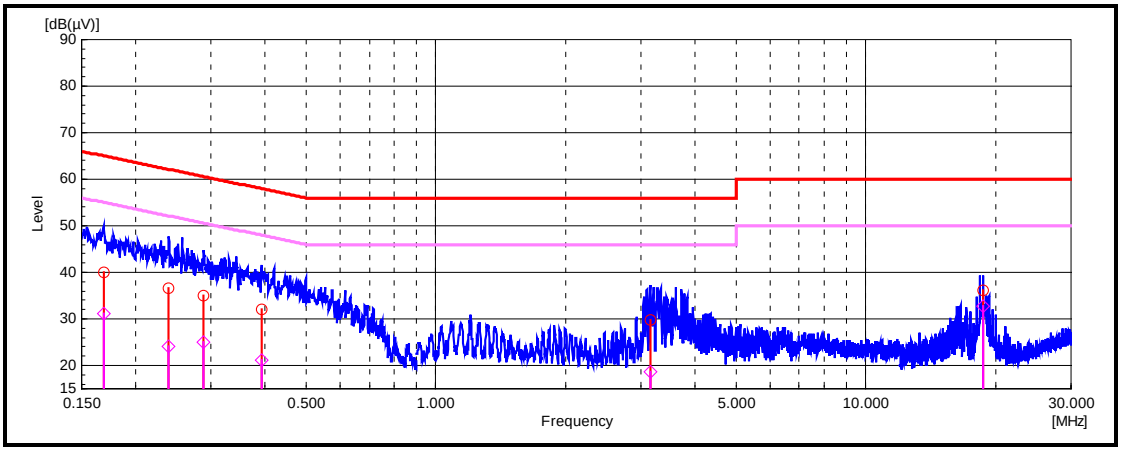
Results: Neutral (N) / Average / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading AV [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
0.16854	Neutral (N)	21.1	9.9	31.0	55.0	24.0	Complied
0.23918	Neutral (N)	14.2	9.9	24.1	52.1	28.0	Complied
0.28878	Neutral (N)	15.3	9.8	25.1	50.6	25.5	Complied
0.39248	Neutral (N)	11.3	9.9	21.2	48.0	26.8	Complied
3.1503	Neutral (N)	8.8	9.9	18.7	46.0	27.3	Complied
18.75551	Neutral (N)	22.6	10.1	32.7	50.0	17.3	Complied

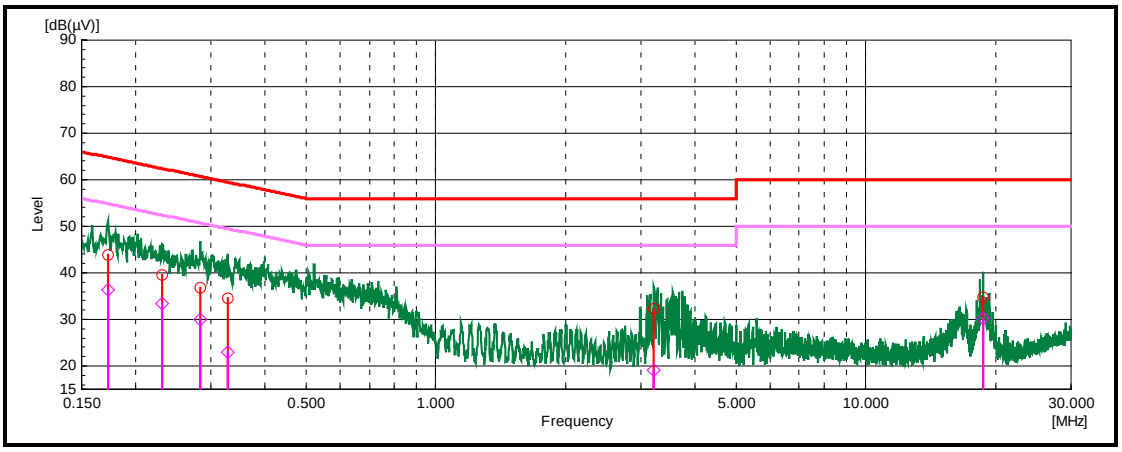
Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/9 dBi Antenna Group

Plot: Live and Neutral Line



Neutral(N)



Live(L1)

Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

Transmitter AC Conducted Spurious Emissions (continued) :
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/9 dBi Antenna Group

Results: Live (L1) / Quasi Peak / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
10.48348	Live (L1)	17.2	10	27.2	60	32.8	Complied
12.23522	Live (L1)	18	10	28	60	32	Complied
13.98282	Live (L1)	21.4	10.1	31.5	60	28.5	Complied
14.99173	Live (L1)	20	10.1	30.1	60	29.9	Complied
15.7254	Live (L1)	19.2	10.1	29.3	60	30.7	Complied
16.89244	Live (L1)	15.6	10.1	25.7	60	34.3	Complied

Results: Live (L1) / Average / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading AV [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
10.48348	Live (L1)	15.3	10	25.3	50	24.7	Complied
12.23522	Live (L1)	14.9	10	24.9	50	25.1	Complied
13.98282	Live (L1)	17.7	10.1	27.8	50	22.2	Complied
14.99173	Live (L1)	18.8	10.1	28.9	50	21.1	Complied
15.7254	Live (L1)	16.4	10.1	26.5	50	23.5	Complied
16.89244	Live (L1)	13.1	10.1	23.2	50	26.8	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/9 dBi Antenna Group

Results: Neutral (N) / Quasi Peak / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
2.12527	Neutral (N)	1.3	9.9	11.2	56	44.8	Complied
2.38247	Neutral (N)	-2	9.9	7.9	56	48.1	Complied
14.6735	Neutral (N)	17.6	10.1	27.7	60	32.3	Complied
15.30937	Neutral (N)	16.7	10.1	26.8	60	33.2	Complied
16.26729	Neutral (N)	17.7	10.1	27.8	60	32.2	Complied
19.21621	Neutral (N)	16.8	10.1	26.9	60	33.1	Complied

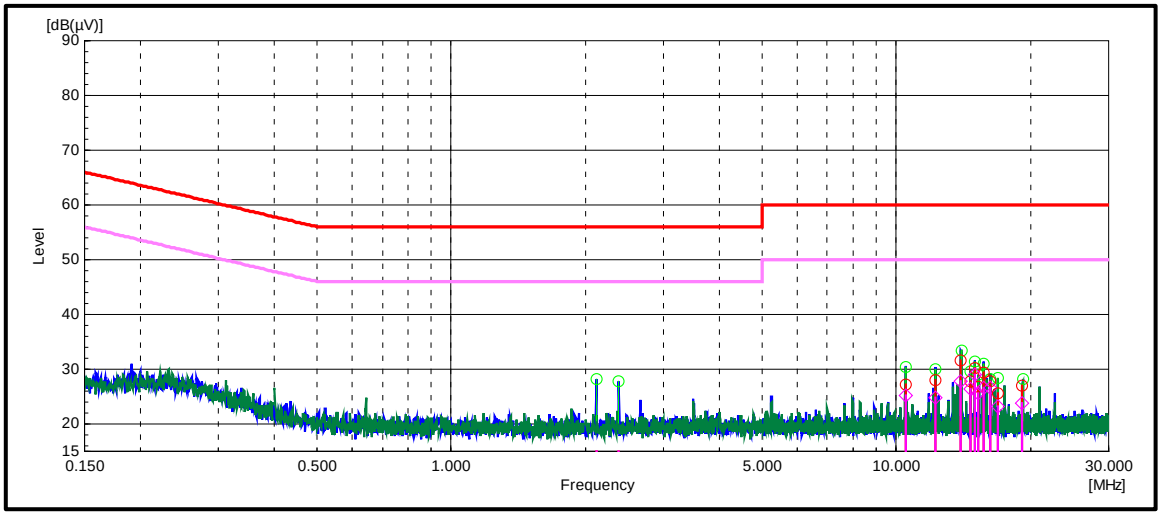
Results: Neutral (N) / Average / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading AV [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
2.12527	Neutral (N)	-4	9.9	5.9	46	40.1	Complied
2.38247	Neutral (N)	-6.5	9.9	3.4	46	42.6	Complied
14.6735	Neutral (N)	16.4	10.1	26.5	50	23.5	Complied
15.30937	Neutral (N)	15.6	10.1	25.7	50	24.3	Complied
16.26729	Neutral (N)	16.4	10.1	26.5	50	23.5	Complied
19.21621	Neutral (N)	13.6	10.1	23.7	50	26.3	Complied

Result: **Pass**

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 157/9 dBi Antenna Group

Plot: Live and Neutral Line



Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

Transmitter AC Conducted Spurious Emissions (continued) :
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 149/23 dBi Antenna Group

Results: Live (L1) / Quasi Peak / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
0.171	Live (L1)	34.2	9.9	44.1	64.9	20.8	Complied
0.21033	Live (L1)	29.1	9.9	39	63.2	24.2	Complied
0.28539	Live (L1)	28.3	9.8	38.1	60.7	22.6	Complied
3.38635	Live (L1)	20.4	9.9	30.3	56	25.7	Complied
14.01017	Live (L1)	20.2	10.1	30.3	60	29.7	Complied
16.83191	Live (L1)	19.1	10.1	29.2	60	30.8	Complied

Results: Live (L1) / Average / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading AV [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
0.171	Live (L1)	27	9.9	36.9	54.9	18	Complied
0.21033	Live (L1)	15.9	9.9	25.8	53.2	27.4	Complied
0.28539	Live (L1)	21.7	9.8	31.5	50.7	19.2	Complied
3.38635	Live (L1)	6.7	9.9	16.6	46	29.4	Complied
14.01017	Live (L1)	16.7	10.1	26.8	50	23.2	Complied
16.83191	Live (L1)	7.3	10.1	17.4	50	32.6	Complied

Result: **Pass**

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 149/23 dBi Antenna Group

Results: Neutral (N) / Quasi Peak / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
0.15357	Neutral (N)	31.5	9.9	41.4	65.8	24.4	Complied
0.22514	Neutral (N)	28.1	9.9	38	62.6	24.6	Complied
0.25823	Neutral (N)	26.9	9.8	36.7	61.5	24.8	Complied
3.50455	Neutral (N)	24.7	9.9	34.6	56	21.4	Complied
14.00496	Neutral (N)	22.3	10.1	32.4	60	27.6	Complied
16.98672	Neutral (N)	18.5	10.1	28.6	60	31.4	Complied

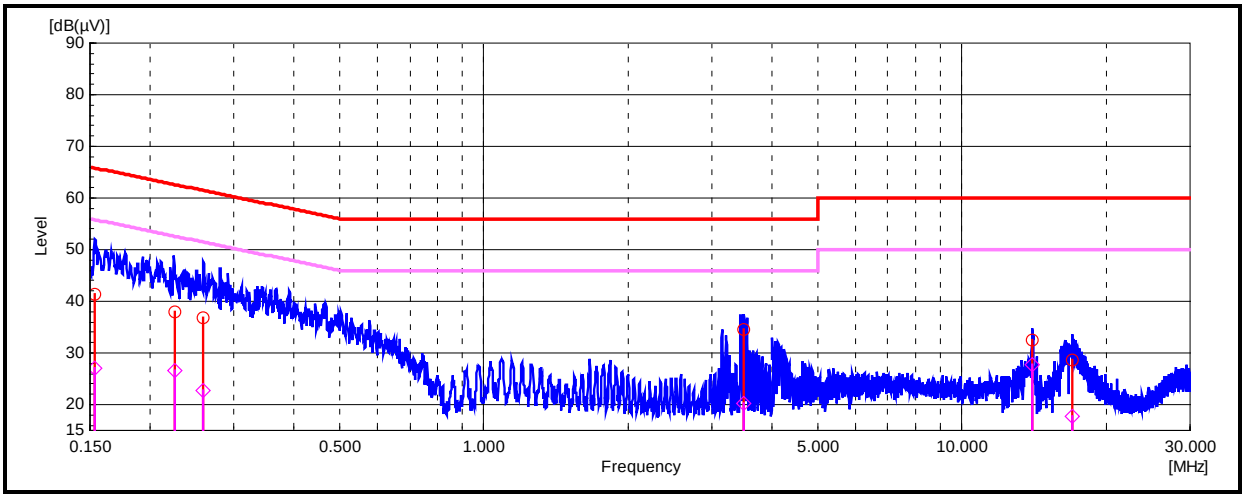
Results: Neutral (N) / Average / 120 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading AV [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
0.15357	Neutral (N)	17.2	9.9	27.1	55.8	28.7	Complied
0.22514	Neutral (N)	16.6	9.9	26.5	52.6	26.1	Complied
0.25823	Neutral (N)	13	9.8	22.8	51.5	28.7	Complied
3.50455	Neutral (N)	10.3	9.9	20.2	46	25.8	Complied
14.00496	Neutral (N)	17.7	10.1	27.8	50	22.2	Complied
16.98672	Neutral (N)	7.7	10.1	17.8	50	32.2	Complied

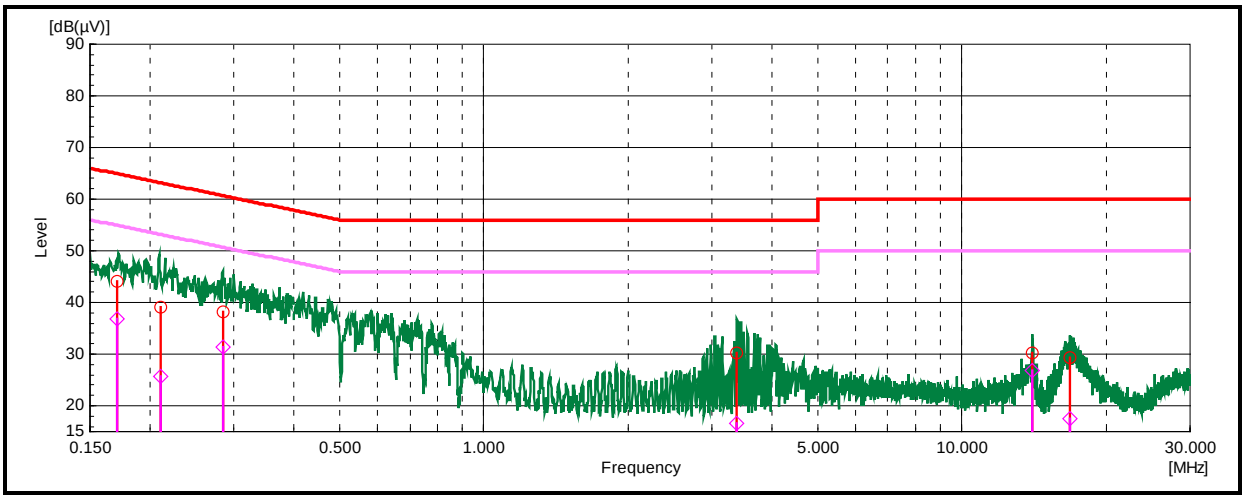
Result: **Pass**

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 149/23 dBi Antenna Group

Plot: Live and Neutral Line



Neutral(N)



Live(L1)

Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

Transmitter AC Conducted Spurious Emissions (continued) :
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 149/23 dBi Antenna Group

Results: Live (L1) / Quasi Peak / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
10.49061	Live (L1)	16.2	10	26.2	60	33.8	Complied
12.24123	Live (L1)	17.7	10	27.7	60	32.3	Complied
13.98292	Live (L1)	23.6	10.1	33.7	60	26.3	Complied
14.6745	Live (L1)	18.9	10.1	29	60	31	Complied
14.99193	Live (L1)	20.2	10.1	30.3	60	29.7	Complied
15.31277	Live (L1)	15.5	10.1	25.6	60	34.4	Complied

Results: Live (L1) / Average / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading AV [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
10.49061	Live (L1)	14.3	10	24.3	50	25.7	Complied
12.24123	Live (L1)	15.1	10	25.1	50	24.9	Complied
13.98292	Live (L1)	21.1	10.1	31.2	50	18.8	Complied
14.6745	Live (L1)	17.5	10.1	27.6	50	22.4	Complied
14.99193	Live (L1)	18.9	10.1	29	50	21	Complied
15.31277	Live (L1)	14.9	10.1	25	50	25	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Results: Neutral (N) / Quasi Peak / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading QP [dB(µV)]	Correction Factor [dB]	Level QP [dB(µV)]	Limit QP [dB(µV)]	Margin QP [dB]	Result
5.24496	Neutral (N)	12.8	9.9	22.7	60	37.3	Complied
9.24918	Neutral (N)	12.3	10	22.3	60	37.7	Complied
9.57194	Neutral (N)	10.8	10	20.8	60	39.2	Complied
12.123	Neutral (N)	12.6	10	22.6	60	37.4	Complied
15.73432	Neutral (N)	16.6	10.1	26.7	60	33.3	Complied
19.22956	Neutral (N)	14.9	10.1	25	60	35	Complied

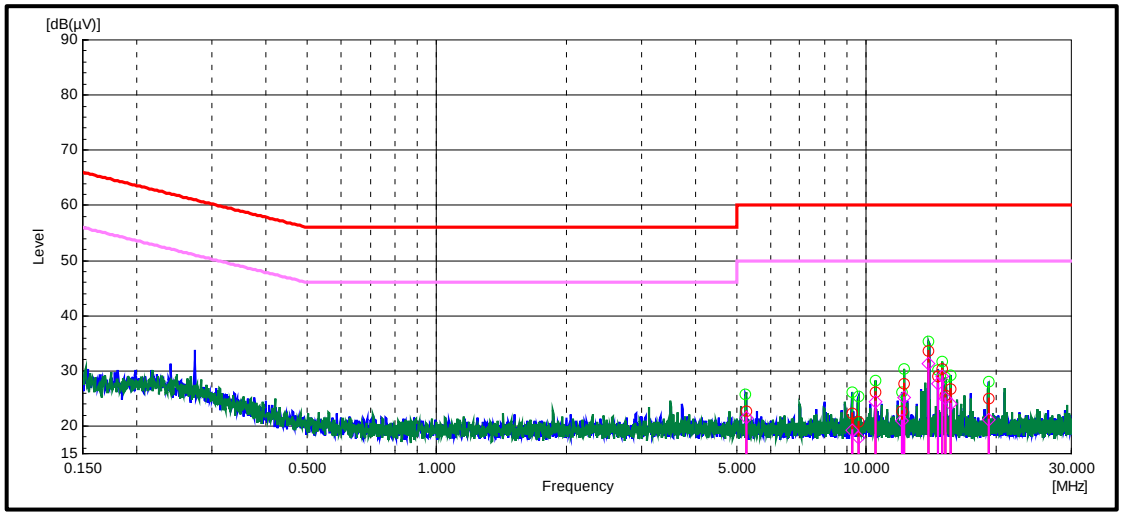
Results: Neutral (N) / Average / 240 VAC 60 Hz

Frequency [MHz]	Line Phase	Reading AV [dB(µV)]	Correction Factor [dB]	Level AV [dB(µV)]	Limit AV [dB(µV)]	Margin AV [dB]	Result
5.24496	Neutral (N)	11.6	9.9	21.5	50	28.5	Complied
9.24918	Neutral (N)	9.2	10	19.2	50	30.8	Complied
9.57194	Neutral (N)	7.9	10	17.9	50	32.1	Complied
12.123	Neutral (N)	11	10	21	50	29	Complied
15.73432	Neutral (N)	13.9	10.1	24	50	26	Complied
19.22956	Neutral (N)	11	10.1	21.1	50	28.9	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)
Results: 802.11n/20 MHz/MCS0/MIMO/Port 1+2+3+4 /PWL 26/CH 149/23 dBi Antenna Group

Plot: Live and Neutral Line



Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

5.2.2. Transmitter 26 dB Emission Bandwidth

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Dates:**	13 February 2019 to 06 February 2020
Test Sample Serial Number:	192.168.0.60		
Test Site Identification	SR 9		

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

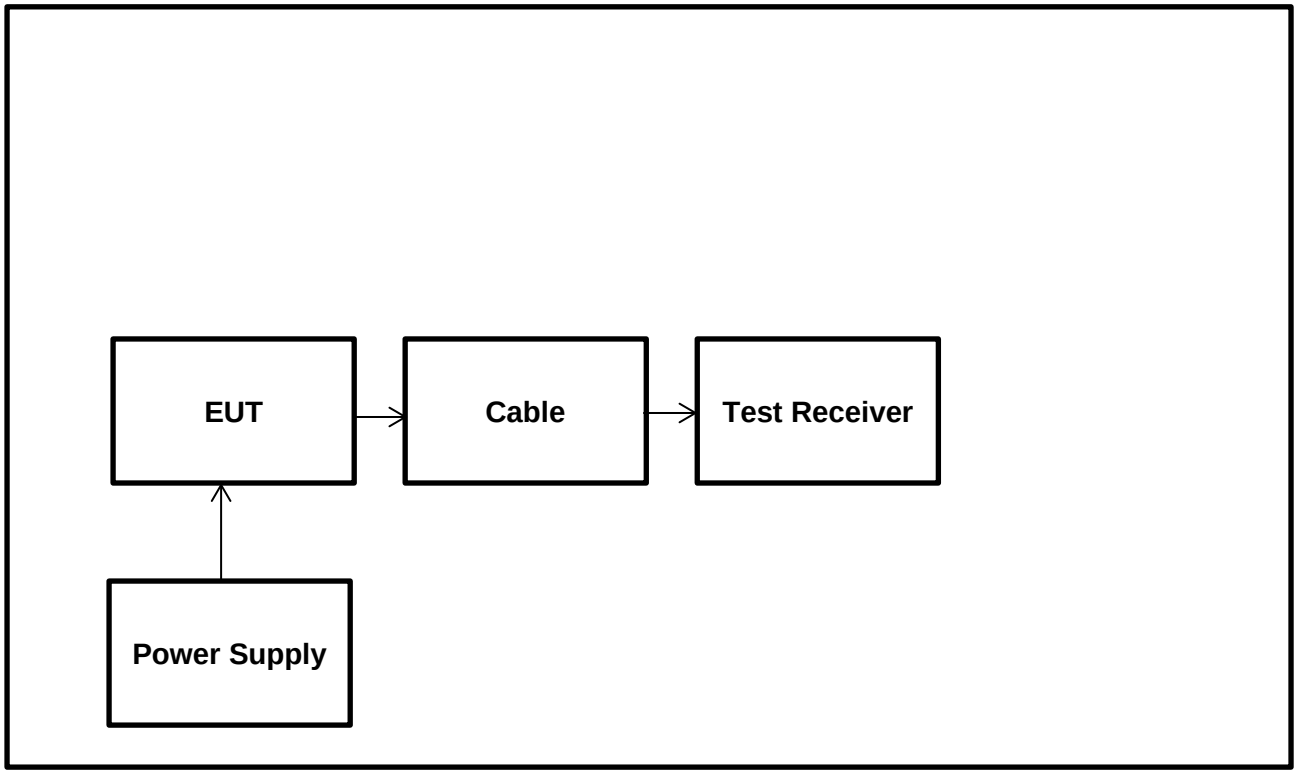
Environmental Conditions:

Temperatures (°C):	22 to 24
Relative Humidity (%):	25 to 36

Notes:

1. All configurations supported by the EUT were investigated on the one channel in accordance with KDB 789033 Section II.C.1. Emission Bandwidth (EBW) test procedure.
2. Final measurements were performed in each supported operating band using the above configurations on the bottom, middle and top or single channels.
3. Plots for all data rates are archived on the Company server and available for inspection upon request.
4. 26 dB Emission Bandwidth were measured with worst case SISO mode; as they found to be same independent of number of transmitter chains used.
5. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors. The RF cable attenuation (maximum 2.0 dB at the tested frequencies) from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input was added as a reference level offset (12.0 dB) to each of the conducted plots.

Transmitter 26 dB Emission Bandwidth (continued)
Test Setup:

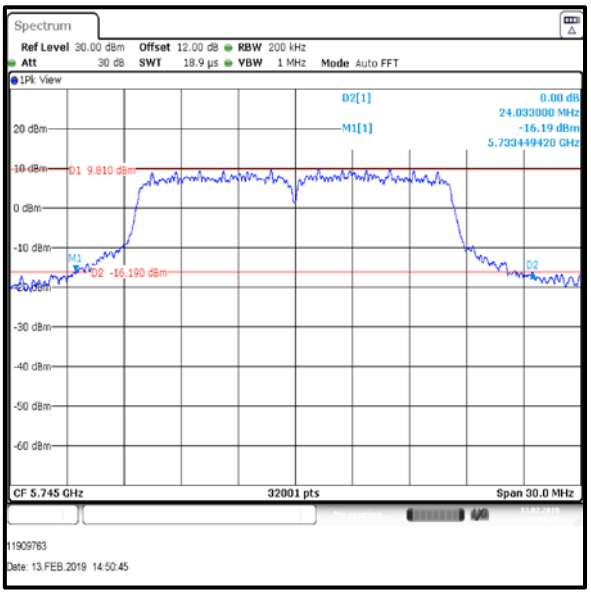


Transmitter 26 dB Emission Bandwidth (continued)

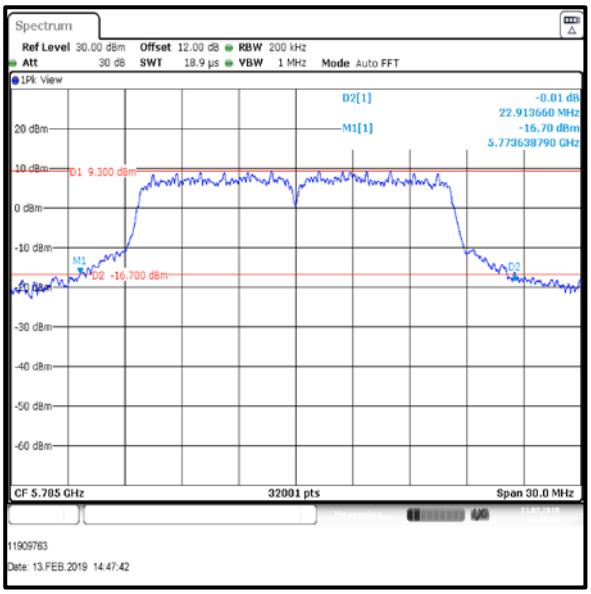
8 dBi Antenna Group

Results: 802.11a / 20 MHz / 6 Mbps / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

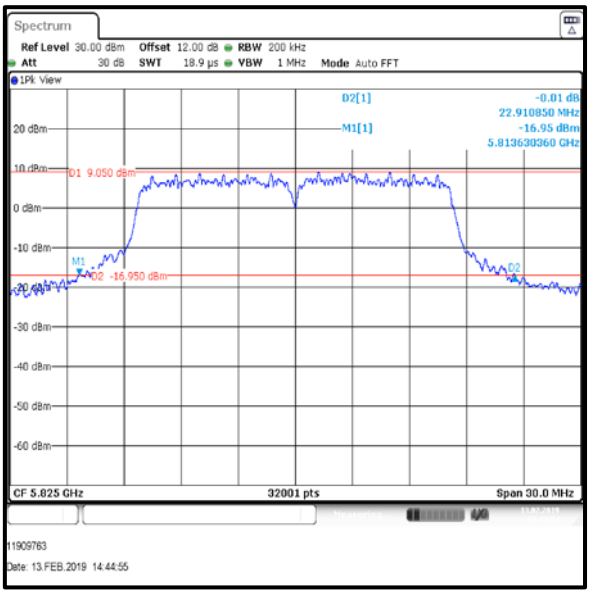
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	24.033
Middle	5785	22.914
Top	5825	22.911



Bottom Channel



Middle Channel



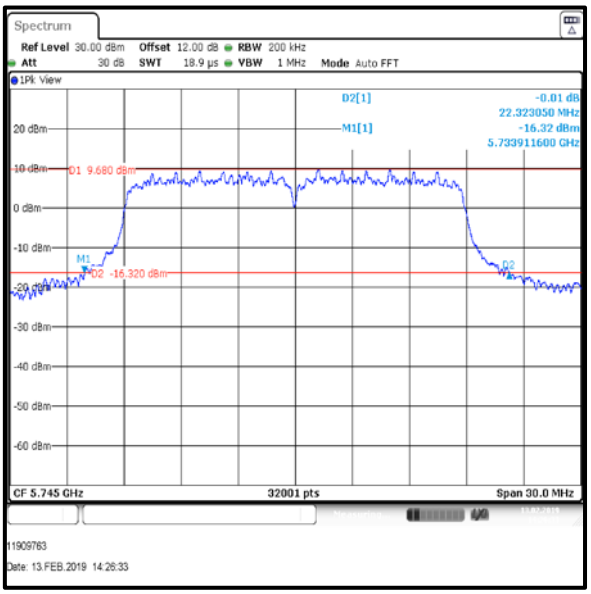
Top Channel

Result: Pass

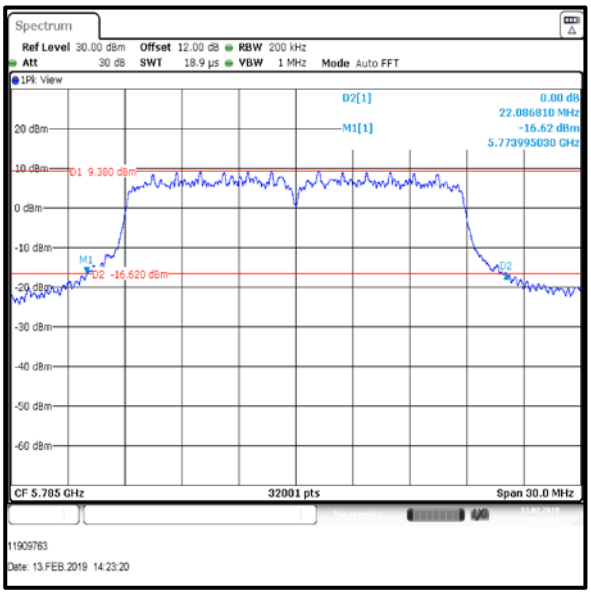
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

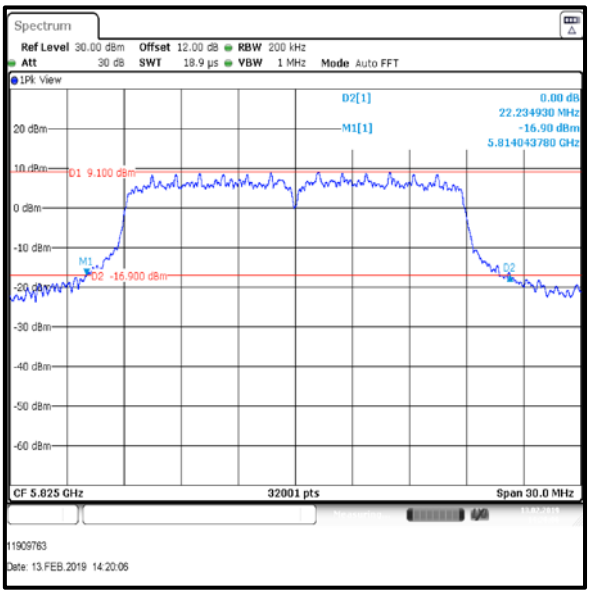
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	22.323
Middle	5785	22.087
Top	5825	22.235



Bottom Channel



Middle Channel



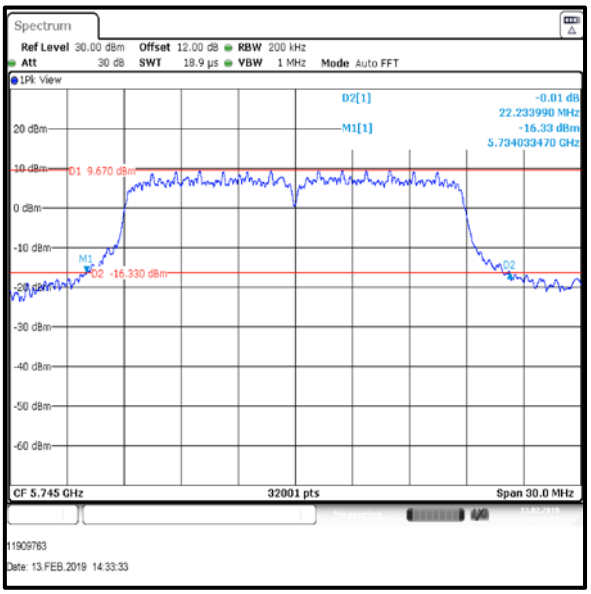
Top Channel

Result: Pass

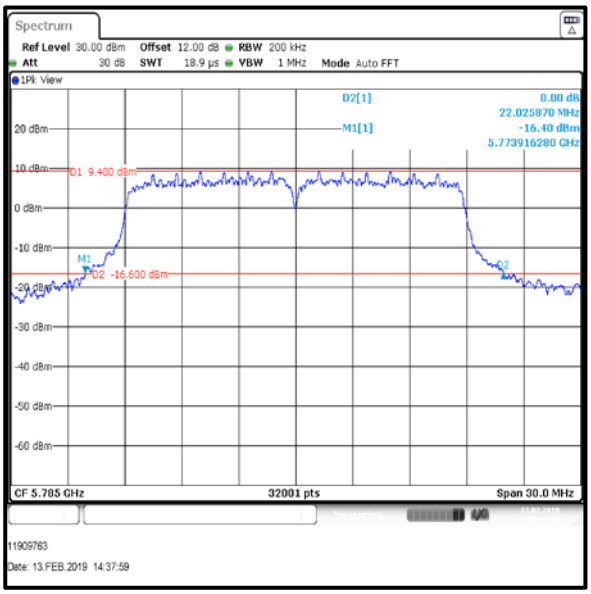
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

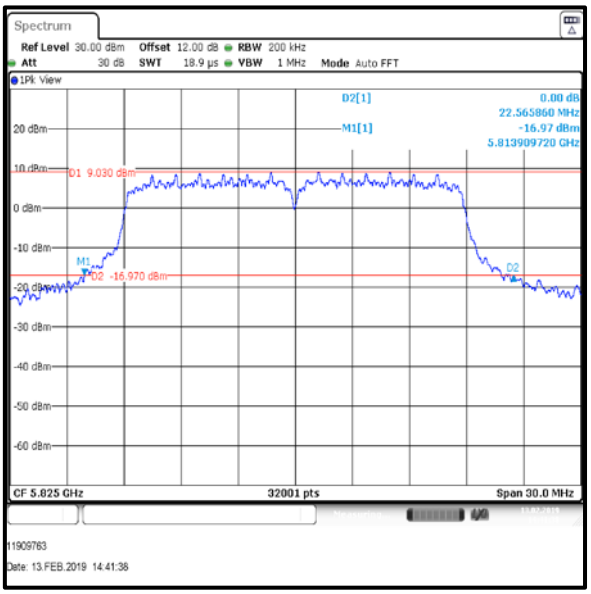
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	22.234
Middle	5785	22.026
Top	5825	22.566



Bottom Channel



Middle Channel



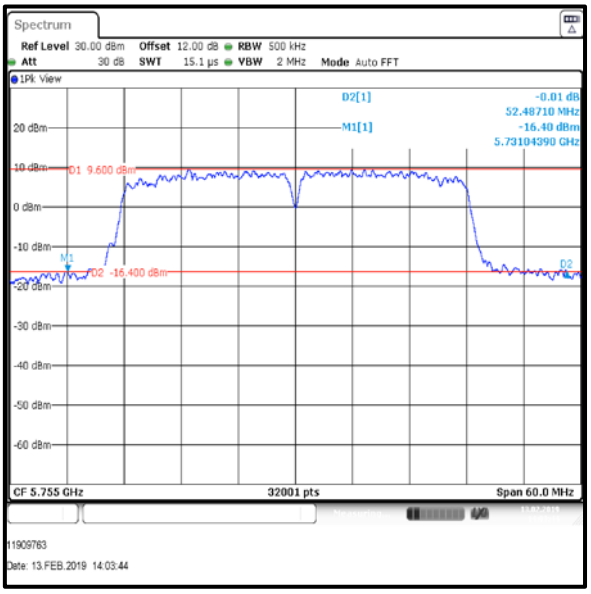
Top Channel

Result: Pass

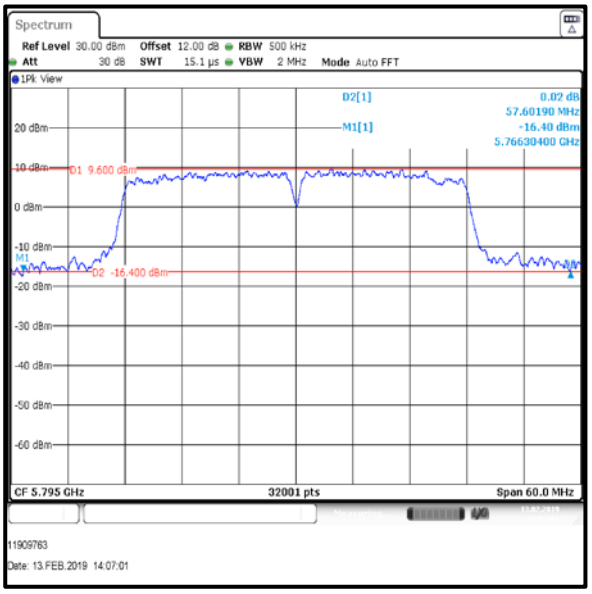
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / HT40 / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5755	52.487
Top	5795	57.602



Bottom Channel



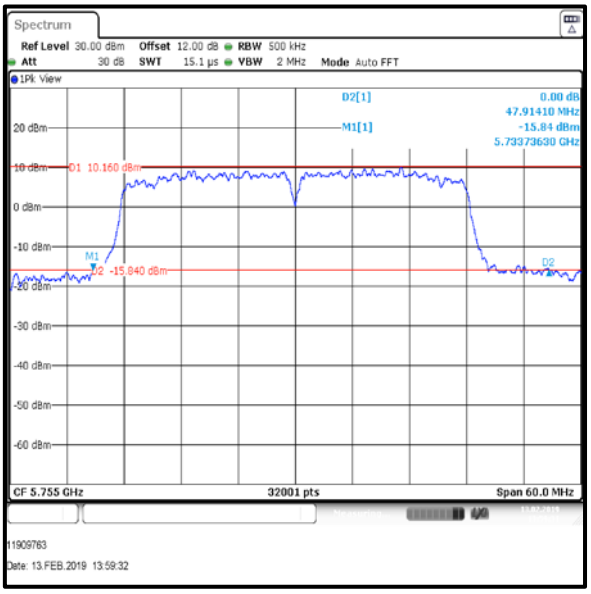
Top Channel

Result: Pass

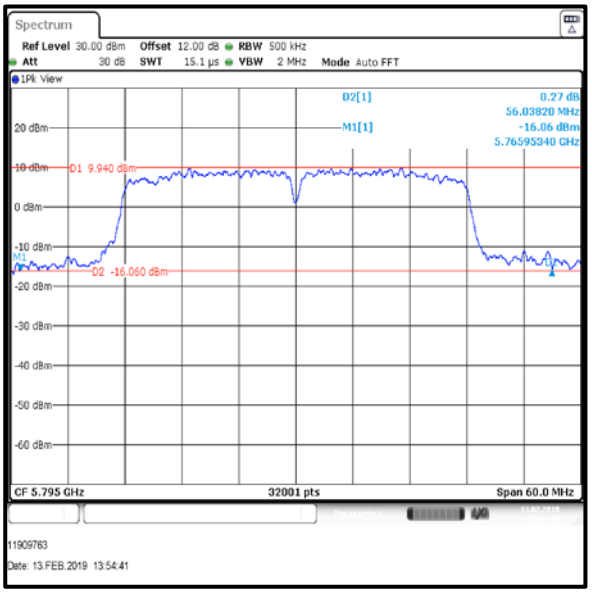
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / HT40 / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5755	47.914
Top	5795	56.038



Bottom Channel



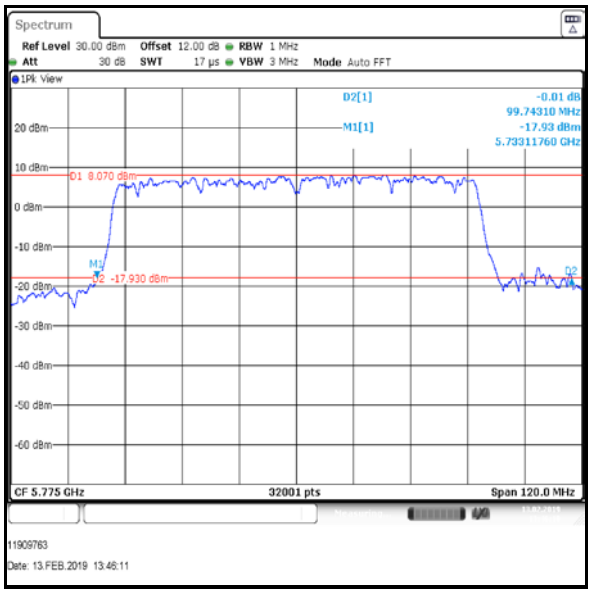
Top Channel

Result: Pass

Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / HT80 / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5775	99.743



Single Channel

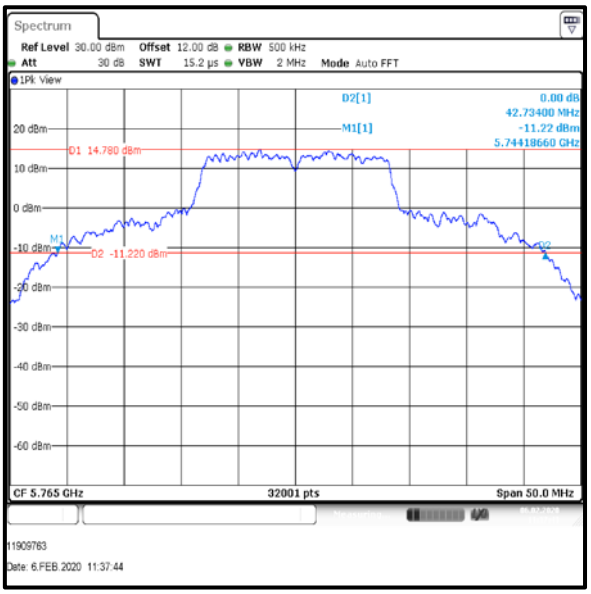
Result: Pass

Transmitter 26 dB Emission Bandwidth (continued)

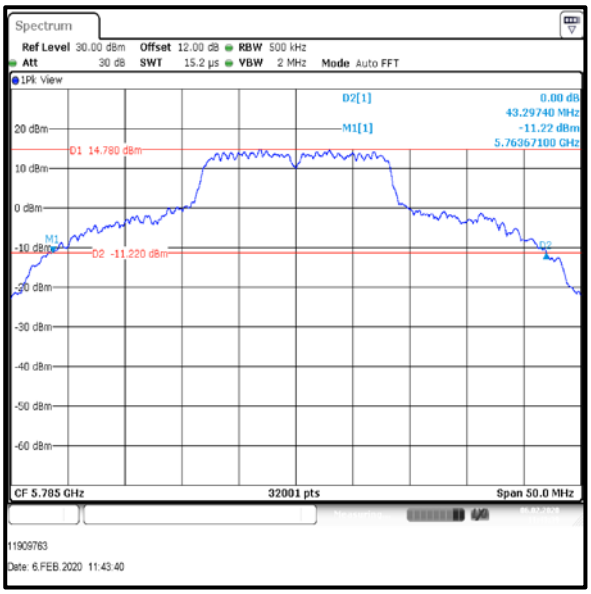
9 dBi Antenna Group

Results: 802.11a / 20 MHz / 6 MBits / SISO / Port 1 / PWL 26 / 9 dBi Antenna Group

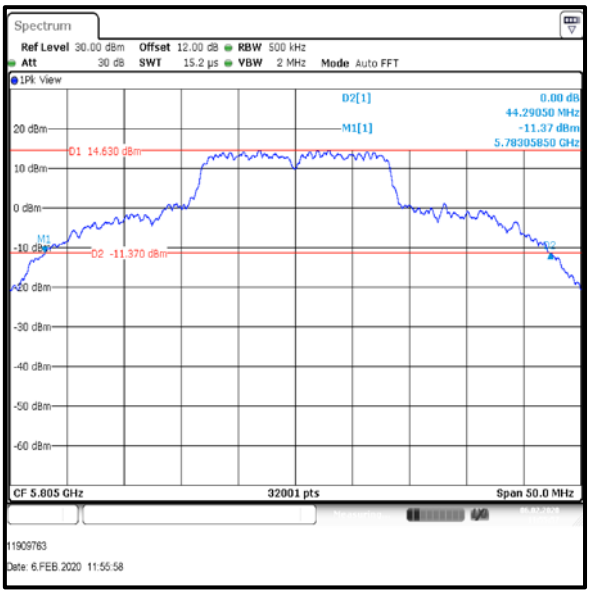
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom +1	5765	42.734
Middle	5785	43.297
Top -1	5805	44.290



Bottom +1 Channel



Middle Channel



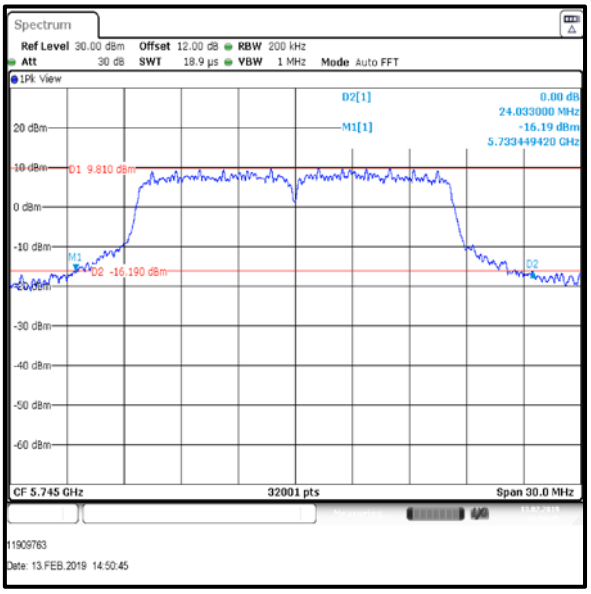
Top -1 Channel

Result: Pass

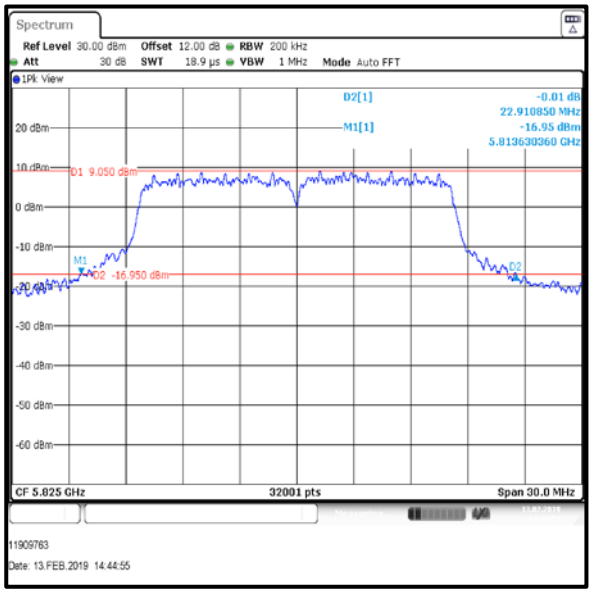
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11a / 20 MHz / 6 Mbps / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	24.033
Top	5825	22.911



Bottom Channel



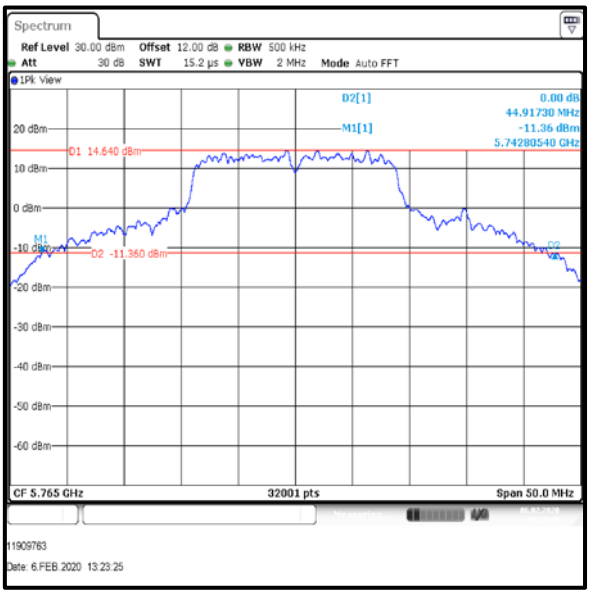
Top Channel

Result: Pass

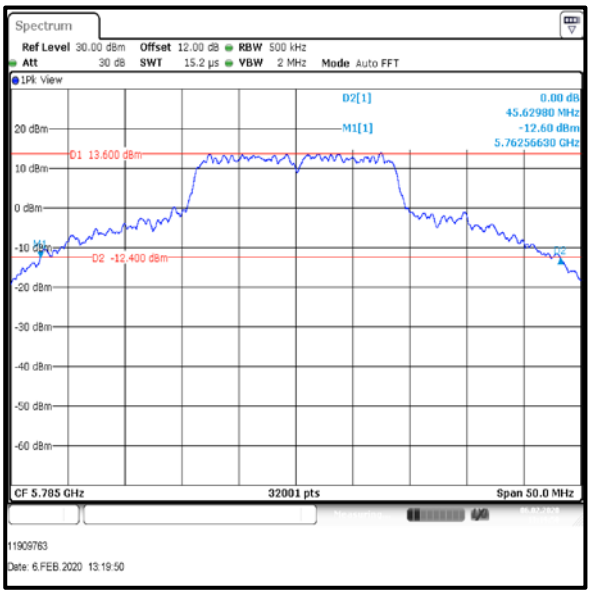
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 9 dBi Antenna Group

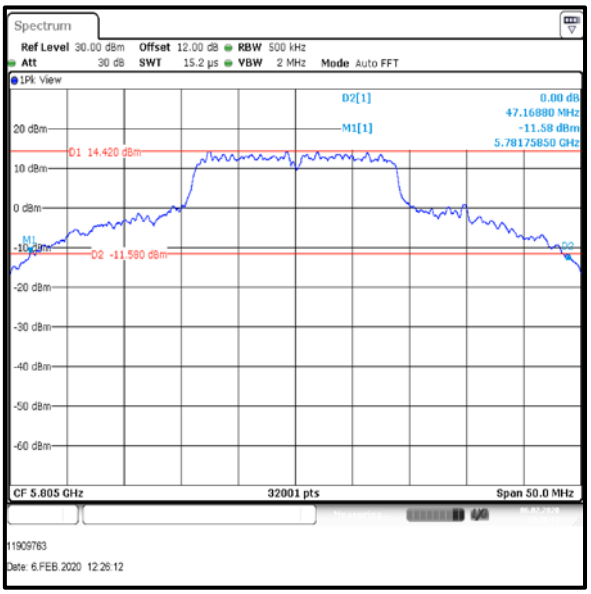
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom +1	5765	44.917
Middle	5785	45.630
Top -1	5805	47.169



Bottom +1 Channel



Middle Channel



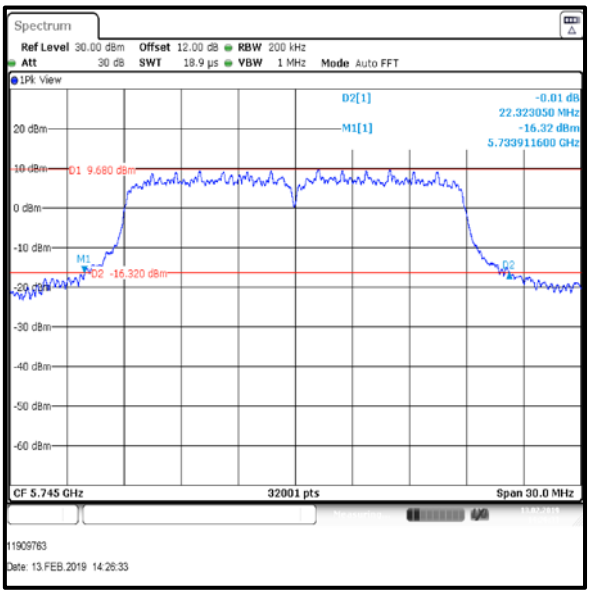
Top -1 Channel

Result: Pass

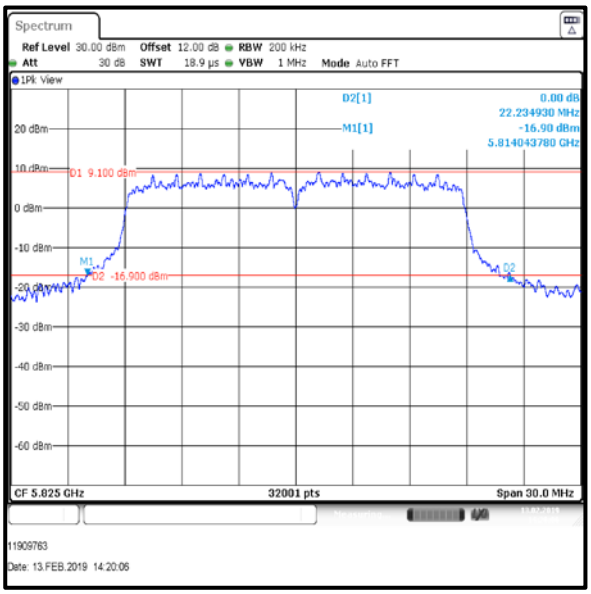
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	22.323
Middle	5785	22.087
Top	5825	22.235



Bottom Channel



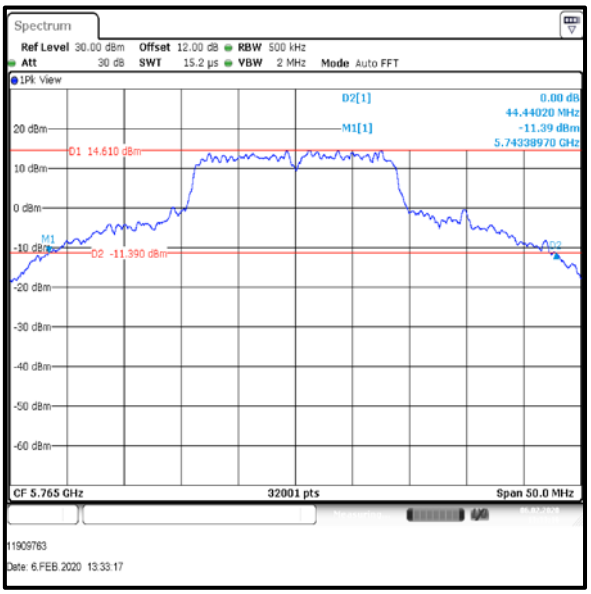
Top Channel

Result: Pass

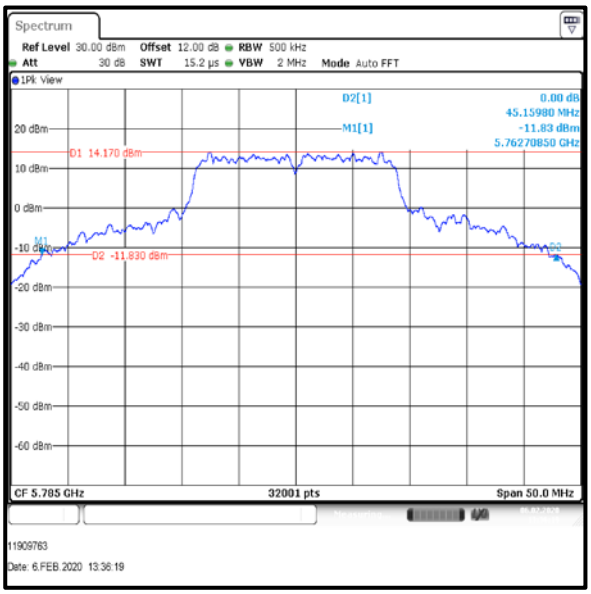
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 9 dBi Antenna Group

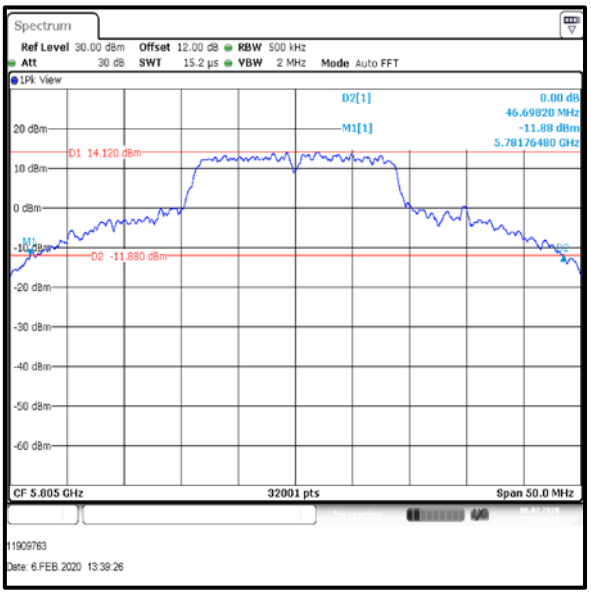
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom +1	5765	44.440
Middle	5785	45.160
Top -1	5805	46.700



Bottom +1 Channel



Middle Channel



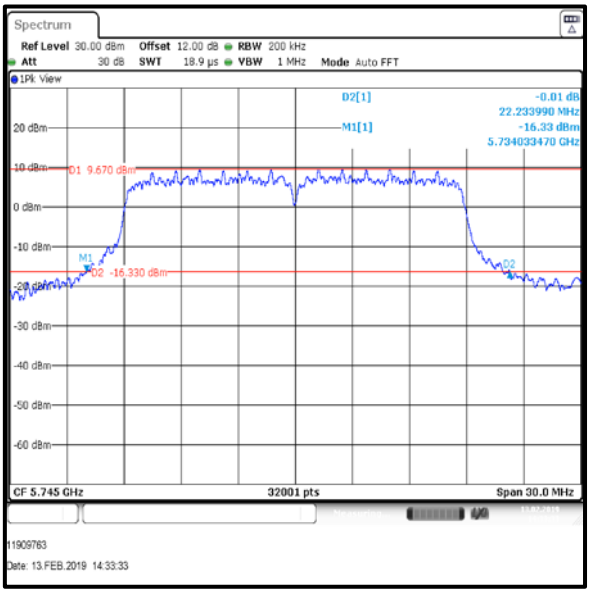
Top -1 Channel

Result: Pass

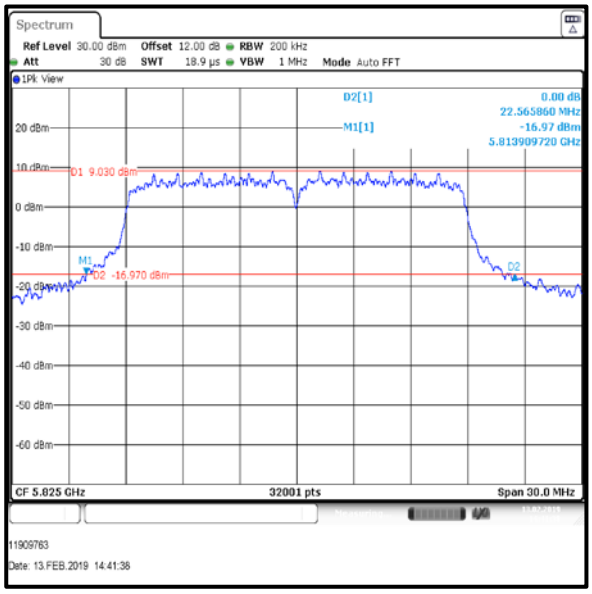
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	22.234
Top	5825	22.566



Bottom Channel



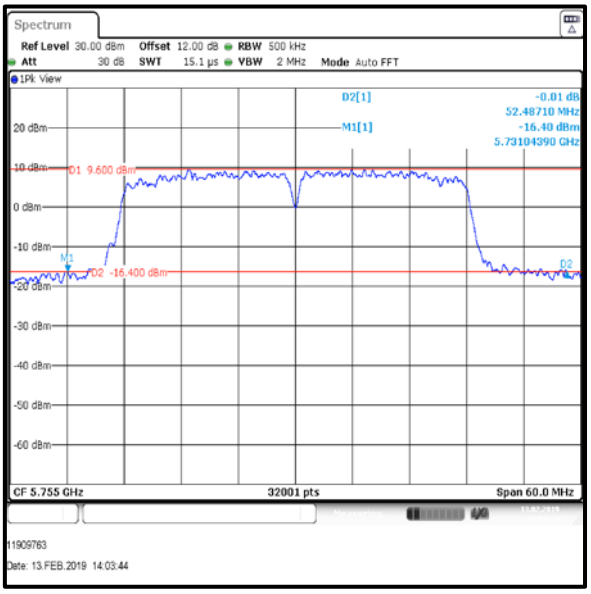
Top Channel

Result: Pass

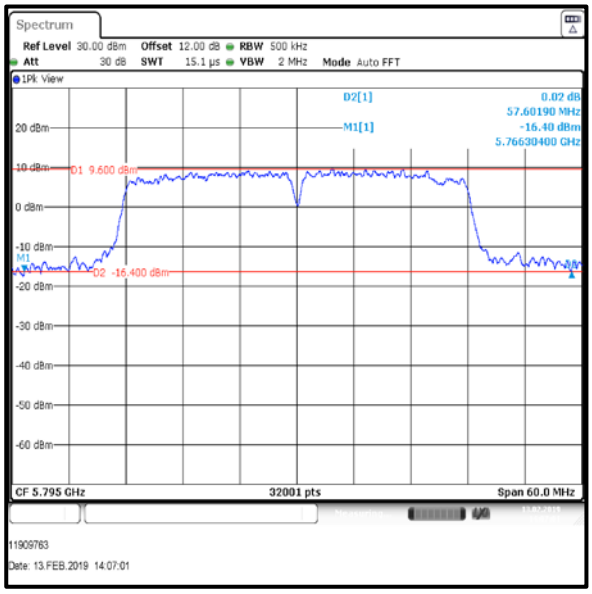
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / HT40 / MCS0 / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5755	52.487
Top	5795	57.602



Bottom Channel



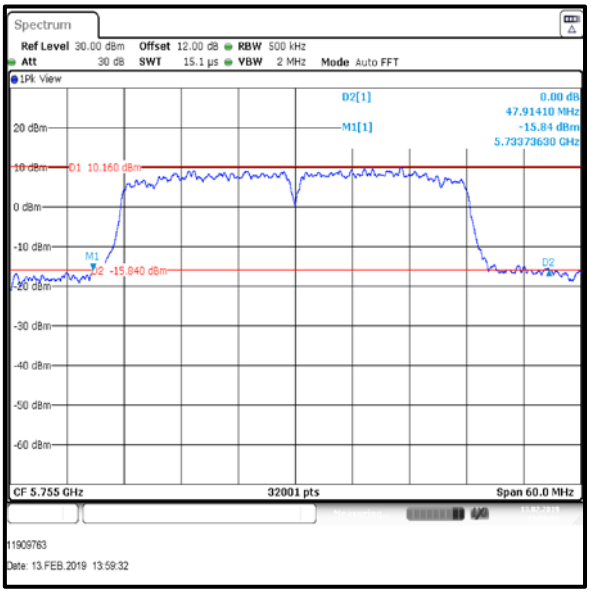
Top Channel

Result: Pass

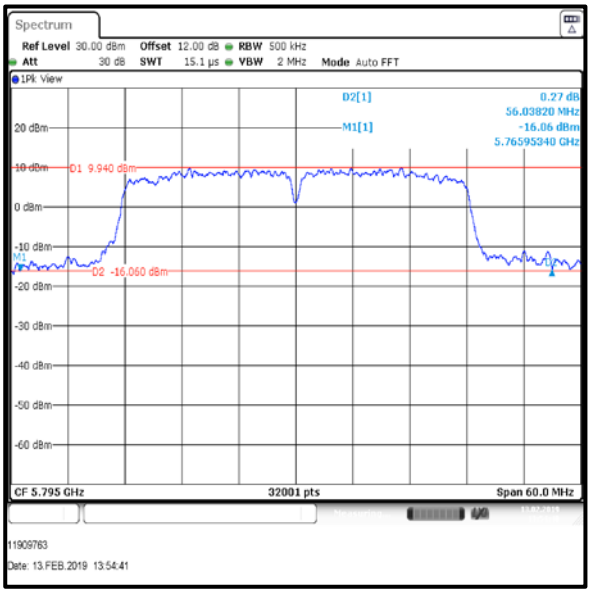
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / HT40 / MCS0 / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5755	47.914
Top	5795	56.038



Bottom Channel



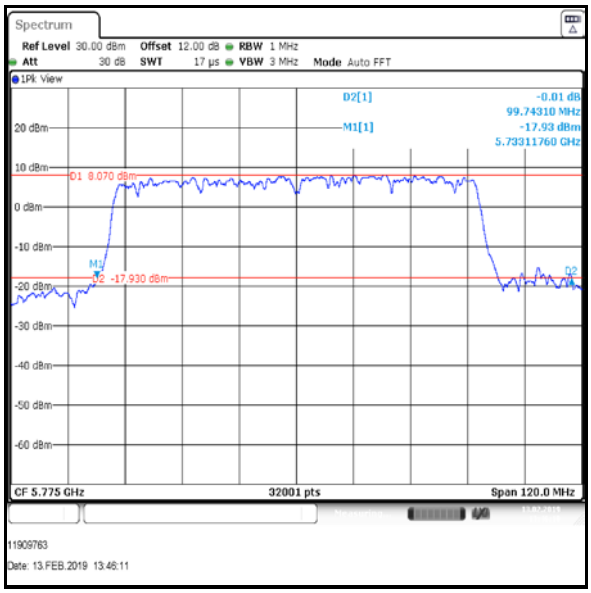
Top Channel

Result: Pass

Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / HT80 / MCS0 / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5775	99.743



Single Channel

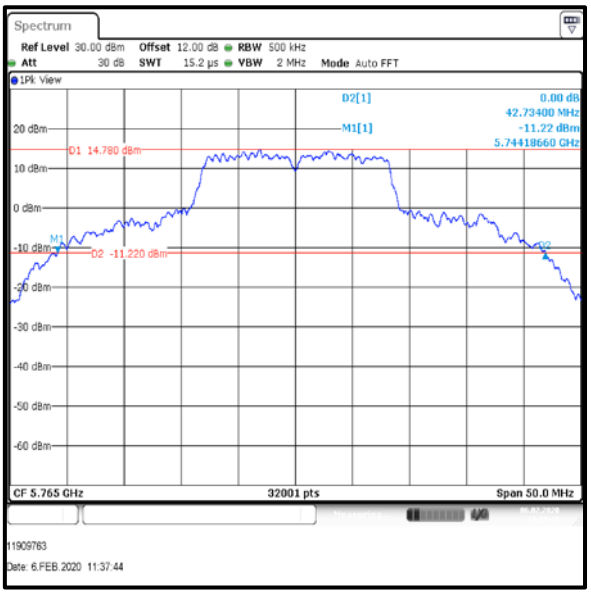
Result: Pass

Transmitter 26 dB Emission Bandwidth (continued)

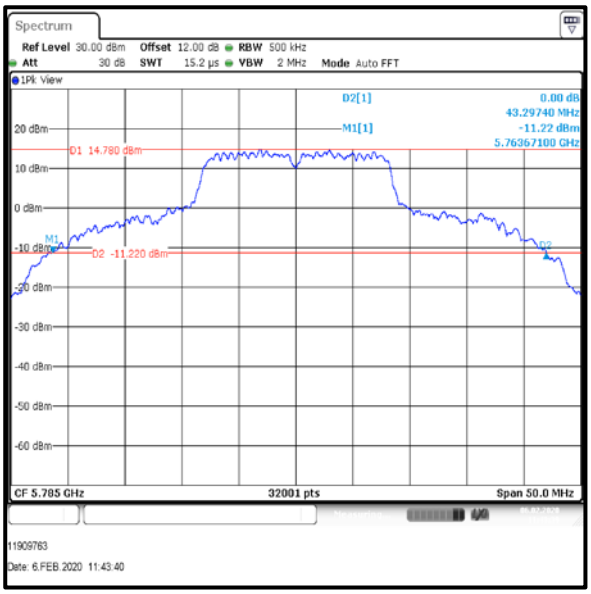
23 dBi Antenna Group

Results: 802.11a / 20 MHz / 6 MBits / SISO / Port 1 / PWL 26 / 23 dBi Antenna Group

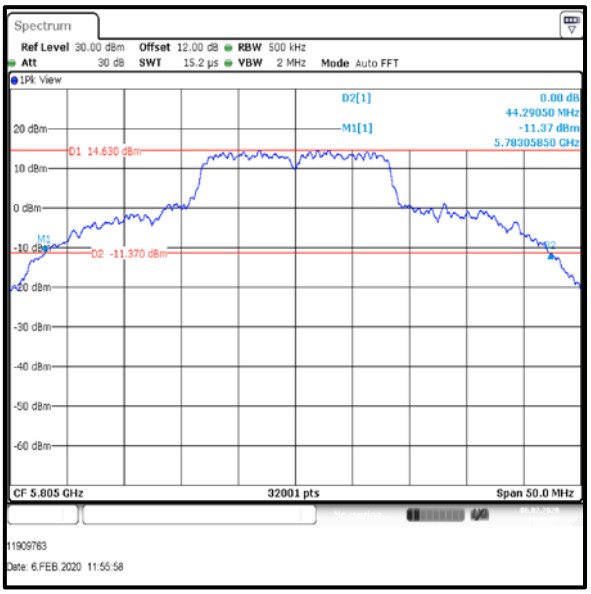
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom +1	5765	42.734
Middle	5785	43.297
Top -1	5805	44.290



Bottom +1 Channel



Middle Channel



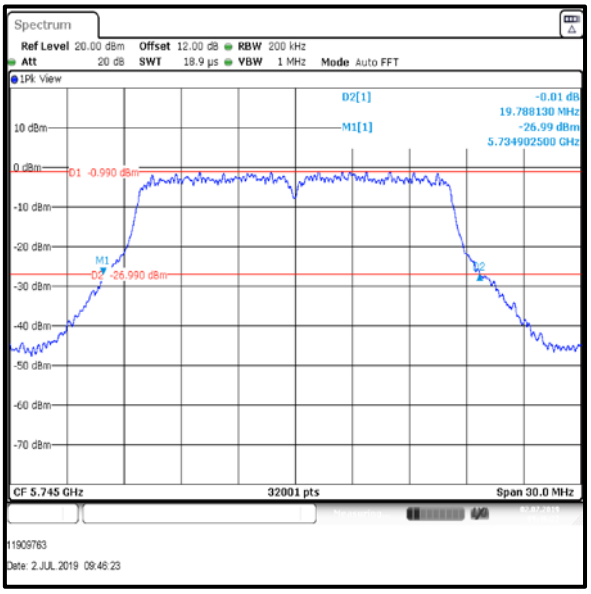
Top -1 Channel

Result: Pass

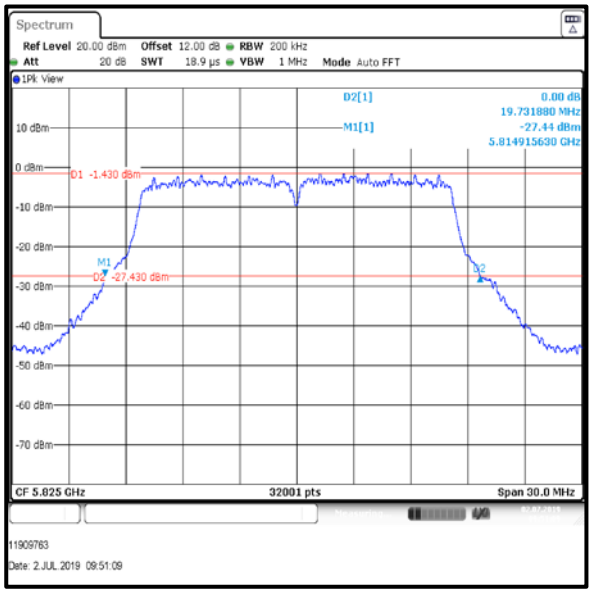
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11a / 20 MHz / 6 Mbps / SISO / Port 1 / PWL 11 / 23 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	19.788
Top	5825	19.732



Bottom Channel



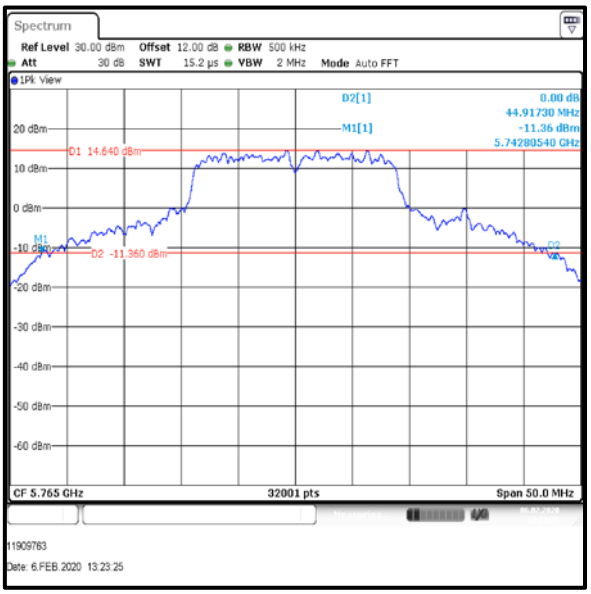
Top Channel

Result: Pass

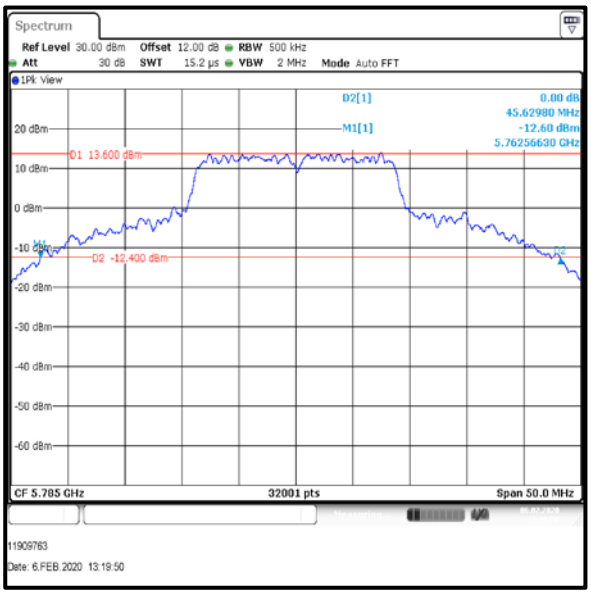
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 23 dBi Antenna Group

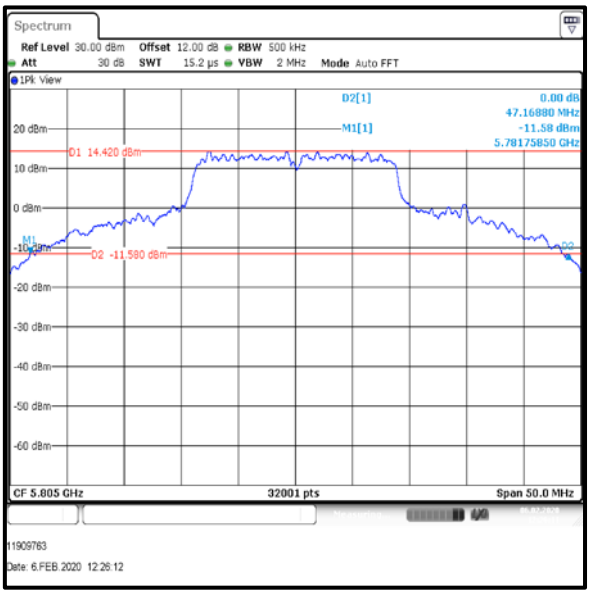
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom +1	5765	44.917
Middle	5785	45.630
Top -1	5805	47.169



Bottom +1 Channel



Middle Channel



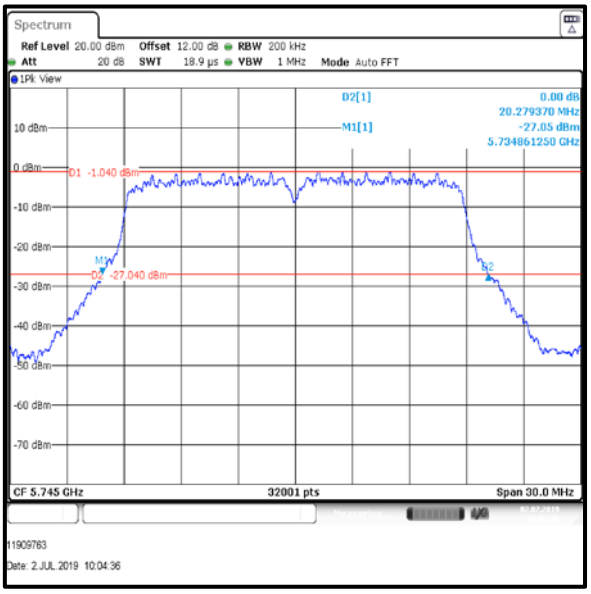
Top -1 Channel

Result: Pass

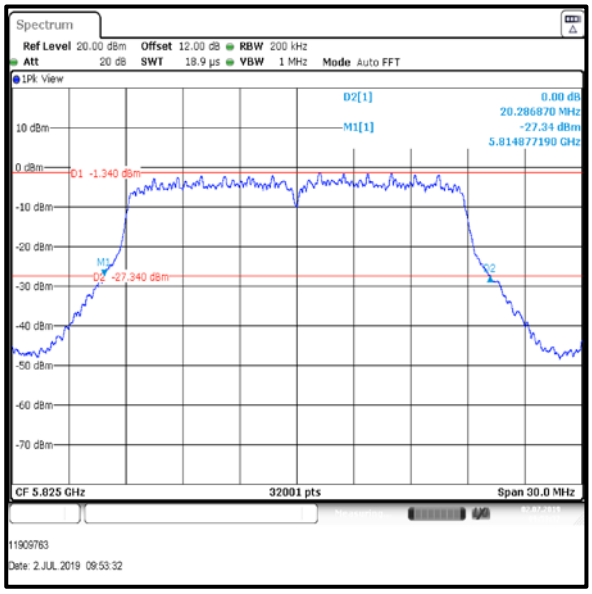
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 11 / 23 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	20.279
Top	5825	20.287



Bottom Channel



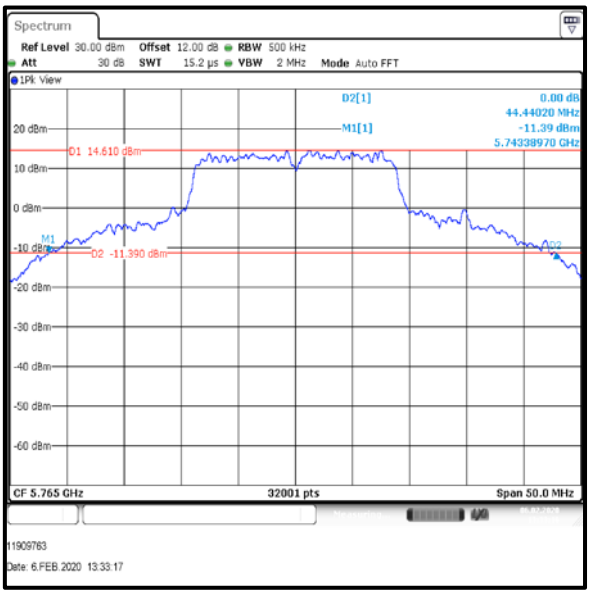
Top Channel

Result: Pass

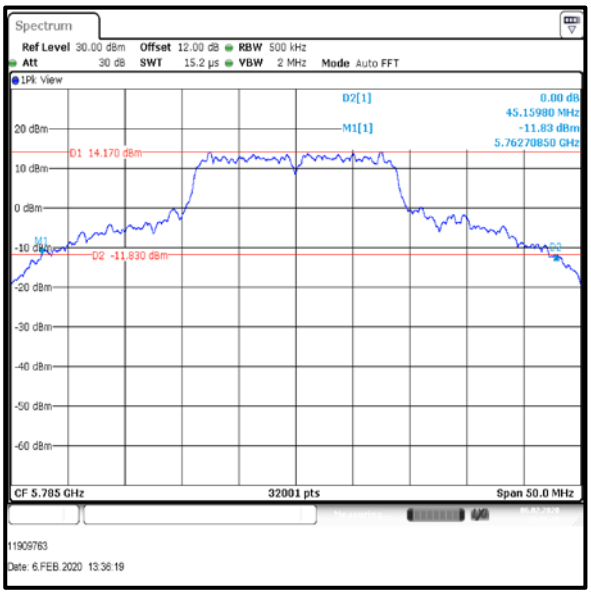
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 23 dBi Antenna Group

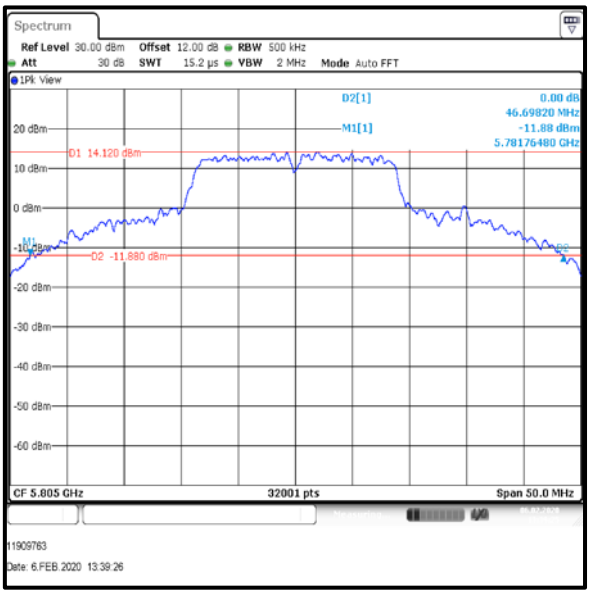
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom +1	5765	44.440
Middle	5785	45.160
Top -1	5805	46.700



Bottom +1 Channel



Middle Channel



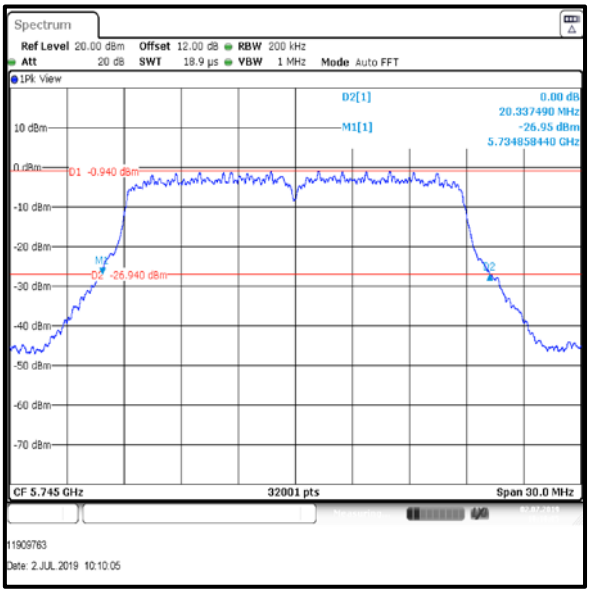
Top -1 Channel

Result: Pass

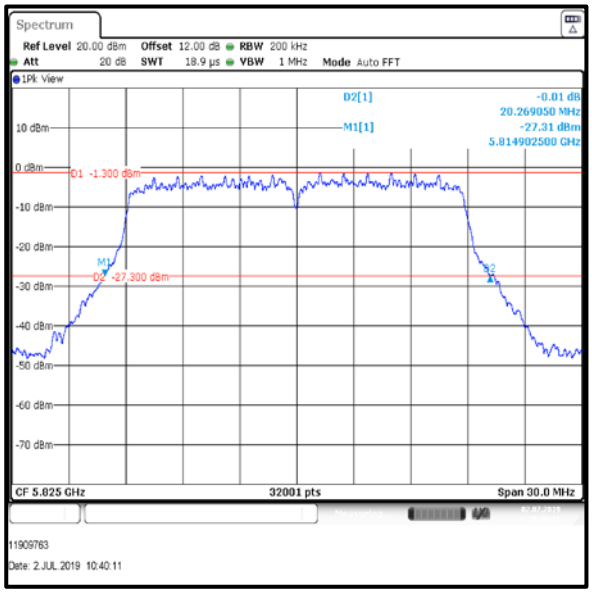
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 11 / 23 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5745	20.337
Top	5825	20.269



Bottom Channel



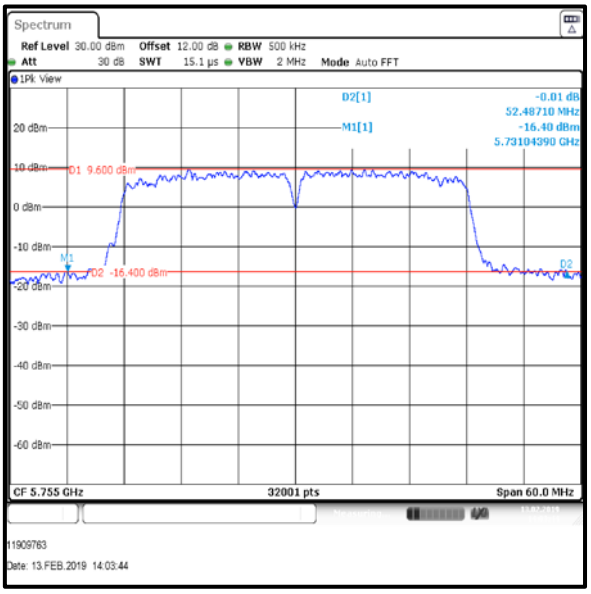
Top Channel

Result: Pass

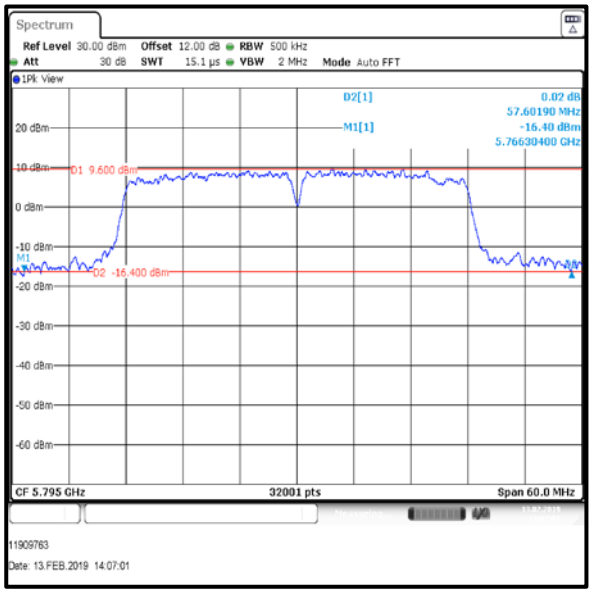
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / HT40 / MCS0 / SISO / Port 1 / PWL 26 / 23 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5755	52.487
Top	5795	57.602



Bottom Channel



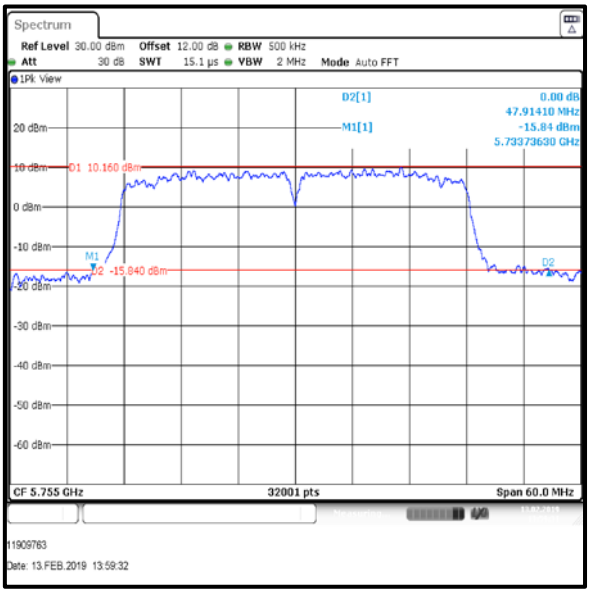
Top Channel

Result: Pass

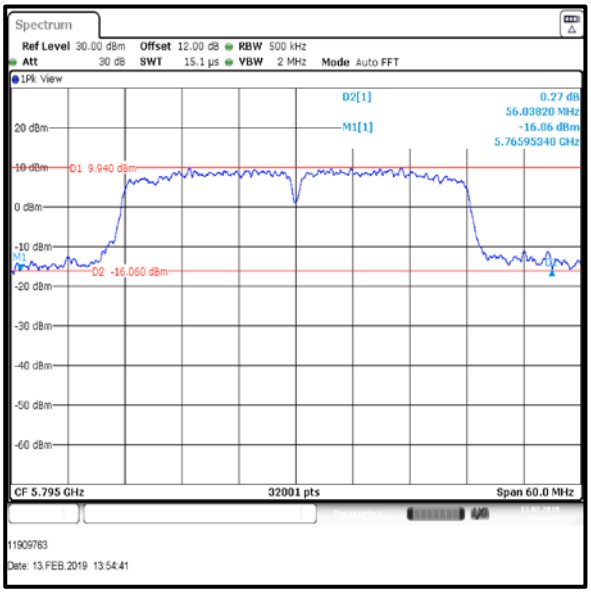
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / HT40 / MCS0 / SISO / Port 1 / PWL 26 / 23 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Bottom	5755	47.914
Top	5795	56.038



Bottom Channel



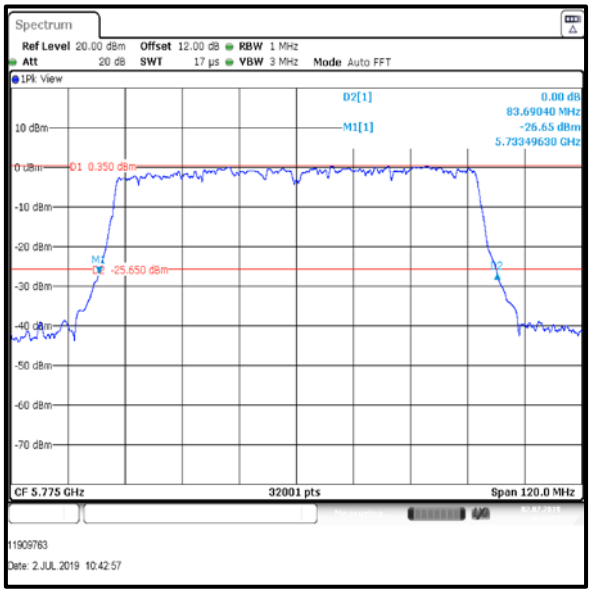
Top Channel

Result: Pass

Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11ac / HT80 / MCS0 / SISO / Port 1 / PWL 11 / 23 dBi Antenna Group

Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)
Single	5775	83.690



Single Channel

Result: Pass

5.2.3. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Dates:**	13 February 2019 to 02 July 2019
Test Sample Serial Number:	192.168.0.60		
Test Site Identification	SR 9		

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

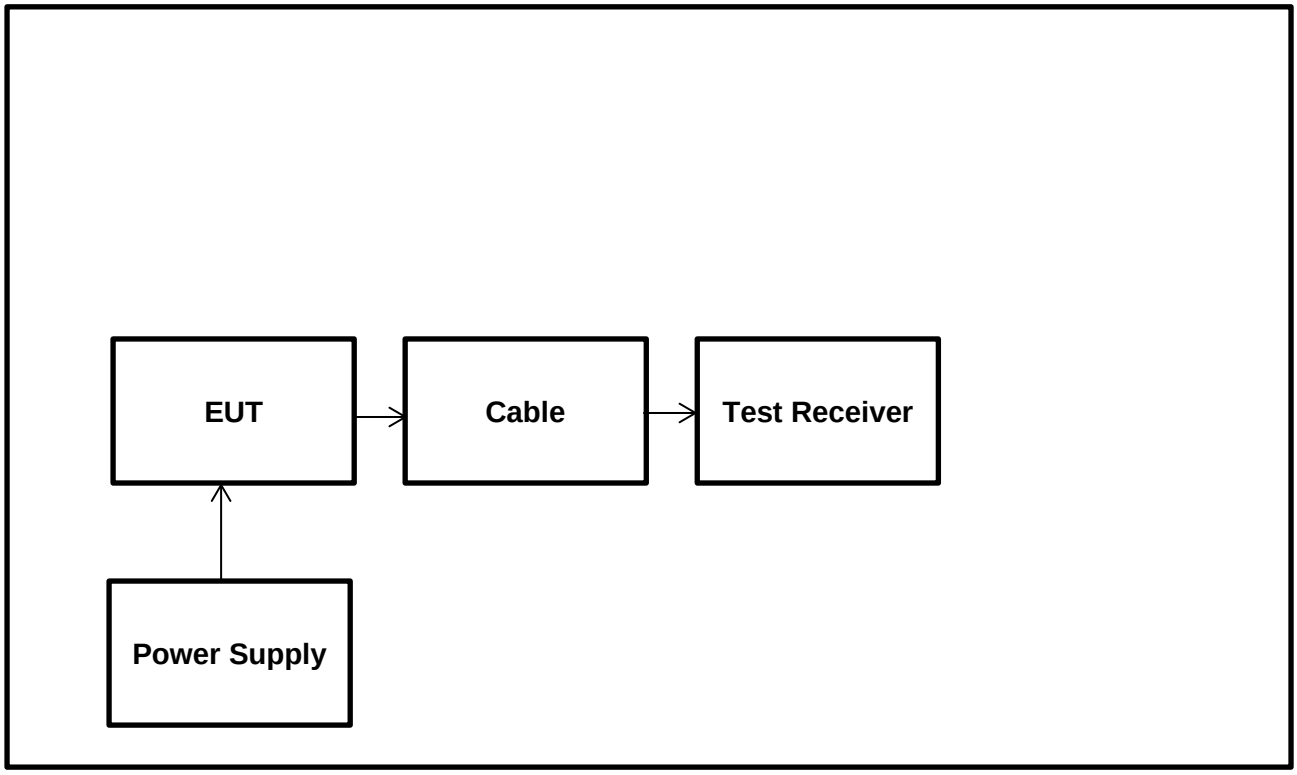
Environmental Conditions:

Temperature (°C):	22 to 24
Relative Humidity (%):	24 to 33

Notes:

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 789033 Section II.C.2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz measurement procedure. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 30 MHz for 20 MHz, 60 MHz for 40 MHz and 120 MHz for 80 MHz The bandwidth was measured at 6 dB down from the peak of the signal.
2. Final measurements were performed using the above configurations on the bottom, middle and top channels or single channels.
3. 6 dB were measured with worst case SISO mode; as they found to be same independent of number of transmitter chains used.
4. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors. The RF cable attenuation (maximum 2.0 dB at the tested frequencies) from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input was added as a reference level offset (12.0 dB) to each of the conducted plots.

Transmitter Minimum 6 dB Bandwidth (continued)
Test Setup:

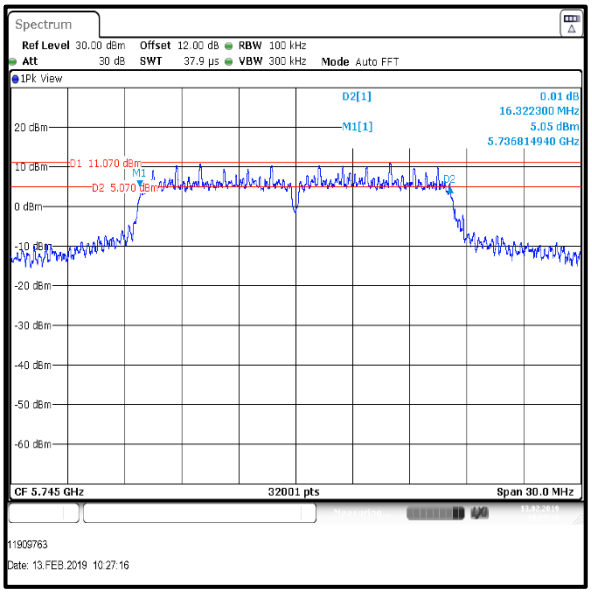


Transmitter Minimum 6 dB Bandwidth (continued)

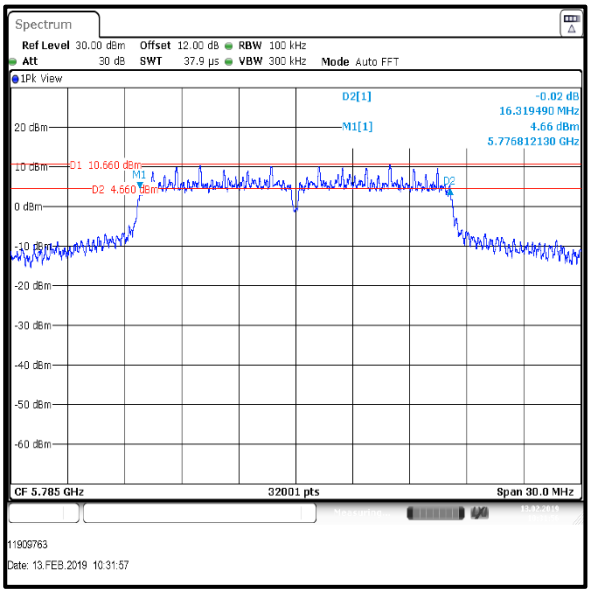
8 dBi Antenna Group

Results: 802.11a / 20 MHz / 6 Mbps / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

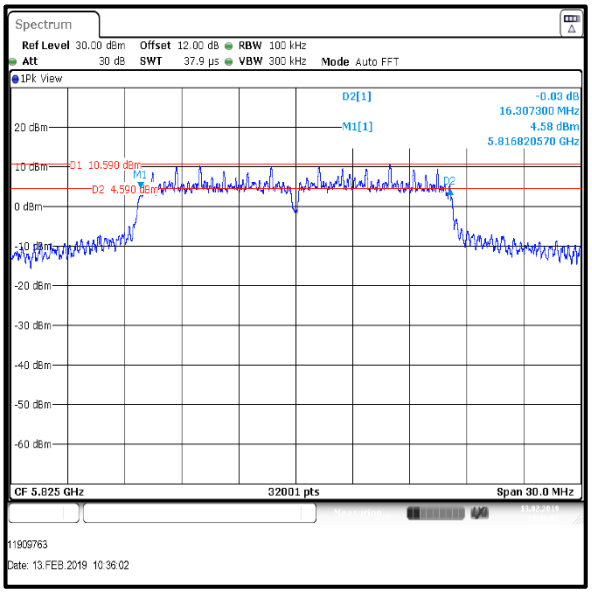
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16322.300	≥500	15822.300	Complied
Middle	16319.490	≥500	15819.490	Complied
Top	16307.300	≥500	15807.300	Complied



Bottom Channel



Middle Channel



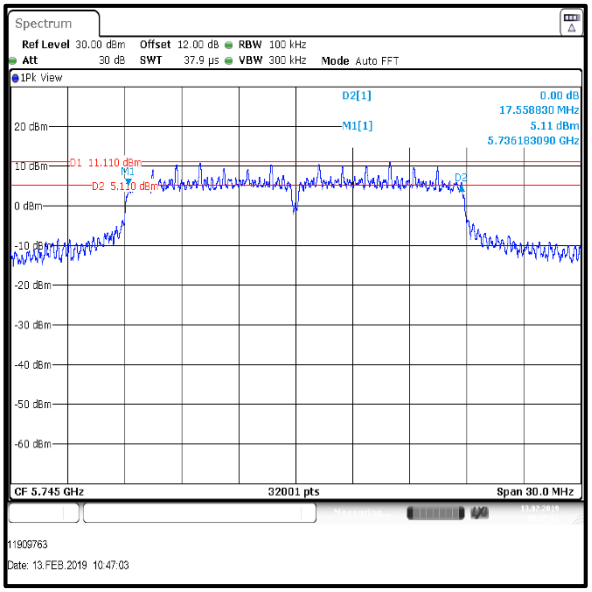
Top Channel

Result: Pass

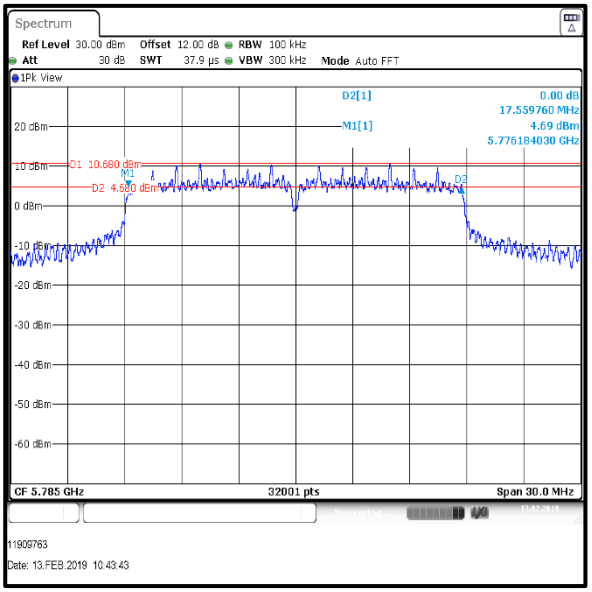
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

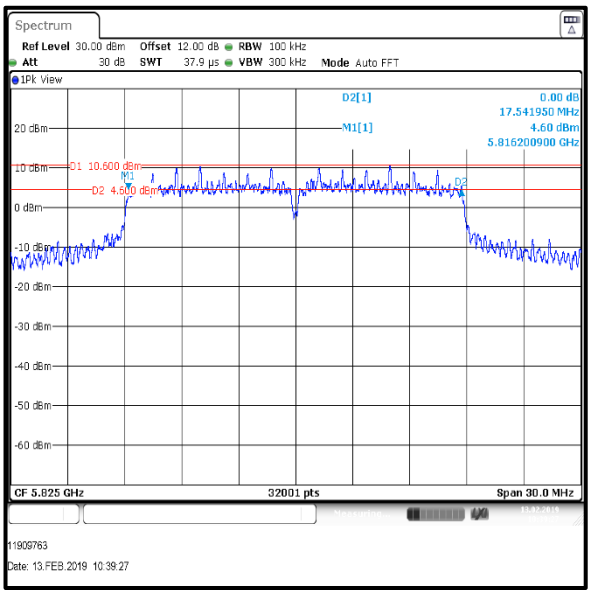
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17558.830	≥500	17058.830	Complied
Middle	17559.760	≥500	17059.670	Complied
Top	17541.950	≥500	17041.950	Complied



Bottom Channel



Middle Channel



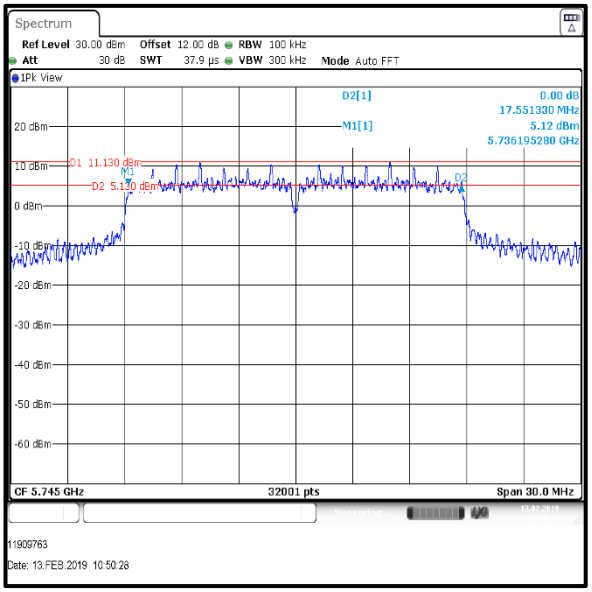
Top Channel

Result: Pass

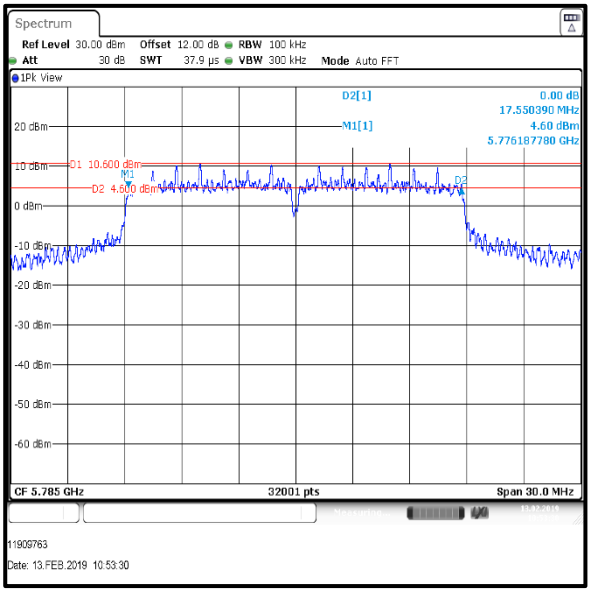
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

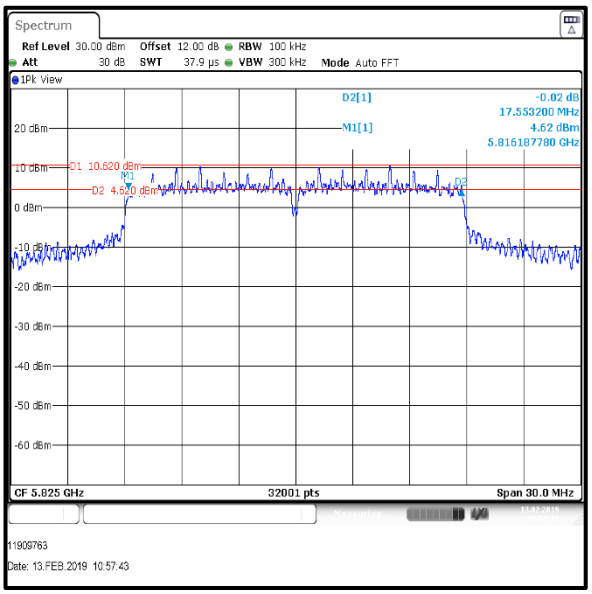
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17551.330	≥500	17051.330	Complied
Middle	17550.390	≥500	17050.390	Complied
Top	17553.200	≥500	17053.200	Complied



Bottom Channel



Middle Channel



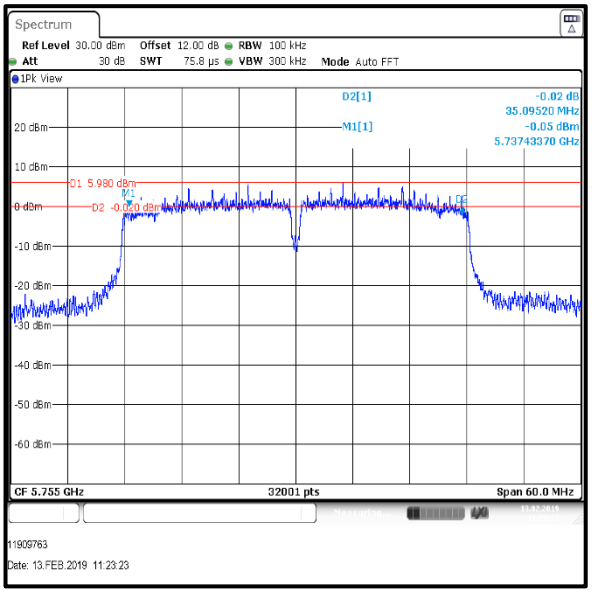
Top Channel

Result: Pass

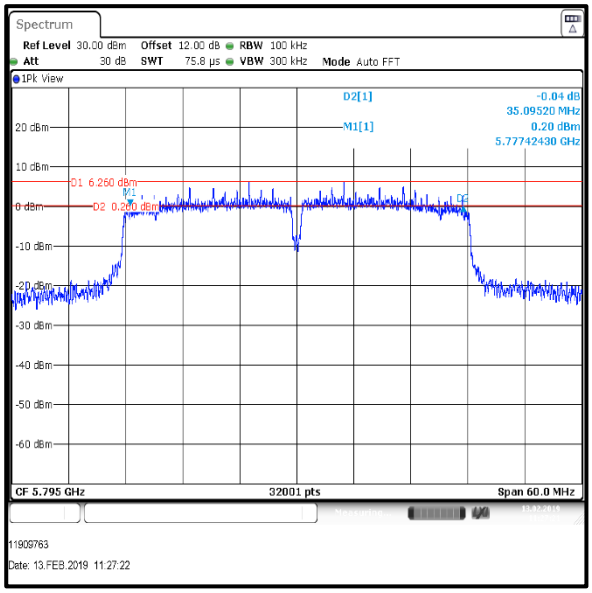
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / HT40 / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	35095.200	≥500	34595.200	Complied
Top	35095.200	≥500	34595.200	Complied



Bottom Channel



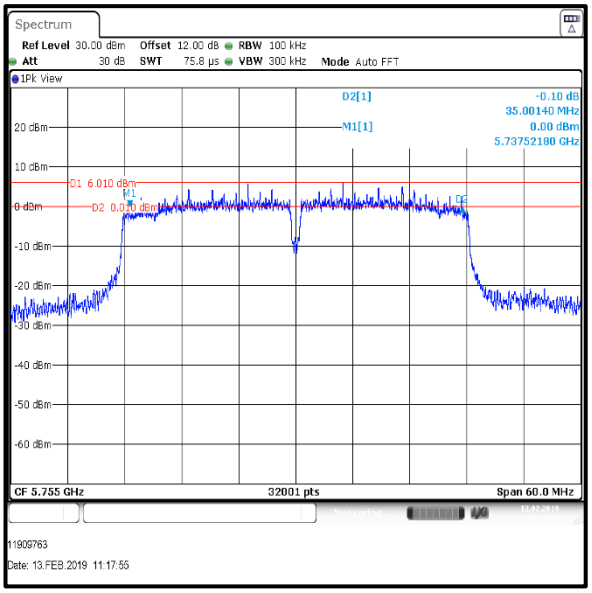
Top Channel

Result: Pass

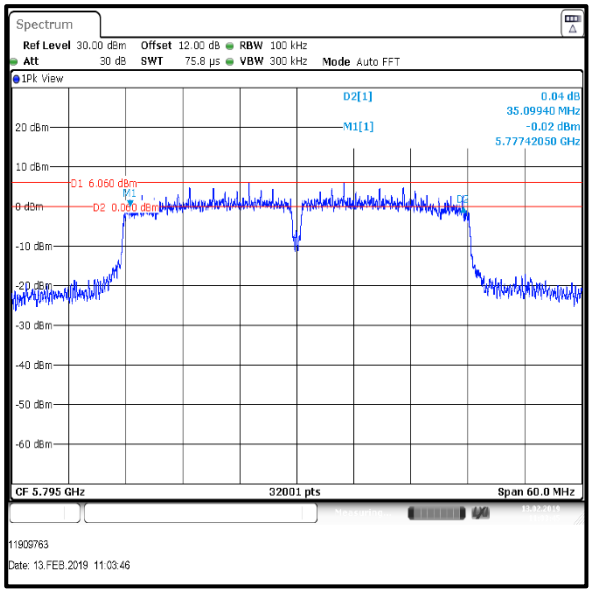
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / HT40 / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	35001.400	≥500	34501.400	Complied
Top	35099.400	≥500	34599.400	Complied



Bottom Channel



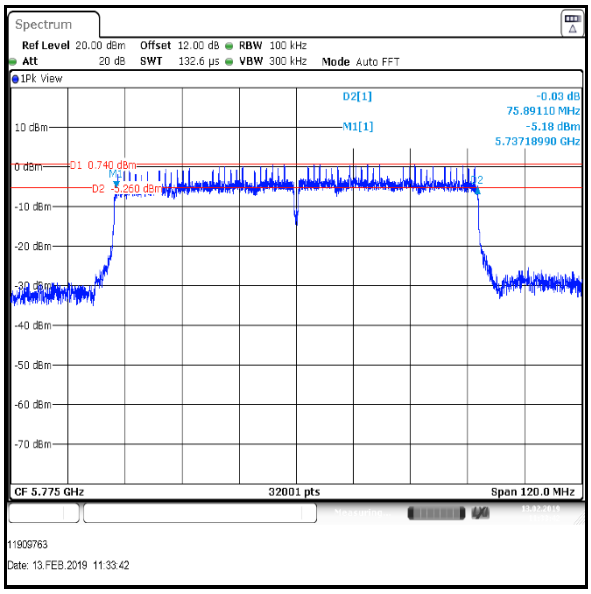
Top Channel

Result: Pass

Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / HT80 / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	75891.100	≥500	75391.100	Complied



Single Channel

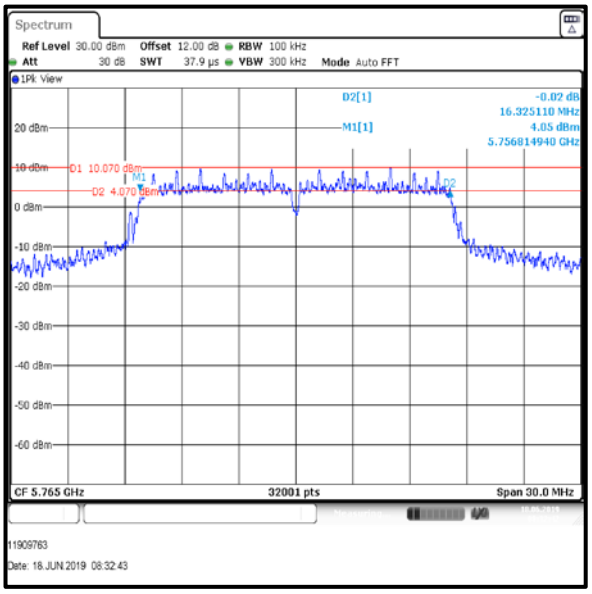
Result: Pass

Transmitter Minimum 6 dB Bandwidth (continued)

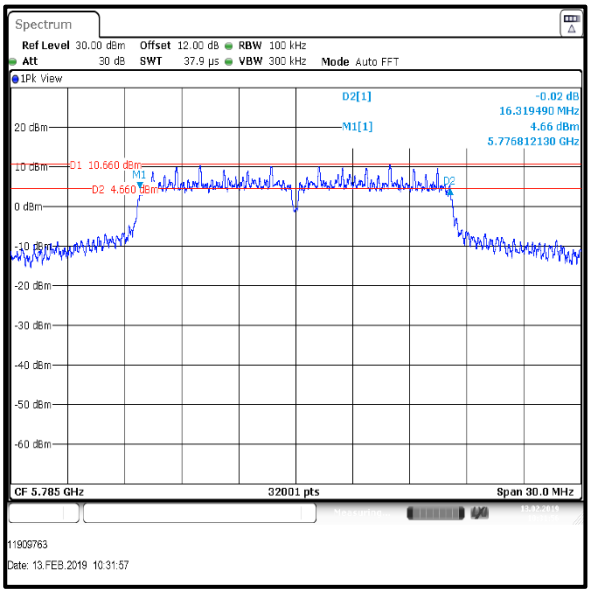
9 dBi Antenna Group

Results: 802.11a / 20 MHz / 6 Mbps / SISO / Port 1 / PWL 26 / 9 dBi Antenna Group

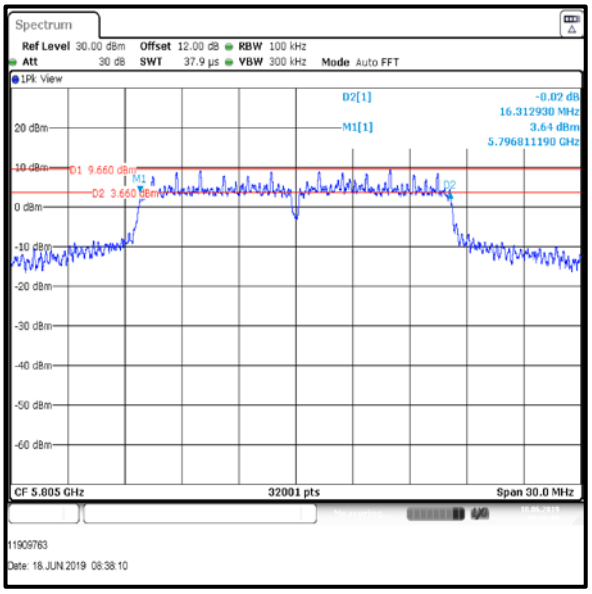
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom +1	16325.110	≥500	15825.110	Complied
Middle	16319.490	≥500	15819.490	Complied
Top -1	16312.930	≥500	15812.930	Complied



Bottom +1 Channel



Middle Channel



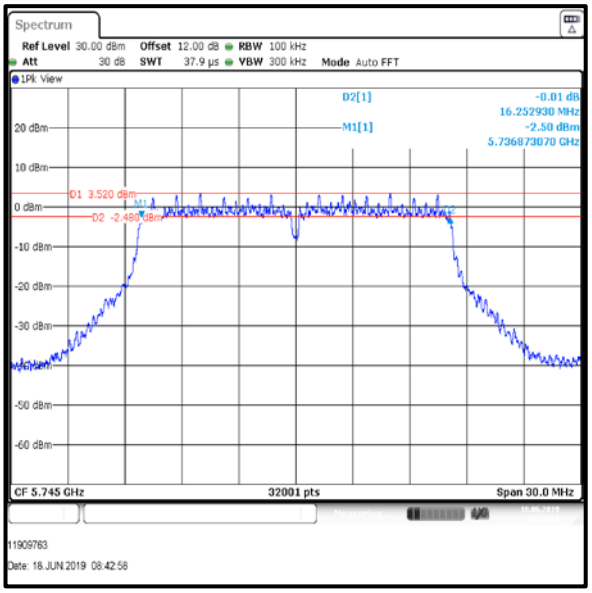
Top -1 Channel

Result: Pass

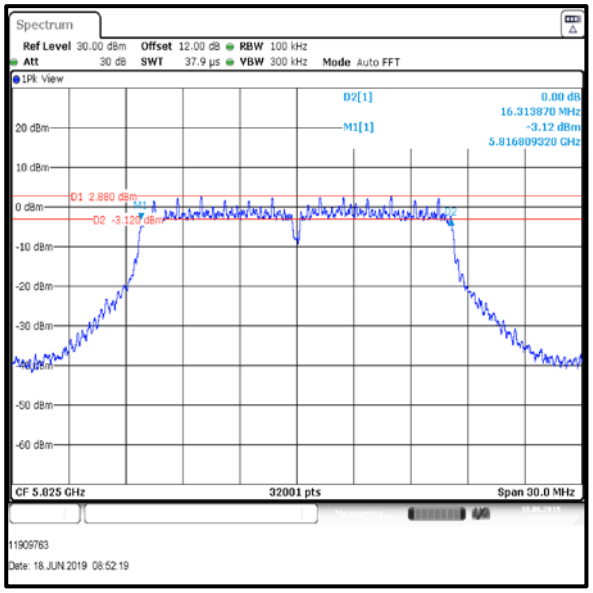
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11a / 20 MHz / 6 Mbps / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16252.930	≥500	15752.930	Complied
Top	16313.870	≥500	15813.870	Complied



Bottom Channel



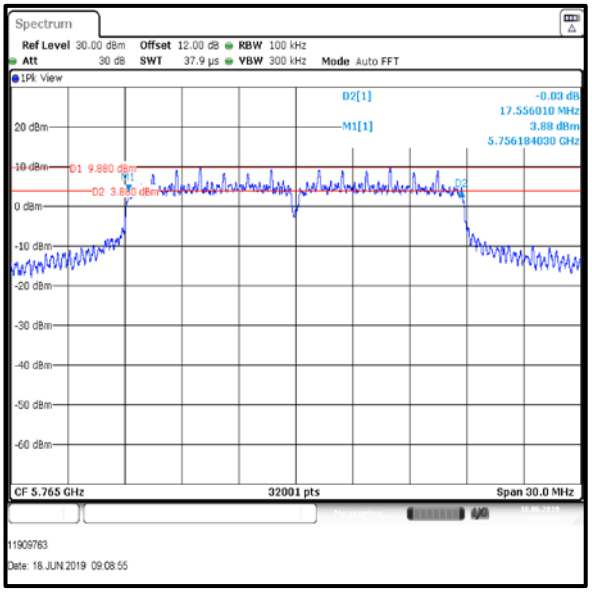
Top Channel

Result: Pass

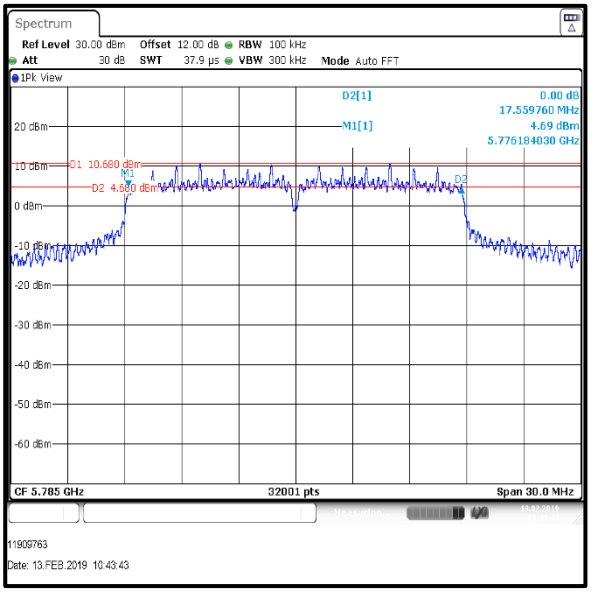
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 9 dBi Antenna Group

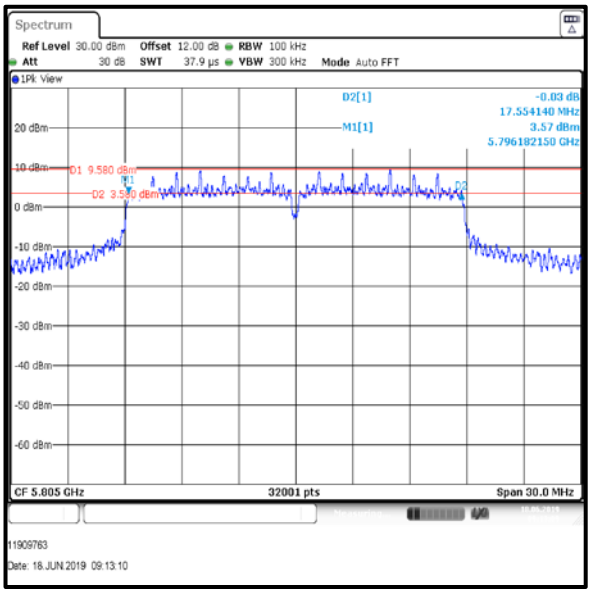
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom +1	17556.010	≥500	17056.010	Complied
Middle	17559.760	≥500	17059.670	Complied
Top -1	17554.140	≥500	17054.140	Complied



Bottom +1 Channel



Middle Channel



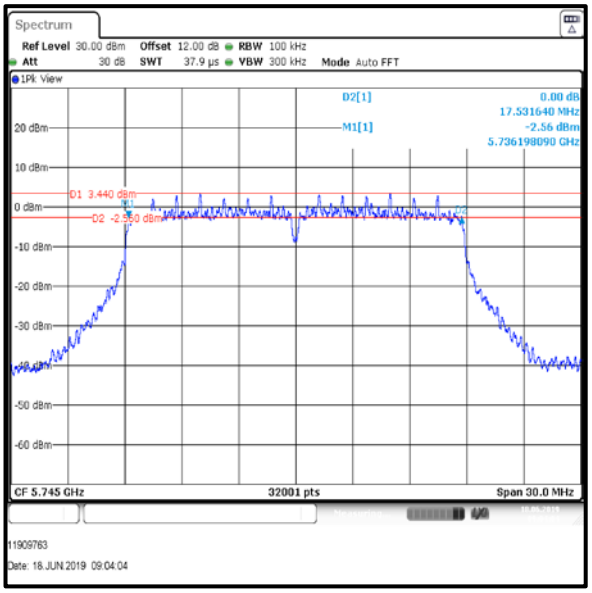
Top -1 Channel

Result: Pass

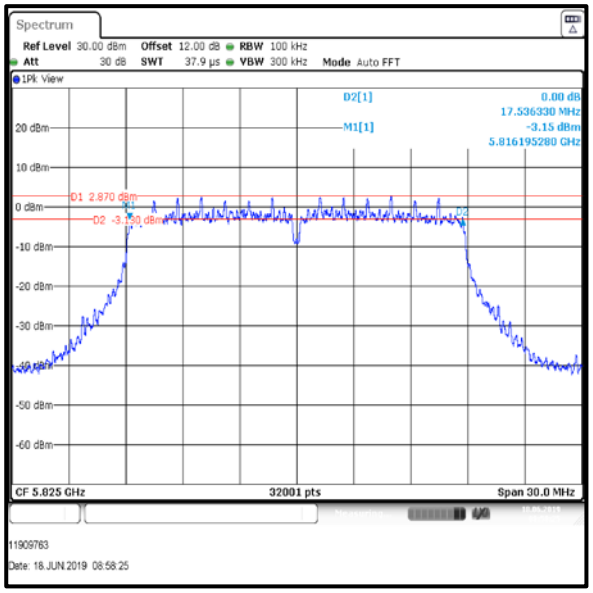
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17531.640	≥500	17031.640	Complied
Top	17536.330	≥500	17036.330	Complied



Bottom Channel



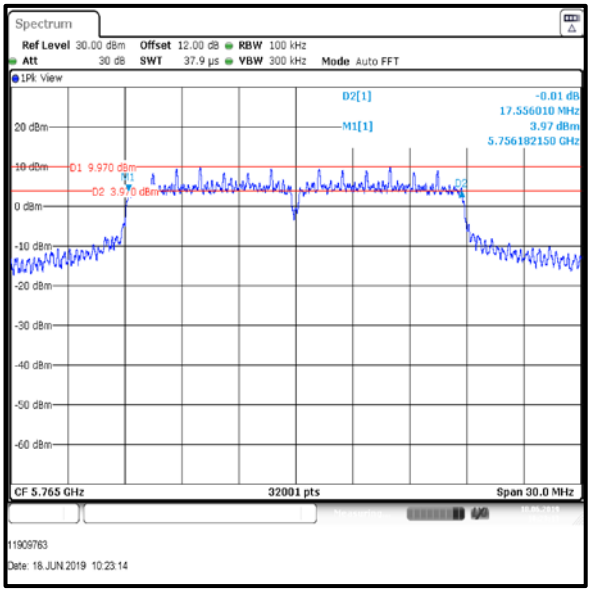
Top Channel

Result: Pass

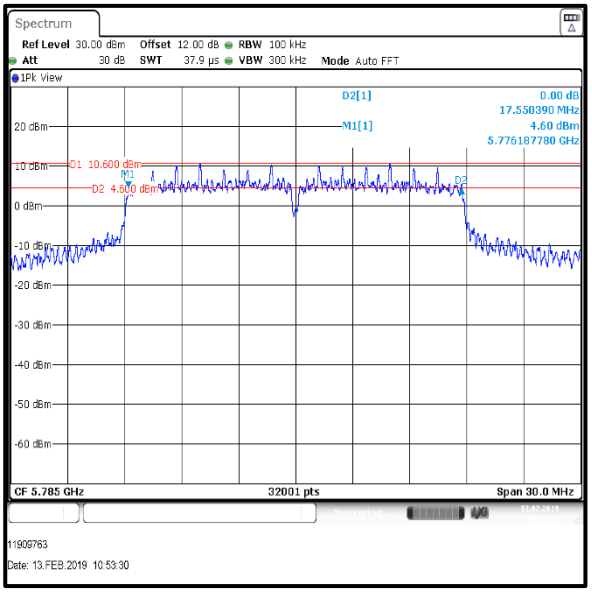
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 9 dBi Antenna Group

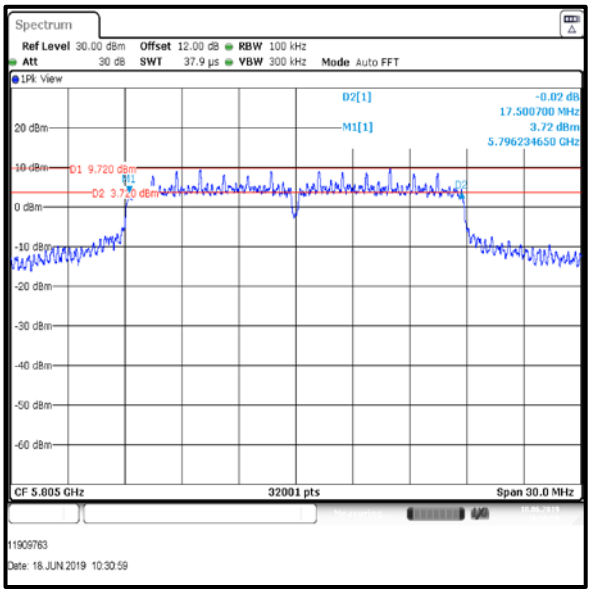
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom +1	17556.010	≥500	17056.010	Complied
Middle	17550.390	≥500	17050.390	Complied
Top -1	17500.700	≥500	17000.700	Complied



Bottom +1 Channel



Middle Channel



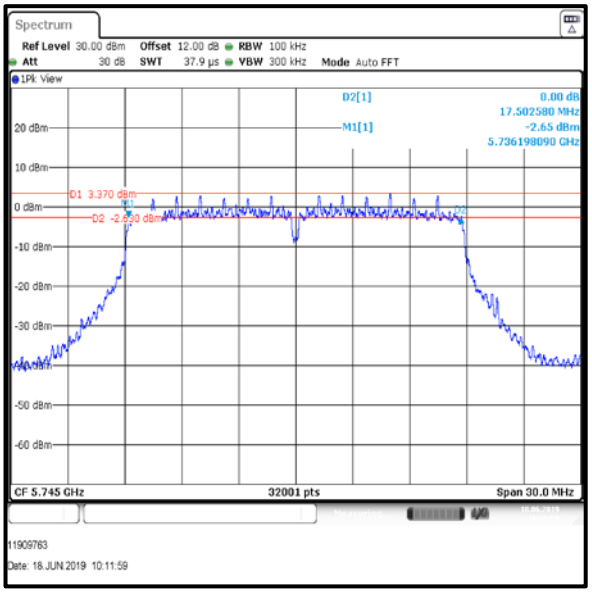
Top -1 Channel

Result: Pass

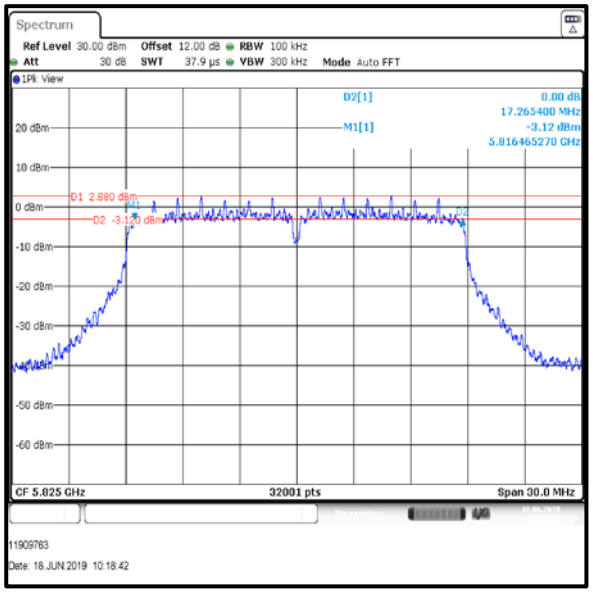
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17502.580	≥500	17002.580	Complied
Top	17265.400	≥500	16765.400	Complied



Bottom Channel



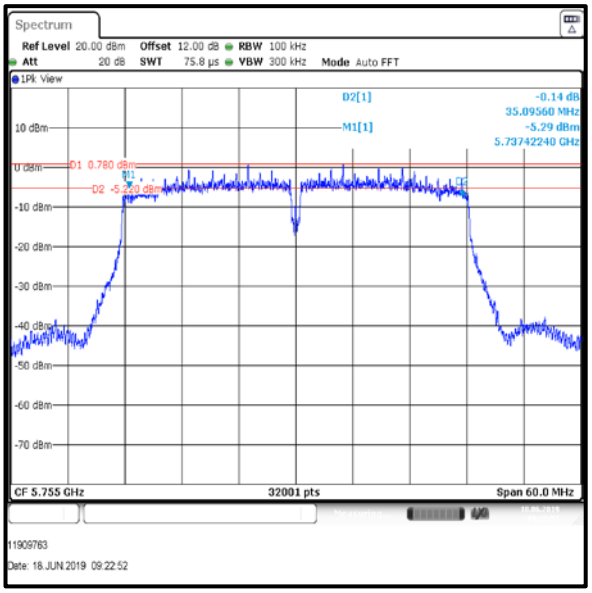
Top Channel

Result: Pass

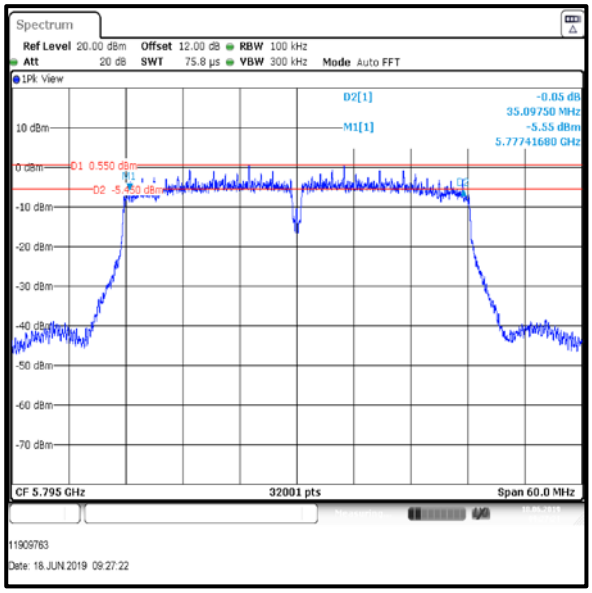
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / HT40 / MCS0 / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	35095.600	≥500	34595.600	Complied
Top	35097.500	≥500	34597.500	Complied



Bottom Channel



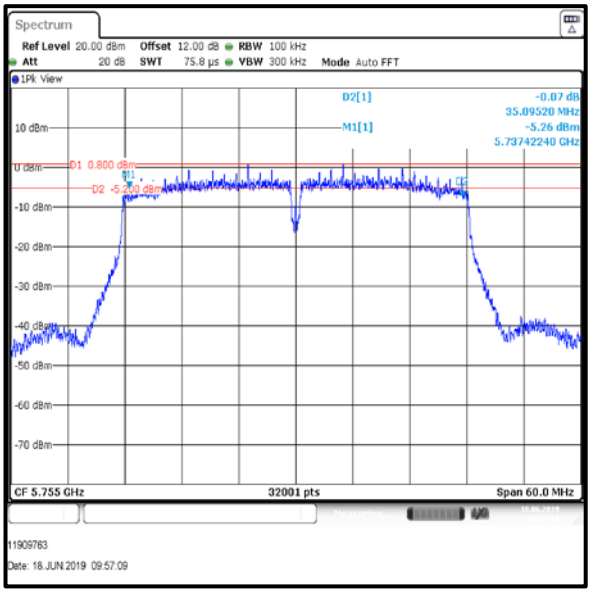
Top Channel

Result: Pass

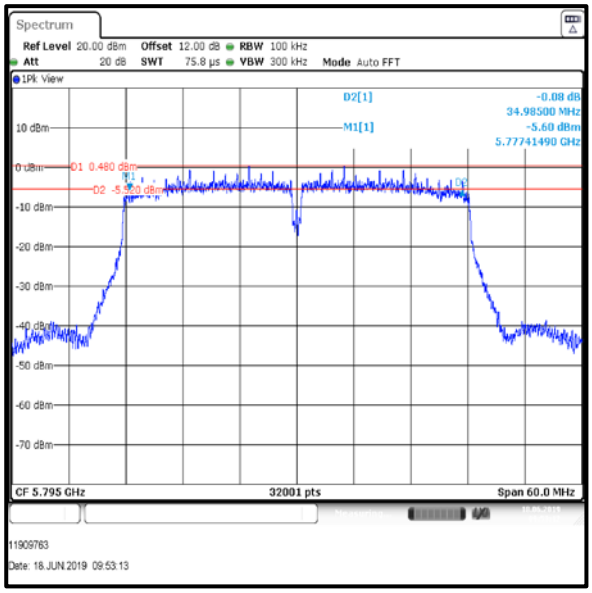
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / HT40 / MCS0 / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	35095.200	≥500	34595.200	Complied
Top	34985.000	≥500	34485.000	Complied



Bottom Channel



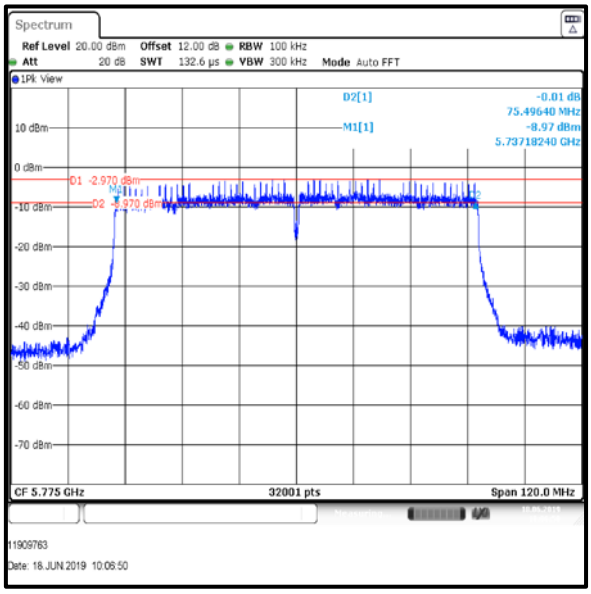
Top Channel

Result: Pass

Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / HT80 / MCS0 / SISO / Port 1 / PWL 16 / 9 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	75496.400	≥500	74996.400	Complied



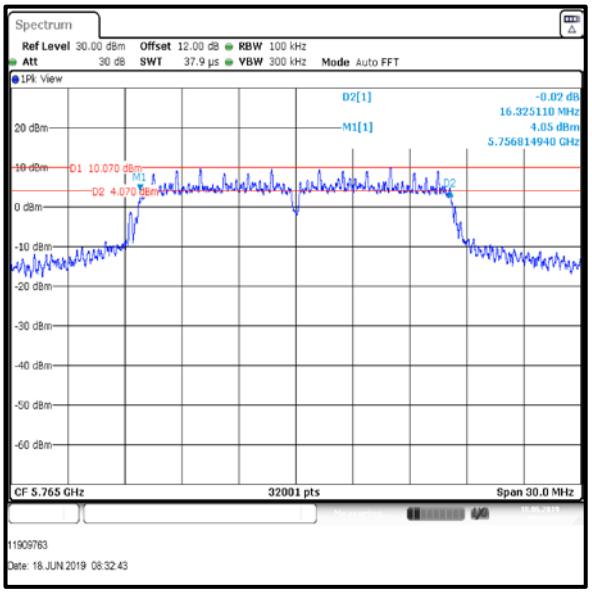
Result: **Pass**

Transmitter Minimum 6 dB Bandwidth (continued)

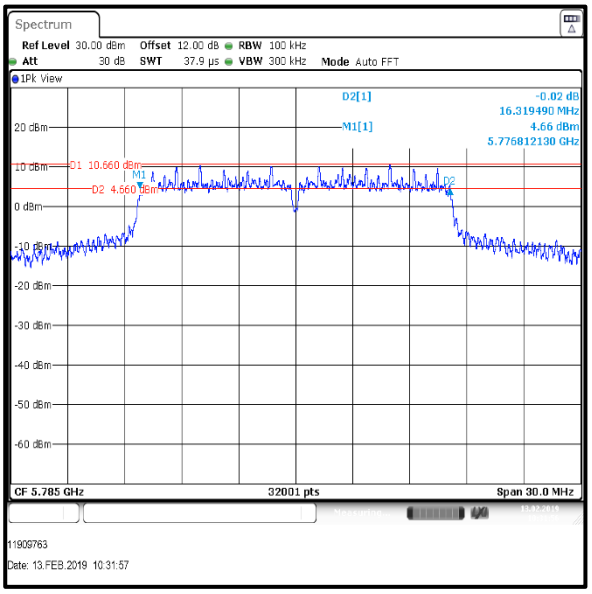
23 dBi Antenna Group

Results: 802.11a / 20 MHz / 6 Mbps / SISO / Port 1 / PWL 26 / 23 dBi Antenna Group

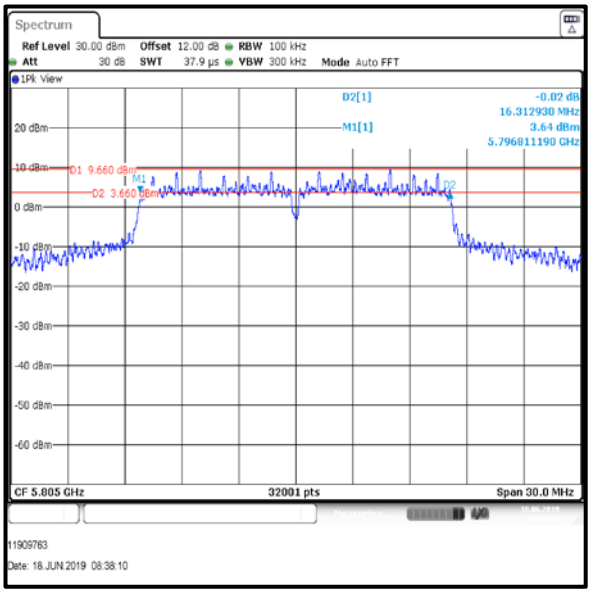
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom +1	16325.110	≥500	15825.110	Complied
Middle	16319.490	≥500	15819.490	Complied
Top -1	16312.930	≥500	15812.930	Complied



Bottom +1 Channel



Middle Channel



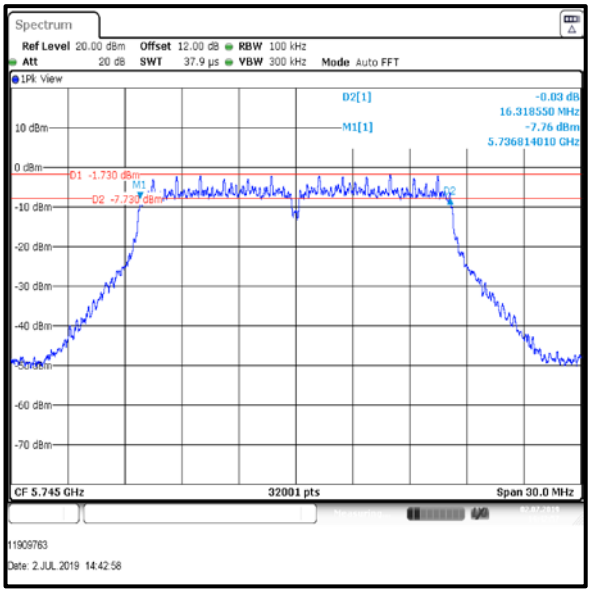
Top -1 Channel

Result: Pass

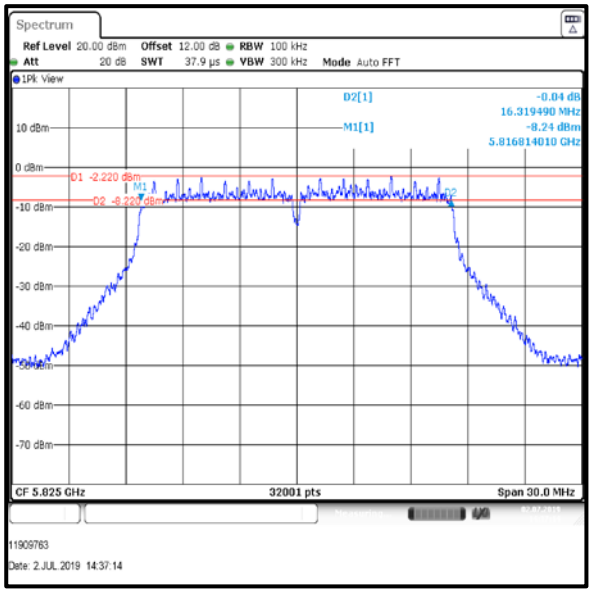
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11a / 20 MHz / 6 Mbps / SISO / Port 1 / PWL 11 / 23 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16318.550	≥500	15818.550	Complied
Top	16319.490	≥500	15819.490	Complied



Bottom Channel



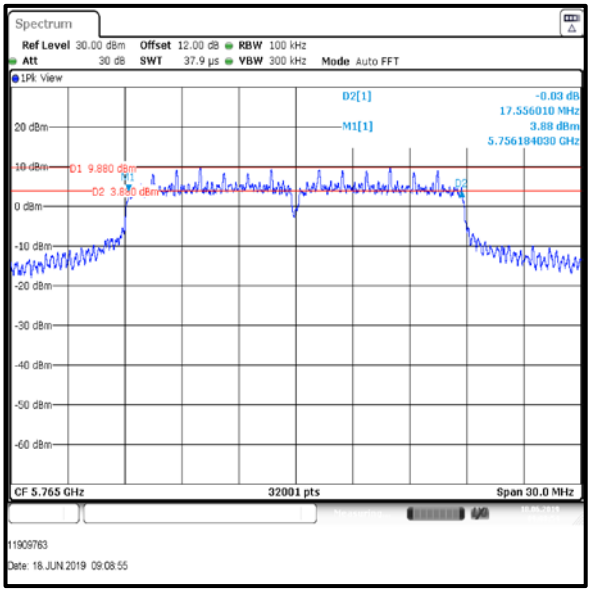
Top Channel

Result: Pass

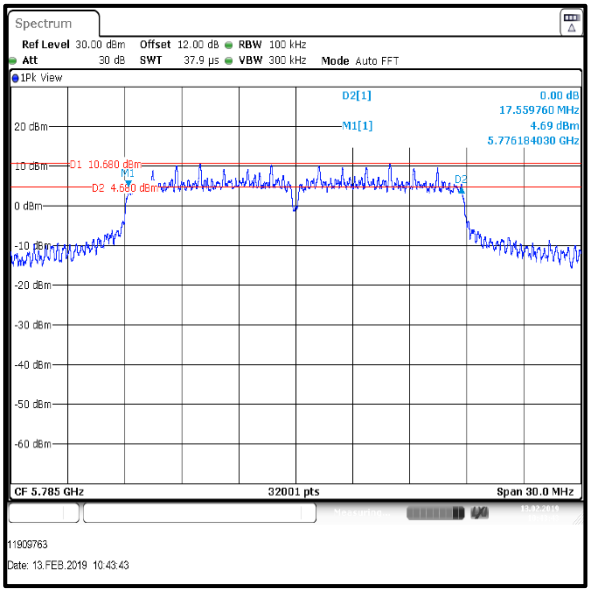
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 23 dBi Antenna Group

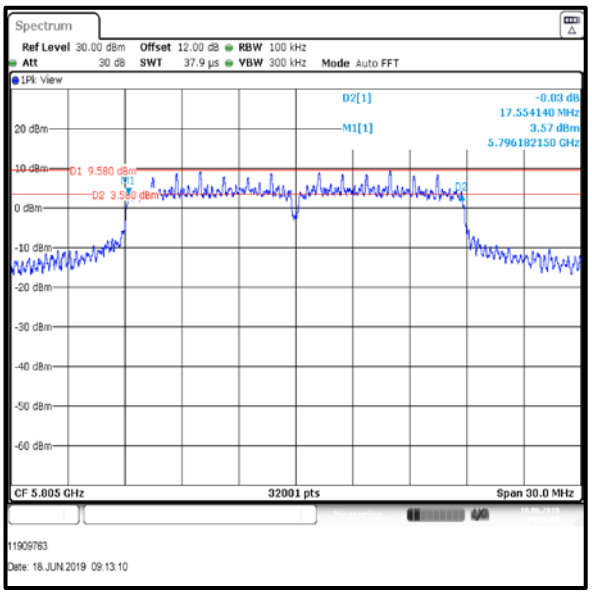
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom +1	17556.010	≥500	17056.010	Complied
Middle	17559.760	≥500	17059.760	Complied
Top -1	17554.140	≥500	17054.140	Complied



Bottom +1 Channel



Middle Channel



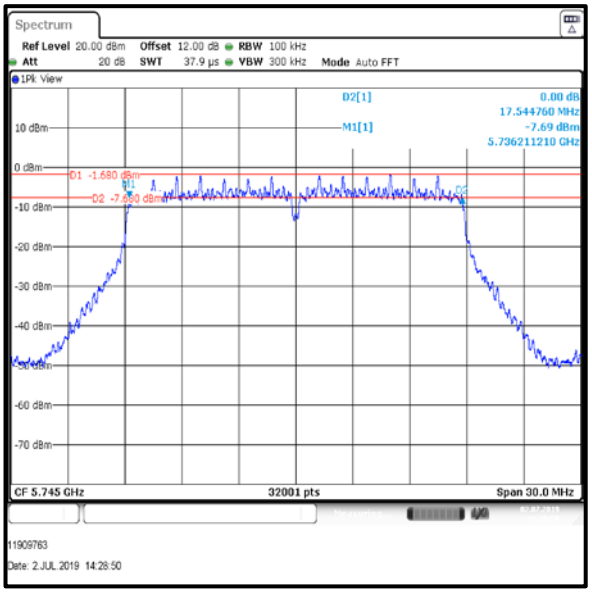
Top -1 Channel

Result: Pass

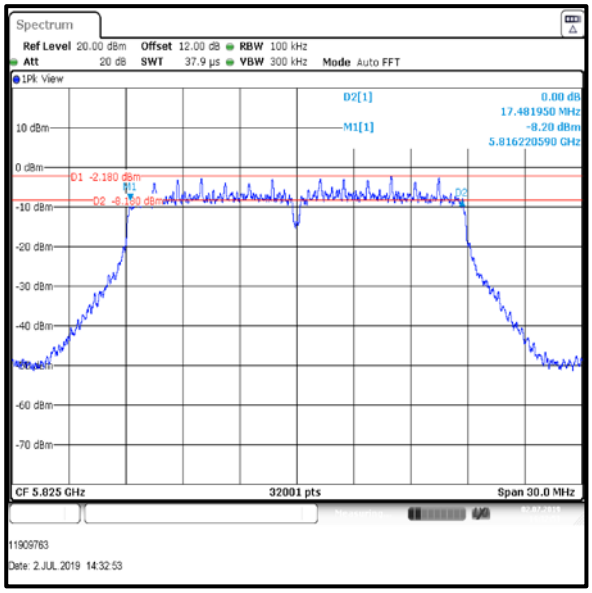
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 11 / 23 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17544.760	≥500	17044.760	Complied
Top	17481.950	≥500	16981.950	Complied



Bottom Channel



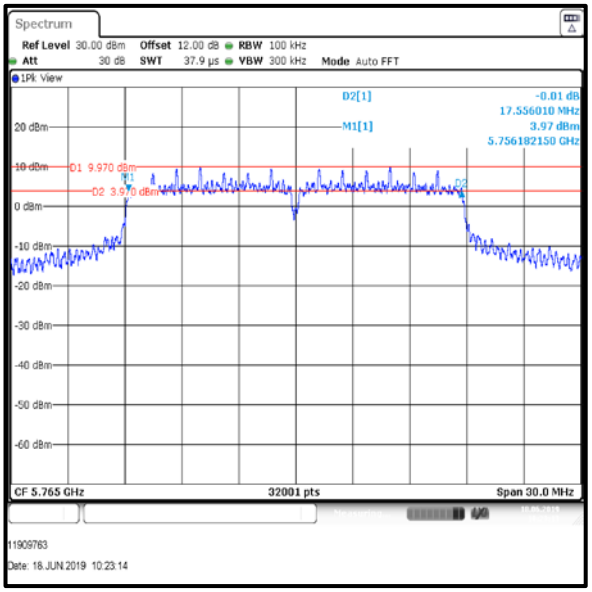
Top Channel

Result: Pass

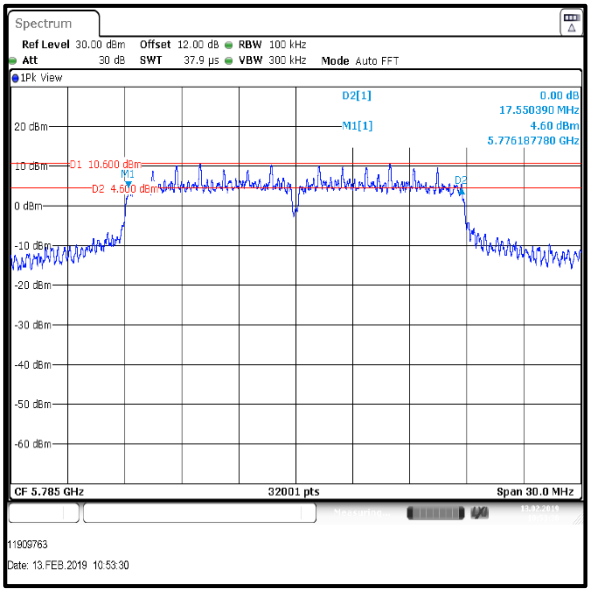
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 23 dBi Antenna Group

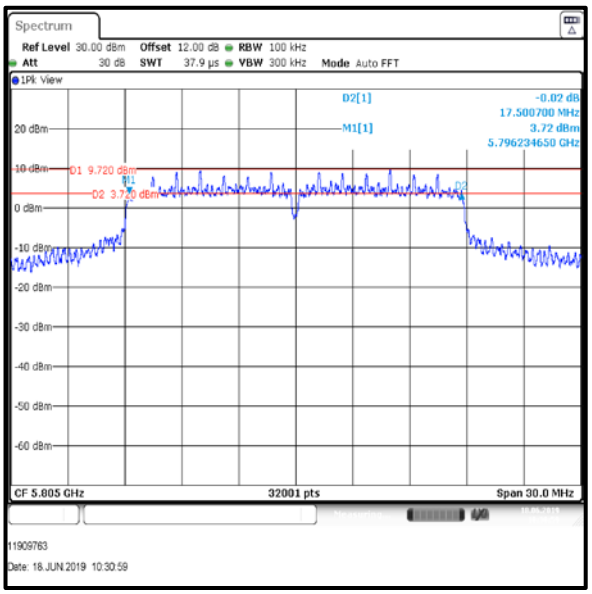
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom +1	17556.010	≥500	17056.010	Complied
Middle	17550.390	≥500	17050.390	Complied
Top -1	17500.700	≥500	17000.700	Complied



Bottom +1 Channel



Middle Channel



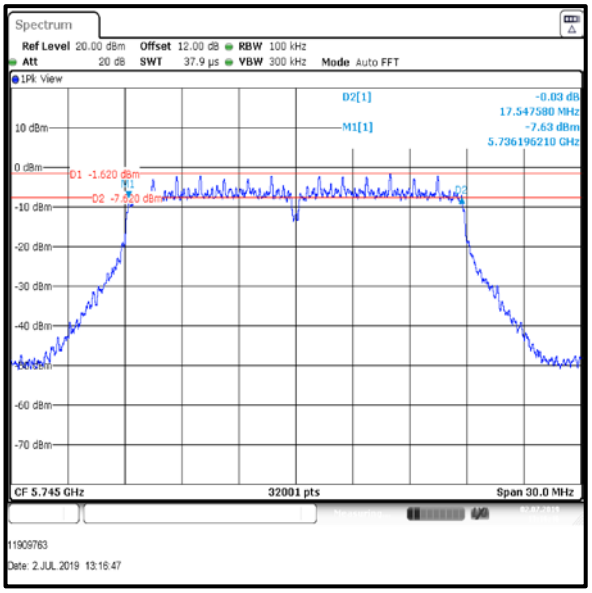
Top -1 Channel

Result: Pass

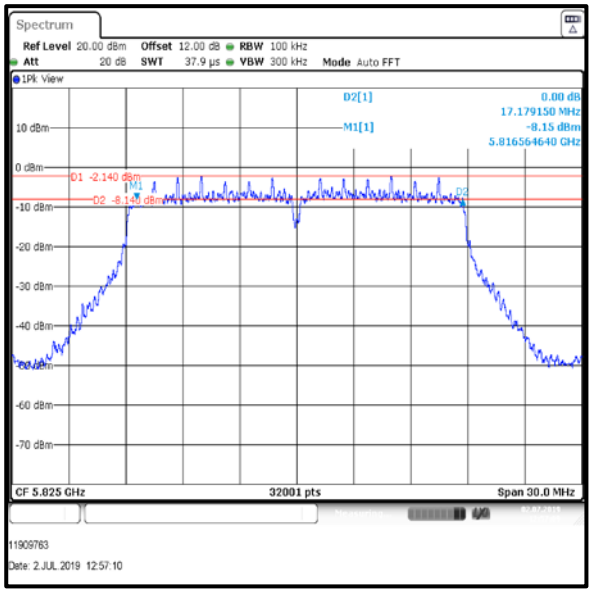
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 11 / 23 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17547.580	≥500	17047.580	Complied
Top	17179.150	≥500	16679.150	Complied



Bottom Channel



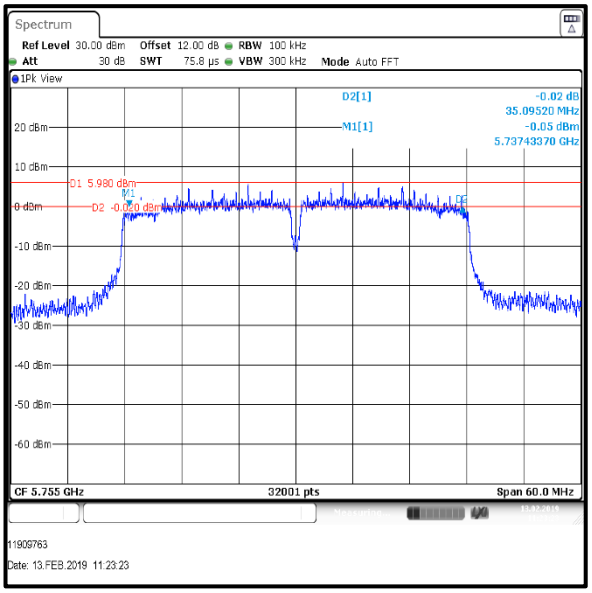
Top Channel

Result: Pass

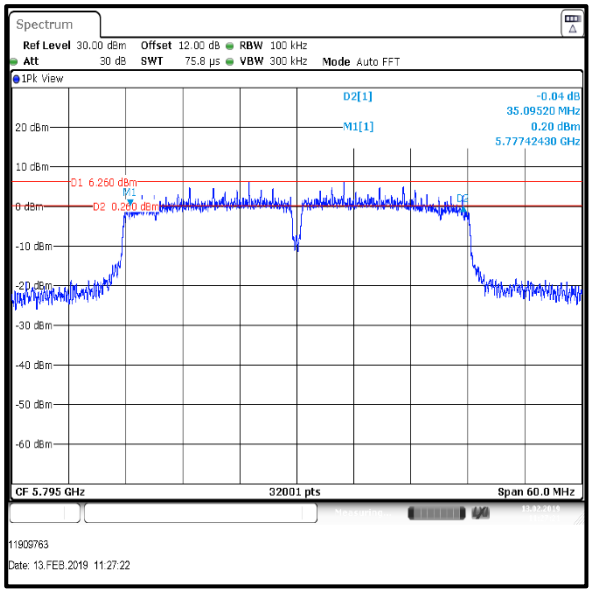
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / HT40 / MCS0 / SISO / Port 1 / PWL 26 / 23 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	35095.200	≥500	34595.200	Complied
Top	35095.200	≥500	34595.200	Complied



Bottom Channel



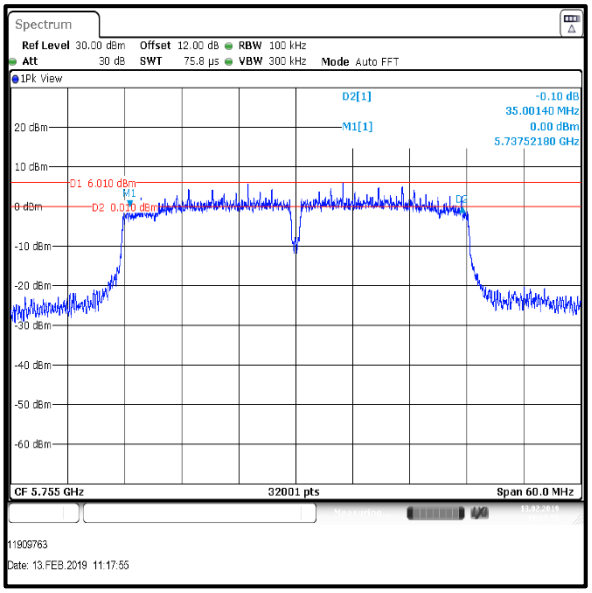
Top Channel

Result: Pass

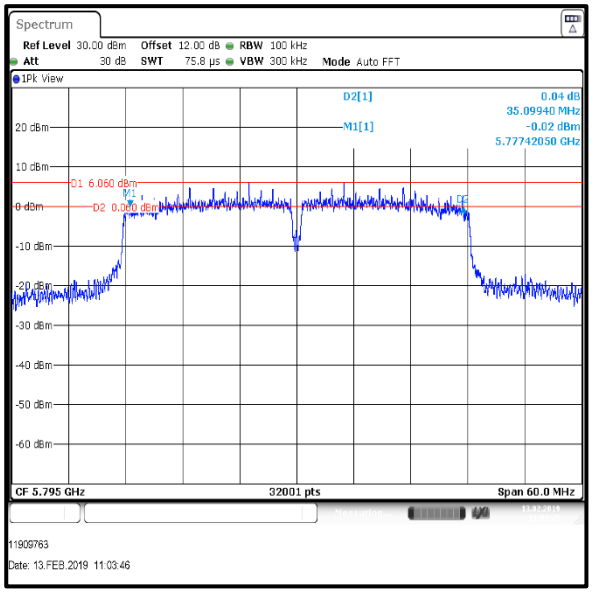
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / HT40 / MCS0 / SISO / Port 1 / PWL 26 / 23 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	35001.400	≥500	34501.400	Complied
Top	35099.400	≥500	34599.400	Complied



Bottom Channel



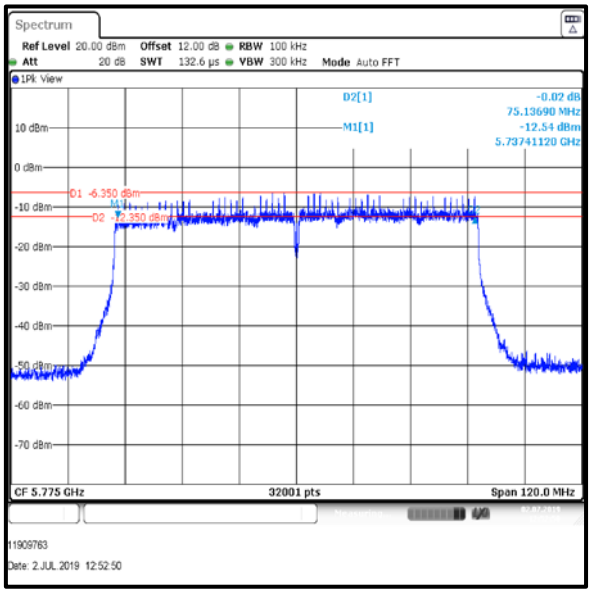
Top Channel

Result: Pass

Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11ac / HT80 / MCS0 / SISO / Port 1 / PWL 11 / 23 dBi Antenna Group

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	75136.900	≥500	74636.900	Complied



Single Channel

Result: Pass

5.2.4. Transmitter Duty Cycle

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Date:**	16 August 2019
Test Sample Serial Number:	192.168.0.60		

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

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	30

Note:

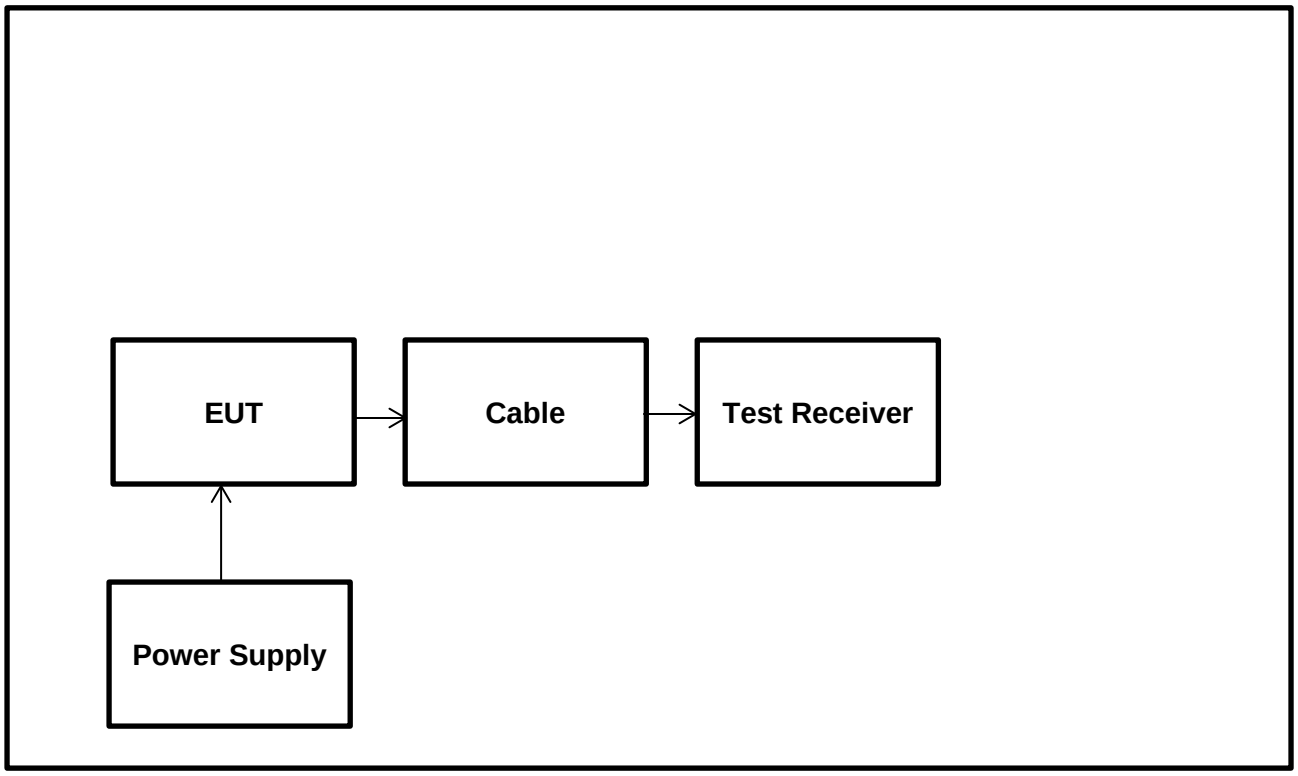
1. During initial investigations it is found that EUT was transmitting with Duty Cycle ≤ 98 %.
2. In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent 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:

   Duty Cycle (%) = 100 X [On Time (T_{ON})] / [Period(T_{ON}+ T_{OFF}) or 100ms whichever is the lesser]

   Duty Cycle Correction Factor= 10 log 1 / [On Time (T_{ON})] / [Period(T_{ON}+ T_{OFF}) or 100ms whichever is the lesser]
3. Duty cycles were measured with worst case SISO mode; as they found to be same independent of number of transmitter chains used.
4. Theese results are valid for all supported SISO & MIMO modes as well as for listed Antenna groups.
5. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors. The RF cable attenuation (maximum 2.0 dB at the tested frequencies) from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input was added as a reference level offset (12.0 dB) to each of the conducted plots.

Transmitter Duty Cycle (continued)

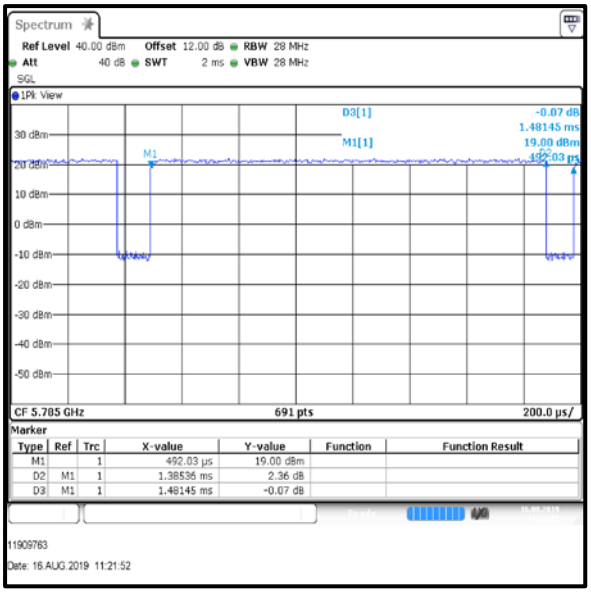
Test Setup:



Transmitter Duty Cycle (continued)

Results: 802.11a / 20 MHz / 6 Mbps

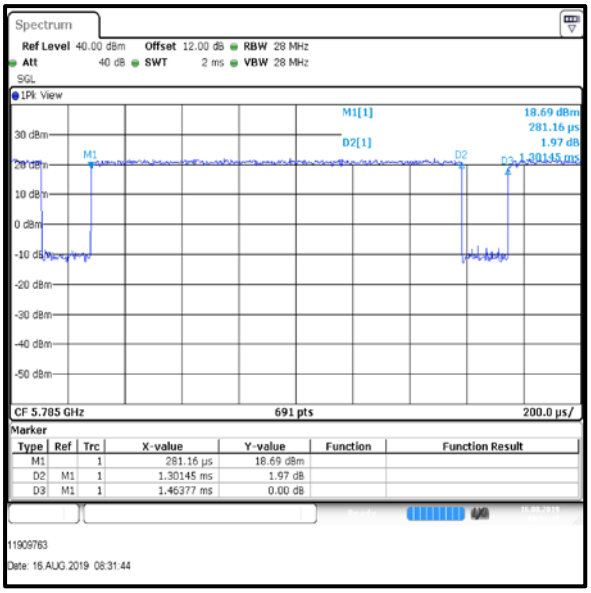
Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
1.385	1.481	93.51	0.3



Transmitter Duty Cycle (continued)

Results: 802.11n / 20 MHz / MCS0

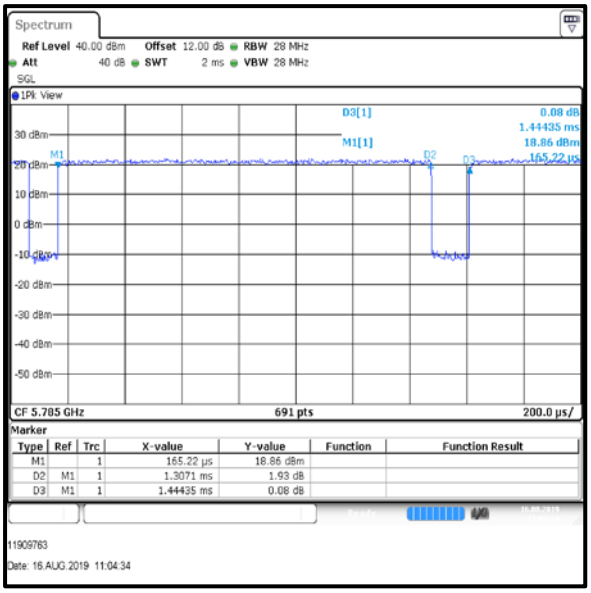
Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
1.301	1.464	88.87	0.5



Transmitter Duty Cycle (continued)

Results: 802.11ac / 20 MHz / MCS0

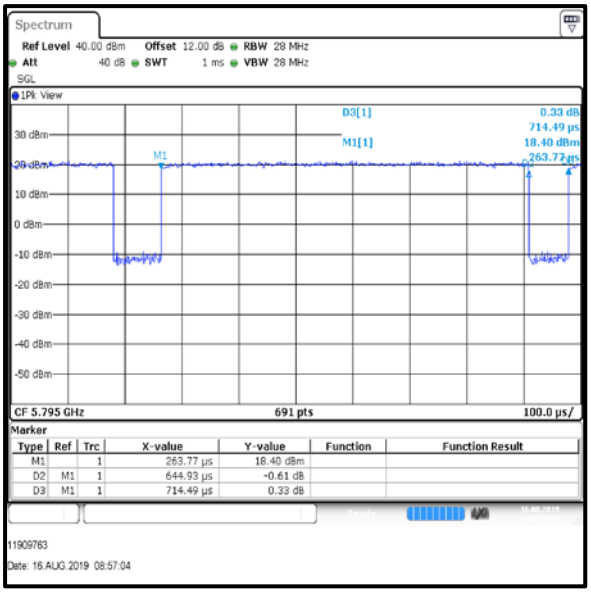
Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
1.307	1.444	90.51	0.4



Transmitter Duty Cycle (continued)

Results: 802.11n / 40 MHz / MCS0

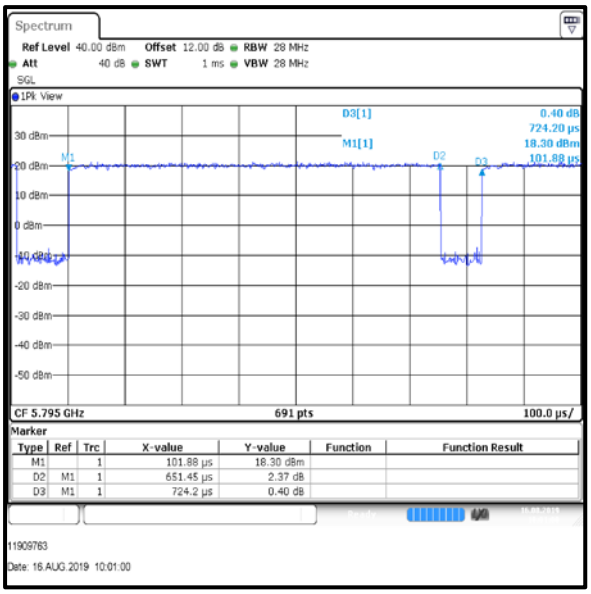
Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
0.645	0.714	90.34	0.4



Transmitter Duty Cycle (continued)

Results: 802.11ac / 40 MHz / MCS0

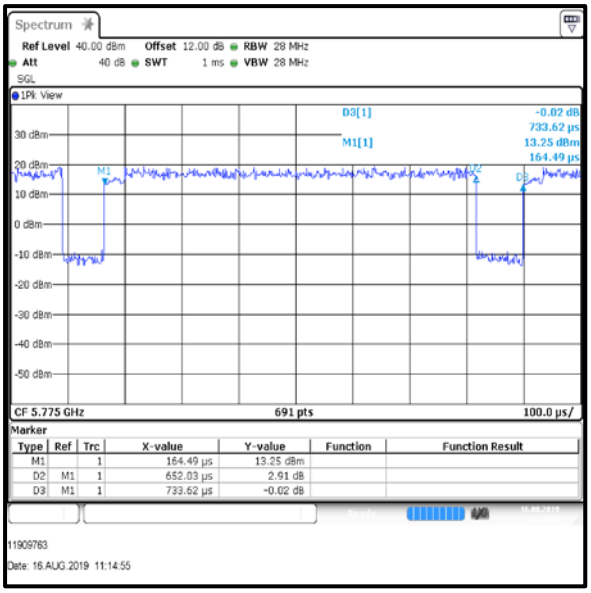
Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
0.651	0.724	89.90	0.4



Transmitter Duty Cycle (continued)

Results: 802.11ac / 80 MHz / MCS0

Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
0.652	0.734	88.82	0.5



5.2.5. Transmitter Maximum Conducted Output Power

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Dates:**	20 February 2019 to 28 September 2019
Test Sample Serial Number:	192.168.0.60		
Test Site Identification	SR 9		

FCC Reference:	Part 15.407(a)(3)
Test Method Used:	KDB 789033 D02 Section II.E.2.d) KDB 662911 D01 Section E) 1)

Environmental Conditions:

Temperature (°C):	19 to 26
Relative Humidity (%):	23 to 41

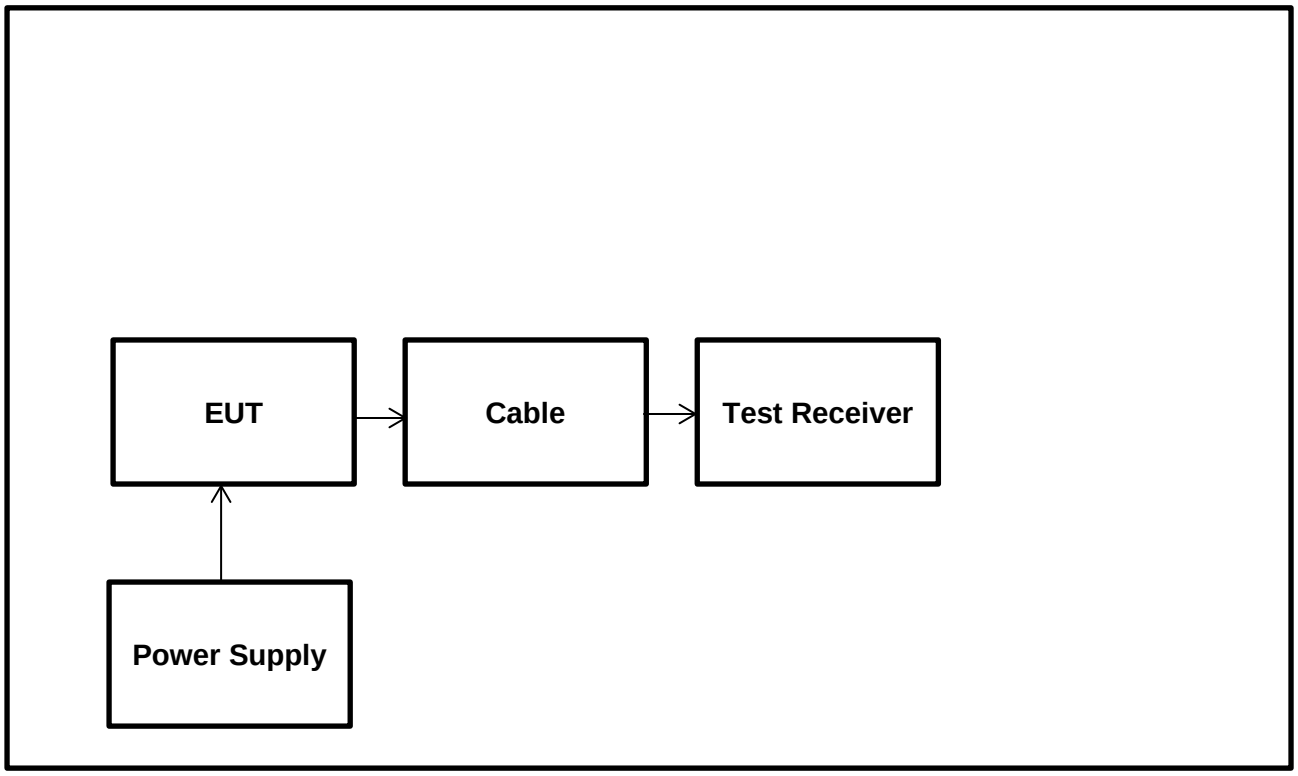
Notes:

1. For conducted power tests 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 99% 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 300 traces performed. The span was set to encompass the entire 99% occupied bandwidth. The channel power results are recorded in the tables below.
2. For all data rates the EUT was transmitting at <98% duty cycle, the calculated duty cycle in section 5.2.4 was added to the measured power in order to compute the average power during the actual transmission time.
3. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors. The RF cable attenuation (maximum 2.0 dB at the tested frequencies) from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input was added as a reference level offset (12.0 dB) to each of the conducted plots.
4. For MIMO, power was measured across relevant ports and then combined using the measure-and-sum technique stated in FCC KDB 662911 D01 Section E)1).
5. The EUT antennas have a directional gain of > 6 dBi.
6. In accordance with 15.407(a)(3), transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power limits shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
7. Therefore reduced maximum conducted output power limits are as follows:

- 8 dBi Antenna Group :
  - Therefore the limit of 30 dBm has been reduced by 2 dB to 28 dBm.
- 9 dBi Antenna Group :
  - Therefore the limit of 30 dBm has been reduced by 3 dB to 27 dBm.
- 23 dBi Antenna Group:
  - As per applicant's declaration 23 dBi Antenna shall be only used with RF cable of length 10 m having 8.8 dB Attenuation @ 5 GHz bands.
  - Effective Antenna Gain = 23 dBi – 8.8 dB = 14.2 dBi
  - Therefore the limit of 30 dBm has been reduced by 8.2 dB to 21.8 dBm.

Transmitter Maximum Conducted Output Power (continued)

Test Setup:



Transmitter Maximum Conducted Output Power (continued)

8 dBi Antenna Group

Results: 802.11a / 20 MHz / 6Mbps / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

Channel	Conducted Power (dBm)	Duty Cycle Correction (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	20.4	0.3	20.7	28.0	7.3	Complied
Middle	20.2	0.3	20.5	28.0	7.5	Complied
Top	20.1	0.3	20.4	28.0	7.6	Complied

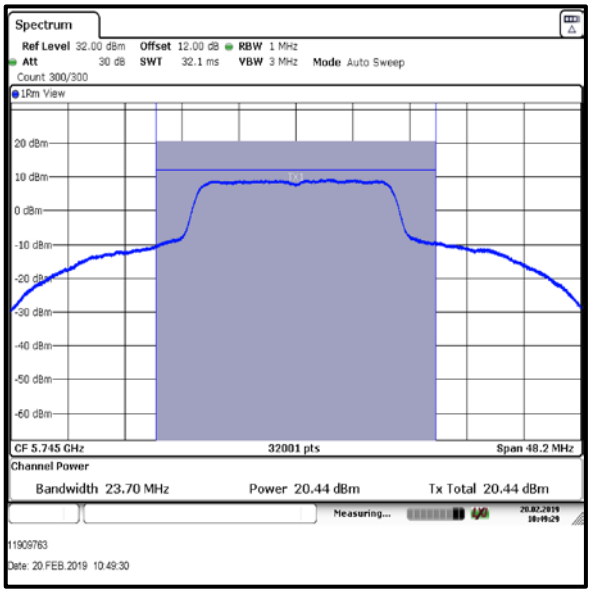
De Facto EIRP Limit Comparison

Channel	Corrected Conducted Power (dBm)	Directional Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	20.7	8.0	28.7	36.0	7.3	Complied
Middle	20.5	8.0	28.5	36.0	7.5	Complied
Top	20.4	8.0	28.4	36.0	7.6	Complied

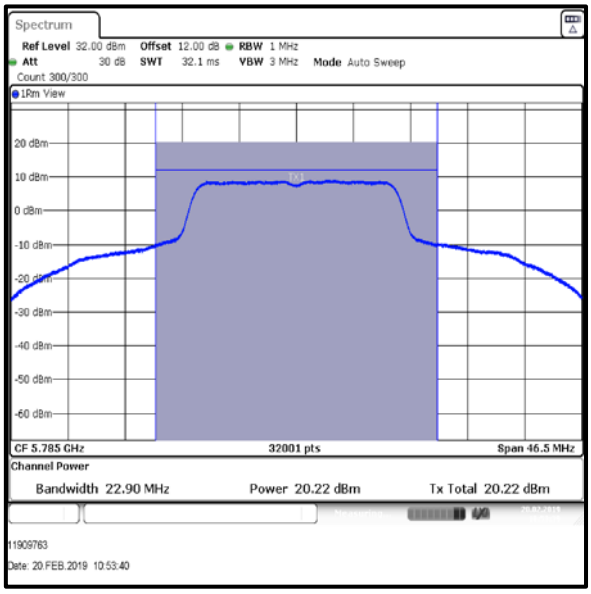
Result: Pass

Transmitter Maximum Conducted Output Power (continued)

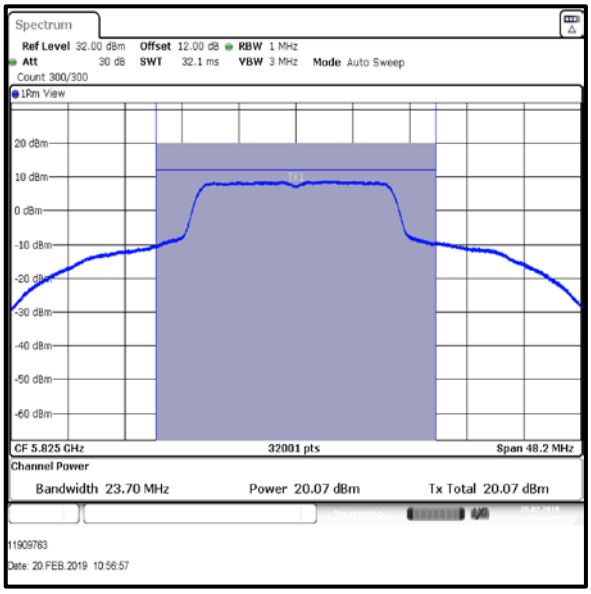
Results: 802.11a / 20 MHz / 6Mbps / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (continued)

Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

Channel	Conducted Power (dBm)	Duty Cycle Correction (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	20.5	0.5	21.0	28.0	7.0	Complied
Middle	20.1	0.5	20.6	28.0	7.4	Complied
Top	20.0	0.5	20.5	28.0	7.5	Complied

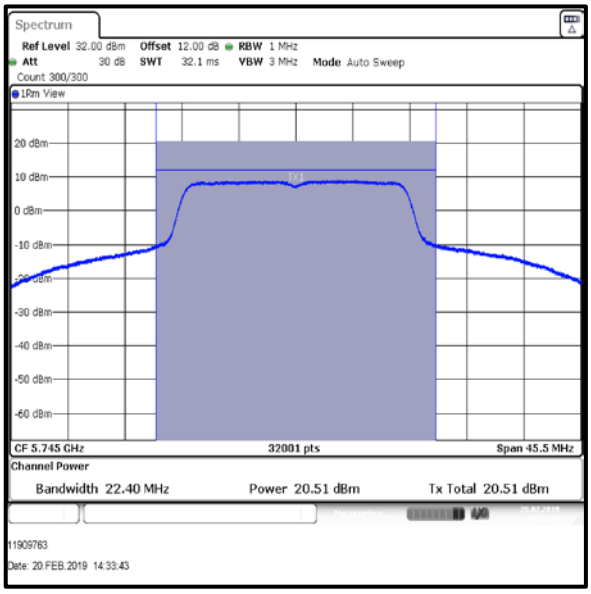
De Facto EIRP Limit Comparison

Channel	Corrected Conducted Power (dBm)	Directional Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	21.0	8.0	29.0	36.0	7.0	Complied
Middle	20.6	8.0	28.6	36.0	7.4	Complied
Top	20.5	8.0	28.5	36.0	7.5	Complied

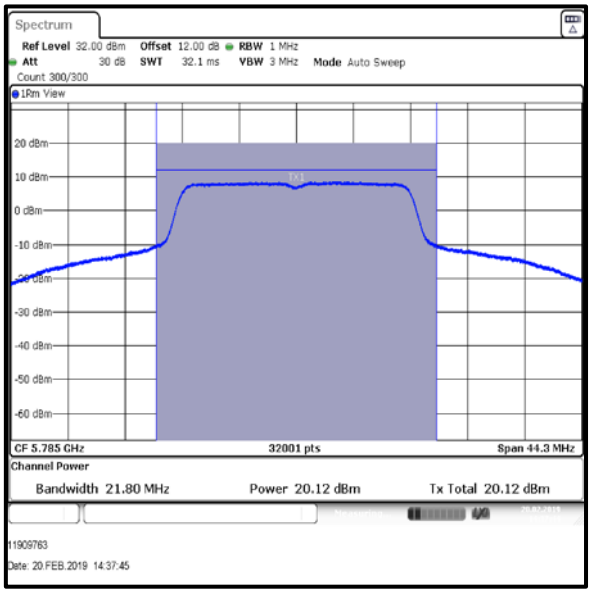
Result: Pass

Transmitter Maximum Conducted Output Power (continued)

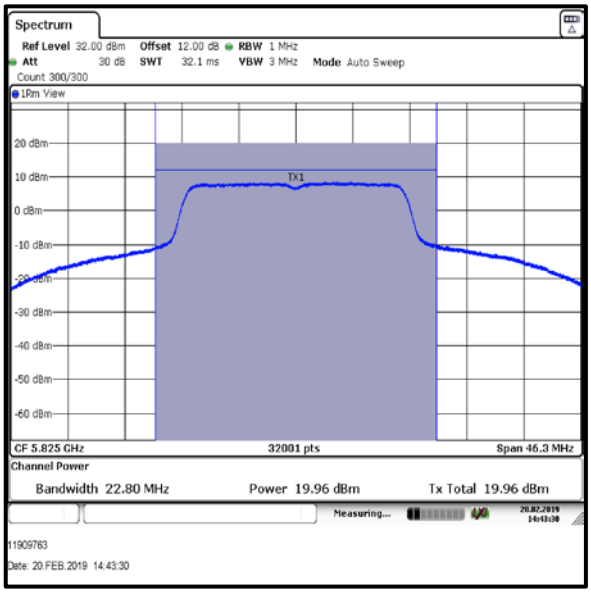
Results: 802.11n / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (continued)

Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

Channel	Conducted Power (dBm)	Duty Cycle Correction (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	20.5	0.4	20.9	28.0	7.1	Complied
Middle	20.1	0.4	20.5	28.0	7.5	Complied
Top	20.0	0.4	20.4	28.0	7.6	Complied

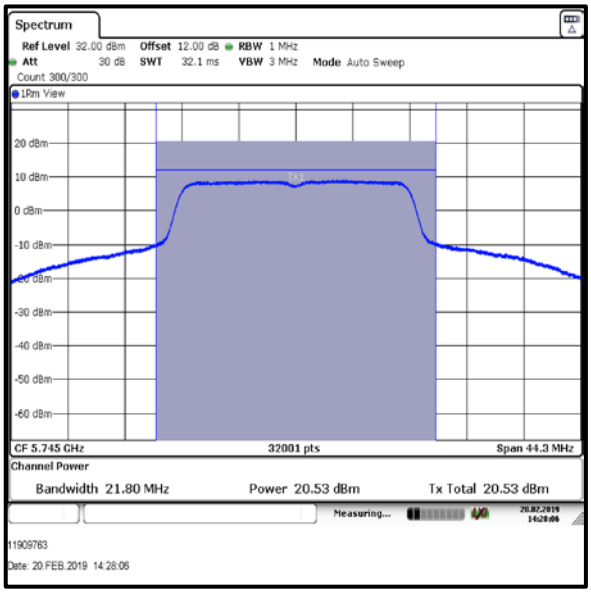
De Facto EIRP Limit Comparison

Channel	Corrected Conducted Power (dBm)	Directional Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	20.9	8.0	28.9	36.0	7.1	Complied
Middle	20.5	8.0	28.5	36.0	7.5	Complied
Top	20.4	8.0	28.4	36.0	7.6	Complied

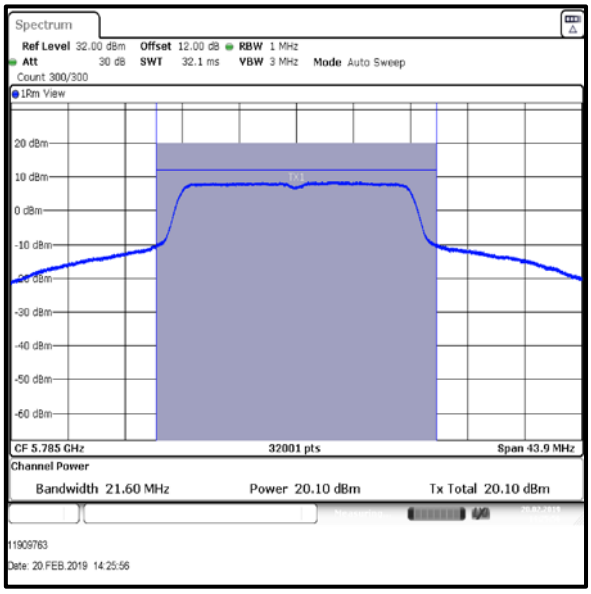
Result: Pass

Transmitter Maximum Conducted Output Power (continued)

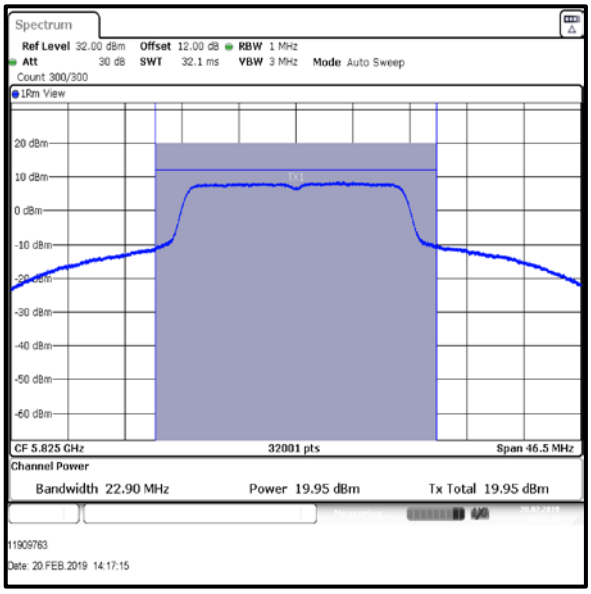
Results: 802.11ac / 20 MHz / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group



Bottom Channel



Middle Channel



Top Channel

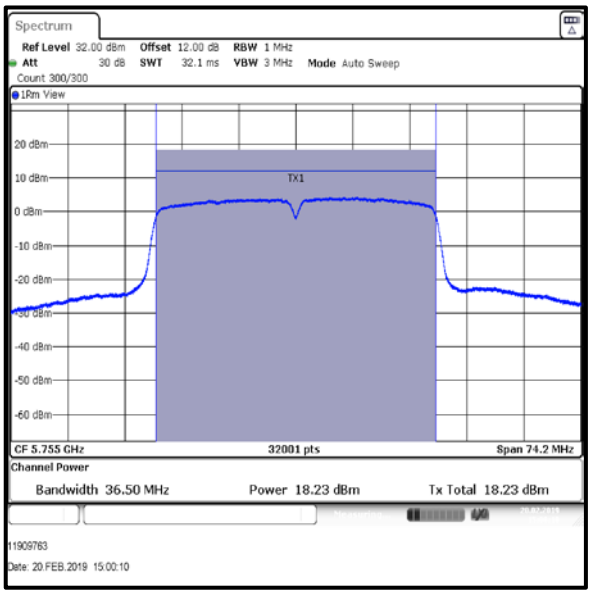
Transmitter Maximum Conducted Output Power (continued)

Results: 802.11n / HT40 / MCS0 / SISO / Port 1 / PWL 26 / 8 dBi Antenna Group

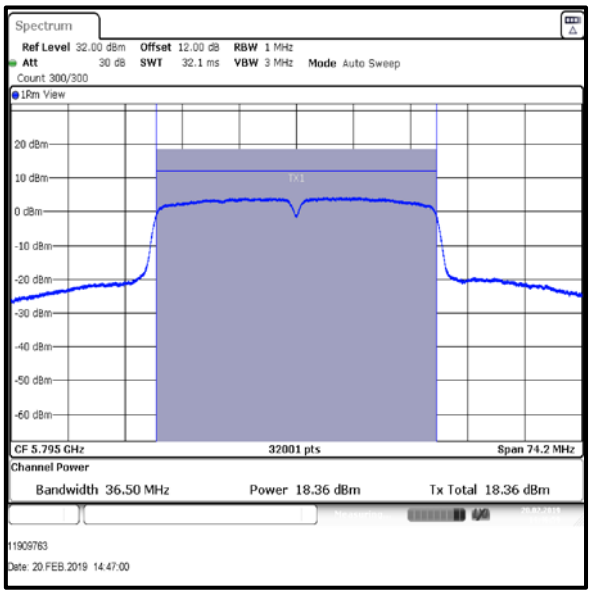
Channel	Conducted Power (dBm)	Duty Cycle Correction (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	18.2	0.4	18.6	28.0	9.4	Complied
Top	18.4	0.4	18.8	28.0	9.2	Complied

De Facto EIRP Limit Comparison

Channel	Corrected Conducted Power (dBm)	Directional Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	18.6	8.0	26.6	36.0	9.4	Complied
Top	18.8	8.0	26.8	36.0	9.2	Complied



Bottom Channel



Top Channel

Result: Pass