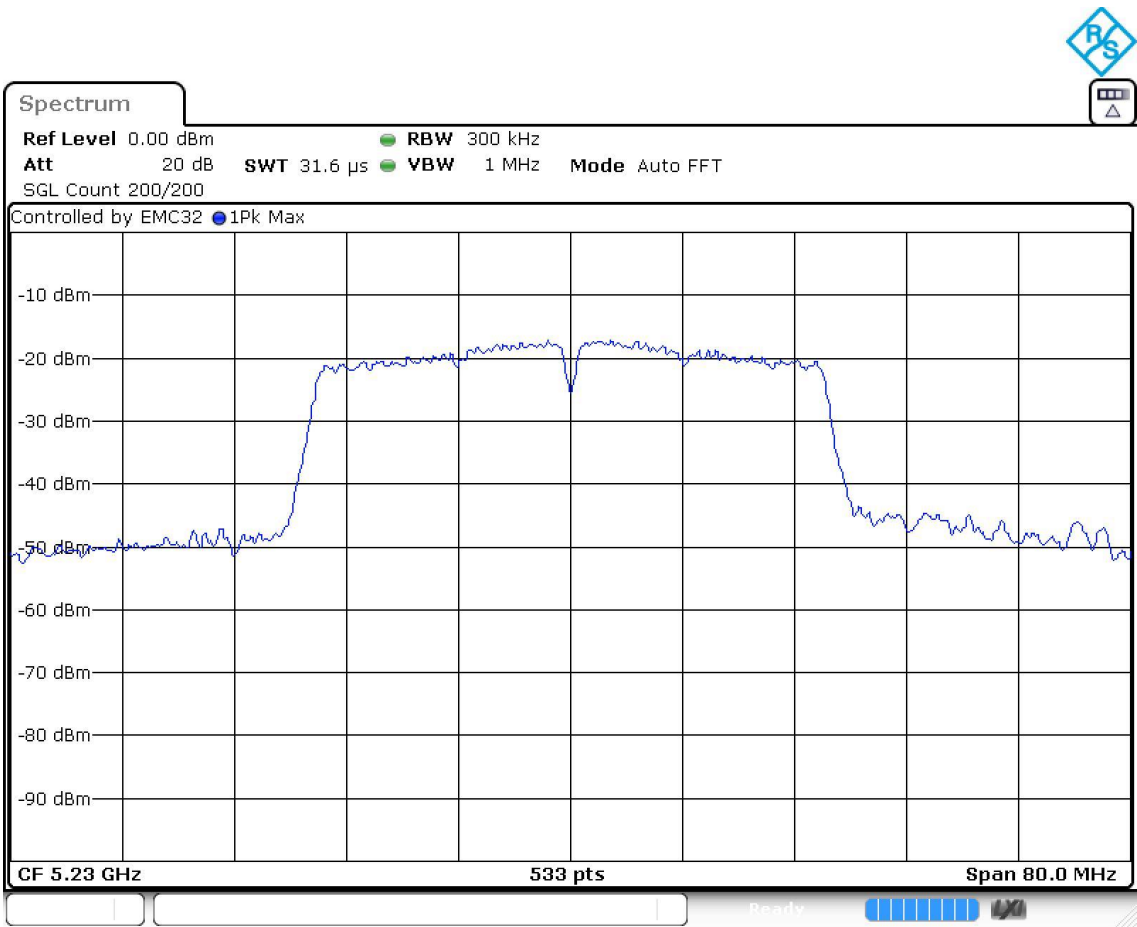
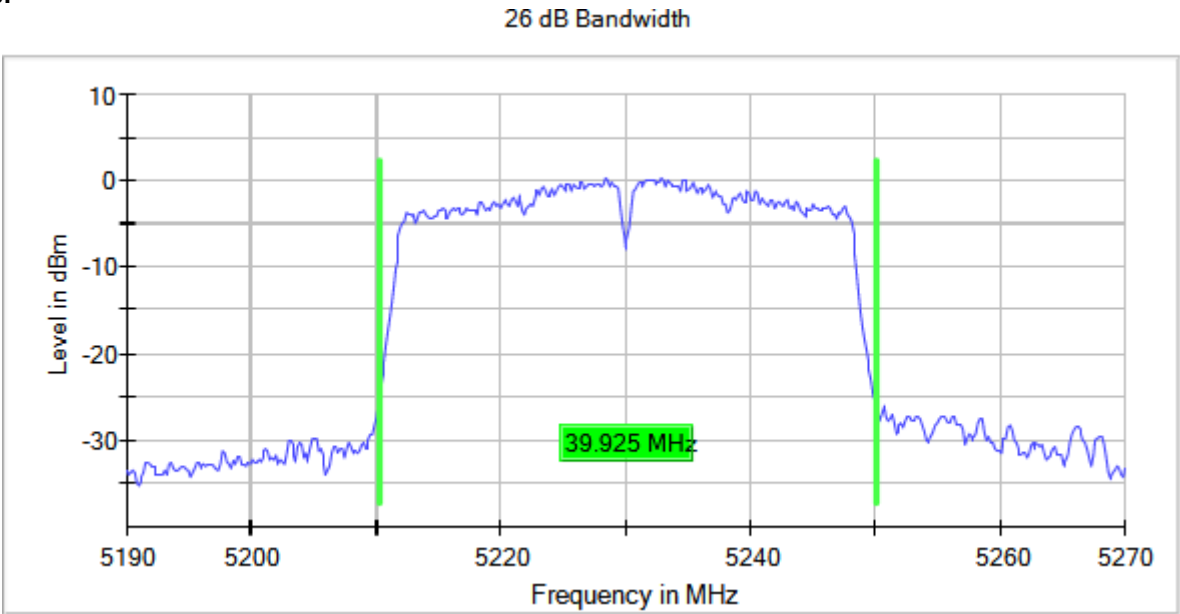


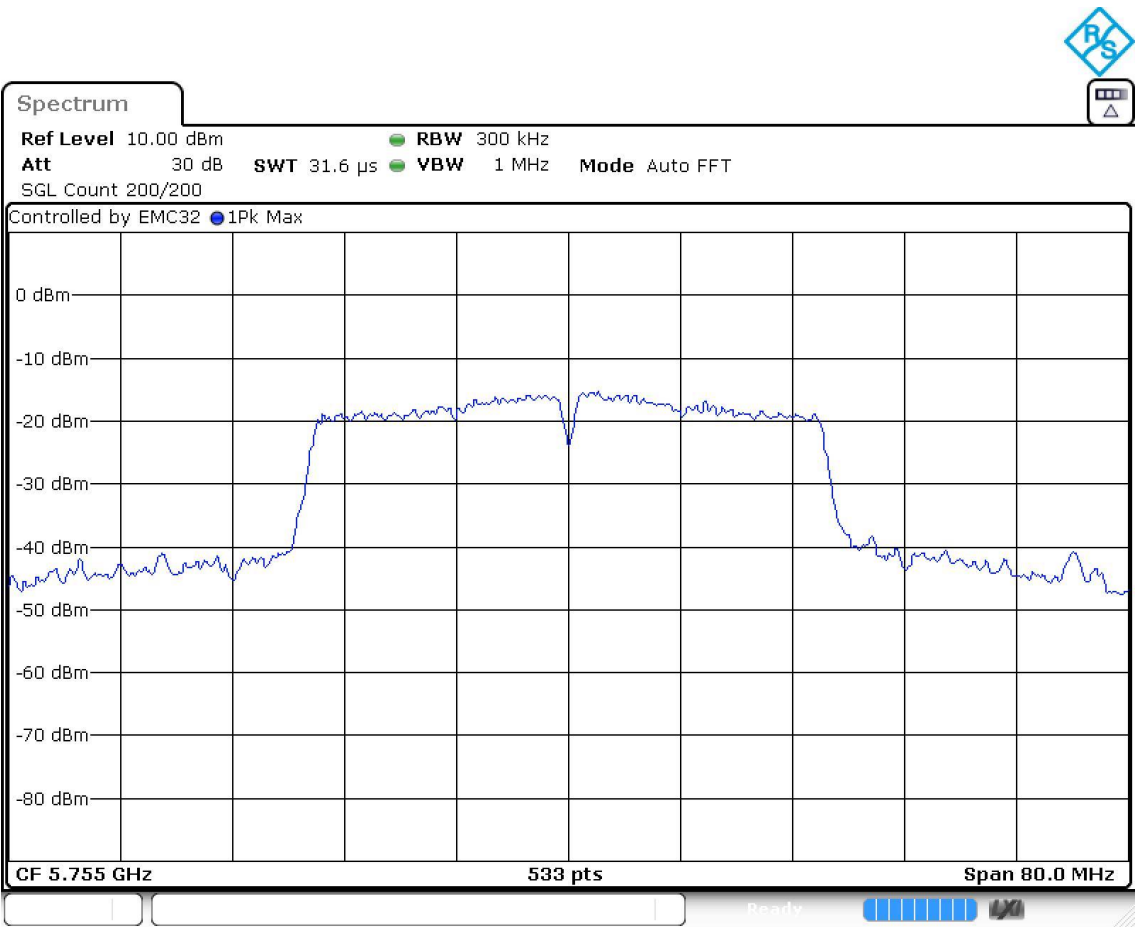
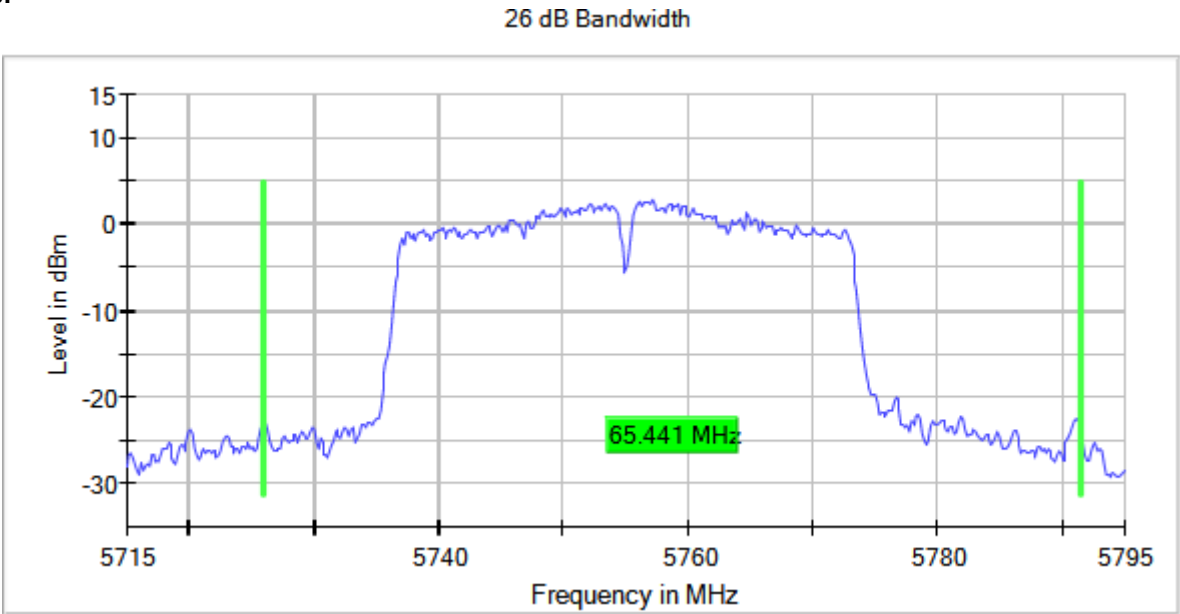
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5230.00000 Modulation = 802.11n HT40 (OFDM MCS0 13.5 Mbit/s)
MIMO Mode = SISO

Images:



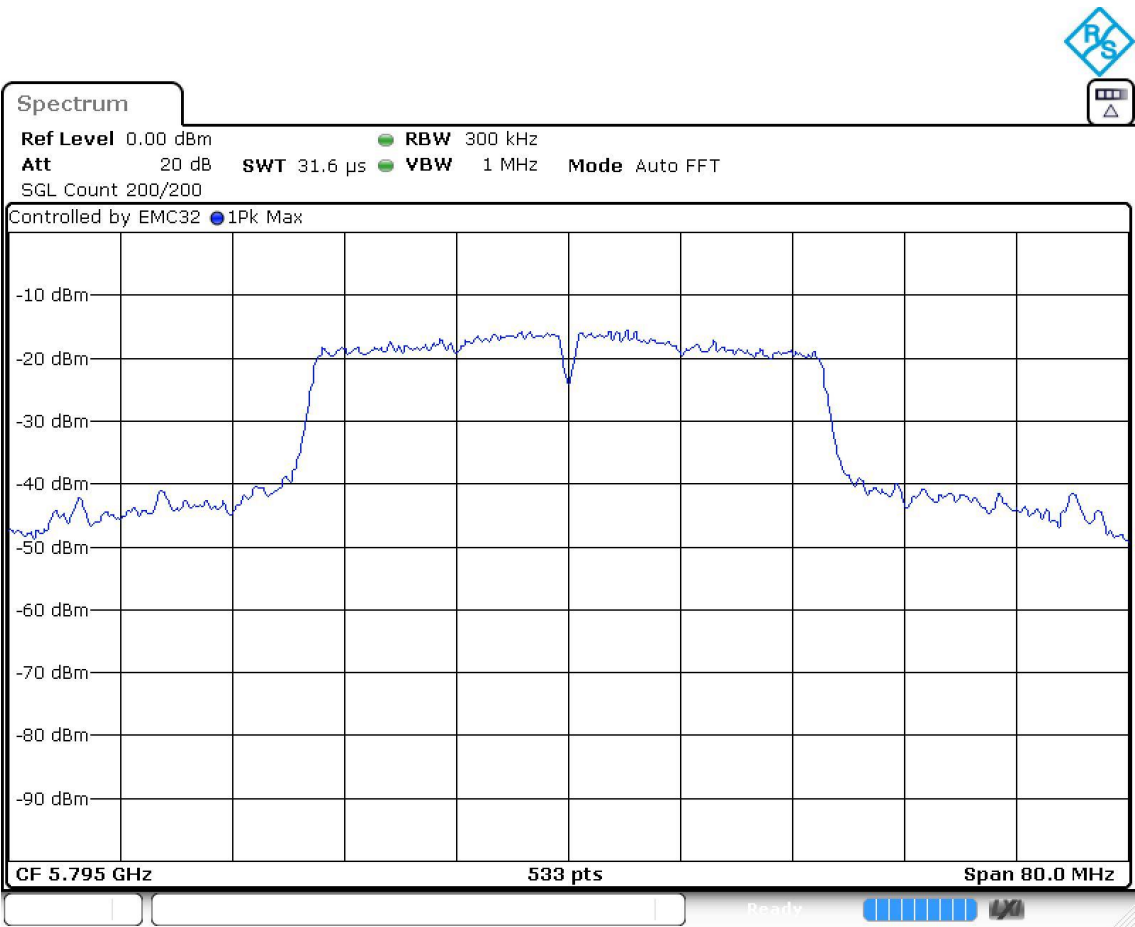
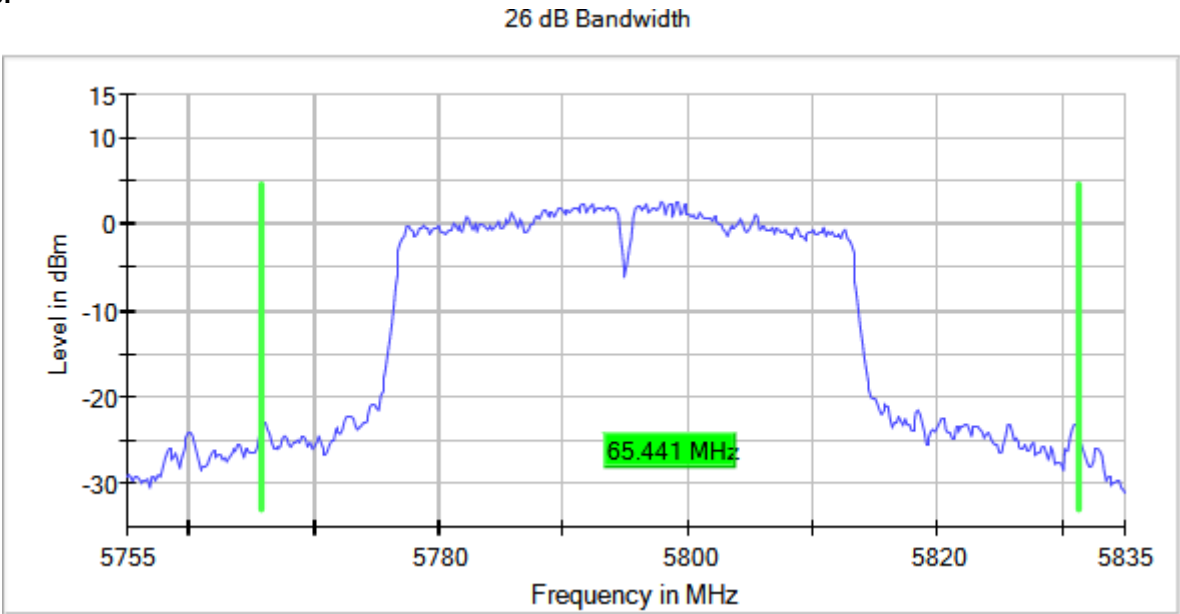
Operation Band MHz = [5725, 5850] Active Port = 1
Frequency MHz = 5755.00000 Modulation = 802.11n HT40 (OFDM MCS0 13.5 Mbit/s)
MIMO Mode = SISO

Images:



Operation Band MHz = [5725, 5850] Active Port = 1
Frequency MHz = 5795.00000 Modulation = 802.11n HT40 (OFDM MCS0 13.5 Mbit/s)
MIMO Mode = SISO

Images:



Modulation: 802.11a (OFDM 6 Mbit/s)

MIMO Mode: SISO

Results

Operation Band (MHz)	Port	Freq (MHz)	Ebw (MHz)
[5150, 5250]	1	5180.00000	21.500
		5220.00000	21.400
		5240.00000	21.300
[5725, 5850]		5745.00000	24.300
		5785.00000	23.300
		5825.00000	23.800

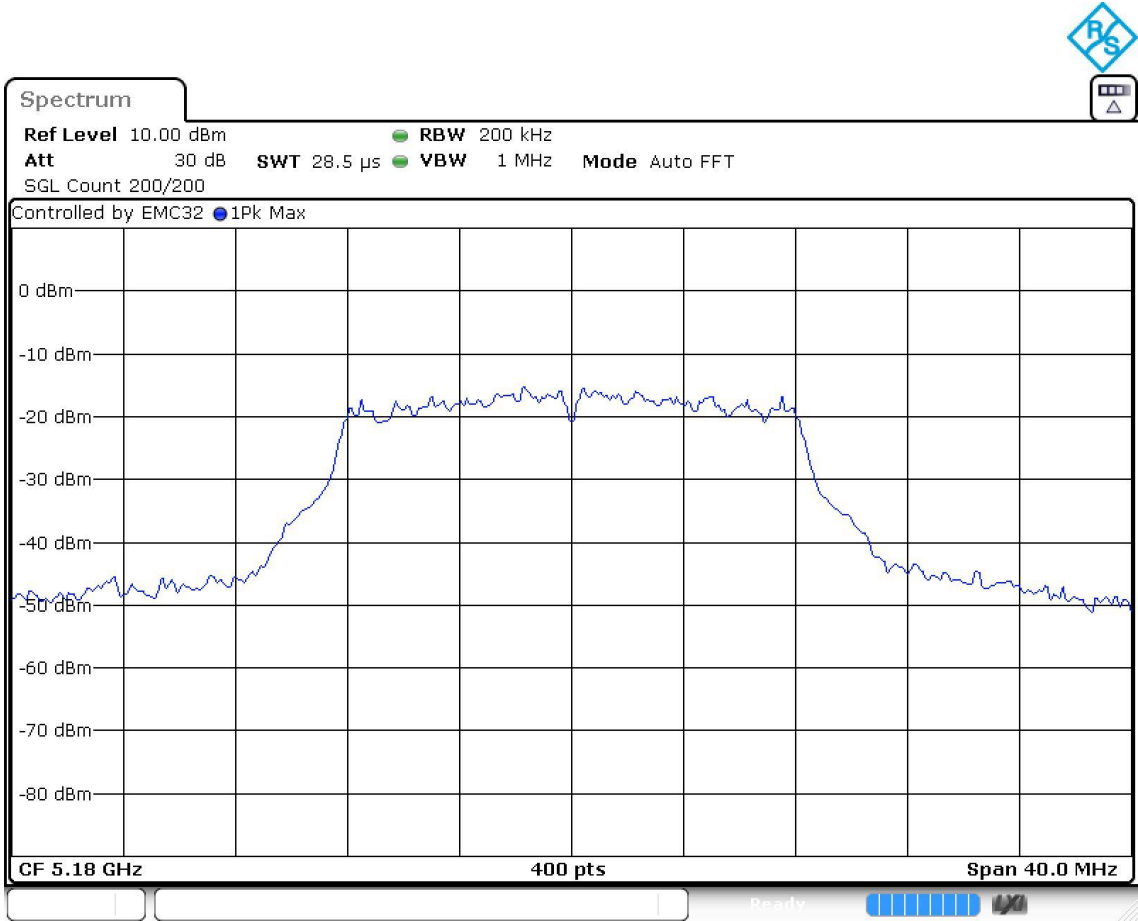
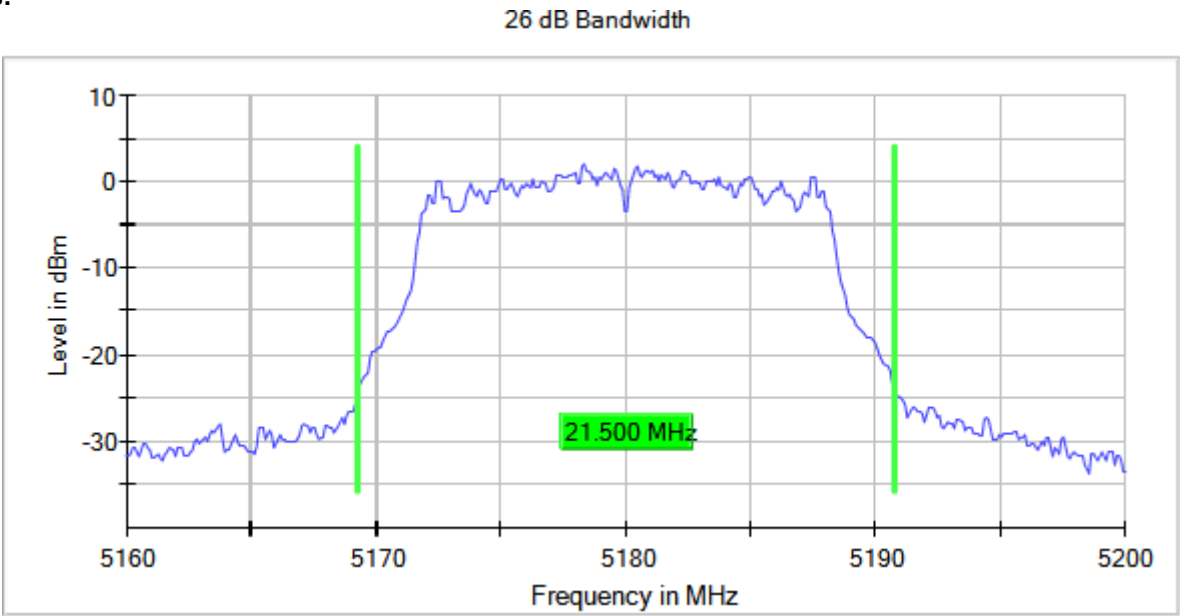
Verdict

Pass

Attachments

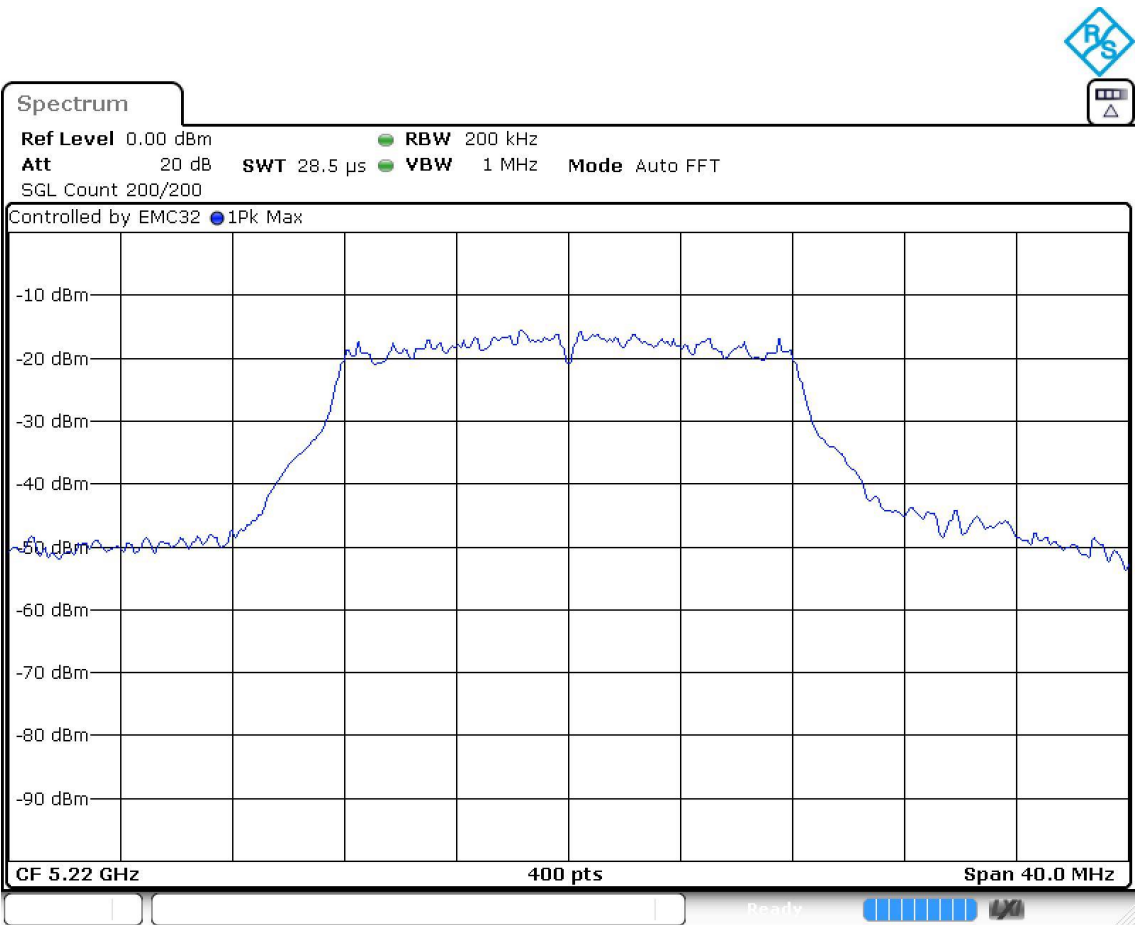
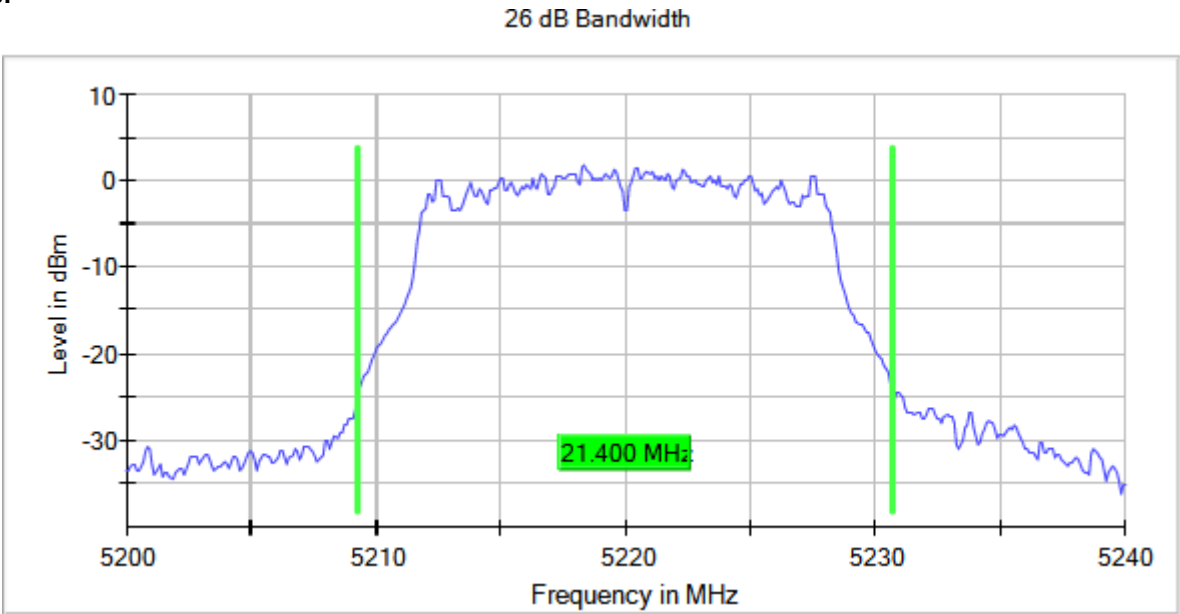
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5180.00000 Modulation = 802.11a (OFDM 6 Mbit/s)
MIMO Mode = SISO

Images:



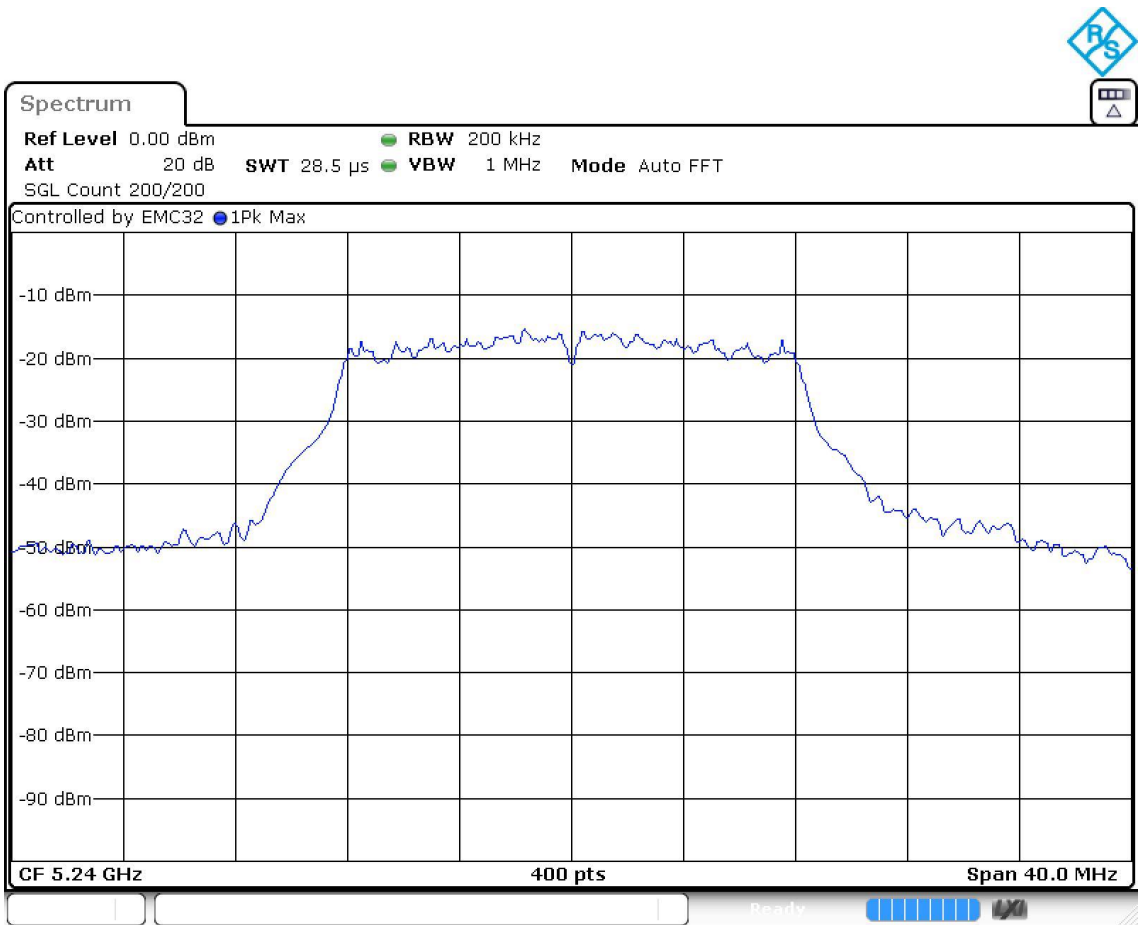
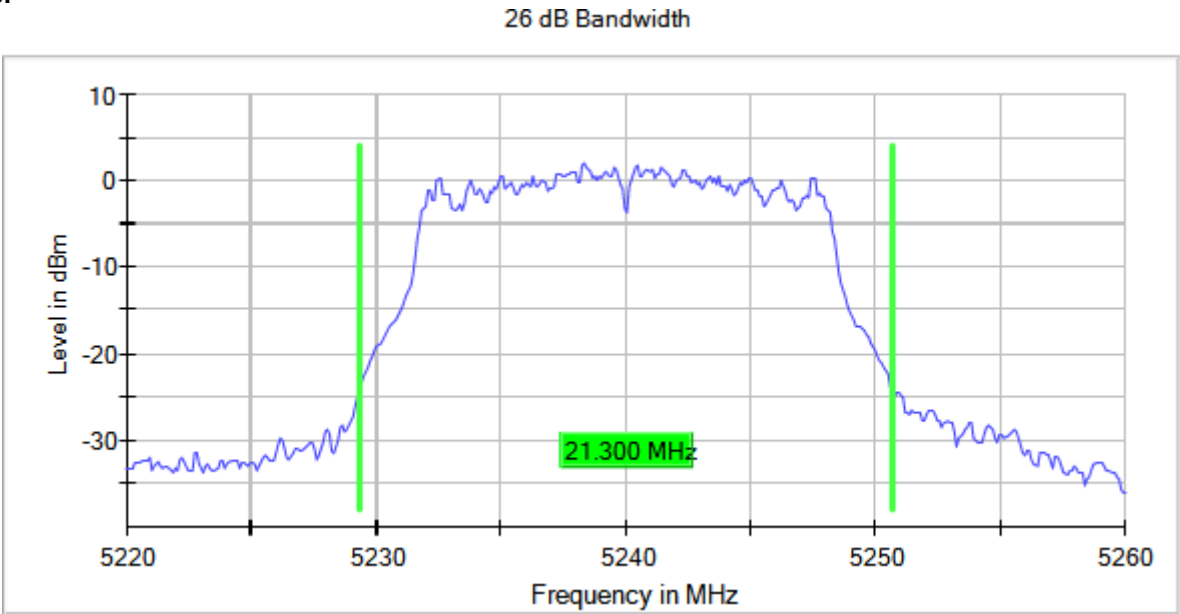
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5220.00000 Modulation = 802.11a (OFDM 6 Mbit/s)
MIMO Mode = SISO

Images:



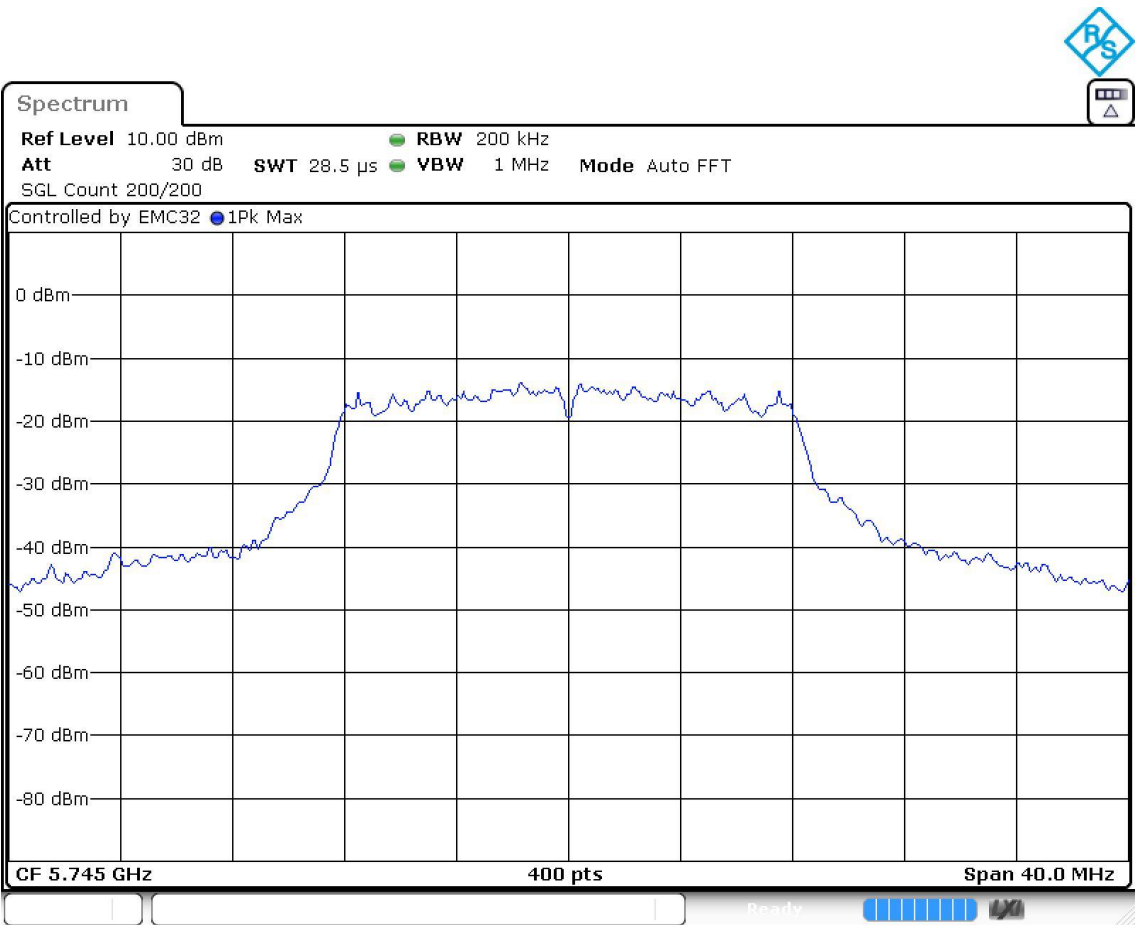
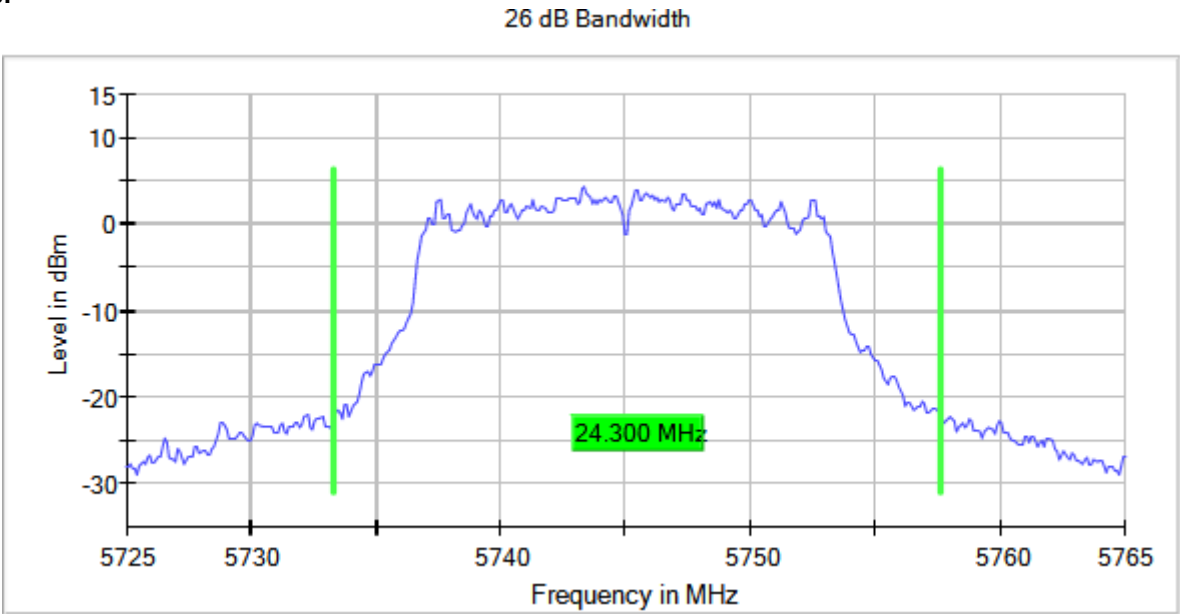
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5240.00000 Modulation = 802.11a (OFDM 6 Mbit/s)
MIMO Mode = SISO

Images:



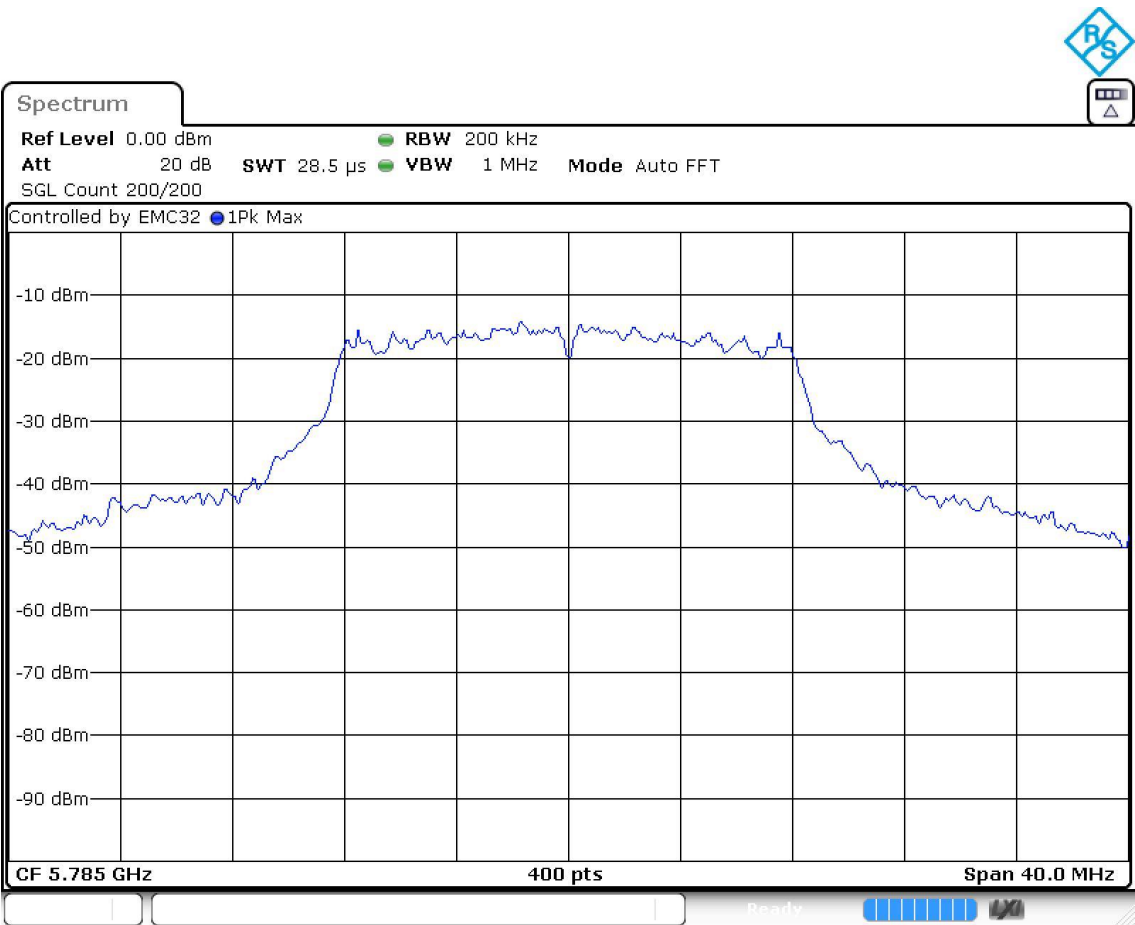
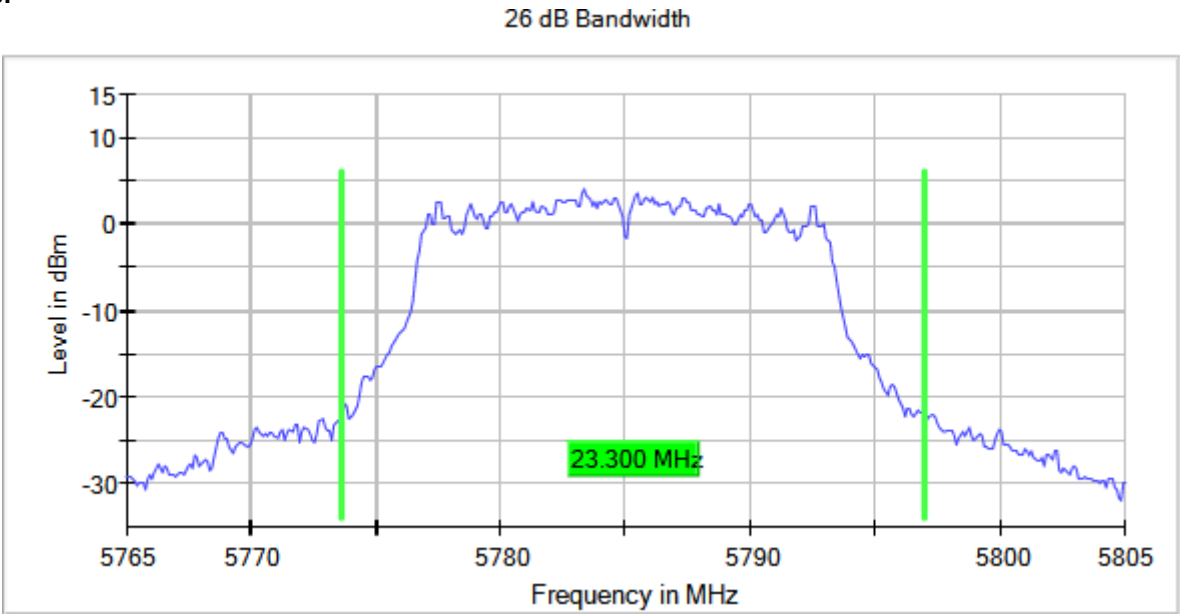
Operation Band MHz = [5725, 5850] Active Port = 1
Frequency MHz = 5745.00000 Modulation = 802.11a (OFDM 6 Mbit/s)
MIMO Mode = SISO

Images:



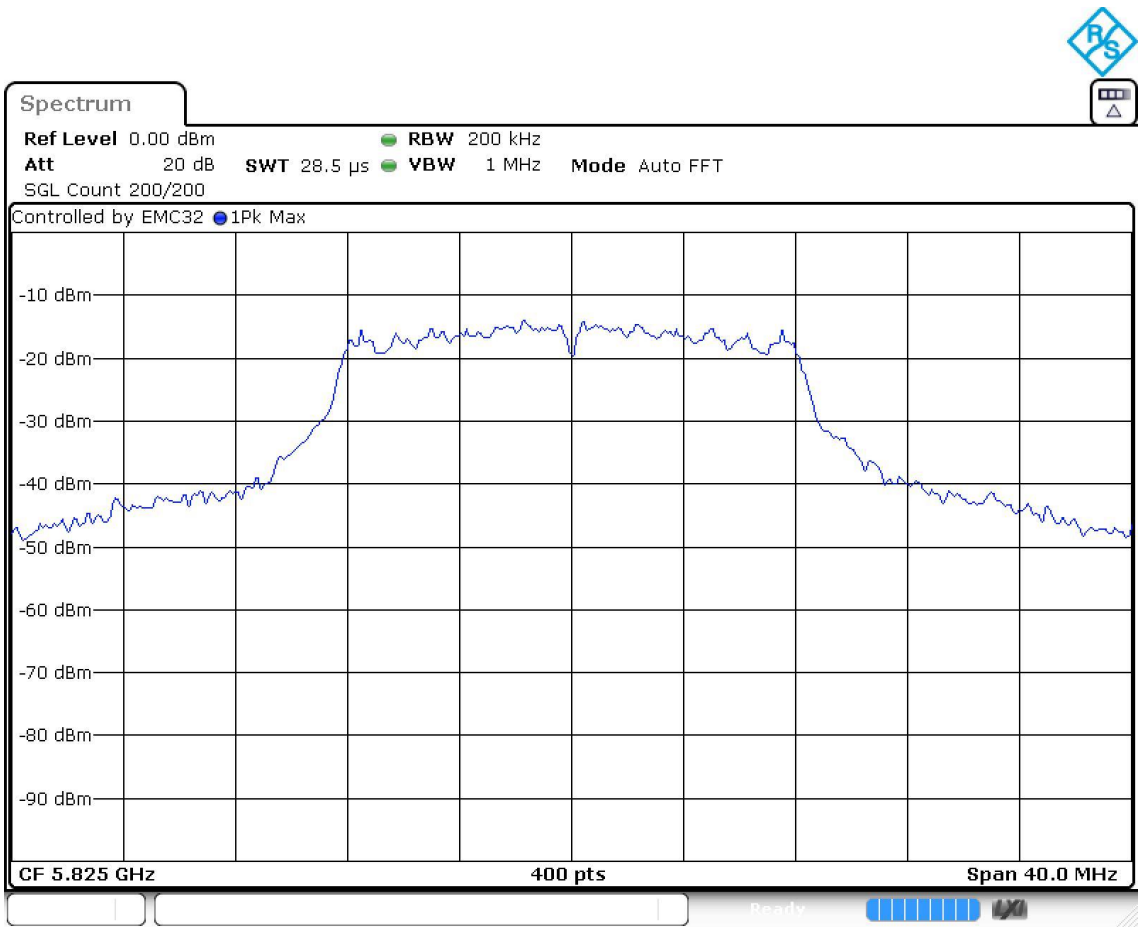
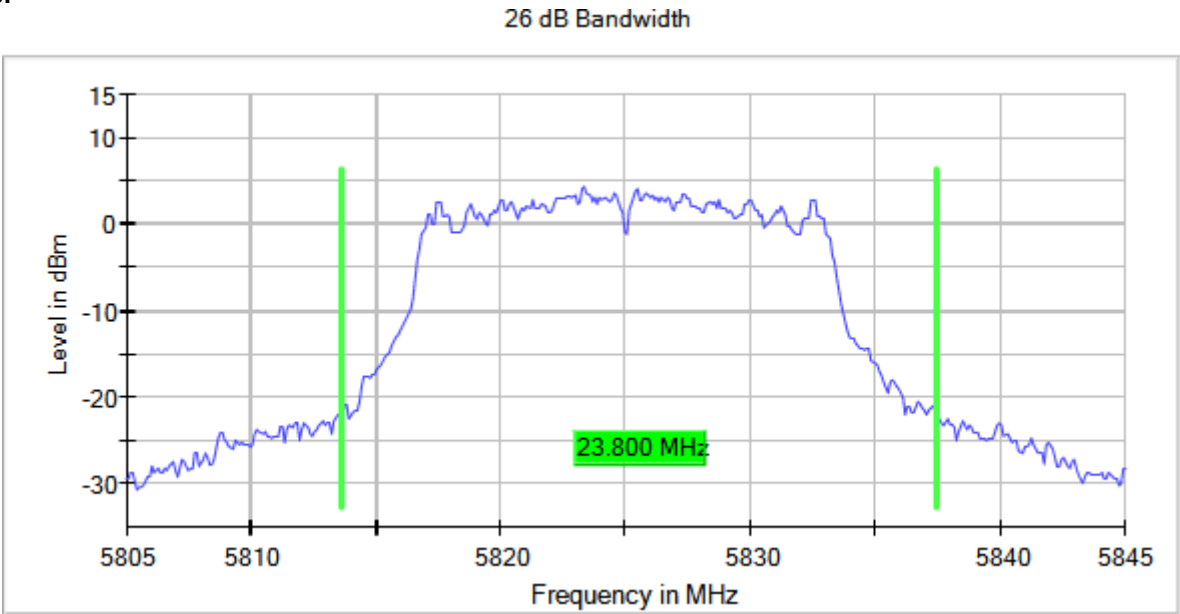
Operation Band MHz = [5725, 5850] Active Port = 1
Frequency MHz = 5785.00000 Modulation = 802.11a (OFDM 6 Mbit/s)
MIMO Mode = SISO

Images:



Operation Band MHz = [5725, 5850] Active Port = 1
Frequency MHz = 5825.00000 Modulation = 802.11a (OFDM 6 Mbit/s)
MIMO Mode = SISO

Images:



Modulation: 802.11ac VHT20 (OFDM MCS0)

MIMO Mode: SISO

Results

Operation Band (MHz)	Port	Freq (MHz)	Ebw (MHz)
[5150, 5250]	1	5180.00000	21.500
		5220.00000	21.300
		5240.00000	21.400
[5725, 5850]		5745.00000	22.500
		5785.00000	22.100
		5825.00000	22.300

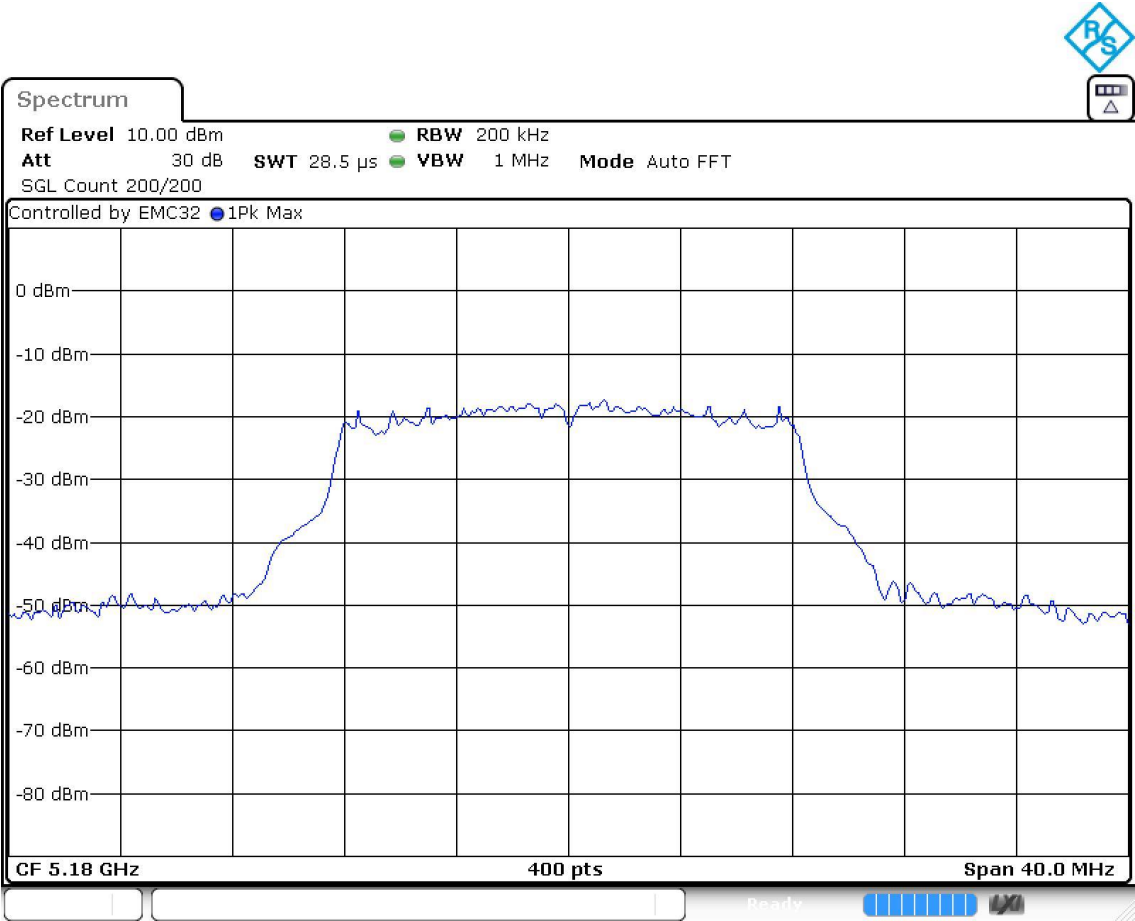
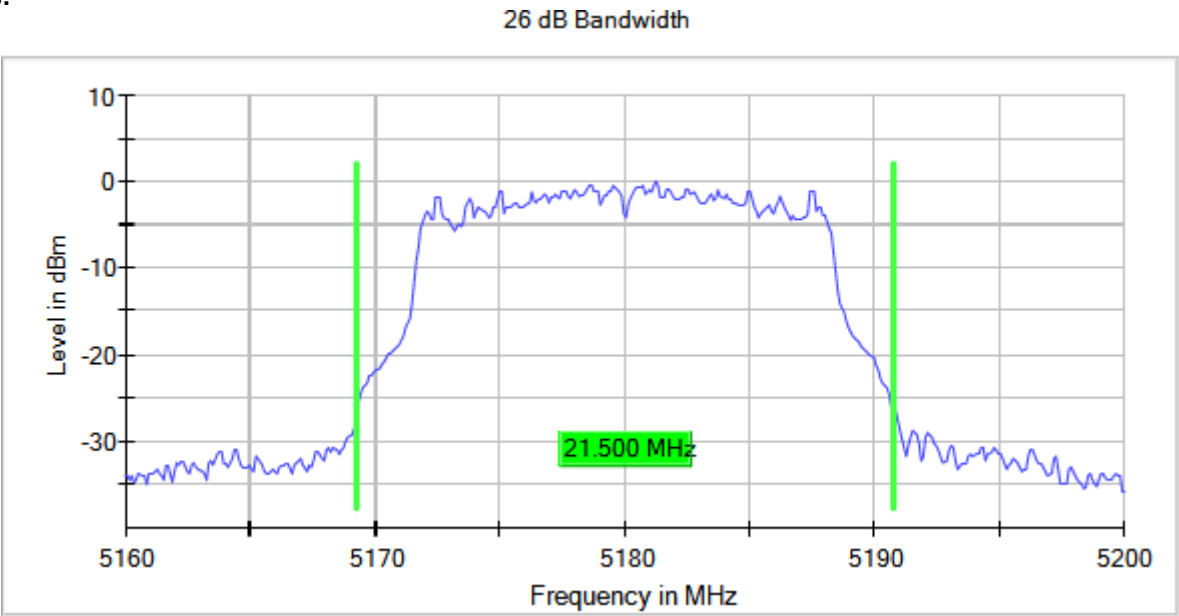
Verdict

Pass

Attachments

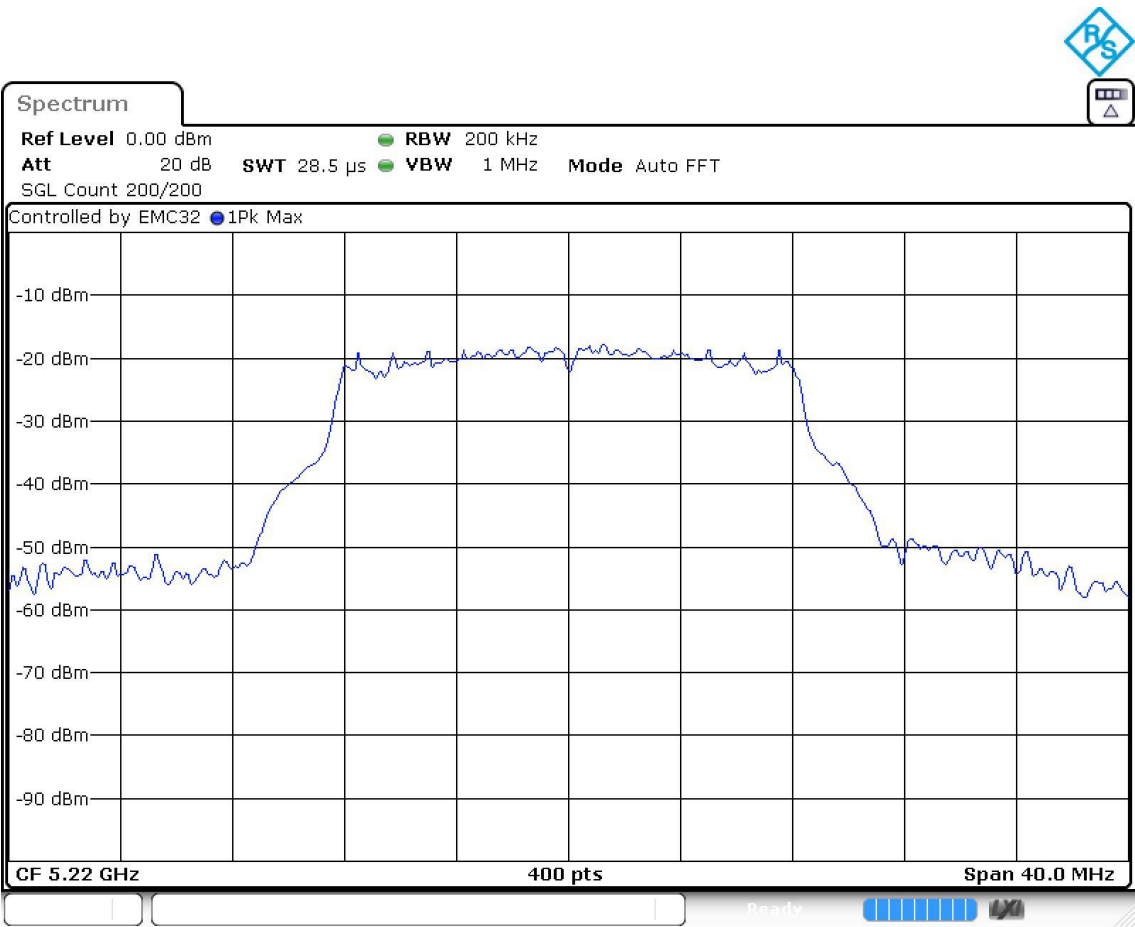
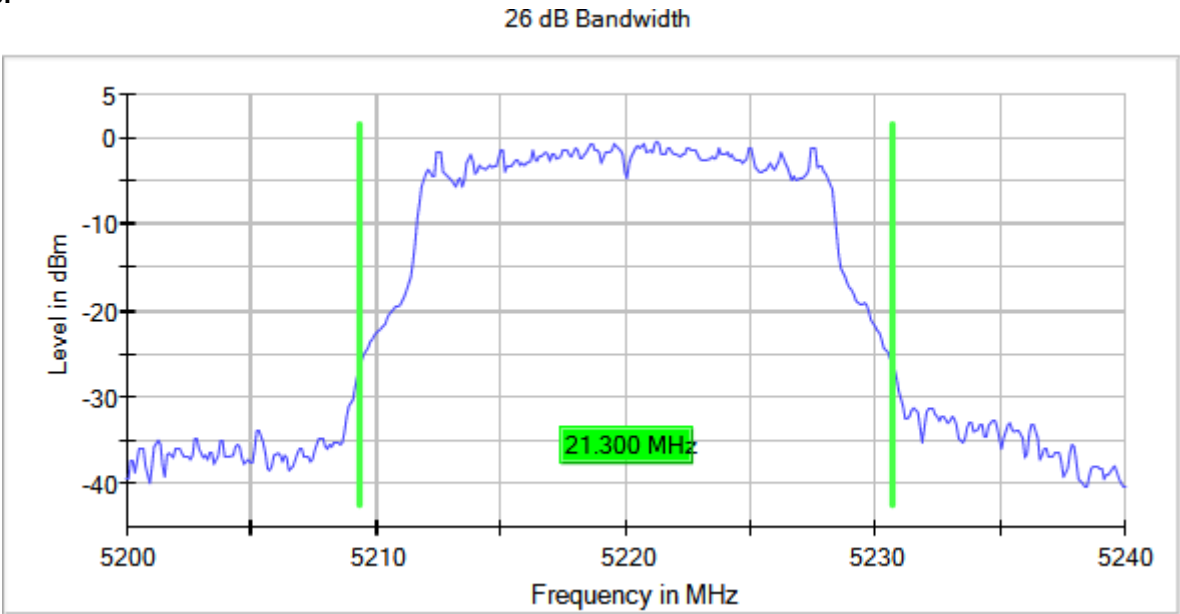
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5180.00000 Modulation = 802.11ac VHT20 (OFDM MCS0)
MIMO Mode = SISO

Images:



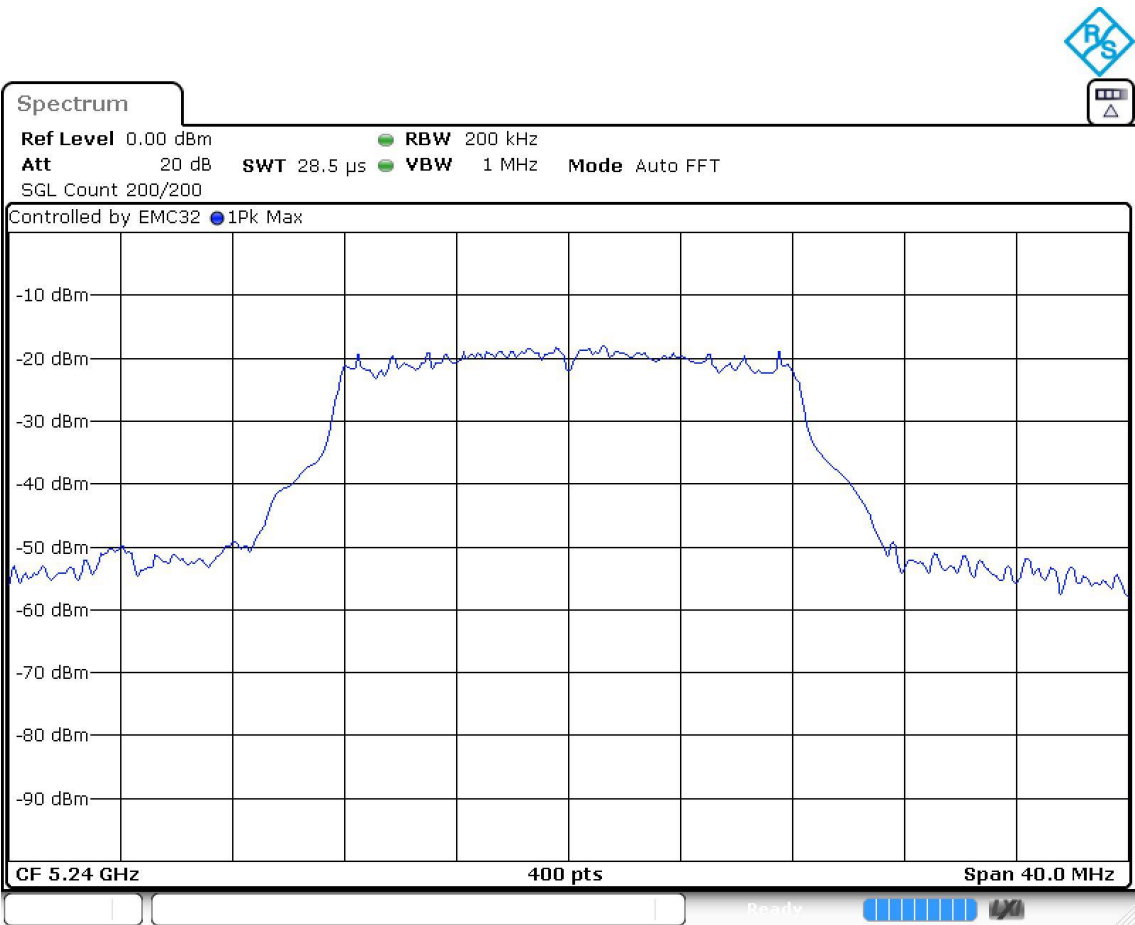
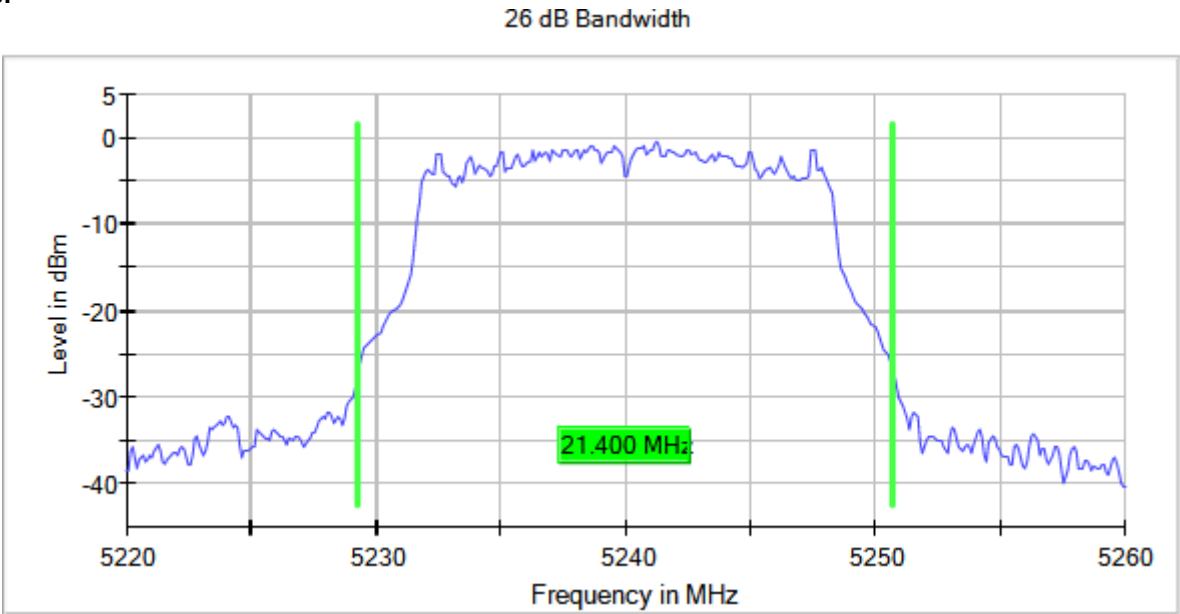
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5220.00000 Modulation = 802.11ac VHT20 (OFDM MCS0)
MIMO Mode = SISO

Images:



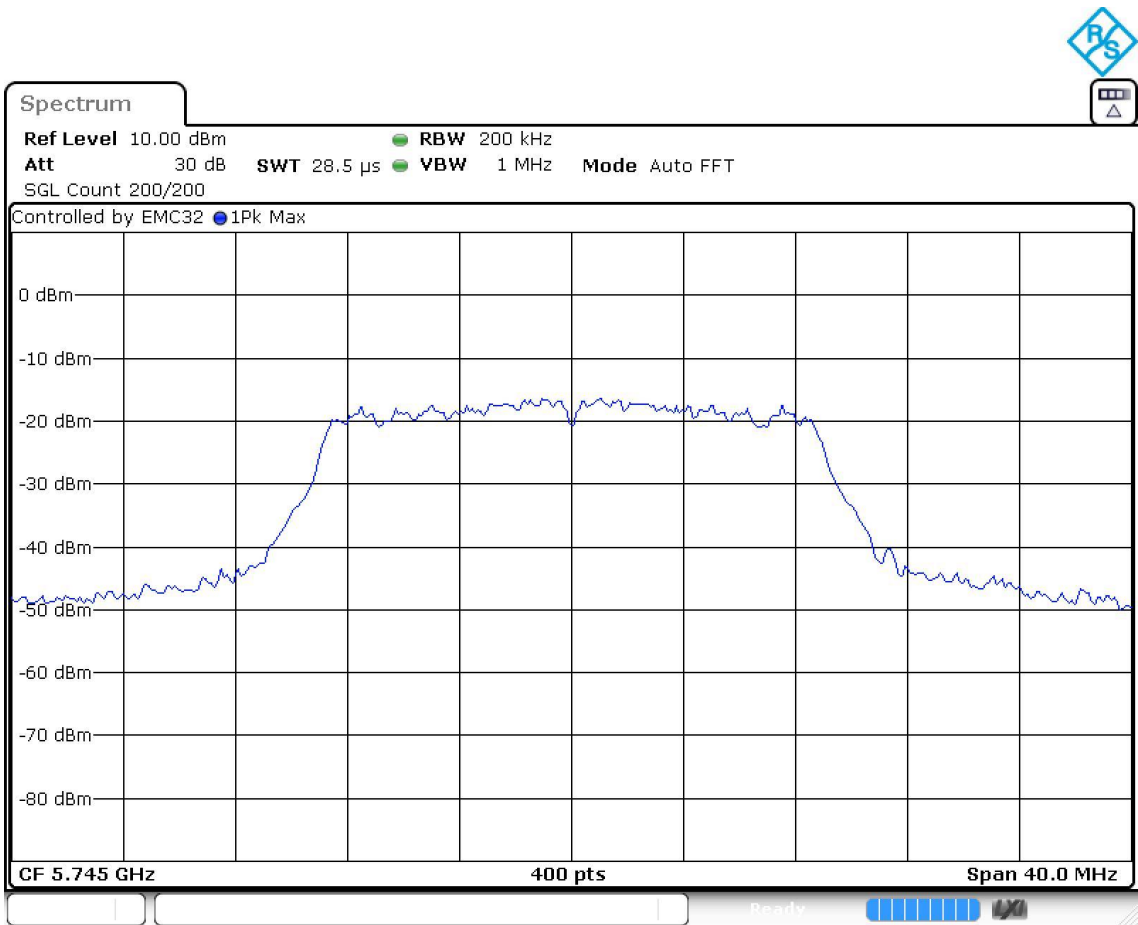
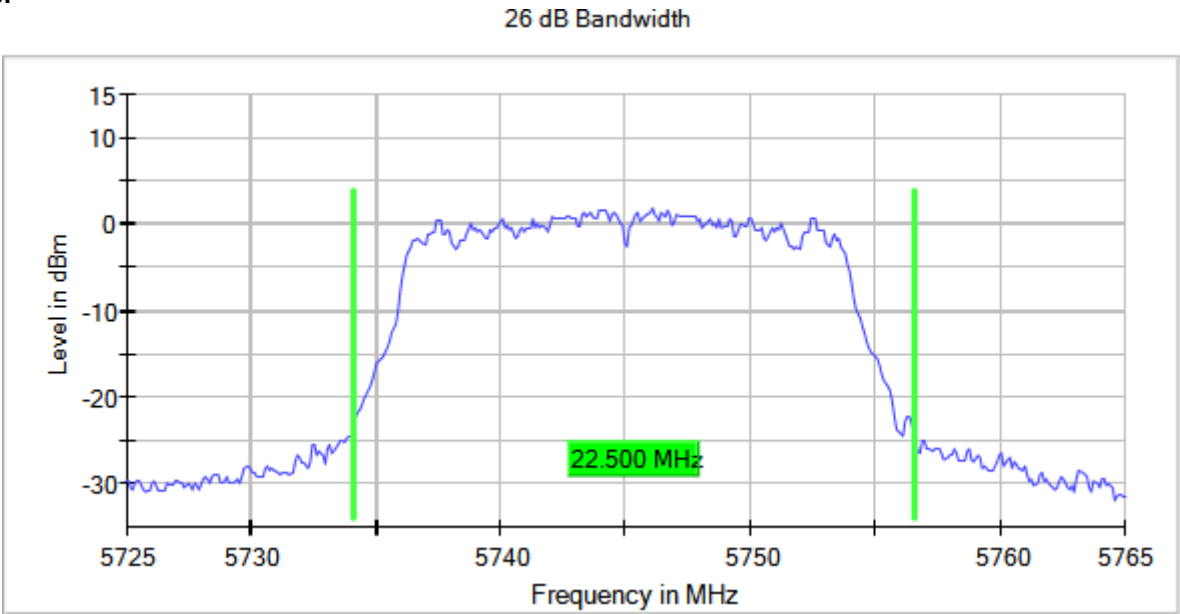
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5240.00000 Modulation = 802.11ac VHT20 (OFDM MCS0)
MIMO Mode = SISO

Images:



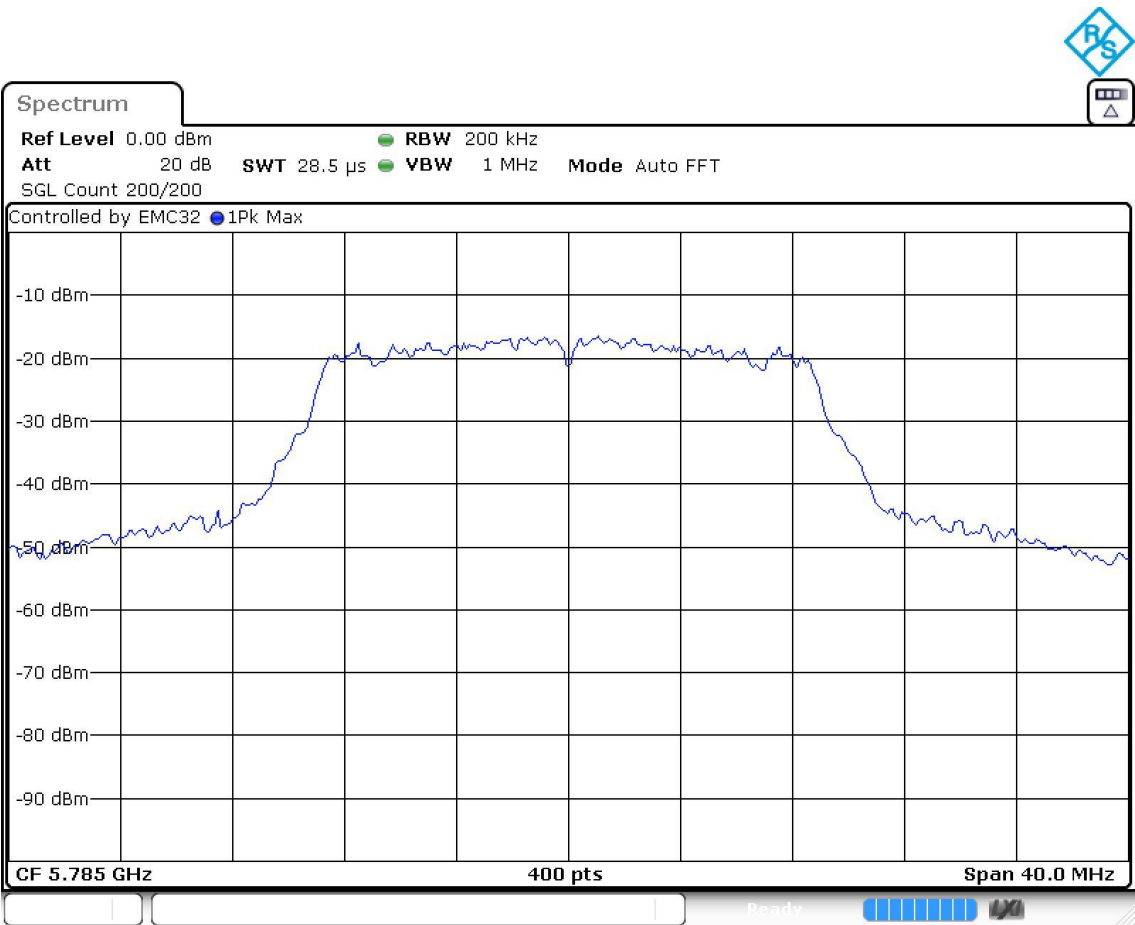
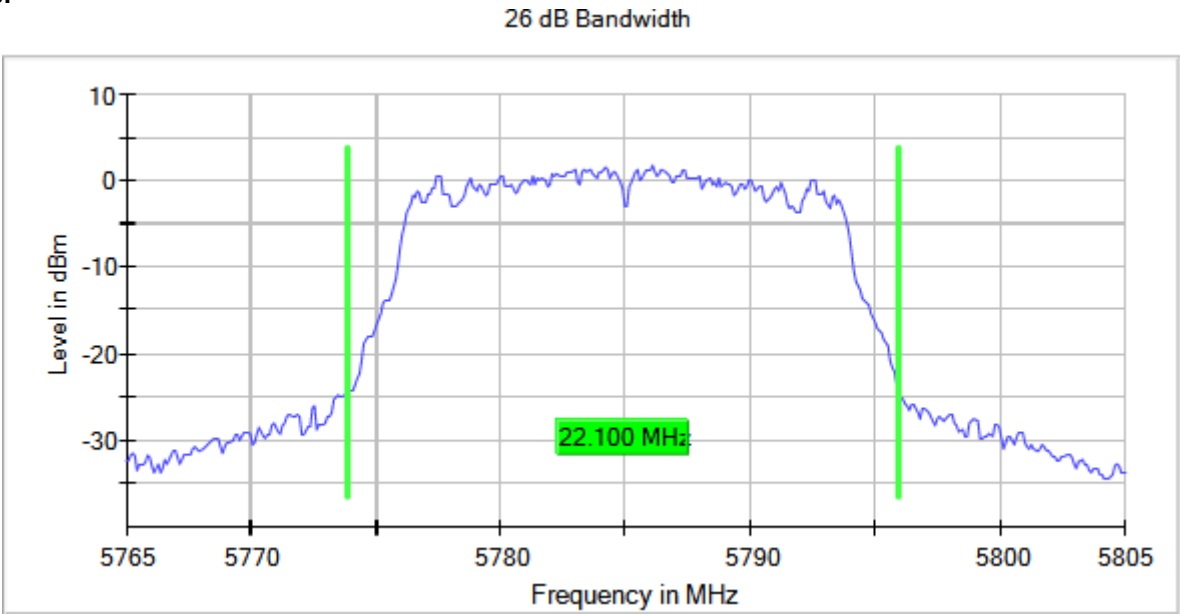
Operation Band MHz = [5725, 5850] Active Port = 1
Frequency MHz = 5745.00000 Modulation = 802.11ac VHT20 (OFDM MCS0)
MIMO Mode = SISO

Images:



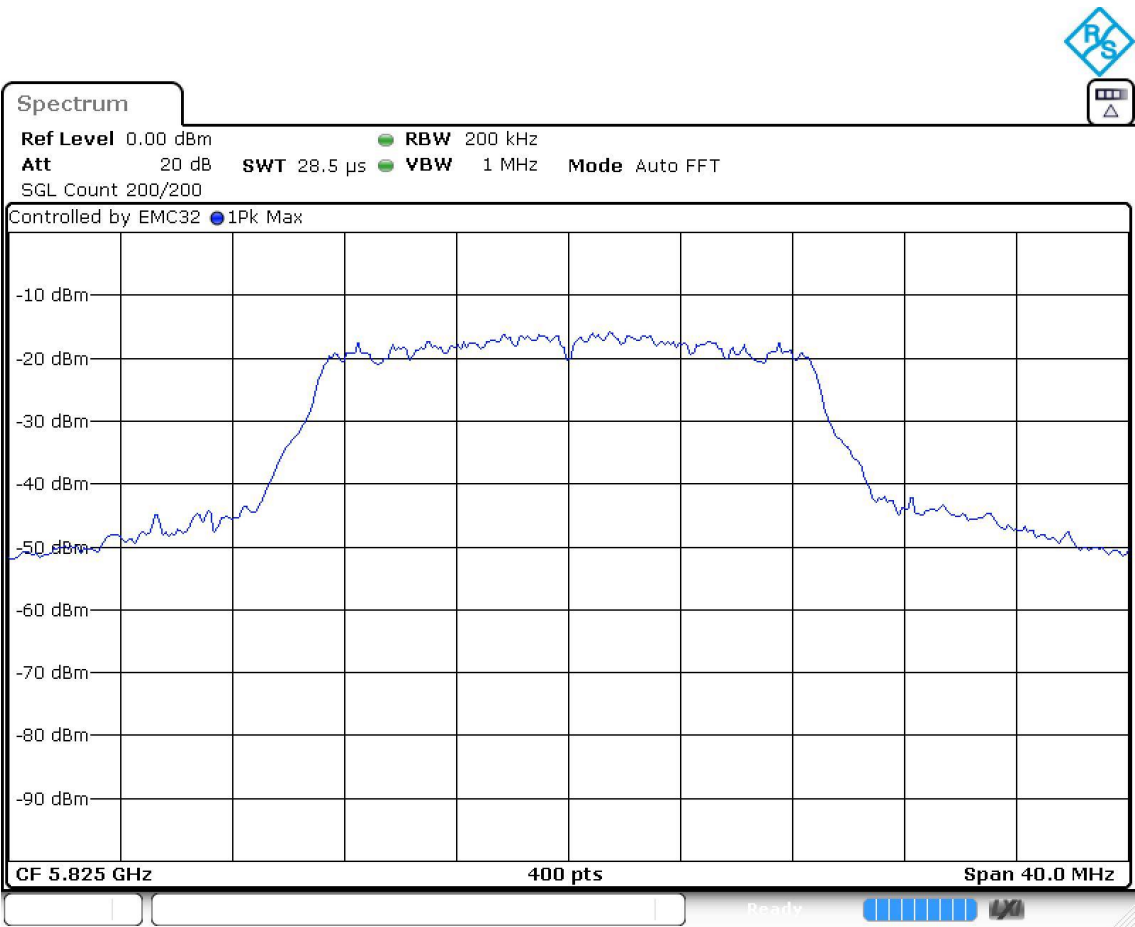
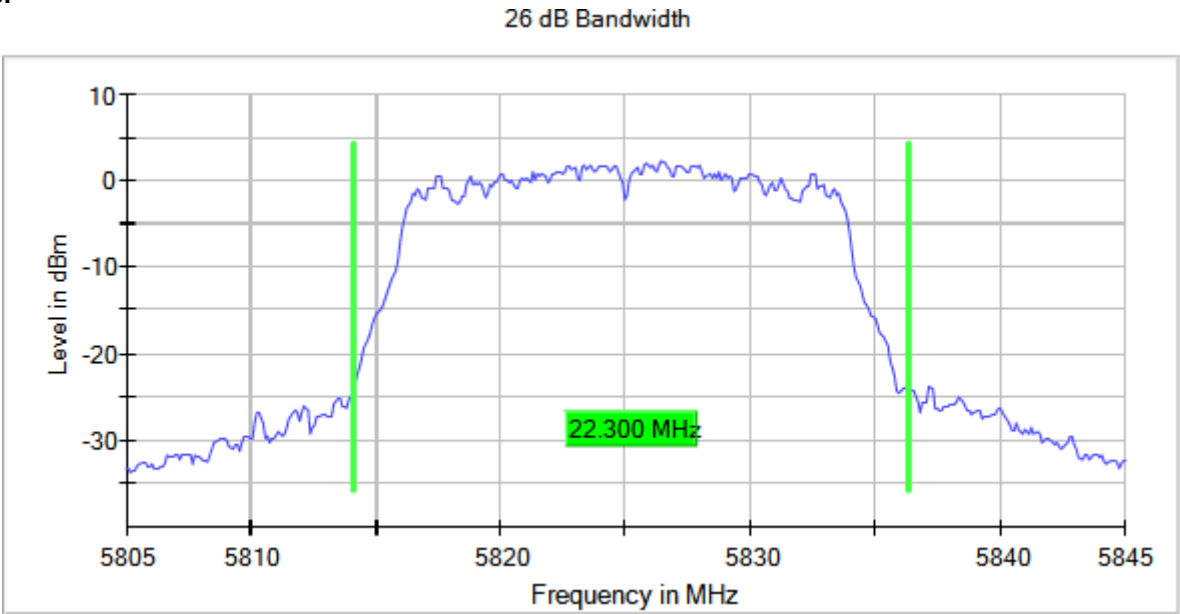
Operation Band MHz = [5725, 5850] Active Port = 1
Frequency MHz = 5785.00000 Modulation = 802.11ac VHT20 (OFDM MCS0)
MIMO Mode = SISO

Images:



Operation Band MHz = [5725, 5850] Active Port = 1
Frequency MHz = 5825.00000 Modulation = 802.11ac VHT20 (OFDM MCS0)
MIMO Mode = SISO

Images:



Modulation: 802.11ac VHT40 (OFDM MCS0)

MIMO Mode: SISO

Results

Operation Band (MHz)	Port	Freq (MHz)	Ebw (MHz)
[5150, 5250]	1	5190.00000	39.775
		5230.00000	39.775
[5725, 5850]		5755.00000	40.075
		5795.00000	39.775

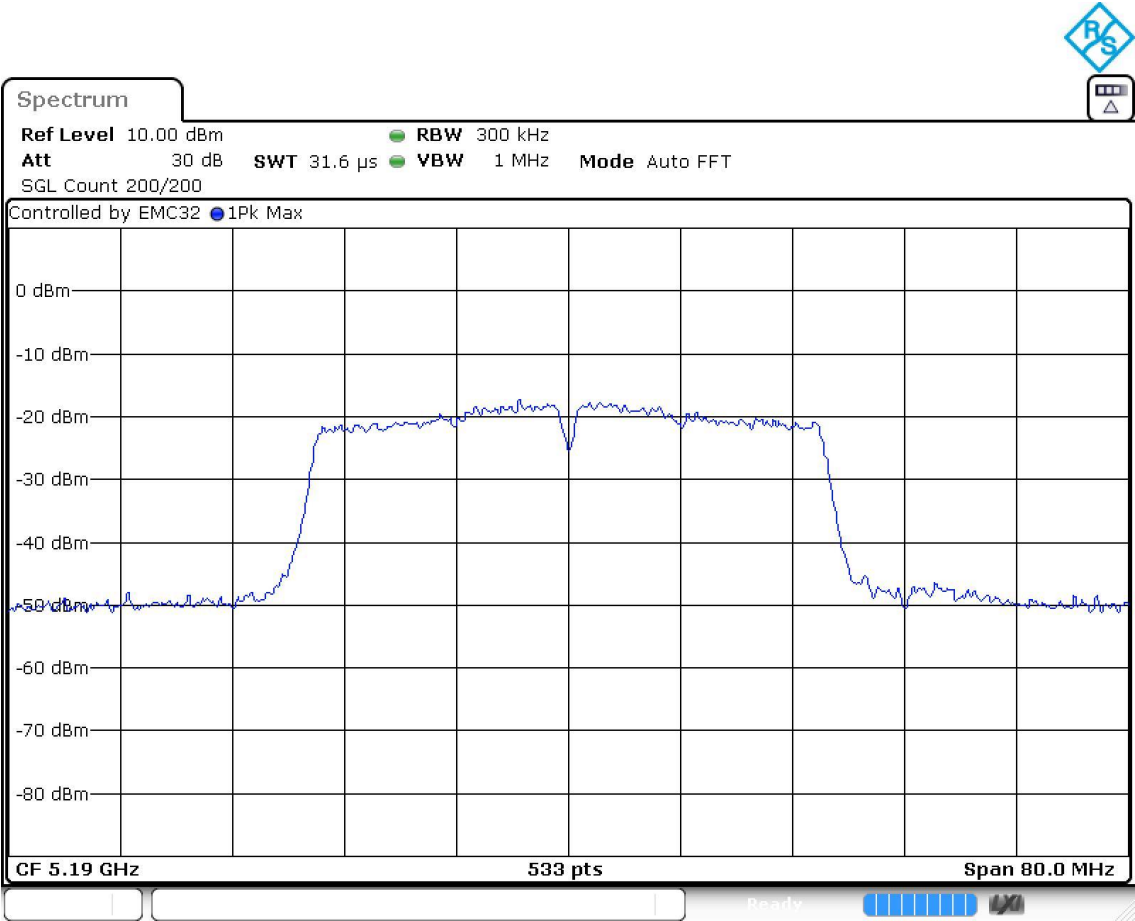
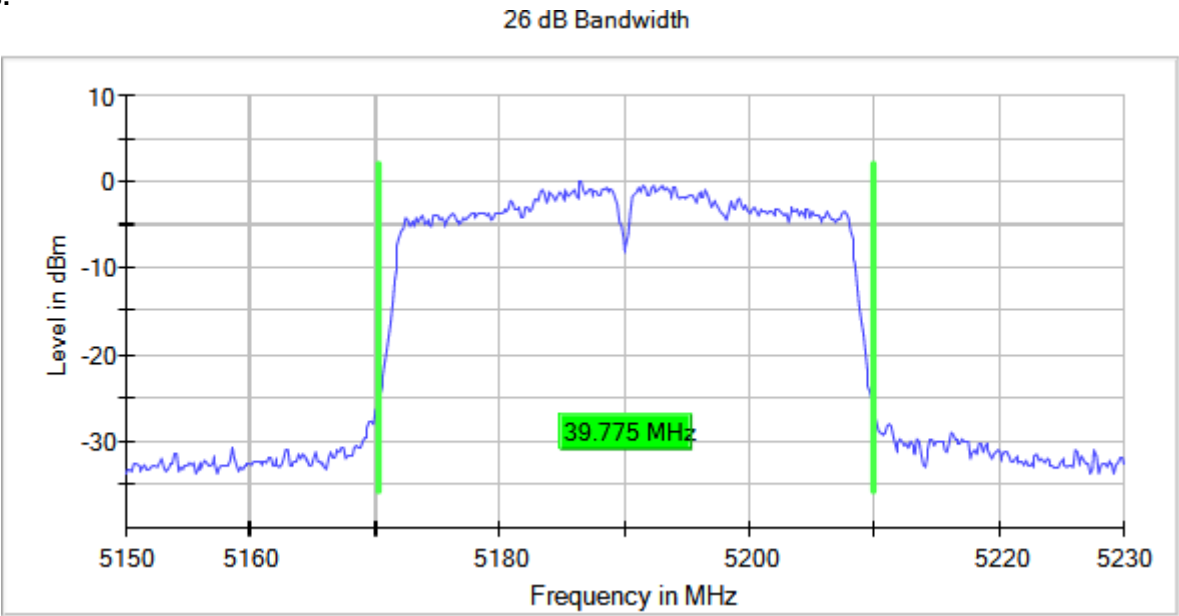
Verdict

Pass

Attachments

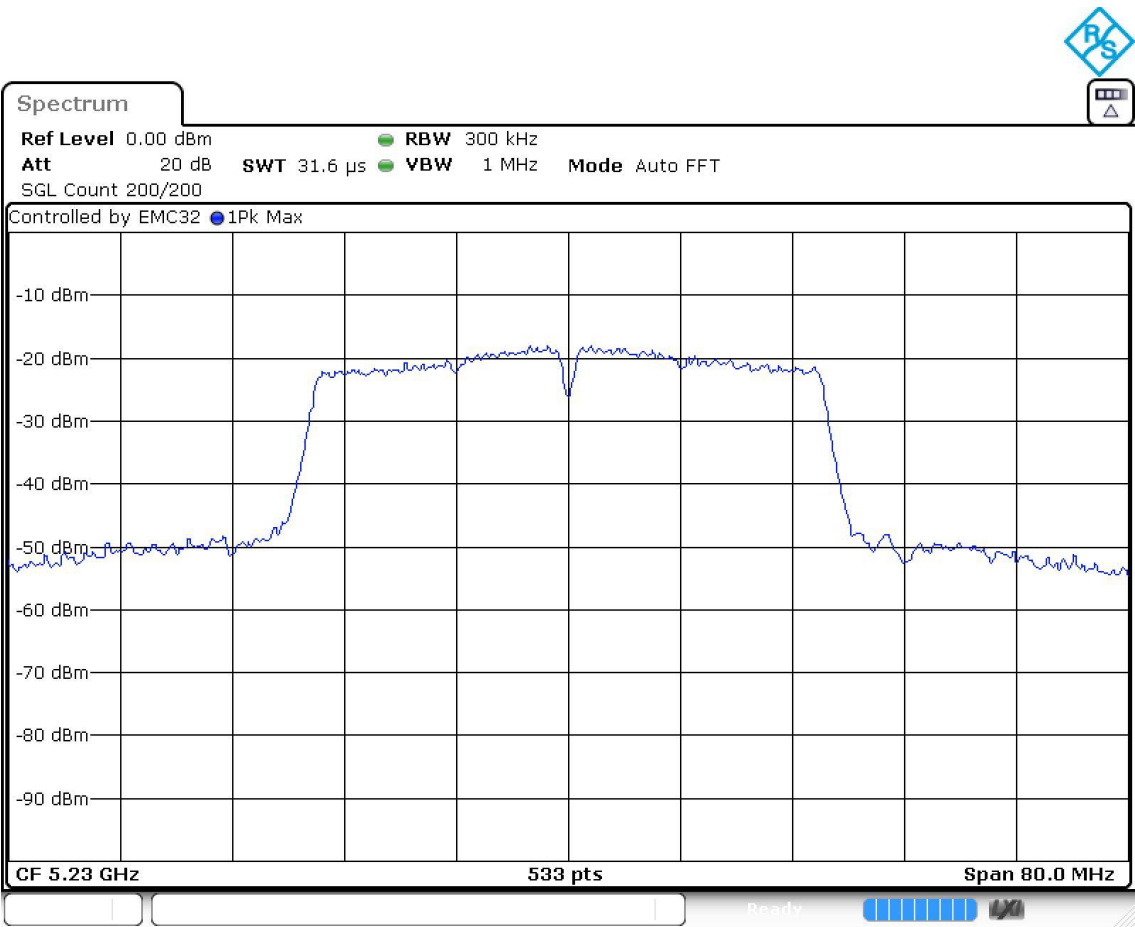
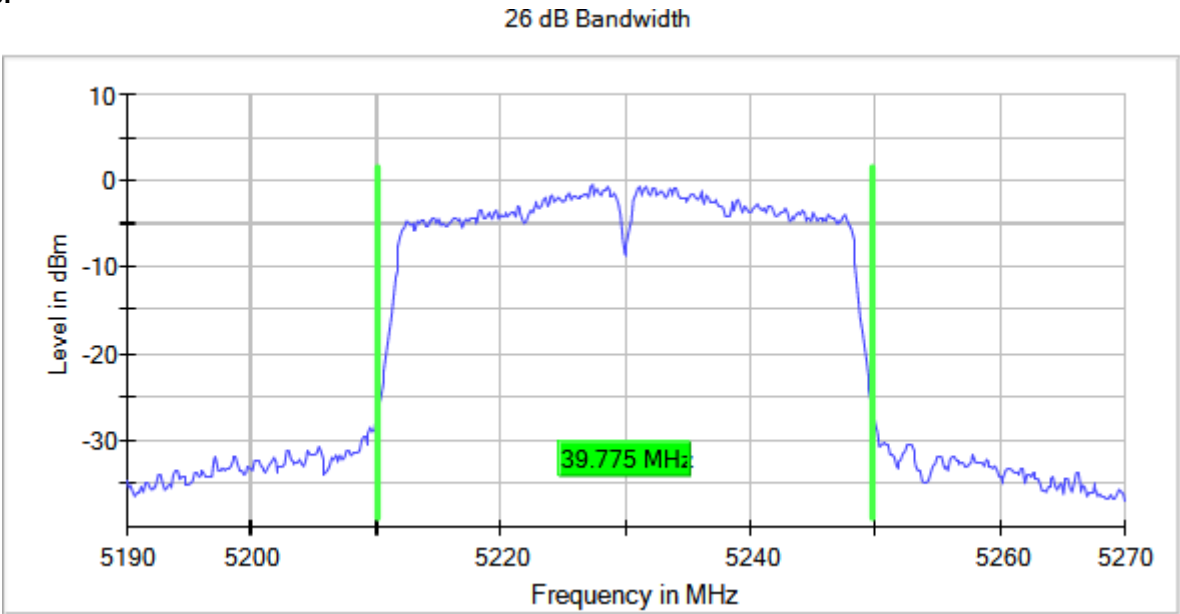
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5190.00000 Modulation = 802.11ac VHT40 (OFDM MCS0)
MIMO Mode = SISO

Images:



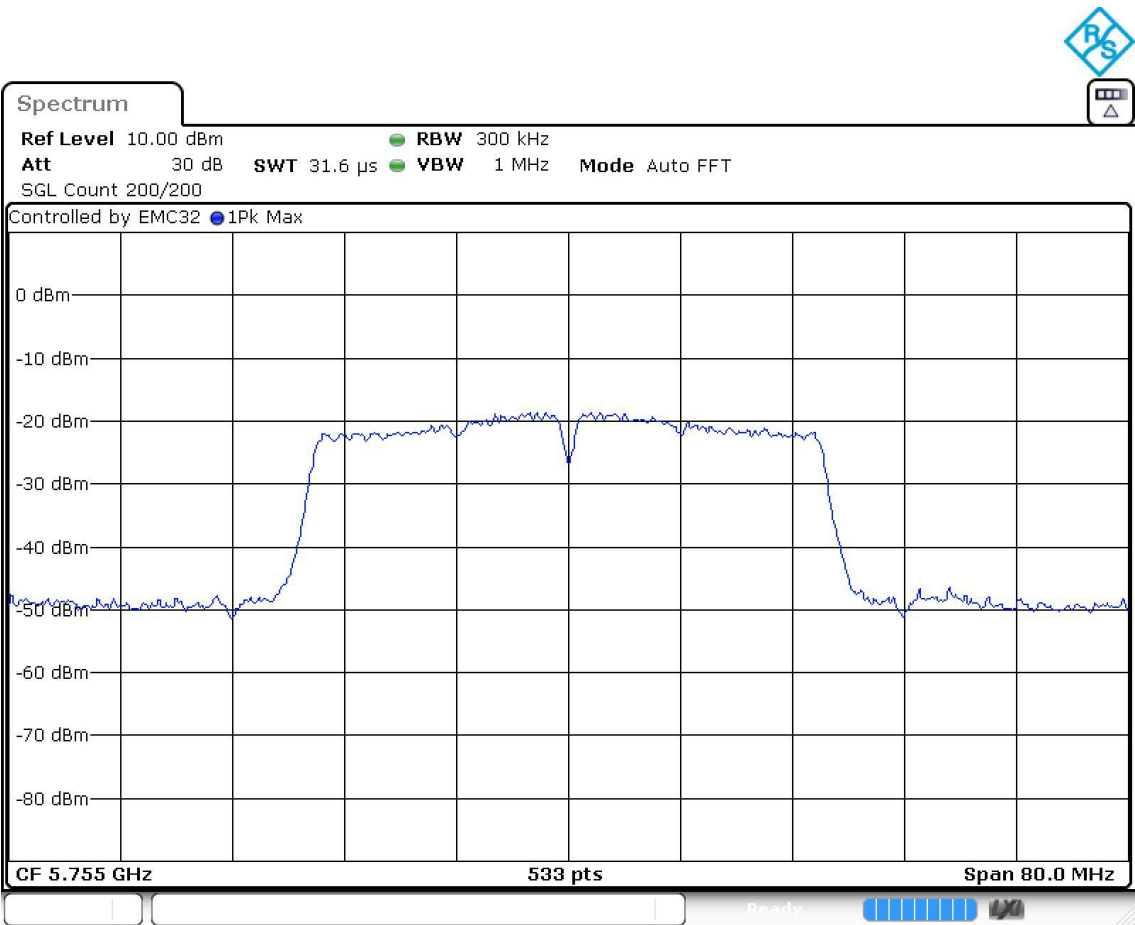
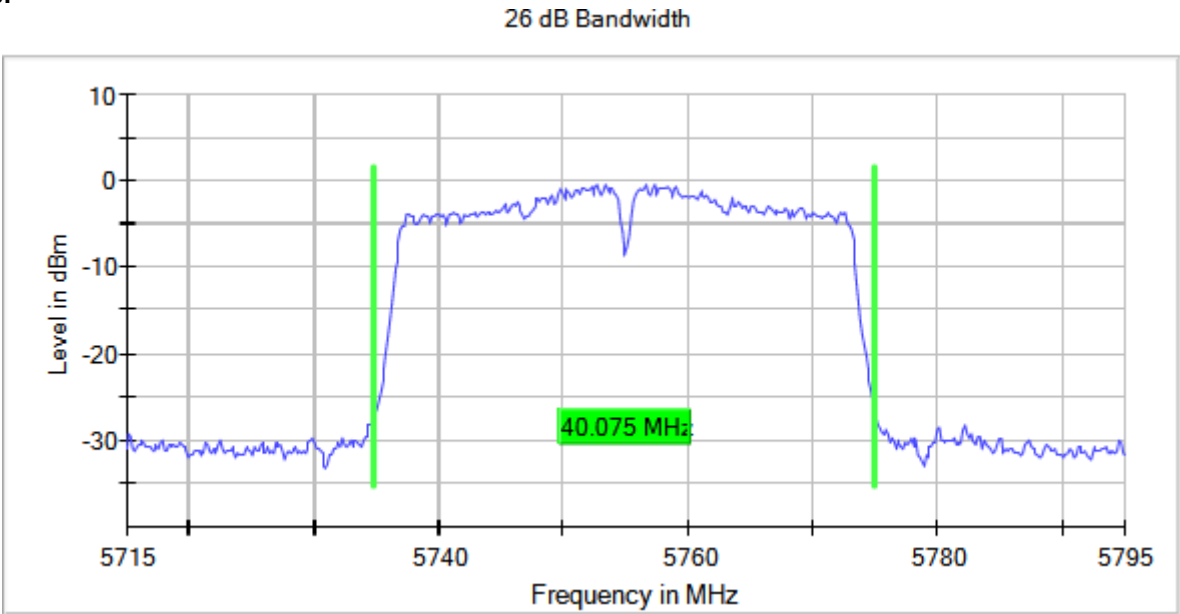
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5230.00000 Modulation = 802.11ac VHT40 (OFDM MCS0)
MIMO Mode = SISO

Images:



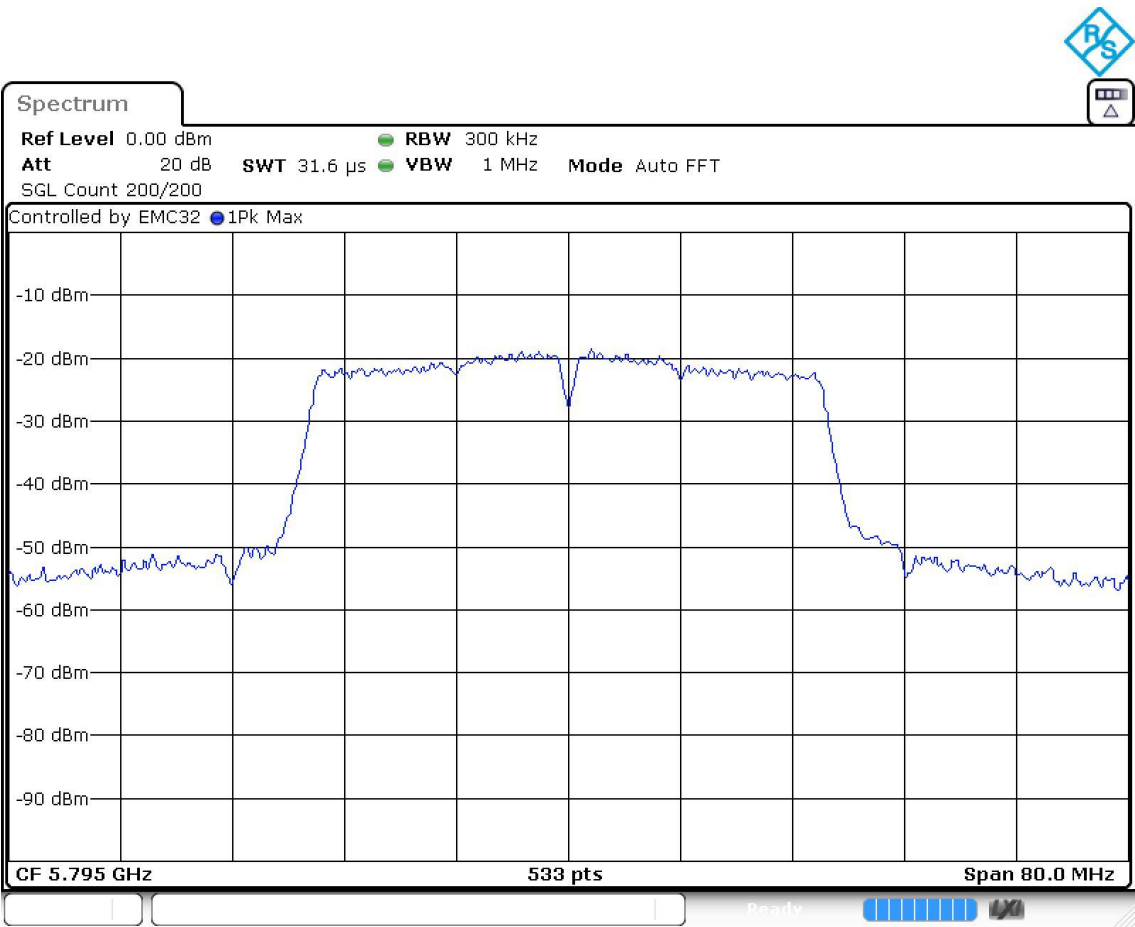
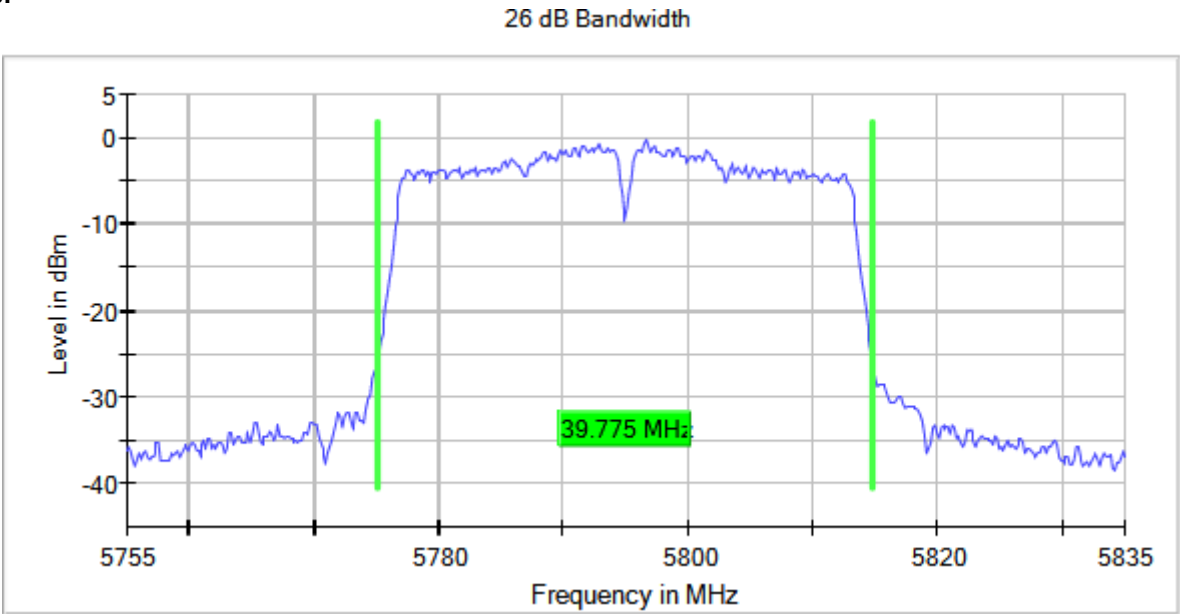
Operation Band MHz = [5725, 5850] Active Port = 1
Frequency MHz = 5755.00000 Modulation = 802.11ac VHT40 (OFDM MCS0)
MIMO Mode = SISO

Images:



Operation Band MHz = [5725, 5850] Active Port = 1
Frequency MHz = 5795.00000 Modulation = 802.11ac VHT40 (OFDM MCS0)
MIMO Mode = SISO

Images:



Modulation: 802.11ac VHT80 (OFDM MCS0)

MIMO Mode: SISO

Results

Operation Band (MHz)	Port	Freq (MHz)	Ebw (MHz)
[5150, 5250]	1	5210.00000	83.000
[5725, 5850]		5775.00000	98.500

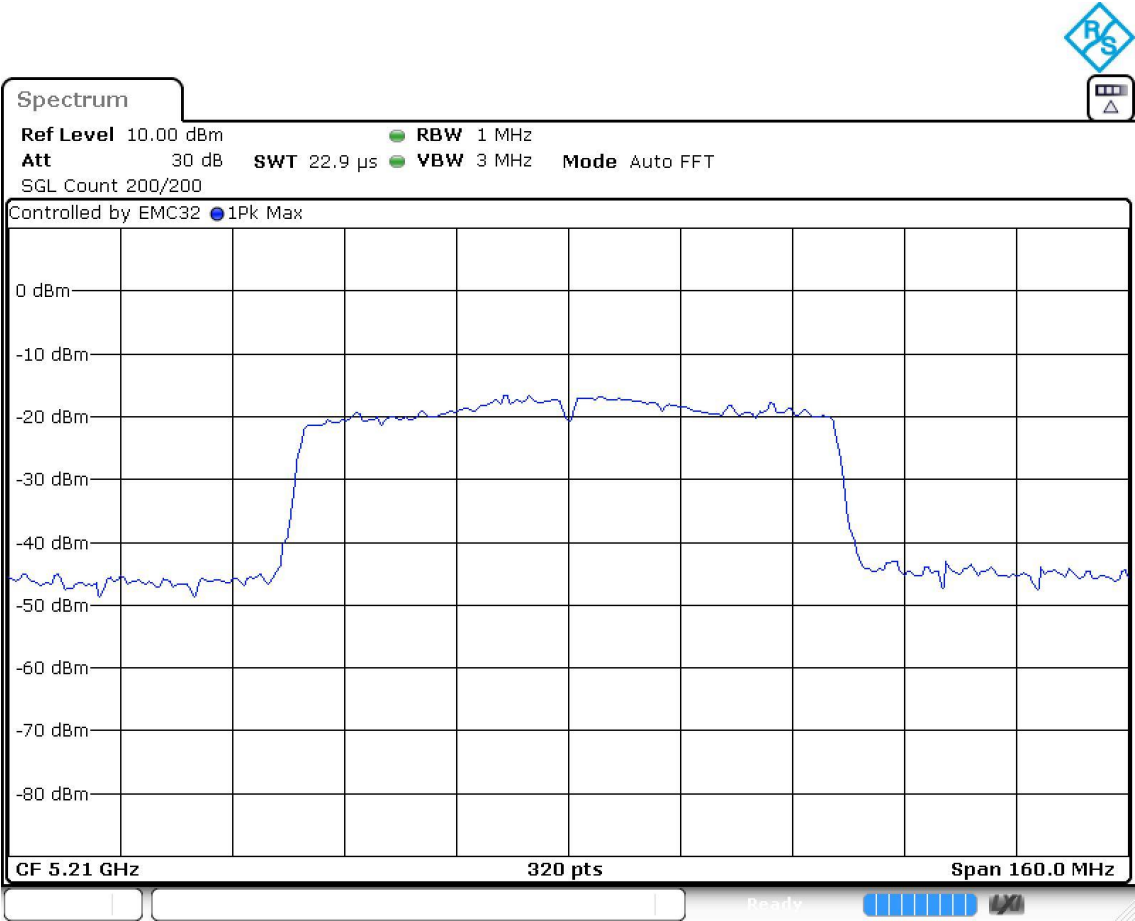
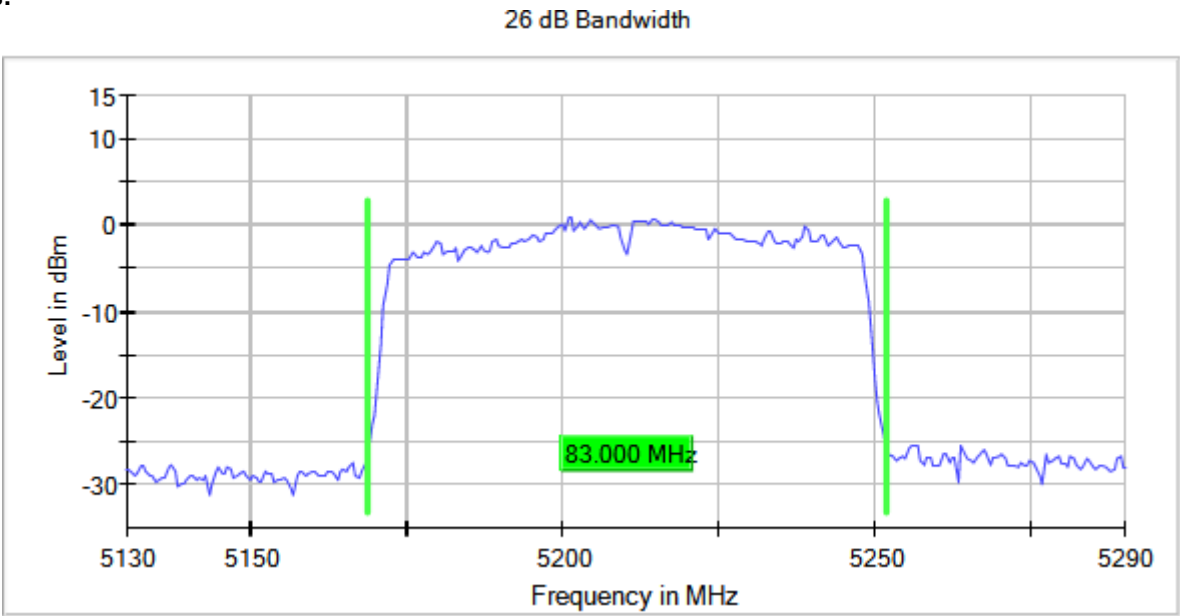
Verdict

Pass

Attachments

Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5210.00000 Modulation = 802.11ac VHT80 (OFDM MCS0)
MIMO Mode = SISO

Images:



Operation Band MHz = [5725, 5850] Active Port = 1

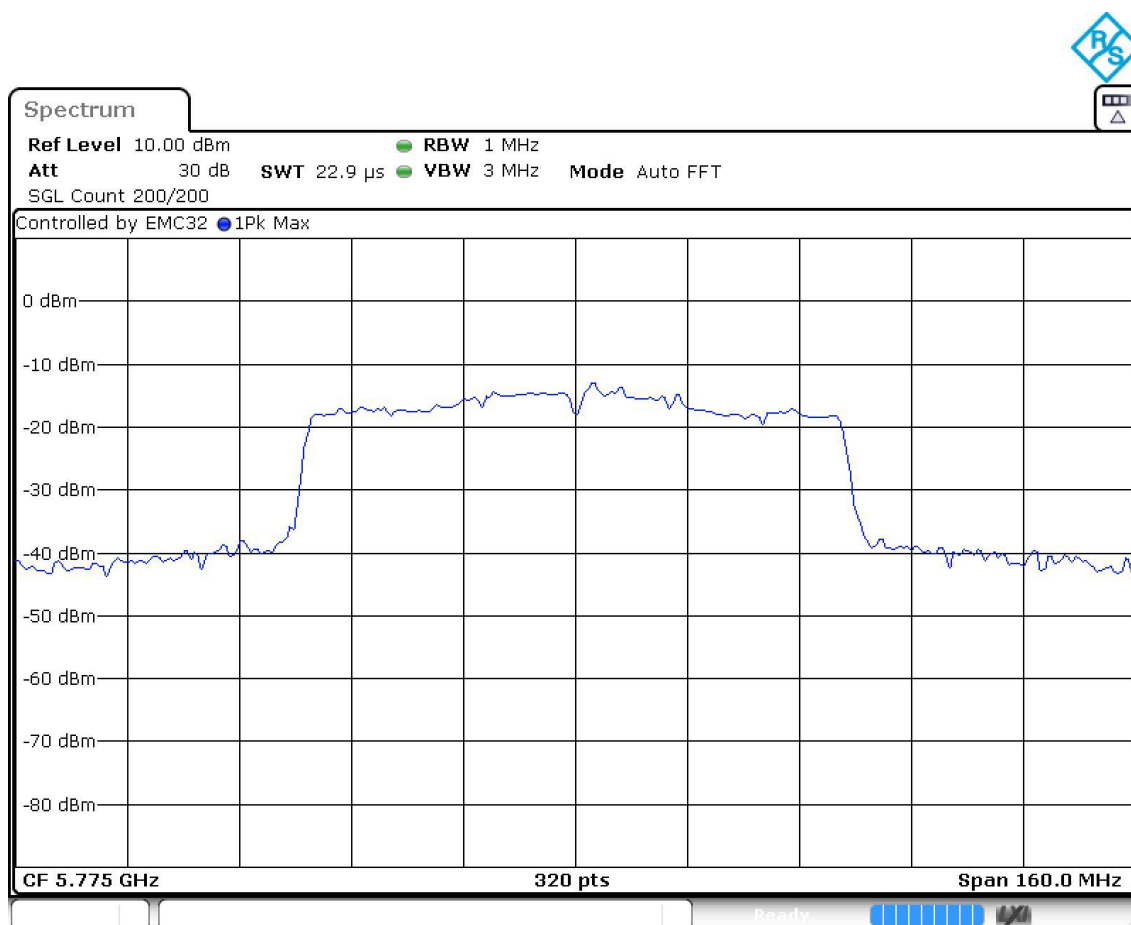
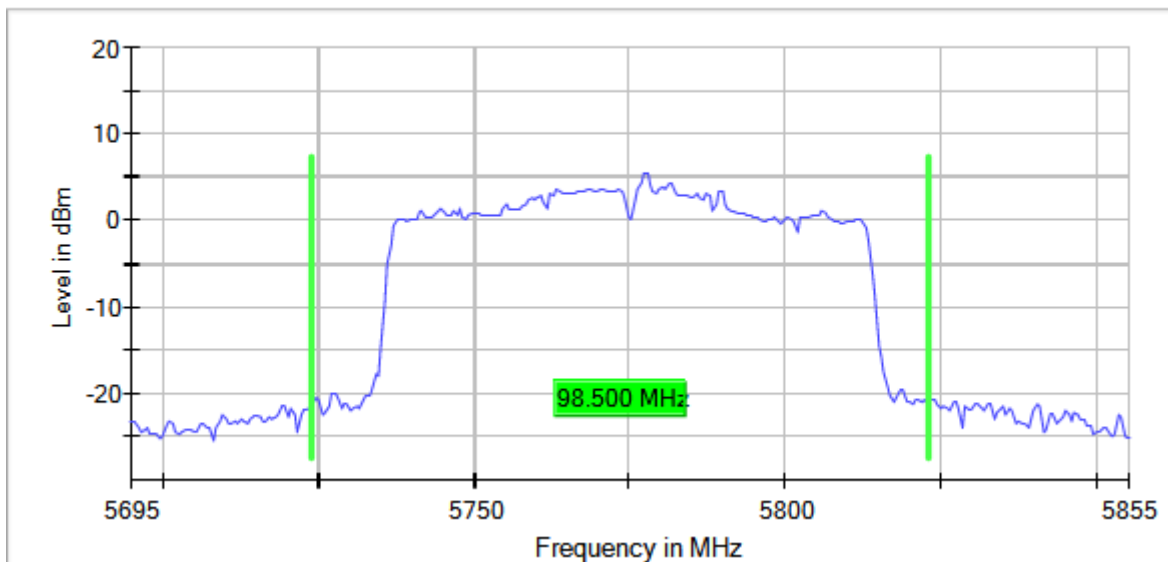
Frequency MHz = 5775.00000

Modulation = 802.11ac VHT80 (OFDM MCS0)

MIMO Mode = SISO

Images:

26 dB Bandwidth



Appendix B: Tests results for the U-NII-1: 5.15 GHz – 5.25 GHz Band

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TEST CONDITIONS

(*) Declared by the Client.

POWER SUPPLY (*):

Vnominal: -48 V DC
Type of Power Supply: DC power

ANTENNA (*):

Type of Antennas: Rod Antenna

Maximum Declared Antenna Gain: +2 dBi

POWER SETTING (*):

For all modes, the EUT was configured in test mode using a software application. The application was used to enable a continuous transmission and to select the test channels as required. The client supplied instructions to configure the EUT. The customer supplied a power setting table with the maximum level for each mode and band:

Mode	POWER CONFIGURED FOR TESTING		
	Ch.36	Ch.44	Ch.48
802.11a	14	14	14
802.11n-20	14	14	14
11ac-20	12	12	12
Mode	Ch.38	Ch.46	
11n-40	14	14	
11ac-40	12,5	12,5	
Mode	Ch.42		
11ac-80	12		

TEST FREQUENCIES (*):

Technology Tested:	WLAN (IEEE 802.11 a20 / n2040 / ac204080 1x1 & 2x2)
	802.11a: 6, 9, 12, 18, 24, 36, 48 & 54 Mbps
	802.11n HT20: MCS0 to MCS23
Modes:	802.11n HT40: MCS0 to MCS23
	802.11ac VHT20: MCS0 to MCS9
	802.11ac VHT40: MCS0 to MCS9
	802.11ac VHT80: MCS0 to MCS9
Beamforming:	No.

Band U-NII-1:

Operating Channel Bandwidth:	20 MHz	Channels	Channel Frequency (MHz)
		Low (36)	5180
Transmission Channels:		Middle (40)	5200
		Middle (44)	5220
		High (48)	5240
Operating Channel Bandwidth:	40 MHz	Channels	Channel Frequency (MHz)
Transmission Channels:		Low (38)	5190
		High (46)	5230
Operating Channel Bandwidth:	80 MHz	Channels	Channel Frequency (MHz)
Transmission Channels:		Single (42)	5210

The test set-up was made in accordance to the general provisions of FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuously transmitting with a modulated carrier at maximum power on all required channels using the supported data rates/modulations types.

The field strength at the band edges was evaluated for each mode on the lowest and highest channels at the rated power for the channel under test.

For all modes, the EUT was configured in test mode using a software application. The application was used to enable a continuous transmission and to select the test channels as required. The client supplied instructions to configure the EUT. The customer supplied a document containing the setup instructions.

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and connected to the TS8997 using a low-loss RF cable. The reading in the spectrum analyzer is corrected considering the internal and external RF cable loss.

For all modes:



RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) and 1 GHz-18 GHz Double ridge horn antenna is situated at a distance of 3 m and a distance of 1.5 m for the frequency range 17 GHz-40 GHz (18 GHz-40 GHz horn antenna).

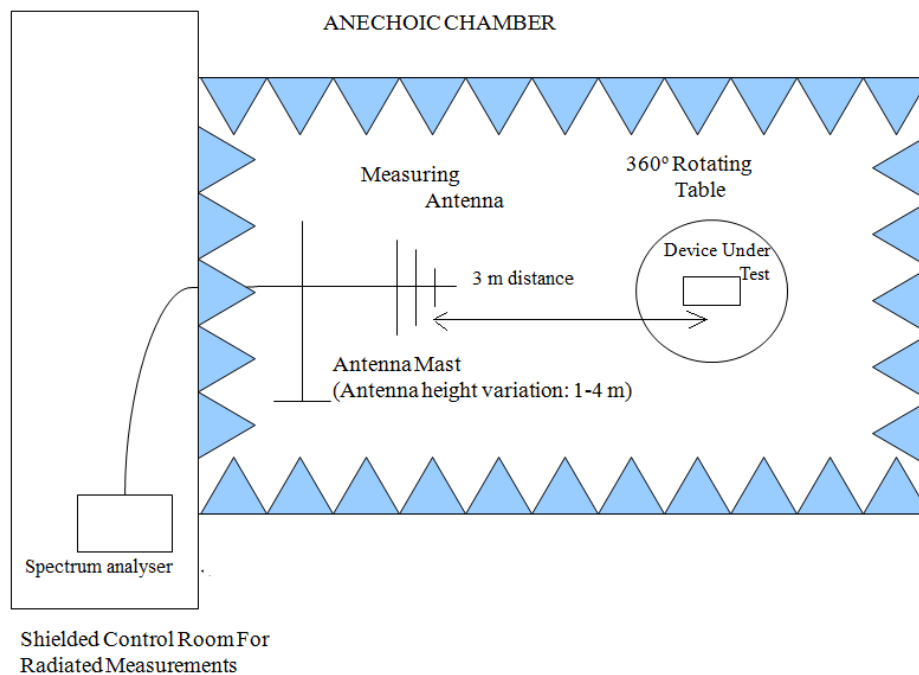
For radiated emissions in the range 17 GHz-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

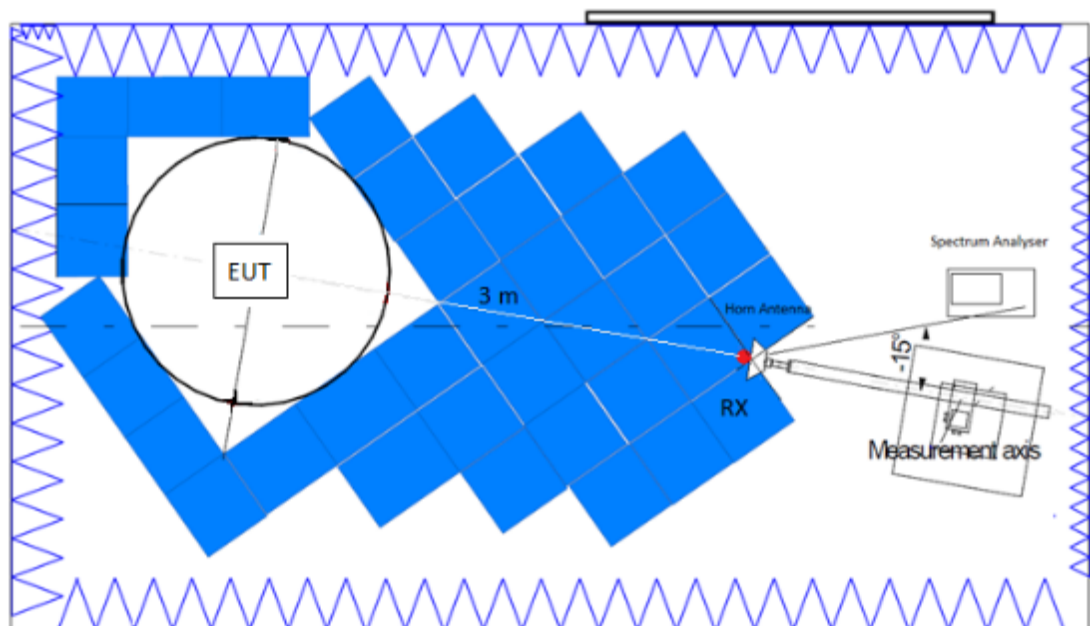
Measurements were made in both horizontal and vertical planes of polarization.

The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.

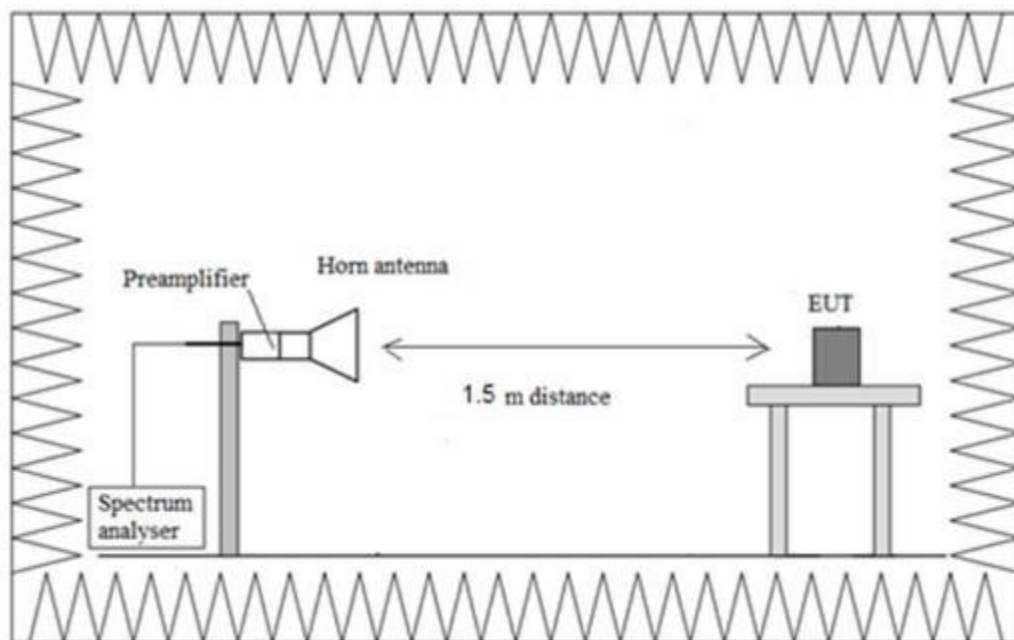
Radiated measurements setup $f < 1$ GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



FCC 15.407 (a)(1)(iv) Transmitter Maximum Conducted Output Power/ RSS-247 Clause 6.2.1.1. Transmitter Maximum Equivalent Isotropically Radiated Power

Limit:

FCC 15.407:

For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247:

The maximum e.i.r.p. shall not exceed 200 mW (23 dBm) or $10 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

Modulation: 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)

Results

The maximum conducted output power was measured using the method according to clause E) 3) b) (Method PM-G) of 789033 D02 General UNII Test Procedures New Rules v02r01.

The e.i.r.p. levels are calculated by adding the declared maximum antenna gain (dBi).

Antenna Gain:

- Antenna – +2 dBi

Operation Band (MHz)	Port	Freq (MHz)	TPC	Avg Power (dBm)	Max EIRP (dBm)
[5150, 5250]	1	5180.00000	No	12.80	14.80
		5220.00000		12.71	14.71
		5240.00000		12.89	14.89

Verdict

Pass

Modulation: 802.11n HT40 (OFDM MCS0 13.5 Mbit/s)

Results

Operation Band (MHz)	Port	Freq (MHz)	TPC	Avg Power (dBm)	Max EIRP (dBm)
[5150, 5250]	1	5190.00000	No	11.99	13.99
		5230.00000		12.05	14.05

Verdict

Pass

Modulation: 802.11a (OFDM 6 Mbit/s)

Results

Operation Band (MHz)	Port	Freq (MHz)	TPC	Avg Power (dBm)	Max EIRP (dBm)
[5150, 5250]	1	5180.00000	No	12.85	14.85
		5220.00000		12.69	14.69
		5240.00000		12.76	14.76

Verdict

Pass

Modulation: 802.11ac VHT20 (OFDM MCS0)

Results

Operation Band (MHz)	Port	Freq (MHz)	TPC	Avg Power (dBm)	Max EIRP (dBm)
[5150, 5250]	1	5180.00000	No	10.95	12.95
		5220.00000		10.68	12.68
		5240.00000		10.81	12.81

Verdict

Pass

Modulation: 802.11ac VHT40 (OFDM MCS0)

Results

Operation Band (MHz)	Port	Freq (MHz)	TPC	Avg Power (dBm)	Max EIRP (dBm)
[5150, 5250]	1	5190.00000	No	11.10	13.10
		5230.00000		10.99	12.99

Verdict

Pass

Modulation: 802.11ac VHT80 (OFDM MCS0)

Results

Operation Band (MHz)	Port	Freq (MHz)	TPC	Avg Power (dBm)	Max EIRP (dBm)
[5150, 5250]	1	5210.00000	No	10.08	12.08

Verdict

Pass

FCC 15.407 (a)(1)(iv) / RSS-247 Clause 6.2.1.1. Transmitter EIRP
Spectral Density

Limit:

The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Results

The maximum Power Spectral Density (PSD) was measured using the method according to clause F) referencing E.2.b) (Method SA-1) of Guidance 789033 D02 General UNII Test Procedures New Rules v02r01.

The result of PSD was measured by setting a marker on the peak of the signal on the spectrum analyzer. The results are in the tables below.

- Antenna –: +2 dBi

Modulation: 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)

MIMO Mode: SISO

Operation Band (MHz)	Port	Freq (MHz)	TPC	Freq (MHz)	PSD (dBm)
[5150, 5250]	1	5180.00000	No	5179.207921	0.91
		5220.00000		5219.009901	0.79
		5240.00000		5241.188119	1.01

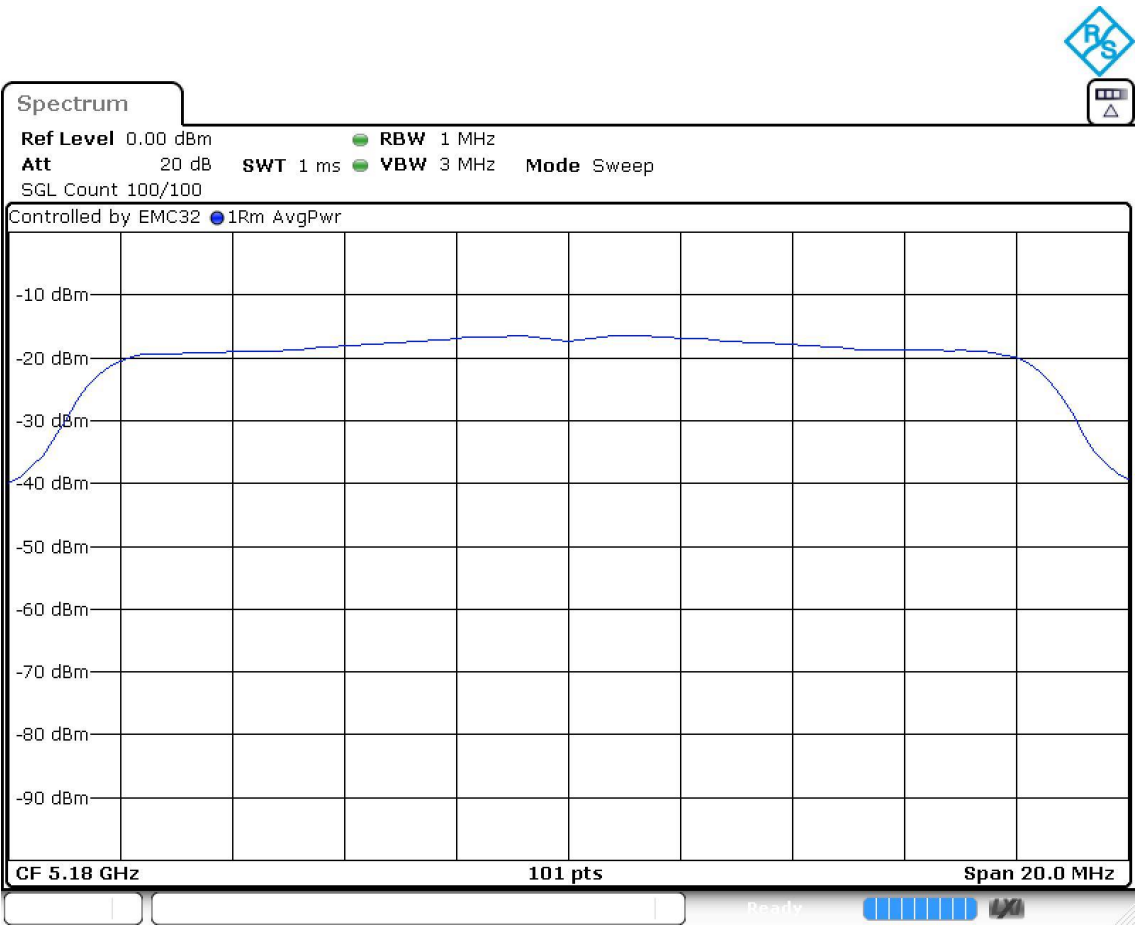
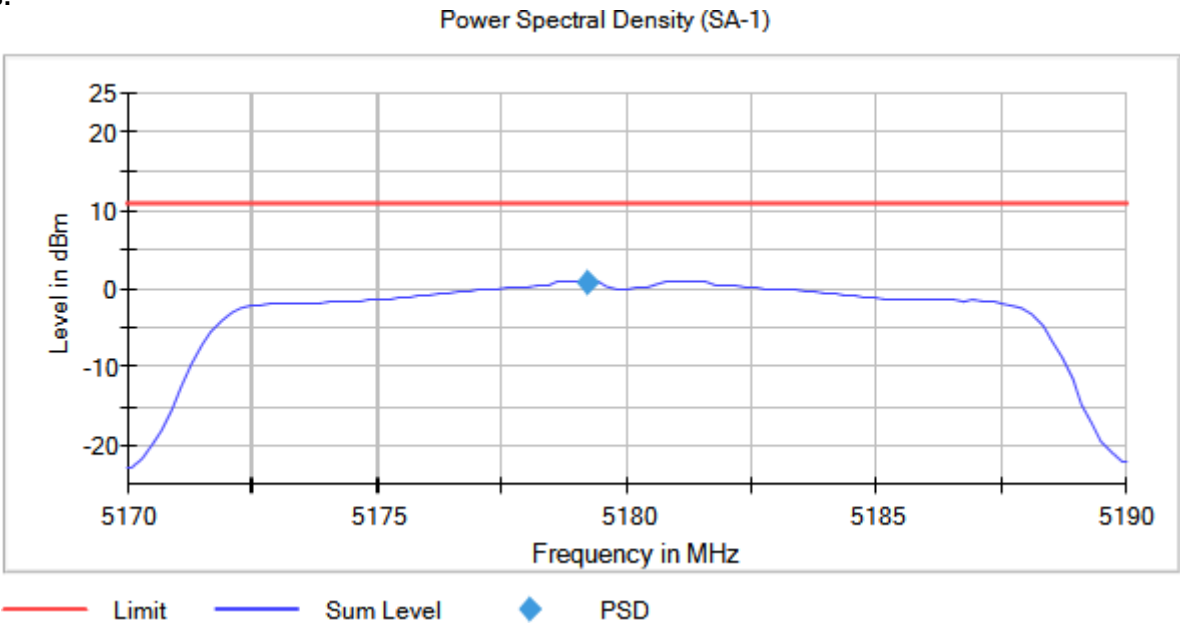
Verdict

Pass

Attachments

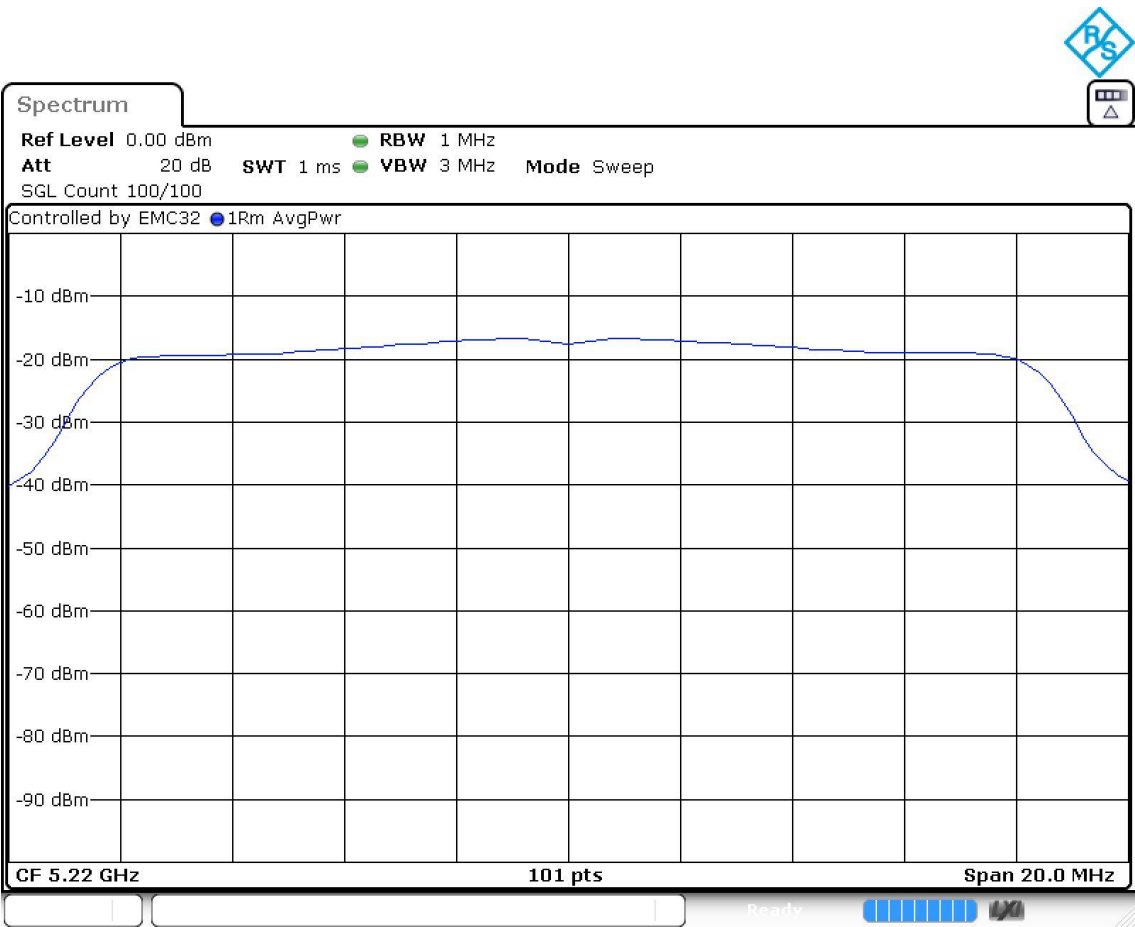
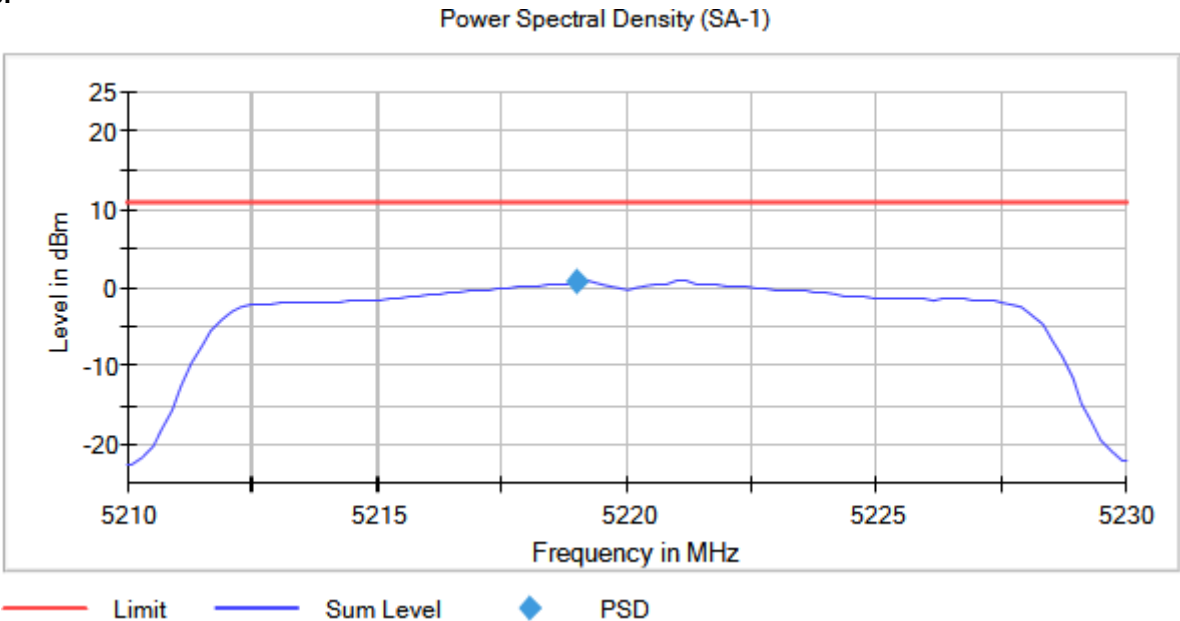
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5180.00000 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
TPC = No MIMO Mode = SISO

Images:



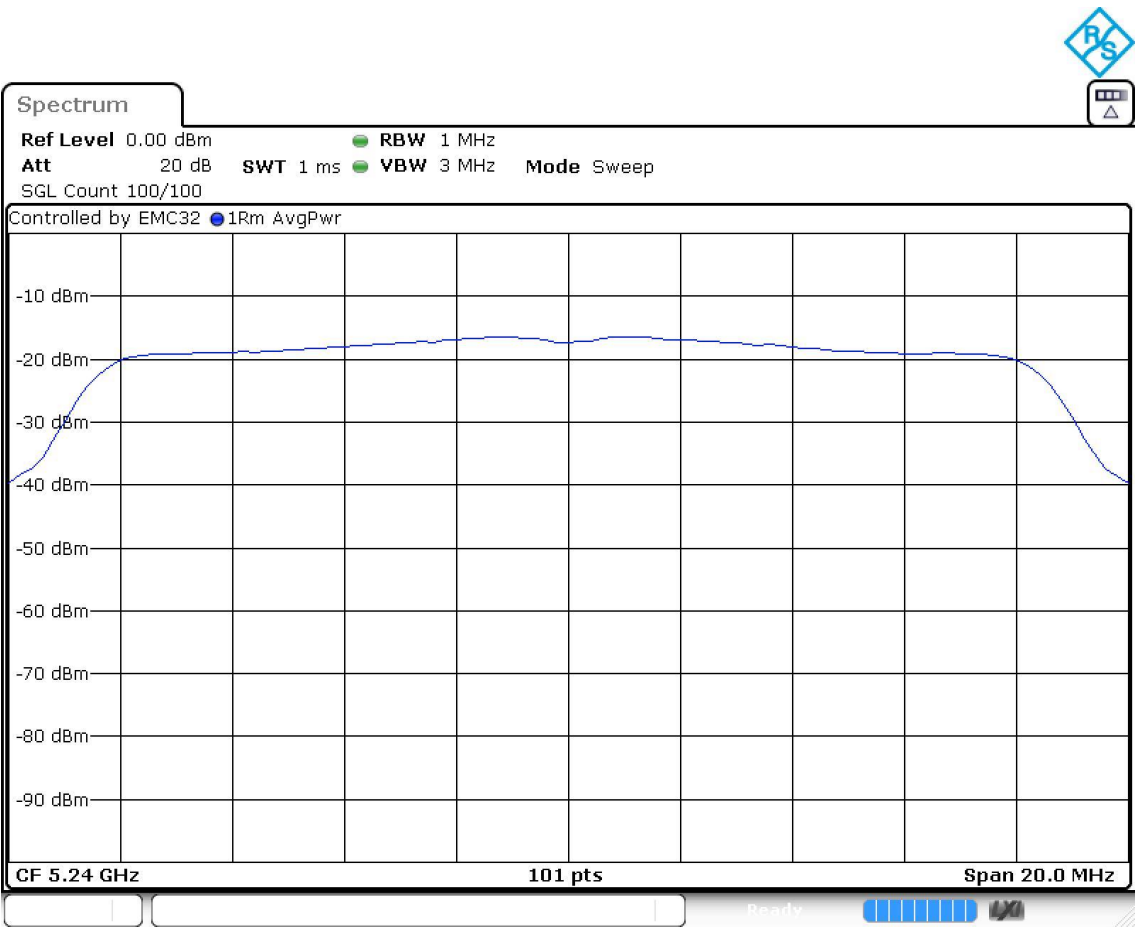
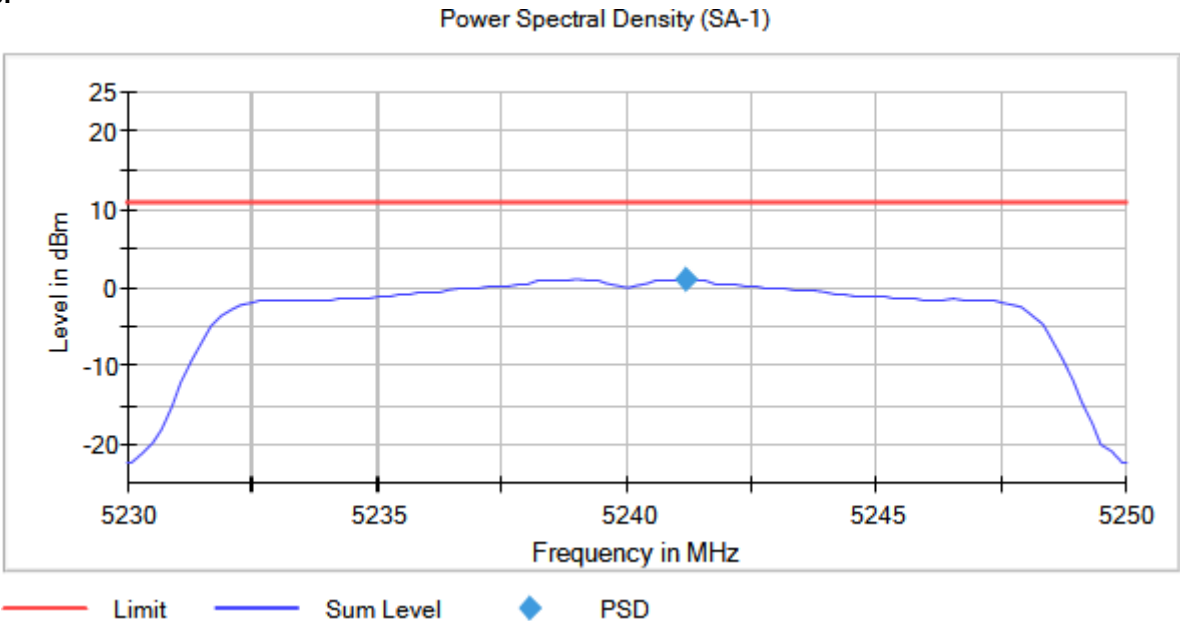
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5220.00000 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
TPC = No MIMO Mode = SISO

Images:



Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5240.00000 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
TPC = No MIMO Mode = SISO

Images:



Modulation: 802.11n HT40 (OFDM MCS0 13.5 Mbit/s)

MIMO Mode: SISO

Results

Operation Band (MHz)	Port	Freq (MHz)	TPC	Freq (MHz)	PSD (dBm)
[5150, 5250]	1	5190.00000	No	5187.623762	-2.98
		5230.00000		5232.376238	-2.75

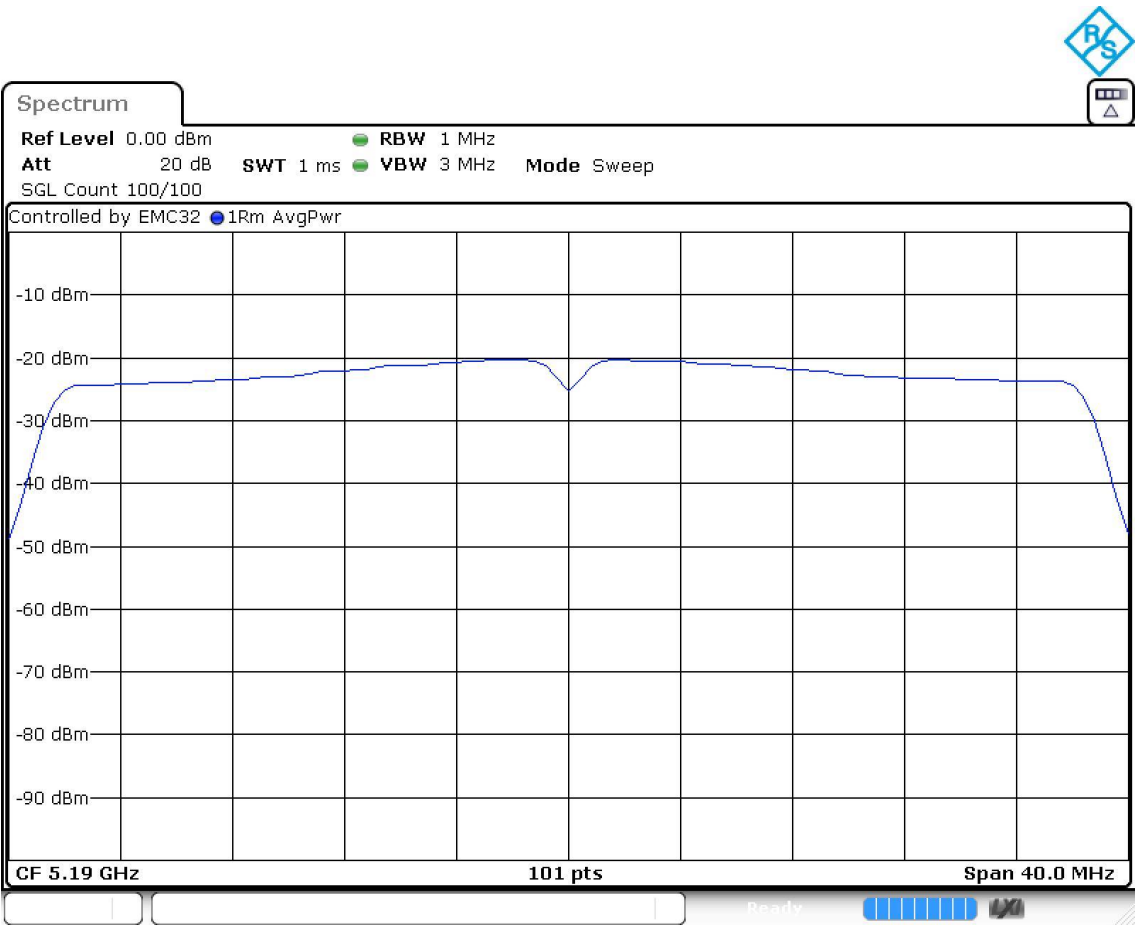
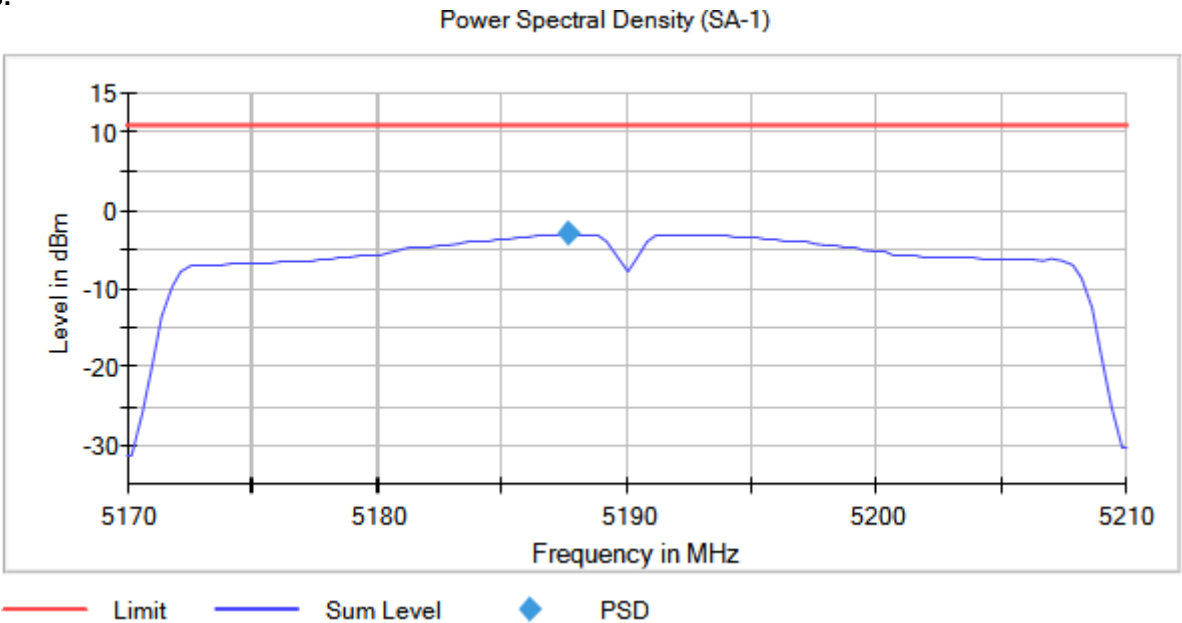
Verdict

Pass

Attachments

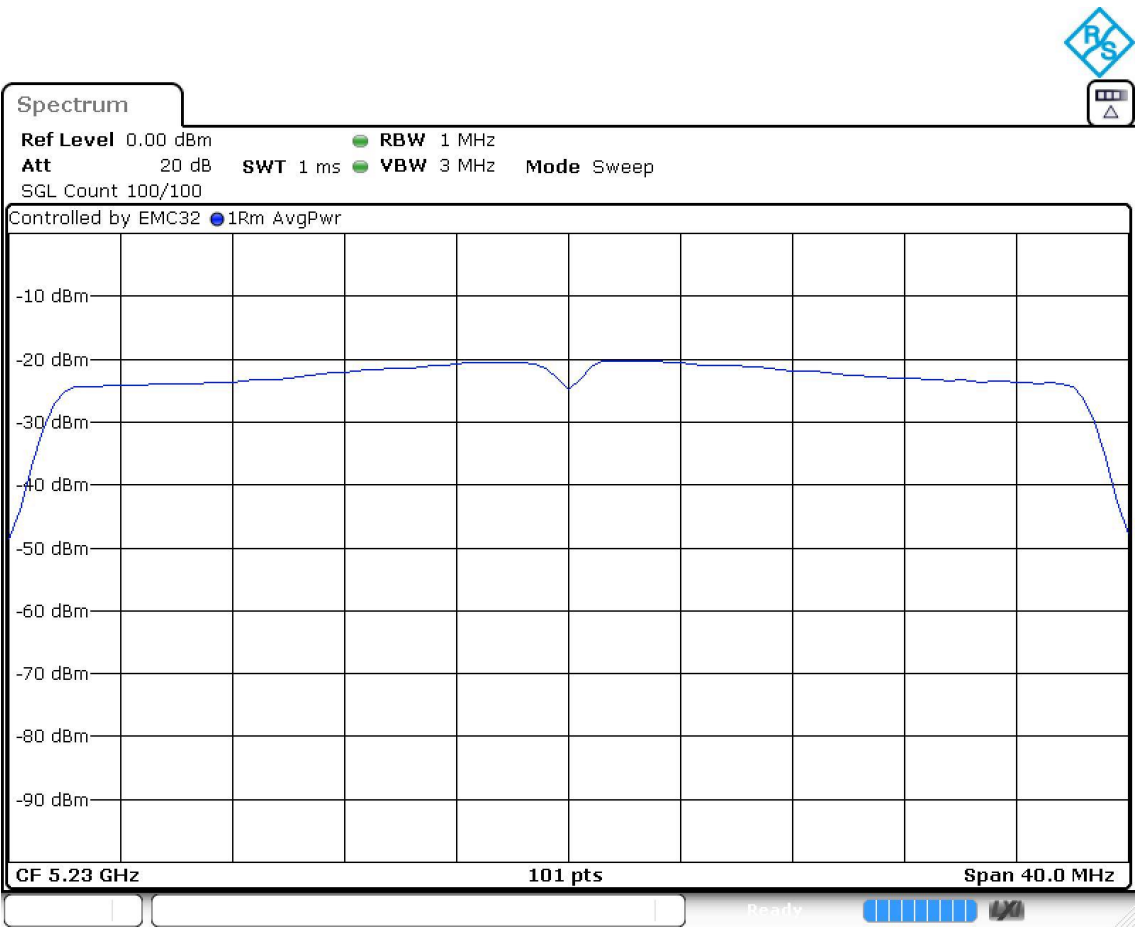
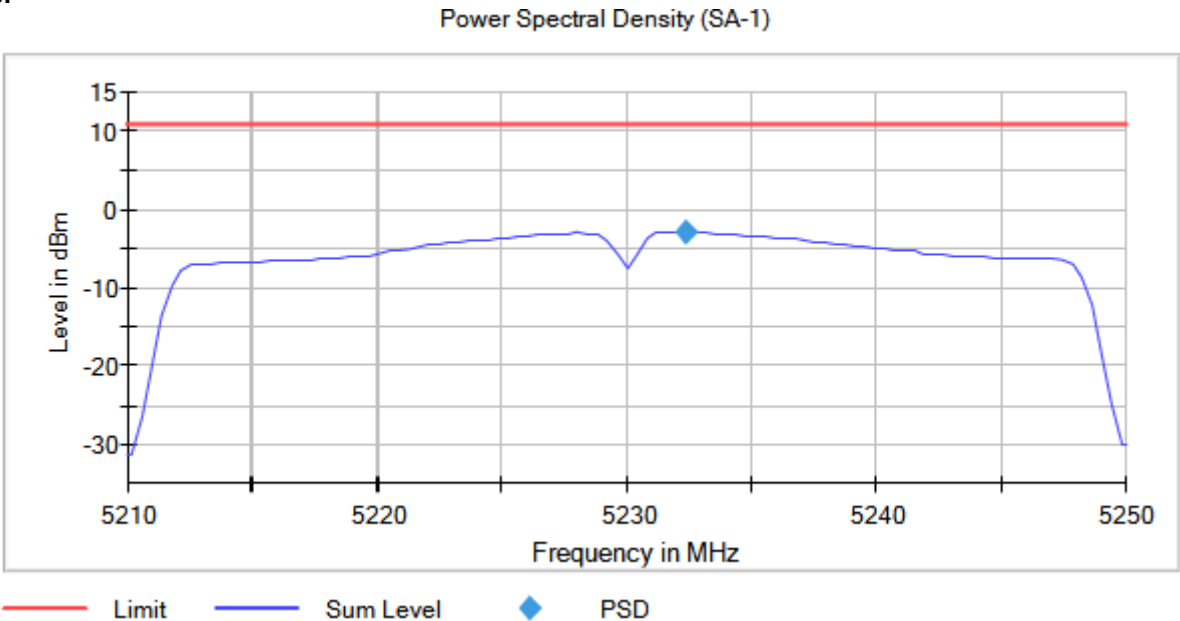
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5190.00000 Modulation = 802.11n HT40 (OFDM MCS0 13.5 Mbit/s)
TPC = No MIMO Mode = SISO

Images:



Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5230.00000 Modulation = 802.11n HT40 (OFDM MCS0 13.5 Mbit/s)
TPC = No MIMO Mode = SISO

Images:



Modulation: 802.11a (OFDM 6 Mbit/s)

MIMO Mode: SISO

Results

Operation Band (MHz)	Port	Freq (MHz)	TPC	Freq (MHz)	PSD (dBm)
[5150, 5250]	1	5180.00000	No	5180.990099	1.09
		5220.00000		5220.990099	0.84
		5240.00000		5239.207921	0.99

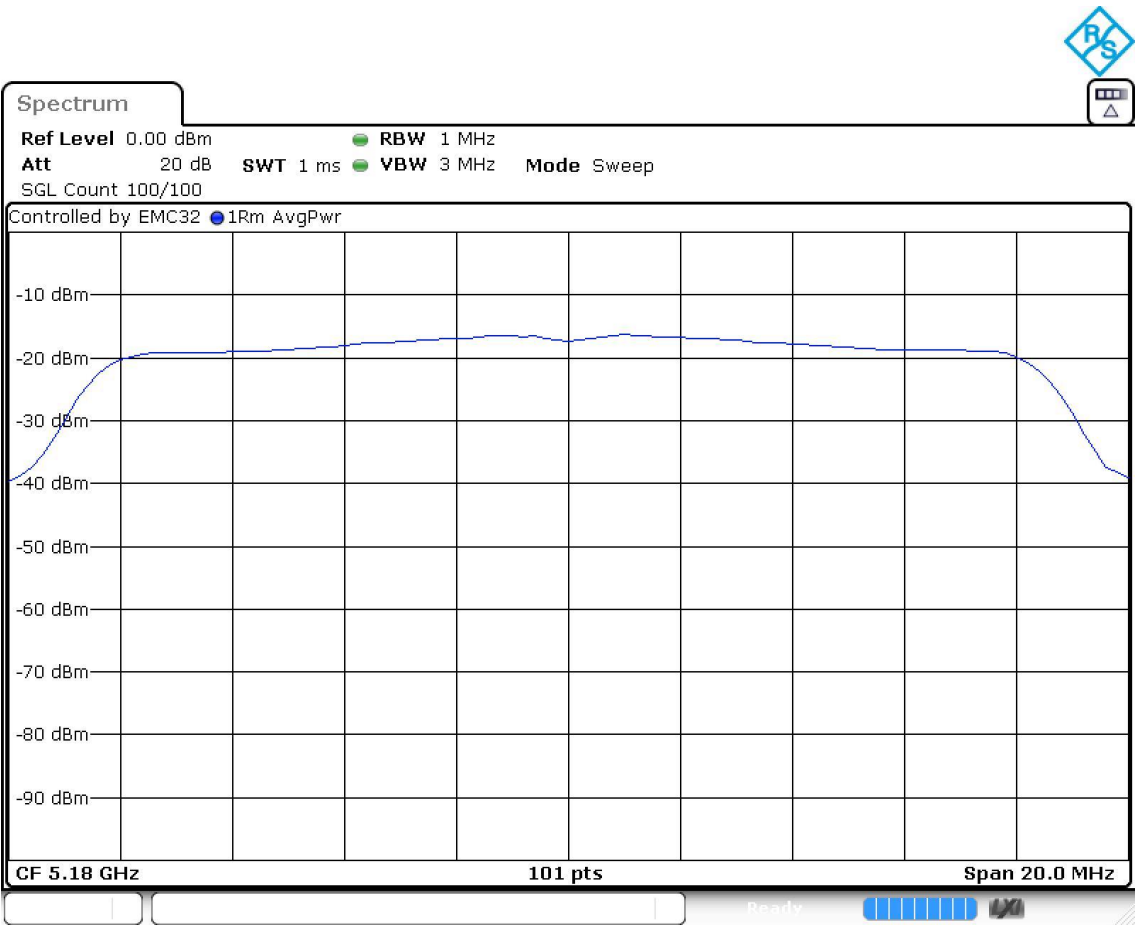
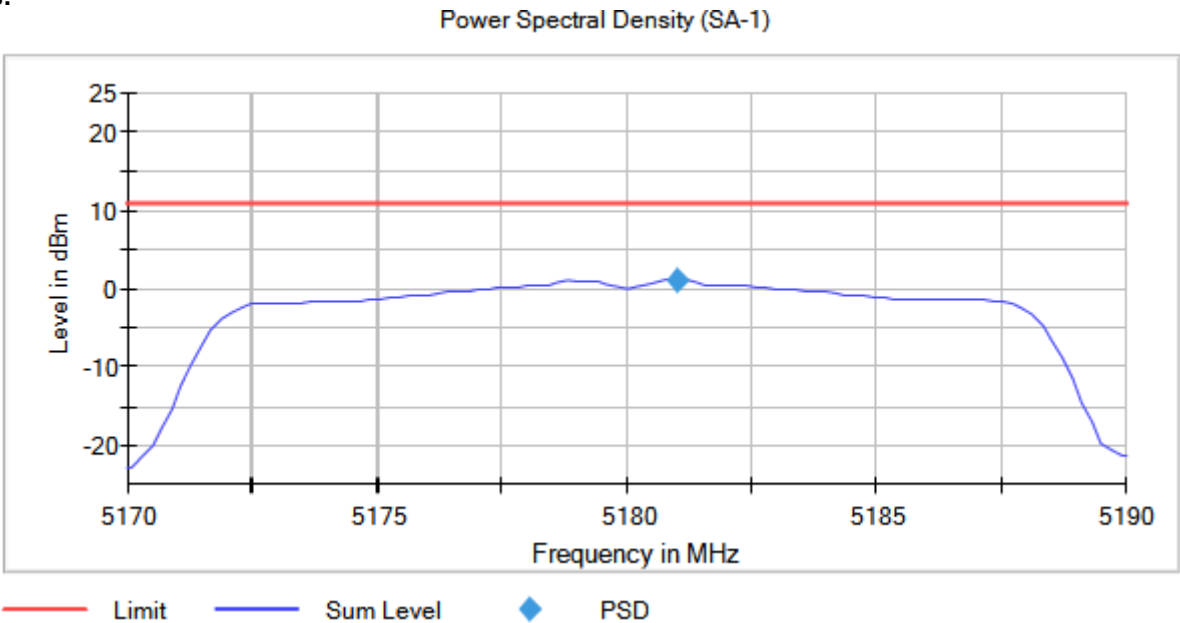
Verdict

Pass

Attachments

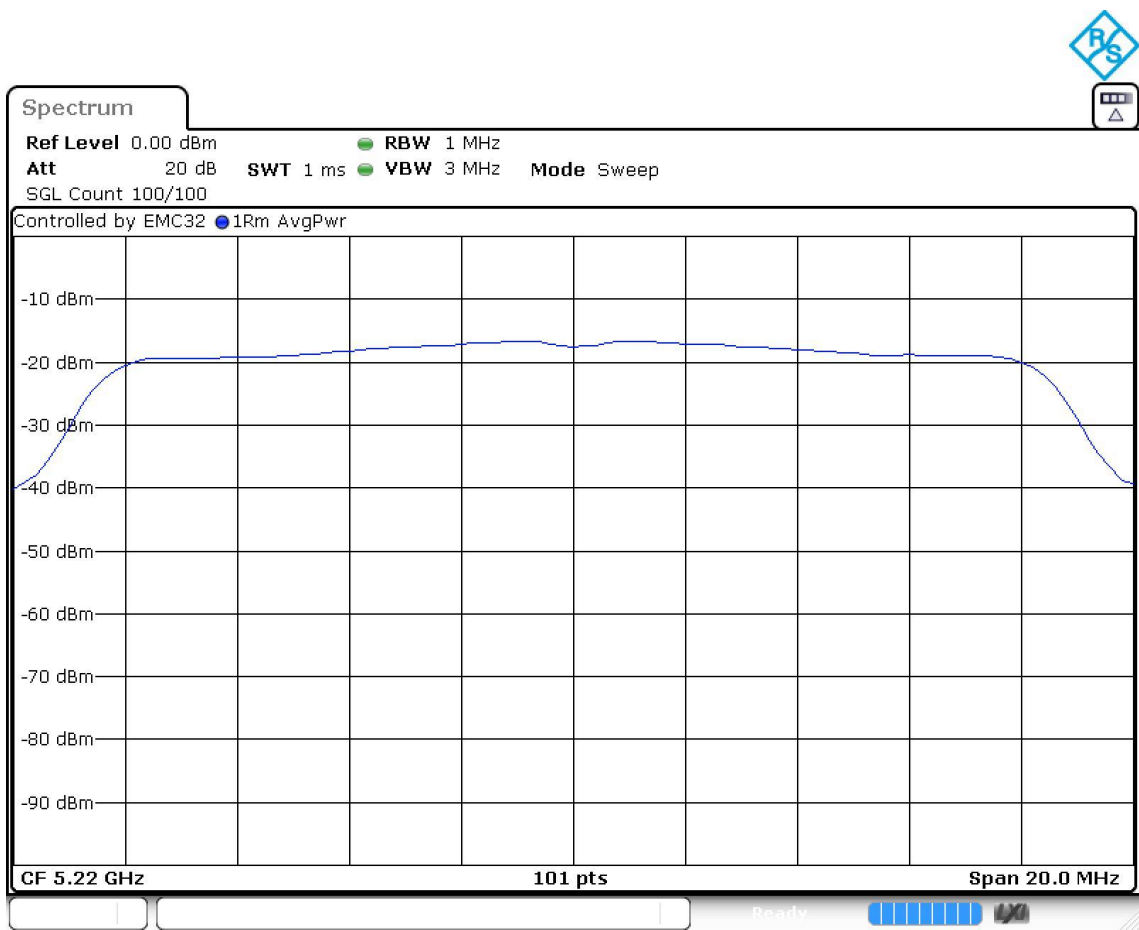
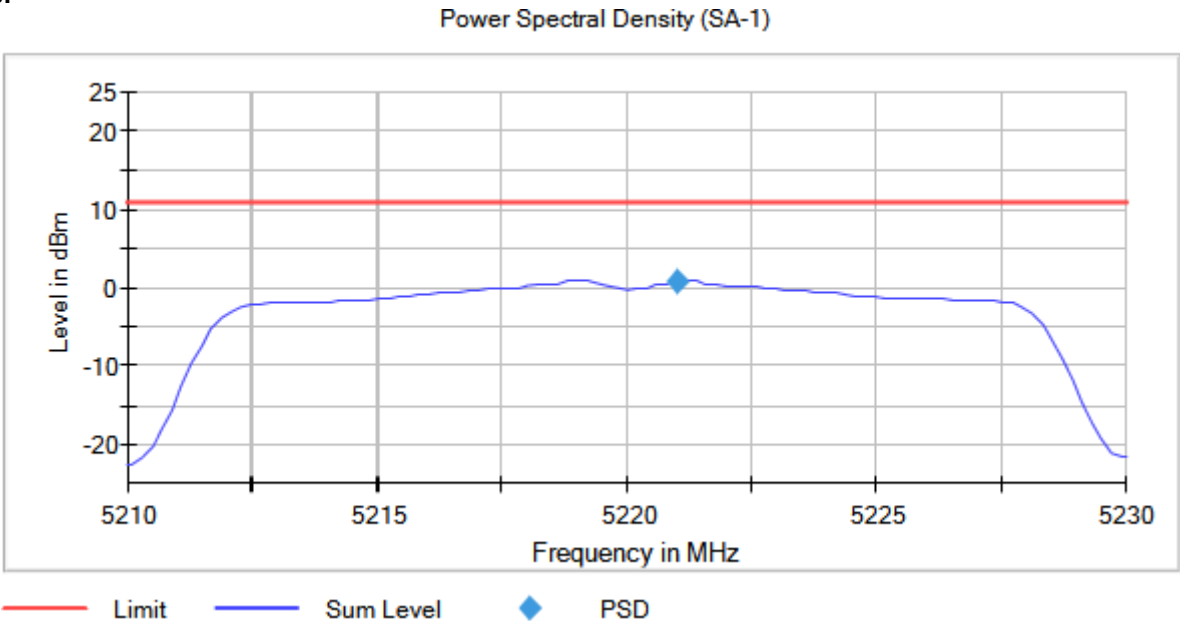
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5180.00000 Modulation = 802.11a (OFDM 6 Mbit/s)
TPC = No MIMO Mode = SISO

Images:



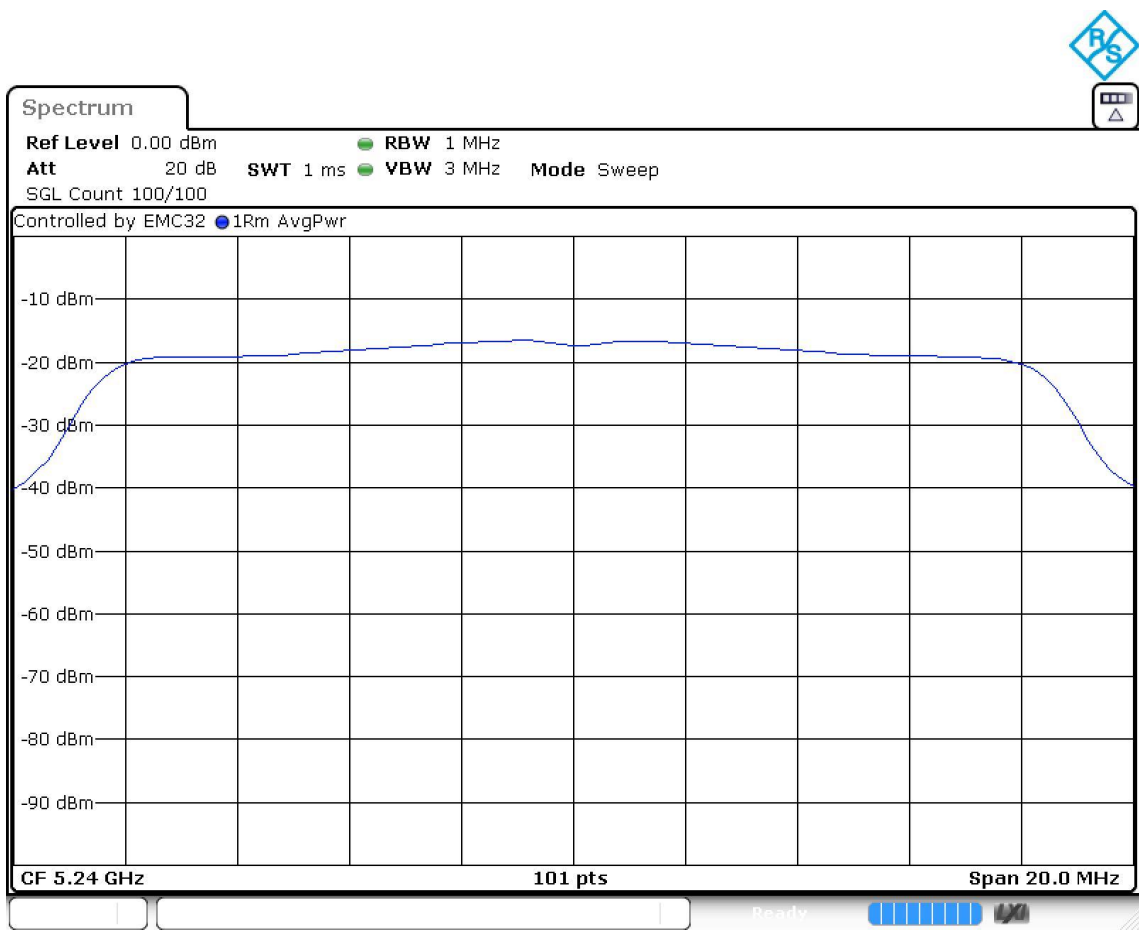
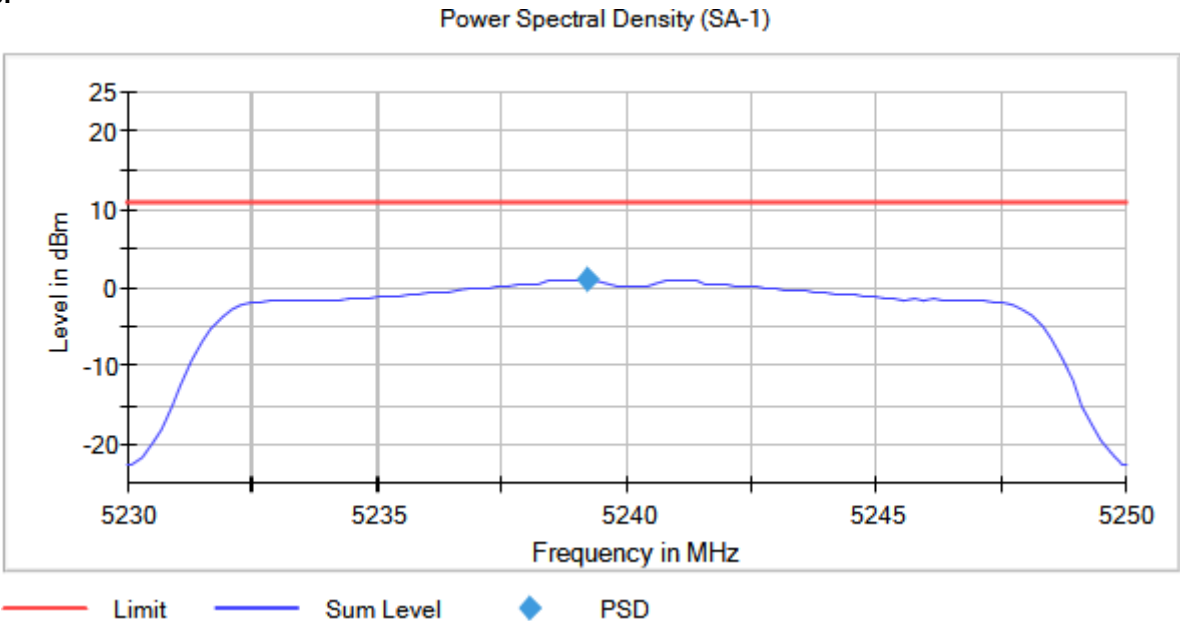
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5220.00000 Modulation = 802.11a (OFDM 6 Mbit/s)
TPC = No MIMO Mode = SISO

Images:



Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5240.00000 Modulation = 802.11a (OFDM 6 Mbit/s)
TPC = No MIMO Mode = SISO

Images:



Modulation: 802.11ac VHT20 (OFDM MCS0)

MIMO Mode: SISO

Results

Operation Band (MHz)	Port	Freq (MHz)	TPC	Freq (MHz)	PSD (dBm)
[5150, 5250]	1	5180.00000	No	5180.792079	-1.11
		5220.00000		5220.792079	-1.34
		5240.00000		5240.990099	-1.15

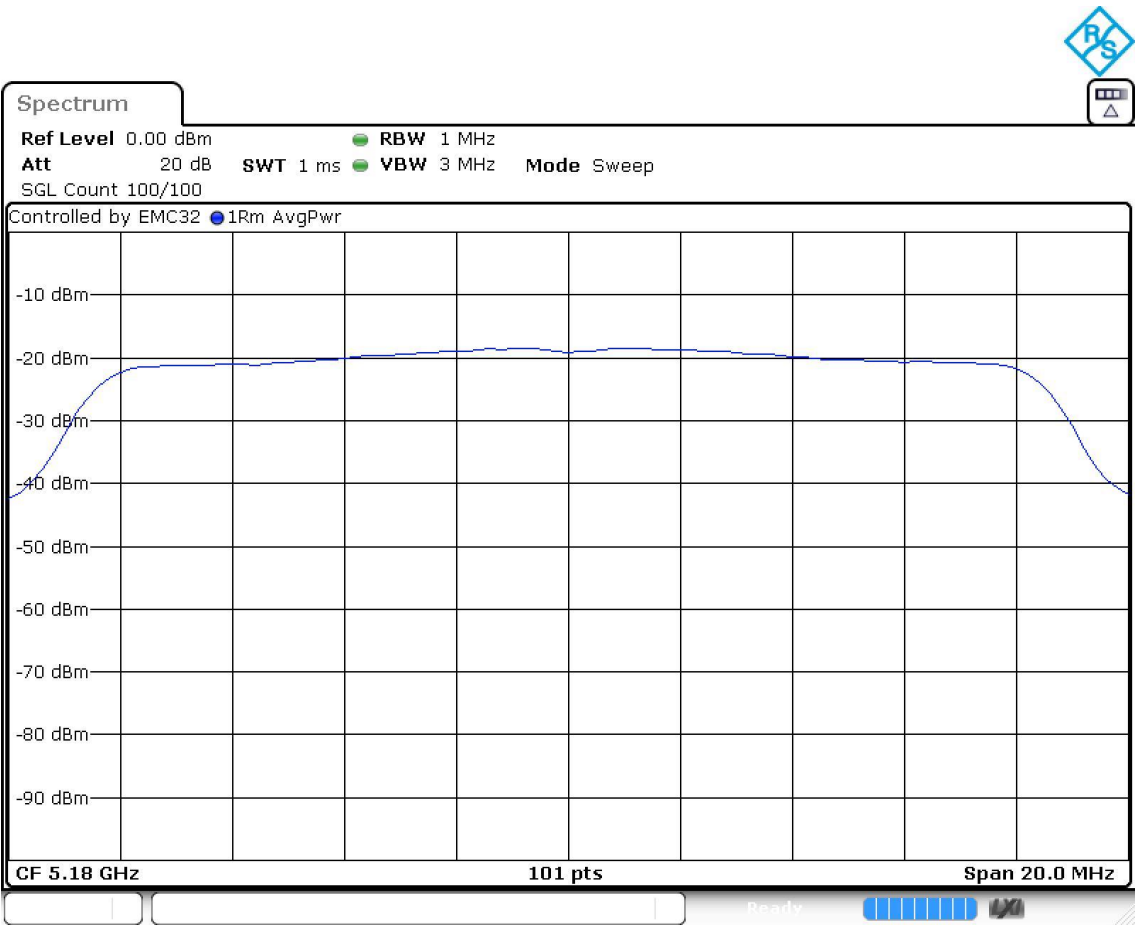
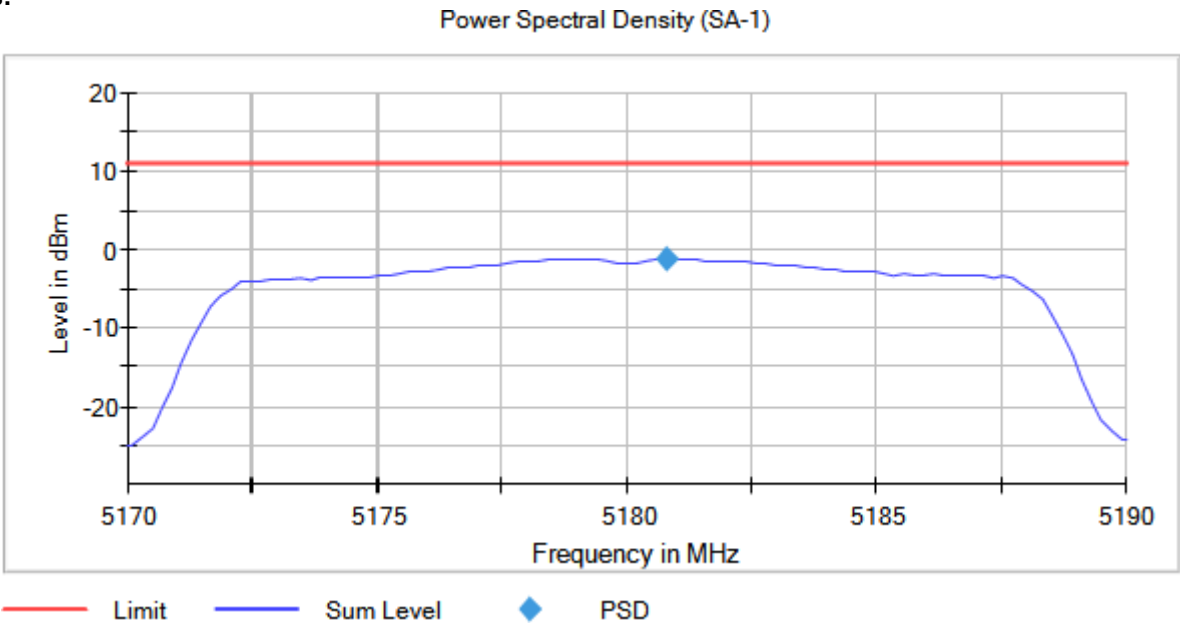
Verdict

Pass

Attachments

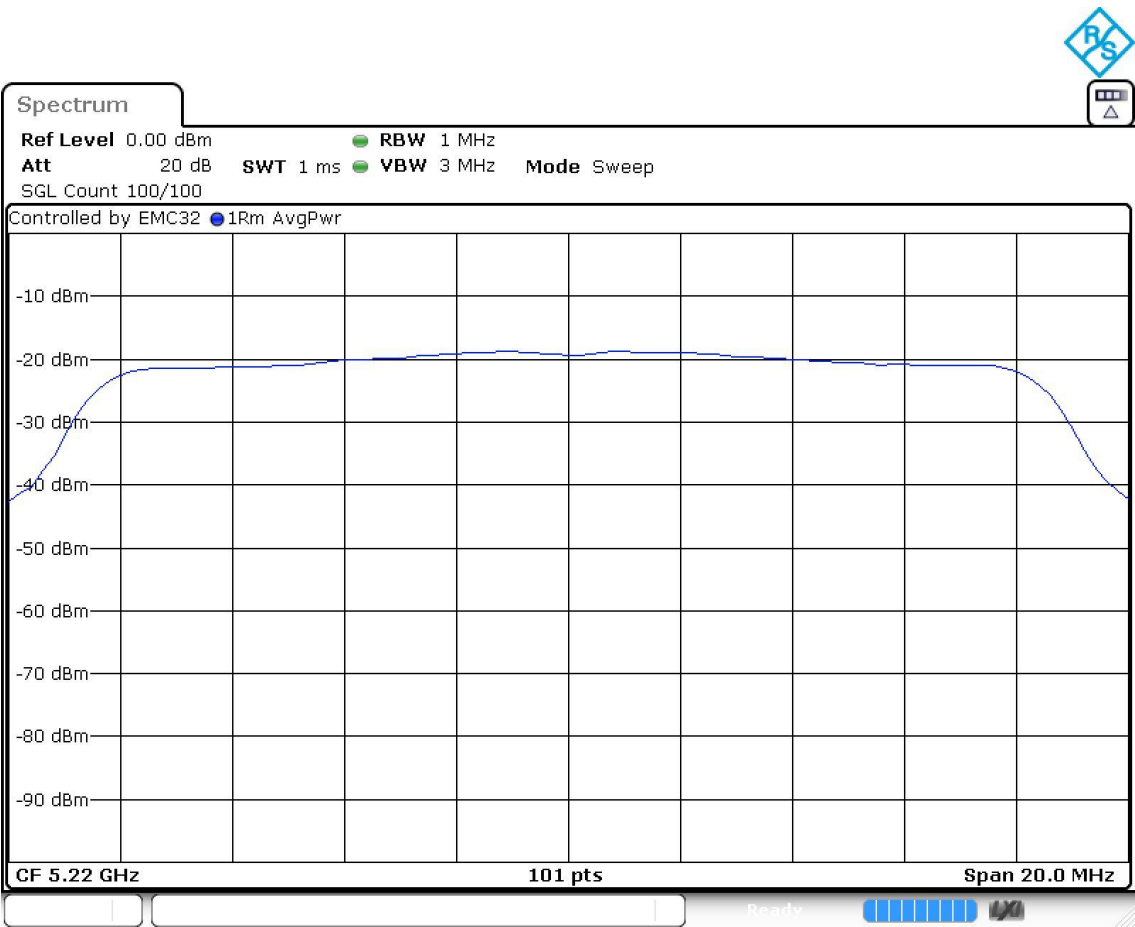
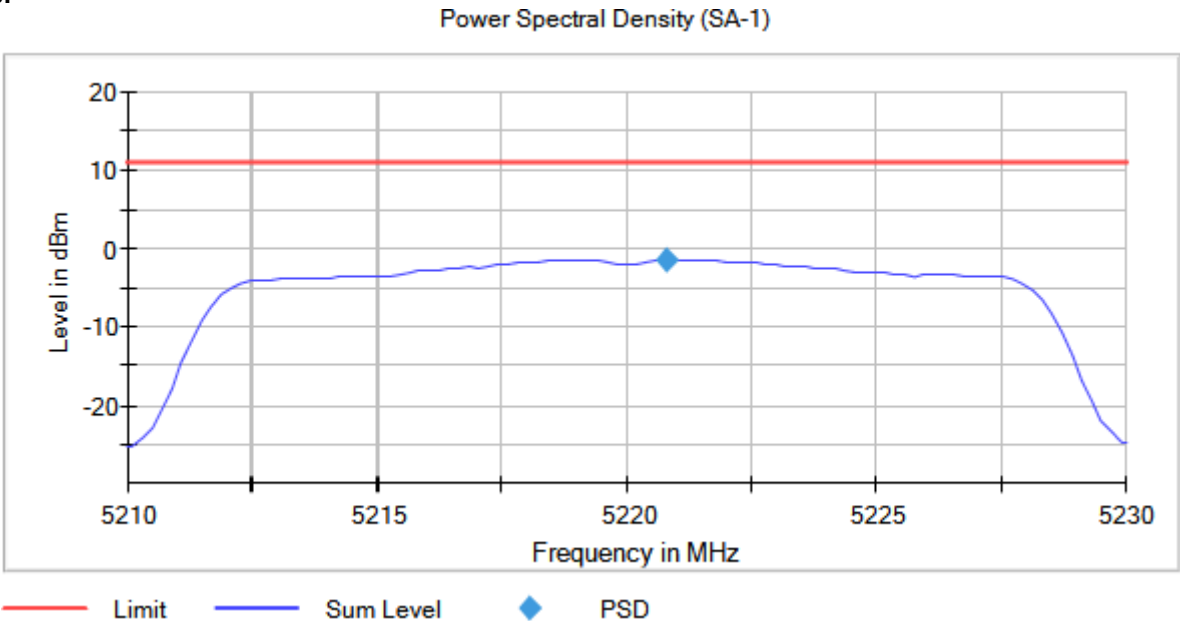
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5180.00000 Modulation = 802.11ac VHT20 (OFDM MCS0)
TPC = No MIMO Mode = SISO

Images:



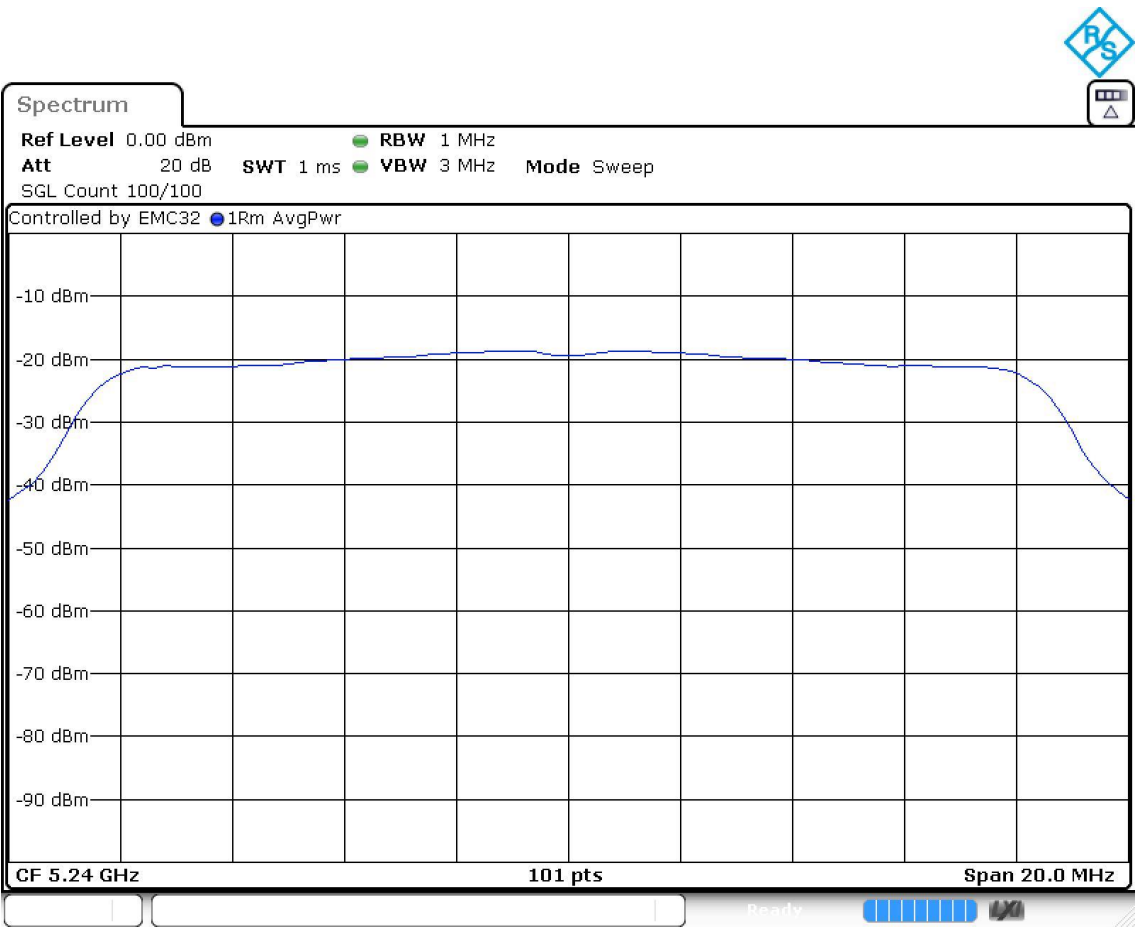
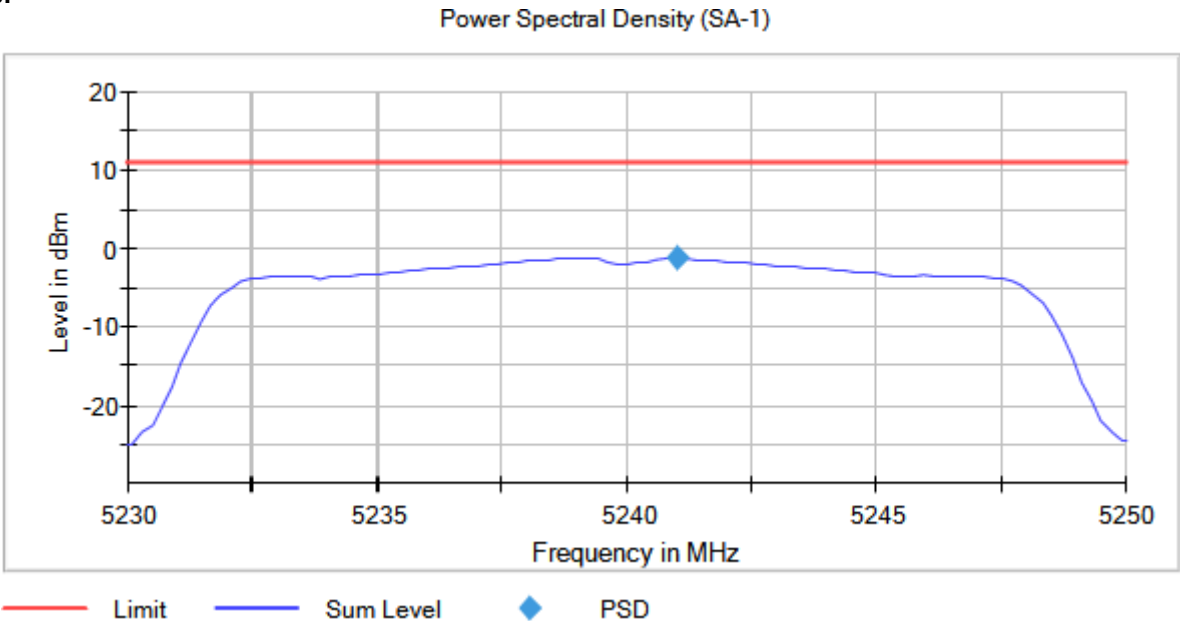
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5220.00000 Modulation = 802.11ac VHT20 (OFDM MCS0)
TPC = No MIMO Mode = SISO

Images:



Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5240.00000 Modulation = 802.11ac VHT20 (OFDM MCS0)
TPC = No MIMO Mode = SISO

Images:



Modulation: 802.11ac VHT40 (OFDM MCS0)

MIMO Mode: SISO

Results

Operation Band (MHz)	Port	Freq (MHz)	TPC	Freq (MHz)	PSD (dBm)
[5150, 5250]	1	5190.00000	No	5191.584158	-3.66
		5230.00000		5232.376238	-3.85

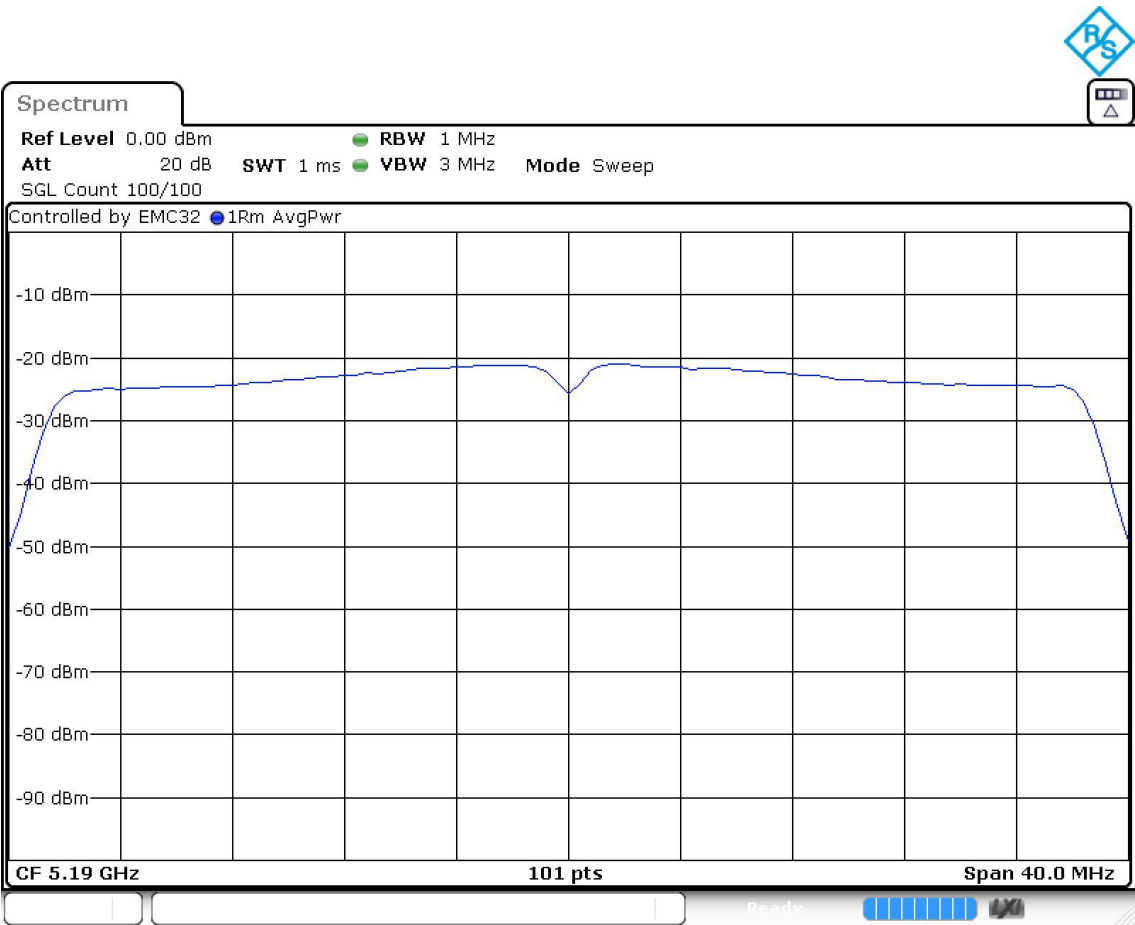
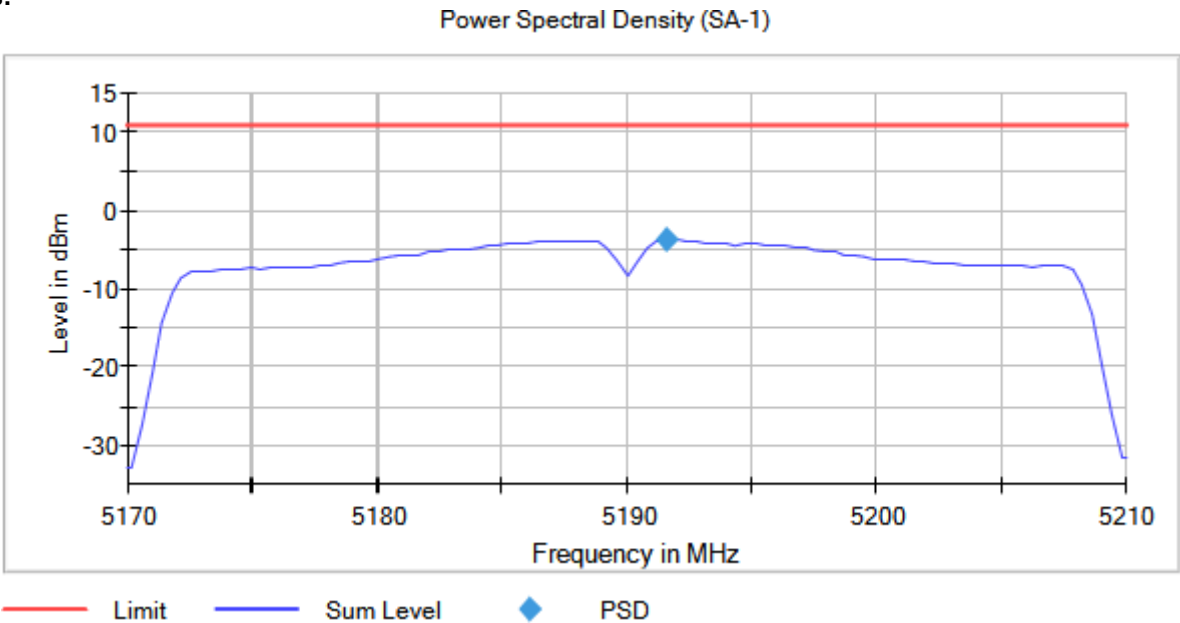
Verdict

Pass

Attachments

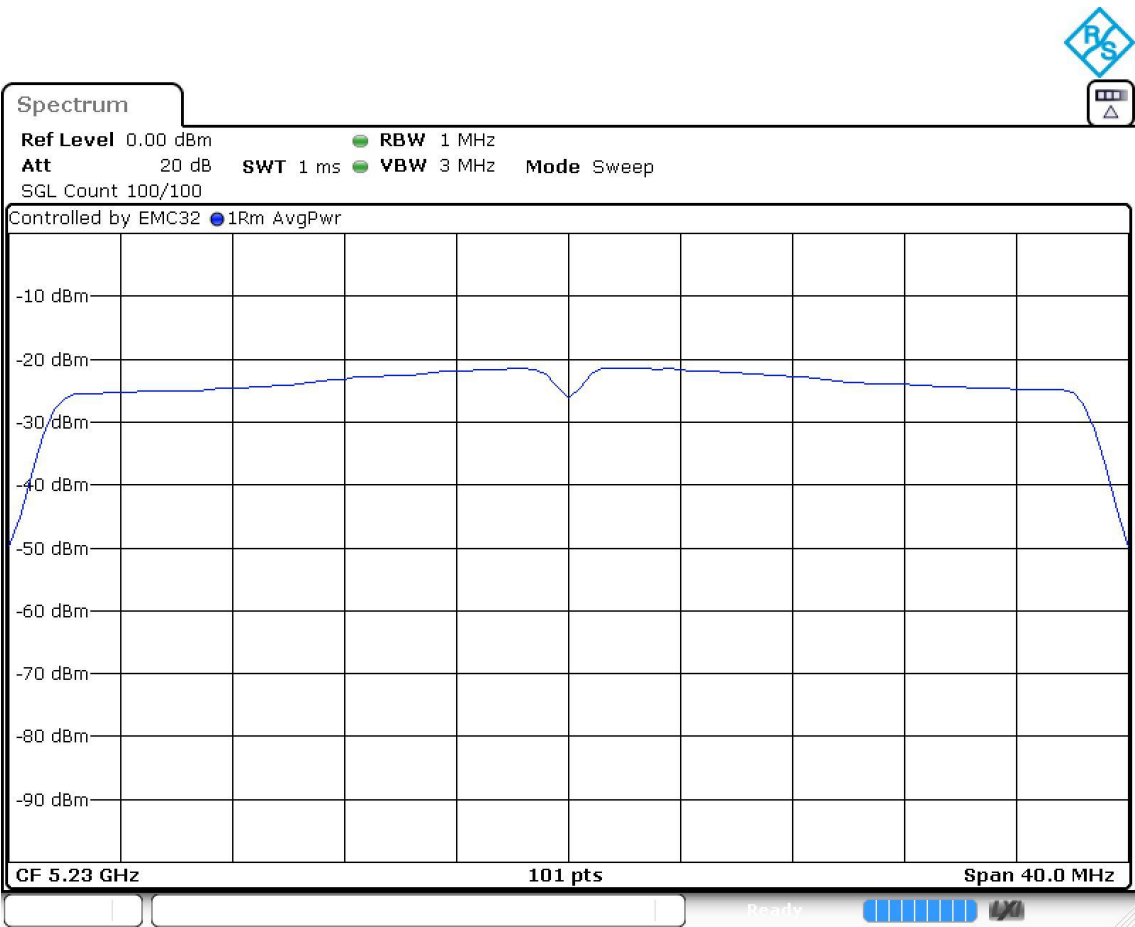
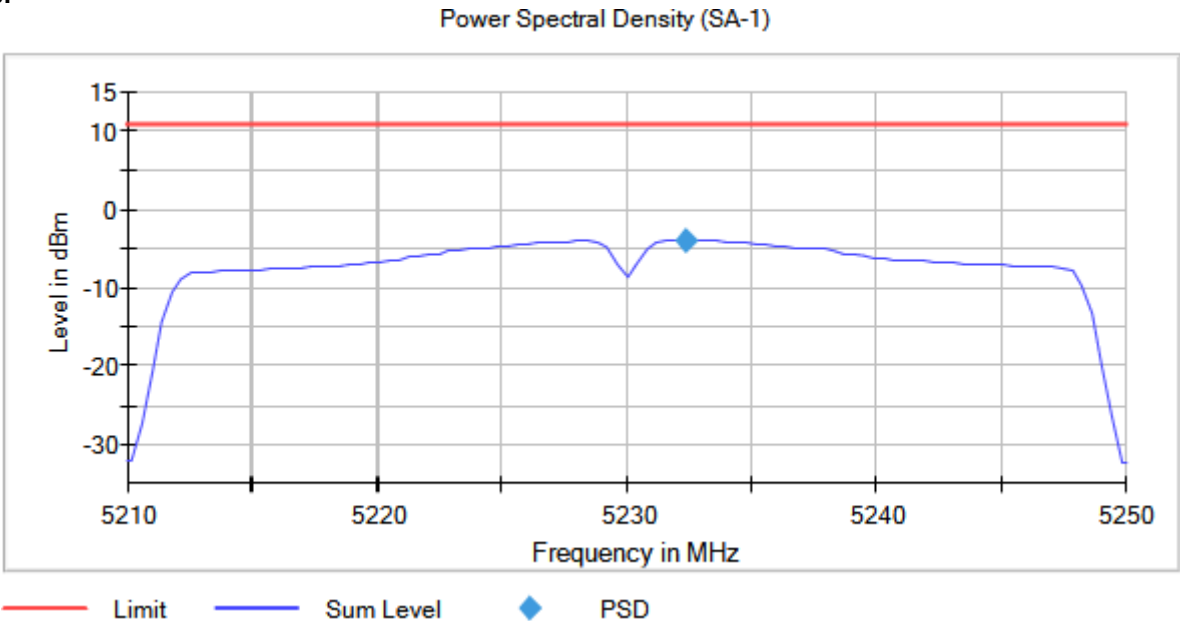
Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5190.00000 Modulation = 802.11ac VHT40 (OFDM MCS0)
TPC = No MIMO Mode = SISO

Images:



Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5230.00000 Modulation = 802.11ac VHT40 (OFDM MCS0)
TPC = No MIMO Mode = SISO

Images:



Modulation: 802.11ac VHT80 (OFDM MCS0)

MIMO Mode: SISO

Results

Operation Band (MHz)	Port	Freq (MHz)	TPC	Freq (MHz)	PSD (dBm)
[5150, 5250]	1	5210.00000	No	5212.750000	-7.99

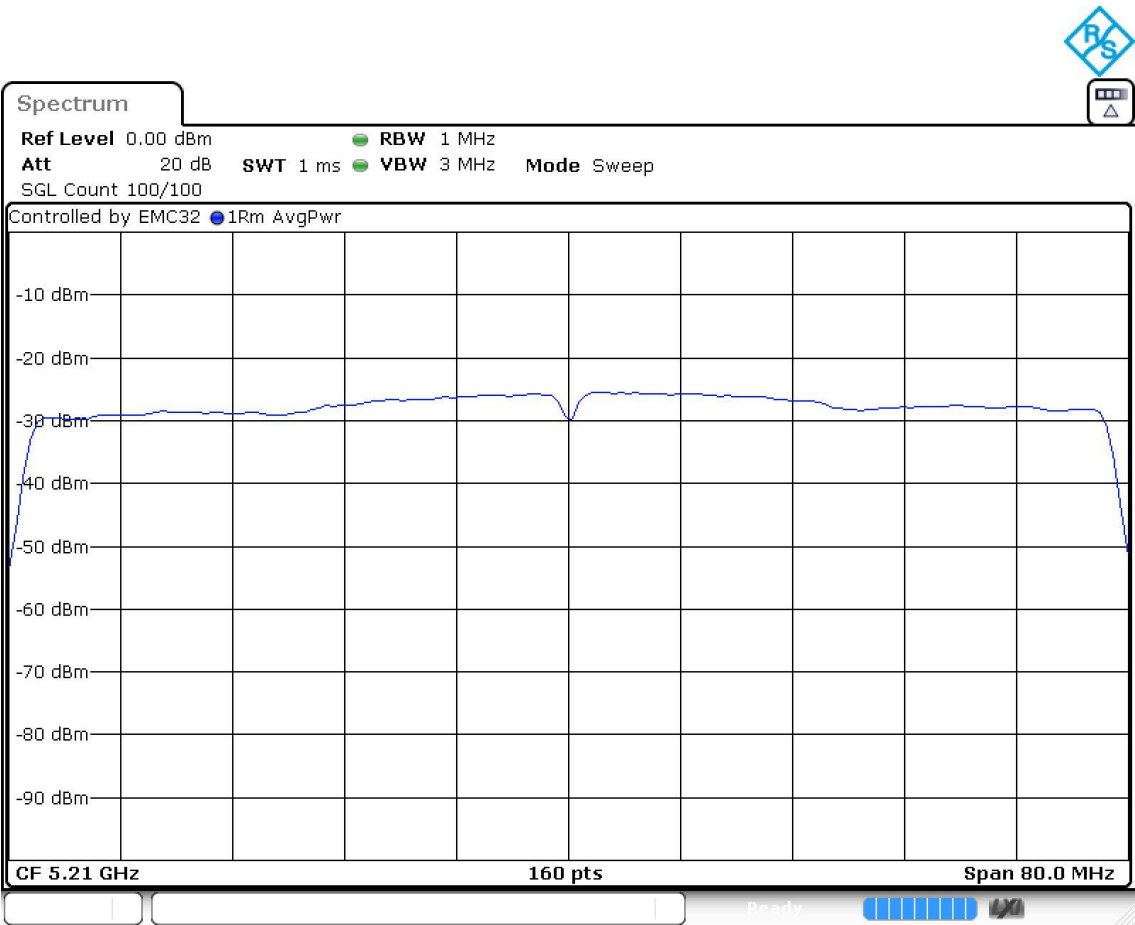
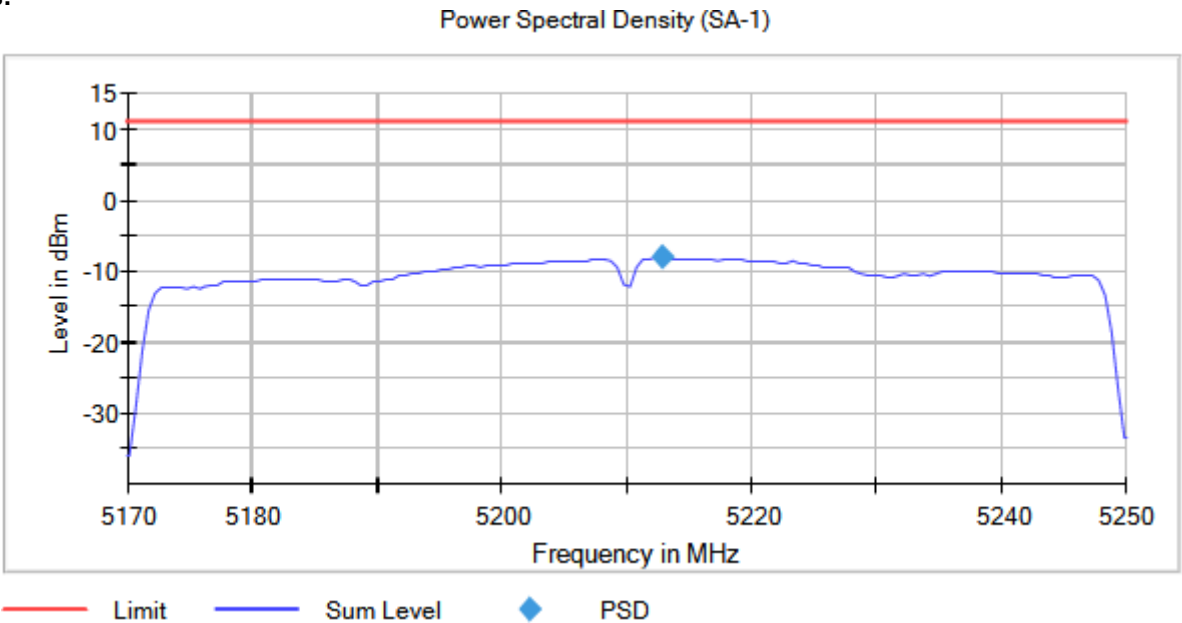
Verdict

Pass

Attachments

Operation Band MHz = [5150, 5250] Active Port = 1
Frequency MHz = 5210.00000 Modulation = 802.11ac VHT80 (OFDM MCS0)
TPC = No MIMO Mode = SISO

Images:



FCC 15.407 (b)(1) / RSS-247 6.2.1.2. Transmitter Out of Band Radiated Emissions

Limit:

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.23 dBμV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table, specified when measuring with peak detector function.

Frequency range tested for Radiated emissions:

Start frequency: no radiofrequency signal generated in the device found below 10th sub-harmonic, no further investigation required.

Stop frequency: it has been performed the radiated spurious emissions until 10th harmonic.

Results

The situation and orientation of the equipment under test were varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 1.5 m for the frequency range 17 GHz-40 GHz and a distance of 3m for frequency range 30MHz-17GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

The worst case was determined by measuring the e.i.r.p density (radiated). Test performed on the worst-case:

Test performed on all the supported modes of the EUT, in the worst data rates after preliminary testing.

Worst case mode in terms of spurious emissions is reported below.