FCC 15.407 (e) / RSS-247 6.2.4.1
6 dB Bandwidth

Limits

The minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Results

SISO 802.11 a20:

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
6 dB Bandwidth (MHz)	16.450000	16.400000	16.450000
Measurement uncertainty (%)	< ±1.14		

SISO 802.11 n20 (HT20):

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
6 dB Bandwidth (MHz)	17.400000	17.650000	17.400000
Measurement uncertainty (%)	< ±1.14		

SISO 802.11 ac20 (VHT20):

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
6 dB Bandwidth (MHz)	17.400000	17.650000	17.400000
Measurement uncertainty (%)	< ±1.14		

SISO 802.11 n40 (HT40):

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
6 dB Bandwidth (MHz)	35.650000	35.750000
Measurement uncertainty (%)	< ±1.14	

SISO 802.11 ac40 (VHT40):

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
6 dB Bandwidth (MHz)	35.450000	35.750000
Measurement uncertainty (%)	< ±1.14	

SISO 802.11 ac80 (VHT80):

Channel	Single Channel 155 (5775 MHz)
6 dB Bandwidth (MHz)	76.400000
Measurement uncertainty (%)	< ±1.14

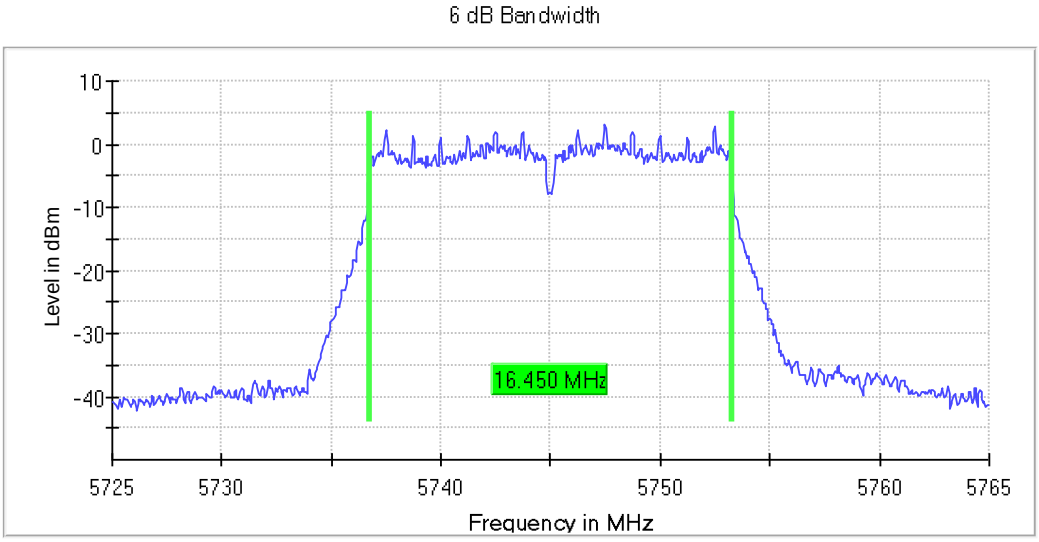
Verdict

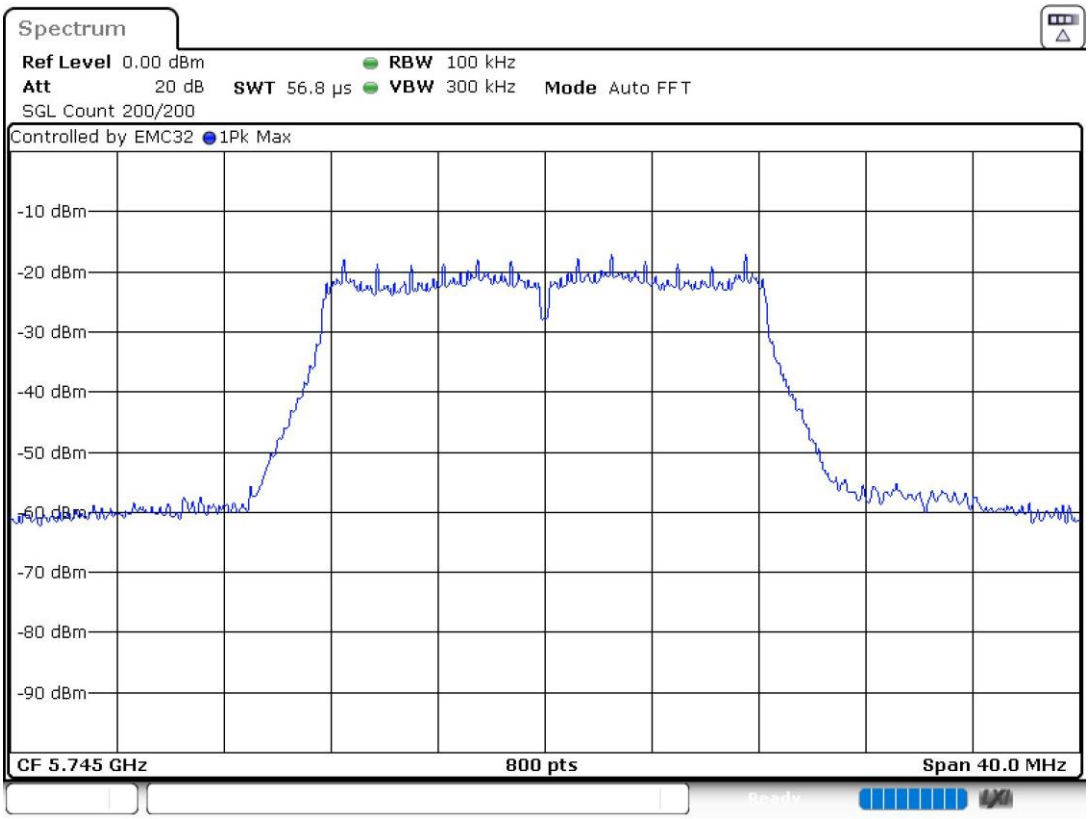
Pass

Attachments

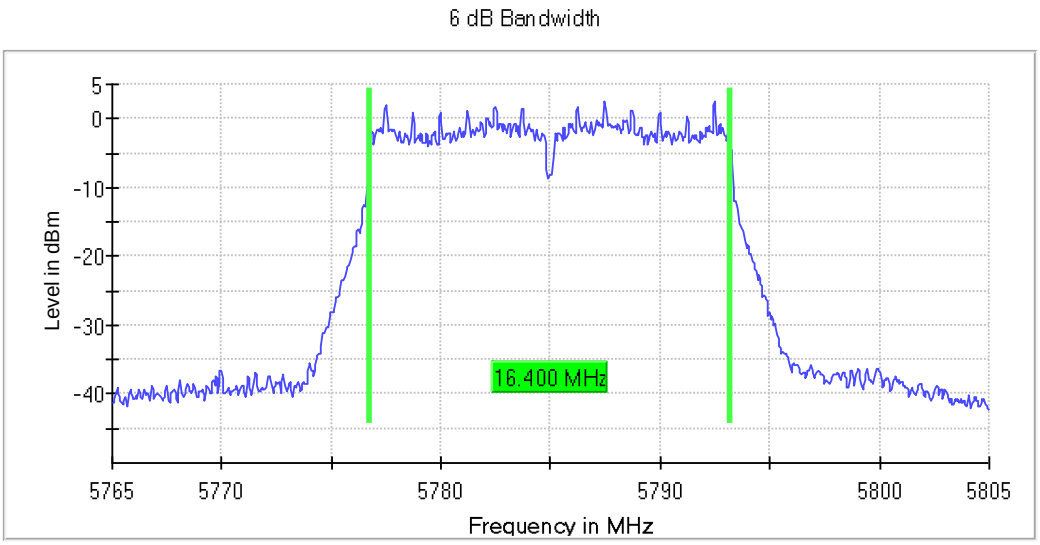
SISO 802.11 a20

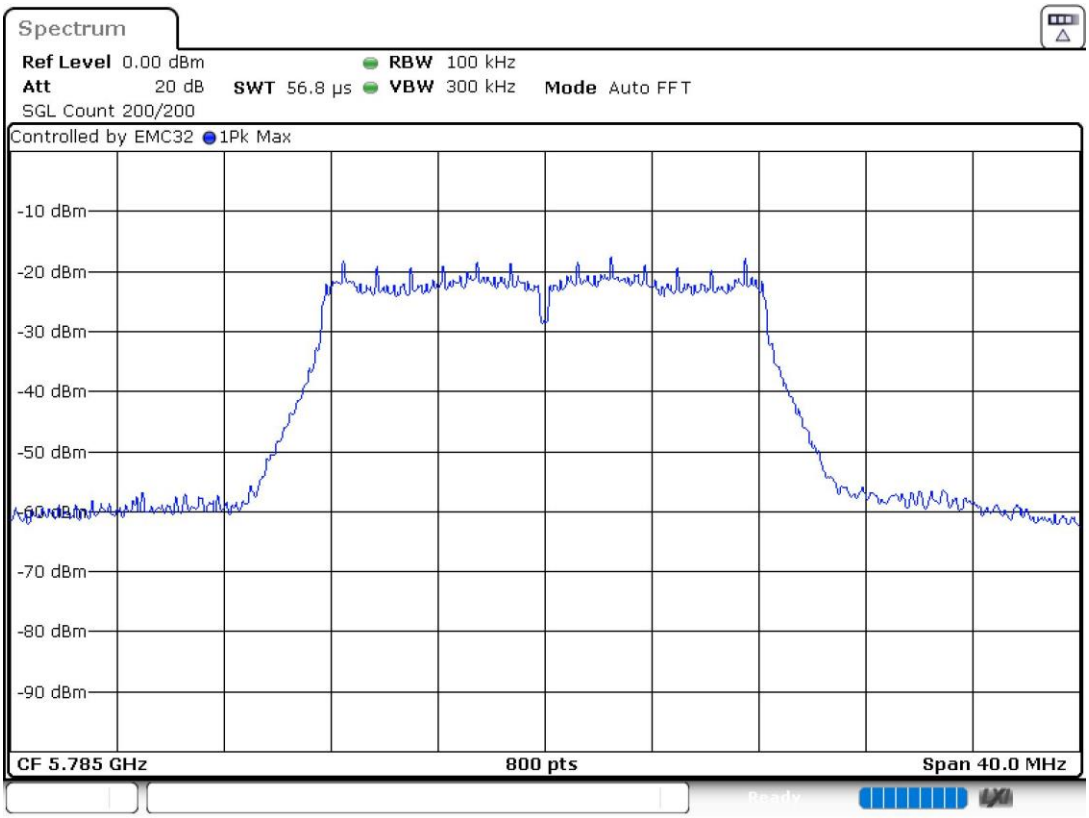
- Low Channel 149 (5745 MHz):



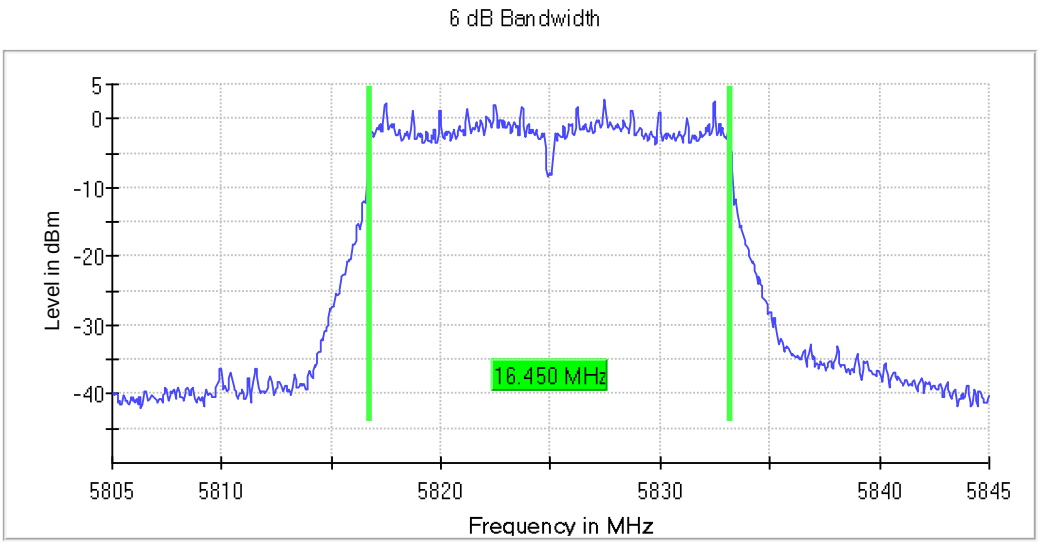


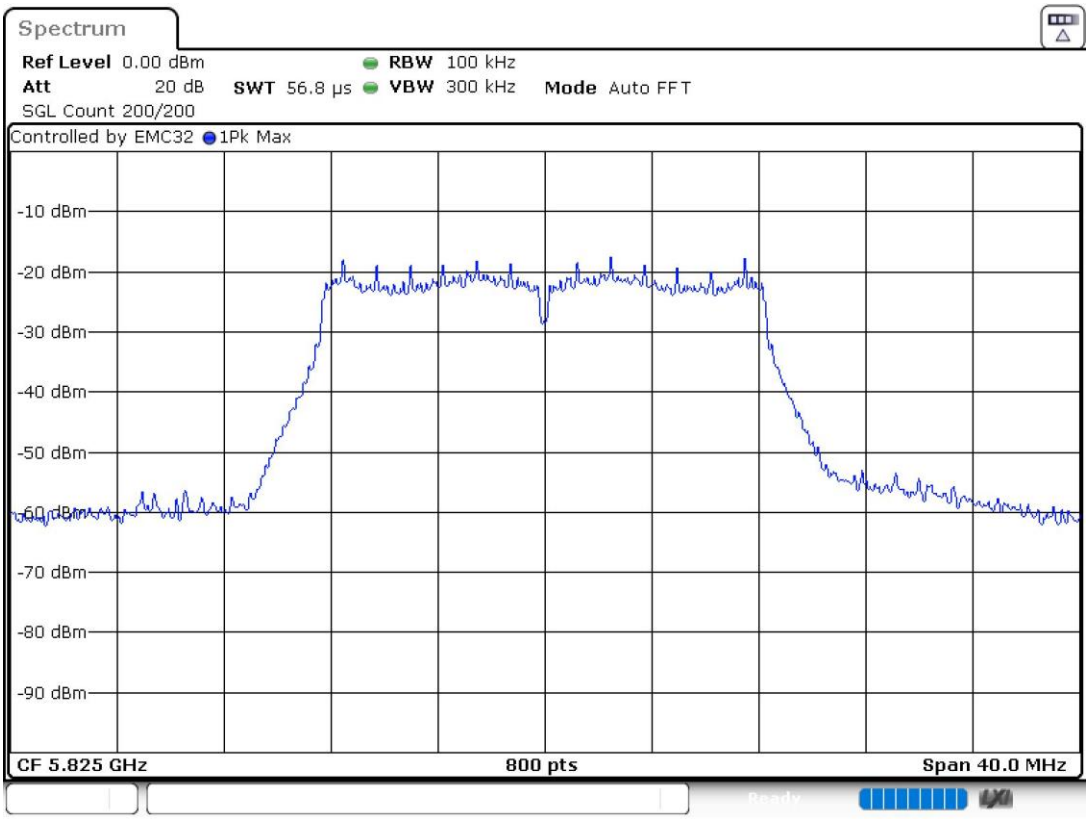
- Middle Channel 157 (5785 MHz):





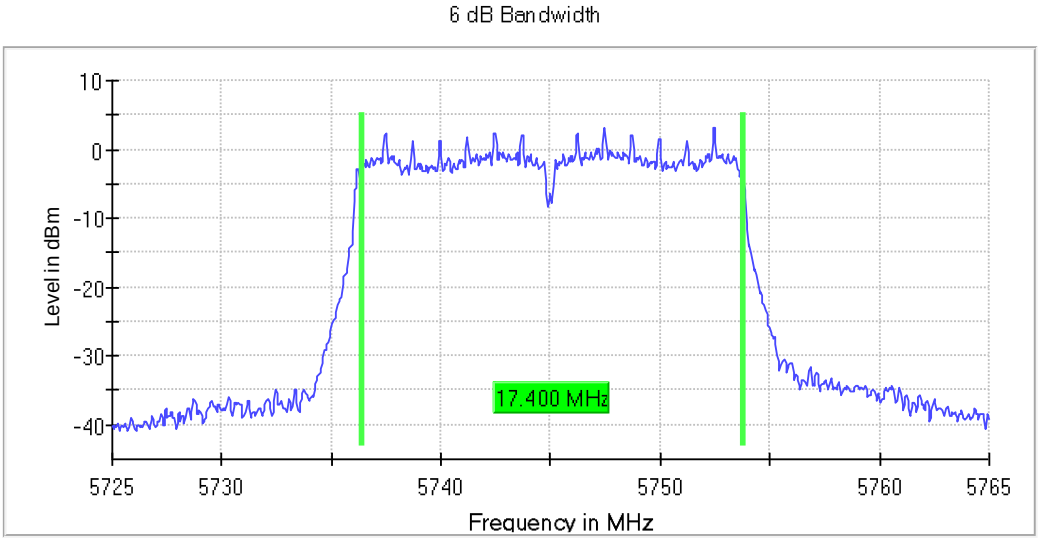
- High Channel 165 (5825 MHz):

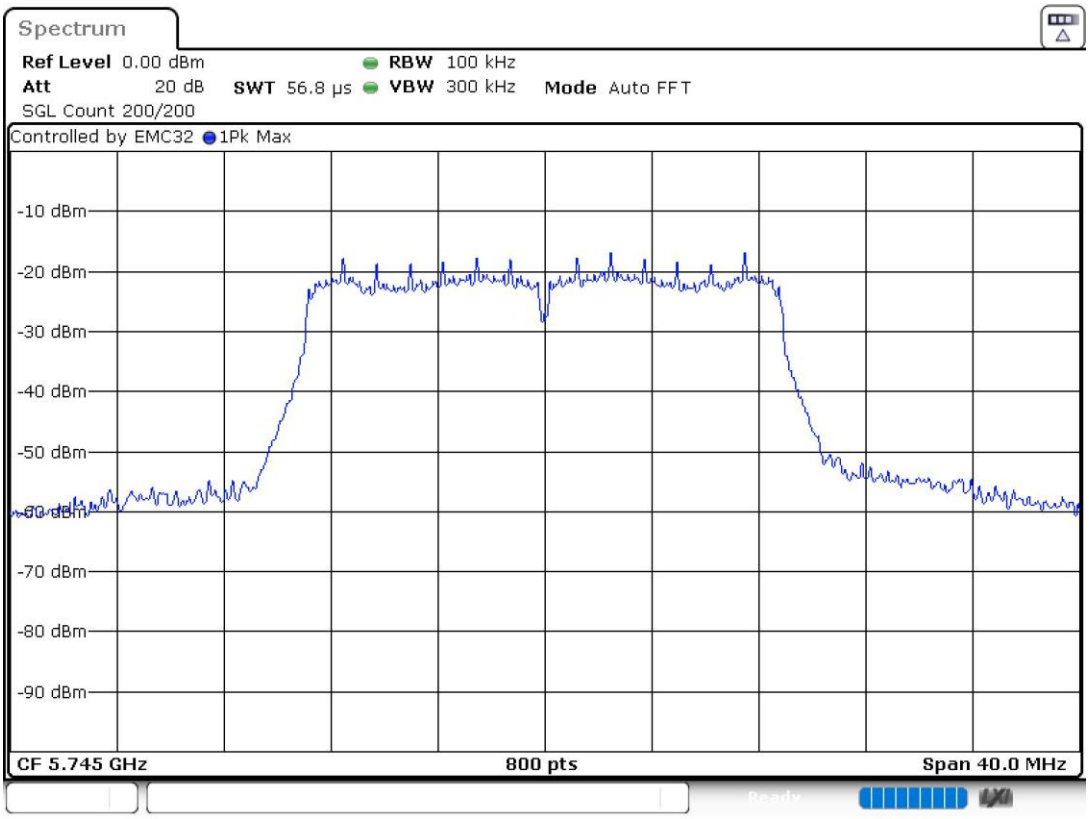




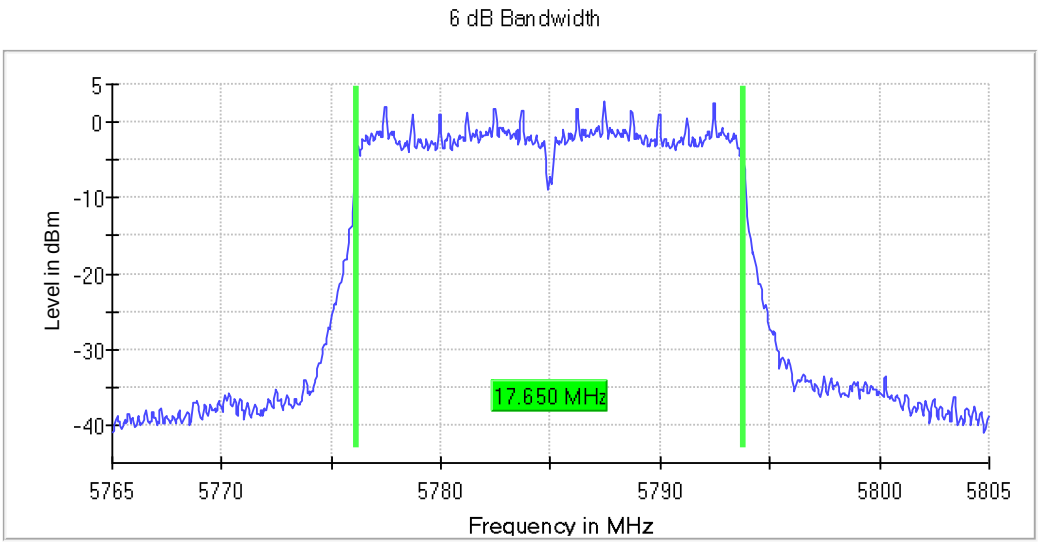
SISO 802.11 n20 (HT20)

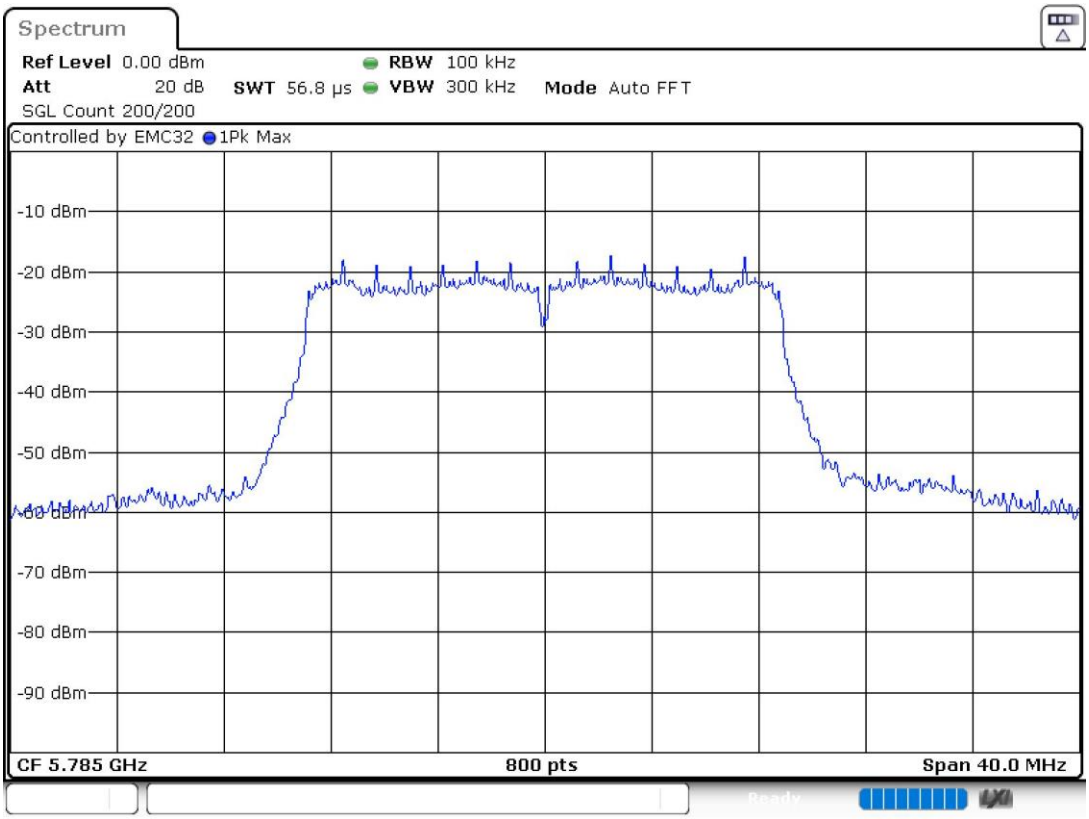
- Low Channel 149 (5745 MHz):



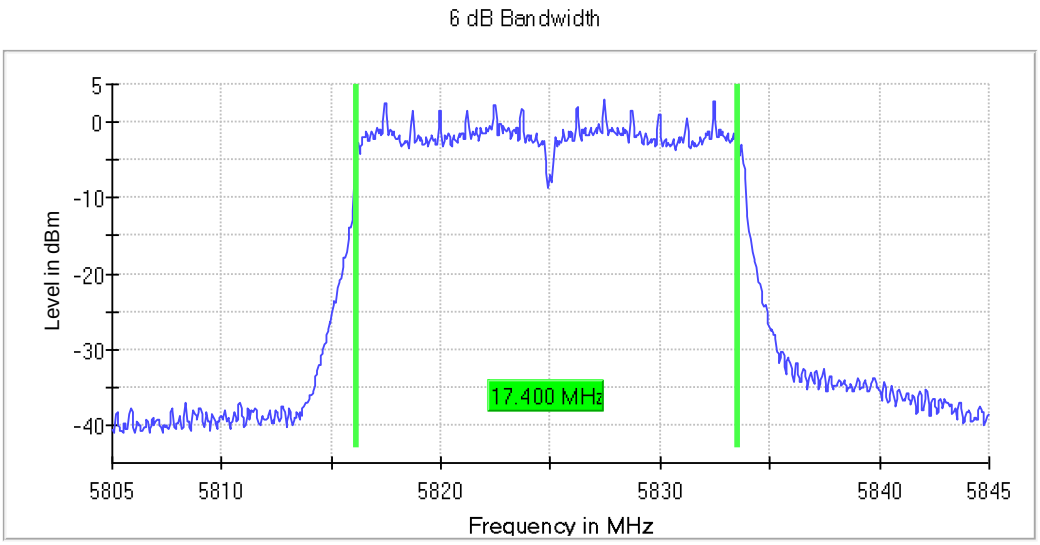


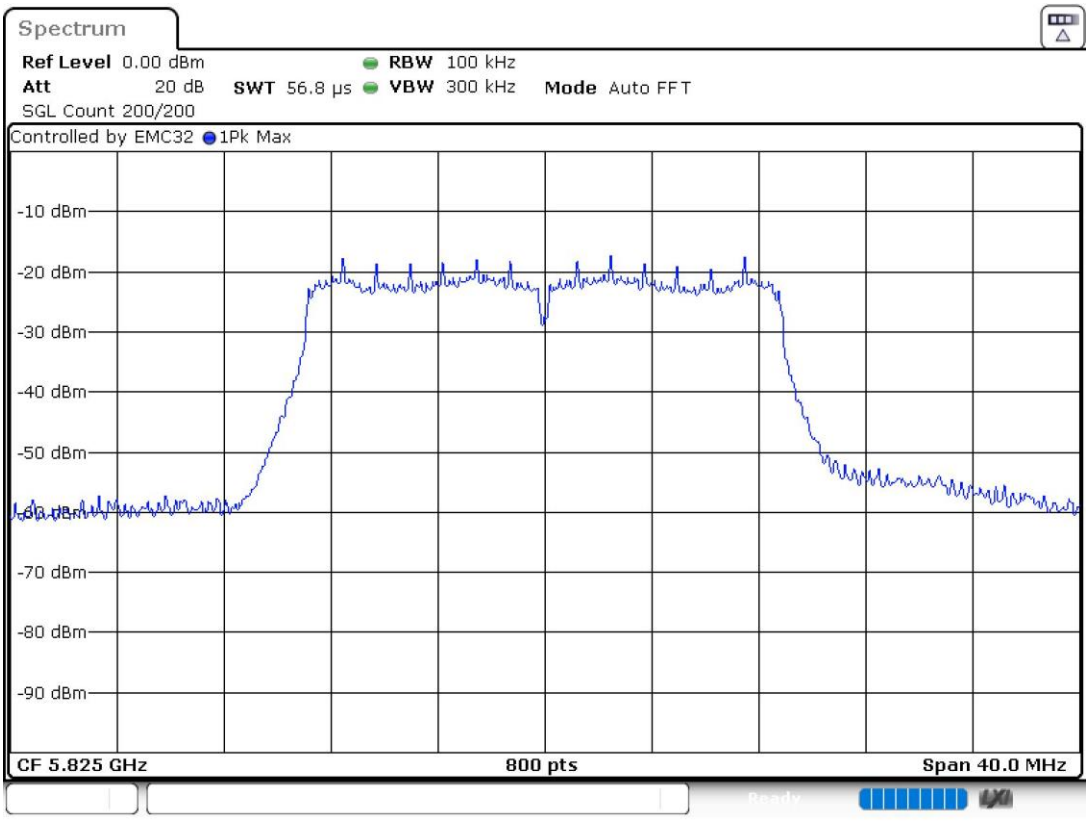
- Middle Channel 157 (5785 MHz):





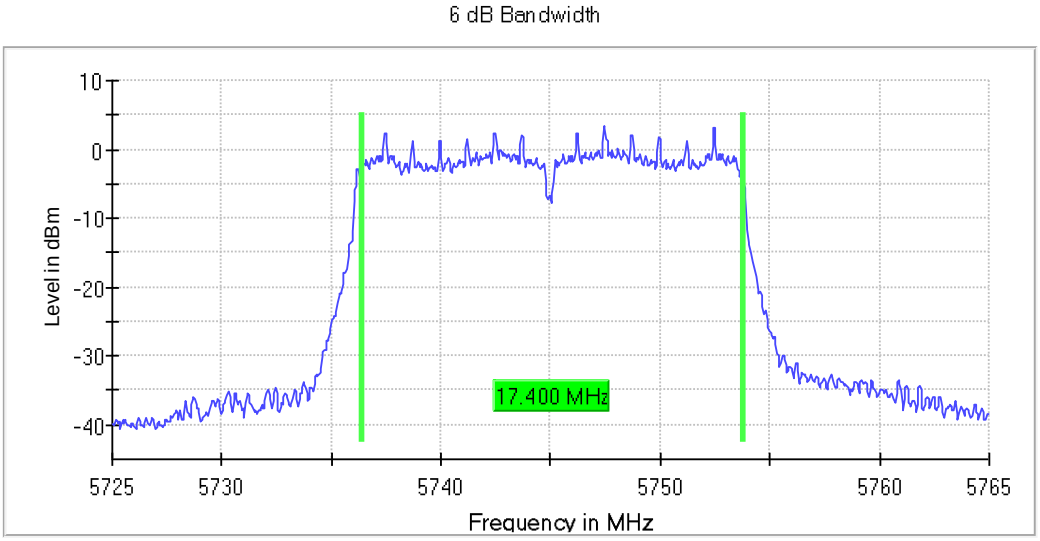
- High Channel 165 (5825 MHz):

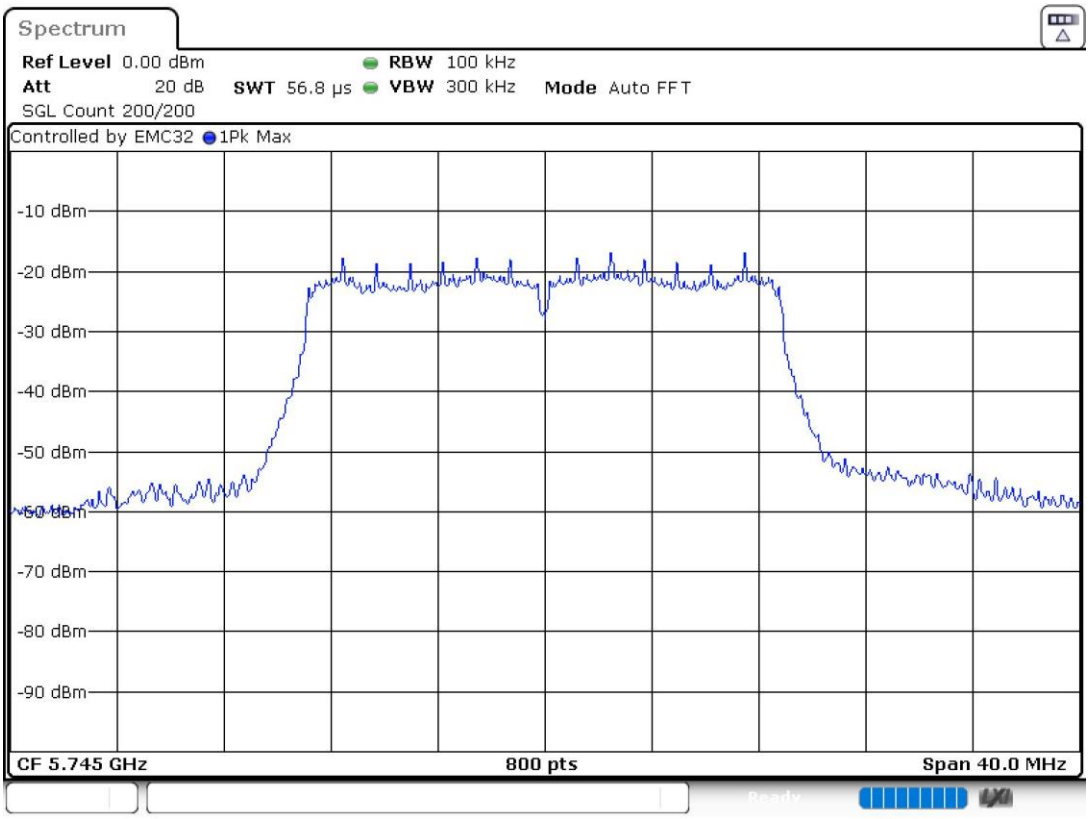




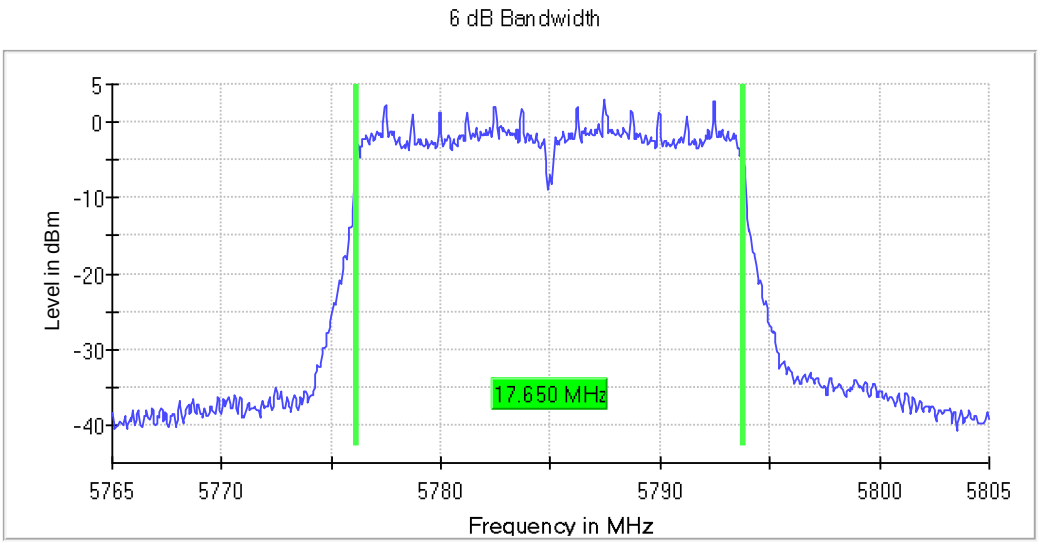
SISO 802.11 ac20 (VHT20)

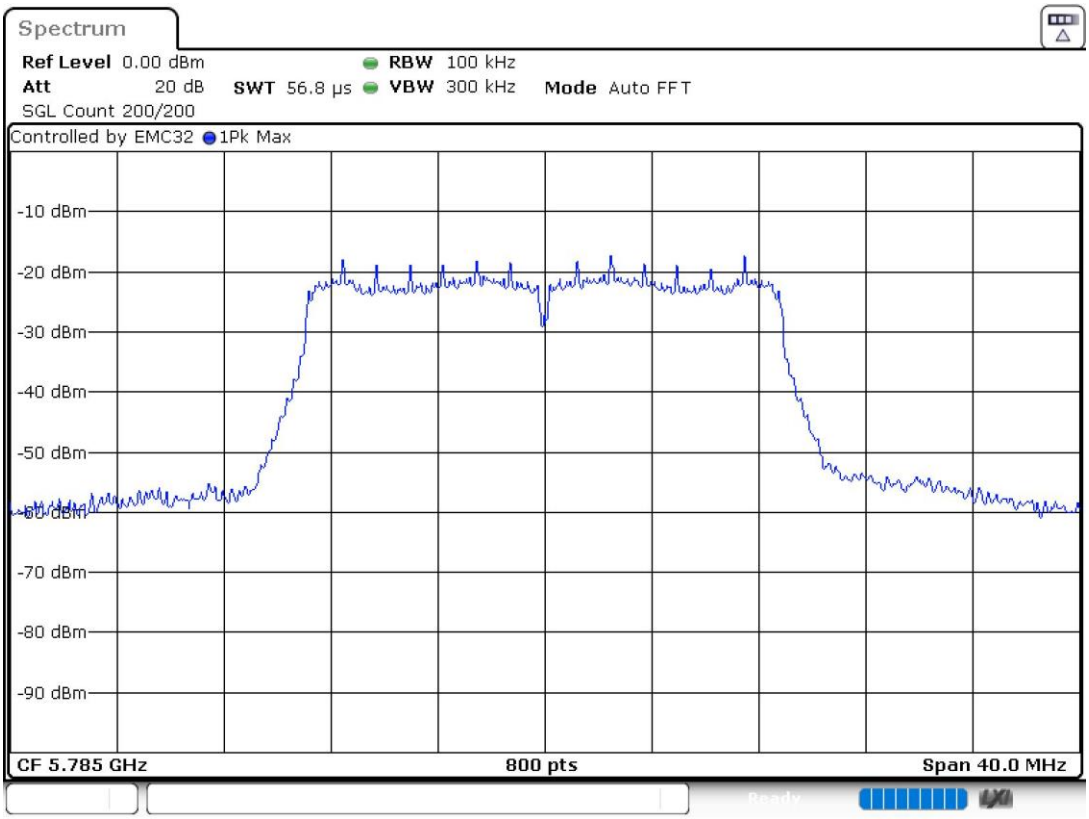
- Low Channel 149 (5745 MHz):



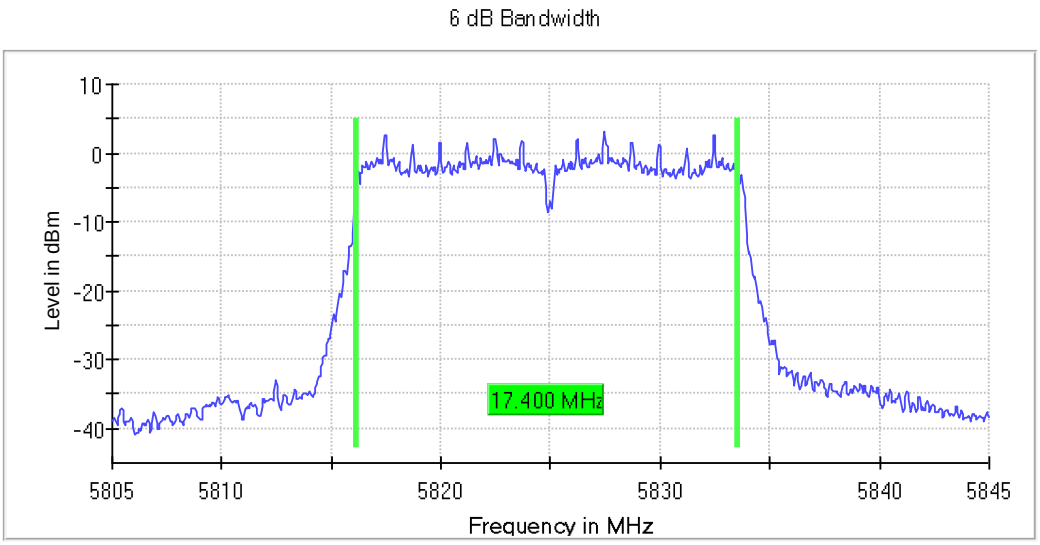


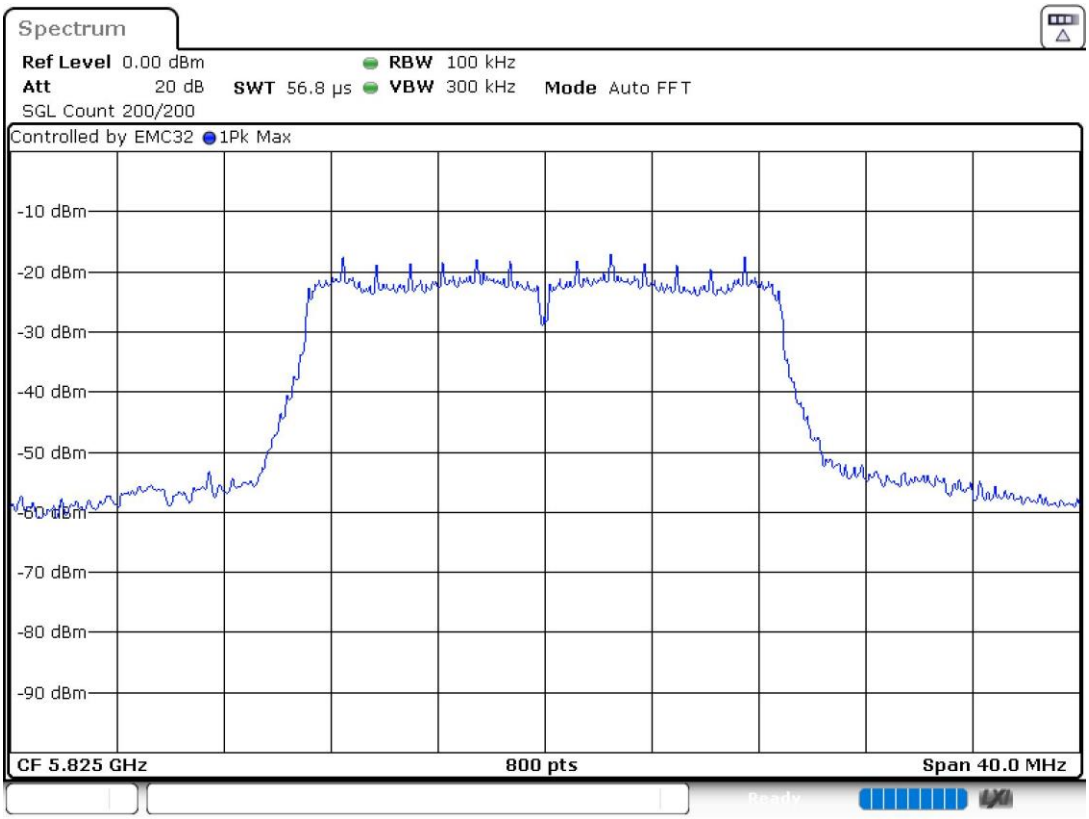
- Middle Channel 157 (5785 MHz):





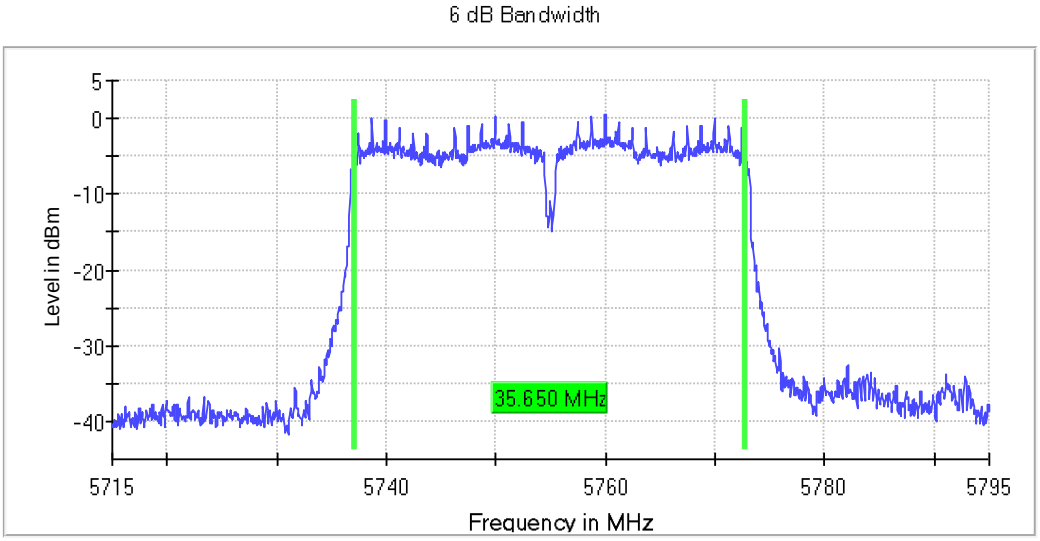
- High Channel 165 (5825 MHz):

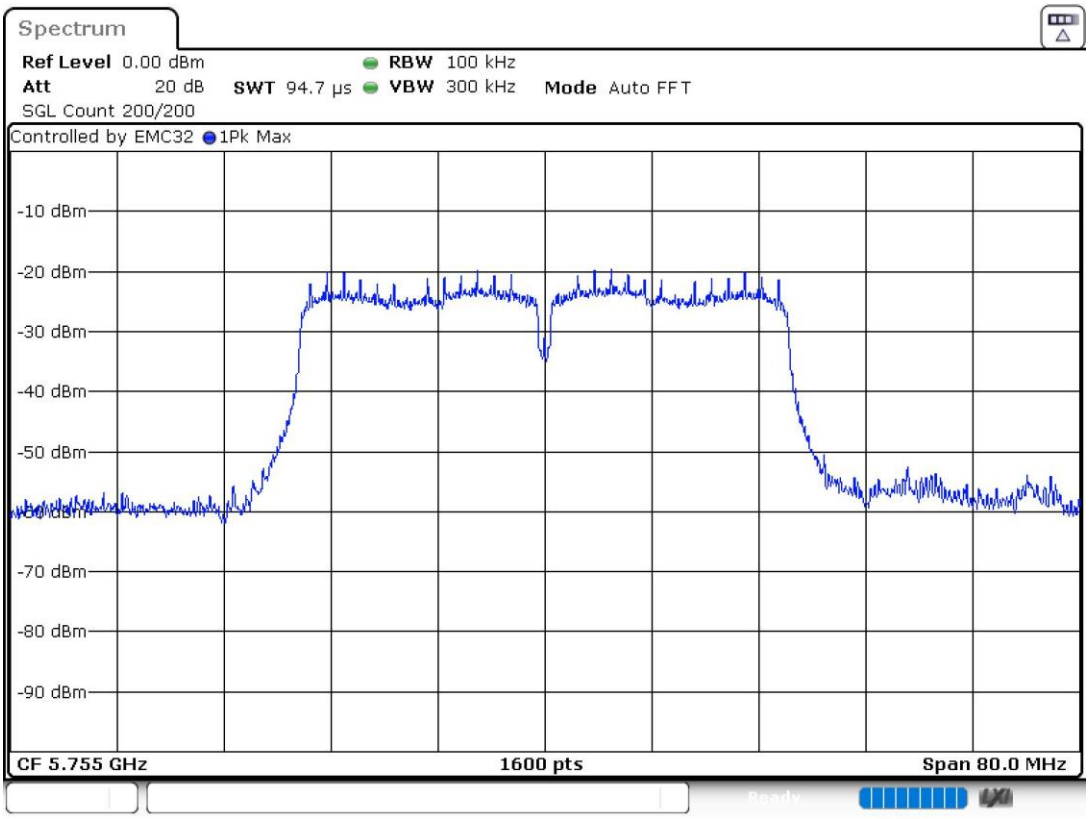




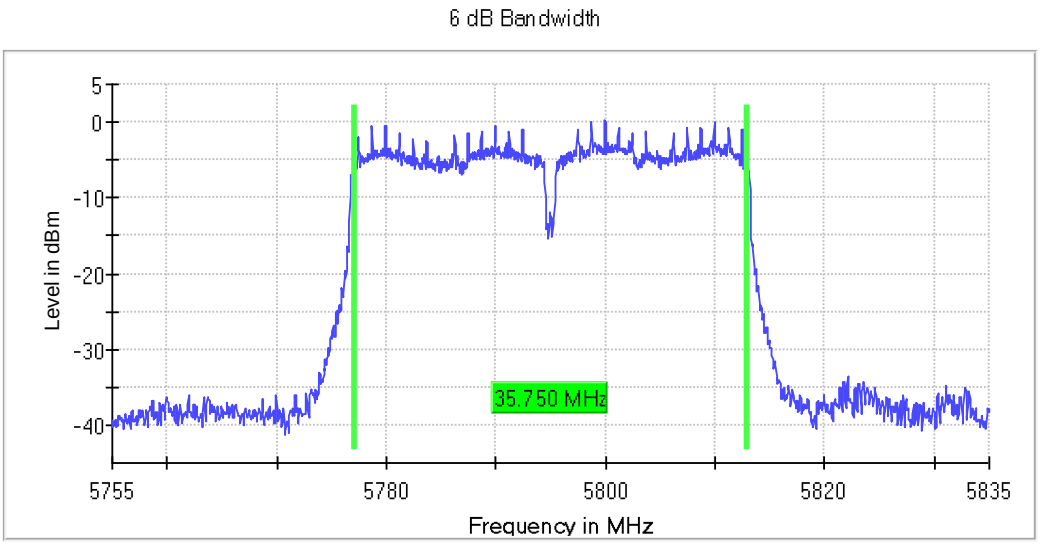
SISO 802.11 n40 (HT40)

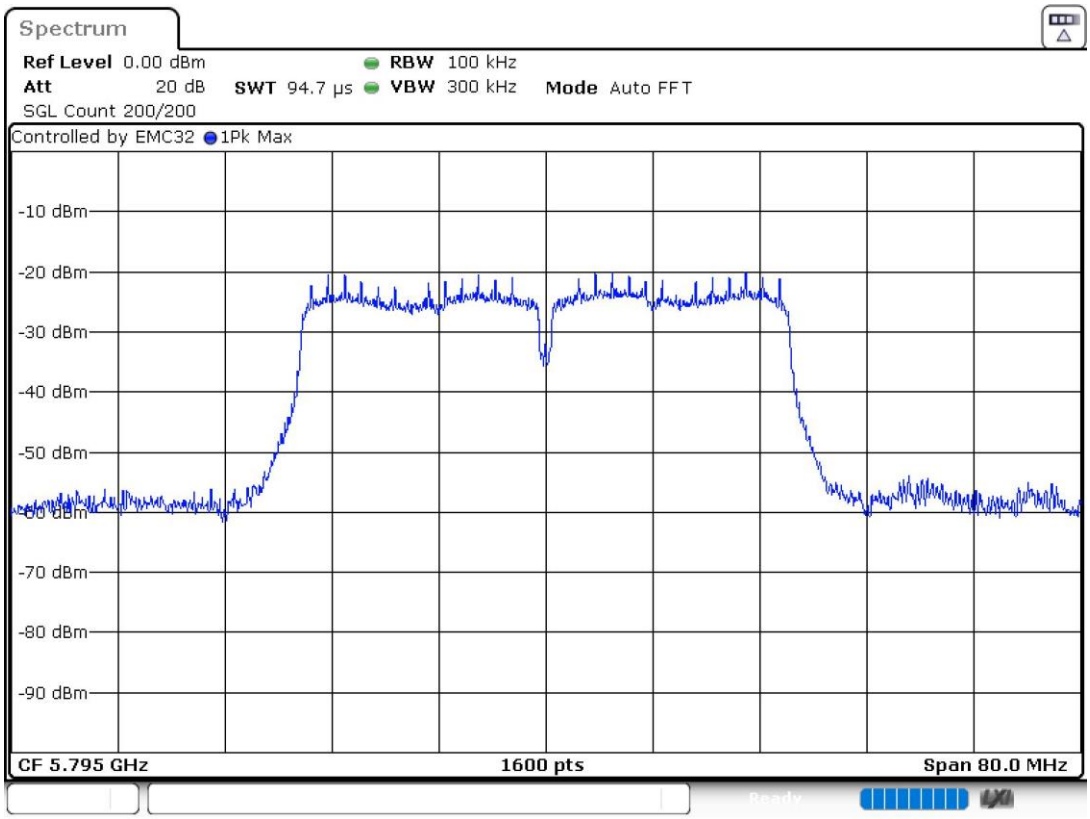
- Low Channel 151 (5755 MHz):





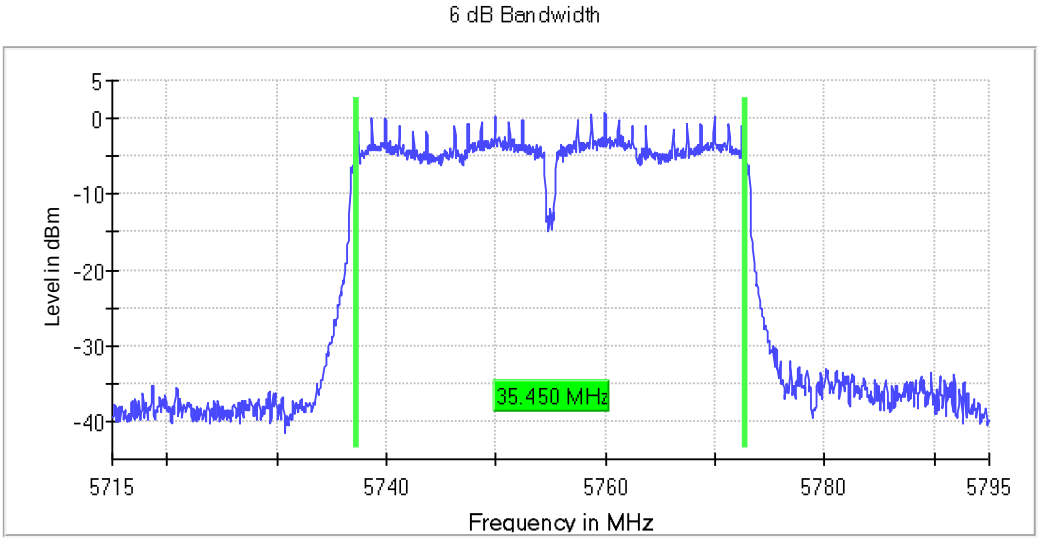
- High Channel 159 (5795 MHz):

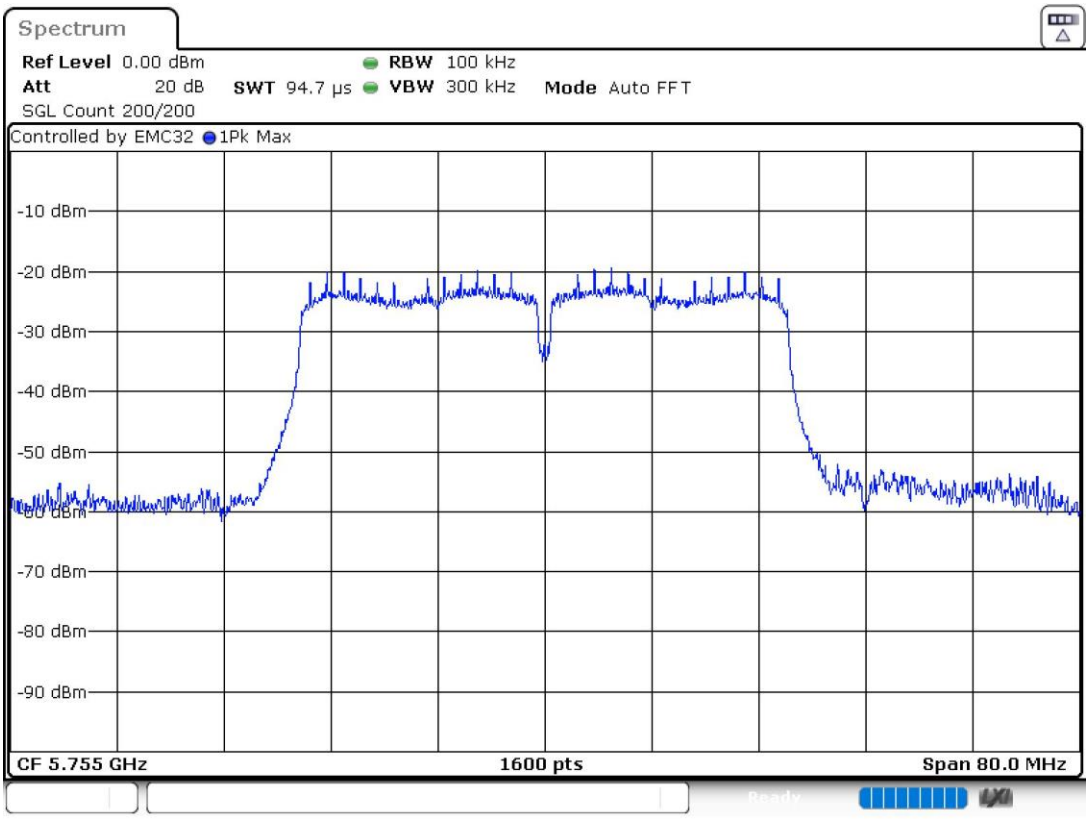




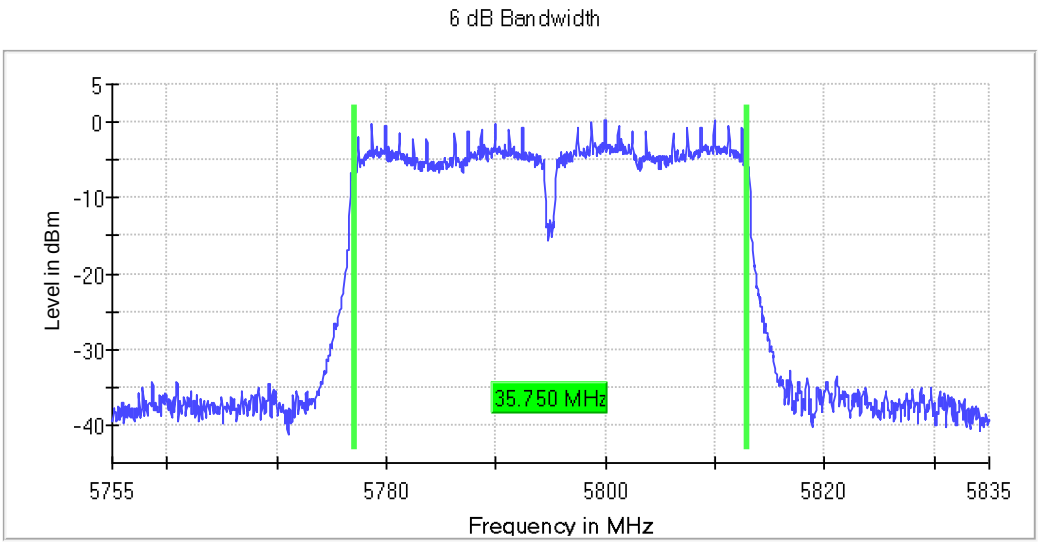
SISO 802.11 ac40 (VHT40)

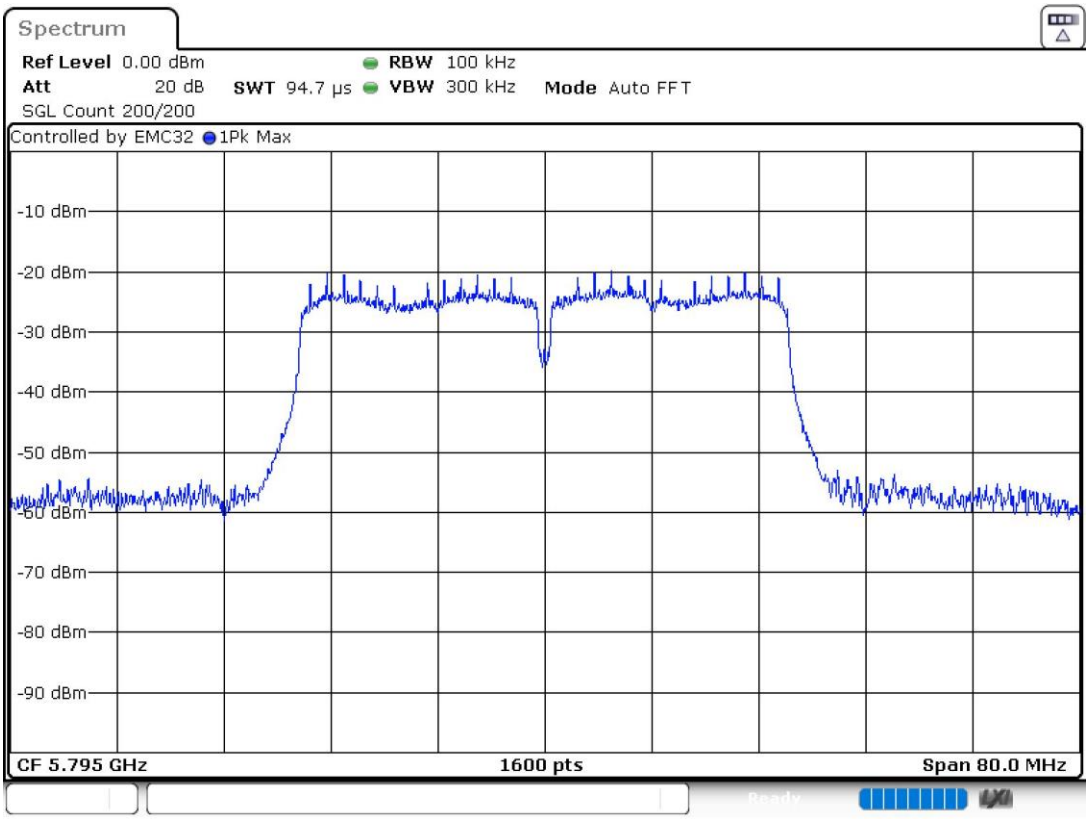
- Low Channel 151 (5755 MHz):





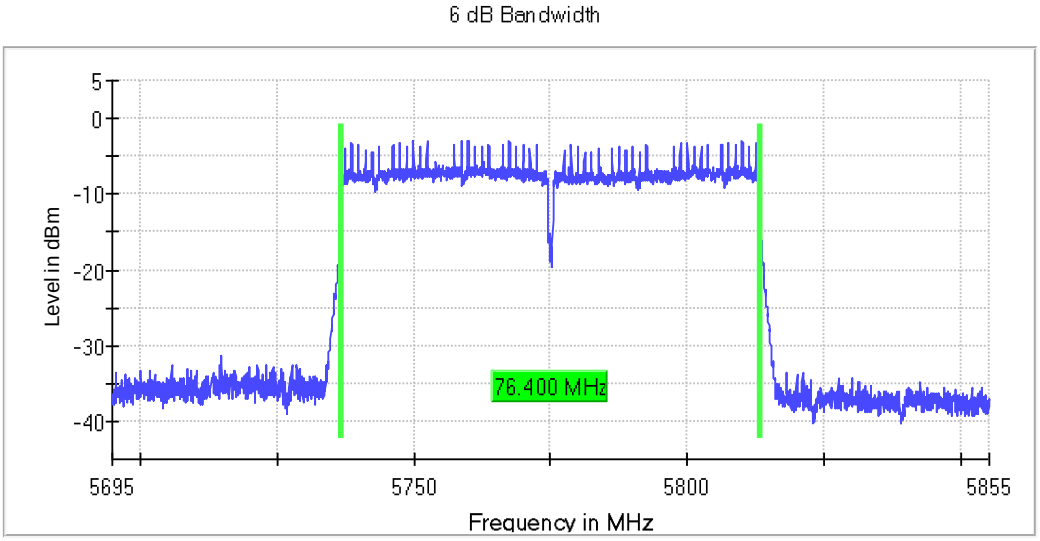
- High Channel 159 (5795 MHz):

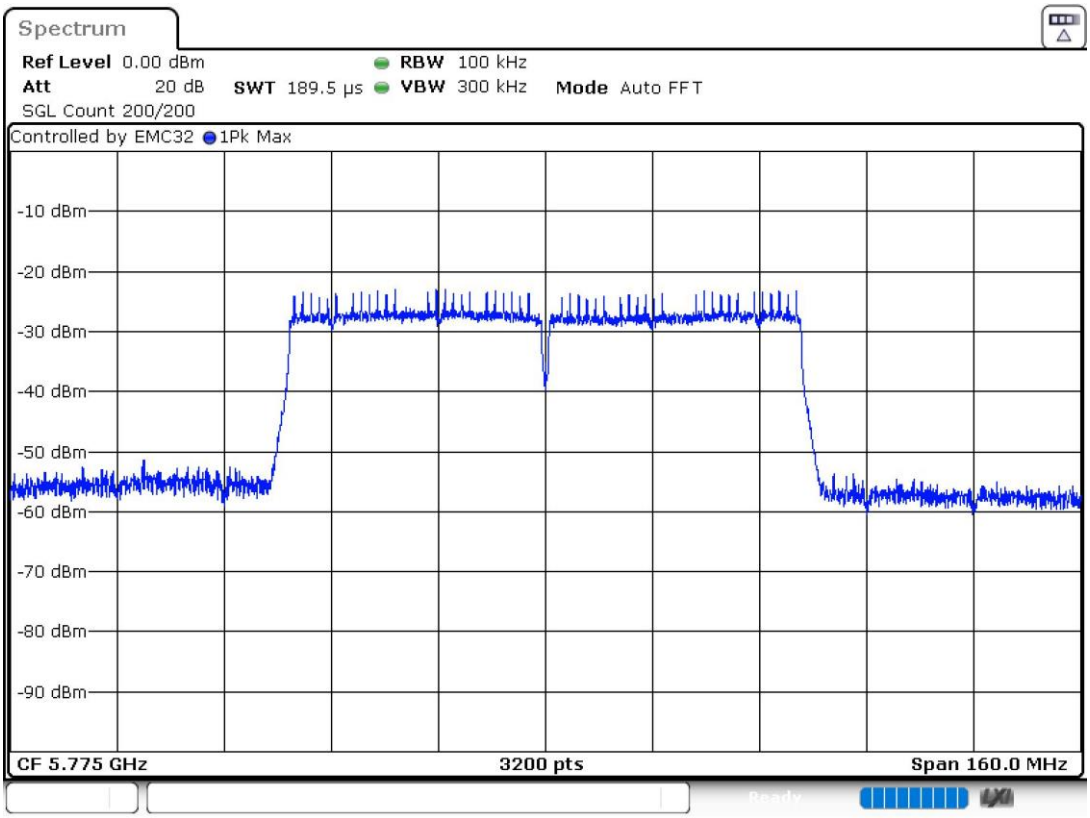




SISO 802.11 ac80 (VHT80)

- Single Channel 155 (5775 MHz):





FCC 15.407 (a)(3)(i) / RSS-247 6.2.4.1
Transmitter Maximum Conducted Output Power

Limits

For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

Results

The maximum conducted output power was measured using the method according to clause II.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).

For all modes of operation, the antenna gain is less than 6 dBi.

Maximum Declared Antenna Gain: +2.38 dBi

SISO 802.11 a20:

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
Maximum Conducted Power (dBm)	14.568	13.930	14.078
Maximum Power EIRP (dBm)	16.948	16.310	16.458
Measurement uncertainty (dB)	< ±1 dB		

SISO 802.11 n20 (HT20):

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
Maximum Conducted Power (dBm)	14.461	13.870	14.077
Maximum Power EIRP (dBm)	16.841	16.250	16.457
Measurement uncertainty (dB)	< ±1 dB		

SISO 802.11 ac20 (VHT20):

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
Maximum Conducted Power (dBm)	14.465	13.899	14.049
Maximum Power EIRP (dBm)	16.845	16.279	16.429
Measurement uncertainty (dB)	< ±1 dB		

SISO 802.11 n40 (HT40):

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
Maximum Conducted Power (dBm)	14.486	14.046
Maximum Power EIRP (dBm)	16.866	16.426
Measurement uncertainty (dB)	< ±1 dB	

SISO 802.11 ac40 (VHT40):

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
Maximum Conducted Power (dBm)	14.617	14.179
Maximum Power EIRP (dBm)	16.997	16.559
Measurement uncertainty (dB)	< ±1 dB	

SISO 802.11 ac80 (VHT80):

Channel	Single Channel 155 (5775 MHz)
Maximum Conducted Power (dBm)	14.518
Maximum Power EIRP (dBm)	16.898
Measurement uncertainty (dB)	< ±1 dB

Verdict

Pass

FCC 15.407 (a)(3)(i) / RSS-247 6.2.4.1
Transmitter Maximum Power Spectral Density

Limits

For the band 5.725-5.850 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Results

The maximum power spectral density (PSD) was measured using the method according to clause II.F) referencing clauses II.E.2.b) (Method SA-1) and E.2.d) (Method SA-2) 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.

Duty cycle correction factor is added to the conducted meadured PSD value when applicable (duty cycle < 98%).

For all modes of operation, the antenna gain is less than 6 dBi.

Maximum Declared Antenna Gain: +2.38 dBi

SISO 802.11 a20:

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
Maximum Conducted PSD (dBm/500kHz)	-0.243	-0.731	-0.442
Measurement uncertainty (dB)	< ±1.3		

SISO 802.11 n20 (HT20):

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
Maximum Conducted PSD (dBm/500kHz)	-0.575	-1.078	-0.734
Measurement uncertainty (dB)	< ±1.3		

SISO 802.11 ac20 (VHT20):

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
Maximum Conducted PSD (dBm/500kHz)	-0.437	-0.998	-0.725
Measurement uncertainty (dB)	< ±1.3		

SISO 802.11 n40 (HT40):

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
Maximum Conducted PSD (dBm/500kHz)	-3.231	-3.601
Measurement uncertainty (dB)	< ±1.3	

SISO 802.11 ac40 (VHT40):

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
Maximum Conducted PSD (dBm/500kHz)	-3.150	-3.424
Measurement uncertainty (dB)	< ±1.3	

SISO 802.11 ac80 (VHT80):

Duty Cycle Correction Factor: 0.21 dB

Channel	Single Channel 155 (5775 MHz)
Maximum Conducted PSD (dBm/500kHz)	-6.662
Maximum Corrected Conducted PSD (dBm/500kHz)	-6.452
Measurement uncertainty (dB)	< ±1.3

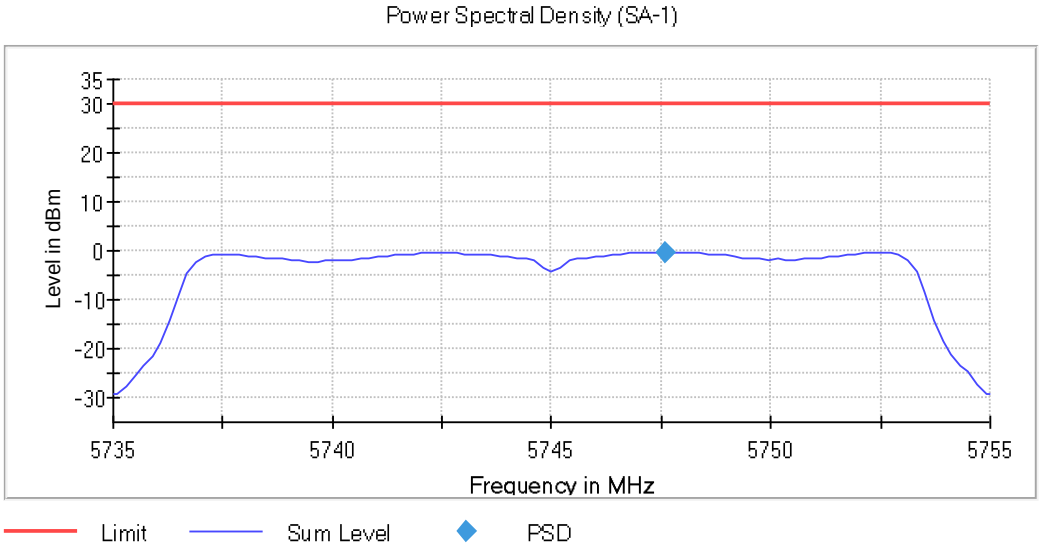
Verdict

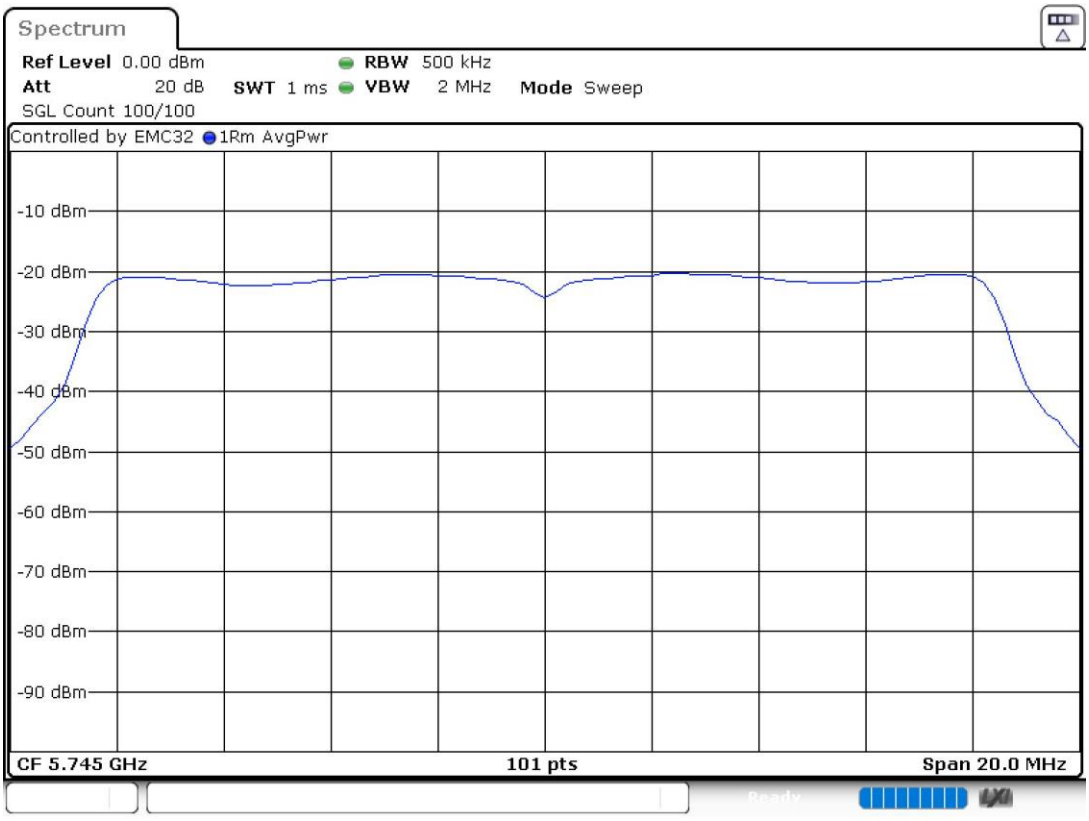
Pass

Attachments

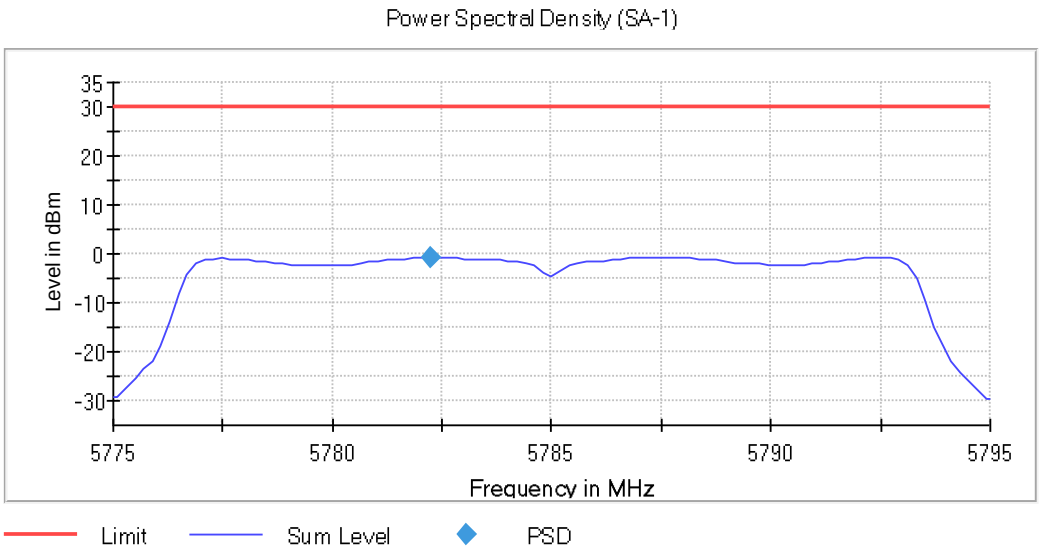
SISO 802.11 a20

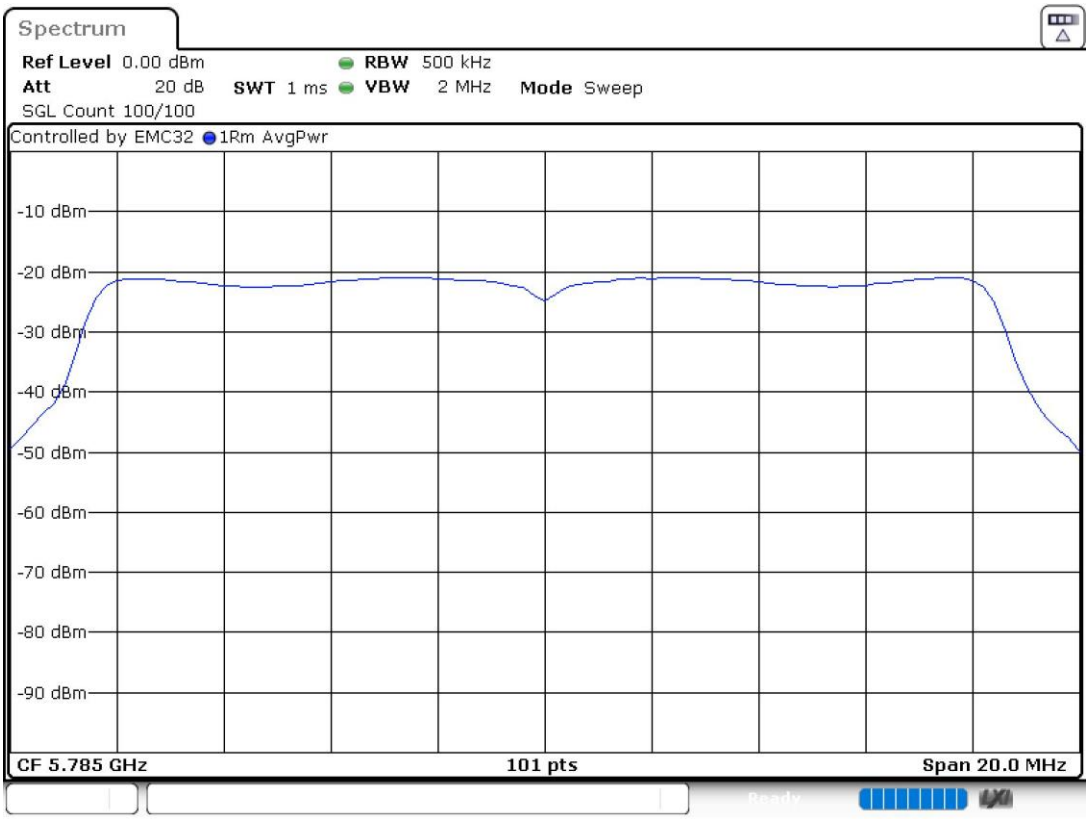
- Low Channel 149 (5745 MHz):



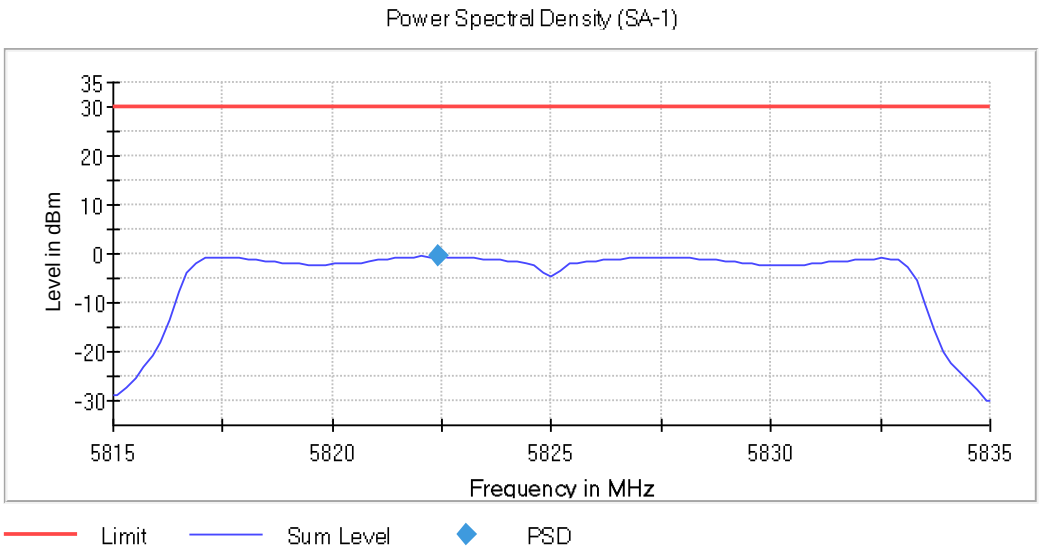


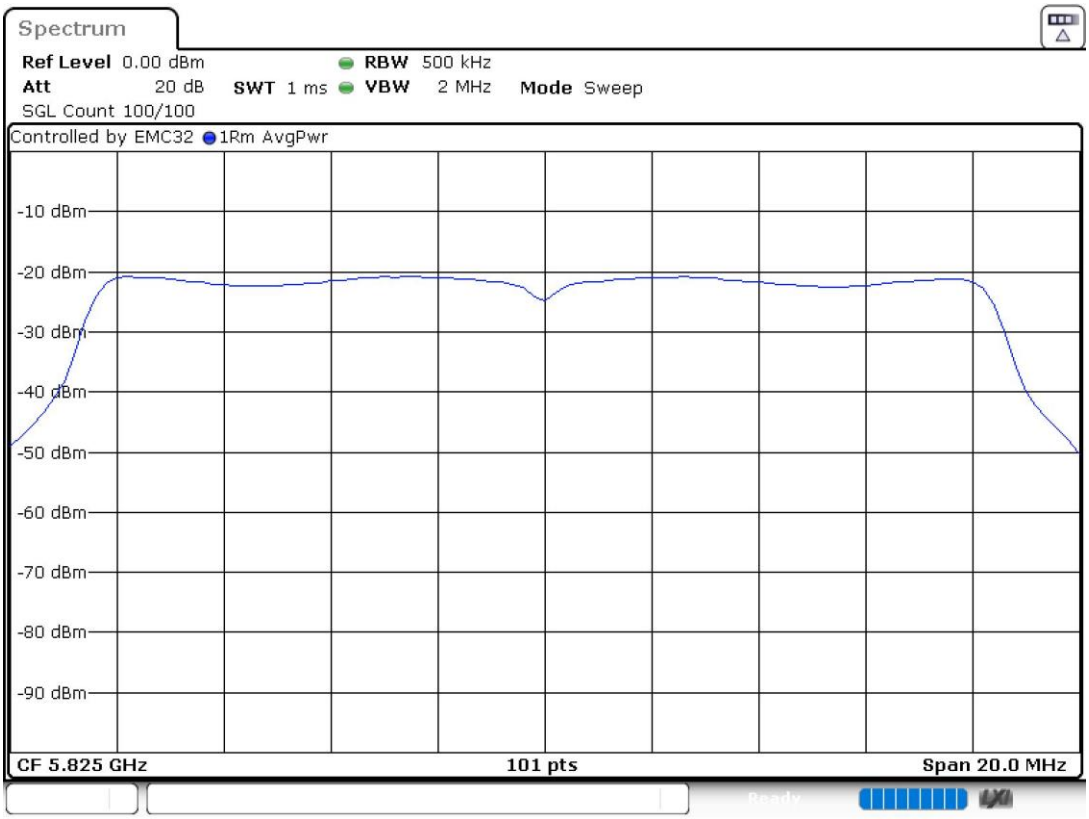
- Middle Channel 157 (5785 MHz):





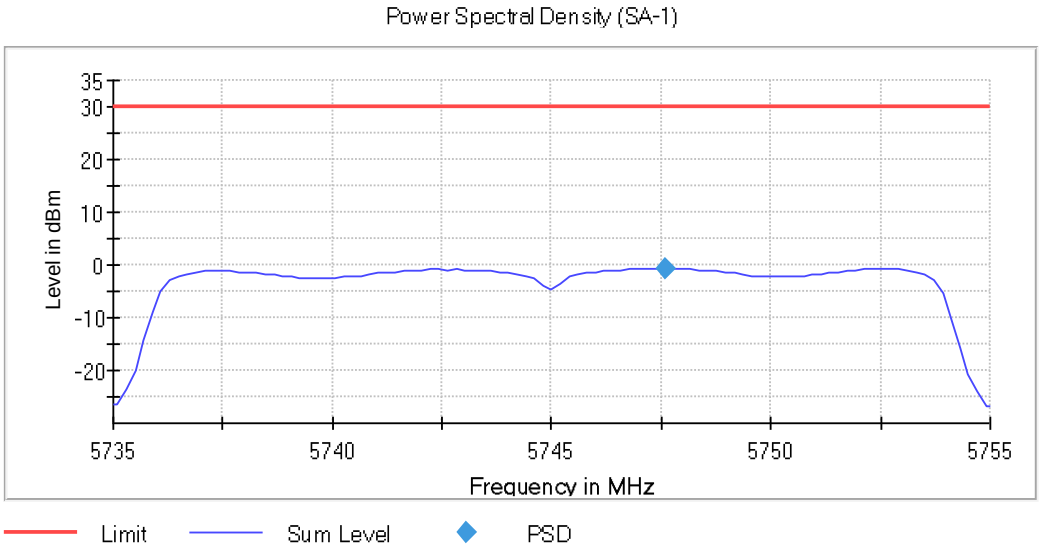
- High Channel 165 (5825 MHz):

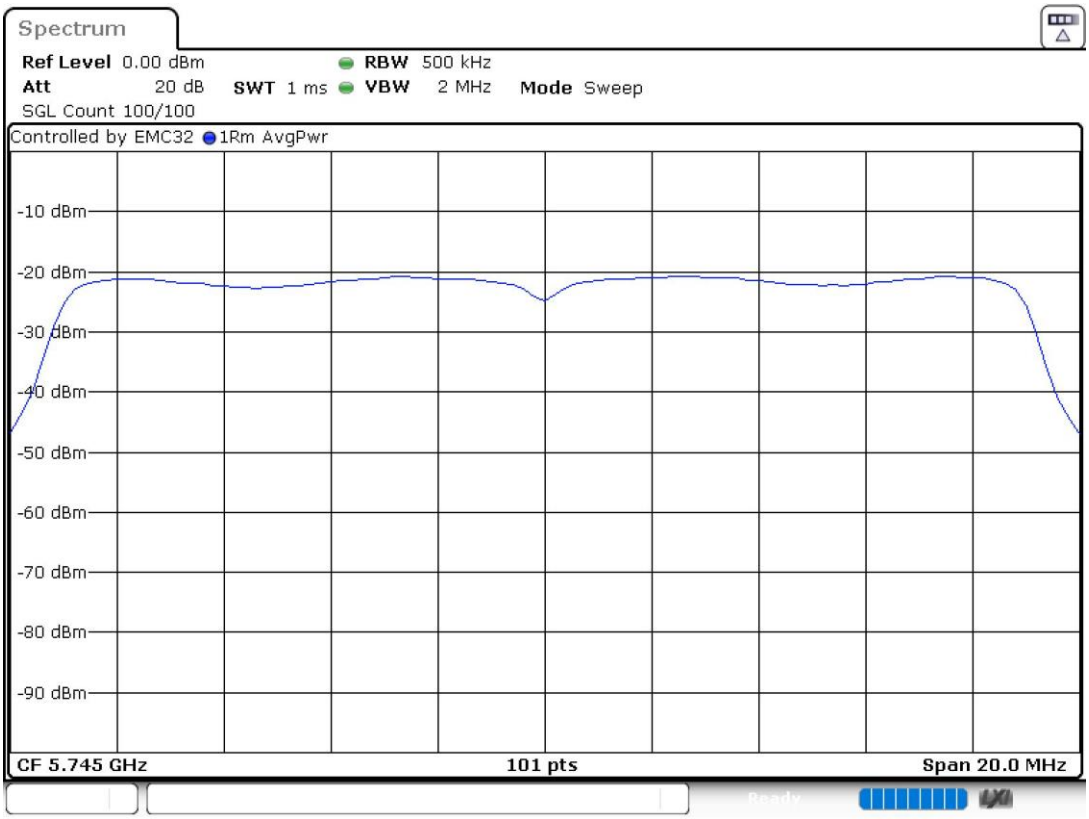




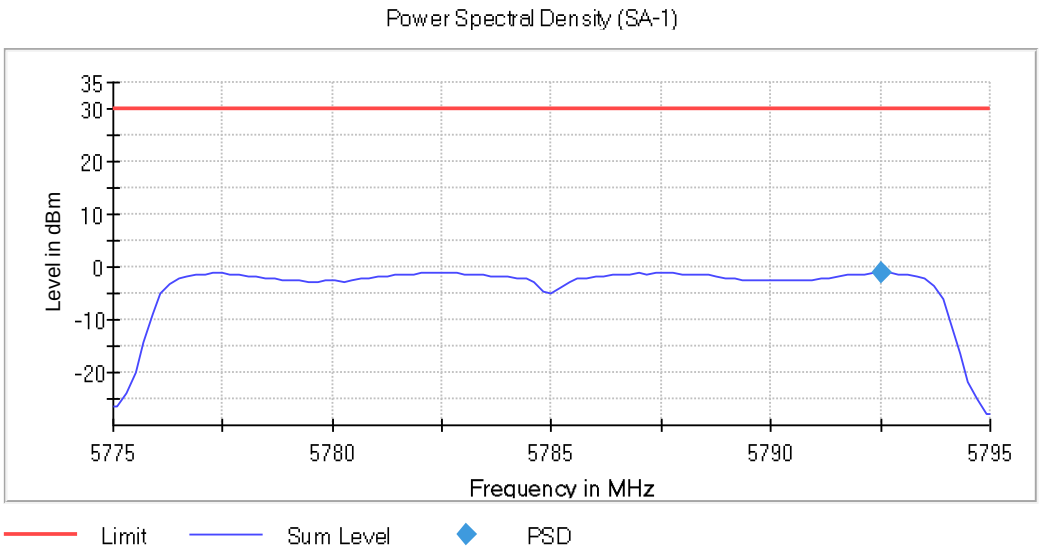
SISO 802.11 n20 (HT20)

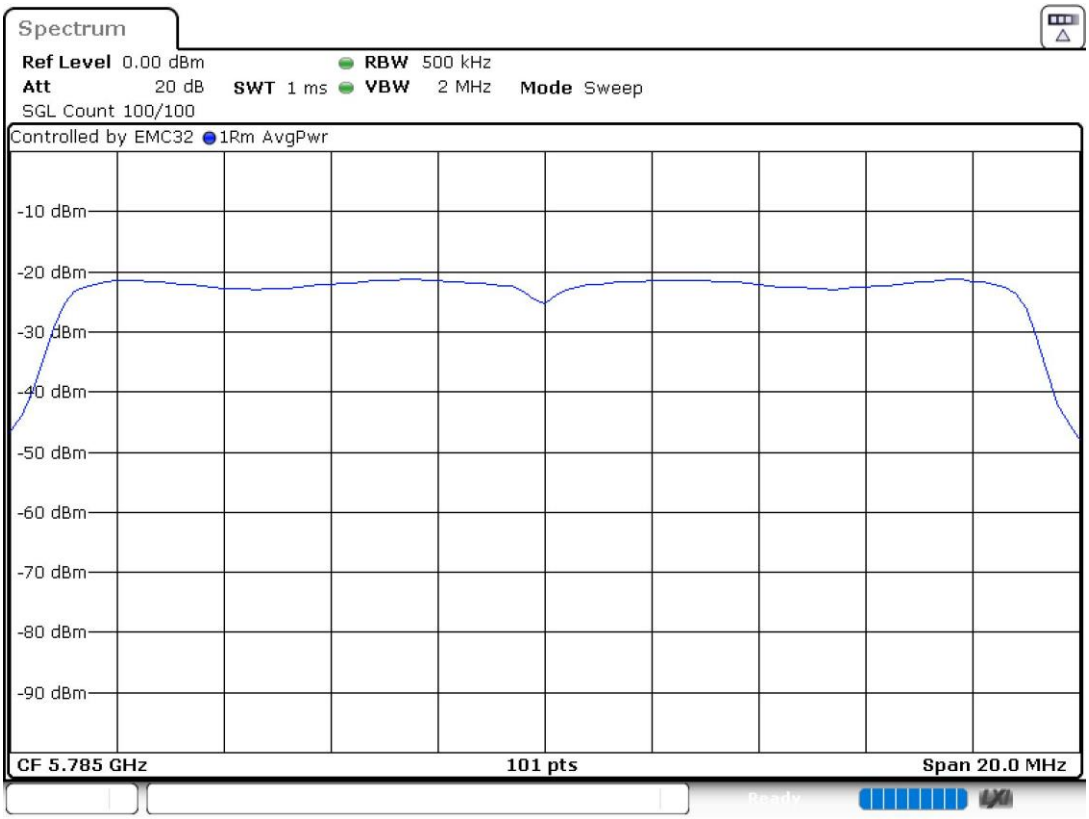
- Low Channel 149 (5745 MHz):



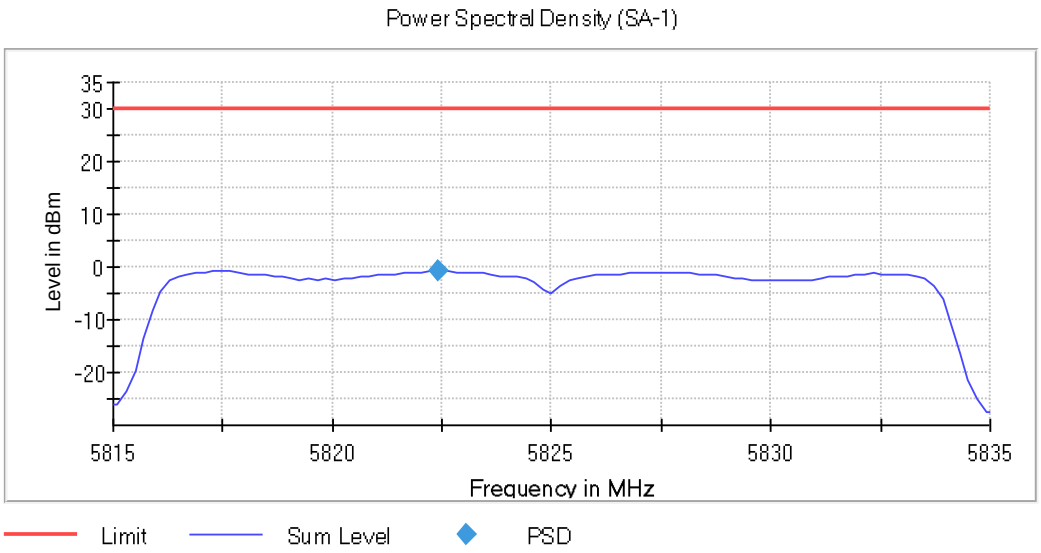


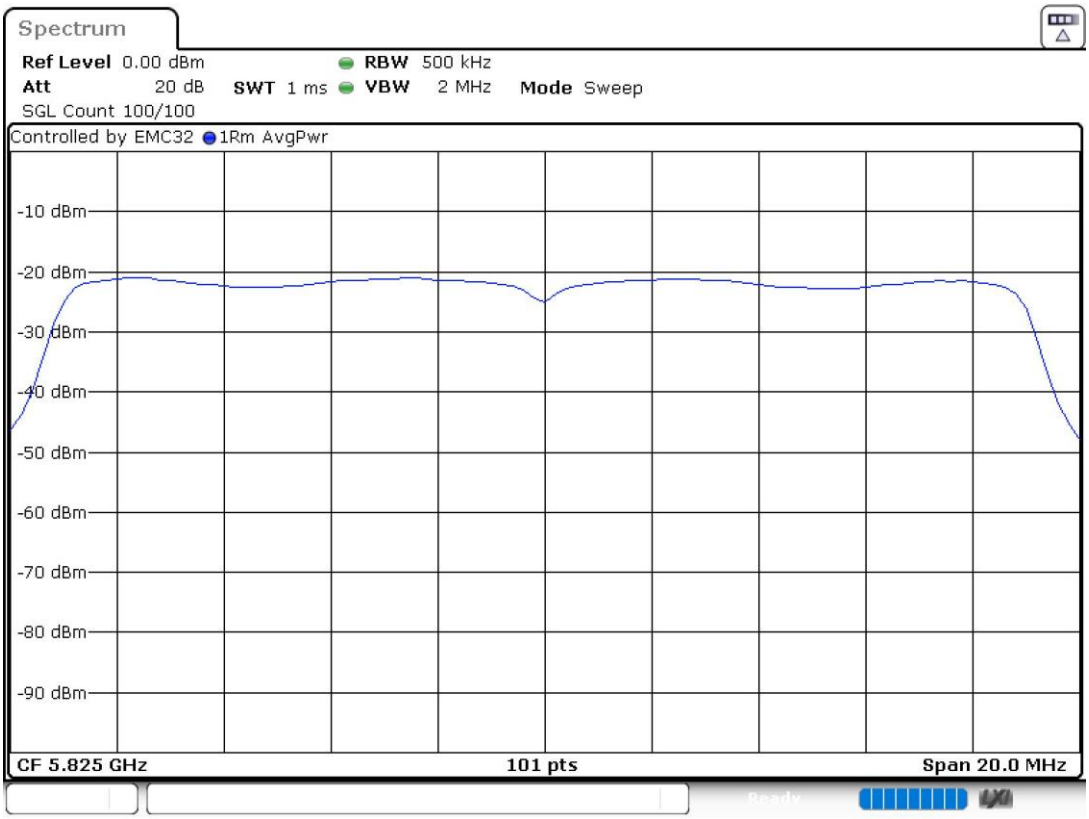
- Middle Channel 157 (5785 MHz):





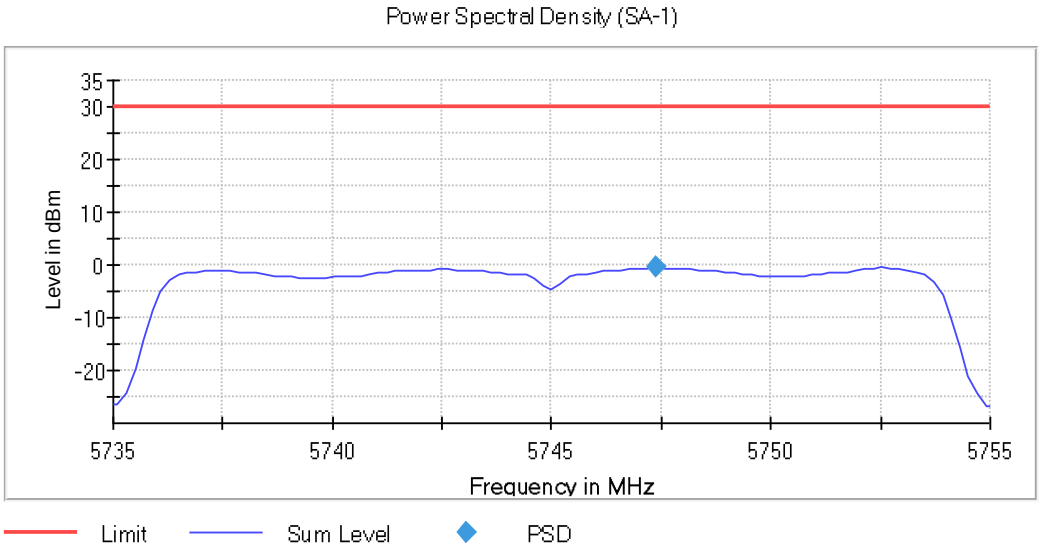
- High Channel 165 (5825 MHz):

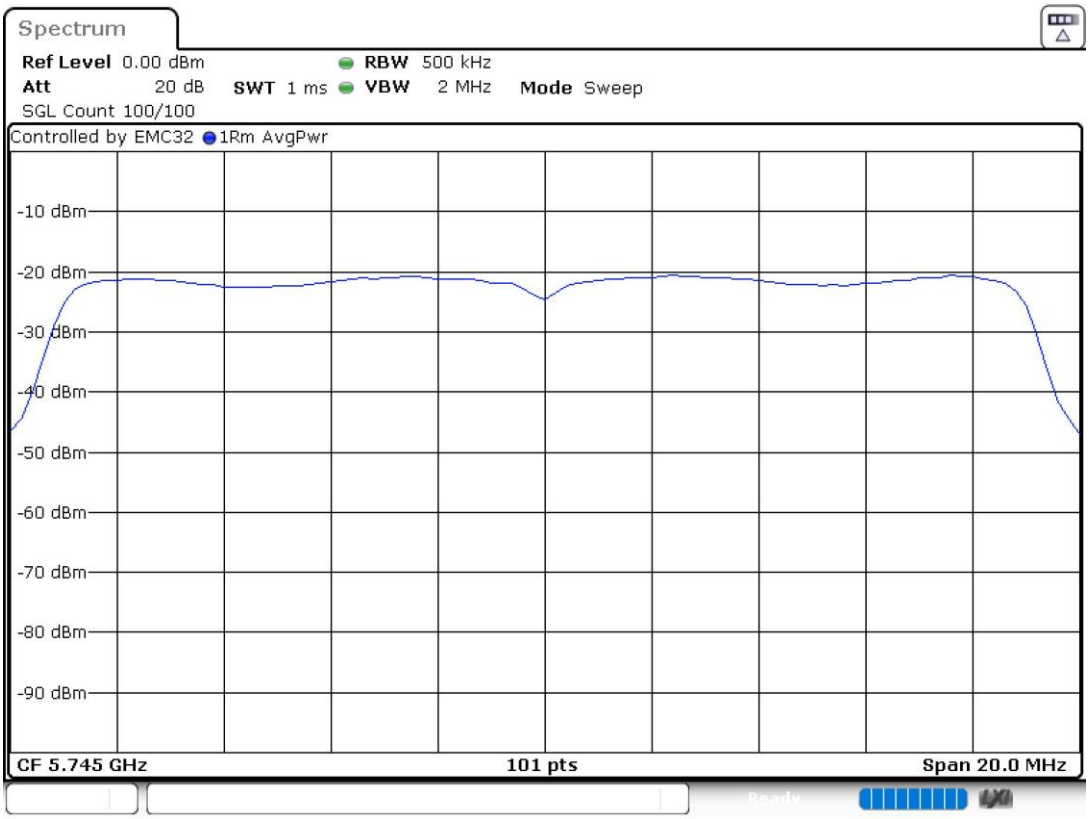




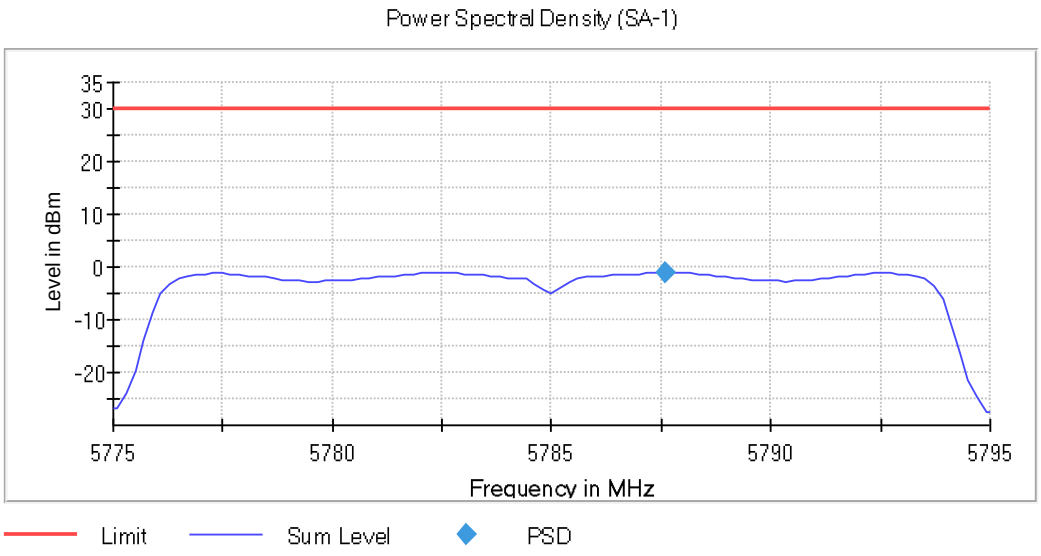
SISO 802.11 ac20 (VHT20)

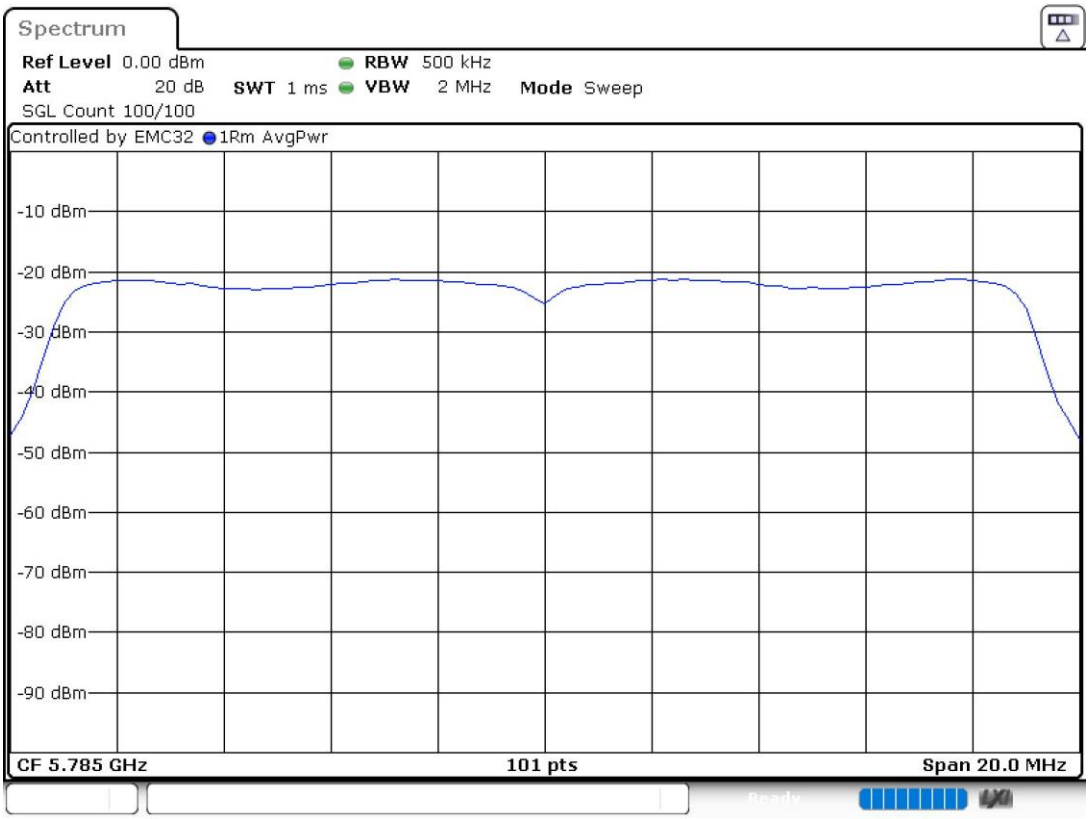
- Low Channel 149 (5745 MHz):



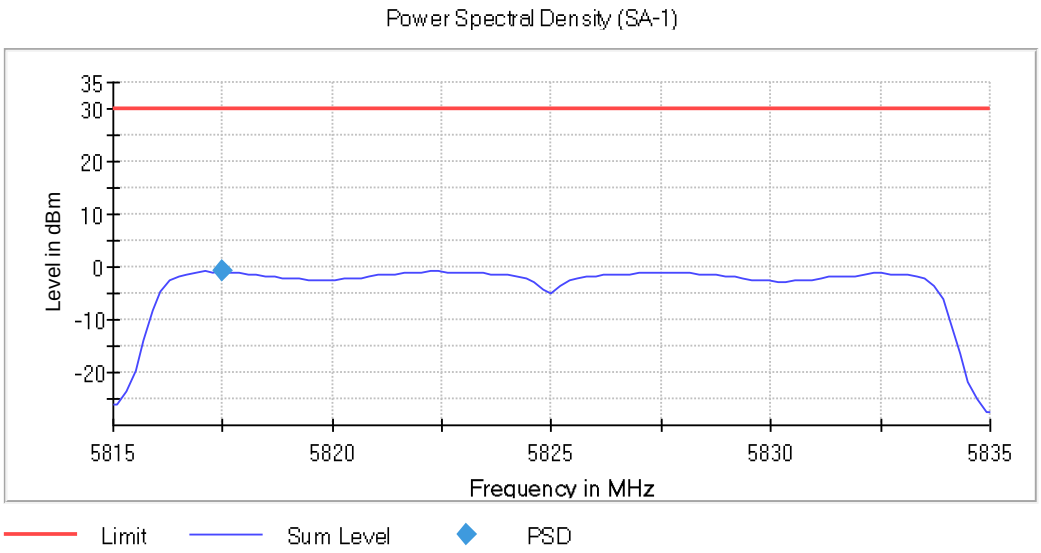


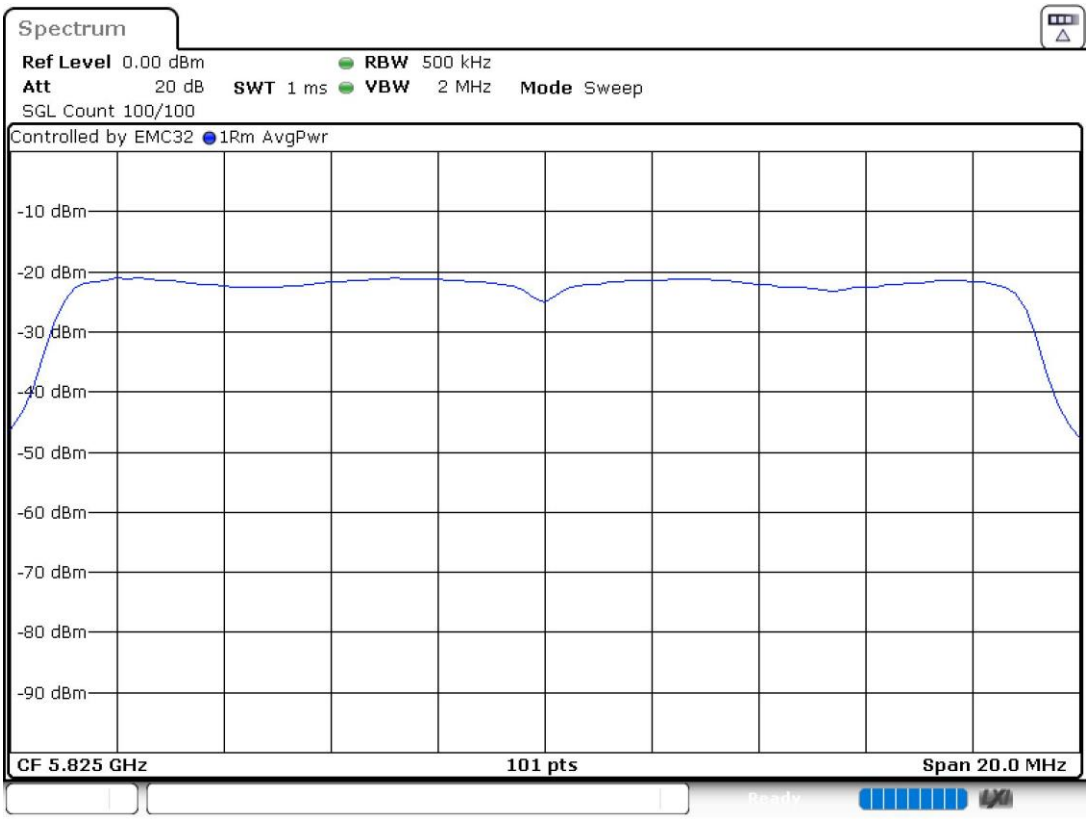
- Middle Channel 157 (5785 MHz):





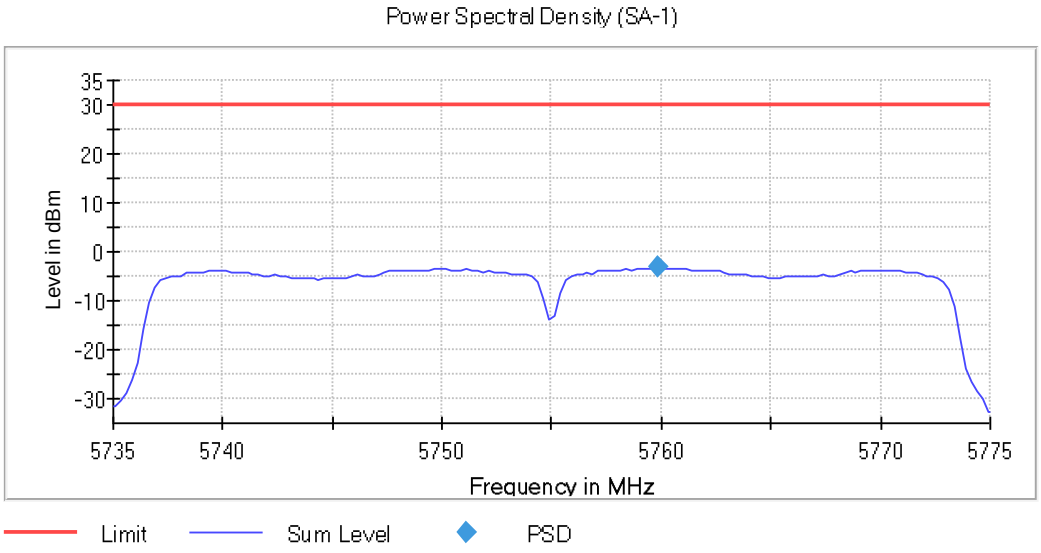
- High Channel 165 (5825 MHz):

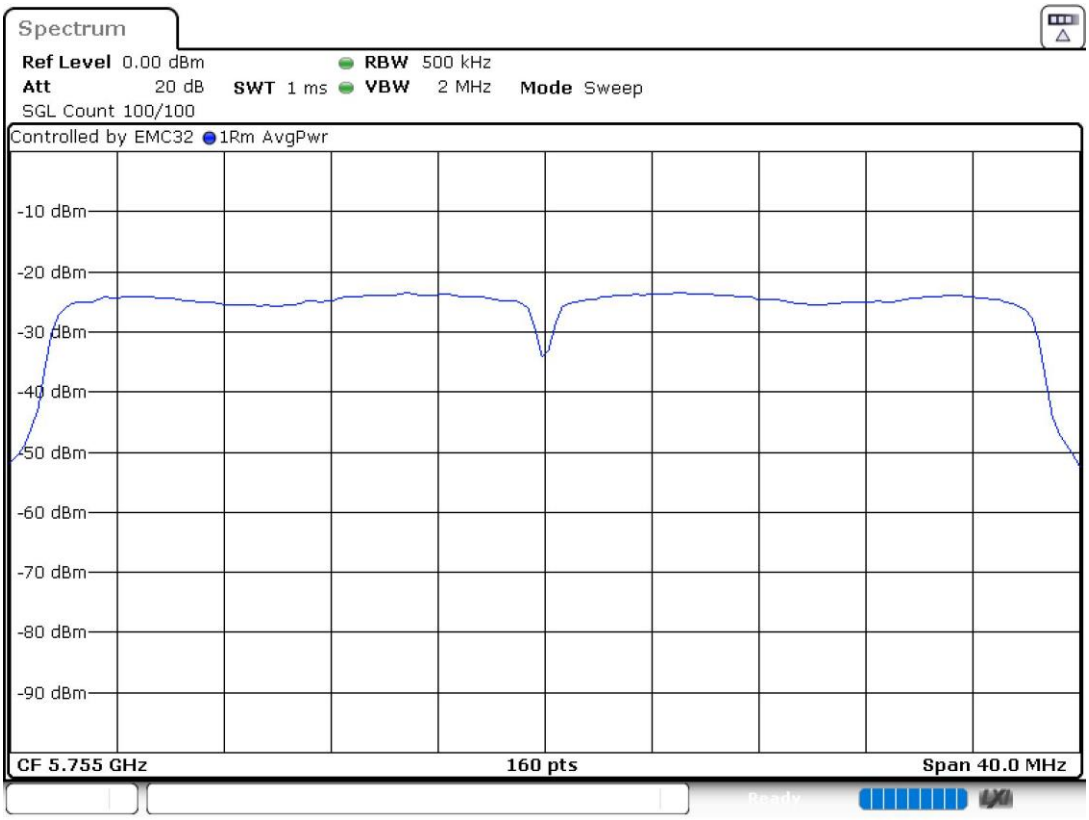




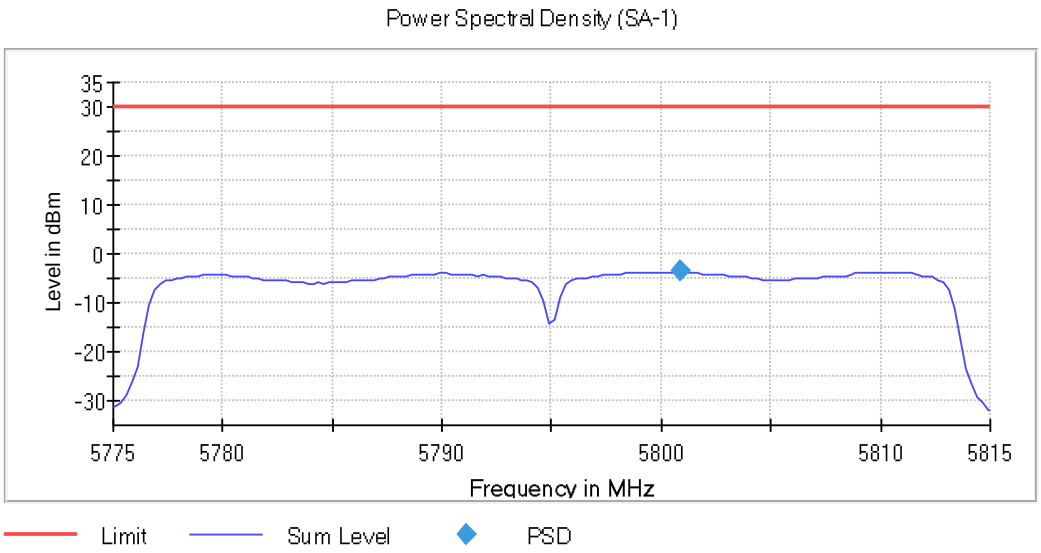
SISO 802.11 n40 (HT40)

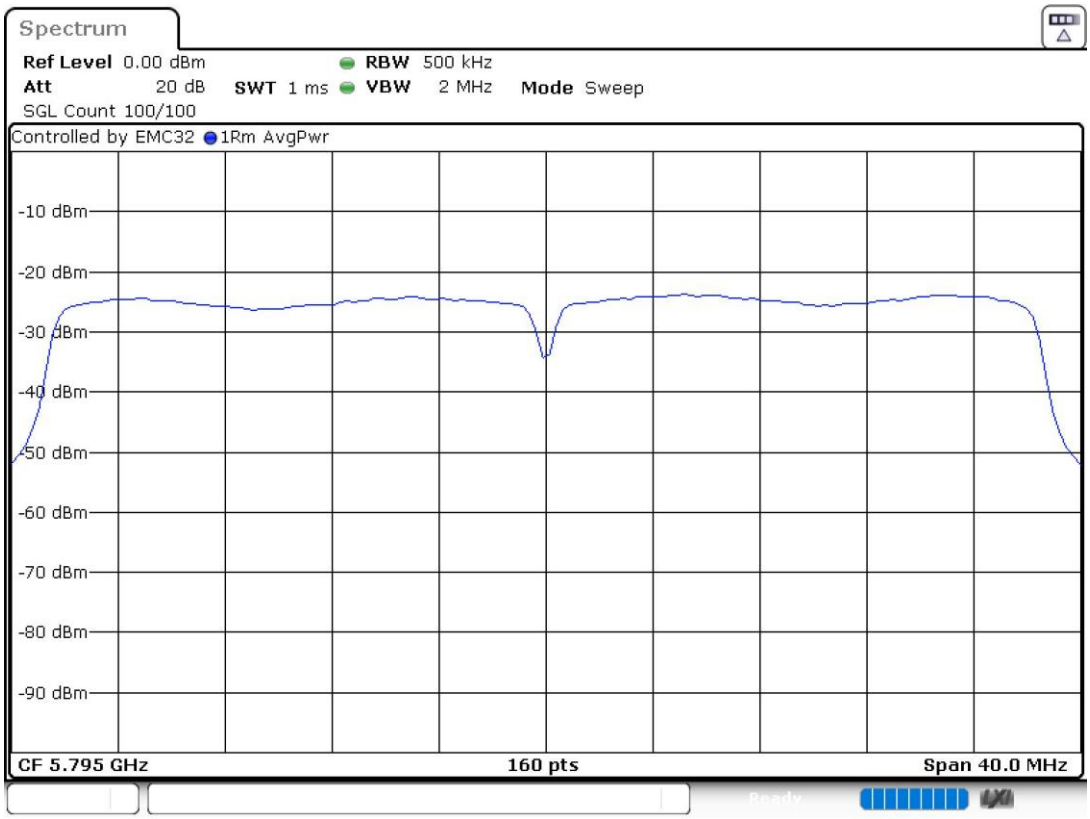
- Low Channel 151 (5755 MHz):





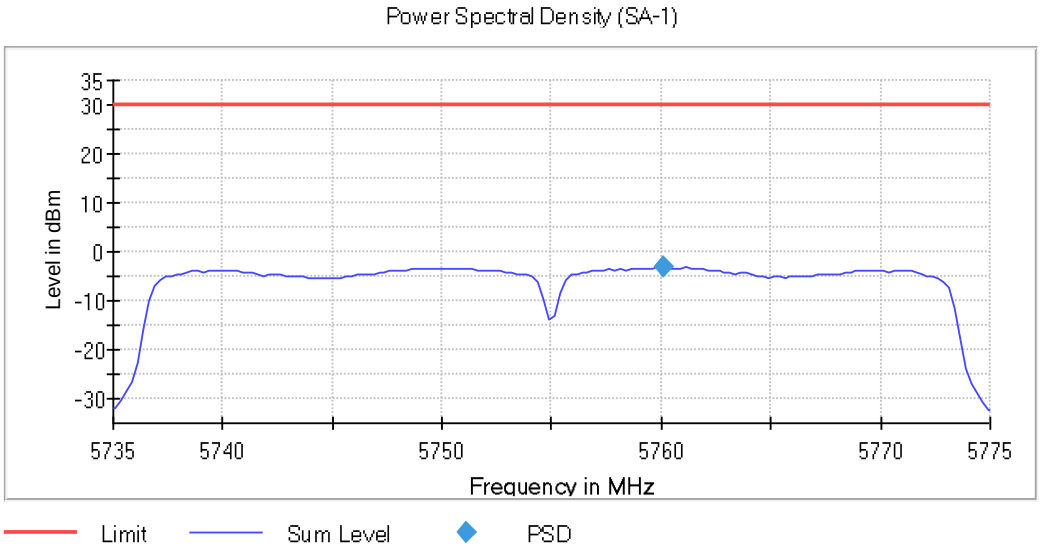
- High Channel 159 (5795 MHz):

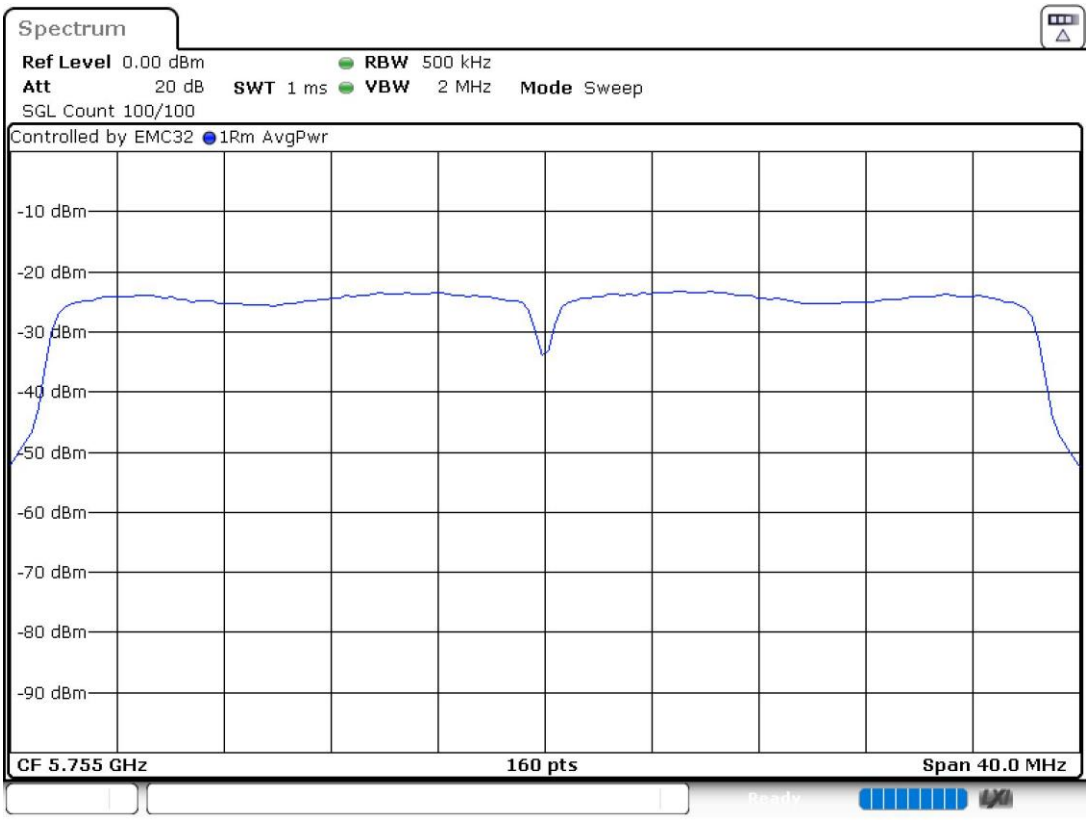




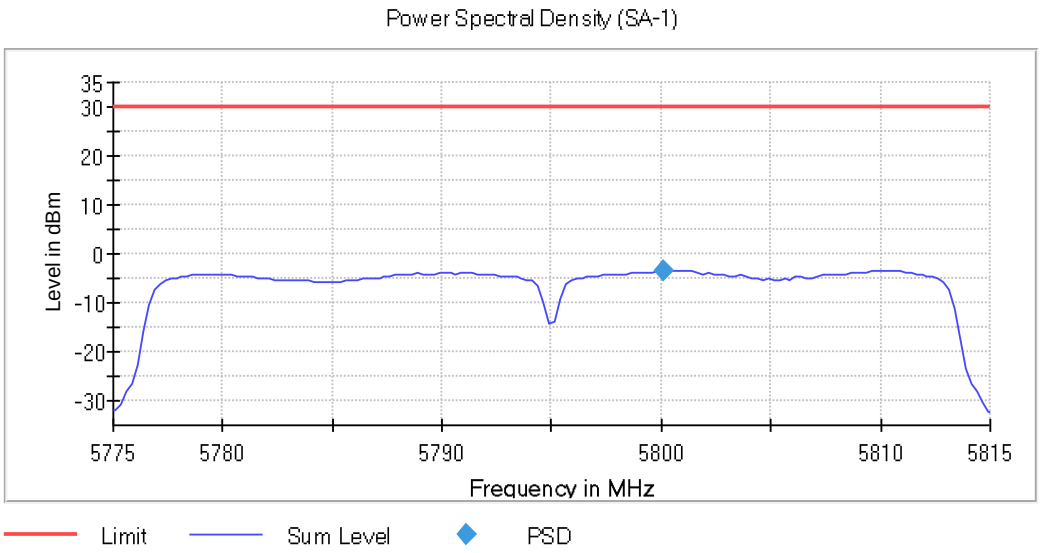
SISO 802.11 ac40 (VHT40)

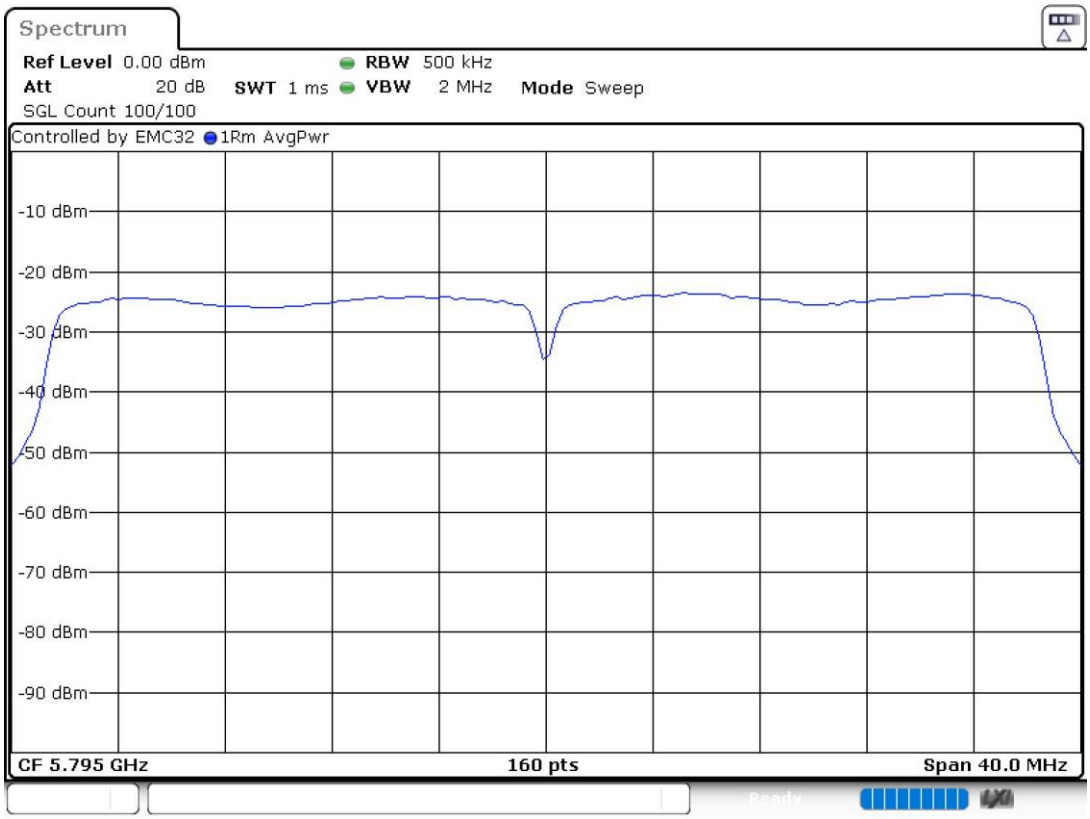
- Low Channel 151 (5755 MHz):





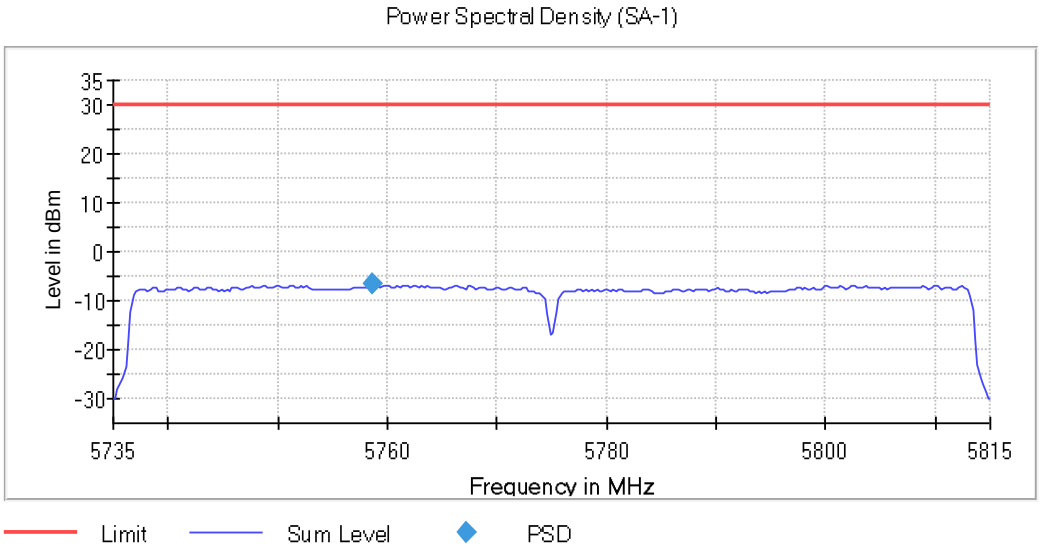
- High Channel 159 (5795 MHz):

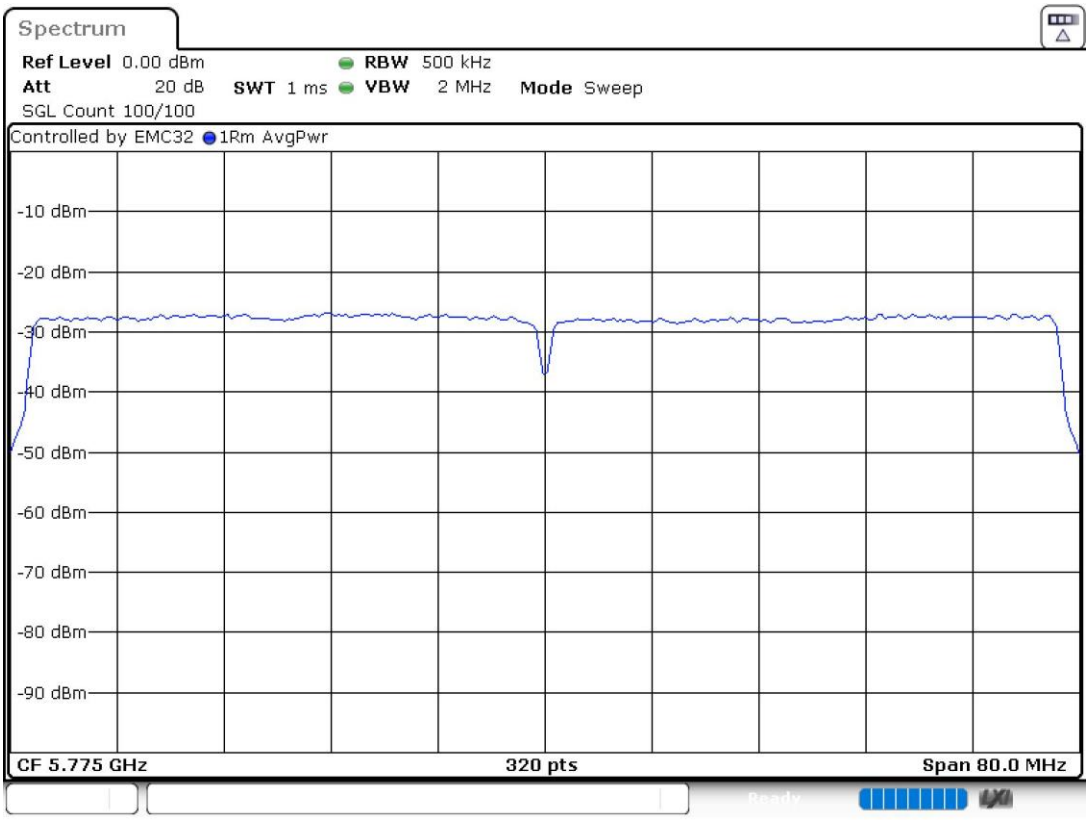




SISO 802.11 ac80 (VHT80)

- Single Channel 155 (5775 MHz):





FCC 15.407(b)(4) / RSS-247 6.2.4.2
Transmitter Out of Band Radiated Emissions and Transmitter Band Edge Radiated Emissions

Limits

For transmitters operating in the 5.725–5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz (68.23 dBµV/m at 3 m distance) at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

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)	Magnetic field strength (µA/m)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009 - 0.490	6.37/F (F in kHz)	--	-	300
0.490 - 1.705	63.7/F (F in kHz)	--	-	30
1.705 - 30.000	0.08	--	-	30
30 - 88	--	100	40	3
88 - 216	--	150	43.5	3
216 - 960	--	200	46	3
Above 960	--	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.

RSS-247:

Attenuation below the general field strength limits specified in RSS-Gen is not required.

Results

The field strength is calculated by adding a correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss, pre-amplifiers gain and the distance correction factor for measurements above 17 GHz performed at 1.5-meter distance.

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

OUT OF BAND EMISSIONS

For spurious emissions outside of the U-NII-3 band mask of 5.65-5.925 GHz, the worst-case mode was determined by measuring the e.i.r.p density (radiated).

This worst-case mode is reported below.

Worst case: 802.11 a20 (6 Mbps)

Frequency range 30 MHz - 1 GHz (worst case):

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
124.999375	29.10	V	Quasi-Peak
174.984688	29.05	V	Quasi-Peak
294.810000	31.99	H	Quasi-Peak
325.001250	29.88	H	Quasi-Peak
350.009063	29.54	H	Quasi-Peak
374.956250	28.74	H	Quasi-Peak
400.024688	26.85	V	Quasi-Peak
424.971875	27.29	H	Quasi-Peak
474.987500	27.51	H	Quasi-Peak
574.988438	26.97	V	Quasi-Peak

Measurement Uncertainty (dB) < ±5.35

Frequency range 1 - 40 GHz (worst case):

The results in this section show the maximum measured levels in the 1-40 GHz range except the 5.65-5.725 GHz and 5.85-5.925GHz adjacent bands. The results in these adjacent bands are reported in the next section.

Spurious frequencies with peak levels above the average limit (54 dBµV/m at 3 m) are measured with an average detector for checking compliance with the average limit.

- Low Channel: Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
11488.865000	52.62	V	Peak

- Middle Channel: Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
11569.190000	52.91	V	Peak

- High Channel: Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
11651.720000	52.00	V	Peak

Measurement uncertainty (dB):
< ±4.32 for f ≥ 1 GHz up to 17 GHz
< ±5.51 for f ≥ 17 GHz up to 26.5 GHz
< ±5.72 for f ≥ 26.5 GHz up to 40 GHz

Verdict

Pass

Attachments

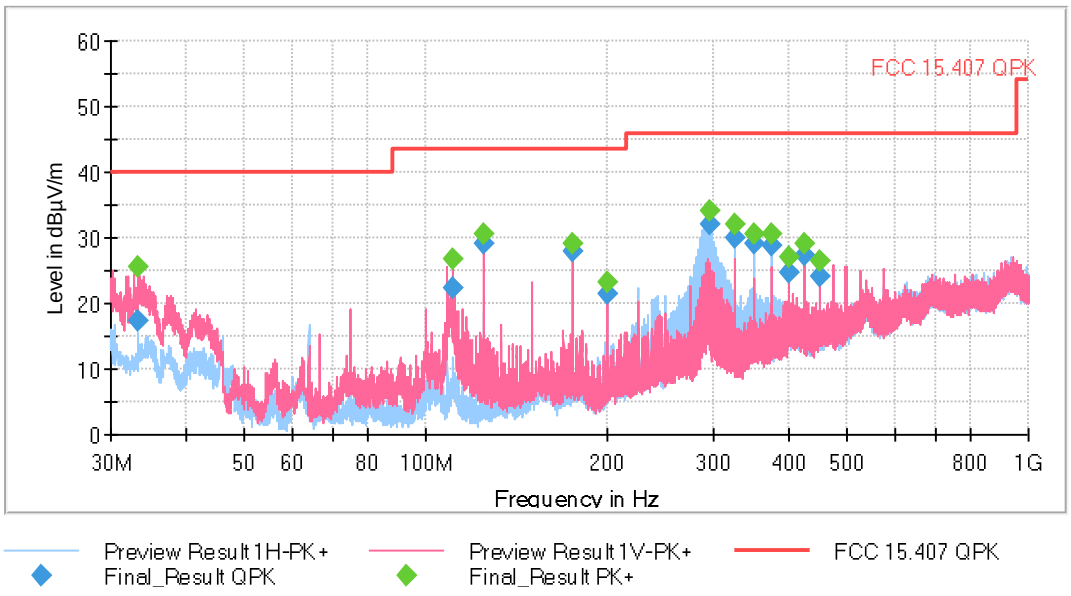
Worst case: 802.11 a20 (6 Mbps)

Measurement settings:

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESR 7] 30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB
Receiver: [ESW 44] 1 GHz - 6,5 GHz	100 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
Receiver: [ESW 44] 6,5 GHz - 17 GHz	105 kHz	PK+ ; AVG	1 MHz	1 s	30 dB
Receiver: [FSW 50] 17 GHz - 40 GHz	766,667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

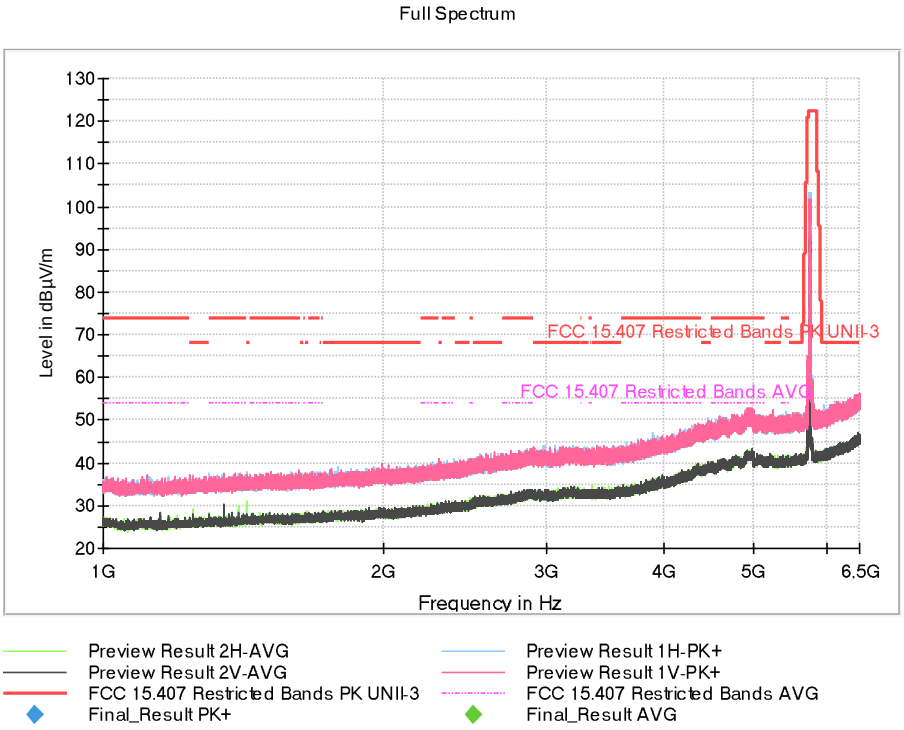
FREQUENCY RANGE 30 MHz - 1 GHz

This plot is valid for all the Channels and all the modulation modes and bandwidths.



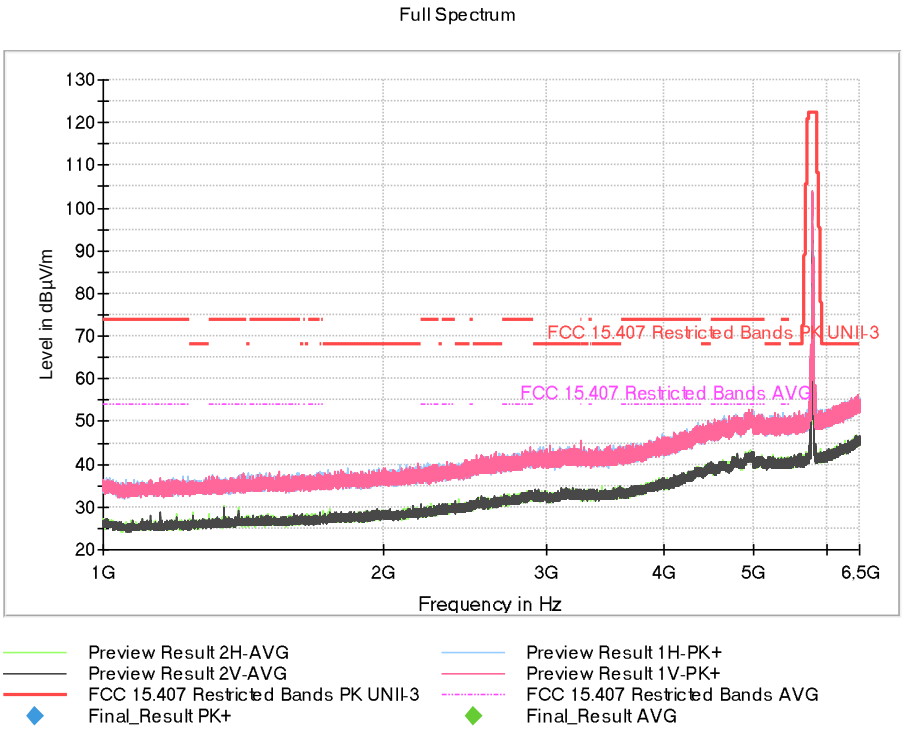
FREQUENCY RANGE 1 - 6.5 GHz

- Low Channel:



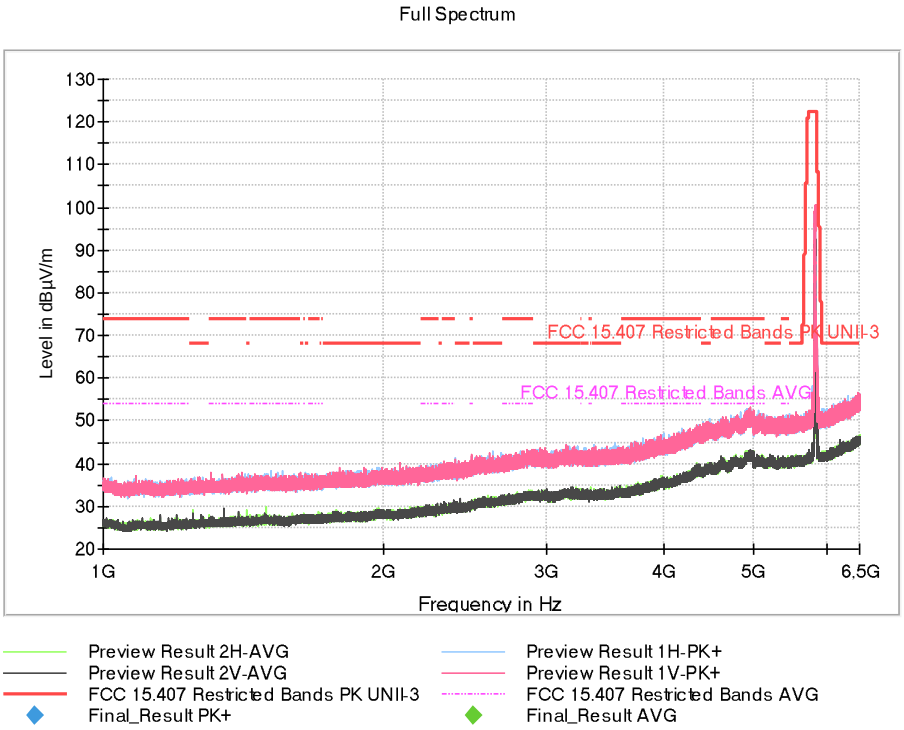
The highest peak on the plot is the carrier frequency.

- Middle Channel:



The highest peak on the plot is the carrier frequency.

- High Channel:



The highest peak on the plot is the carrier frequency.