

Appendix B: Test results. 802.11 B/G/N 20 MHz 1x1

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:6 x AA 1.5 V

Type of Power Supply:Battery powered device.

ANTENNA (*):

Type of Antenna:Microstrip antenna, Inverted-F (PIFA)

Maximum Declared Antenna Gain:+2.0 dBi

TEST FREQUENCIES (*):

Modulation	Channel	Frequency (MHz)
802.11b (DSSS 1 Mbit/s)	1	2412
	6	2437
	11	2462
802.11g (OFDM 6 Mbit/s)	1	2412
	2	2417
	3	2422
	6	2437
	9	2452
	10	2457
	11	2462
802.11n HT20 (OFDM MCS0 6.5 Mbit/s)	1	2412
	2	2417
	3	2422
	6	2437
	9	2452
	10	2457
	11	2462

POWER VALUES USED FOR TESTING (*):

Modulation	Channel	Frequency (MHz)	Power setting
802.11b (DSSS 1 Mbit/s)	1	2412	65
	6	2437	65
	11	2462	65
802.11g (OFDM 6 Mbit/s)	1	2412	62
	2	2417	70
	3	2422	76
	6	2437	76
	9	2452	76
	10	2457	72
	11	2462	62
802.11n HT20 (OFDM MCS0 6.5 Mbit/s)	1	2412	60
	2	2417	67
	3	2422	76
	6	2437	76
	9	2452	76
	10	2457	70
	11	2462	60

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



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-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1.5 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

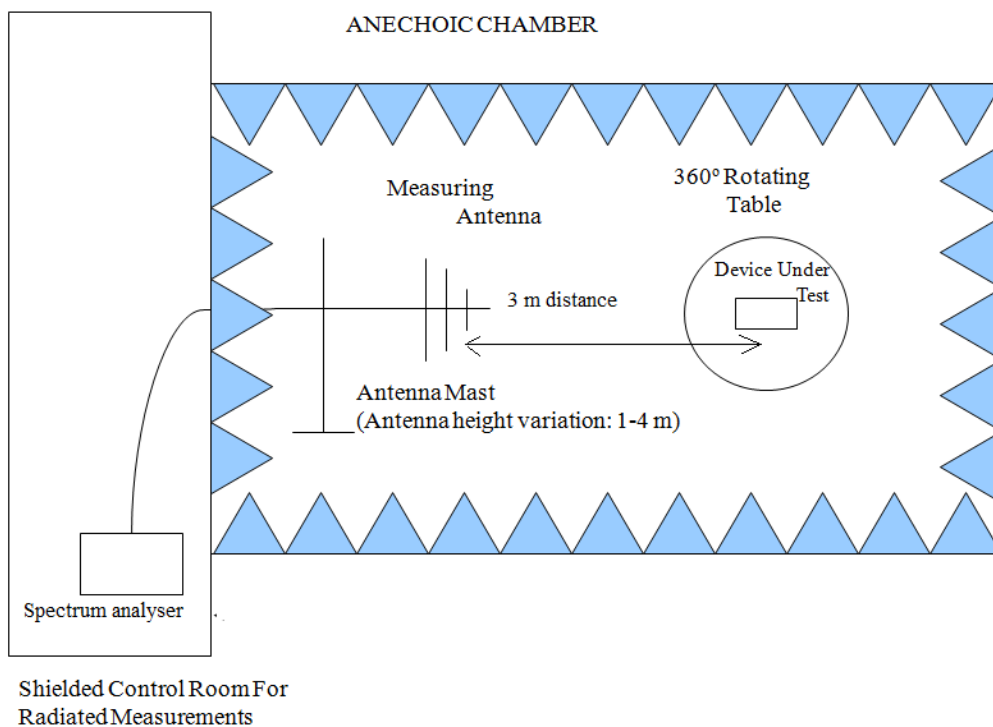
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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.

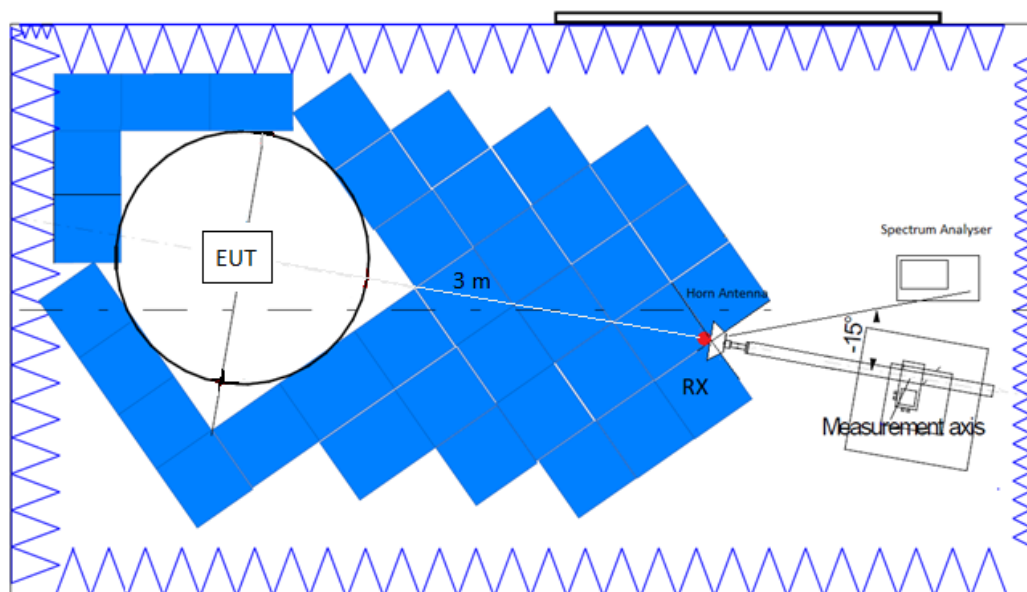
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

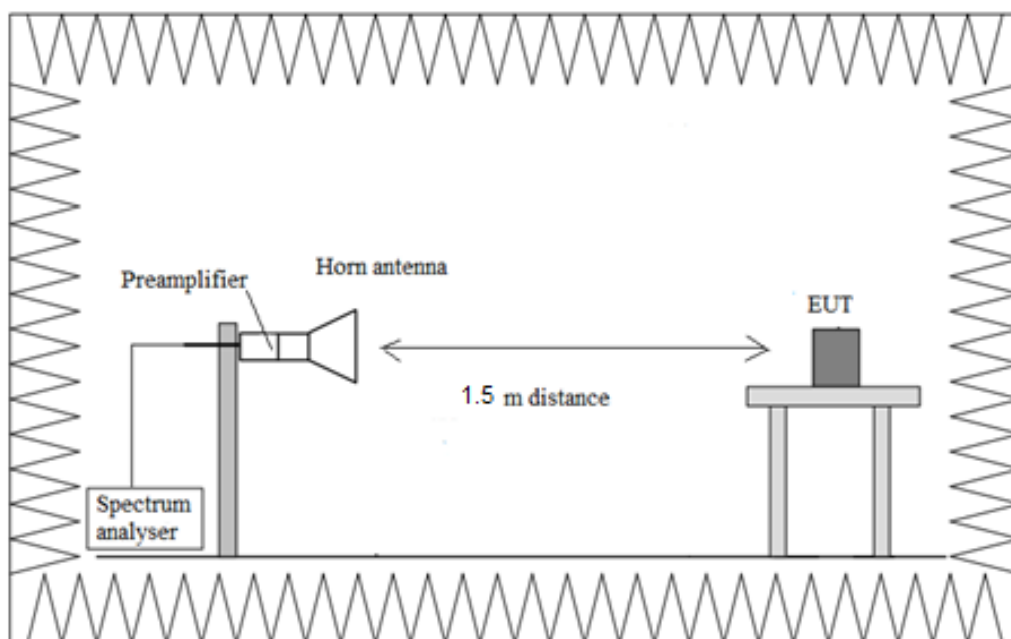
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



TEST CASES DETAILS

Occupied Bandwidth

Results

Modulation: 802.11b (DSSS 1 Mbit/s)

Freq (MHz)	# of Tx Chains	Port	Occ Ch BW (MHz)
2412.00	1	1	11.20
2437.00			11.20
2462.00			11.00

Modulation: 802.11g (OFDM 6 Mbit/s)

Freq (MHz)	# of Tx Chains	Port	Occ Ch BW (MHz)
2412.00	1	1	16.80
2417.00			16.90
2422.00			17.20
2437.00			16.90
2452.00			17.10
2457.00			16.90
2462.00			16.90

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

Freq (MHz)	# of Tx Chains	Port	Occ Ch BW (MHz)
2412.00	1	1	18.00
2417.00			18.00
2422.00			18.60
2437.00			18.10
2452.00			18.20
2457.00			18.10
2462.00			18.00

Attachments

Frequency MHz = 2412.00000

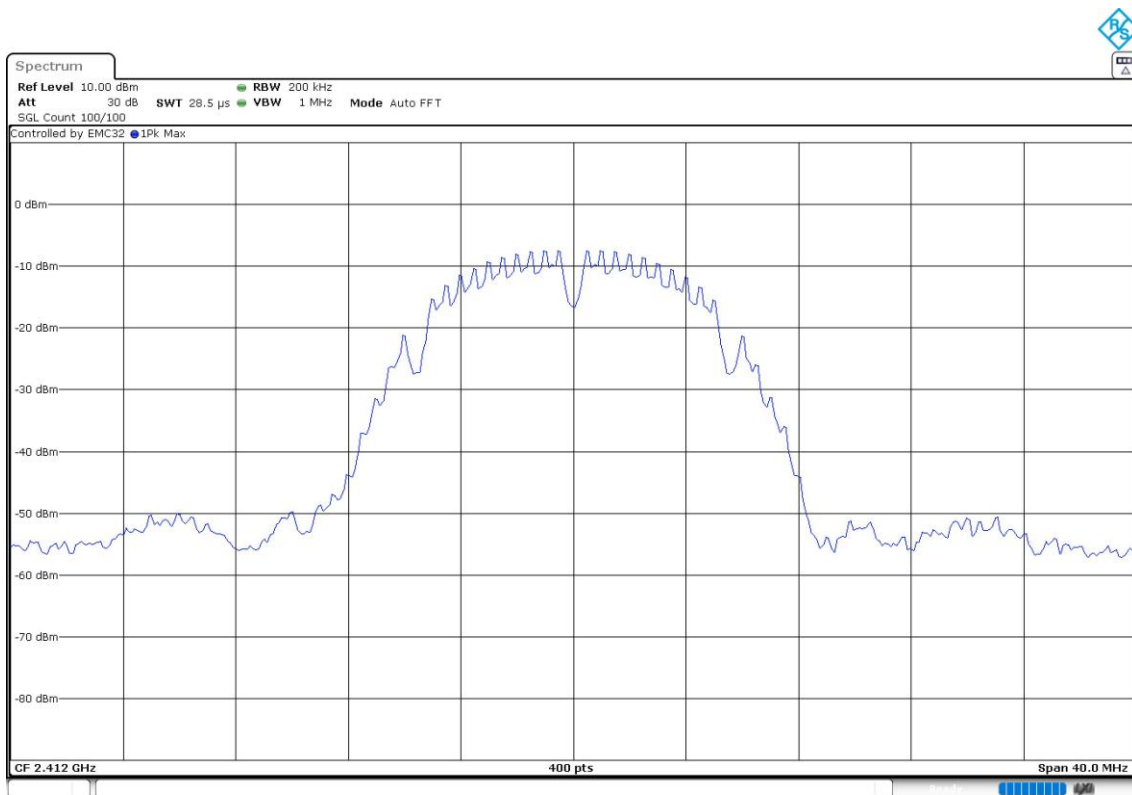
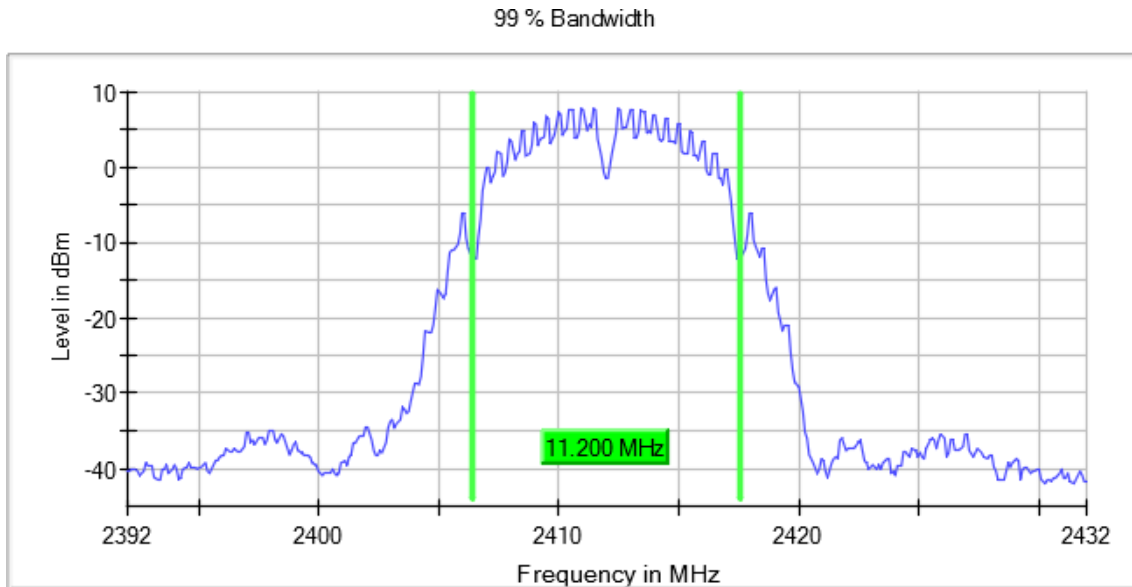
Equipment Type = Digital Transmission System (DTS)

Bandwidth MHz = 20

Modulation = 802.11b (DSSS 1 Mbit/s)

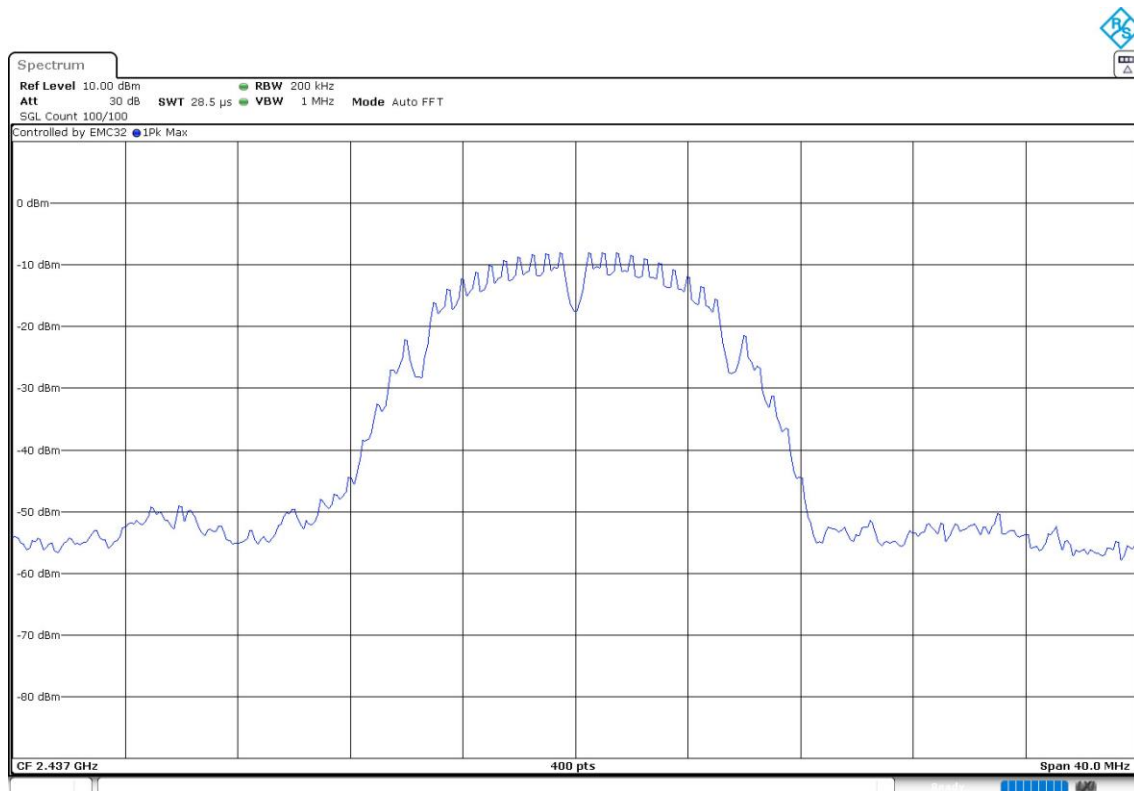
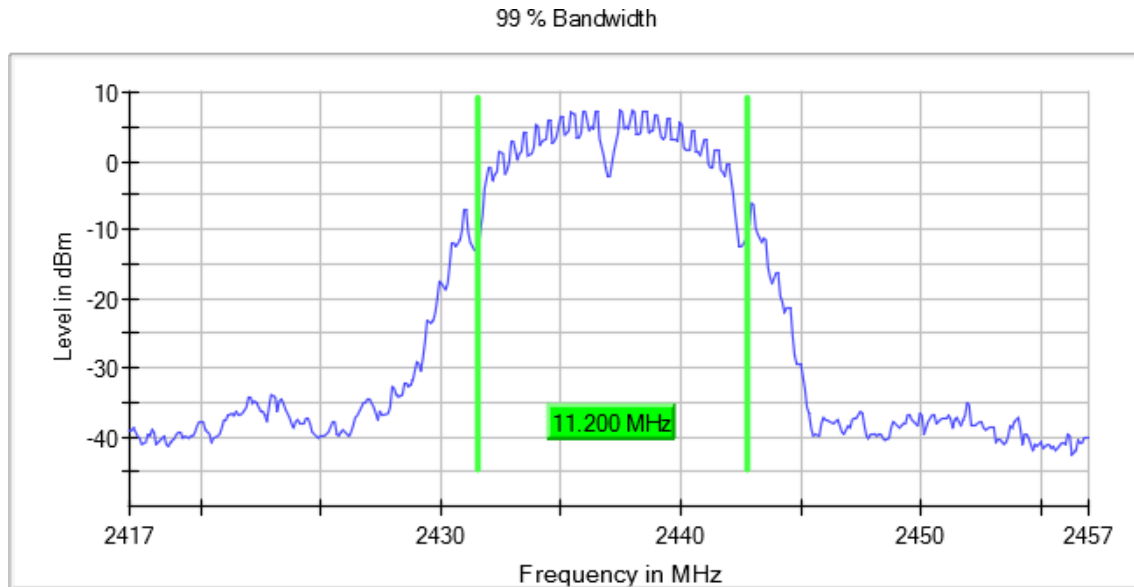
Number of Transmission Chains = 1 Active Port = 1

Images:



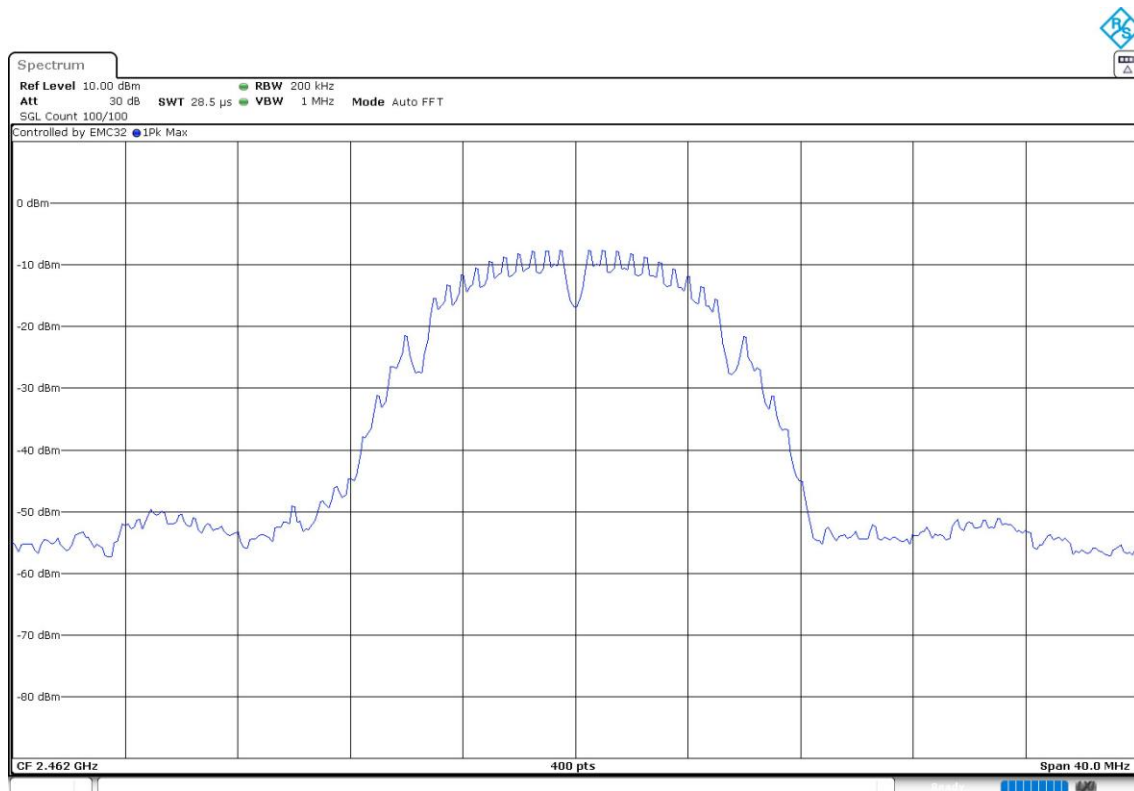
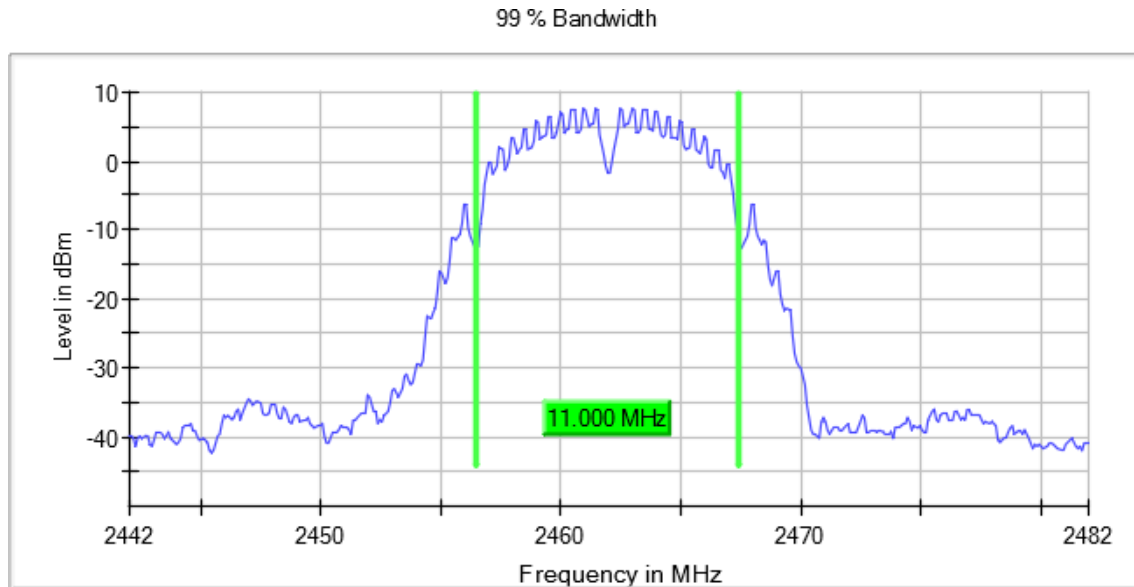
Frequency MHz = 2437.00000 Equipment Type = Digital Transmission System (DTS)
 Bandwidth MHz = 20 Modulation = 802.11b (DSSS 1 Mbit/s)
 Number of Transmission Chains = 1 Active Port = 1

Images:



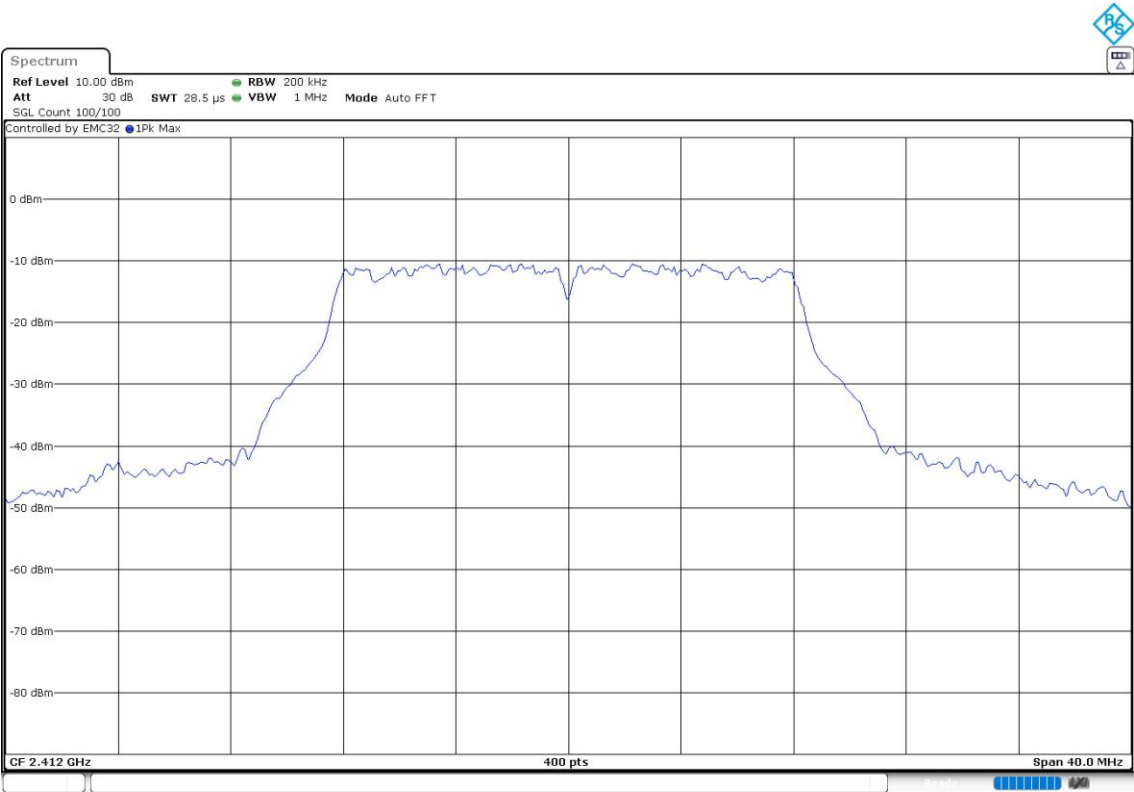
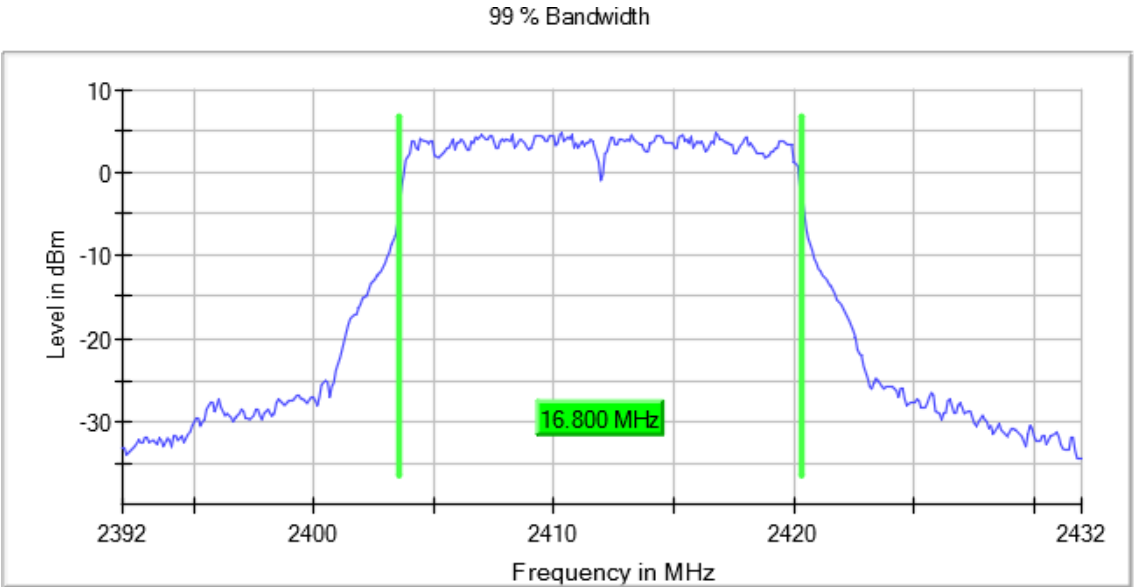
Frequency MHz = 2462.00000 Equipment Type = Digital Transmission System (DTS)
 Bandwidth MHz = 20 Modulation = 802.11b (DSSS 1 Mbit/s)
 Number of Transmission Chains = 1 Active Port = 1

Images:



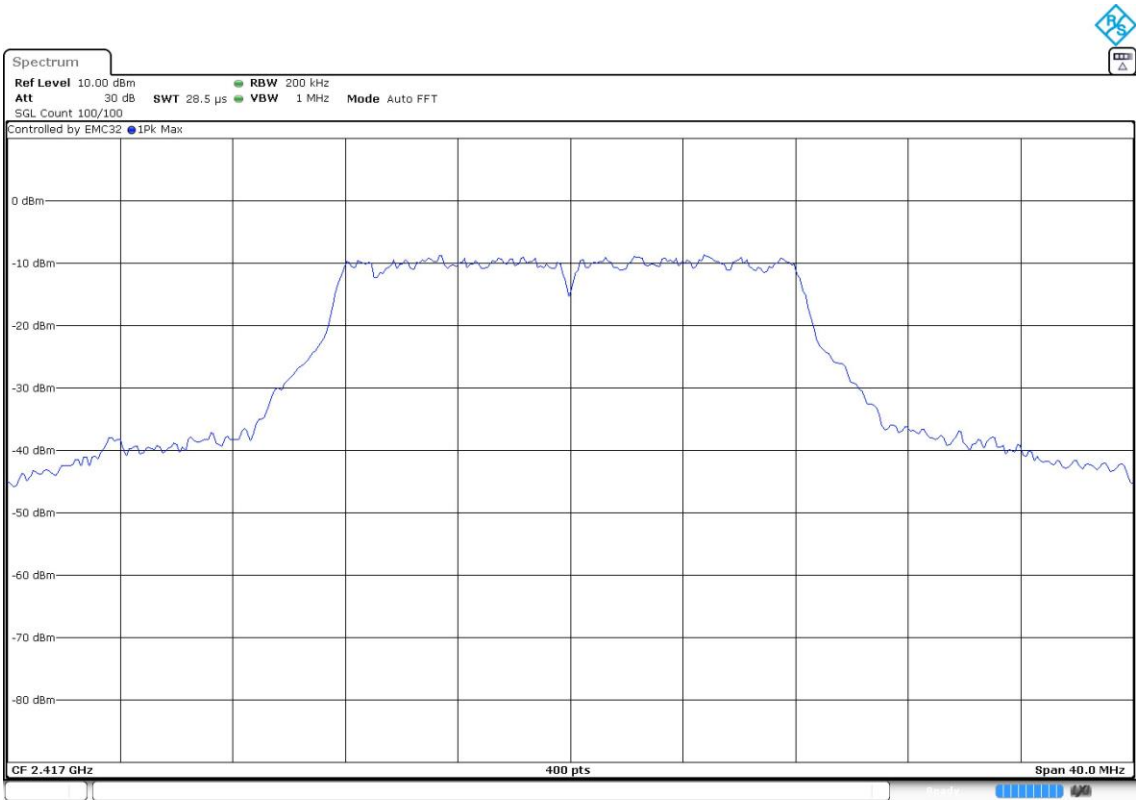
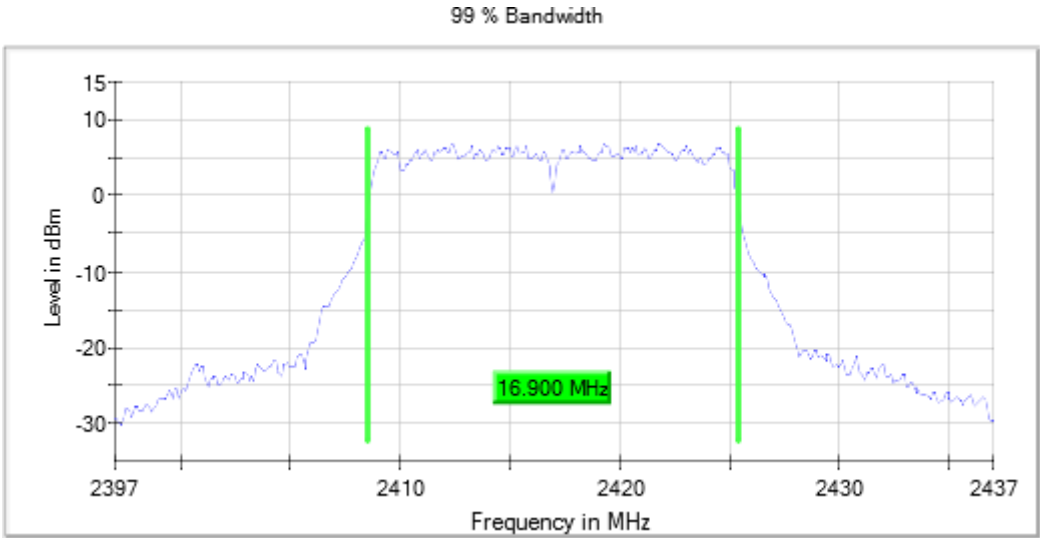
Frequency MHz = 2412.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



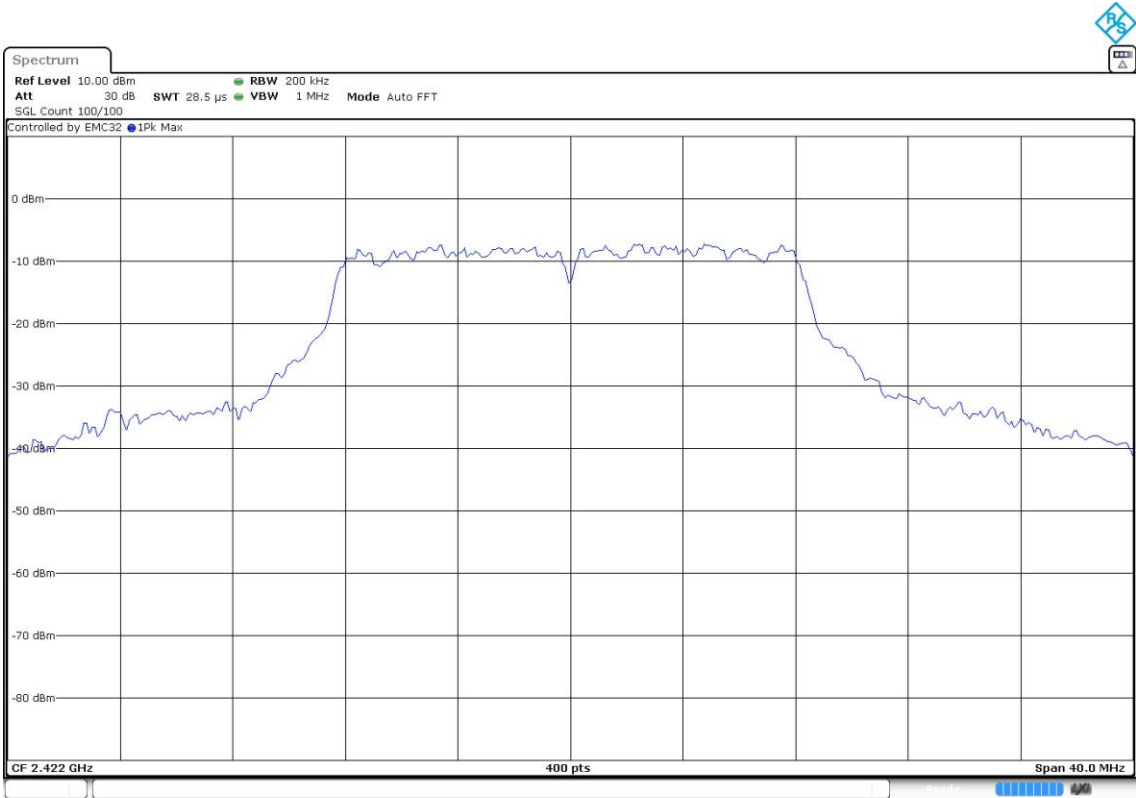
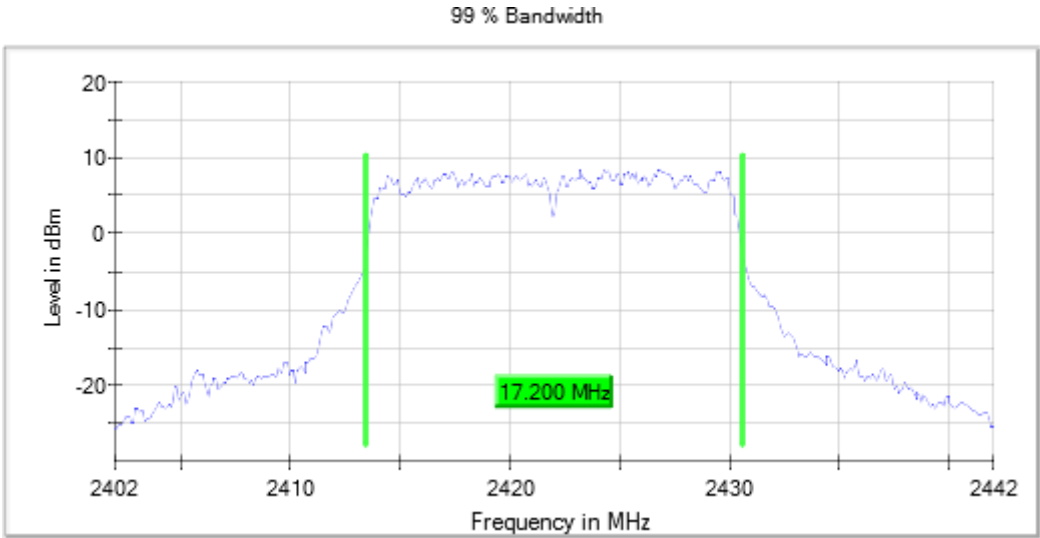
Frequency MHz = 2417.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



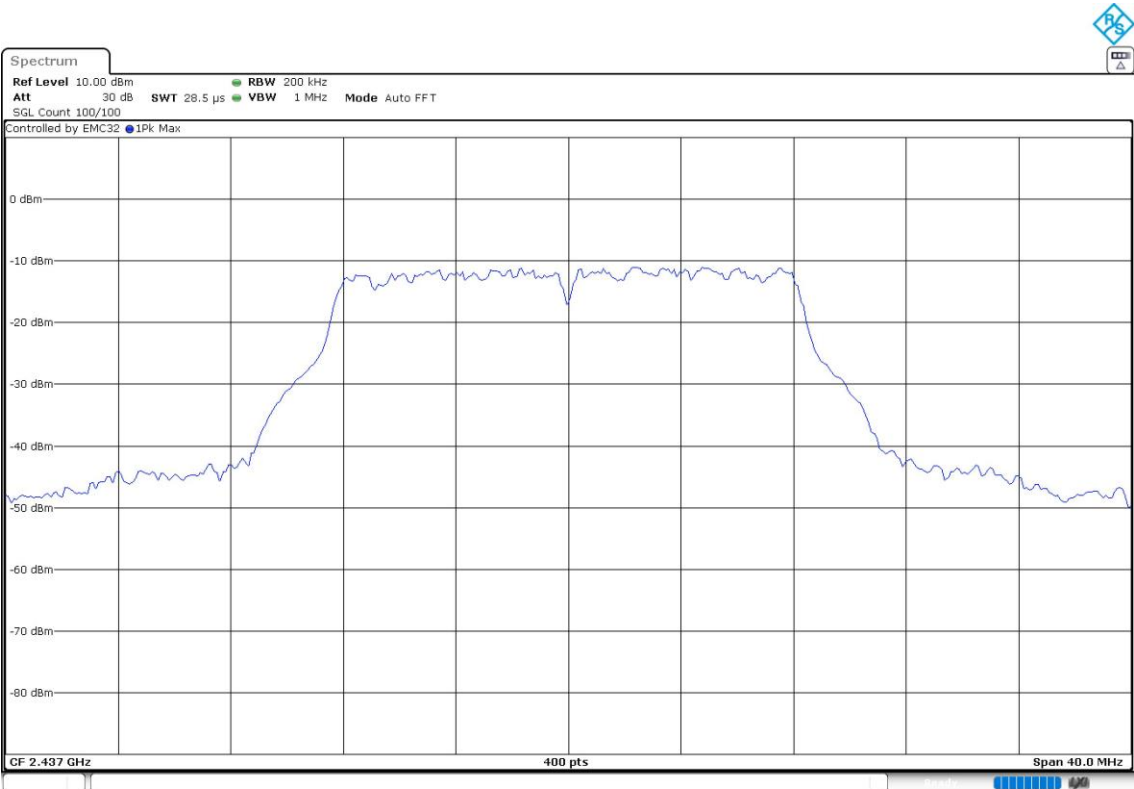
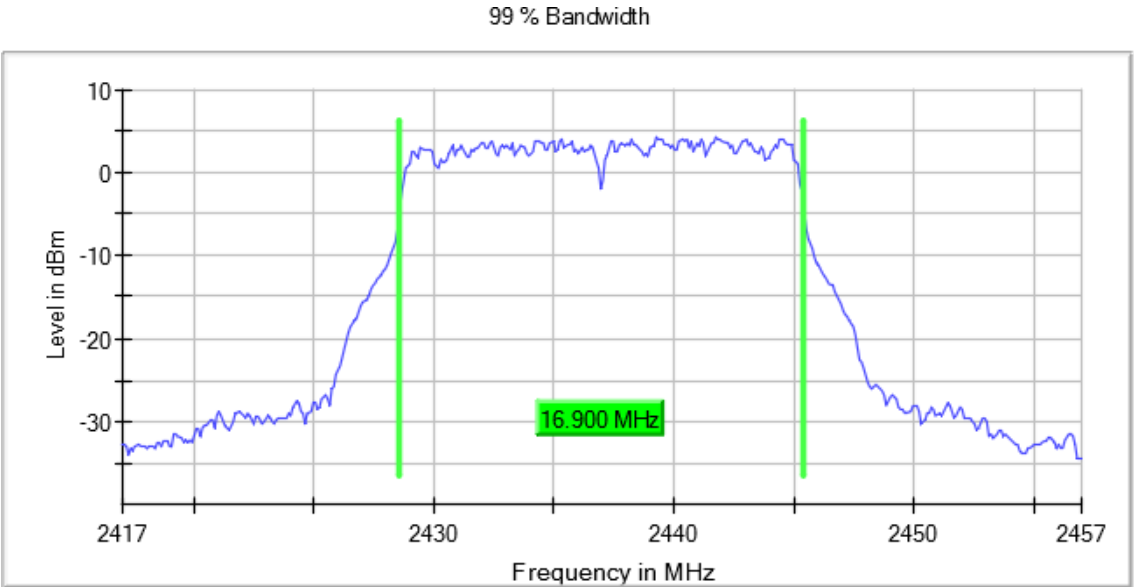
Frequency MHz = 2422.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



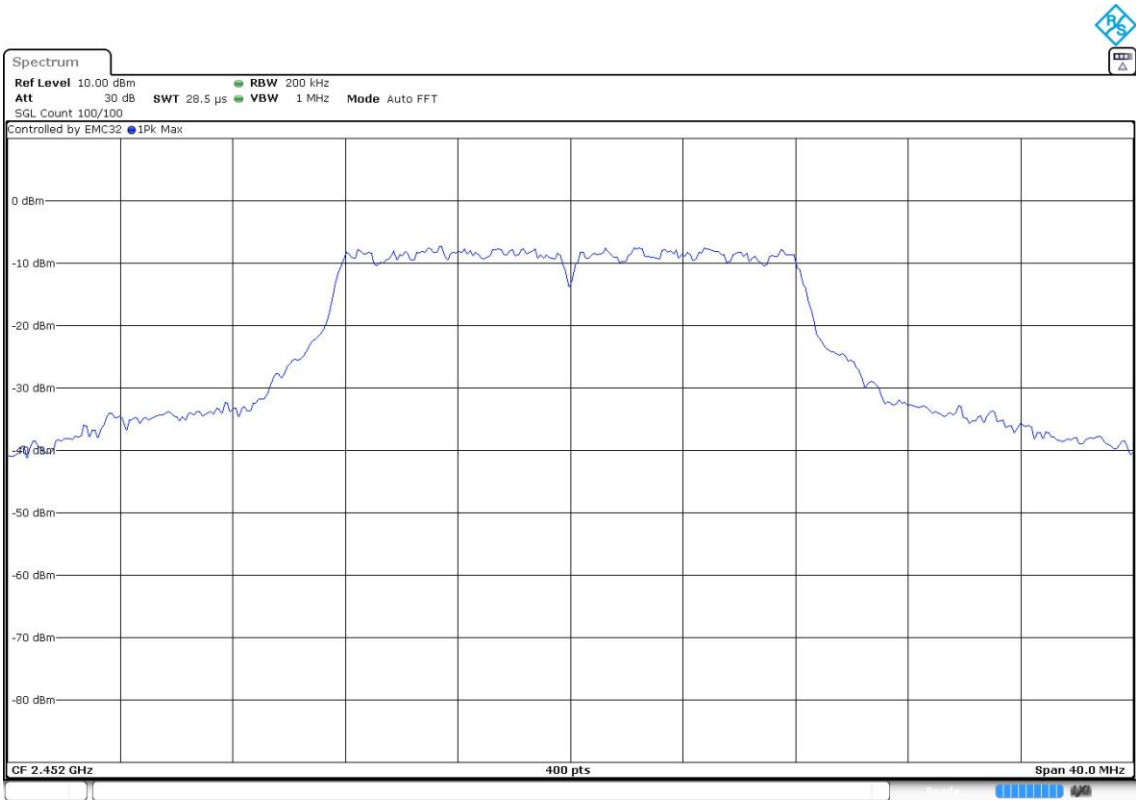
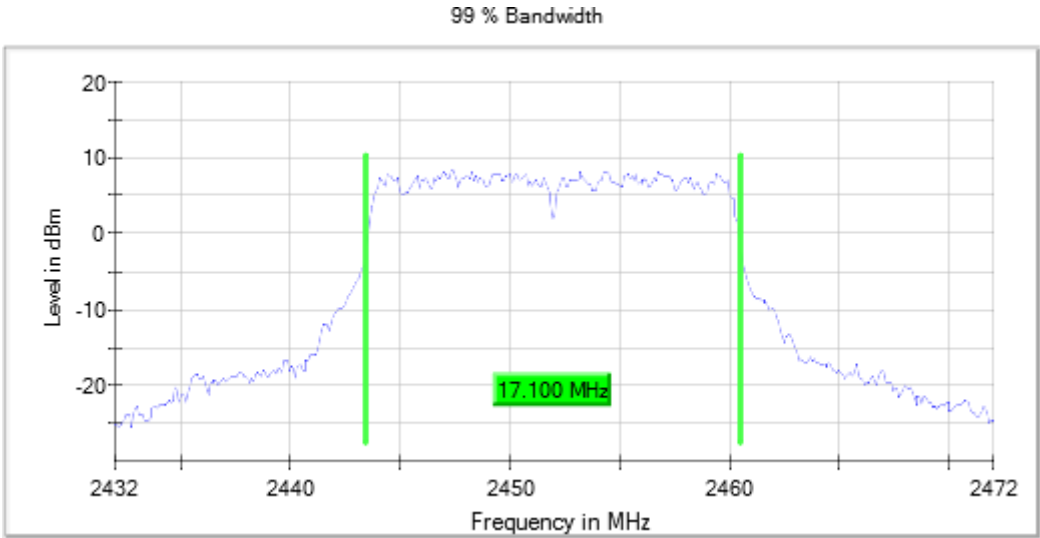
Frequency MHz = 2437.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



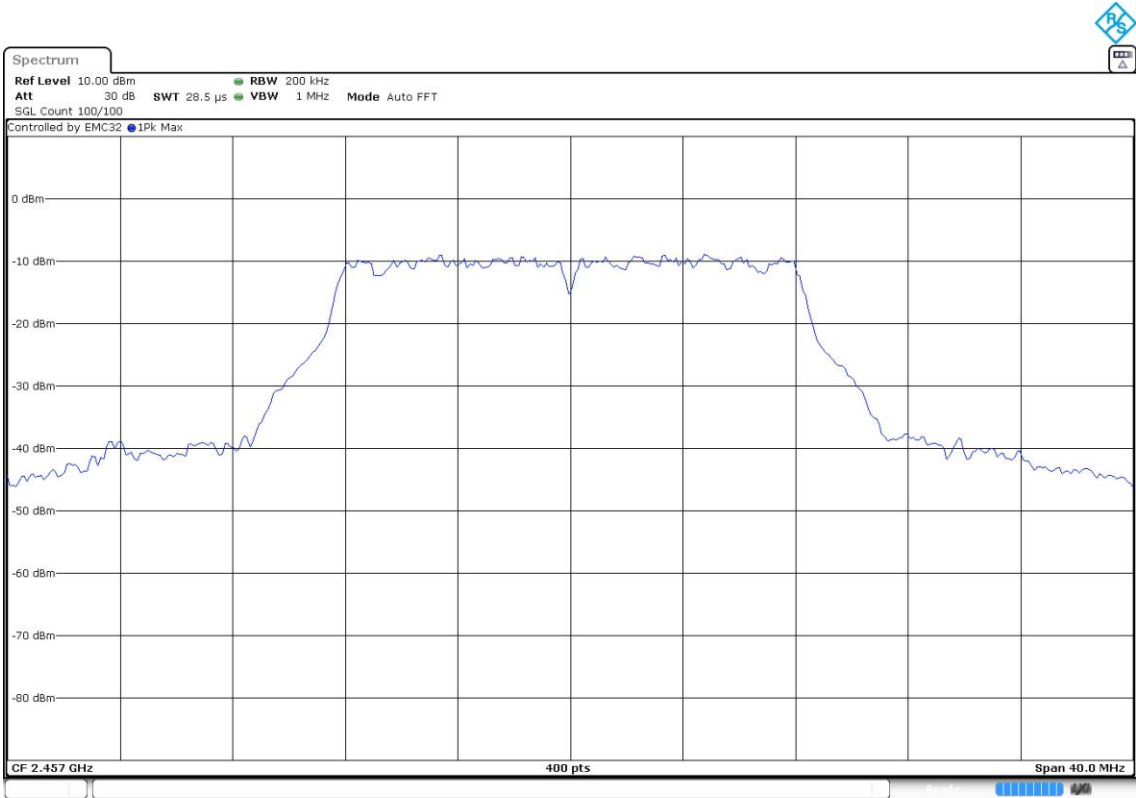
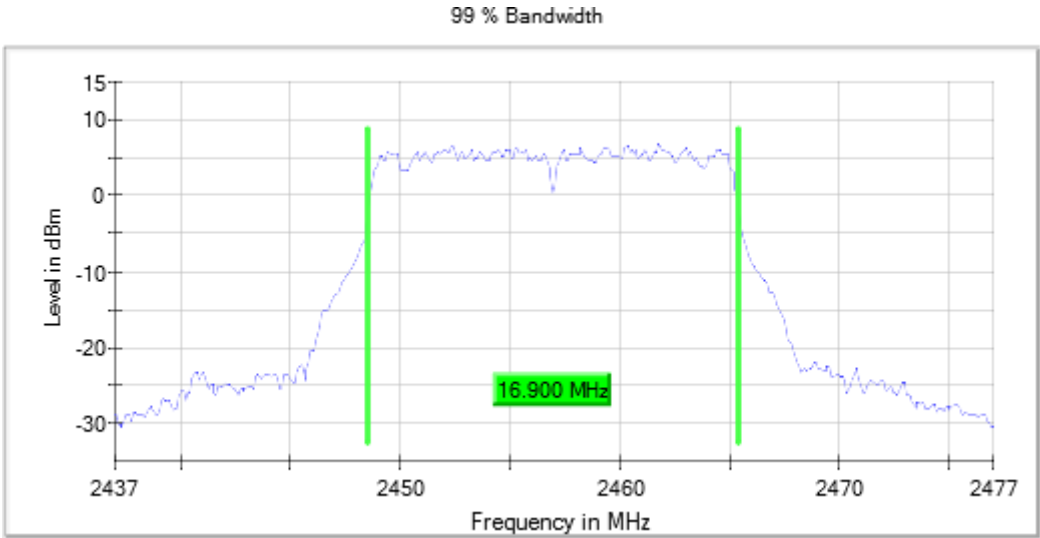
Frequency MHz = 2452.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



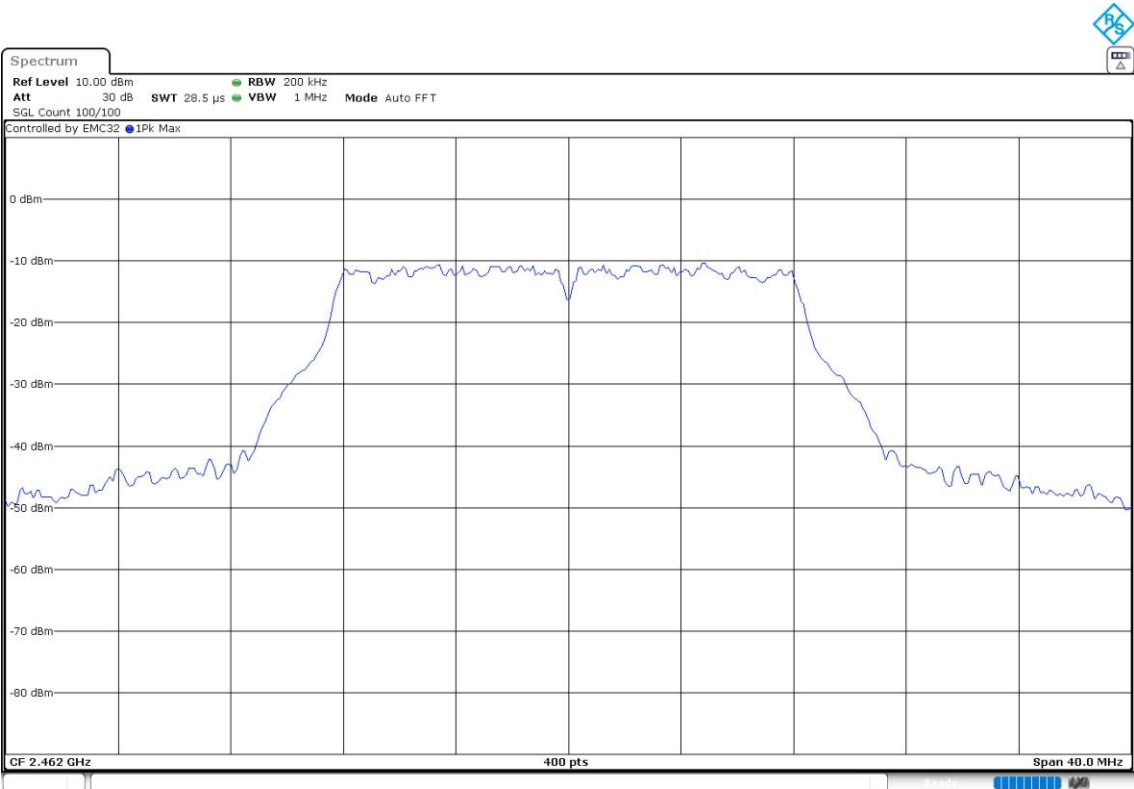
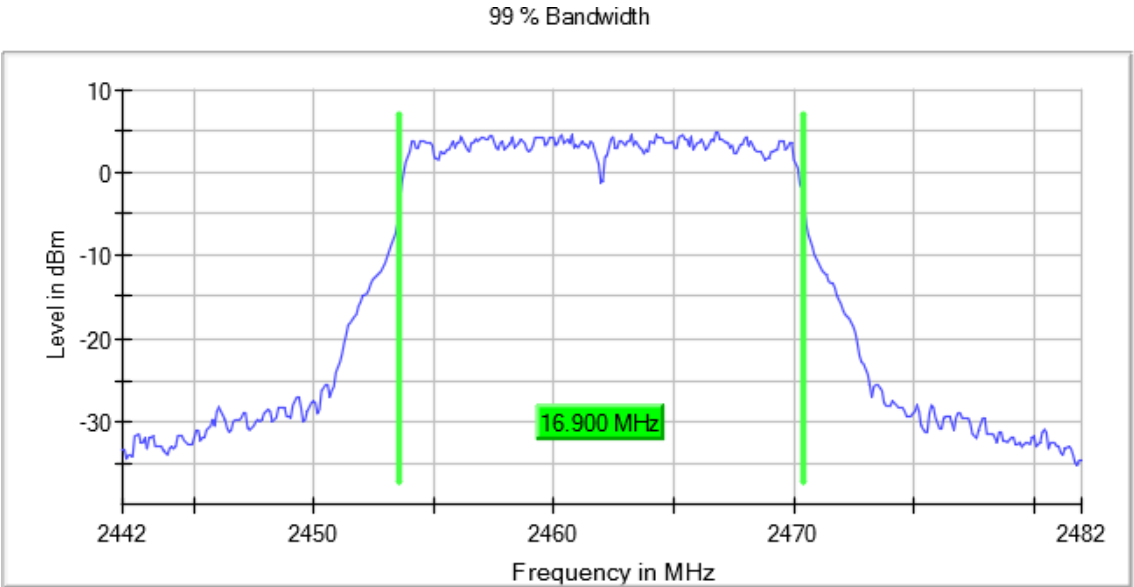
Frequency MHz = 2457.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



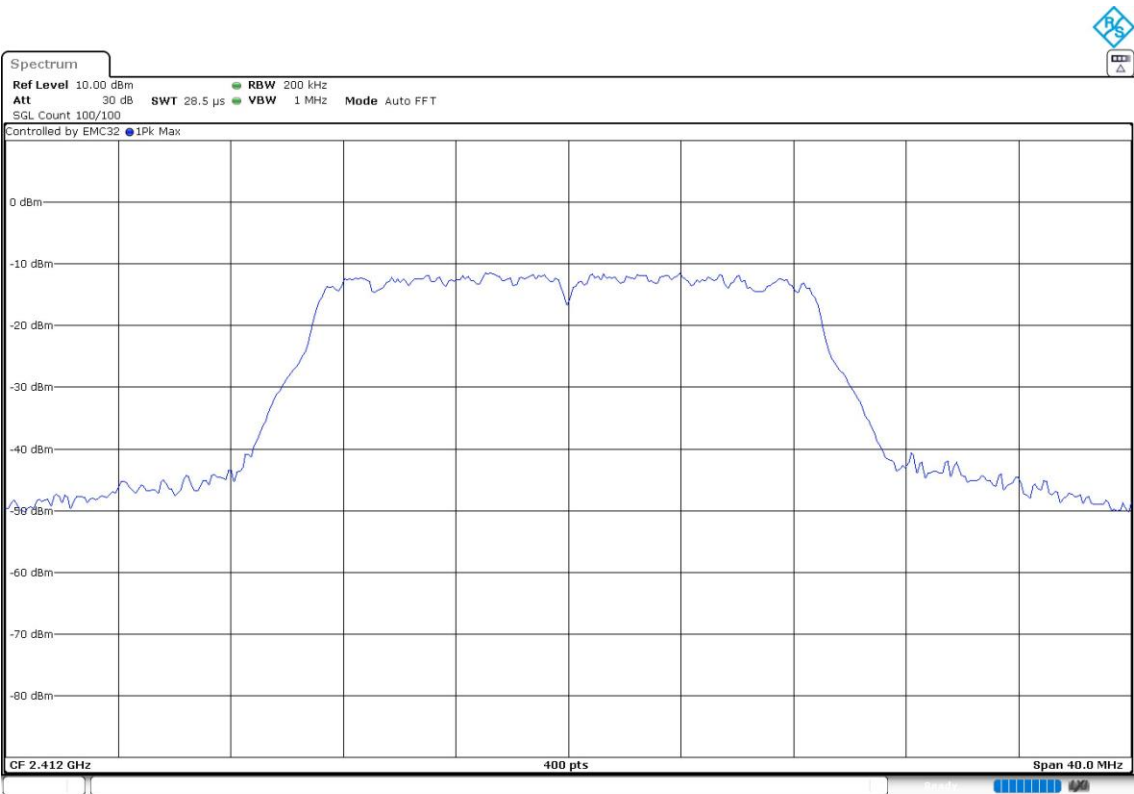
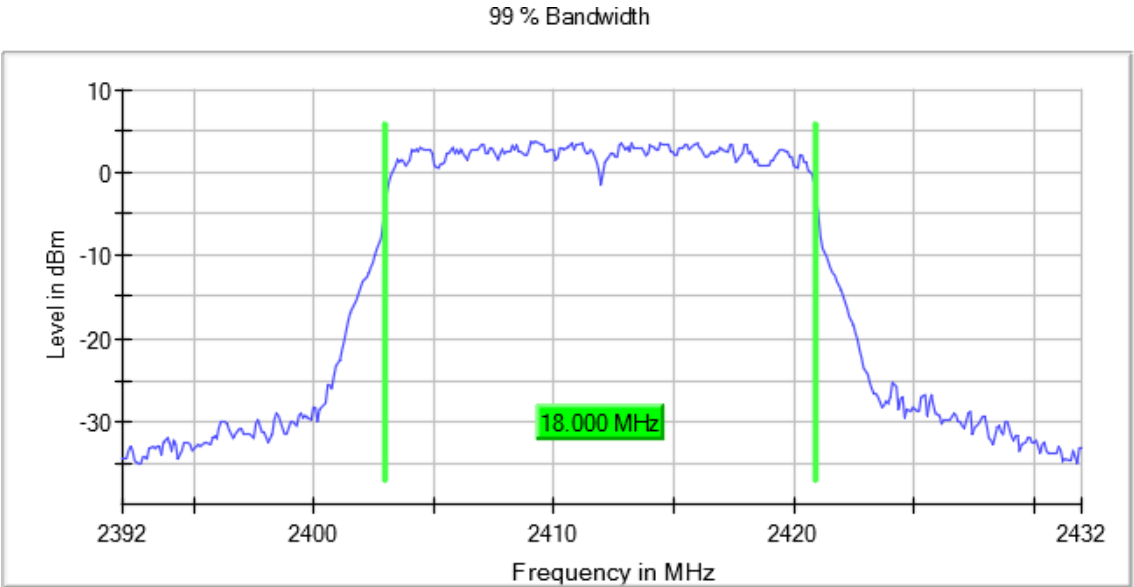
Frequency MHz = 2462.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



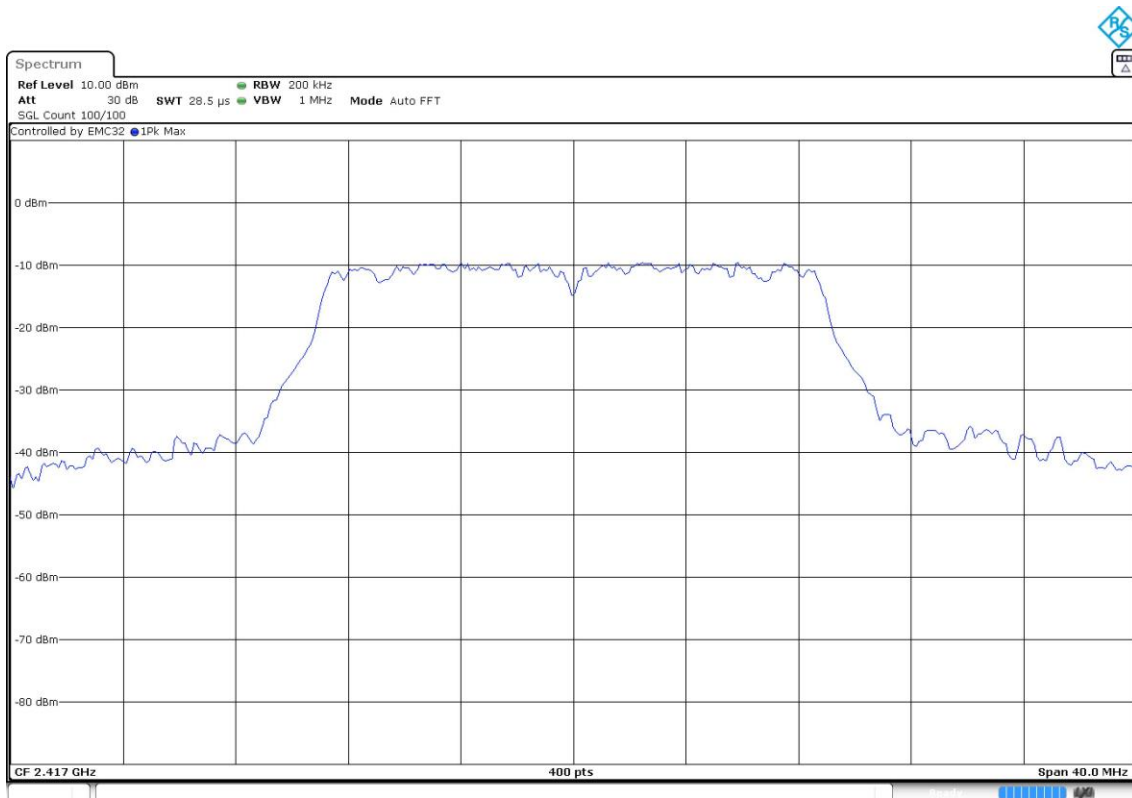
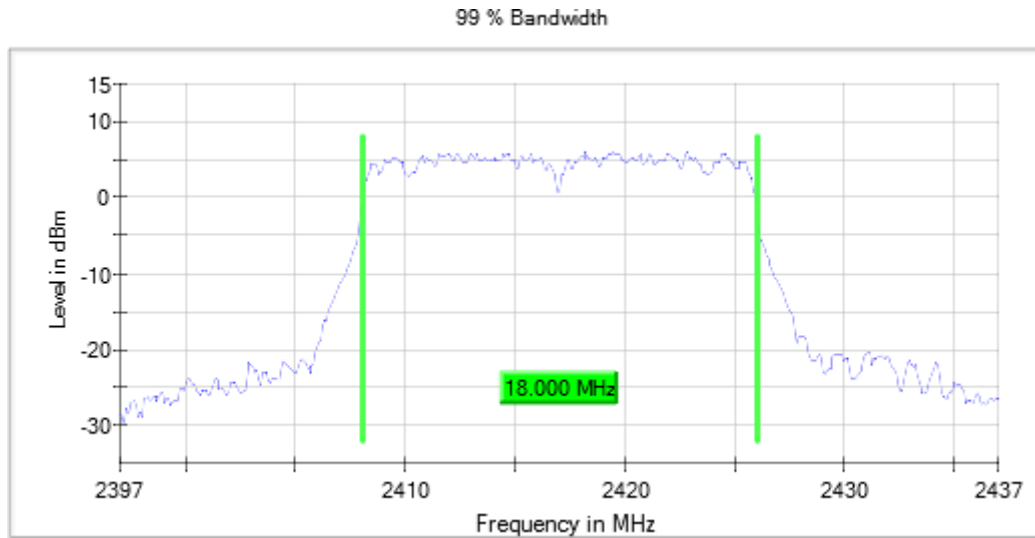
Frequency MHz = 2412.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



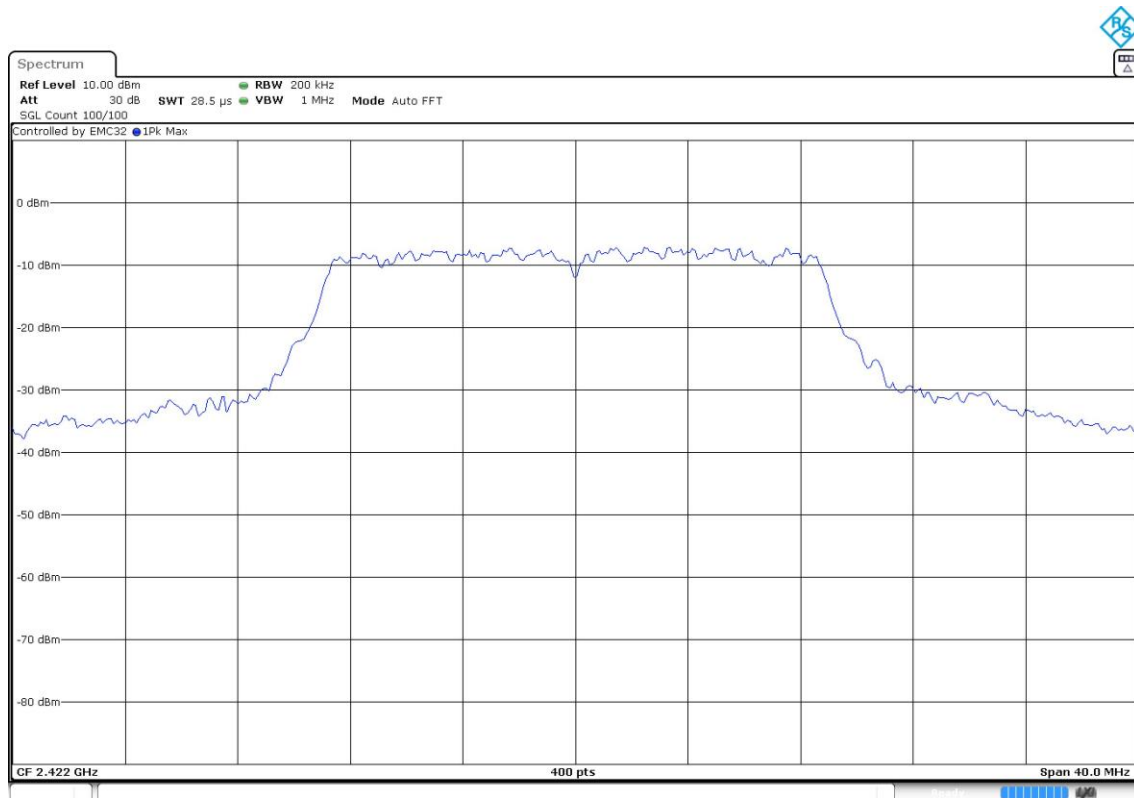
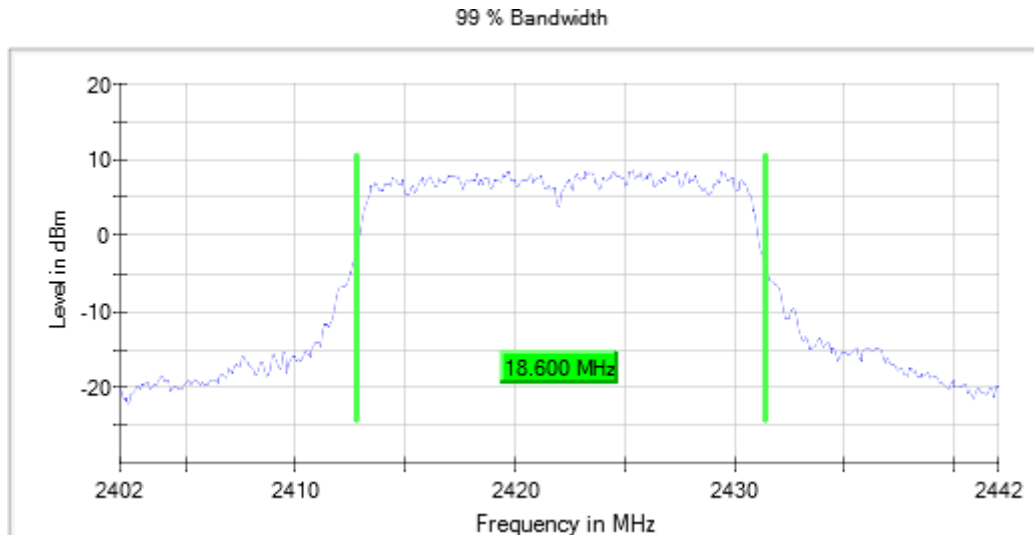
Frequency MHz = 2417.00000 Equipment Type = Digital Transmission System (DTS)
 Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
 Number of Transmission Chains = 1 Active Port = 1

Images:



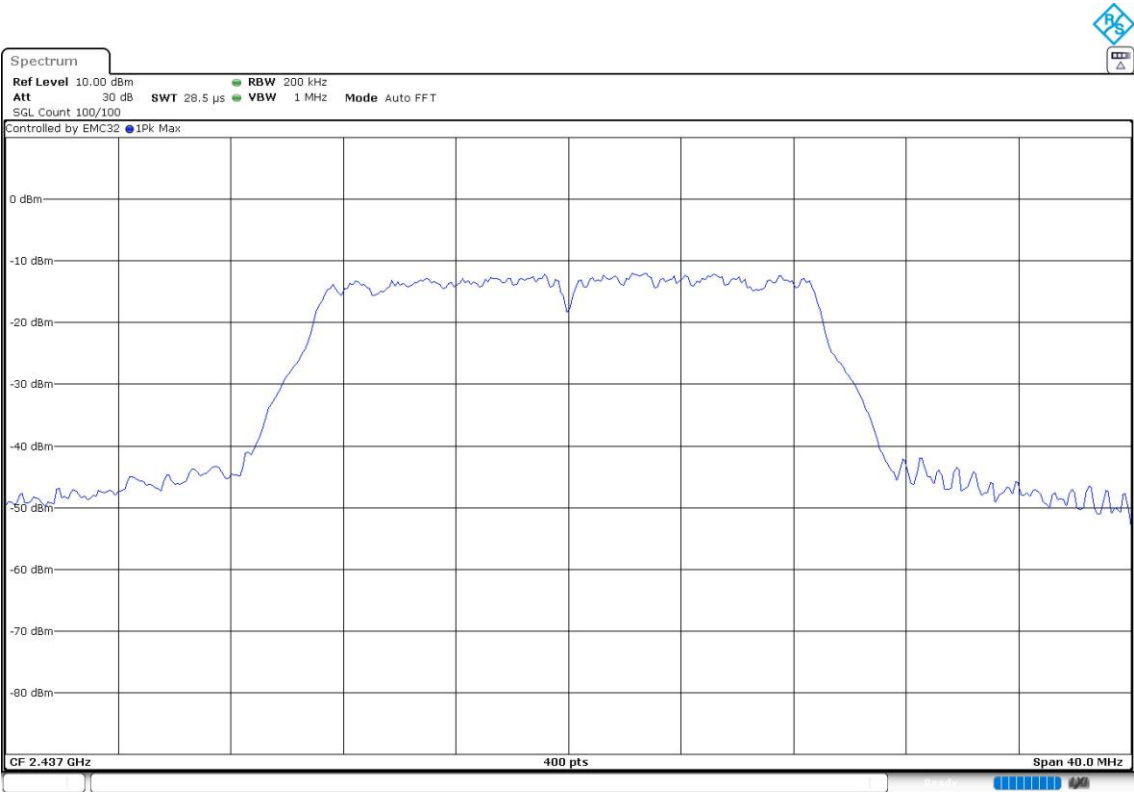
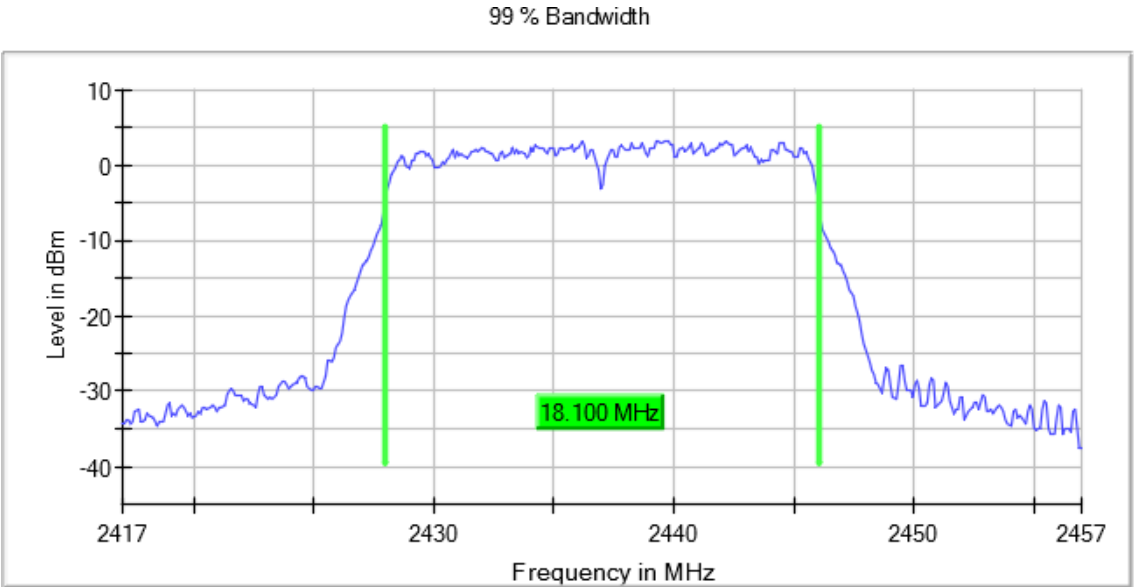
Frequency MHz = 2422.00000 Equipment Type = Digital Transmission System (DTS)
 Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
 Number of Transmission Chains = 1 Active Port = 1

Images:



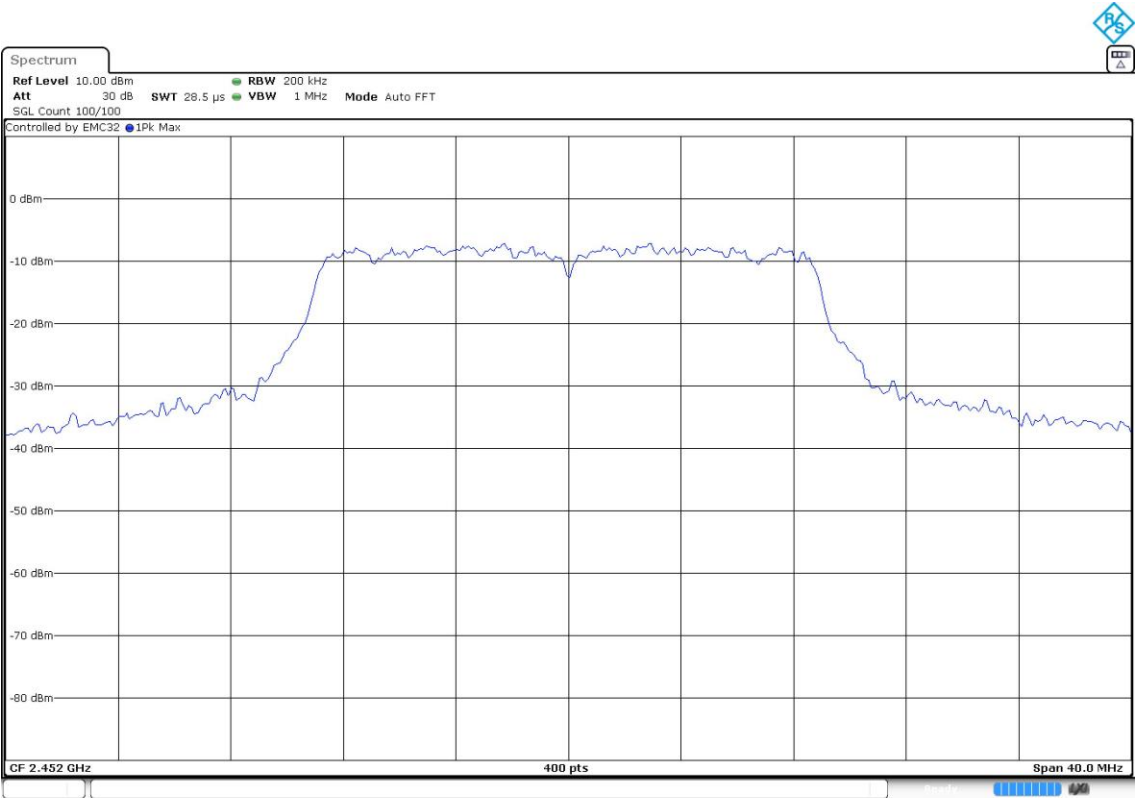
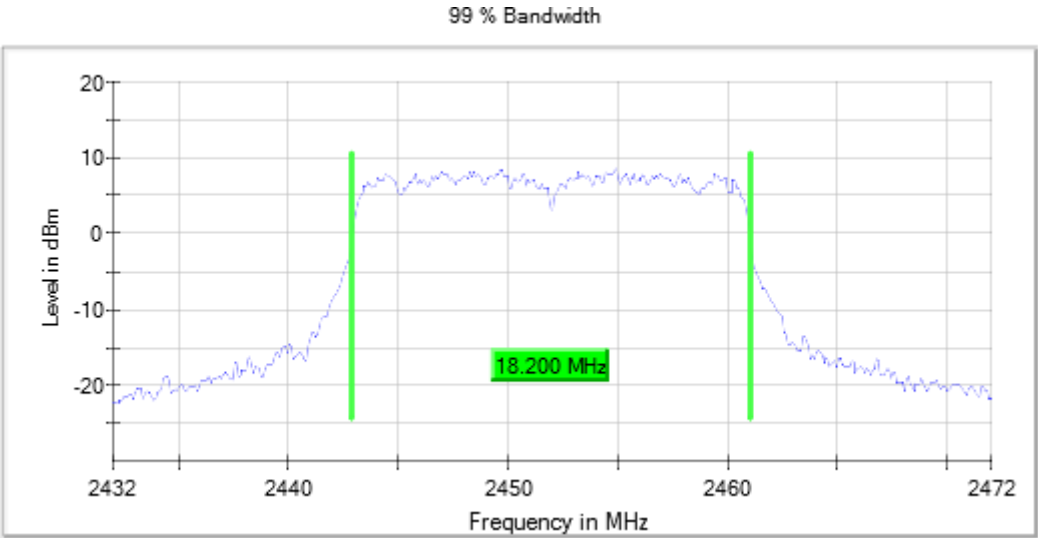
Frequency MHz = 2437.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



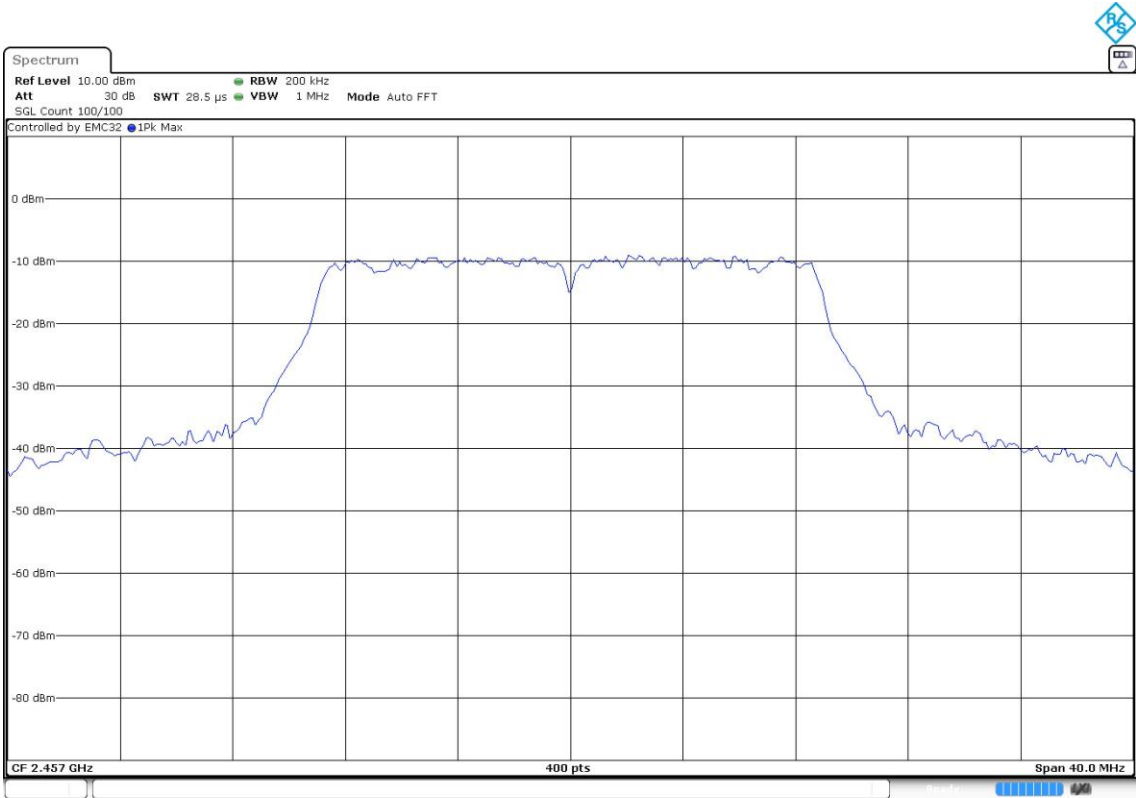
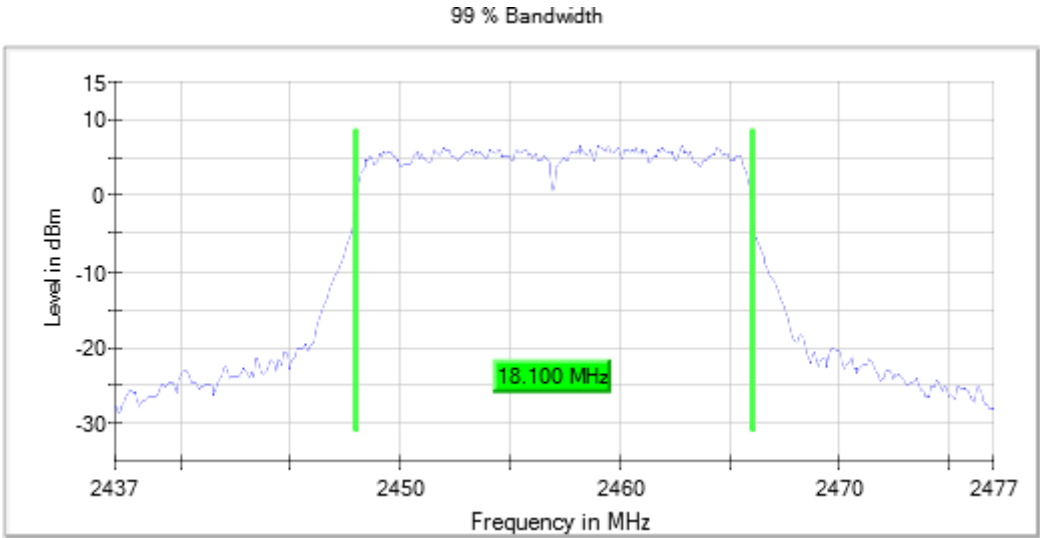
Frequency MHz = 2452.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



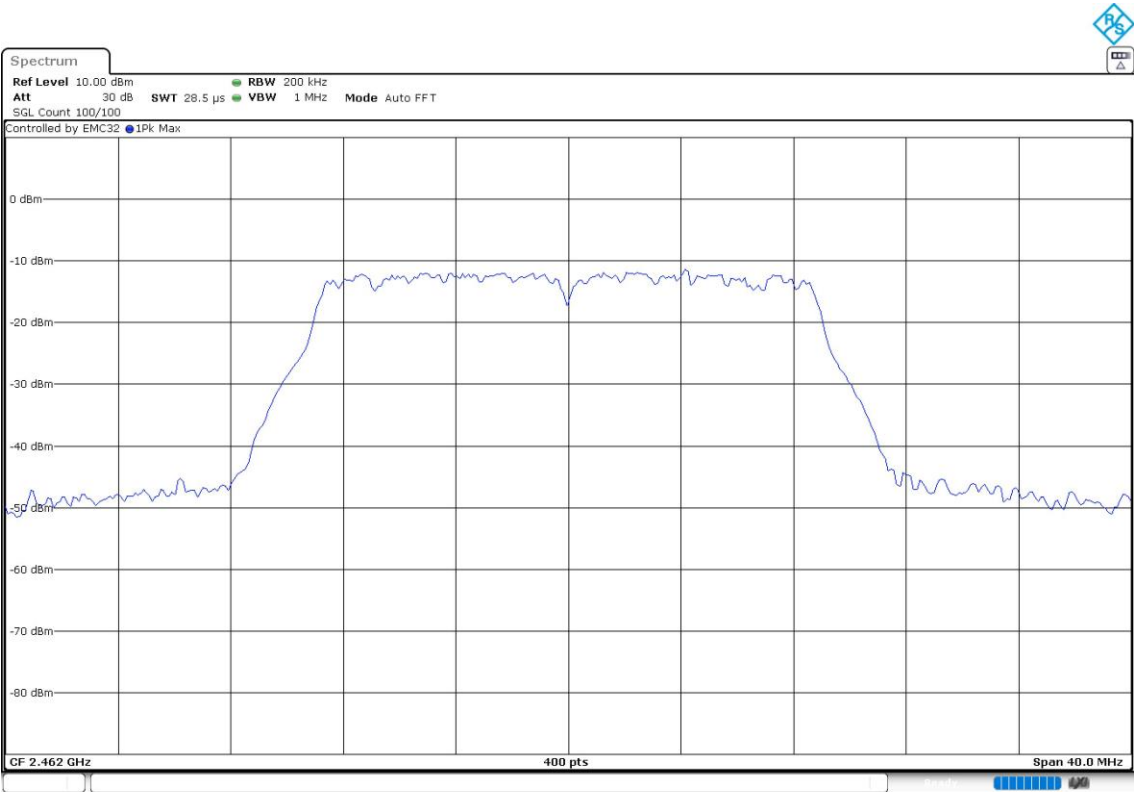
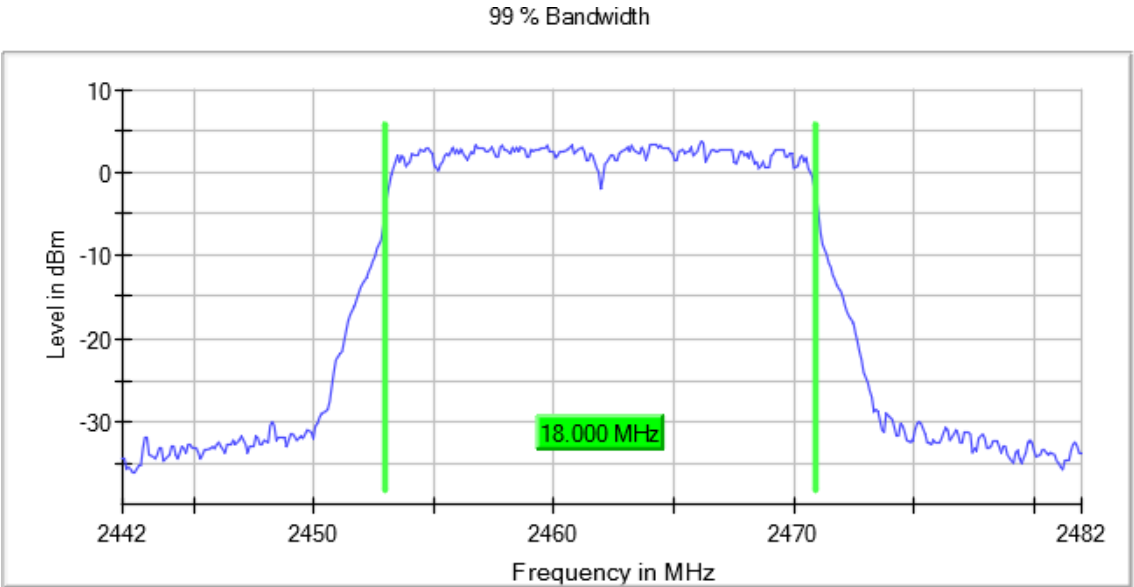
Frequency MHz = 2457.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



Frequency MHz = 2462.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



RSS-247 5.2 (a) / FCC 15.247 (a) 6 dB Bandwidth

Limits

The minimum 6 dB bandwidth shall be at least 500 kHz.

Results

Modulation: 802.11b (DSSS 1 Mbit/s)

Freq (MHz)	# of Tx Chains	Port	Ebw (MHz)
2412.00	1	1	9.10
2437.00			8.65
2462.00			9.10

Modulation: 802.11g (OFDM 6 Mbit/s)

Freq (MHz)	# of Tx Chains	Port	Ebw (MHz)
2412.00	1	1	16.45
2417.00			16.45
2422.00			16.45
2437.00			16.45
2452.00			16.50
2457.00			16.45
2462.00			16.50

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

Freq (MHz)	# of Tx Chains	Port	Ebw (MHz)
2412.00	1	1	17.70
2417.00			17.70
2422.00			17.65
2437.00			17.75
2452.00			17.70
2457.00			17.70
2462.00			17.70

Verdict

Pass

Attachments

Frequency MHz = 2412.00000

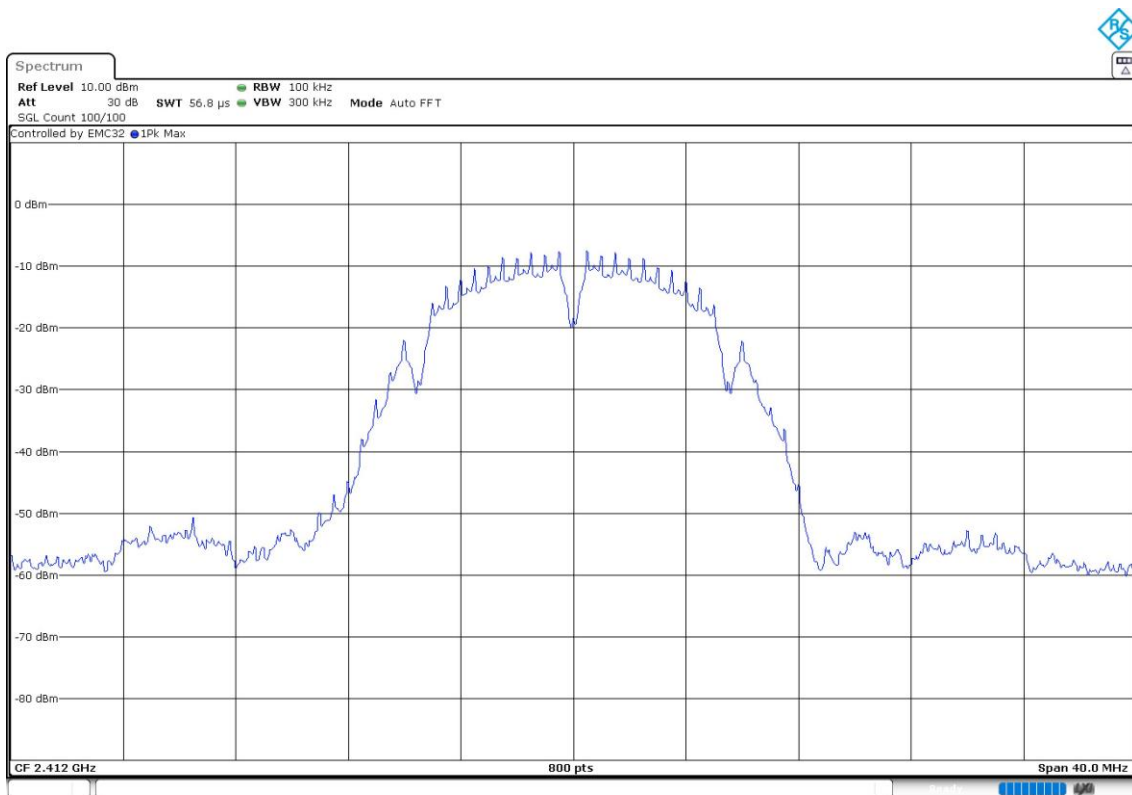
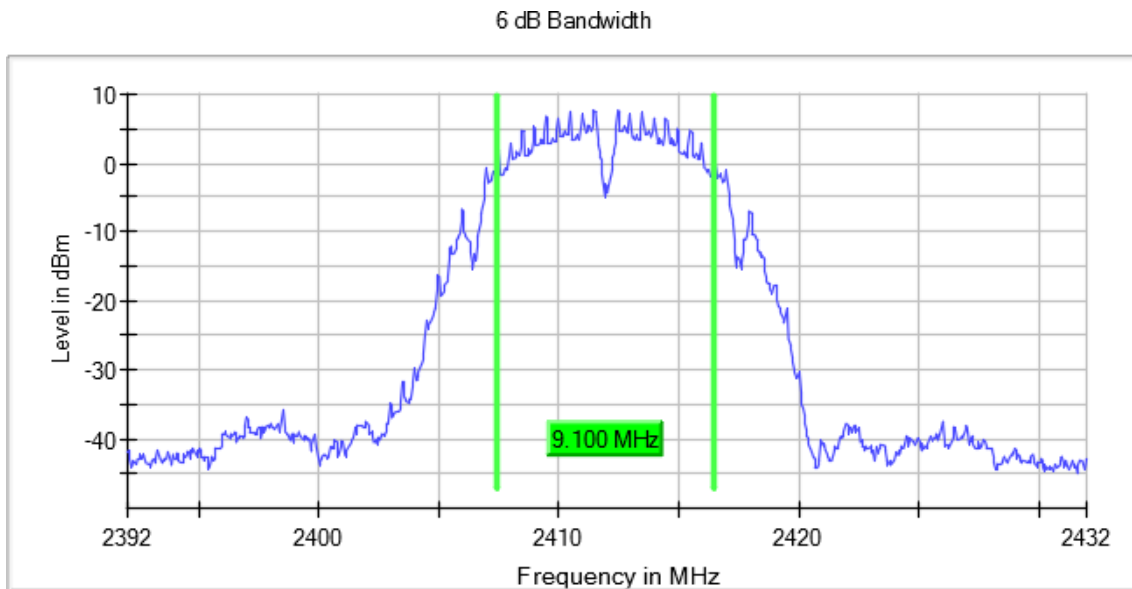
Bandwidth MHz = 20

Modulation = 802.11b (DSSS 1 Mbit/s)

Number of Transmission Chains = 1

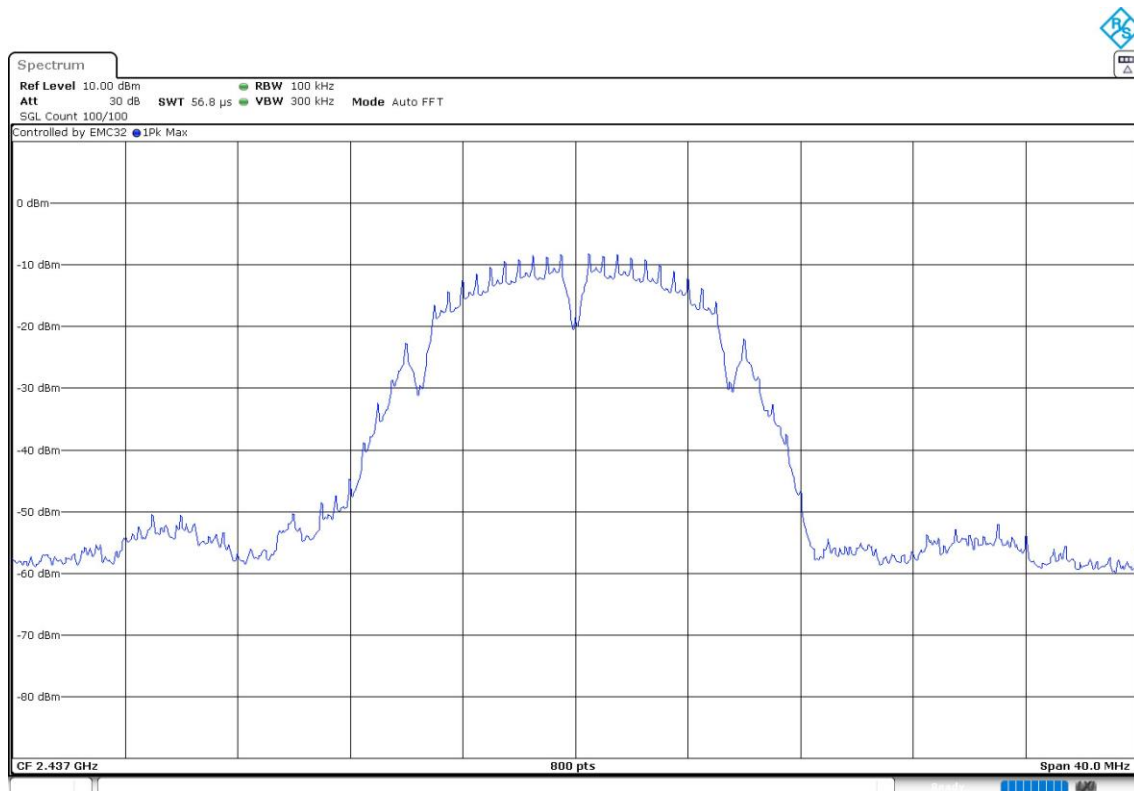
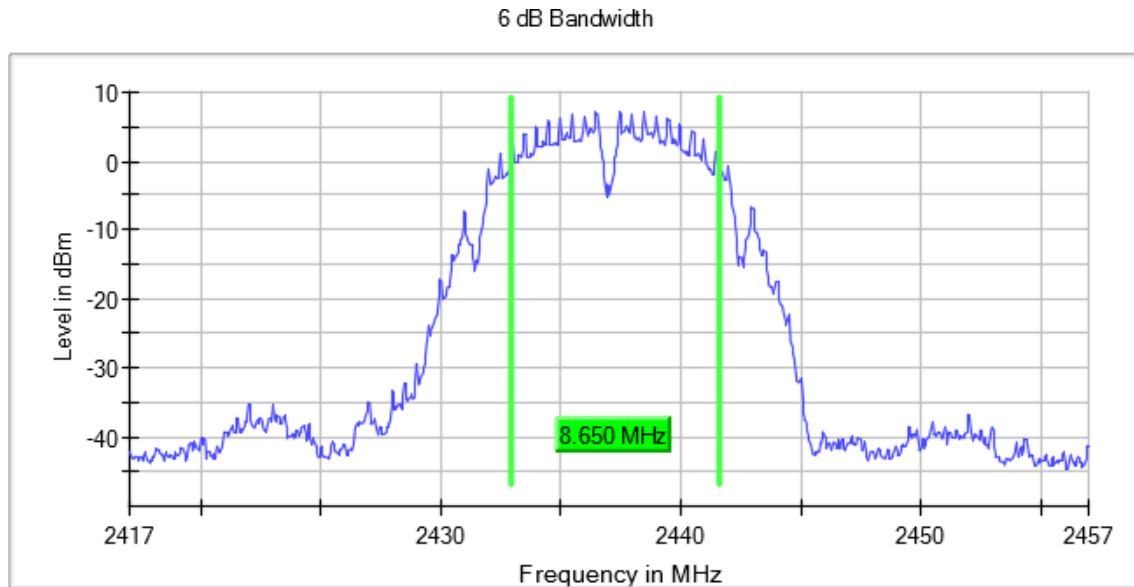
Active Port = 1

Images:



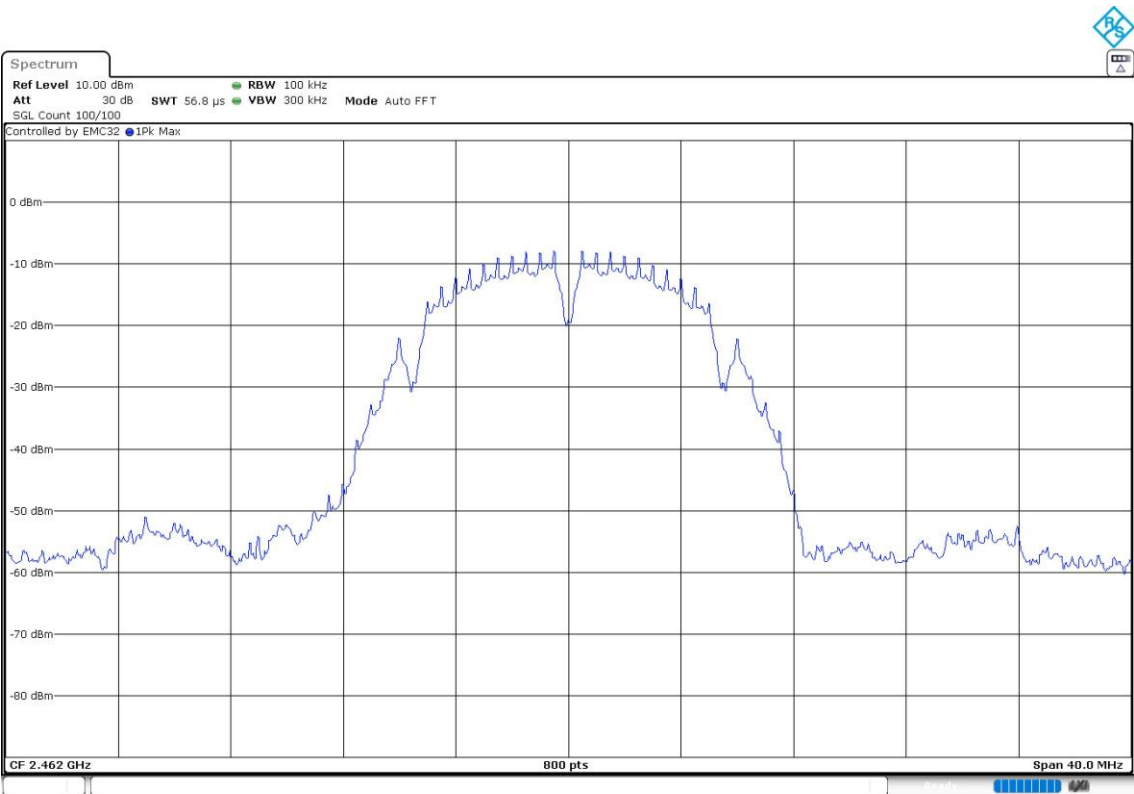
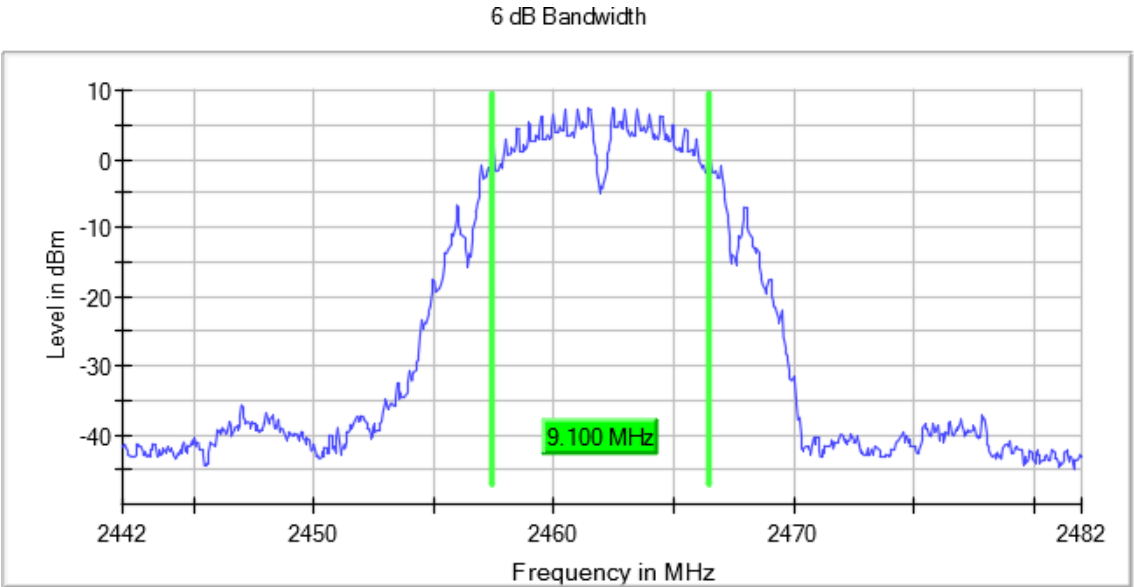
Frequency MHz = 2437.00000 Bandwidth MHz = 20
 Modulation = 802.11b (DSSS 1 Mbit/s) Number of Transmission Chains = 1
 Active Port = 1

Images:



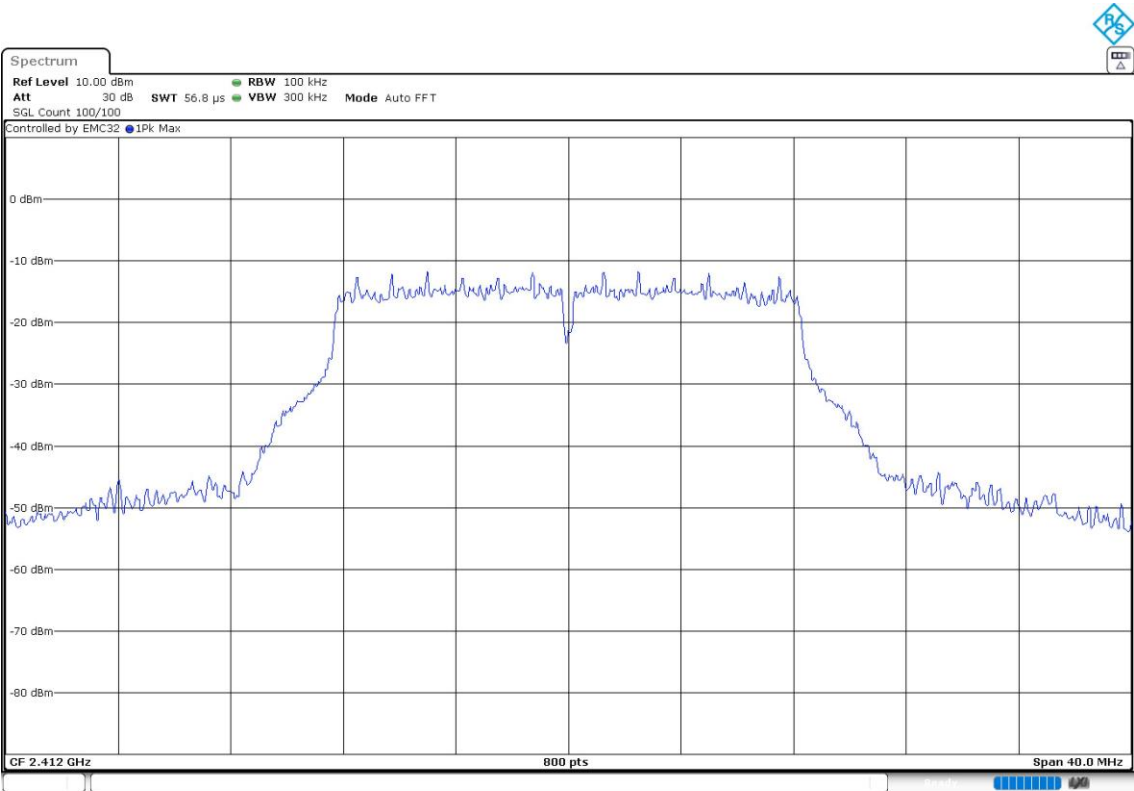
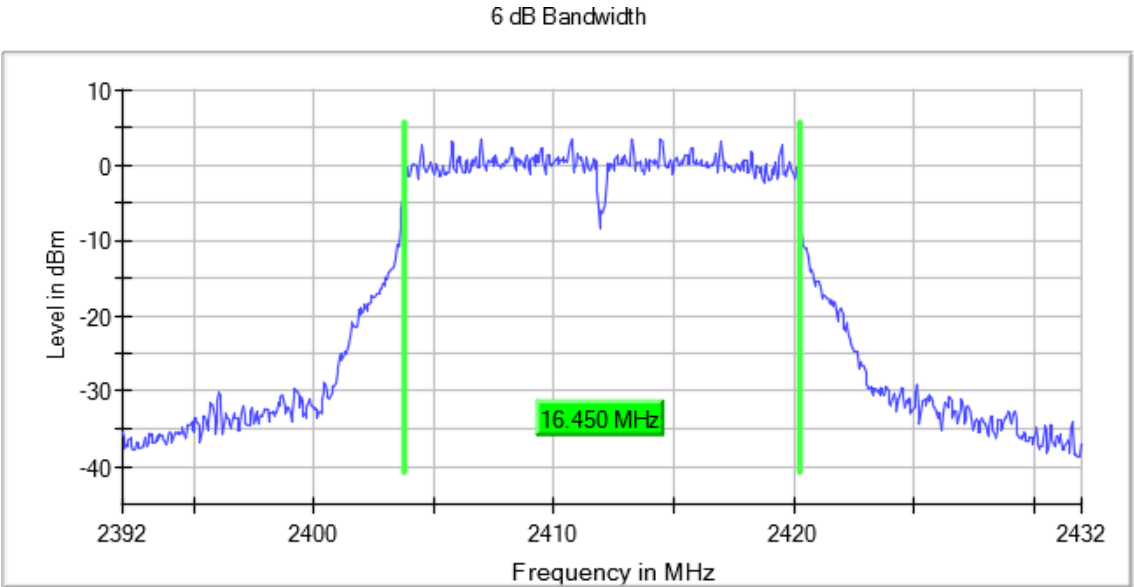
Frequency MHz = 2462.00000 Bandwidth MHz = 20
Modulation = 802.11b (DSSS 1 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



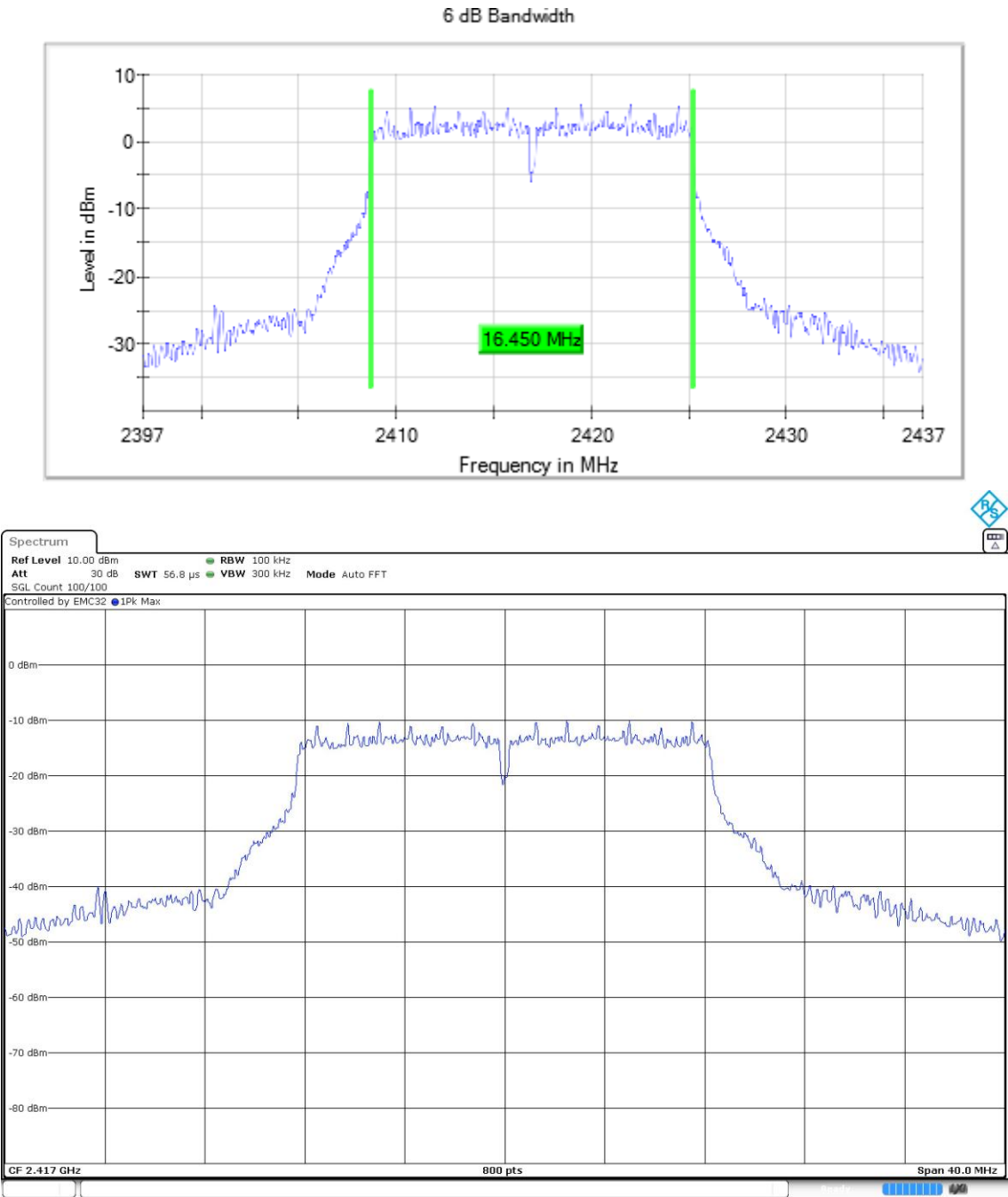
Frequency MHz = 2412.00000 Bandwidth MHz = 20
Modulation = 802.11g (OFDM 6 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



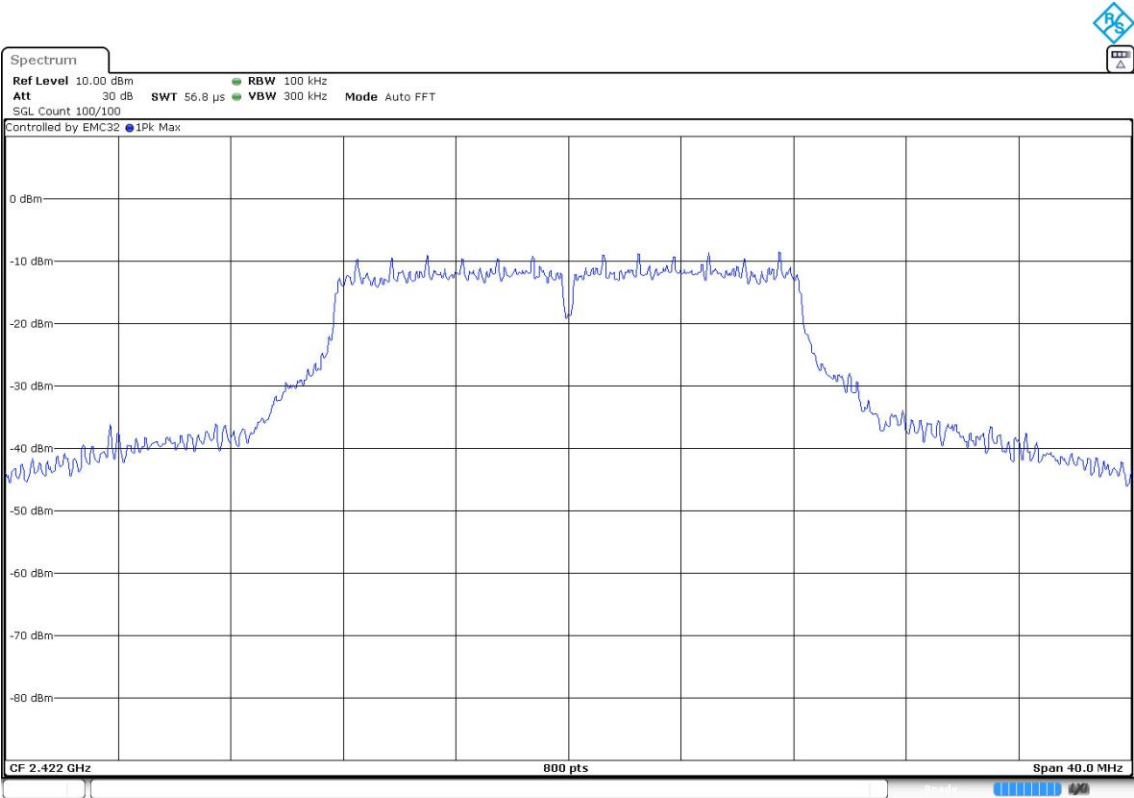
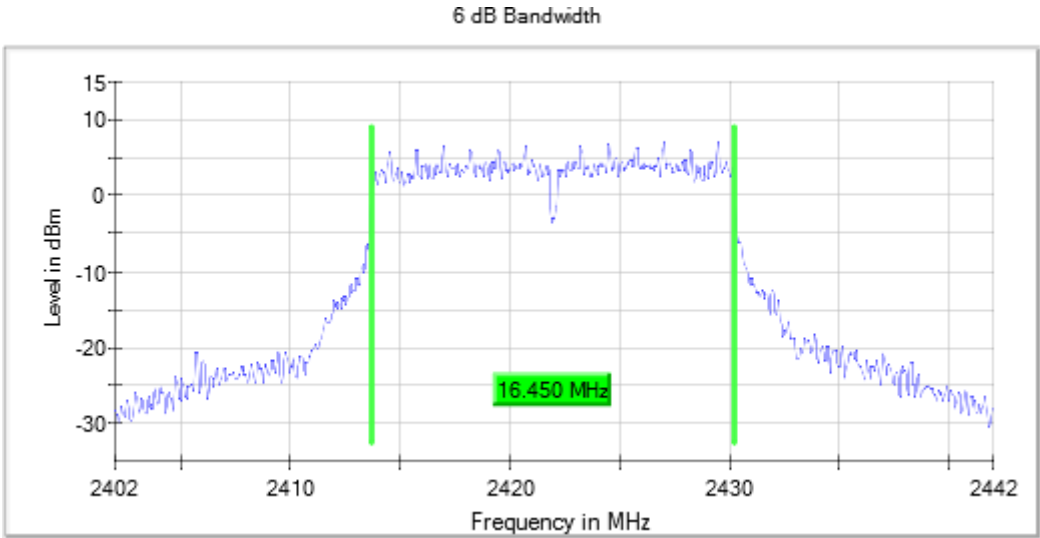
Frequency MHz = 2417.00000 Bandwidth MHz = 20
Modulation = 802.11g (OFDM 6 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



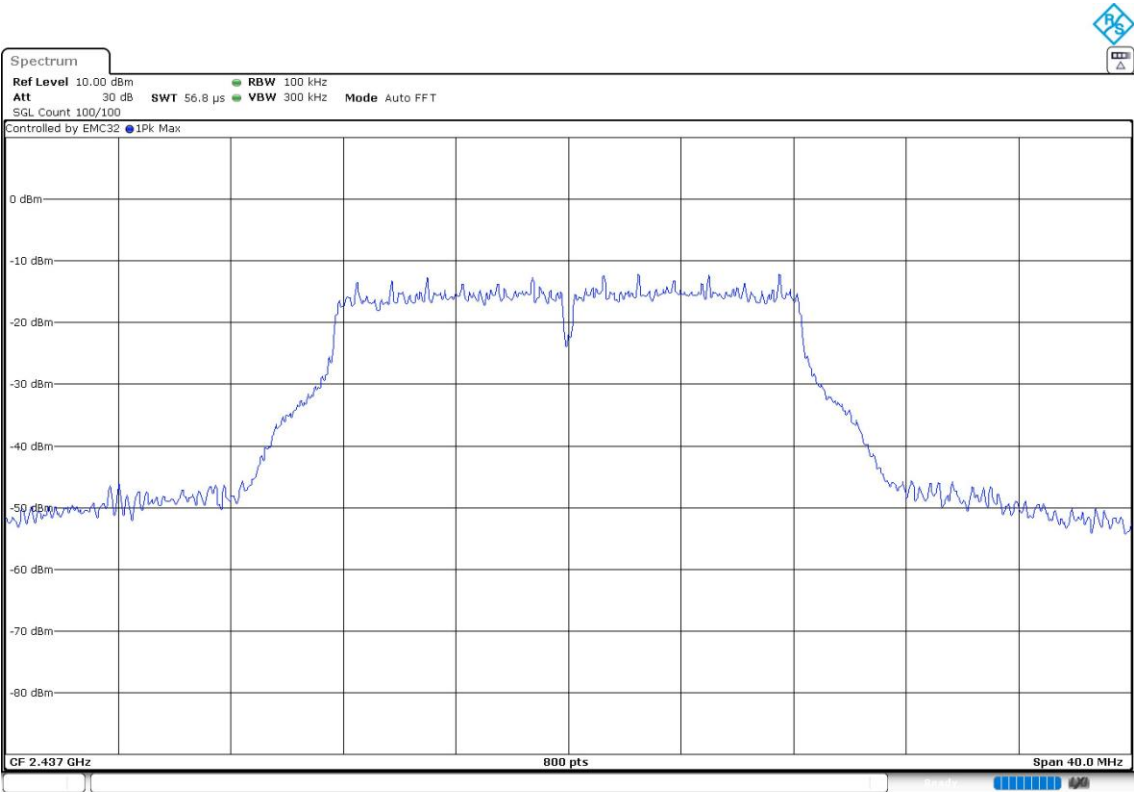
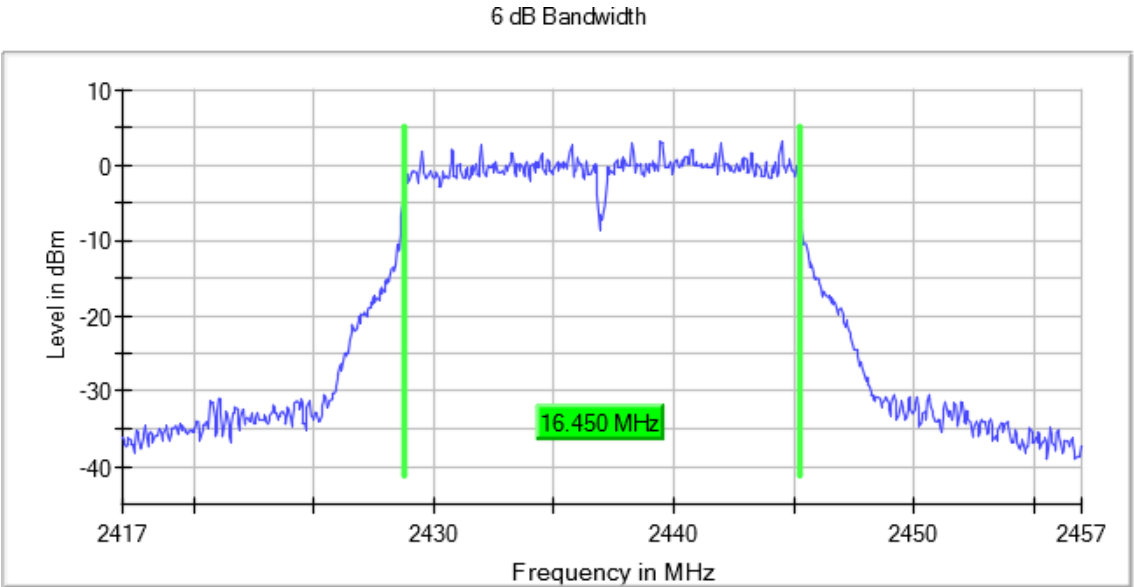
Frequency MHz = 2422.00000 Bandwidth MHz = 20
Modulation = 802.11g (OFDM 6 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



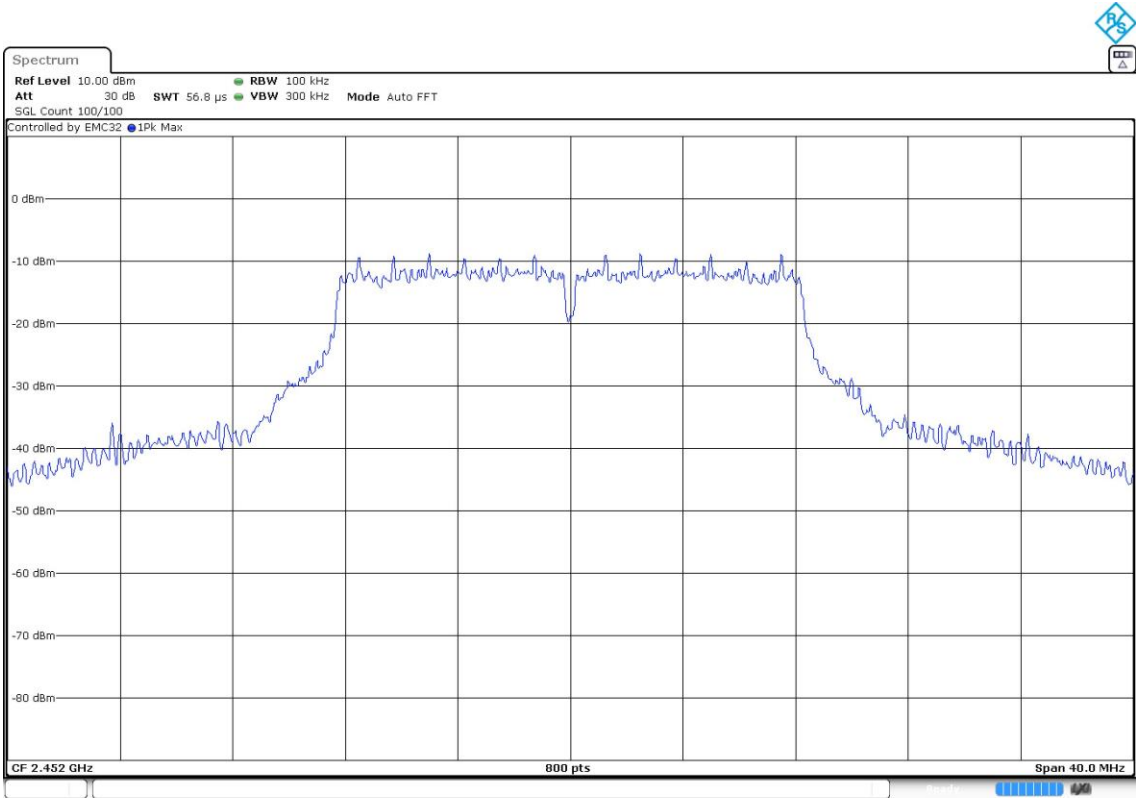
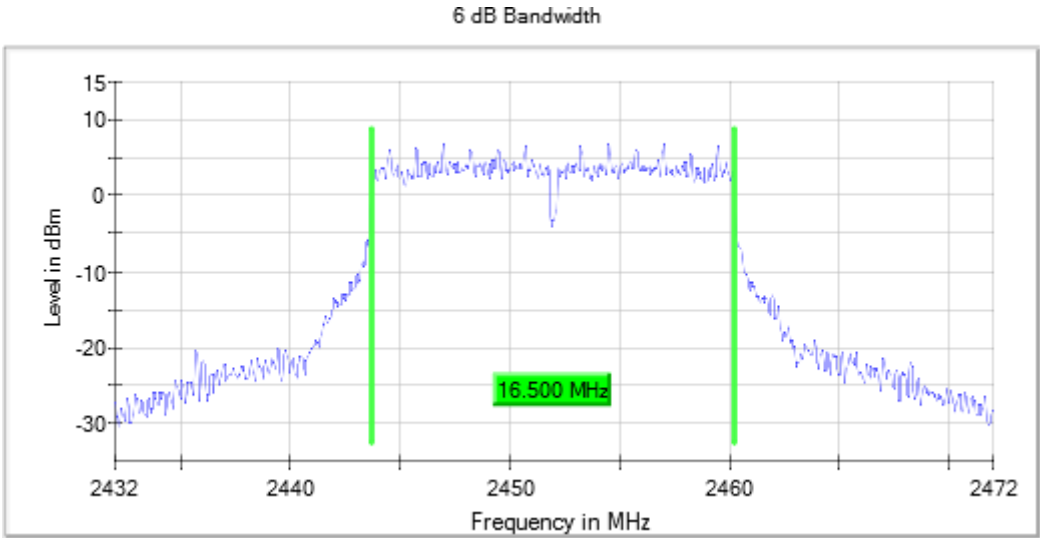
Frequency MHz = 2437.00000 Bandwidth MHz = 20
Modulation = 802.11g (OFDM 6 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



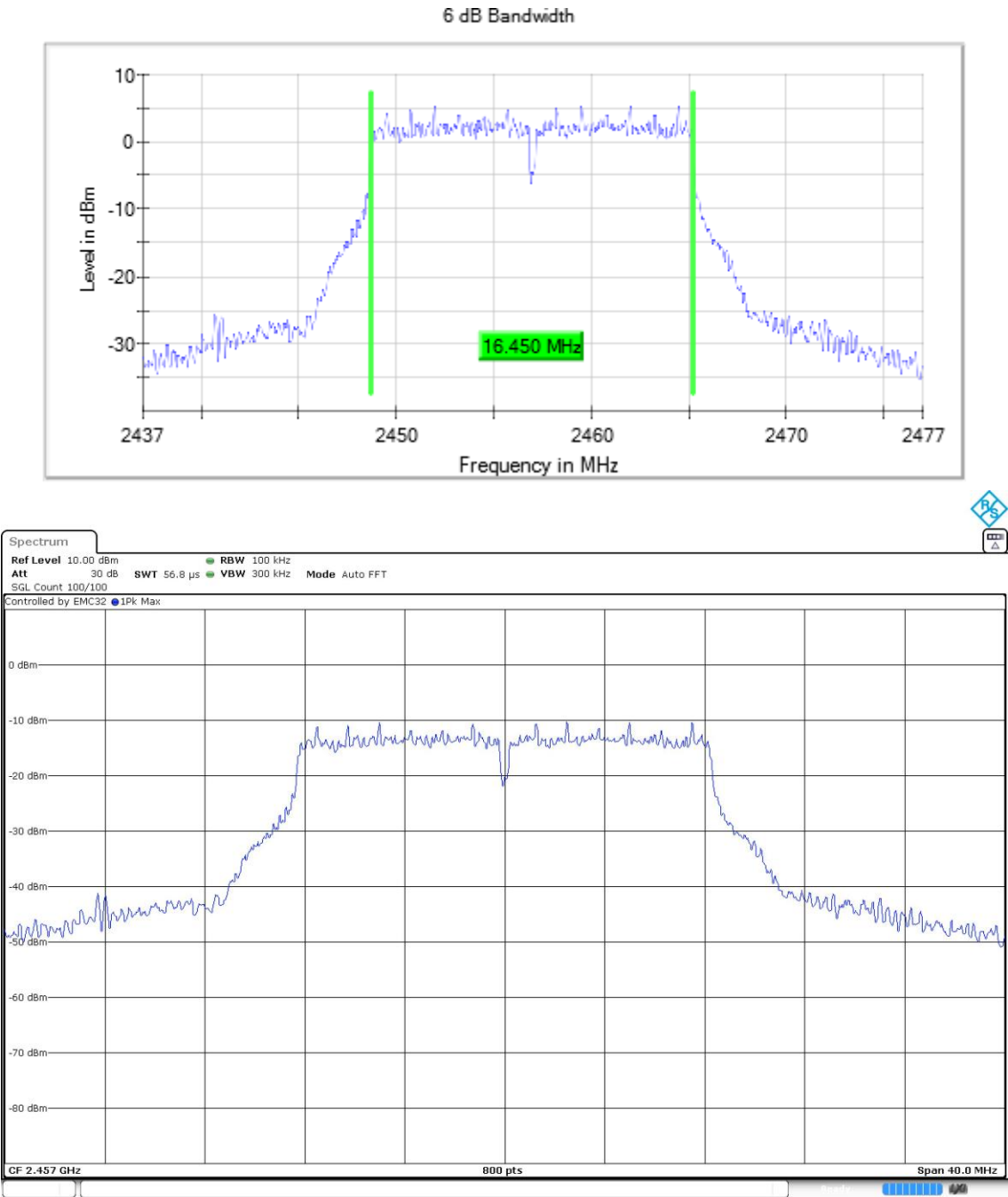
Frequency MHz = 2452.00000 Bandwidth MHz = 20
Modulation = 802.11g (OFDM 6 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



Frequency MHz = 2457.00000 Bandwidth MHz = 20
Modulation = 802.11g (OFDM 6 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

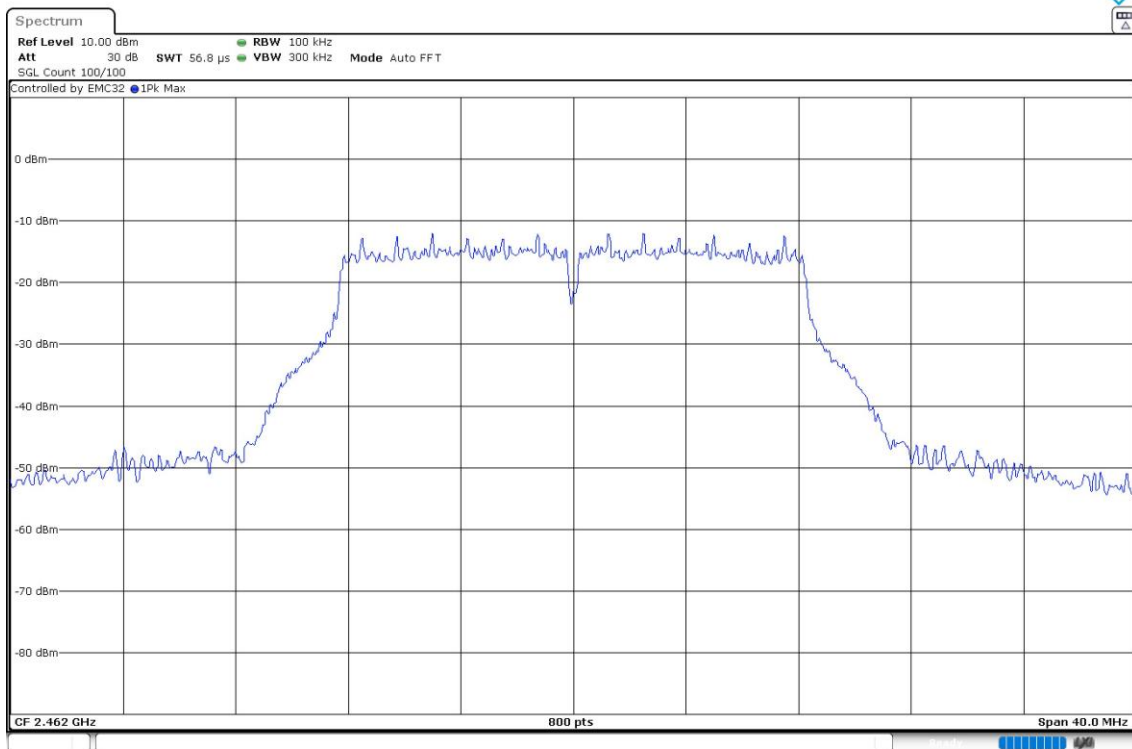
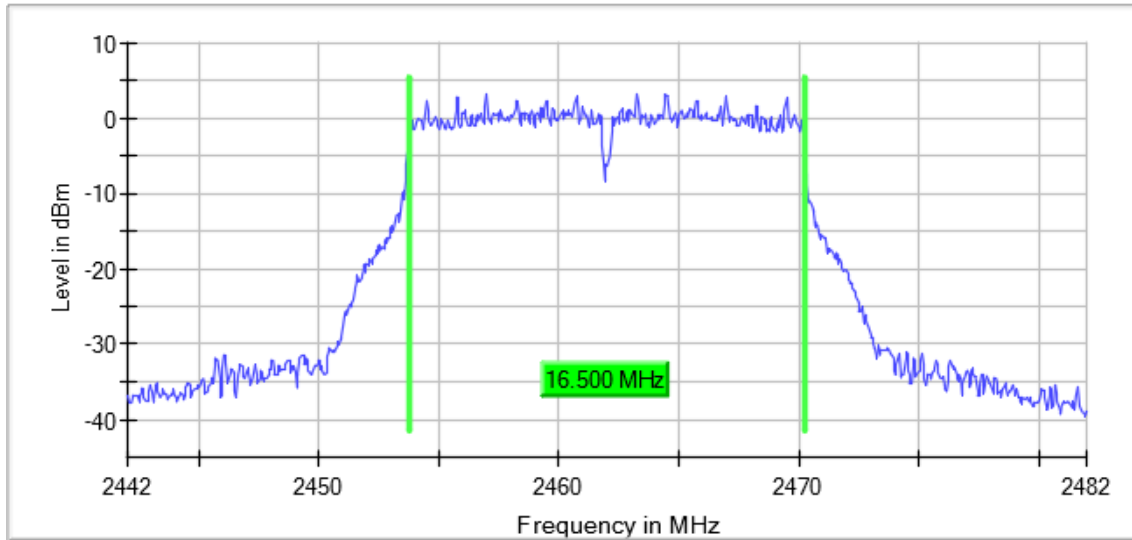
Images:



Frequency MHz = 2462.00000 Bandwidth MHz = 20
 Modulation = 802.11g (OFDM 6 Mbit/s) Number of Transmission Chains = 1
 Active Port = 1

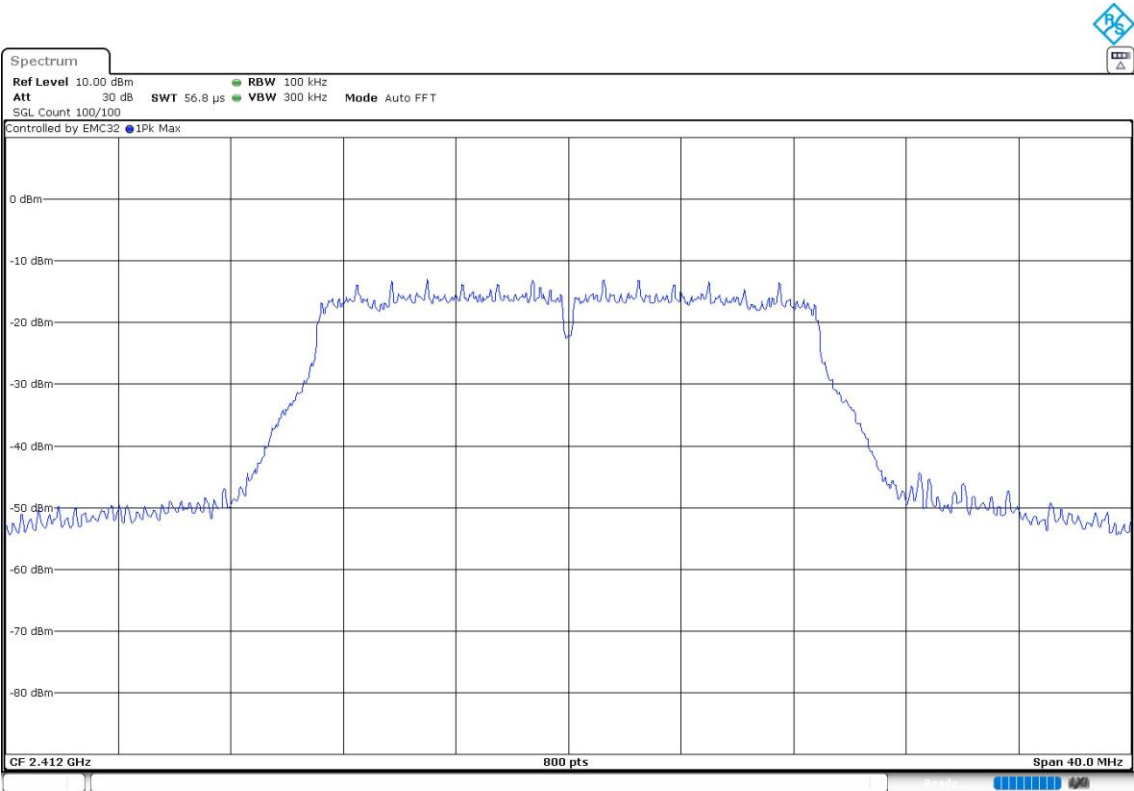
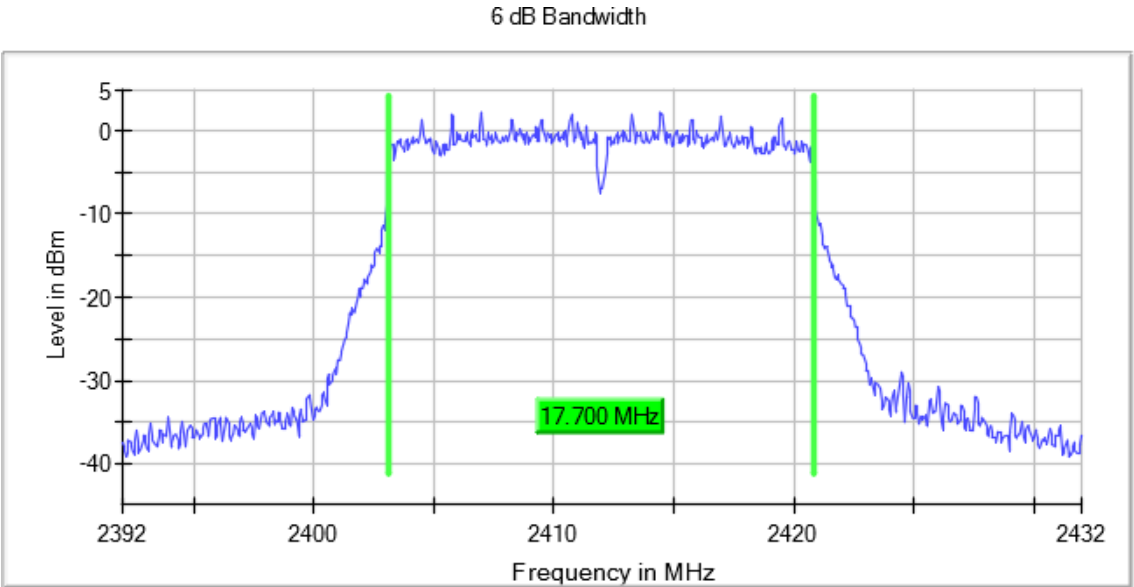
Images:

6 dB Bandwidth



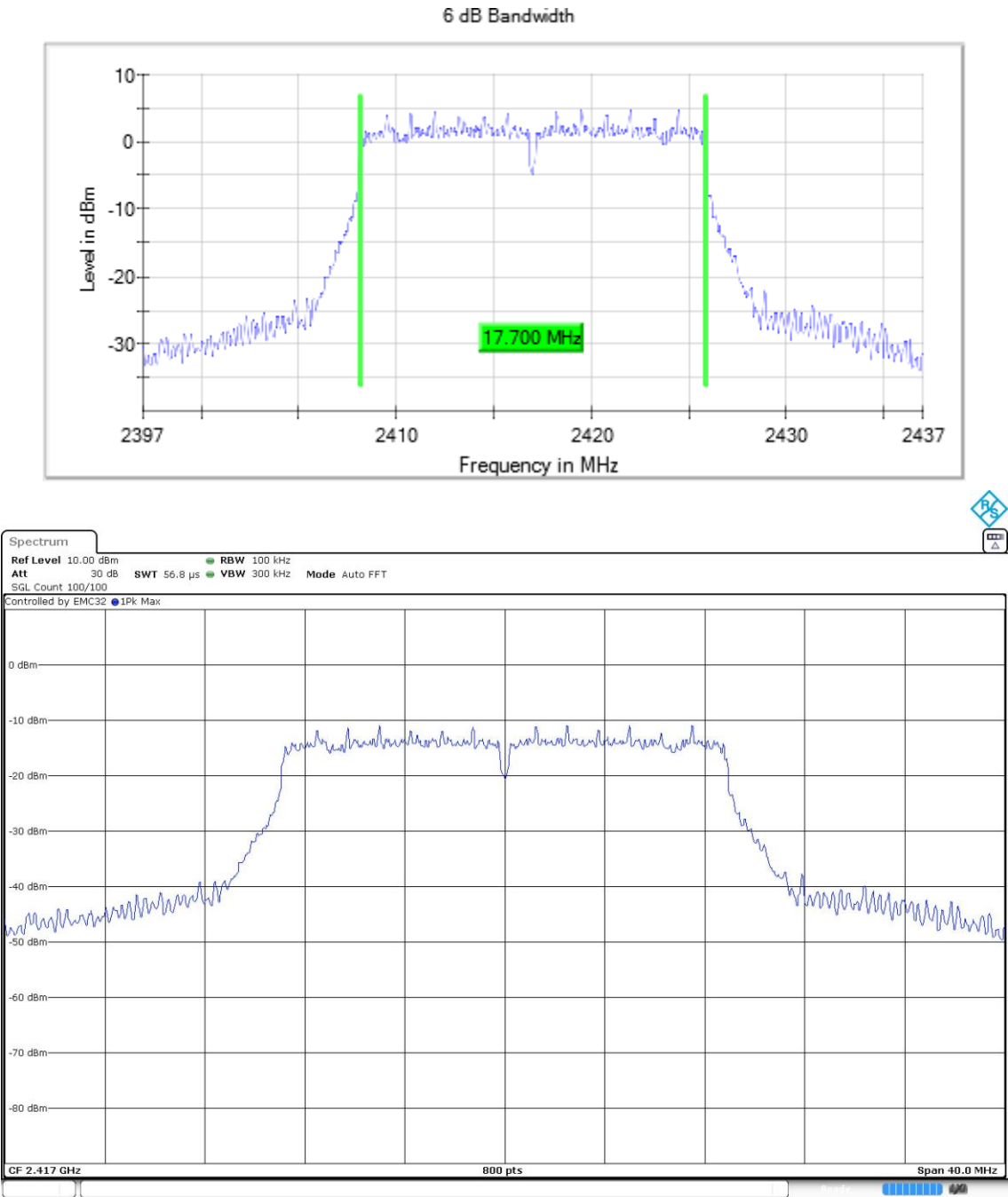
Frequency MHz = 2412.00000 Bandwidth MHz = 20
Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



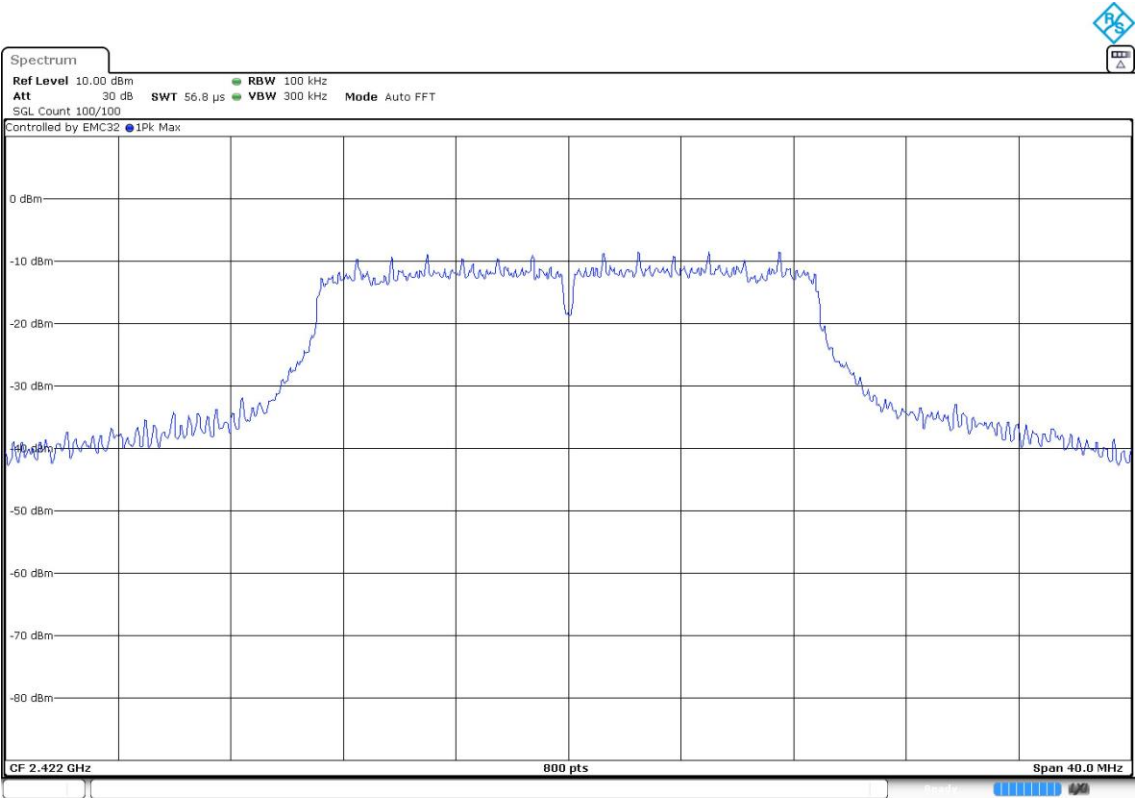
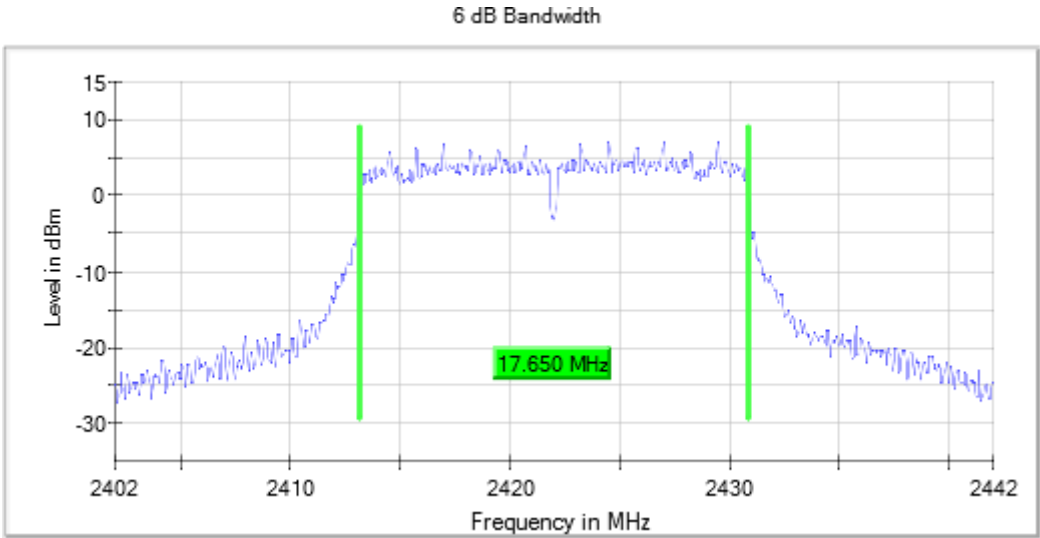
Frequency MHz = 2417.00000 Bandwidth MHz = 20
Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



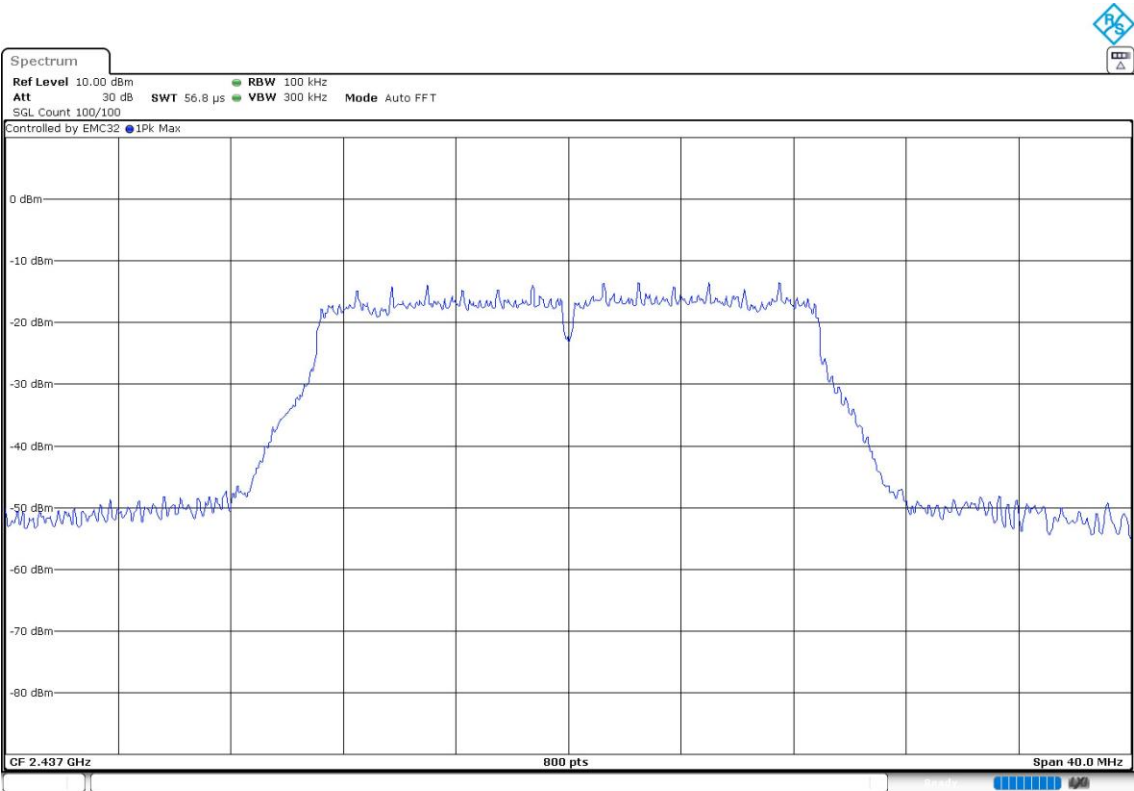
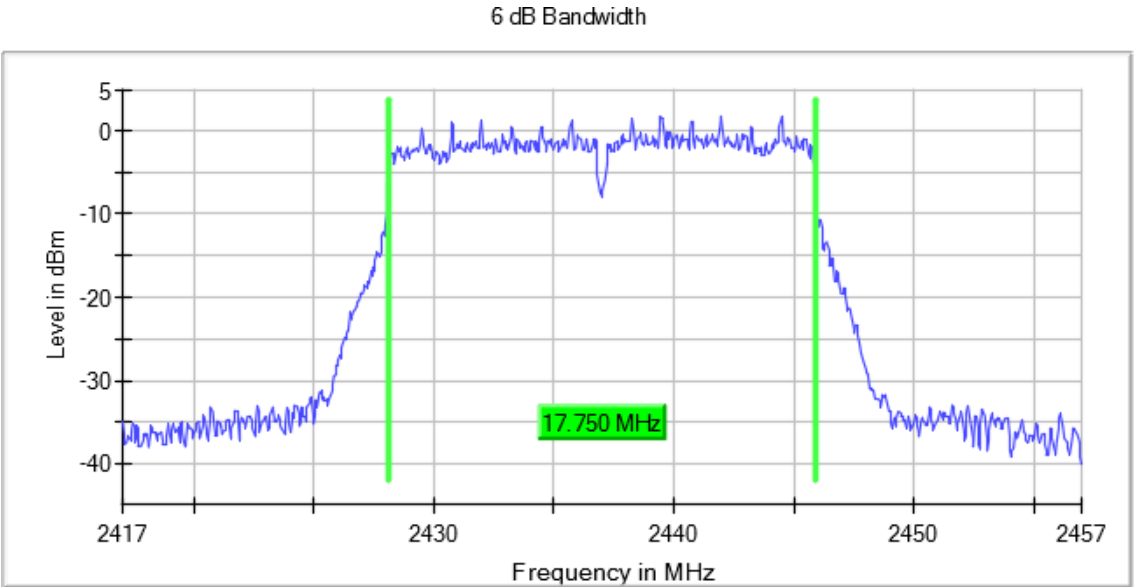
Frequency MHz = 2422.00000 Bandwidth MHz = 20
Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



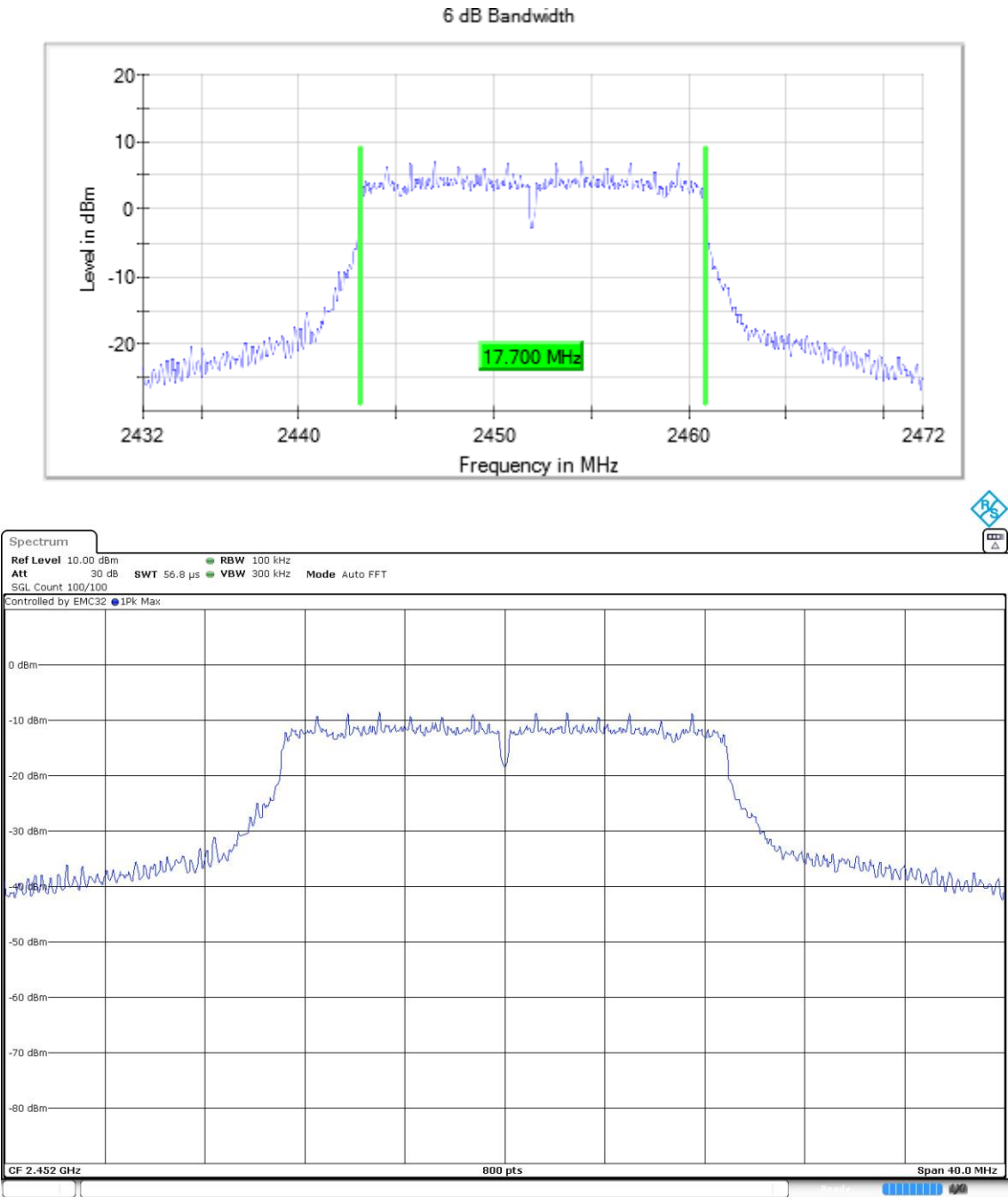
Frequency MHz = 2437.00000 Bandwidth MHz = 20
Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



Frequency MHz = 2452.00000 Bandwidth MHz = 20
Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s) Number of Transmission Chains = 1
Active Port = 1

Images:



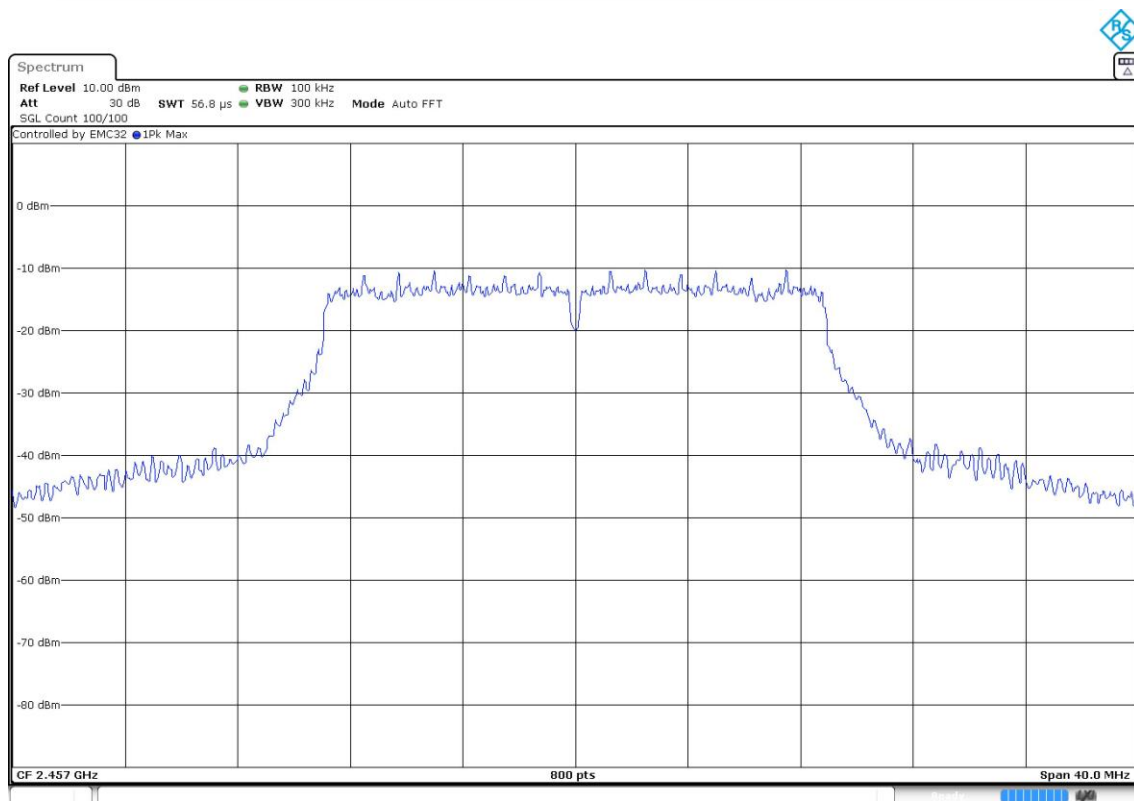
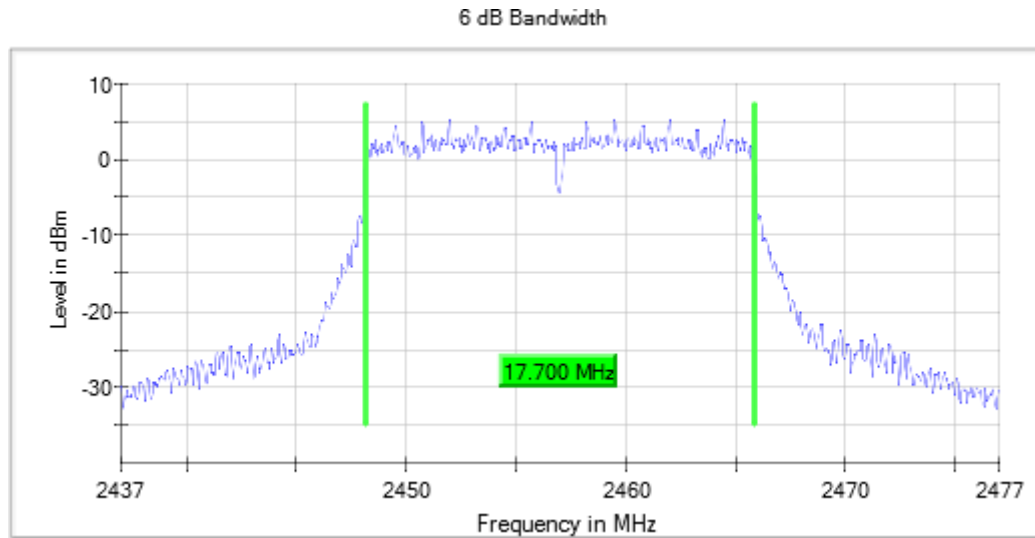
Frequency MHz = 2457.00000

Bandwidth MHz = 20

Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s) Number of Transmission Chains = 1

Active Port = 1

Images:



Frequency MHz = 2462.00000

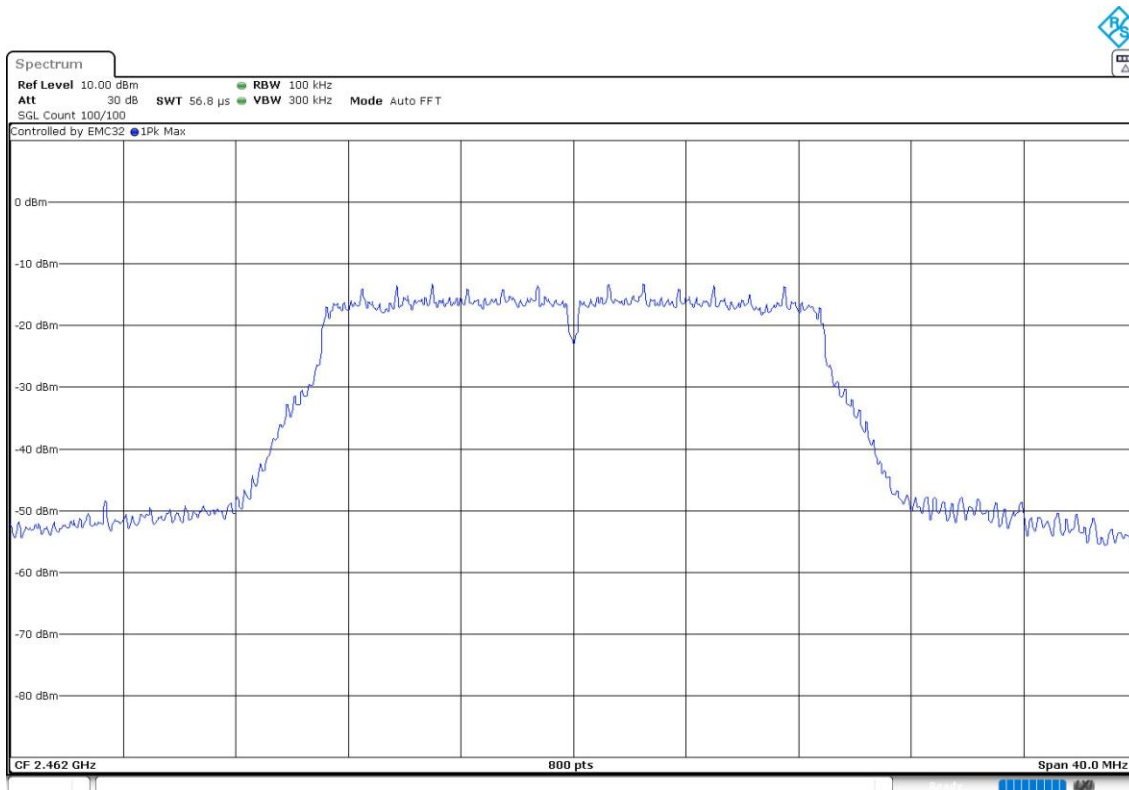
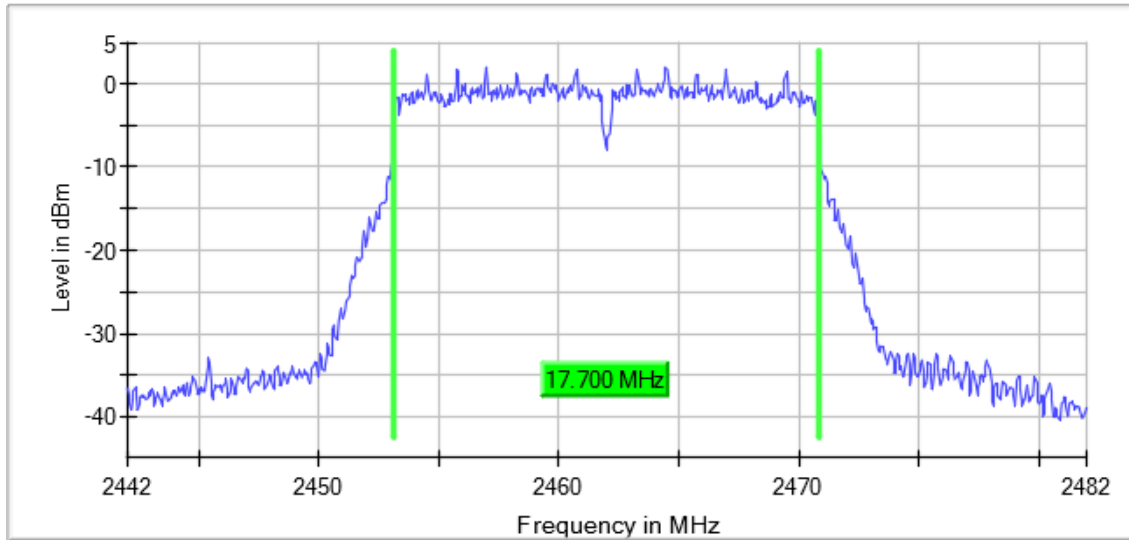
Bandwidth MHz = 20

Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s) Number of Transmission Chains = 1

Active Port = 1

Images:

6 dB Bandwidth



RSS-247 5.2 (b) / FCC 15.247 (e) Power spectral density

Limits

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Results

Modulation: 802.11b (DSSS 1 Mbit/s)

Freq (MHz)	# of Tx Chains	Port	PSD (dBm)
2412.00	1	1	-1.20
2437.00			-1.63
2462.00			-0.95

Modulation: 802.11g (OFDM 6 Mbit/s)

Freq (MHz)	# of Tx Chains	Port	PSD (dBm)
2412.00	1	1	-4.41
2417.00			-2.85
2422.00			-1.12
2437.00			-4.98
2452.00			-1.00
2457.00			-2.71
2462.00			-4.92

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

Freq (MHz)	# of Tx Chains	Port	PSD (dBm)
2412.00	1	1	-6.13
2417.00			-4.10
2422.00			-1.82
2437.00			-6.79
2452.00			-2.12
2457.00			-3.34
2462.00			-6.48

Verdict

Pass

Attachments

Frequency MHz = 2412.00000

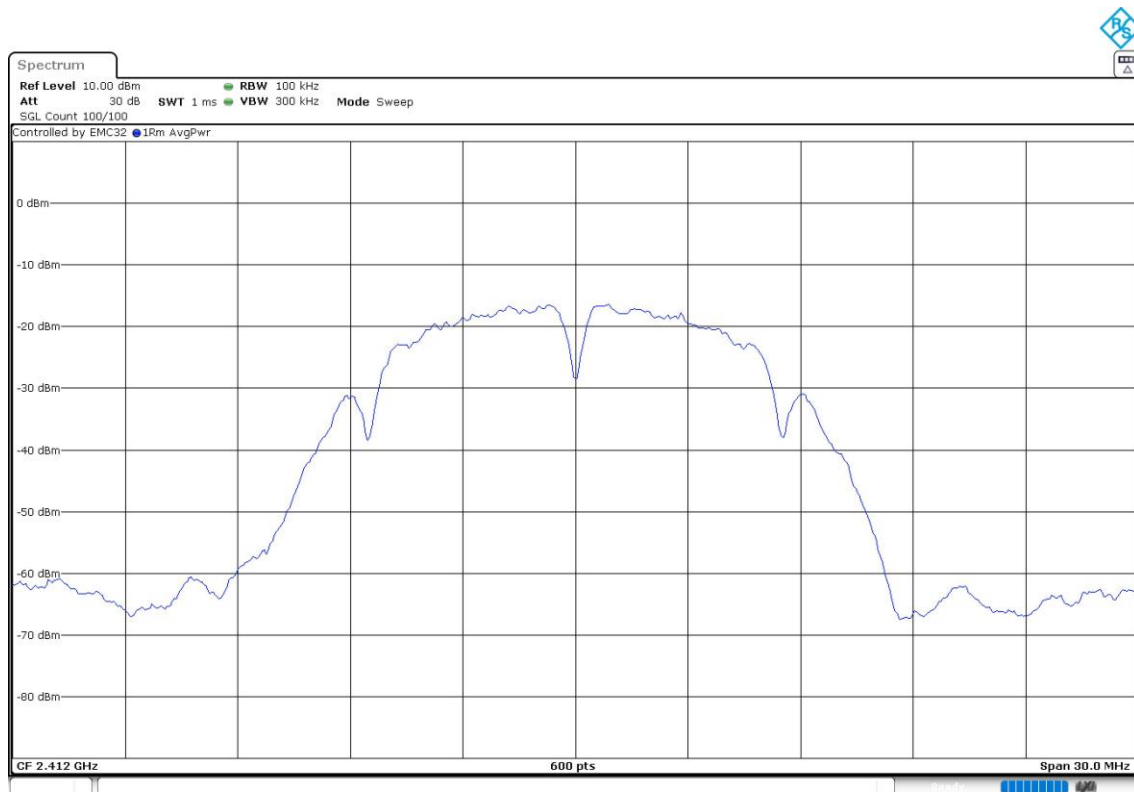
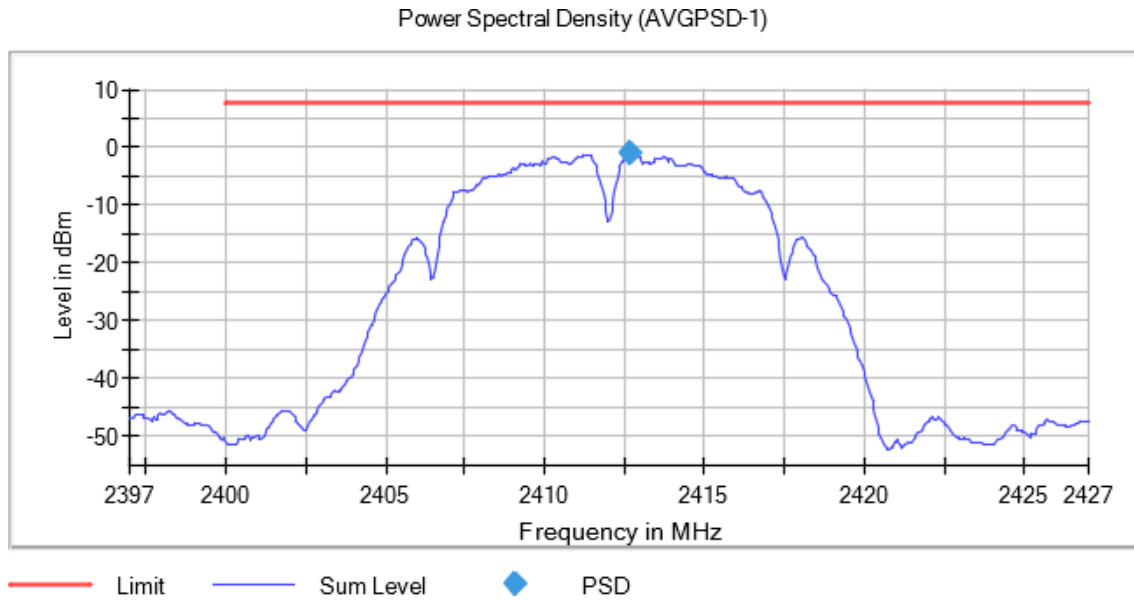
Equipment Type = Digital Transmission System (DTS)

Bandwidth MHz = 20

Modulation = 802.11b (DSSS 1 Mbit/s)

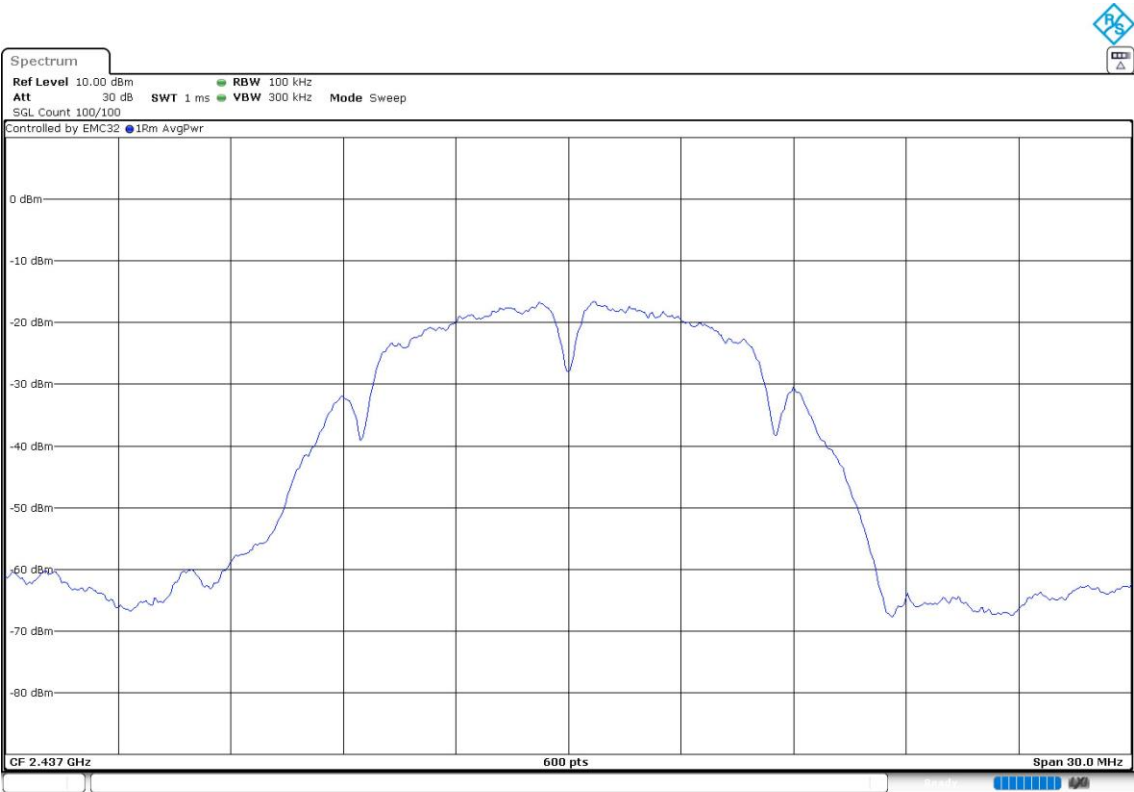
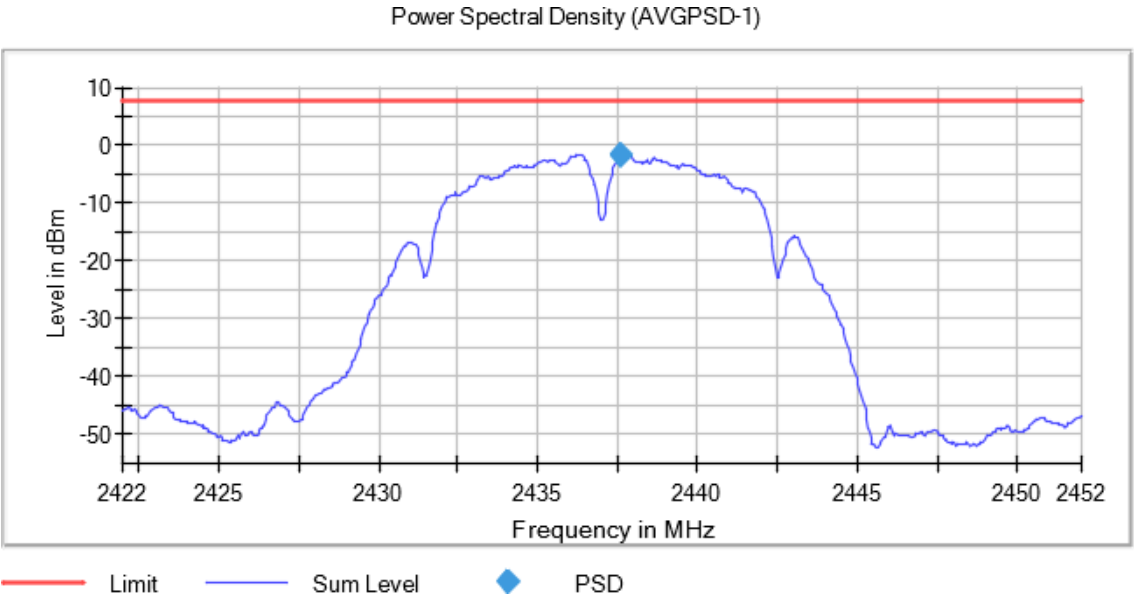
Number of Transmission Chains = 1 Active Port = 1

Images:



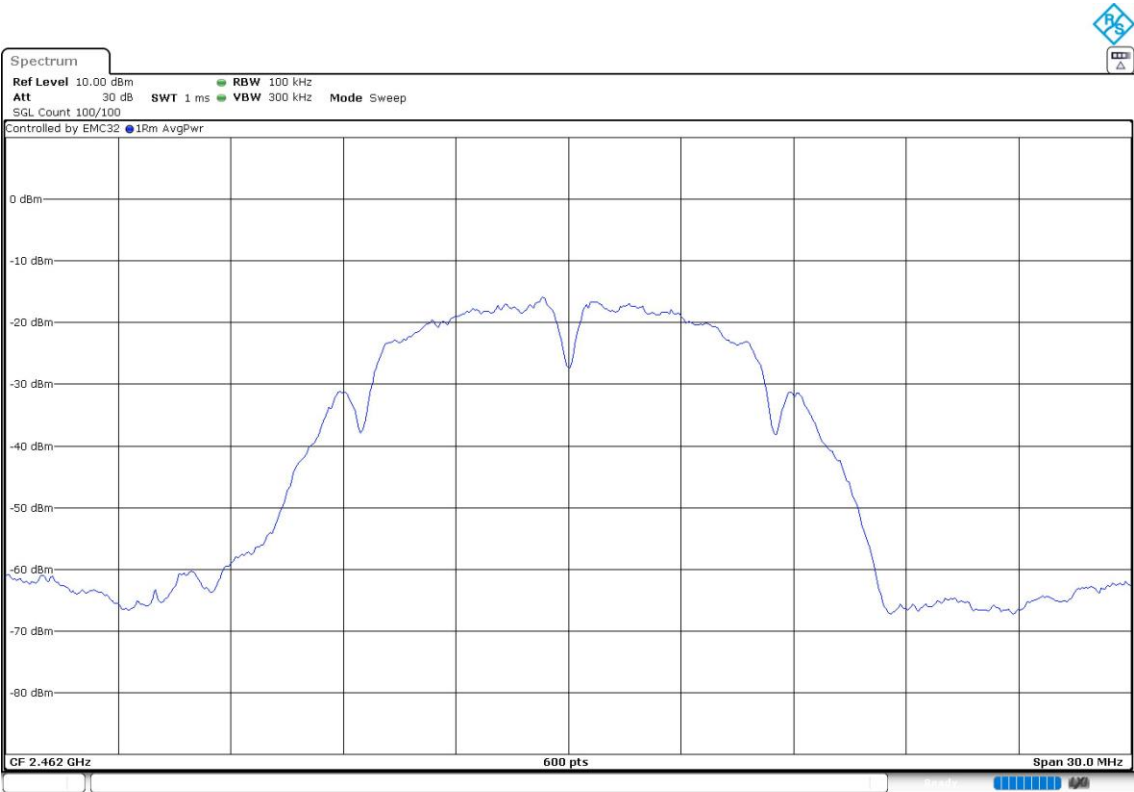
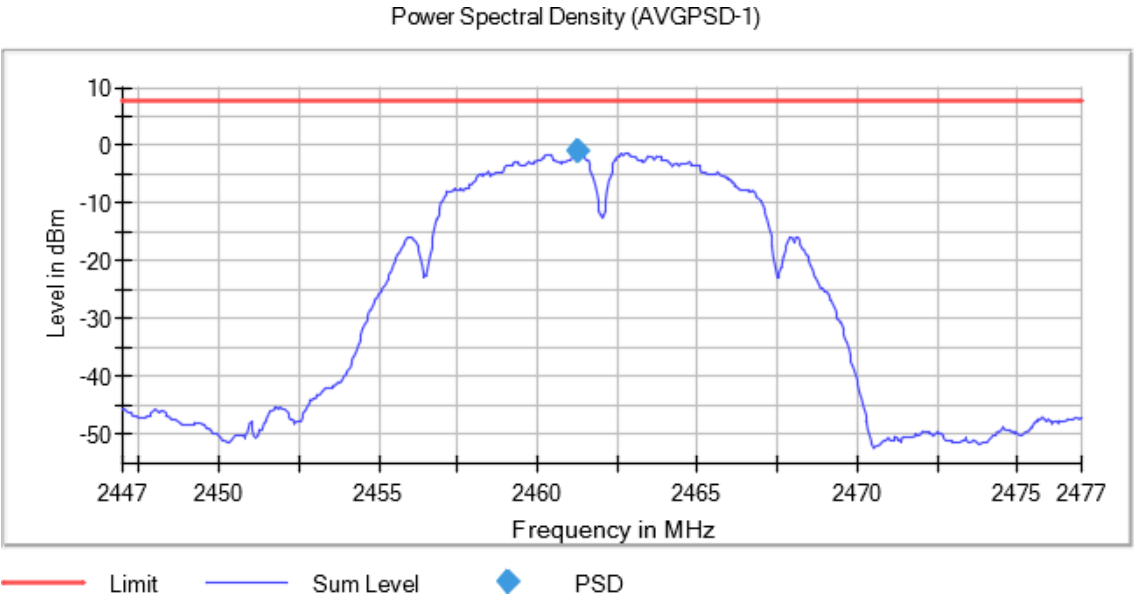
Frequency MHz = 2437.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11b (DSSS 1 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



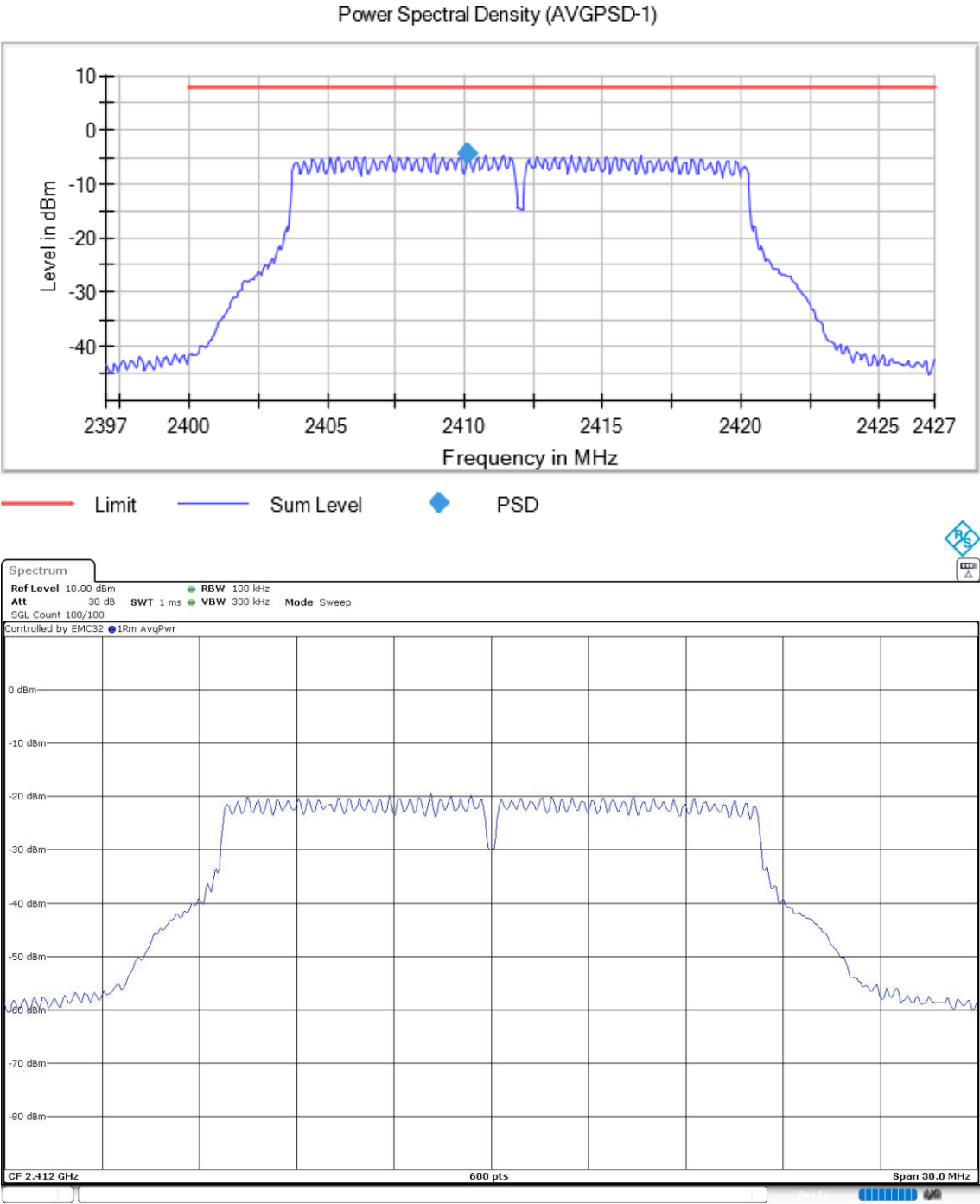
Frequency MHz = 2462.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11b (DSSS 1 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



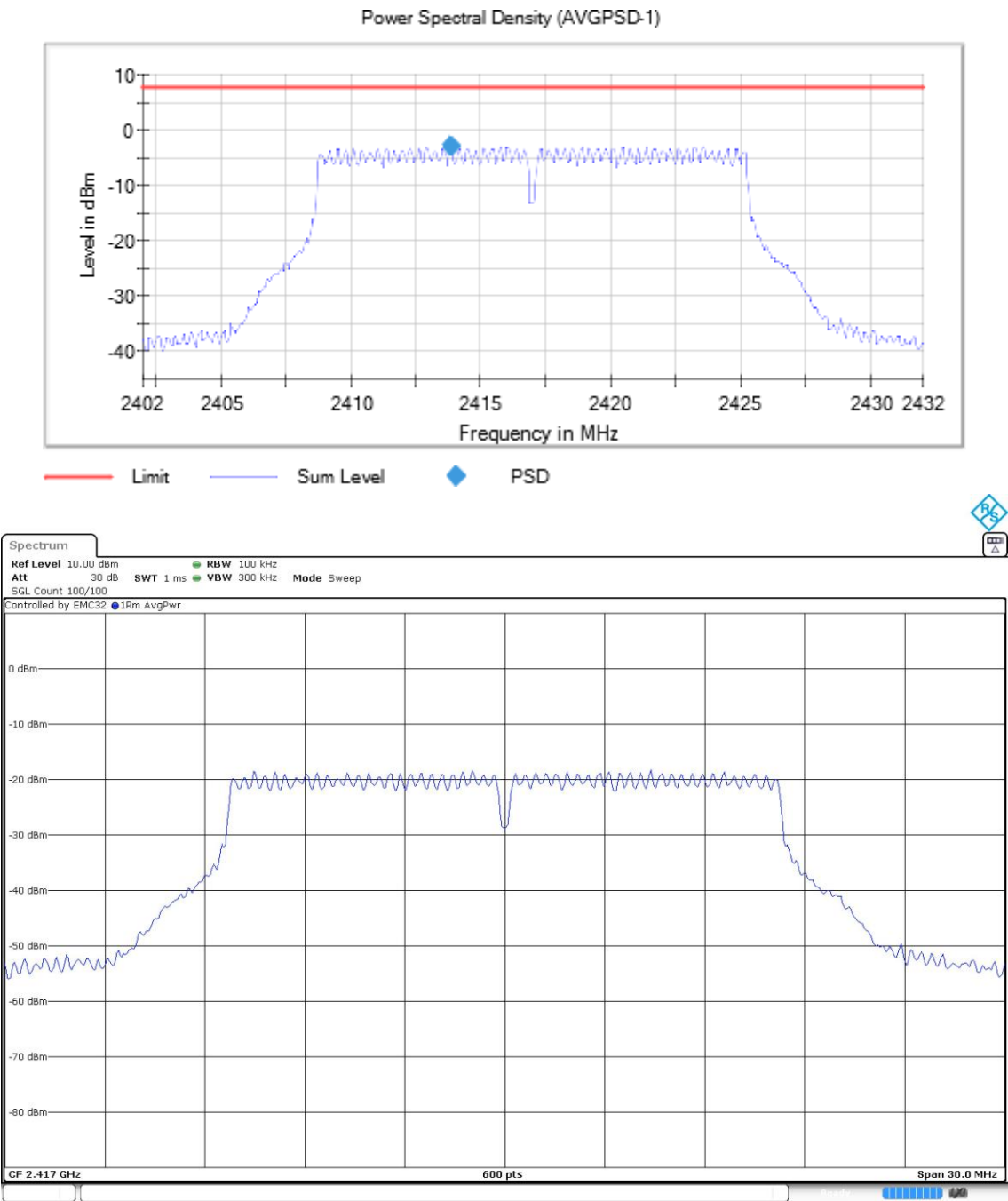
Frequency MHz = 2412.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



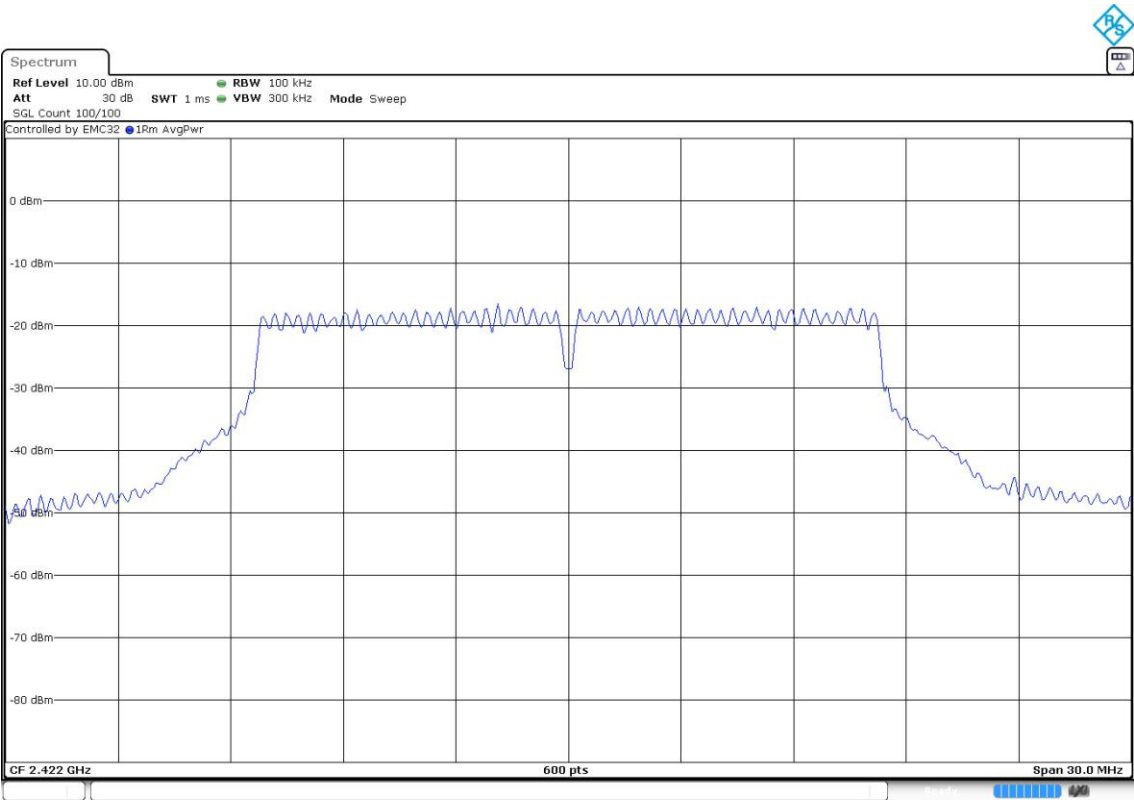
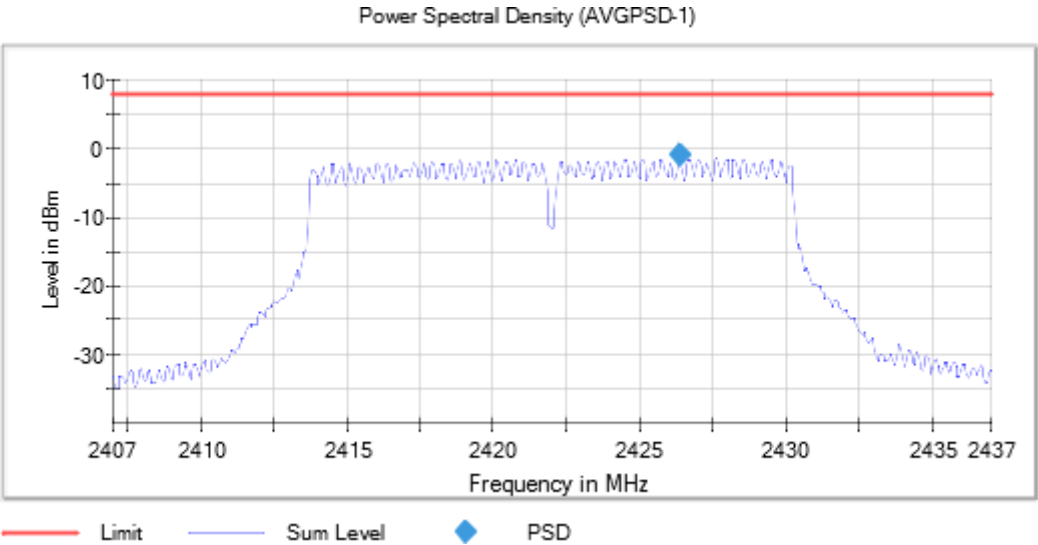
Frequency MHz = 2417.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



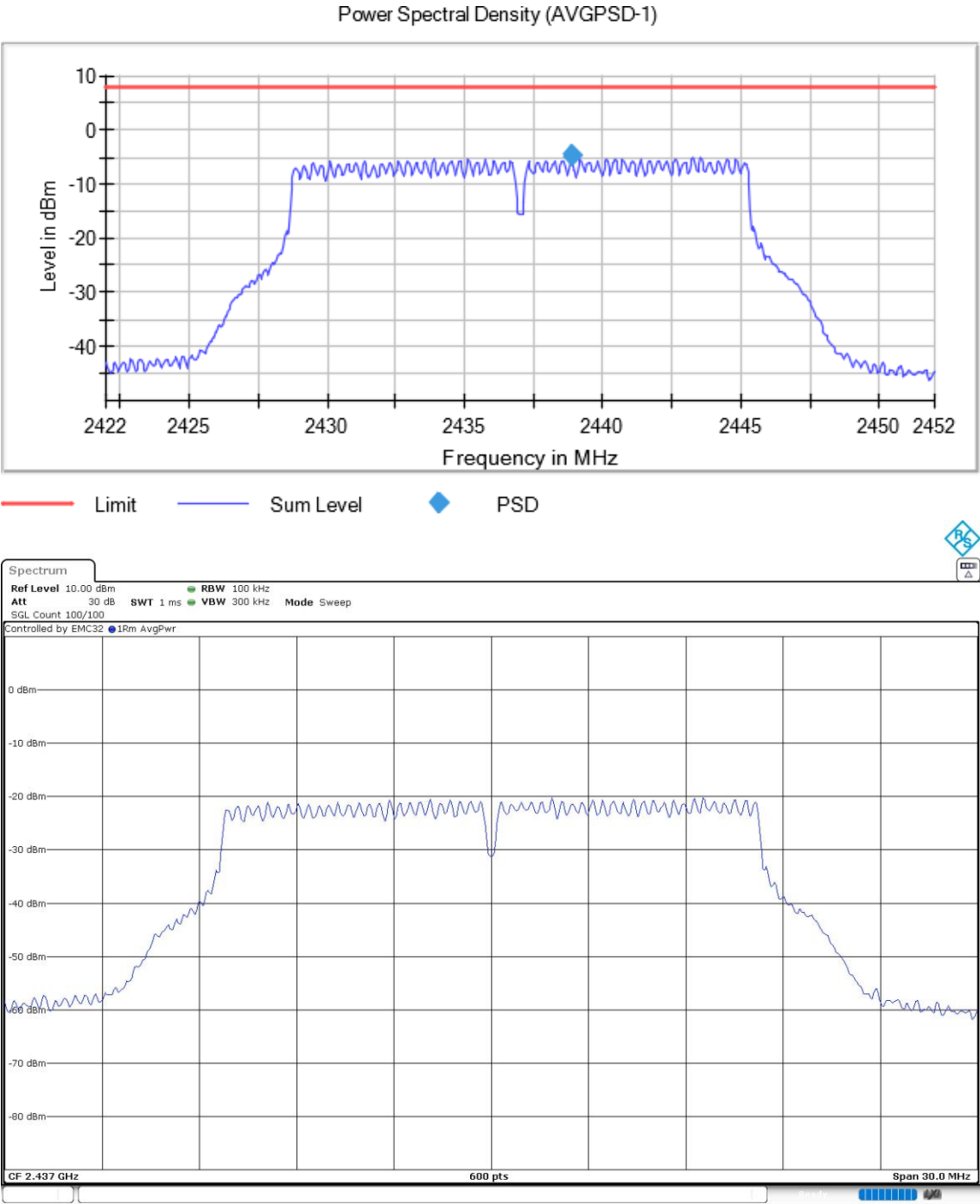
Frequency MHz = 2422.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



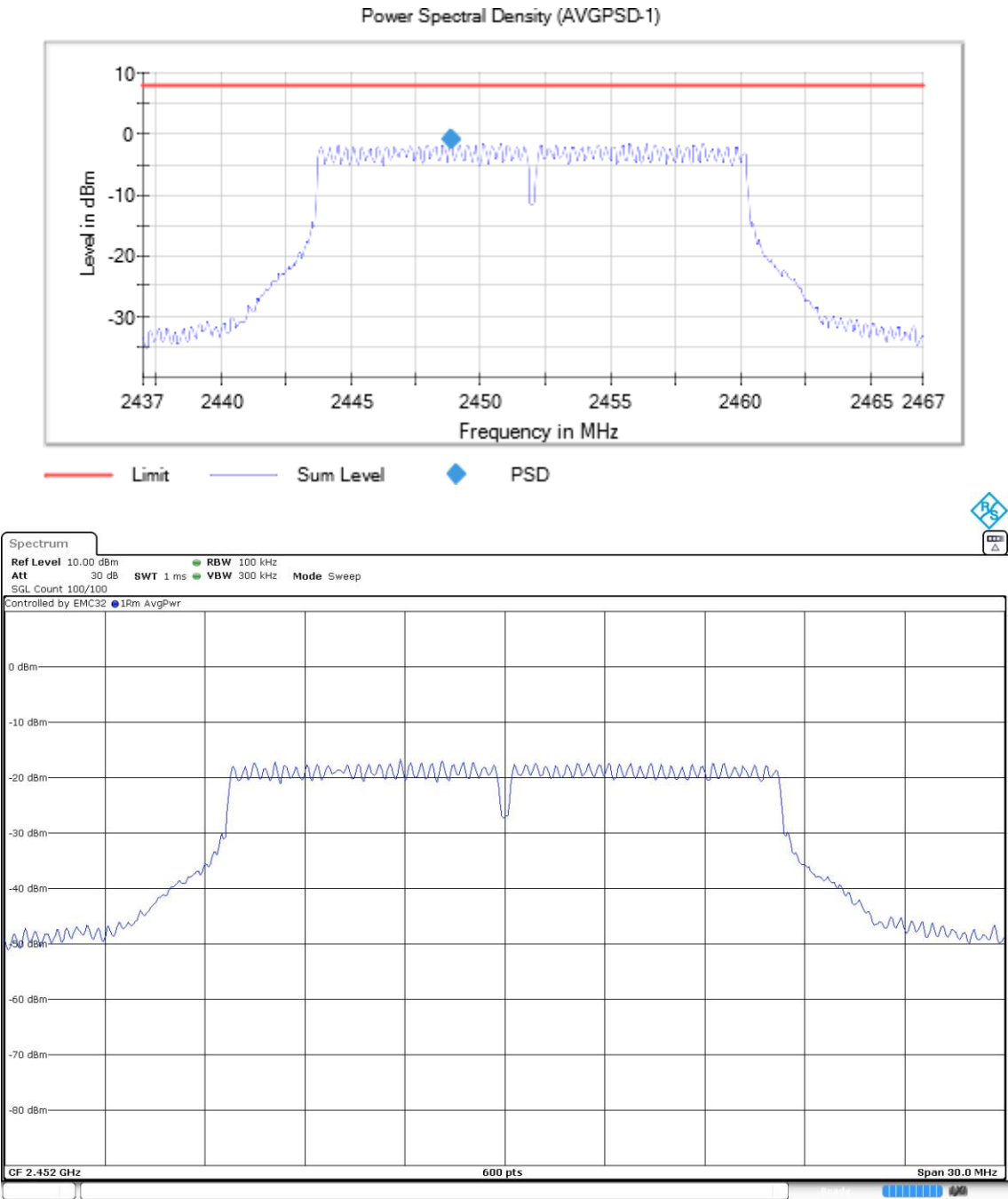
Frequency MHz = 2437.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



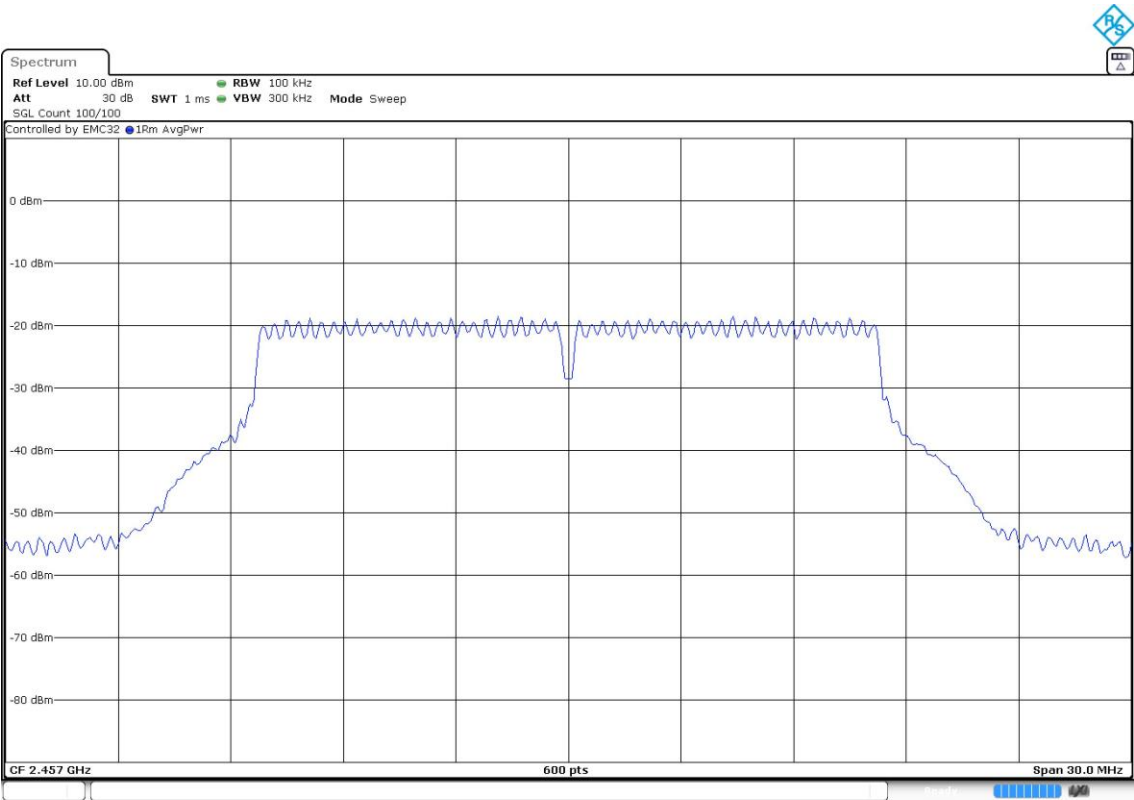
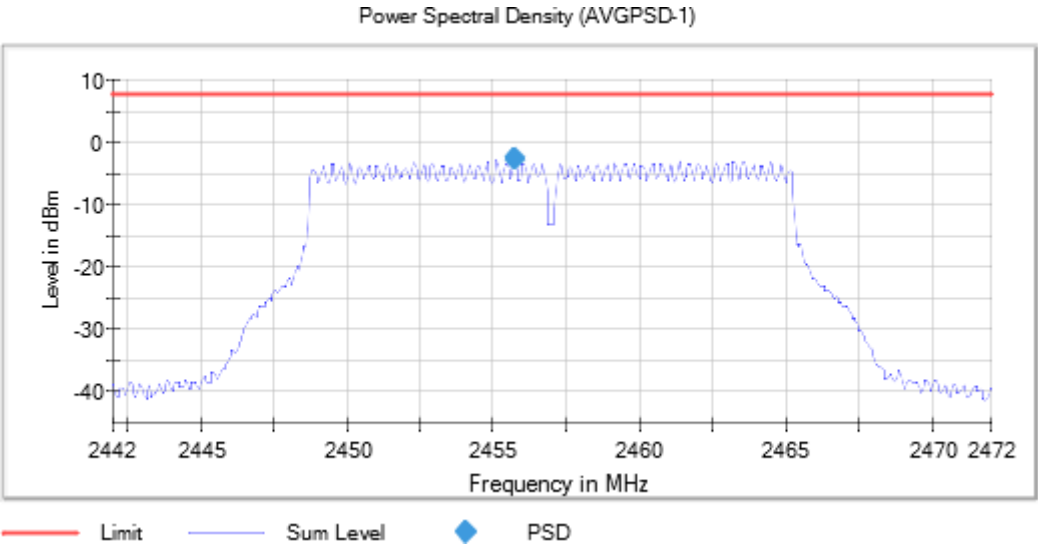
Frequency MHz = 2452.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



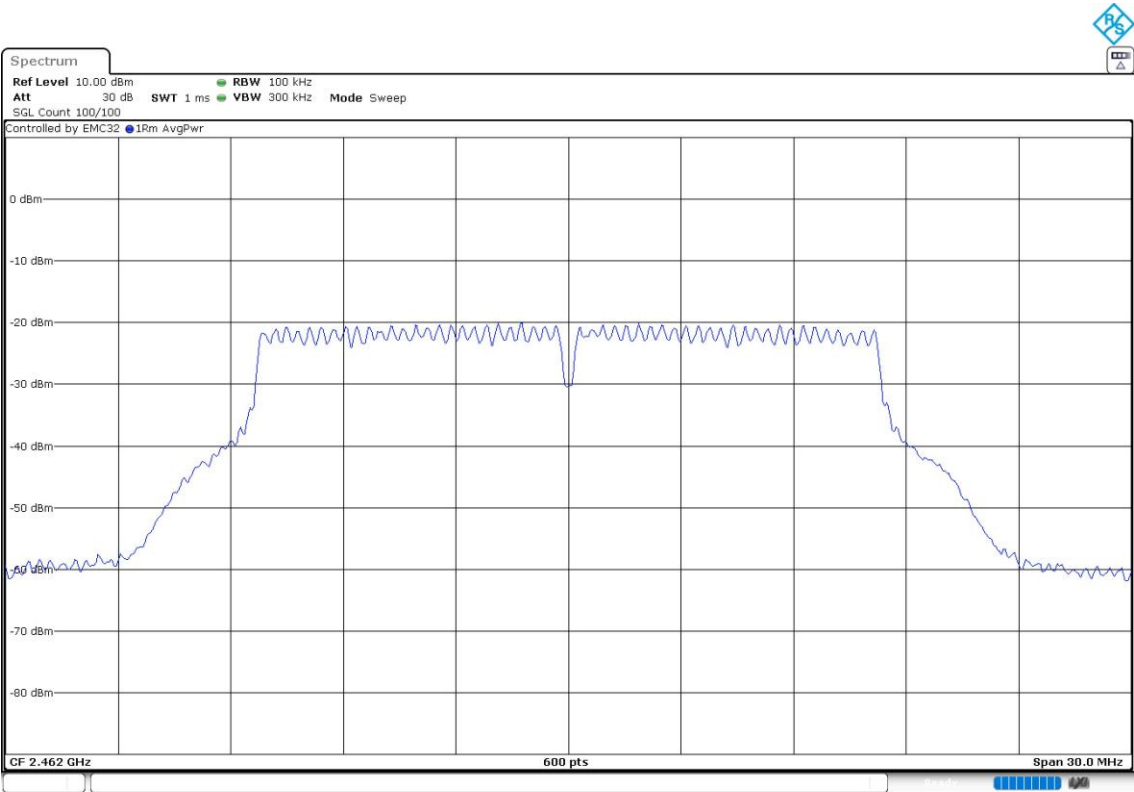
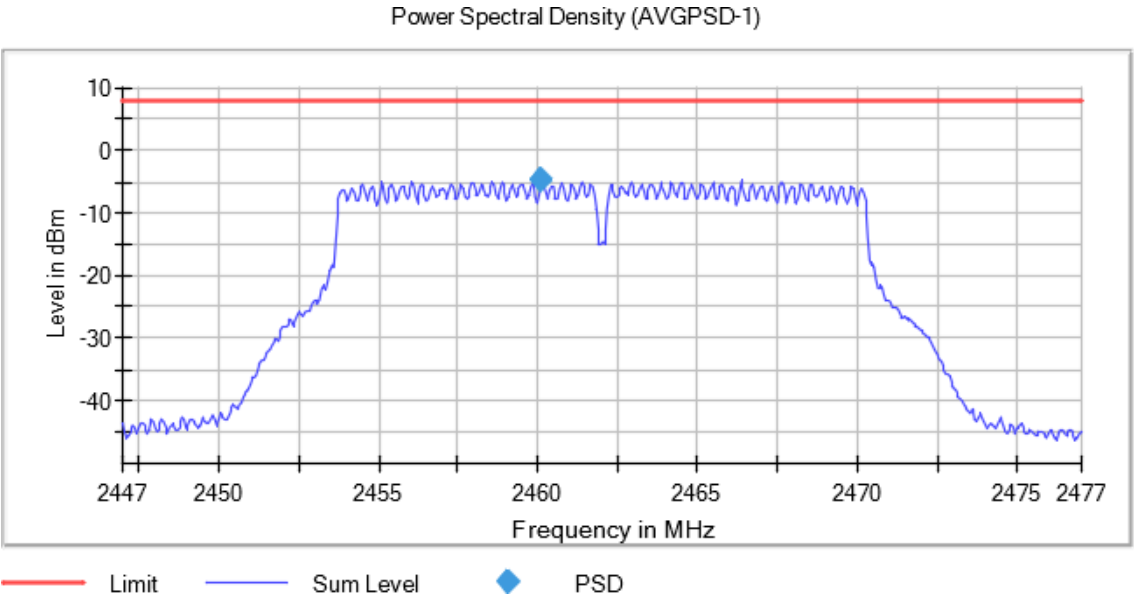
Frequency MHz = 2457.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



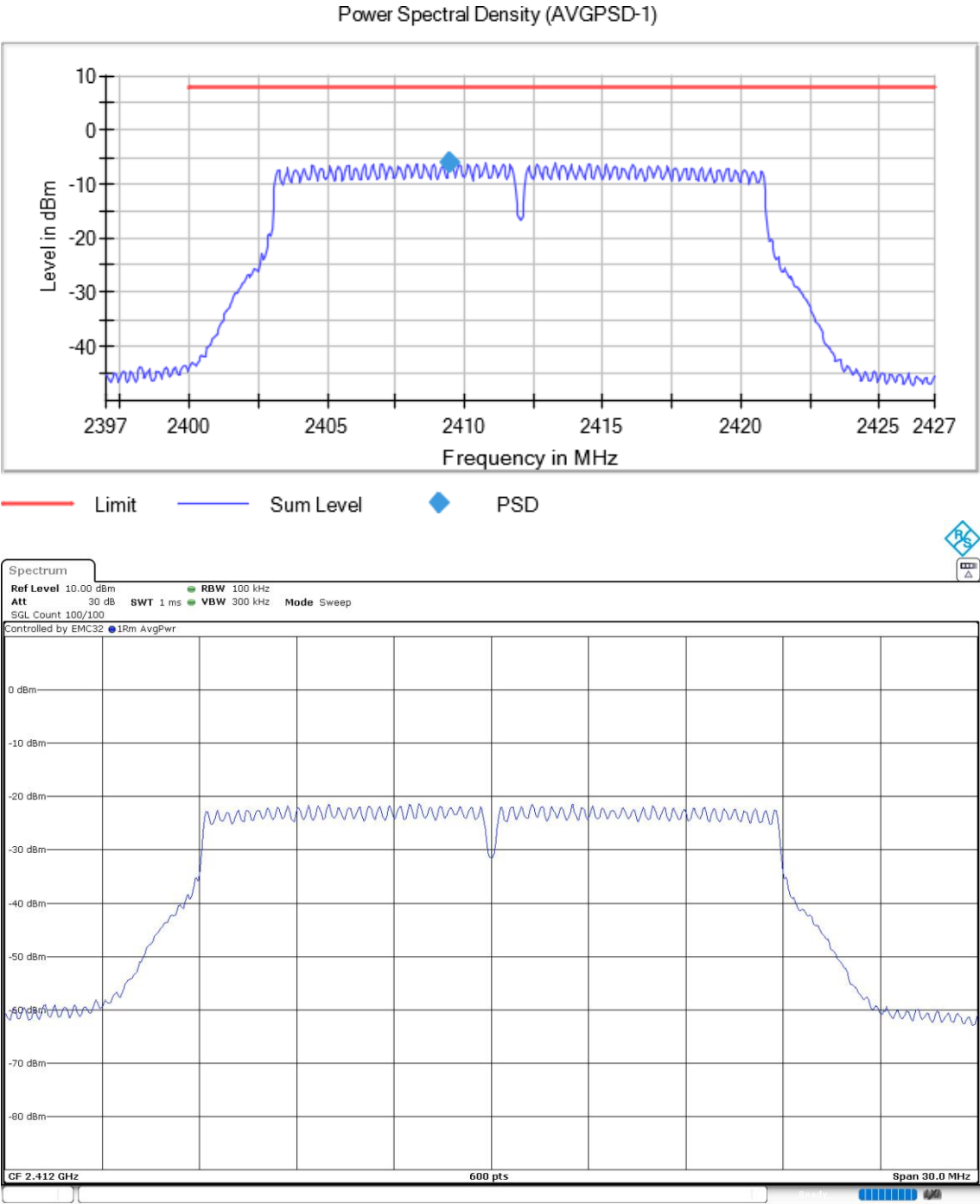
Frequency MHz = 2462.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11g (OFDM 6 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



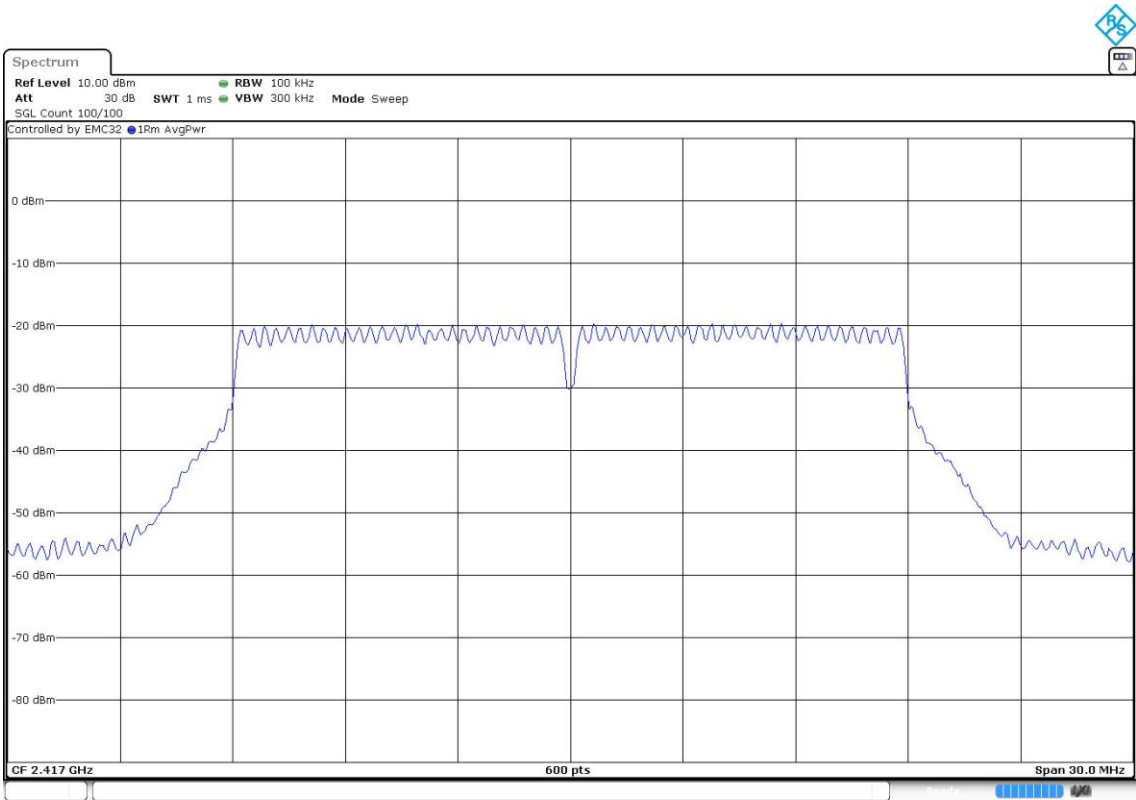
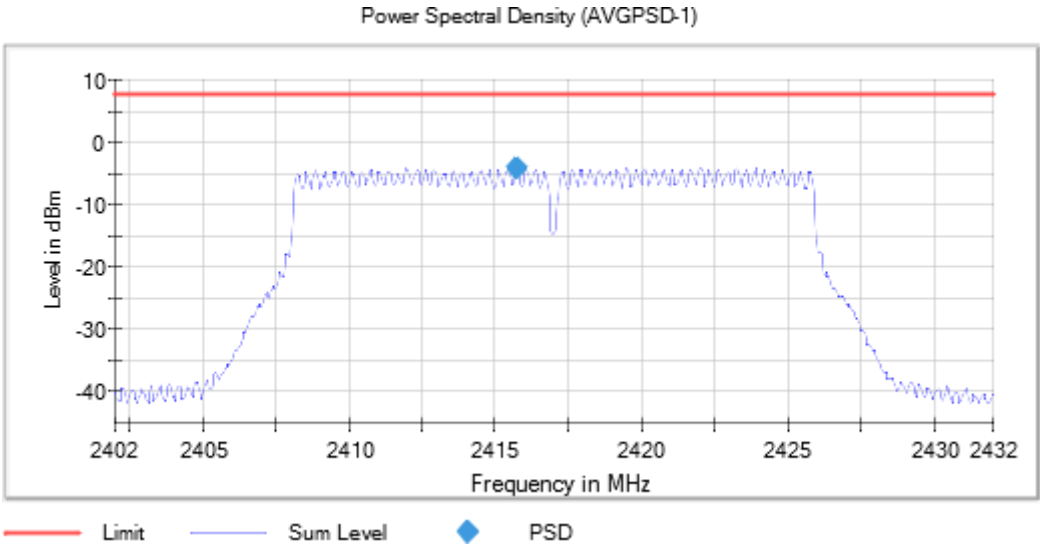
Frequency MHz = 2412.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



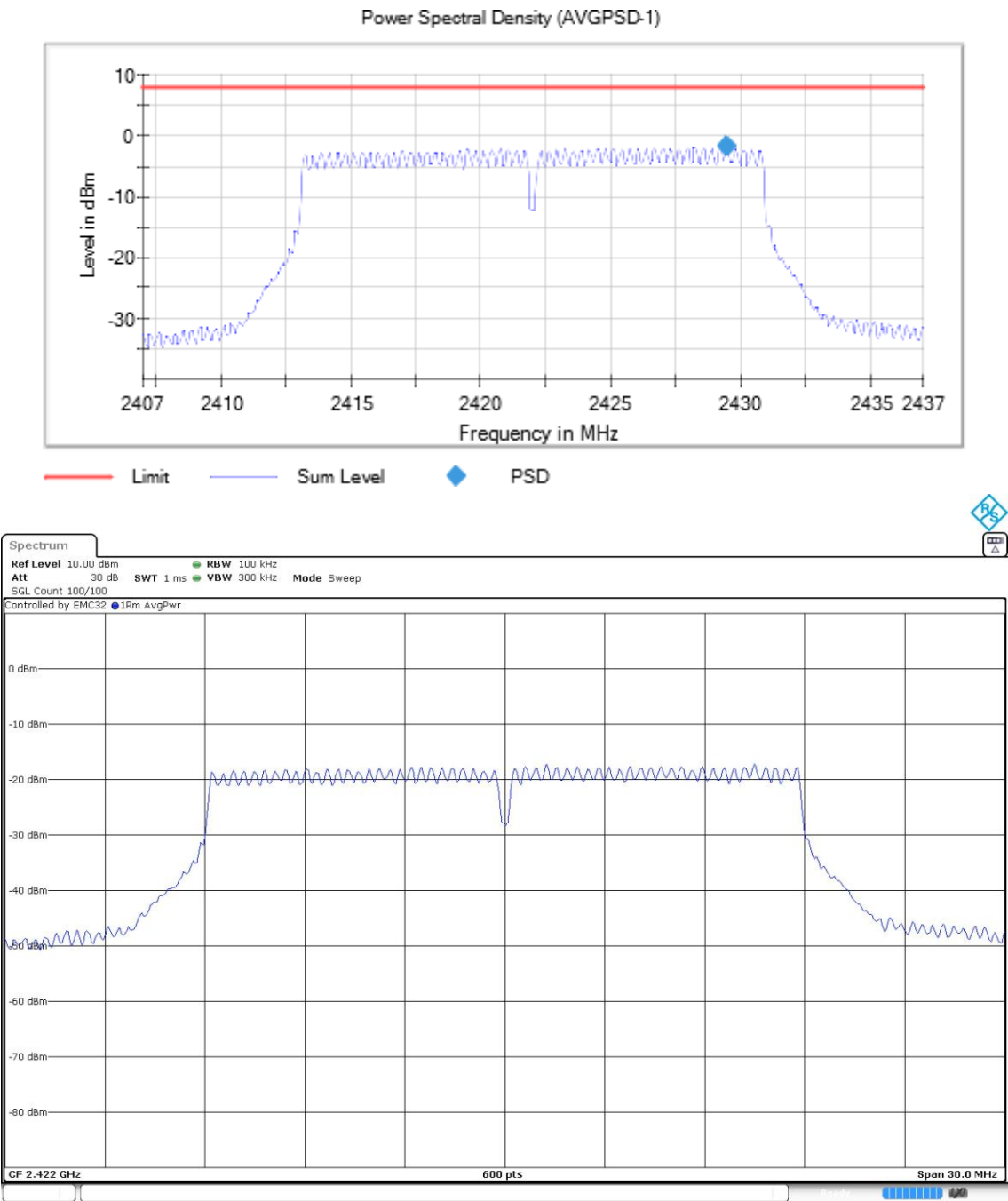
Frequency MHz = 2417.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



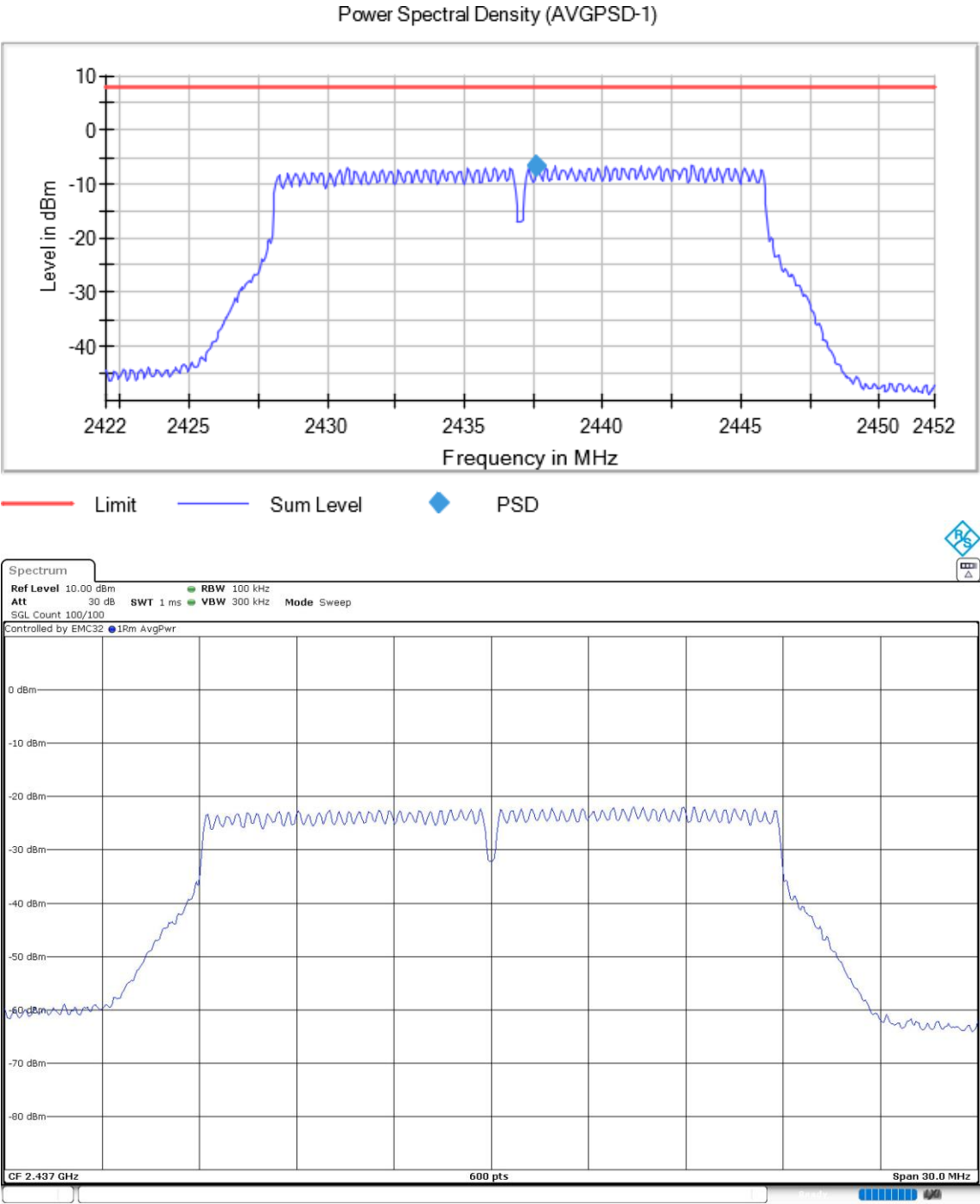
Frequency MHz = 2422.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



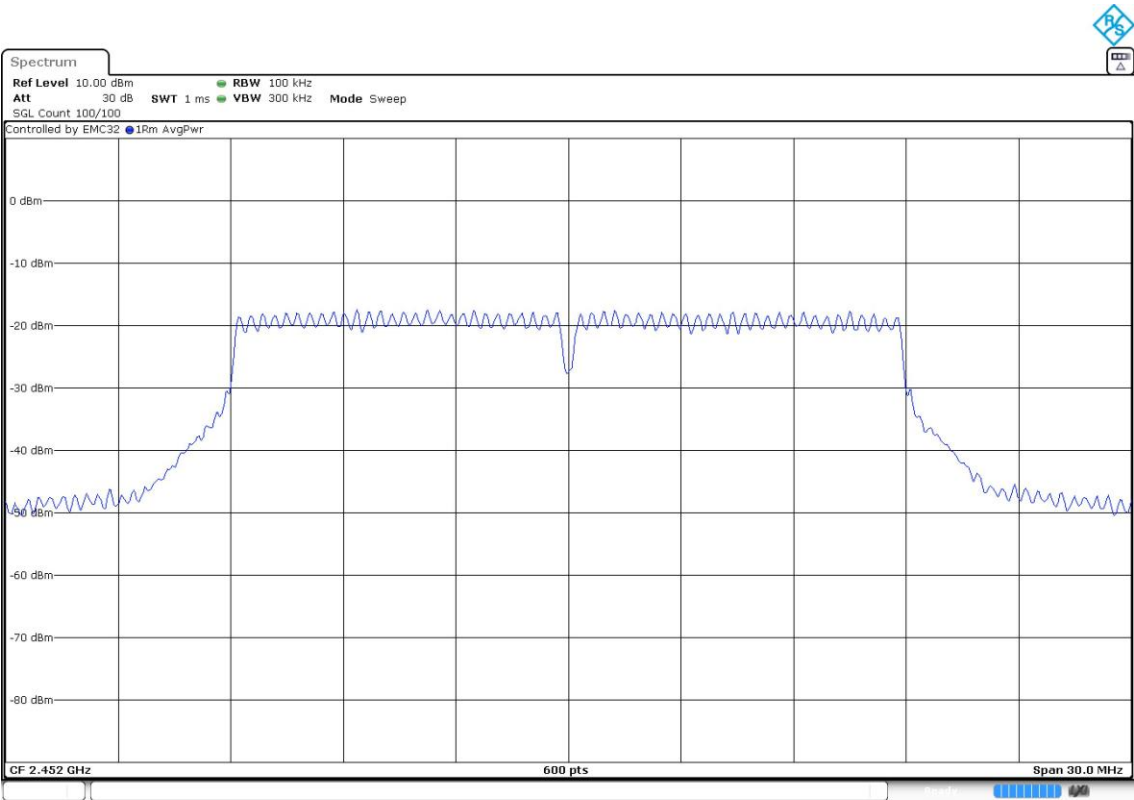
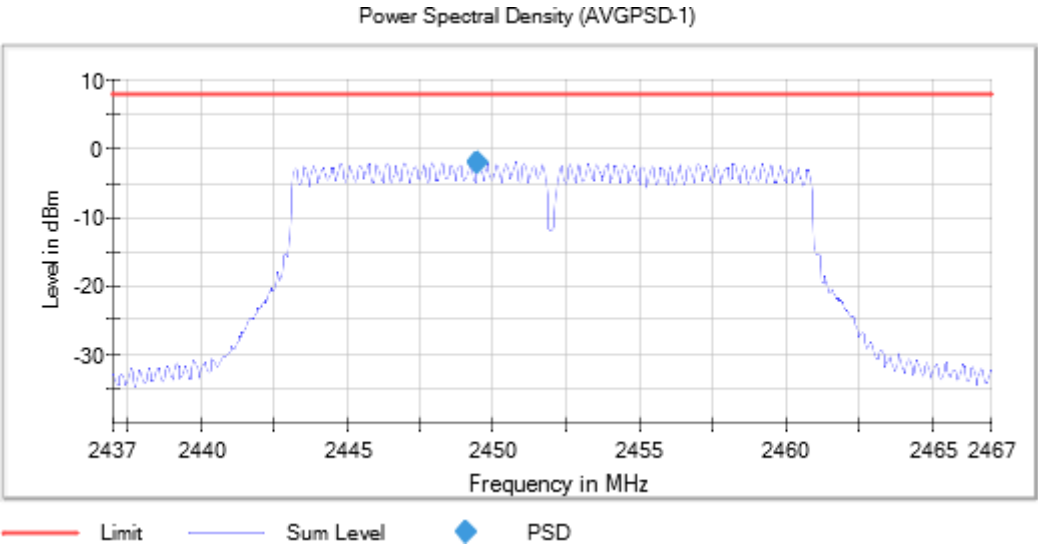
Frequency MHz = 2437.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



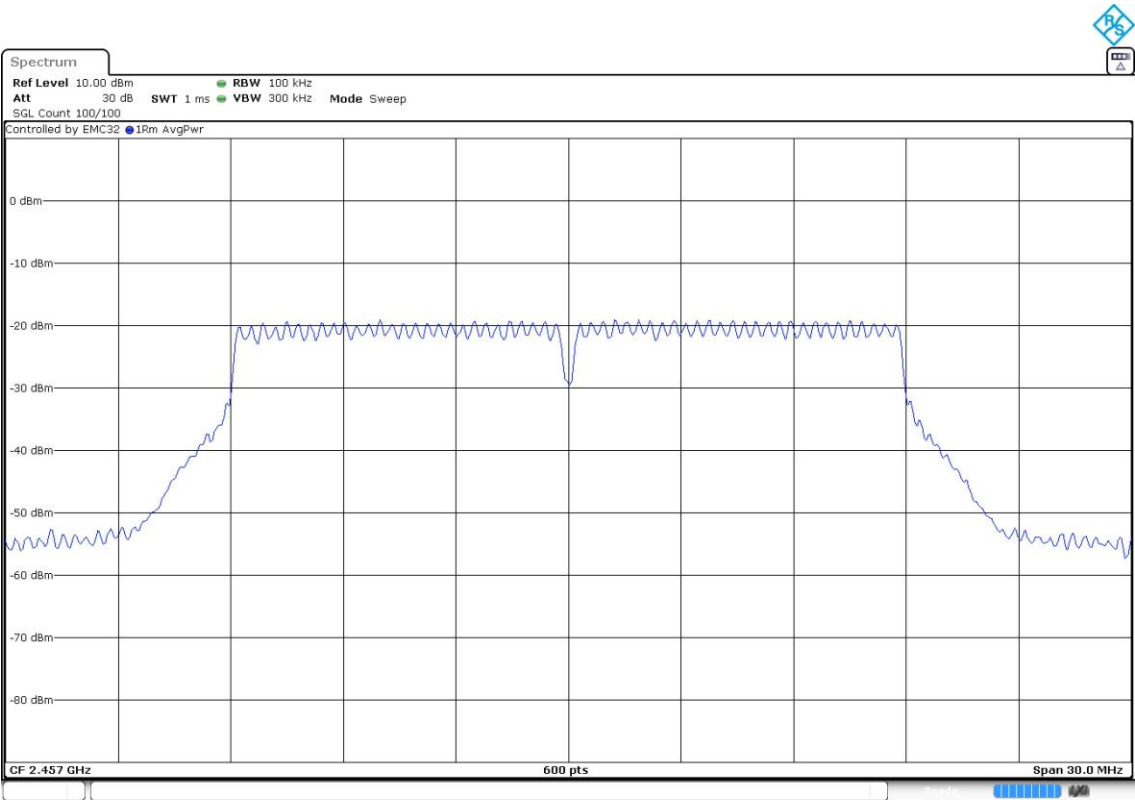
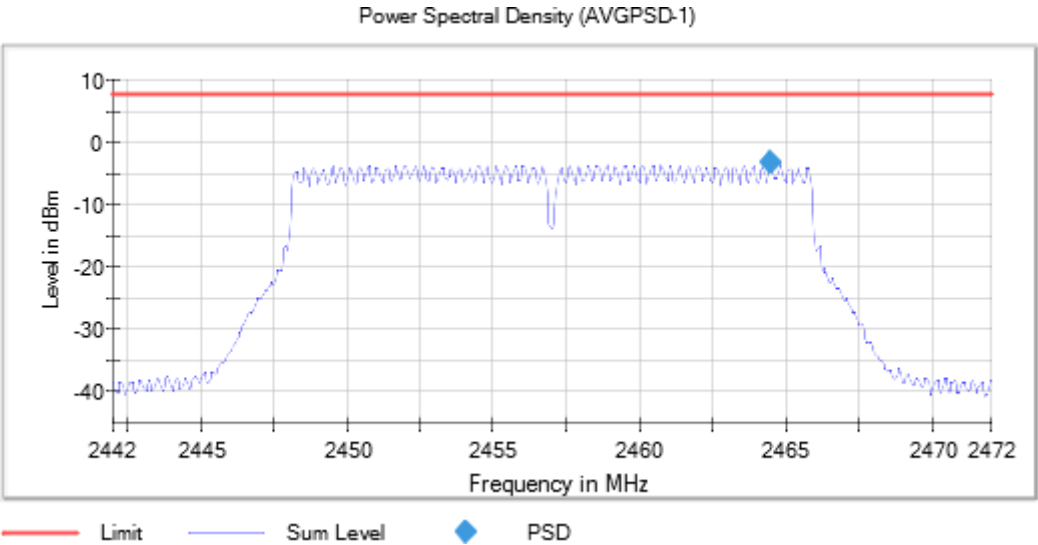
Frequency MHz = 2452.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



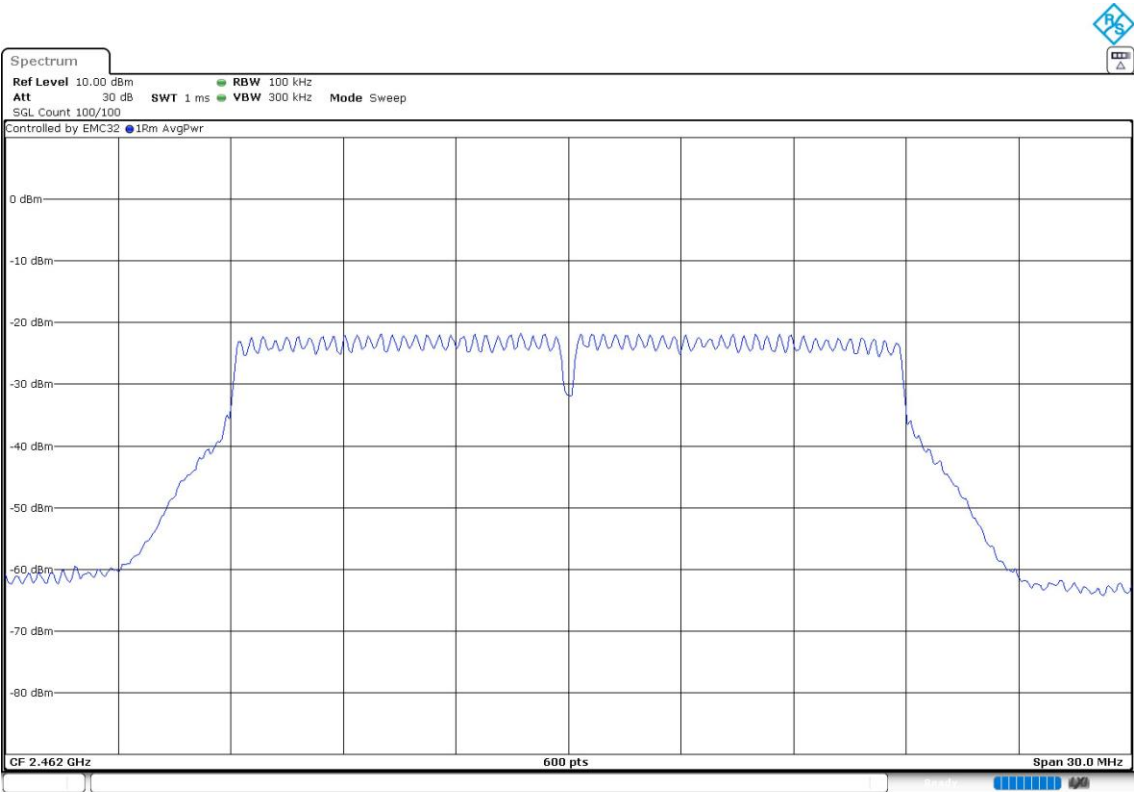
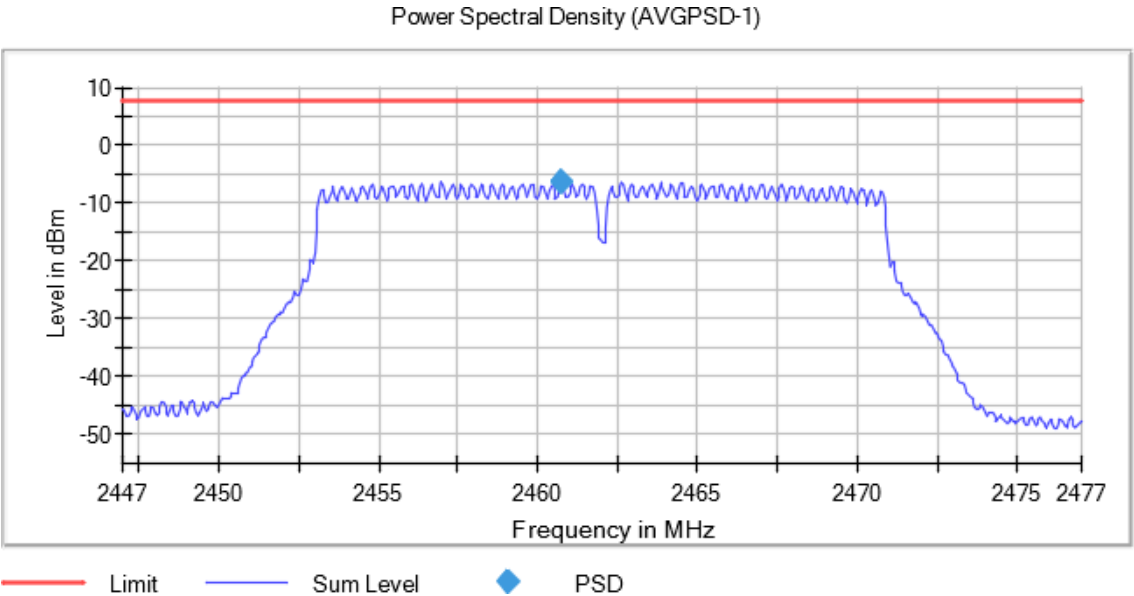
Frequency MHz = 2457.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



Frequency MHz = 2462.00000 Equipment Type = Digital Transmission System (DTS)
Bandwidth MHz = 20 Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Number of Transmission Chains = 1 Active Port = 1

Images:



RSS-247 5.4 (d) / FCC 15.247 (b) (1) Maximum Output Power and antenna gain

Limits

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).
The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

Results

Modulation: 802.11b (DSSS 1 Mbit/s)

Freq (MHz)	# of Tx Chains	Port	Avg Power (dBm)	EIRP (dBm)
2412.00	1	1	17.20	19.20
2437.00			16.90	18.90
2462.00			17.40	19.40

Modulation: 802.11g (OFDM 6 Mbit/s)

Freq (MHz)	# of Tx Chains	Port	Avg Power (dBm)	EIRP (dBm)
2412.00	1	1	17.10	19.10
2417.00			17.70	19.70
2422.00			19.20	21.20
2437.00			18.90	20.90
2452.00			16.70	18.70
2457.00			19.10	21.10
2462.00			17.50	19.50

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

Freq (MHz)	# of Tx Chains	Port	Avg Power (dBm)	EIRP (dBm)
2412.00	1	1	15.80	17.80
2417.00			16.90	18.90
2422.00			19.00	21.00
2437.00			18.80	20.80
2452.00			15.60	17.60
2457.00			19.00	21.00
2462.00			17.50	19.50

Verdict

Pass