

Radiated emission

EUT Information

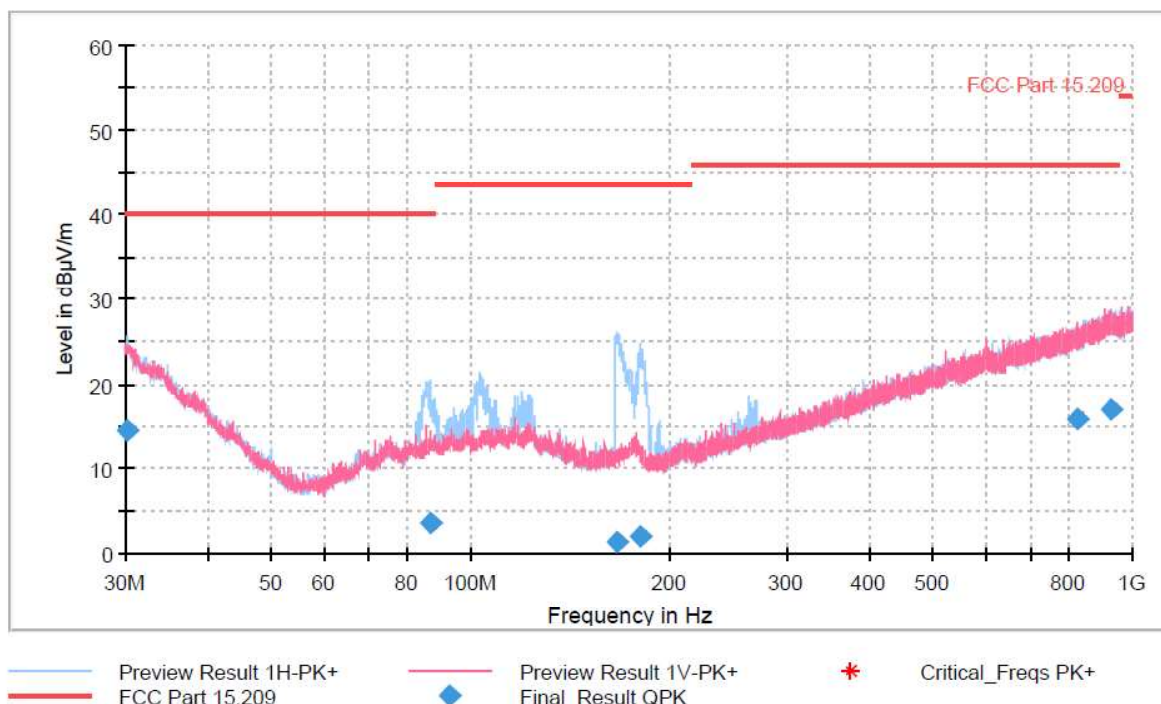
EUT:

BP 18 Li 5,0

Operating Mode

TX 2480 MHz

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
30.330000	14.44	40.00	25.56	102.0	H	27.0
929.400000	17.06	46.00	28.94	102.0	H	13.0
824.670000	16.00	46.00	30.00	127.0	V	196.0
87.000000	3.54	40.00	36.46	104.0	H	318.0
180.420000	2.03	43.50	41.47	100.0	H	318.0
166.920000	1.38	43.50	42.12	141.0	H	318.0

Radiated emission

EUT Information

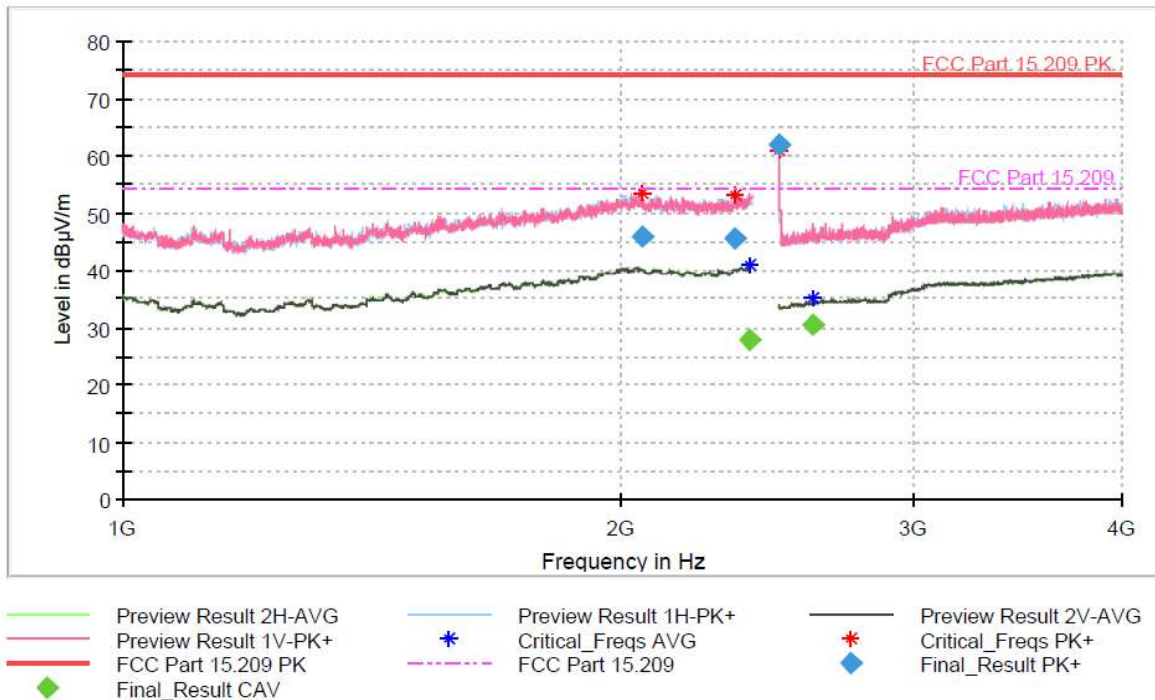
EUT:

BP 18 Li 5,0

Operating Mode:

TX 2480 MHz

Full Spectrum



Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
2483.500000	62.10	---	74.00	11.90	150.0	V	75.0
2607.750000	---	30.46	54.00	23.54	150.0	V	264.0
2388.000000	---	27.78	54.00	26.22	150.0	H	2.0
2054.500000	46.07	---	74.00	27.93	150.0	V	358.0
2340.250000	45.54	---	74.00	28.46	150.0	V	117.0

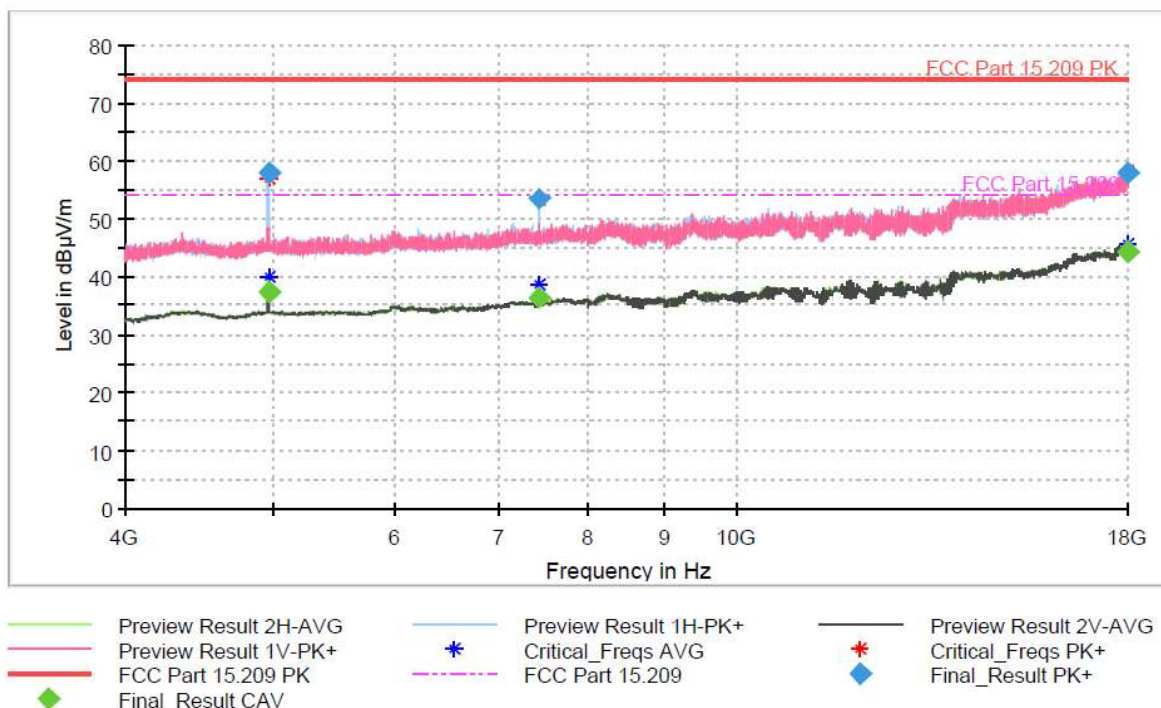
Radiated emission

EUT Information

EUT:
Operating Mode

BP 18 Li 5,0
TX 2480 MHz

Full Spectrum



Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
17999.000000	---	44.16	54.00	9.84	150.0	V	0.0
4960.250000	58.15	---	74.00	15.85	150.0	H	26.0
17978.750000	58.03	---	74.00	15.97	150.0	H	303.0
4960.250000	---	37.52	54.00	16.48	150.0	H	26.0
7439.750000	---	36.31	54.00	17.69	150.0	H	26.0
7440.750000	53.43	---	74.00	20.57	150.0	H	358.0



3.5 47 CFR § 15.247 (a) (2) – 6 dB Emission Bandwidth

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

3.5.1 Test procedure

According to ANSI C63.10-2013:

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.
- c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level. Specific guidance is given in 4.1.5.2.
- d) Steps a) through c) might require iteration to adjust within the specified tolerances.
- e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target “-xx dB down” requirement; that is, if the requirement calls for measuring the -20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
- f) Set detection mode to peak and trace mode to max hold.
- g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyser marker to the highest level of the displayed trace (this is the reference value).
- h) Determine the “-xx dB down amplitude” using $[(\text{reference value}) - xx]$. Alternatively, this calculation may be made by using the marker-delta function of the instrument.
- i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyser and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).
- j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the “-xx dB down amplitude” determined in step h). If a marker is below this “-xx dB down amplitude” value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the “-xx dB down amplitude” determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.
- k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

3.5.2 Test setup

For the test setup refer to chapter 1.4.

3.5.3 Test equipment

For the test setup refer to chapter 1.3.

3.5.4 Test results

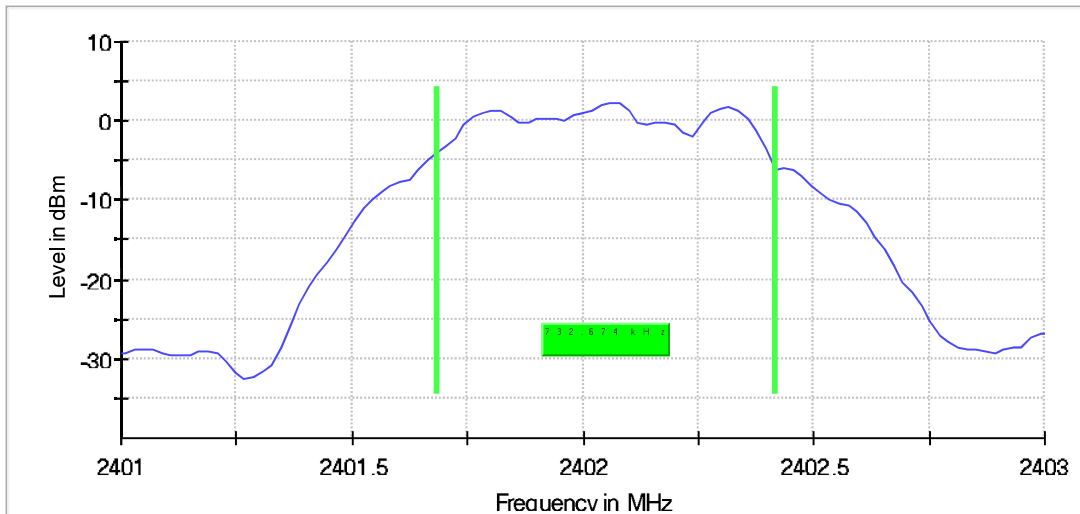
Channel 2402 MHz:

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	0.732674	0.500000	---	2401.683168	2402.415842

(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2402.000000	2.4	PASS

6 dB Bandwidth



Bandwidth

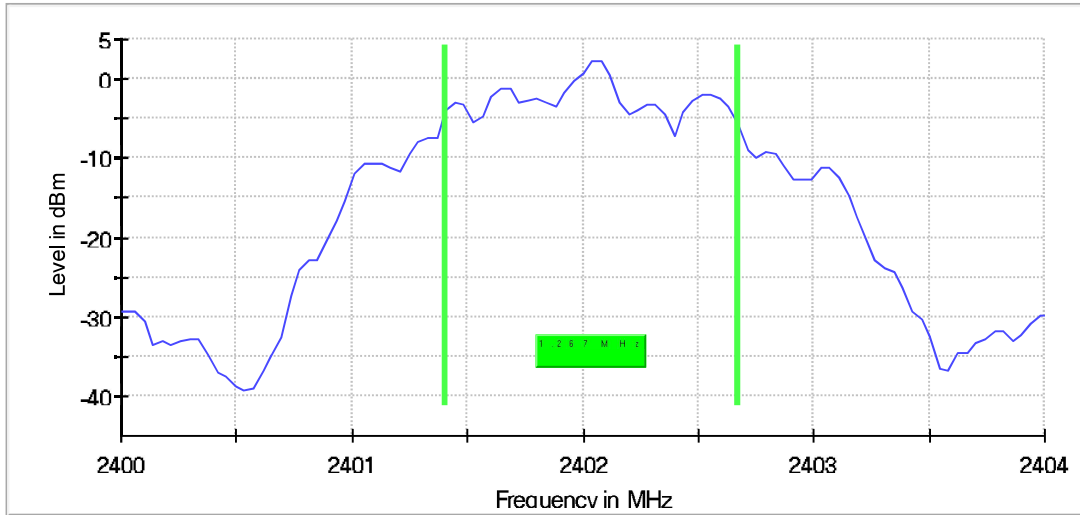


DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	1.267326	0.500000	---	2401.405941	2402.673267

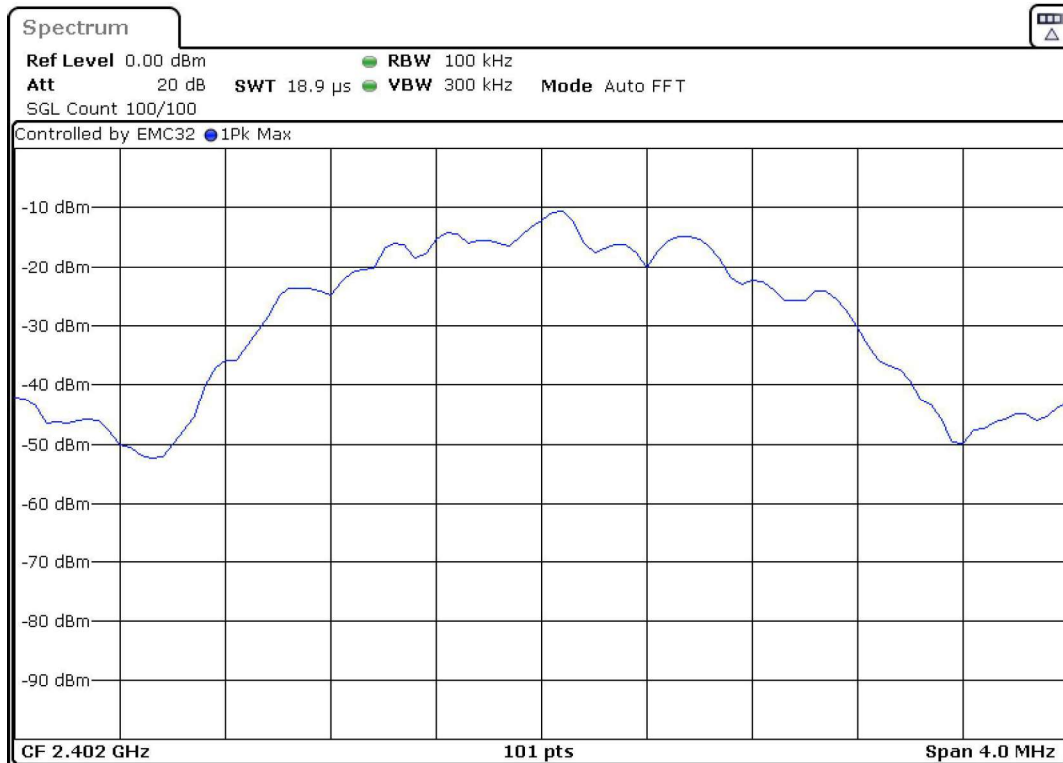
(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2402.000000	2.4	PASS

6 dB Bandwidth



Bandwidth





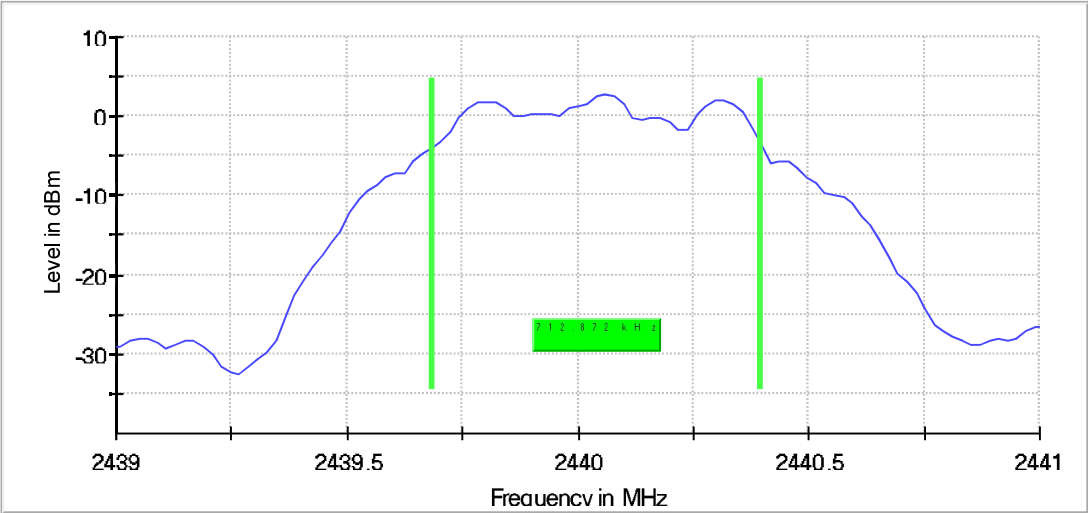
Channel 2440 MHz:

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2440.000000	0.712872	0.500000	---	2439.683168	2440.396040

(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2440.000000	2.7	PASS

6 dB Bandwidth



Bandwidth

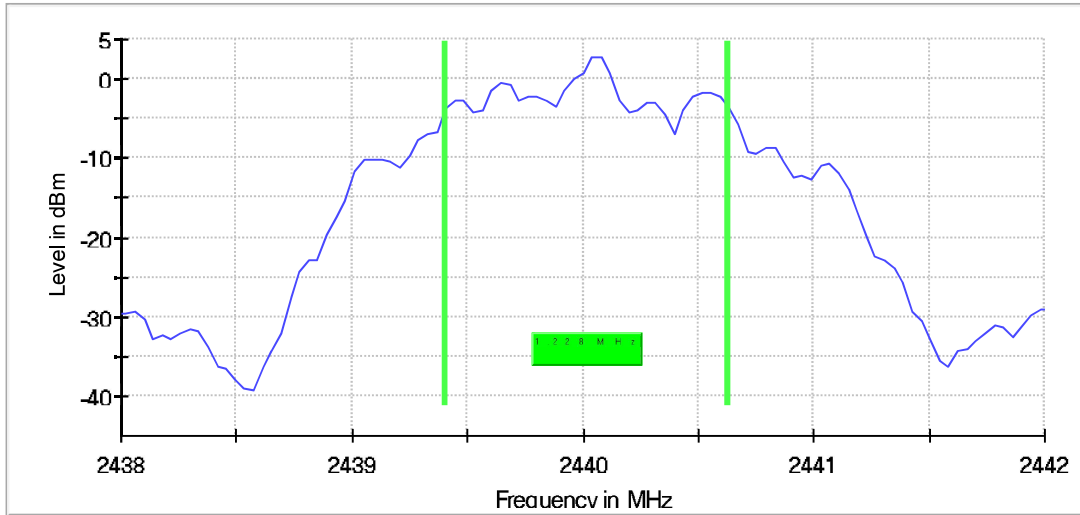


DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2440.000000	1.227722	0.500000	---	2439.405941	2440.633663

(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2440.000000	2.7	PASS

6 dB Bandwidth



Bandwidth





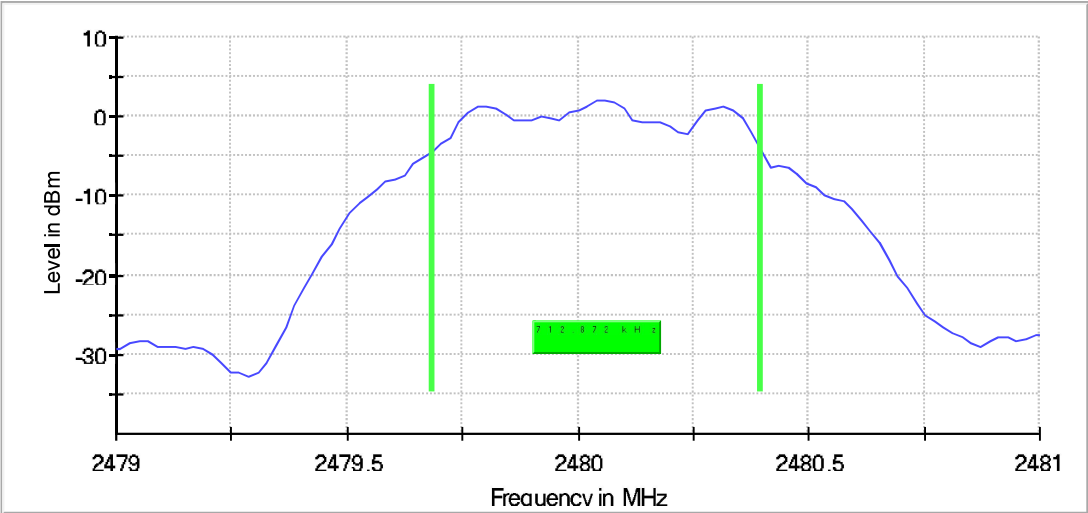
Channel 2480 MHz:

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	0.712872	0.500000	---	2479.683168	2480.396040

(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2480.000000	2.1	PASS

6 dB Bandwidth



Bandwidth

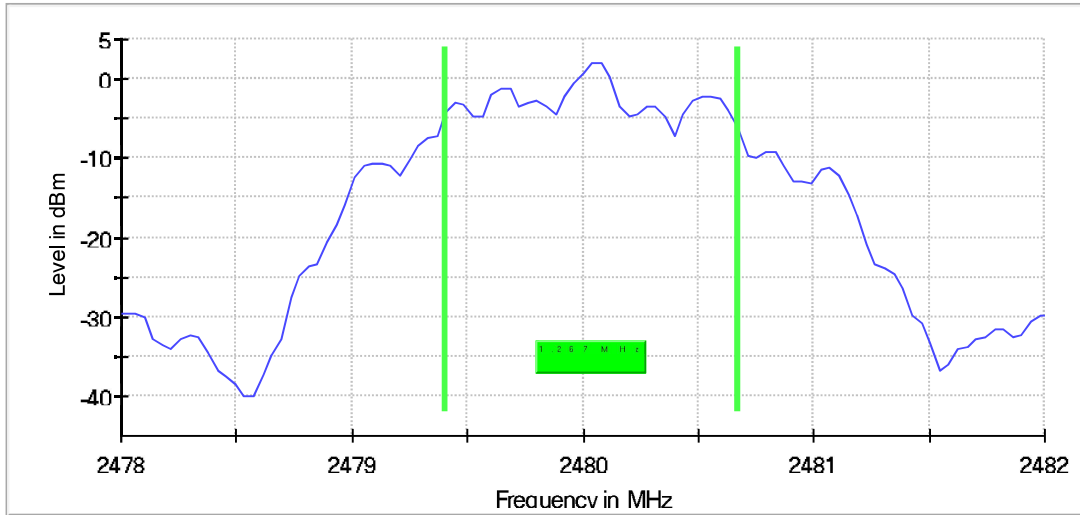


DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	1.267326	0.500000	---	2479.405941	2480.673267

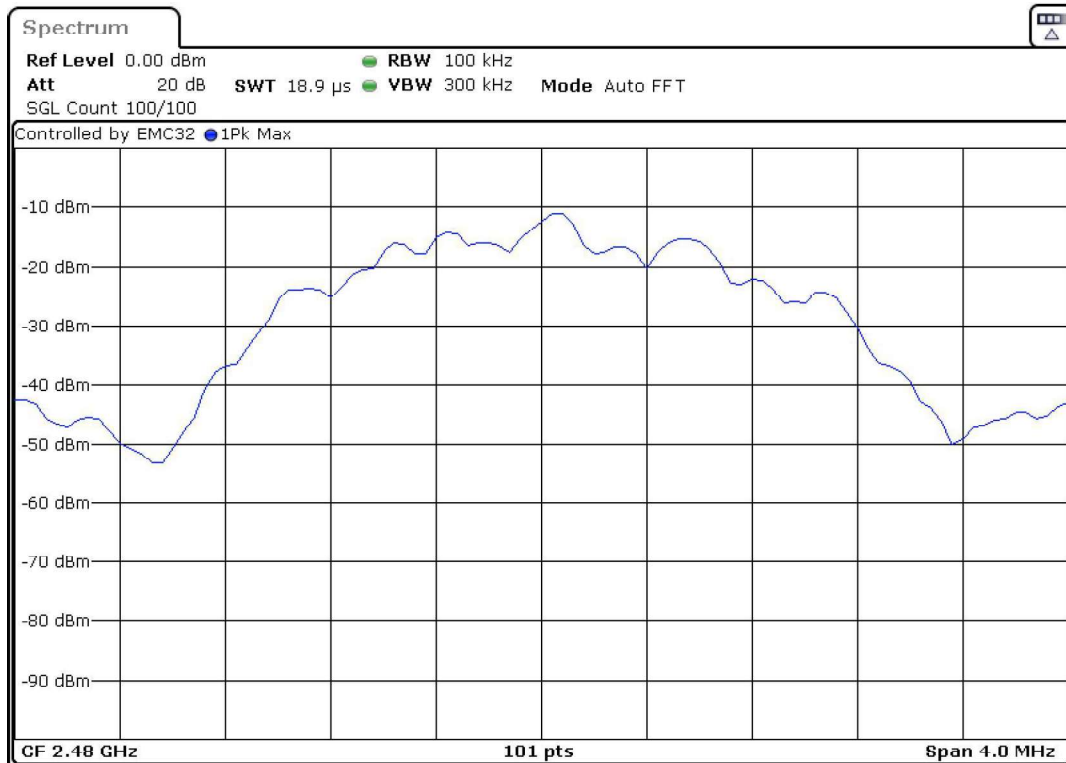
(continuation of the "6 dB Bandwidth" table from column 6 ...)

DUT Frequency (MHz)	Max Level (dBm)	Result
2480.000000	2.0	PASS

6 dB Bandwidth



Bandwidth



3.6 47 CFR § 15.247 (b) (3) – Maximum peak output power

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

3.6.1 Test procedure

According ANSI C63.10-2013:

Measurement using an RF average power meter. The procedure for this method is as follows:

- a) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the following conditions are satisfied:
 - 1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
 - 2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
 - 3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
- b) If the transmitter does not transmit continuously, measure the duty cycle D of the transmitter output signal as described in 12.2.
- c) Measure the average power of the transmitter. This measurement is an average over both the ON and OFF periods of the transmitter.
- d) Adjust the measurement in dBm by adding $[10 \log (1 / D)]$, where D is the duty cycle {e.g., $[10 \log (1 / 0.25)]$, if the duty cycle is 25%}.

3.6.2 Test setup

For the test setup refer to chapter 1.4.

3.6.3 Test equipment

For the test setup refer to chapter 1.3.

3.6.4 Test results

47 CFR § 15.247 Requirement

DUT Frequency (MHz)	Bandwidth (MHz)	Conducted output power (dBm)	Limit Max (dBm)	Result
2402.000000	1	2.7	30.0	PASS
2440.000000	1	3.0	30.0	PASS
2480.000000	1	2.4	30.0	PASS
2402.000000	2	2.6	30.0	PASS
2440.000000	2	2.9	30.0	PASS
2480.000000	2	2.3	30.0	PASS

RSS 247 Requirement

DUT Frequency (MHz)	Bandwidth (MHz)	Conducted output power (dBm)	Limit Max (dBm)	Equivalent isotropically radiated power (e.i.r.p)	Limit Max (dBm)	Result
2402.000000	1	2.7	30.0	-6.83	36.2	PASS
2440.000000	1	3.0	30.0	-6.53	36.2	PASS
2480.000000	1	2.4	30.0	-7.13	36.2	PASS
2402.000000	2	2.6	30.0	-6.93	36.2	PASS
2440.000000	2	2.9	30.0	-6.63	36.2	PASS
2480.000000	2	2.3	30.0	-7.23	36.2	PASS



3.7 47 CFR § 15.247 (d) –100 kHz Bandwidth of Frequency Band Edge

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB attenuation below the general limits specified in § 15.209(a) is not required. In addition, 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)).

3.7.1 Test procedure

According to ANSI C63.10-2013:

- a) Connect the EMI receiver or spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described in step e) (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).
- b) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequence shall include the lowest frequency channel).
- c) Set the EUT to operate at maximum output power and 100% duty cycle, or equivalent “normal mode of operation” as specified in 6.10.3.
- d) If using the radiated method, then use the applicable procedure(s) of 6.4, 6.5 6.6, and orient the EUT and measurement antenna positions to produce the highest emission level.
- e) Perform the test as follows:
 - 1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
 - 2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level. Specific guidance is given in 4.1.5.2.
 - 3) Attenuation: Auto (at least 10 dB preferred).
 - 4) Sweep time: Coupled.
 - 5) Resolution bandwidth: 100 kHz.
 - 6) Video bandwidth: 300 kHz.
 - 7) Detector: Peak.
 - 8) Trace: Max hold.
- f) Allow the trace to stabilize. For the test with the hopping function turned ON, this can take several minutes to achieve
- g) Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
- h) Repeat step c) through step e) for every applicable modulation.
- i) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequence shall include the highest frequency channel) and repeat step c) through step d).
- j) The band-edge measurement shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

3.7.2 Test setup

For the test setup refer to chapter 1.4.

3.7.3 Test equipment

For the test setup refer to chapter 1.3.

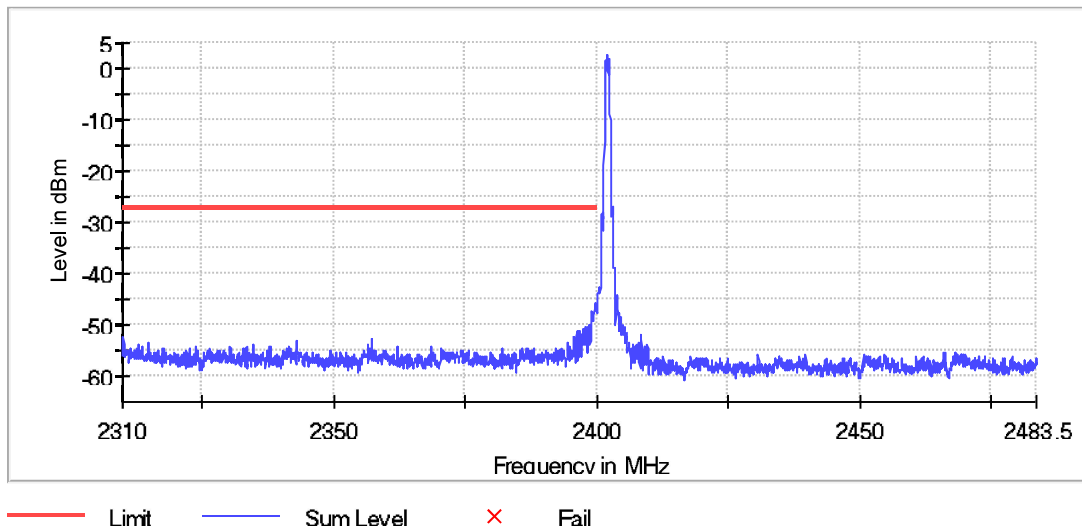
3.7.4 Test results – Conducted measurement of band edges

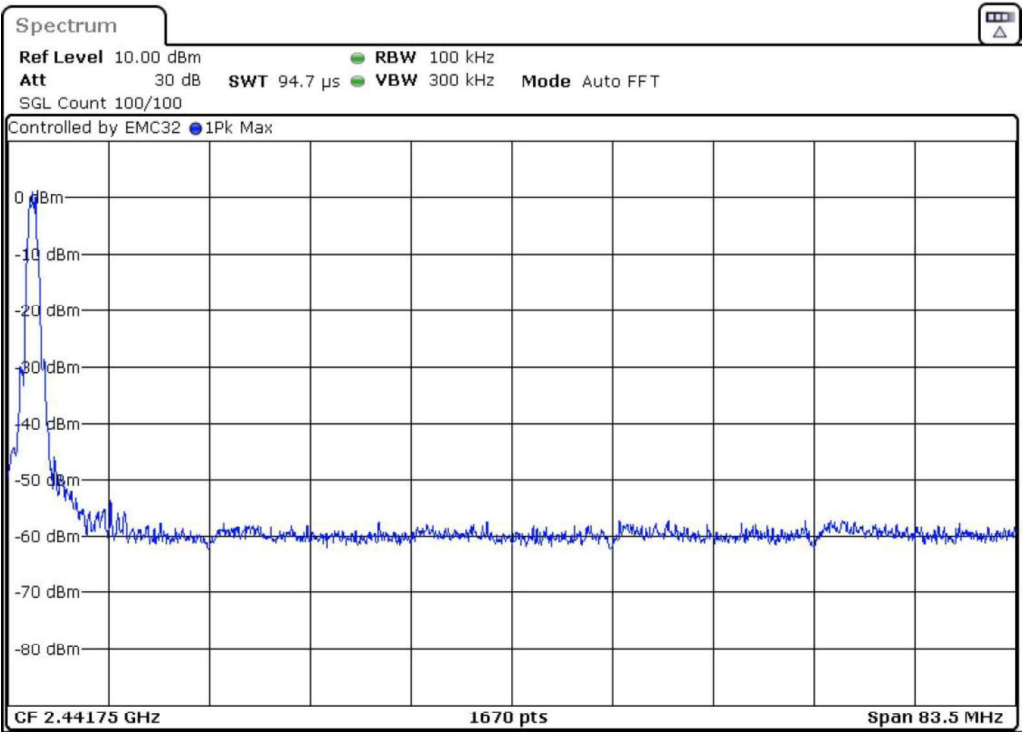
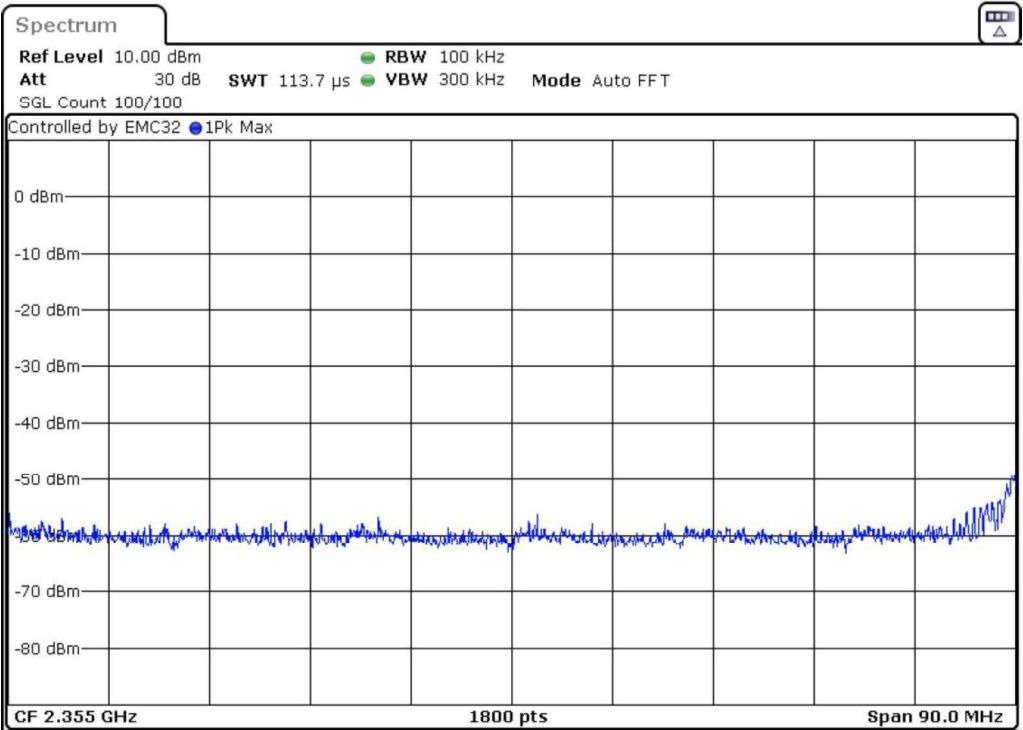
DUT Frequency (MHz)	Bandwidth (MHz)	Result
2402.000000	1	PASS

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.825000	-45.7	18.3	-27.5	PASS
2399.875000	-45.8	18.4	-27.5	PASS
2399.625000	-46.0	18.5	-27.5	PASS
2399.675000	-46.0	18.6	-27.5	PASS
2399.775000	-46.3	18.8	-27.5	PASS
2399.725000	-46.5	19.1	-27.5	PASS
2399.575000	-46.6	19.2	-27.5	PASS
2399.925000	-46.8	19.3	-27.5	PASS
2399.175000	-47.4	19.9	-27.5	PASS
2399.125000	-47.6	20.1	-27.5	PASS
2399.975000	-47.6	20.1	-27.5	PASS
2399.225000	-47.7	20.3	-27.5	PASS
2399.275000	-48.0	20.6	-27.5	PASS
2399.525000	-48.1	20.7	-27.5	PASS
2399.075000	-48.6	21.2	-27.5	PASS

Band Edge



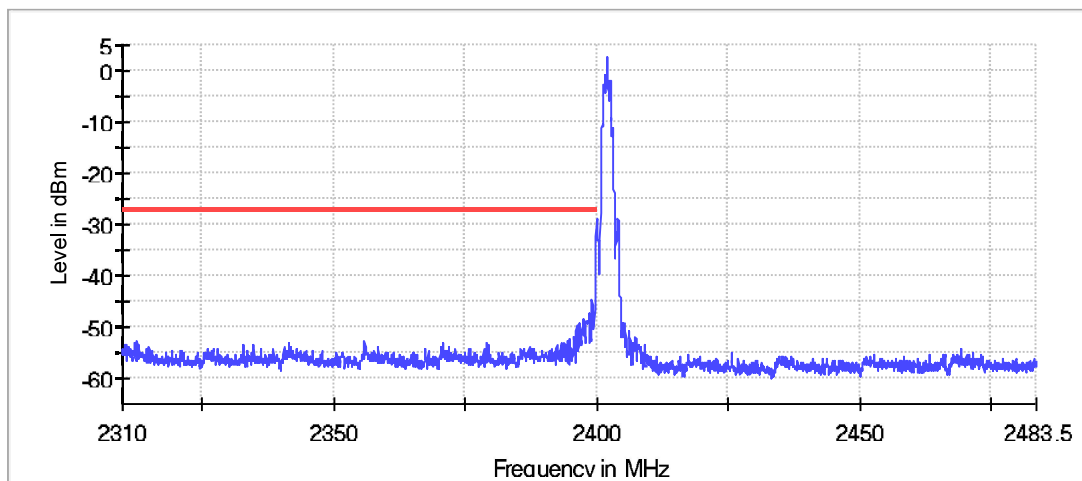


DUT Frequency (MHz)	Bandwidth (MHz)	Result
2402.000000	2	PASS

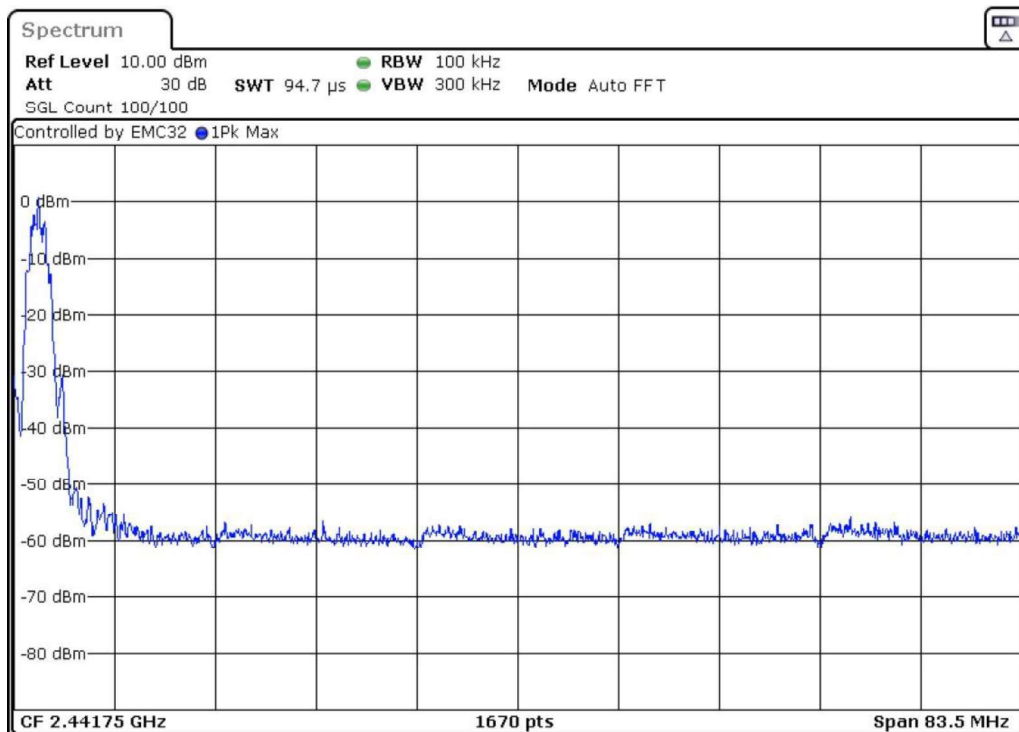
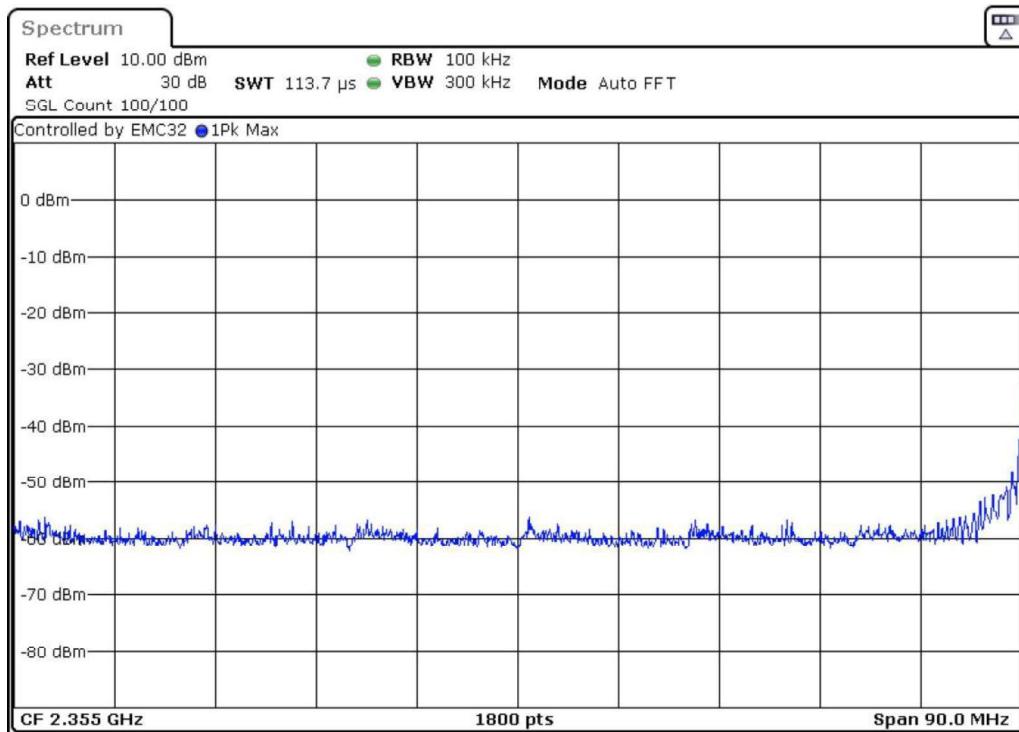
Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-28.9	1.4	-27.5	PASS
2399.925000	-32.2	4.7	-27.5	PASS
2399.875000	-36.2	8.7	-27.5	PASS
2399.825000	-38.0	10.5	-27.5	PASS
2399.775000	-38.8	11.3	-27.5	PASS
2399.725000	-40.4	12.9	-27.5	PASS
2399.675000	-41.8	14.3	-27.5	PASS
2399.625000	-43.6	16.1	-27.5	PASS
2399.125000	-44.5	17.0	-27.5	PASS
2399.075000	-44.6	17.2	-27.5	PASS
2399.175000	-44.7	17.2	-27.5	PASS
2399.025000	-45.7	18.3	-27.5	PASS
2399.225000	-45.9	18.4	-27.5	PASS
2399.575000	-46.5	19.1	-27.5	PASS
2399.275000	-47.0	19.6	-27.5	PASS

Band Edge



— Limit — Sum Level × Fail

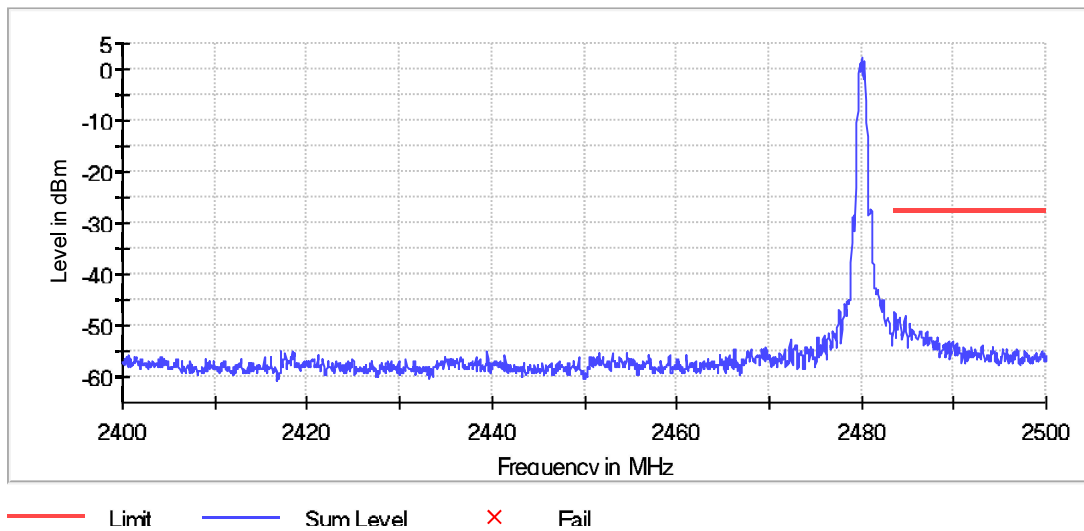


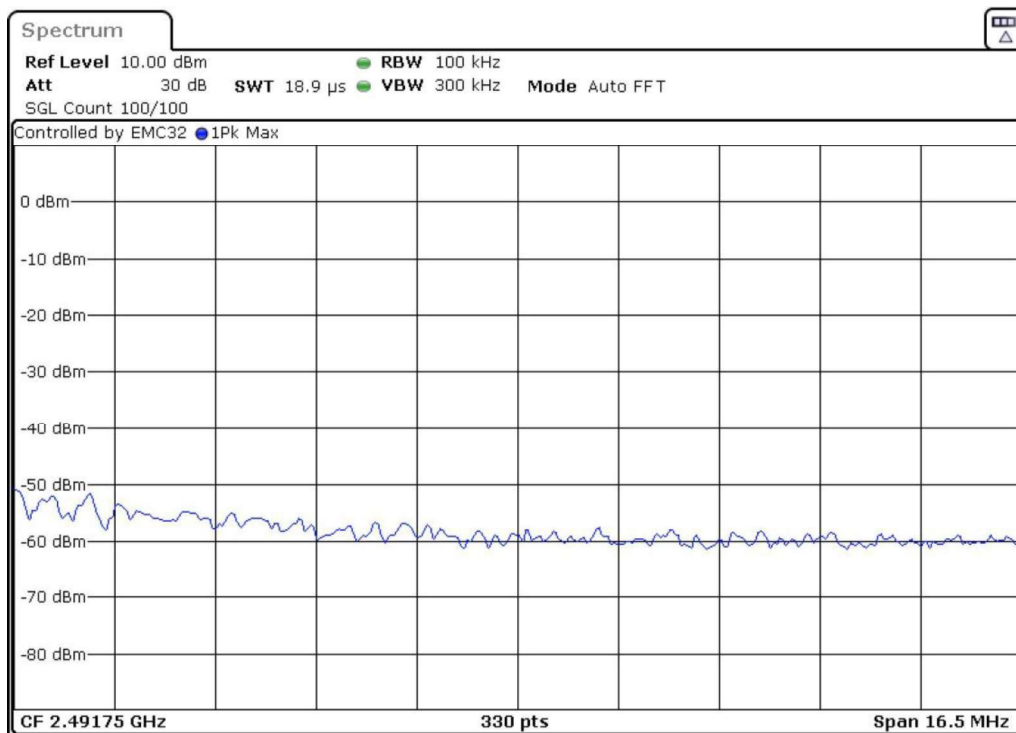
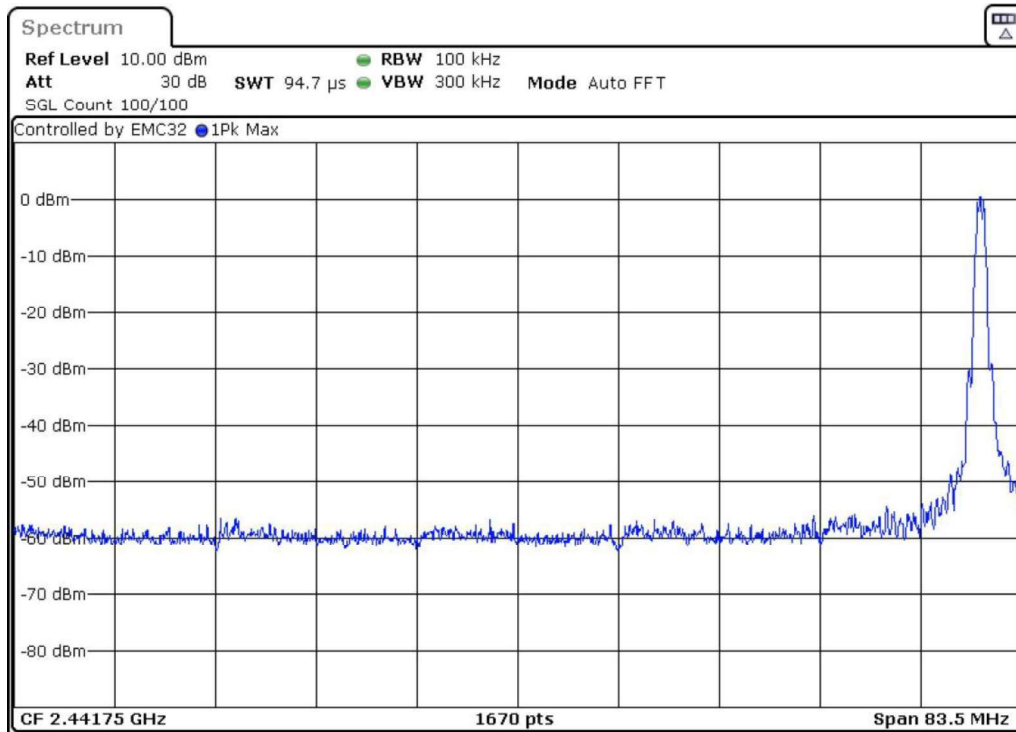
DUT Frequency (MHz)	Bandwidth (MHz)	Result
2480.000000	1	PASS

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.525000	-47.1	19.4	-27.8	PASS
2483.575000	-47.1	19.4	-27.8	PASS
2483.625000	-47.6	19.9	-27.8	PASS
2484.775000	-48.0	20.2	-27.8	PASS
2484.725000	-48.1	20.3	-27.8	PASS
2484.175000	-48.4	20.7	-27.8	PASS
2484.125000	-48.4	20.7	-27.8	PASS
2483.675000	-48.7	21.0	-27.8	PASS
2484.825000	-48.9	21.1	-27.8	PASS
2483.975000	-48.9	21.2	-27.8	PASS
2484.025000	-49.0	21.2	-27.8	PASS
2484.675000	-49.1	21.3	-27.8	PASS
2484.225000	-49.3	21.5	-27.8	PASS
2484.075000	-49.4	21.6	-27.8	PASS
2483.925000	-49.5	21.7	-27.8	PASS

Band Edge





DUT Frequency (MHz)	Bandwidth (MHz)	Result
2480.000000	2	PASS

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2484.675000	-46.9	19.1	-27.8	PASS
2484.625000	-47.0	19.2	-27.8	PASS
2484.725000	-47.1	19.4	-27.8	PASS
2483.525000	-47.3	19.5	-27.8	PASS
2484.775000	-47.9	20.1	-27.8	PASS
2484.075000	-48.0	20.2	-27.8	PASS
2484.125000	-48.1	20.3	-27.8	PASS
2484.575000	-48.2	20.4	-27.8	PASS
2484.025000	-48.3	20.6	-27.8	PASS
2483.575000	-48.5	20.7	-27.8	PASS
2483.675000	-48.7	20.9	-27.8	PASS
2484.175000	-48.7	20.9	-27.8	PASS
2483.625000	-48.8	21.0	-27.8	PASS
2483.875000	-48.9	21.2	-27.8	PASS
2483.725000	-49.0	21.2	-27.8	PASS

Band Edge

