3. 6 dB Bandwidth & 99 % Bandwidth

3.1. Test Setup

3.2. Limit

3.2.1. FCC

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902-928 ㎒, 2 400-2 483.5 ㎒, and 5 725-5 850 ㎒ bands. The minimum 6 dB bandwidth shall be at least 500 ㎑.

3.2.2. IC

According to RSS-247 Issue 2, 5.2(a), the minimum 6 dB bandwidth shall be 500 ㎑.

3.3. Test Procedure

3.3.1. 6 dB Bandwidth

The test follows section 11.8 DTS bandwidth of ANSI C63.10-2013.

Tests performed using section 11.8.1 Option 1.

- Option 1:
1. Set RBW to = 100 ㎑.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

3.3.2. 99 % Bandwidth

● The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

● The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

● The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

For the 99 % emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99 % emission bandwidth).

3.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Operation Mode	Data Rate	Channel	Frequency (㎒)	6 ㏈ Bandwidth (㎒)		99 % Bandwidth (㎒)	
				DC 5 V	DC 12 V	DC 5 V	DC 12 V
DSSS (802.11b)	11 Mbps	Low	2 412	8.671	8.671	13.786	13.786
		Middle	2 437	8.671	8.671	13.746	13.746
		High	2 462	8.671	8.671	13.746	13.746
OFDM (802.11g)	12 Mbps	Low	2 412	16.464	16.504	17.263	17.343
		Middle	2 437	16.464	16.504	17.223	17.263
		High	2 462	16.504	16.504	17.223	17.183
OFDM (802.11n_HT20)	MCS1	Low	2 412	17.702	17.423	18.302	18.382
		Middle	2 437	17.742	17.662	18.302	18.422
		High	2 462	17.742	17.622	18.222	18.262
OFDM (802.11n_HT40)	MCS2	Low	2 422	35.644	35.644	36.603	36.523
		Middle	2 437	35.644	35.644	36.683	36.523
		High	2 452	35.644	35.644	36.523	36.523

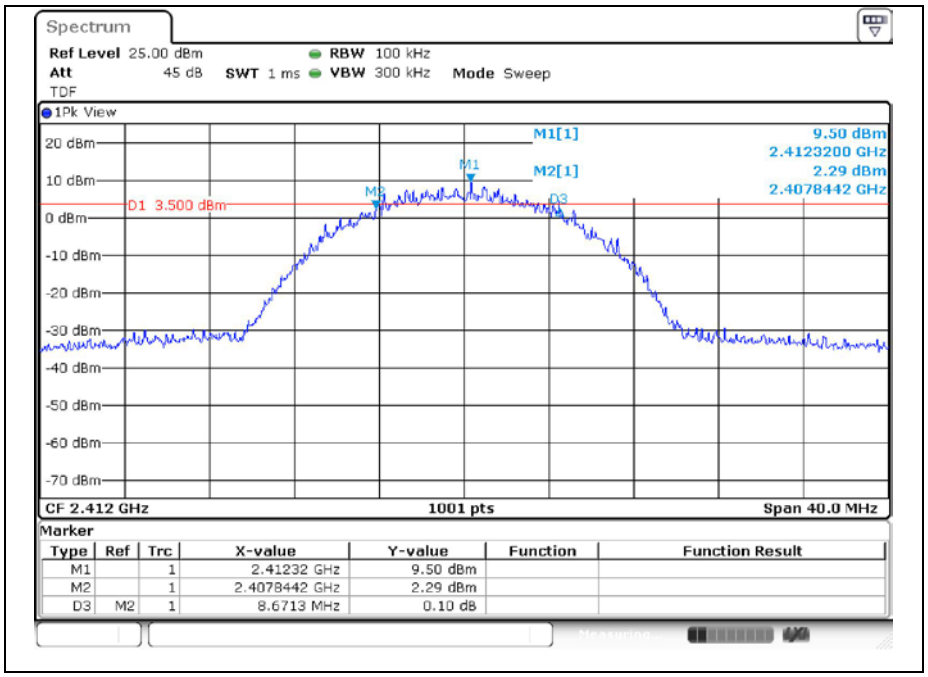
- Test plots

6 dB Bandwidth

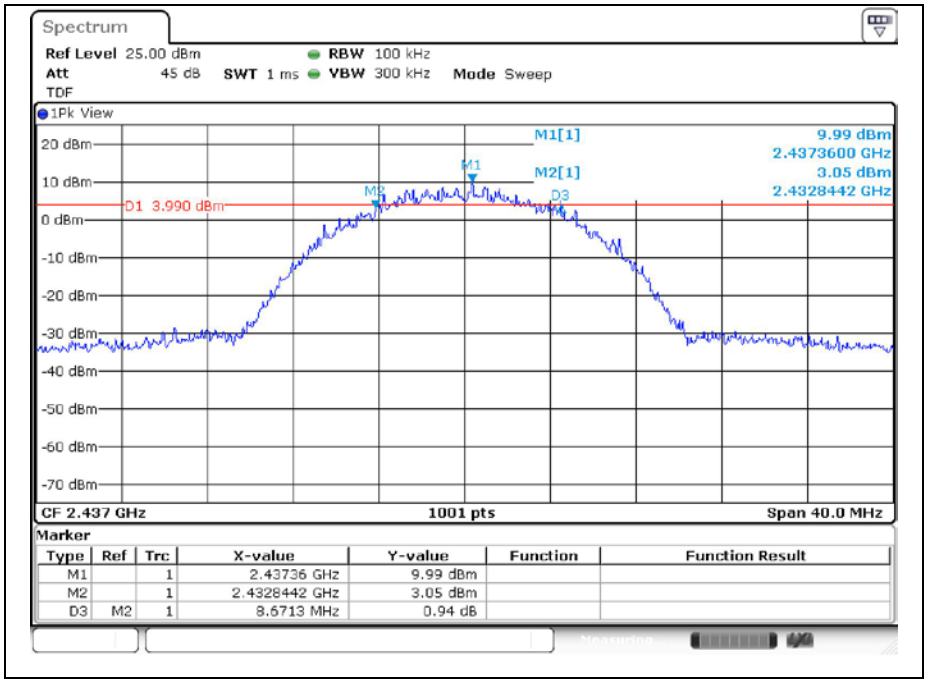
Test Condition: DC 5 V

DSSS: 802.11b

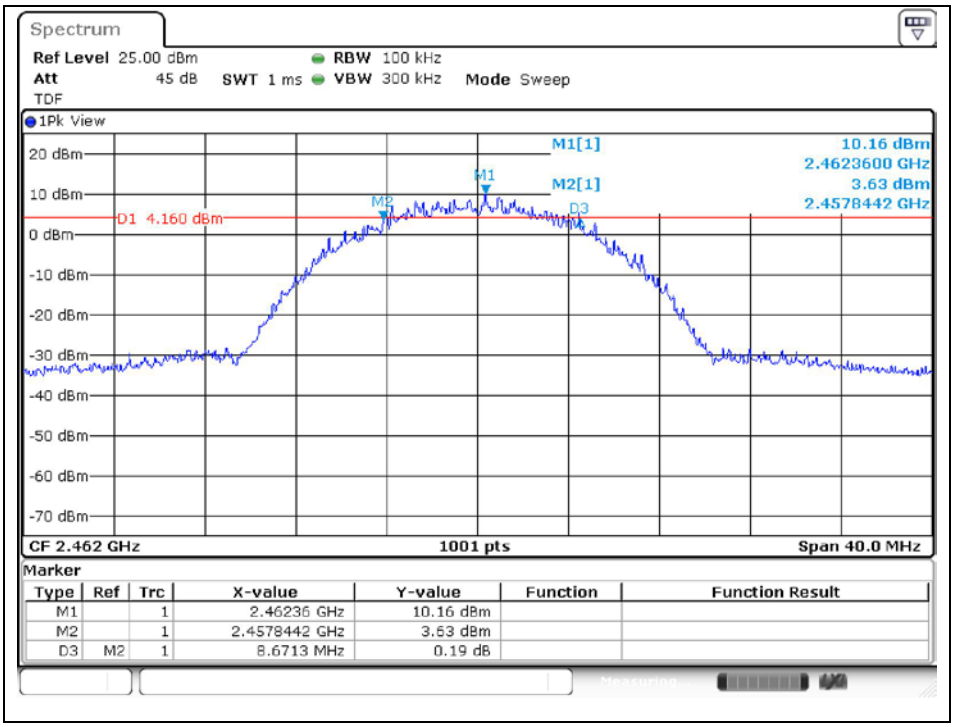
Low Channel



Middle Channel

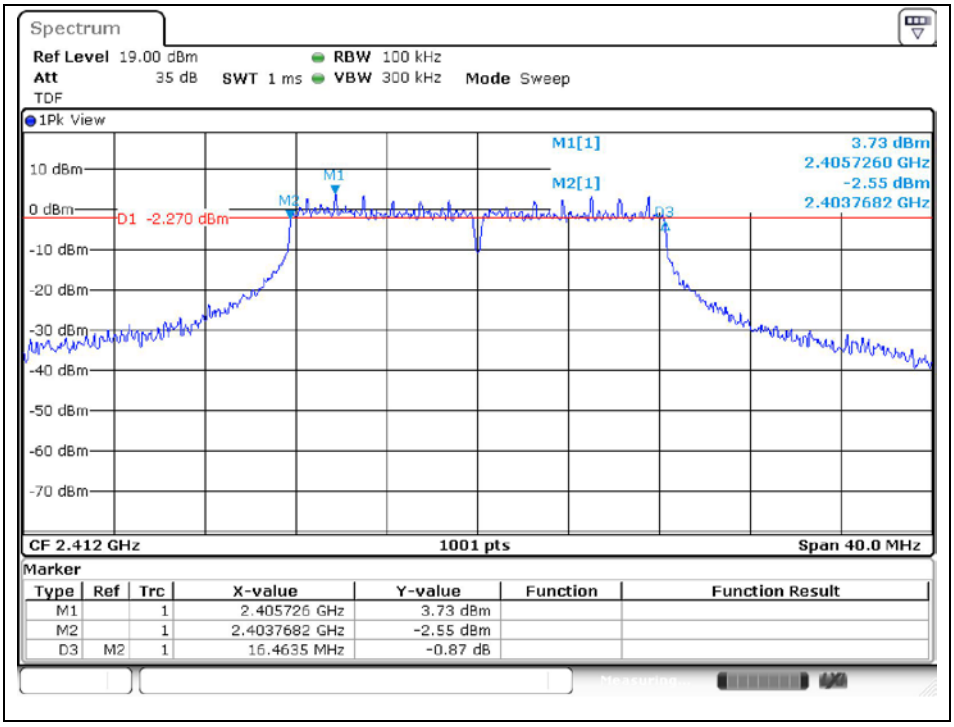


High Channel

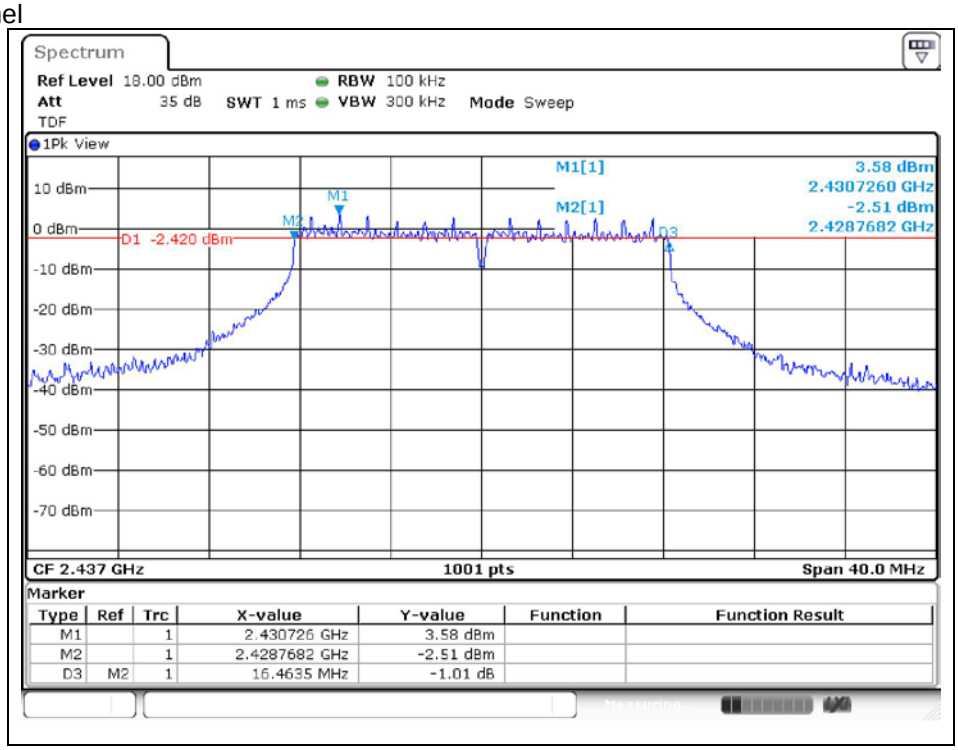


OFDM: 802.11g

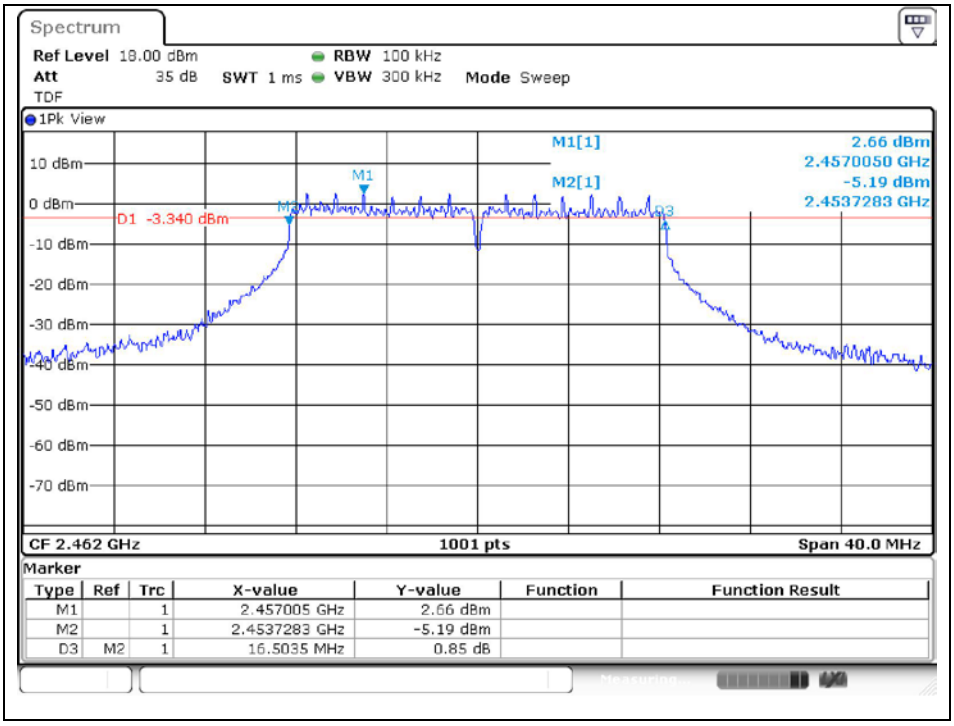
Low Channel



Middle Channel

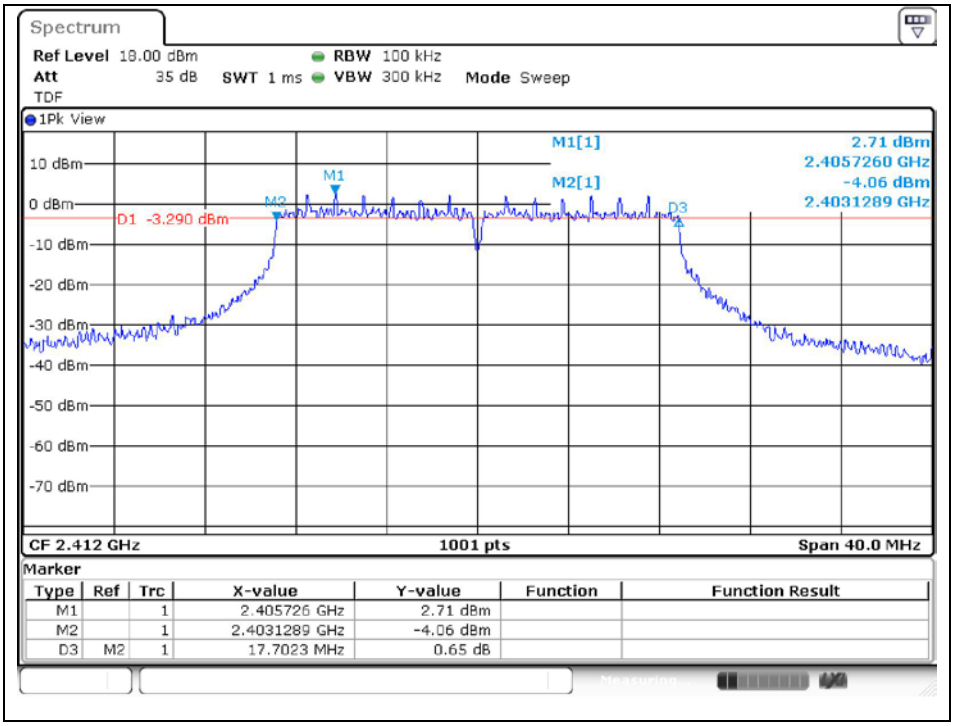


High Channel

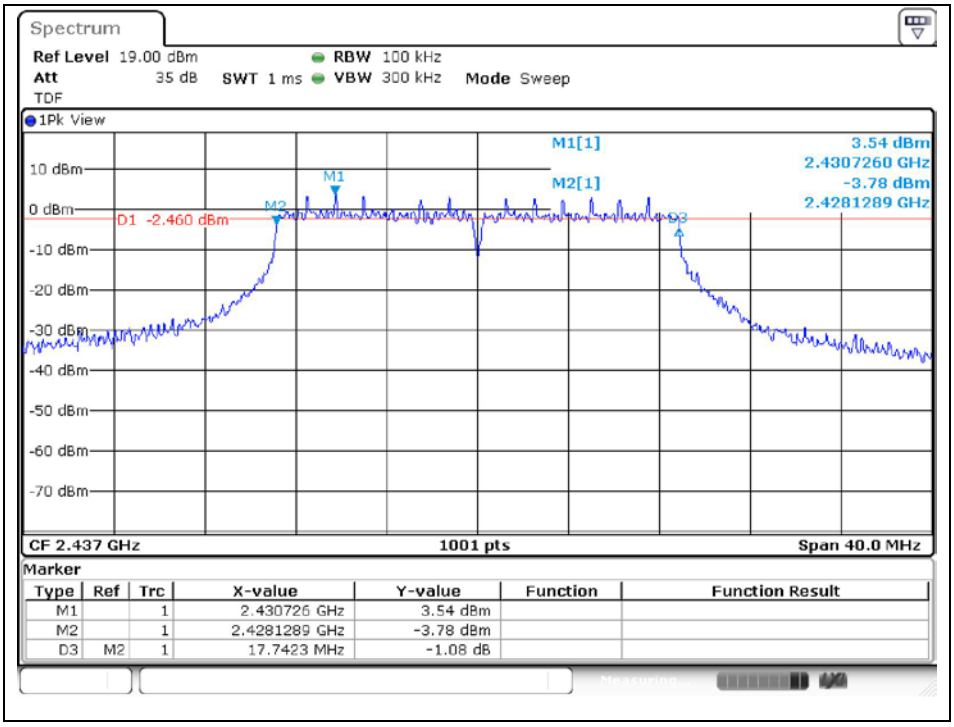


OFDM: 802.11n_HT20

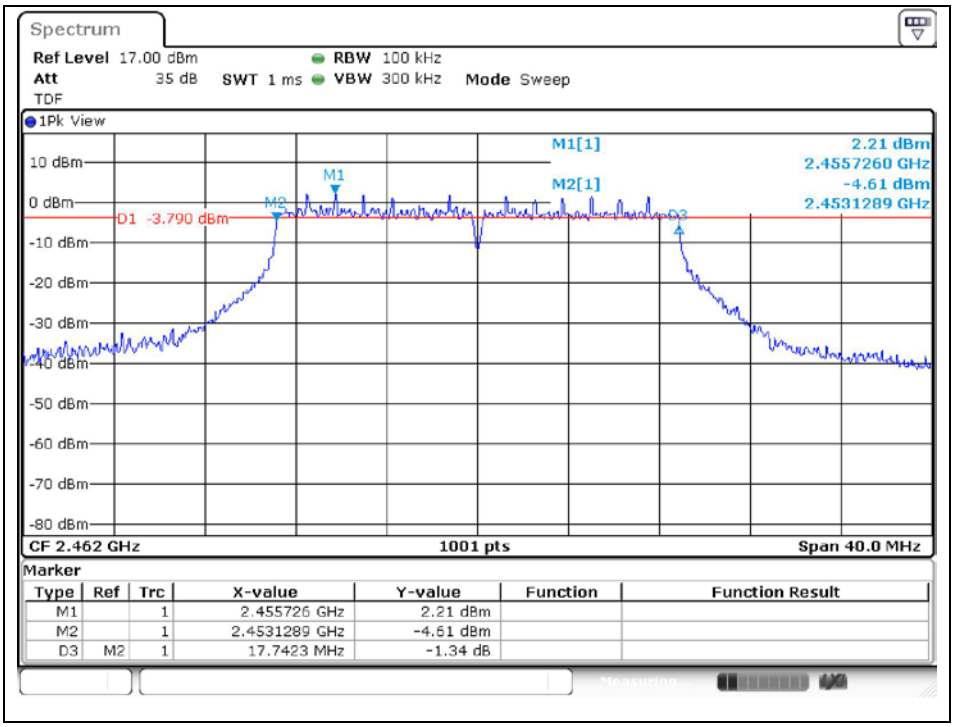
Low Channel



Middle Channel

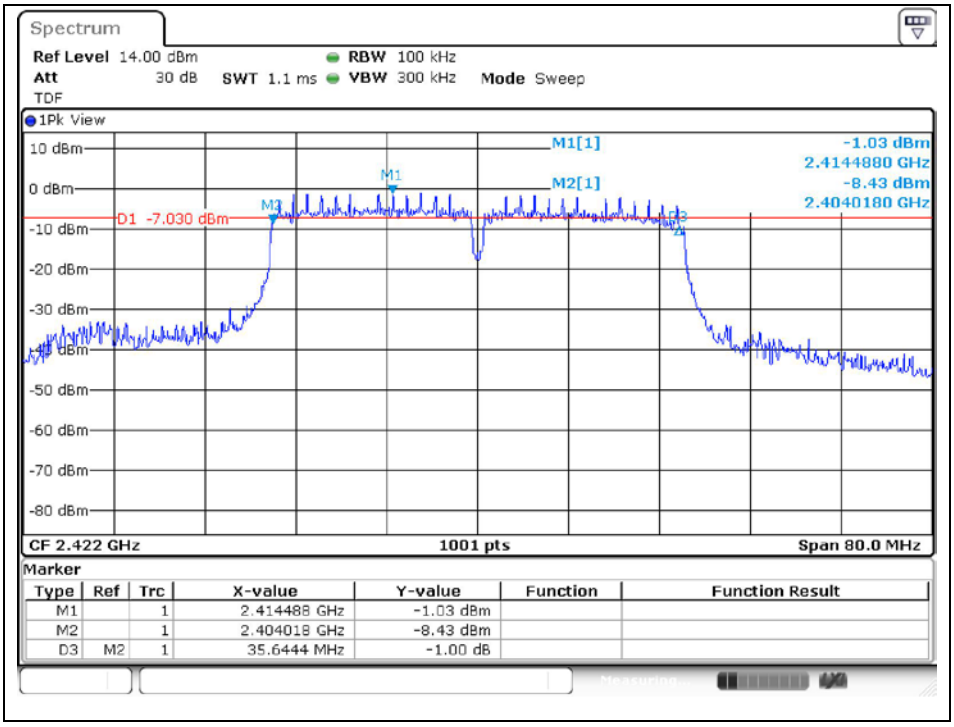


High Channel

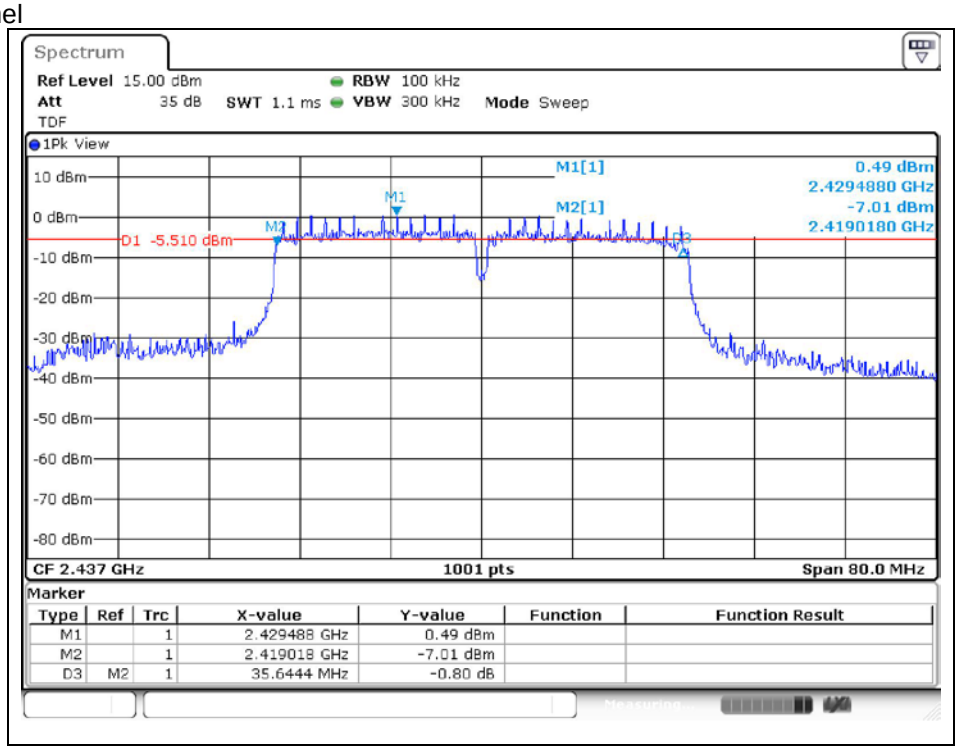


OFDM: 802.11n_HT40

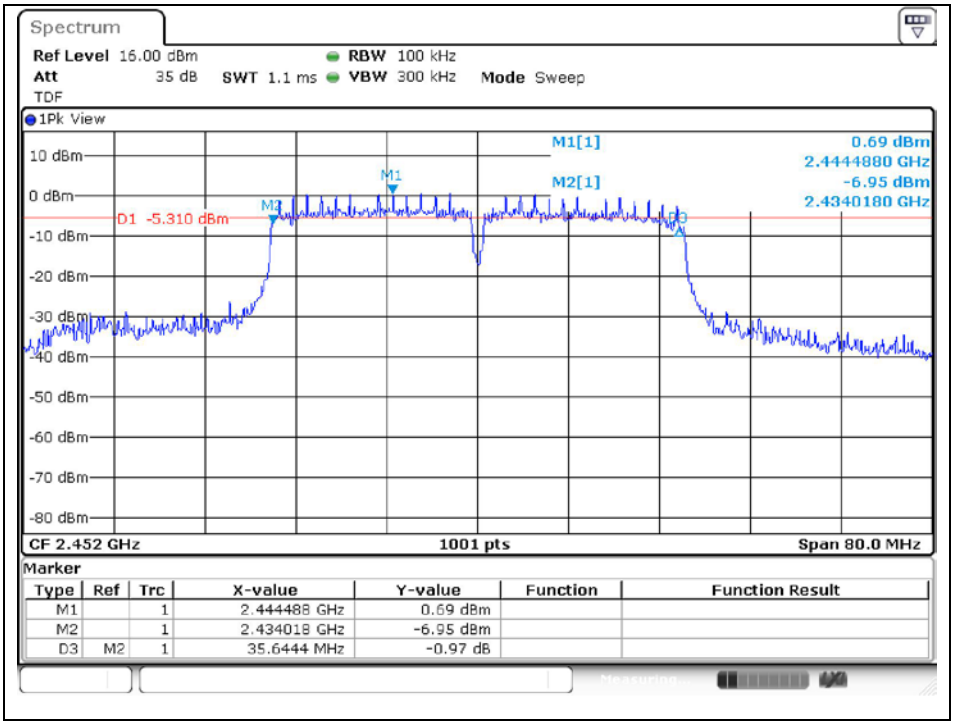
Low Channel



Middle Channel



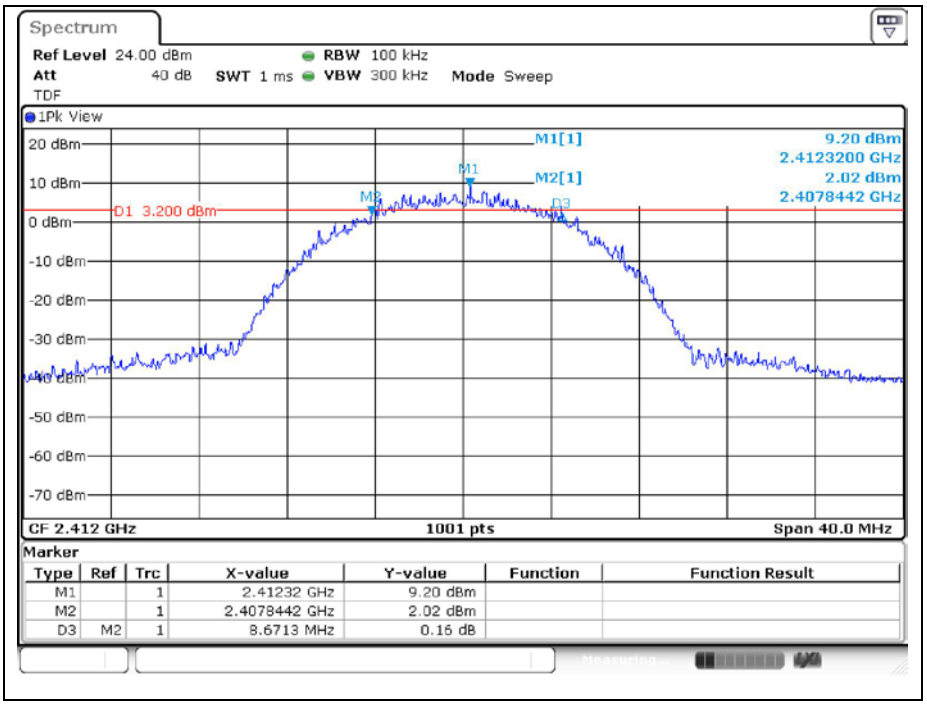
High Channel



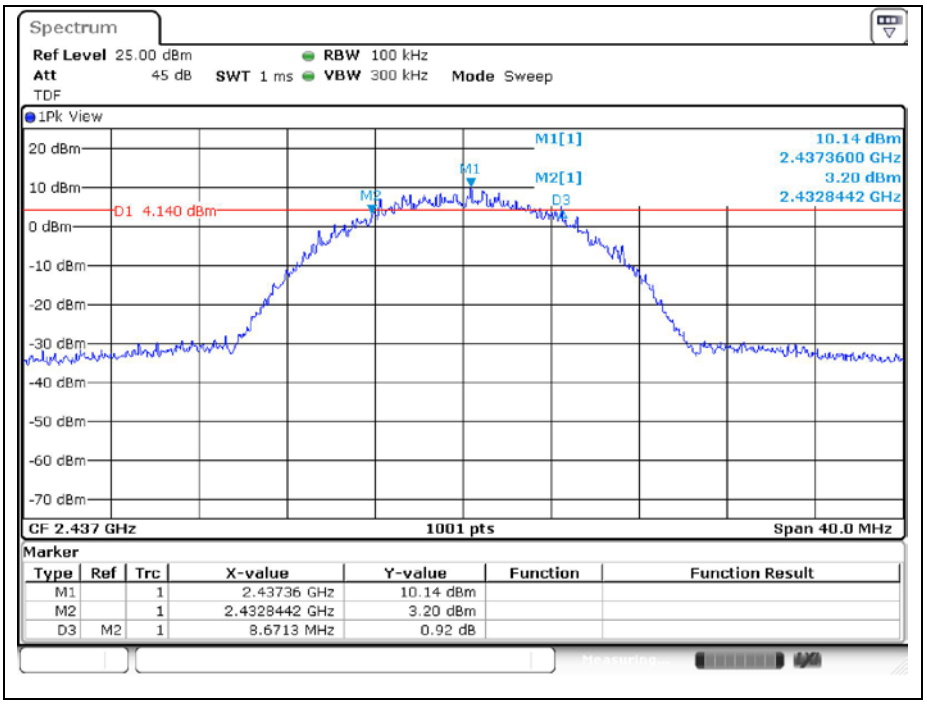
Test Condition: DC 12 V

DSSS: 802.11b

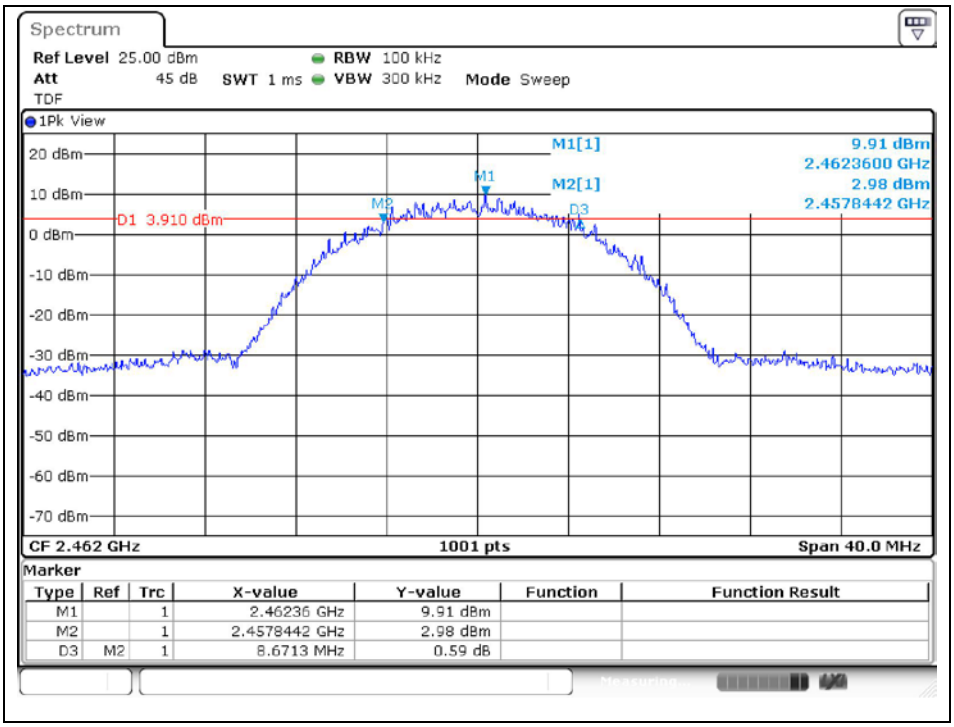
Low Channel



Middle Channel

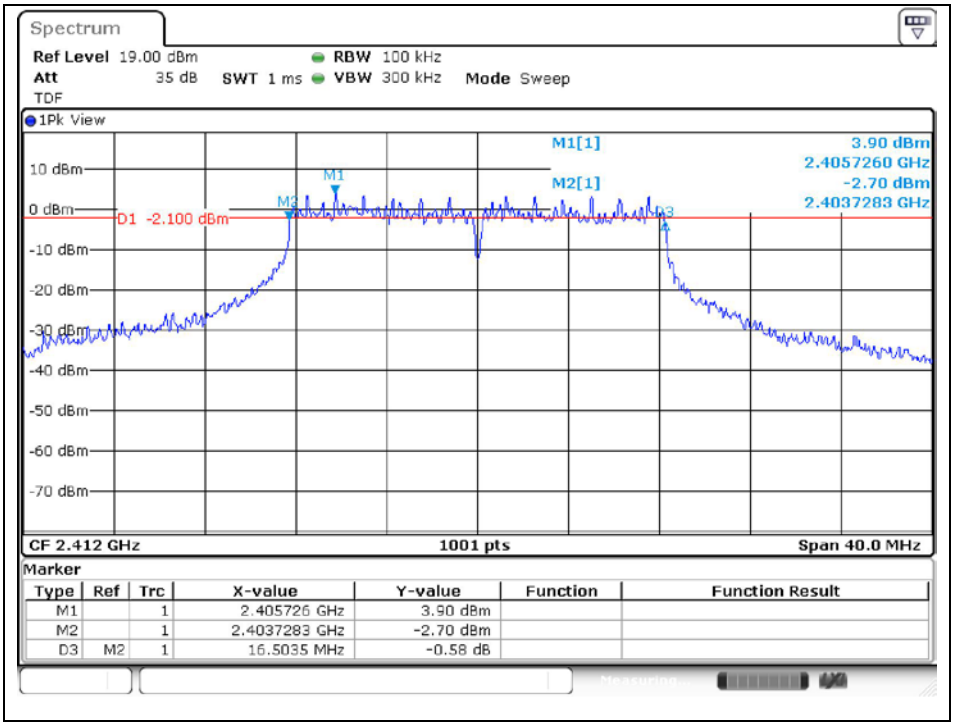


High Channel

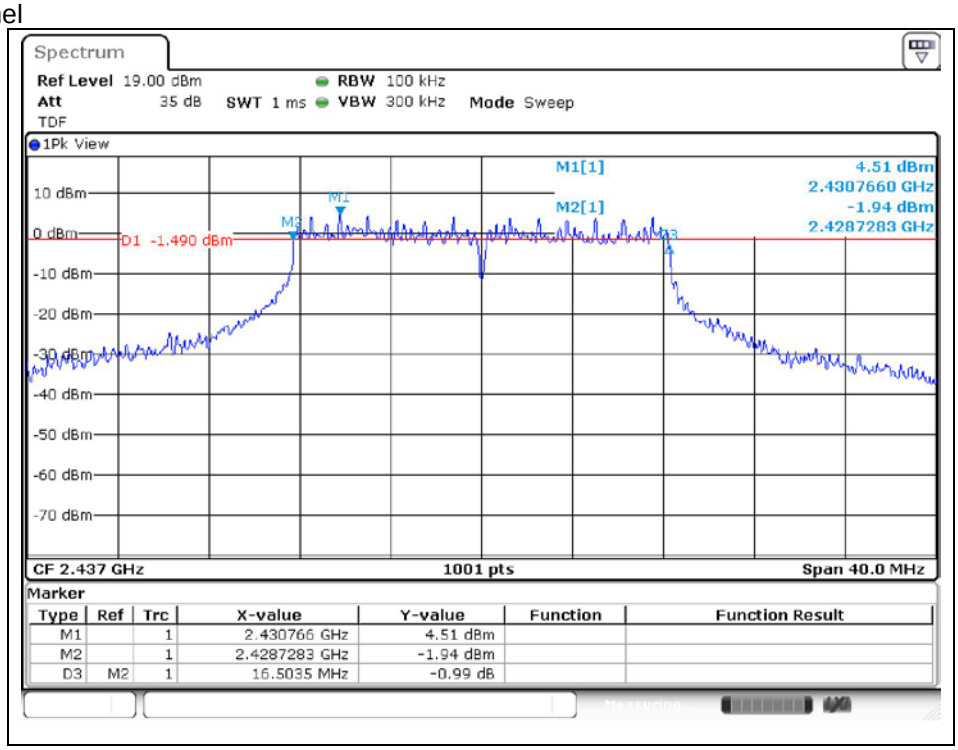


OFDM: 802.11g

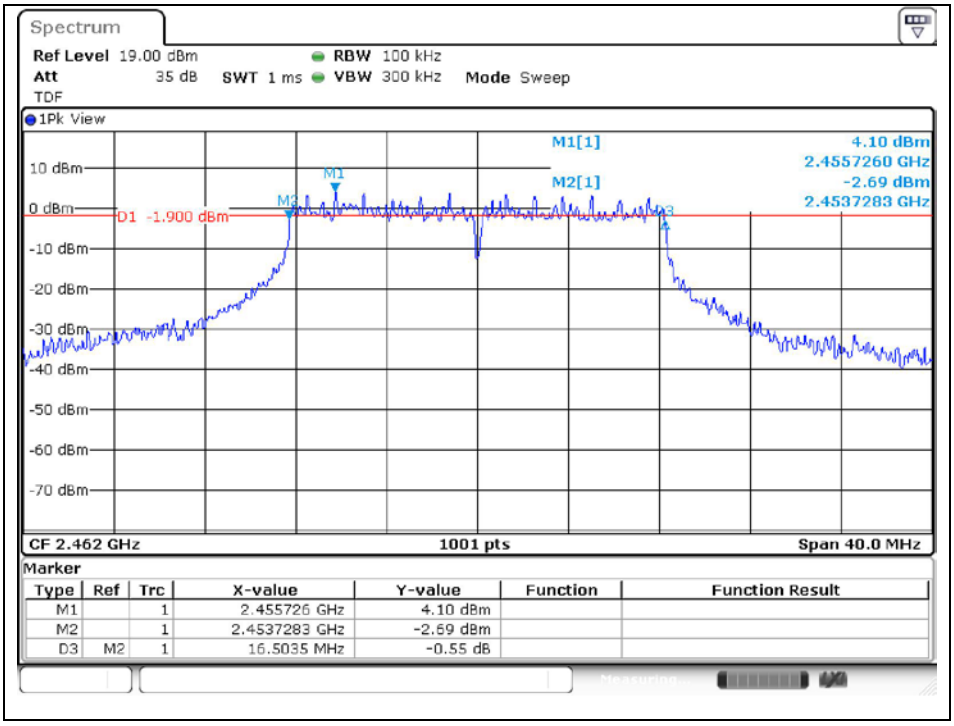
Low Channel



Middle Channel

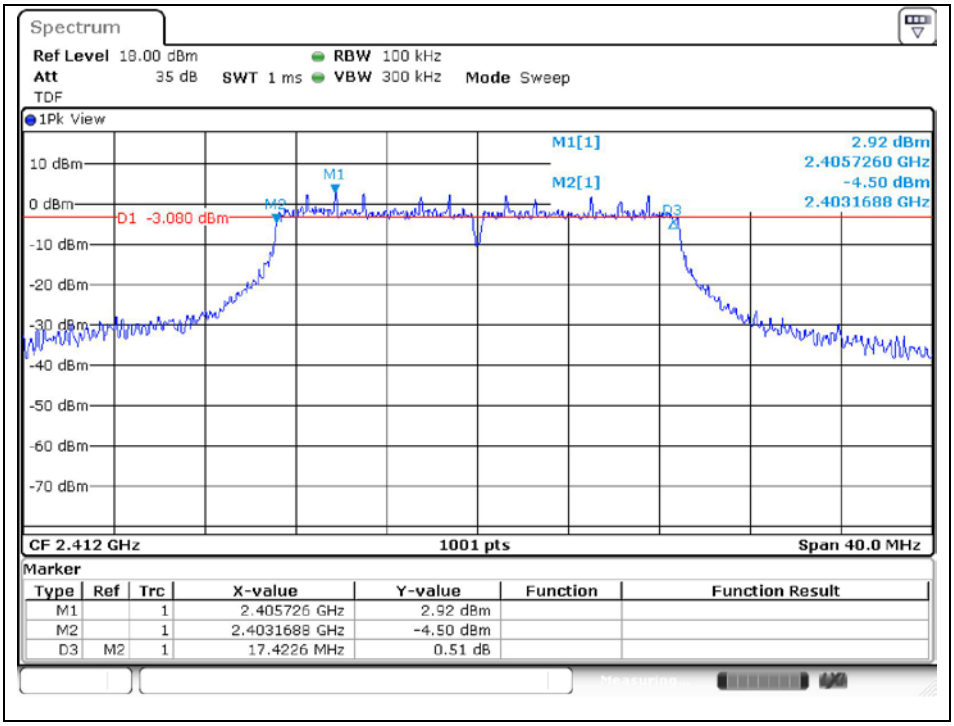


High Channel

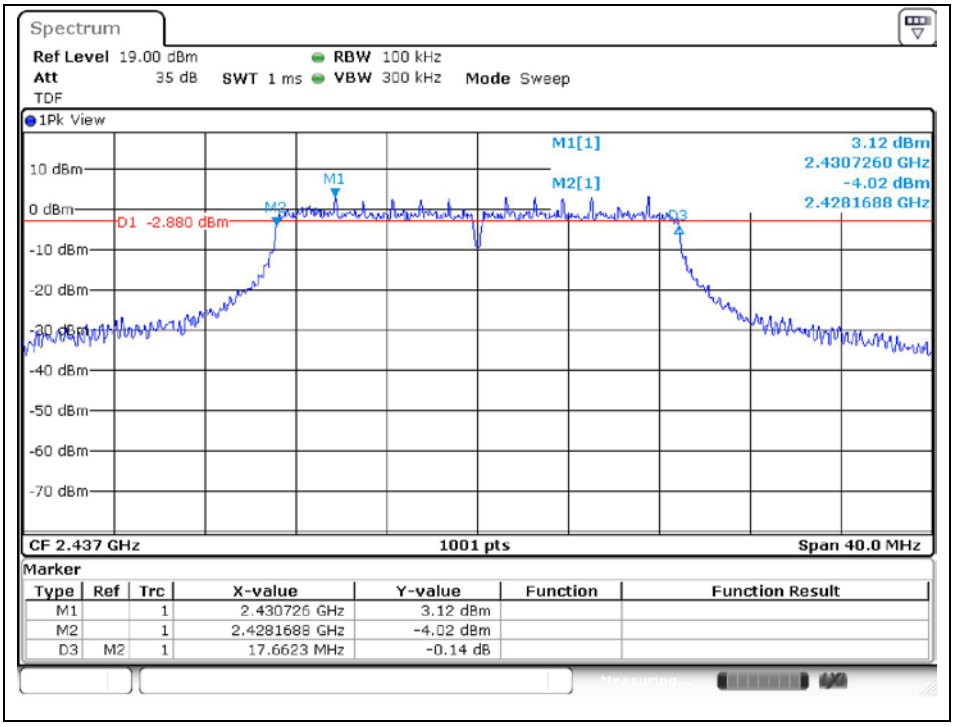


OFDM: 802.11n_HT20

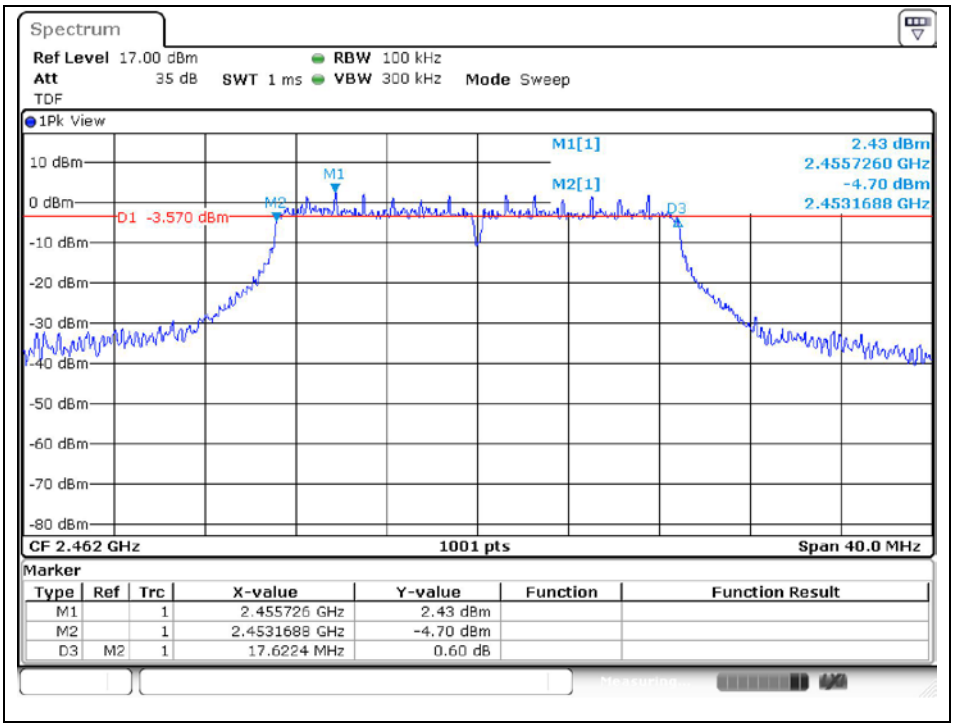
Low Channel



Middle Channel

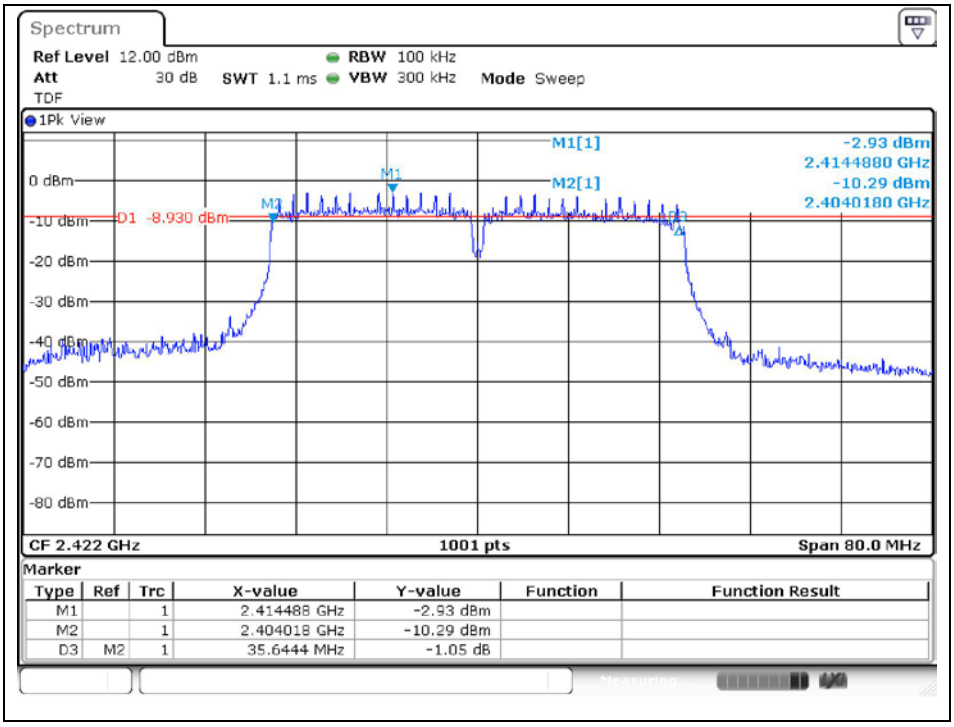


High Channel

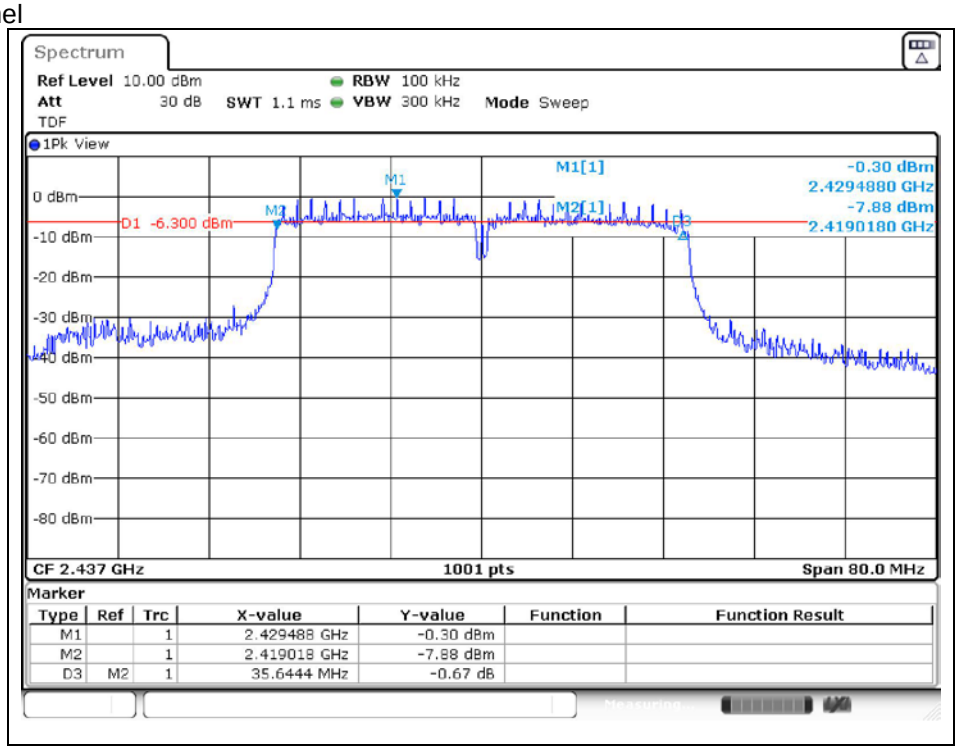


OFDM: 802.11n_HT40

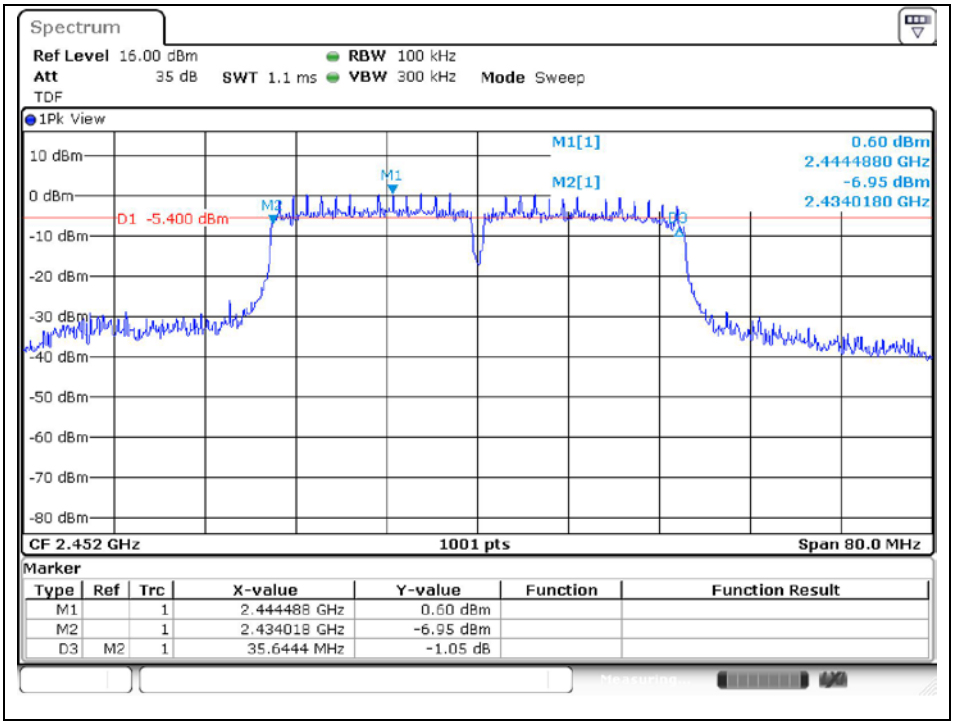
Low Channel



Middle Channel



High Channel

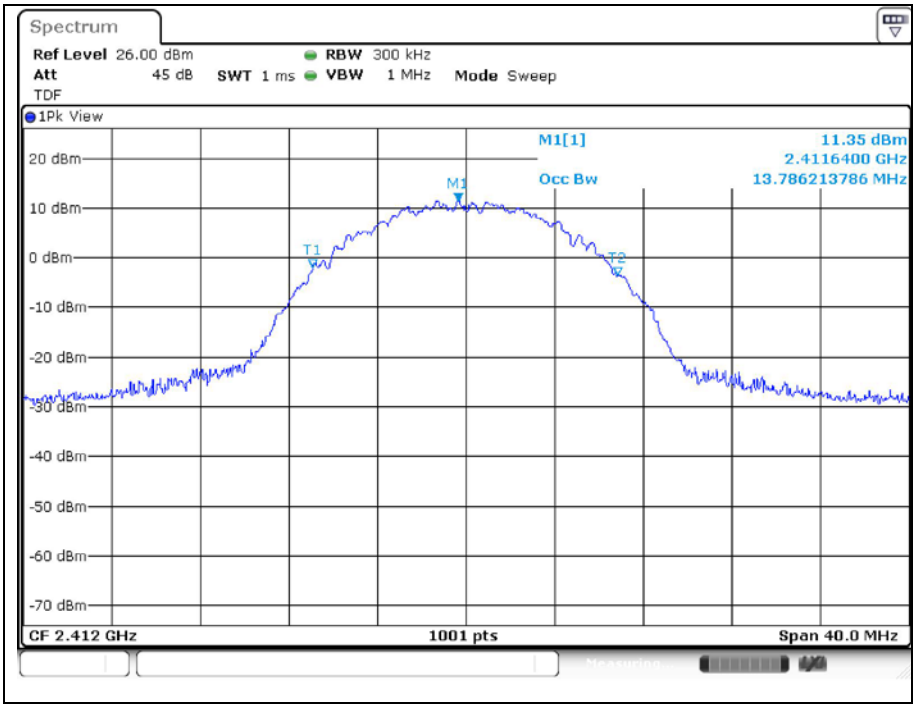


99 % Bandwidth

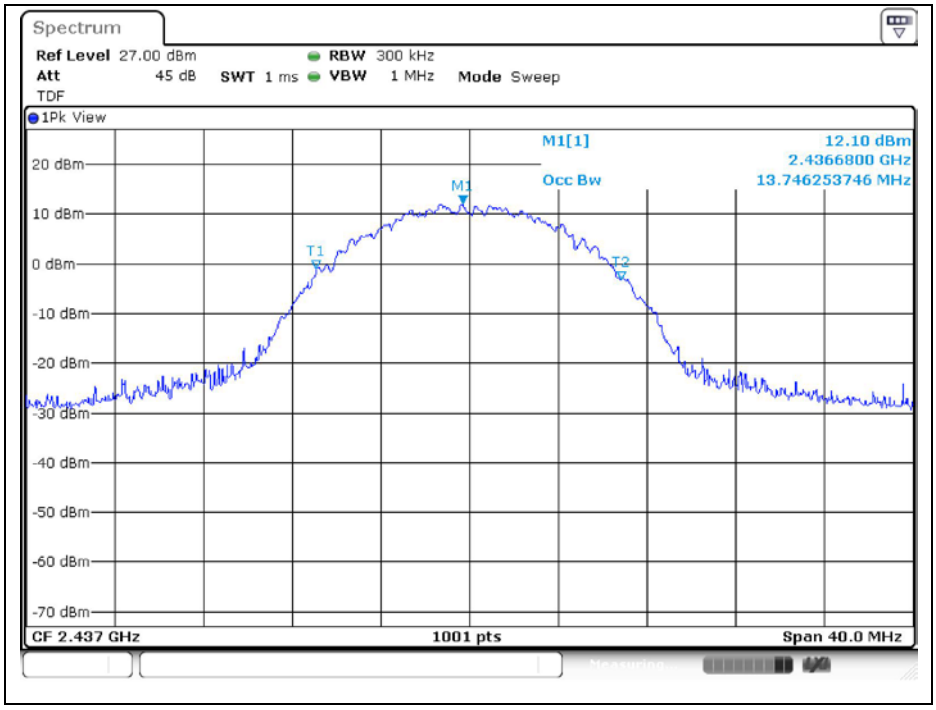
Test Condition: DC 5 V

DSSS: 802.11b

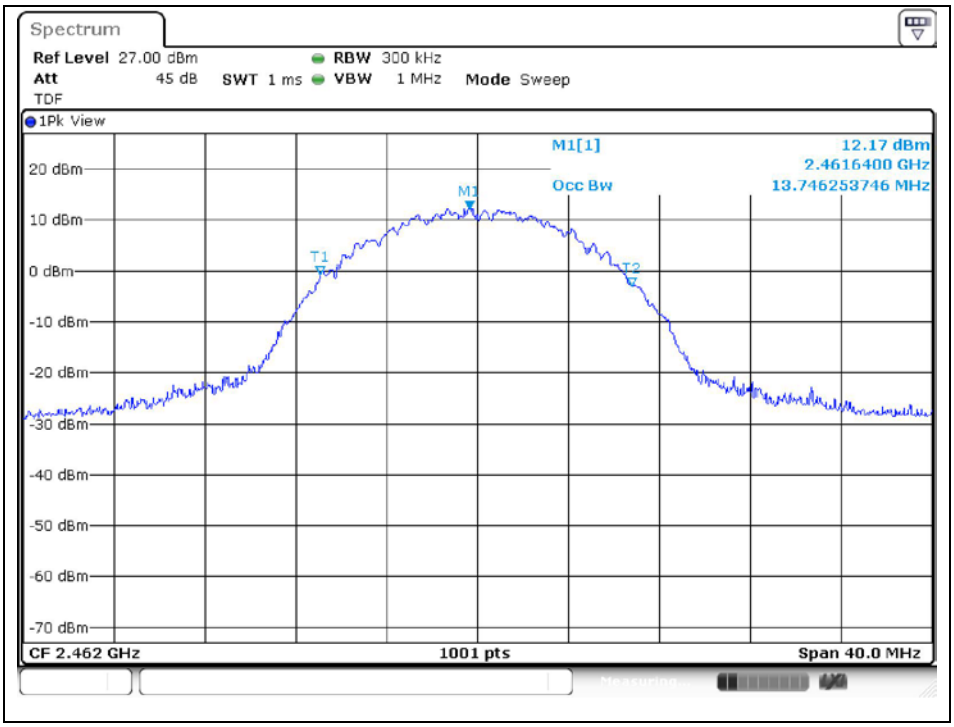
Low Channel



Middle Channel

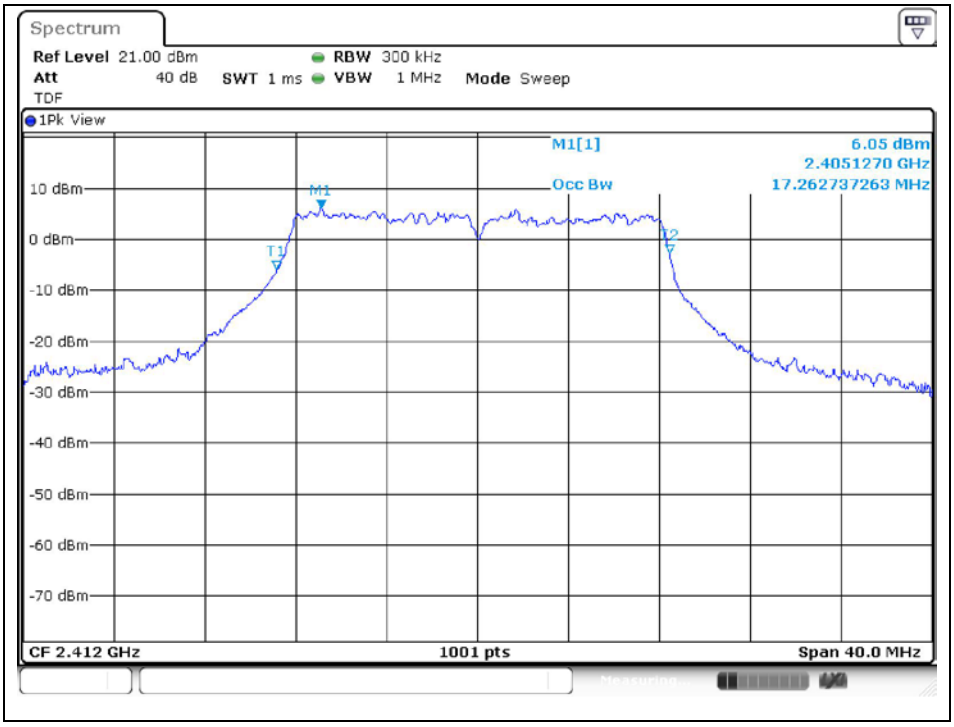


High Channel

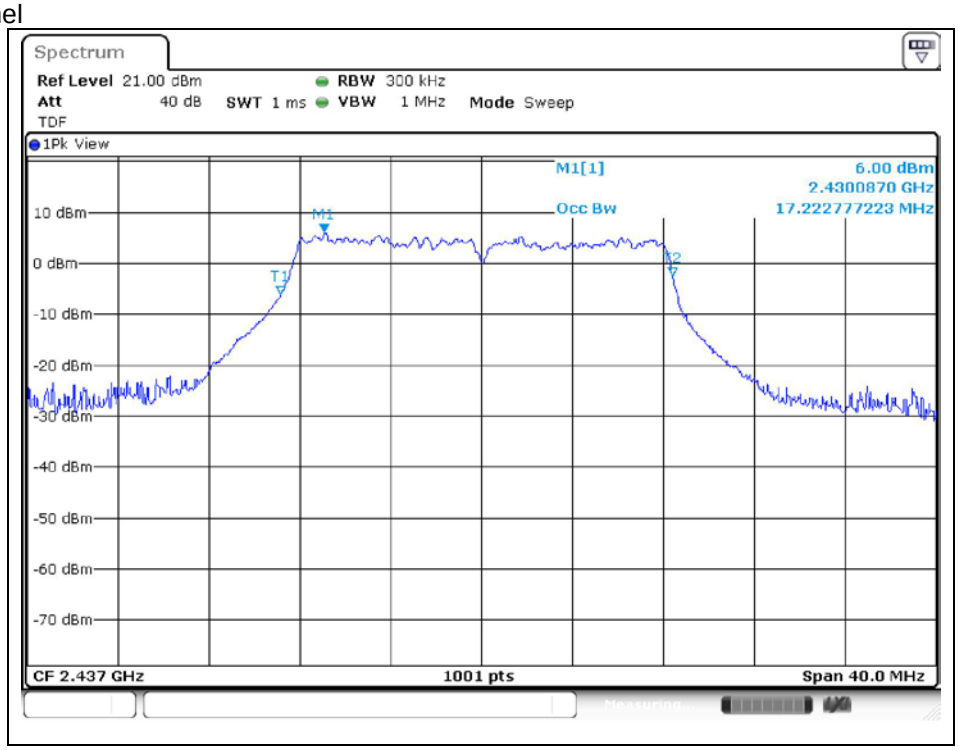


OFDM: 802.11g

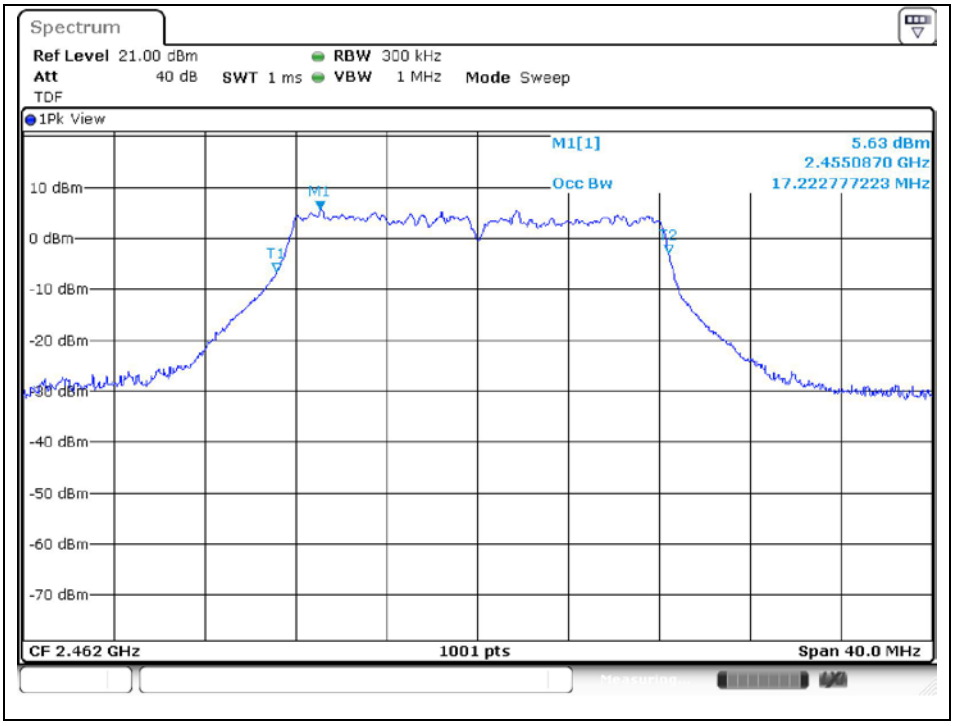
Low Channel



Middle Channel

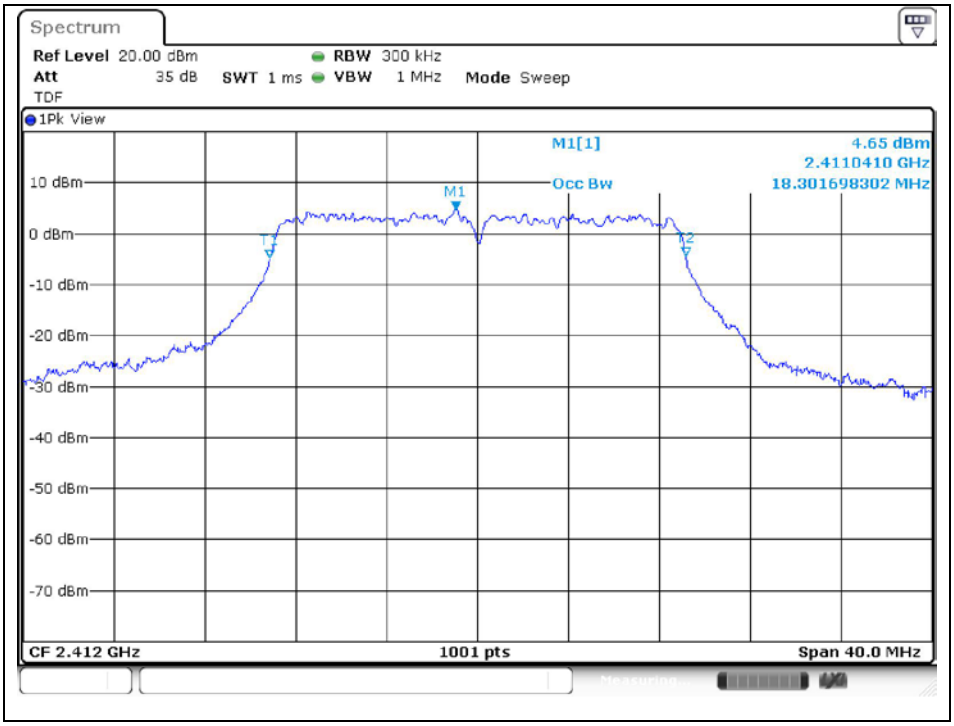


High Channel

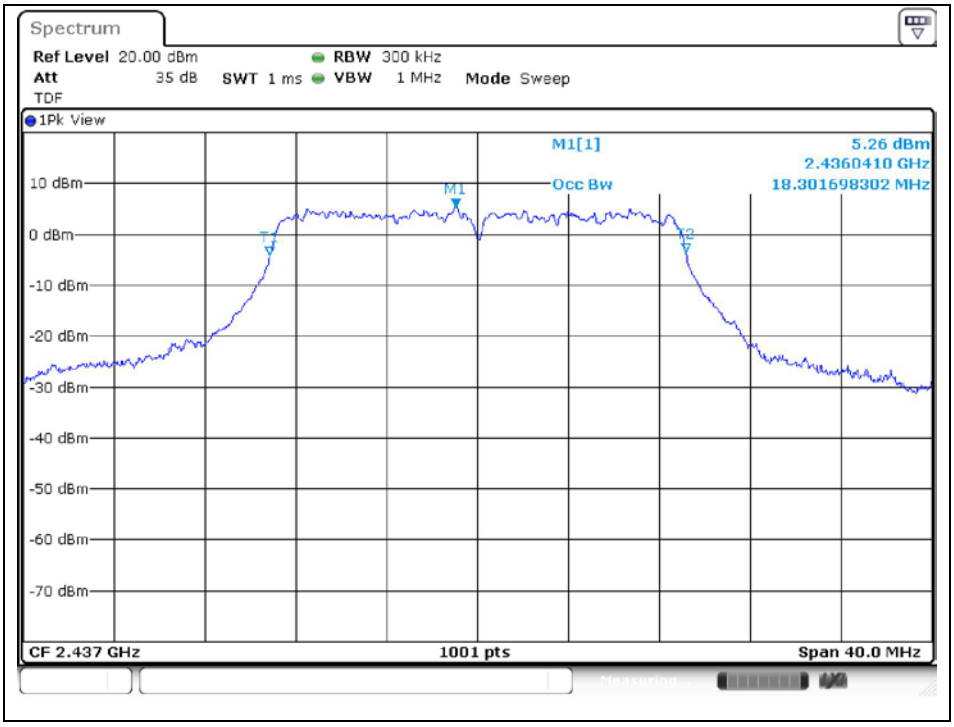


OFDM: 802.11n_HT20

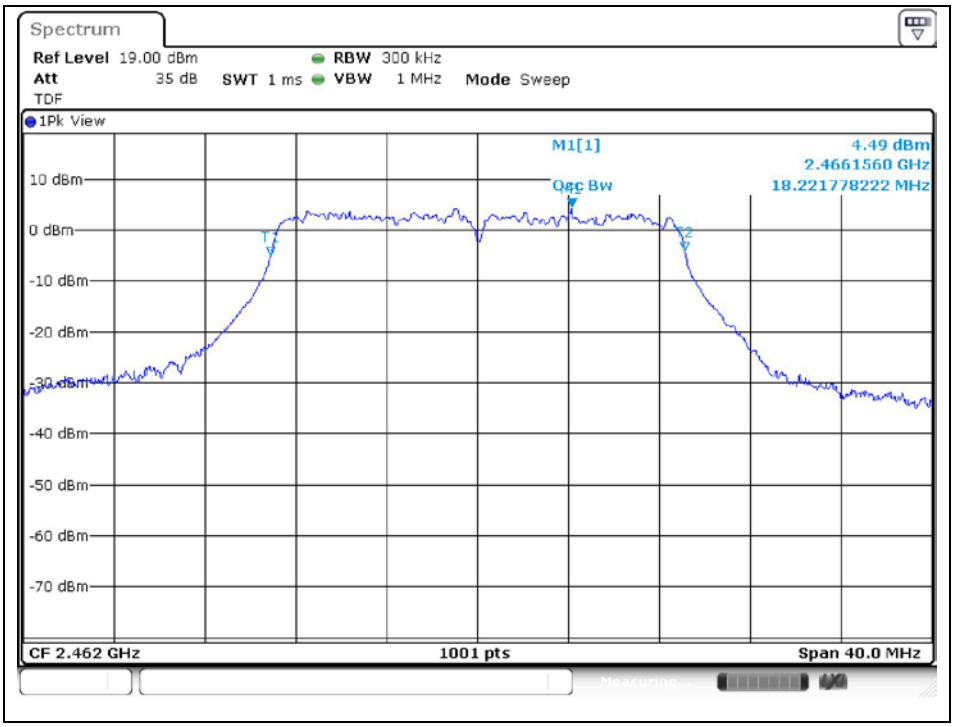
Low Channel



Middle Channel

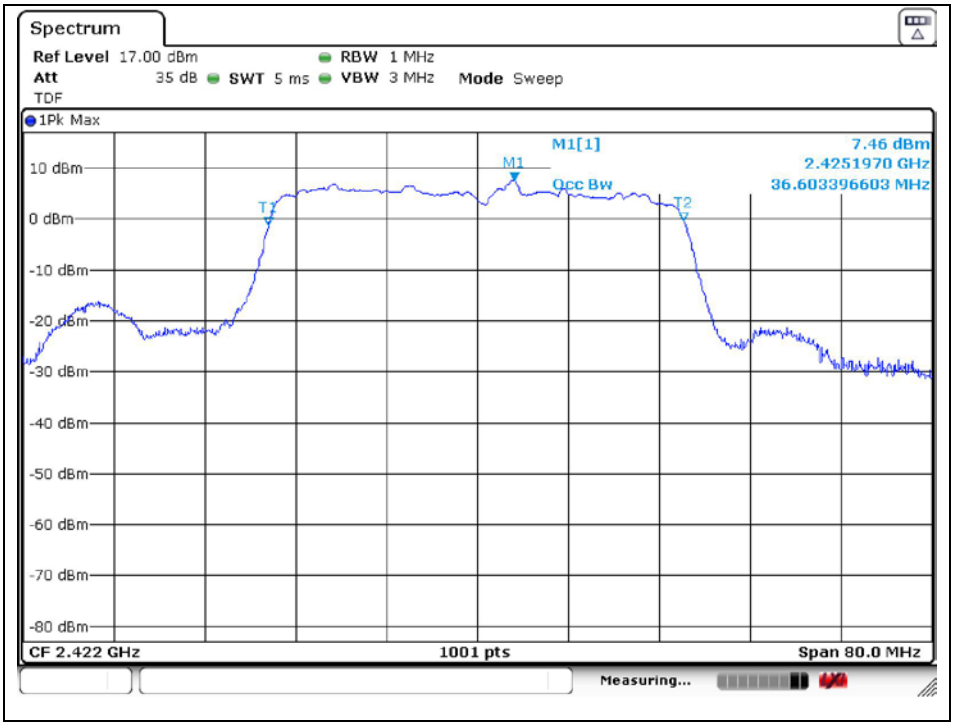


High Channel

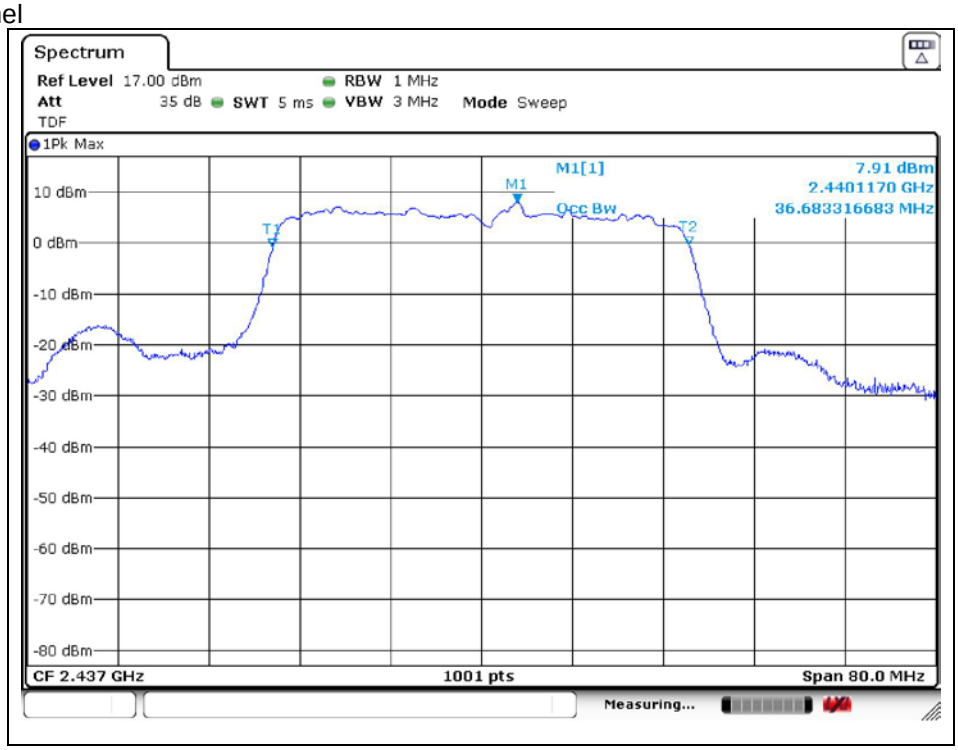


OFDM: 802.11n_HT40

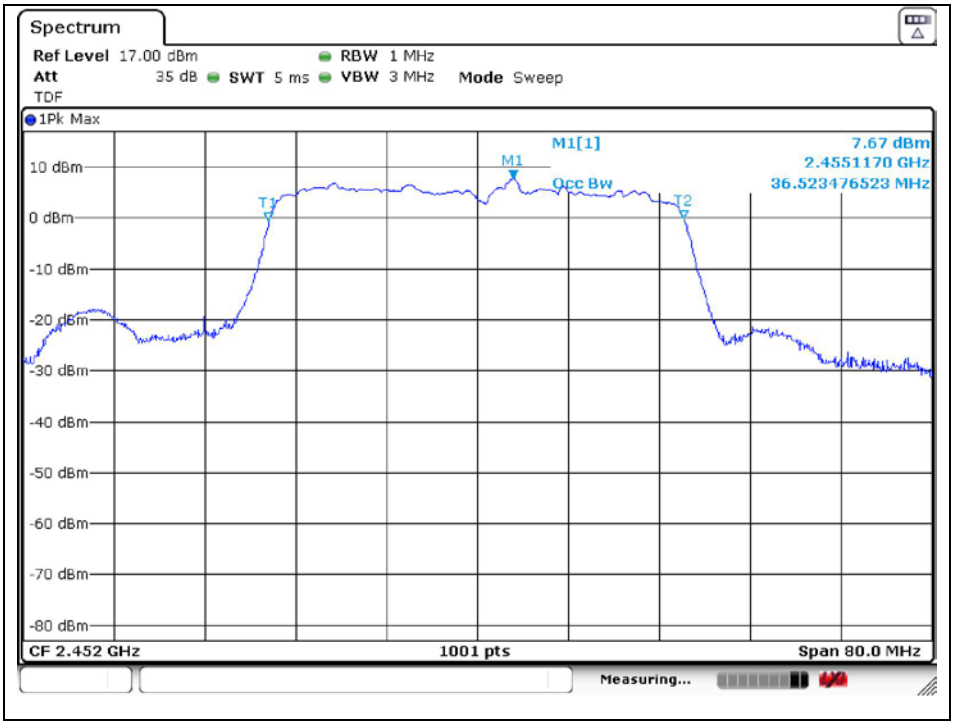
Low Channel



Middle Channel



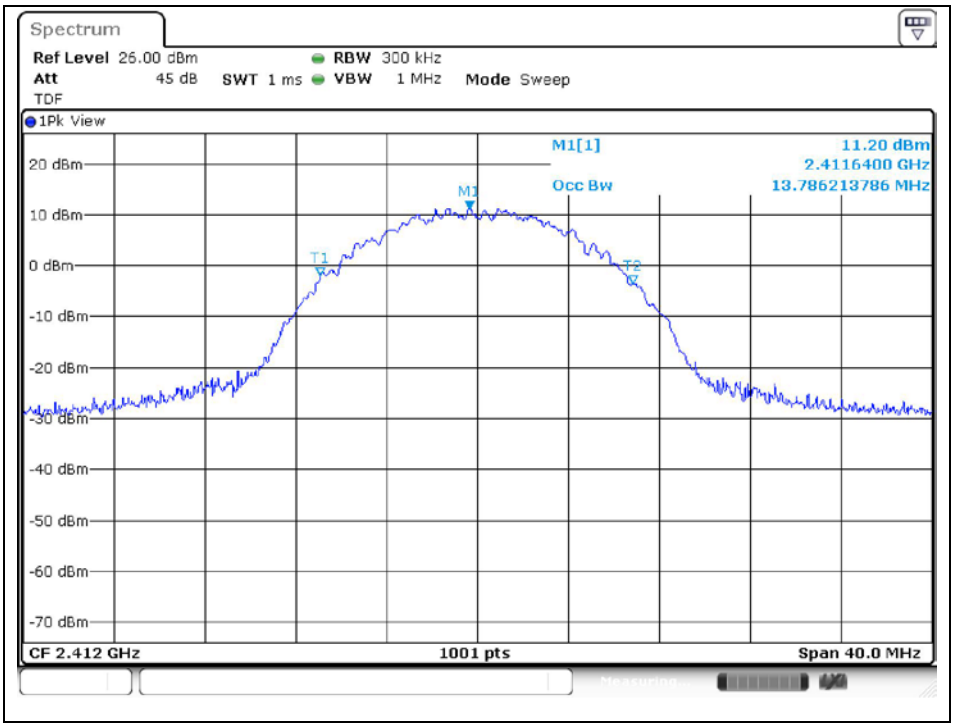
High Channel



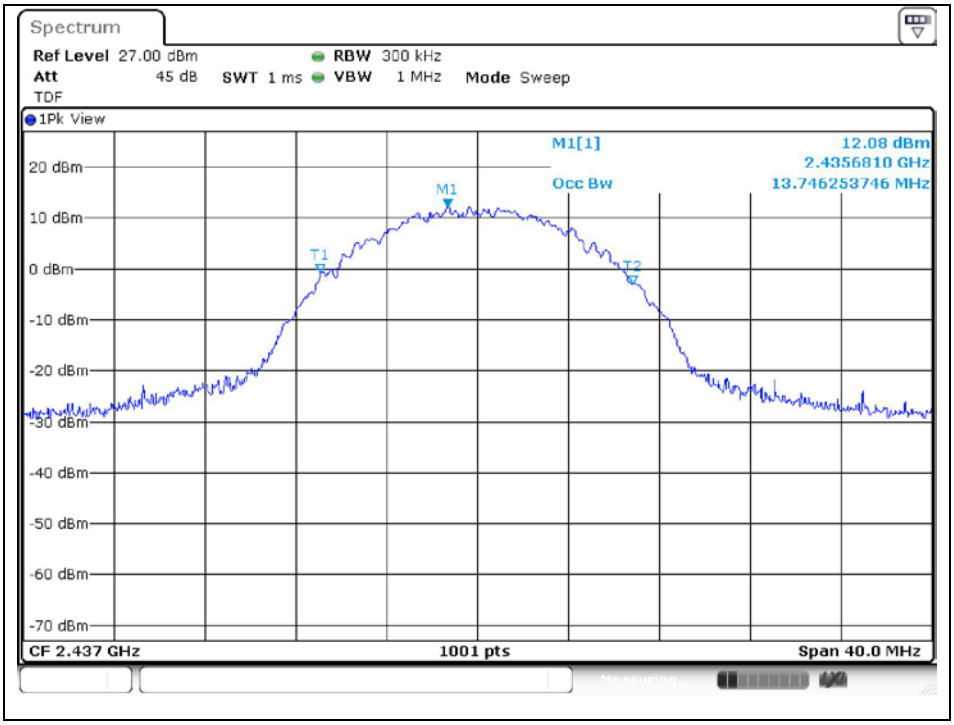
Test Condition: DC 12 V

DSSS: 802.11b

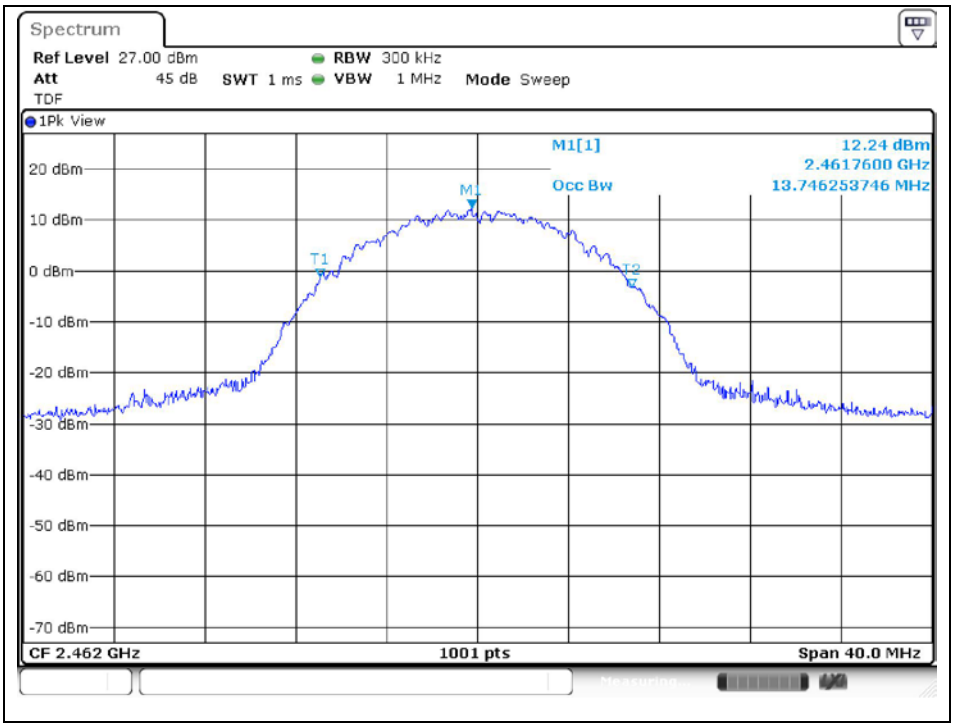
Low Channel



Middle Channel

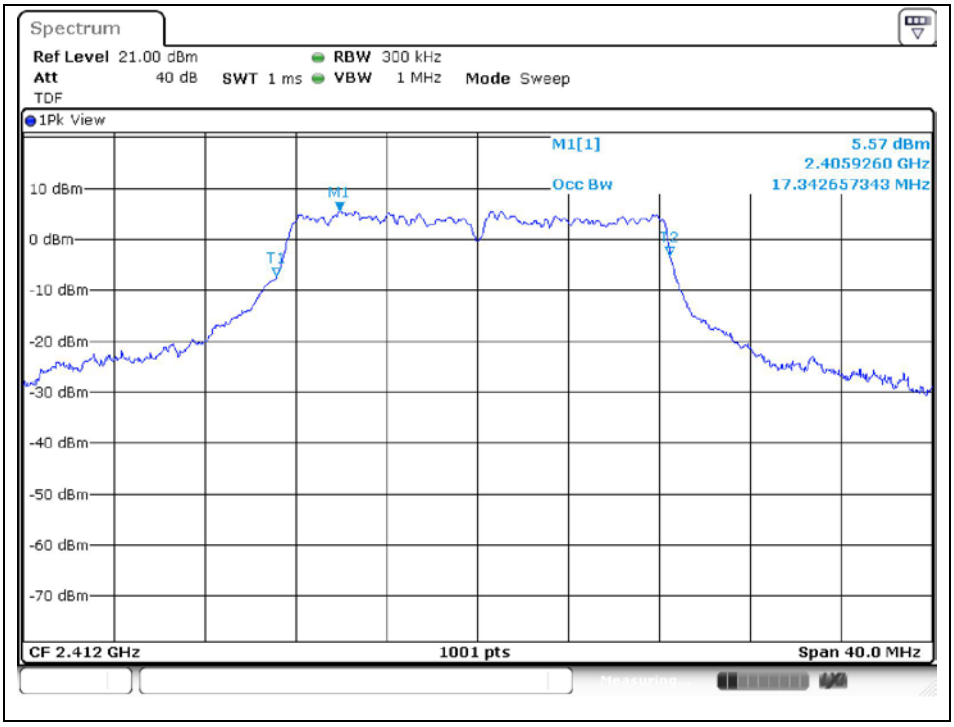


High Channel

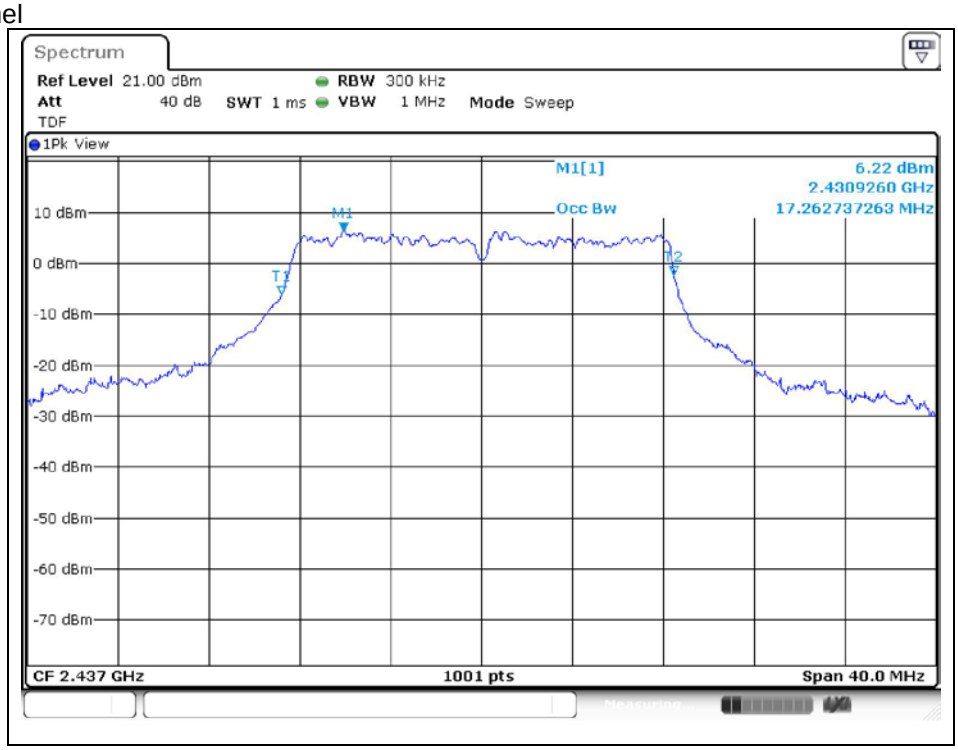


OFDM: 802.11g

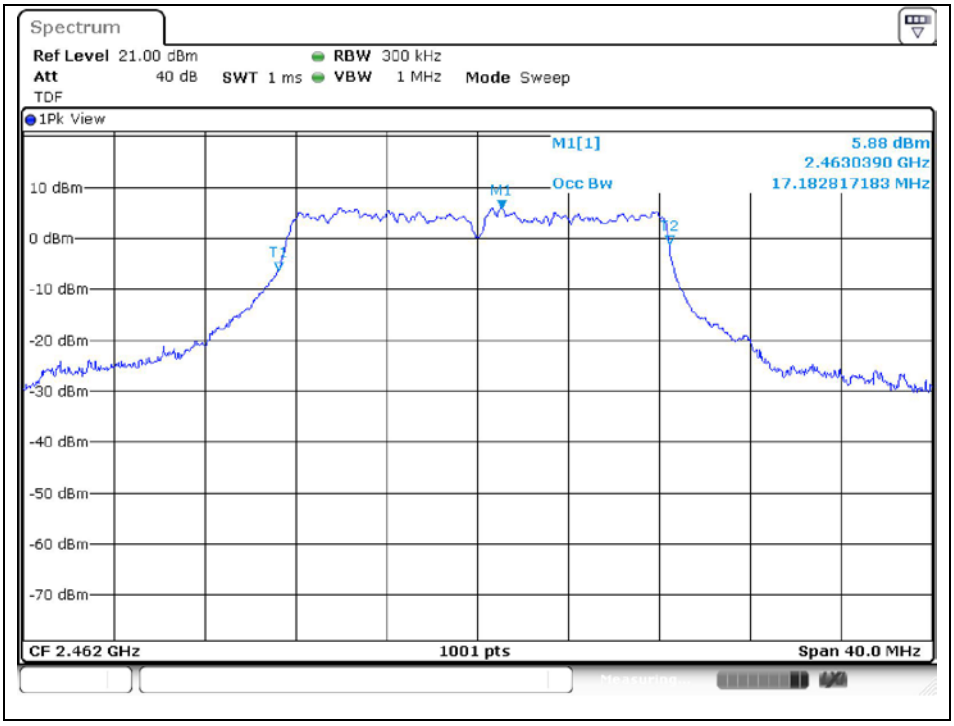
Low Channel



Middle Channel

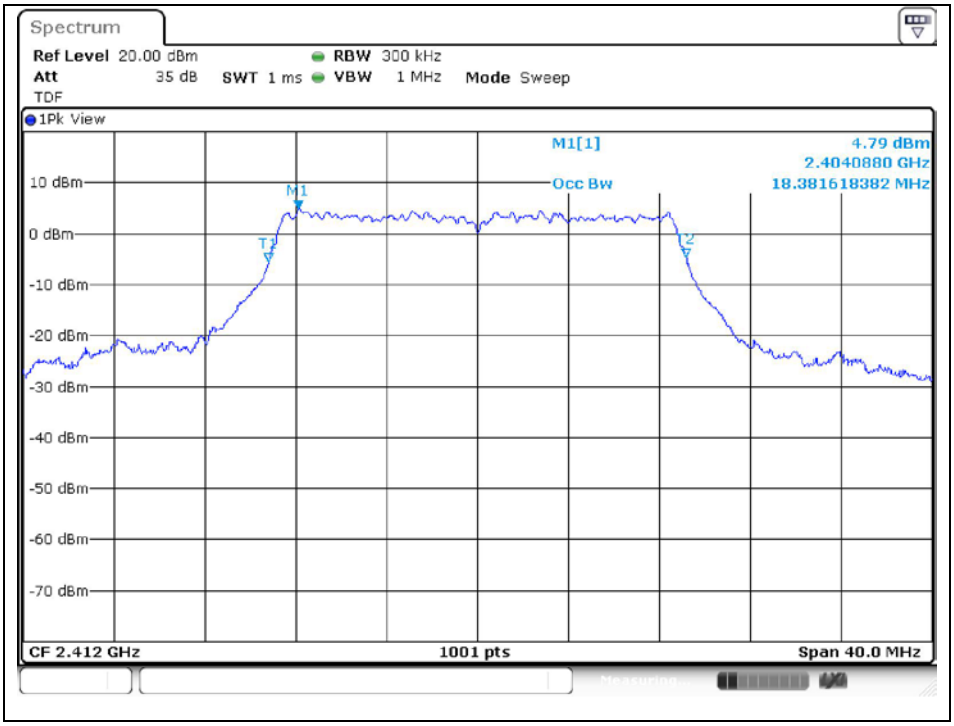


High Channel

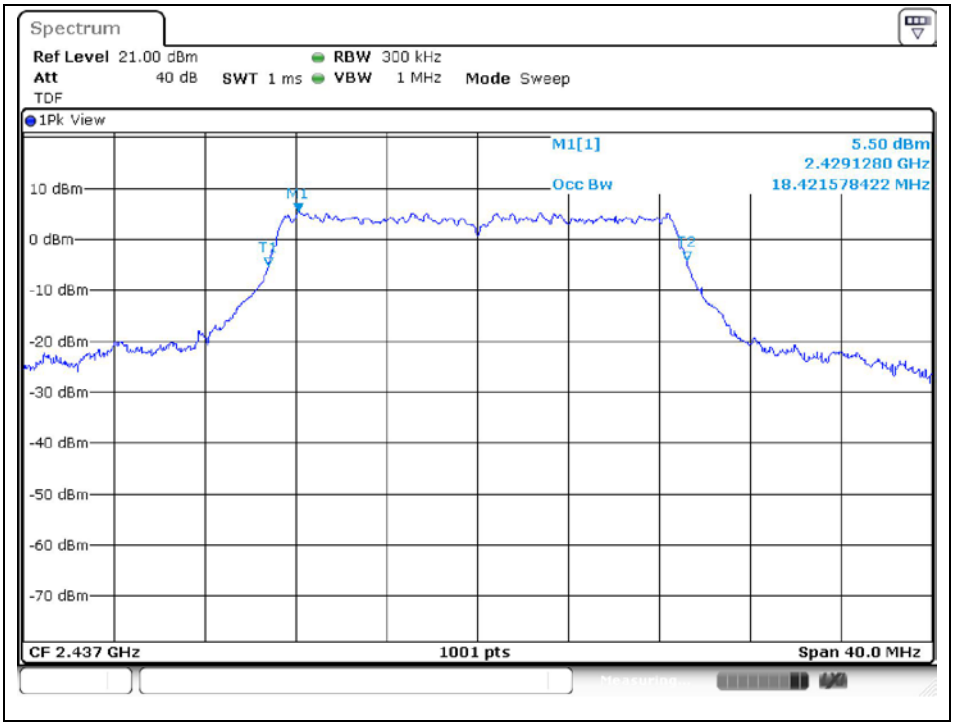


OFDM: 802.11n_HT20

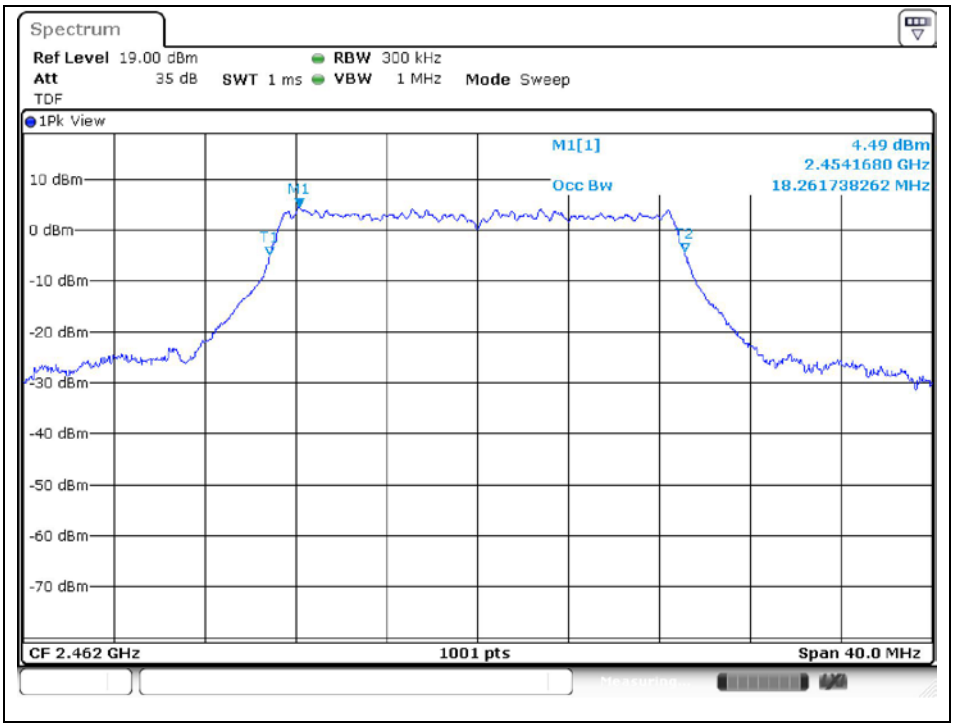
Low Channel



Middle Channel

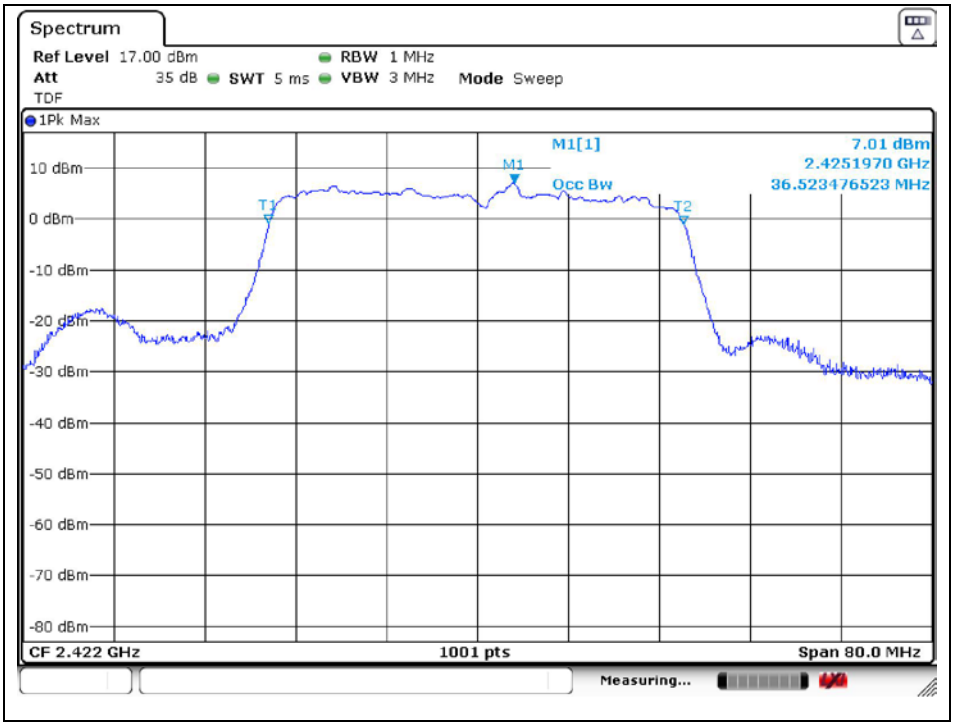


High Channel

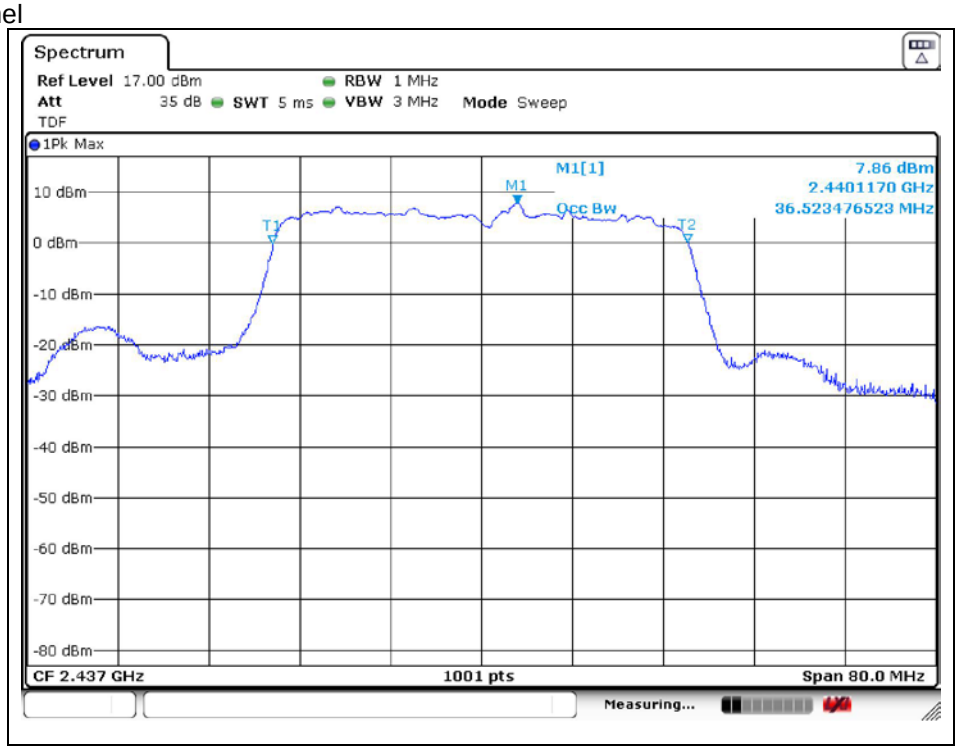


OFDM: 802.11n_HT40

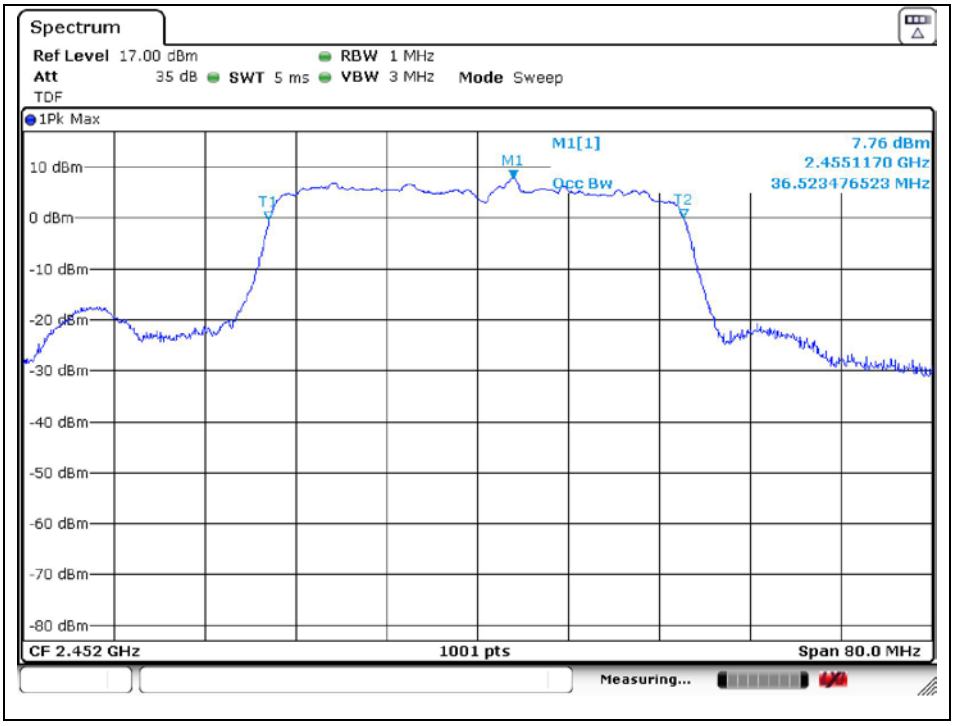
Low Channel



Middle Channel

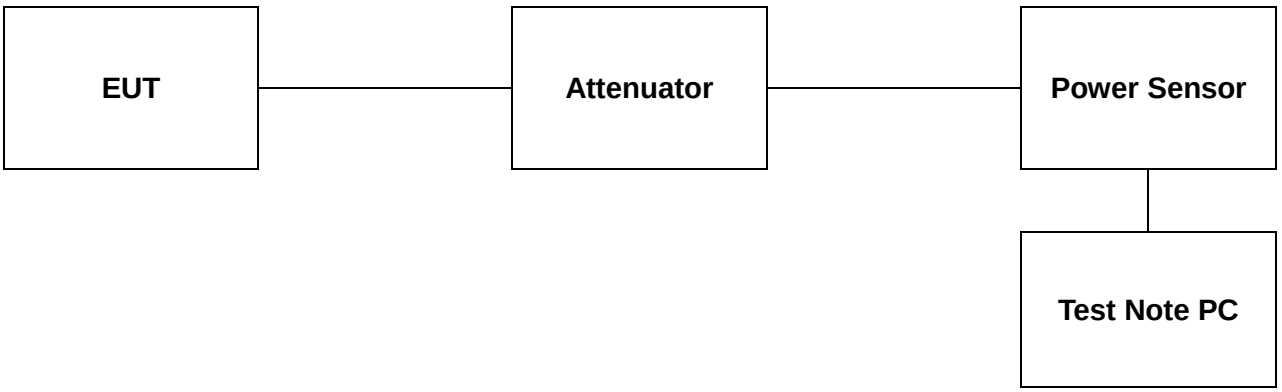


High Channel



4. Maximum Peak Conducted Output Power

4.1. Test Setup



4.2. Limit

4.2.1. FCC

According to §15.247(b)(3), for systems using digital modulation in the 902-928 ㎒, 2 400-2 483.5 ㎒, and 5 725-5 850 ㎒ 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.

According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 ㏈i. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 ㏈i are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

4.2.2. IC

According to RSS-247 Issue 2, 5.4(d), for DTSs employing digital modulation techniques operating in the bands 902-928 ㎒ and 2 400-2 483.5 ㎒, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e),

As an alternative to a peak measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling 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 transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

4.3. Test Procedure

The test follows section 11.9.1.3 of ANSI C63.10-2013.

PKPM1 Peak-reading power meter method
- The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

The test follows section 11.9.2.3.2 of ANSI C63.10-2013.

Method AVGPM-G (Measurement using a gated RF average-reading power meter)
- Alternatively, measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

Test program: (S/W name: R&S Power Viewer, Version: 3.2.0)

1. Initially overall offset for attenuator and cable loss is measured per frequency.
2. Measured offset is inserted in test program in advance of measurement for output power.
3. Power for each frequency (channel) of device is investigated as final result.
4. Final result reported on this section from R&S power viewer program includes with several factors and test program shows only final result.

4.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Test Condition: DC 5 V

Mode	Data Rate	Channel	Frequency (㎒)	Average Power Result (dB m)	Peak Power Result (dB m)	Peak Power Limit (dB m)
DSSS (802.11b)	11 Mbps	Low	2 412	15.64	18.78	30
		Middle	2 437	16.70	19.97	
		High	2 462	**17.42**	**20.55**	
OFDM (802.11g)	12 Mbps	Low	2 412	**15.53**	22.37	
		Middle	2 437	14.96	**22.74**	
		High	2 462	14.56	22.69	
OFDM (802.11n_HT20)	MCS1	Low	2 412	13.45	21.64	
		Middle	2 437	**13.94**	**22.25**	
		High	2 462	13.41	21.81	
OFDM (802.11n_HT40)	MCS2	Low	2 422	**14.06**	21.70	
		Middle	2 437	13.49	**21.91**	
		High	2 452	13.07	21.17	

Remark;

Attenuator and cable offset was compensated in test program (R&S Power Viewer) before measuring.

Test Condition: DC 12 V

Mode	Data Rate	Channel	Frequency (㎒)	Average Power Result (㏈m)	Peak Power Result (㏈m)	Peak Power Limit (㏈m)
DSSS (802.11b)	11 Mbps	Low	2 412	16.14	19.11	30
		Middle	2 437	16.55	19.57	
		High	2 462	**17.13**	**20.26**	
OFDM (802.11g)	12 Mbps	Low	2 412	**15.56**	22.38	
		Middle	2 437	15.28	**22.84**	
		High	2 462	15.06	22.77	
OFDM (802.11n_HT20)	MCS1	Low	2 412	13.13	21.53	
		Middle	2 437	**13.85**	**22.25**	
		High	2 462	13.38	21.93	
OFDM (802.11n_HT40)	MCS2	Low	2 422	13.49	21.53	
		Middle	2 437	**13.83**	**21.80**	
		High	2 452	13.07	21.59	

Remark;

Attenuator and cable offset was compensated in test program (R&S Power Viewer) before measuring.