3. 6 dB Bandwidth

3.1. Test Setup

3.2. Limit

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 ㏈ bandwidth shall be at least 500 ㎑.

3.3. Test Procedure

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 ㏈ relative to the maximum level measured in the fundamental emission.

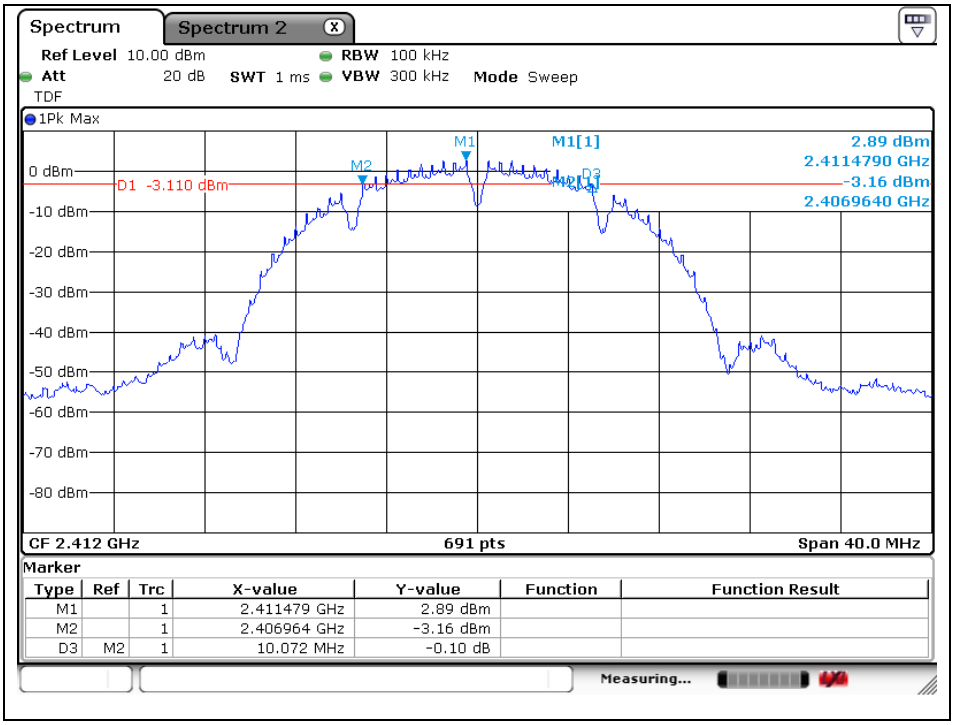
3.4. Test Results

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

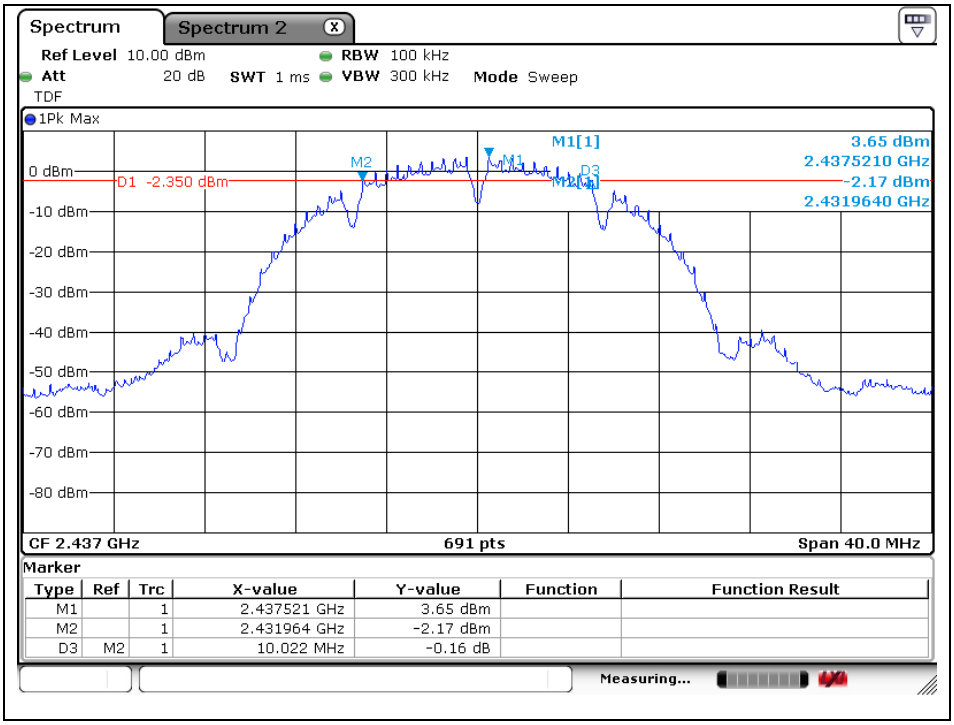
Operation Mode	Data Rate	Channel	Frequency (㎒)	6 ㏈ Bandwidth (㎒)
DSSS (802.11b)	1 Mbps	Low	2 412	10.072
		Middle	2 437	10.022
		High	2 462	10.072
OFDM (802.11g)	6 Mbps	Low	2 412	16.324
		Middle	2 437	16.331
		High	2 462	16.324
OFDM (802.11n_HT20)	MCS8	Low	2 412	16.903
		Middle	2 437	16.563
		High	2 462	17.019

- Test plots

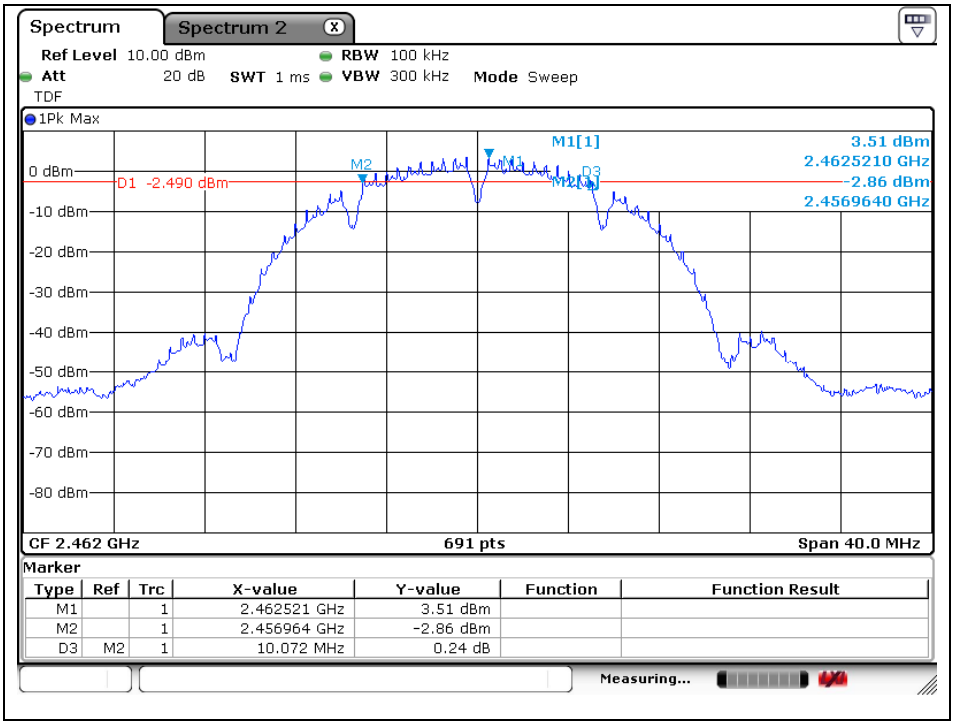
DSSS: 802.11b
Low Channel



Middle Channel

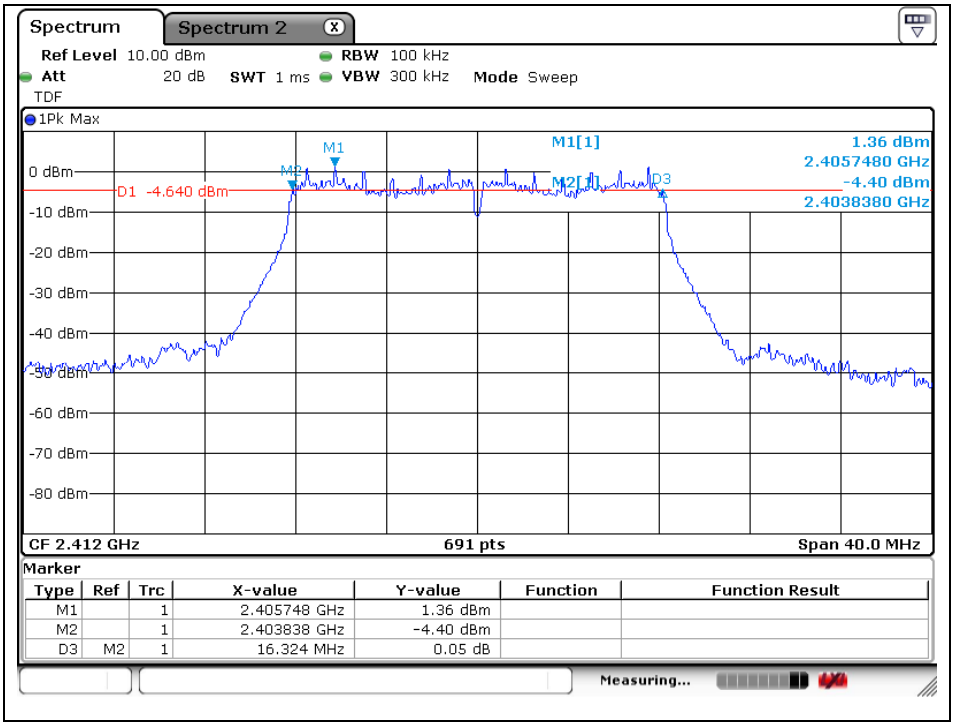


High Channel

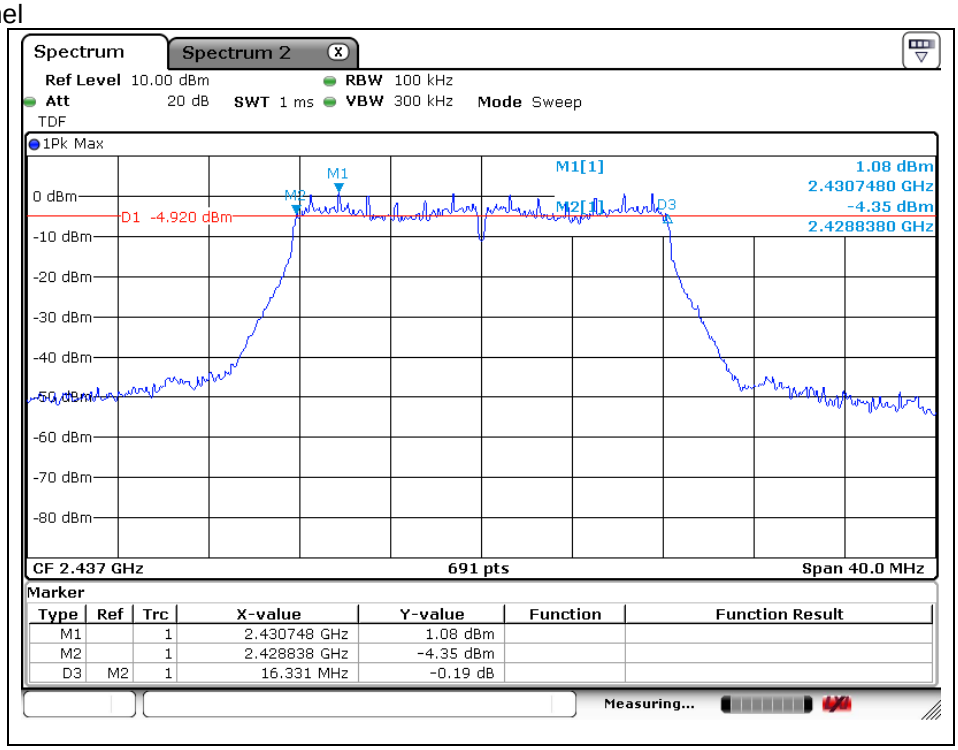


OFDM: 802.11g

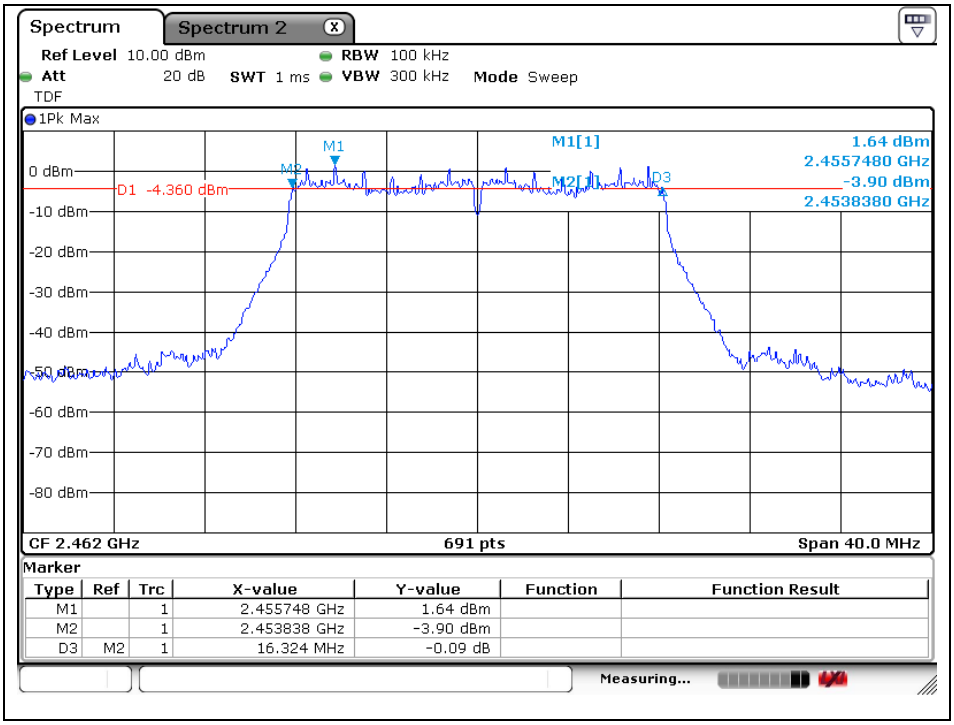
Low Channel



Middle Channel

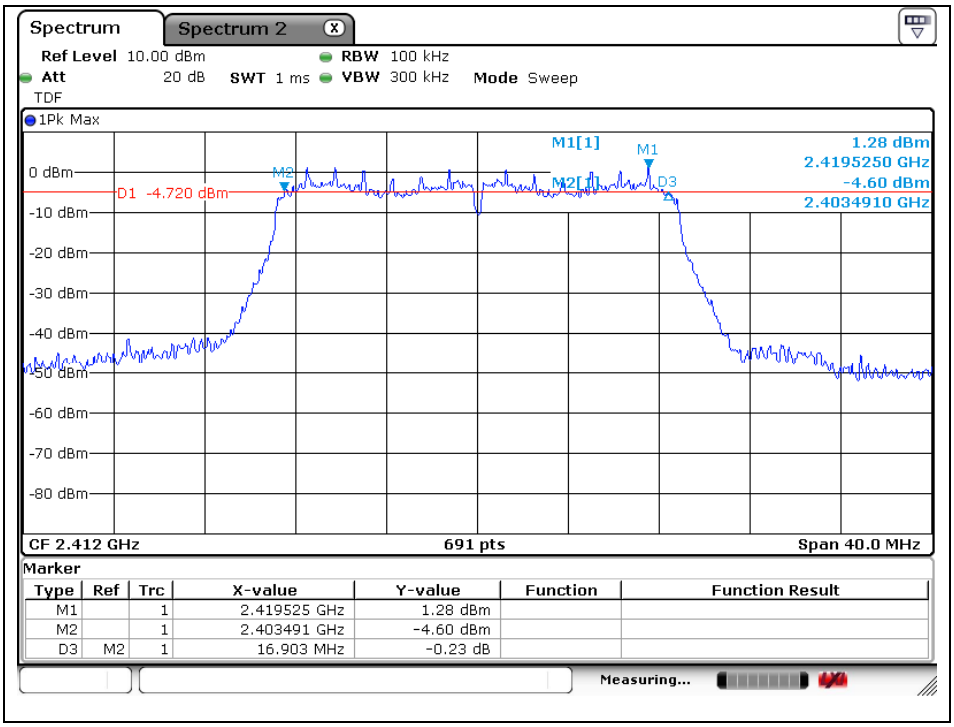


High Channel

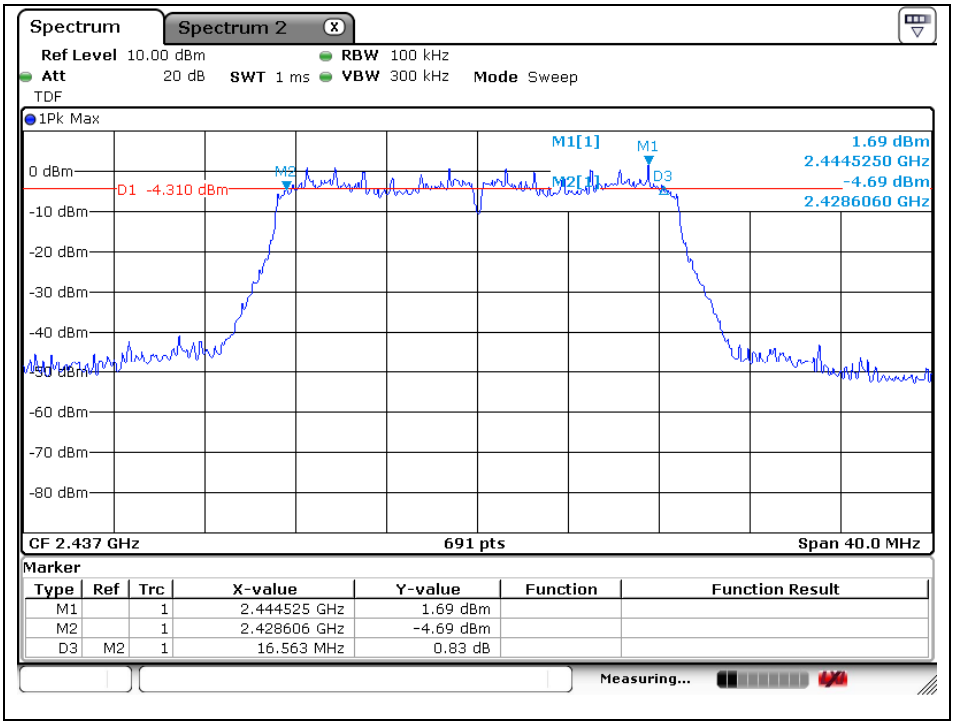


OFDM: 802.11n_HT20

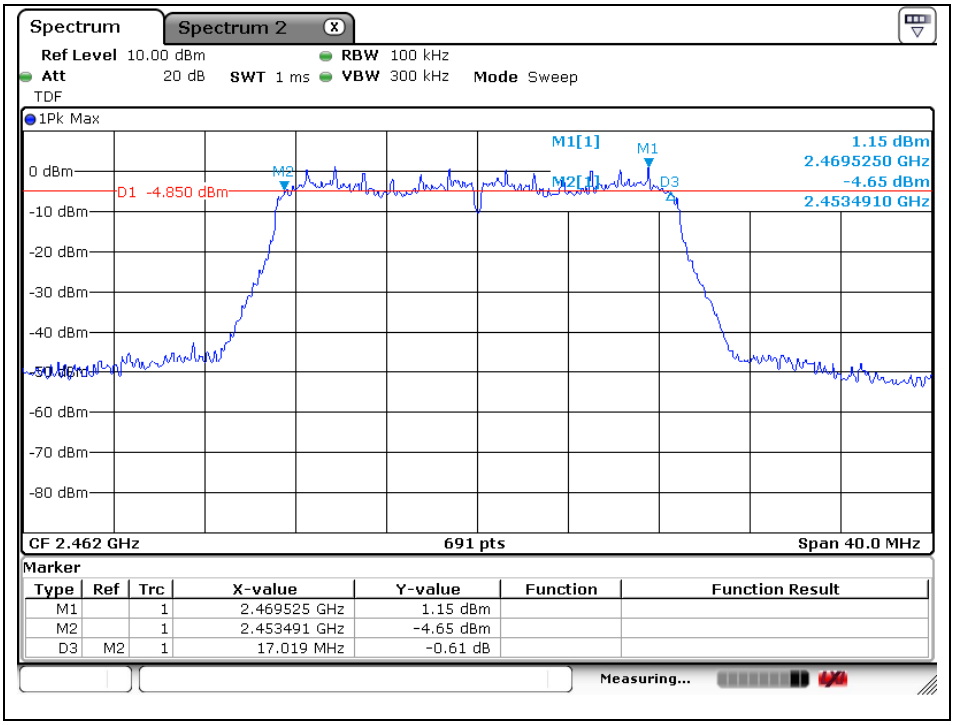
Low Channel



Middle Channel

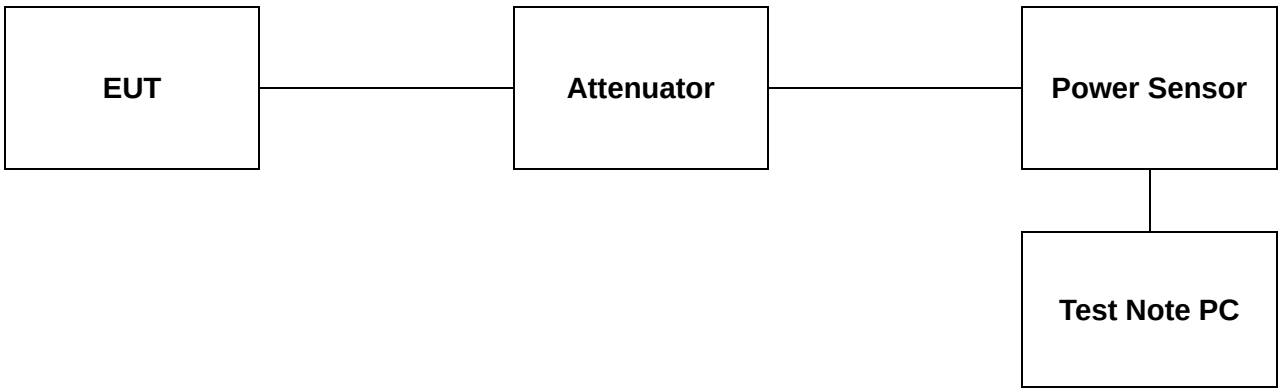


High Channel



4. Maximum Peak Conducted Output Power

4.1. Test Setup



4.2. Limit

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 antenna 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.

4.3. 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.

Mode	Channel	Frequency (㎒)	Data Rate	Peak Power Result (㏈m)			Limit (㏈m)
				ANT 1	ANT 2	ANT 1+ANT 2	
DSSS (802.11b)	Low	2 412	1 Mbps	18.68	19.02	21.86	30
	Middle	2 437		18.79	19.04	21.93	
	High	2 462		19.32	19.35	22.35	
	Channel	**Frequency (㎒)**	**Data Rate**	**Average Power Result (㏈m)**			
				ANT 1	**ANT 2**	**ANT 1+ANT 2**	
	Low	2 412	1 Mbps	15.92	16.29	19.12	
	Middle	2 437		16.07	16.39	19.24	
	High	2 462		16.48	16.60	19.55	

Mode	Channel	Frequency (㎒)	Data Rate	Peak Power Result (㏈m)			Limit (㏈m)
				ANT 1	ANT 2	ANT 1+ANT 2	
OFDM (802.11g)	Low	2 412	6 Mbps	24.34	23.25	26.84	30
	Middle	2 437		24.16	23.18	26.71	
	High	2 462		23.72	23.27	26.51	
	Channel	**Frequency (㎒)**	**Data Rate**	**Average Power Result (㏈m)**			
				ANT 1	**ANT 2**	**ANT 1+ANT 2**	
	Low	2 412	6 Mbps	15.15	14.29	17.75	
	Middle	2 437		14.21	14.01	17.12	
	High	2 462		14.22	14.05	17.15	

Mode	Channel	Frequency (㎒)	Data Rate	Peak Power Result (dB m)			Limit (dB m)
				ANT 1	ANT 2	ANT 1+ANT 2	
OFDM (802.11n_HT20)	Low	2 412	MCS 8	24.02	23.77	26.91	30
	Middle	2 437		24.01	23.88	26.96	
	High	2 462		23.79	23.99	26.90	
	Channel	**Frequency (㎒)**	**Data Rate**	**Average Power Result (dB m)**			
				ANT 1	**ANT 2**	**ANT 1+ANT 2**	
	Low	2 412	MCS 8	14.67	14.38	17.54	
	Middle	2 437		14.66	14.26	17.47	
	High	2 462		14.33	14.40	17.38	

Remark;

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

According to KDB 662911 D01 v02r01, peak power of each port (ANT 1+ANT 2) was combined by using below calculation.

Power: 10log {10^(ANT 1 power / 10)+10^(ANT 2 power / 10)}

5. Power Spectral Density

5.1. Test Setup

5.2. Limit

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 ㏈m in any 3 ㎑ band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.3. Test Procedure

The measurements are recorded using the PKPSD measurement procedure in section 11.10.2 of ANSI C63.10-2013.

- This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 x DTS bandwidth.
3. Set the RBW to: 3 ㎑ ≤ RBW ≤ 100 ㎑.
4. Set the VBW ≥ 3 x RBW.
5. Detector = Peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 ㎑) and repeat.

5.4. Test Results

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

Operation Mode	Data Rate	Channel	Frequency (㎒)	Measured PSD (㏈ m/3 ㎑)			Maximum Limit (㏈ m/3 ㎑)
				ANT 1	ANT 2	ANT 1+ANT 2	
DSSS (802.11b)	1 Mbps	Low	2 412	-0.56	-0.95	2.26	8
		Middle	2 437	-0.47	-0.73	2.41	
		High	2 462	0.34	0.19	3.28	

Operation Mode	Data Rate	Channel	Frequency (㎒)	Measured PSD (㏈ m/3 ㎑)			Maximum Limit (㏈ m/3 ㎑)
				ANT 1	ANT 2	ANT 1+ANT 2	
OFDM (802.11g)	6 Mbps	Low	2 412	-11.86	-11.53	-8.68	8
		Middle	2 437	-13.15	-12.70	-9.91	
		High	2 462	-12.19	-13.33	-9.71	

Operation Mode	Data Rate	Channel	Frequency (㎒)	Measured PSD (㏈ m/3 ㎑)			Maximum Limit (㏈ m/3 ㎑)
				ANT 1	ANT 2	ANT 1+ANT 2	
OFDM (802.11n_HT20)	MCS8	Low	2 412	-14.21	-13.99	-11.09	8
		Middle	2 437	-14.56	-14.55	-11.54	
		High	2 462	-14.22	-14.06	-11.13	

Remark;

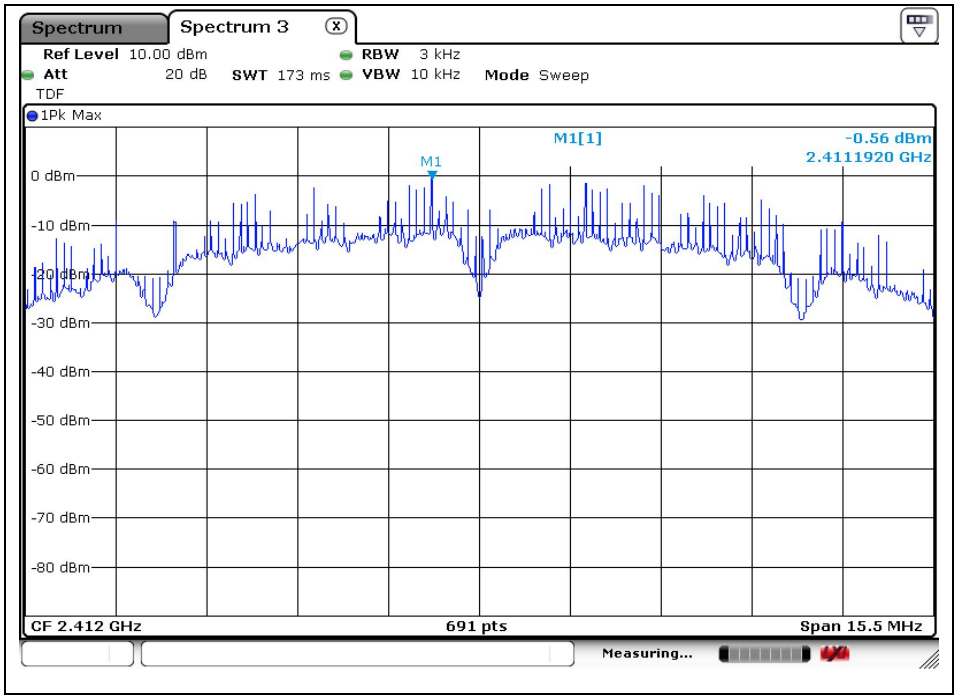
According to KDB 662911 D01 v02r01, power spectral density of each port (ANT 1+ANT 2) was combined by using below calculation.

Total PSD: 10log {10^(ANT 1 PSD / 10)+10^(ANT 2 PSD / 10)}

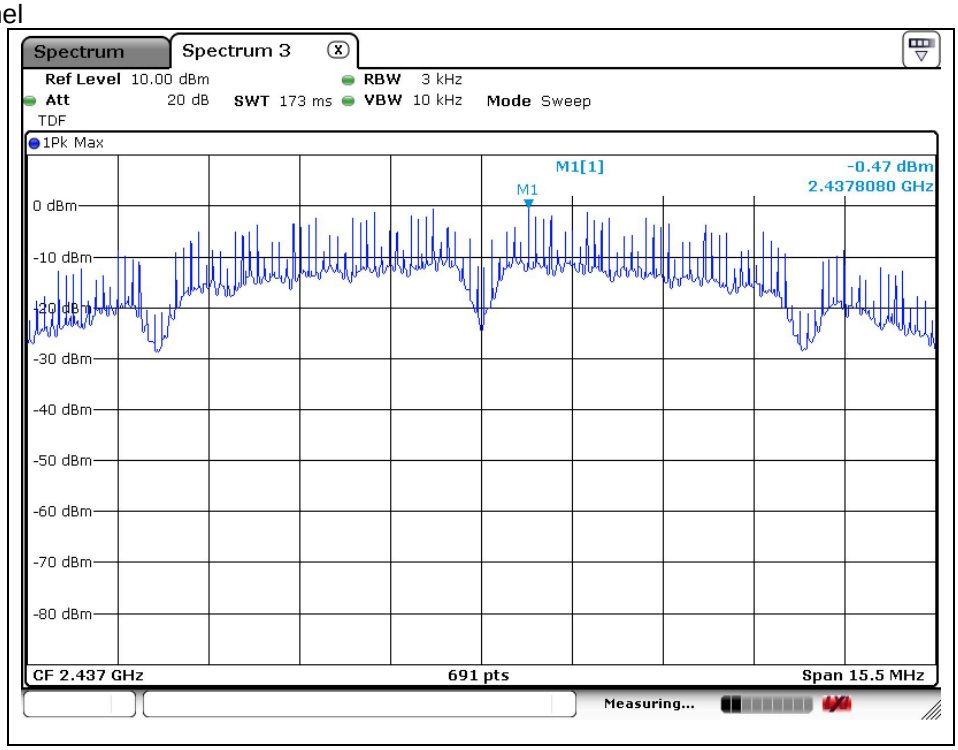
- Test plots

DSSS: 802.11b_ANT 1

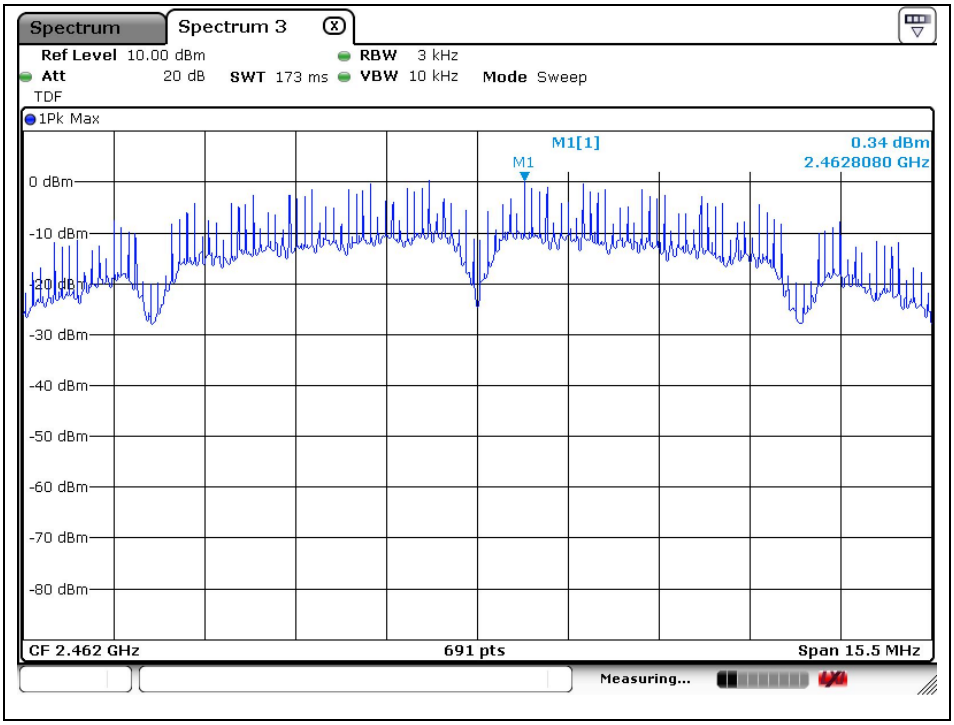
Low Channel



Middle Channel

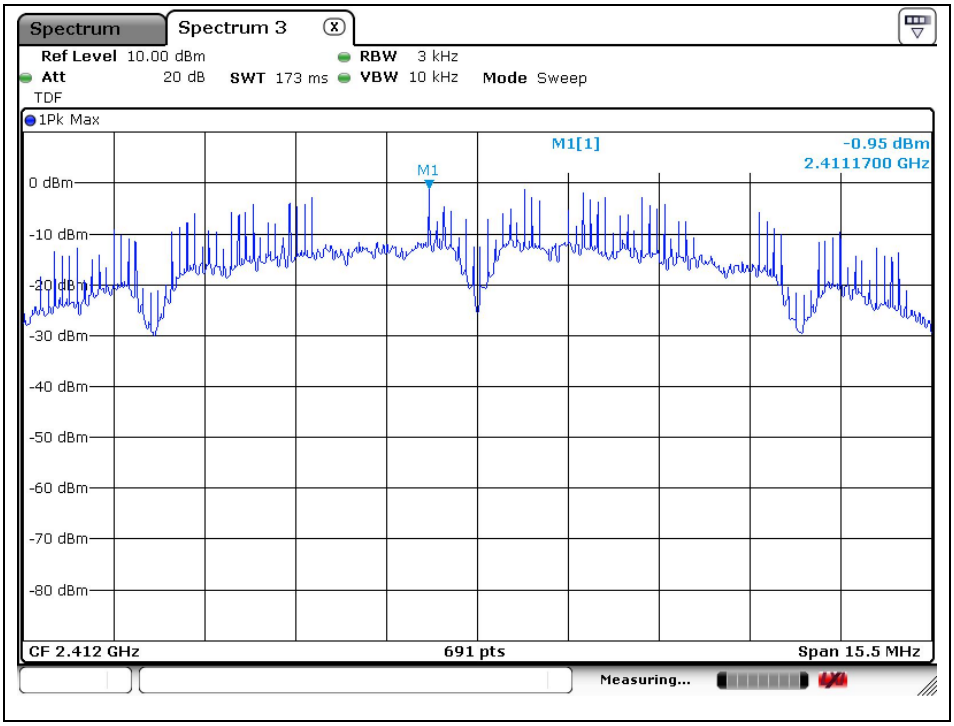


High Channel

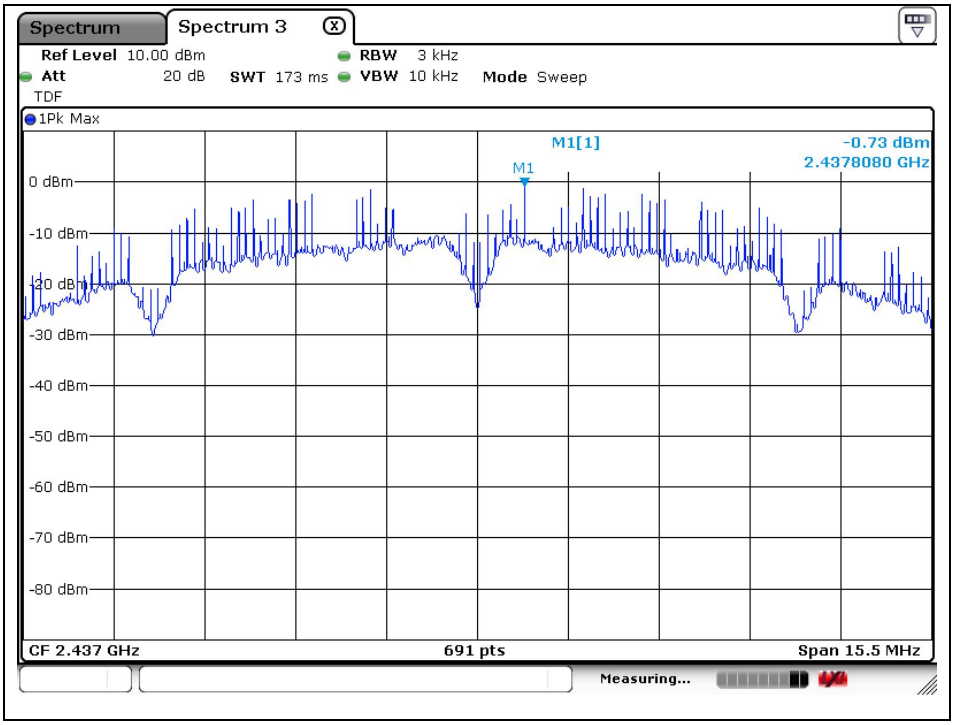


DSSS: 802.11b_ANT 2

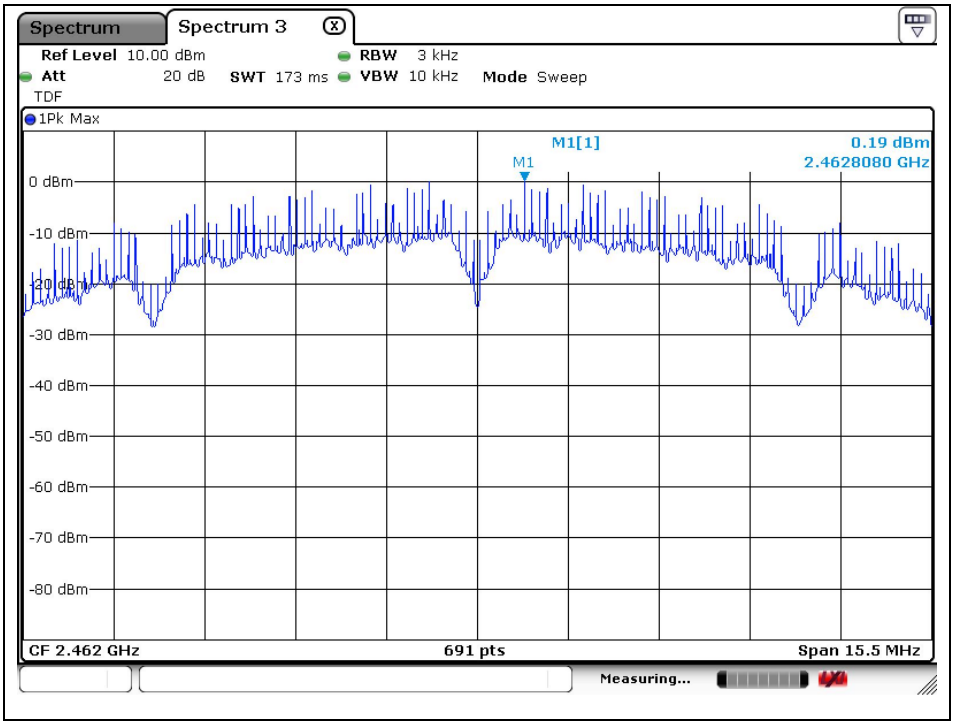
Low Channel



Middle Channel

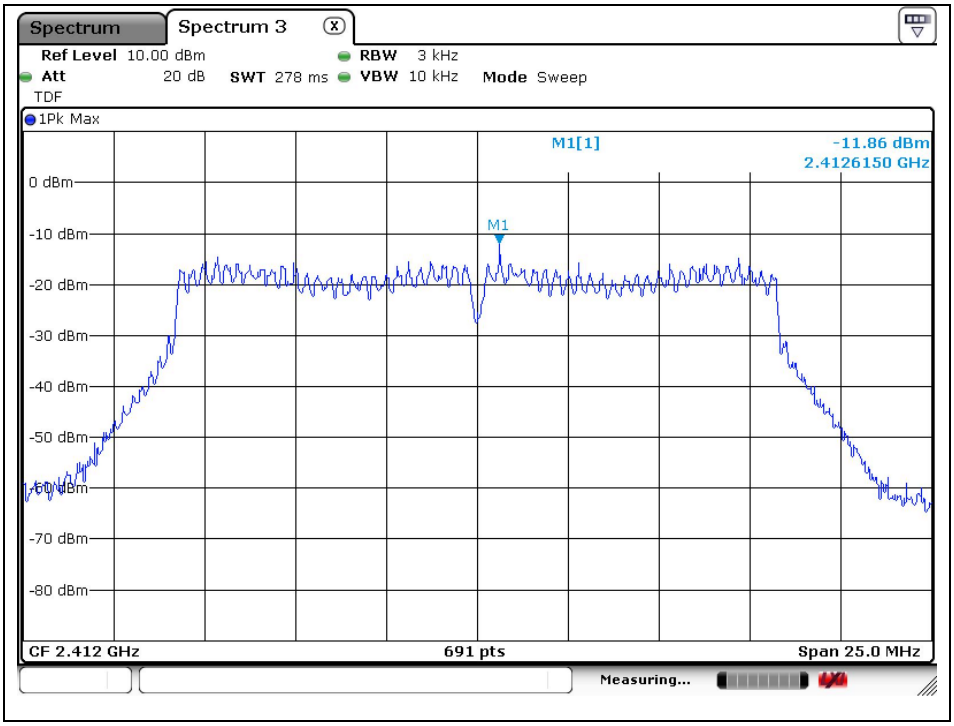


High Channel

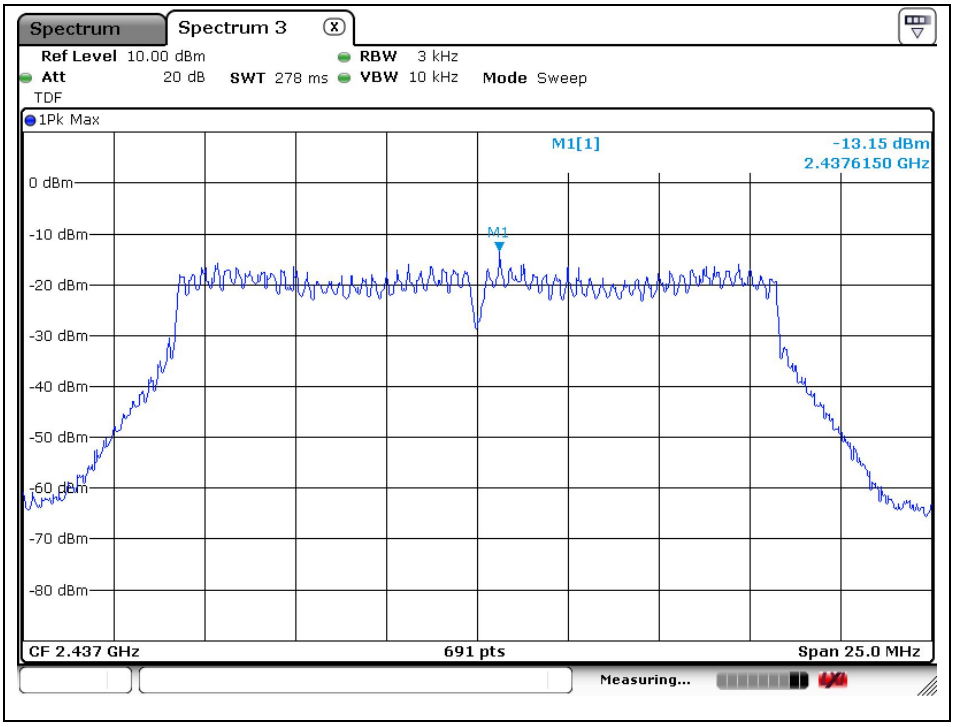


OFDM: 802.11g_ANT 1

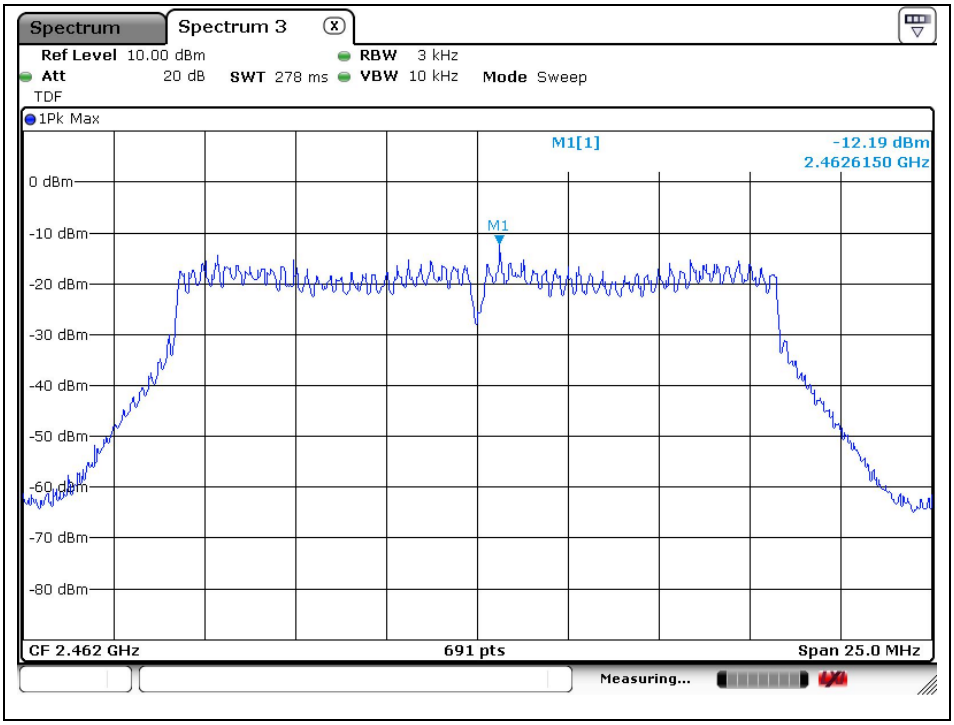
Low Channel



Middle Channel

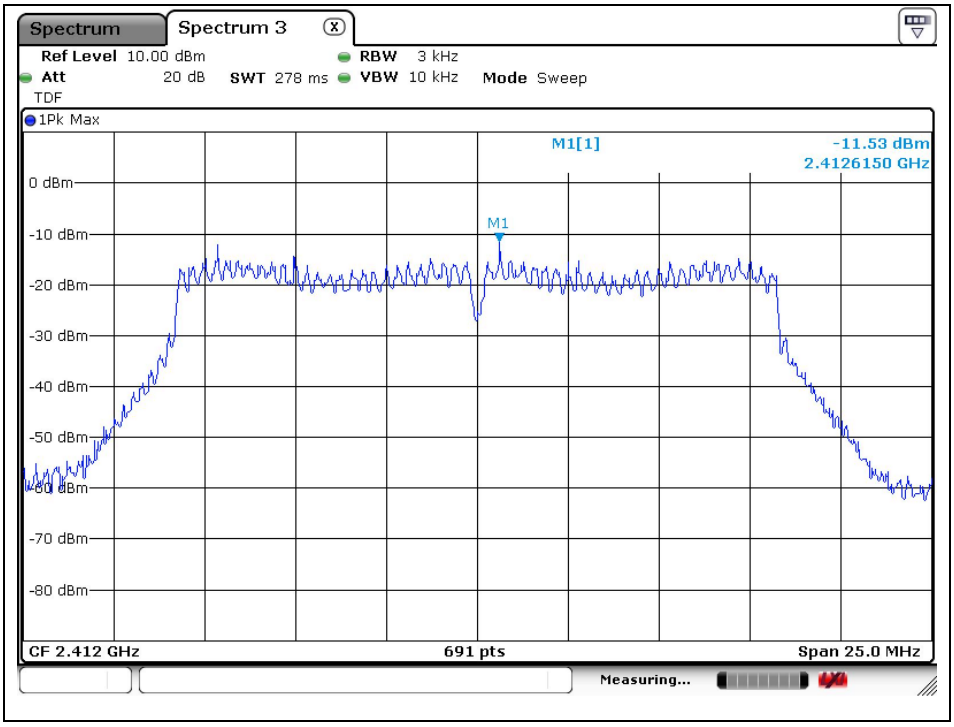


High Channel

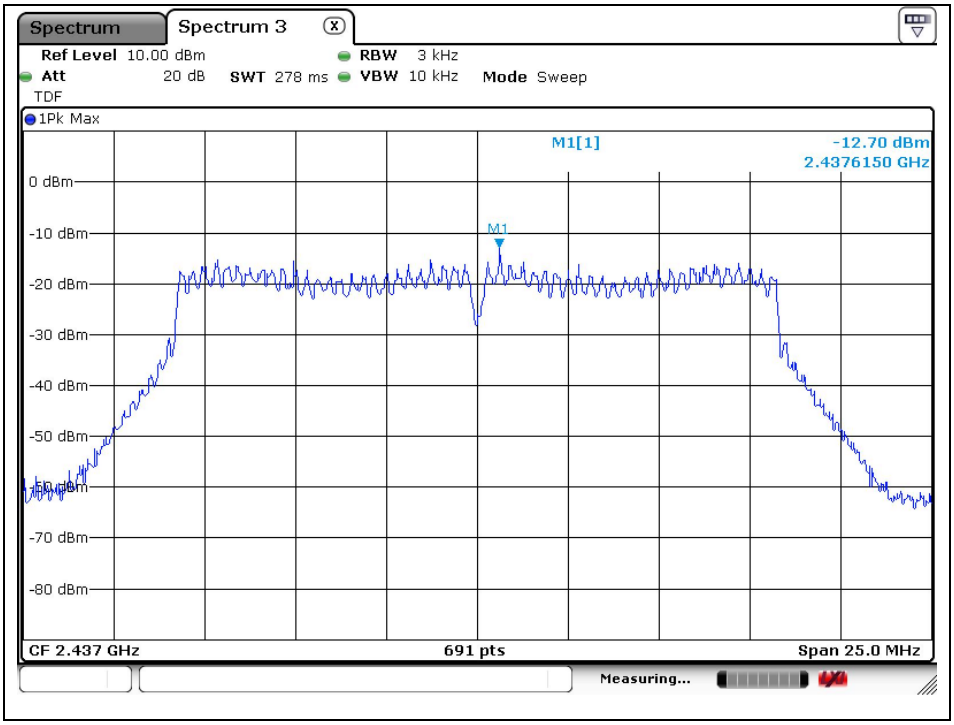


OFDM: 802.11g_ANT 2

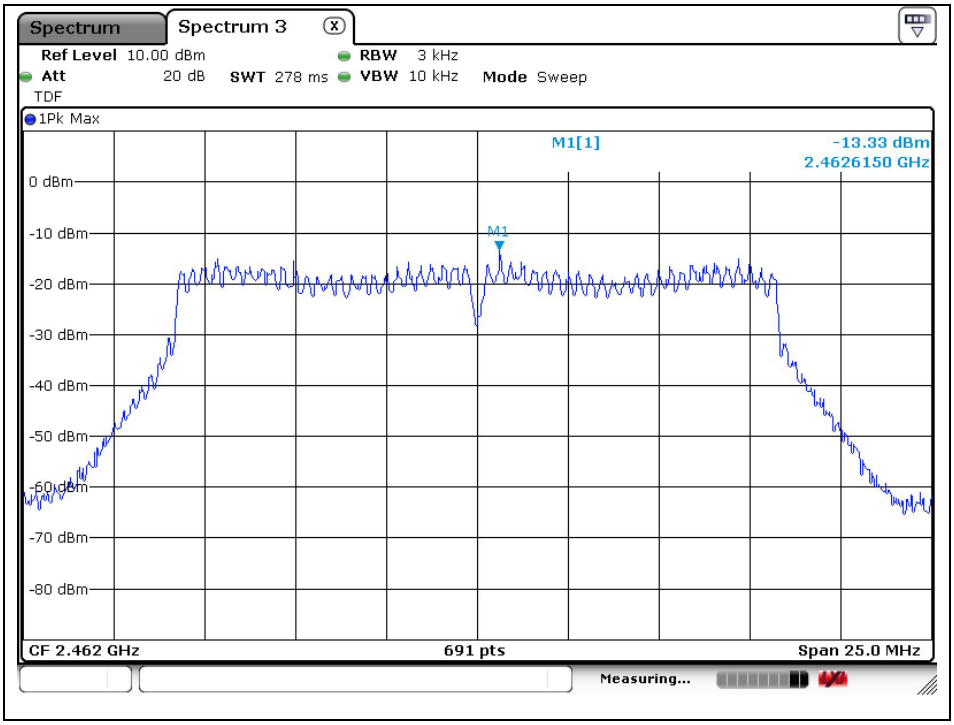
Low Channel



Middle Channel

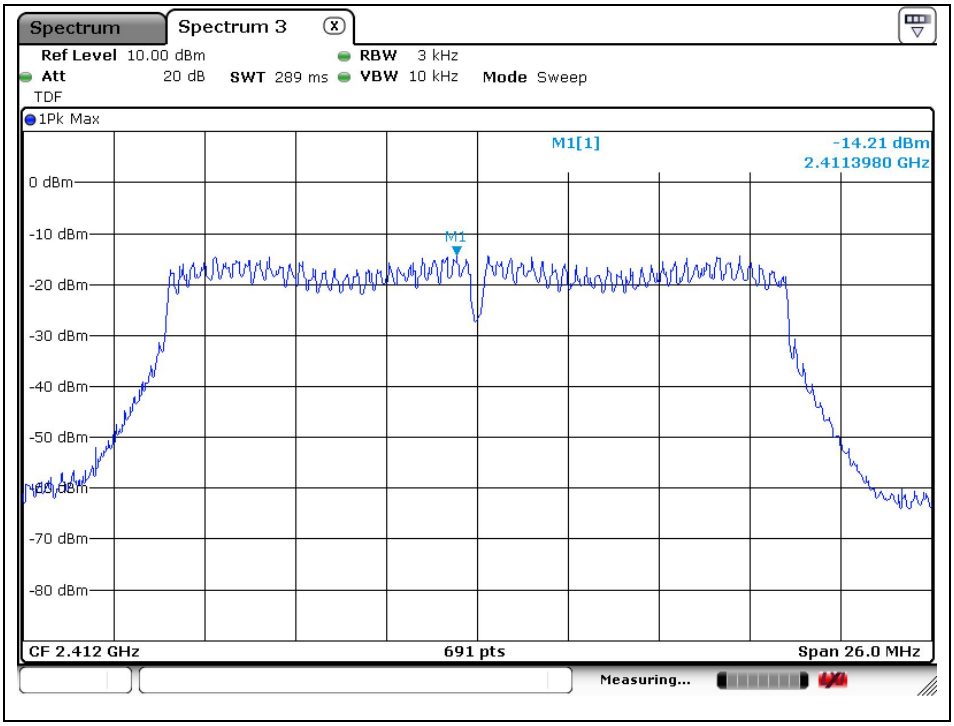


High Channel

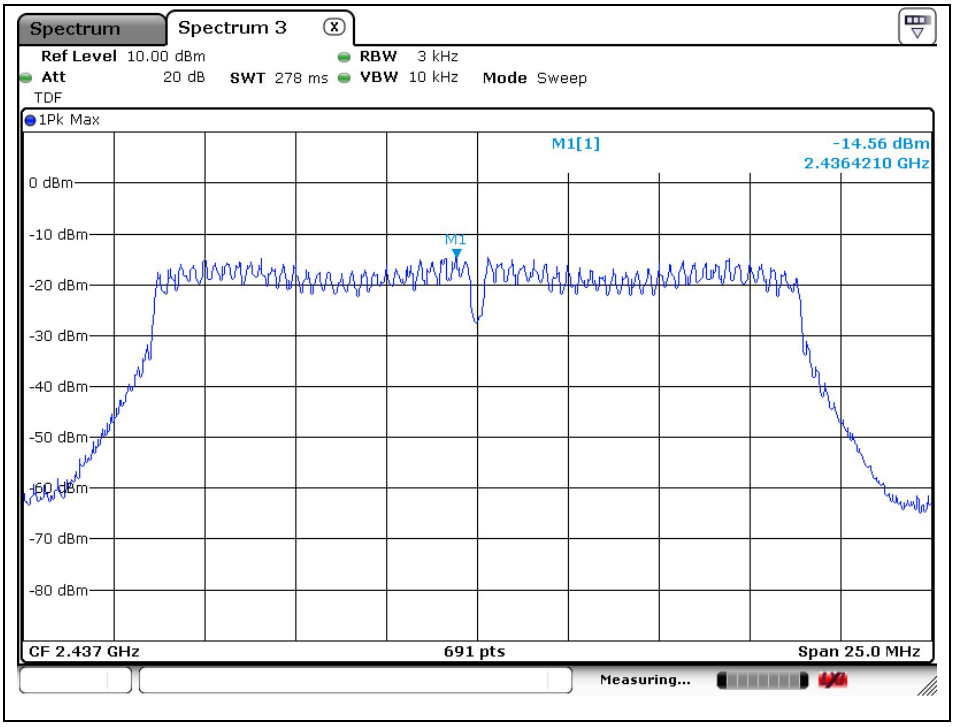


OFDM: 802.11n_HT20_ANT 1

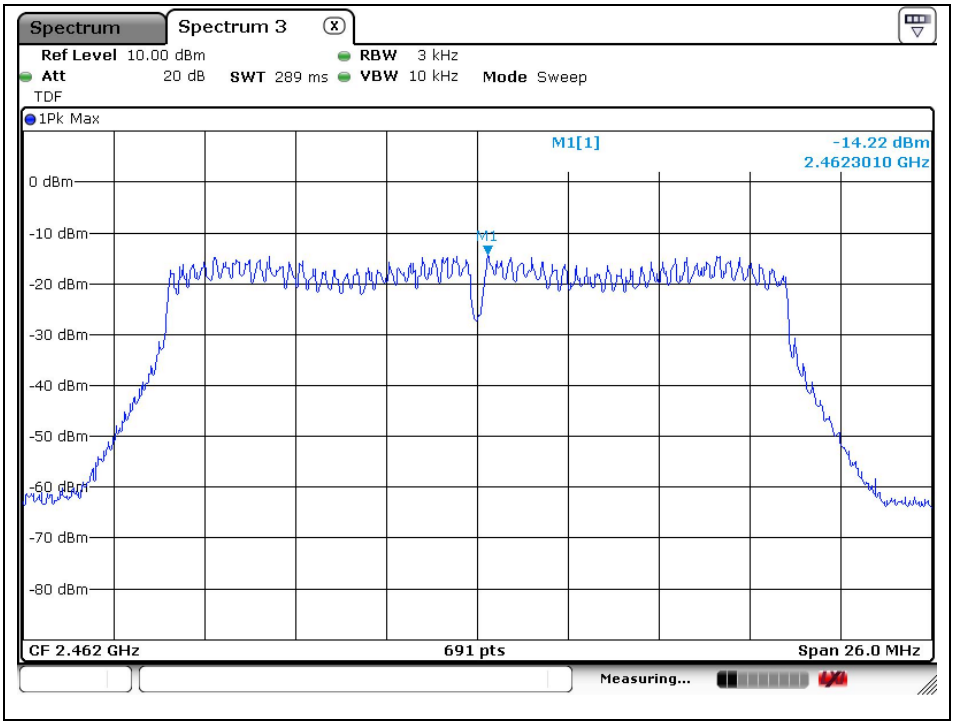
Low Channel



Middle Channel

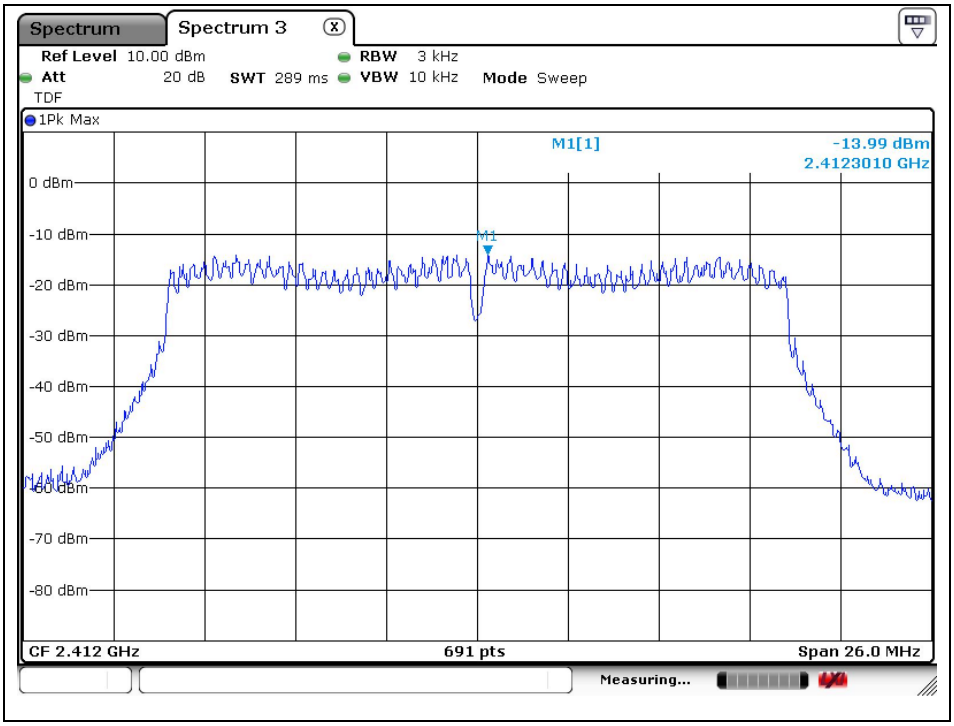


High Channel

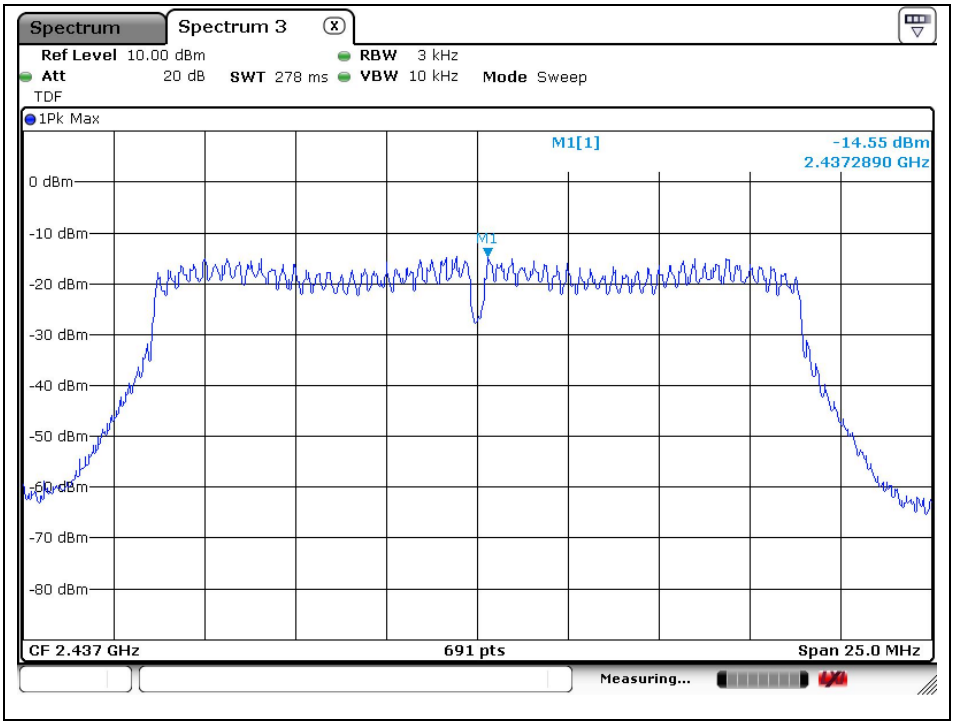


OFDM: 802.11n_HT20_ANT 2

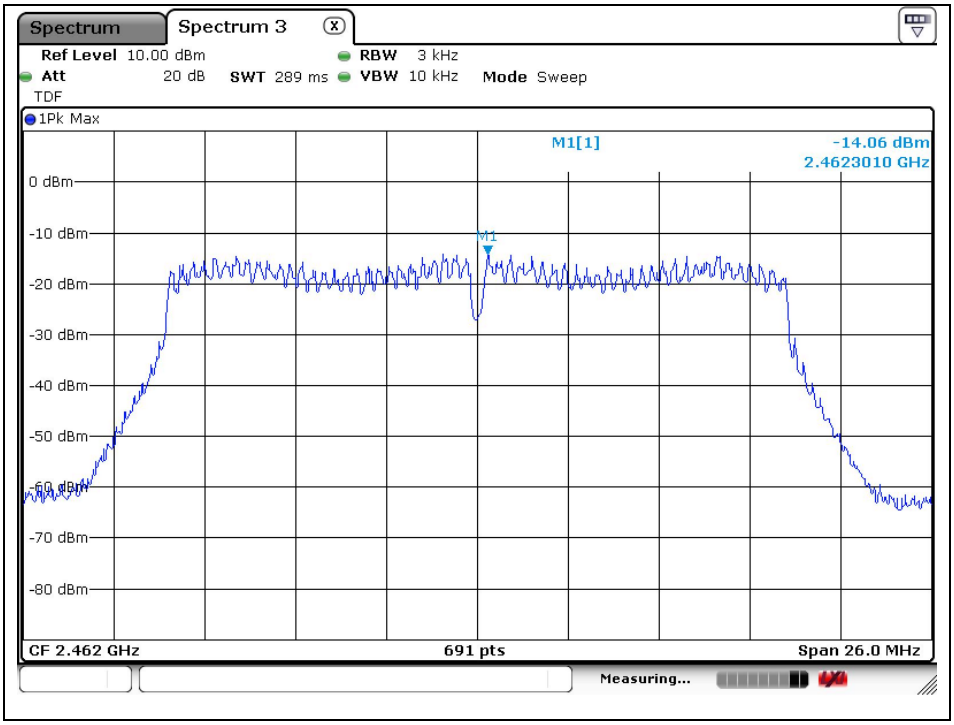
Low Channel



Middle Channel

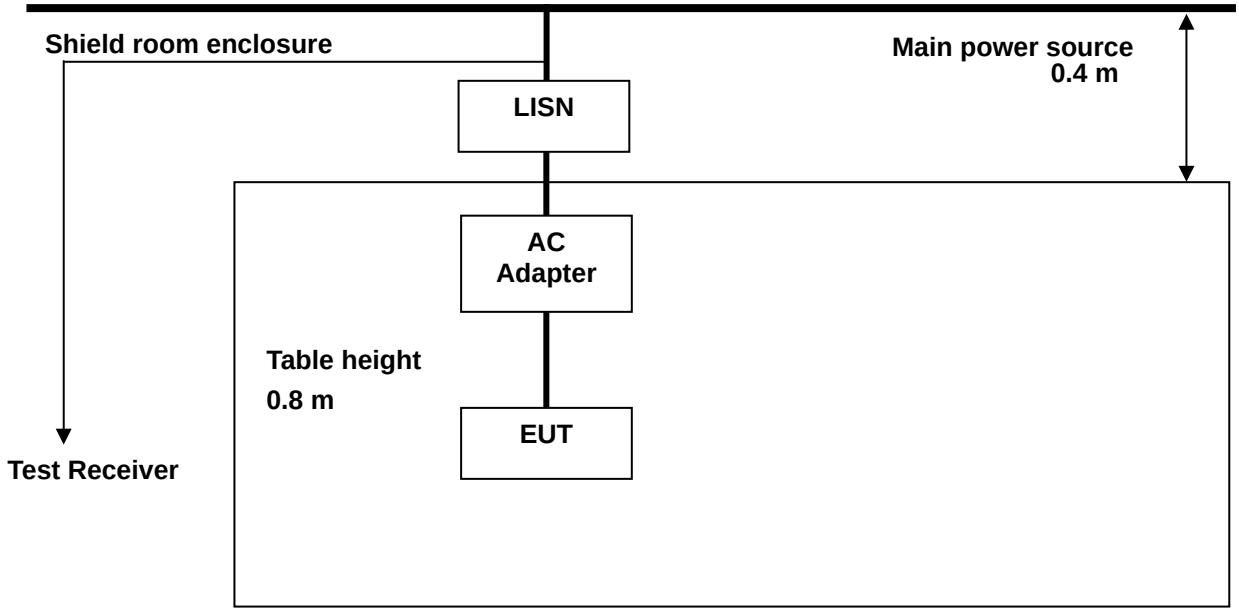


High Channel



6. Transmitter AC Power Line Conducted Emission

6.1. Test Setup



6.2. Limit

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 ㎕H /50 ohms line impedance stabilization network (LISN).
Compliance with the provision of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (㎒)	Conducted limit (dB㎶)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

6.3. Test Procedures

AC conducted emissions from the EUT were measured according to the dictates of ANSI C63.10-2013

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

6.4. Test Results

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

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

Frequency range : 0.15 ㎒ - 30 ㎒
Measured Bandwidth : 9 ㎑

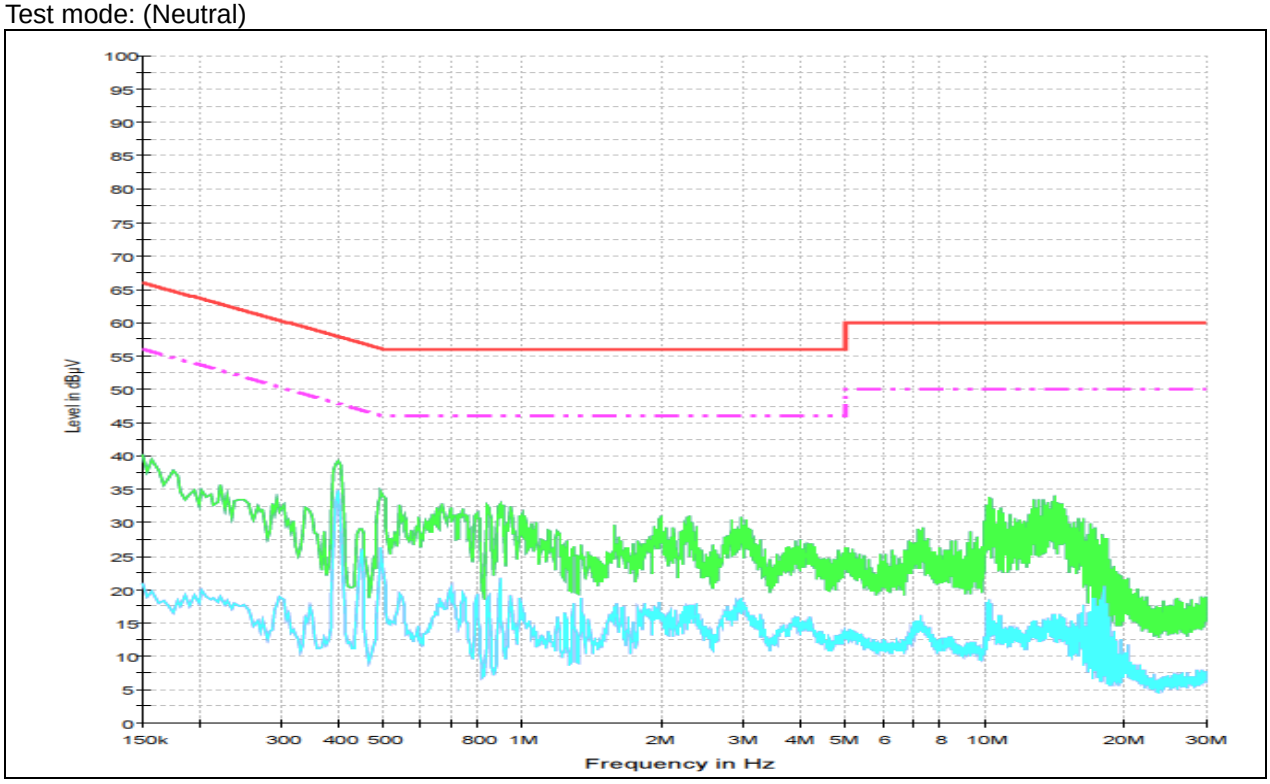
FREQ.	LEVEL (dBμV)		LINE	LIMIT (dBμV)		MARGIN (dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.40	37.10	34.10	N	57.85	47.85	20.75	13.75
0.49	31.80	26.40	N	56.17	46.17	24.37	19.77
0.90	24.40	13.20	N	56.00	46.00	31.60	32.80
2.29	25.90	17.90	N	56.00	46.00	30.10	28.10
10.13	26.00	13.60	N	60.00	50.00	34.00	36.40
14.21	27.40	16.40	N	60.00	50.00	32.60	33.60
0.39	36.10	29.20	H	58.06	48.06	21.96	18.86
0.44	32.70	27.00	H	57.06	47.06	24.36	20.06
1.97	28.40	20.90	H	56.00	46.00	27.60	25.10
2.93	31.20	2.00	H	56.00	46.00	24.80	44.00
10.16	34.10	21.40	H	60.00	50.00	25.90	28.60
13.97	32.20	22.00	H	60.00	50.00	27.80	28.00

Remark;

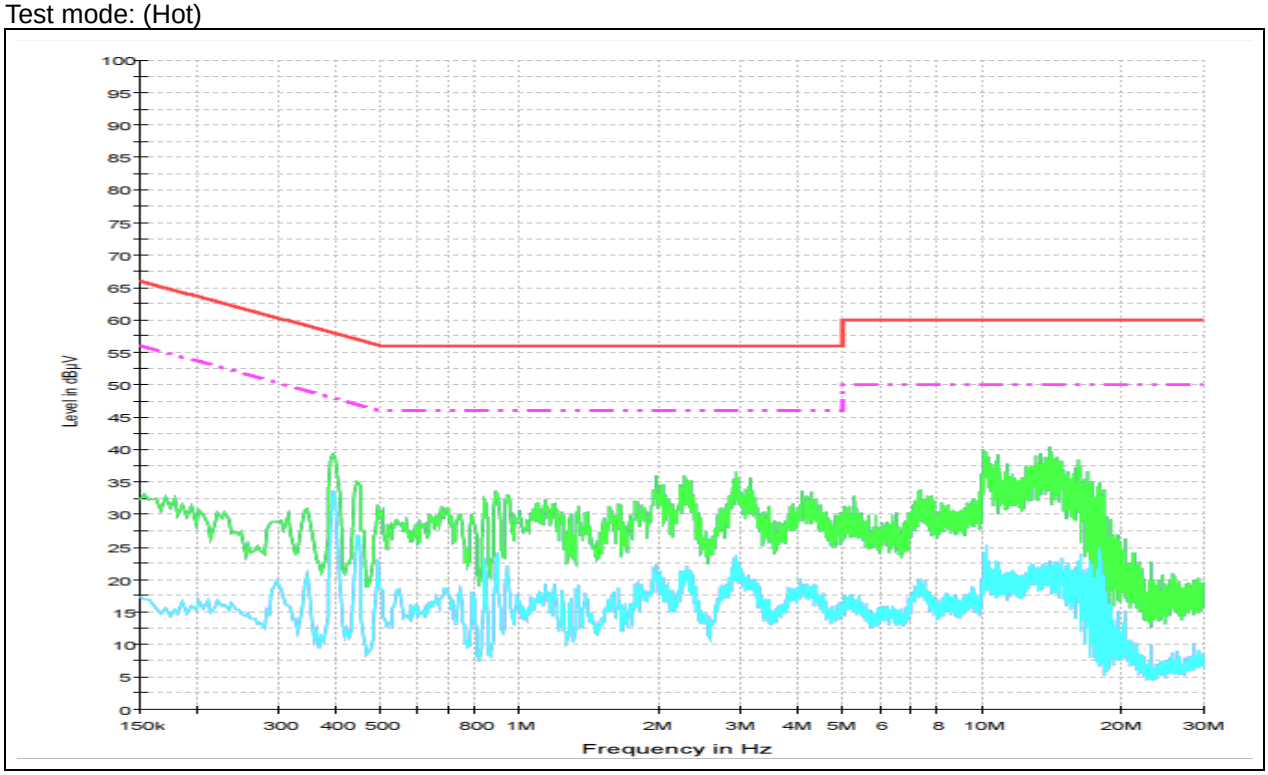
1. Line (H): Hot, Line (N): Neutral.
2. All modes of operation were investigated and the worst-case emissions were reported using **11n / MCS8 / Middle channel.**
3. The limit for Class B device(s) from 150 ㎑ to 30 ㎒ are specified in Section of the Title 47 CFR.
4. Traces shown in plot were made by using a peak detector and average detector.
5. Deviations to the Specifications: None.

- Test plots

Test mode: (Neutral)



Test mode: (Hot)



7. Antenna Requirement

7.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section §15.247(b) if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

7.2. Antenna Connected Construction

Antenna used in this product is PCB antenna and peak max gain of antenna as below.

Band	2 412 ㎒ – 2 462 ㎒
Mode	11b/g/n_HT20
ANT 1 Gain	1.43 dBi
ANT 2 Gain	1.53 dBi

Unequal antenna gains, with equal transmit powers. For antenna gains given by G_1, G_2, …, G_N dBi
(i) If transmit signals are correlated, then
Directional gain = 10 log[$(10^{G_1/20} + 10^{G_2/20} + \ldots + 10^{G_N/20})^2/N_{ANT}$] dBi [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

Directional Gain = 4.49 dBi

- End of the Test Report -