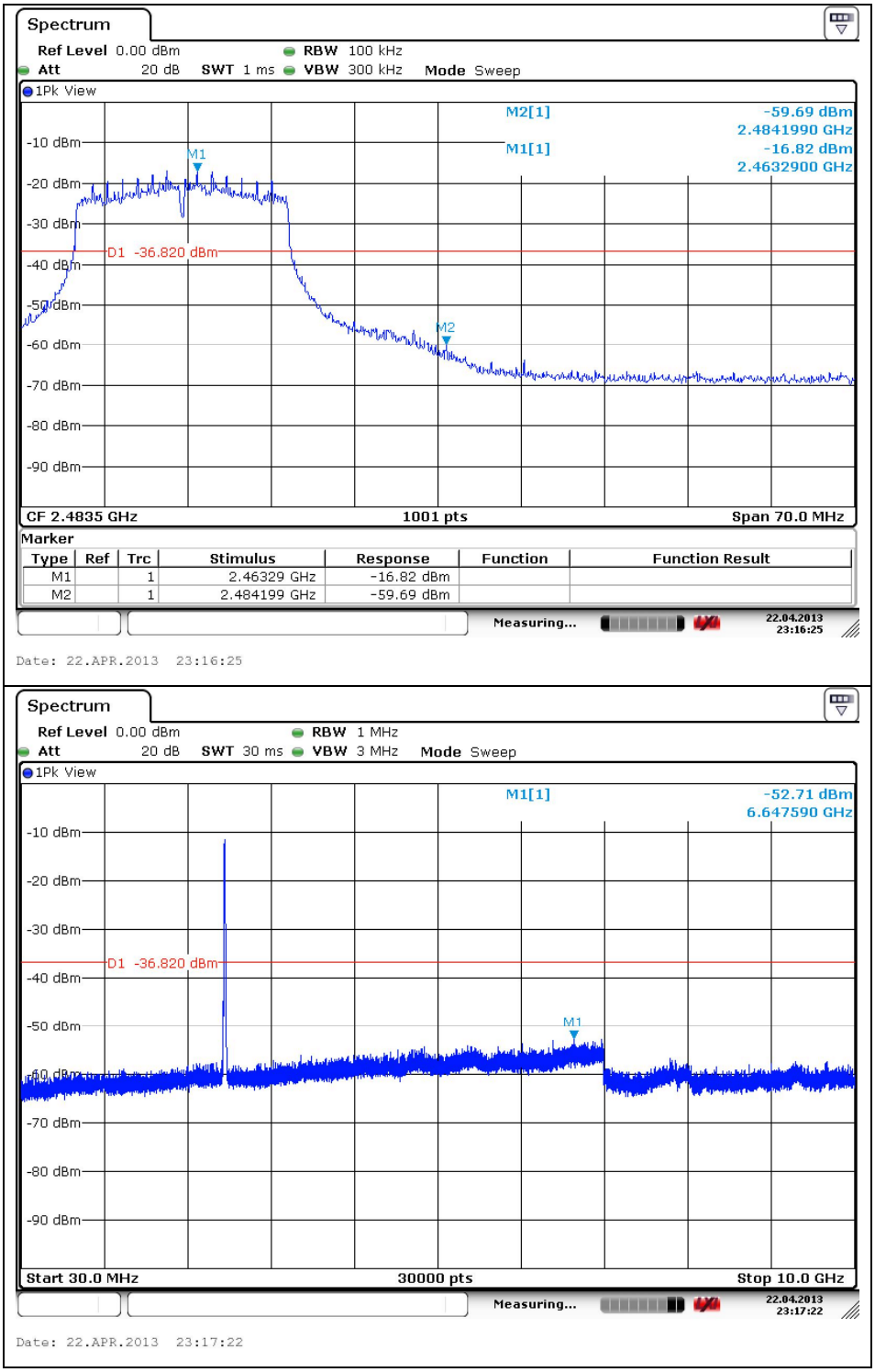
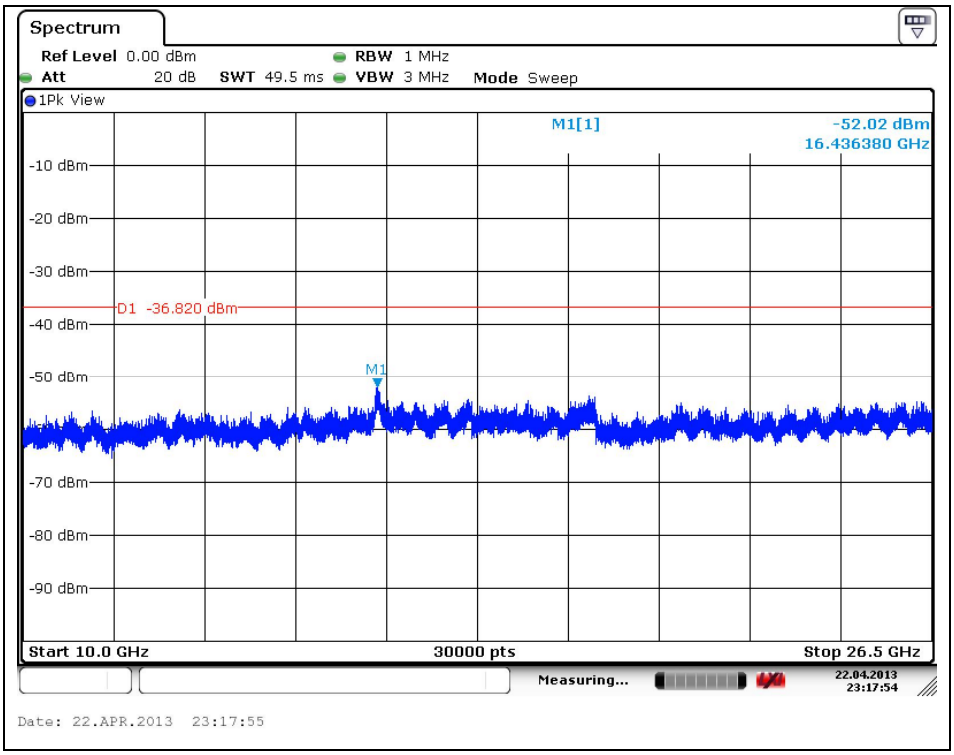
High Channel



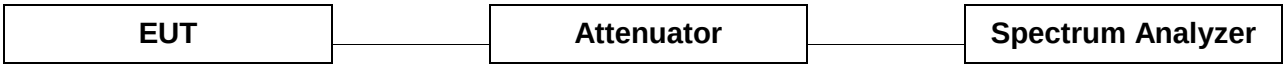


Note:
Offset (dB) = Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

Frequency (MHz)	Reading values (dB m)	Spurious offset (dB)	Result (dB m)
2 484.20	-59.69	21.26	-38.43
6 647.59	Noise floor	-	-
16 436.38	Noise floor	-	-

3. 6 dB Bandwidth Measurement & 99% Occupied 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 ~ 5 825 ㎒ bands. The minimum of 6 dB Bandwidth shall be at least 500 ㎑

3.3. Test Procedure

3.3.1. 6 dB Bandwidth

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The test follows section 8.0 of FCC KDB Publication 558074

1. Set RBW = 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 point (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 test follows section 4.6.1 of RSS-Gen

1. Set the spectrum analyzer as SPAN = 2 or 3 times necessary bandwidth
2. RBW = approximately 1 % of the SPAN
3. VBW is set to 3 times RBW
4. Detector = sampling
5. Trace mode = max hold.
6. Measure lowest and highest frequencies are placed in a running sum until 0.5 % and 99.5 % of the total is reached.
7. Record 99% occupied bandwidth between the lowest and the highest frequencies repeat measurement for all the test channels.

3.4. Test Results

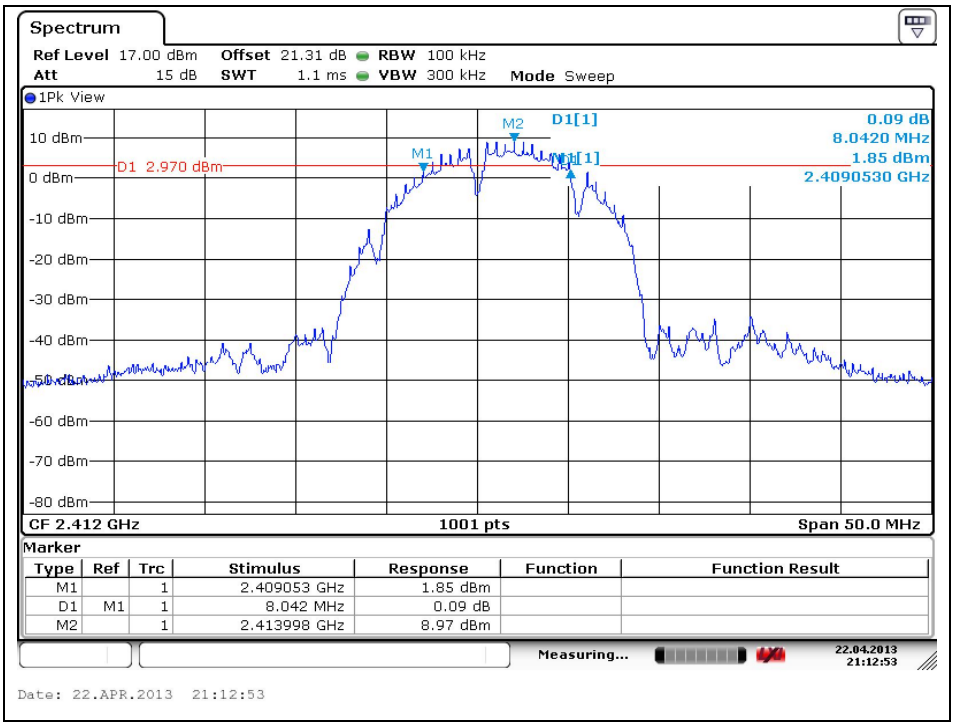
Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

Operation Mode	Data Rate (Mbps)	Channel	Channel Frequency (㎒)	6 ㏈ Bandwidth (㎒)	99% Occupied Bandwidth (㎒)
DSSS (802.11b)	1	Low	2 412	8.04	11.79
		Middle	2 437	8.04	11.79
		High	2 462	8.04	11.87
OFDM (802.11g)	6	Low	2 412	15.14	17.08
		Middle	2 437	15.14	17.08
		High	2 462	15.14	17.08
OFDM (802.11n_HT20)	MCS0	Low	2 412	15.78	18.02
		Middle	2 437	15.93	18.02
		High	2 462	16.23	18.02

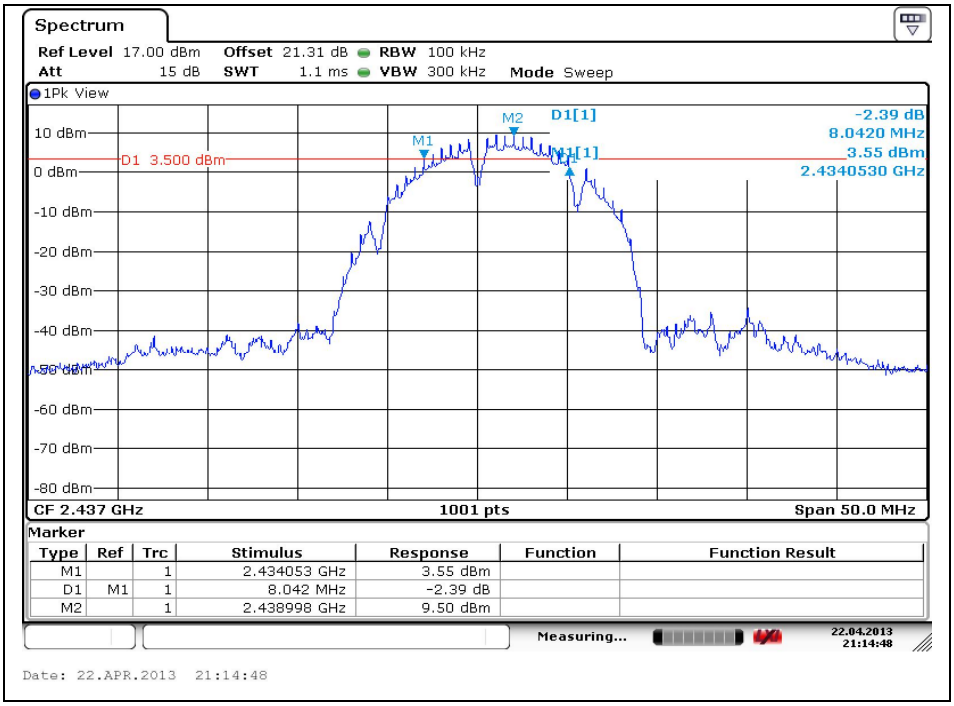
6 dB Bandwidth

DSSS : 802.11b

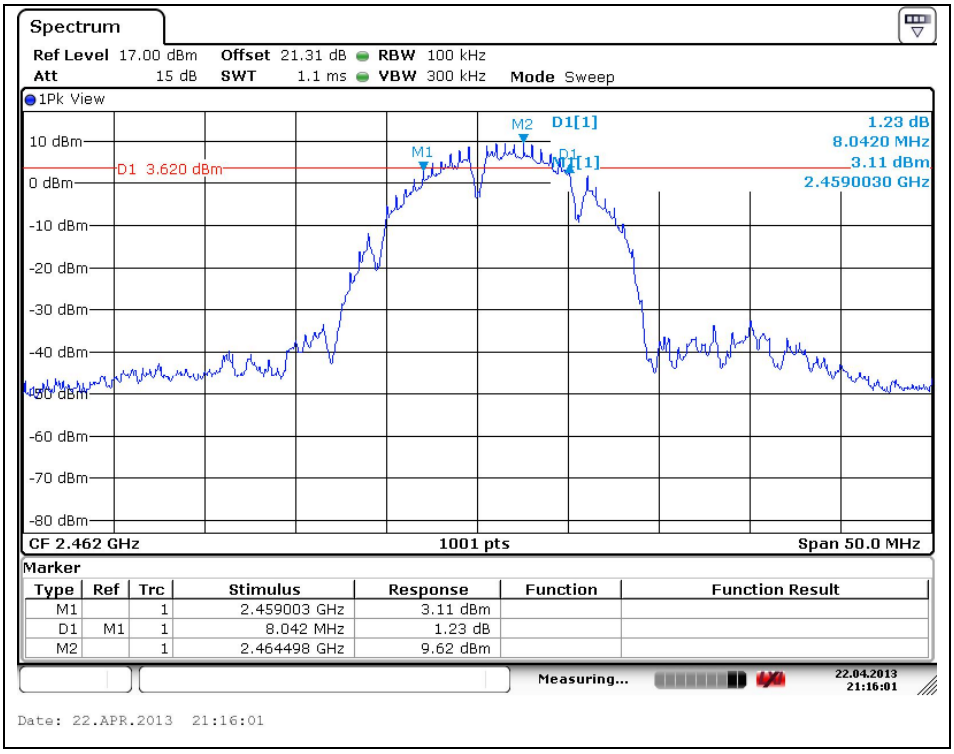
Low Channel



Middle Channel

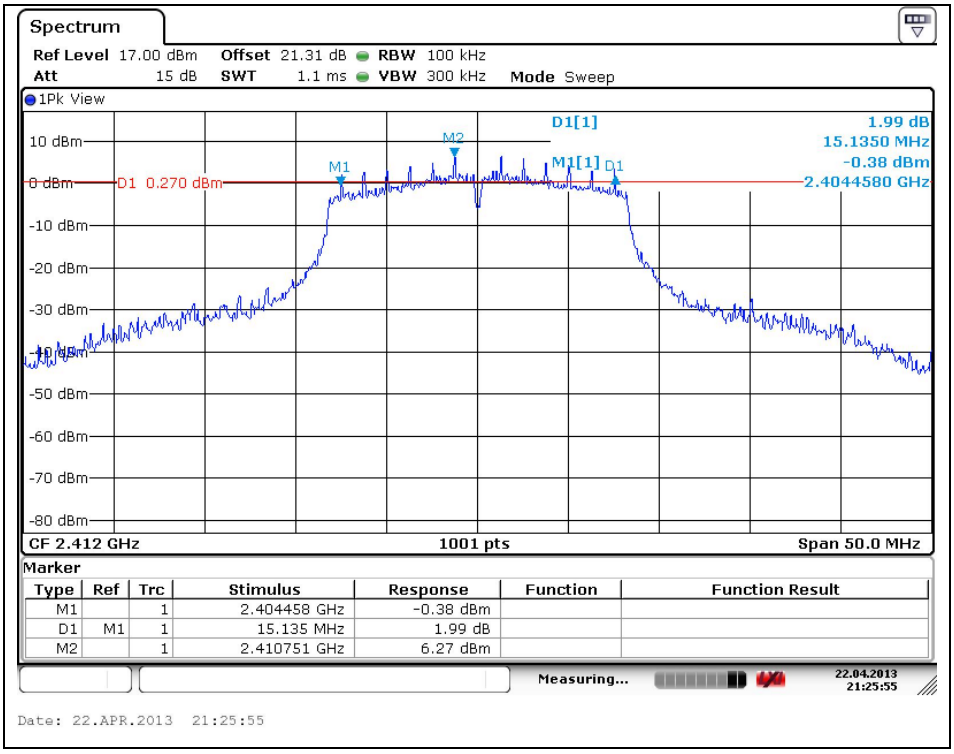


High Channel

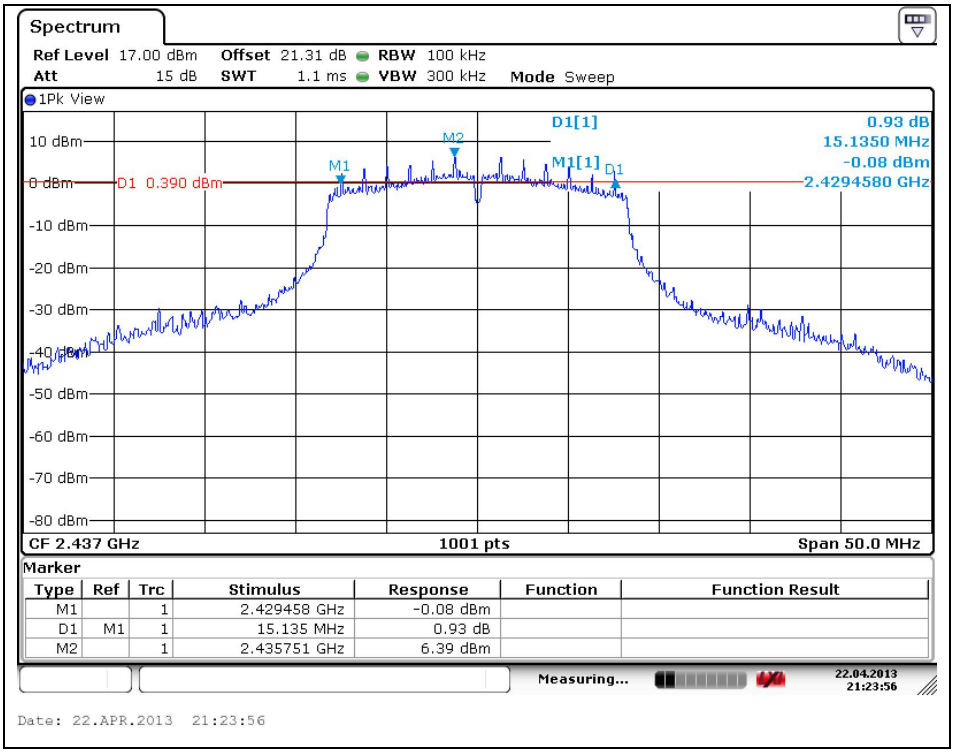


OFDM : 802.11g

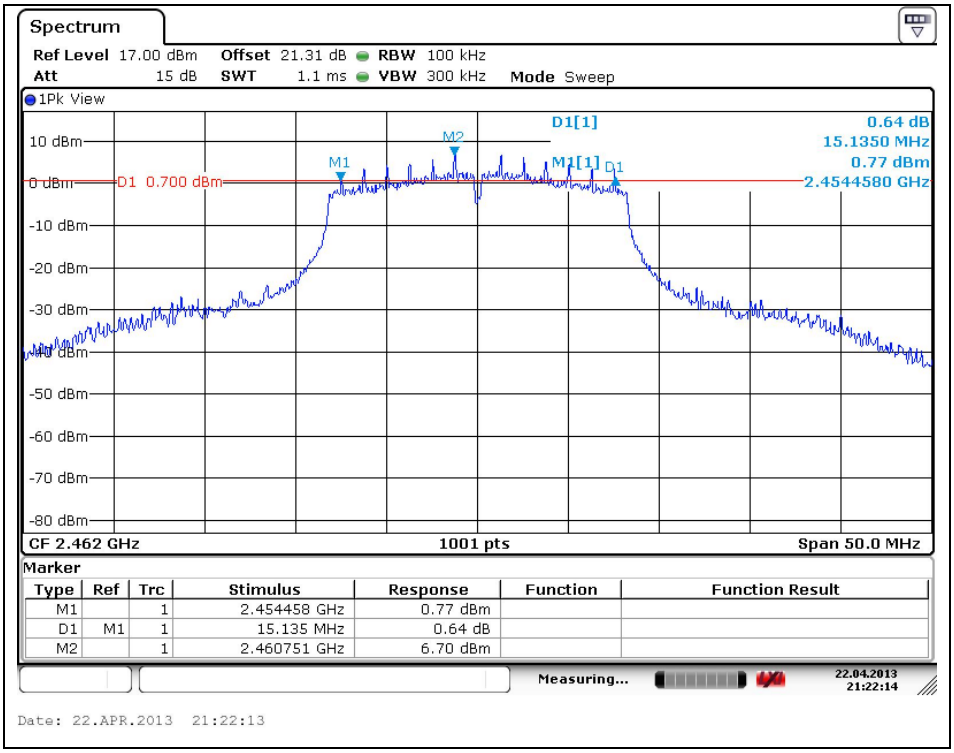
Low Channel



Middle Channel

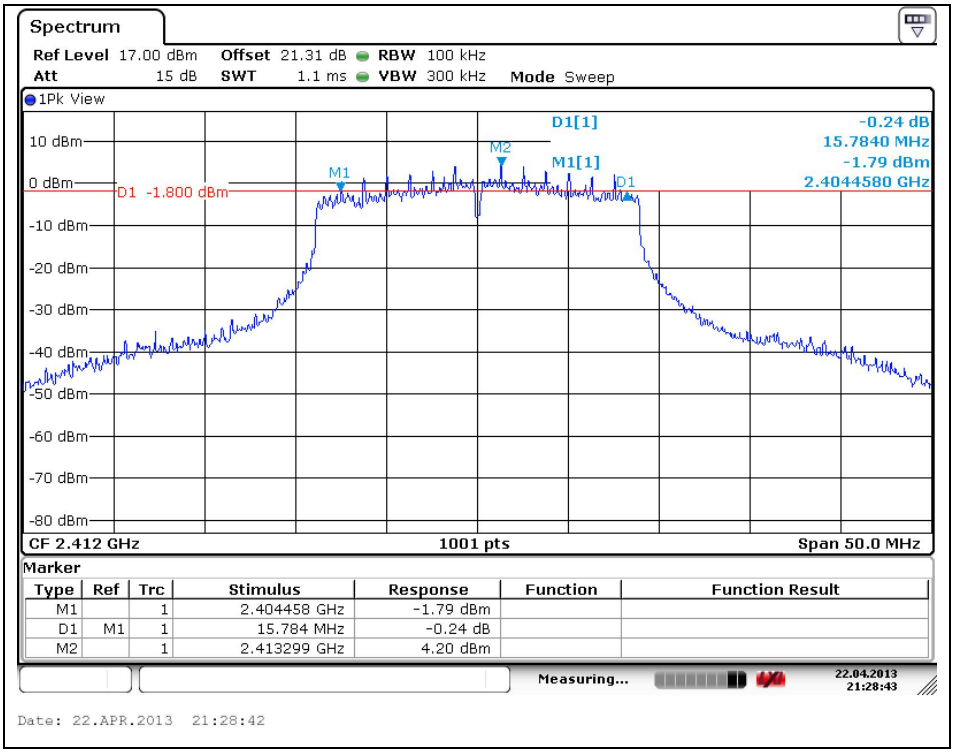


High Channel

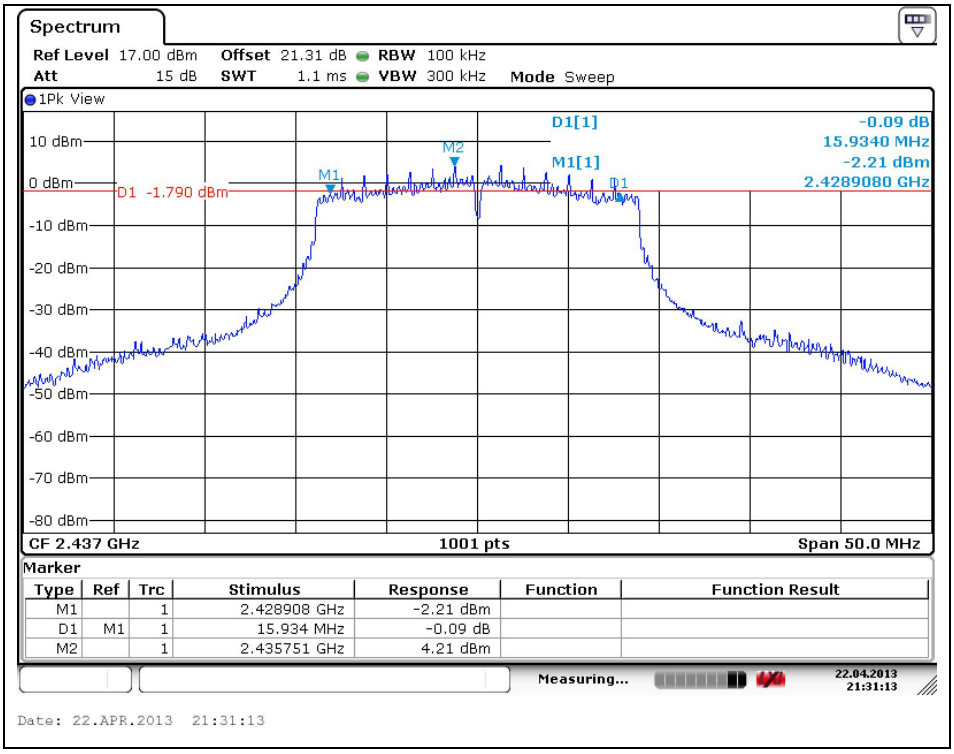


OFDM : 802.11n_HT20

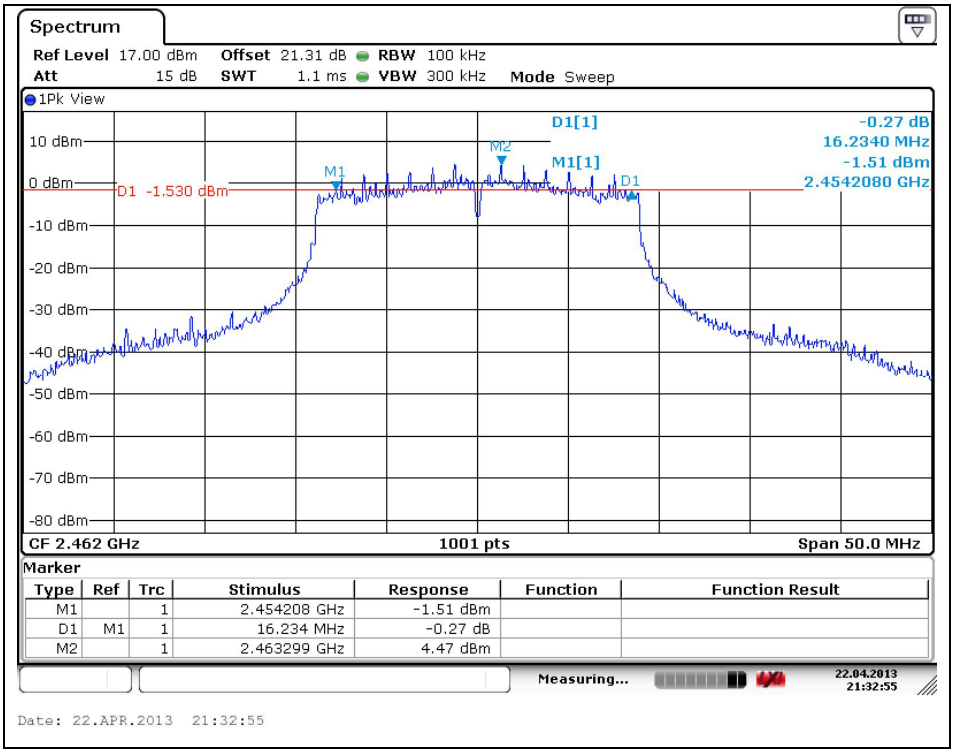
Low Channel



Middle Channel



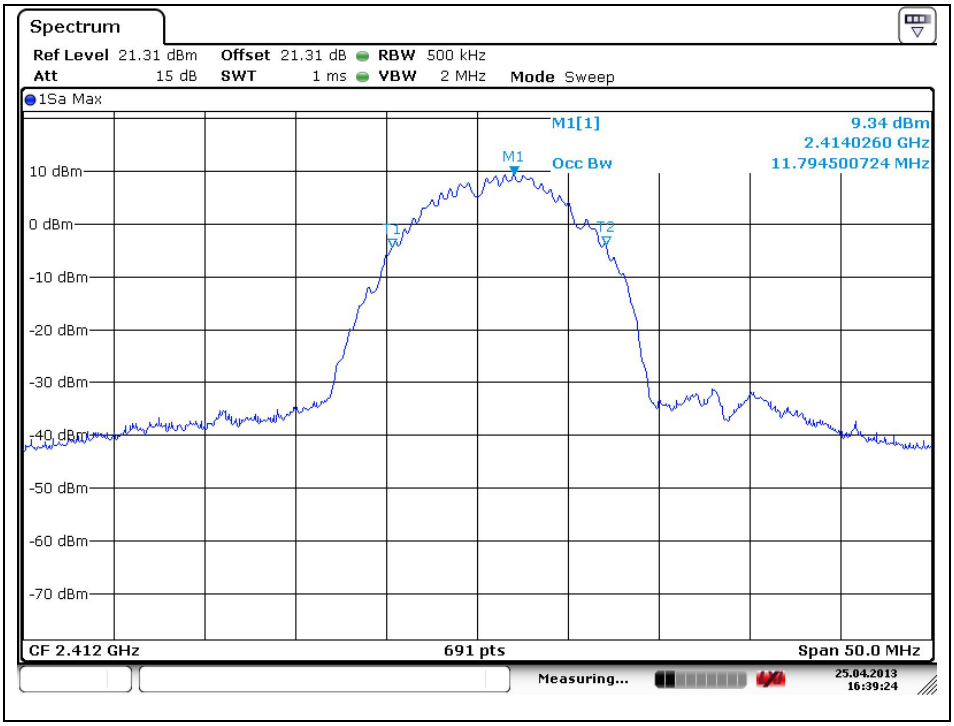
High Channel



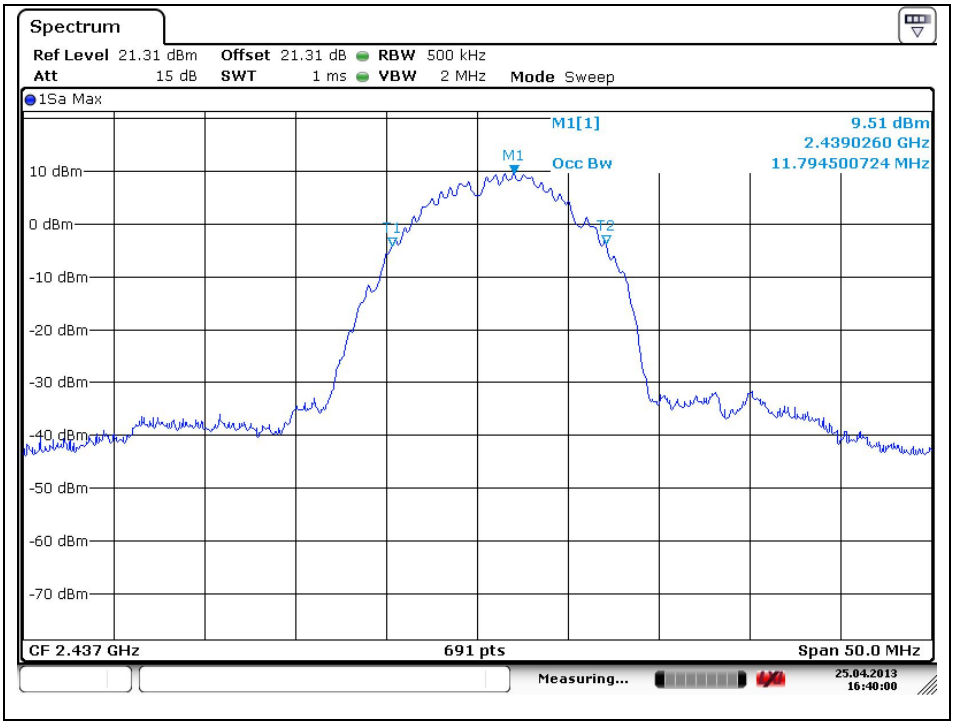
99% Occupied Bandwidth

DSSS : 802.11b

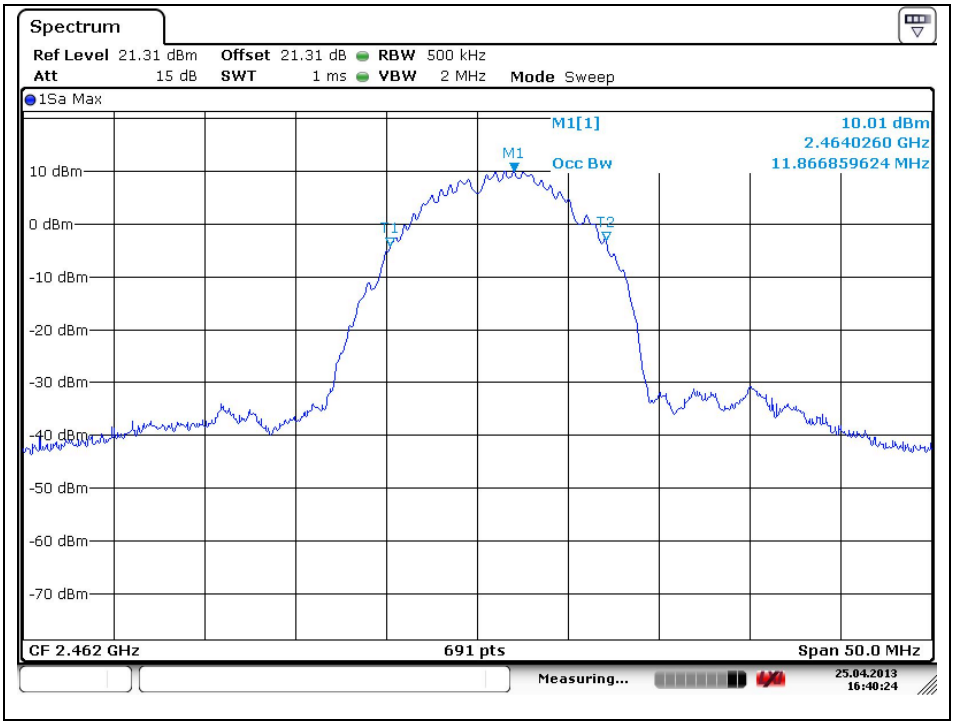
Low Channel



Middle Channel

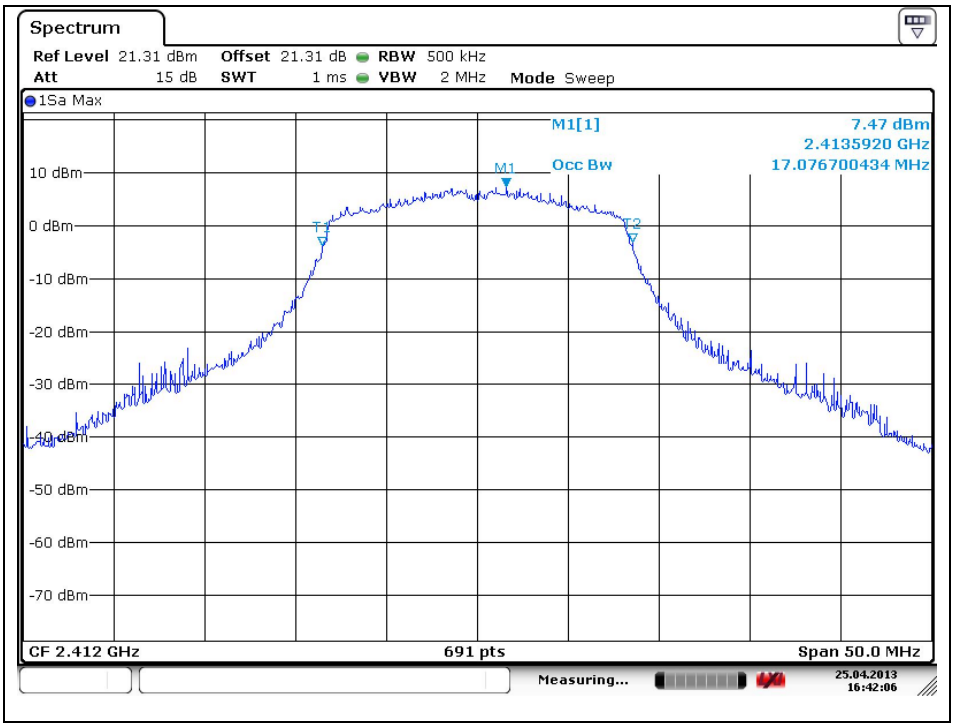


High Channel

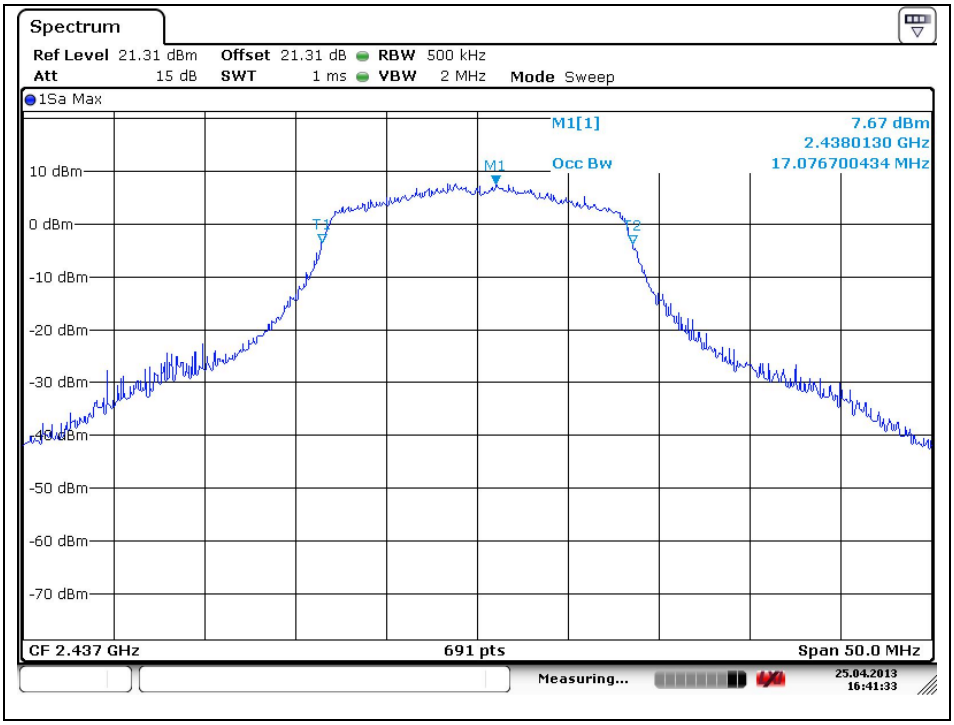


OFDM : 802.11g

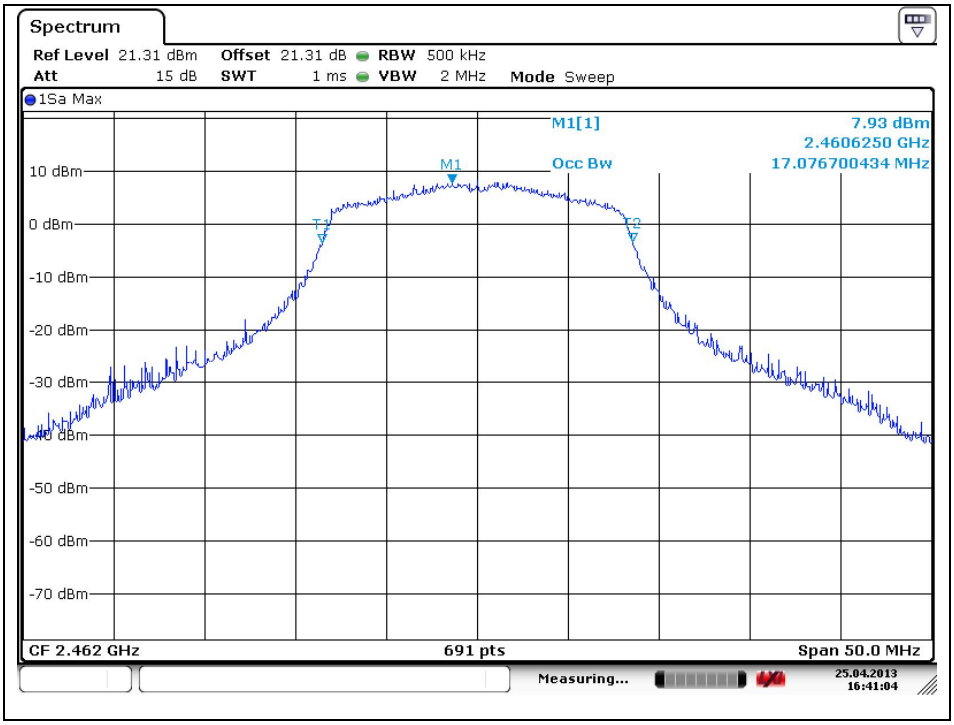
Low Channel



Middle Channel

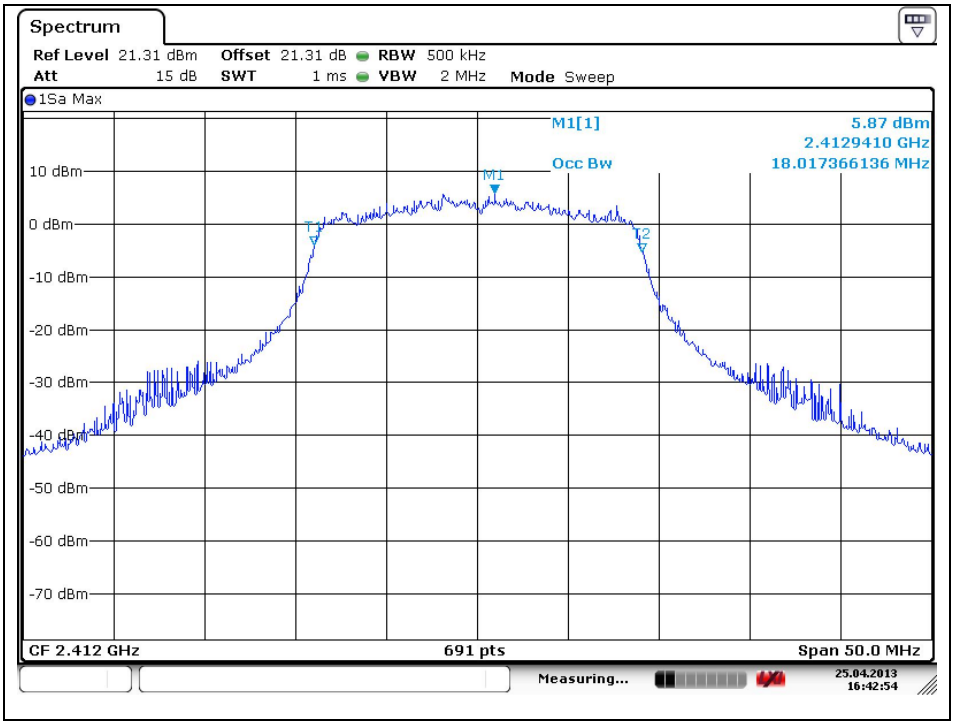


High Channel

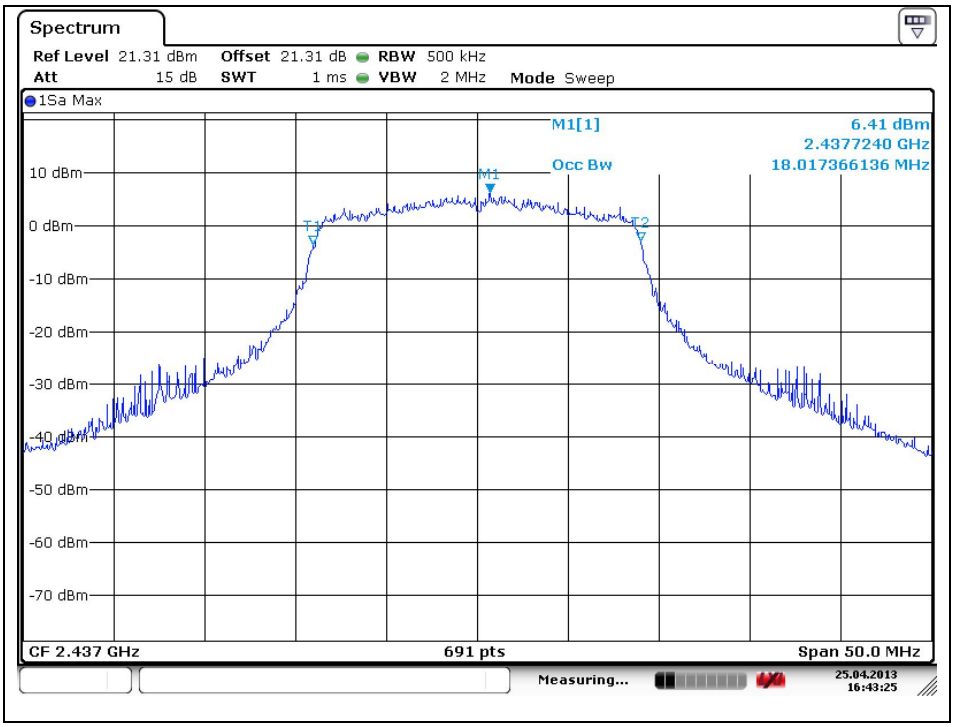


OFDM : 802.11n_HT20

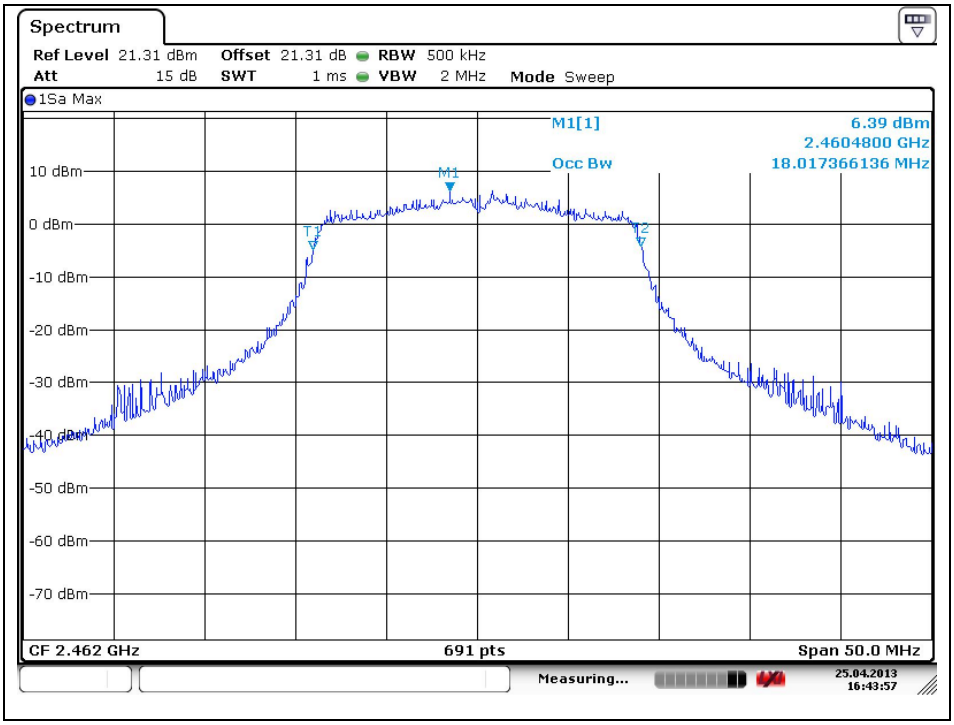
Low Channel



Middle Channel

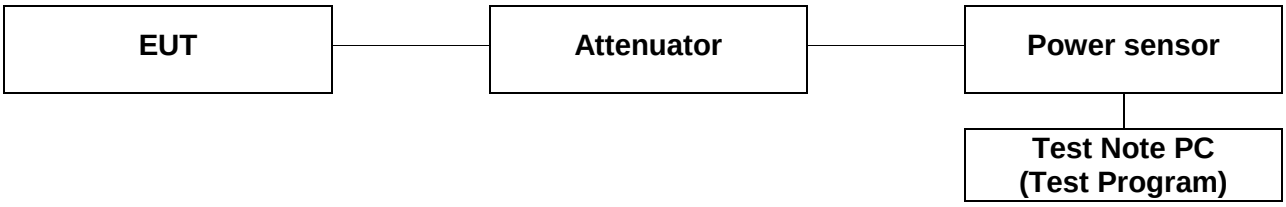


High Channel



4. Maximum Peak Output Power Measurement

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 ㎒ band: 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 antenna elements. The average must not include any 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 antenna 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

- Peak and average power meter method.

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The test follows section 9.1.3 & 9.2.2 of FCC KDB Publication 558074

-The maximum peak conducted output power can be measured using a broad band peak RF power meter. The power meter must have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast, average-responding diode type detector.

- Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

1) The EUT is configured to transmit continuously, of to transmit with a constant duty factor.
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.

If the transmitter does not transmit continuously, measure the duty cycle (x) of the transmitter output signal as described in Section 6.0 of KDB 558074.

Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

Adjust the measurement in dBm by adding 10 log(1/x), where x is the duty cycle to the measurement result.

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor. (S/W name : R&S Power Viewer, Version : 3.2.0)
3. Measure peak & average power each channel.

4.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

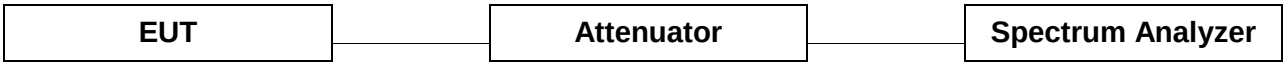
Mode	Ch.	Channel Frequency (㎒)	Data Rate (Mbps)	Attenuator + Cable offset (㏈)	Average power			Peak Power Result (㏈m)
					Reading	Duty factor	Result	
DSSS (802.11b)	Low	2 412	1	21.15	17.13	0.10	17.23	20.01
			2		16.62	0.20	16.82	19.54
			5.5		15.65	0.60	16.25	19.56
			11		15.77	0.95	16.72	19.91
	Middle	2 437	1	20.96	17.32	0.10	17.42	19.94
			2		16.94	0.20	17.14	19.75
			5.5		16.78	0.60	17.38	19.66
			11		16.14	0.95	17.09	19.81
	High	2 462	1	21.19	17.43	0.10	17.53	20.31
			2		17.02	0.20	17.22	20.29
			5.5		16.89	0.60	17.49	20.17
			11		16.31	0.95	17.26	20.15
OFDM (802.11g)	Low	2 412	6	21.15	10.88	0.61	11.49	21.62
			9		10.61	0.84	11.45	21.59
			12		10.50	1.11	11.61	20.63
			18		10.44	1.55	11.99	21.03
			24		9.89	1.97	11.86	21.00
			36		9.43	2.61	12.04	20.65
			48		9.23	3.23	12.46	20.63
			54		9.22	3.43	12.65	20.69
	Middle	2 437	6	20.96	10.74	0.61	11.35	21.41
			9		10.64	0.84	11.48	21.08
			12		10.50	1.11	11.61	20.66
			18		10.48	1.55	12.03	20.69
			24		9.91	1.97	11.88	20.74
			36		9.43	2.61	12.04	20.73
			48		9.20	3.23	12.43	20.63
			54		9.25	3.43	12.68	20.60
	High	2 462	6	21.19	10.65	0.61	11.26	20.76
			9		10.64	0.84	11.48	20.75
			12		10.56	1.11	11.67	20.73
			18		10.47	1.55	12.02	20.70
			24		9.86	1.97	11.83	20.75
			36		9.43	2.61	12.04	20.72
			48		9.20	3.23	12.43	20.75
			54		9.21	3.43	12.64	20.73

Mode	Ch.	Channel Frequency (㎒)	Data rate (Mbps)	Attenuator + Cable offset (㏈)	Average power Result (㏈ m)			Peak Power Result (㏈ m)
					Reading	Duty factor	Result	
OFDM (802.11n _HT20)	Low	2 412	MCS0	21.15	9.03	0.65	9.68	20.75
			MCS1		8.74	1.19	9.93	20.66
			MCS2		8.41	1.63	10.04	20.71
			MCS3		8.22	2.03	10.25	20.65
			MCS4		8.17	2.73	10.90	20.48
			MCS5		8.23	3.24	11.47	20.30
			MCS6		8.21	3.42	11.63	20.33
			MCS7		8.12	3.62	11.74	20.41
	Middle	2 437	MCS0	20.96	8.92	0.65	9.57	20.64
			MCS1		8.47	1.19	9.66	20.60
			MCS2		8.53	1.63	10.16	20.56
			MCS3		8.33	2.03	10.36	20.42
			MCS4		8.15	2.73	10.88	20.44
			MCS5		8.10	3.24	11.34	20.32
			MCS6		8.11	3.42	11.53	20.34
			MCS7		8.08	3.62	11.70	20.40
	High	2 462	MCS0	21.19	8.88	0.65	9.53	20.63
			MCS1		8.43	1.19	9.62	20.62
			MCS2		8.38	1.63	10.01	20.70
			MCS3		8.15	2.03	10.18	20.65
			MCS4		8.19	2.73	10.92	20.45
			MCS5		8.30	3.24	11.54	20.30
			MCS6		8.24	3.42	11.66	20.48
			MCS7		8.25	3.62	11.87	20.36

Note;
Average power result = Reading + Duty factor
Duty factor = 10log(1/x), x = duty cycle.

5. Power Spectral Density Measurement

5.1. Test Setup



5.2. Limit

§15.247(e) For digitally modulated system, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 ㏈ m in any 3 ㎑ band 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

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The measurements are recorded using the PKPSD measurement procedure in section 10.2 of KDB 558074.

1. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.

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

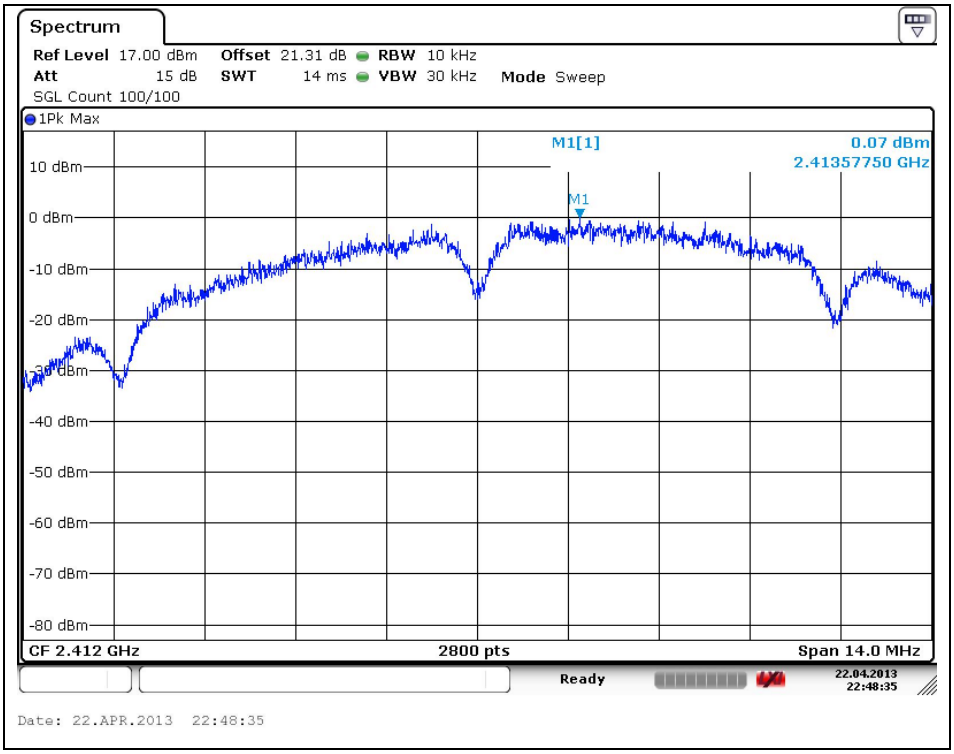
5.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

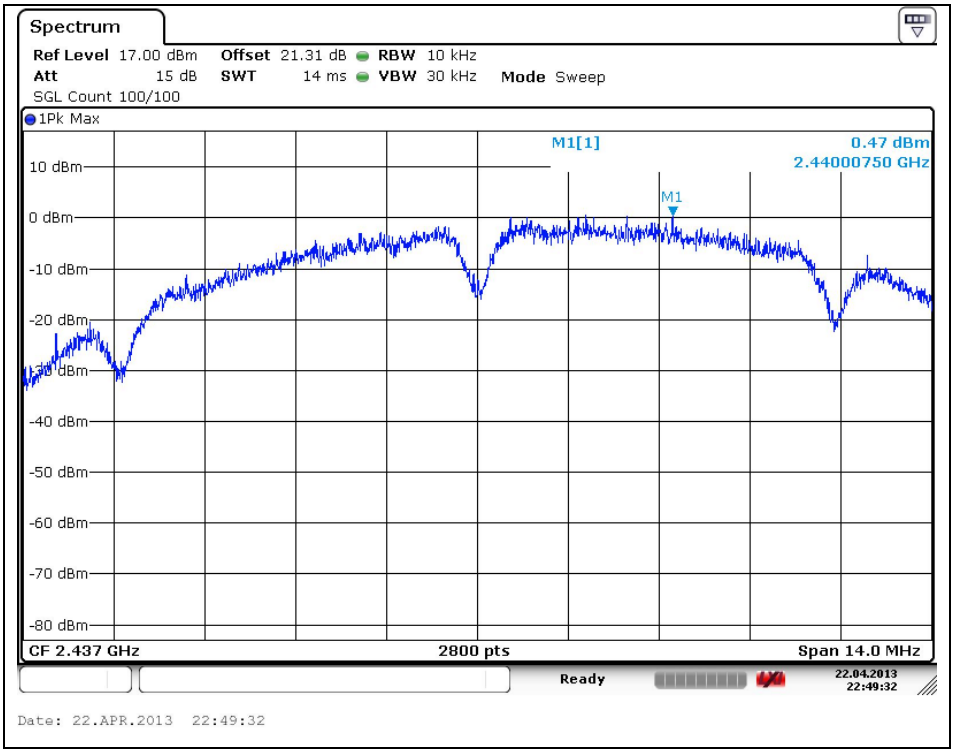
Operation Mode	Data Rate (Mbps)	Channel	Frequency	Measured PSD (dB m)	Maximum Limit (dB m)
DSSS (802.11b)	1	Low	2 412 ㎒	0.07	8
		Middle	2 437 ㎒	0.47	8
		High	2 462 ㎒	0.19	8
OFDM (802.11g)	6	Low	2 412 ㎒	-7.58	8
		Middle	2 437 ㎒	-4.89	8
		High	2 462 ㎒	-6.88	8
OFDM (802.11n_HT20)	MCS0	Low	2 412 ㎒	-11.02	8
		Middle	2 437 ㎒	-9.68	8
		High	2 462 ㎒	-9.97	8

DSSS : 802.11b

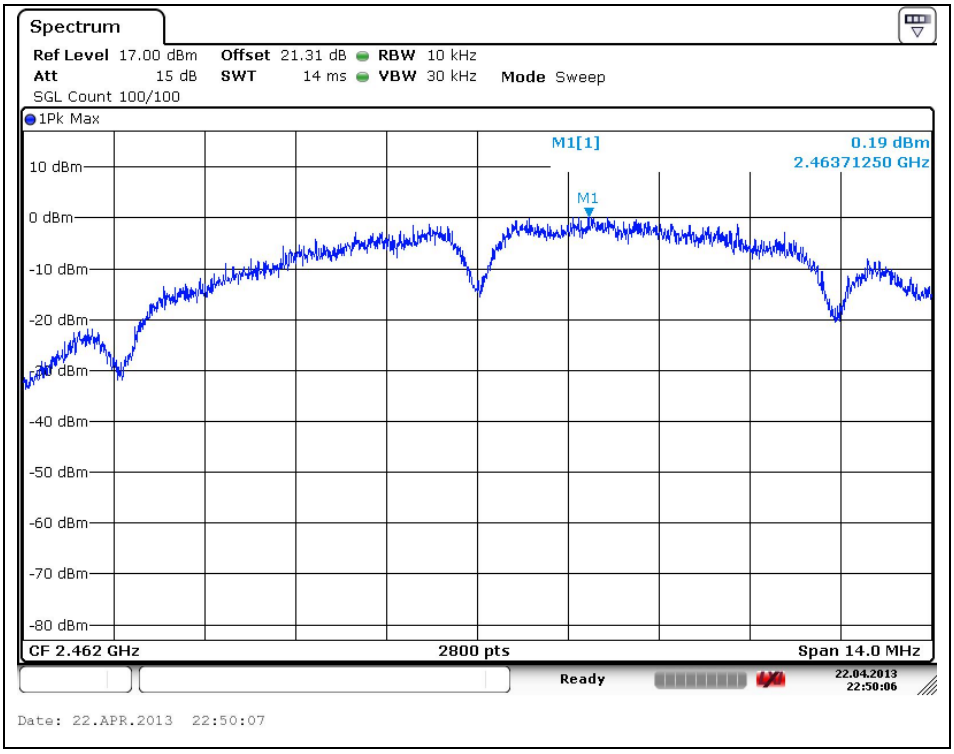
Low Channel



Middle Channel

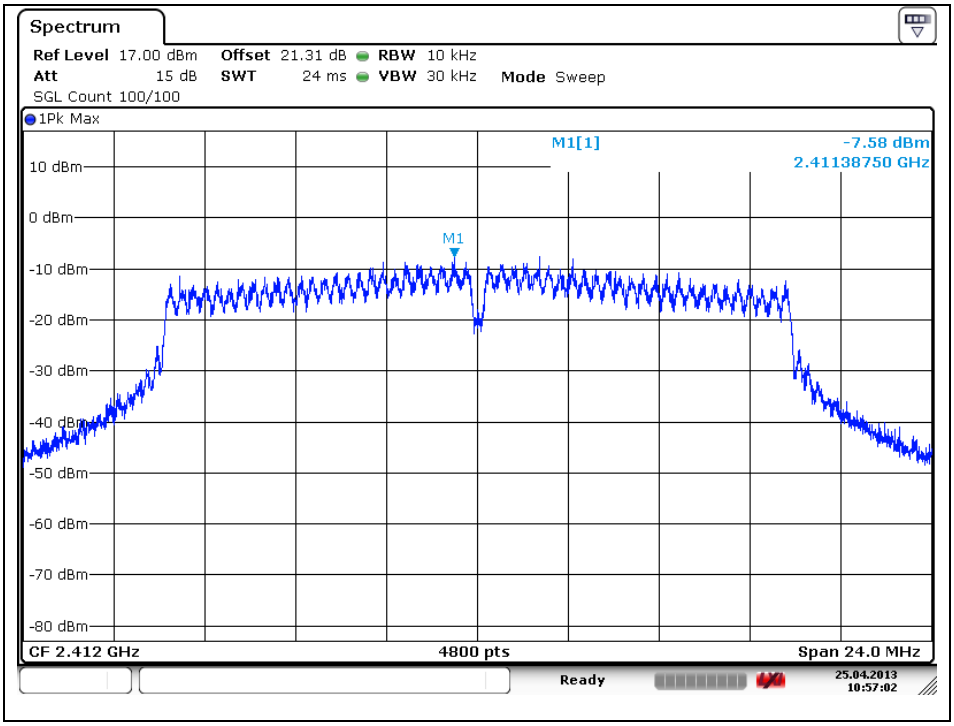


High Channel

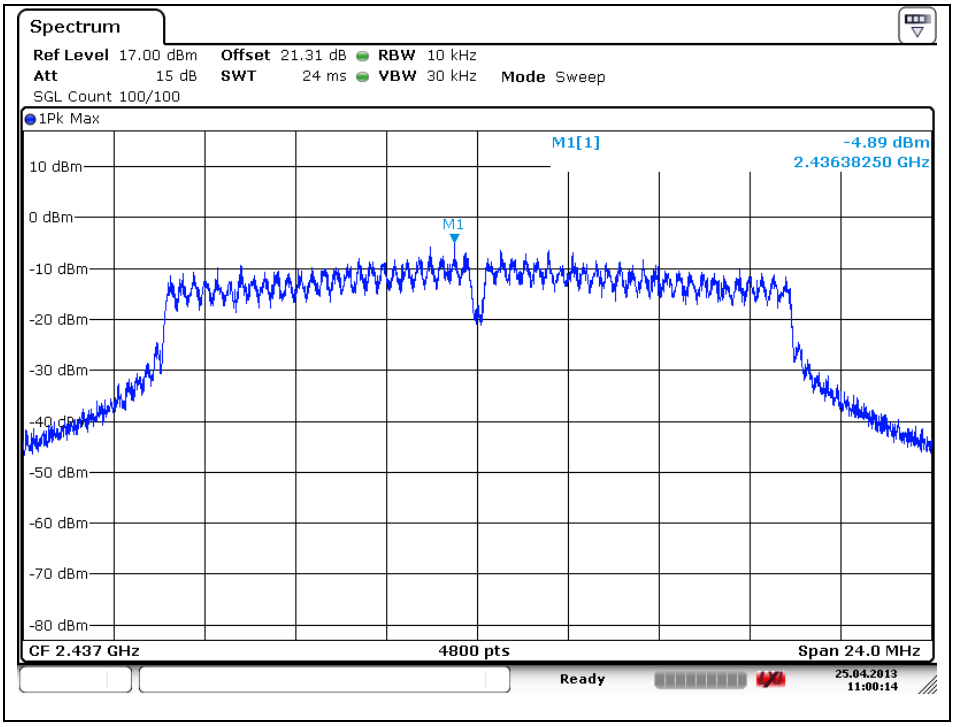


OFDM : 802.11g

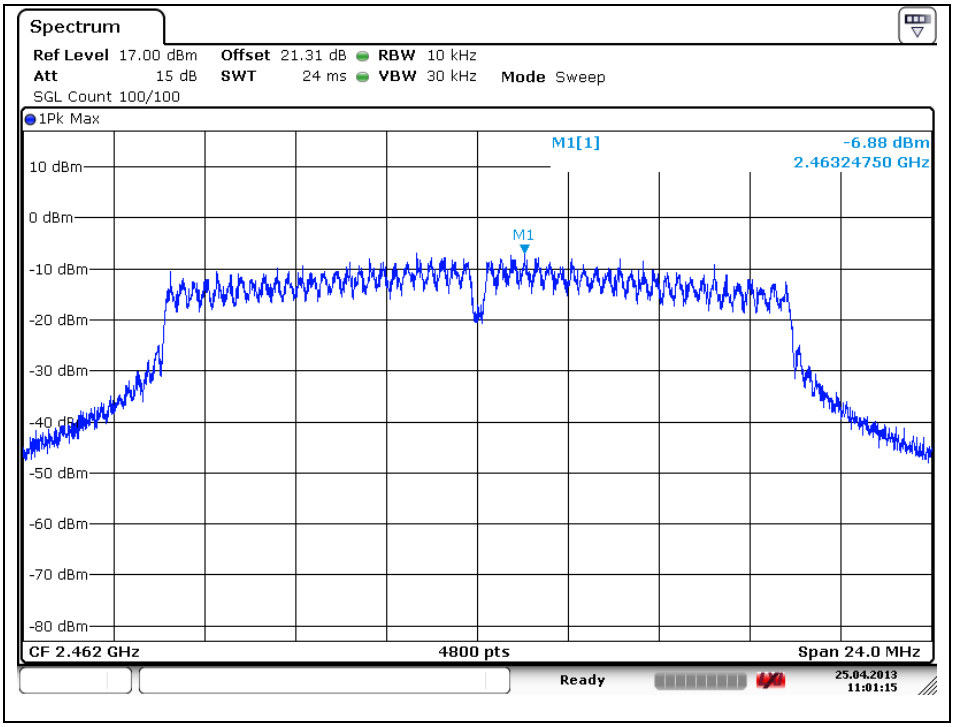
Low Channel



Middle Channel

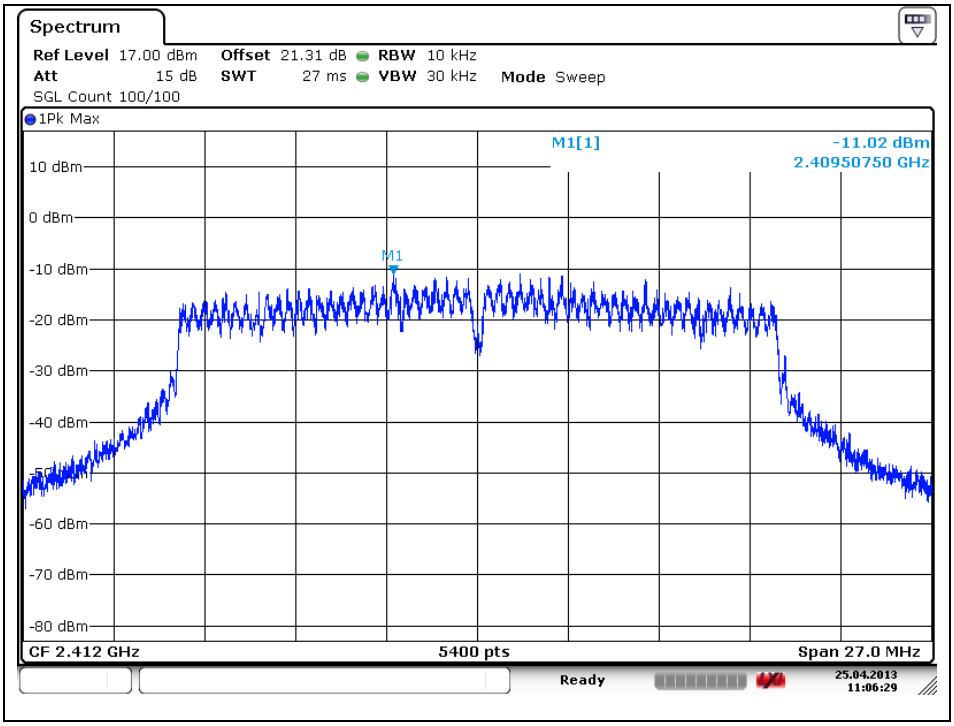


High Channel

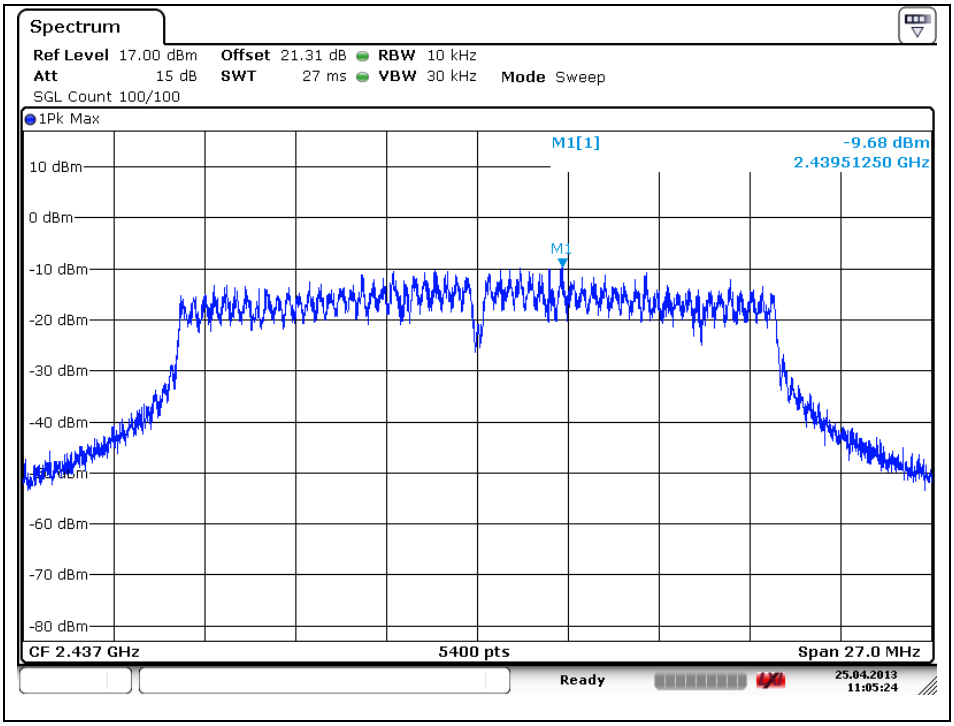


OFDM : 802.11n_HT20

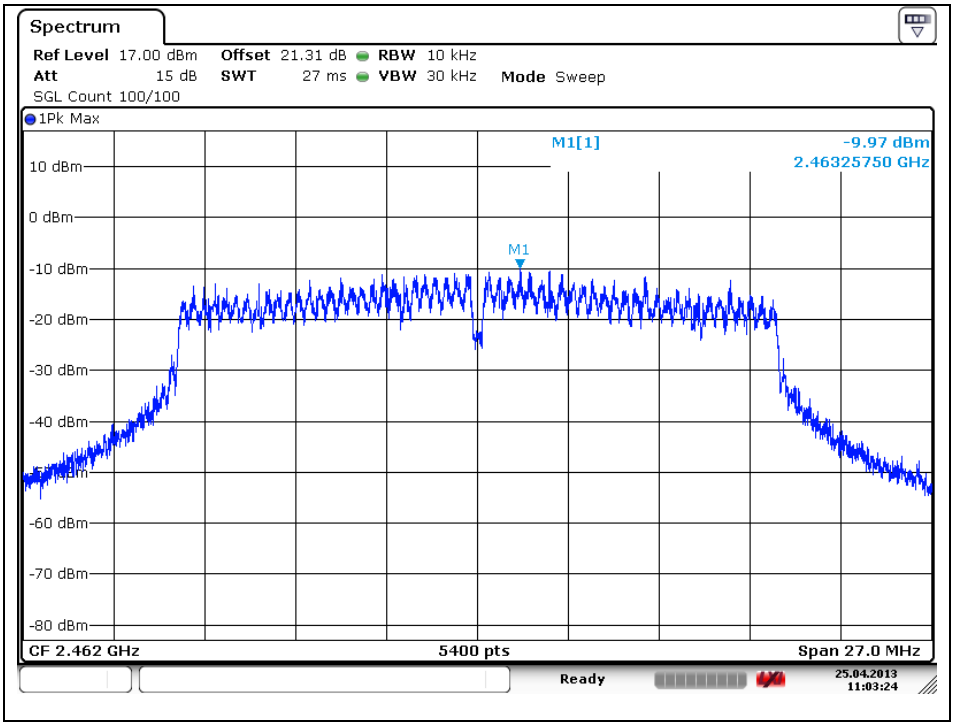
Low Channel



Middle Channel

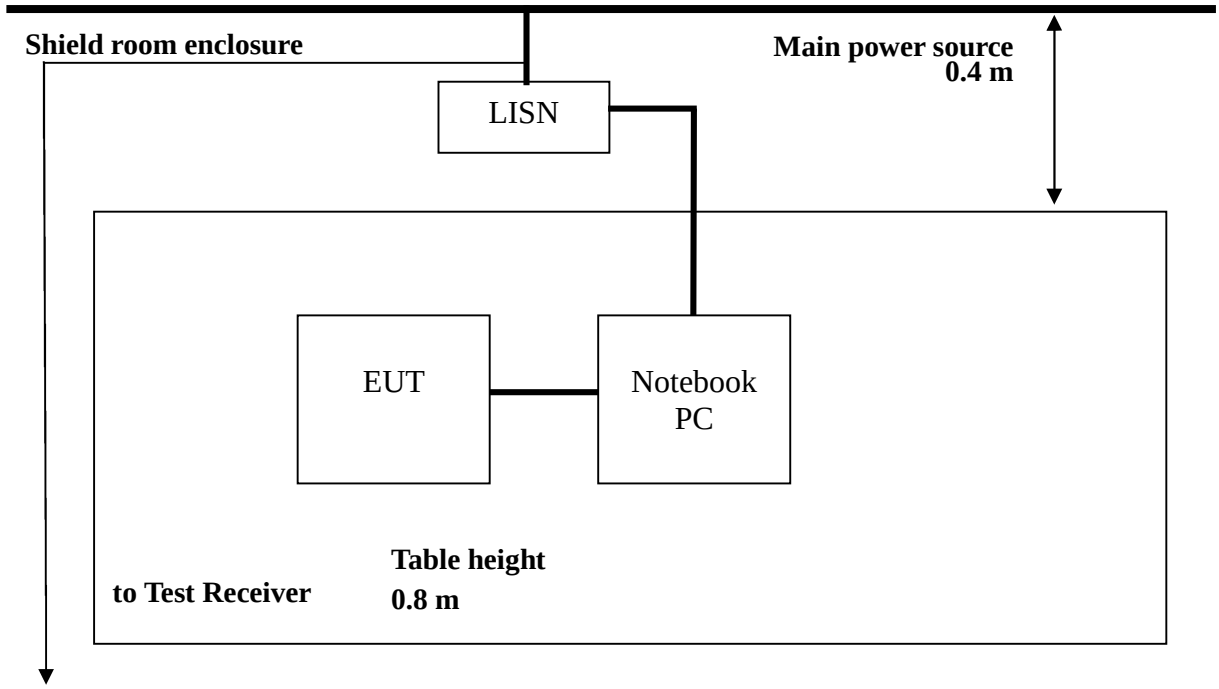


High Channel



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 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (㎒)	Conducted limit (㏈ μV)	
	Quasi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

6.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The test procedure is performed in a 6.5 m × 3.6 m× 3.6 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

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

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

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

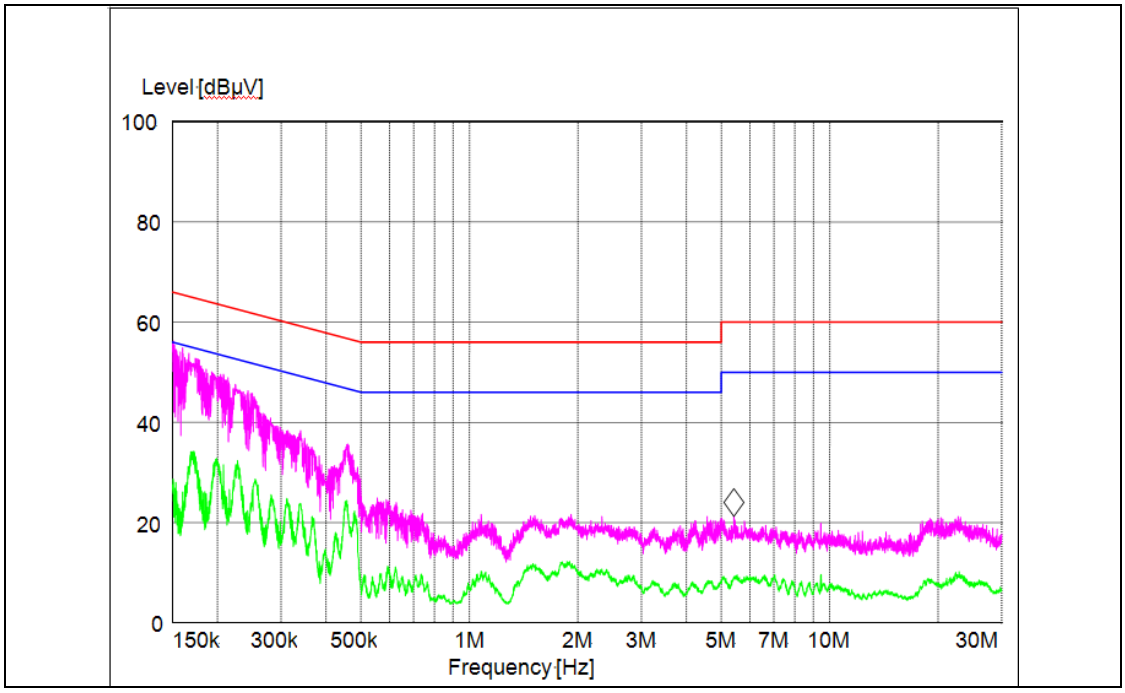
FREQ.	LEVEL(dBμV)		LINE	LIMIT(dBμV)		MARGIN(dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	58.68	39.68	H	66.00	56.00	7.32	16.32
0.16	53.68	35.78	H	65.52	55.52	11.84	19.74
0.20	52.88	40.48	H	63.49	53.49	10.61	13.01
0.46	39.30	32.30	H	56.71	46.71	17.41	14.41
1.08	24.12	19.92	H	56.00	46.00	31.88	26.08
5.41	23.76	18.86	H	60.00	50.00	36.24	31.14
0.15	60.66	47.46	N	66.00	56.00	5.34	8.54
0.24	48.06	37.96	N	62.27	52.27	14.21	14.31
0.31	40.97	30.37	N	60.11	50.11	19.14	19.74
0.46	38.88	34.98	N	56.77	46.77	17.89	11.79
1.63	28.91	25.01	N	56.00	46.00	27.09	20.99
4.25	25.53	19.53	N	56.00	46.00	30.47	26.47

Note ;

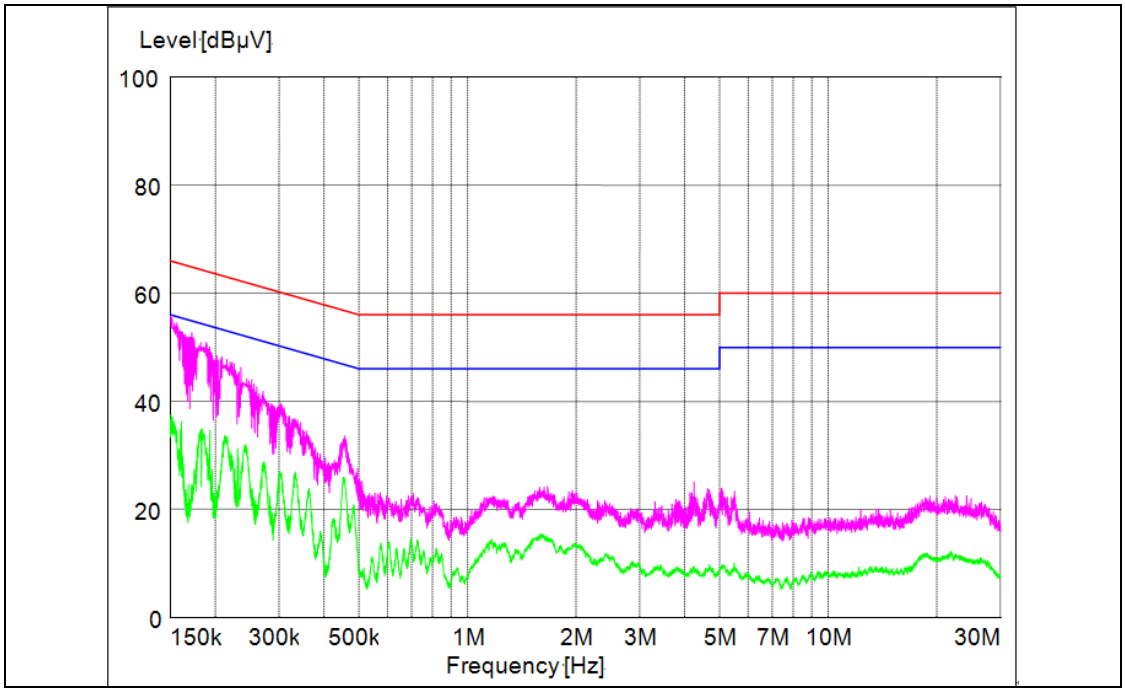
1. Line (H): Hot, Line (N): Neutral
2. All modes of operation were investigated and the worst-case emissions are reported using 11b_1Mbps
3. The limit for Class B device(s) from 150 ㎑ to 30 ㎒ are specified in Section of the Title 47 CFR.
4. Traces shown in plot using a peak detector and average detector
5. Deviations to the Specifications: None.

Plot of Conducted Power line

Test mode : (Hot)



Test mode : (Neutral)



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 FPCB type with gain of 2.48 dBi.