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TEST REPORT

KCTL Inc.
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

KCTL

1. Client

- Name : Vieworks Co., Ltd.
- Address : (Gwanyang-dong) 41-3, Burim-ro 170beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 431-060 Republic of Korea
- Date of Receipt : 2017-01-17

2. Use of Report : -

3. Name of Product and Model : 802.11ac Dual Band Module / WLE900VX 7AA000S-VW

4. Manufacturer and Country of Origin : Compex (Suzhou) Co. Ltd / China

5. FCC ID : PFRWLE900VXVW

6. IC : 11233A-WLE900VXVW

7. Date of Test : 2017-03-20 to 2017-04-20

8. Test Standards : FCC Part 15 Subpart C, 15.247
RSS-247 Issue 1 May 2015
RSS-GEN Issue 4 November 2014

9. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Taeyoung Kim (Signature)	Technical Manager Name : Bongok Ko (Signature)

2017-07-18

KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2017-06-20	Originally issued	-
2017-07-11	Revised all not ok comment	Several page
2017-07-18	Added antenna connector specification and test jig note	7, 11

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[Contents]

1. Client information 4
2. Laboratory information 5
3. Description of E.U.T. 6
3.1 Basic description 6
3.2 General description 6
3.3 Test frequency 8
3.4 Test Voltage 8
4. Summary of test results 9
4.1 Standards & results 9
4.2 Uncertainty 9
5. Test results 10
5.1 Antenna Requirement 10
5.2 Maximum Peak Output Power 12
5.3 Peak Power Spectral Density 56
5.4 6 dB Bandwidth(DTS Channel Bandwidth) 94
5.5 Spurious Emission, Band Edge, and Restricted bands 147
5.6 Conducted Emission 225
6. Test equipment used for test 227

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1. Client information

Applicant:	Vieworks Co., Ltd.
Address:	(Gwanyang-dong) 41-3, Burim-ro 170beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 431-060 Republic of Korea
Telephone number:	82-70-4496-1859
Facsimile number:	82-31-386-8631
Contact person:	Jordin Kim / trubloomer@vieworks.com

Manufacturer:	Compex (Suzhou) Co. Ltd
Address:	12 ChuangTou Industrial Square Lou Feng North, Suzhou Industrial Park Suzhou, P.R. China 215122

KCTL

2. Laboratory information

Address

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea

Telephone Number: 82 31 285 0894

Facsimile Number: 82 505 299 8311

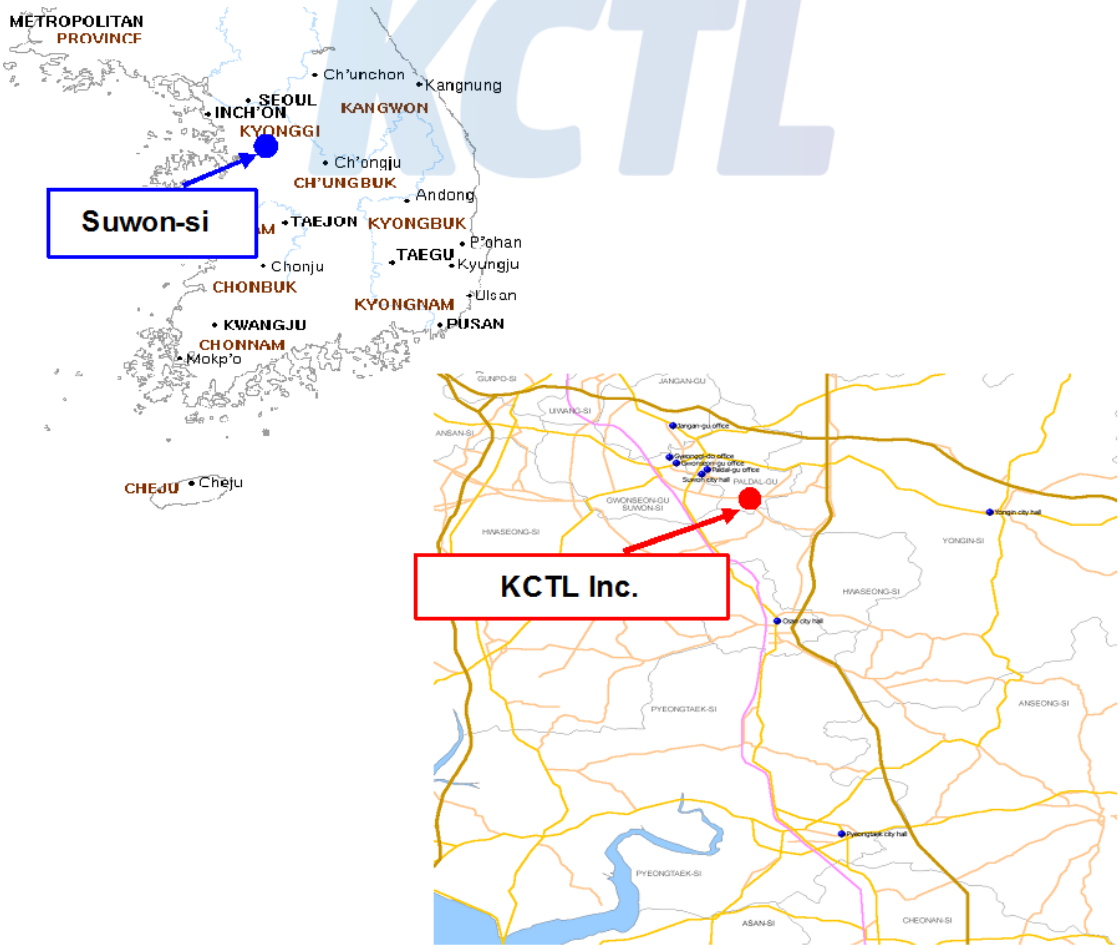
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

VCCI Registration No. : R-3327, G-198, C-3706, T-1849

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant	Vieworks Co., Ltd.
Address of Applicant	(Gwanyang-dong) 41-3, Burim-ro 170beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 431-060 Republic of Korea
Manufacturer	Compex (Suzhou) Co. Ltd
Address of Manufacturer	12 ChuangTou Industrial Square Lou Feng North, Suzhou Industrial Park Suzhou, P.R. China 215122
Type of equipment	802.11ac Dual Band Module
Basic Model	WLE900VX 7AA000S-VW
Serial number	N/A

3.2 General description

Frequency Range	2 412 ㎒ ~ 2 462 ㎒ (802.11b/g/n_HT20) 2 422 ㎒ ~ 2 452 ㎒ (802.11n_HT40) 5 180 ㎒ ~ 5 240 ㎒ (802.11a/n_HT20/ac_VHT20) 5 190 ㎒ ~ 5 230 ㎒ (802.11n_HT40/ac_VHT40) 5 210 ㎒ (802.11ac_VHT80) 5 745 ㎒ ~ 5 825 ㎒ (802.11a/n_HT20/ac_VHT20) 5 755 ㎒ ~ 5 795 ㎒ (802.11n_HT40/ac_VHT40) 5 775 ㎒ (802.11ac_VHT80)
Type of Modulation	802.11b : DSSS, 802.11a/g/n/ac : OFDM
The number of channels	2.4 ㎓: 11 ch (802.11b/g/n_HT20), 7 ch (802.11n_HT40) 5 ㎓: 5 150 ㎒ Band: 4 (802.11a/n_HT20/ac_VHT20) 5 150 ㎒ Band: 2 (802.11n_HT40/ac_VHT40) 5 150 ㎒ Band: 1 (802.11ac_VHT80) 5 725 ㎒ Band: 4 (802.11a/n_HT20/ac_VHT20) 5 725 ㎒ Band: 2 (802.11n_HT40/ac_VHT40) 5 725 ㎒ Band: 1 (802.11ac_VHT40)

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Type of Antenna	Connected PCB Antenna (3 x U.FL)
Antenna Gain	2.4 ㎓: 2.83 ㏈i (2 400 ㎒ ~ 2 483.5 ㎒)_ANT 0 2.38 ㏈i (2 400 ㎒ ~ 2 483.5 ㎒)_ANT 1 2.19 ㏈i (2 400 ㎒ ~ 2 483.5 ㎒)_ANT 2 5 ㎓: 1.99 ㏈i (5 150 ㎒ ~ 5 250 ㎒)_ANT 0 1.40 ㏈i (5 150 ㎒ ~ 5 250 ㎒)_ANT 1 1.89 ㏈i (5 150 ㎒ ~ 5 250 ㎒)_ANT 2 3.89 ㏈i (5 725 ㎒ ~ 5 850 ㎒)_ANT 0 2.59 ㏈i (5 725 ㎒ ~ 5 850 ㎒)_ANT 1 2.80 ㏈i (5 725 ㎒ ~ 5 850 ㎒)_ANT 2
Transmit Power	19.55 ㏈m
Power supply	DC 5.00 V
Product SW/HW version	V1.0.0.6TS / D04
Radio SW/HW version	V1.01 / V1.01
Test SW Version	CTS2 v1043
RF power setting in TEST SW	- ANT 0 802.11b: 19 (Low) / 19 (Mid) / 19 (High) 802.11g/n HT20 : 15.5 (Low) / 19 (Mid) / 15.5 (High) 802.11n HT40 : 13.5 (Low) / 16.5 (Mid) / 13.5 (High) - ANT 1 802.11n HT20 : 13.5 (Low) / 16.5 (Mid) / 13.5 (High) 802.11n HT40 : 11 (Low) / 13.5 (Mid) / 11 (High) - ANT 2 802.11n HT20 : 11.5 (Low) / 14.5 (Mid) / 11.5 (High) 802.11n HT40 : 9.5 (Low) / 11.5 (Mid) / 9.5 (High)

Note1) : The above EUT information was declared by the manufacturer.
Note2) : This EUT is a board other than a module because it is tested by attaching a module to the test jig.

3.3 Test frequency

	802.11n HT20	802.11n HT40
Lowest frequency	2 412 ㎒	2 422 ㎒
Middle frequency	2 437 ㎒	2 437 ㎒
Highest frequency	2 462 ㎒	2 452 ㎒

3.4 Test Voltage

Mode	Voltage
Nominal Voltage	DC 5.00 V

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4. Summary of test results

4.1 Standards & results

FCC Rule Reference	IC Rule Reference	Parameter	Report Section	Test Result
15.203, 15.247(b)(4)	-	Antenna Requirement	5.1	C
15.247(b)(3)	RSS-247, 5.4(4)	Maximum Peak Output Power	5.2	C
15.247(e)	RSS-247, 5.2	Peak Power Spectral Density	5.3	C
15.247(a)(2)	RSS-247, 5.2	6 ㏈ Channel Bandwidth	5.4	C
-	RSS-247, 5.2	Occupied Bandwidth	5.4	C
15.247(d), 15.205(a), 15.209(a)	RSS-247, 5.5 RSS-GEN, 8.9,10	Spurious Emission, Band Edge and Restricted bands	5.5	C
15.207(a)	RSS-GEN, 8.8	Conducted Emissions	5.6	C
Note: C = complies, NC = Not complies, NT = Not tested, NA = Not Applicable				

- The general test methods used to test this device is ANSI C63.10:2013

4.2 Uncertainty

Measurement Item	Expanded Uncertainty U = *k*Uc (*k* = 2)	
Conducted RF power	1.44 ㏈	
Conducted Spurious Emissions	1.52 ㏈	
Radiated Spurious Emissions	30 ㎒ ~ 300 ㎒:	+4.94 ㏈, -5.06 ㏈
		+4.93 ㏈, -5.05 ㏈
	300 ㎒ ~ 1 000 ㎒:	+4.97 ㏈, -5.08 ㏈
		+4.84 ㏈, -4.96 ㏈
	1 ㎓ ~ 25 ㎓:	+6.03 ㏈, -6.05 ㏈
Conducted Emissions	9 ㎑ ~ 150 ㎑:	3.75 ㏈
	150 ㎑ ~ 30 ㎒:	3.36 ㏈

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And 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 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.2 Result

-Complied

The transmitter has Connected PCB Antenna (3 x U.FL) antenna(external antenna).
The total directional peak gain of the antenna not exceeds 6.0 dBi

	ANT 0	ANT 1	ANT 2
ANT Gain	2.83 dBi	2.38 dBi	2.19 dBi

According to KDB 662911 D01 Multiple Transmitter Output v02r01
- Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

In case of 2 Tx MIMO

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

Total gain = 5.84 dBi (individual gain(2.83 dBi) + Array gain(3.01 dBi))

For power measurements on IEEE 802.11 devices

Array Gain = 0 dB (i.e., no array gain) for N_{ANT} ≤ 4;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with N_{ANT} ≥ 5.

Total gain = 2.83 dBi (individual gain(2.83 dBi) + Array gain(0 dBi))

For power measurements on all other devices:

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

In case of 3 Tx MIMO

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

Total gain = 7.60 dBi (individual gain(2.83 dBi) + Array gain(4.77 dBi))

For power measurements on IEEE 802.11 devices

Array Gain = 0 dB (i.e., no array gain) for N_{ANT} ≤ 4;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};

Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less, for 20-MHz channel widths with N_{ANT} ≥ 5.

Total gain = 2.83 dBi (individual gain(2.83 dBi) + Array gain(0 dBi))

For power measurements on all other devices:

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

5.2 Maximum Peak Output Power

5.2.1 Regulation

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 paragraphs (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.

5.2.2 Measurement Procedure

These test measurement settings are specified in section 9.0 of 558074 D01 DTS Meas Guidance.

5.2.2.1 Maximum conducted (average) output power

5.2.2.1.1 General

§15.247 permits the maximum conducted (average) output power to be measured as an alternative to the maximum peak conducted output power for demonstrating compliance to the limit. When this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth (see ANSI C63.10 for measurement guidance).
When using a spectrum analyzer or EMI receiver to perform these measurements, it shall be capable of utilizing a number of measurement points in each sweep that is greater than or equal to twice the span/RBW to set a bin-to-bin spacing of ≤ RBW/2 so that narrowband signals are not lost between frequency bins

If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level. The intent is to test at 100 % duty cycle; however a small reduction in duty cycle (to no lower than 98 %) is permitted, if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.
If continuous transmission (or at least 98 % duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level, with the transmit duration as long as possible, and the duty cycle as high as possible during which sweep triggering/signal gating techniques may be used to perform the measurement over the transmission duration.

5.2.2.1.2 Measurement using a spectrum analyzer (SA)

5.2.2.1.2.1 Method AVGSA-1 (trace averaging with the EUT transmitting at full power throughout each sweep)

a) Set span to at least 1.5 times the OBW.
b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
c) Set VBW ≥ 3 x RBW.
d) Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
e) Sweep time = auto.
f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
g) If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.
h) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

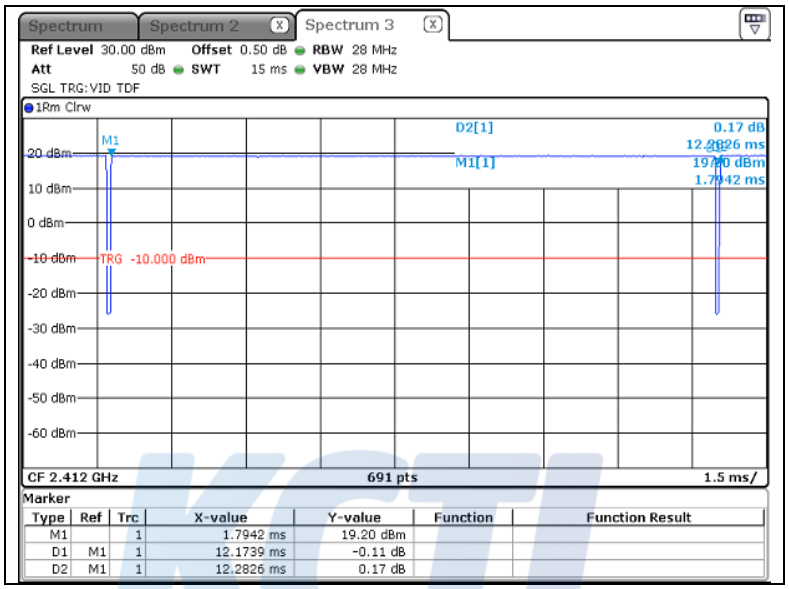
5.2.2.1.2.2 Method AVGSA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction)

a)Measure the duty cycle, x, of the transmitter output signal as described in 6.0.
b) Set span to at least 1.5 times the OBW.
c) Set RBW = 1-5% of the OBW, not to exceed 1 ㎒.
d) Set VBW ≥ 3 x RBW.
e) Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
f) Sweep time = auto.
g) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
h) Do not use sweep triggering. Allow the sweep to “free run”.
i) Trace average at least 100 traces in power averaging (i.e., RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the on and off periods of the transmitter.
j) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
k) Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log (1/0.25) = 6 ㏈ if the duty cycle is 25 %.

- Duty Cycle Correction Factor

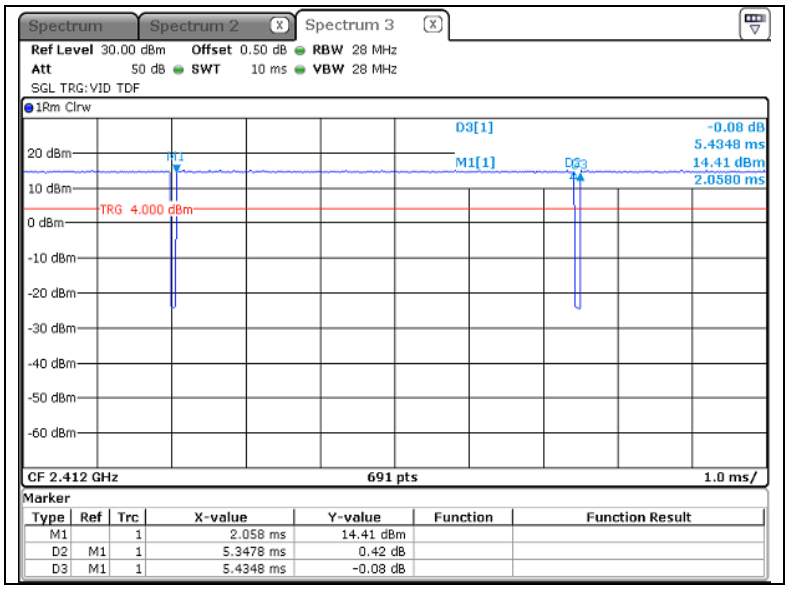
- ANT 0, 1, 2

- 802.11b



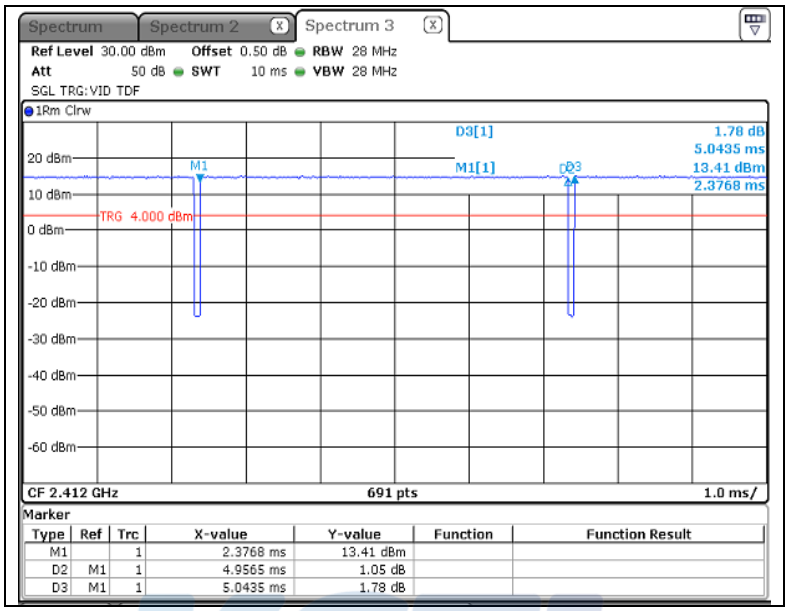
Note1) : period : 12.28 ms, On time : 12.17 ms
Note2) : DCCF = 10 log(1 / x) = 10 log(12.28 / 12.17) = 0.04, x = 0.99
Note3) : 802.11b is a continuous transmission (duty cycle >=98 %)"

- 802.11g



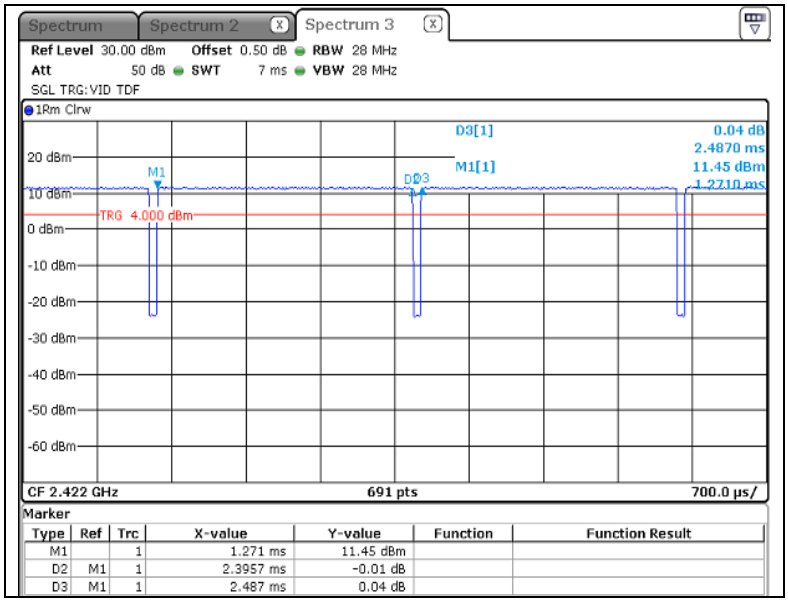
Note1) : period : 5.43 ms, On time : 5.35 ms
Note2) : DCCF = 10 log(1 / x) = 10 log(5.43 / 5.35) = 0.07, x = 0.98
Note3) : 802.11g is a continuous transmission (duty cycle >=98 %)"

- 802.11n HT20



Note1) : period : 5.04 ms, On time : 4.96 ms
Note2) : DCCF = 10 log(1 / x) = 10 log(5.04 / 4.96) = 0.08, x = 0.98
Note3) : 802.11n HT20 is a continuous transmission (duty cycle >=98 %)"

- 802.11n HT40

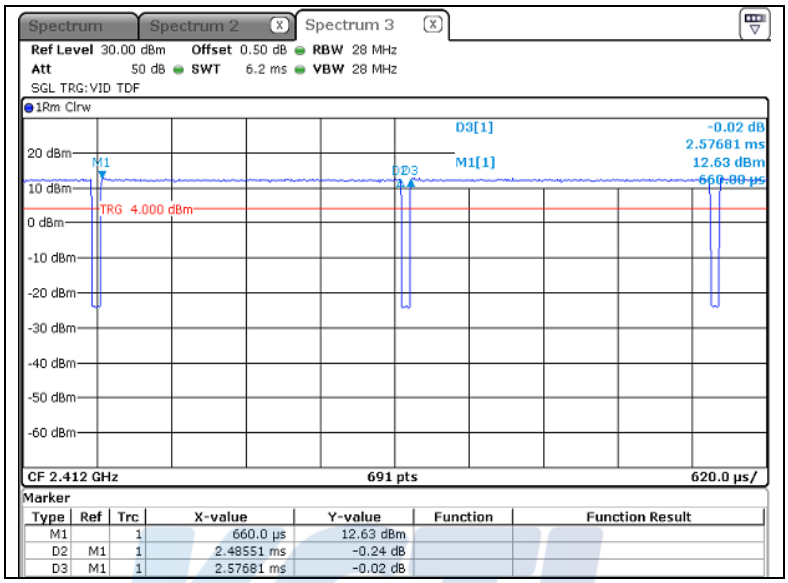


Note1) : period : 2.49 ms, On time : 2.40 ms
Note2) : DCCF = 10 log(1 / x) = 10 log(2.49 / 2.40) = 0.16, x = 0.96

-

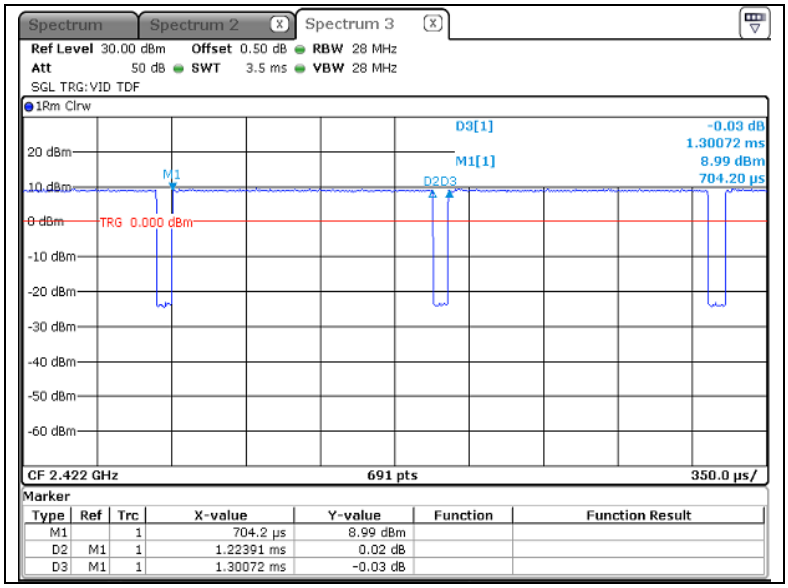
- MIMO (ANT 0+1)

- 802.11n HT20



- Note1) : period : 2.58 ms, On time : 2.49 ms
- Note2) : DCCF = 10 log(1 / x) = 10 log(2.49 / 2.58) = 0.16, x = 0.97

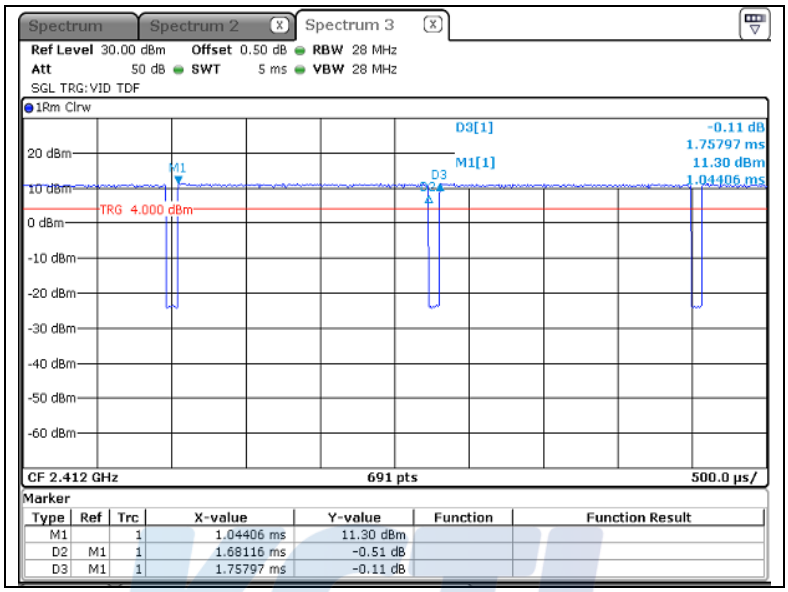
- 802.11n HT40



- Note1) : period : 1.30 ms, On time : 1.22 ms
- Note2) : DCCF = 10 log(1 / x) = 10 log(1.30 / 1.22) = 0.26, x = 0.94

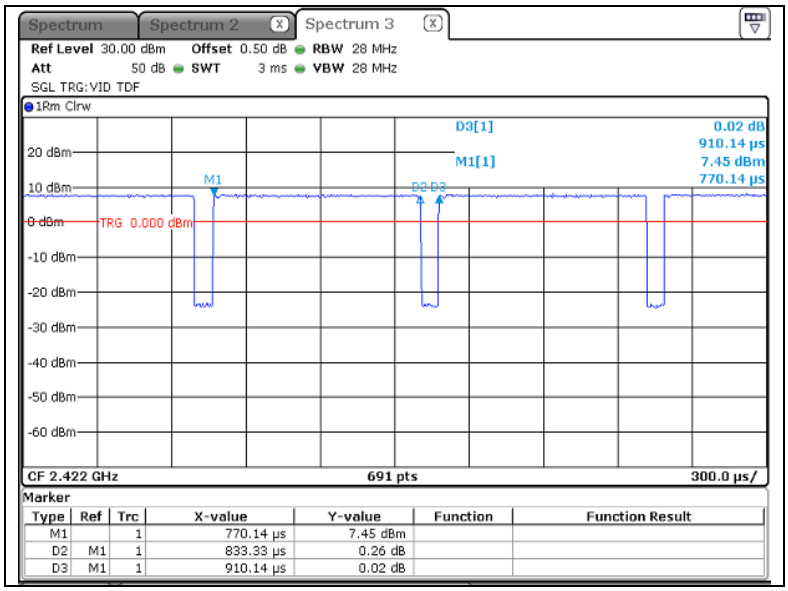
- MIMO (ANT 0+1+2)

- 802.11n HT20



Note1) : period : 1.76 ms, On time : 1.68 ms
Note2) : DCCF = 10 log(1 / x) = 10 log(1.68 / 1.76) = 0.19, x = 0.96

- 802.11n HT40



Note1) : period : 0.91 ms, On time : 0.83 ms
Note2) : DCCF = 10 log(1 / x) = 10 log(0.91 / 0.83) = 0.38, x = 0.92

5.2.3 Test Result

- Complied

- ANT 0

- 802.11b

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	19.18	0.04	19.22	30.00	10.78
Middle	2 437	19.39	0.04	19.43	30.00	10.57
Highest	2 462	19.24	0.04	19.28	30.00	10.72

- 802.11g

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	14.69	0.07	14.76	30.00	15.24
Middle	2 437	18.55	0.07	18.62	30.00	11.38
Highest	2 462	14.73	0.07	14.80	30.00	15.20

- 802.11n HT20

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	14.56	0.08	14.64	30.00	15.36
Middle	2 437	18.47	0.08	18.55	30.00	11.45
Highest	2 462	14.55	0.08	14.63	30.00	15.37

- 802.11n HT40

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 422	12.74	0.16	12.90	30.00	17.10
Middle	2 437	15.98	0.16	16.14	30.00	13.86
Highest	2 452	12.86	0.16	13.02	30.00	16.98

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- ANT 1

- 802.11b

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	19.13	0.04	19.17	30.00	10.83
Middle	2 437	19.42	0.04	19.46	30.00	10.54
Highest	2 462	19.29	0.04	19.33	30.00	10.67

- 802.11g

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	15.01	0.07	15.08	30.00	14.92
Middle	2 437	18.65	0.07	18.72	30.00	11.28
Highest	2 462	15.21	0.07	15.28	30.00	14.72

- 802.11n HT20

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	14.81	0.08	14.89	30.00	15.11
Middle	2 437	18.47	0.08	18.55	30.00	11.45
Highest	2 462	15.23	0.08	15.31	30.00	14.69

- 802.11n HT40

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 422	12.52	0.16	12.68	30.00	17.32
Middle	2 437	16.05	0.16	16.21	30.00	13.79
Highest	2 452	12.56	0.16	12.72	30.00	17.28

- ANT 2

- 802.11b

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	19.17	0.04	19.21	30.00	10.79
Middle	2 437	19.51	0.04	19.55	30.00	10.45
Highest	2 462	19.08	0.04	19.12	30.00	10.88

- 802.11g

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	15.08	0.07	15.15	30.00	14.85
Middle	2 437	18.65	0.07	18.72	30.00	11.28
Highest	2 462	14.57	0.07	14.64	30.00	15.36

- 802.11n HT20

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	15.02	0.08	15.10	30.00	14.90
Middle	2 437	18.64	0.08	18.72	30.00	11.28
Highest	2 462	14.53	0.08	14.61	30.00	15.39

- 802.11n HT40

Channel	Frequency [㎒]	Average power [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 422	12.85	0.16	13.01	30.00	16.99
Middle	2 437	15.74	0.16	15.90	30.00	14.10
Highest	2 452	12.83	0.16	12.99	30.00	17.01

- MIMO (ANT 0+1)

- 802.11n HT20

Channel	Frequency [㎒]	Average power _ANT 0 [dBm]	Average power _ANT 1 [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	12.00	12.63	0.16	15.49	30.00	14.51
Middle	2 437	14.86	15.70	0.16	18.47	30.00	11.53
Highest	2 462	11.85	12.61	0.16	15.41	30.00	14.59

- 802.11n HT40

Channel	Frequency [㎒]	Average power _ANT 0 [dBm]	Average power _ANT 1 [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 422	9.77	10.36	0.26	13.35	30.00	16.65
Middle	2 437	12.31	12.96	0.26	15.92	30.00	14.08
Highest	2 452	9.90	10.45	0.26	13.46	30.00	16.54

- MIMO (ANT 0+1+2)

- 802.11n HT20

Channel	Frequency [㎒]	Average power _ANT 0 [dBm]	Average power _ANT 1 [dBm]	Average power _ANT 2 [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 412	11.03	11.67	11.39	0.19	16.34	30.00	13.66
Middle	2 437	13.84	14.21	13.56	0.19	18.84	30.00	11.16
Highest	2 462	11.13	11.58	11.05	0.19	16.22	30.00	13.78

- 802.11n HT40

Channel	Frequency [㎒]	Average power _ANT 0 [dBm]	Average power _ANT 1 [dBm]	Average power _ANT 2 [dBm]	D.C.C.F [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Lowest	2 422	8.45	9.44	8.93	0.38	14.11	30.00	15.89
Middle	2 437	10.82	11.40	10.98	0.38	16.23	30.00	13.77
Highest	2 452	8.82	9.32	8.90	0.38	14.17	30.00	15.83

NOTE:
1. Since the directional gain of Internal Antenna declared by the manufacturer (GANT =Ant 0: 2.83 dBi, Ant 1: 2.38 dBi, Ant 2: 2.19 dBi), does not exceed 6.0 dBi , there was no need to reduce the output power.
2. We took the insertion loss of the cable loss into consideration within the measuring instrument.

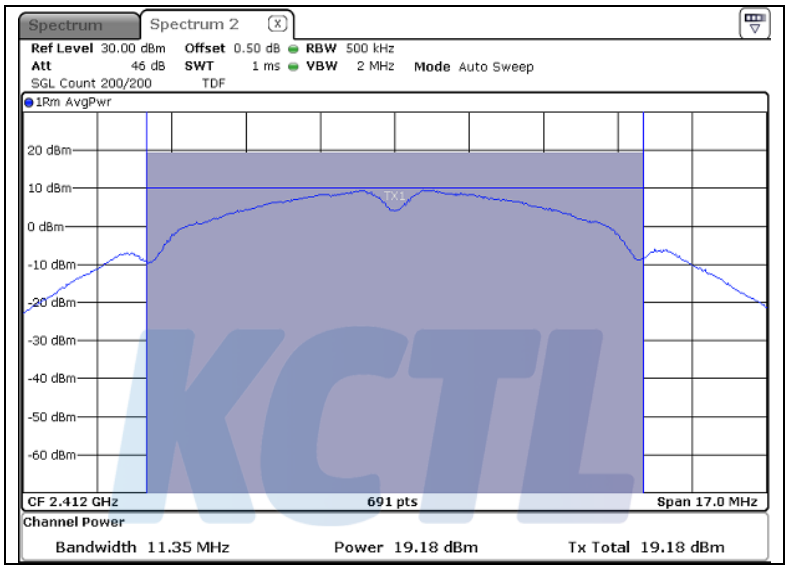
5.2.4 Test Plot

Figure 1. Plot of Maximum Peak Output Power

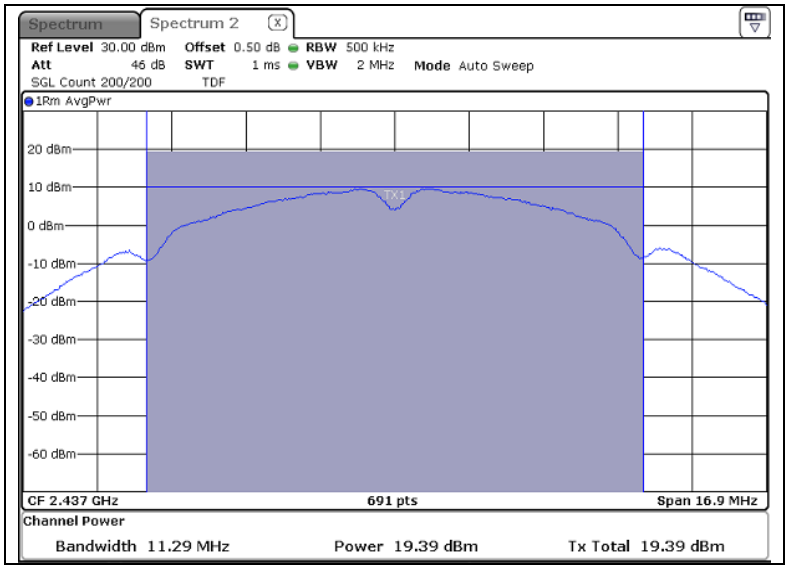
- ANT 0

- 802.11b

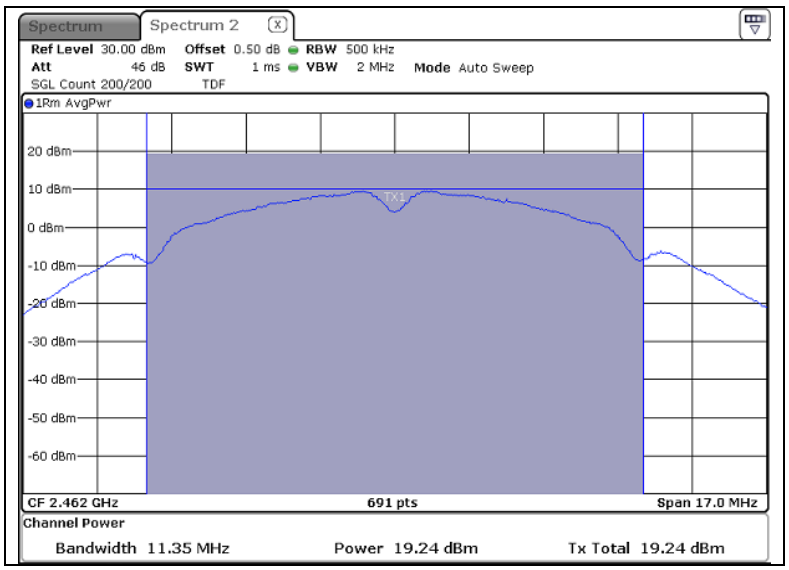
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

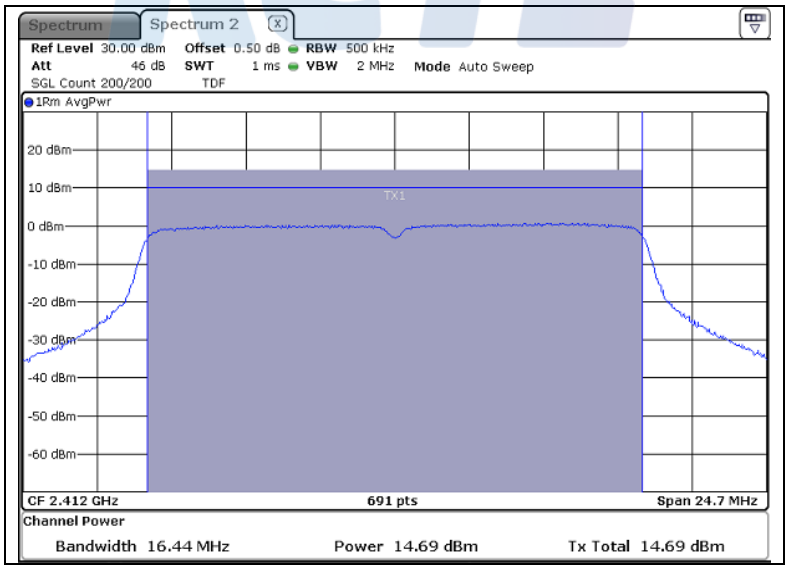


Highest Channel (2 462 ㎒)

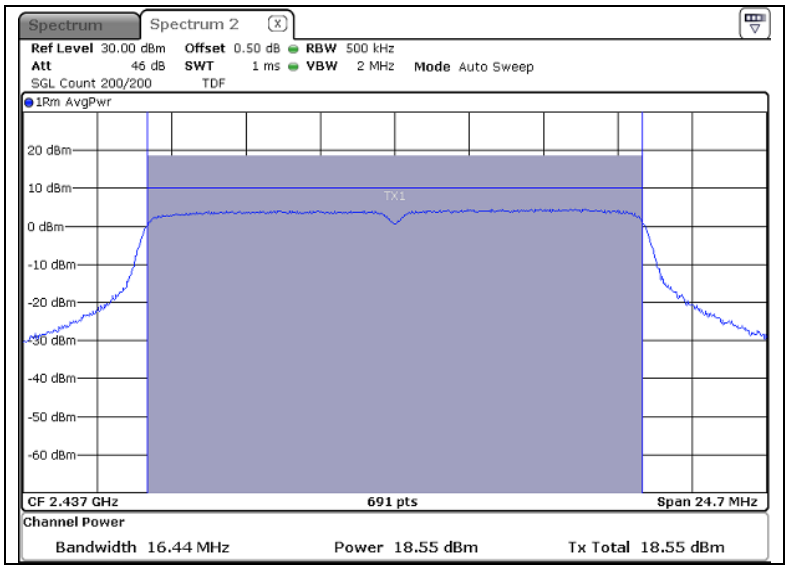


- 802.11g

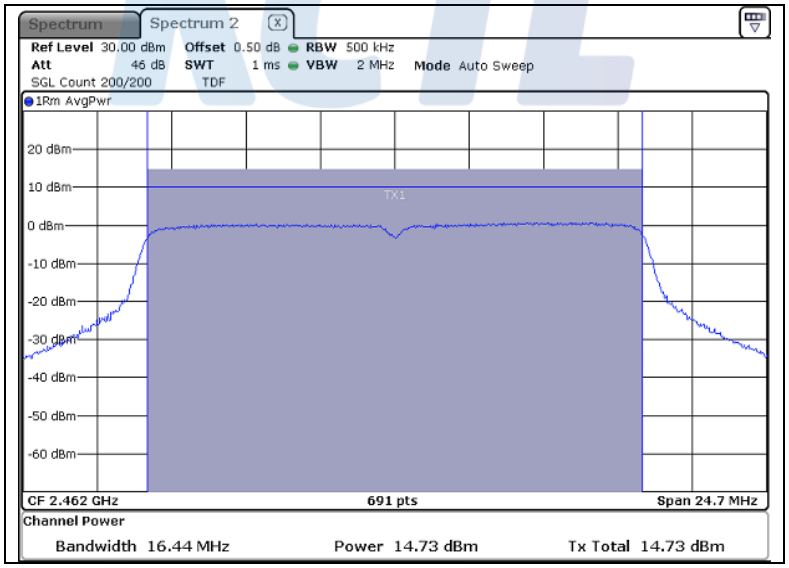
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

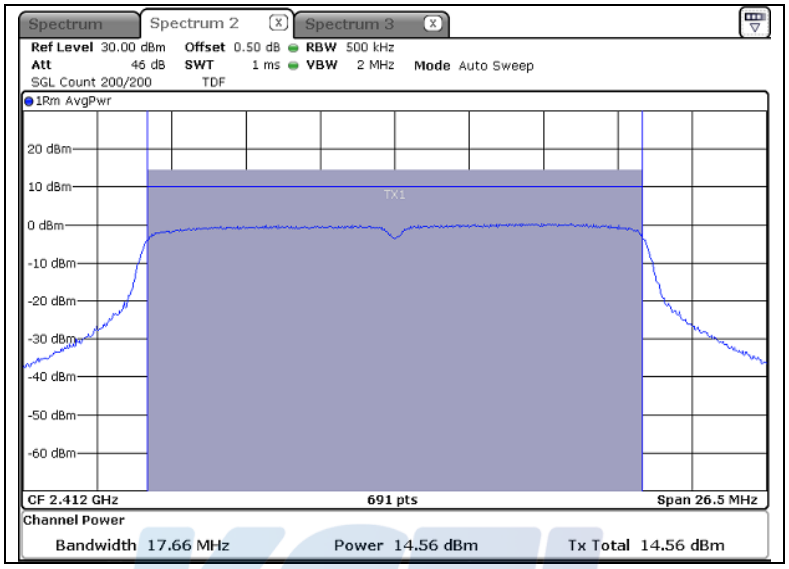


Highest Channel (2 462 ㎒)

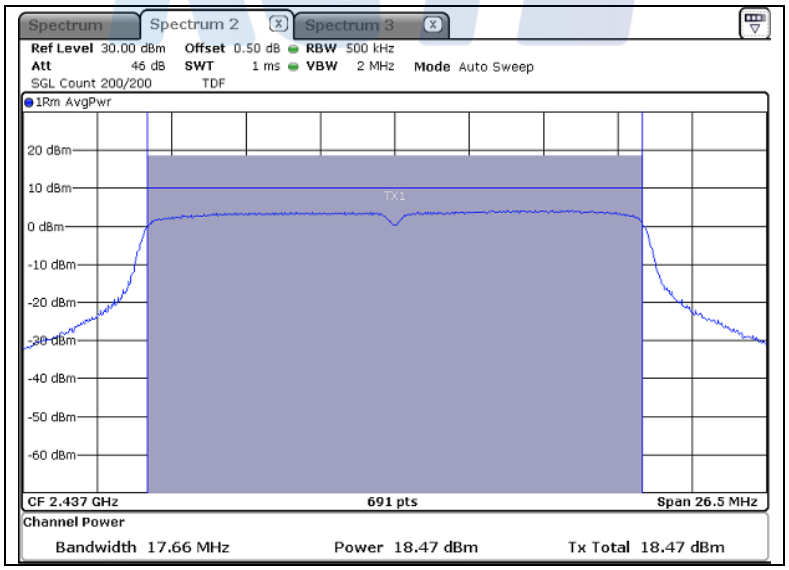


- 802.11n HT20

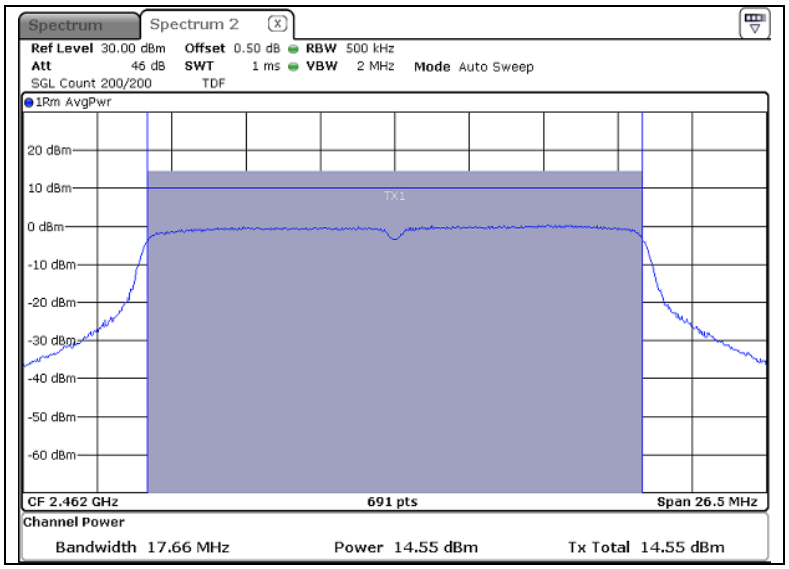
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

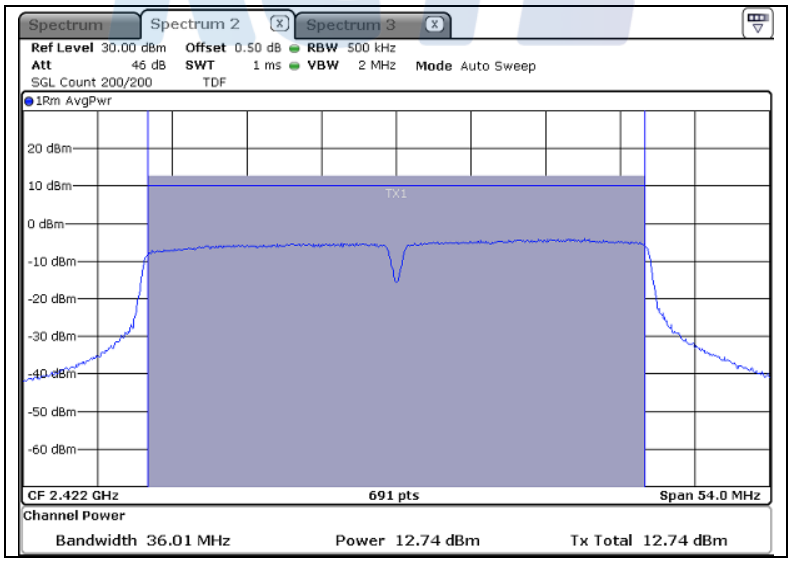


Highest Channel (2 462 ㎒)

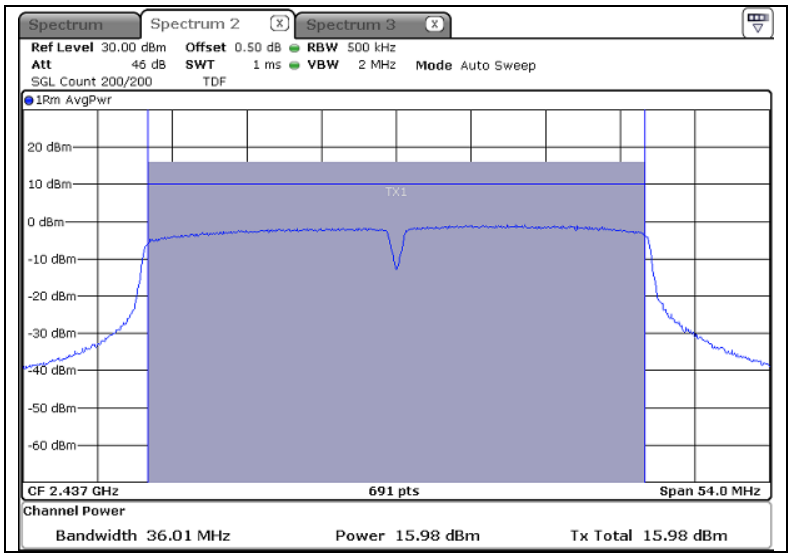


- 802.11n HT40

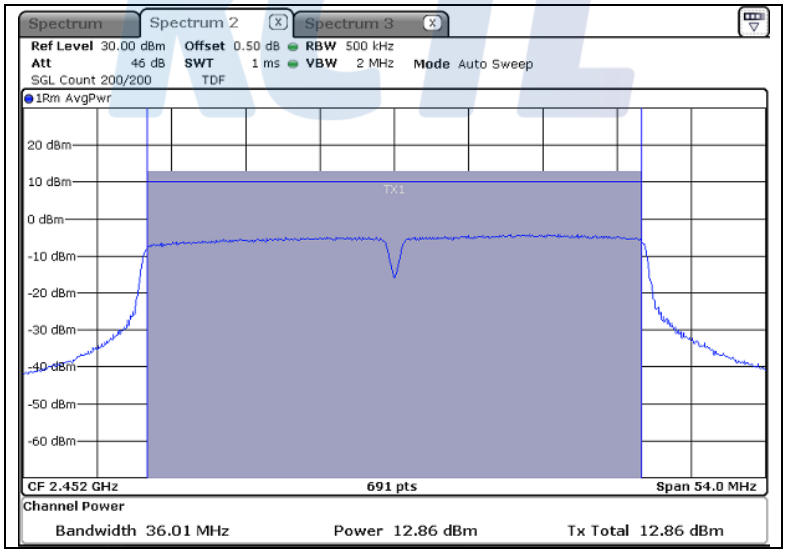
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



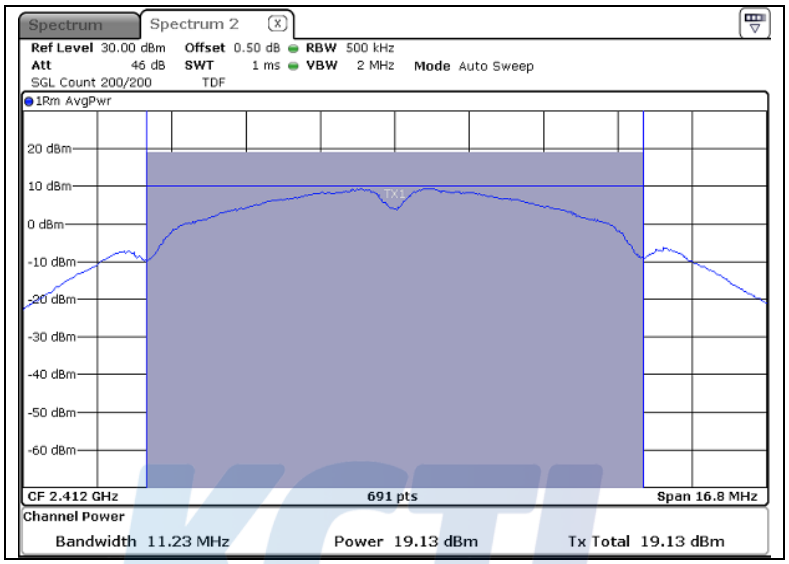
Highest Channel (2 452 ㎒)



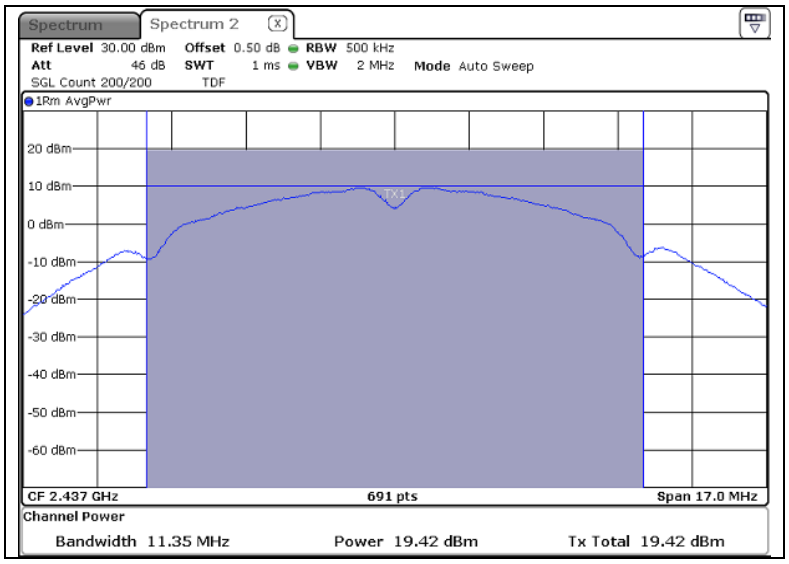
- ANT 1

- 802.11b

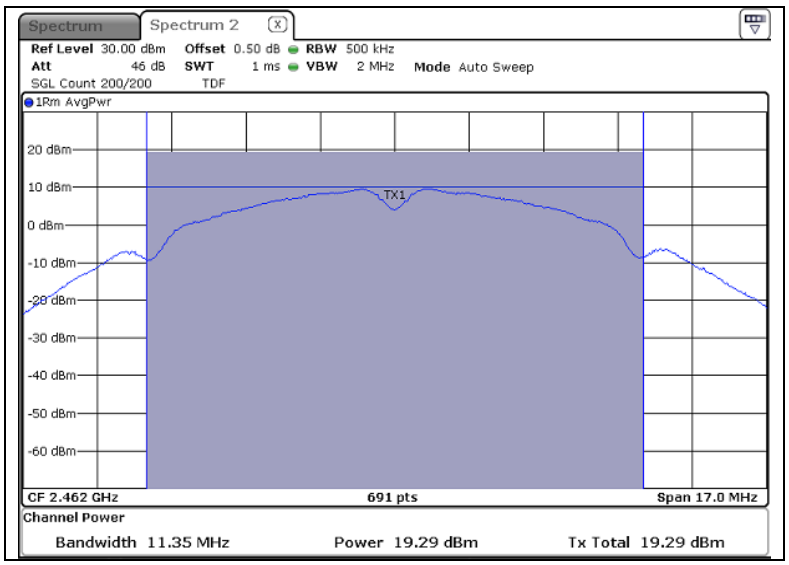
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

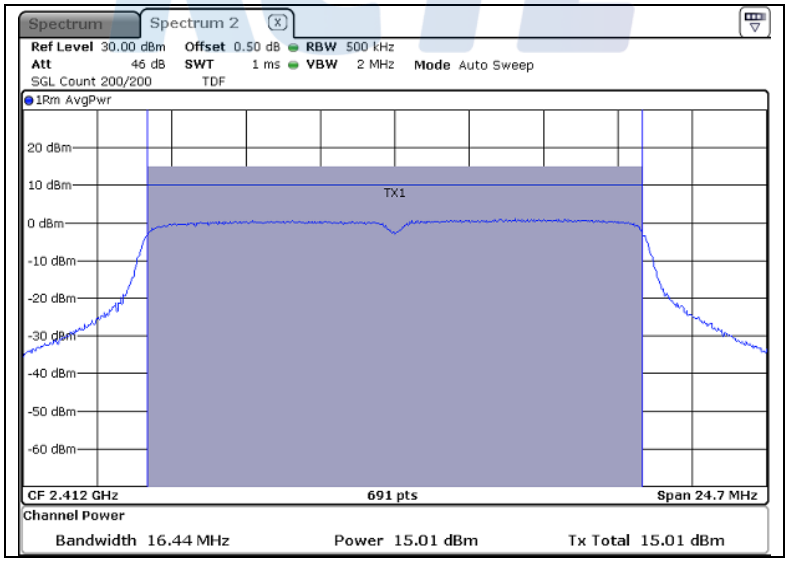


Highest Channel (2 462 ㎒)

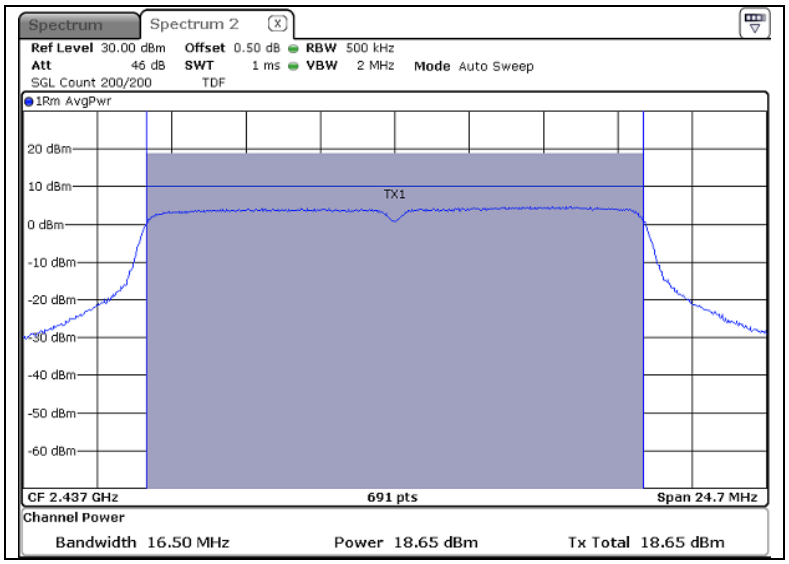


- 802.11g

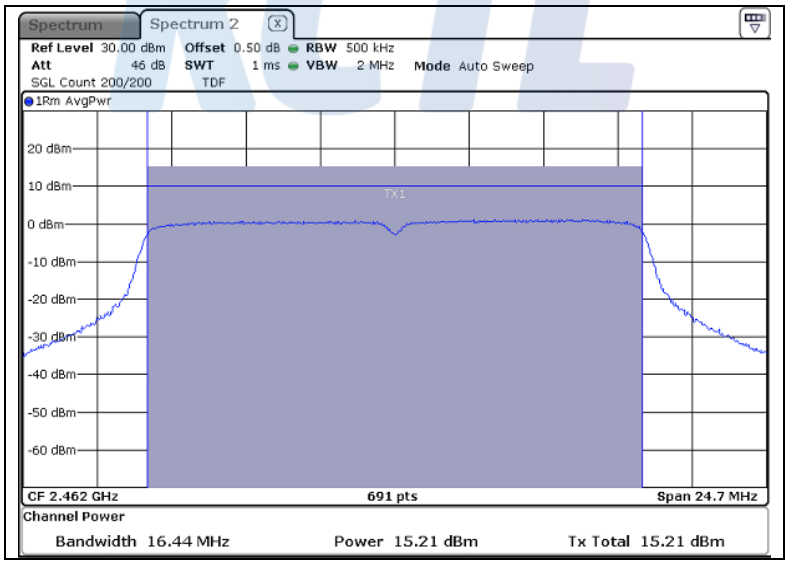
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

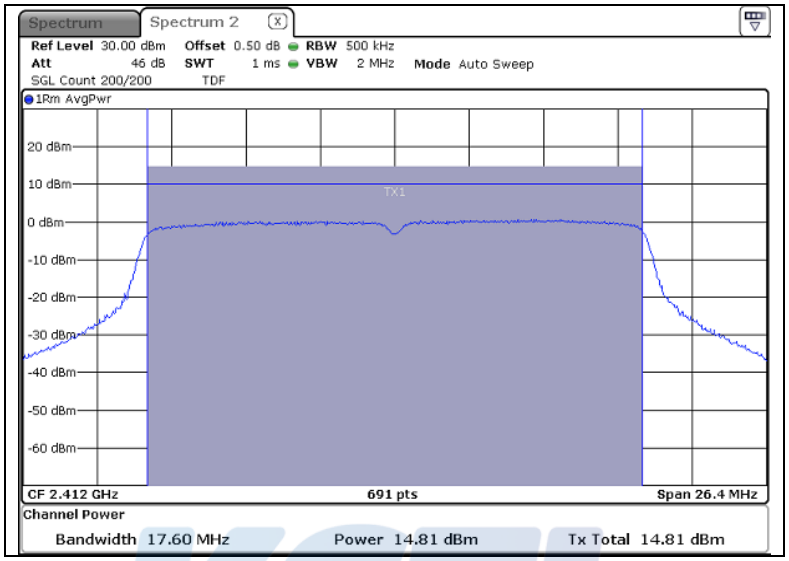


Highest Channel (2 462 ㎒)

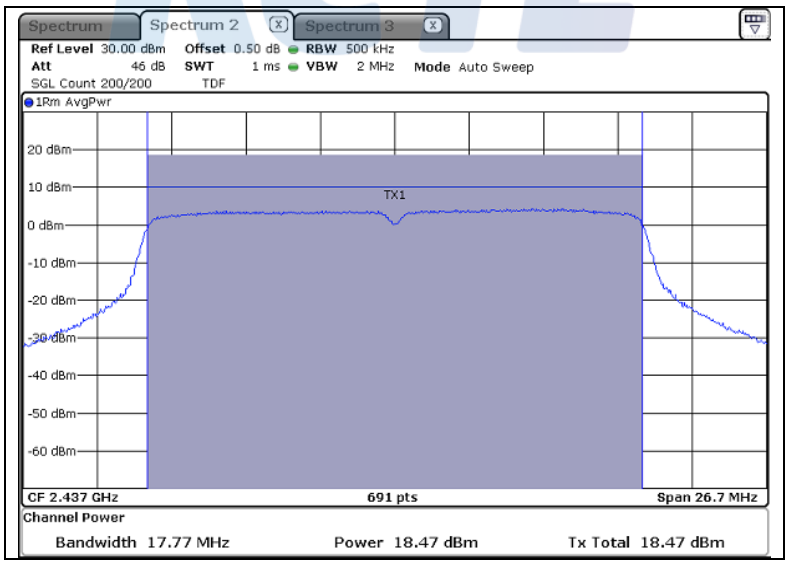


- 802.11n HT20

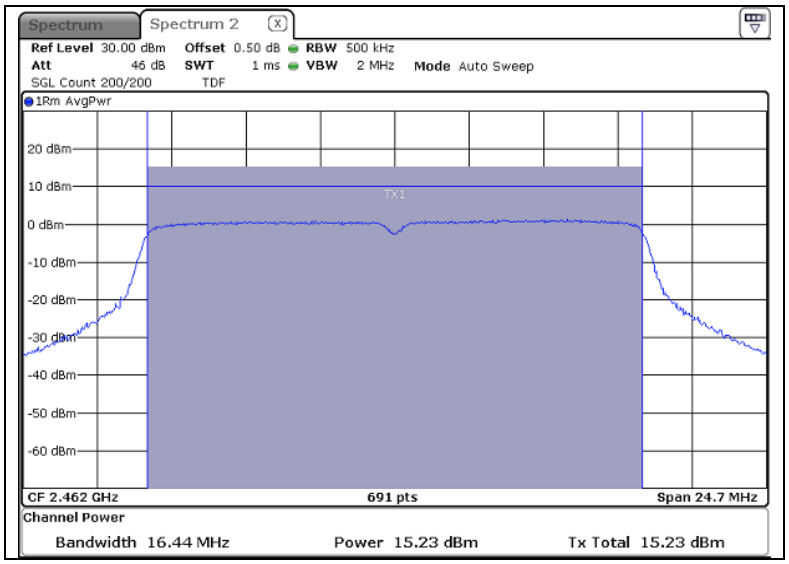
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

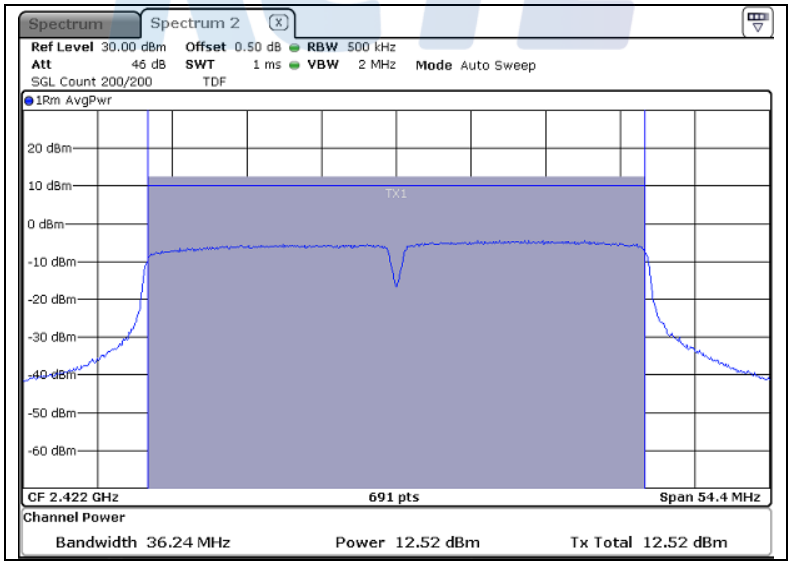


Highest Channel (2 462 ㎒)

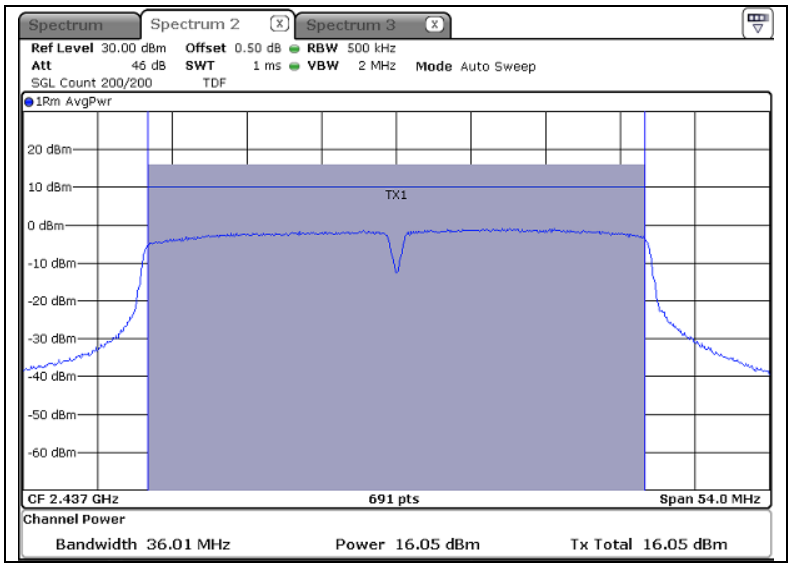


- 802.11n HT40

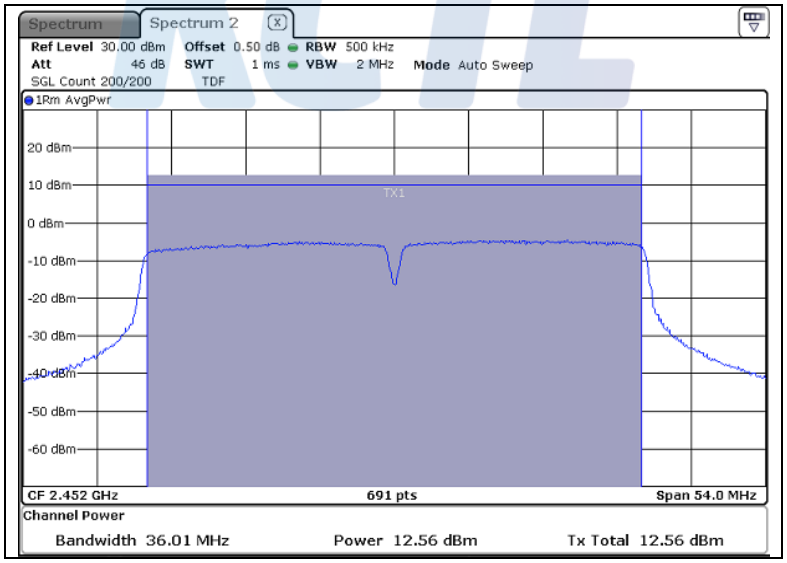
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



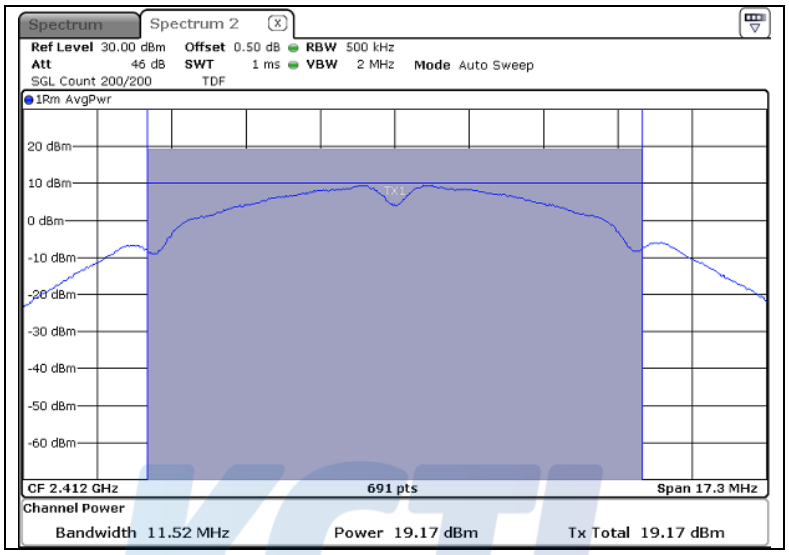
Highest Channel (2 452 ㎒)



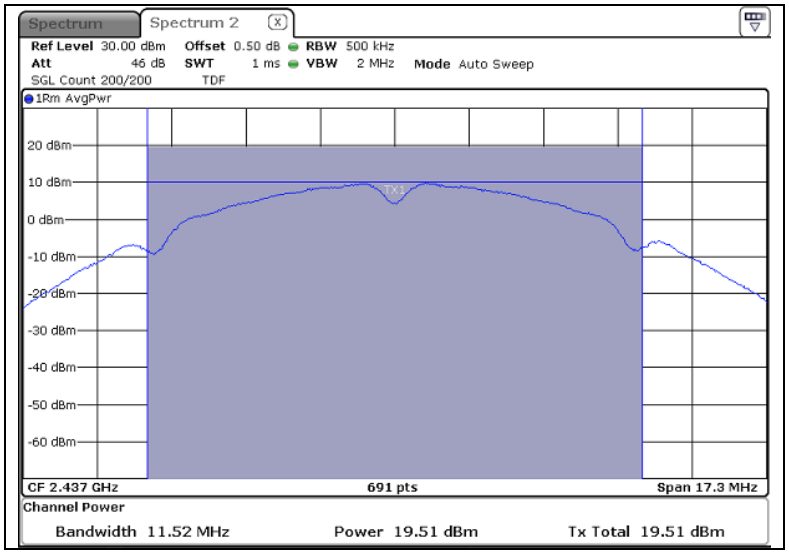
- ANT 2

- 802.11b

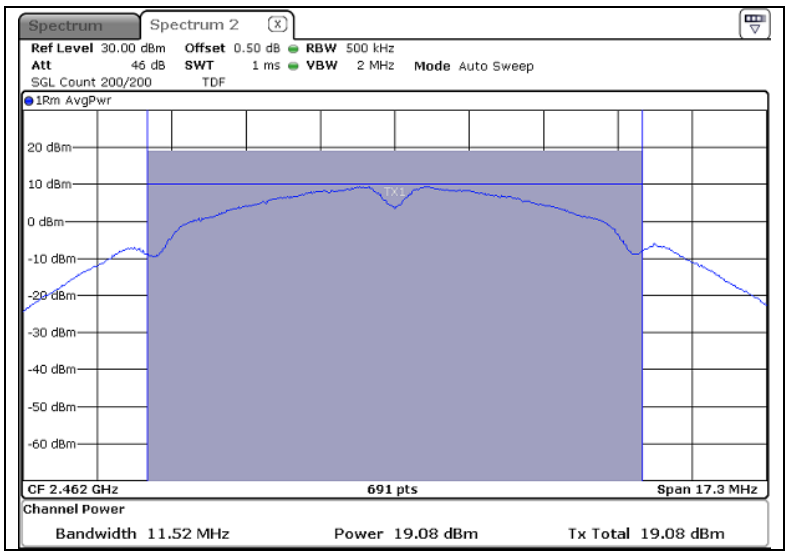
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

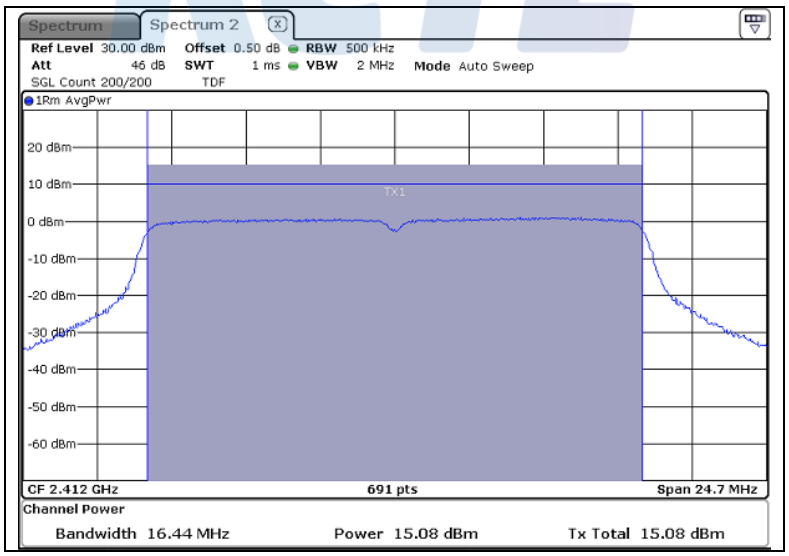


Highest Channel (2 462 ㎒)

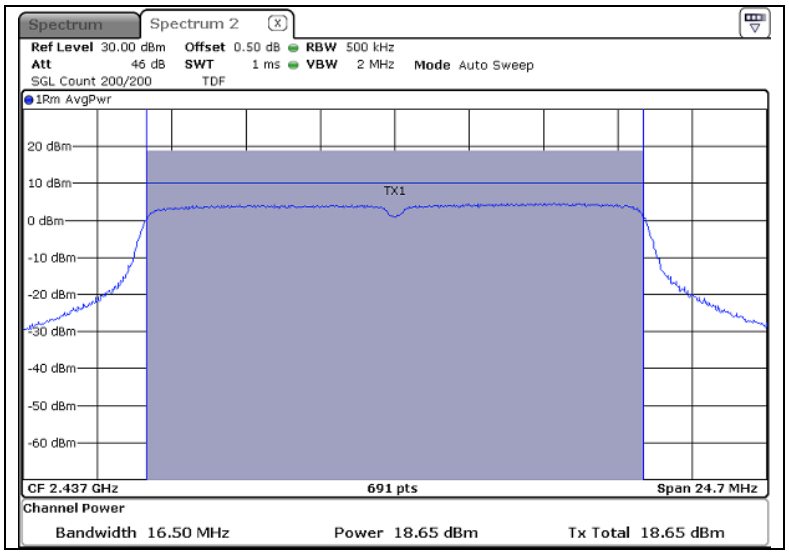


- 802.11g

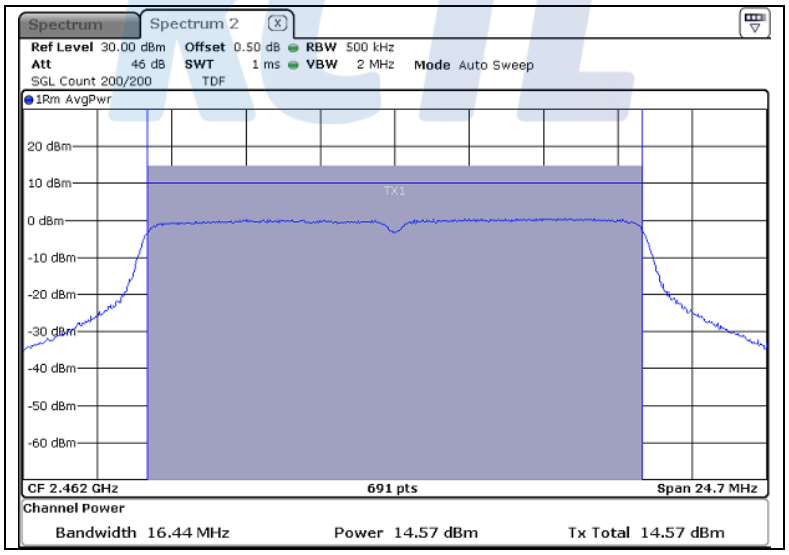
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

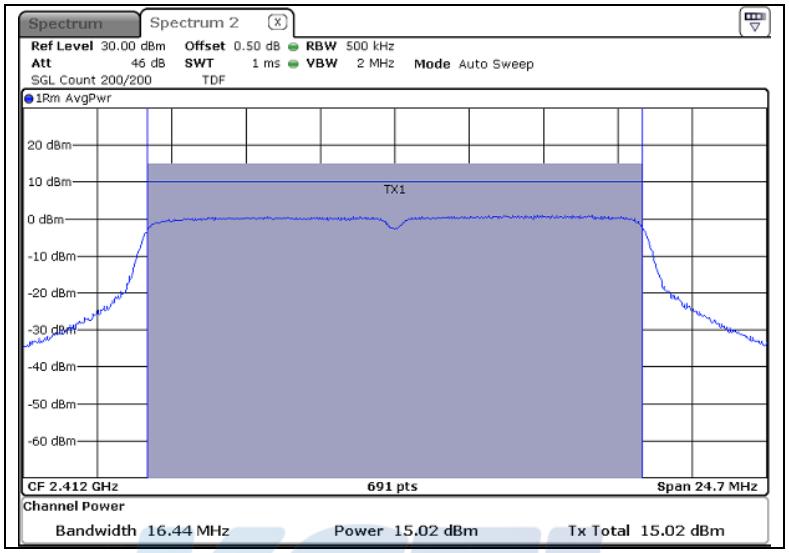


Highest Channel (2 462 ㎒)

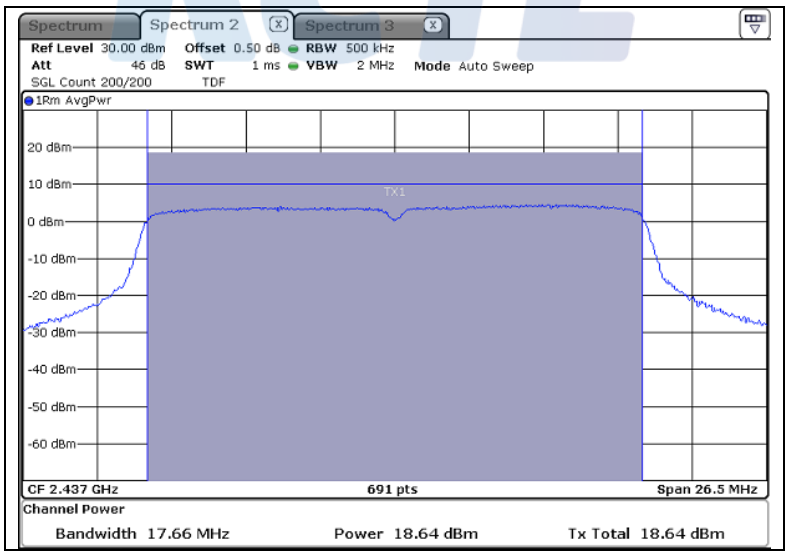


- 802.11n HT20

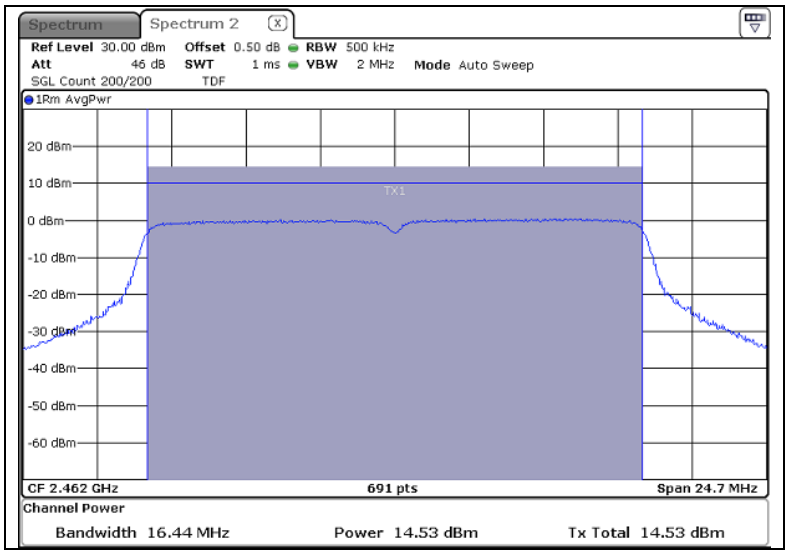
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

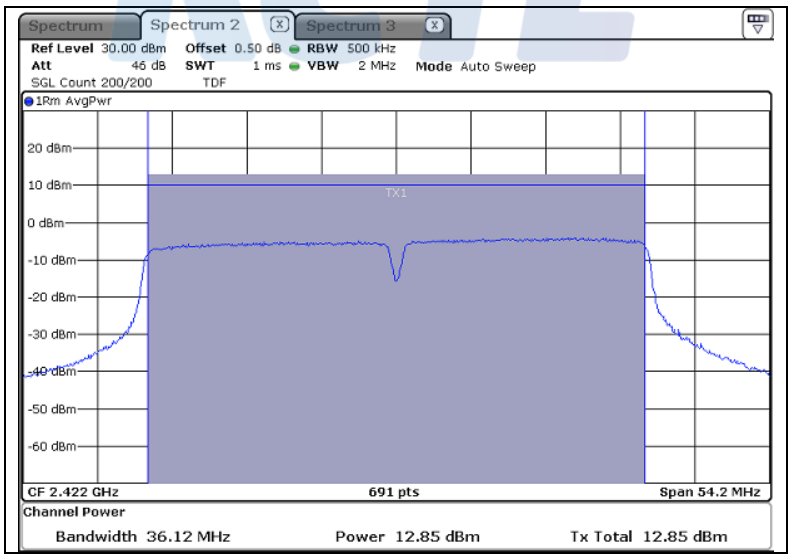


Highest Channel (2 462 ㎒)

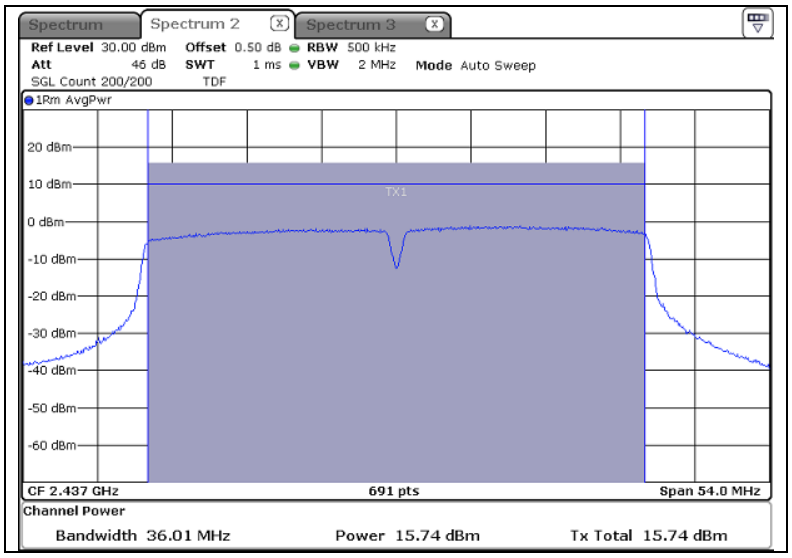


- 802.11n HT40

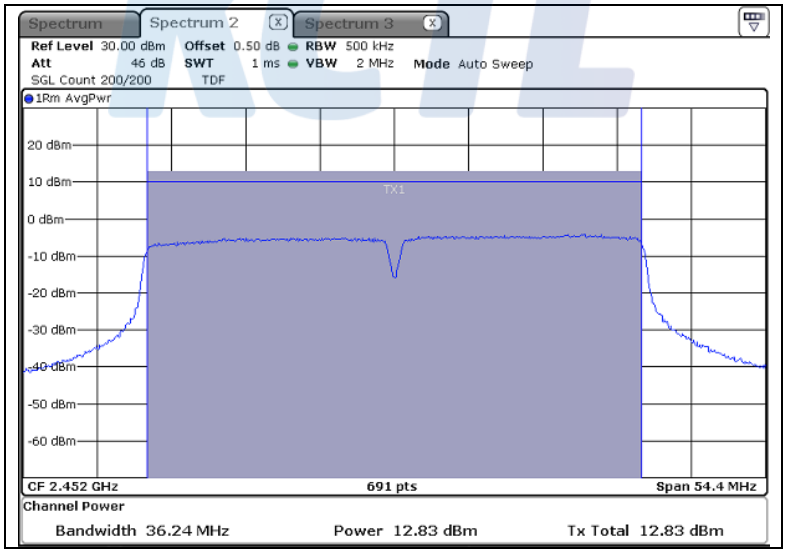
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



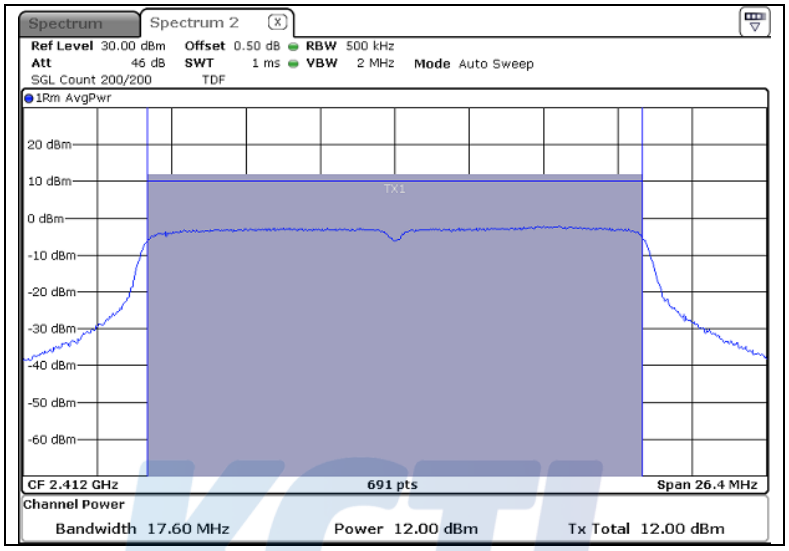
Highest Channel (2 452 ㎒)



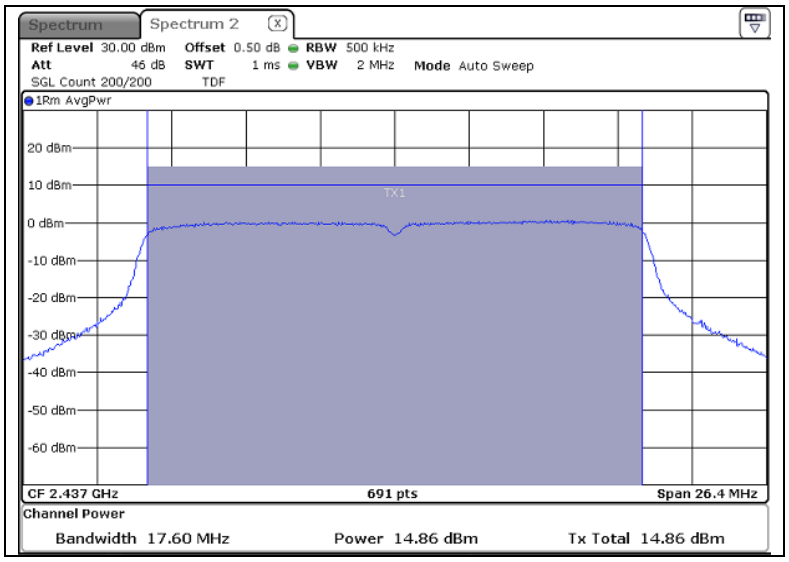
- MIMO 2 Tx (ANT 0)

- 802.11n HT20

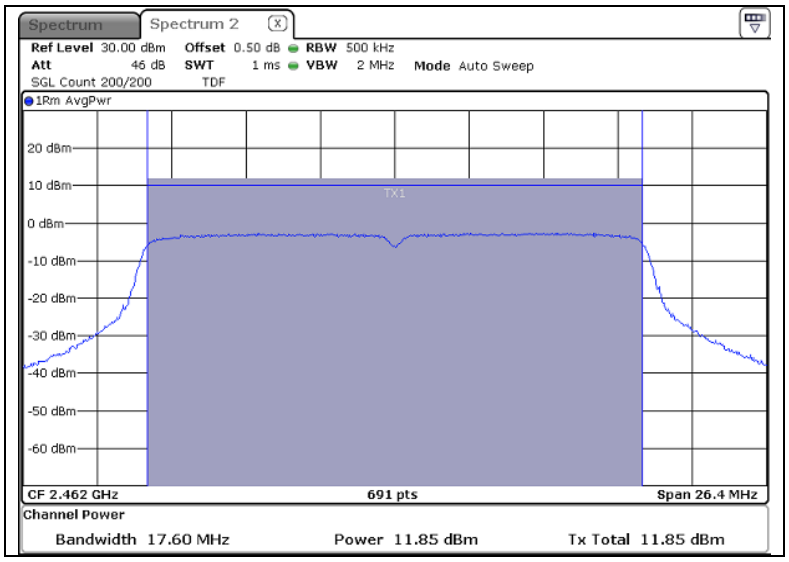
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

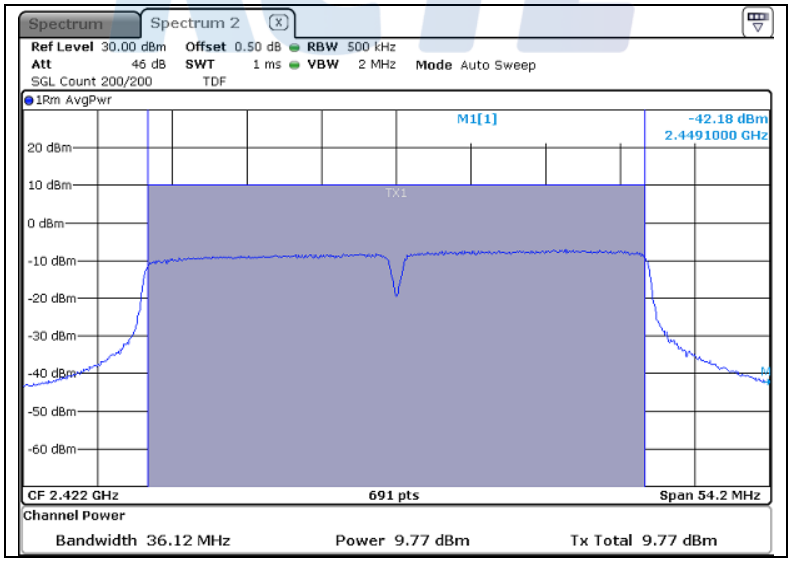


Highest Channel (2 462 ㎒)

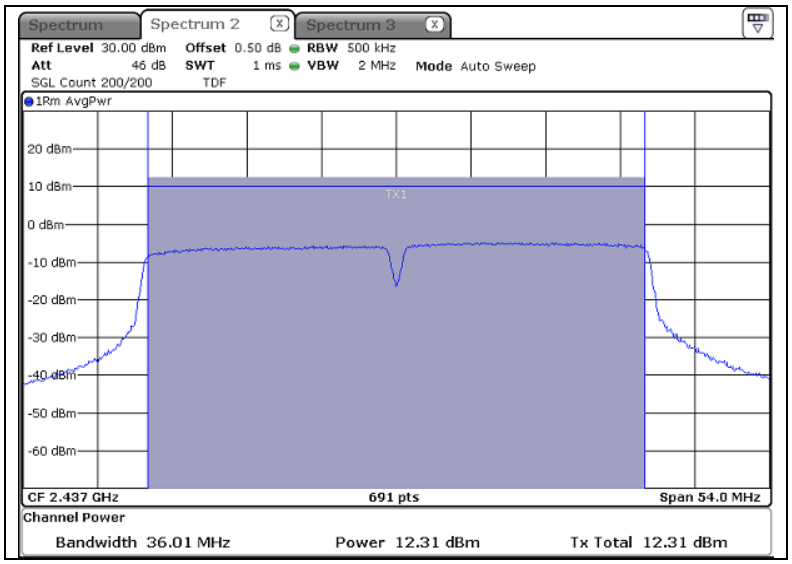


- 802.11n HT40

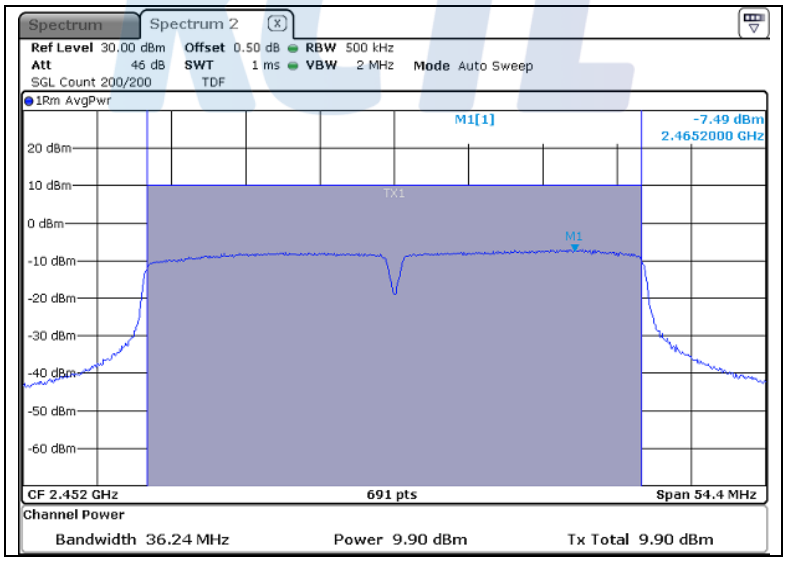
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



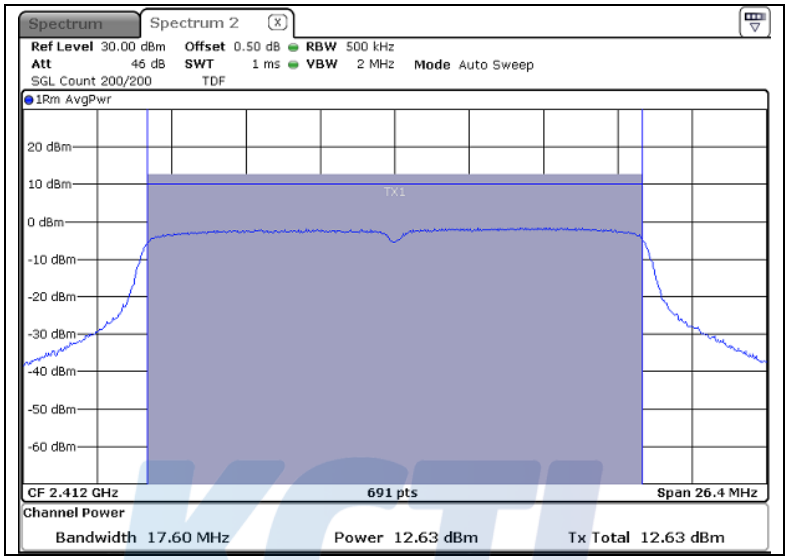
Highest Channel (2 452 ㎒)



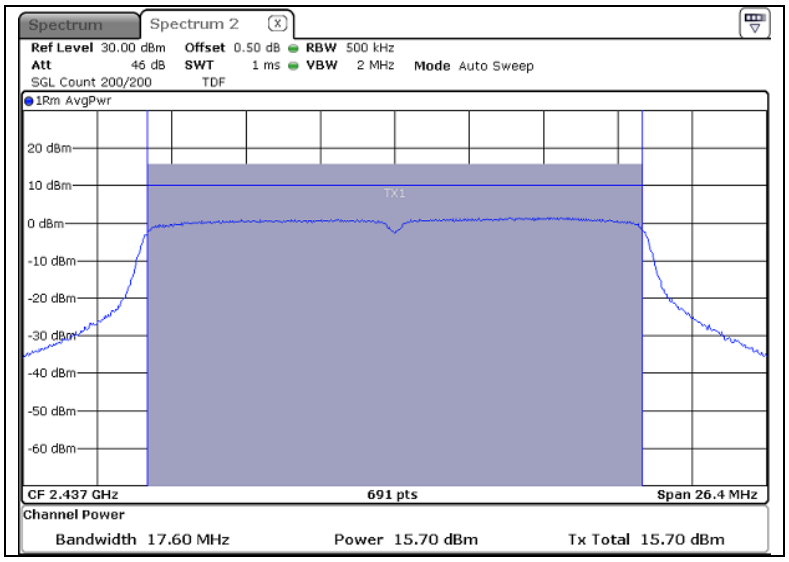
- MIMO 2 Tx (ANT 1)

- 802.11n HT20

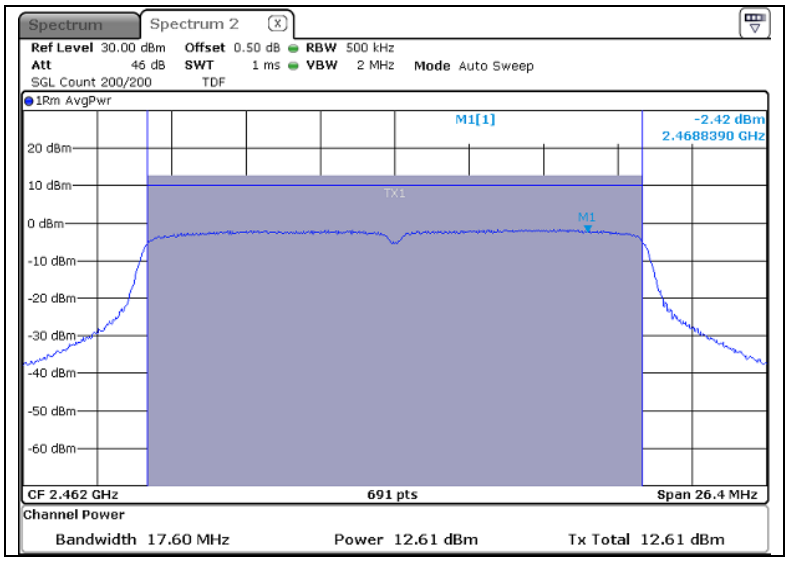
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

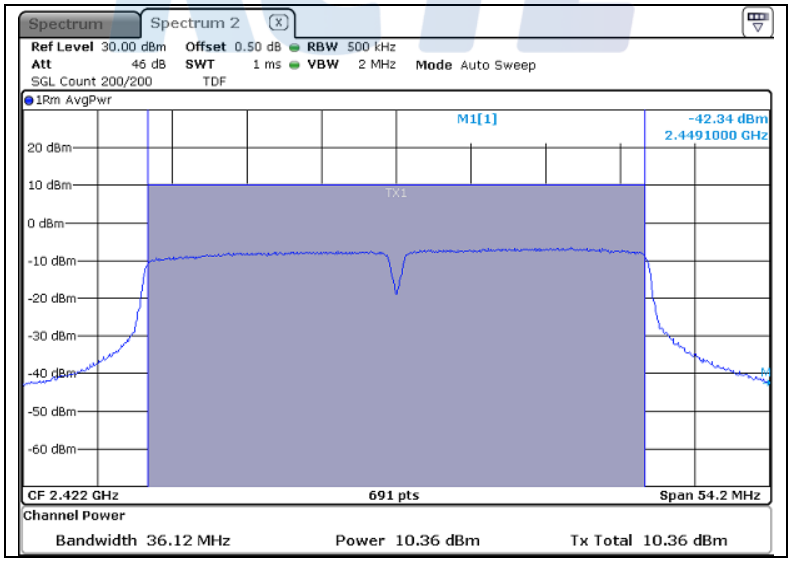


Highest Channel (2 462 ㎒)

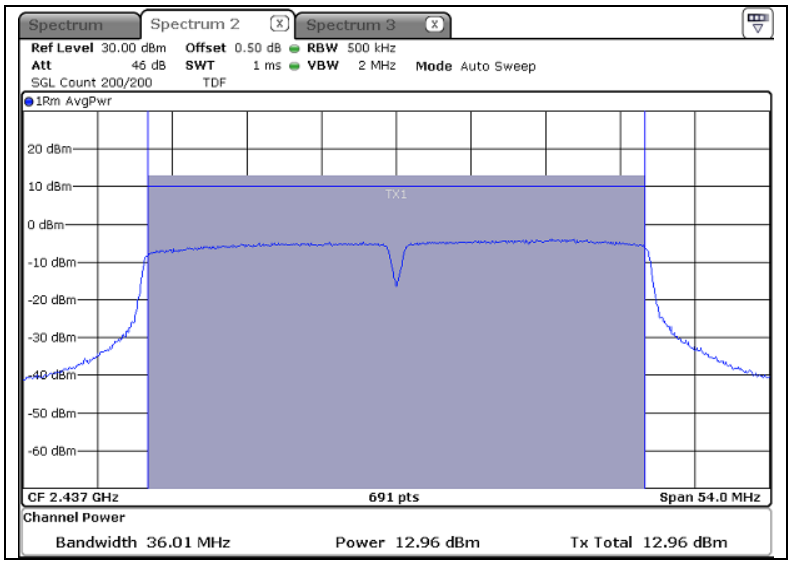


- 802.11n HT40

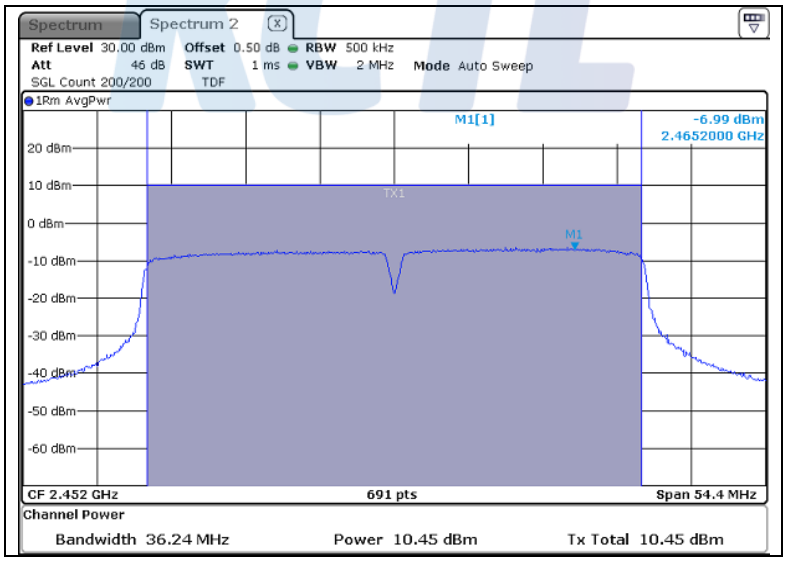
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



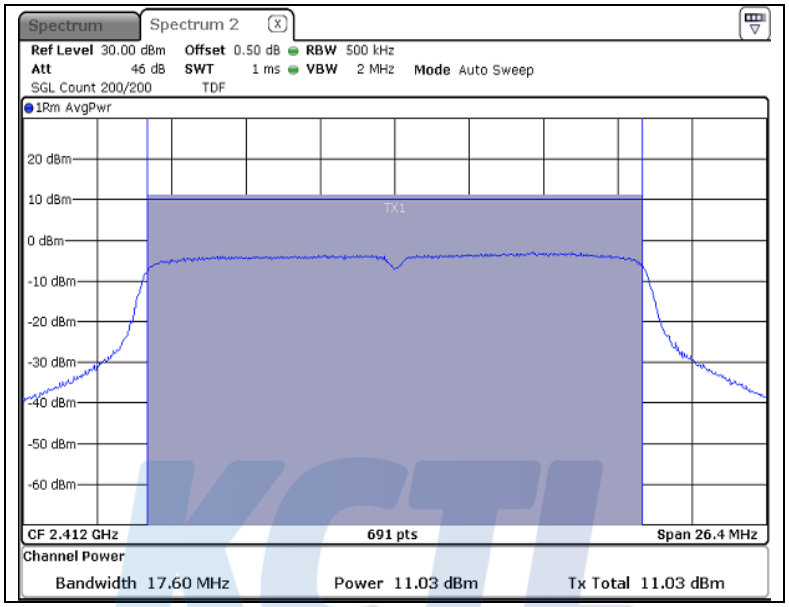
Highest Channel (2 452 ㎒)



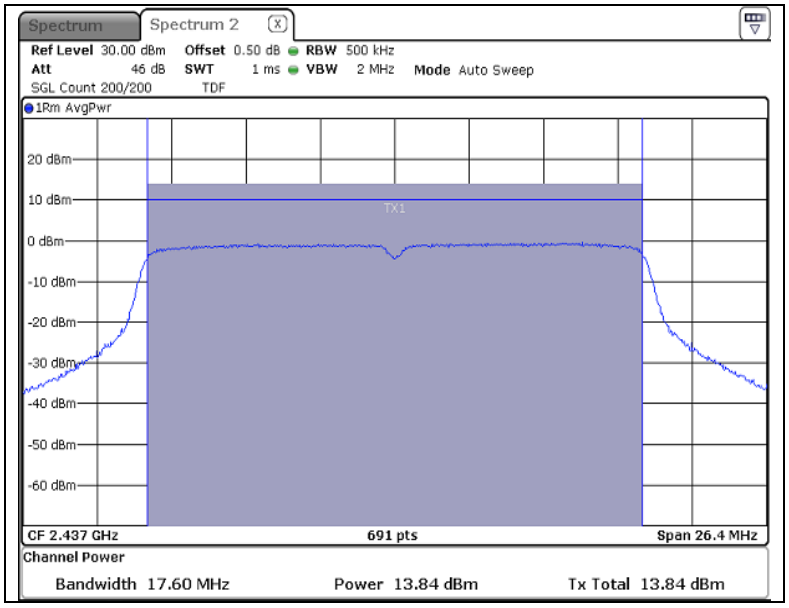
- MIMO 3 Tx (ANT 0)

- 802.11n HT20

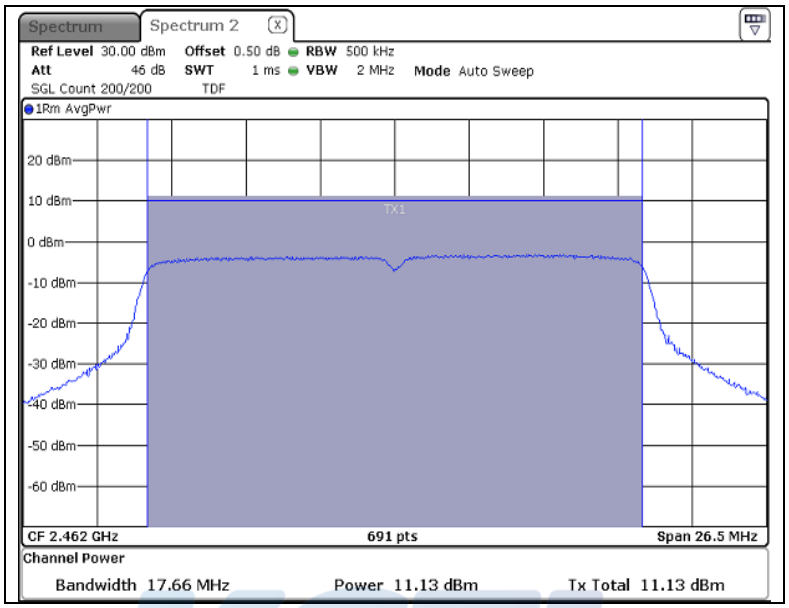
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

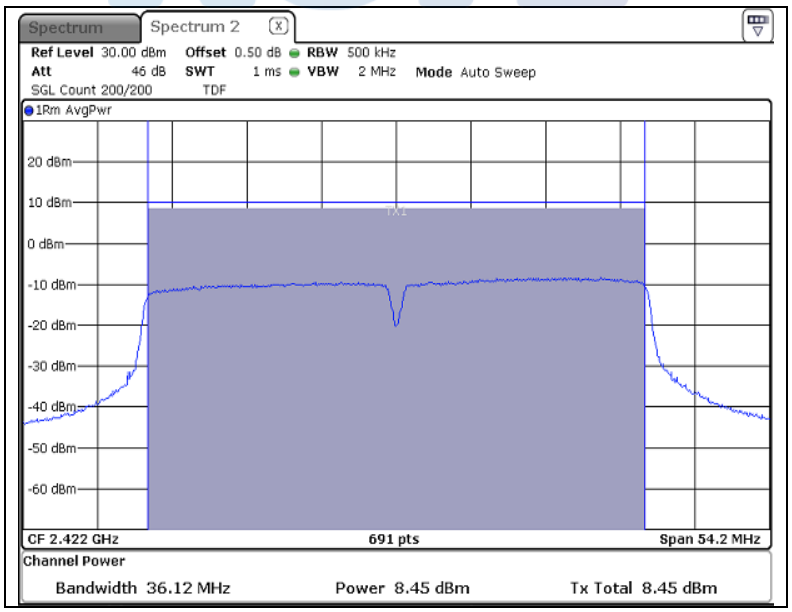


Highest Channel (2 462 ㎒)

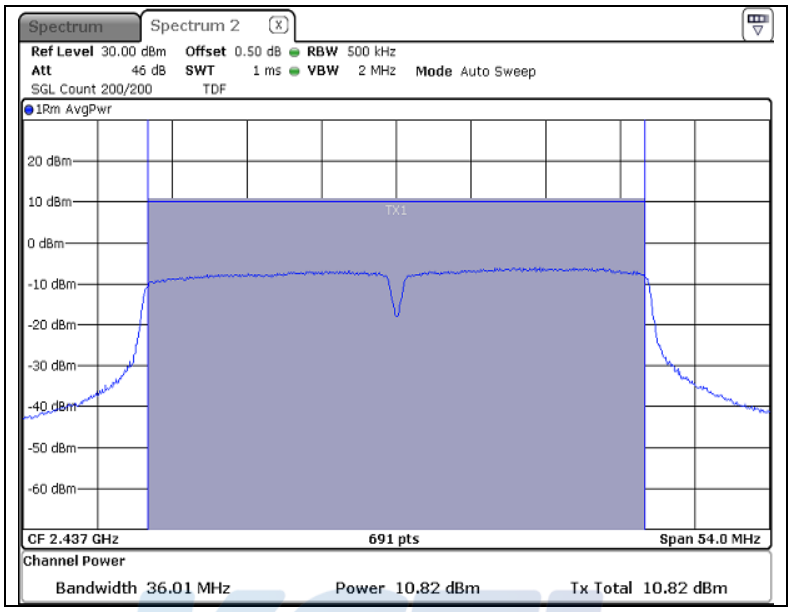


- 802.11n HT40

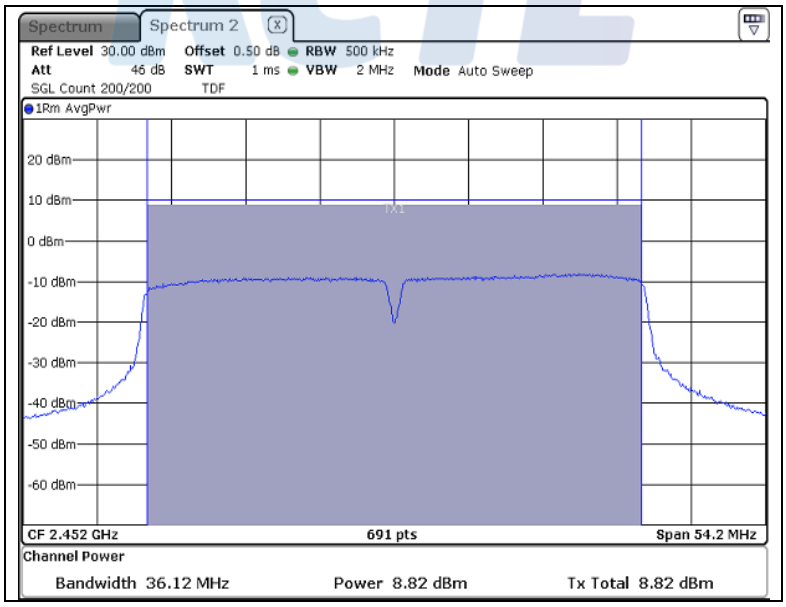
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



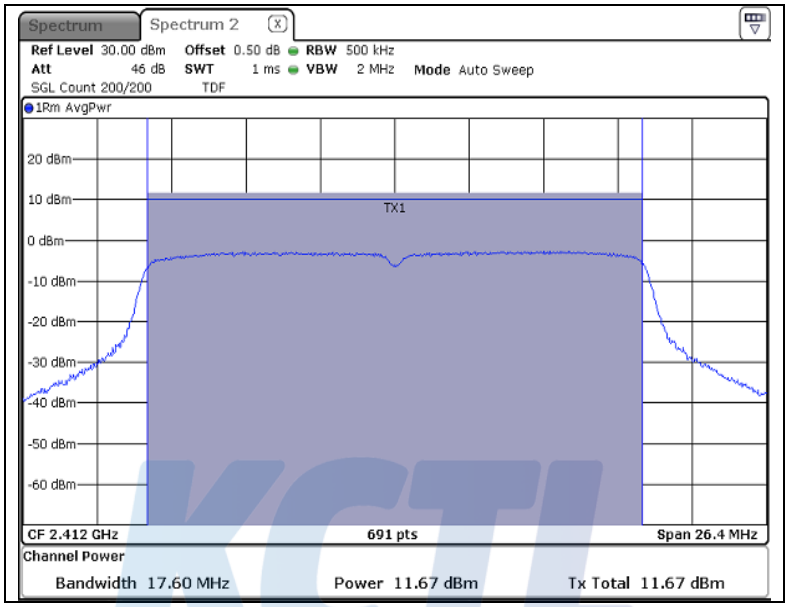
Highest Channel (2 452 ㎒)



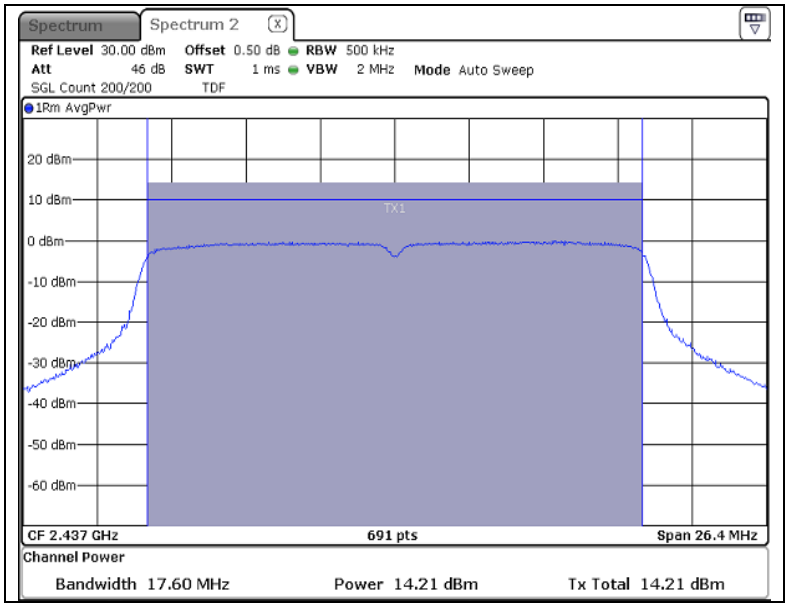
- MIMO 3 Tx (ANT 1)

- 802.11n HT20

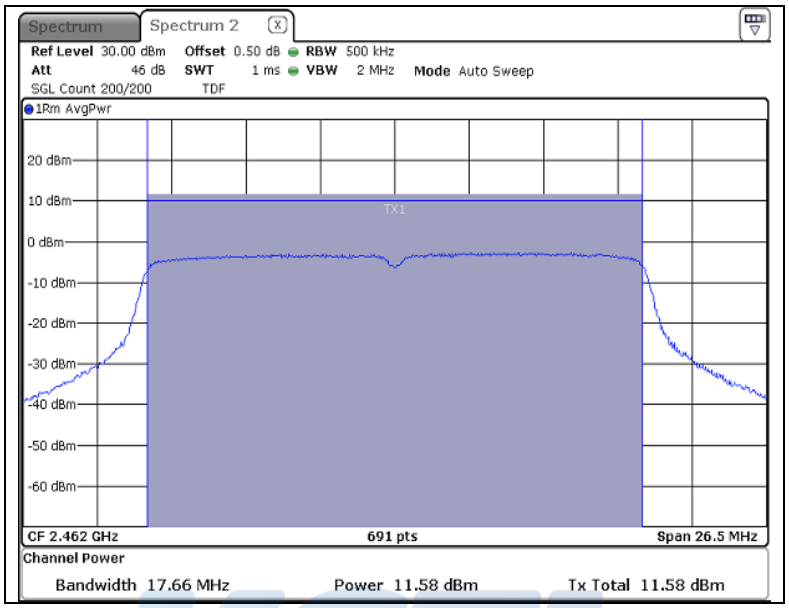
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

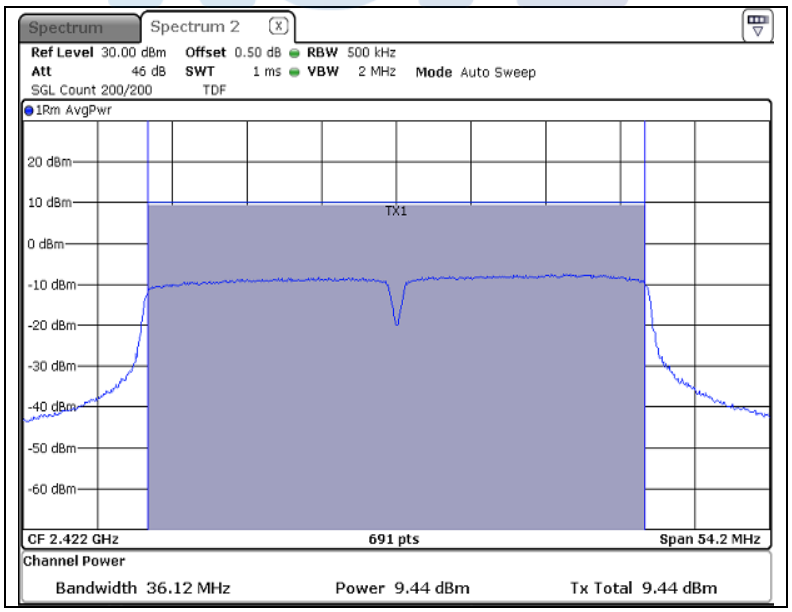


Highest Channel (2 462 ㎒)

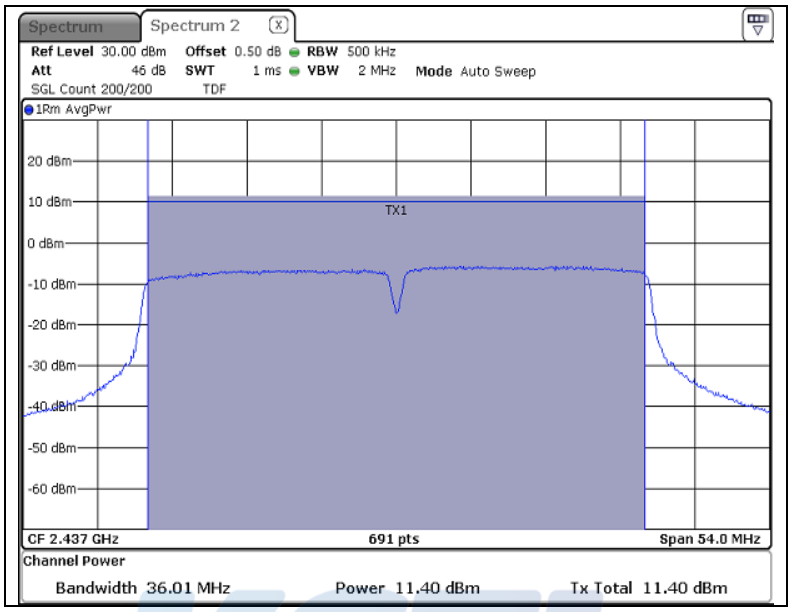


- 802.11n HT40

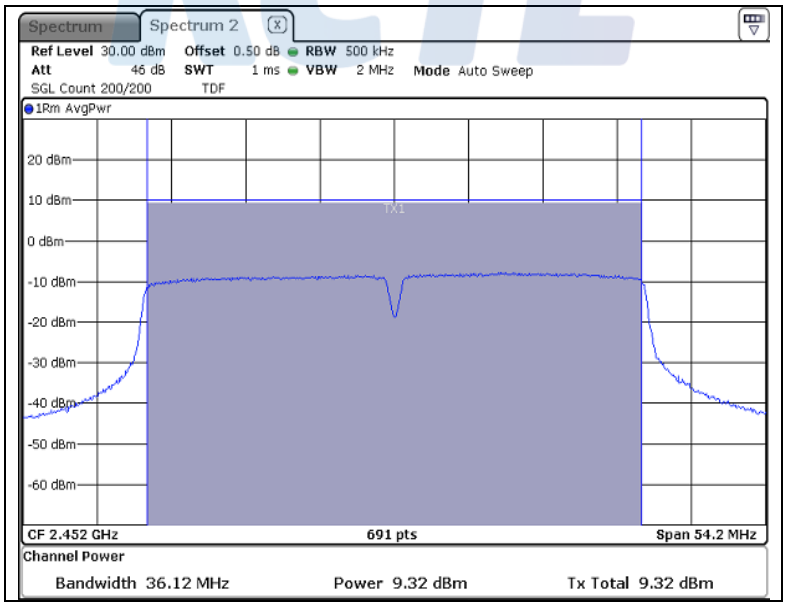
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



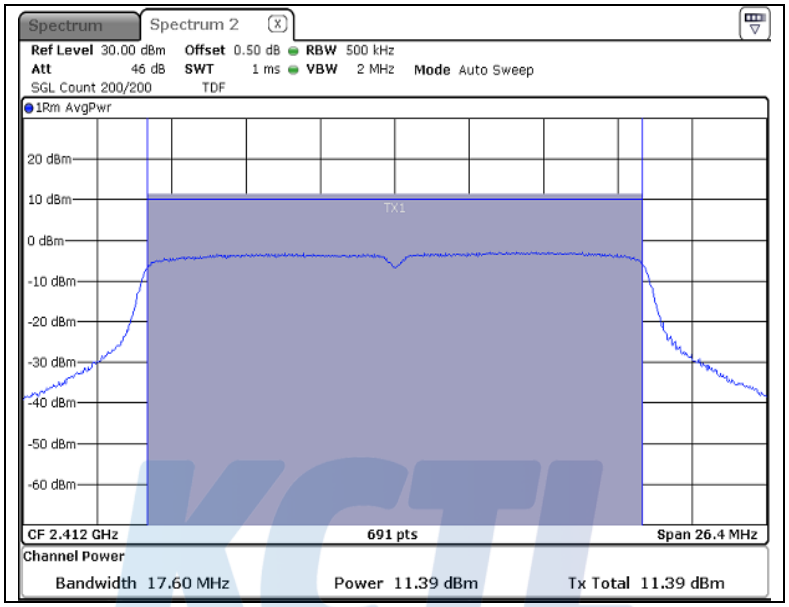
Highest Channel (2 452 ㎒)



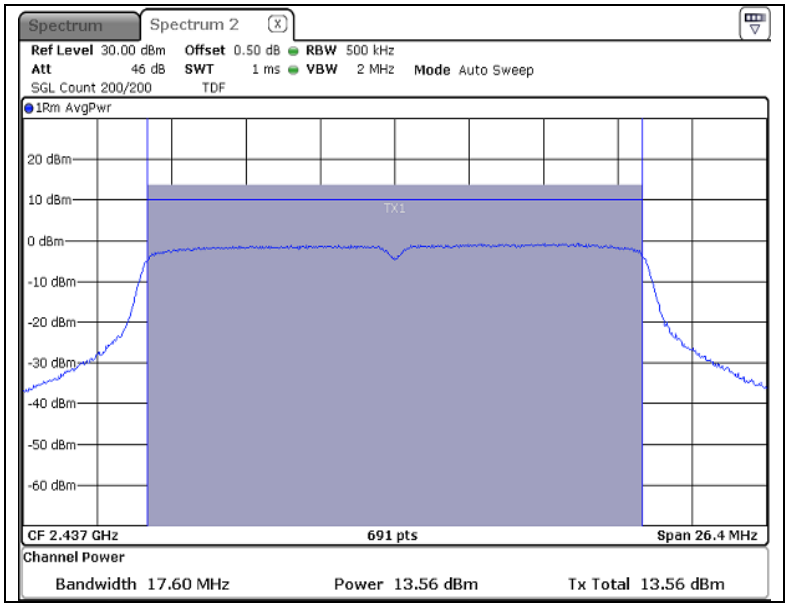
- MIMO 3 Tx (ANT 2)

- 802.11n HT20

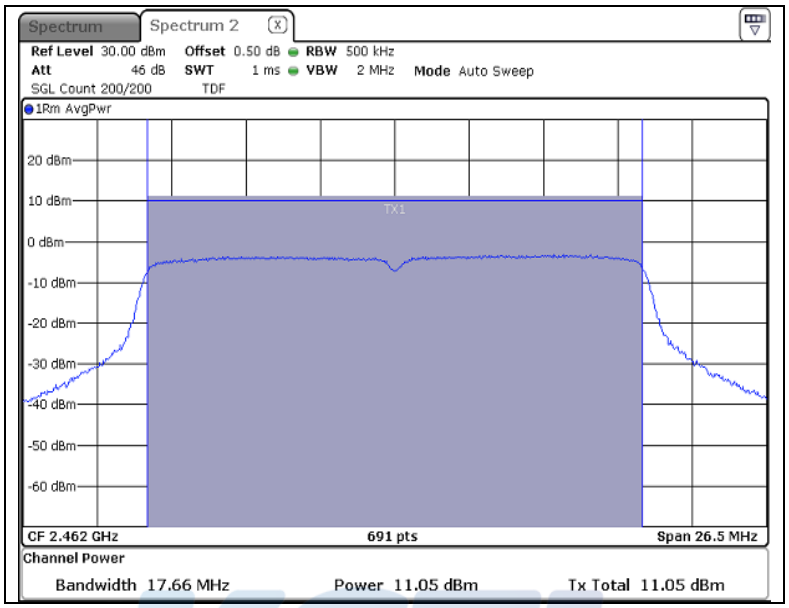
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

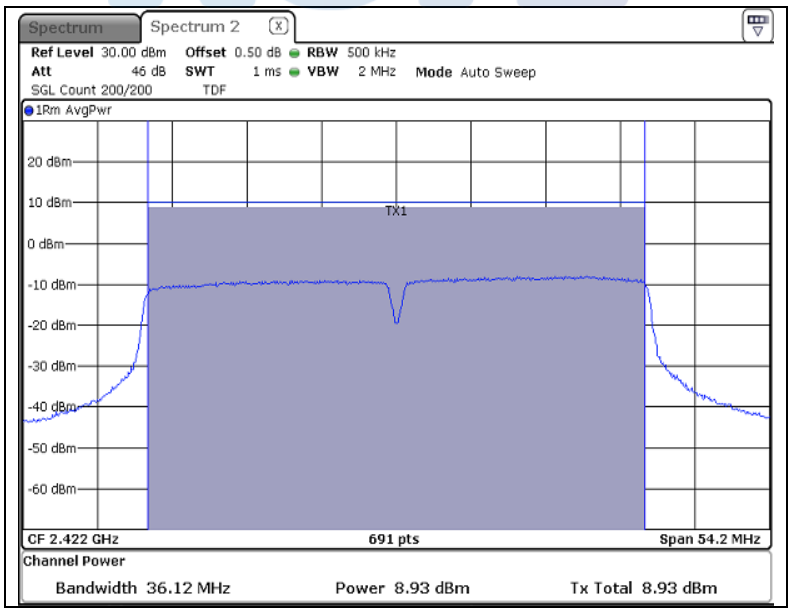


Highest Channel (2 462 ㎒)

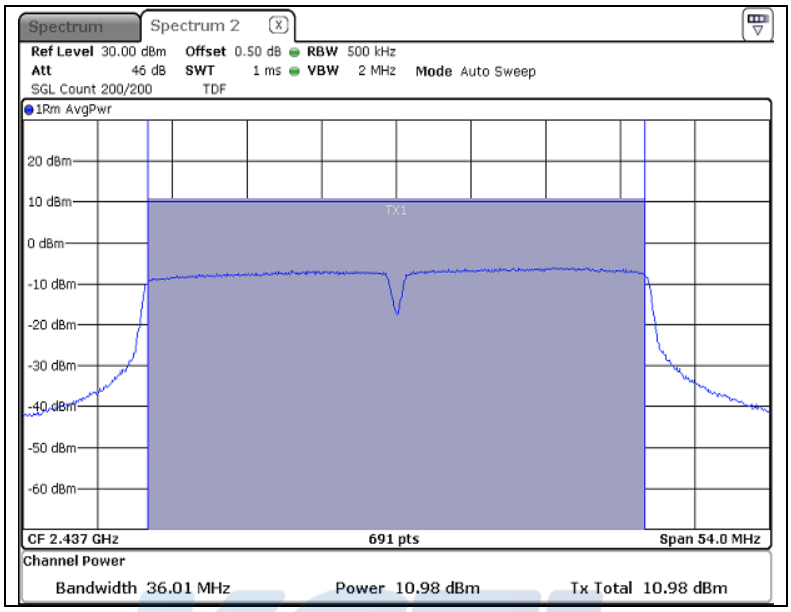


- 802.11n HT40

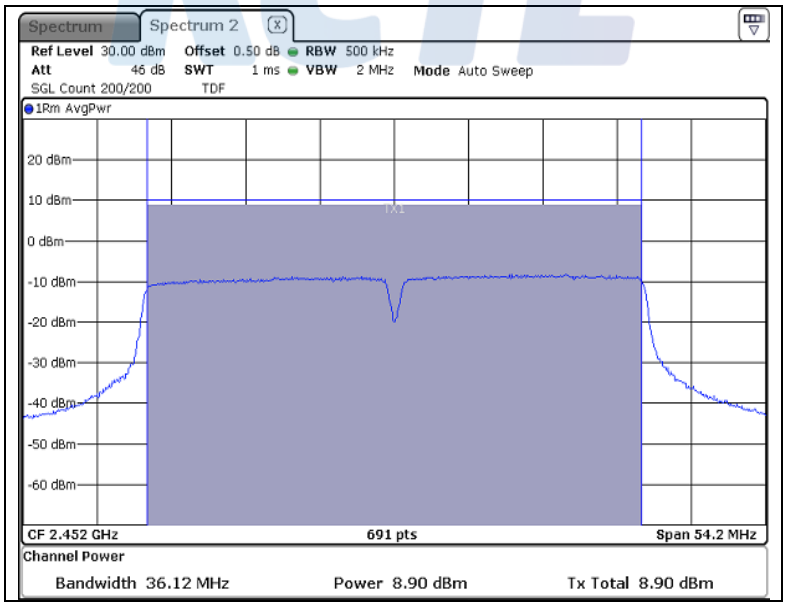
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



Highest Channel (2 452 ㎒)



5.3 Peak Power Spectral Density

5.3.1 Regulation

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 dBm 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.

5.3.2 Measurement Procedure

These test measurement settings are specified in section 10.0 of 558074 D01 DTS Meas Guidance.

5.3.2.1 Method PKPSD (peak PSD)

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 times the 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.

5.3.3 Test Result

- Complied

- ANT 0

- 802.11b

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-2.03	8.00	10.03
Middle	2 437	-1.64	8.00	9.64
Highest	2 462	-2.66	8.00	10.66

- 802.11g

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-8.13	8.00	16.13
Middle	2 437	-3.67	8.00	11.67
Highest	2 462	-7.70	8.00	15.70

- 802.11n HT20

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-8.86	8.00	16.86
Middle	2 437	-4.89	8.00	12.89
Highest	2 462	-9.71	8.00	17.71

- 802.11n HT40

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 422	-14.41	8.00	22.41
Middle	2 437	-11.22	8.00	19.22
Highest	2 452	-14.63	8.00	22.63

- ANT 1

- 802.11b

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-1.80	8.00	9.80
Middle	2 437	-1.26	8.00	9.26
Highest	2 462	-2.36	8.00	10.36

- 802.11g

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-8.00	8.00	16.00
Middle	2 437	-3.41	8.00	11.41
Highest	2 462	-7.35	8.00	15.35

- 802.11n HT20

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-9.68	8.00	17.68
Middle	2 437	-5.09	8.00	13.09
Highest	2 462	-8.63	8.00	16.63

- 802.11n HT40

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 422	-14.70	8.00	22.70
Middle	2 437	-10.89	8.00	18.89
Highest	2 452	-11.01	8.00	19.01

- ANT 2

- 802.11b

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-1.40	8.00	9.40
Middle	2 437	-1.54	8.00	9.54
Highest	2 462	-2.43	8.00	10.43

- 802.11g

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-9.91	8.00	17.91
Middle	2 437	-3.69	8.00	11.69
Highest	2 462	-8.24	8.00	16.24

- 802.11n HT20

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-9.70	8.00	17.70
Middle	2 437	-5.06	8.00	13.06
Highest	2 462	-10.03	8.00	18.03

- 802.11n HT40

Channel	Frequency [㎒]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 422	-13.93	8.00	21.93
Middle	2 437	-11.10	8.00	19.10
Highest	2 452	-14.99	8.00	22.99

- MIMO (ANT 0+1)

- 802.11n HT20

Channel	Frequency [㎒]	Result_ANT 0 (RBW=3 ㎑) [dB m]	Result_ANT 1 (RBW=3 ㎑) [dB m]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-12.13	-12.22	-9.16	8.00	17.16
Middle	2 437	-8.65	-7.73	-5.16	8.00	13.16
Highest	2 462	-12.64	-11.42	-8.98	8.00	16.98

- 802.11n HT40

Channel	Frequency [㎒]	Result_ANT 0 (RBW=3 ㎑) [dB m]	Result_ANT 1 (RBW=3 ㎑) [dB m]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 422	-16.94	-16.74	-13.83	8.00	21.83
Middle	2 437	-13.78	-13.69	-10.72	8.00	18.72
Highest	2 452	-17.39	-16.33	-13.82	8.00	21.82

- MIMO (ANT 0+1+2)

- 802.11n HT20

Channel	Frequency [㎒]	Result _ANT 0 (RBW=3 ㎑) [dB m]	Result _ANT 1 (RBW=3 ㎑) [dB m]	Result _ANT 2 (RBW=3 ㎑) [dB m]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 412	-13.18	-13.54	-13.33	-8.58	6.40	14.98
Middle	2 437	-10.29	-10.17	-9.53	-5.21	6.40	11.61
Highest	2 462	-14.04	-13.25	-12.82	-8.57	6.40	14.97

- 802.11n HT40

Channel	Frequency [㎒]	Result _ANT 0 (RBW=3 ㎑) [dB m]	Result _ANT 1 (RBW=3 ㎑) [dB m]	Result _ANT 2 (RBW=3 ㎑) [dB m]	Result (RBW=3 ㎑) [dB m]	Limit [dBm/3 ㎑]	Margin [dB]
Lowest	2 422	-18.58	-17.63	-17.19	-12.99	6.40	19.39
Middle	2 437	-16.10	-16.57	-16.50	-11.61	6.40	18.01
Highest	2 452	-17.94	-18.46	-17.77	-13.28	6.40	19.68

1. Since the directional gain of Internal Antenna declared by the manufacturer (GANT =Ant 0: 2.83 dBi, Ant 1: 2.38 dBi, Ant 2: 2.19 dBi), does exceed 6.0 dBi, So need to reduce the power spectral density limit (in case of 3 Tx MIMO).
2. We took the insertion loss of the cable loss into consideration within the measuring instrument.

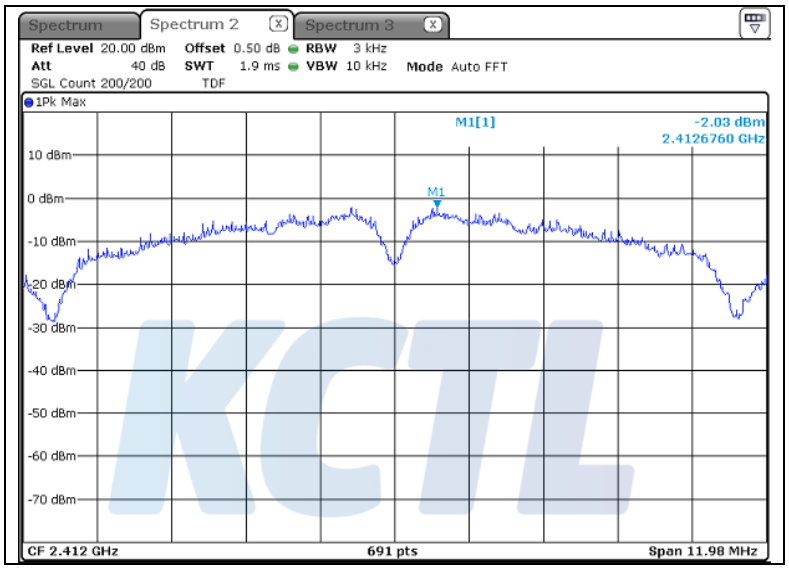
5.3.4 Test Plot

Figure 1. Plot of the Power Density

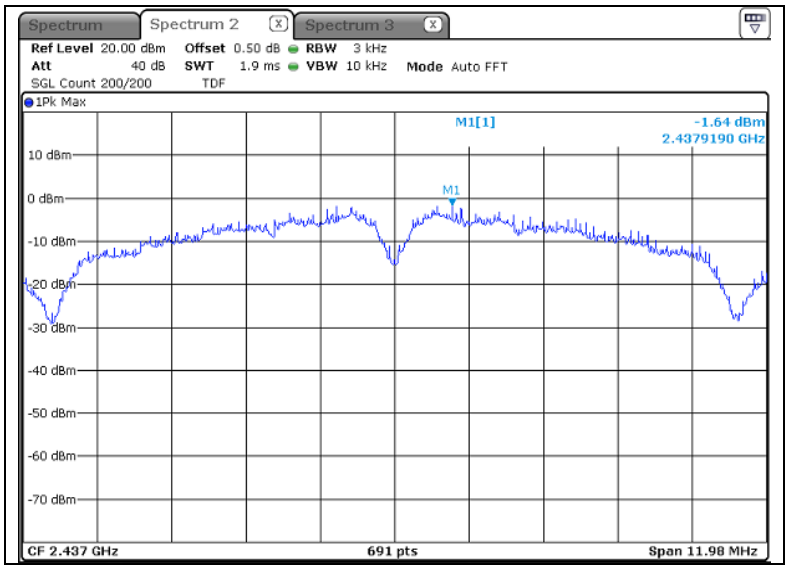
- ANT 0

- 802.11b

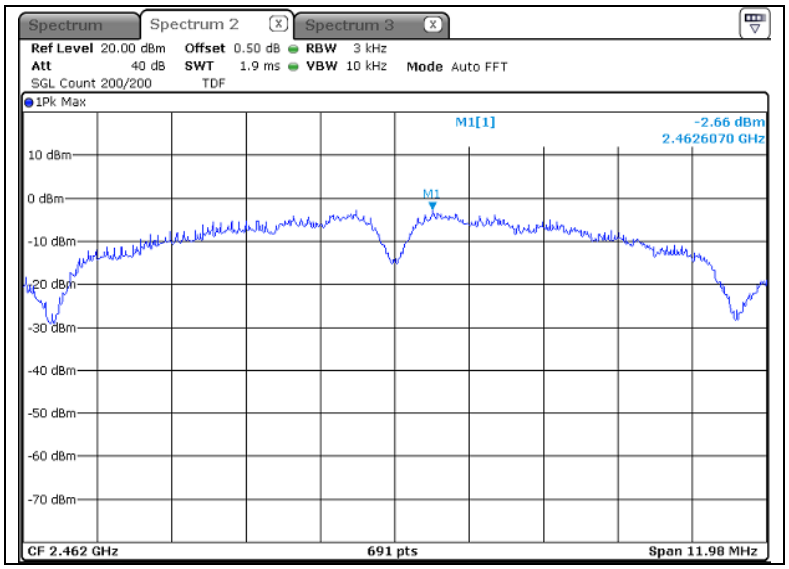
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

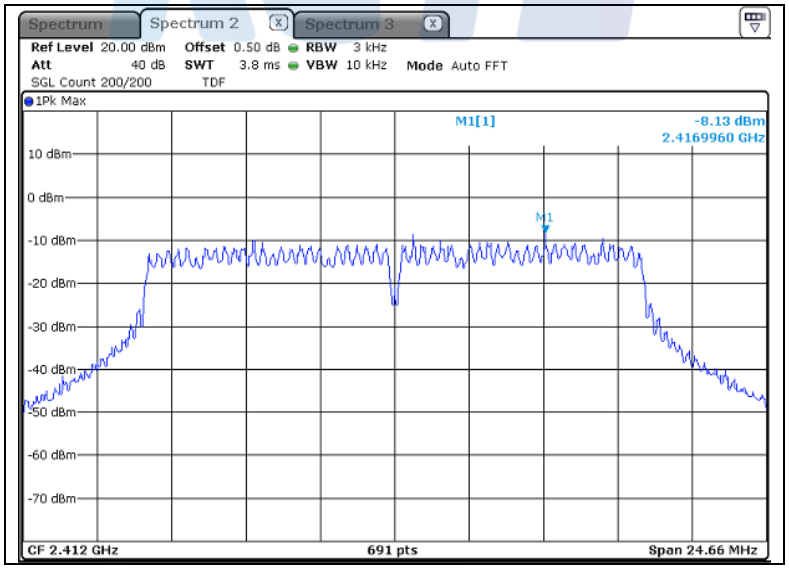


Highest Channel (2 462 ㎒)

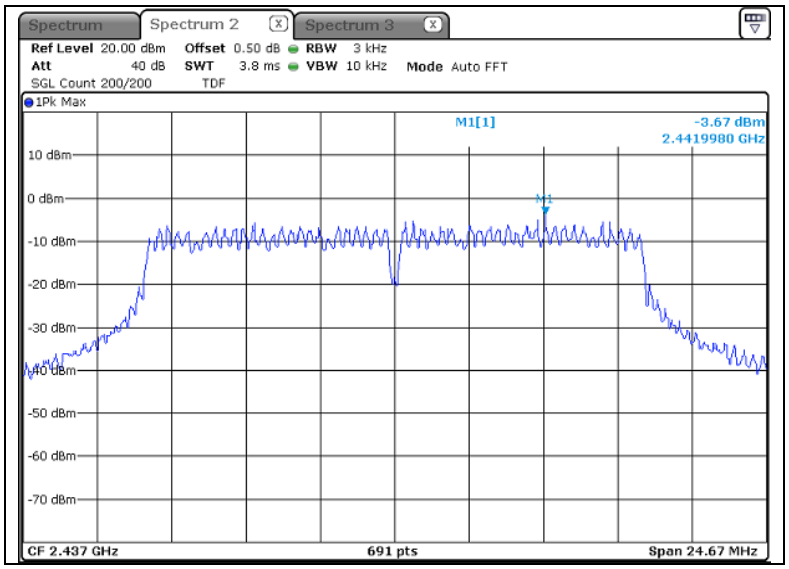


- 802.11g

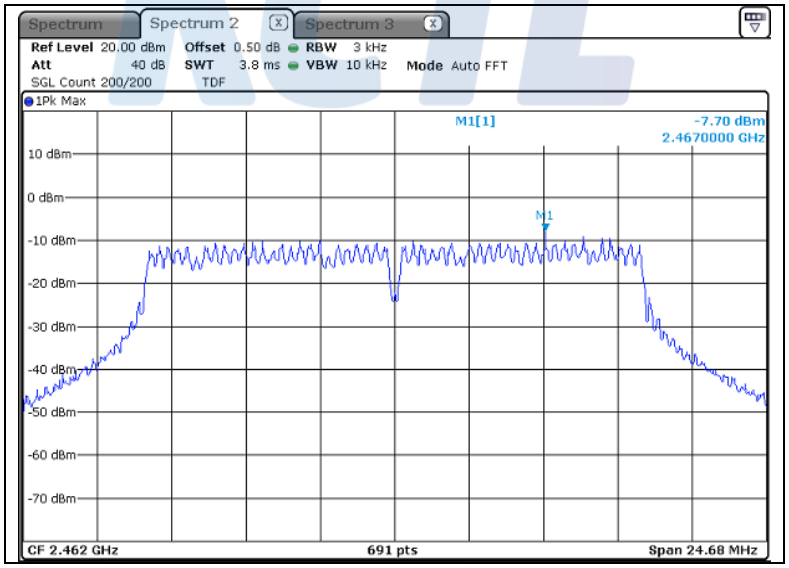
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

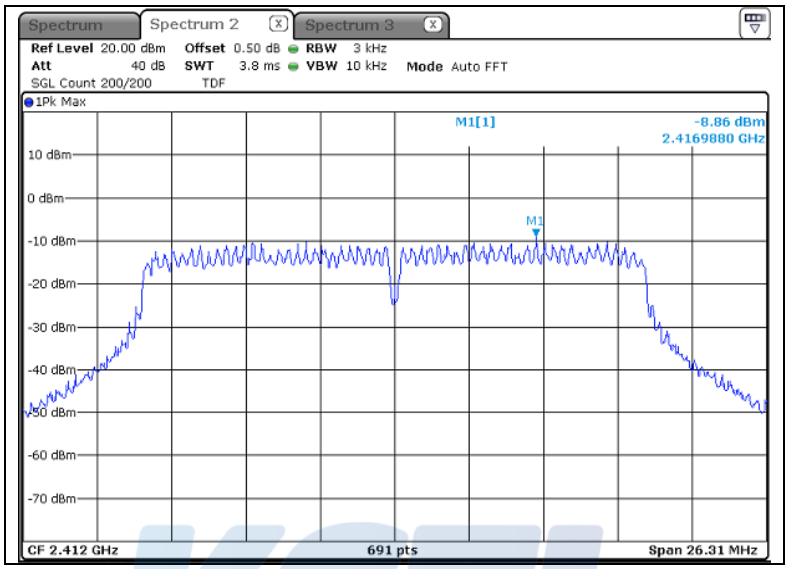


Highest Channel (2 462 ㎒)

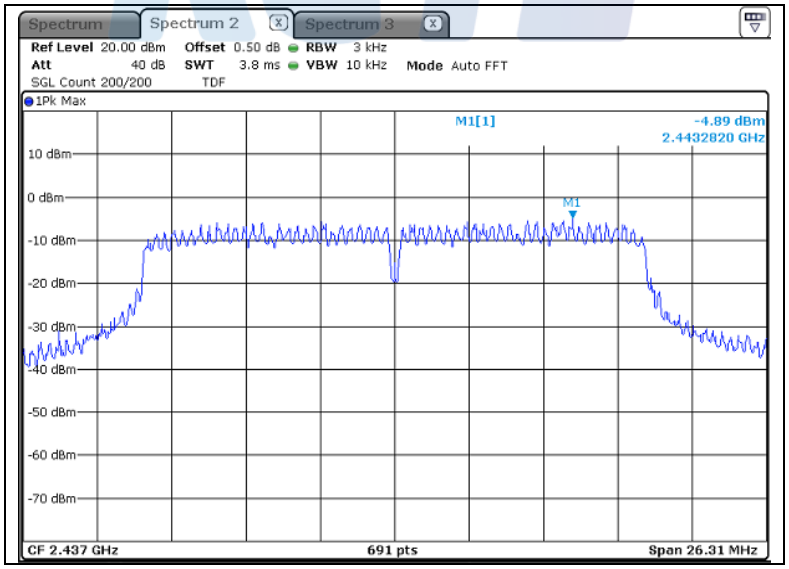


- 802.11n HT20

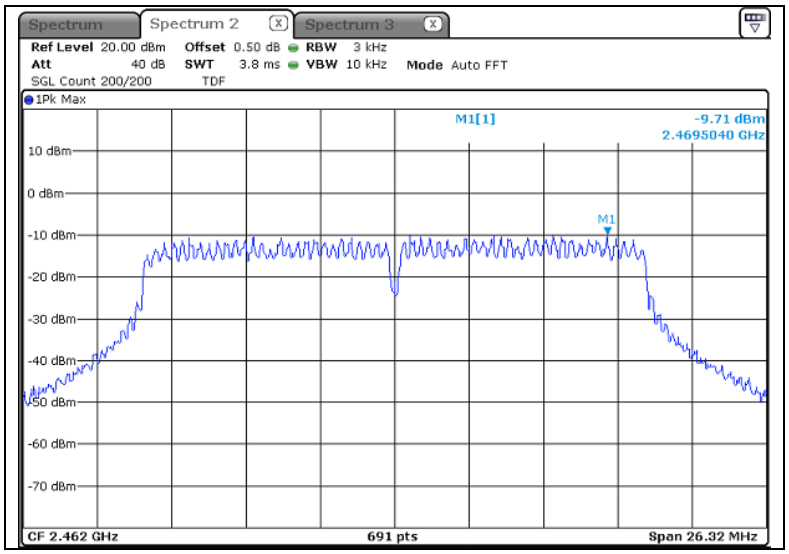
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

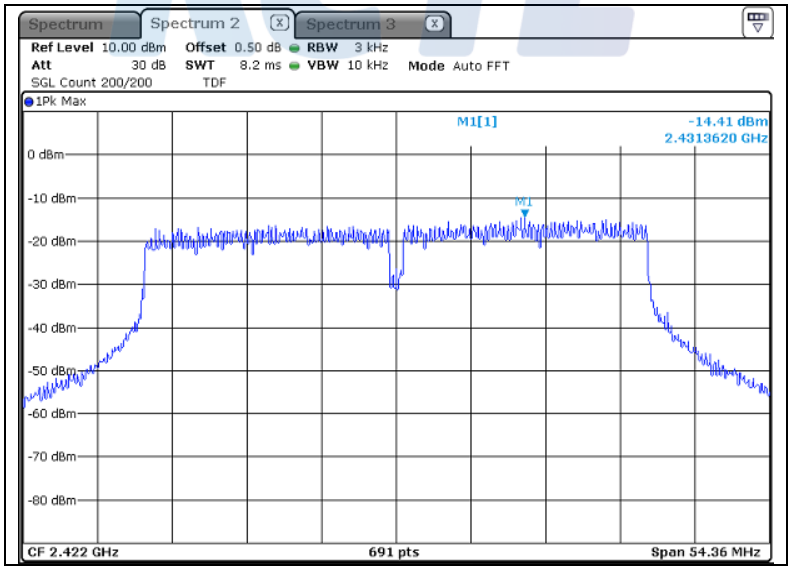


Highest Channel (2 462 ㎒)

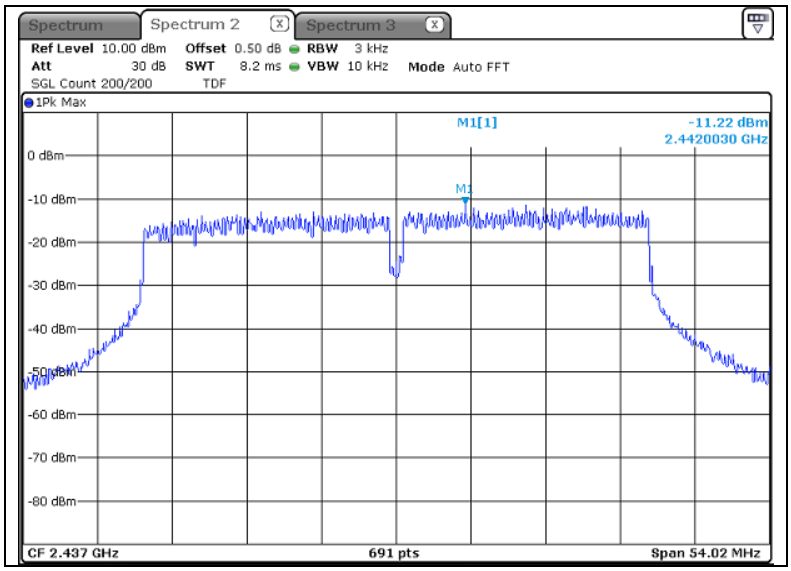


- 802.11n HT40

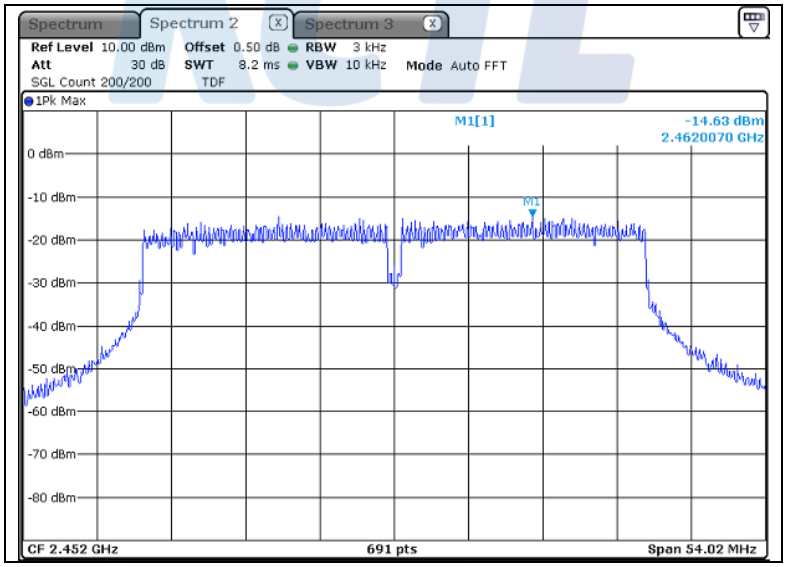
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



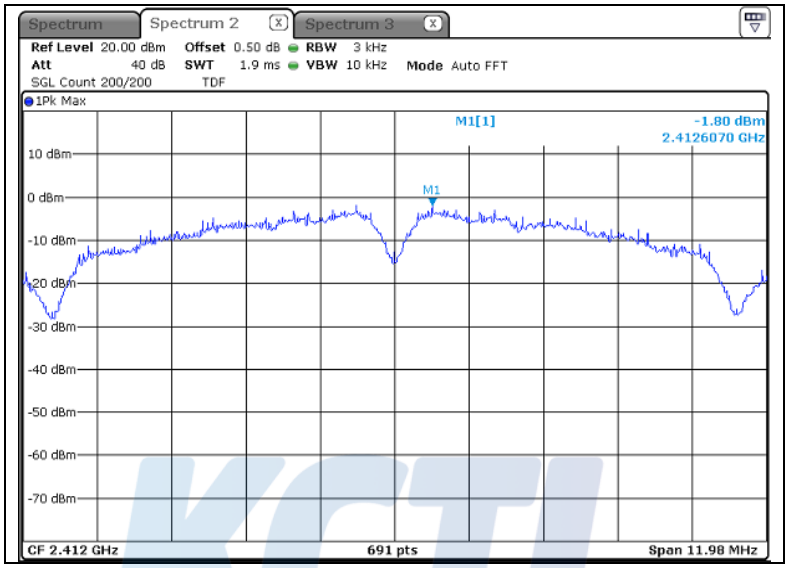
Highest Channel (2 452 ㎒)



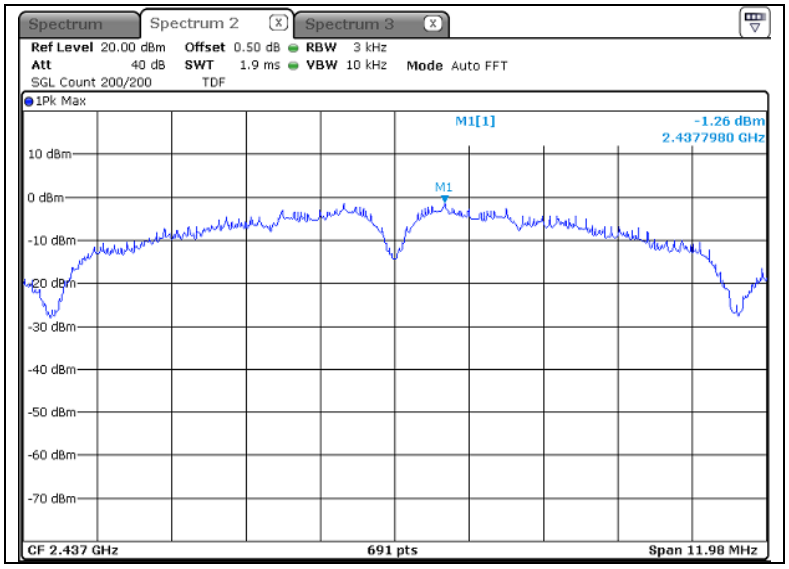
- ANT 1

- 802.11b

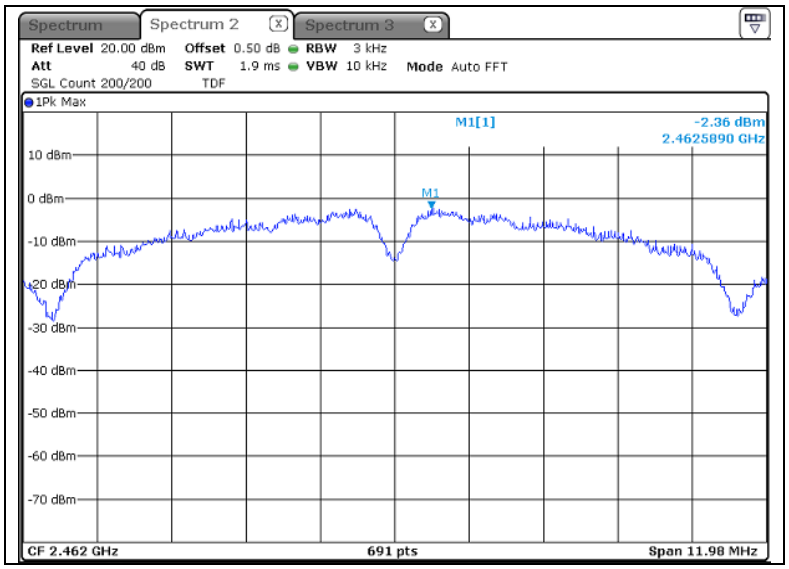
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

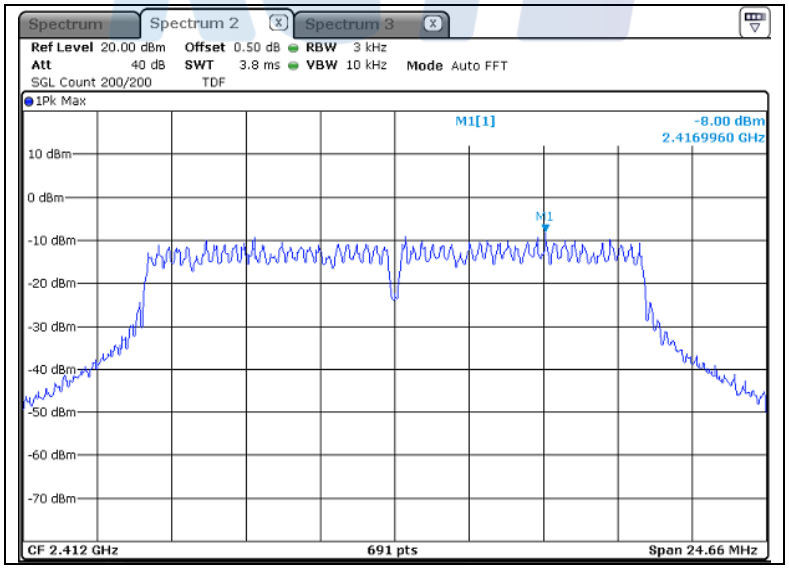


Highest Channel (2 462 ㎒)

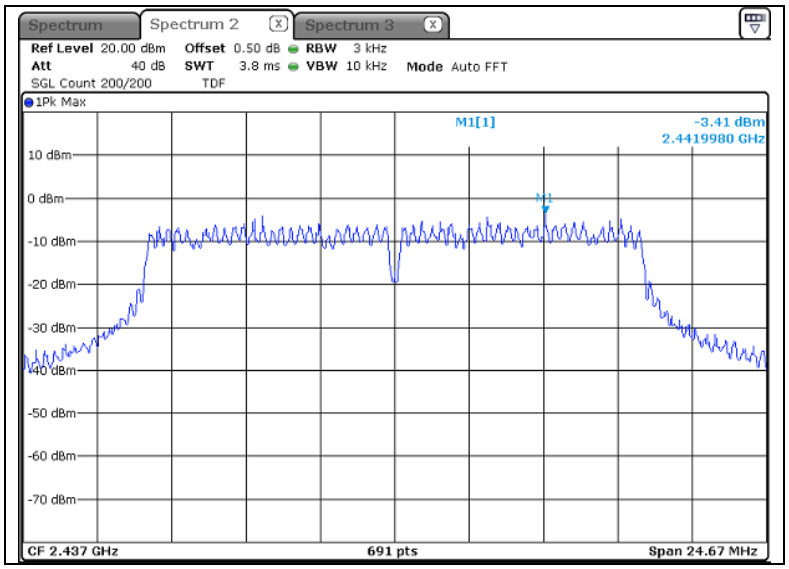


- 802.11g

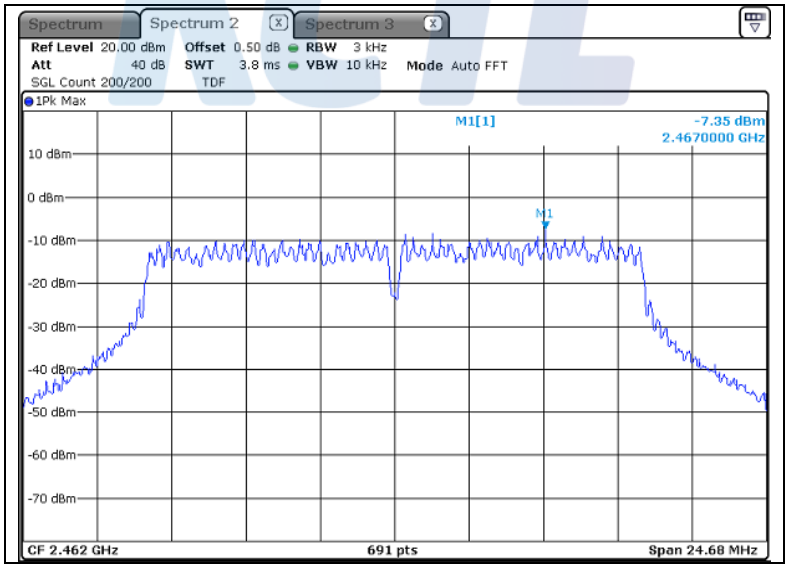
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

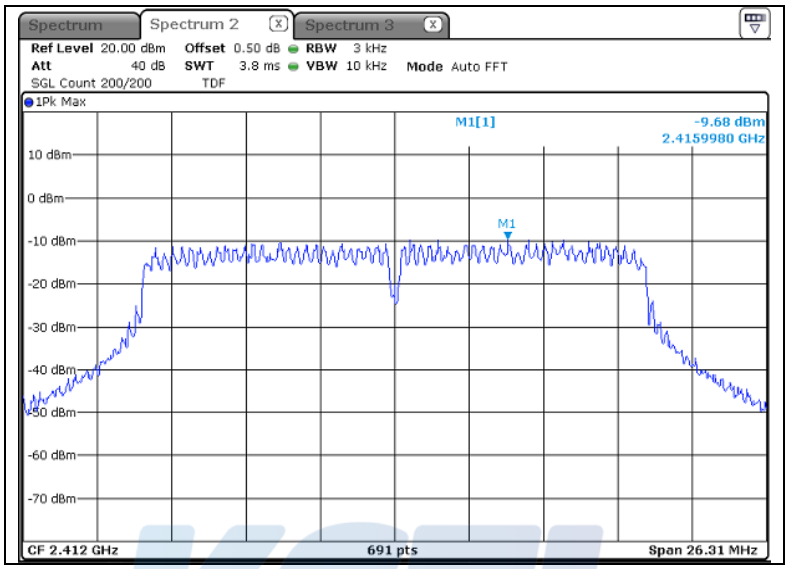


Highest Channel (2 462 ㎒)

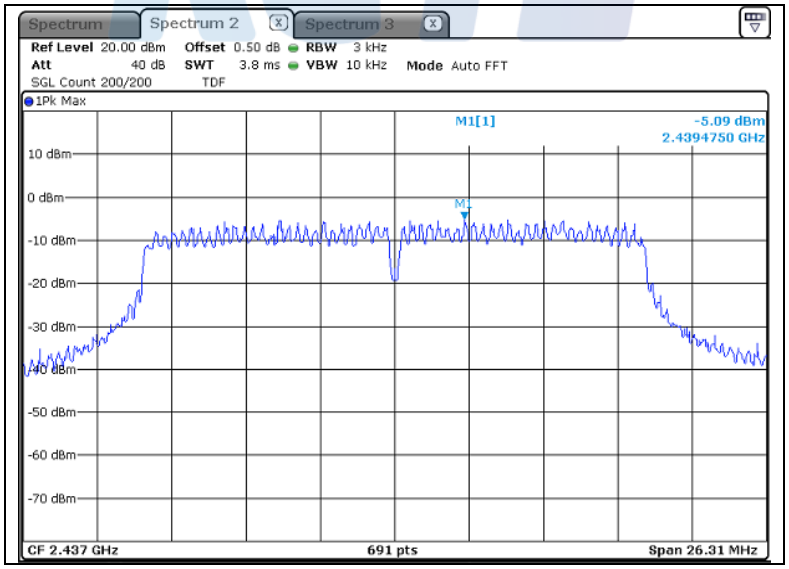


- 802.11n HT20

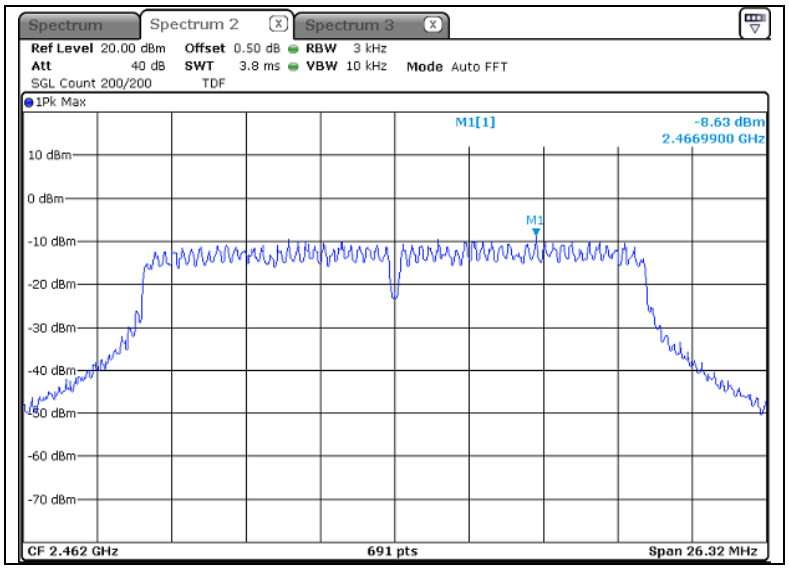
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

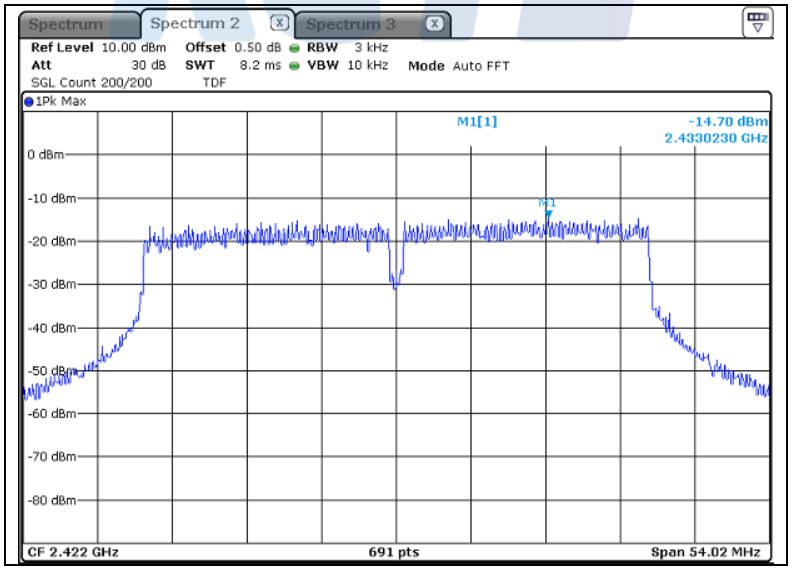


Highest Channel (2 462 ㎒)

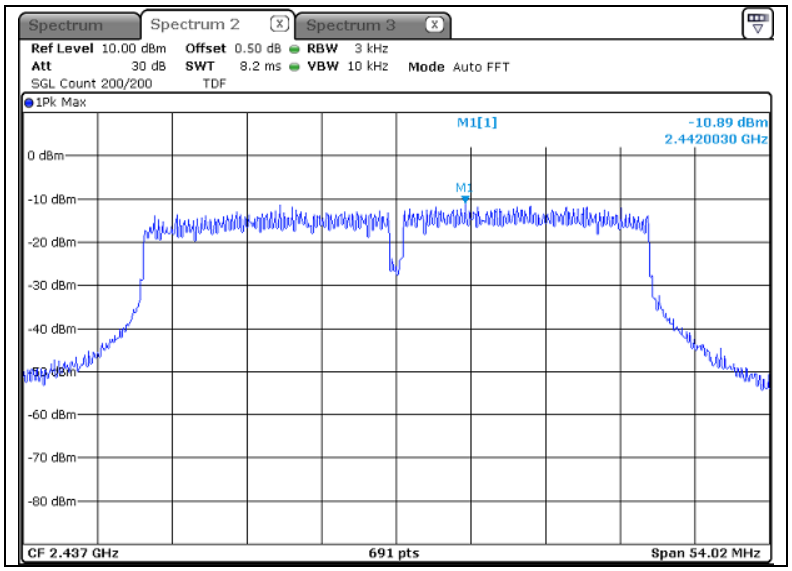


- 802.11n HT40

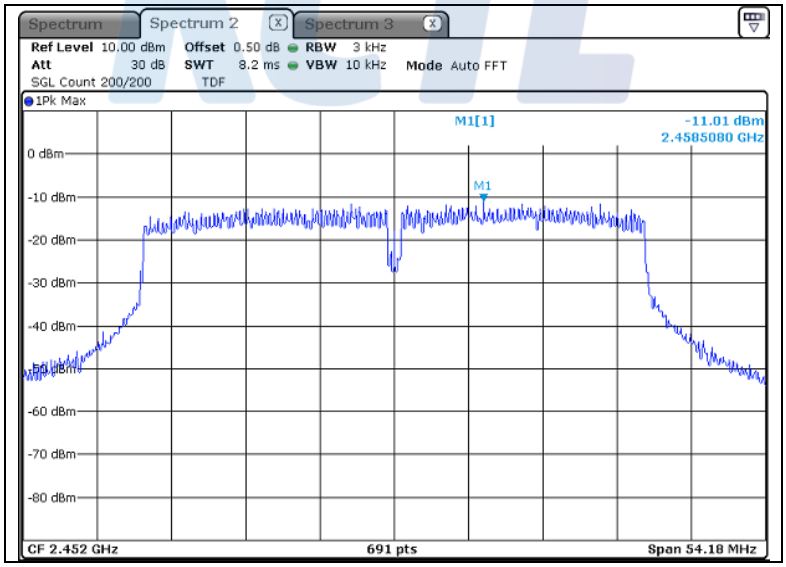
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



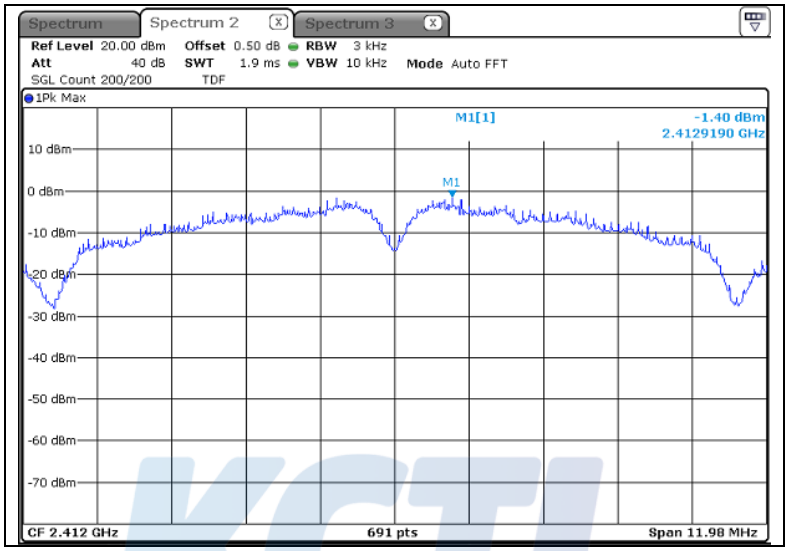
Highest Channel (2 452 ㎒)



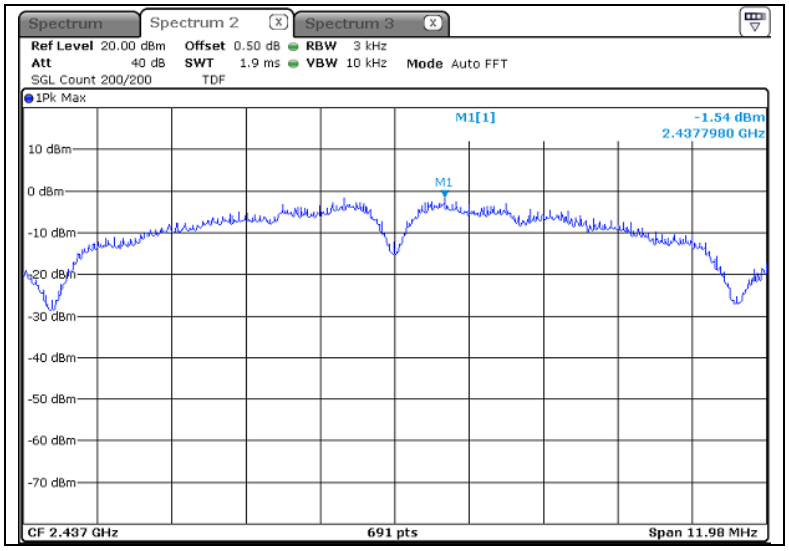
- ANT 2

- 802.11b

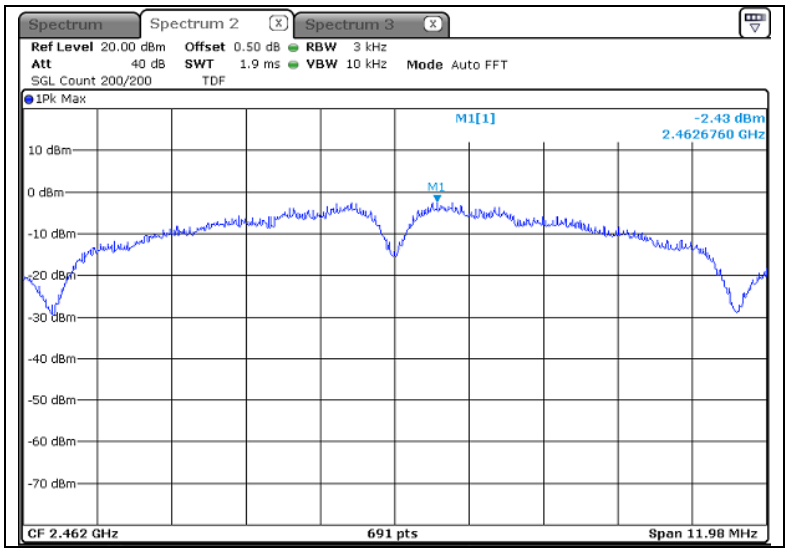
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

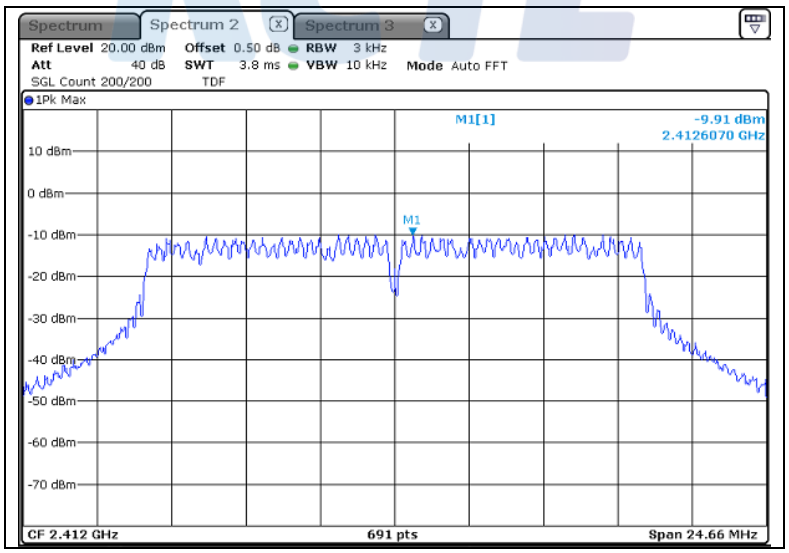


Highest Channel (2 462 ㎒)

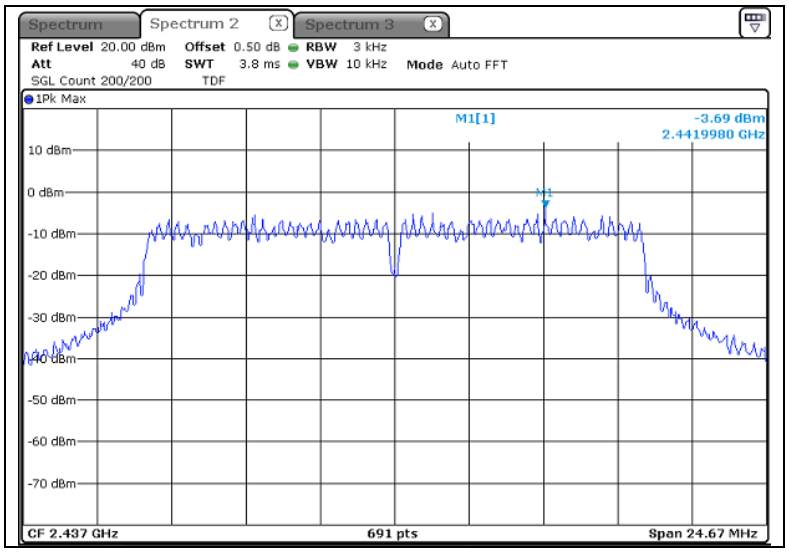


- 802.11g

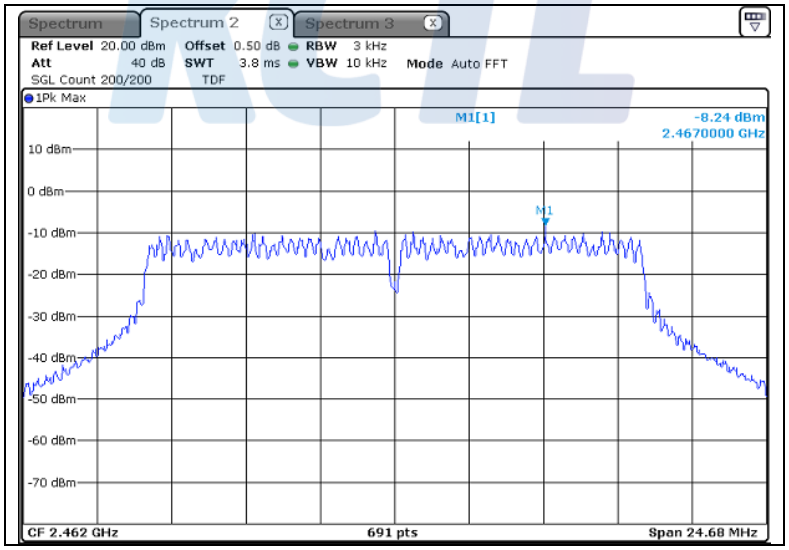
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

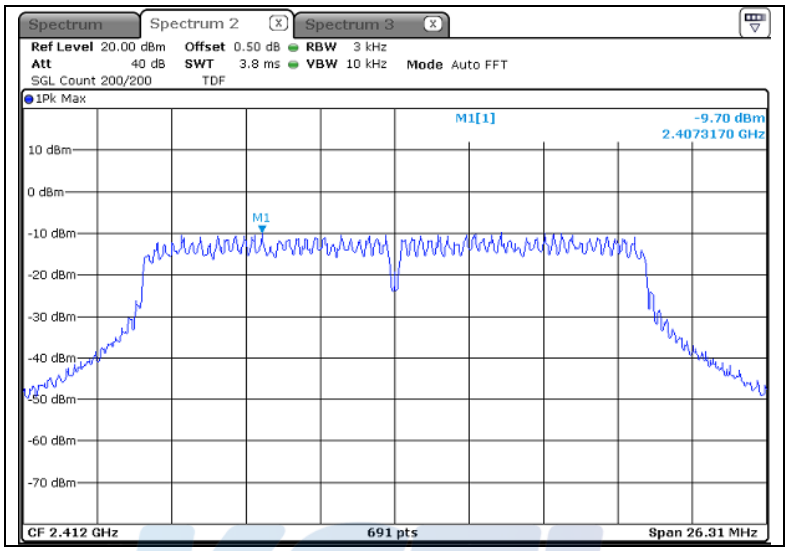


Highest Channel (2 462 ㎒)

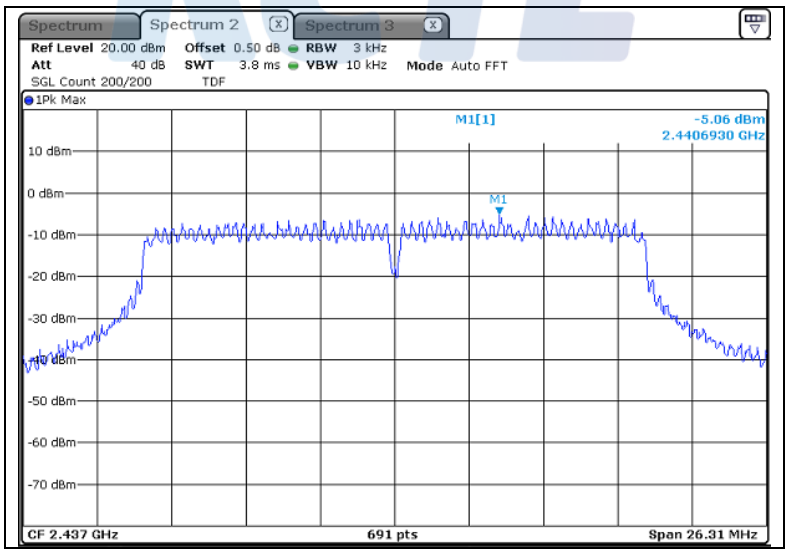


- 802.11n HT20

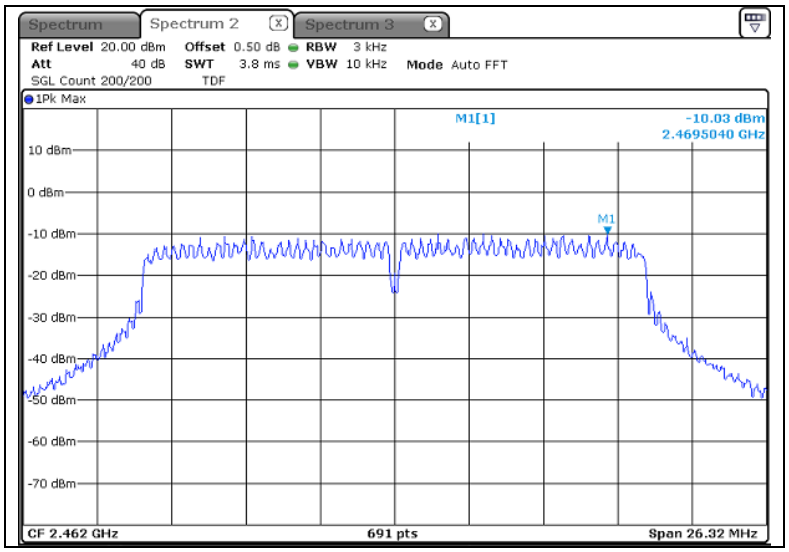
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

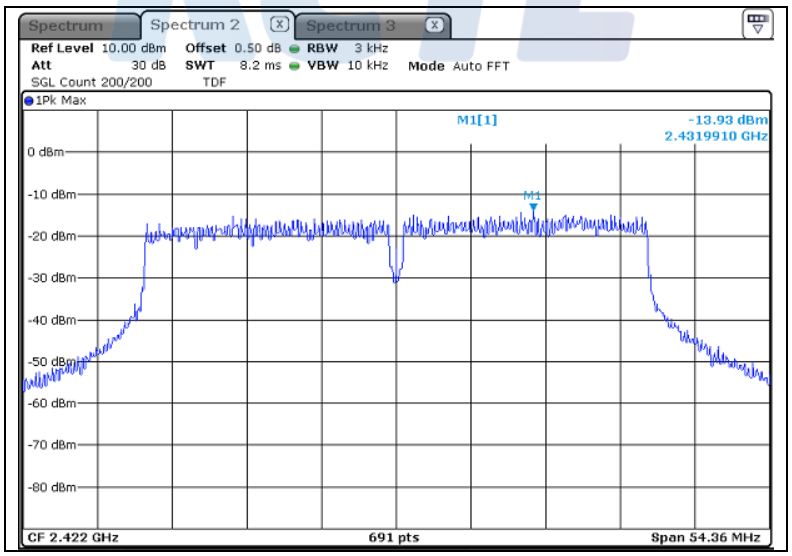


Highest Channel (2 462 ㎒)

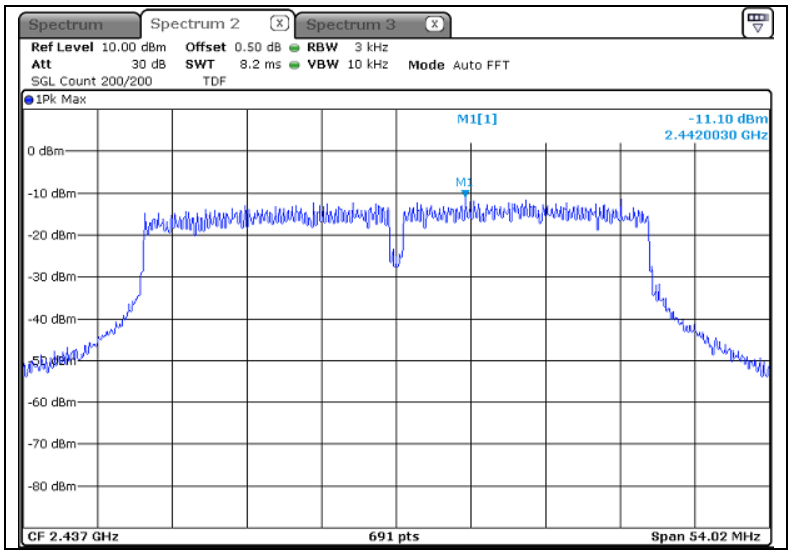


- 802.11n HT40

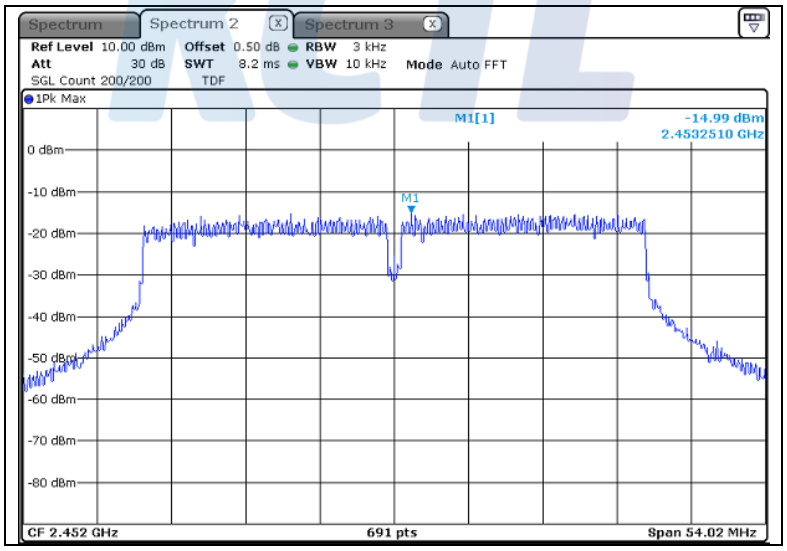
Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



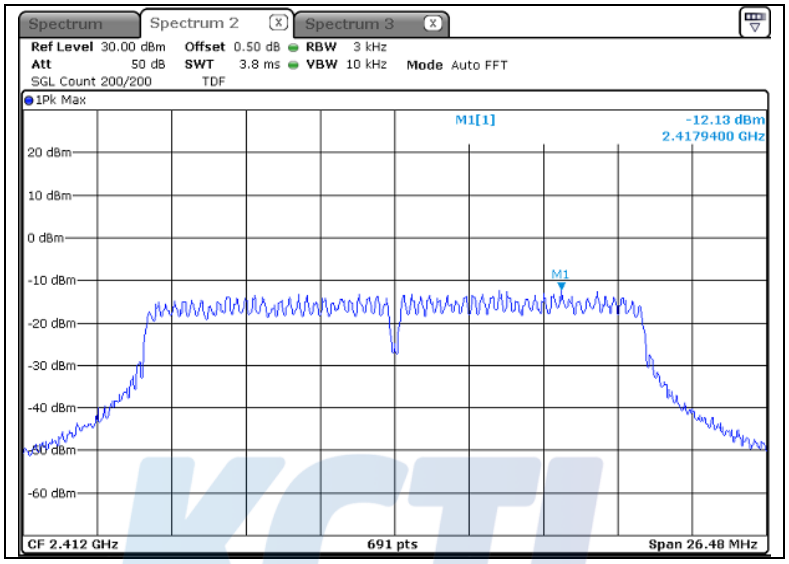
Highest Channel (2 452 ㎒)



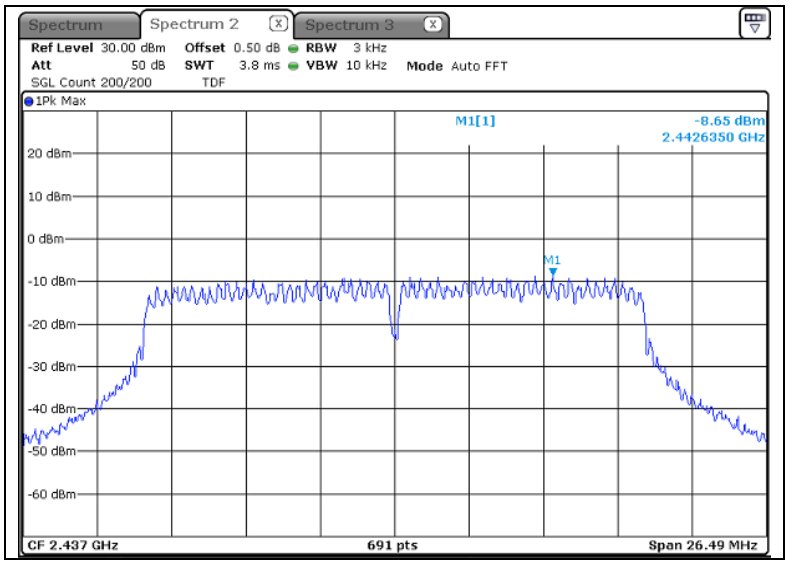
- MIMO 2 Tx (ANT 0)

- 802.11n HT20

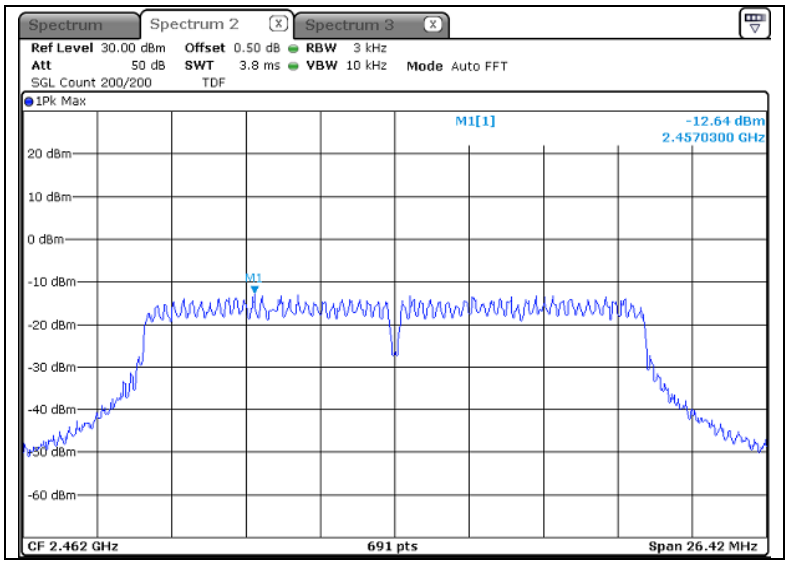
Lowest Channel (2 412 ㎒)



Middle Channel (2 437 ㎒)

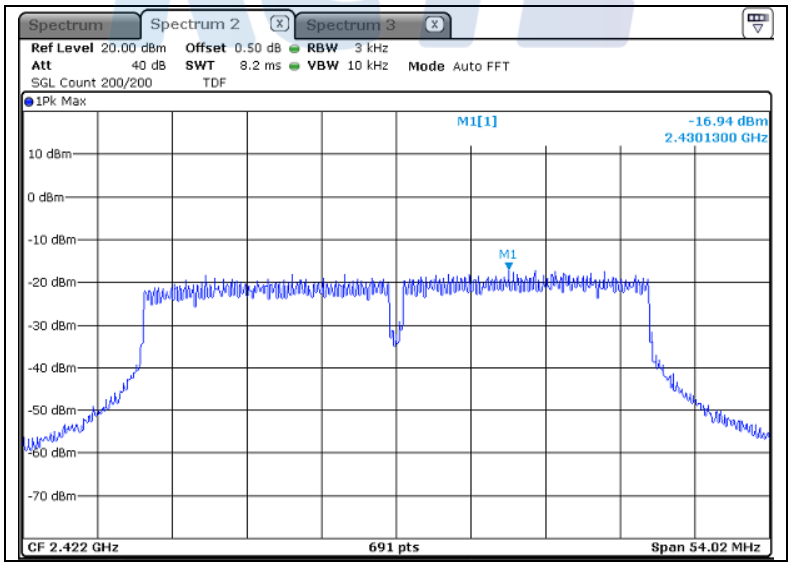


Highest Channel (2 462 ㎒)

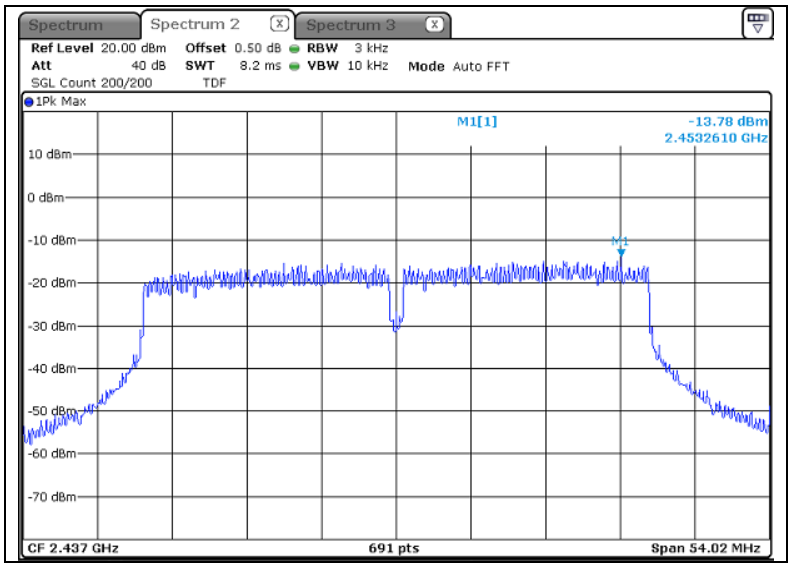
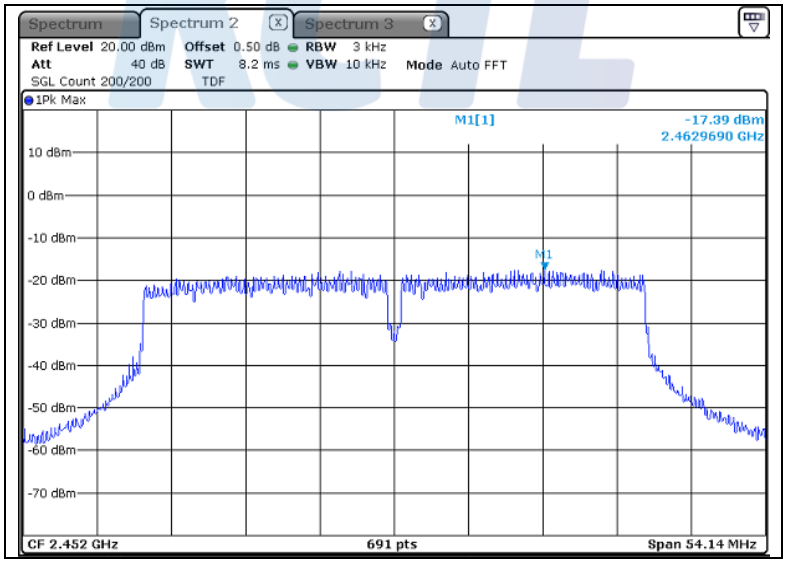


- 802.11n HT40

Lowest Channel (2 422 ㎒)



Middle Channel (2 437 ㎒)



Highest Channel (2 452 ㎒)