TEST REPORT

Part 15 Subpart C 15.247

Equipment under test APM-PRO

Model name APM-PRO

FCC ID XYCAPMPRO

Applicant Aram Huvis Co., LTD.

Manufacturer Aram Huvis Co., LTD.

Date of test(s) 2017.11.09 ~ 2017.11.21

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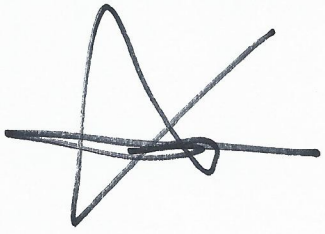	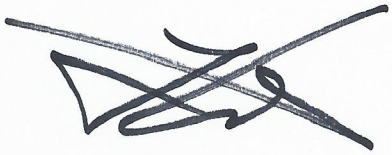
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Revision history

Revision	Date of issue	Test report No.	Description
-	2018.01.03	KES-RF-18T0003	Initial

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1. General information

Applicant:	Aram Huvis Co., LTD.
Applicant address:	Jung-Ja Dong-Rm401-402, Seoul National University Hospital's Health Care Innovation Park, 172, Dolma-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea
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Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC rule part(s):	15.247
FCC ID:	XYCAPMPRO
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	APM-PRO
Frequency range	2 402 ㎒ ~ 2 480 ㎒ (BDR/EDR) 2 402 ㎒ ~ 2 480 ㎒ (LE) 2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20) UNII-1 5 180 ㎒ ~ 5 240 ㎒ (11a/n_HT20) UNII-3 5 745 ㎒ ~ 5 825 ㎒ (11a/n_HT20)
Model:	APM-PRO
Modulation technique	WIFI : DSSS, OFDM BT : GFSK, π/4DQPSK, 8DPSK
Number of channels	2 402 ㎒ ~ 2 480 ㎒ (BDR/EDR) : 79 ch 2 402 ㎒ ~ 2 480 ㎒ (LE) : 40 ch 2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20) : 11 ch 5 180 ㎒ ~ 5 240 ㎒ (11a/n_HT20) : 4 ch 5 745 ㎒ ~ 5 825 ㎒ (11a/n_HT20) : 5 ch
Antenna specification	2.4 ㎓ Antenna type : Chip antenna, Peak gain : 3.44 ㏈i 5 ㎓ Antenna type : Chip antenna, Peak gain(UNII-1) : -1.97 ㏈i Peak gain(UNII-3) : -1.95 ㏈i
Power source	DC 3.7 V (Internal Rechargeable Battery)

1.2. Test configuration

The **Aram Huvis Co., LTD. APM-PRO FCC ID: XYCAPMPRO** was tested per the guidance of KDB 558074 D01 v04, ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

1.3. Device modifications

N/A

1.4. Frequency/channel operations

Ch.	Frequency (㎒)	Mode
01	2412	802.11b/g/n_HT20
. .	. .	. .
06	2437	802.11b/g/n_HT20
. .	. .	. .
11	2462	802.11b/g/n_HT20

1.5. Worst case data rate

1. Radiated emission was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.
2. Worst-case data rates were:
   802.11b: **1 Mbps**
   802.11g: **54 Mbps**
   802.11n_HT20: **MCS7**

1.6. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Smart Cradle	Aram Huvis Co., LTD.	APM-PRO	APM-C-A-AGJE2500106	DC 5 V

1.7. Software and Firmware description

The software and firmware installed in the EUT is version 1.01-02.

1.8. Measurement results explanation example

For all conducted test items

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Offset(㏈) = RF cable loss(㏈) + attenuator factor(㏈).
= 1.05 + 10 = 11.05 (㏈)

1.9. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.62 dB
Uncertainty for Radiation emission test (include Fundamental emission)	9kHz - 30MHz	4.54 dB
	30MHz - 1GHz	4.36 dB
	Above 1GHz	5.00 dB
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

2. Summary of tests

Reference	Parameter	Test results
15.247(a)(2)	6 dB bandwidth	Pass
15.247(b)(3)	Output power	Pass
15.247(e)	Power spectral density	Pass
15.205 15.209	Radiated restricted band and emission	Pass
15.247(d)	Conducted spurious emission and band edge	Pass
15.207(a)	AC conducted emissions	Pass

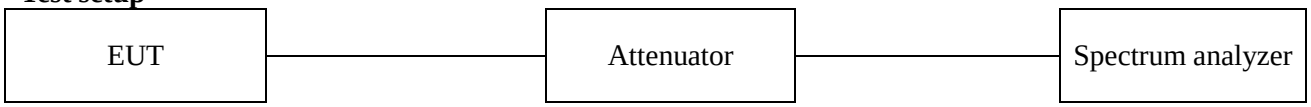
3. Test results

3.1. 6 dB bandwidth

Test procedure

KDB 558074 D01 v04 – Section 8.1 or 8.2
Used test method is section 8.1.

Test setup



Section 8.1

1. RBW = 100 ㎑.
2. VBW ≥ 3 × 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.

Section 8.2

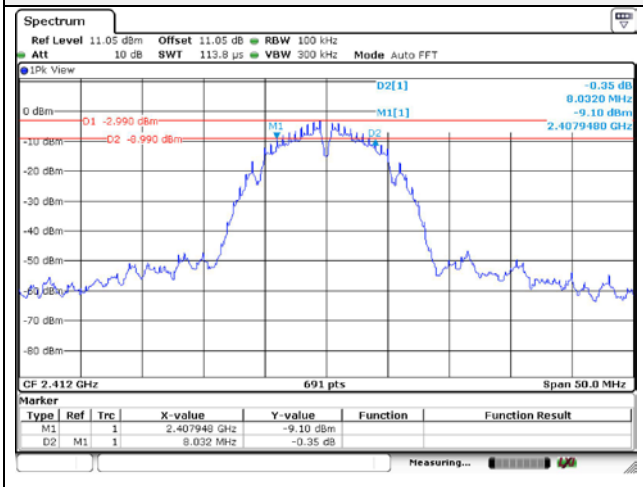
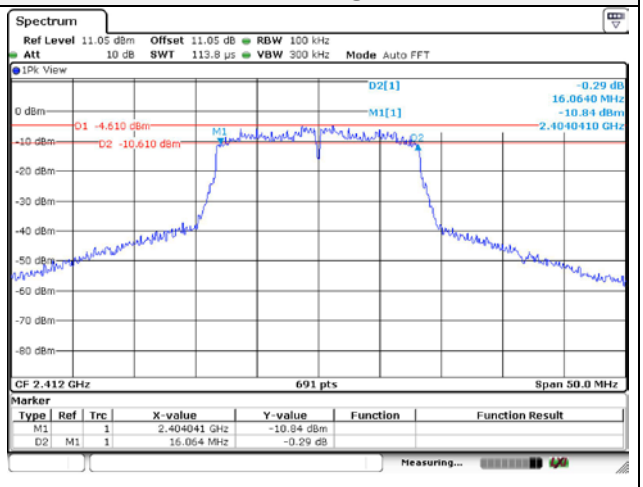
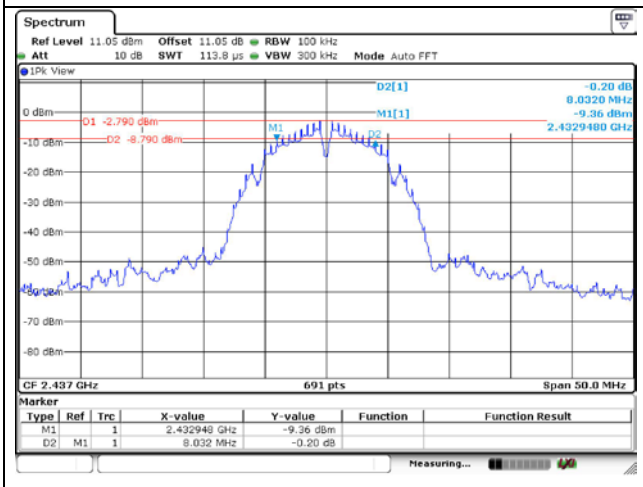
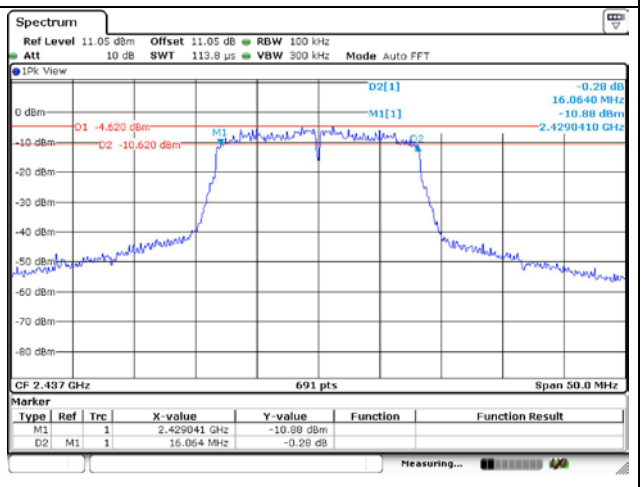
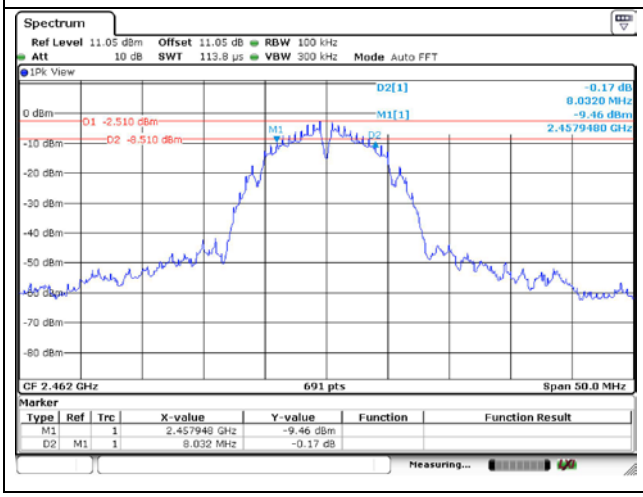
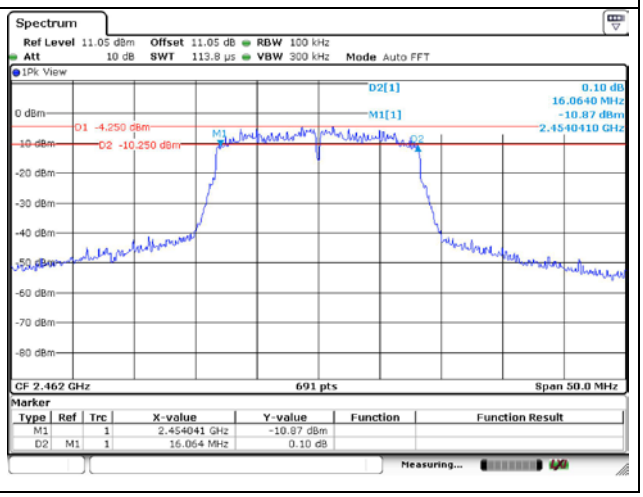
The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 ㏈, if the functionality described above (i.e., RBW = 100 ㎑, VBW ≥ 3 × RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 ㏈.

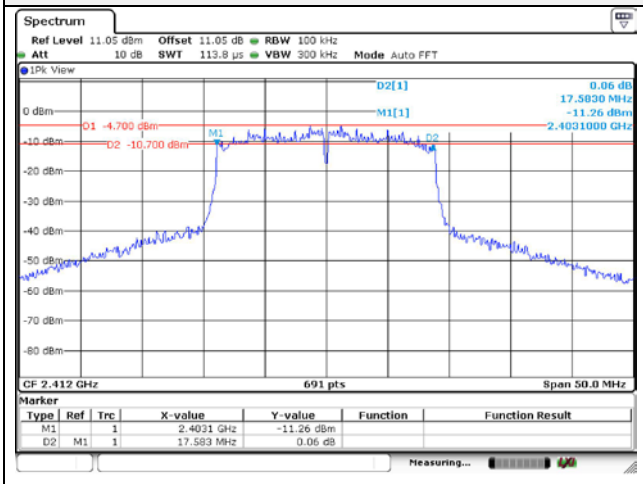
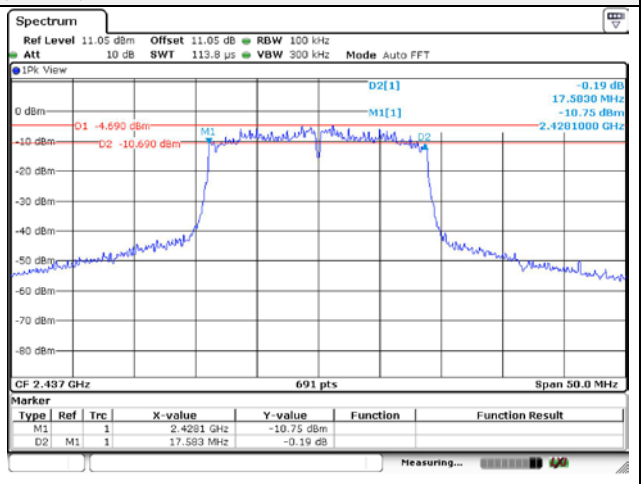
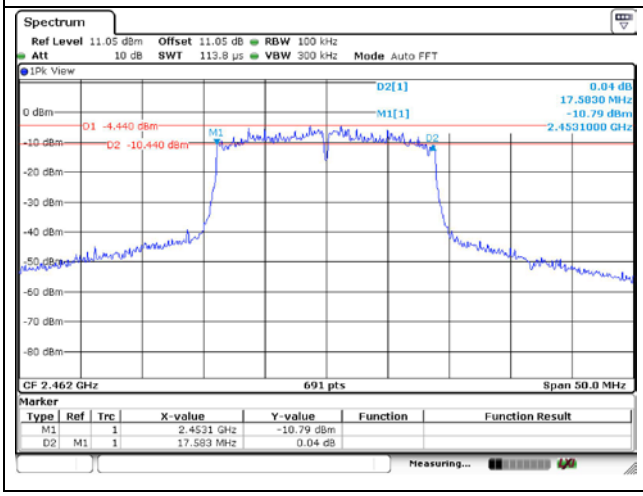
Limit

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

Test results

6 dB bandwidth of 20 ㎒ bandwidth				
Measured 6 dB bandwidth(㎒)				Limit(㎒)
Frequency(㎒)	802.11b	802.11g	802.11n	
2412	8.03	16.06	17.58	0.5
2437	8.03	16.06	17.58	
2462	8.03	16.06	17.58	

802.11b	802.11g
	
	
	

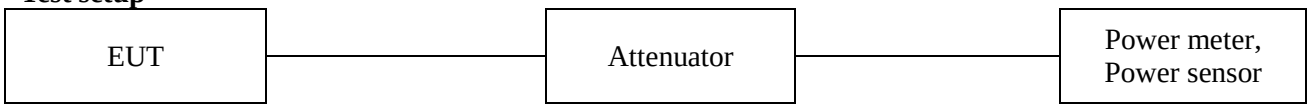
802.11n(HT20)	
	
	Blank

3.2. Output power

Test procedure

KDB 558074 D01 v04 – section 9.1.1 or 9.1.3 and 9.2.3.2
Used test method is section 9.1.3 , 9.2.3.2

Test setup



Section 9.1.1

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is gr eater than the DTS bandwidth.

1. Set the RBW ≥ DTS bandwidth.
2. Set VBW ≥ 3 × RBW.
3. Set span ≥ 3 × RBW
4. Sweep time = auto couple
5. Detector = peak
6. Trace mode = max hold
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level

Section 9.1.3

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 ba ndwidth and shall utilize a fast-responding diode detector.

Section 9.2.3.2

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.

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 out-put power. Maximum Conducted Out-put 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 transmit-ting 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 dB that the directional gain of the antenna exceeds 6 ㏈i.

Test results

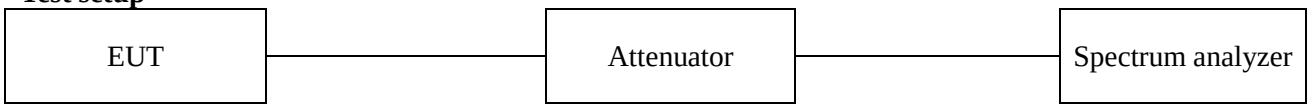
Measured output power (dBm)						
Mode	2412 ㎒		2437 ㎒		2462 ㎒	
	Peak	Average	Peak	Average	Peak	Average
11b	7.67	4.20	7.90	4.42	7.91	4.45
11g	14.69	6.12	15.64	6.20	14.40	6.07
11n_HT 20	14.52	6.02	13.97	6.07	14.20	6.41

3.3. Power spectral density

Test procedure

KDB 558074 D01 v04– section 10.2

Test setup



Section 10.2

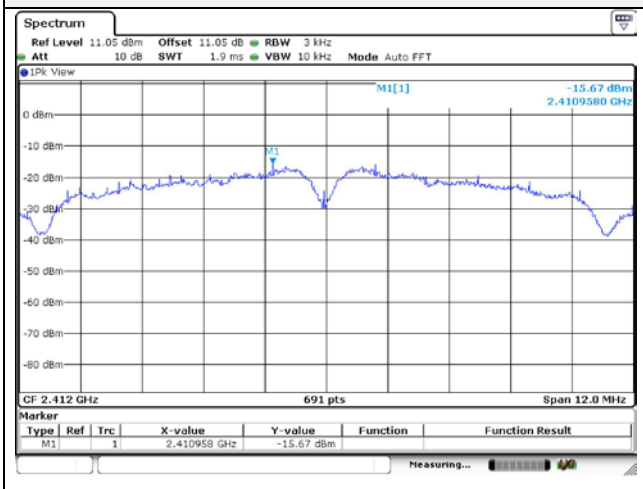
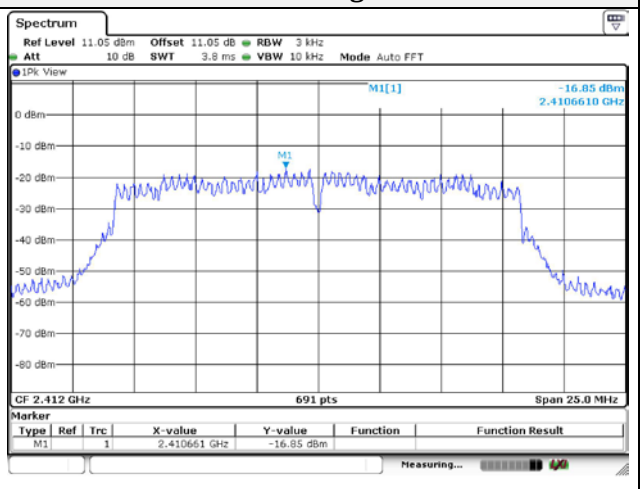
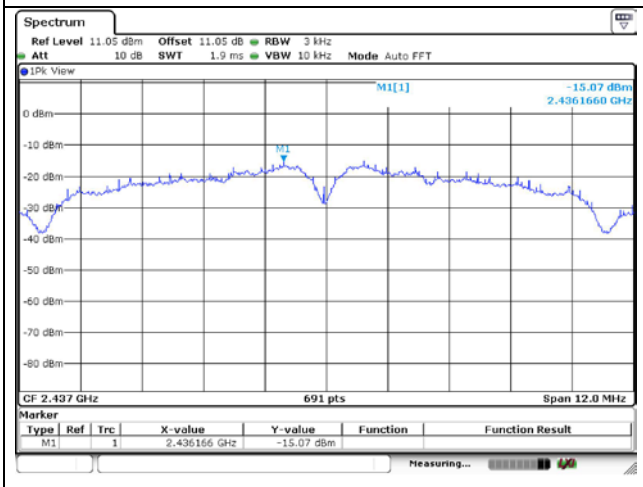
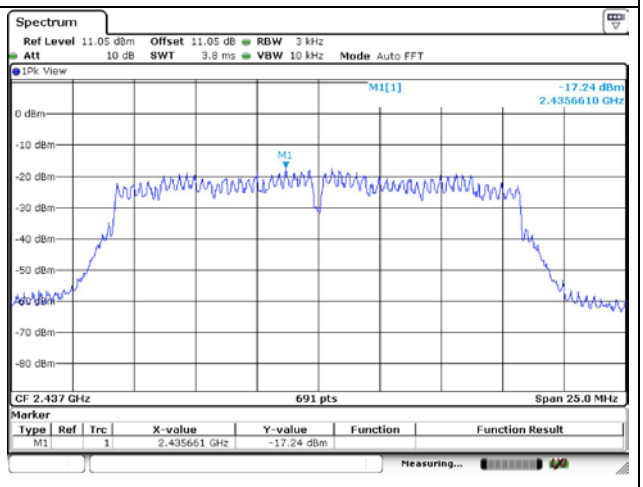
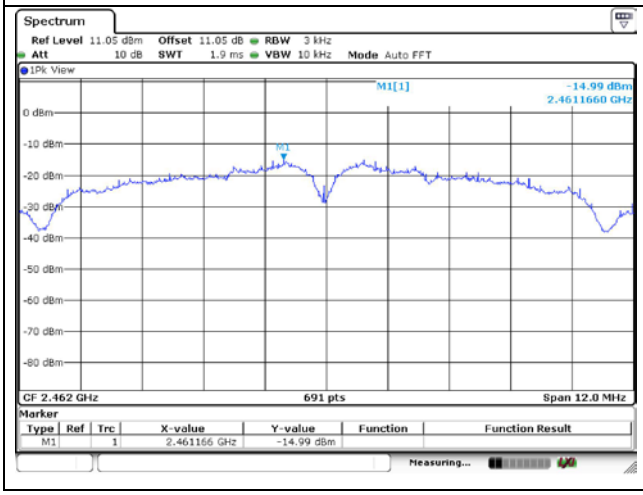
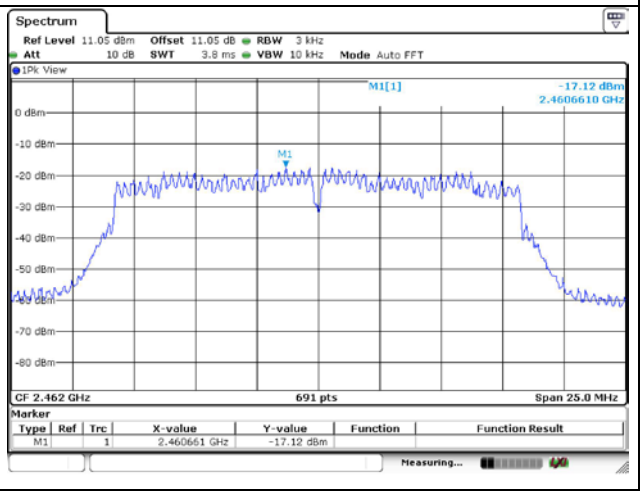
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW : 3 ㎑ ≤ RBW ≤ 100 ㎑
4. Set the VBW ≥ 3 × RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the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

Limit

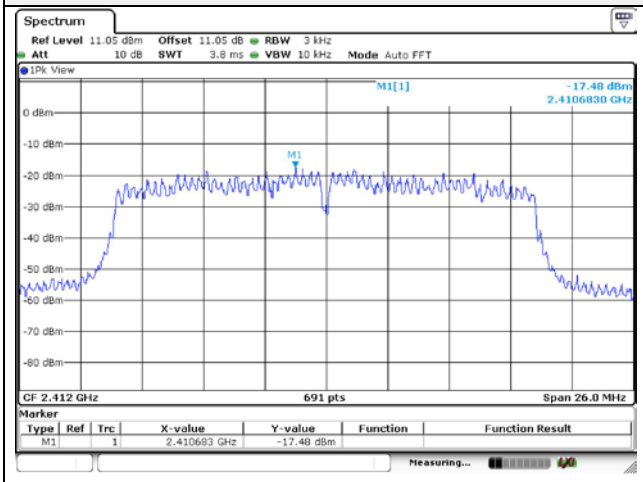
According to §15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 ㏈m in any 3 ㎑ band during any time interval of continuous transmission. This power spectral density shall be determined in accordance 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.

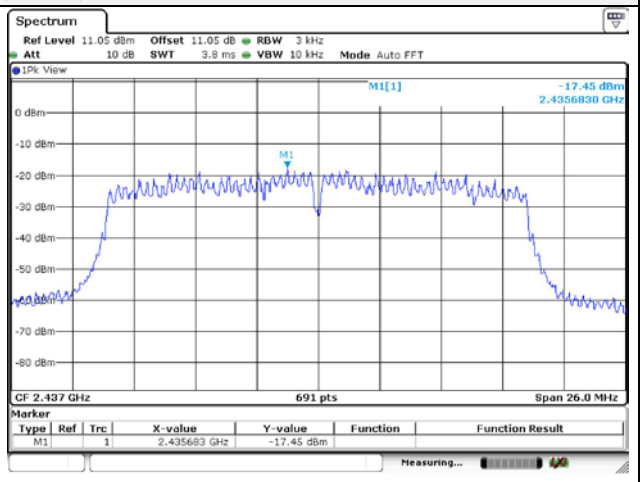
Test results

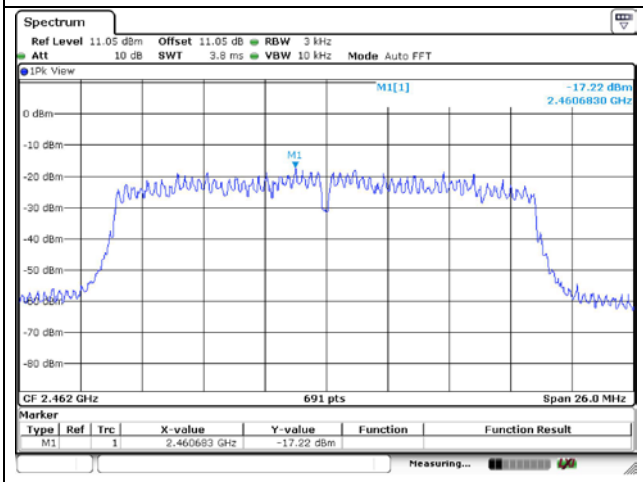
PSD of 20 ㎒ bandwidth				
Measured PDS(dBm/3㎑)				Limit(dBm/3㎑)
Frequency(㎒)	802.11b	802.11g	802.11n	
2412	-15.67	-16.85	-17.48	8
2437	-15.07	-17.24	-17.45	
2462	-14.99	-17.12	-17.22	

802.11b	802.11g
	
	
	

802.11n(HT20)







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