FCC RADIO TEST REPORT

No. 180502775SHA-001

Applicant	:	Qingdao Intelligent&Precise Electronics Co., Ltd No.218, Qianwangang Road, Qingdao Economic&Technological Development Zone, Shandong, China.
Manufacturing site	:	Qingdao Intelligent&Precise Electronics Co., Ltd No.218, Qianwangang Road, Qingdao Economic&Technological Development Zone, Shandong, China.
Product Name	:	Wireless Module
Type/Model	:	ZDGFMT7601U-M
TEST RESULT	**:**	**PASS**

SUMMARY

The equipment complies with the requirements according to the following standard(s) or specification:

47CFR Part 15 (2017): Radio Frequency Devices (Subpart C)

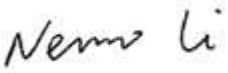
ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

RSS-247 Issue 2 (February 2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen Issue 5 (April 2018): General Requirements for Compliance of Radio Apparatus

Date of issue: June 12, 2018

Prepared by:



Nemo Li (Project engineer)

Reviewed by:

Daniel Zhao (Reviewer)

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Revision History

Issue No.	Version	Description	Date Issued
180502775SHA-001	Rev. 01	Initial issue of report	June 12, 2018

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name	:	Wireless Module
Type/Model	:	ZDGFMT7601U-M
Description of EUT	:	EUT is a Wireless Module with WiFi function, and has only one model.
Rating	:	DC 3.3V
Sample received date	:	May 29, 2018
Date of test	:	May 29, 2018 ~ June 11, 2018

1.2 RF Technical Information

Assigned Frequency Band	:	2400MHz to 2483.5MHz
Operating Frequency	:	802.11b/g/n(HT20): 2412MHz to 2462MHz 802.11n(HT40): 2422MHz to 2452MHz
Type of Modulation	:	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11n(HT20): OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11n(HT40): OFDM (BPSK, QPSK, 16QAM, 64QAM)
Number of Channels	:	802.11b/g/n(HT20): 11 Channels 802.11n(HT40): 9 Channels
Channel Separation	:	5MHz
FCC ID	:	2AJVQ-MT7601U-M
IC	:	22470-MT7601UM

Alternative Antenna List

No.	Model	Antenna Type	Antenna Gain	Note
1	ACG-00113	PIFA	3.22dBi	Antenna 1 and Antenna 2 are the same except the length of the cable. Antenna 2 and Antenna 3 were chosen to do the tests.
2	ACG-00112	PIFA	4.10dBi	
3	MSA-3507-25GC1-A6	PIFA	4.12dBi	

1.3 Description of Test Facility

Name	:	Intertek Testing Services Shanghai
Address	:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone	:	86 21 61278200
Telefax	:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations	:	CNAS Accreditation Lab Registration No. CNAS L0139 FCC Accredited Lab Designation Number: CN1175 IC Registration Lab Registration code No.: 2042B-1 VCCI Registration Lab Registration No.: R-4243, G-845, C-4723, T-2252 NVLAP Accreditation Lab NVLAP LAB CODE: 200849-0 A2LA Accreditation Lab Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2017)
ANSI C63.10 (2013)
KDB 558074 (v04)
RSS-247 Issue 2 (February 2017)
RSS-Gen Issue 5 (April 2018)

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the continuously transmission was applied by following software.

Software name	Manufacturer	Version	Supplied by
QA Tool	-	-	Client

The lowest, middle and highest channel were tested as representatives.

Frequency Band (MHz)	Mode	Lowest (MHz)	Middle (MHz)	Highest (MHz)
2400-2483.5	802.11b	2412	2437	2462
	802.11g	2412	2437	2462
	802.11n(HT20)	2412	2437	2462
	802.11n(HT40)	2422	2437	2452

MIMO Function Description:

Frequency Band (MHz)	Mode	Tx/Rx Function	Beamforming function	CDD function	Note
2400-2483.5	802.11b	1TX/1RX	NO	NO	-
	802.11g	1TX/1RX	NO	NO	-
	802.11n(HT20)	1TX/1RX	NO	NO	-
	802.11n(HT40)	1TX/1RX	NO	NO	-

After this pre-scan, the following data rata was chosen to do the test as the worst case.

Frequency Band (MHz)	Mode	Worst case data rate
2400-2483.5	802.11b	1Mbps
	802.11g	6Mbps
	802.11n(HT20)	MCS0
	802.11n(HT40)	MCS0

2.3 Test environment condition:

Temperature:	22-24°C
Humidity:	54-60% RH
Atmospheric Pressure:	101-102kPa

2.4 Test peripherals used

Item No	Description	Manufacturer	Model No.	Serial Number
1	Laptop computer	HP	5480	-

2.5 Test software list:

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.6 Instrument list

Conducted Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESCS 30	EC 2107	2018-09-12
☒	A.M.N.	R&S	ESH2-Z5	EC 3119	2018-12-01
☐	A.M.N.	R&S	ENV 216	EC 3393	2018-07-30
Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESIB 26	EC 3045	2018-09-12
☒	Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2019-05-30
☒	Horn antenna	R&S	HF 906	EC 3049	2018-09-23
☒	Horn antenna	ETS	3117	EC 4792-1	2018-08-24
☒	Horn antenna	TOYO	HAP18-26W	EC 4792-3	2020-07-09
☒	Pre-amplifier	R&S	Pre-amp 18	EC5881	2018-06-19
☒	Active loop antenna	Schwarzbeck	FMZB1519	EC 5345	2019-01-25
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	PXA Signal Analyzer	Keysight	N9030A	EC 5338	2018-09-10
☐	Power sensor/ Power meter	Agilent	N1911A/ N1921A	EC4318	2019-05-12
☐	Test Receiver	R&S	ESCI 7	EC 4501	2018-09-12
Tet Site					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☐	Shielded room	Zhongyu	-	EC 2838	2019-01-07
☒	Semi-anechoic chamber	Albatross project	-	EC 3048	2018-09-15
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☐	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3323	2018-06-14
☐	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3324	2019-04-15
☒	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3325	2019-03-28
☒	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3326	2019-03-28
☒	Pressure meter	YM3	Shanghai Mengde	EC 3320	2018-06-28

2.7 Measurement Uncertainty

Test Items	Expanded Uncertainty (k=2) (±)
Maximum conducted output power	0.74dB
Radiated Emissions in restricted frequency bands below 1GHz	4.90dB
Radiated Emissions in restricted frequency bands above 1GHz	5.02dB
Emission outside the frequency band	2.89dB
Power line conducted emission	3.19dB

2.8 Test Summary

This report applies to tested sample only. The test results have been compared directly with the limits, and the measurement uncertainty is recorded. This report shall not be reproduced in part without written approval of Intertek Testing Services Shanghai.

TEST ITEM	FCC REFERANCE	IC REFERANCE	RESULT
Minimum 6dB bandwidth	15.247(a)(2)	RSS-247 Issue 2 Clause 5.2	Pass
Maximum conducted output power and e.i.r.p.	15.247(b)	RSS-247 Issue 2 Clause 5.4	Pass
Power Spectrum density	15.247(e)	RSS-247 Issue 2 Clause 5.2	Pass
Emission outside the frequency band	15.247(d)	RSS-247 Issue 2 Clause 5.5	Pass
Radiated Emissions in restricted frequency bands	15.205 & 15.209	RSS-Gen Issue 5 Clause 8.9 & 8.10	Pass
Power line conducted emission	15.207	RSS-Gen Issue 5 Clause 8.8	NA
Antenna requirement	15.203	-	Pass
Occupied bandwidth	-	RSS-Gen Issue 5 Clause 6.7	Tested

Notes: 1: NA =Not Applicable

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3 Minimum 6dB bandwidth

Test result: Pass

3.1 Limit

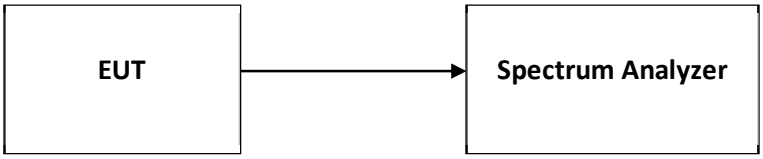
For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Measurement Procedure

The minimum 6dB bandwidth per FCC §15.247(a)(2) is measured using the Spectrum Analyzer according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" for compliance to FCC 47CFR 15.247 requirements (clause 8.2).

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

3.3 Test Configuration



3.4 Test Results of Minimum 6dB bandwidth

Please refer to Appendix A

4 Maximum conducted output power and e.i.r.p.

Test result: Pass

4.1 Limit

☐ For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt

☐ For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

☒ For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 W. (The e.i.r.p. shall not exceed 4 W)

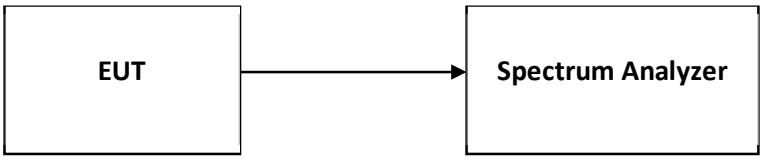
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 30dBm and 30+ (6 –antenna gain-beam forming gain).

4.2 Measurement Procedure

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” for compliance to FCC 47CFR 15.247 requirements (clause 9.2.2.4).

a) Measure the duty cycle, x, of the transmitter output signal as described in Section 6.0.
b) Set span to at least 1.5 x OBW.
c) Set RBW = 1 % to 5 % of the OBW, not to exceed 1 MHz.
d) Set VBW ≥ 3 x RBW.
e) Number of points in sweep ≥ 2 x 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 dB if the duty cycle is 25 %.

4.3 Test Configuration



4.4 Test Results of Maximum conducted output power

Please refer to Appendix A

5 Power spectrum density

Test result: **Pass**

5.1 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 8dBm/MHz and 8+ (6 –antenna gain-beam forming gain).

5.2 Measurement Procedure

The power output per FCC §15.247(e) was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 10.5) for compliance to FCC 47CFR 15.247 requirements.

This procedure is applicable when the EUT cannot be configured to transmit continuously (i.e., duty cycle < 98 %), and when sweep triggering/signal gating cannot be used to measure only when the EUT is transmitting at its maximum power control level, and when the transmission duty cycle is constant (i.e., duty cycle variations are less than ± 2 %):

a) Measure the duty cycle (x) of the transmitter output signal as described in Section 6.0.

b) Set instrument center frequency to DTS channel center frequency.

c) Set span to at least 1.5 x OBW.

d) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

e) Set VBW ≥3 x RBW.

f) Detector = power averaging (RMS) or sample detector (when RMS not available).

g) Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.

h) Sweep time = auto couple.

i) Do not use sweep triggering. Allow sweep to "free run".

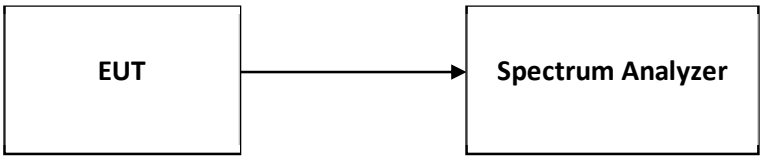
j) Employ trace averaging (RMS) mode over a minimum of 100 traces.

k) Use the peak marker function to determine the maximum amplitude level.

l) Add 10 log (1/x), where x is the duty cycle measured in step (a, to the measured PSD to compute the average PSD during the actual transmission time.

m) If resultant value exceeds the limit, then reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

5.3 Test Configuration



5.4 Test Results of Power spectrum density

Please refer to Appendix A

6 Emission outside the frequency band

Test result: **Pass**

6.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

6.2 Measurement Procedure

The EUT was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

Reference level measurement

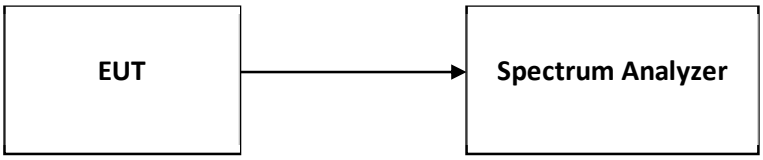
Establish a reference level by using the following procedure:
a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 times the DTS bandwidth.
c) Set the RBW = 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum PSD level.

Emission level measurement

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ 3 x RBW.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

6.3 Test Configuration



6.4 The results of Emission outside the frequency band

Please refer to Appendix A

7 Radiated Emissions in restricted frequency bands

Test result: **Pass**

7.1 Limit

The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

7.2 Measurement Procedure

For Radiated emission below 30MHz:

a) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c) Both X and Y axes of the antenna are set to make the measurement.

d) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e) The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz:

a) The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c) The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

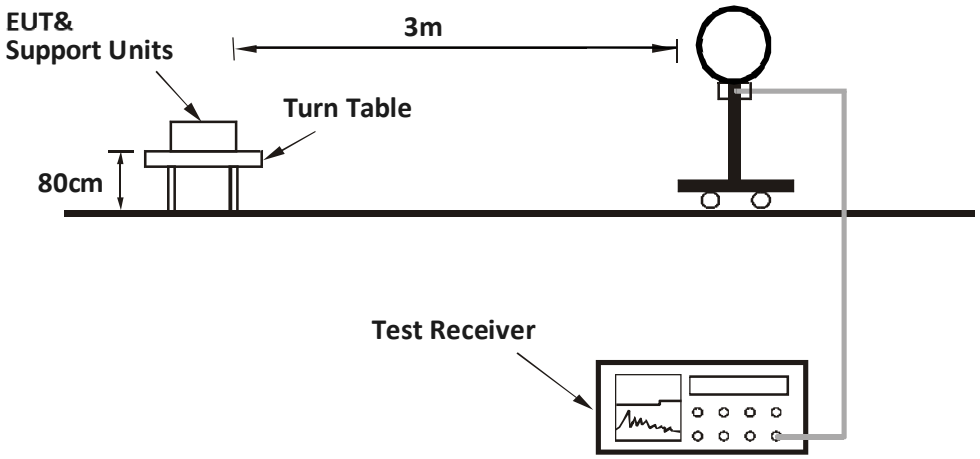
f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

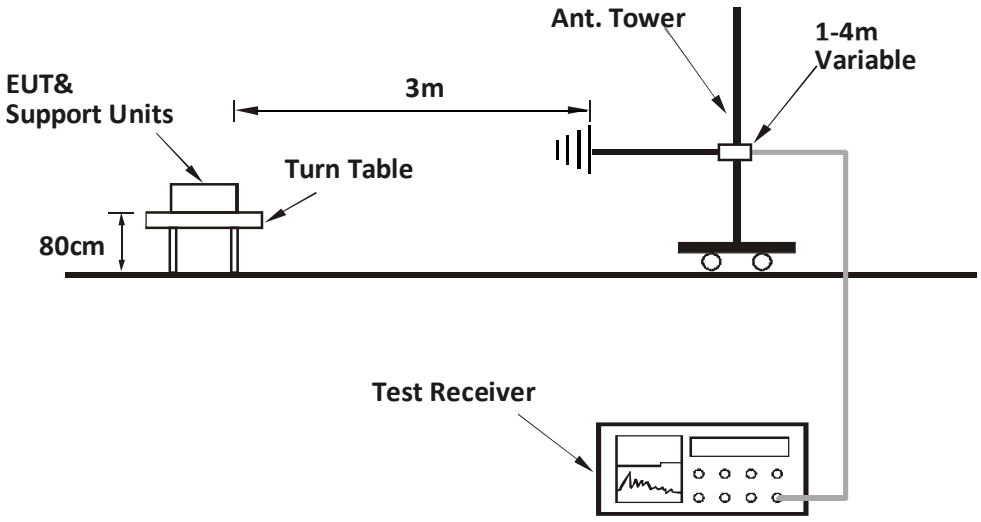
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 3 x RBW (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported

7.3 Test Configuration

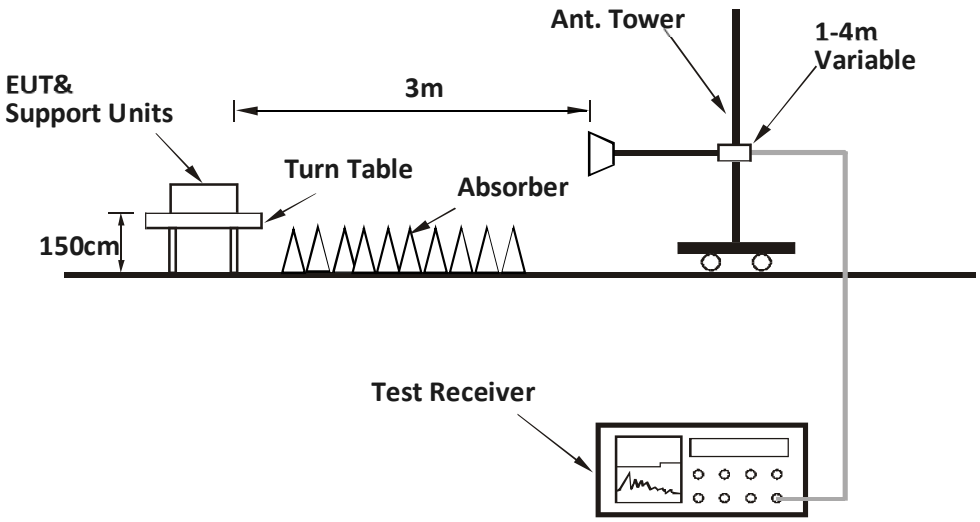
For Radiated emission below 30MHz:



For Radiated emission 30MHz to 1GHz:



For Radiated emission above 1GHz:

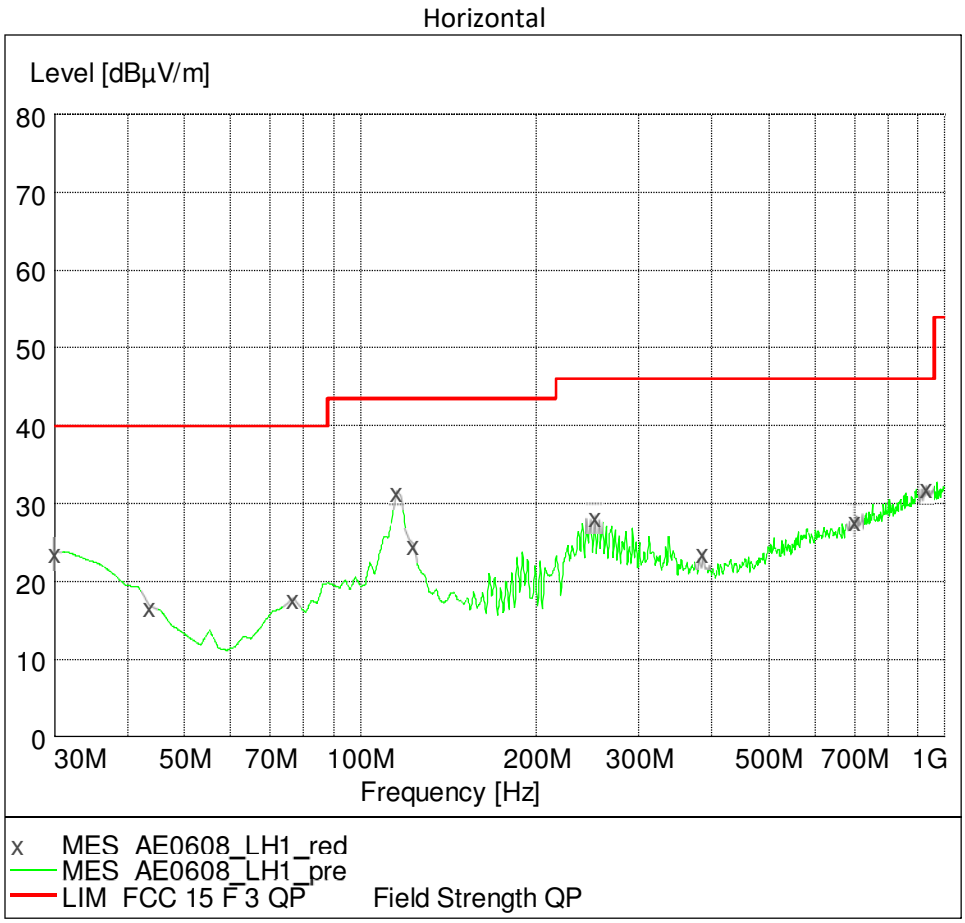


7.4 Test Results of Radiated Emissions

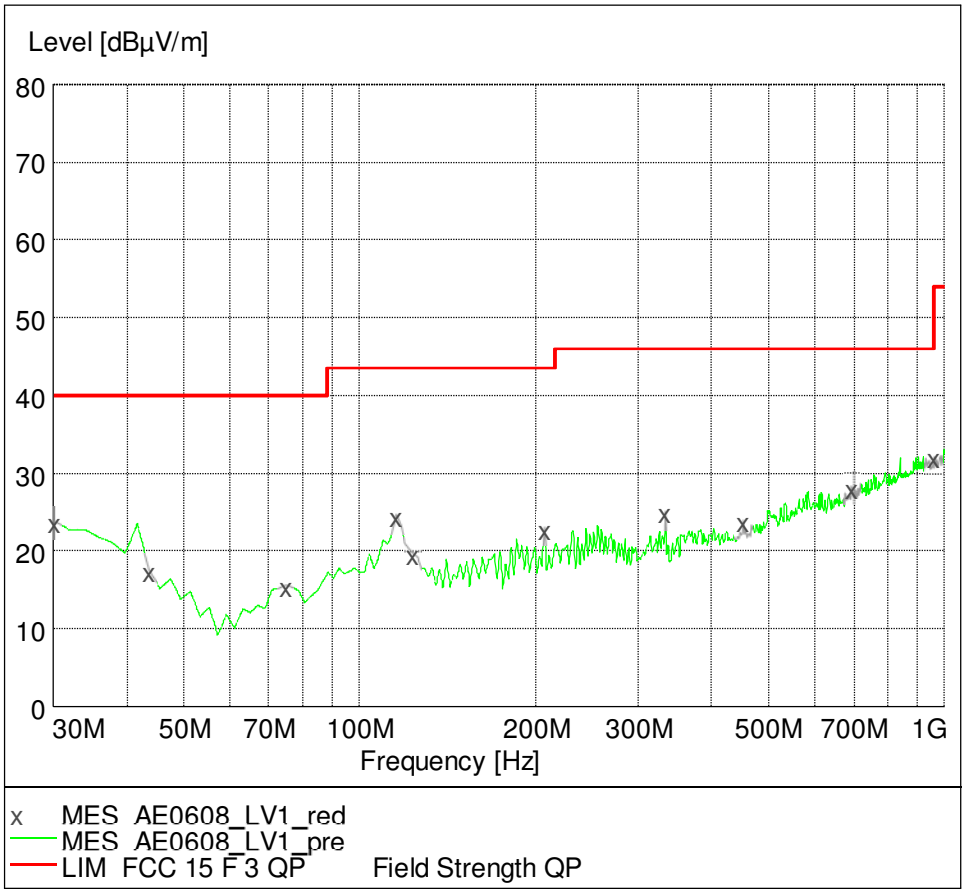
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

EUT was tested with Antenna 2 and Antenna 3, and the worst data was listed in the report.

The worst waveform from 30MHz to 1000MHz is listed as below:



Vertical



Test data below 1GHz

Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	30.00	23.8	21.1	40	16.2	PK
H	115.53	31.7	11.6	43.5	11.8	PK
H	123.30	24.9	11.6	43.5	18.6	PK
H	243.82	28.1	12.7	46	17.9	PK
H	251.60	28.5	12.9	46	17.5	PK
H	698.69	28.0	22.0	46	18.0	PK
H	930.02	32.3	25.2	46	13.7	PK
V	30.00	23.9	21.1	40	16.1	PK

V	115.53	24.7	11.6	43.5	18.8	PK
V	206.89	23.1	11.0	43.5	20.4	PK
V	333.24	25.1	15.4	46	20.9	PK
V	692.86	28.3	22.0	46	17.7	PK
V	959.17	32.2	25.1	46	13.8	PK

Test result above 1GHz:
The emission was conducted from 1GHz to 25GHz

802.11b

CH	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2412	97.80	34.10	Fundamental	/	PK
	H	2389.58	50.16	34.20	74.00	23.84	PK
	V	2389.58	49.60	34.20	74.00	24.40	PK
M	H	2437	98.20	34.20	Fundamental	/	PK
H	H	2462	98.50	34.40	Fundamental	/	PK
	H	2484.39	51.50	34.80	74.00	22.50	PK
	V	2484.39	50.80	34.80	74.00	23.20	PK

802.11g

CH	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2412	100.50	34.10	Fundamental	/	PK
	H	2389.20	63.19	34.20	74.00	10.81	PK
	H	2389.20	44.79	34.20	54.00	9.21	AV
M	H	2437	100.80	34.20	Fundamental	/	PK
H	H	2462	101.10	34.40	Fundamental	/	PK
	H	2483.50	65.38	34.80	74.00	8.62	PK
	H	2483.50	41.94	34.80	54.00	12.06	AV

802.11n(HT20)

CH	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2412	98.50	34.10	Fundamental	/	PK
	H	2388.45	64.04	34.20	74.00	9.96	PK
	H	2388.45	43.48	34.20	54.00	10.52	AV
M	H	2437	99.10	34.20	Fundamental	/	PK
H	H	2462	99.50	34.40	Fundamental	/	PK
	H	2483.50	63.45	34.80	74.00	10.55	PK
	H	2483.50	40.25	34.80	54.00	13.75	AV

802.11n(HT40)

CH	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2422	95.00	34.10	Fundamental	/	PK
	H	2388.40	65.50	34.20	74.00	8.50	PK
	H	2388.40	47.47	34.20	54.00	6.53	AV
M	H	2437	95.30	34.20	Fundamental	/	PK
H	H	2452	95.50	34.40	Fundamental	/	PK
	H	2483.50	57.13	34.80	74.00	6.87	PK
	H	2483.50	40.64	34.80	54.00	13.36	AV

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
Limit = 40.00dBuV/m.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m;
Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

8 Power line conducted emission

Test result: **NA**

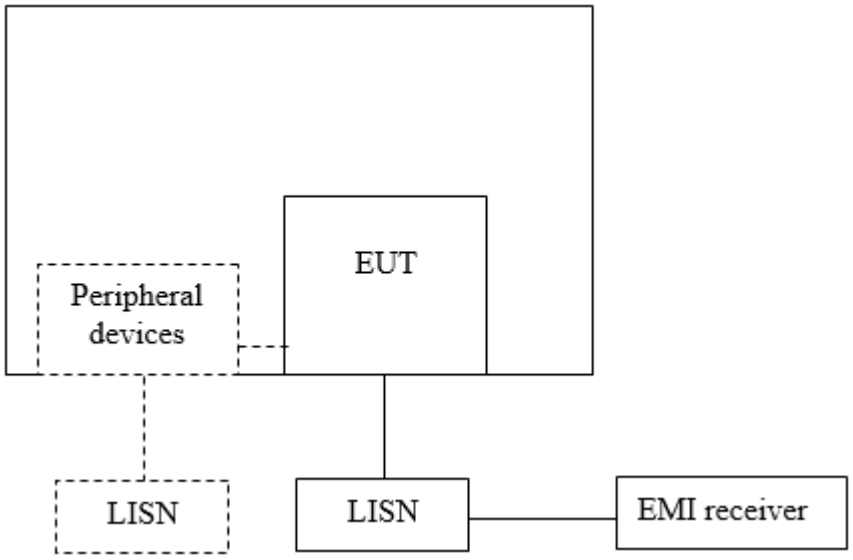
8.1 Measurement Procedure

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

8.2 Test Configuration



8.3 Test Results of Power line conducted emission

Test Curve:

Test Data:

Frequency (MHz)	Quasi-peak			Average			Line
	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)	
Note: * means the emission level 20dB below the relevant limit.							

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming LISN Factor = 10.00dB, Cable Loss = 2.00dB,
Original Receiver Reading = 10.00dBuV, Limit = 66.00dBuV.
Then Correct Factor = 10.00 + 2.00 = 12.00dB;
Corrected Reading = 10dBuV + 12.00dB = 22.00dBuV;
Margin = 66.00dBuV – 22.00dBuV = 44.00dB.

9 Antenna requirement

Requirement:
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.

Result:
EUT uses permanently attached antenna to the intentional radiator, so it can comply with the provisions of this section.

10 Occupied Bandwidth

Test result: **Pass**

10.1 Limit

None

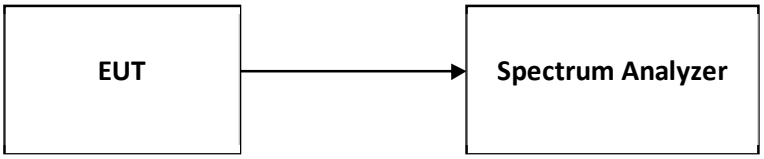
10.2 Measurement Procedure

The occupied bandwidth per RSS-Gen Issue 4 Clause 6.6 was measured using the Spectrum Analyzer.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

10.3 Test Configuration



10.4 The results of Occupied Bandwidth

Please refer to Appendix A

Appendix A: Test results

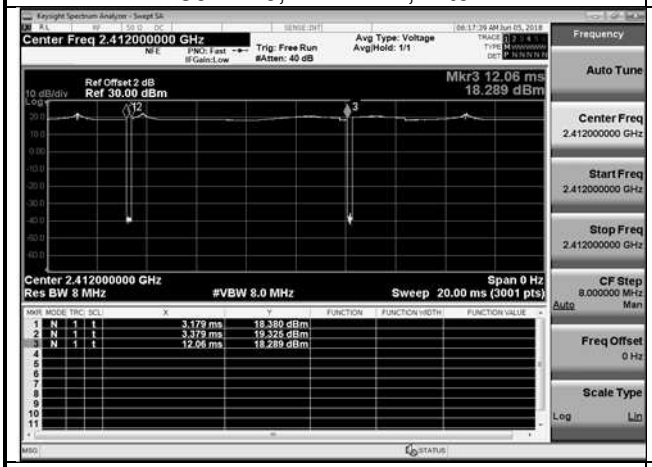
1. Duty Cycle

1.1 Test Data

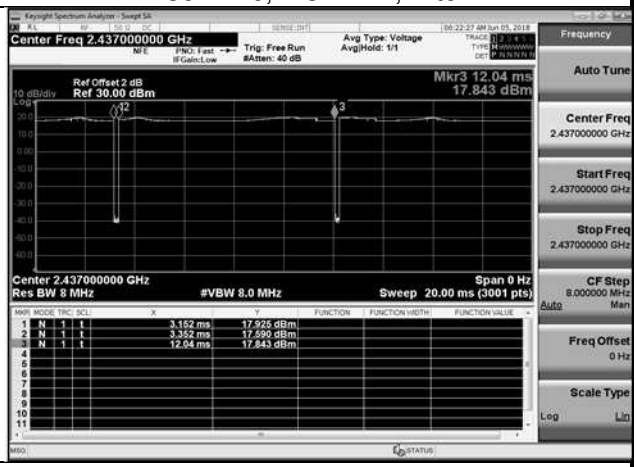
WLAN Duty Cycle				
Mode	Test Frequency (MHz)	Ant	Duty Cycle (%)	Duty Cycle Factor (dB)
802.11b	2412	Ant0	97.75	0.10
802.11b	2437	Ant0	97.75	0.10
802.11b	2462	Ant0	97.75	0.10
802.11g	2412	Ant0	87.80	0.57
802.11g	2437	Ant0	87.80	0.57
802.11g	2462	Ant0	87.80	0.57
802.11n (HT20)	2412	Ant0	87.12	0.60
802.11n (HT20)	2437	Ant0	87.07	0.60
802.11n (HT20)	2462	Ant0	87.12	0.60
802.11n (HT40)	2422	Ant0	77.10	1.13
802.11n (HT40)	2437	Ant0	76.92	1.14
802.11n (HT40)	2452	Ant0	76.92	1.14

1.2 Test Plots

802.11b,2412MHz,Ant0

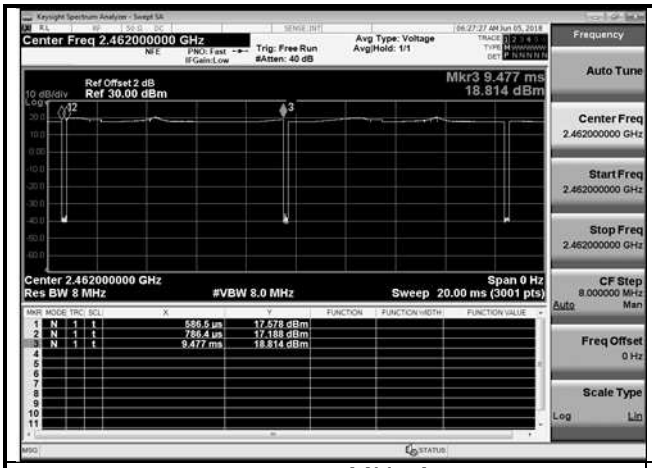


802.11b,2437MHz,Ant0

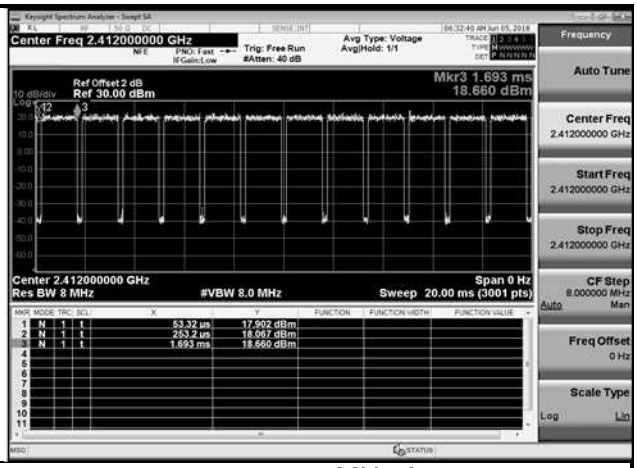


802.11b,2462MHz,Ant0

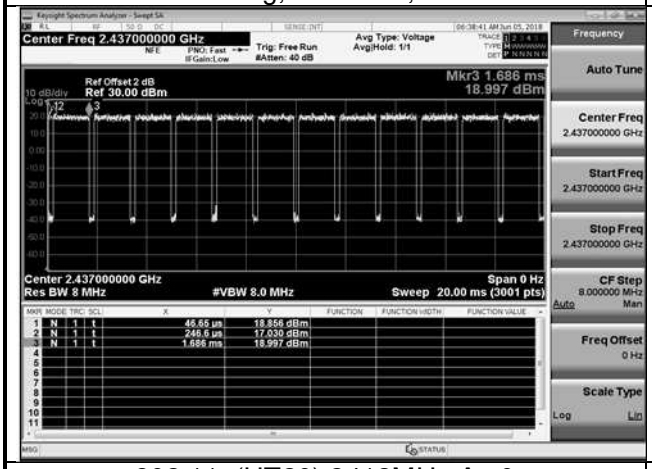
802.11g,2412MHz,Ant0



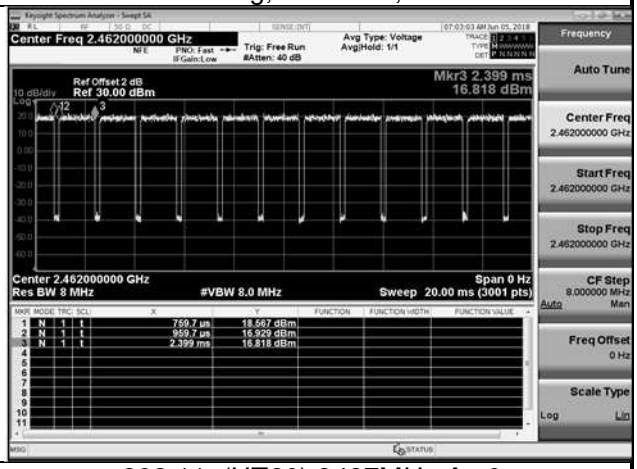
802.11g,2437MHz,Ant0



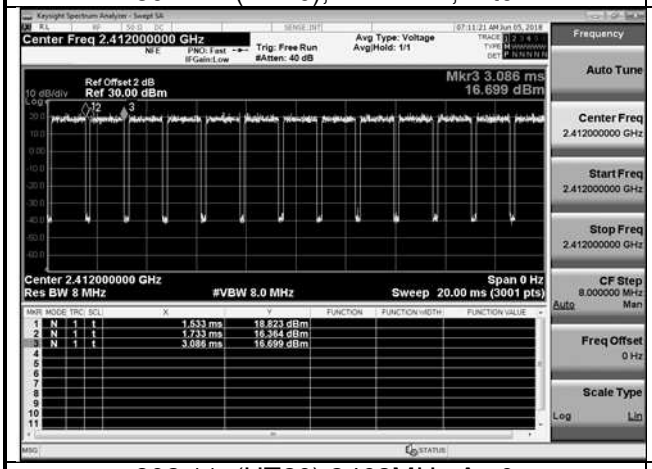
802.11g,2462MHz,Ant0



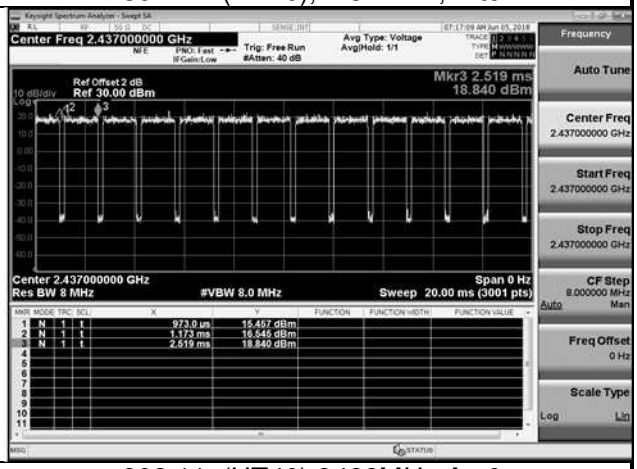
802.11n(HT20),2412MHz,Ant0



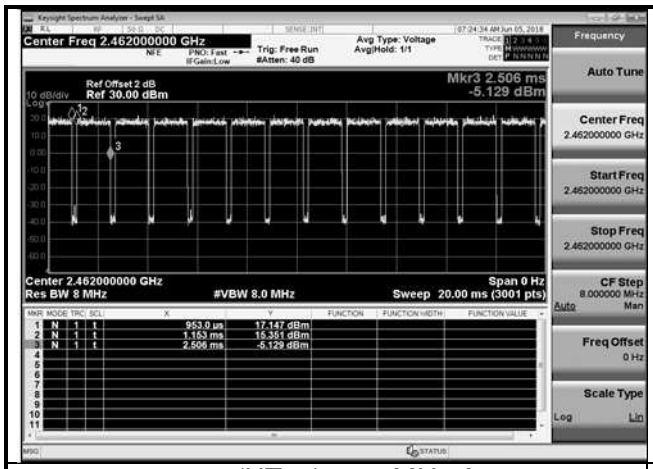
802.11n(HT20),2437MHz,Ant0



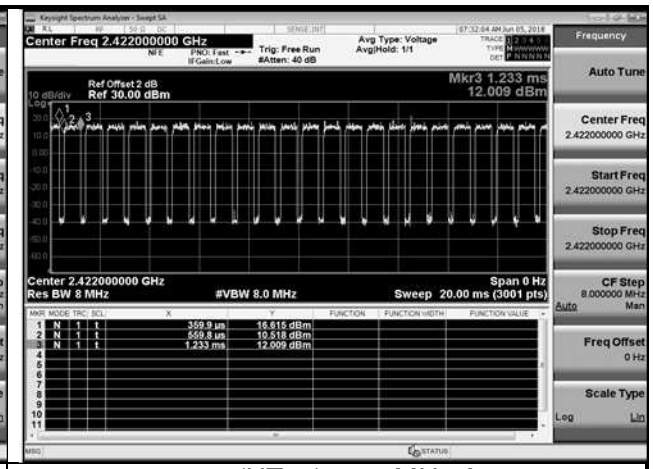
802.11n(HT20),2462MHz,Ant0



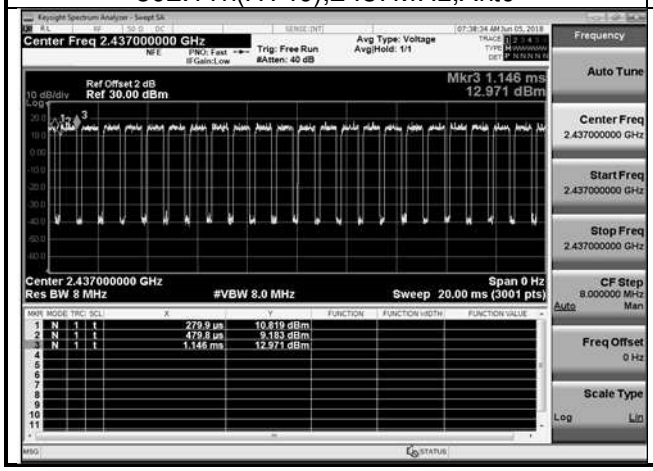
802.11n(HT40),2422MHz,Ant0

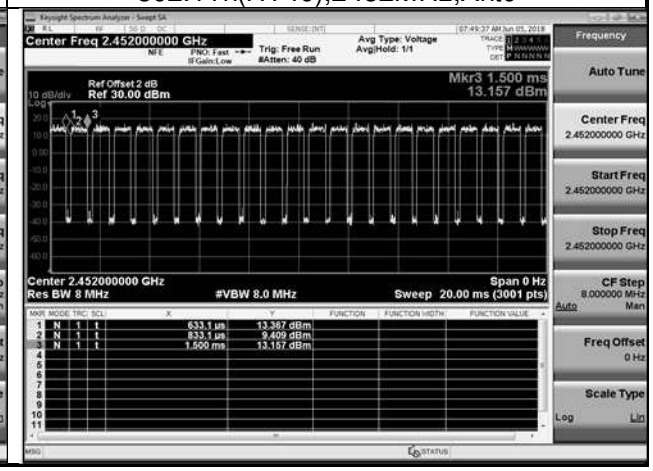


802.11n(HT40),2437MHz,Ant0



802.11n(HT40),2452MHz,Ant0





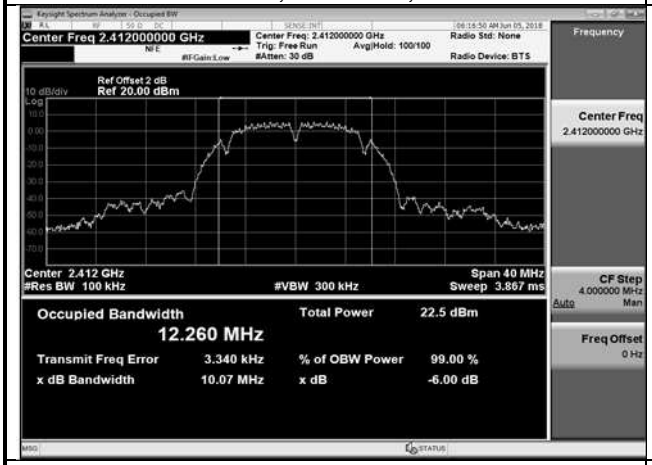
2. Minimum 6dB bandwidth

2.1 Test Data

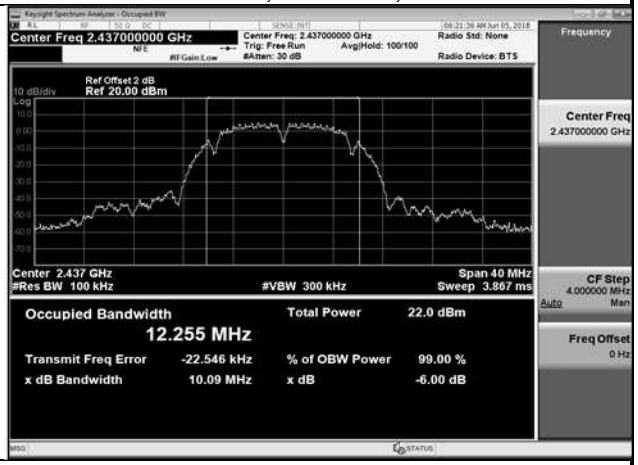
WLAN Occupied 6dB Bandwidth				
Mode	Test Frequency (MHz)	Ant	Occupied Bandwidth (MHz)	Result
802.11b	2412	Ant0	10.07	Pass
802.11b	2437	Ant0	10.09	Pass
802.11b	2462	Ant0	10.08	Pass
802.11g	2412	Ant0	16.40	Pass
802.11g	2437	Ant0	16.39	Pass
802.11g	2462	Ant0	16.39	Pass
802.11n (HT20)	2412	Ant0	17.59	Pass
802.11n (HT20)	2437	Ant0	17.58	Pass
802.11n (HT20)	2462	Ant0	17.09	Pass
802.11n (HT40)	2422	Ant0	36.09	Pass
802.11n (HT40)	2437	Ant0	35.84	Pass
802.11n (HT40)	2452	Ant0	35.95	Pass

2.2 Test Plots

802.11b,2412MHz,Ant0

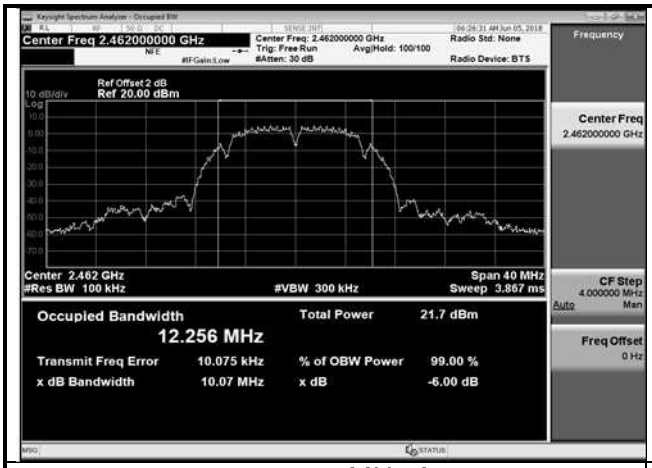


802.11b,2437MHz,Ant0

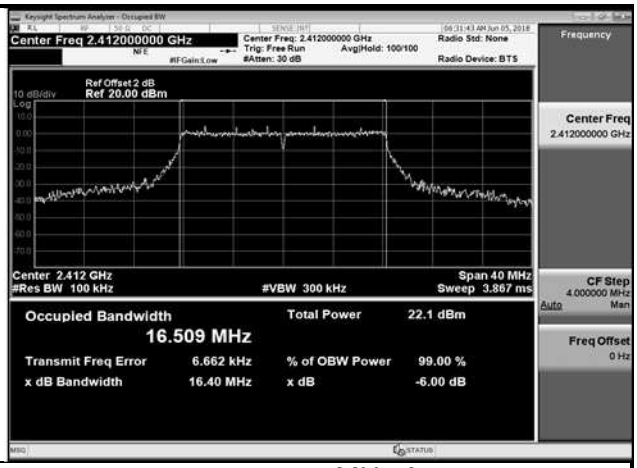


802.11b,2462MHz,Ant0

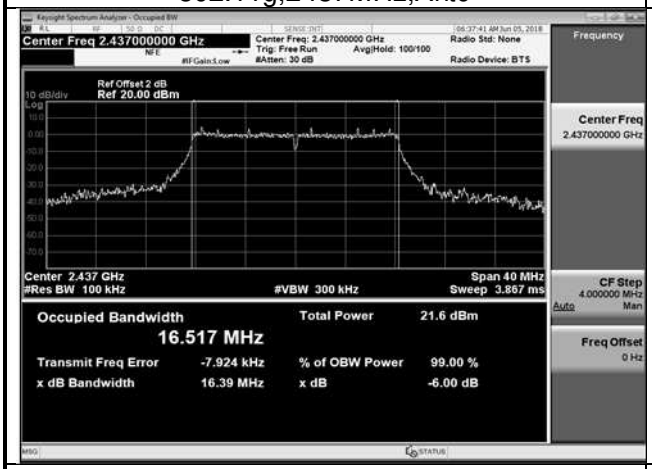
802.11g,2412MHz,Ant0



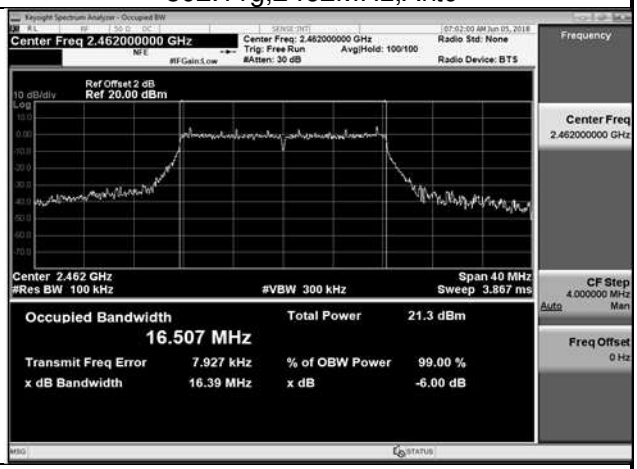
802.11g,2437MHz,Ant0



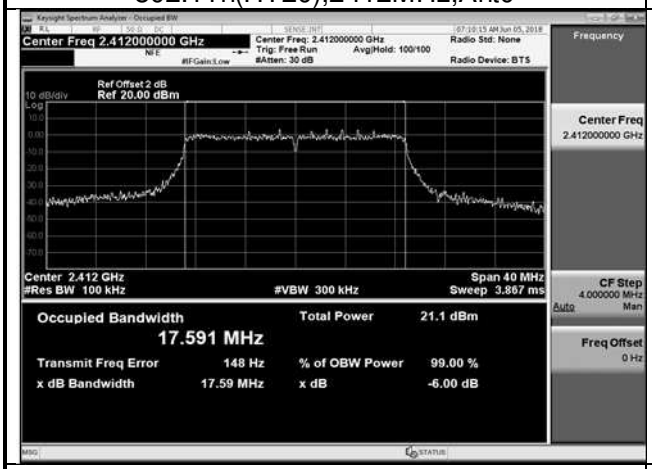
802.11g,2462MHz,Ant0



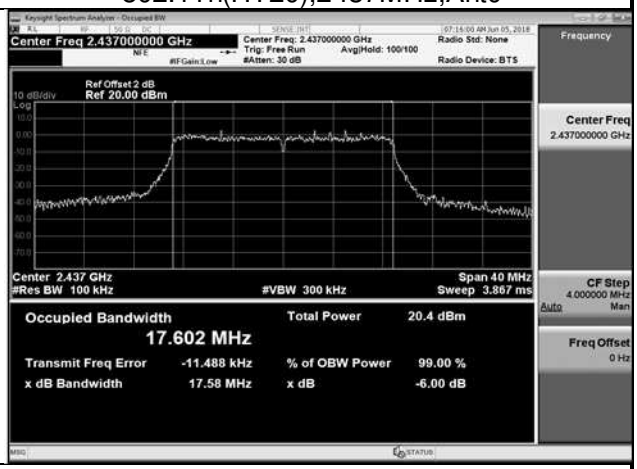
802.11n(HT20),2412MHz,Ant0



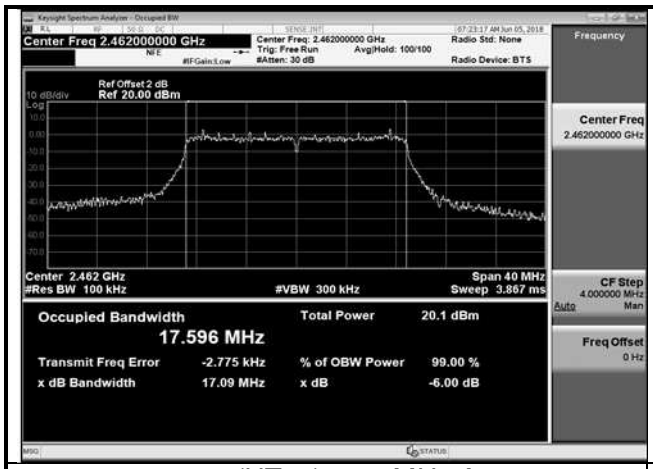
802.11n(HT20),2437MHz,Ant0



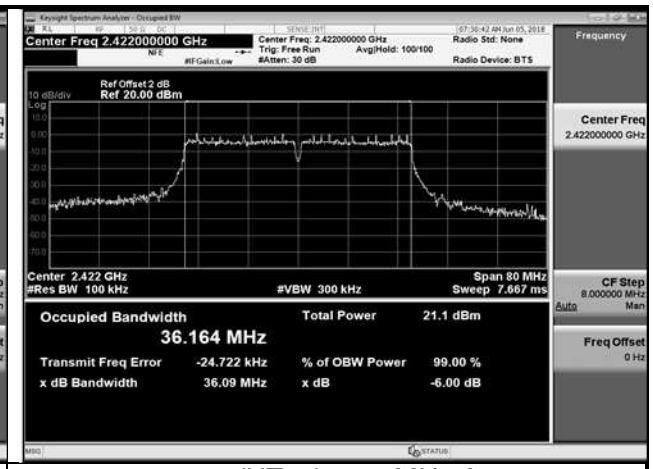
802.11n(HT20),2462MHz,Ant0



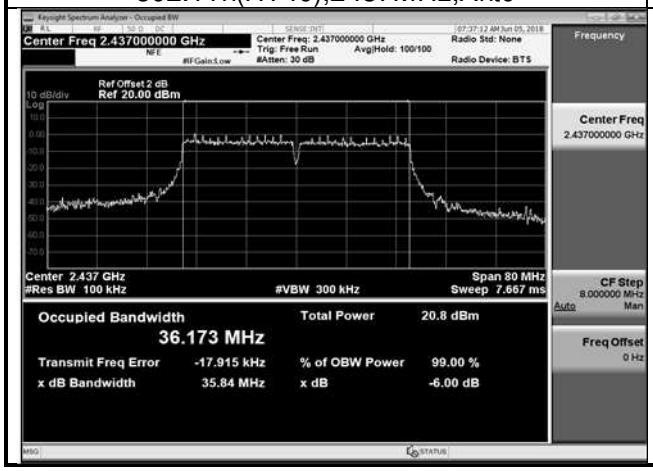
802.11n(HT40),2422MHz,Ant0

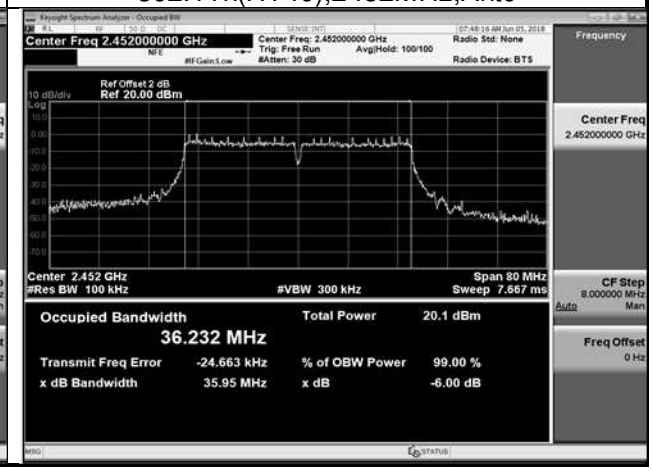


802.11n(HT40),2437MHz,Ant0



802.11n(HT40),2452MHz,Ant0





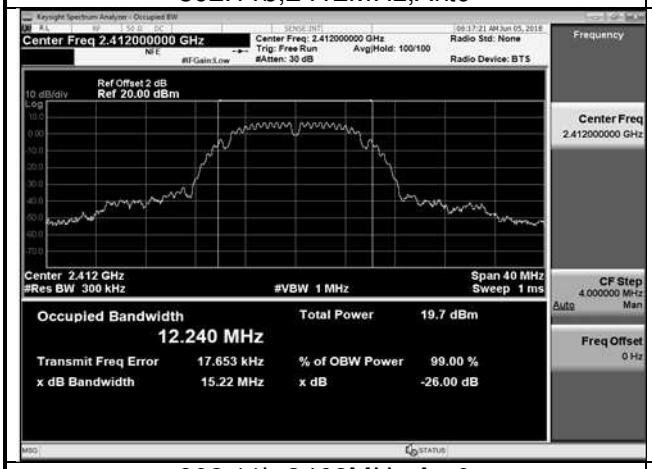
3. Occupied Bandwidth

3.1 Test Data

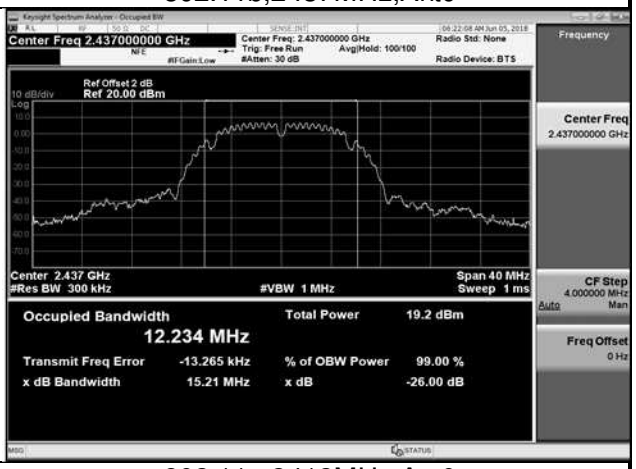
WLAN 99% Occupied Bandwidth				
Mode	Test Frequency (MHz)	Ant	99% Occupied Bandwidth (MHz)	Result
802.11b	2412	Ant0	12.240	Pass
802.11b	2437	Ant0	12.234	Pass
802.11b	2462	Ant0	12.230	Pass
802.11g	2412	Ant0	16.832	Pass
802.11g	2437	Ant0	16.845	Pass
802.11g	2462	Ant0	16.829	Pass
802.11n (HT20)	2412	Ant0	17.720	Pass
802.11n (HT20)	2437	Ant0	17.702	Pass
802.11n (HT20)	2462	Ant0	17.710	Pass
802.11n (HT40)	2422	Ant0	36.559	Pass
802.11n (HT40)	2437	Ant0	36.604	Pass
802.11n (HT40)	2452	Ant0	36.704	Pass

3.2 Test Plots

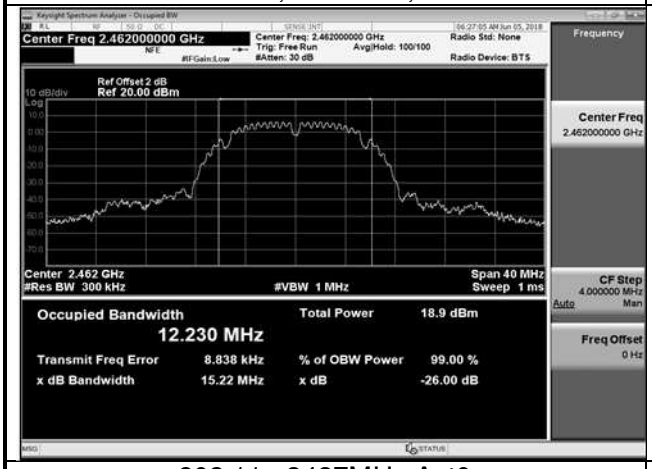
802.11b,2412MHz,Ant0



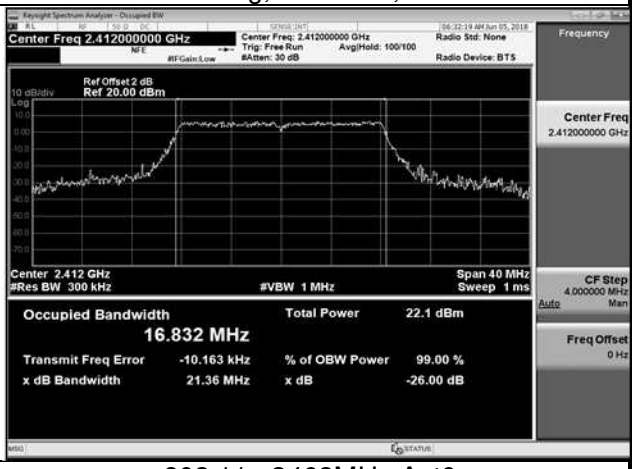
802.11b,2437MHz,Ant0



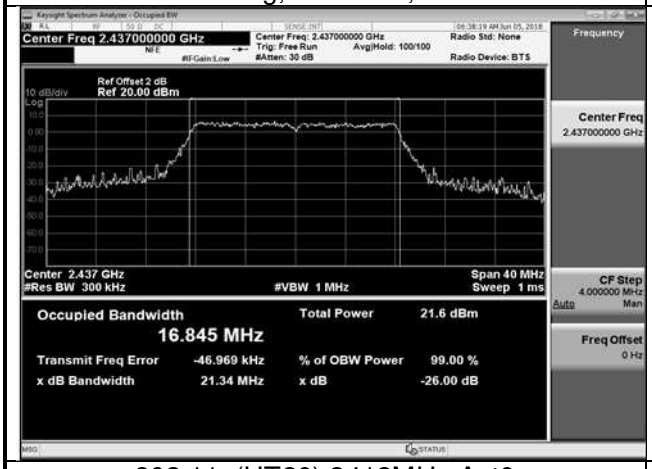
802.11b,2462MHz,Ant0



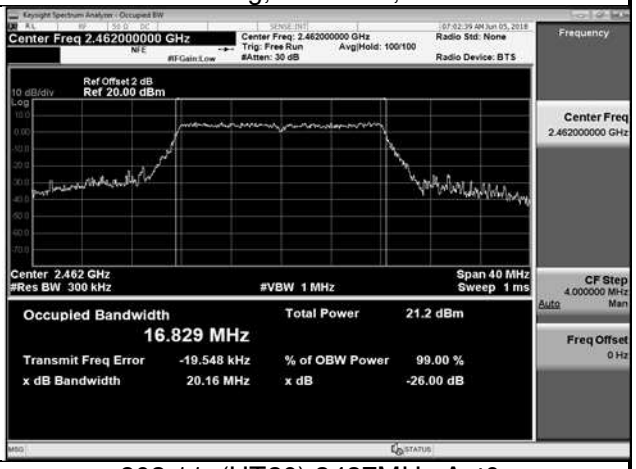
802.11g,2412MHz,Ant0



802.11g,2437MHz,Ant0

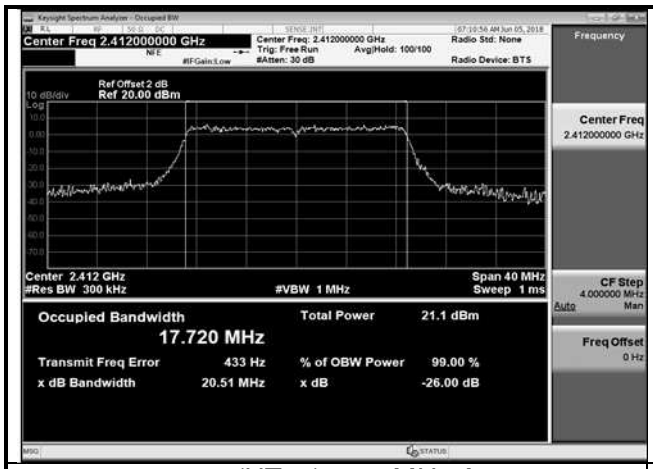


802.11g,2462MHz,Ant0

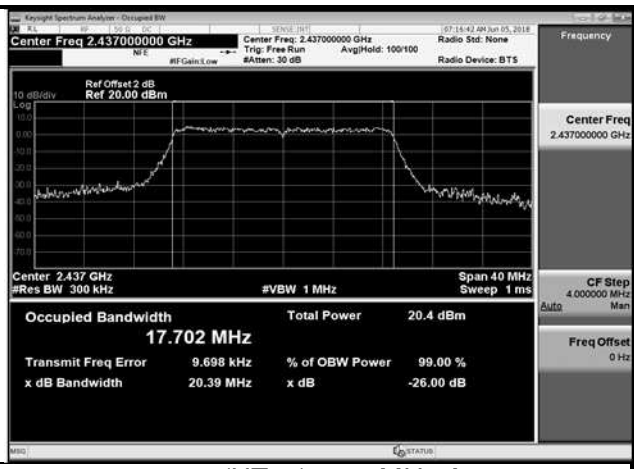


802.11n(HT20),2412MHz,Ant0

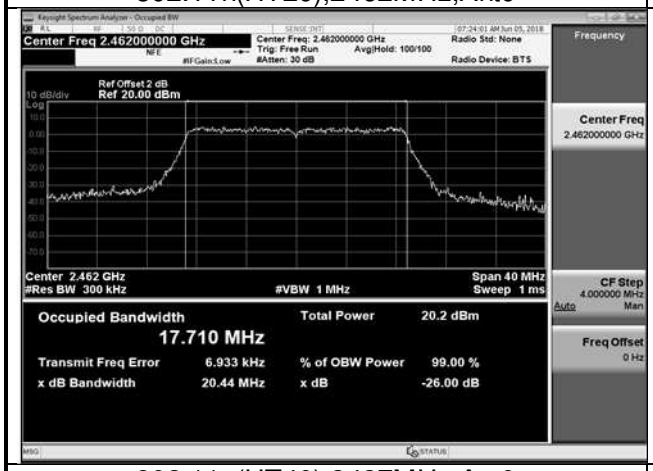
802.11n(HT20),2437MHz,Ant0



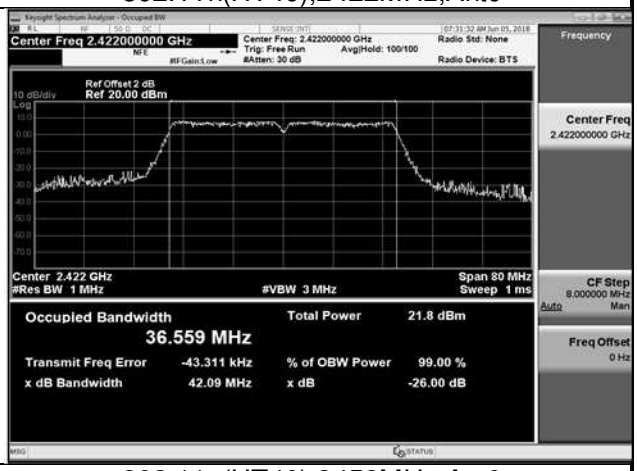
802.11n(HT20),2462MHz,Ant0



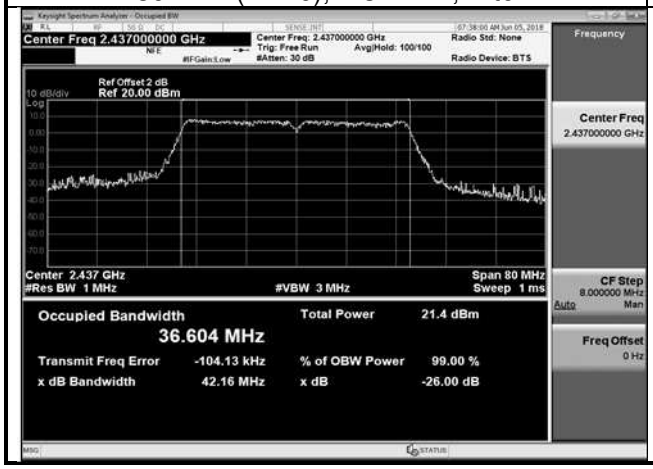
802.11n(HT40),2422MHz,Ant0

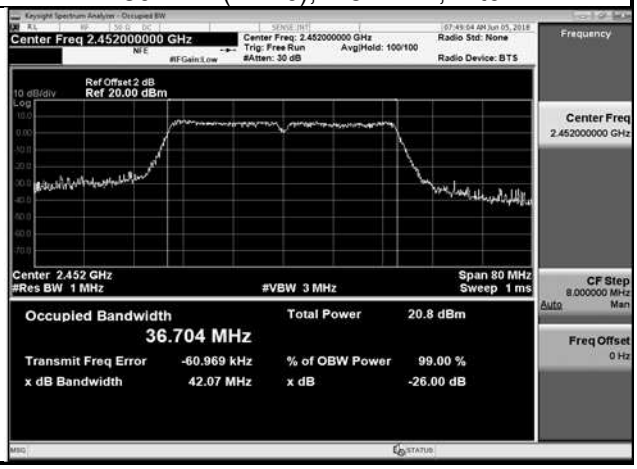


802.11n(HT40),2437MHz,Ant0



802.11n(HT40),2452MHz,Ant0





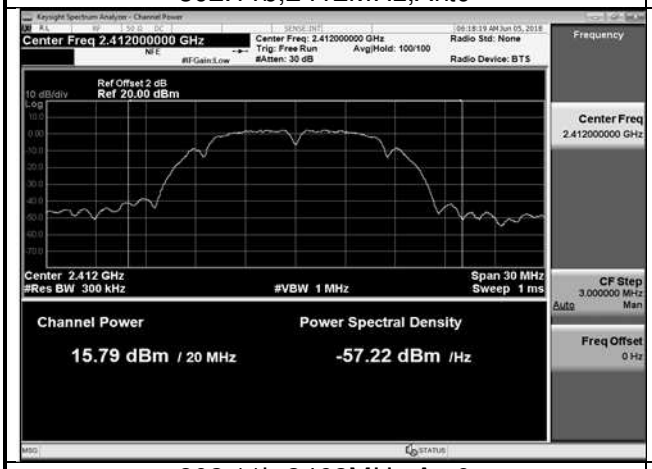
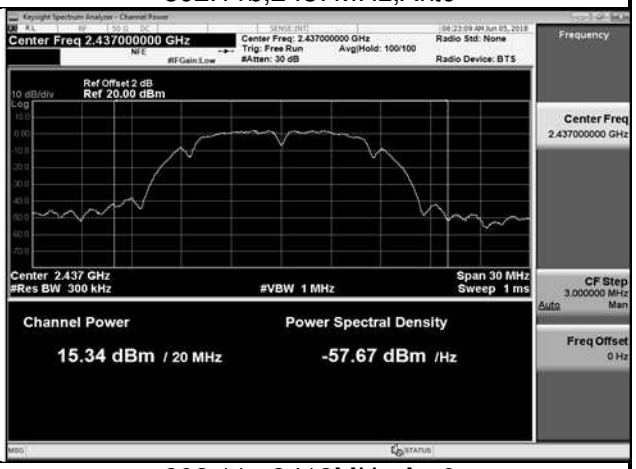
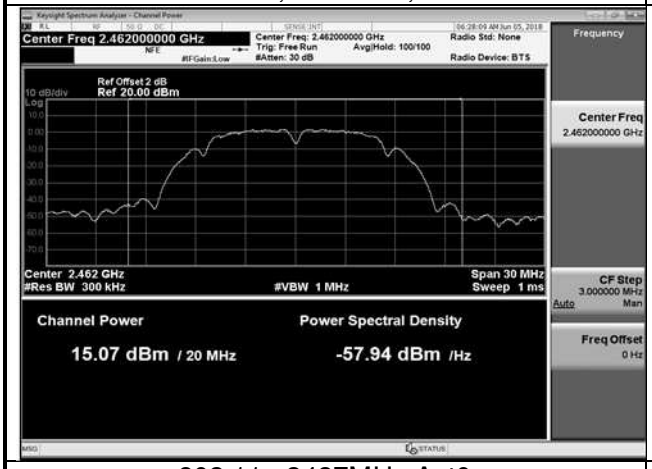
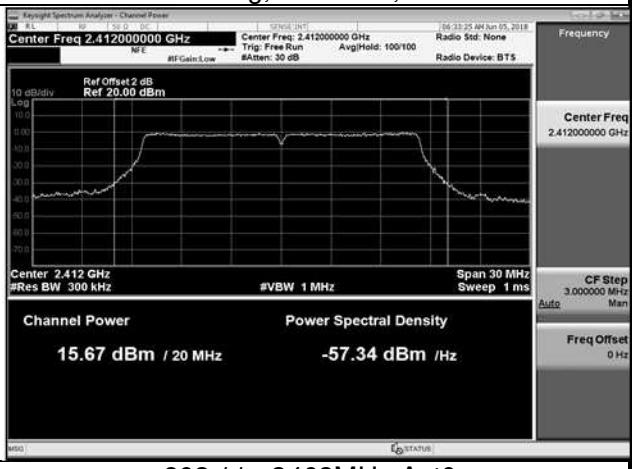
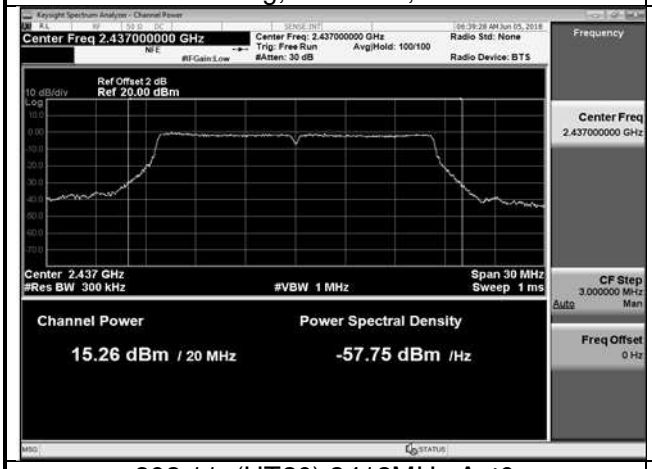
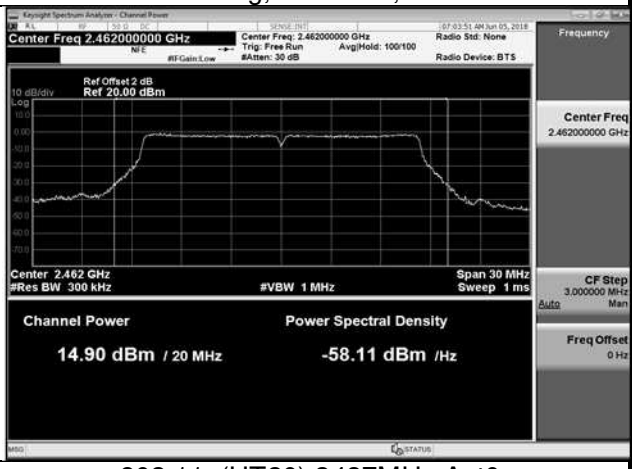
4. Maximum conducted output power and e.i.r.p

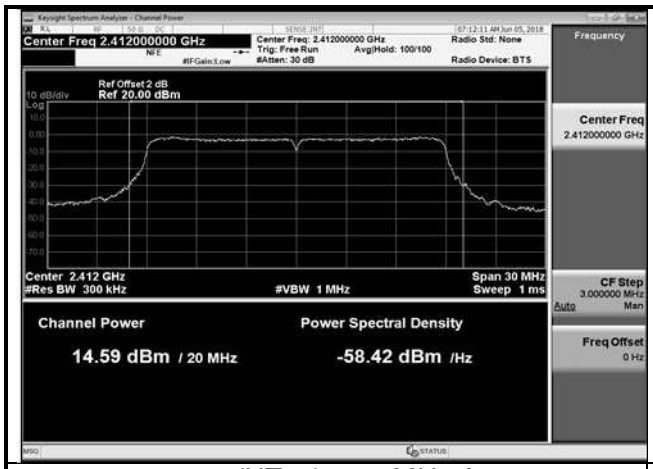
4.1 Test Data

WLAN AVGSA Output Power							
Mode	Test Frequency (MHz)	Ant	Duty Cycle Factor (dB)	Max Power (dBm)	Limit (dBm)	EIRP (dBm)	Result
802.11b	2412	Ant0	0.10	15.89	30	19.99	Pass
802.11b	2437	Ant0	0.10	15.44	30	19.54	Pass
802.11b	2462	Ant0	0.10	15.17	30	19.27	Pass
802.11g	2412	Ant0	0.57	16.24	30	20.34	Pass
802.11g	2437	Ant0	0.57	15.83	30	19.93	Pass
802.11g	2462	Ant0	0.57	15.47	30	19.57	Pass
802.11n (HT20)	2412	Ant0	0.60	15.19	30	19.29	Pass
802.11n (HT20)	2437	Ant0	0.60	14.42	30	18.52	Pass
802.11n (HT20)	2462	Ant0	0.60	14.22	30	18.32	Pass
802.11n (HT40)	2422	Ant0	1.13	14.74	30	18.84	Pass
802.11n (HT40)	2437	Ant0	1.14	14.32	30	18.42	Pass
802.11n (HT40)	2452	Ant0	1.14	13.69	30	17.79	Pass

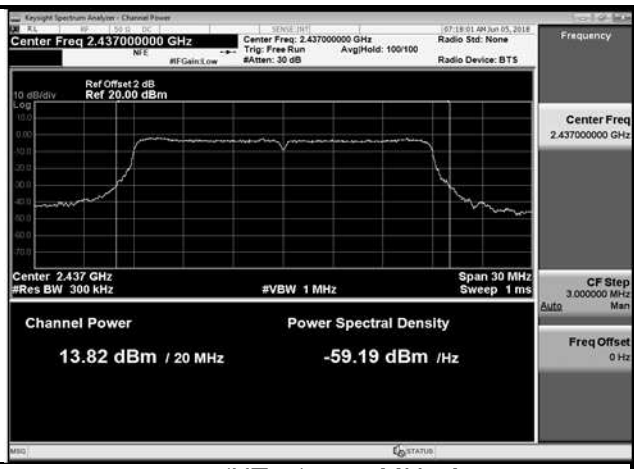
Max conducted output power (dBm)	Max antenna gain (dBi)	Max e.i.r.p. (W)	Limit (W)	Result
16.24	4.12	0.109	4	Pass

4.2 Test Plots

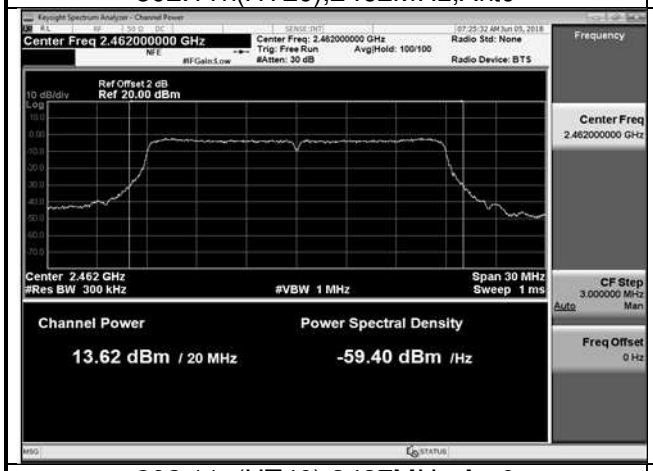
802.11b,2412MHz,Ant0	802.11b,2437MHz,Ant0
	
802.11b,2462MHz,Ant0	802.11g,2412MHz,Ant0
	
802.11g,2437MHz,Ant0	802.11g,2462MHz,Ant0
	
802.11n(HT20),2412MHz,Ant0	802.11n(HT20),2437MHz,Ant0



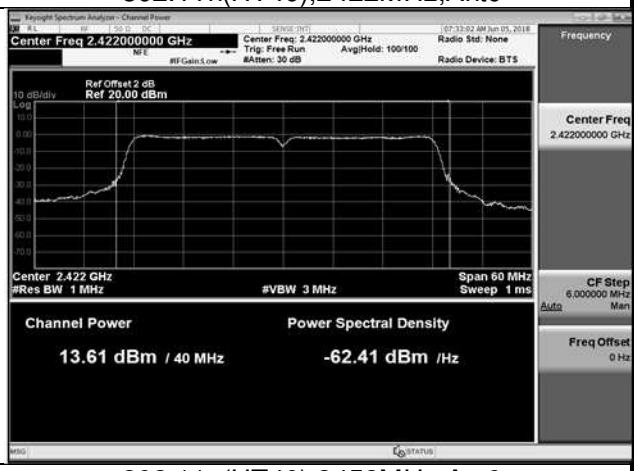
802.11n(HT20),2462MHz,Ant0



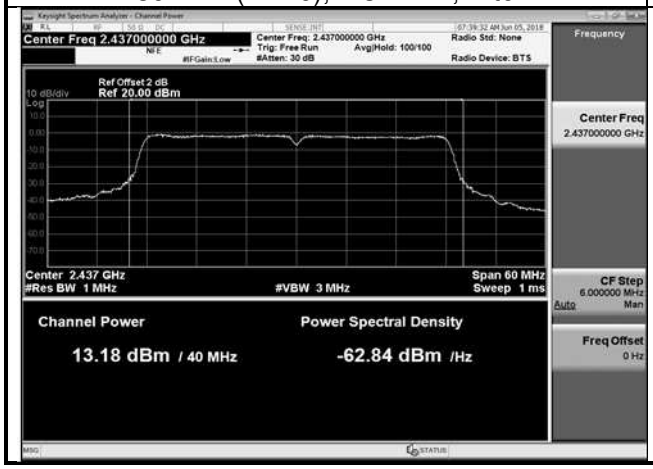
802.11n(HT40),2422MHz,Ant0

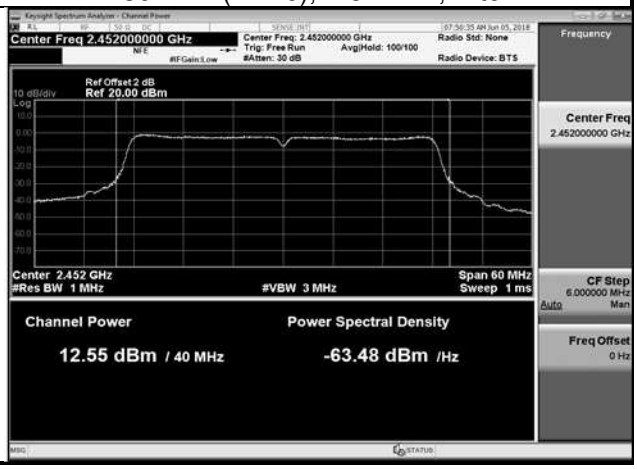


802.11n(HT40),2437MHz,Ant0



802.11n(HT40),2452MHz,Ant0





5. Power spectrum density

5.1 Test Data

WLAN AVGSA Power Spectral Density							
Mode	Test Frequency (MHz)	Ant	Duty Cycle Factor (dB)	PSD (dBm)	RBW (kHz)	Limit (dBm)	Result
802.11b	2412	Ant0	0.10	-1.559	100	8	Pass
802.11b	2437	Ant0	0.10	-2.223	100	8	Pass
802.11b	2462	Ant0	0.10	-2.490	100	8	Pass
802.11g	2412	Ant0	0.57	-3.229	100	8	Pass
802.11g	2437	Ant0	0.57	-2.958	100	8	Pass
802.11g	2462	Ant0	0.57	-4.020	100	8	Pass
802.11n (HT20)	2412	Ant0	0.60	-4.473	100	8	Pass
802.11n (HT20)	2437	Ant0	0.60	-5.199	100	8	Pass
802.11n (HT20)	2462	Ant0	0.60	-5.894	100	8	Pass
802.11n (HT40)	2422	Ant0	1.13	-8.478	100	8	Pass
802.11n (HT40)	2437	Ant0	1.14	-8.336	100	8	Pass
802.11n (HT40)	2452	Ant0	1.14	-9.128	100	8	Pass

5.2 Test Plots

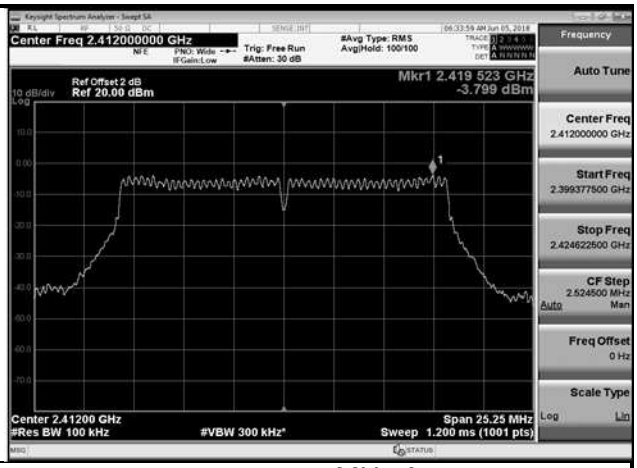
802.11b,2412MHz,Ant0

802.11b,2437MHz,Ant0

802.11b,2462MHz,Ant0

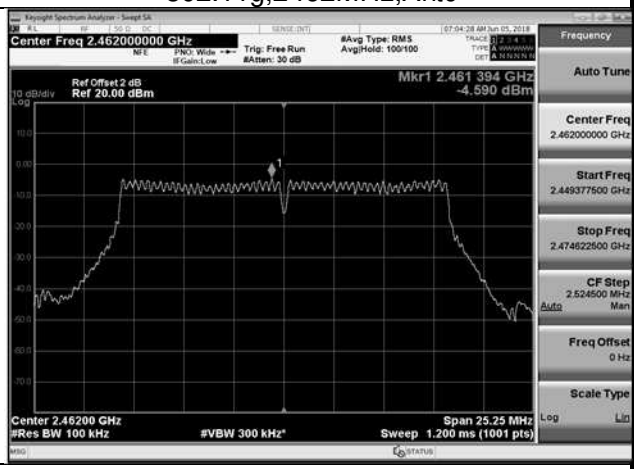
802.11g,2412MHz,Ant0

802.11g,2437MHz,Ant0



802.11g,2462MHz,Ant0

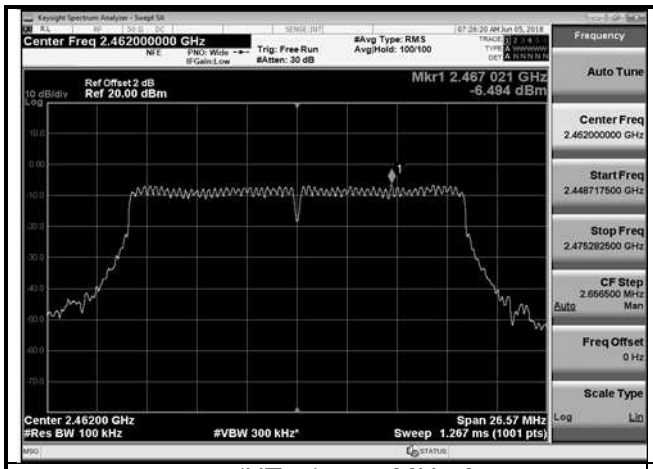
802.11n(HT20),2412MHz,Ant0



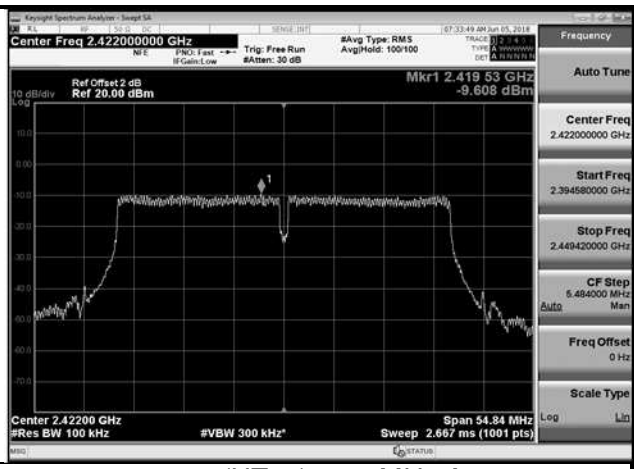
802.11n(HT20),2437MHz,Ant0

802.11n(HT20),2462MHz,Ant0

802.11n(HT40),2422MHz,Ant0



802.11n(HT40),2437MHz,Ant0



802.11n(HT40),2452MHz,Ant0

6. Emission outside the frequency band

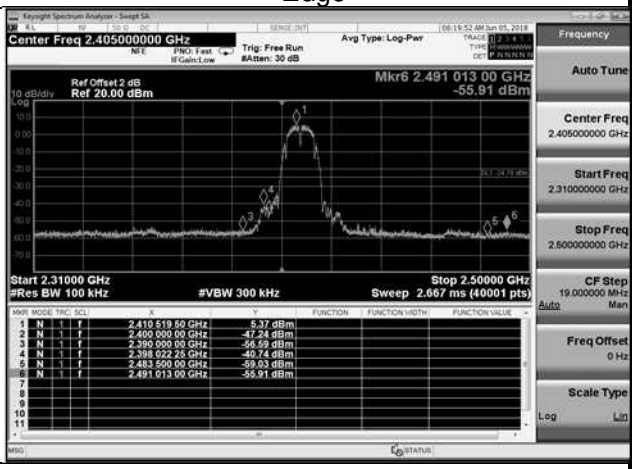
6.1 Test Data

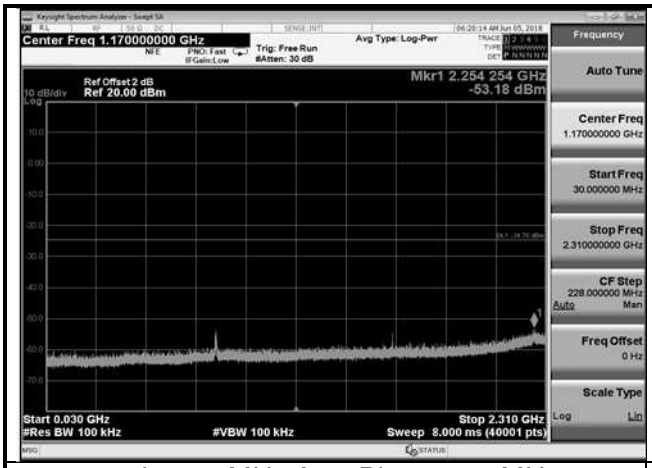
WLAN Transmitter Spurious Emission						
Mode	Test Frequency (MHz)	Ant	Plot No.	Frequency Range	Emission (dBm)	Result
802.11b	2412	Ant0	1	Reference Level	5.24	Pass
802.11b	2412	Ant0	2	Band Edge	-40.74	Pass
802.11b	2412	Ant0	3	30MHz~2310MHz	-53.18	Pass
802.11b	2412	Ant0	4	2500MHz~5000MHz	-40.11	Pass
802.11b	2412	Ant0	5	5000MHz~25000MHz	-41.63	Pass
802.11b	2437	Ant0	1	Reference Level	4.89	Pass
802.11b	2437	Ant0	2	Band Edge	-54.12	Pass
802.11b	2437	Ant0	3	30MHz~2310MHz	-53.84	Pass
802.11b	2437	Ant0	4	2500MHz~5000MHz	-42.42	Pass
802.11b	2437	Ant0	5	5000MHz~25000MHz	-42.09	Pass
802.11b	2462	Ant0	1	Reference Level	4.83	Pass
802.11b	2462	Ant0	2	Band Edge	-54.38	Pass
802.11b	2462	Ant0	3	30MHz~2310MHz	-52.08	Pass
802.11b	2462	Ant0	4	2500MHz~5000MHz	-42.71	Pass
802.11b	2462	Ant0	5	5000MHz~25000MHz	-42.34	Pass
802.11g	2412	Ant0	1	Reference Level	5.36	Pass
802.11g	2412	Ant0	2	Band Edge	-29.49	Pass
802.11g	2412	Ant0	3	30MHz~2310MHz	-46.21	Pass
802.11g	2412	Ant0	4	2500MHz~5000MHz	-46.16	Pass
802.11g	2412	Ant0	5	5000MHz~25000MHz	-42.68	Pass
802.11g	2437	Ant0	1	Reference Level	4.7	Pass
802.11g	2437	Ant0	2	Band Edge	-52.26	Pass
802.11g	2437	Ant0	3	30MHz~2310MHz	-52.58	Pass
802.11g	2437	Ant0	4	2500MHz~5000MHz	-46.25	Pass
802.11g	2437	Ant0	5	5000MHz~25000MHz	-42.97	Pass

802.11g	2462	Ant0	1	Reference Level	4.31	Pass
802.11g	2462	Ant0	2	Band Edge	-41.62	Pass
802.11g	2462	Ant0	3	30MHz~2310MHz	-51.40	Pass
802.11g	2462	Ant0	4	2500MHz~5000MHz	-47.40	Pass
802.11g	2462	Ant0	5	5000MHz~25000MHz	-41.86	Pass
802.11n (HT20)	2412	Ant0	1	Reference Level	3.4	Pass
802.11n (HT20)	2412	Ant0	2	Band Edge	-32.94	Pass
802.11n (HT20)	2412	Ant0	3	30MHz~2310MHz	-52.23	Pass
802.11n (HT20)	2412	Ant0	4	2500MHz~5000MHz	-44.14	Pass
802.11n (HT20)	2412	Ant0	5	5000MHz~25000MHz	-42.16	Pass
802.11n (HT20)	2437	Ant0	1	Reference Level	3.52	Pass
802.11n (HT20)	2437	Ant0	2	Band Edge	-53.39	Pass
802.11n (HT20)	2437	Ant0	3	30MHz~2310MHz	-51.76	Pass
802.11n (HT20)	2437	Ant0	4	2500MHz~5000MHz	-44.43	Pass
802.11n (HT20)	2437	Ant0	5	5000MHz~25000MHz	-42.28	Pass
802.11n (HT20)	2462	Ant0	1	Reference Level	3.24	Pass
802.11n (HT20)	2462	Ant0	2	Band Edge	-48.32	Pass
802.11n (HT20)	2462	Ant0	3	30MHz~2310MHz	-53.10	Pass
802.11n (HT20)	2462	Ant0	4	2500MHz~5000MHz	-46.33	Pass
802.11n (HT20)	2462	Ant0	5	5000MHz~25000MHz	-42.50	Pass
802.11n (HT40)	2422	Ant0	1	Reference Level	0.90	Pass
802.11n (HT40)	2422	Ant0	2	Band Edge	-32.80	Pass
802.11n (HT40)	2422	Ant0	3	30MHz~2310MHz	-50.68	Pass
802.11n (HT40)	2422	Ant0	4	2500MHz~5000MHz	-44.65	Pass
802.11n (HT40)	2422	Ant0	5	5000MHz~25000MHz	-42.70	Pass
802.11n (HT40)	2437	Ant0	1	Reference Level	0.92	Pass

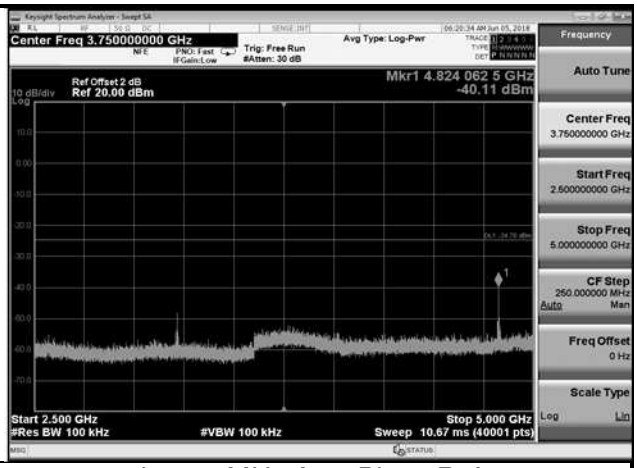
802.11n (HT40)	2437	Ant0	2	Band Edge	-36.88	Pass
802.11n (HT40)	2437	Ant0	3	30MHz~2310MHz	-52.61	Pass
802.11n (HT40)	2437	Ant0	4	2500MHz~5000MHz	-44.68	Pass
802.11n (HT40)	2437	Ant0	5	5000MHz~25000MHz	-41.90	Pass
802.11n (HT40)	2452	Ant0	1	Reference Level	0.56	Pass
802.11n (HT40)	2452	Ant0	2	Band Edge	-44.65	Pass
802.11n (HT40)	2452	Ant0	3	30MHz~2310MHz	-47.64	Pass
802.11n (HT40)	2452	Ant0	4	2500MHz~5000MHz	-45.95	Pass
802.11n (HT40)	2452	Ant0	5	5000MHz~25000MHz	-42.61	Pass

9.2 Test Plots

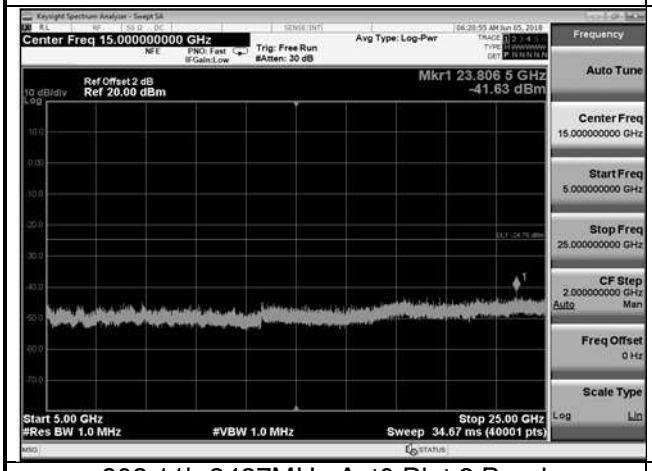
802.11b,2412MHz,Ant0,Plot 1,Reference Level	802.11b,2412MHz,Ant0,Plot 2,Band Edge
	
802.11b,2412MHz,Ant0,Plot 3,30MHz~2310MHz	802.11b,2412MHz,Ant0,Plot 4,2500MHz~5000MHz



802.11b,2412MHz,Ant0,Plot 5,5000MHz~25000MHz



802.11b,2437MHz,Ant0,Plot 1,Reference Level

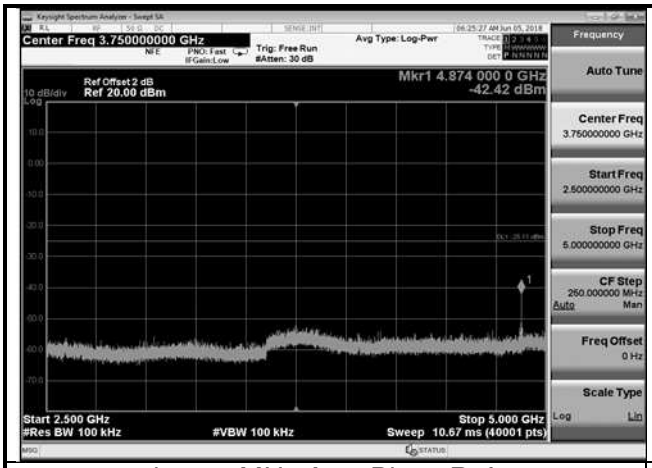


802.11b,2437MHz,Ant0,Plot 2,Band Edge

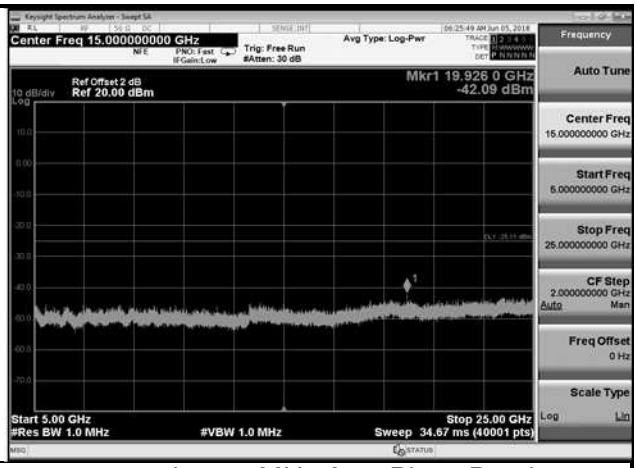
802.11b,2437MHz,Ant0,Plot 3,30MHz~2310MHz

802.11b,2437MHz,Ant0,Plot 4,2500MHz~5000MHz

802.11b,2437MHz,Ant0,Plot 5,5000MHz~25000MHz

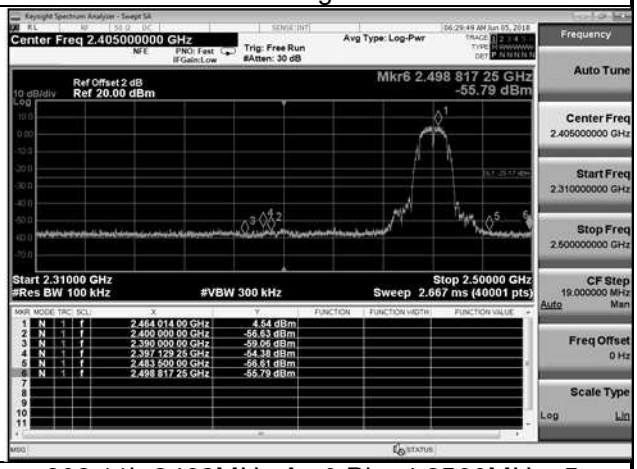


802.11b,2462MHz,Ant0,Plot 1,Reference Level

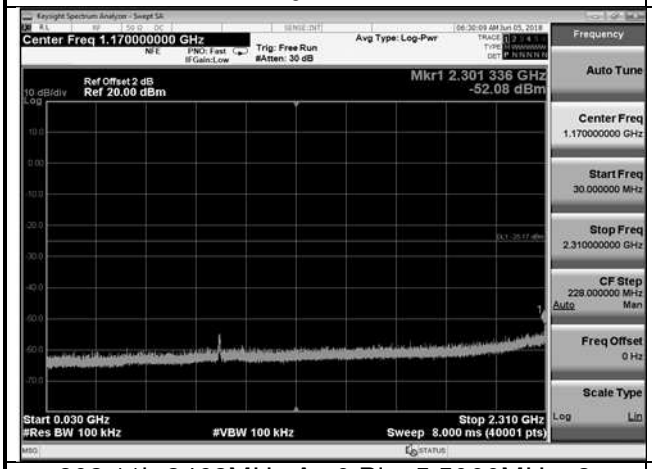


802.11b,2462MHz,Ant0,Plot 2,Band Edge

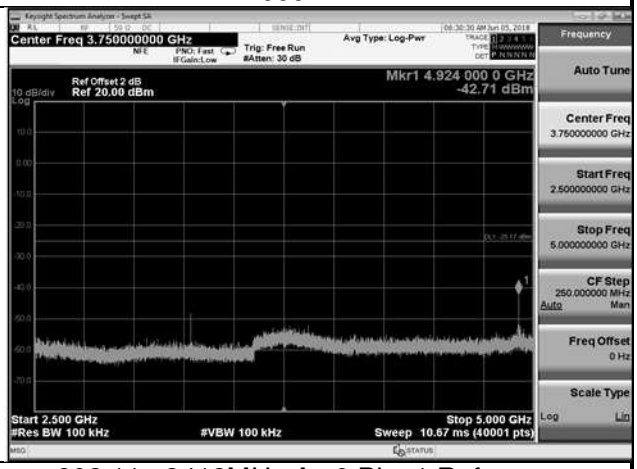
802.11b,2462MHz,Ant0,Plot 3,30MHz~2310MHz



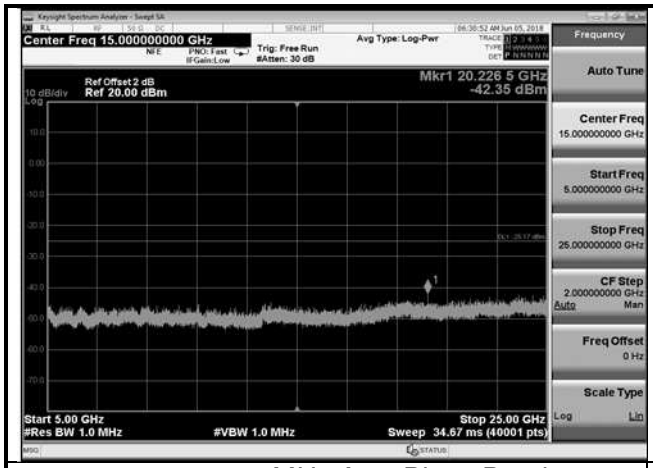
802.11b,2462MHz,Ant0,Plot 4,2500MHz~5000MHz



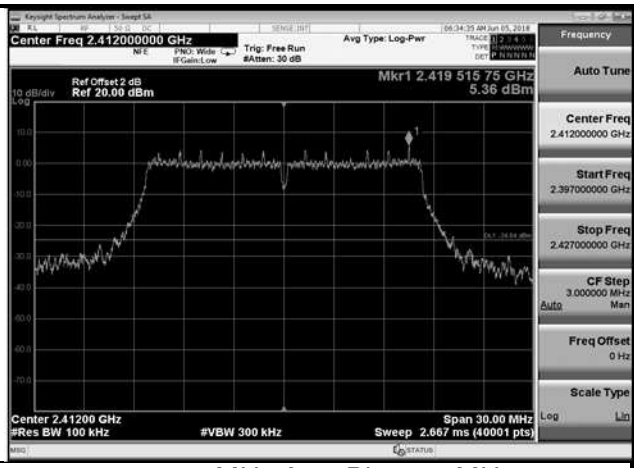
802.11b,2462MHz,Ant0,Plot 5,5000MHz~25000MHz



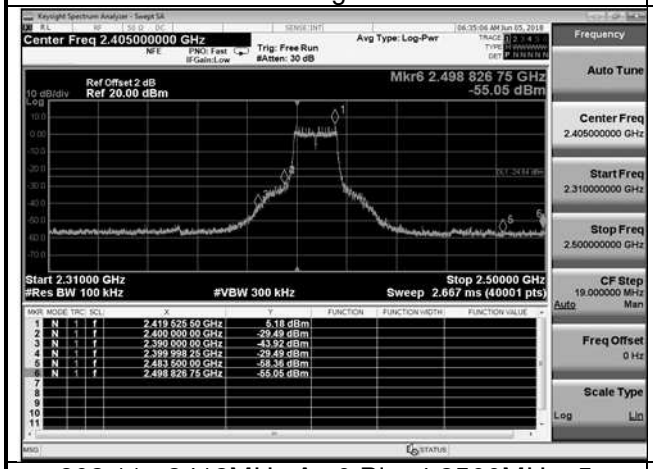
802.11g,2412MHz,Ant0,Plot 1,Reference Level



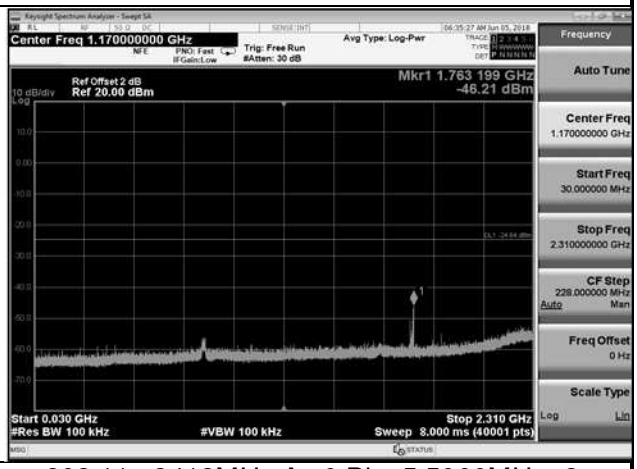
802.11g,2412MHz,Ant0,Plot 2,Band Edge



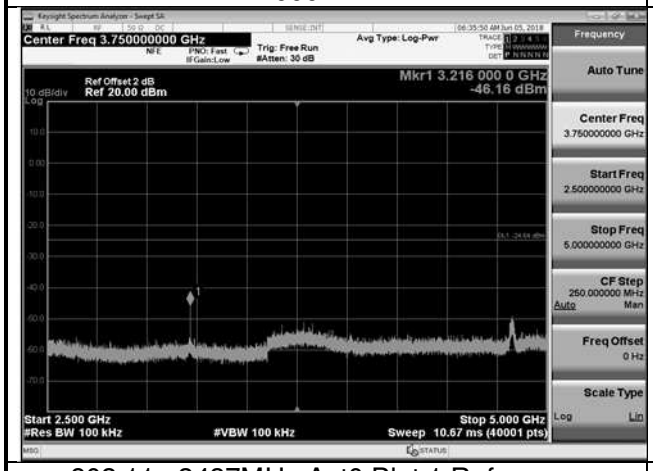
802.11g,2412MHz,Ant0,Plot 3,30MHz~2310MHz



802.11g,2412MHz,Ant0,Plot 4,2500MHz~5000MHz

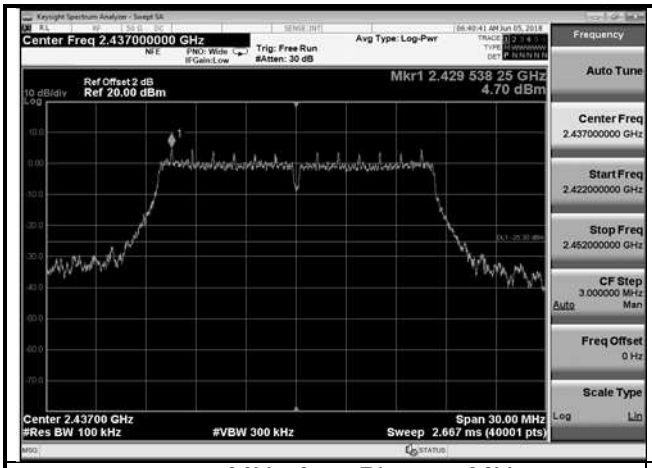


802.11g,2412MHz,Ant0,Plot 5,5000MHz~25000MHz

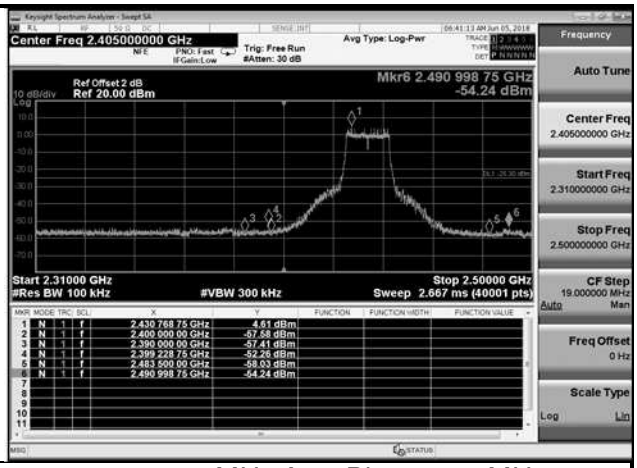


802.11g,2437MHz,Ant0,Plot 1,Reference Level

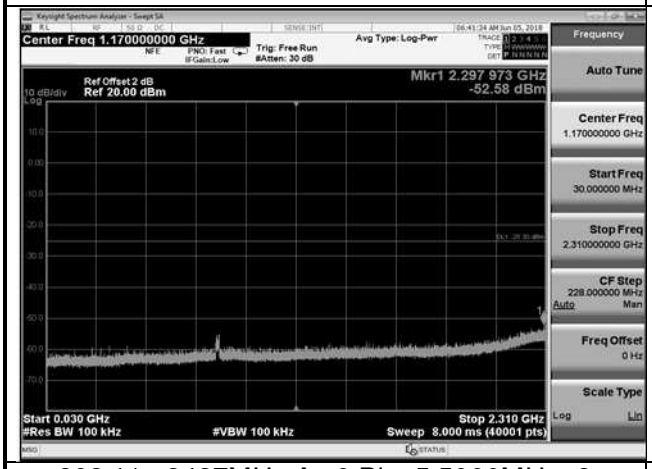
802.11g,2437MHz,Ant0,Plot 2,Band Edge



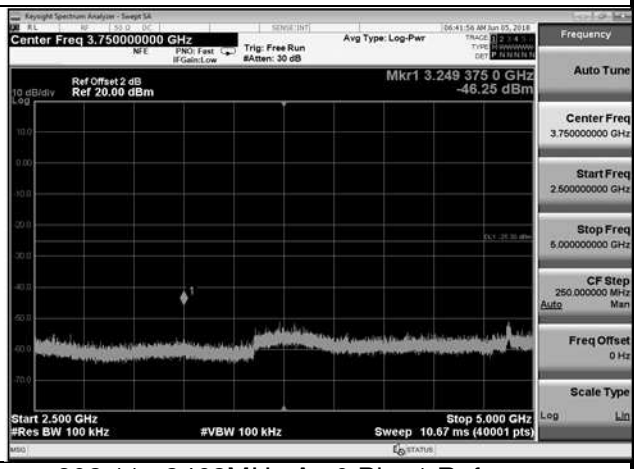
802.11g,2437MHz,Ant0,Plot 3,30MHz~2310MHz



802.11g,2437MHz,Ant0,Plot 4,2500MHz~5000MHz



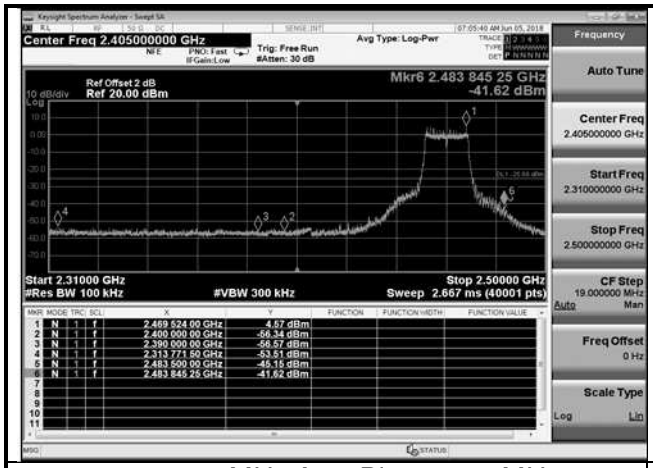
802.11g,2437MHz,Ant0,Plot 5,5000MHz~25000MHz



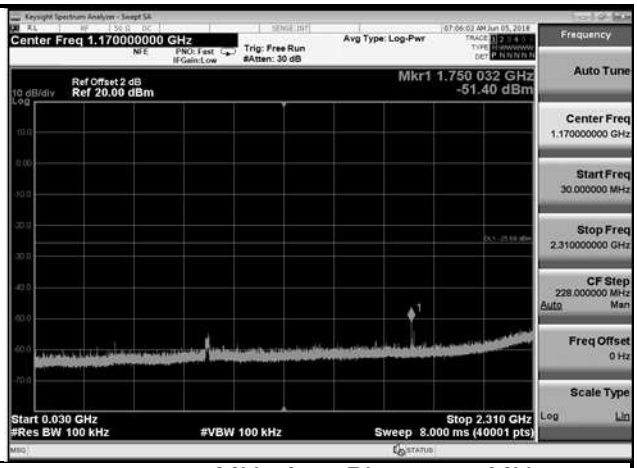
802.11g,2462MHz,Ant0,Plot 1,Reference Level

802.11g,2462MHz,Ant0,Plot 2,Band Edge

802.11g,2462MHz,Ant0,Plot 3,30MHz~2310MHz



802.11g,2462MHz,Ant0,Plot 4,2500MHz~5000MHz

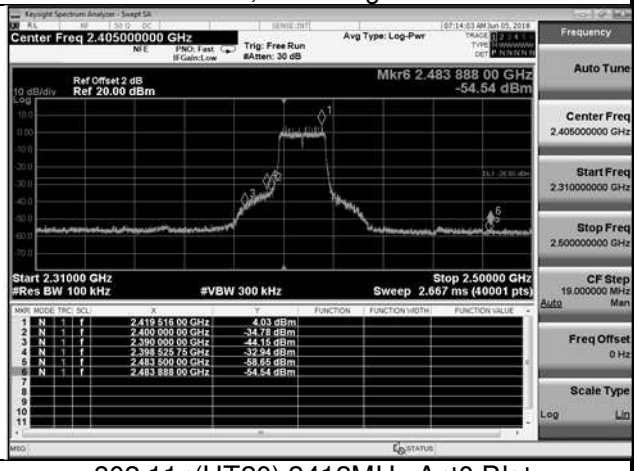


802.11g,2462MHz,Ant0,Plot 5,5000MHz~25000MHz

802.11n(HT20),2412MHz,Ant0,Plot 1,Reference Level

802.11n(HT20),2412MHz,Ant0,Plot 2,Band Edge

802.11n(HT20),2412MHz,Ant0,Plot 3,30MHz~2310MHz



802.11n(HT20),2412MHz,Ant0,Plot 4,2500MHz~5000MHz