FCC PART 15C & RSS 247
TEST REPORT
No. I19N01941-WLAN

For

Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd

Tracker

Model Name: cp311A-CT

With

Hardware Version: V1.01

Software Version: 3.18.004.P0.190809.cp311A-CT

FCC ID: R38YLCP311A-CT

IC: 10367A-YL311ACT

Issued Date: 2019-09-26

Designation Number: CN1210

ISED Assigned Code: 23289

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

Test Laboratory:

Shenzhen Academy of Information and Communications Technology

Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China 518026.

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I19N01941-WLAN	Rev.0	1st edition	2019-09-26

CONTENTS

1. Test Laboratory

1.1. Testing Location

Location: Shenzhen Academy of Information and Communications Technology
Address: Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong Province ,China
Postal Code: 518026
Telephone: +86(0)755-33322000
Fax: +86(0)755-33322001

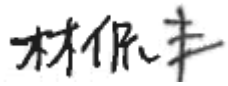
1.2. Testing Environment

Normal Temperature: 15-35℃
Relative Humidity: 20-75%

1.3. Project data

Testing Start Date: 2019-09-05
Testing End Date: 2019-09-10

1.4. Signature



Lin Kanfeng
(Prepared this test report)

Tang Weisheng
(Reviewed this test report)

Zhang Bojun
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd
Address:	Building B, Boton Science Park, Chaguang Road, Xili Town, Nanshan District, Shenzhen
Contact:	Yentl Chen
Email:	chenyanting@yulong.com
Tel.:	+86 15927320221

2.2. Manufacturer Information

Company Name:	Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd
Address:	Building B, Boton Science Park, Chaguang Road, Xili Town, Nanshan District, Shenzhen
Contact:	Yentl Chen
Email:	chenyanting@yulong.com
Tel.:	+86 15927320221

3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	Tracker
Model Name	cp311A-CT
Brand Name	/
RF Protocol	IEEE 802.11 b/g/n-HT20/ n-HT40
Operating Frequency	2412MHz~2462MHz
Number of Channels	11
Antenna Type	Integrated
Antenna Gain	See Page 12
Power Supply	3.8V DC by Battery
FCC ID	R38YLCP311A-CT
IC	10367A-YL311ACT
Condition of EUT as received	No abnormality in appearance

Note: Components list, please refer to documents of the manufacturer.

3.2. Internal Identification of EUT

EUT ID*	IMEI	HW Version	SW Version	Receive Date
EUT1	860778040000218	V1.01	3.18.004.P0.190809.cp311A-CT	2019-09-04

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE

AE ID*	Description	Mode	Manufacturer
AE1	Battery	Li-polymer	Ningbo Veken
AE2	Charger	618045	Shenzhen Kosun
AE3	Charger	RD0501000-USBA-18MG	Shenzhen RUIDE

*AE ID: is used to identify the test sample in the lab internally.

3.4. General Description

The Equipment under Test (EUT) is a model of Tracker with integrated antenna and battery.
It consists of normal options: Charger, USB cable and Tracker.
Manual and specifications of the EUT were provided to fulfil the test.
Samples undergoing test were selected by the client.

4. Reference Documents

4.1. Documents supplied by applicant

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part15	FCC CFR 47, Part 15, Subpart C: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.247 Operation within the bands 902-928MHz, 2400-2483.5 MHz, and 5725-5850 MHz	2018
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013
RSS-247	Spectrum Management and Telecommunications Radio Standards Specification Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices	Issue 2 February, 2017
RSS-Gen	Spectrum Management and Telecommunications Radio Standards Specification General Requirements for Compliance of Radio Apparatus	Issue 5 A1 March, 2019

5. Test Results

5.1. Summary of Test Results

No	Test cases	Sub-clause of Part 15C	Sub-clause of IC	Verdict
0	Antenna Requirement	15.203	/	**P**
1	Maximum Output Power	15.247 (b)	RSS-247 section 5.4	**P**
2	Peak Power Spectral Density	15.247 (e)	RSS-247 section 5.2	**P**
3	6dB Bandwidth	15.247 (a)	RSS-247 section 5.2	**P**
4	Band Edges Compliance	15.247 (d)	RSS-247 section 5.5	**P**
5	Conducted Emission	15.247 (d)	RSS-247 section 5.5/ RSS-Gen section 6.13	**P**
6	Radiated Emission	15.247, 15.205, 15.209	RSS-247 section 5.5/ RSS-Gen section 6.13	**P**
7	AC Power Line Conducted	15.107, 15.207	RSS-Gen section 8.8	**P**
8	Occupied Bandwidth	/	RSS-Gen section 6.7	**P**

See **ANNEX A** for details.

5.2. Statements

SAICT has evaluated the test cases requested by the applicant/manufacturer as listed in section 5.1 of this report, for the EUT specified in section 3, according to the standards or reference documents listed in section 4.2.

5.3. Terms used in the result table

Terms used in Verdict column

P	Pass
NA	Not Available
F	Fail

Abbreviations

AC	Alternating Current
AFH	Adaptive Frequency Hopping
BW	Band Width
E.I.R.P.	equivalent isotropic radiated power
ISM	Industrial, Scientific and Medical
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
Tx	Transmitter

5.4. Laboratory Environment

Semi-anechoic chamber

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014 MHz - 1 MHz, > 60 dB; 1 MHz - 1000 MHz, > 90 dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4 Ω
Normalised site attenuation (NSA)	< ±4 dB, 3m/10m distance, from 30 to 1000 MHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 3000 MHz

Shielded room

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014 MHz - 1 MHz, > 60 dB; 1 MHz - 1000 MHz, > 90 dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4 Ω

Fully-anechoic chamber

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014 MHz - 1MHz, > 60dB; 1 MHz - 1000 MHz, > 90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4 Ω
Voltage Standing Wave Ratio (VSWR)	≤ 6 dB, from 1 to 18 GHz, 3m distance

6. Test Facilities Utilized

Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Date	Calibration Period
1	Vector Signal Analyzer	FSV40	100903	Rohde & Schwarz	2020-01-16	1 year
2	Power Sensor	U2021XA	MY55430013	Agilent	2020-01-16	1 year
3	Data Acquisiton	U2531A	TW55443507	Agilent	/	/

Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Date	Calibration Period
1	LISN	ESH2-Z5	100196	R&S	2020-01-03	1 year
2	Test Receiver	ESCI	100701	R&S	2020-08-06	1 year
3	Loop Antenna	HLA6120	35779	TESEQ	2022-05-01	3 year
4	BiLog Antenna	VULB9163	9163 329	Schwarzbeck	2020-02-17	3 year
5	Horn Antenna	3117	00066585	ETS-Lindgren	2022-03-04	3 year
6	Test Receiver	ESR7	101675	R&S	2020-07-18	1 year
7	Spectrum Analyzer	FSP 40	100378	R&S	2019-12-13	1 year
8	Chamber	FACT5-2.0	4166	ETS-Lindgren	2021-05-12	3 year
9	Antenna	QSH-SL-18-26-S-20	17013	Q-par	2020-01-15	3 year
10	Antenna	QSH-SL-26-40-K-20	17014	Q-par	2020-01-11	3 year

Test software

No.	Equipment	Manufacturer	Version
1	TechMgr Software	CAICT	2.1.1
2	EMC32	Rohde & Schwarz	8.53.0
3	EMC32	Rohde & Schwarz	10.01.00

EUT is engineering software provided by the customer to control the transmitting signal.
The EUT was programmed to be in continuously transmitting mode.

Anechoic chamber

Fully anechoic chamber by ETS-Lindgren

7. Measurement Uncertainty

Test Name	Uncertainty	
1. RF Output Power	±1.32dB	
2. Power Spectral Density	±2.32dB	
3. Occupied Channel Bandwidth	±66Hz	
4. Transmitter Spurious Emission - Conducted	30MHz≤f≤1GHz	±1.41dB
	1GHz≤f≤7GHz	±1.92dB
	7GHz≤f≤13GHz	±2.31dB
	13GHz≤f≤26GHz	±2.61dB
5. Transmitter Spurious Emission - Radiated	9kHz≤f≤30MHz	±1.84dB
	30MHz≤f≤1GHz	±4.90dB
	1GHz≤f≤18GHz	±5.12dB
	18GHz≤f≤40GHz	±4.66dB
6. AC Power line Conducted Emission	150kHz≤f≤30MHz	±3.10dB

ANNEX A: Detailed Test Results

A.0 Antenna Requirement

Measurement Limit:

Standard	Requirement
FCC CRF Part 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Antenna Gain:

Channel	CH 1	CH 3	CH 6	CH 9	CH 11
Gain (dBi)	-4.94	-4.62	-4.58	-4.58	-4.64

Note: The RF transmitter uses an integrate antenna without connector.

A.1 Test Configuration

A.1.1 Conducted Measurements

The measurement is made according to ANSI C63.10.

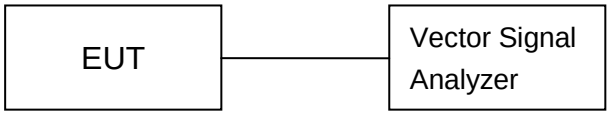
1). Connect the EUT to the test system correctly.

2). Set the EUT to the required work mode.

3). Set the EUT to the required channel.

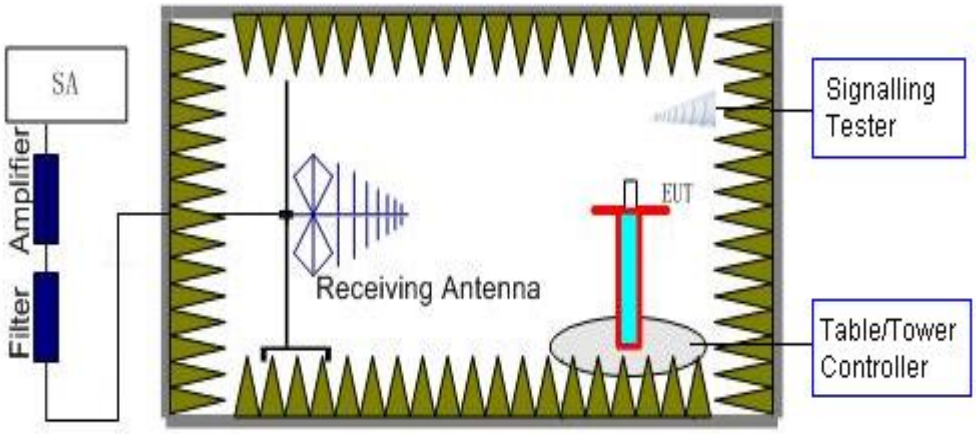
4). Set the spectrum analyzer to start measurement.

5). Record the values.



A.1.2 Radiated Measurements

Test setup: EUT was placed on a 1.5 meter high non-conductive table at a 3 meter test distance from the receive antenna. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT and adjusting the receiving antenna polarization.



A.2 Maximum Output Power

Measurement of method :See ANSI C63.10-Clause 11.9.2.3.2

Method AVGPM-G is a measurement using a gated RF average power meter.

Alternatively, measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Because the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

Measurement Limit:

Standard	Limit (dBm)	E.I.R.P Limit (dBm)
FCC CRF Part 15.247(b) & RSS-247 section 5.4	< 30	< 36

Measurement Results:

Mode	Channel	Frequency (MHz)	Average Conducted Power (dBm)	E.I.R.P (dBm)	Conclusion
802.11b	CH 1	2412	15.65	10.71	P
	CH 6	2437	15.15	10.57	P
	CH 11	2462	15.52	10.88	P
802.11g	CH 1	2412	12.64	7.70	P
	CH 6	2437	12.74	8.16	P
	CH 11	2462	12.53	7.89	P
802.11n HT20	CH 1	2412	10.65	5.71	P
	CH 6	2437	10.79	6.21	P
	CH 11	2462	10.56	5.92	P
802.11n HT40	CH 3	2422	10.53	5.91	P
	CH 6	2437	10.59	6.01	P
	CH 9	2452	10.28	5.70	P

Note: E.I.R.P value = Conducted values (with conducted samples) + Antenna Gain.

Note: Worst-case data rates as provided by the client were: 11Mbps (802.11b), 54Mbps (802.11g), MCS7 (802.11n). The following cases and test graphs are performed with this condition. The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

A.3 Peak Power Spectral Density

Measurement Limit:

Standard	Limit
FCC CRF Part 15.247(e) & RSS-247 section 5.2	< 8 dBm/3 kHz

Measurement Results:

Mode	Channel	Frequency (MHz)	Test Results (dBm)		Conclusion
802.11b	CH 1	2412	Fig.1	-6.59	P
	CH 6	2437	Fig.2	-7.77	P
	CH 11	2462	Fig.3	-7.29	P
802.11g	CH 1	2412	Fig.4	-12.94	P
	CH 6	2437	Fig.5	-12.28	P
	CH 11	2462	Fig.6	-12.76	P
802.11n HT20	CH 1	2412	Fig.7	-15.49	P
	CH 6	2437	Fig.8	-15.78	P
	CH 11	2462	Fig.9	-15.84	P
802.11n HT40	CH 3	2422	Fig.10	-18.06	P
	CH 6	2437	Fig.11	-18.00	P
	CH 9	2452	Fig.12	-18.36	P

See below for test graphs.
Conclusion: PASS

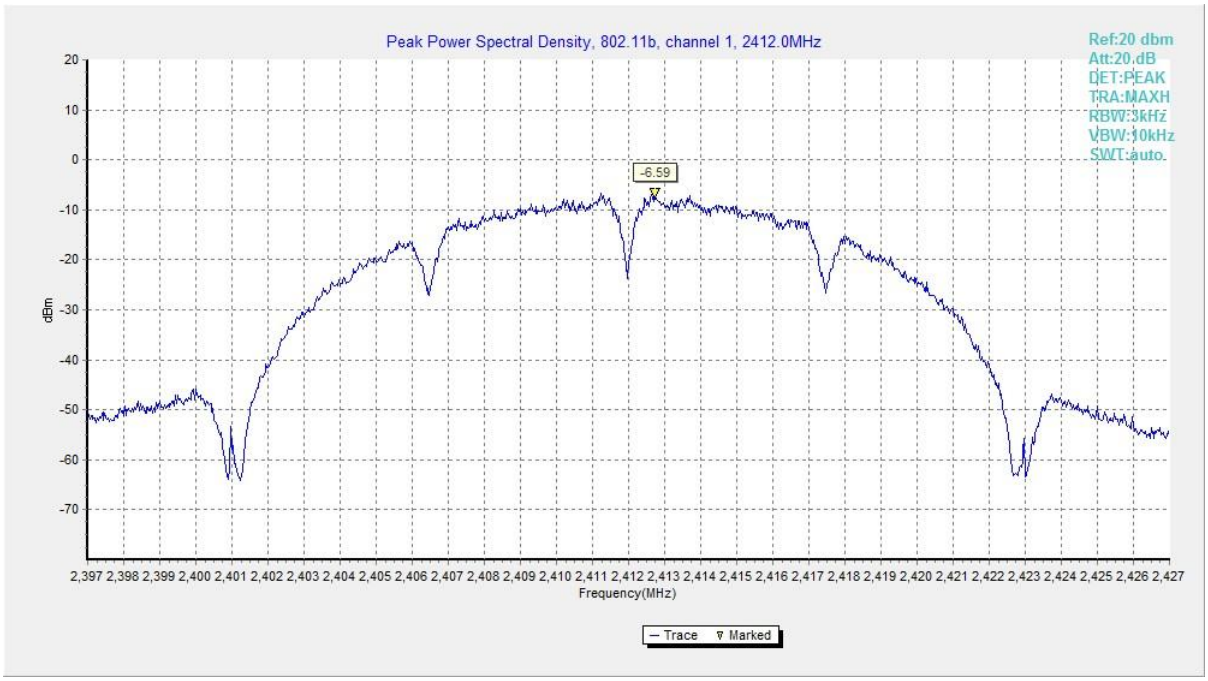


Fig.1 Power Spectral Density (802.11b, CH1)

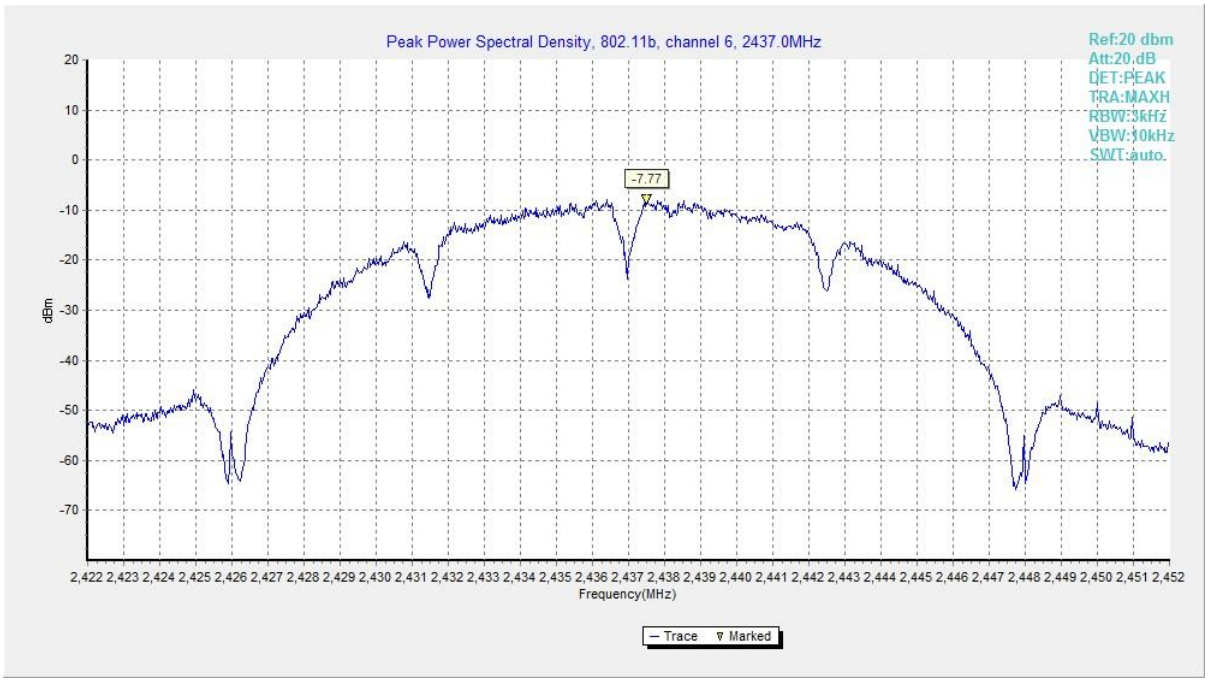


Fig.2 Power Spectral Density (802.11b, CH6)

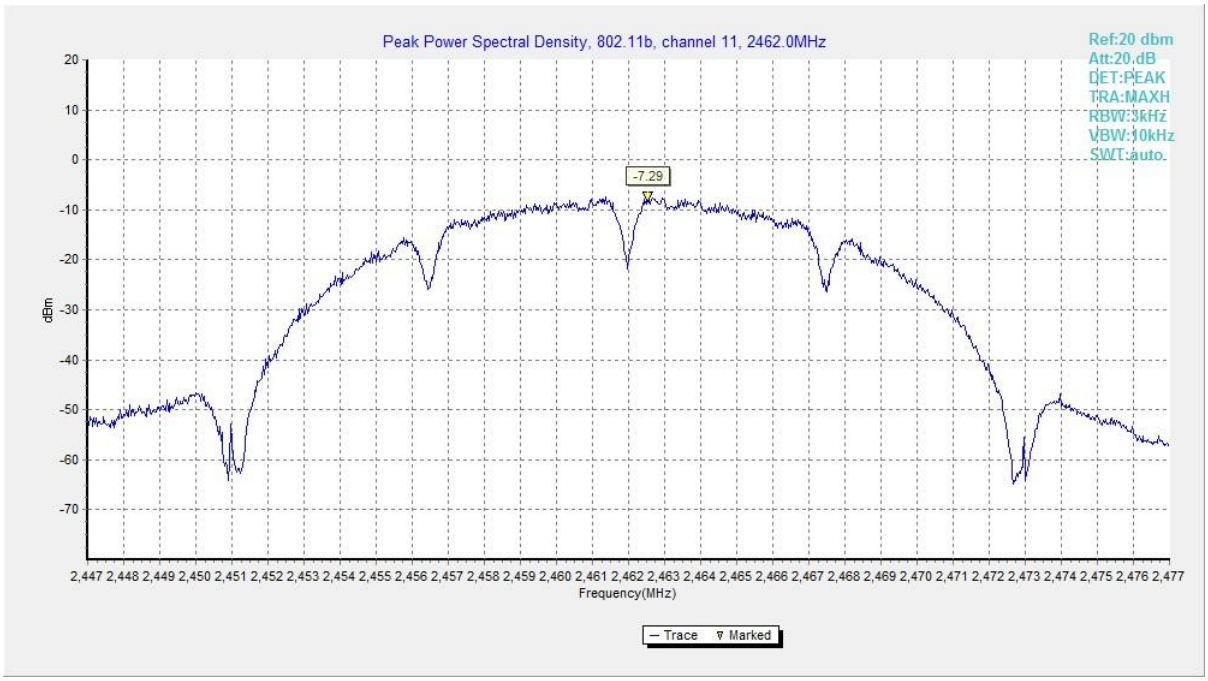


Fig.3 Power Spectral Density (802.11b, CH11)

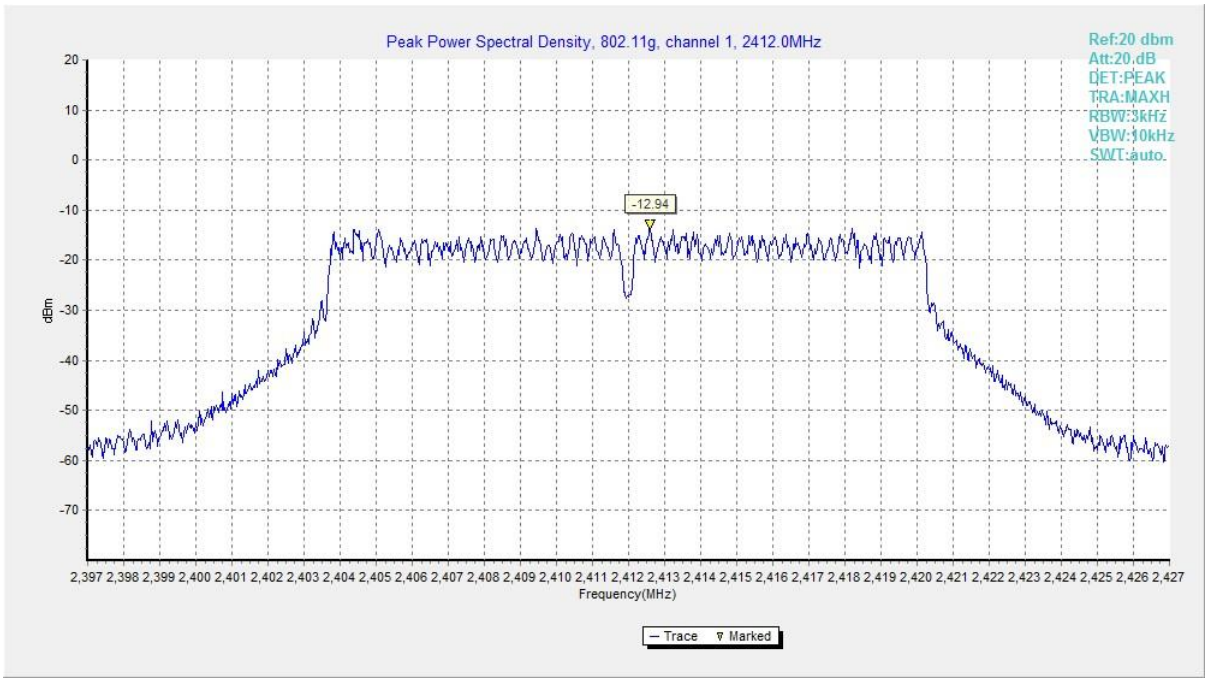


Fig.4 Power Spectral Density (802.11g, CH1)

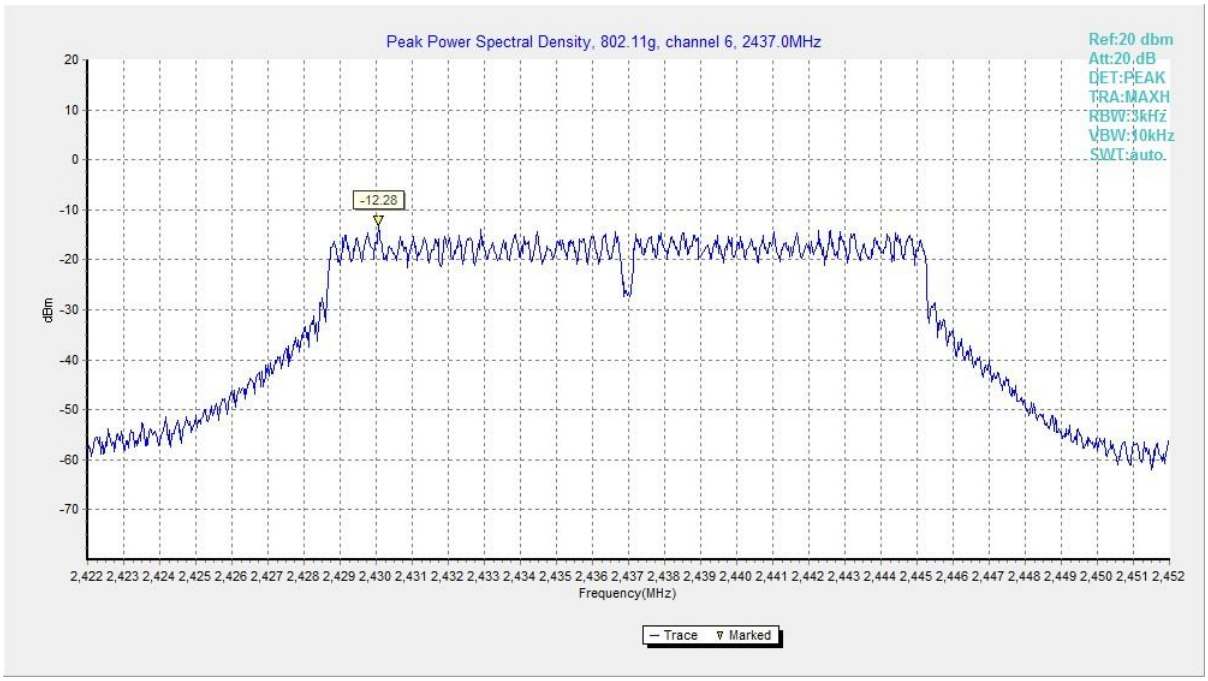


Fig.5 Power Spectral Density (802.11g, CH6)

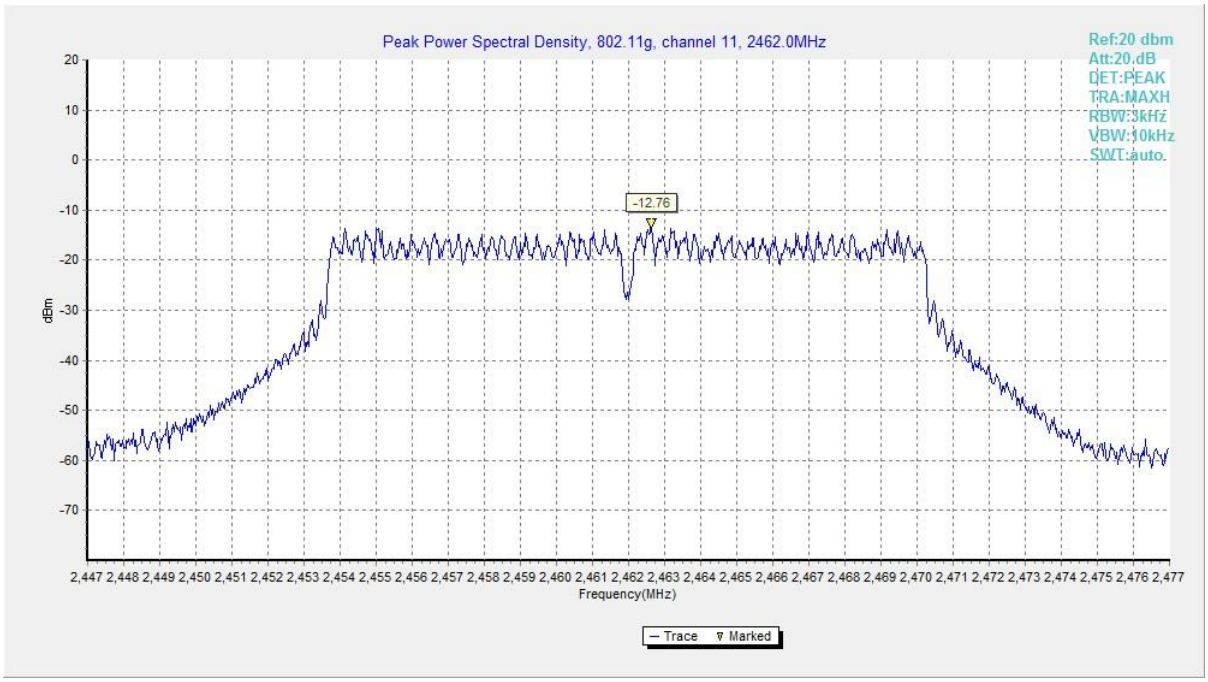


Fig.6 Power Spectral Density (802.11g, CH11)

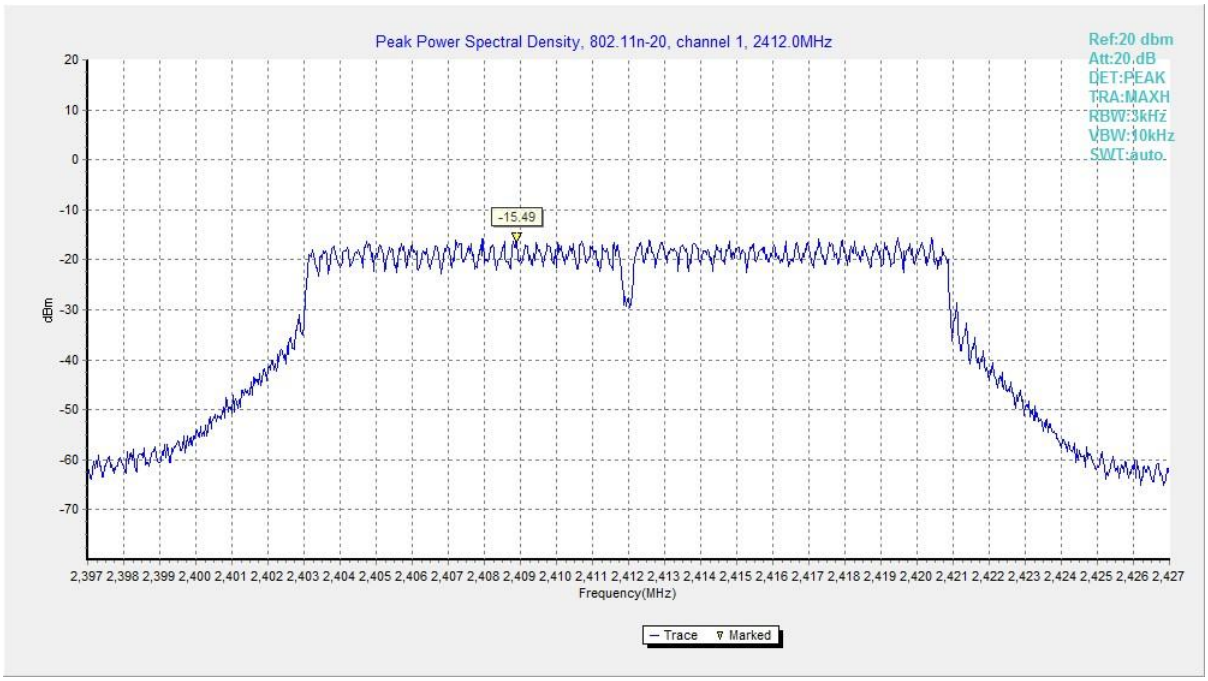


Fig.7 Power Spectral Density (802.11n HT20, CH1)

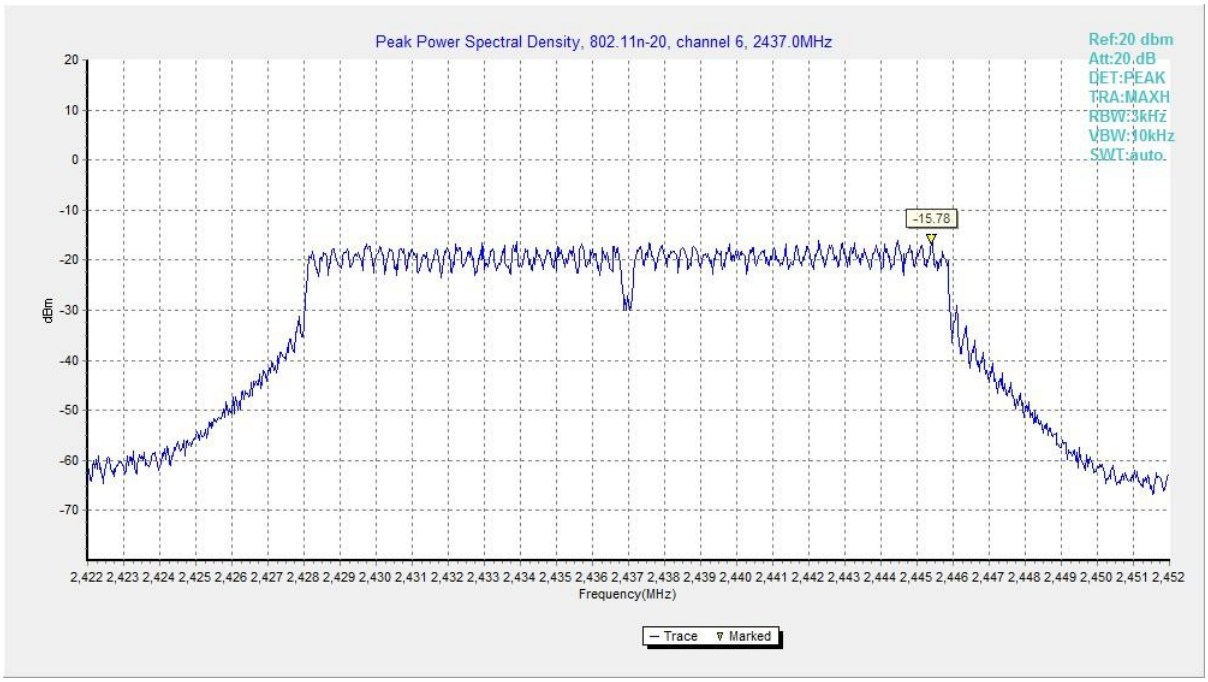


Fig.8 Power Spectral Density (802.11n HT20, CH6)

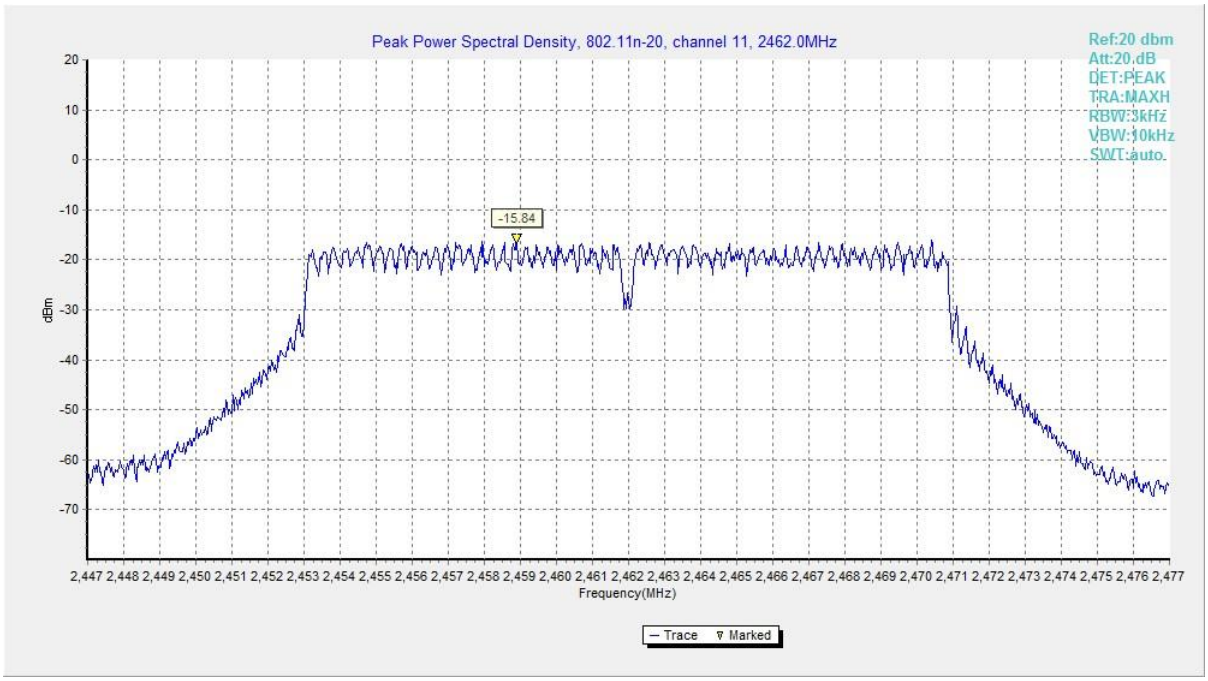


Fig.9 Power Spectral Density (802.11n HT20, CH11)

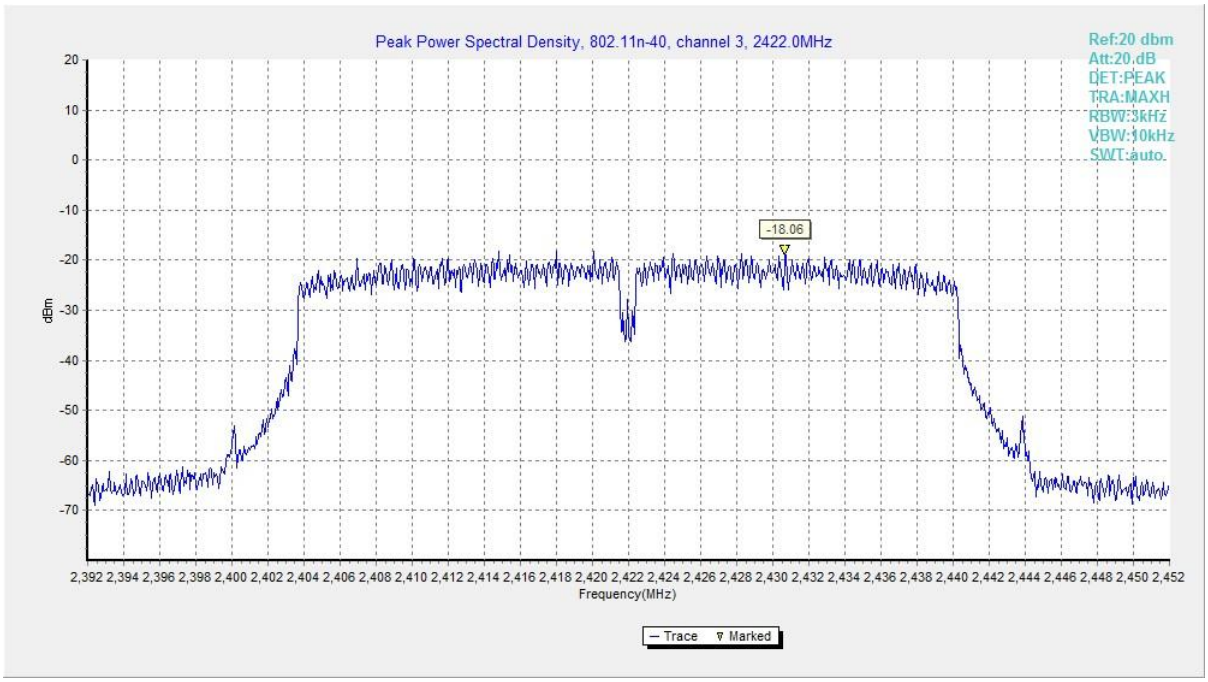


Fig.10 Power Spectral Density (802.11n HT40, CH3)

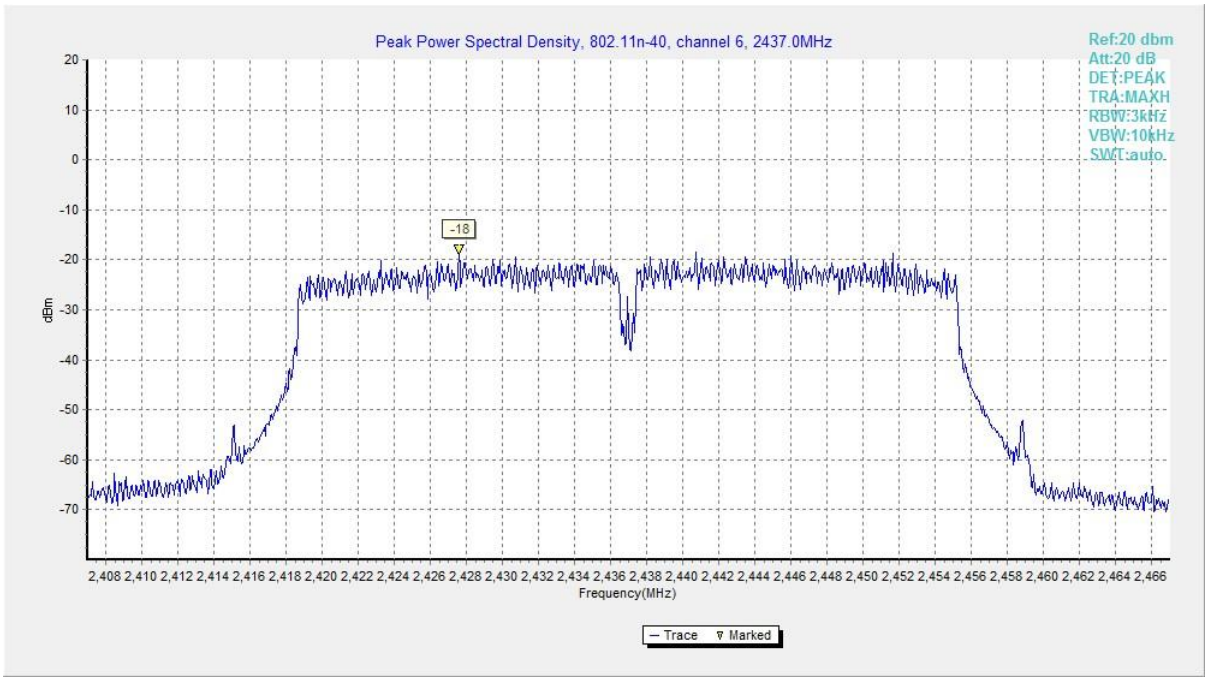


Fig.11 Power Spectral Density (802.11n HT40, CH6)

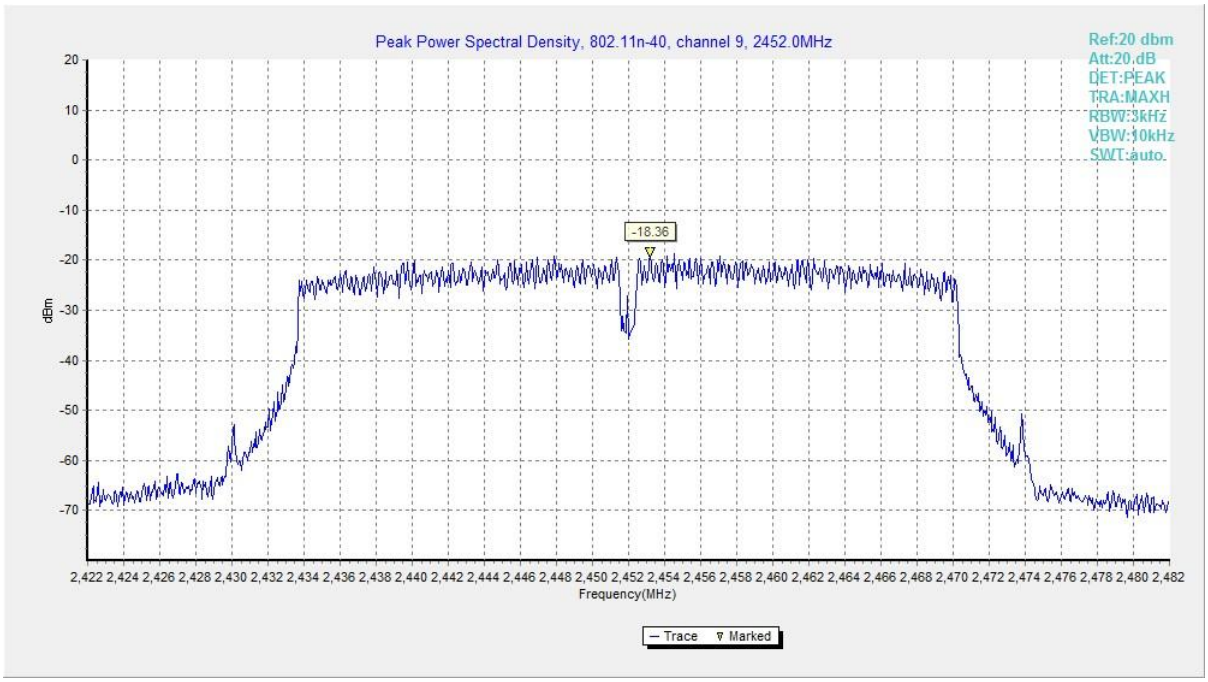


Fig.12 Power Spectral Density (802.11n HT40, CH9)

A.4 6dB Bandwidth

Measurement Limit:

Standard	Limit (kHz)
FCC 47 CFR Part 15.247 (a) & RSS-247 section 5.2	≥ 500

Measurement Result:

Mode	Channel	Frequency (MHz)	Test Results (kHz)		Conclusion
802.11b	CH 1	2412	Fig.13	9550	P
	CH 6	2437	Fig.14	10000	P
	CH 11	2462	Fig.15	10050	P
802.11g	CH 1	2412	Fig.16	16350	P
	CH 6	2437	Fig.17	16350	P
	CH 11	2462	Fig.18	16350	P
802.11n HT20	CH 1	2412	Fig.19	17350	P
	CH 6	2437	Fig.20	17550	P
	CH 11	2462	Fig.21	17550	P
802.11n HT40	CH 3	2422	Fig.22	35200	P
	CH 6	2437	Fig.23	35200	P
	CH 9	2452	Fig.24	35120	P

See below for test graphs.
Conclusion: PASS

Fig.13 6dB Bandwidth (802.11b, CH1)

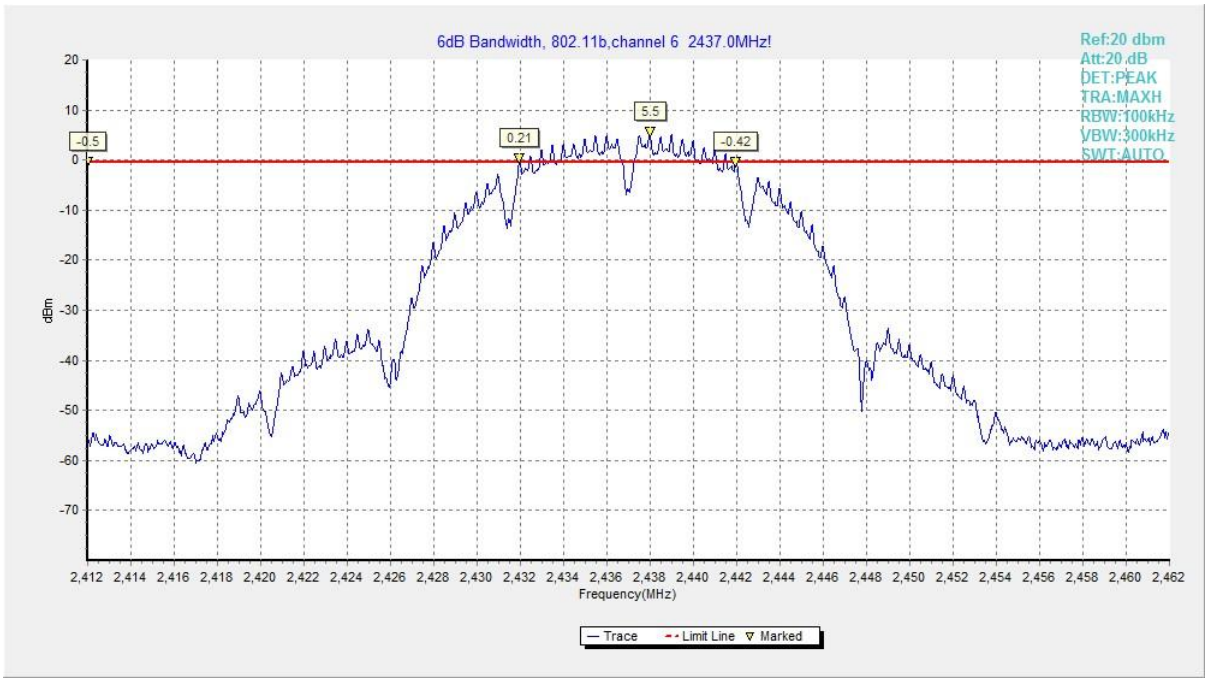


Fig.14 6dB Bandwidth (802.11b, CH6)

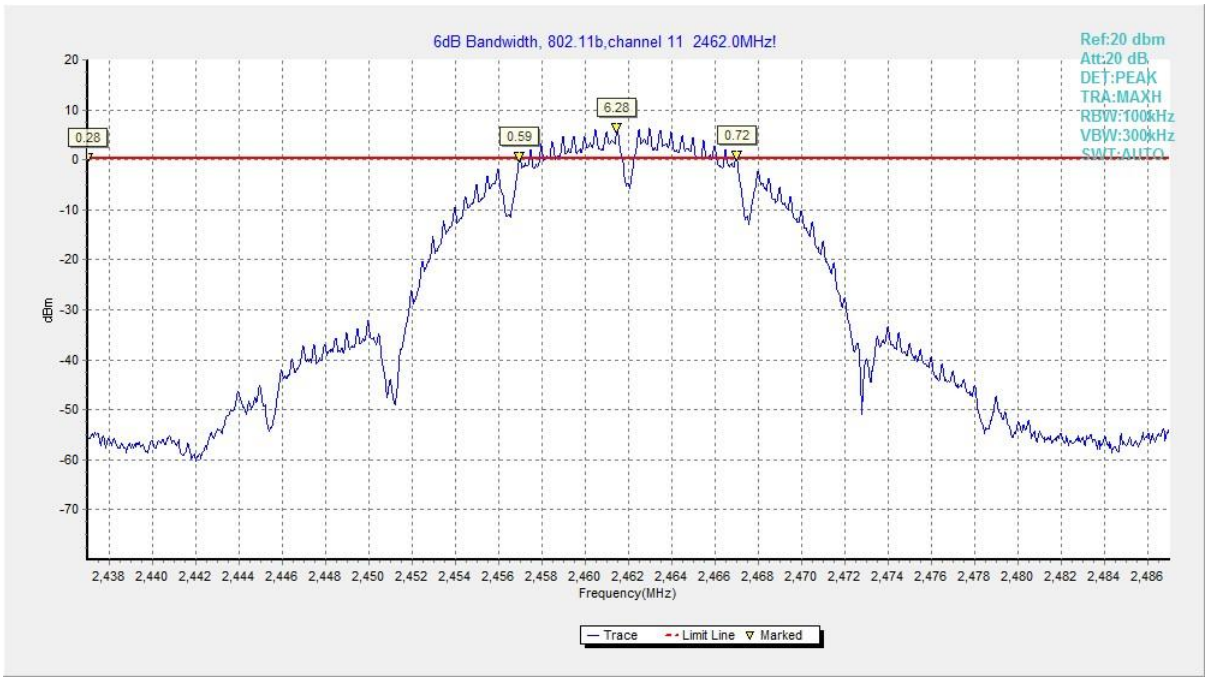


Fig.15 6dB Bandwidth (802.11b, CH11)

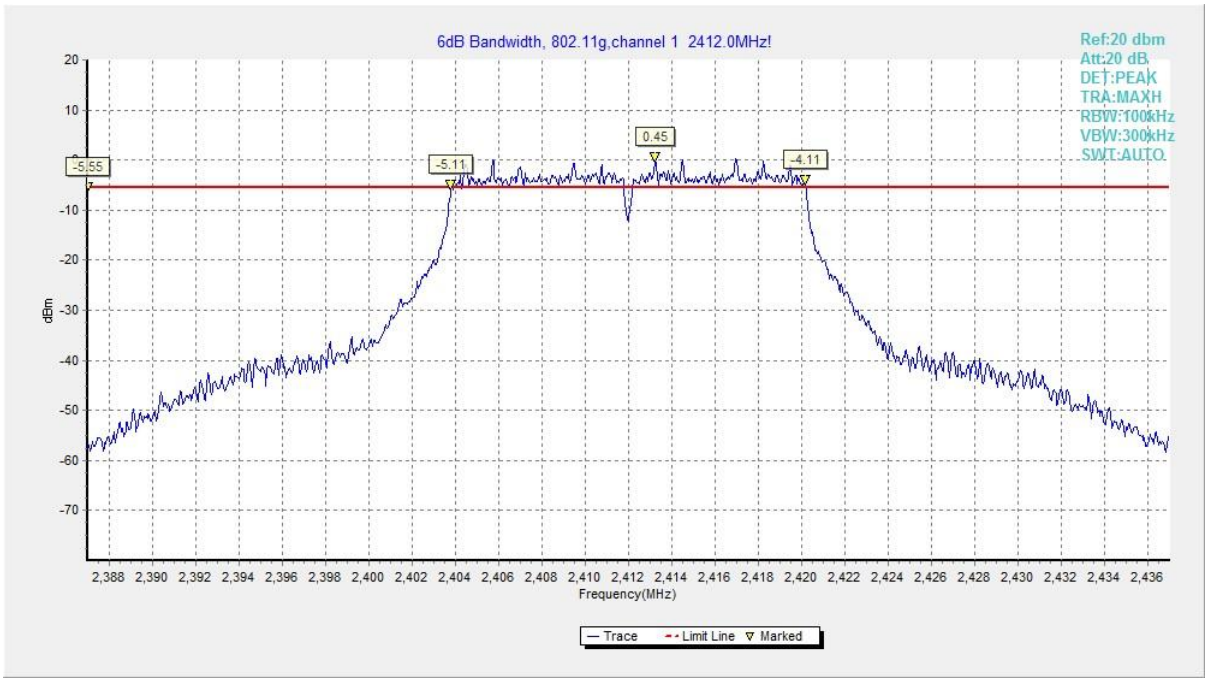


Fig.16 6dB Bandwidth (802.11g, CH1)

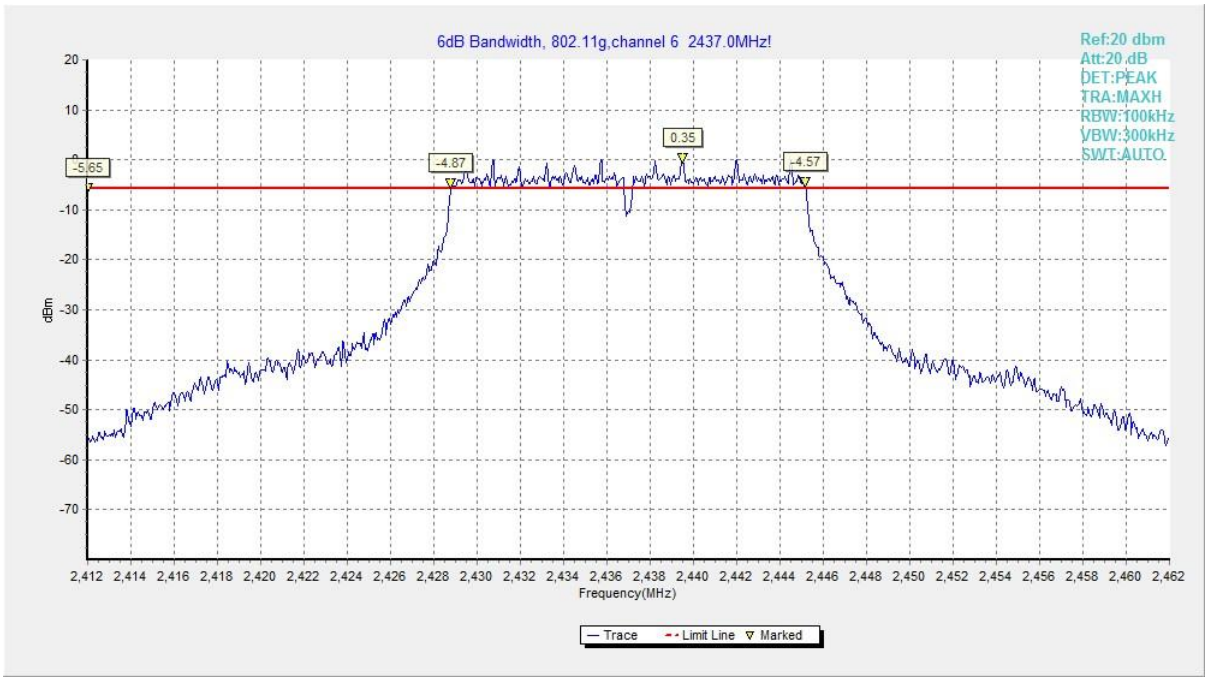


Fig.17 6dB Bandwidth (802.11g, CH6)

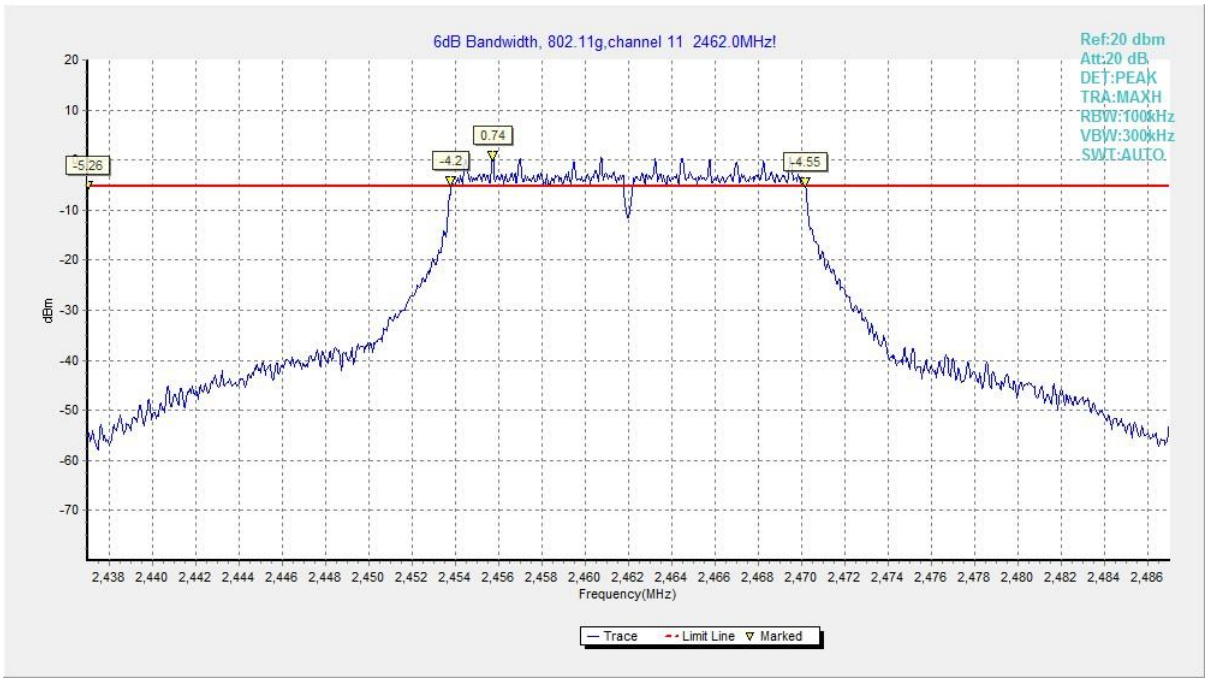


Fig.18 6dB Bandwidth (802.11g, CH11)

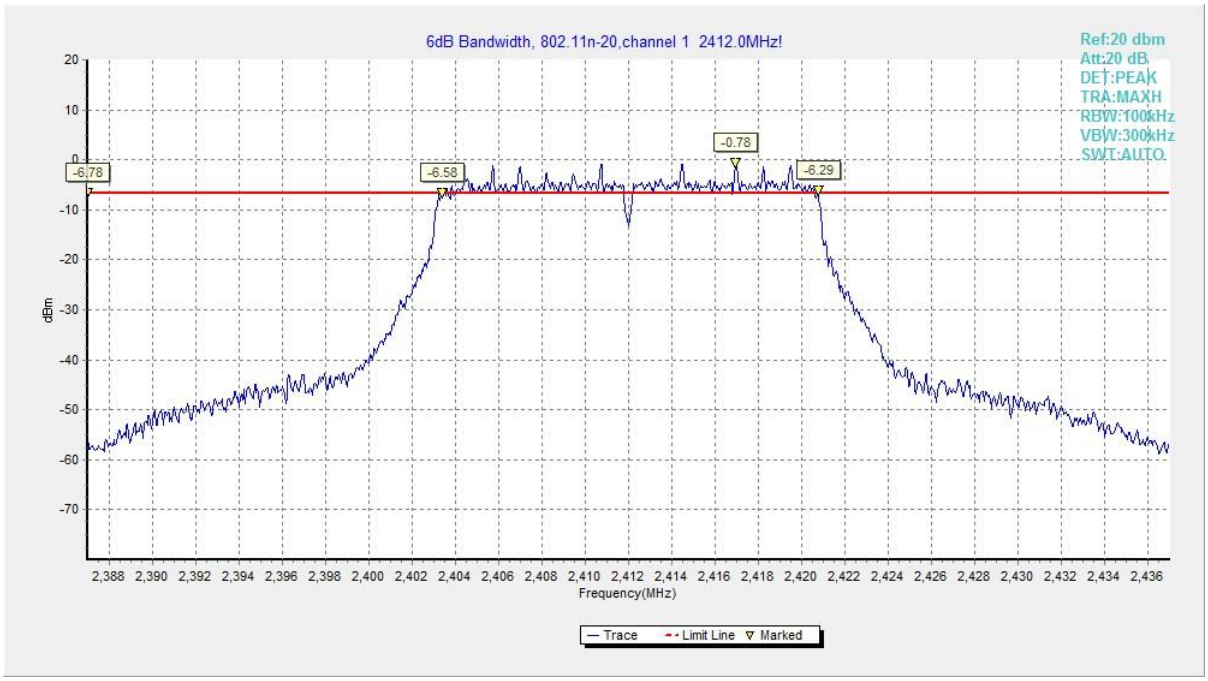


Fig.19 6dB Bandwidth (802.11n HT20, CH1)

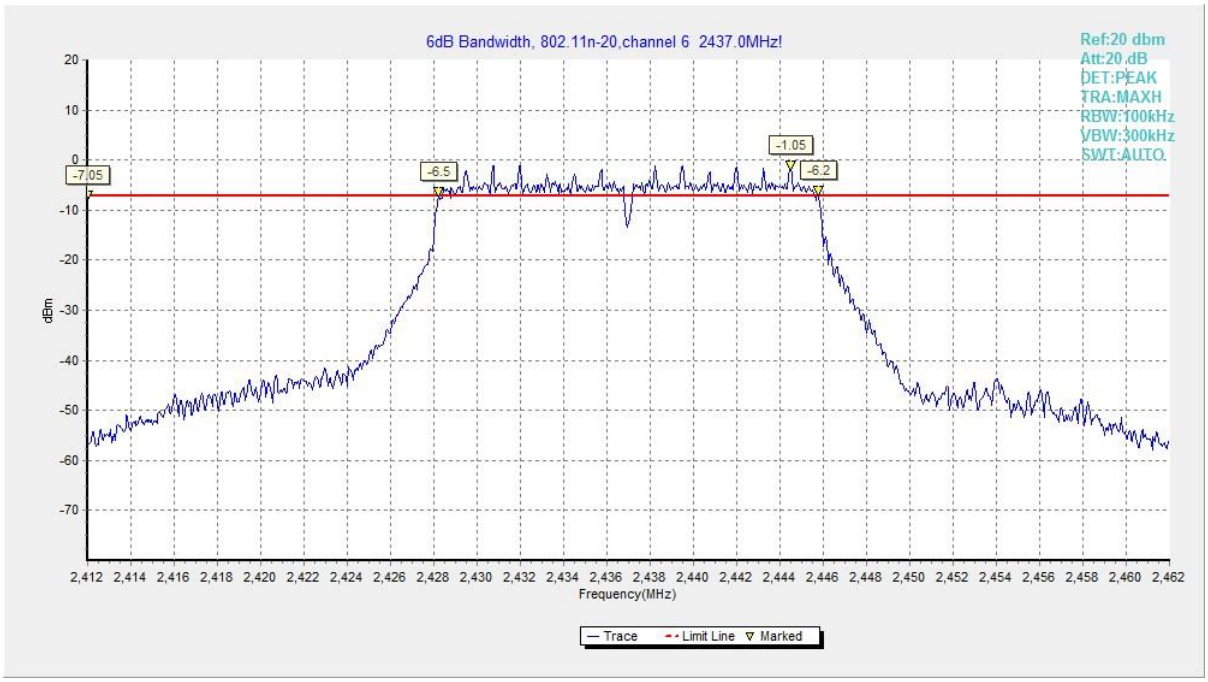


Fig.20 6dB Bandwidth (802.11n HT20, CH6)

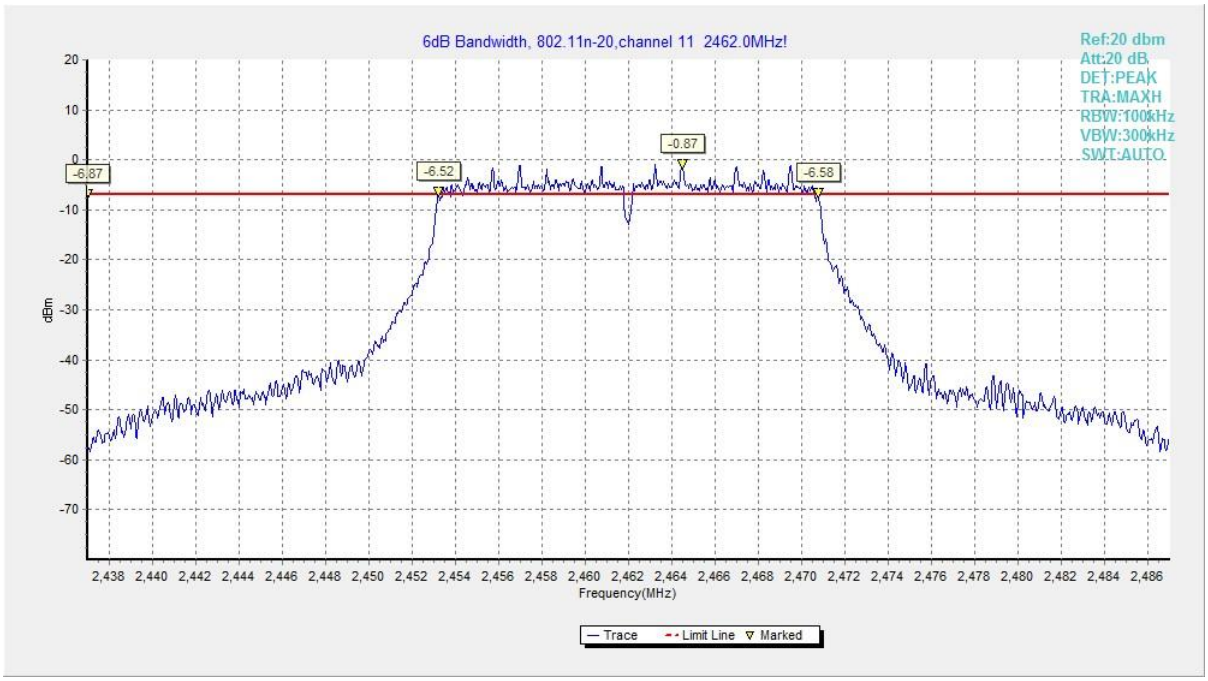


Fig.21 6dB Bandwidth (802.11n HT20, CH11)

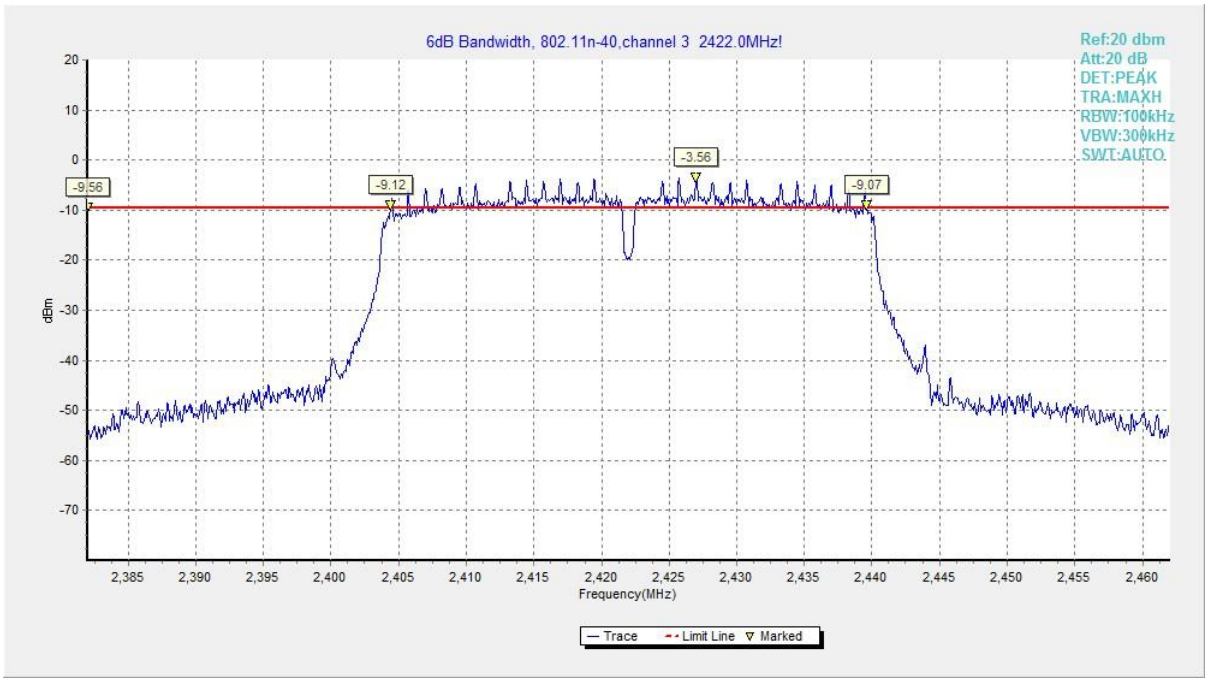


Fig.22 6dB Bandwidth (802.11n HT40, CH3)

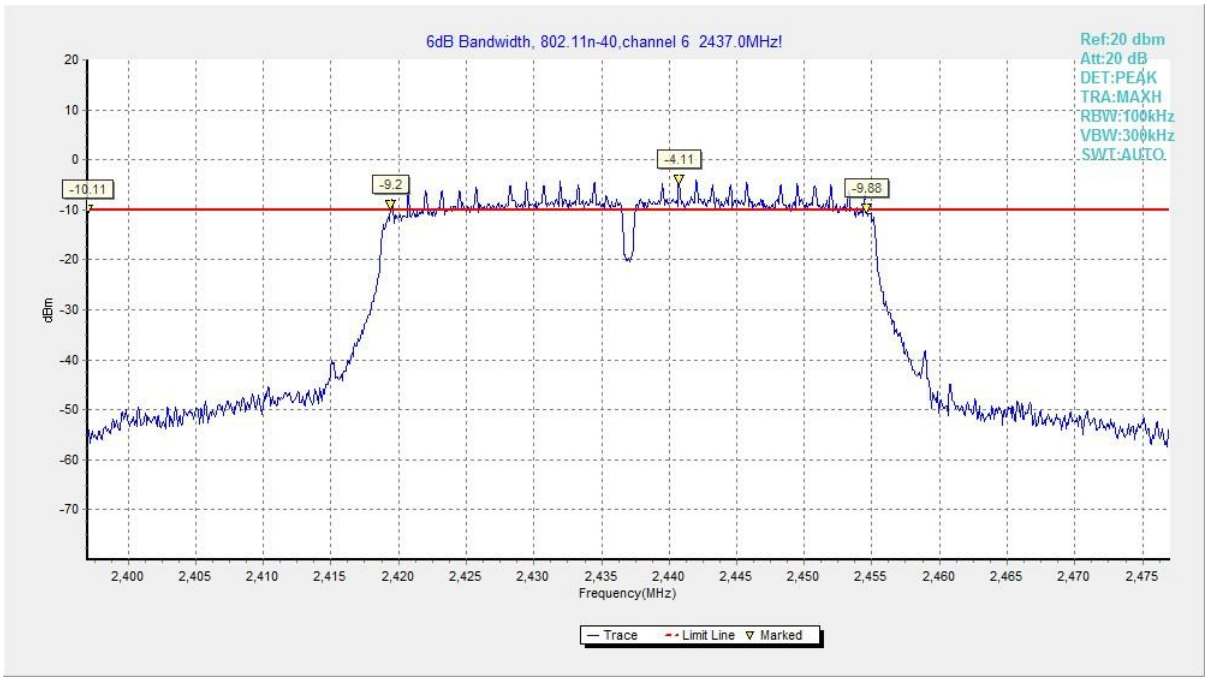


Fig.23 6dB Bandwidth (802.11n HT40, CH6)

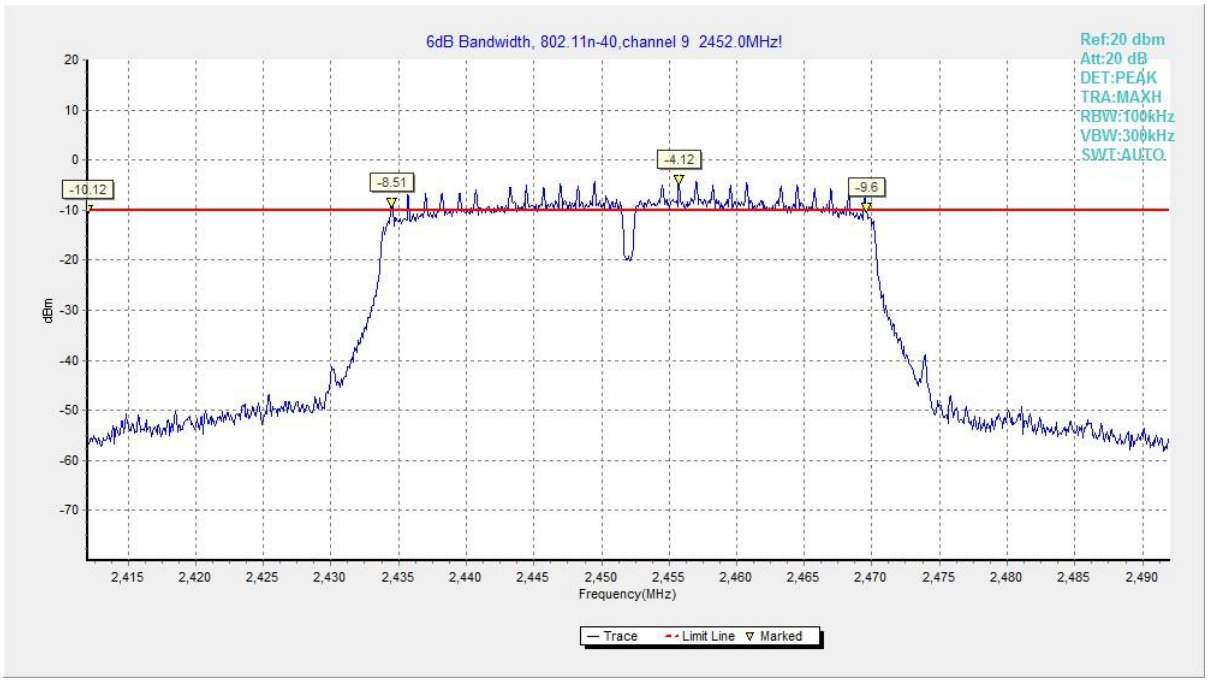


Fig.24 6dB Bandwidth (802.11n HT40, CH9)

A.5 Band Edges Compliance

Measurement Limit:

Standard	Limit (dB)
FCC 47 CFR Part 15.247 (d) & RSS-247 section 5.5	> 20

Measurement Result:

Mode	Channel	Frequency (MHz)	Test Results (dB)		Conclusion
802.11b	CH 1	2412	Fig.25	39.33	P
	CH 11	2462	Fig.26	61.45	P
802.11g	CH 1	2412	Fig.27	38.70	P
	CH 11	2462	Fig.28	49.39	P
802.11n HT20	CH 1	2412	Fig.29	40.26	P
	CH 11	2462	Fig.30	52.69	P
802.11n HT40	CH 3	2422	Fig.31	39.36	P
	CH 9	2452	Fig.32	47.67	P

See below for test graphs.
Conclusion: PASS

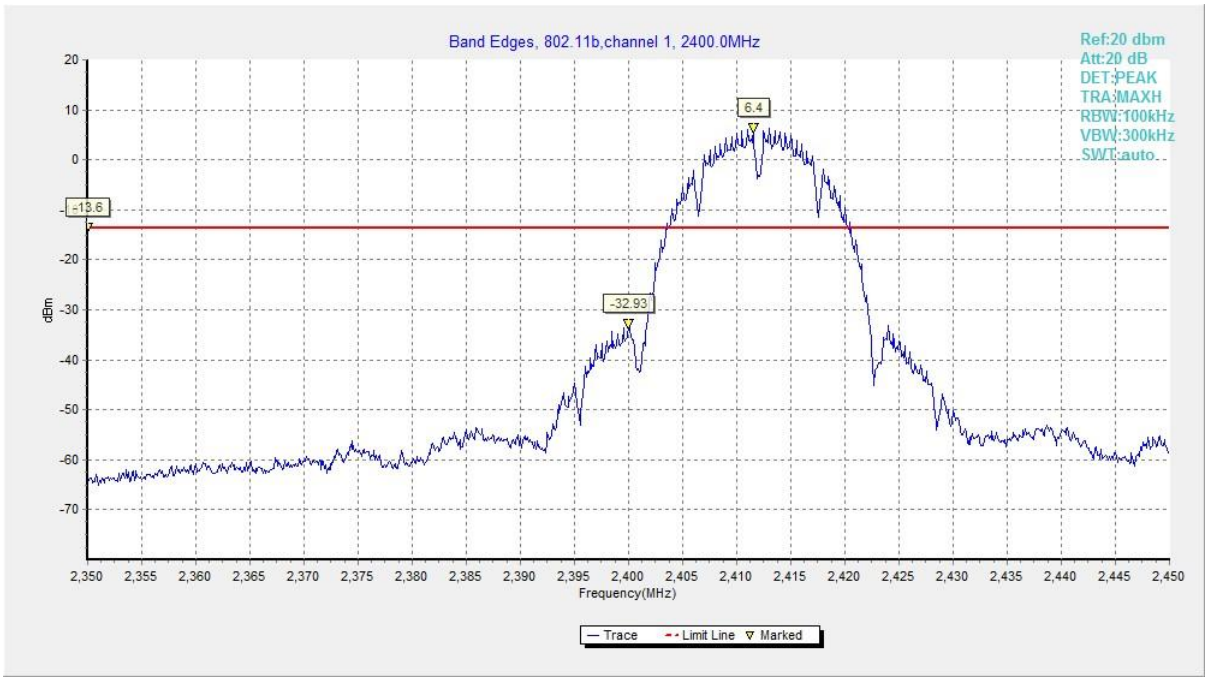


Fig.25 Band Edges (802.11b, CH1)

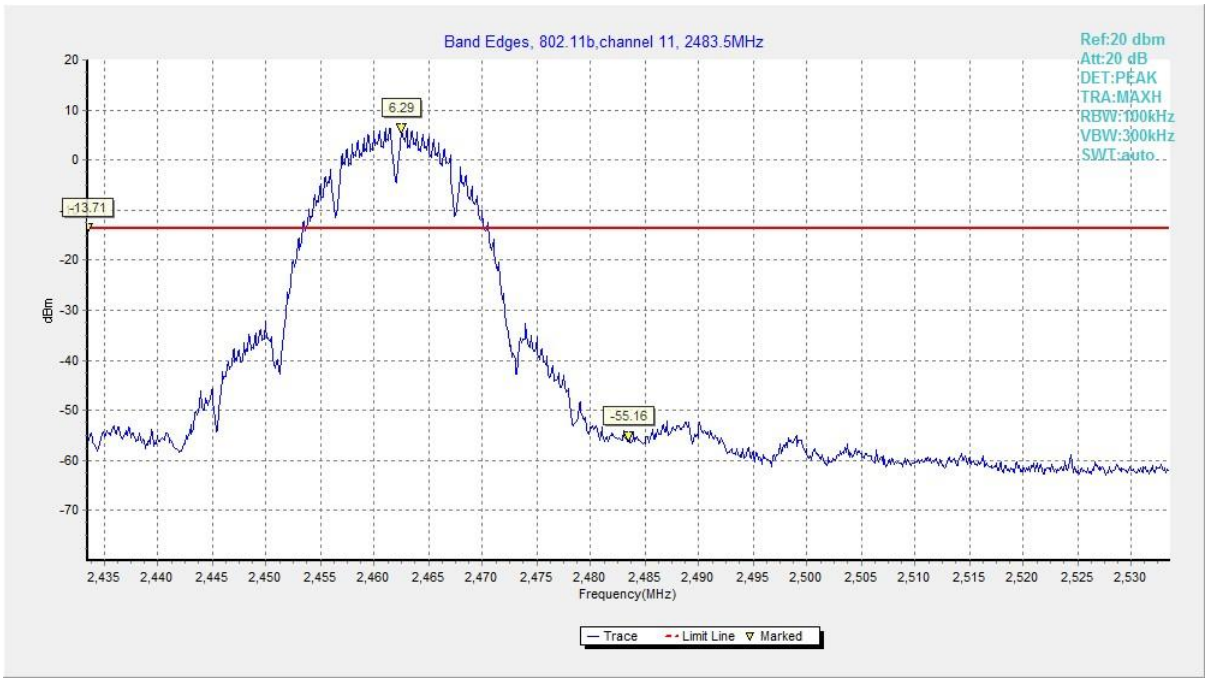


Fig.26 Band Edges (802.11b, CH11)

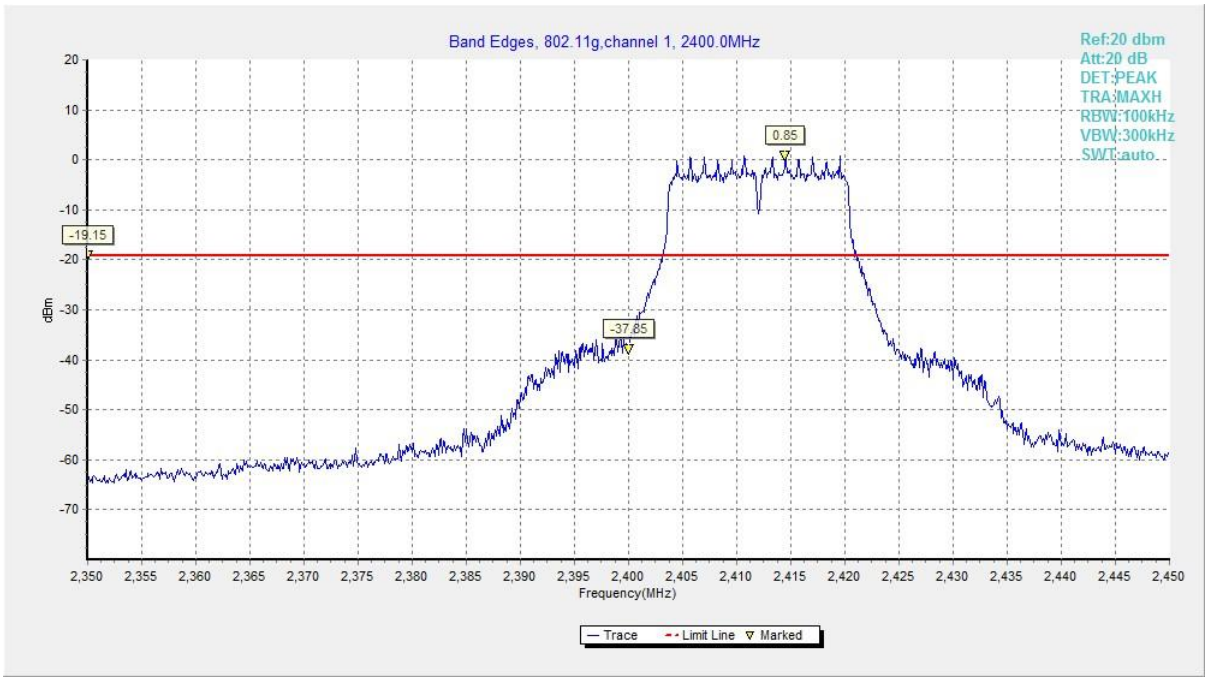


Fig.27 Band Edges (802.11g, CH1)

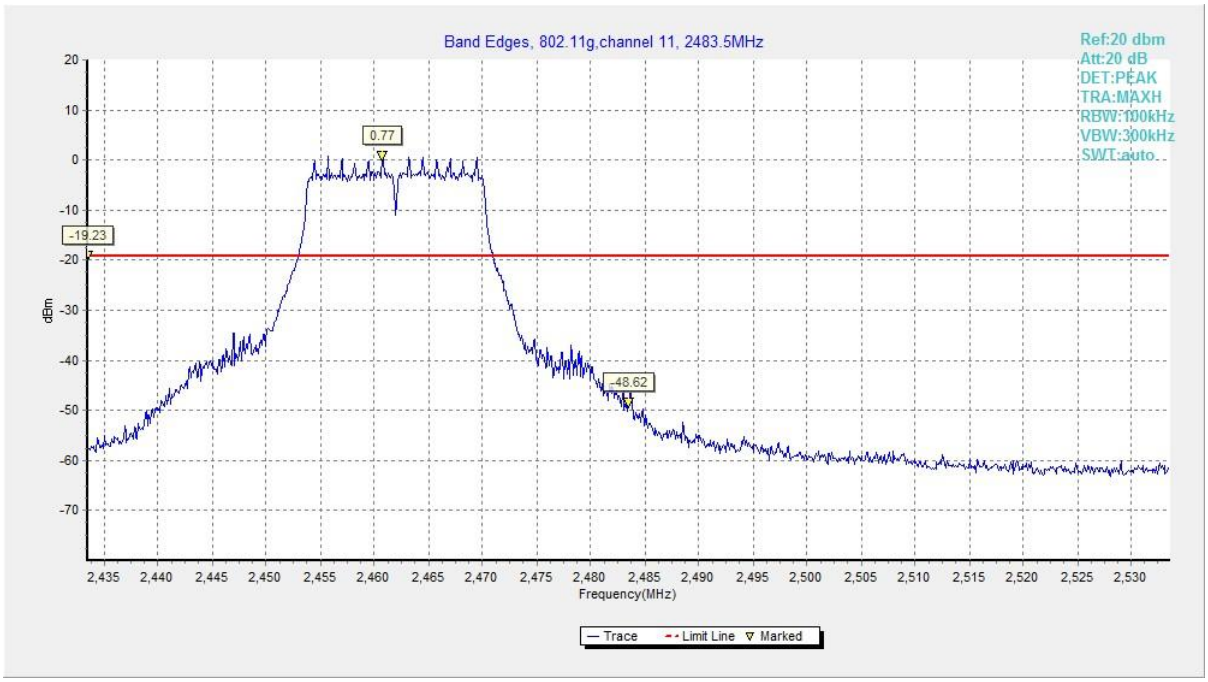


Fig.28 Band Edges (802.11g, CH11)

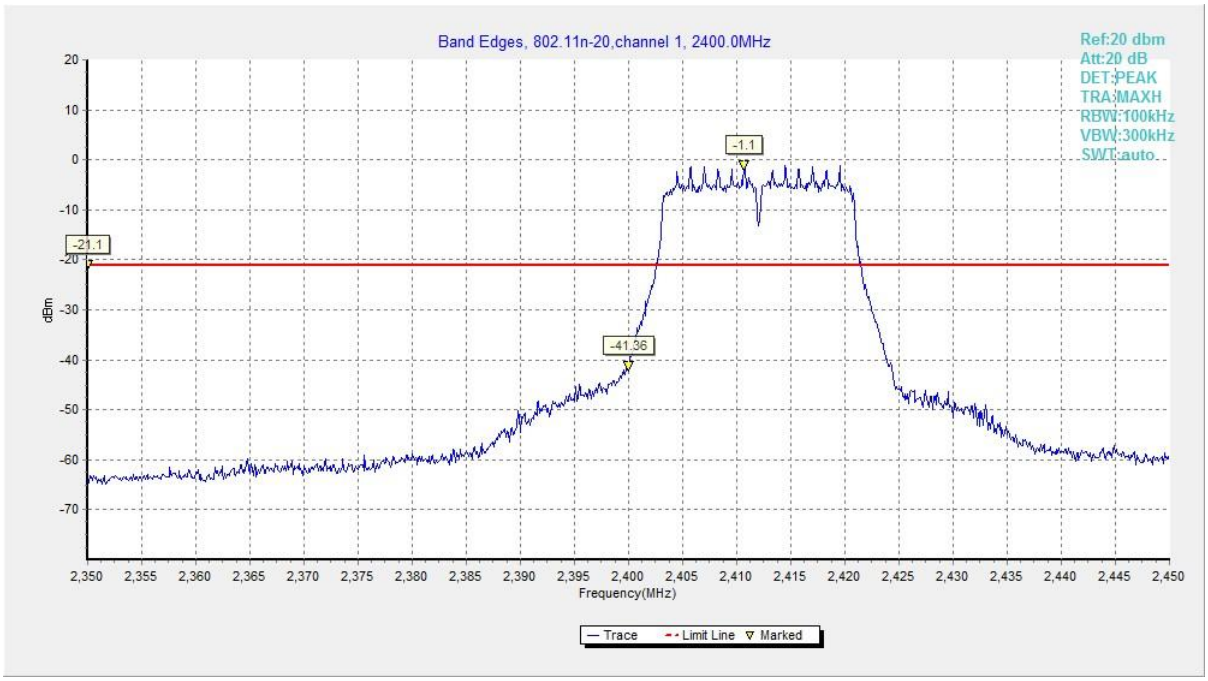


Fig.29 Band Edges (802.11n HT20, CH1)

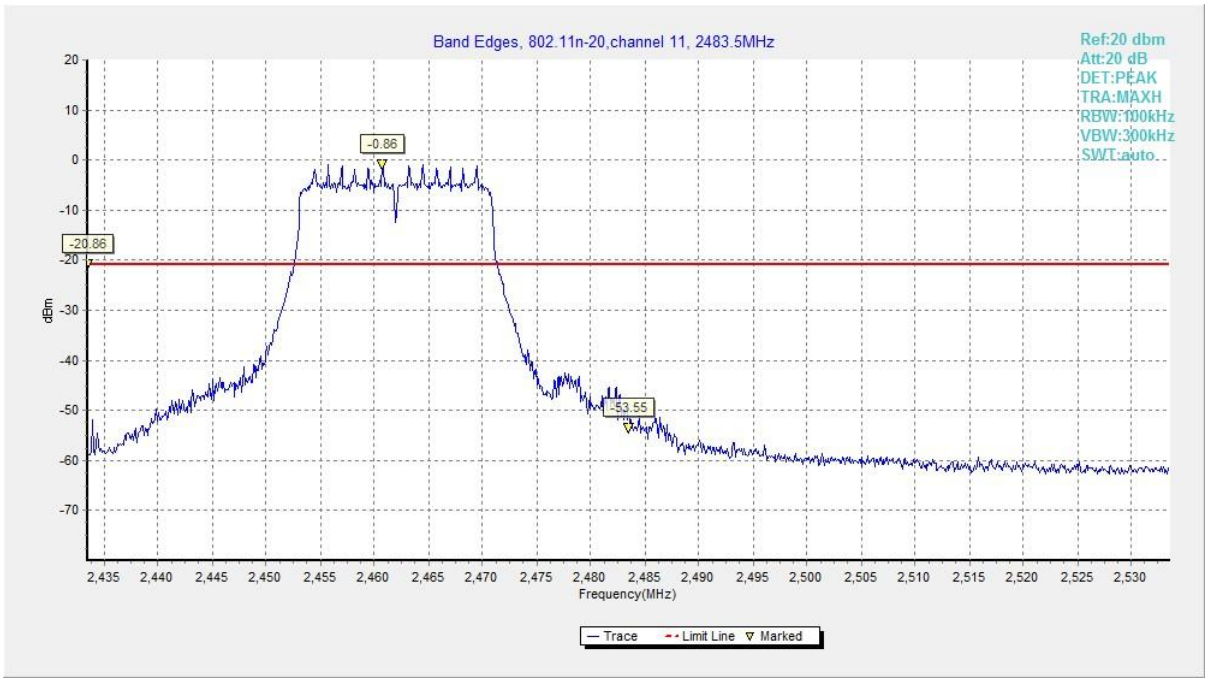


Fig.30 Band Edges (802.11n HT20, CH11)

Fig.31 Band Edges (802.11n HT40, CH3)

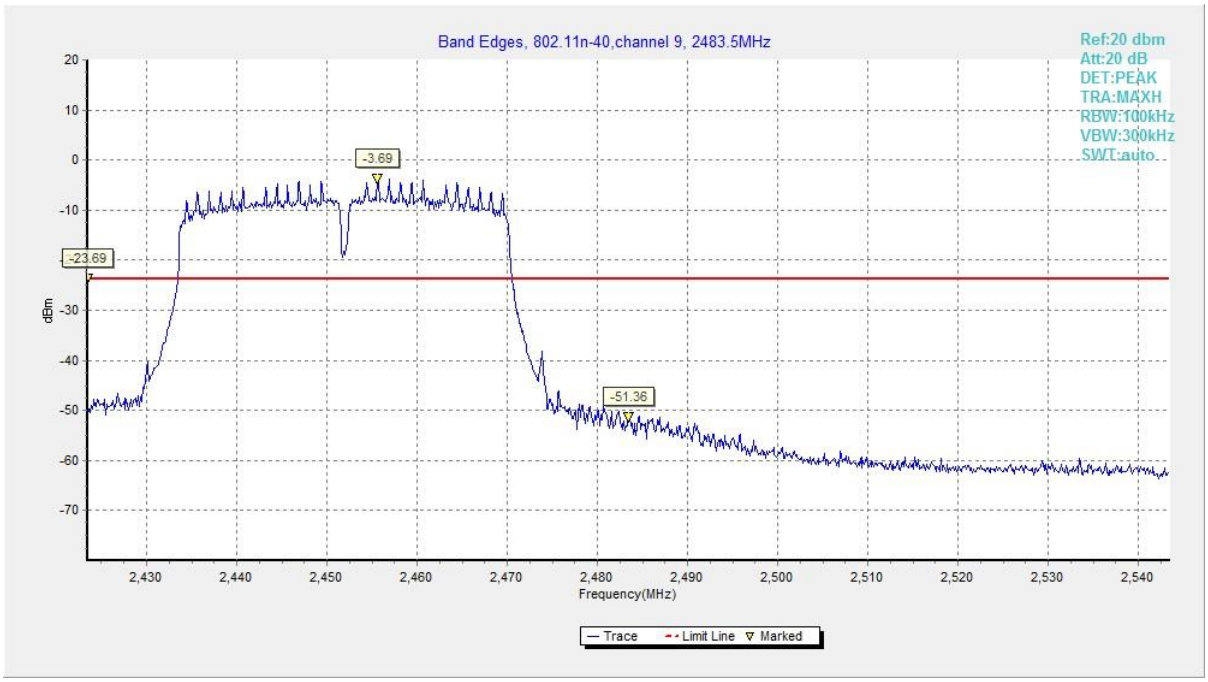


Fig.32 Band Edges (802.11n HT40, CH9)

A.6 Conducted Emission

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247 (d) & RSS-247 section 5.5/ RSS-Gen section 6.13	30dB below peak output power in 100kHz bandwidth

Measurement Results:

Mode	Channel	Frequency (MHz)	Frequency Range	Test Results	Conclusion
802.11b	CH 1	2412	30MHz~26GHz	Fig.33	P
	CH 6	2437	30MHz~26GHz	Fig.34	P
	CH 11	2462	30MHz~26GHz	Fig.35	P
802.11g	CH 1	2412	30MHz~26GHz	Fig.36	P
	CH 6	2437	30MHz~26GHz	Fig.37	P
	CH 11	2462	30MHz~26GHz	Fig.38	P
802.11n HT20	CH 1	2412	30MHz~26GHz	Fig.39	P
	CH 6	2437	30MHz~26GHz	Fig.40	P
	CH 11	2462	30MHz~26GHz	Fig.41	P
802.11n HT40	CH 3	2422	30MHz~26GHz	Fig.42	P
	CH 6	2437	30MHz~26GHz	Fig.43	P
	CH 9	2452	30MHz~26GHz	Fig.44	P

See below for test graphs.
Conclusion: PASS

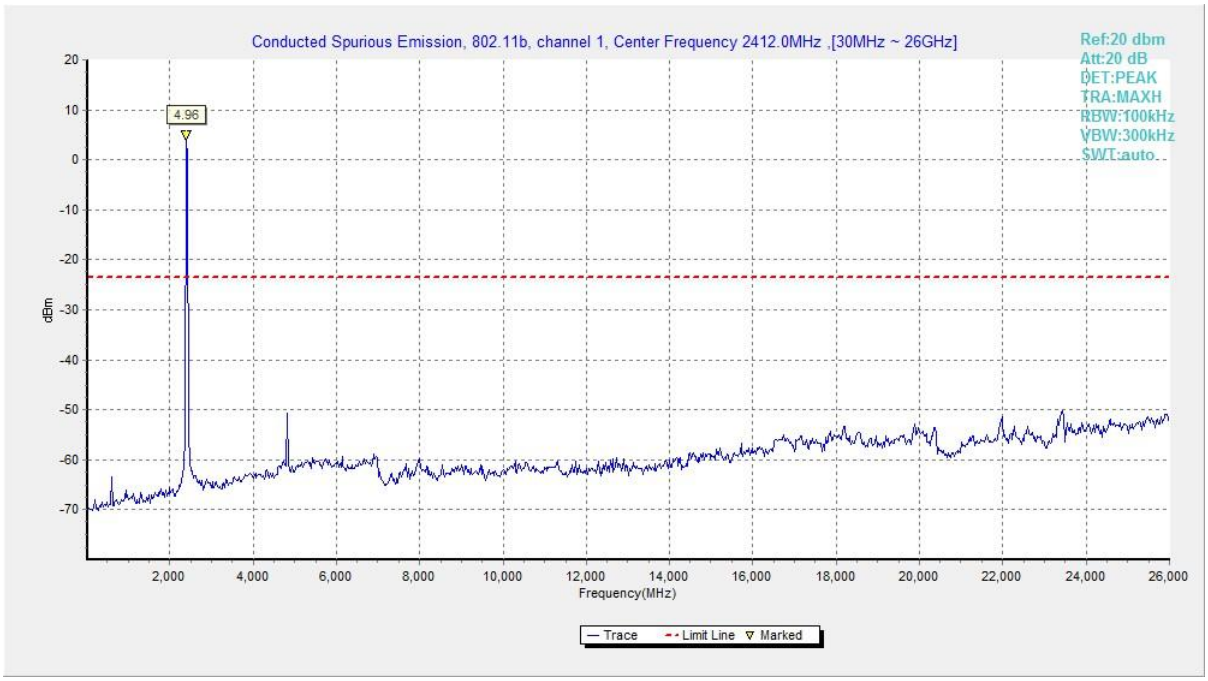


Fig.33 Conducted Spurious Emission (802.11b, CH1)

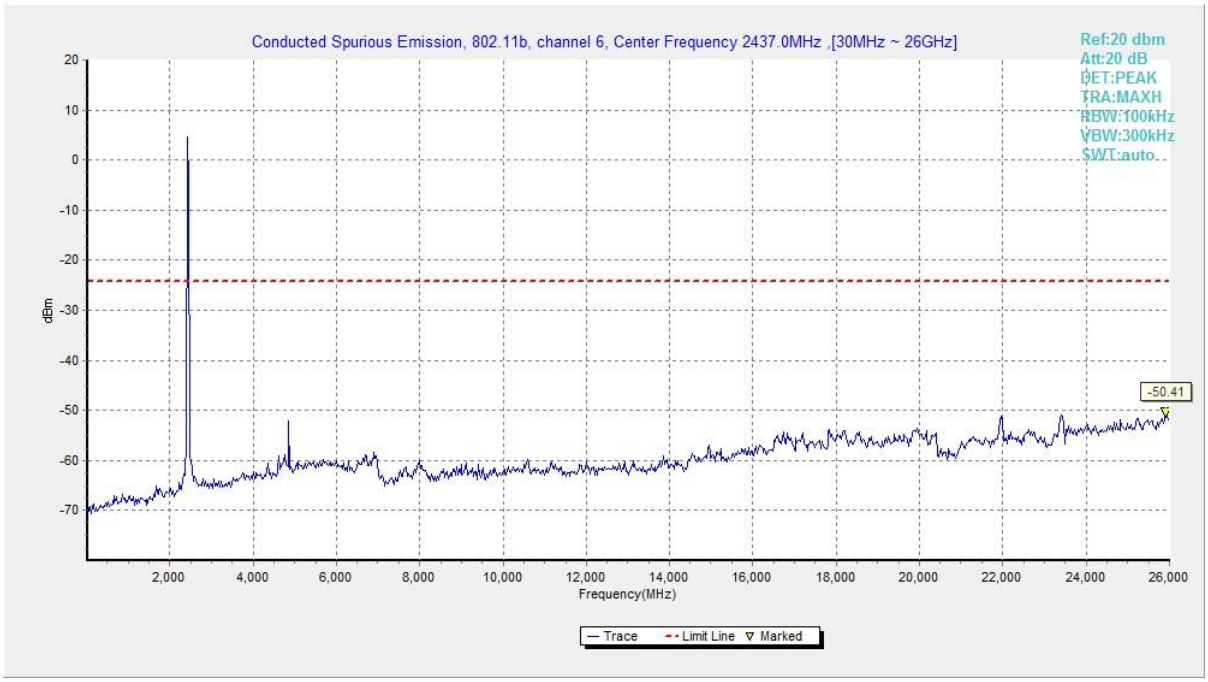


Fig.34 Conducted Spurious Emission (802.11b, CH6)

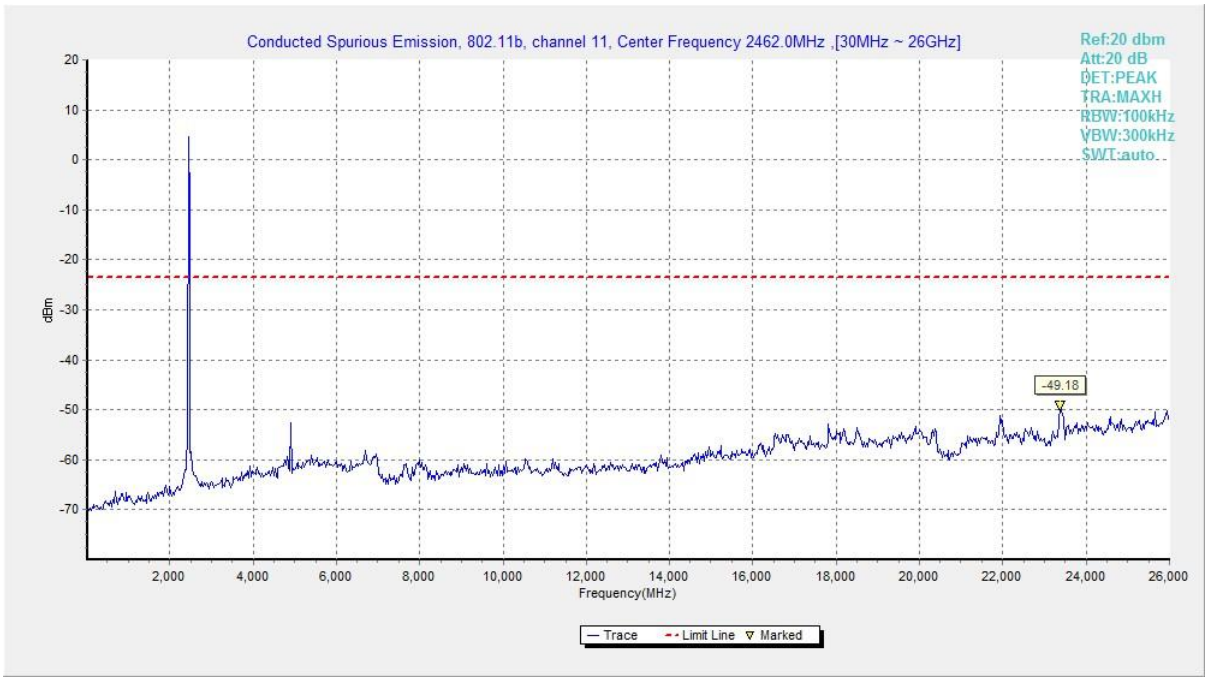


Fig.35 Conducted Spurious Emission (802.11b, CH11)

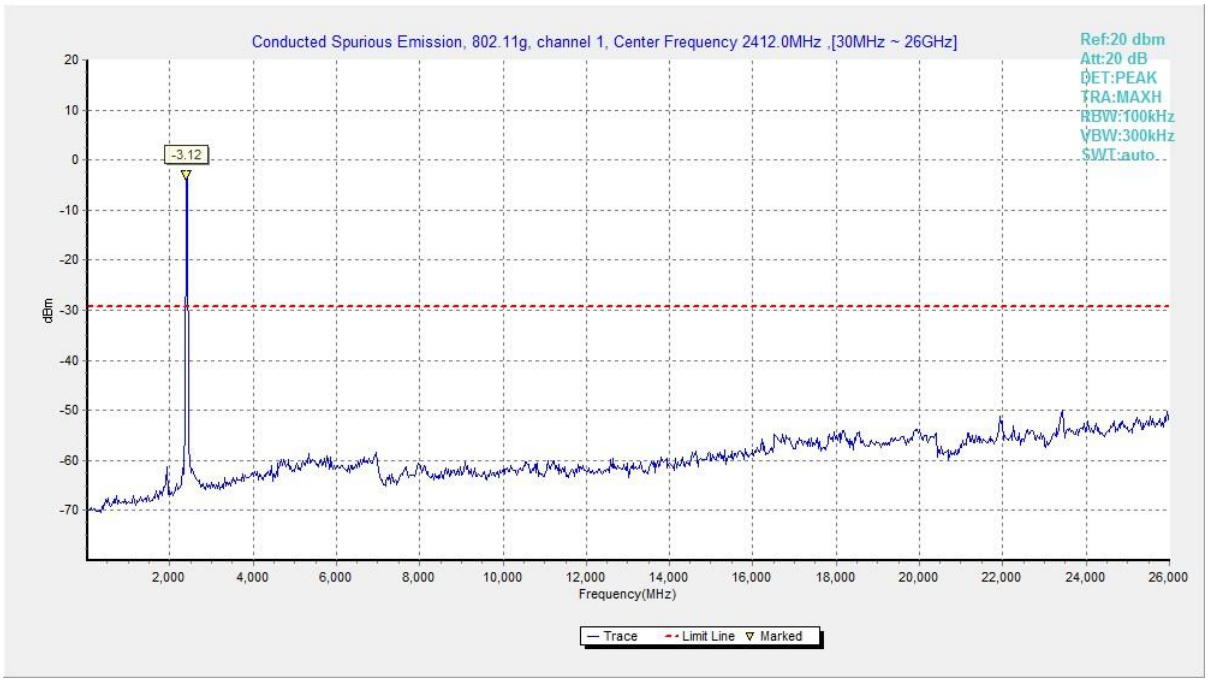


Fig.36 Conducted Spurious Emission (802.11g, CH1)

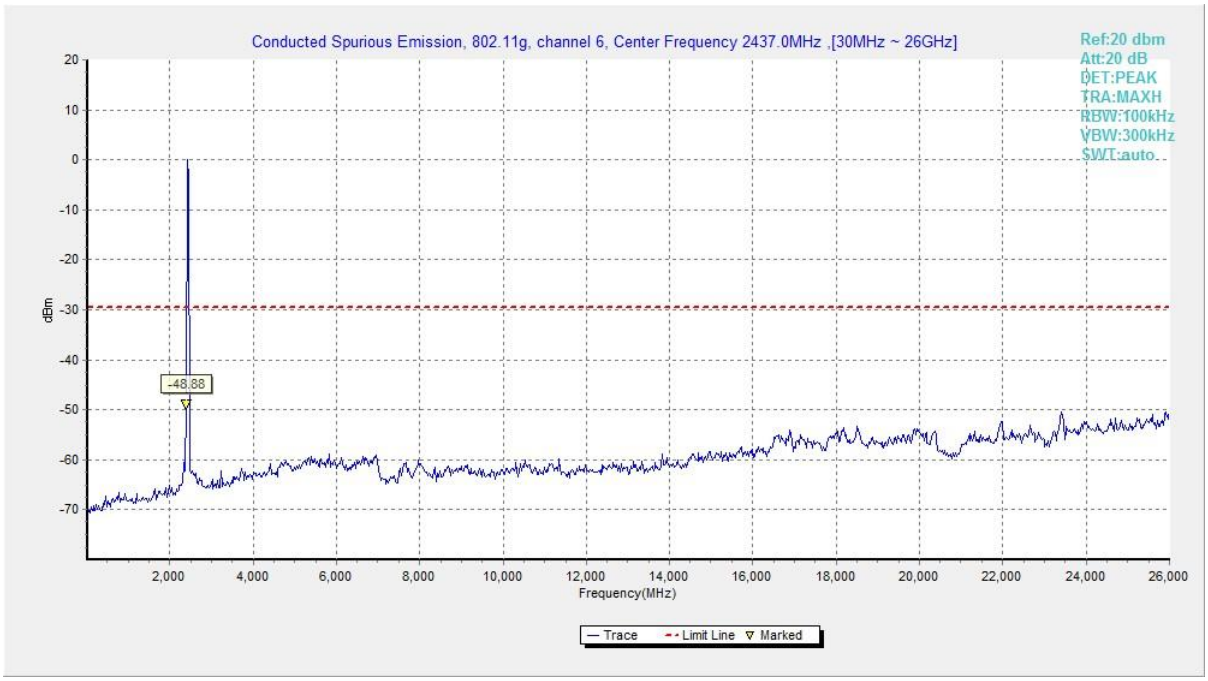


Fig.37 Conducted Spurious Emission (802.11g, CH6)

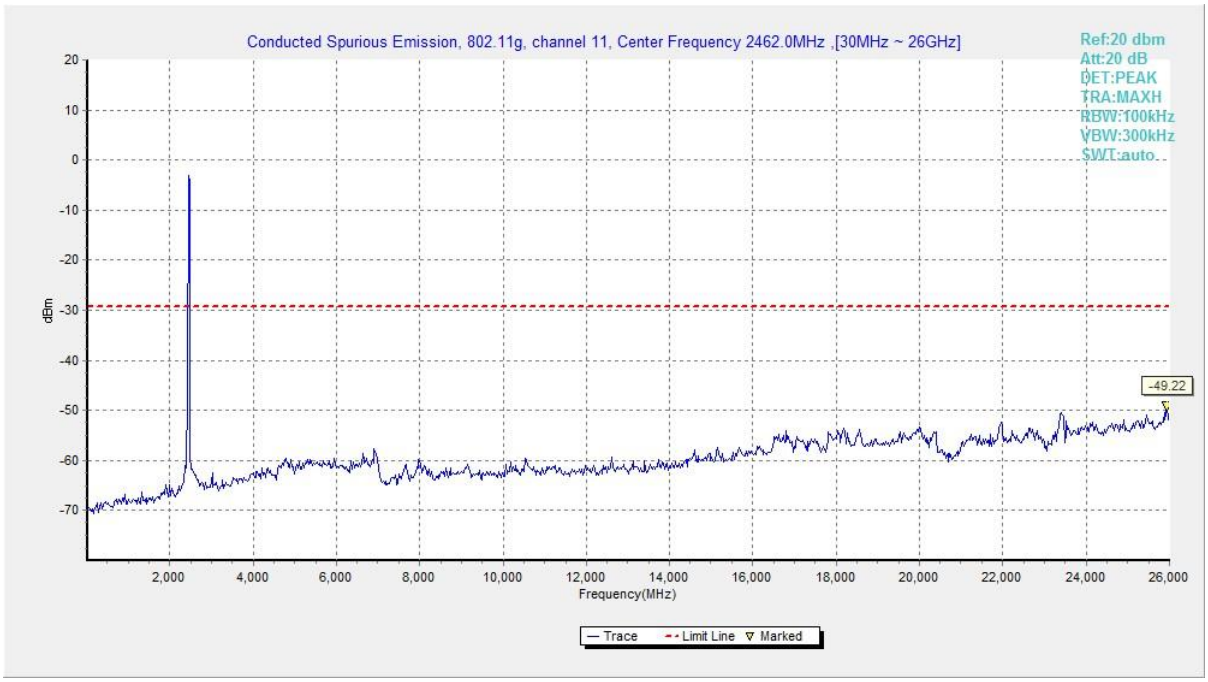


Fig.38 Conducted Spurious Emission (802.11g, CH11)

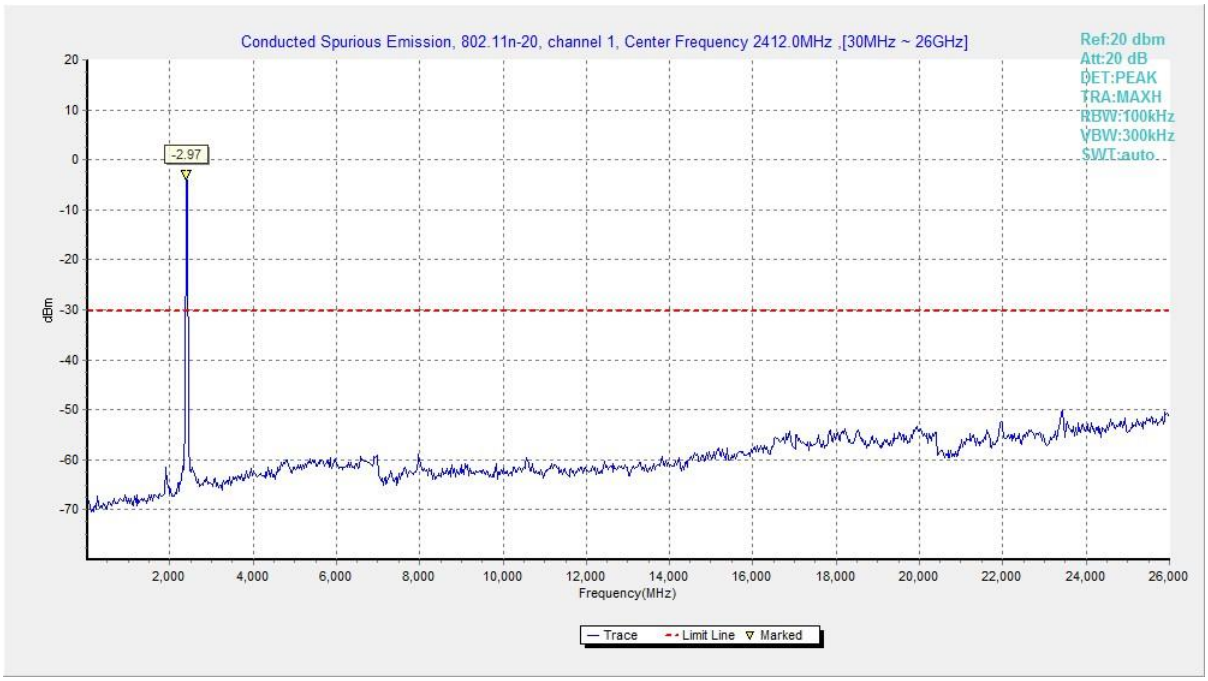


Fig.39 Conducted Spurious Emission (802.11n HT20, CH1)

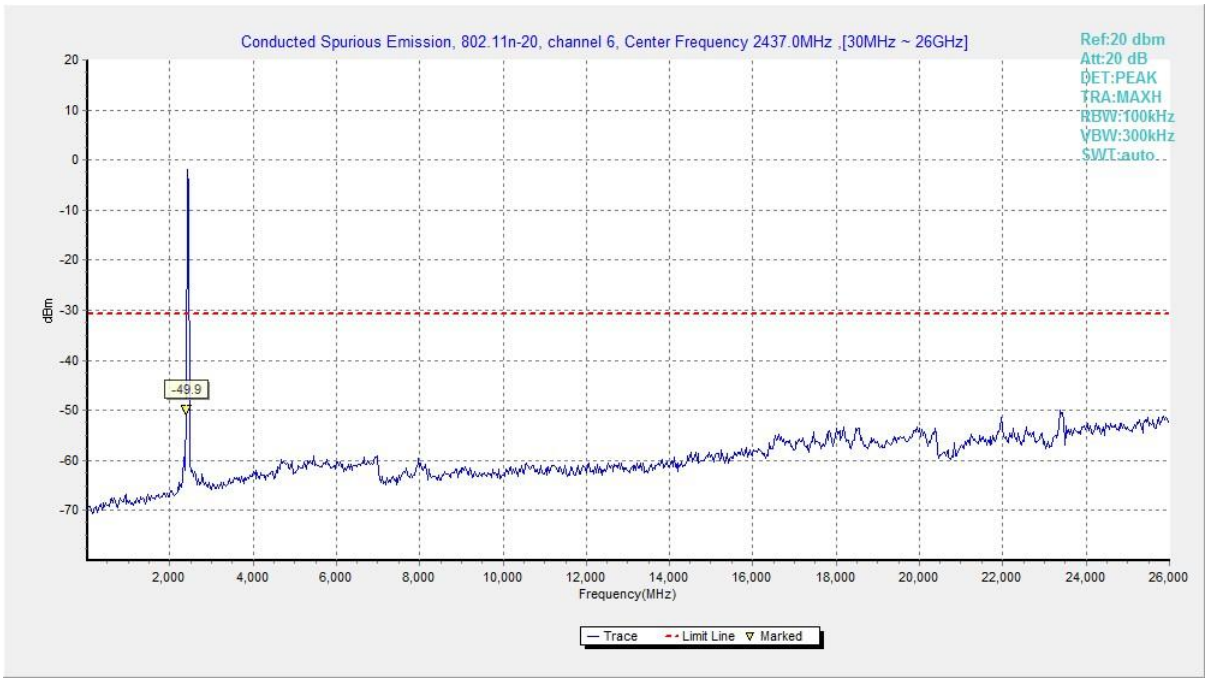


Fig.40 Conducted Spurious Emission (802.11n HT20, CH6)

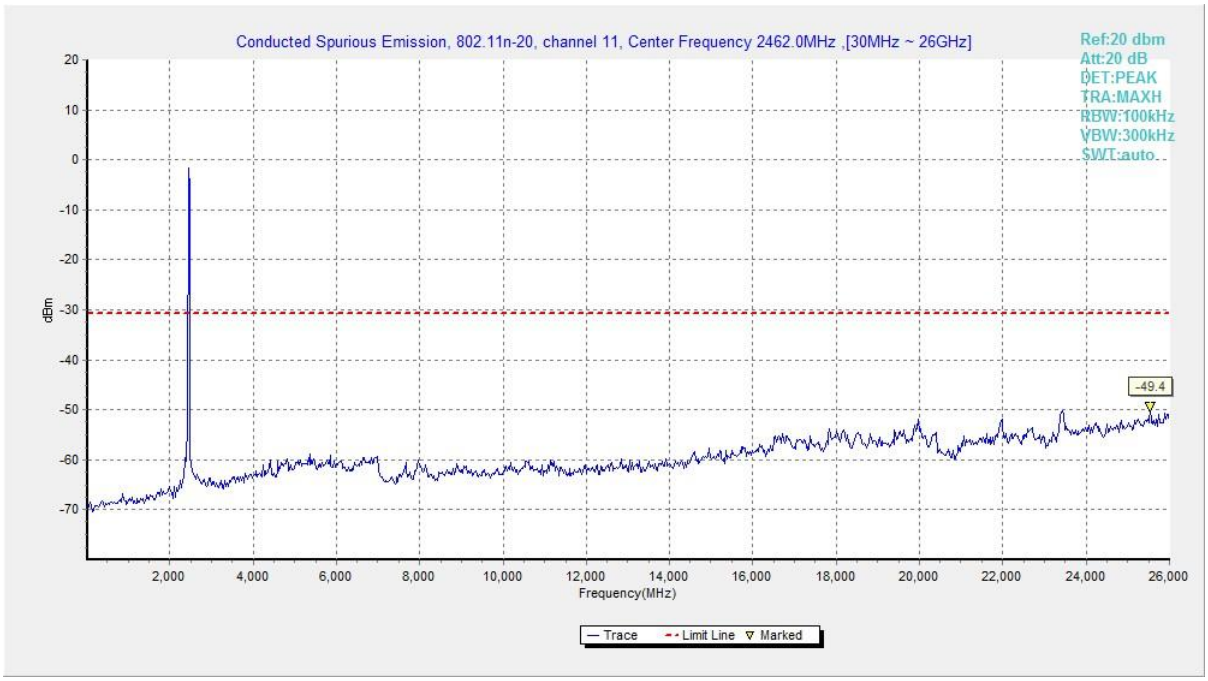


Fig.41 Conducted Spurious Emission (802.11n HT20, CH11)

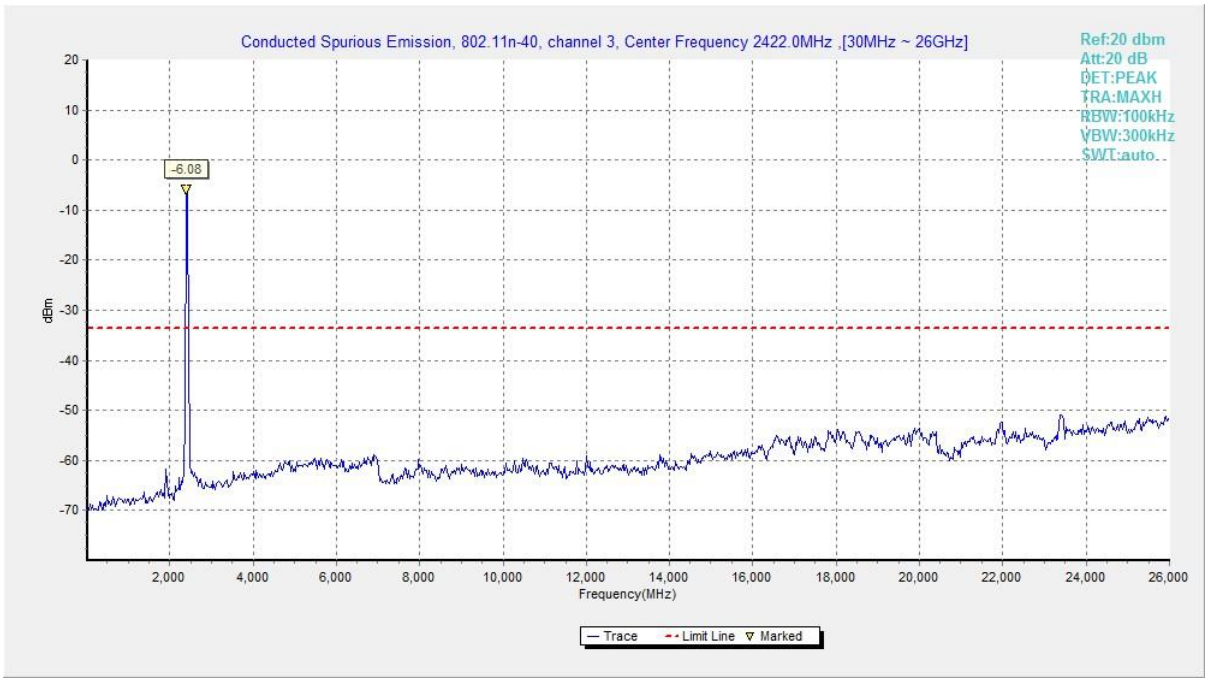


Fig.42 Conducted Spurious Emission (802.11n HT40, CH3)