FCC PART 15C & RSS 247
TEST REPORT
No. I18N00673-WLAN

for

Spectralink Corp

GSM Quad-band/UMTS five-band/LTE/CA Mobile phone

9653

with

Hardware Version: PIO

Software Version: vF03

FCC ID: IYG96XX

IC: 2128B-96XX

Issued Date: 2018-08-15

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:

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I18N00673-WLAN	Rev.0	1st edition	2018-07-26
I18N00673-WLAN	Rev.1	Add MIMO PPSD	2018-08-15

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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
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Fax:	+86(0)755-33322001

1.2. Testing Environment

Normal Temperature:	15-30℃
Relative Humidity:	35-60%

1.3. Project data

Testing Start Date:	2018-06-04
Testing End Date:	2018-07-13

1.4. Signature

An Ran
(Prepared this test report)

Tang Weisheng
(Reviewed this test report)

Zhang Bojun
(Approved this test report)

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2. Client Information

2.1. Applicant Information

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Contact Person	Andrew Duncan
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Telephone:	+1 720-925-0480
Fax:	/

2.2. Manufacturer Information

Company Name:	Spectralink Corp
Address:	2560 55th Street Boulder, CO 80301 USA
Contact Person	Andrew Duncan
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3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	GSM Quad-band/UMTS five-band/LTE/CA Mobile phone
Model Name	9653
Market Name	Versity
RF Protocol	IEEE 802.11 b/g/n-HT20/n-HT40
Operating Frequency	2412MHz~2462MHz
Number of Channels	11
Antenna Type	Integrated
Antenna Gain	0.5dBi(ANT0),0.6dBi(ANT1)
Power Supply	3.7V DC by Battery
FCC ID	IYG96XX
IC number	2128B-96XX
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	/	PIO	vF03	2018-05-14

*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	Switching Adapter	ASUC71w-050912300	Aquil Star Precision Industrial (ShenZhen) Co., Ltd

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

3.4. General Description

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

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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	2016
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 April, 2018
KDB 662911	D01 Multiple Transmitter Output	v02r01

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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	15.207	RSS-Gen section 8.8	**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

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5.4. Laboratory Environment

Semi-anechoic Chamber did not exceed following limits along the EMC testing

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

Shielded room did not exceed following limits along the EMC testing

Temperature	Min. = 15 ˚C, Max. = 30 ˚C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4 Ω

Fully-anechoic Chamber did not exceed following limits along the EMC testing

Temperature	Min. = 15 ˚C, Max. = 30 ˚C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4Ω
Voltage Standing Wave Ratio (VSWR)	≤6dB, from 1 to 18 GHz,3m distance

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6. Test Facilities Utilized

Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Vector Signal Analyzer	FSV40	100903	Rohde & Schwarz	2019.01.17	1 year
2	Power Sensor	U2021XA	MY55430013	Agilent	2019.02.01	1 year
3	Test Receiver	ESCI	100702	Rohde & Schwarz	2019.06.21	1 year
4	LISN	ENV216	102067	Rohde & Schwarz	2018.07.19	1 year

Radiated test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Chamber	FACT3-2.0	1285	ETS-Lindgren	2019.11.27	3 years
2	Test Receiver	ESR7	101676	Rohde & Schwarz	2018.11.29	1 year
3	Spectrum Analyser	FSV40	101192	Rohde & Schwarz	2019.05.22	1 year
4	BiLog Antenna	VULB9163	9163 329	Schwarzbeck	2020.02.27	3 years
5	Horn Antenna	3117	00066577	ETS-Lindgren	2019.04.05	3 years
6	Loop Antenna	HLA6120	35779	TESEQ	2019.05.02	3 years
7	Horn Antenna	QSH-SL-18-26-S-20	17013	Q-par	2020.01.15	3 years

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.

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7. Measurement Uncertainty

Test Name	Uncertainty	
1. RF Output Power - Conducted	±1.32dB	
2.Power Spectral Density - Conducted	±2.32dB	
3.Occupied channel bandwidth - Conducted	±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	±5.32dB
	18GHz≤f≤40GHz	±4.66dB
6. AC Power line Conducted Emission	150kHz≤f≤30MHz	±2.72dB

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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.

Conclusion: The Directional gains of antenna used for transmitting are 0.5dBi(ANT0) and 0.6dBi(ANT1).The RF transmitter uses an integrate antenna without connector.

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A.1 Maximum Output Power - Conduced

Measurement of method :See ANSI C63.10-2013-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)
FCC CRF Part 15.247(b) & RSS-247 Section 5.4	< 30

Measurement Results:

SISO:

Mode	Channel	Frequency (MHz)	Average Conducted Power (dBm)		Conclusion
			Ant0	Ant1	
802.11b	CH 1	2412	18.35	17.56	P
	CH 6	2437	18.39	18.06	P
	CH 11	2462	18.37	18.36	P
802.11g	CH 1	2412	15.13	14.70	P
	CH 6	2437	14.97	14.64	P
	CH 11	2462	15.02	14.90	P
802.11n HT20	CH 1	2412	14.26	13.57	P
	CH 6	2437	14.05	13.68	P
	CH 11	2462	14.07	13.84	P
802.11n HT40	CH 3	2422	14.17	13.97	P
	CH 6	2437	14.13	13.86	P
	CH 9	2452	14.08	13.41	P

MIMO:

Mode	Channel	Frequency (MHz)	Average Conducted Power (dBm)			Conclusion
			Ant0	Ant1	Sum	
802.11n HT20	CH 1	2412	14.22	14.19	17.21	P
	CH 6	2437	13.87	13.64	16.77	P
	CH 11	2462	13.92	13.86	16.90	P
802.11n HT40	CH 3	2422	14.22	14.19	17.21	P
	CH 6	2437	13.87	13.64	16.77	P
	CH 9	2452	13.92	13.86	16.90	P

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Note:

Worst-case data rates as provided by the client were: 11Mbps (802.11b), 54Mbps (802.11g), MCS7 (802.11n) is selected as the worst condition.

For SISO modes, there are two transmission antennas, used in any given time can be either Ant0 or Ant1. Both antenna ports have the same power class, output power measurement for SISO modes on both antennas are reported. The Ant0 transmits higher out power as worst-case.

For MIMO modes, both Ant0 and Ant1 used at the same time.

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%.

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A.2 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:

SISO (Antenna 0):

Mode	Channel	Frequency (MHz)	Test Results		Conclusion
802.11b	CH 1	2412	Fig.1	6.46	P
	CH 6	2437	Fig.2	6.78	P
	CH 11	2462	Fig.3	7.28	P
802.11g	CH 1	2412	Fig.4	-10.32	P
	CH 6	2437	Fig.5	-10.86	P
	CH 11	2462	Fig.6	-11.04	P
802.11n HT20	CH 1	2412	Fig.7	-11.51	P
	CH 6	2437	Fig.8	-13.30	P
	CH 11	2462	Fig.9	-11.60	P
802.11n HT40	CH 3	2422	Fig.10	-13.19	P
	CH 6	2437	Fig.11	-13.22	P
	CH 9	2452	Fig.12	-12.85	P

MIMO:

Mode	Channel	Frequency (MHz)	Test Results			Conclusion
			Ant0	Ant1	Sum	
802.11n HT20	CH 1	2412	-12.62	-12.80	-9.70	P
	CH 6	2437	-12.03	-13.14	-9.54	P
	CH 11	2462	-12.91	-12.95	-9.92	P
802.11n HT40	CH 3	2422	14.22	-14.09	-15.77	P
	CH 6	2437	-14.66	-15.78	-12.17	P
	CH 9	2452	-14.20	-15.99	-11.99	P

See below for test graphs.

Conclusion: PASS

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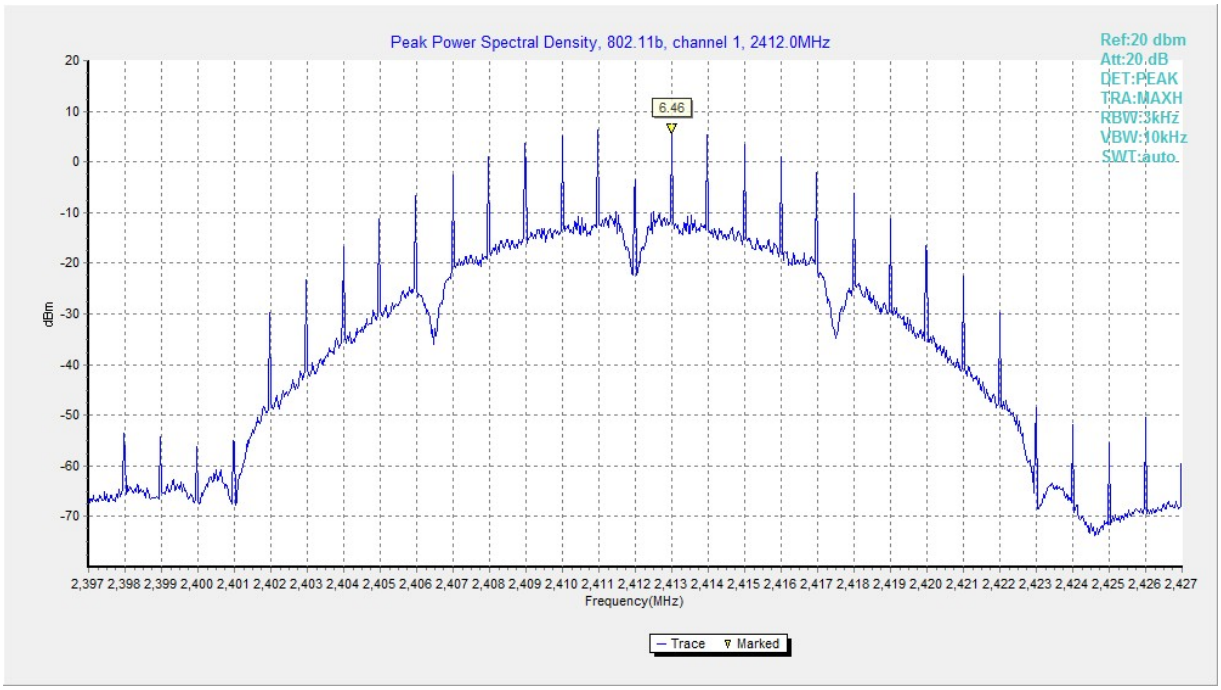

Fig.1 Power Spectral Density (802.11b, CH 1)

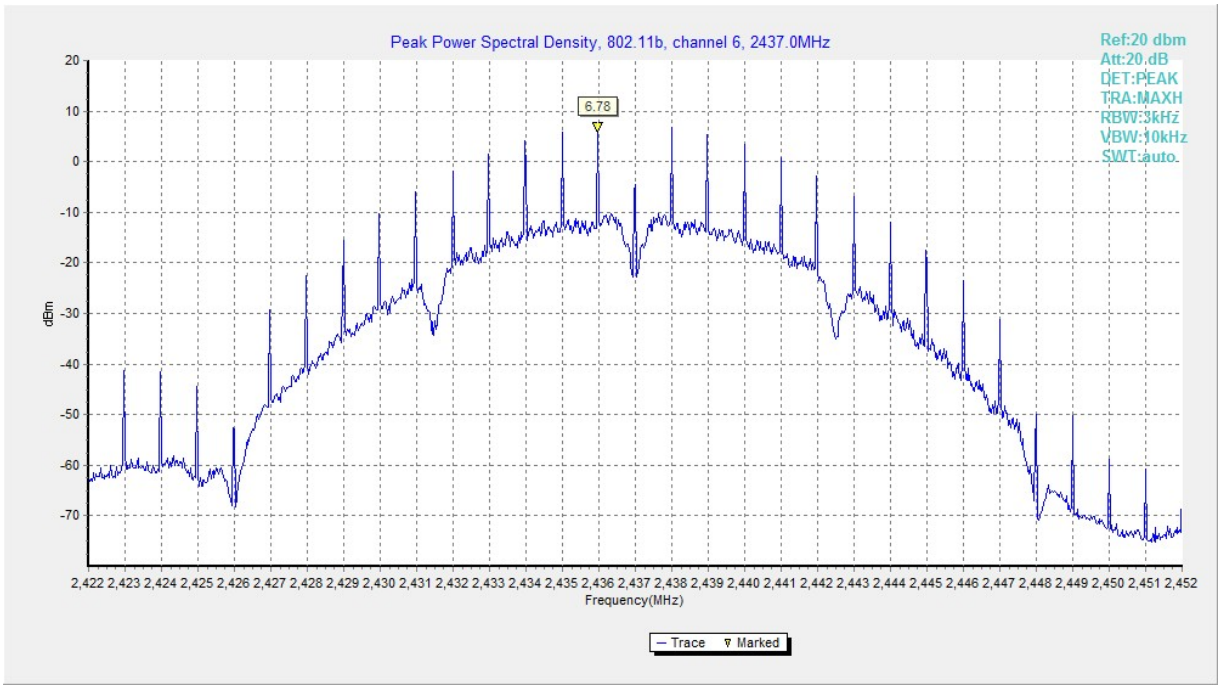

Fig.2 Power Spectral Density (802.11b, CH 6)

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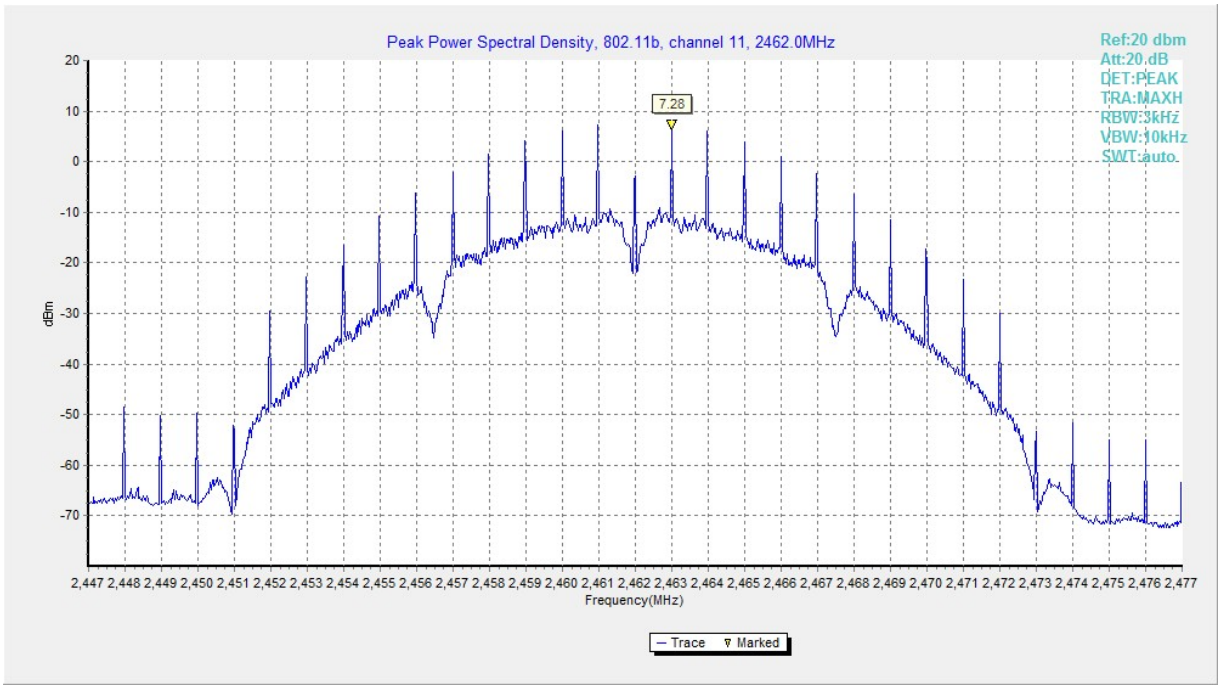

Fig.3 Power Spectral Density (802.11b, CH 11)

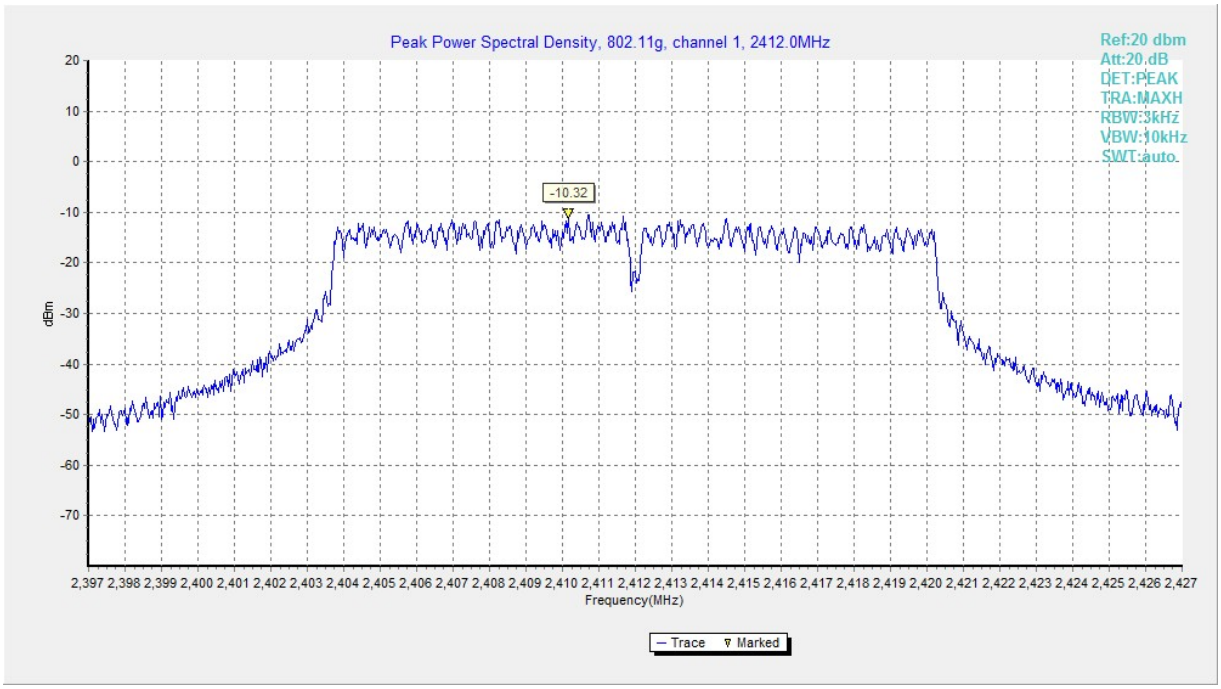

Fig.4 Power Spectral Density (802.11g, CH 1)

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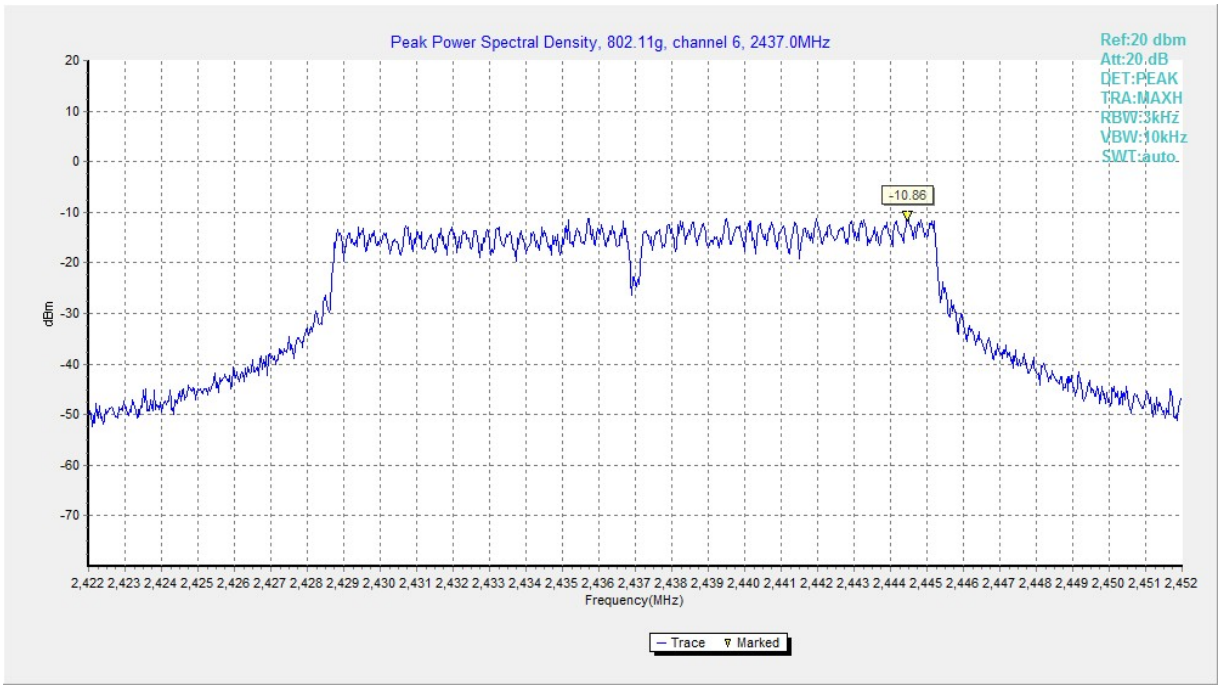

Fig.5 Power Spectral Density (802.11g, CH 6)

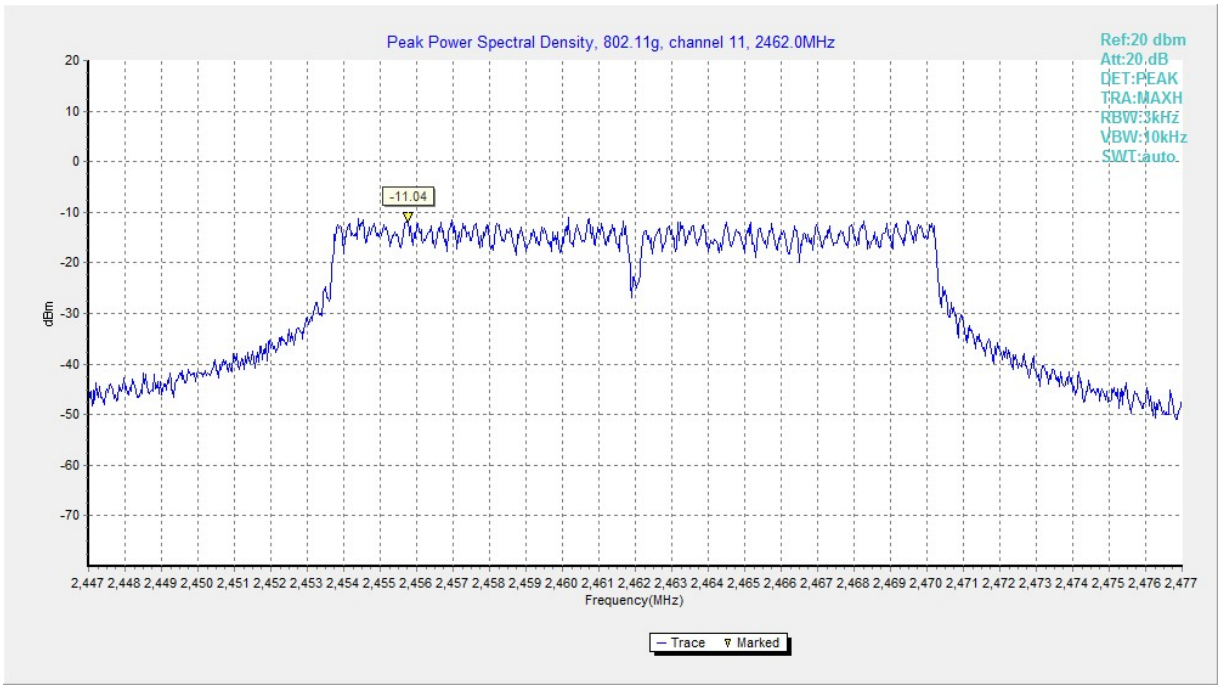

Fig.6 Power Spectral Density (802.11g, CH 11)

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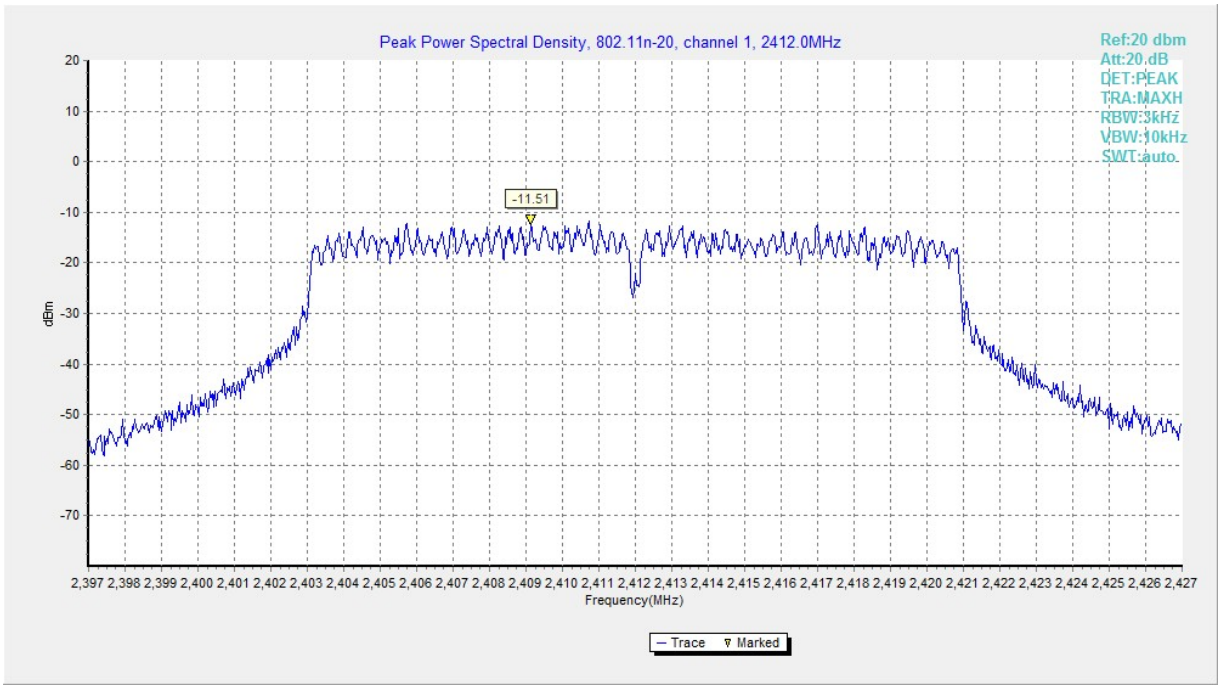

Fig.7 Power Spectral Density (802.11n HT20, CH 1)

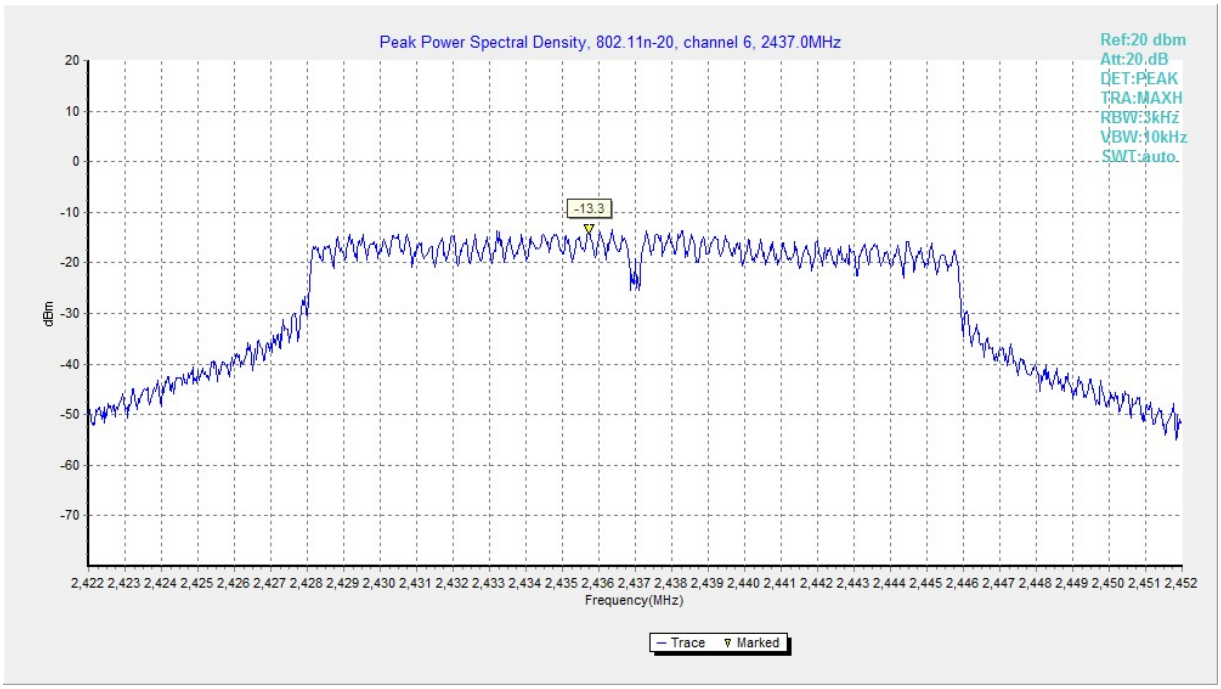

Fig.8 Power Spectral Density (802.11n HT20, CH 6)

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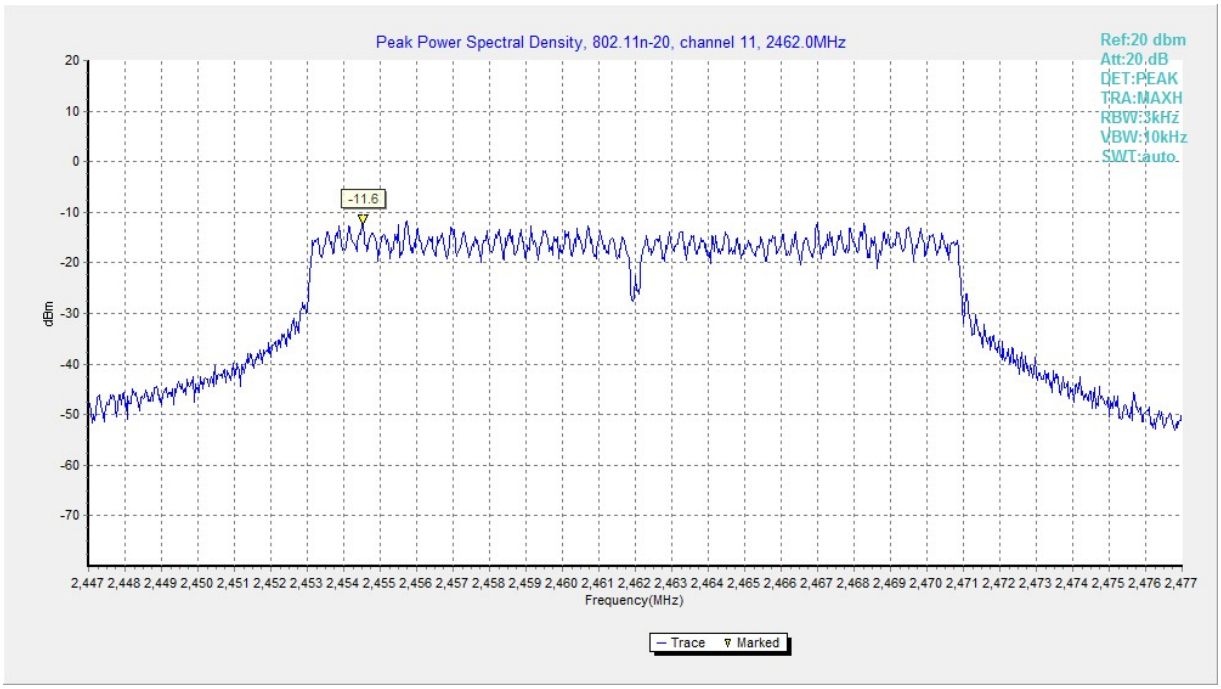

Fig.9 Power Spectral Density (802.11n HT20, CH 11)

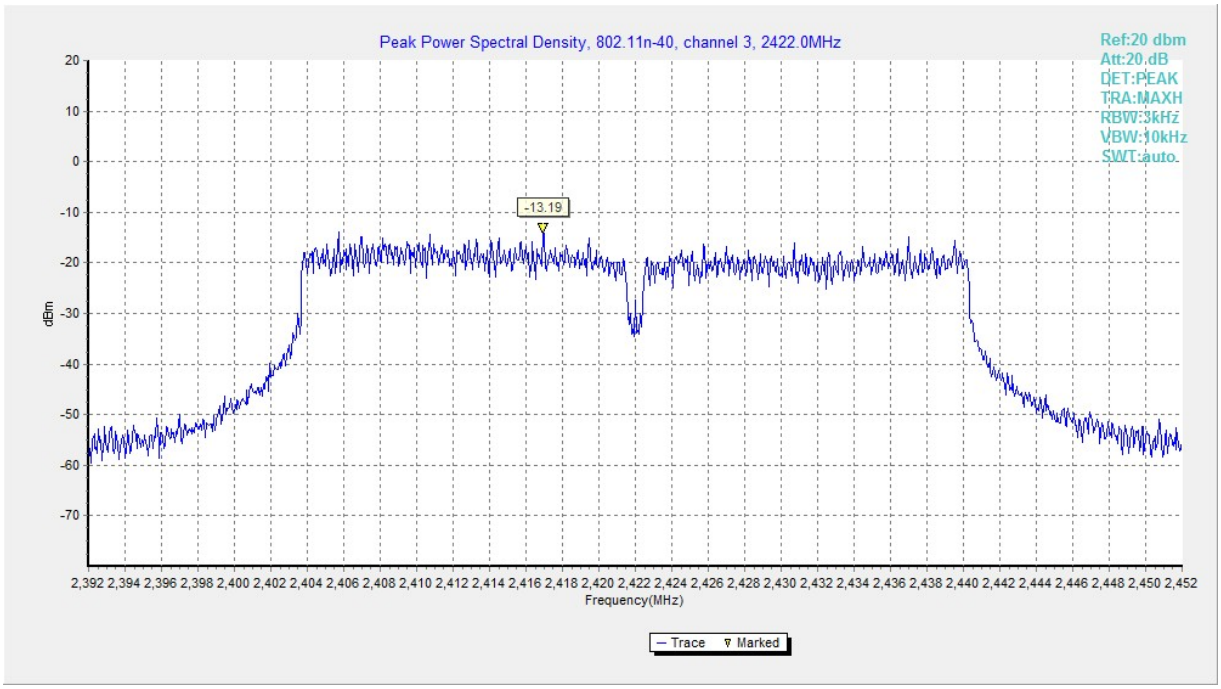

Fig.10 Power Spectral Density (802.11n HT40, CH 3)

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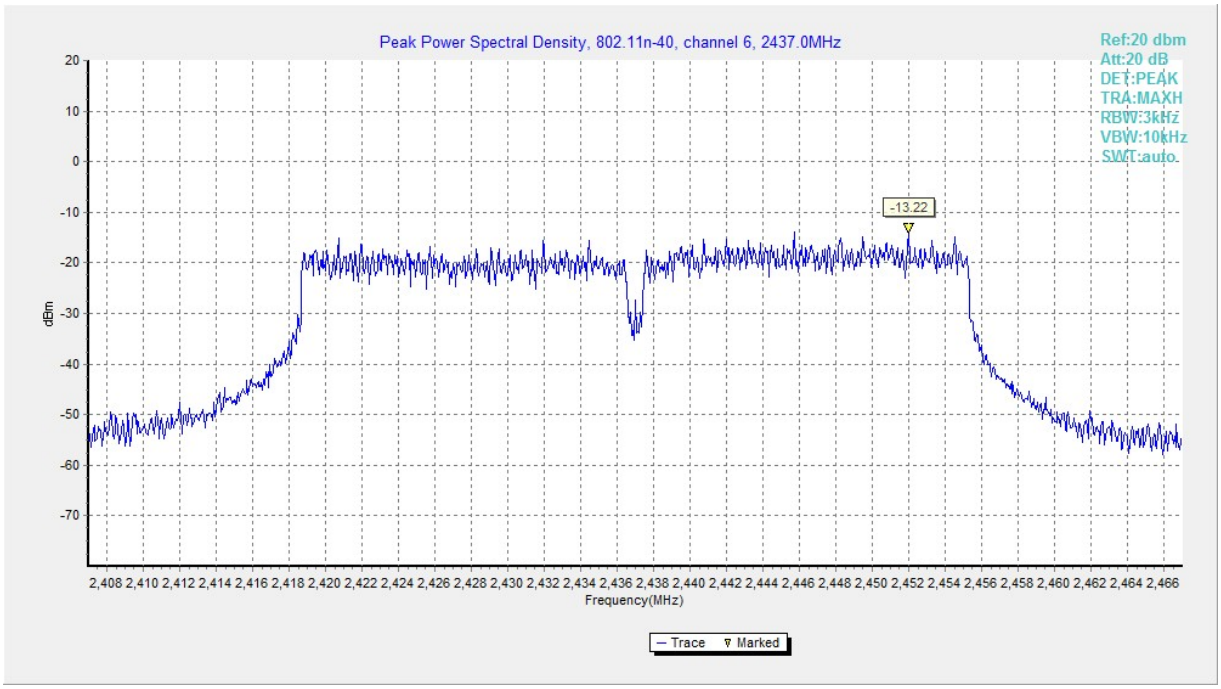

Fig.11 Power Spectral Density (802.11n HT40, CH 6)

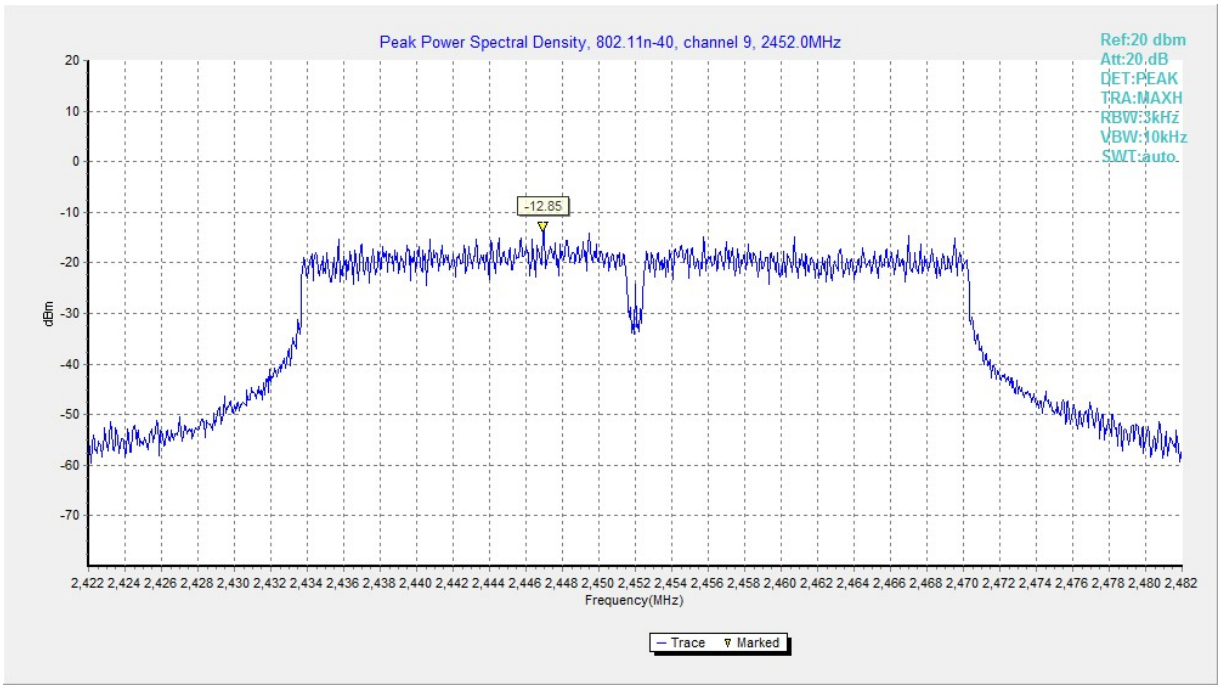

Fig.12 Power Spectral Density (802.11n HT40, CH 9)

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A.3 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	7600	**P**
	CH 6	2437	Fig.14	8300	**P**
	CH 11	2462	Fig.15	7600	**P**
802.11g	CH 1	2412	Fig.16	16450	**P**
	CH 6	2437	Fig.17	16450	**P**
	CH 11	2462	Fig.18	16500	**P**
802.11n HT20	CH 1	2412	Fig.19	17650	**P**
	CH 6	2437	Fig.20	16300	**P**
	CH 11	2462	Fig.21	17700	**P**
802.11n HT40	CH 3	2422	Fig.22	36400	**P**
	CH 6	2437	Fig.23	36480	**P**
	CH 9	2452	Fig.24	36400	**P**

See below for test graphs.

Conclusion: PASS

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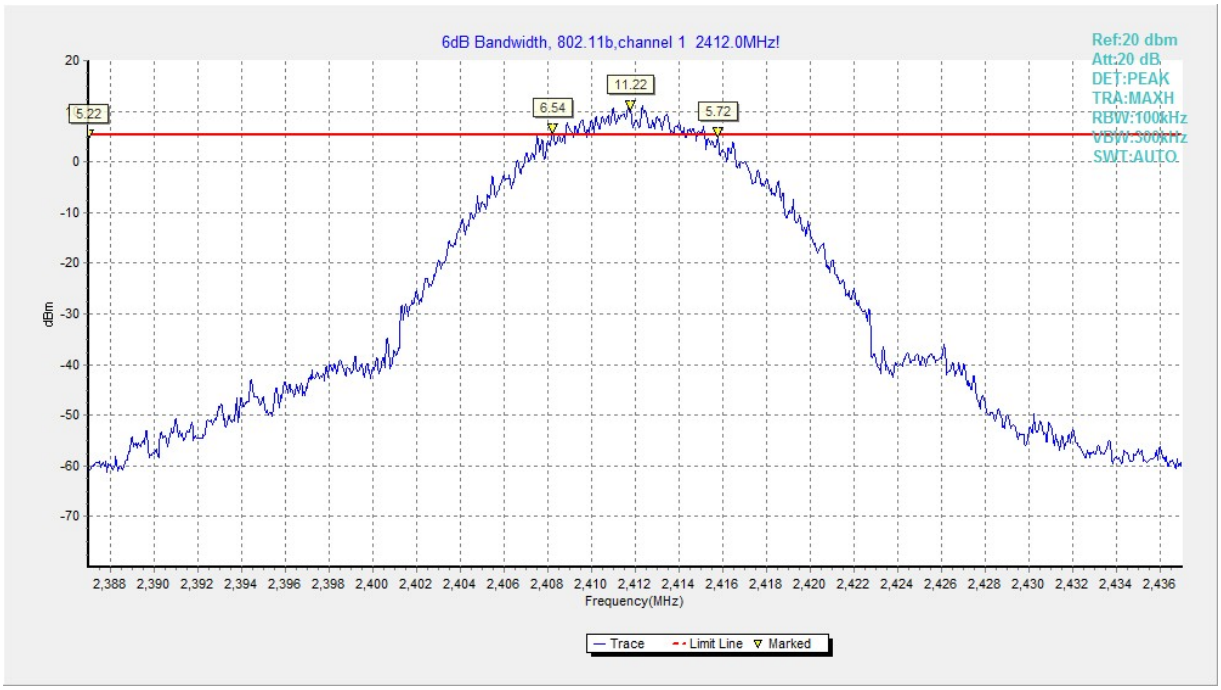

Fig.13 6dB Bandwidth (802.11b, CH 1)

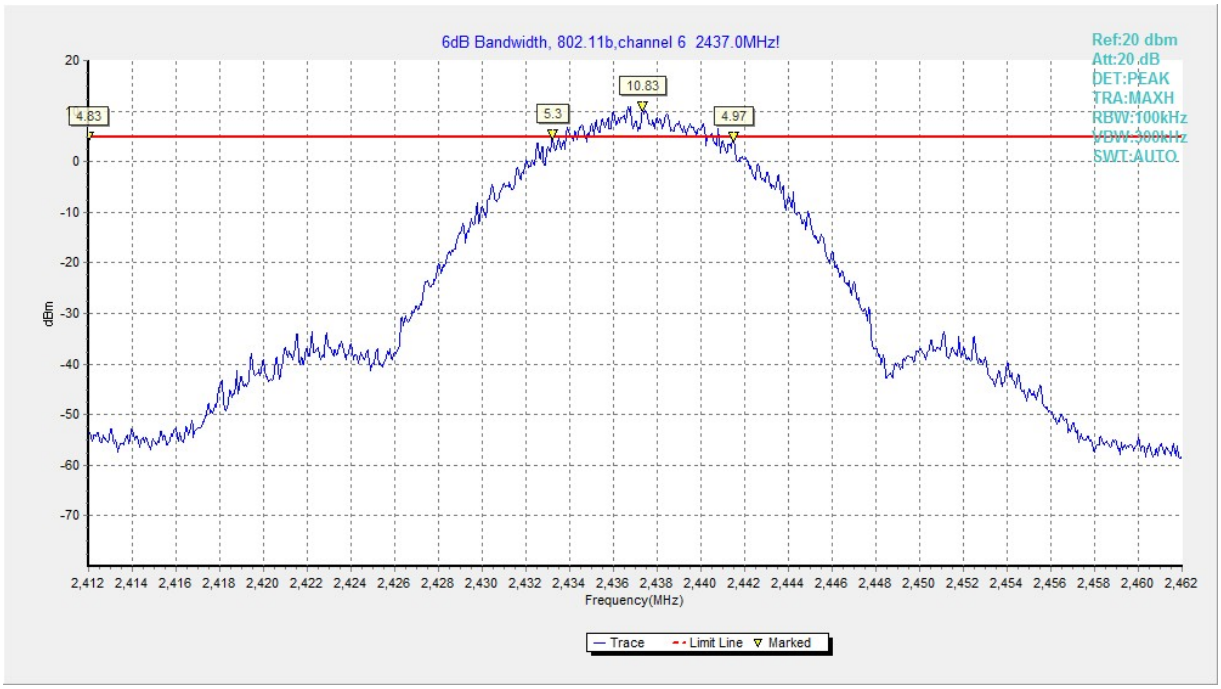

Fig.14 6dB Bandwidth (802.11b, CH 6)

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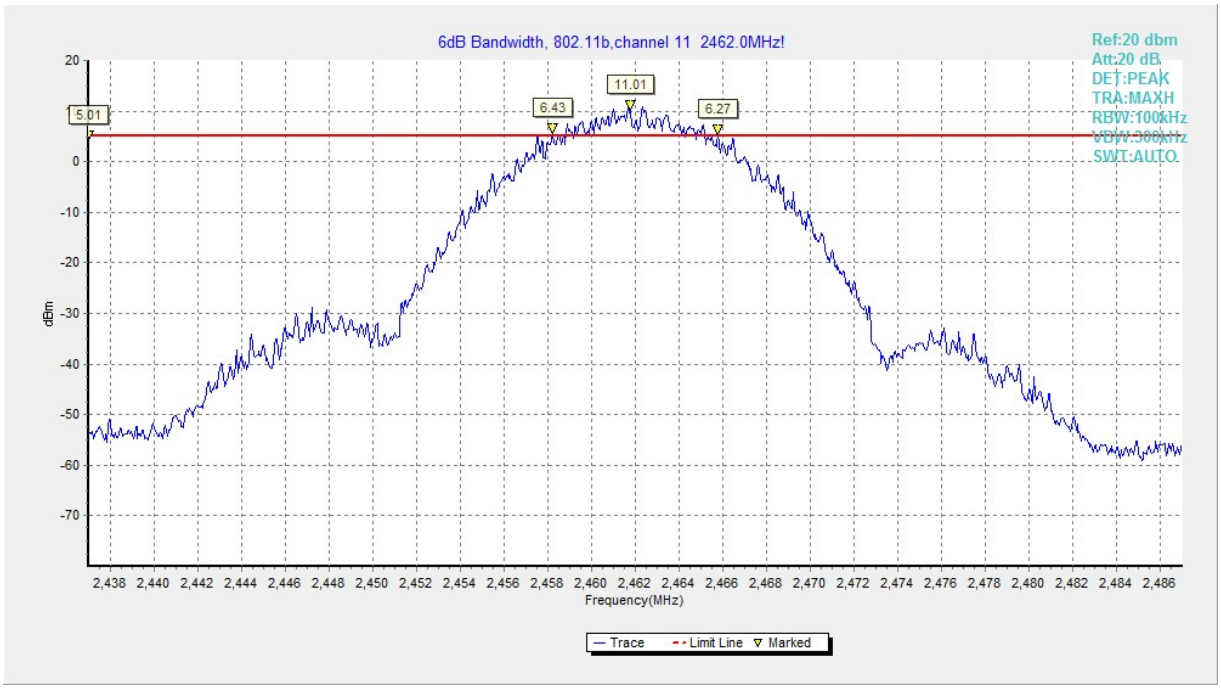

Fig.15 6dB Bandwidth (802.11b, CH 11)

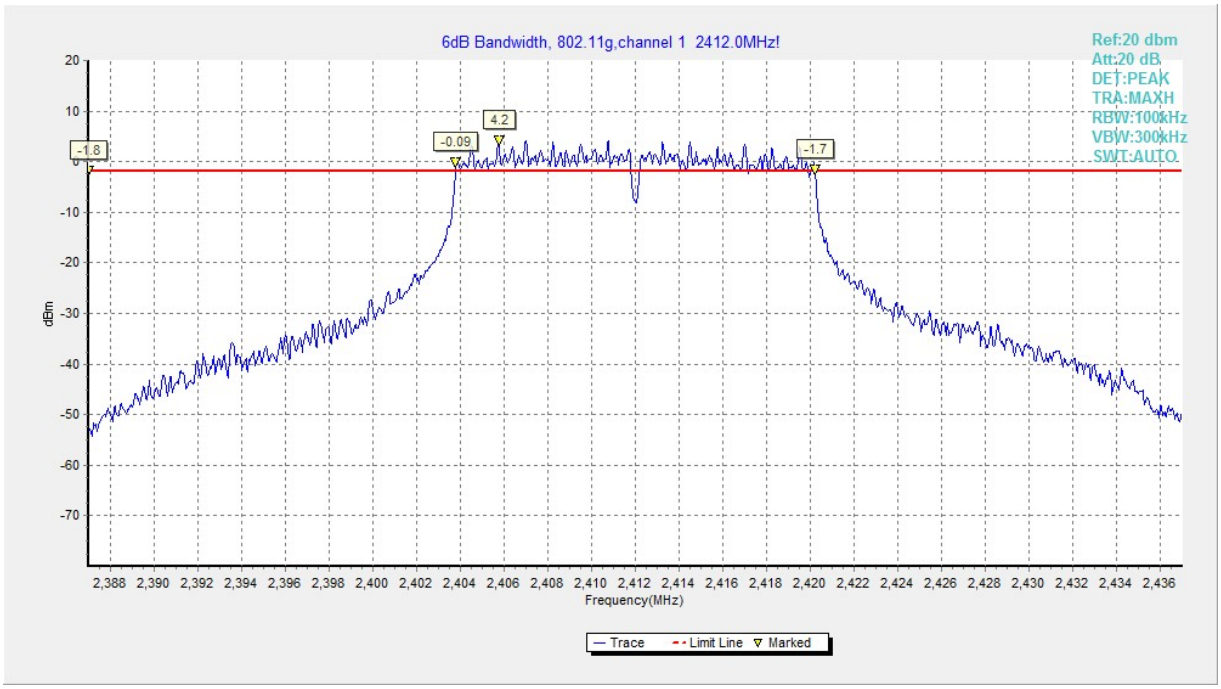

Fig.16 6dB Bandwidth (802.11g, CH 1)

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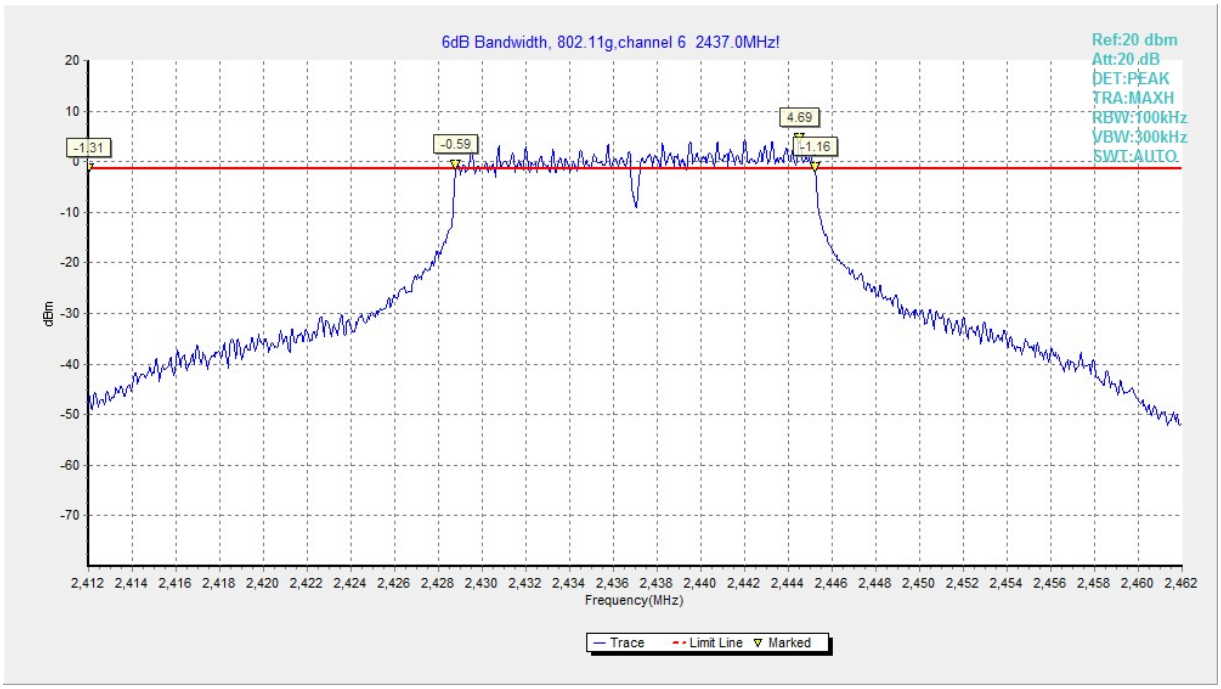

Fig.17 6dB Bandwidth (802.11g, CH 6)

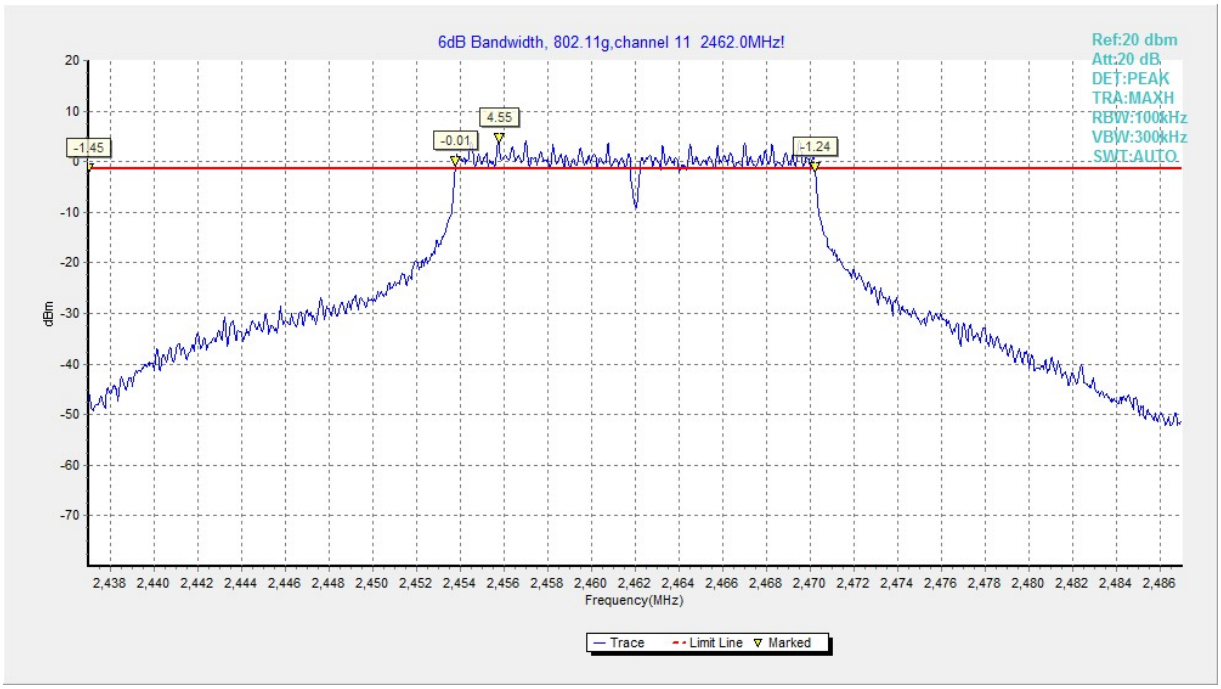

Fig.18 6dB Bandwidth (802.11g, CH 11)

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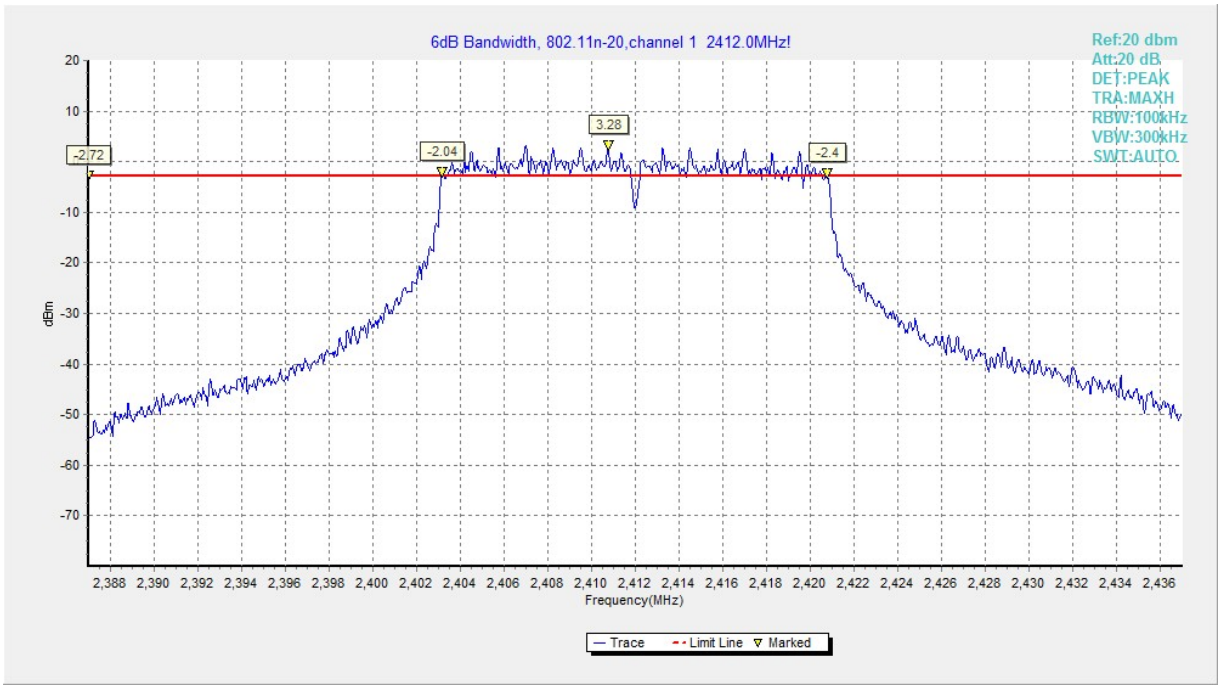

Fig.19 6dB Bandwidth (802.11n HT20, CH 1)

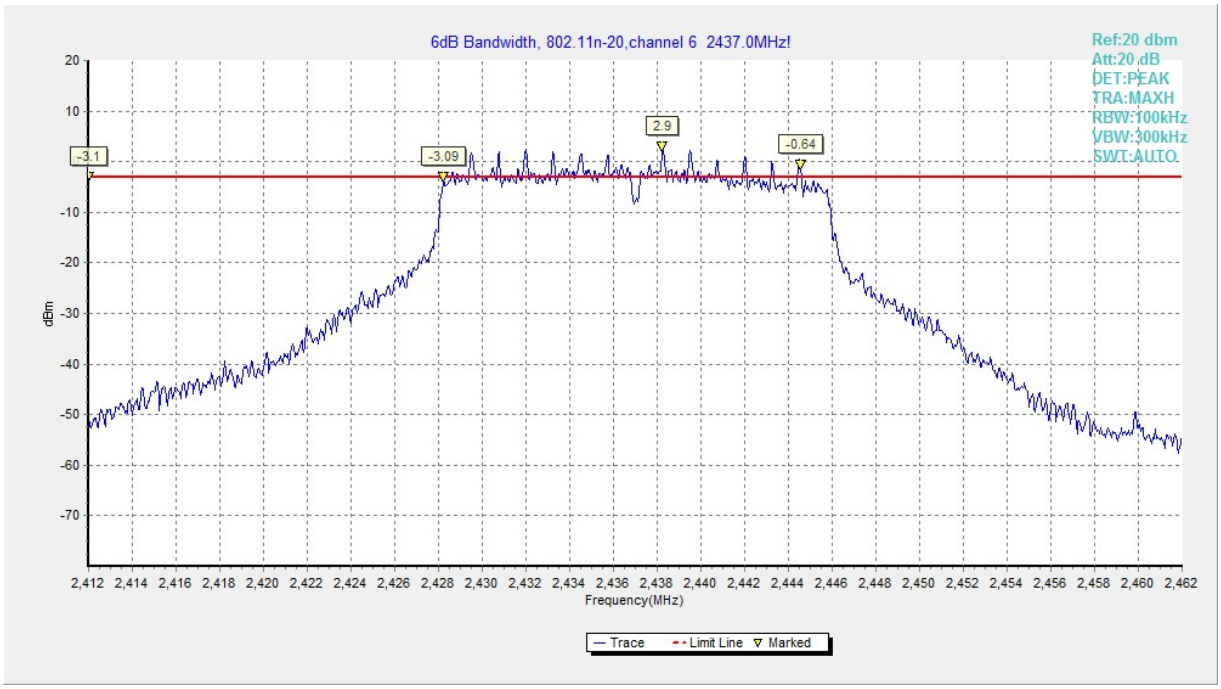

Fig.20 6dB Bandwidth (802.11n HT20, CH 6)

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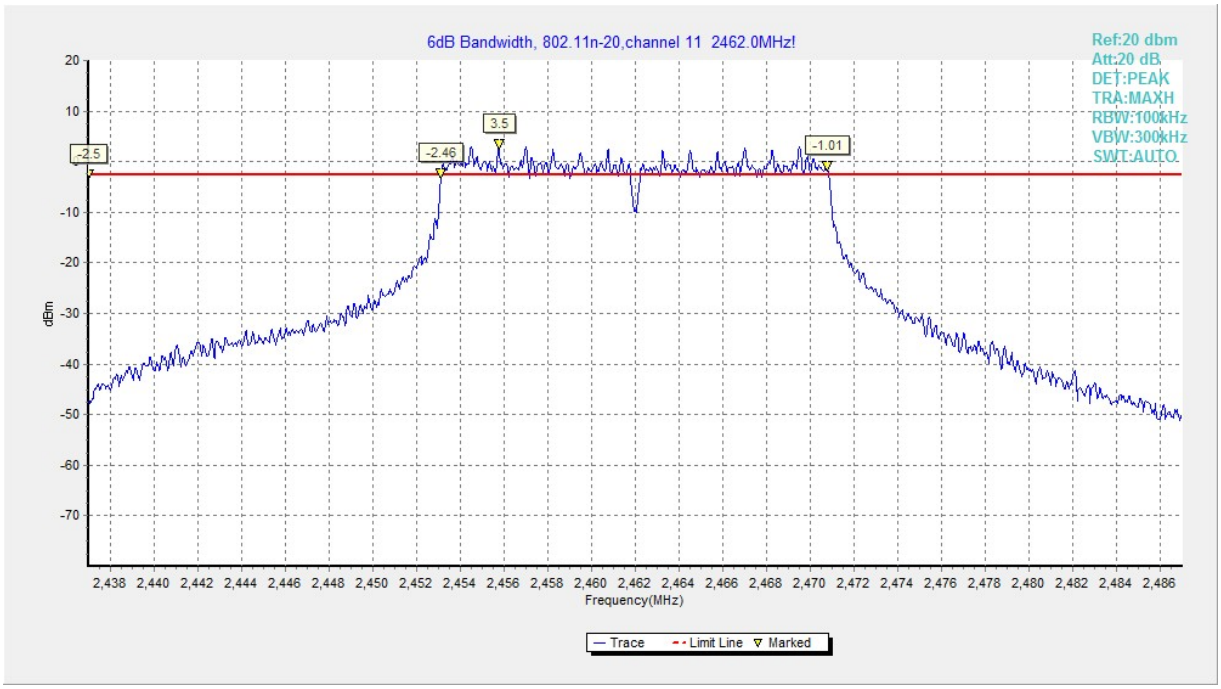

Fig.21 6dB Bandwidth (802.11n HT20, CH 11)

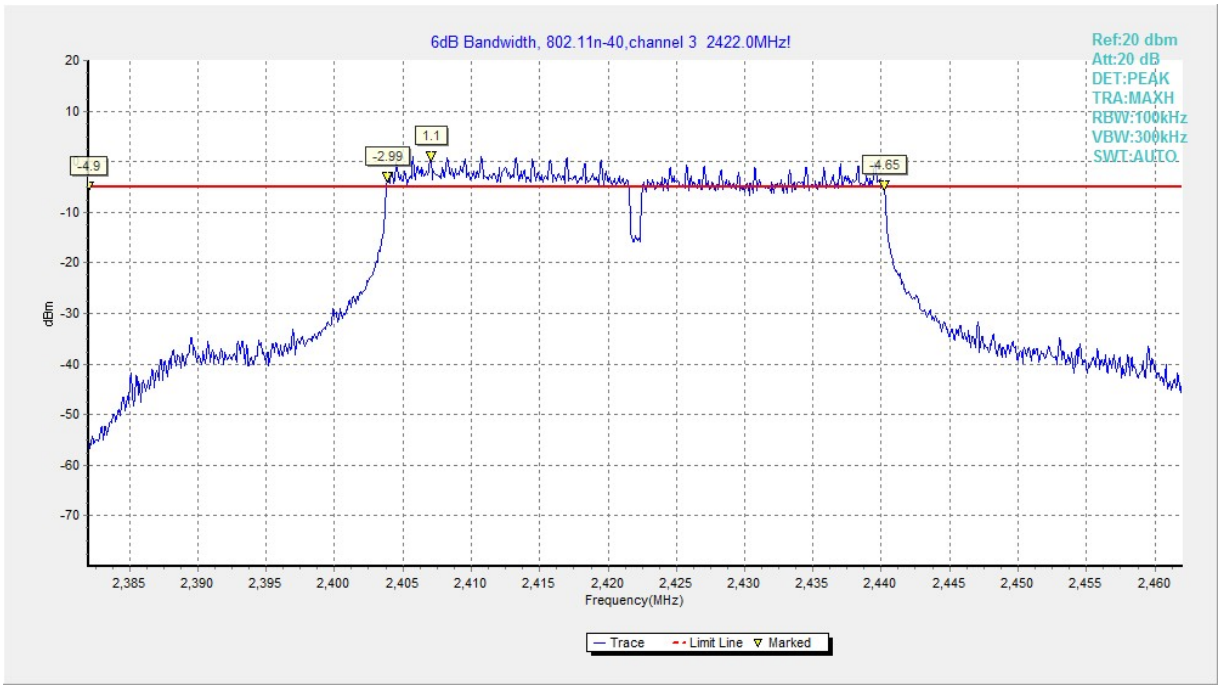

Fig.22 6dB Bandwidth (802.11n HT40, CH 3)

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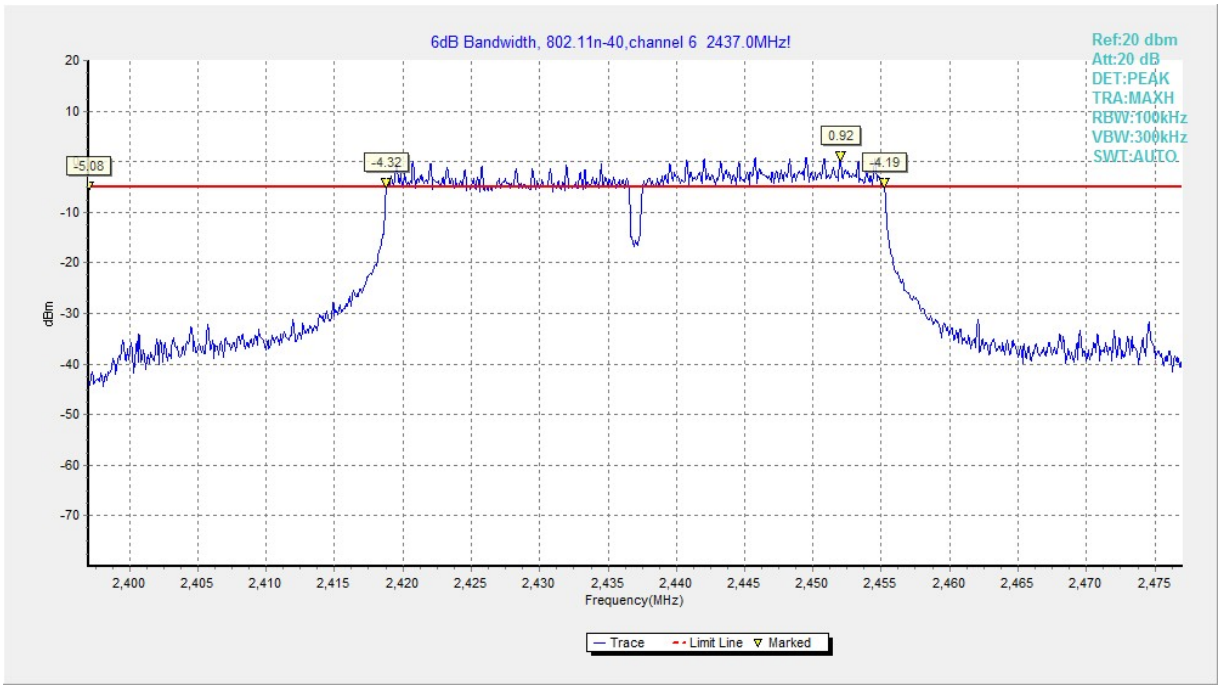

Fig.23 6dB Bandwidth (802.11n HT40, CH 6)

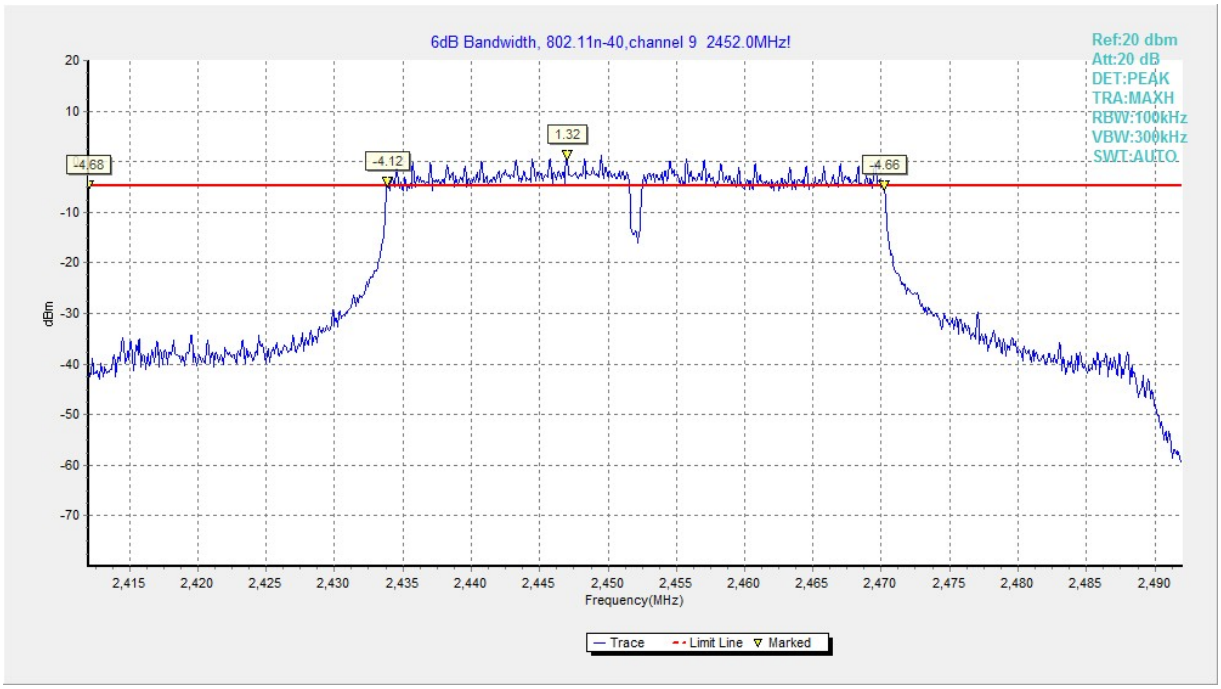

Fig.24 6dB Bandwidth (802.11n HT40, CH 9)

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A.4 Band Edges Compliance

Measurement Limit:

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

Measurement Result:

Mode	Channel	Frequency (MHz)	Test Results (dBc)		Conclusion
802.11b	CH1	2412	Fig.25	51.66	**P**
	CH11	2462	Fig.26	66.44	**P**
802.11g	CH1	2412	Fig.27	33.42	**P**
	CH11	2462	Fig.28	48.39	**P**
802.11n HT20	CH1	2412	Fig.29	35.66	**P**
	CH11	2462	Fig.30	48.25	**P**
802.11n HT40	CH3	2422	Fig.31	30.45	**P**
	CH9	2452	Fig.32	42.25	**P**

See below for test graphs.

Conclusion: PASS

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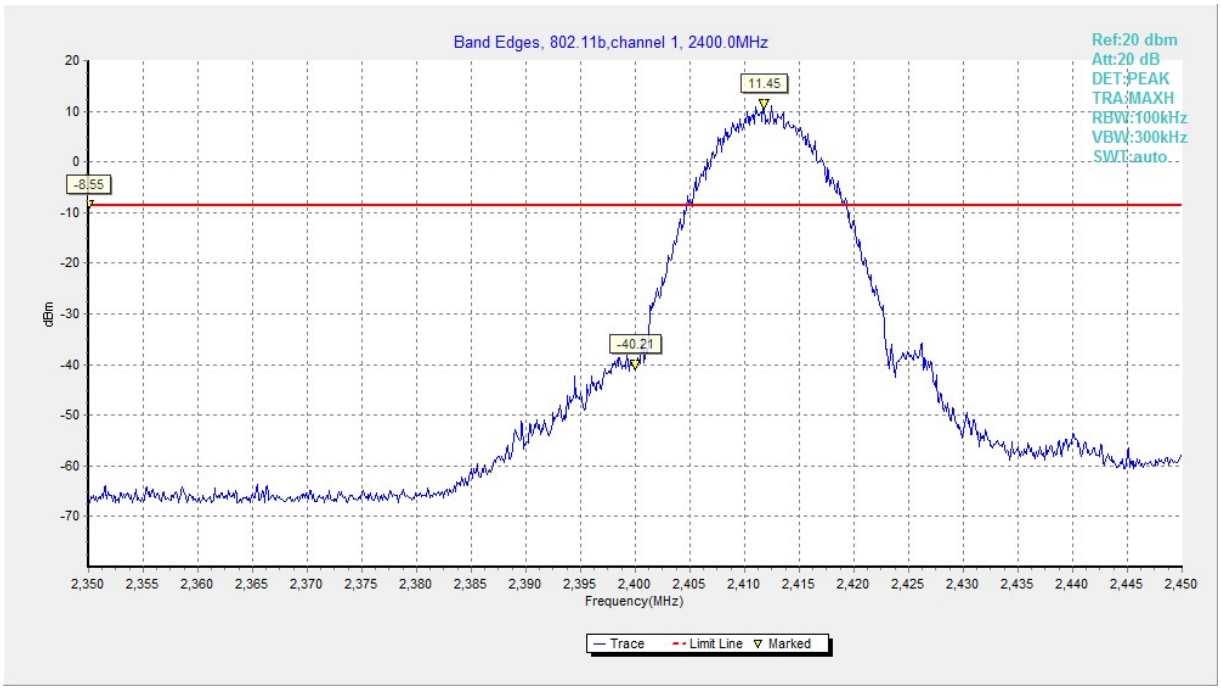

Fig.25 Band Edges (802.11b, CH 1)

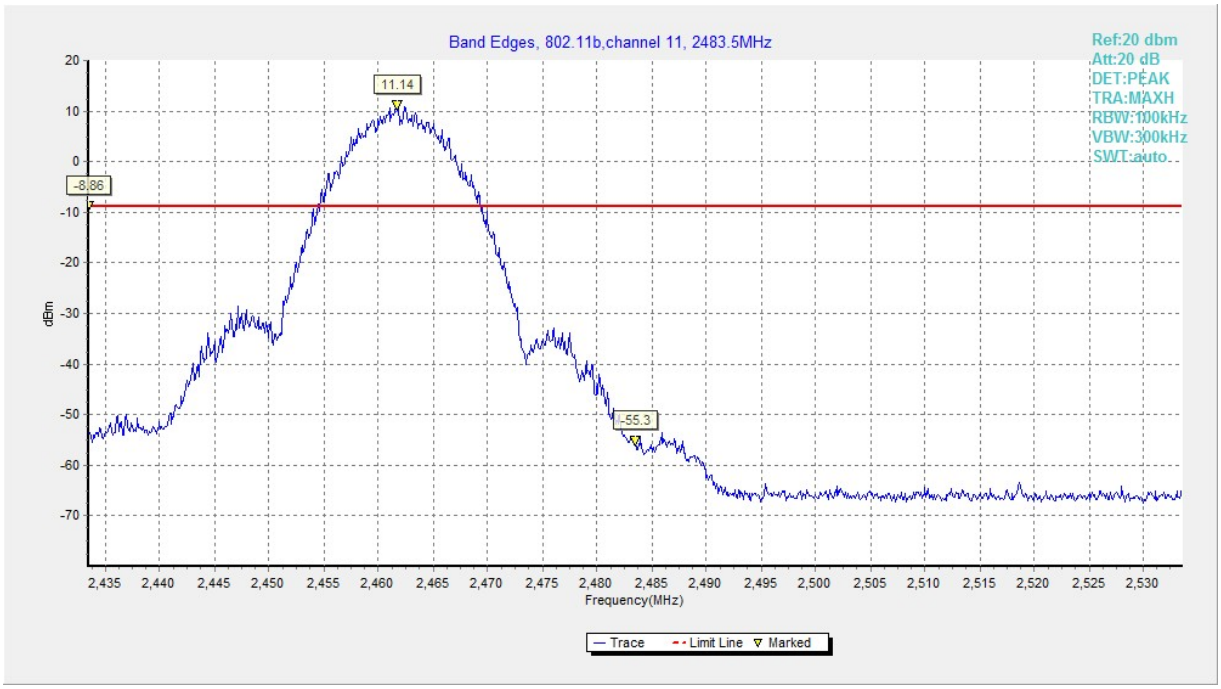

Fig.26 Band Edges (802.11b, CH 11)

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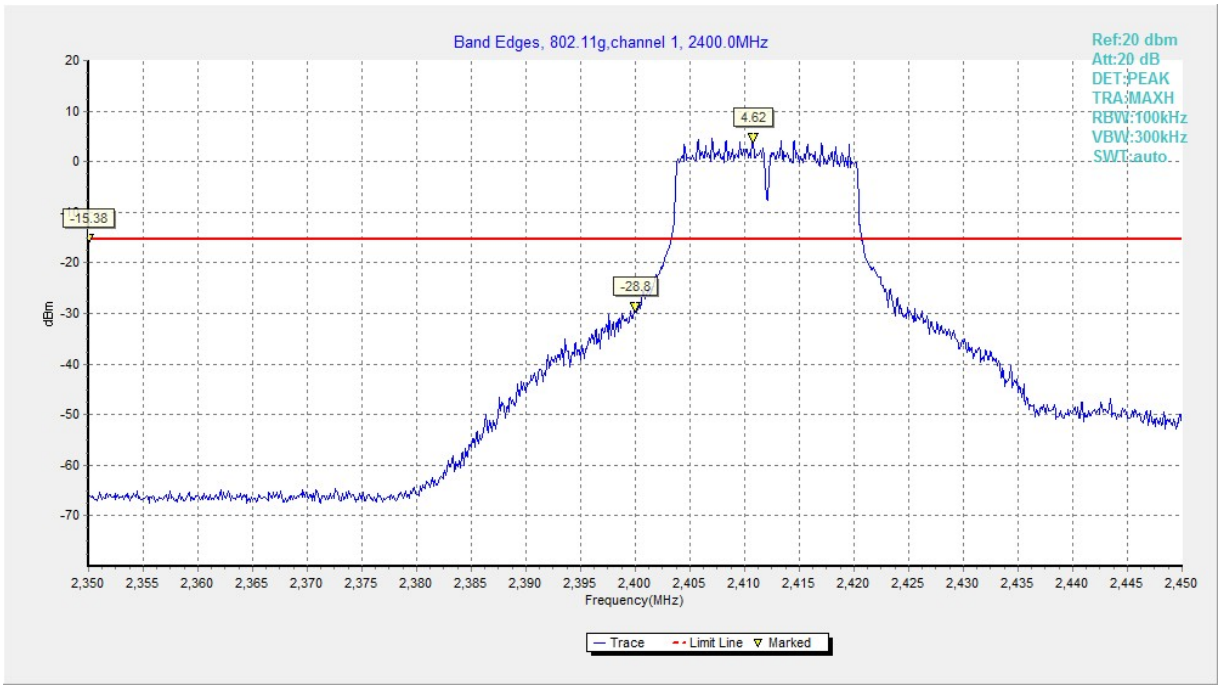

Fig.27 Band Edges (802.11g, CH 1)

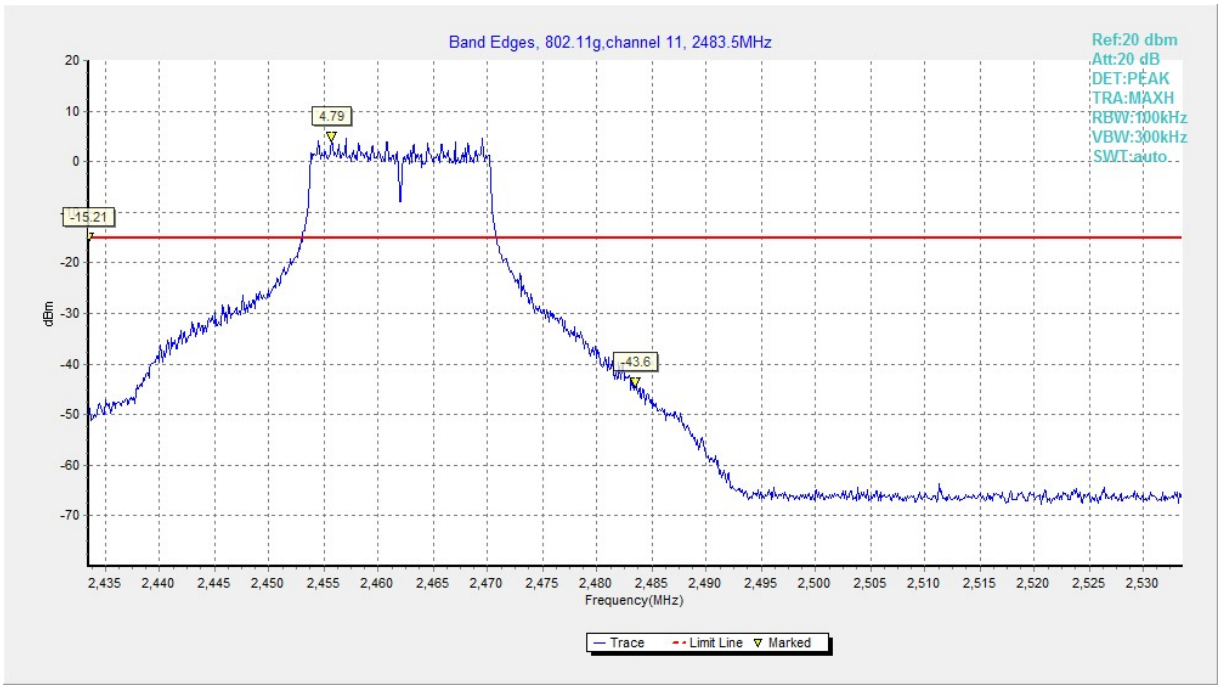

Fig.28 Band Edges (802.11g, CH 11)

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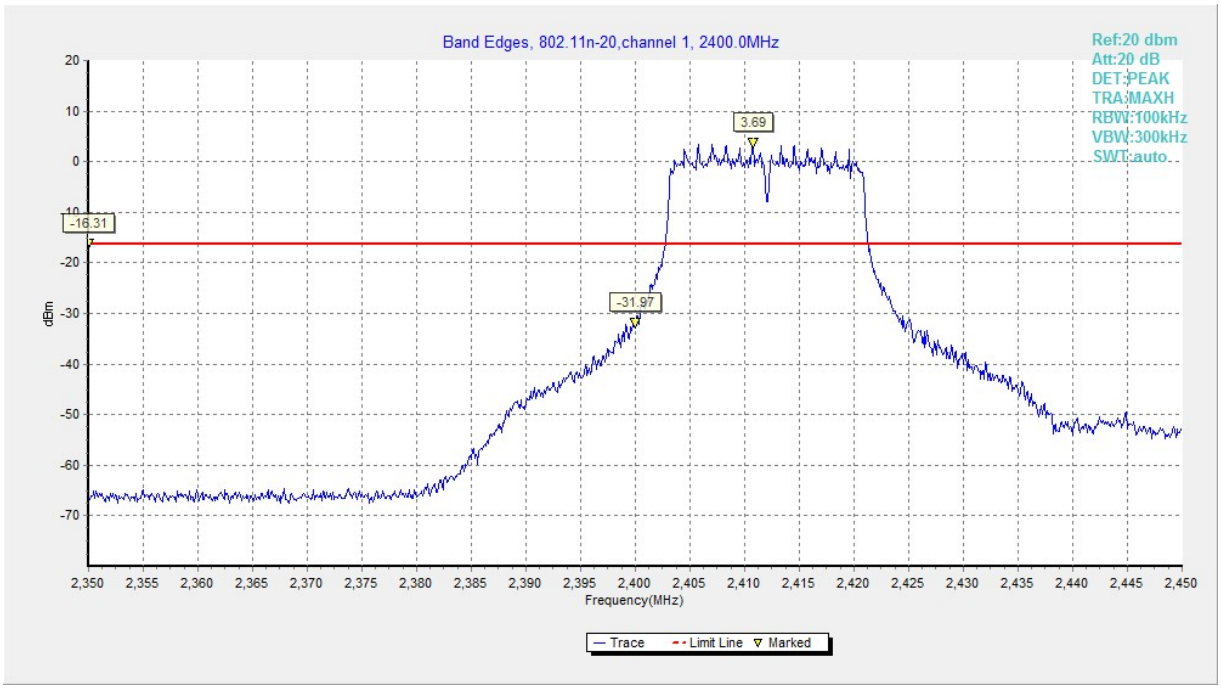

Fig.29 Band Edges (802.11n HT20, CH 1)

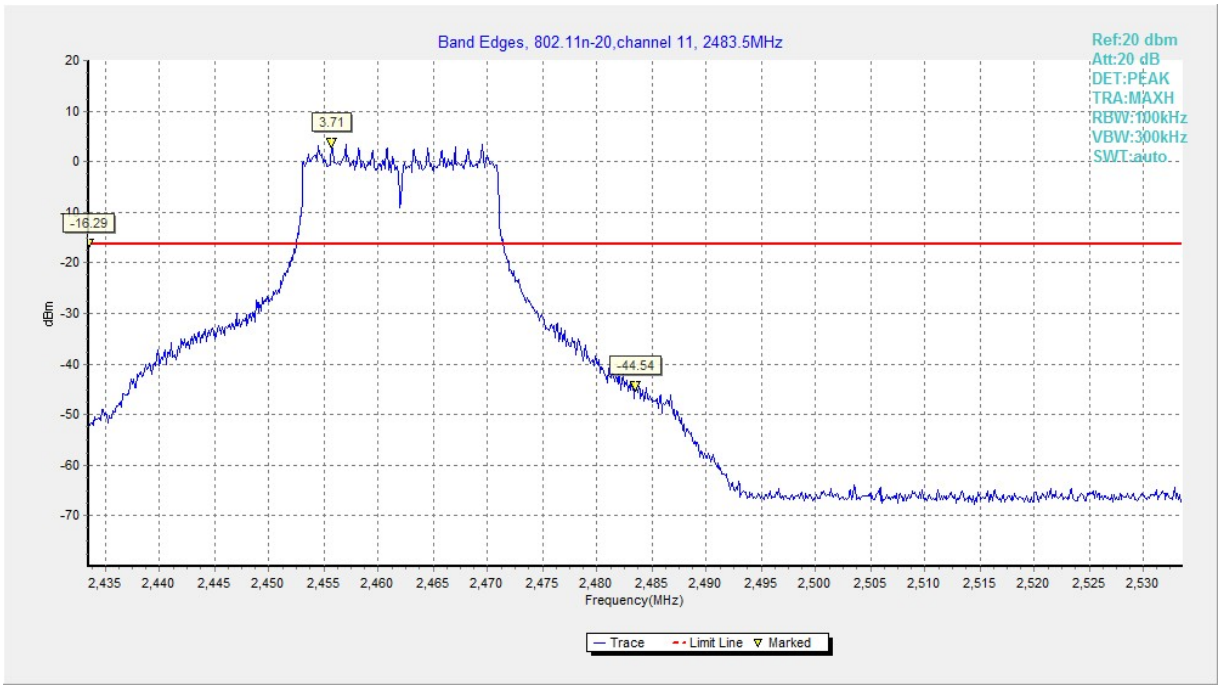

Fig.30 Band Edges (802.11n HT20, CH 11)

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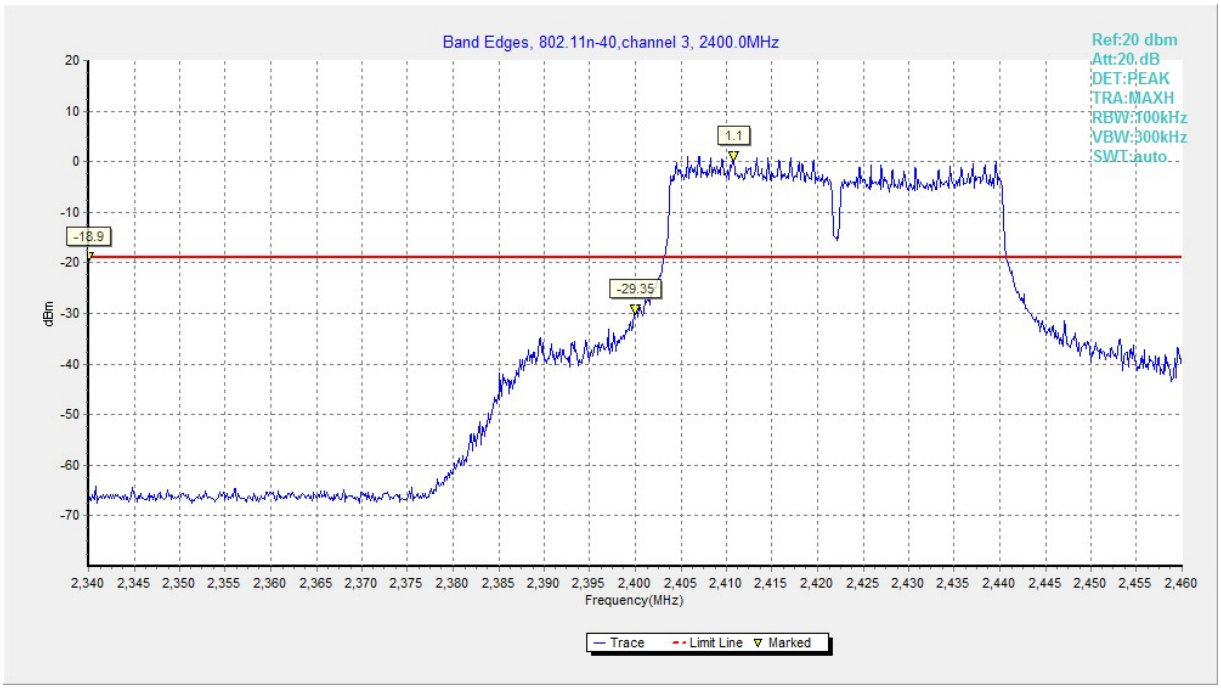

Fig.31 Band Edges (802.11n HT40, CH 3)

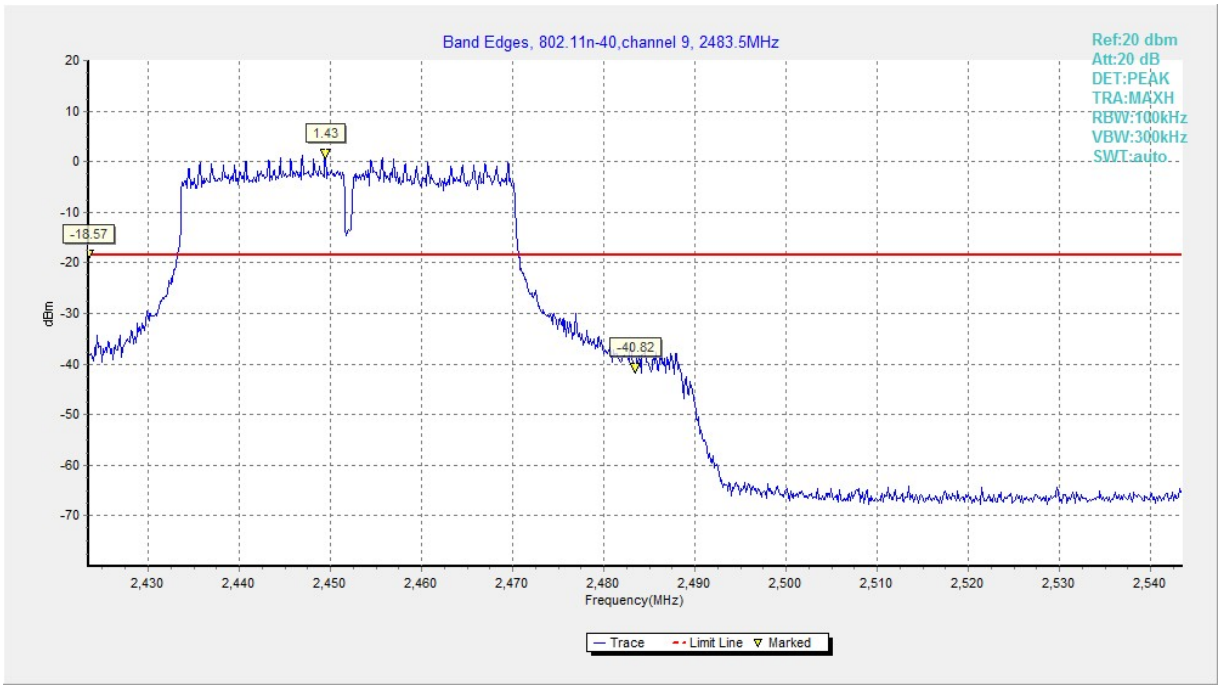

Fig.32 Band Edges (802.11n HT40, CH 9)

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A.5 Conducted Emission

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247 (d) & RSS-247 Section 5.5/RSS-Gen 6.13	20dB below peak output power in 100 kHz bandwidth

Measurement Results:

SISO (Antenna 0):

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**

MIMO Note：

10log2（NANT）db=10log2=3.01.

The margin of conducted emission is over 20db, add 10 log(NANT) dB meet the limit.

See below for test graphs.

Conclusion: PASS

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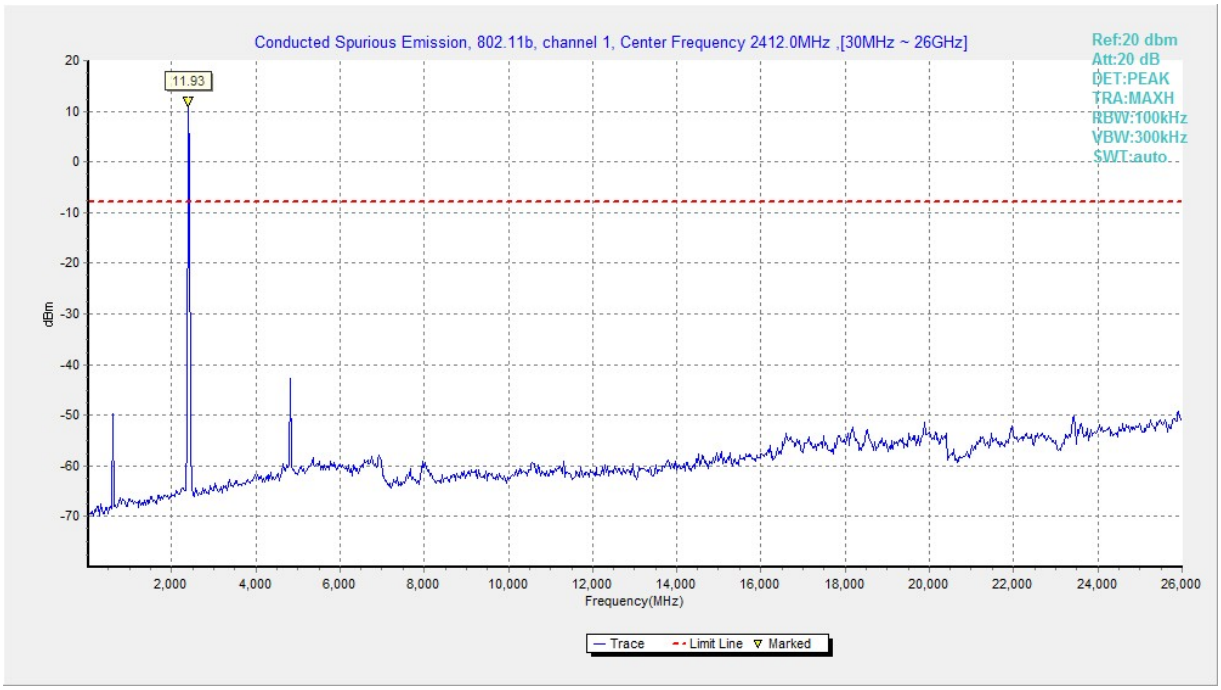

Fig.33 Conducted Spurious Emission (802.11b, CH1)

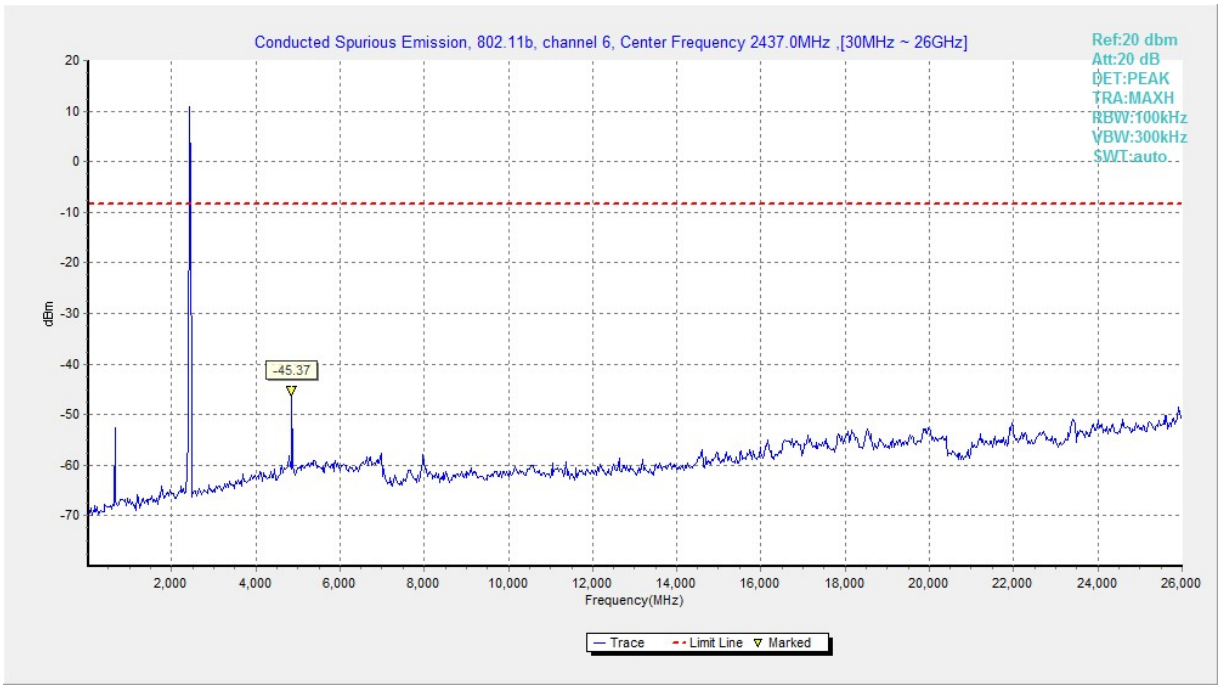

Fig.34 Conducted Spurious Emission (802.11b, CH6)

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