



TEST REPORT

No. I22N01324-WLAN 2.4GHz

TCL Communication Ltd.

LINKZONE

Model Name: R228t

with

Hardware Version: R228t-V1.0

Software Version: vdfeu_R228t_IZ_02.00_04

FCC ID: 2ACCJB182

Issued Date: 2022-08-25

Designation Number: CN1210

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.

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1. Summary of Test Report

1.1. Test Items

| | |
|---------------------|------------------------|
| Description | LINKZONE |
| Model Name | R228t |
| Applicant's name | TCL Communication Ltd. |
| Manufacturer's Name | TCL Communication Ltd. |

1.2. Test Standards

FCC Part15-2019; ANSI C63.10-2013

1.3. Test Result

Pass

Please refer to 5.2 Test Results.

1.4. Testing Location

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

1.5. Project data

| | |
|---------------------|------------|
| Testing Start Date: | 2022-06-17 |
| Testing End Date: | 2022-07-14 |

1.6. Signature

Lin Kanfeng
(Prepared this test report)

An Ran
(Reviewed this test report)

Zhang Bojun
(Approved this test report)



2. Client Information

2.1. Applicant Information

Company Name: TCL Communication Ltd.
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2.2. Manufacturer Information

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Fax: +86 755 3661 2000-81722



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

3.1. About EUT

| | |
|------------------------------|--|
| Description | LINKZONE |
| Model Name | R228t |
| RF Protocol | IEEE 802.11 b/g/n20/n40 |
| Operating Frequency | 2412MHz~2462MHz |
| Number of Channels | 11 |
| Antenna Type | Integrated |
| Antenna Gain | SISO: Antenna 0 = 4.5 dBi, Antenna 1 = 3.1 dBi; MIMO: Antenna 01 = 6.81 dBi. |
| Power Supply | 4V DC by Battery |
| FCC ID | 2ACCJB182 |
| Condition of EUT as received | No abnormality in appearance |
| Note: | According to KDB 662911, beamforming directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}]$ dBi |

3.2. Internal Identification of EUT

| EUT ID* | IMEI | HW Version | SW Version | Receive Date |
|---------|------|------------|-------------------------|--------------|
| UT01aa | / | R228t-V1.0 | vdfeu_R228t_IZ_02.00_04 | 2022-06-15 |
| UT07aa | / | R228t-V1.0 | vdfeu_R228t_IZ_02.00_04 | 2022-06-15 |

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

*UT01aa is used for Conduction test; UT07aa is used for radiation test.

3.3. Internal Identification of AE

| AE ID* | Description | Mode |
|--------|-------------|----------|
| AE1 | Battery | TLi021F7 |
| AE2 | Battery | TLi021FA |
| AE3 | Charger | UC11US |

*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 LINKZONE with integrated antenna and battery. It consists of normal options: Lithium Battery and Charger. 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 | 2019 |
| ANSI C63.10 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices | 2013 |
| KDB 558074 | GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES | v05r02 |
| KDB 662911 | Provision to Allow Measurement of Directional Gain of Multi-Antenna Systems for Compliance Verification | v01 |



5. Test Results

5.1. Testing Environment

Normal Temperature: 15~35°C

Relative Humidity: 20~75%

5.2. Test Results

| No | Test cases | Sub-clause of Part 15C | Verdict |
|----|-----------------------------|------------------------|---------|
| 0 | Antenna Requirement | 15.203 | P |
| 1 | Maximum Output Power | 15.247 (b) | P |
| 2 | Peak Power Spectral Density | 15.247 (e) | P |
| 3 | 6dB Bandwidth | 15.247 (a) | P |
| 4 | Band Edges Compliance | 15.247 (d) | P |
| 5 | Conducted Emission | 15.247 (d) | P |
| 6 | Radiated Emission | 15.247, 15.205, 15.209 | P |
| 7 | AC Power line Conducted | 15.107, 15.207 | P |

See **ANNEX A** for details.

5.3. Statements

SAICT has evaluated the test cases requested by the applicant/matrix manufacturer as listed in section 5.2 of this report, for the EUT specified in section 3, according to the standards or reference documents listed in section 4.2.

Disclaimer:

A. After confirmation with the customer, the sample information provided by the customer may affect the validity of the measurement results in this report, and the impact and consequences arising therefrom shall be borne by the customer.

B. The samples in this report are provided by the customer, and the test results are only applicable to the samples received.



6. Test Equipments Utilized

Conducted test system

| No. | Equipment | Model | Serial Number | Manufacturer | Calibration Date | Calibration Period |
|-----|------------------------|---------|---------------|-----------------|------------------|--------------------|
| 1 | Vector Signal Analyzer | FSV40 | 100903 | Rohde & Schwarz | 2022-12-29 | 1 year |
| 2 | Power Sensor | U2021XA | MY55430013 | Agilent | 2022-12-29 | 1 year |
| 3 | Data Acquisition | U2531A | TW55443507 | Agilent | / | / |

Radiated emission test system

| No. | Equipment | Model | Serial Number | Manufacturer | Calibration Date | Calibration Period |
|-----|-------------------|-----------------------|---------------|--------------|------------------|--------------------|
| 1 | LISN | ENV216 | 102067 | R&S | 2023-07-14 | 1 year |
| 2 | Test Receiver | ESCI | 100702 | R&S | 2023-01-12 | 1 year |
| 3 | Loop Antenna | HLA6120 | 35779 | TESEQ | 2025-04-24 | 3 year |
| 4 | BiLog Antenna | 3142E | 0224831 | ETS-Lindgren | 2024-05-27 | 3 year |
| 5 | Horn Antenna | 3117 | 00066577 | ETS-Lindgren | 2025-04-01 | 3 year |
| 6 | Test Receiver | ESR7 | 101676 | R&S | 2022-11-24 | 1 year |
| 7 | Spectrum Analyzer | FSV40 | 101192 | R&S | 2023-01-12 | 1 year |
| 8 | Chamber | FACT3-2.0 | 1285 | ETS-Lindgren | 2023-05-29 | 2 year |
| 9 | Antenna | QSH-SL-1 8-26-S-20 | 17013 | Q-par | 2023-01-06 | 3 year |
| 10 | Antenna | QSH-SL-1 8-40-K-SG | 15979 | Q-par | 2023-01-06 | 3 year |

Test software

| No. | Equipment | Manufacturer | Version |
|-----|------------------|-----------------|----------|
| 1 | TechMgr Software | CAICT | 2.1.1 |
| 2 | EMC32 | Rohde & Schwarz | 10.50.40 |

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. Laboratory Environment

Semi-anechoic chamber

| | |
|-----------------------------------|--|
| Temperature | Min. = 15 °C, Max. = 35 °C |
| Relative humidity | Min. = 20 %, Max. = 75 % |
| Shielding effectiveness | 0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB |
| Electrical insulation | > 2MΩ |
| Ground system resistance | < 4 Ω |
| Normalised site attenuation (NSA) | < ±4 dB, 3 m distance, from 30 to 1000 MHz |

Shielded room

| | |
|--------------------------|---|
| Temperature | Min. = 15 °C, Max. = 35 °C |
| Relative humidity | Min. = 20 %, Max. = 75 % |
| Shielding effectiveness | 0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB |
| Electrical insulation | > 2MΩ |
| Ground system resistance | < 4 Ω |

Fully-anechoic chamber

| | |
|------------------------------------|---|
| Temperature | Min. = 15 °C, Max. = 35 °C |
| Relative humidity | Min. = 20 %, Max. = 75 % |
| Shielding effectiveness | 0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB |
| Electrical insulation | > 2MΩ |
| Ground system resistance | < 4 Ω |
| Voltage Standing Wave Ratio (VSWR) | ≤ 6 dB, from 1 to 18 GHz, 3 m distance |
| Uniformity of field strength | Between 0 and 6 dB, from 80 to 6000 MHz |

8. Measurement Uncertainty

| Test Name | Uncertainty ($k=2$) | |
|--|--|--------|
| 1. RF Output Power - Conducted | 1.32dB | |
| 2. Power Spectral Density - Conducted | 1.32dBm/MHz | |
| 3. Occupied channel bandwidth - Conducted | 4.56kHz | |
| 4. Transmitter Spurious Emission - Conducted | $30\text{MHz} \leq f < 1\text{GHz}$ | 1.41dB |
| | $1\text{GHz} \leq f < 7\text{GHz}$ | 1.92dB |
| | $7\text{GHz} \leq f < 13\text{GHz}$ | 2.31dB |
| | $13\text{GHz} \leq f \leq 26\text{GHz}$ | 2.61dB |
| 5. Transmitter Spurious Emission - Radiated | $9\text{kHz} \leq f < 30\text{MHz}$ | 1.79dB |
| | $30\text{MHz} \leq f < 1\text{GHz}$ | 4.86dB |
| | $1\text{GHz} \leq f < 18\text{GHz}$ | 4.50dB |
| | $18\text{GHz} \leq f \leq 40\text{GHz}$ | 2.90dB |
| 6. AC Power line Conducted Emission | $150\text{kHz} \leq f \leq 30\text{MHz}$ | 2.62dB |



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. |

Note: The Directional gains of antenna used for transmitting is 4.5 dBi (Antenna 0), 3.1 dBi (Antenna 1), 6.81 dBi (Antenna 01). The RF transmitter uses an integrate antenna without connector.



A.1 Maximum Output Power

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

Method AVGP-M-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) | < 30 | < 36 |

Measurement Results:

SISO: Antenna 0

| Mode | Output Power (dBm) | | |
|----------------|--------------------|---------------|----------------|
| | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462MHz (Ch11) |
| 802.11b | 15.26 | 15.69 | 16.31 |
| 802.11g | 14.10 | 14.41 | 15.06 |
| 802.11n (HT20) | 12.92 | 13.34 | 13.88 |
| / | 2422MHz (Ch3) | 2437MHz (Ch6) | 2452MHz (Ch9) |
| 802.11n (HT40) | 12.11 | 12.67 | 13.21 |

Antenna 1

| Mode | Output Power (dBm) | | |
|----------------|--------------------|---------------|----------------|
| | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462MHz (Ch11) |
| 802.11b | 15.07 | 15.51 | 15.97 |
| 802.11g | 13.73 | 14.34 | 14.57 |
| 802.11n (HT20) | 12.65 | 13.24 | 13.51 |
| / | 2422MHz (Ch3) | 2437MHz (Ch6) | 2452MHz (Ch9) |
| 802.11n (HT40) | 12.35 | 12.72 | 12.94 |

MIMO: Antenna 01

| Mode | Output Power (dBm) | | | | | | | | |
|------------|--------------------|-------|-------|---------------|-------|-------|----------------|-------|-------|
| | 2412MHz (Ch1) | | | 2437MHz (Ch6) | | | 2462MHz (Ch11) | | |
| | Ant 1 | Ant 2 | Sum | Ant 1 | Ant 2 | Sum | Ant 1 | Ant 2 | Sum |
| 802.11n-20 | 12.87 | 12.61 | 15.75 | 13.26 | 13.13 | 16.21 | 13.84 | 13.44 | 16.65 |
| Mode | 2422MHz (Ch3) | | | 2437MHz (Ch6) | | | 2452MHz (Ch9) | | |
| 802.11n-40 | 12.02 | 12.25 | 15.15 | 12.61 | 12.68 | 15.66 | 13.13 | 12.84 | 16.00 |

Conclusion: PASS



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Note: Worst-case data rates as provided by the client were: 1Mbps (802.11b), 6Mbps (802.11g), MCS0 (802.11n). Antenna 0 is selected as the worst condition (SISO). 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.2 Peak Power Spectral Density

Measurement Limit:

| Standard | Limit |
|------------------------|---------------|
| FCC CRF Part 15.247(e) | < 8 dBm/3 kHz |

Measurement Results:

SISO

| Mode | Channel | Frequency (MHz) | Test Results (dBm) | | Conclusion |
|-----------------|---------|-----------------|--------------------|--------|------------|
| 802.11b | CH 1 | 2412 | Fig.1 | -10.41 | P |
| | CH 6 | 2437 | Fig.2 | -10.11 | P |
| | CH 11 | 2462 | Fig.3 | -9.26 | P |
| 802.11g | CH 1 | 2412 | Fig.4 | -14.16 | P |
| | CH 6 | 2437 | Fig.5 | -14.67 | P |
| | CH 11 | 2462 | Fig.6 | -13.05 | P |
| 802.11n HT20 | CH 1 | 2412 | Fig.7 | -15.45 | P |
| | CH 6 | 2437 | Fig.8 | -15.15 | P |
| | CH 11 | 2462 | Fig.9 | -15.03 | P |
| 802.11n HT40 | CH 3 | 2422 | Fig.10 | -18.93 | P |
| | CH 6 | 2437 | Fig.11 | -18.45 | P |
| | CH 9 | 2452 | Fig.12 | -17.94 | P |

MIMO

| Mode | Test Results (dBm) | | | | | | | | |
|------------|--------------------|--------|--------|---------------|--------|--------|----------------|--------|--------|
| | 2412MHz (Ch1) | | | 2437MHz (Ch6) | | | 2462MHz (Ch11) | | |
| | Ant 1 | Ant 2 | Sum | Ant 1 | Ant 2 | Sum | Ant 1 | Ant 2 | Sum |
| 802.11n-20 | -15.52 | -15.84 | -12.67 | -14.31 | -15.35 | -11.79 | -15.78 | -14.23 | -11.93 |
| Mode | 2422MHz (Ch3) | | | 2437MHz (Ch6) | | | 2452MHz (Ch9) | | |
| | Ant 1 | Ant 2 | Sum | Ant 1 | Ant 2 | Sum | Ant 1 | Ant 2 | Sum |
| | 802.11n-40 | -19.33 | -18.63 | -15.96 | -19.07 | -17.99 | -15.49 | -17.82 | -17.34 |

See below for test graphs.

Conclusion: PASS

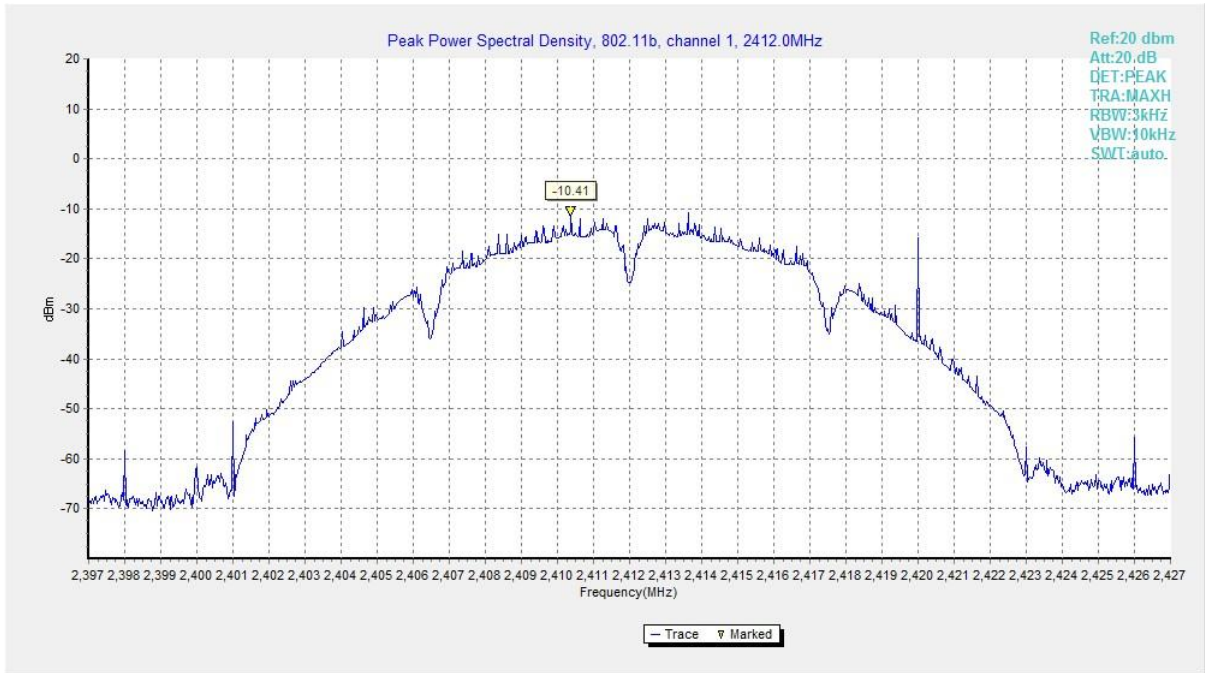


Fig.1 Power Spectral Density (802.11b, CH 1)

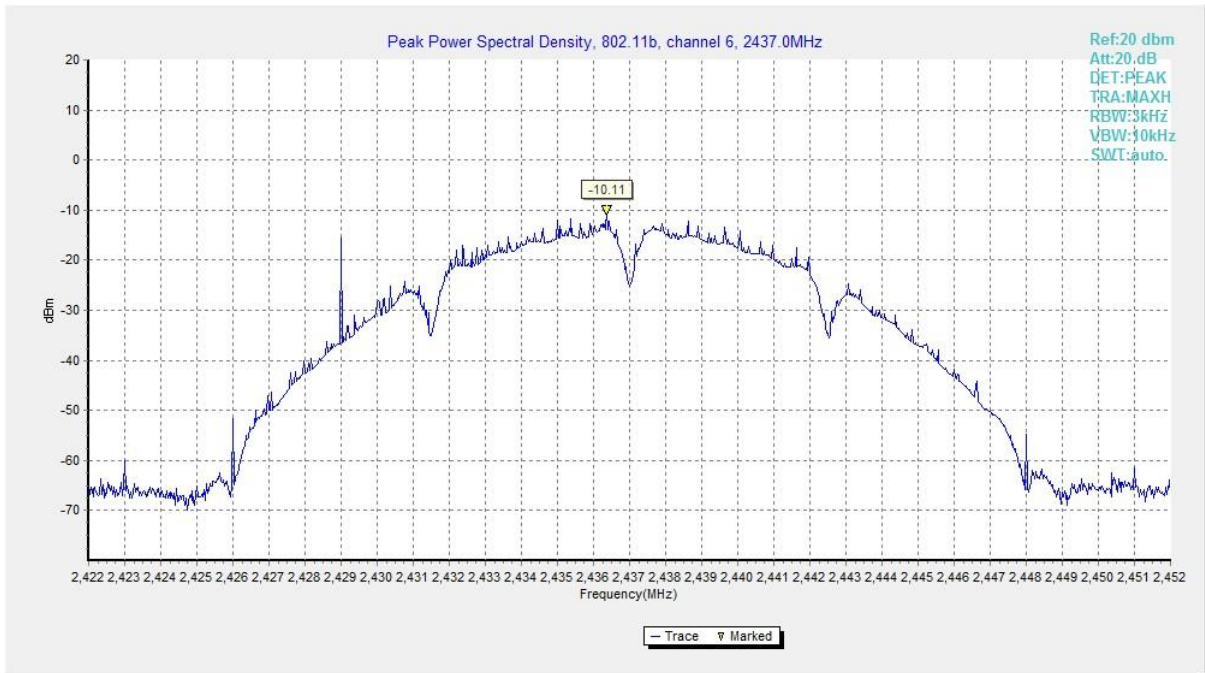


Fig.2 Power Spectral Density (802.11b, CH 6)

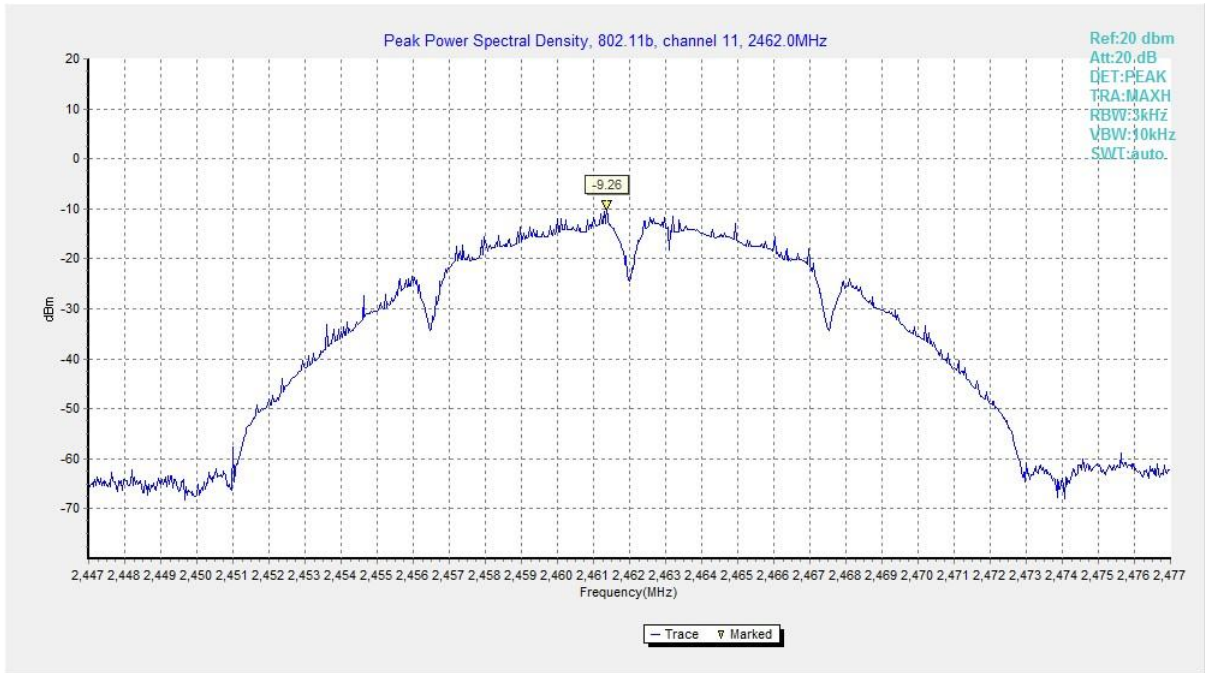


Fig.3 Power Spectral Density (802.11b, CH 11)

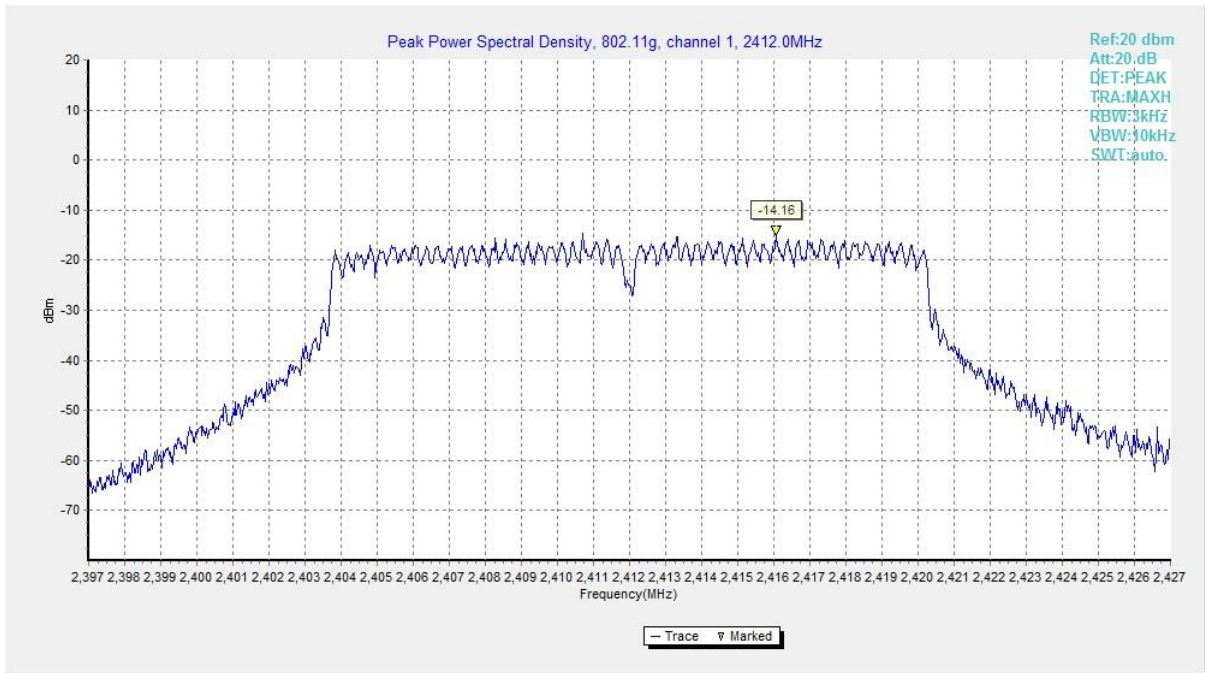


Fig.4 Power Spectral Density (802.11g, CH 1)

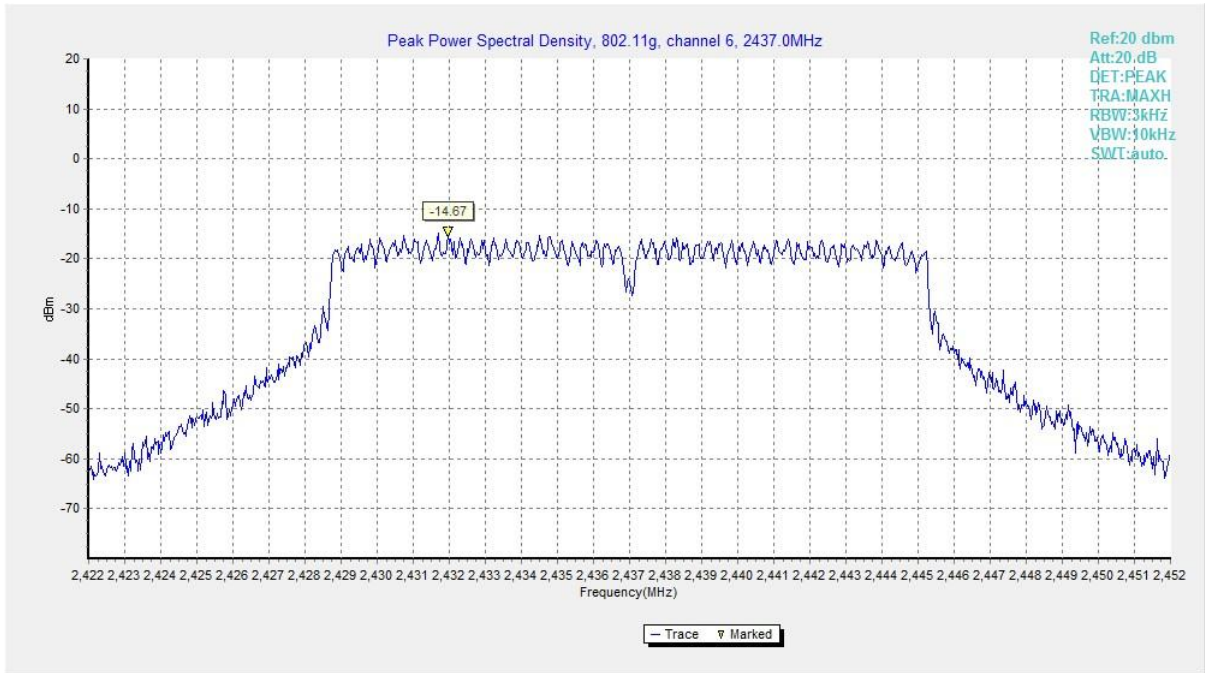


Fig.5 Power Spectral Density (802.11g, CH 6)

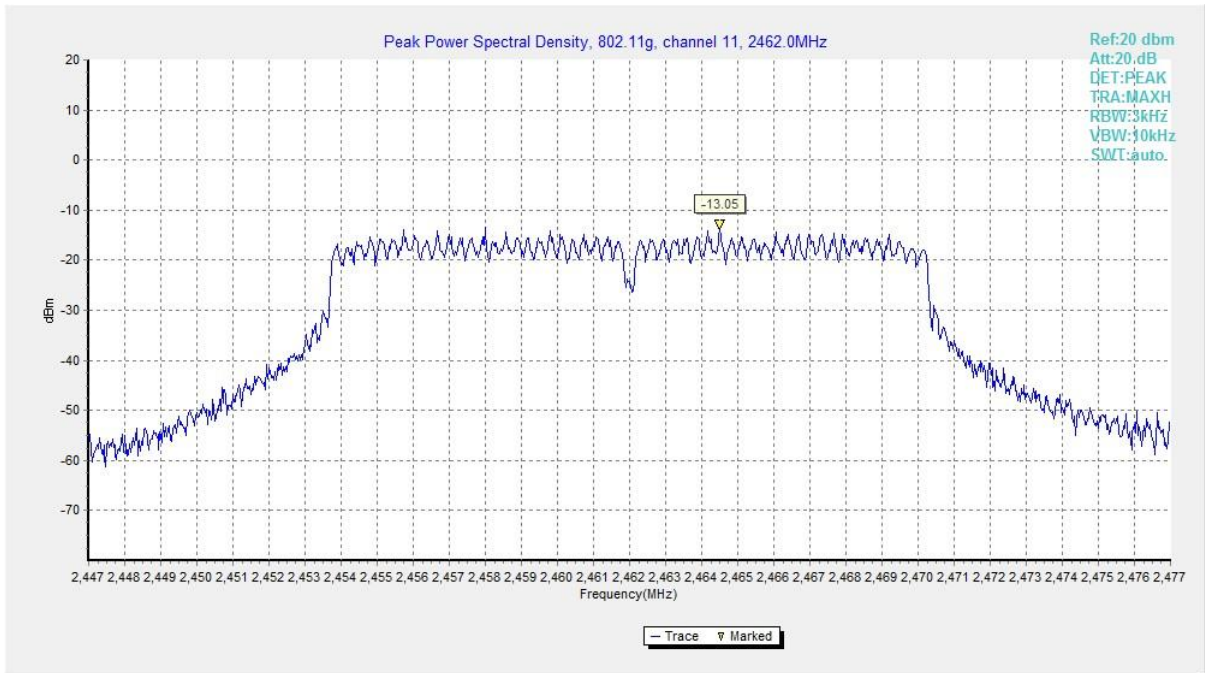


Fig.6 Power Spectral Density (802.11g, CH 11)

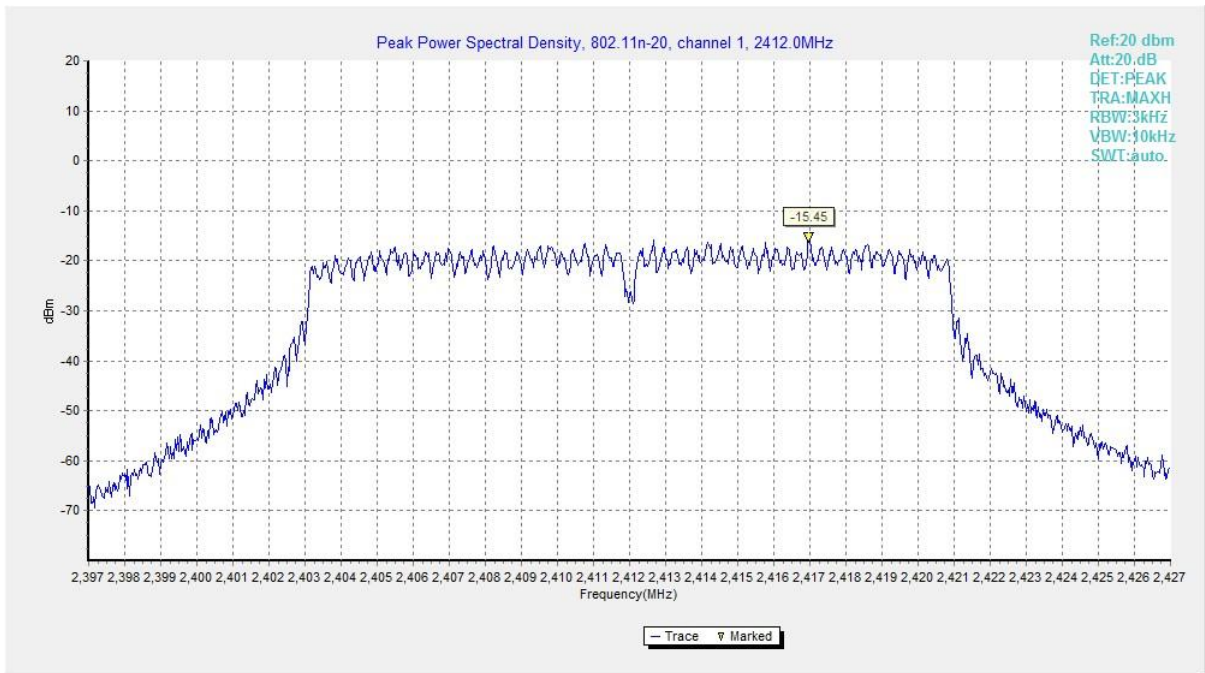


Fig.7 Power Spectral Density (802.11n HT20, CH 1)

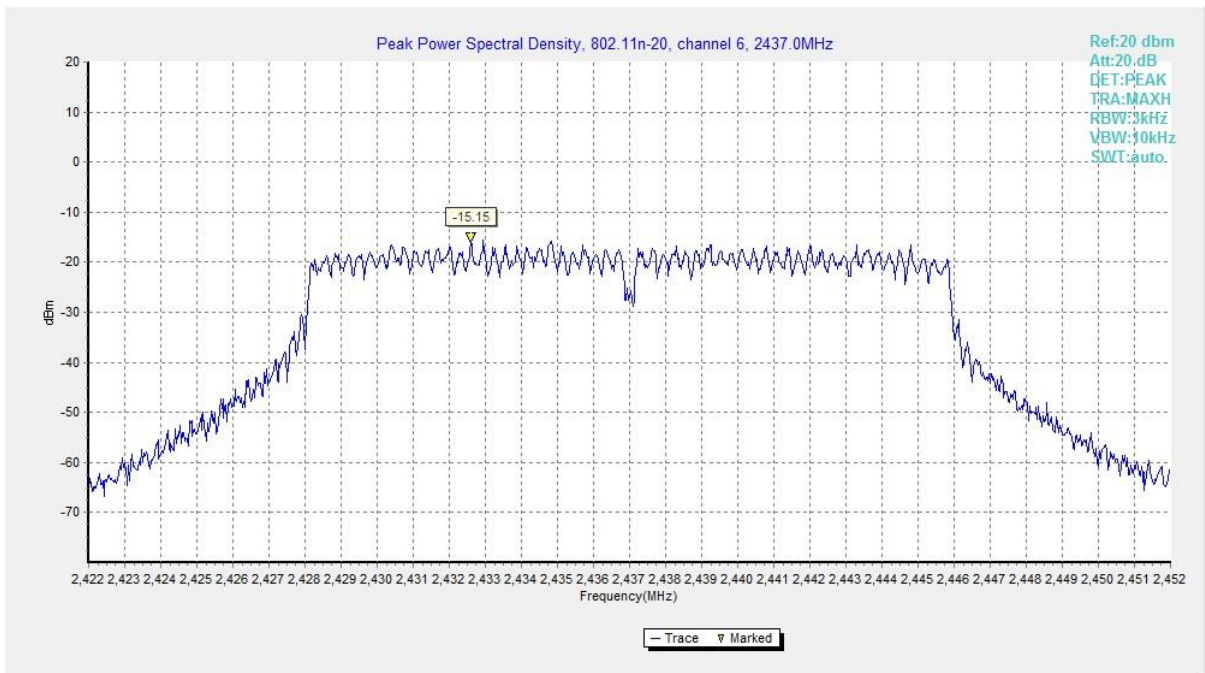


Fig.8 Power Spectral Density (802.11n HT20, CH 6)

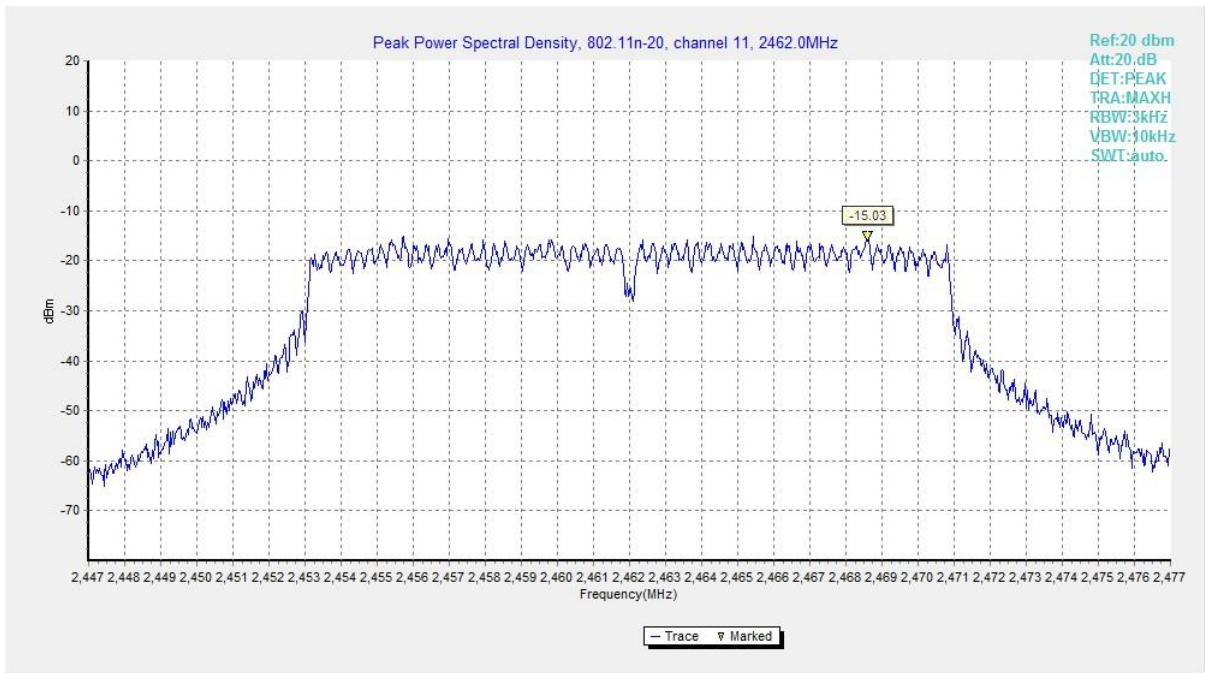


Fig.9 Power Spectral Density (802.11n HT20, CH 11)

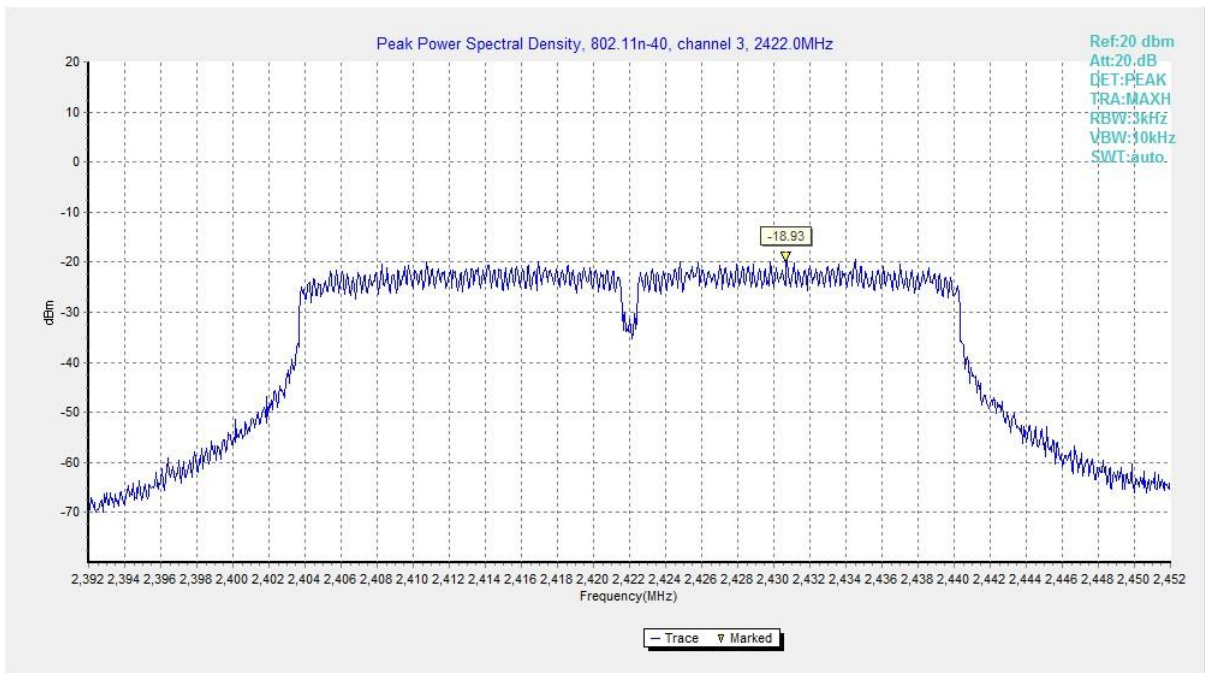


Fig.10 Power Spectral Density (802.11n HT40, CH 3)

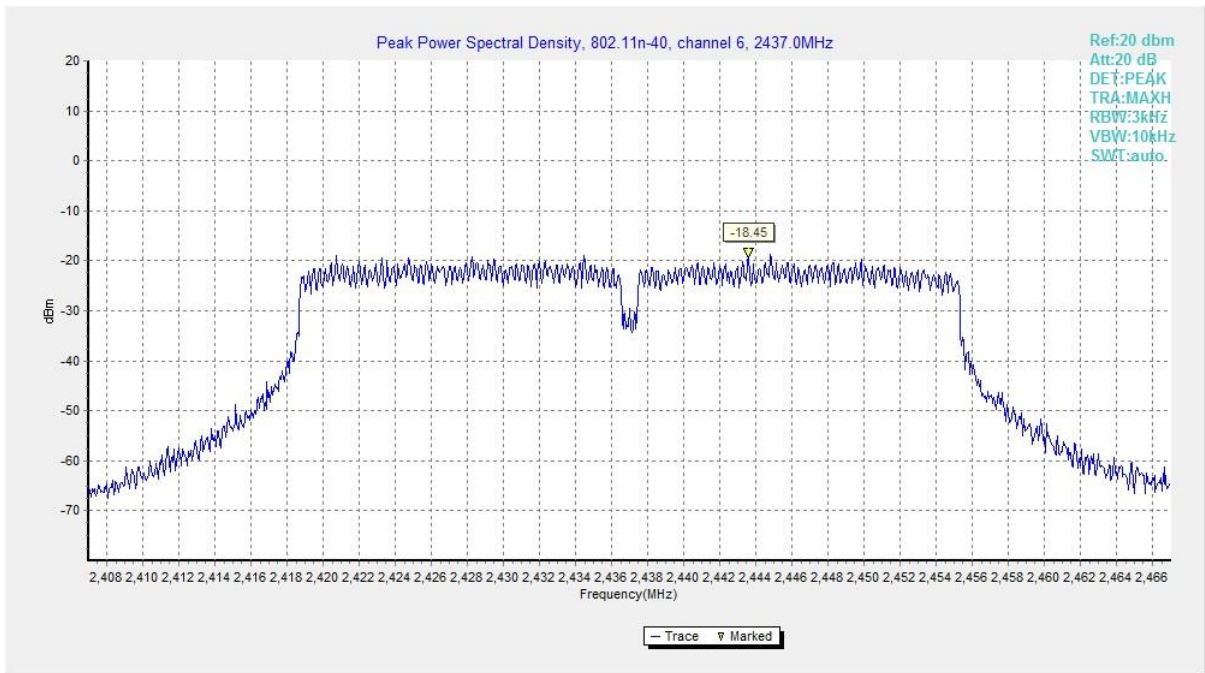


Fig.11 Power Spectral Density (802.11n HT40, CH 6)

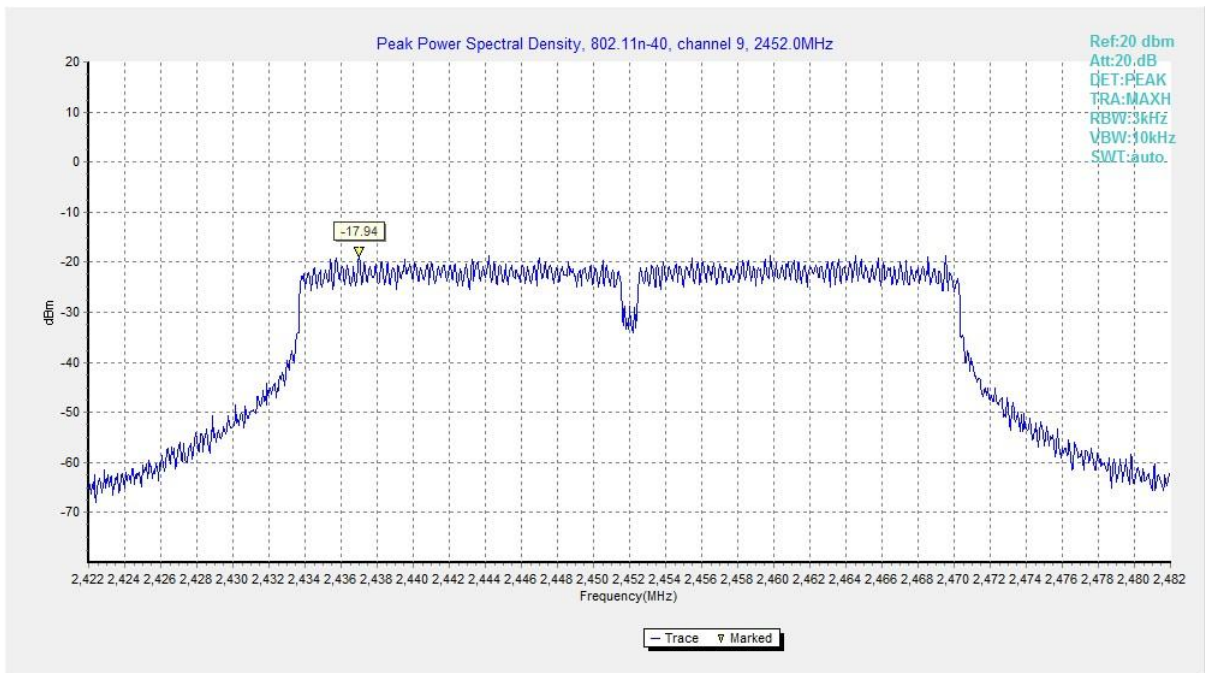


Fig.12 Power Spectral Density (802.11n HT40, CH 9)



A.3 6dB Bandwidth

Measurement Limit:

| Standard | Limit (kHz) |
|----------------------------|-------------|
| FCC 47 CFR Part 15.247 (a) | ≥ 500 |

Measurement Result:

| Mode | Channel | Frequency (MHz) | Test Results (kHz) | | Conclusion |
|-----------------|---------|-----------------|--------------------|-------|------------|
| 802.11b | CH 1 | 2412 | Fig.13 | 8100 | P |
| | CH 6 | 2437 | Fig.14 | 7600 | P |
| | CH 11 | 2462 | Fig.15 | 8050 | P |
| 802.11g | CH 1 | 2412 | Fig.16 | 15650 | P |
| | CH 6 | 2437 | Fig.17 | 16300 | P |
| | CH 11 | 2462 | Fig.18 | 15700 | P |
| 802.11n HT20 | CH 1 | 2412 | Fig.19 | 16800 | P |
| | CH 6 | 2437 | Fig.20 | 16300 | P |
| | CH 11 | 2462 | Fig.21 | 16550 | P |
| 802.11n HT40 | CH 3 | 2422 | Fig.22 | 35440 | P |
| | CH 6 | 2437 | Fig.23 | 35360 | P |
| | CH 9 | 2452 | Fig.24 | 35120 | P |

See below for test graphs.

Conclusion: PASS

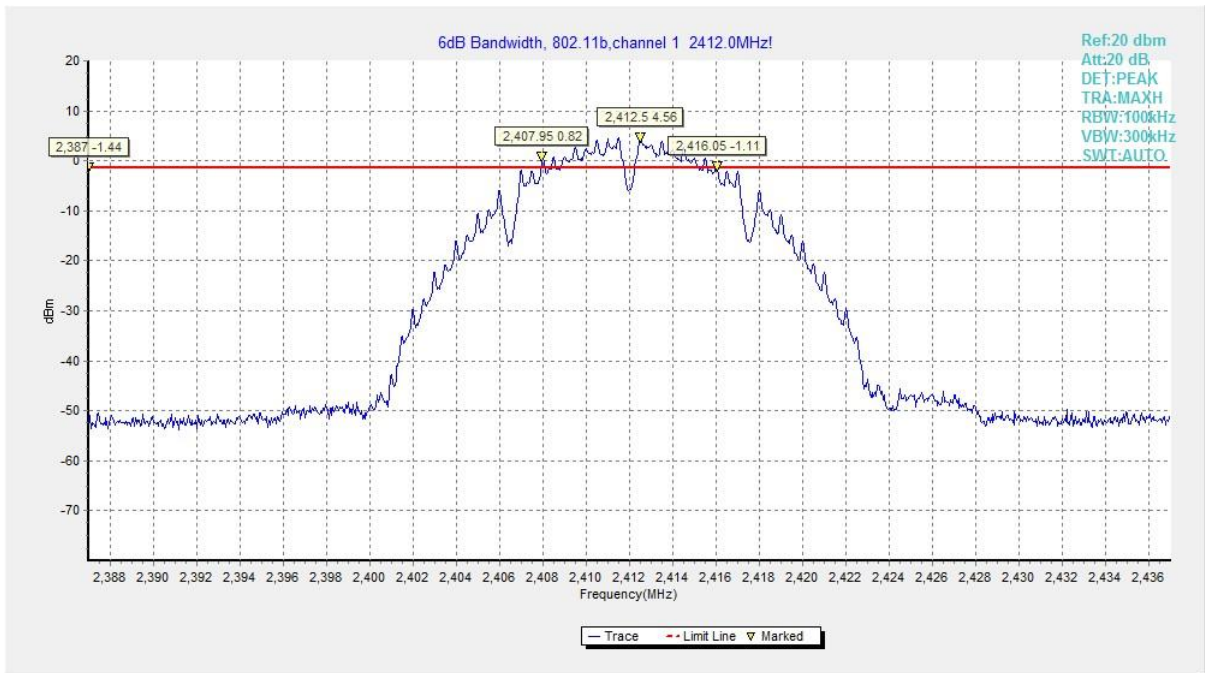


Fig.13 6dB Bandwidth (802.11b, CH 1)



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

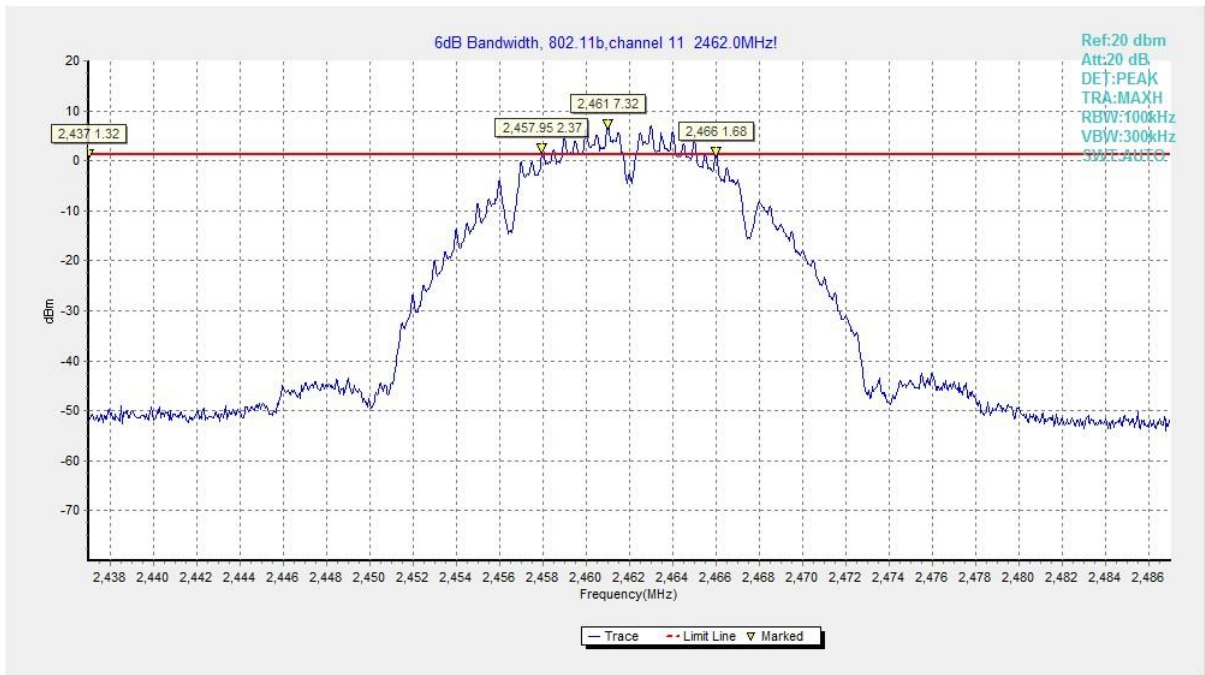


Fig.15 6dB Bandwidth (802.11b, CH 11)

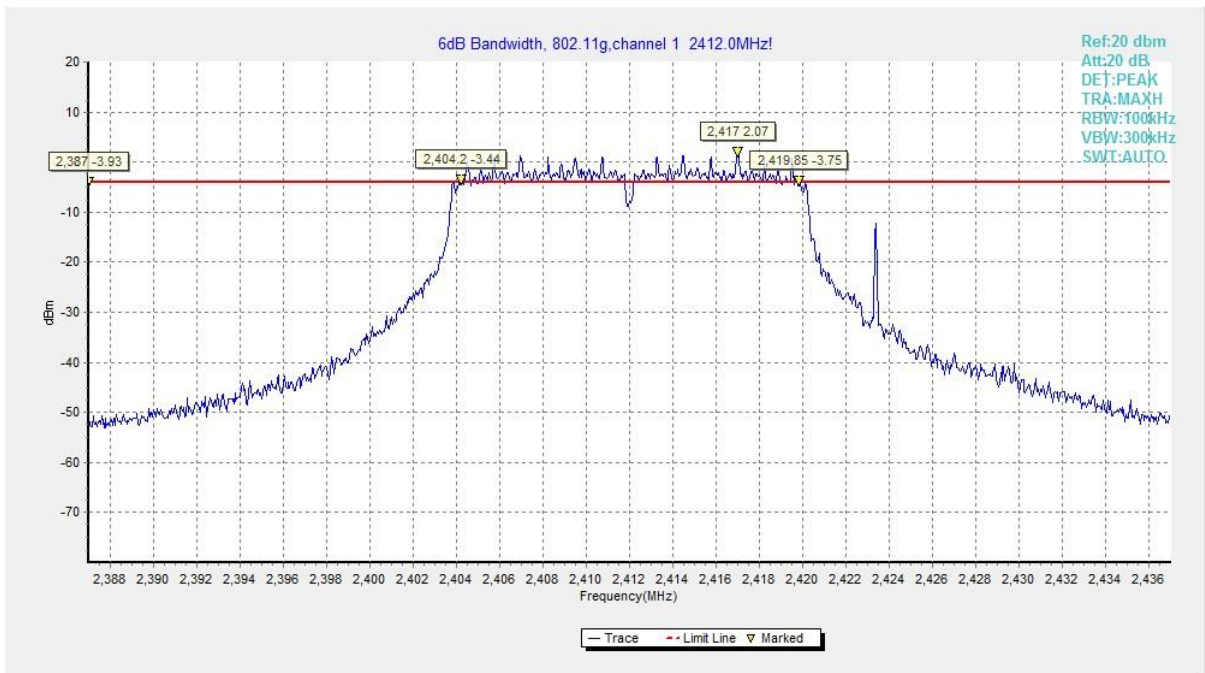


Fig.16 6dB Bandwidth (802.11g, CH 1)

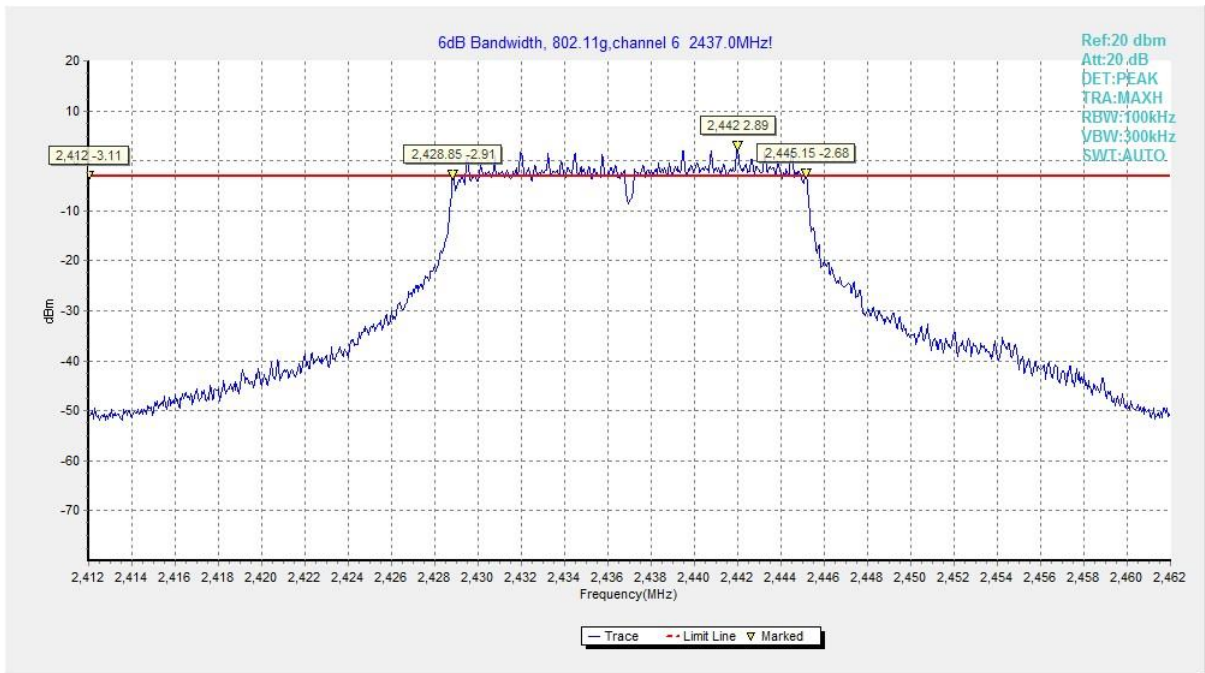


Fig.17 6dB Bandwidth (802.11g, CH 6)

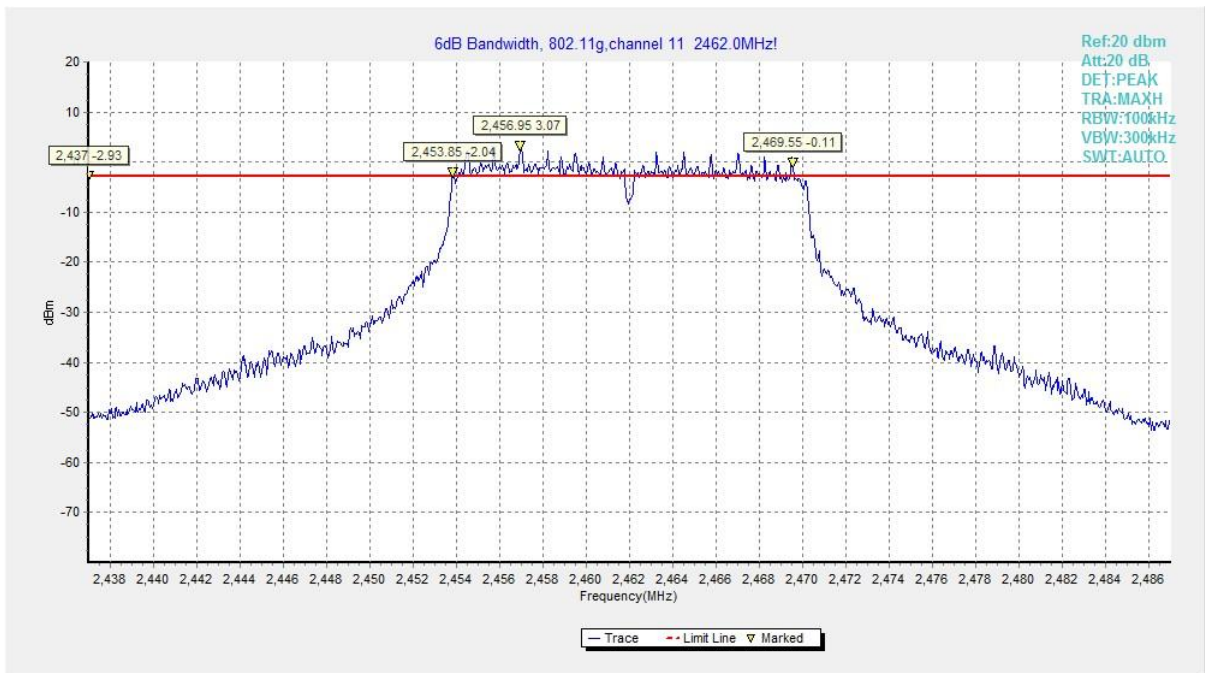


Fig.18 6dB Bandwidth (802.11g, CH 11)

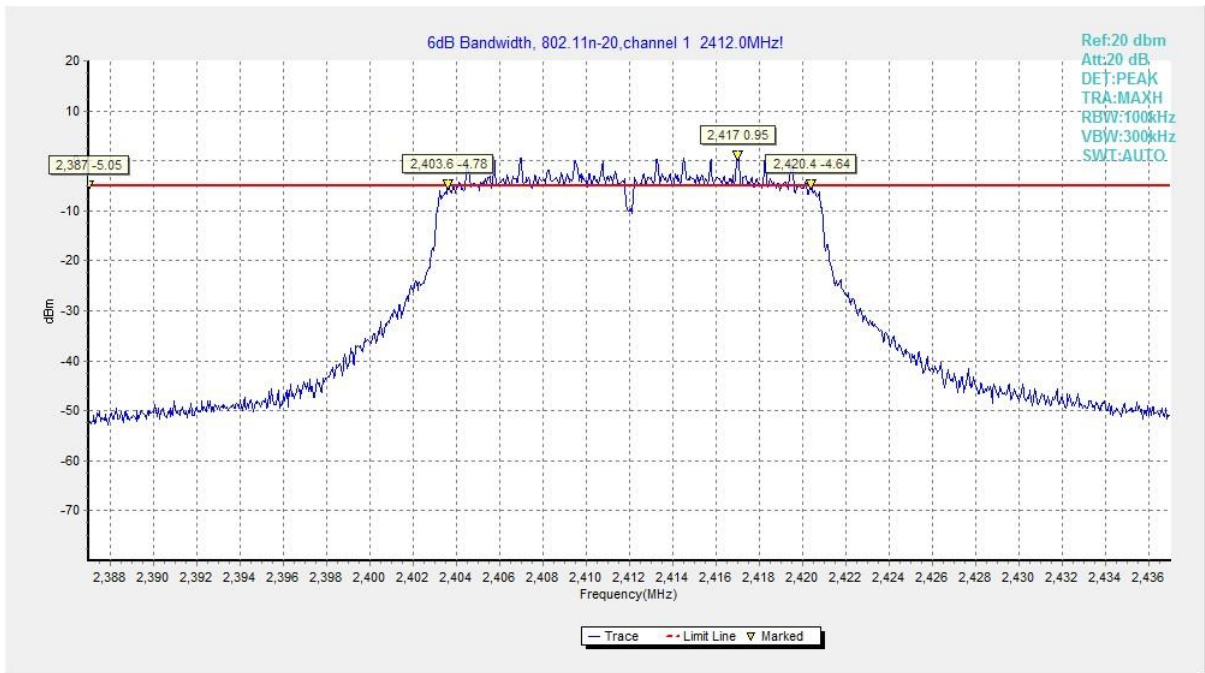


Fig.19 6dB Bandwidth (802.11n HT20, CH 1)

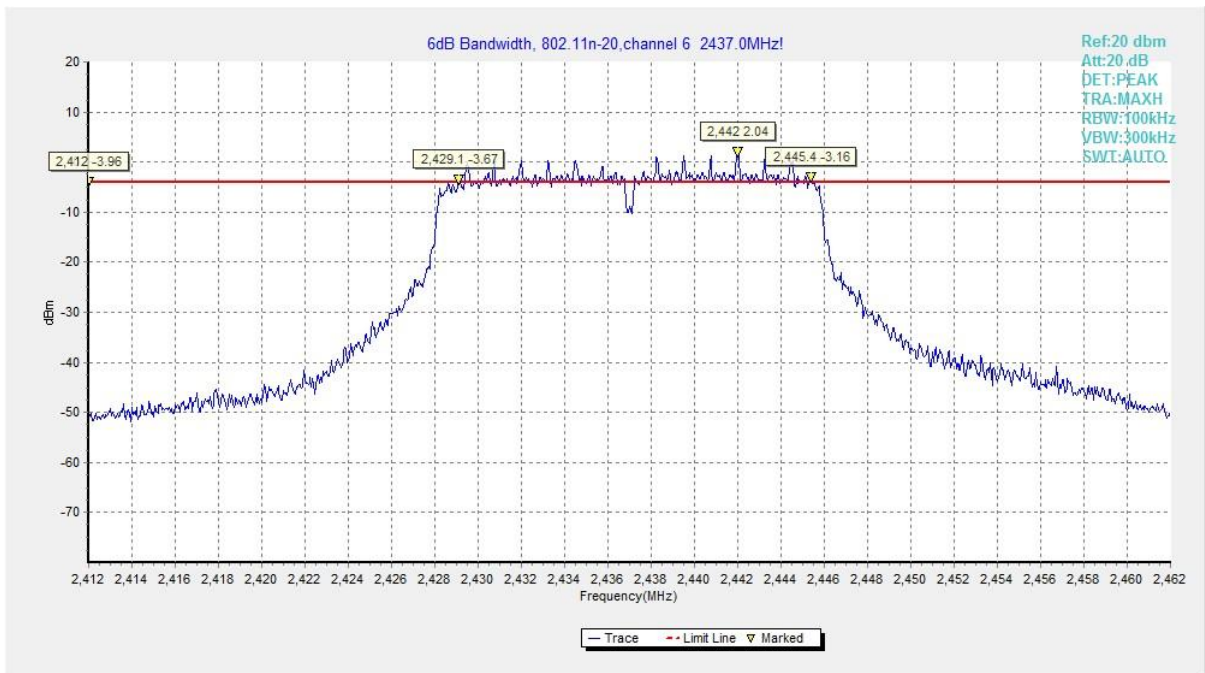


Fig.20 6dB Bandwidth (802.11n HT20, CH 6)

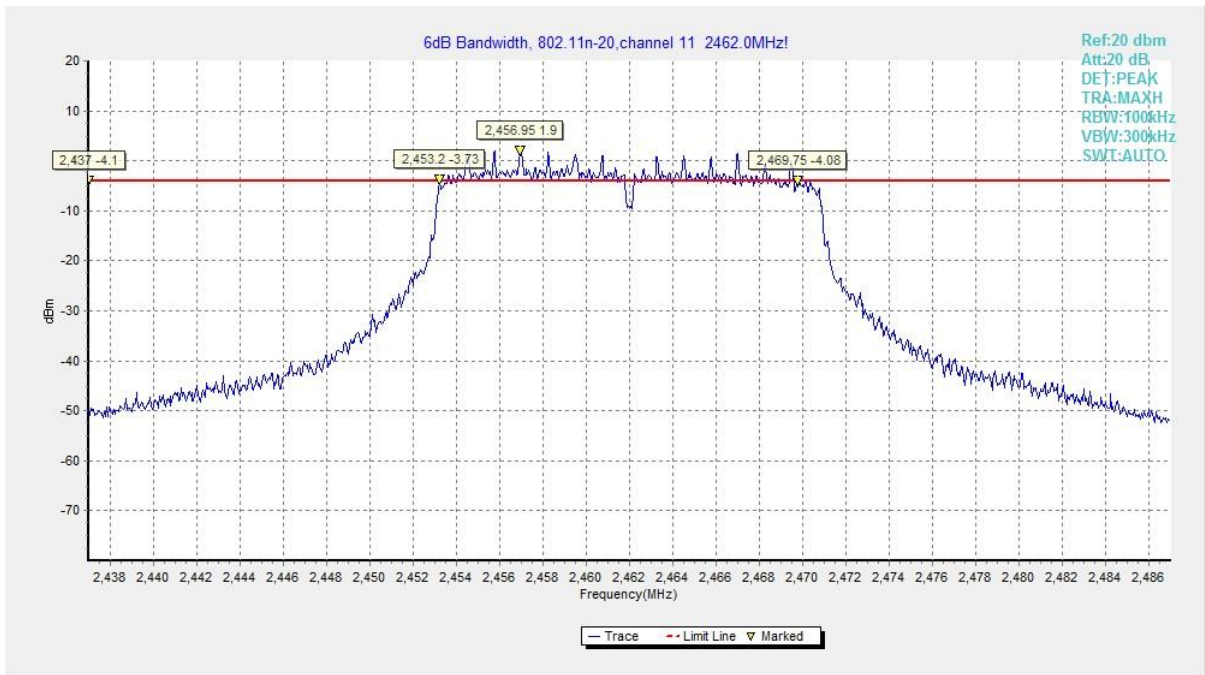


Fig.21 6dB Bandwidth (802.11n HT20, CH 11)

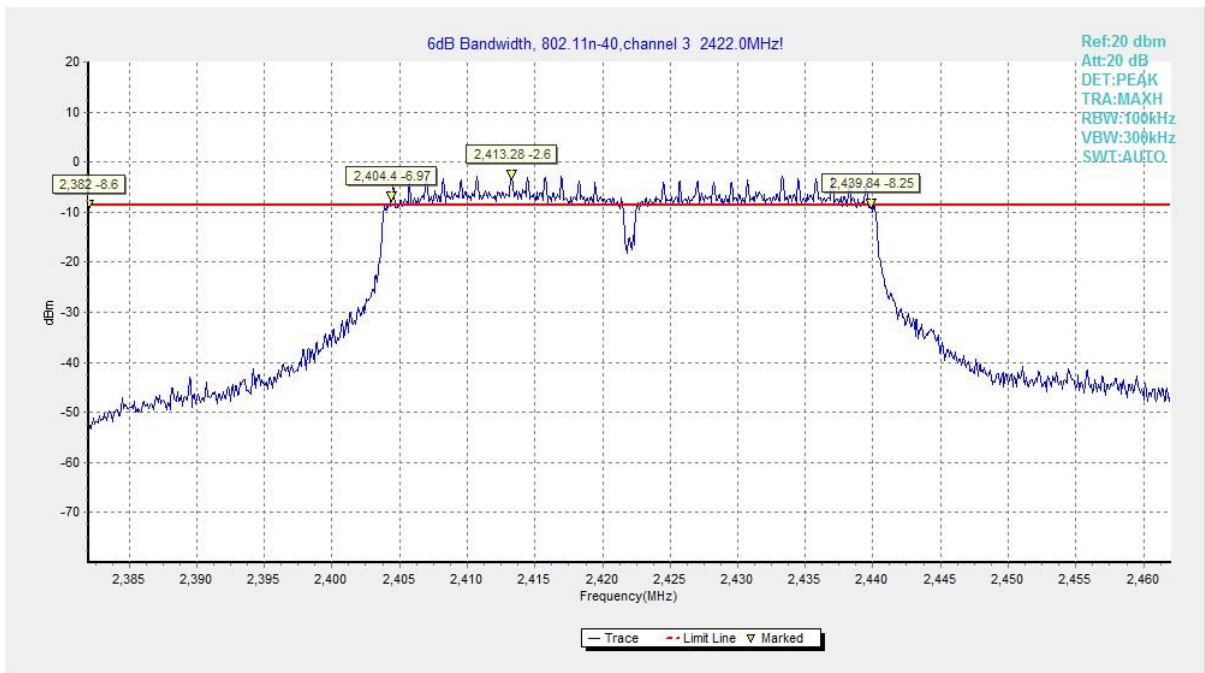


Fig.22 6dB Bandwidth (802.11n HT40, CH 3)

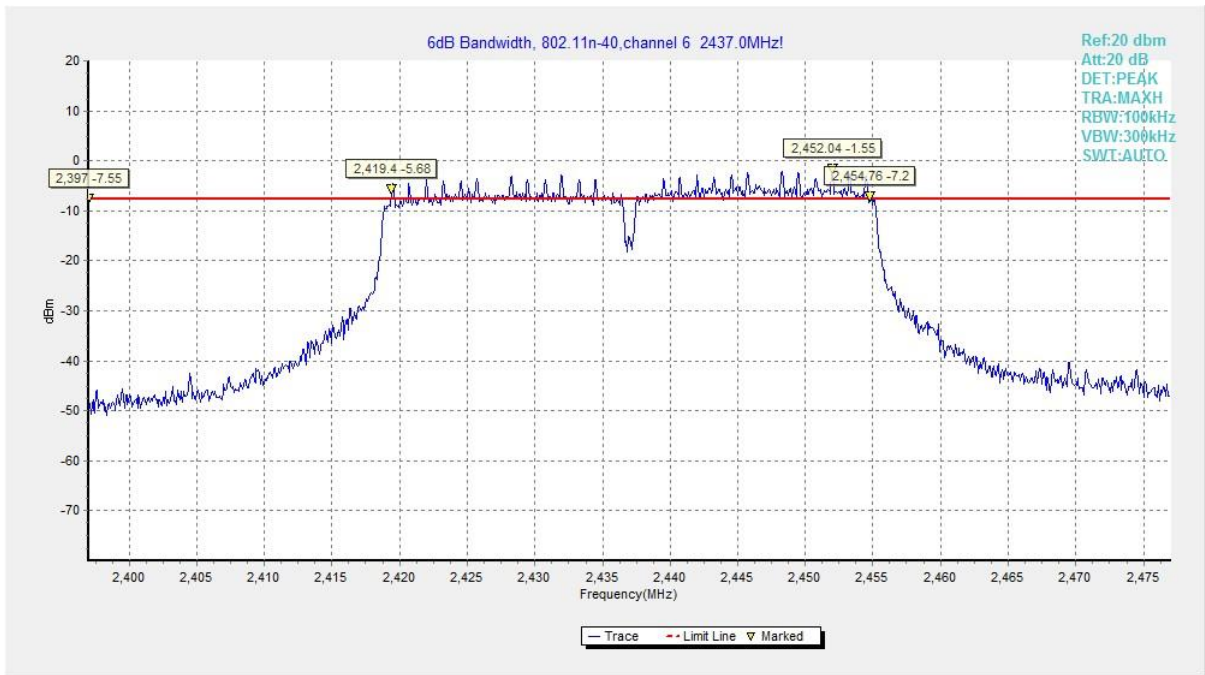


Fig.23 6dB Bandwidth (802.11n HT40, CH 6)

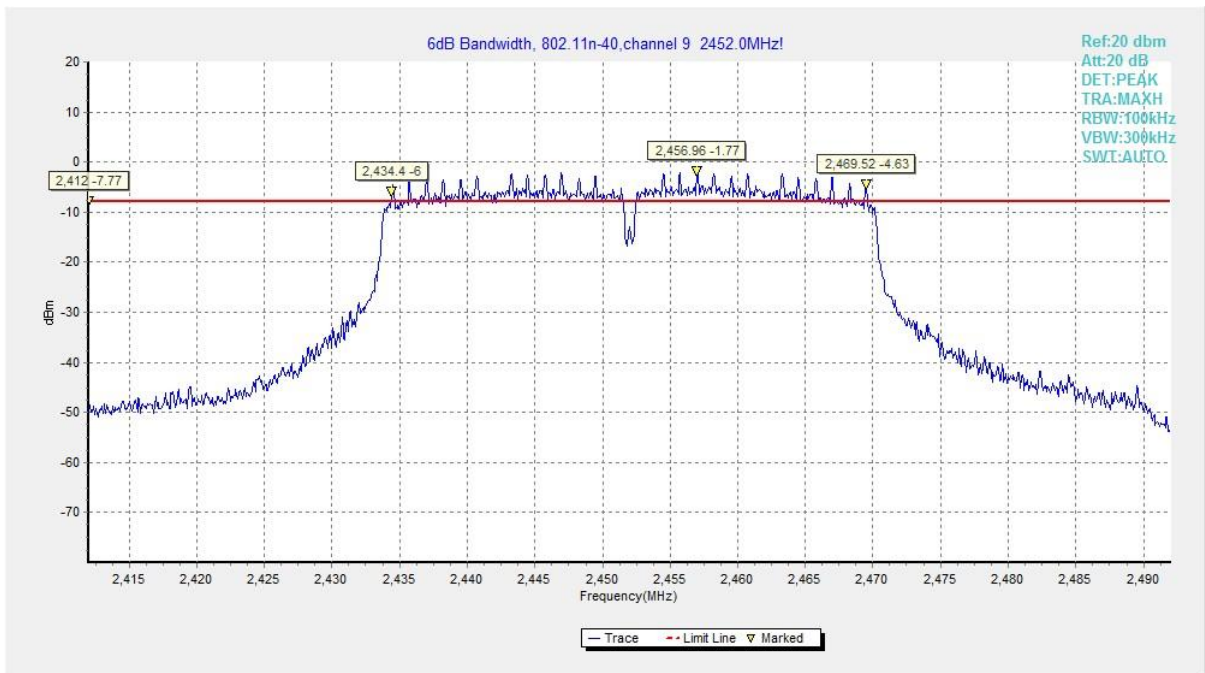


Fig.24 6dB Bandwidth (802.11n HT40, CH 9)



A.4 Band Edges Compliance

Measurement Limit:

| Standard | Limit (dB) |
|----------------------------|------------|
| FCC 47 CFR Part 15.247 (d) | > 20 |

Measurement Result:

| Mode | Channel | Frequency (MHz) | Test Results (dB) | | Conclusion |
|-----------------|---------|-----------------|-------------------|-------|------------|
| | | | Fig. | Value | |
| 802.11b | CH 1 | 2412 | Fig.25 | 56.44 | P |
| | CH 11 | 2462 | Fig.26 | 60.28 | P |
| 802.11g | CH 1 | 2412 | Fig.27 | 38.75 | P |
| | CH 11 | 2462 | Fig.28 | 49.11 | P |
| 802.11n HT20 | CH 1 | 2412 | Fig.29 | 38.60 | P |
| | CH 11 | 2462 | Fig.30 | 49.14 | P |
| 802.11n HT40 | CH 3 | 2422 | Fig.31 | 35.37 | P |
| | CH 9 | 2452 | Fig.32 | 44.95 | P |

See below for test graphs.

Conclusion: PASS

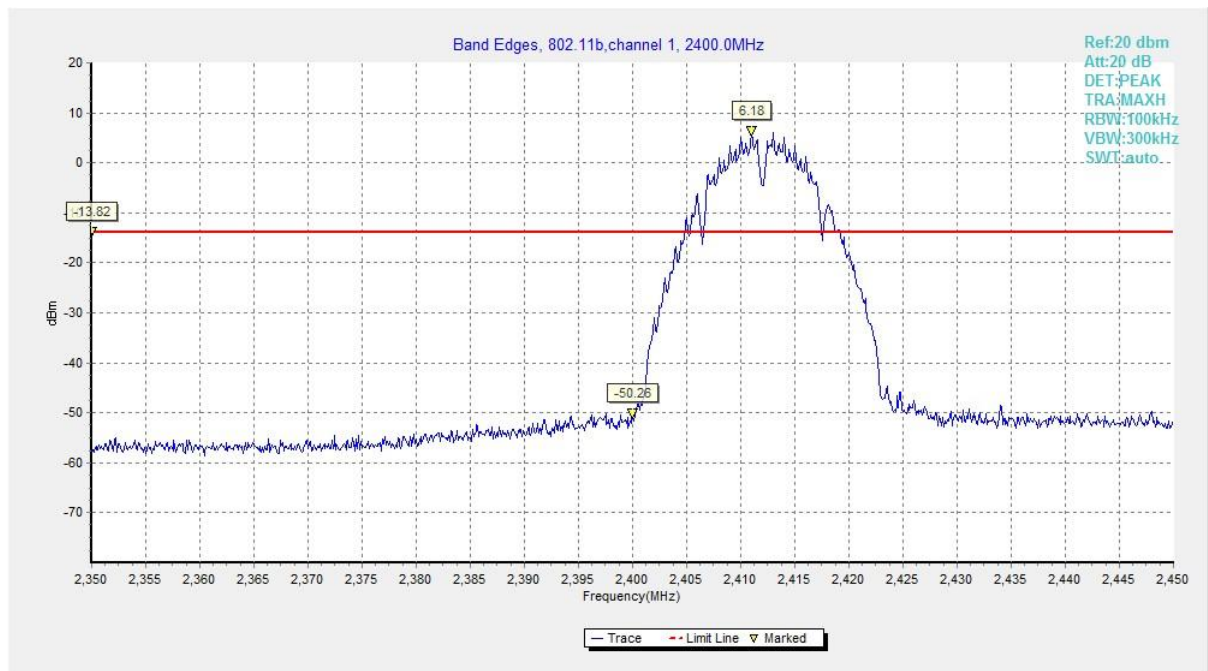


Fig.25 Band Edges (802.11b, CH 1)



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

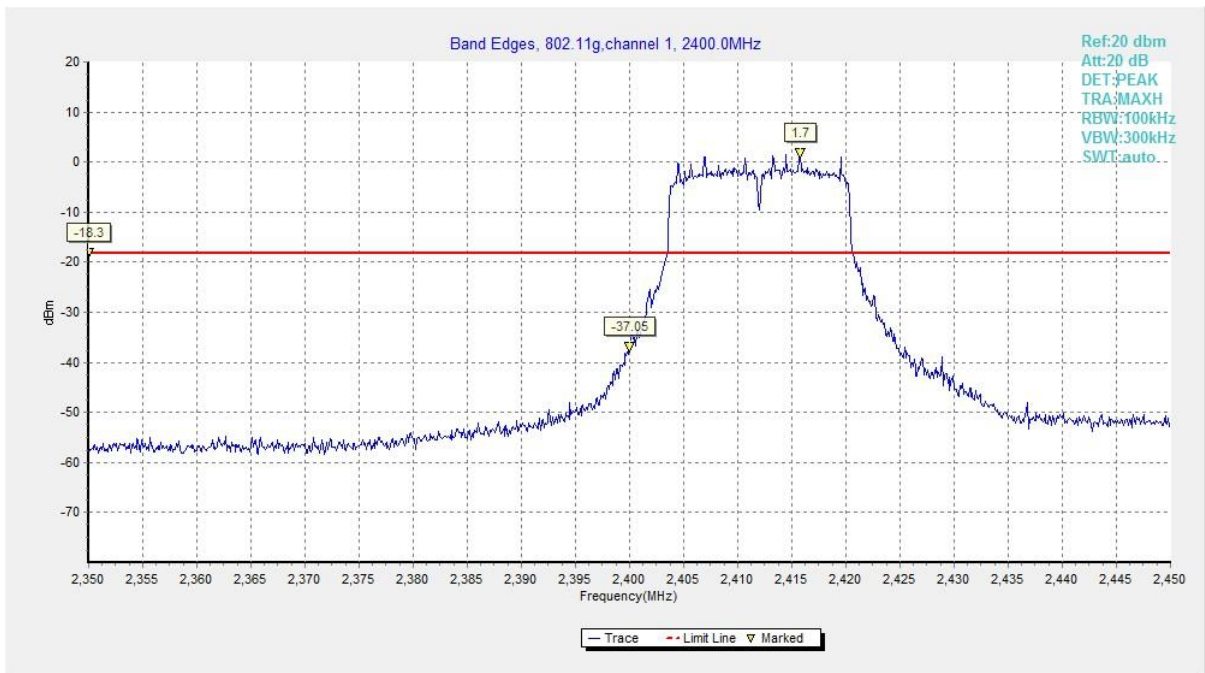


Fig.27 Band Edges (802.11g, CH 1)

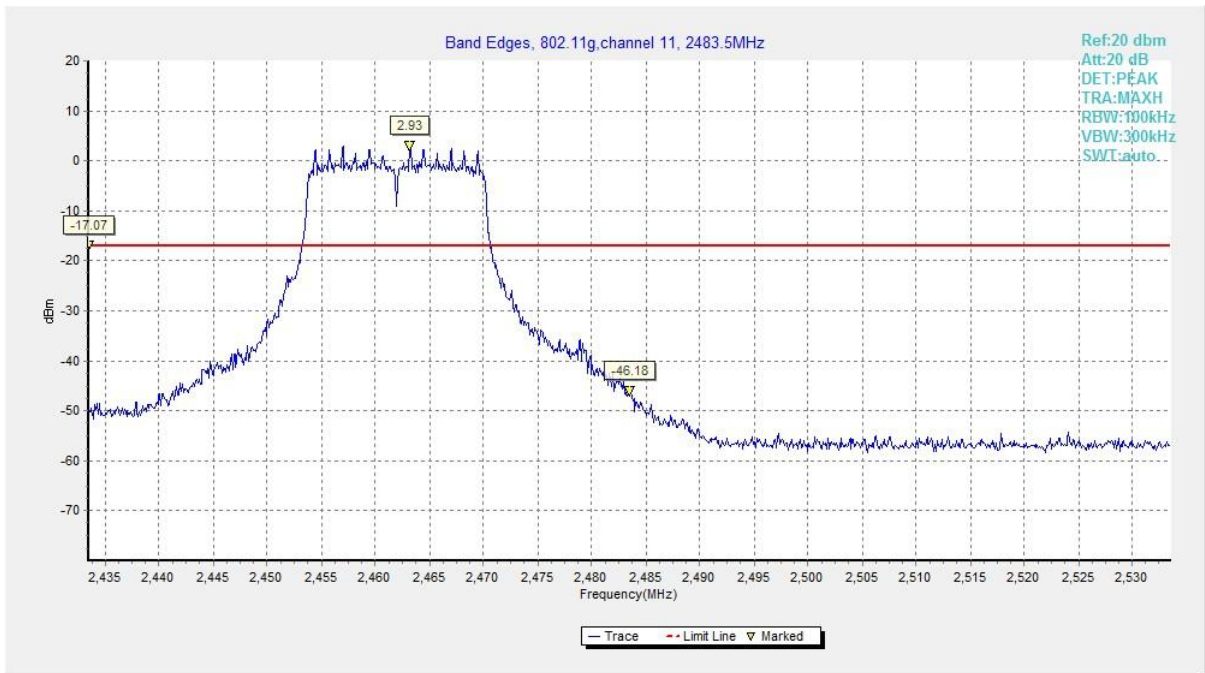


Fig.28 Band Edges (802.11g, CH 11)

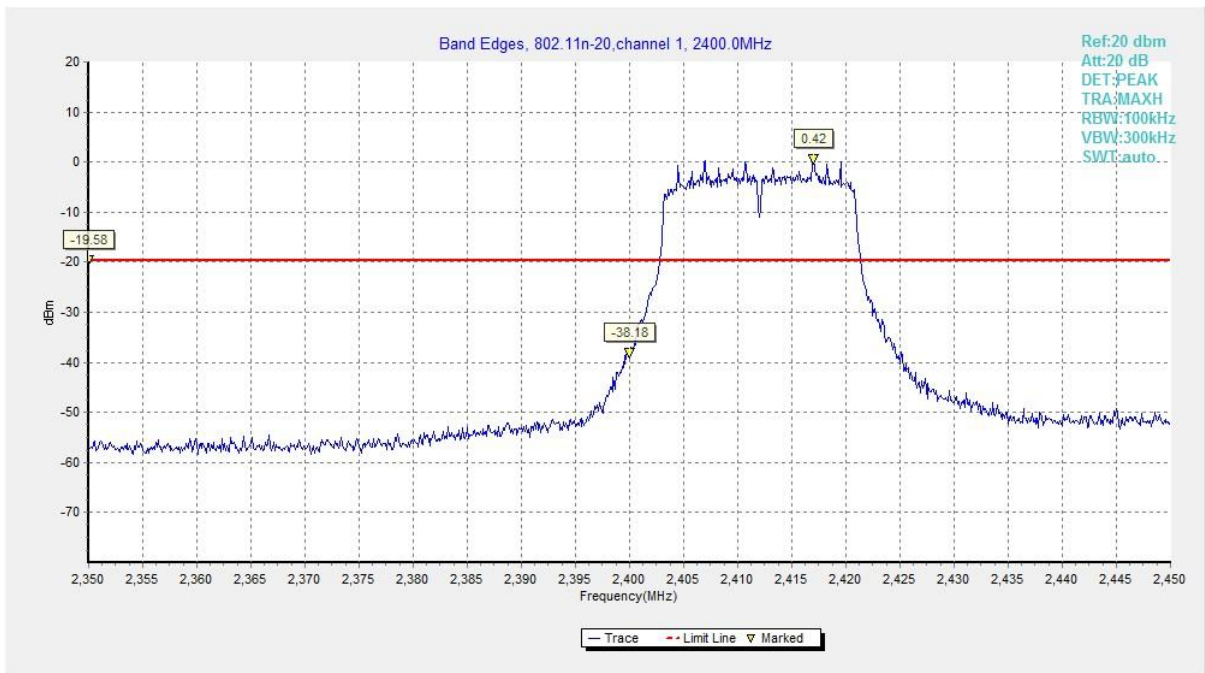


Fig.29 Band Edges (802.11n HT20, CH 1)

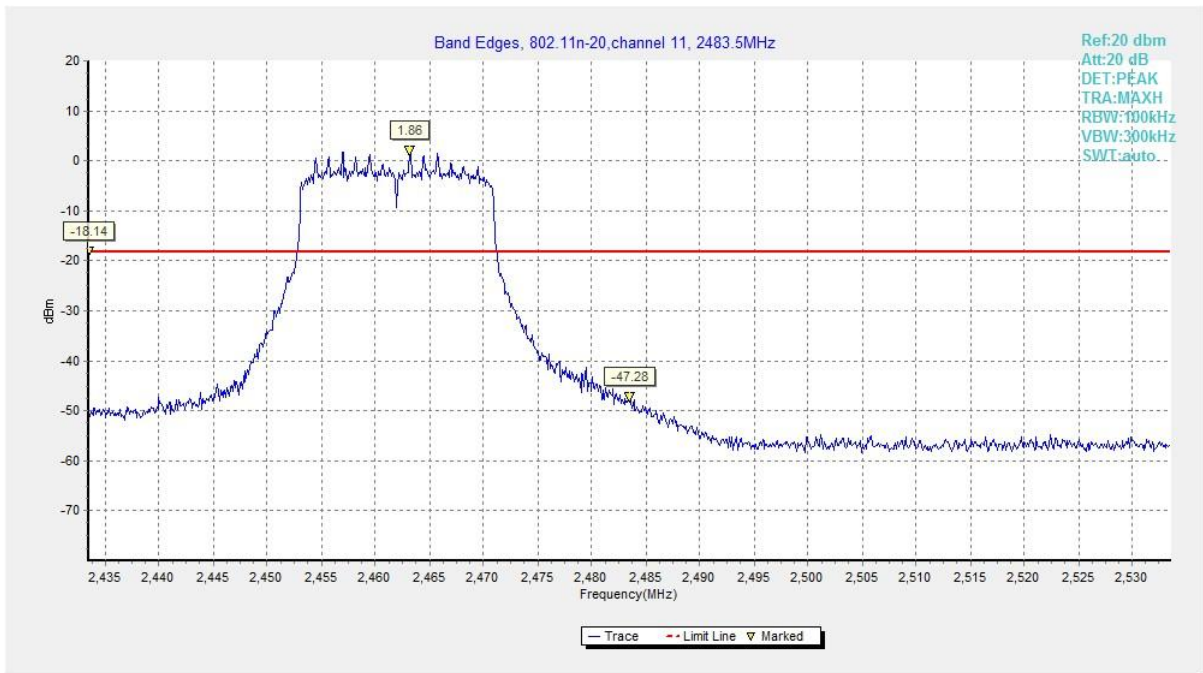


Fig.30 Band Edges (802.11n HT20, CH 11)

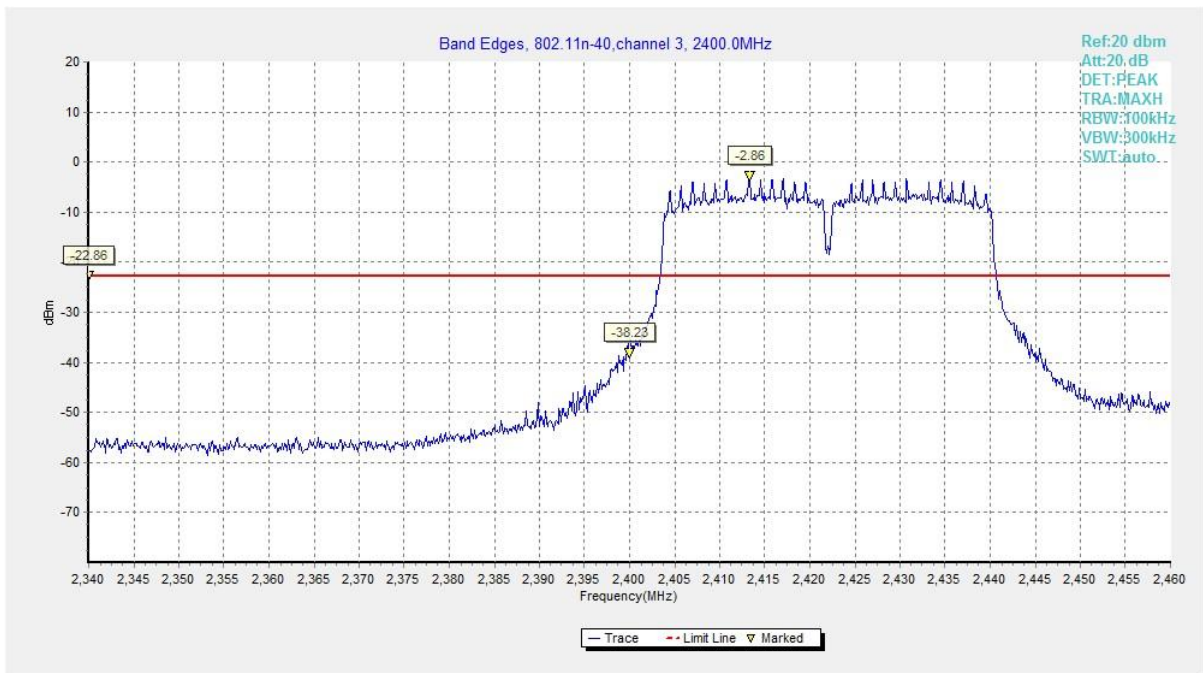


Fig.31 Band Edges (802.11n HT40, CH 3)

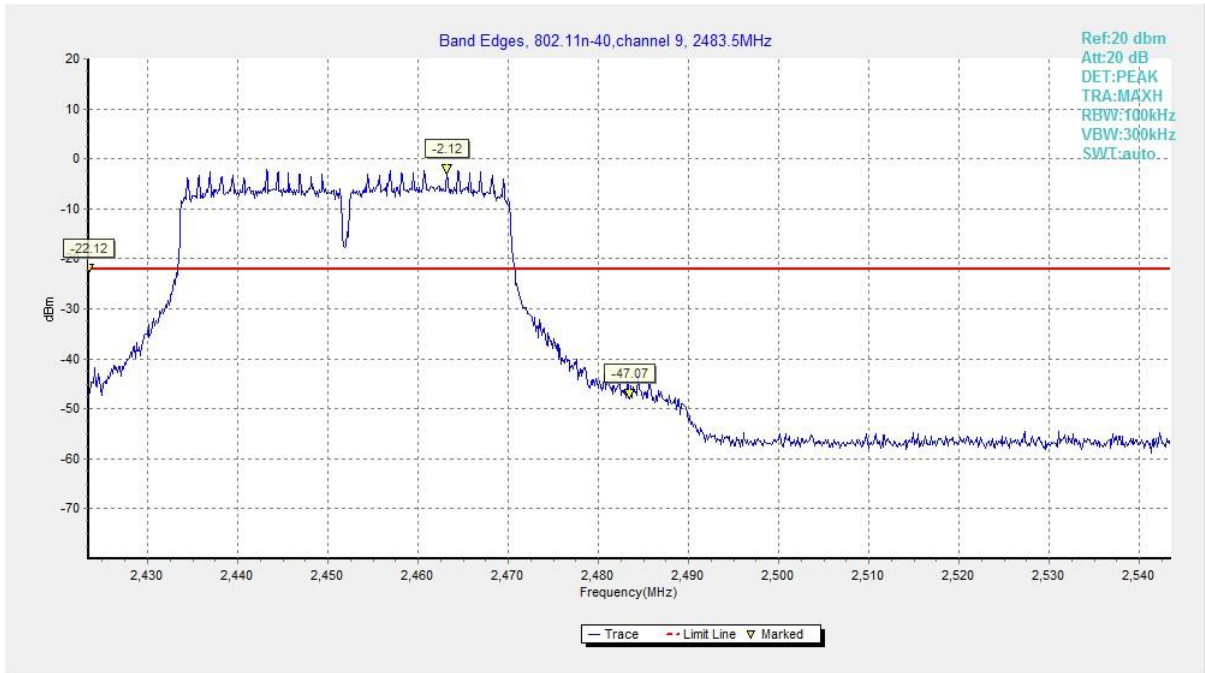


Fig.32 Band Edges (802.11n HT40, CH 9)



A.5 Conducted Emission

Measurement Limit:

| Standard | Limit |
|----------------------------|--|
| FCC 47 CFR Part 15.247 (d) | 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

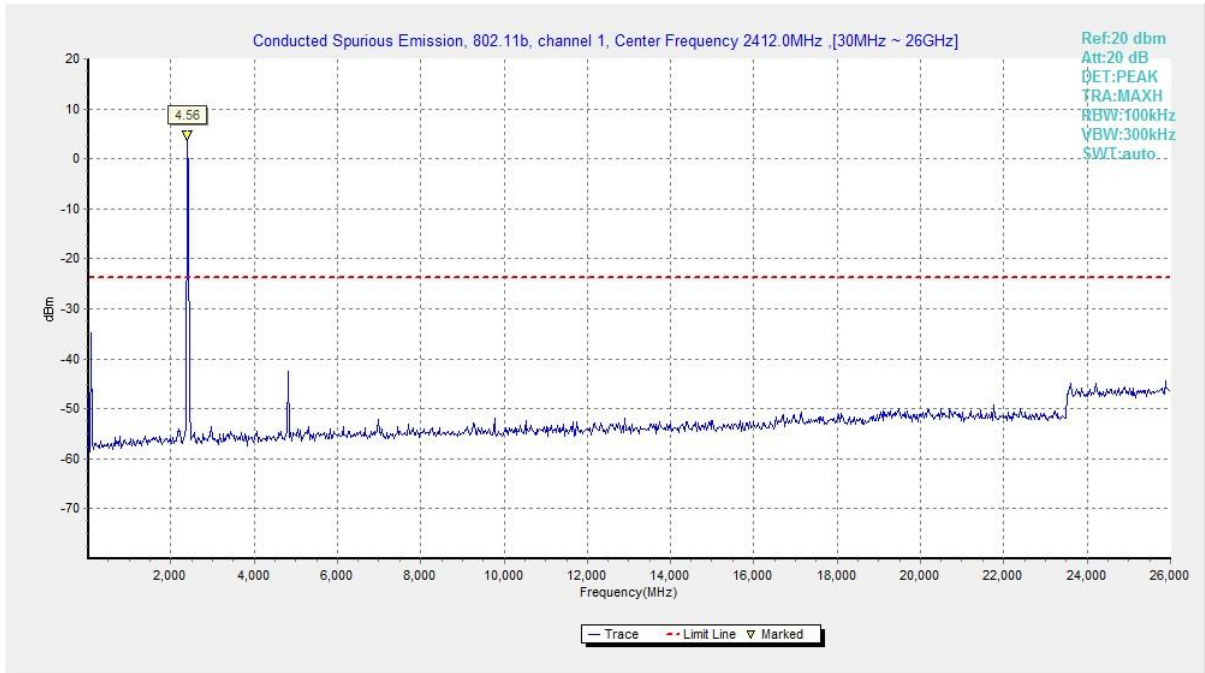


Fig.33 Conducted Spurious Emission (802.11b, CH1)

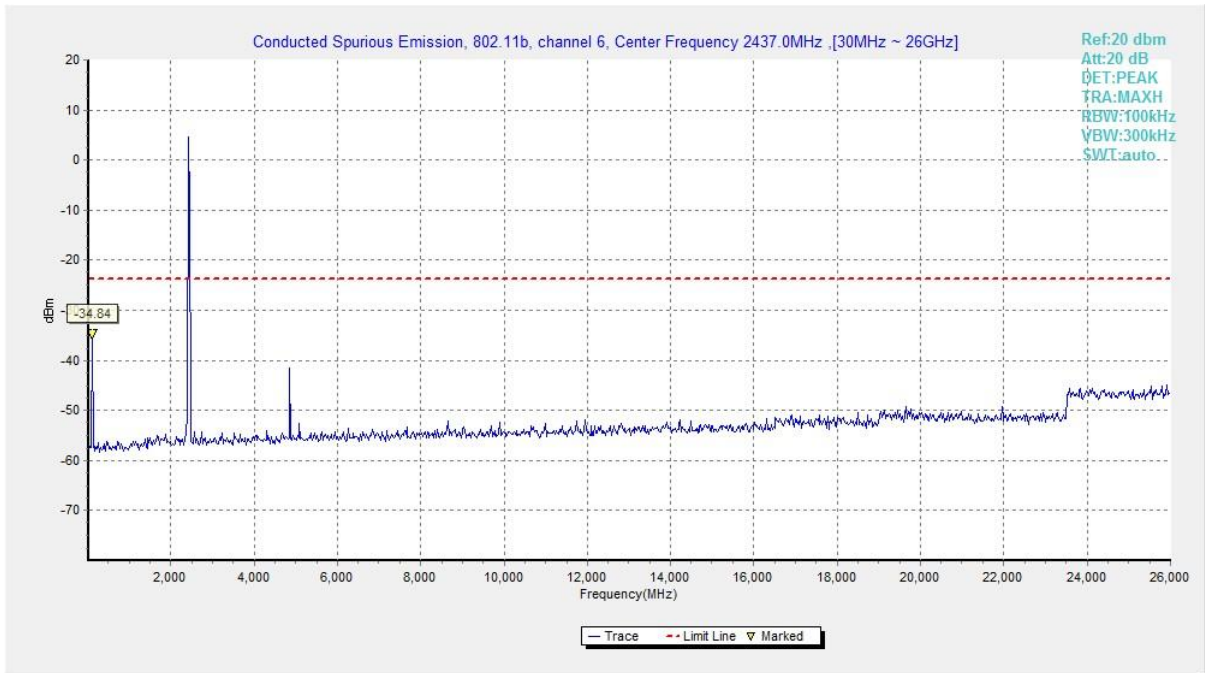


Fig.34 Conducted Spurious Emission (802.11b, CH6)

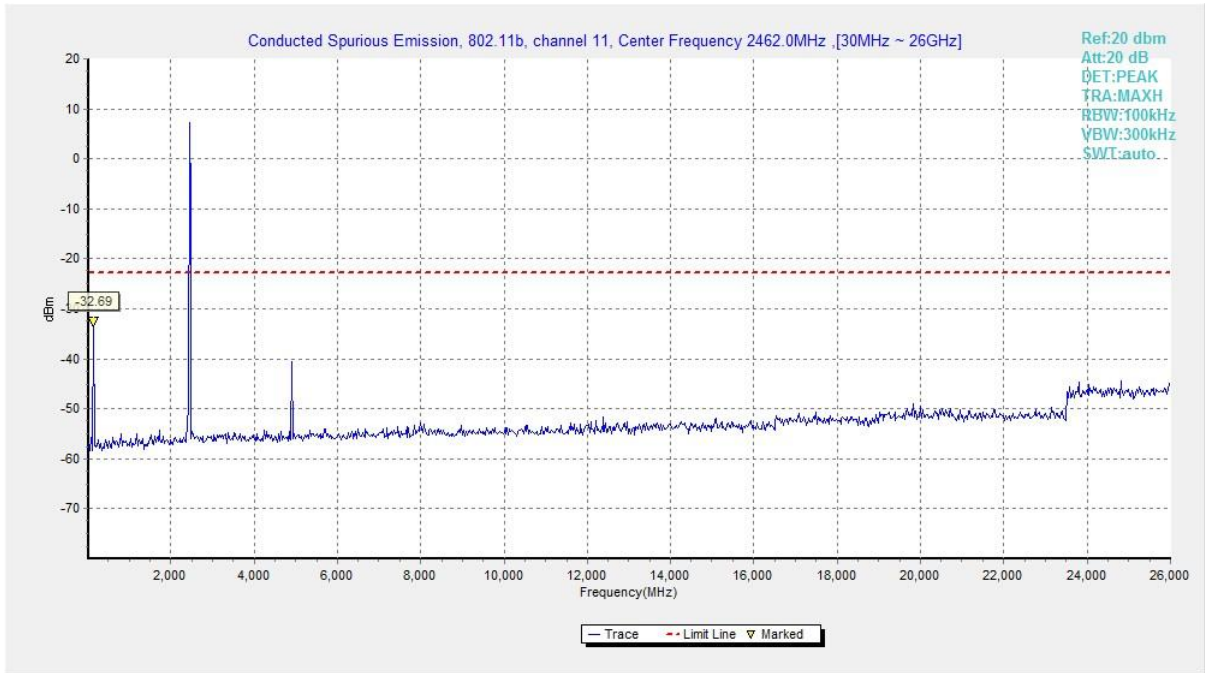


Fig.35 Conducted Spurious Emission (802.11b, CH11)

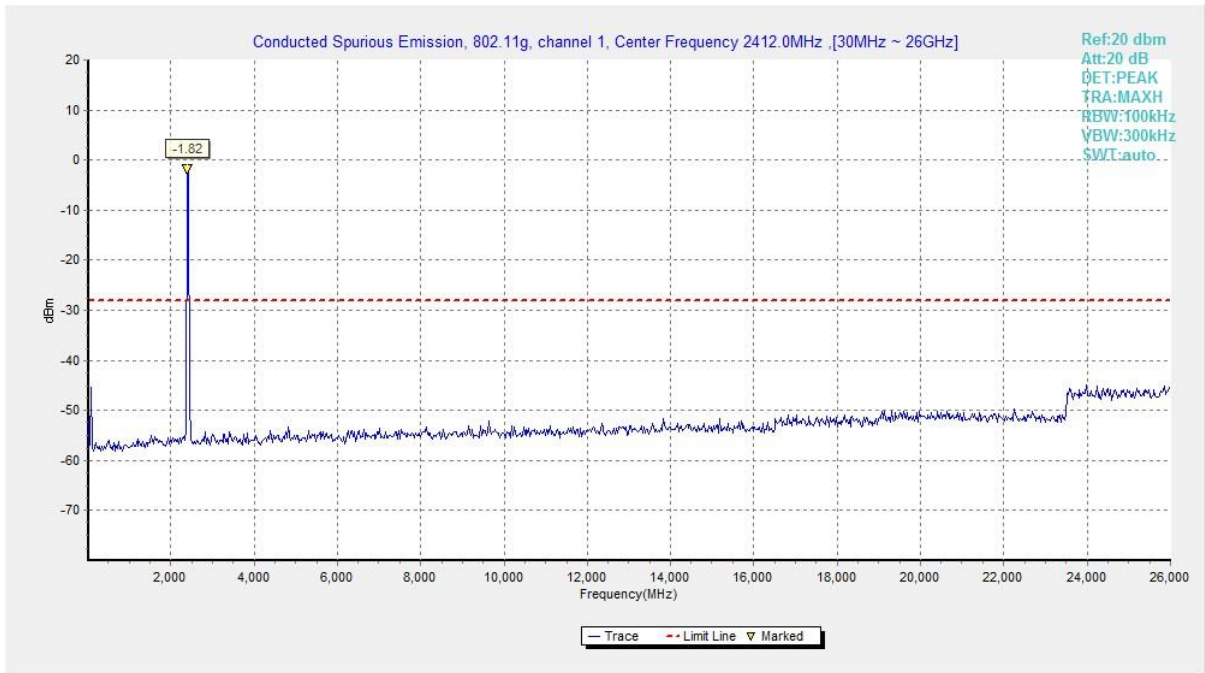


Fig.36 Conducted Spurious Emission (802.11g, CH1)

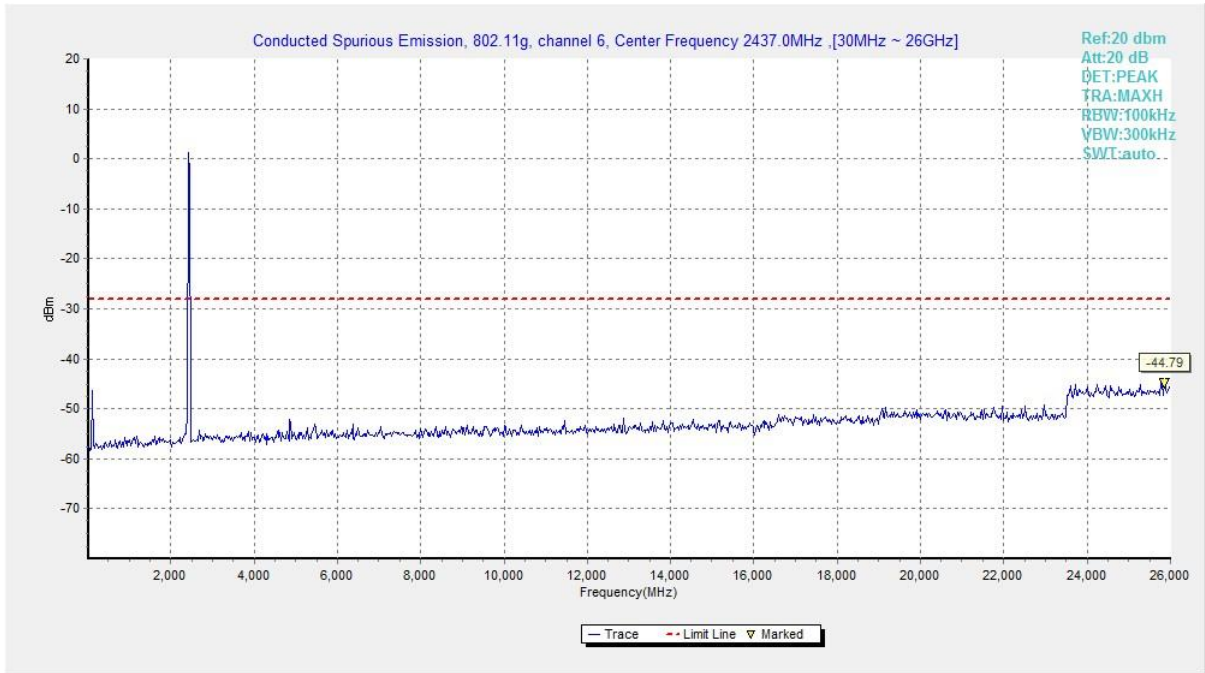


Fig.37 Conducted Spurious Emission (802.11g, CH6)

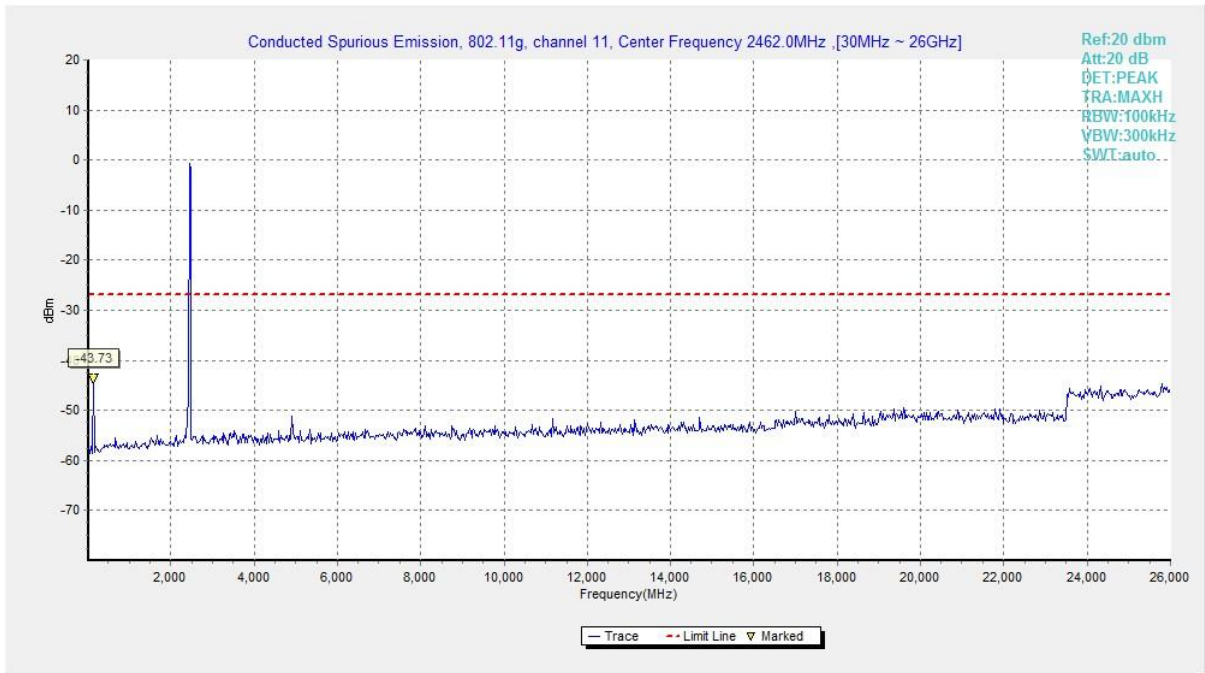


Fig.38 Conducted Spurious Emission (802.11g, CH11)

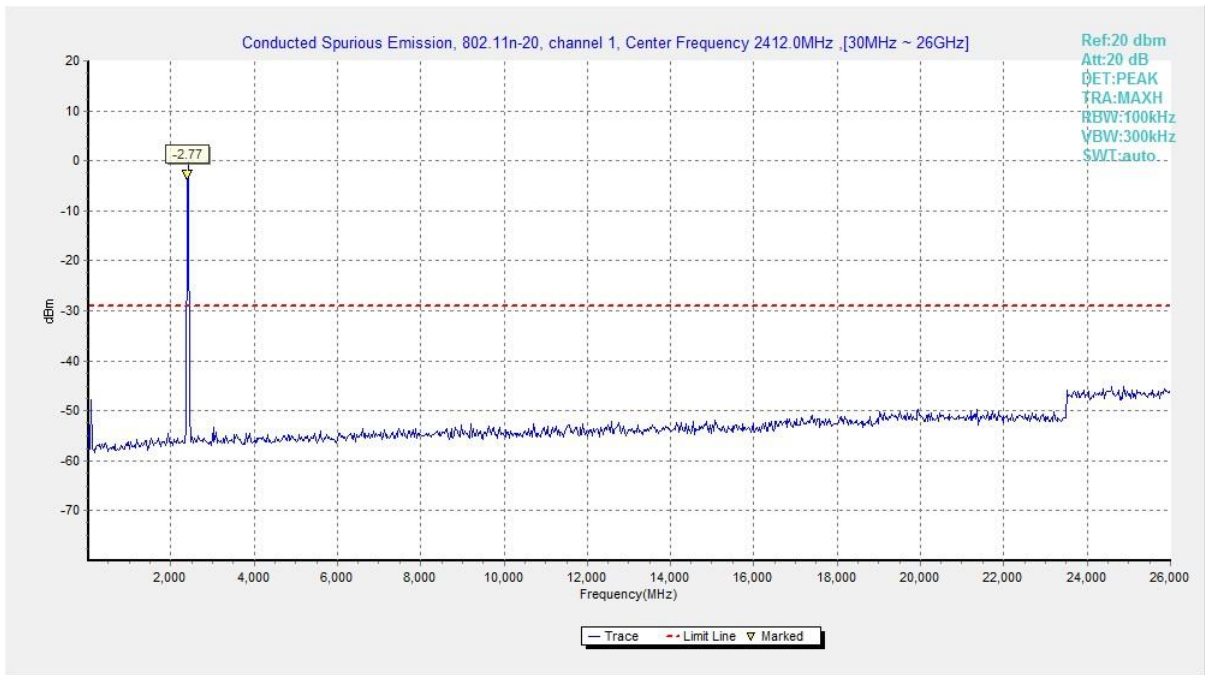


Fig.39 Conducted Spurious Emission (802.11n HT20, CH1)

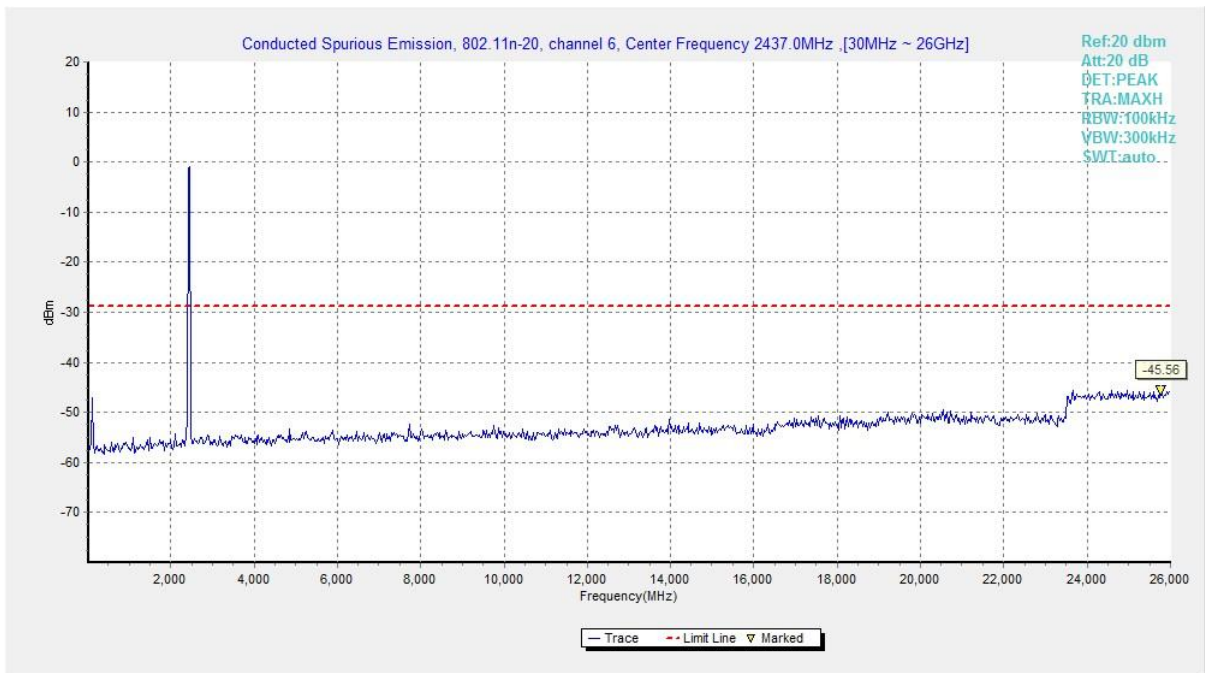


Fig.40 Conducted Spurious Emission (802.11n HT20, CH6)

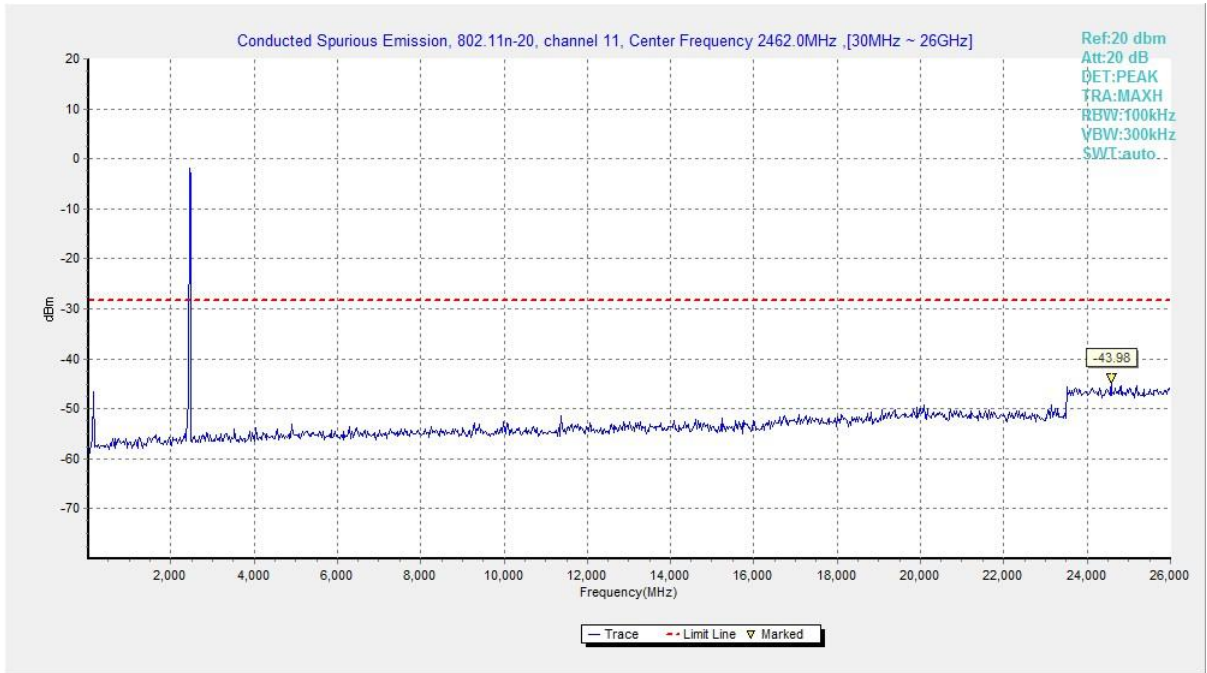


Fig.41 Conducted Spurious Emission (802.11n HT20, CH11)

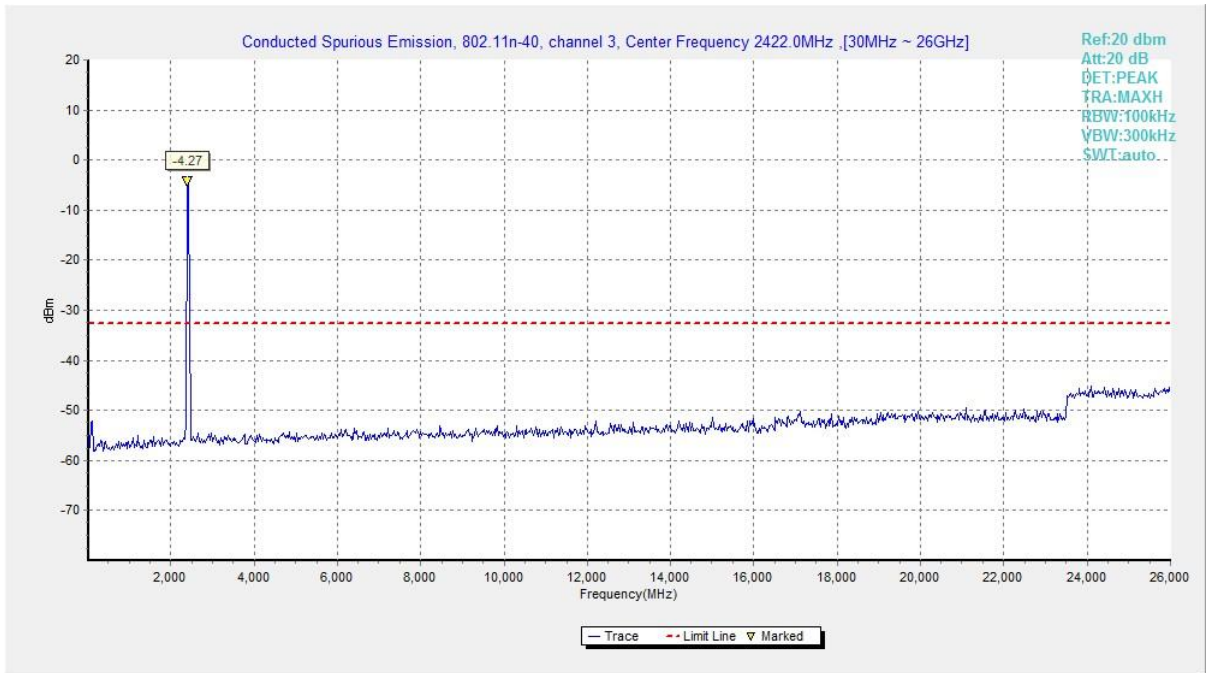


Fig.42 Conducted Spurious Emission (802.11n HT40, CH3)

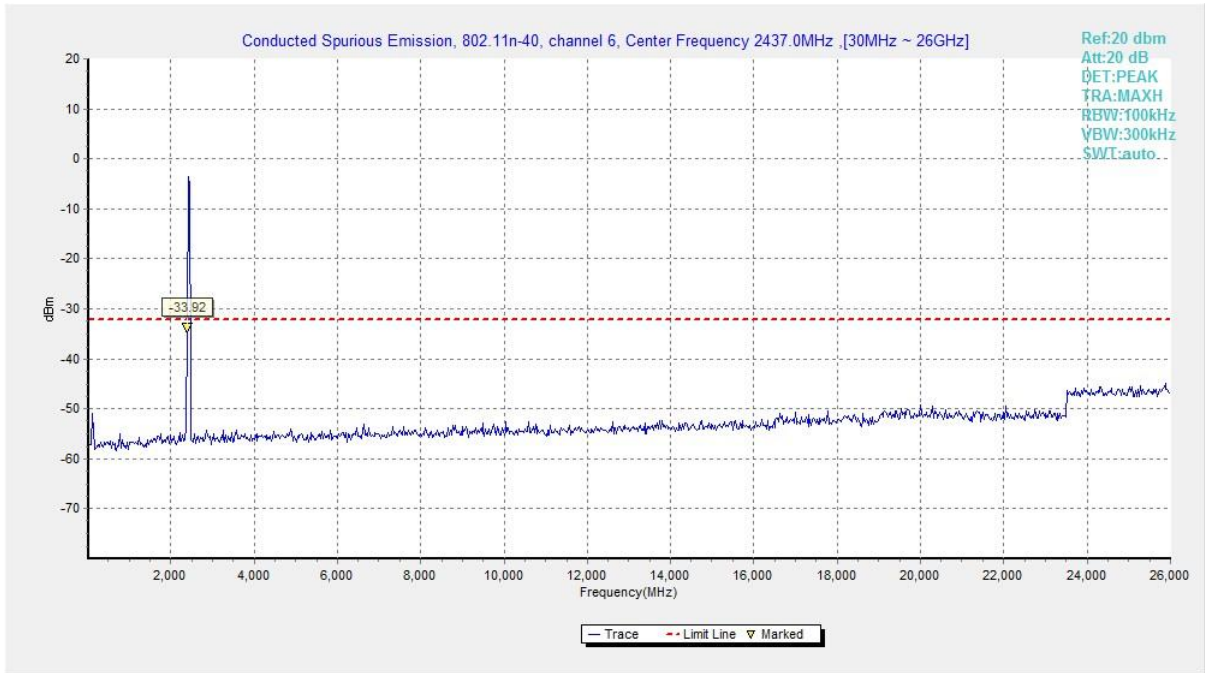


Fig.43 Conducted Spurious Emission (802.11n HT40, CH6)

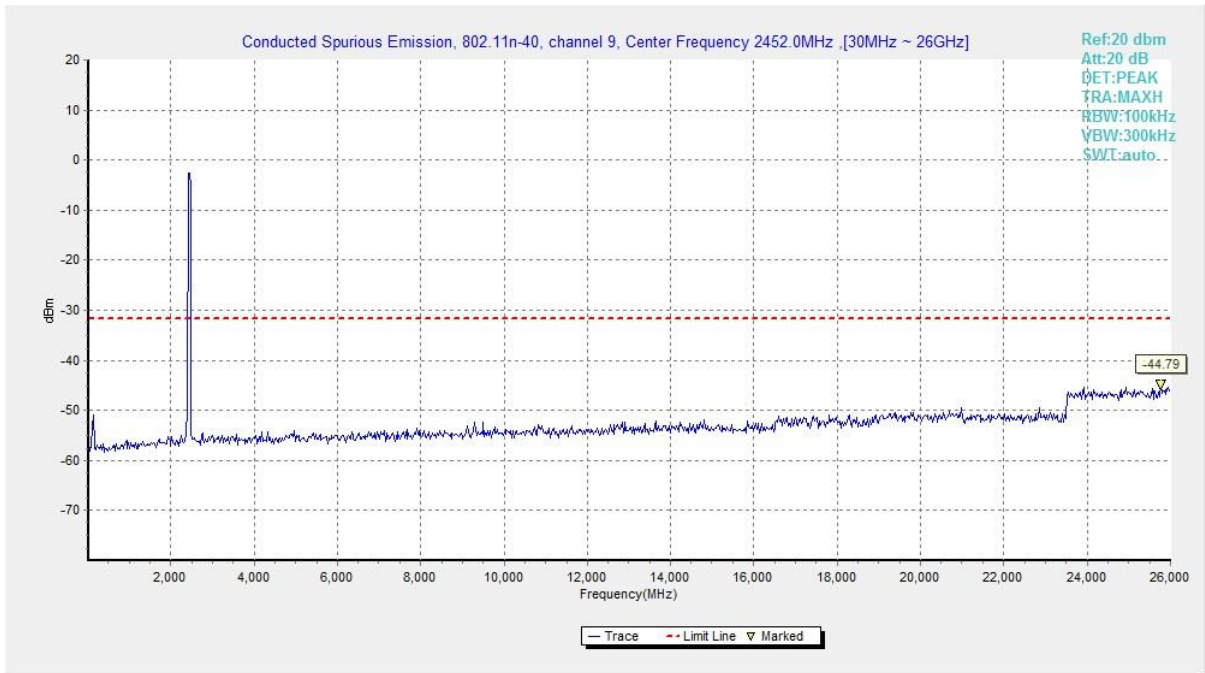


Fig.44 Conducted Spurious Emission (802.11n HT40, CH9)

A.6 Radiated Emission

Measurement Limit:

| Standard | Limit |
|--|------------------------------|
| FCC 47 CFR Part 15.247, 15.205, 15.209 | 20dB below peak output power |

In addition, 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) (see § 15.205(c)).

Limit in restricted band:

| Frequency of emission (MHz) | Field strength ($\mu\text{V}/\text{m}$) | 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 |

Test Condition:

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

| Frequency of emission (MHz) | RBW/VBW | Sweep Time (s) |
|-----------------------------|---------------|----------------|
| 30-1000 | 120kHz/300kHz | 5 |
| 1000-4000 | 1MHz/3MHz | 15 |
| 4000-18000 | 1MHz/3MHz | 40 |
| 18000-26500 | 1MHz/3MHz | 20 |

Note: According to the performance evaluation, the radiated emission margin of EUT is over 20dB in the band from 9kHz to 30MHz. Therefore, the measurement starts from 30MHz to tenth harmonic. The measurement results include the horizontal polarization and vertical polarization measurements.

Measurement Results:

| Mode | Channel | Frequency Range | Test Results | Conclusion |
|-----------------|------------------------|---------------------|--------------|------------|
| 802.11b | CH 1 | 1 GHz ~ 18 GHz | Fig.45 | P |
| | CH 6 | 1 GHz ~ 18 GHz | Fig.46 | P |
| | CH 11 | 1 GHz ~ 18 GHz | Fig.47 | P |
| | Restricted Band (CH1) | 2.38 GHz ~ 2.45 GHz | Fig.48 | P |
| | Restricted Band (CH11) | 2.45 GHz ~ 2.5 GHz | Fig.49 | P |
| 802.11g | CH 1 | 1 GHz ~ 18 GHz | Fig.50 | P |
| | CH 6 | 1 GHz ~ 18 GHz | Fig.51 | P |
| | CH 11 | 1 GHz ~ 18 GHz | Fig.52 | P |
| | Restricted Band (CH1) | 2.38 GHz ~ 2.45 GHz | Fig.53 | P |
| | Restricted Band (CH11) | 2.45 GHz ~ 2.5 GHz | Fig.54 | P |
| 802.11n HT20 | CH 1 | 1 GHz ~ 18 GHz | Fig.55 | P |
| | CH 6 | 1 GHz ~ 18 GHz | Fig.56 | P |
| | CH 11 | 1 GHz ~ 18 GHz | Fig.57 | P |
| | Restricted Band (CH1) | 2.38 GHz ~ 2.45 GHz | Fig.58 | P |
| | Restricted Band (CH11) | 2.45 GHz ~ 2.5 GHz | Fig.59 | P |
| 802.11n HT40 | CH 3 | 1 GHz ~ 18 GHz | Fig.60 | P |
| | CH 6 | 1 GHz ~ 18 GHz | Fig.61 | P |
| | CH 9 | 1 GHz ~ 18 GHz | Fig.62 | P |
| | Restricted Band (CH3) | 2.38 GHz ~ 2.45 GHz | Fig.63 | P |
| | Restricted Band (CH9) | 2.45 GHz ~ 2.5 GHz | Fig.64 | P |
| / | All Channels | 9 kHz ~ 30 MHz | Fig.65 | P |
| | | 30 MHz ~ 1 GHz | Fig.66 | P |
| | | 18 GHz ~ 26.5 GHz | Fig.67 | P |



Worst-Case Result:

802.11b CH6 (1-18GHz)

| Frequency (MHz) | MaxPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 2996.071429 | 51.96 | 74.00 | 22.04 | V | 6.7 |
| 5272.500000 | 47.73 | 74.00 | 26.27 | H | 4.0 |
| 8879.142857 | 46.24 | 74.00 | 27.76 | H | 6.5 |
| 12872.571429 | 49.42 | 74.00 | 24.58 | V | 11.0 |
| 16956.428571 | 54.99 | 74.00 | 19.01 | V | 18.2 |
| 17919.857143 | 55.35 | 74.00 | 18.65 | V | 18.9 |

| Frequency (MHz) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 2996.071429 | 39.85 | 54.00 | 14.15 | V | 6.7 |
| 5272.500000 | 37.09 | 54.00 | 16.91 | H | 4.0 |
| 8879.142857 | 37.95 | 54.00 | 16.05 | H | 6.5 |
| 12872.571429 | 37.36 | 54.00 | 16.64 | V | 11.0 |
| 16956.428571 | 42.45 | 54.00 | 11.55 | V | 18.2 |
| 17919.857143 | 43.02 | 54.00 | 10.98 | V | 18.9 |

802.11g CH6 (1-18GHz)

| Frequency (MHz) | MaxPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 8985.857143 | 47.00 | 74.00 | 27.00 | V | 6.5 |
| 10442.571429 | 48.06 | 74.00 | 25.94 | V | 9.0 |
| 12545.142857 | 50.09 | 74.00 | 23.91 | V | 11.3 |
| 14815.714286 | 50.56 | 74.00 | 23.44 | V | 12.9 |
| 16794.000000 | 53.96 | 74.00 | 20.04 | V | 17.8 |
| 17914.714286 | 54.90 | 74.00 | 19.10 | H | 18.9 |

| Frequency (MHz) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 8985.857143 | 34.05 | 54.00 | 19.95 | V | 6.5 |
| 10442.571429 | 35.75 | 54.00 | 18.25 | V | 9.0 |
| 12545.142857 | 36.80 | 54.00 | 17.20 | V | 11.3 |
| 14815.714286 | 38.69 | 54.00 | 15.31 | V | 12.9 |
| 16794.000000 | 42.05 | 54.00 | 11.95 | V | 17.8 |
| 17914.714286 | 43.13 | 54.00 | 10.87 | H | 18.9 |



802.11n HT20 CH6 (1-18GHz)

| Frequency (MHz) | MaxPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 7926.000000 | 45.83 | 74.00 | 28.17 | V | 6.0 |
| 9491.142857 | 46.78 | 74.00 | 27.22 | V | 7.0 |
| 10404.857143 | 48.22 | 74.00 | 25.78 | V | 9.1 |
| 12450.000000 | 49.32 | 74.00 | 24.68 | V | 11.4 |
| 14913.857143 | 51.58 | 74.00 | 22.42 | V | 13.0 |
| 16938.857143 | 54.88 | 74.00 | 19.12 | V | 18.2 |

| Frequency (MHz) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 7926.000000 | 33.27 | 54.00 | 20.73 | V | 6.0 |
| 9491.142857 | 34.33 | 54.00 | 19.67 | V | 7.0 |
| 10404.857143 | 35.73 | 54.00 | 18.27 | V | 9.1 |
| 12450.000000 | 37.14 | 54.00 | 16.86 | V | 11.4 |
| 14913.857143 | 38.89 | 54.00 | 15.11 | V | 13.0 |
| 16938.857143 | 42.37 | 54.00 | 11.63 | V | 18.2 |

802.11n HT40 CH9 (1-18GHz)

| Frequency (MHz) | MaxPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 9626.142857 | 46.44 | 74.00 | 27.56 | H | 7.4 |
| 10440.000000 | 47.75 | 74.00 | 26.25 | V | 9.0 |
| 11932.285714 | 48.26 | 74.00 | 25.74 | V | 10.2 |
| 13251.857143 | 49.83 | 74.00 | 24.17 | V | 11.1 |
| 14785.285714 | 50.89 | 74.00 | 23.11 | V | 12.7 |
| 16952.142857 | 54.57 | 74.00 | 19.43 | H | 18.2 |

| Frequency (MHz) | Average (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 9626.142857 | 33.91 | 54.00 | 20.09 | H | 7.4 |
| 10440.000000 | 35.73 | 54.00 | 18.27 | V | 9.0 |
| 11932.285714 | 35.69 | 54.00 | 18.31 | V | 10.2 |
| 13251.857143 | 36.97 | 54.00 | 17.03 | V | 11.1 |
| 14785.285714 | 38.52 | 54.00 | 15.48 | V | 12.7 |
| 16952.142857 | 42.51 | 54.00 | 11.49 | H | 18.2 |

Note:

A "reference path loss" is established and the A_{Rpl} is the attenuation of "reference path loss", and Antenna Factor, the gain of the preamplifier, the cable loss. P_{Mea} is the field strength recorded from the instrument.



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The measurement results are obtained as described below:

Result = P_{Mea} + Cable Loss + Antenna Factor - Gain of the preamplifier

See below for test graphs.

Conclusion: PASS

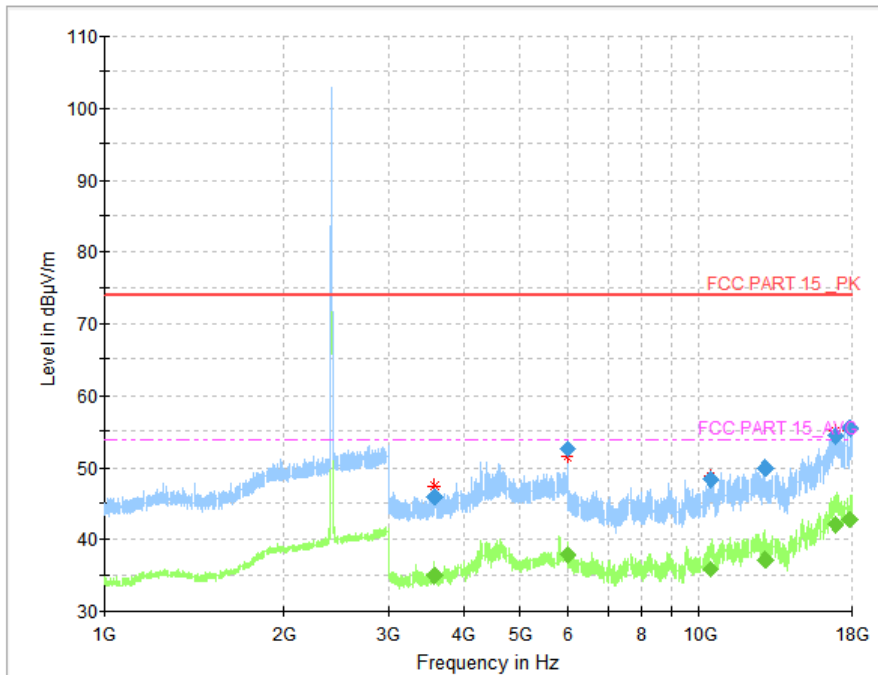


Fig.45 Radiated Spurious Emission (802.11b, CH1, 1GHz-18GHz)

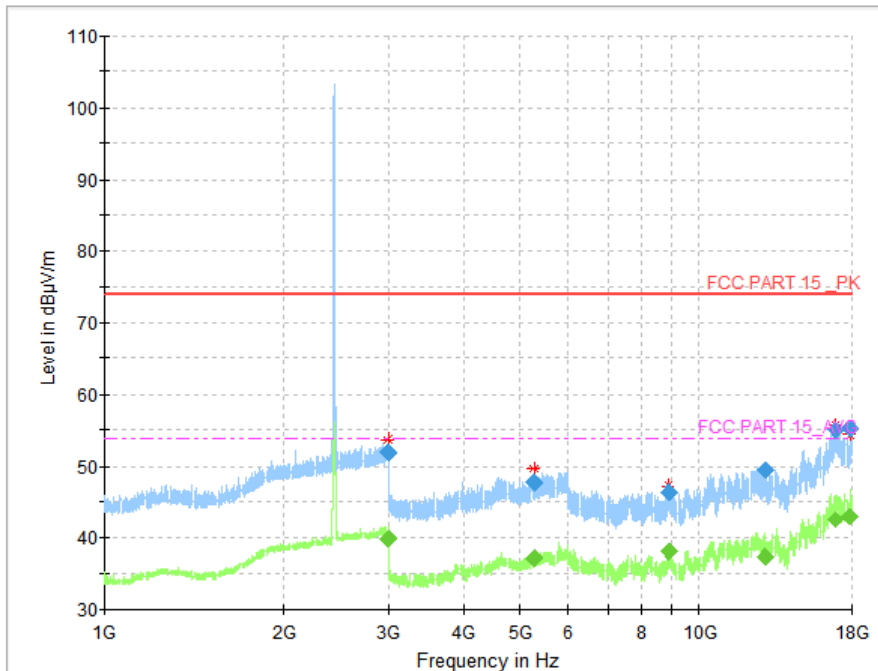


Fig.46 Radiated Spurious Emission (802.11b, CH6, 1GHz-18GHz)

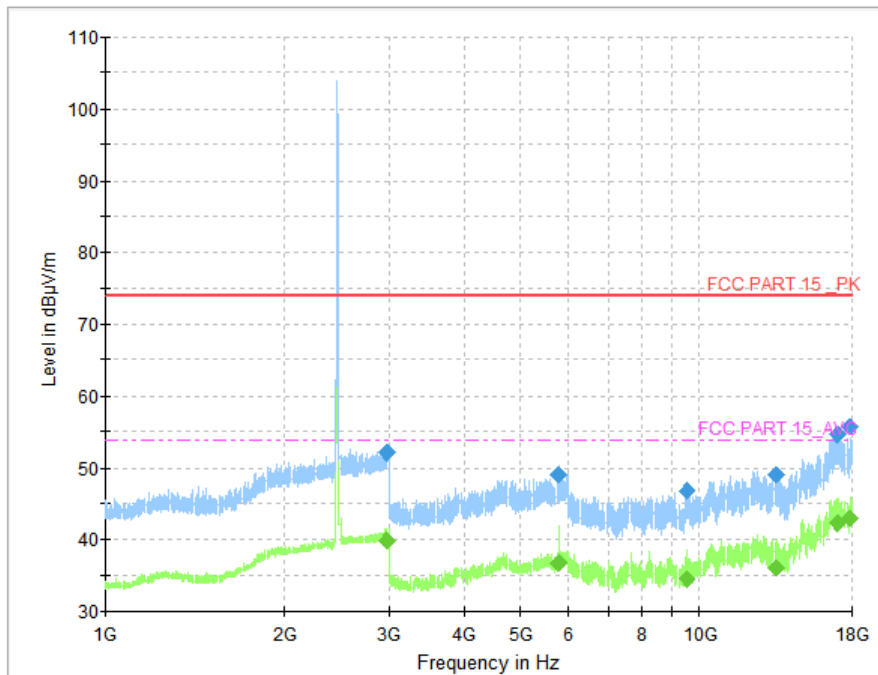


Fig.47 Radiated Spurious Emission (802.11b, CH11, 1GHz-18GHz)

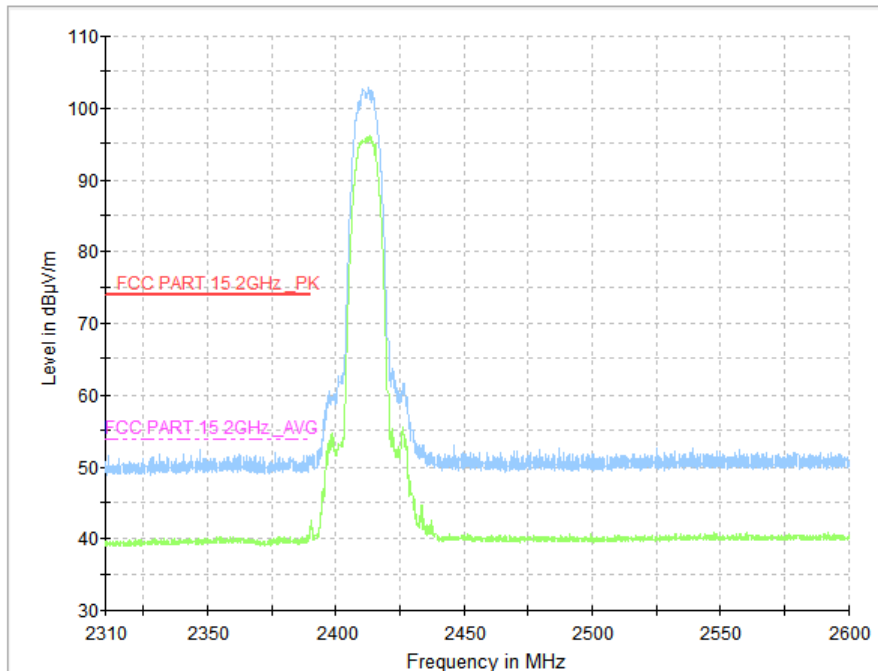


Fig.48 Radiated Restricted Band (802.11b, CH1, 2.38GHz~2.45GHz)

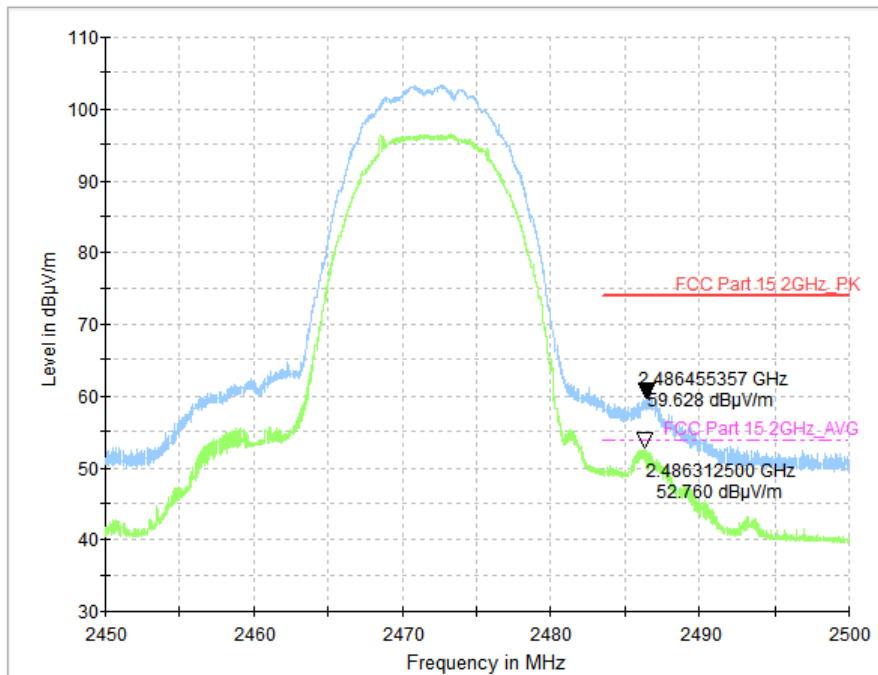


Fig.49 Radiated Restricted Band (802.11b, CH11, 2.45GHz~2.5GHz)

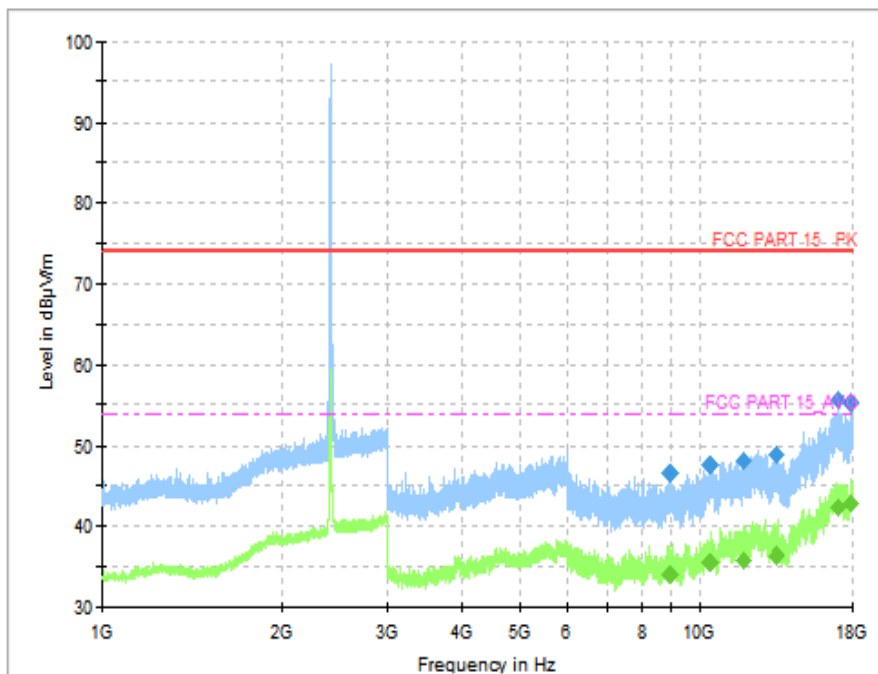


Fig.50 Radiated Spurious Emission (802.11g, CH1, 1GHz-18GHz)

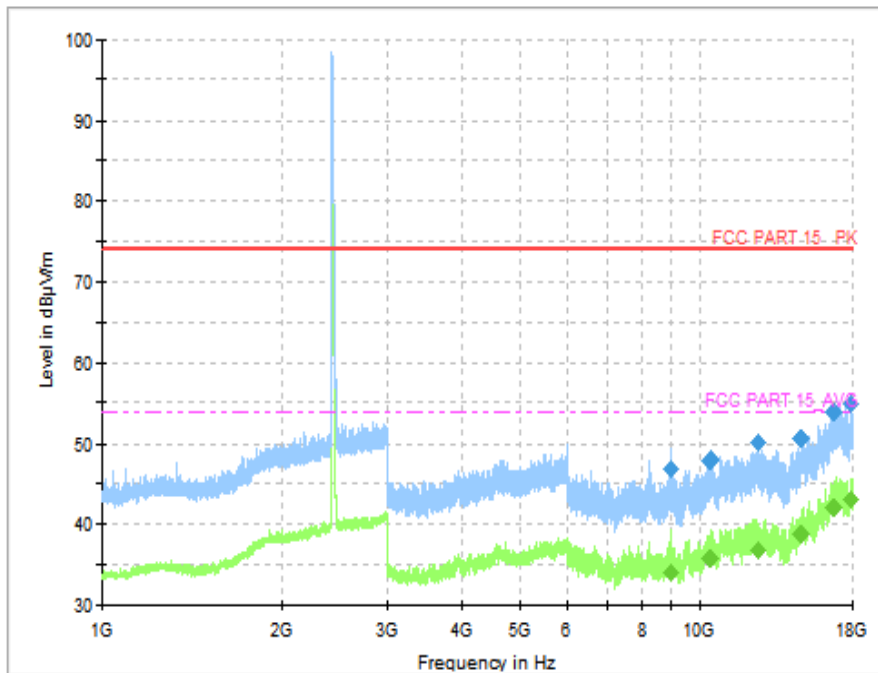


Fig.51 Radiated Spurious Emission (802.11g, CH6, 1GHz-18GHz)

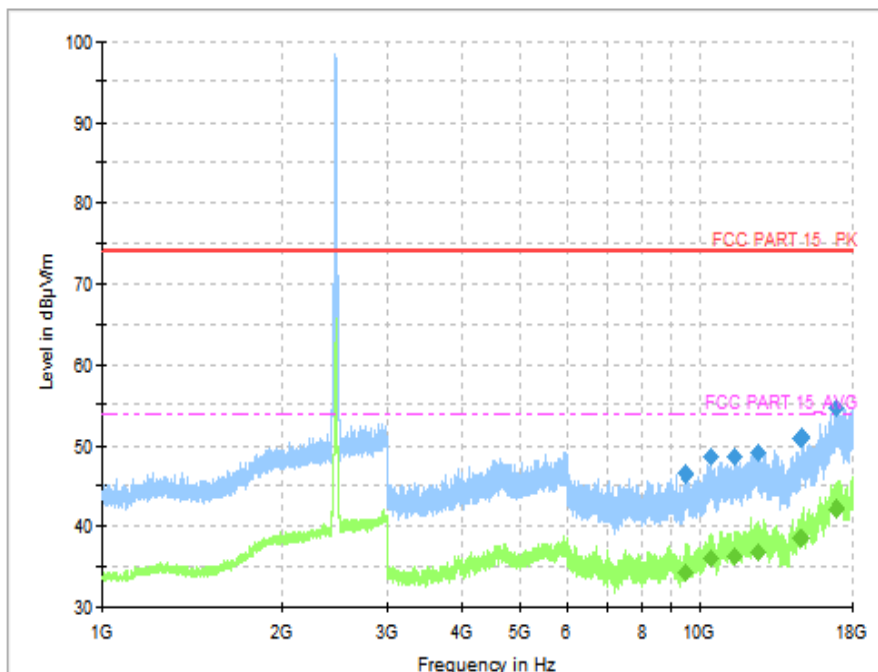


Fig.52 Radiated Spurious Emission (802.11g, CH11, 1GHz-18GHz)

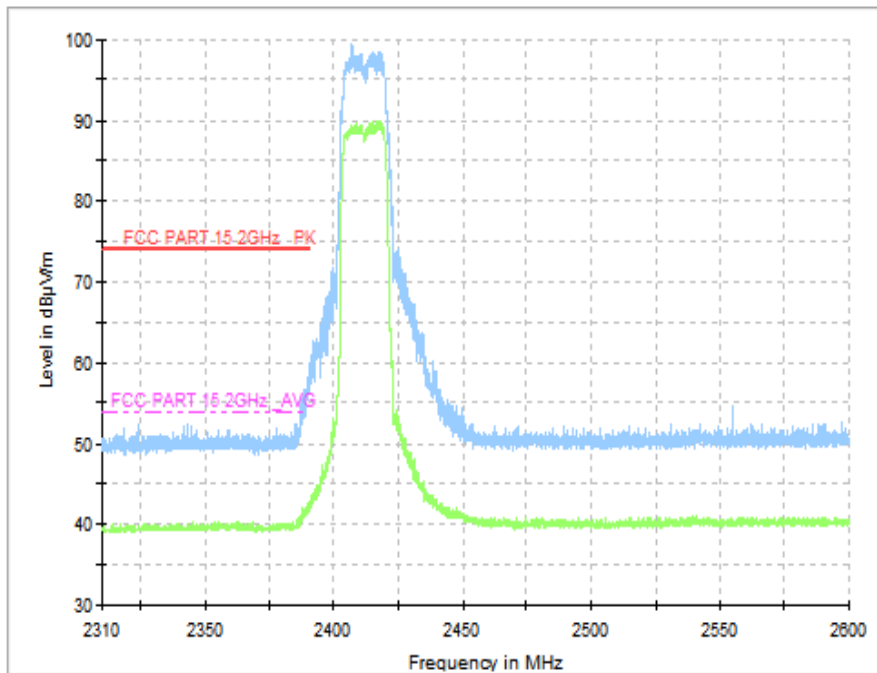


Fig.53 Radiated Restricted Band (802.11g, CH1, 2.38GHz~2.45GHz)

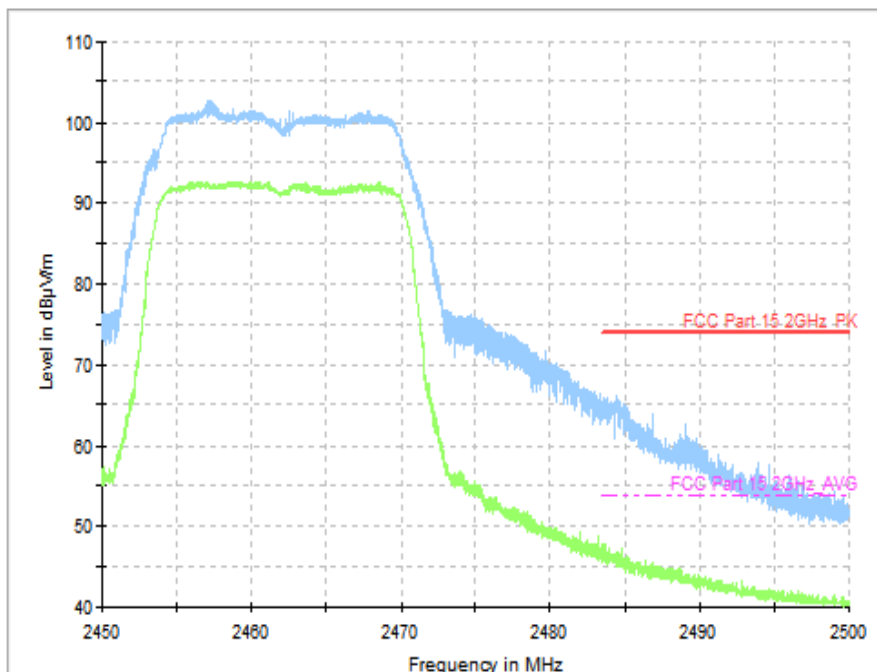


Fig.54 Radiated Restricted Band (802.11g, CH11, 2.45GHz~2.5GHz)

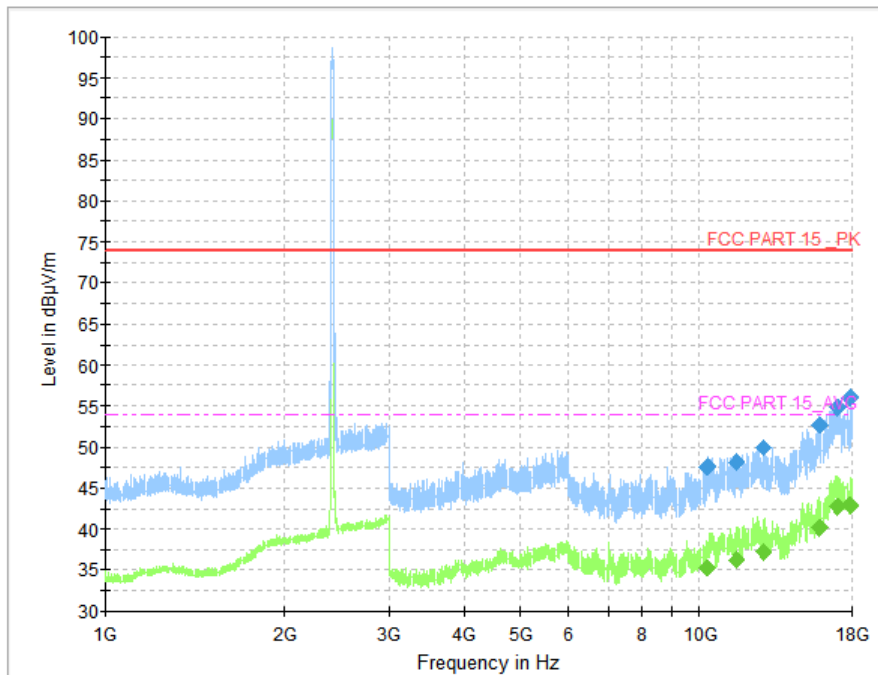


Fig.55 Radiated Spurious Emission (802.11n HT20, CH1, 1GHz-18GHz)

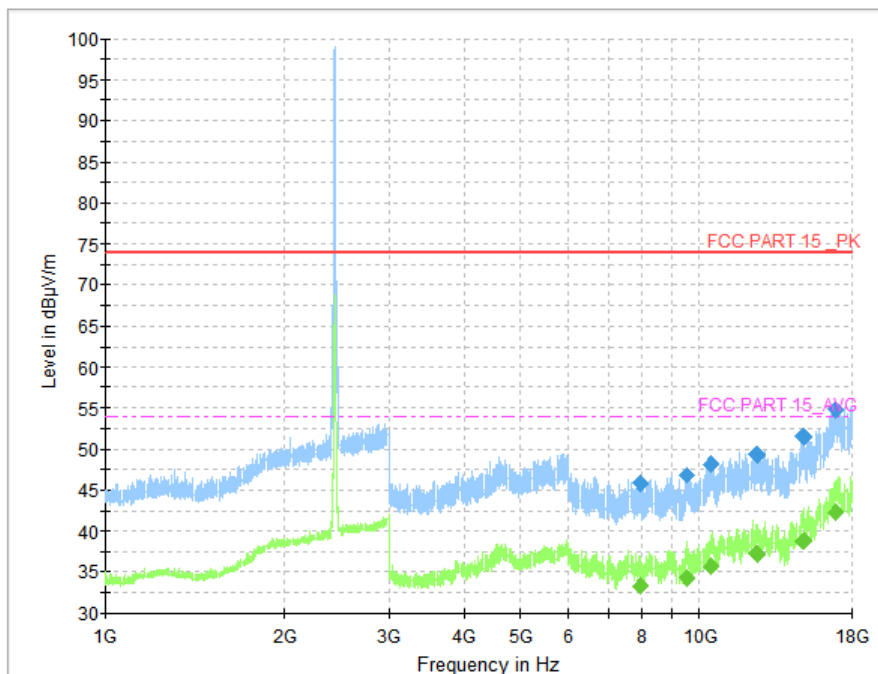


Fig.56 Radiated Spurious Emission (802.11n HT20, CH6, 1GHz-18GHz)

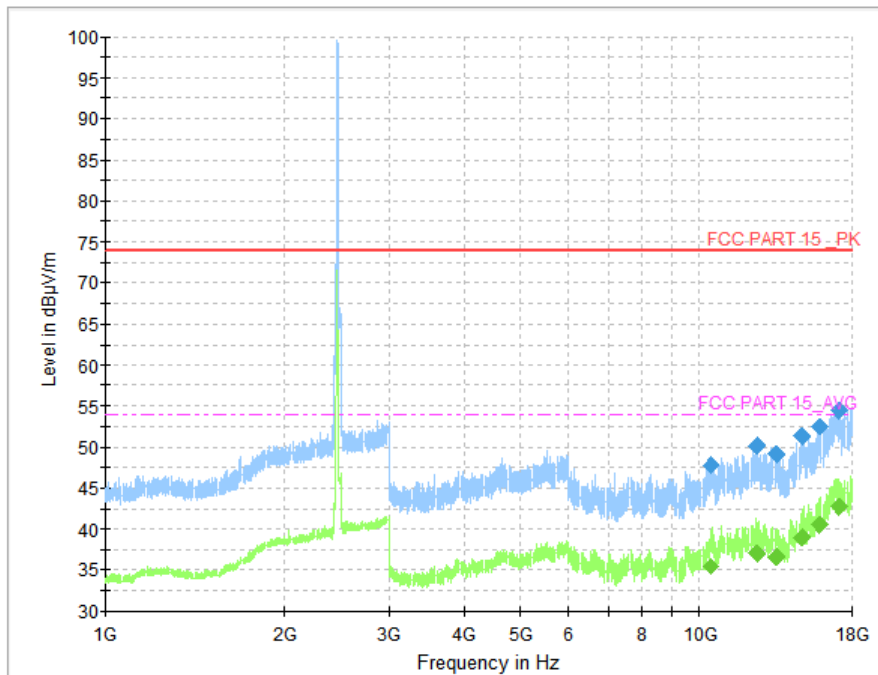


Fig.57 Radiated Spurious Emission (802.11n HT20, CH11, 1GHz-18GHz)

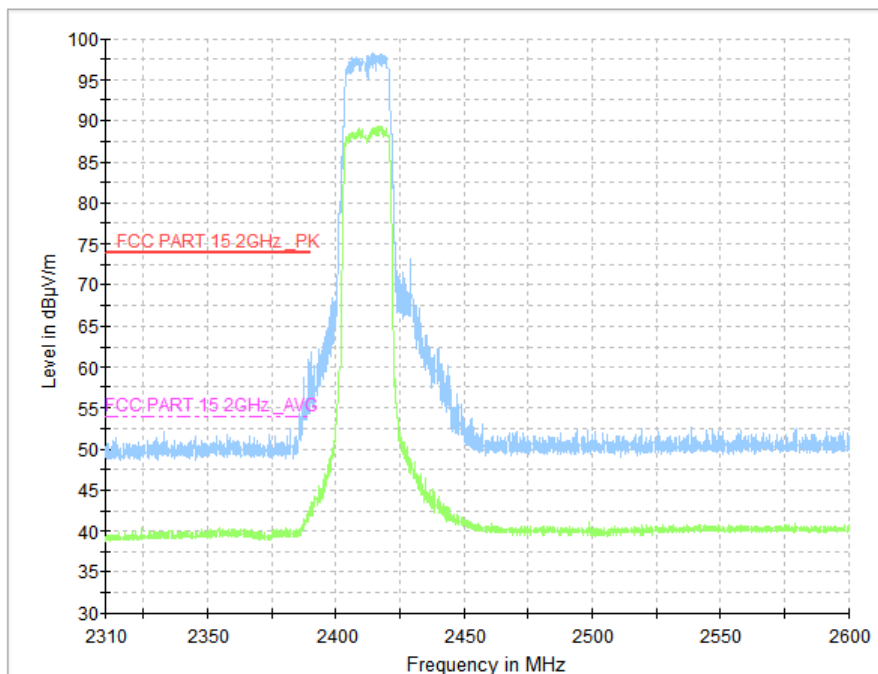


Fig.58 Radiated Restricted Band (802.11n HT20, CH1, 2.38GHz~2.45GHz)

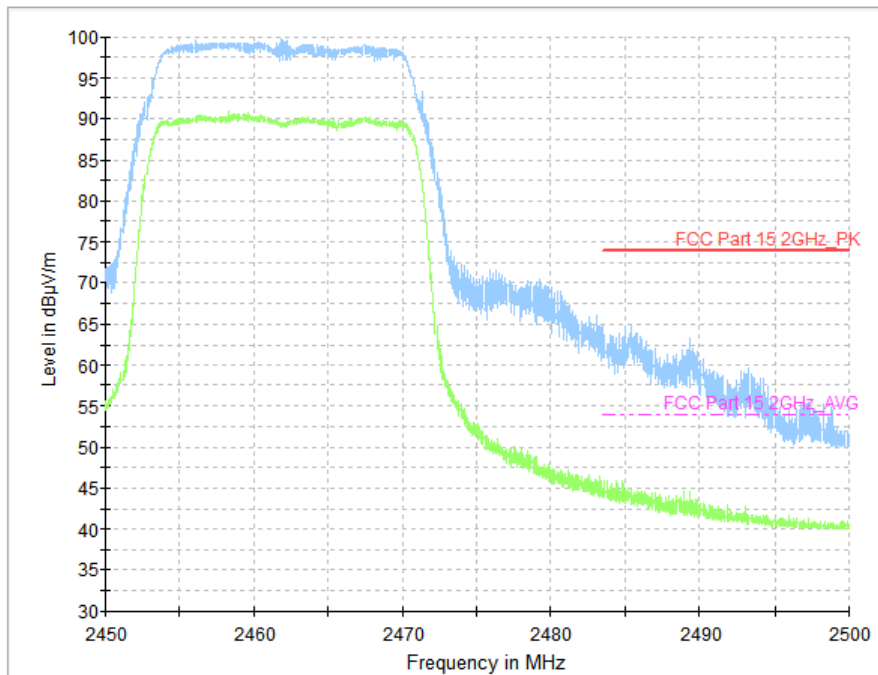


Fig.59 Radiated Restricted Band (802.11n HT20, CH11, 2.45GHz~2.5GHz)

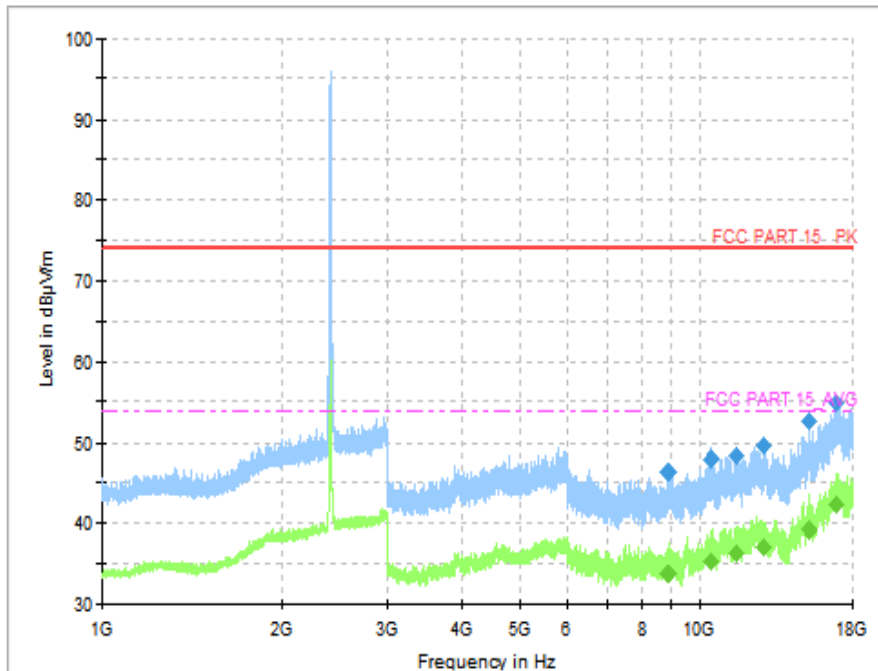


Fig.60 Radiated Spurious Emission (802.11n HT40, CH3, 1GHz-18GHz)

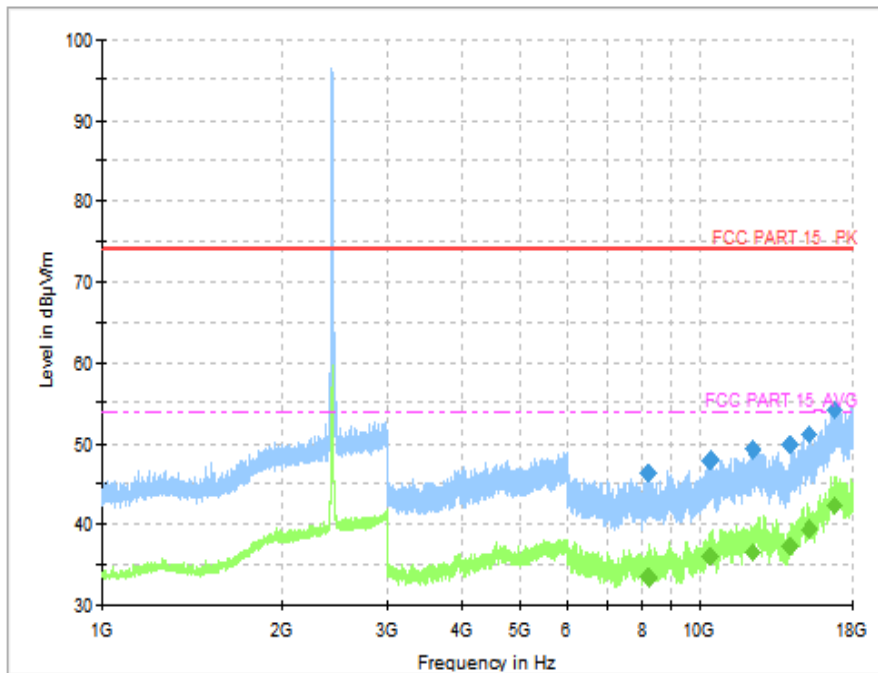


Fig.61 Radiated Spurious Emission (802.11n HT40, CH6, 1GHz-18GHz)

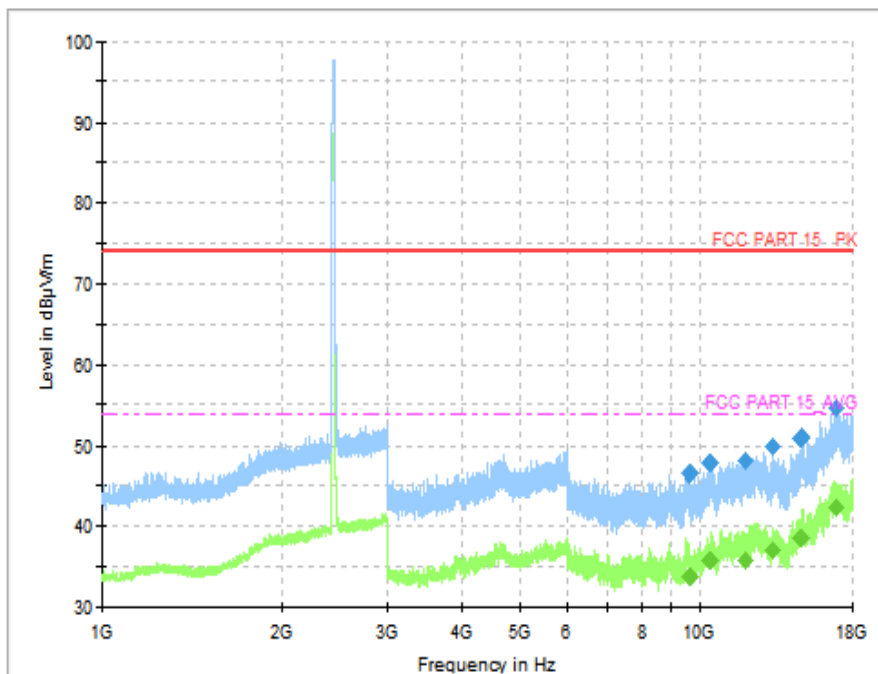


Fig.62 Radiated Spurious Emission (802.11n HT40, CH9, 1GHz-18GHz)

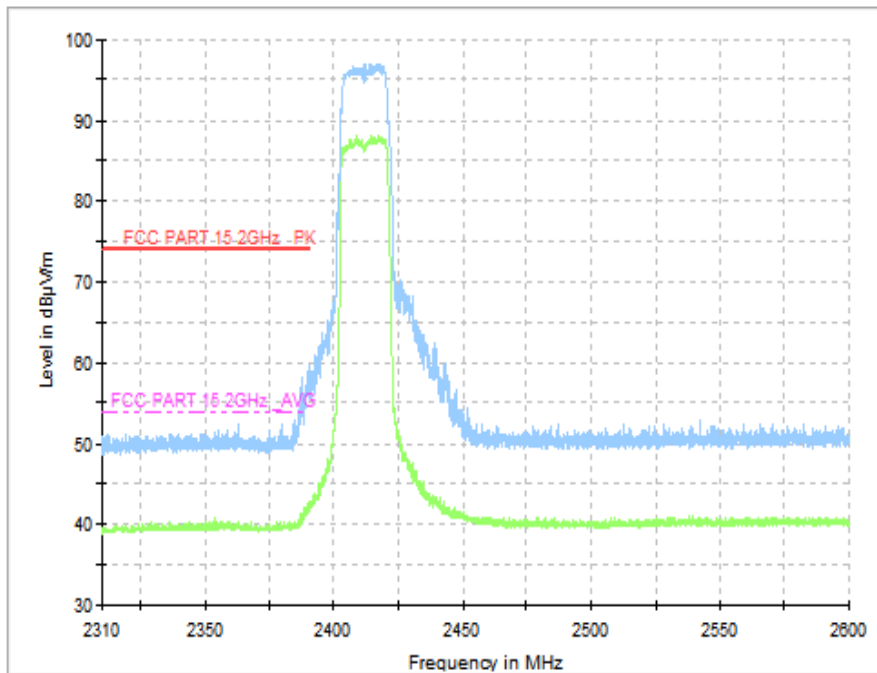


Fig.63 Radiated Restricted Band (802.11n HT40, CH3, 2.38GHz~2.45GHz)

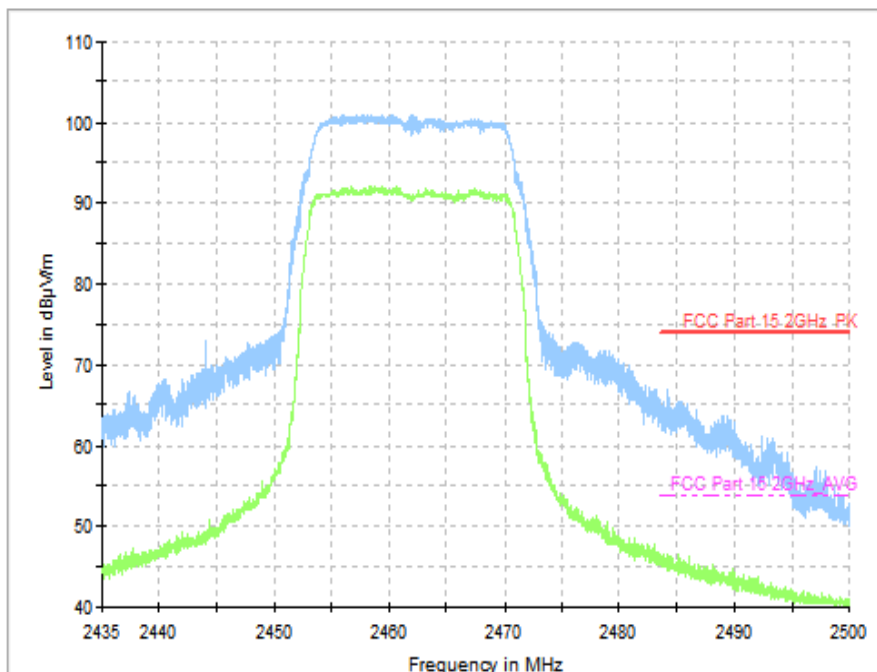


Fig.64 Radiated Restricted Band (802.11n HT40, CH9, 2.45GHz~2.5GHz)

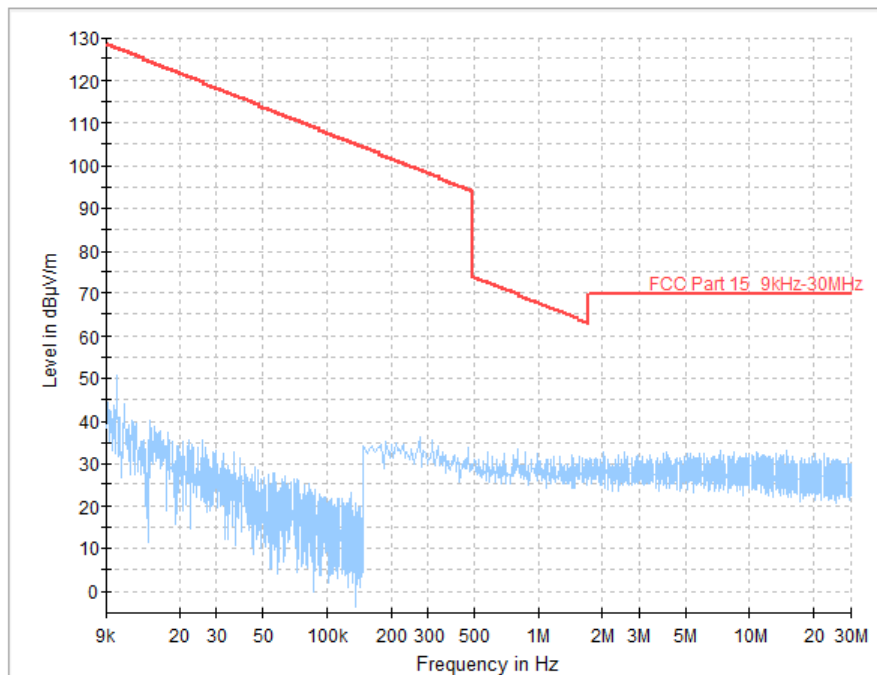


Fig.65 Radiated Spurious Emission (All Channels, 9KHz-30MHz)

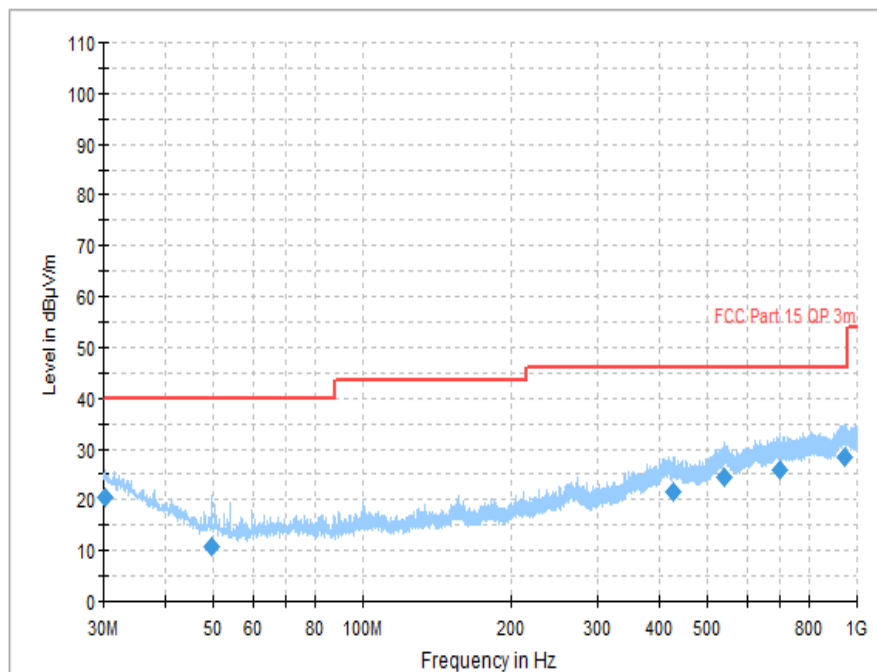


Fig.66 Radiated Spurious Emission (All Channels, 30MHz-1GHz)

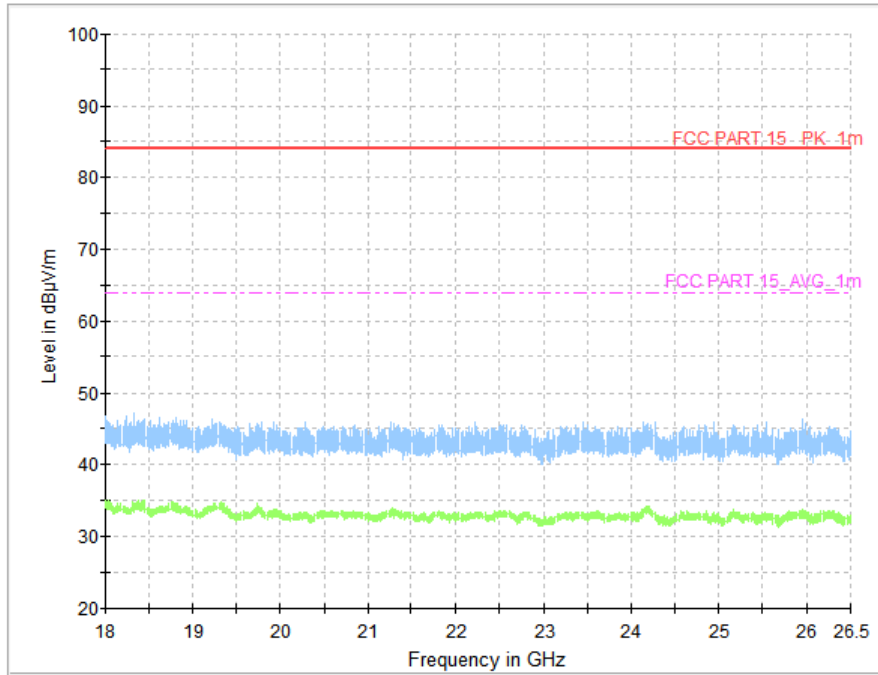


Fig.67 Radiated Spurious Emission (All Channels, 18GHz-26.5GHz)

**A.7 AC Power line Conducted Emission****Test Condition:**

| Voltage (V) | Frequency (Hz) |
|-------------|----------------|
| 120 | 60 |

Measurement Result and limit:

WLAN (Quasi-peak Limit) - AE3

| Frequency range (MHz) | Quasi-peak Limit (dB μ V) | Result (dB μ V) | | Conclusion |
|-----------------------|-------------------------------|---------------------|--------|------------|
| | | Traffic | Idle | |
| 0.15 to 0.5 | 66 to 56 | Fig.68 | Fig.69 | P |
| 0.5 to 5 | 56 | | | |
| 5 to 30 | 60 | | | |

Note: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

WLAN (Average Limit) - AE3

| Frequency range (MHz) | Average-peak Limit (dB μ V) | Result (dB μ V) | | Conclusion |
|-----------------------|---------------------------------|---------------------|--------|------------|
| | | Traffic | Idle | |
| 0.15 to 0.5 | 56 to 46 | Fig.68 | Fig.69 | P |
| 0.5 to 5 | 46 | | | |
| 5 to 30 | 50 | | | |

Note: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Note: The measurement results include the L1 and N measurements.

See below for test graphs.

Conclusion: PASS

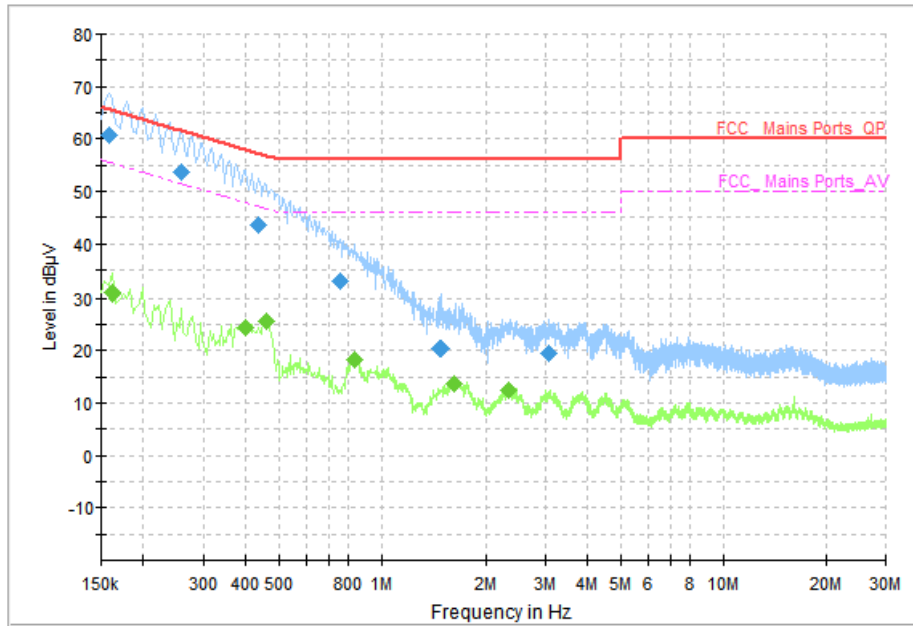


Fig.68 AC Power line Conducted Emission (Traffic, AE3, 120V)

Measurement Results: Quasi Peak

| Frequency (MHz) | QuasiPeak (dBµV) | Limit (dBµV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|--------------|-------------|------|--------|------------|
| 0.158000 | 60.84 | 65.57 | 4.73 | N | ON | 10 |
| 0.258000 | 53.69 | 61.50 | 7.80 | N | ON | 10 |
| 0.434000 | 43.58 | 57.18 | 13.59 | L1 | ON | 10 |
| 0.758000 | 32.89 | 56.00 | 23.11 | N | ON | 10 |
| 1.490000 | 20.34 | 56.00 | 35.66 | L1 | ON | 10 |
| 3.078000 | 19.54 | 56.00 | 36.46 | L1 | ON | 10 |

Measurement Results: Average

| Frequency (MHz) | Average (dBµV) | Limit (dBµV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|----------------|--------------|-------------|------|--------|------------|
| 0.162000 | 30.74 | 55.36 | 24.62 | N | ON | 10 |
| 0.398000 | 24.38 | 47.90 | 23.51 | L1 | ON | 10 |
| 0.458000 | 25.53 | 46.73 | 21.20 | L1 | ON | 10 |
| 0.838000 | 18.08 | 46.00 | 27.92 | L1 | ON | 10 |
| 1.614000 | 13.58 | 46.00 | 32.42 | L1 | ON | 10 |
| 2.346000 | 12.33 | 46.00 | 33.67 | L1 | ON | 10 |

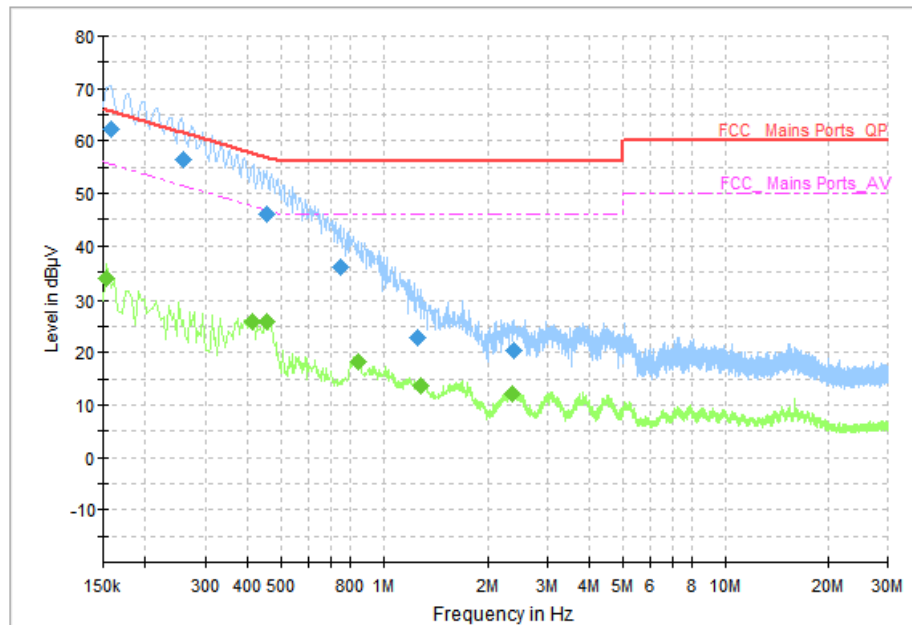


Fig.69 AC Power line Conducted Emission (Idle, AE3, 120V)

Measurement Results: Quasi Peak

| Frequency (MHz) | QuasiPeak (dBµV) | Limit (dBµV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|--------------|-------------|------|--------|------------|
| 0.158000 | 62.25 | 65.57 | 3.32 | L1 | ON | 10 |
| 0.258000 | 56.38 | 61.50 | 5.11 | L1 | ON | 10 |
| 0.454000 | 46.03 | 56.80 | 10.77 | L1 | ON | 10 |
| 0.746000 | 36.07 | 56.00 | 19.93 | L1 | ON | 10 |
| 1.258000 | 22.67 | 56.00 | 33.33 | L1 | ON | 10 |
| 2.378000 | 20.26 | 56.00 | 35.74 | L1 | ON | 10 |

Measurement Results: Average

| Frequency (MHz) | Average (dBµV) | Limit (dBµV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|----------------|--------------|-------------|------|--------|------------|
| 0.154000 | 33.85 | 55.78 | 21.93 | L1 | ON | 10 |
| 0.410000 | 25.95 | 47.65 | 21.69 | L1 | ON | 10 |
| 0.454000 | 25.82 | 46.80 | 20.98 | L1 | ON | 10 |
| 0.842000 | 18.37 | 46.00 | 27.63 | L1 | ON | 10 |
| 1.286000 | 13.73 | 46.00 | 32.27 | N | ON | 10 |
| 2.362000 | 12.13 | 46.00 | 33.87 | L1 | ON | 10 |

END OF REPORT