# TEST REPORT

| | | |
|---|---|---|
| **Reference No.** | : | WTS18S04109771-2W |
| **Applicant** | : | Winstars Technology Limited |
| **Address** | : | Block 4, TaiSong Industrial Park, DaLang Street, LongHua Town, Bao'an district,Shenzhen, China |
| **Manufacturer** | : | Winstars Technology Limited |
| **Address** | : | Block 4, TaiSong Industrial Park, DaLang Street, LongHua Town, Bao'an district,Shenzhen, China |
| **Factory** | : | SHENZHEN SINOBRY ELECTRONICS CO., LTD. |
| **Address** | : | 1/F-5/F, No.5, Taisong Industrial Park, Dalang Community, Dalang Office Longhua District, Shenzhen, Guangdong, China |
| **Product Name** | : | Wireless AC1200 Router |
| **Model No.** | : | WS-WN535G3R, WL-WN535G3R, halo1, halo3, halo5, halo7 |
| **Brand Name** | : | N/A |
| **Standards** | : | Article 2 Section 1 No.19-3 |
| **Date of Receipt sample** | : | 2018-04-28 |
| **Date of Test** | : | 2018-04-28 to 2018-06-01 |
| **Date of Issue** | : | 2018-06-01 |
| **Test Result** | : | **Pass** |

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company.

The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.


**Prepared By:**

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# 2 Laboratories Introduction

**Waltek Services (Shenzhen) Co., Ltd** is a professional third-party testing and certification laboratory with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by ILAC (International Laboratory Accreditation Cooperation) member. A2LA (American Association for Laboratory Accreditation) of USA, Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CEC(California energy efficiency), IC(Industry Canada). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as Intertek(ETL-SEMKO), TÜV Rheinland, TÜV SÜD, etc.


Waltek Services (Shenzhen) Co., Ltd is one of the largest and the most comprehensive third party testing laboratory in China. Our test capability covered four large fields: safety test. ElectroMagnetic Compatibility(EMC), and energy performance, wireless radio. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

## 2.1 Test Facility

**A. Accreditations for Conformity Assessment (International)**

| Country/Region | Accreditation Body | Scope | Note |
|---|---|---|---|
| USA | **A2LA (Certificate No.: 4243.01)** | FCC ID \ DOC \ VOC | 1 |
| Canada | | IC ID \ VOC | 2 |
| Japan | | MIC-T \ MIC-R | - |
| Europe | | EMCD \ RED | - |
| Taiwan | | NCC | - |
| Hong Kong | | OFCA | - |
| Australia | | RCM | - |
| India | **International Services** | WPC | - |
| Thailand | | NTC | - |
| Singapore | | IDA | - |

Note:

1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476.
2. IC Canada Registration No.: 7760A

**B.TCBs and Notify Bodies Recognized Testing Laboratory.**

| Recognized Testing Laboratory of … | Notify body number |
|---|---|
| TUV Rheinland | Optional. |
| Intertek | |
| TUV SUD | |
| SGS | |
| Phoenix Testlab GmbH | 0700 |
| Element Materials Technology Warwick Ltd | 0891 |
| Timco Engineering, Inc. | 1177 |
| Eurofins Product Service GmbH | 0681 |

# 3 Contents

# 4 Report Revision History

| Test report No. | Date of Receipt sample | Date of Test | Date of Issue | Purpose | Comment | Approved |
|---|---|---|---|---|---|---|
| WTS18S04109771-2W | 2018-04-28 | 2018-04-28 to 2018-06-01 | 2018-06-01 | original | - | Valid |

# 5 General Information

## 5.1 General Description of E.U.T

| | |
|---|---|
| Product Name: | Wireless AC1200 Router |
| Model No.: | WS-WN535G3R, WL-WN535G3R, halo1, halo3, halo5, halo7 |
| Model difference description: | Only the model names are different. |
| Type of Modulation: | IEEE for 802.11a: OFDM(BPSK/QPSK/16QAM/64QAM)<br>IEEE for 802.11n : OFDM(BPSK/QPSK/16QAM/64QAM)<br>IEEE for 802.11ac : OFDM (BPSK/QPSK/16QAM/64QAM/256QAM) |
| Frequency Range: | IEEE 802.11a/n(HT20/40)/ac(VHT20/40/80): 5150MHz to 5250MHz |
| Antenna Gain: | ANT3, ANT4: 2.53dBi |
| Antenna installation: | Integrated Antenna |
| Hardware Version: | WS-WN535G3-B-V1.2 |
| Software Version: | M35G3R.V5030.180402 |

## 5.2 Details of E.U.T

Ratings: Input: DC 5V 2A

## 5.3 Channel List

| Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) |
|---|---|---|---|---|---|---|---|
| 36 | 5180 | 38 | 5190 | 40 | 5200 | 42 | 5210 |
| 44 | 5220 | 46 | 5230 | 48 | 5240 | - | - |

## 5.4 General condition

Ambient Condition: 25.5 ℃ 58 %RH

### 5.4.1 Environmental condition of test site

A power supply with the rated voltage and also the rated voltage +10% shall be used. However when it was confirmed that input voltage variation at the radio unit (except power supply section) in the radio equipment to be tested is less than +1% against a variation of +10% at the input voltage from the external power supply to the radio equipment, the test may be done for the rated voltage only and when the radio equipment was designed so as to be operated in a specified voltage variation limit within +10%, and which is indicated in the installation specification with the upper and the lower limits, the test shall be done for the rated voltage and the specified upper and lower limits of voltage.

| Test Voltage | Input voltage of EUT | Input voltage of RF module | Tolerances |
|---|---|---|---|
| Rated voltage-10% | AC 90V | DC 3.3V | 0% |
| **Rated voltage** | AC 100V | DC 3.3V | / |
| Rated voltage+10% | AC 110V | DC 3.3V | 0% |
| Rated voltage-10% for DC | DC 4.5V | DC 3.3V | 0% |
| Rated voltage for DC | DC 5V | DC 3.3V | / |
| Rated voltage+10% for DC | DC 5.5V | DC 3.3V | 0% |

Remark:

The EUT was pretested three voltages, rated power-10%,rated power and rated power+10%,and all the voltages just the same. so the following test are conducted at rated voltage only.

The regulator voltage IC is MT7620A

Only the worst case(Rated voltage+10% ANT3) were record in the report.The max.data transfer rate identical for all models.

### 5.4.2 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, only the worst data ANT3 were recorded and reported.

| Test mode | Low channel | Middle channel | High channel |
|---|---|---|---|
| Transmitting(802.11a/n/ac) | 5180MHz | 5200MHz | 5240MHz |
| Transmitting(802.11n/ac) | 5190MHz | - | 5230MHz |
| Transmitting(802.11ac) | 5210MHz | - | - |
| Receiving(802.11a/n/ac) | 5180MHz | 5200MHz | 5240MHz |
| Receiving(802.11n/ac) | 5190MHz | - | 5230MHz |
| Transmitting(802.11ac) | 5210MHz | - | - |

## 5.5 Construction of Test Equipment Calibration

All the test equipments used are valid and calibrated by GUANG ZHOU GRG METROLOGY & TEST CO., LTD. address is No.163, Pingyun Rd. West of Huangpu Ave,Tianhe District, Guangzhou, Guang dong, China.

## 5.6 Test Equipment

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|---|
| 1 | EXA Signal Analyzer | Malaysia Keysight | N9010A | MY50520207 | 2018-04-27 | 2019-04-26 |
| 2 | Spectrum Analyzer | R&S | FSL6 | 100959 | 2017-09-11 | 2018-09-10 |
| 3 | DC power supply | Agilent | E3640A | MY40006693 | 2018-04-17 | 2019-04-16 |
| 4 | Temperature & Humidity Chamber | Agilent | TH-1P-B | WIT-05121302 | 2017-10-14 | 2018-10-13 |
| 5 | Temperature/ Humidity Meter | Agilent | ZC1-2 | TR7-TH | 2018-05-26 | 2019-05-25 |
| 6. | EXG Analog Signal Generator | Keysight | N5171B | MY53050845503 | 2017-09-11 | 2018-09-10 |

# 6 Test Summary

| Test Item | Result |
|---|---|
| **Transmitting equipment** | |
| Antenna Power | PASS |
| Tolerances for Antenna Power | PASS |
| Frequency Tolerance | PASS |
| Equivalent Isotropic Radiated Power | PASS |
| Transmission Rate | PASS |
| Transmission Burst Length | PASS |
| Unwanted Emissions Strength | PASS |
| Adjacent Channel Emitted Power | PASS |
| Out-band Leakage Power | PASS |
| Occupied Frequency Bandwidth | PASS |
| **Receiving equipment** | |
| Secondary Radiated Emissions | PASS |
| **Controlling equipment** | |
| Interference prevention function | PASS |
| Carrier Sensing Function | PASS |
| N/A is an abbreviation for Not Applicable. | |

# 7 Measurements of Transmitting Equipment

## 7.1 Antenna Power and Antenna Power Tolerances

### 7.1.1 Test Requirement

Article 2-1.

### 7.1.2 Limit

Antenna power of those using OFDM etc modulation scheme, the average power in the bandwidth of 1MHz is not more than 10 mW for HT20 and 5mW for HT40.

### 7.1.3 Test Result

ANT1：

| Modulation | Channel | Antenna Power (dBm/MHz) | Test Result for Antenna Power (mW/MHz) | Antenna power Limit ((10mW/MHz) | Declared Antenna Power (mW/MHz) | Tolerance(%) |
|---|---|---|---|---|---|---|
| 802.11a | Low | 1.41 | 1.38 | 10 | 1.38 | 0.00 |
| | Middle | 1.31 | 1.35 | 10 | 1.38 | -0.02 |
| | High | 1.41 | 1.38 | 10 | 1.38 | -0.00 |
| 802.11n-HT20 | Low | 1.36 | 1.37 | 10 | 1.39 | -0.02 |
| | Middle | 1.27 | 1.34 | 10 | 1.39 | -0.04 |
| | High | 1.44 | 1.39 | 10 | 1.39 | 0.00 |
| 802.11ac-VHT20 | Low | 1.15 | 1.30 | 10 | 1.33 | -0.02 |
| | Middle | 1.19 | 1.31 | 10 | 1.33 | -0.02 |
| | High | 1.25 | 1.33 | 10 | 1.33 | 0.00 |
| 802.11n-HT40 | Low | -3.68 | 0.43 | 5 | 0.43 | 0.00 |
| | High | -3.77 | 0.42 | 5 | 0.42 | 0.00 |
| 802.11ac-VHT40 | Low | -3.88 | 0.41 | 5 | 0.41 | 0.00 |
| | High | -3.90 | 0.41 | 5 | 0.41 | 0.00 |
| 802.11ac-VHT80 | Low | -5.96 | 0.25 | 2.5 | 0.25 | 0.00 |

ANT2:

| Modulation | Channel | Antenna Power (dBm/MHz) | Test Result for Antenna Power (mW/MHz) | Antenna power Limit ((10mW/MHz) | Declared Antenna Power (mW/MHz) | Tolerance(%) |
|---|---|---|---|---|---|---|
| 802.11a | Low | 1.36 | 1.37 | 10 | 1.39 | -0.02 |
| | Middle | 1.42 | 1.39 | 10 | 1.39 | 0.00 |
| | High | 1.34 | 1.36 | 10 | 1.39 | -0.02 |
| 802.11n-HT20 | Low | 1.23 | 1.33 | 10 | 1.37 | -0.03 |
| | Middle | 1.36 | 1.37 | 10 | 1.37 | 0.00 |
| | High | 1.32 | 1.36 | 10 | 1.37 | -0.01 |
| 802.11ac-VHT20 | Low | 1.44 | 1.39 | 10 | 1.44 | -0.03 |
| | Middle | 1.36 | 1.37 | 10 | 1.44 | -0.05 |
| | High | 1.58 | 1.44 | 10 | 1.44 | 0.00 |
| 802.11n-HT40 | Low | -3.67 | 0.43 | 5 | 0.43 | 0.00 |
| | High | -3.82 | 0.42 | 5 | 0.43 | -0.03 |
| 802.11ac-VHT40 | Low | -3.70 | 0.43 | 5 | 0.43 | 0.00 |
| | High | -3.82 | 0.41 | 5 | 0.41 | 0.00 |
| 802.11ac-VHT80 | Low | -6.02 | 0.25 | 2.5 | 0.25 | 0.00 |

ANT1+ANT2:

| Modulation | Channel | Test Result for Antenna Power (mW/MHz) | Antenna power Limit ((10mW/MHz) | Declared Antenna Power (mW/MHz) | Tolerance(%) |
|---|---|---|---|---|---|
| 802.11a | Low | 2.75 | 10 | 2.75 | 0.00 |
| | Middle | 2.74 | 10 | 2.75 | -0.00 |
| | High | 2.74 | 10 | 2.75 | -0.00 |
| 802.11n-HT20 | Low | 2.70 | 10 | 2.75 | -0.02 |
| | Middle | 2.71 | 10 | 2.75 | -0.01 |
| | High | 2.75 | 10 | 2.75 | 0.00 |
| 802.11ac-VHT20 | Low | 2.69 | 10 | 2.77 | -0.03 |
| | Middle | 2.68 | 10 | 2.77 | -0.03 |
| | High | 2.77 | 10 | 2.77 | 0.00 |
| 802.11n-HT40 | Low | 0.86 | 5 | 0.86 | 0.00 |
| | High | 0.84 | 5 | 0.86 | -2.33 |
| 802.11ac-VHT40 | Low | 0.84 | 5 | 0.84 | 0.00 |
| | High | 0.82 | 5 | 0.84 | -2.38 |
| 802.11ac-VHT80 | Low | 0.50 | 2.5 | 0.50 | 0.00 |

## 7.2 Frequency Tolerance

### 7.2.1 Test Requirement

Article 2-1.

### 7.2.2 Limit

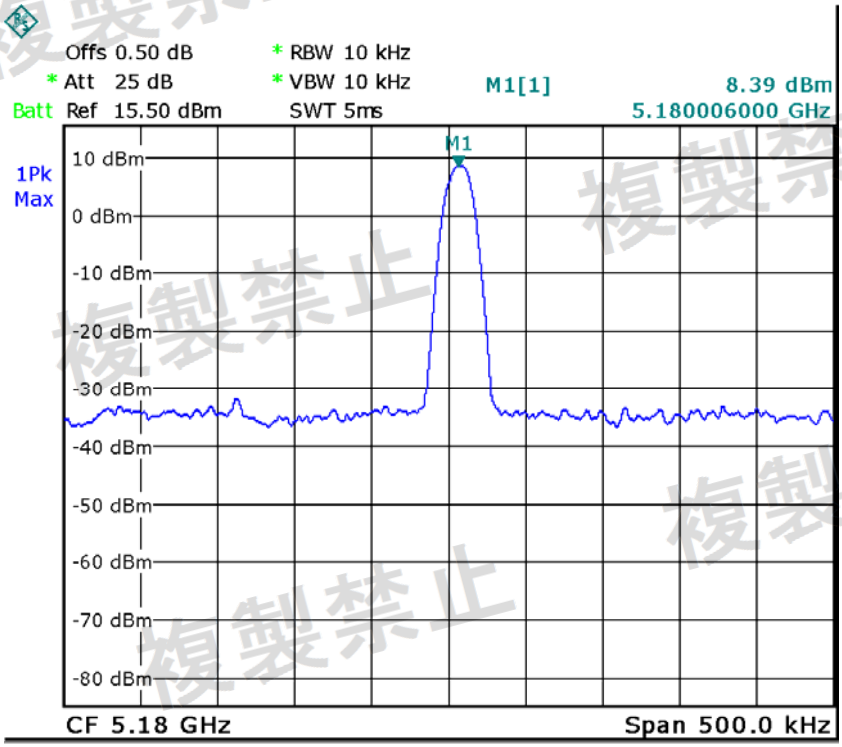
According to Article 2-1, the Tolerance of frequency: ±20x10$^{-6}$.

### 7.2.3 Test Result

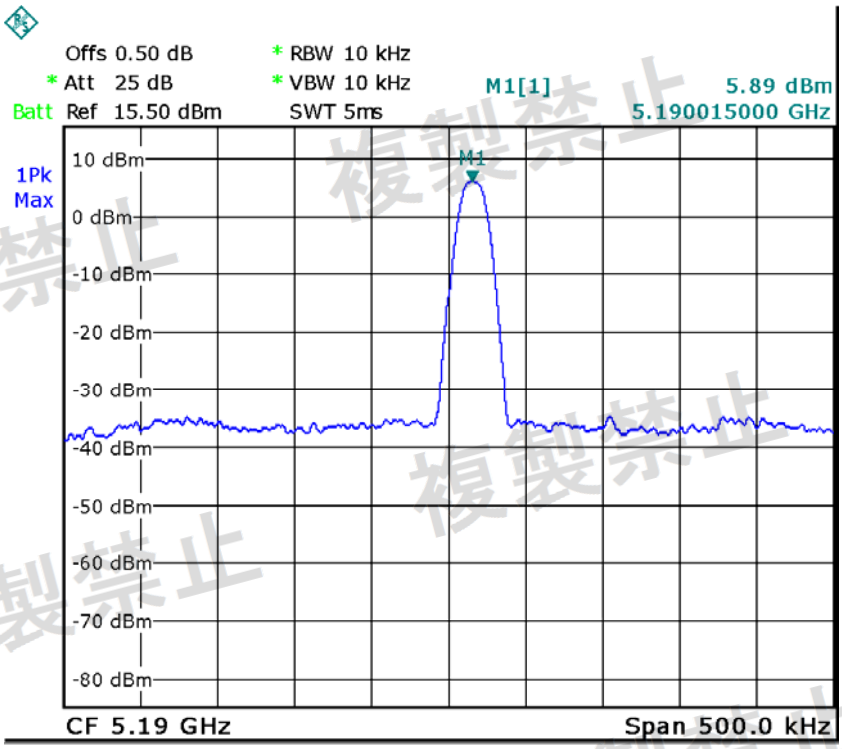
| Frequency (MHz) | Result (MHz) | Tolerance (kHz) | Tolerance (ppm) | Limit |
|---|---|---|---|---|
| 5180 | 5180.006 | 6 | 1.16 | ±20 |
| 5190 | 5190.015 | 15 | 2.89 | ±20 |
| 5200 | 5200.013 | 13 | 2.50 | ±20 |
| 5210 | 5209.995 | -5 | -0.96 | ±20 |
| 5230 | 5230.009 | 9 | 1.72 | ±20 |
| 5240 | 5240.021 | 21 | 4.01 | ±20 |

Test Plots

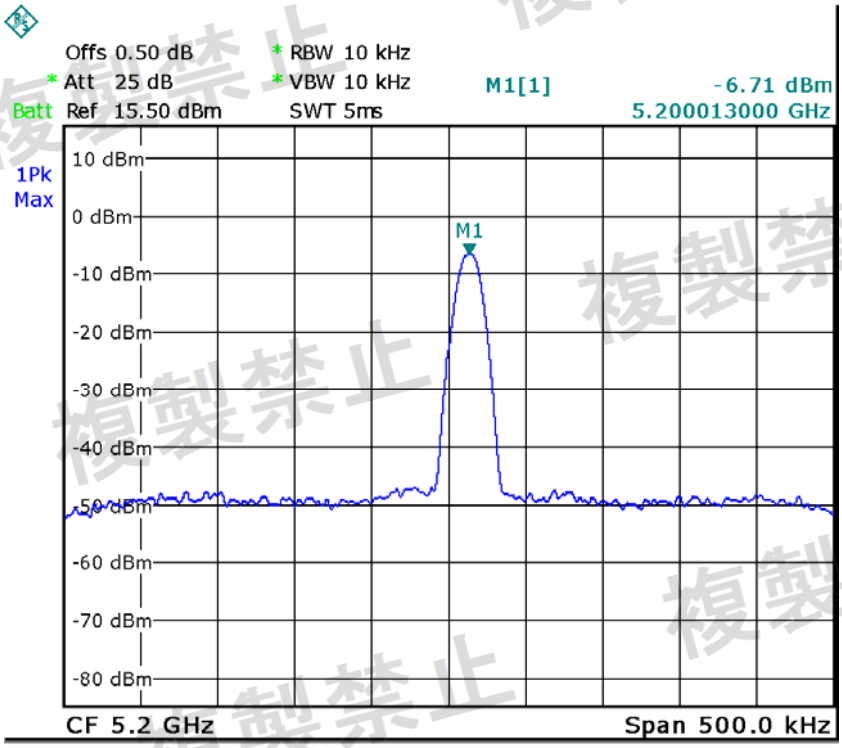
Channel 5180MHz



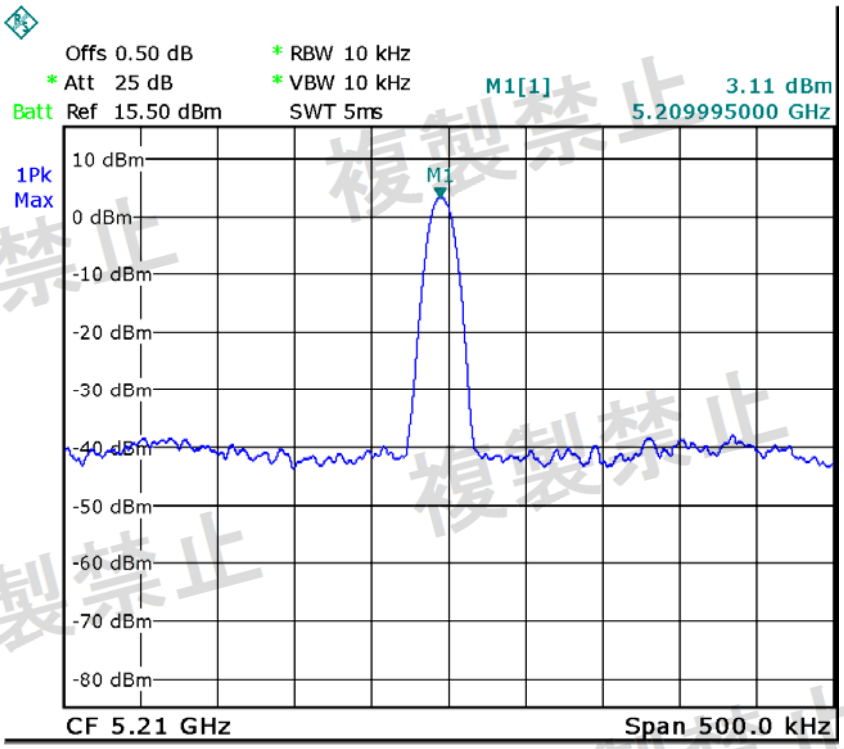
Channel 5190MHz



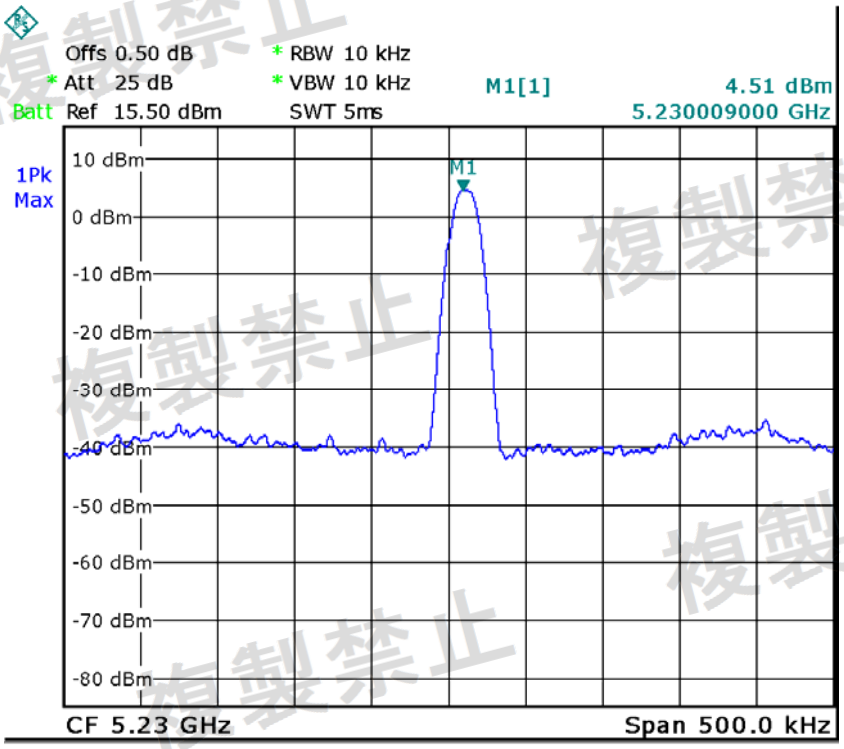

Channel 5200MHz



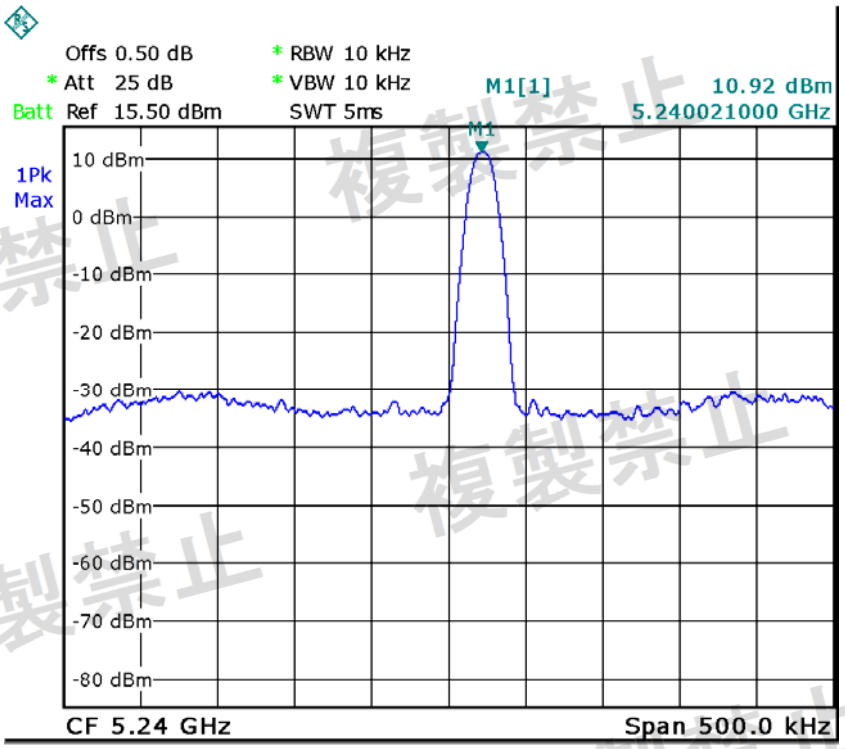
Channel 5210MHz




Channel 5230MHz



Channel 5240MHz



## 7.3 Equivalent Isotropic Radiated Power

### 7.3.1 Test Requirement

Article 2-1.

### 7.3.2 Limit

According to Article 2-1, It equivalent isotropic radiated power in the bandwidth of 1MHz are as follows. However, there is a transitional measure.

a, Use radio waves in the frequency of 5,180 MHz ; 5,200 MHz; 5,220MHz or 5,240MHz, the isotropic radiated powe should be 10mW or less for HT20 and 5mW or less for HT40;

### 7.3.3 Test Result

**802.11a**

| Frequency | Receiver Reading | Turn table Angle | RX Antenna | | Substituted | | | Absolute Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height | Polar | SG Level | Cable | Antenna Gain | | | |
| (MHz) | (dBμV) | Degree | (m) | (H/V) | (dBm) | (dB) | (dB) | (dBm) | (dBm) | (dB) |
| Low channel 5180MHz | | | | | | | | | | |
| 5180 | 93.96 | 345 | 1.21 | H | -1.30 | 2.81 | 12.80 | 8.69 | 10 | -1.31 |
| 5180 | 93.87 | 99 | 1.53 | V | -1.39 | 2.81 | 12.80 | 8.60 | 10 | -1.40 |
| Middle channel 5200MHz | | | | | | | | | | |
| 5200 | 93.52 | 349 | 1.45 | H | -1.74 | 2.81 | 12.80 | 8.25 | 10 | -1.75 |
| 5200 | 93.41 | 85 | 1.51 | V | -1.85 | 2.81 | 12.80 | 8.14 | 10 | -1.86 |
| High Channel 5240MHz | | | | | | | | | | |
| 5240 | 93.87 | 63 | 1.89 | H | -1.39 | 2.81 | 12.80 | 8.60 | 10 | -1.40 |
| 5240 | 93.86 | 301 | 1.54 | V | -1.40 | 2.81 | 12.80 | 8.59 | 10 | -1.41 |

**802.11n-HT20**

| Frequency | Receiver Reading | Turn table Angle | RX Antenna | | Substituted | | | Absolute Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height | Polar | SG Level | Cable | Antenna Gain | | | |
| (MHz) | (dBμV) | Degree | (m) | (H/V) | (dBm) | (dB) | (dB) | (dBm) | (dBm) | (dB) |
| Low channel 5180MHz | | | | | | | | | | |
| 5180 | 94.01 | 26 | 1.35 | H | -1.25 | 2.81 | 12.80 | 8.74 | 10 | -1.26 |
| 5180 | 93.99 | 197 | 1.22 | V | -1.27 | 2.81 | 12.80 | 8.72 | 10 | -1.28 |
| Middle channel 5200MHz | | | | | | | | | | |
| 5200 | 93.41 | 303 | 1.97 | H | -1.85 | 2.81 | 12.80 | 8.14 | 10 | -1.86 |
| 5200 | 93.40 | 310 | 1.18 | V | -1.86 | 2.81 | 12.80 | 8.13 | 10 | -1.87 |
| High Channel 5240MHz | | | | | | | | | | |
| 5240 | 93.98 | 261 | 1.99 | H | -1.28 | 2.81 | 12.80 | 8.71 | 10 | -1.29 |
| 5240 | 93.84 | 187 | 1.67 | V | -1.42 | 2.81 | 12.80 | 8.57 | 10 | -1.43 |

**802.11ac-VHT20**

| Frequency | Receiver Reading | Turn table Angle | RX Antenna | | Substituted | | | Absolute Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height | Polar | SG Level | Cable | Antenna Gain | | | |
| (MHz) | (dBμV) | Degree | (m) | (H/V) | (dBm) | (dB) | (dB) | (dBm) | (dBm) | (dB) |
| Low channel 5180MHz | | | | | | | | | | |
| 5180 | 92.93 | 215 | 1.74 | H | -2.33 | 2.81 | 12.80 | 7.66 | 10 | -2.34 |
| 5180 | 92.96 | 58 | 1.46 | V | -2.30 | 2.81 | 12.80 | 7.69 | 10 | -2.31 |
| Middle channel 5200MHz | | | | | | | | | | |
| 5200 | 92.45 | 3 | 1.34 | H | -2.81 | 2.81 | 12.80 | 7.18 | 10 | -2.82 |
| 5200 | 92.40 | 313 | 1.59 | V | -2.86 | 2.81 | 12.80 | 7.13 | 10 | -2.87 |
| High Channel 5240MHz | | | | | | | | | | |
| 5240 | 92.33 | 303 | 1.34 | H | -2.93 | 2.81 | 12.80 | 7.06 | 10 | -2.94 |
| 5240 | 92.33 | 291 | 1.51 | V | -2.93 | 2.81 | 12.80 | 7.06 | 10 | -2.94 |

**802.11n-HT40**

| Frequency | Receiver Reading | Turn table Angle | RX Antenna | | Substituted | | | Absolute Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height | Polar | SG Level | Cable | Antenna Gain | | | |
| (MHz) | (dBμV) | Degree | (m) | (H/V) | (dBm) | (dB) | (dB) | (dBm) | (dBm) | (dB) |
| Low channel 5190MHz | | | | | | | | | | |
| 5190 | 89.19 | 6 | 1.49 | H | -6.07 | 2.83 | 12.90 | 4.00 | 5 | -1.00 |
| 5190 | 89.10 | 273 | 1.59 | V | -6.16 | 2.83 | 12.90 | 3.91 | 5 | -1.09 |
| Middle channel 5230MHz | | | | | | | | | | |
| 5230 | 89.29 | 68 | 1.95 | H | -5.97 | 2.83 | 12.90 | 4.10 | 5 | -0.90 |
| 5230 | 89.25 | 114 | 1.46 | V | -6.01 | 2.83 | 12.90 | 4.06 | 5 | -0.94 |

**802.11ac-VHT40**

| Frequency | Receiver Reading | Turn table Angle | RX Antenna | | Substituted | | | Absolute Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height | Polar | SG Level | Cable | Antenna Gain | | | |
| (MHz) | (dBμV) | Degree | (m) | (H/V) | (dBm) | (dB) | (dB) | (dBm) | (dBm) | (dB) |
| Low channel 5190MHz | | | | | | | | | | |
| 5190 | 88.76 | 35 | 1.73 | H | -6.50 | 2.83 | 12.90 | 3.57 | 5 | -1.43 |
| 5190 | 88.76 | 259 | 1.36 | V | -6.50 | 2.83 | 12.90 | 3.57 | 5 | -1.43 |
| Middle channel 5230MHz | | | | | | | | | | |
| 5230 | 89.63 | 337 | 1.52 | H | -5.63 | 2.83 | 12.90 | 4.44 | 5 | -0.56 |
| 5230 | 89.54 | 288 | 1.87 | V | -5.72 | 2.83 | 12.90 | 4.35 | 5 | -0.65 |

**802.11ac-VHT80**

| Frequency | Receiver Reading | Turn table Angle | RX Antenna | | Substituted | | | Absolute Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height | Polar | SG Level | Cable | Antenna Gain | | | |
| (MHz) | (dBμV) | Degree | (m) | (H/V) | (dBm) | (dB) | (dB) | (dBm) | (dBm) | (dB) |
| Low channel 5210MHz | | | | | | | | | | |
| 5210 | 85.45 | 143 | 1.16 | H | -9.81 | 2.83 | 12.90 | 0.26 | 2.5 | -2.24 |
| 5210 | 85.59 | 155 | 1.01 | V | -9.67 | 2.83 | 12.90 | 0.40 | 2.5 | -2.10 |

## 7.4 Occupied Frequency Bandwidth

### 7.4.1 Test Requirement

Article 2-1.

### 7.4.2 Limit

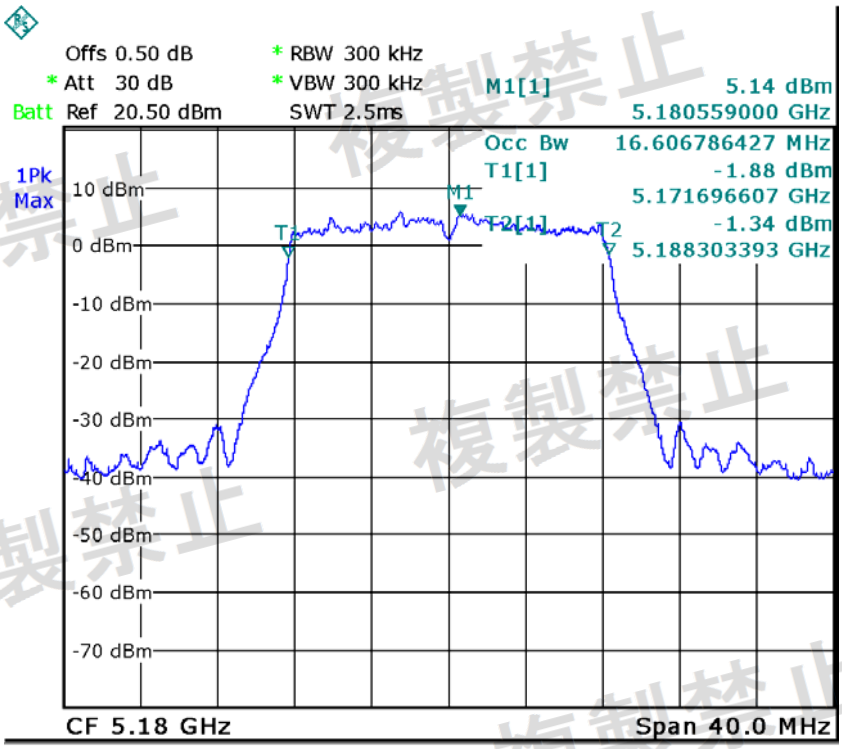
According to Article 2-1, permissible value for occupied bandwidth shall be HT20 mode of OCW should be 19MHz or less, for HT40 mode of OCW should be 38MHz or less.

### 7.4.3 Test Result

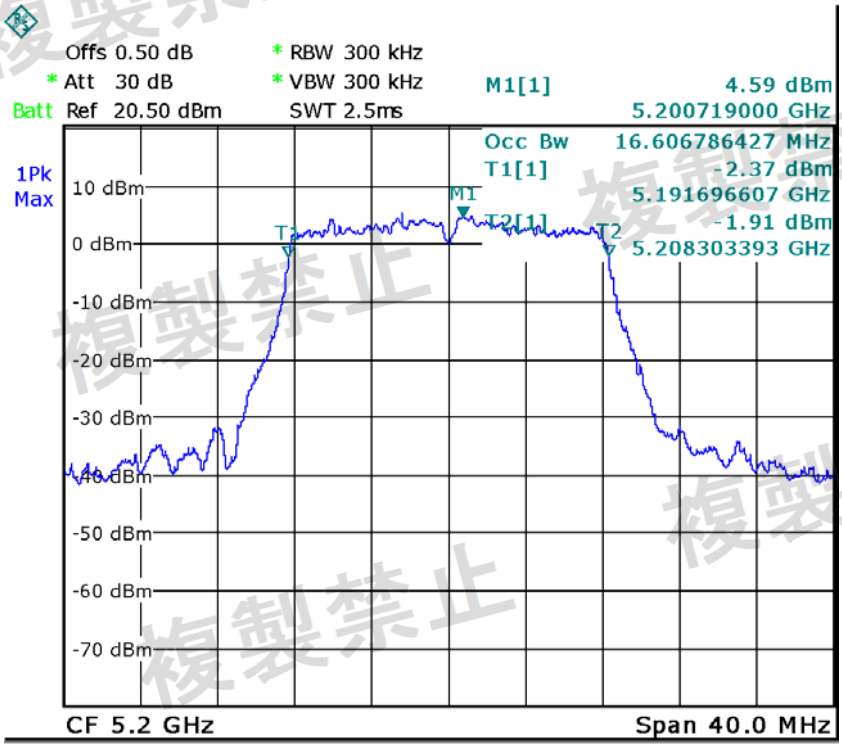
| Modulation | Channel | Occupied Frequency Bandwidth (MHz) | Limit (MHz) |
|---|---|---|---|
| 802.11a | Low | 16.607 | < 19 |
| | Middle | 16.607 | < 19 |
| | High | 16.527 | < 19 |
| 802.11n-HT20 | Low | 17.565 | < 19 |
| | Middle | 17.565 | < 19 |
| | High | 17.565 | < 19 |
| 802.11ac-VHT20 | Low | 17.565 | < 19 |
| | Middle | 17.565 | < 19 |
| | High | 17.485 | < 19 |
| 802.11n-HT40 | Low | 36.088 | < 38 |
| | High | 36.886 | < 38 |
| 802.11ac-VHT40 | Low | 37.643 | < 38 |
| | High | 36.886 | < 38 |
| 802.11ac-VHT80 | Low | 77.605 | < 78 |

Test Plots

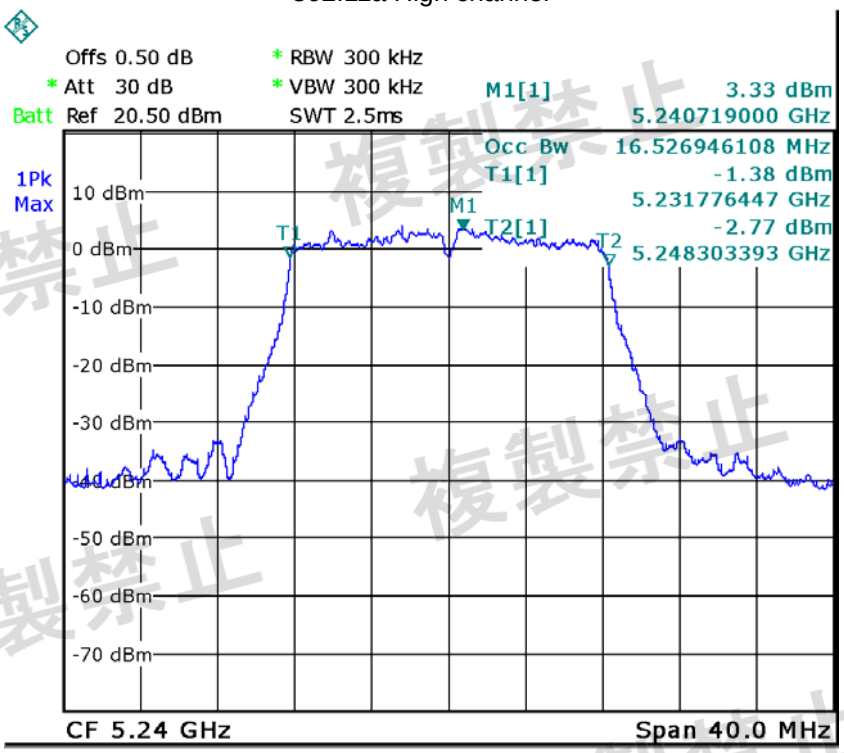
802.11a Low channel



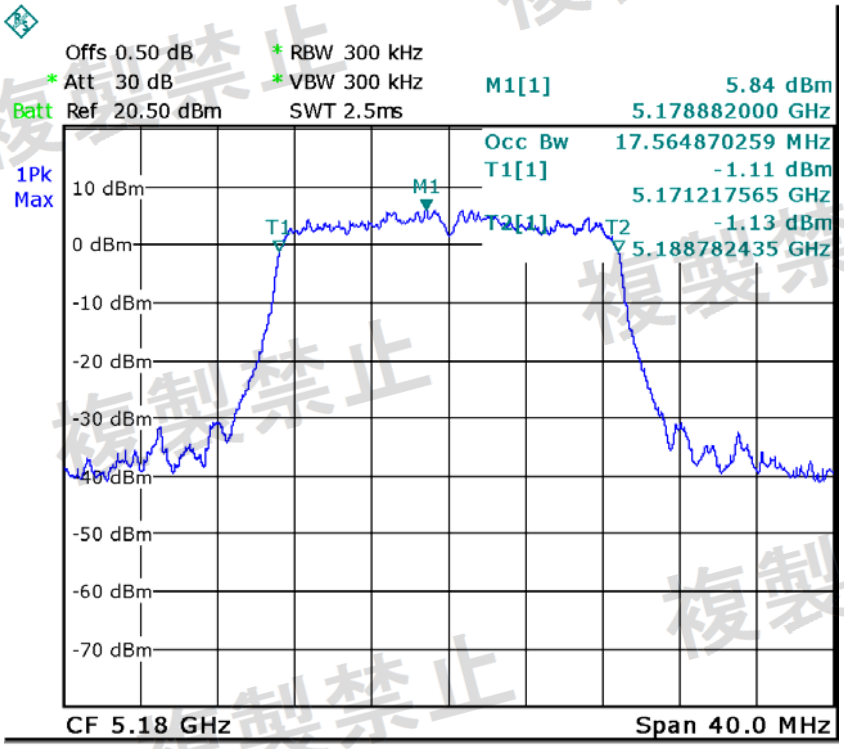

802.11a Middle channel



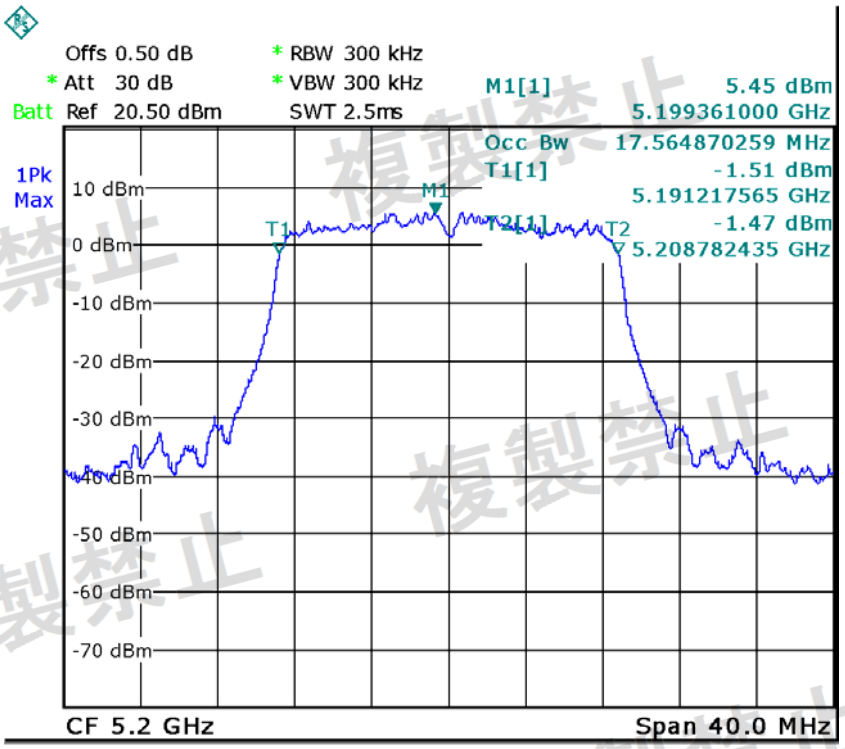
802.11a High channel



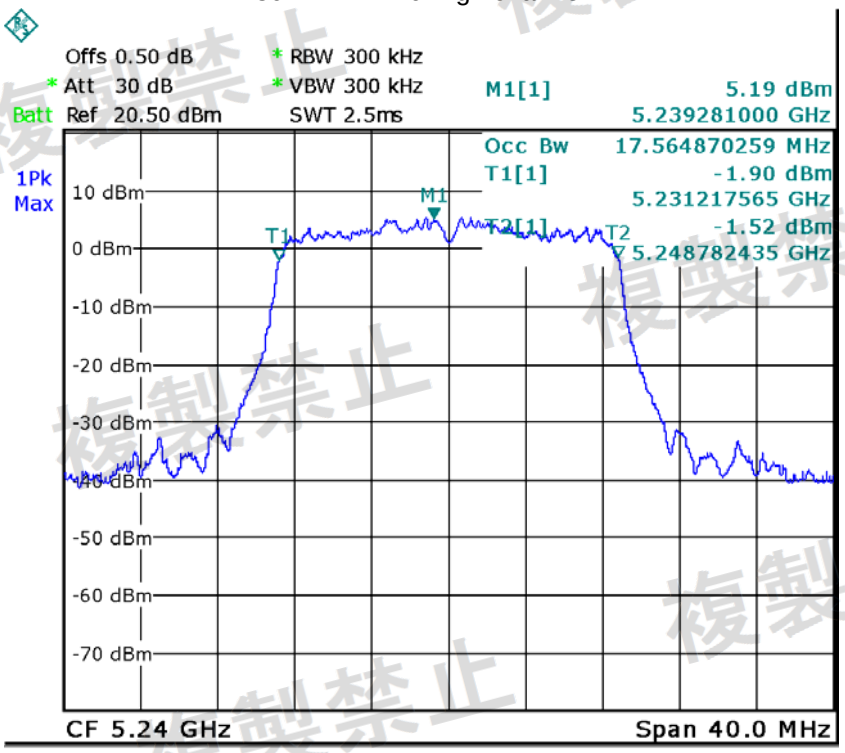

802.11n-HT20 Low channel



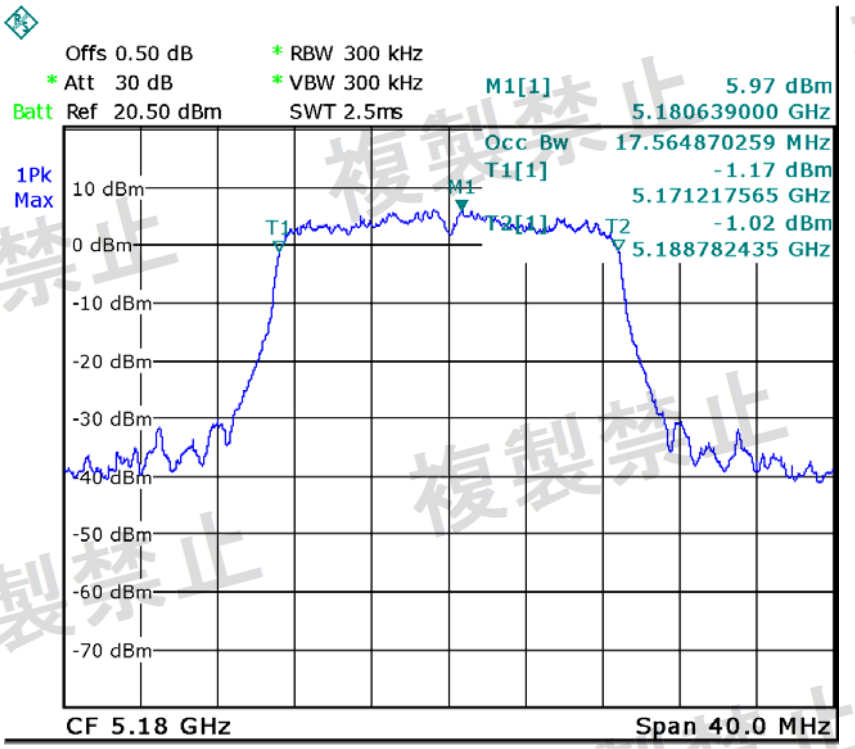
802.11n-HT20 Middle channel



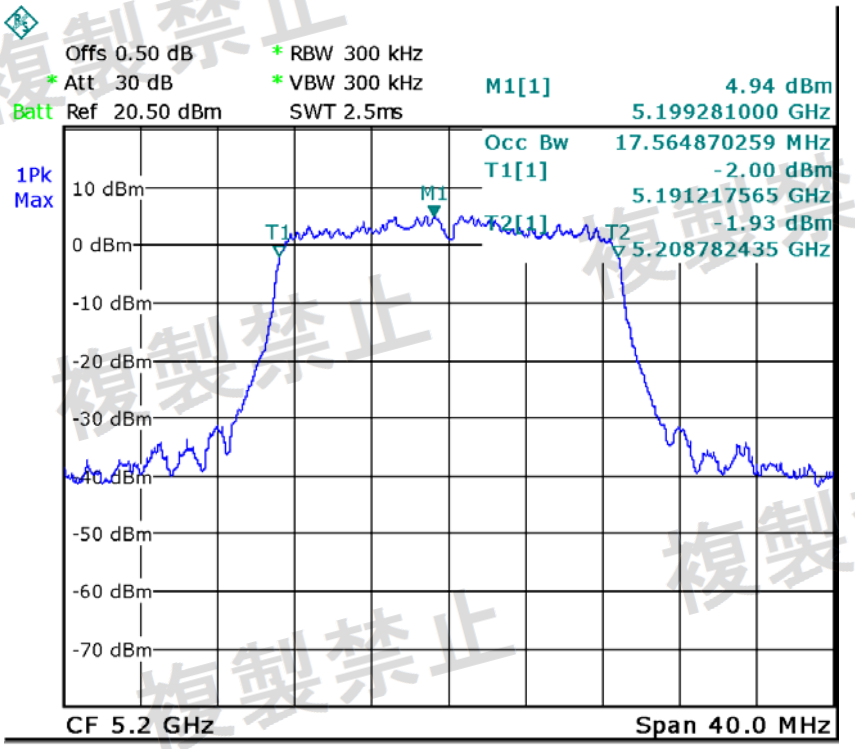

802.11n-HT20 High channel



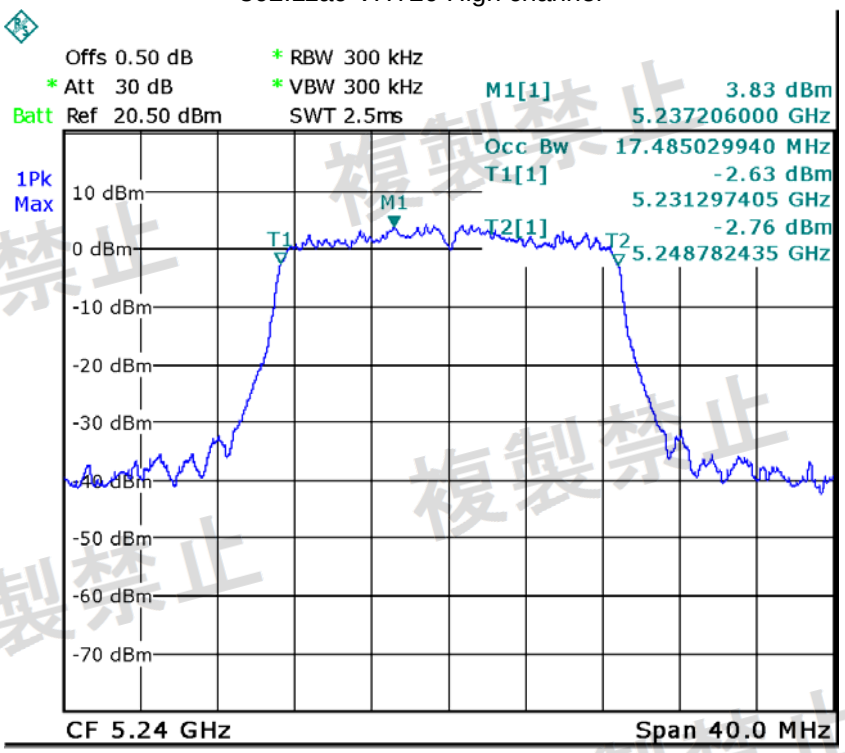
802.11ac-VHT20 Low channel



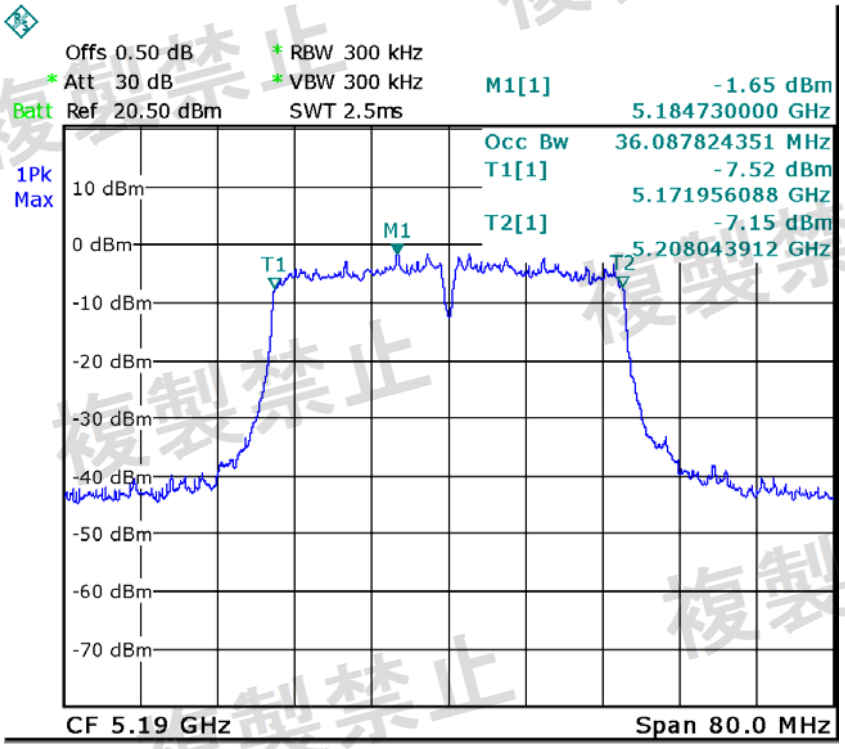

802.11ac-VHT20 Middle channel



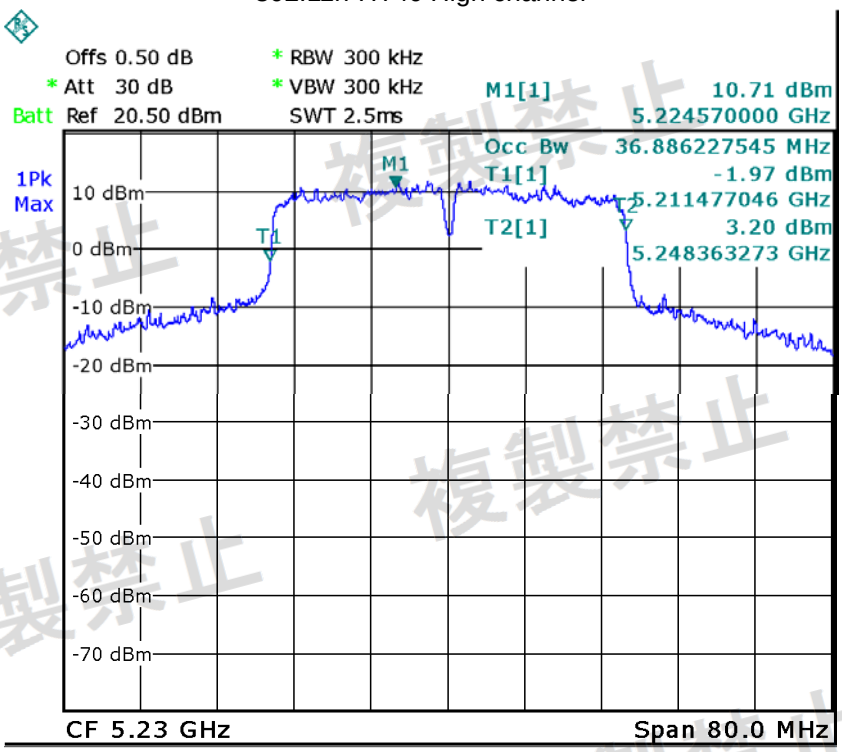
802.11ac-VHT20 High channel



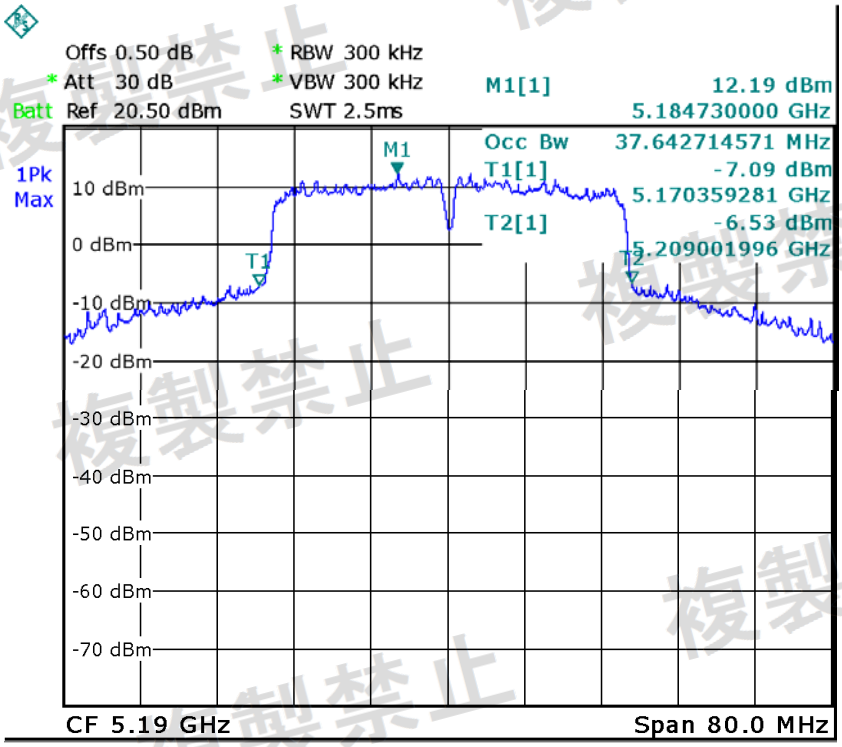

802.11n-HT40 Low channel



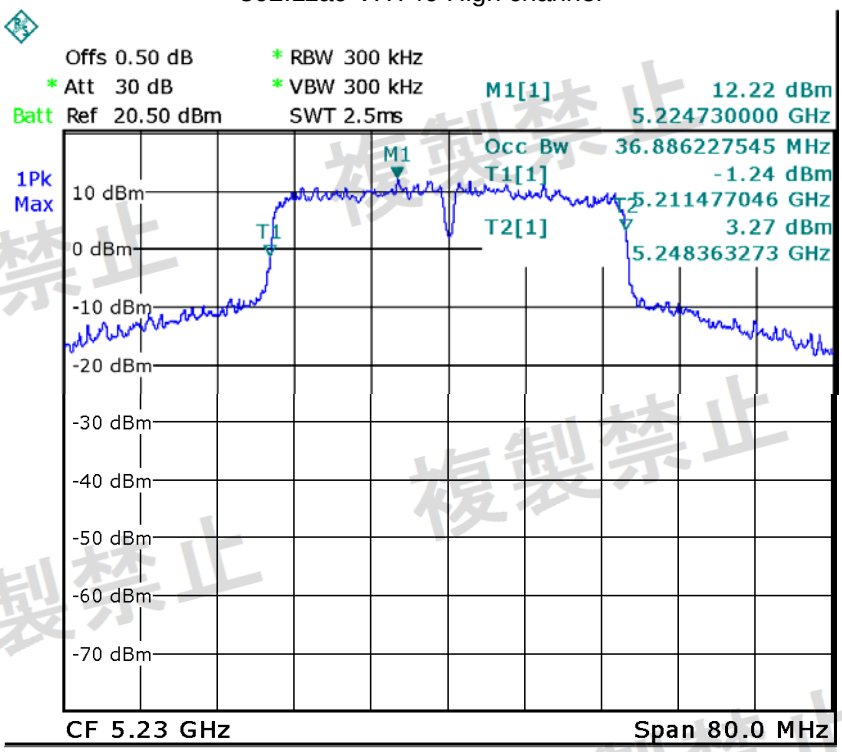
802.11n-HT40 High channel



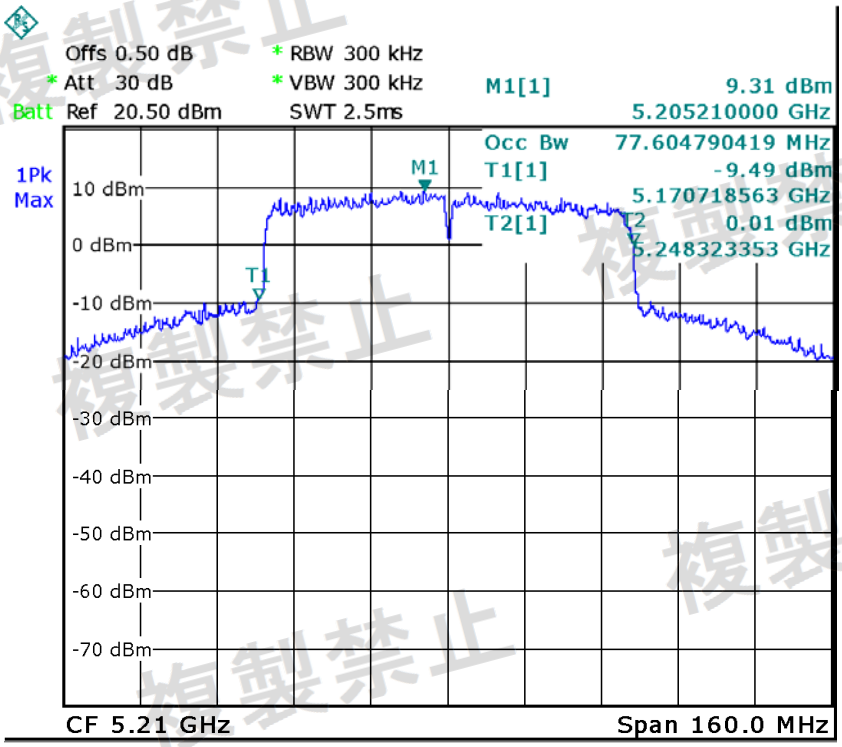

802.11ac-VHT40 Low channel



802.11ac-VHT40 High channel




802.11ac-VHT80 Low channel



## 7.5 Transmission Rate

### 7.5.1 Test Requirement

Article 2-1.

### 7.5.2 Limit

According to Article 2-1, transmission speed is 10Mbit / s or higher. However, radio equipment shall be capable of transmitting signals at 20 Mbit / s or faster for HT20 and 40 Mbit / s for HT40.

### 7.5.3 Result

| Modulation | Transmission rate(Mbps) |
|---|---|
| 802.11a | 54 |
| 802.11n | 160 |
| 802.11ac | 433.3 |

## 7.6 Transmission Burst Length

### 7.6.1 Test Requirement

Article 2-1.

### 7.6.2 Limit

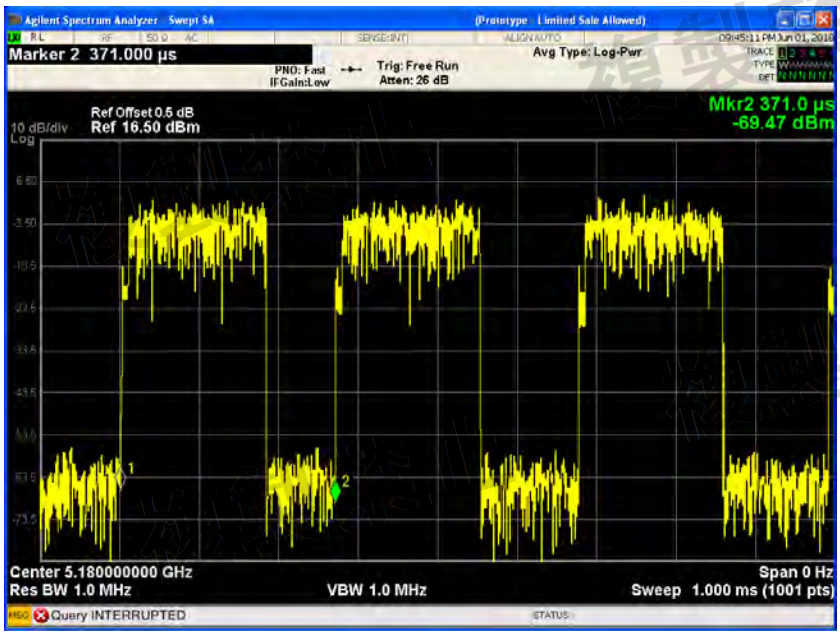
According to Article 2-1, transmission burst length is 4ms or less.

### 7.6.3 Result

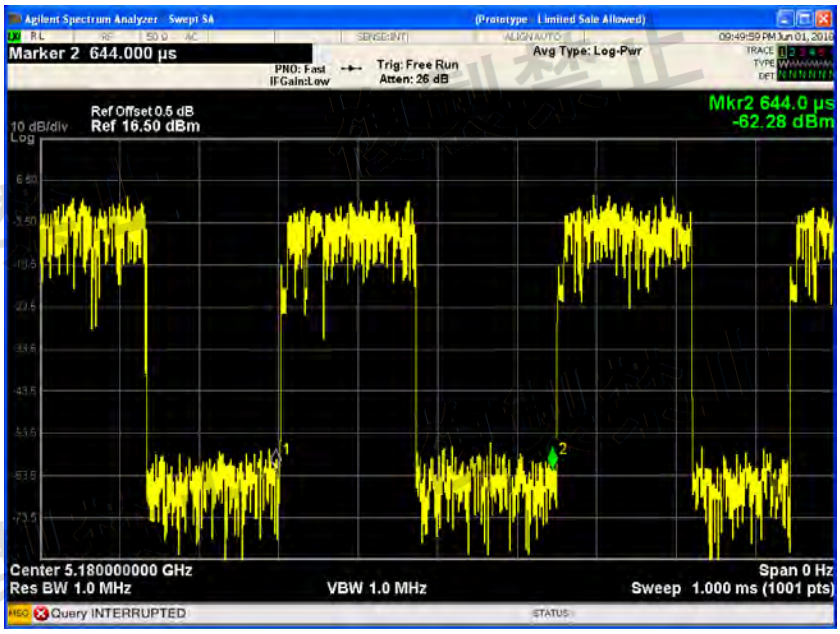
| Modulation | Measurement Burst Length(ms) | Limit(ms) |
|---|---|---|
| 802.11a | 0.371 | 4 |
| 802.11n-HT20 | 0.644 | 4 |
| 802.11ac-VHT20 | 0.702 | 4 |
| 802.11n-HT40 | 0.336 | 4 |
| 802.11ac-VHT40 | 0.277 | 4 |
| 802.11ac-VHT80 | 0.337 | 4 |
| Note: The result only show the worst channel each mode. | | |

Test Plots

802.11a Low channel

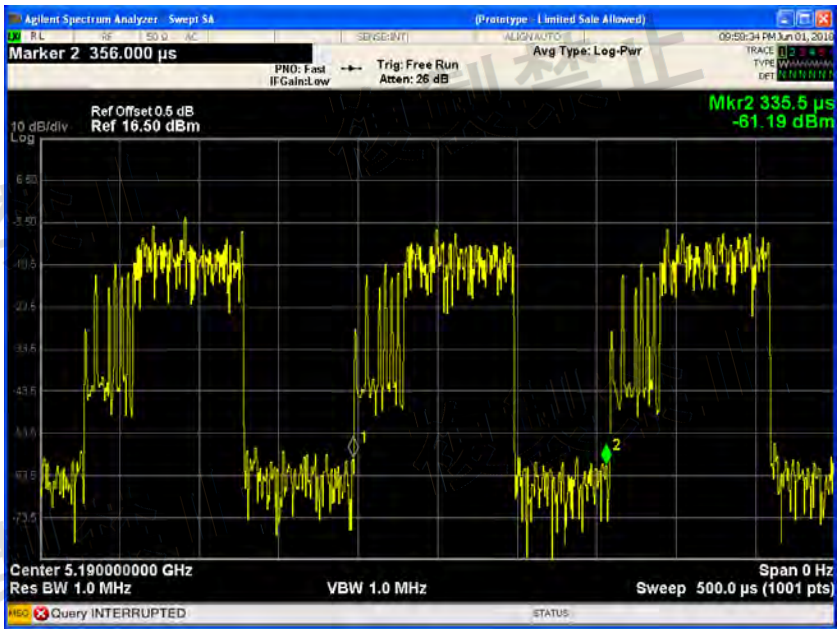


802.11n-HT20 Low channel

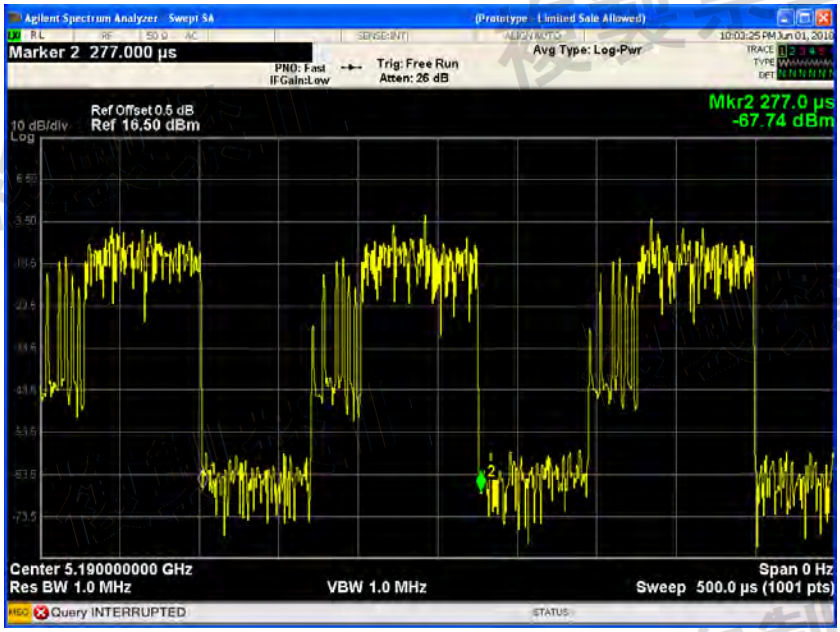



802.11ac-VHT20 Low channel

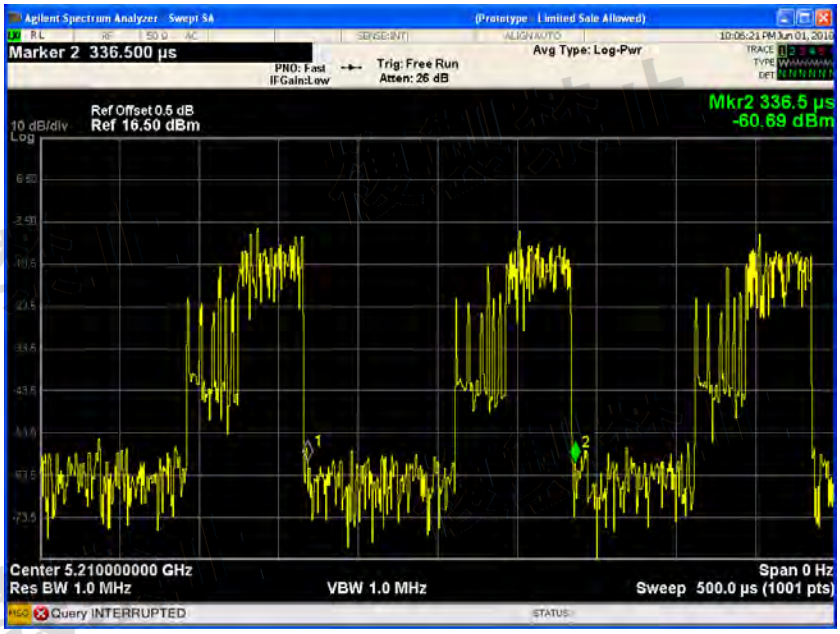
802.11n-HT40 Low channel




802.11ac-VHT40 Low channel



802.11ac-VHT80 Low channel



## 7.7 Unwanted Emissions Strength

### 7.7.1 Test Requirement

Article 2-1.

### 7.7.2 Limit

According to Article 2-1, unwanted emission intensity of tolerance (tolerance defined by the average power of the unwanted emission for each frequency supplied to the feeder at the time of modulation) is as follows.

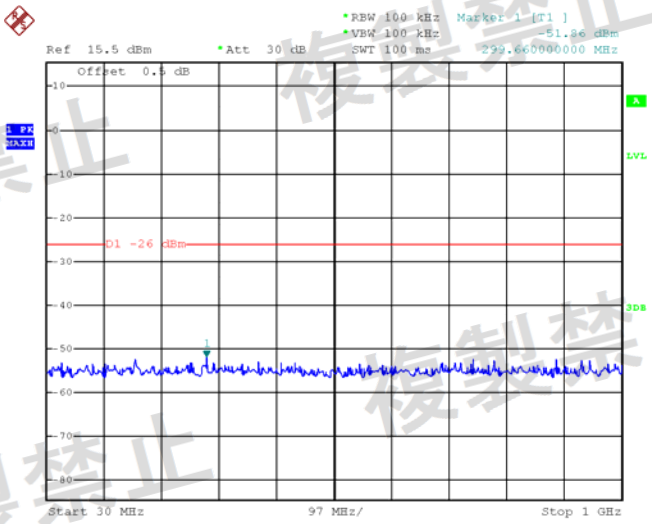
| Frequency | Permissible value of the unwanted emission intensity |
|---|---|
| For HT20 mode,That less than 5,140MHz and more than 5,360MHz | The average power in the bandwidth of any 1MHz 2.5μW or less |
| For HT40 mode,That less than 5,100MHz and more than 5,400MHz | The average power in the bandwidth of any 1MHz 2.5μW or less |

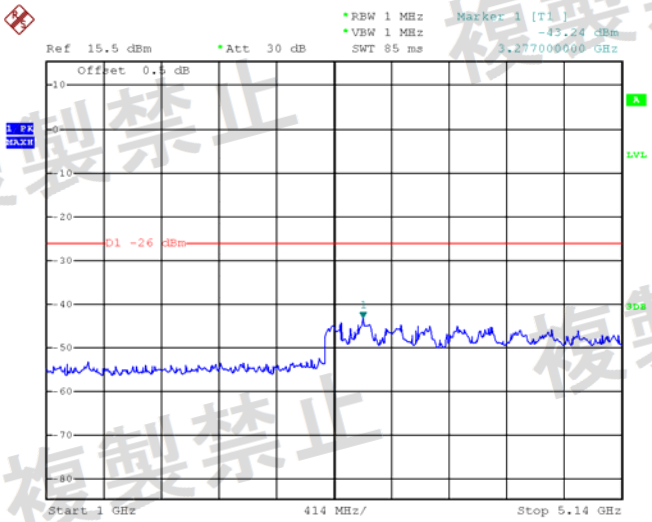
### 7.7.3 Test Result

| Modulation | Channel | Test Mode | Test Result |
|---|---|---|---|
| 802.11a | Low | Transmitting | PASS |
| | Middle | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11n-HT20 | Low | Transmitting | PASS |
| | Middle | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11ac-VHT20 | Low | Transmitting | PASS |
| | Middle | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11n-HT40 | Low | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11ac-VHT40 | Low | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11ac-VHT80 | Low | Transmitting | PASS |

Test Plots

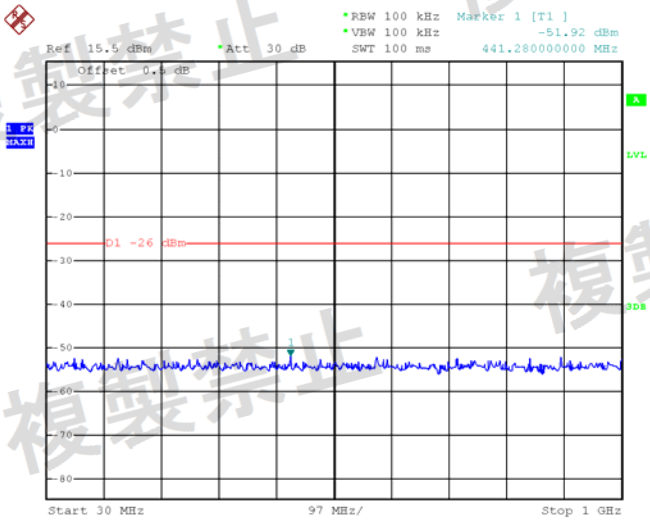
802.11a Low Channel 0.03-5.14GHz

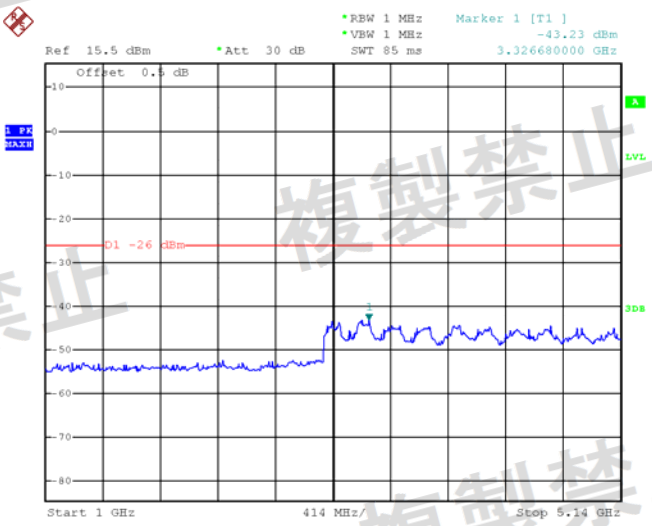


802.11a Low Channel 5.36-26GHz

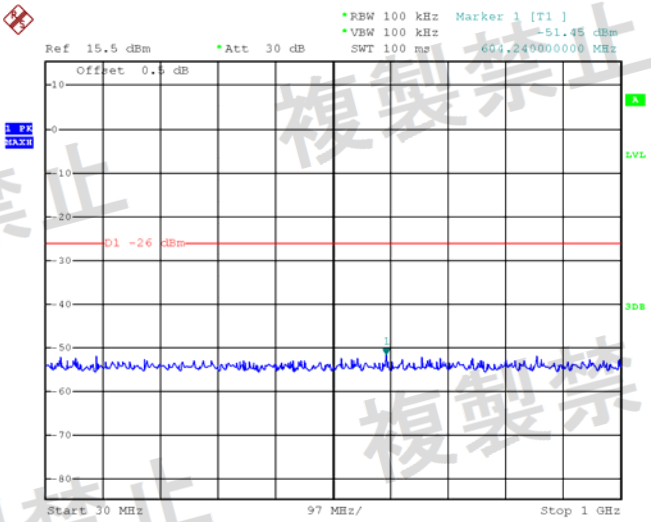

802.11a Middle Channel 0.03-5.14GHz

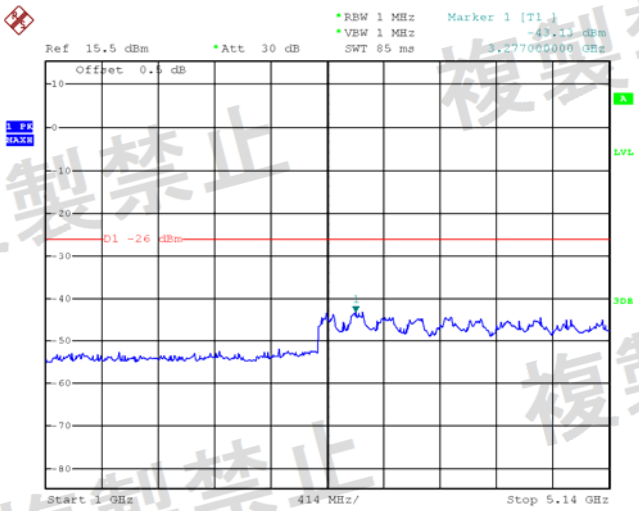




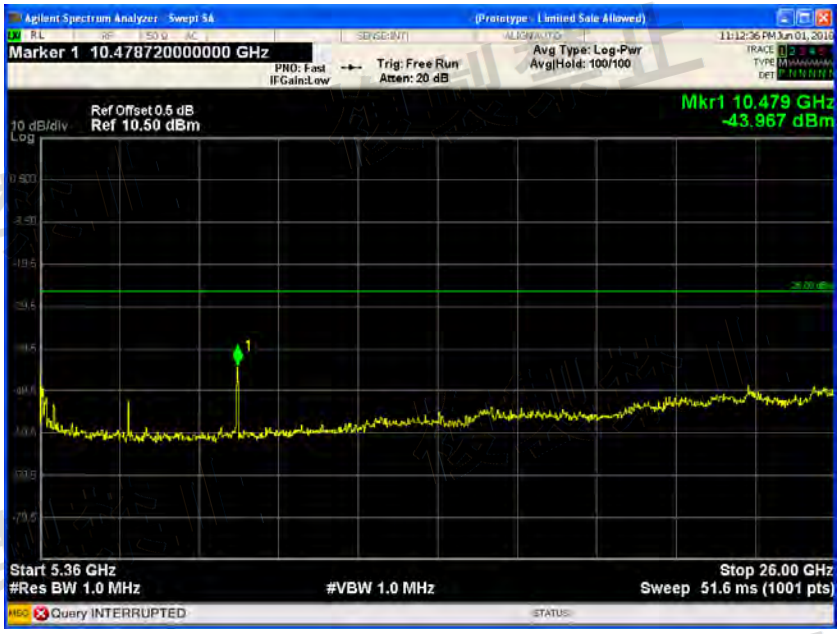

802.11a Middle Channel 5.36-26GHz

802.11a High Channel 0.03-5.14GHz

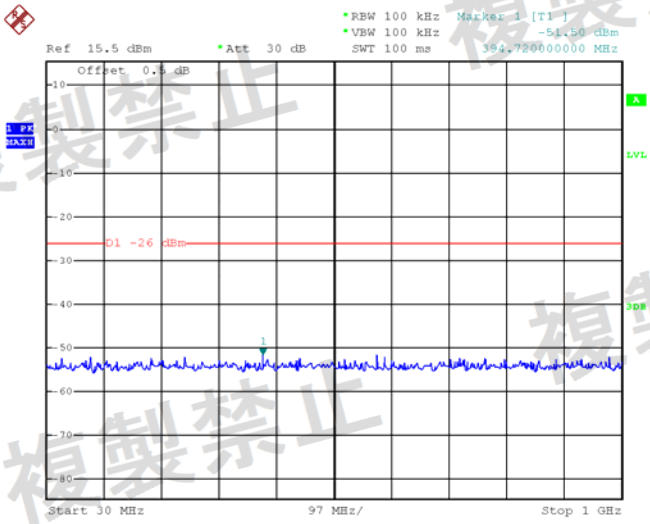


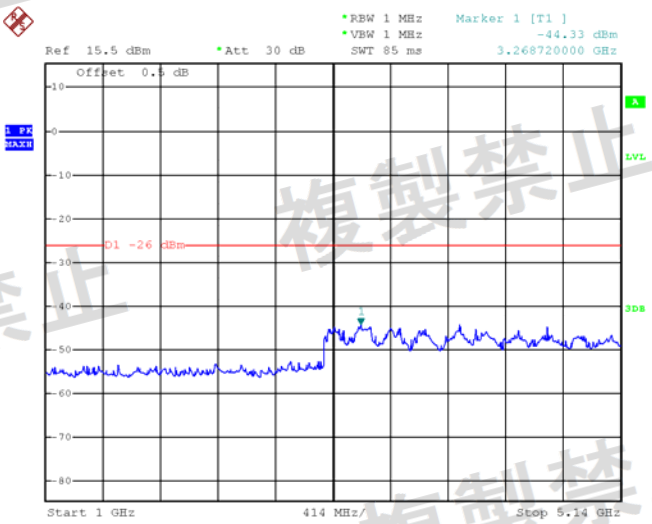



802.11a High Channel 5.36-26GHz



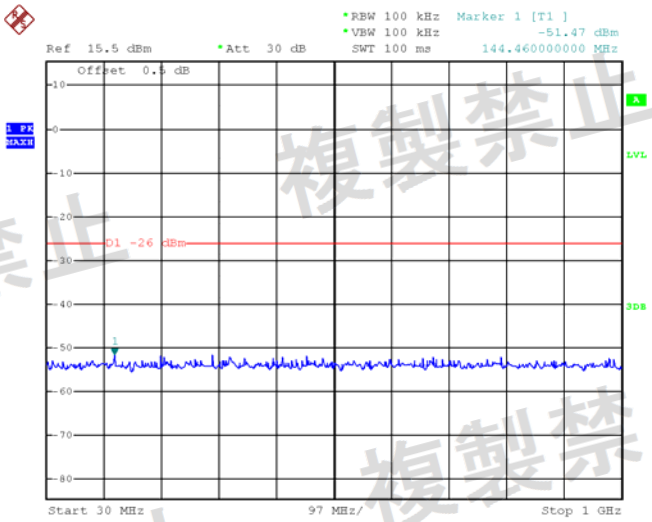

802.11n-HT20 Low Channel 0.03-5.14GHz

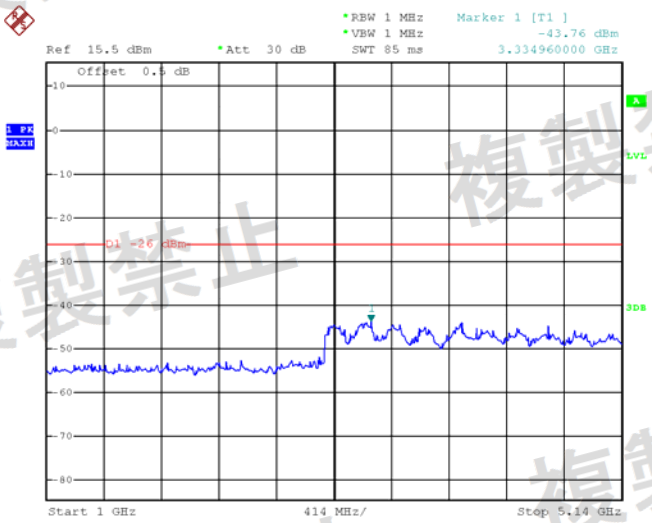





802.11n-HT20 Low Channel 5.36-26GHz

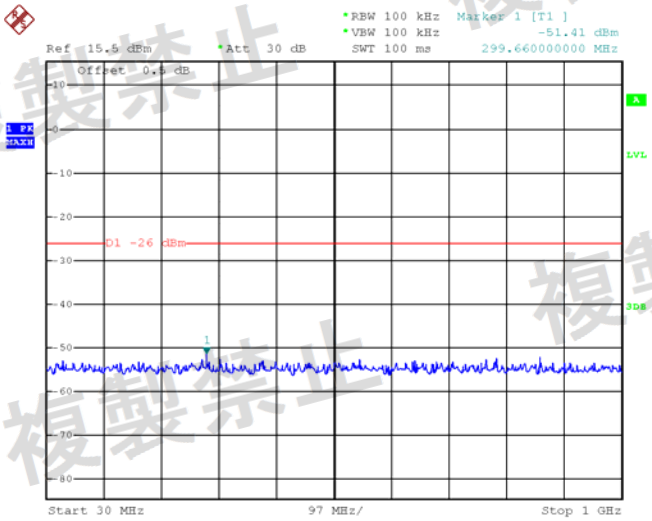
802.11n-HT20 Middle Channel 0.03-5.14GHz

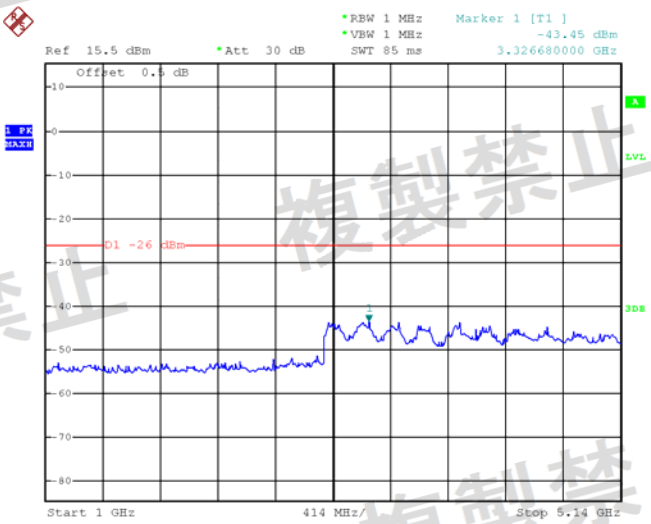


802.11n-HT20 Middle Channel 5.36-26GHz

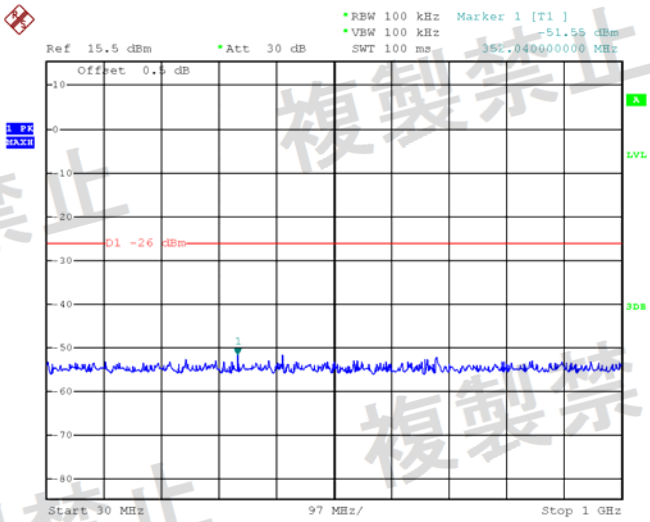

802.11n-HT20 High Channel 0.03-5.14GHz

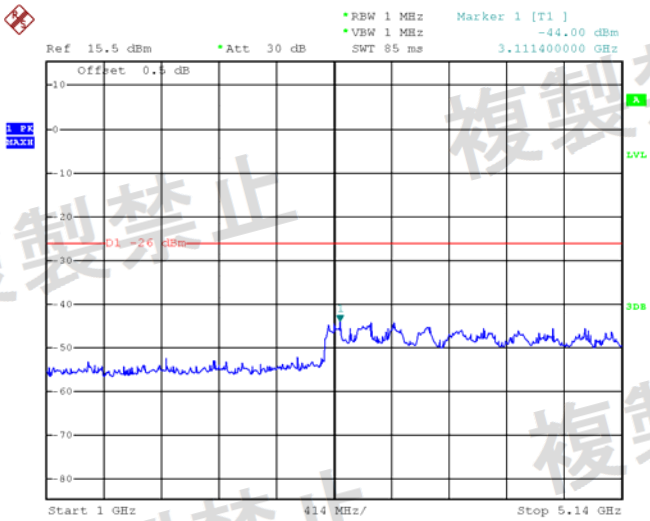





802.11n-HT20 High Channel 5.36-26GHz

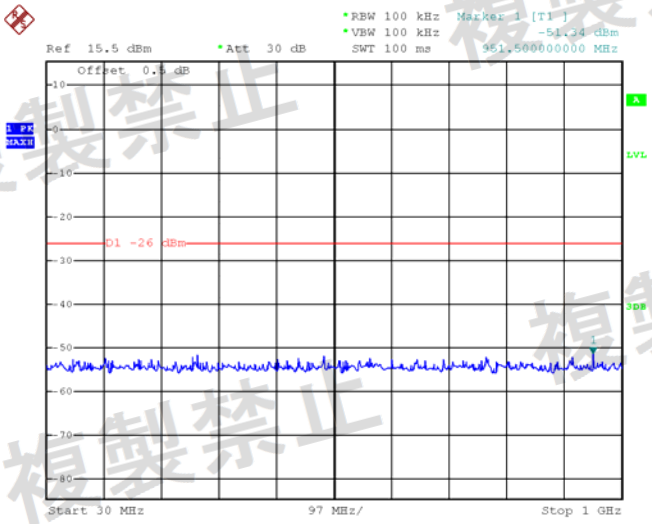
802.11ac-VHT20 Low Channel 0.03-5.14GHz

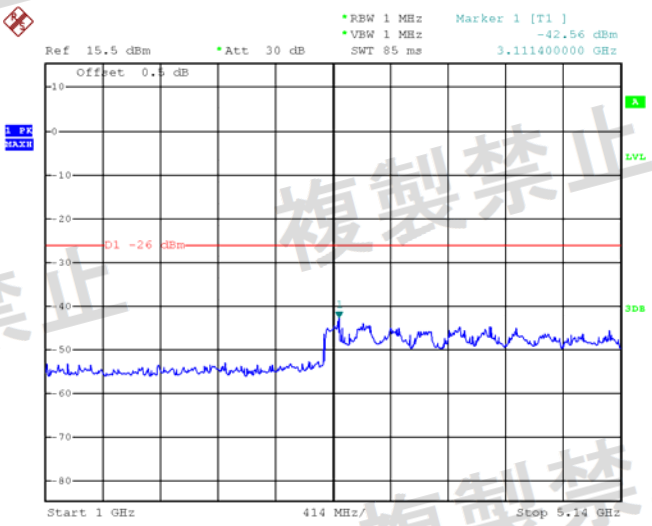


802.11ac-VHT20 Low Channel 5.36-26GHz

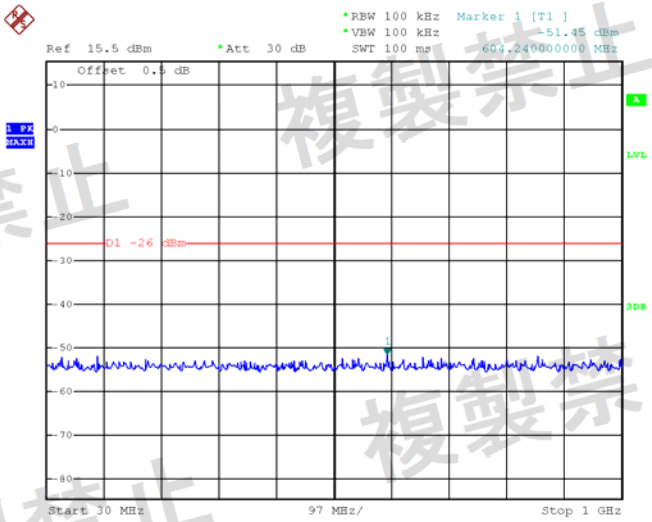

802.11ac-VHT20 Middle Channel 0.03-5.14GHz

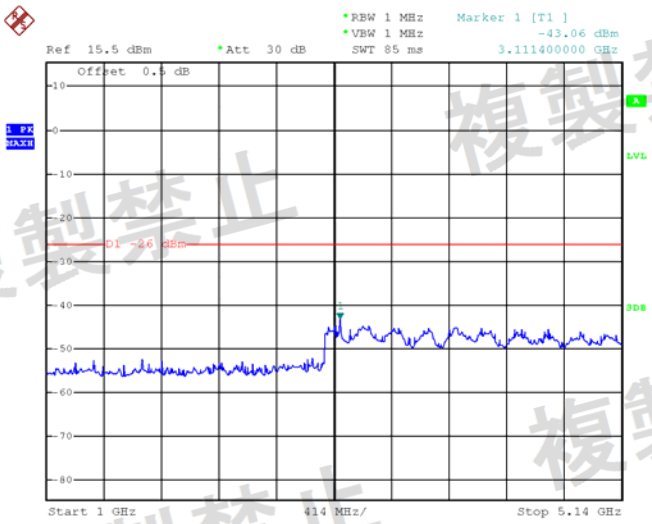





802.11ac-VHT20 Middle Channel 5.36-26GHz

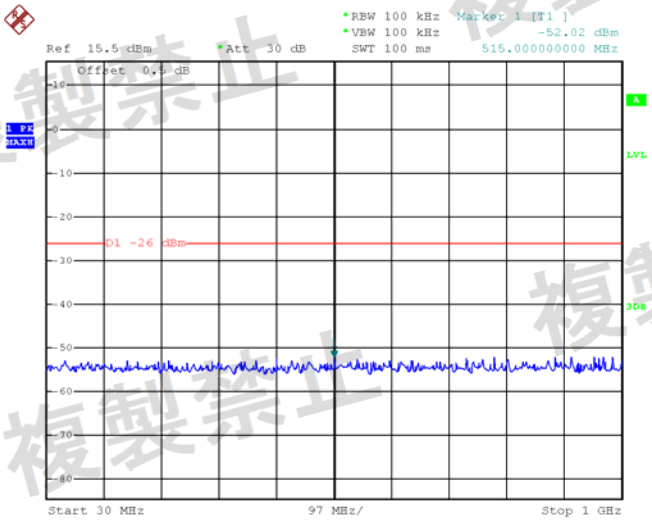
802.11ac-VHT20 High Channel 0.03-5.14GHz

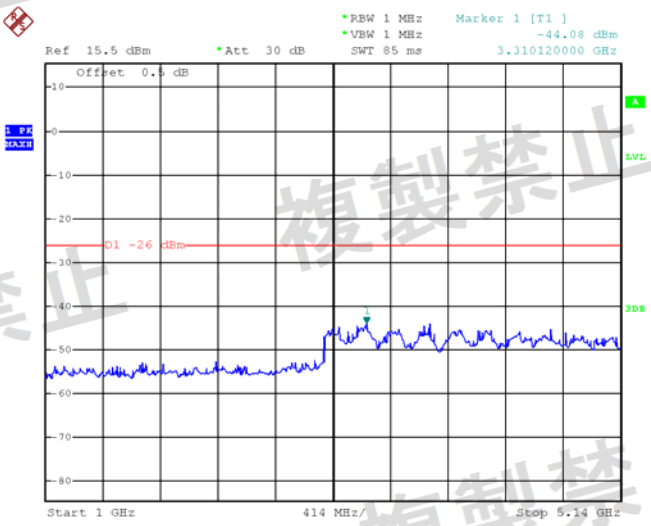


802.11ac-VHT20 High Channel 5.36-26GHz

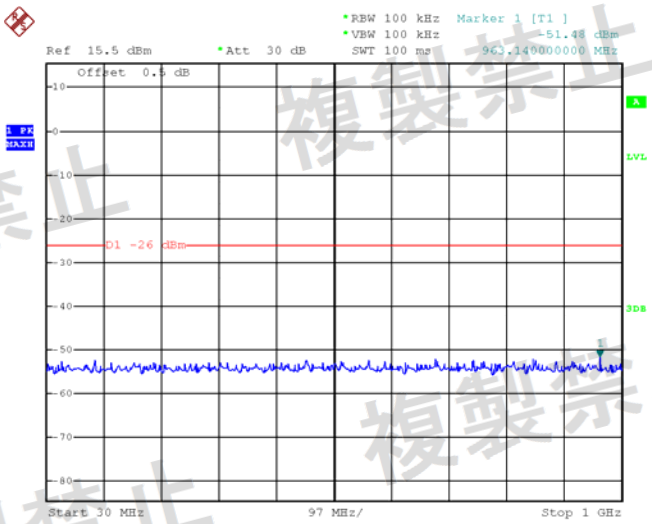

802.11n-HT40 Low Channel 0.03-5.1GHz

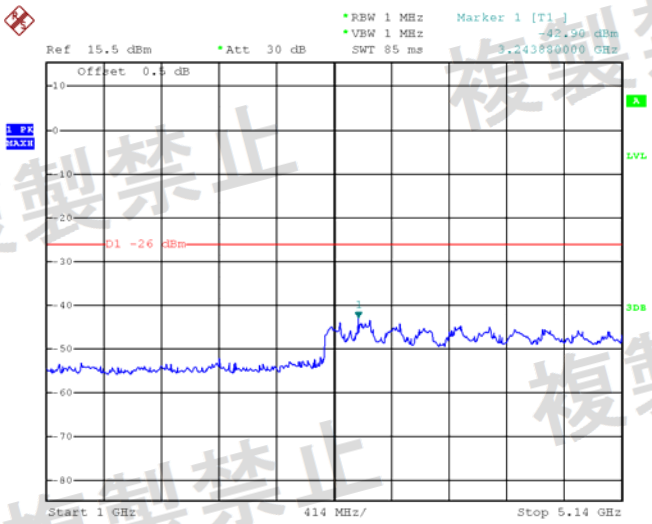




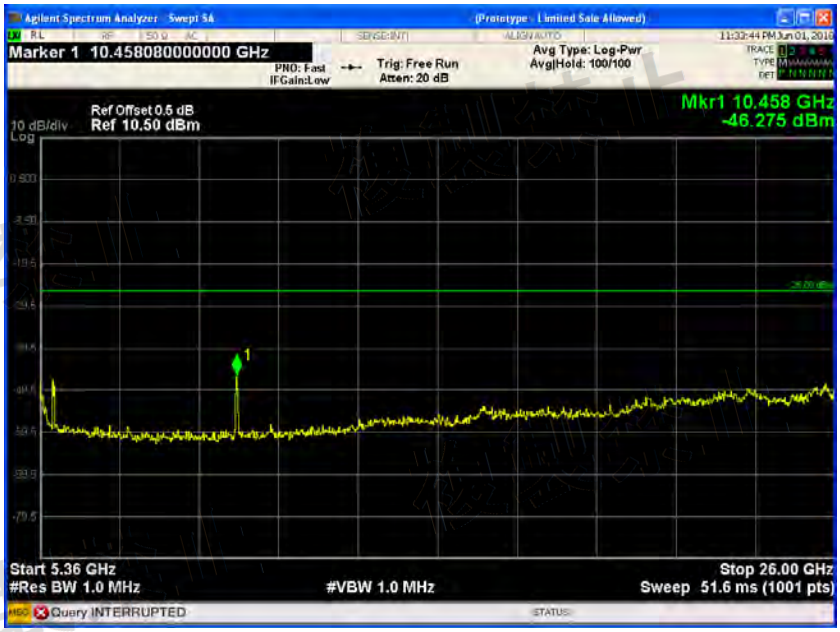

802.11n-HT40 Low Channel 5.4-26GHz

802.11n-HT40 High Channel 0.03-5.1GHz

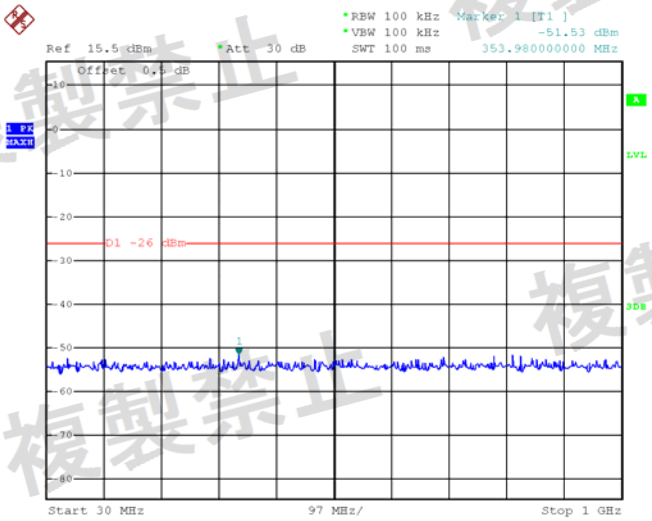


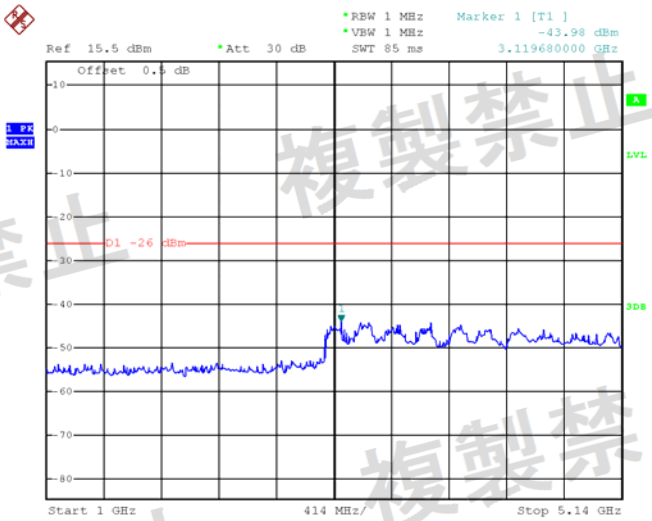



802.11n-HT40 High Channel 5.4-26GHz



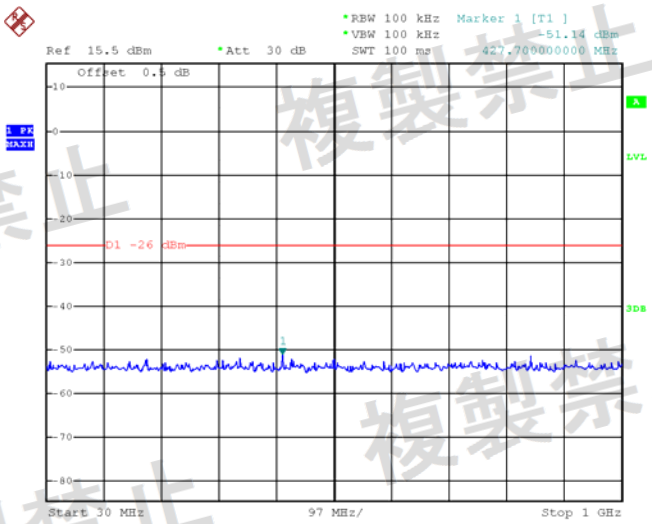

802.11ac-VHT40 Low Channel 0.03-5.1GHz

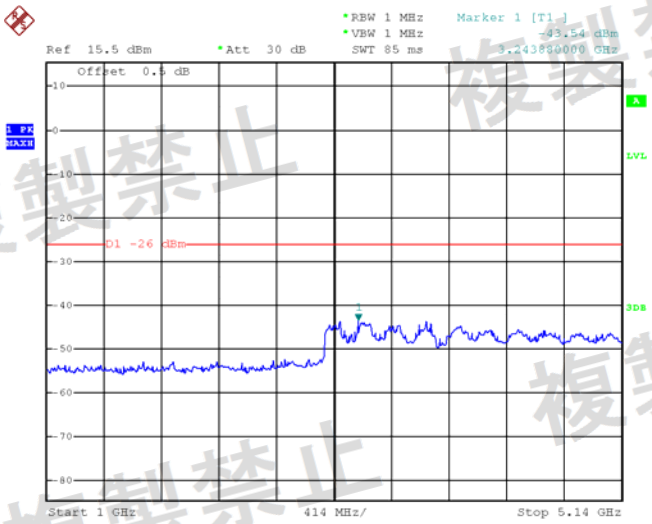





802.11ac-VHT40 Low Channel 5.4-26GHz

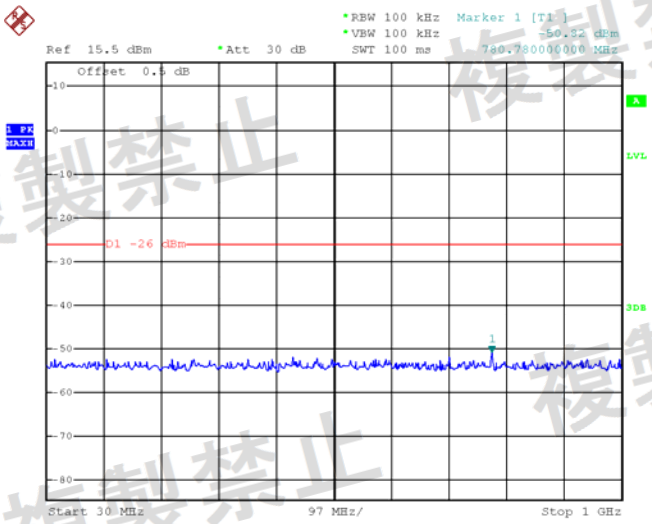
802.11ac-VHT40 High Channel 0.03-5.1GHz

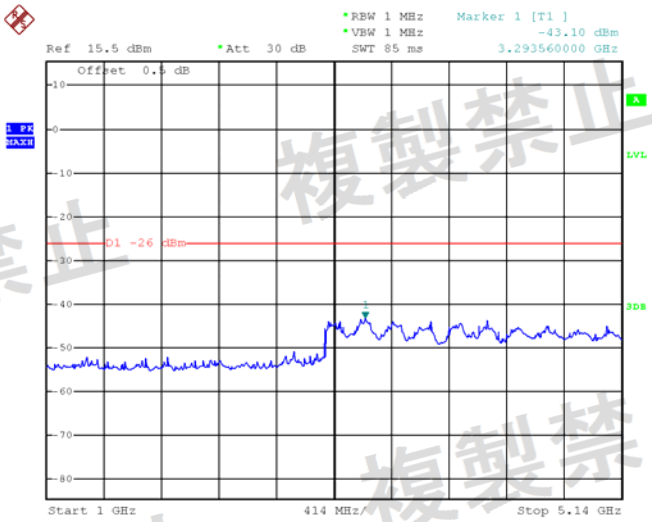


802.11ac-VHT40 High Channel 5.4-26GHz


802.11ac-VHT80 Low Channel 0.03-5.1GHz






802.11ac-VHT80 Low Channel 5.4-26GHz

## 7.8 Adjacent Channel Emitted Power

### 7.8.1 Test Requirement

Article 2-1

### 7.8.2 Limit

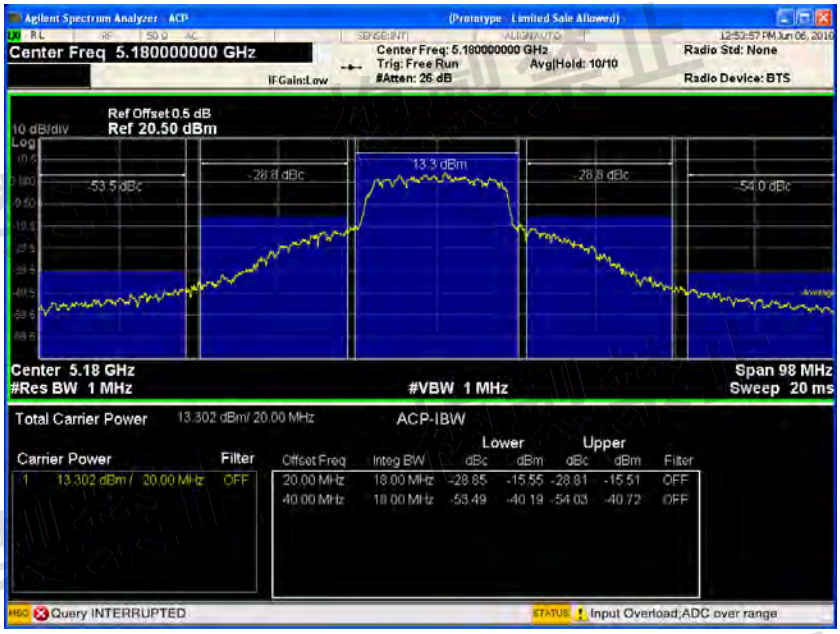
According to Article 2-1,for HT20, the average power radiated from the carrier frequency in a band of ± 9 MHz frequency apart 20MHz and 40MHz is a low value, respectively 25dB and 40dB higher than that of the carrier wave. for HT40, the average power radiated from the carrier frequency in a band of ± 9 MHz frequency apart 40MHz and 80MHz is a low value, respectively 25dB and 40dB higher than that of the carrier wave.

### 7.8.3 Test Result

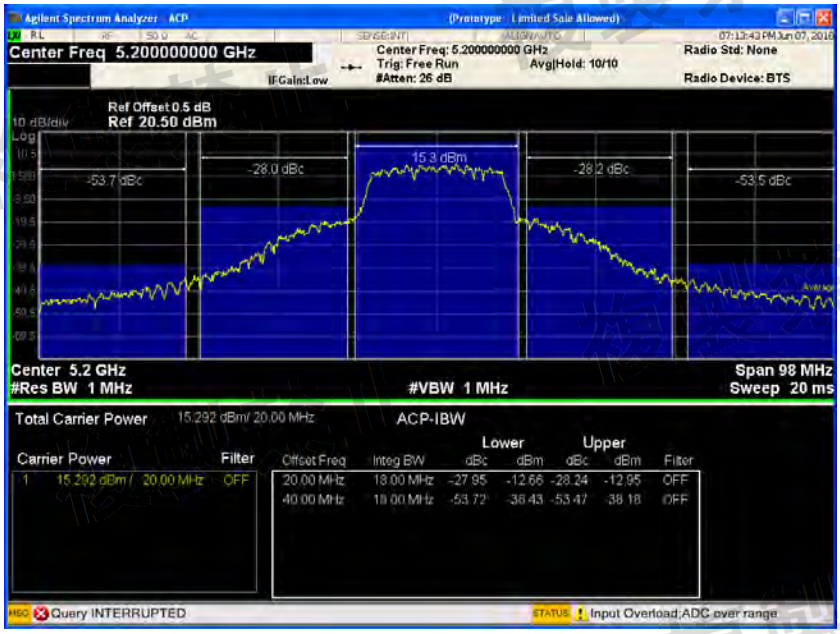
| Modulation | Channel | Test Mode | Test Result |
|---|---|---|---|
| 802.11a | Low | Transmitting | PASS |
| | Middle | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11n-HT20 | Low | Transmitting | PASS |
| | Middle | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11ac-VHT20 | Low | Transmitting | PASS |
| | Middle | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11n-HT40 | Low | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11ac-VHT40 | Low | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11ac-VHT80 | Low | Transmitting | PASS |

Test Plots

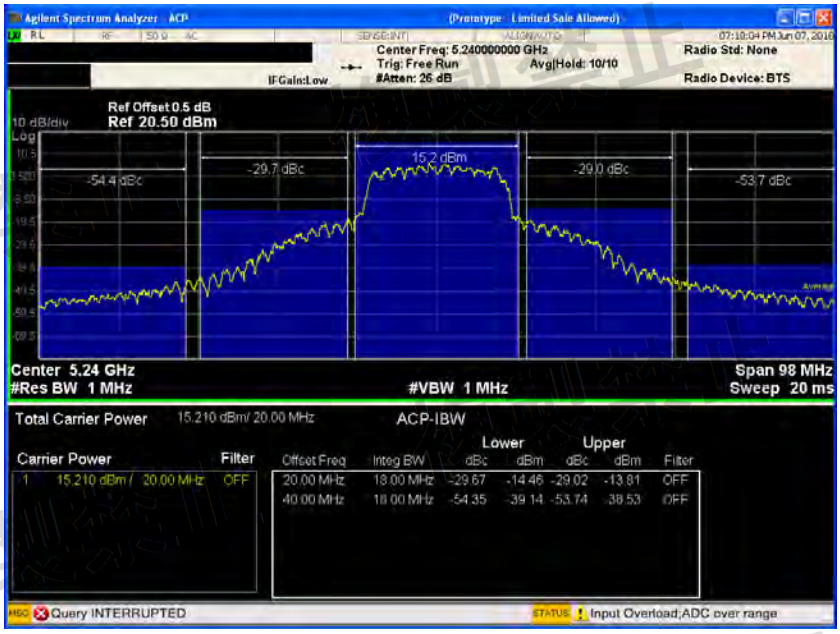
802.11a Low Channel



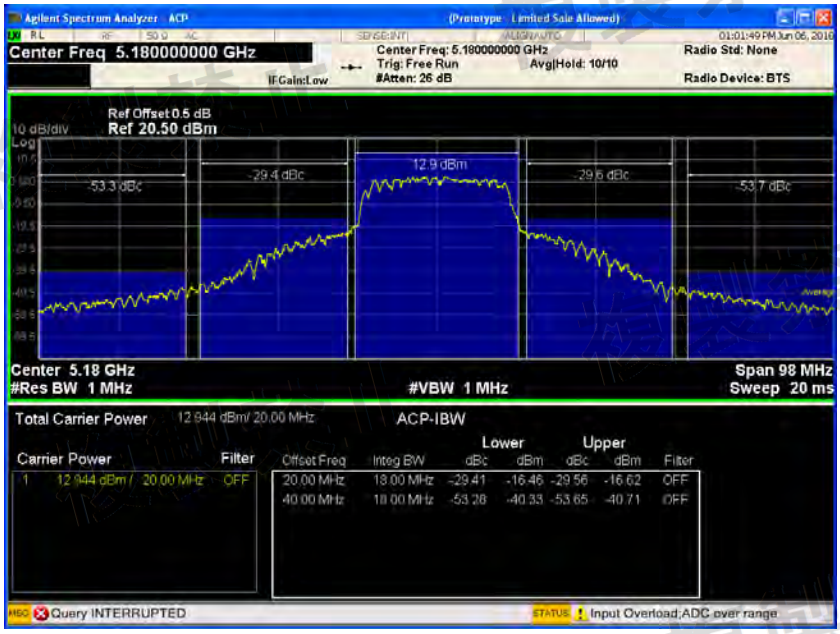

802.11a Middle Channel



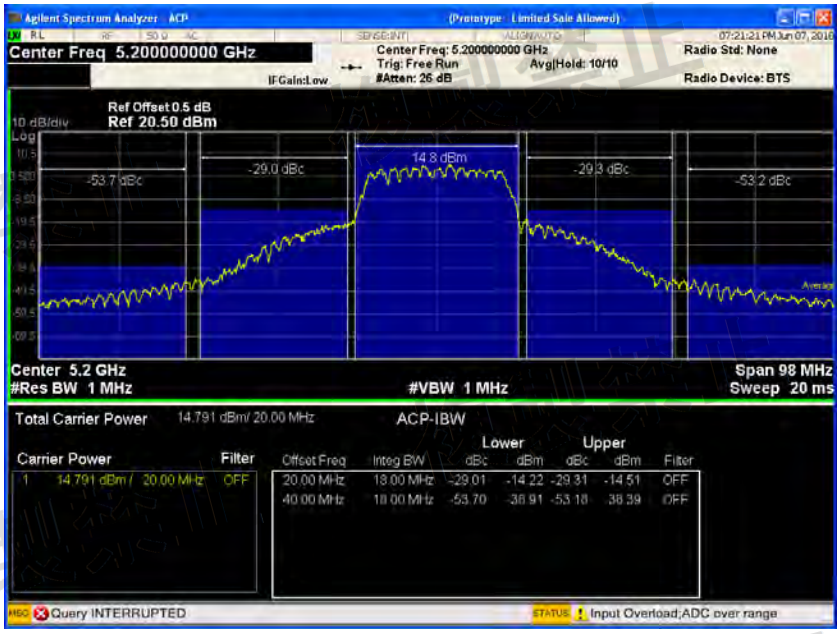
802.11a High Channel



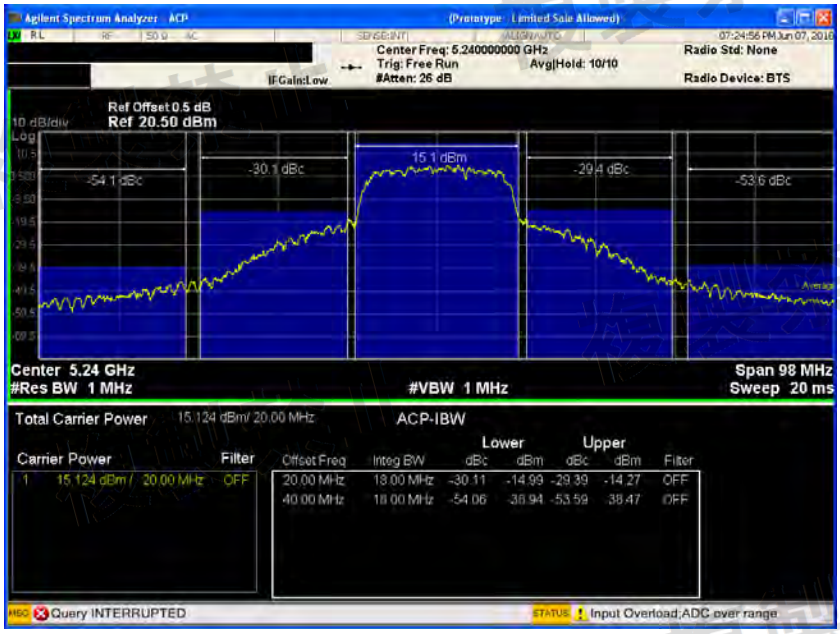

802.11n-HT20 Low Channel



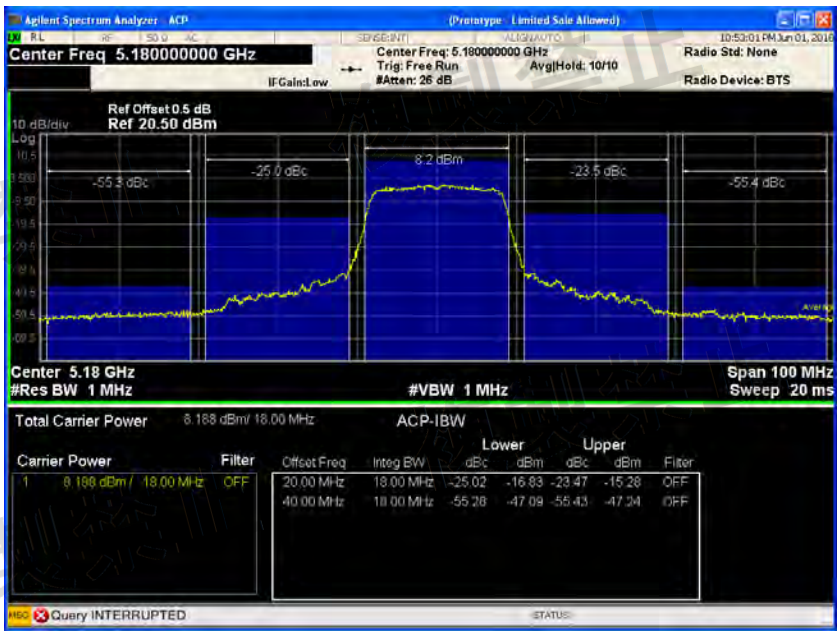
802.11n-HT20 Middle Channel



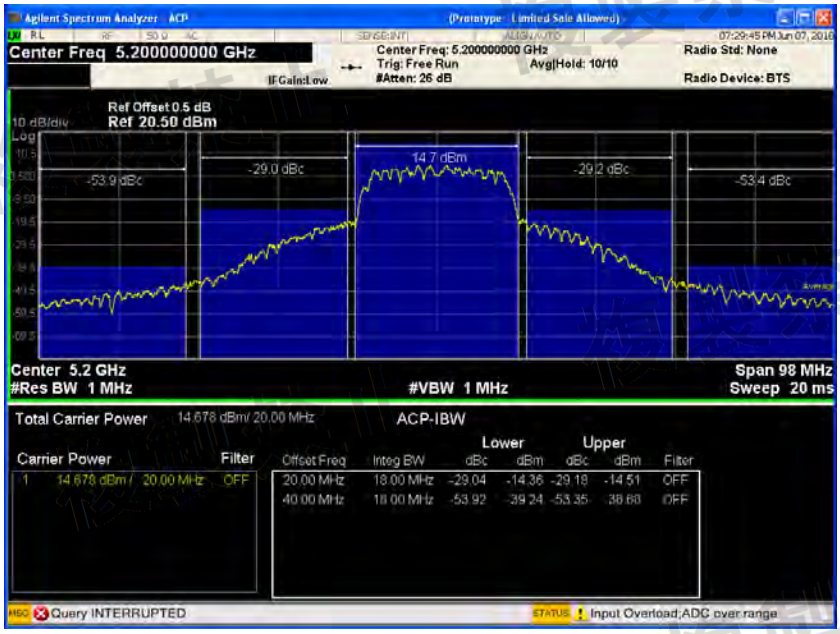

802.11n-HT20 High Channel



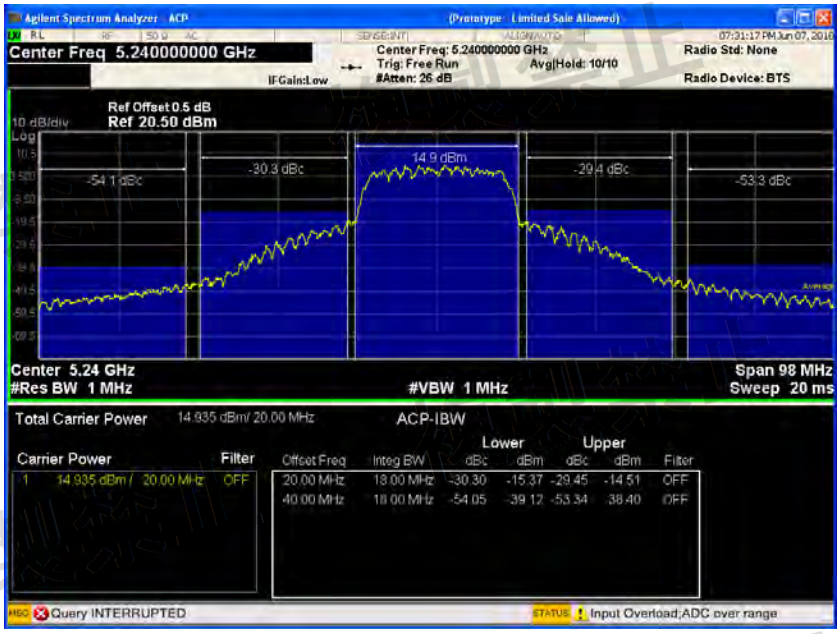
802.11ac-VHT20 Low Channel



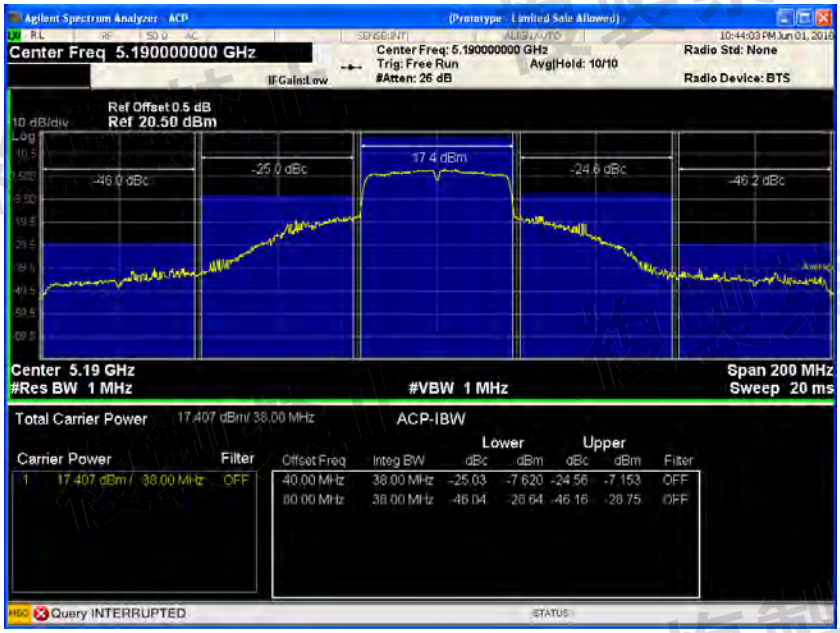

802.11ac-VHT20 Middle Channel



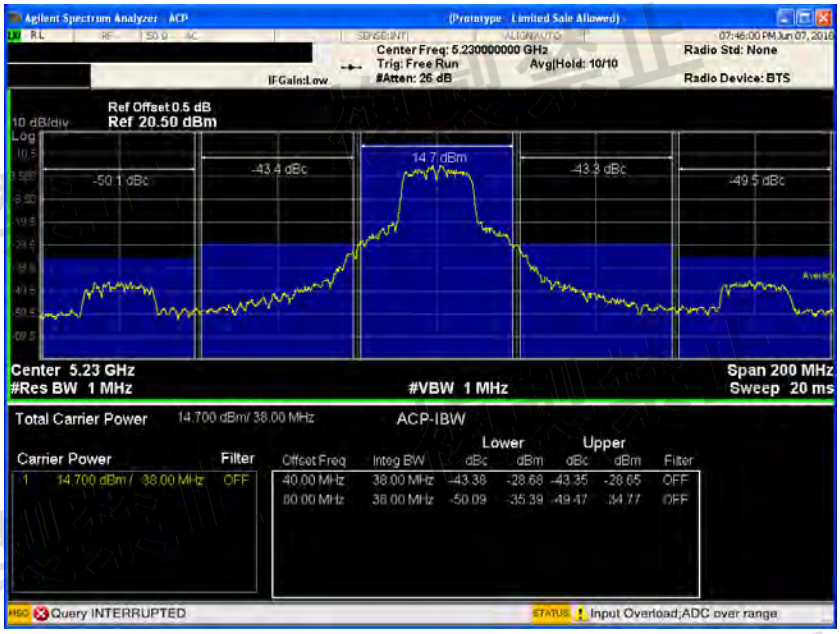
802.11ac-VHT20 High Channel




802.11n-HT40 Low Channel

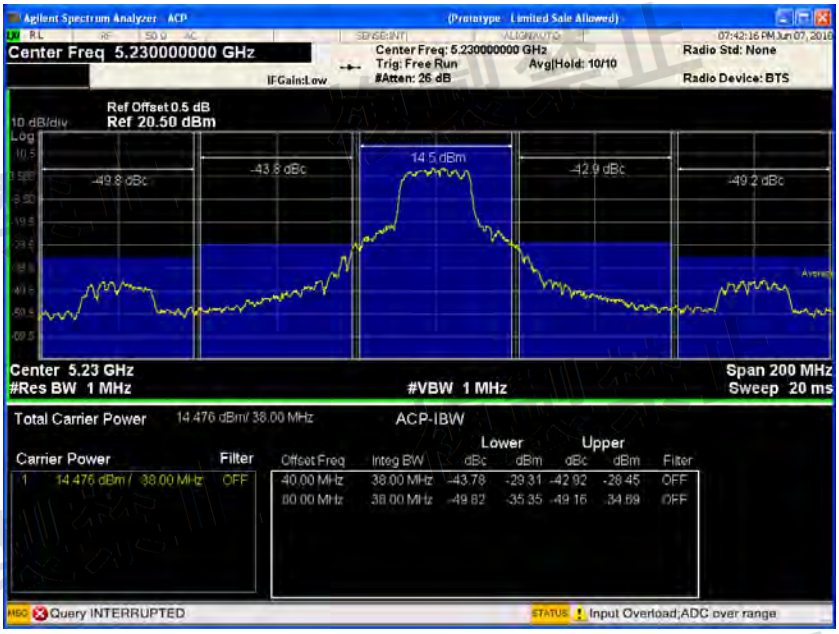


802.11n-HT40 High Channel




802.11ac-VHT40 Low Channel

802.11n-VHT40 High Channel




802.11ac-VHT80 Low Channel

## 7.9 Out-band Leakage Power

### 7.9.1 Test Requirement

Article 2-1.

### 7.9.2 Limit

The limit refer to Article 2-1.Follow as:

HT 20:

5140MHz ≤ fo ≤ 5142MHz; 2.5uW/MHz

5142MHz < fo ≤ 5150MHz; 15uW/MHz

5250MHz ≤ fo < 5251MHz;

$10^{1-(f-9)}$ mW/MHz

5251MHz ≤ fo < 5260MHz;

$10^{-1-(8/90)(f-11)}$ mW/MHz

5260MHz ≤ fo < 5266.7MHz;

$10^{-1.8-(6/50)(f-20)}$ mW/MHz

f = fo - (5240MHz)

5266.7MHz ≤ fo ≤ 5360MHz; 2.5uW/MHz

HT 40:

5100MHz ≤ fo ≤ 5142MHz; 2.5uW/MHz

5142MHz < fo ≤ 5150MHz; 15uW/MHz

5250MHz ≤ fo < 5251MHz;

$10^{-(f-20)+\log(1/2)}$ mW/MHz

5251MHz ≤ fo < 5270MHz;

$10^{-(8/190)(f-21)-1+\log(1/2)}$ mW/MHz

5270MHz ≤ fo < 5275.8MHz;

$10^{-(17/200)(f-40)-1.8+\log(1/2)}$ mW/MHz

f = fo - (5230MHz)

5275.8MHz ≤ fo ≤ 5400MHz; 2.5uW/MHz

**HT 80:**

30MHz~5020MHz: ≤2.5uW/MHz;

5020MHz~5123.2MHz: ≤2.5uW/MHz;

5123.2MHz~5150MHz: ≤15uW/MHz;

5250MHz~5251MHz:

$10^{-(f-40)+\log(1/4)}$ mW/MHz

5251MHz~5290MHz:

$10^{-(8/390)(f-41)-1+\log(1/4)}$ mW/MHz

5290MHz~5296.7MHz:

$10^{-(3/100)(f-80)-1.8+\log(1/4)}$ mW/MHz

5296.7MHz~5480MHz: ≤2.5uW/MHz

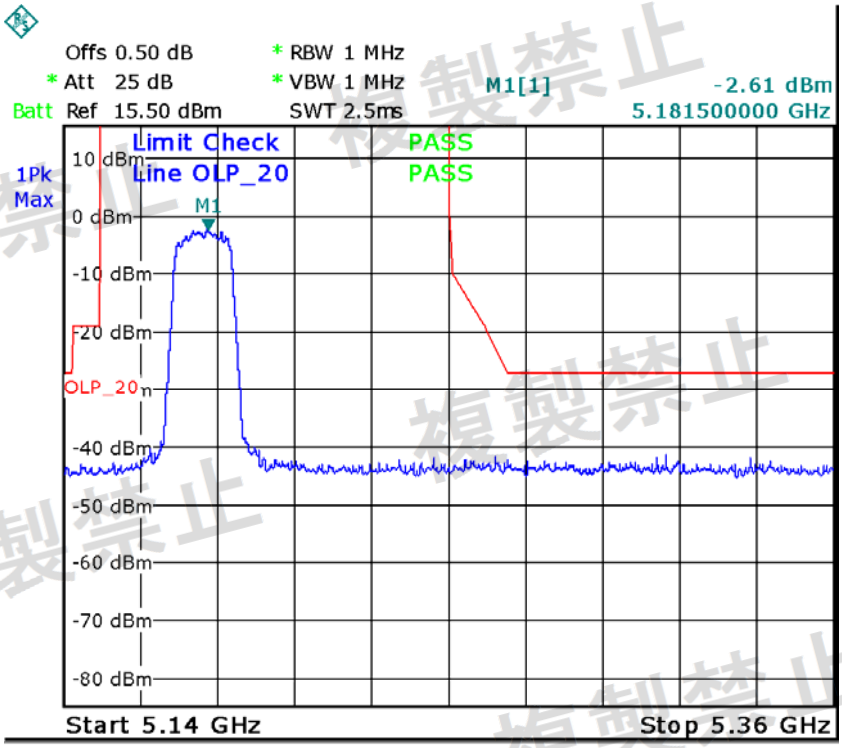
5480MHz~26500MHz: ≤2.5uW/MHz

### 7.9.3 Test Result

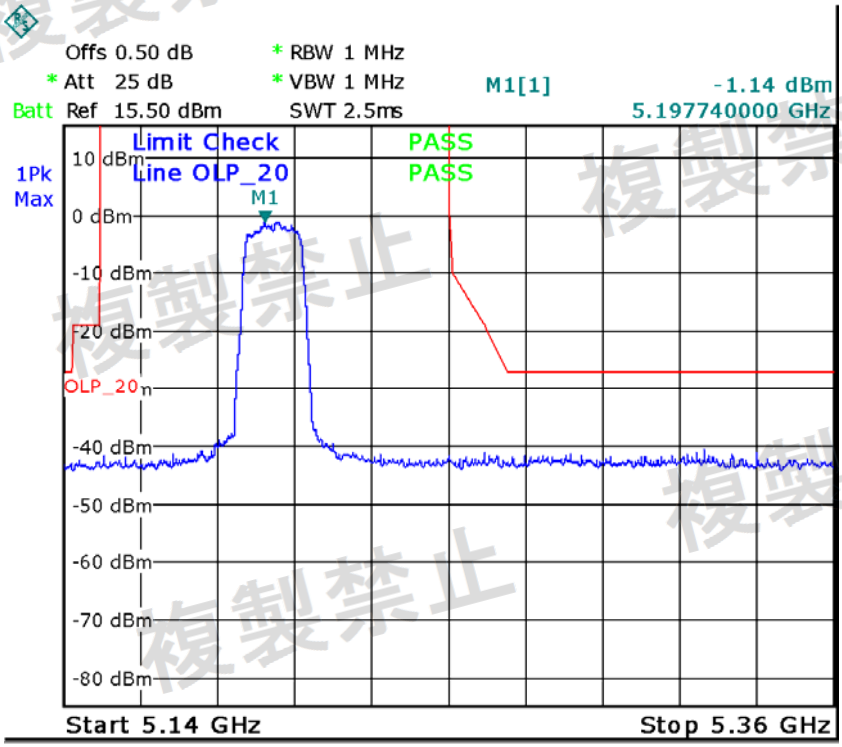
| Modulation | Channel | Test Mode | Test Result |
|---|---|---|---|
| 802.11a | Low | Transmitting | PASS |
| | Middle | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11n-HT20 | Low | Transmitting | PASS |
| | Middle | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11ac-VHT20 | Low | Transmitting | PASS |
| | Middle | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11n-HT40 | Low | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11ac-VHT40 | Low | Transmitting | PASS |
| | High | Transmitting | PASS |
| 802.11ac-VHT80 | Low | Transmitting | PASS |

Test Plots

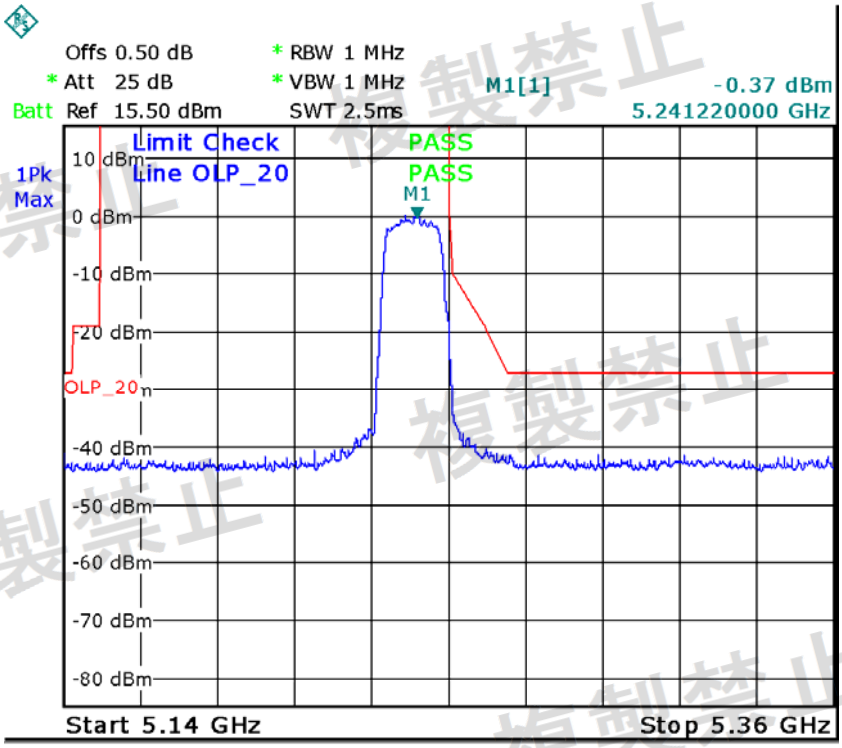
802.11a Low Channel



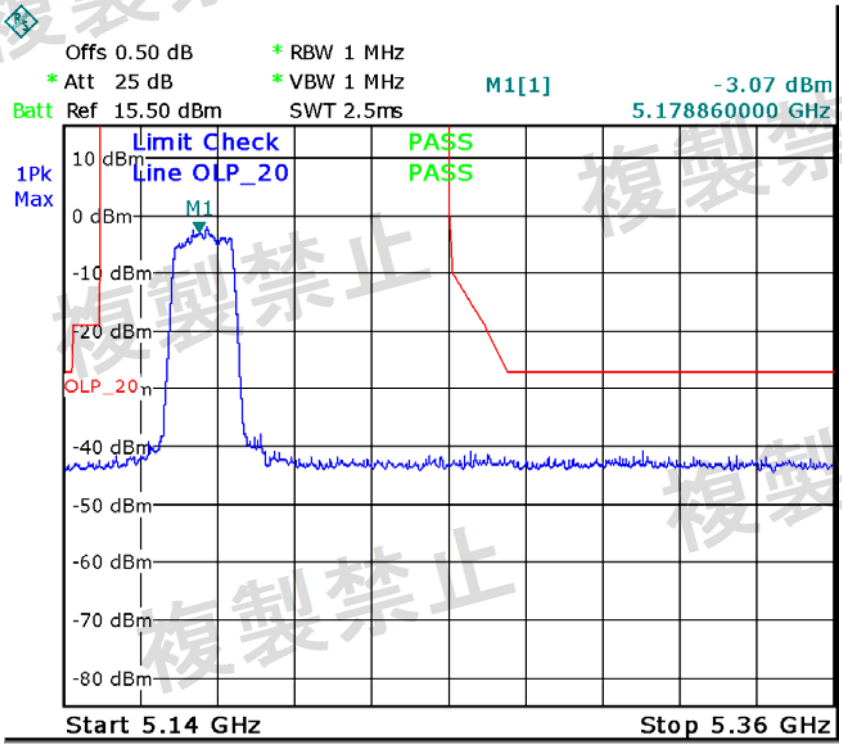

802.11a Middle Channel



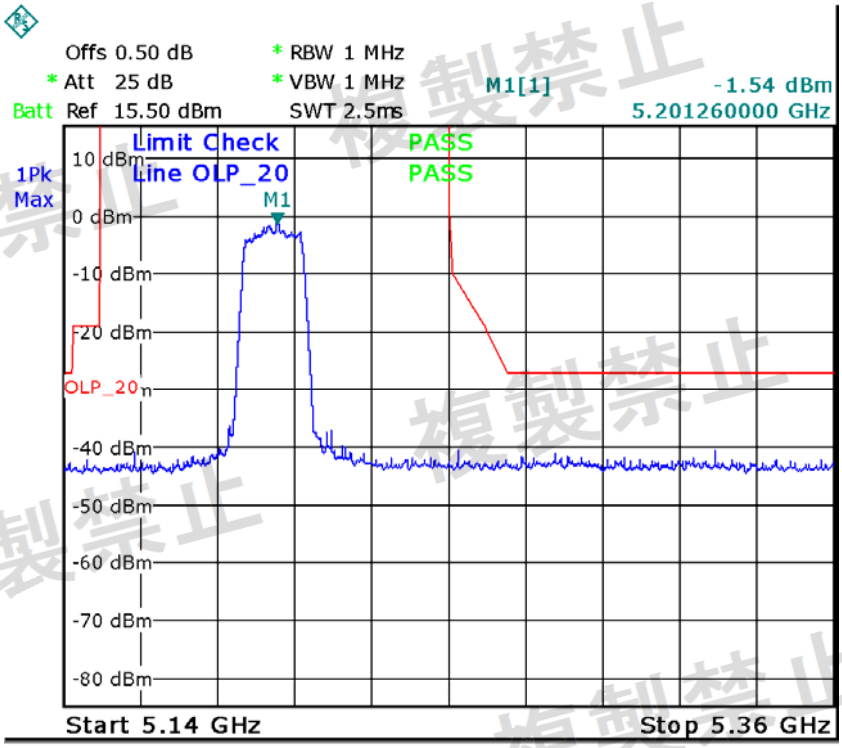
802.11a High Channel



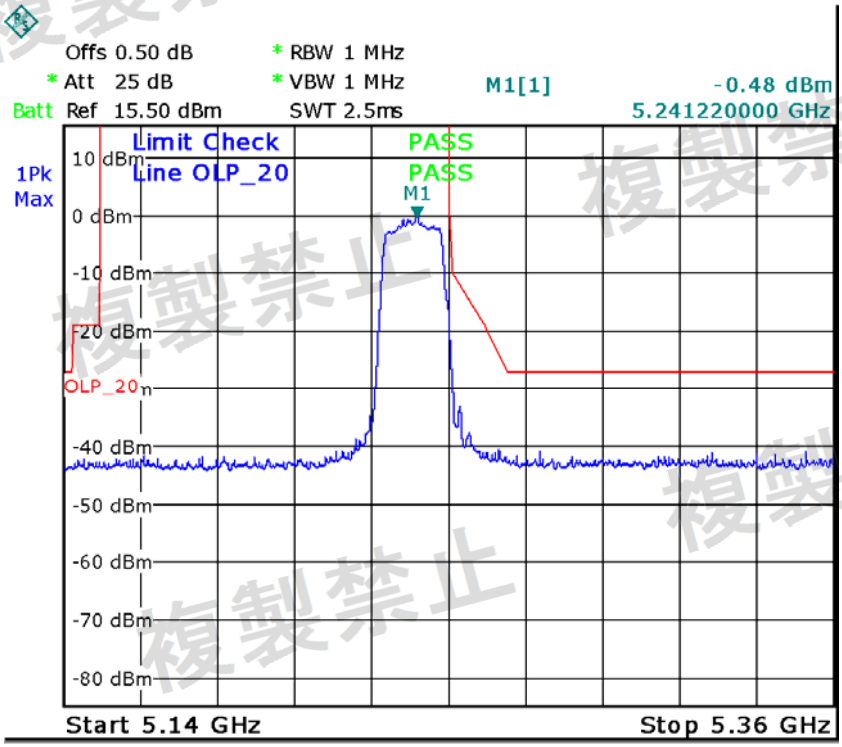

802.11n-HT20 Low Channel



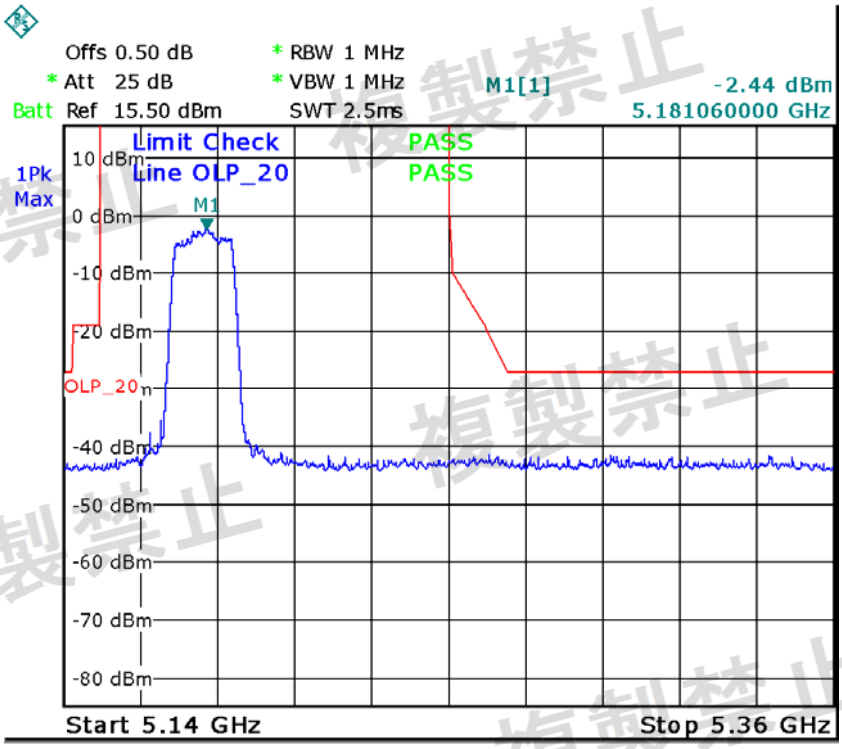
802.11n-HT20 Middle Channel



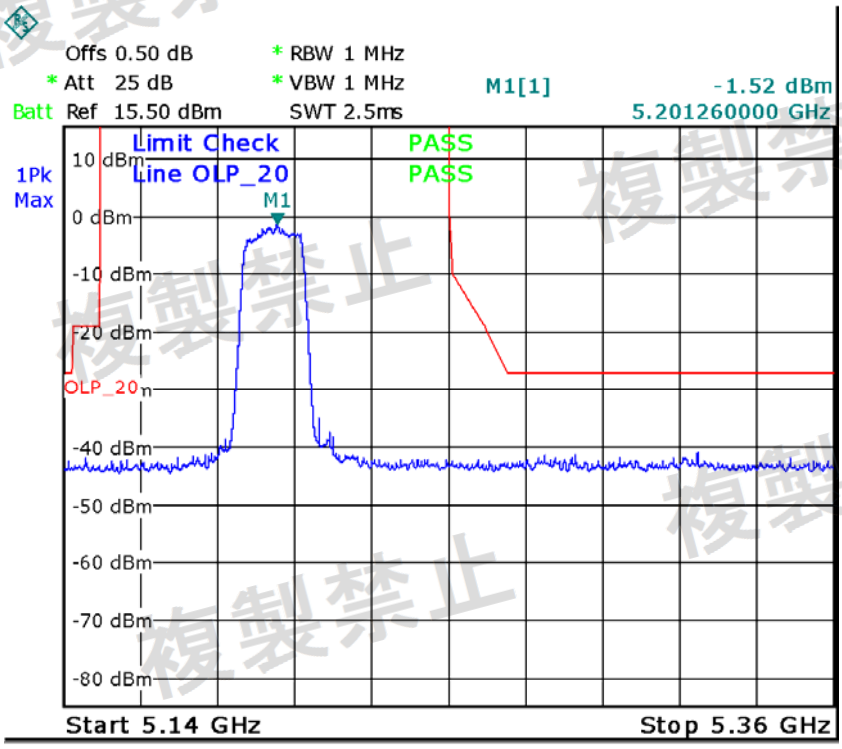

802.11n-HT20 High Channel



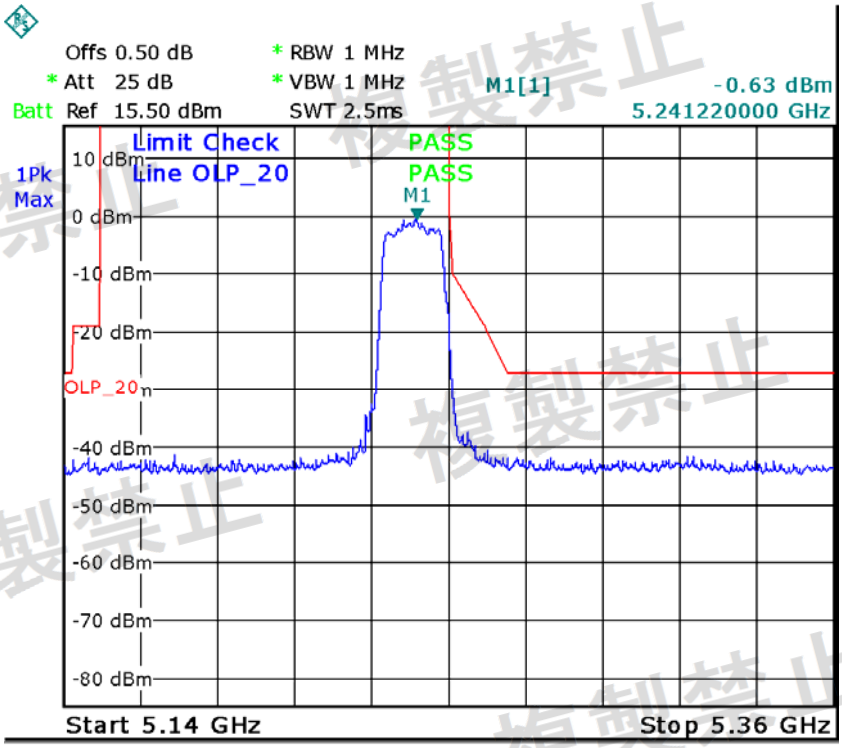
802.11ac-VHT20 Low Channel



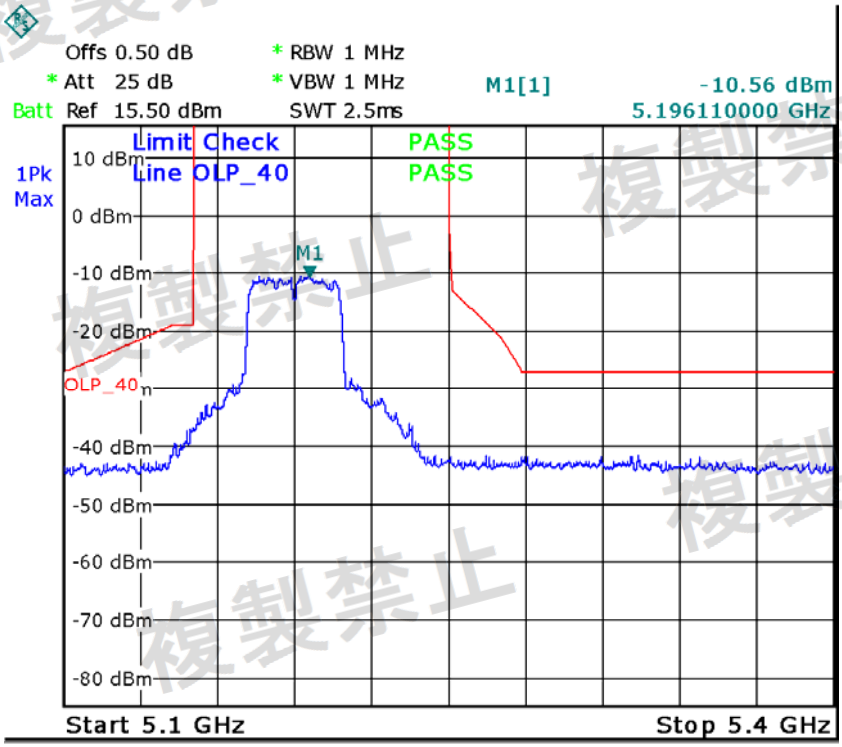

802.11ac-VHT20 Middle Channel



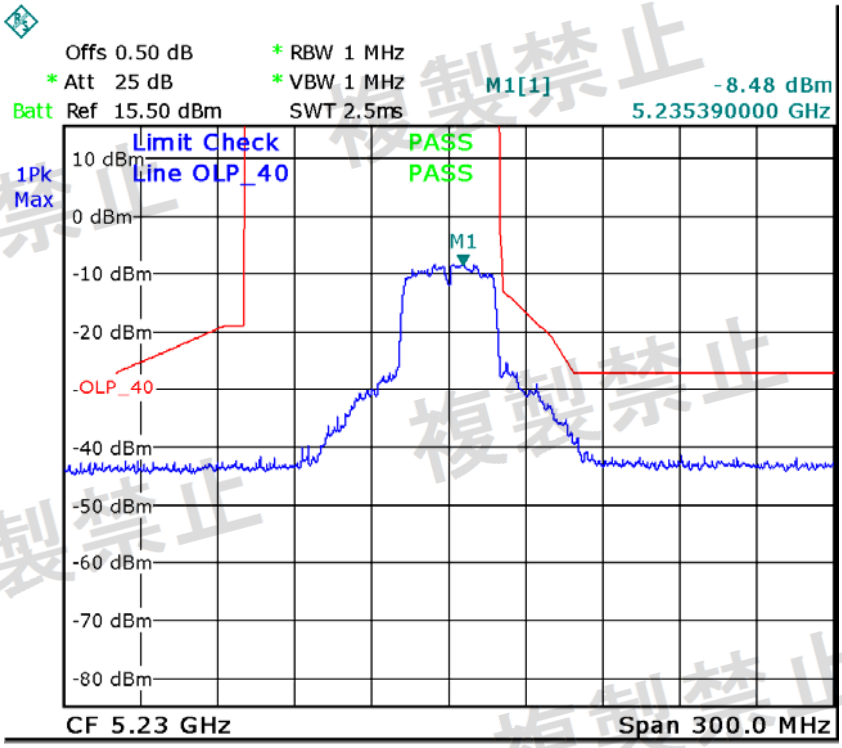
802.11ac-VHT20 High Channel



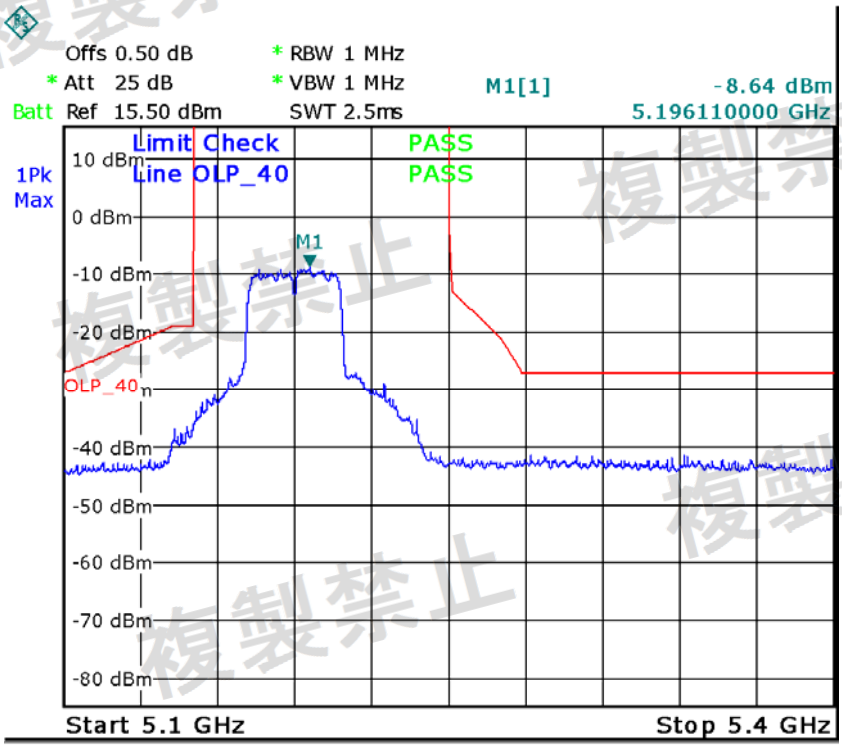

802.11n-HT40 Low Channel



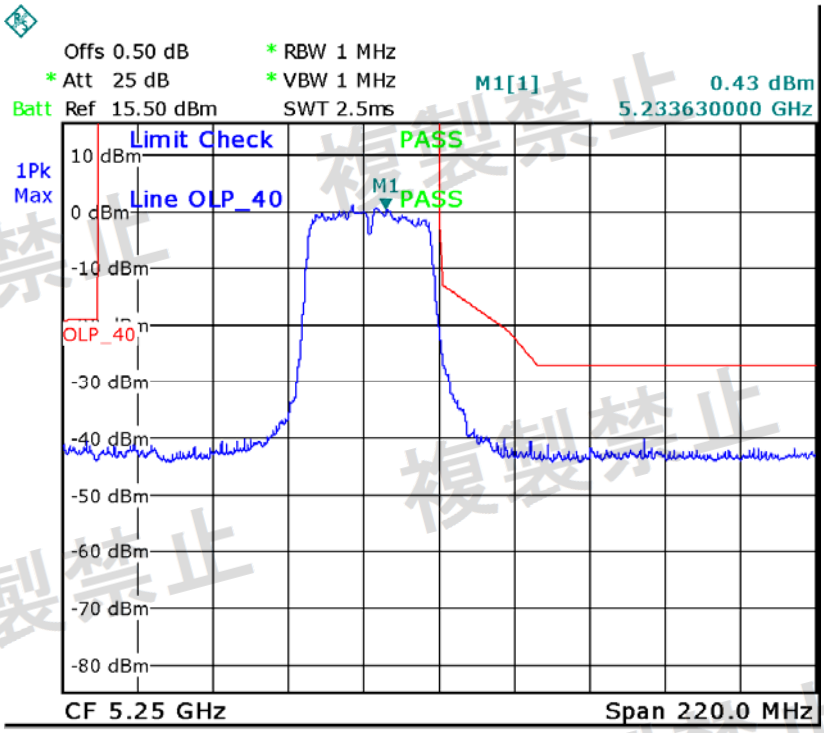
802.11n-HT40 High Channel



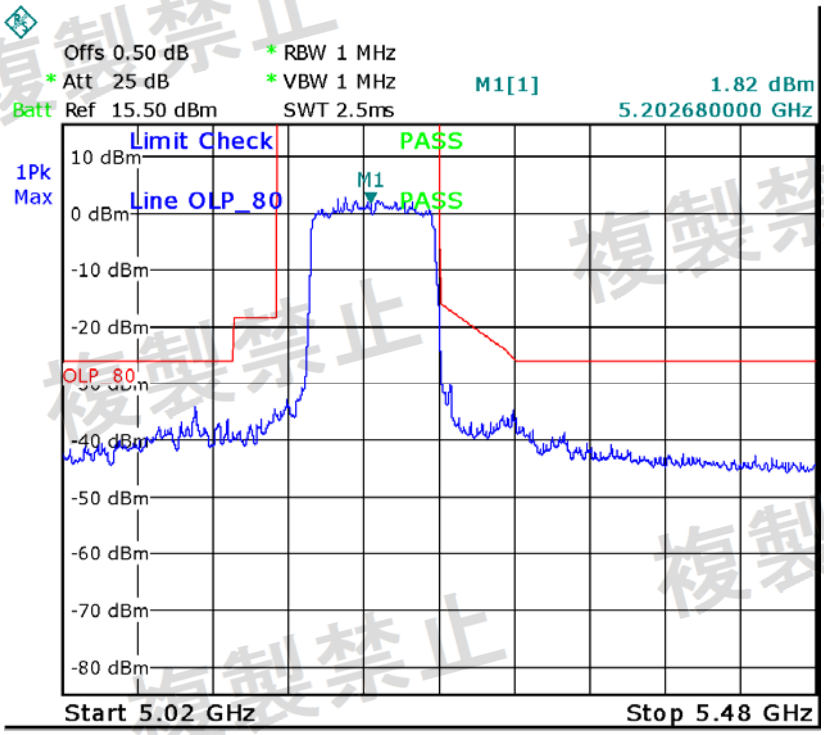

802.11ac-VHT40 Low Channel



802.11ac-VHT40 High Channel




802.11ac-VHT80 Low Channel



# 8 Measurements of Receiving Equipment

## 8.1 Secondary Radiated Emissions

### 8.1.1 Test Requirement

Article 2-1.

### 8.1.2 Limit

According to Article 2-1., the limit as follow:

below 1GHz:4nW or less;.

above 1GHz:20nW or less.

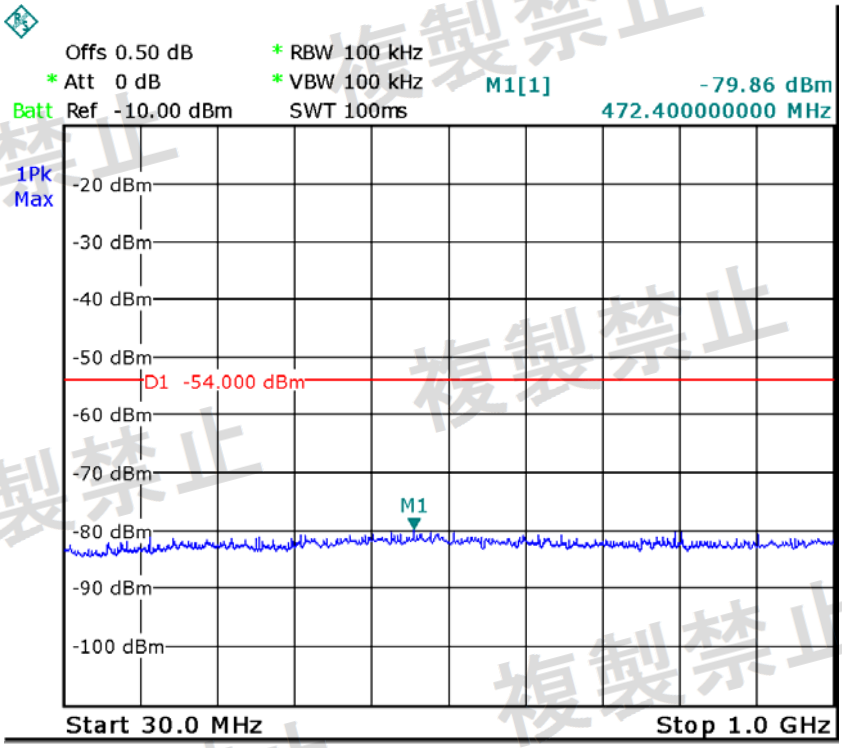
### 8.1.3 Test Result

| Modulation | Channel | Test Mode | Test Result |
|---|---|---|---|
| 802.11a | Low | Receiving | PASS |
| | Middle | Receiving | PASS |
| | High | Receiving | PASS |
| 802.11n-HT20 | Low | Receiving | PASS |
| | Middle | Receiving | PASS |
| | High | Receiving | PASS |
| 802.11ac-VHT20 | Low | Receiving | PASS |
| | Middle | Receiving | PASS |
| | High | Receiving | PASS |
| 802.11n-HT40 | Low | Receiving | PASS |
| | High | Receiving | PASS |
| 802.11ac-VHT40 | Low | Receiving | PASS |
| | High | Receiving | PASS |
| 802.11ac-VHT80 | Low | Receiving | PASS |
| Note: The result only show the worst mode. | | | |

802.11ac

Low Channel

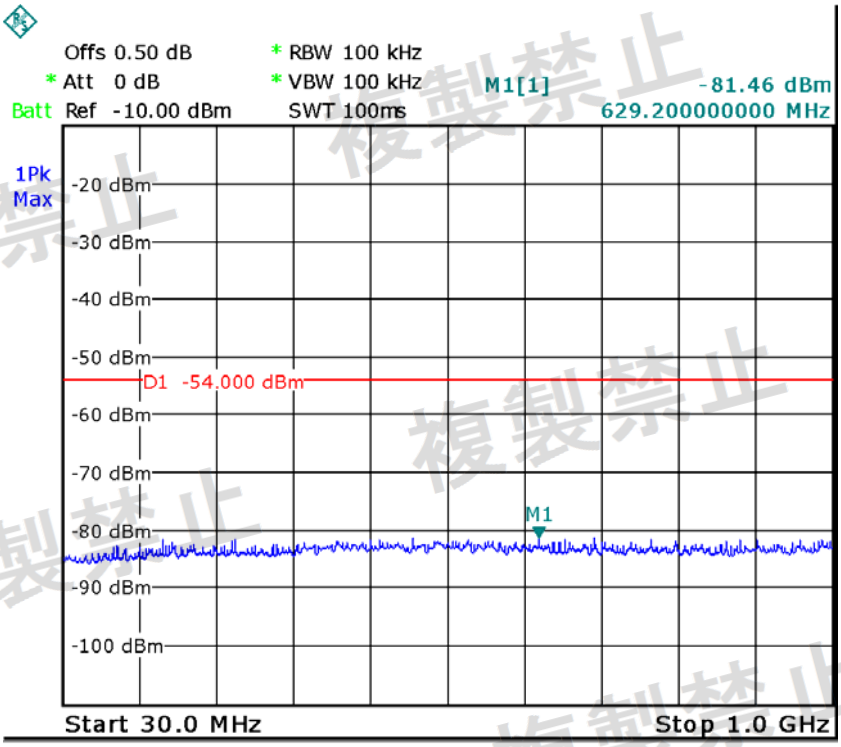
0.03-1GHz



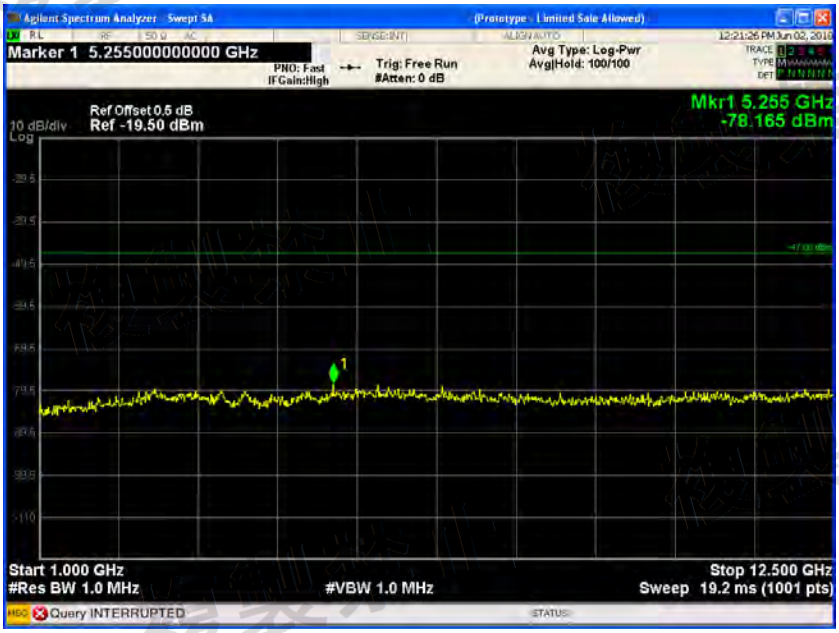

Low Channel

1-12.5GHz

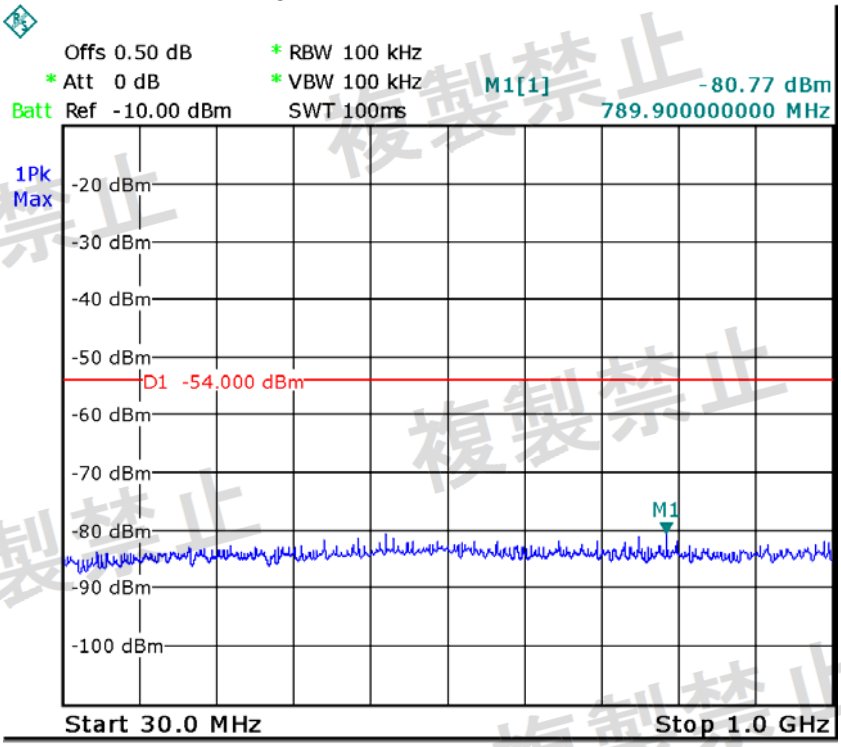
Middle Channel 0.03-1GHz



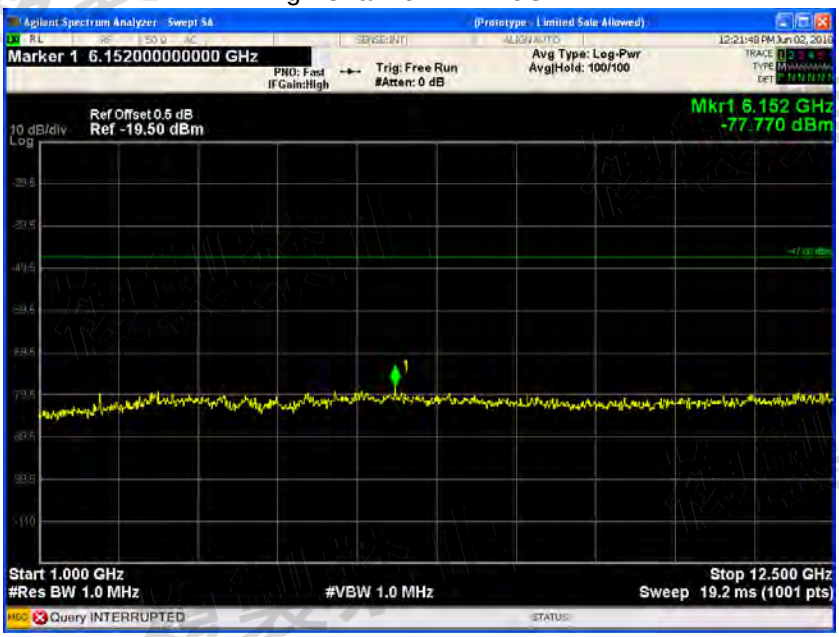

Middle Channel 1-12.5GHz



High Channel 0.03-1GHz




High Channel 1-12.5GHz



# 9 Measurements of Controlling Equipment

## 9.1 Interference prevention function

### 9.1.1 Test Requirement

Article 2-1.

### 9.1.2 Conditions etc. of test equipment

(1) The demodulator shall be able to demodulate the transmitting signal from the radio equipment and display contents of the identification code.

(2) The opposite equipment shall be able to transmit the identification code as same as the transmitting signal from the radio equipment

### 9.1.3 Test Procedure

(1) The radio equipment with automatic transmitting function of identification code A. Transmit the assigned identification code from the radio equipment. B. Confirm the identification code received by the demodulator.

(2) The radio equipment with automatic receiving function of identification code A. Transmit the assigned identification code from the opposite equipment.

### 9.1.4 Test Result

| Item | Modulation | Test mode | Results |
|---|---|---|---|
| Identification code | 802.11a | transmitting | PASS |
| Identification code | 802.11n-HT20 | transmitting | PASS |
| Identification code | 802.11ac-VHT20 | transmitting | PASS |
| Identification code | 802.11n-HT40 | transmitting | PASS |
| Identification code | 802.11ac-VHT40 | transmitting | PASS |
| Identification code | 802.11ac-VHT80 | transmitting | PASS |

## 9.2 Carrier Sensing Function

### 9.2.1 Test Requirement

Article 2-1.

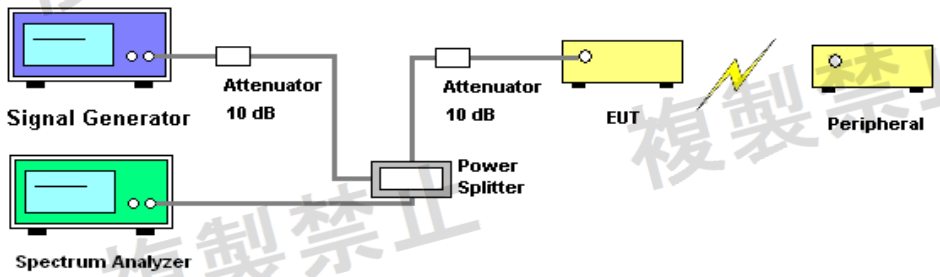
| Item | Limits |
|---|---|
| Carrier Sense | Good – EUT stop RF transmission signal after carrier inject to EUT. (On 22.79+Gr-20*log (f)[dBm] (Gr: dBi; f: MHz) or 100mV/m) |

### 9.2.2 Conditions etc. of test equipment

Please refer to section 6 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| RB / VB | 1 MHz |
| Span | 0 MHz |
| Sweep | Continuous |
| Detector | Peak |
| Trigger mode | Video |

### 9.2.3 Test Setup Layout




### 9.2.4 Test Procedure

(1) SSG adjusted the frequency as same as the EUT transmitted signal and emitted the absence of modulation from SSG and power level is (On 22.79+Gr-20*log (f) [dBm] (Gr: dBi; f: MHz). Then turn off the RF signal of SSG.

(2) EUT have transmitted the maximum modulation signal and fixed channelize.

(3) Setting of SA is following as: RB: 1MHz / VB: 1MHz / SPAN: 0MHz / AT: 10dB /Ref: 0dBm / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak.

(4) SSG RF Signal On.

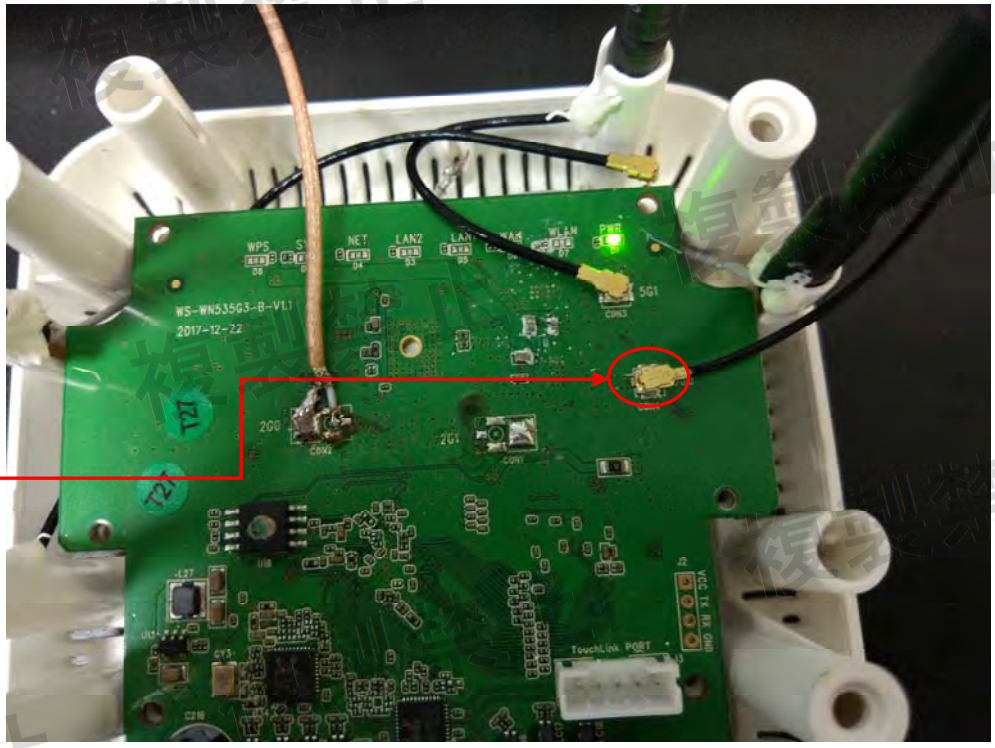
(5) EUT shall be stop the transmitted any signal and SSG RF Signal Off. Then EUT will be continuous transmitted signal.

### 9.2.5 Test Result

Good.

Note: The register value-R30 which control the carrier sense level is 11 00 00 00.

# 10 Test Setup Photos



## 11 Photographs - Constructional Details

Refer to Annex WTS18S04109771W-Photos.

======End of Report======