# FCC RADIO TEST REPORT
# FCC ID: 2AIQPAP220

| | |
|---|---|
| **Product：** | WiFi Router |
| **Trade Name：** | N/A |
| **Model Name：** | AP220 |
| **Serial Model：** | N/A |
| **Report No.：** | POCE- 2016050222R2 |

**Prepared for**

Shenzhen Scalene-link Technology Co., Ltd

307 Room, HongKong University of Science and Technology Chanxueyan Building, Yuexing 1st Road, Nan Shan District, Shenzhen, China

**Prepared by**

Shenzhen POCE Technology Co.,Ltd.

Room 502, Bldg. 1, Xinghua Garden, Baoan Road Xixiang, Baoan District,Shenzhen, China

# TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| **Applicant's name** | : | Shenzhen Scalene-link Technology Co., Ltd |
| Address | : | 307 Room, HongKong University of Science and Technology Chanxueyan Building, Yuexing 1st Road, Nan Shan District,Shenzhen, China |
| **Manufacture's Name** | : | Shenzhen Scalene-link Technology Co., Ltd |
| Address | : | 307 Room, HongKong University of Science and Technology Chanxueyan Building, Yuexing 1st Road, Nan Shan District,Shenzhen, China |
| **Product description** | | |
| Product name | : | WiFi Router |
| Model and/or type reference | : | AP220 |
| **Standards** | : | FCC Part15.407: 01 Oct. 2015 |
| Test procedure | | ANSI C63.10-2013 and KDB 789033 D02 General UNII Test Procedures New Rules v01r01 |

This device described above has been tested by POCE, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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| | | |
|---|---|---|
| **Date of Test** | : | |
| Date (s) of performance of tests | : | 27 May. 2016 ~30 May. 2016 |
| Date of Issue | : | 30 May. 2016 |
| Test Result | : | **Pass** |

Testing Engineer : 

(Ken Li)

Technical Manager : 

(Jimmy Yao)

Authorized Signatory : 

(Terry Yang)

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## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

| FCC Part15 (15.247) , Subpart C | | | |
|---|---|---|---|
| Standard Section | Test Item | Judgment | Remark |
| 15.207 | AC Power Line Conducted Emissions | PASS | |
| 15.407 (a)(1)<br>15.407 (a)(3)<br>15.1049 | 26 dB and 99% Emission Bandwidth | PASS | |
| 15.407(e) | Minimum 6 dB bandwidth | PASS | |
| 15.407 (a)(1)<br>15.407 (a)(3) | Maximum Conducted Output Power | PASS | |
| 15.209(a),<br>15.407 (b)(1)<br>15.407 (b)(4)<br>15.407 (b)(6) | Radiated Spurious Emission | PASS | |
| 15.407 (a)(1)<br>15.407 (a)(3) | Power Spectral Density | PASS | |
| 2.1051,<br>15.407(b)(1)<br>15.407(b)(4) | Band Edge Emission | PASS | |
| 2.1051,<br>15.407(b) | Spurious Emissions at Antenna Terminals | PASS | |
| 15.203 | Antenna Requirement | PASS | |

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

## 1.1 TEST FACILITY

Shenzhen POCE Technology Co.,Ltd.

Add.: Room 502, Bldg. 1, Xinghua Garden, Baoan Road Xixiang, Baoan District, Shenzhen, China

FCC-Registration No.: 222278

## 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y ± U**，where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**，providing a level of confidence of approximately **95** %。

| No. | Item | Uncertainty |
|---|---|---|
| 1 | Conducted Emission Test | ±1.38dB |
| 2 | RF power,conducted | ±0.16dB |
| 3 | Spurious emissions,conducted | ±0.21dB |
| 4 | All emissions,radiated(<1G) | ±4.68dB |
| 5 | All emissions,radiated(>1G) | ±4.89dB |
| 6 | Temperature | ±0.5°C |
| 7 | Humidity | ±2% |

# 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF EUT

<table>
<tr><td>Equipment</td><td>WiFi Router</td></tr>
<tr><td>Trade Name</td><td>N/A</td></tr>
<tr><td>Model Name</td><td>AP220</td></tr>
<tr><td>Serial Model</td><td>N/A</td></tr>
<tr><td>Model Difference</td><td>N/A</td></tr>
<tr><td>Product Description</td><td>The EUT is a WiFi Router
<table>
<tr><td>Operation Frequency:</td><td>5745-5825 MHz for 802.11a/n(HT20);<br>5755-5795 MHz for 802.11n(HT40);</td></tr>
<tr><td>Modulation Type:</td><td>OFDM with BPSK/QPSK/16QAM/<br>64QAM for 802.11a/n;</td></tr>
<tr><td>Bit Rate of Transmitter</td><td>802.11 a: 6,9,12,18,24,36,48,54Mbps;<br>802.11n(HT20):MCS0-MCS7;<br>802.11n(HT40):MCS8-MCS15;</td></tr>
<tr><td>Number Of Channel</td><td>5 channels for 802.11a/(HT20) in the 5745-5825MHz band ;<br>3 channels for 802.11a/(HT40) in the 5755-5795MHz band</td></tr>
<tr><td>Antenna Designation:</td><td>Please see Note 3.</td></tr>
<tr><td>Output Power(Conducted):</td><td>802.11a: 19.78 dBm (Max.)<br>802.11n(20M) : 23.57dBm (Max.)<br>802.11n(40M) : 21.52 dBm (Max.)</td></tr>
</table></td></tr>
<tr><td>Channel List</td><td>Please refer to the Note 2.</td></tr>
<tr><td>Adapter</td><td>Model:TPT30S54A-PW<br>Input: AC 100-240V, 50/60Hz, 0.5A<br>Output:DC 54V, 0.55A</td></tr>
</table>

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.

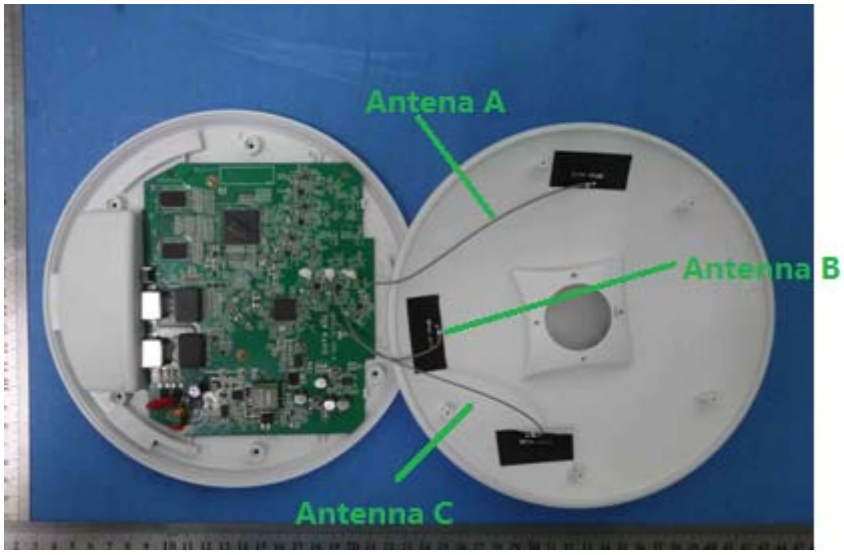
| 802.11a/n( 20 MHz) Carrier Frequency Channel | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 149 | 5745 | 153 | 5765 | 157 | 5785 | 161 | 5805 |
| 165 | 5825 | | | | | | |

| 802.11n 40MHz Carrier Frequency Channel | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 151 | 5755 | 155 | 5775 | 159 | 5795 | -- | -- |

3.

Table for Filed Antenna

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) | NOTE |
|---|---|---|---|---|---|---|
| A | N/A | N/A | Internal Antenna | N/A | 1.1 | Wifi Antenna |
| B | N/A | N/A | Internal Antenna | N/A | 1.1 | Wifi Antenna |
| C | N/A | N/A | Internal Antenna | N/A | 1.1 | Wifi Antenna |




The Control software(tool_WIFI.exe) can control antenna A B C ,

For 5GHz mode, antenna A B C are transmitting, three antennas simultaneously transmit in MIMO mode.And the data is recorded for radiated emission and band edge.

For MIMO mode , Directional gain=GANT +10log(N)dbi =5.87dbi in 5GHz

## 2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

| Pretest Mode | Description |
|---|---|
| Mode 1 | 802.11a(CH149/ CH157/ CH 165) |
| Mode 2 | n 20 (CH149/ CH157/ CH 165) |
| Mode 3 | 802.11n40( CH 151 / CH 159) |
| Mode 4 | Link Mode |

| **For Conducted Emission** | |
|---|---|
| Final Test Mode | Description |
| Mode 4 | Link Mode |

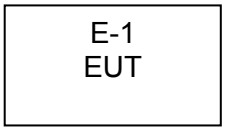
| **For Radiated Emission** | |
|---|---|
| Final Test Mode | Description |
| Mode 1 | 802.11a(CH149/ CH157/ CH 165) |
| Mode 2 | n 20 (CH149/ CH157/ CH 165) |
| Mode 3 | 802.11n40( CH 151 / CH 159) |
| Mode 4 | Link Mode |

Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

(2) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported

## 2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



## 2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Item | Equipment | Brand | Model/Type No. | Series No. | Note |
|---|---|---|---|---|---|
| E-1 | WiFi Router | N/A | AP220 | N/A | EUT |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Item | Shielded Type | Ferrite Core | Length | Note |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Note:

(1) The support equipment was authorized by Declaration of Confirmation.
(2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.

## 2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test equipment

| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until | Calibration period |
|---|---|---|---|---|---|---|---|
| 1 | Spectrum Analyzer | Agilent | E4407B | MY45108040 | 2015.07.06 | 2016.07.05 | 1 year |
| 2 | Test Receiver | R&S | ESPI | 101318 | 2015.06.07 | 2016.06.06 | 1 year |
| 3 | Bilog Antenna | TESEQ | CBL6111D | 31216 | 2015.07.06 | 2016.07.05 | 1 year |
| 4 | 50Ω Coaxial Switch | Anritsu | MP59B | 6200264416 | 2015.06.07 | 2016.06.06 | 1 year |
| 5 | Spectrum Analyzer | ADVANTEST | R3132 | 150900201 | 2015.06.07 | 2016.06.06 | 1 year |
| 6 | Horn Antenna | EM | EM-AH-10180 | 2011071402 | 2015.07.06 | 2016.07.05 | 1 year |
| 7 | Horn Ant | Schwarzbeck | BBHA 9170 | 9170-181 | 2015.07.06 | 2016.07.05 | 1 year |
| 8 | Amplifier | EM | EM-30180 | 060538 | 2015.12.22 | 2016.12.21 | 1 year |
| 9 | Loop Antenna | ARA | PLA-1030/B | 1029 | 2015.06.08 | 2016.06.07 | 1 year |
| 10 | Power Meter | R&S | NRVS | 100696 | 2015.07.06 | 2016.07.05 | 1 year |
| 11 | Power Sensor | R&S | URV5-Z4 | 0395.1619.05 | 2015.07.06 | 2016.07.05 | 1 year |
| 12 | Signal Analyzer | Agilent | N9020A | MY49100060 | 2015.07.06 | 2016.07.05 | 1 year |

Conduction Test equipment

| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until | Calibration period |
|---|---|---|---|---|---|---|---|
| 1 | Test Receiver | R&S | ESCI | 101160 | 2015.06.06 | 2016.06.05 | 1 year |
| 2 | LISN | R&S | ENV216 | 101313 | 2015.08.24 | 2016.08.23 | 1 year |
| 3 | LISN | EMCO | 3816/2 | 00042990 | 2015.08.24 | 2016.08.23 | 1 year |
| 4 | 50Ω Coaxial Switch | Anritsu | MP59B | 6200264417 | 2015.06.07 | 2016.06.06 | 1 year |
| 5 | Passive Voltage Probe | R&S | ESH2-Z3 | 100196 | 2015.06.07 | 2016.06.06 | 1 year |
| 6 | Absorbing clamp | R&S | MOS-21 | 100423 | 2015.06.08 | 2016.06.07 | 1 year |

# 3. EMC EMISSION TEST

## 3.1 CONDUCTED EMISSION MEASUREMENT

### 3.1.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

| FREQUENCY (MHz) | Class A (dBuV) | | Class B (dBuV) | | Standard |
|---|---|---|---|---|---|
| | Quasi-peak | Average | Quasi-peak | Average | |
| 0.15 -0.5 | 79.00 | 66.00 | 66 - 56 * | 56 - 46 * | CISPR |
| 0.50 -5.0 | 73.00 | 60.00 | 56.00 | 46.00 | CISPR |
| 5.0 -30.0 | 73.00 | 60.00 | 60.00 | 50.00 | CISPR |

| | | | | | |
|---|---|---|---|---|---|
| 0.15 -0.5 | 79.00 | 66.00 | 66 - 56 * | 56 - 46 * | FCC |
| 0.50 -5.0 | 73.00 | 60.00 | 56.00 | 46.00 | FCC |
| 5.0 -30.0 | 73.00 | 60.00 | 60.00 | 50.00 | FCC |

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

| Receiver Parameters | Setting |
|---|---|
| Attenuation | 10 dB |
| Start Frequency | 0.15 MHz |
| Stop Frequency | 30 MHz |
| IF Bandwidth | 9 kHz |

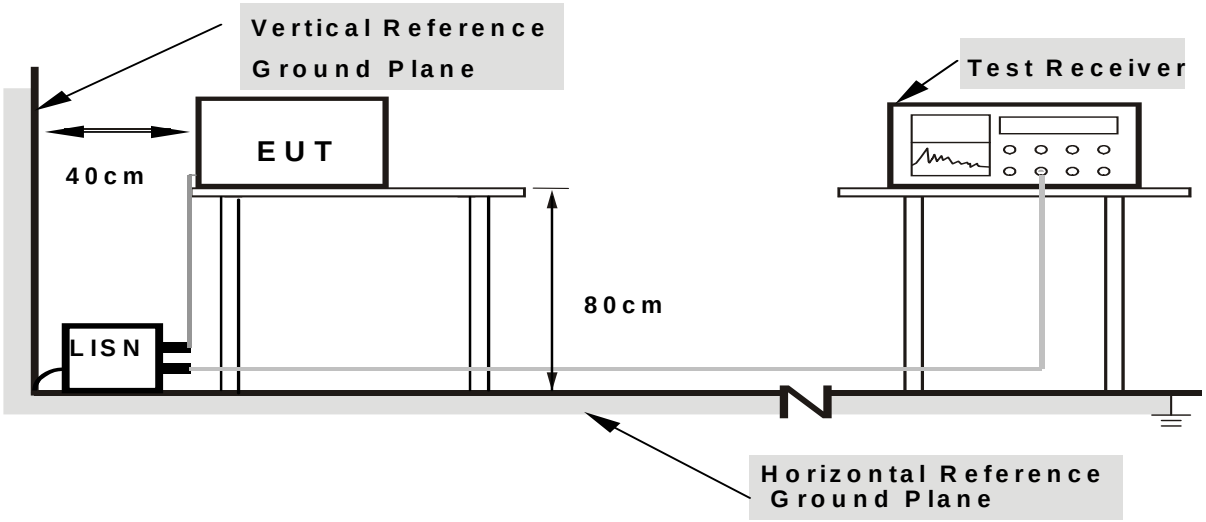
### 3.1.2 TEST PROCEDURE

a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

### 3.1.3 DEVIATION FROM TEST STANDARD

No deviation

### 3.1.4 TEST SETUP




Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

### 3.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

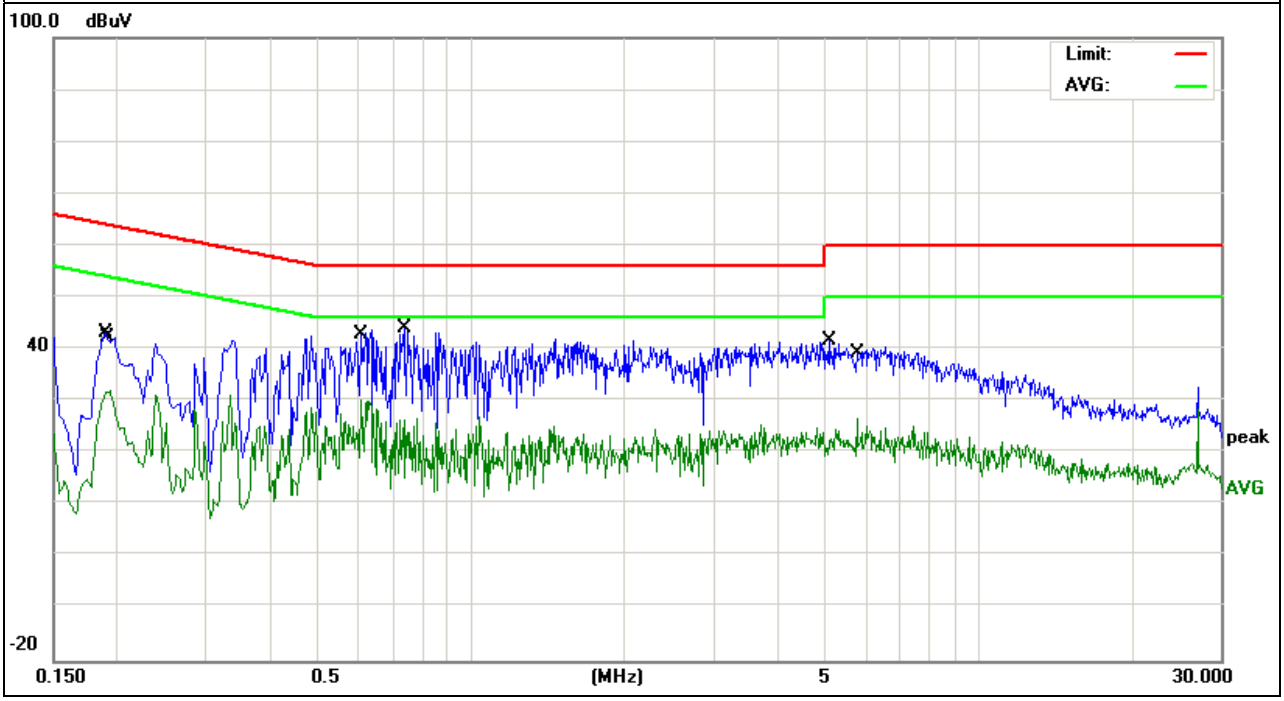
### 3.1.6 TEST RESULTS

| | | | |
|---|---|---|---|
| EUT： | WiFi Router | Model Name. ： | AP220 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010hPa | Phase： | L |
| Test Voltage ： | AC 120V/60Hz | Test Mode： | Mode 5 |

| Frequency | Reading Level | Correct Factor | Measure-ment | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV) | (dBμV) | (dB) | |
| 0.19 | 32.86 | 10.4 | 43.26 | 64.03 | -20.77 | QP |
| 0.194 | 21.54 | 10.41 | 31.95 | 53.86 | -21.91 | AVG |
| 0.6058 | 19.92 | 10.4 | 30.32 | 46 | -15.68 | AVG |
| 0.7378 | 33.61 | 10.41 | 44.02 | 56 | -11.98 | QP |
| 5.0579 | 30.91 | 10.67 | 41.58 | 60 | -18.42 | QP |
| 5.7458 | 15.89 | 10.67 | 26.56 | 50 | -23.44 | AVG |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

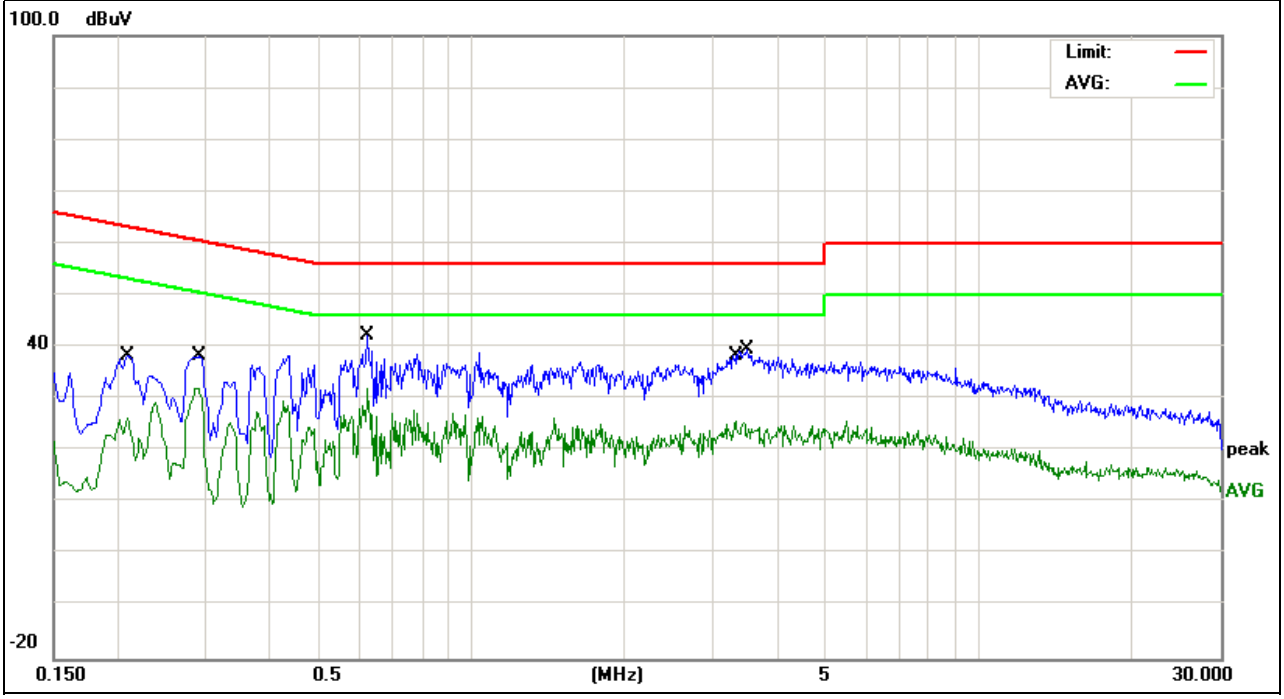


| | | | |
|---|---|---|---|
| EUT： | WiFi Router | Model Name. ： | AP220 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010hPa | Phase： | L |
| Test Voltage ： | AC 120V/60Hz | Test Mode： | Mode 4 |

| Frequency | Reading Level | Correct Factor | Measure-ment | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV) | (dBμV) | (dB) | |
| 0.2099 | 28.01 | 10.44 | 38.45 | 63.21 | -24.76 | QP |
| 0.2859 | 21.65 | 10.43 | 32.08 | 50.64 | -18.56 | AVG |
| 0.626 | 31.99 | 10.41 | 42.4 | 56 | -13.6 | QP |
| 0.626 | 21.76 | 10.41 | 32.17 | 46 | -13.83 | AVG |
| 3.322 | 15.15 | 10.53 | 25.68 | 46 | -20.32 | AVG |
| 3.5019 | 28.89 | 10.6 | 39.49 | 56 | -16.51 | QP |
| | | | | | | |
| | | | | | | |

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. '*' means the worst case



## 3.2 RADIATED EMISSION MEASUREMENT

### 3.2.1 RADIATED EMISSION LIMITS (Frequency Range 9kHz-1000MHz)

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

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

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start Frequency | 1000 MHz |
| Stop Frequency | 10th carrier harmonic |
| RB / VB (emission in restricted band) | 1 MHz / 1 MHz for Peak, 1 MHz / *10Hz* for Average |

| Receiver Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |

### 3.2.2 TEST PROCEDURE

a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

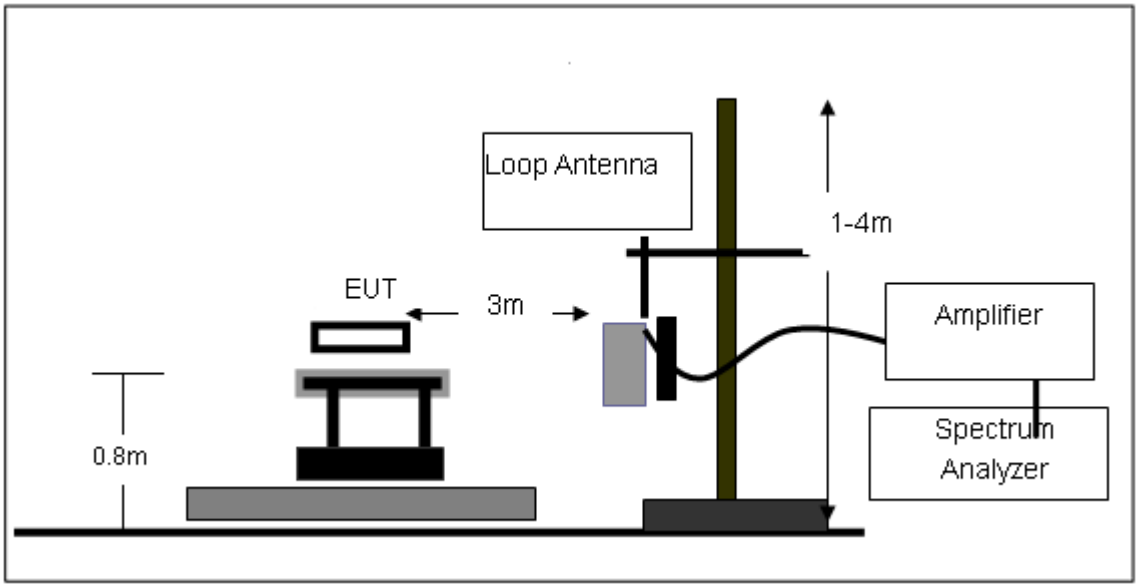
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

### 3.2.3 DEVIATION FROM TEST STANDARD

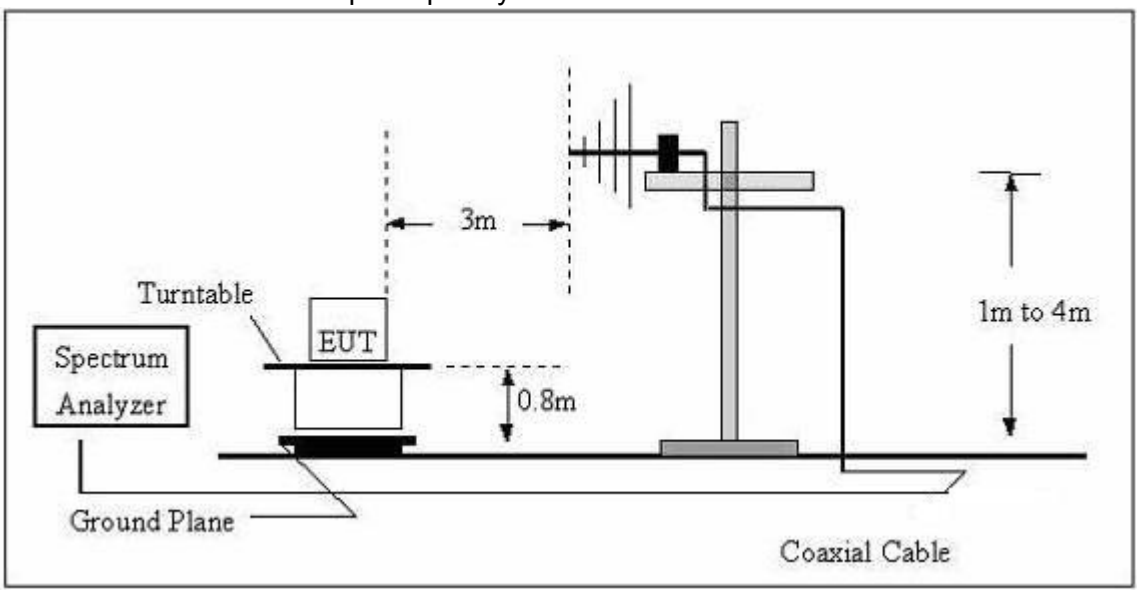
No deviation

### 3.2.4 TEST SETUP

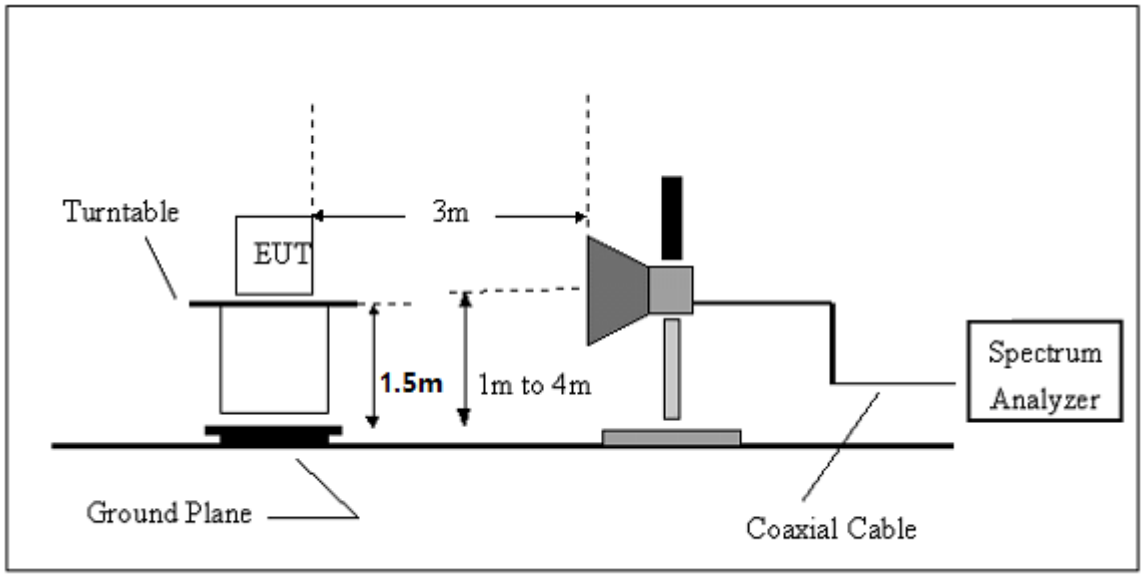
（A）Radiated Emission Test-Up Frequency Below 30MHz




（B）Radiated Emission Test-Up Frequency 30MHz~1GHz



（C）Radiated Emission Test-Up Frequency Above 1GHz




### 3.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

### 3.2.6 TEST RESULTS (BETWEEN 9KHZ – 30 MHZ)

| | | | |
|---|---|---|---|
| EUT： | WiFi Router | Model Name. ： | AP220 |
| Temperature： | 20 ℃ | Relative Humidtity： | 48% |
| Pressure： | 1010 hPa | Test Voltage ： | AC 120V |
| Test Mode ： | TX | Polarization : | -- |

| Freq. | Reading | Limit | Margin | State |
|---|---|---|---|---|
| (MHz) | (dBuV/m) | (dBuV/m) | (dB) | P/F |
| -- | -- | -- | -- | PASS |
| -- | -- | -- | -- | PASS |

**NOTE:**

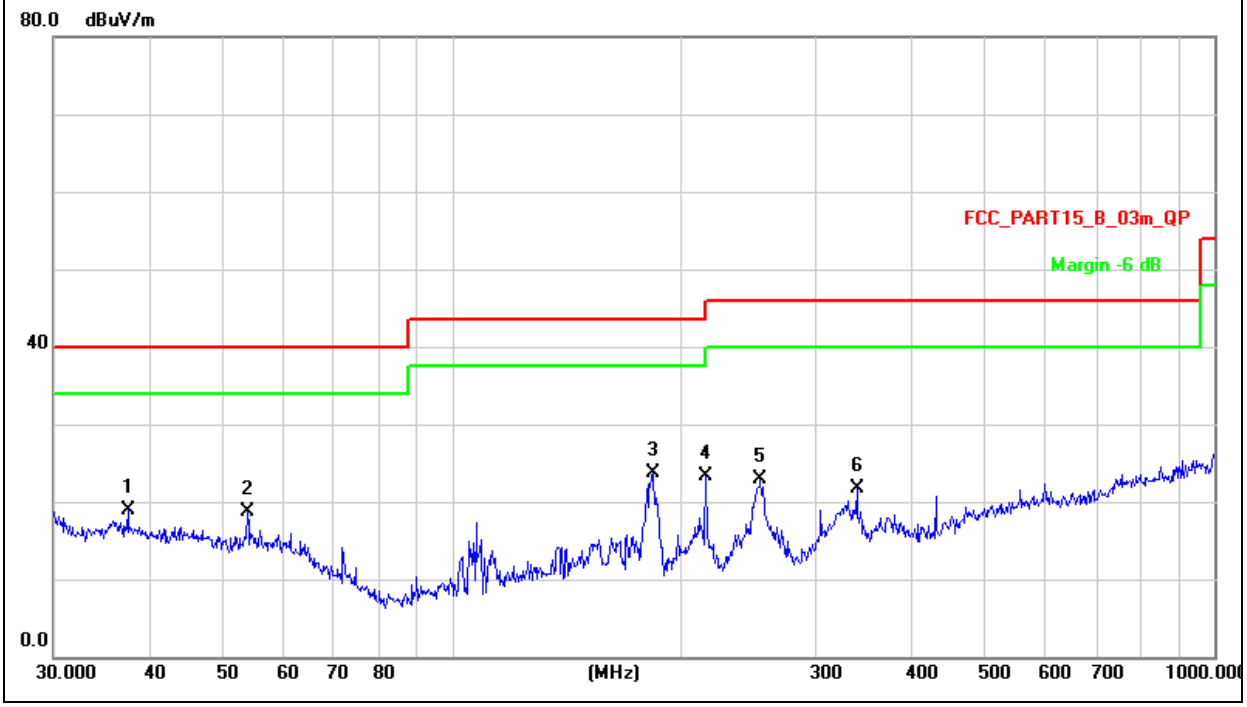
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

### 3.2.7 TEST RESULTS (BETWEEN 30MHZ – 1GHZ)

| | | | |
|---|---|---|---|
| EUT： | WiFi Router | Model Name ： | AP220 |
| Temperature： | 20 ℃ | Relative Humidity： | 48% |
| Pressure： | 1010 hPa | Polarization： | Horizontal |
| Test Voltage ： | AC 120V/60Hz | | |
| Test Mode ： | TX | | |

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 37.5479 | 27.55 | -8.73 | 18.82 | 40.00 | -21.18 | QP |
| 53.8818 | 29.57 | -10.93 | 18.64 | 40.00 | -21.36 | QP |
| 183.2005 | 38.44 | -14.73 | 23.71 | 43.50 | -19.79 | QP |
| 215.2678 | 39.09 | -15.77 | 23.32 | 43.50 | -20.18 | QP |
| 253.8367 | 37.06 | -14.09 | 22.97 | 46.00 | -23.03 | QP |
| 339.5888 | 33.35 | -11.57 | 21.78 | 46.00 | -24.22 | QP |

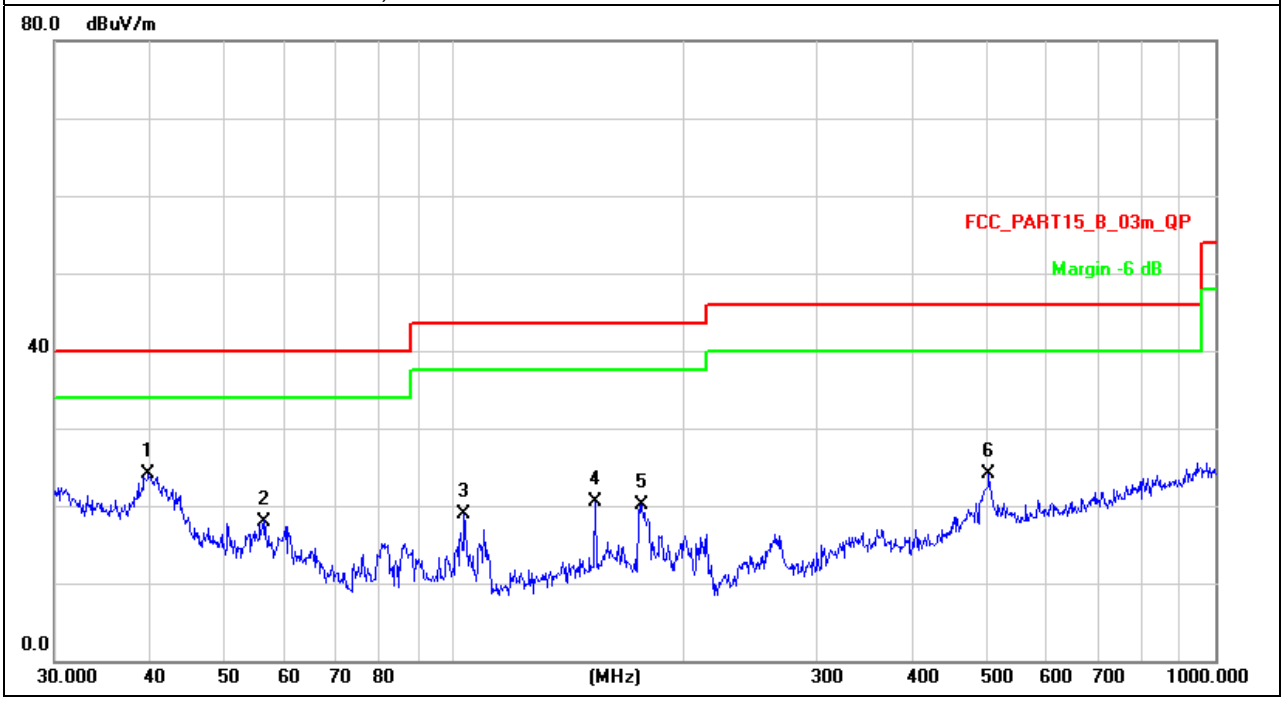
Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.
All interfaces was connected, and WIFI TX mode was link.



| | | | |
|---|---|---|---|
| EUT： | WiFi Router | Model Name ： | AP220 |
| Temperature： | 20 ℃ | Relative Humidity： | 48% |
| Pressure： | 1010 hPa | Polarization： | Vertical |
| Test Voltage ： | AC 120V/60Hz | | |
| Test Mode ： | TX | | |

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 39.8542 | 32.98 | -8.84 | 24.14 | 40.00 | -15.86 | QP |
| 56.5929 | 29.25 | -11.25 | 18.00 | 40.00 | -22.00 | QP |
| 103.4421 | 35.13 | -16.19 | 18.94 | 43.50 | -24.56 | QP |
| 153.7385 | 33.34 | -12.86 | 20.48 | 43.50 | -23.02 | QP |
| 176.8878 | 34.26 | -14.07 | 20.19 | 43.50 | -23.31 | QP |
| 504.7062 | 32.25 | -8.12 | 24.13 | 46.00 | -21.87 | QP |

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.
All interfaces was connected, and WIFI TX mode was link.



### 3.2.8 TEST RESULTS (ABOVE 1000 MHZ)

| Polar (H/V) | Frequency (MHz) | Meter Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|---|
| Low Channel (5745 MHz)-Above 1G | | | | | | | |
| Vertical | 11490 | 56.89 | -3.64 | 53.25 | 74.00 | -20.75 | Pk |
| Vertical | 11490 | 41.65 | -3.64 | 38.01 | 54.00 | -15.99 | AV |
| Vertical | 17235 | 50.37 | -0.95 | 49.42 | 74.00 | -24.58 | Pk |
| Vertical | 17235 | 36.45 | -0.95 | 35.50 | 54.00 | -18.50 | AV |
| Horizontal | 11490 | 59.41 | -3.64 | 55.77 | 74.00 | -18.23 | Pk |
| Horizontal | 11490 | 41.57 | -3.64 | 37.93 | 54.00 | -16.07 | AV |
| Horizontal | 17235 | 50.68 | -0.95 | 49.73 | 74.00 | -24.27 | Pk |
| Horizontal | 17235 | 37.54 | -0.95 | 36.59 | 54.00 | -17.41 | AV |
| middle Channel (5785 MHz)-Above 1G | | | | | | | |
| Vertical | 11570 | 57.62 | -3.68 | 53.94 | 74.00 | -20.06 | Pk |
| Vertical | 11570 | 40.37 | -3.68 | 36.69 | 54.00 | -17.31 | AV |
| Vertical | 17355 | 54.28 | -0.82 | 53.46 | 74.00 | -20.54 | Pk |
| Vertical | 17355 | 39.15 | -0.82 | 38.33 | 54.00 | -15.67 | AV |
| Horizontal | 11570 | 58.38 | -3.68 | 54.70 | 74.00 | -19.30 | Pk |
| Horizontal | 11570 | 40.27 | -3.68 | 36.59 | 54.00 | -17.41 | AV |
| Horizontal | 17355 | 55.63 | -0.82 | 54.81 | 74.00 | -19.19 | Pk |
| Horizontal | 17355 | 41.57 | -0.82 | 40.75 | 54.00 | -13.25 | AV |
| High Channel (5825 MHz)-Above 1G | | | | | | | |
| Vertical | 11650 | 57.62 | -3.59 | 54.03 | 74.00 | -19.97 | Pk |
| Vertical | 11650 | 41.27 | -3.59 | 37.68 | 54.00 | -16.32 | AV |
| Vertical | 17475 | 52.74 | -0.68 | 52.06 | 74.00 | -21.94 | Pk |
| Vertical | 17475 | 37.42 | -0.68 | 36.74 | 54.00 | -17.26 | AV |
| Horizontal | 11650 | 58.75 | -3.59 | 55.16 | 74.00 | -18.84 | Pk |
| Horizontal | 11650 | 40.64 | -3.59 | 37.05 | 54.00 | -16.95 | AV |
| Horizontal | 17475 | 54.46 | -0.68 | 53.78 | 74.00 | -20.22 | Pk |
| Horizontal | 17475 | 38.25 | -0.68 | 37.57 | 54.00 | -16.43 | AV |

Note:"802.11N(20)(5G)" mode is the worst mode. PK value is lower than the Average value limit, So average didn't record.

# 4. POWER SPECTRAL DENSITY TEST

## 4.1 APPLIED PROCEDURES / LIMIT

**According to FCC §15.407(a)(3)**

For the band 5.15-5.25 GHz,

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz

(3)For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 4.2 TEST PROCEDURE

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.I.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

### 4.3 TEST SETUP


### 4.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.1 Unless otherwise a special operating condition is specified in the follows during the testing.

## 4.5 TEST RESULT

| | | | |
|---|---|---|---|
| EUT： | WiFi Router | Model Name ： | AP220 |
| Temperature： | 25 ℃ | Relative Humidity： | 60% |
| Pressure： | 1015 hPa | Test Voltage ： | AC 120V |
| Test Mode ： | TX a Mode | | |

| Frequency | Power Density A (dBm) | Power Density B (dBm) | Power Density C (dBm) |
|---|---|---|---|
| 5745 MHz | 8.84 | 8.21 | 8.01 |
| 5785 MHz | 9.26 | 9.12 | 9.01 |
| 5825 MHz | 10.6 | 9.78 | 9.21 |

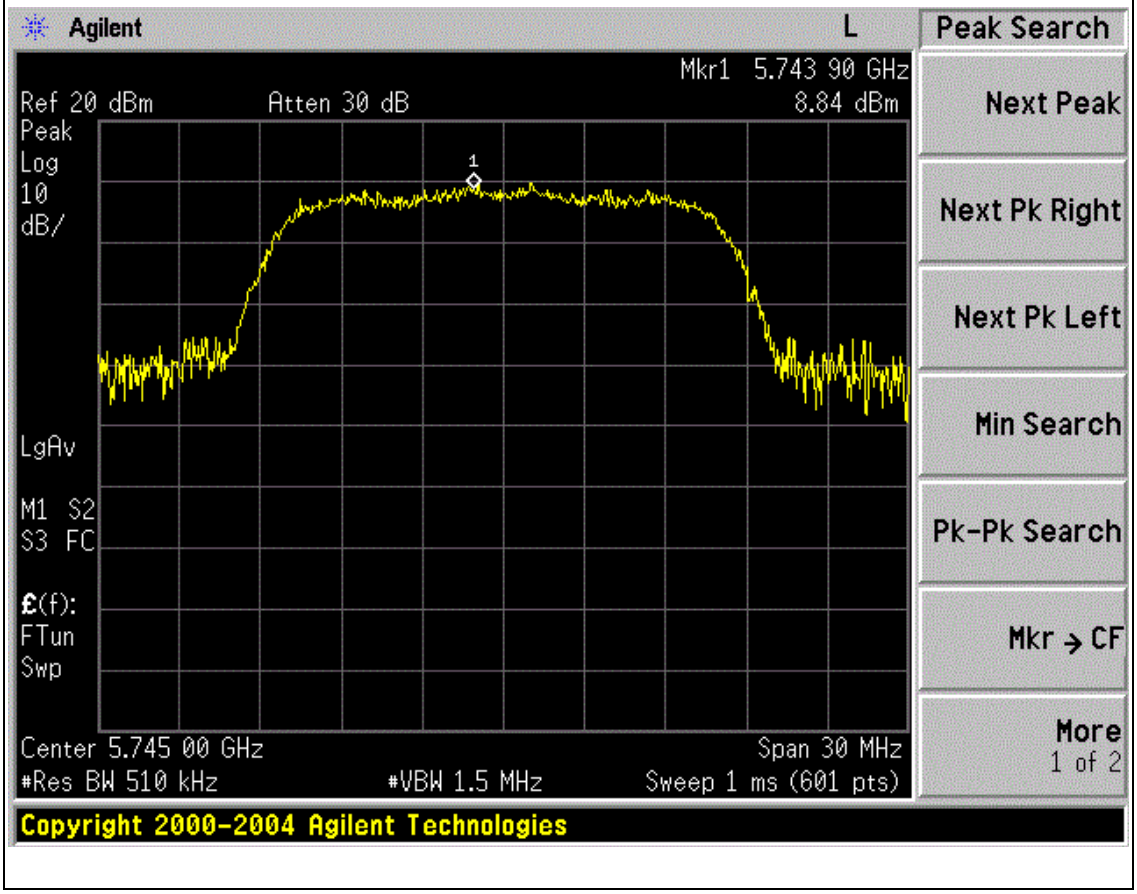
| Frequency | Power Density A (dBm) +2.92 | Power Density B (dBm)+2.92 | Power Density C (dBm)+2.92 | Limit (dBm) | Result |
|---|---|---|---|---|---|
| 5745 MHz | 11.76 | 11.13 | 10.93 | 30 | PASS |
| 5785 MHz | 12.18 | 12.04 | 11.93 | 30 | PASS |
| 5825 MHz | 13.52 | 12.7 | 12.13 | 30 | PASS |

NOTE: A B C Represent the value of antennaA and B,C,The worst data is A Antenna a ,only shown Antenna A Plot.

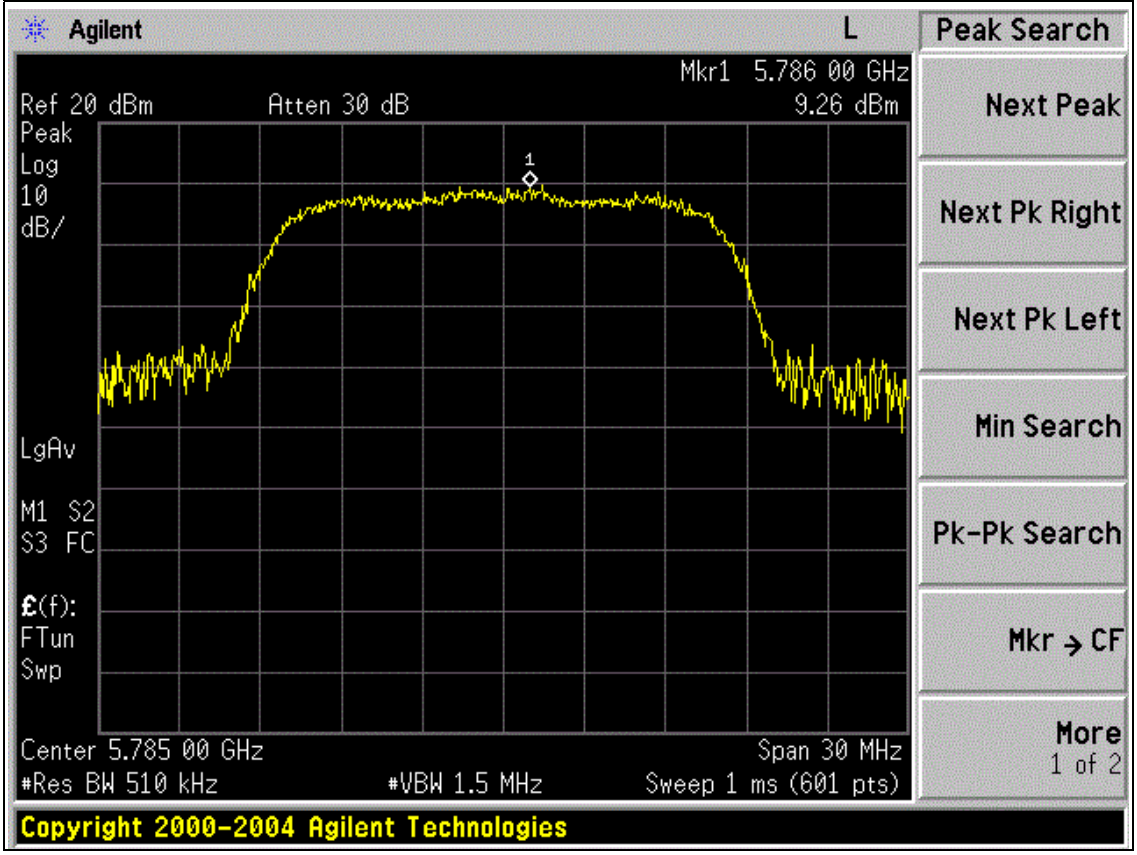
Calculate power density= Measured Power Density+10log(1MHz/0.51MHz)

= Measured Power Density+2.92

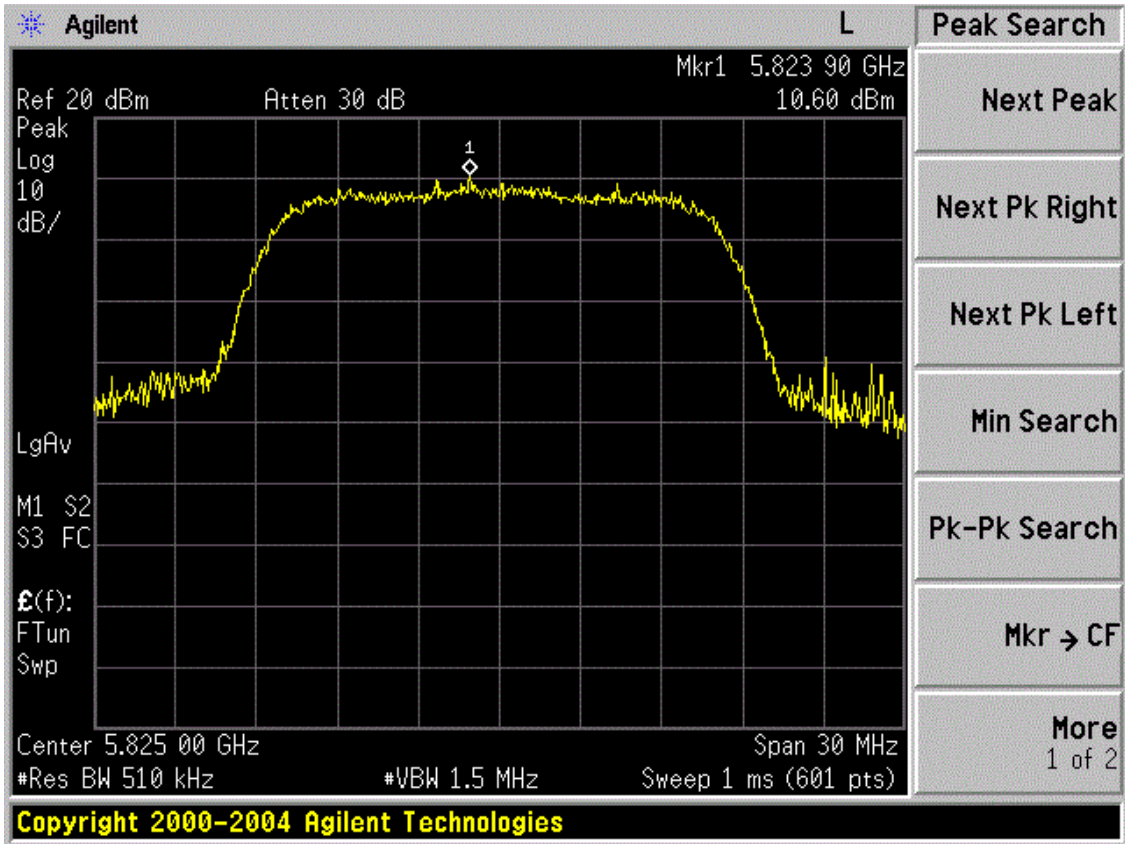
**802.11 a Mode/TX CH 149**



**TX CH 157**




**TX CH 165**



| EUT： | WiFi Router | Model Name ： | AP220 |
|---|---|---|---|
| Temperature： | 25 ℃ | Relative Humidity： | 60% |
| Pressure： | 1015 hPa | Test Voltage ： | AC 120V |
| Test Mode ： | TX g Mode | | |

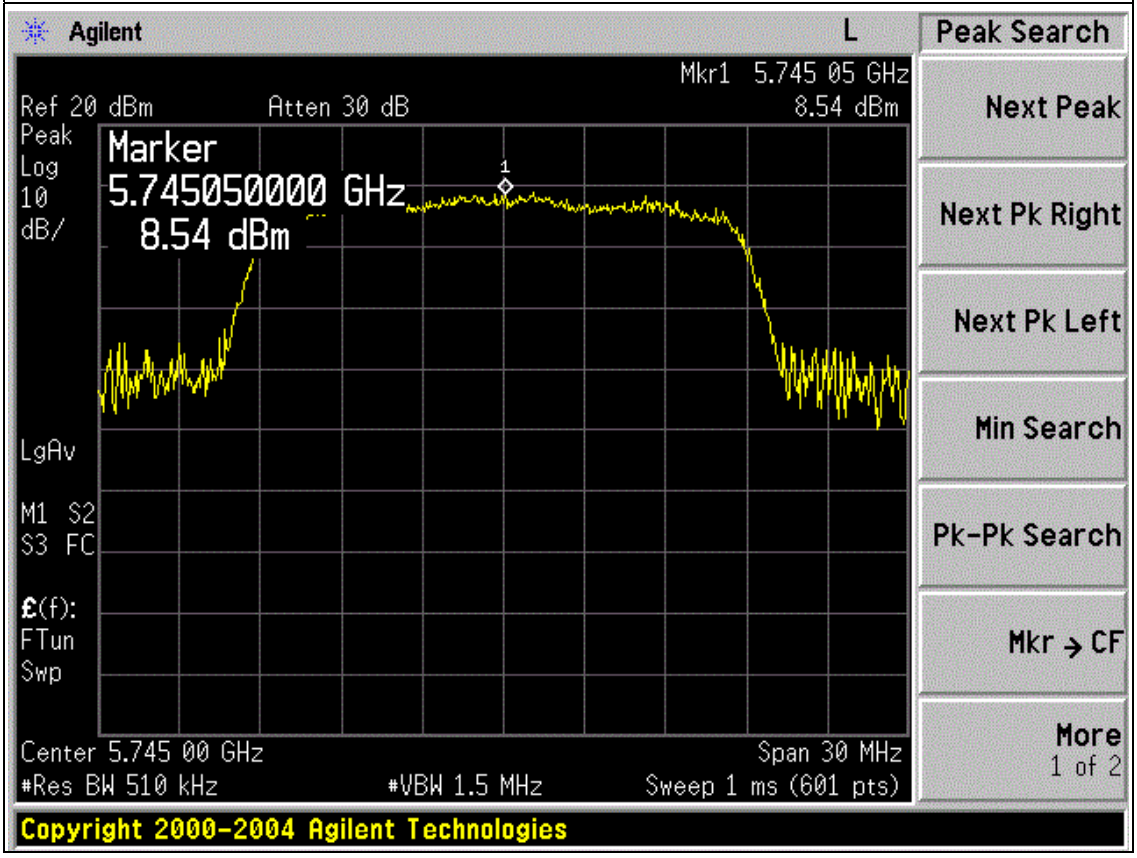
| Frequency | Power Density A (dBm) | Power Density B (dBm) | Power Density C (dBm) | 10log (1MHz/ 0.51) | Tolal Power Density (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| 5745 MHz | 8.54 | 8.21 | 8.01 | 2.92 | 15.95 | 30 | PASS |
| 5785 MHz | 8.37 | 8.10 | 8.01 | 2.92 | 15.85 | 30 | PASS |
| 5825 MHz | 8.12 | 8.00 | 7.98 | 2.92 | 15.72 | 30 | PASS |

NOTE: A B C Represent the value of antenna A and B,C,The worst data is A Antenna a ,only shown Antenna A Plot.

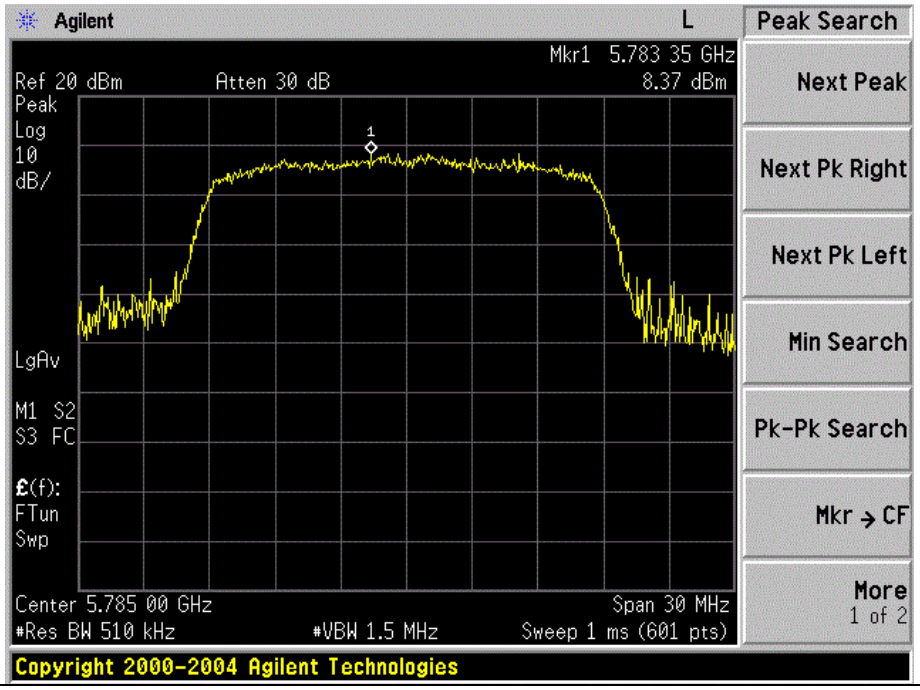
Calculate power density= Measured Power Density+10log(1MHz/0.51MHz)

= Measured Power Density+2.92

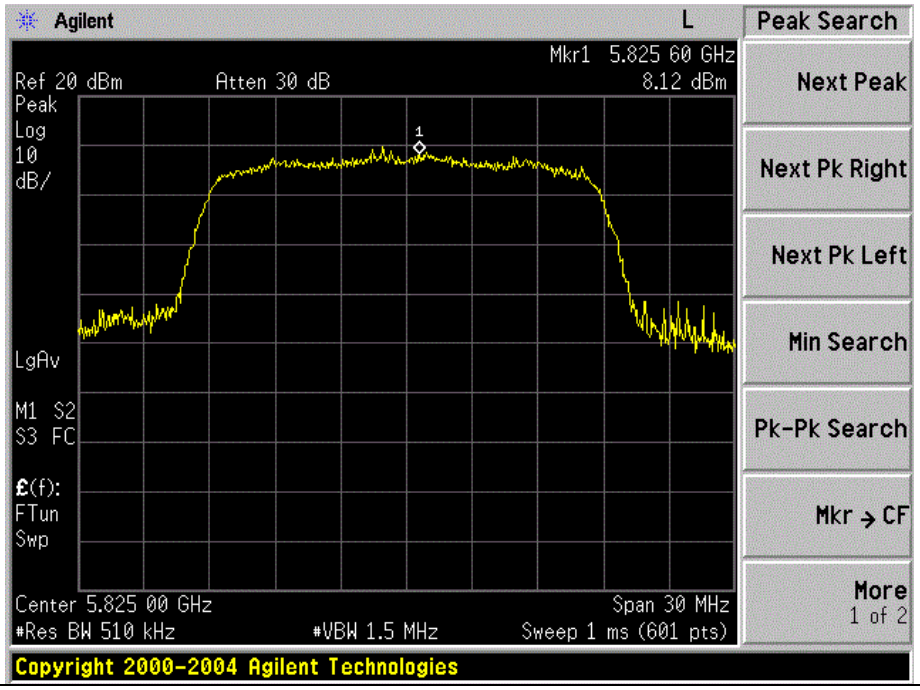
**802.11 n20 Mode/TX CH 149**



**TX CH 157**




**TX CH 165**



| EUT： | WiFi Router | Model Name ： | AP220 |
|---|---|---|---|
| Temperature： | 25 ℃ | Relative Humidity： | 60% |
| Pressure： | 1015 hPa | Test Voltage ： | AC 120V |
| Test Mode ： | TX n Mode(20M) /CH01, CH06, CH11 | | |

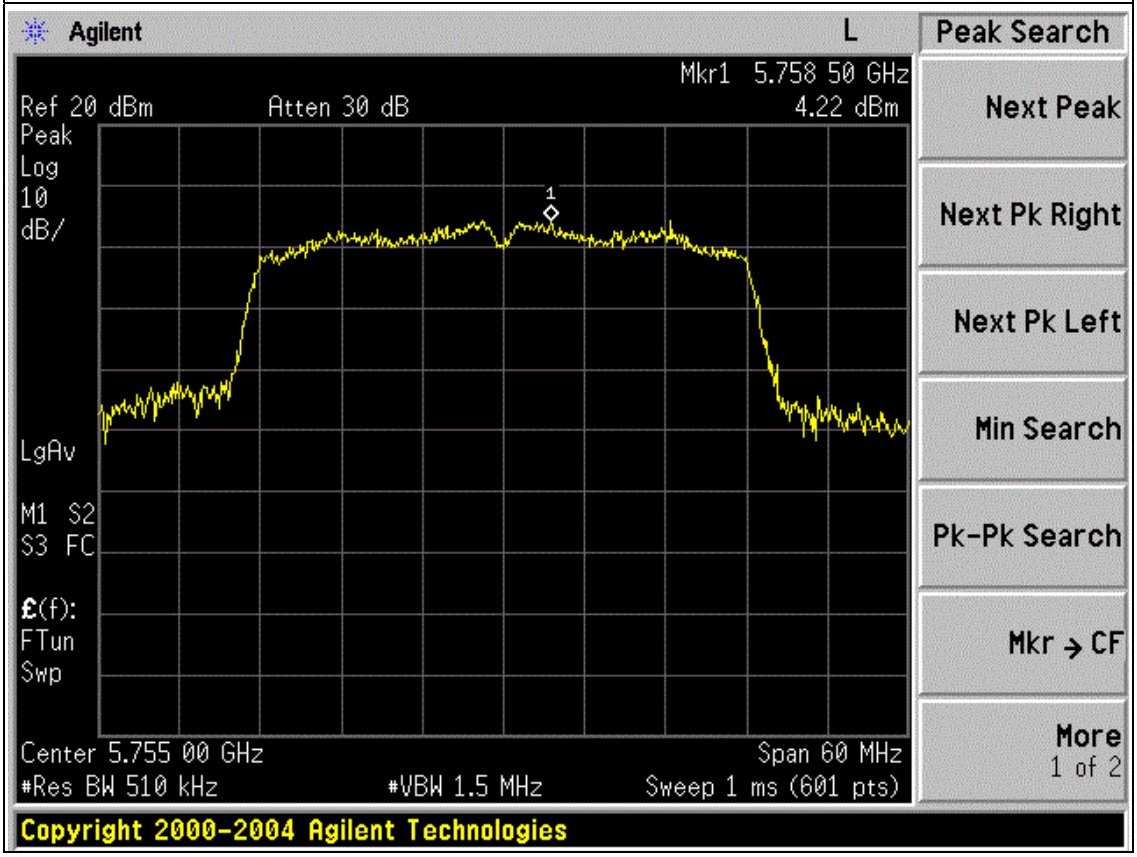
| Frequency | Power Density A (dBm) | Power Density B (dBm) | Power Density C (dBm) | 10log (1MHz/ 0.51) | Tolal Power Density (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|
| 5755 MHz | 4.22 | 4.20 | 4.10 | 2.92 | 11.86 | 30 | PASS |
| 5795 MHz | 3.60 | 3.50 | 3.41 | 2.92 | 11.20 | 30 | PASS |

NOTE: A B C Represent the value of antennaA and B,C,The worst data is A Antenna a ,only shown Antenna A Plot.

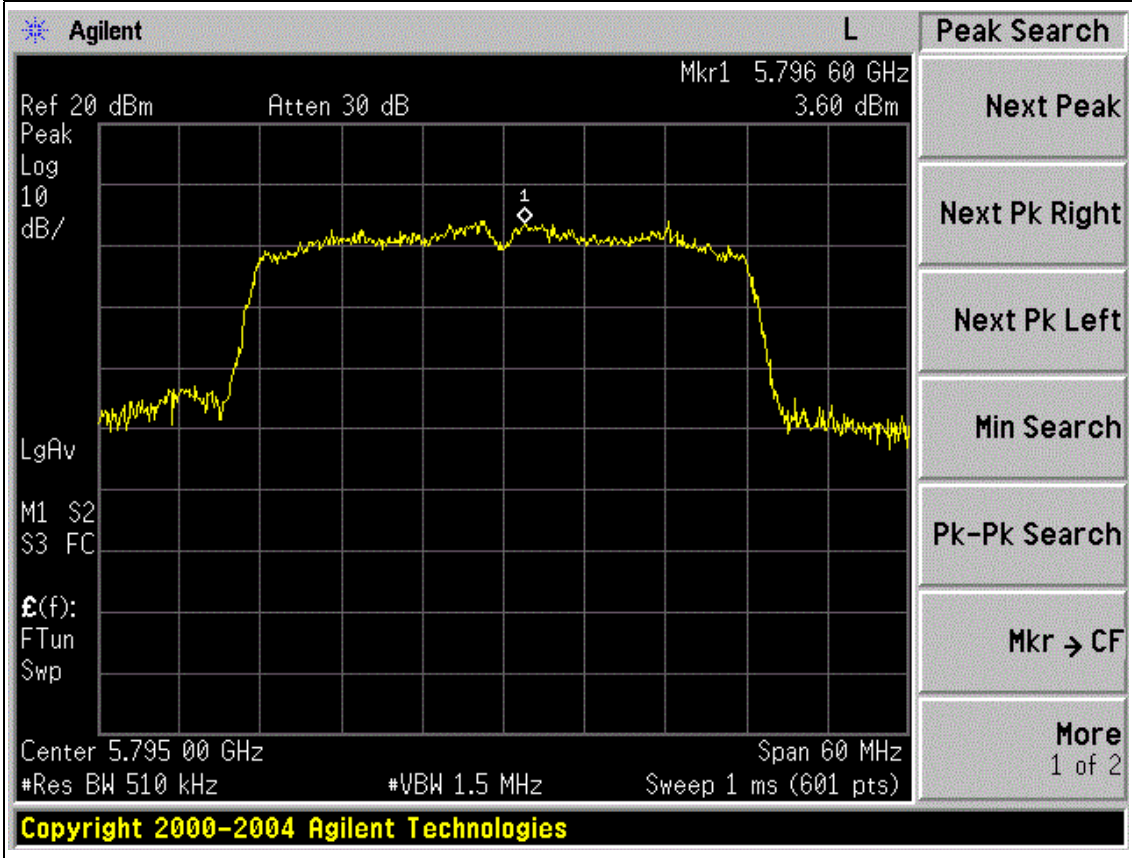
Calculate power density= Measured Power Density+10log(1MHz/0.51MHz)

= Measured Power Density+2.92

**802.11 n40 Mode/TX CH 151**



**802.11 n40 Mode/TX CH 151**



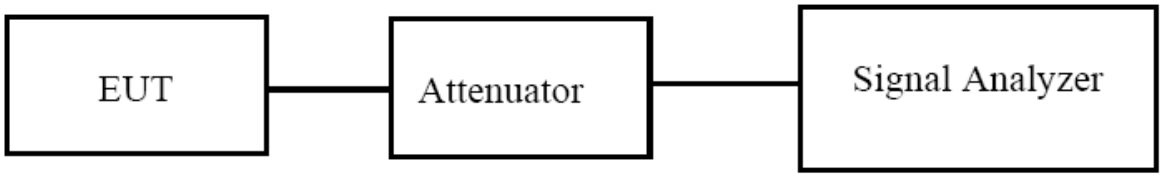
## 5. 26 DB & 99% EMISSION BANDWIDTH

### 5.1 APPLIED PROCEDURES / LIMIT

The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

#### 5.1.1 TEST PROCEDURE

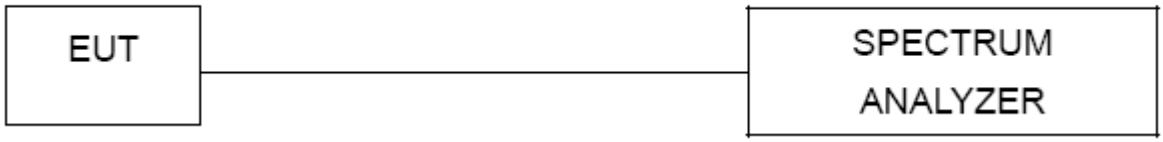
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
The following procedure shall be used for measuring (99 %) power bandwidth:
1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ≥ 3 · RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.



### 5.1.2 DEVIATION FROM STANDARD

No deviation.

### 5.1.3 TEST SETUP




### 5.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

### 5.1.5 TEST RESULTS

| EUT： | WiFi Router | Model Name ： | AP220 |
|---|---|---|---|
| Temperature： | 25 ℃ | Relative Humidity： | 60% |
| Pressure： | 1012 hPa | Test Voltage ： | AC 120V |
| Test Mode ： | TX Frequency (5745-5850MHz) | | |

802.11a:

| Channel | Frequency (MHz) | 99% bandwidth (MHz) | 26dB bandwidth (MHz) | Result |
|---|---|---|---|---|
| Low | 5745 MHz | 16.412 | 18.165 | Pass |
| Middle | 5785 MHz | 16.429 | 18.765 | Pass |
| High | 5825 MHz | 16.445 | 18.848 | Pass |

802.11n20:

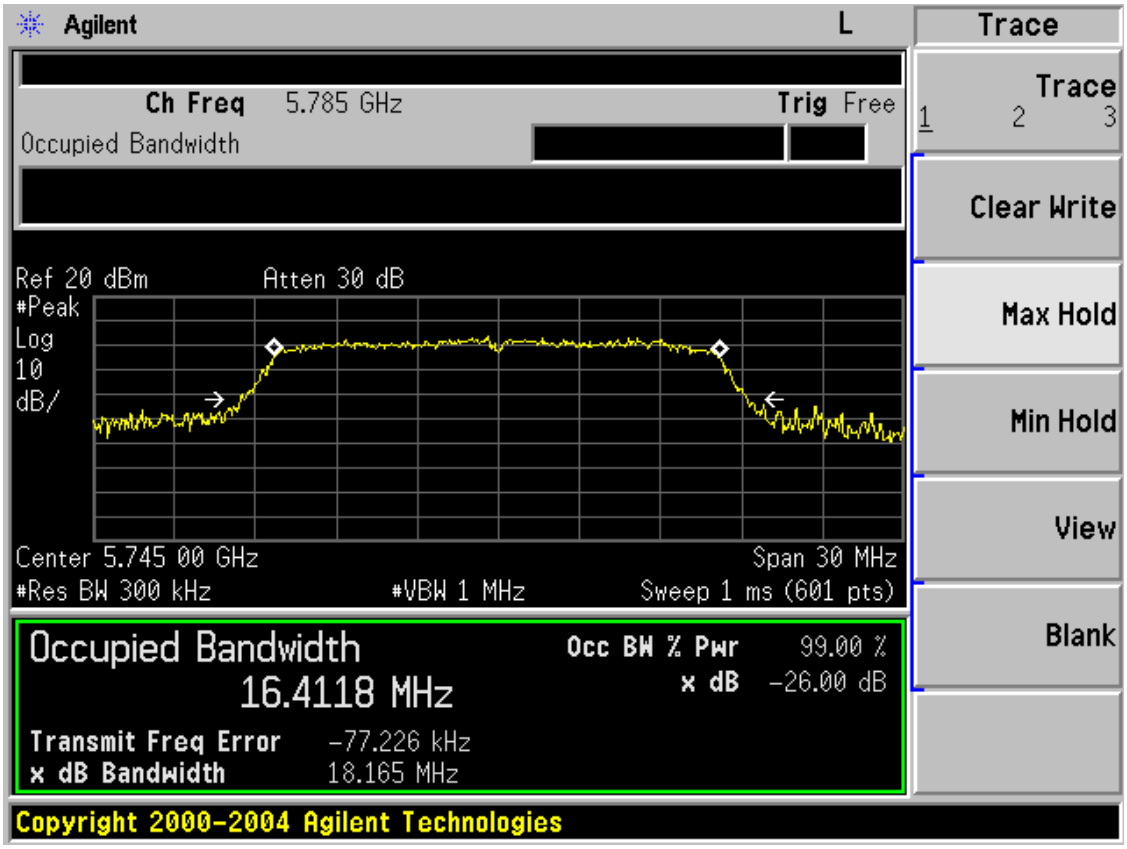
| Channel | Frequency (MHz) | 99% bandwidth (MHz) | 26dB bandwidth (MHz) | Result |
|---|---|---|---|---|
| Low | 5745 MHz | 17.568 | 19.076 | Pass |
| Middle | 5785 MHz | 17.559 | 19.101 | Pass |
| High | 5825 MHz | 17.578 | 19.025 | Pass |

802.11n40:

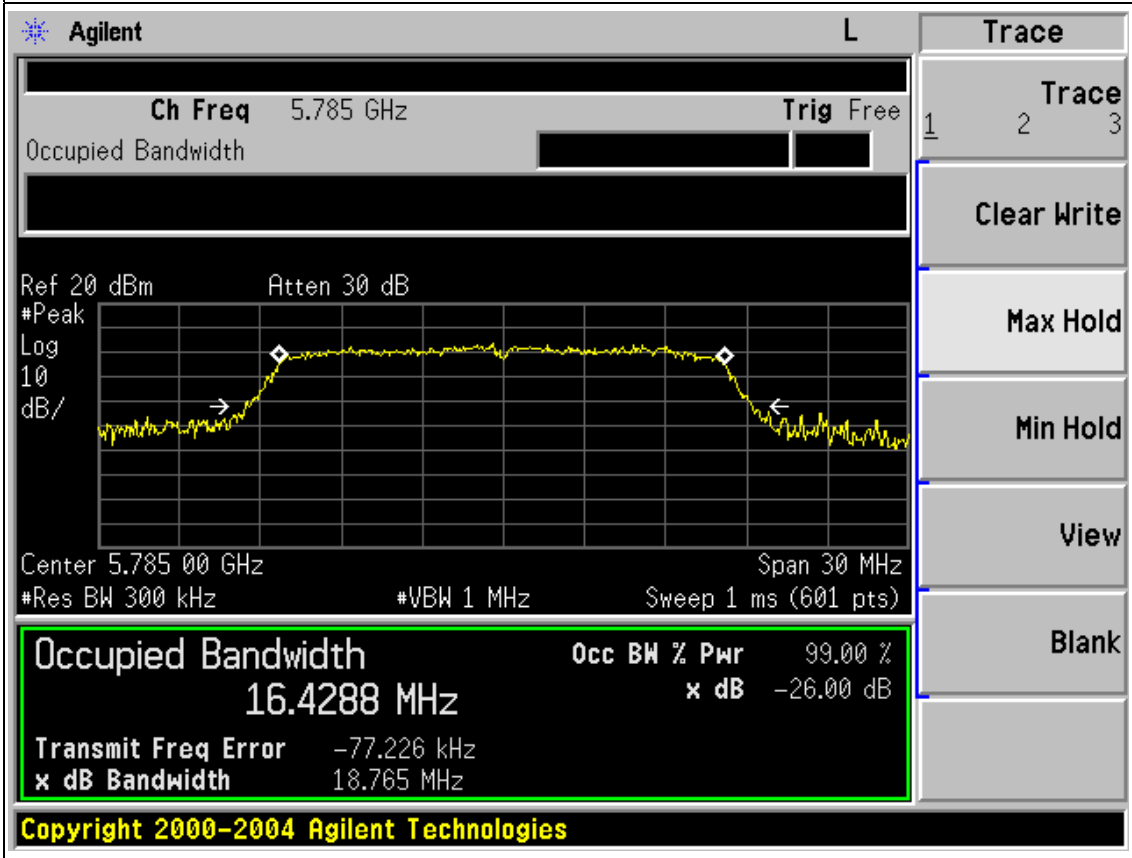
| Channel | Frequency (MHz) | 99% bandwidth (MHz) | 26dB bandwidth (MHz) | Result |
|---|---|---|---|---|
| Low | 5755 MHz | 36.020 | 38.656 | Pass |
| High | 5795 MHz | 35.908 | 38.189 | Pass |

**802.11 a**

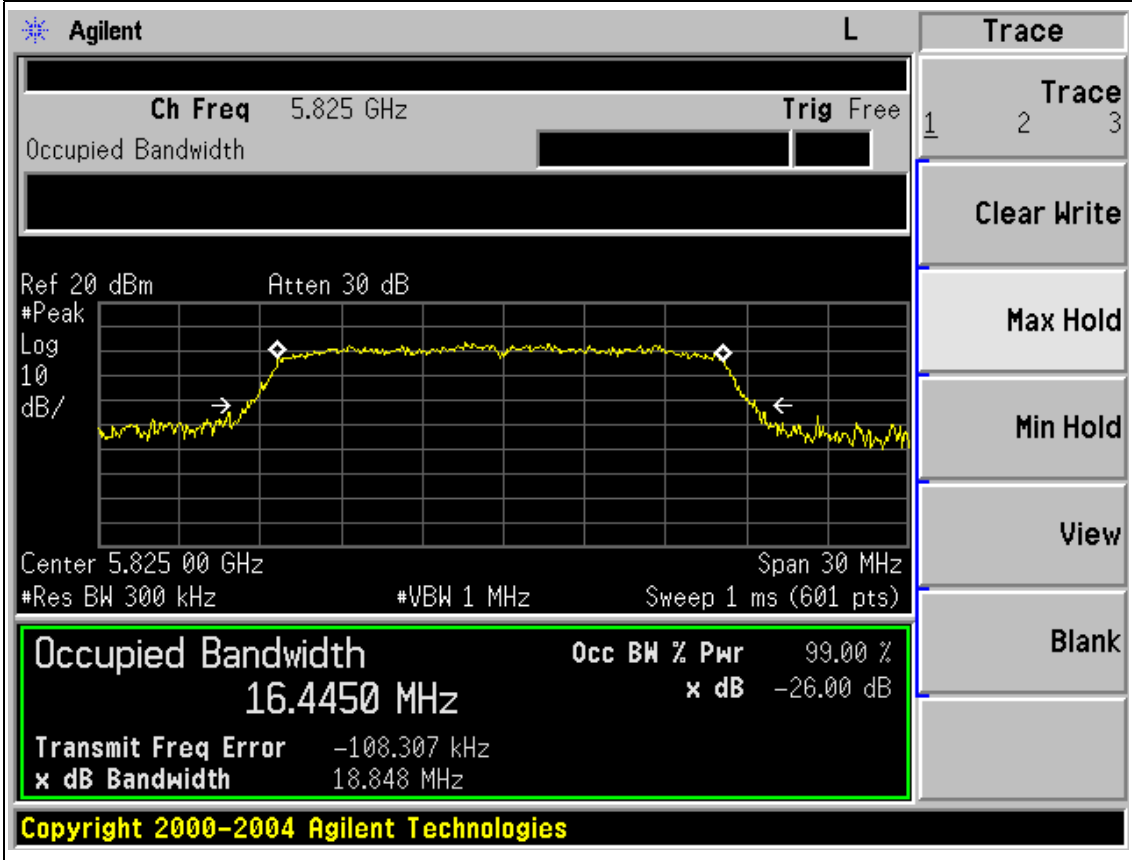
**TX**
**CH149**



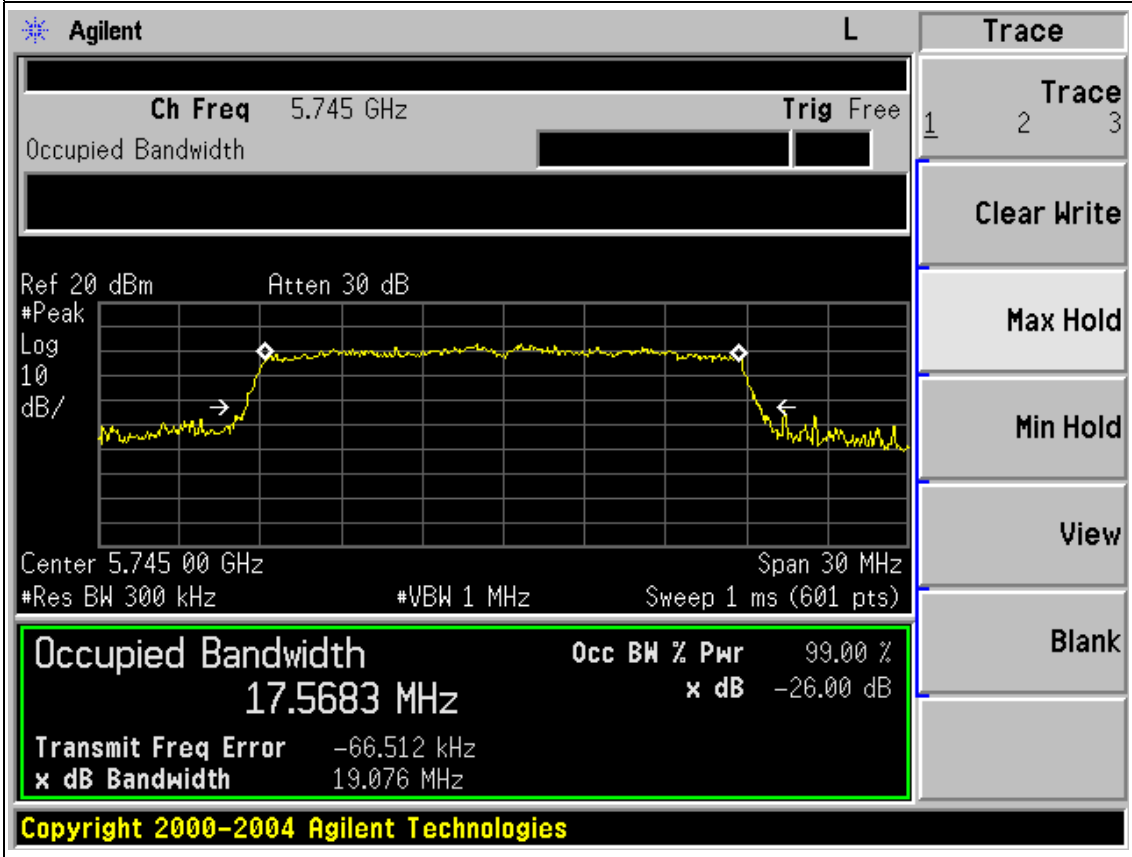
**TX CH 157**



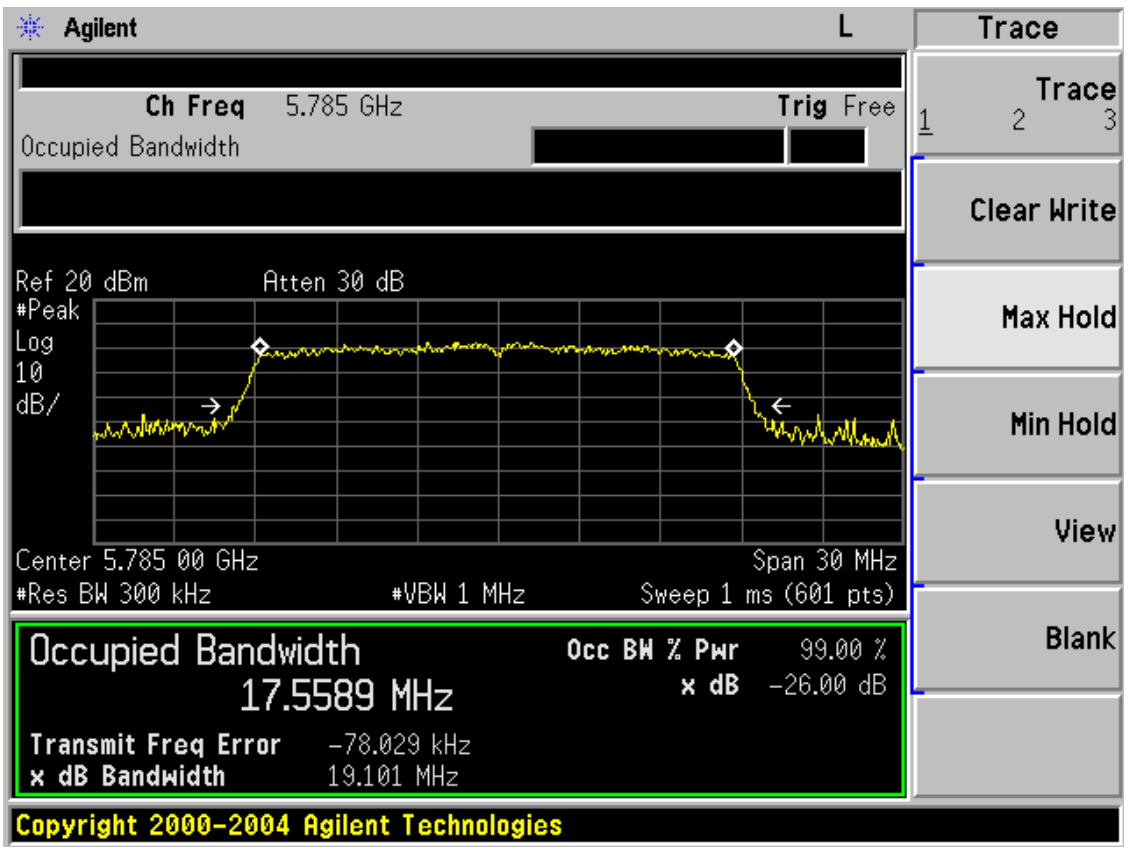

**TX CH 165**



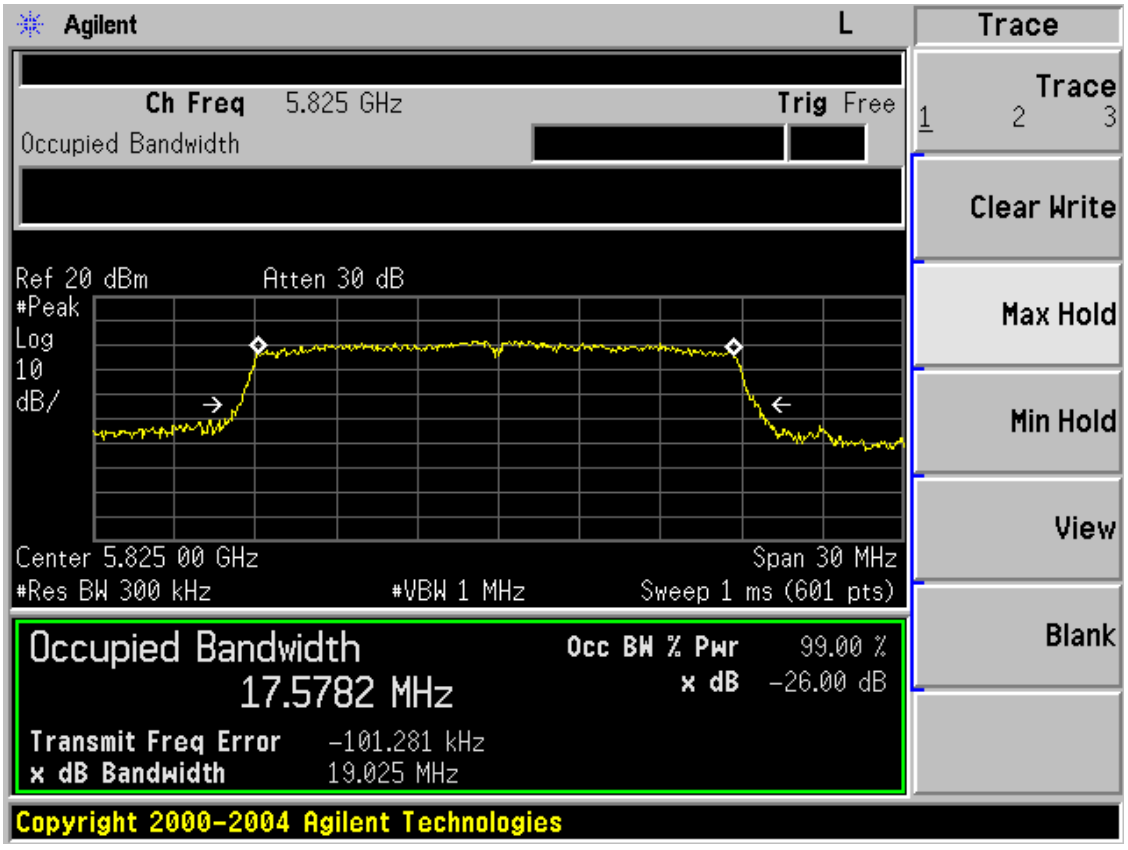
| 802.11 n20 Mode |
| --- |
| TX CH 149 |



**TX CH 157**

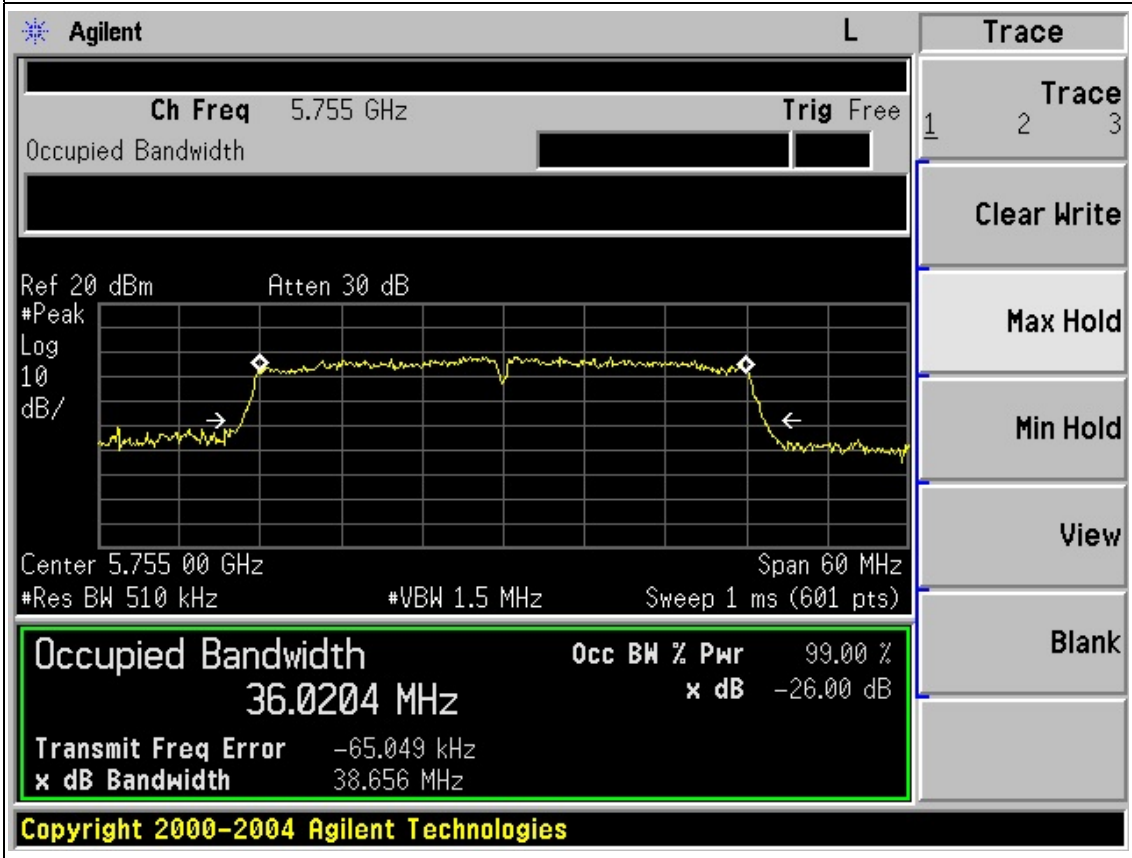



**TX CH 165**

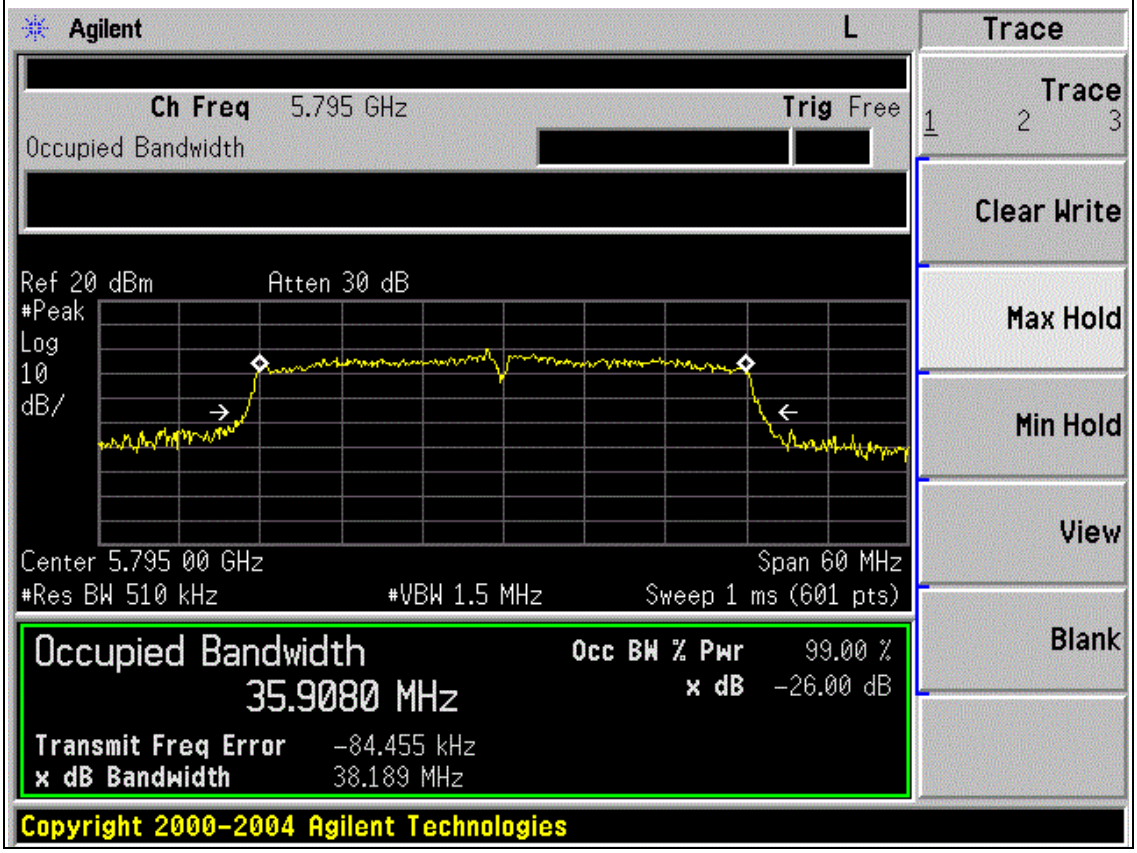


**802.11 n40 Mode**

**TX CH 151**




**TX CH 159**



# 6. PEAK OUTPUT POWER TEST

## 6.1 APPLIED PROCEDURES / LIMIT

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

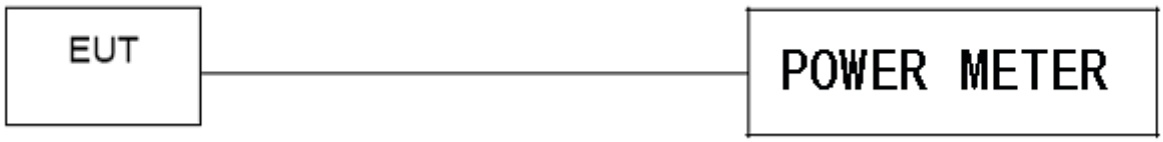
### 6.1.1 TEST PROCEDURE

a. The EUT was directly connected to the Power meter

### 6.1.2 DEVIATION FROM STANDARD

No deviation.

### 6.1.3 TEST SETUP




### 6.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

### 6.1.5 TEST RESULTS

| EUT： | WiFi Router | Model Name ： | AP220 |
|---|---|---|---|
| Temperature： | 25 ℃ | Relative Humidity： | 60% |
| Pressure： | 1012 hPa | Test Voltage ： | AC 120V |
| Test Mode ： | TX a/n(20M, 40M) Mode | | |

| TX 802.11a Mode | | | | | | |
|---|---|---|---|---|---|---|
| Test Channe | Frequency | Maximum Conducted Output Power A (PK) | Maximum Conducted Output Power B (PK) | Maximum Conducted Output Power C (PK) | Total Maximum Conducted Output Power(PK) | LIMIT |
| | (MHz) | (dBm) | (dBm) | (dBm) | (dBm) | dBm |
| CH 149 | 5745 | 19.21 | 18.88 | 18.21 | -- | 30 |
| CH 157 | 5785 | 19.78 | 18.65 | 18.22 | -- | 30 |
| CH 165 | 5825 | 19.70 | 18.21 | 18.16 | -- | 30 |
| **TX 802.11n-HT20 Mode** | | | | | | |
| CH 149 | 5745 | 19.33 | 18.76 | 18.01 | 23.50 | 30 |
| CH 157 | 5785 | 19.66 | 18.44 | 18.17 | 23.57 | 30 |
| CH 165 | 5825 | 19.67 | 18.11 | 18.15 | 23.48 | 30 |
| **TX 802.11n-HT40 Mode** | | | | | | |
| CH 151 | 5755 | 17.12 | 16.21 | 16.81 | 21.50 | 30 |
| CH 159 | 5795 | 17.33 | 16.01 | 16.81 | 21.52 | 30 |

## 7. 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE

### APPLICABLE STANDARD

**According to FCC §15.407(b)**

Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.

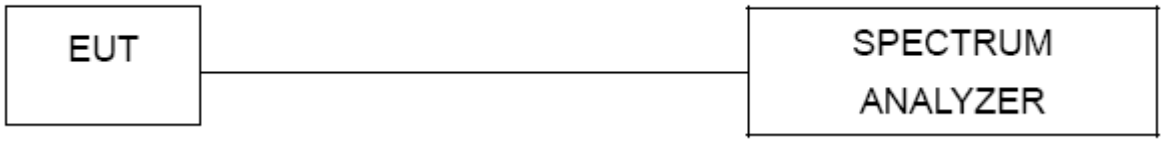
### TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### 7.1 DEVIATION FROM STANDARD

No deviation.

### 7.2 TEST SETUP

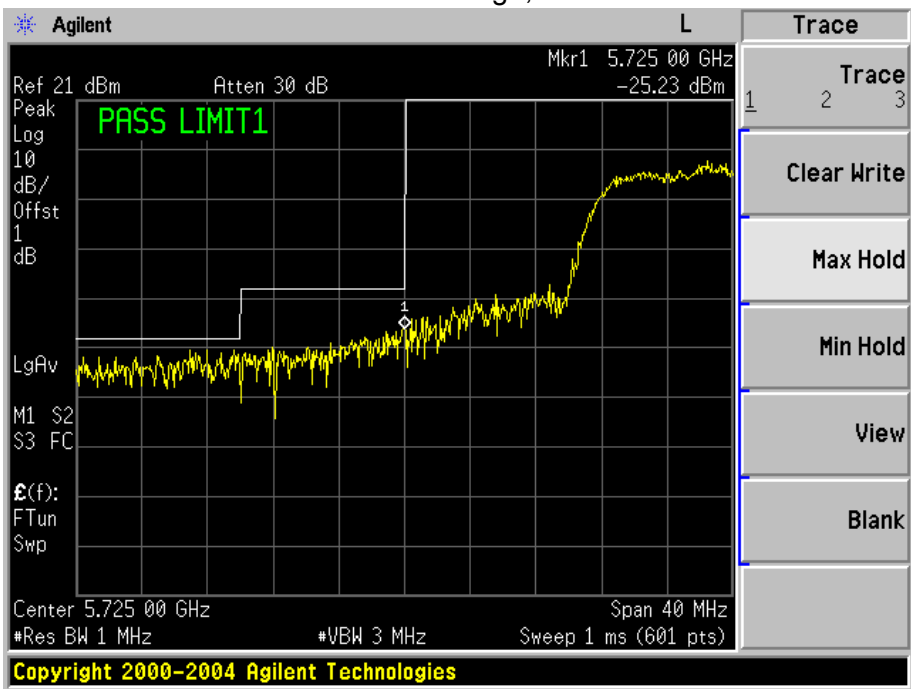



### 7.3 EUT OPERATION CONDITIONS

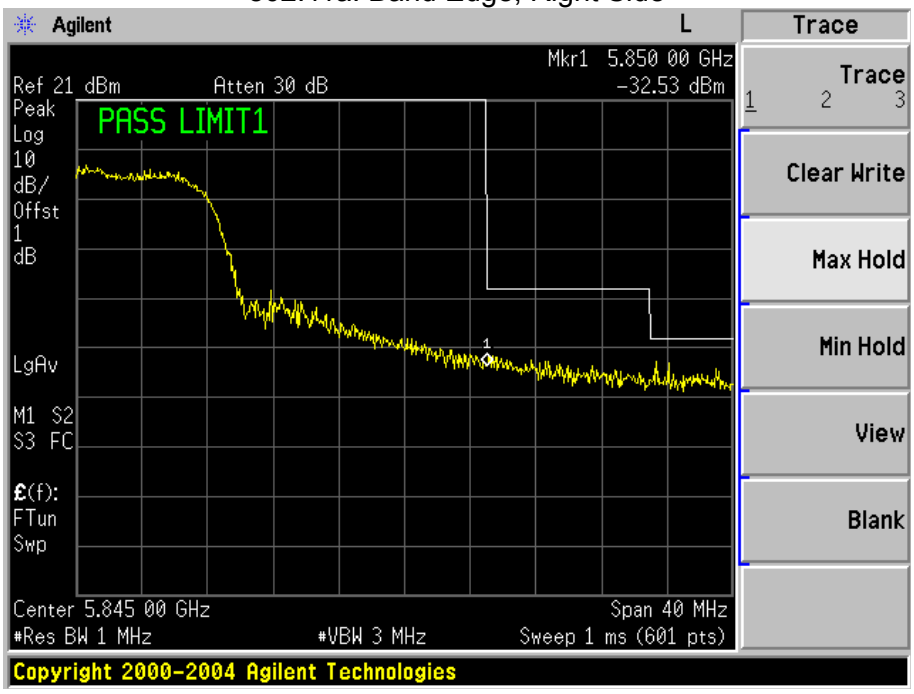
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

## 7.4 TEST RESULTS

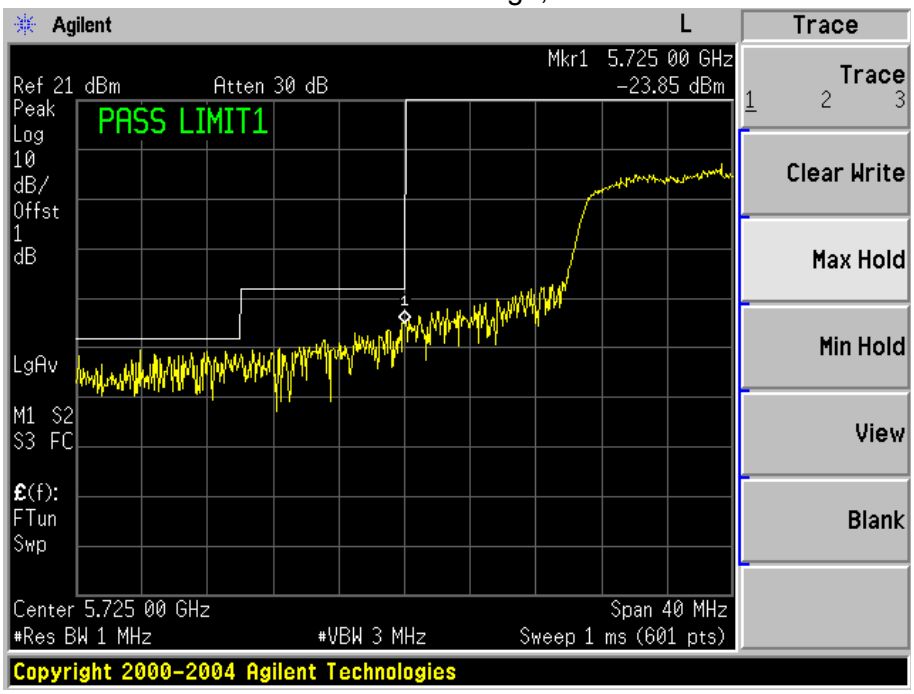
802.11a: Band Edge, Left Side



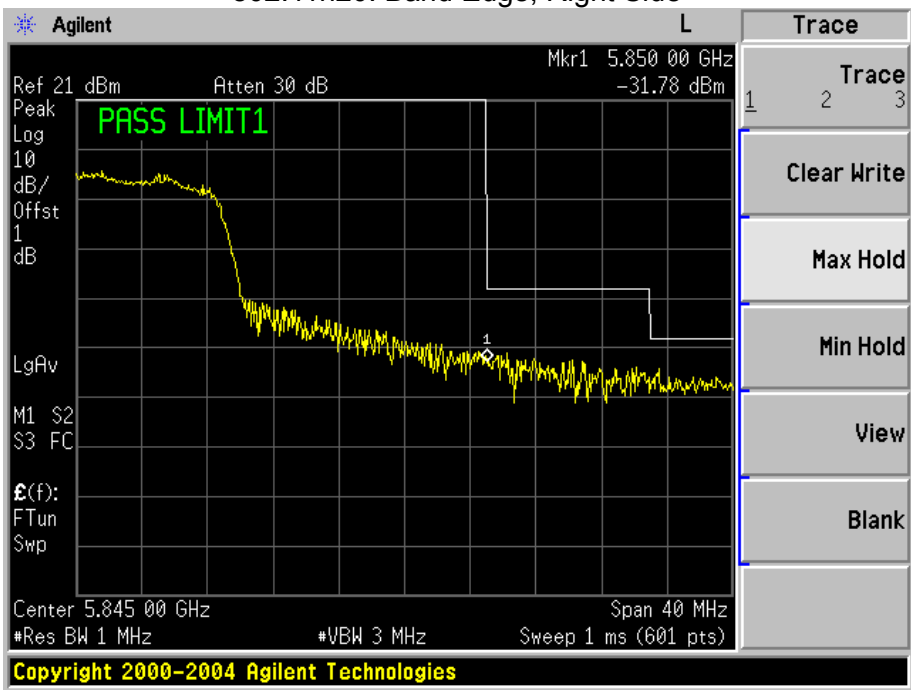

802.11a: Band Edge, Right Side



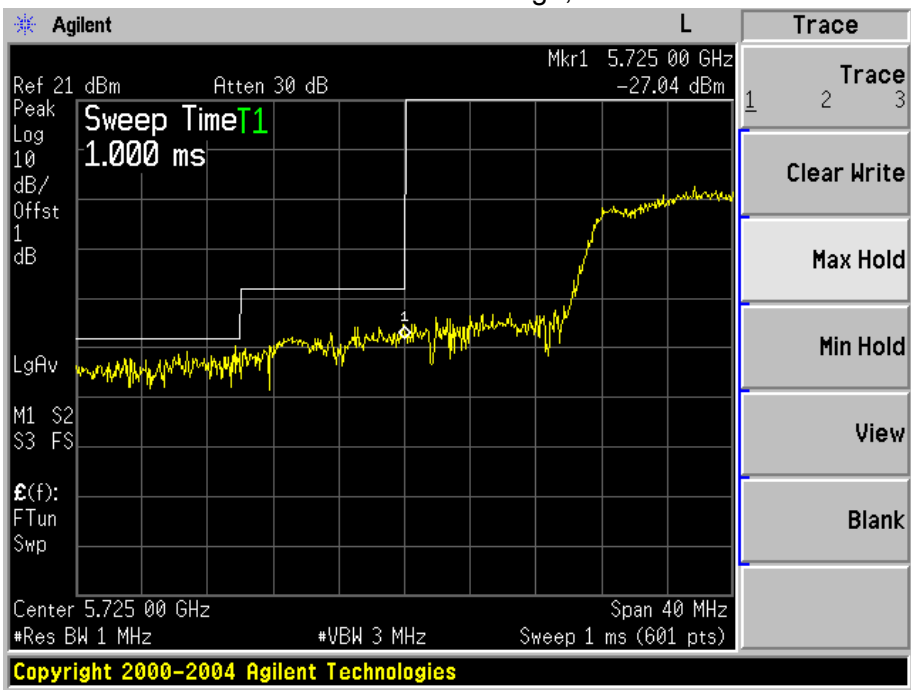
802.11n20: Band Edge, Left Side



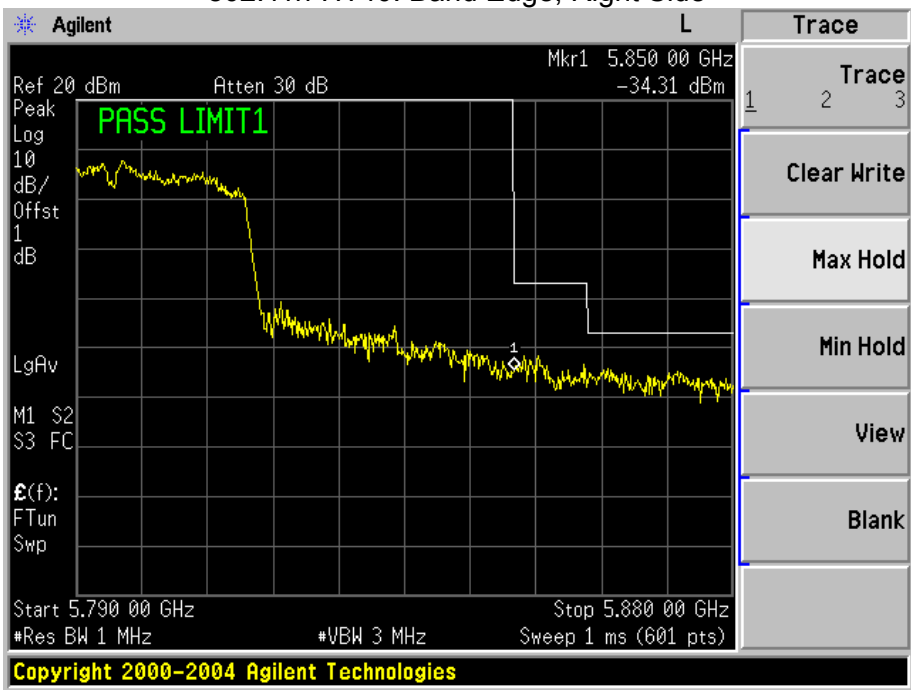

802.11n20: Band Edge, Right Side



802.11n-HT40: Band Edge, Left Side




802.11n-HT40: Band Edge, Right Side



# 8. ANTENNA REQUIREMENT

## 8.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 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.

## 8.2 EUT ANTENNA

The EUT antenna is permanent attached antenna. It comply with the standard requirement.

## 9. MINIMUM 6 DB BANDWIDTH

### 9.1 APPLIED PROCEDURES / LIMIT

**According to FCC §15.407(e)**

(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

### 9.2 TEST PROCEDURE

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 × RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

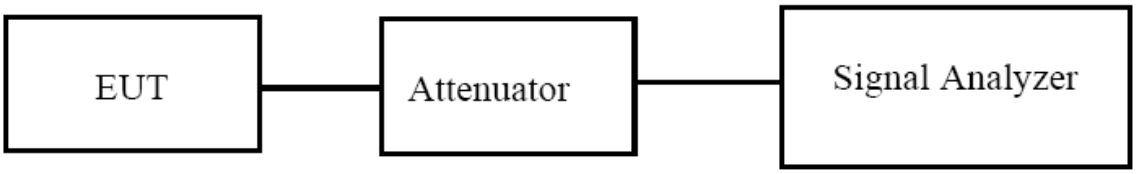
f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 9.3 DEVIATION FROM STANDARD

No deviation.

### 9.4 TEST SETUP




### 9.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

**9.6 TEST RESULTS**

802.11a:

| Channel | Frequency (MHz) | -6dB bandwidth (MHz) | Result |
|---|---|---|---|
| Low | 5745 MHz | 16.100 | Pass |
| Middle | 5785 MHz | 16.104 | Pass |
| High | 5825 MHz | 16.151 | Pass |

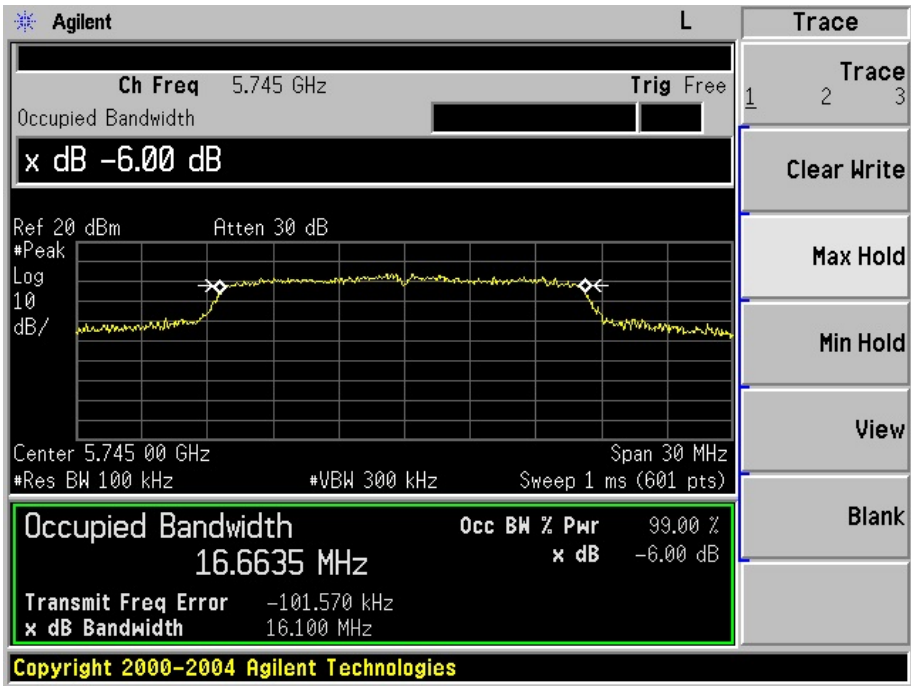
802.11n20:

| Channel | Frequency (MHz) | -6dB bandwidth (MHz) | Result |
|---|---|---|---|
| Low | 5745 MHz | 17.593 | Pass |
| Middle | 5785 MHz | 17.503 | Pass |
| High | 5825 MHz | 16.752 | Pass |

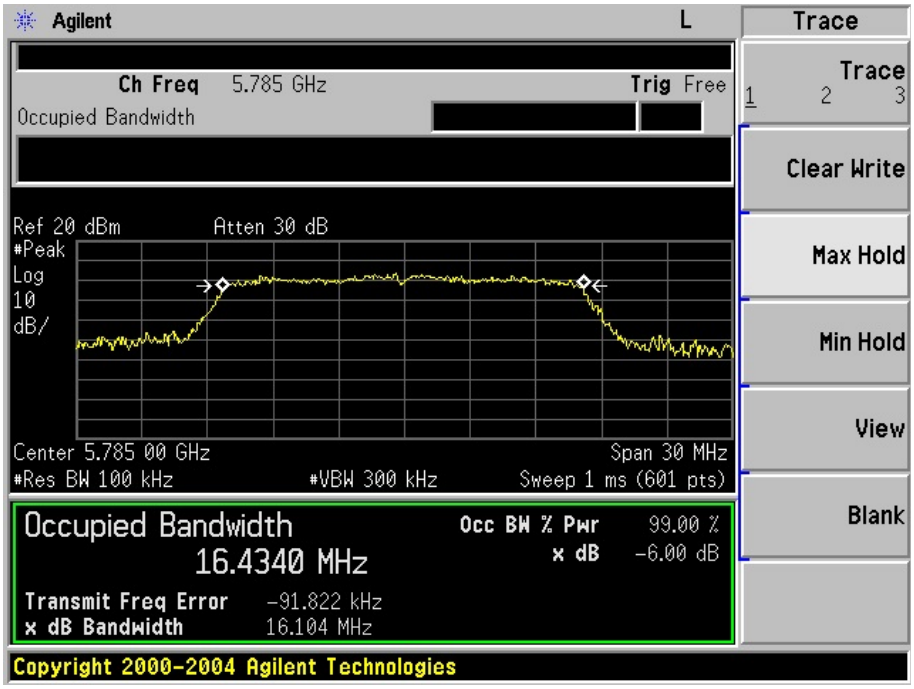
802.11n40:

| Channel | Frequency (MHz) | -6dB bandwidth (MHz) | Result |
|---|---|---|---|
| Low | 5755 MHz | 35.762 | Pass |
| High | 5795 MHz | 35.825 | Pass |

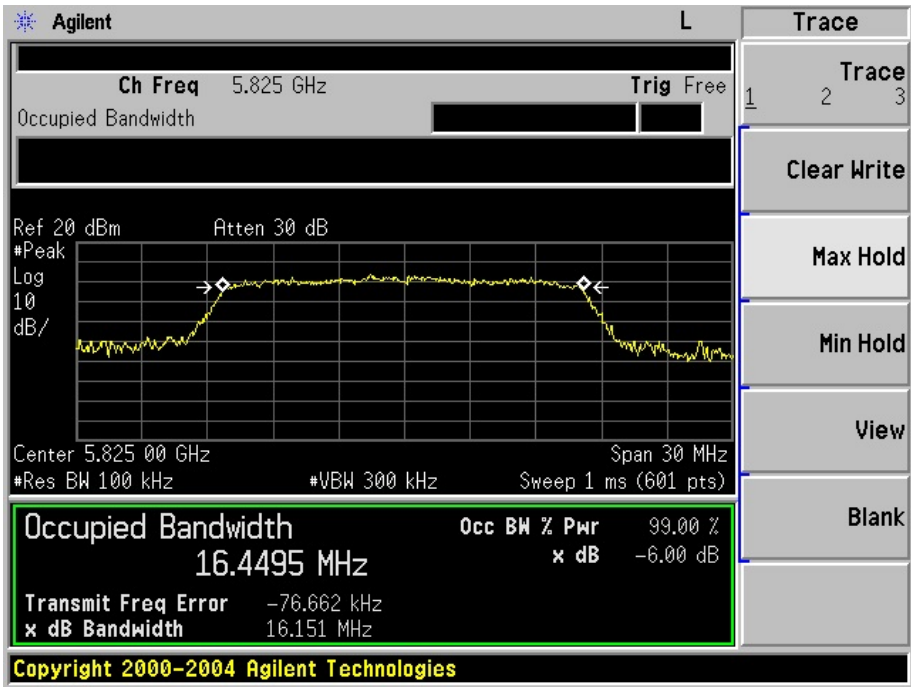
**802.11 a Mode**
**TX CH 149**



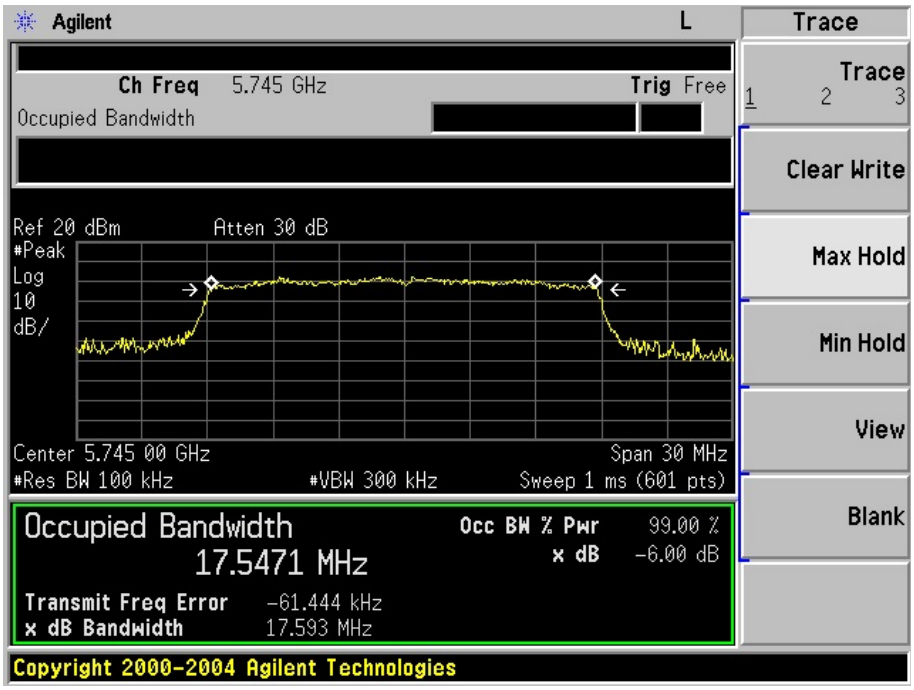

**TX CH 157**



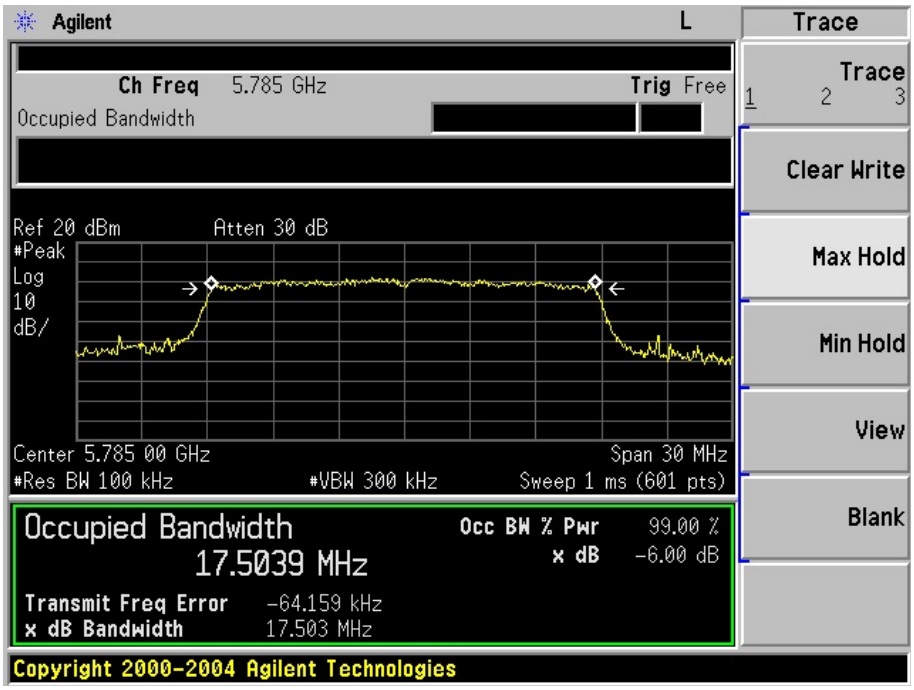
**TX CH 165**



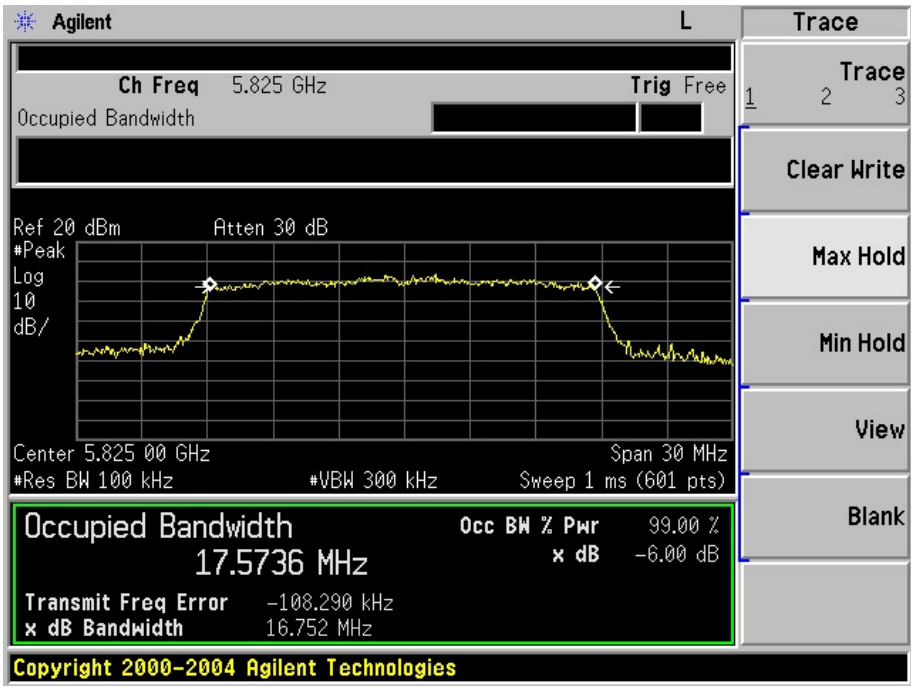

**802.11 n20 Mode**
**TX CH 149**



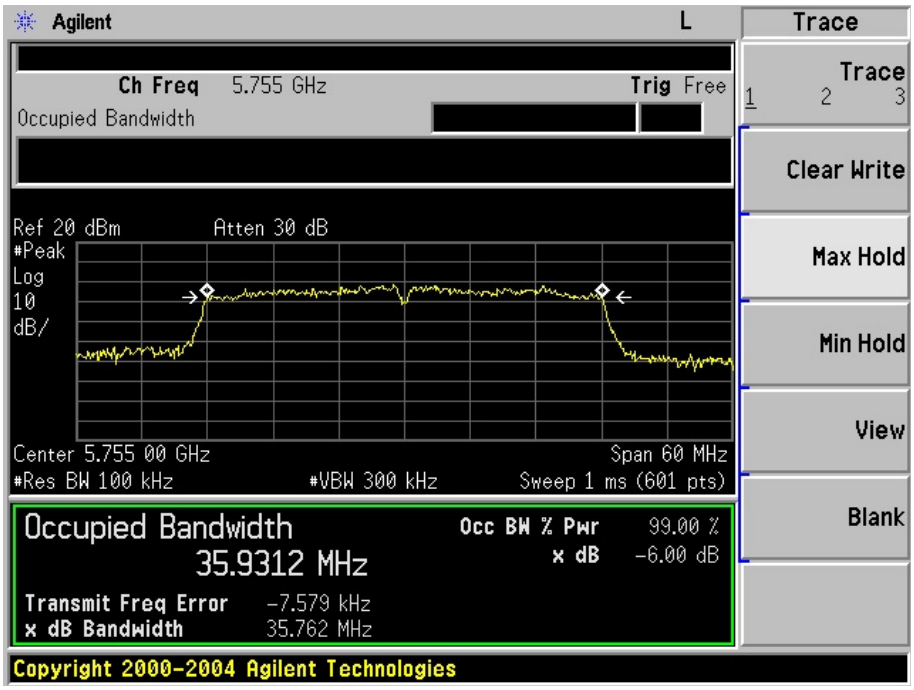
**TX CH 157**




**TX CH 165**



**802.11 n40 Mode**
**TX CH 151**




**TX CH 159**