



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

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Prepared by

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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) 15.407 (a)(3) 15.1049	26 dB and 99% Emission Bandwidth	PASS	
15.407(e)	Minimum 6 dB bandwidth	PASS	
15.407 (a)(1) 15.407 (a)(3)	Maximum Conducted Output Power	PASS	
15.209(a), 15.407 (b)(1) 15.407 (b)(4) 15.407 (b)(6)	Radiated Spurious Emission	PASS	
15.407 (a)(1) 15.407 (a)(3)	Power Spectral Density	PASS	
2.1051, 15.407(b)(1) 15.407(b)(4)	Band Edge Emission	PASS	
2.1051, 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 $y \pm U$, where expanded 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	$\pm 1.38\text{dB}$
2	RF power,conducted	$\pm 0.16\text{dB}$
3	Spurious emissions,conducted	$\pm 0.21\text{dB}$
4	All emissions,radiated(<1G)	$\pm 4.68\text{dB}$
5	All emissions,radiated(>1G)	$\pm 4.89\text{dB}$
6	Temperature	$\pm 0.5^{\circ}\text{C}$
7	Humidity	$\pm 2\%$

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

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

Note:

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

2.

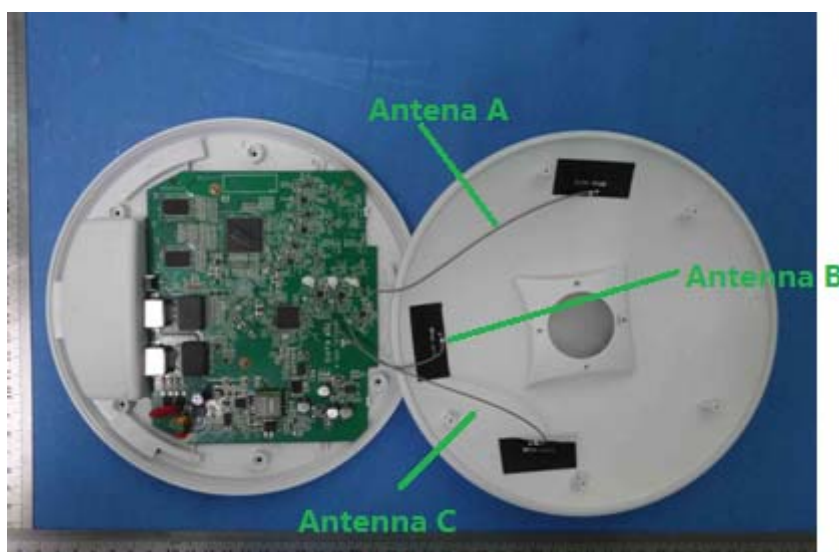
802.11a/n(20 MHz) Carrier Frequency Channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	153	5765	157	5785	161	5805
165	5825						

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= $G_{ANT} + 10\log(N)_{dbi} = 5.87_{dbi}$ 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

E-1
EUT

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

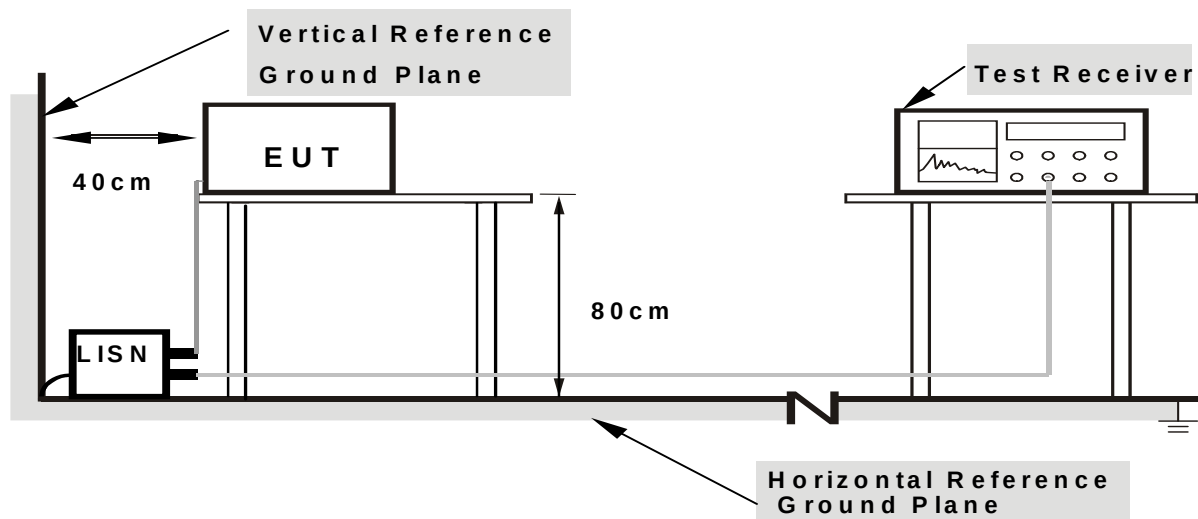
3.1.2 TEST PROCEDURE

- 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.
- 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.
- 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.
- LISN at least 80 cm from nearest part of EUT chassis.
- 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.

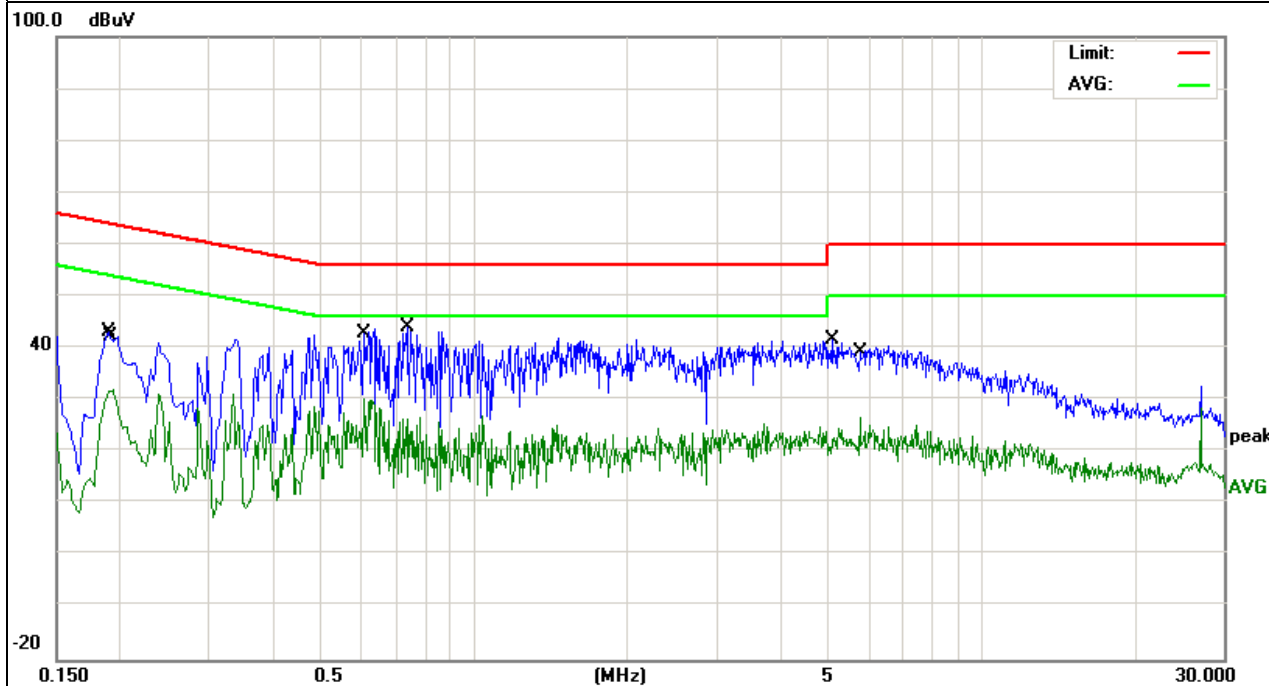
3.1.6 TEST RESULTS

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

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measure-ment (dBμV)	Limits (dBμV)	Margin (dB)	Detector Type
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.



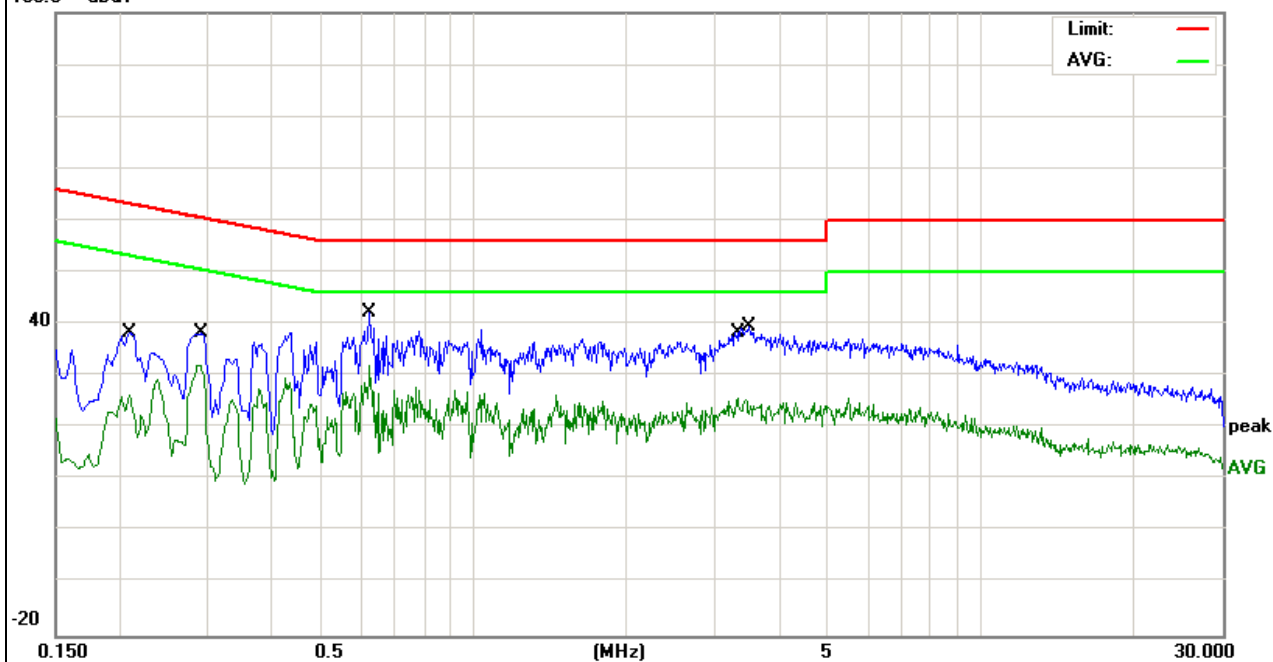
EUT :	WiFi Router	Model Name. :	AP220
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	AC 120V/60Hz	Test Mode :	Mode 4

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

100.0 dBμV



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:

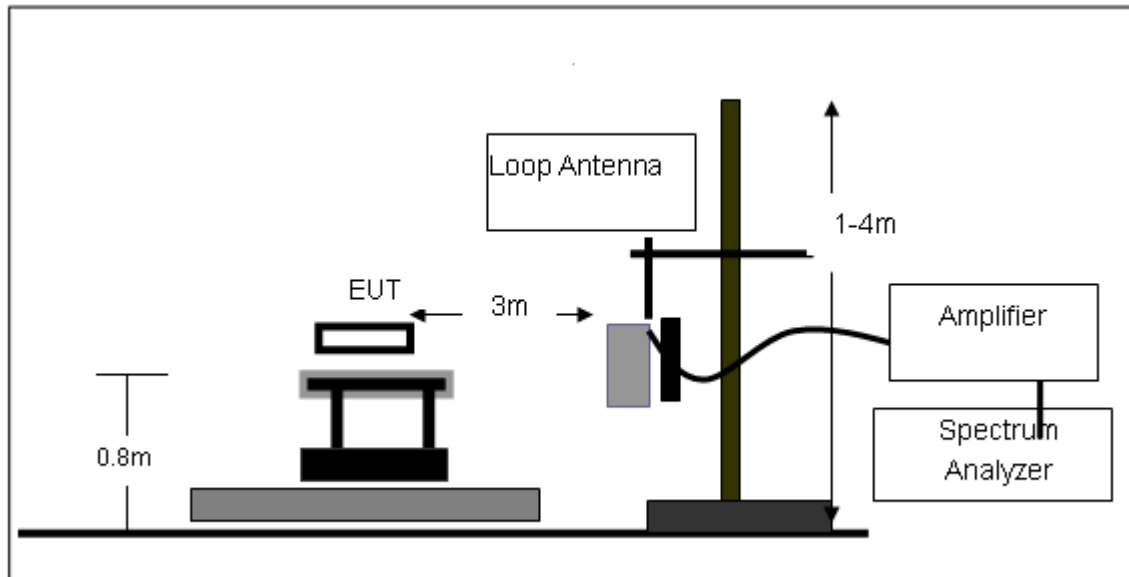
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

3.2.3 DEVIATION FROM TEST STANDARD

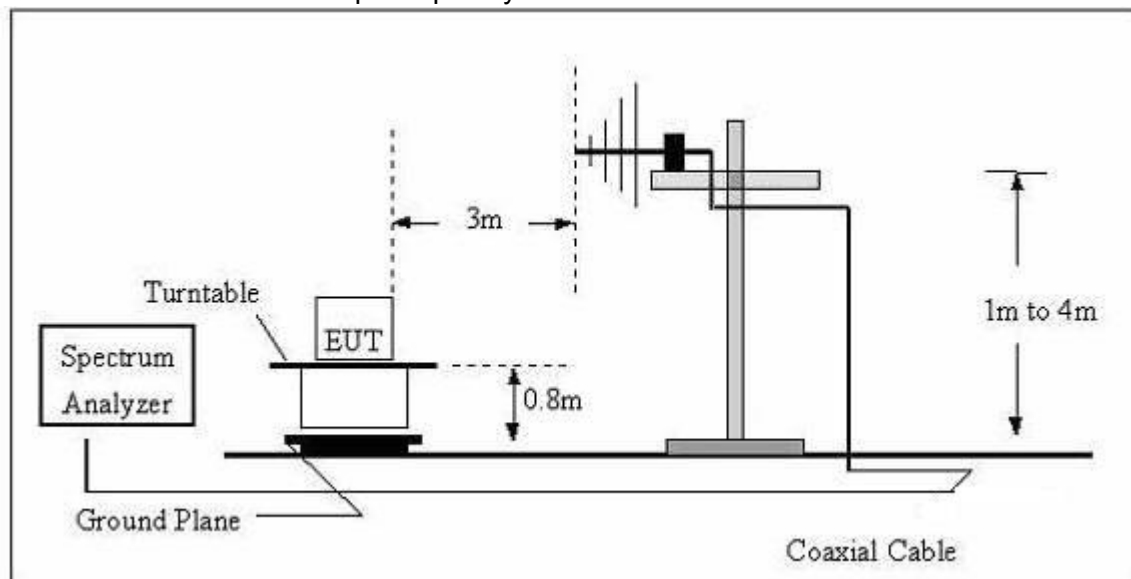
No deviation

3.2.4 TEST SETUP

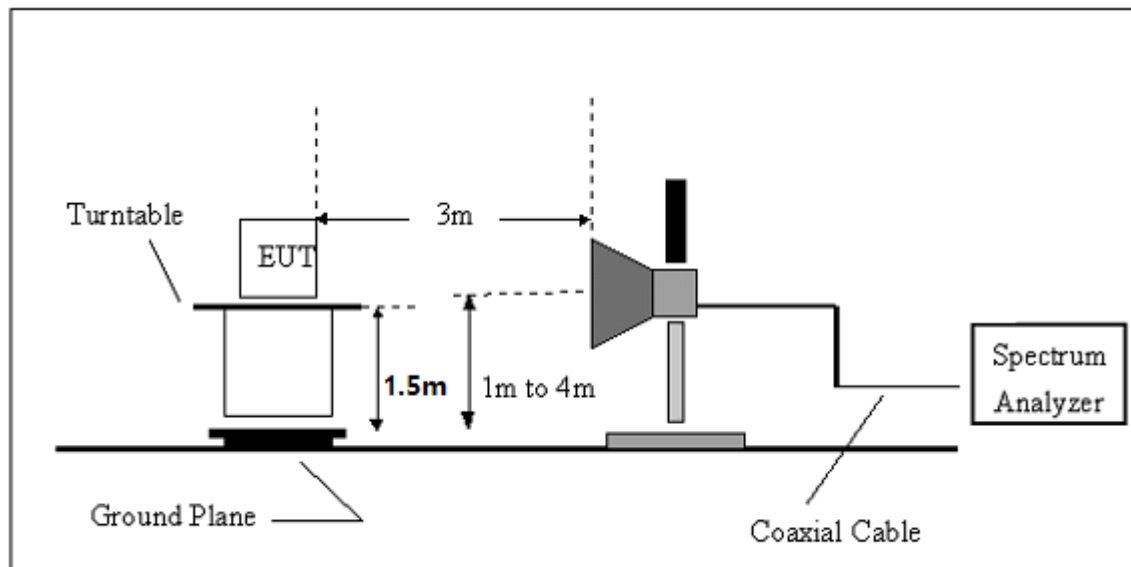
(A) Radiated Emission Test-Up Frequency Below 30MHz



(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 °C	Relative Humidity:	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 = $40 \log (\text{specific distance/test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

3.2.7 TEST RESULTS (BETWEEN 30MHZ – 1GHZ)

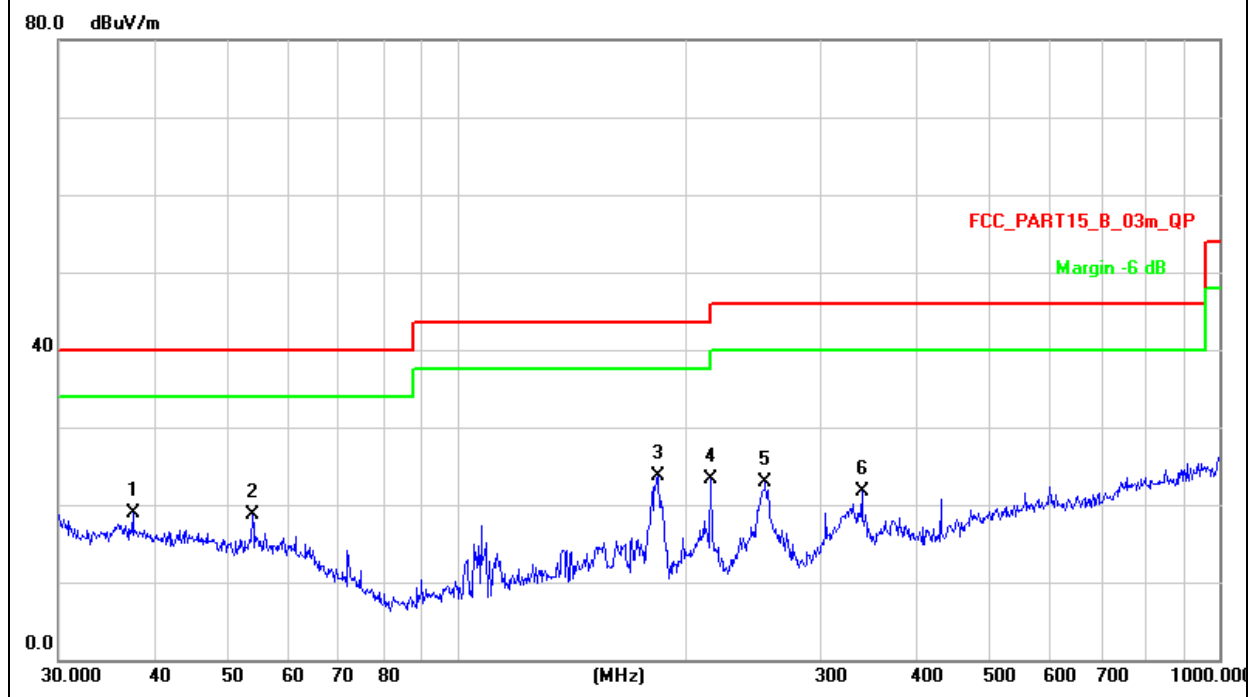
EUT :	WiFi Router	Model Name :	AP220
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz		
Test Mode :	TX		

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.



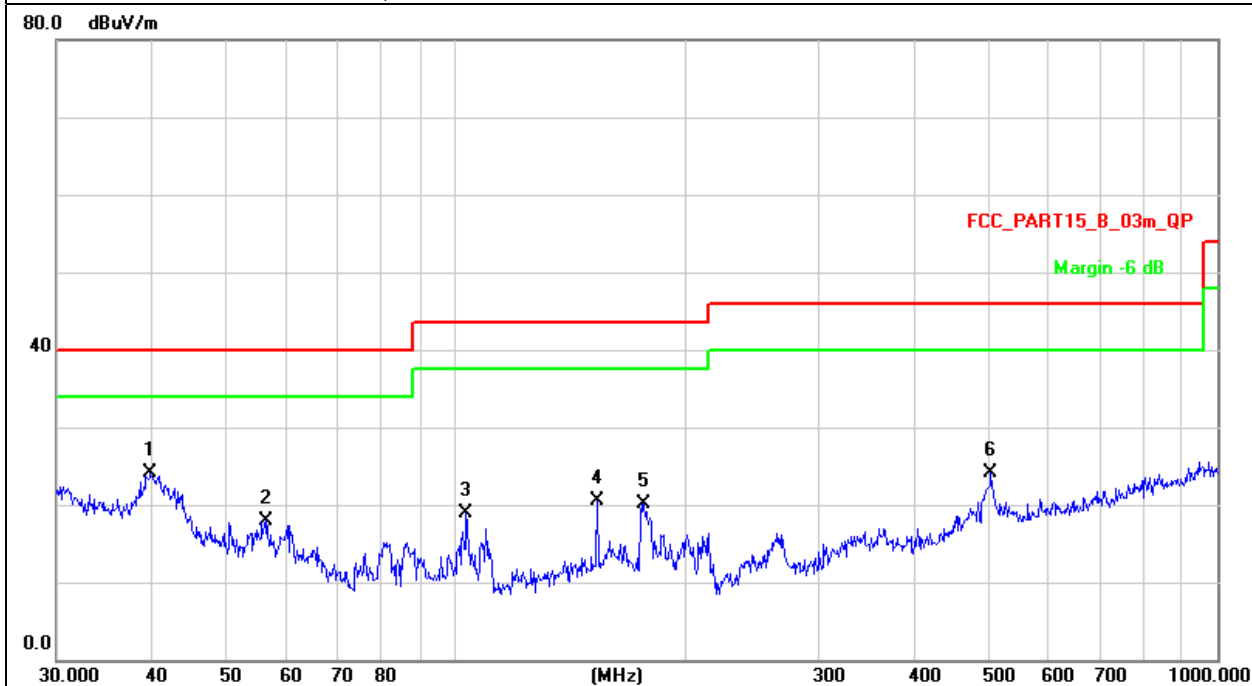
EUT :	WiFi Router	Model Name :	AP220
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz		
Test Mode :	TX		

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
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 colocated 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 $RBW \geq 1/T$, where T is defined in section II.B.I.a).
- b) Set $VBW \geq 3$ RBW.
- c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500\text{kHz}/RBW)$ 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 $10\log(1\text{MHz}/RBW)$ 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

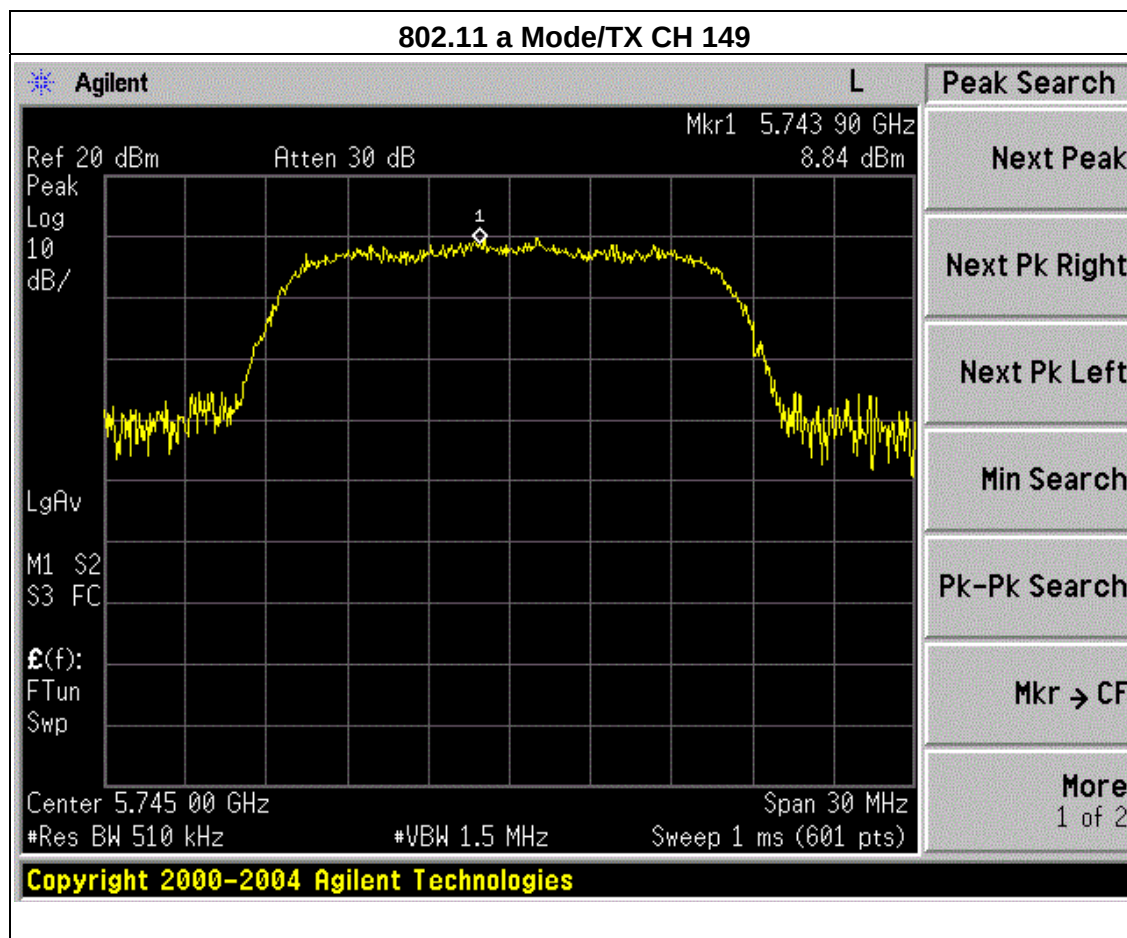
EUT :	WiFi Router	Model Name :	AP220
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1015 hPa	Test Voltage :	AC 120V
Test Mode :	TX a Mode		

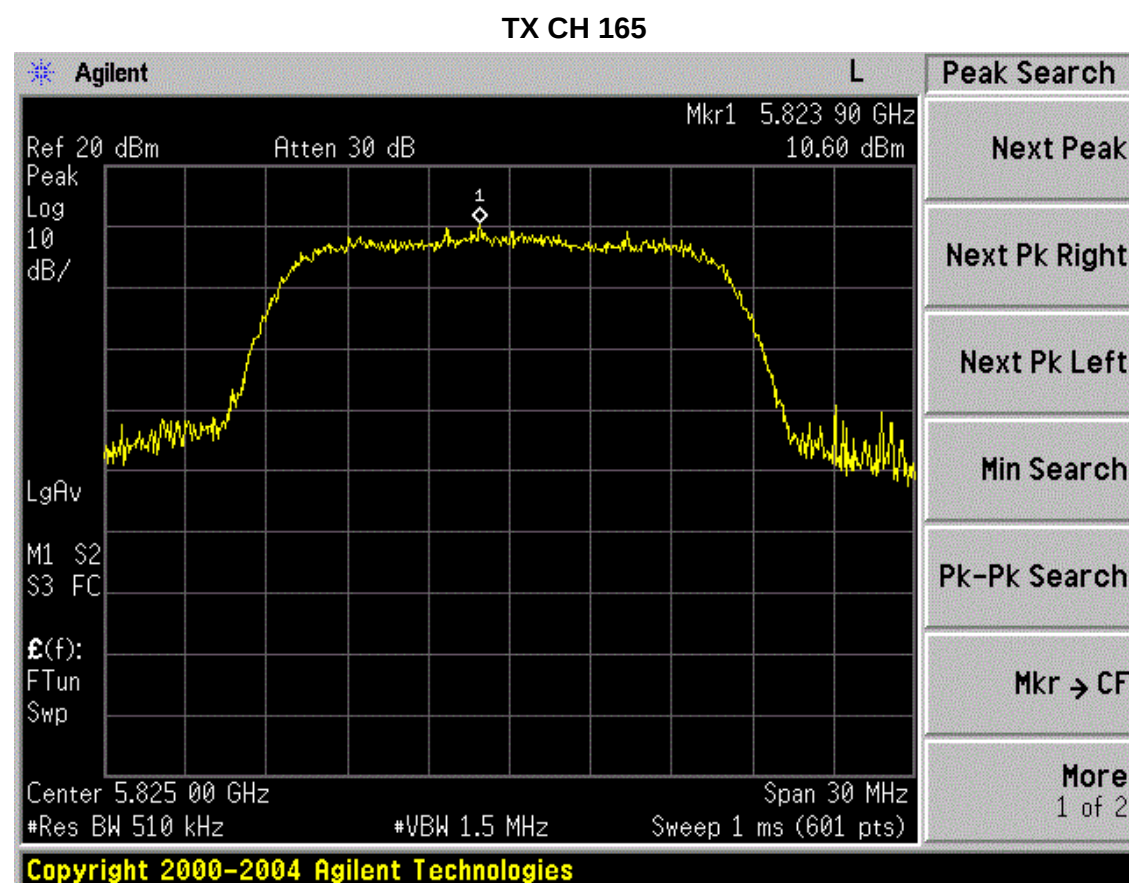
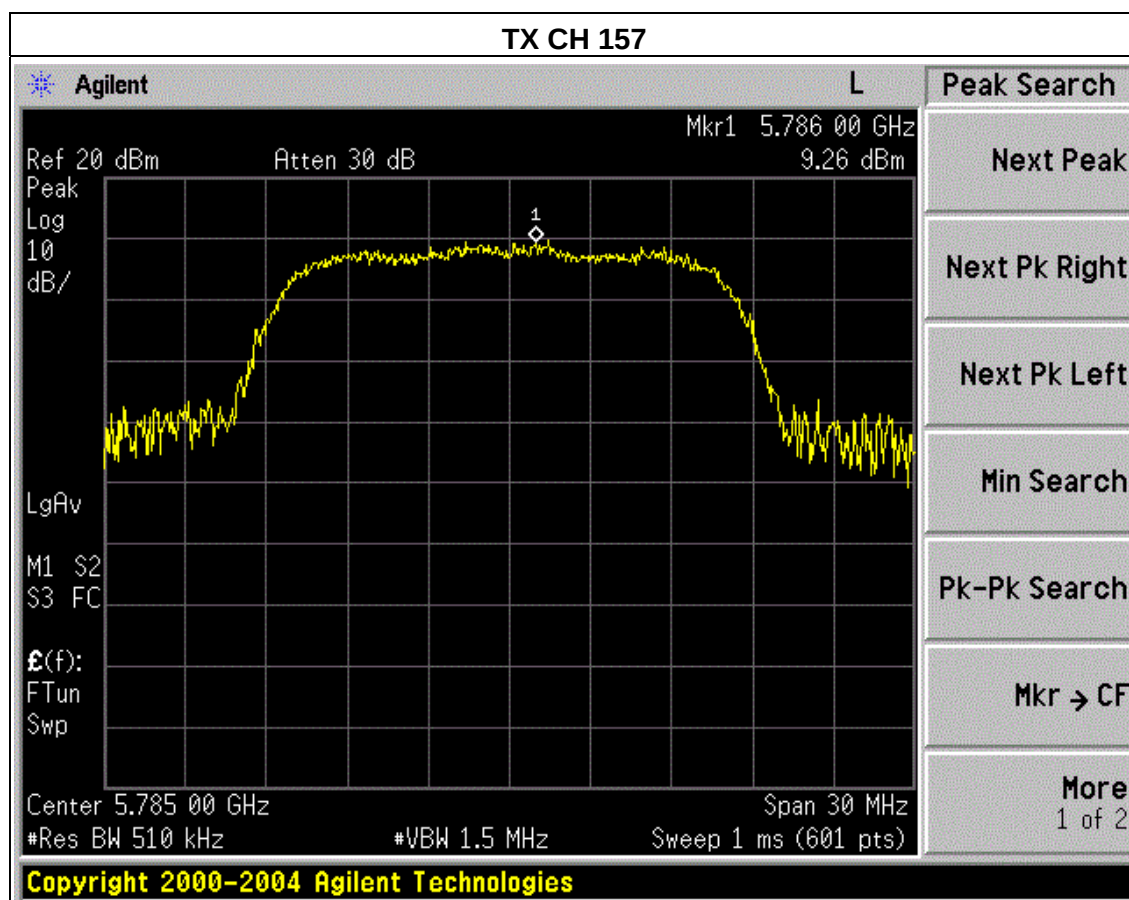
Frequency	Power Density A (dBm)	Power Density B (dBm)	Power Density C (dBm)
5745 MHz	8.84	8.21	8.01
5785 MHz	9.26	9.12	9.01
5825 MHz	10.6	9.78	9.21

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 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



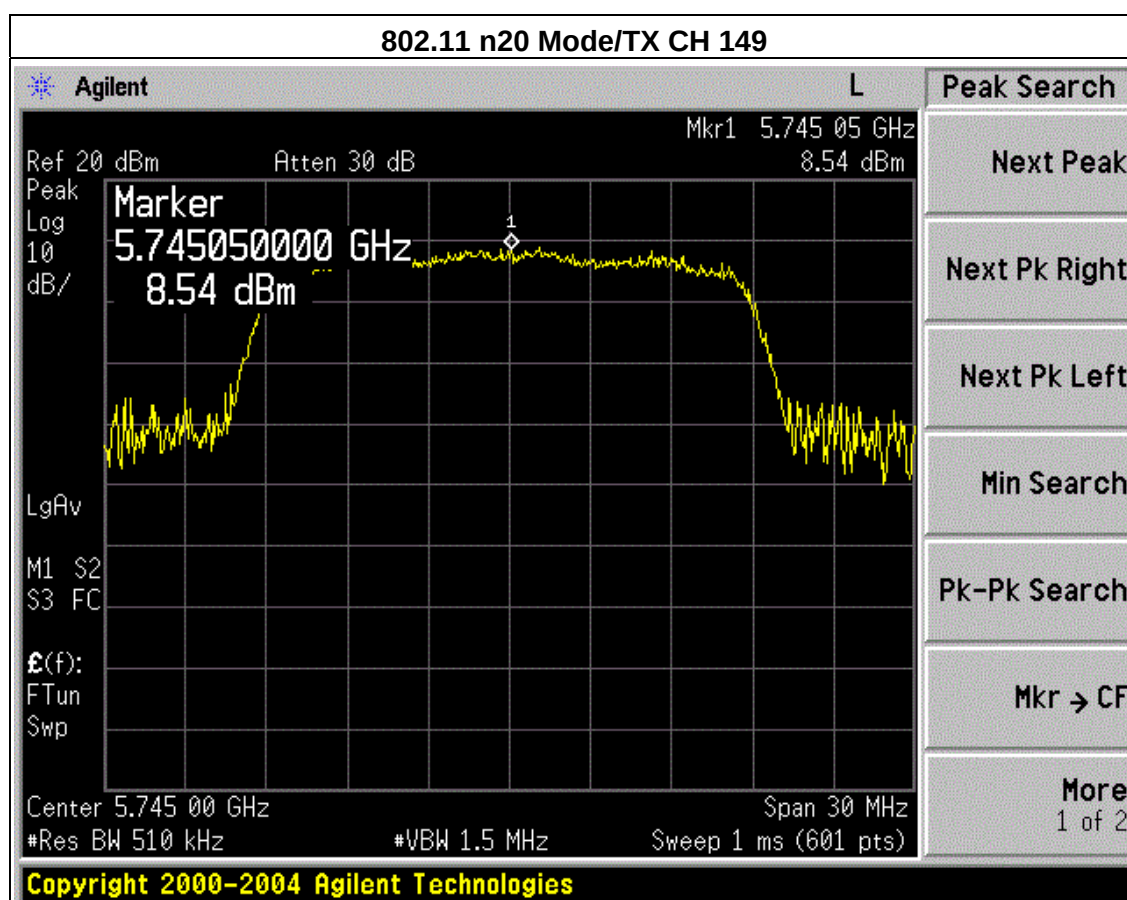


EUT :	WiFi Router	Model Name :	AP220
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1015 hPa	Test Voltage :	AC 120V
Test Mode :	TX g Mode		

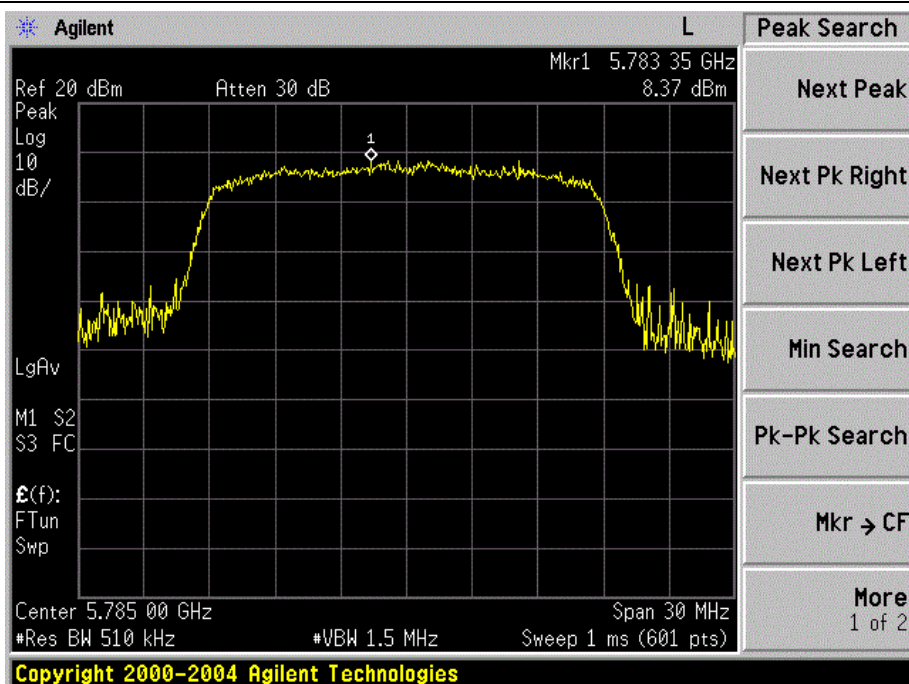
Frequency	Power Density A (dBm)	Power Density B (dBm)	Power Density C (dBm)	10log (1MHz/0.51)	Total Power Density (dBm)	Limit (dBm)	Result
5745 MHz	8.54	8.21	8.01	2.92	15.95	30	PASS
5785 MHz	8.37	8.10	8.01	2.92	15.85	30	PASS
5825 MHz	8.12	8.00	7.98	2.92	15.72	30	PASS

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.

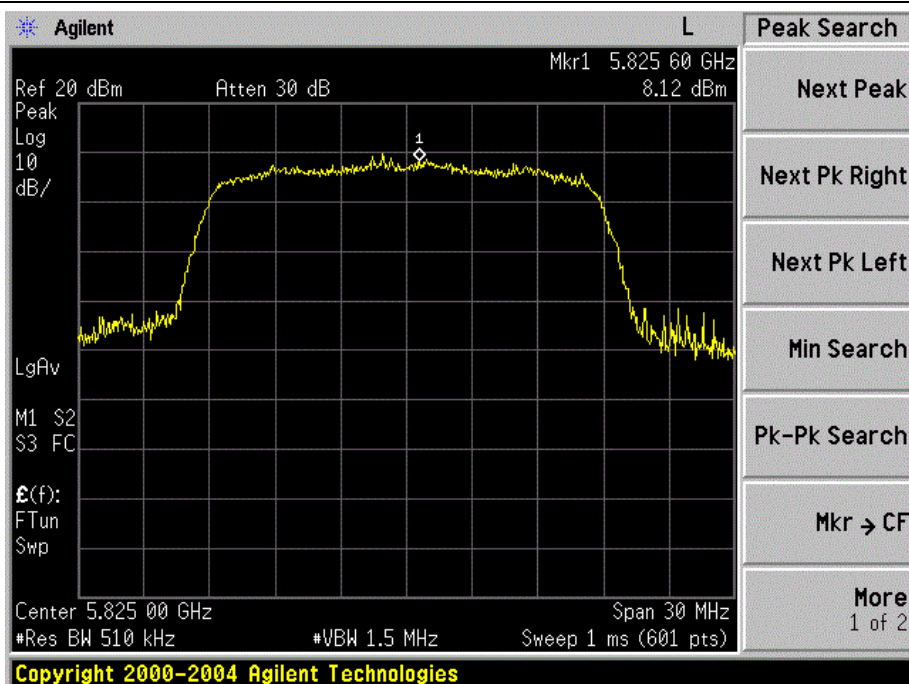
Calculate power density= Measured Power Density+10log(1MHz/0.51MHz)
= Measured Power Density+2.92



TX CH 157



TX CH 165

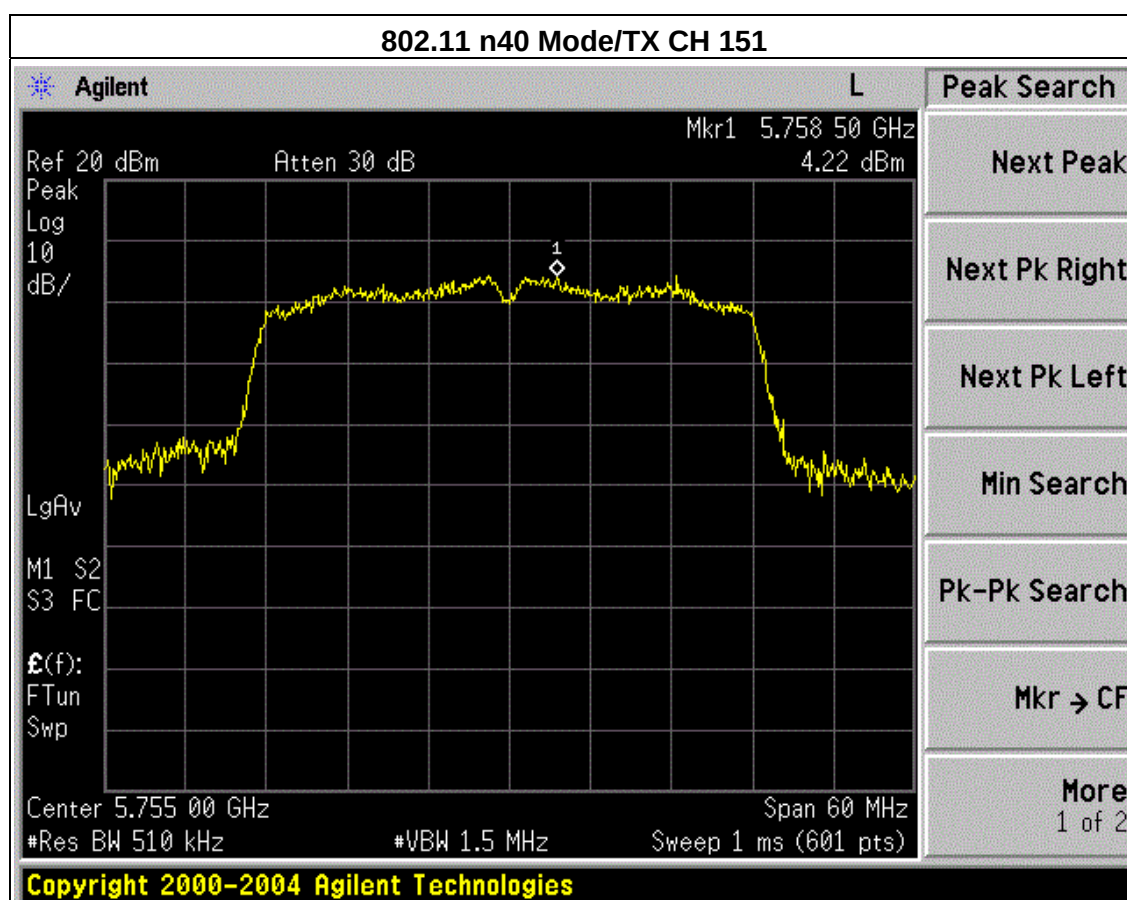


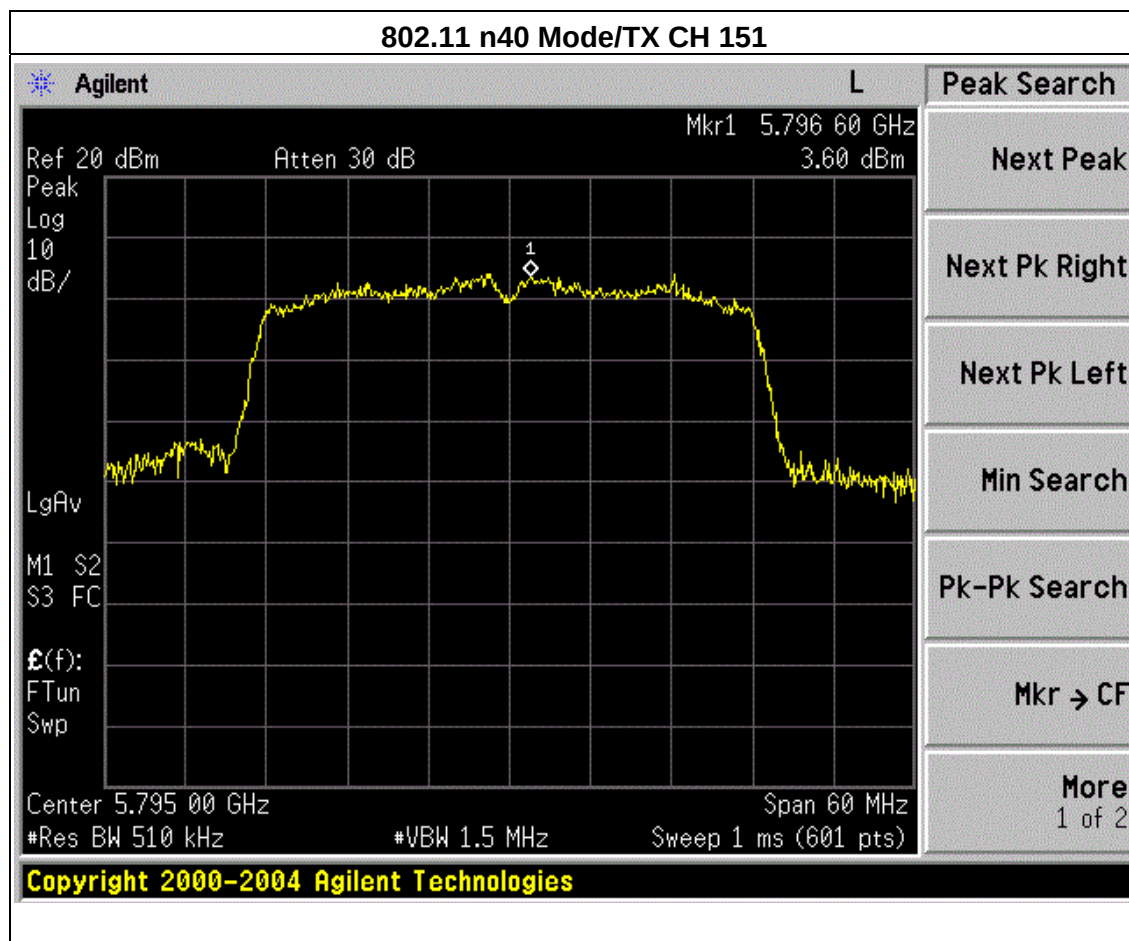
EUT :	WiFi Router	Model Name :	AP220
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1015 hPa	Test Voltage :	AC 120V
Test Mode :	TX n Mode(20M) /CH01, CH06, CH11		

Frequency	Power Density A (dBm)	Power Density B (dBm)	Power Density C (dBm)	10log (1MHz/0.51)	Total 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





5. 26 DB & 99% EMISSION BANDWIDTH

5.1 APPLIED PROCEDURES / LIMIT

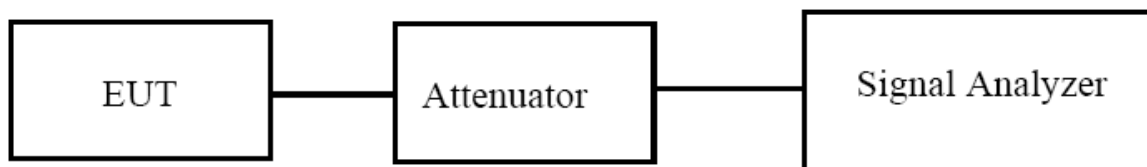
The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band 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%.

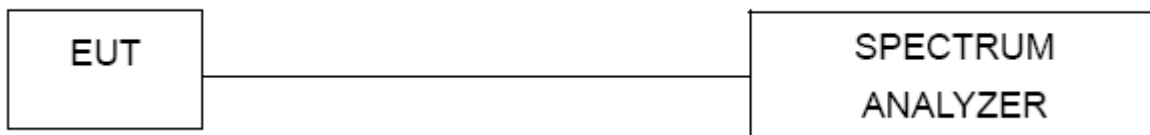
The following procedure shall be used for measuring (99 %) power bandwidth:

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 $\geq 3 \cdot$ 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 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	AC 120V
Test Mode :	TX Frequency (5745-5850MHz)		

802.11a:

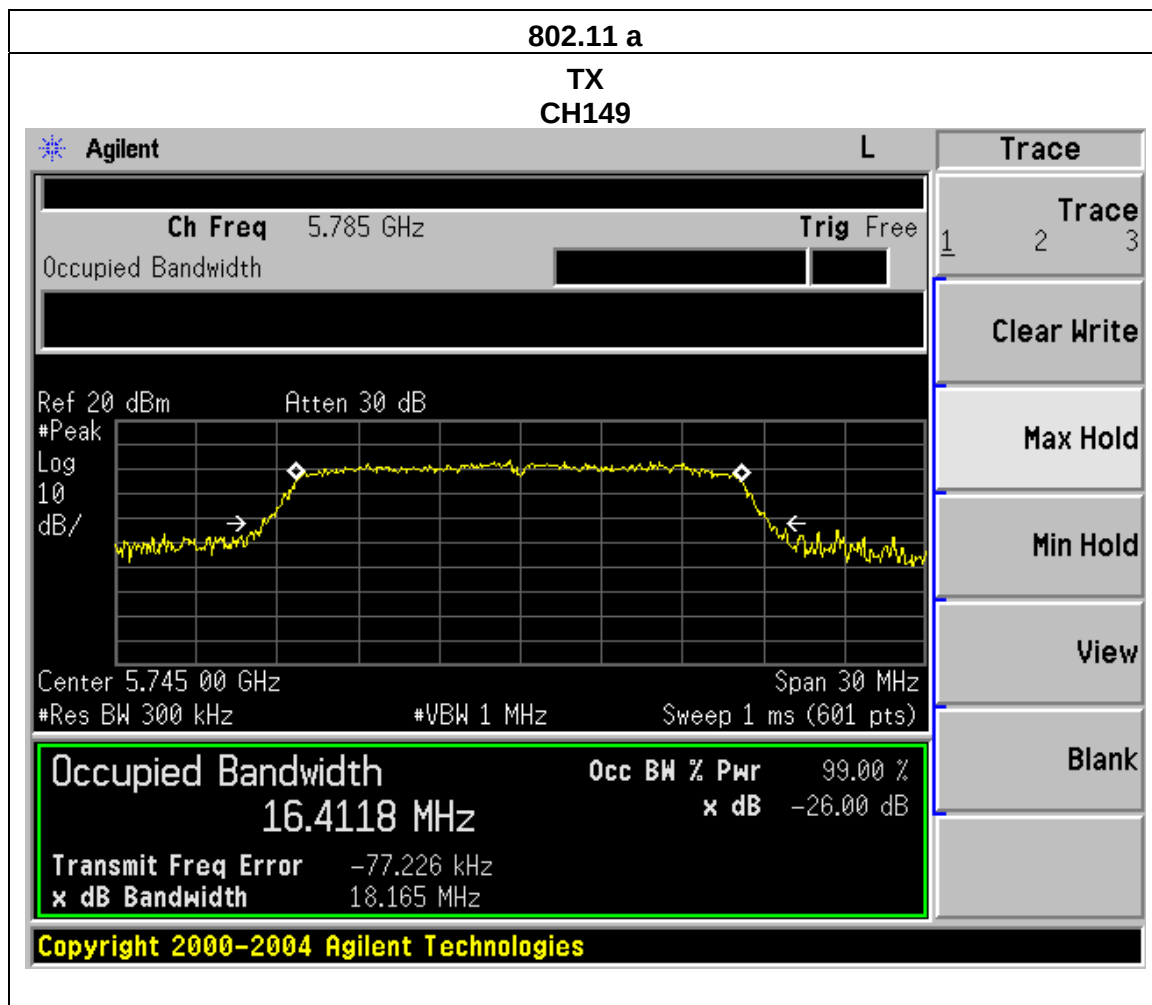
Channel	Frequency (MHz)	99% bandwidth (MHz)	26dB bandwidth (MHz)	Result
Low	5745 MHz	16.412	18.165	Pass
Middle	5785 MHz	16.429	18.765	Pass
High	5825 MHz	16.445	18.848	Pass

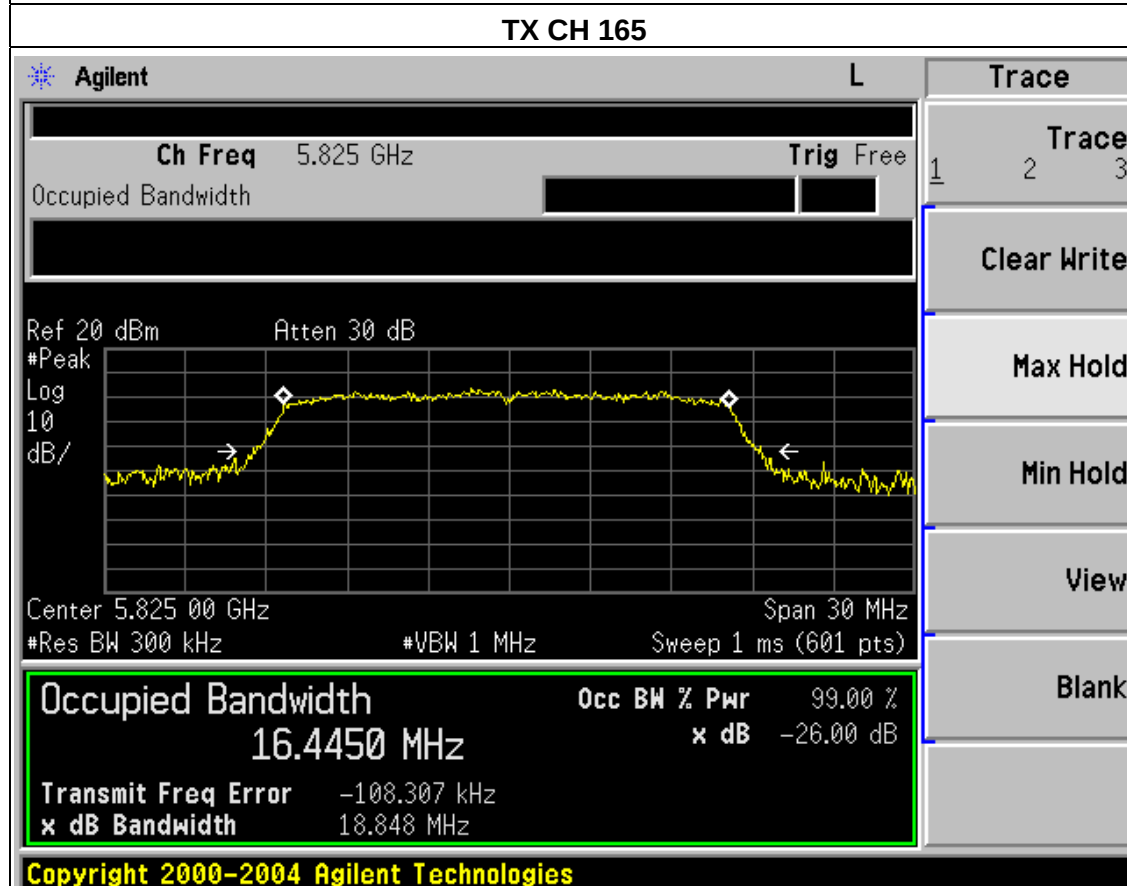
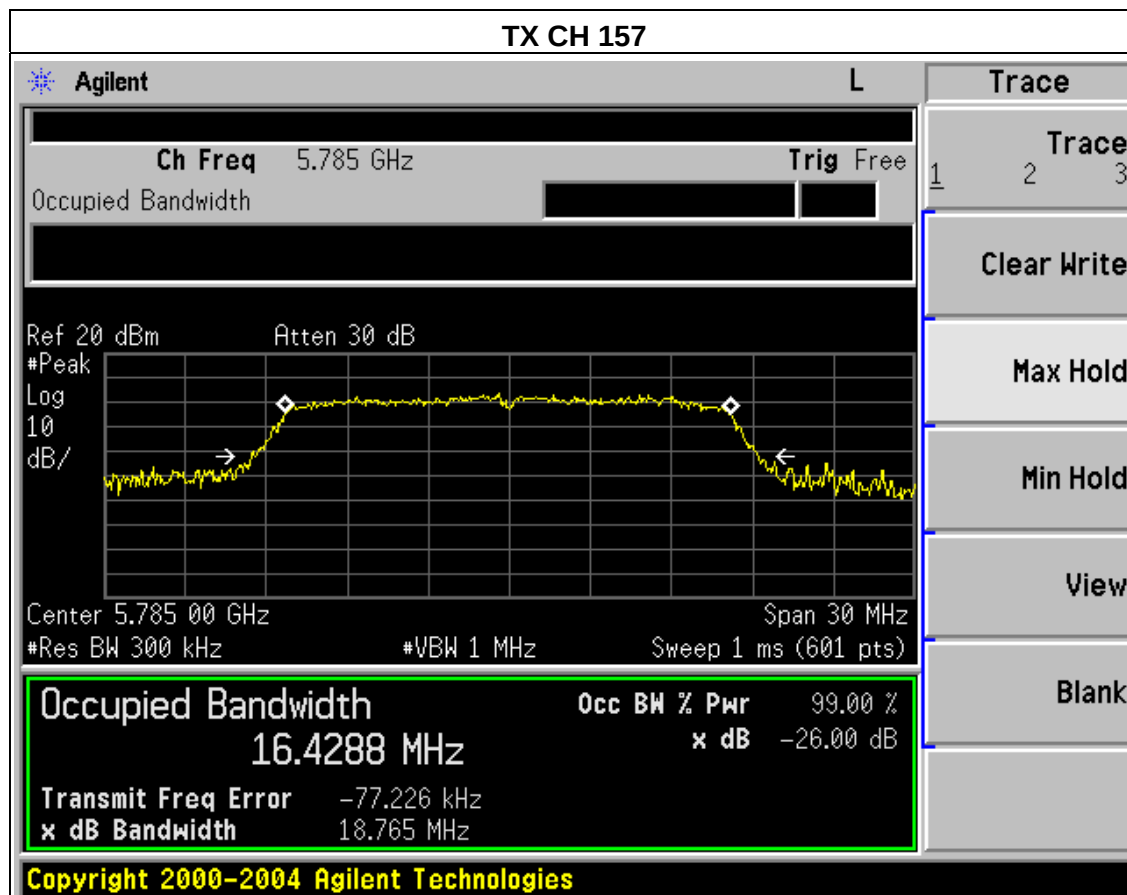
802.11n20:

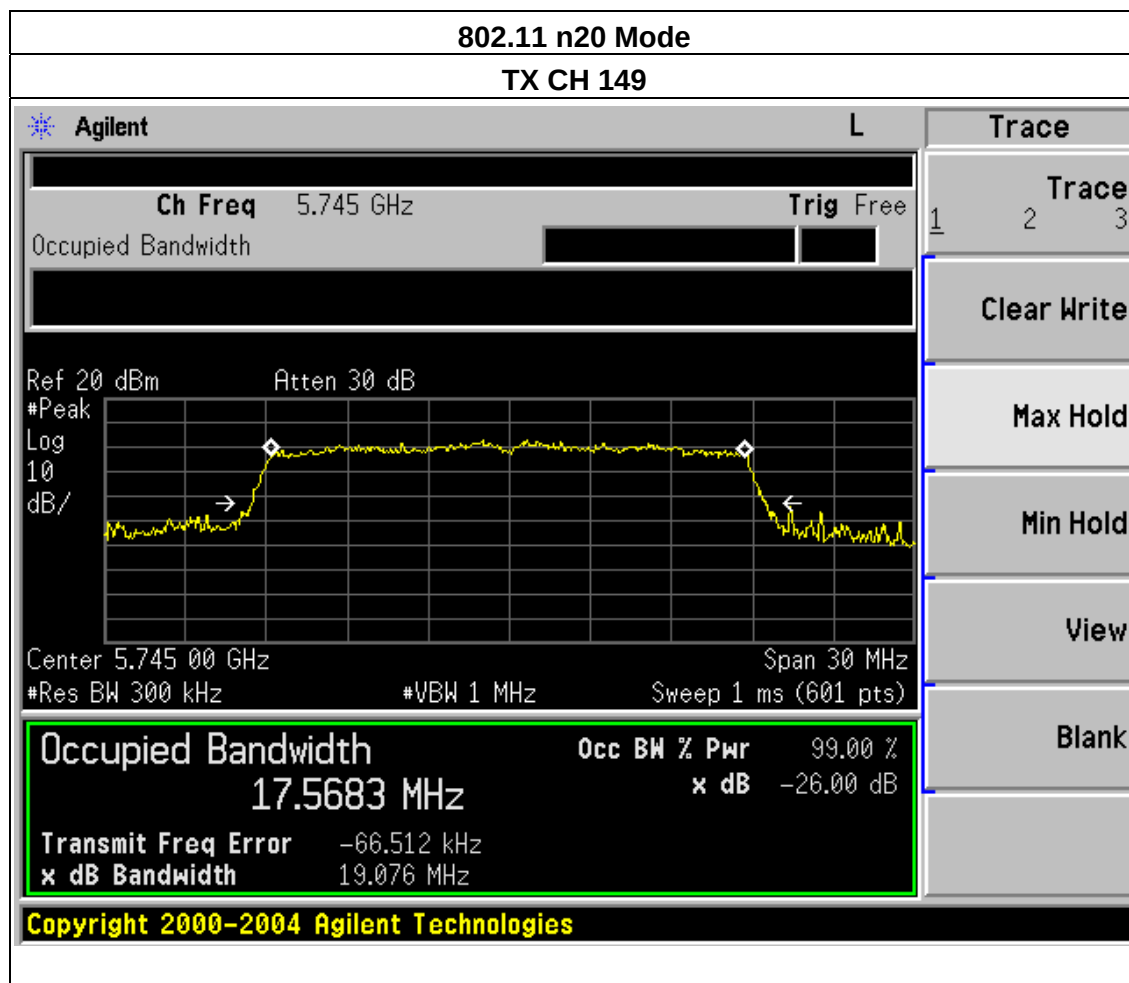
Channel	Frequency (MHz)	99% bandwidth (MHz)	26dB bandwidth (MHz)	Result
Low	5745 MHz	17.568	19.076	Pass
Middle	5785 MHz	17.559	19.101	Pass
High	5825 MHz	17.578	19.025	Pass

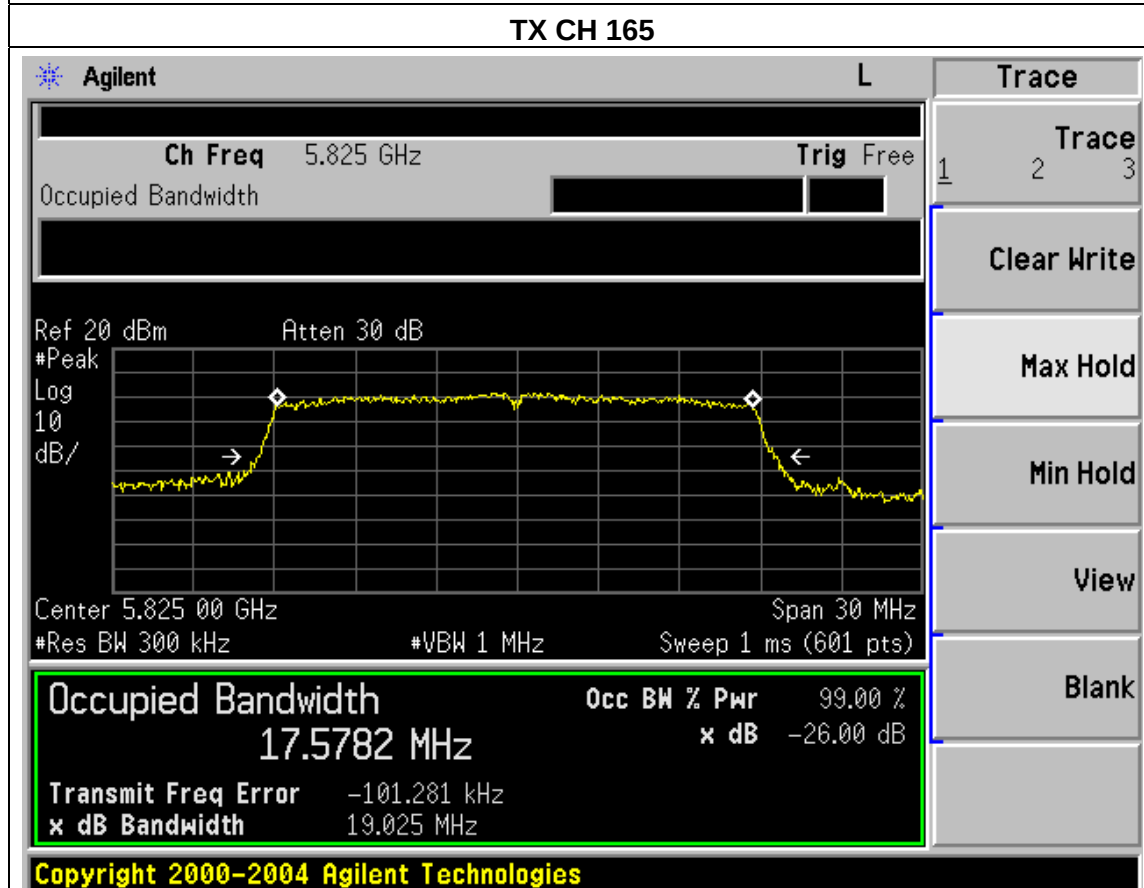
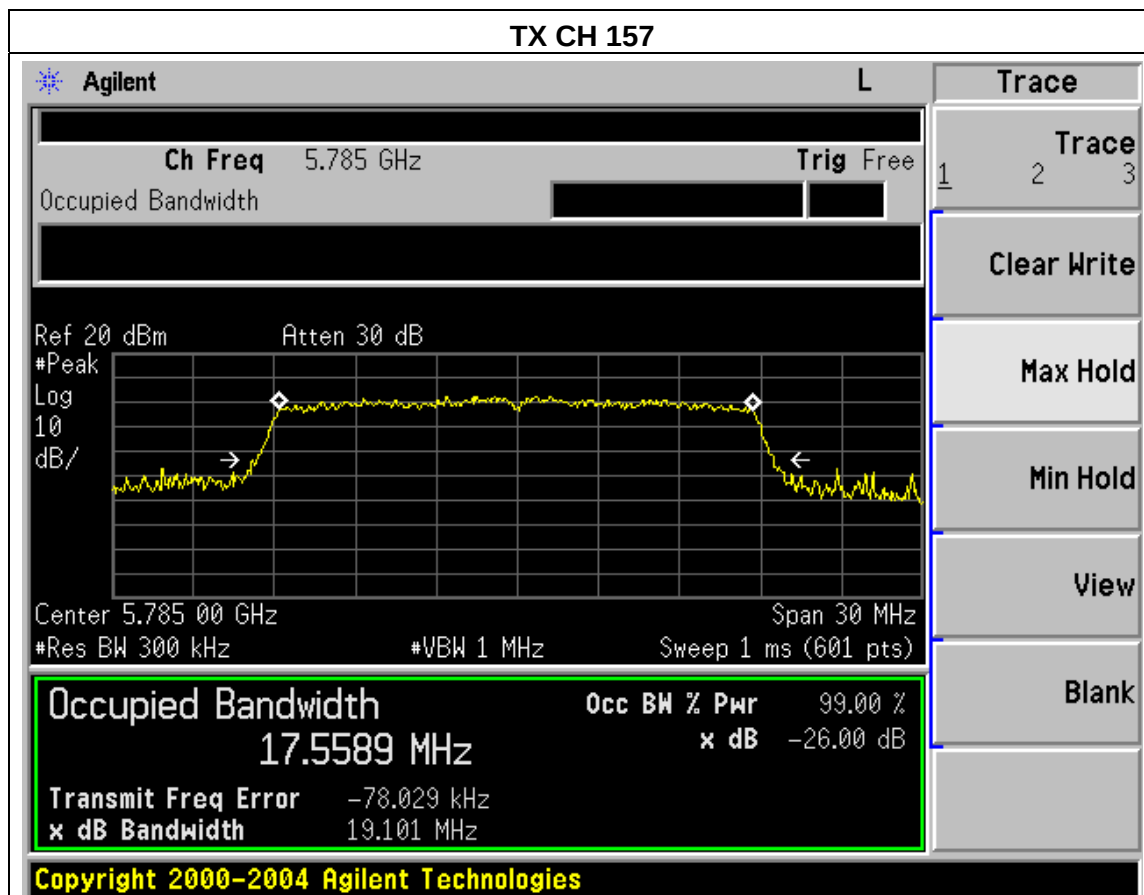
802.11n40:

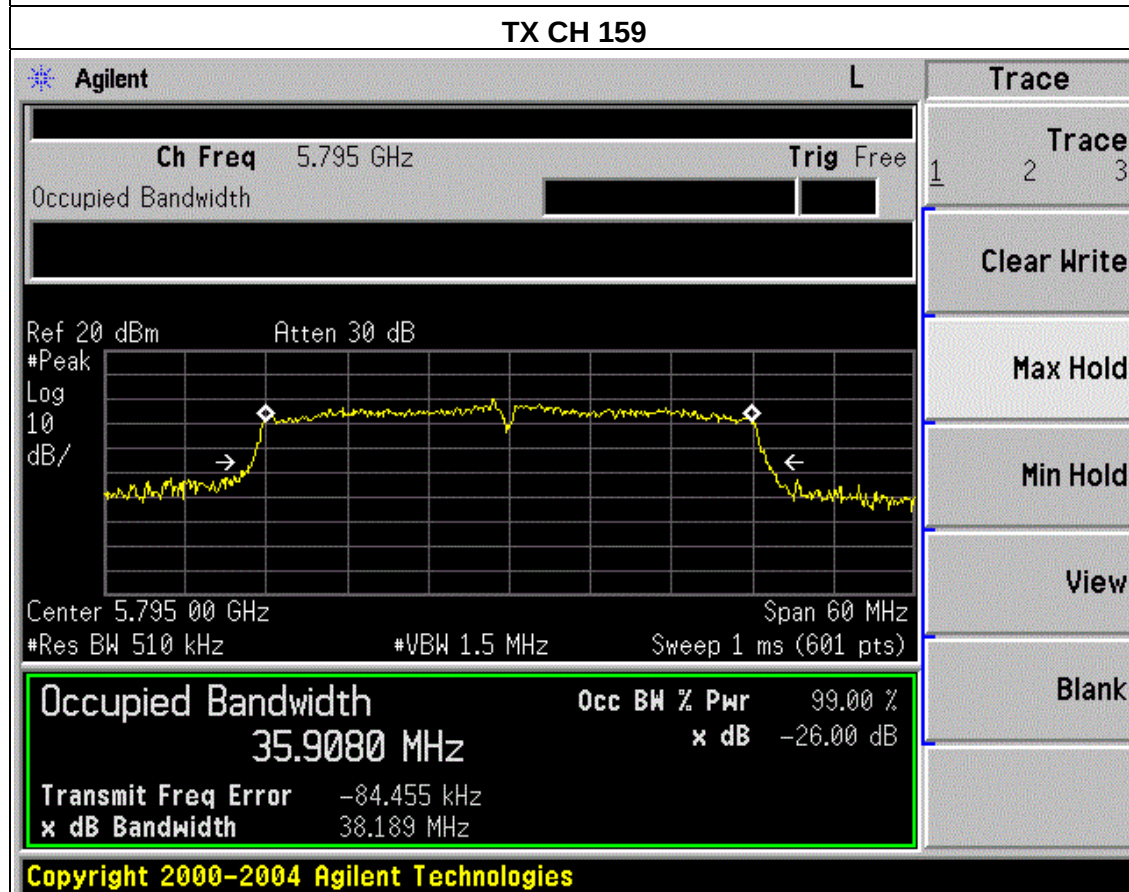
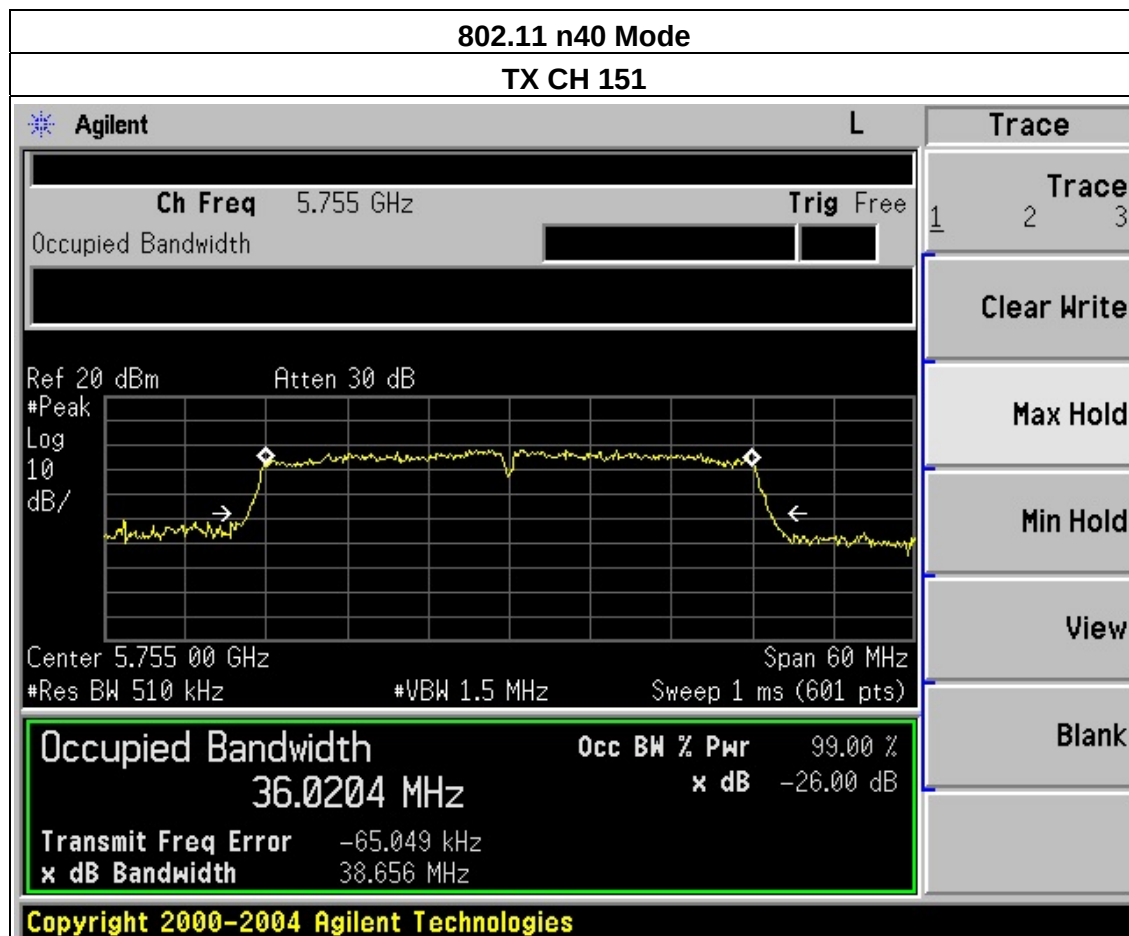
Channel	Frequency (MHz)	99% bandwidth (MHz)	26dB bandwidth (MHz)	Result
Low	5755 MHz	36.020	38.656	Pass
High	5795 MHz	35.908	38.189	Pass











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 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	AC 120V
Test Mode :	TX a/n(20M, 40M) Mode		

TX 802.11a Mode						
Test Channel	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.

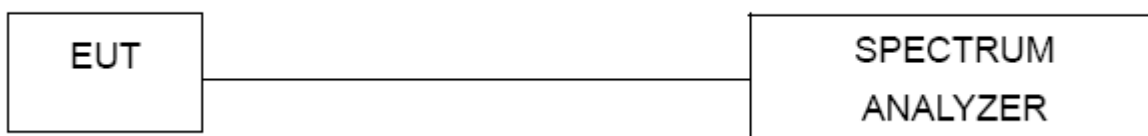
TEST PROCEDURE

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

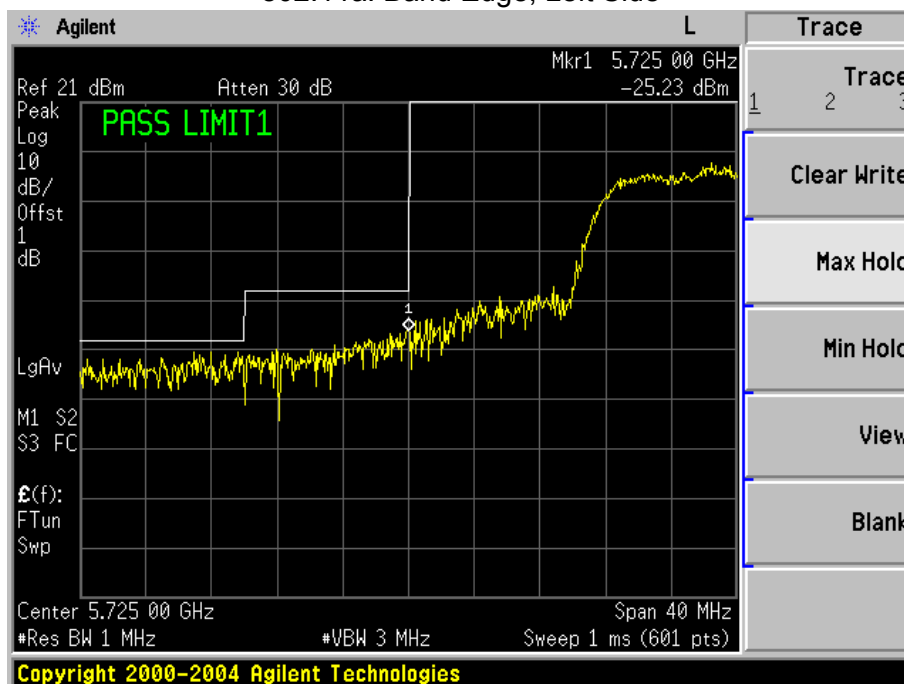


7.3 EUT OPERATION CONDITIONS

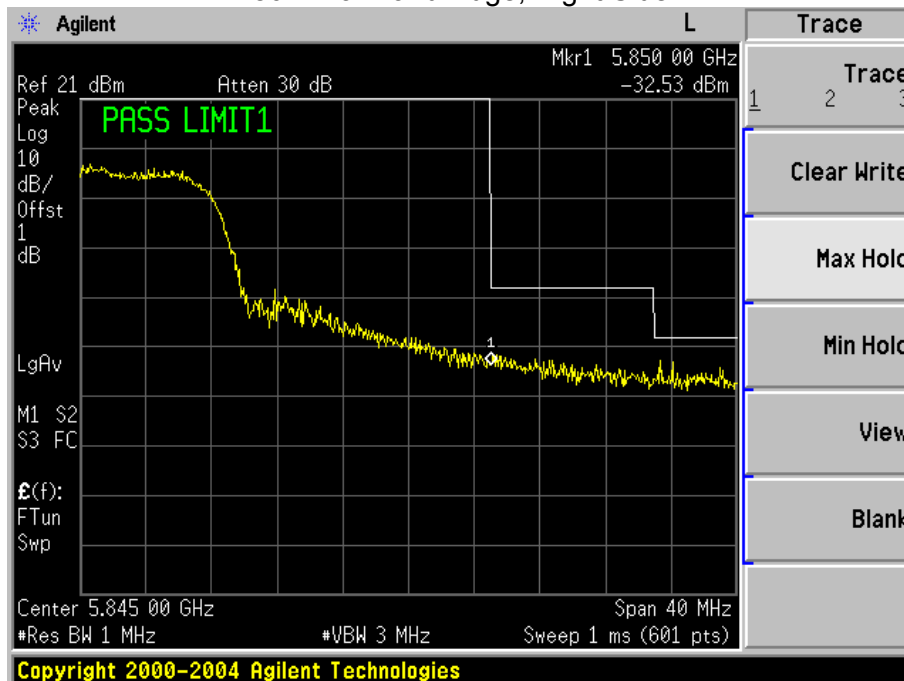
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

7.4 TEST RESULTS

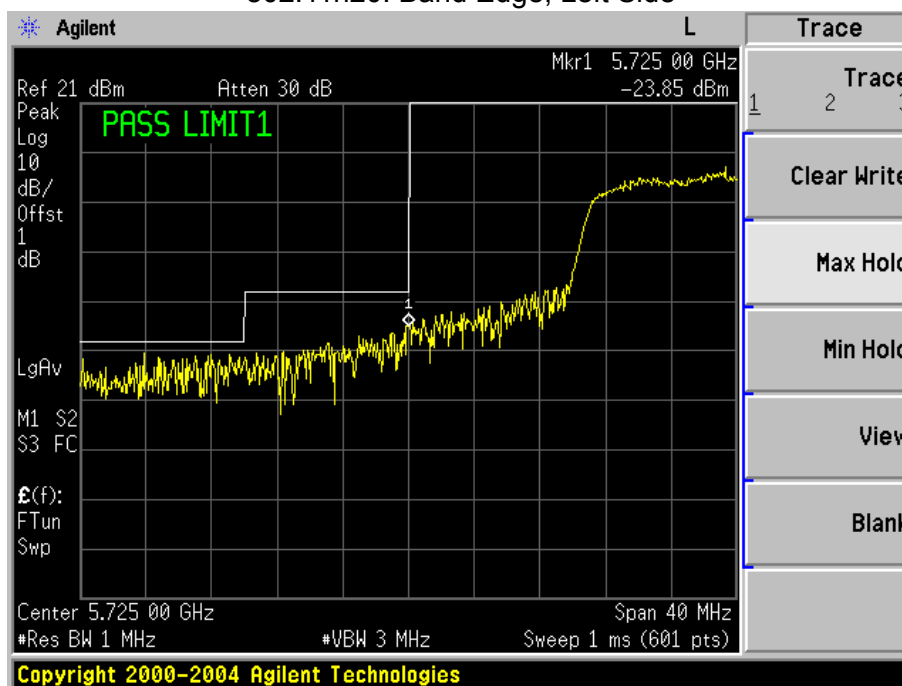
802.11a: Band Edge, Left Side



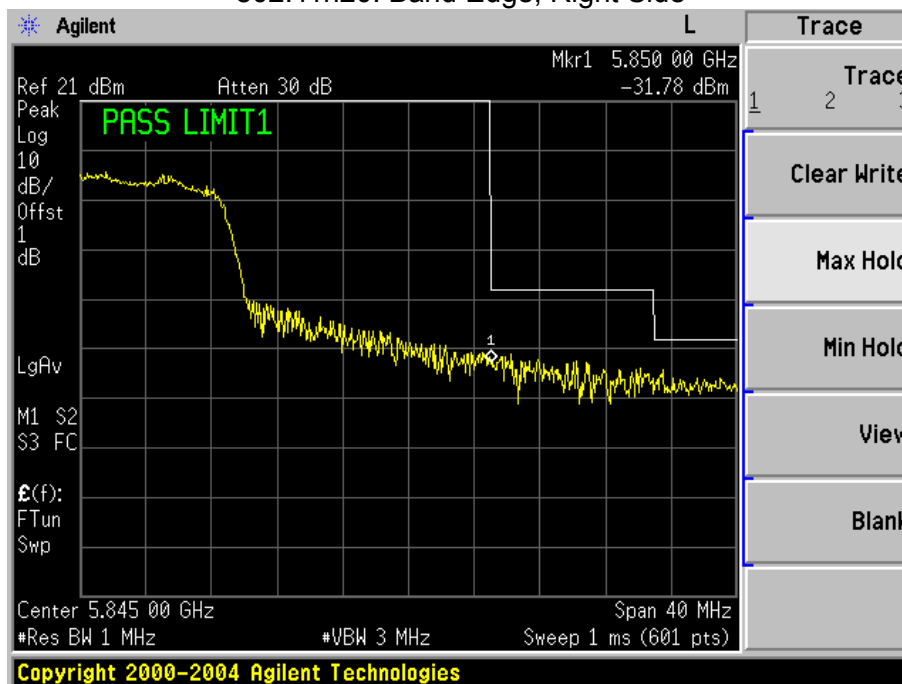
802.11a: Band Edge, Right Side



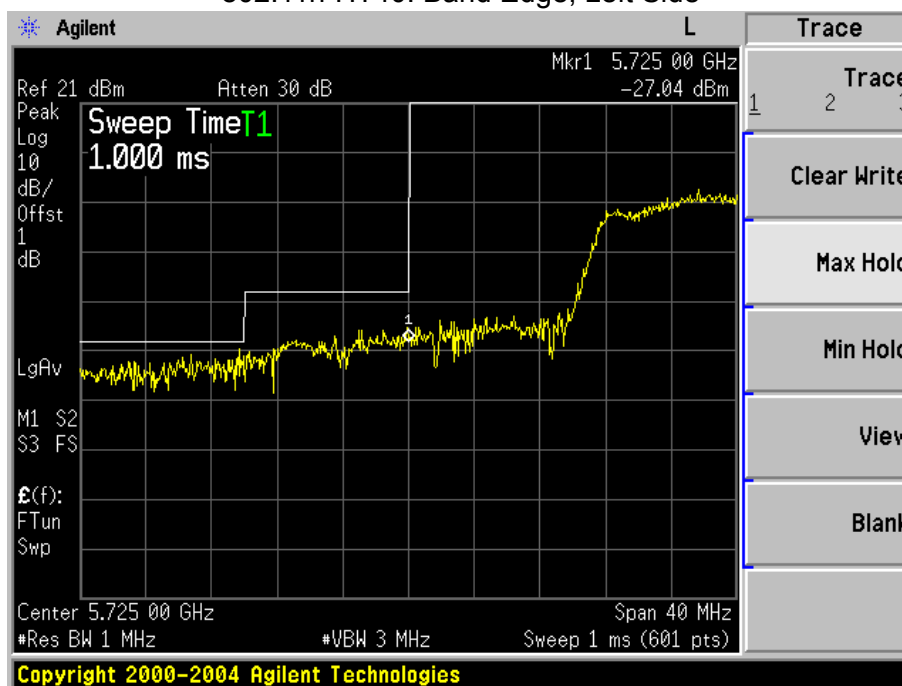
802.11n20: Band Edge, Left Side



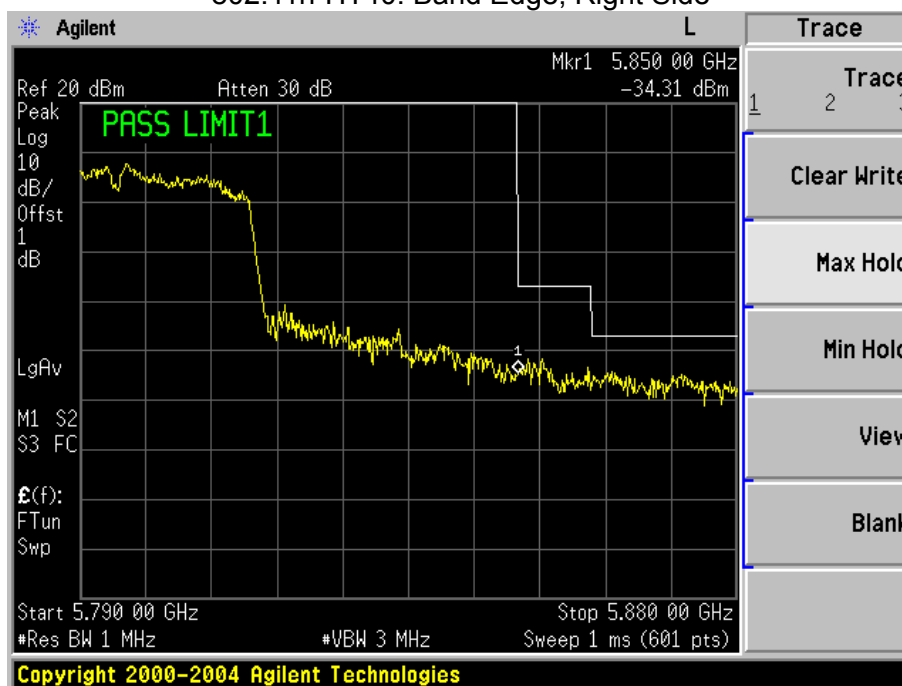
802.11n20: Band Edge, Right Side



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

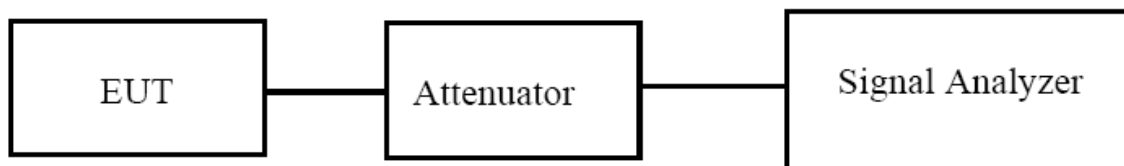
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ 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

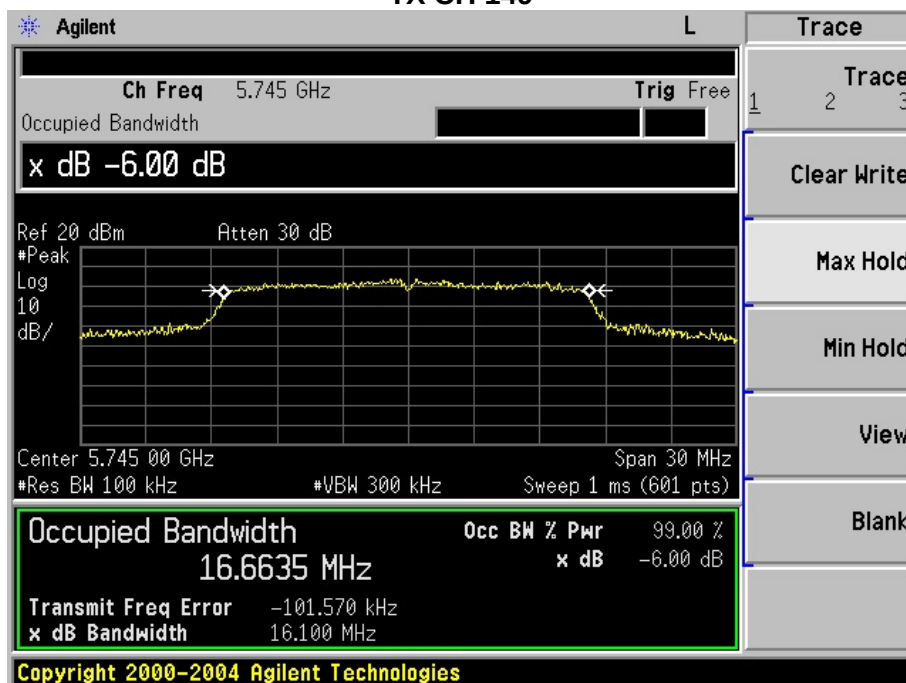
802.11n20:

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

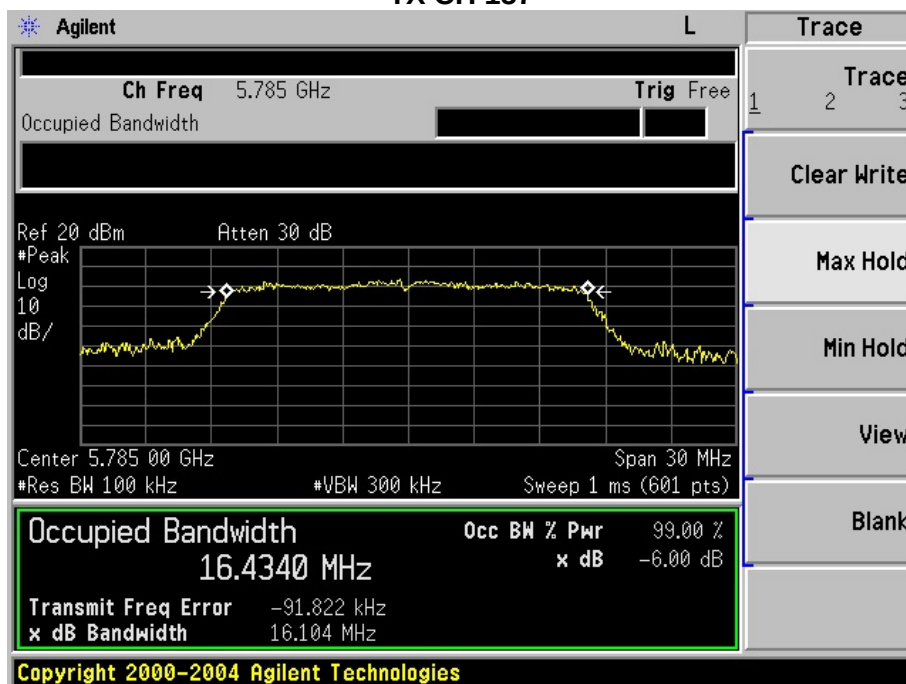
802.11n40:

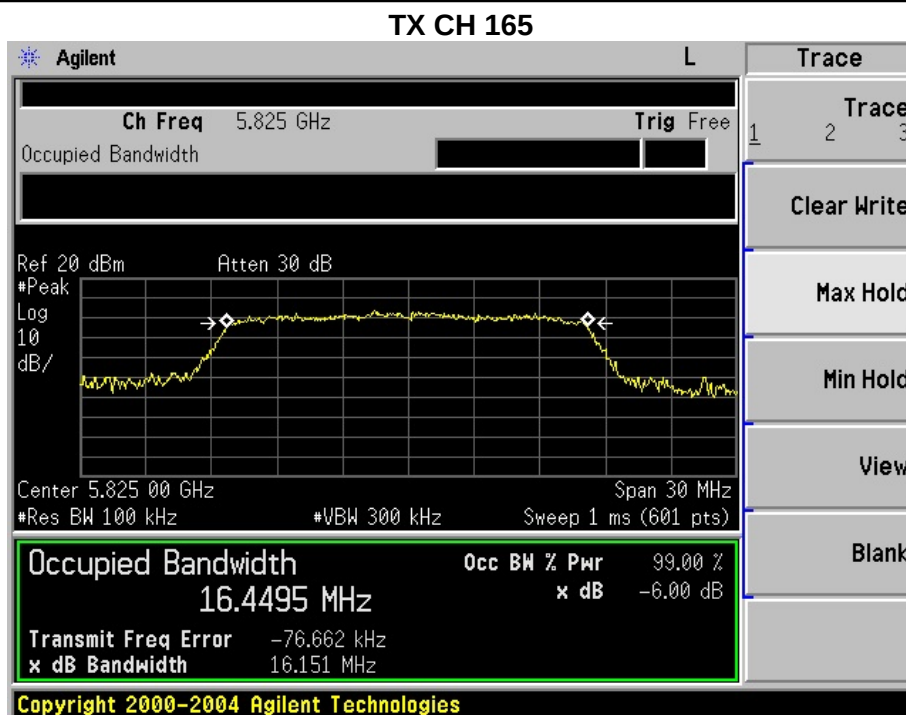
Channel	Frequency (MHz)	-6dB bandwidth (MHz)	Result
Low	5755 MHz	35.762	Pass
High	5795 MHz	35.825	Pass

802.11 a Mode TX CH 149

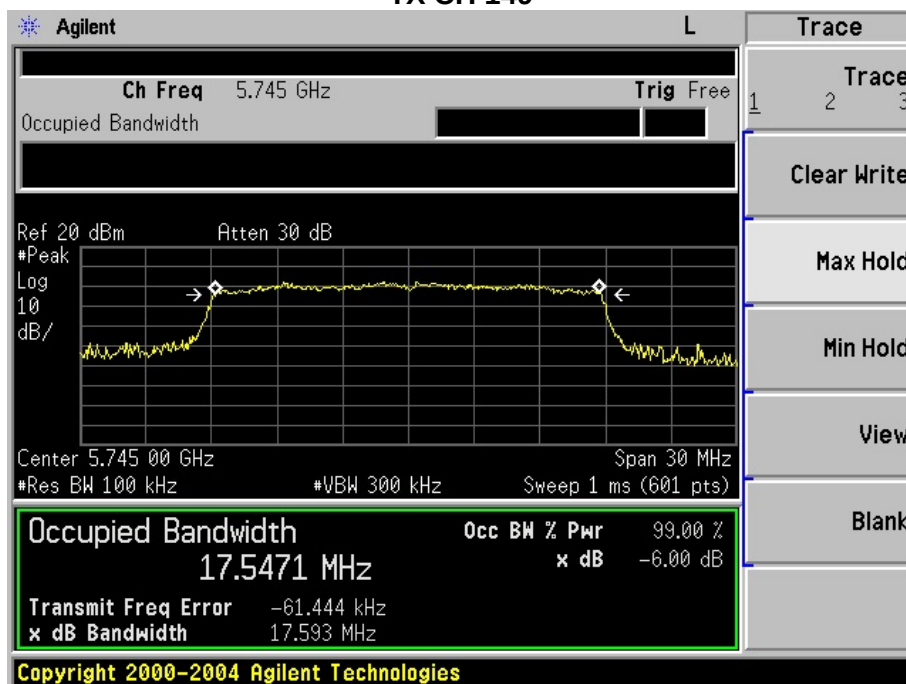


TX CH 157

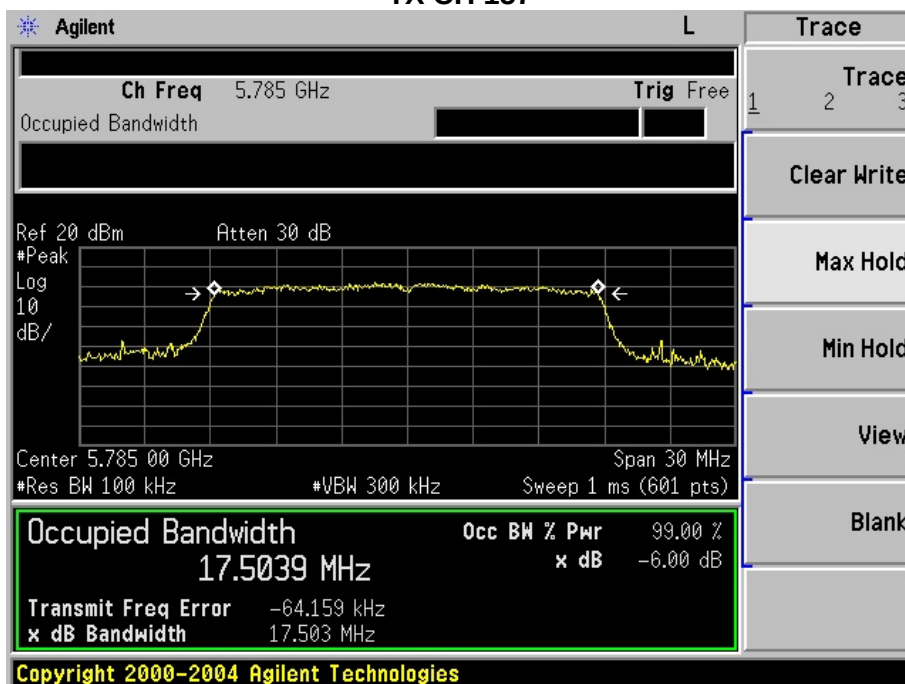




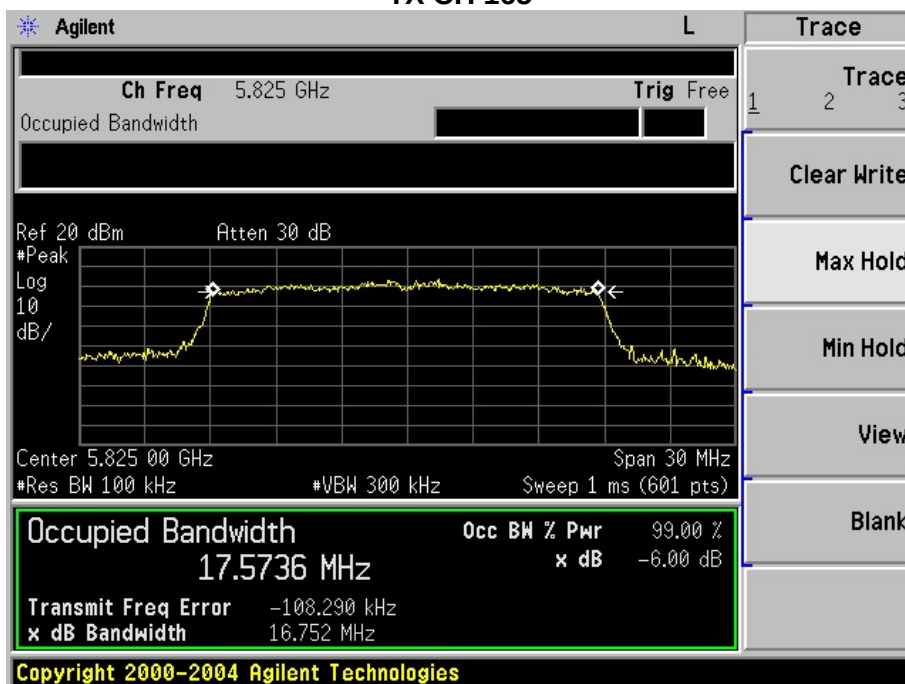
802.11 n20 Mode
TX CH 149



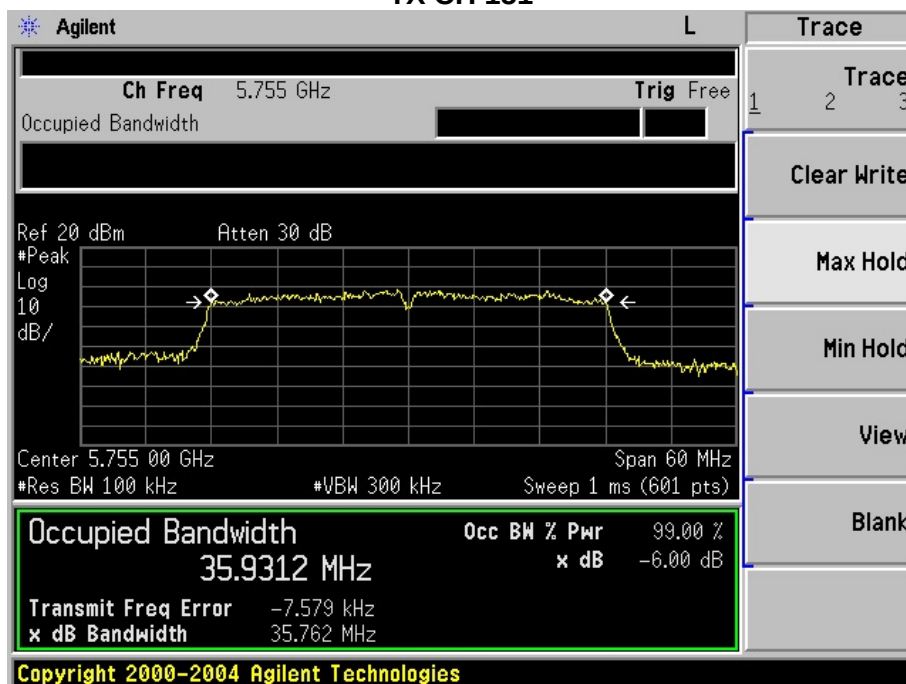
TX CH 157



TX CH 165



802.11 n40 Mode TX CH 151



TX CH 159

