6. 26DB AND 6DB BANDWIDTH TEST

6.1 Applicable Standard

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum power control level, as defined in KDB 789033, at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26 dB bandwidth.

The 26 dB bandwidth is used to determine the conducted power limits.

The minimum of 6dB Bandwidth measurement is 0.5 MHz for U-NII-3

6.2Test Procedure

1. Emission Bandwidth (EBW)

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%.

2. **Minimum Emission Bandwidth for the band 5.725-5.85 GHz**

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.

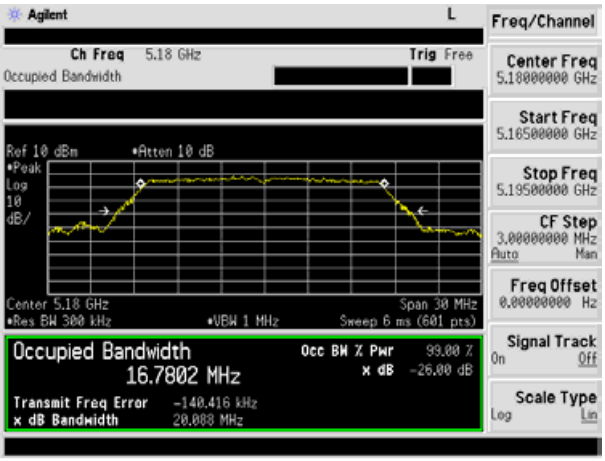
6.3 Test setup

Mode	Channel number	Frequency (MHz)	26dB Bandwidth (MHz)	26dB Bandwidth (MHz)
			ANT3	ANT4
802.11a	36	5180	20.088	20.065
	40	5200	19.942	20.029
	48	5240	20.230	20.239
802.11n (HT20)	36	5180	20.311	20.285
	40	5200	20.276	20.314
	48	5240	20.326	20.340
802.11n (HT40)	38	5190	42.262	42.242
	46	5230	42.473	42.422
802.11ac (VHT20)	36	5180	20.300	20.197
	40	5200	20.280	20.209
	48	5240	20.401	20.278
802.11ac (VHT40)	38	5190	41.924	42.020
	46	5230	42.368	42.225
802.11ac (VHT80)	42	5210	82.922	82.776

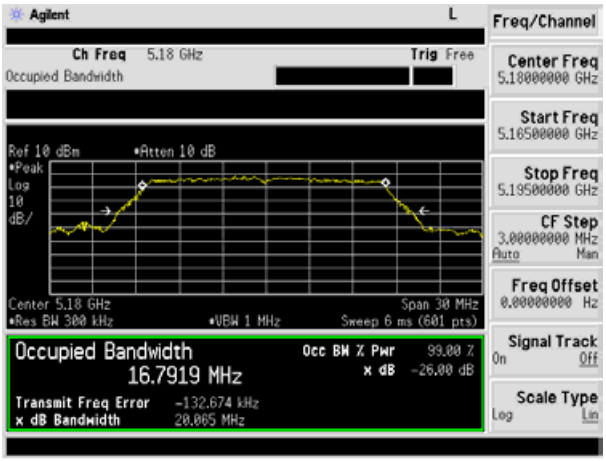
Mode	Channel number	Frequency (MHz)	6dB Bandwidth (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
			Ant3	Ant4	
802.11a	149	5745	16.539	16.517	0.5
	157	5785	16.435	16.482	0.5
	165	5825	16.418	16.448	0.5
802.11n (HT20)	149	5745	17.641	17.641	0.5
	157	5785	17.627	17.641	0.5
	165	5825	17.653	17.641	0.5
802.11n (HT40)	151	5755	36.4	36.331	0.5
	159	5795	36.368	36.338	0.5
802.11ac (VHT20)	149	5745	17.669	17.635	0.5
	157	5785	17.625	17.634	0.5
	165	5825	17.646	17.673	0.5
802.11ac (VHT40)	151	5755	36.363	36.368	0.5
	159	5795	36.121	36.387	0.5
802.11ac (VHT80)	155	5775	74.907	74.403	0.5

5150-5250 MHz:

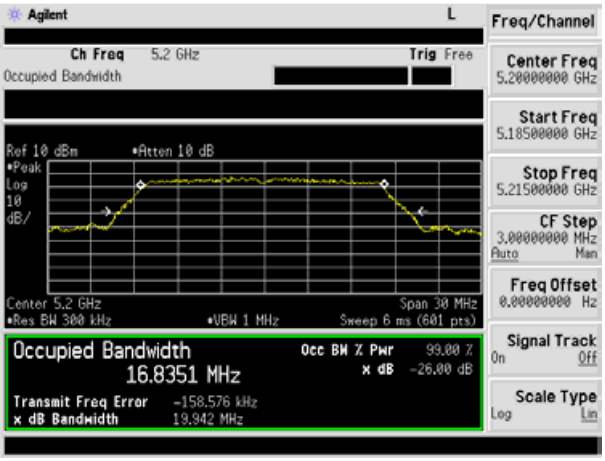
802.11a mode-ch36-Ant3



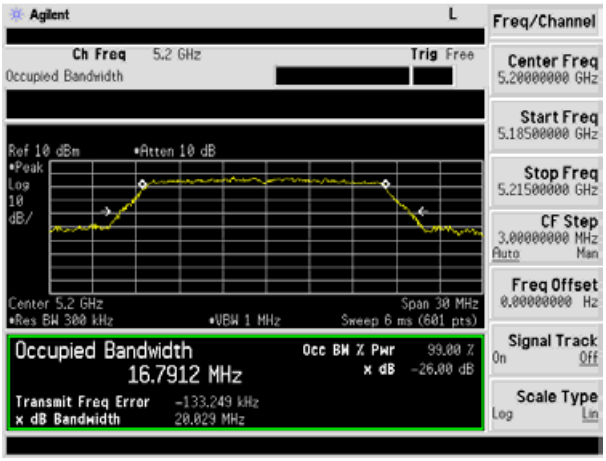
802.11a mode-ch36-Ant4



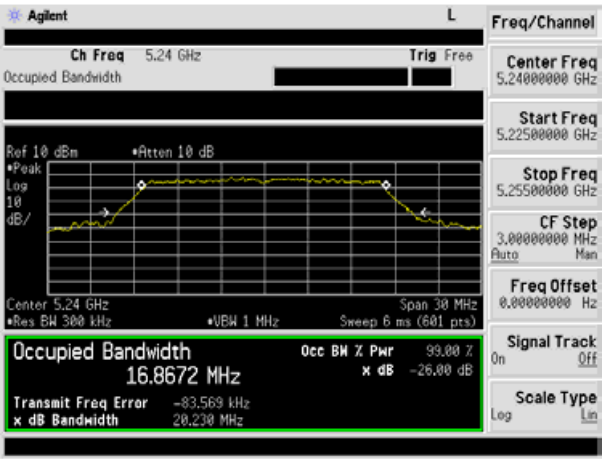
802.11a mode-ch40-Ant3



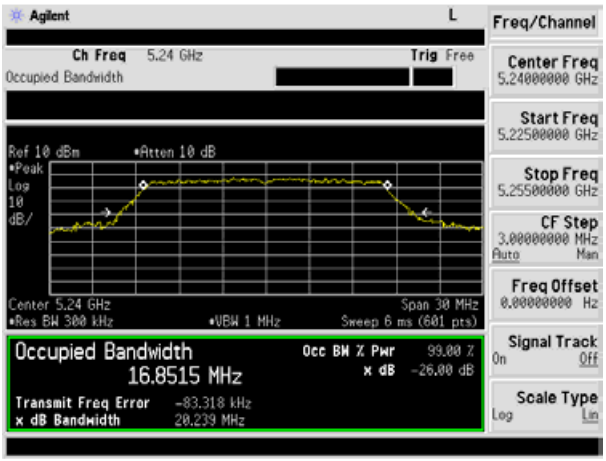
802.11a mode-ch40-Ant4



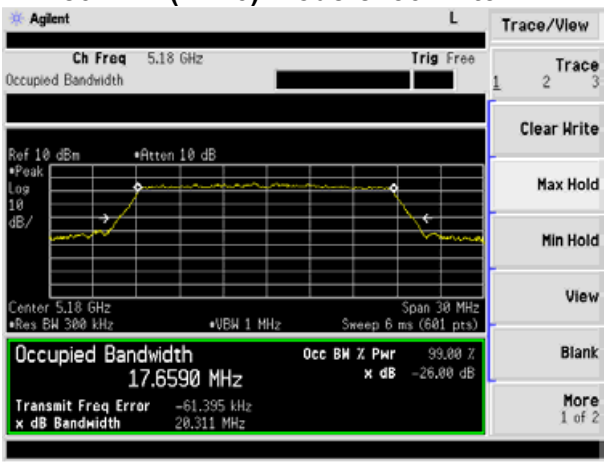
802.11a mode-ch48-Ant3



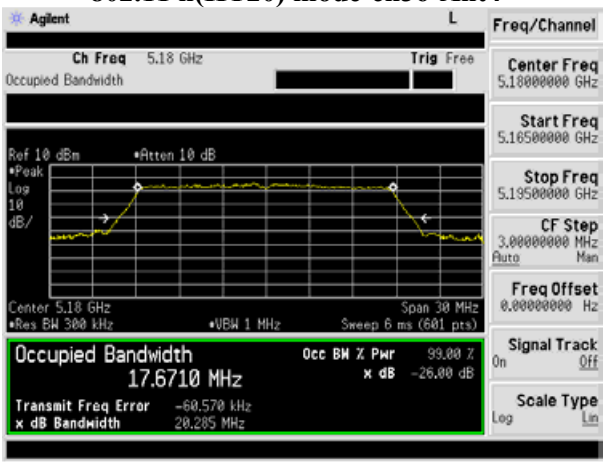
802.11a mode-ch48-Ant4



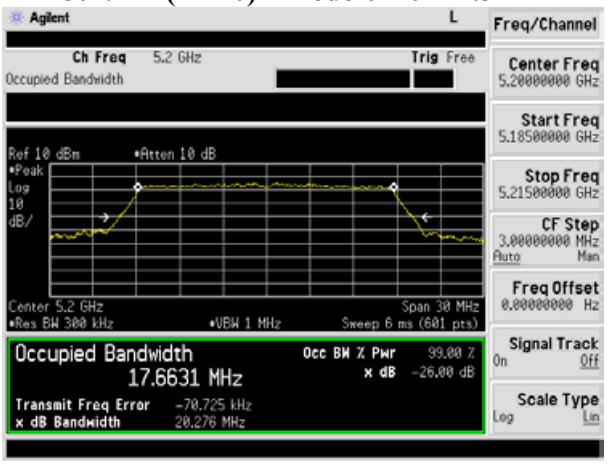
802.11n(HT20) mode-ch36-Ant3



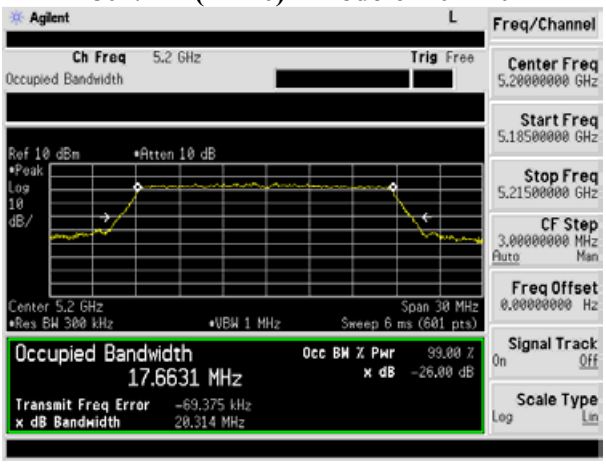
802.11 n(HT20) mode-ch36-Ant4



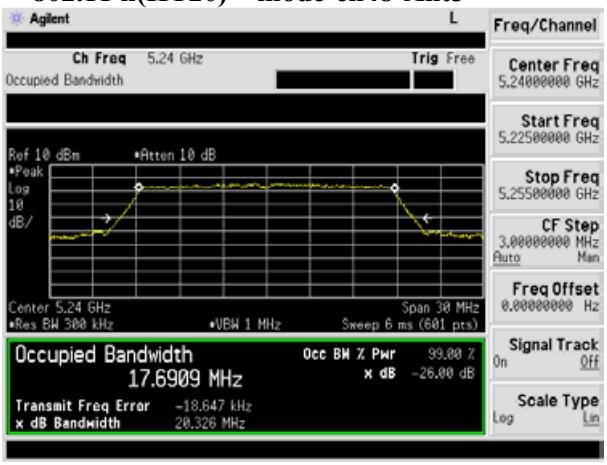
802.11 n(HT20) mode-ch40-Ant3



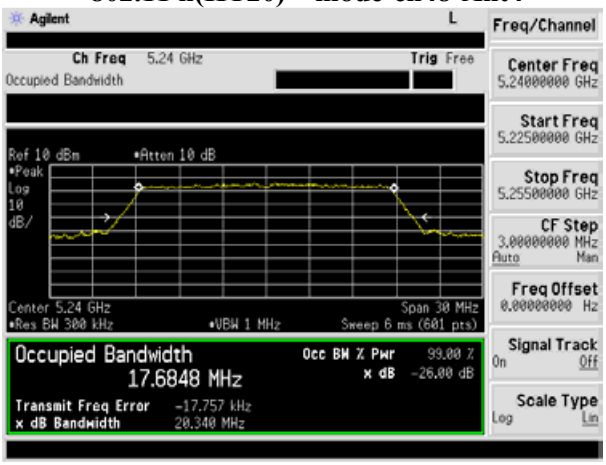
802.11 n(HT20) mode-ch40-Ant4



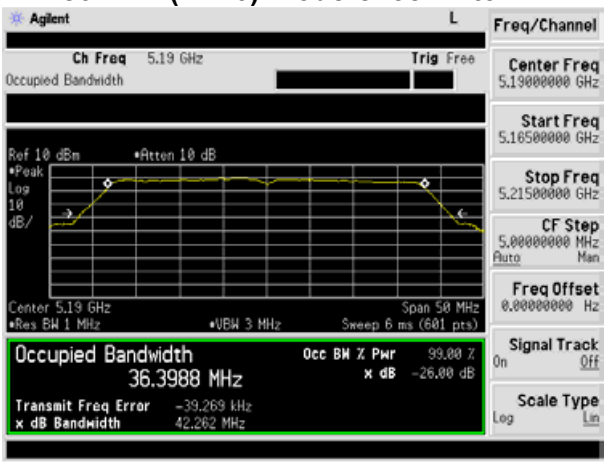
802.11 n(HT20) mode-ch48-Ant3



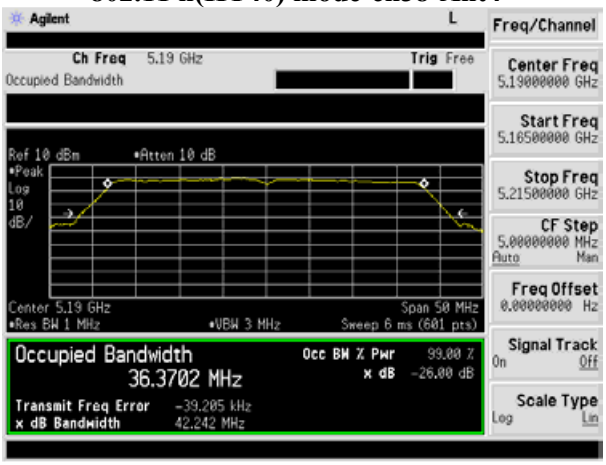
802.11 n(HT20) mode-ch48-Ant4



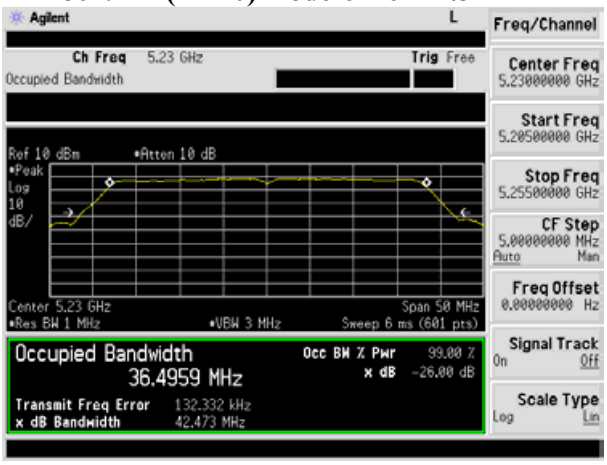
802.11n(HT40) mode-ch38-Ant3



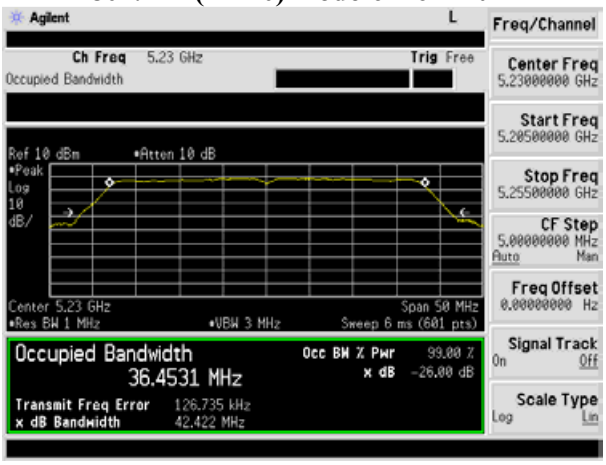
802.11 n(HT40) mode-ch38-Ant4



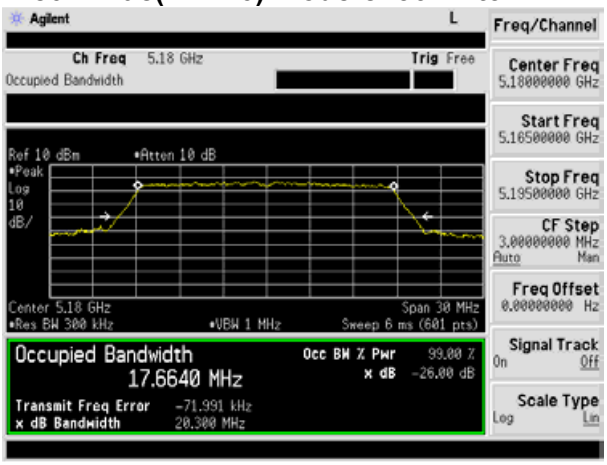
802.11 n(HT40) mode-ch46-Ant3



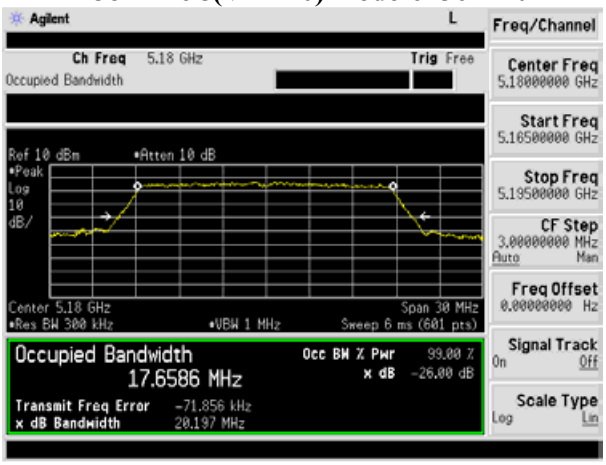
802.11 n(HT40) mode-ch46-Ant4



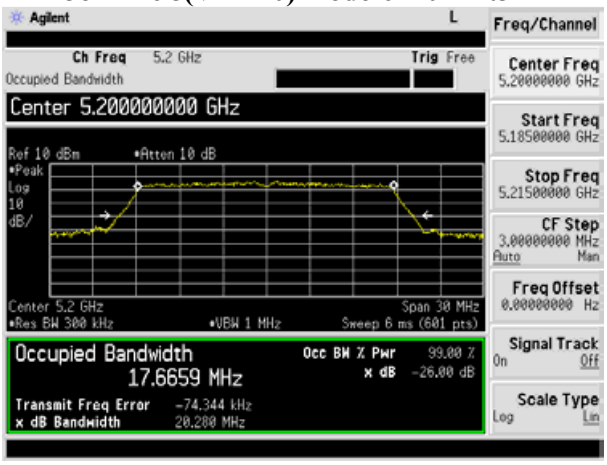
802.11ac(VHT20) mode-ch36-Ant3



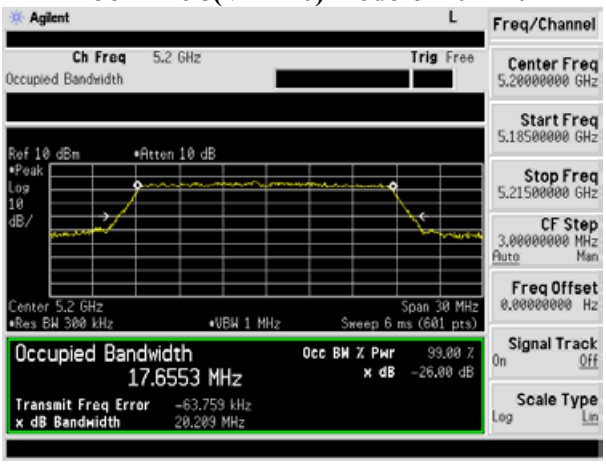
802.11ac(VHT20) mode-ch36-Ant4



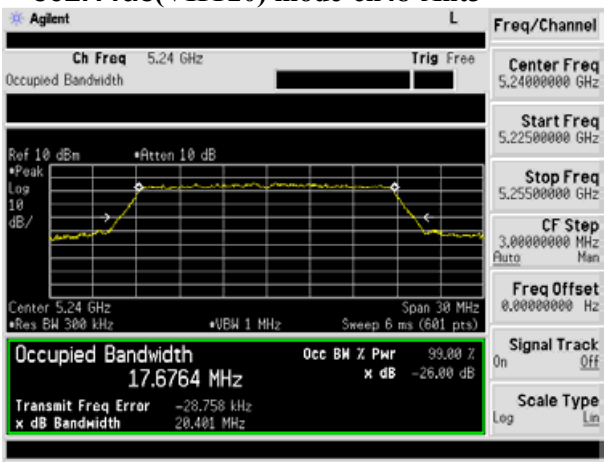
802.11ac(VHT20) mode-ch40-Ant3



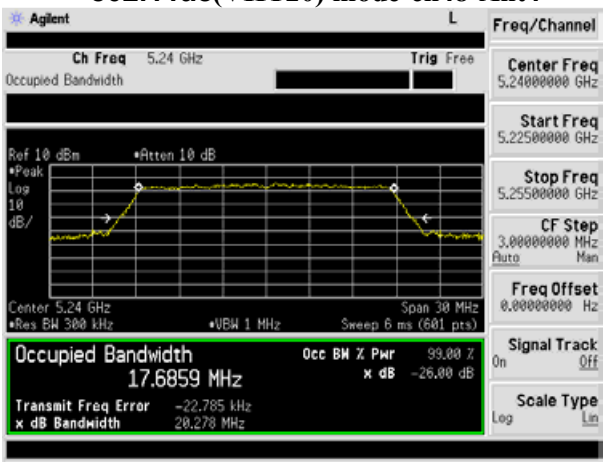
802.11ac(VHT20) mode-ch40-Ant4



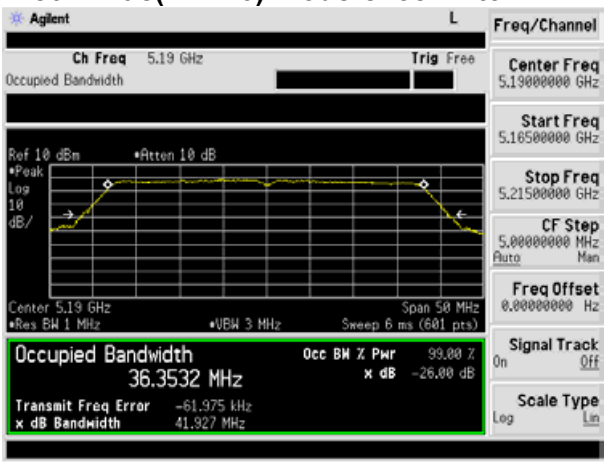
802.11ac(VHT20) mode-ch48-Ant3



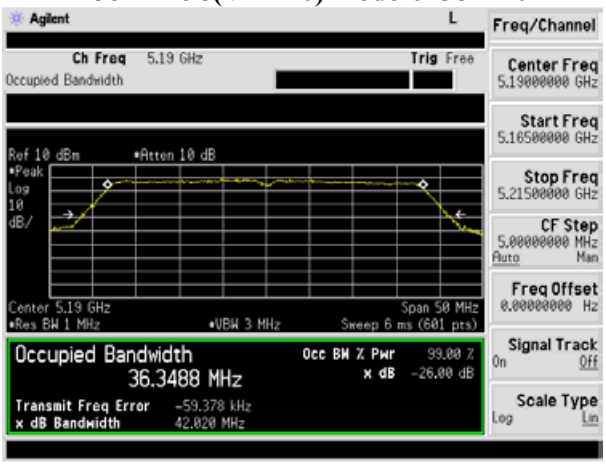
802.11ac(VHT20) mode-ch48-Ant4



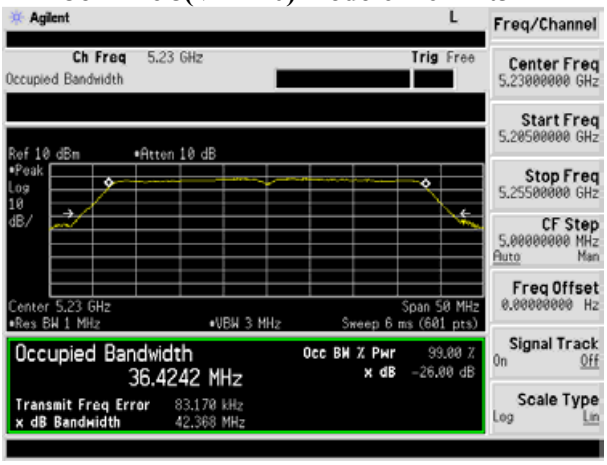
802.11ac(VHT40) mode-ch38-Ant3



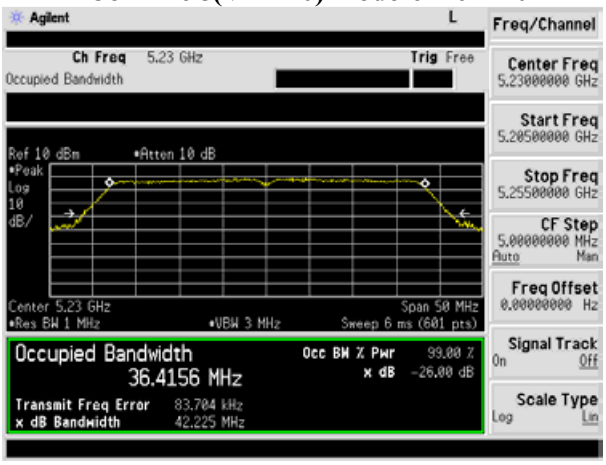
802.11ac(VHT40) mode-ch38-Ant4



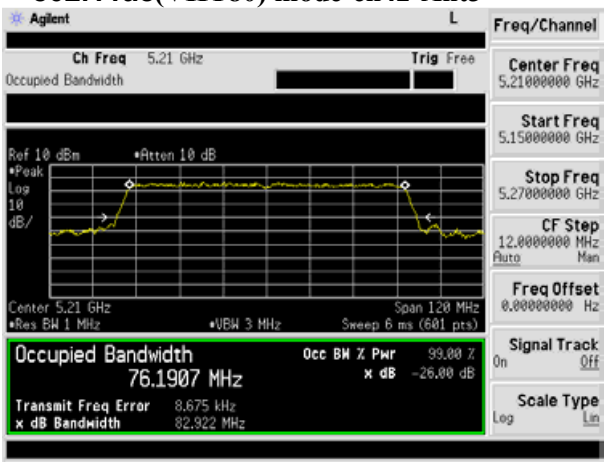
802.11ac(VHT40) mode-ch46-Ant3



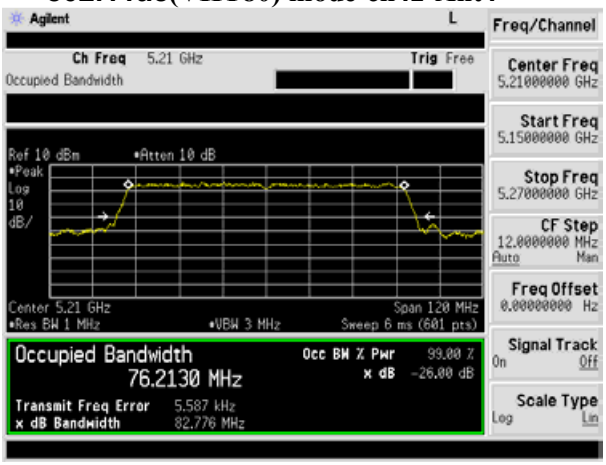
802.11ac(VHT40) mode-ch46-Ant4



802.11ac(VHT80) mode-ch42-Ant3

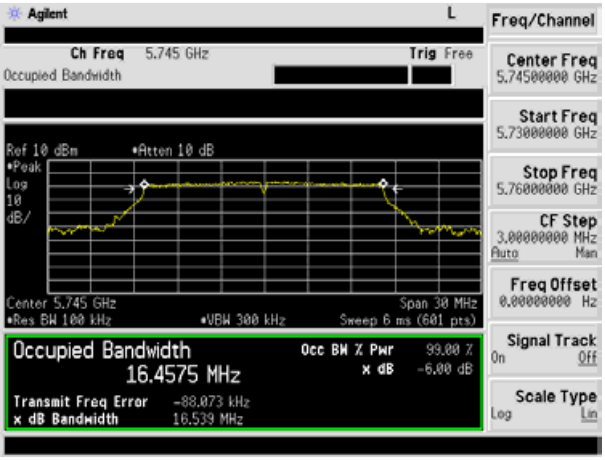


802.11ac(VHT80) mode-ch42-Ant4

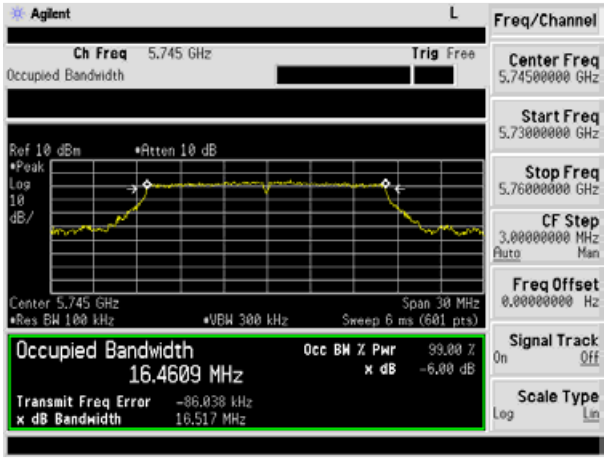


5725-5850MHz:

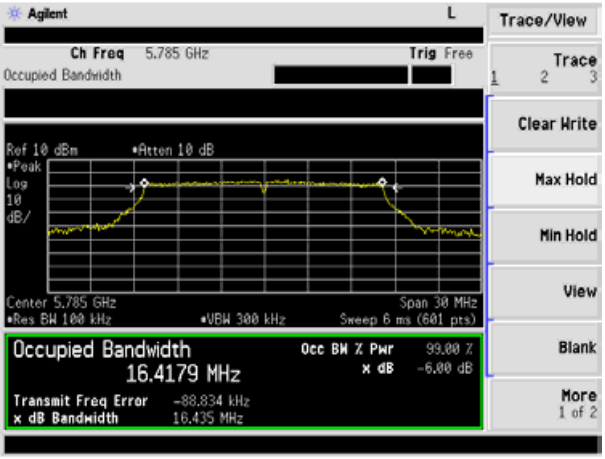
802.11a mode-ch149-Ant3



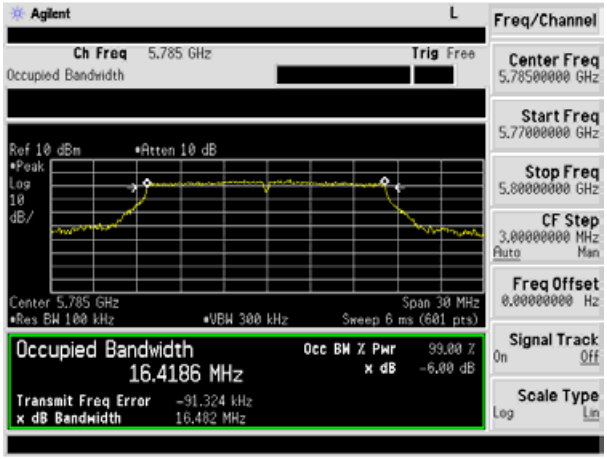
802.11a mode-ch149-Ant4



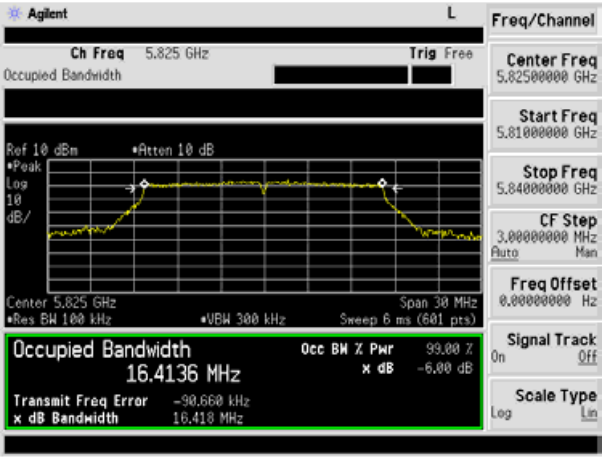
802.11a mode-ch157-Ant3



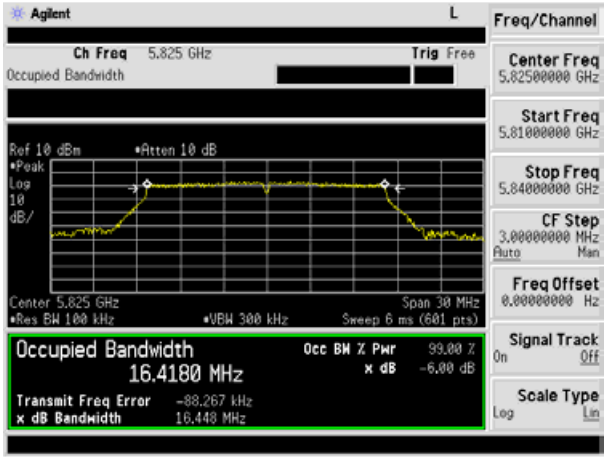
802.11a mode-ch157-Ant4



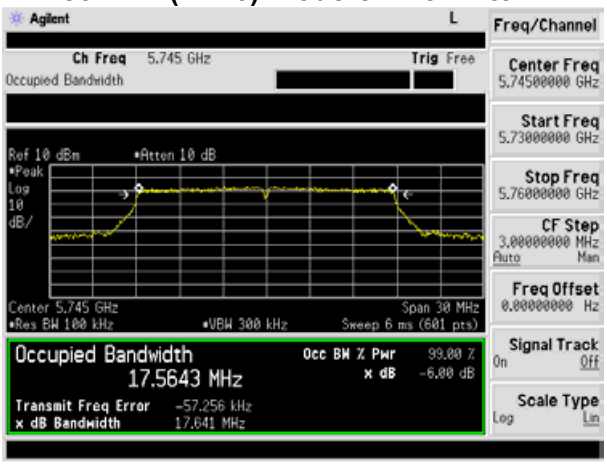
802.11a mode-ch165-Ant3



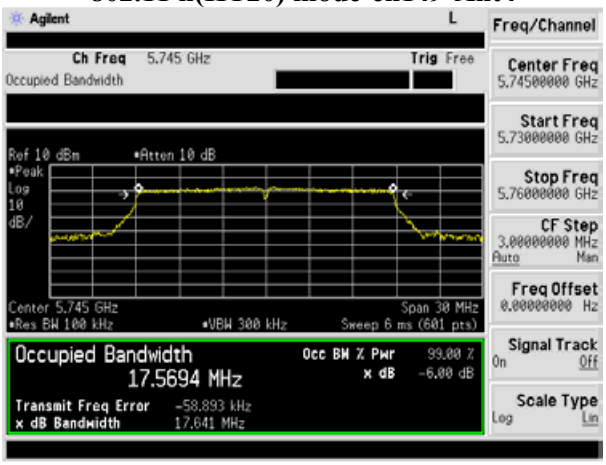
802.11a mode-ch165-Ant4



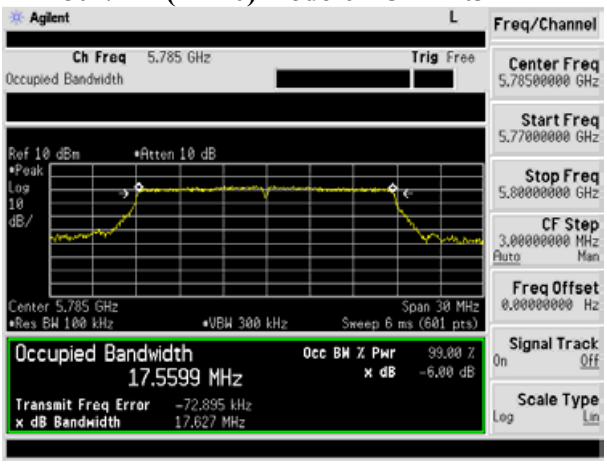
802.11n(HT20) mode-ch149-Ant3



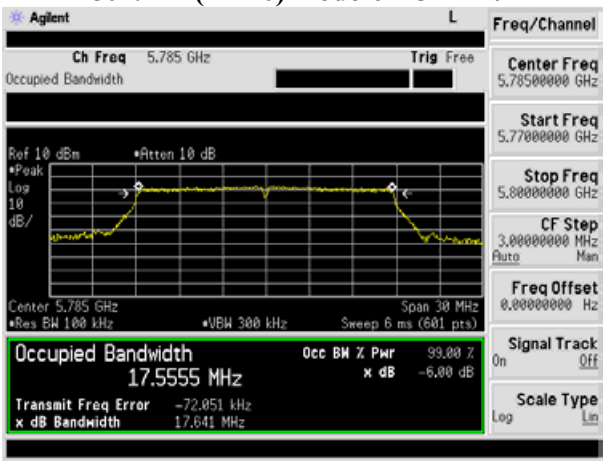
802.11 n(HT20) mode-ch149-Ant4



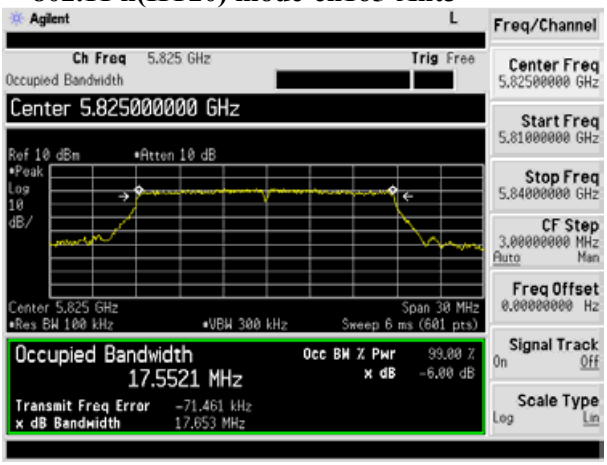
802.11 n(HT20) mode-ch157-Ant3



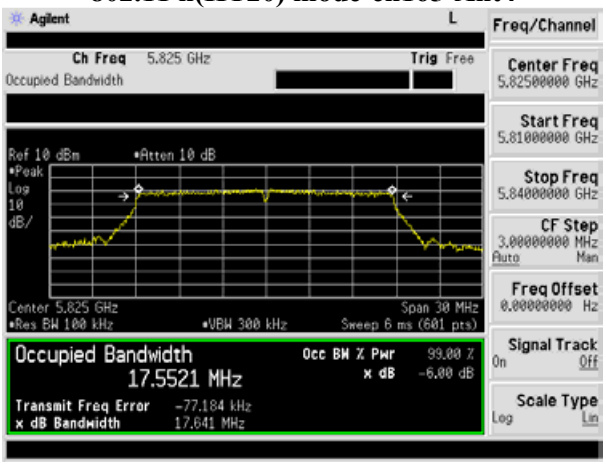
802.11 n(HT20) mode-ch157-Ant4



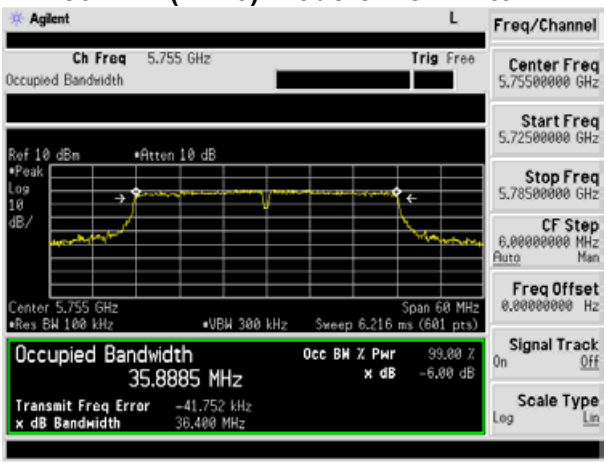
802.11 n(HT20) mode-ch165-Ant3



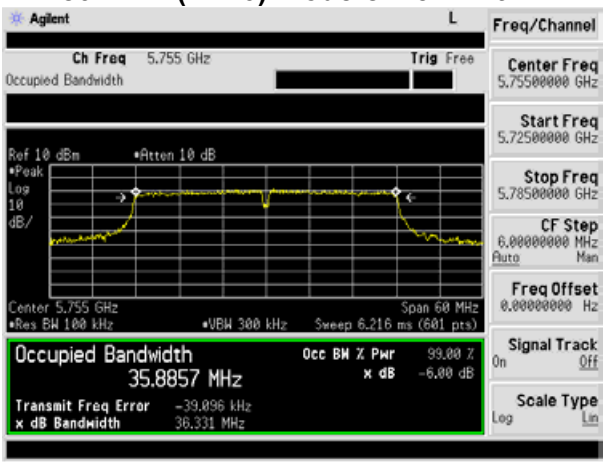
802.11 n(HT20) mode-ch165-Ant4



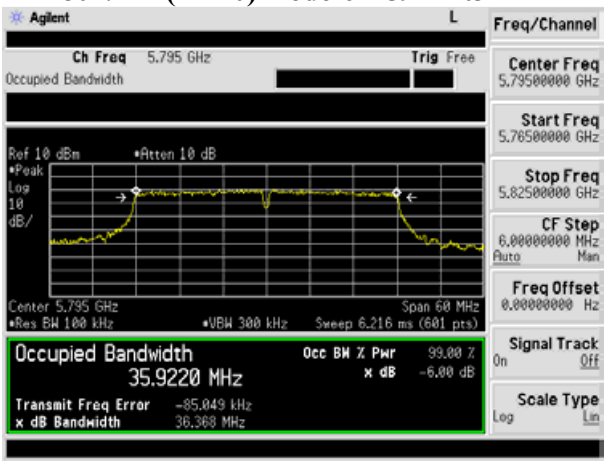
802.11n(HT40) mode-ch151-Ant3



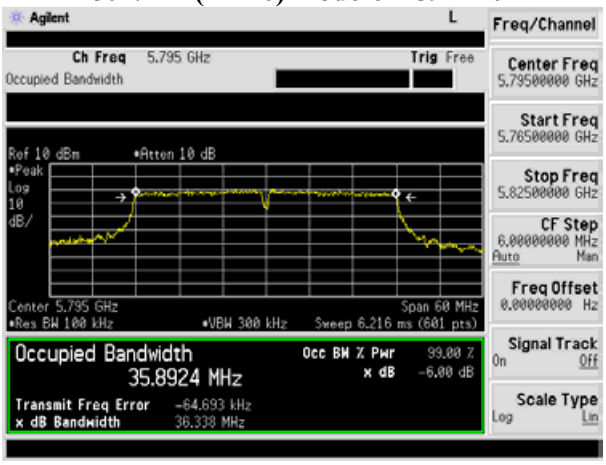
802.11 n(HT40) mode-ch151-Ant4



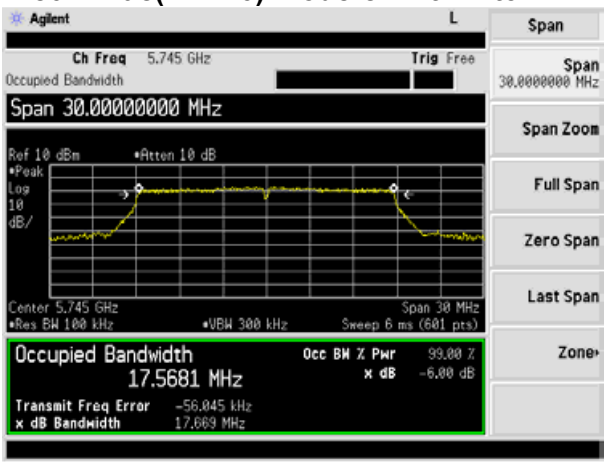
802.11 n(HT40) mode-ch159-Ant3



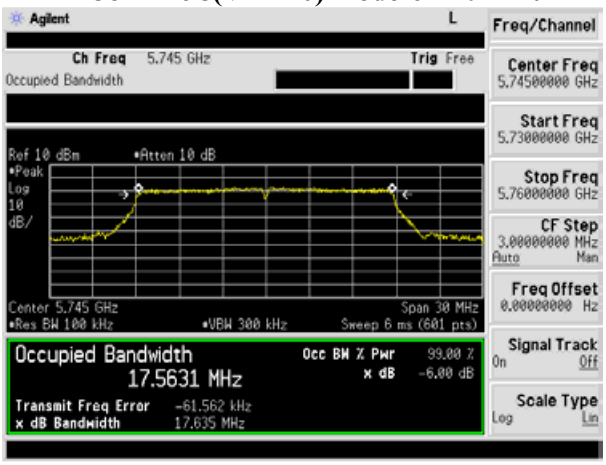
802.11 n(HT40) mode-ch159-Ant4



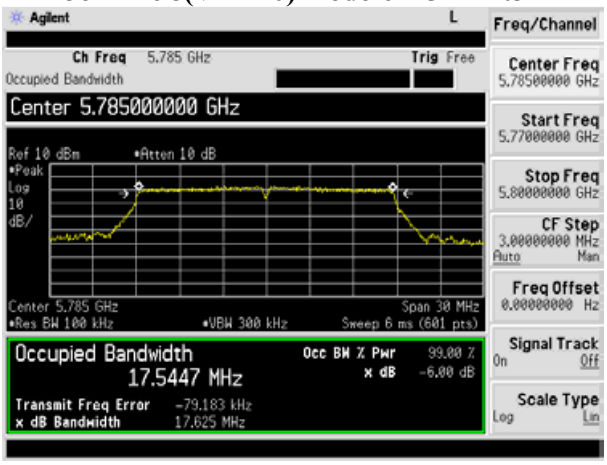
802.11ac(VHT20) mode-ch149-Ant3



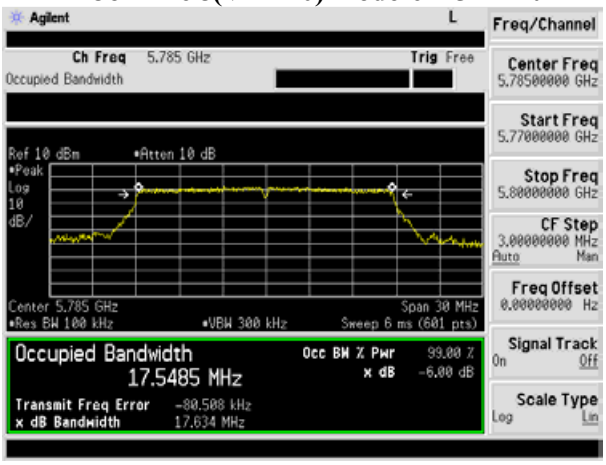
802.11ac(VHT20) mode-ch149-Ant4



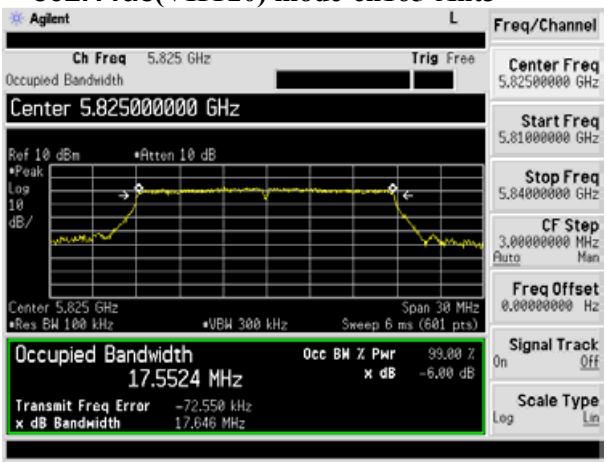
802.11ac(VHT20) mode-ch157-Ant3



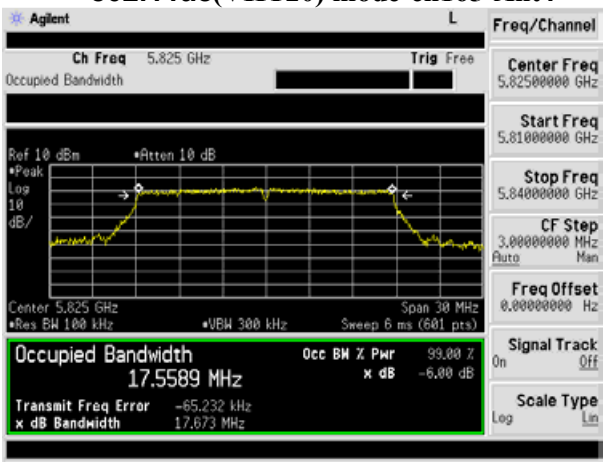
802.11ac(VHT20) mode-ch157-Ant4



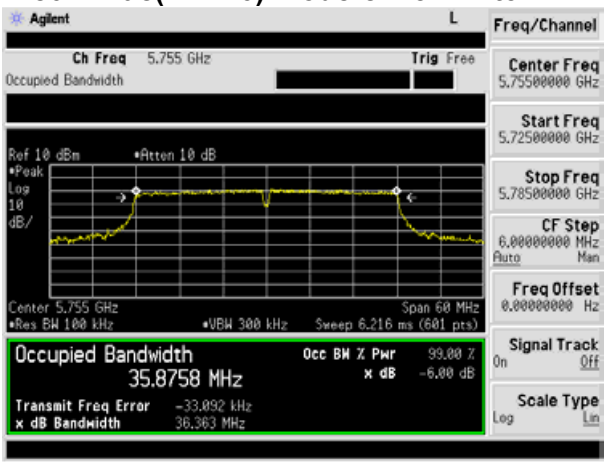
802.11ac(VHT20) mode-ch165-Ant3



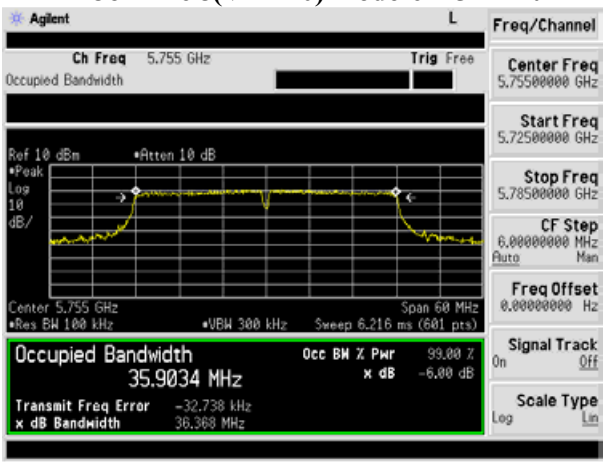
802.11ac(VHT20) mode-ch165-Ant4



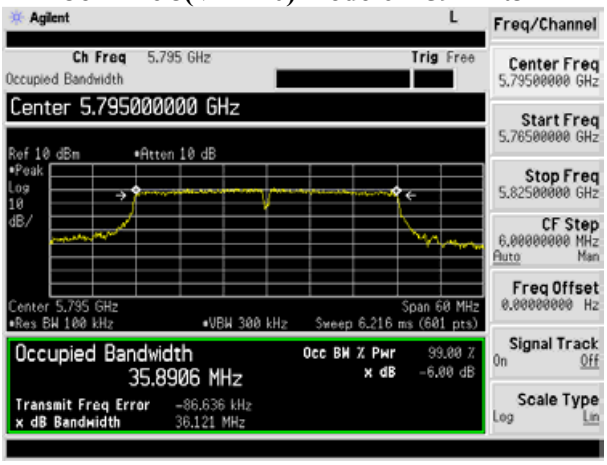
802.11ac(VHT40) mode-ch151-Ant3



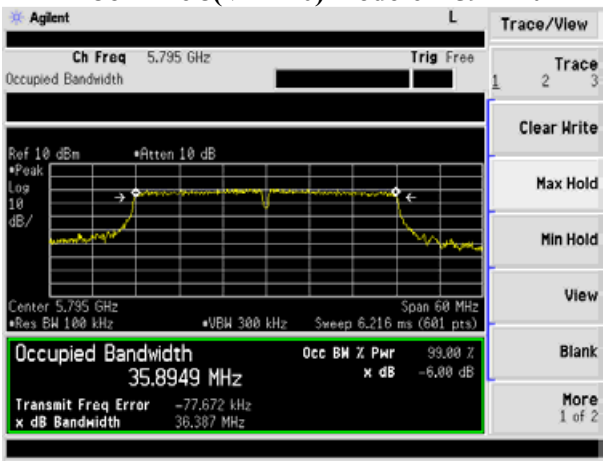
802.11ac(VHT40) mode-ch151-Ant4



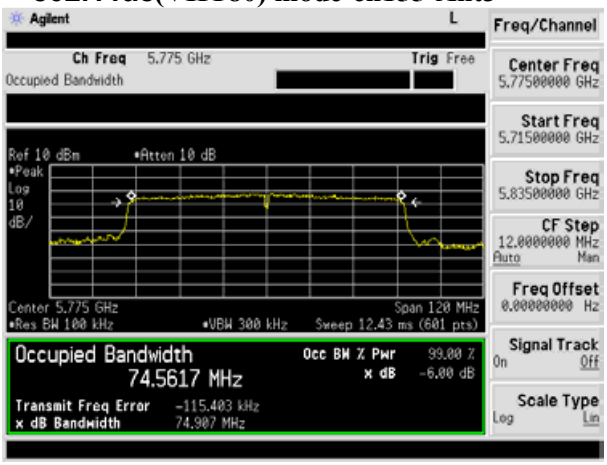
802.11ac(VHT40) mode-ch159-Ant3



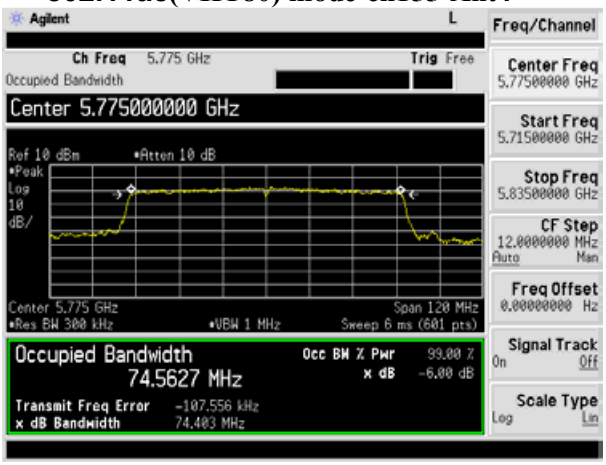
802.11ac(VHT40) mode-ch159-Ant4



802.11ac(VHT80) mode-ch155-Ant3



802.11ac(VHT80) mode-ch155-Ant4



7. OUTPUT POWER TEST

7.1 Limits

Band 5.15-5.25GHz:

FCC: For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

Band 5.725-5.825GHz:

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

7.2 Test setup

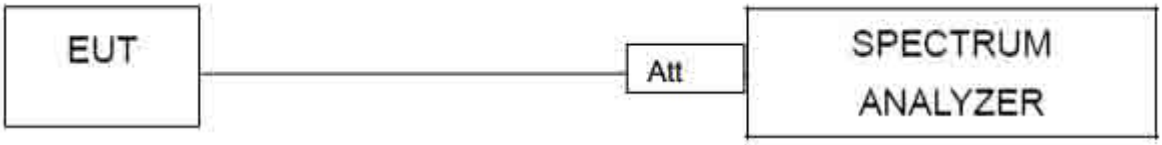
1. The maximum average conducted output power can be measured using Method PM-G (Measurement using a gated RF average power meter):
2. Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

a. The Transmitter output (antenna port) was connected to the power meter.

b. Turn on the EUT and power meter and then record the power value.

c. Repeat above procedures on all channels needed to be tested.

Duty cycle



7.3Test result

	Frequency (MHz)	Average Output Power (dBm)	Average Output Power (dBm)	Sum Power (dBm)	FCC Limit (dBm)	Result
		ANT3	ANT4			
802.11a	5180	15.09	14.03	-	24	Pass
	5200	15.24	14.17	-	24	Pass
	5240	15.15	14.12	-	24	Pass
	5745	15.46	14.32	-	30	Pass
	5785	15.31	14.21	-	30	Pass
	5825	15.15	14.07	-	30	Pass
802.11n (HT20)	5180	11.62	10.32	14.03	21.99	Pass
	5200	11.11	10.54	13.84	21.99	Pass
	5240	11.13	10.57	13.87	21.99	Pass
	5745	11.18	10.53	13.88	27.99	Pass
	5785	11.25	10.36	13.84	27.99	Pass
	5825	11.31	10.65	14.00	27.99	Pass
802.11n (HT40)	5190	10.43	10.14	13.30	21.99	Pass
	5230	10.52	10.26	13.40	21.99	Pass
	5755	10.13	10.07	13.11	27.99	Pass
	5795	10.53	10.34	13.45	27.99	Pass
802.11ac (VHT20)	5180	11.06	10.94	14.01	21.99	Pass
	5200	11.32	10.85	14.10	21.99	Pass
	5240	11.23	10.45	13.87	21.99	Pass
	5745	11.14	10.63	13.90	27.99	Pass
	5785	11.09	10.76	13.94	27.99	Pass
	5825	11.27	10.88	14.09	27.99	Pass
802.11ac (VHT40)	5190	10.43	10.06	13.26	21.99	Pass
	5230	10.54	10.14	13.35	21.99	Pass
	5755	10.31	10.21	13.27	27.99	Pass
	5795	10.08	9.98	13.04	27.99	Pass
802.11ac (VHT80)	5210	9.65	9.44	12.56	21.99	Pass
	5775	9.83	9.52	12.69	27.99	Pass

NOTE: During the test the EUT is in 100% duty cycle transmitting.

802.11a , the ANT3 and ANT4 can not TX and RX at the same time

802.11n(20),802.11n(40)，802.11ac(VHT20) ，802.11ac(VHT40)，802.11ac(VHT80) mode the ANT3 and ANT4 can TX and RX at the same time
Directional gain=GANT +10log(N)dbi =5+10log2=8.01dbi

For MIMO the correct Limit = Limit-(Directional gain-6dBi)

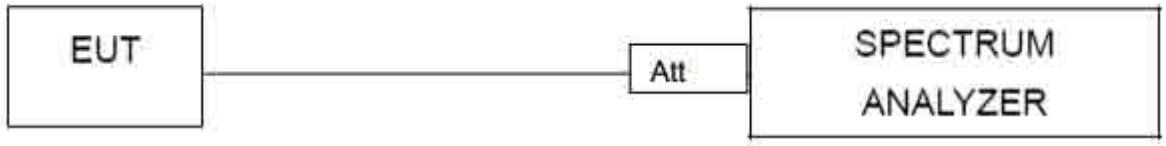
8. DUTY CYCLE

8.1Test Procedure

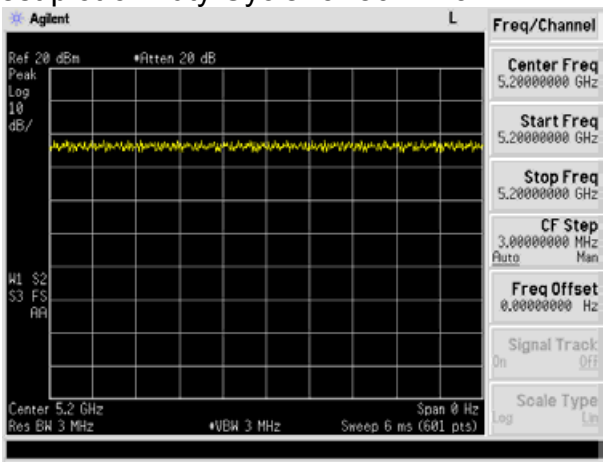
The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ⩾ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ⩾ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ⩽ 16.7 microseconds.)

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously.
The EUT was operating in controlled its channel.
Use the following spectrum analyzer settings:
Span = Zero Span
RBW = 3MHz
VBW =3MHz
Number of points in Sweep >100
Detector function = peak
Trace = Clear write Measure T_{total} and T_{on}
Calculate Duty Cycle = T_{on} / T_{total} and Duty Cycle Factor=10*log(1/Duty Cycle)

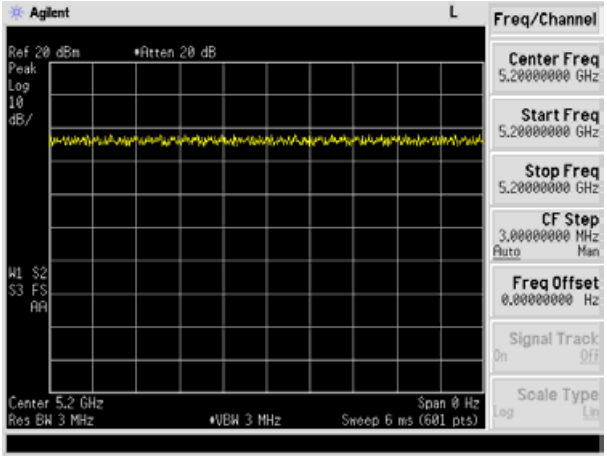
8.2TEST SETUP



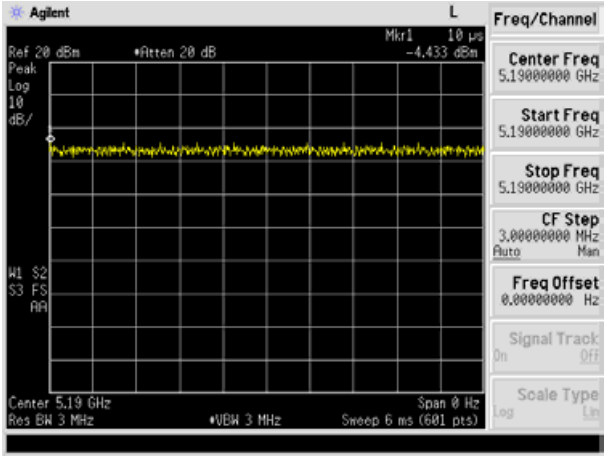
Test plot of Duty Cycle for 802.11a



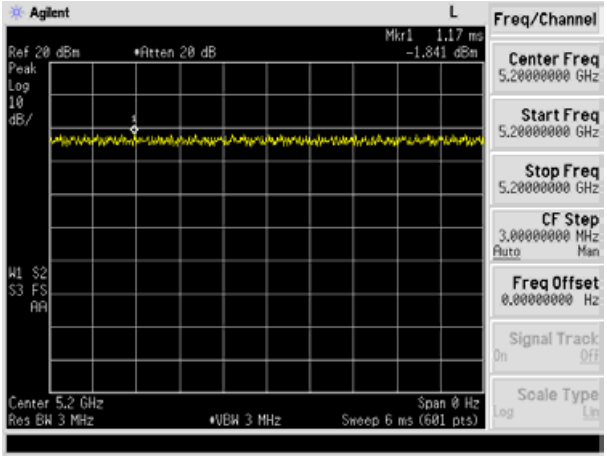
Test plot of Duty Cycle for 802.11n(HT20)



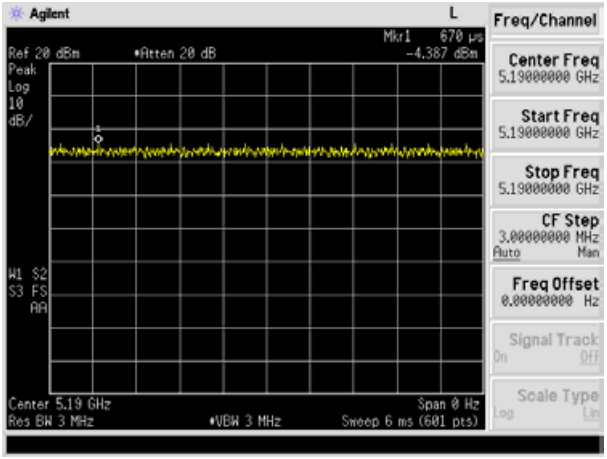
Test plot of Duty Cycle for 802.11n(HT40)



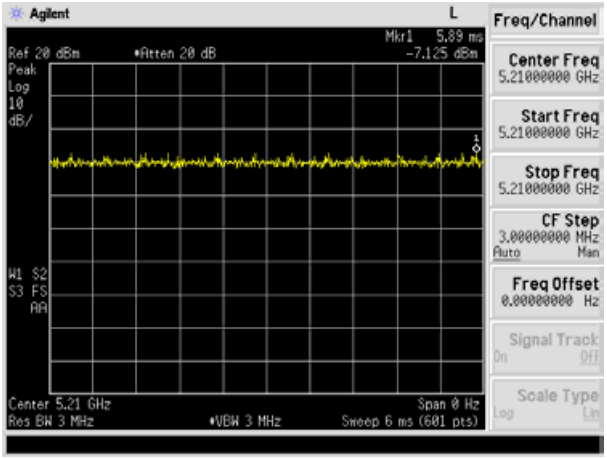
Test plot of Duty Cycle for 802.11ac(VHT20)



Test plot of Duty Cycle for 802.11ac(VHT40)



Test plot of Duty Cycle for 802.11ac(VHT80)



9. PEAK POWER SPECTRAL DENSITY TEST

9.1 Limits

Band 5.15-5.25GHz:

FCC: In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

Band 5.725-5.825GHz:

FCC: In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

9.2 Test setup

Methods refer to FCC KDB 789033

1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section E)2) for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power…”.

2) Use the peak search function on the instrument to find the peak of the spectrum.

3) The result is the PPSD.

4) The above procedures make use of 1 MHz resolution bandwidth to satisfy the 1 MHz measurement bandwidth specified in the 15.407(a)(5). That rule section also permits use of resolution bandwidths less than 1 MHz “provided that the measured power is integrated to show the total power over the measurement bandwidth” (i.e., 1 MHz). If measurements are performed using a reduced resolution bandwidth and integrated over 1 MHz bandwidth

9.3 Test data

Test data as below

5150MHz-5250MHz:

Mode	Frequency (MHz)	Power Density. Antenna port 3 (dBm/MHz)	Power Density. Antenna port 4 (dBm/MHz)	Sum PSD (dBm/MHz)	FCC Limit (dBm)
802.11a	5180	0.958	1.345	-	11
	5200	0.152	0.156	-	11
	5240	0.836	2.016	-	11
802.11n (HT20)	5180	1.514	0.927	4.24	8.99
	5200	0.47	0.687	3.59	8.99
	5240	-0.516	0.373	2.96	8.99
802.11n (HT40)	5190	-1.239	-1.547	1.62	8.99
	5230	0.909	0.512	3.73	8.99
802.11ac (VHT20)	5180	2.159	2.182	5.18	8.99
	5200	1.281	1.171	4.24	8.99
	5240	-0.125	0.088	2.99	8.99
802.11ac (VHT40)	5190	-1.822	-1.269	1.47	8.99
	5230	-3.317	-2.606	0.06	8.99
802.11ac (VHT80)	5210	-3.889	-4.506	-1.18	8.99

5725MHz-5850MHz:

Mode	Frequency (MHz)	Power Density. Antenna port 3 (dBm /300KHz)	Power Density. Antenna port 4 (dBm /300KHz)	Power Density. Antenna port 3 (dBm /500KHz)	Power Density. Antenna port 4 (dBm /500KHz)	Sum PSD (dBm /500KHz)	FCC Limit (dBm /500KHz)
802.11a	5745	-1.033	-0.681	1.19	1.54	-	30
	5785	1.934	1.398	4.15	3.62	-	30
	5825	0.676	0.804	2.89	3.02	-	30
802.11n (HT20)	5745	-1.785	-1.553	0.43	0.67	3.56	27.99
	5785	-0.65	0.294	1.57	2.51	5.08	27.99
	5825	-1.051	-1.259	1.17	0.96	4.08	27.99
802.11n (HT40)	5755	-4.905	-5.961	-2.69	-3.74	-0.17	27.99
	5795	-3.825	-4.225	-1.61	-2.01	1.20	27.99
802.11ac (VHT20)	5745	-1.474	-1.612	0.74	0.61	3.69	27.99
	5785	-0.1	0.036	2.12	2.25	5.20	27.99
	5825	-1.115	-1.308	1.10	0.91	4.02	27.99
802.11ac (VHT40)	5755	-4.393	-4.912	-2.17	-2.69	0.59	27.99
	5795	-4.009	-4.458	-1.79	-2.24	1.00	27.99
802.11ac (VHT80)	5775	-7.02	-7.54	-4.80	-5.32	-2.04	27.99

802.11a , the ANT3 and ANT4 can not TX and RX at the same time

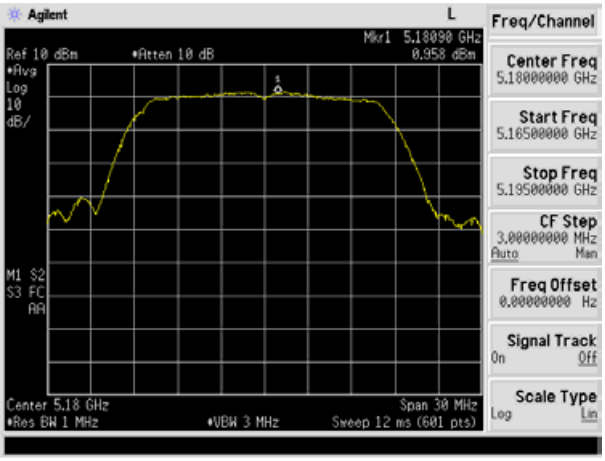
802.11n(20),802.11n(40)，802.11ac(VHT20) ，802.11ac(VHT40)，802.11ac(VHT80) mode the ANT3 and ANT4 can TX and RX at the same time

Directional gain=GANT +10log(N)dbi =5+10log2=8.01dbi

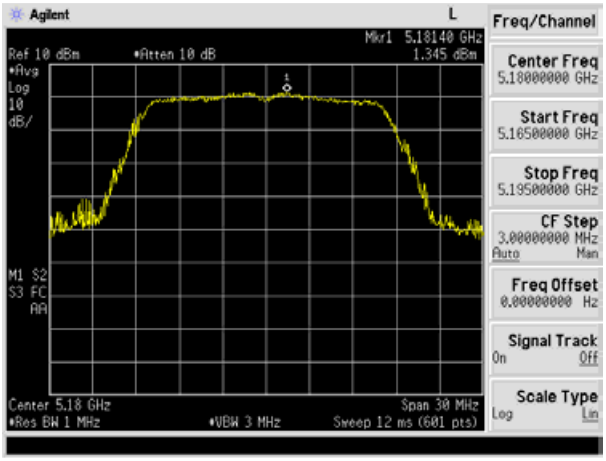
For MIMO the correct Limit = Limit-(Directional gain-6dBi)

5150-5250 MHz:

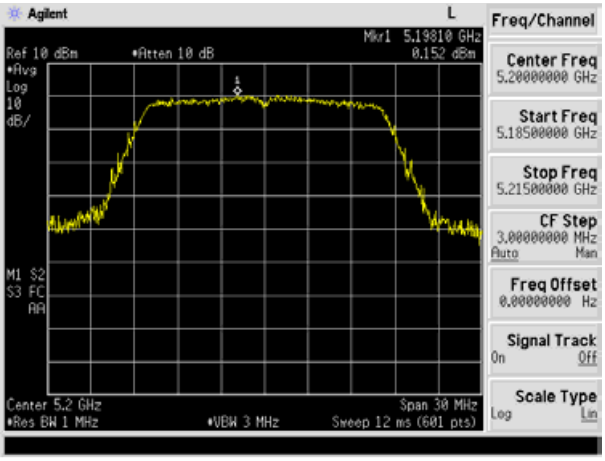
802.11a mode-ch36-Ant3



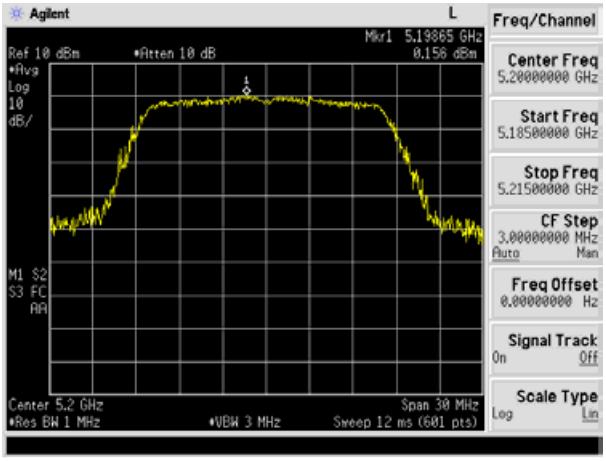
802.11a mode-ch36-Ant4



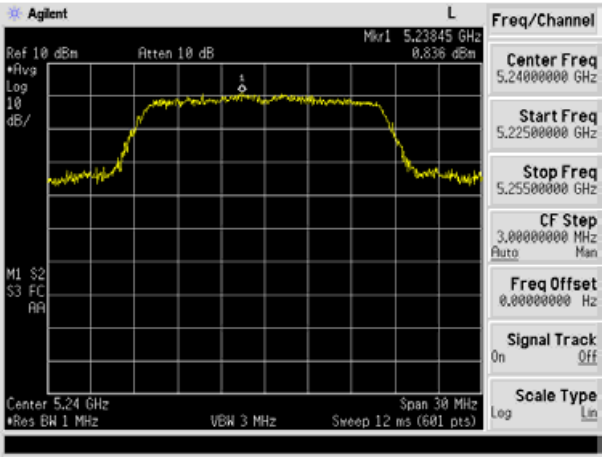
802.11a mode-ch40-Ant3



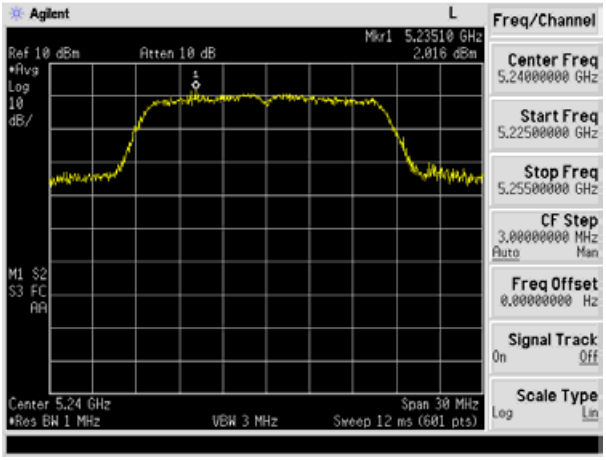
802.11a mode-ch40-Ant4



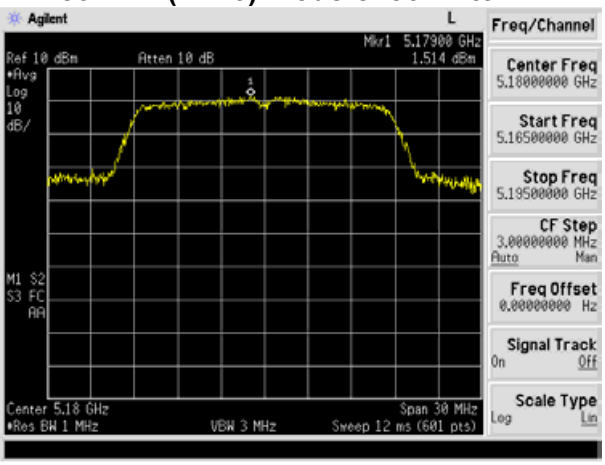
802.11a mode-ch48-Ant3



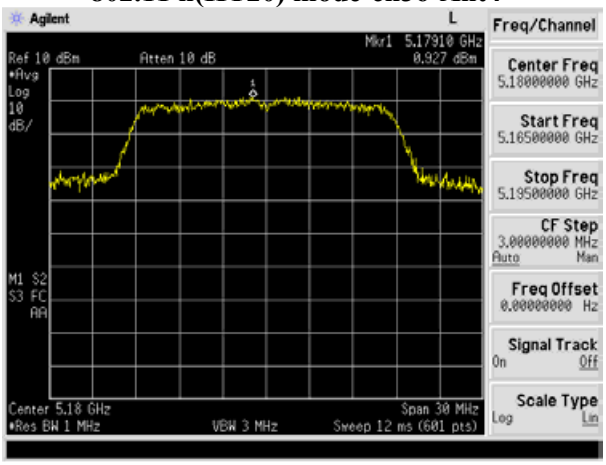
802.11a mode-ch48-Ant4



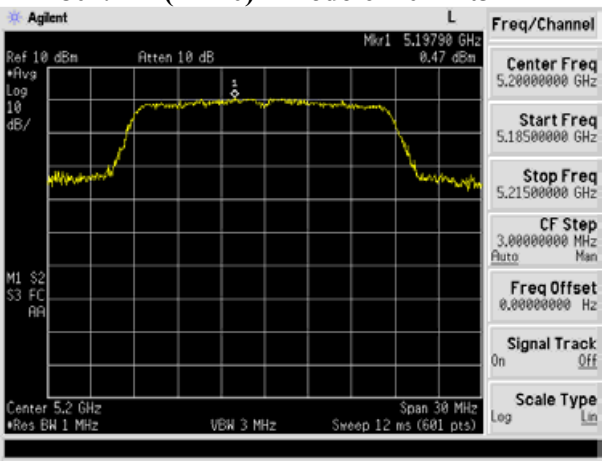
802.11n(HT20) mode-ch36-Ant3



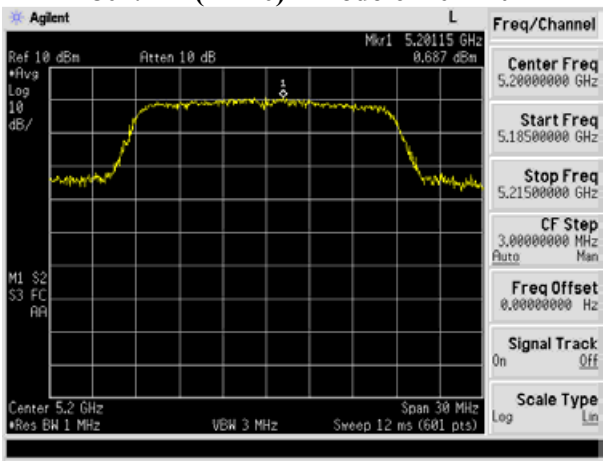
802.11 n(HT20) mode-ch36-Ant4



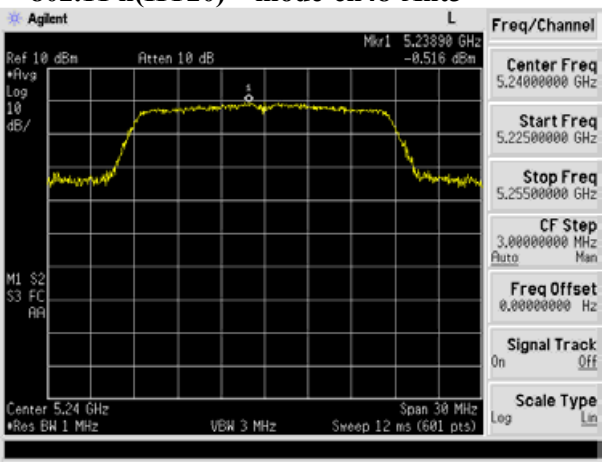
802.11 n(HT20) mode-ch40-Ant3



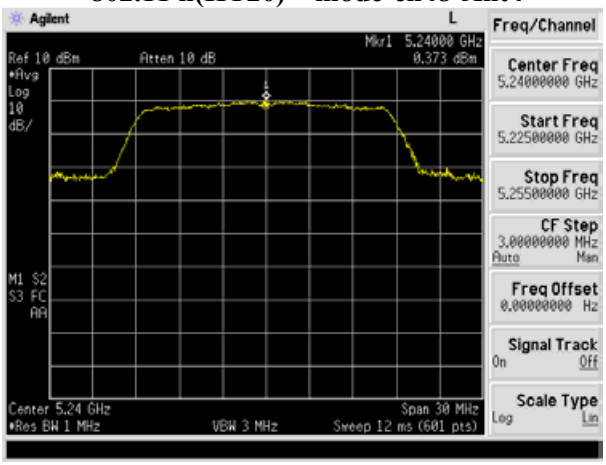
802.11 n(HT20) mode-ch40-Ant4



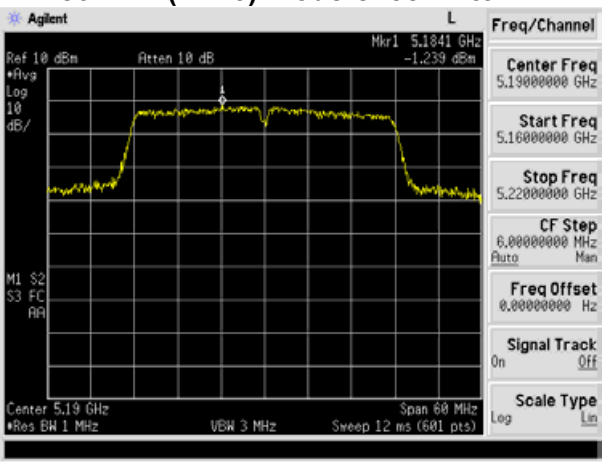
802.11 n(HT20) mode-ch48-Ant3



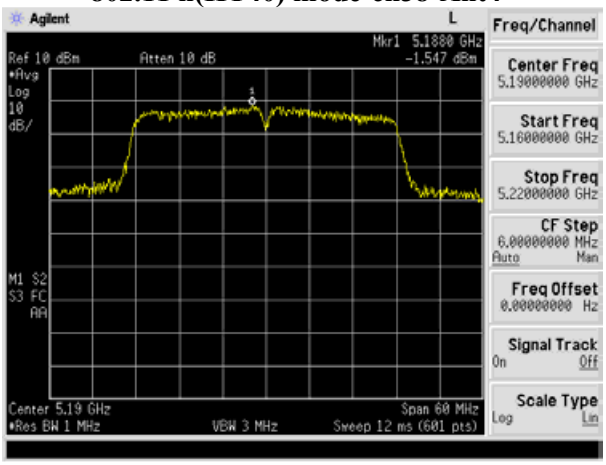
802.11 n(HT20) mode-ch48-Ant4



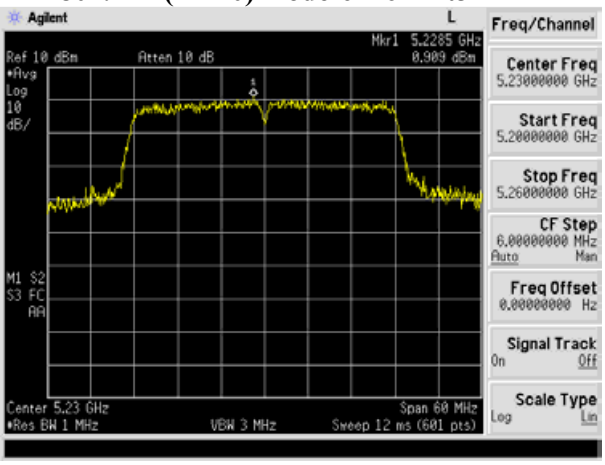
802.11n(HT40) mode-ch38-Ant3



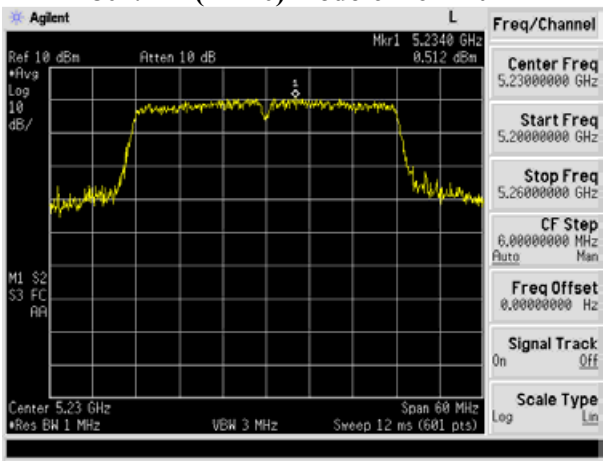
802.11 n(HT40) mode-ch38-Ant4



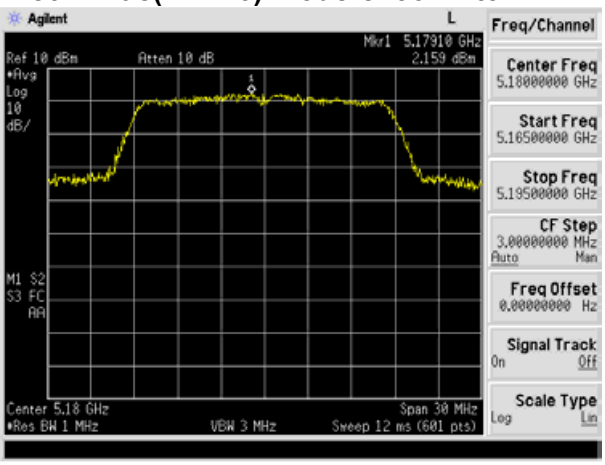
802.11 n(HT40) mode-ch46-Ant3



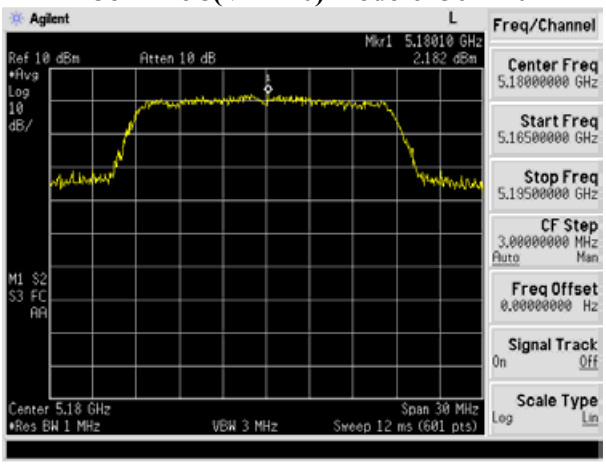
802.11 n(HT40) mode-ch46-Ant4



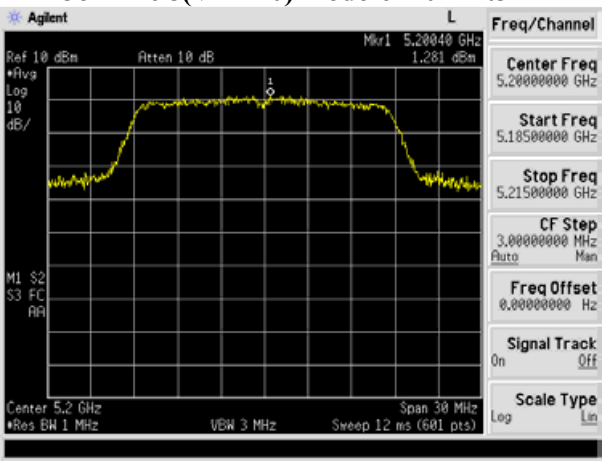
802.11ac(VHT20) mode-ch36-Ant3



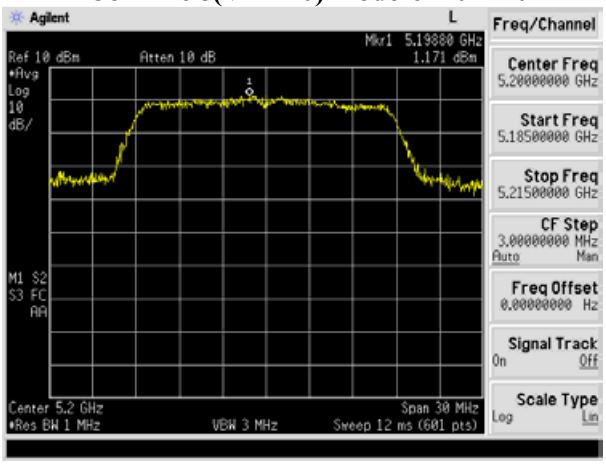
802.11ac(VHT20) mode-ch36-Ant4



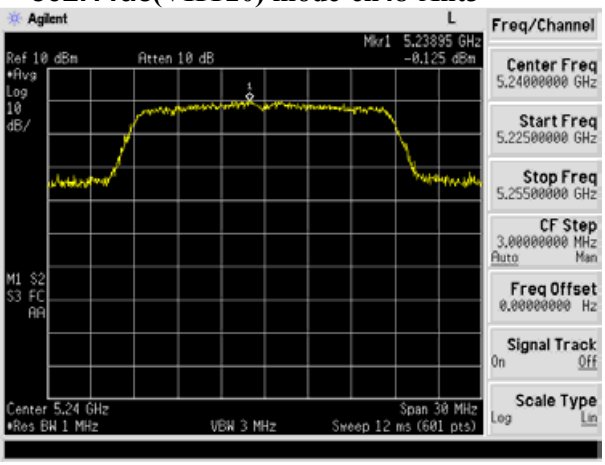
802.11ac(VHT20) mode-ch40-Ant3



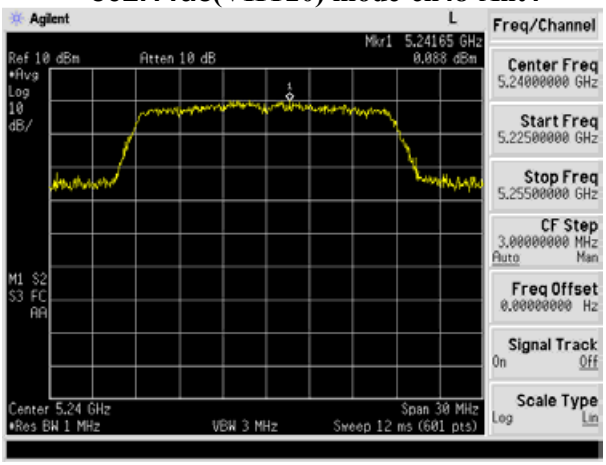
802.11ac(VHT20) mode-ch40-Ant4



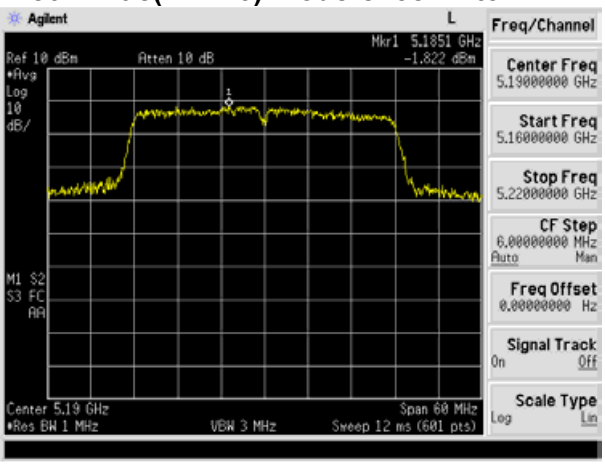
802.11ac(VHT20) mode-ch48-Ant3



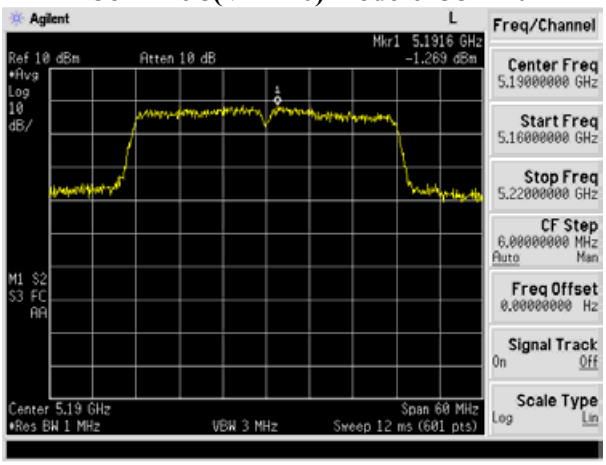
802.11ac(VHT20) mode-ch48-Ant4



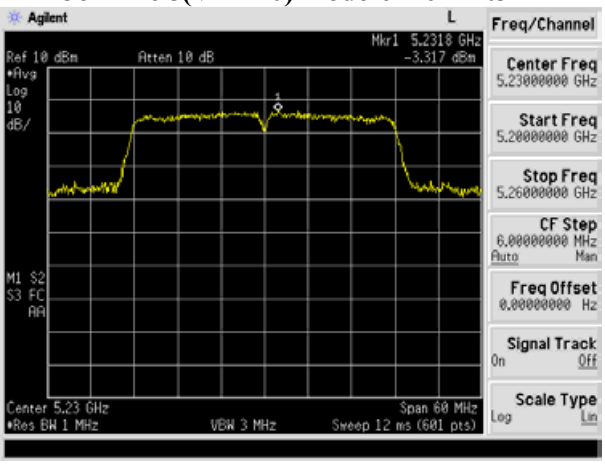
802.11ac(VHT40) mode-ch38-Ant3



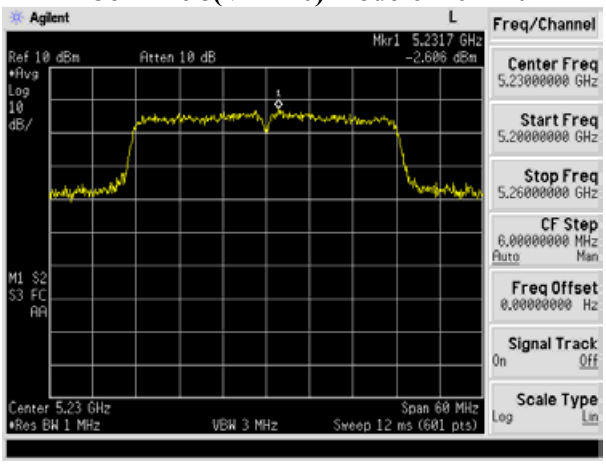
802.11ac(VHT40) mode-ch38-Ant4



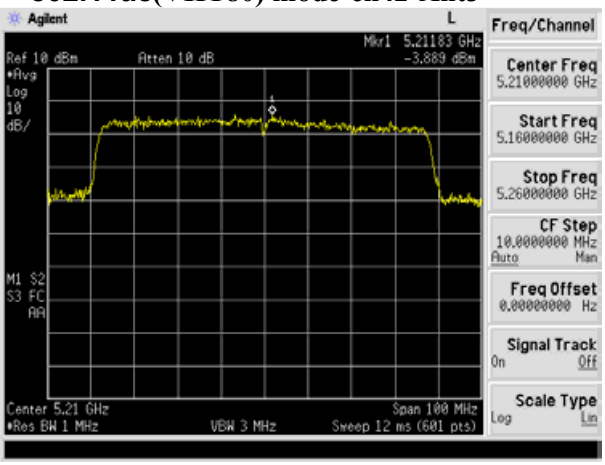
802.11ac(VHT40) mode-ch46-Ant3



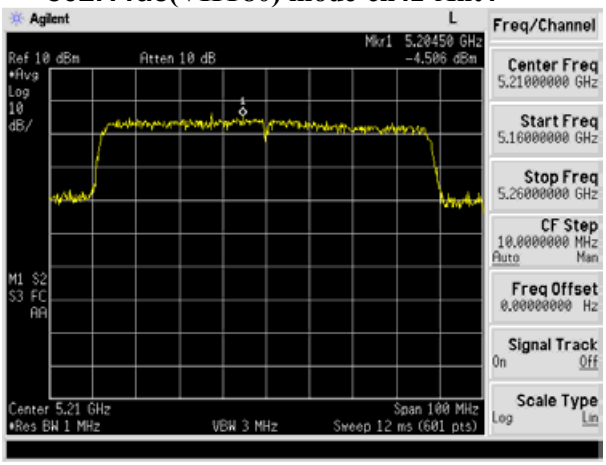
802.11ac(VHT40) mode-ch46-Ant4



802.11ac(VHT80) mode-ch42-Ant3

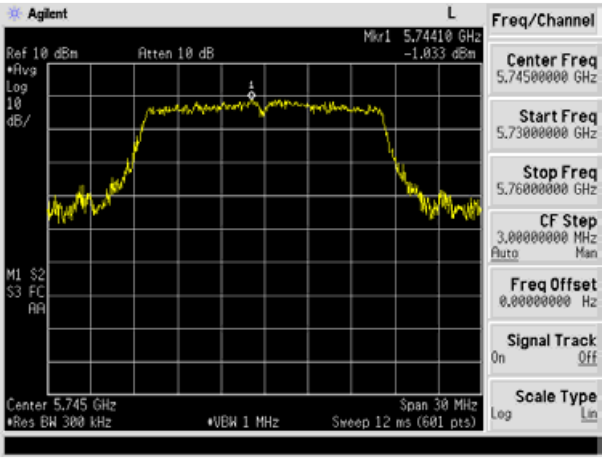


802.11ac(VHT80) mode-ch42-Ant4

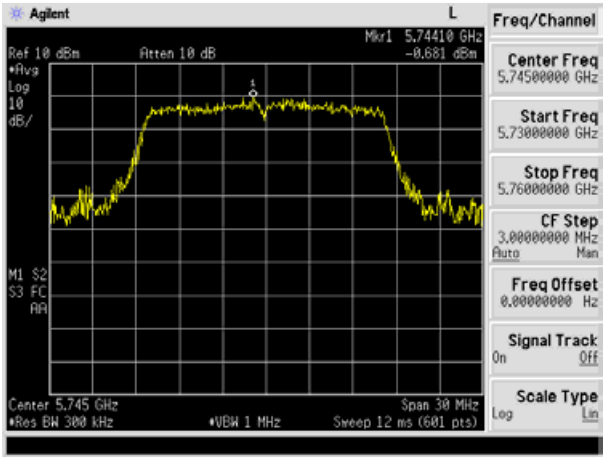


5725-5850MHz:

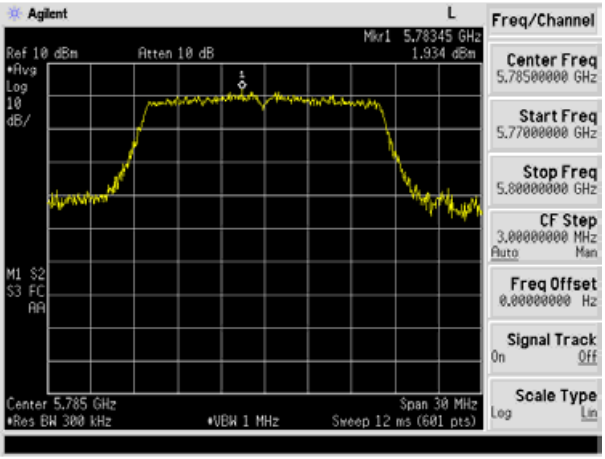
802.11a mode-ch149-Ant3



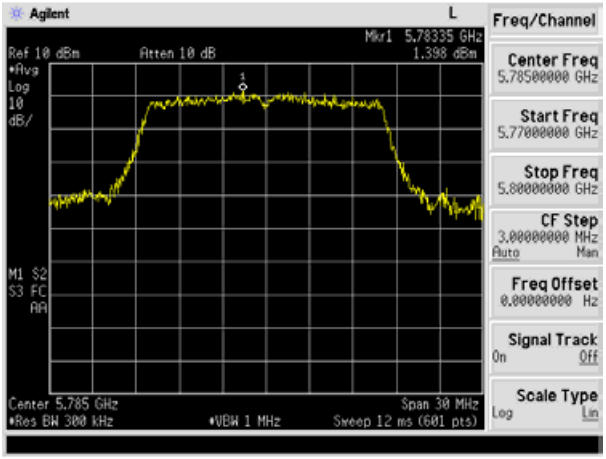
802.11a mode-ch149-Ant4



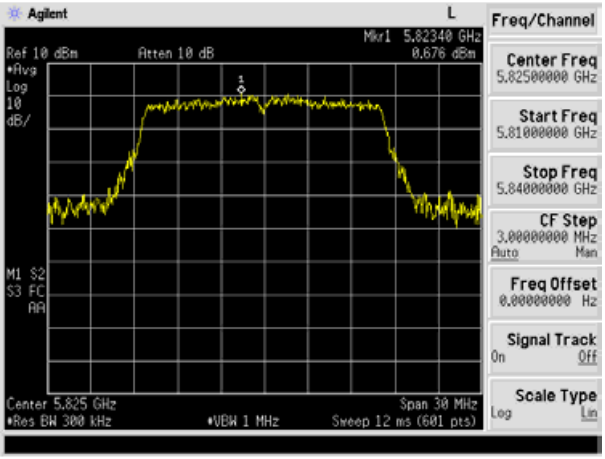
802.11a mode-ch157-Ant3



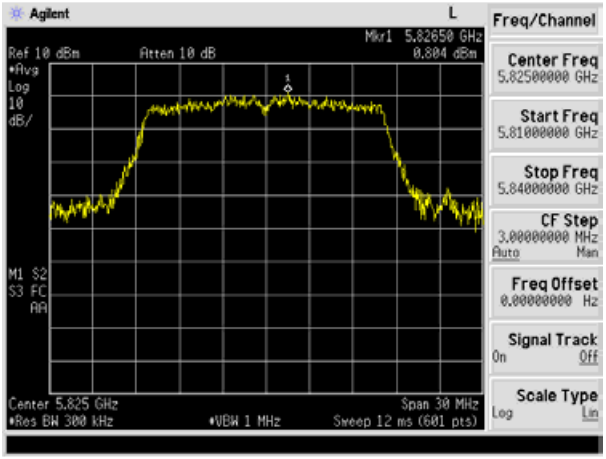
802.11a mode-ch157-Ant4



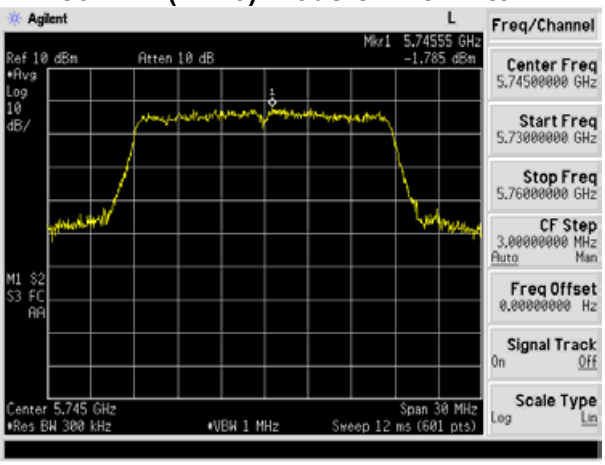
802.11a mode-ch165-Ant3



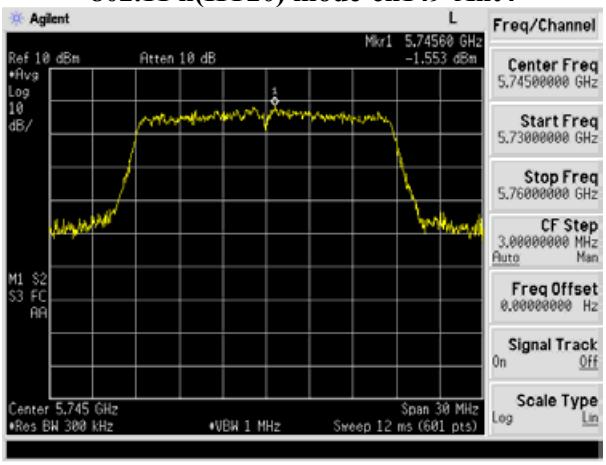
802.11a mode-ch165-Ant4



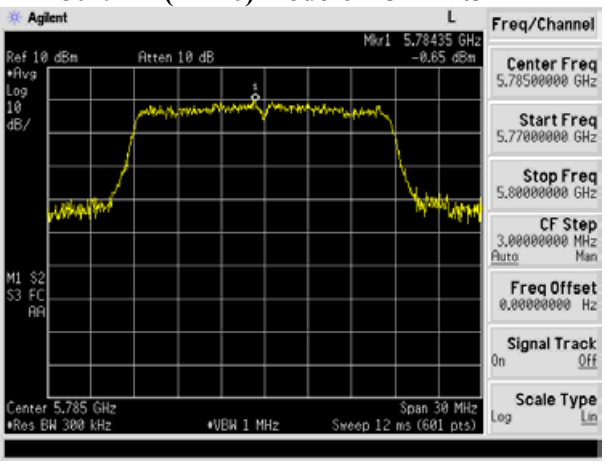
802.11n(HT20) mode-ch149-Ant3



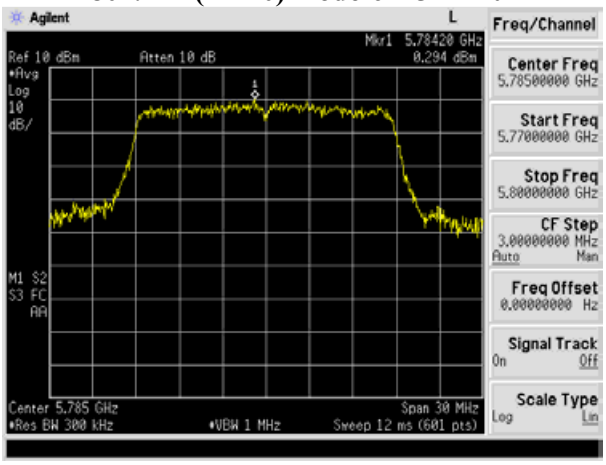
802.11 n(HT20) mode-ch149-Ant4



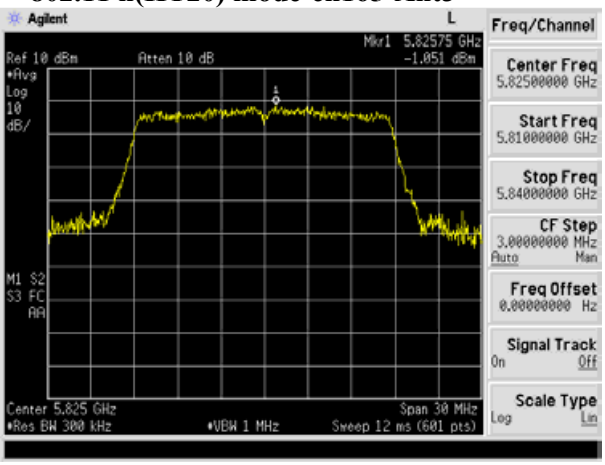
802.11 n(HT20) mode-ch157-Ant3



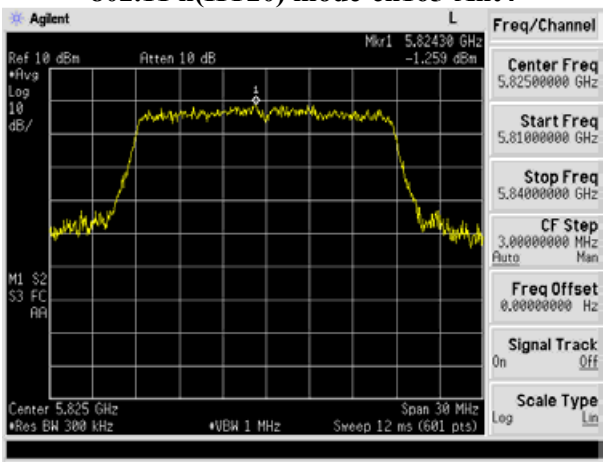
802.11 n(HT20) mode-ch157-Ant4



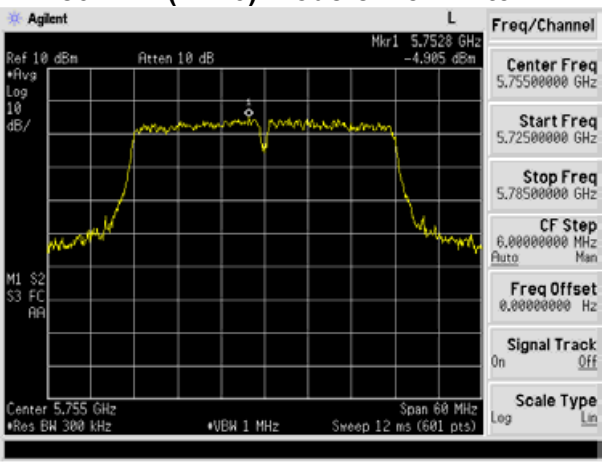
802.11 n(HT20) mode-ch165-Ant3



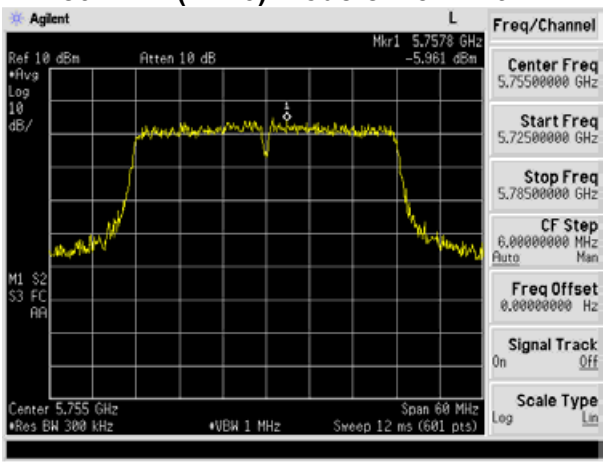
802.11 n(HT20) mode-ch165-Ant4



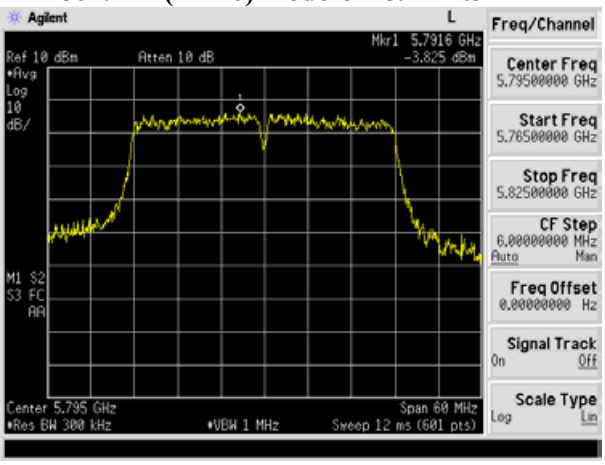
802.11n(HT40) mode-ch151-Ant3



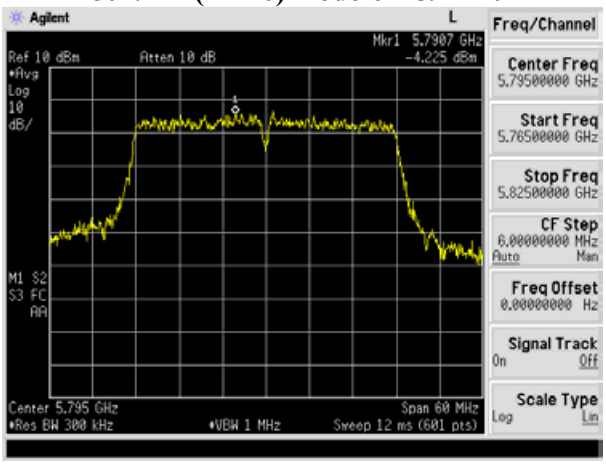
802.11 n(HT40) mode-ch151-Ant4



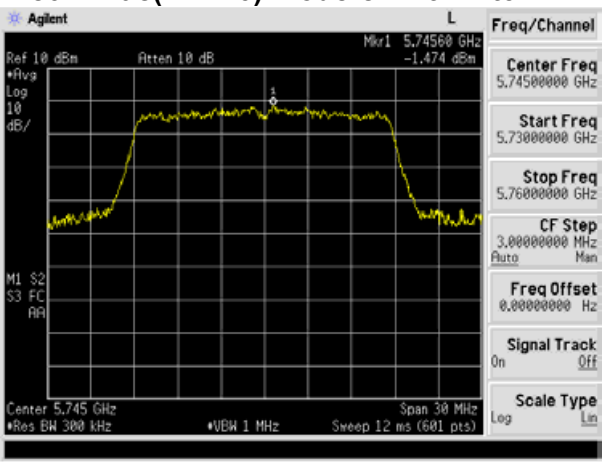
802.11 n(HT40) mode-ch159-Ant3



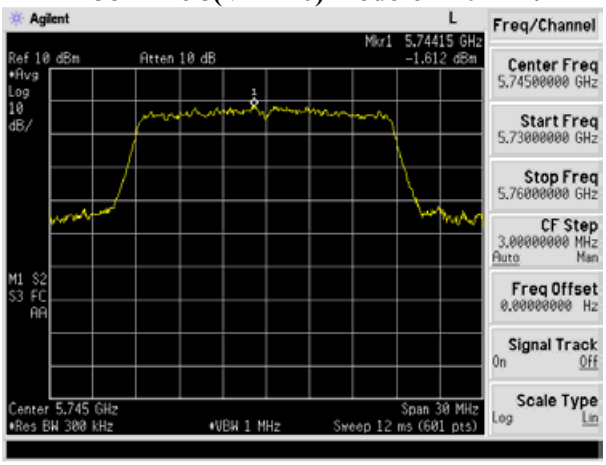
802.11 n(HT40) mode-ch159-Ant4



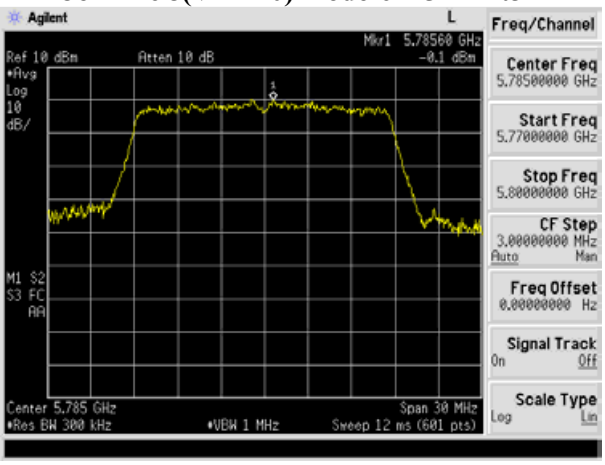
802.11ac(VHT20) mode-ch149-Ant3



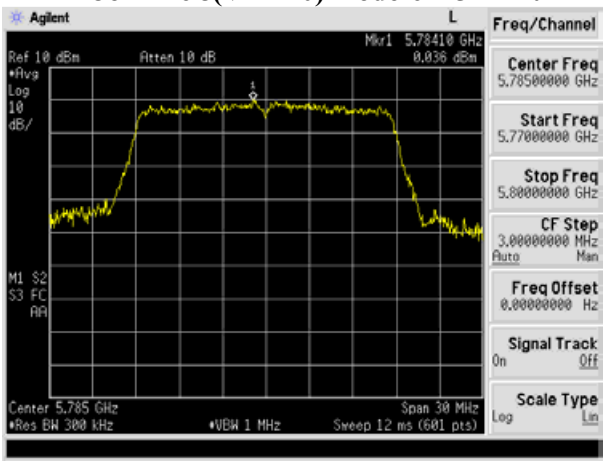
802.11ac(VHT20) mode-ch149-Ant4



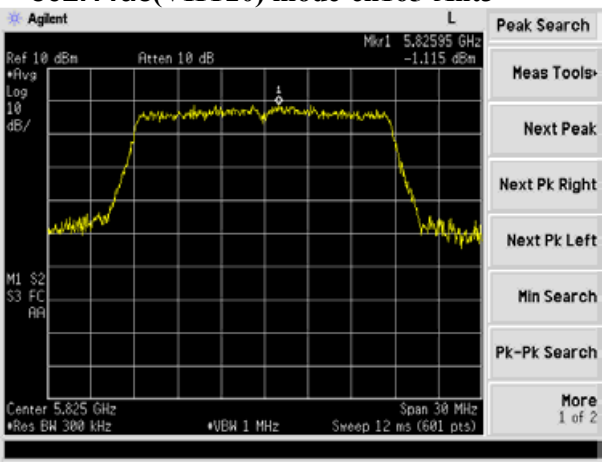
802.11ac(VHT20) mode-ch157-Ant3



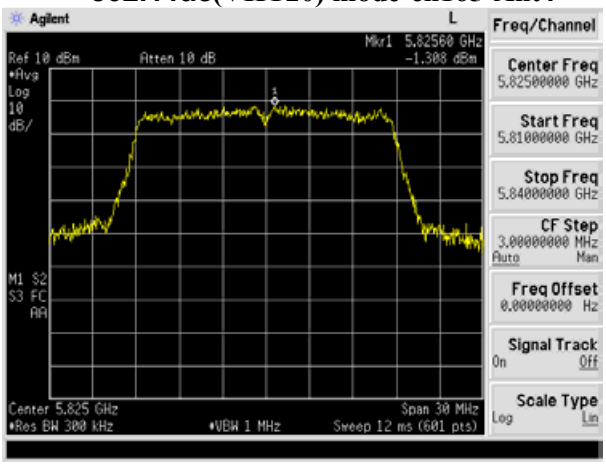
802.11ac(VHT20) mode-ch157-Ant4



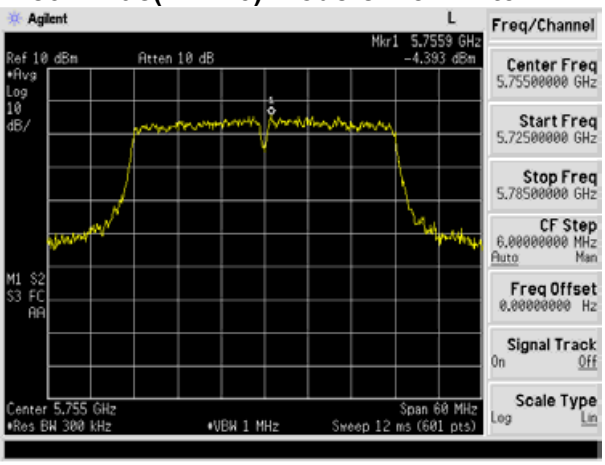
802.11ac(VHT20) mode-ch165-Ant3



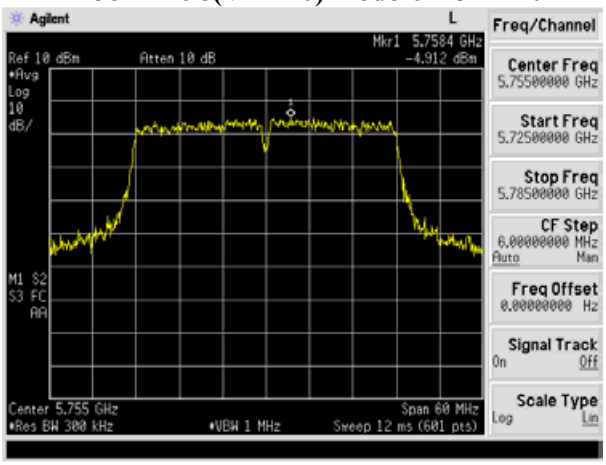
802.11ac(VHT20) mode-ch165-Ant4



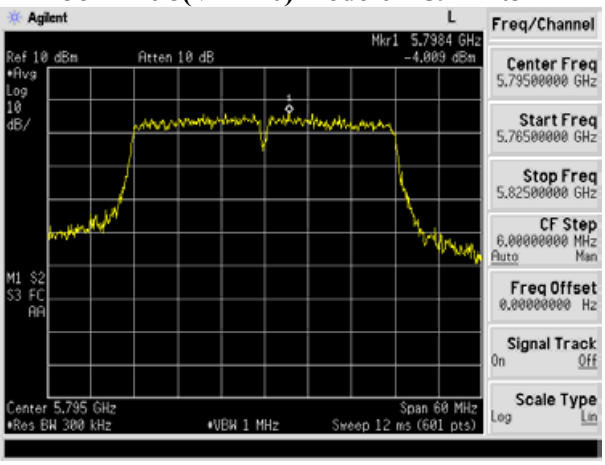
802.11ac(VHT40) mode-ch151-Ant3



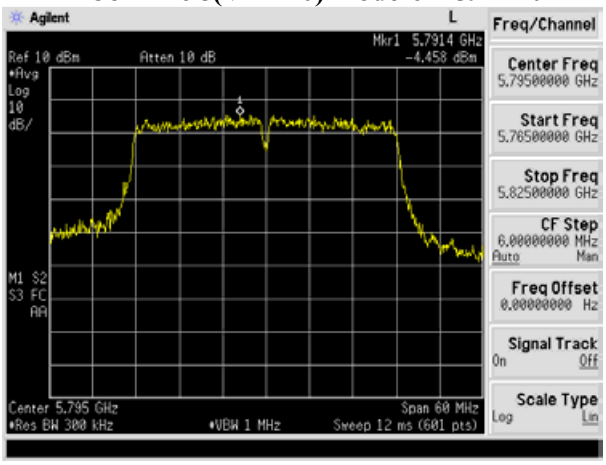
802.11ac(VHT40) mode-ch151-Ant4



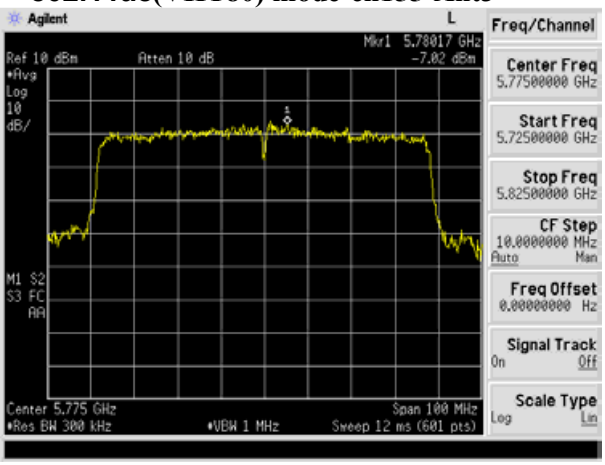
802.11ac(VHT40) mode-ch159-Ant3



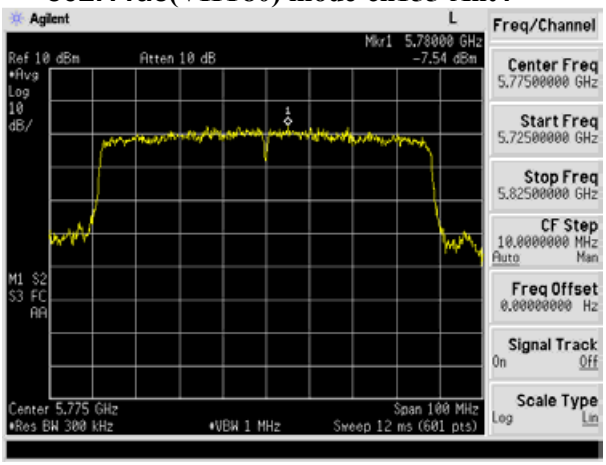
802.11ac(VHT40) mode-ch159-Ant4



802.11ac(VHT80) mode-ch155-Ant3



802.11ac(VHT80) mode-ch155-Ant4

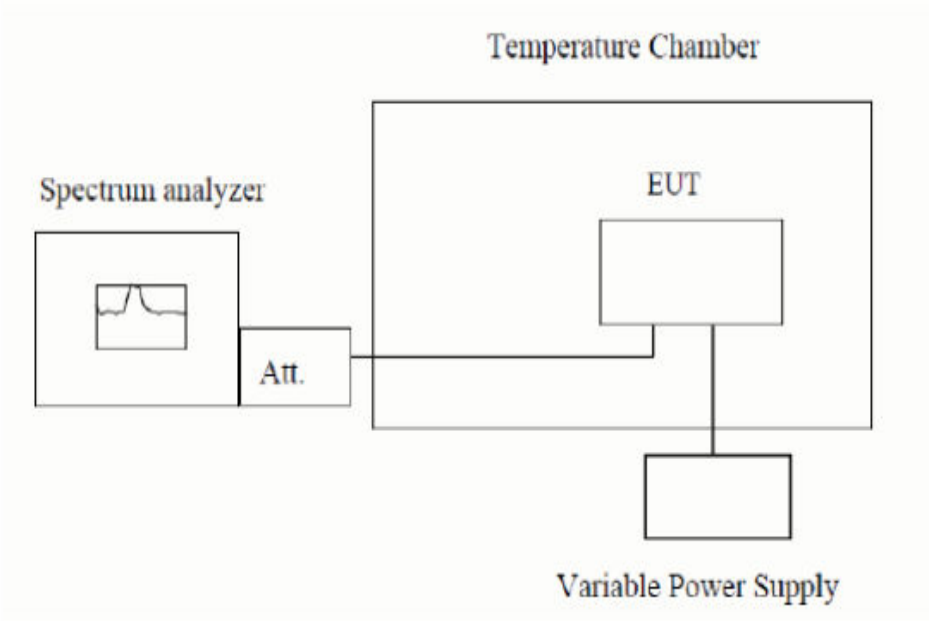


10. FREQUENCY STABILITY TEST

10.1.limit

According to §15.407(g), manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

10.2Test Configuration



10.3 test procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 106 ppm and the limit is less than ±20ppm (IEEE 802.11nspecification).
6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature rule is -30°C~50°C..

Test result

Measurement Data (the worst channel):

Frequency Stability under Temperature

Operating Frequency: 5180 MHz				
Environment Temperature (°C)	**Voltage (V)**	**Measured Frequency (MHz)**	**Test Result (MHz)**	**Max. Deviation (ppm)**
50	12	5180	5180.0135	2.606
40	12	5180	5180.0103	1.988
30	12	5180	5180.0112	2.162
20	12	5180	5180.0117	2.258
10	12	5180	5180.0105	2.027
0	12	5180	5180.0143	2.761
-10	12	5180	5180.0112	2.162
-20	12	5180	5180.0133	2.568
-30	12	5180	5180.0124	2.394

Frequency Stability under Voltage

Operating Frequency: 5180 MHz			
DC Voltage (V)	**Measured Frequency (MHz)**	**Test Result (MHz)**	**Max. Deviation (ppm)**
10.8	5180	5180.0132	2.548
12	5180	5180.0238	4.595
13.2	5180	5180.0134	2.587

11.ANTENNA REQUIREMENTS

11.1 Limits

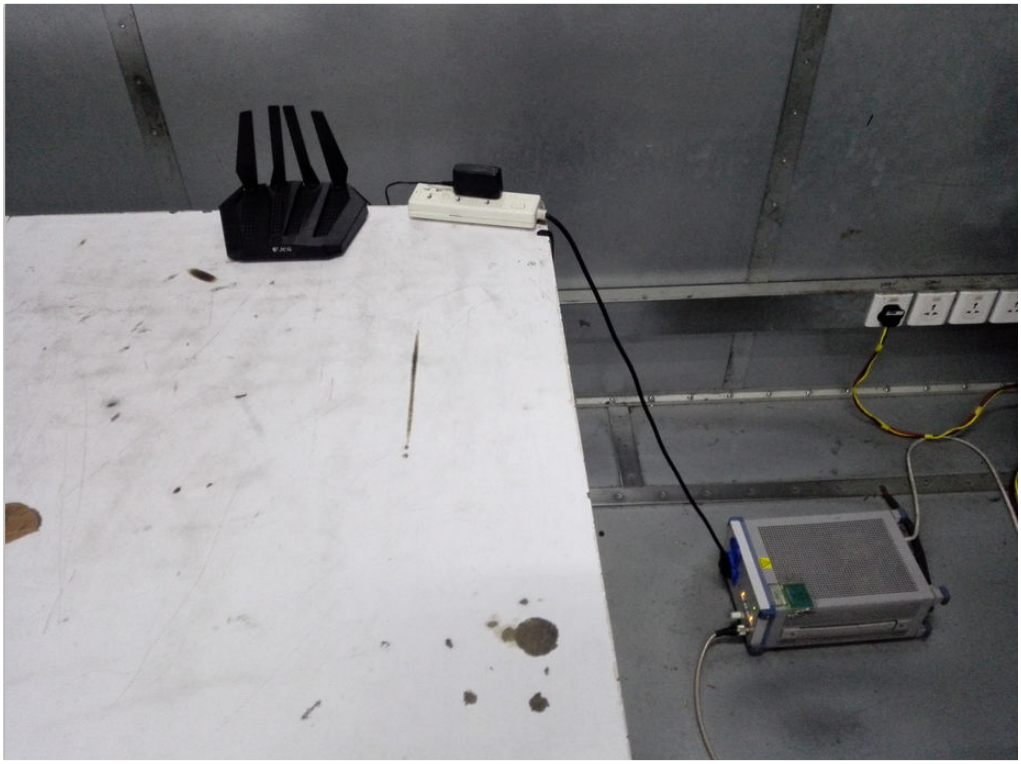
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2 Result

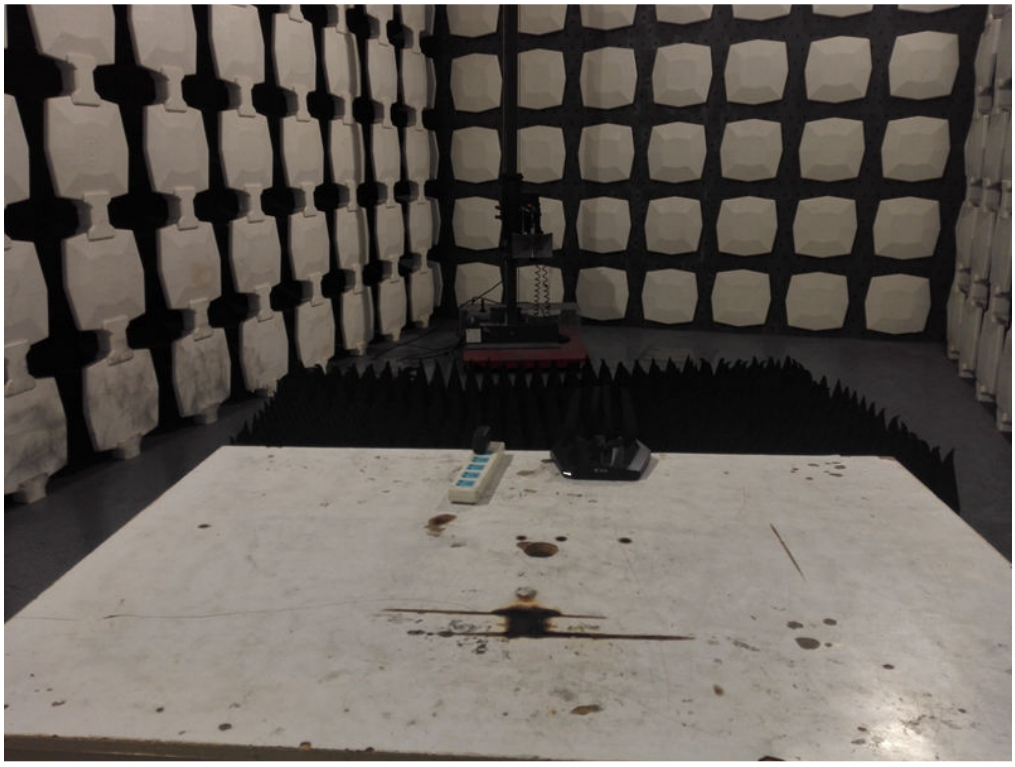
The antennas used for this product are external antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 5.0dBi.

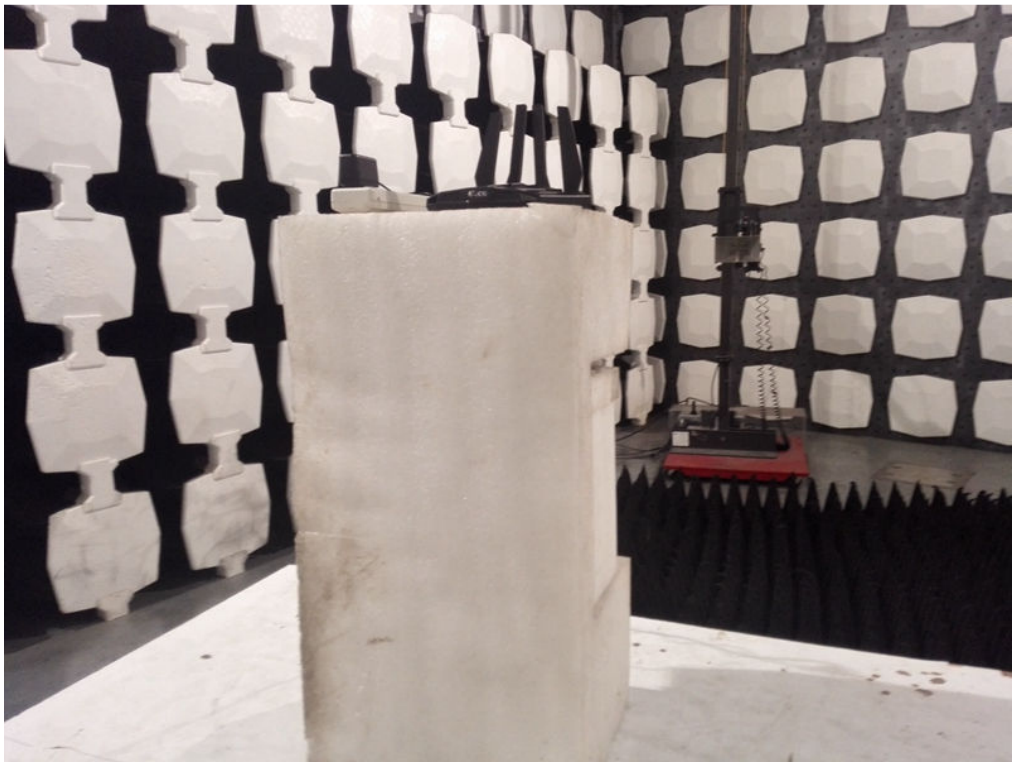
12.PHOTOGRAPHS OF TEST SET-UP

Conducted Emission

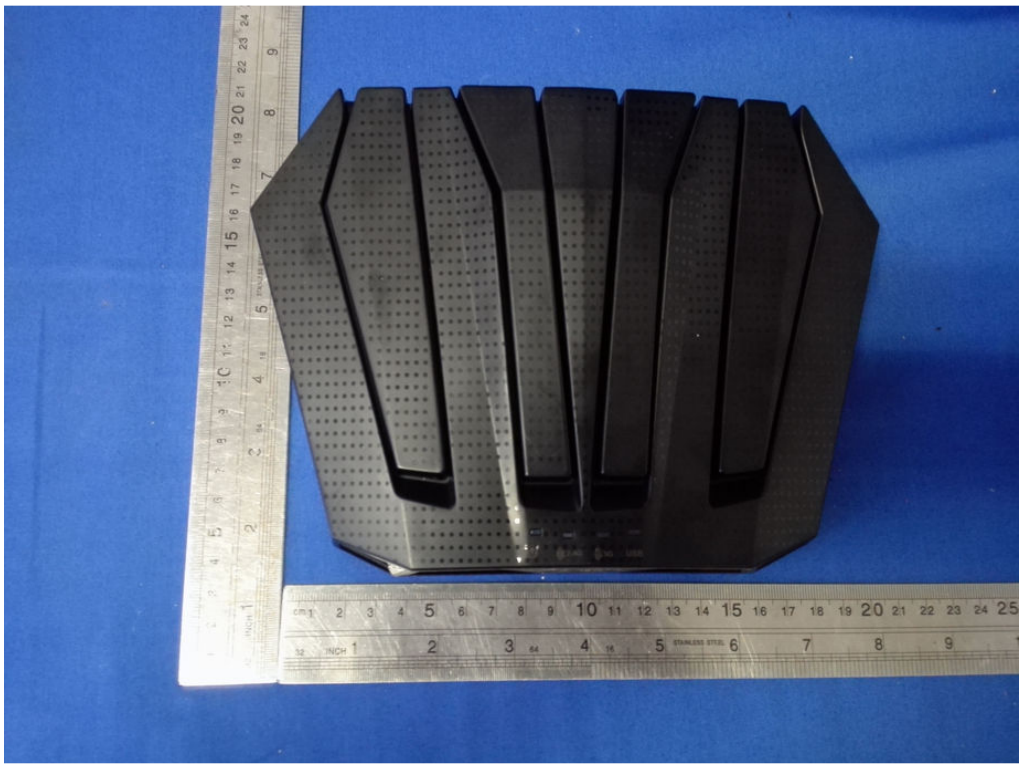


Radiated Emission Test

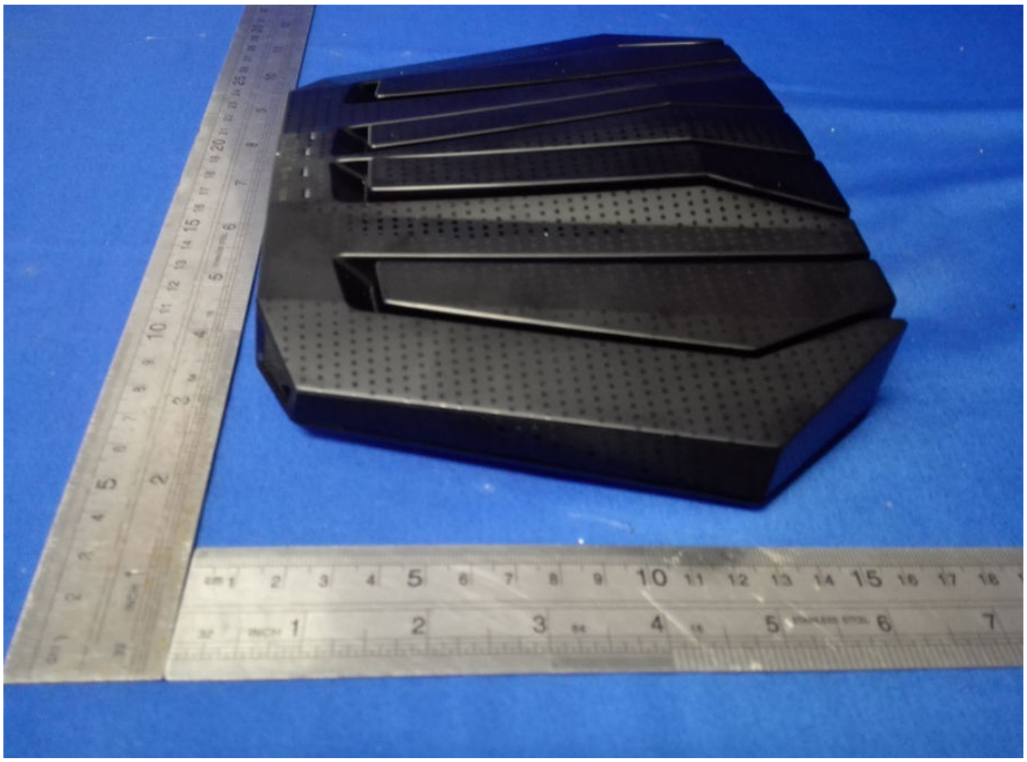




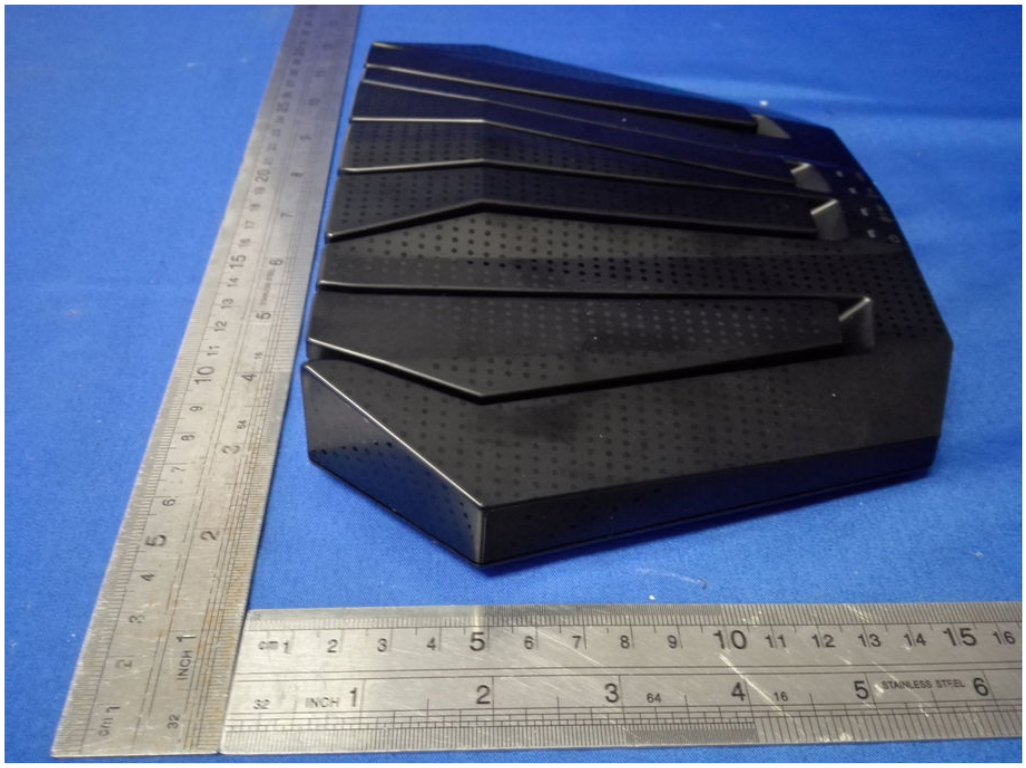
13.PHOTOGRAPHS OF THE EUT



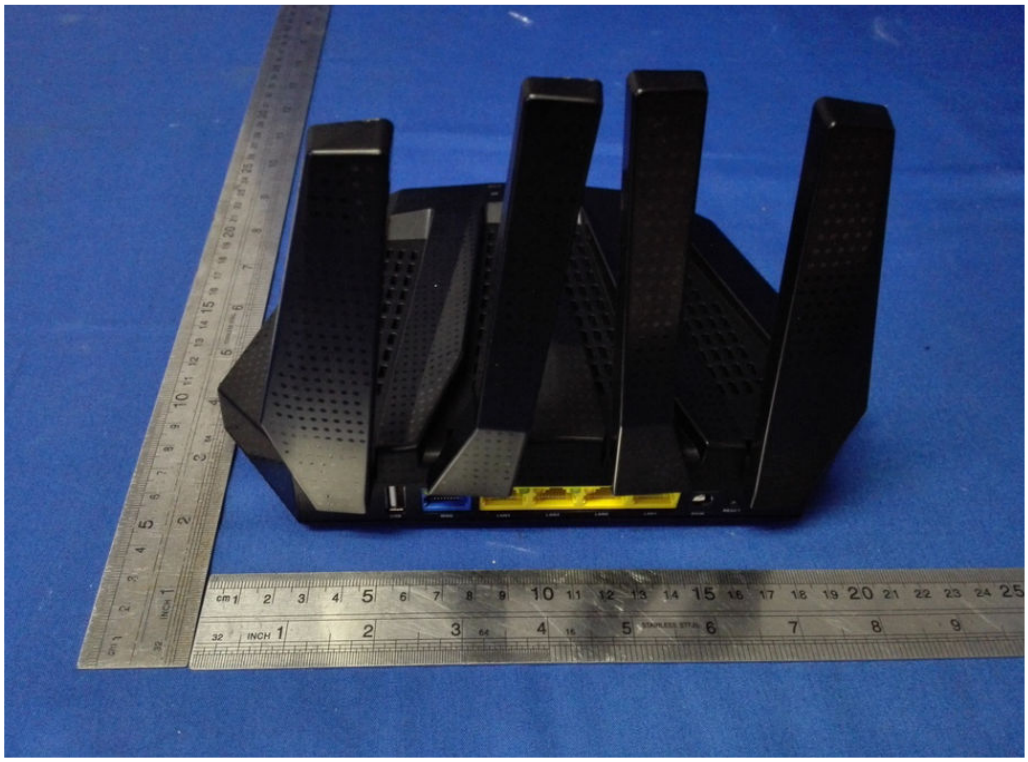
2.4G
5G
USB
JCG

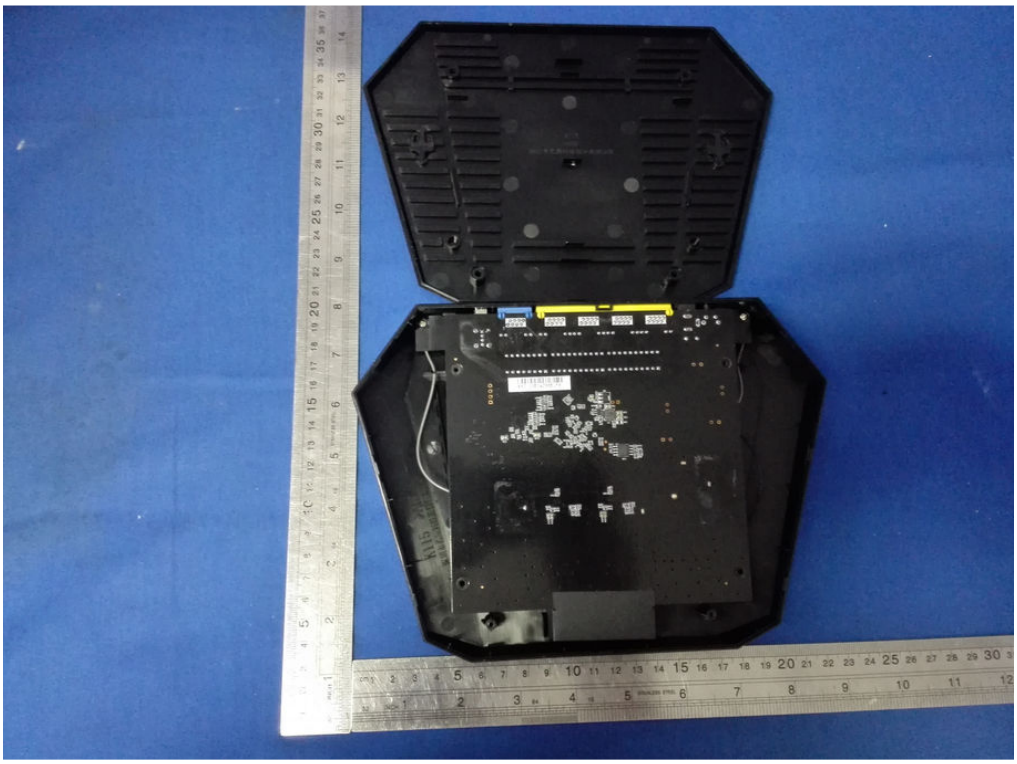


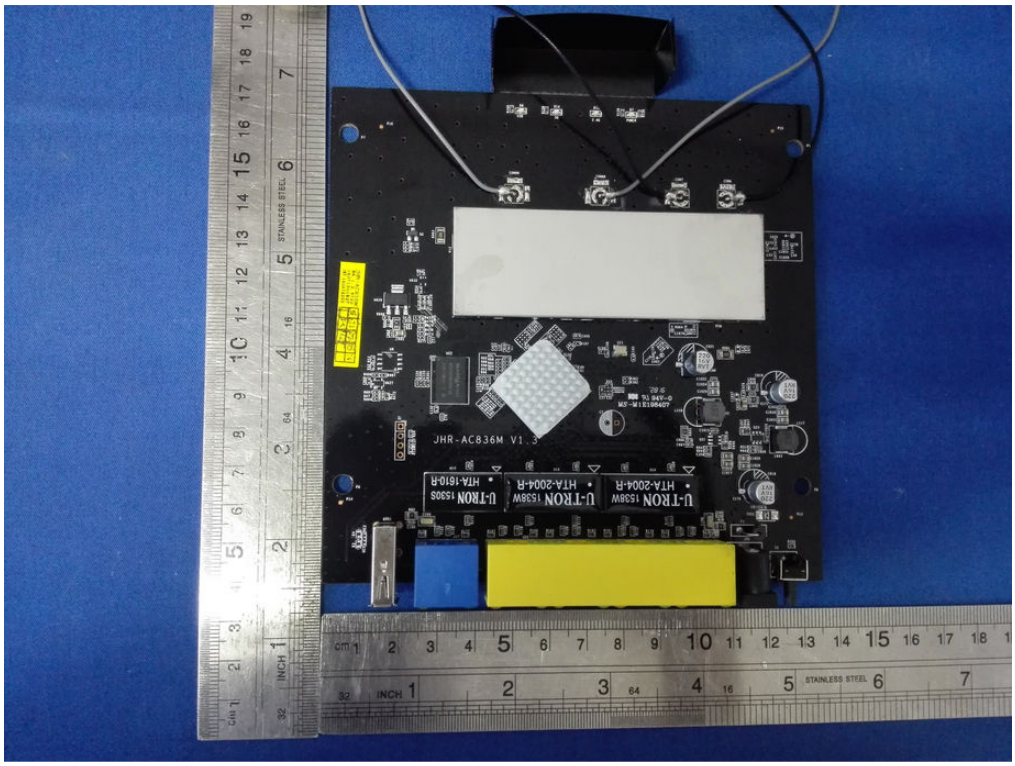
USB
WAN
LAN4
LAN3
LAN2
LAN1
RESET

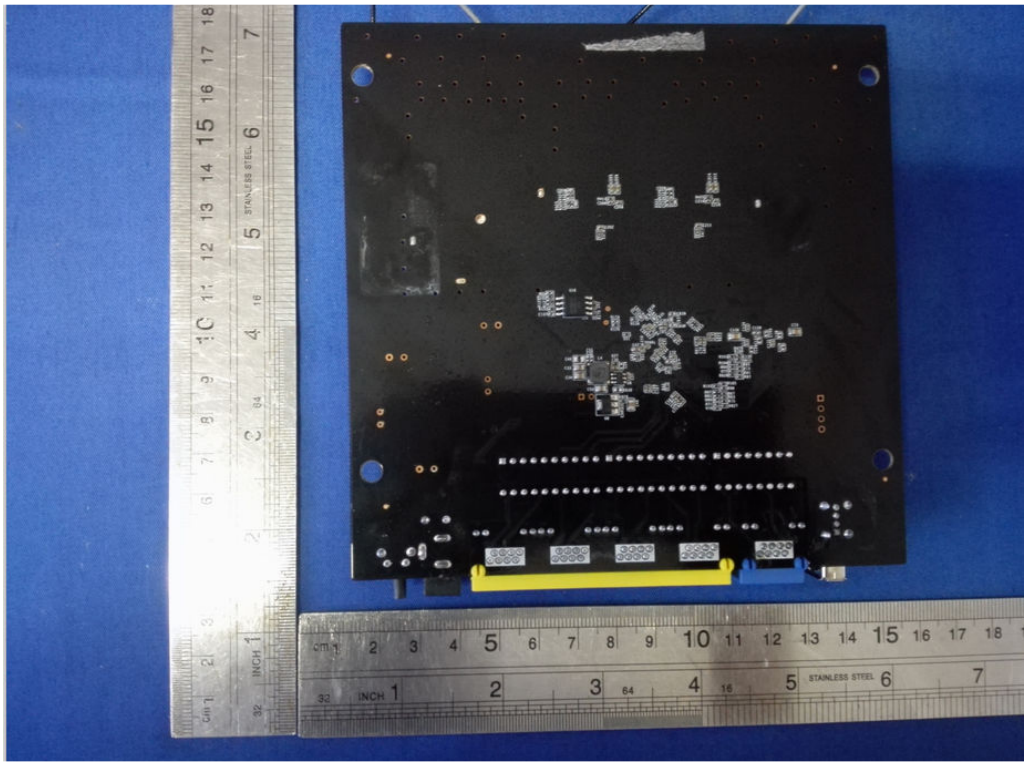


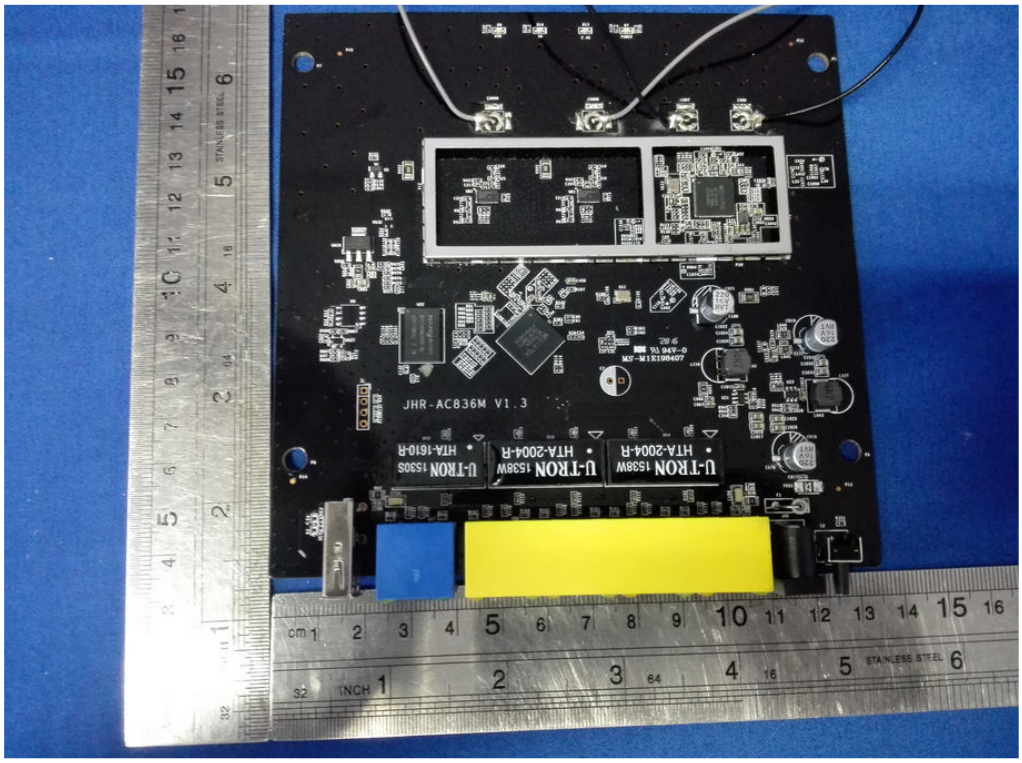
JCG
型号: JHR-AC836M
电源: DC 12V=1A
设置地址: h1wifi.com
或192.168.1.1






JHR-AC836M V1.3
U-TRON 1590S
HTA-1610-R
U-TRON 1598W
HTA-2004-R
U-TRON 1598W
HTA-2004-R




JHR-AC836M V1.3

JCG
AC ADAPTER
MODEL:NBS12E120100VU
INPUT:100-240V~, 50/60Hz, 0.3A
OUTPUT:12.0V⎓1.0A L.P.S.
MADE IN CHINA

------END------