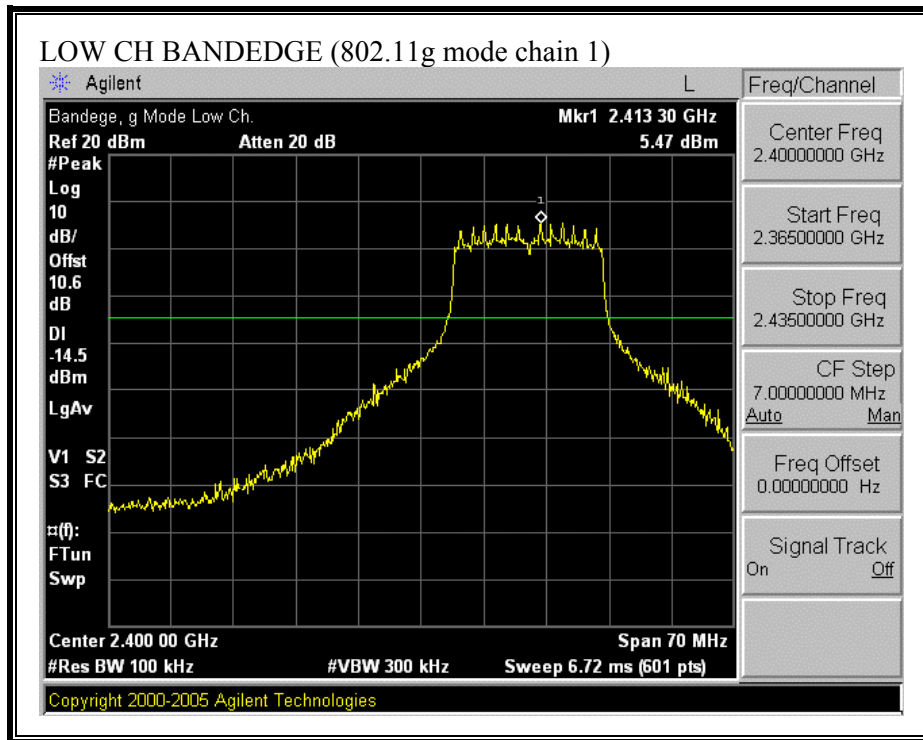
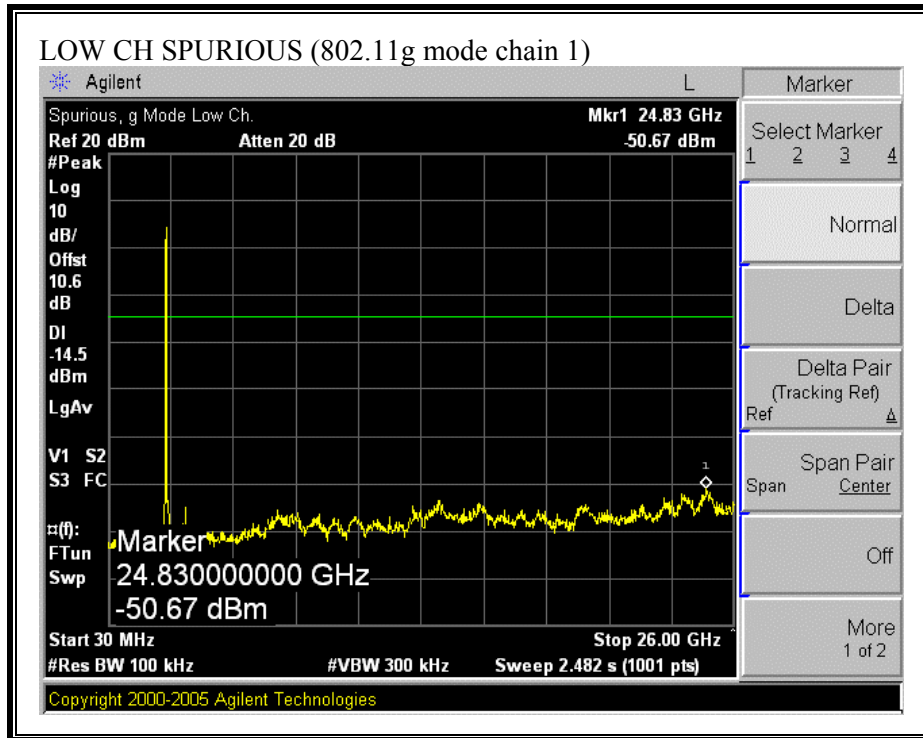
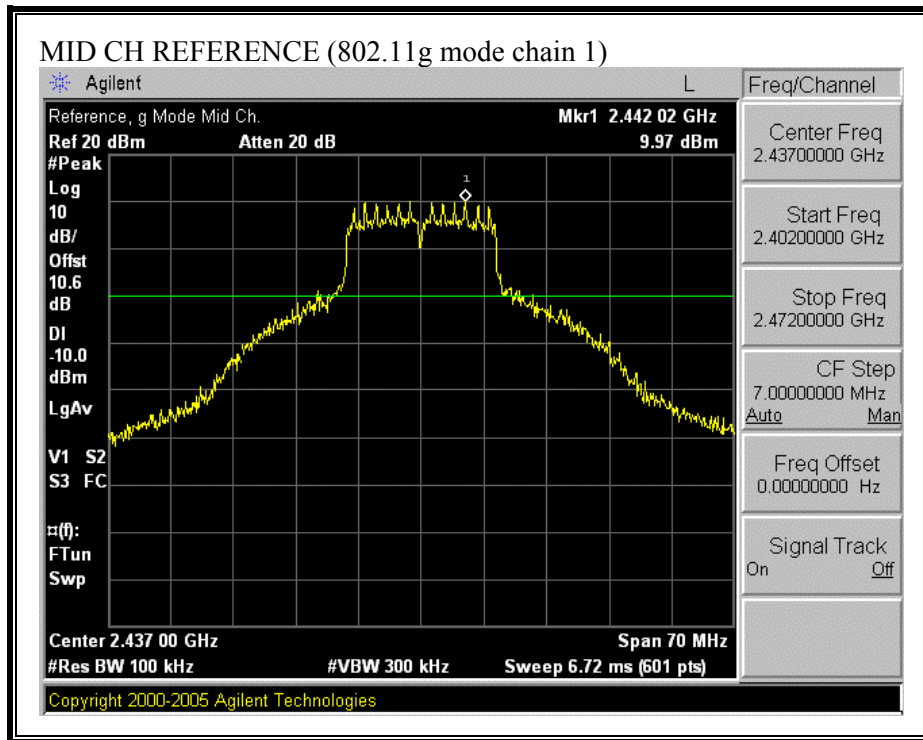
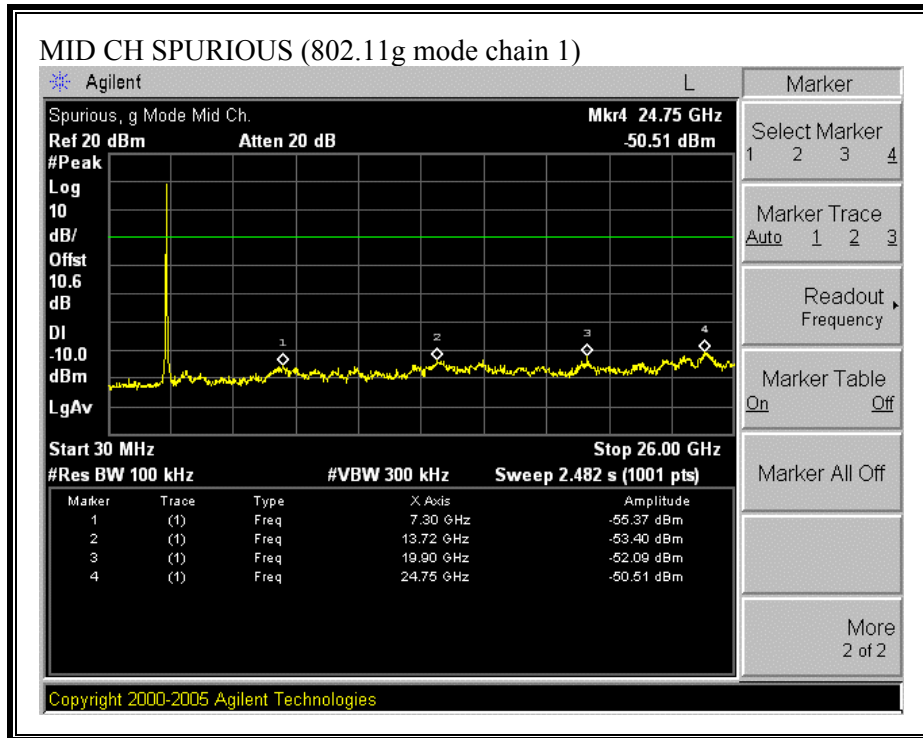


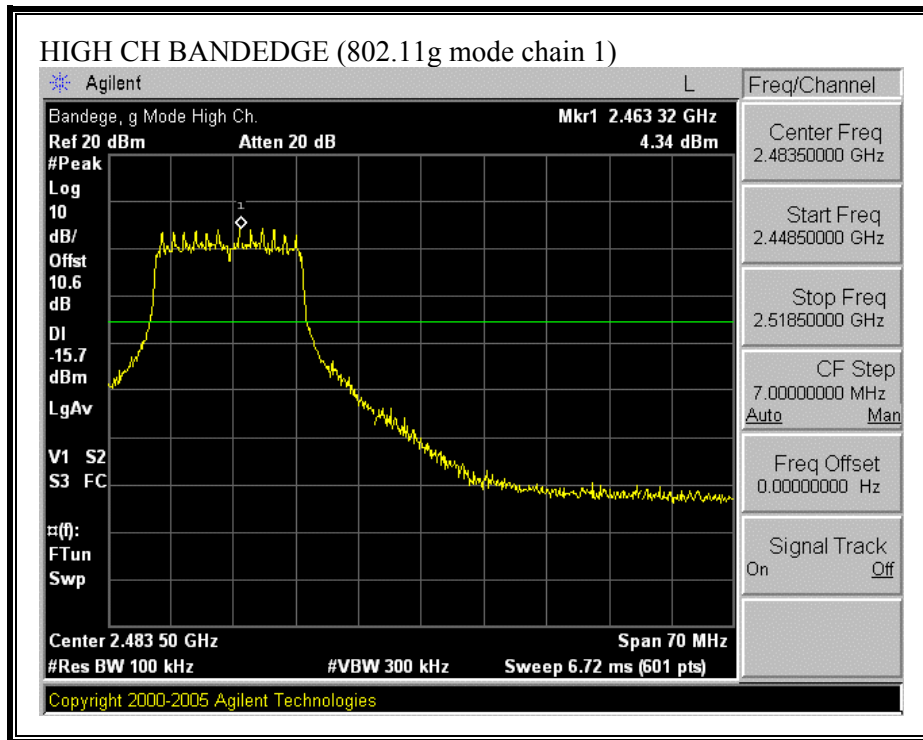
SPURIOUS EMISSIONS (802.11g MODE CHAIN 1)

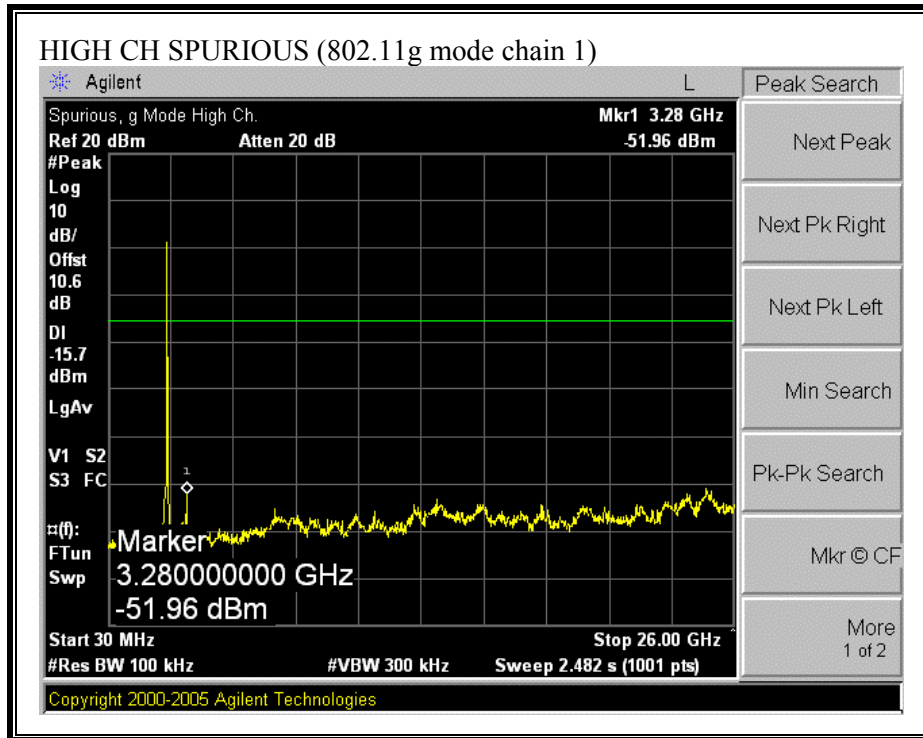




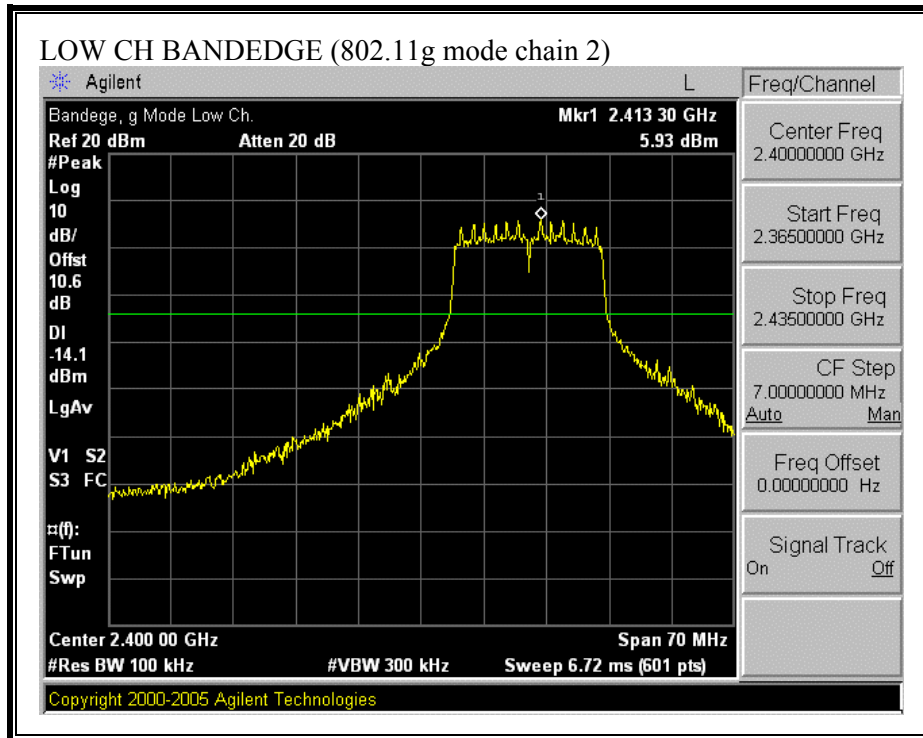




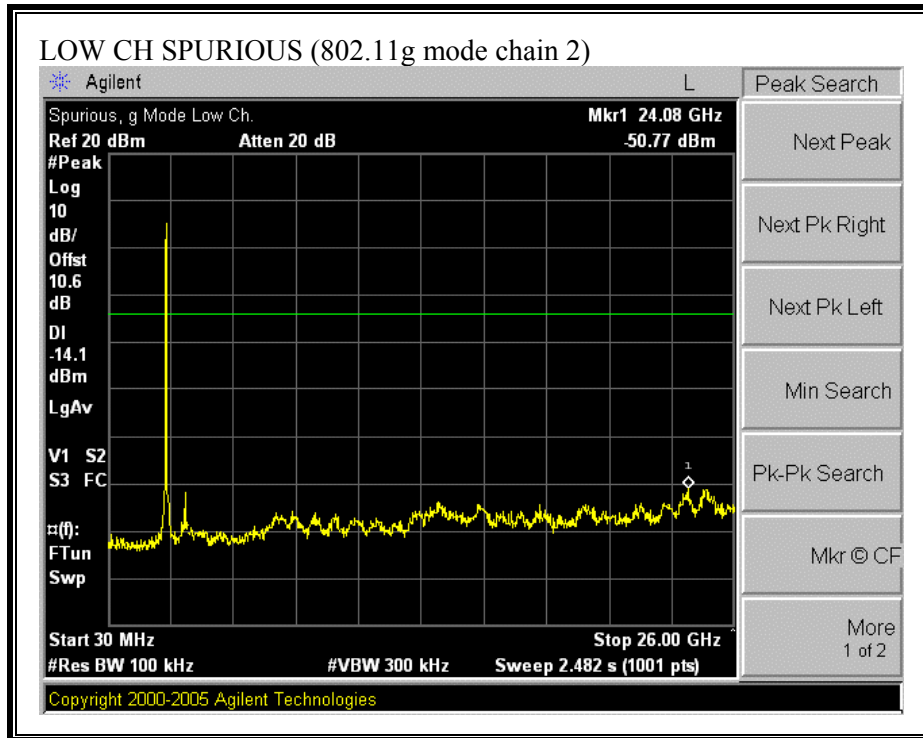




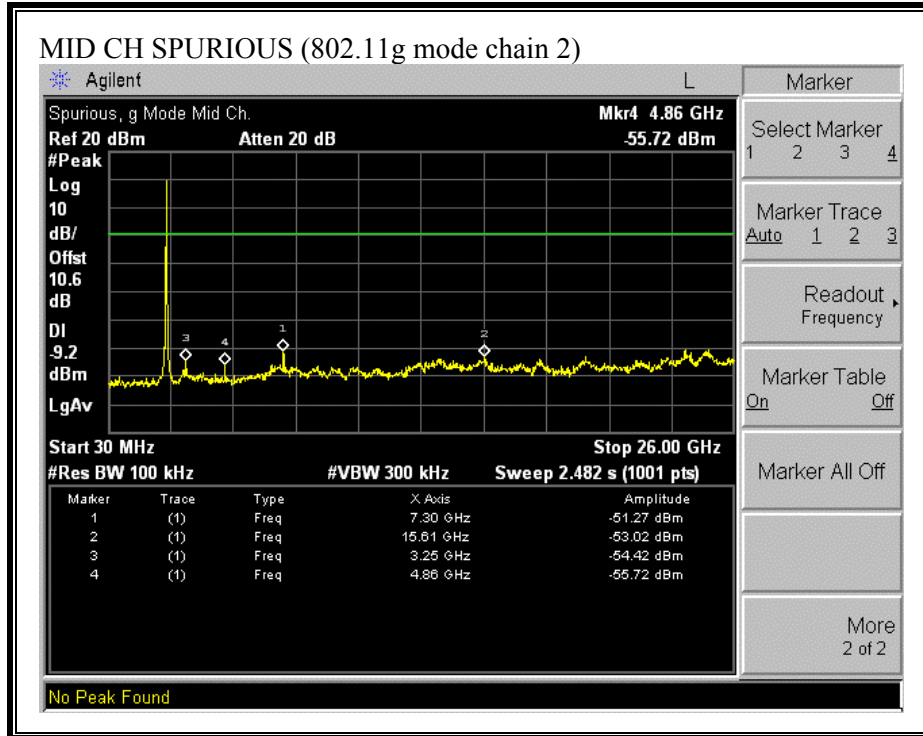
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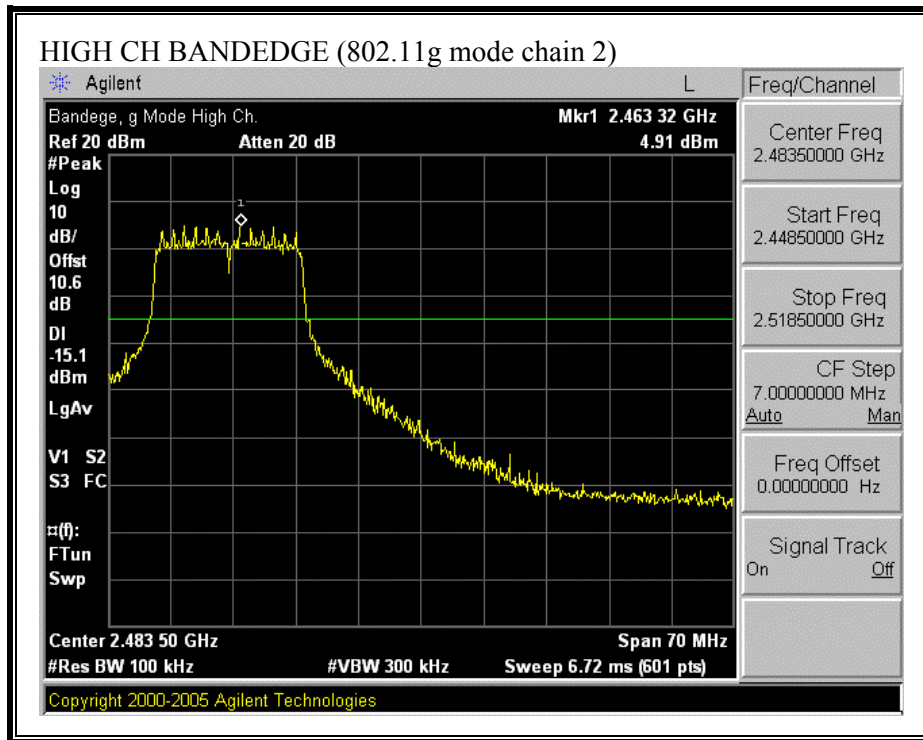


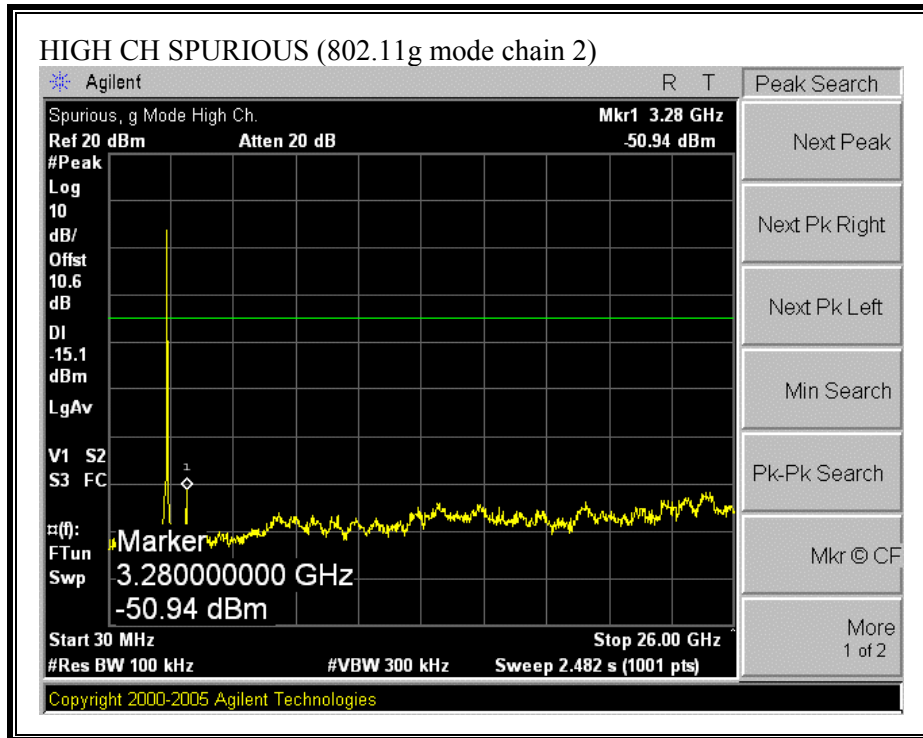




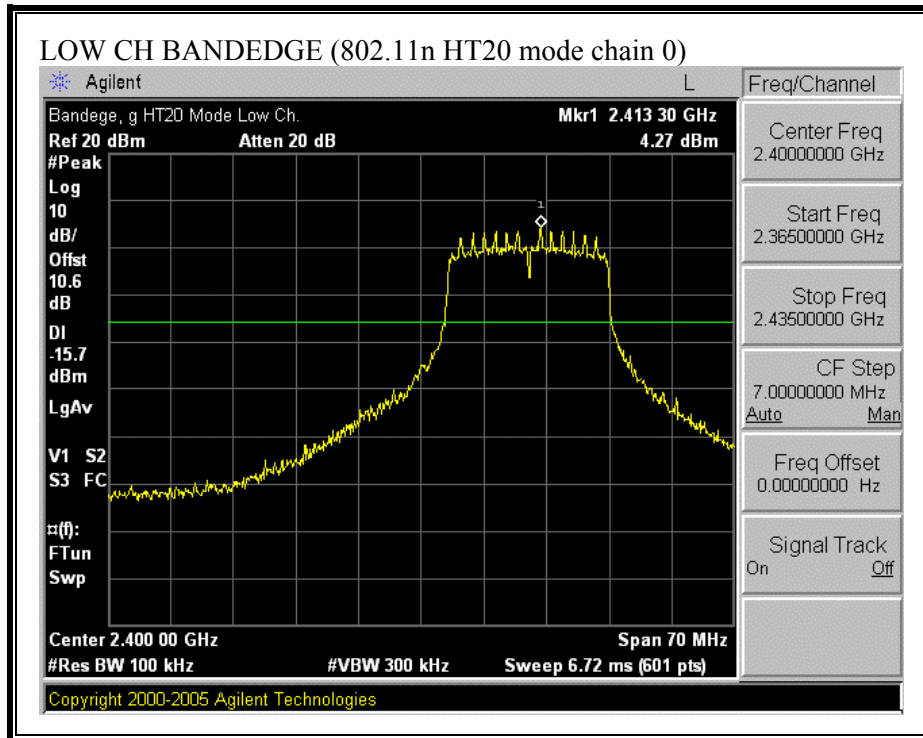


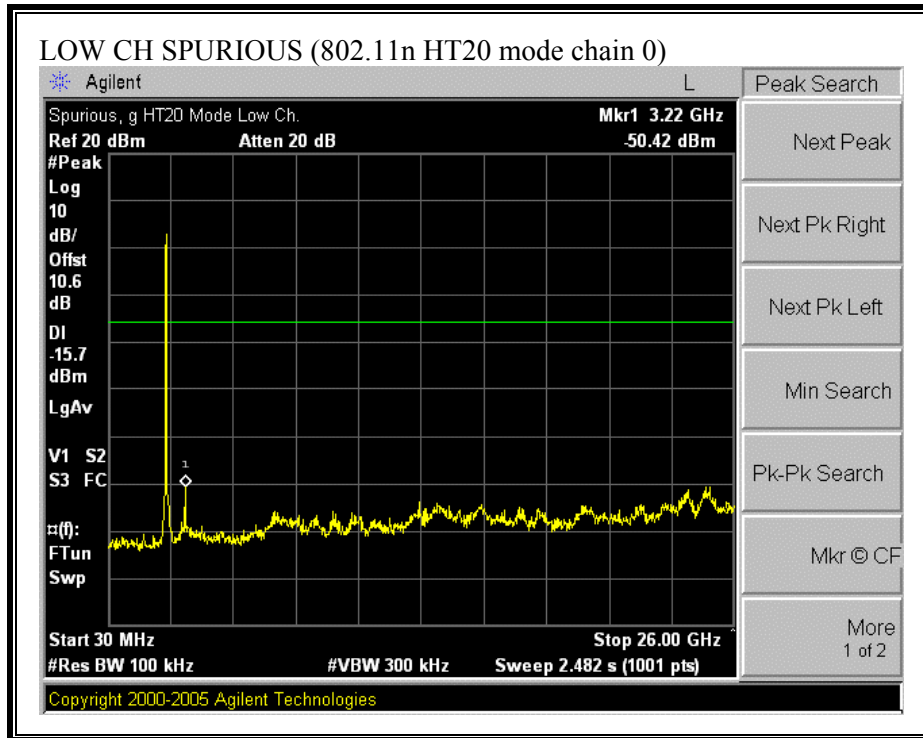


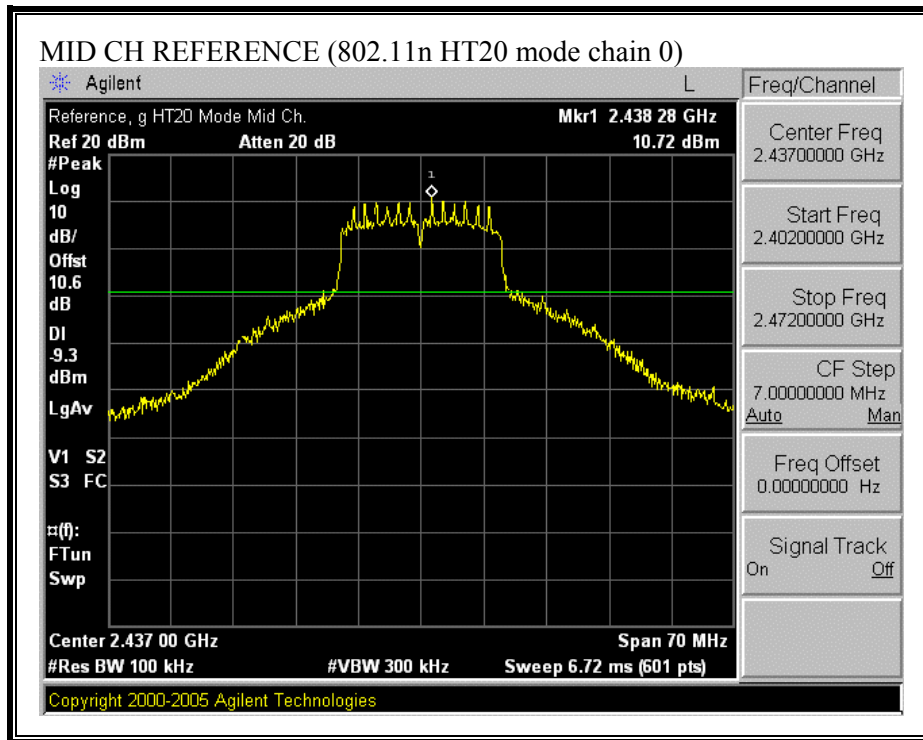




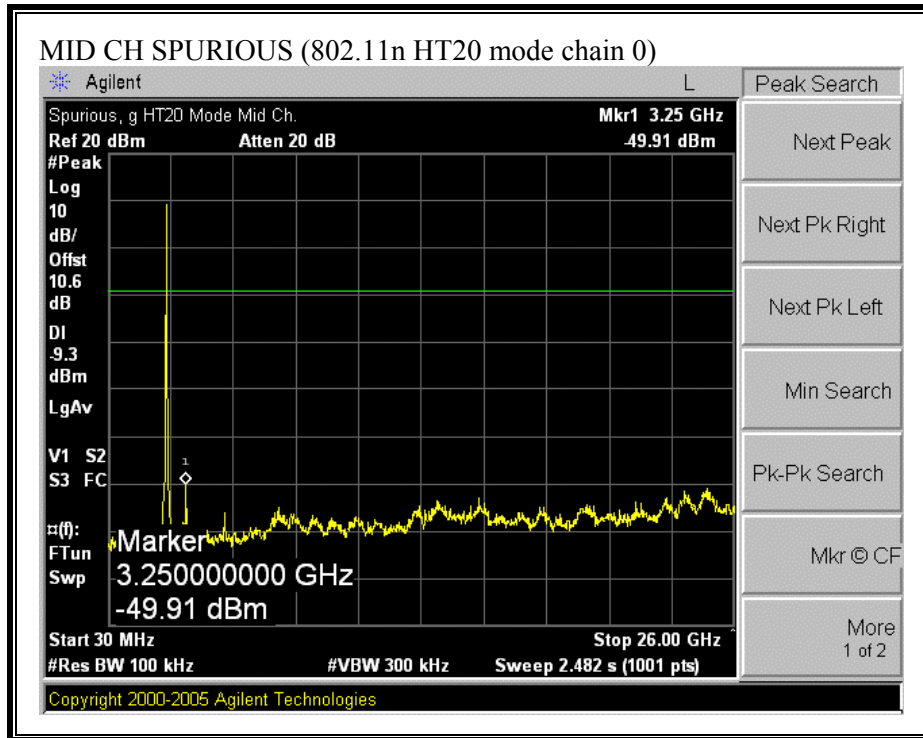
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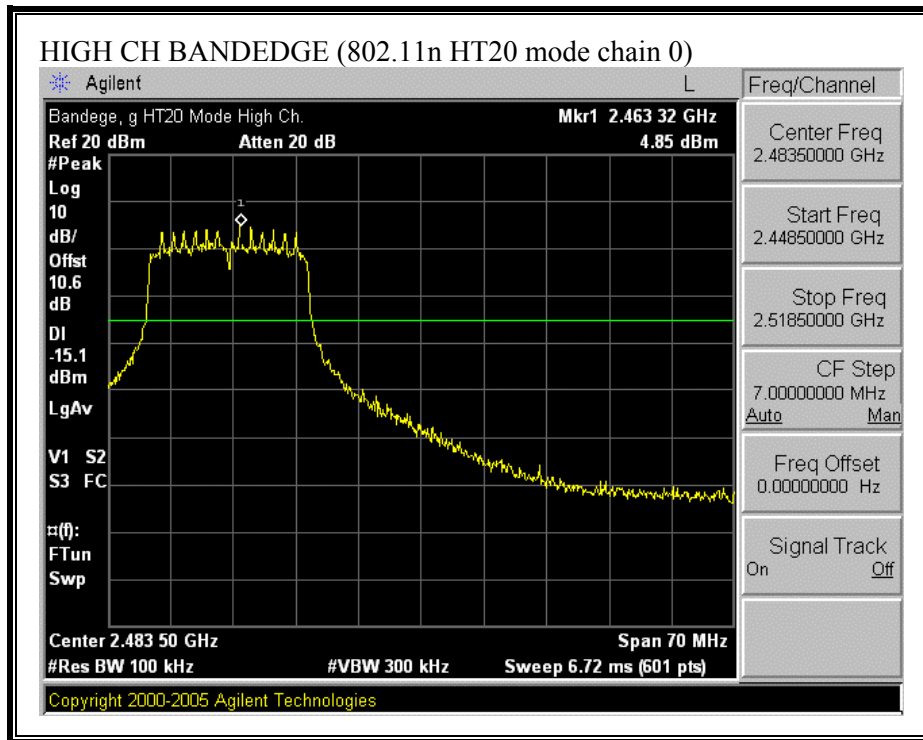


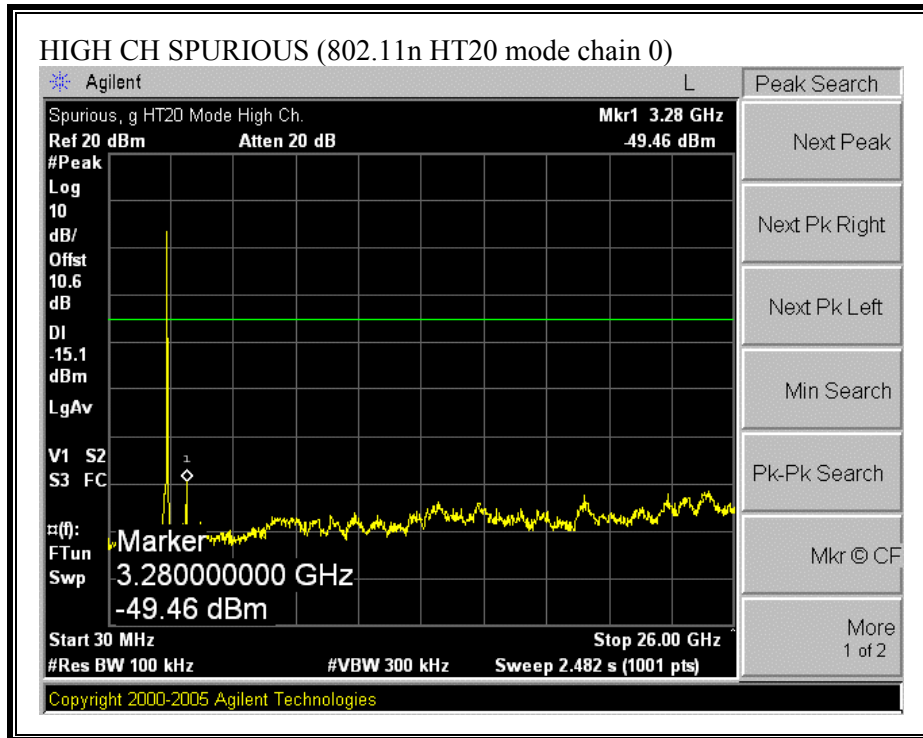




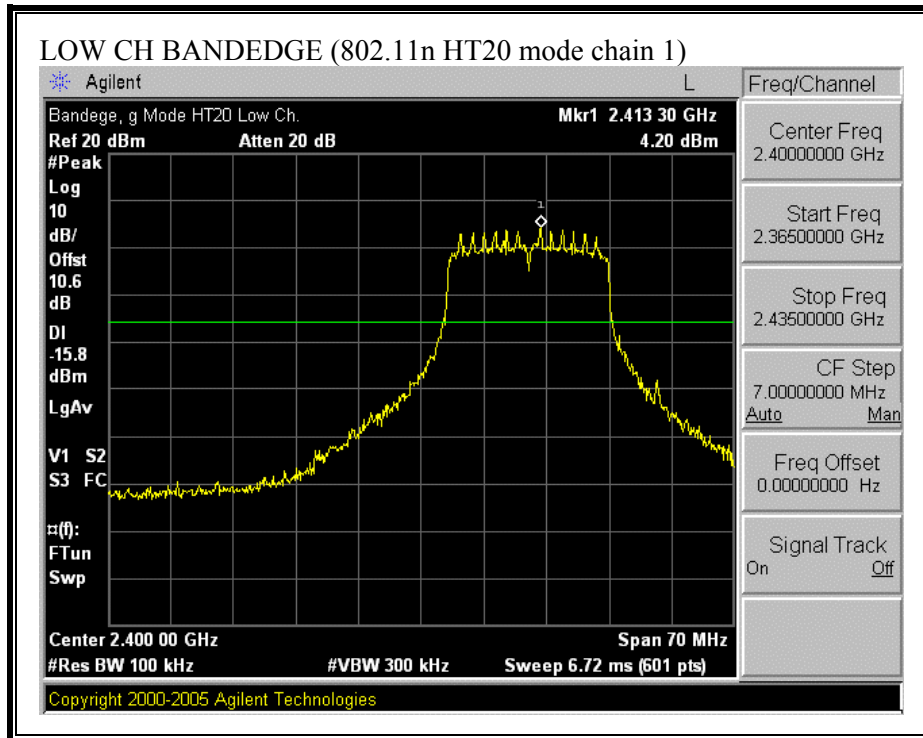


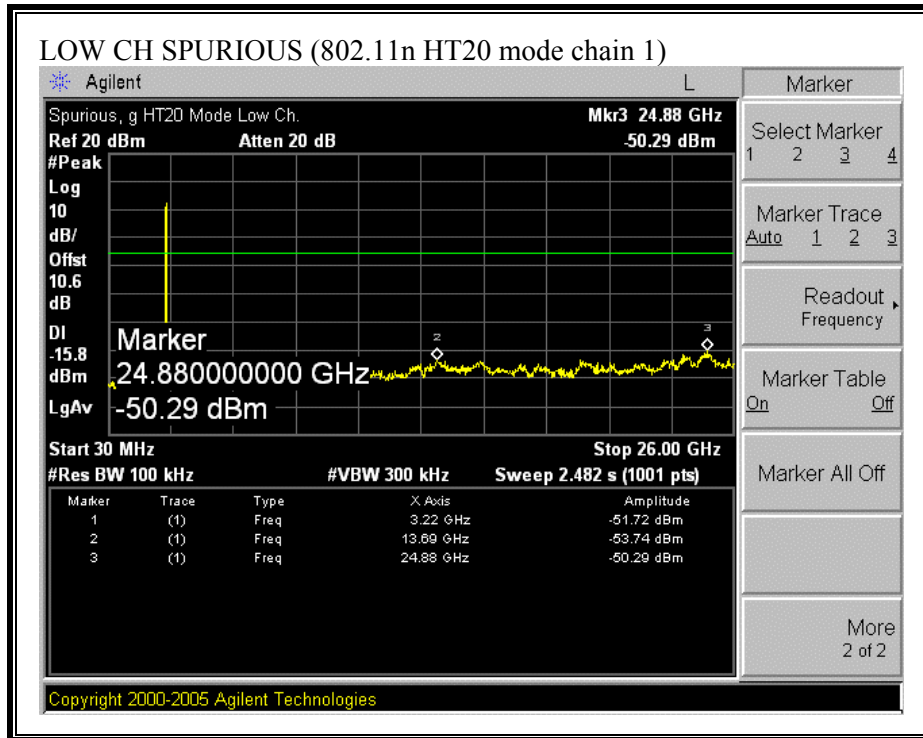


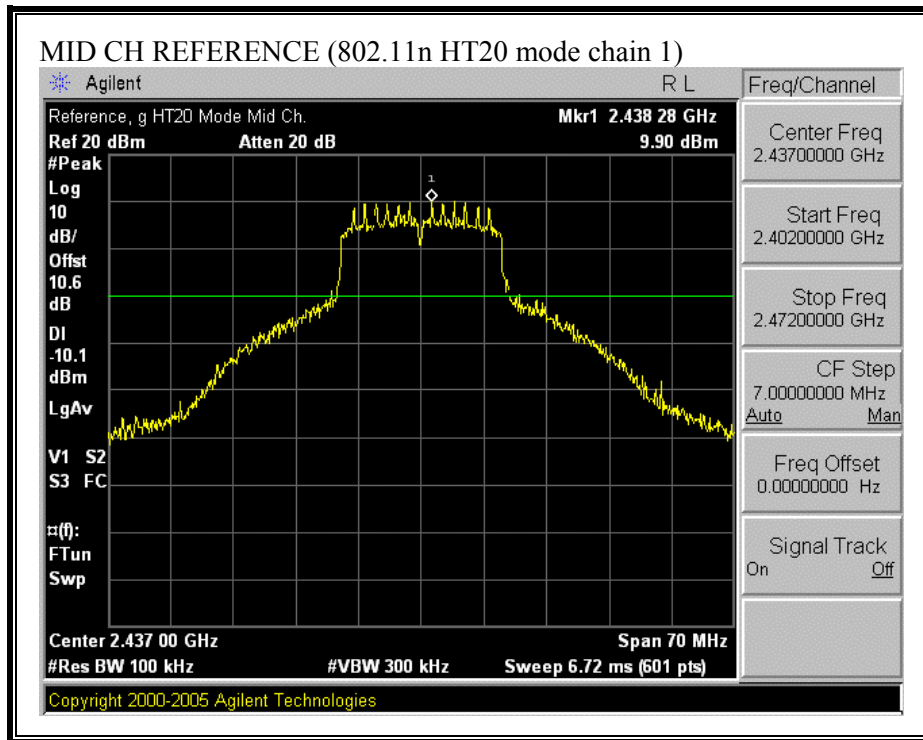


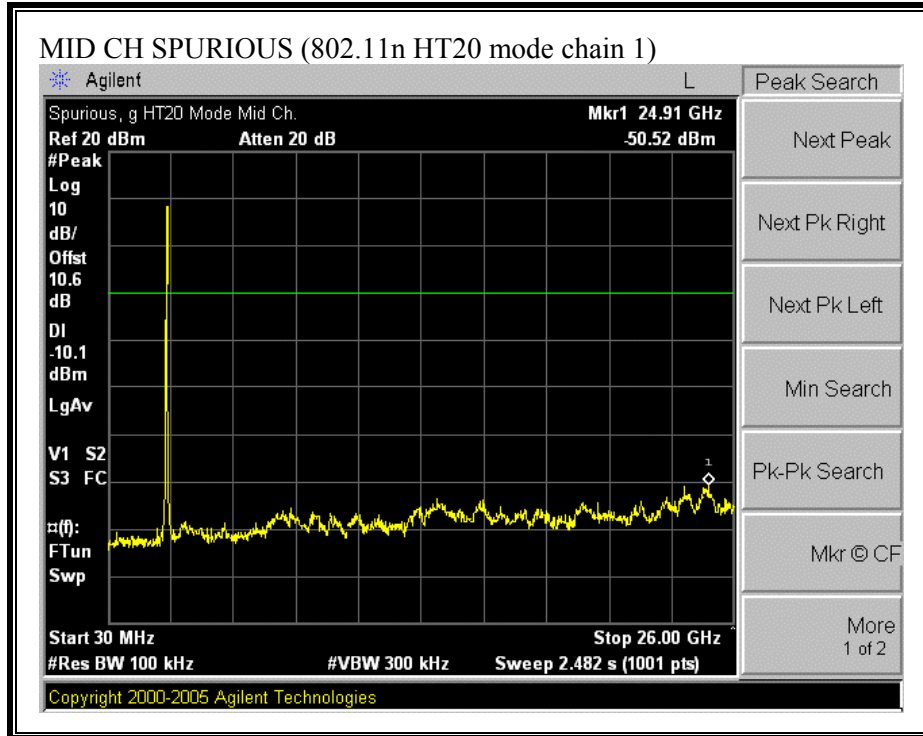


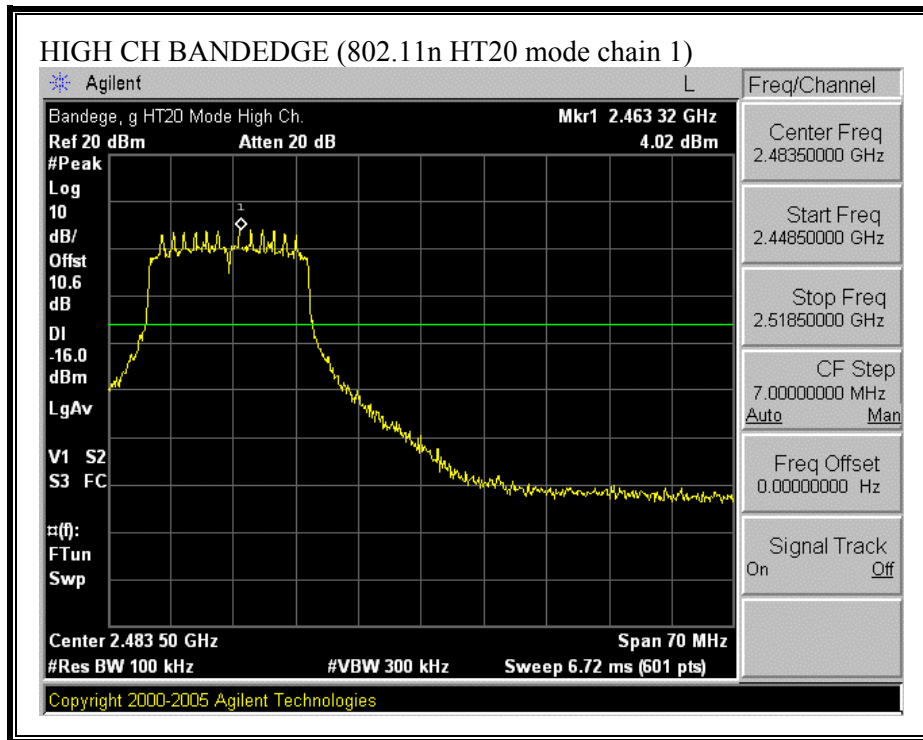
**SPURIOUS EMISSIONS (802.11n HT20 MODE CHAIN 1)**



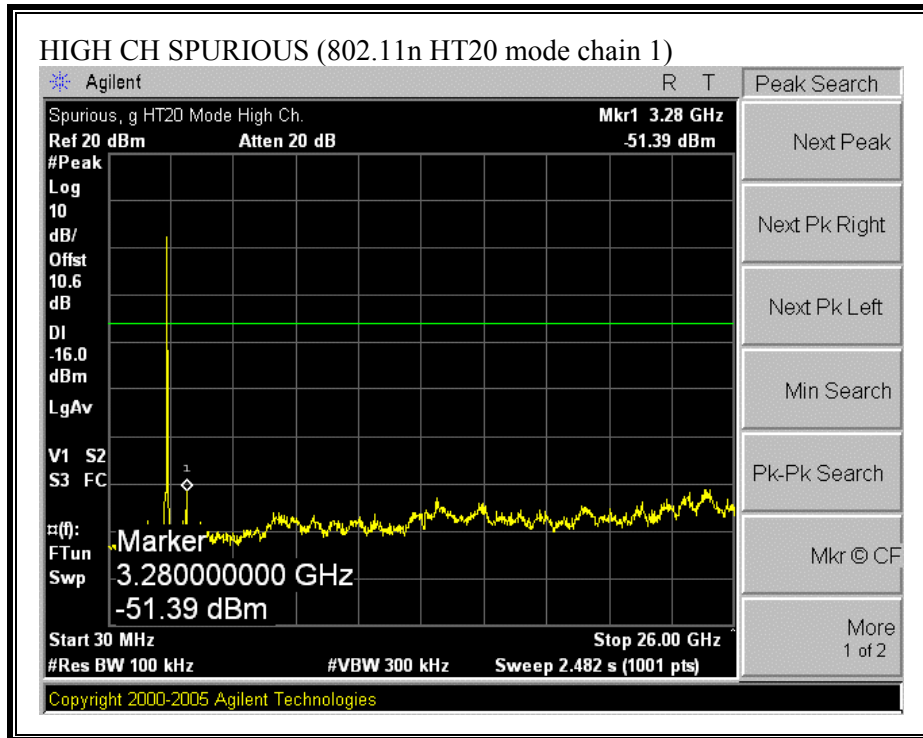




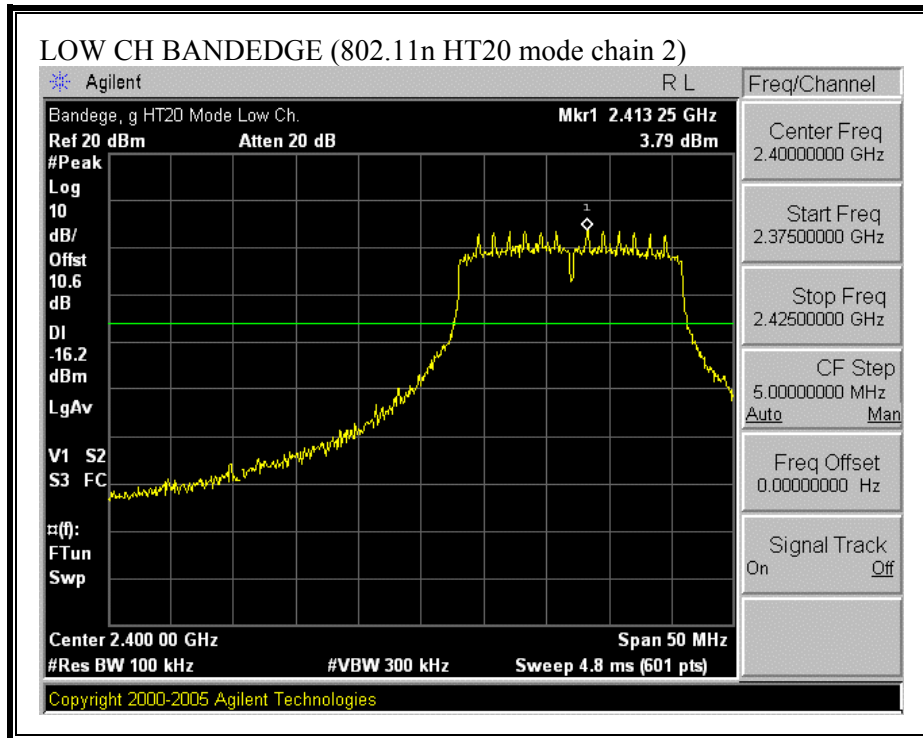


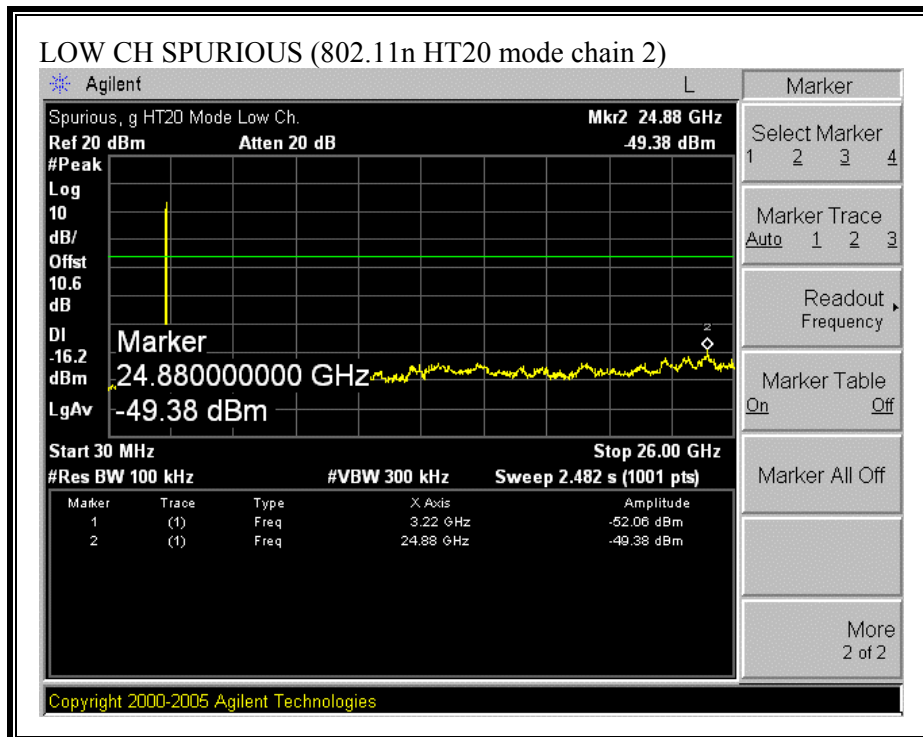


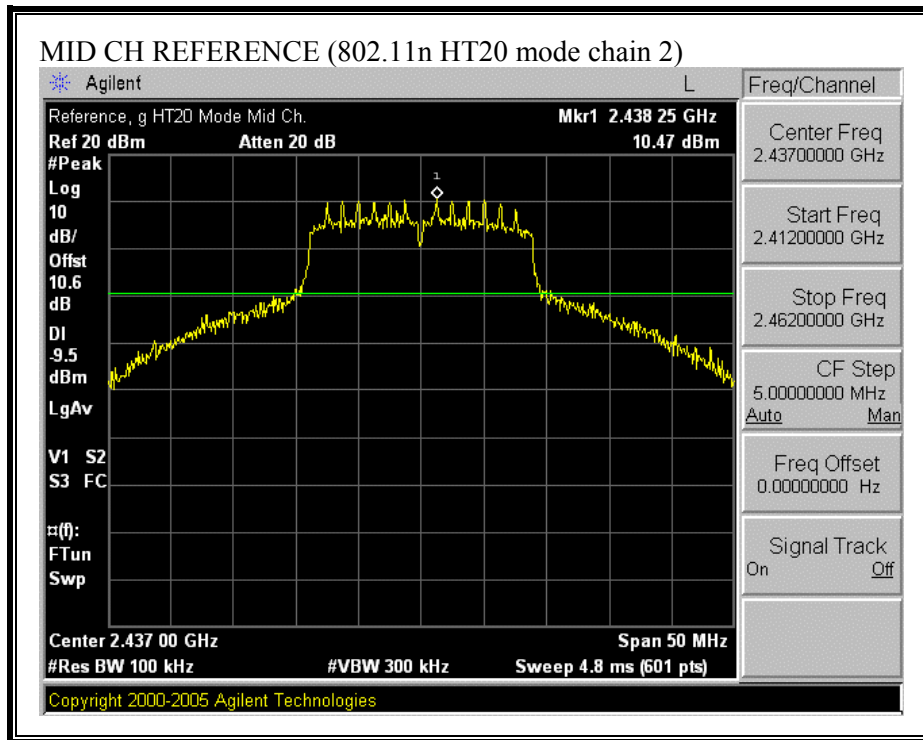


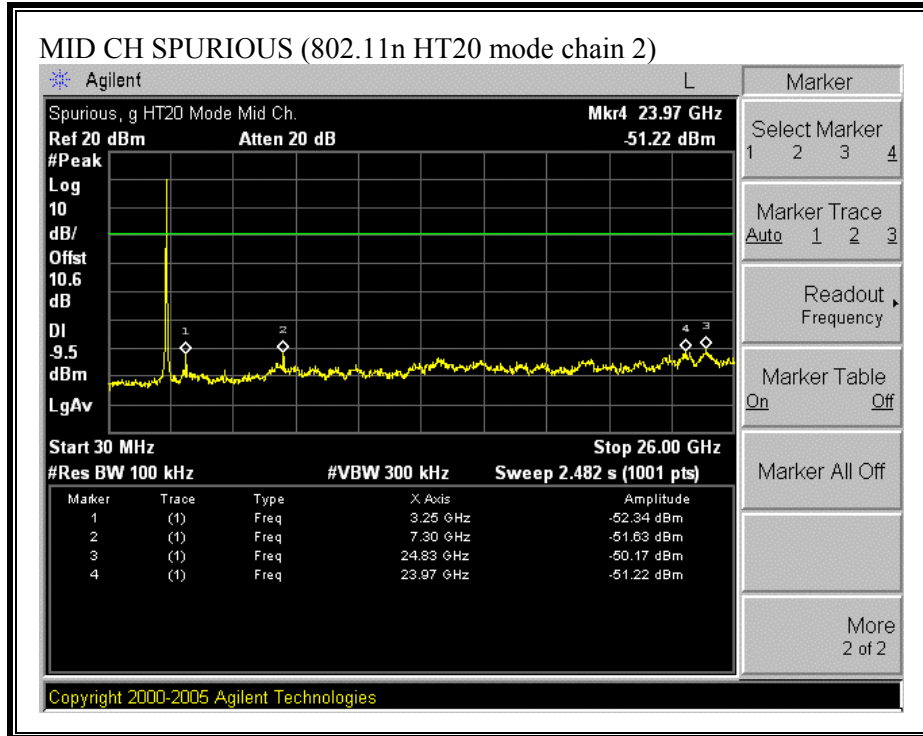


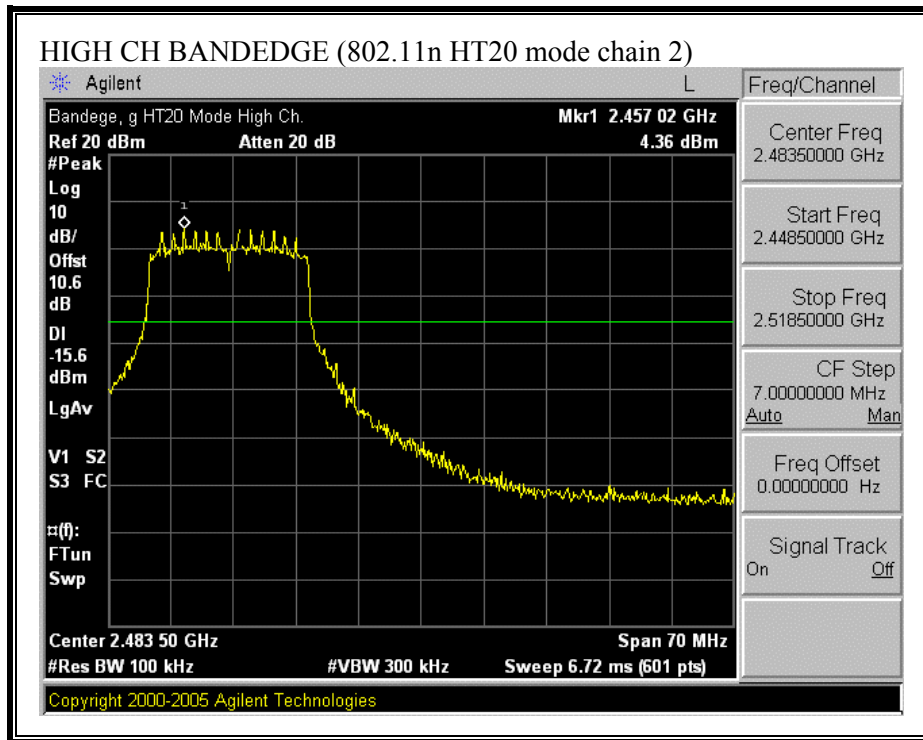
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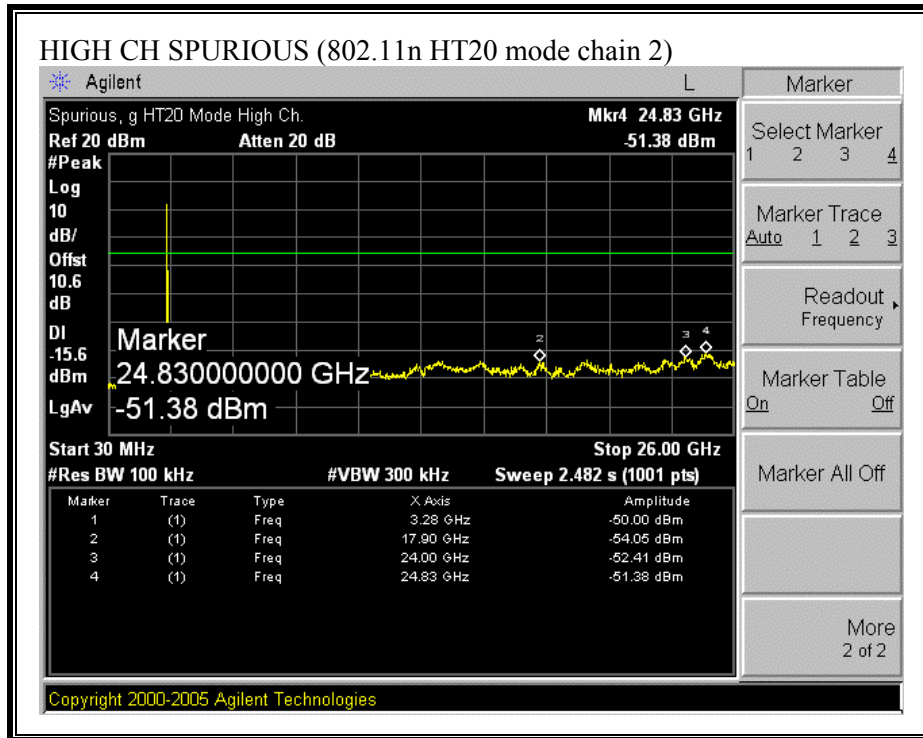




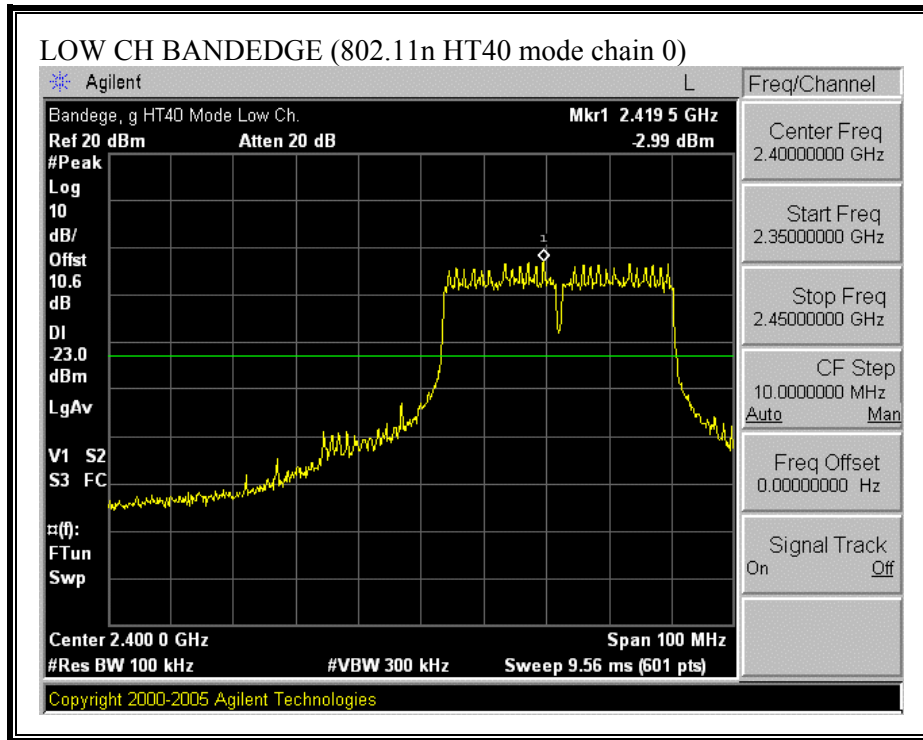




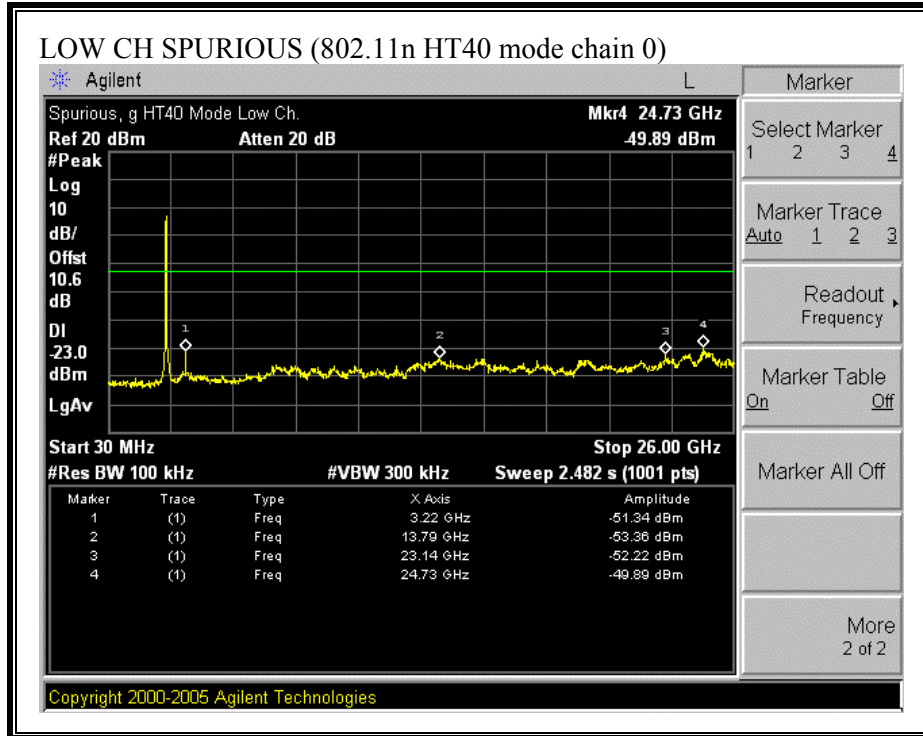


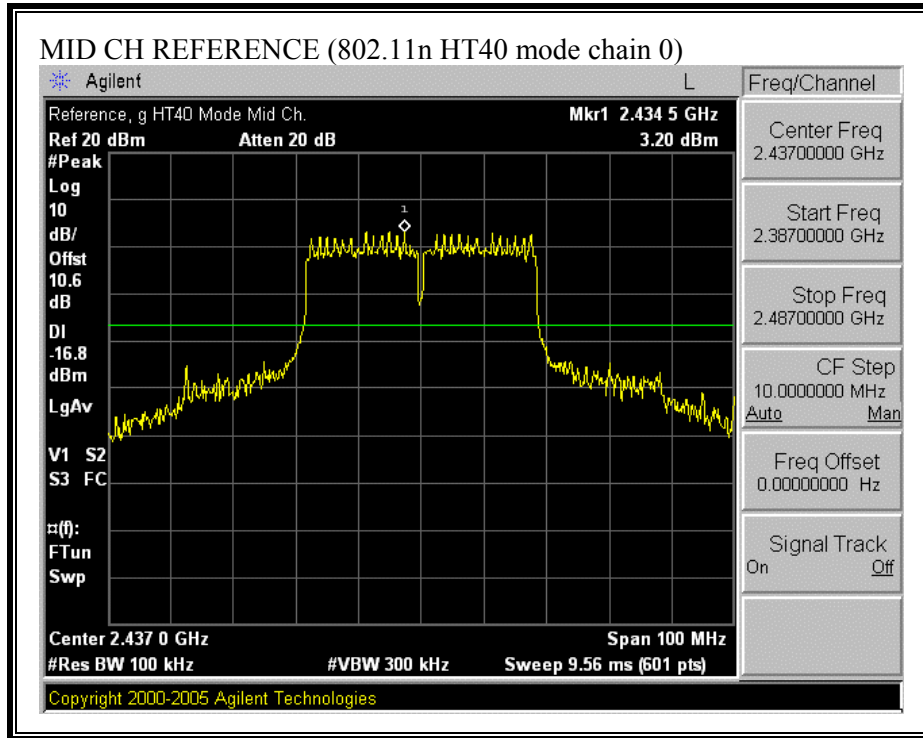


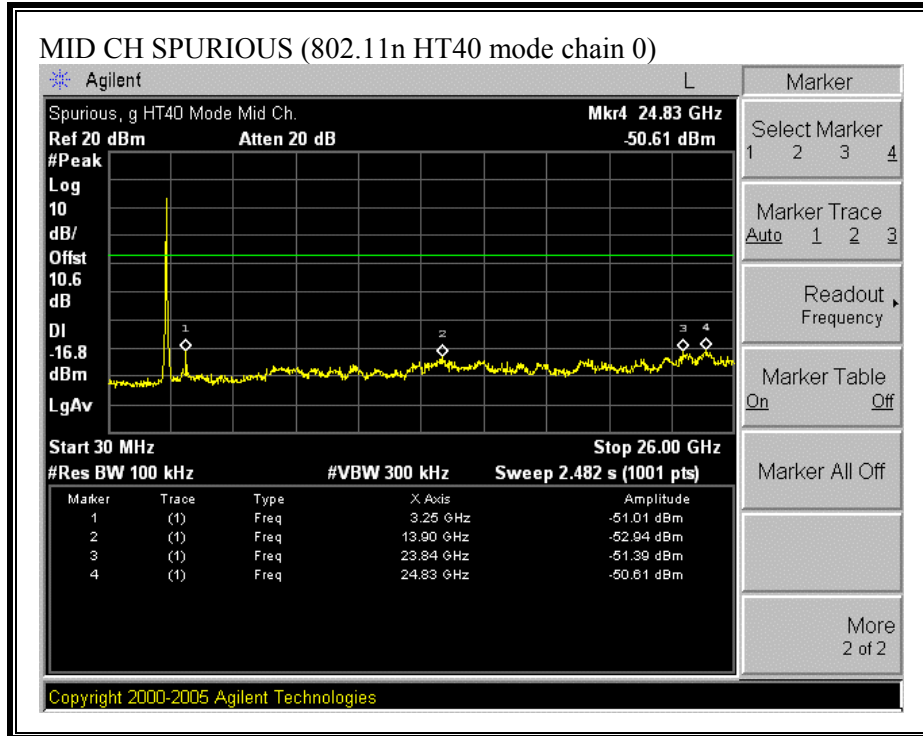
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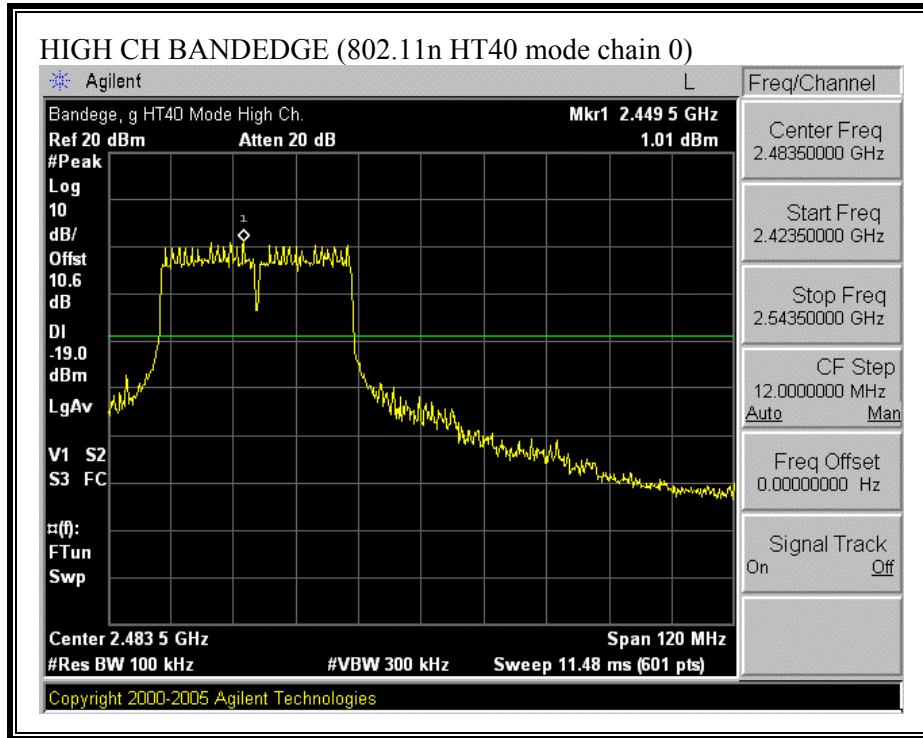


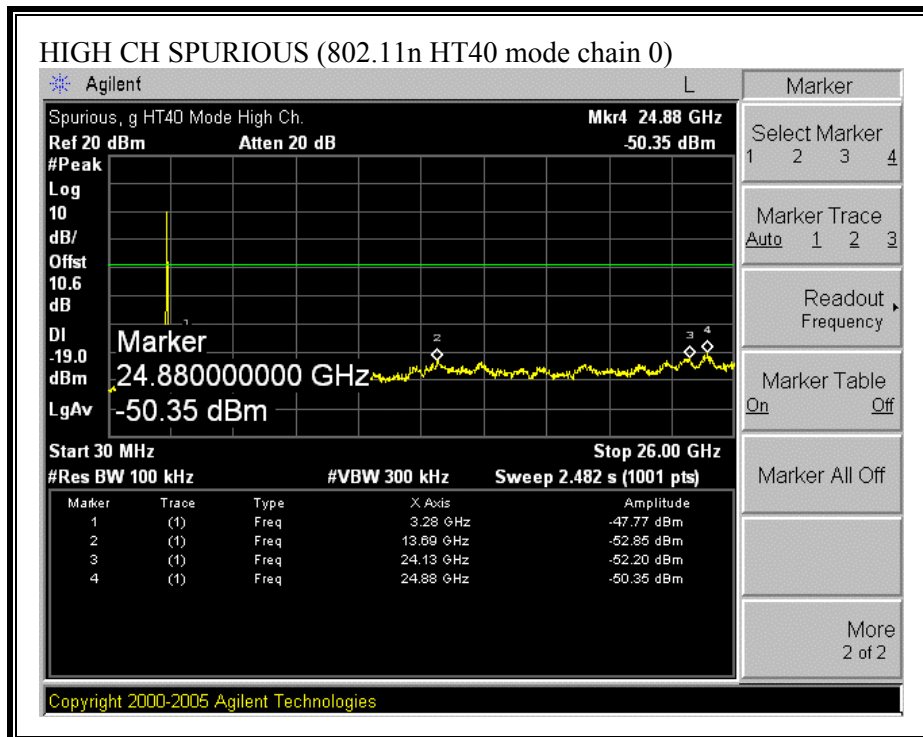




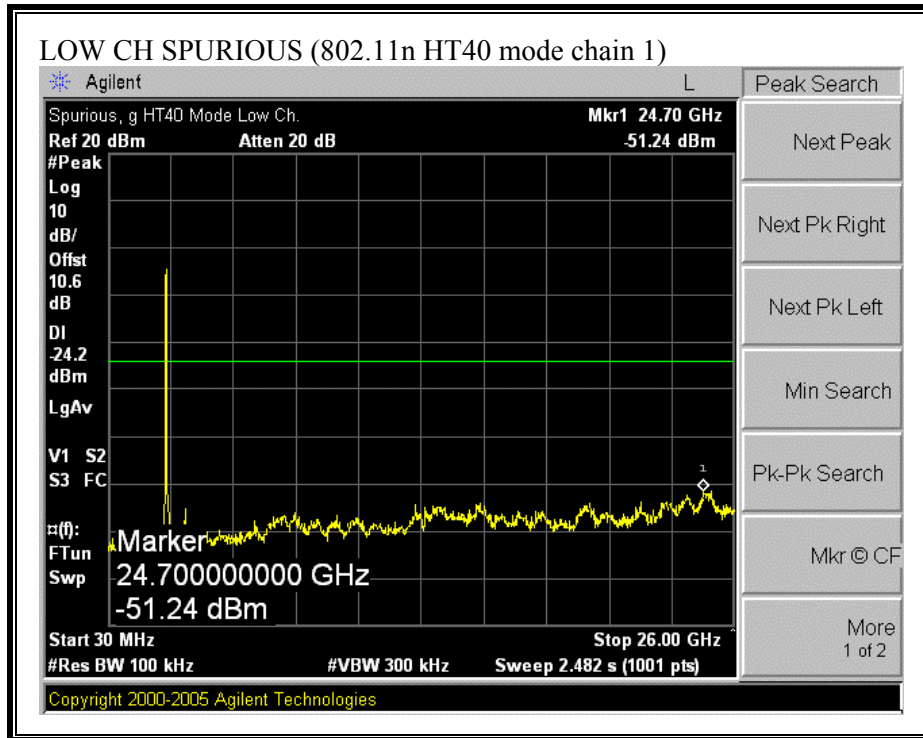


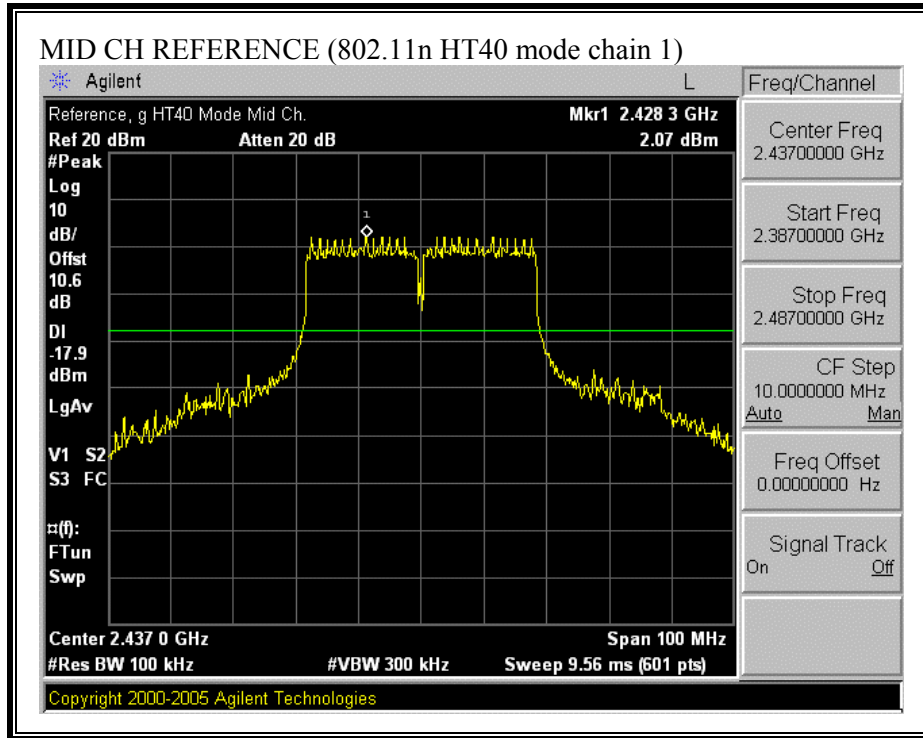




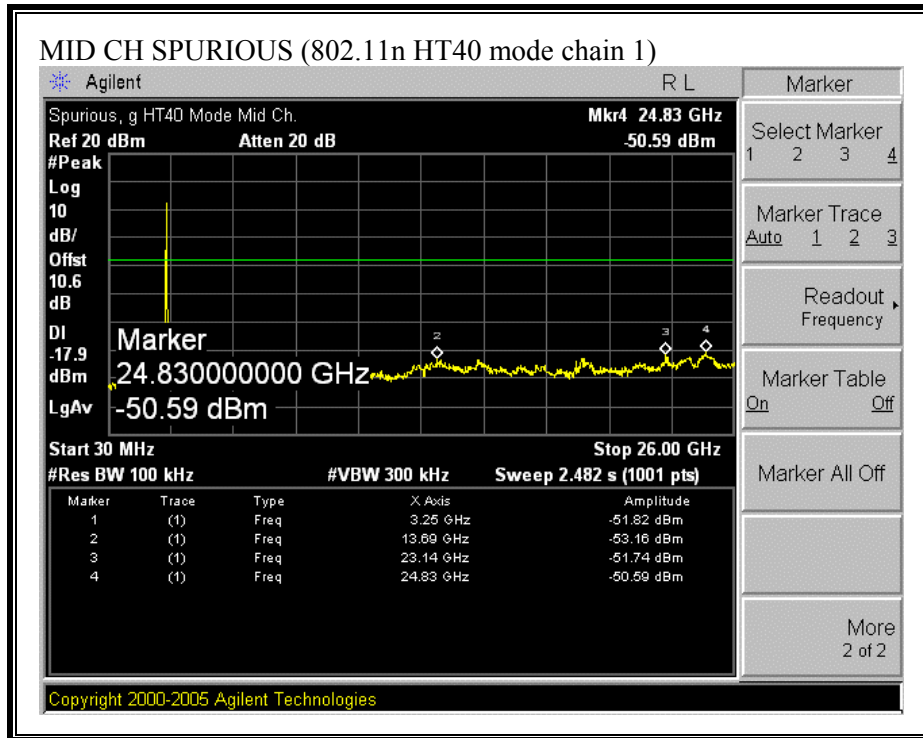


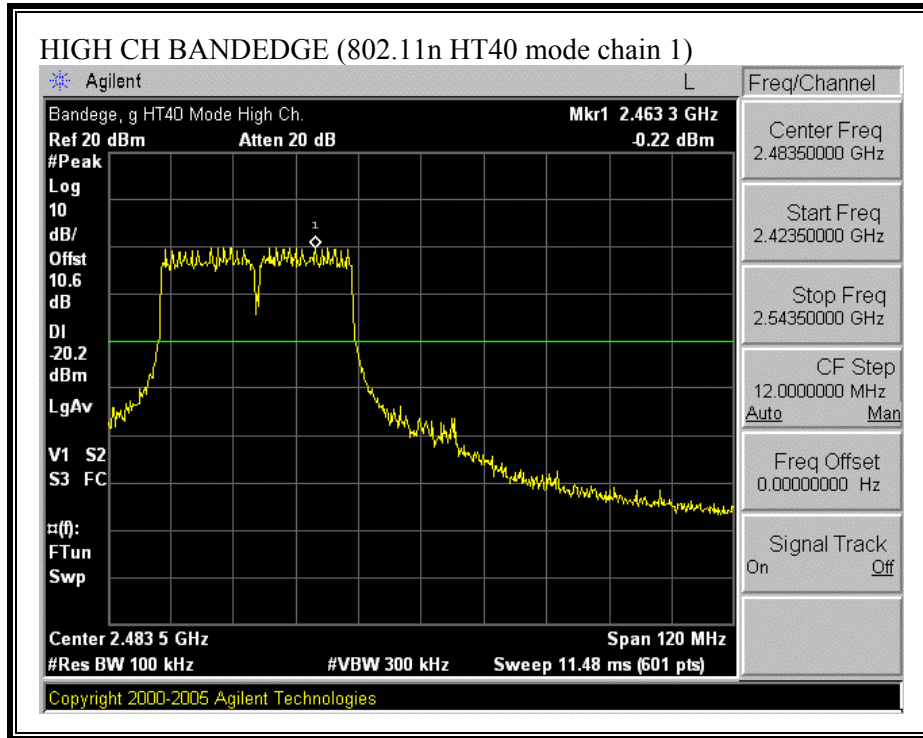


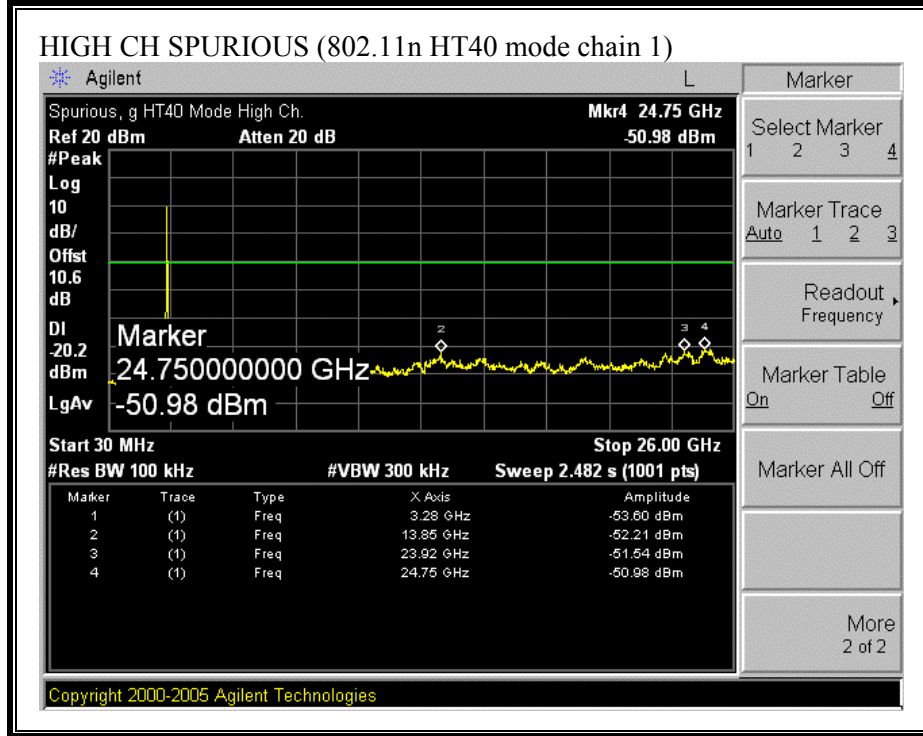




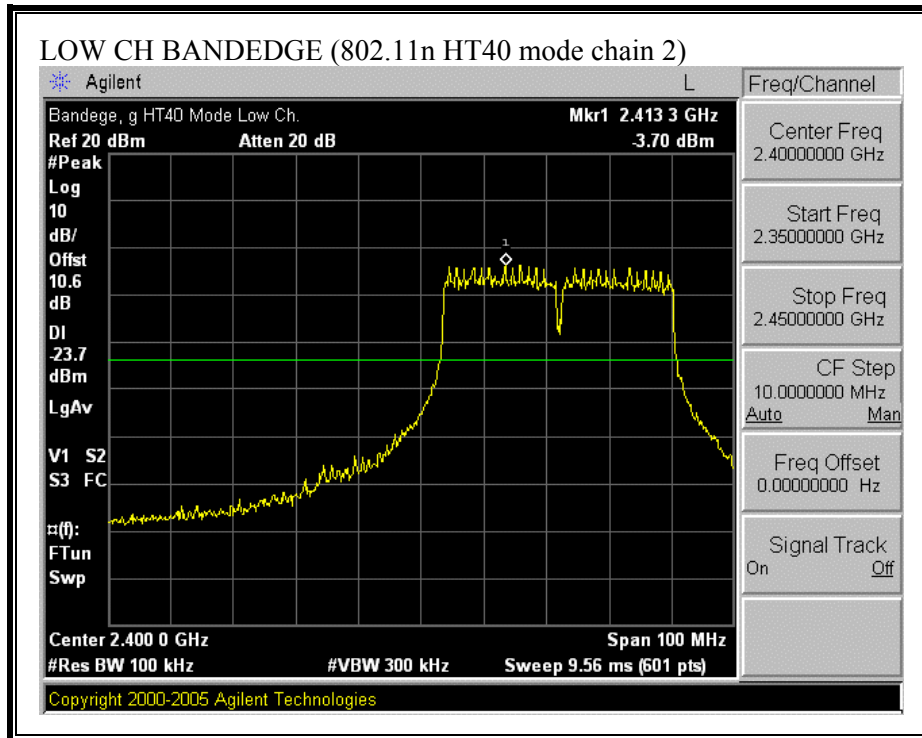


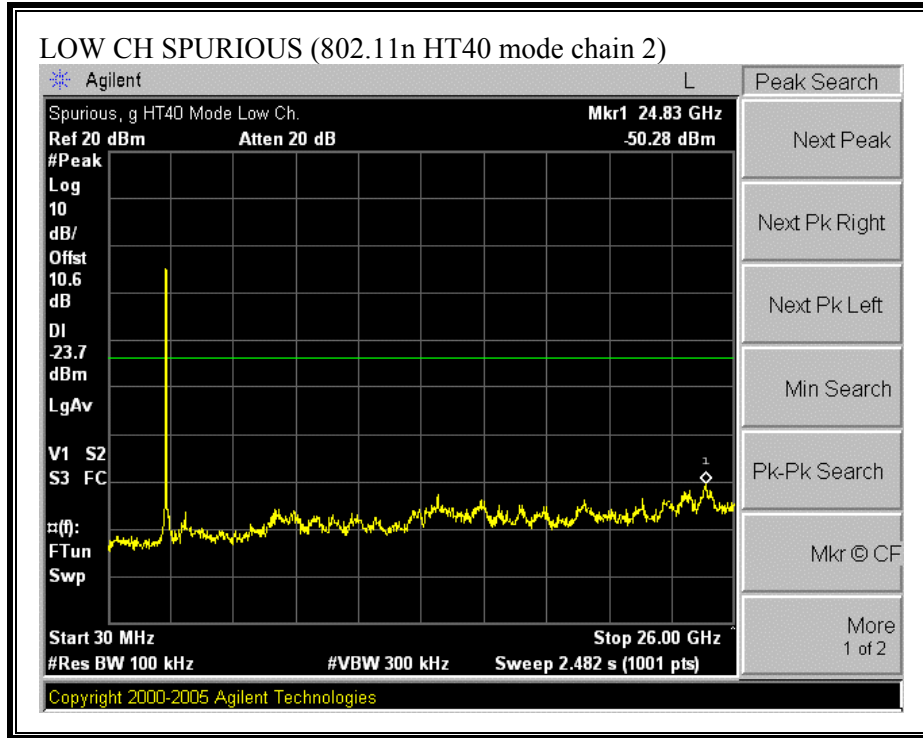


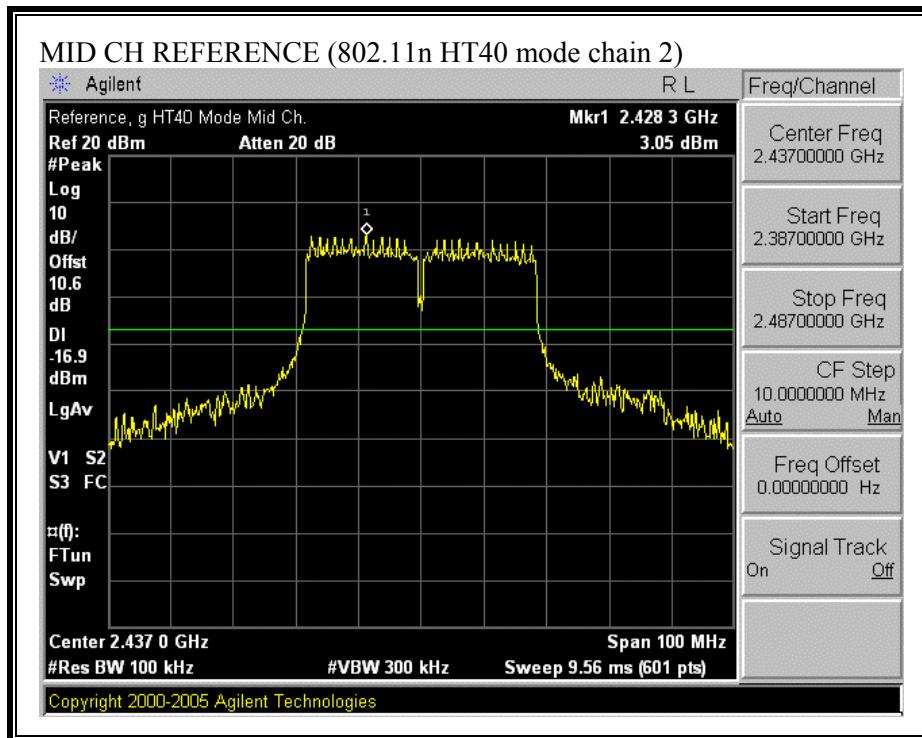


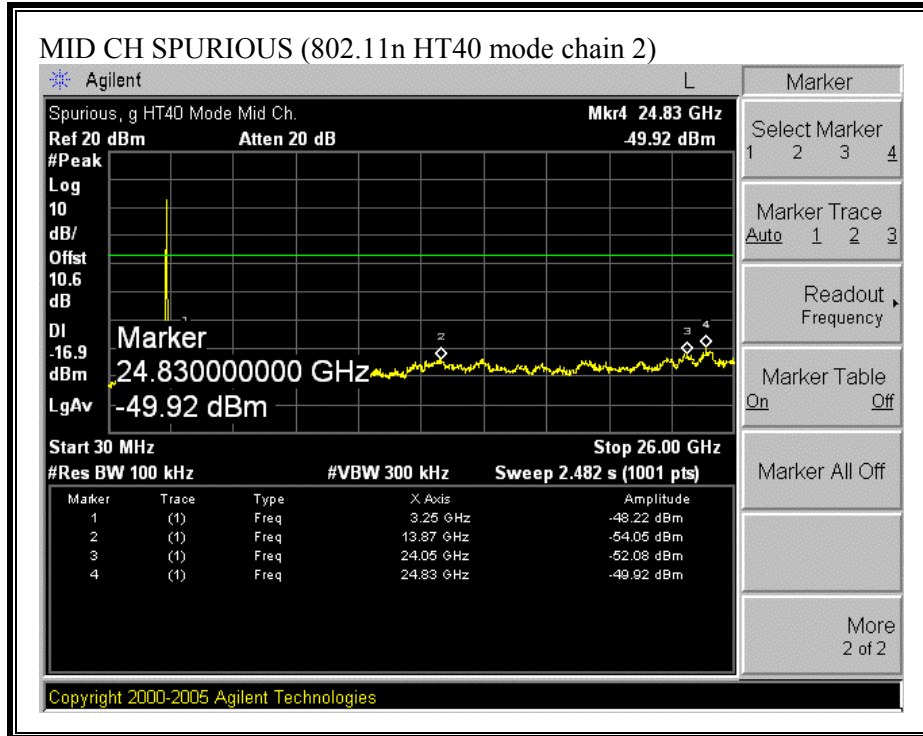


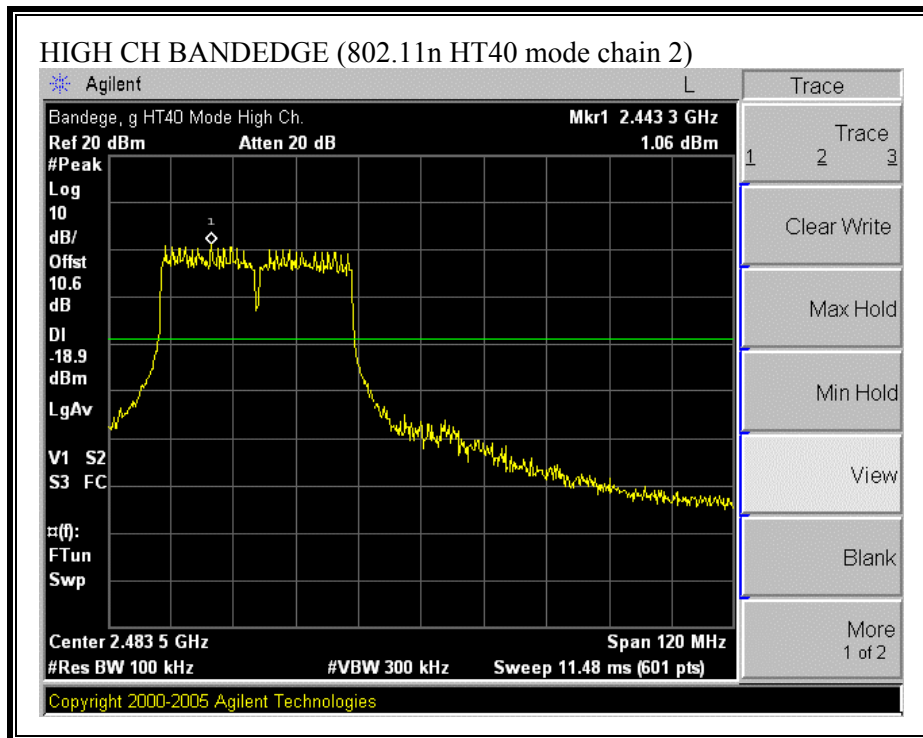
**SPURIOUS EMISSIONS (802.11 HT40 MODE CHAIN 2)**



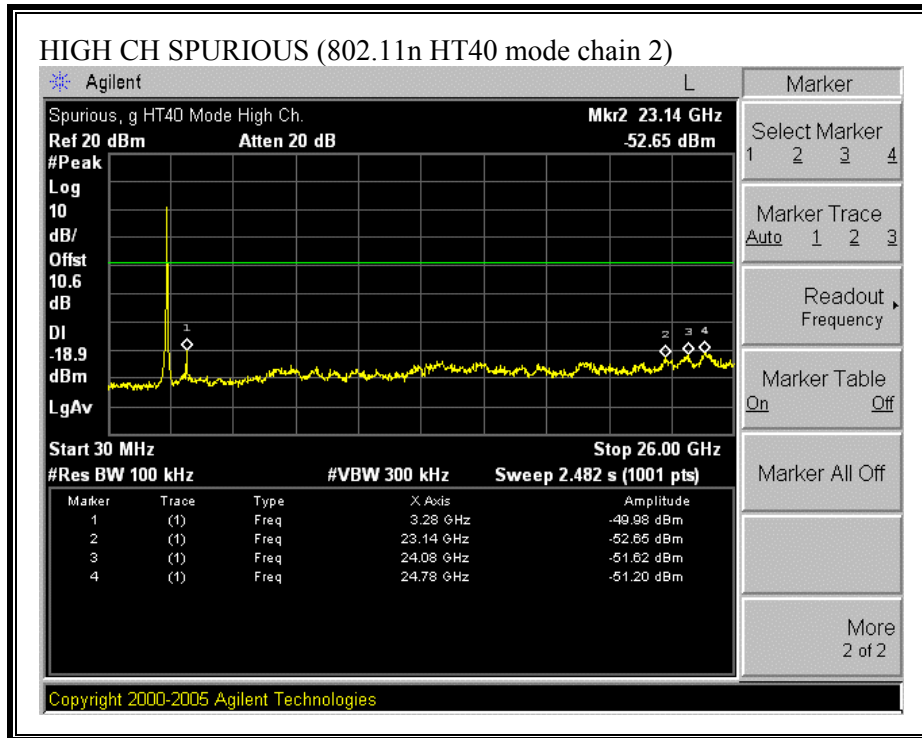




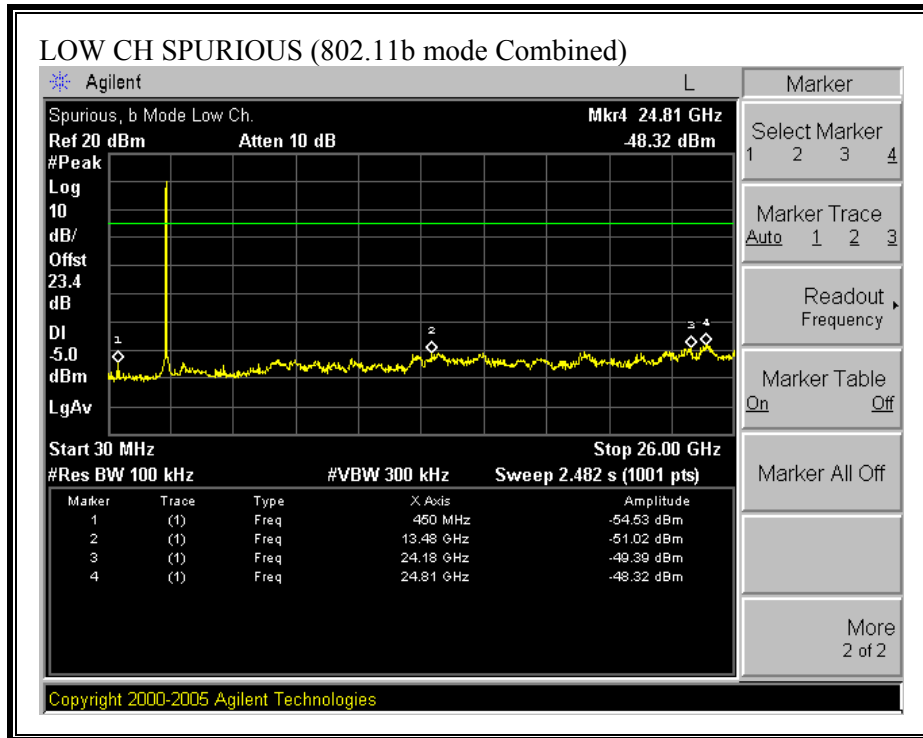


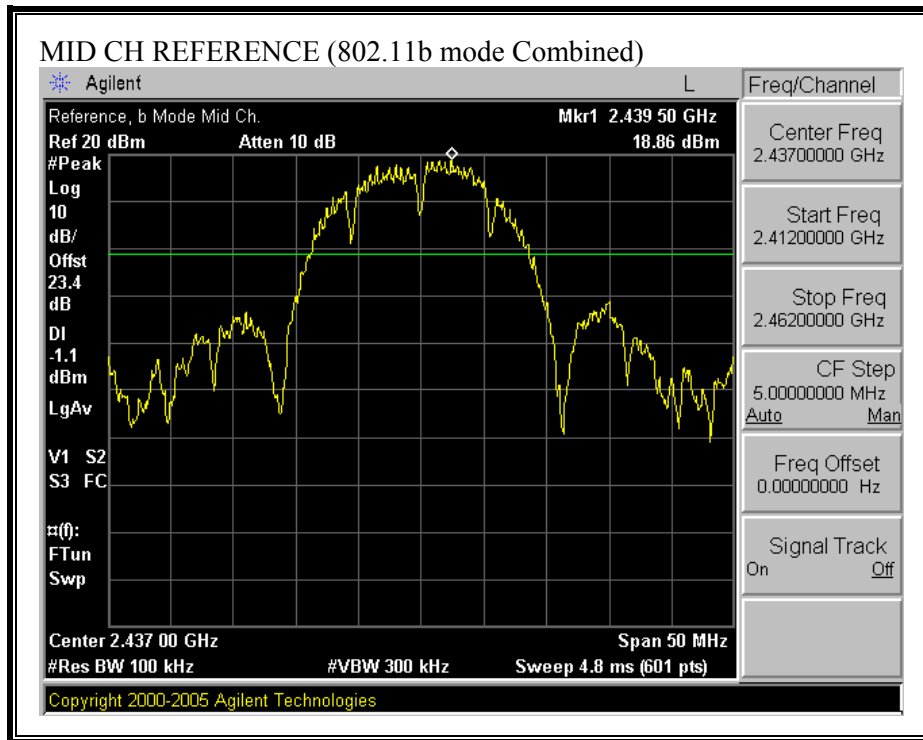


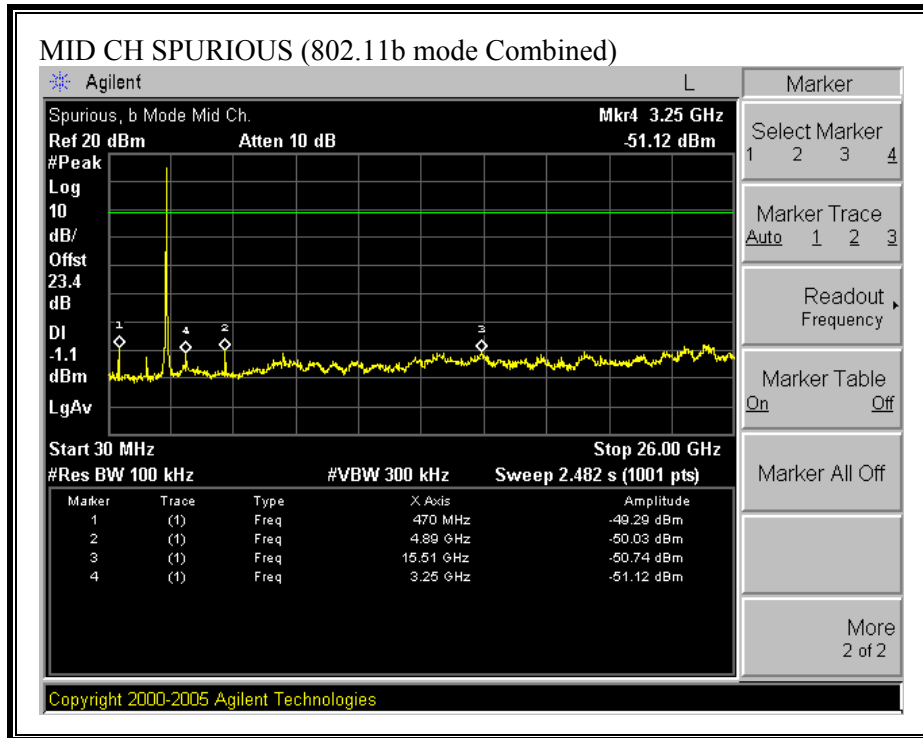


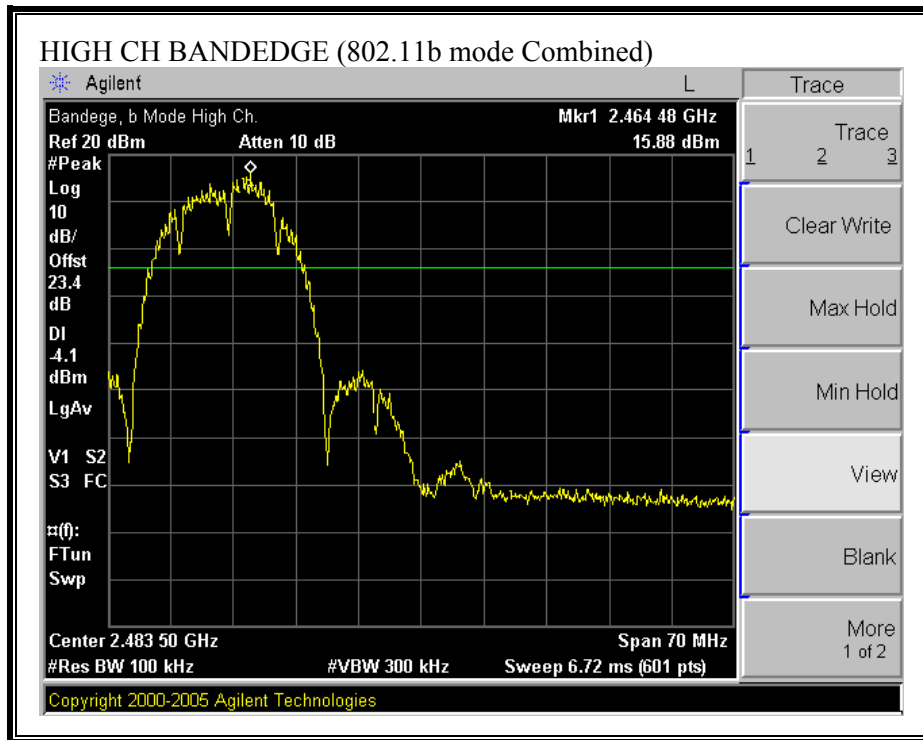


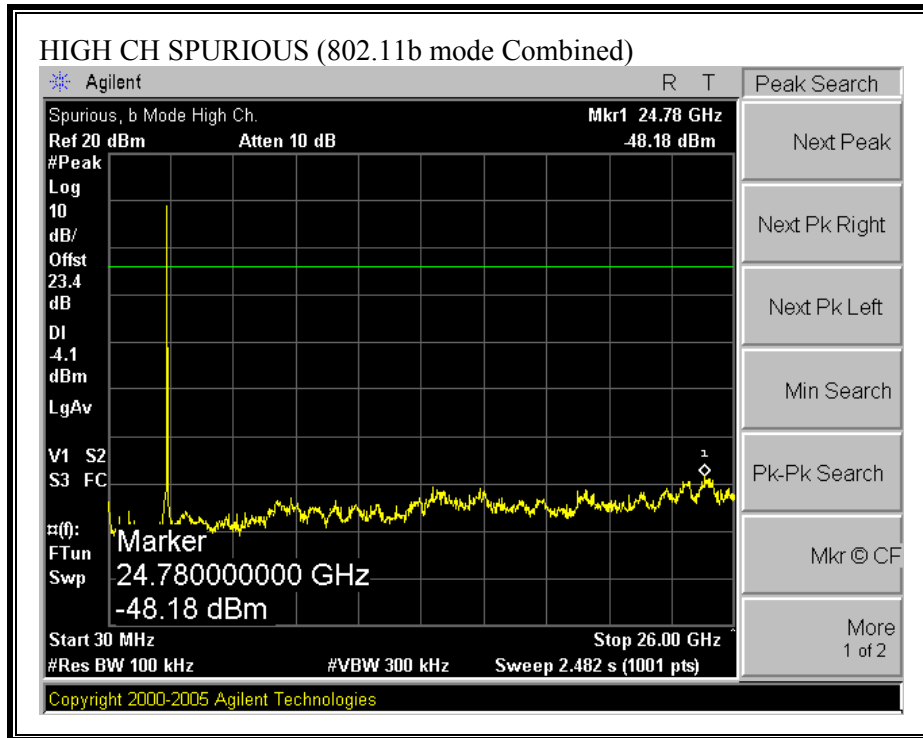




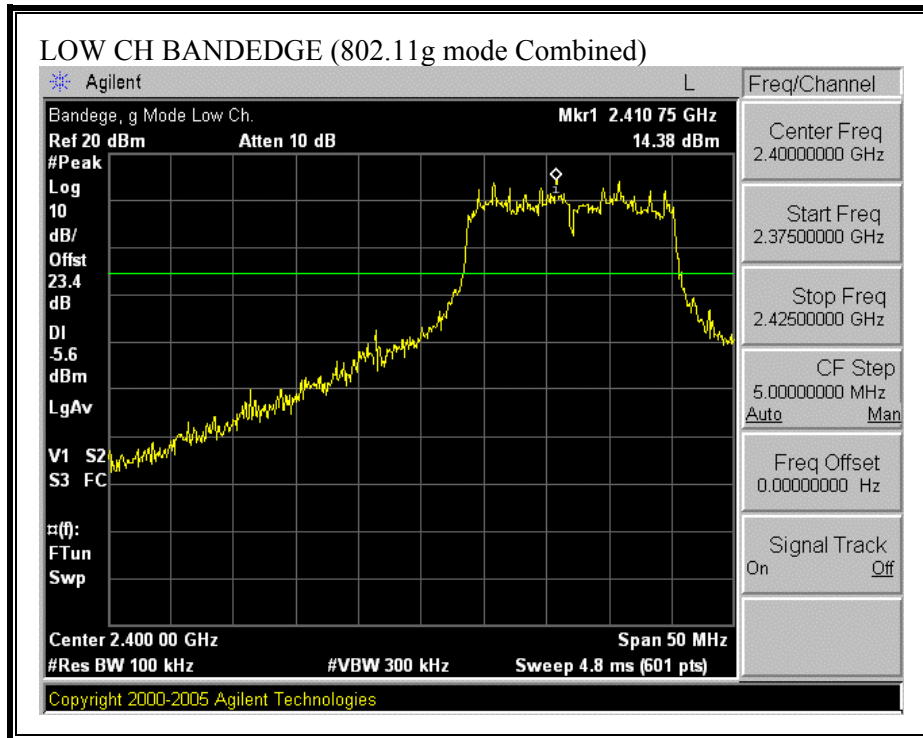




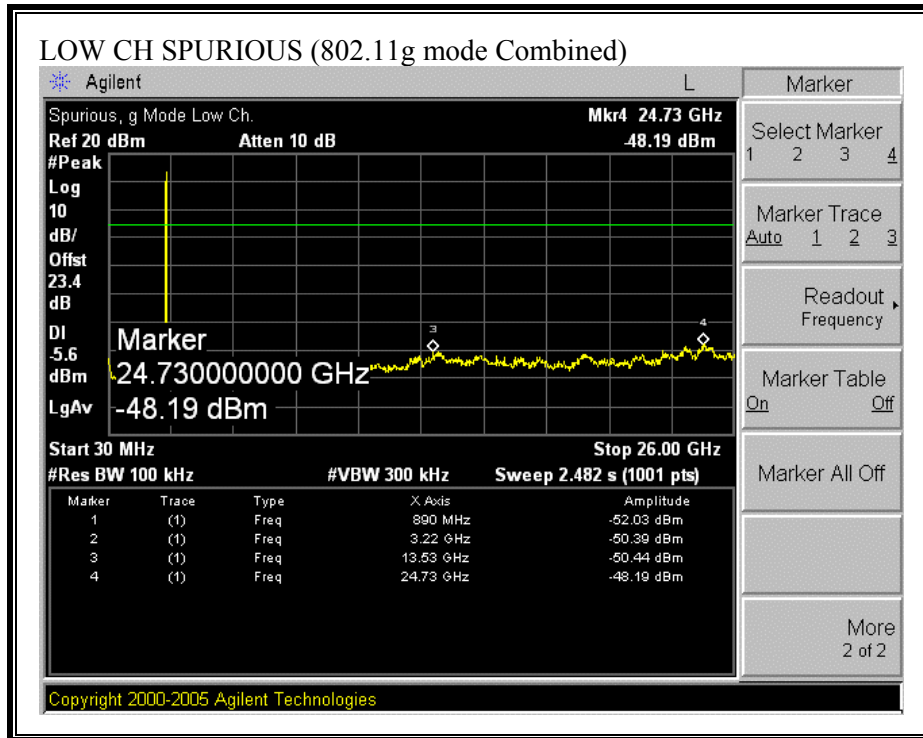


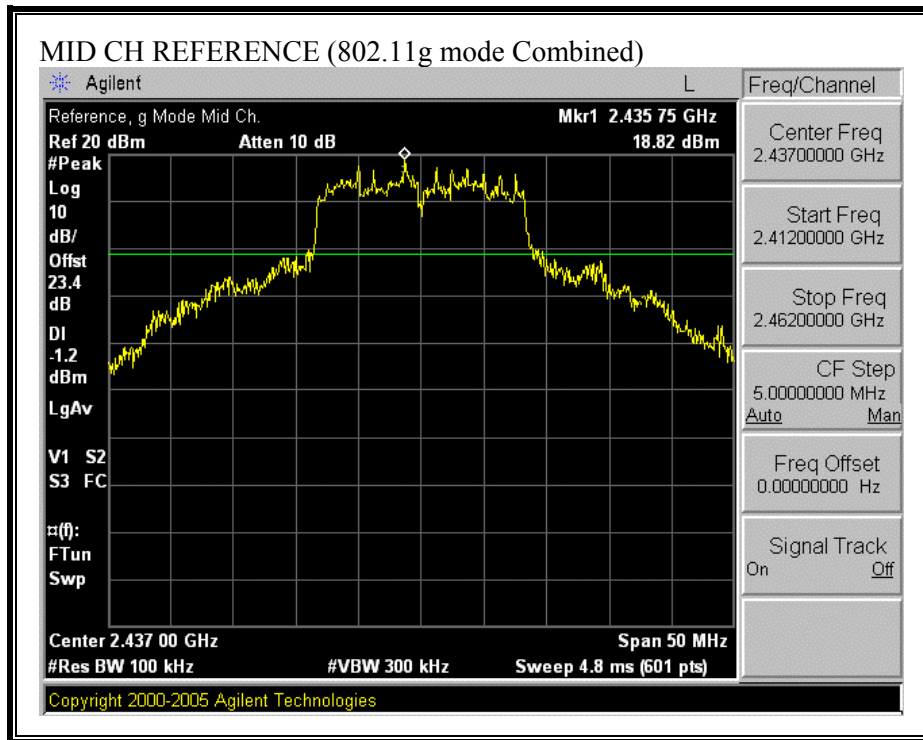


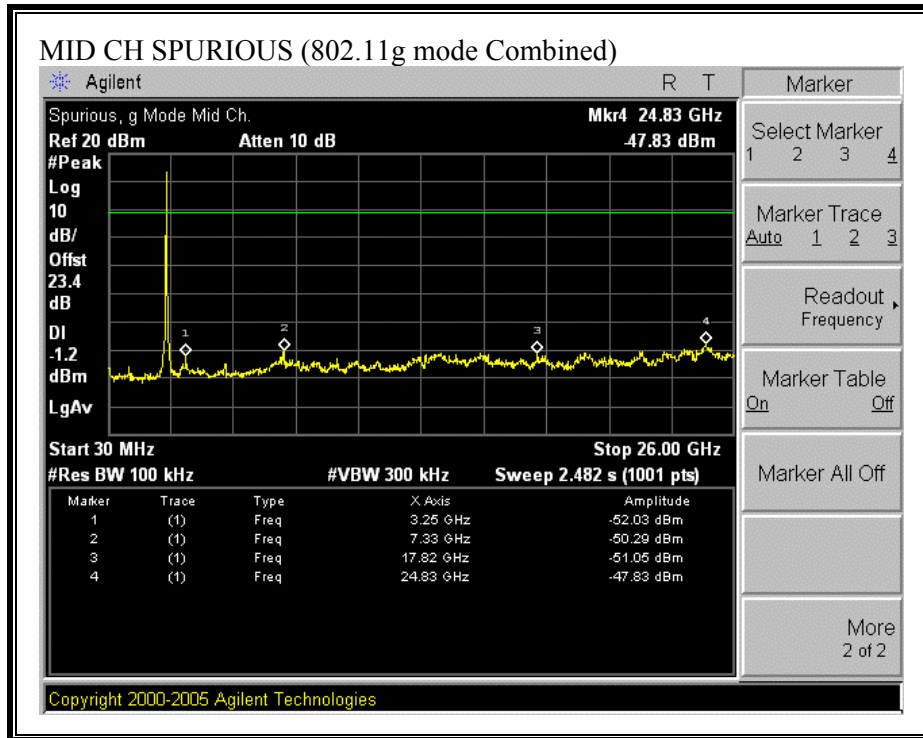
**COMBINED SPURIOUS EMISSIONS (802.11g MODE)**

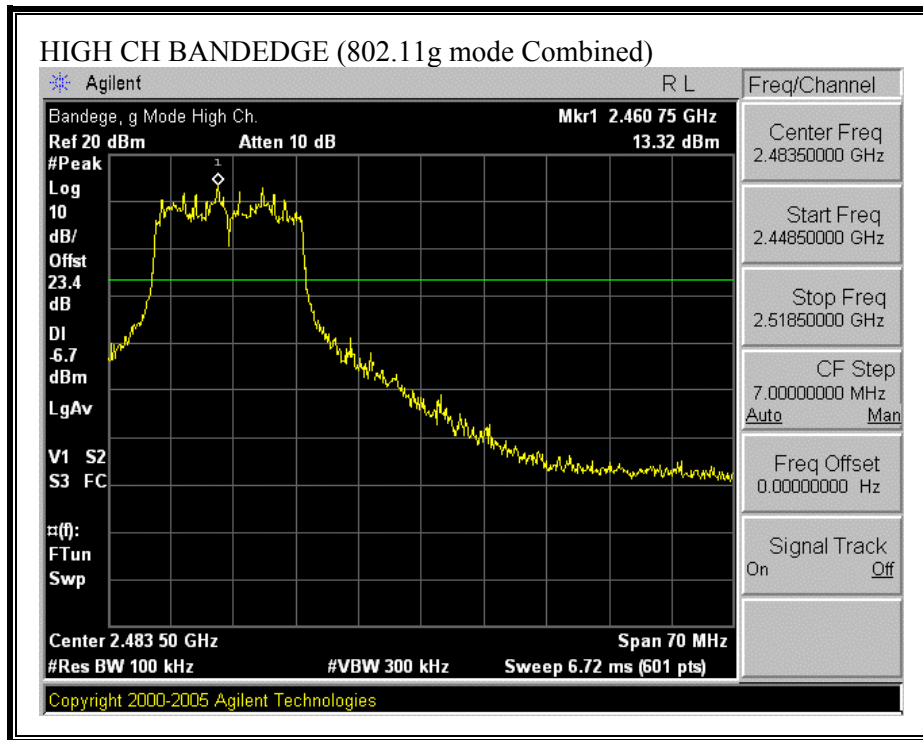


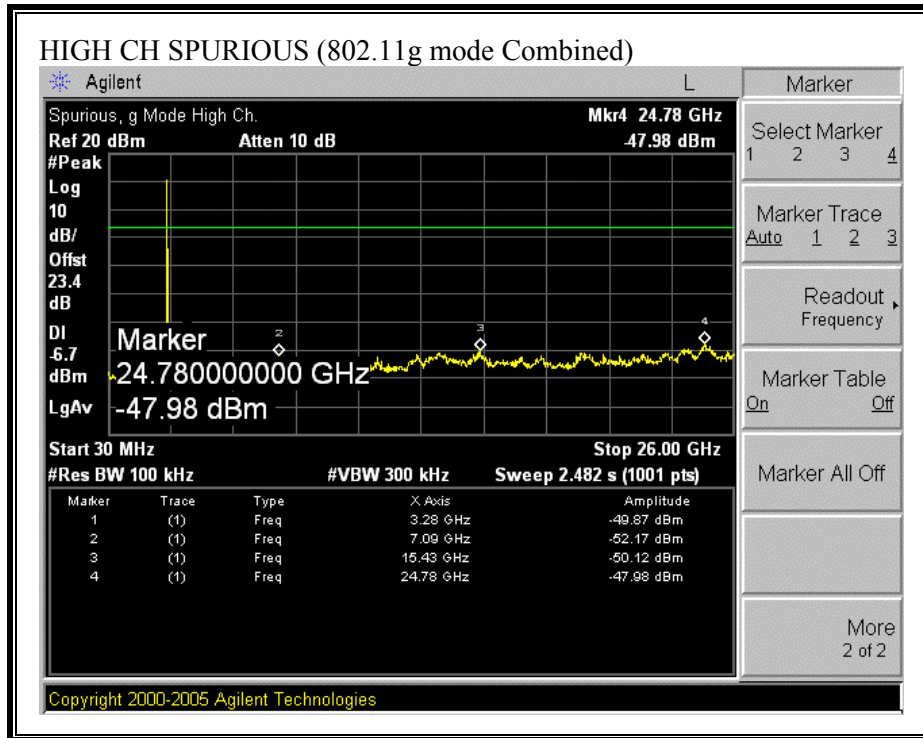




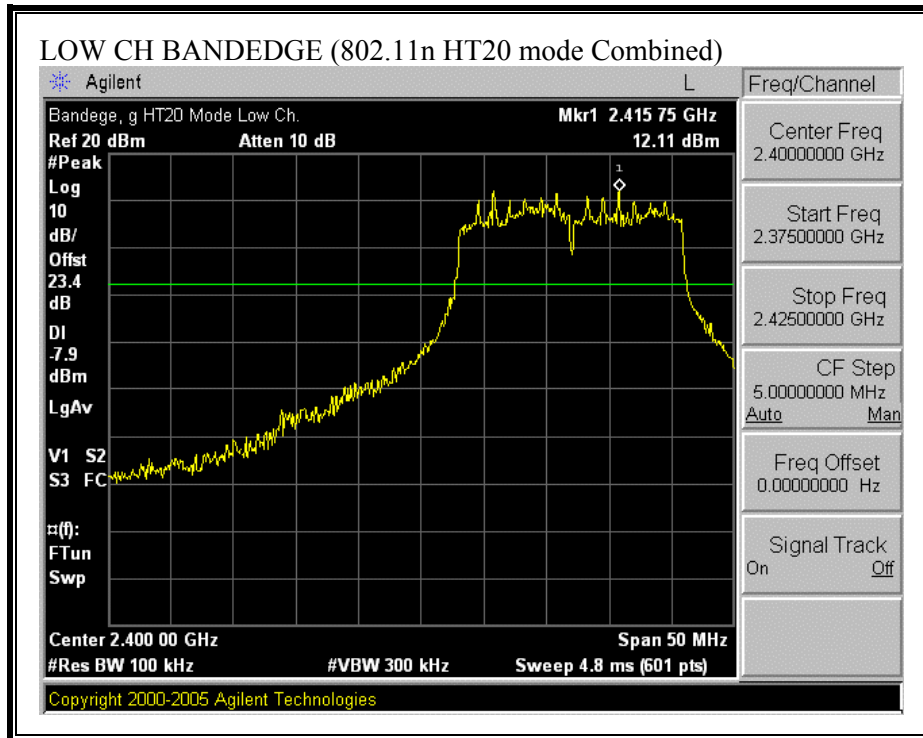


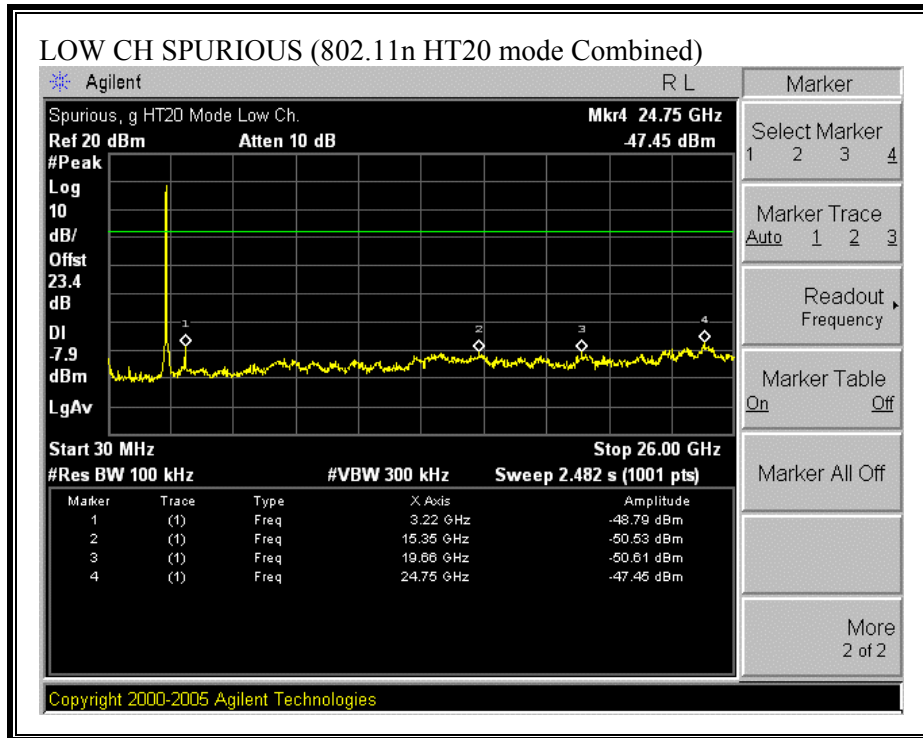


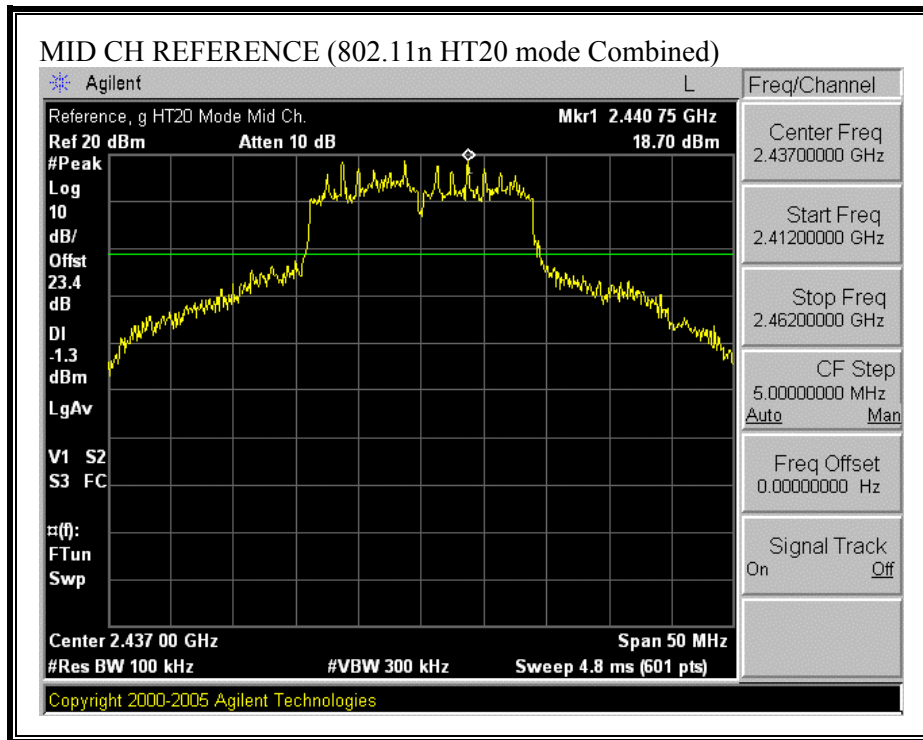




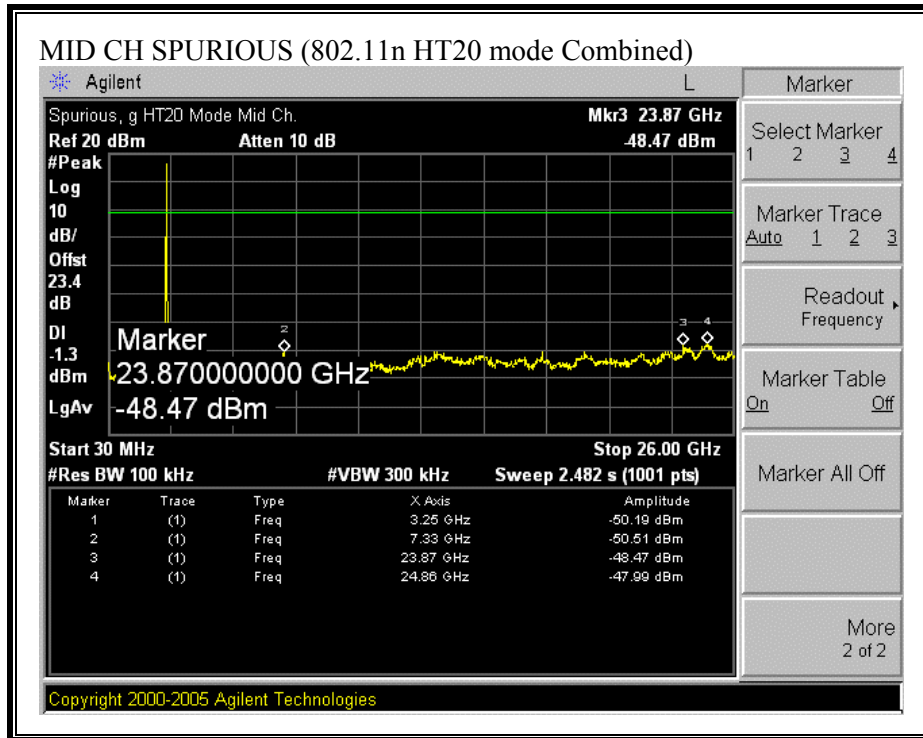
**COMBINED SPURIOUS EMISSIONS (802.11n HT20 MODE)**

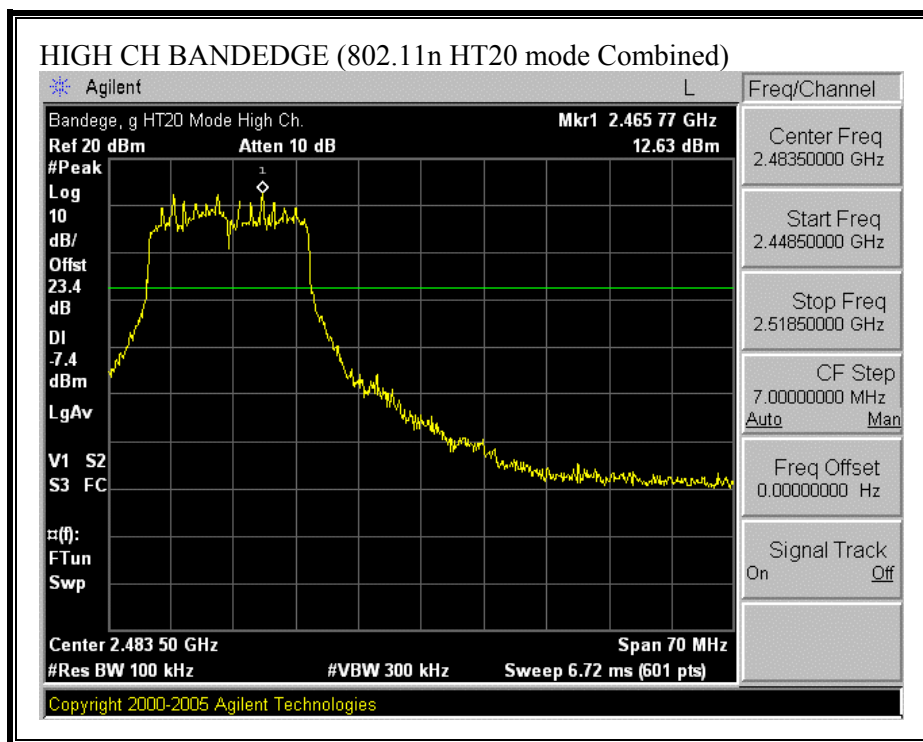


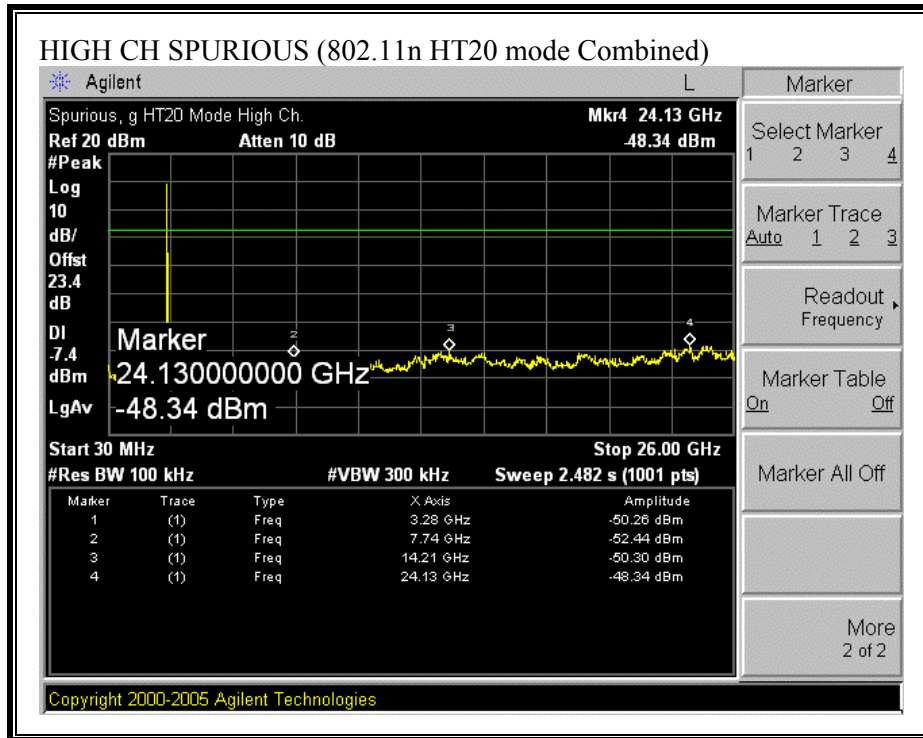




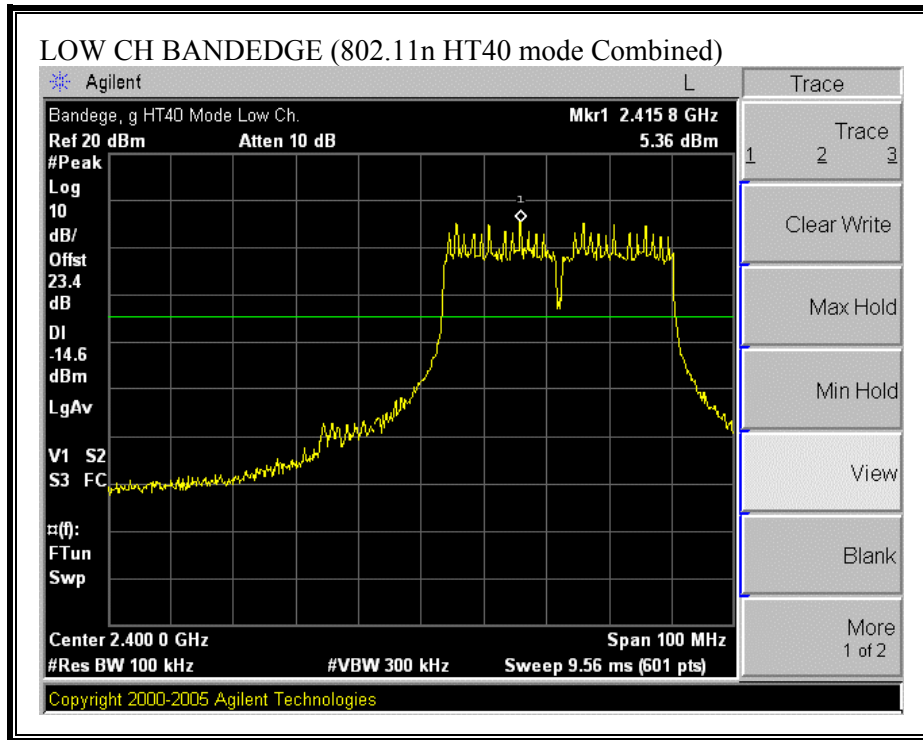


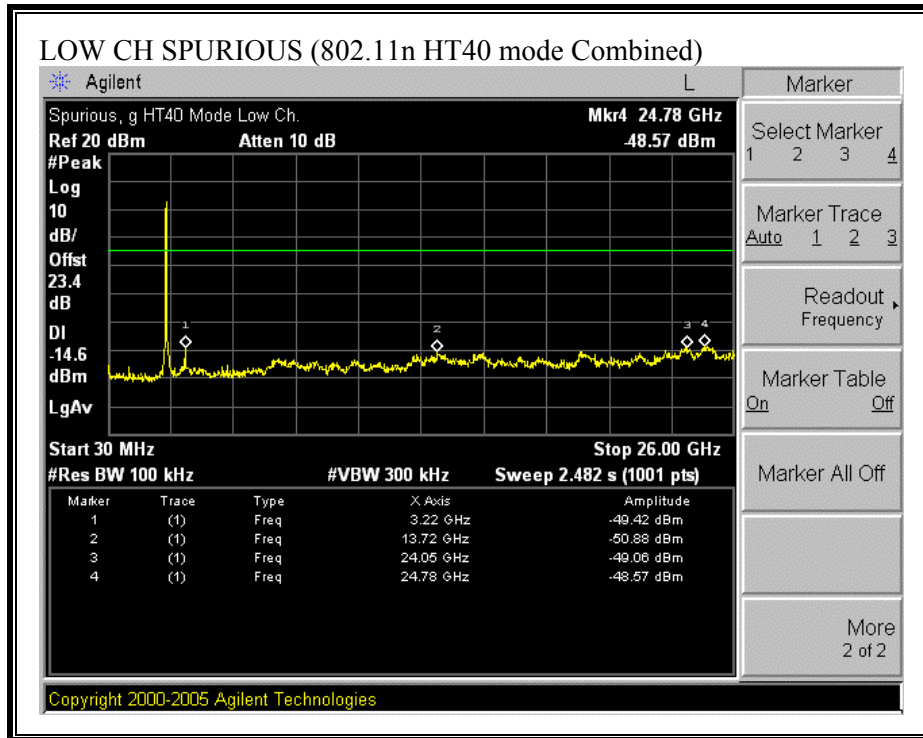


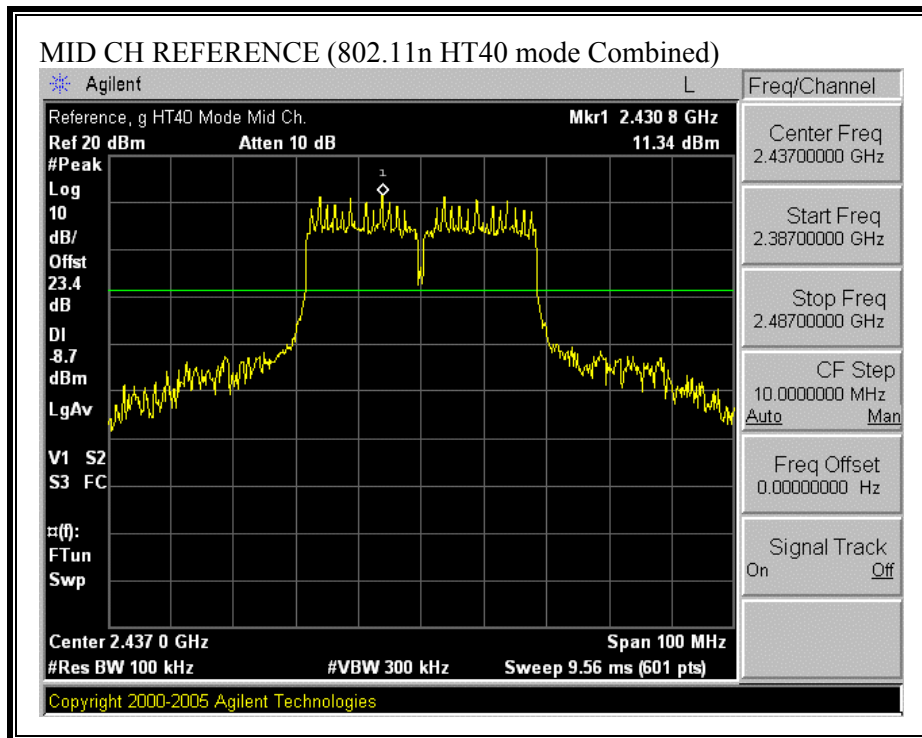


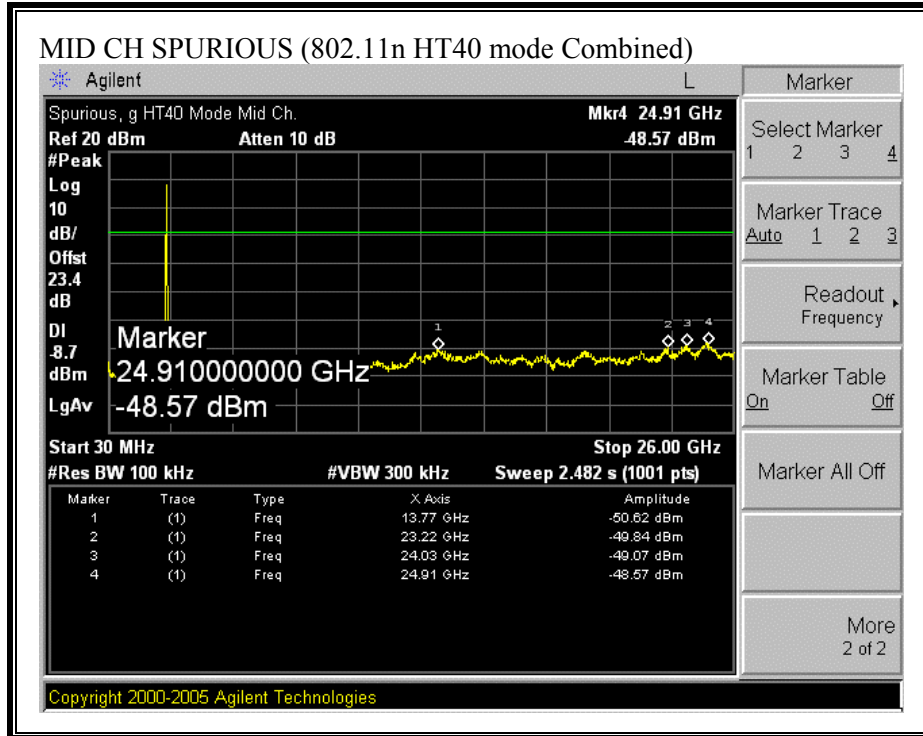


**COMBINED SPURIOUS EMISSIONS (802.11 HT40 MODE)**



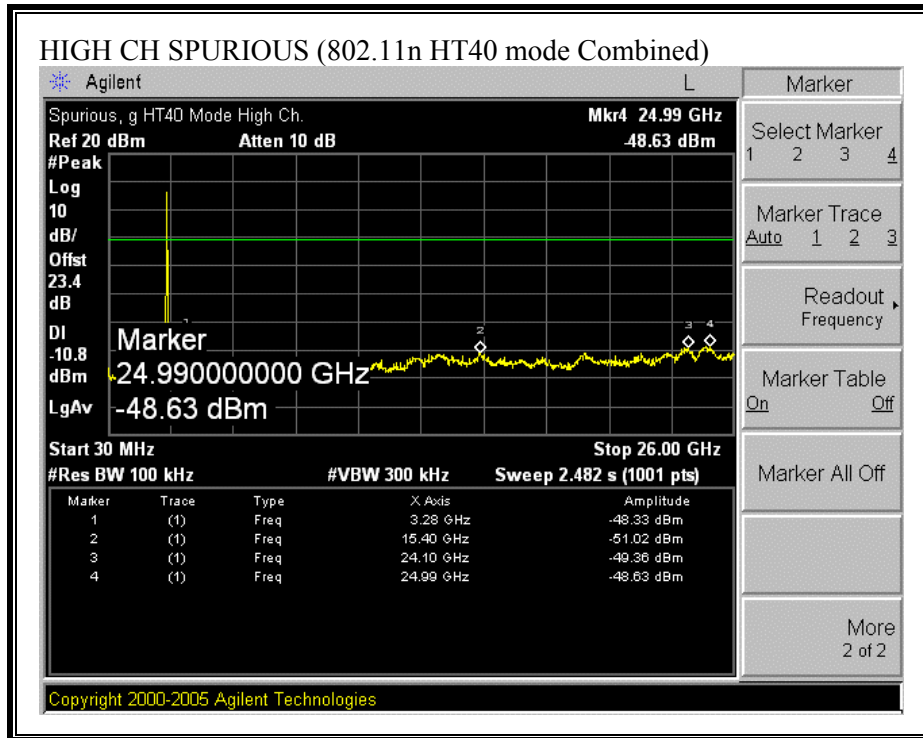












### 7.1.6. MAXIMUM PERMISSIBLE EXPOSURE

#### LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(180/f <sup>2</sup> )	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
30–300 .....	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

## **CALCULATIONS**

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations yields:

$$S = (30 * P * G) / (3770 * (d^2))$$

Changing to units of Power to mW and Distance to cm, using:

$$P (W) = P (mW) / 1000 \text{ and}$$

$$d (m) = d (cm) / 100$$

and substituting the logarithmic form of power and gain using:

$$P (mW) = 10^{(P (dBm) / 10)} \text{ and}$$

$$G (\text{numeric}) = 10^{(G (dBi) / 10)}$$

yields

$$S = 0.0795 * 10^{((P + G) / 10)} / (d^2)$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm<sup>2</sup>

**LIMITS**

From §1.1310 Table 1 (B), the maximum value of  $S = 1.0 \text{ mW/cm}^2$

**RESULTS**

No non-compliance noted:

Mode	MPE Distance (cm)	Total Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm <sup>2</sup> )
802.11b	20.0	27.72	2.00	0.19
802.11g	20.0	28.29	2.00	0.21
802.11n HT20	20.0	28.05	2.00	0.20
802.11n HT40	20.0	23.12	2.00	0.06

## **7.2. CHANNEL TESTS FOR THE 5725 to 5850 MHz BAND**

### **7.2.1. 6 dB BANDWIDTH**

#### **LIMIT**

§15.247 (a) (2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

#### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

**RESULTS**

No non-compliance noted:

Mode Channel	Frequency (MHz)	6 dB BW Chain 0 (kHz)	6 dB BW Chain 1 (kHz)	6 dB BW Chain 2 (kHz)	Minimum Limit (kHz)	Minimum Margin (kHz)
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802.11a Mode

Low	5745	16333.333	16000	16333.333	500	15500
Middle	5785	16333.333	16250	15750	500	15250
High	5825	16250	16333.333	16333.333	500	15750

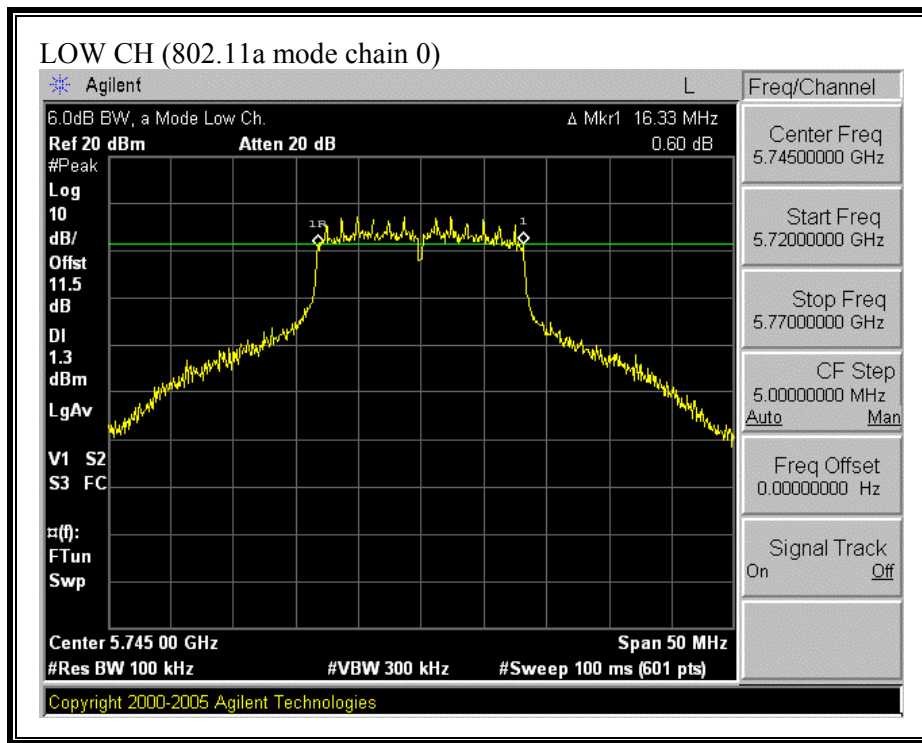
802.11n HT20 Mode

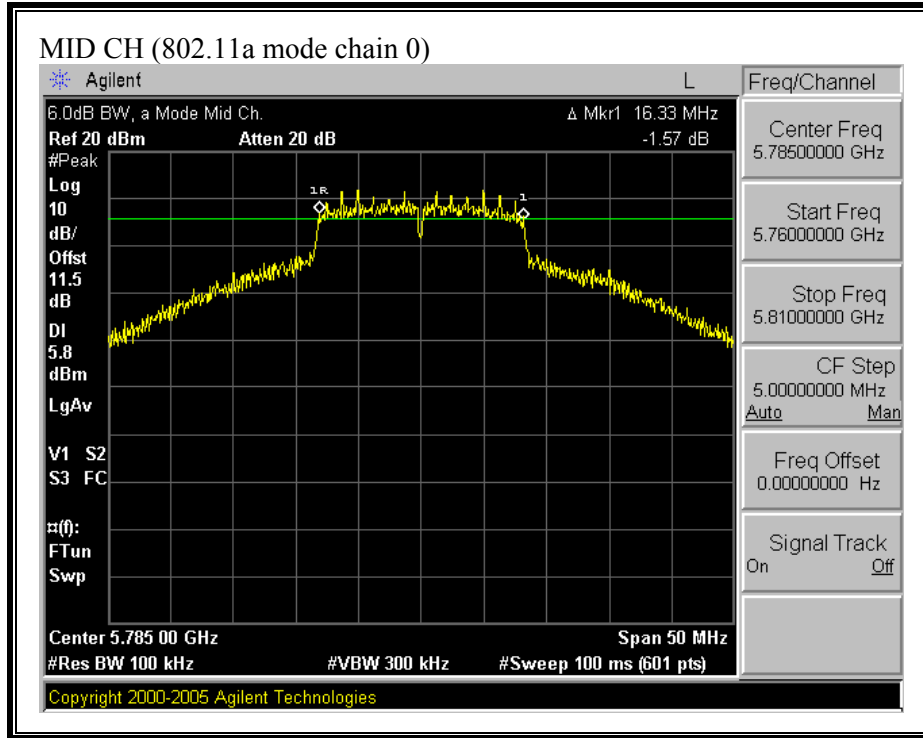
Low	5745	16833.333	16833.333	15750	500	15250
Mid	5785	16416.667	17000	16250	500	15750
High	5825	16833.333	16083.333	15500	500	15000

802.11n HT40 Mode

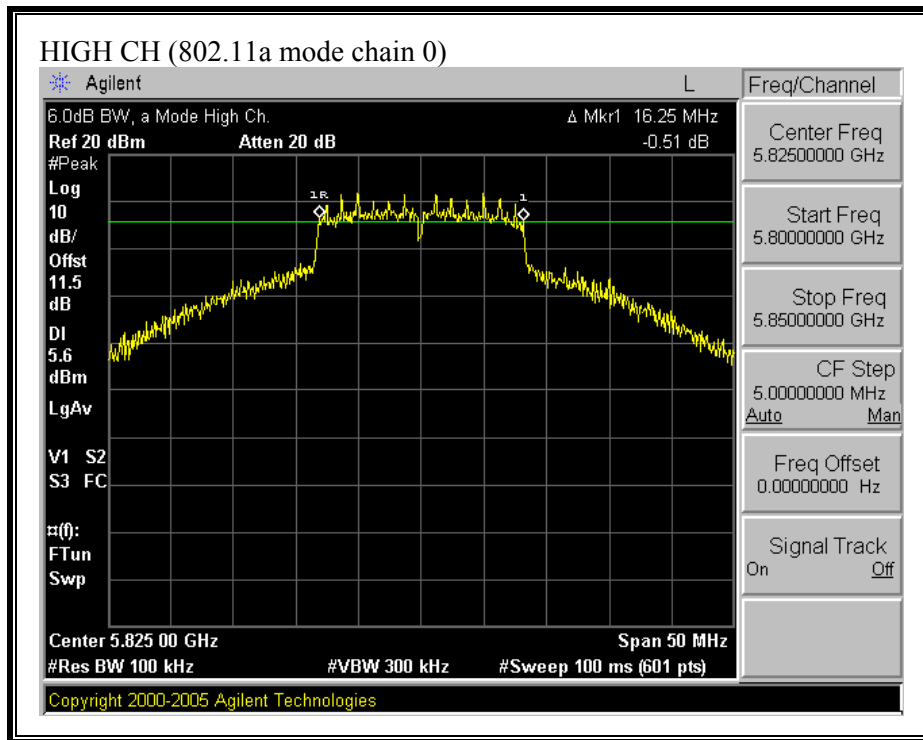
Low	5755	35666.667	35666.667	35833.333	500	35167
Mid	5795	35833.333	35833.333	36333.333	500	35333
High	5815	35833.333	35833.333	35833.333	500	35333

**(802.11a MODE CHAIN 0)**

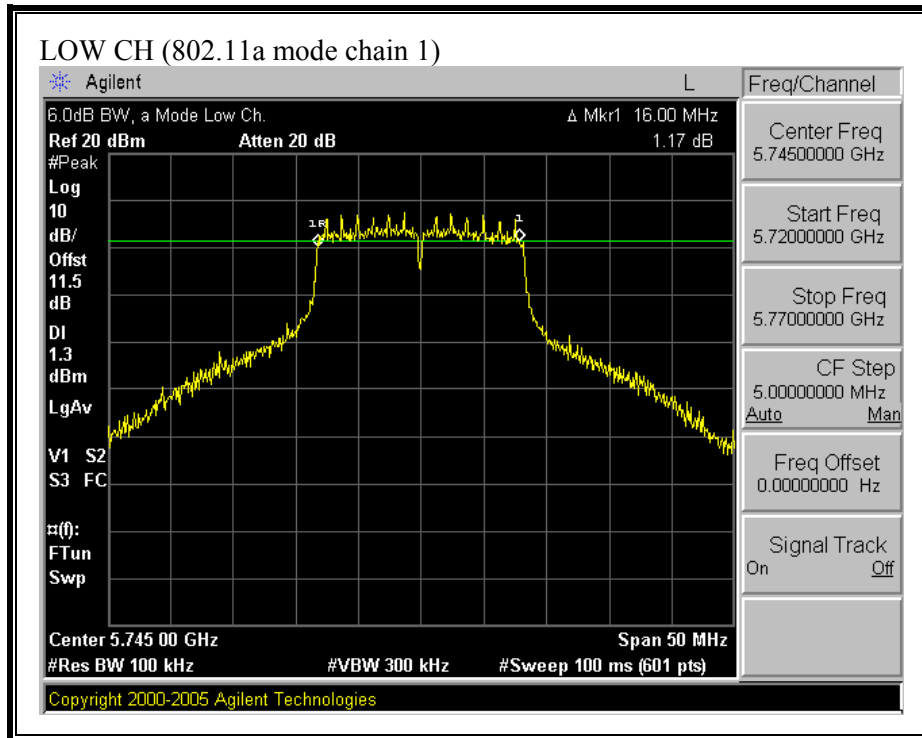


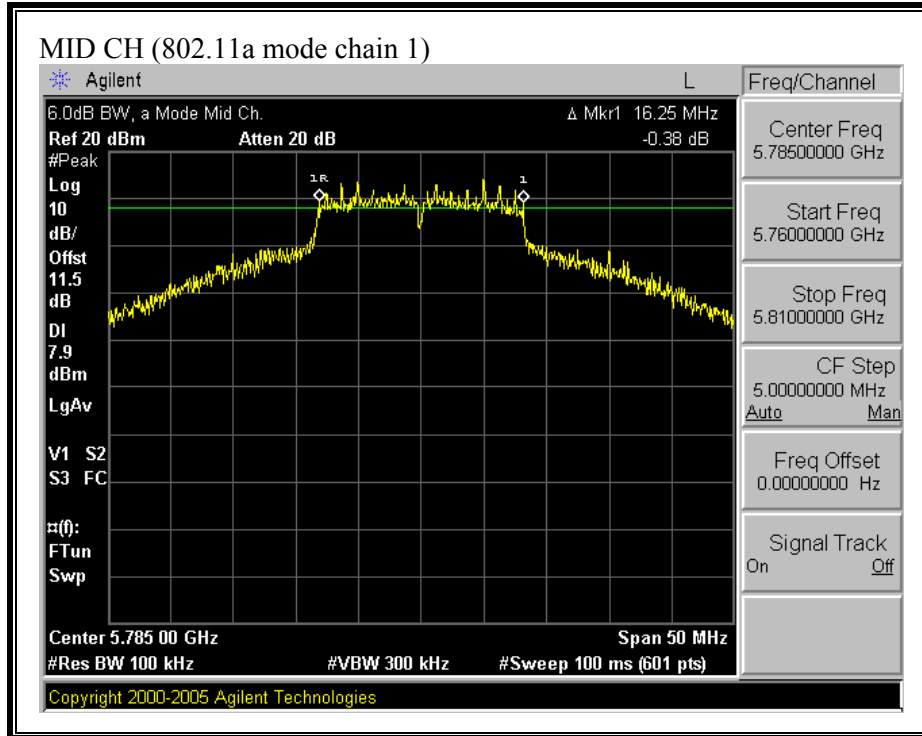


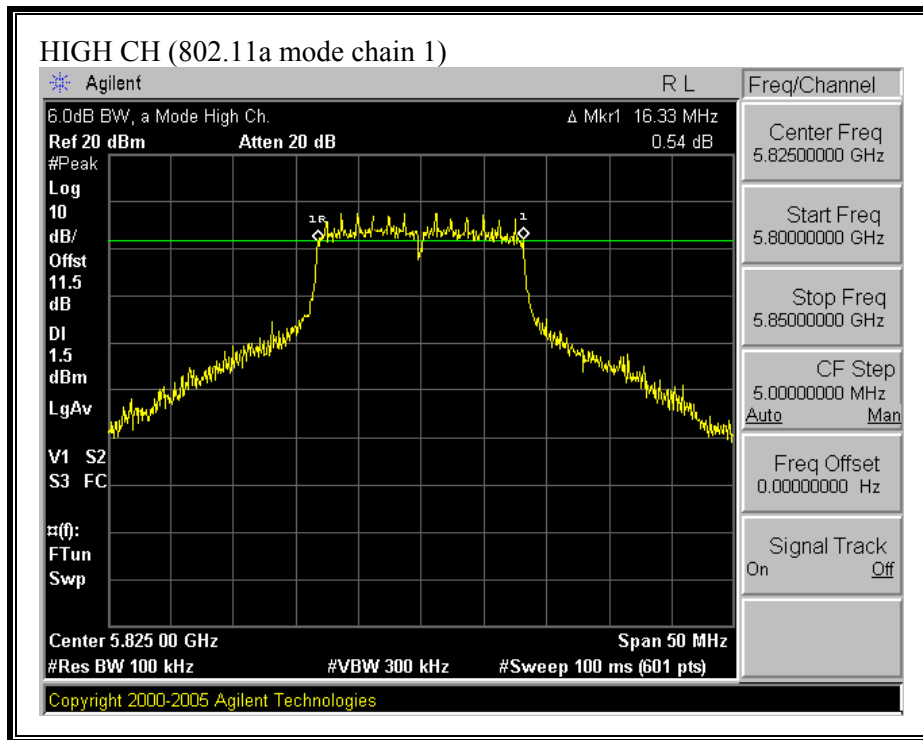




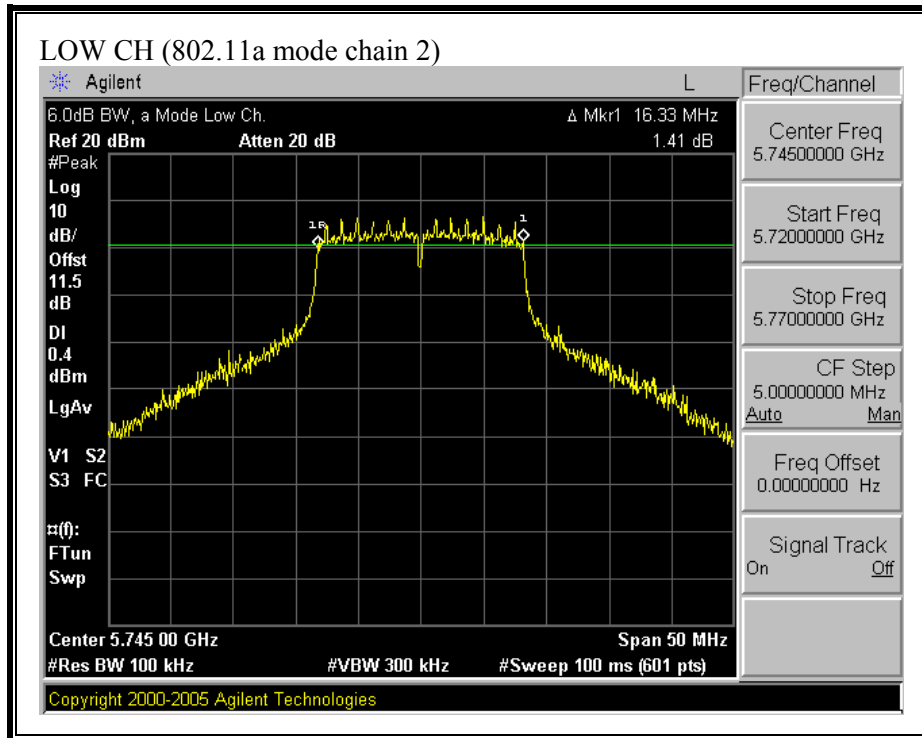
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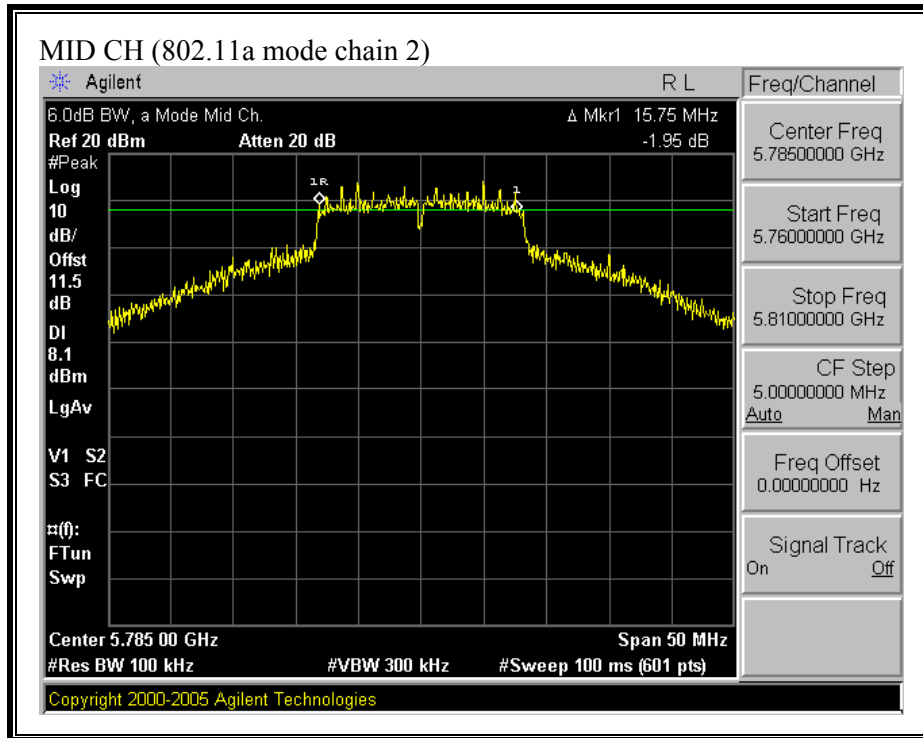


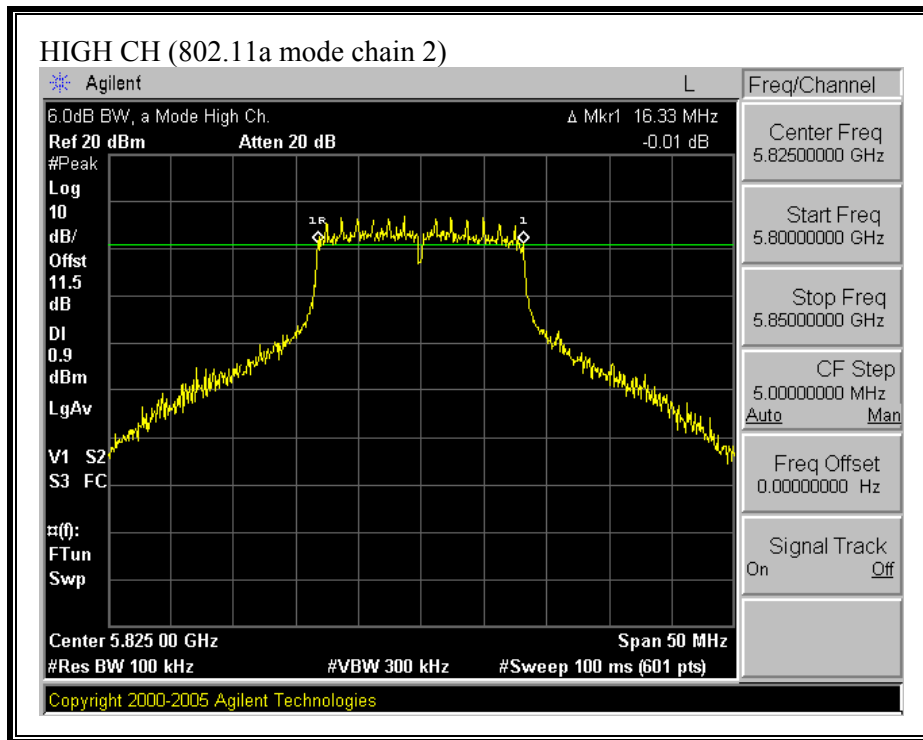




**(802.11a MODE CHAIN 2)**

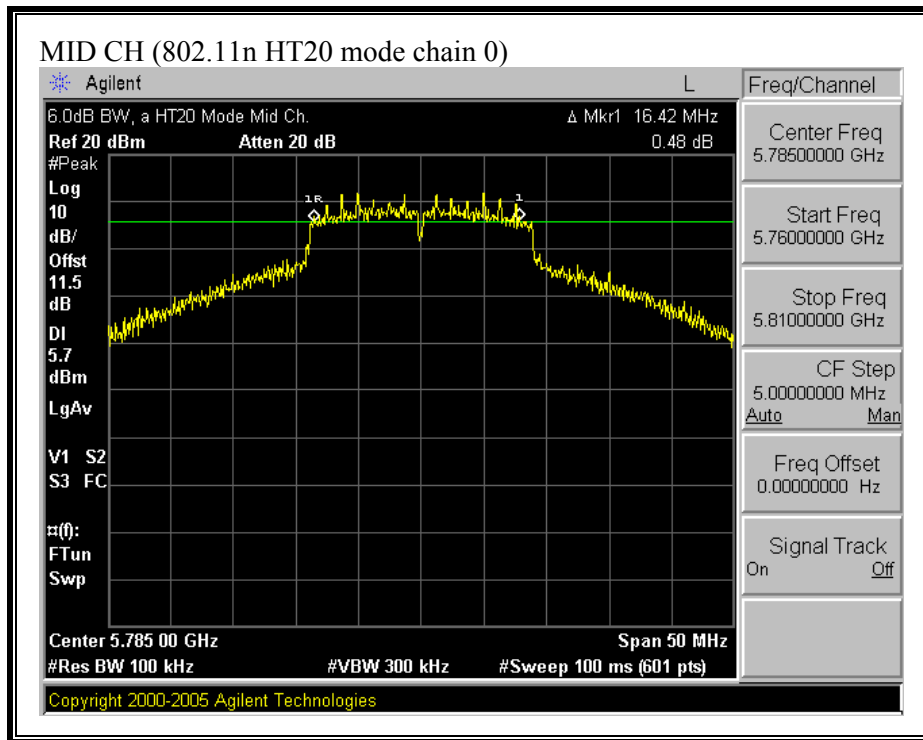


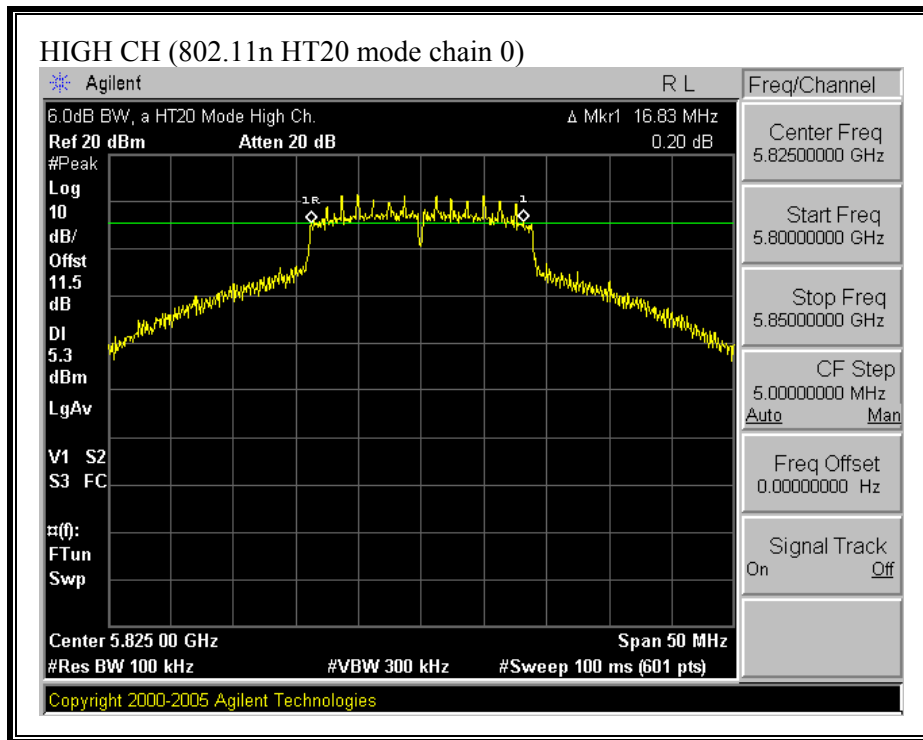




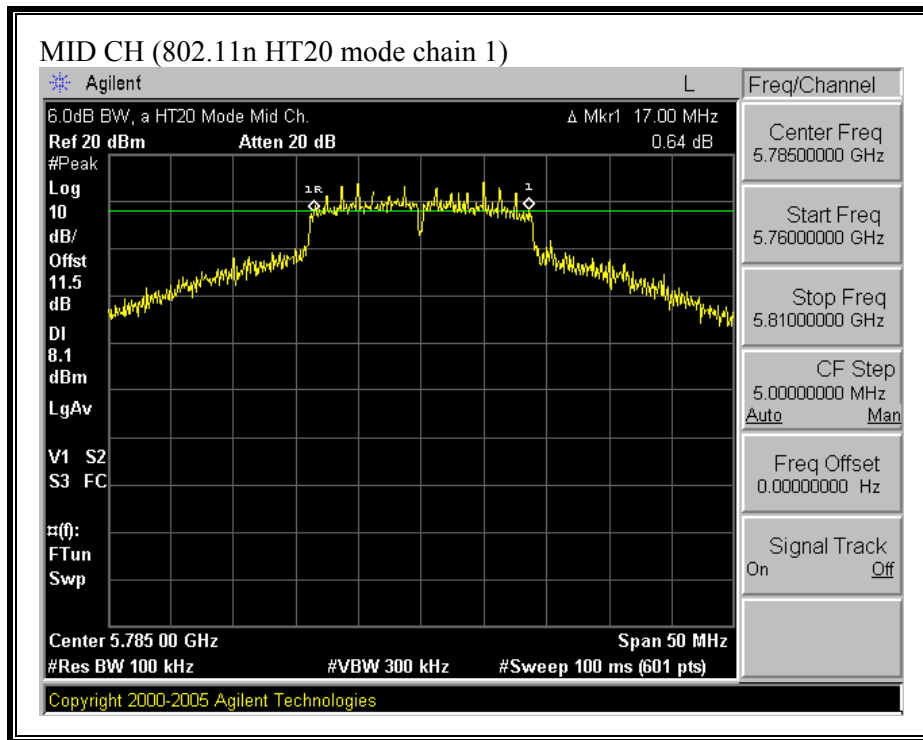


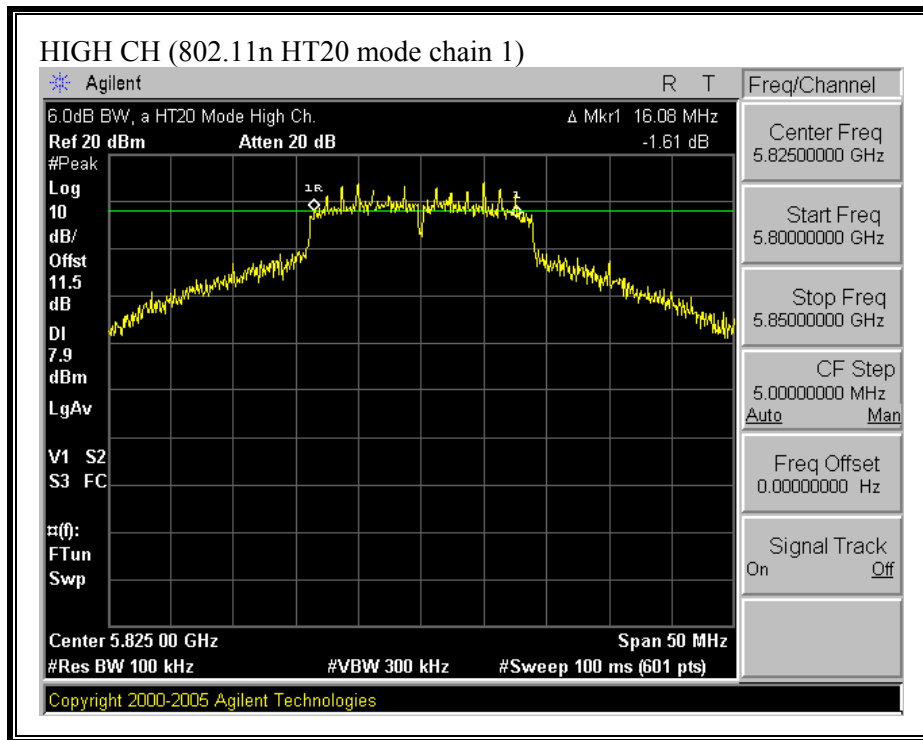




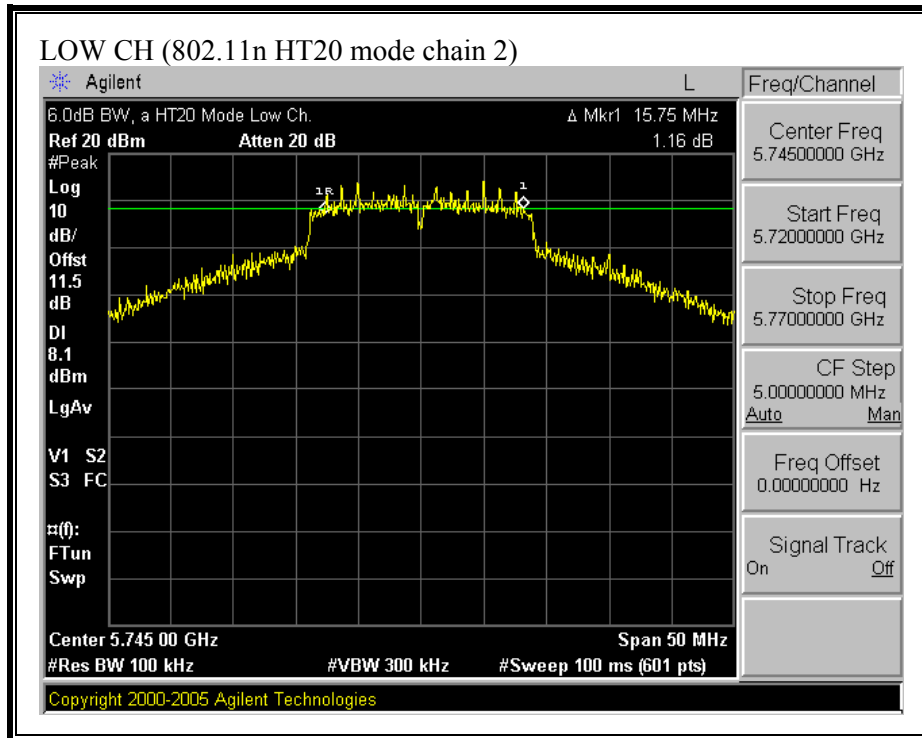


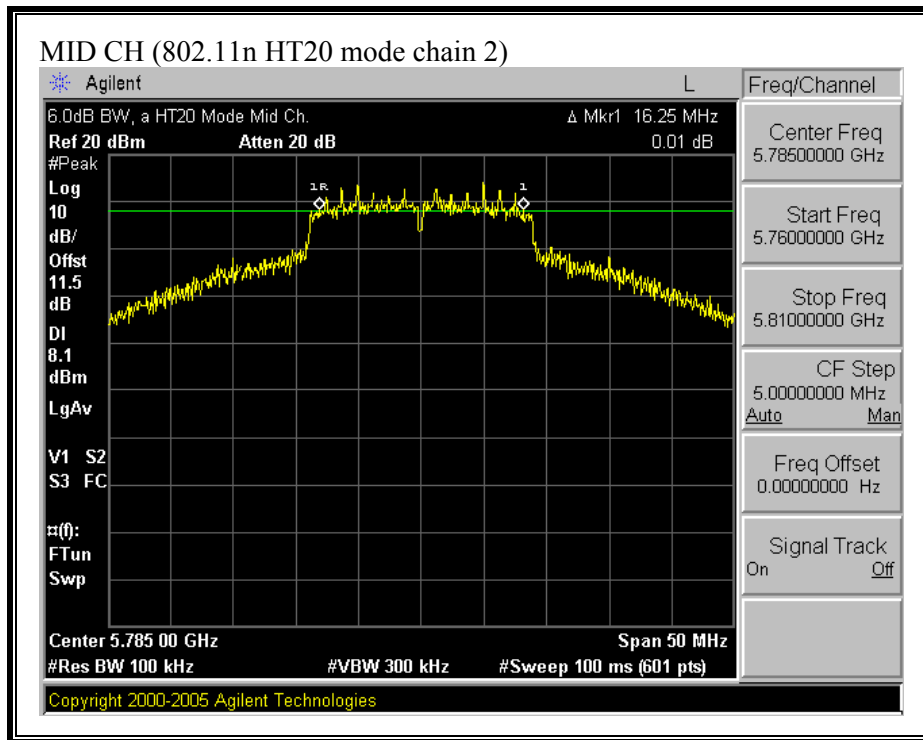


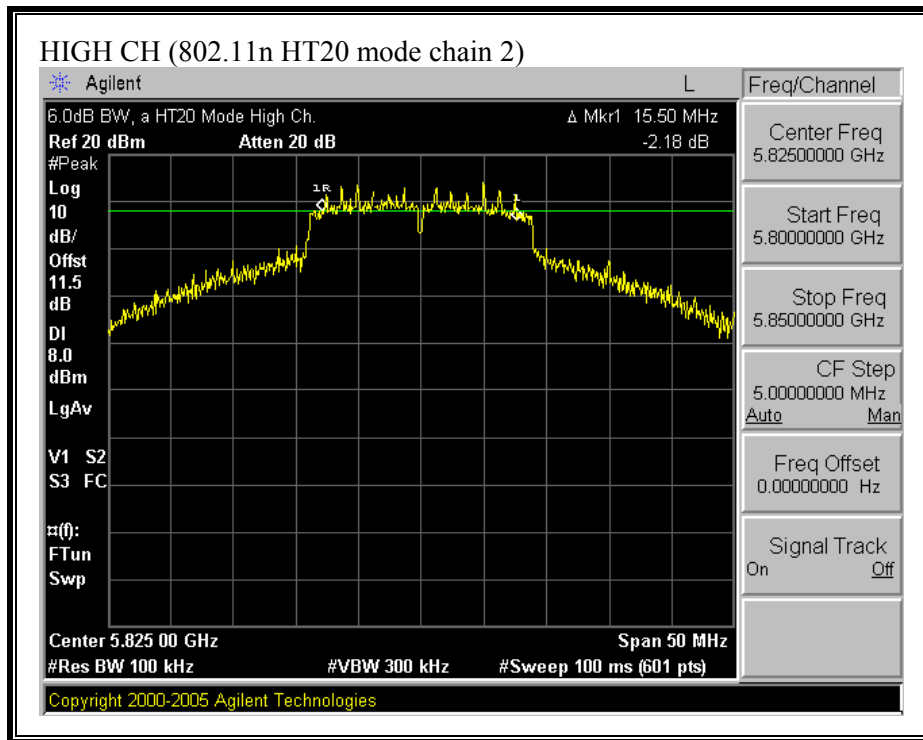




**(802.11n HT20 MODE CHAIN 2)**

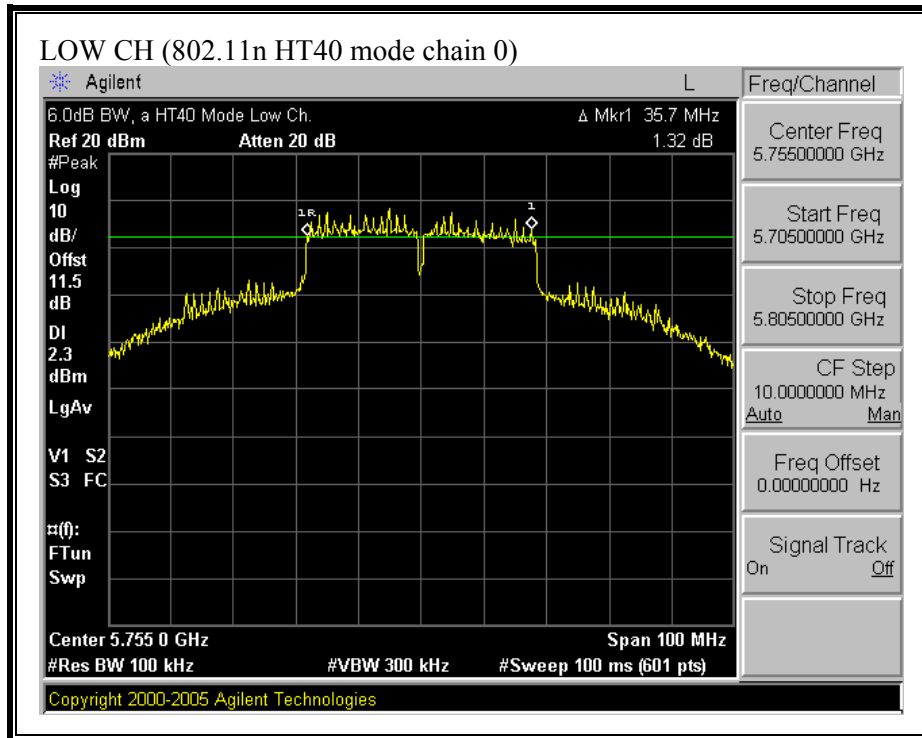


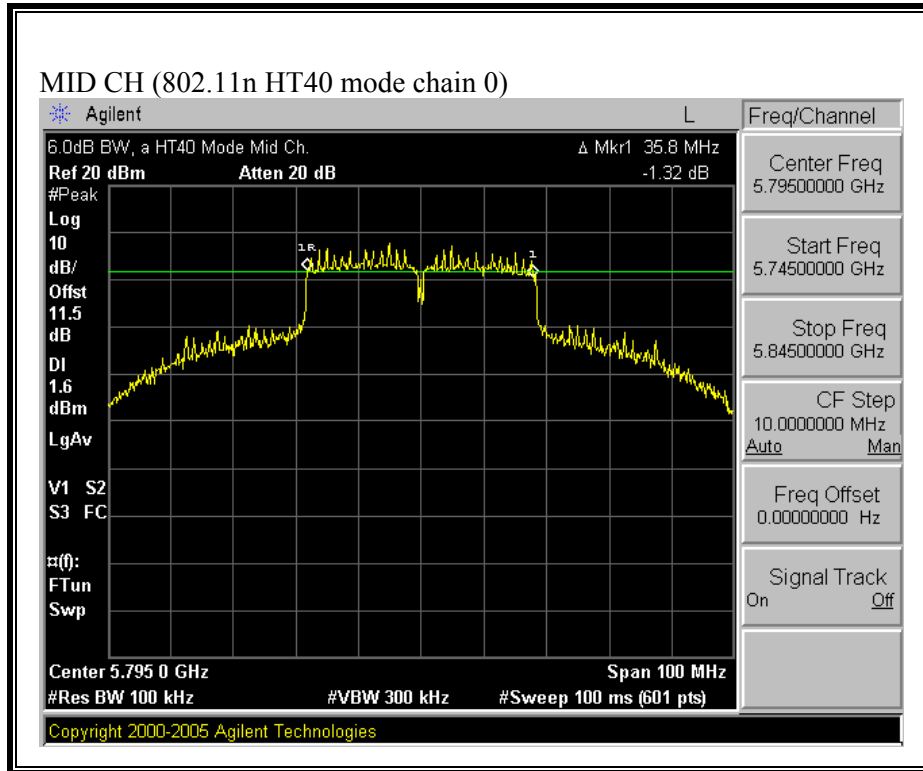


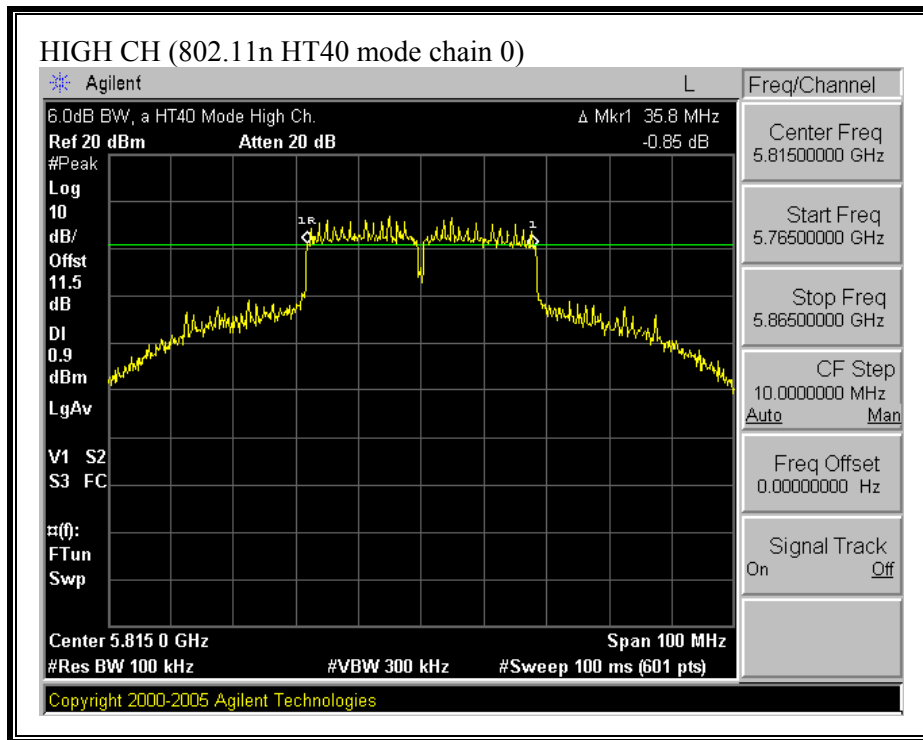




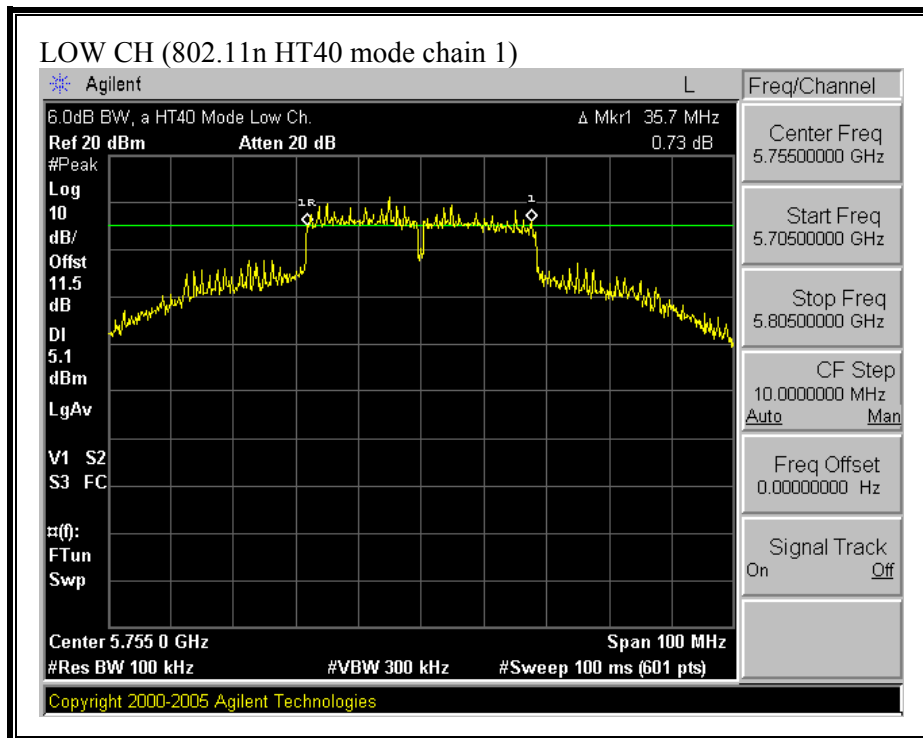
**(802.11n HT40 MODE CHAIN 0)**

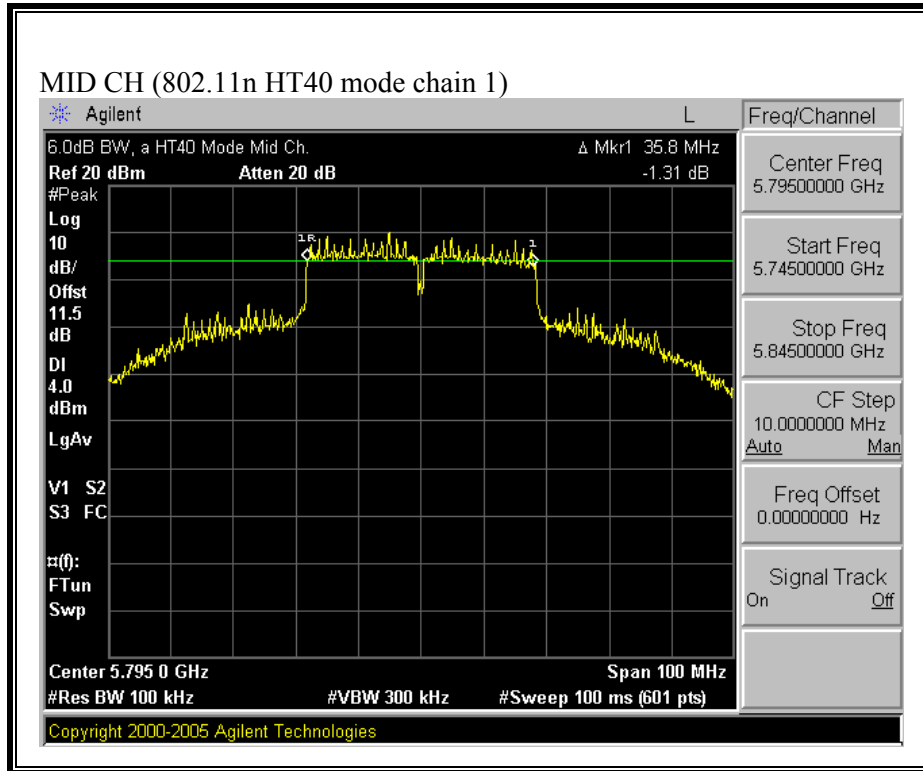


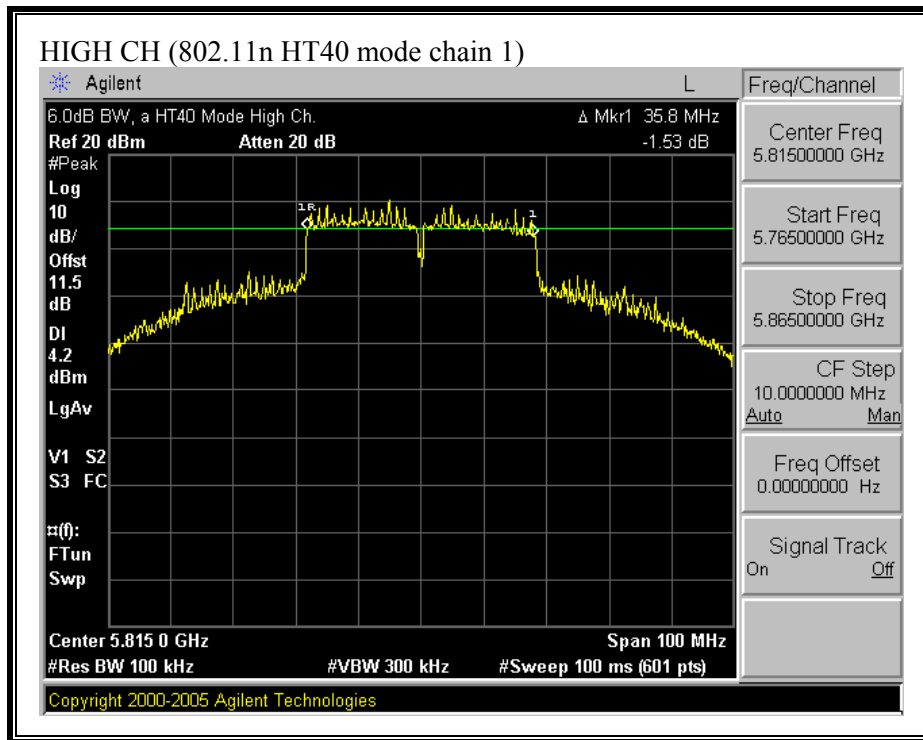




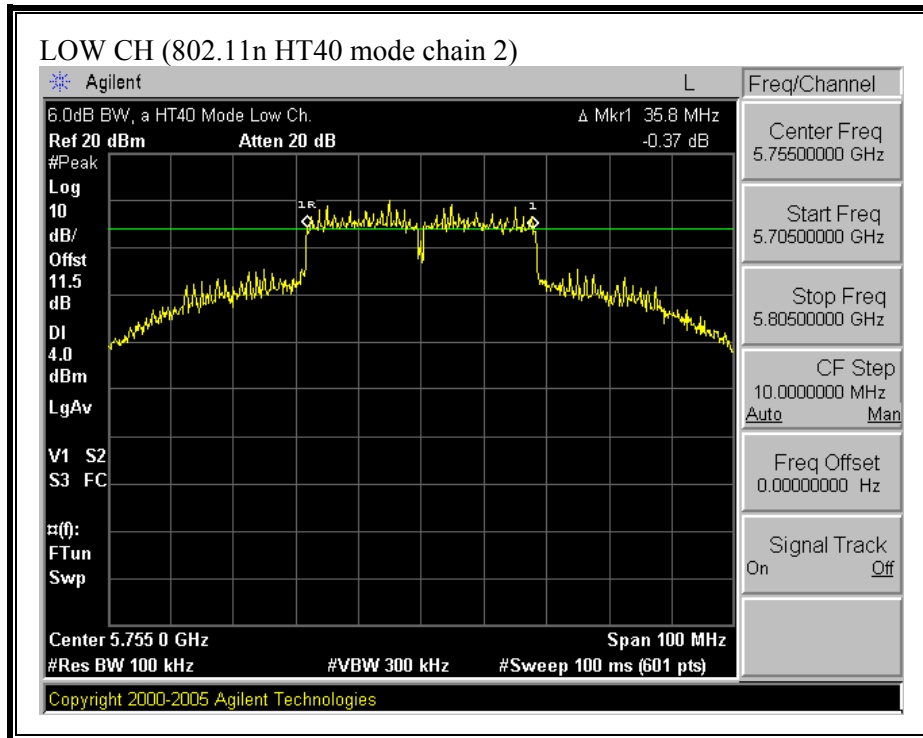
**(802.11n HT40 MODE CHAIN 1)**

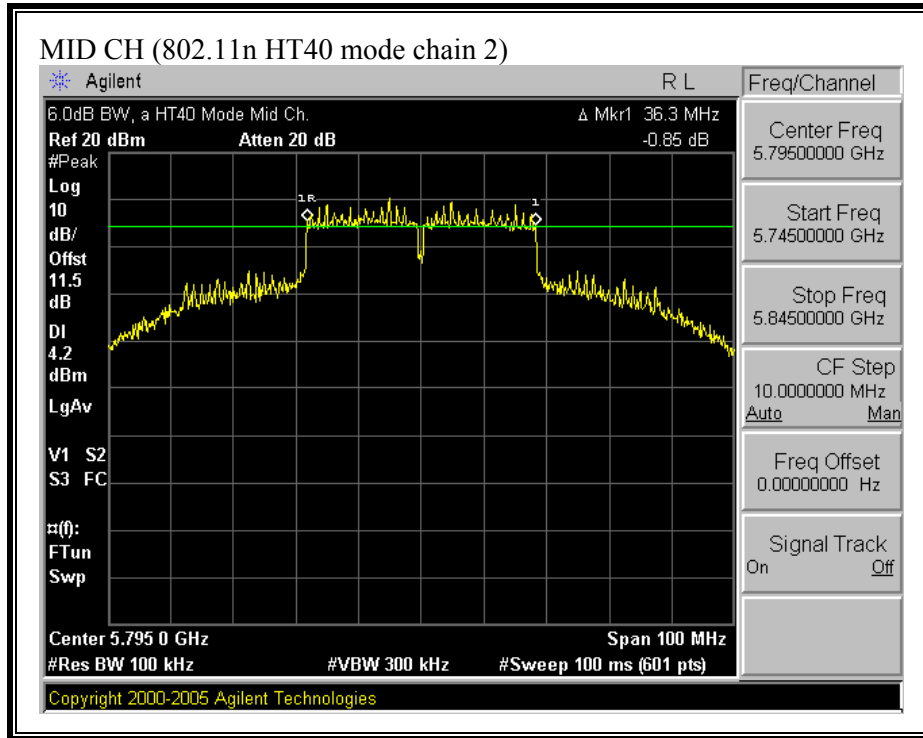




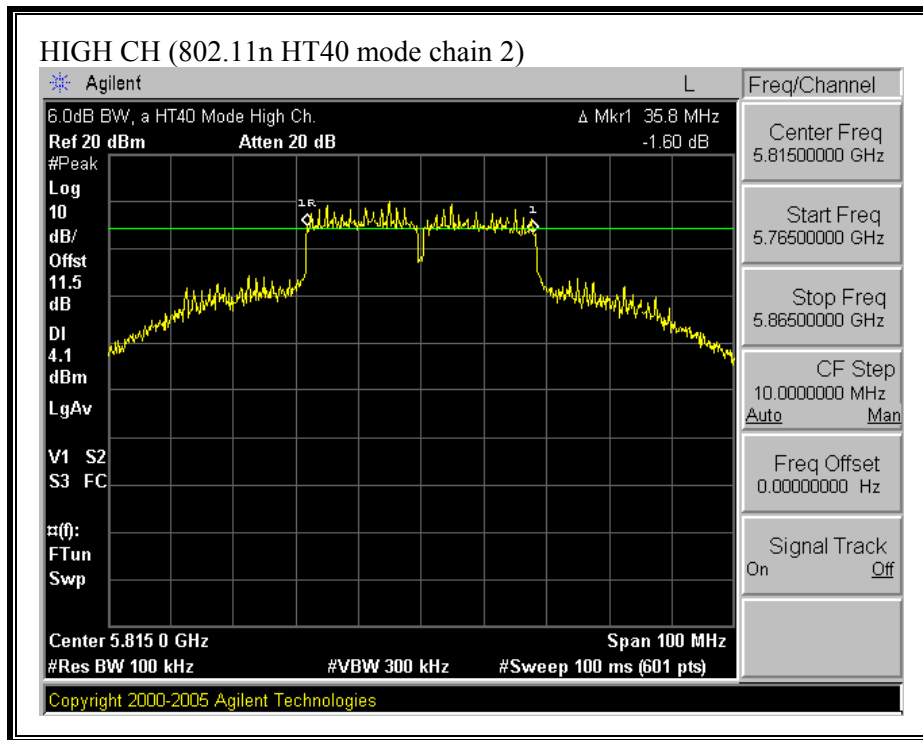


**(802.11n HT40 MODE CHAIN 2)**









## **7.2.2. 99% BANDWIDTH**

### **LIMIT**

None; for reporting purposes only.

### **TEST PROCEDURE**

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to  $\geq 3$  times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

**RESULTS**

No non-compliance noted:

<b>Mode Channel</b>	<b>Frequency (MHz)</b>	<b>99% BW Chain 0 (MHz)</b>	<b>99% BW Chain 1 (MHz)</b>	<b>99% BW Chain 2 (MHz)</b>
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802.11a Mode

Low	5745	16.516	16.372	16.354
Middle	5785	25.969	26.103	25.879
High	5825	21.092	16.520	16.400

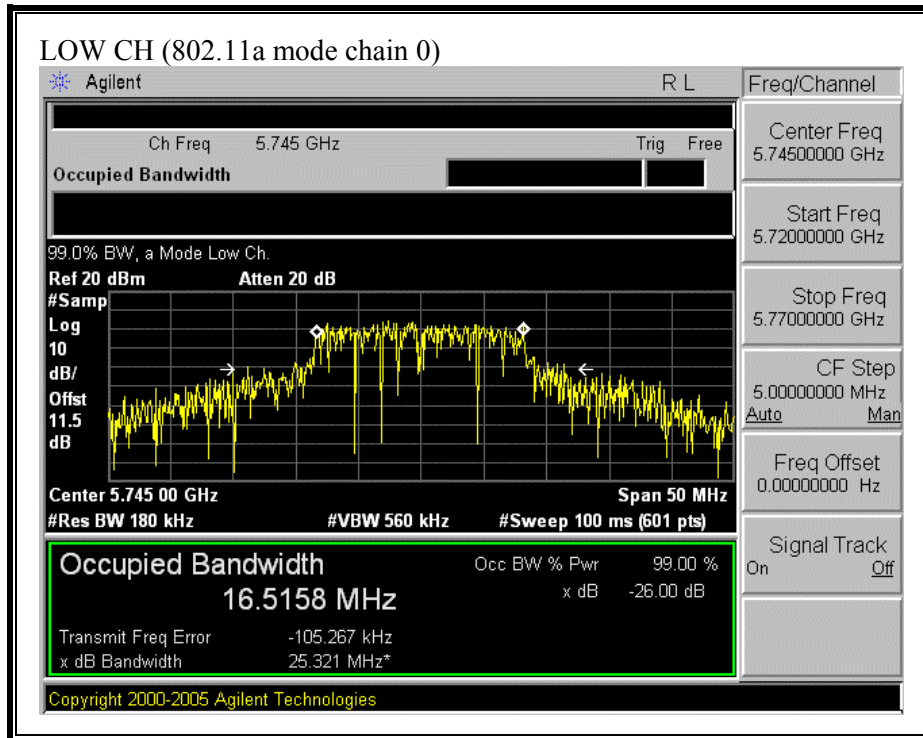
802.11n HT20 Mode

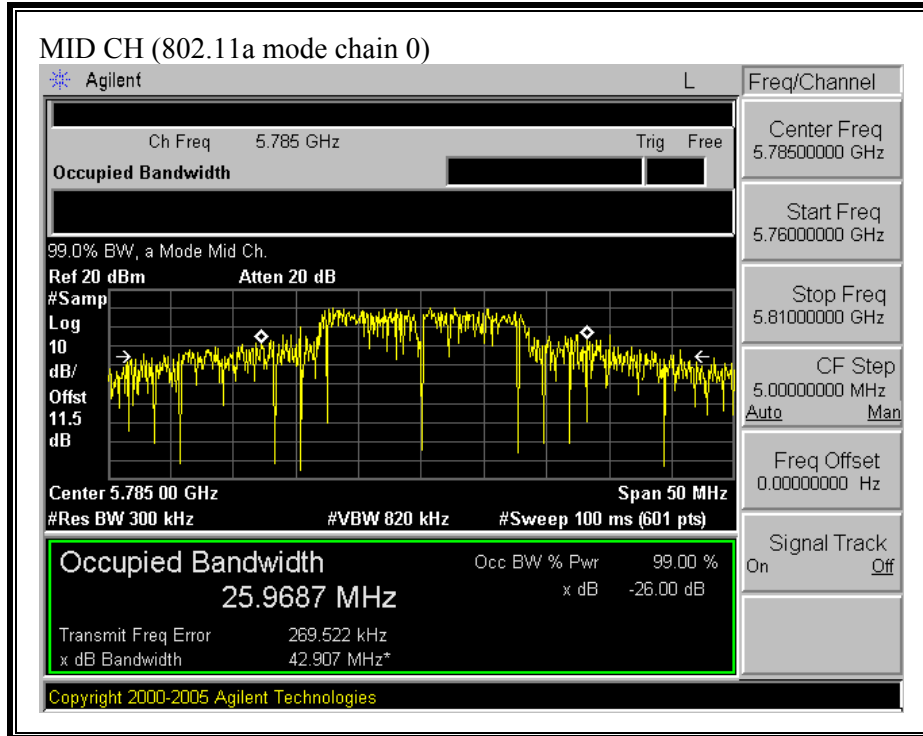
Low	5745	29.837	29.407	26.077
Mid	5785	26.904	29.649	27.283
High	5825	24.000	21.196	26.710

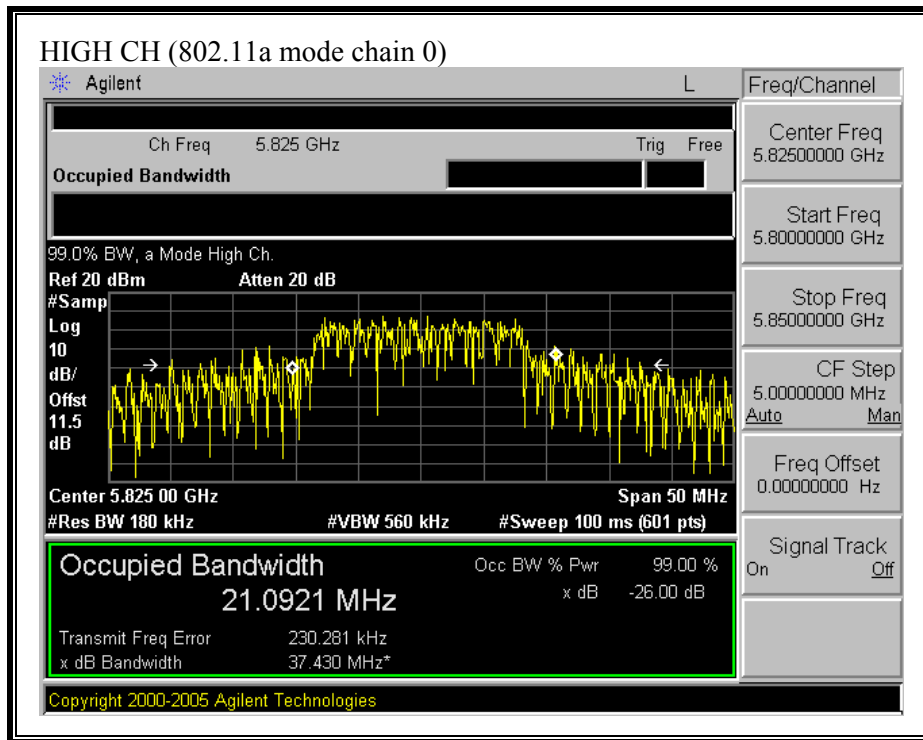
802.11n HT40 Mode

Low	5755	55.898	62.861	59.777
Mid	5795	50.387	52.519	56.757
High	5815	44.853	52.999	52.628

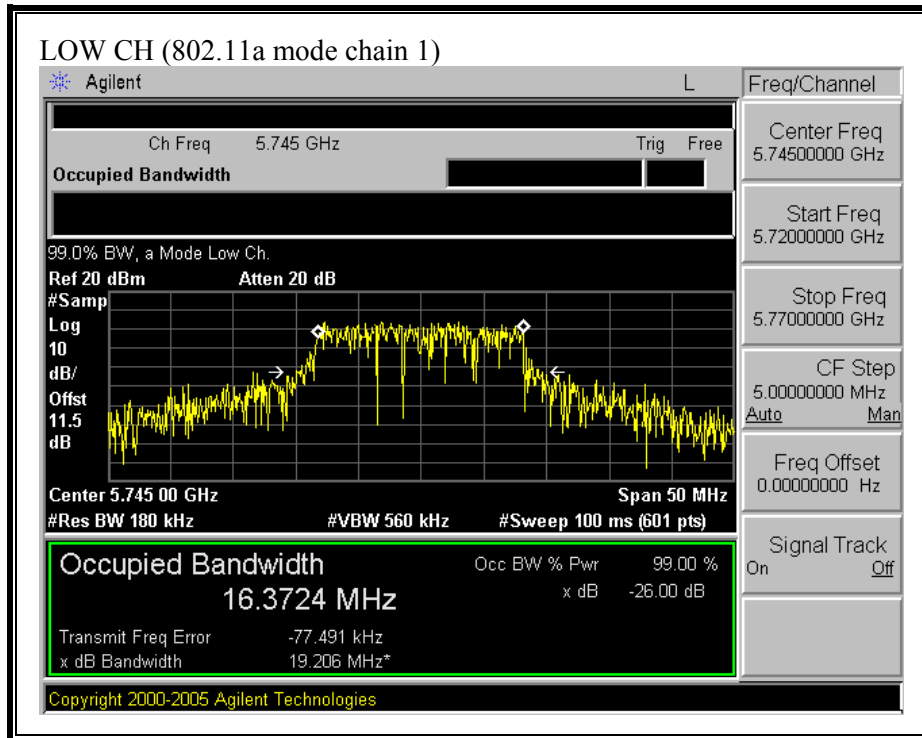
**(802.11a MODE CHAIN 0)**

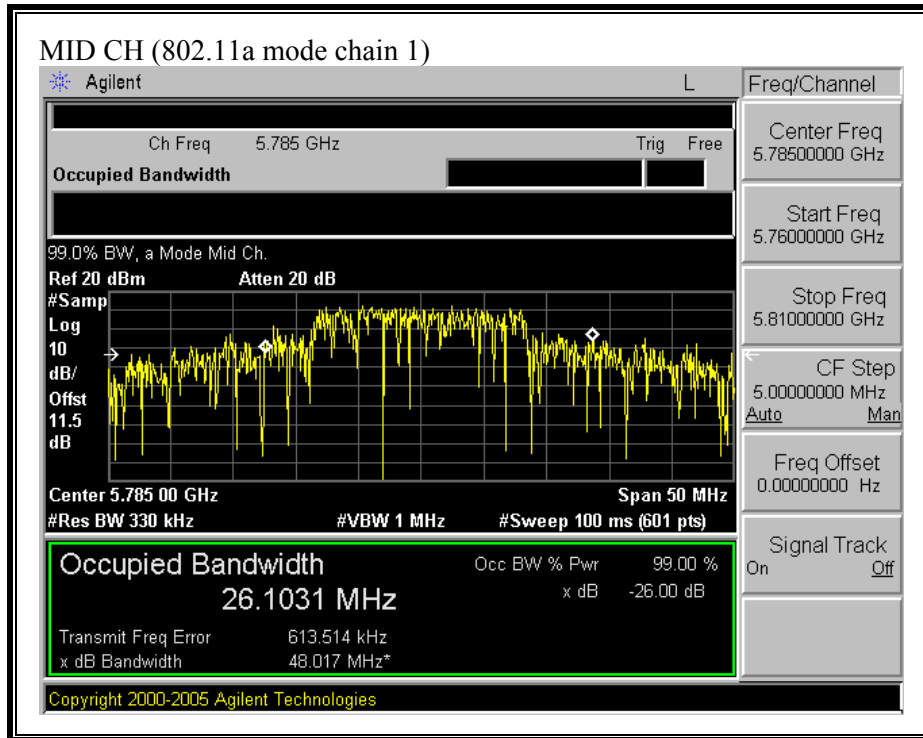




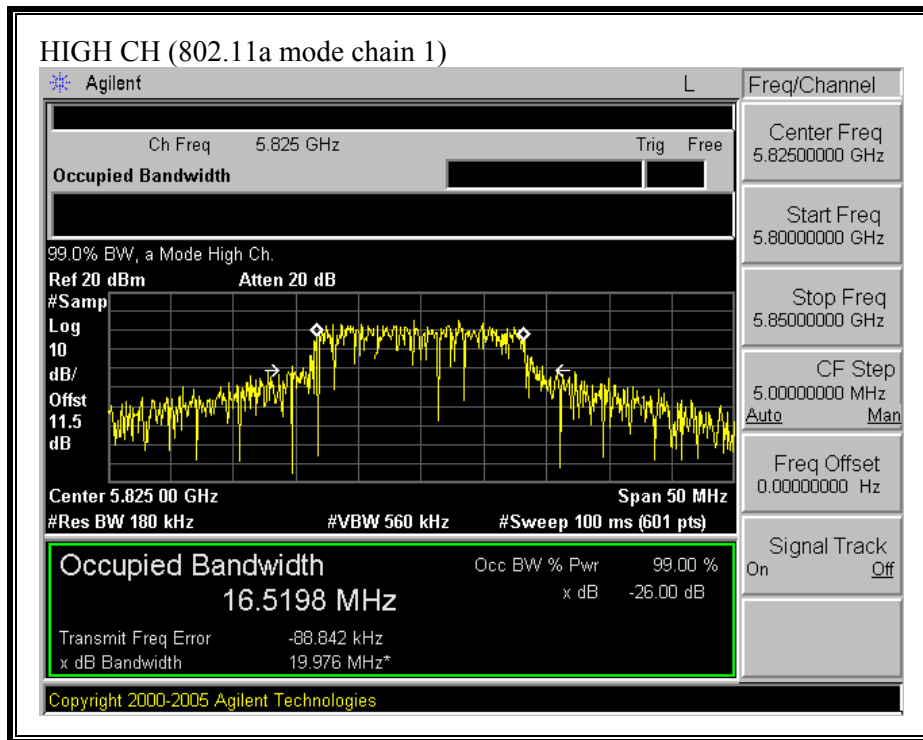


**(802.11a MODE CHAIN 1)**

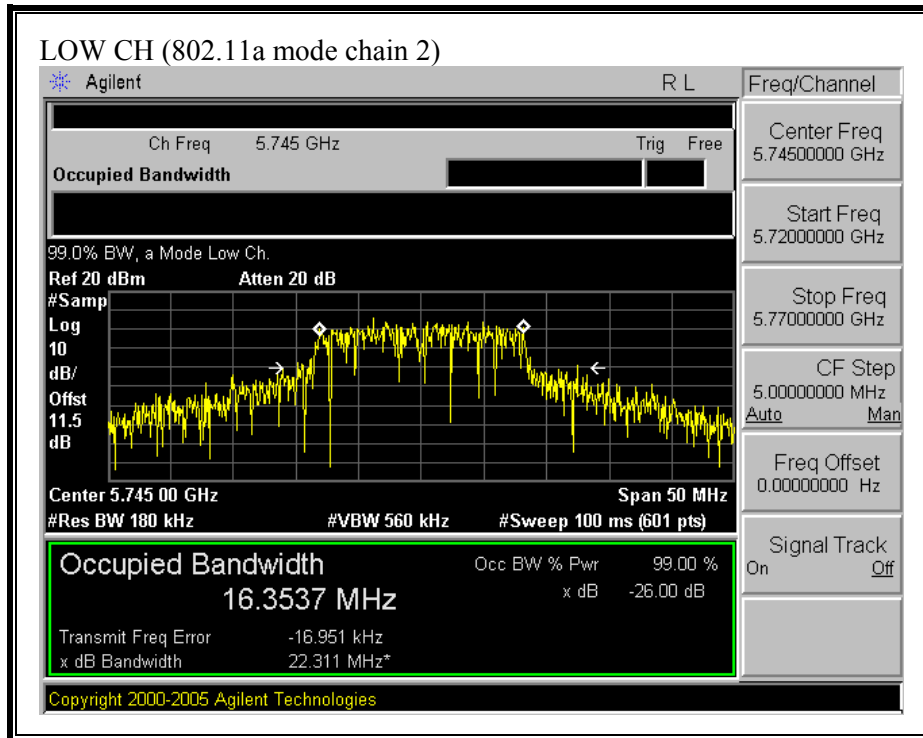


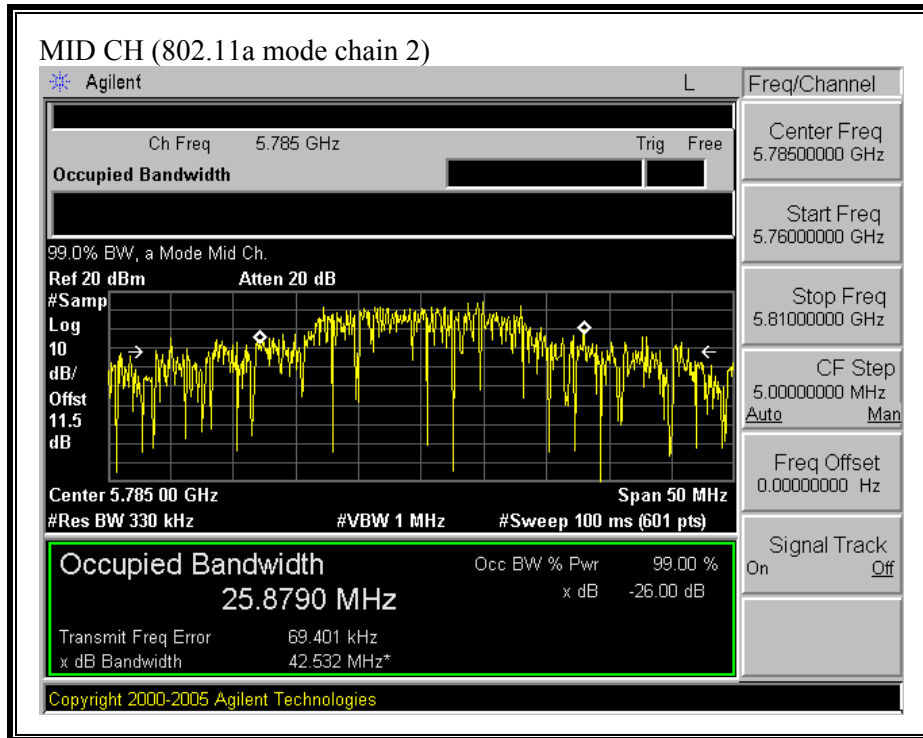


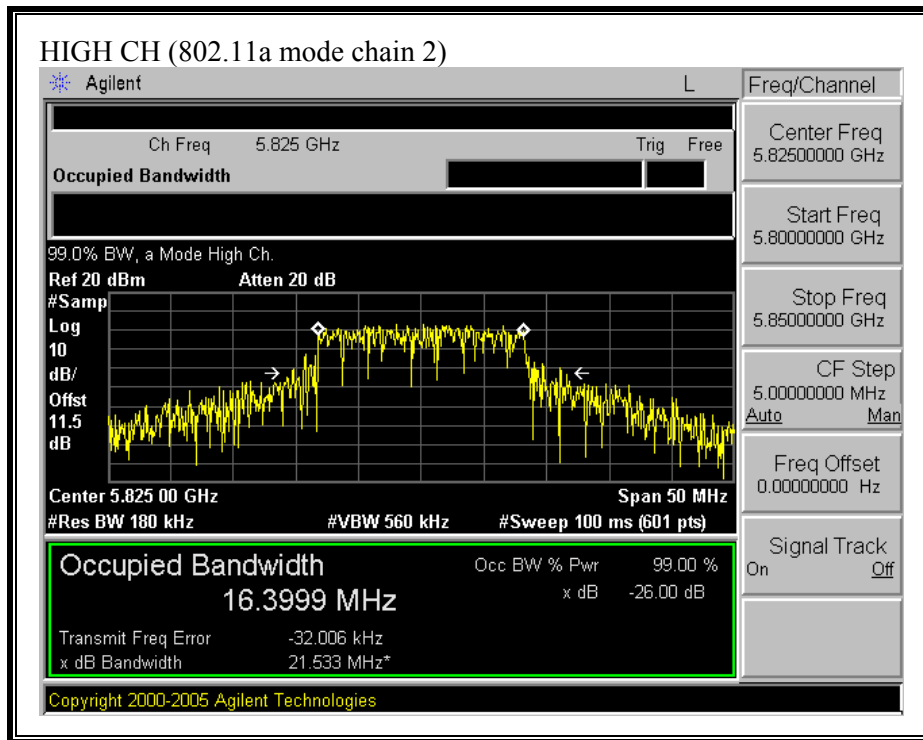




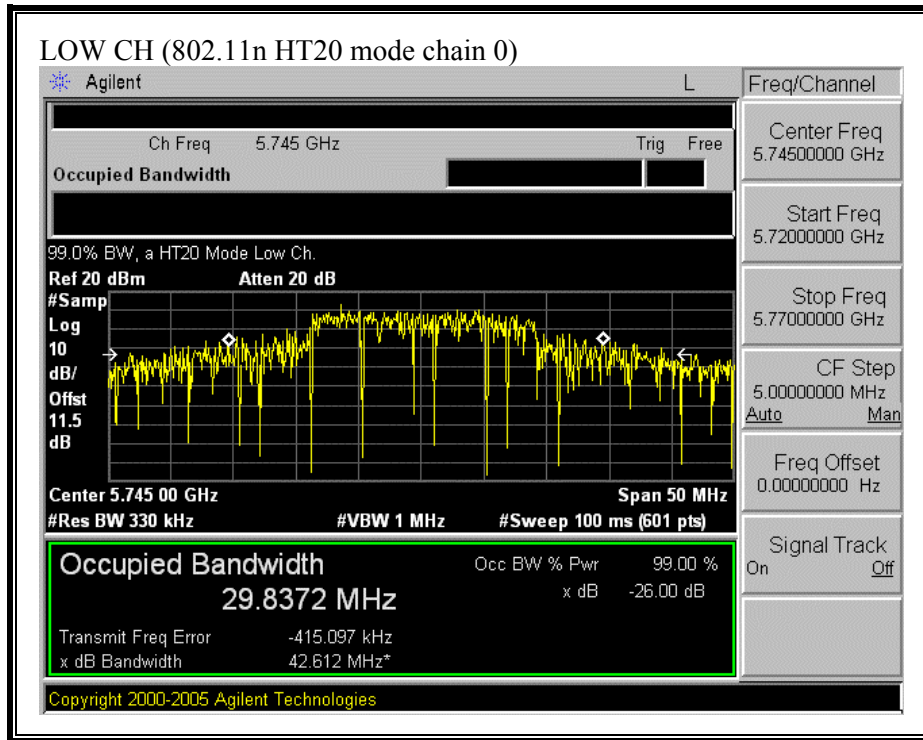
**(802.11a MODE CHAIN 2)**

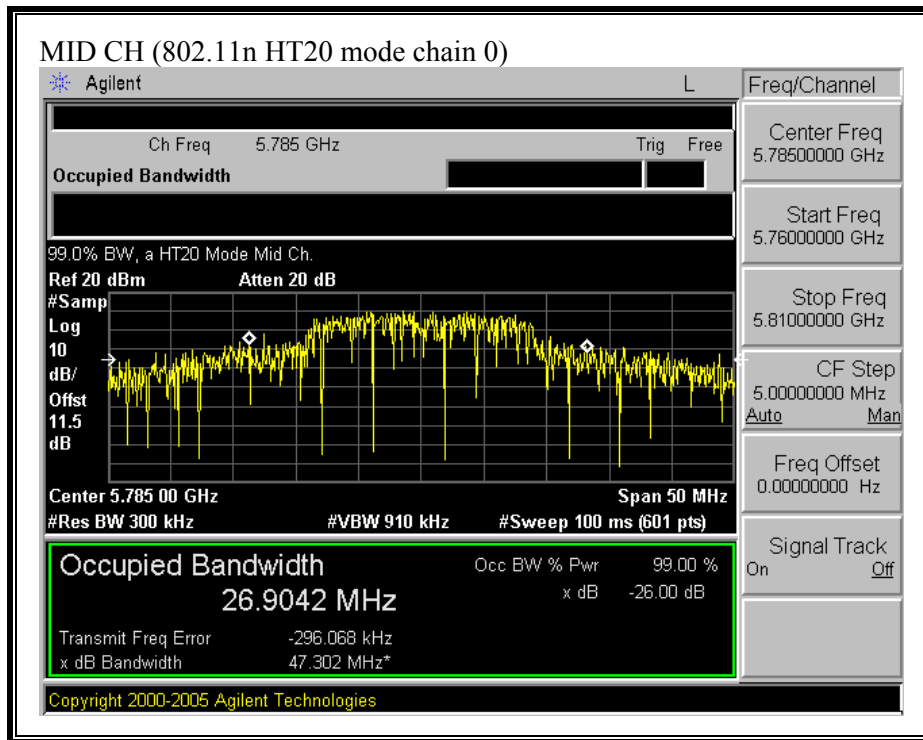


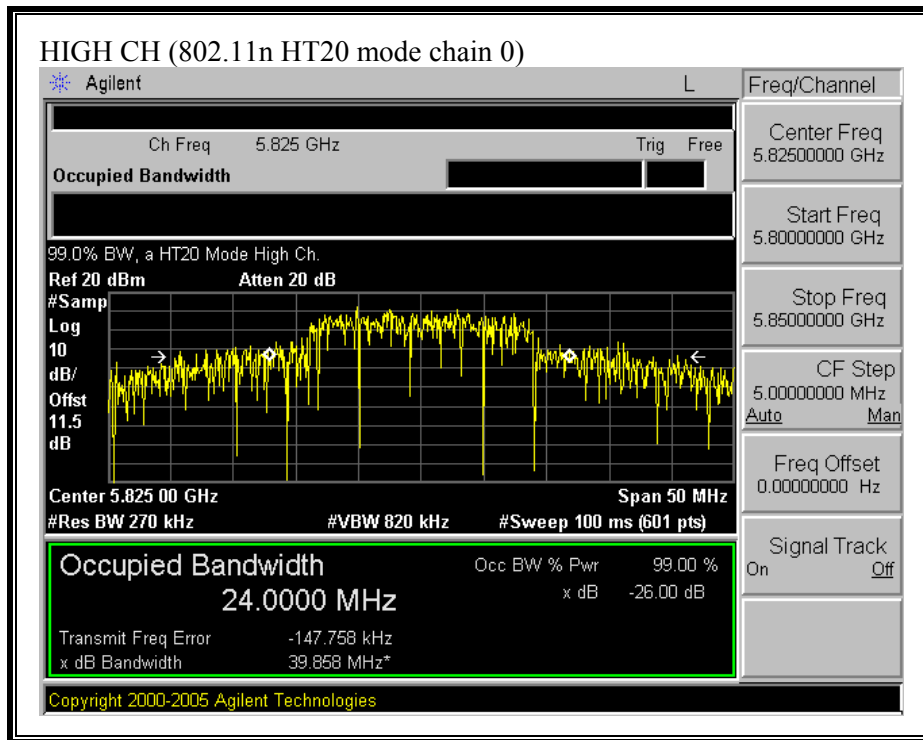




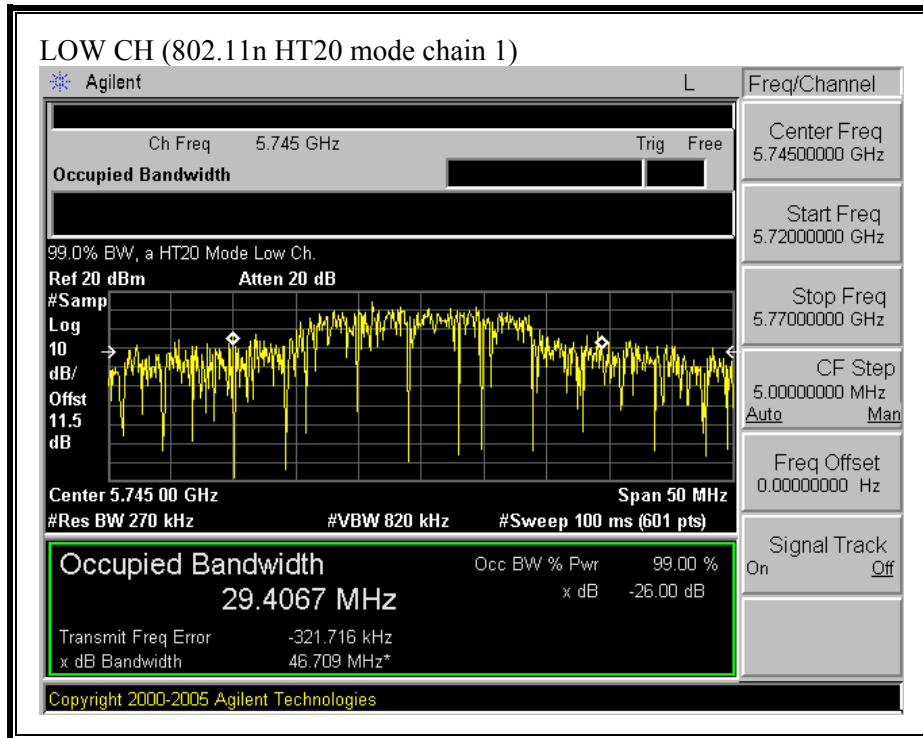
**(802.11n HT20 MODE CHAIN 0)**



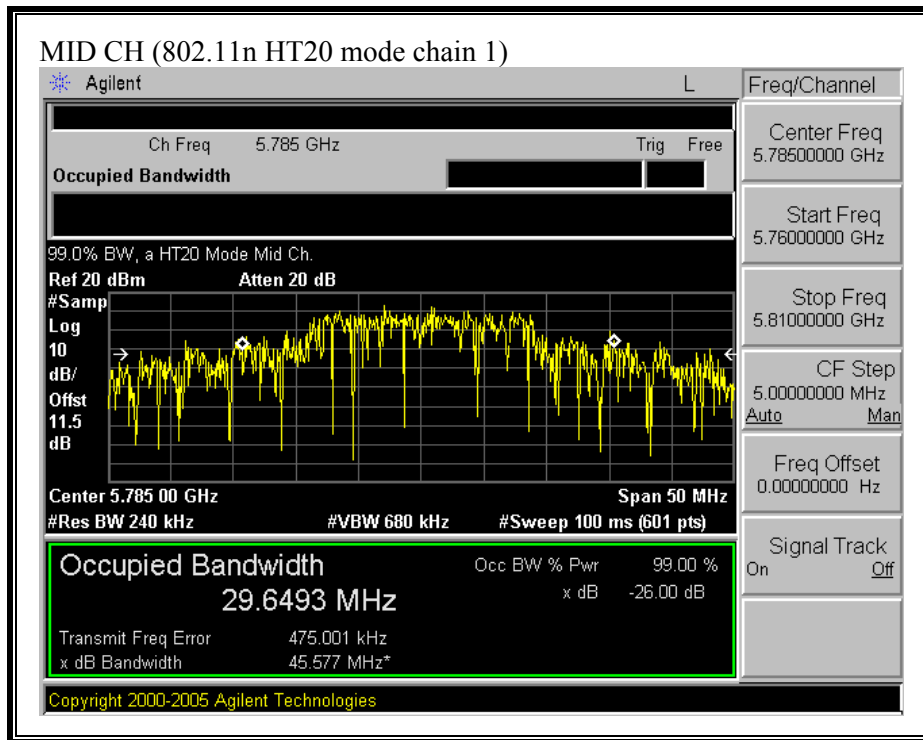


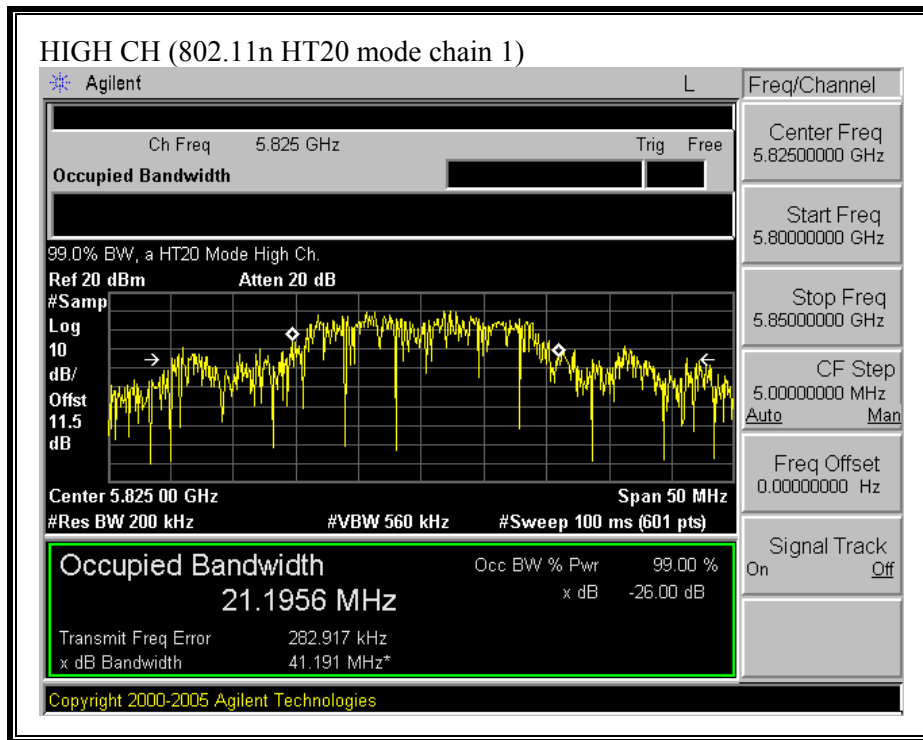


**(802.11n HT20 MODE CHAIN 1)**

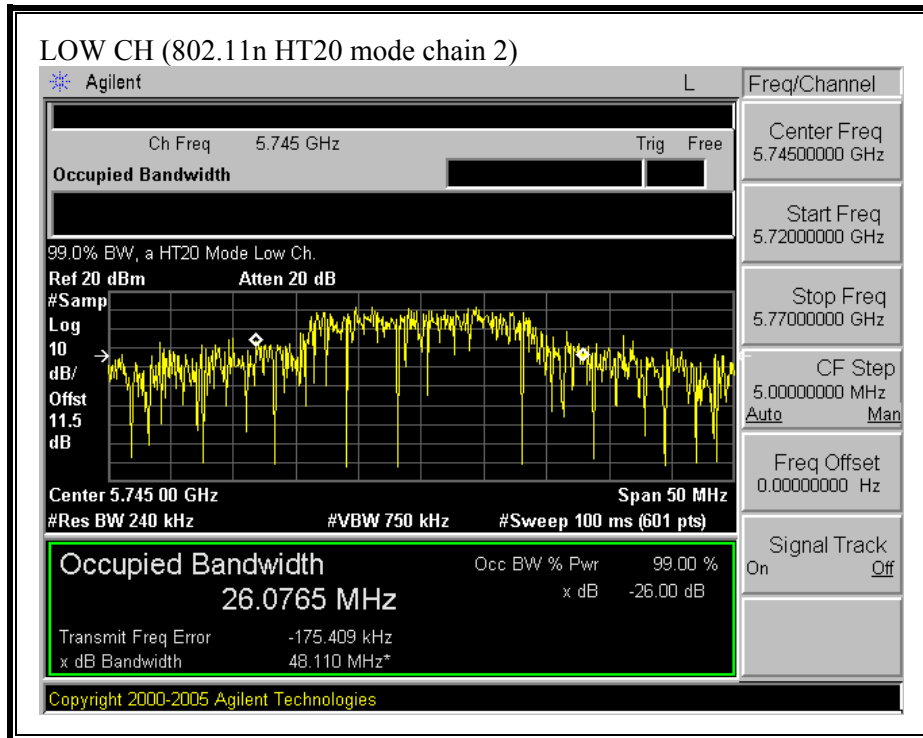


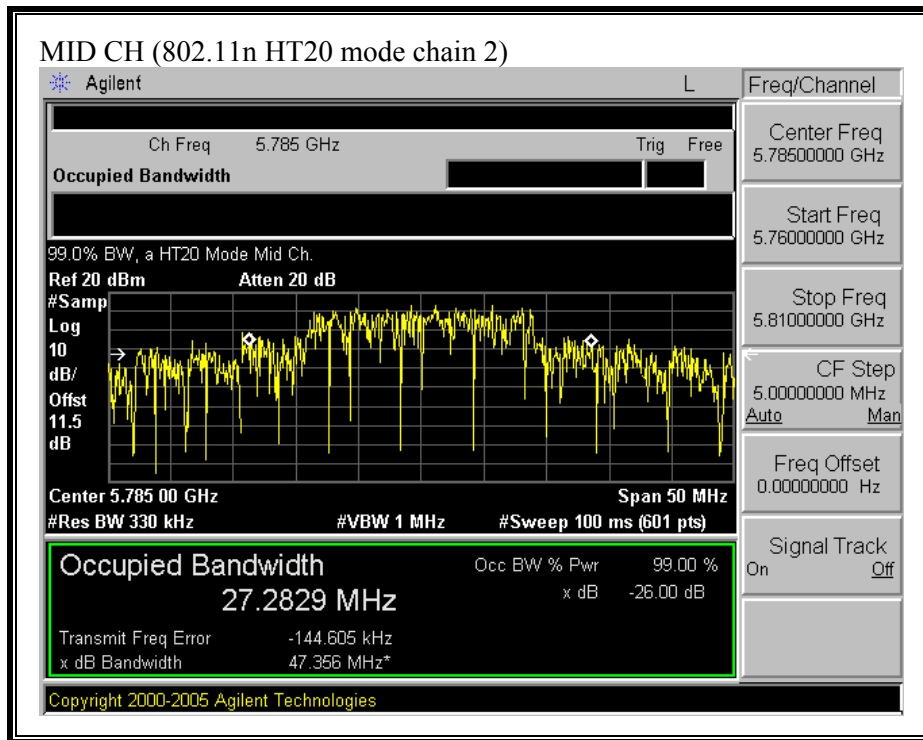


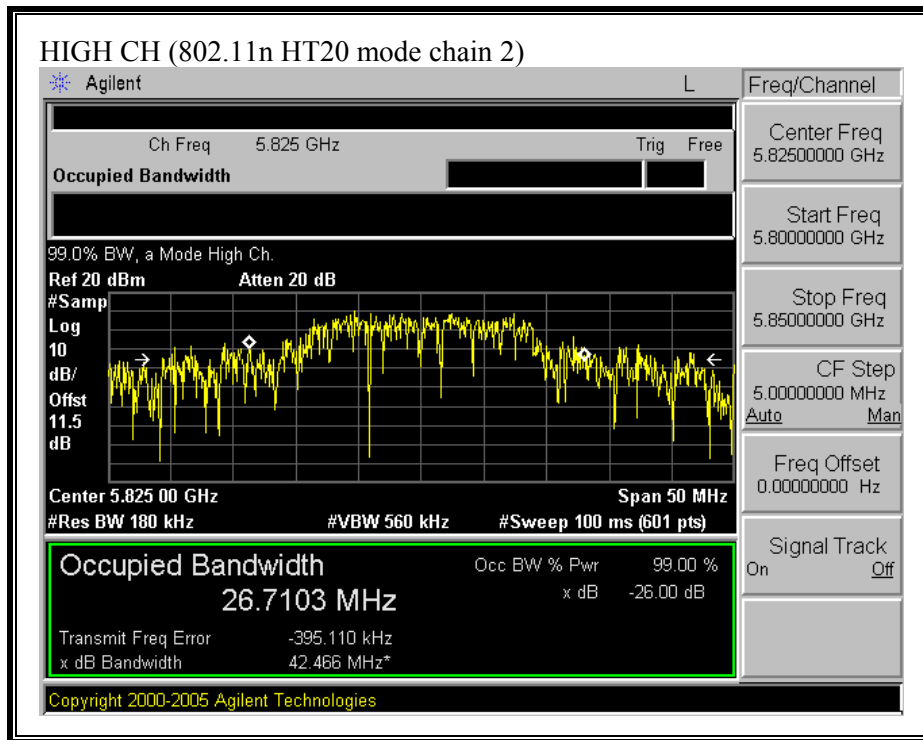




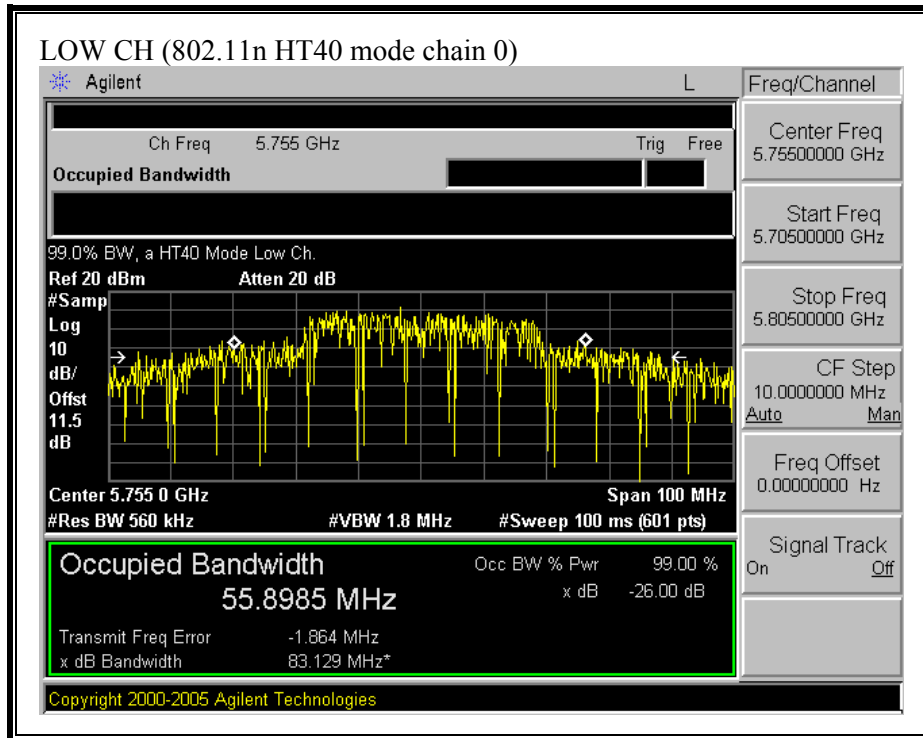
**(802.11n HT20 MODE CHAIN 2)**

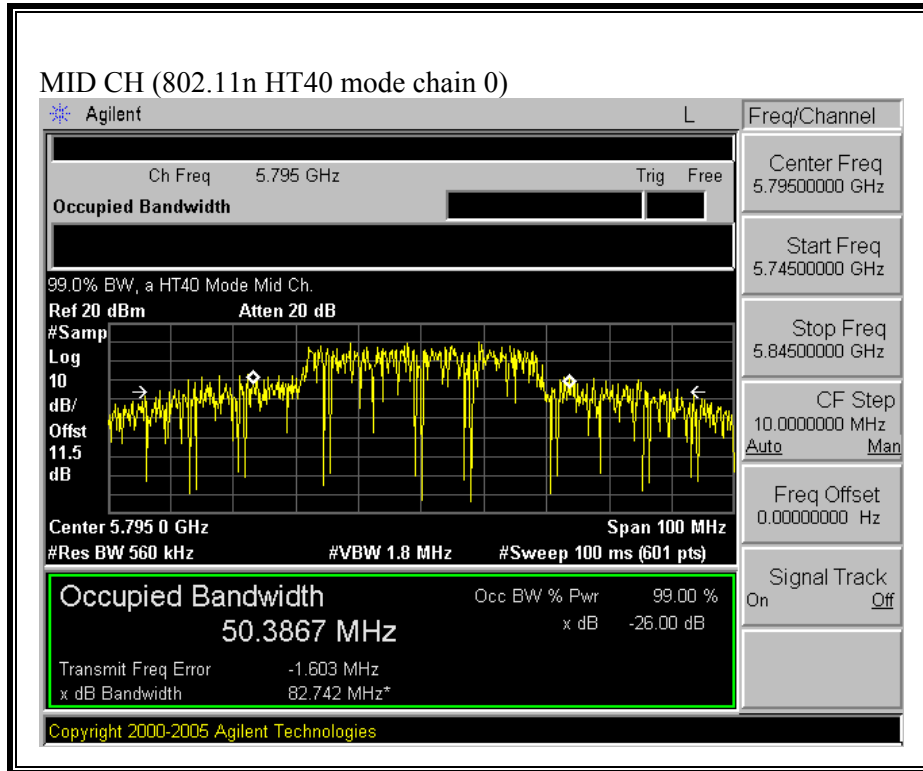


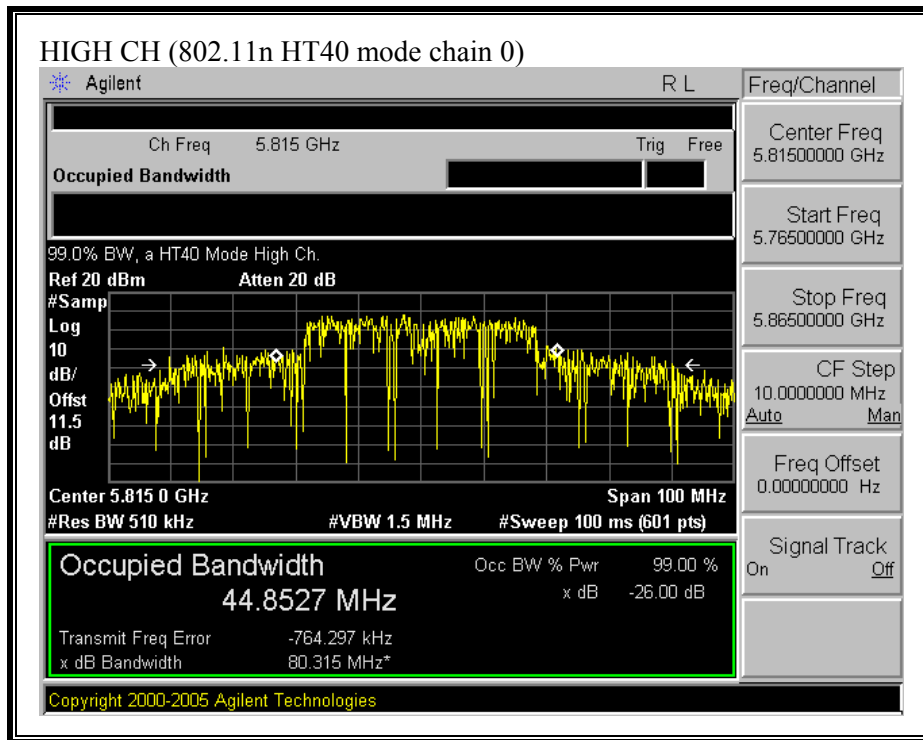




**(802.11n HT40 MODE CHAIN 0)**

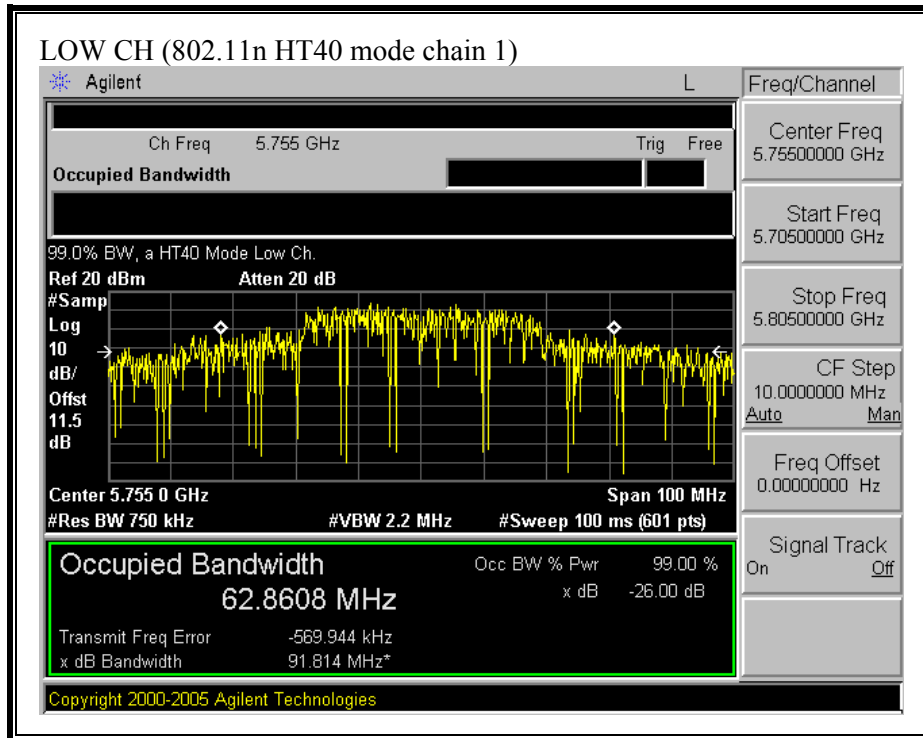


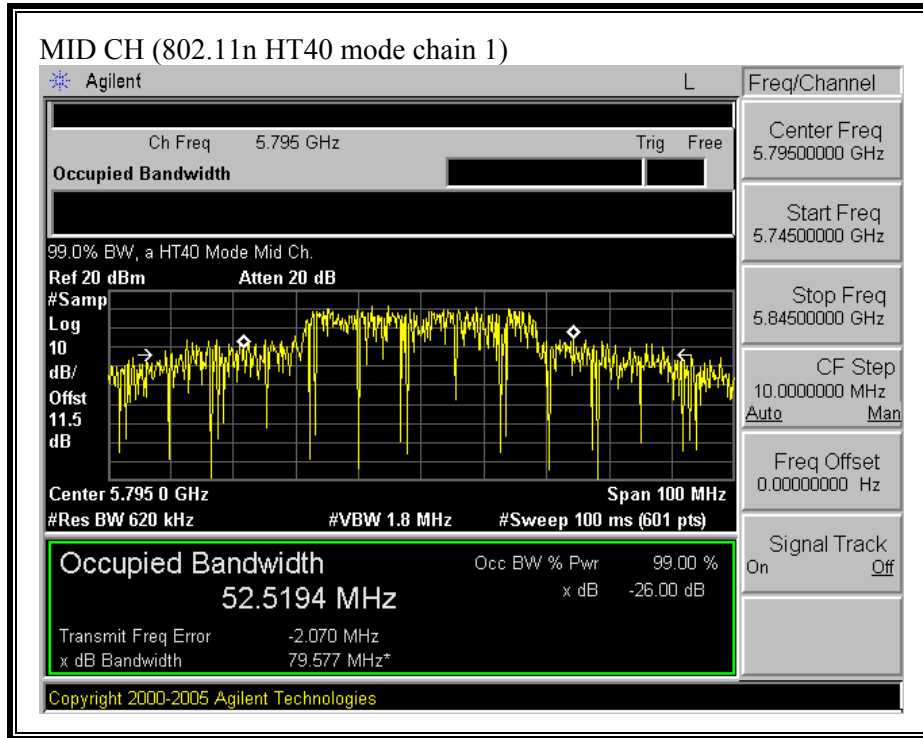


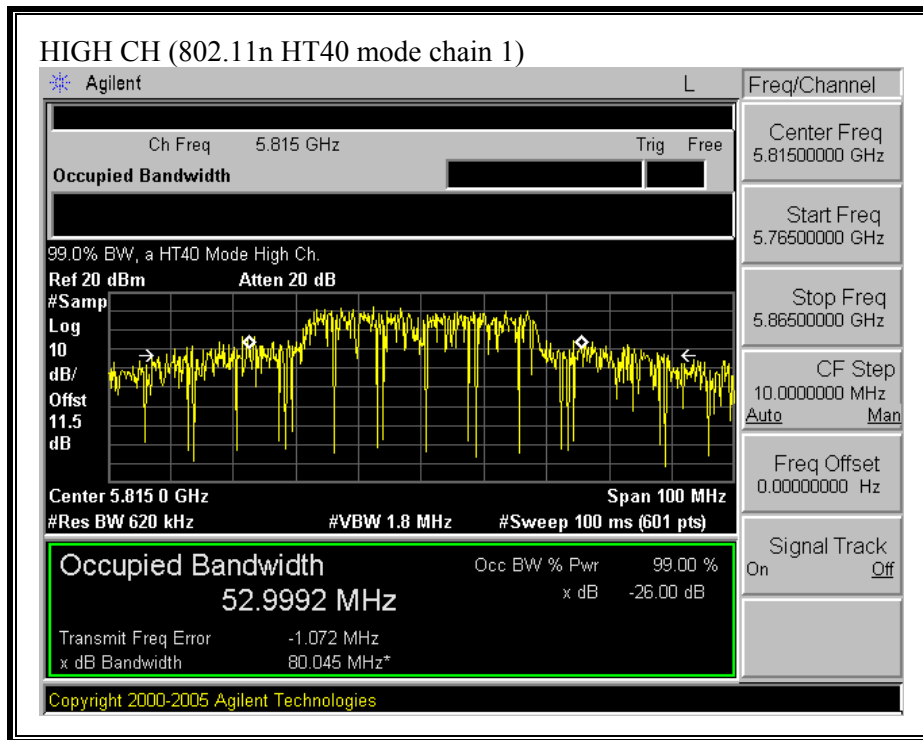




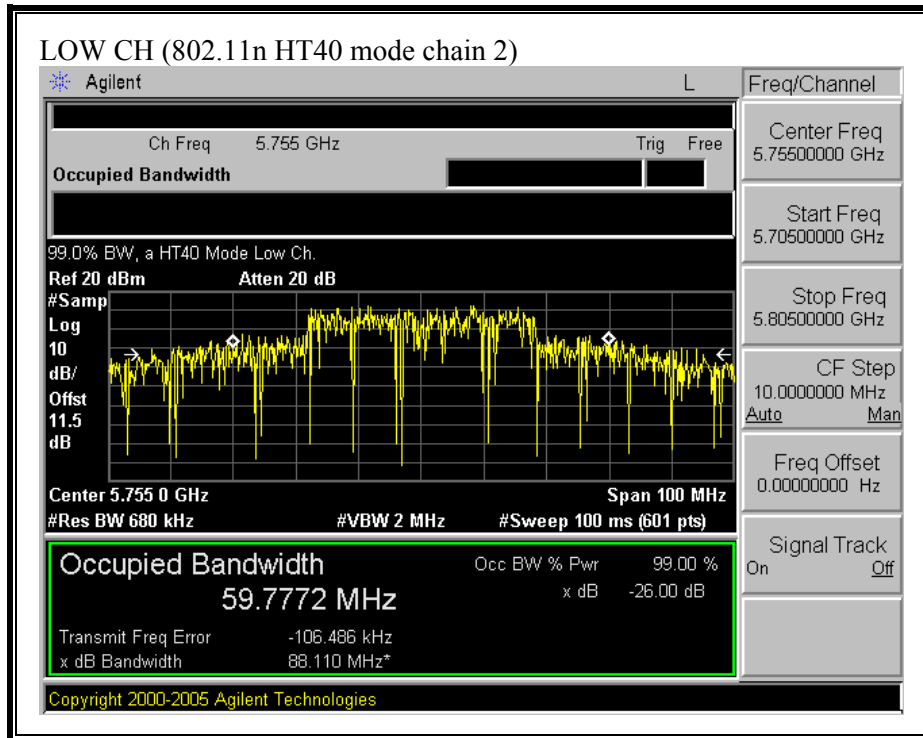
**(802.11n HT40 MODE CHAIN 1)**

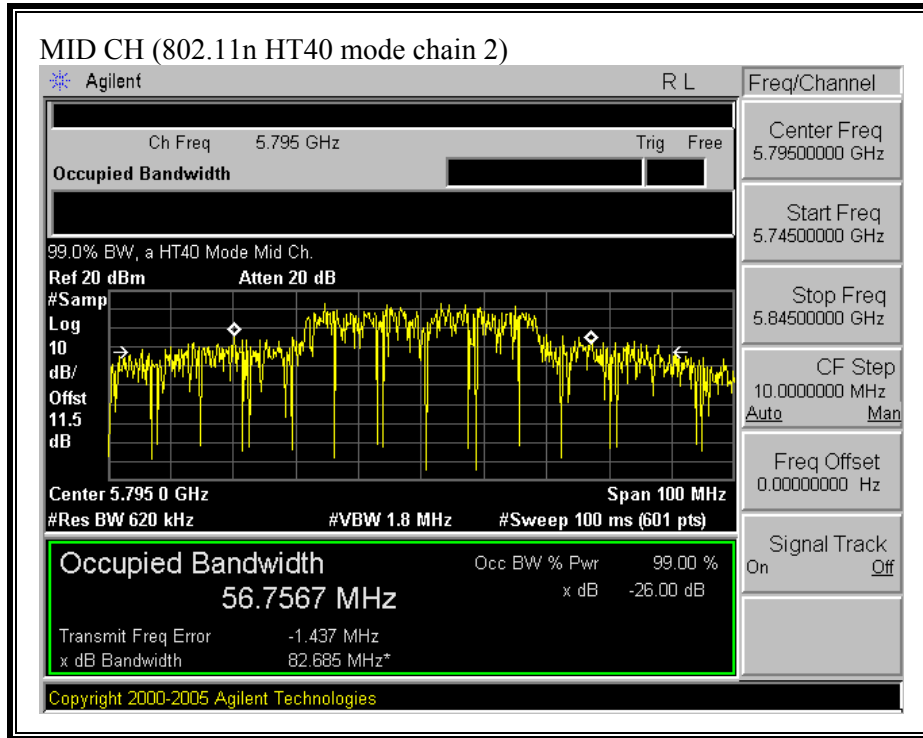


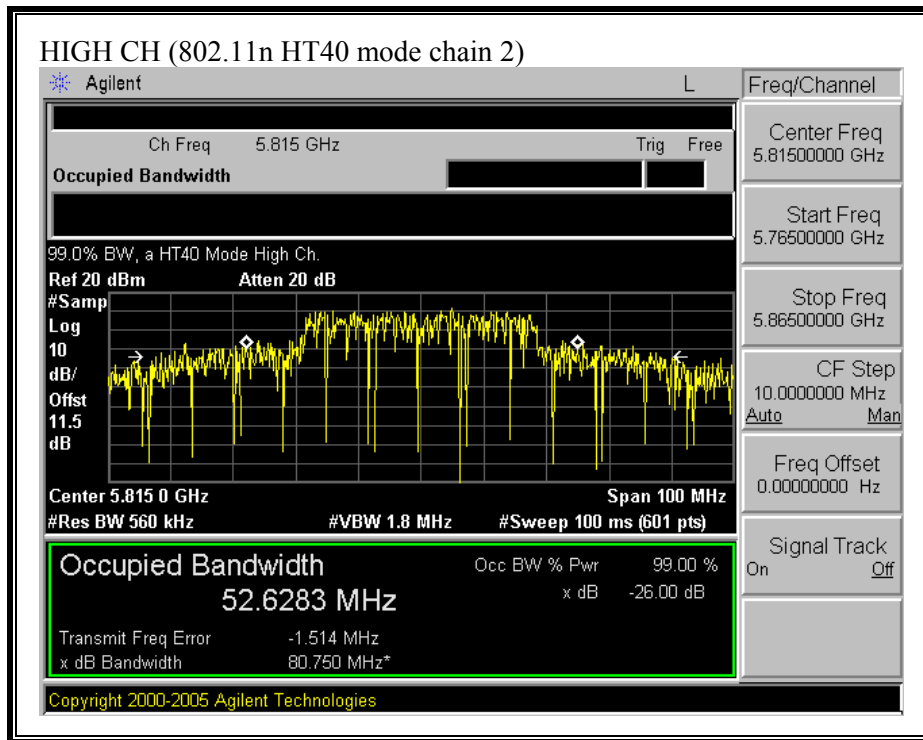




**(802.11n HT40 MODE CHAIN 2)**







### 7.2.3. PEAK OUTPUT POWER

#### LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz , and 5725-5850 MHz bands: 1 watt.

§15.247 (b) (4) (i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.

Each chain is measured separately and the total power is calculated using:

Total Power =  $10 \log (10^{\text{Chain 0 Power} / 10} + 10^{\text{Chain 1 Power} / 10} + 10^{\text{Chain 2 Power} / 10})$

**RESULTS**

No non-compliance noted:

<b>Antenna Gain (dBi)</b>	2.9
<b>10 Log (# Tx Chains)</b>	4.77
<b>Effective Legacy Gain</b>	7.67

<b>Mode Channel</b>	<b>Frequency (MHz)</b>	<b>Max Power Chain 0 (dBm)</b>	<b>Max Power Chain 1 (dBm)</b>	<b>Max Power Chain 2 (dBm)</b>	<b>Max Power Total (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
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802.11a Mode

Low	5745	21.27	21.14	21.14	25.95	28.33	-2.37
Middle	5785	23.07	22.61	22.39	27.47	28.33	-0.86
High	5825	23.42	21.13	21.21	26.83	28.33	-1.50

802.11n HT20 Mode

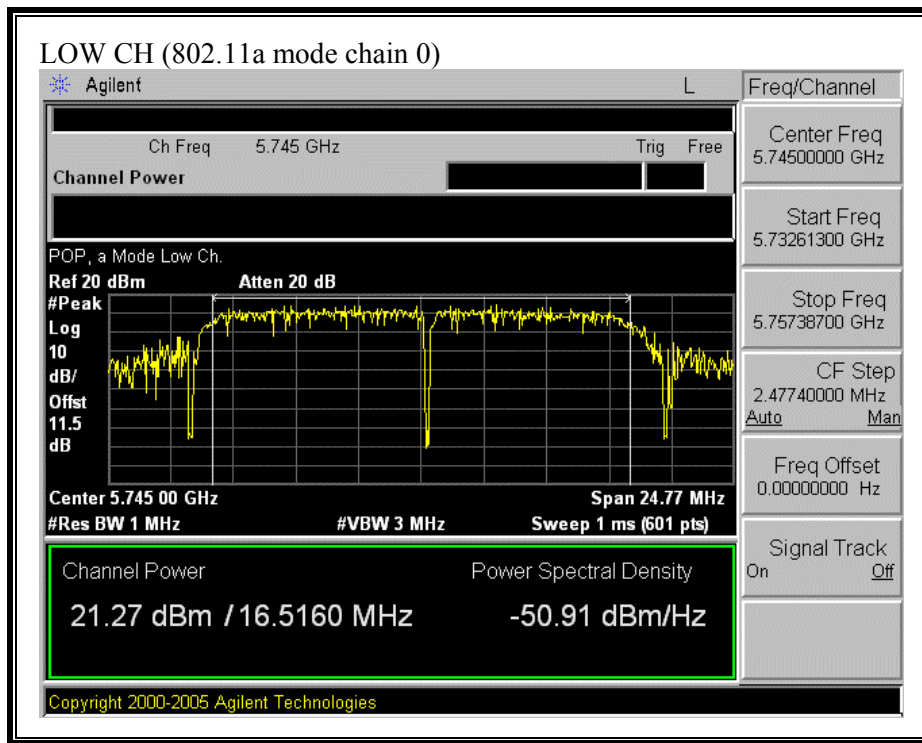
Low	5745	22.71	22.42	22.96	27.47	30.00	-2.53
Mid	5785	22.95	22.39	22.47	27.38	30.00	-2.62
High	5825	23.25	25.60	22.09	28.67	30.00	-1.33

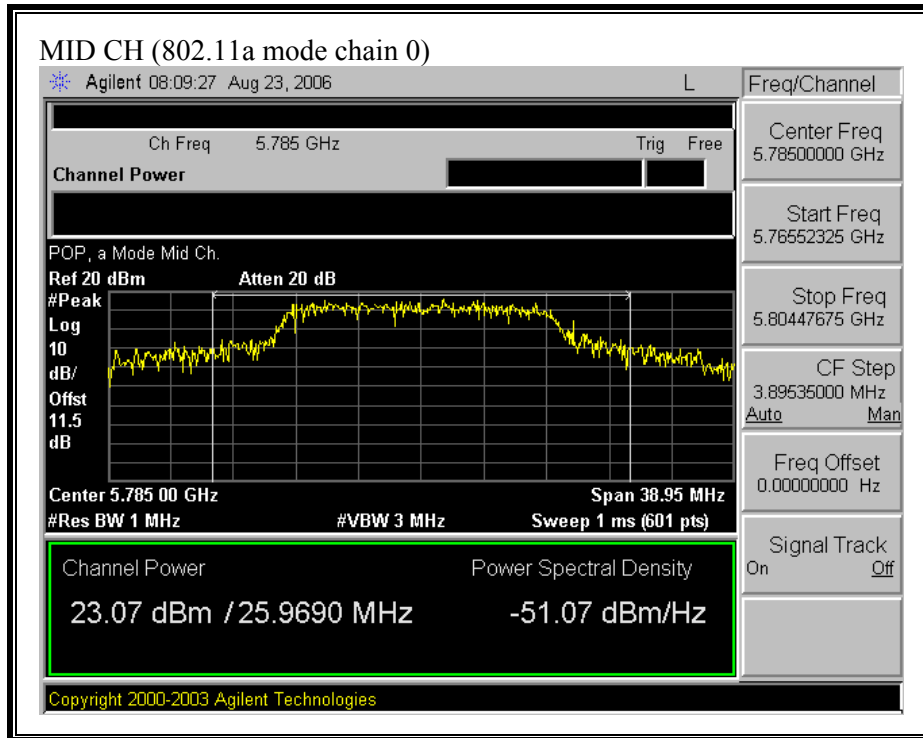
802.11n HT40 Mode

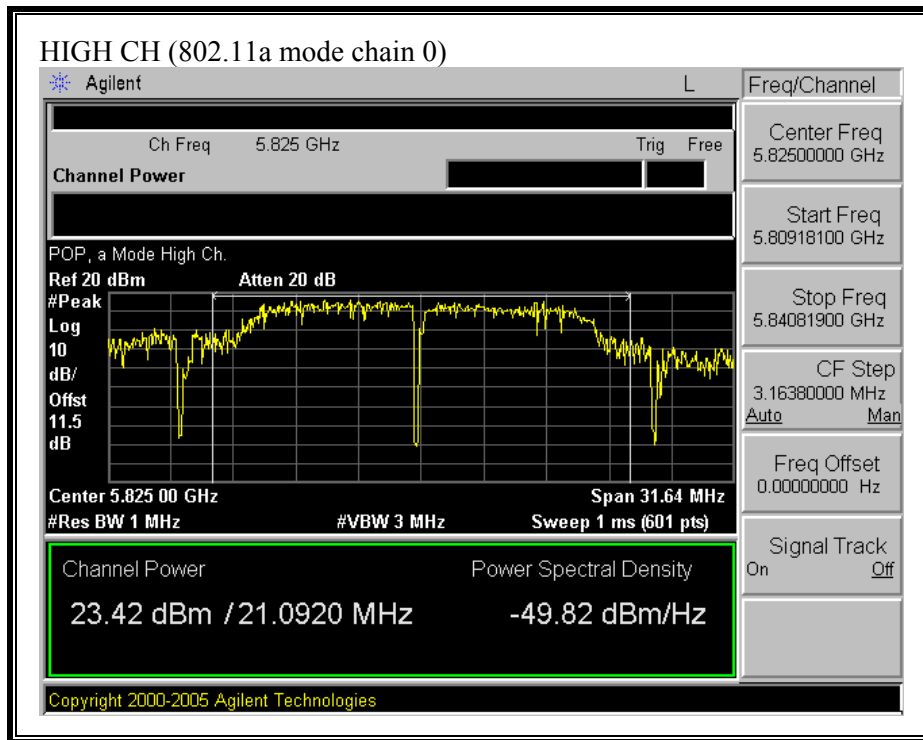
Low	5755	24.68	23.98	24.29	29.10	30.00	-0.90
Mid	5795	24.49	23.60	23.84	28.76	30.00	-1.24
High	5815	24.15	23.86	23.52	28.62	30.00	-1.38



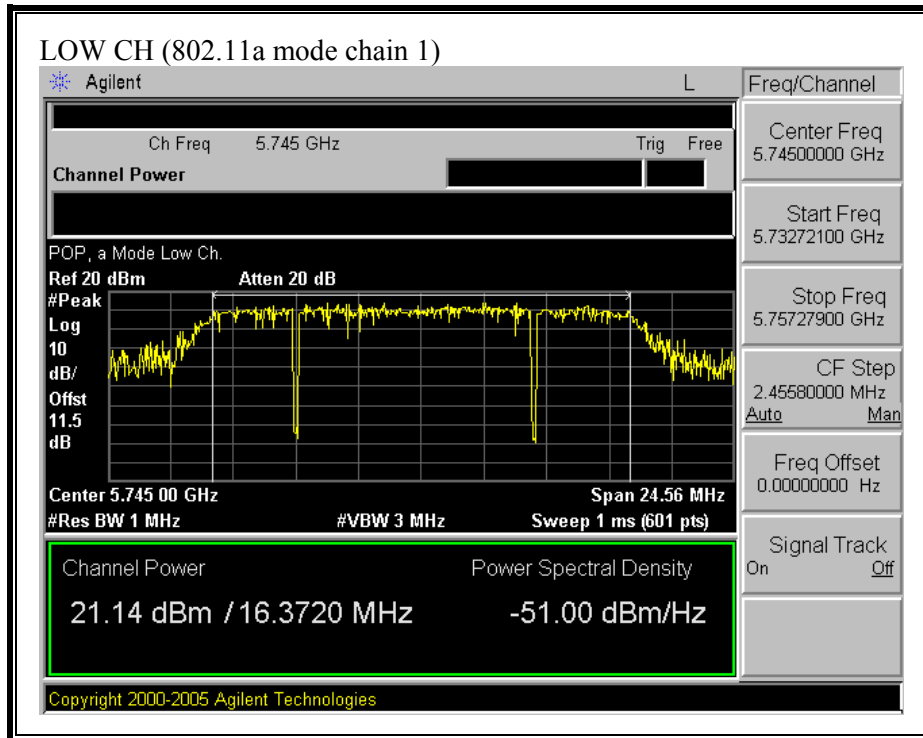
**(802.11a MODE CHAIN 0)**

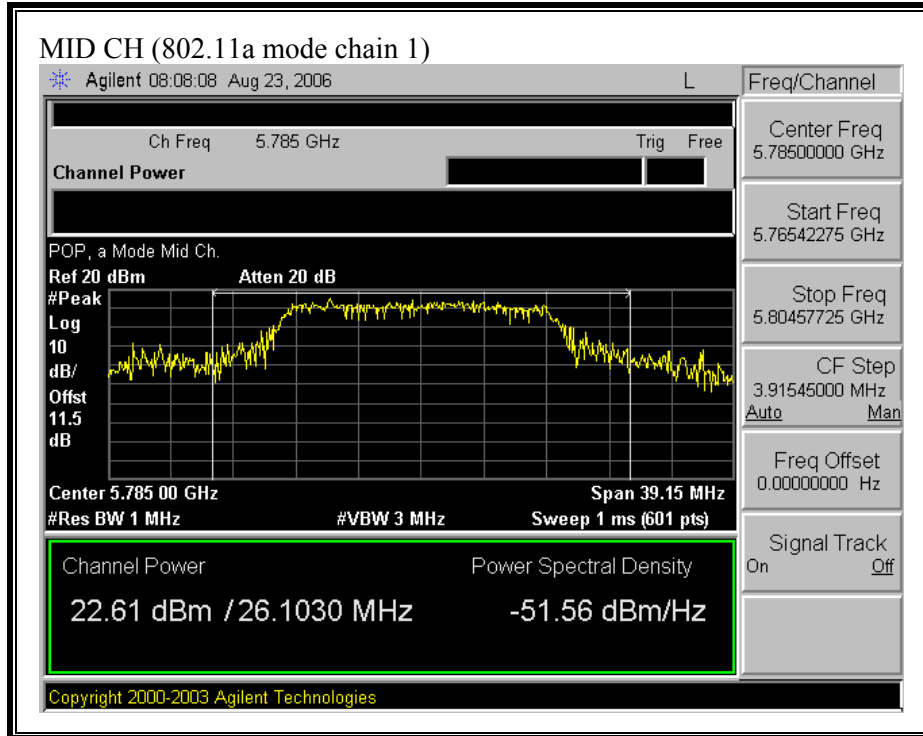


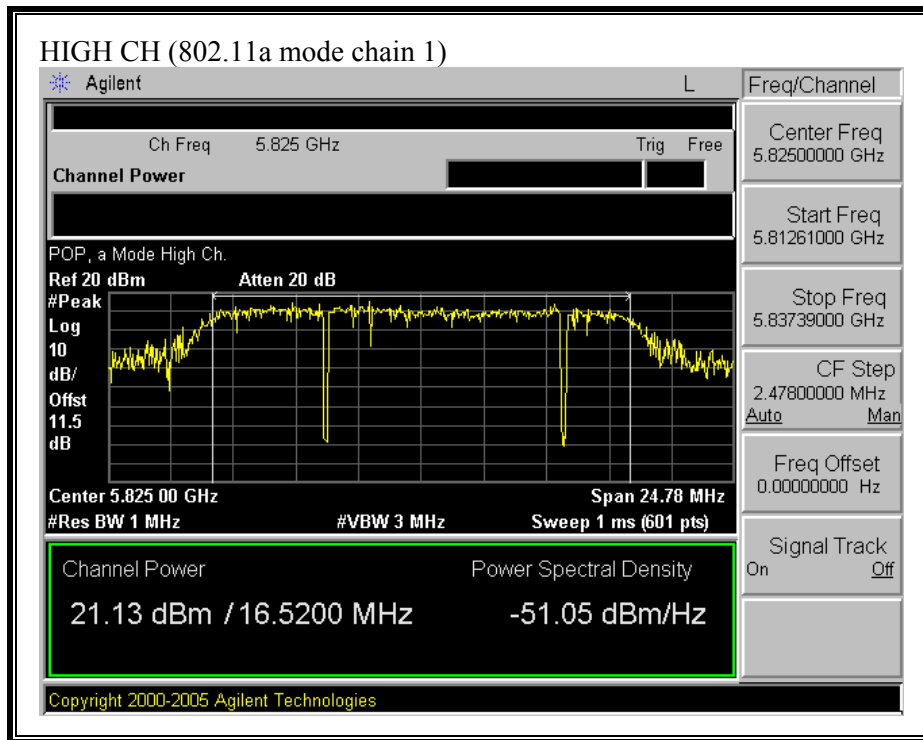




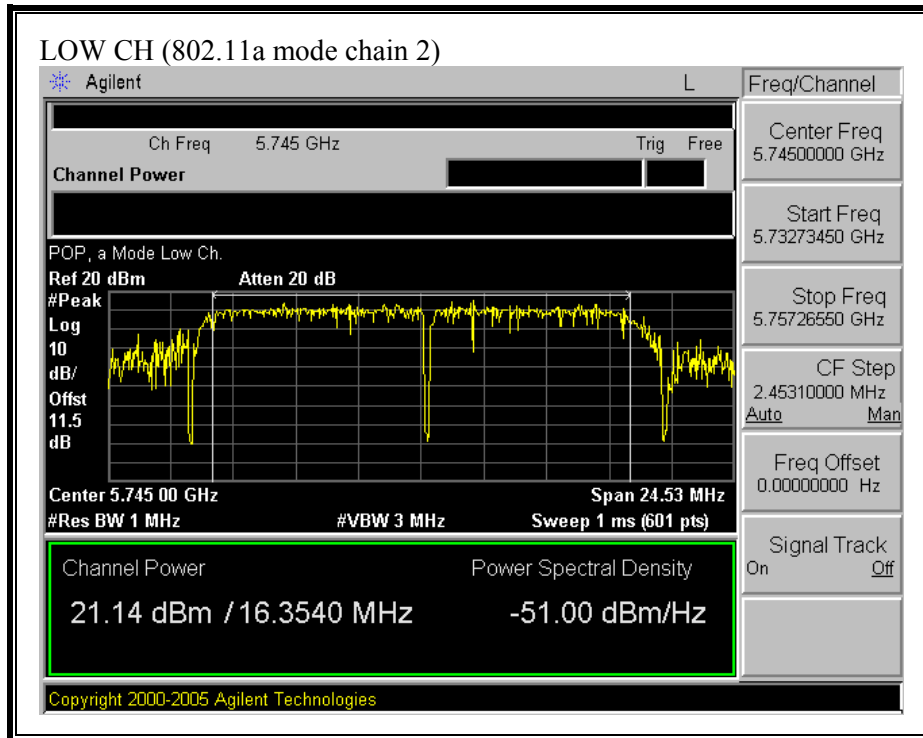
**(802.11a MODE CHAIN 1)**

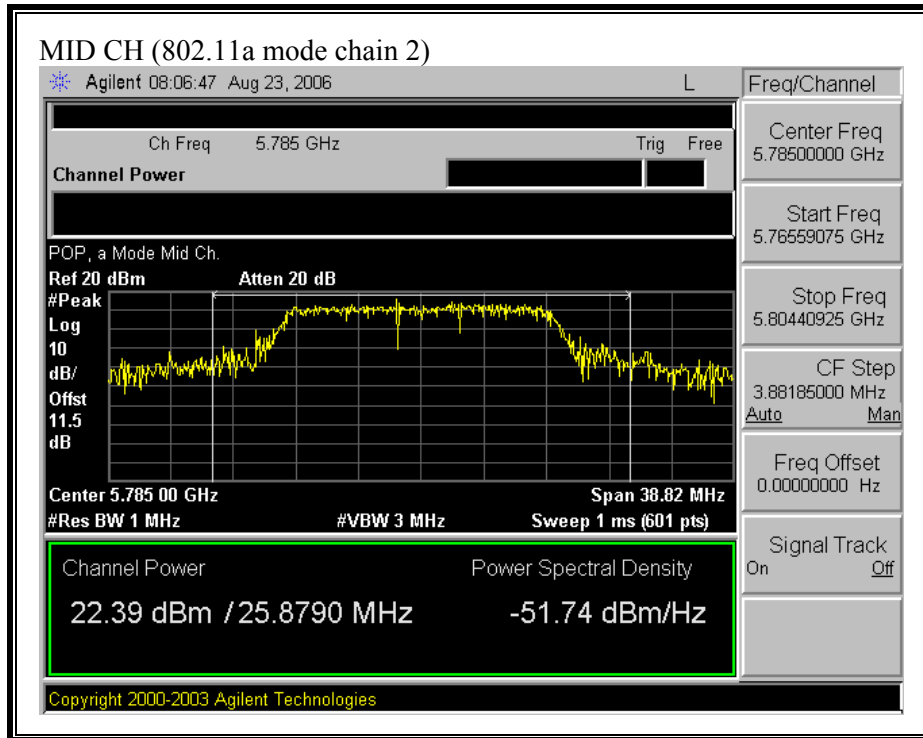




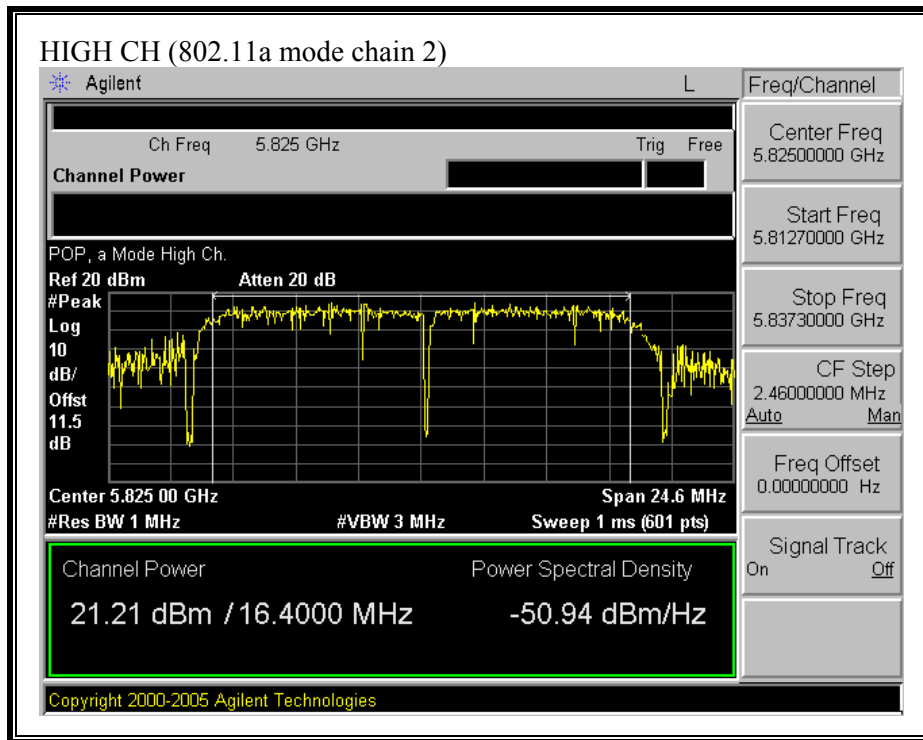


**(802.11a MODE CHAIN 2)**

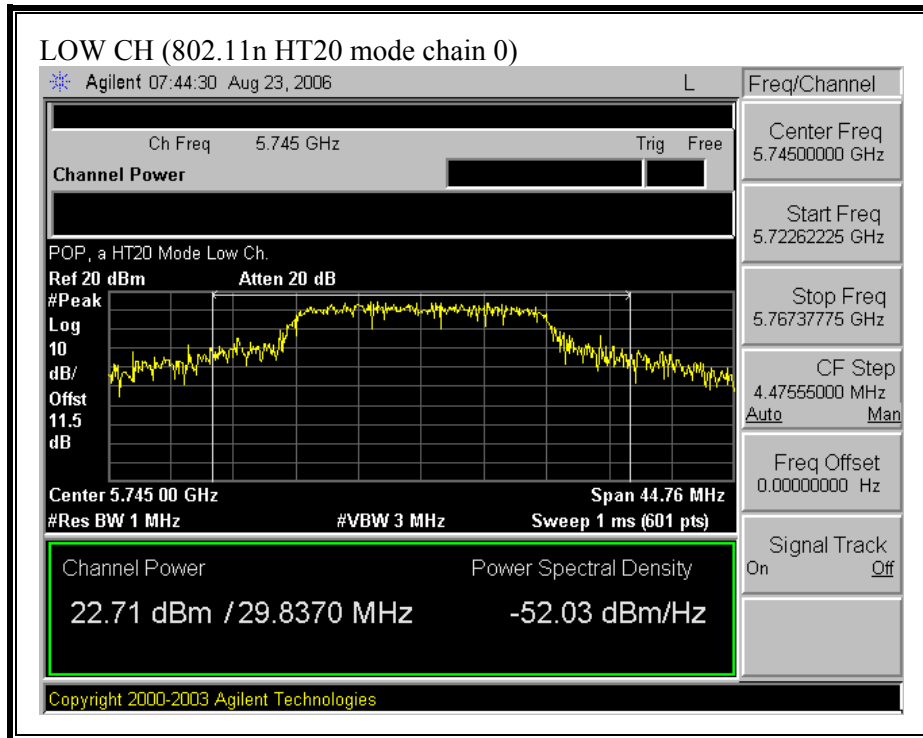


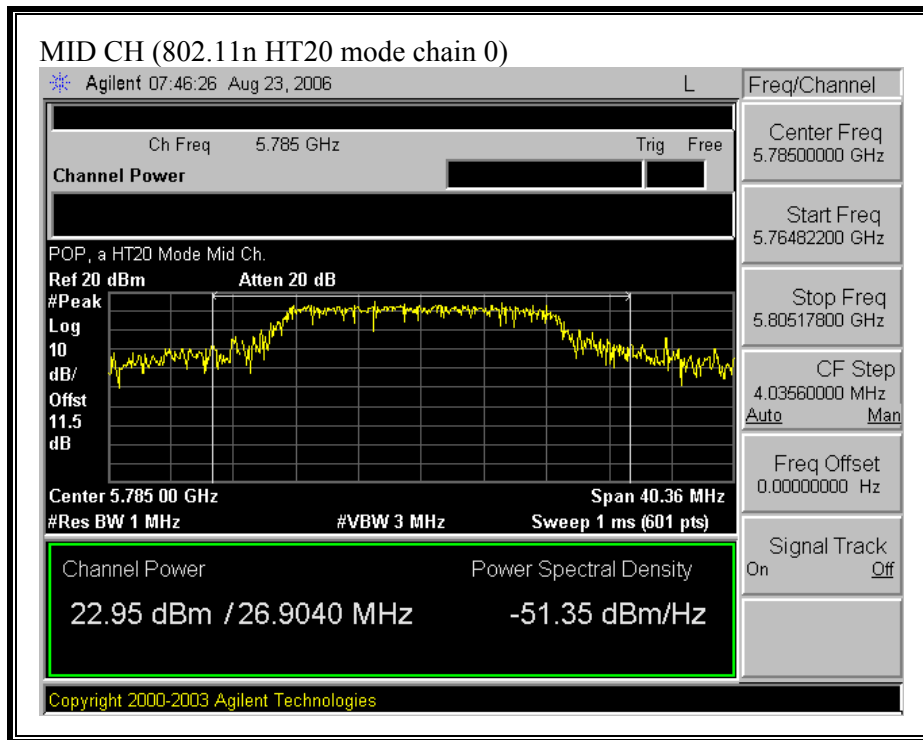


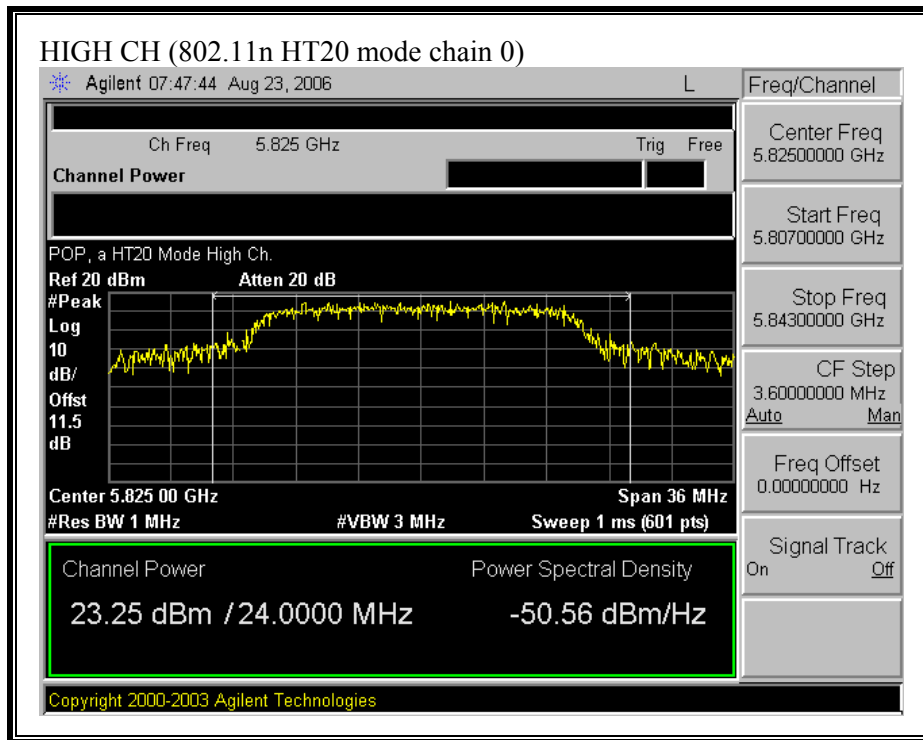




**(802.11n HT20 MODE CHAIN 0)**







**(802.11n HT20 MODE CHAIN 1)**

