



## Test Report

### Cisco Aironet 802.11n Dual Band Access Points

FCC ID: LDK102084

IC: 2461B-102084

**AIR-CAP1602y-A-K9**  
**AIR-SAP1602y-A-K9**  
**AIR-CLD1602y-A-K9**

Also covers:

AIR-CAP1602y-N-K9, AIR-SAP1602y-N-K9, AIR-CLD1602y-N-K9  
AIR-CAP1602y-T-K9, AIR-SAP1602y-T-K9, AIR-CLD1602y-T-K9  
AIR-CAP1602y-Z-K9, AIR-SAP1602y-Z-K9, AIR-CLD1602y-Z-K9

y = E (External Antenna) or I (Internal Antenna)

**2400-2483.5 MHz**

Against the following Specifications:

CFR47 Part 15.247

RSS210

Cisco Systems

170 West Tasman Drive  
San Jose, CA 95134



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## Section 1: Overview

### 1.1 Test Summary

The samples were assessed against the tests detailed in section 3 under the requirements of the following specifications:

Emission	Immunity
CFR47 Part 15.247 RSS210	N/A

The specifications listed above represent actual tests performed to demonstrate compliance against the specifications and basic standards listed on the front cover of this report. This list is not a one to one match to the front cover for one or more of the following reasons.

1. Basic standards call up many different test phenomena specifications such as the 61000-4-X series. The basic standards define which elements and levels shall be applied from these specifications and as such it is not appropriate to list the individual specifications on the front cover.
2. A Standard listed on the front cover may be required in a particular country but is not appropriate for the particular technologies included in the equipment under test. E.g. You cannot test a DC product to the mains Harmonics requirements in EN61000-3-2. See section 3.2.
3. Test results against a particular standard or specification may be included in a different test report. See section 3.2 for an EDCS reference of this data.
4. Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.
5. Where relevant, testing has been carried out to the requirements of both EN and IEC Specifications. This was possible because of the similarities of the test methods involved and the Cisco EMC test procedures.
6. Testing may have been performed to an equivalent test that satisfies the requirements of the standards and specifications listed on the front cover of the report. See section 3.2.
7. Where radiated emissions testing has been performed to EN55022/CISPR22 the additional requirements of VCCI: V- 3/2006.04, EN55022: 1994 +A1/2 and CAN/CSA- CISPR 22-02 have also been evaluated unless otherwise stated.
8. Testing to the requirements of CFR47 Part 15 was performed against the CISPR22 limits. The results are therefore deemed satisfactory evidence of compliance with Industry Canada Interference Causing Equipment Standard ICES-003.
9. Where assessment has been performed to CISPR24, all the applicable test requirements may have not been covered. Refer to the results section for the tests performed.

#### Notes:

- 1) Where a specification listed on the front cover of this report has deviations from the basic standards listed above, the additional technical requirements of the specification were also assessed.
- 2) Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.
- 3) Where relevant, testing has been carried out to the requirements of both EN and IEC Specifications. This was possible because of the similarities of the test methods involved and the Cisco EMC test procedures.



## Section 2: Assessment Information

### 2.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on the samples submitted. The testing was performed by and for the use of Cisco systems Inc:

With regard to this assessment, the following points should be noted:

- a) The results contained in this report relate only to the items tested and were obtained in the period between the date of the initial assessment and the date of issue of the report. Manufactured products will not necessarily give identical results due to production and measurement tolerances.
- b) The apparatus was set up and exercised using the configuration and modes of operation defined in this report only.
- c) Where relevant, the apparatus was only assessed using the susceptibility criteria defined in this report and the Test Assessment Plan (TAP).
- d) All testing was performed under the following environmental conditions:
  - Temperature 15°C to 35°C (54°F to 95°F)
  - Atmospheric Pressure 860mbar to 1060mbar (25.4" to 31.3")
  - Humidity 10% to 75\*%

\*[Where applicable] For ESD testing the humidity limits used were 30% to 60% and for EFT/B tests the humidity limits used were 25% to 75%.
- e) All AC testing was performed at one or more of the following supply voltages:
  - 110V 60 Hz (+/-20%)
  - 220V 50 Hz (+/-20%)

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**2.2 Date of testing**

02-July-2012 – 22-July-2012

**2.3 Report Issue Date**

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**2.4 Testing facilities**

This assessment was performed by:

**Testing Laboratory**

Cisco Systems, Inc.,	Cisco Systems, Inc.
4125 Highlander Parkway	170 West Tasman Drive
Richfield, OH 44286	San Jose, CA 95134
USA	USA

**Test Engineers**

James Nicholson

**2.5 Equipment Assessed (EUT)**

AIR-CAP1602E-A-K9 Cisco Aironet 802.11n Dual Band Access Point



## 2.6 EUT Description

The 1600 Series Cisco Aironet 802.11n Dual Band Access Points support the following modes of operation. The modes are further defined in the radio Theory of Operation. The modes included in this report represent the worst case data for all modes.

Legacy CCK, One Antenna, 1 to 11 Mbps  
Legacy CCK, Two Antennas, 1 to 11 Mbps  
Legacy CCK, Three Antennas, 1 to 11 Mbps

Non HT-20, One Antenna, 6 to 54 Mbps  
Non HT-20, Two Antennas, 6 to 54 Mbps  
Non HT-20, Three Antennas, 6 to 54 Mbps

Non HT-20 Beam Forming, Two Antennas, 6 to 54 Mbps  
Non HT-20 Beam Forming, Three Antennas, 6 to 54 Mbps

HT-20, One Antenna, M0 to M7  
HT-20, Two Antennas, M0 to M15  
HT-20, Three Antennas, M0 to M15

HT-20 STBC, Two Antennas, M0 to M7  
HT-20 STBC, Three Antennas, M0 to M7

HT-20 Beam Forming, Two Antennas, M0 to M7  
HT-20 Beam Forming, Three Antennas, M8 to M15



The following antennas are supported by this product series.

The data included in this report represent the worst case data for all antennas.

Frequency	Part Number	Antenna Type	Antenna Gain (dBi)
<b>2.4/5 GHz</b>	AIR-ANT2524DB-R	Dual-resonant black dipole	2 / 4
	AIR-ANT2524DW-R	Dual-resonant white dipole	2 / 4
	AIR-ANT2524DG-R	Dual-resonant gray dipole	2 / 4
	AIR-ANT2524V4C-R	Dual-resonant ceiling mount omni (4-pack)	2 / 4
	Internal	Omni-Directional	4 / 4
	AIR-ANT2544V4M-R	Dual-resonant omni (4-pack)	4 / 4
	AIR-ANT2566P4W-R	Dual-resonant "directional" antenna (4-pack)	6 / 6



#### Section 4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing. Please also refer to the "Justification for worst Case test Configuration" section of this report for further details on the selection of EUT samples.

##### 4.1 Sample Details (Photographs of the test samples, where appropriate can be found in appendix H)

Sample No.	Equipment Details	Part Number	Manufacturer	Hardware Rev.	Firmware Rev.	Software Rev.	Serial Number
S01	AIR-CAP1602E-A-K9		Cisco Systems	NA	NA	NA	
S02	AIR-PWR-B	341-0306-01	Cisco Systems	NA	NA	NA	

##### 4.2 System Details

System #	Description	Samples
1	EUT	S01, S02

##### 4.3 Mode of Operation Details

Mode#	Description	Comments
1	Continuous Transmitting	Continuous Transmitting

All tests in this report were performed as described in FCC KDB 662911 D01





## Appendix A: Emission Test Results

**Testing Laboratory:** Cisco Systems, Inc., 4125 Highlander Parkway, Richfield, OH, USA

### Target Maximum Channel Power

The following table details the maximum supported Total Channel Power for all operating modes.

Operating Mode	Maximum Channel Power (dBm)		
	Frequency (MHz)		
	2412	2437	2462
Legacy CCK, 1 to 11 Mbps	22	22	22
Non HT-20, 6 to 54 Mbps	19	22	19
Non HT-20 Beam Forming, 6 to 54 Mbps	17	22	17
HT-20, M0 to M15	17	22	18
HT-20 STBC, M0 to M7	17	22	18
HT-20 Beam Forming, M0 to M7	16	22	15
HT-20 Beam Forming, M8 to M15	17	22	17



## 6dB Bandwidth

15.247 / RSS-210 A8.2: Systems using digital modulation techniques may operate in the 2400-2483.5MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.

Connect the antenna port(s) to the spectrum analyzer input. Using the spectrum analyzer Channel Bandwidth mode, configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).

Center Frequency:	Frequency from table below
Span:	2 x Nominal Bandwidth (e.g. 40MHz for a 20MHz channel)
Reference Level:	20 dBm
Attenuation:	10 dB
Sweep Time:	5 s
Resolution Bandwidth:	100 kHz
Video Bandwidth:	100 kHz
X dB Bandwidth:	6 dB
Detector:	Peak
Trace:	Single

Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:

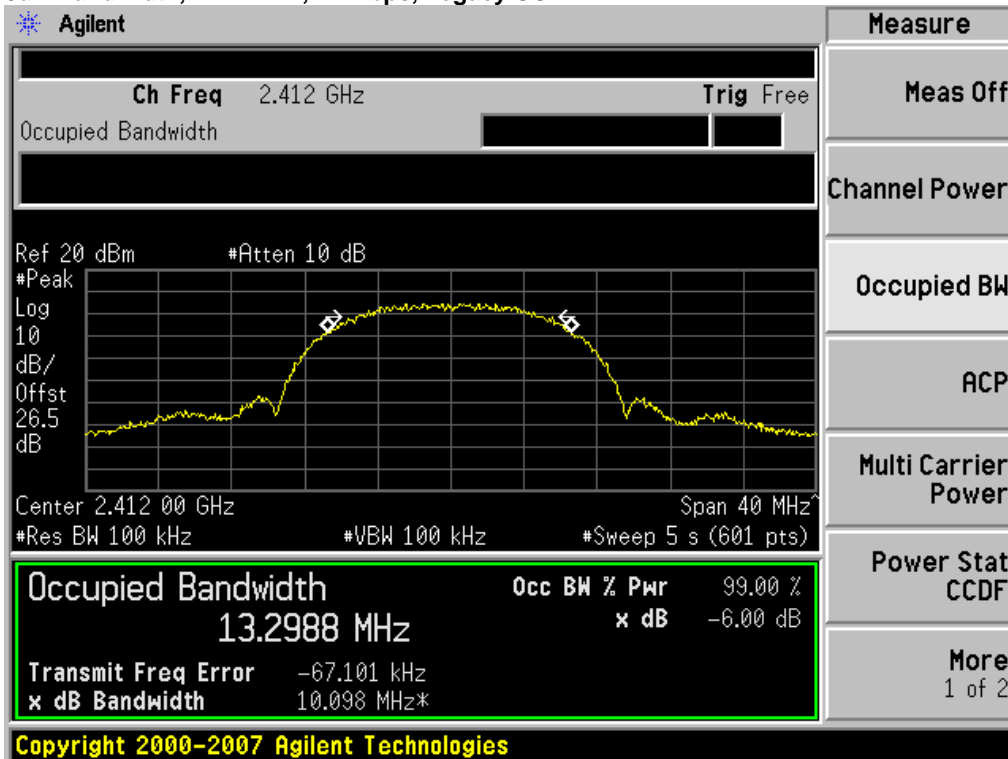


**6dB Channel Bandwidth**

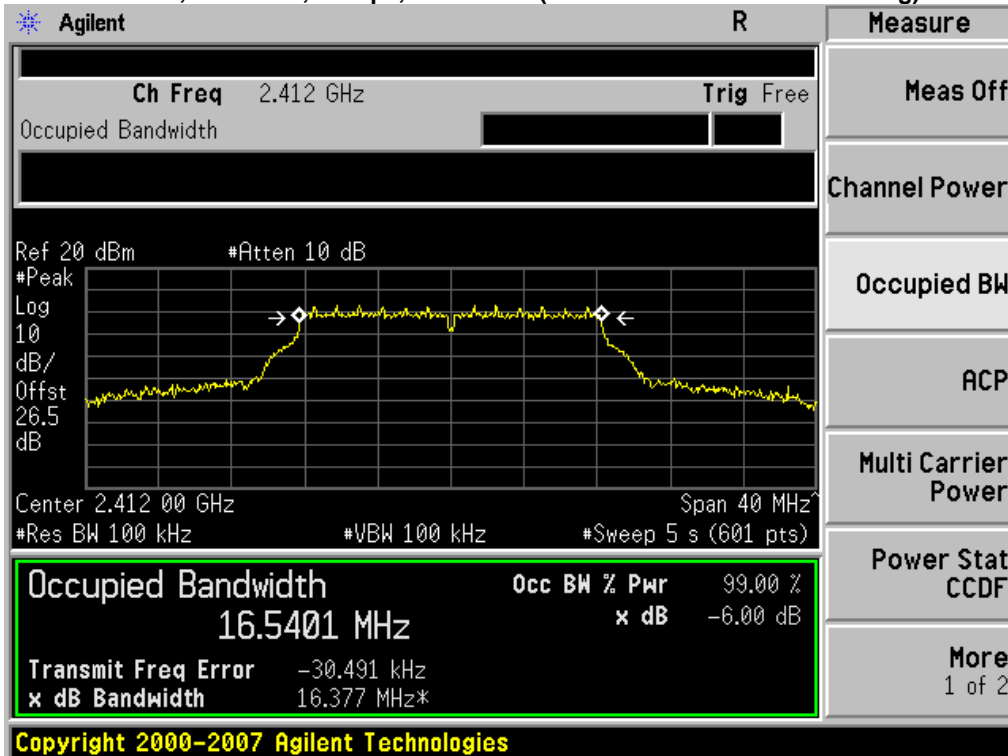
Frequency (MHz)	Mode	Data Rate (Mbps)	6dB BW (MHz)	Limit (kHz)	Margin (MHz)
2412	Legacy CCK, 1 to 11 Mbps	11	10.1	>500	9.6
	Non HT-20, 6 to 54 Mbps	6	16.4	>500	15.9
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	16.4	>500	15.9
	HT-20, M0 to M15	m0	17.7	>500	17.2
	HT-20 STBC, M0 to M7	m0	17.7	>500	17.2
	HT-20 Beam Forming, M0 to M15	m0	17.7	>500	17.2
2437	Legacy CCK, 1 to 11 Mbps	11	9.6	>500	9.1
	Non HT-20, 6 to 54 Mbps	6	16.4	>500	15.9
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	16.4	>500	15.9
	HT-20, M0 to M15	m0	17.7	>500	17.2
	HT-20 STBC, M0 to M7	m0	17.7	>500	17.2
	HT-20 Beam Forming, M0 to M15	m0	17.7	>500	17.2
2462	Legacy CCK, 1 to 11 Mbps	11	10.0	>500	9.5
	Non HT-20, 6 to 54 Mbps	6	16.6	>500	16.1
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	16.6	>500	16.1
	HT-20, M0 to M15	m0	17.6	>500	17.1
	HT-20 STBC, M0 to M7	m0	17.6	>500	17.1
	HT-20 Beam Forming, M0 to M15	m0	17.6	>500	17.1



6dB Bandwidth, 2412 MHz, 11 Mbps, Legacy CCK

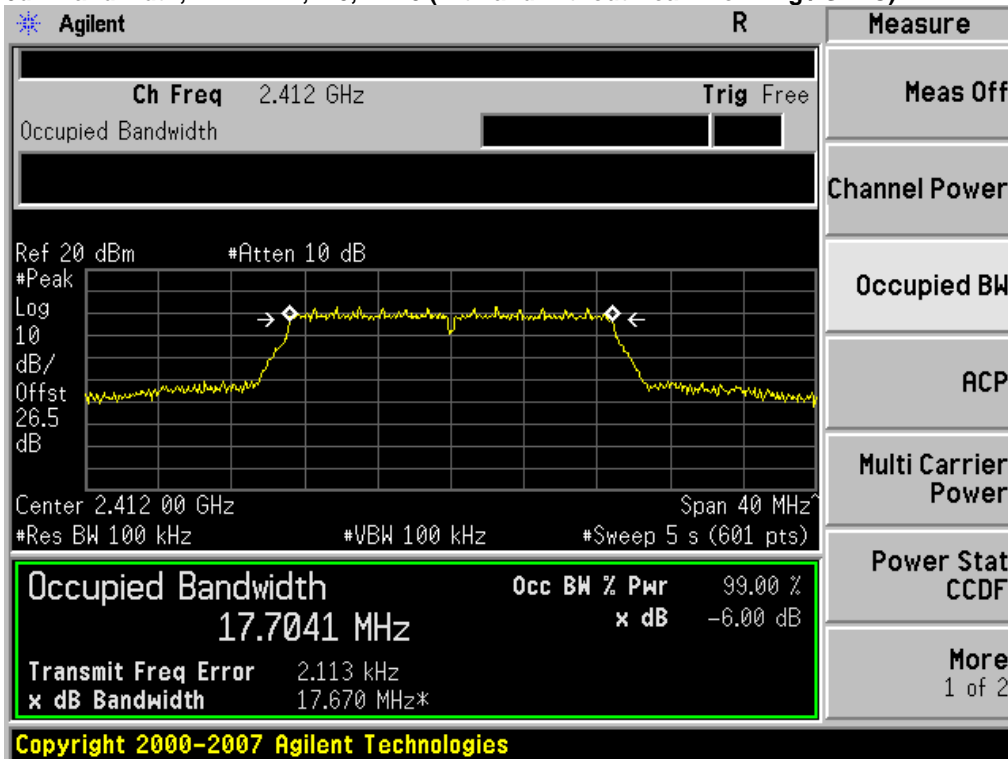


6dB Bandwidth, 2412 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)

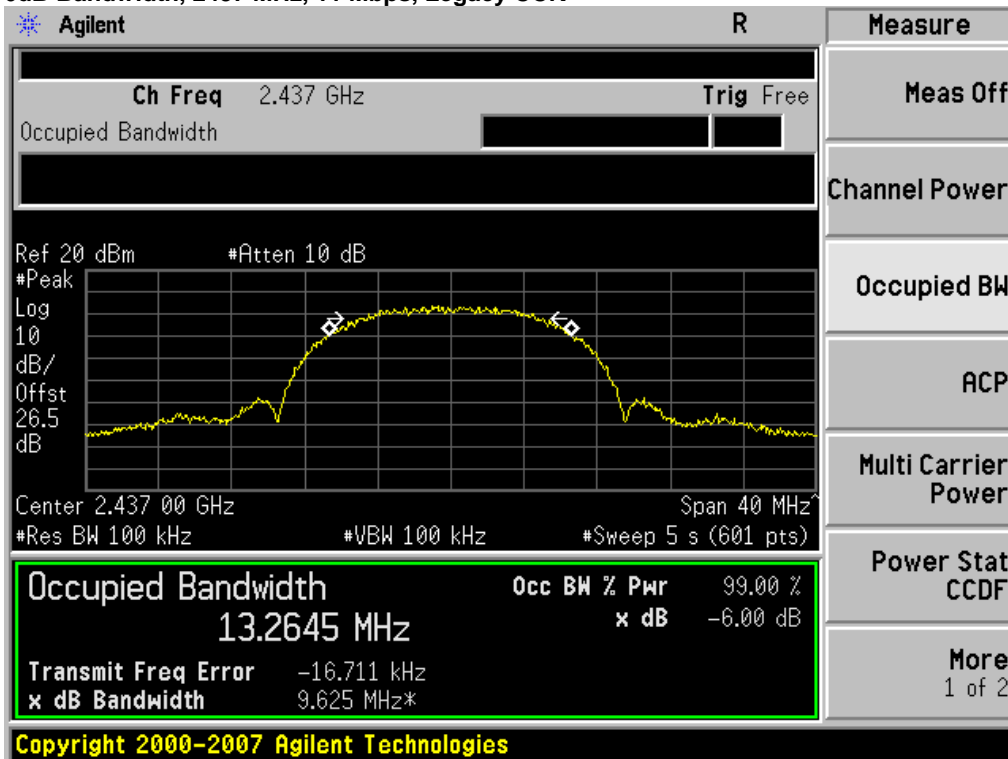




6dB Bandwidth, 2412 MHz, m0, HT20 (with and without Beam Forming / STBC)

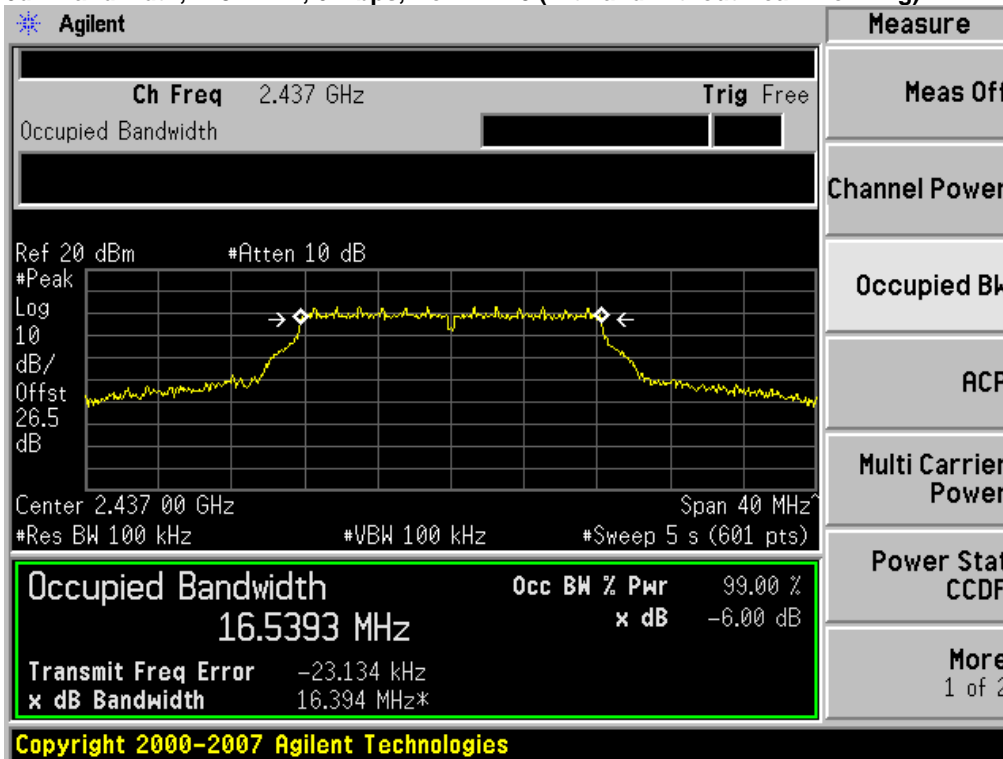


6dB Bandwidth, 2437 MHz, 11 Mbps, Legacy CCK

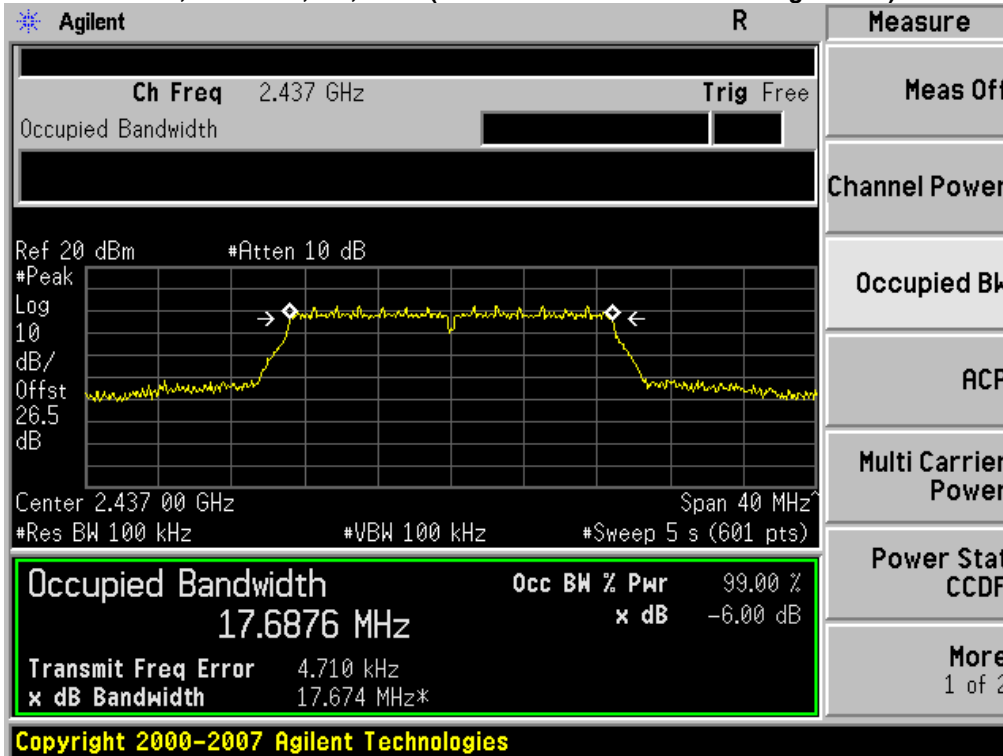




6dB Bandwidth, 2437 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)

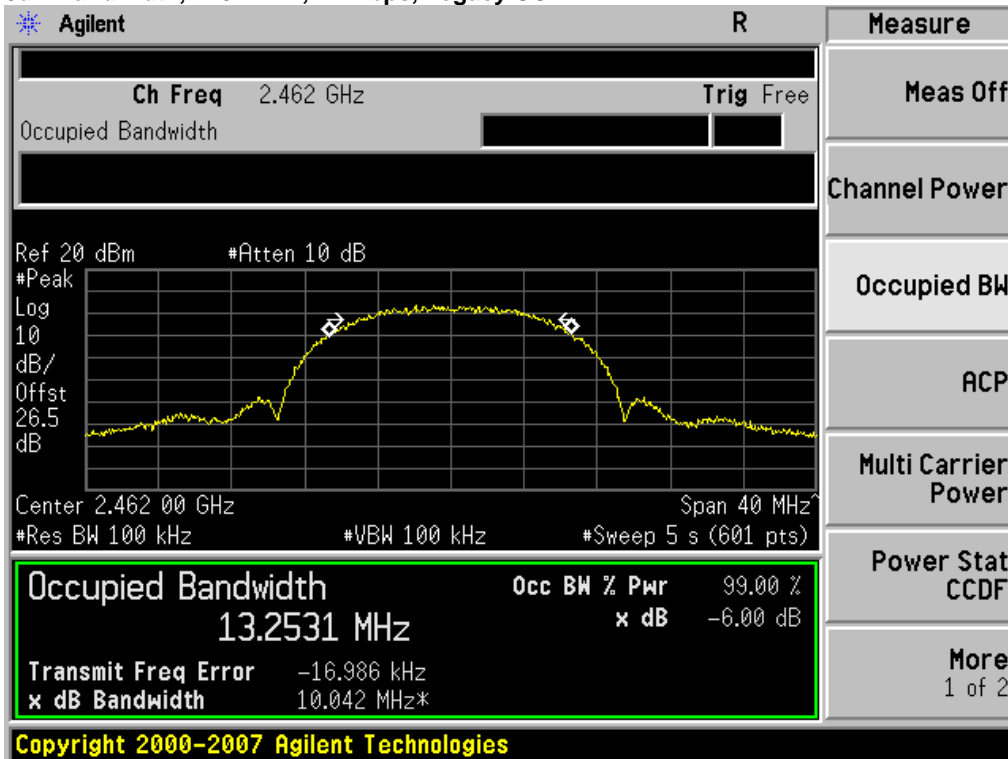


6dB Bandwidth, 2437 MHz, m0, HT20 (with and without Beam Forming / STBC)

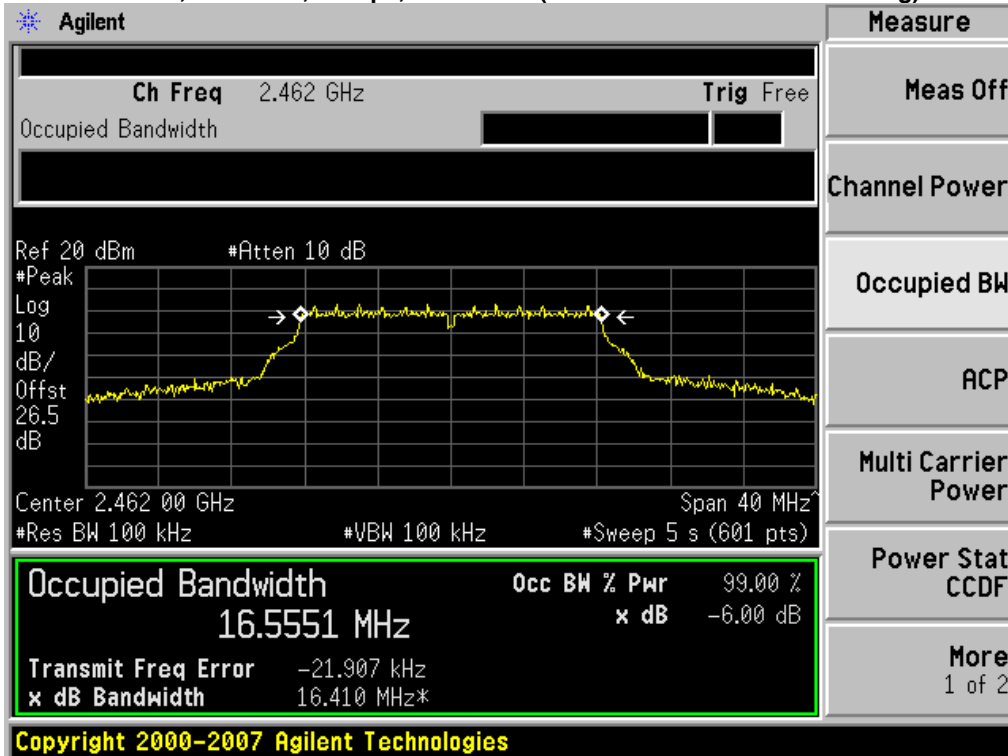




6dB Bandwidth, 2462 MHz, 11 Mbps, Legacy CCK



6dB Bandwidth, 2462 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)





6dB Bandwidth, 2462 MHz, m0, HT20 (with and without Beam Forming / STBC)

Agilent
Measure

Ch Freq 2.462 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm #Atten 10 dB

Center 2.462 00 GHz Span 40 MHz

#Res BW 100 kHz #VBW 100 kHz #Sweep 5 s (601 pts)

<b>Occupied Bandwidth</b>	<b>Occ BW % Pwr</b>	99.00 %
17.6992 MHz	x dB	-6.00 dB
<b>Transmit Freq Error</b>		2.404 kHz
<b>x dB Bandwidth</b>		17.683 MHz*

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Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More 1 of 2





## 99% and 26dB Bandwidth

Connect the antenna port(s) to the spectrum analyzer input. Using the spectrum analyzer Channel Bandwidth mode, configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).

Center Frequency:	Frequency from table below
Span:	2 x Nominal Bandwidth (e.g. 40MHz for a 20MHz channel)
Reference Level:	20 dBm
Attenuation:	10 dB
Sweep Time:	5 s
Resolution Bandwidth:	1%-3% of 26 dB Bandwidth
Video Bandwidth:	≥Resolution Bandwidth
X dB Bandwidth:	26 dB
Detector:	Peak
Trace:	Single

Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:

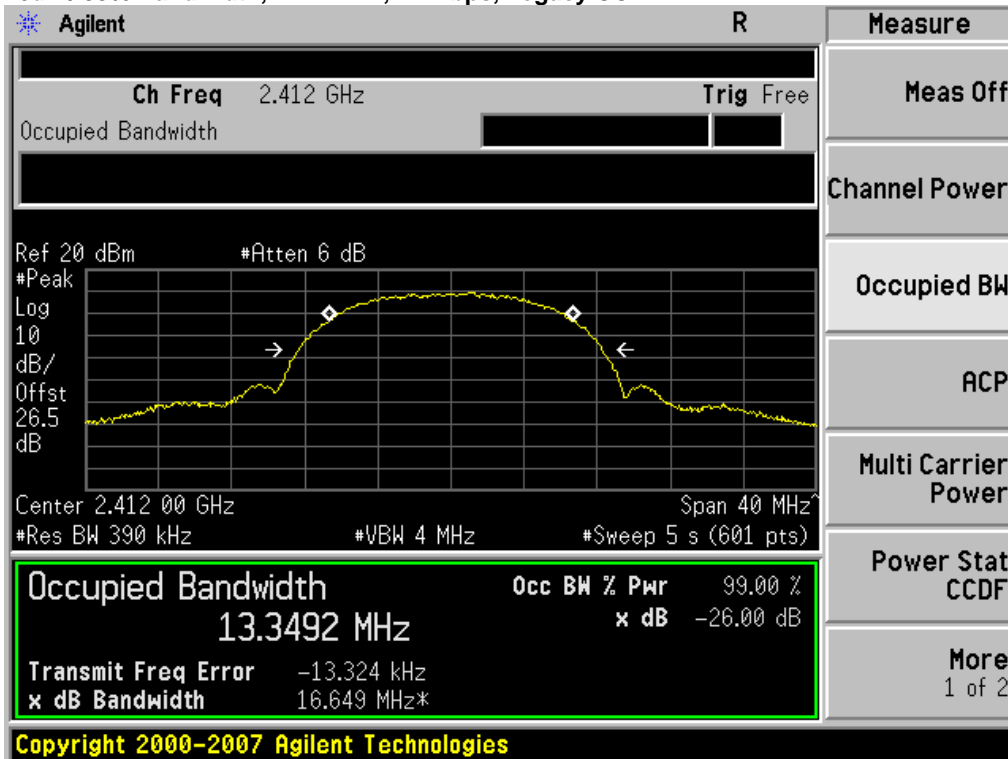


**99% and 26dB Bandwidth**

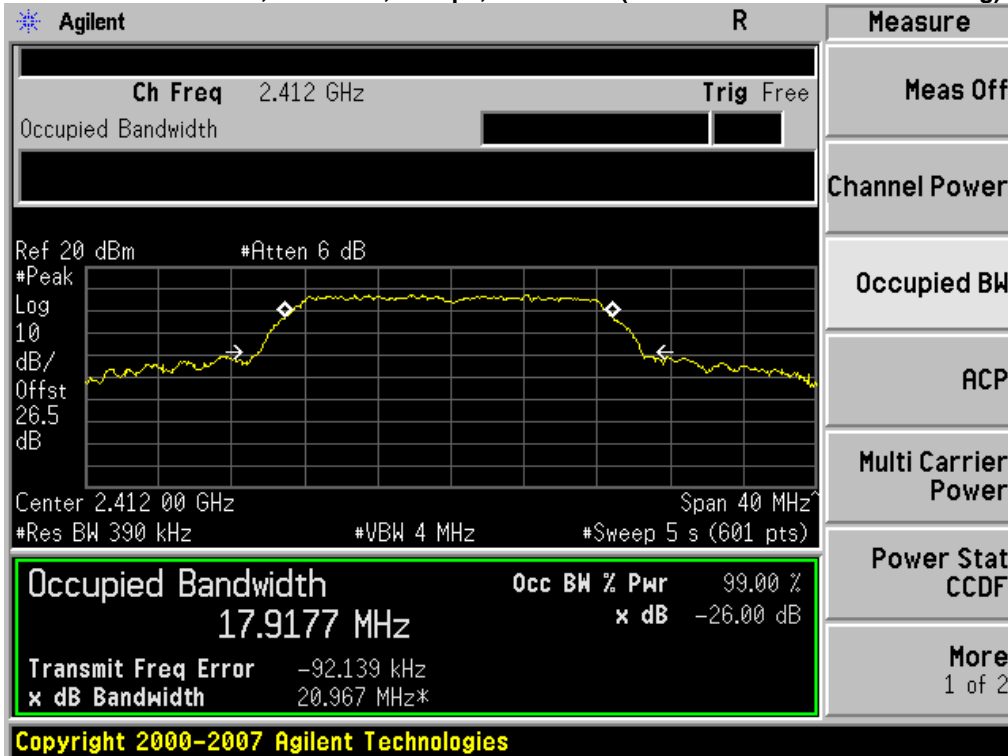
Frequency (MHz)	Mode	Data Rate (Mbps)	26dB BW (MHz)	99% BW (MHz)
2412	Legacy CCK, 1 to 11 Mbps	11	<b>16.6</b>	13.3
	Non HT-20, 6 to 54 Mbps	6	<b>20.9</b>	17.9
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	<b>20.9</b>	18.2
	HT-20, M0 to M15	m0	<b>30.0</b>	18.3
	HT-20 STBC, M0 to M7	m0	<b>30.0</b>	18.3
	HT-20 Beam Forming, M0 to M15	m0	<b>30.0</b>	18.3
2437	Legacy CCK, 1 to 11 Mbps	11	<b>16.7</b>	13.3
	Non HT-20, 6 to 54 Mbps	6	<b>21.2</b>	17.9
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	<b>21.2</b>	17.9
	HT-20, M0 to M15	m0	<b>22.9</b>	18.2
	HT-20 STBC, M0 to M7	m0	<b>22.9</b>	18.2
	HT-20 Beam Forming, M0 to M15	m0	<b>22.9</b>	18.2
2462	Legacy CCK, 1 to 11 Mbps	11	<b>16.7</b>	13.3
	Non HT-20, 6 to 54 Mbps	6	<b>25.1</b>	17.9
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	<b>25.1</b>	17.9
	HT-20, M0 to M15	m0	<b>20.9</b>	18.2
	HT-20 STBC, M0 to M7	m0	<b>20.9</b>	18.2
	HT-20 Beam Forming, M0 to M15	m0	<b>20.9</b>	18.2



26dB / 99% Bandwidth, 2412 MHz, 11 Mbps, Legacy CCK

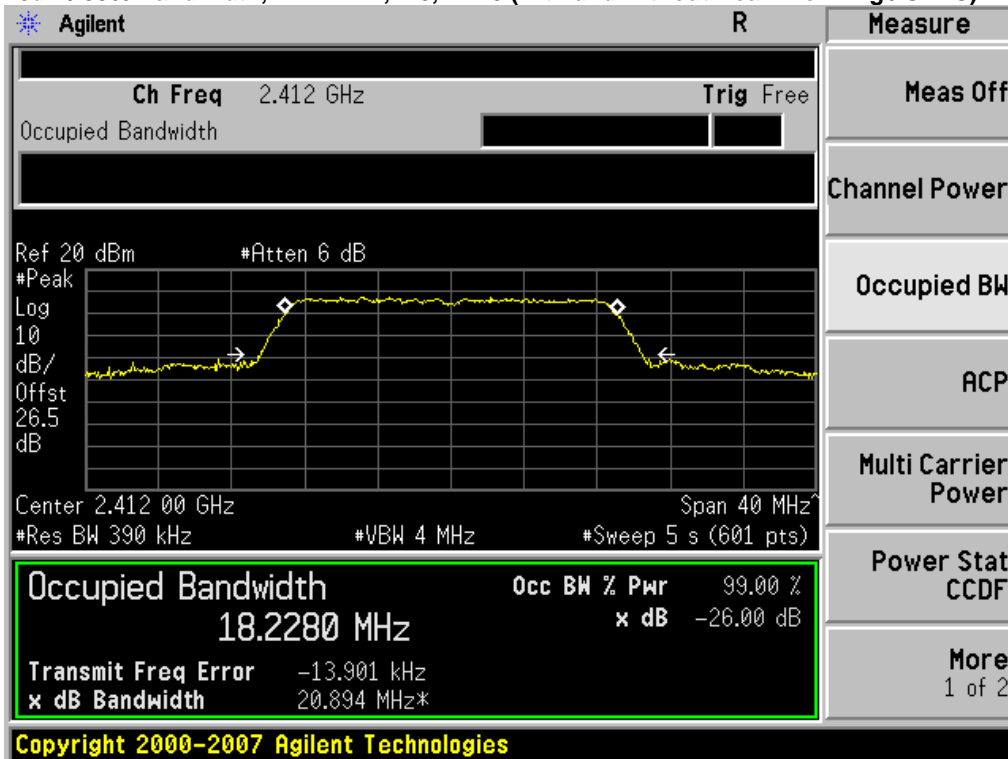


26dB / 99% Bandwidth, 2412 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)

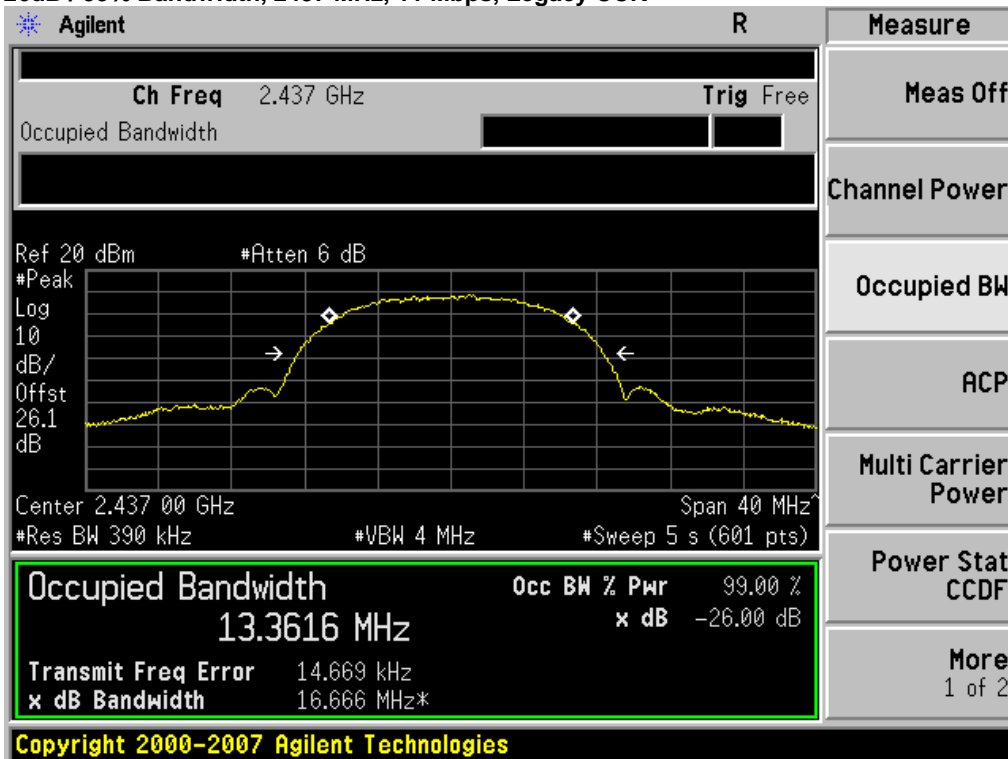




26dB / 99% Bandwidth, 2412 MHz, m0, HT20 (with and without Beam Forming / STBC)



26dB / 99% Bandwidth, 2437 MHz, 11 Mbps, Legacy CCK





26dB / 99% Bandwidth, 2437 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)

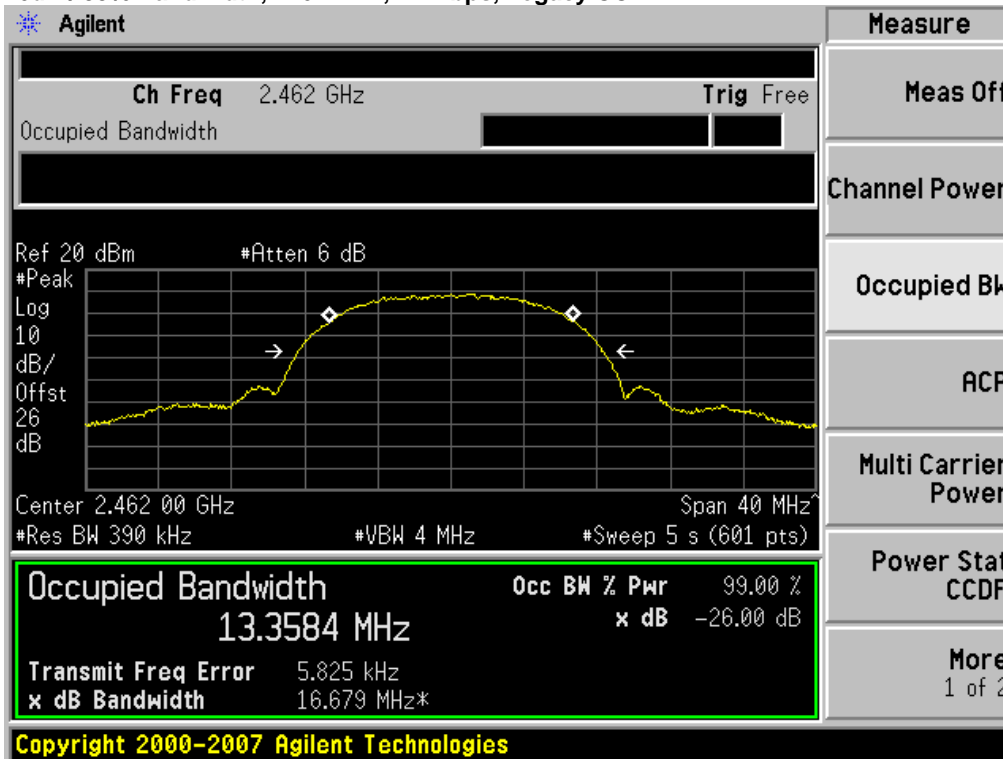
Agilent		R	Measure
Ch Freq 2.437 GHz		Trig Free	Meas Off
Occupied Bandwidth			Channel Power
Ref 20 dBm #Atten 6 dB #Peak Log 10 dB/ Offst 26.1 dB			Occupied BW
Center 2.437 00 GHz Span 40 MHz #Res BW 390 kHz #VBW 4 MHz #Sweep 5 s (601 pts)			ACP
<b>Occupied Bandwidth</b> Occ BW % Pwr 99.00 % 17.9310 MHz x dB -26.00 dB			Multi Carrier Power
Transmit Freq Error -39.668 kHz x dB Bandwidth 21.185 MHz*			Power Stat CCDF
Copyright 2000-2007 Agilent Technologies			More 1 of 2

26dB / 99% Bandwidth, 2437 MHz, m0, HT20 (with and without Beam Forming / STBC)

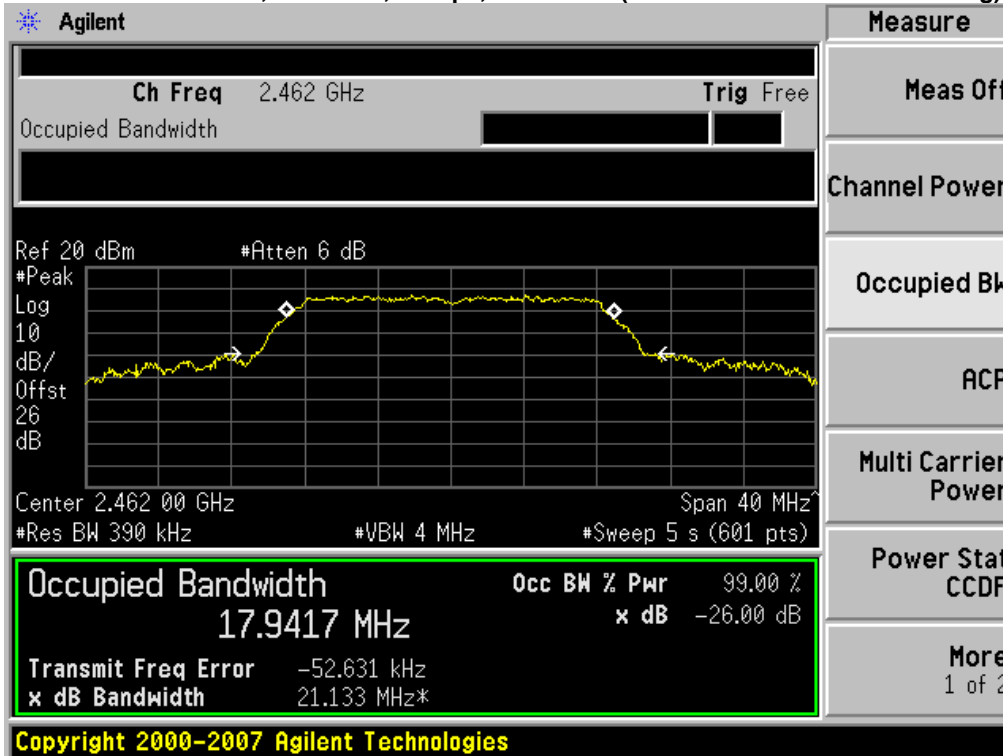
Agilent			Measure
Ch Freq 2.437 GHz		Trig Free	Meas Off
Occupied Bandwidth			Channel Power
Ref 20 dBm #Atten 6 dB #Peak Log 10 dB/ Offst 26.1 dB			Occupied BW
Center 2.437 00 GHz Span 40 MHz #Res BW 390 kHz #VBW 4 MHz #Sweep 5 s (601 pts)			ACP
<b>Occupied Bandwidth</b> Occ BW % Pwr 99.00 % 18.2778 MHz x dB -26.00 dB			Multi Carrier Power
Transmit Freq Error -3.416 kHz x dB Bandwidth 22.964 MHz*			Power Stat CCDF
Copyright 2000-2007 Agilent Technologies			More 1 of 2



26dB / 99% Bandwidth, 2462 MHz, 11 Mbps, Legacy CCK



26dB / 99% Bandwidth, 2462 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)





26dB / 99% Bandwidth, 2462 MHz, m0, HT20 (with and without Beam Forming / STBC)

Agilent		R	Measure
Ch Freq 2.462 GHz		Trig Free	Meas Off
Occupied Bandwidth			Channel Power
Ref 20 dBm #Atten 6 dB #Peak Log 10 dB/ Offst 26 dB			Occupied BW
Center 2.462 00 GHz Span 40 MHz #Res BW 390 kHz #VBW 4 MHz #Sweep 5 s (601 pts)			ACP
<b>Occupied Bandwidth</b> 18.2042 MHz		Occ BW % Pwr 99.00 % x dB -26.00 dB	Multi Carrier Power
Transmit Freq Error 18.869 kHz x dB Bandwidth 20.968 MHz*			Power Stat CCDF
Copyright 2000-2007 Agilent Technologies			More 1 of 2



## Peak Output Power

15.247 / RSS-210 A8.4: The maximum conducted output power of the intentional radiator for systems using digital modulation in the 2400-2483.5 MHz band shall not exceed 1 Watt (30dBm). If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum supported antenna gain is 6dBi. The peak correlated gain for each mode is listed in the table below. See the Theory of Operation for details on the correlated gain for each mode.

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below.

Enable "Channel Power" function of analyzer	
Center Frequency:	Frequency from table below
Span:	20 MHz (must be greater than 26dB bandwidth, adjust as necessary)
Ref Level Offset:	Correct for attenuator and cable loss.
Reference Level:	20 dBm
Attenuation:	20 dB
Sweep Time:	100ms, Single sweep
Resolution Bandwidth:	1 MHz
Video Bandwidth:	3 MHz
Detector:	Sample
Trace:	Trace Average 100 traces in Power Averaging Mode
Integration BW:	=26 dB BW from 26 dB Bandwidth Data

After averaging 100 traces of the transmitter waveform on the spectrum analyzer, record the spectrum analyzer Channel Power.

The "measure-and-sum technique" is used for measuring in-band transmit power of a device. In the measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units.

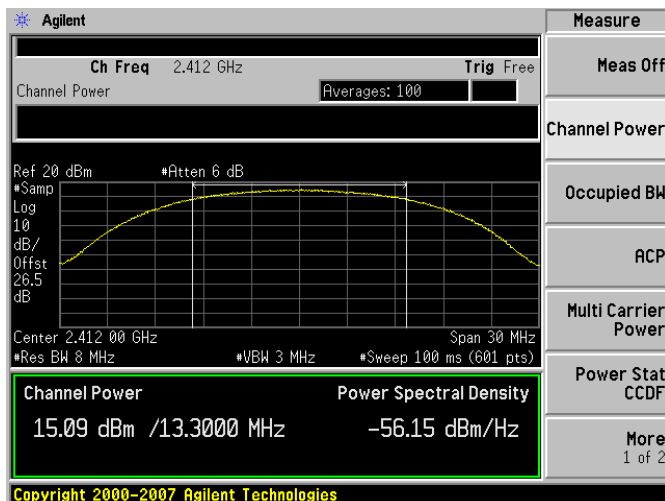




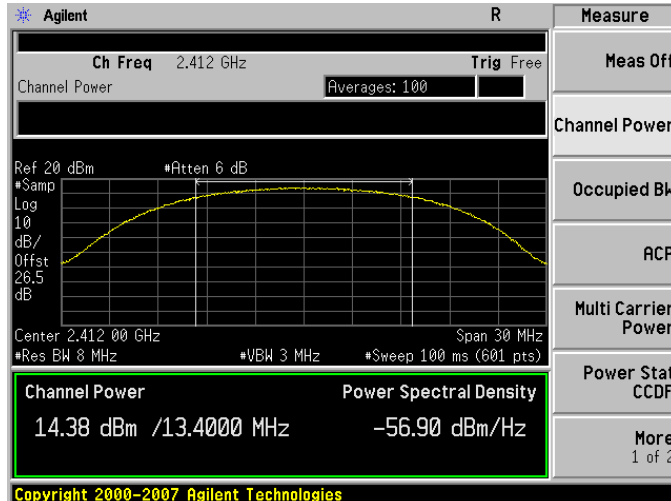
Frequency (MHz)	Operating Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Peak Power (dBm)	Tx 2 Peak Power (dBm)	Tx 3 Peak Power (dBm)	Total Tx Channel Power (dBm)	Limit (dBm)	Margin (dB)	Target Channel Power (dBm)
2412	Legacy CCK, 1 to 11 Mbps	3	6	15.1	14.4	14.2	19.3	30	10.7	22
	Non HT-20, 6 to 54 Mbps	3	6	10.9	11.1	12.1	16.1	30	13.9	19
	Non HT-20 Beam Forming, 6 to 54 Mbps	3	11	10.9	11.1	10.1	15.5	25	9.7	17
	HT-20, M0 to M15	3	6	12.2	11.1	12.1	16.6	30	13.4	17
	HT-20 STBC, M0 to M7	3	6	12.2	11.1	12.1	16.6	30	13.4	17
	HT-20 Beam Forming, M0 to M7	3	11	10.7	11.1	11.1	15.7	25	9.5	16
	HT-20 Beam Forming, M8 to M15	3	8	10.8	11.5	10.0	15.6	28	12.6	17
2437	Legacy CCK, 1 to 11 Mbps	3	6	13.2	13.5	13.9	18.3	30	11.7	22
	Non HT-20, 6 to 54 Mbps	3	6	13.3	13.5	14.0	18.4	30	11.6	22
	Non HT-20 Beam Forming, 6 to 54 Mbps	3	11	13.3	13.5	14.0	18.4	25	6.8	22
	HT-20, M0 to M15	3	6	13.2	13.5	14.0	18.3	30	11.7	22
	HT-20 STBC, M0 to M7	3	6	13.2	13.5	14.0	18.3	30	11.7	22
	HT-20 Beam Forming, M0 to M7	3	11	13.2	13.5	14.0	18.3	25	6.9	22
	HT-20 Beam Forming, M8 to M15	3	8	13.2	13.5	14.0	18.3	28	9.9	22
2462	Legacy CCK, 1 to 11 Mbps	3	6	13.3	13.3	13.6	18.2	30	11.8	22
	Non HT-20, 6 to 54 Mbps	3	6	10.0	11.5	11.8	16.0	30	14.0	19
	Non HT-20 Beam Forming, 6 to 54 Mbps	3	11	9.2	9.3	9.6	14.1	25	11.1	17
	HT-20, M0 to M15	3	6	9.0	9.2	10.5	14.4	30	15.6	18
	HT-20 STBC, M0 to M7	3	6	9.0	9.2	10.5	14.4	30	15.6	18
	HT-20 Beam Forming, M0 to M7	3	11	5.5	5.6	6.5	10.7	25	14.5	15



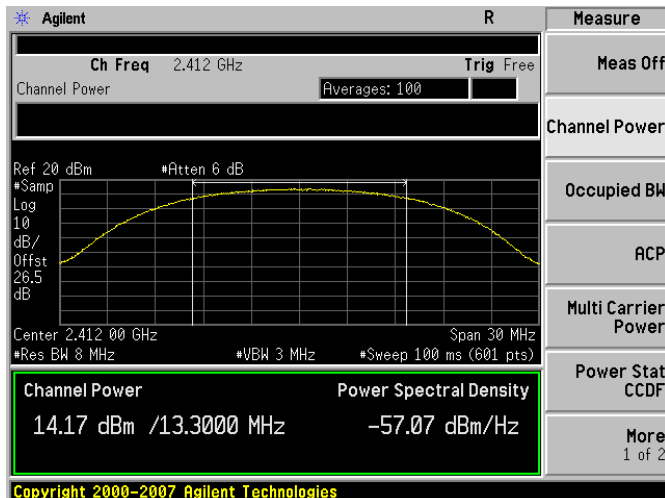
Peak Output Power, 2412 MHz, 11 Mbps, Legacy CCK



Antenna A



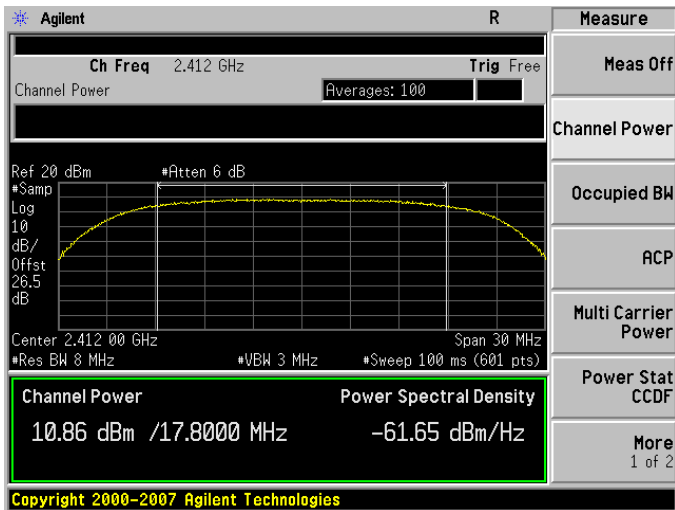
Antenna B



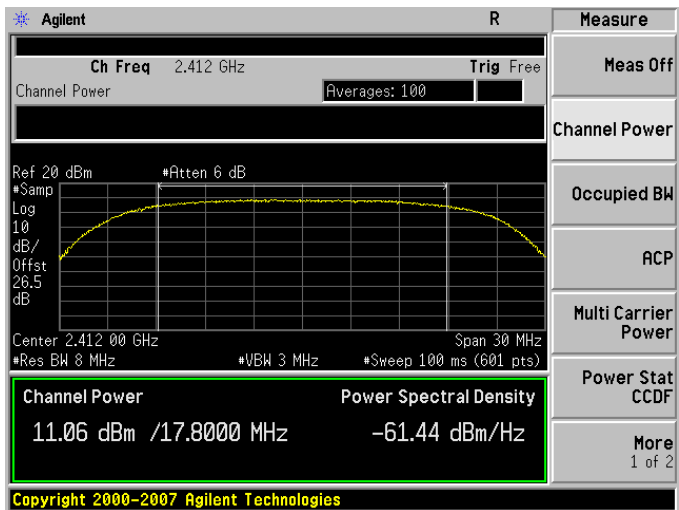
Antenna C



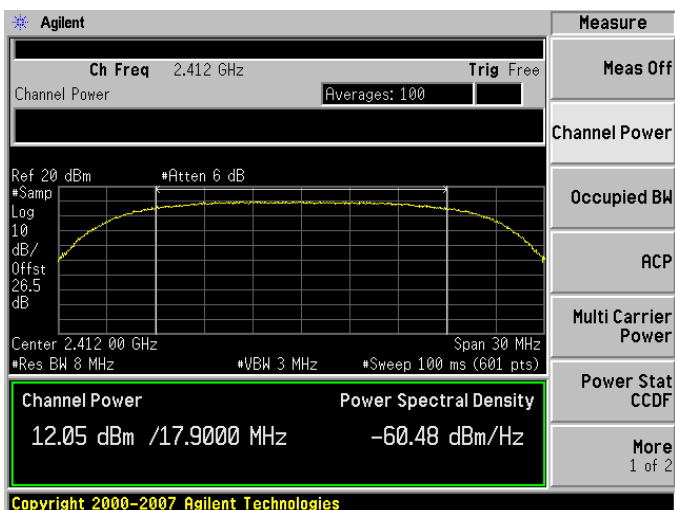
Peak Output Power, 2412 MHz, 6 Mbps, Non HT-20



Antenna A



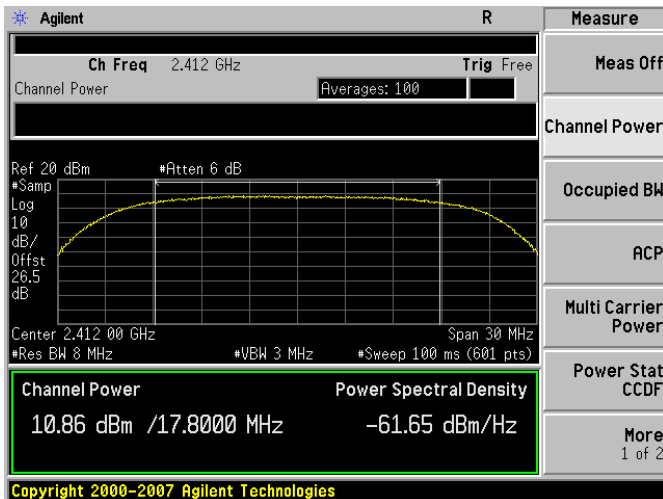
Antenna B



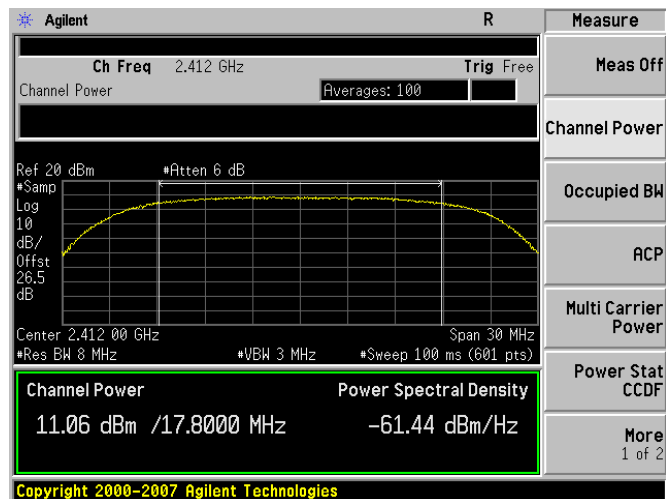
Antenna C



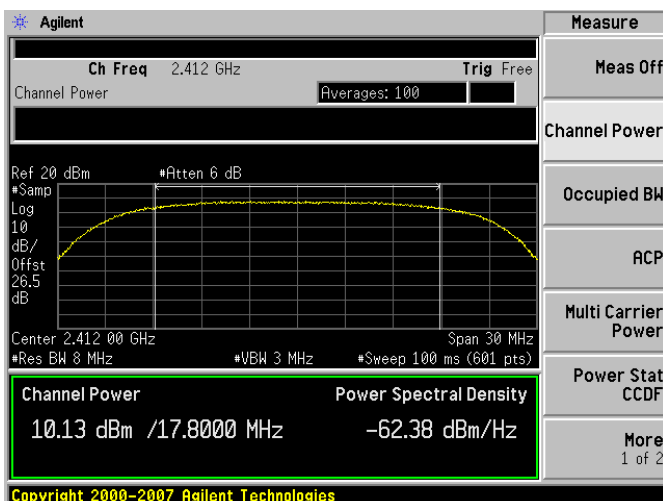
Peak Output Power, 2412 MHz, 6 Mbps, Non HT-20 Beam Forming



Antenna A



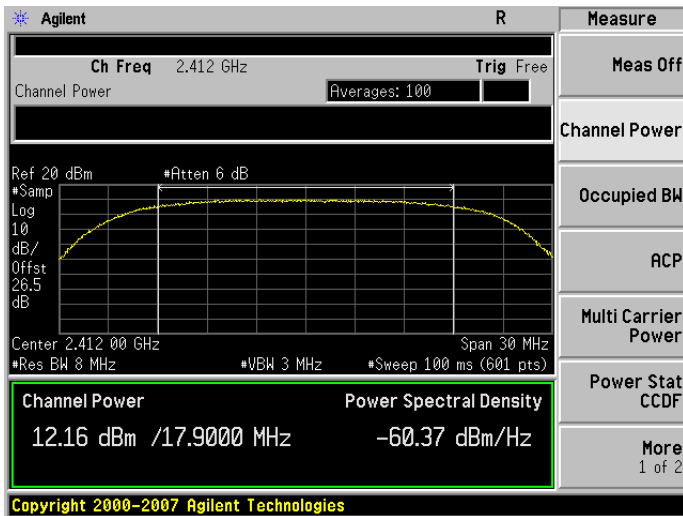
Antenna B



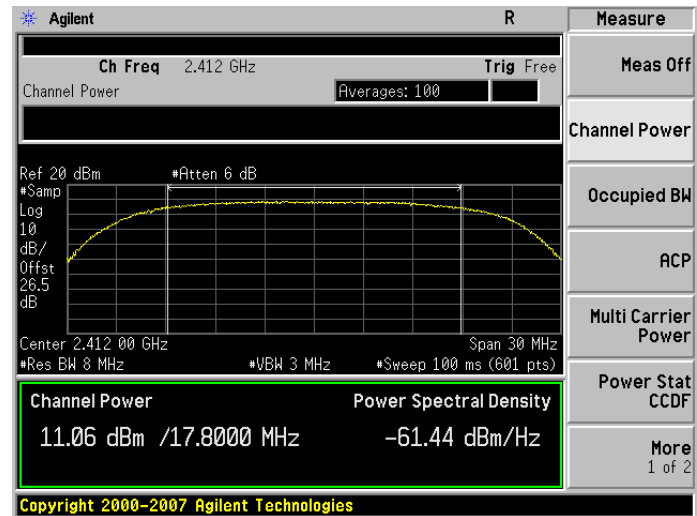
Antenna C



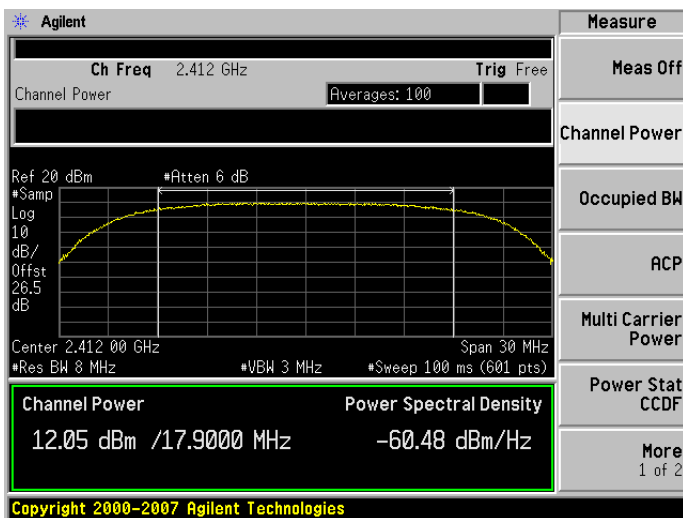
Peak Output Power, 2412 MHz, m0, HT20 Beam Forming, with and without STBC



Antenna A



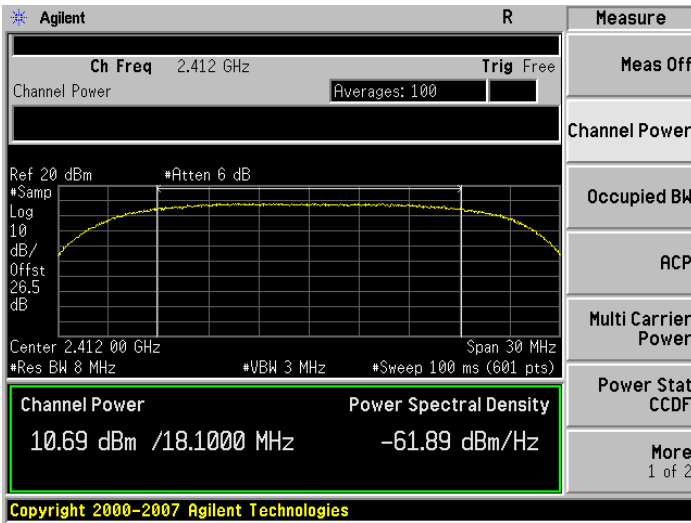
Antenna B



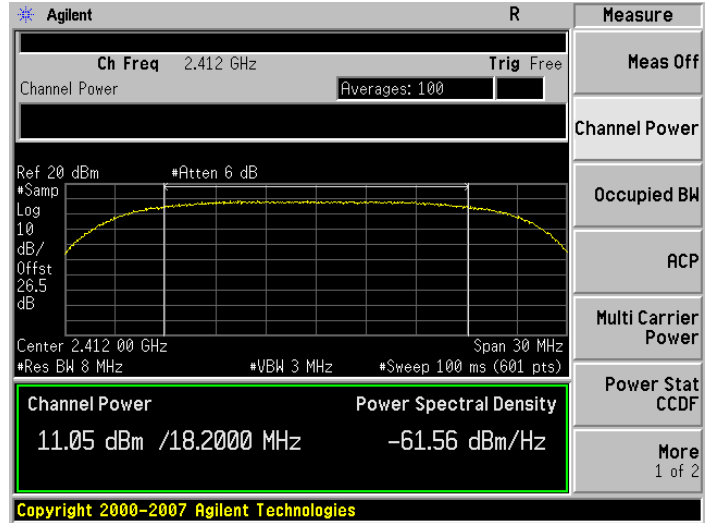
Antenna C



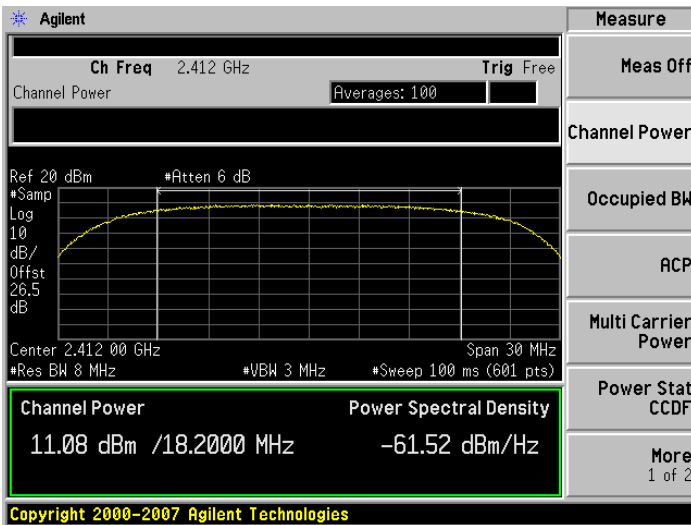
Peak Output Power, 2412 MHz, m8, m16, HT20 Beam Forming



Antenna A



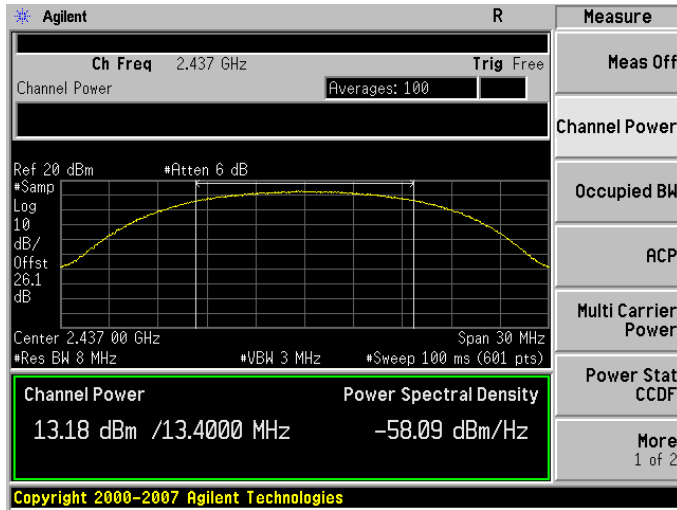
Antenna B



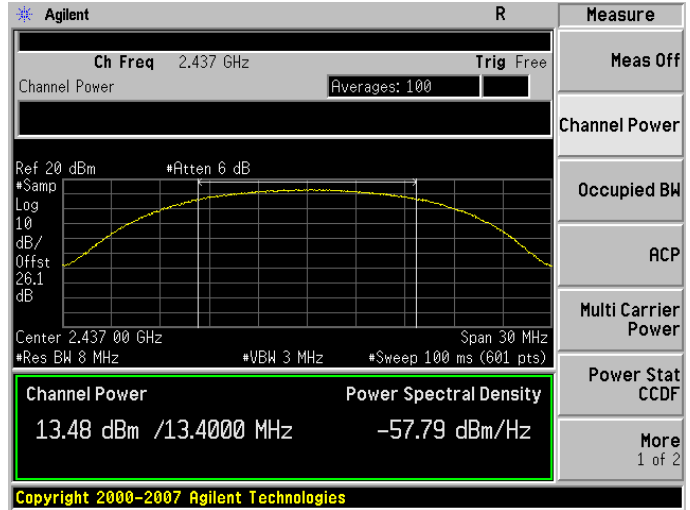
Antenna C



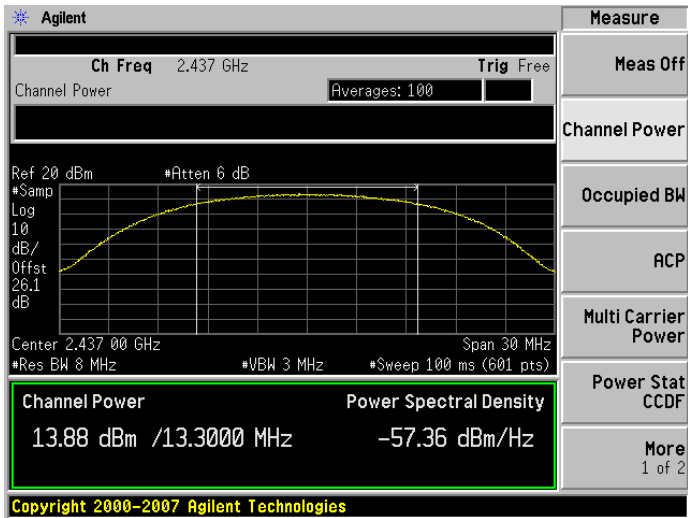
Peak Output Power, 2437 MHz, 11 Mbps, Legacy CCK



Antenna A



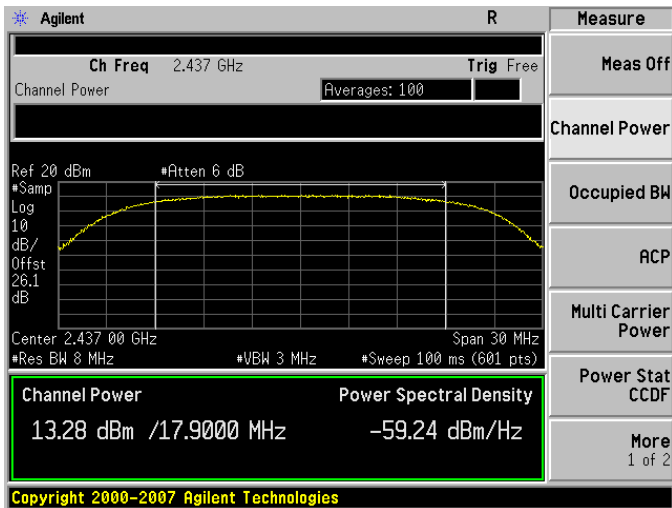
Antenna B



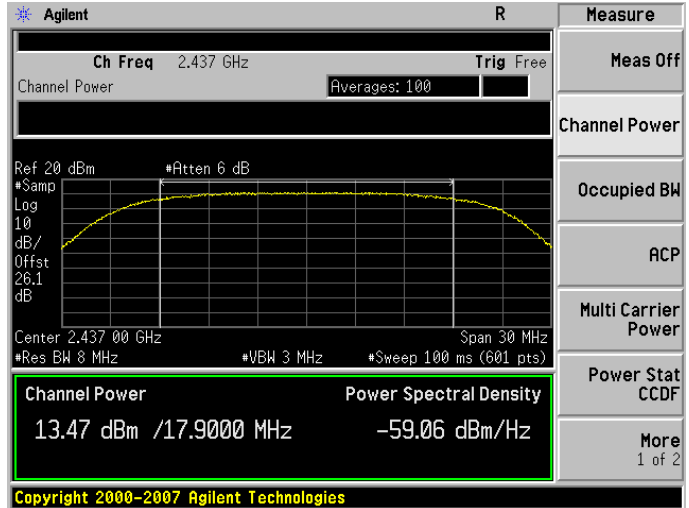
Antenna C



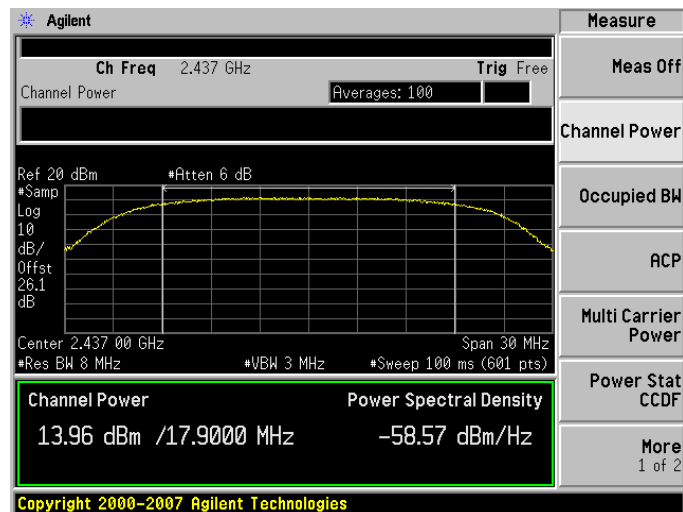
Peak Output Power, 2437 MHz, 6 Mbps, Non HT-20



Antenna A



Antenna B

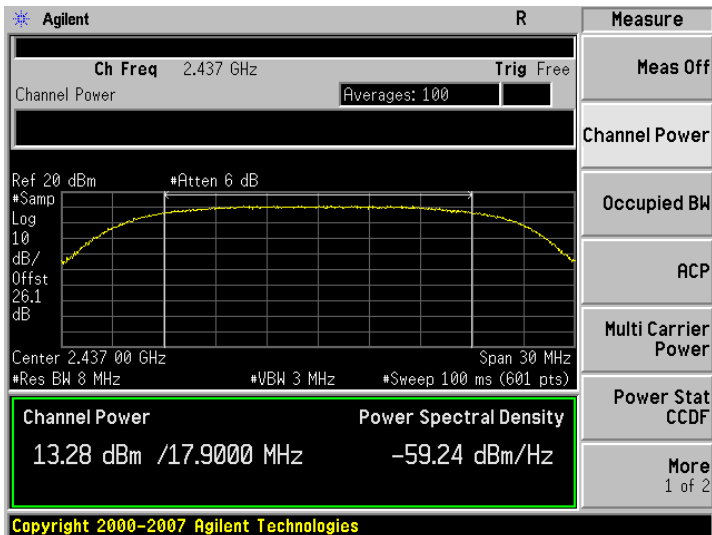


Antenna C

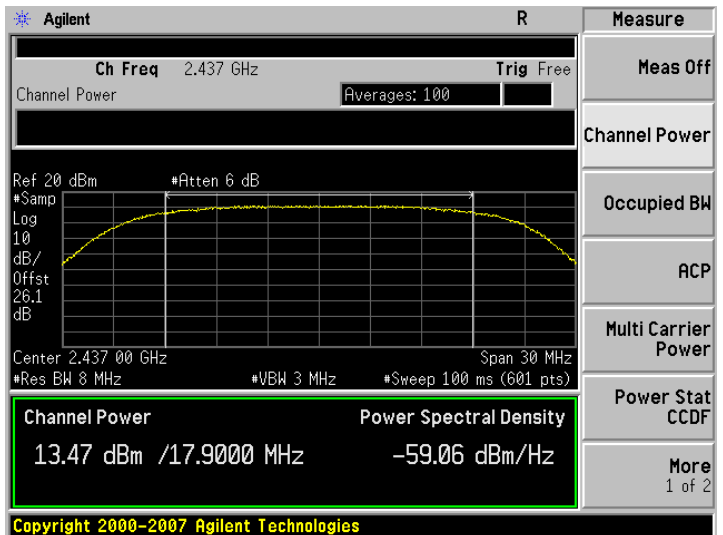




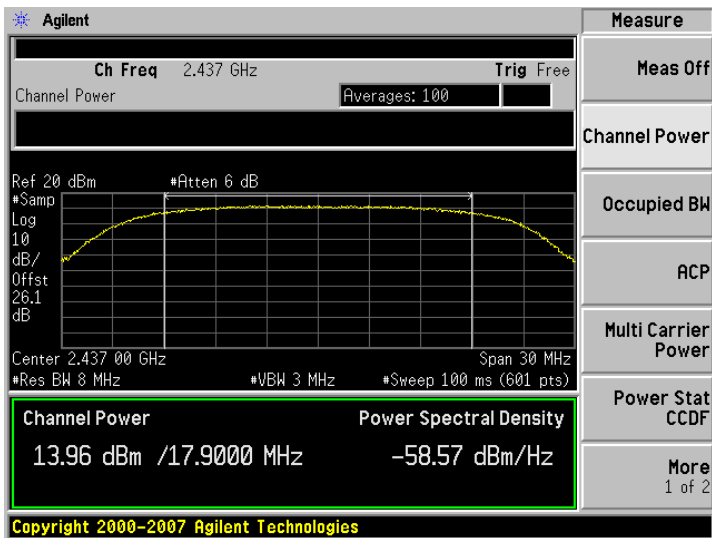
Peak Output Power, 2437 MHz, 6 Mbps, Non HT-20 Beam Forming



Antenna A



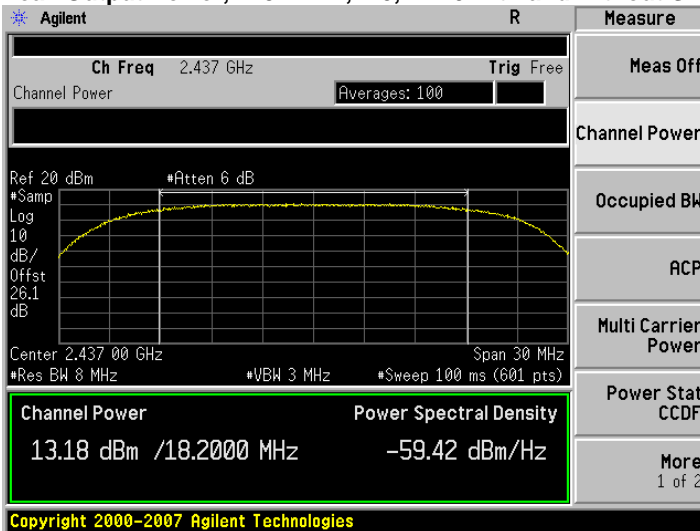
Antenna B



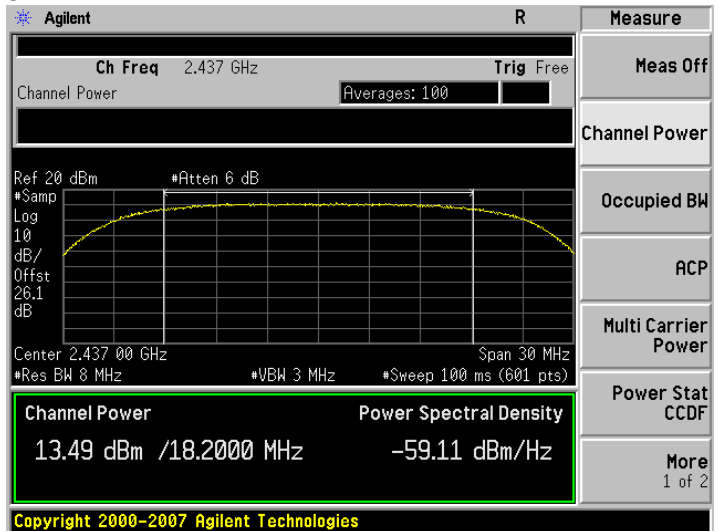
Antenna C



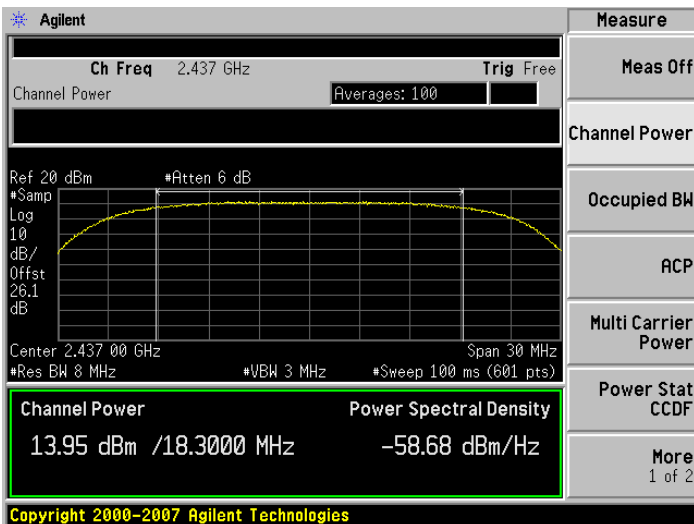
Peak Output Power, 2437 MHz, m0, HT20 with and without STBC



Antenna A



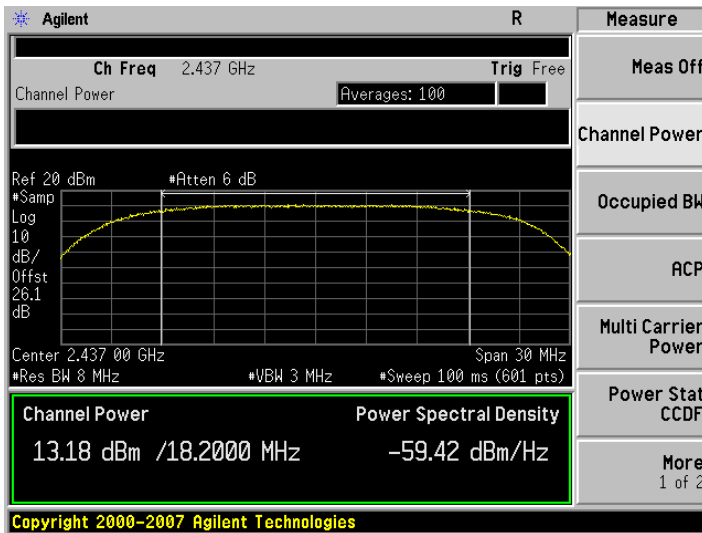
Antenna B



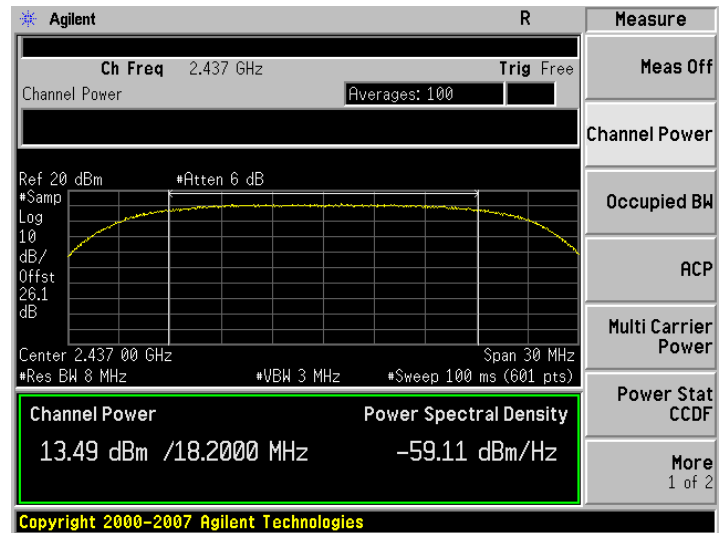
Antenna C



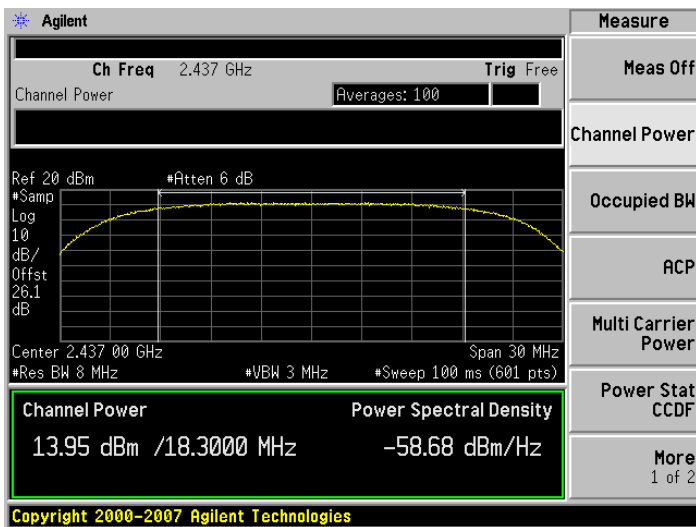
Peak Output Power, 2437 MHz, m0, HT20 Beam Forming



Antenna A



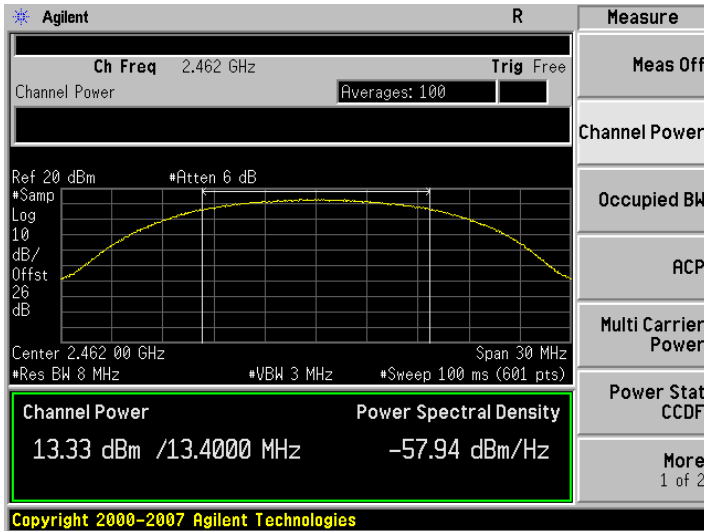
Antenna B



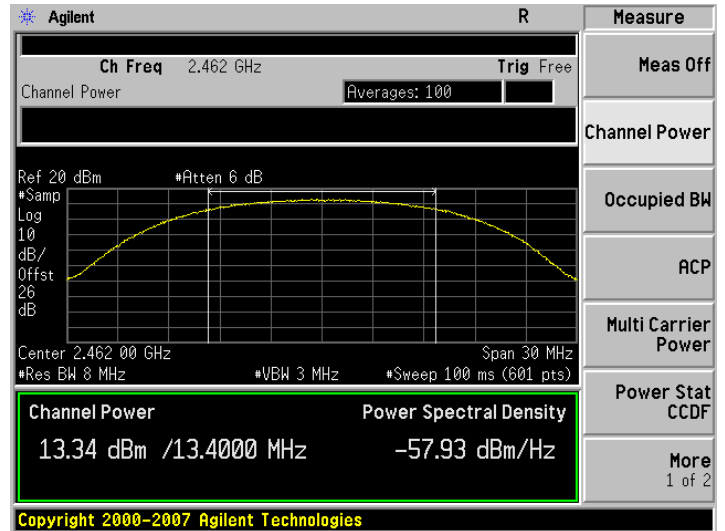
Antenna C



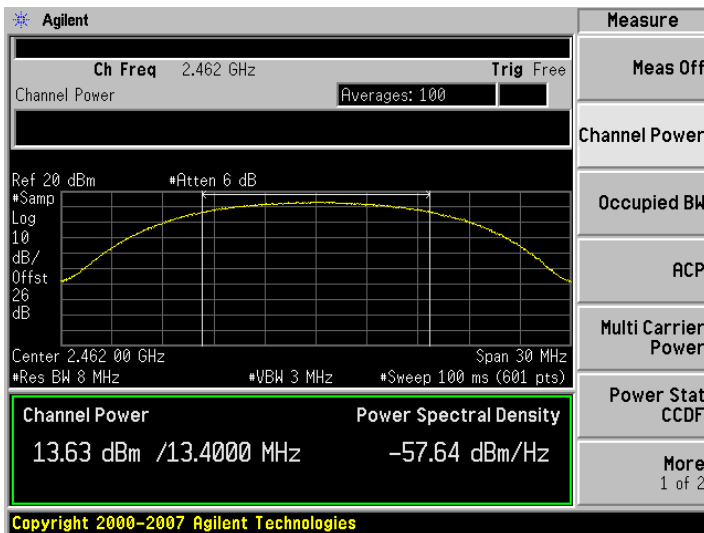
Peak Output Power, 2462 MHz, 11 Mbps, Legacy CCK



Antenna A



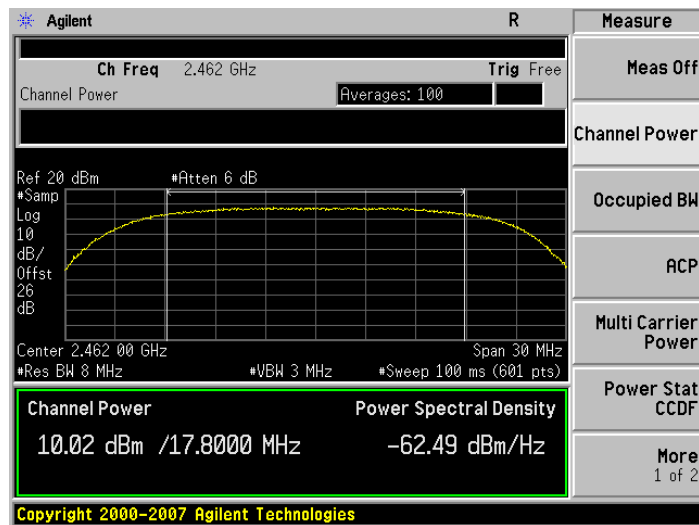
Antenna B



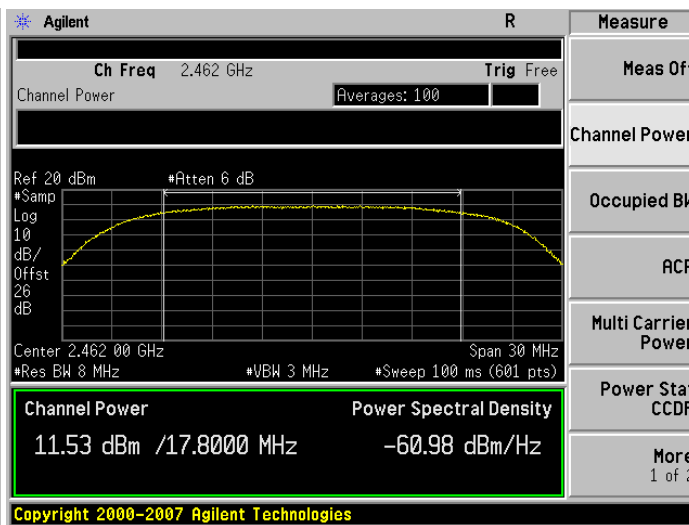
Antenna C



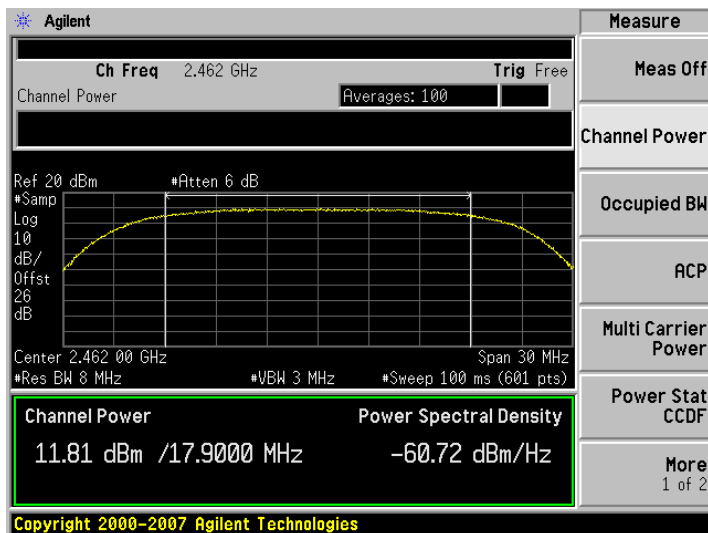
Peak Output Power, 2462 MHz, 6 Mbps, Non HT-20



Antenna A



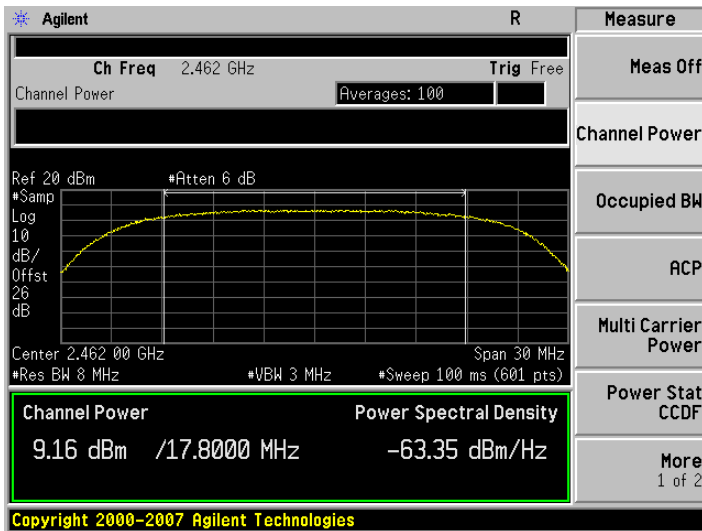
Antenna B



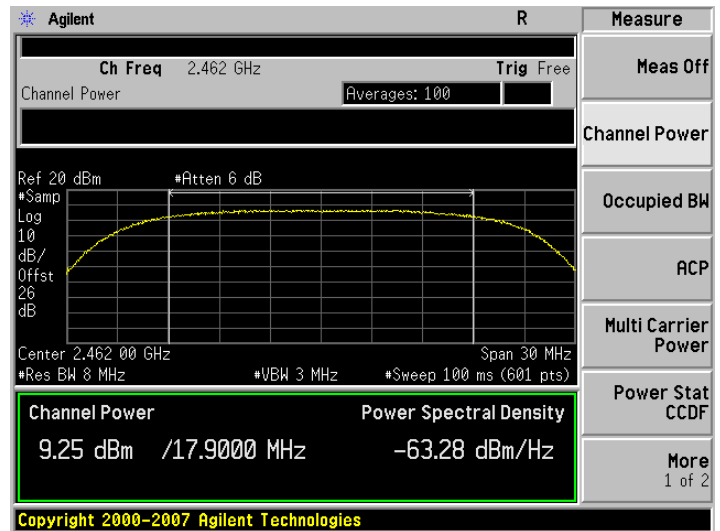
Antenna C



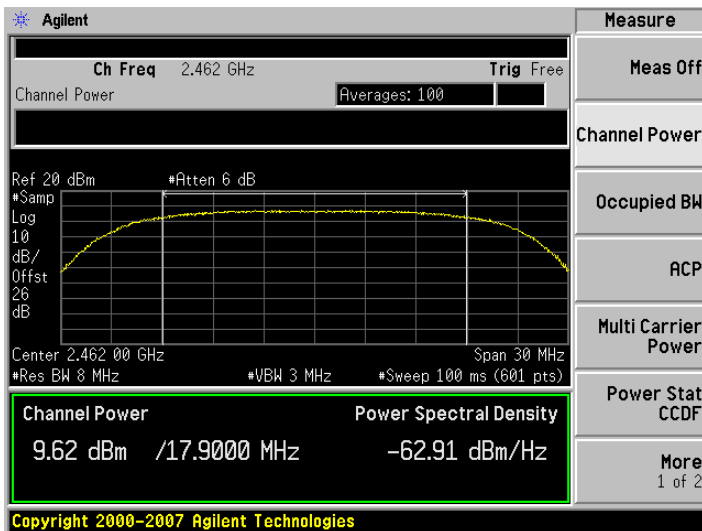
Peak Output Power, 2462 MHz, 6 Mbps, Non HT-20 Beam Forming



Antenna A



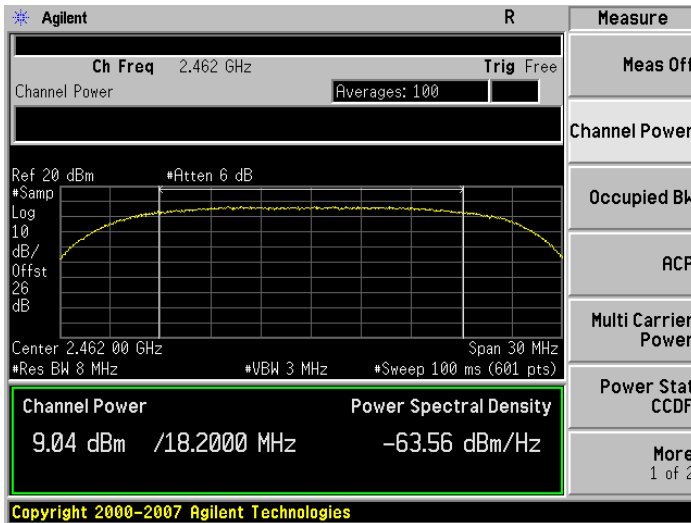
Antenna B



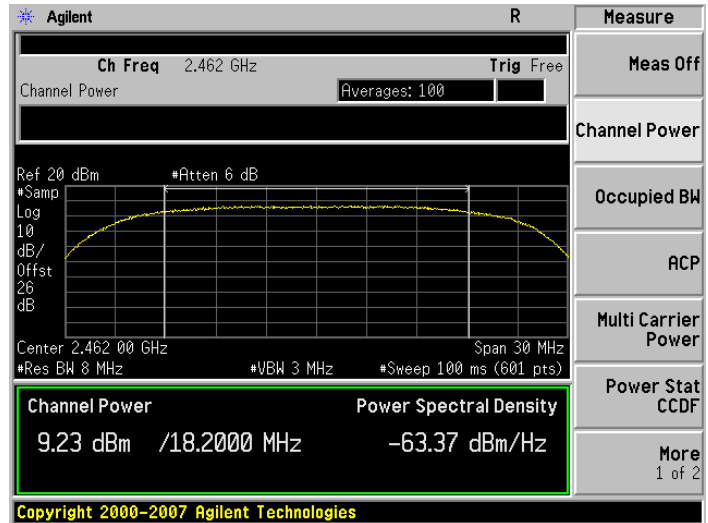
Antenna C



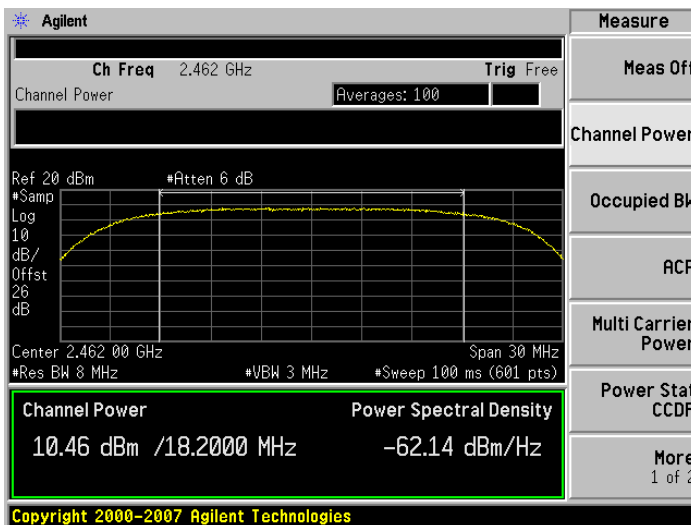
Peak Output Power, 2462 MHz, m0, HT20 with and without STBC



Antenna A



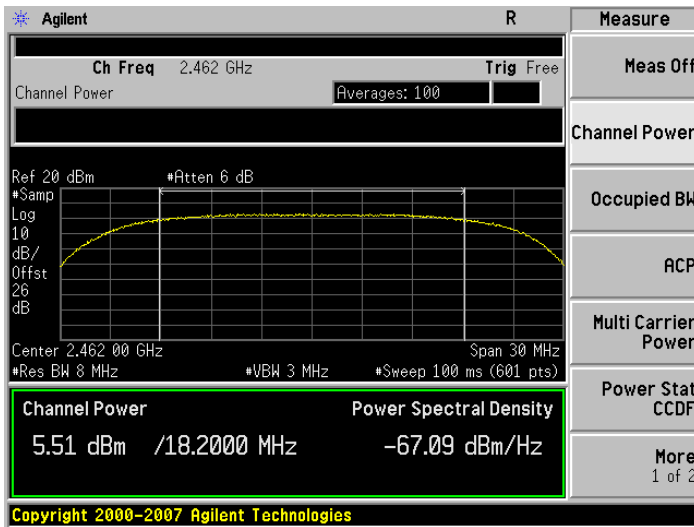
Antenna B



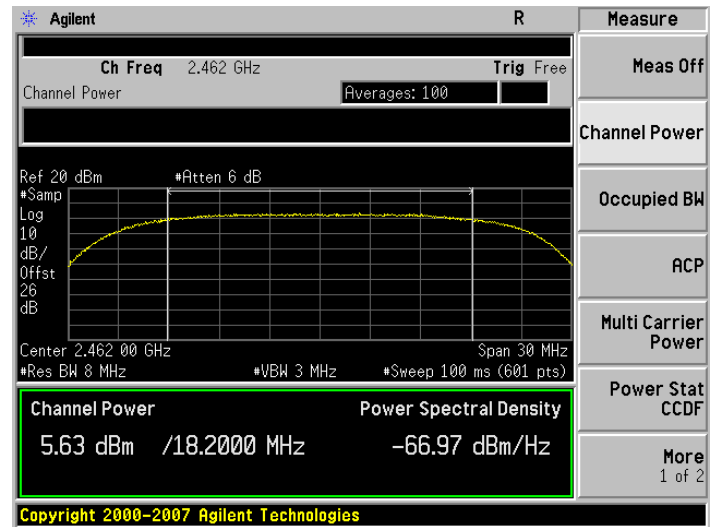
Antenna C



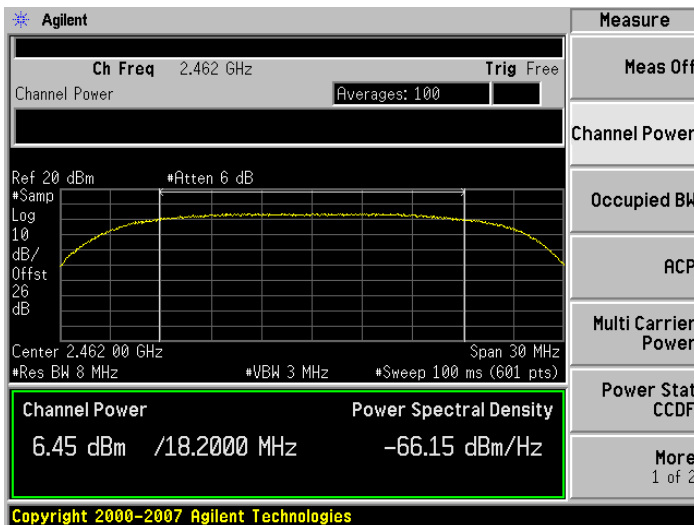
Peak Output Power, 2462 MHz, m0, HT20 Beam Forming



Antenna A



Antenna B

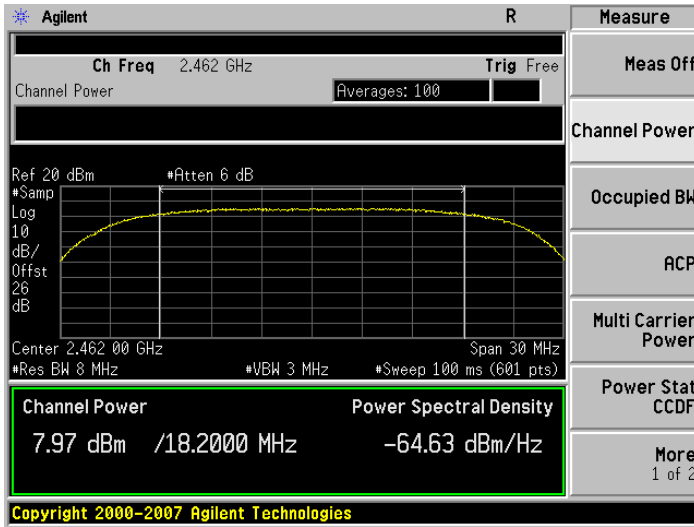


Antenna C

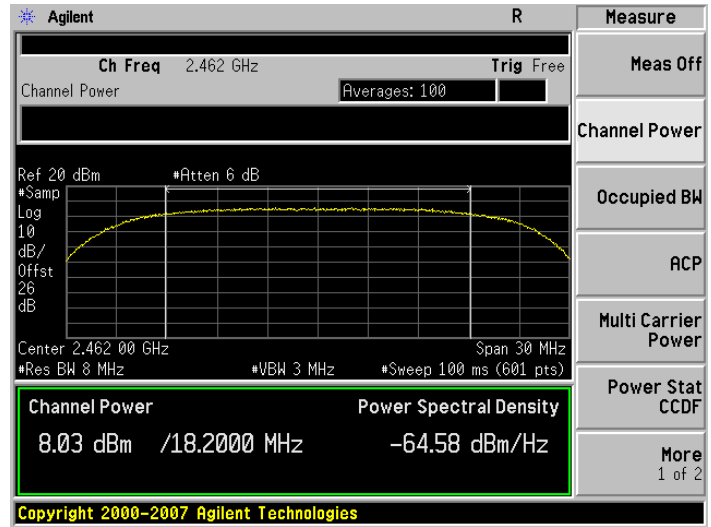




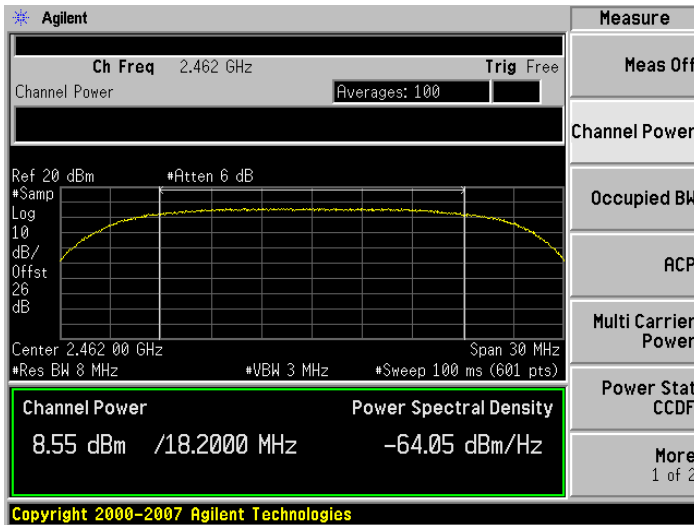
Peak Output Power, 2462 MHz, m8,HT20 Beam Forming



Antenna A



Antenna B



Antenna C



## Power Spectral Density

15.247 / RSS-210 A8.2: For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below.

Center Frequency:	Frequency from table below
Span:	20 MHz
Ref Level Offset:	Correct for attenuator and cable loss.
Reference Level:	20 dBm
Attenuation:	20 dB
Sweep Time:	10s
Resolution Bandwidth:	3 kHz
Video Bandwidth:	10 kHz
Detector:	Peak
Trace:	Single
Marker:	Peak Search

Record the Marker value.

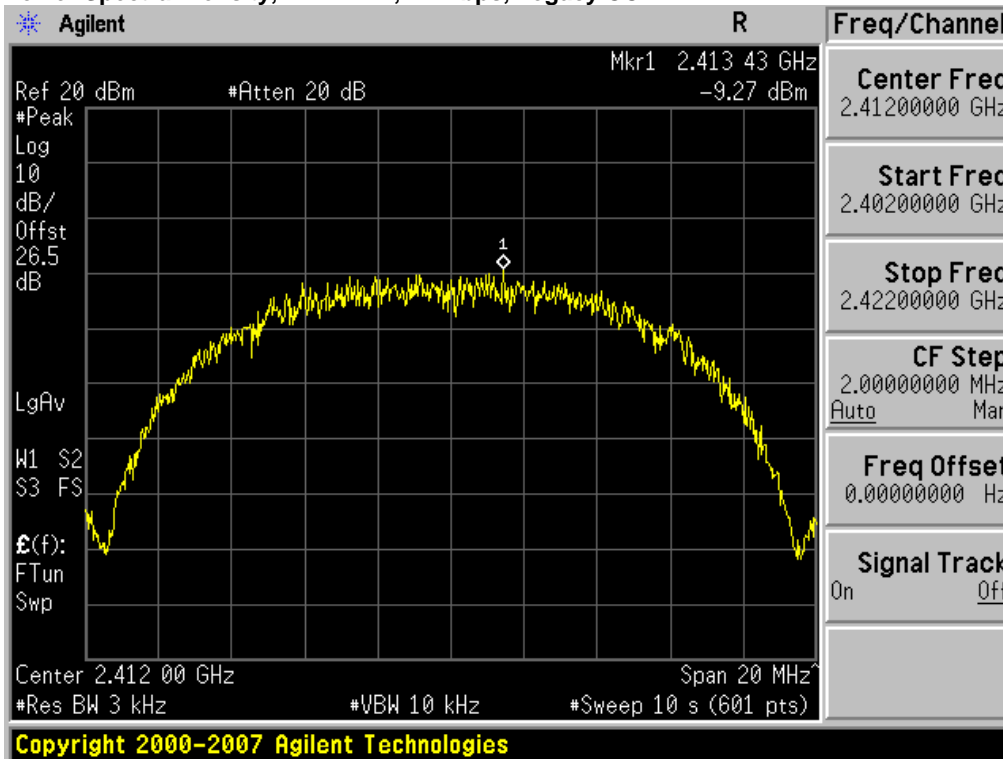
The "Measure and add  $10 \log(N)$  dB technique", where N is the number of outputs, is used for measuring in-band Power Spectral Density. With this technique, spectrum measurements are performed at each output of the device, and the quantity  $10 \log(4)$  (or 6dB) is added to the worst case spectrum value before comparing to the emission limit.



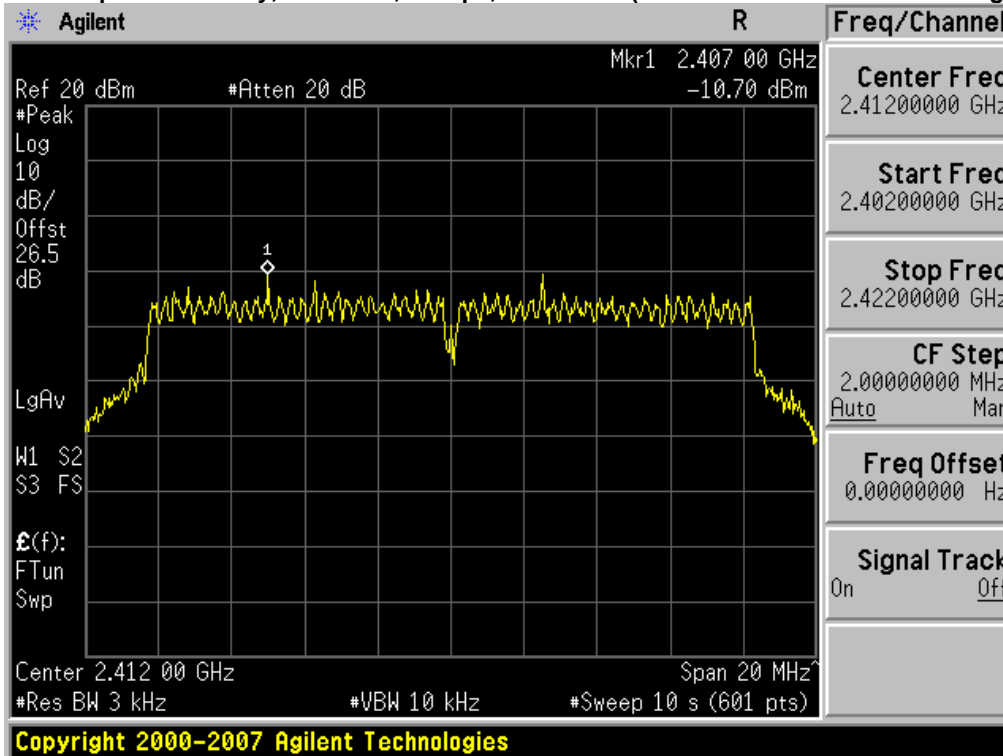
Frequency (MHz)	Mode	Data Rate (Mbps)	PSD / Antenna (dBm/3kHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
2412	Legacy CCK, 1 to 11 Mbps	11	-9.3	-4.5	8	12.5
	Non HT-20, 6 to 54 Mbps	6	-10.2	-10.7	8	18.7
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	-10.2	-5.4	8	13.4
	HT-20, M0 to M15	m0	-12.3	-7.5	8	15.5
	HT-20 STBC, M0 to M7	m0	-12.3	-7.5	8	15.5
	HT-20 Beam Forming, M0 to M15	m0	-12.3	-7.5	8	15.5
2437	Legacy CCK, 1 to 11 Mbps	11	-10.3	-5.5	8	13.5
	Non HT-20, 6 to 54 Mbps	6	-12.6	-7.8	8	15.8
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	-12.6	-7.8	8	15.8
	HT-20, M0 to M15	m0	-11.8	-7.0	8	15.0
	HT-20 STBC, M0 to M7	m0	-11.8	-7.0	8	15.0
	HT-20 Beam Forming, M0 to M15	m0	-11.8	-7.0	8	15.0
2462	Legacy CCK, 1 to 11 Mbps	11	-3.8	1.0	8	7.0
	Non HT-20, 6 to 54 Mbps	6	-12.9	-8.1	8	16.1
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	-12.9	-8.1	8	16.1
	HT-20, M0 to M15	m0	-13.4	-8.6	8	16.6
	HT-20 STBC, M0 to M7	m0	-13.4	-8.6	8	16.6
	HT-20 Beam Forming, M0 to M15	m0	-13.4	-8.6	8	16.6



**Power Spectral Density, 2412 MHz, 11 Mbps, Legacy CCK**

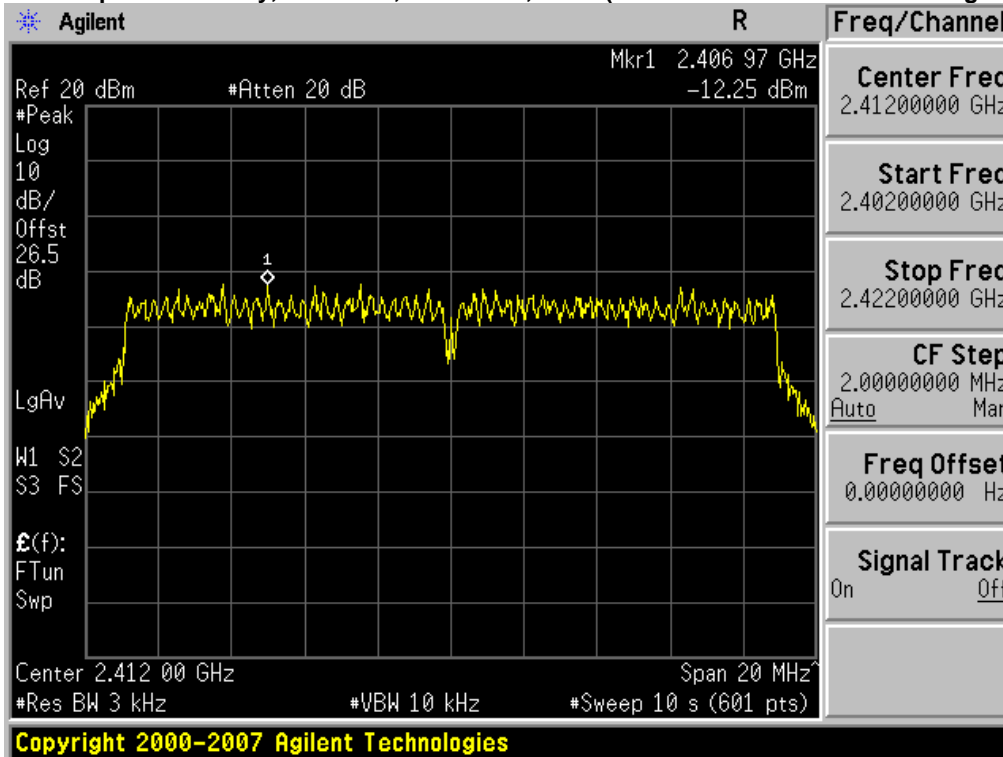


**Power Spectral Density, 2412 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

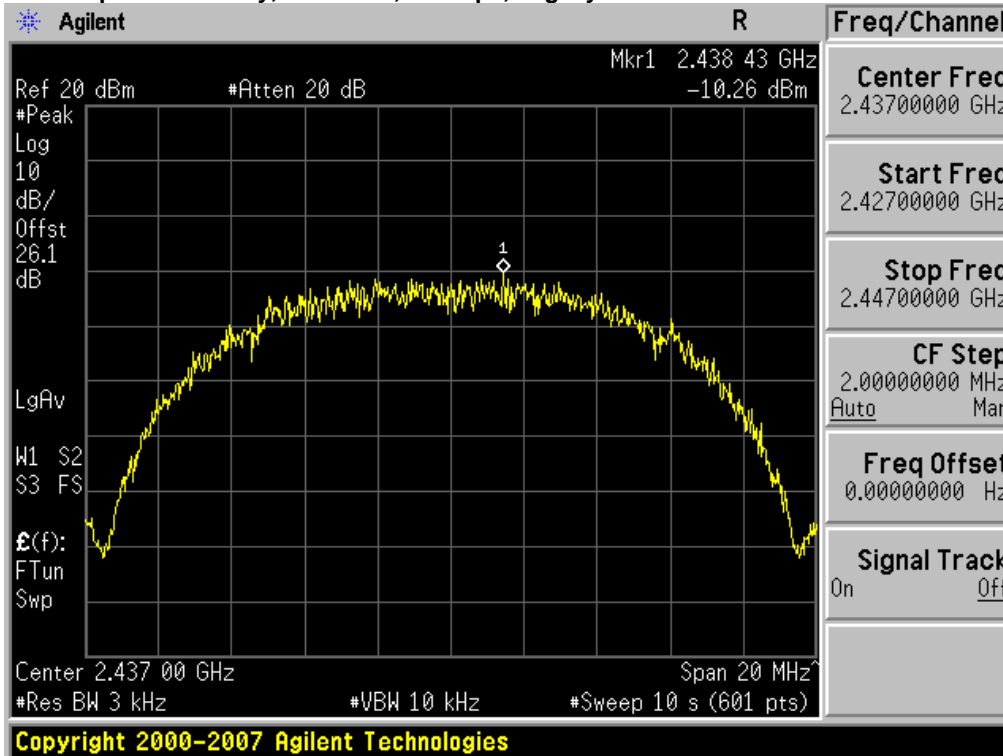




**Power Spectral Density, 2412 MHz, m0 to m23, HT20 (with and without Beam Forming / STBC)**

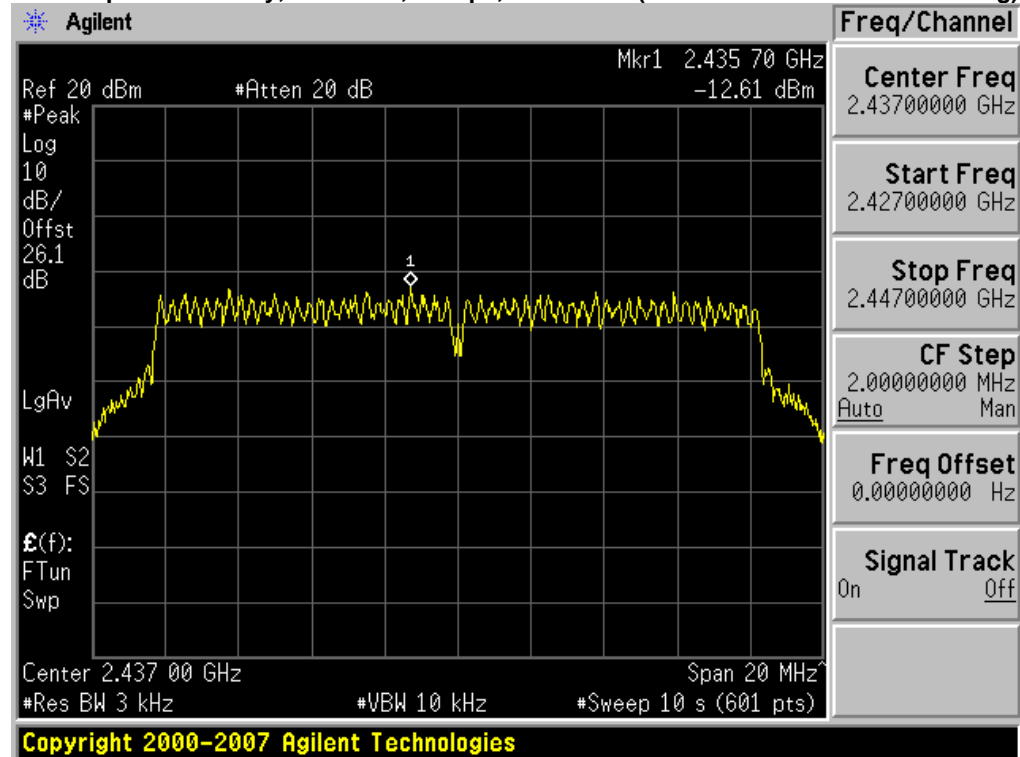


**Power Spectral Density, 2437 MHz, 11 Mbps, Legacy CCK**

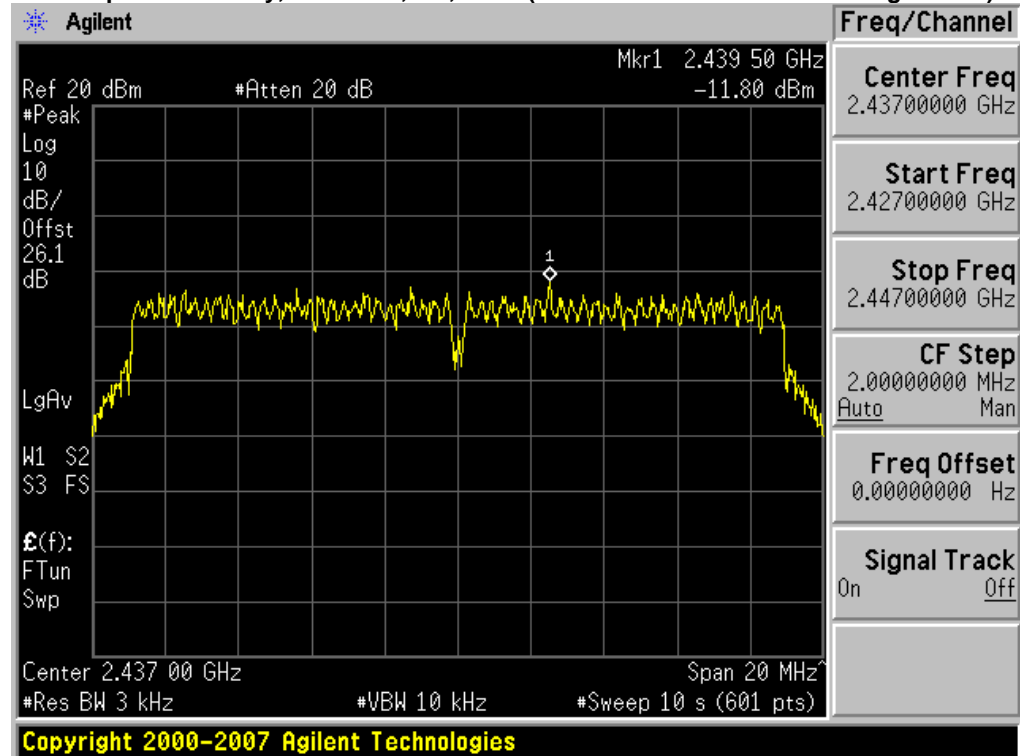




**Power Spectral Density, 2437 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

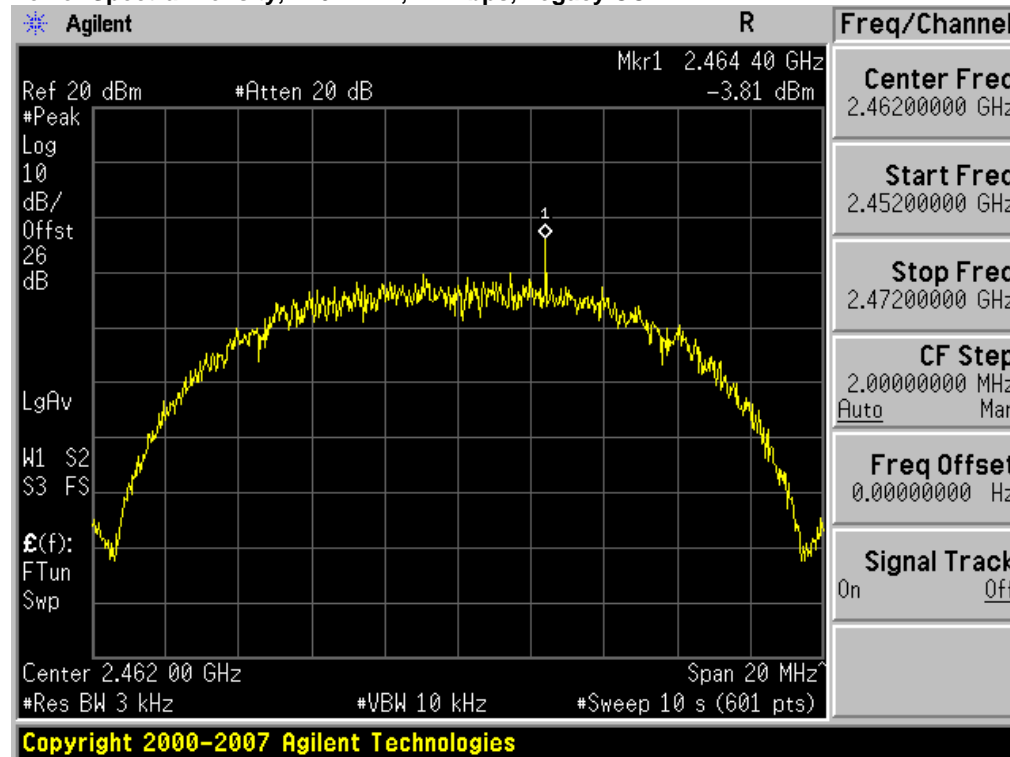


**Power Spectral Density, 2437 MHz, m0, HT20 (with and without Beam Forming / STBC)**

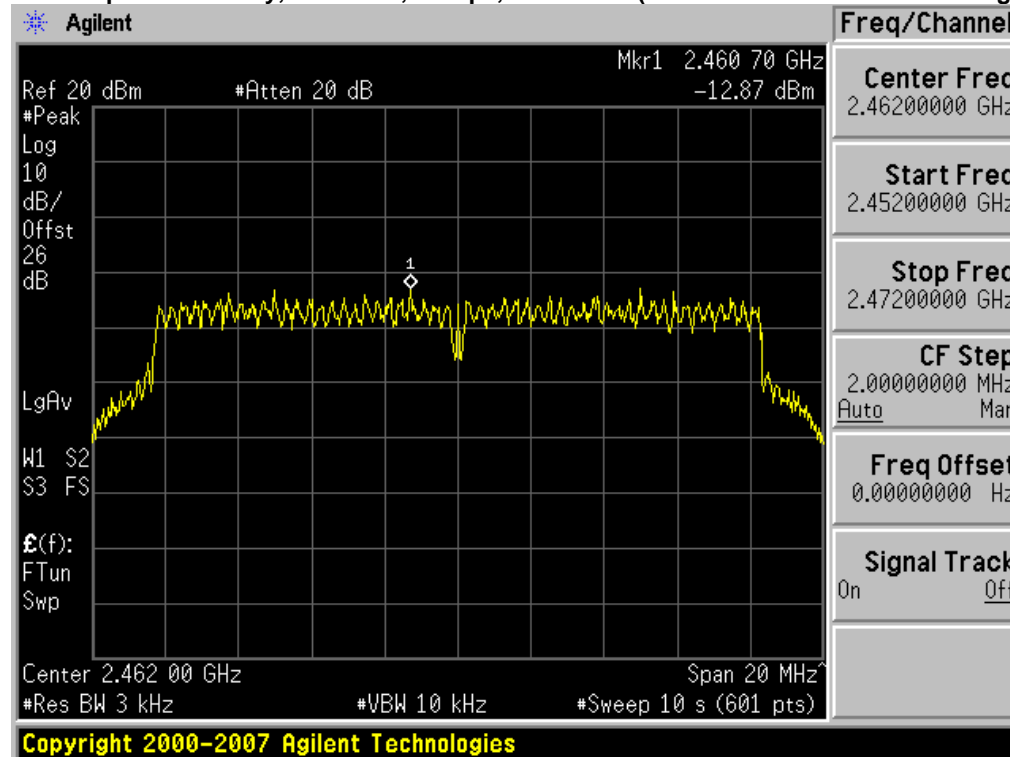




**Power Spectral Density, 2462 MHz, 11 Mbps, Legacy CCK**

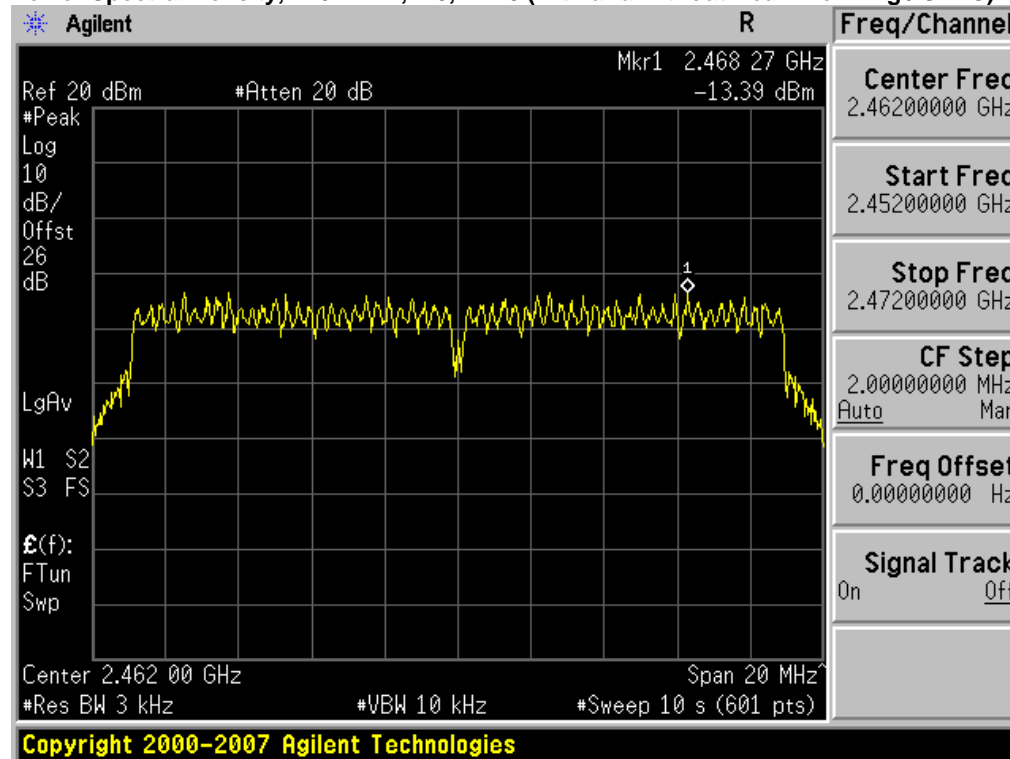


**Power Spectral Density, 2462 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**





Power Spectral Density, 2462 MHz, m0, HT20 (with and without Beam Forming / STBC)







## Conducted Spurious Emissions

15.247 / RSS-210 A8.5: In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer).

Span:	30 MHz-26 GHz
Reference Level:	20 dBm
Attenuation:	10 dB
Sweep Time:	5s
Resolution Bandwidth:	100 kHz
Video Bandwidth:	300 kHz
Detector:	Peak
Trace:	Single
Marker:	Peak

Record the marker waveform peak to spur difference

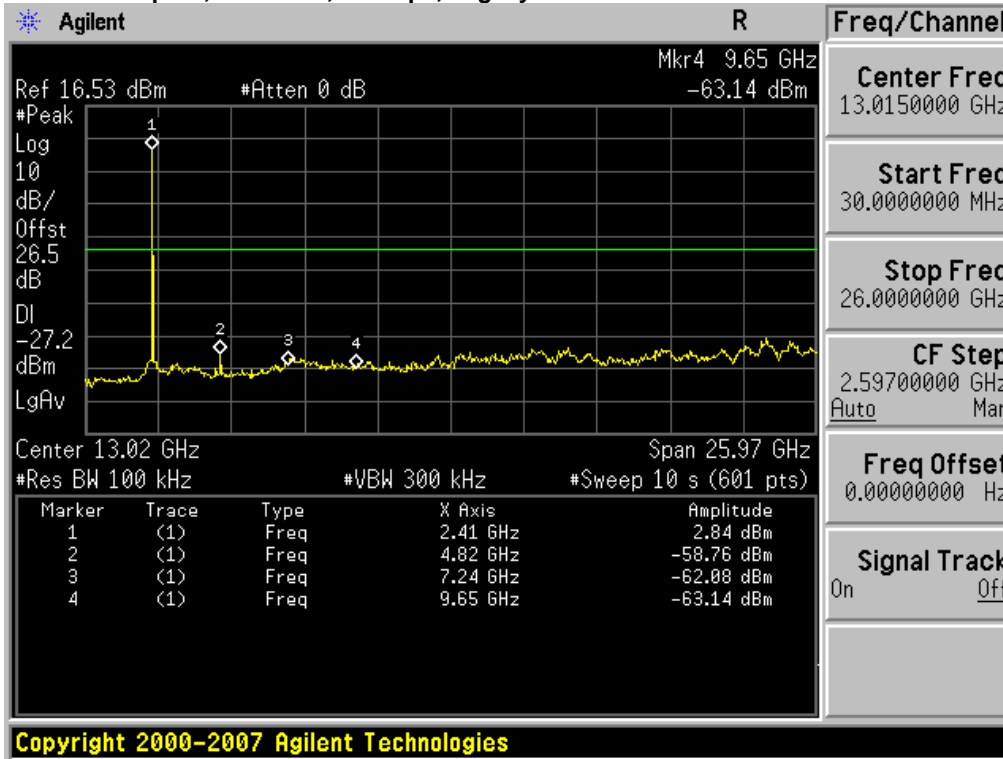
Out-of-band and spurious emissions tests are performed on each output individually without summing or adding  $10 \log(N)$  since the measurements are made relative to the in-band emissions on the individual outputs. The worst case output is recorded.



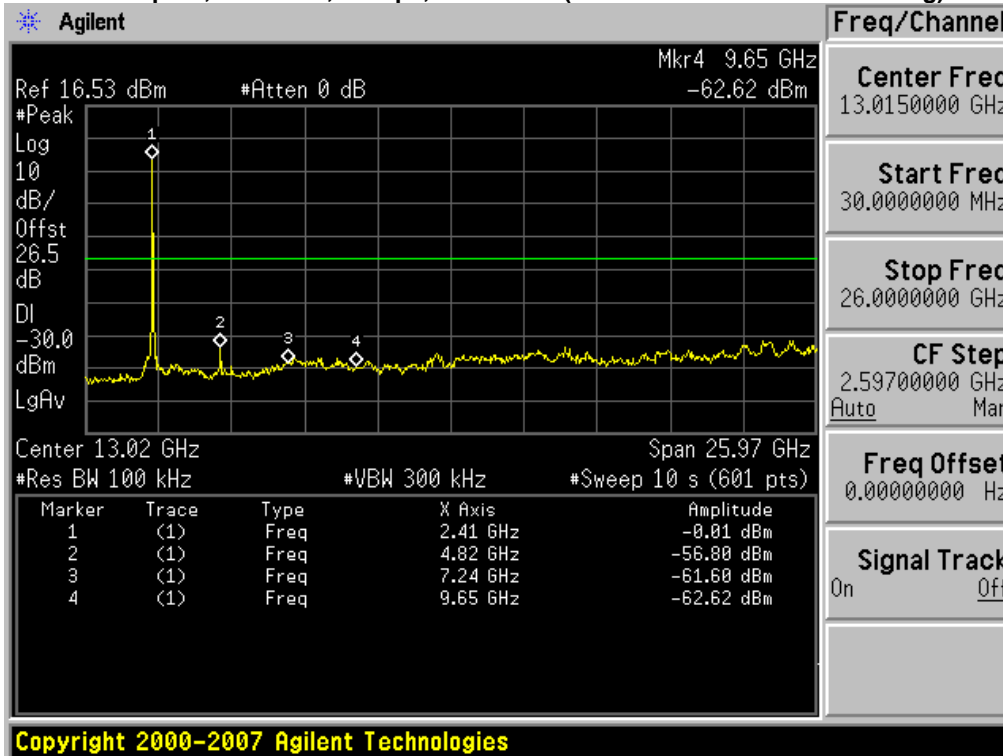
Frequency (MHz)	Mode	Data Rate (Mbps)	Conducted Spur Delta (dB)	Limit (dBc)	Margin (dB)
2412	Legacy CCK, 1 to 11 Mbps	11	58.8	30.0	28.8
	Non HT-20, 6 to 54 Mbps	6	56.8	30.0	26.8
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	56.8	30.0	26.8
	HT-20, M0 to M15	m0	55.8	30.0	25.8
	HT-20 STBC, M0 to M7	m0	55.8	30.0	25.8
	HT-20 Beam Forming, M0 to M15	m0	55.8	30.0	25.8
2437	Legacy CCK, 1 to 11 Mbps	11	58.9	30.0	28.9
	Non HT-20, 6 to 54 Mbps	6	54.0	30.0	24.0
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	54.0	30.0	24.0
	HT-20, M0 to M15	m0	56.6	30.0	26.6
	HT-20 STBC, M0 to M7	m0	56.6	30.0	26.6
	HT-20 Beam Forming, M0 to M15	m0	56.6	30.0	26.6
2462	Legacy CCK, 1 to 11 Mbps	11	57.1	30.0	27.1
	Non HT-20, 6 to 54 Mbps	6	53.8	30.0	23.8
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	53.8	30.0	23.8
	HT-20, M0 to M15	m0	58.1	30.0	28.1
	HT-20 STBC, M0 to M7	m0	58.1	30.0	28.1
	HT-20 Beam Forming, M0 to M15	m0	58.1	30.0	28.1



**Conducted Spurs, 2412 MHz, 11 Mbps, Legacy CCK**

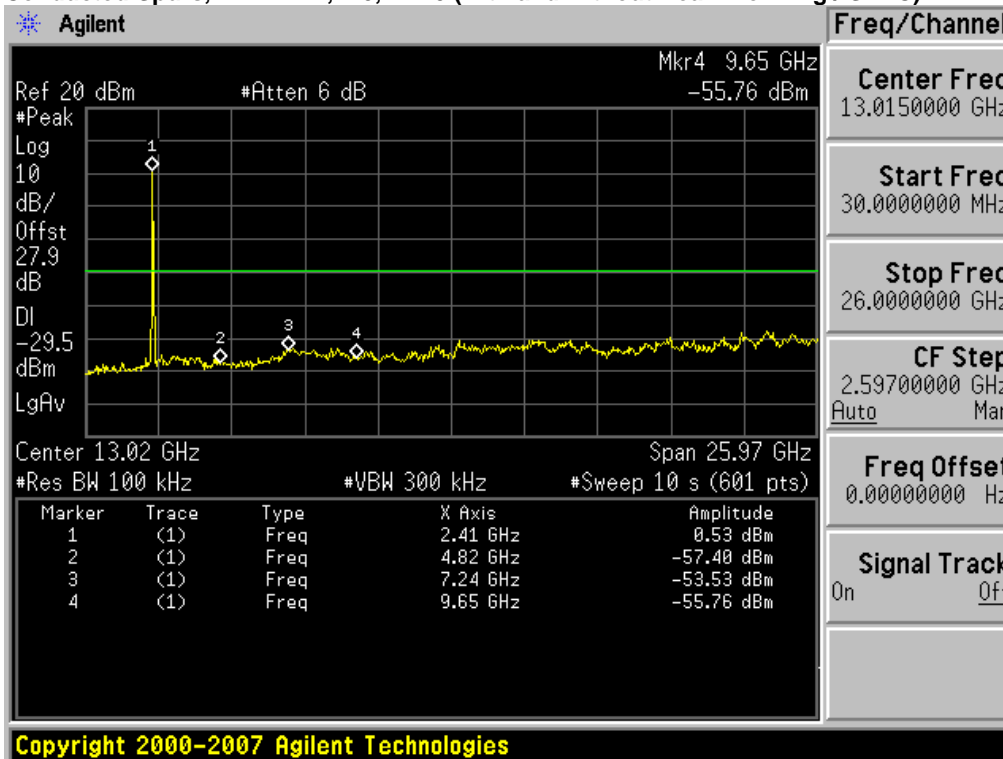


**Conducted Spurs, 2412 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

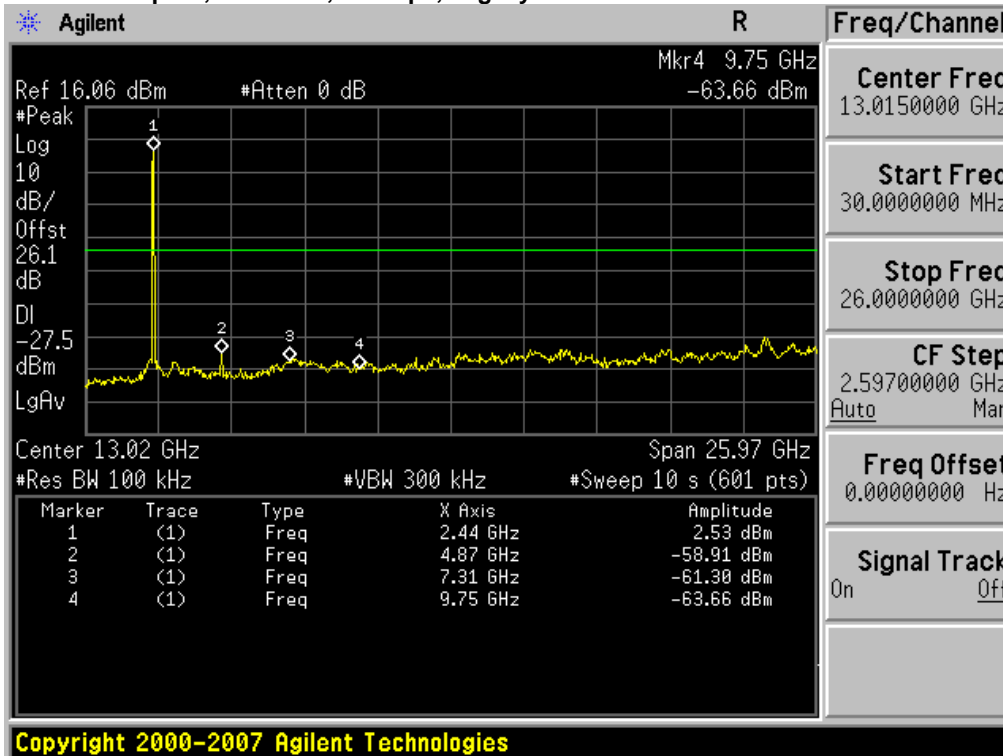




**Conducted Spurs, 2412 MHz, m0, HT20 (with and without Beam Forming / STBC)**

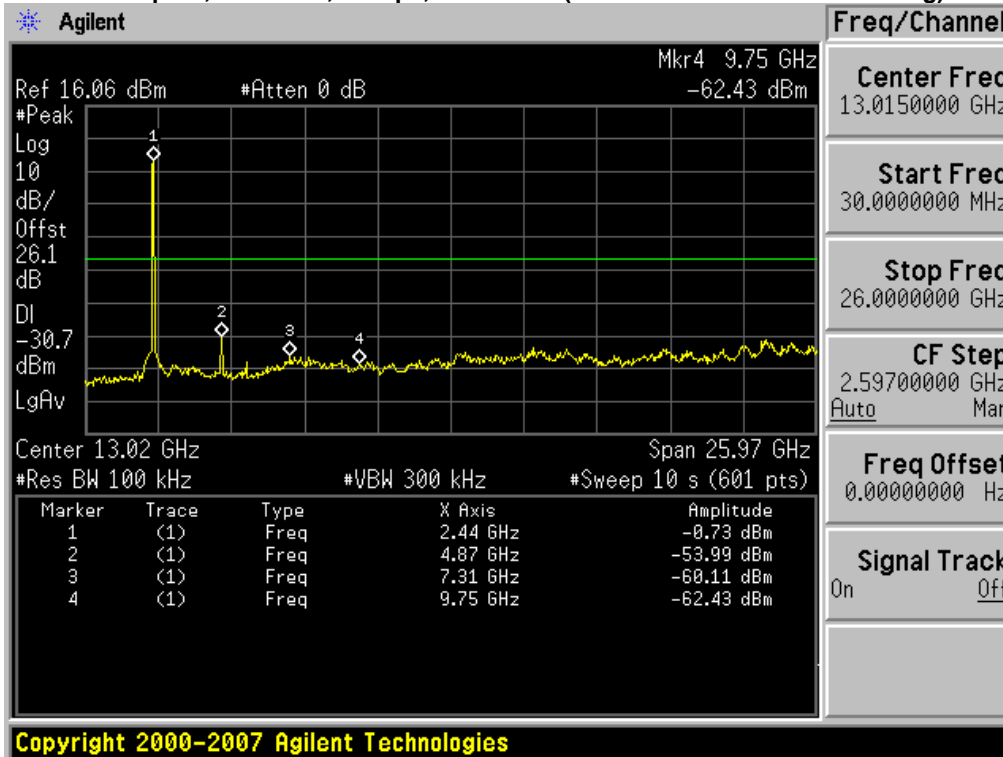


**Conducted Spurs, 2437 MHz, 11 Mbps, Legacy CCK**

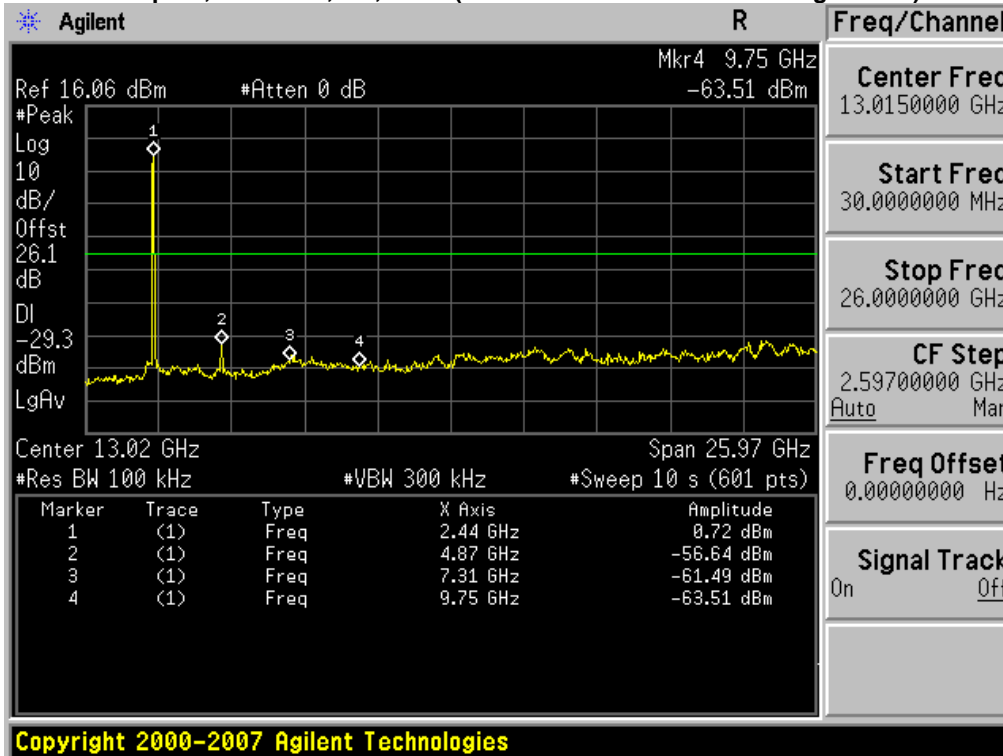




**Conducted Spurs, 2437 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**

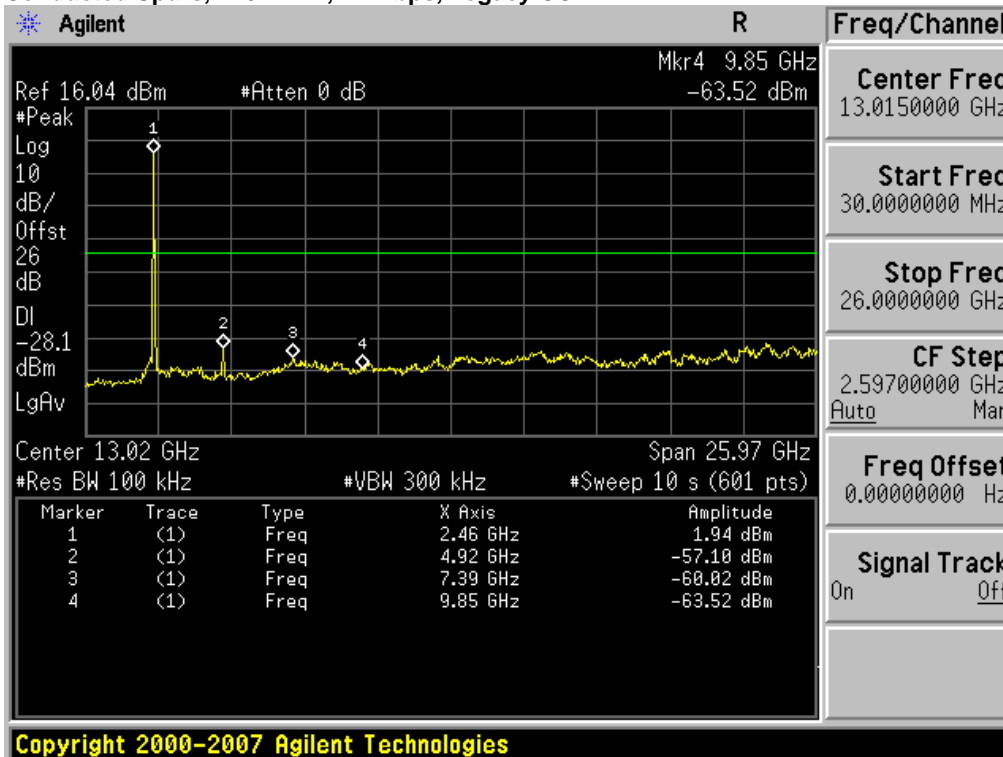


**Conducted Spurs, 2437 MHz, m0, HT20 (with and without Beam Forming / STBC)**

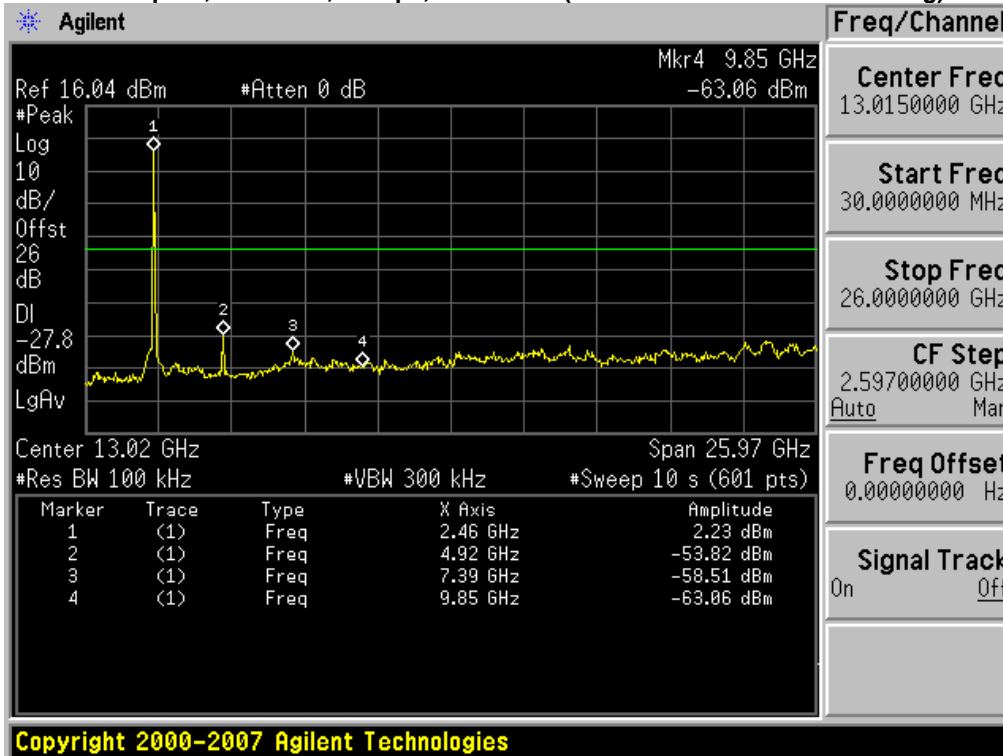




**Conducted Spurs, 2462 MHz, 11 Mbps, Legacy CCK**

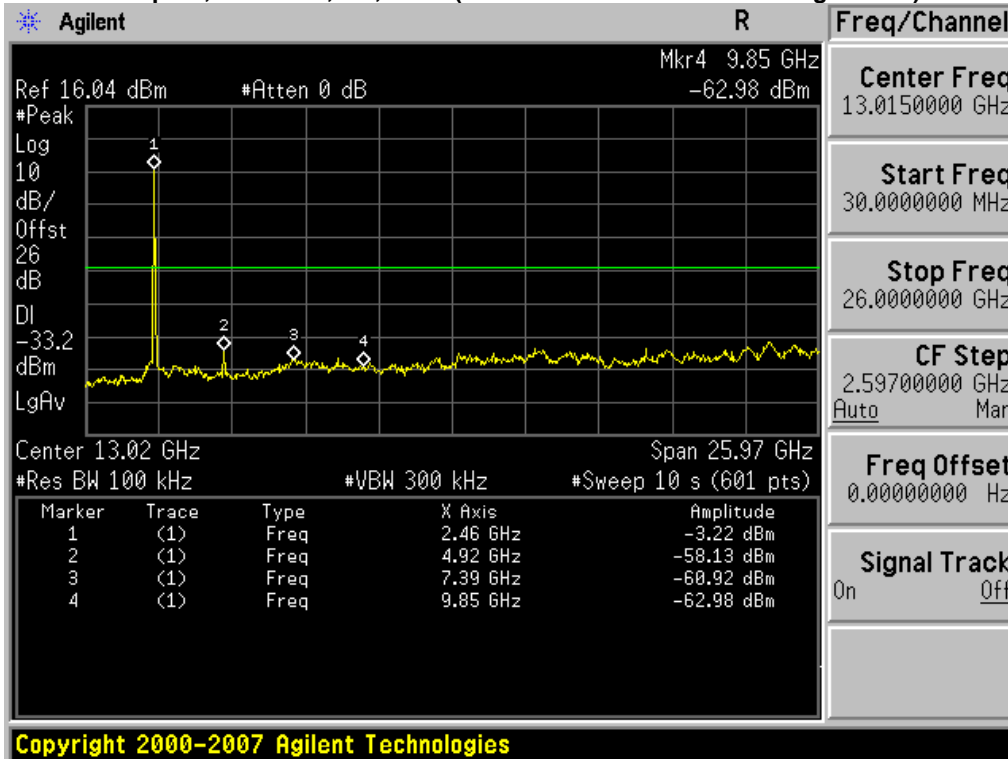


**Conducted Spurs, 2462 MHz, 6 Mbps, Non HT-20 (with and without Beam Forming)**





**Conducted Spurs, 2462 MHz, m0, HT20 (with and without Beam Forming / STBC)**





## Conducted Bandedge

15.205 / RSS-210 2.7: Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Use the procedures in 718828 D01 DTS Meas Guidance v01 to substitute conducted measurements in place of radiated measurements.

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Be sure to enter all losses between the transmitter output and the spectrum analyzer.

Reference Level:	10 dBm
Attenuation:	4 dB
Sweep Time:	Coupled
Resolution Bandwidth:	1MHz
Video Bandwidth:	1 MHz for peak, 100 Hz for average
Detector:	Peak

Save 2 plots:    1) Average Plot (Vertical and Horizontal), Limit= -41.25 dBm eirp (54dBuV/m @3m)  
                  2) Peak plot (Vertical and Horizontal), Limit = -21.25 dBm eirp (74dBuV/m @3m)

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands.

The “measure-and-sum technique” is used for measuring in-band transmit power of a device. In the measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units.

This report represents the worst case data for all supported operating modes and antennas.

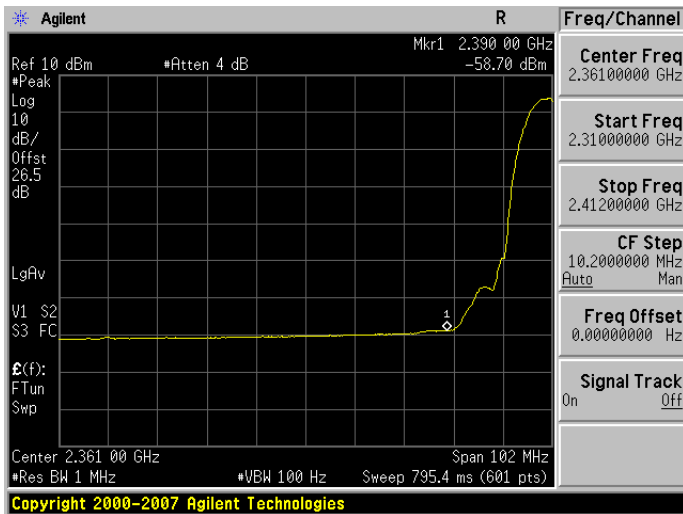




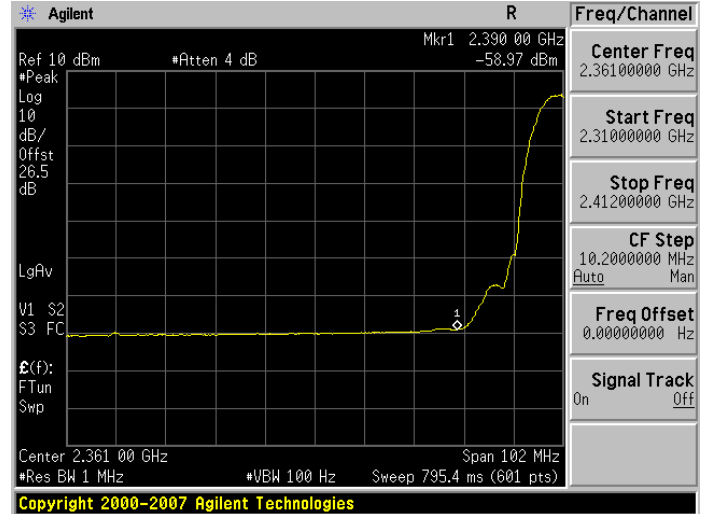
Frequency (MHz)	Operating Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Bandedge Level (dBm)	Tx 2 Bandedge Level (dBm)	Tx 3 Bandedge Level (dBm)	Total Tx Bandedge Level (dBm)	Limit (dBm)	Margin (dB)
2412	Legacy CCK, 1 to 11 Mbps	3	6	-58.7	-60.0	-58.6	-48.3	-41.25	7.0
	Non HT-20, 6 to 54 Mbps	3	6	-57.0	-56.7	-55.6	-45.6	-41.25	4.4
	Non HT-20 Beam Forming, 6 to 54 Mbps	3	11	-59.5	-59.2	-58.4	-43.4	-41.25	2.2
	HT-20, M0 to M15	3	6	-56.2	-55.8	-55.1	-44.9	-41.25	3.7
	HT-20 STBC, M0 to M7	3	6	-56.2	-55.8	-55.1	-44.9	-41.25	3.7
	HT-20 Beam Forming, M0 to M7	3	11	-59.1	-58.2	-58.1	-42.9	-41.25	1.6
	HT-20 Beam Forming, M8 to M15	3	8	-58.3	-57.5	-57.0	-45.0	-41.25	3.7
2462	Legacy CCK, 1 to 11 Mbps	3	6	-60.3	-60.1	-60.3	-49.4	-41.25	8.2
	Non HT-20, 6 to 54 Mbps	3	6	-59.3	-60.0	-59.8	-48.9	-41.25	7.7
	Non HT-20 Beam Forming, 6 to 54 Mbps	3	11	-60.3	-59.6	-61.0	-44.7	-41.25	3.4
	HT-20, M0 to M15	3	6	-58.7	-58.5	-58.1	-47.7	-41.25	6.4
	HT-20 STBC, M0 to M7	3	6	-58.7	-58.5	-58.1	-47.7	-41.25	6.4
	HT-20 Beam Forming, M0 to M7	3	11	-60.6	-60.5	-59.7	-44.6	-41.25	3.4
	HT-20 Beam Forming, M8 to M15	3	8	-57.6	-58.4	-59.3	-45.8	-41.25	4.6



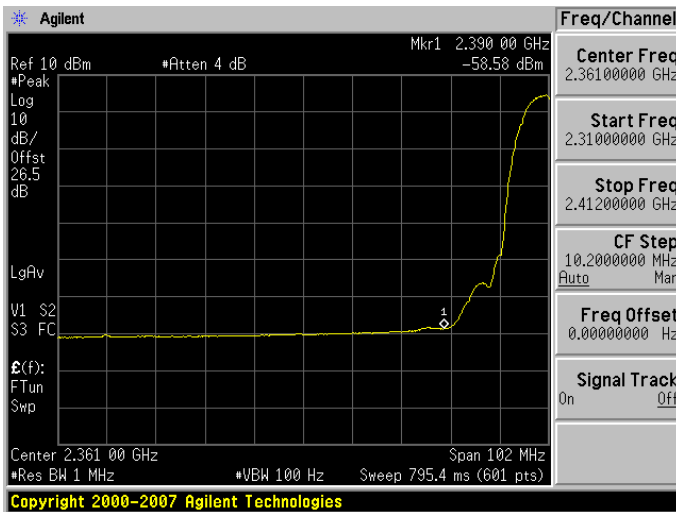
Conducted Bandedge, 2412 MHz, 11 Mbps, Legacy CCK, Average



Antenna A



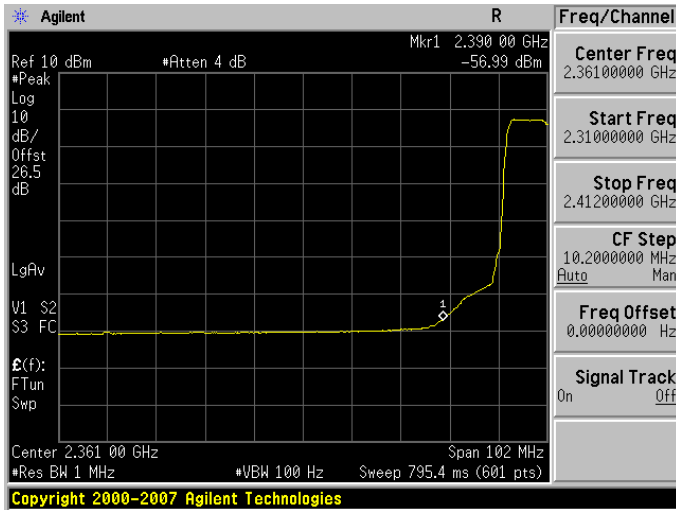
Antenna B



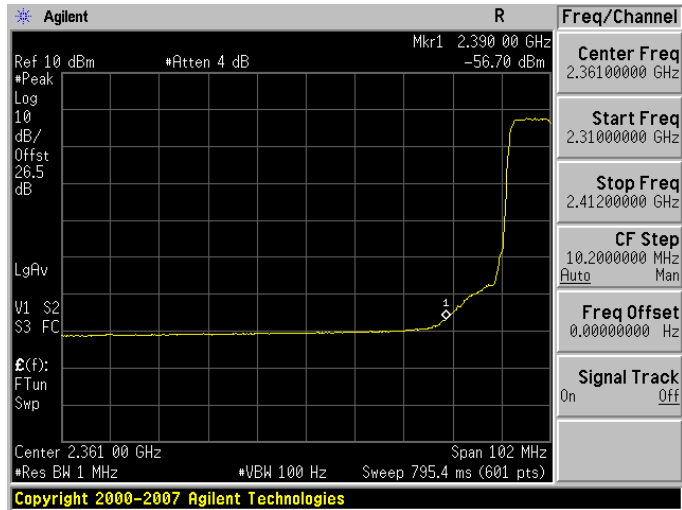
Antenna C



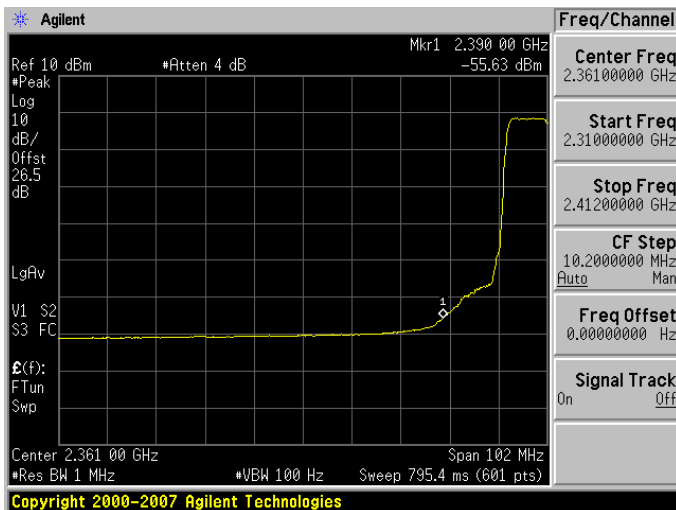
Conducted Bandedge, 2412 MHz, 6 Mbps, Non HT-20, Average



Antenna A



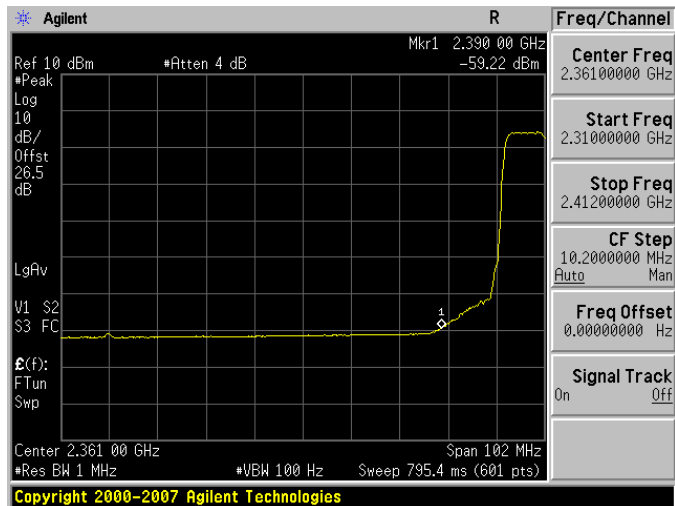
Antenna B



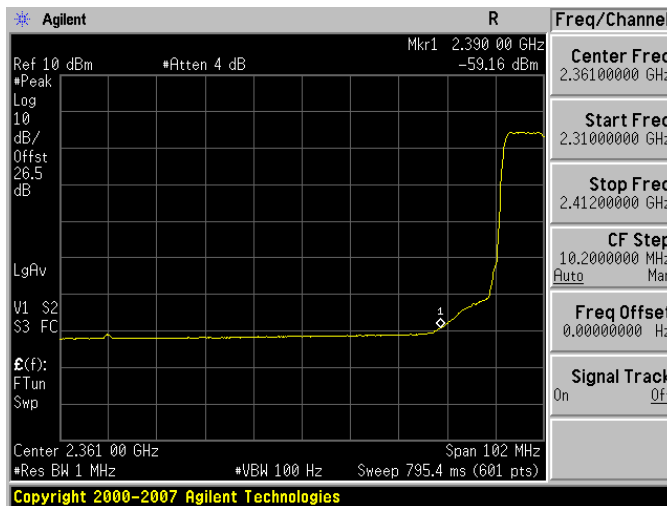
Antenna C



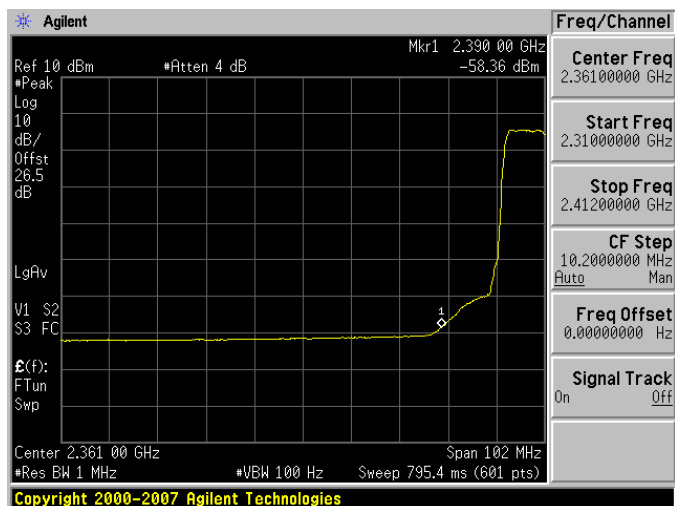
Conducted Bandedge, 2412 MHz, 6 Mbps, Non HT-20 Beam Forming, Average



Antenna A



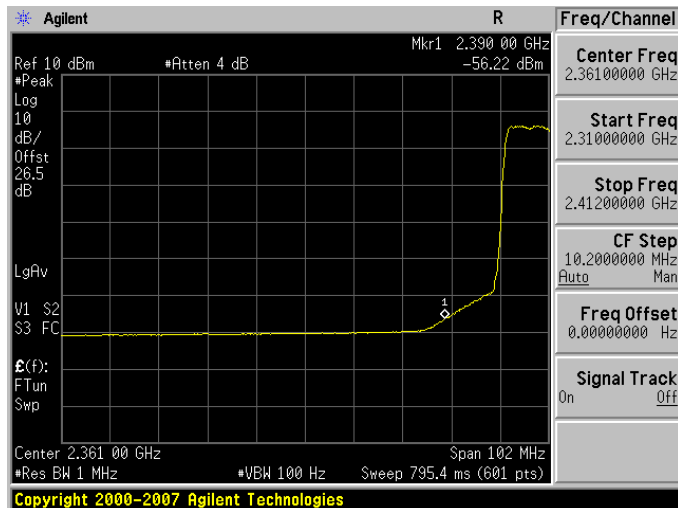
Antenna B



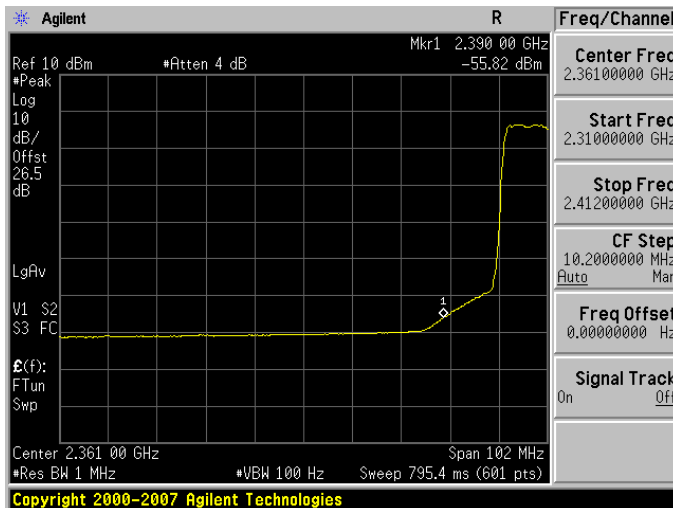
Antenna C



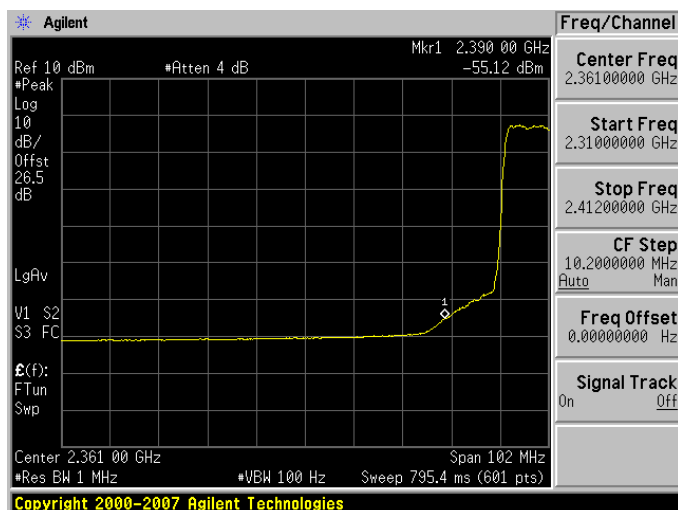
Conducted Bandedge, 2412 MHz, m0, HT20 Beam Forming, with and without STBC, Average



Antenna A



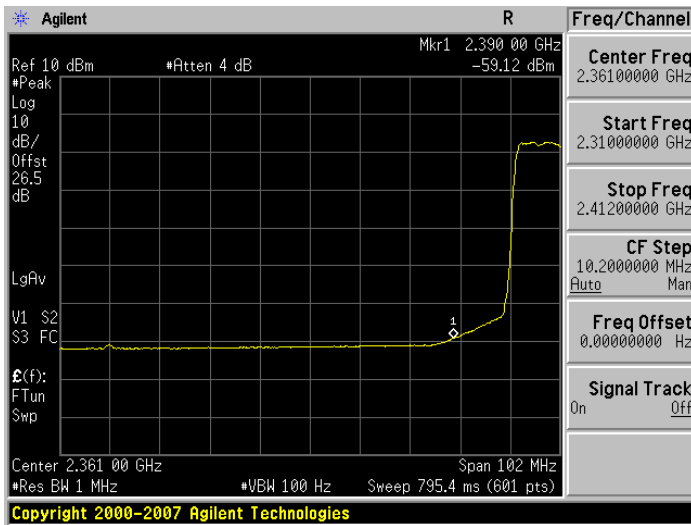
Antenna B



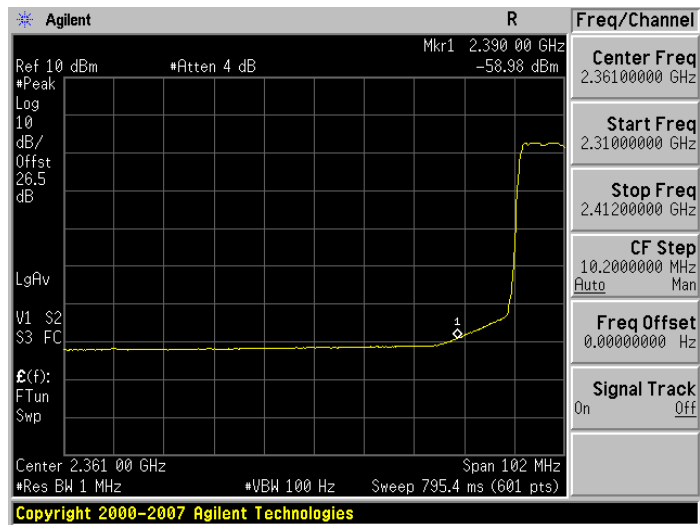
Antenna C



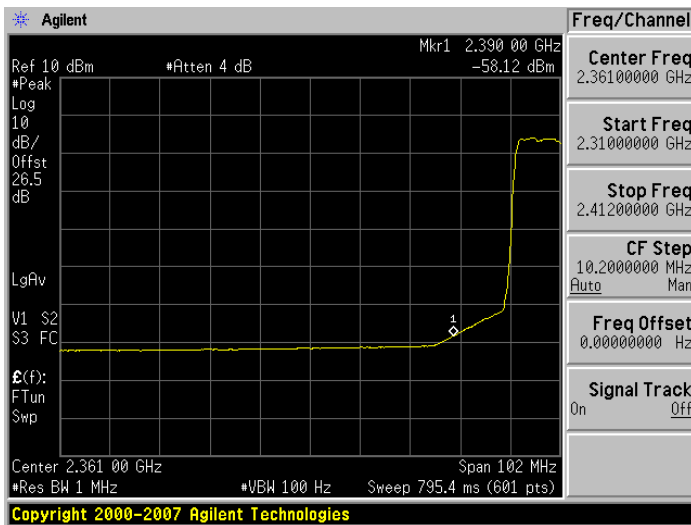
Conducted Bandedge, 2412 MHz, m0, HT20 Beam Forming , Average



Antenna A



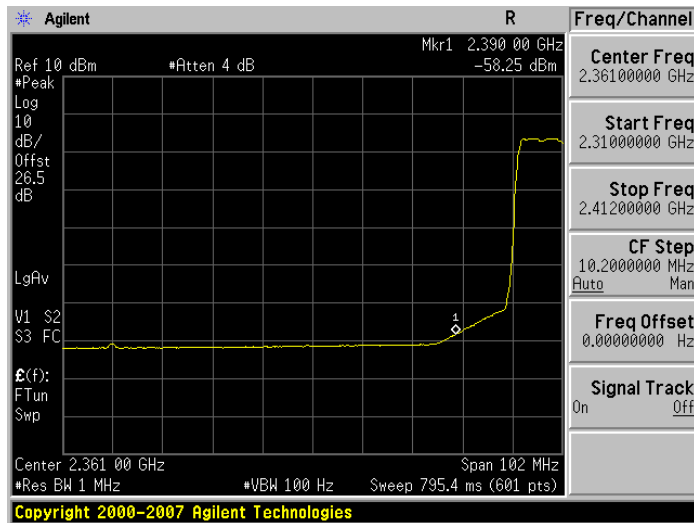
Antenna B



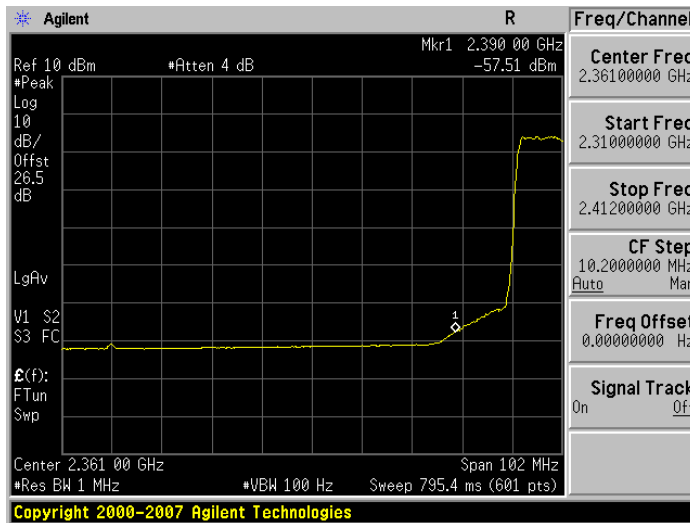
Antenna C



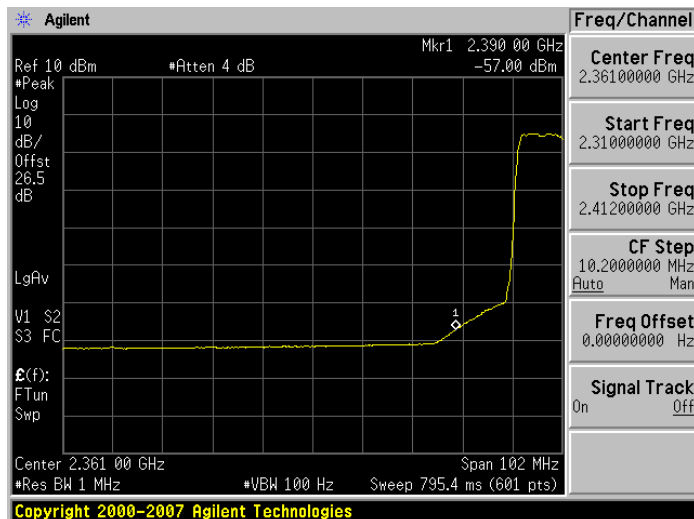
Conducted Bandedge, 2412 MHz, m8, HT20 Beam Forming , Average



Antenna A



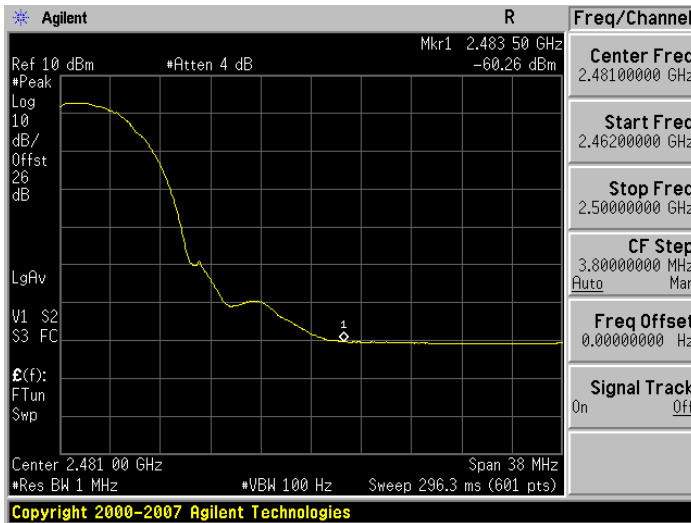
Antenna B



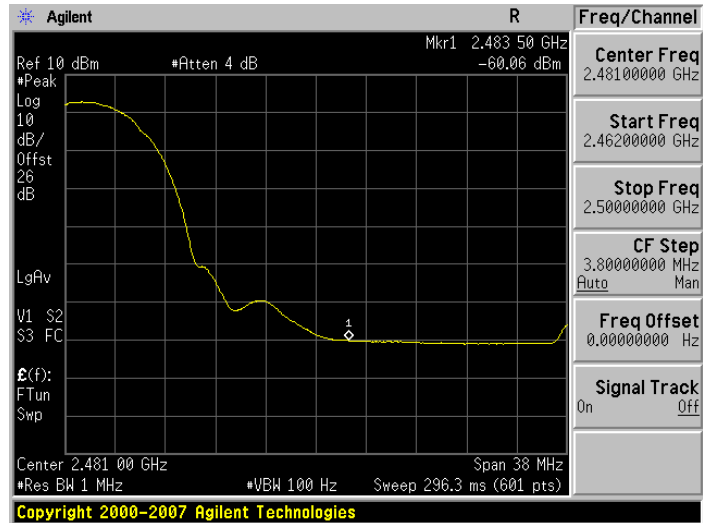
Antenna C



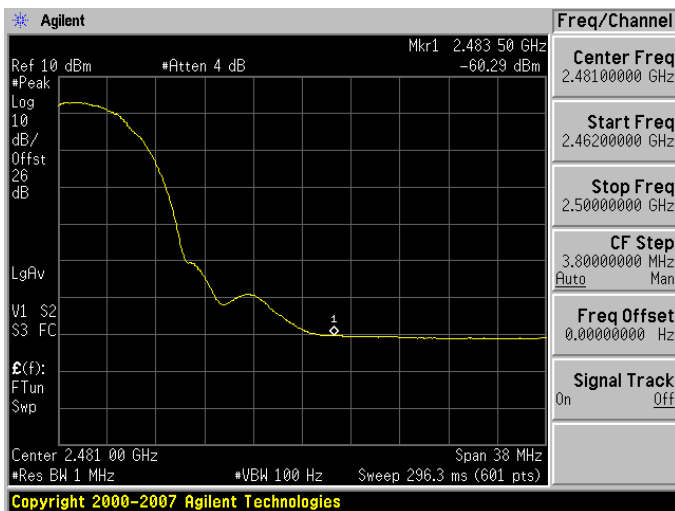
Conducted Bandedge, 2462 MHz, 11 Mbps, Legacy CCK, Average



Antenna A



Antenna B

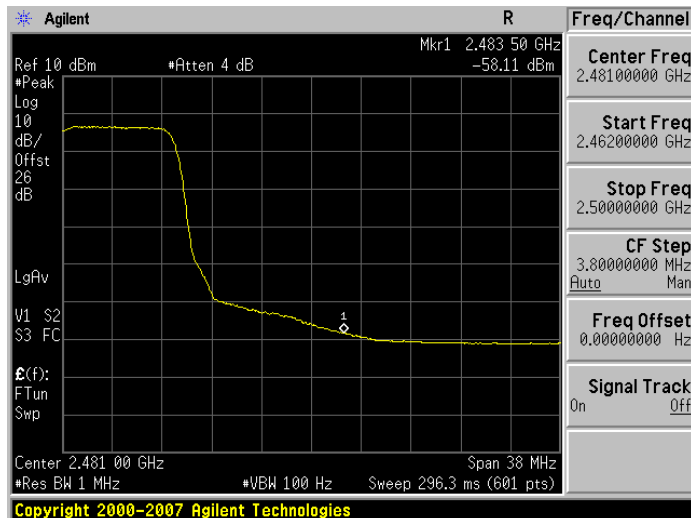


Antenna C

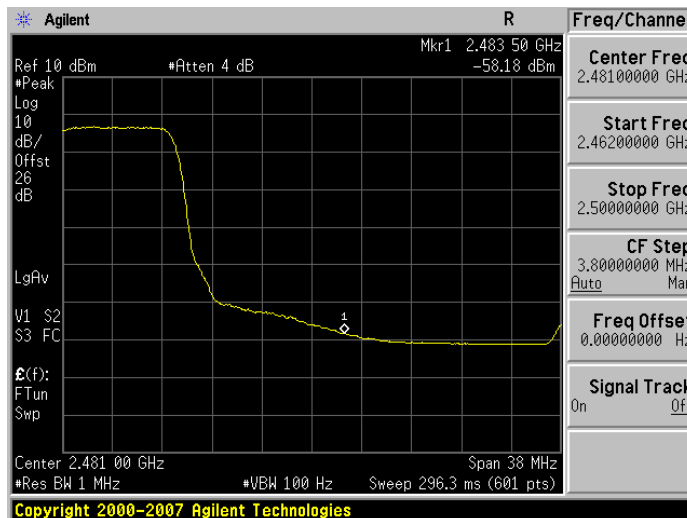




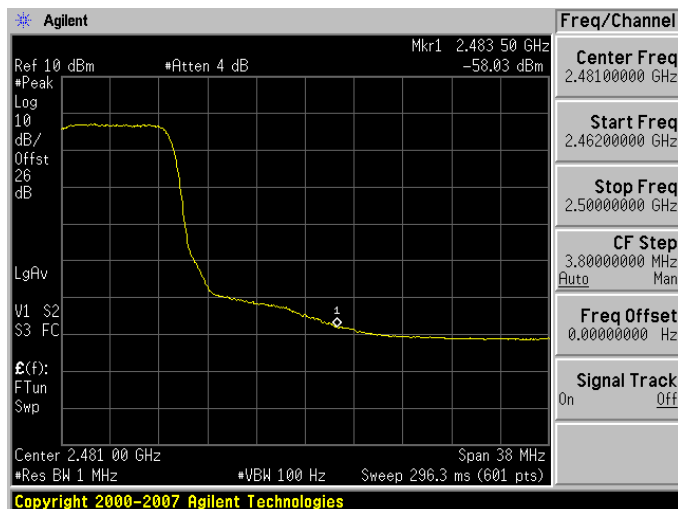
**Conducted Bandedge, 2462 MHz, 6 Mbps, Non HT-20, Average**



**Antenna A**



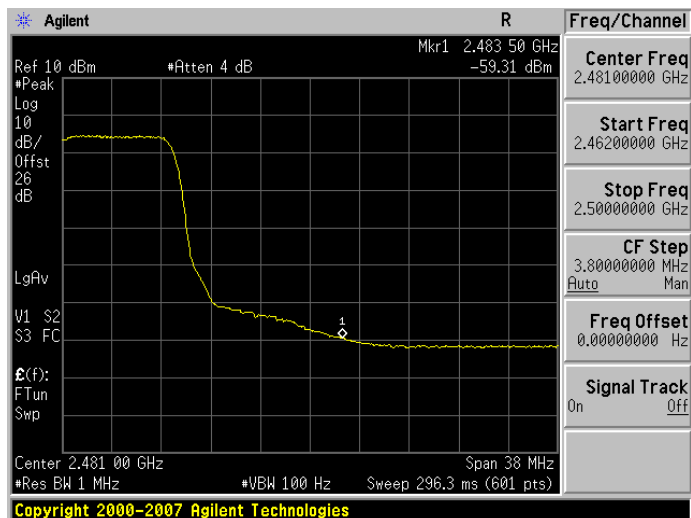
**Antenna B**



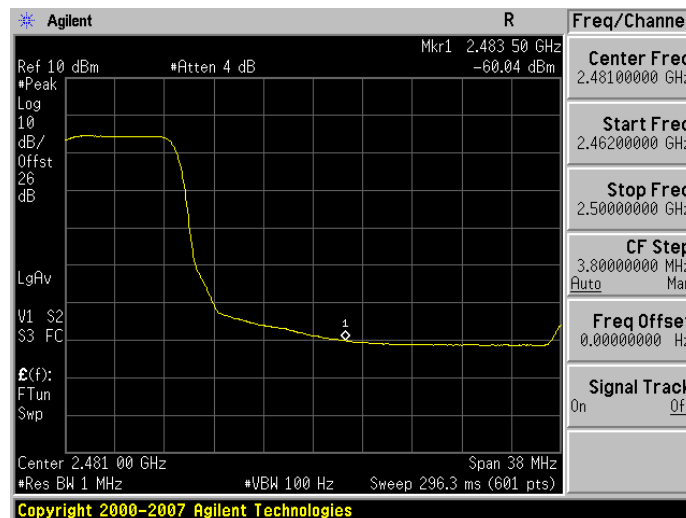
**Antenna C**



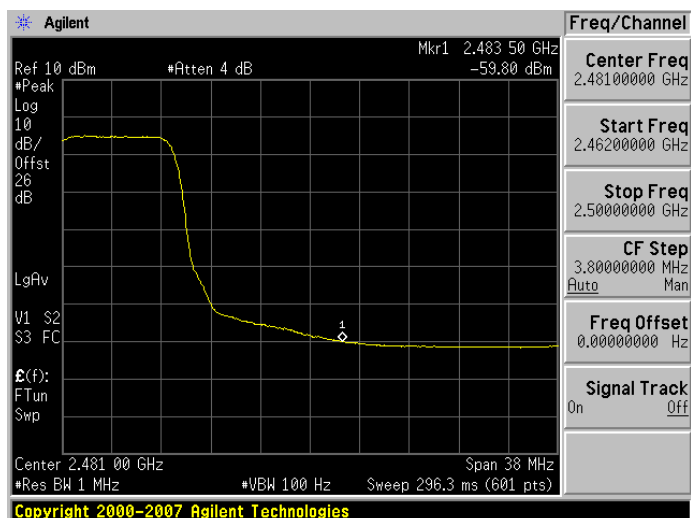
Conducted Bandedge, 2462 MHz, 6 Mbps, Non HT-20 Beam Forming, Average



Antenna A



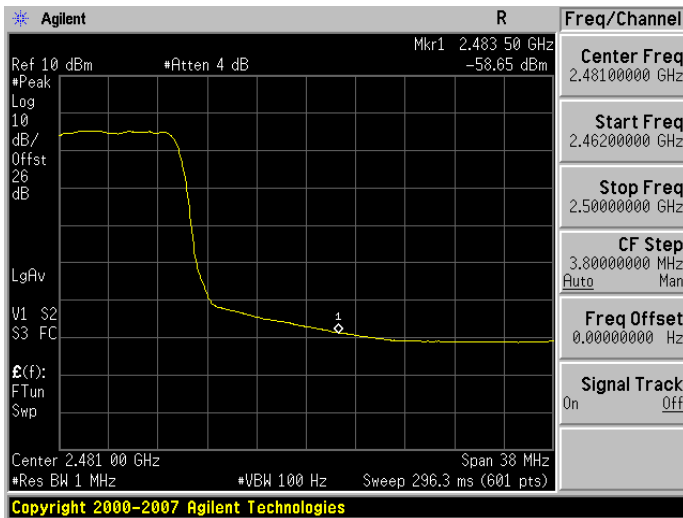
Antenna B



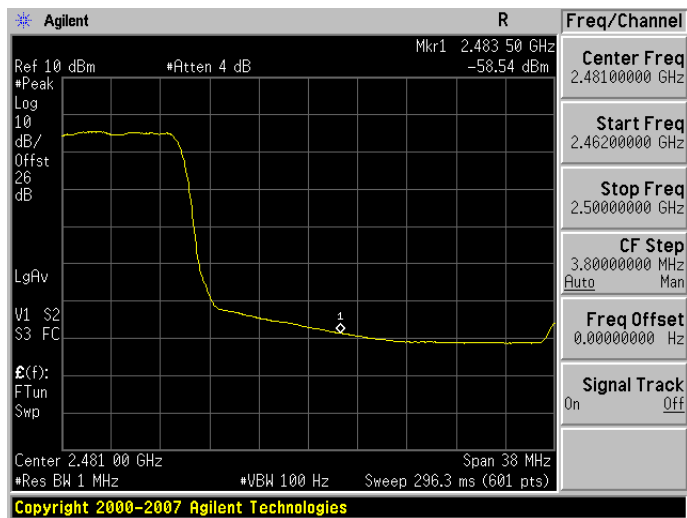
Antenna C



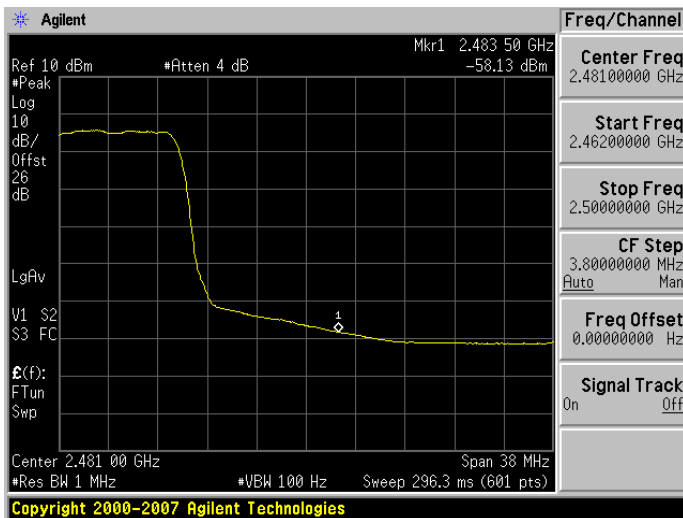
Conducted Bandedge, 2462 MHz, m0, HT20 with and without STBC, Average



Antenna A



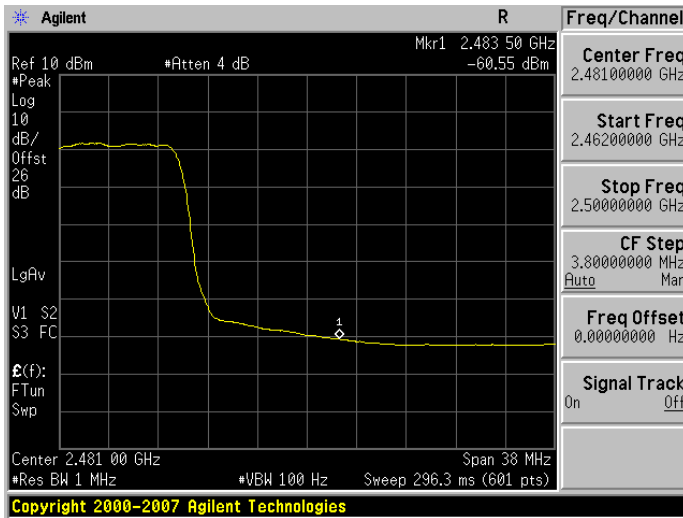
Antenna B



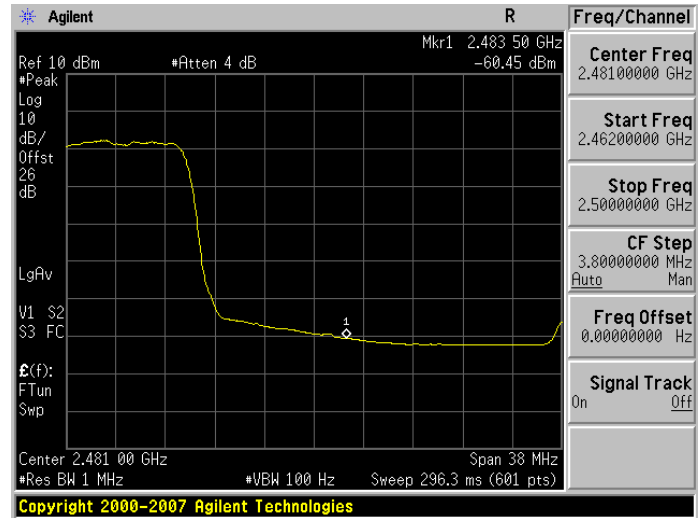
Antenna C



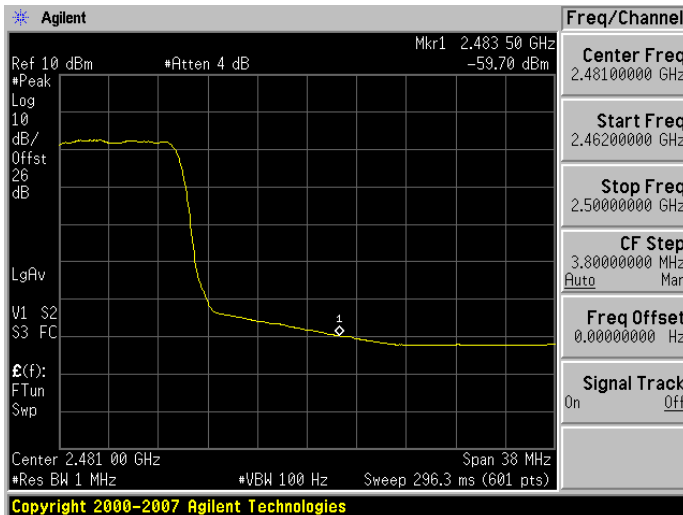
Conducted Bandedge, 2462 MHz, m0, HT20 Beam Forming, Average



Antenna A



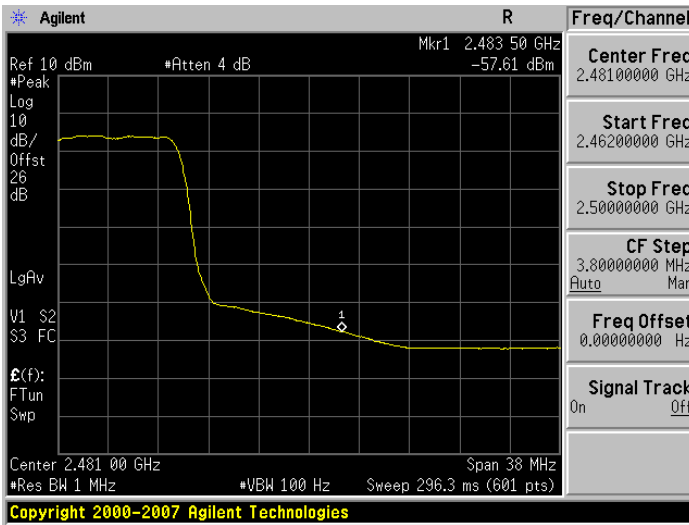
Antenna B



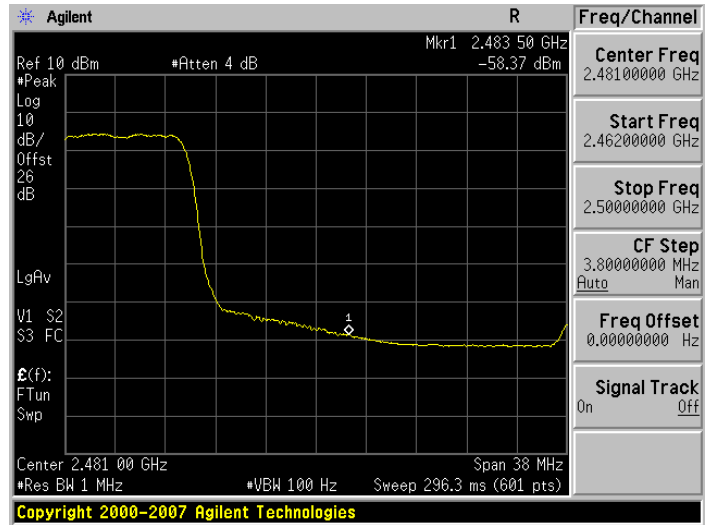
Antenna C



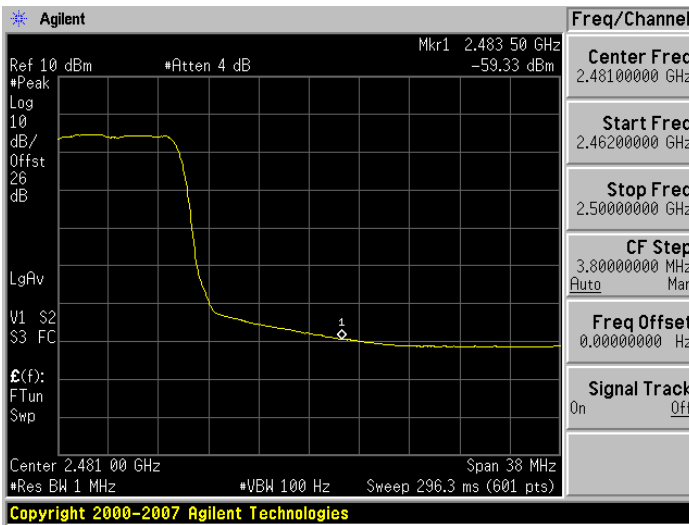
Conducted Bandedge, 2462 MHz, m8, HT20 Beam Forming, Average



Antenna A



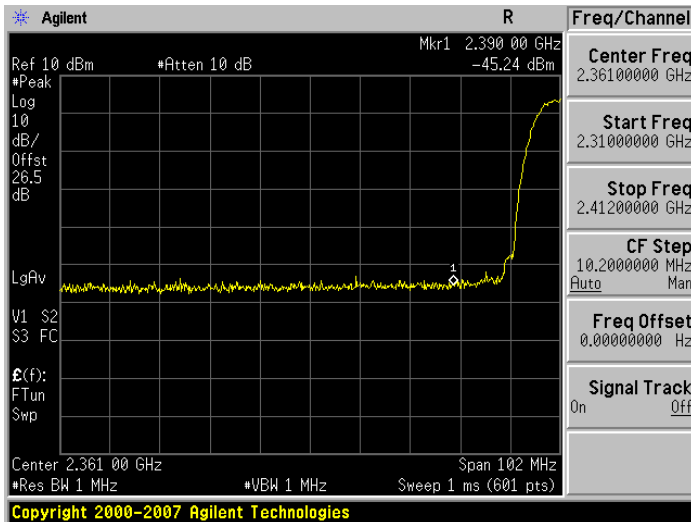
Antenna B



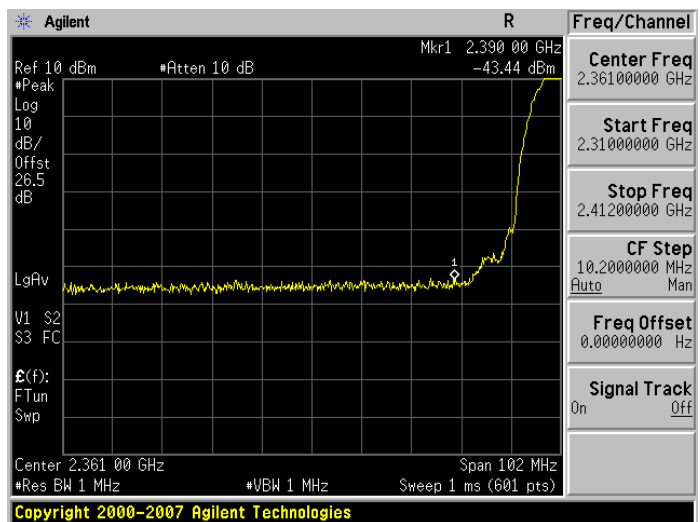
Antenna C



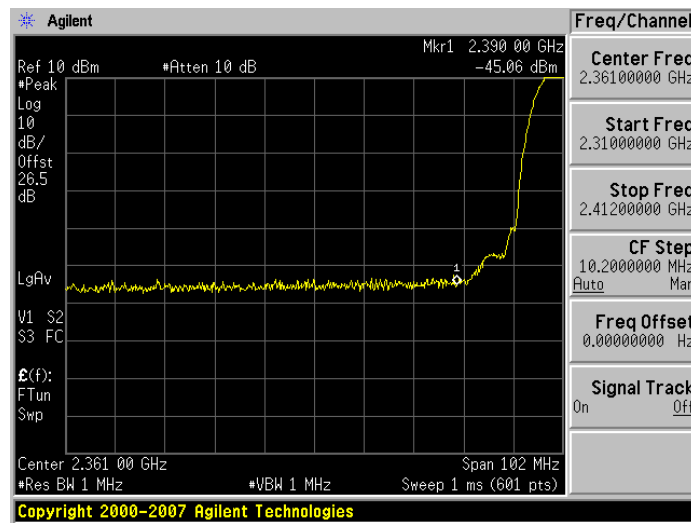
Conducted Bandedge, 2412 MHz, 11 Mbps, Legacy CCK, Peak



Antenna A



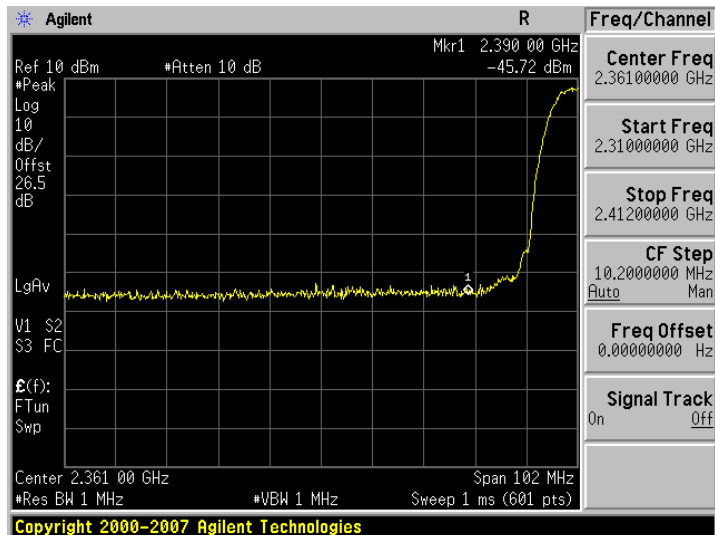
Antenna B



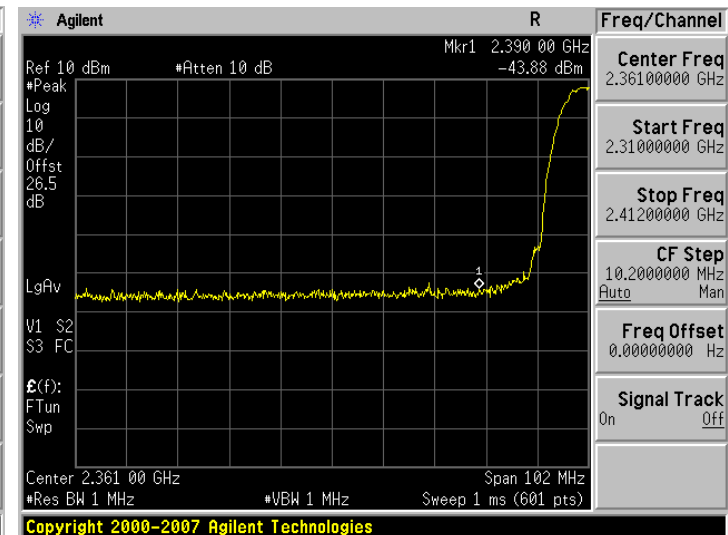
Antenna C



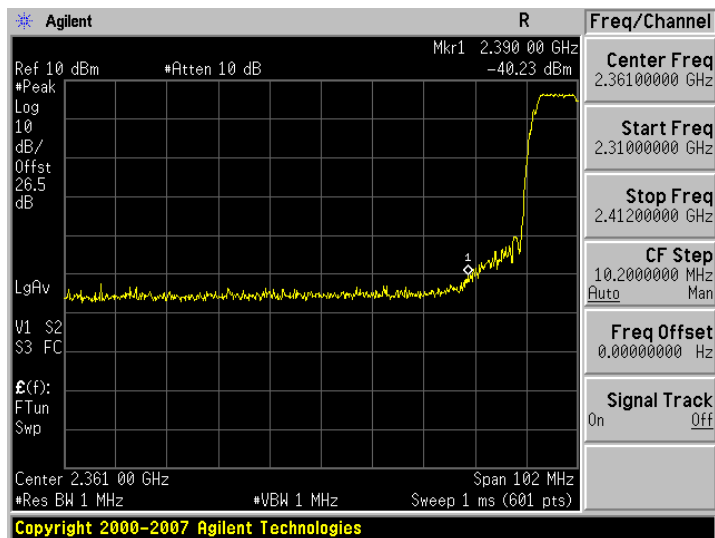
Conducted Bandedge, 2412 MHz, 6 Mbps, Non HT-20, Peak



Antenna A



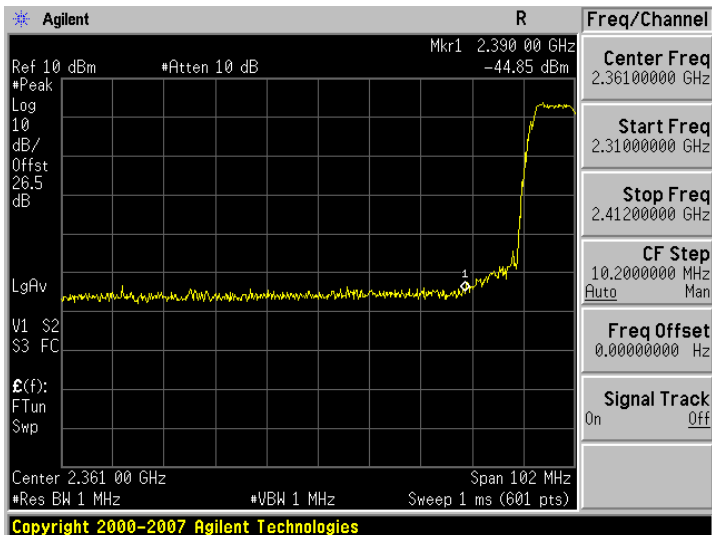
Antenna B



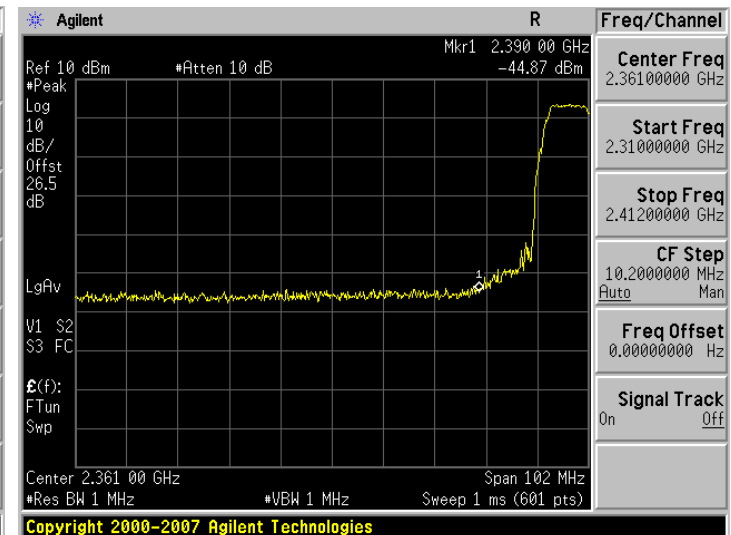
Antenna C



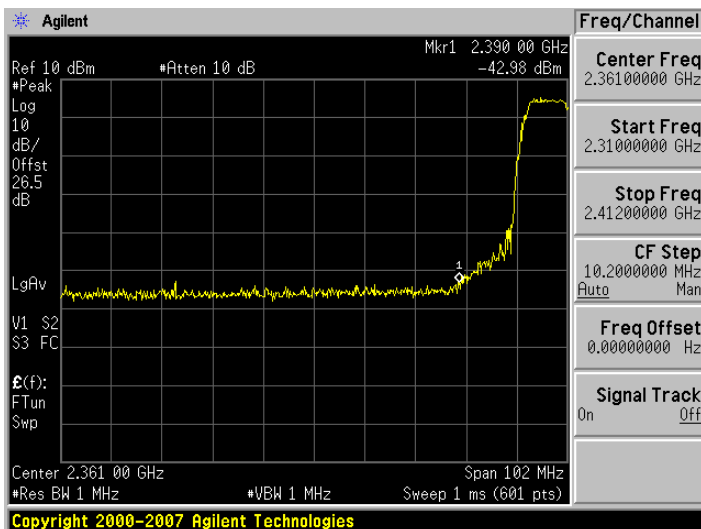
Conducted Bandedge, 2412 MHz, 6 Mbps, Non HT-20 Beam Forming, Peak



Antenna A



Antenna B

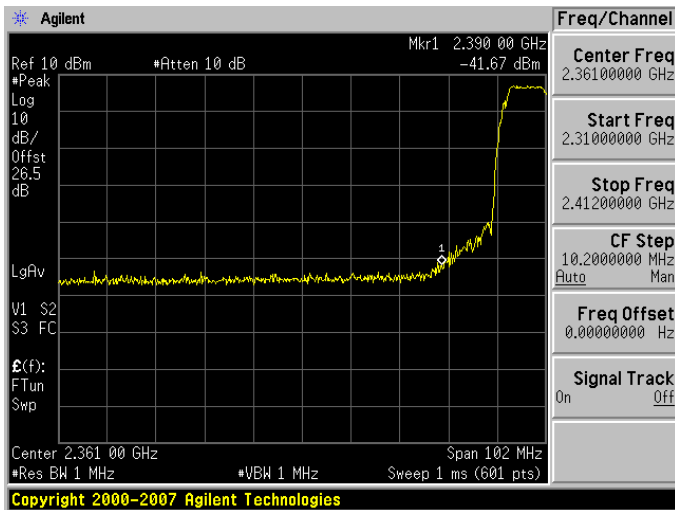


Antenna C

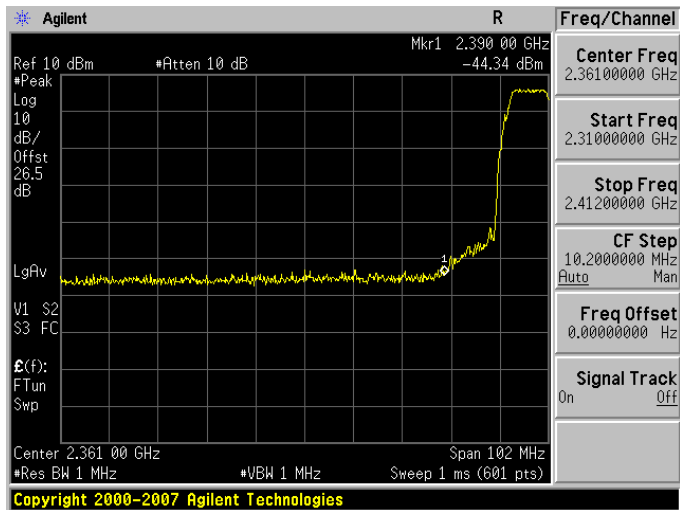




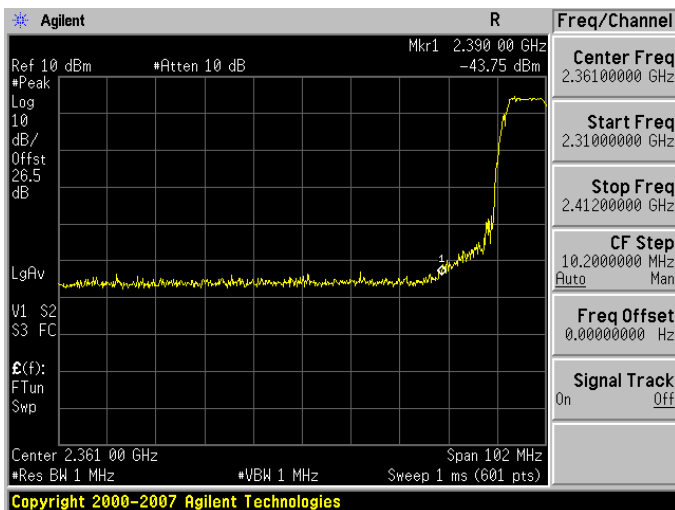
Conducted Bandedge, 2412 MHz, m0, HT20 Beam Forming, with and without STBC, Peak



Antenna A



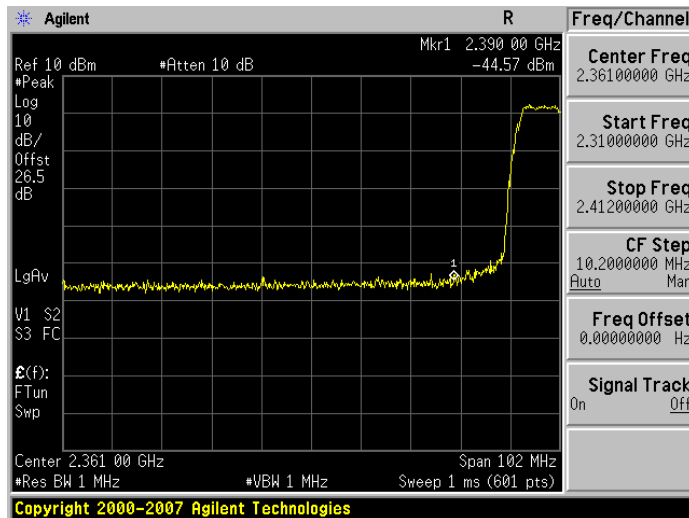
Antenna B



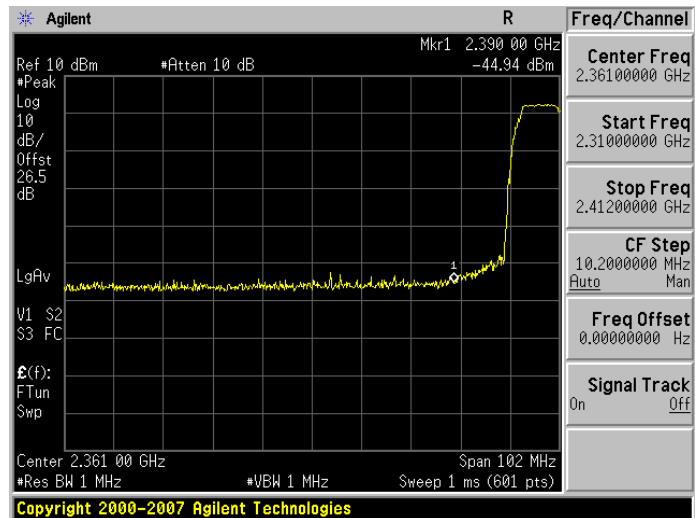
Antenna C



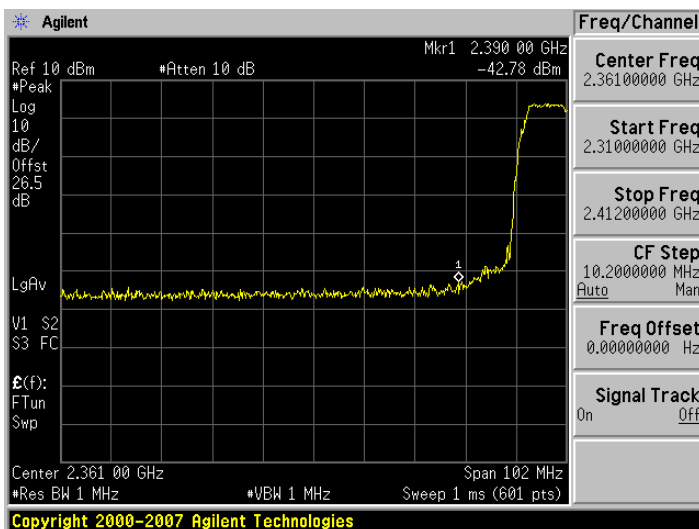
Conducted Bandedge, 2412 MHz, m0, HT20 Beam Forming , Peak



Antenna A



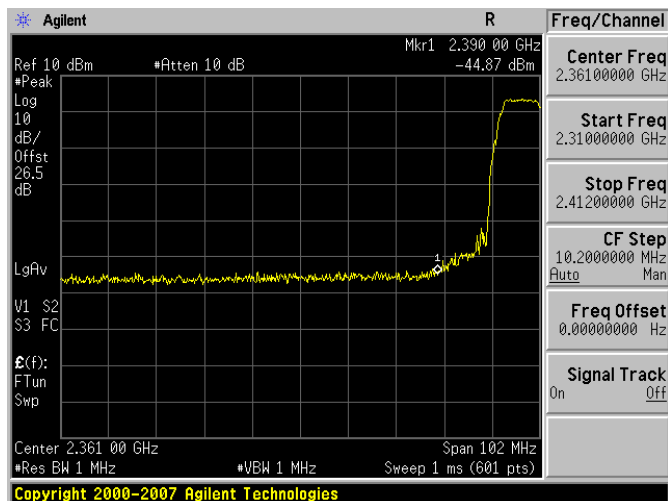
Antenna B



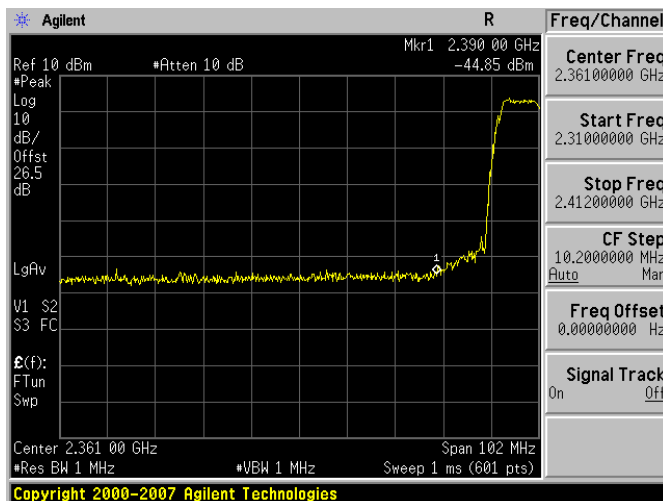
Antenna C



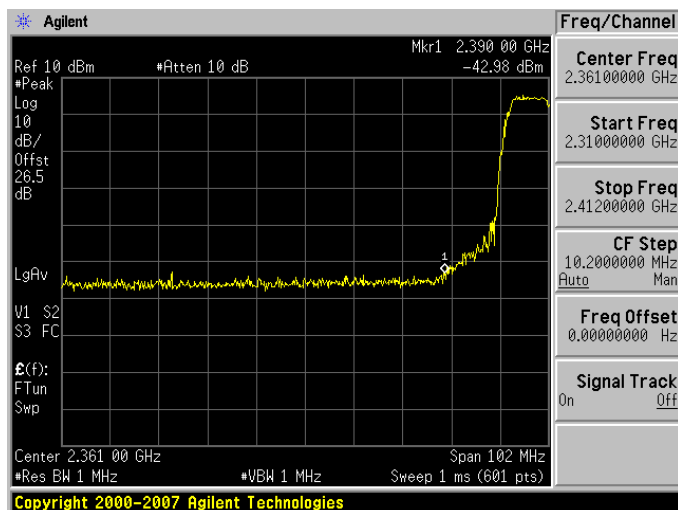
Conducted Bandedge, 2412 MHz, m8, HT20 Beam Forming , Peak



Antenna A



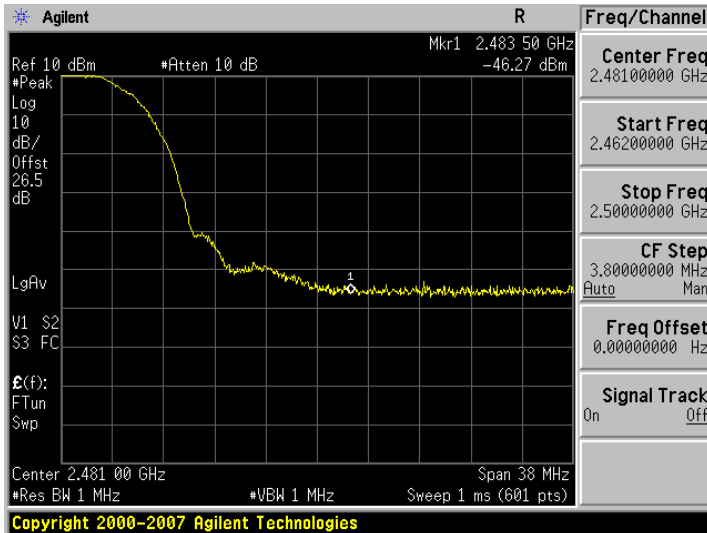
Antenna B



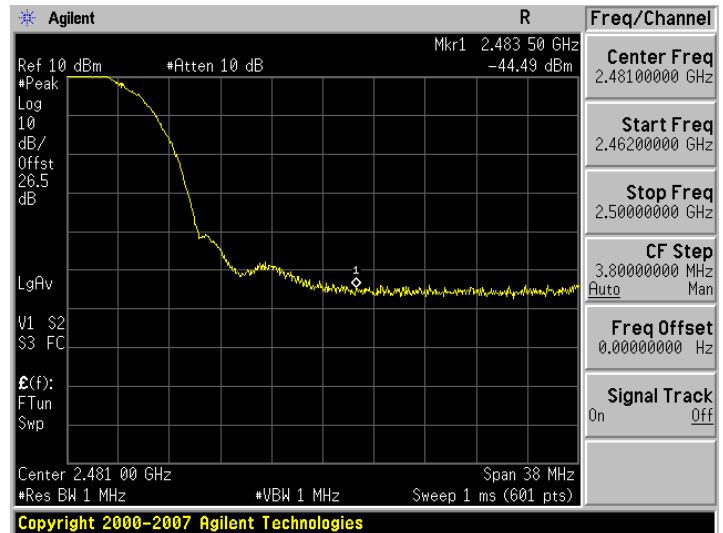
Antenna C



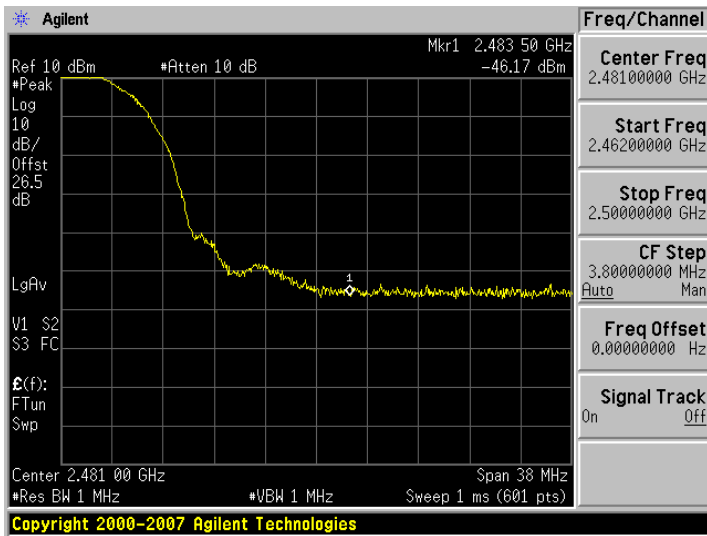
Conducted Bandedge, 2462 MHz, 11 Mbps, Legacy CCK, Peak



Antenna A



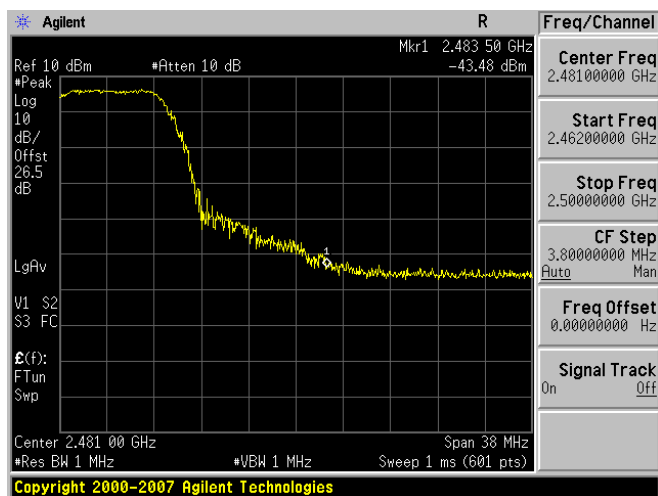
Antenna B



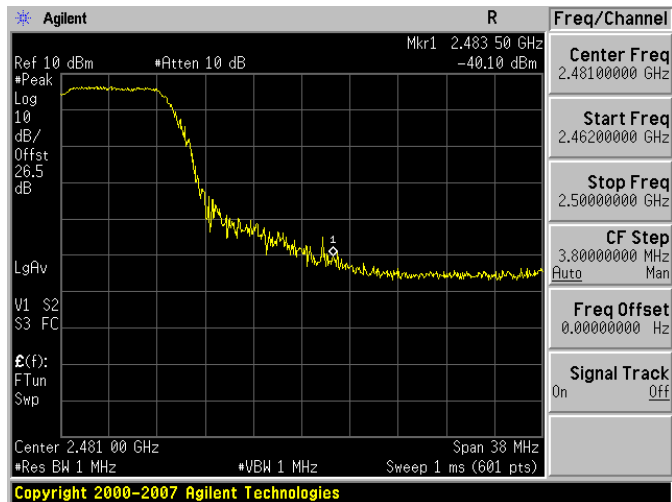
Antenna C



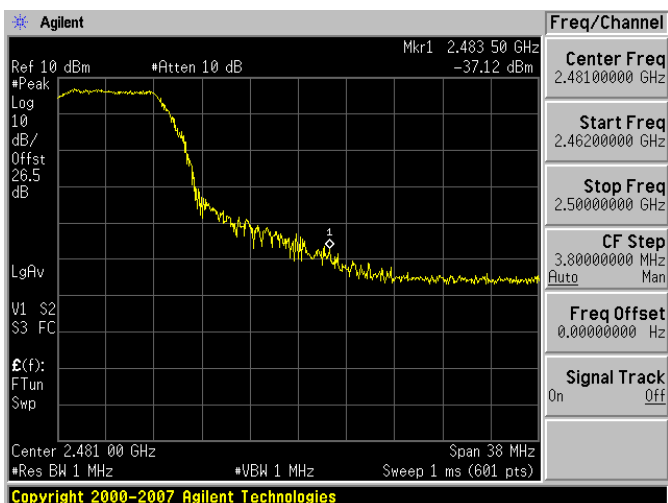
Conducted Bandedge, 2462 MHz, 6 Mbps, Non HT-20, Peak



Antenna A



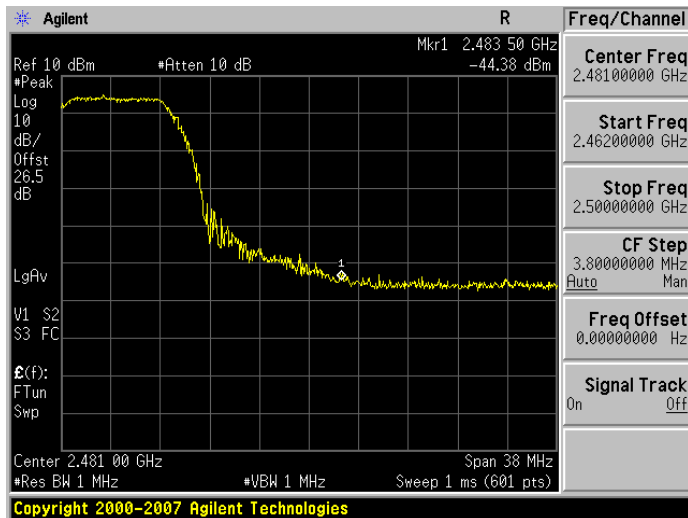
Antenna B



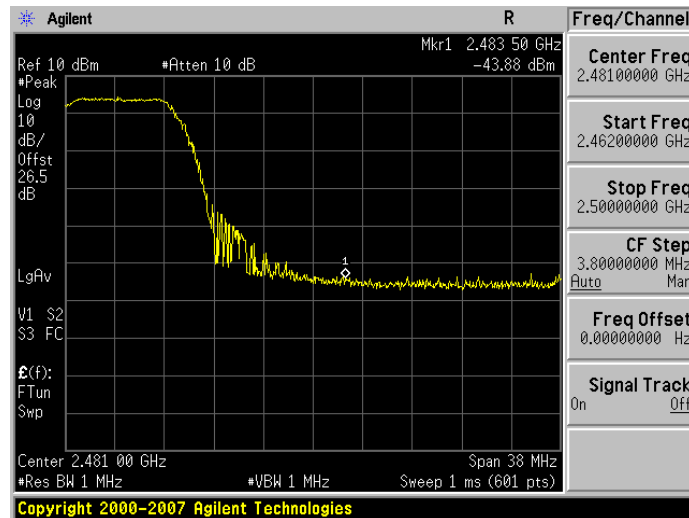
Antenna C



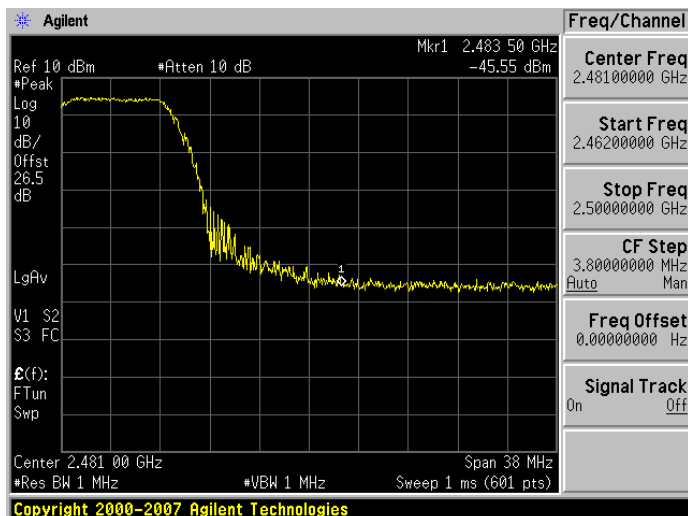
**Conducted Bandedge, 2462 MHz, 6 Mbps, Non HT-20 Beam Forming, Peak**



**Antenna A**



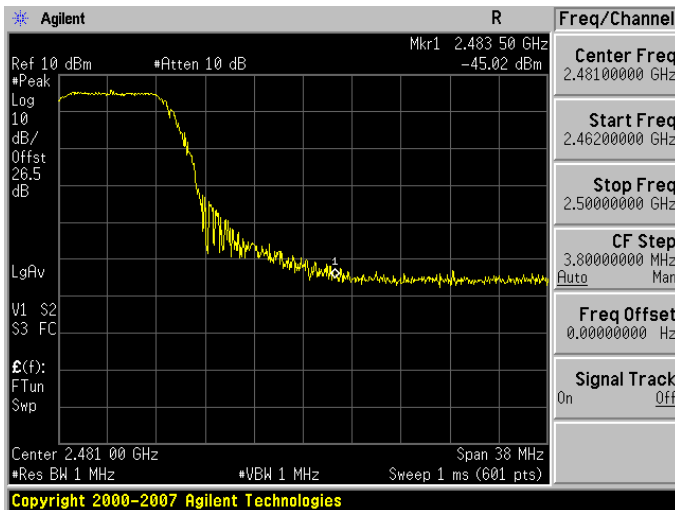
**Antenna B**



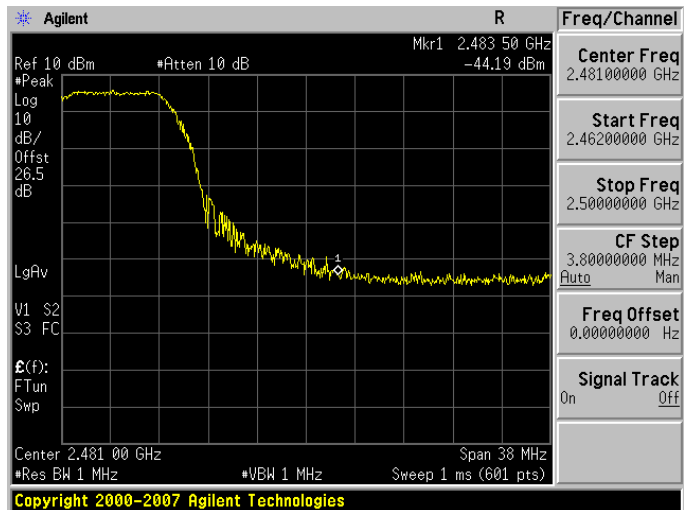
**Antenna C**



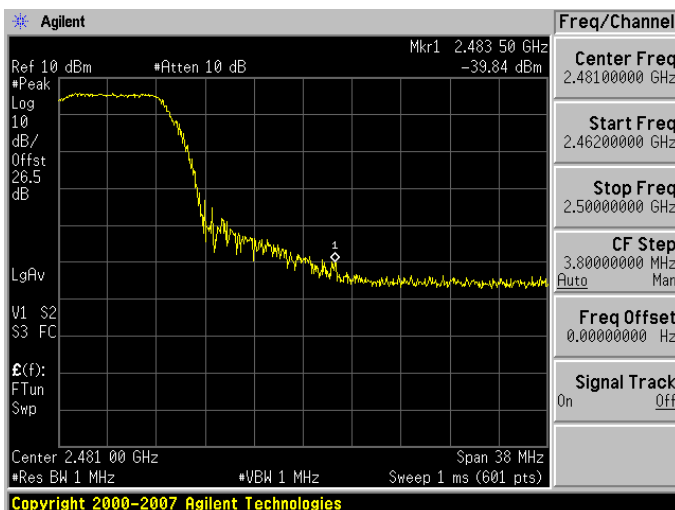
Conducted Bandedge, 2462 MHz, m0, HT20 with and without STBC, Peak



Antenna A



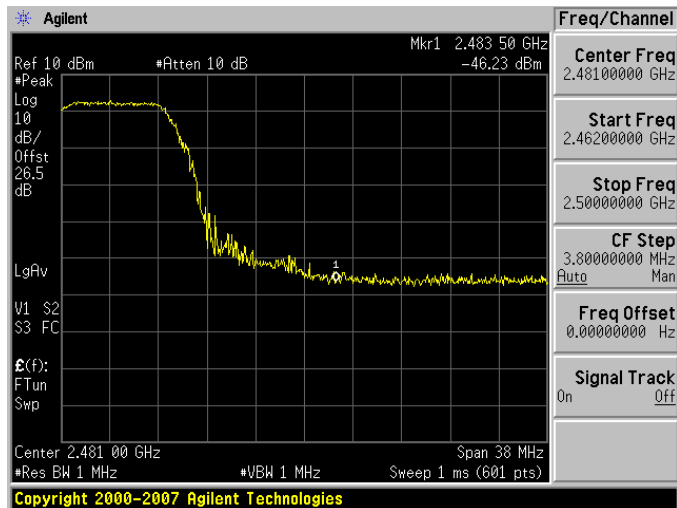
Antenna B



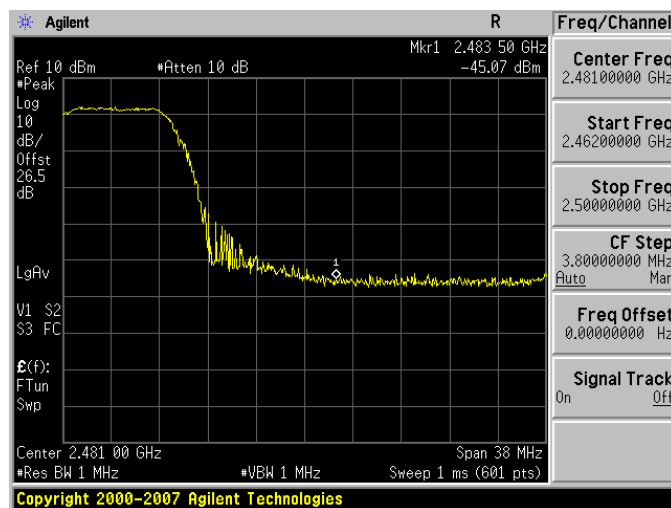
Antenna C



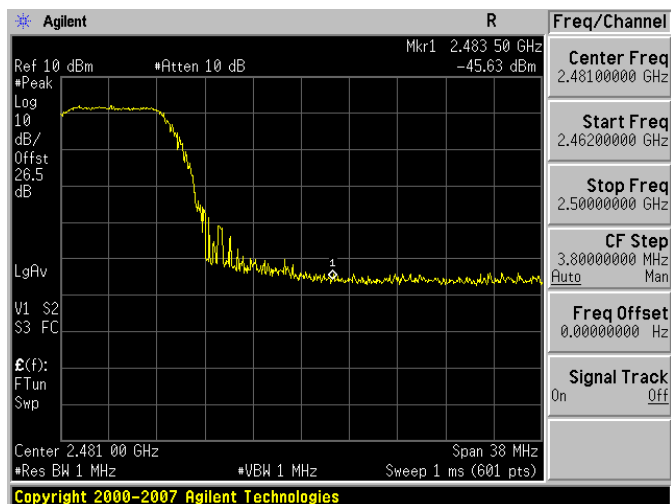
Conducted Bandedge, 2462 MHz, m0, HT20 Beam Forming, Peak



Antenna A



Antenna B

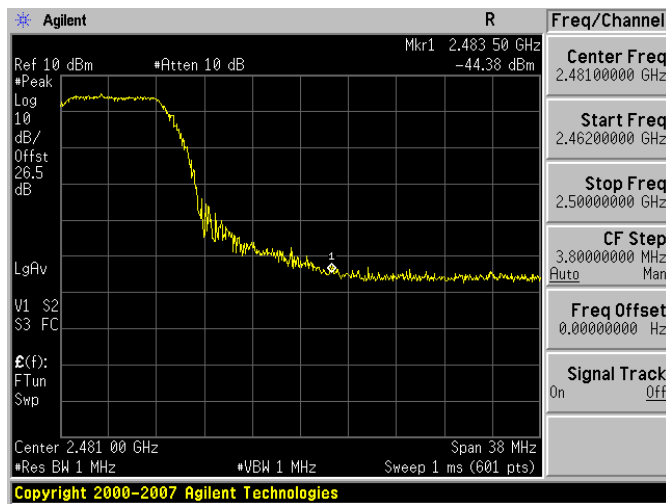


Antenna C

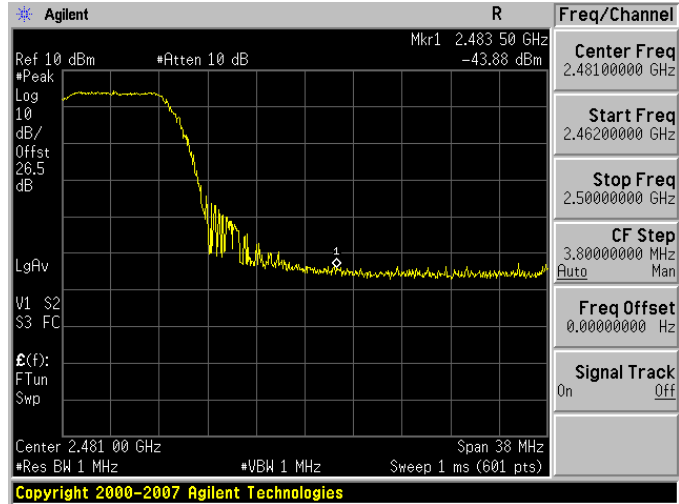




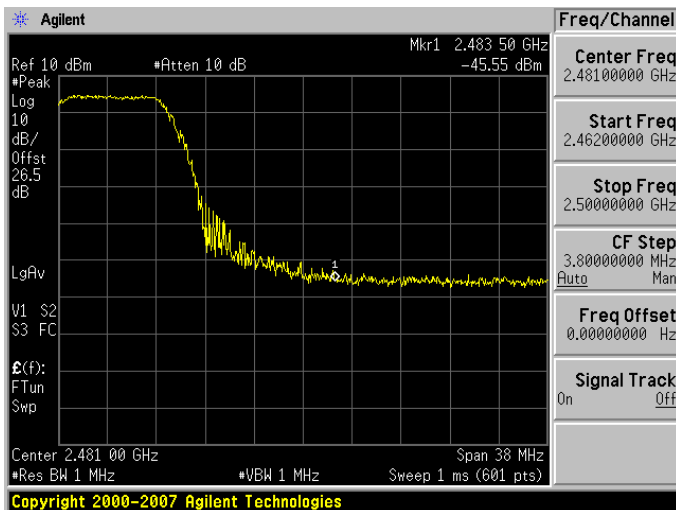
Conducted Bandedge, 2462 MHz, m8, HT20 Beam Forming, Peak



Antenna A



Antenna B



Antenna C



## **Appendix B: Emission Test Results**

**Testing Laboratory:** Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134, USA

### **Radiated Spurious Emissions**

15.205 / RSS-210 2.7: Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

Span:	1GHz – 18 GHz
Reference Level:	80 dBuV
Attenuation:	10 dB
Sweep Time:	Coupled
Resolution Bandwidth:	1MHz
Video Bandwidth:	1 MHz for peak, 10 Hz for average
Detector:	Peak

Terminate the access Point RF ports with 50 ohm loads.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots:    1) Average Plot (Vertical and Horizontal), Limit= 54dBuV/m @3m  
                  2) Peak plot (Vertical and Horizontal), Limit = 74dBuV/m @3m

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands.

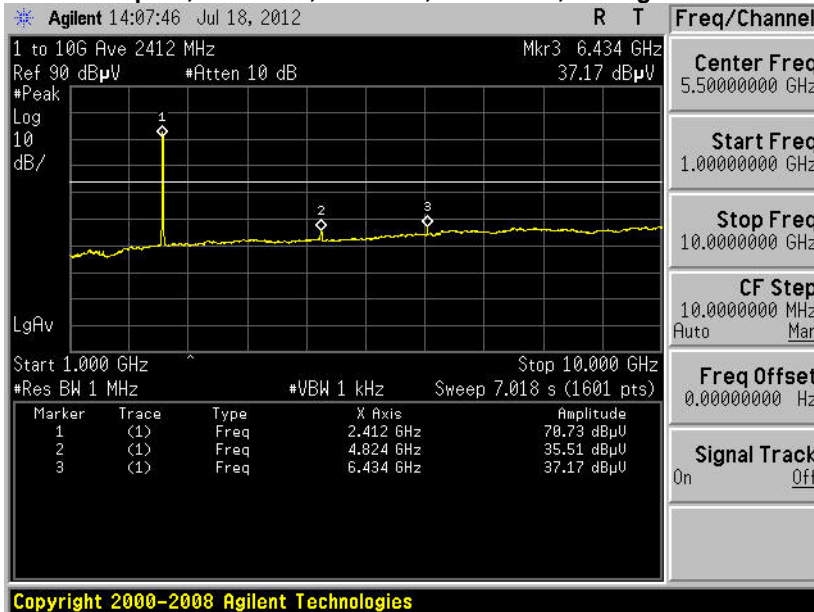
This report represents the worst case data for all supported operating modes and antennas. There are no measurable emissions above 18 GHz.



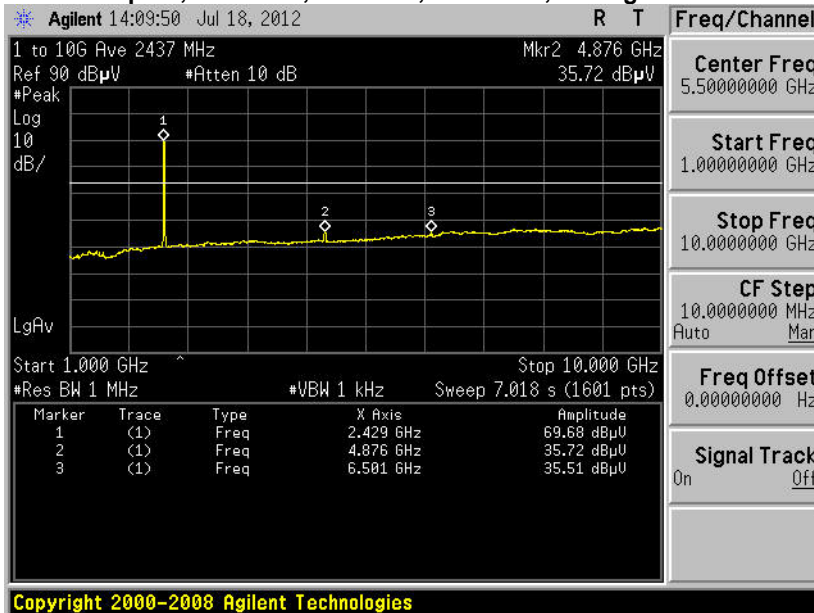
Frequency (MHz)	Mode	Data Rate (Mbps)	Spurious Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2412	Legacy CCK, 1 to 11 Mbps	11	35.5	54.0	18.5
	Non HT-20, 6 to 54 Mbps	6	35.5	54.0	18.5
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	35.5	54.0	18.5
	HT-20, M0 to M15	m0	35.5	54.0	18.5
	HT-20 STBC, M0 to M7	m0	35.5	54.0	18.5
	HT-20 Beam Forming, M0 to M15	m0	35.5	54.0	18.5
2437	Legacy CCK, 1 to 11 Mbps	11	35.5	54.0	18.5
	Non HT-20, 6 to 54 Mbps	6	35.5	54.0	18.5
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	35.5	54.0	18.5
	HT-20, M0 to M15	m0	35.5	54.0	18.5
	HT-20 STBC, M0 to M7	m0	35.5	54.0	18.5
	HT-20 Beam Forming, M0 to M15	m0	35.5	54.0	18.5
2462	Legacy CCK, 1 to 11 Mbps	11	37.0	54.0	17.0
	Non HT-20, 6 to 54 Mbps	6	37.0	54.0	17.0
	Non HT-20 Beam Forming, 6 to 54 Mbps	6	37.0	54.0	17.0
	HT-20, M0 to M15	m0	37.0	54.0	17.0
	HT-20 STBC, M0 to M7	m0	37.0	54.0	17.0
	HT-20 Beam Forming, M0 to M15	m0	37.0	54.0	17.0



**Radiated Spurs, 2412 MHz, All Rates, All Modes, Average**

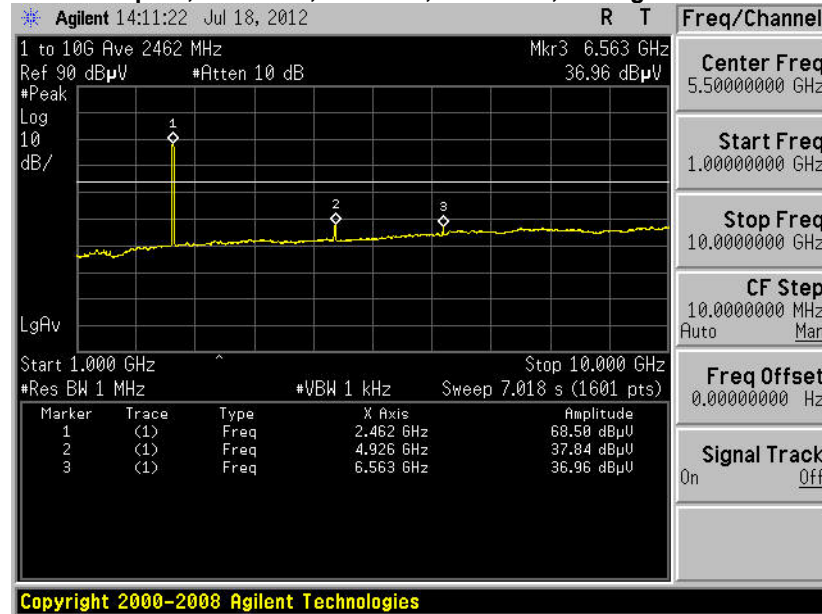


**Radiated Spurs, 2437 MHz, All Rates, All Modes, Average**



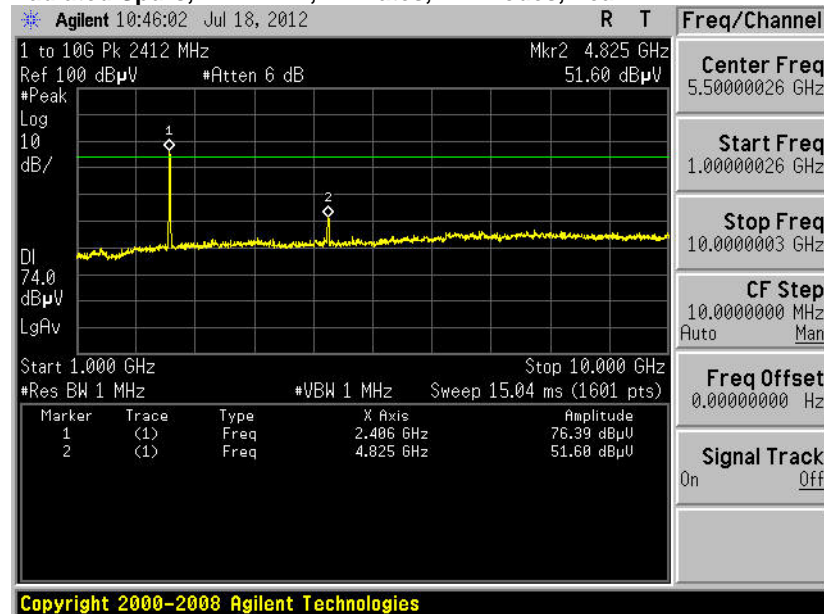


**Radiated Spurs, 2462 MHz, All Rates, All Modes, Average**

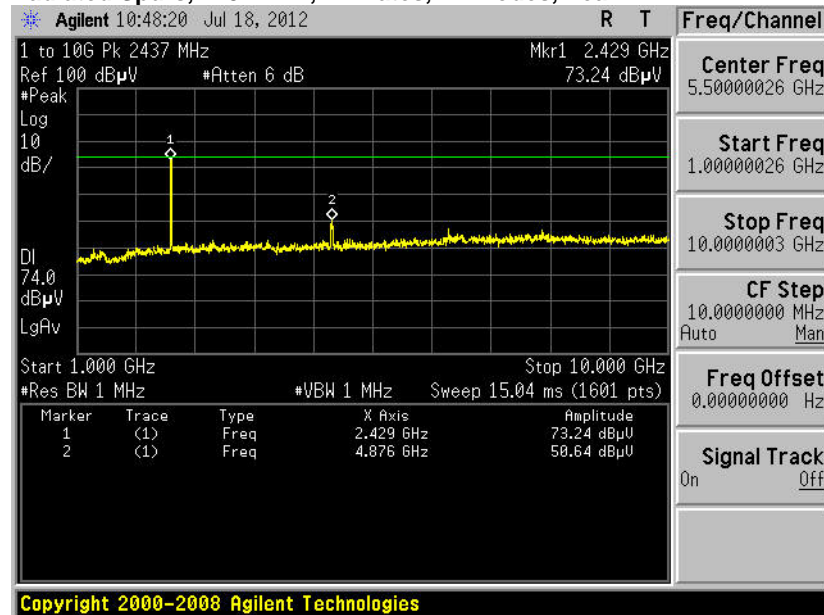




**Radiated Spurs, 2412 MHz, All Rates, All Modes, Peak**

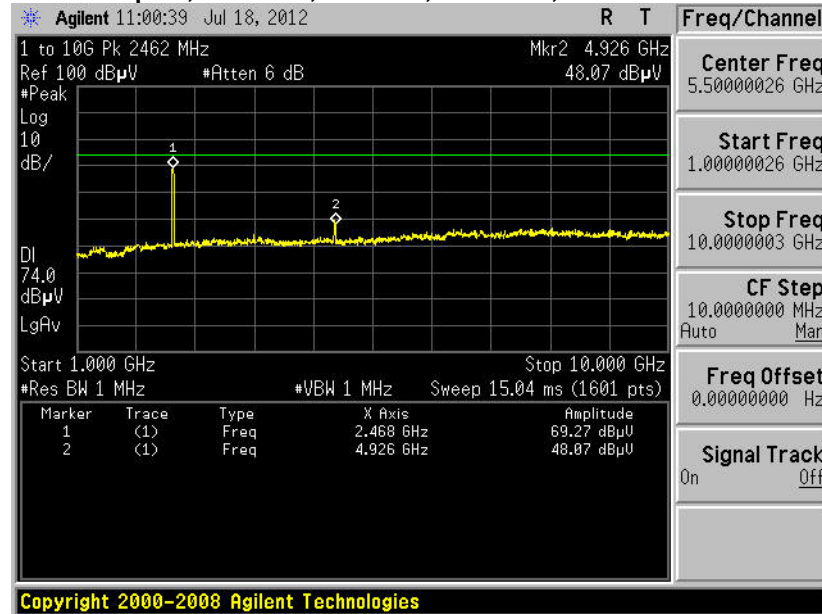


**Radiated Spurs, 2437 MHz, All Rates, All Modes, Peak**



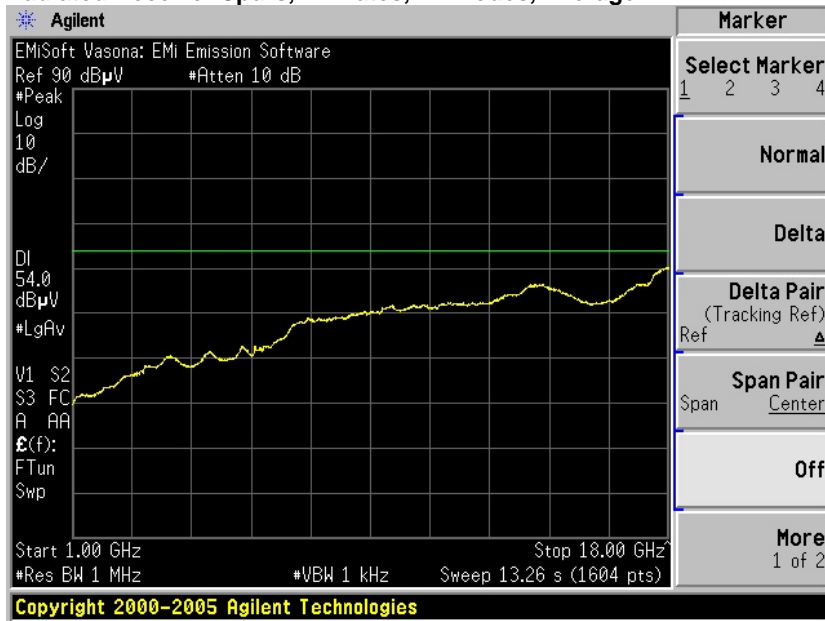


**Radiated Spurs, 2462 MHz, All Rates, All Modes, Peak**

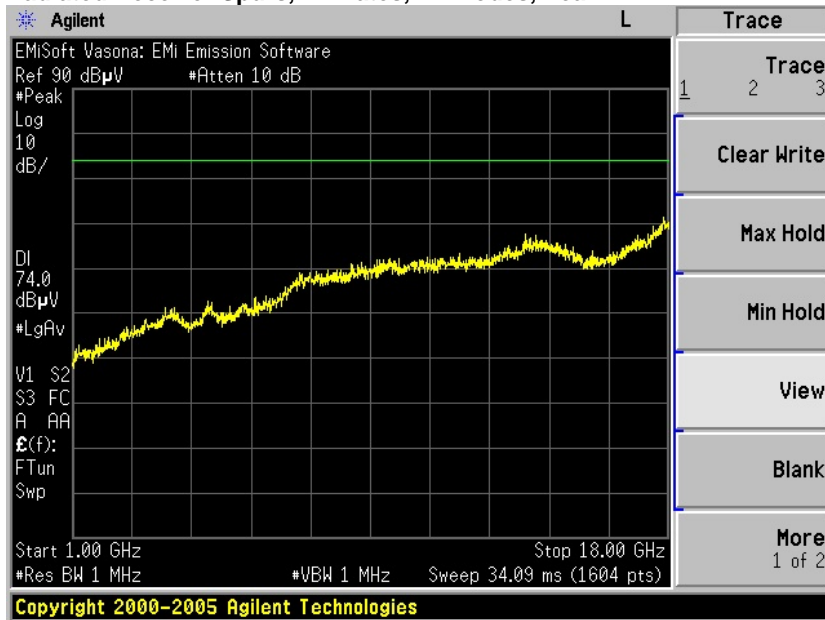




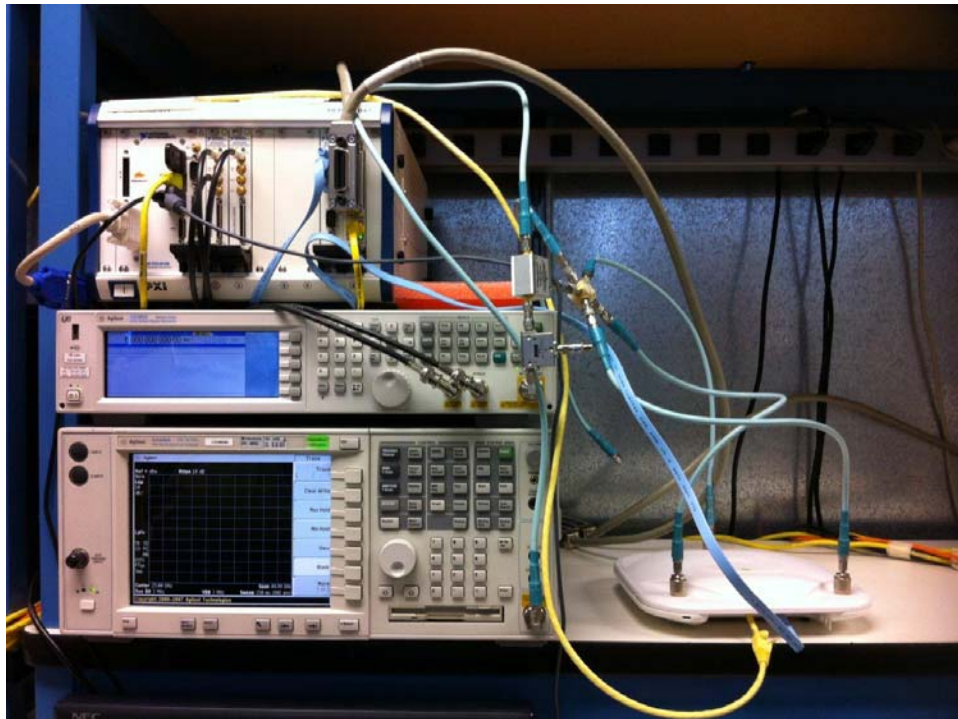
**Radiated Receiver Spurs, All Rates, All Modes, Average**



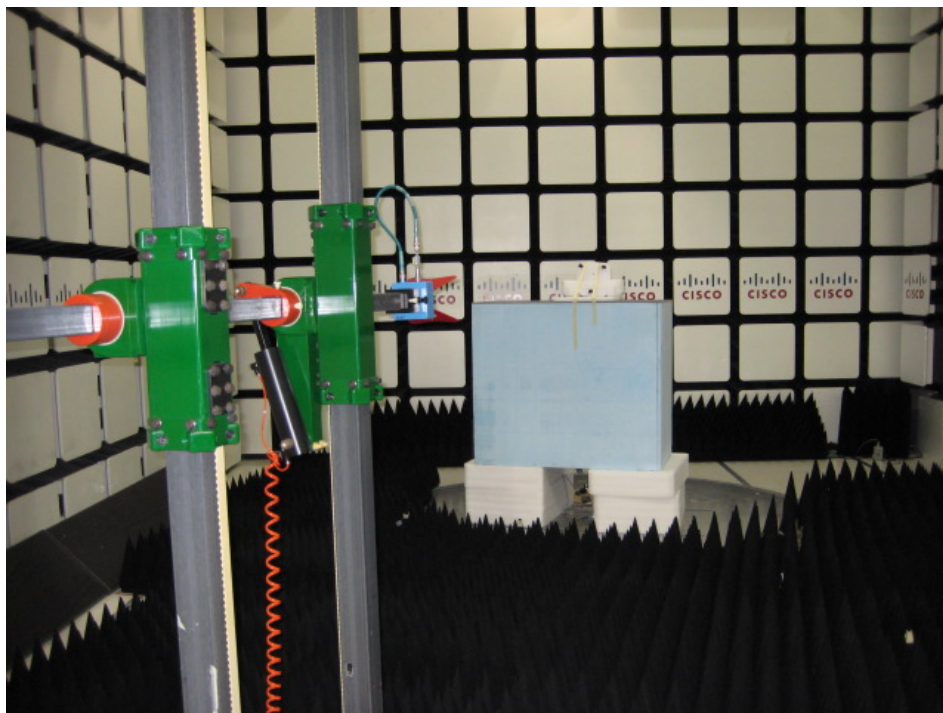
**Radiated Receiver Spurs, All Rates, All Modes, Peak**







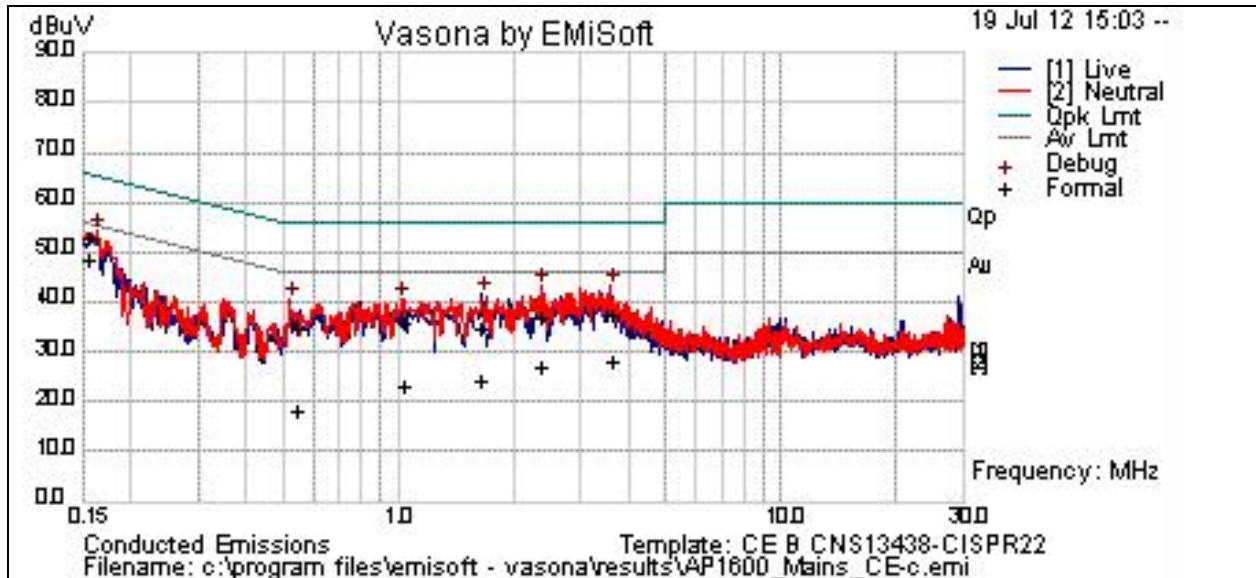
**Test Setup for Conducted Measurements**



**Test Setup for Radiated Measurements**



Conducted Emissions



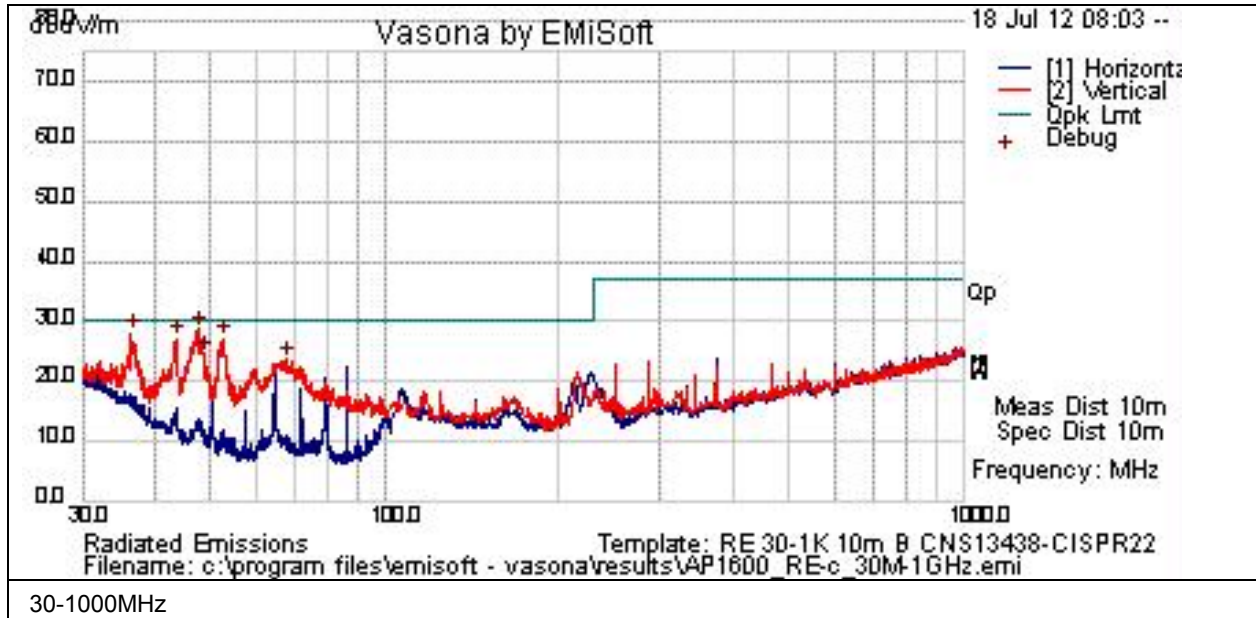
Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
0.155687	25.7	21.4	1.6	48.7	Av	N	55.7	-7	Pass	
0.155687	29.8	21.4	1.6	52.8	Qp	N	65.7	-12.9	Pass	
0.538798	14	20.1	0.6	34.6	Qp	N	56	-21.4	Pass	
0.538798	-2.7	20.1	0.6	18	Av	N	46	-28	Pass	
1.027	15.3	20	0.5	35.9	Qp	N	56	-20.1	Pass	
1.027	2.4	20	0.5	23	Av	N	46	-23	Pass	
1.645	14.1	20.2	0.5	34.7	Qp	L	56	-21.3	Pass	
1.645	3.7	20.2	0.5	24.3	Av	L	46	-21.7	Pass	
2.359	6.5	20.3	0.5	27.3	Av	N	46	-18.7	Pass	
2.359	16	20.3	0.5	36.7	Qp	N	56	-19.3	Pass	
3.617	7.3	20.4	0.5	28.3	Av	N	46	-17.7	Pass	
3.617	16.8	20.4	0.5	37.7	Qp	N	56	-18.3	Pass	



Conducted Emissions Configuration Photograph



Radiated Emissions



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
36.355	34.7	0.6	-10.1	25.2	Qp	V	208	102	30	-4.8	Pass	
43.321	37.9	0.6	-15.1	23.4	Qp	V	350	138	30	-6.6	Pass	
47.511	42.6	0.7	-17.6	25.6	Qp	V	261	78	30	-4.4	Pass	
52.426	40.3	0.7	-19.1	22	Qp	V	221	121	30	-8	Pass	
250.015	34.1	1.5	-14.1	21.5	Qp	V	111	195	37	-15.5	Pass	
375.005	30.6	1.8	-11.1	21.3	Qp	V	101	186	37	-15.7	Pass	
1000	24.8	3	-3.1	24.7	Qp	V	283	60	37	-12.3	Pass	



Radiated Emissions Configuration Photograph

## Maximum Permissible Exposure (MPE) Calculations

15.247: U-NII devices are subject to the radio frequency radiation exposure requirements specified in Sec. 1.1307(b), Sec. 2.1091 and Sec. 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Given

$$E = \sqrt{(30 * P * G) / d} \quad \text{and} \quad S = E^2 / 3770$$

where

E=Field Strength in Volts/meter

P=Power in Watts

G=Numeric Antenna Gain

d=Distance in meters

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

Combine equations and rearrange the terms to express the distance as a function of the remaining variables:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of power in mW and distance in cm, using:

$$P(\text{mW}) = P(\text{W}) / 1000 \quad d(\text{cm}) = 100 * d(\text{m})$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d=Distance in cm

P=Power in mW

G=Numerica Antenna Gain

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

Substituting the logarithmic form of power and gain using:

$$P(\text{mW}) = 10^{(P(\text{dBm}) / 10)} \quad G(\text{numeric}) = 10^{(G(\text{dBi}) / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S} \quad \text{Equation (1)}$$

and

$$s = ((0.282 * 10^{((P + G) / 20)}) / d)^2 \quad \text{Equation (2)}$$

where

d=MPE distance in cm

P=Power in dBm

G=Antenna Gain in dBi

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



Equation (1) and the measured peak power are used to calculate the MPE distance. Note that for mobile or fixed location transmitters such as an access point, the minimum separation distance is 20 cm even if the calculations indicate that the MPE distance may be less.

$S=1\text{mW/cm}^2$  maximum. The highest supported antenna gain is 6 dBi (11 dBi with beamforming). Using the peak power levels recorded in the test report along with Equation 1 above, the MPE distances are calculated as follows.

Frequency (MHz)	Bit Rate (Mbps)	Power Density (mW/cm <sup>2</sup> )	Peak Transmit Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	Limit (cm)	Margin (cm)
2412	11	1	22.0	11	<b>12.60</b>	20	7.40
2437	11	1	22.0	11	<b>12.60</b>	20	7.40
2462	11	1	22.0	11	<b>12.60</b>	20	7.40
2412	54	1	22.0	11	<b>12.60</b>	20	7.40
2437	54	1	22.0	11	<b>12.60</b>	20	7.40
2462	54	1	22.0	11	<b>12.60</b>	20	7.40

**MPE Calculations**

To maintain compliance, installations will assure a separation distance of at least 20cm.

Using Equation 2, the MPE levels (s) at 20 cm are calculated as follows:

Frequency (MHz)	Bit Rate (Mbps)	MPE Distance (cm)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Margin (mW/cm <sup>2</sup> )
2412	11	20	22.0	11	<b>0.40</b>	1	0.60
2437	11	20	22.0	11	<b>0.40</b>	1	0.60
2462	11	20	22.0	11	<b>0.40</b>	1	0.60
2412	54	20	22.0	11	<b>0.40</b>	1	0.60
2437	54	20	22.0	11	<b>0.40</b>	1	0.60
2462	54	20	22.0	11	<b>0.40</b>	1	0.60

**Appendix C: Test Equipment/Software Used to perform the test**

Equip #	Manufacturer	Model	Description	Next Due
CIS004882	EMC Test Systems	3115	Double Ridged Guide Horn Antenna	4-June-13
CIS005691	Miteq	NSP1800-25-S1	Broadband Preamplifier	31-Jan-13
COM001051	TTE	H785-150K-50-21378	Hi Pass Filter - 150KHz cutoff	14-May-13
COM000213	Fischer	FCC-LISN-50-50-2M	Turntable LISN (150KHz-30MHz)	28-Feb-13
CIS021117	Micro-Coax	UFB311A-0-2484-520520	RF Coaxial Cable, to 18GHz, 248.4 in	24-Aug-12
CIS030564	Micro-Coax	UFB311A-1-0950-504504	RF Coaxial Cable, to 18GHz, 95 in	24-Aug-12
COM000233	Sunol Sciences	JB1	Combination Antenna, 30MHz-2GHz	28-Sep-12
COM000239	Rohde & Schwarz	ESI40	EMI Test Receiver	12-Jun-13
CIS034972	Midwest Microwave	ATT-0640-20-29M-02	Attenuator, 20dB	16-May-12
CIS043116	Huber + Suhner	Sucoflex 104PE	N & SMA RF cable	14-Dec-12
CIS040603	Agilent	E4440A	Spectrum Analyzer	6-Aug-13
CIS040053	Agilent	E4448A	Spectrum Analyzer	6-Apr-13