



## Test Report

### **AIR-LAP1141N-A-K9**

**Cisco Aironet 802.11n Draft 2.0 Single Band Access Point**

**FCC ID: LDK102069, IC: 2461B-102069**

### **AIR-LAP1142N-A-K9**

**Cisco Aironet 802.11n Draft 2.0 Dual Band Access Point**

**FCC ID: LDK102070, IC: 2461B-102070**

**(Also covers AIR-LAP1142N-N-K9, AIR-LAP1142N-T-K9)**

**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

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 start of testing

22-May-2008

## 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-LAP1142N-A-K9 Cisco Aironet 802.11n Draft 2.0 Dual Band Access Point

## 2.6 EUT Description

The AIR-LAP1142N-A-K9 Cisco Aironet 802.11n Draft 2.0 Dual Band Access Point supports 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, Single Antenna, 1 to 11 Mbps
- Legacy CCK, Dual Antennas, 1 to 11 Mbps
- Legacy OFDM, Non HT-20, Single Antenna, 6 to 54 Mbps
- Legacy OFDM, Non HT-20, Dual Antennas, 6 to 54 Mbps
- Legacy OFDM, Non HT-20 Dual Antennas with Beam Forming, 6 to 54 Mbps
- HT-20, Single Antenna, M0 to M7
- HT-20, Dual Antennas, M0 to M15
- Non HT-40 Duplicate, Single Antenna, 6-54 Mbps
- Non HT-40 Duplicate, Dual Antennas, 6-54 Mbps
- HT-40, Single Antenna, M0 to M7
- HT-40, Dual Antennas, M0 to M15

The following integral antennas are supported by this product.

- 2.4 GHz 4 dBi inverted-F Omni-directional Antenna
- 5 GHz 3 dBi inverted-F Omni-directional Antenna



#### 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-LAP1142N-A-K9	73-11494-01	Cisco Systems	NA	NA	NA	FHH1217 00LP
S02	AIR-PWR-SPLY1	341-0211-01	Cisco Systems	NA	NA	NA	DTH1030 902Z

##### 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



## Appendix A: Emission Test Results

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

### Average Output Power

Connect the antenna(s) to the power meter at the average power sensor input. Configure the power meter to measure average power for the transmitter frequencies listed below (enter all losses between the transmitter output and the power meter).

Place the radio in continuous transmit mode and record the reading on the power meter.

Frequency	Mode	Data Rate	Target Power Level			Actual Power Level
			Tx A	Tx B	Total	Total
2412	Legacy CCK, Single Tx Path	11	19	Off	19	<b>18.7</b>
2412	Legacy CCK, Dual Tx Path	11	18	18	21	<b>21.2</b>
2412	Non HT-20, Single Tx Path	54	16	Off	16	<b>16.0</b>
2412	Non HT-20, Dual Tx Path	54	14	14	17	<b>16.5</b>
2412	Non HT-20 Beam Forming	54	13	13	16	<b>15.5</b>
2437	Legacy CCK, Dual Tx Path	11	20	20	23	<b>23.2</b>
2437	Non HT-20 Beam Forming	54	17	17	20	<b>19.7</b>
2462	Legacy CCK, Single Tx Path	11	18	Off	18	<b>17.7</b>
2462	Legacy CCK, Dual Tx Path	11	17	17	20	<b>19.9</b>
2462	Non HT-20, Single Tx Path	54	14	Off	14	<b>14.1</b>
2462	Non HT-20, Dual Tx Path	54	13	13	16	<b>16.5</b>
2462	Non HT-20 Beam Forming	54	12	12	15	<b>15.2</b>
2412/2432	Non HT-40 Duplicate, Single Tx Path	54	11	Off	11	<b>10.8</b>
2412/2432	Non HT-40 Duplicate, Dual Tx Path	54	10	10	13	<b>13.4</b>
2412/2432	HT-40, Single Tx Path	M7	13	Off	13	<b>13.5</b>
2412/2432	HT-40, Dual Tx Path	M7	12	12	15	<b>14.5</b>
2427/2447	Non HT-40 Duplicate	54	14	14	17	<b>17.0</b>
2427/2447	HT-40	54	15	15	18	<b>17.5</b>
2442/2462	Non HT-40 Duplicate	54	10	10	13	<b>13.3</b>
2442/2462	HT-40	M7	12	12	15	<b>15.3</b>



## 6dB Bandwidth

15.247: 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

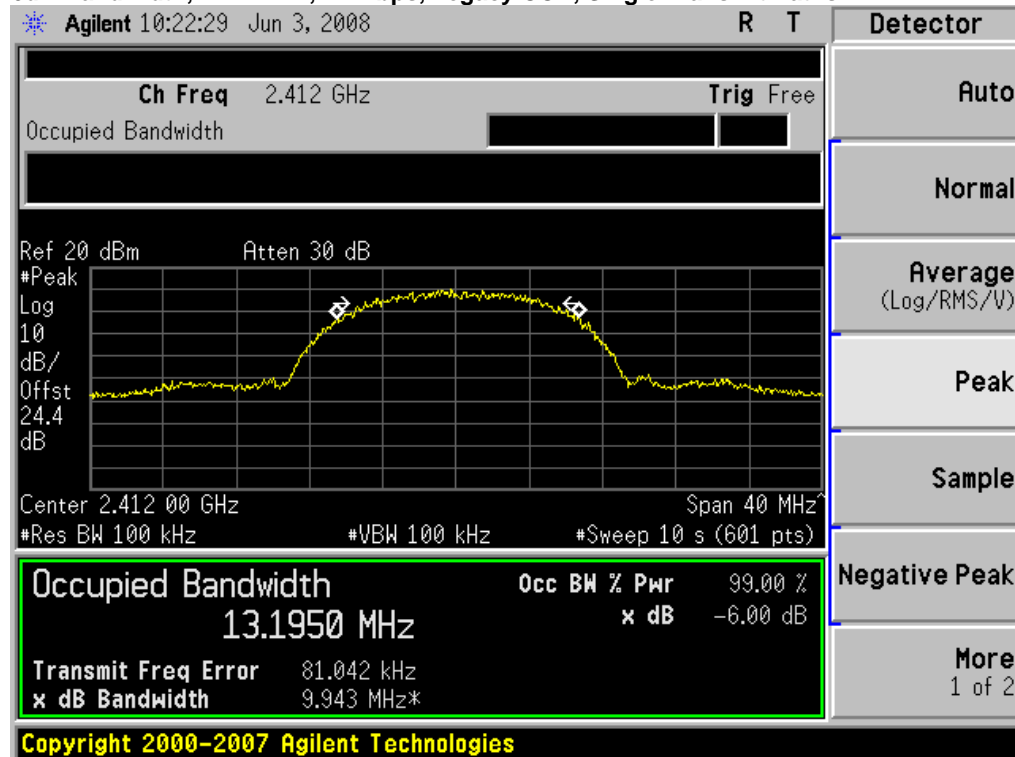
Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:

Frequency (MHz)	Mode	Data Rate (Mbps)	6dB BW (MHz)	Limit (kHz)	Margin (MHz)
2412	Legacy CCK, Single Tx Path	11	<b>9.9</b>	>500	9.4
2412	Legacy CCK, Dual Tx Path	11	<b>9.5</b>	>500	9.0
2412	Non HT-20, Single Tx Path	54	<b>16.5</b>	>500	16.0
2412	Non HT-20, Dual Tx Path	54	<b>16.5</b>	>500	16.0
2412	Non HT-20 Beam Forming	54	<b>16.5</b>	>500	16.0
2437	Legacy CCK, Dual Tx Path	11	<b>10.0</b>	>500	9.5
2437	Non HT-20 Beam Forming	54	<b>16.5</b>	>500	16.0
2462	Legacy CCK, Single Tx Path	11	<b>9.5</b>	>500	9.0
2462	Legacy CCK, Dual Tx Path	11	<b>9.5</b>	>500	9.0
2462	Non HT-20, Single Tx Path	54	<b>16.5</b>	>500	16.0
2462	Non HT-20, Dual Tx Path	54	<b>16.5</b>	>500	16.0
2462	Non HT-20 Beam Forming	54	<b>16.5</b>	>500	16.0
2412/2432	Non HT-40 Duplicate, Single Tx Path	54	<b>36.6</b>	>500	36.1
2412/2432	Non HT-40 Duplicate, Dual Tx Path	54	<b>36.4</b>	>500	35.9
2412/2432	HT-40, Single Tx Path	M7	<b>36.5</b>	>500	36.0
2412/2432	HT-40, Dual Tx Path	M7	<b>36.3</b>	>500	35.8
2427/2447	Non HT-40 Duplicate	54	<b>36.6</b>	>500	36.1
2427/2447	HT-40	54	<b>36.2</b>	>500	35.7
2442/2462	Non HT-40 Duplicate	54	<b>36.4</b>	>500	35.9
2442/2462	HT-40	M7	<b>36.1</b>	>500	35.6

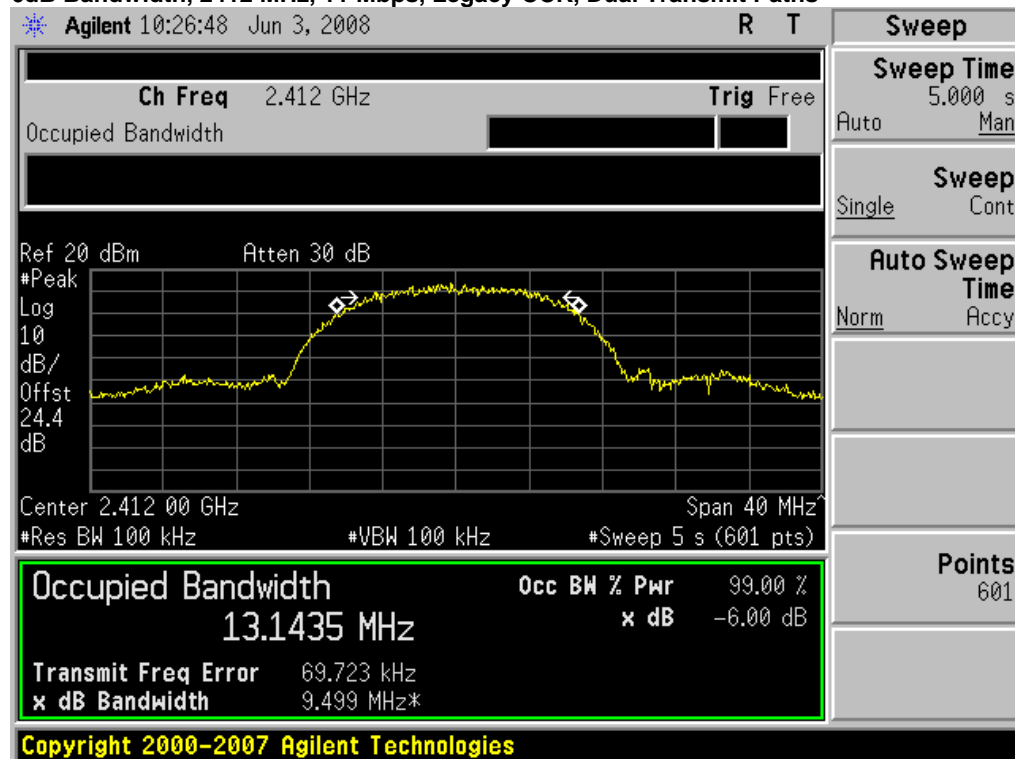




6dB Bandwidth, 2412 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths

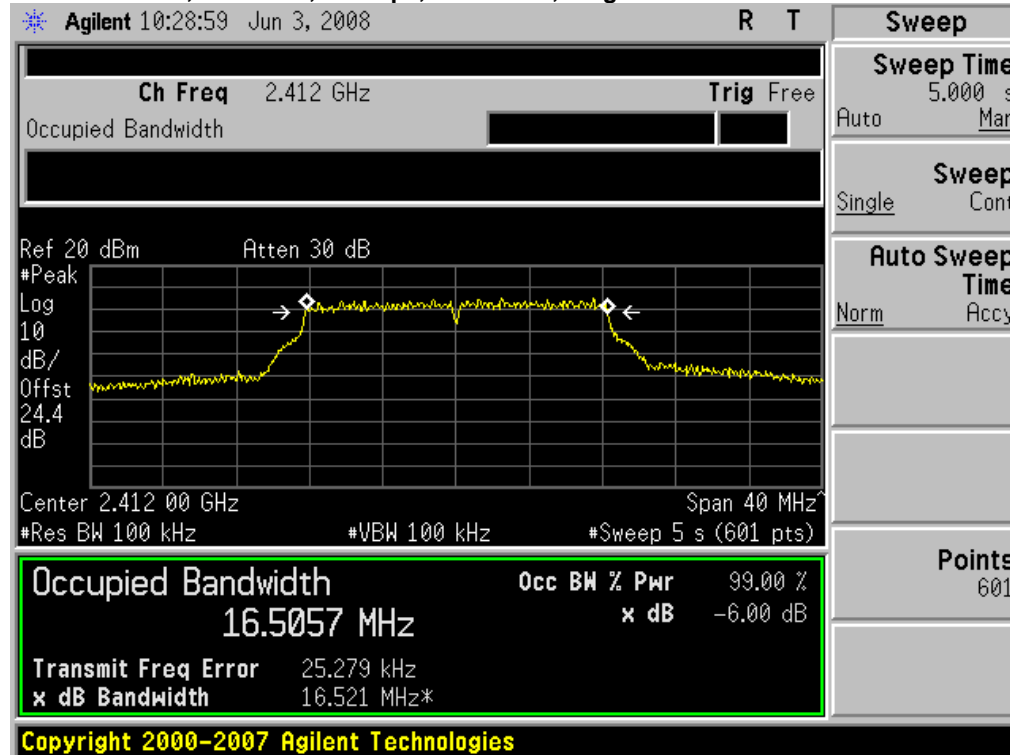


6dB Bandwidth, 2412 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths

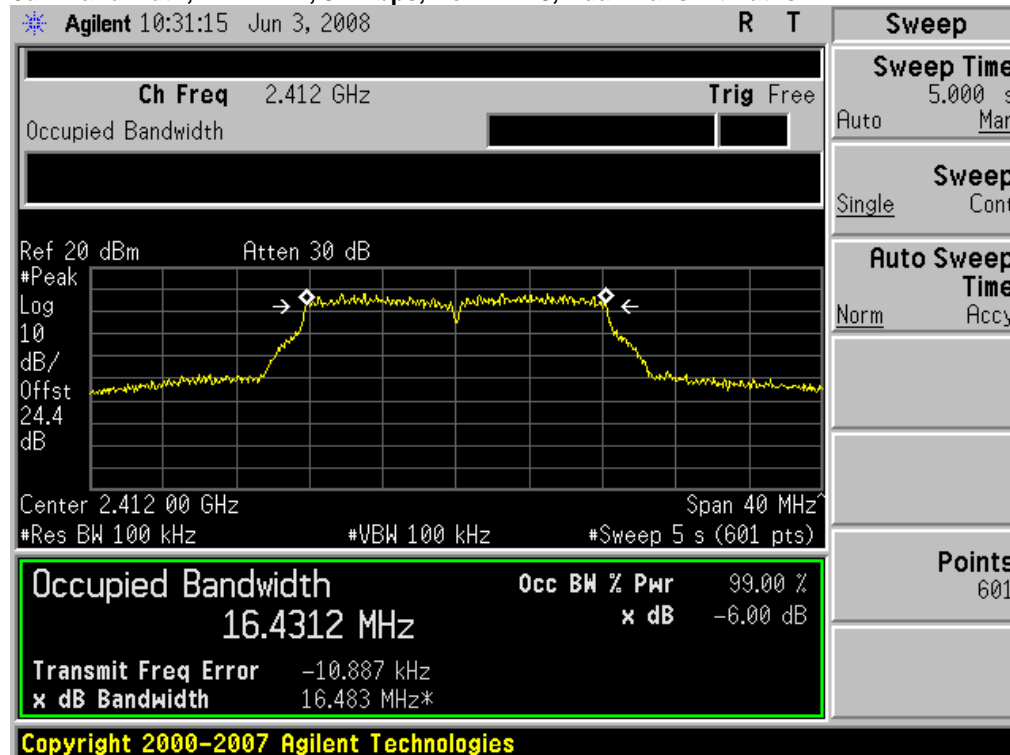




6dB Bandwidth, 2412 MHz, 54 Mbps, Non HT-20, Single Transmit Paths

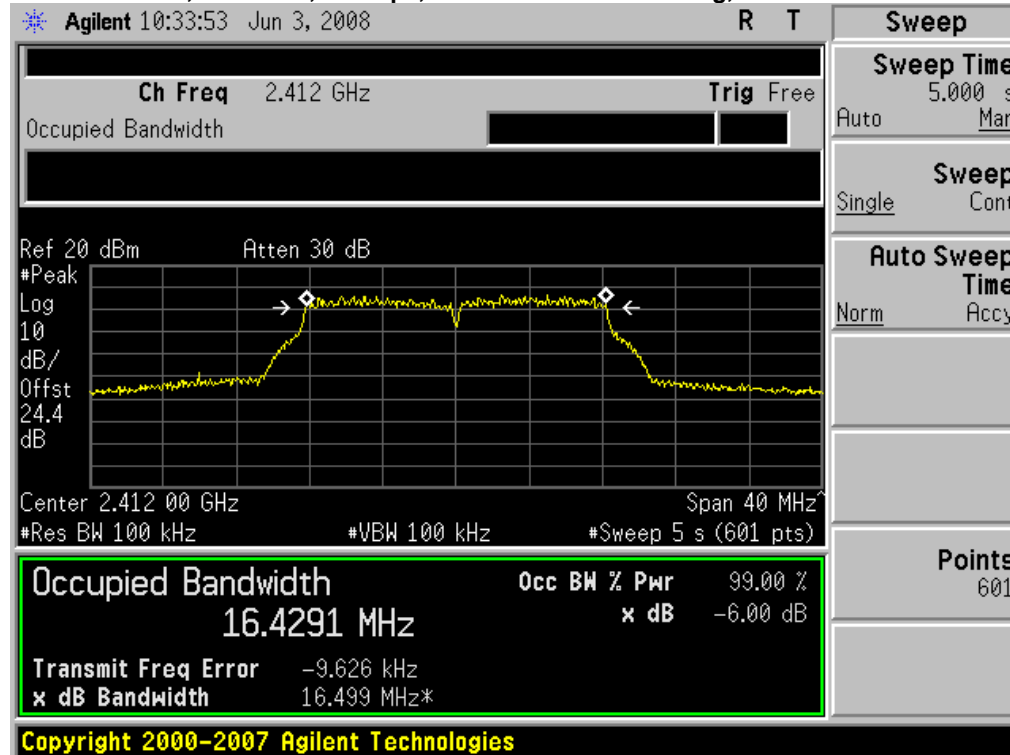


6dB Bandwidth, 2412 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths

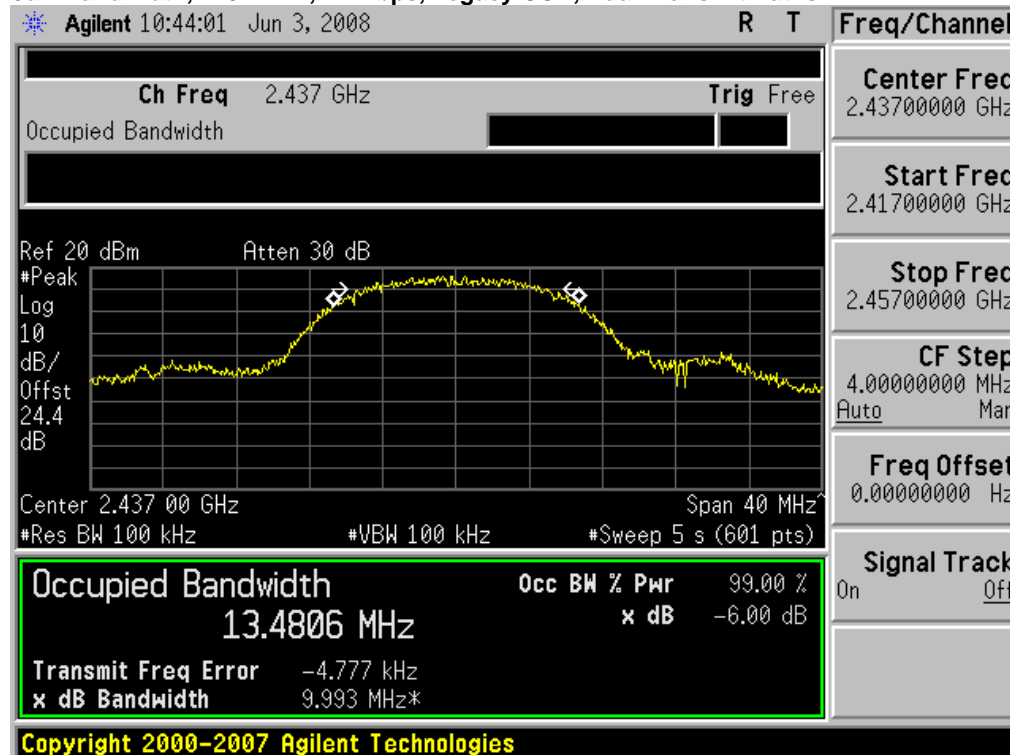




6dB Bandwidth, 2412 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths

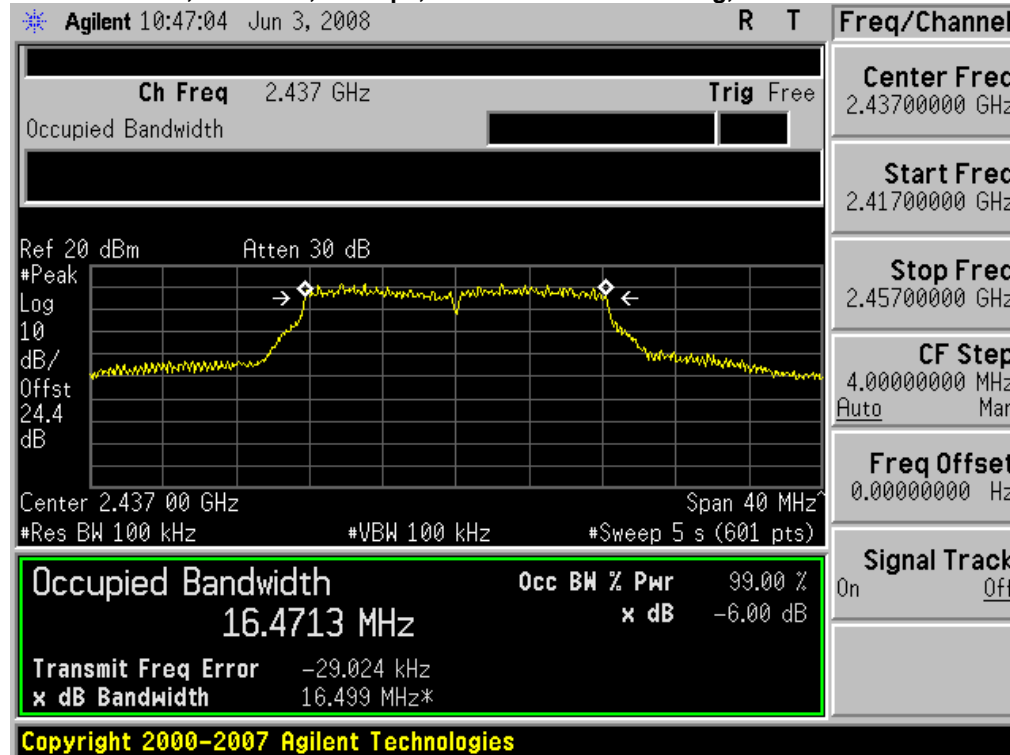


6dB Bandwidth, 2437 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths

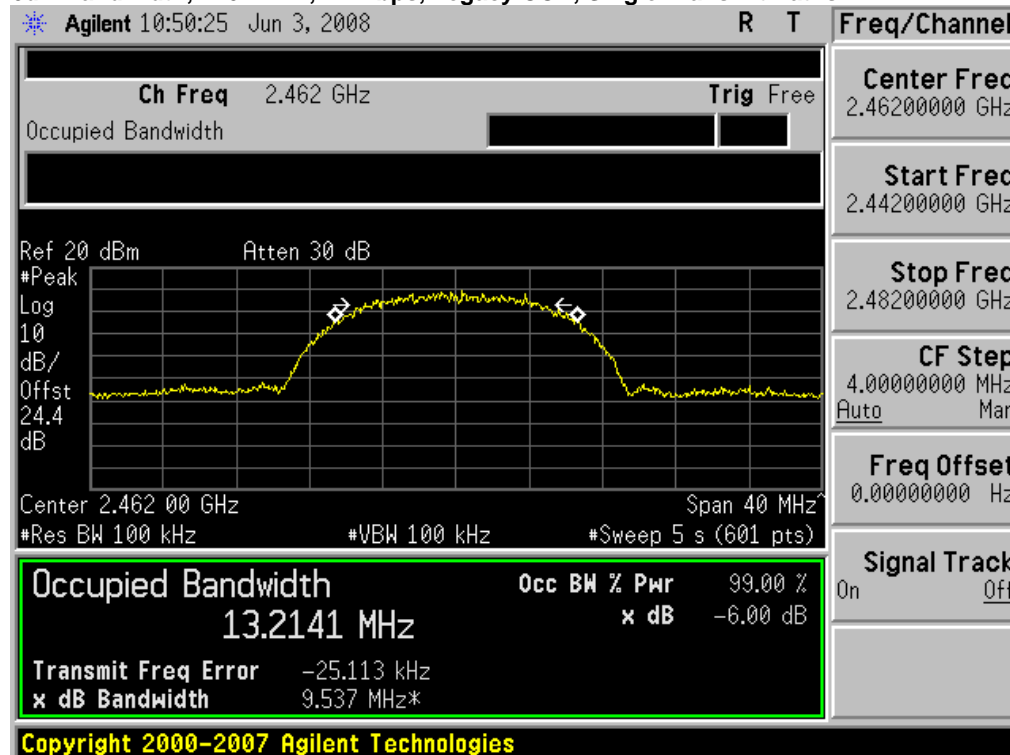




**6dB Bandwidth, 2437 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

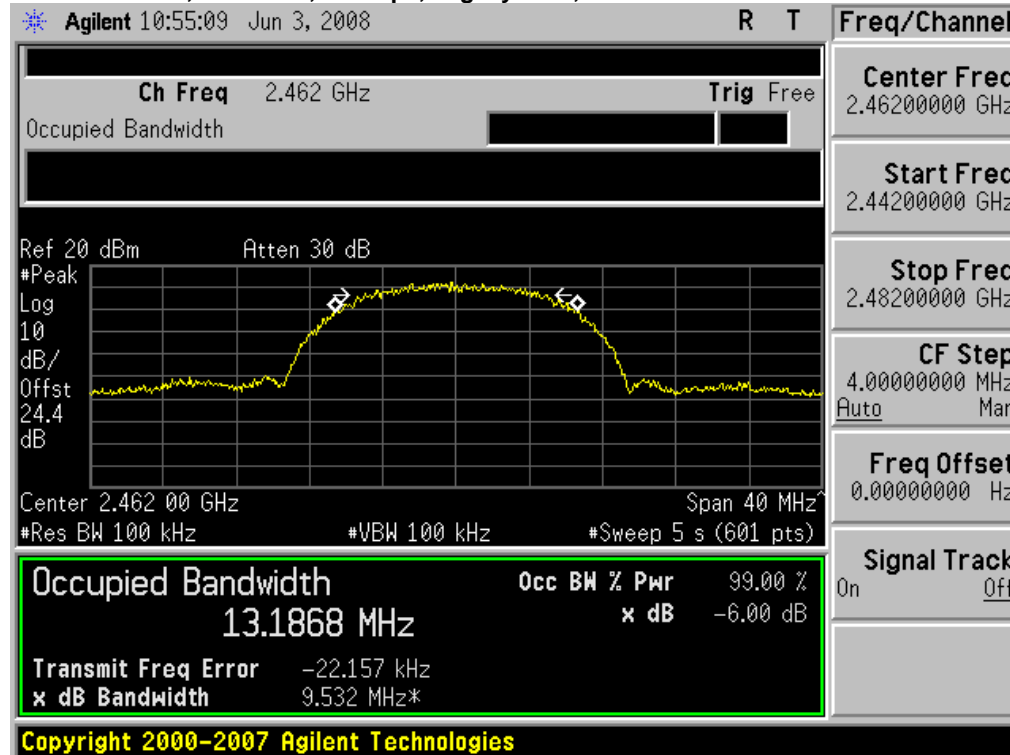


**6dB Bandwidth, 2462 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths**

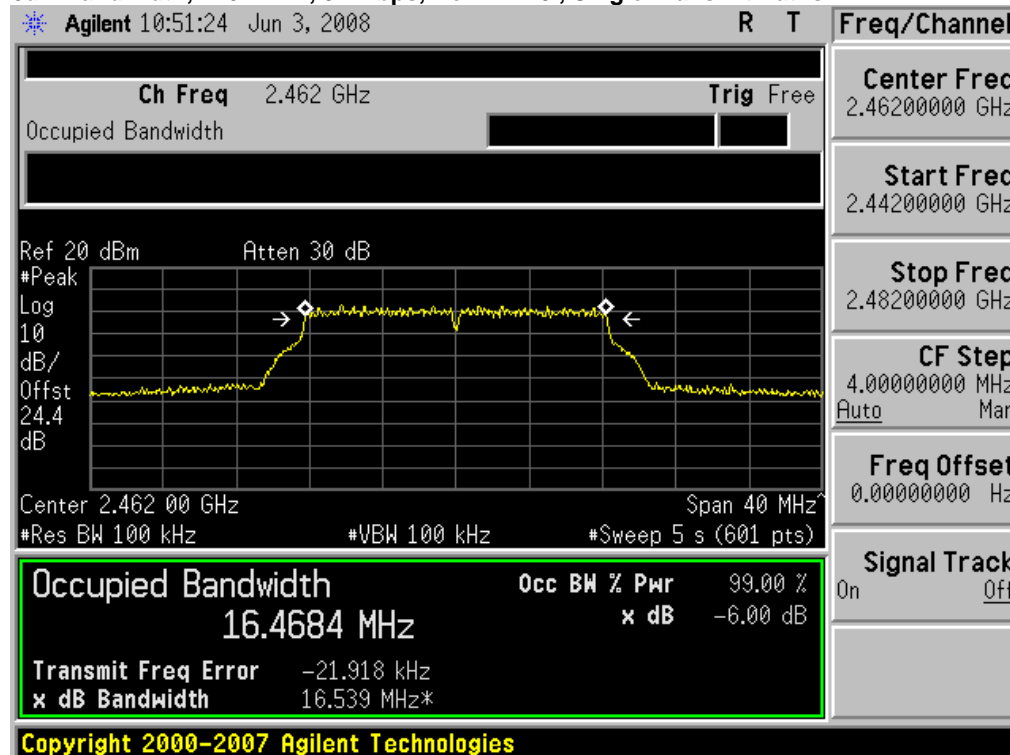




6dB Bandwidth, 2462 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths

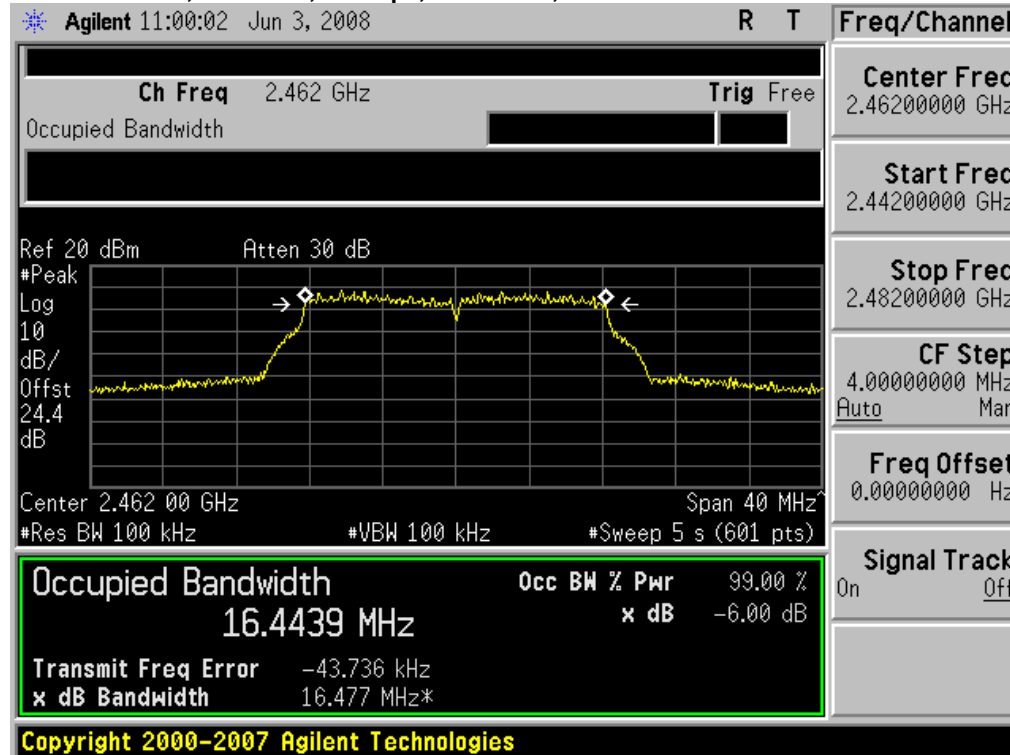


6dB Bandwidth, 2462 MHz, 54 Mbps, Non HT-20 , Single Transmit Paths

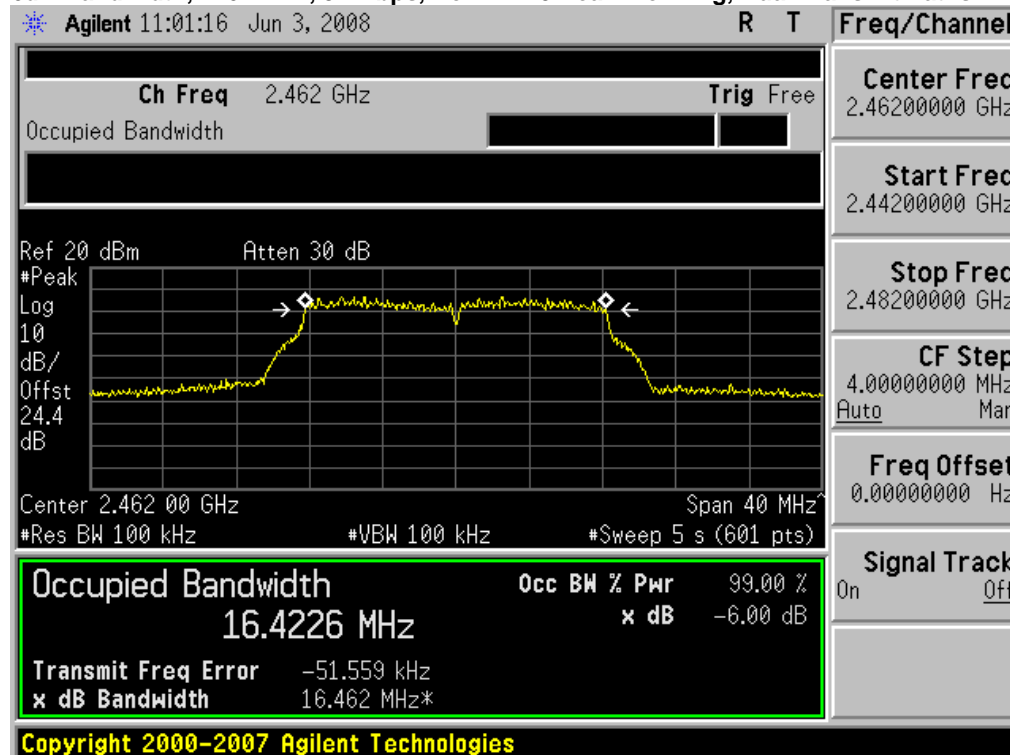




6dB Bandwidth, 2462 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths

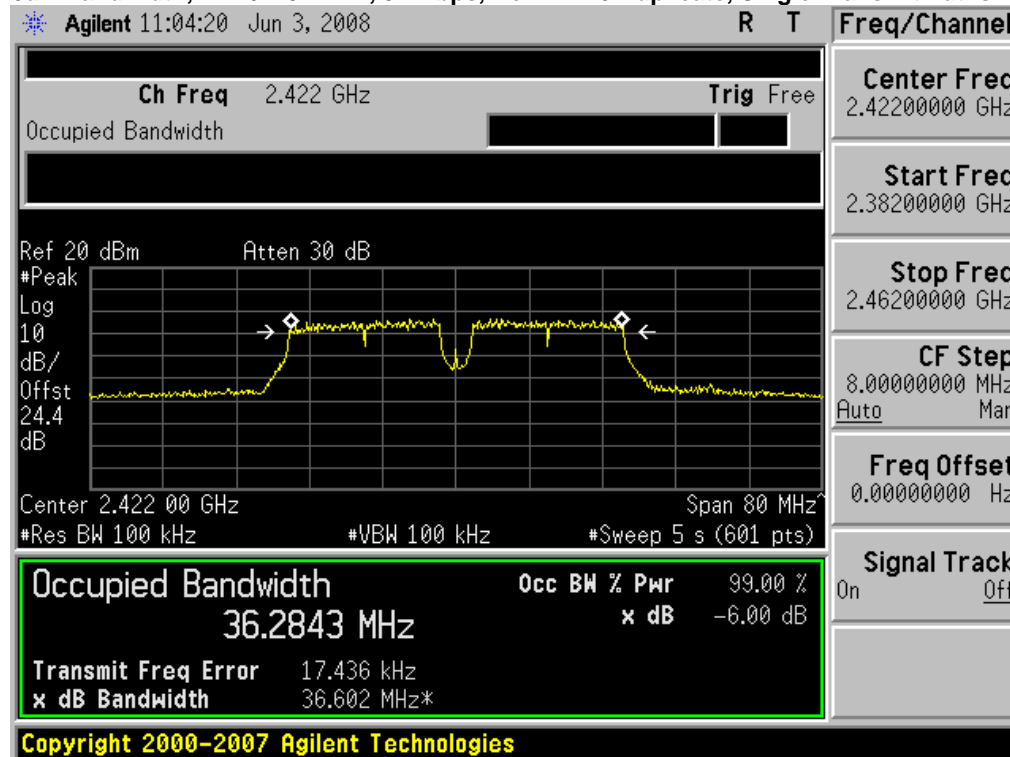


6dB Bandwidth, 2462 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths

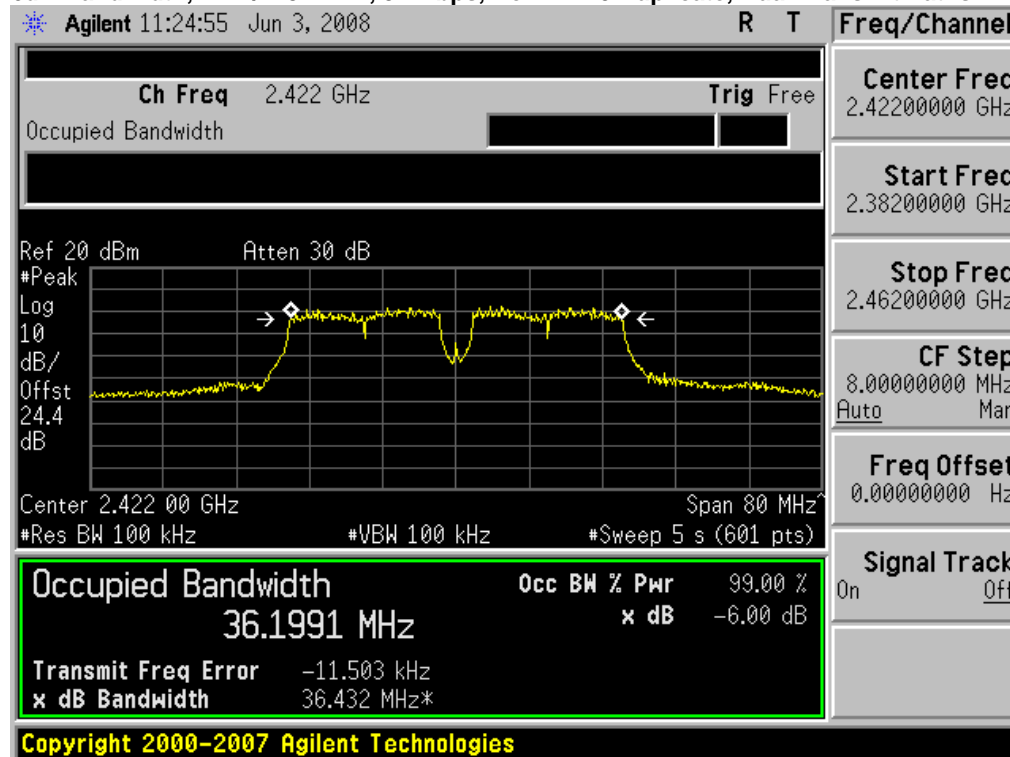




6dB Bandwidth, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Single Transmit Paths

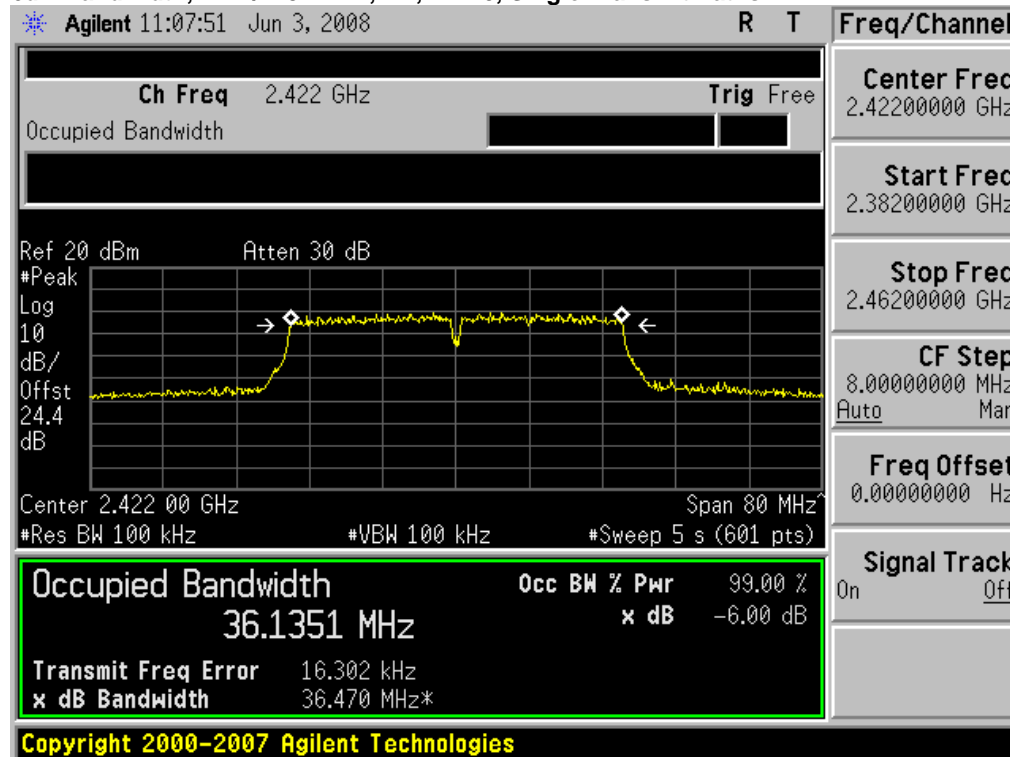


6dB Bandwidth, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

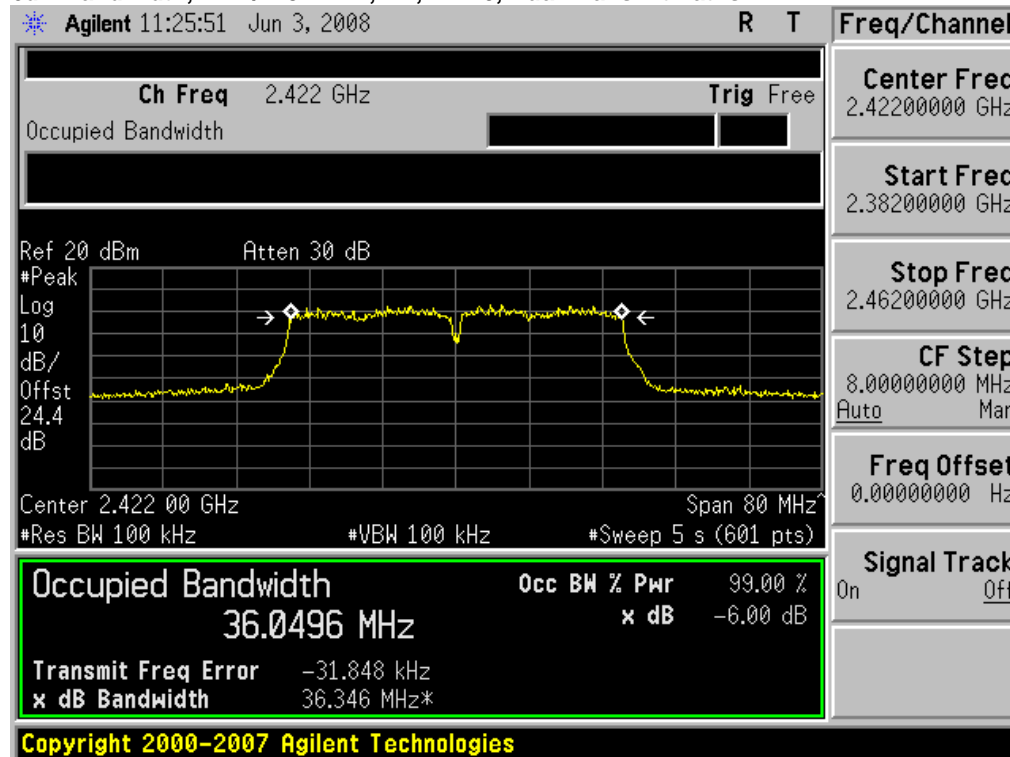




6dB Bandwidth, 2412/2432 MHz, M7, HT-40, Single Transmit Paths



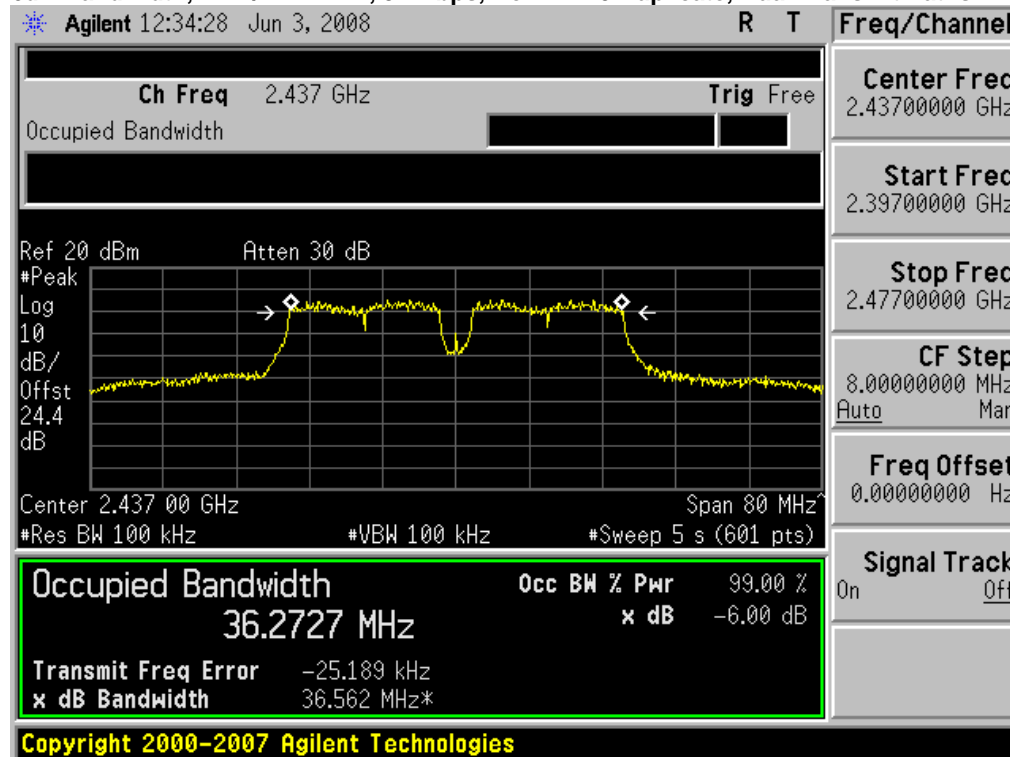
6dB Bandwidth, 2412/2432 MHz, M7, HT-40, Dual Transmit Paths



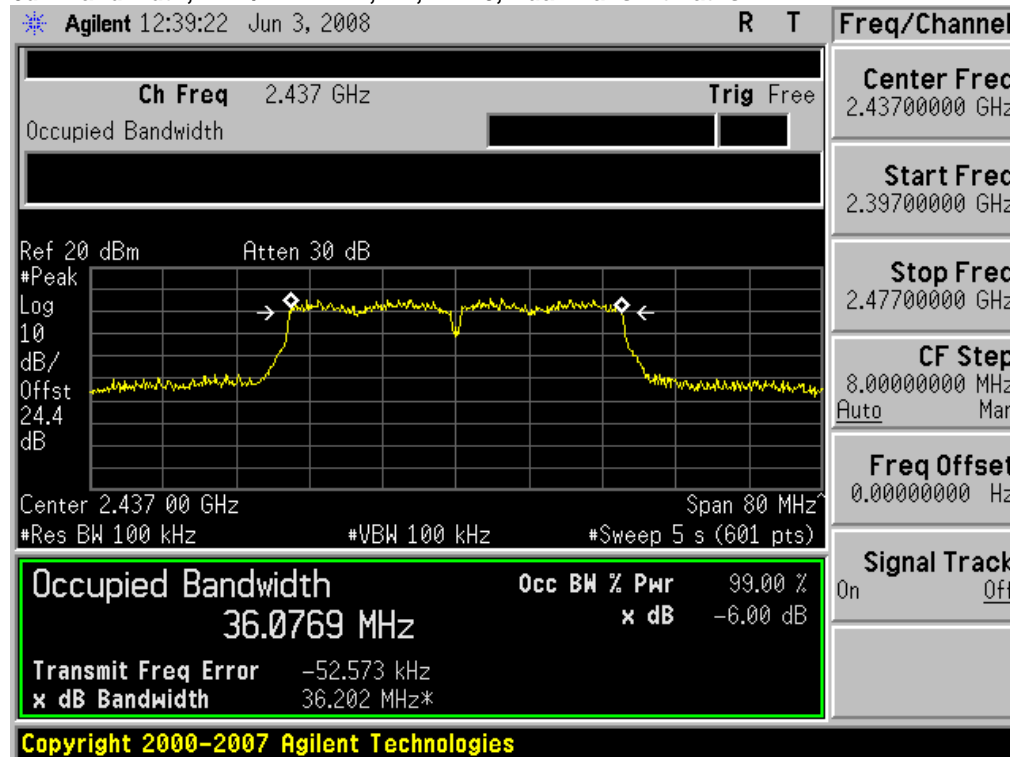




6dB Bandwidth, 2427/2447 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

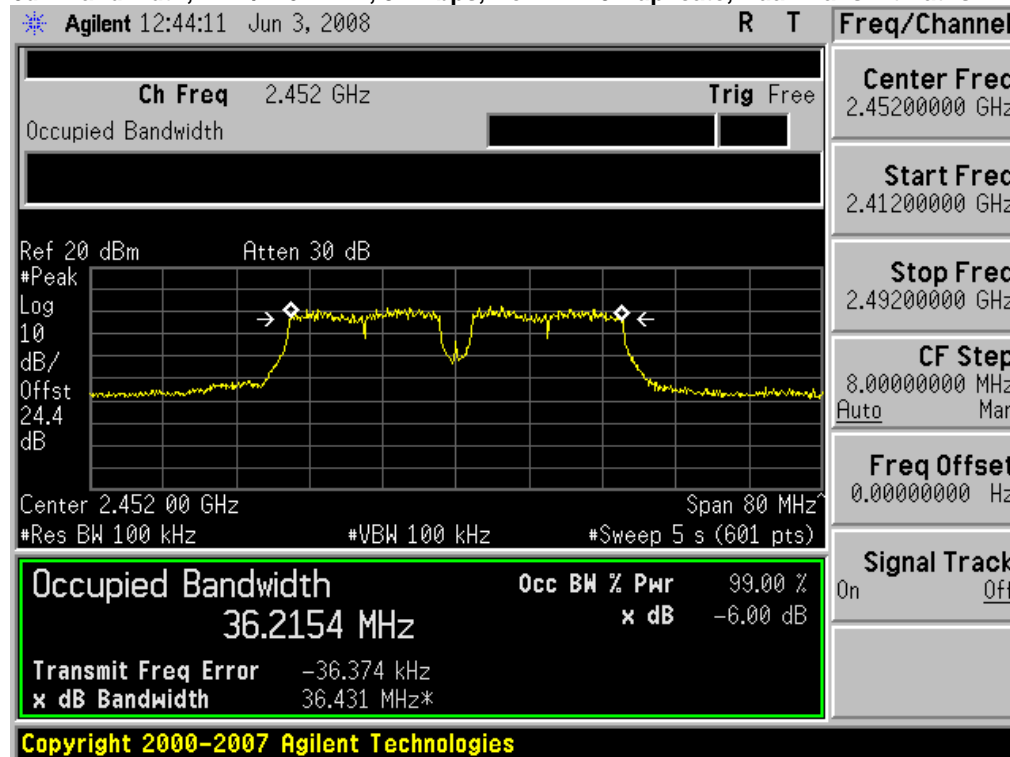


6dB Bandwidth, 2427/2447 MHz, M7, HT-40, Dual Transmit Paths

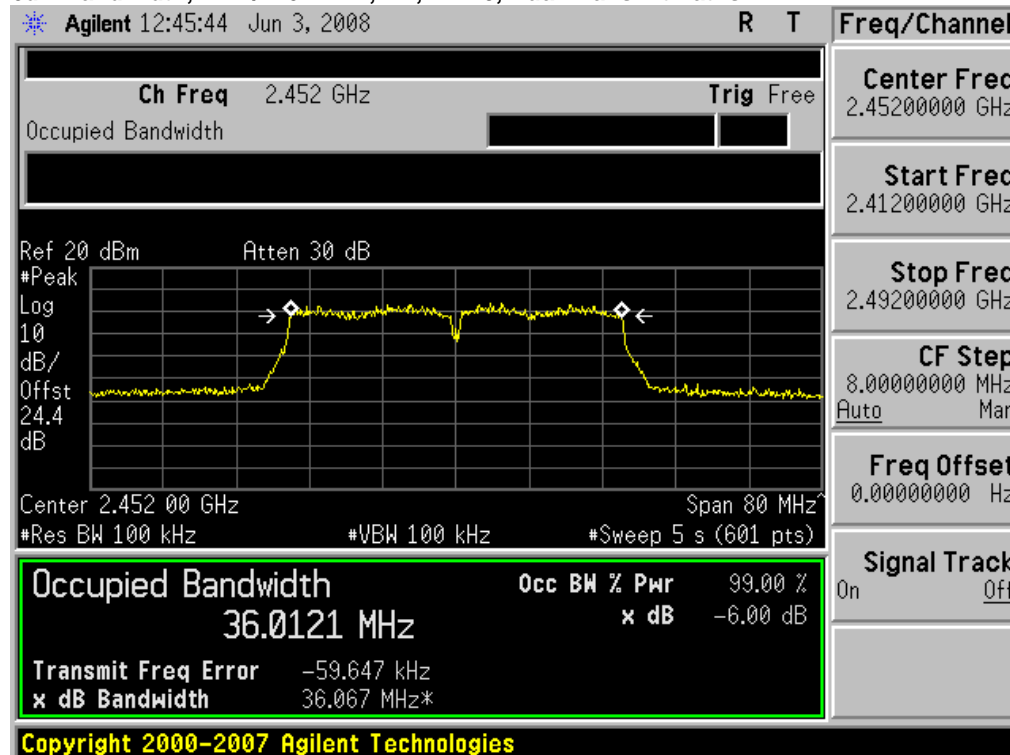




6dB Bandwidth, 2442/2462 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths



6dB Bandwidth, 2442/2462 MHz, M7, HT-40, Dual Transmit Paths





## 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).

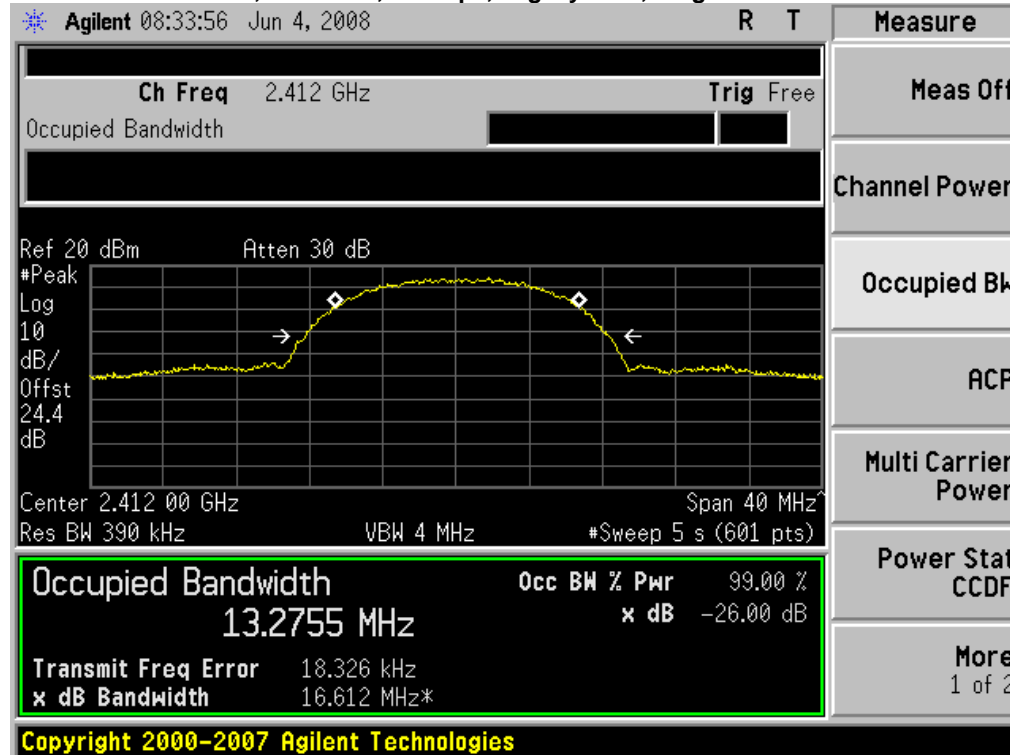
Center Frequency: Frequency from table below  
 Span: 2 x Nominal Bandwidth (e.g. 40MHz for a 20MHz channel)  
 Reference Level: 20 dBm  
 Attenuation: 10 dB  
 Sweep Time: 5 s  
 Resolution Bandwidth: 1%-3% of 26 dB Bandwidth  
 Video Bandwidth: ≥Resolution Bandwidth  
 X dB Bandwidth: 26 dB  
 Detector: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

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

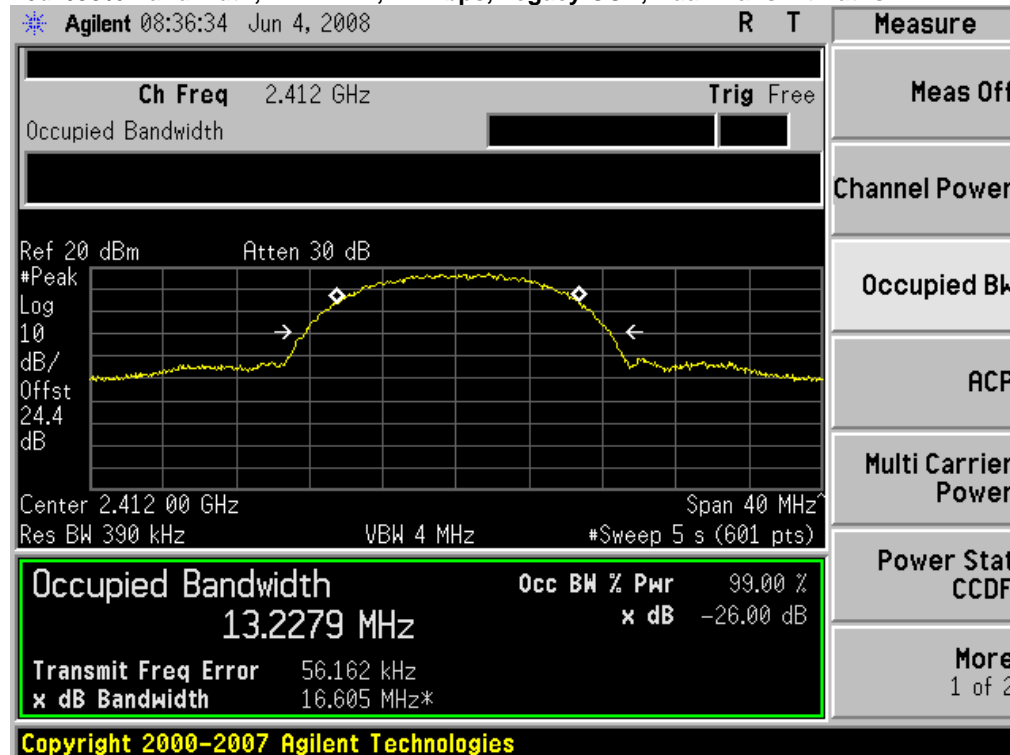
Frequency (MHz)	Mode	Data Rate (Mbps)	26dB BW (MHz)	99% BW (MHz)
2412	Legacy CCK, Single Tx Path	11	16.6	13.3
2412	Legacy CCK, Dual Tx Path	11	16.6	13.2
2412	Non HT-20, Single Tx Path	54	20.6	17.2
2412	Non HT-20, Dual Tx Path	54	20.3	17.0
2412	Non HT-20 Beam Forming	54	20.3	16.9
2437	Legacy CCK, Dual Tx Path	11	16.8	13.4
2437	Non HT-20 Beam Forming	54	21.8	17.1
2462	Legacy CCK, Single Tx Path	11	16.6	13.3
2462	Legacy CCK, Dual Tx Path	11	16.6	13.3
2462	Non HT-20, Single Tx Path	54	20.5	17.1
2462	Non HT-20, Dual Tx Path	54	20.2	16.9
2462	Non HT-20 Beam Forming	54	20.2	17.0
2412/2432	Non HT-40 Duplicate, Single Tx Path	54	45.7	37.2
2412/2432	Non HT-40 Duplicate, Dual Tx Path	54	46.2	36.9
2412/2432	HT-40, Single Tx Path	M7	41.7	36.8
2412/2432	HT-40, Dual Tx Path	M7	41.5	36.5
2427/2447	Non HT-40 Duplicate	54	45.8	37.0
2427/2447	HT-40	54	41.6	36.6
2442/2462	Non HT-40 Duplicate	54	41.9	36.9
2442/2462	HT-40	M7	41.5	36.6



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



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





26dB/99% Bandwidth, 2412 MHz, 54 Mbps, Non HT-20, Single Transmit Paths

Agilent 08:34:53 Jun 4, 2008 R T Measure

Ch Freq 2.412 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm Atten 30 dB

#Peak Log 10 dB/Offst 24.4 dB

Center 2.412 00 GHz Span 40 MHz  
Res BW 390 kHz VBW 4 MHz #Sweep 5 s (601 pts)

<b>Occupied Bandwidth</b>	<b>Occ BW % Pwr</b>	99.00 %
17.1646 MHz	x dB	-26.00 dB
<b>Transmit Freq Error</b>	11.823 kHz	
<b>x dB Bandwidth</b>	20.615 MHz*	

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Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More 1 of 2

26dB/99% Bandwidth, 2412 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths

Agilent 08:37:19 Jun 4, 2008 R T Measure

Ch Freq 2.412 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm Atten 30 dB

#Peak Log 10 dB/Offst 24.4 dB

Center 2.412 00 GHz Span 40 MHz  
Res BW 390 kHz VBW 4 MHz #Sweep 5 s (601 pts)

<b>Occupied Bandwidth</b>	<b>Occ BW % Pwr</b>	99.00 %
16.9537 MHz	x dB	-26.00 dB
<b>Transmit Freq Error</b>	2.908 kHz	
<b>x dB Bandwidth</b>	20.288 MHz*	

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Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More 1 of 2



**26dB/99% Bandwidth, 2412 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

Agilent 08:38:08 Jun 4, 2008 R T

Ch Freq 2.412 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm Atten 30 dB

#Peak Log 10 dB/Offst 24.4 dB

Center 2.412 00 GHz Span 40 MHz  
Res BW 390 kHz VBW 4 MHz #Sweep 5 s (601 pts)

<b>Occupied Bandwidth</b>	<b>Occ BW % Pwr</b>	99.00 %
16.9387 MHz	x dB	-26.00 dB
<b>Transmit Freq Error</b>	-15.434 kHz	
<b>x dB Bandwidth</b>	20.299 MHz*	

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Measure

Meas Off

Channel Power

Occupied BW

ACP

Multi Carrier Power

Power Stat CCDF

More 1 of 2

**26dB/99% Bandwidth, 2437 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**

Agilent 08:39:07 Jun 4, 2008 R T

Ch Freq 2.437 GHz Trig Free

Occupied Bandwidth

Ref 20 dBm Atten 30 dB

#Peak Log 10 dB/Offst 24.4 dB

Center 2.437 00 GHz Span 40 MHz  
Res BW 390 kHz VBW 4 MHz #Sweep 5 s (601 pts)

<b>Occupied Bandwidth</b>	<b>Occ BW % Pwr</b>	99.00 %
13.3763 MHz	x dB	-26.00 dB
<b>Transmit Freq Error</b>	-17.860 kHz	
<b>x dB Bandwidth</b>	16.760 MHz*	

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Freq/Channel

Center Freq 2.43700000 GHz

Start Freq 2.41700000 GHz

Stop Freq 2.45700000 GHz

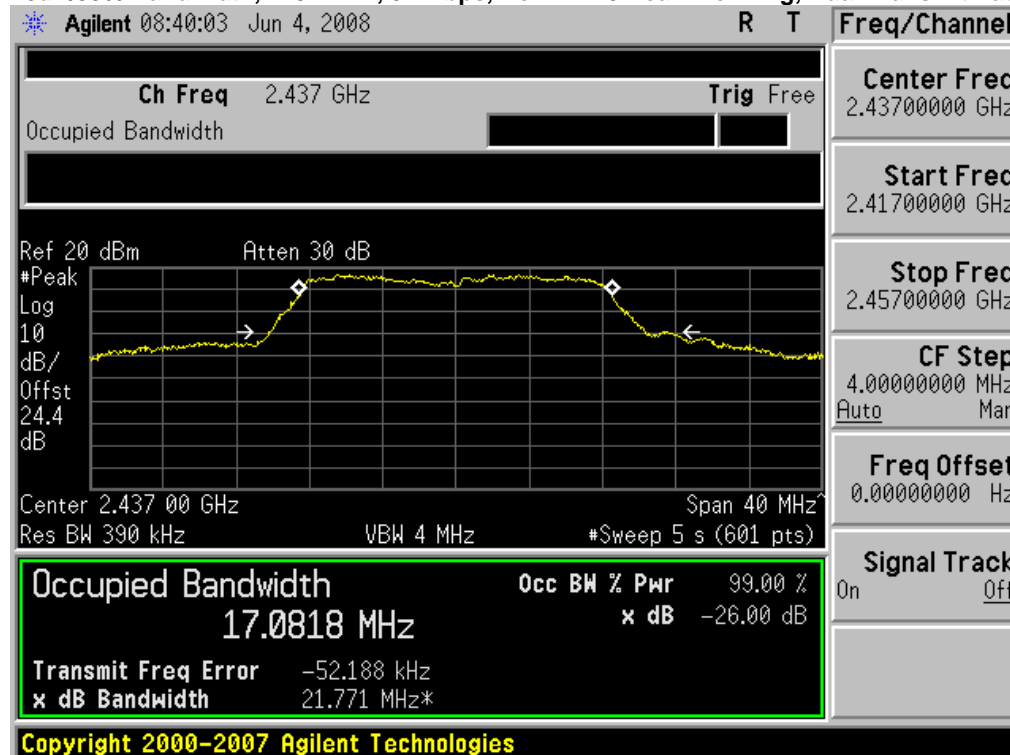
CF Step 4.00000000 MHz  
Auto Man

Freq Offset 0.00000000 Hz

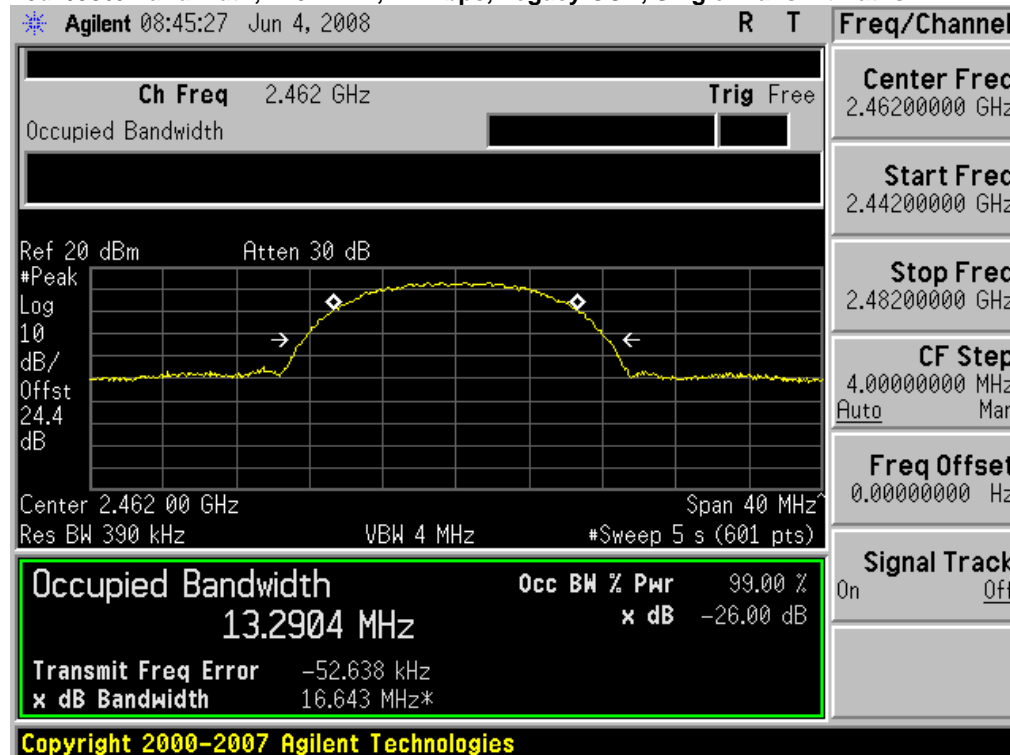
Signal Track On Off



26dB/99% Bandwidth, 2437 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths

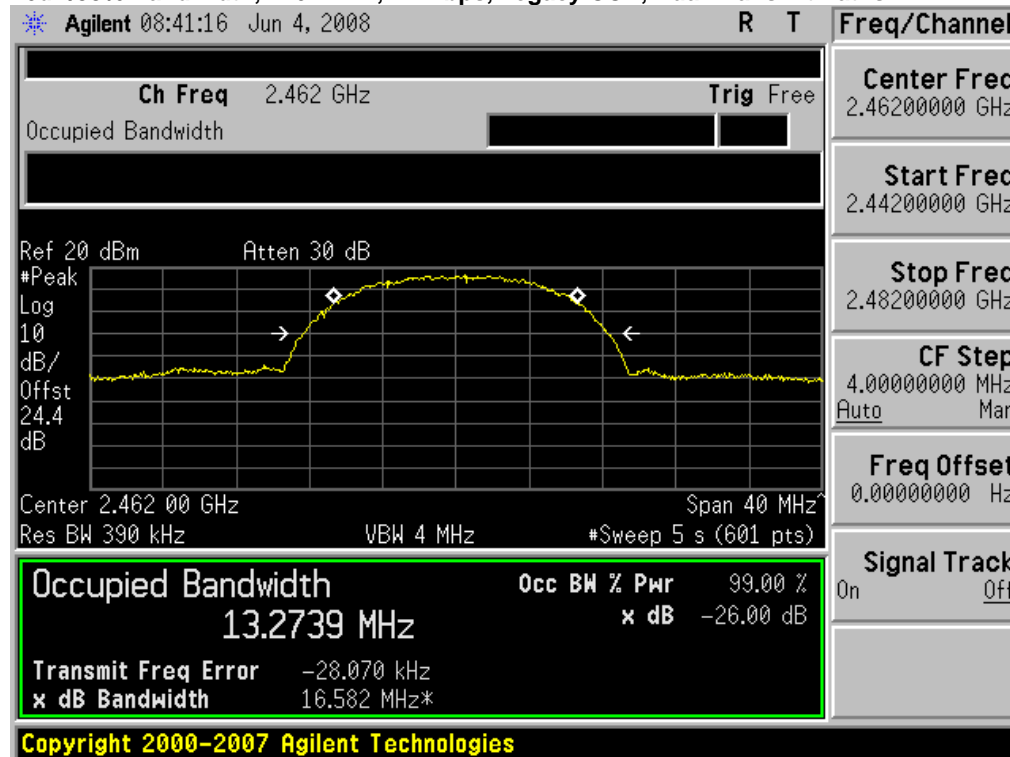


26dB/99% Bandwidth, 2462 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths

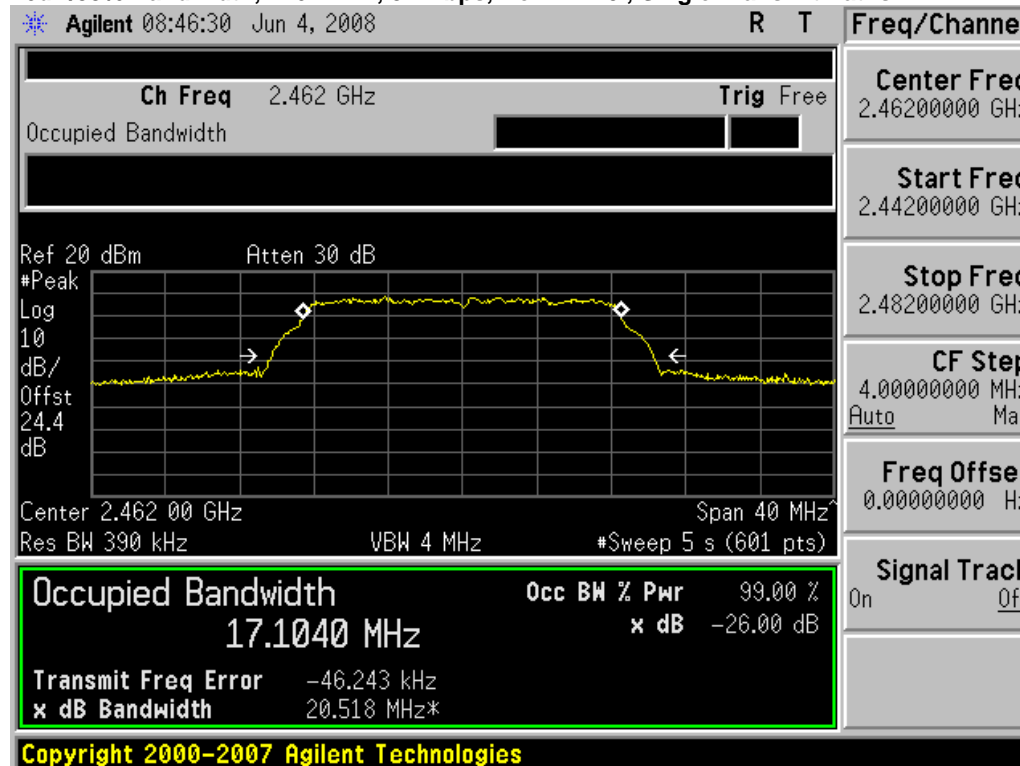




**26dB/99% Bandwidth, 2462 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**



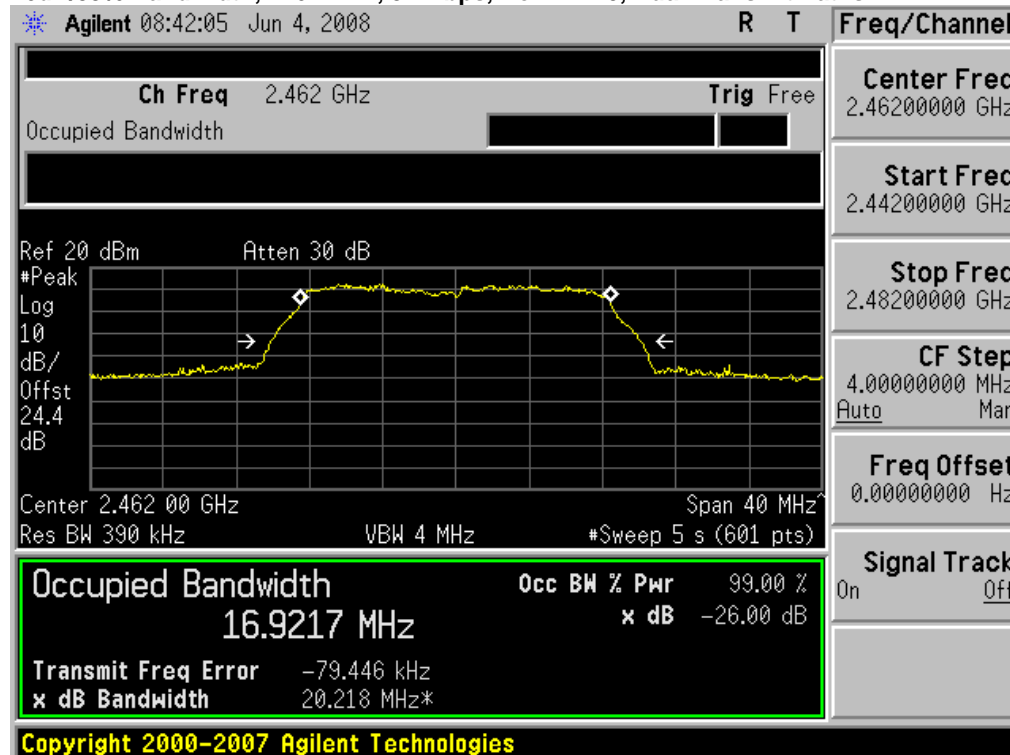
**26dB/99% Bandwidth, 2462 MHz, 54 Mbps, Non HT-20 , Single Transmit Paths**



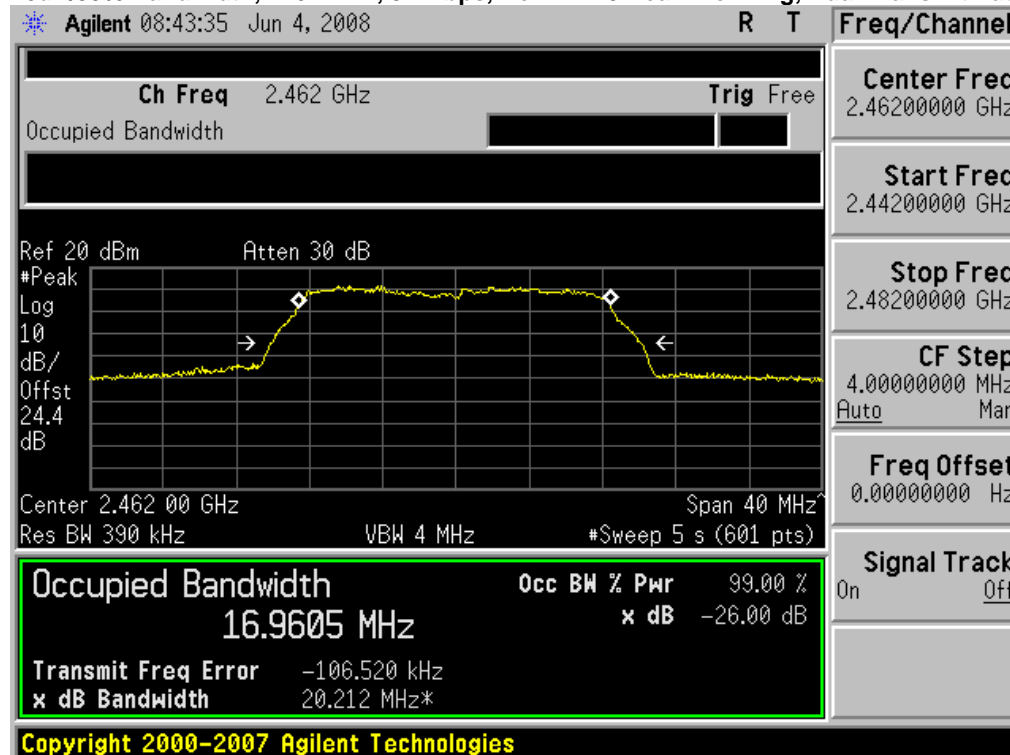




26dB/99% Bandwidth, 2462 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths



26dB/99% Bandwidth, 2462 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths

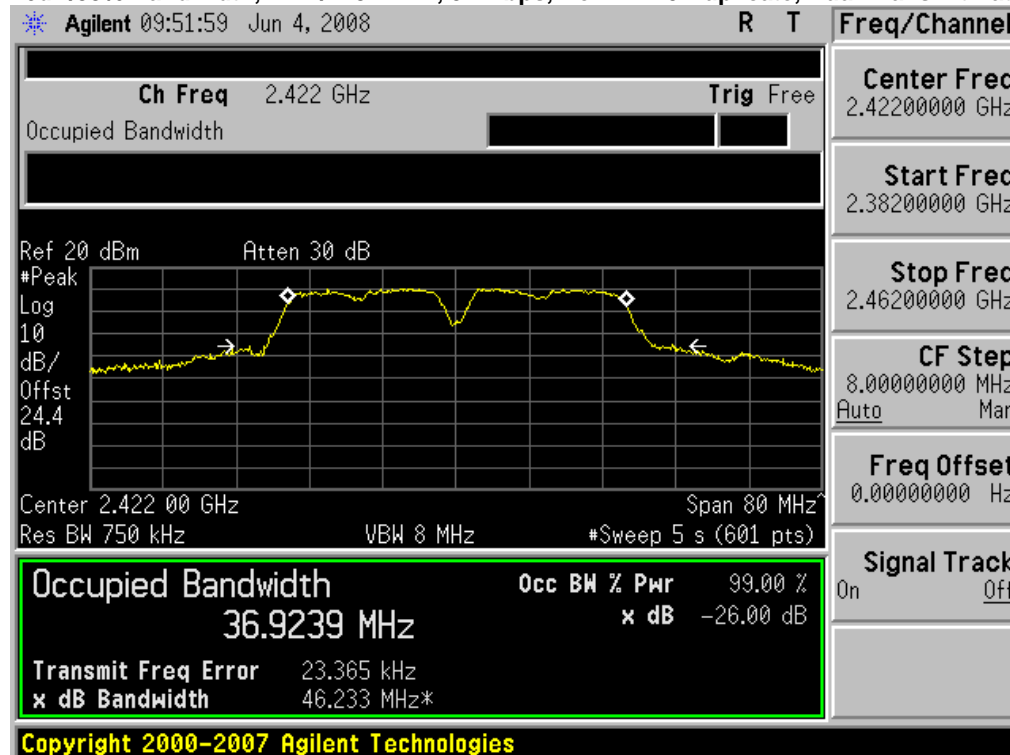




26dB/99% Bandwidth, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Single Transmit Paths

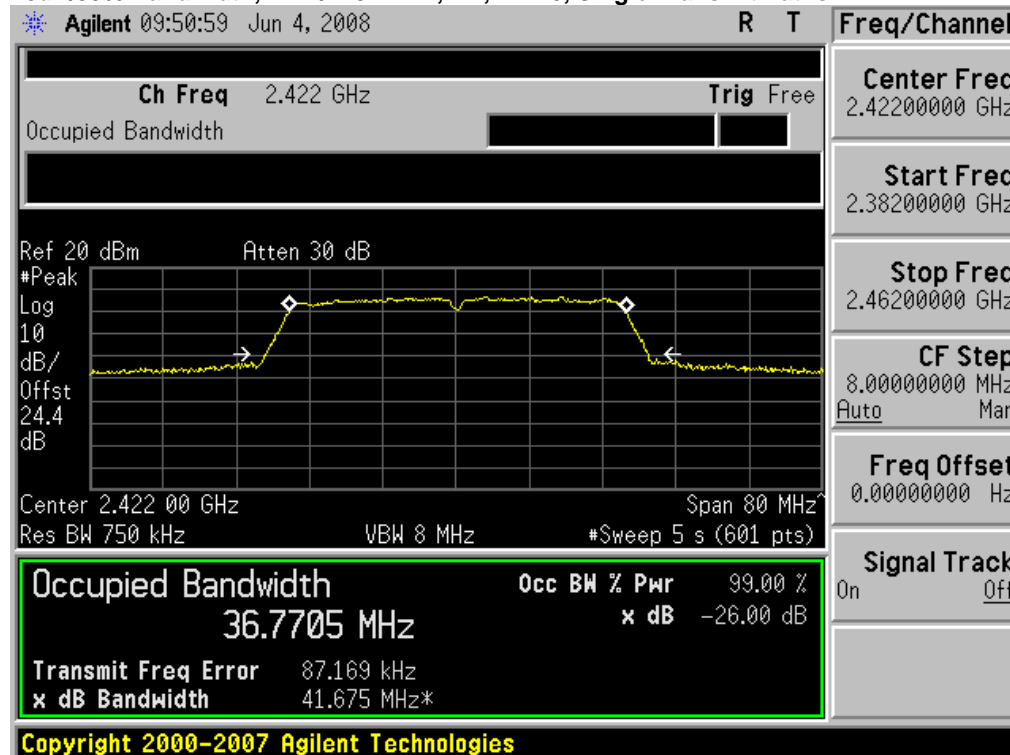


26dB/99% Bandwidth, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

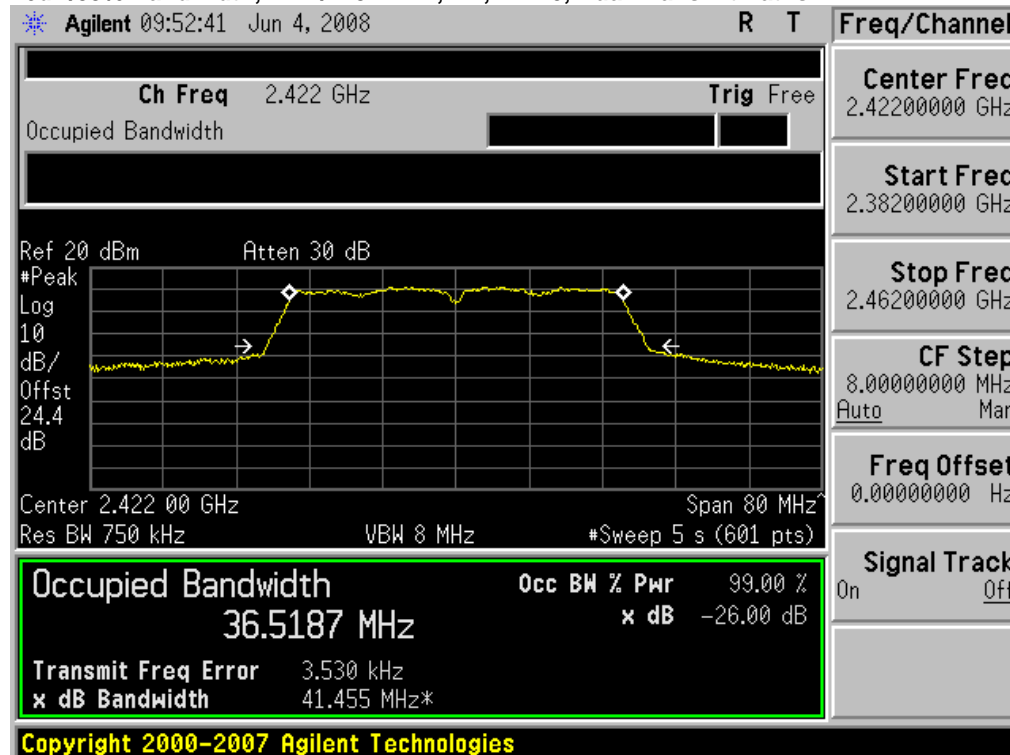




26dB/99% Bandwidth, 2412/2432 MHz, M7, HT-40, Single Transmit Paths

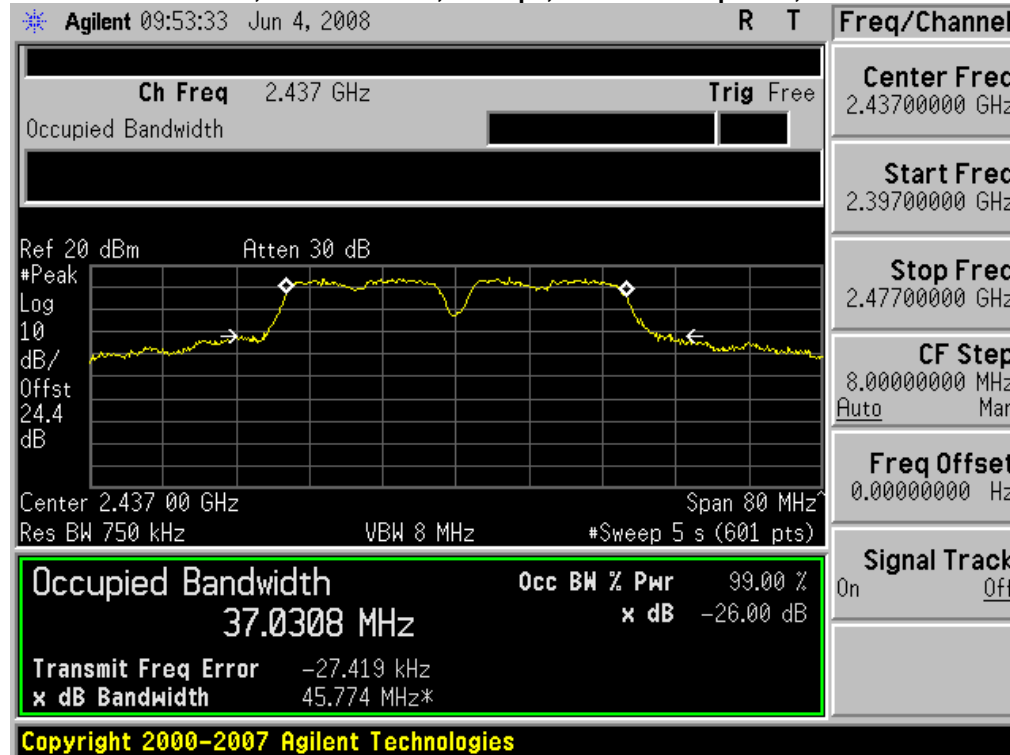


26dB/99% Bandwidth, 2412/2432 MHz, M7, HT-40, Dual Transmit Paths

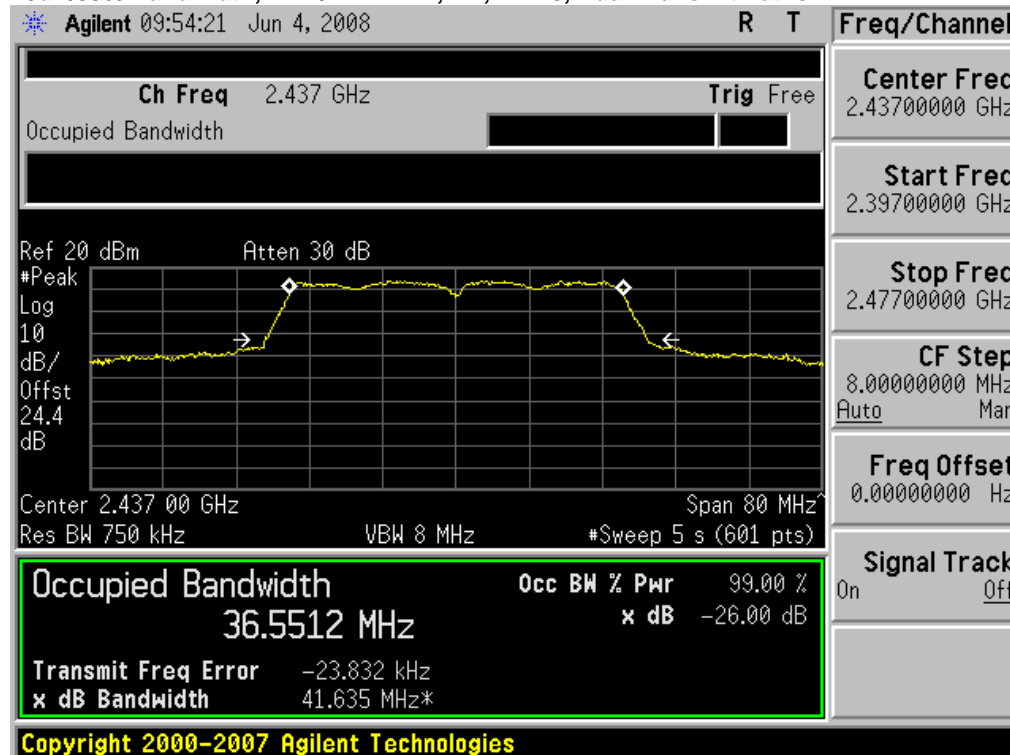




26dB/99% Bandwidth, 2427/2447 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

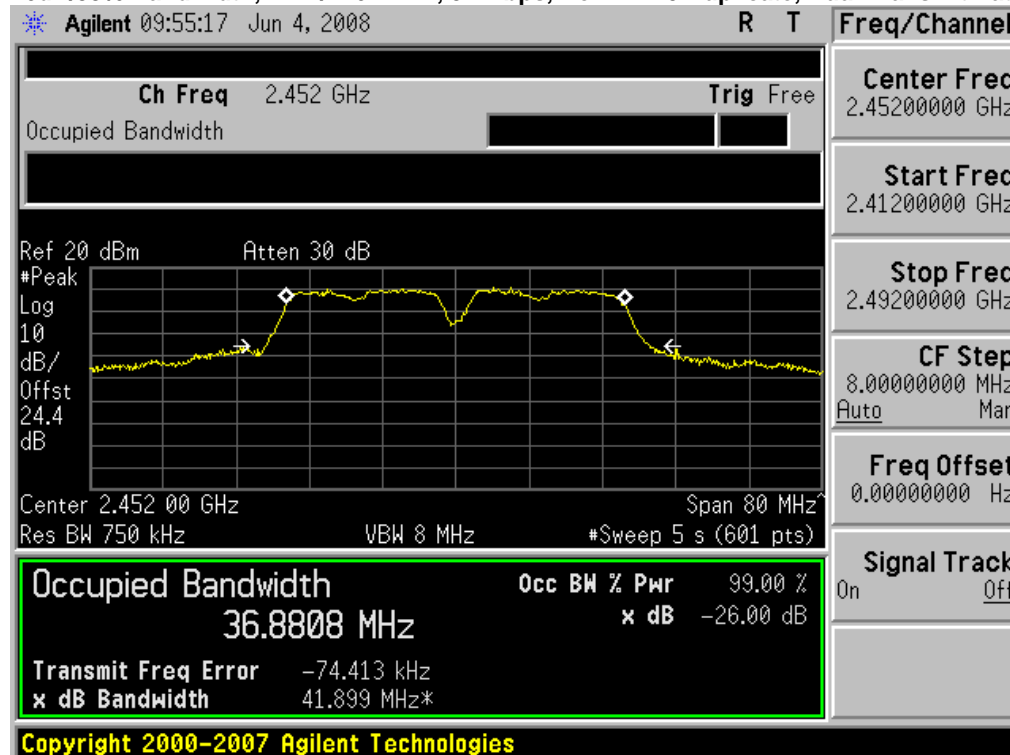


26dB/99% Bandwidth, 2427/2447 MHz, M7, HT-40, Dual Transmit Paths

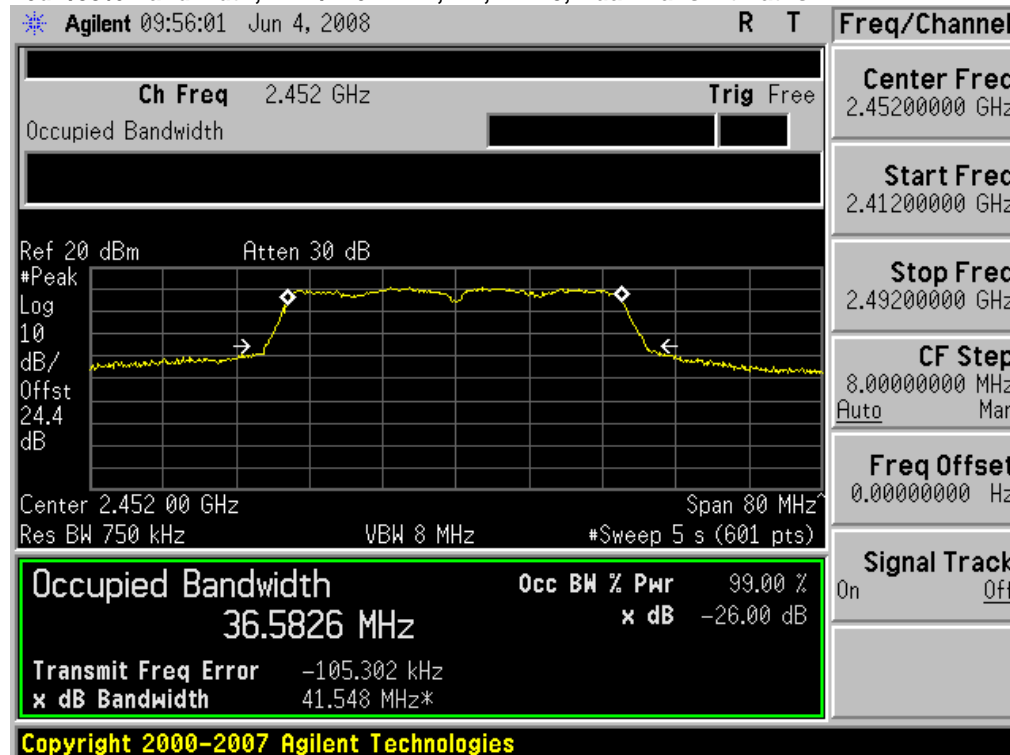




26dB/99% Bandwidth, 2442/2462 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths



26dB/99% Bandwidth, 2442/2462 MHz, M7, HT-40, Dual Transmit Paths





## Peak Output Power

15.247: 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 4dBi. In beamforming mode, the 4dBi behaves as  $3\text{dBi} + 10\log(n)$  ( $n=2$  radiating elements) = 7dBi. Therefore the maximum allowable output power requires 1dB reduction in beam forming 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

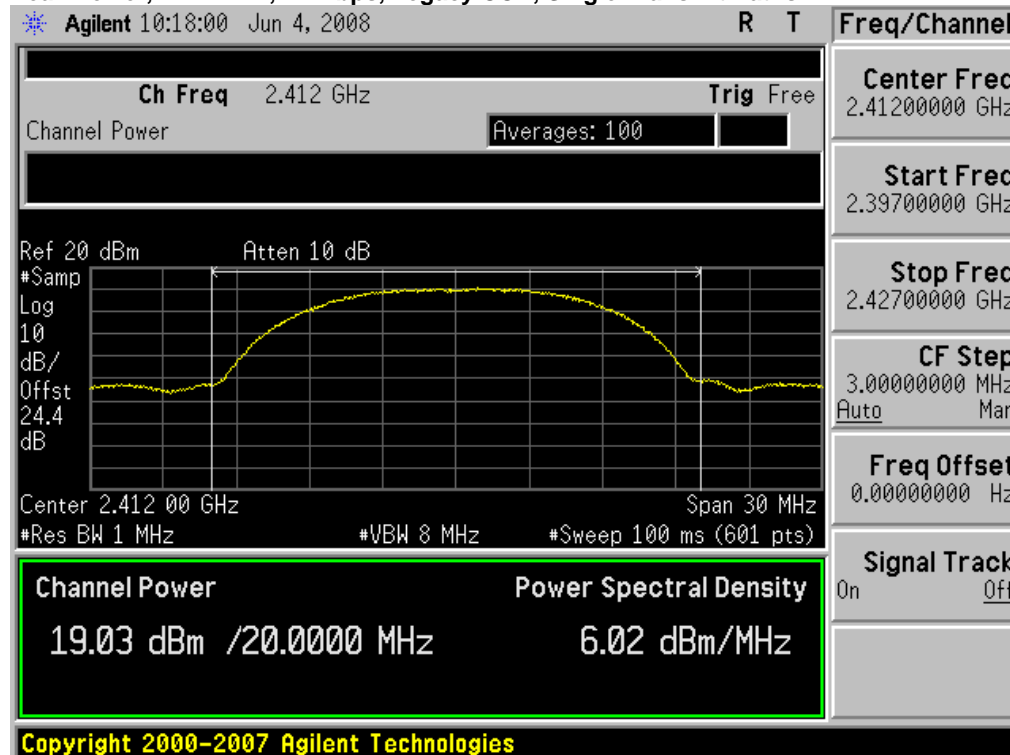
After averaging 100 traces of the transmitter waveform on the spectrum analyzer, record the spectrum analyzer Channel Power.



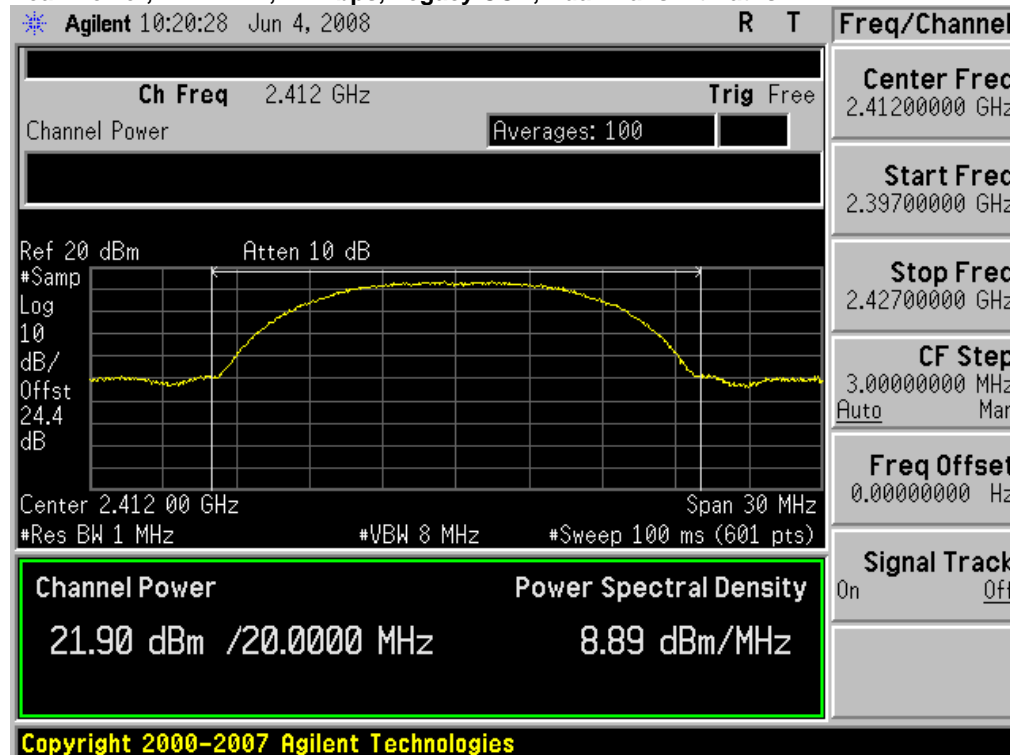
Frequency (MHz)	Mode	Data Rate (Mbps)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
2412	Legacy CCK, Single Tx Path	11	19.0	30	11.0
2412	Legacy CCK, Dual Tx Path	11	21.9	30	8.1
2412	Non HT-20, Single Tx Path	54	16.3	30	13.7
2412	Non HT-20, Dual Tx Path	54	16.9	30	13.1
2412	Non HT-20 Beam Forming	54	15.5	30	14.5
2437	Legacy CCK, Dual Tx Path	11	23.8	30	6.2
2437	Non HT-20 Beam Forming	54	20.0	30	10.0
2462	Legacy CCK, Single Tx Path	11	18.0	30	12.0
2462	Legacy CCK, Dual Tx Path	11	20.2	30	9.8
2462	Non HT-20, Single Tx Path	54	14.3	30	15.7
2462	Non HT-20, Dual Tx Path	54	17.0	30	13.0
2462	Non HT-20 Beam Forming	54	15.6	30	14.4
2412/2432	Non HT-40 Duplicate, Single Tx Path	54	10.9	30	19.1
2412/2432	Non HT-40 Duplicate, Dual Tx Path	54	13.6	30	16.4
2412/2432	HT-40, Single Tx Path	M7	13.8	30	16.2
2412/2432	HT-40, Dual Tx Path	M7	14.6	30	15.4
2427/2447	Non HT-40 Duplicate	54	17.1	30	12.9
2427/2447	HT-40	54	17.6	30	12.4
2442/2462	Non HT-40 Duplicate	54	13.4	30	16.6
2442/2462	HT-40	M7	15.5	30	14.5



**Peak Power, 2412 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths**



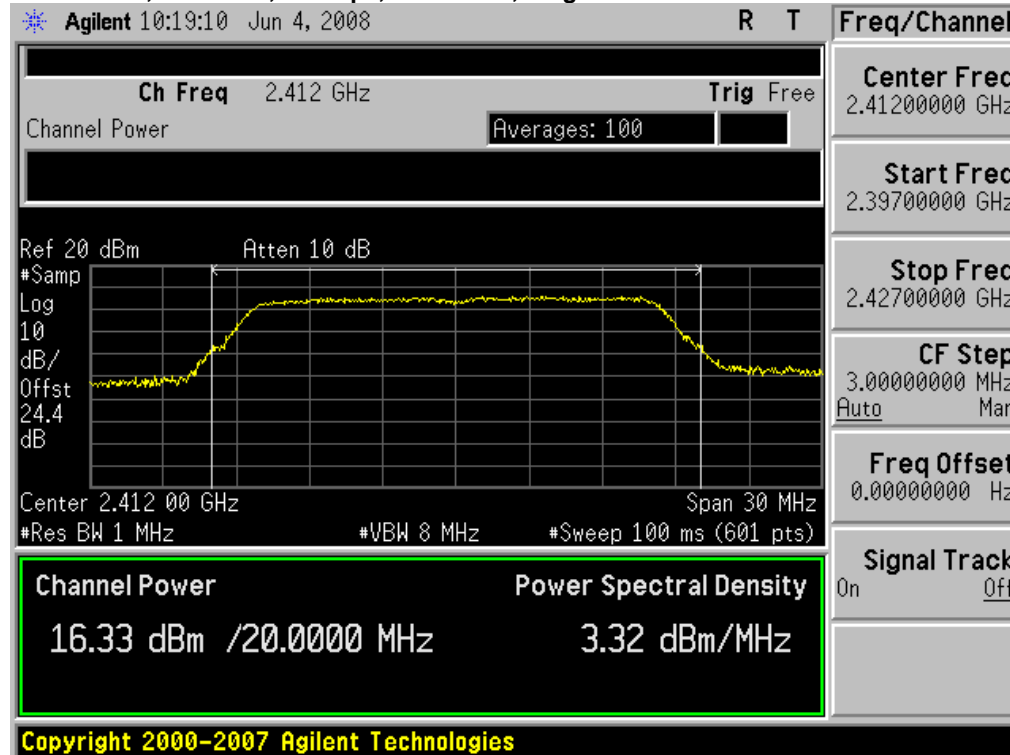
**Peak Power, 2412 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**



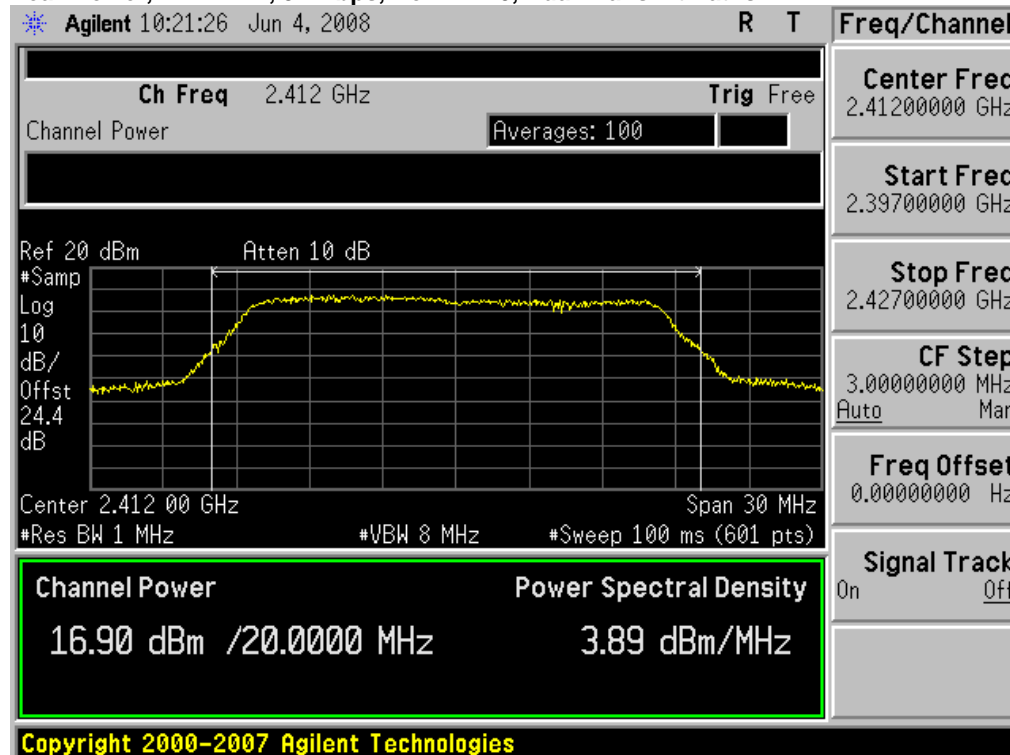




**Peak Power, 2412 MHz, 54 Mbps, Non HT-20, Single Transmit Paths**

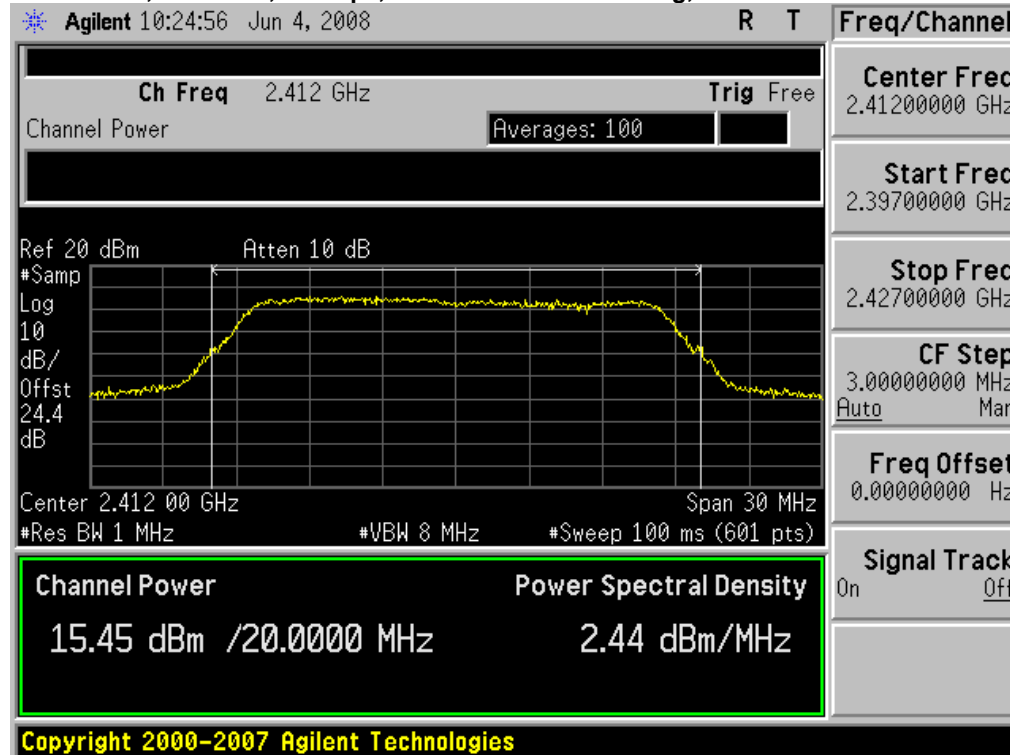


**Peak Power, 2412 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths**





**Peak Power, 2412 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

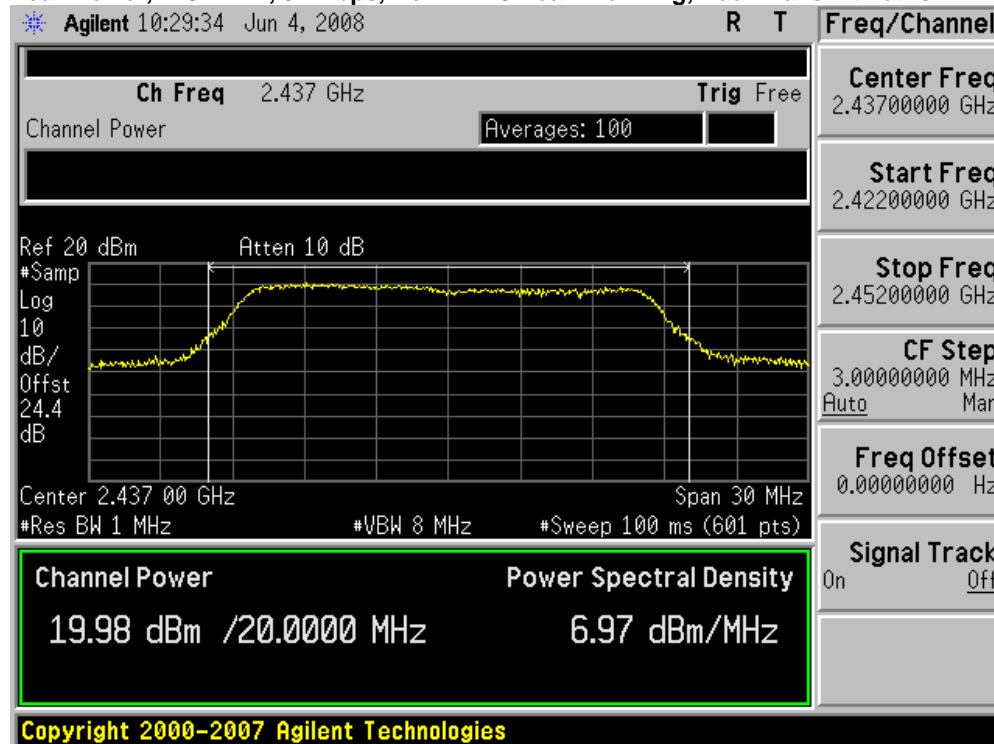


**Peak Power, 2437 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**

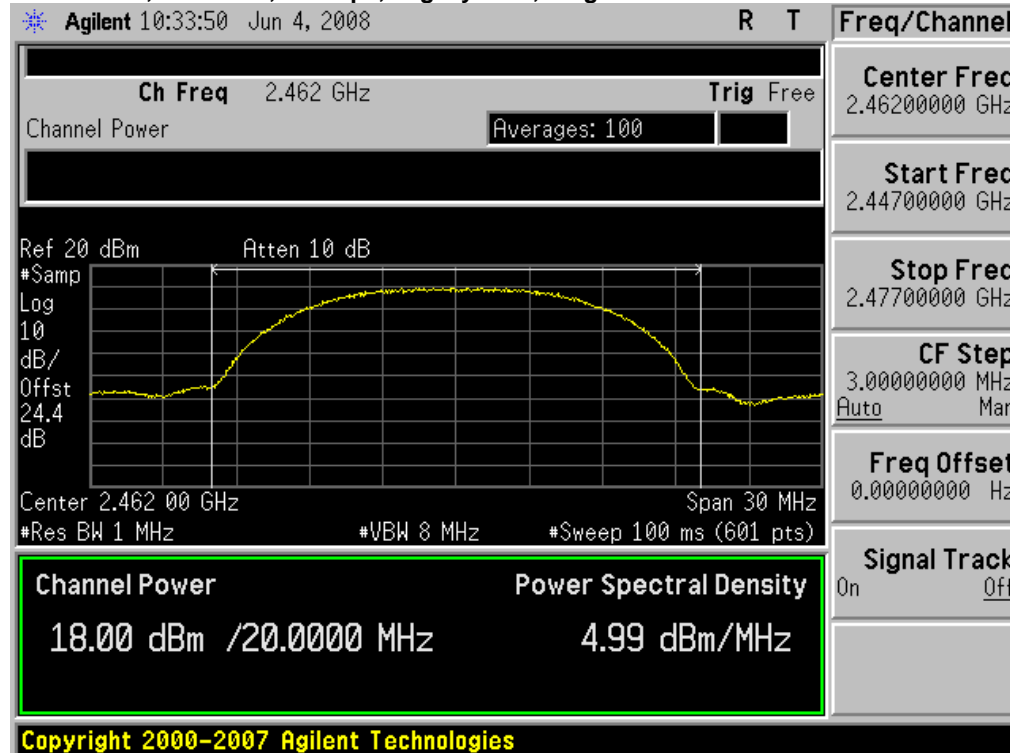




**Peak Power, 2437 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

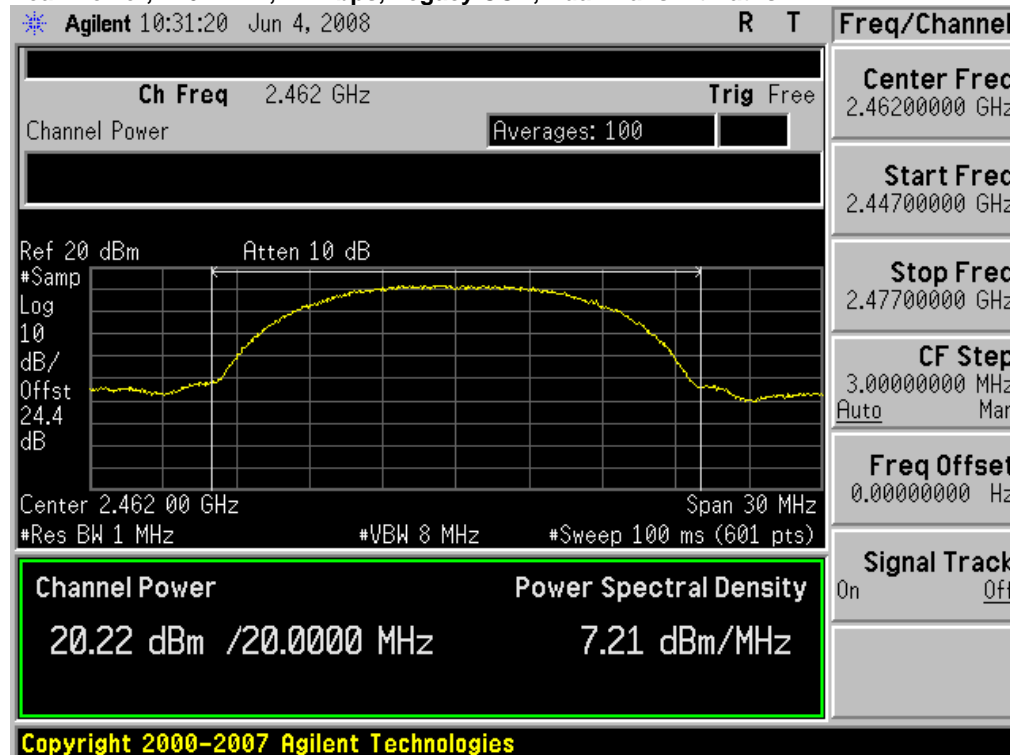


**Peak Power, 2462 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths**

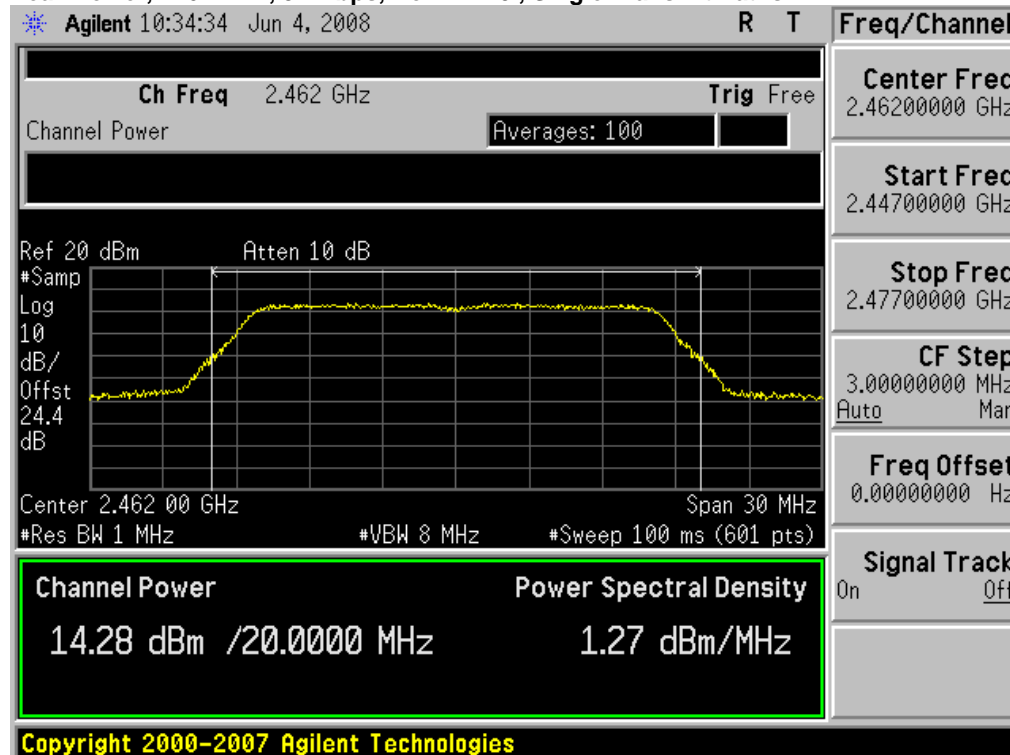




**Peak Power, 2462 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**

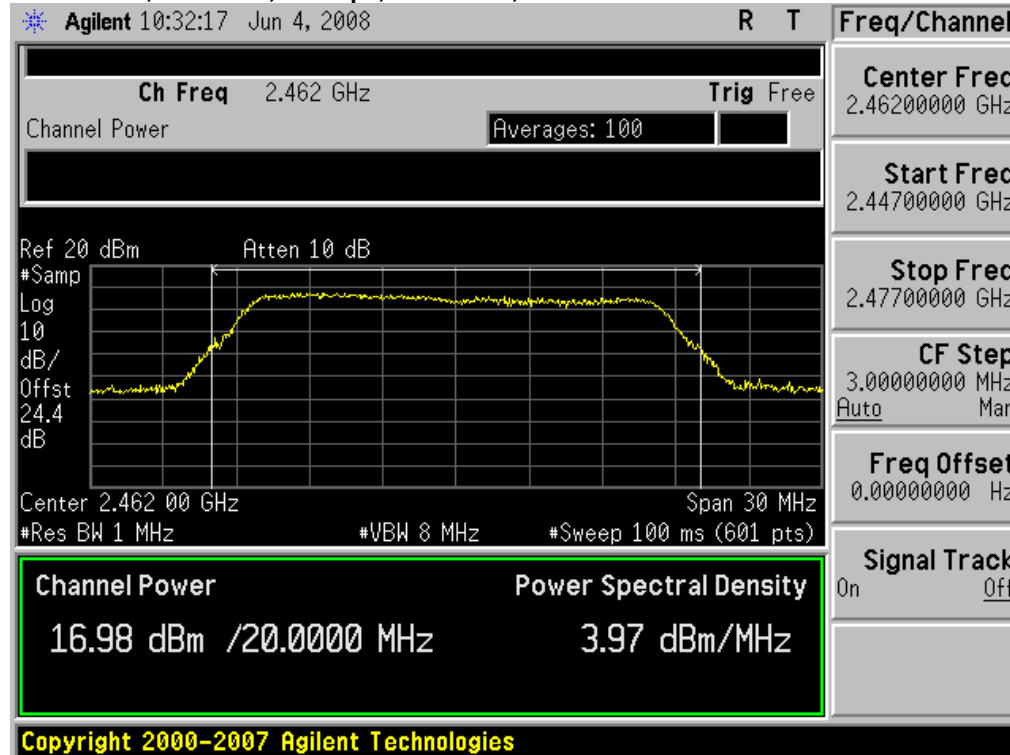


**Peak Power, 2462 MHz, 54 Mbps, Non HT-20 , Single Transmit Paths**

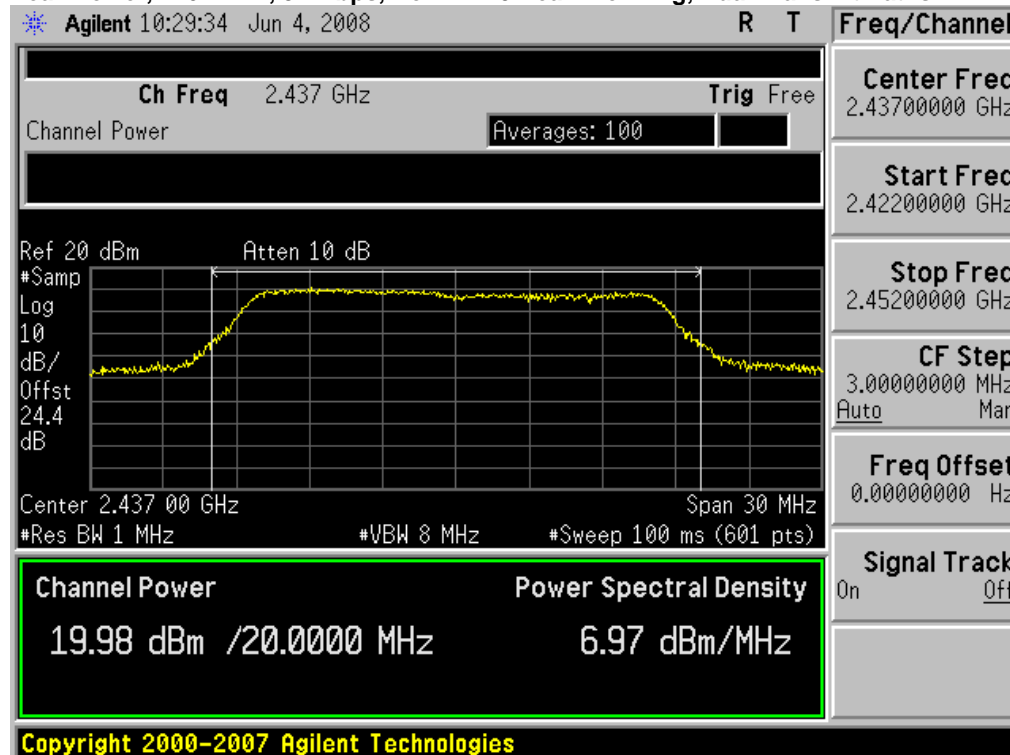




**Peak Power, 2462 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths**

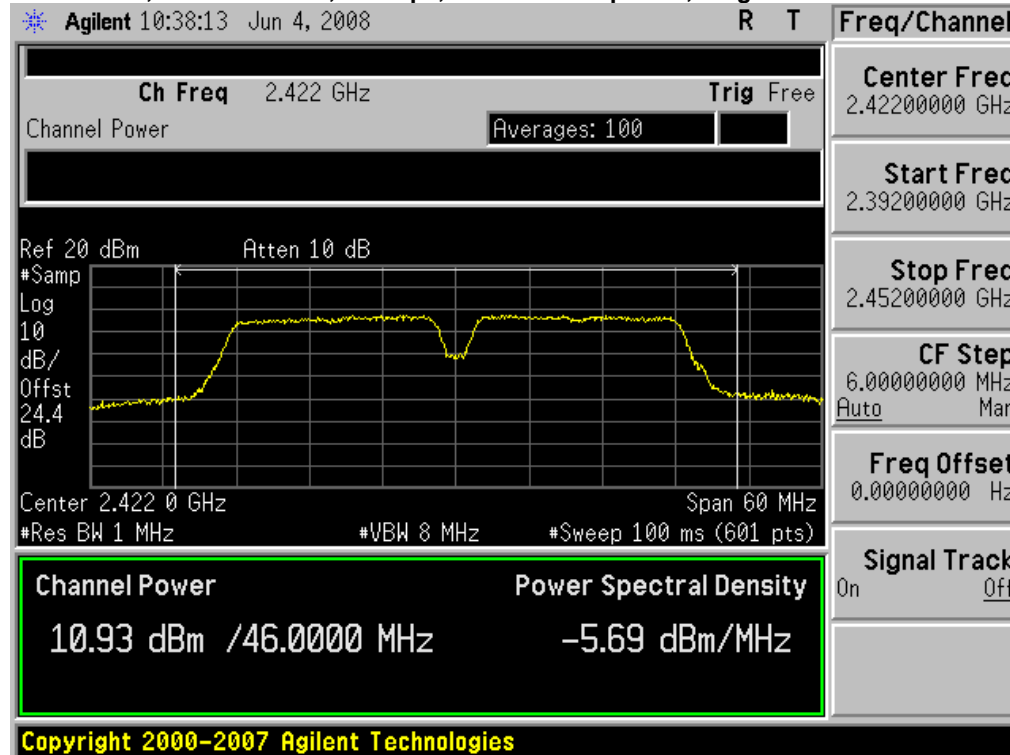


**Peak Power, 2462 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

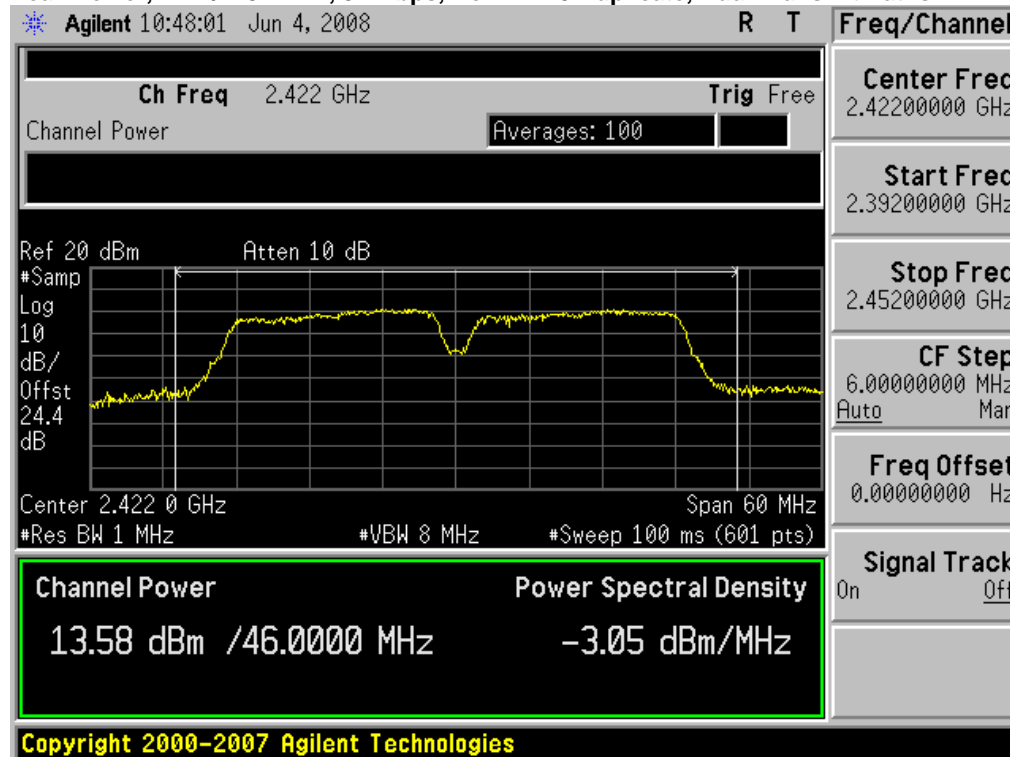




**Peak Power, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Single Transmit Paths**

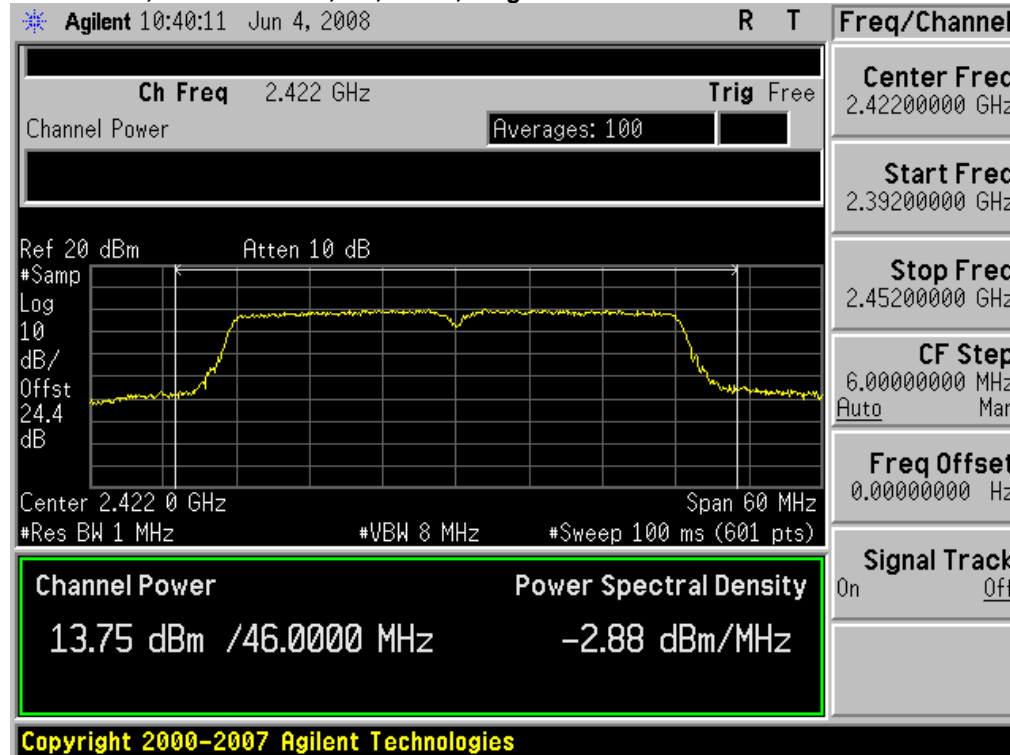


**Peak Power, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**

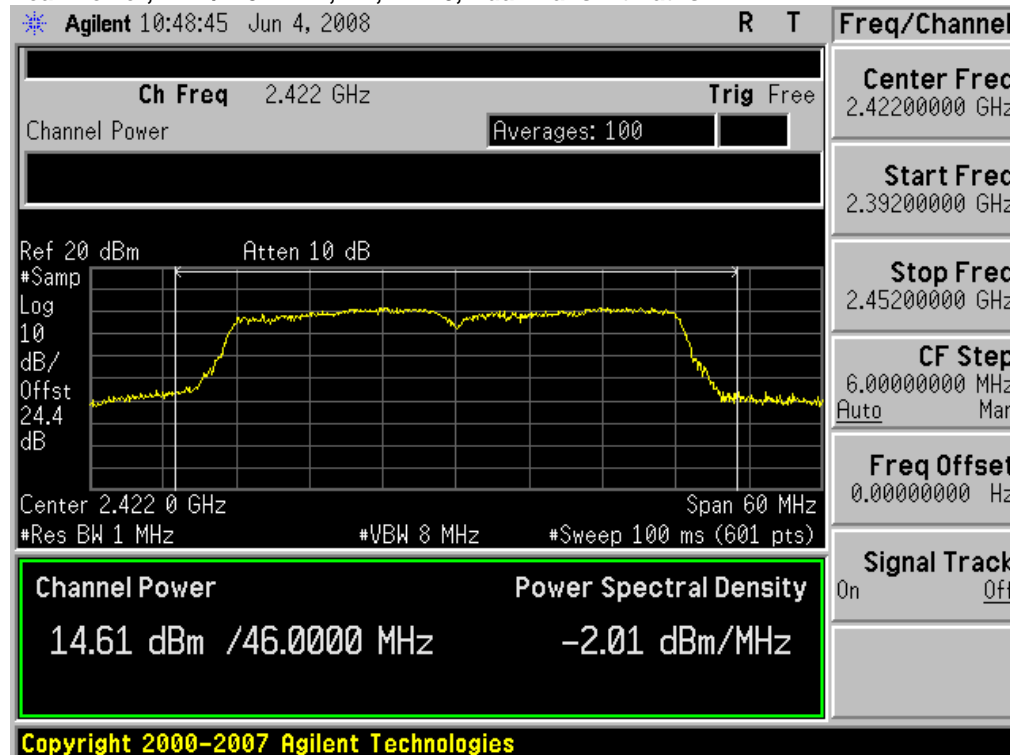




**Peak Power, 2412/2432 MHz, M7, HT-40, Single Transmit Paths**

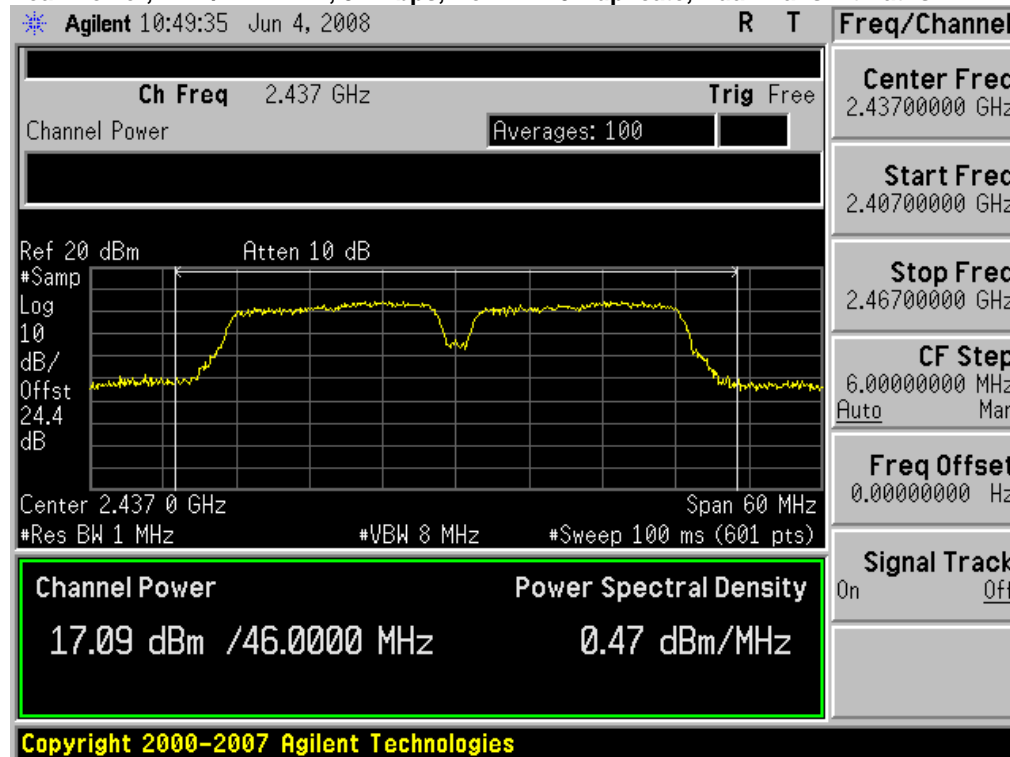


**Peak Power, 2412/2432 MHz, M7, HT-40, Dual Transmit Paths**

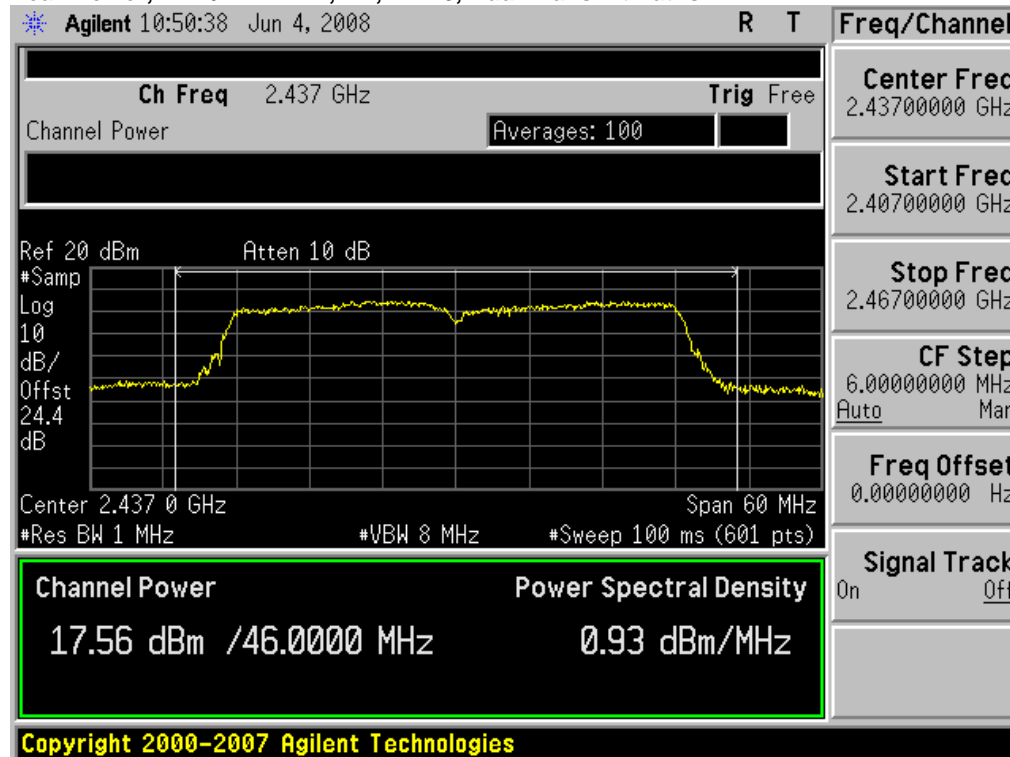




**Peak Power, 2427/2447 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**



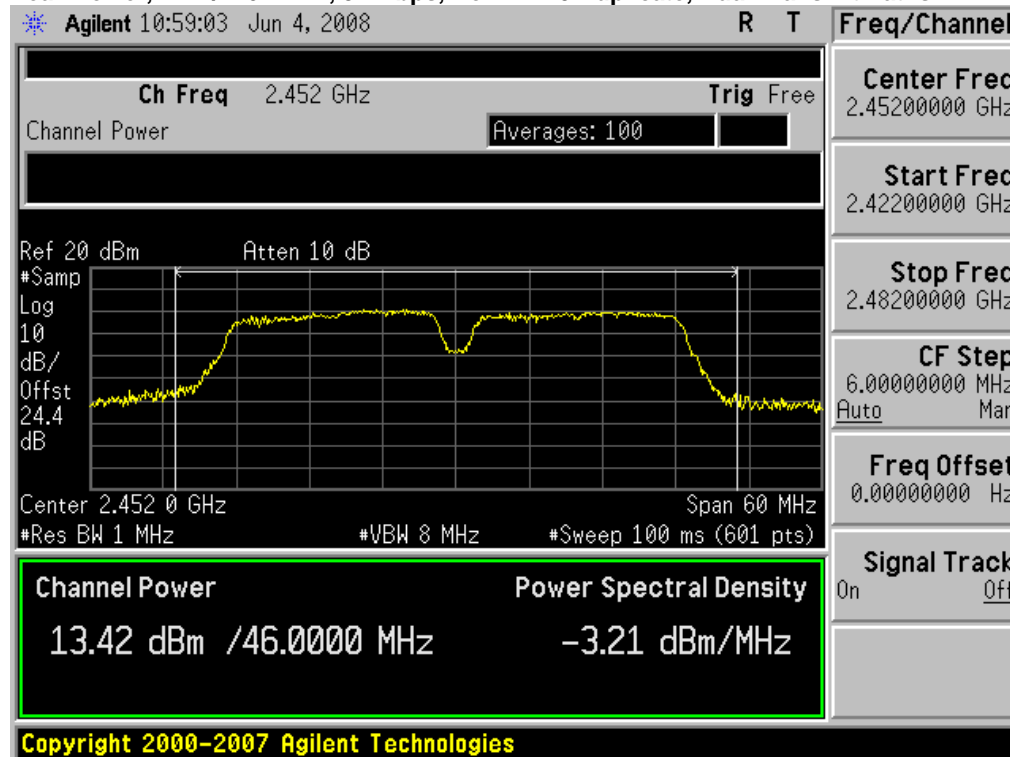
**Peak Power, 2427/2447 MHz, M7, HT-40, Dual Transmit Paths**



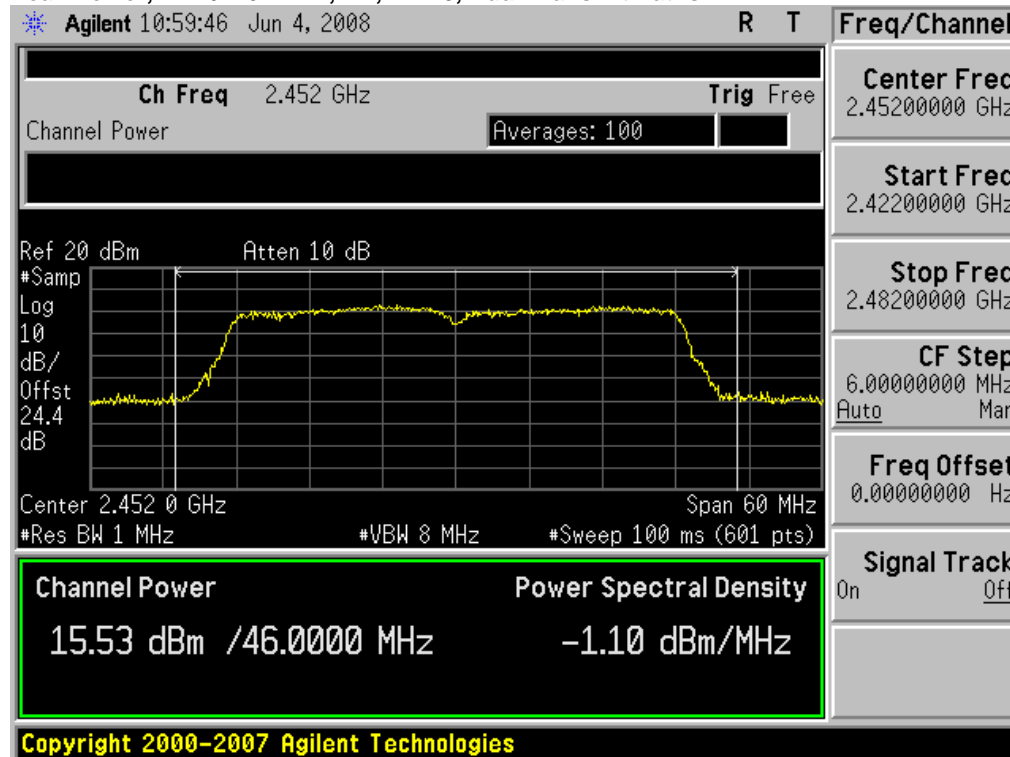




**Peak Power, 2442/2462 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**



**Peak Power, 2442/2462 MHz, M7, HT-40, Dual Transmit Paths**



## Power Spectral Density

15.247: 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.

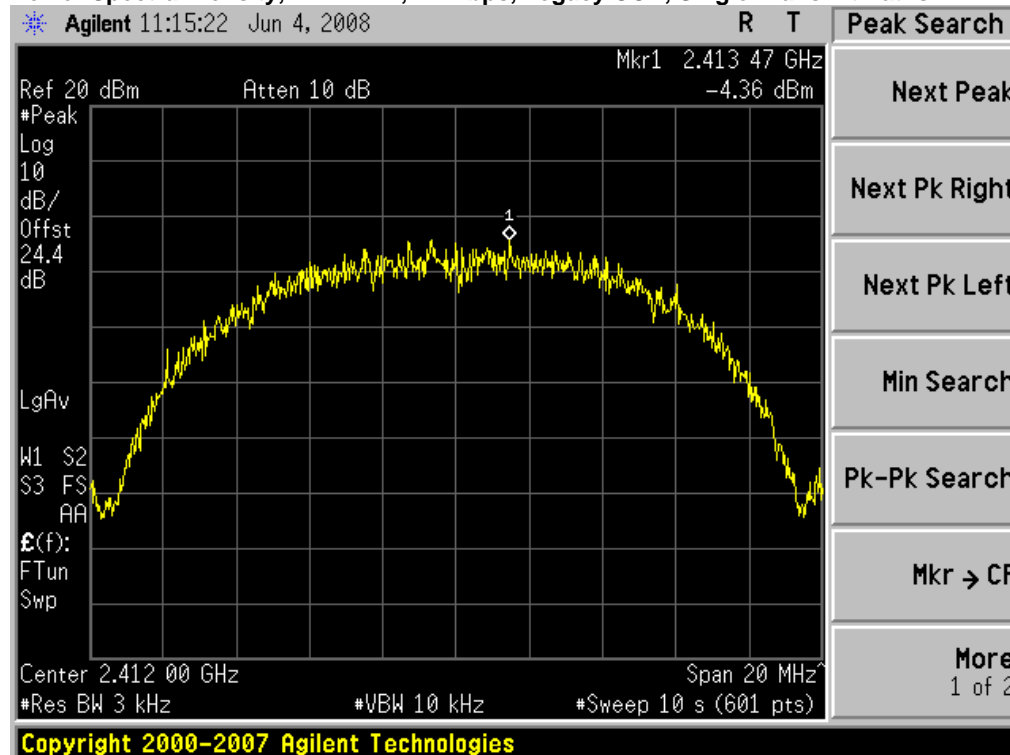
Center Frequency: Frequency from table below  
 Span: 20 MHz  
 Ref Level Offset: Correct for attenuator and cable loss.  
 Reference Level: 20 dBm  
 Attenuation: 20 dB  
 Sweep Time: 10s  
 Resolution Bandwidth: 3 kHz  
 Video Bandwidth: 10 kHz  
 Detector: Peak  
 Trace: Single  
 Marker: Peak Search

Record the Marker value.

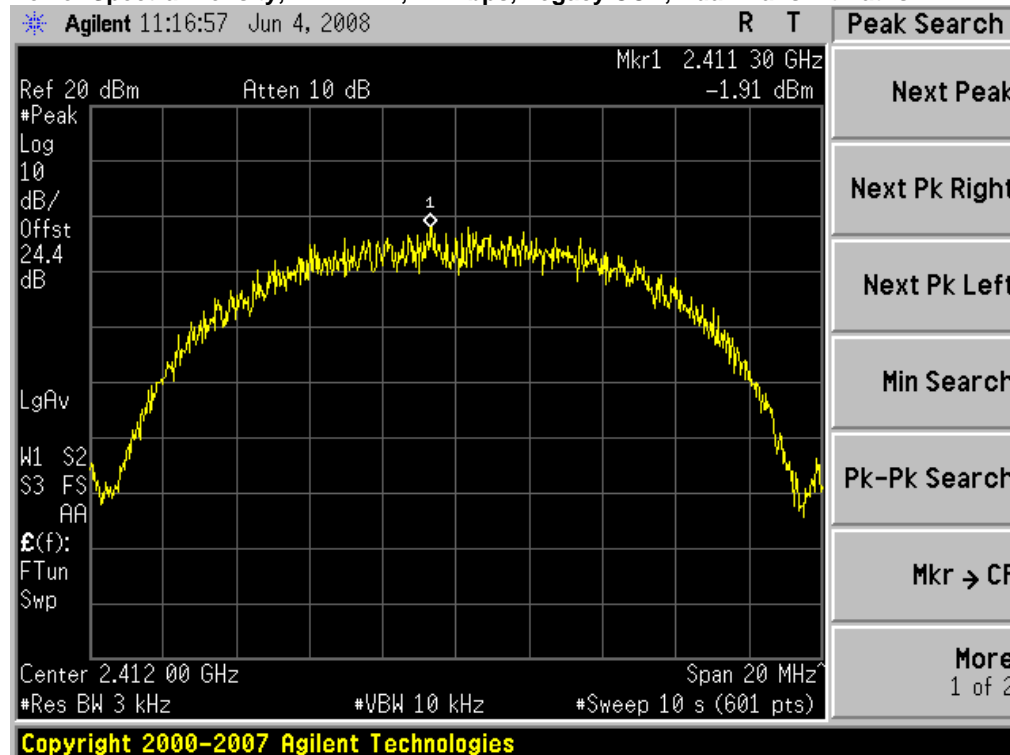
Frequency (MHz)	Mode	Data Rate (Mbps)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
2412	Legacy CCK, Single Tx Path	11	-4.4	8	12.4
2412	Legacy CCK, Dual Tx Path	11	-1.9	8	9.9
2412	Non HT-20, Single Tx Path	54	-9.5	8	17.5
2412	Non HT-20, Dual Tx Path	54	-6.7	8	14.7
2412	Non HT-20 Beam Forming	54	-8.7	8	16.7
2437	Legacy CCK, Dual Tx Path	11	-0.1	8	8.1
2437	Non HT-20 Beam Forming	54	-20.3	8	28.3
2462	Legacy CCK, Single Tx Path	11	-5.3	8	13.3
2462	Legacy CCK, Dual Tx Path	11	-3.3	8	11.3
2462	Non HT-20, Single Tx Path	54	-10.7	8	18.7
2462	Non HT-20, Dual Tx Path	54	-8.1	8	16.1
2462	Non HT-20 Beam Forming	54	-8.7	8	16.7
2412/2432	Non HT-40 Duplicate, Single Tx Path	54	-17.1	8	25.1
2412/2432	Non HT-40 Duplicate, Dual Tx Path	54	-12.7	8	20.7
2412/2432	HT-40, Single Tx Path	M7	-13.5	8	21.5
2412/2432	HT-40, Dual Tx Path	M7	-10.0	8	18.0
2427/2447	Non HT-40 Duplicate	54	-9.7	8	17.7
2427/2447	HT-40	54	-7.6	8	15.6
2442/2462	Non HT-40 Duplicate	54	-13.3	8	21.3
2442/2462	HT-40	M7	-11.0	8	19.0



**Power Spectral Density, 2412 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths**

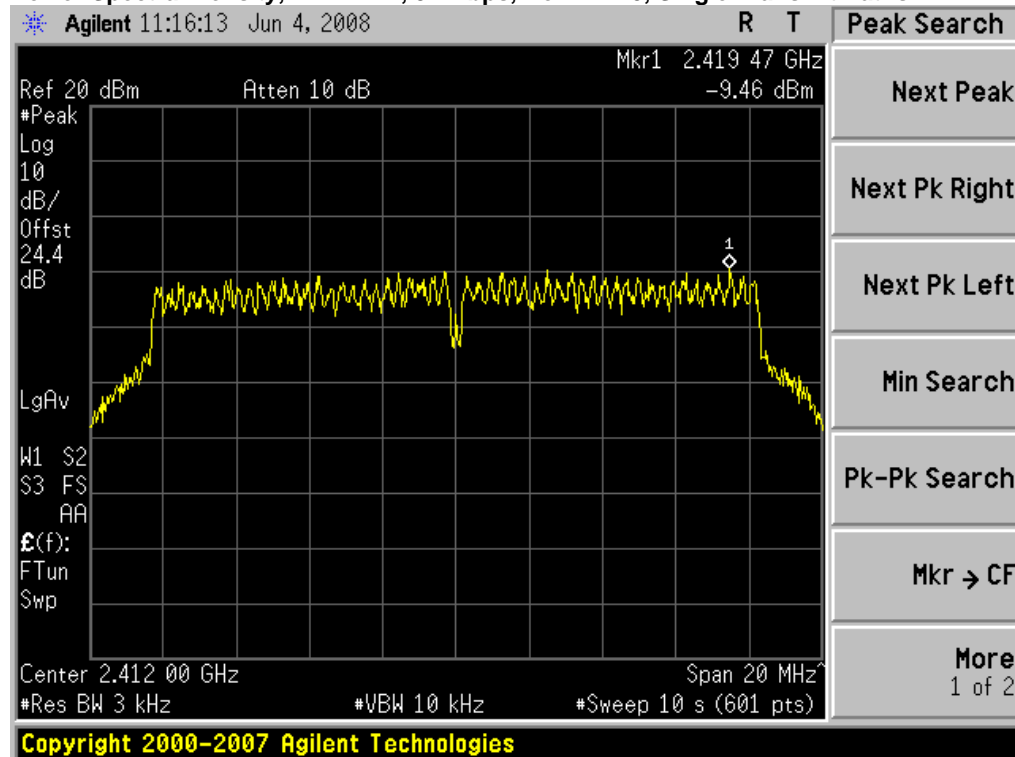


**Power Spectral Density, 2412 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**

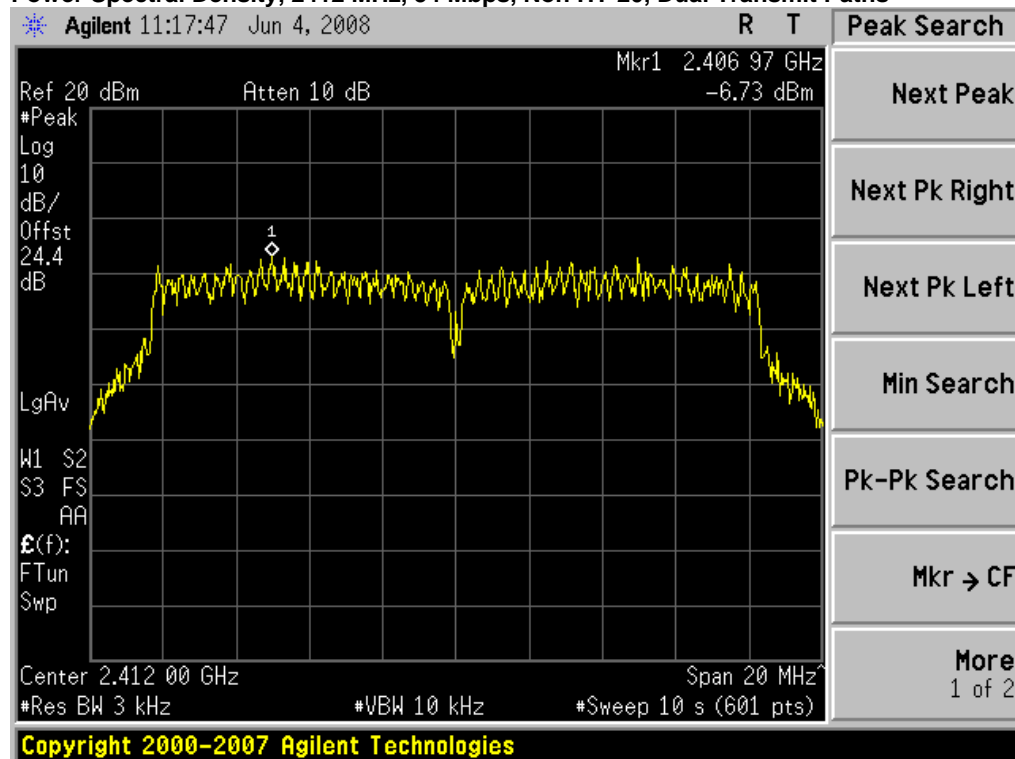




**Power Spectral Density, 2412 MHz, 54 Mbps, Non HT-20, Single Transmit Paths**

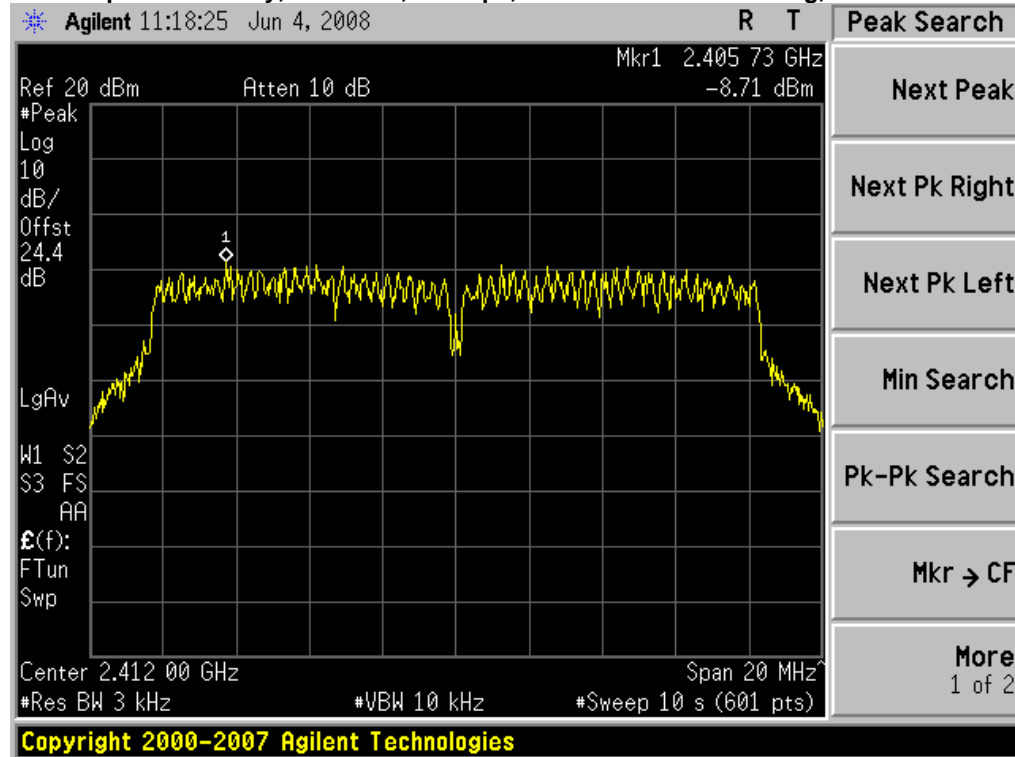


**Power Spectral Density, 2412 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths**

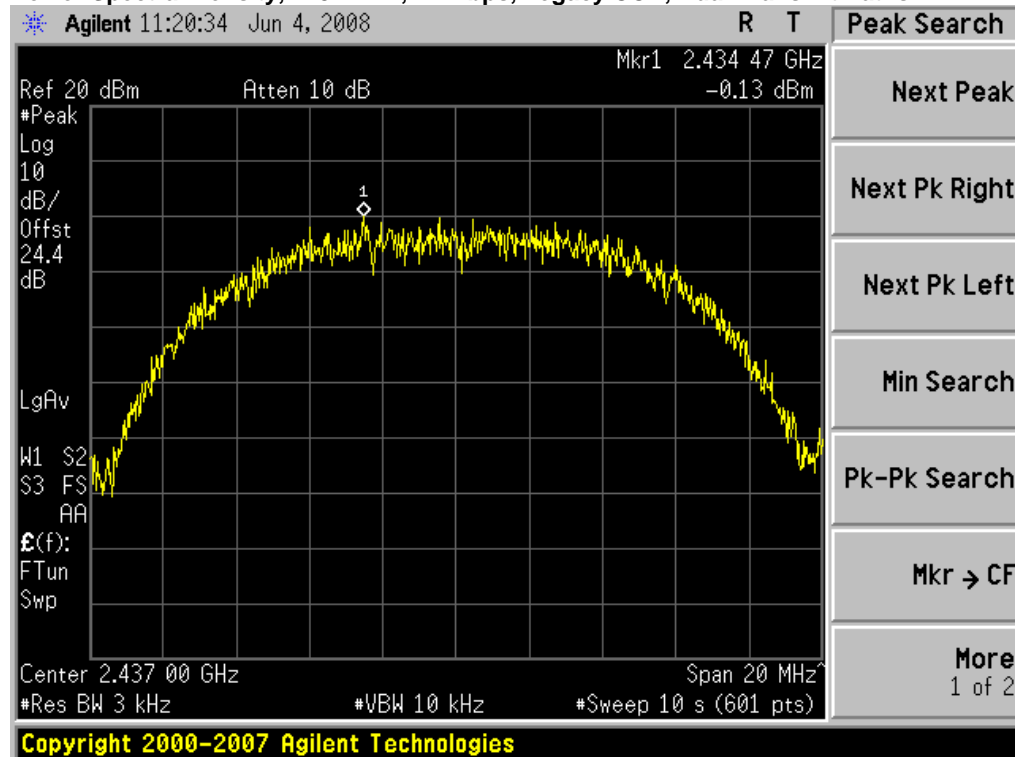




**Power Spectral Density, 2412 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

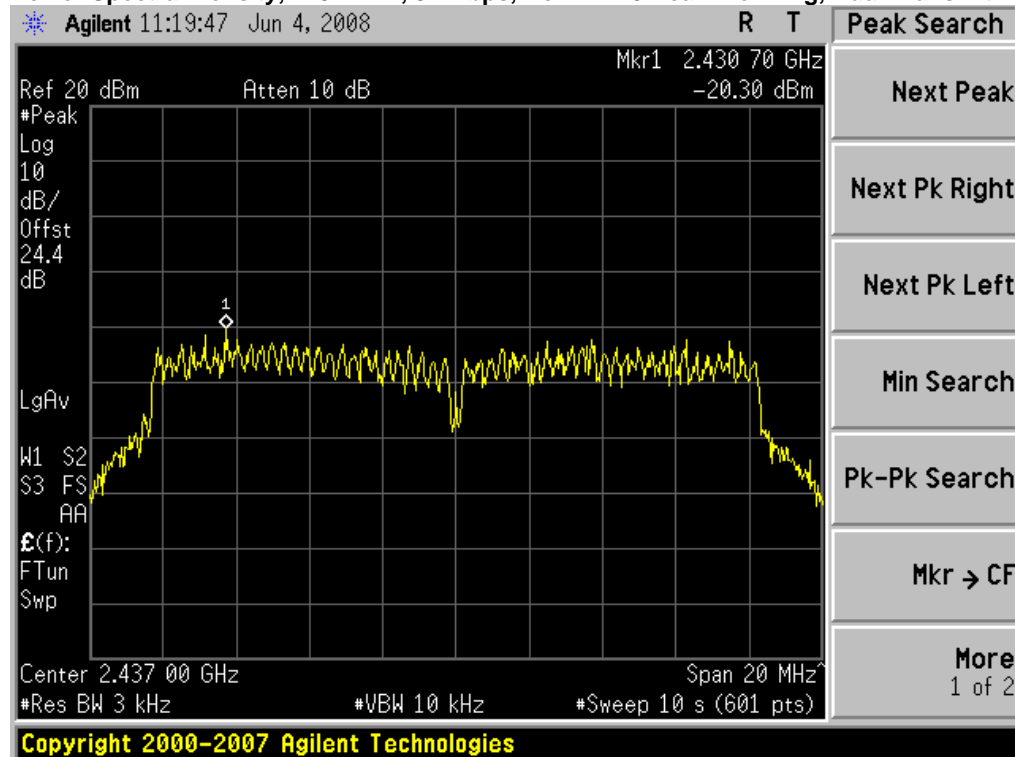


**Power Spectral Density, 2437 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**

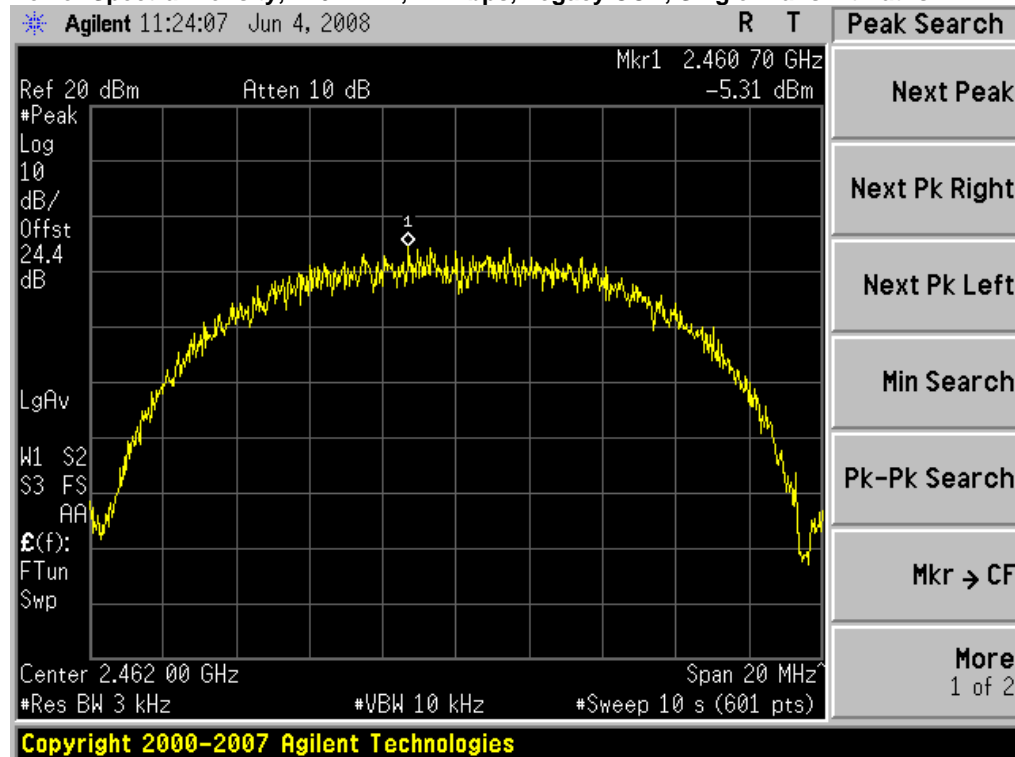




**Power Spectral Density, 2437 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

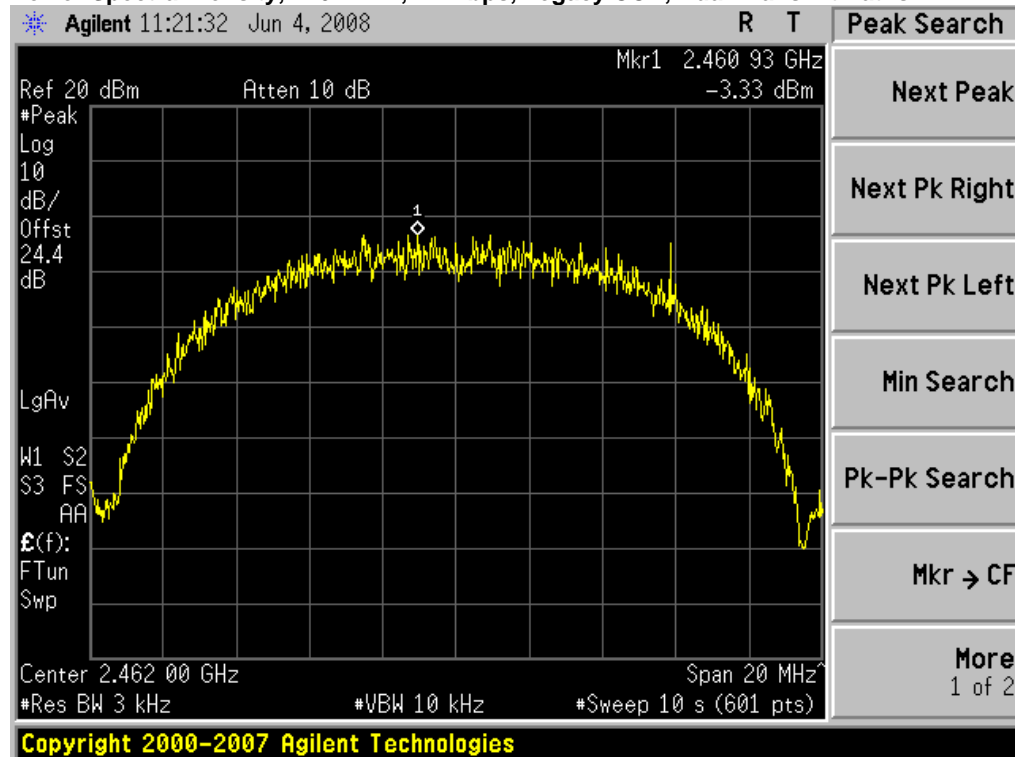


**Power Spectral Density, 2462 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths**

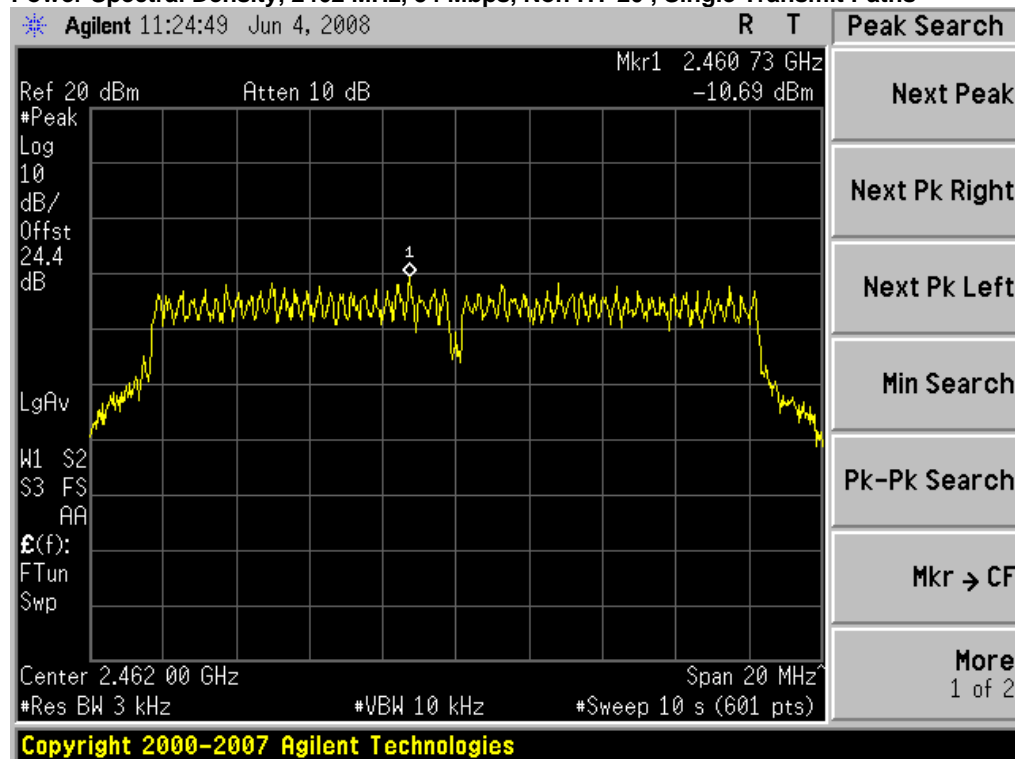




**Power Spectral Density, 2462 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**

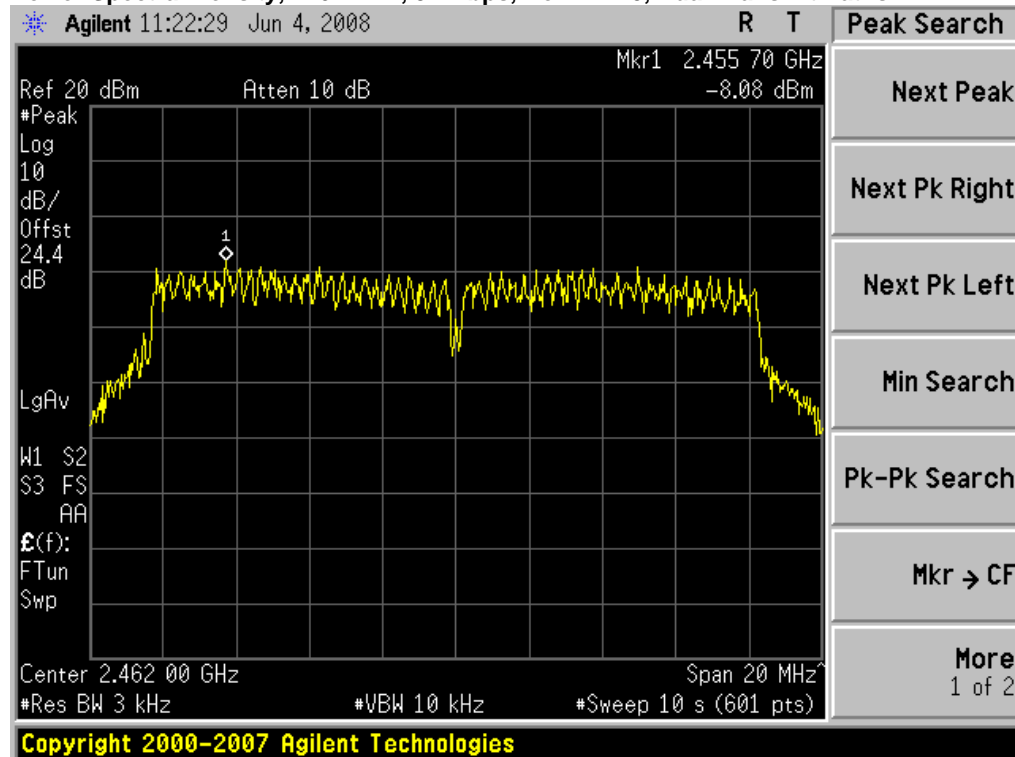


**Power Spectral Density, 2462 MHz, 54 Mbps, Non HT-20 , Single Transmit Paths**

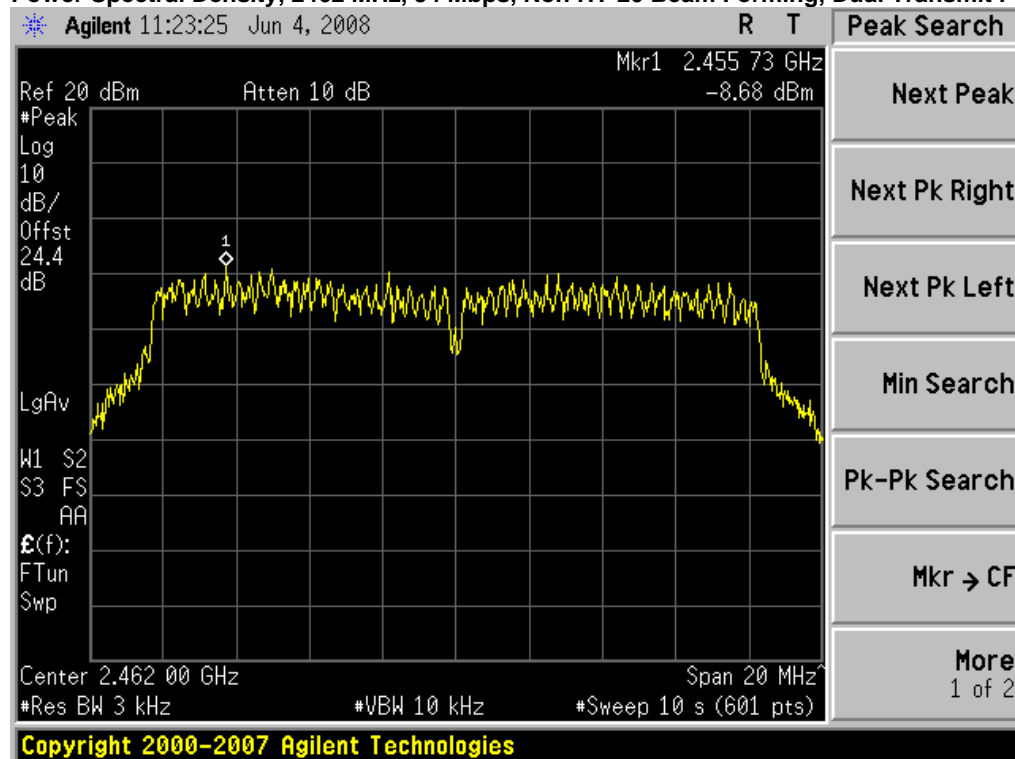




**Power Spectral Density, 2462 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths**



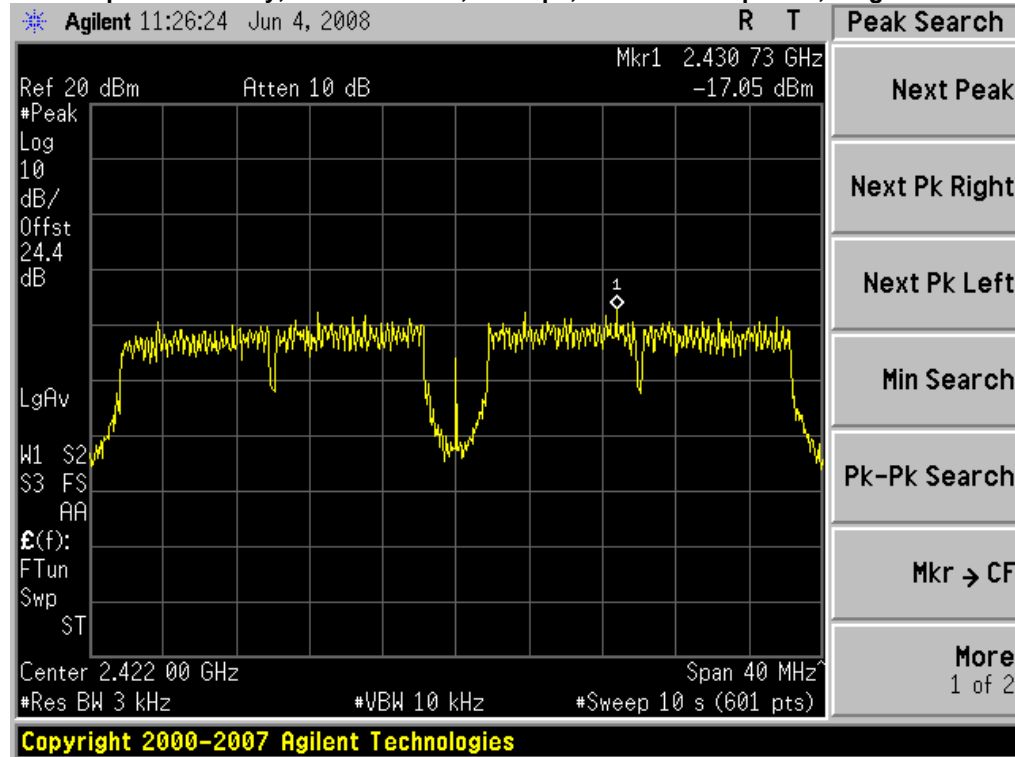
**Power Spectral Density, 2462 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**



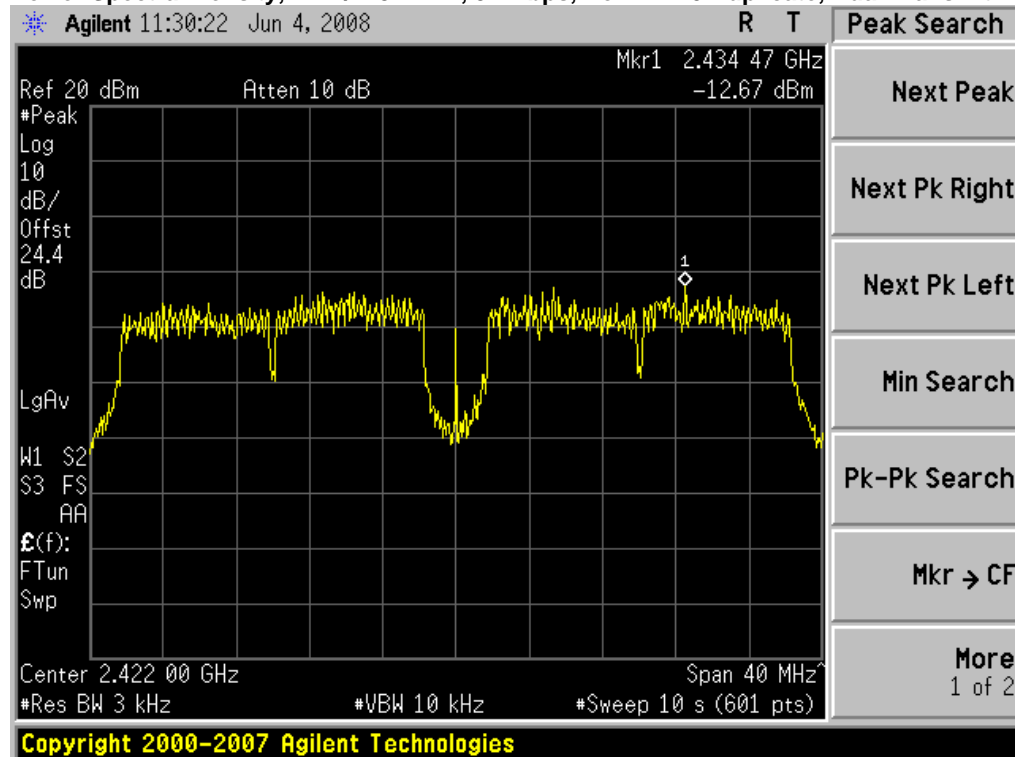




**Power Spectral Density, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Single Transmit Paths**

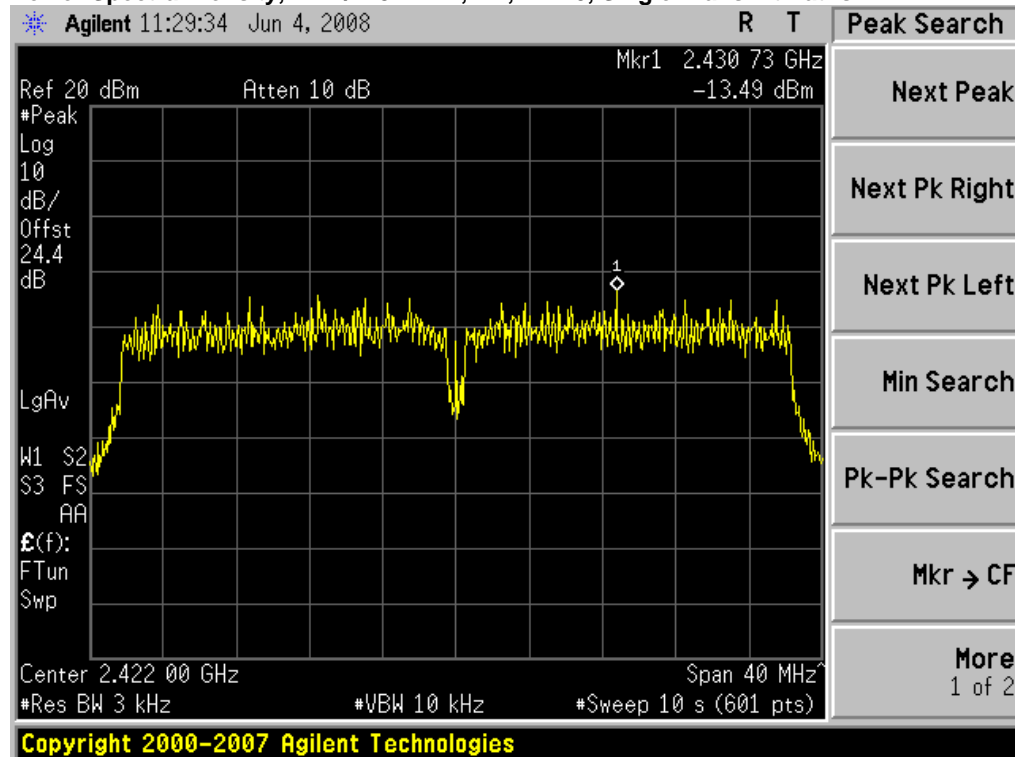


**Power Spectral Density, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**

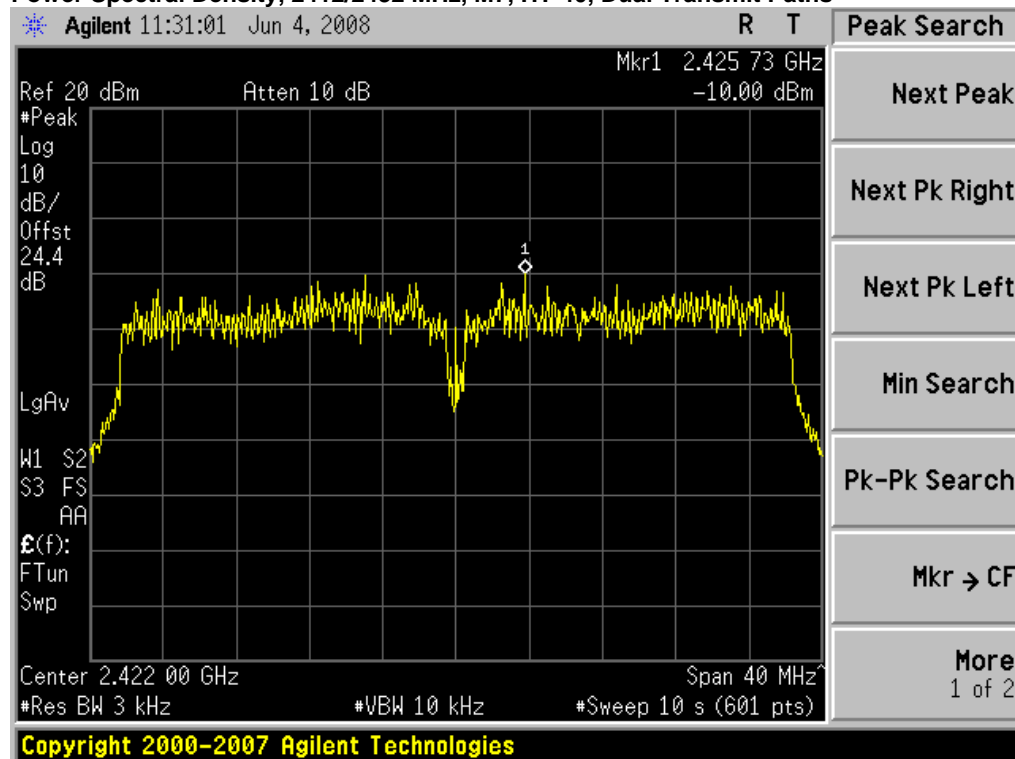




**Power Spectral Density, 2412/2432 MHz, M7, HT-40, Single Transmit Paths**

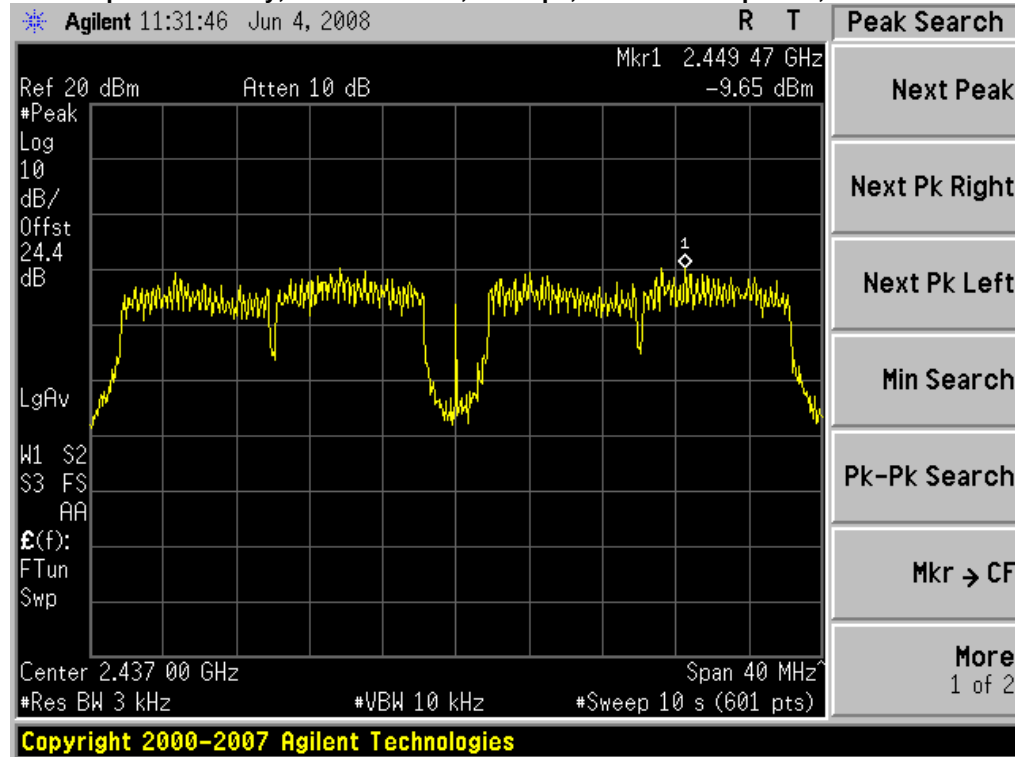


**Power Spectral Density, 2412/2432 MHz, M7, HT-40, Dual Transmit Paths**

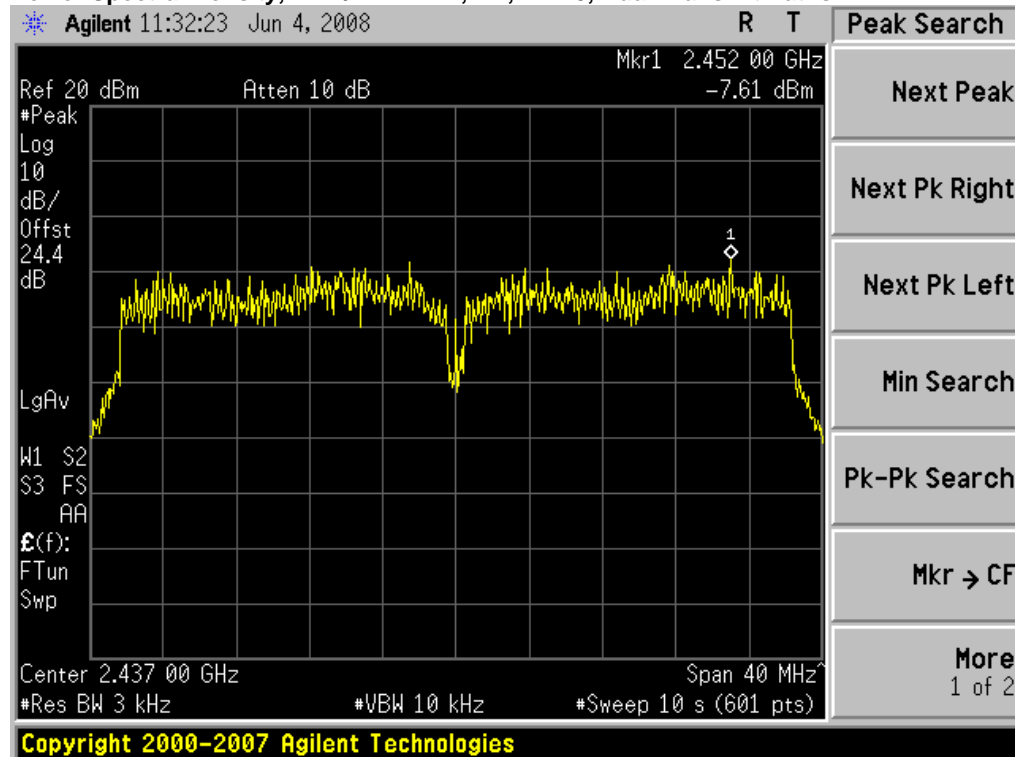




**Power Spectral Density, 2427/2447 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**

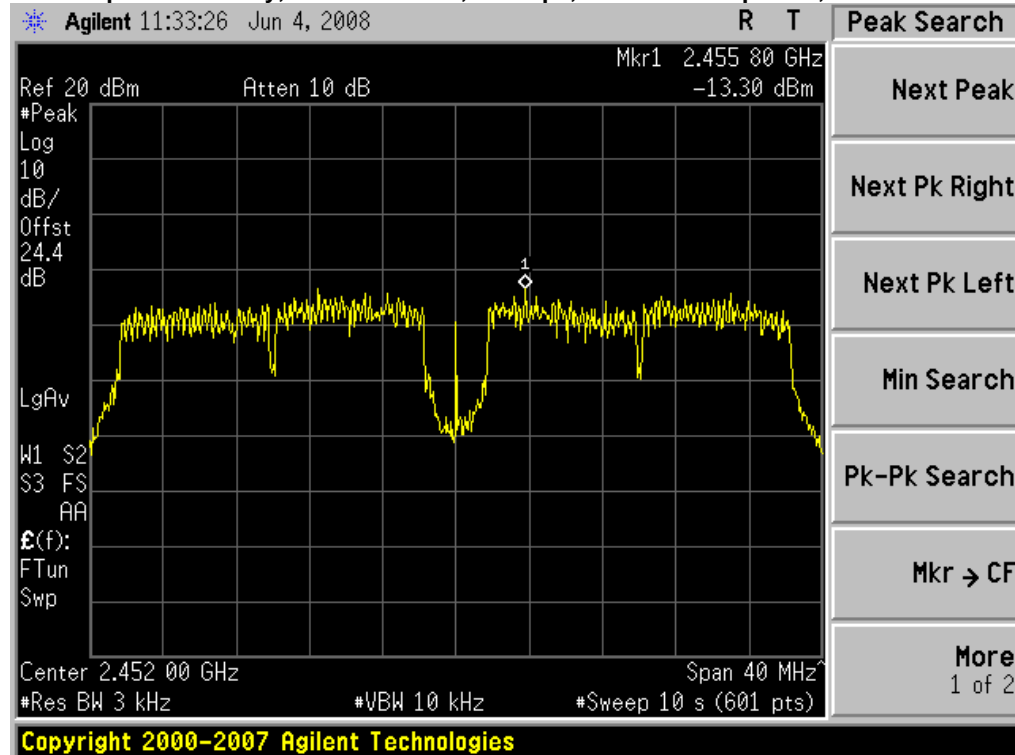


**Power Spectral Density, 2427/2447 MHz, M7, HT-40, Dual Transmit Paths**

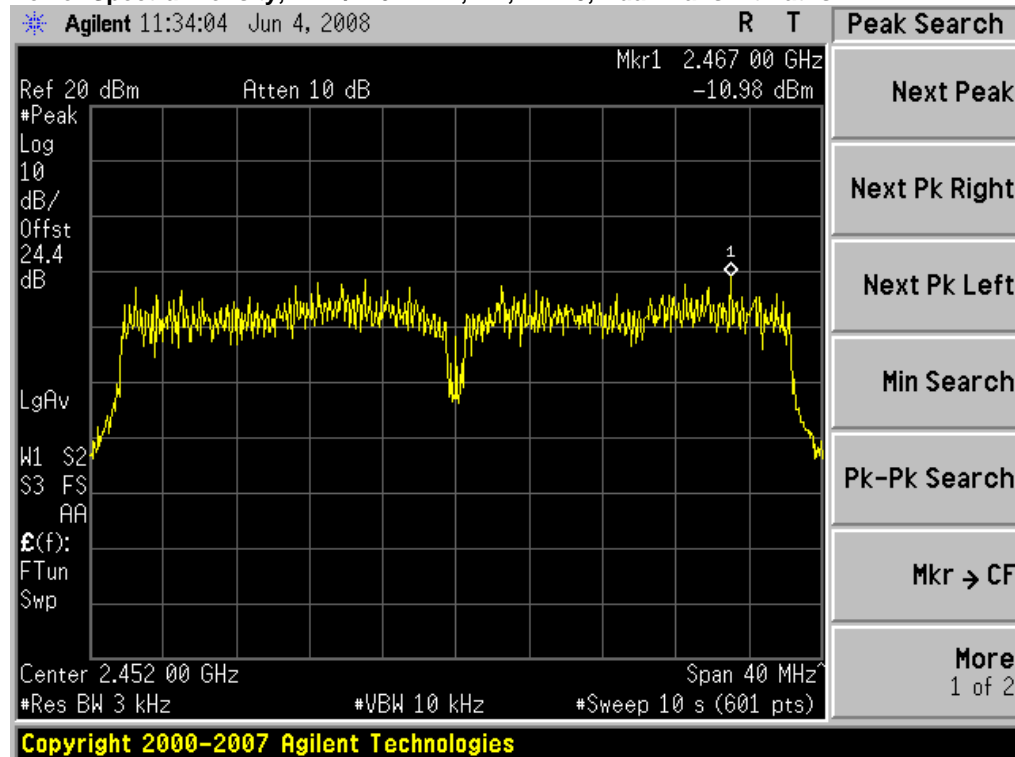




**Power Spectral Density, 2442/2462 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**



**Power Spectral Density, 2442/2462 MHz, M7, HT-40, Dual Transmit Paths**





## Conducted Spurious Emissions

15.247: 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).

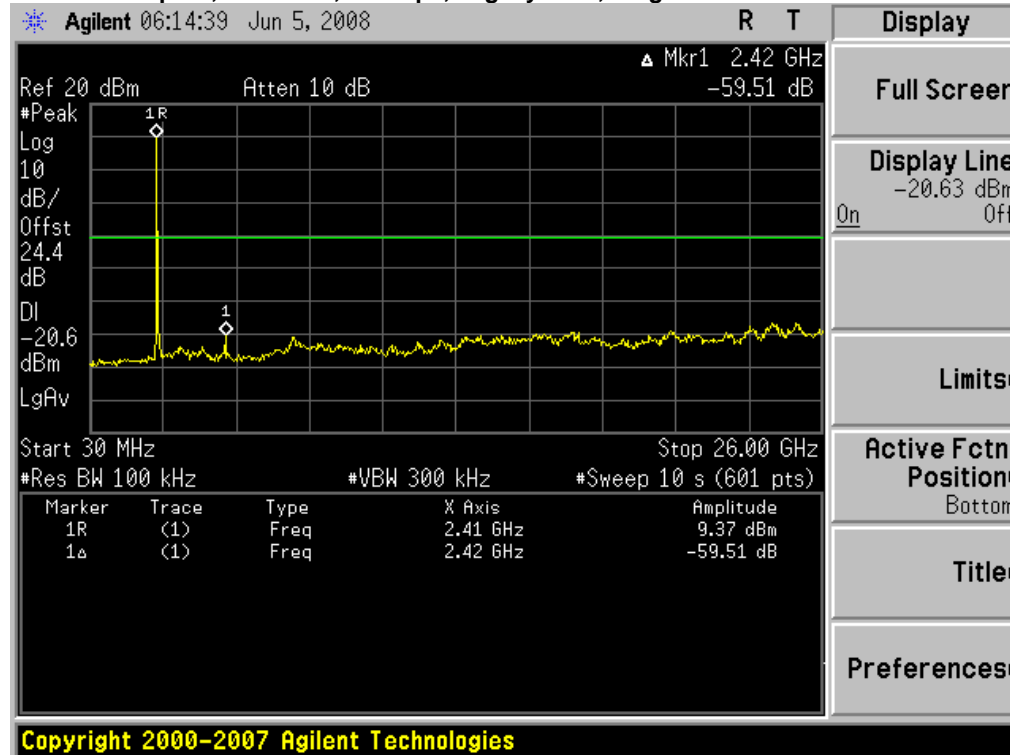
Span:	30 MHz-26 GHz
Reference Level:	20 dBm
Attenuation:	10 dB
Sweep Time:	5s
Resolution Bandwidth:	100 kHz
Video Bandwidth:	300 kHz
Detector:	Peak
Trace:	Single
Marker:	Peak

Record the marker waveform peak to spur difference

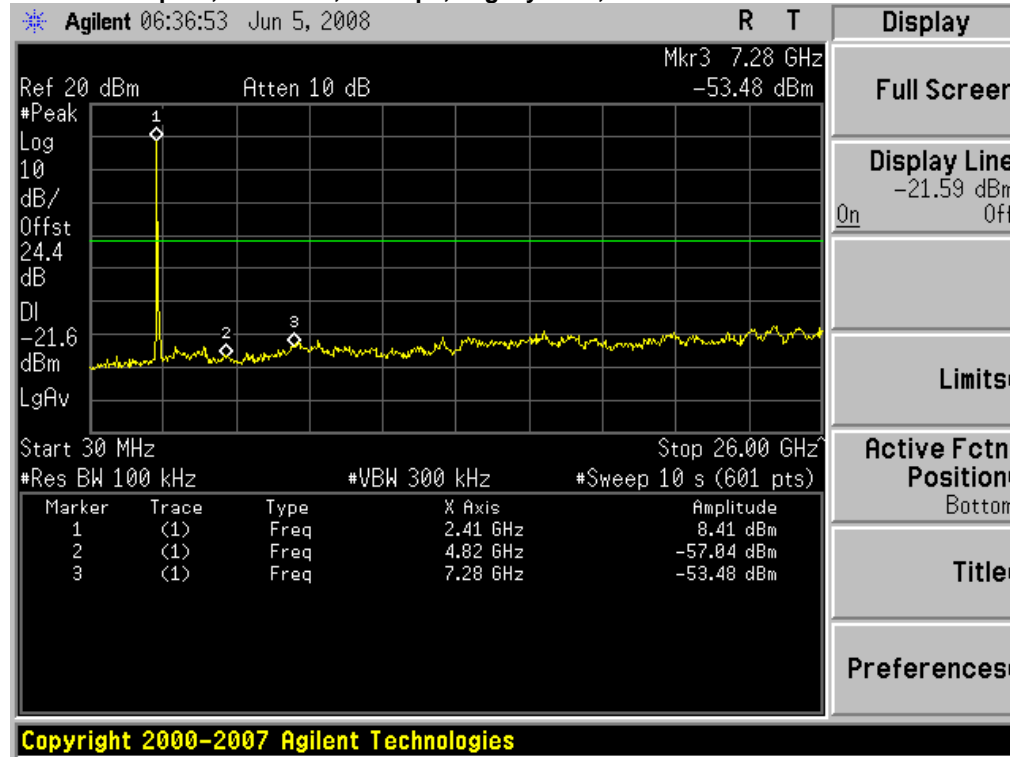
Frequency (MHz)	Mode	Data Rate (Mbps)	Conducted Spur Delta (dB)	Limit (dBc)	Margin (dB)
2412	Legacy CCK, Single Tx Path	11	59.5	30	29.5
2412	Legacy CCK, Dual Tx Path	11	61.9	30	31.9
2412	Non HT-20, Single Tx Path	54	55.4	30	25.4
2412	Non HT-20, Dual Tx Path	54	61.3	30	31.3
2412	Non HT-20 Beam Forming	54	54.8	30	24.8
2437	Legacy CCK, Dual Tx Path	11	62.2	30	32.2
2437	Non HT-20 Beam Forming	54	54.6	30	24.6
2462	Legacy CCK, Single Tx Path	11	55.5	30	25.5
2462	Legacy CCK, Dual Tx Path	11	57.1	30	27.1
2462	Non HT-20, Single Tx Path	54	55.1	30	25.1
2462	Non HT-20, Dual Tx Path	54	57.8	30	27.8
2462	Non HT-20 Beam Forming	54	56.2	30	26.2
2412/2432	Non HT-40 Duplicate, Single Tx Path	54	50.2	30	20.2
2412/2432	Non HT-40 Duplicate, Dual Tx Path	54	54.0	30	24.0
2412/2432	HT-40, Single Tx Path	M7	51.7	30	21.7
2412/2432	HT-40, Dual Tx Path	M7	56.8	30	26.8
2427/2447	Non HT-40 Duplicate	54	56.3	30	26.3
2427/2447	HT-40	54	48.0	30	18.0
2442/2462	Non HT-40 Duplicate	54	55.2	30	25.2
2442/2462	HT-40	M7	55.4	30	25.4



**Conducted Spurs, 2412 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths**

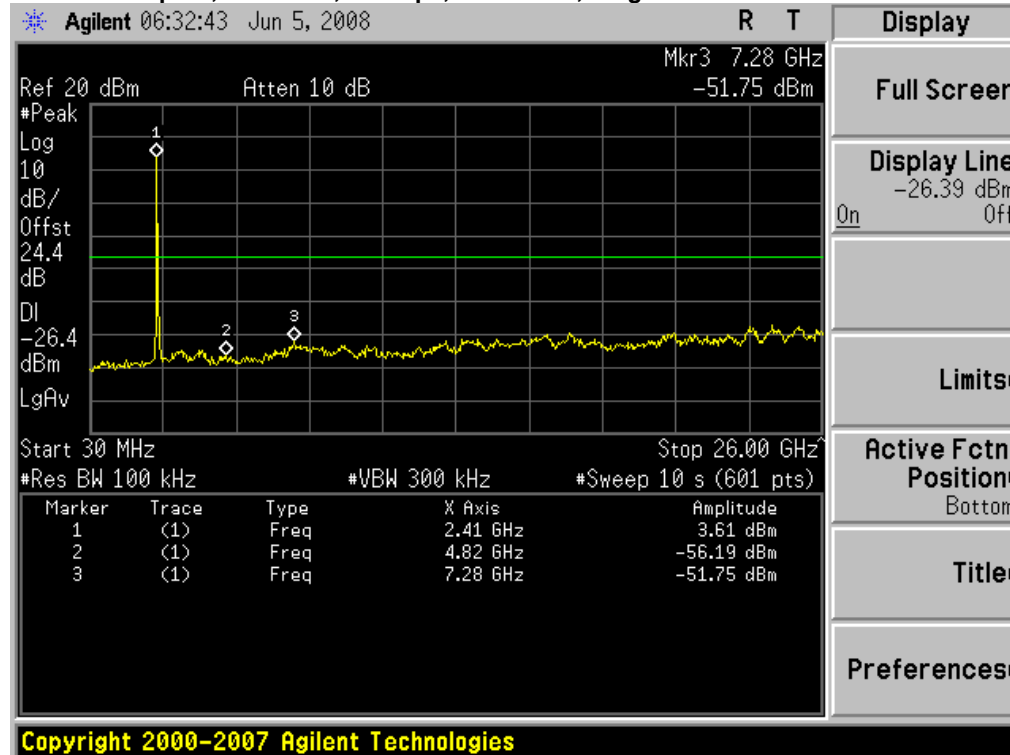


**Conducted Spurs, 2412 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**

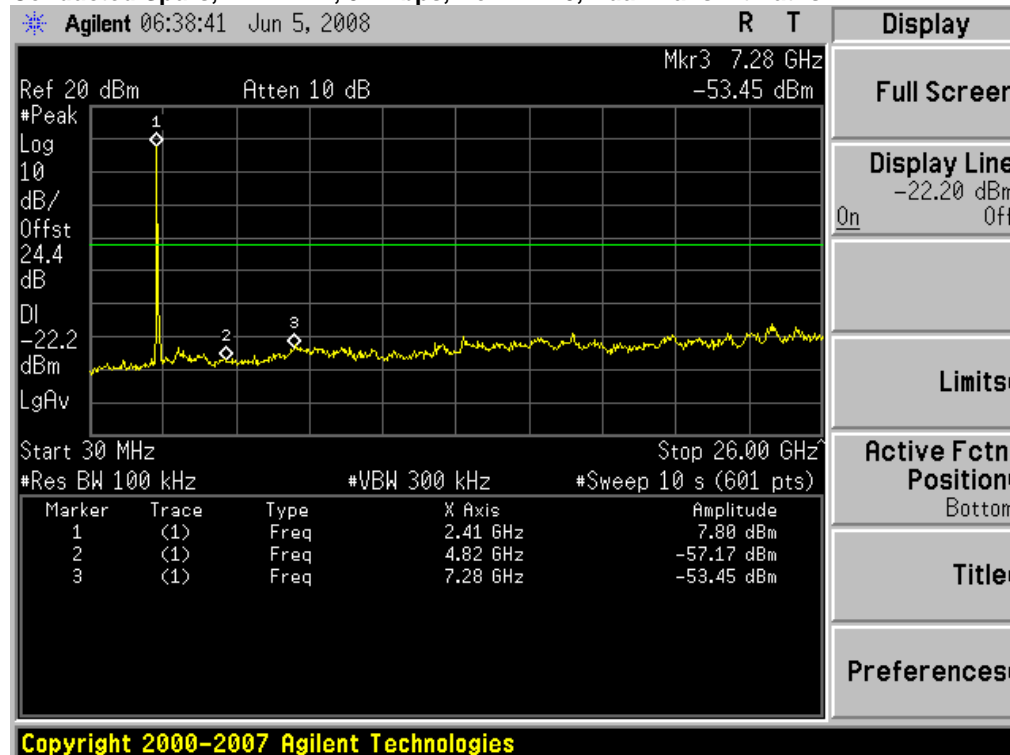




**Conducted Spurs, 2412 MHz, 54 Mbps, Non HT-20, Single Transmit Paths**

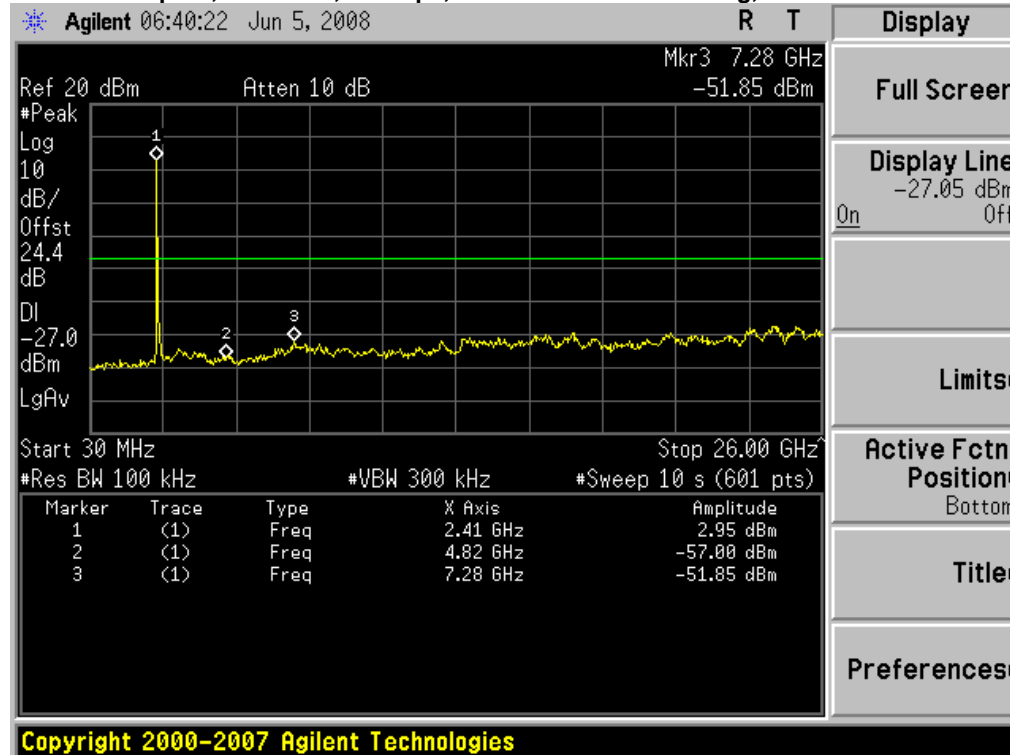


**Conducted Spurs, 2412 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths**

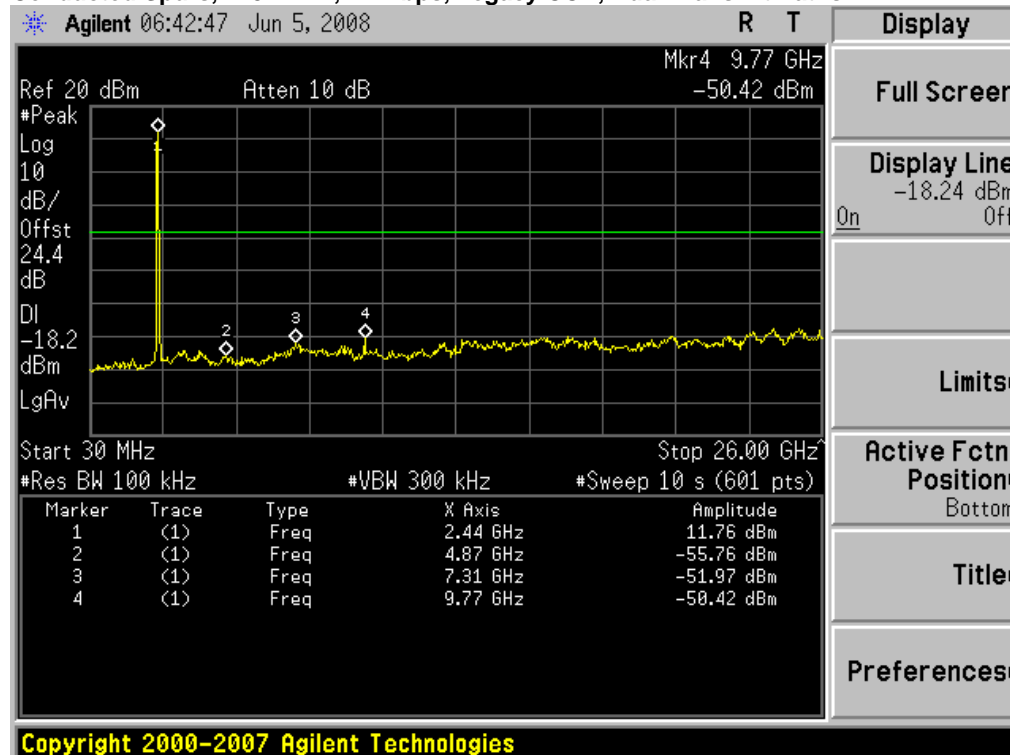




**Conducted Spurs, 2412 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**



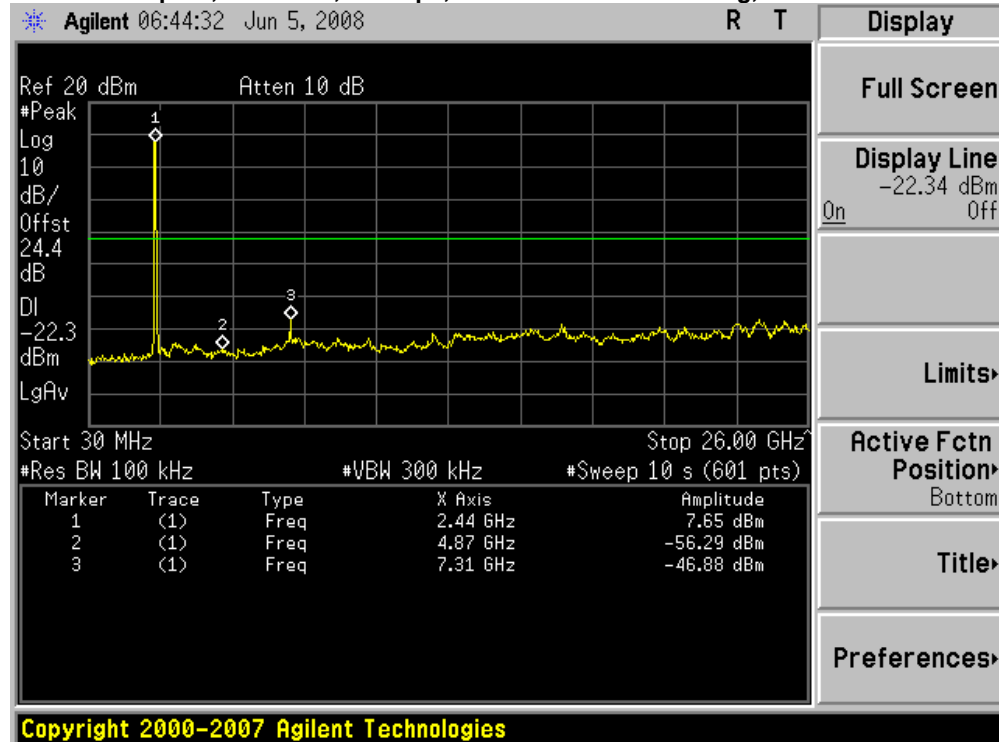
**Conducted Spurs, 2437 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**



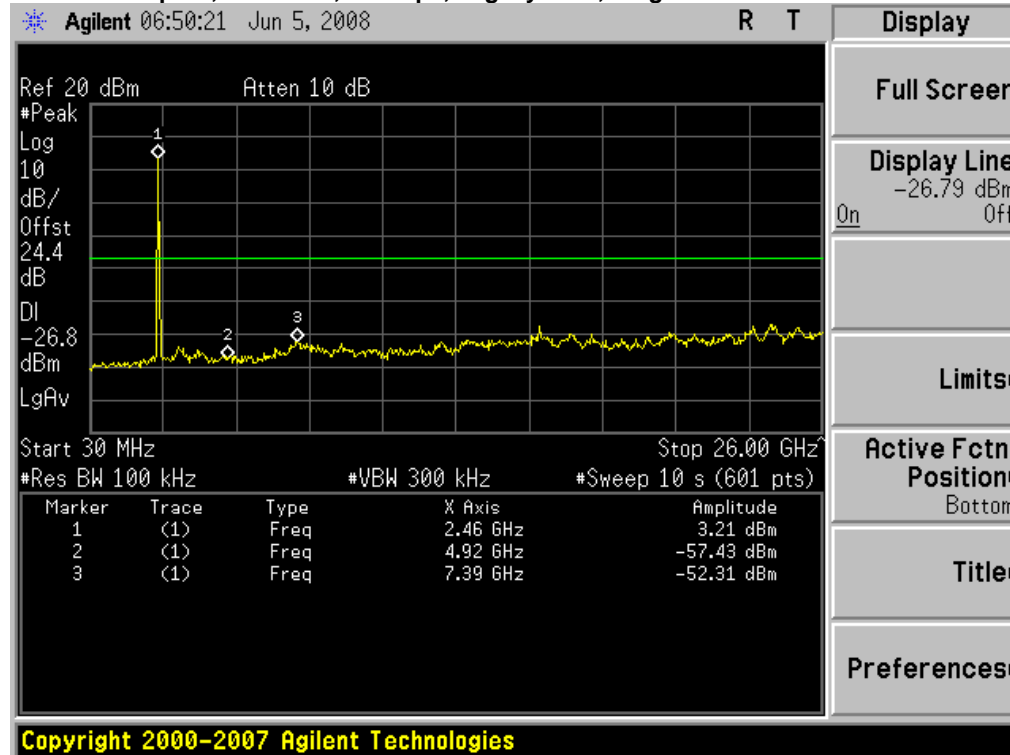




**Conducted Spurs, 2437 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

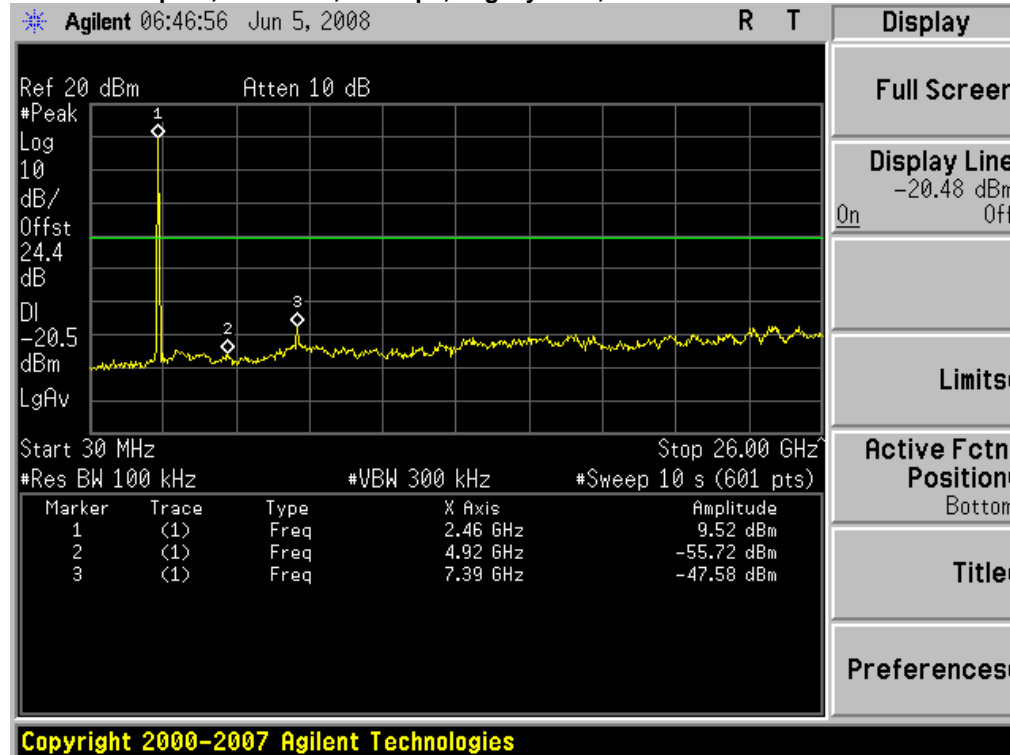


**Conducted Spurs, 2462 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths**

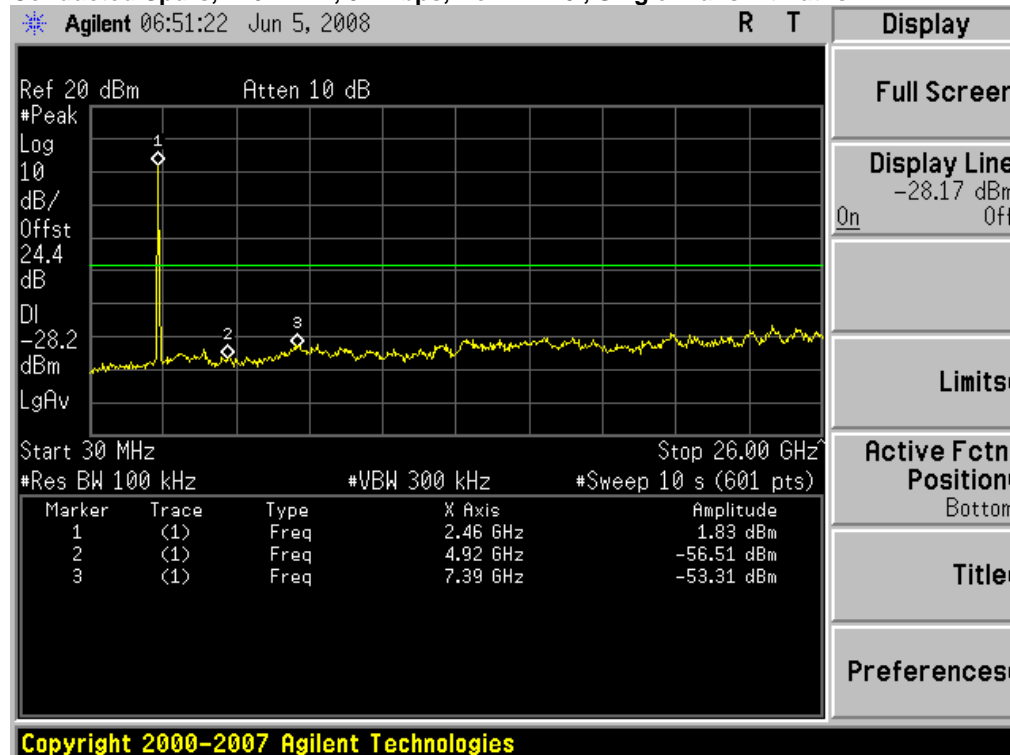




**Conducted Spurs, 2462 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths**

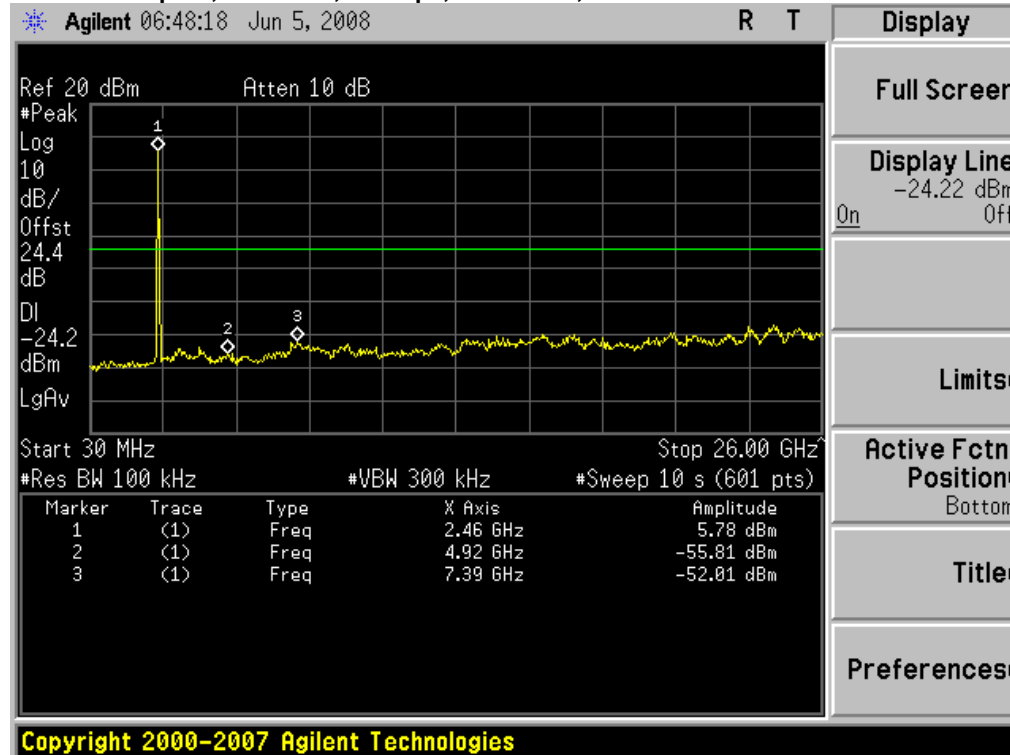


**Conducted Spurs, 2462 MHz, 54 Mbps, Non HT-20 , Single Transmit Paths**

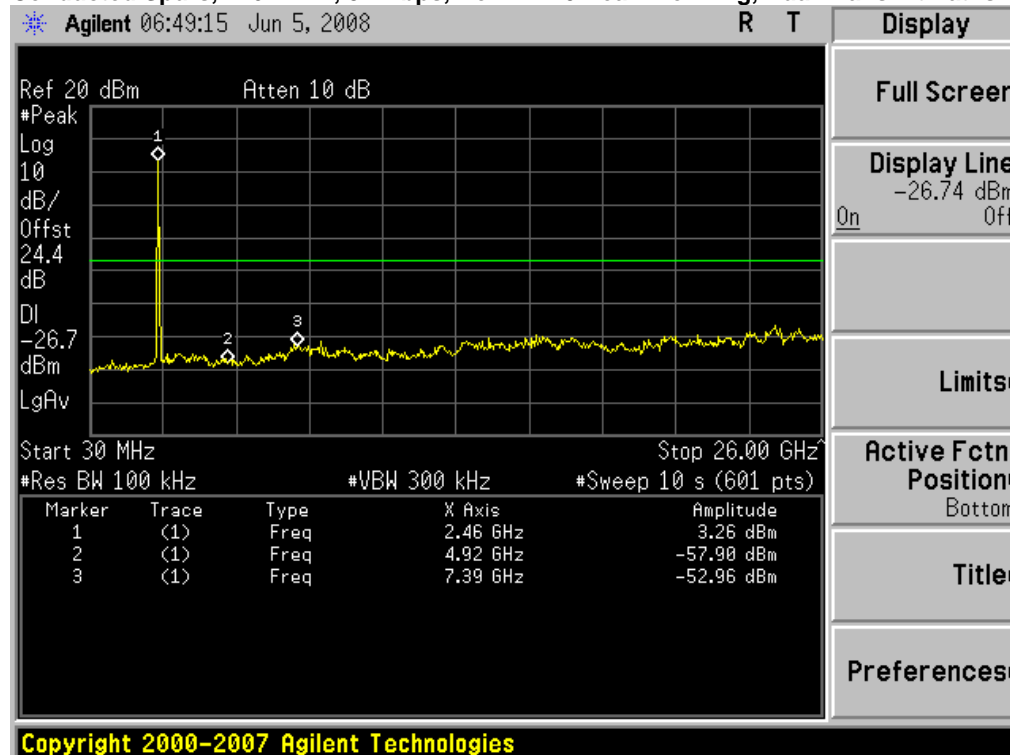




**Conducted Spurs, 2462 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths**

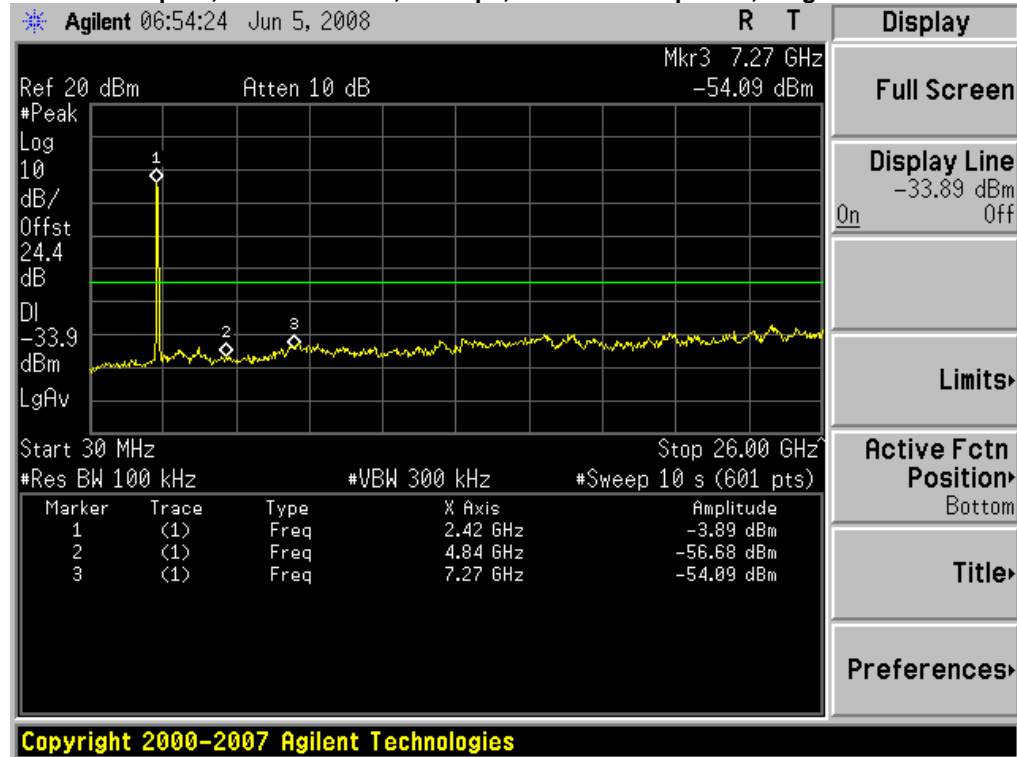


**Conducted Spurs, 2462 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

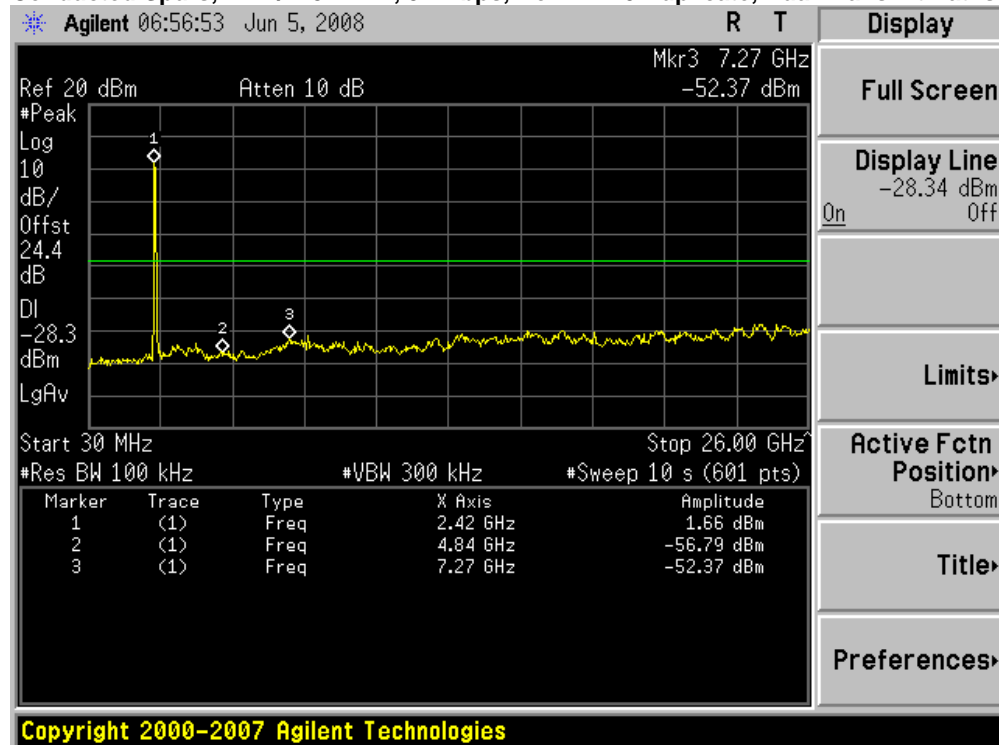




**Conducted Spurs, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Single Transmit Paths**

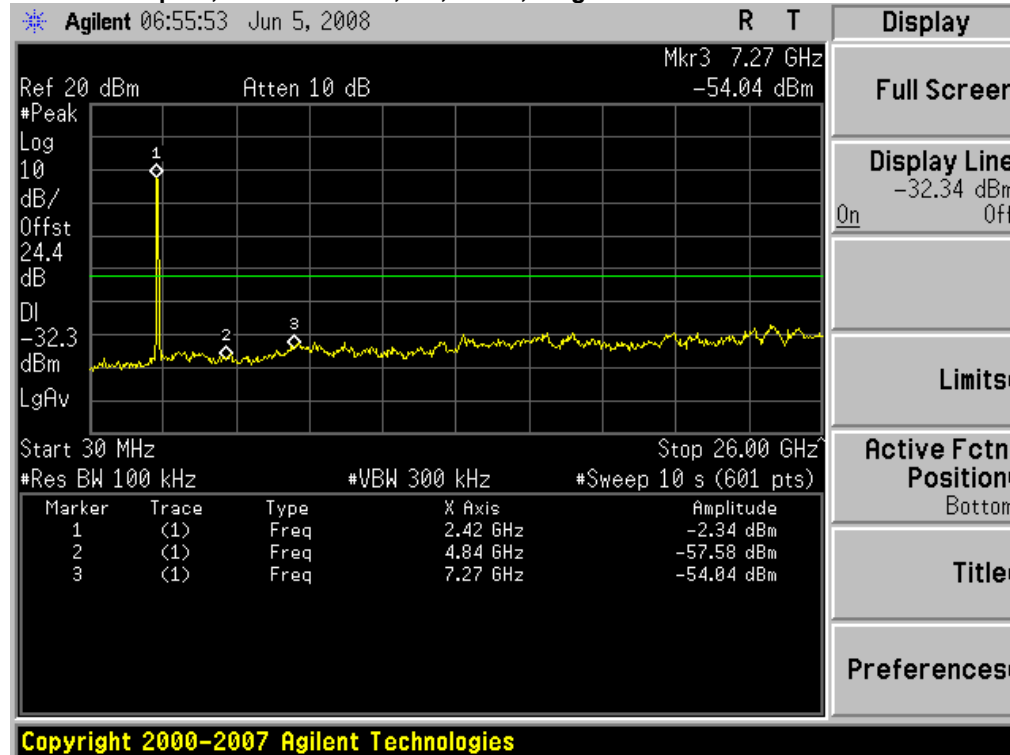


**Conducted Spurs, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**

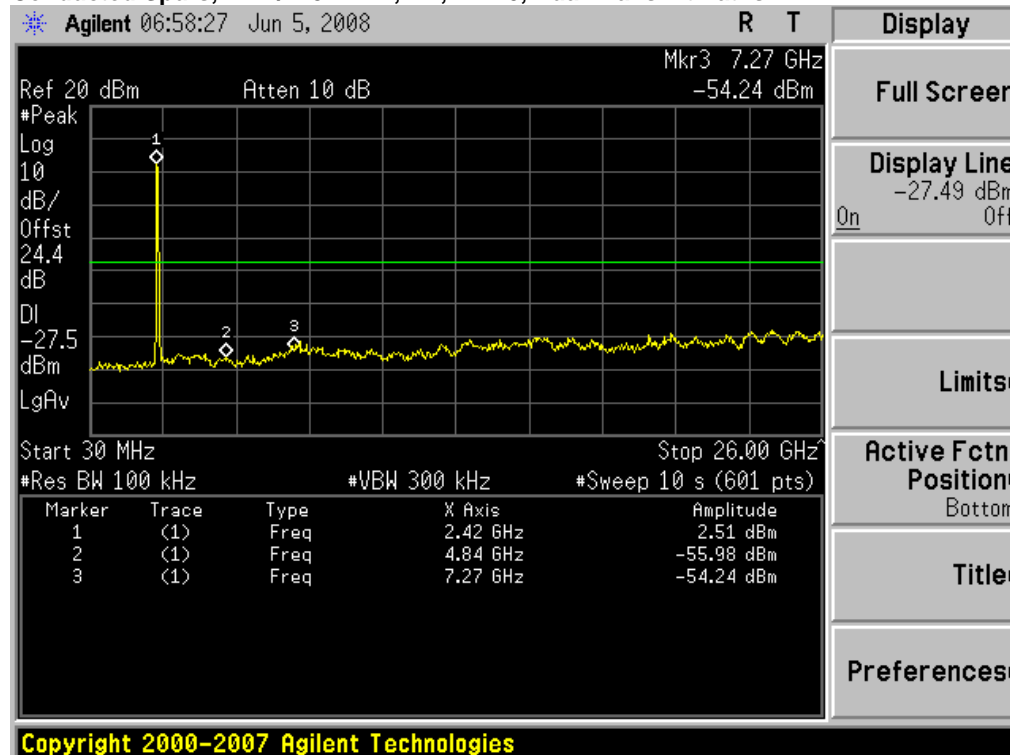




**Conducted Spurs, 2412/2432 MHz, M7, HT-40, Single Transmit Paths**

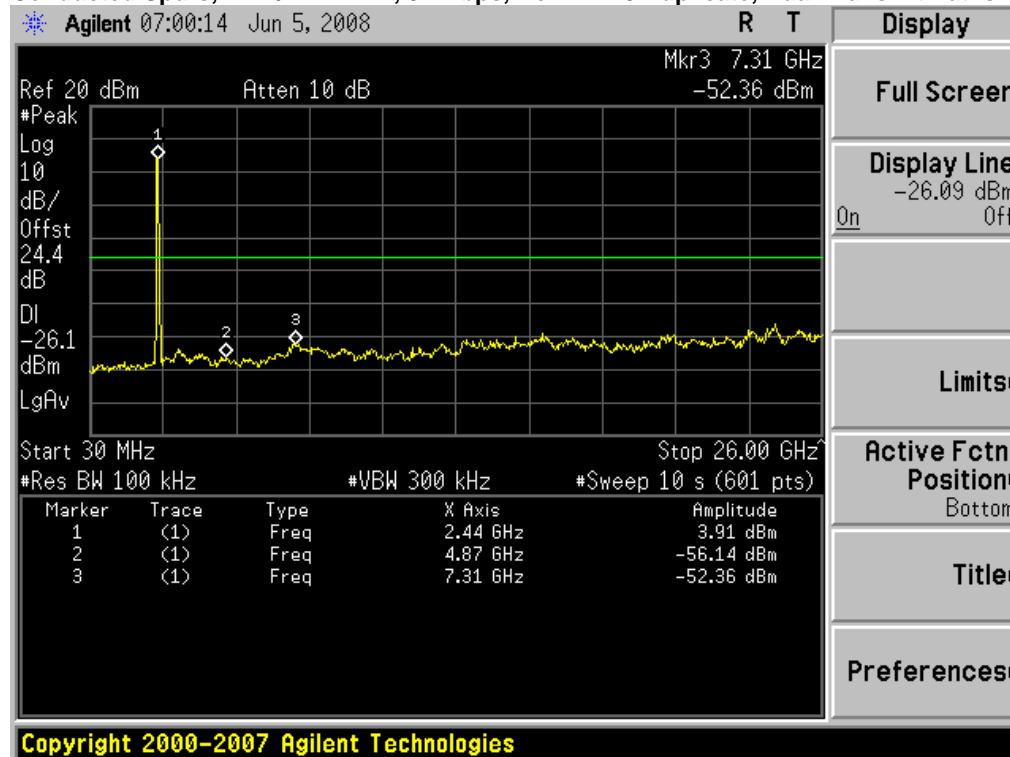


**Conducted Spurs, 2412/2432 MHz, M7, HT-40, Dual Transmit Paths**

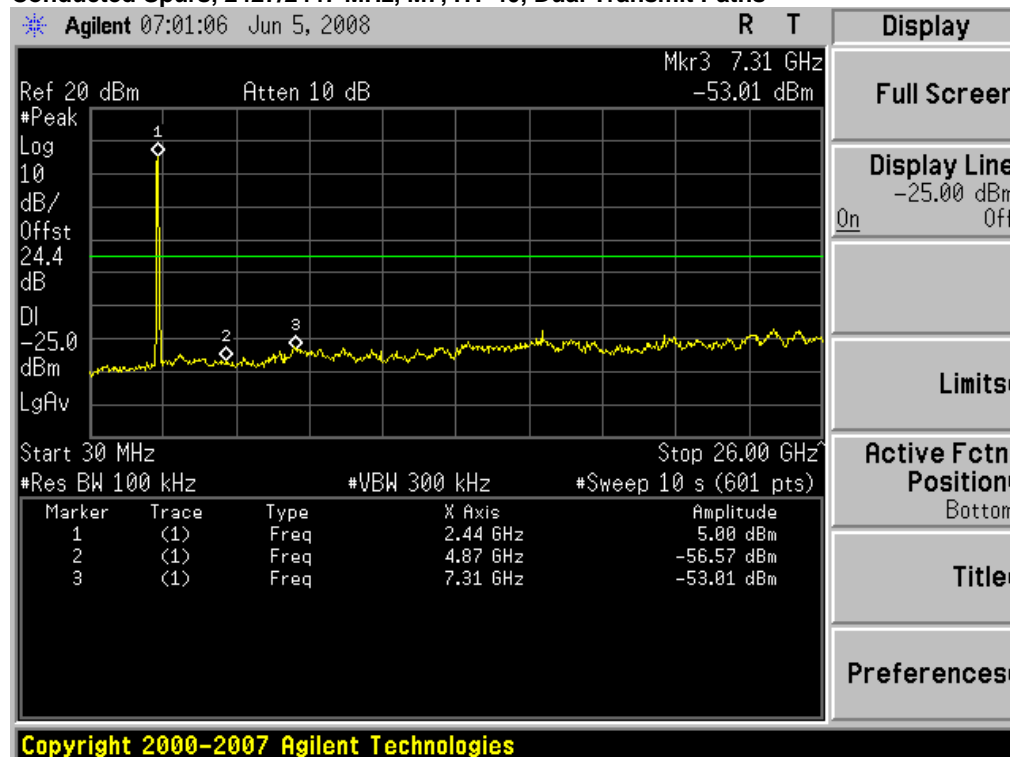




**Conducted Spurs, 2427/2447 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**

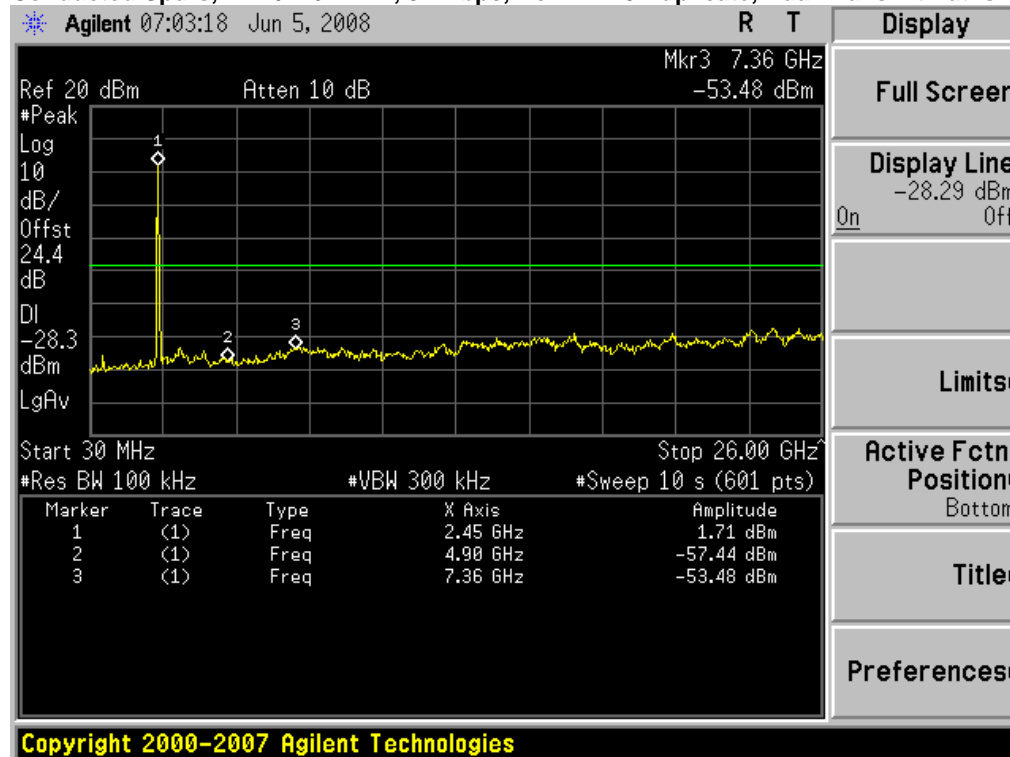


**Conducted Spurs, 2427/2447 MHz, M7, HT-40, Dual Transmit Paths**

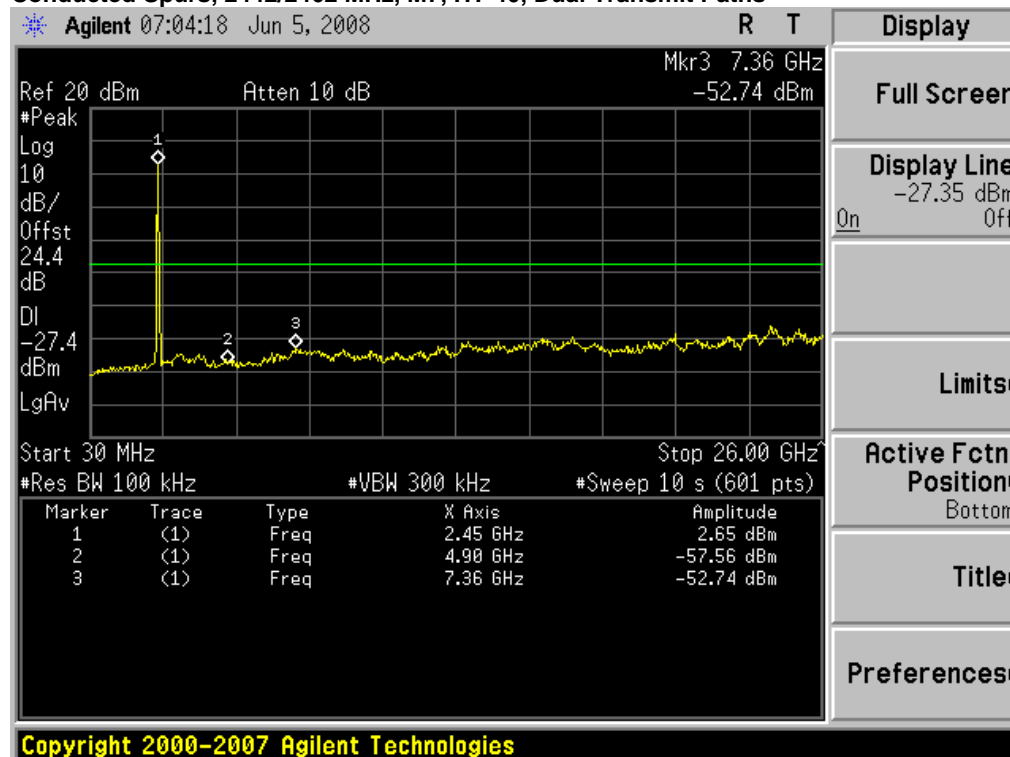


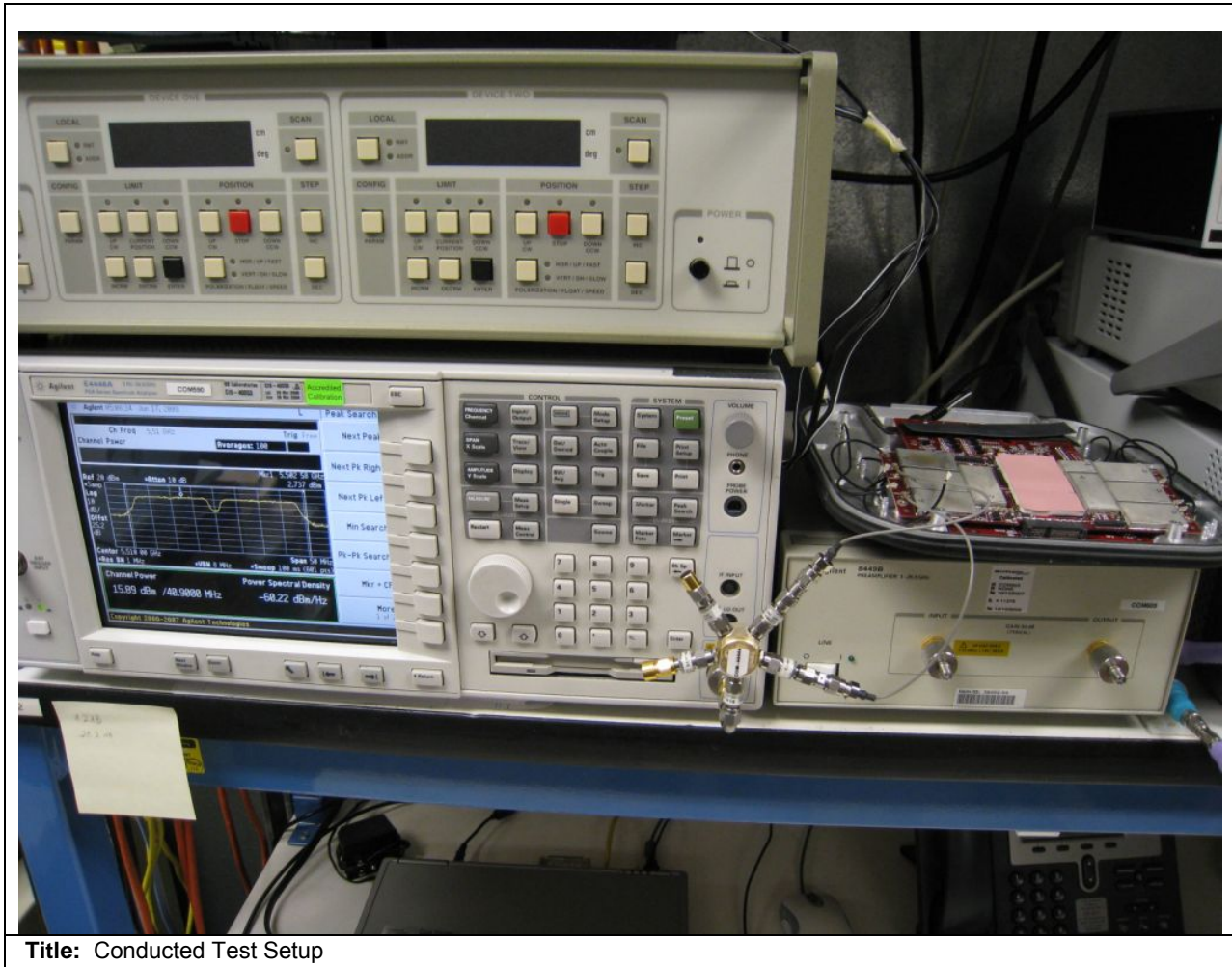


**Conducted Spurs, 2442/2462 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**



**Conducted Spurs, 2442/2462 MHz, M7, HT-40, Dual Transmit Paths**





**Title:** Conducted Test Setup





**Appendix B: Emission Test Results**

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

**Radiated Bandedge**

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.

Reference Level: 110 dBuV  
 Attenuation: 20 dB  
 Sweep Time: Coupled  
 Resolution Bandwidth: 1MHz  
 Video Bandwidth: 1 MHz for peak, 10 Hz for average  
 Detector: Peak

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

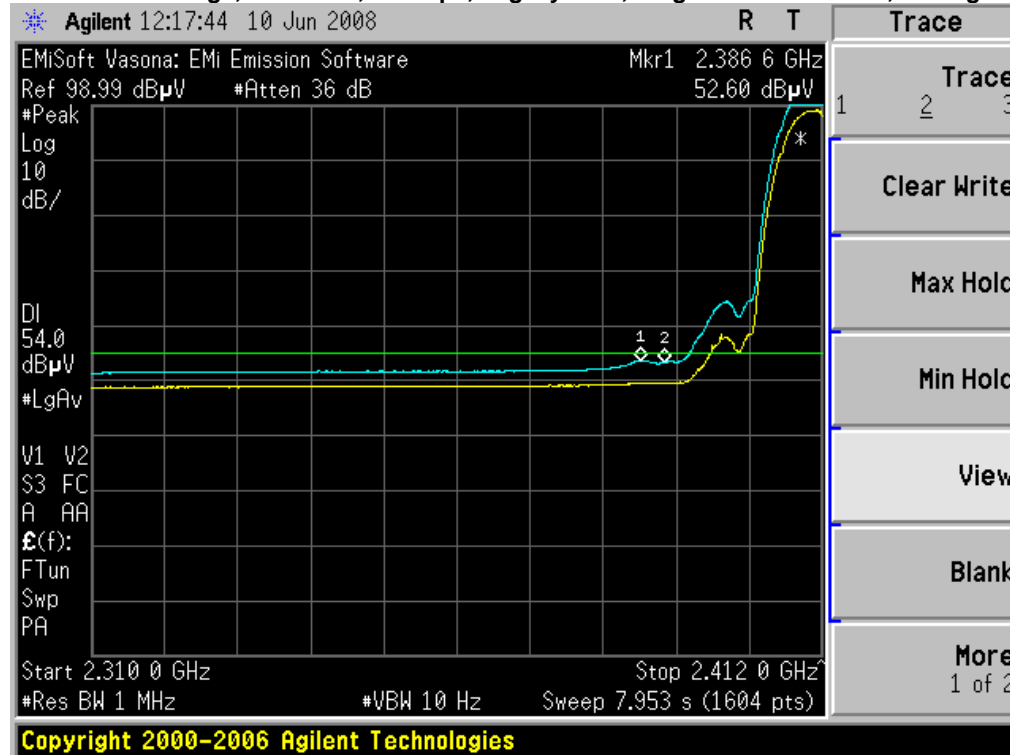
Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= 54dBuV @3m  
 2) Peak plot (Vertical and Horizontal), Limit = 74dBuV @3m

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.

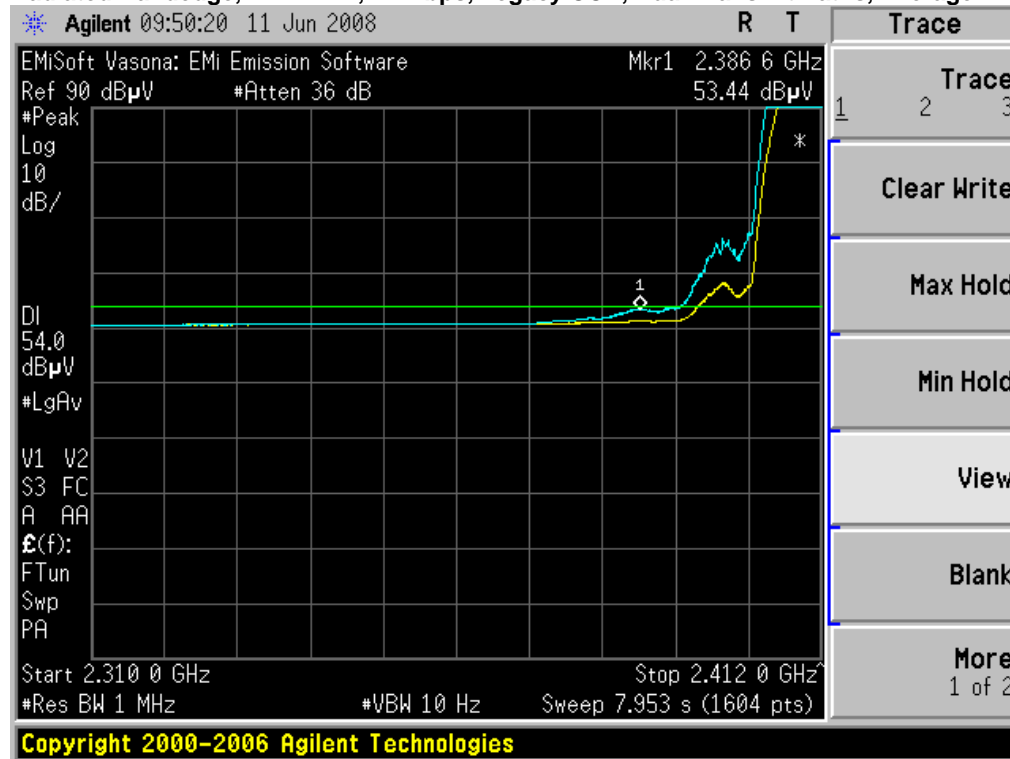
Frequency (MHz)	Mode	Data Rate (Mbps)	Radiated Band Edge Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2412	Legacy CCK, Single Tx Path	11	52.6	54	1.4
2412	Legacy CCK, Dual Tx Path	11	53.4	54	0.6
2412	Non HT-20, Single Tx Path	54	54.0	54	0.0
2412	Non HT-20, Dual Tx Path	54	53.3	54	0.7
2412	Non HT-20 Beam Forming	54	53.6	54	0.4
2462	Legacy CCK, Single Tx Path	11	49.7	54	4.3
2462	Legacy CCK, Dual Tx Path	11	51.8	54	2.2
2462	Non HT-20, Single Tx Path	54	51.2	54	2.8
2462	Non HT-20, Dual Tx Path	54	53.5	54	0.5
2462	Non HT-20 Beam Forming	54	51.3	54	2.7
2412/2432	Non HT-40 Duplicate, Single Tx Path	54	51.4	54	2.6
2412/2432	Non HT-40 Duplicate, Dual Tx Path	54	51.5	54	2.5
2412/2432	HT-40, Single Tx Path	M7	53.3	54	0.7
2412/2432	HT-40, Dual Tx Path	M7	52.7	54	1.3
2442/2462	Non HT-40 Duplicate	54	52.5	54	1.5
2442/2462	HT-40	M7	52.8	54	1.2



**Radiated Bandedge, 2412 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths, Average**

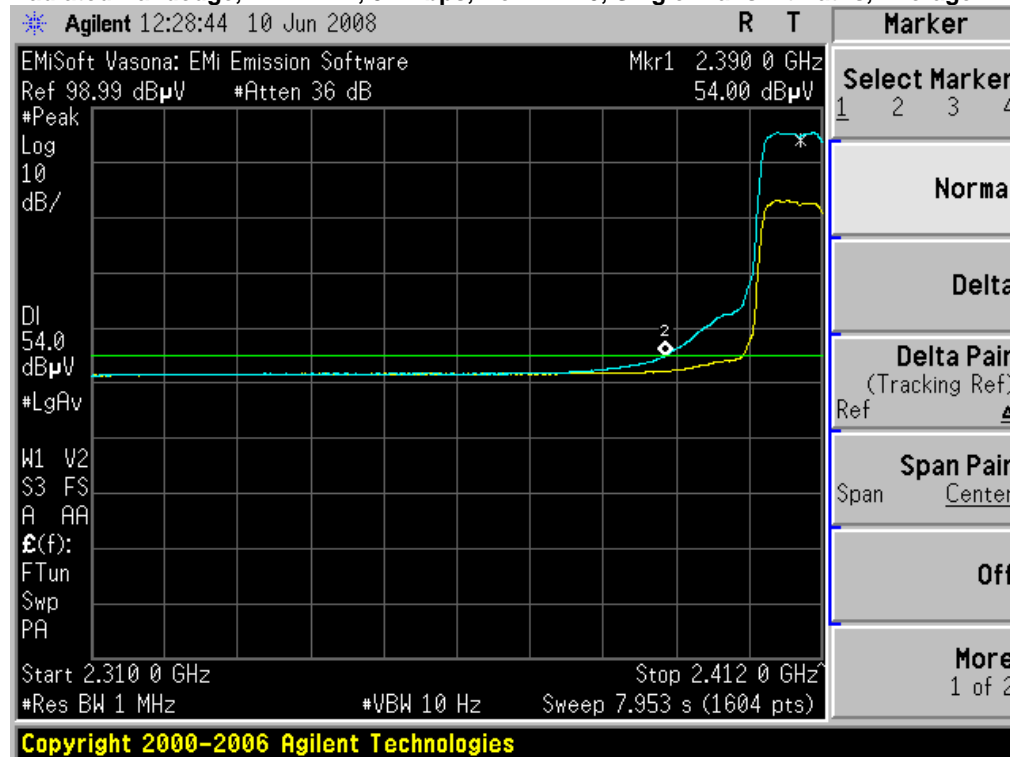


**Radiated Bandedge, 2412 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths, Average**

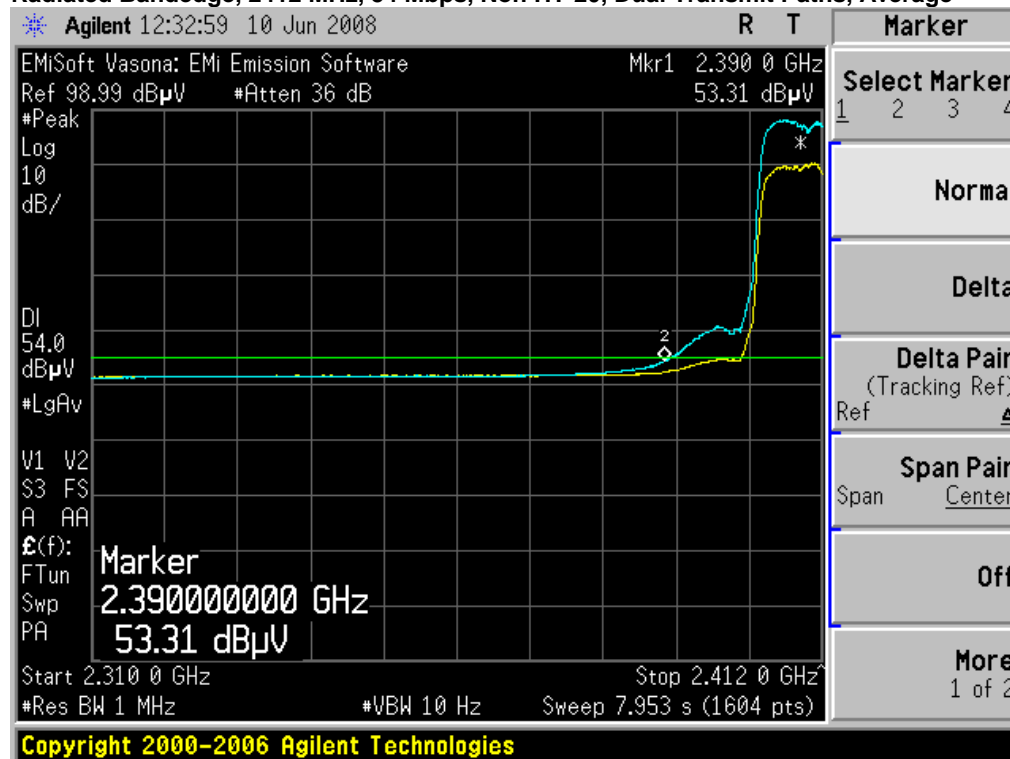




**Radiated Bandedge, 2412 MHz, 54 Mbps, Non HT-20, Single Transmit Paths, Average**

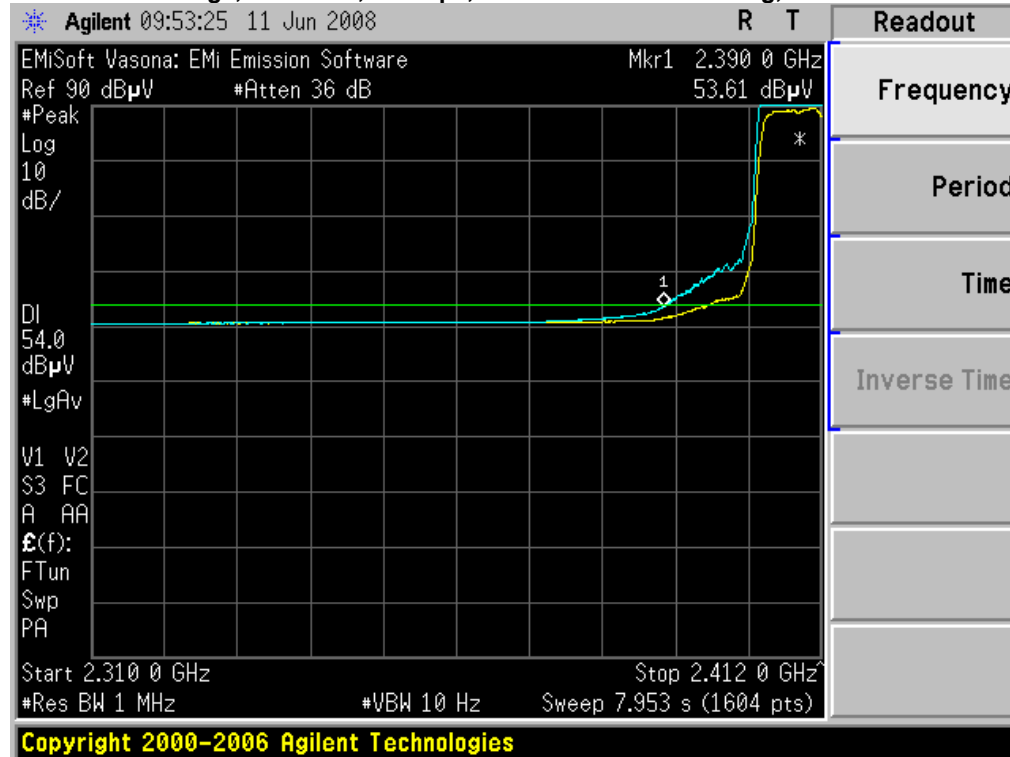


**Radiated Bandedge, 2412 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths, Average**

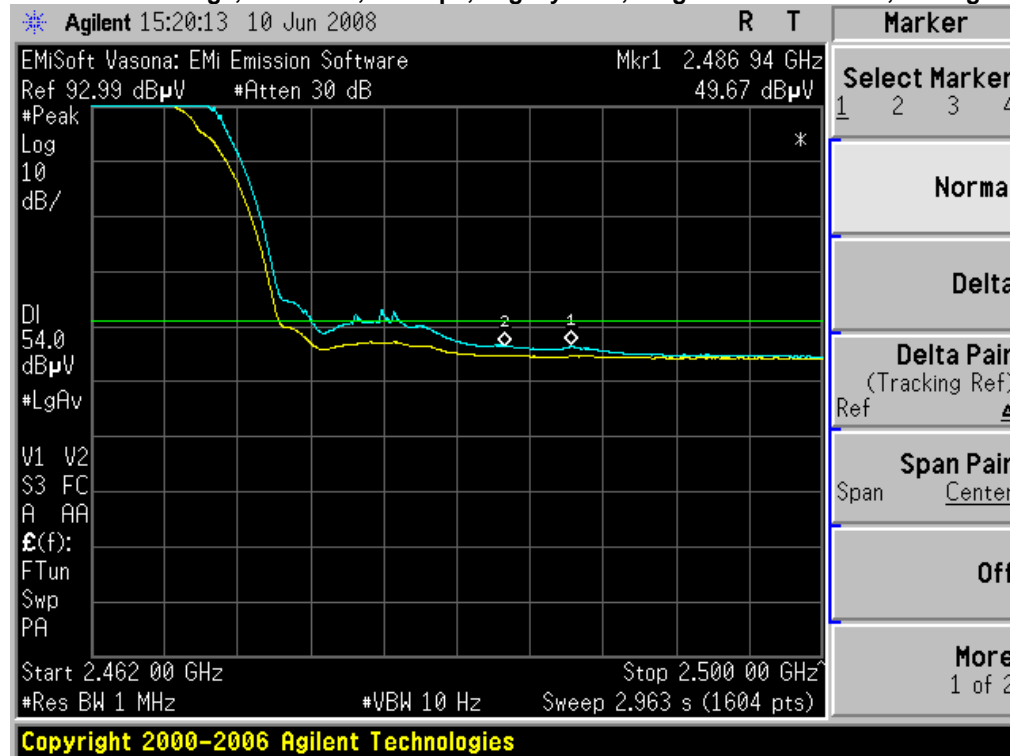




**Radiated Bandedge, 2412 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average**

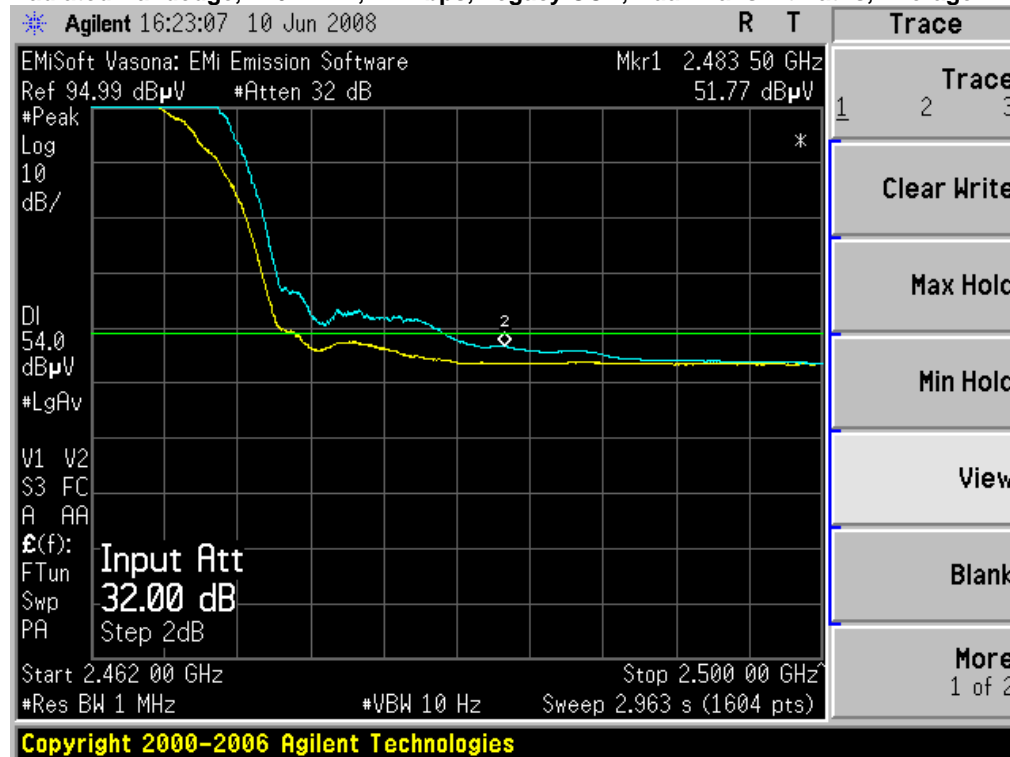


**Radiated Bandedge, 2462 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths, Average**

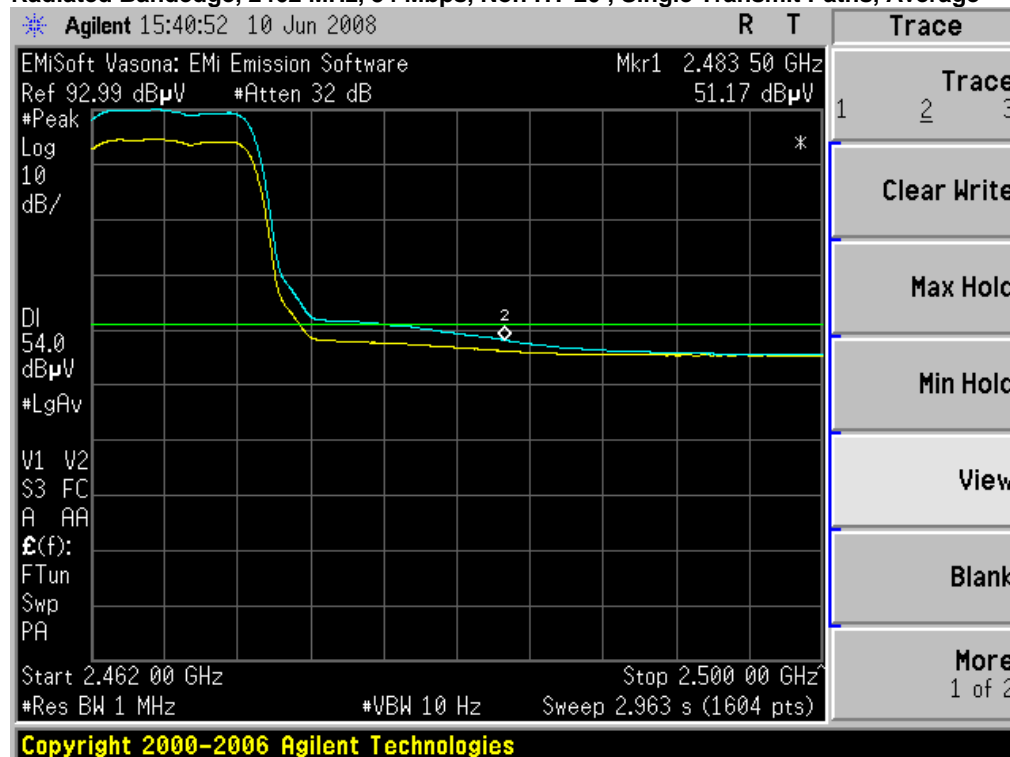




**Radiated Bandedge, 2462 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths, Average**

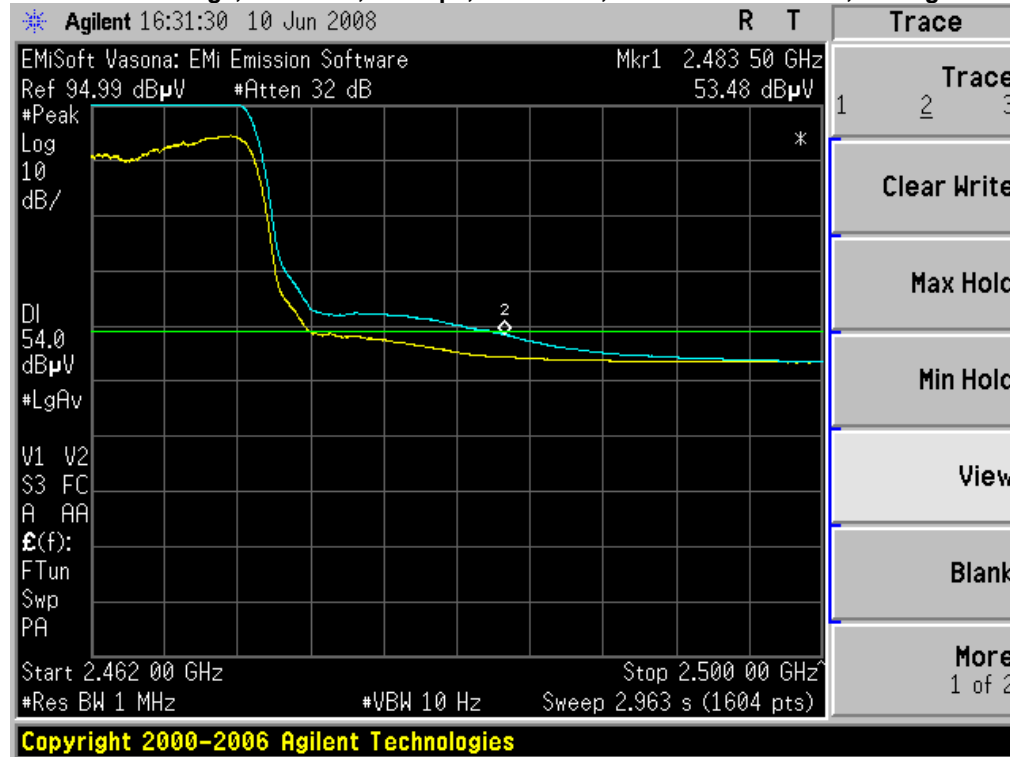


**Radiated Bandedge, 2462 MHz, 54 Mbps, Non HT-20 , Single Transmit Paths, Average**

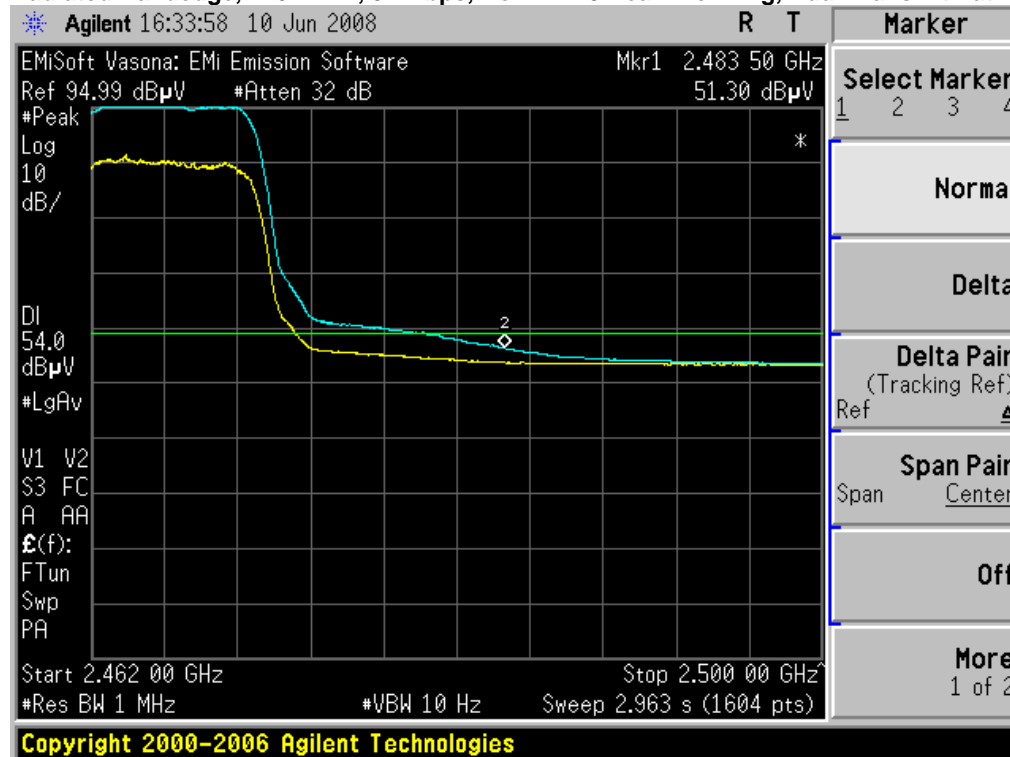




**Radiated Bandedge, 2462 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths, Average**

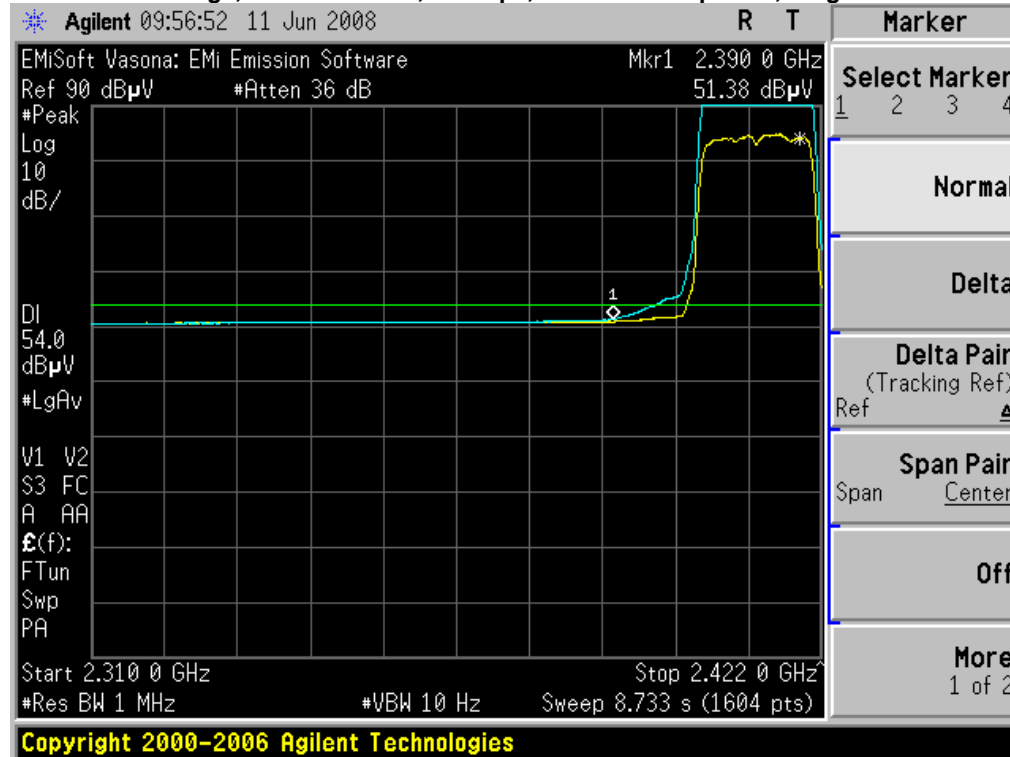


**Radiated Bandedge, 2462 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average**

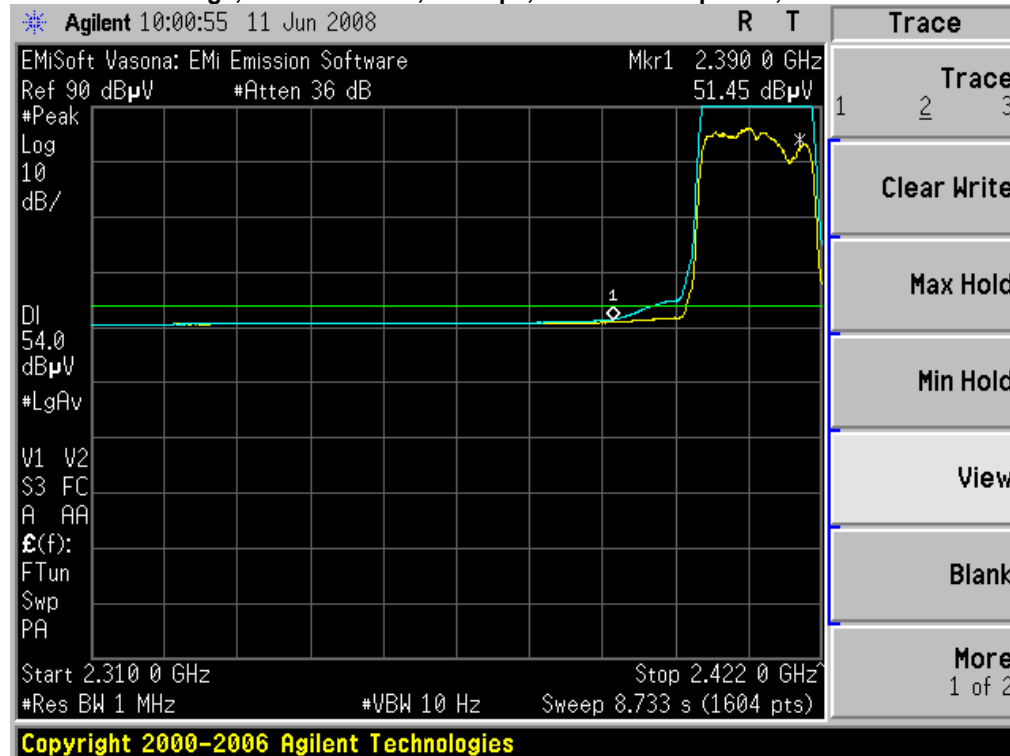




**Radiated Bandedge, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Single Transmit Paths, Average**

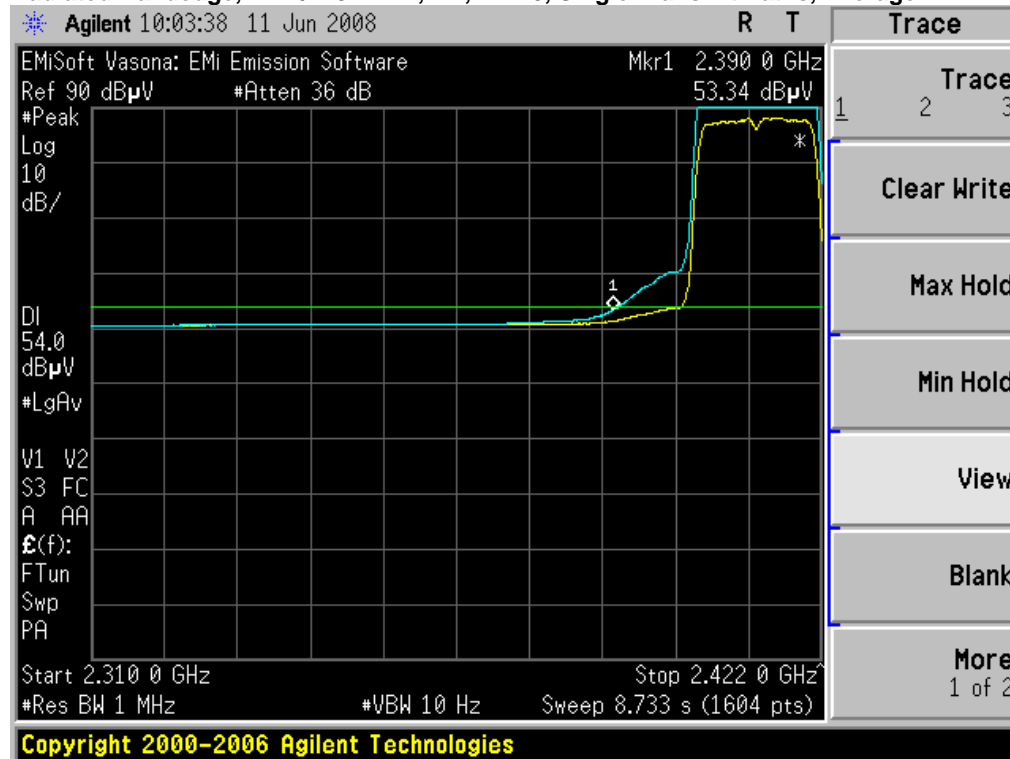


**Radiated Bandedge, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average**

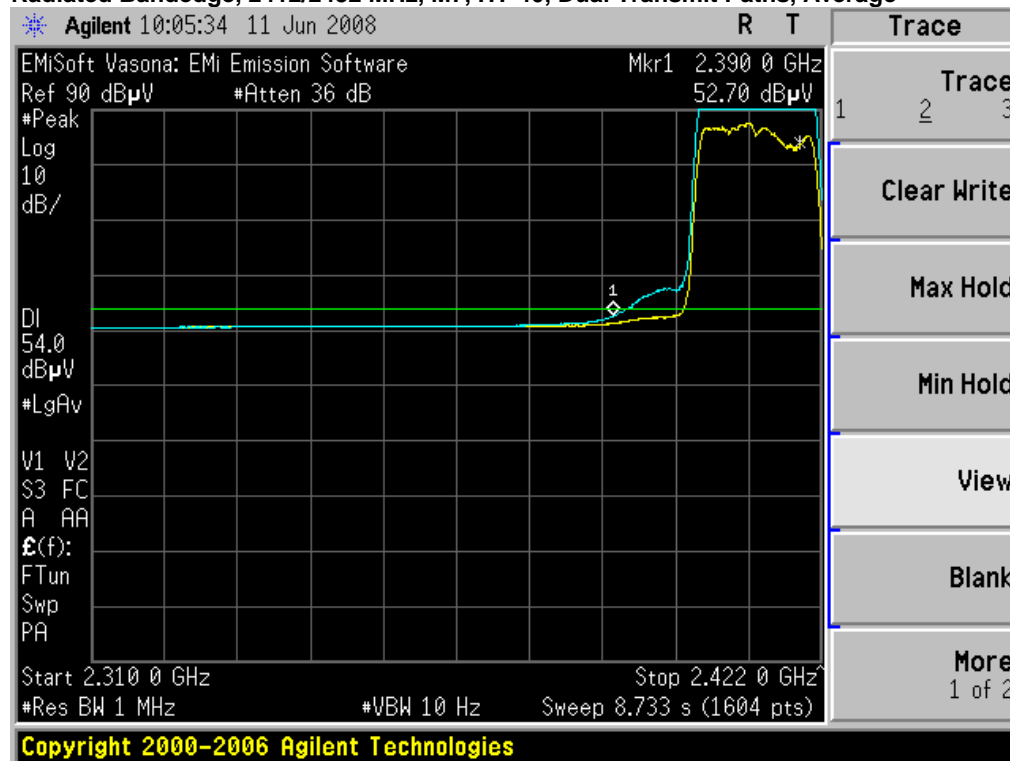




**Radiated Bandedge, 2412/2432 MHz, M7, HT-40, Single Transmit Paths, Average**



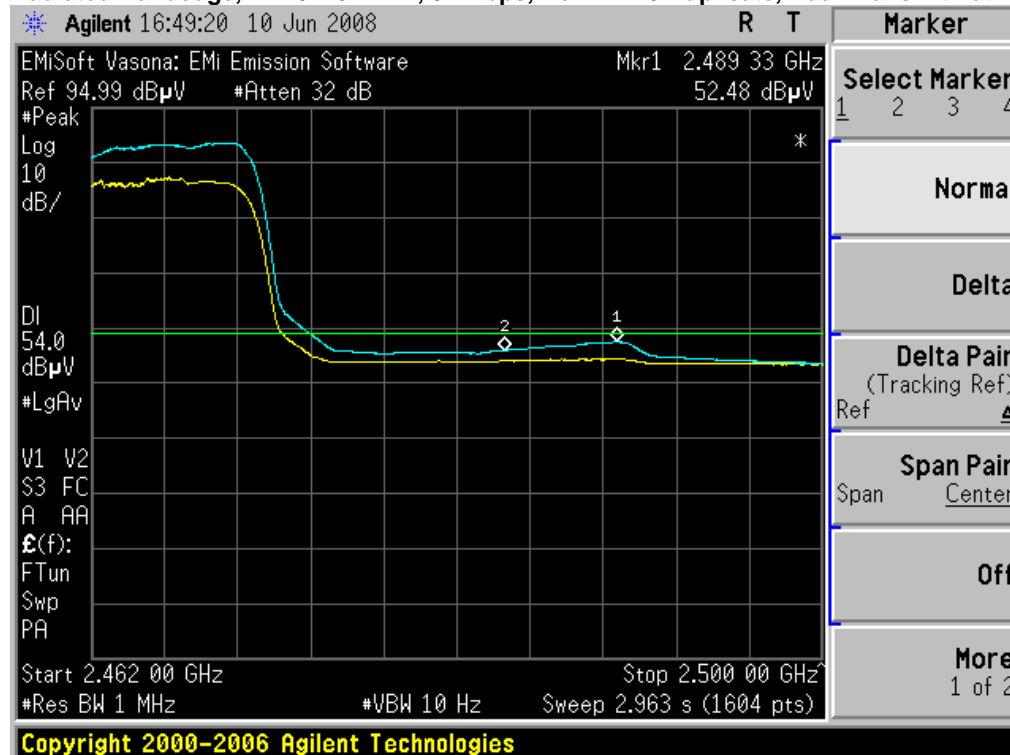
**Radiated Bandedge, 2412/2432 MHz, M7, HT-40, Dual Transmit Paths, Average**



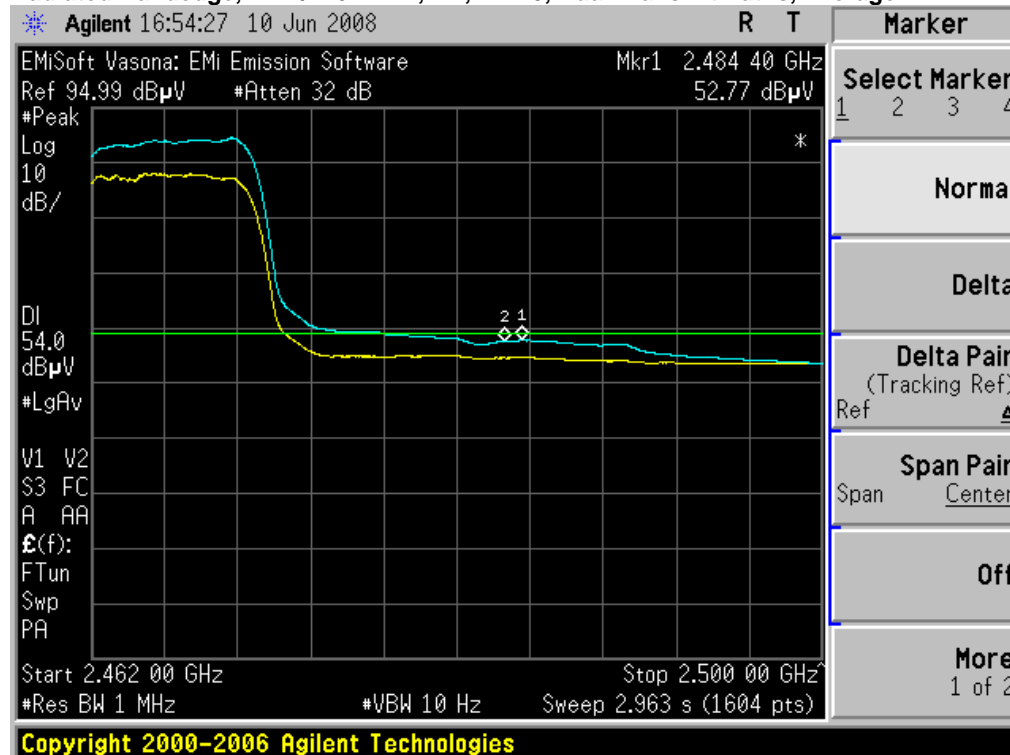




**Radiated Bandedge, 2442/2462 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average**

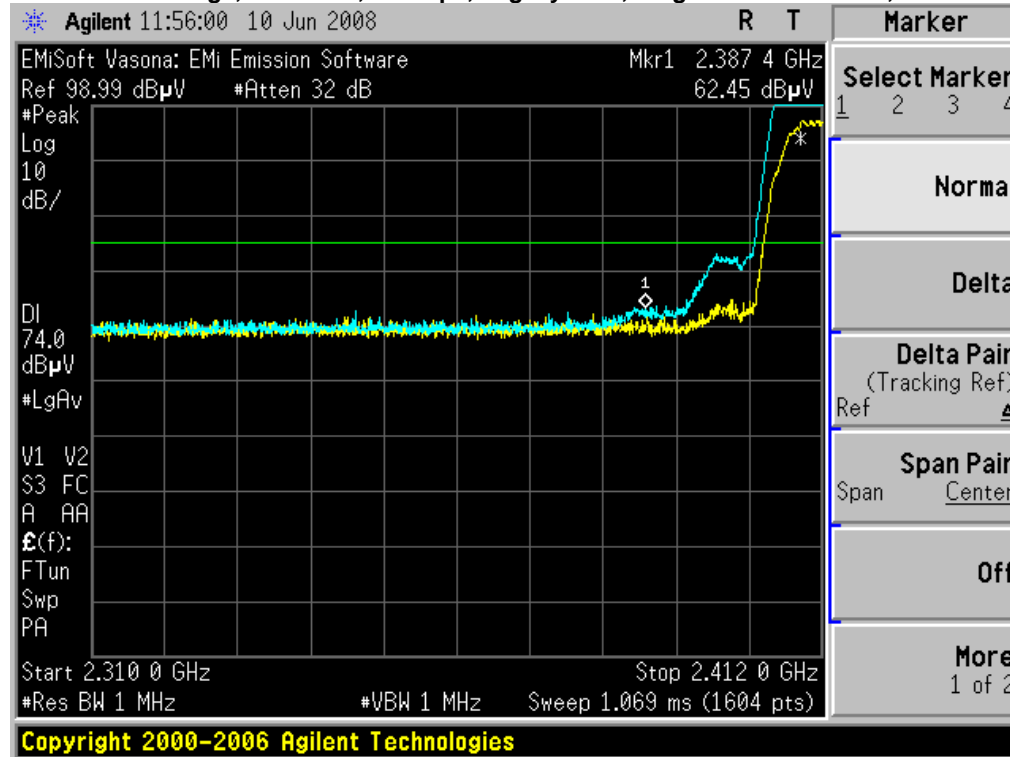


**Radiated Bandedge, 2442/2462 MHz, M7, HT-40, Dual Transmit Paths, Average**

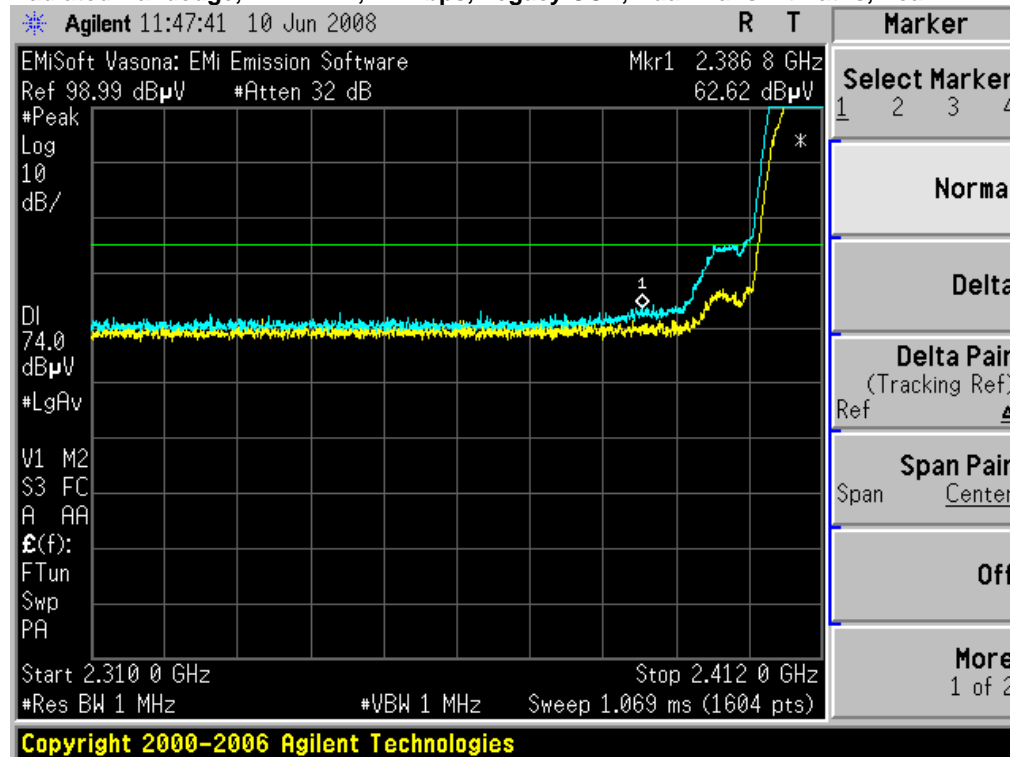




**Radiated Bandedge, 2412 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths, Peak**

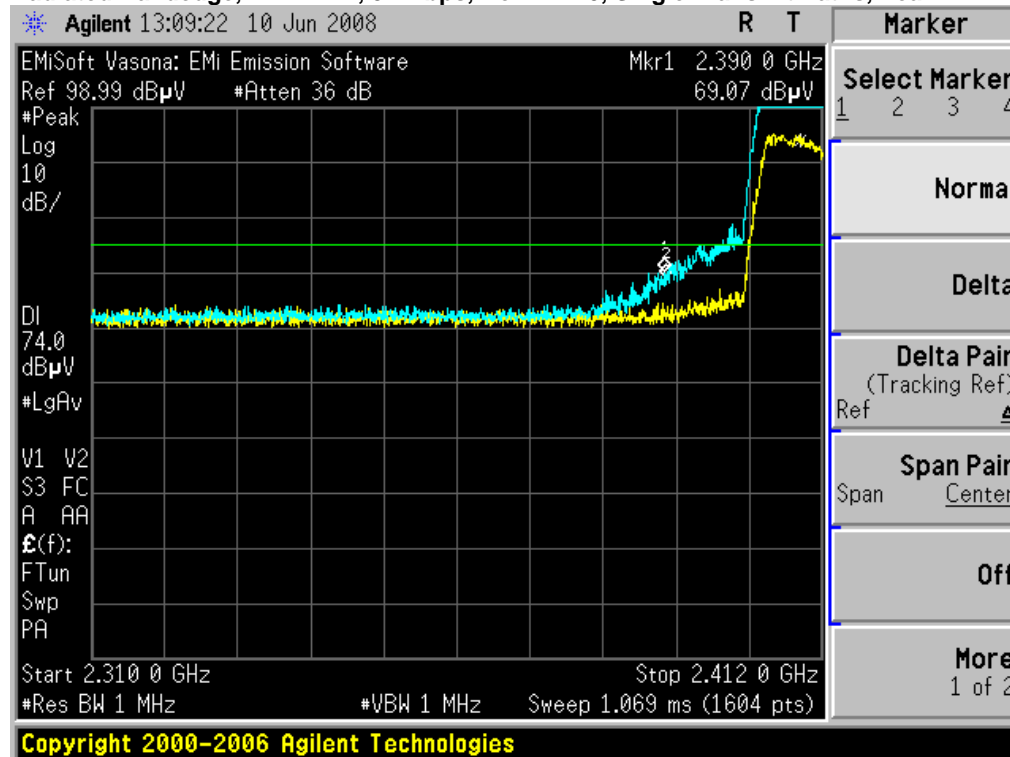


**Radiated Bandedge, 2412 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths, Peak**

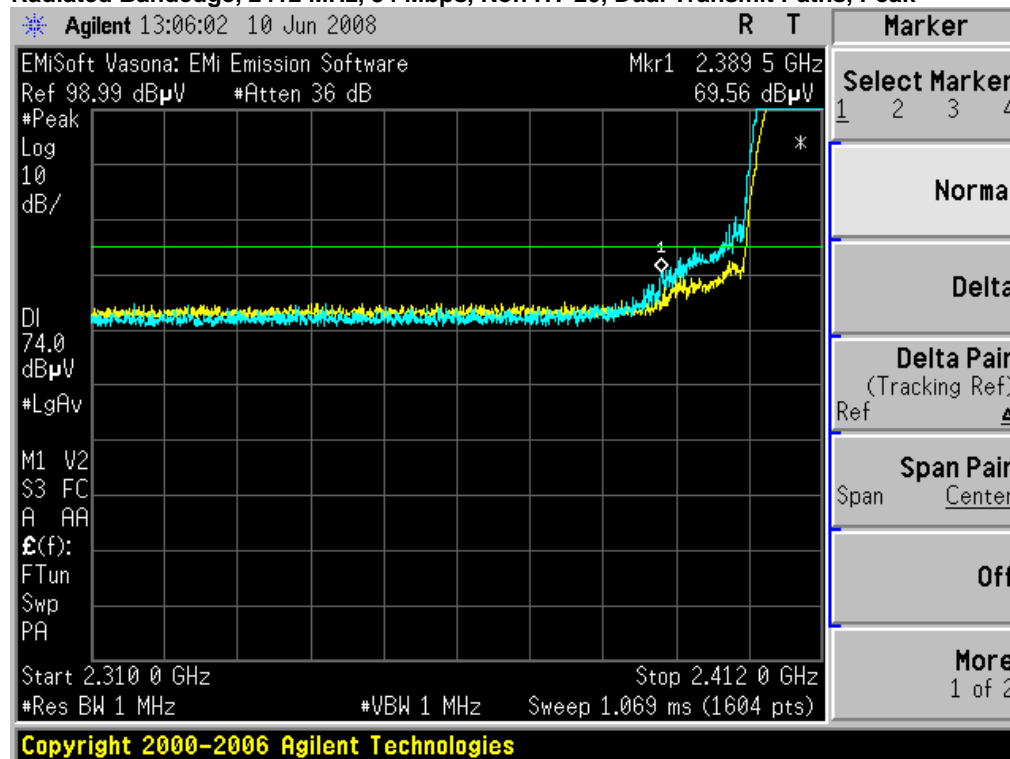




**Radiated Bandedge, 2412 MHz, 54 Mbps, Non HT-20, Single Transmit Paths, Peak**

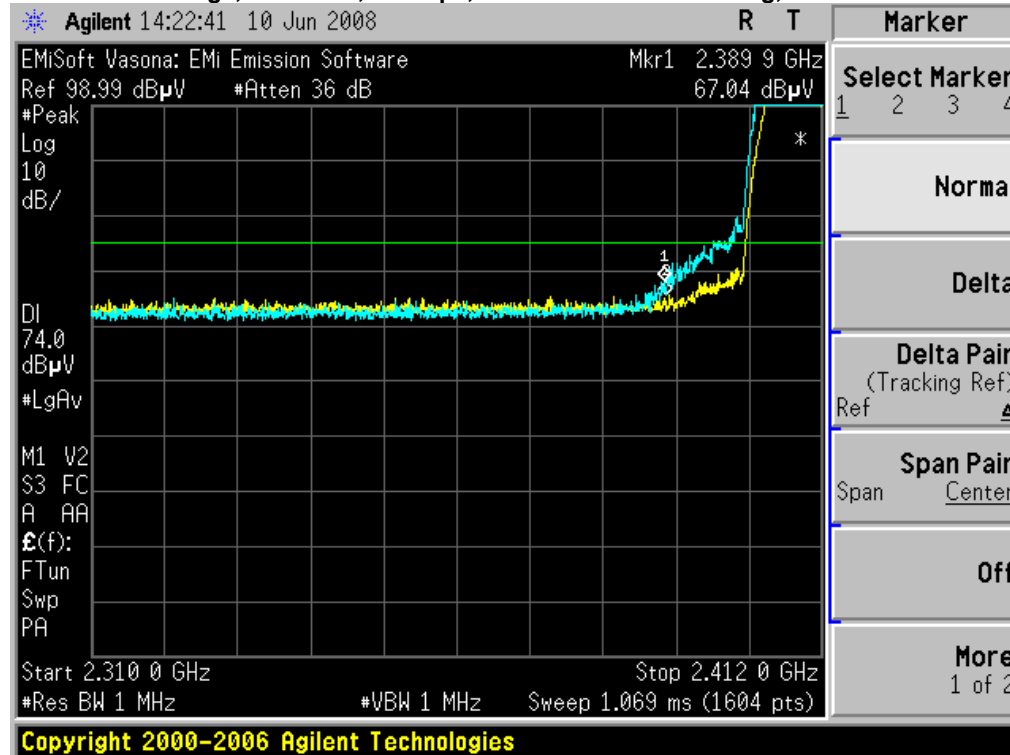


**Radiated Bandedge, 2412 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths, Peak**

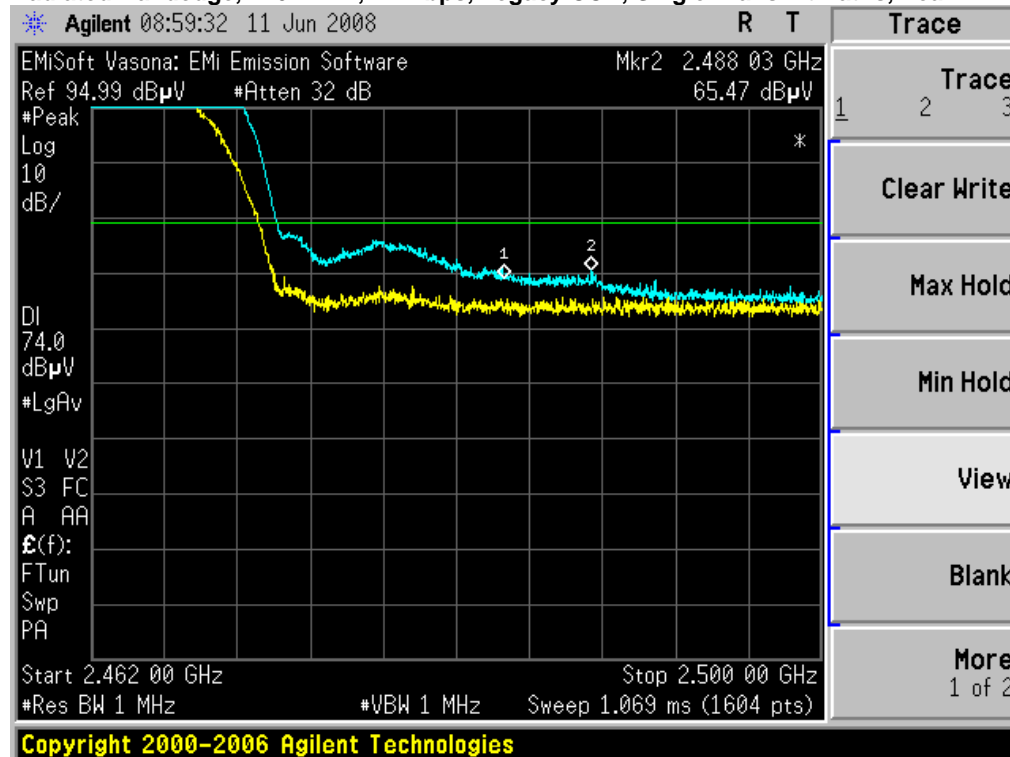




**Radiated Bandedge, 2412 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak**

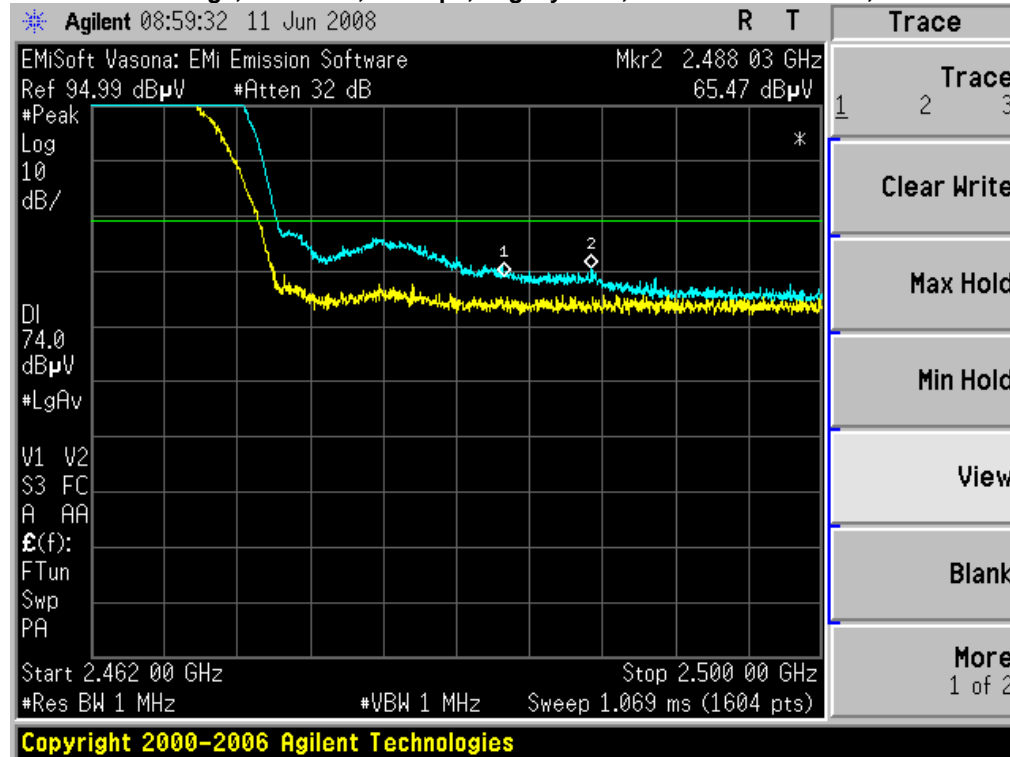


**Radiated Bandedge, 2462 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths, Peak**

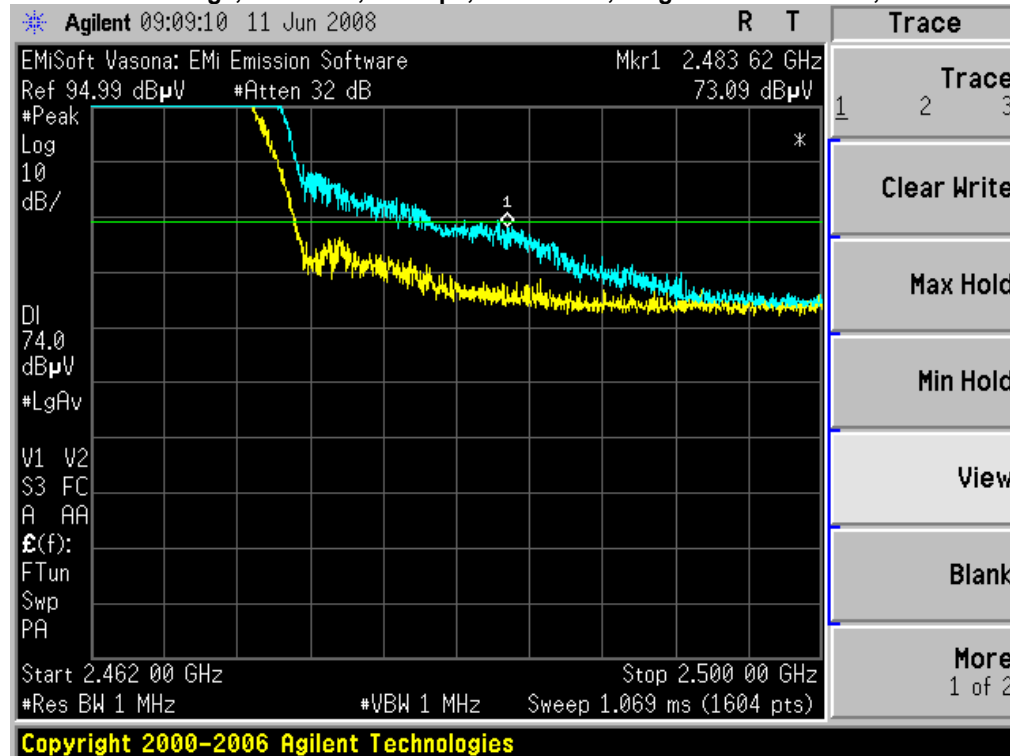




**Radiated Bandedge, 2462 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths, Peak**

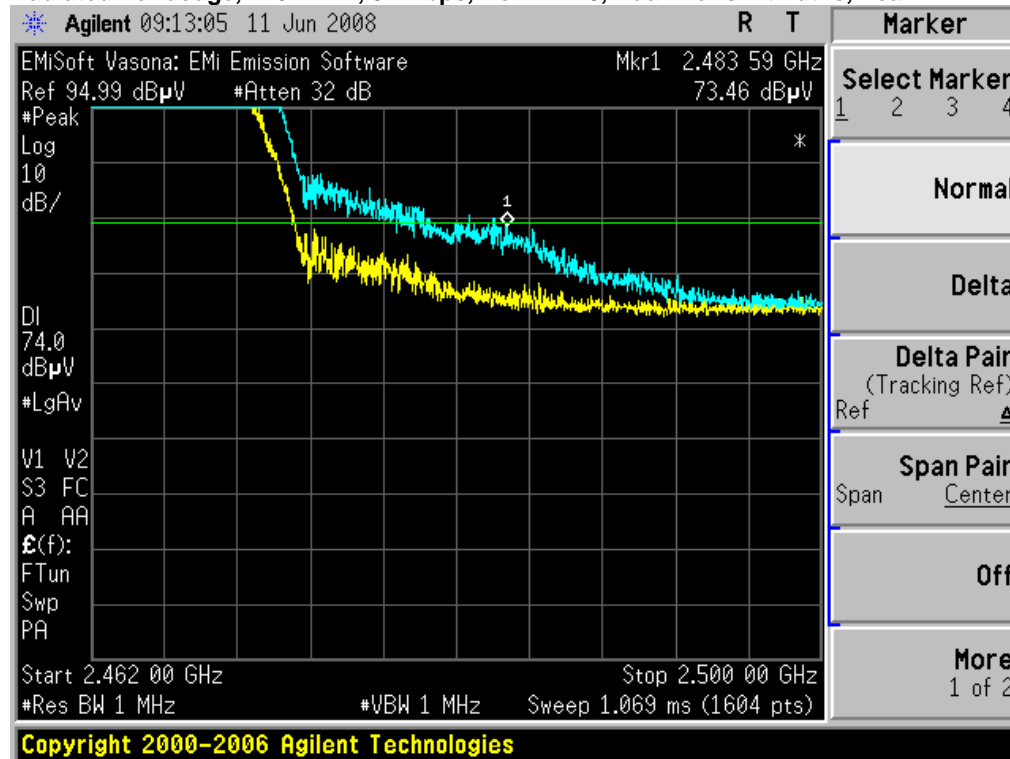


**Radiated Bandedge, 2462 MHz, 54 Mbps, Non HT-20 , Single Transmit Paths, Peak**

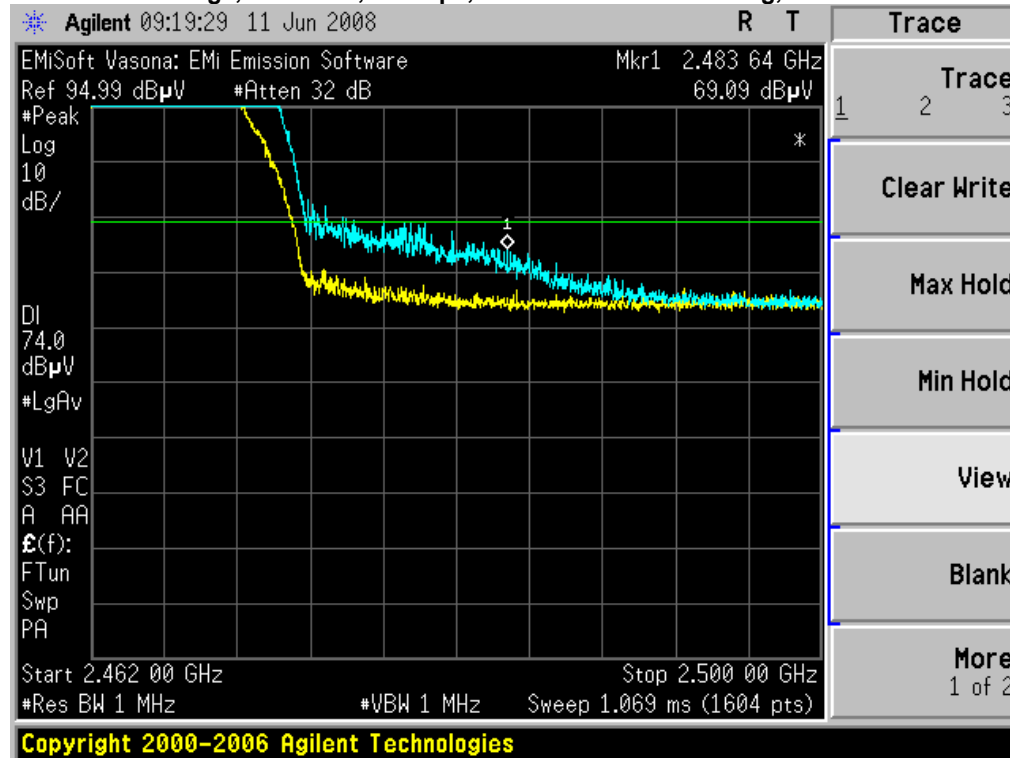




**Radiated Bandedge, 2462 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths, Peak**

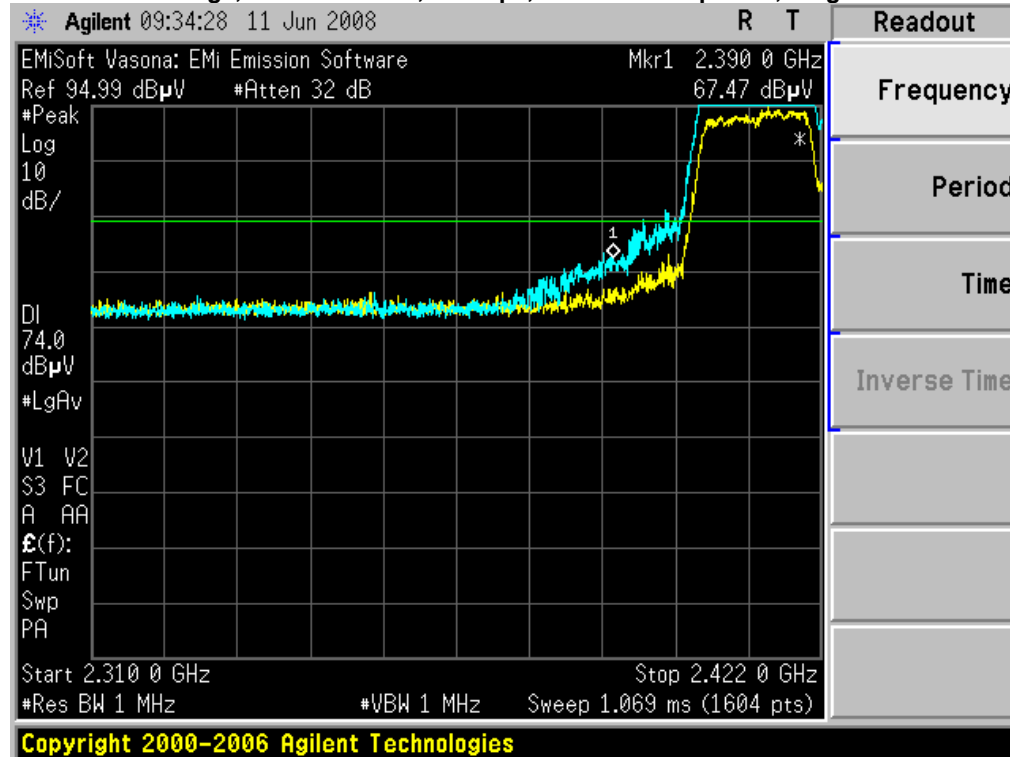


**Radiated Bandedge, 2462 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak**

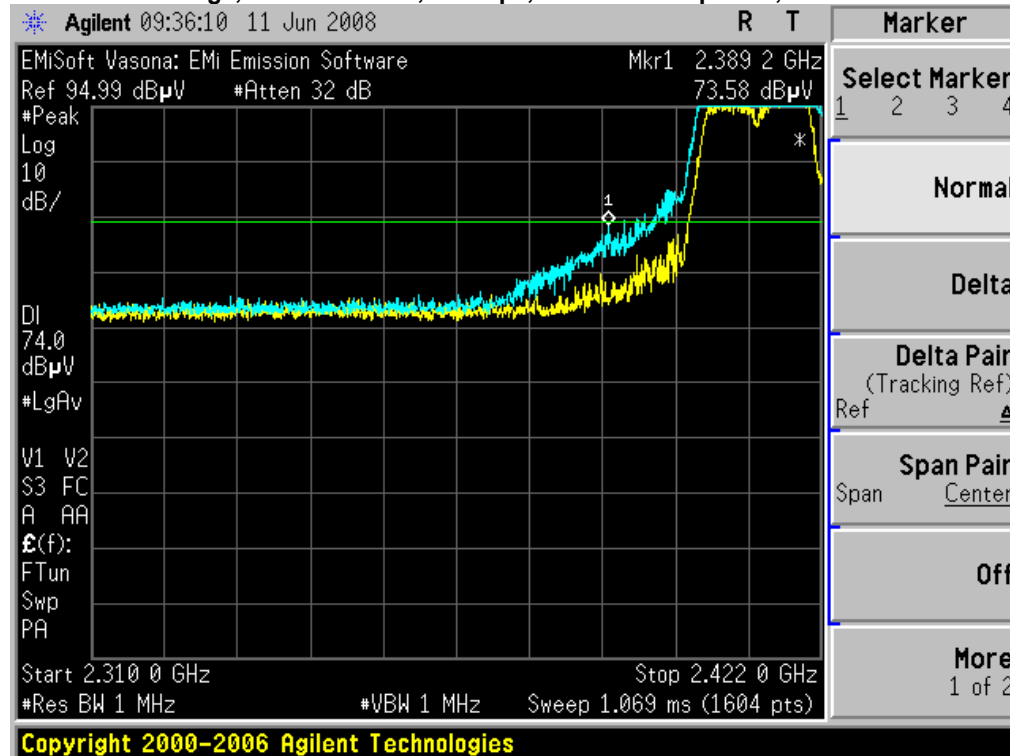




**Radiated Bandedge, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Single Transmit Paths, Peak**

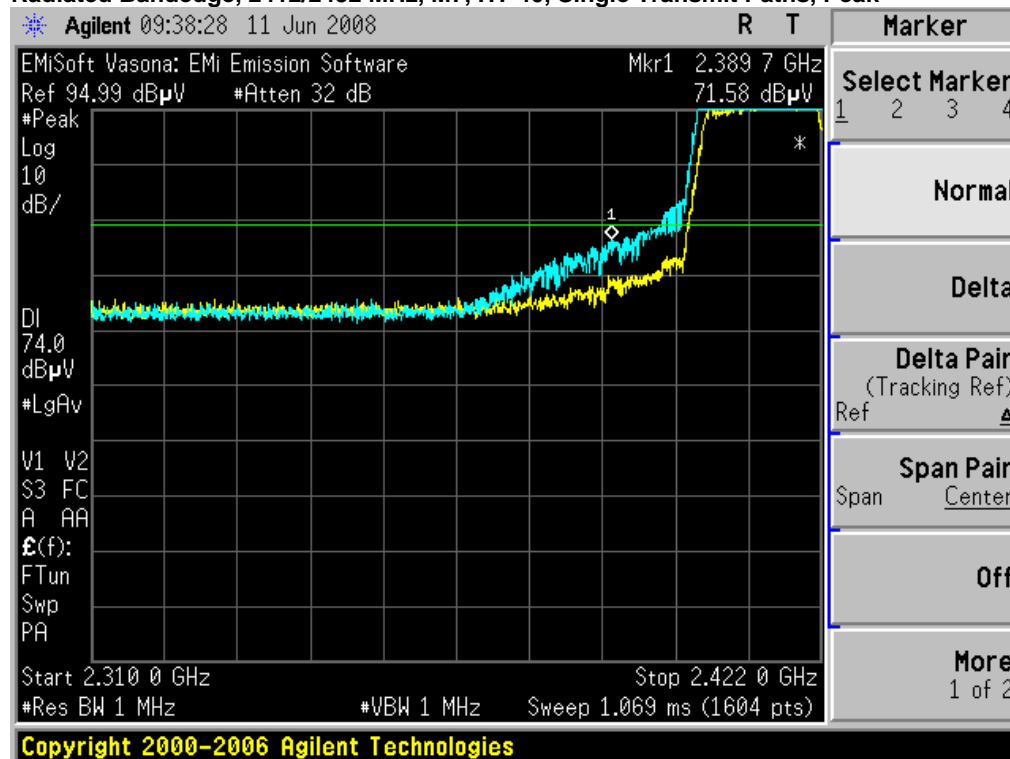


**Radiated Bandedge, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak**

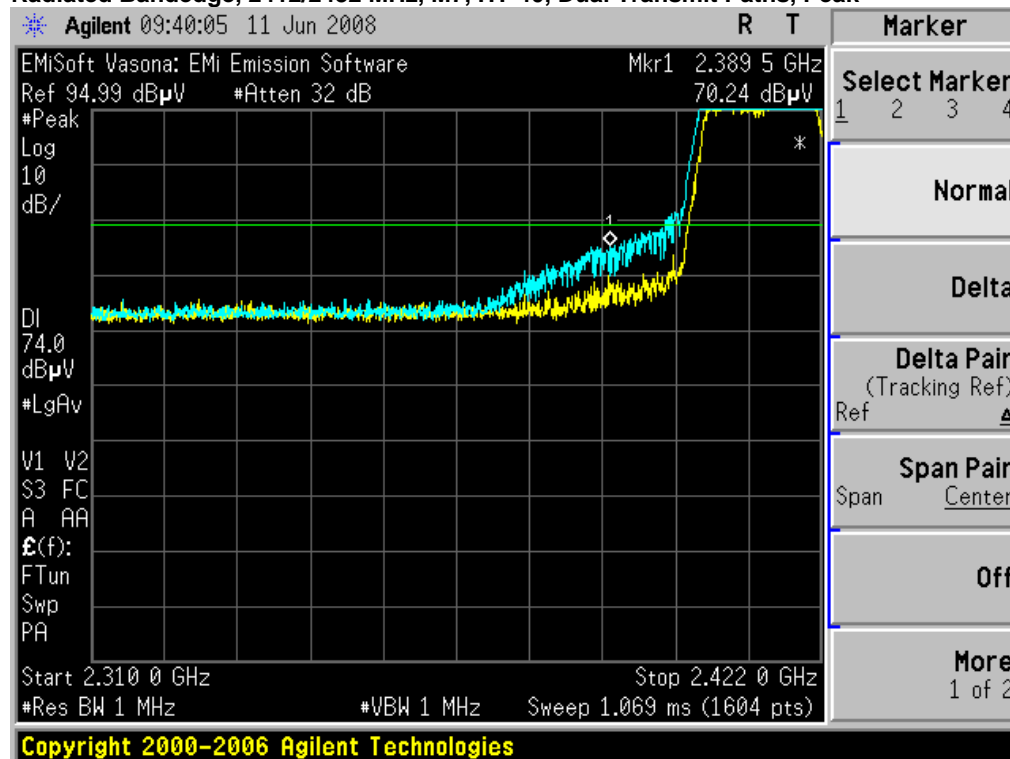




**Radiated Bandedge, 2412/2432 MHz, M7, HT-40, Single Transmit Paths, Peak**



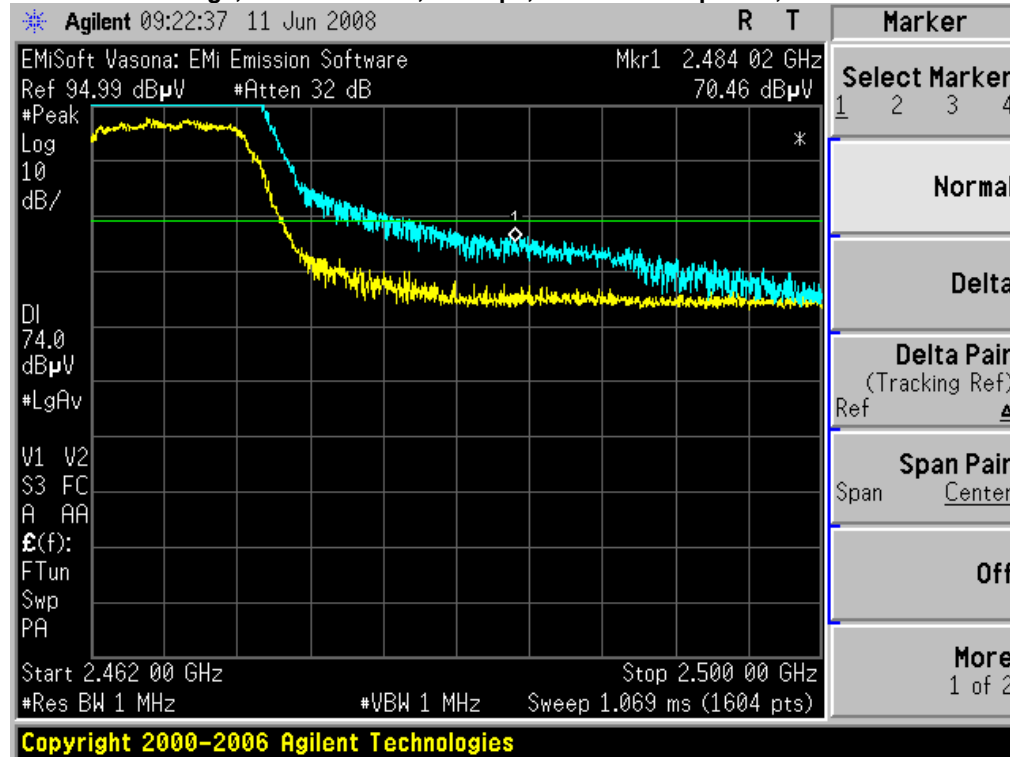
**Radiated Bandedge, 2412/2432 MHz, M7, HT-40, Dual Transmit Paths, Peak**



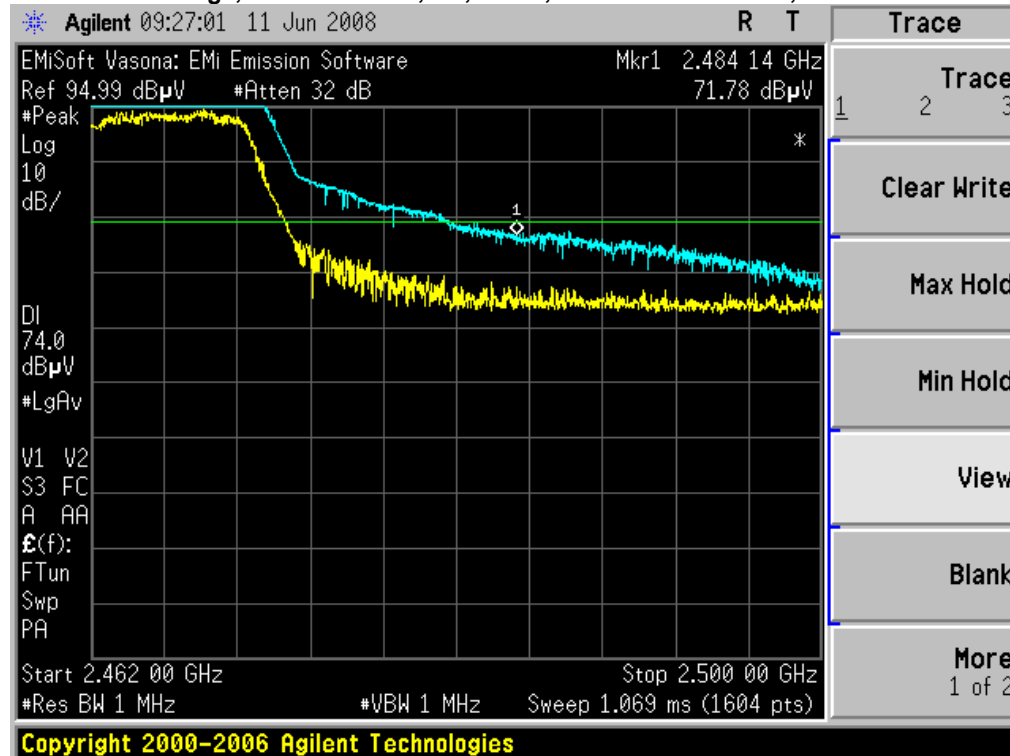




**Radiated Bandedge, 2442/2462 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak**



**Radiated Bandedge, 2442/2462 MHz, M7, HT-40, Dual Transmit Paths, Peak**





## **Radiated Spurious Emissions**

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

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

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

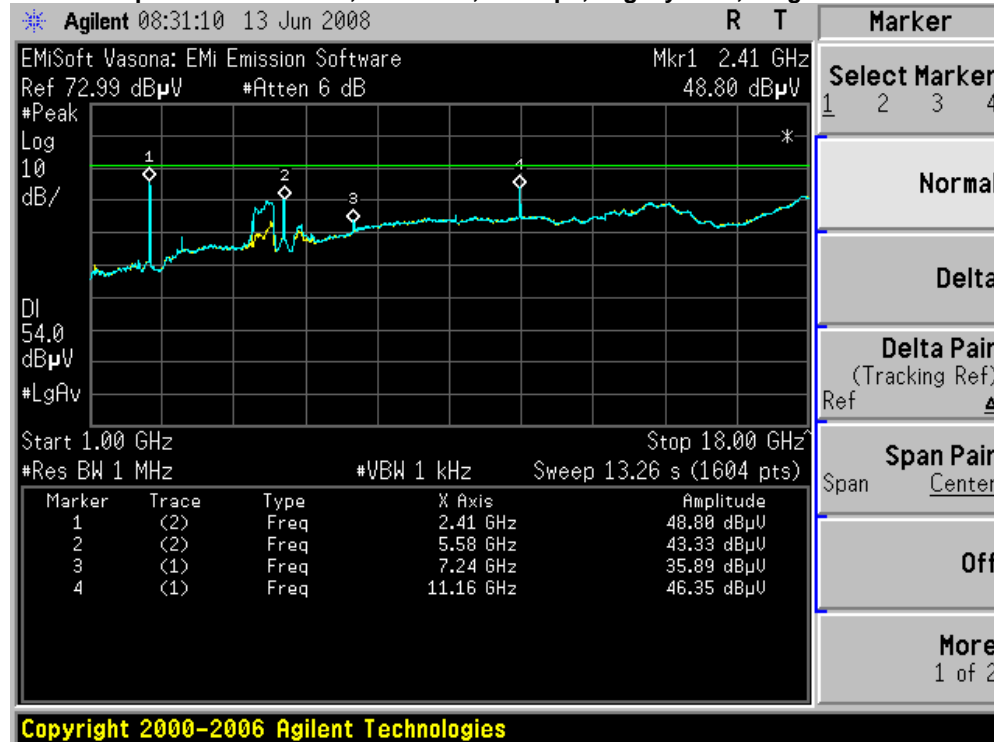
Place a marker at the end of the restricted band closest to the transmit frequency to show compliance.  
Also measure any emissions in the restricted bands.



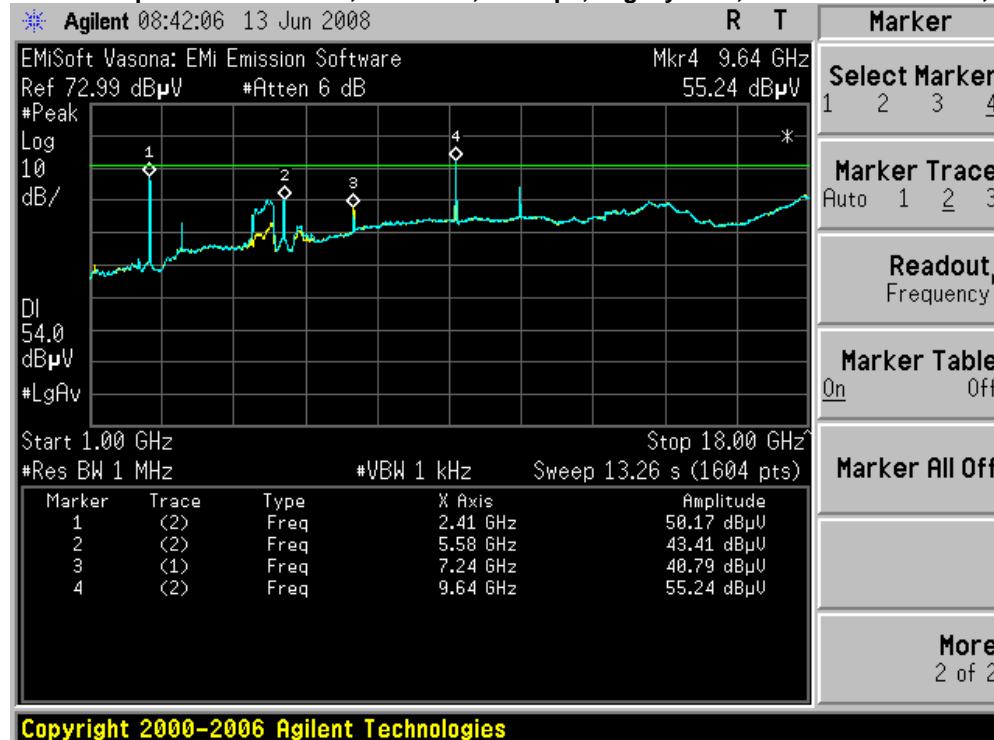
Frequency (MHz)	Mode	Data Rate (Mbps)	Spurious Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2412	Legacy CCK, Single Tx Path	11	<b>35.9</b>	54	18.1
2412	Legacy CCK, Dual Tx Path	11	<b>40.8</b>	54	13.2
2412	Non HT-20, Single Tx Path	54	<b>34.3</b>	54	19.7
2412	Non HT-20, Dual Tx Path	54	<b>35.5</b>	54	18.5
2412	Non HT-20 Beam Forming	54	<b>35.0</b>	54	19.0
2437	Legacy CCK, Dual Tx Path	11	<b>47.7</b>	54	6.3
2437	Non HT-20 Beam Forming	54	<b>37.1</b>	54	16.9
2462	Legacy CCK, Single Tx Path	11	<b>35.3</b>	54	18.7
2462	Legacy CCK, Dual Tx Path	11	<b>37.9</b>	54	16.1
2462	Non HT-20, Single Tx Path	54	<b>34.6</b>	54	19.4
2462	Non HT-20, Dual Tx Path	54	<b>34.7</b>	54	19.3
2462	Non HT-20 Beam Forming	54	<b>35.0</b>	54	19.0
2412/2432	Non HT-40 Duplicate, Single Tx Path	54	<b>33.5</b>	54	20.5
2412/2432	Non HT-40 Duplicate, Dual Tx Path	54	<b>33.7</b>	54	20.3
2412/2432	HT-40, Single Tx Path	M7	<b>33.7</b>	54	20.3
2412/2432	HT-40, Dual Tx Path	M7	<b>33.7</b>	54	20.3
2427/2447	Non HT-40 Duplicate	54	<b>34.2</b>	54	19.8
2427/2447	HT-40	54	<b>34.2</b>	54	19.8
2442/2462	Non HT-40 Duplicate	54	<b>34.9</b>	54	19.1
2442/2462	HT-40	M7	<b>34.9</b>	54	19.1



**Radiated Spurious Emissions, 2412 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths, Average**

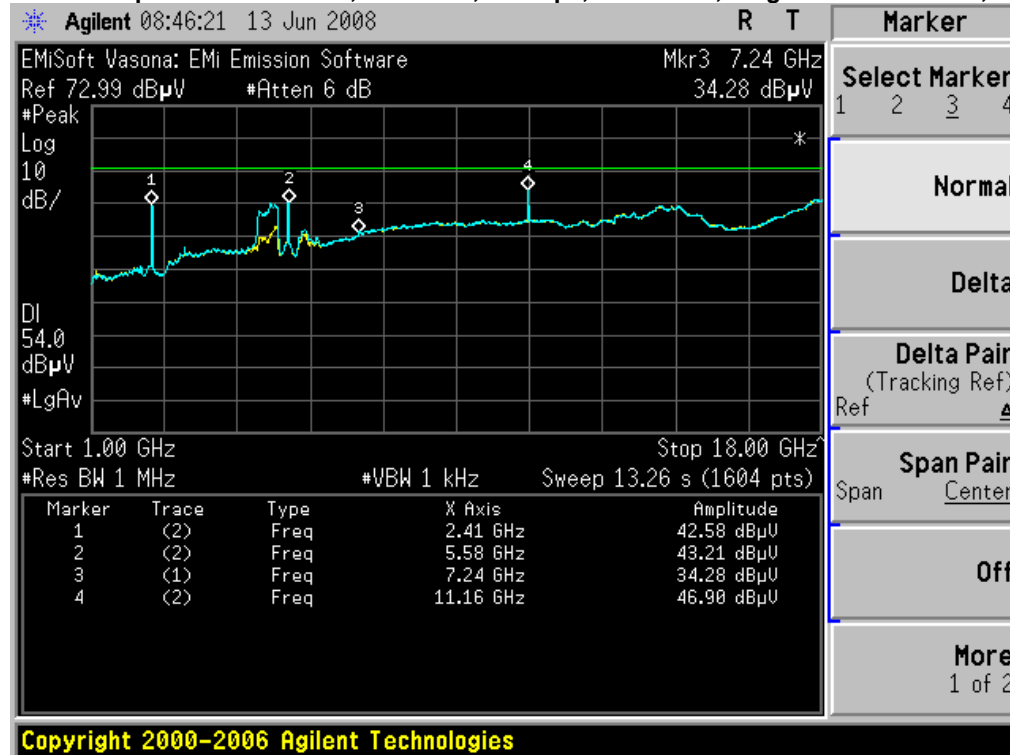


**Radiated Spurious Emissions, 2412 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths, Average**

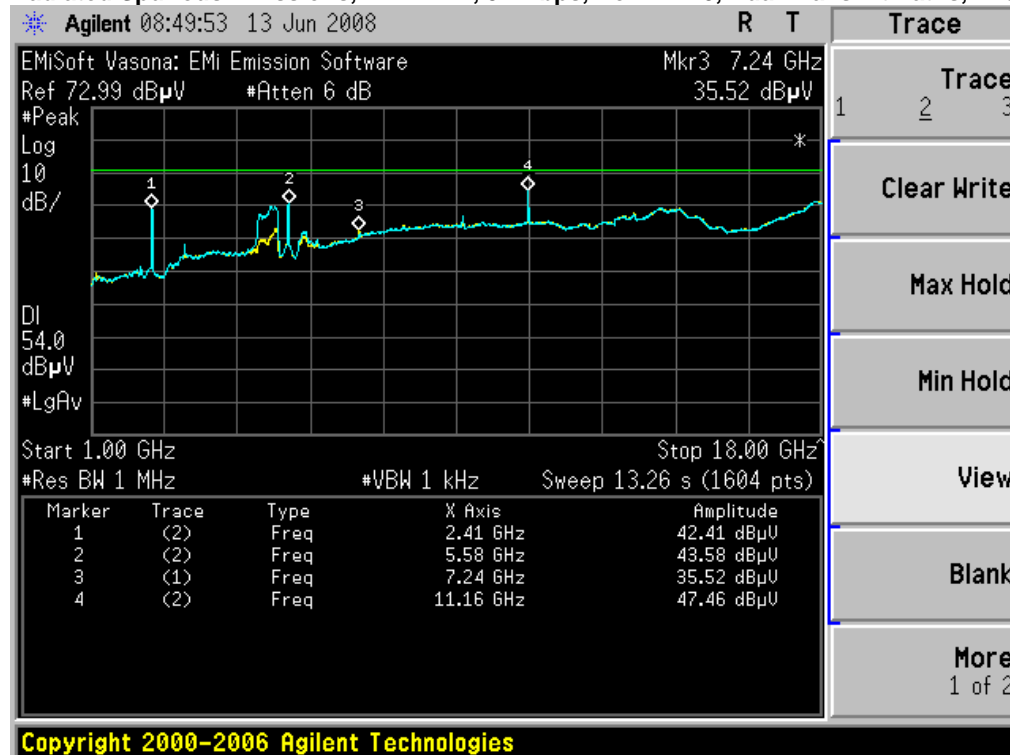




**Radiated Spurious Emissions, 2412 MHz, 54 Mbps, Non HT-20, Single Transmit Paths, Average**

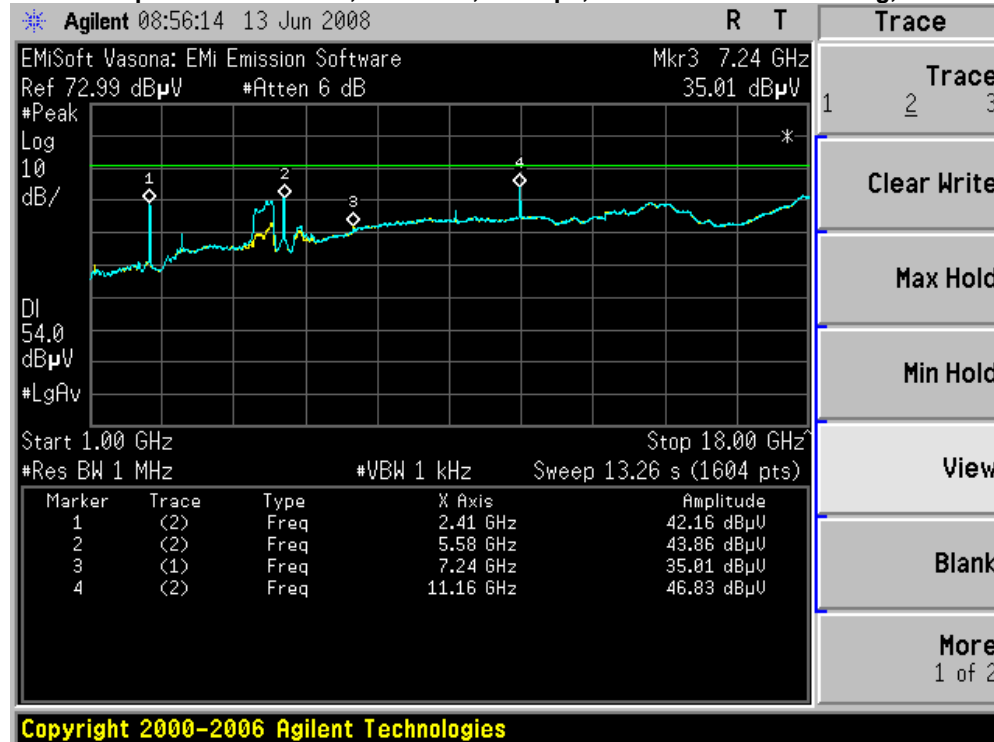


**Radiated Spurious Emissions, 2412 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths, Average**

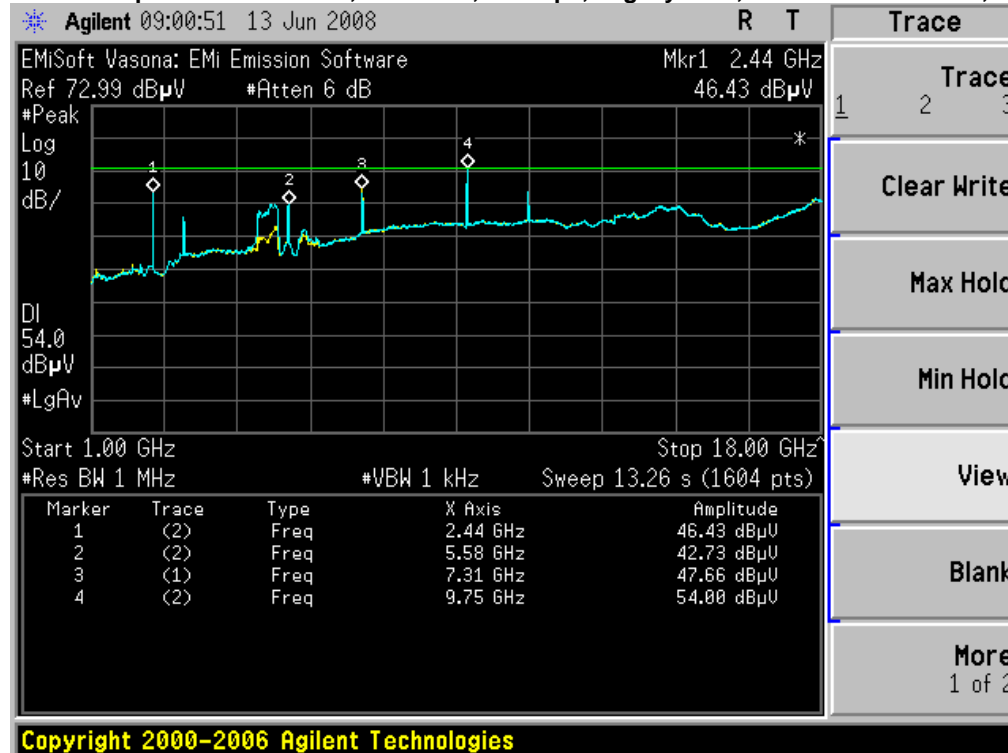




**Radiated Spurious Emissions, 2412 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average**

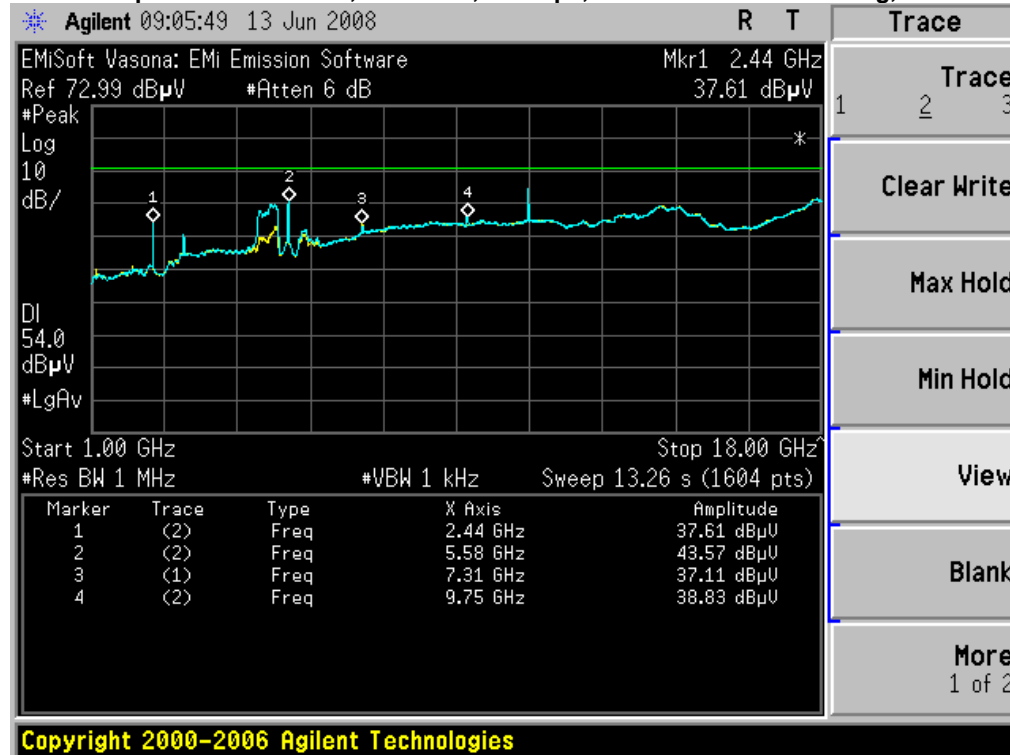


**Radiated Spurious Emissions, 2437 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths, Average**





**Radiated Spurious Emissions, 2437 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average**

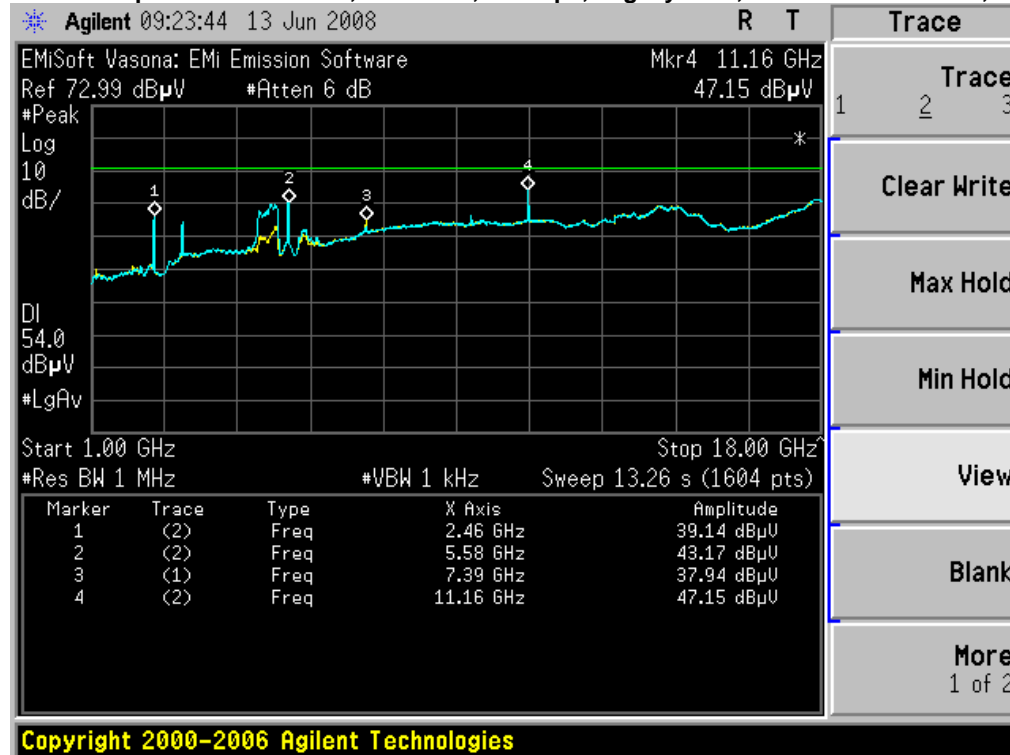


**Radiated Spurious Emissions, 2462 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths, Average**





**Radiated Spurious Emissions, 2462 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths, Average**



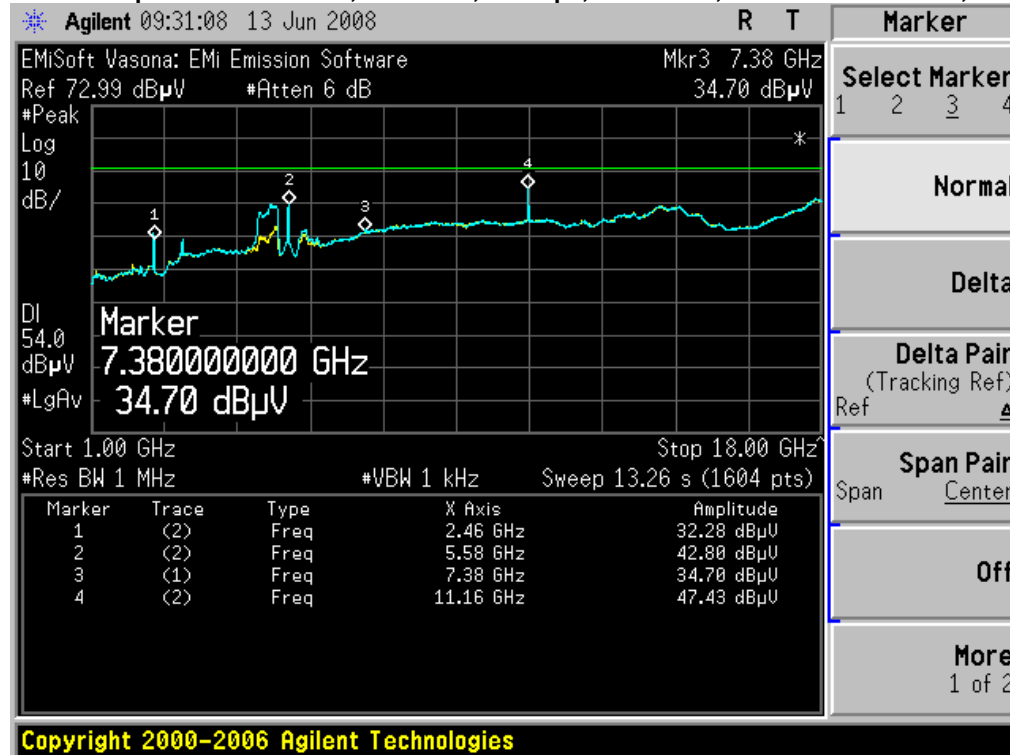
**Radiated Spurious Emissions, 2462 MHz, 54 Mbps, Non HT-20 , Single Transmit Paths, Average**







**Radiated Spurious Emissions, 2462 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths, Average**

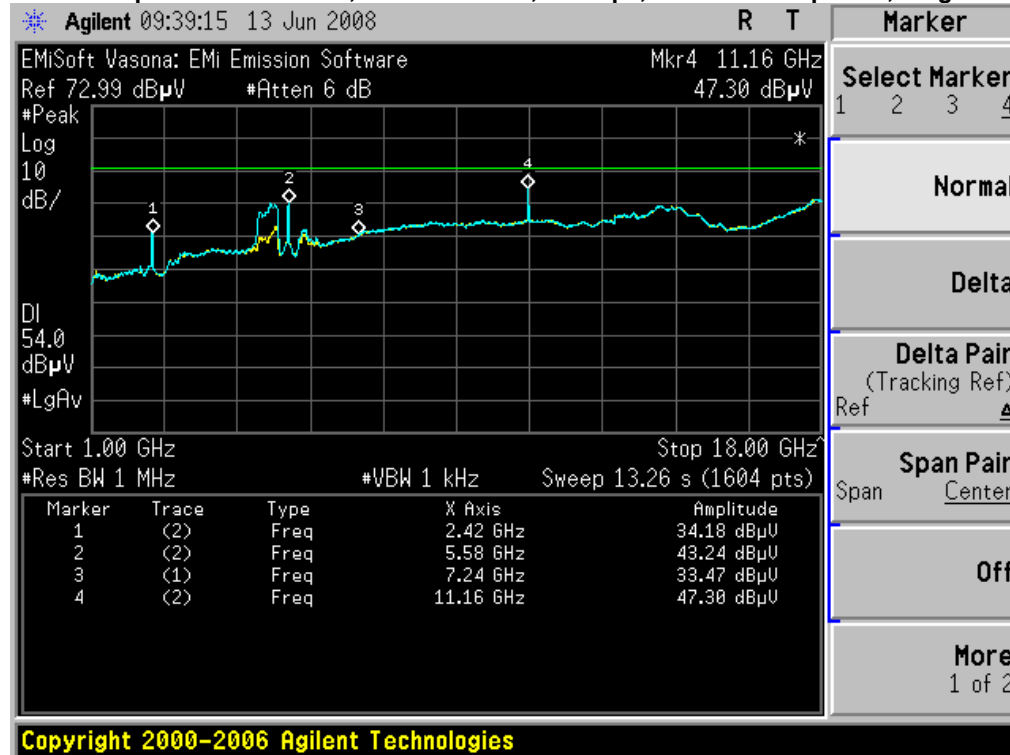


**Radiated Spurious Emissions, 2462 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average**





**Radiated Spurious Emissions, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Single Transmit Paths, Average**



**Radiated Spurious Emissions, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average**





**Radiated Spurious Emissions, 2412/2432 MHz, M7, HT-40, Single Transmit Paths, Average**



**Radiated Spurious Emissions, 2412/2432 MHz, M7, HT-40, Dual Transmit Paths, Average**





**Radiated Spurious Emissions, 2427/2447 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average**



**Radiated Spurious Emissions, 2427/2447 MHz, M7, HT-40, Dual Transmit Paths, Average**





**Radiated Spurious Emissions, 2442/2462 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average**

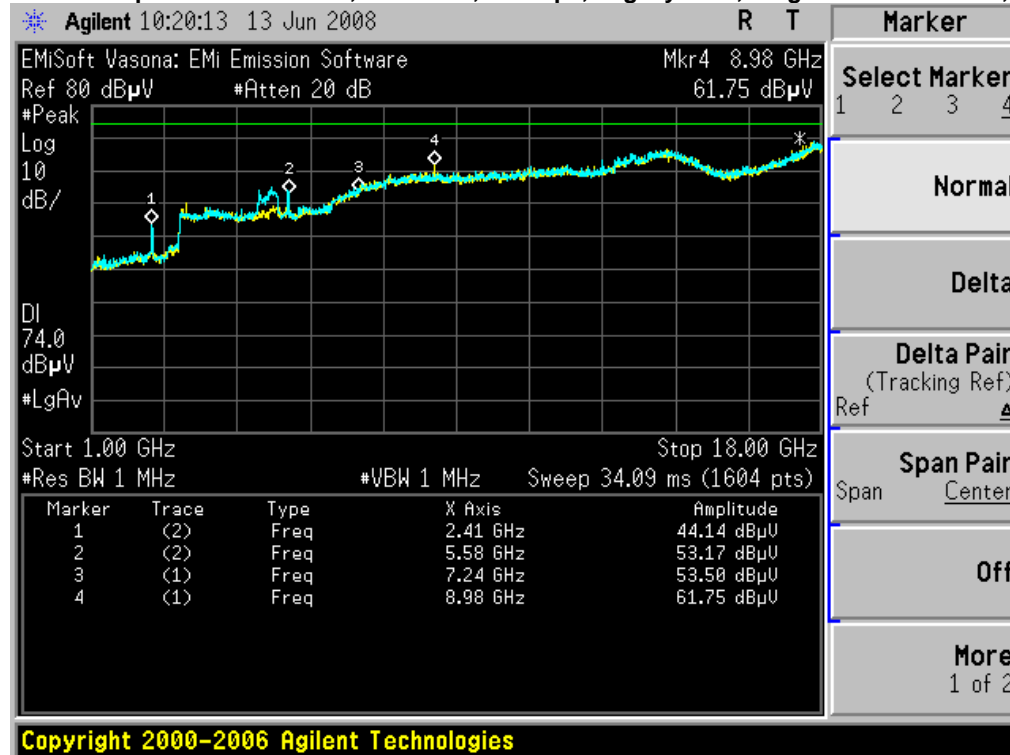


**Radiated Spurious Emissions, 2442/2462 MHz, M7, HT-40, Dual Transmit Paths, Average**

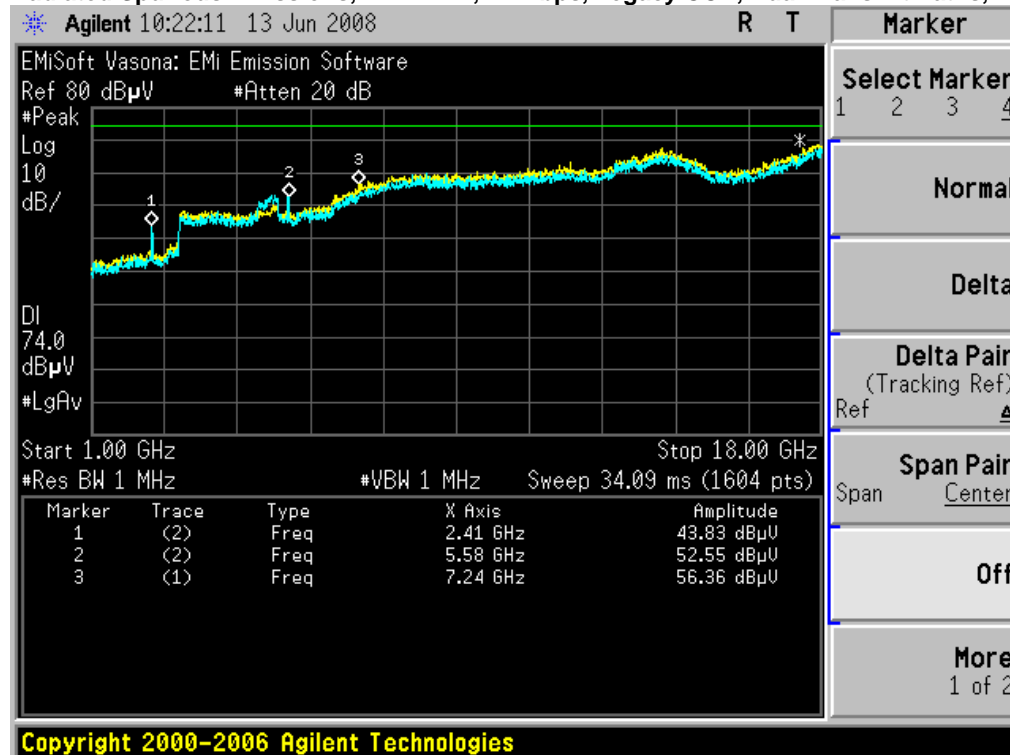




**Radiated Spurious Emissions, 2412 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths, Peak**

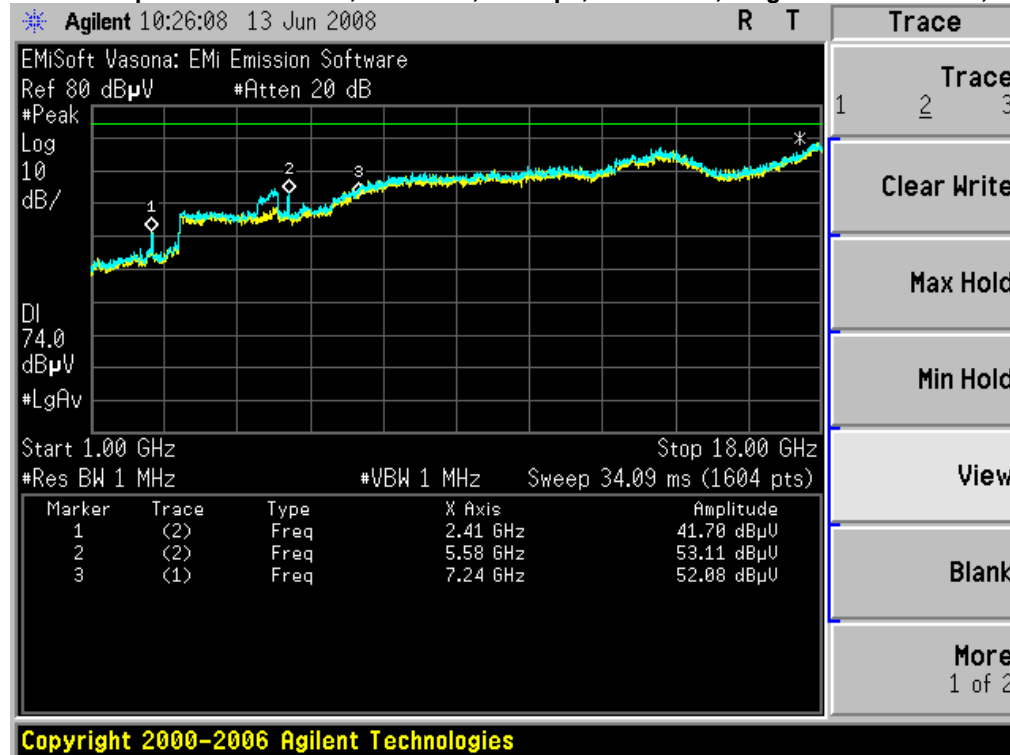


**Radiated Spurious Emissions, 2412 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths, Peak**

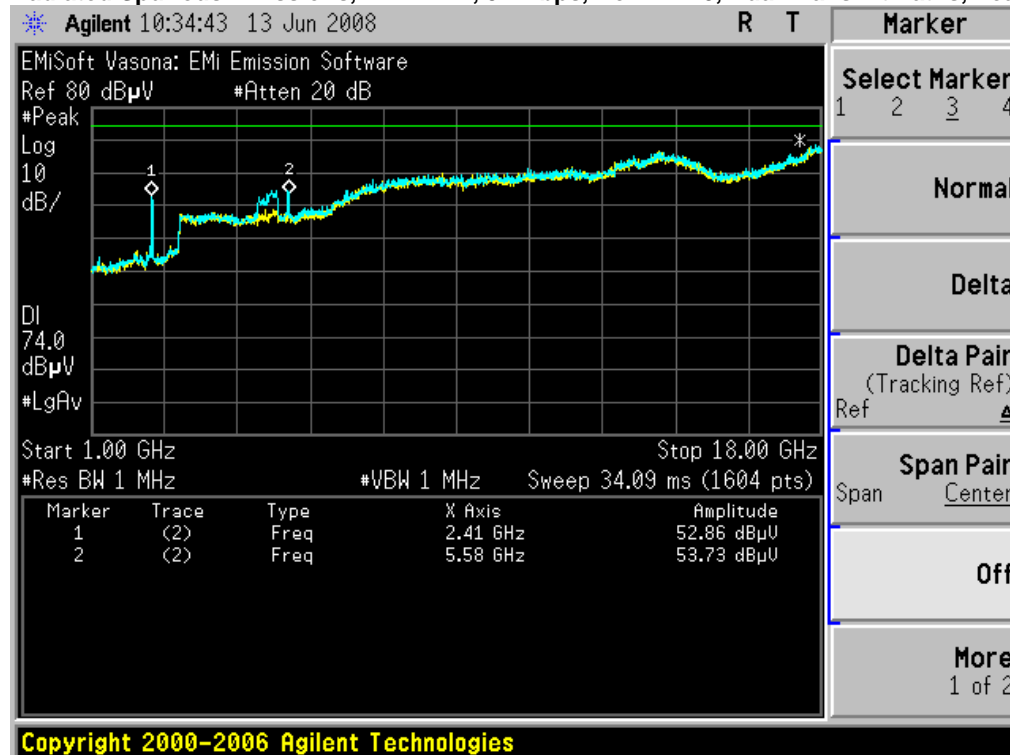




**Radiated Spurious Emissions, 2412 MHz, 54 Mbps, Non HT-20, Single Transmit Paths, Peak**

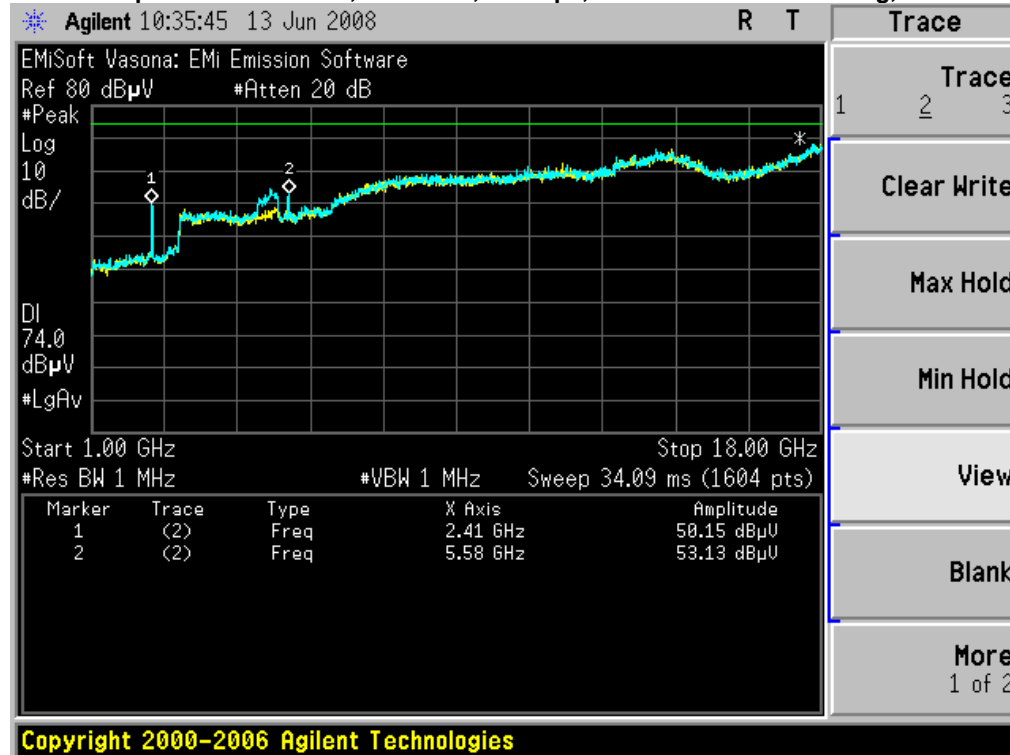


**Radiated Spurious Emissions, 2412 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths, Peak**

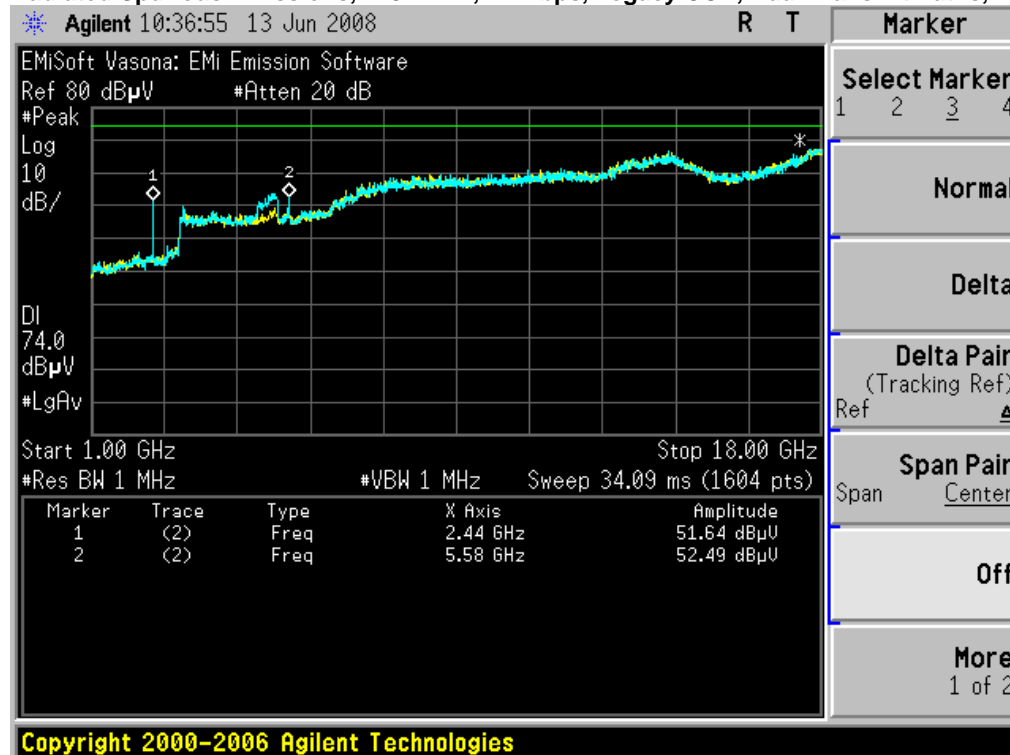




**Radiated Spurious Emissions, 2412 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak**



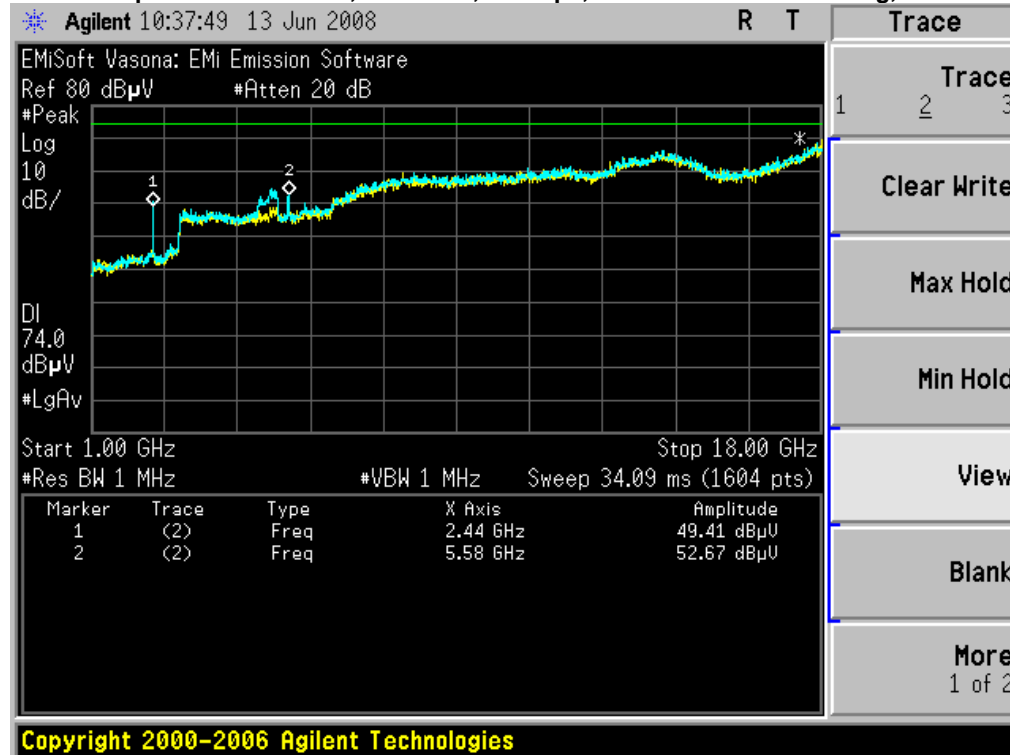
**Radiated Spurious Emissions, 2437 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths, Peak**



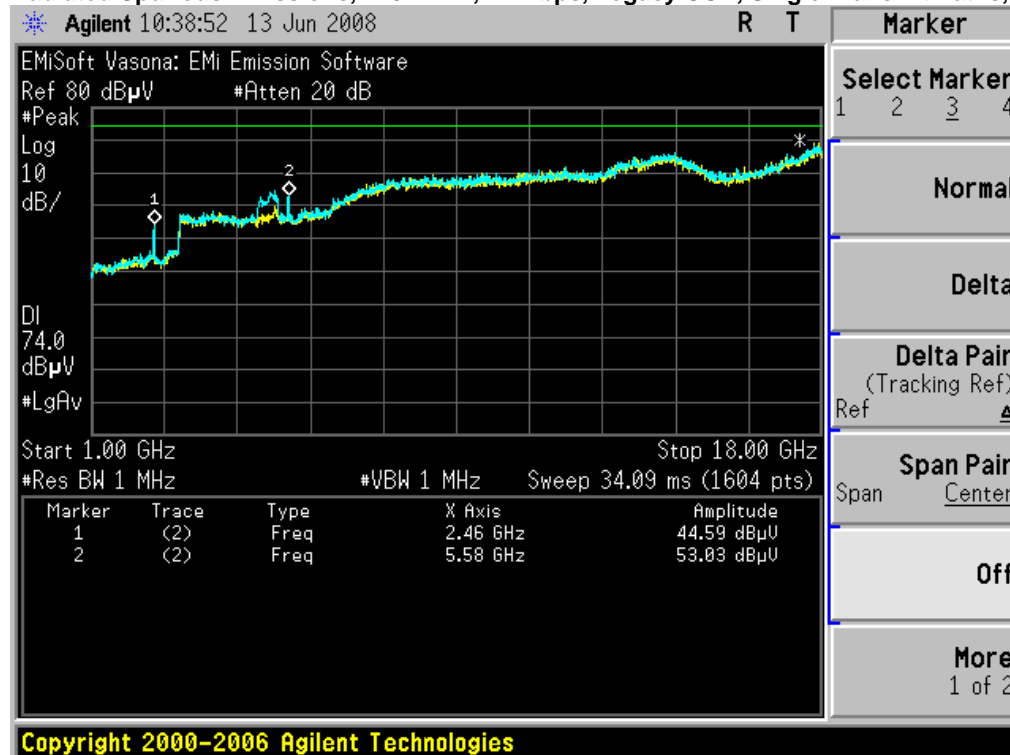




**Radiated Spurious Emissions, 2437 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak**

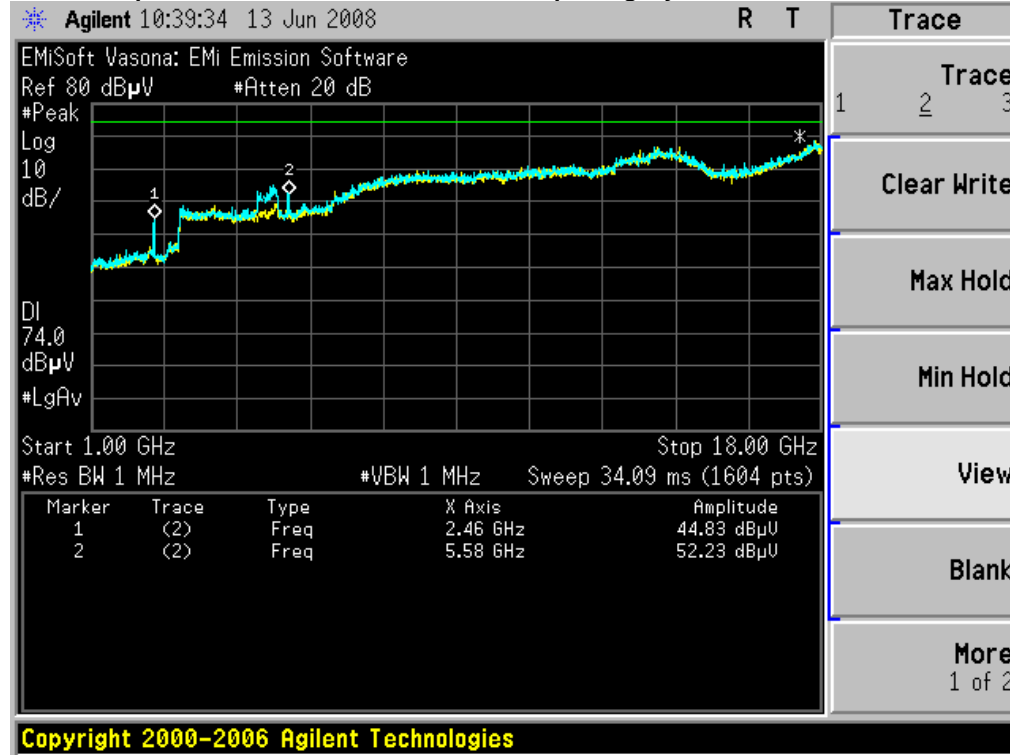


**Radiated Spurious Emissions, 2462 MHz, 11 Mbps, Legacy CCK, Single Transmit Paths, Peak**

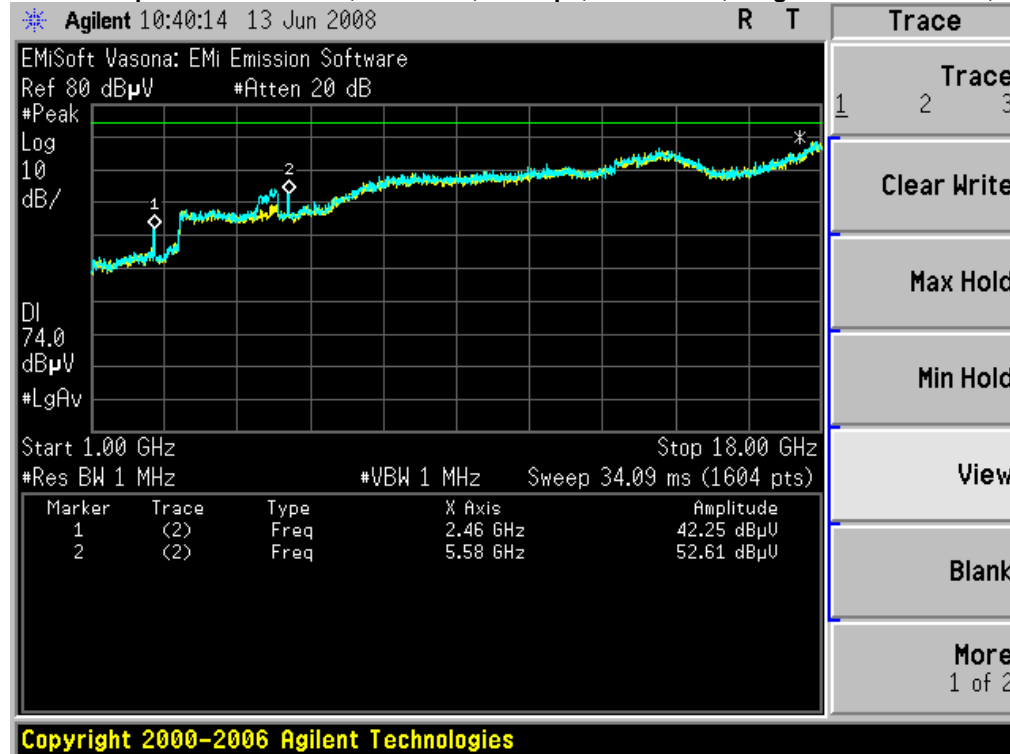




**Radiated Spurious Emissions, 2462 MHz, 11 Mbps, Legacy CCK, Dual Transmit Paths, Peak**

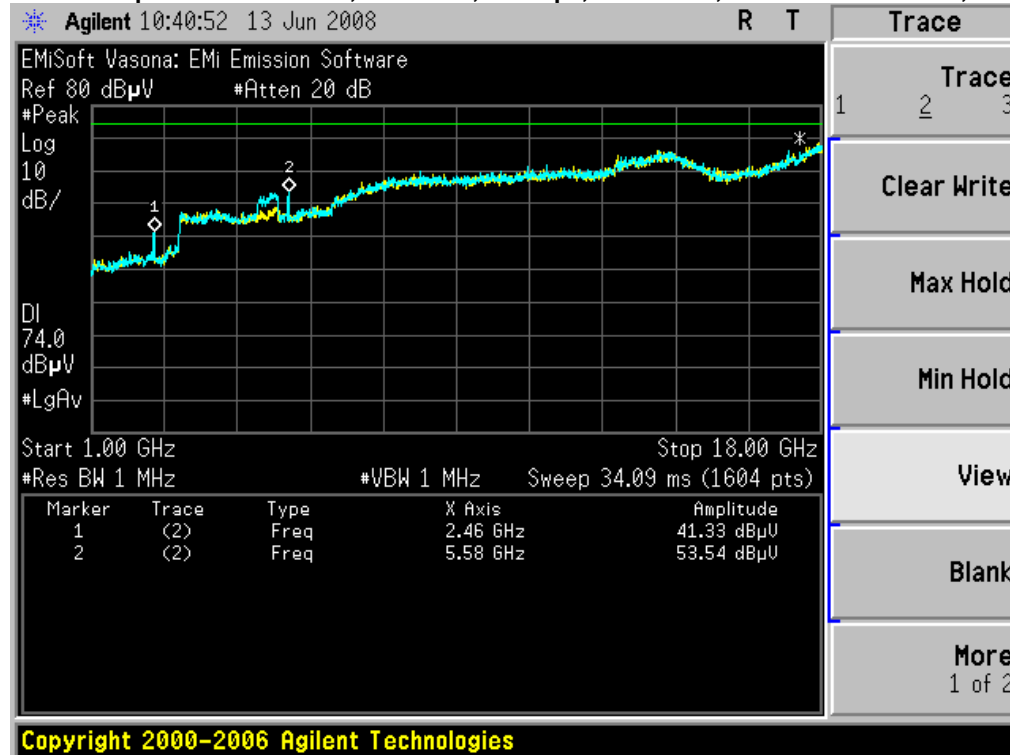


**Radiated Spurious Emissions, 2462 MHz, 54 Mbps, Non HT-20 , Single Transmit Paths, Peak**





**Radiated Spurious Emissions, 2462 MHz, 54 Mbps, Non HT-20, Dual Transmit Paths, Peak**

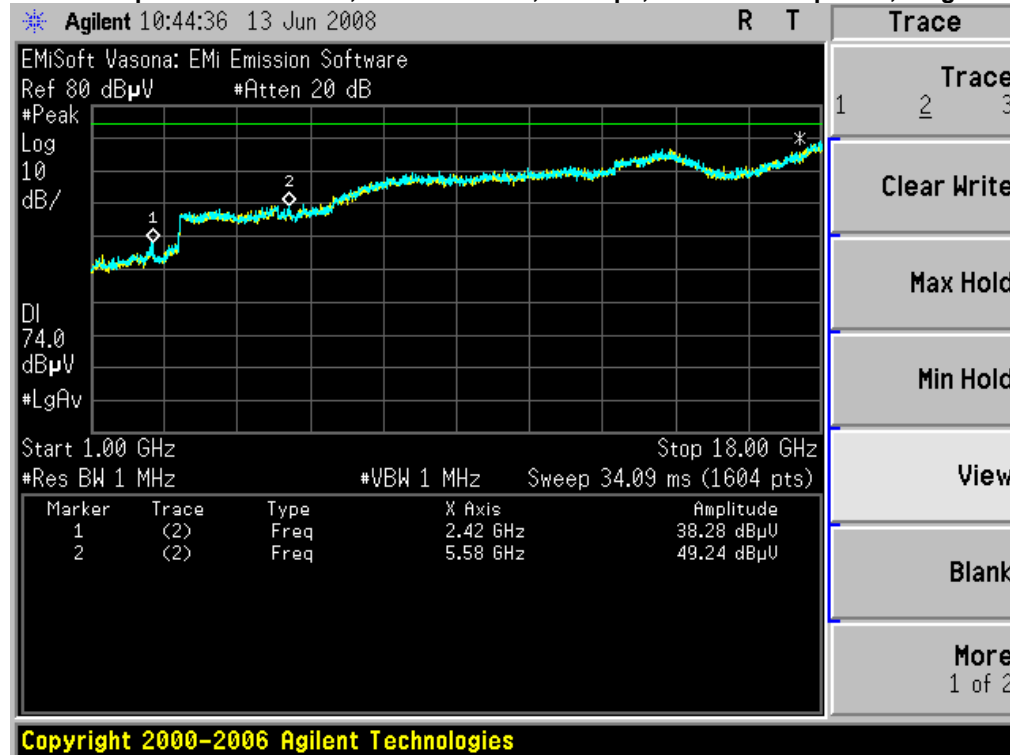


**Radiated Spurious Emissions, 2462 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak**

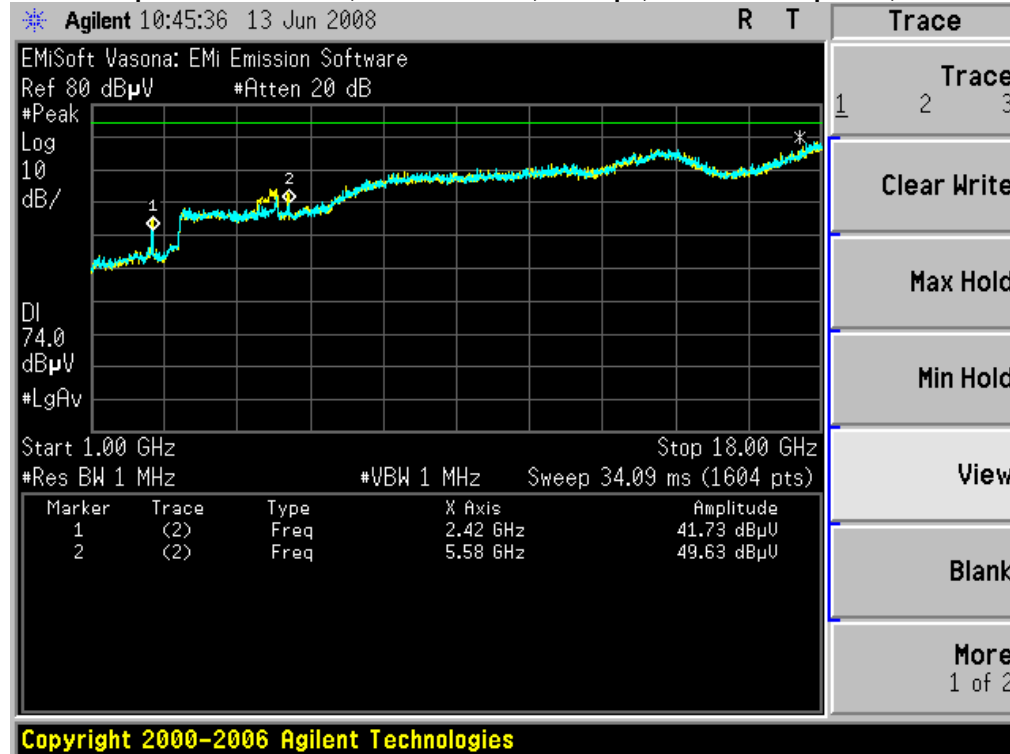




**Radiated Spurious Emissions, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Single Transmit Paths, Peak**

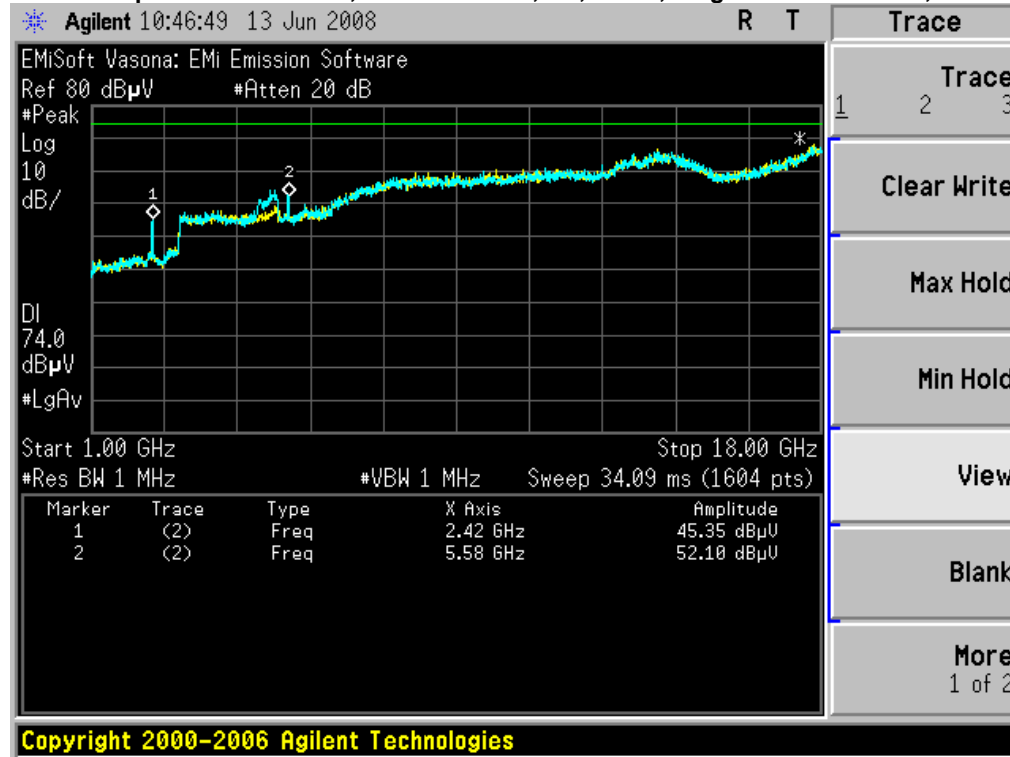


**Radiated Spurious Emissions, 2412/2432 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak**

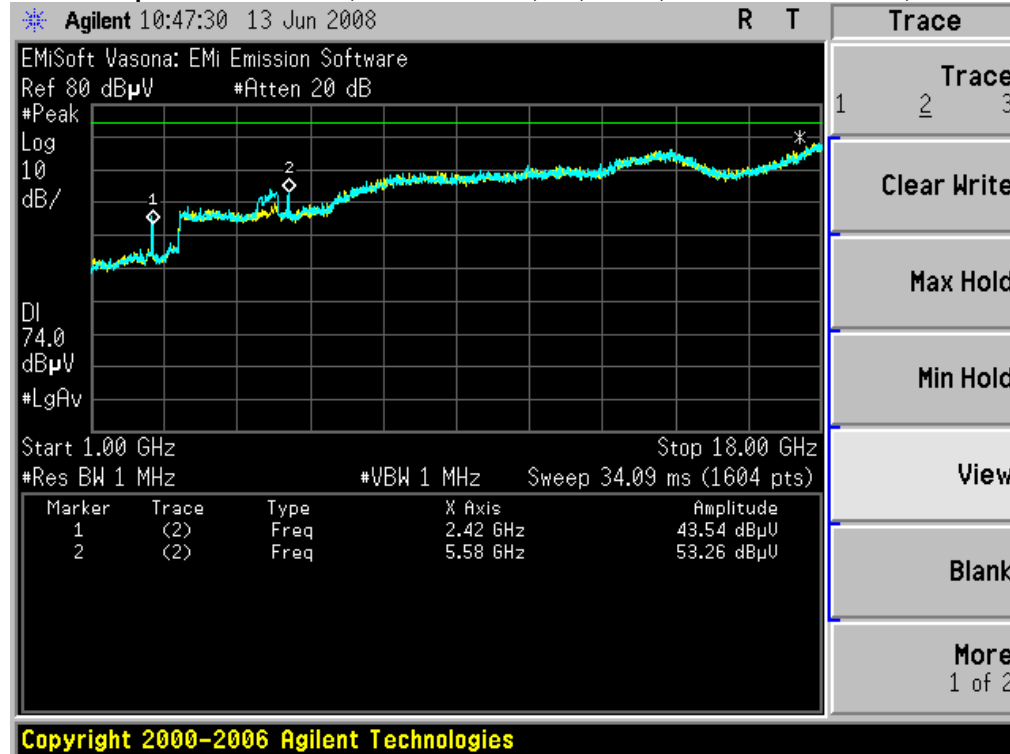




**Radiated Spurious Emissions, 2412/2432 MHz, M7, HT-40, Single Transmit Paths, Peak**

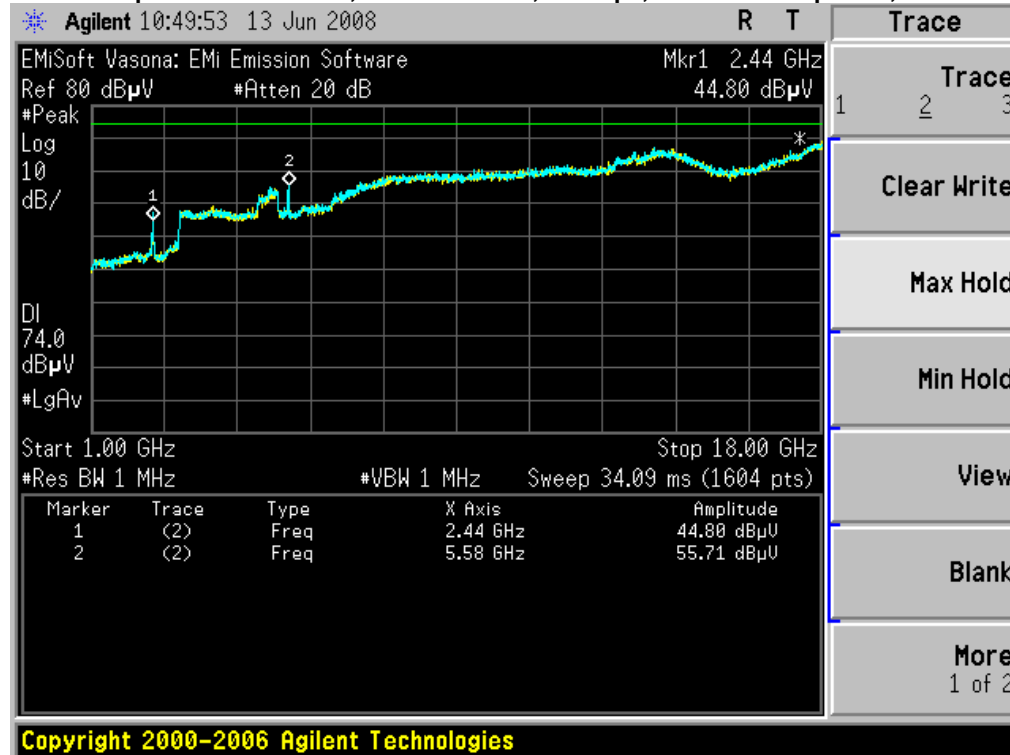


**Radiated Spurious Emissions, 2412/2432 MHz, M7, HT-40, Dual Transmit Paths, Peak**

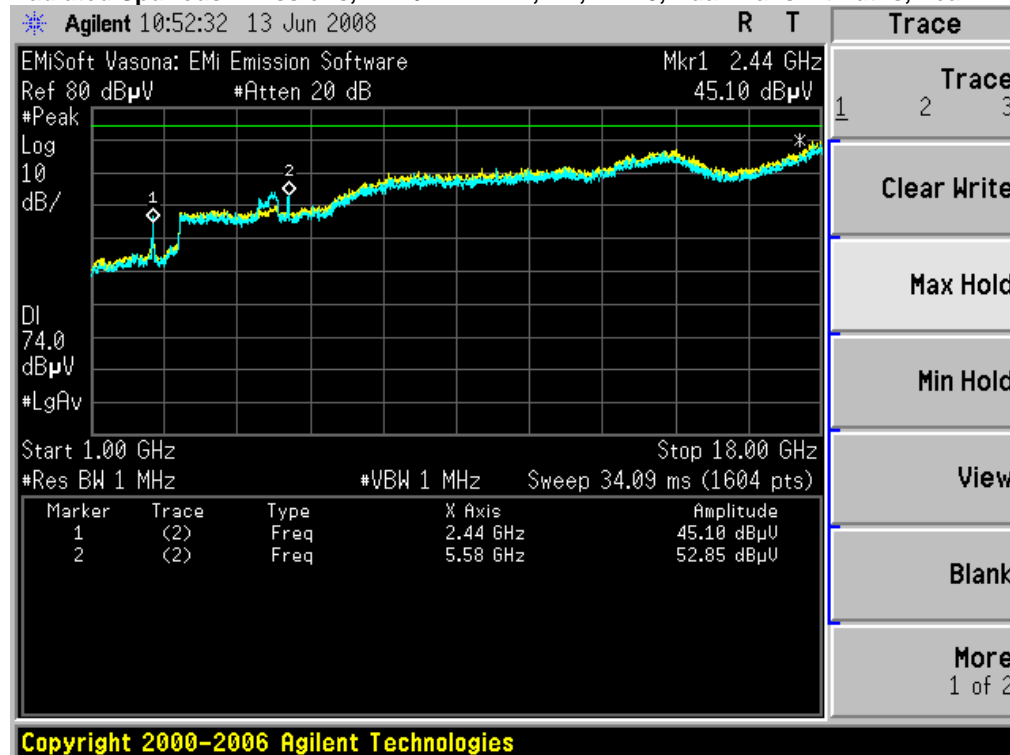




**Radiated Spurious Emissions, 2427/2447 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak**

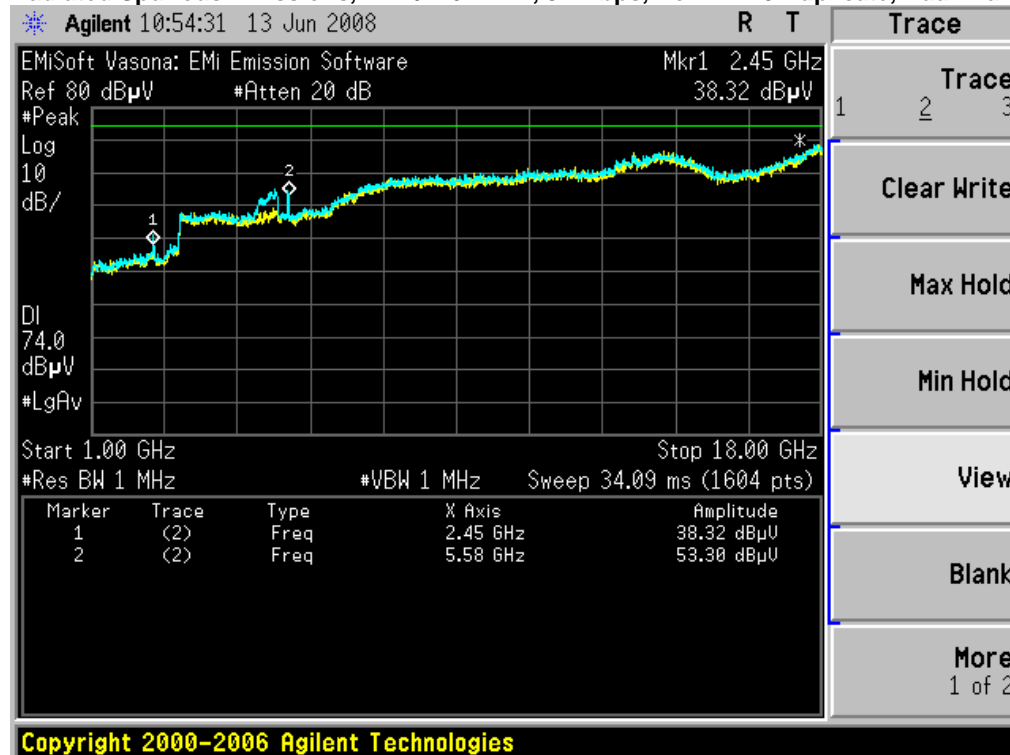


**Radiated Spurious Emissions, 2427/2447 MHz, M7, HT-40, Dual Transmit Paths, Peak**

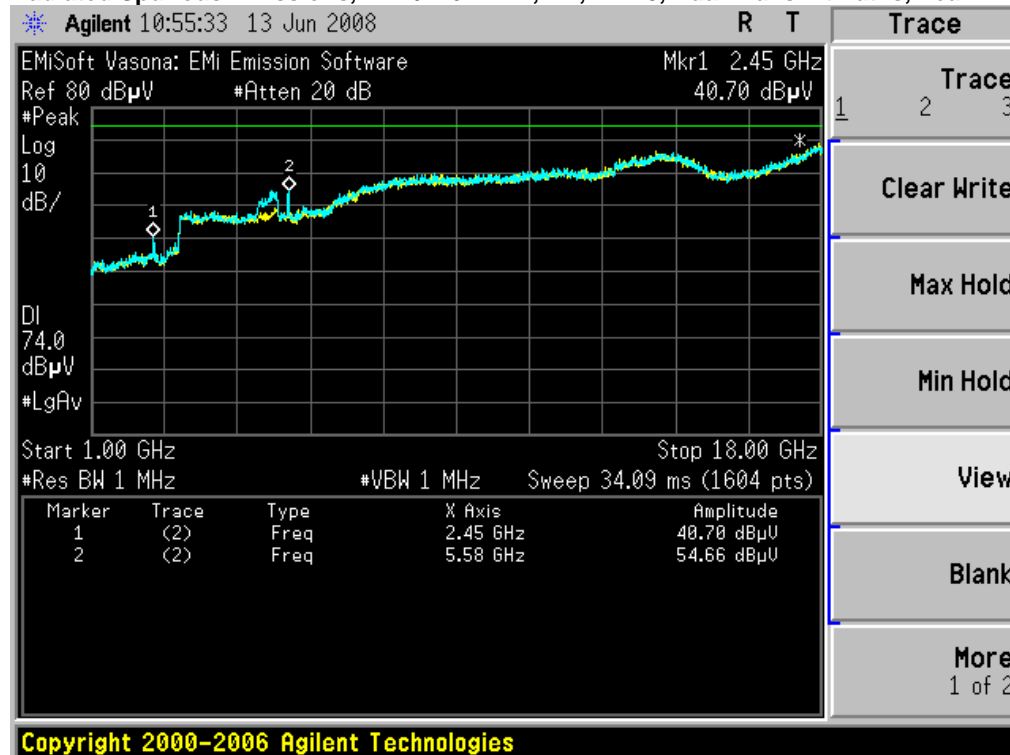


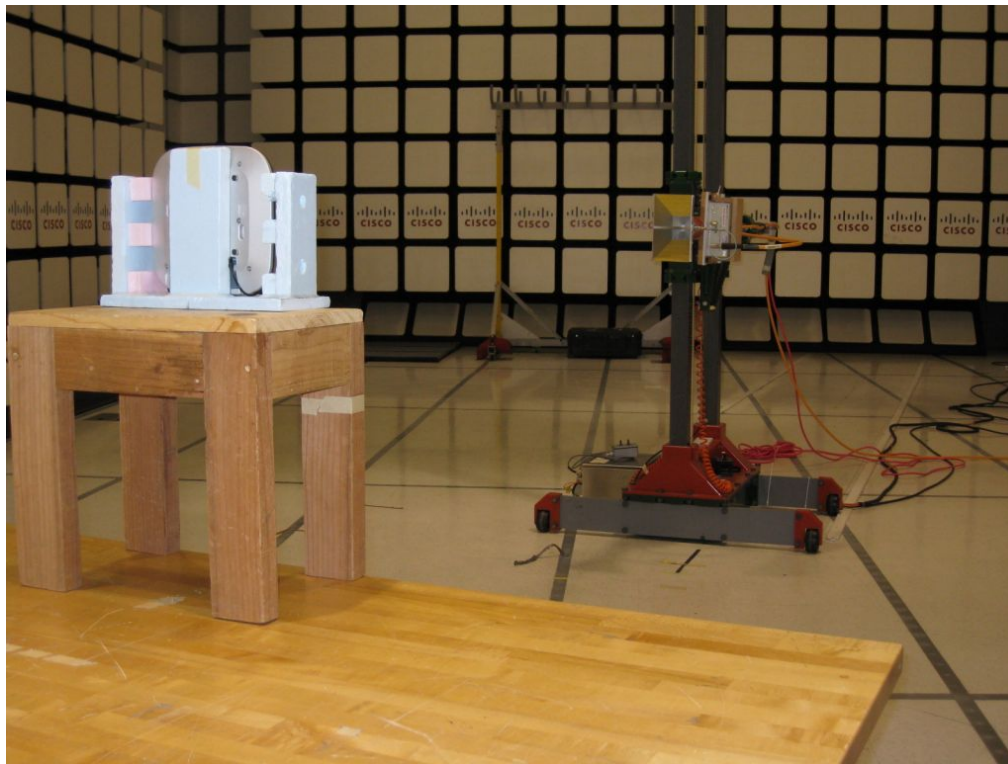


**Radiated Spurious Emissions, 2442/2462 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak**



**Radiated Spurious Emissions, 2442/2462 MHz, M7, HT-40, Dual Transmit Paths, Peak**



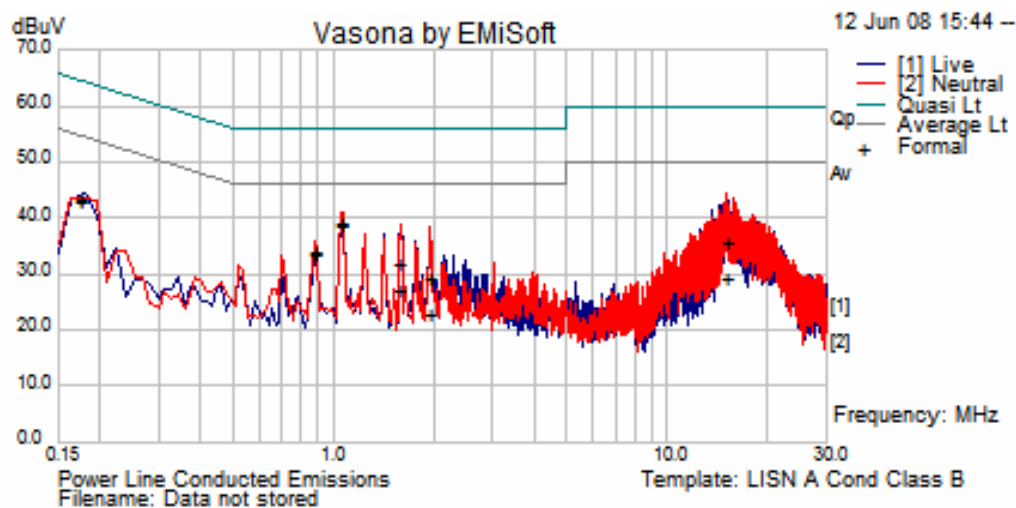


**Title:** Radiated Test Setup

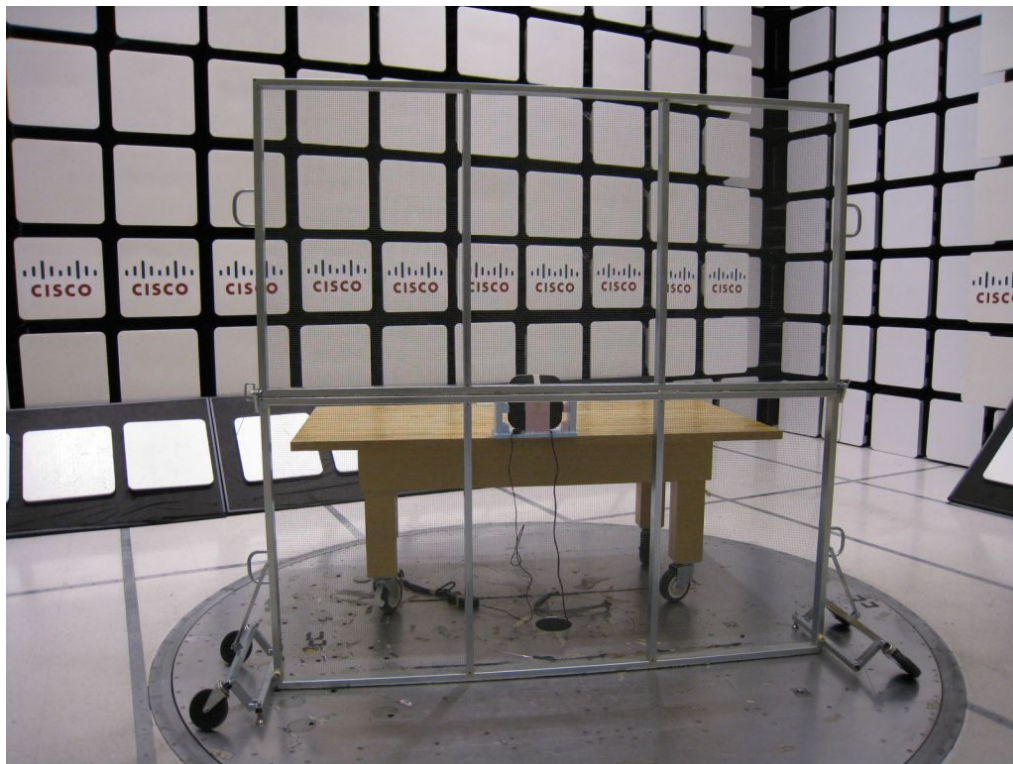
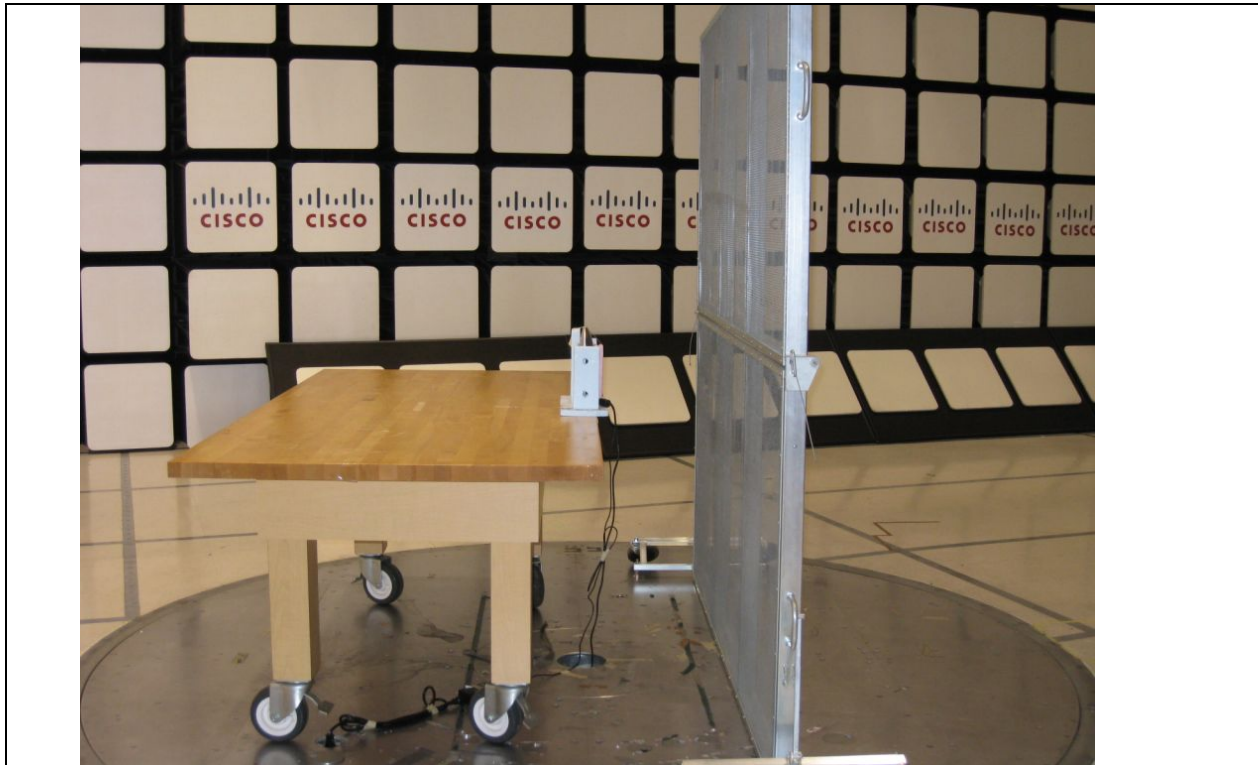




### Conducted emissions



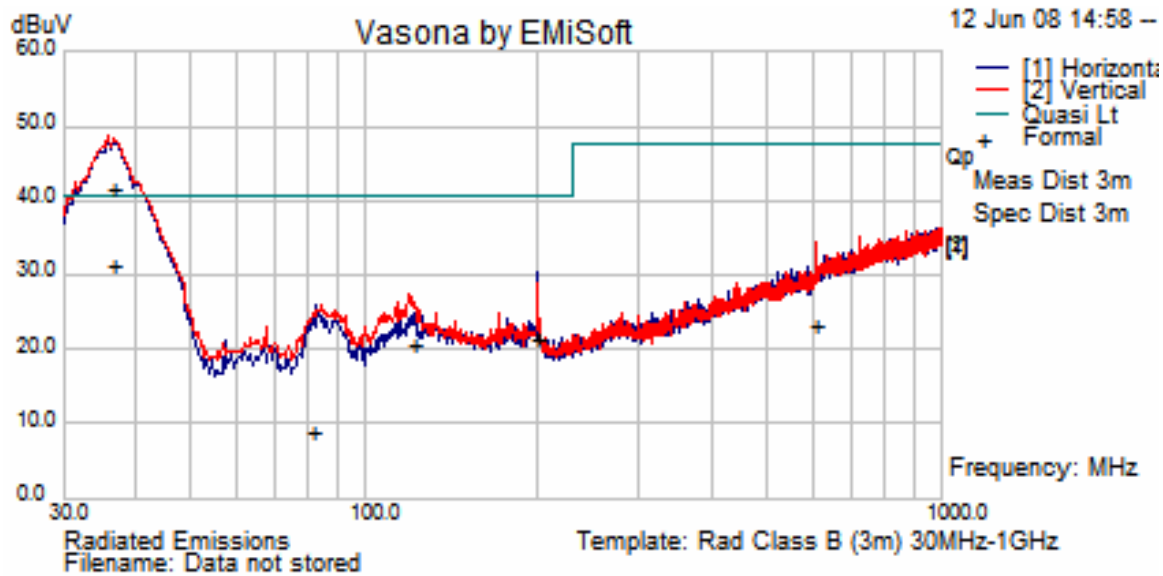
Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail
0.178	20.32	20.41	0.18	40.91	Average	Neutral	54.58	-13.66	Pass
0.178	20.69	20.41	0.18	41.28	Quasi Peak	Neutral	64.58	-23.29	Pass
0.889	11.71	19.96	0.08	31.75	Quasi Peak	Neutral	56	-24.25	Pass
0.889	11.51	19.96	0.08	31.55	Average	Neutral	46	-14.45	Pass
1.068	16.32	19.95	0.09	36.36	Average	Neutral	46	-9.64	Pass
1.068	16.79	19.95	0.09	36.83	Quasi Peak	Neutral	56	-19.17	Pass
1.602	9.74	19.95	0.09	29.78	Quasi Peak	Neutral	56	-26.22	Pass
1.602	4.85	19.95	0.09	24.89	Average	Neutral	46	-21.11	Pass
1.96	0.48	19.95	0.09	20.52	Average	Neutral	46	-25.48	Pass
1.96	7.15	19.95	0.09	27.19	Quasi Peak	Neutral	56	-28.81	Pass
15.163	13.21	20.23	0.14	33.58	Quasi Peak	Neutral	60	-26.42	Pass
15.163	6.59	20.23	0.14	26.96	Average	Neutral	50	-23.04	Pass



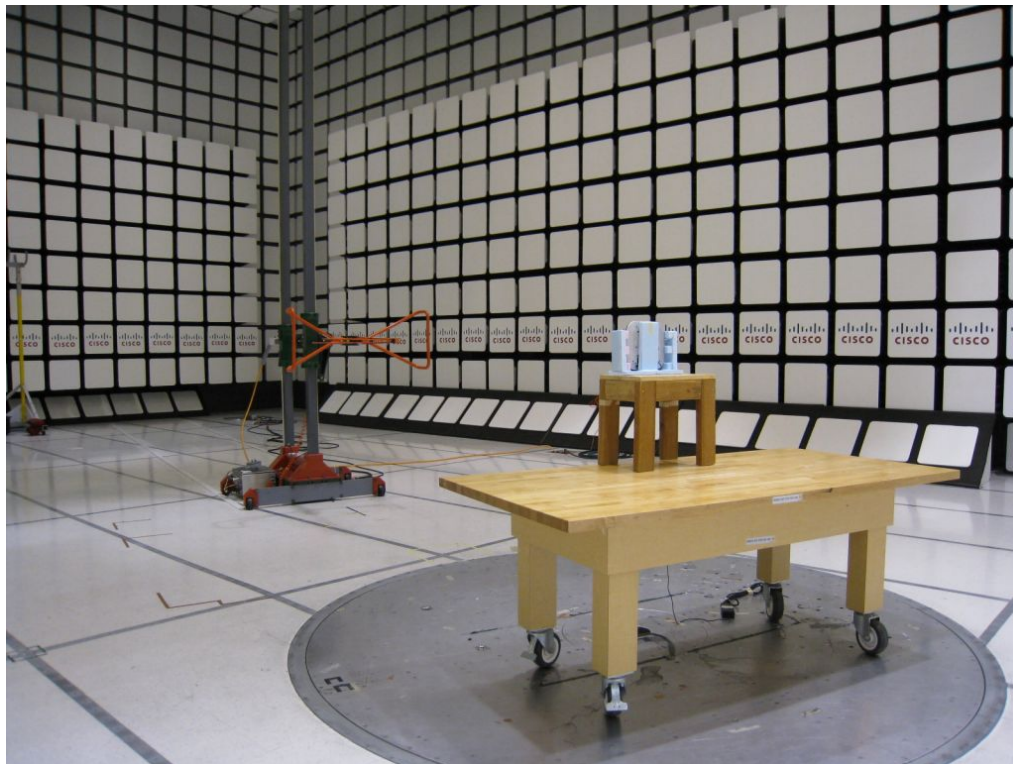
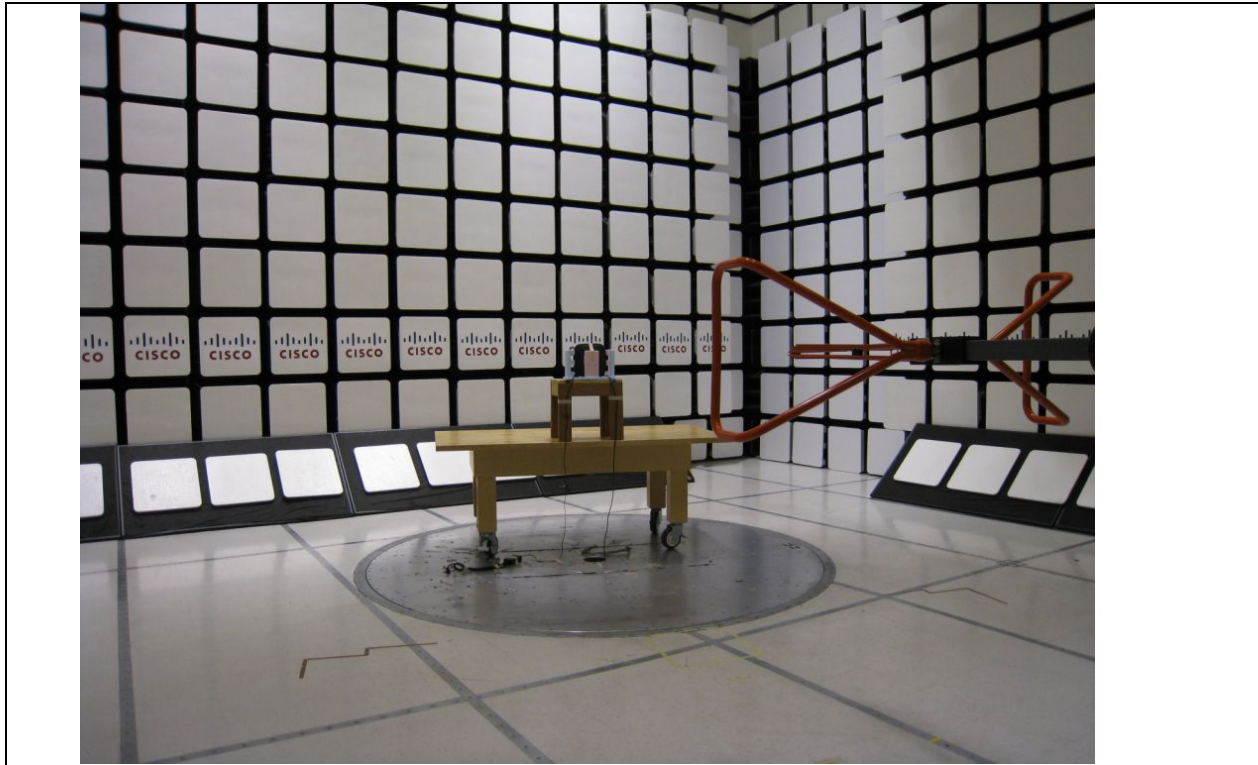
**Title:** Conducted Power Line Emissions



### Radiated emissions



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail
36.913	13.4	0.4	15.7	29.43	Quasi Peak	H	220	282	40.5	-11.1	Pass
36.915	23.8	0.4	15.7	39.85	Quasi Peak	V	180	282	40.5	-0.7	Pass
82.382	-1.1	0.7	7.4	6.88	Quasi Peak	V	240	4	40.5	-33.6	Pass
199.992	5.8	1	12.7	19.54	Quasi Peak	V	105	158	40.5	-21	Pass
122.313	4.23	0.78	13.95	18.95	Quasi Peak	V	125	162	40.5	-21.55	Pass
609.099	0.79	1.74	18.86	21.39	Quasi Peak	V	100	298	47.5	-26.11	Pass



**Title:** Radiated Emissions 30M-1GHZ

## 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 (9dBi 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	21.9	4	<b>5.56</b>	20	14.44
2437	11	1	23.8	4	<b>6.92</b>	20	13.08
2462	11	1	20.2	4	<b>4.57</b>	20	15.43
2412	54	1	16.9	4	<b>3.13</b>	20	16.87
2437	54	1	20.0	4	<b>4.47</b>	20	15.53
2462	54	1	17.0	4	<b>3.16</b>	20	16.84

**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	21.9	4	<b>0.08</b>	1	0.92
2437	11	20	23.8	4	<b>0.12</b>	1	0.88
2462	11	20	20.2	4	<b>0.05</b>	1	0.95
2412	54	20	16.9	4	<b>0.02</b>	1	0.98
2437	54	20	20.0	4	<b>0.05</b>	1	0.95
2462	54	20	17.0	4	<b>0.03</b>	1	0.97

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

Equip #	Manufacturer	Model	Description	Last Cal	Next Due
CIS040503	Agilent	E4440A	Precision Spectrum Analyzer	20-Mar-08	20-Mar-09
CIS005568	HP	8449B	PreAmplifier (1-26.5GHz)	6-Sep-07	6-Sep-08
CIS020975	Micro-Coax	UFB311A-0-1344-520520	RF Coaxial Cable, to 18GHz, 134.4 in	15-Mar-08	15-Mar-09
CIS030559	Micro-Coax	UFB311A-1-0950-504504	RF Coaxial Cable, to 18GHz, 95 in	12-Mar-08	12-Mar-09
CIS004883	EMC Test Systems	3115	Double Ridged Guide Horn Antenna	11-Mar-08	11-Mar-09
CIS034188	Micro-Tronics	BRC50703-02	Notch Filter, SB:5.150-5.350GHz, to 11GHz	16-Jul-07	16-Jul-08
CIS035605	Micro-Tronics	BRC50704-02	Notch Filter, SB:5.470-5.725GHz, to 12GHz	16-Jul-07	16-Jul-08
CIS037228	Micro-Tronics	BRC50705	Notch Filter, SB:5.725-5.875GHz, to 12 GHz	10-Mar-08	10-Mar-09
CIS034304	Micro-Tronics	BRM50702-02	Notch Filter, SB:2.4-2.5GHz, to 18GHz	16-Jul-07	16-Jul-08
CIS034975	Midwest Microwave	ATT-0640-20-29M-02	Attenuator, 20dB, DC-40GHz	15-May-08	15-May-09
CIS030652	Sunol Sciences	JB1	Combination Antenna, 30MHz-2GHz	16-Jul-07	16-Jul-08
CIS005691	Miteq	NSP1800-25-S1	Broadband Preamplifier (1-18GHz)	9-Oct-07	9-Oct-08
CIS008375	Andrew	F4A-PNMNM	49 ft Heliac Cable	15-Mar-08	15-Mar-09
CIS030559	Micro-Coax	UFB311A-1-0950-504504	RF Coaxial Cable, to 18GHz, 95 in	12-Mar-08	12-Mar-09
CIS008195	TTE	H613-150K-50-21378	Hi Pass Filter - 150KHz cutoff	31-Dec-07	31-Dec-08
CIS008588	Fischer	FCC-RFM2F-520R	LISN AC Adaptor - Std 120V outlet	15-Mar-08	15-Mar-09
COM000590	Agilent	E4448A	Spectrum Analyzer	2-Feb-05	2-Feb-07
COM000601	Agilent	E4417A	EPM-P Series Power Meter	5-Mar-08	5-Mar-09
COM000602	Agilent	E9327A	Peak and Average Power Sensor	6-Mar-08	6-Mar-09