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Test Report

AIR-LAP1142N-A-K9

Cisco Aironet 802.11n Draft 2.0 Dual Band Access Point

5250-5350, 5470-5725 MHz

FCC ID: LDK102070, IC: 2461B-102070

Against the following Specifications:

CFR47 Part 15.407

RSS210

Cisco Systems

170 West Tasman Drive

San Jose, CA 95134

Author: James Nicholson

Approved By:

Title:

This report replaces any previously entered test report under EDCS - 674054

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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 15.407 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 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 (be sure to 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
5260	Non HT-20 Beam Forming	54	17	17	20	**20.5**
5320	HT-20	M7	16	16	19	**18.6**
5320	Non HT-20 Beam Forming	54	16	16	19	**19.2**
5500	Non HT-20 Beam Forming	54	17	17	20	**20.3**
5580	Non HT-20 Beam Forming	54	17	17	20	**20.5**
5700	Non HT-20 Beam Forming	54	17	17	20	**20.5**
5260/5280	Non HT-40 Duplicate	54	17	17	20	**20.0**
5260/5280	HT-40	M7	17	17	20	**19.7**
5280/5320	Non HT-40 Duplicate	54	13	13	16	**16.0**
5280/5320	HT-40	M7	14	14	17	**17.4**
5500/5520	Non HT-40 Duplicate	54	13	13	16	**15.9**
5500/5520	HT-40	M7	15	15	18	**18.4**
5540/5560	Non HT-40 Duplicate	54	17	17	20	**20.2**
5540/5560	HT-40	M7	17	17	20	**20.2**
5660/5680	Non HT-40 Duplicate	54	17	17	20	**20.4**
5660/5680	HT-40	M7	17	17	20	**20.1**

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)
5260	Non HT-20 Beam Forming	54	23.5	16.7
5320	HT-20	M7	24.6	17.9
5320	Non HT-20 Beam Forming	54	20.4	16.6
5500	Non HT-20 Beam Forming	54	21.9	16.6
5580	Non HT-20 Beam Forming	54	23.1	16.7
5700	Non HT-20 Beam Forming	54	24.1	16.7
5260/5280	Non HT-40 Duplicate	54	76.1	36.8
5260/5280	HT-40	M7	51.5	36.3
5280/5320	Non HT-40 Duplicate	54	40.7	36.4
5280/5320	HT-40	M7	40.0	36.2
5500/5520	Non HT-40 Duplicate	54	40.9	36.4
5500/5520	HT-40	M7	40.1	36.3
5540/5560	Non HT-40 Duplicate	54	70.7	36.8
5540/5560	HT-40	M7	53.1	36.2
5660/5680	Non HT-40 Duplicate	54	76.1	37.0
5660/5680	HT-40	M7	58.9	36.3

99%/26 dB Bandwidth, 5260 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths
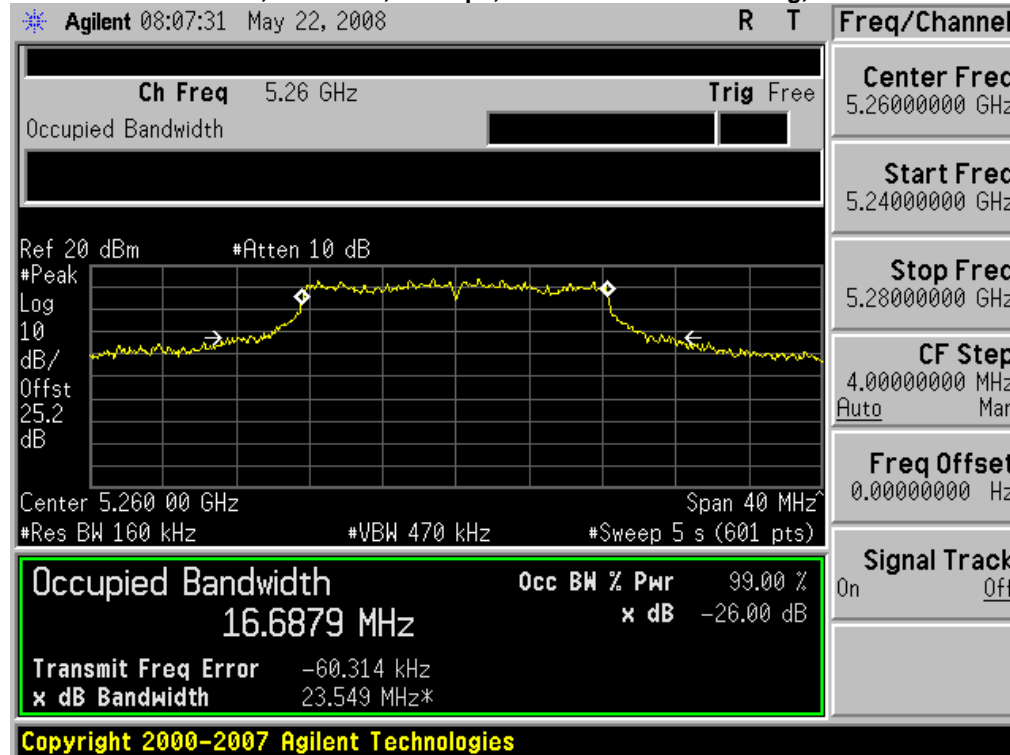
99%/26 dB Bandwidth, 5320 MHz, M7, HT-20, Dual Transmit Path
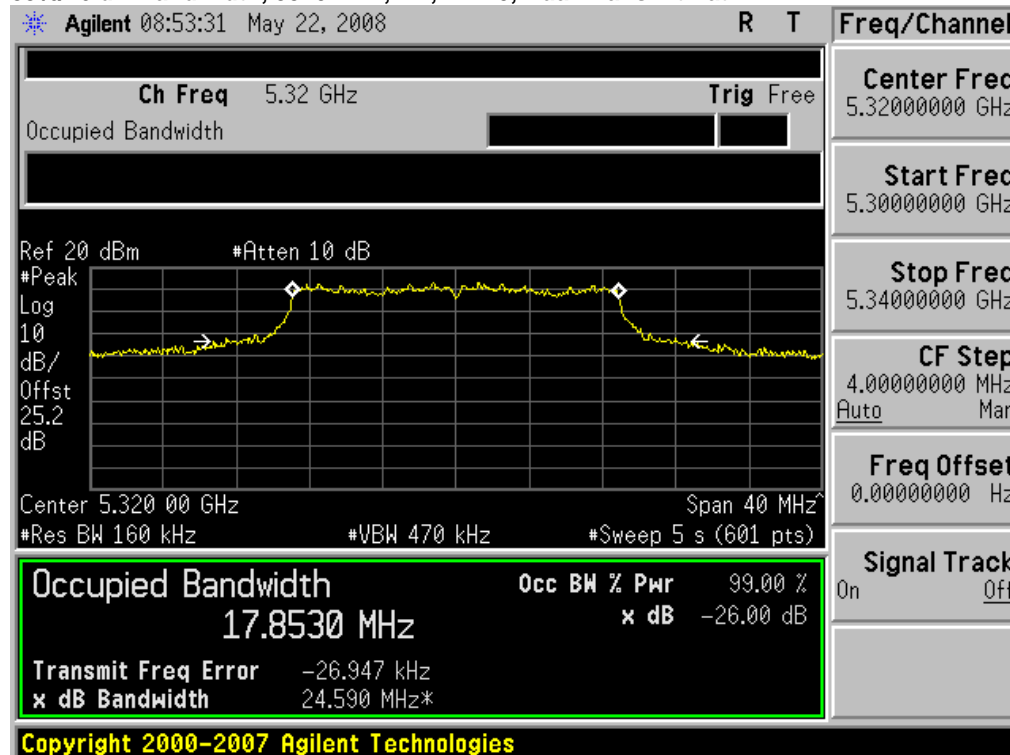
99%/26 dB Bandwidth, 5320 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths
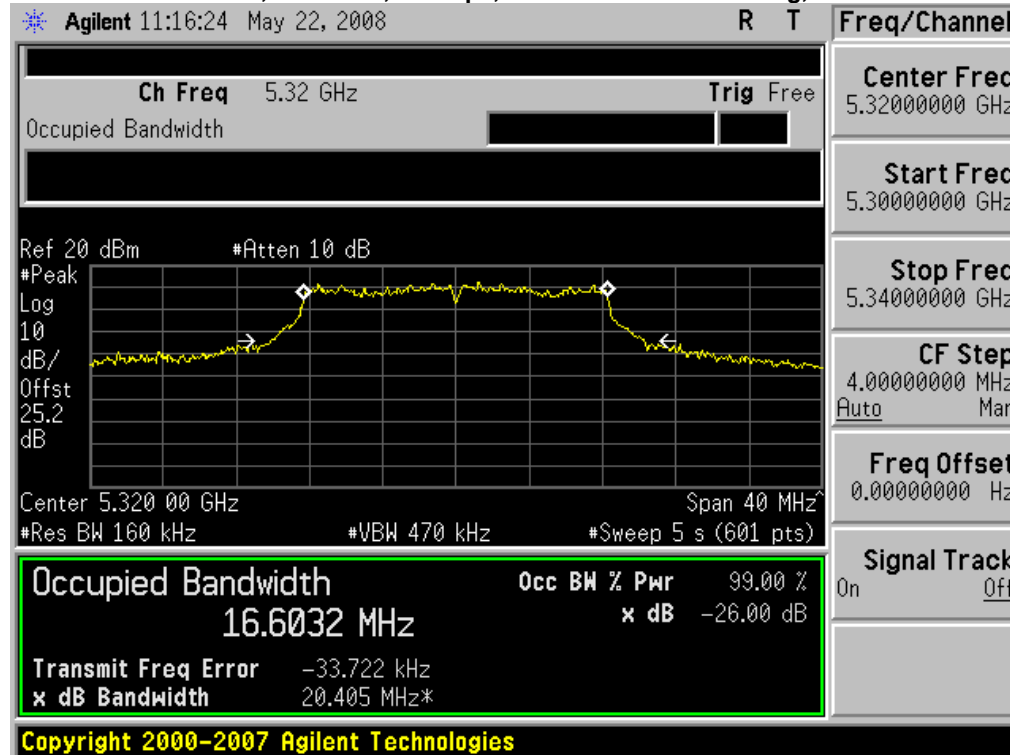
99%/26 dB Bandwidth, 5500 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths
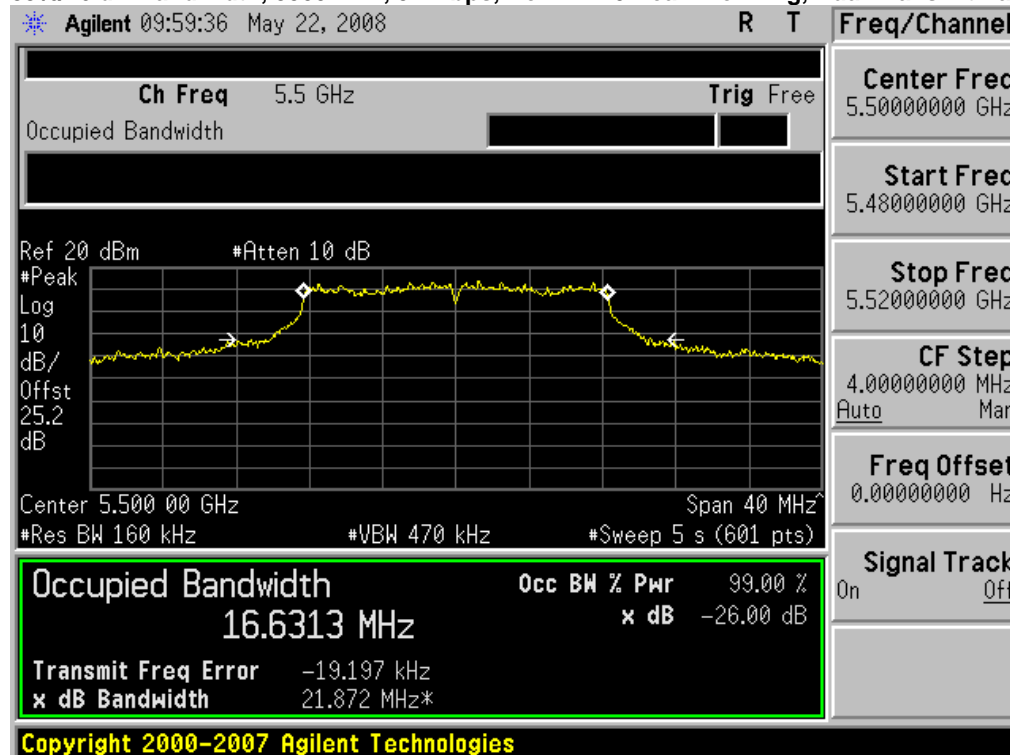
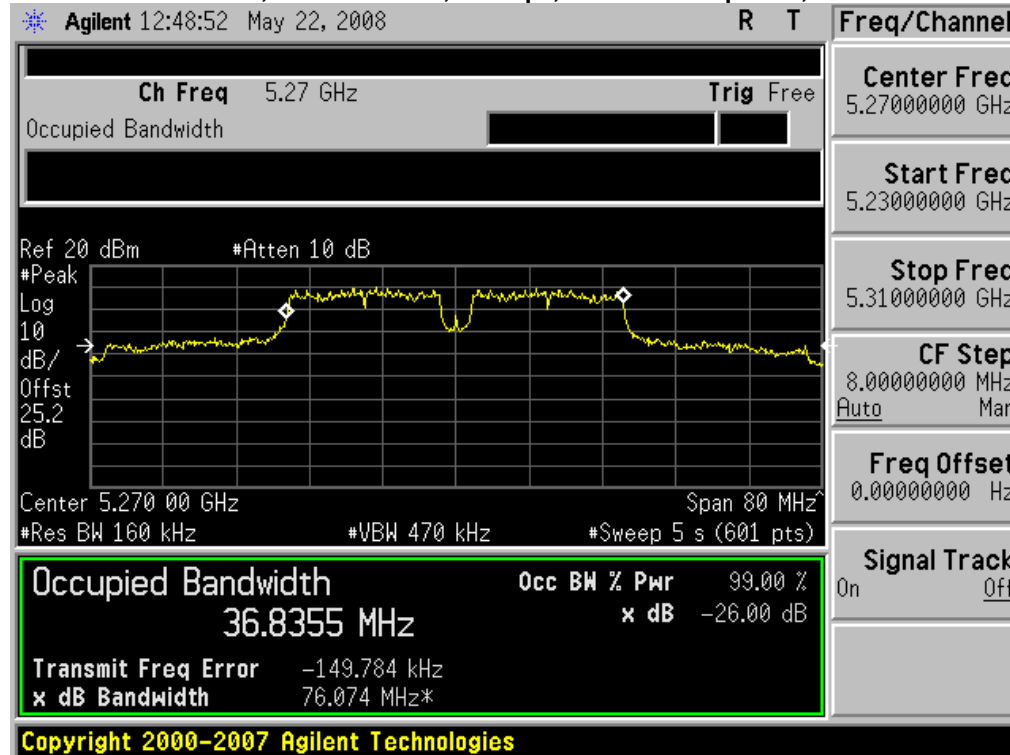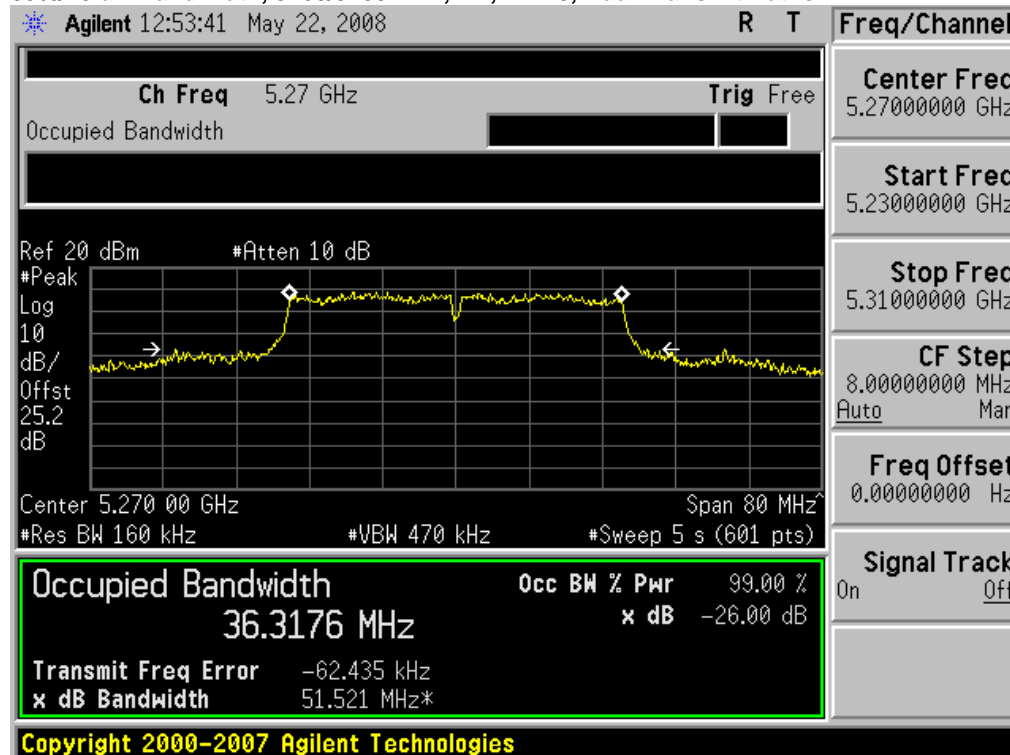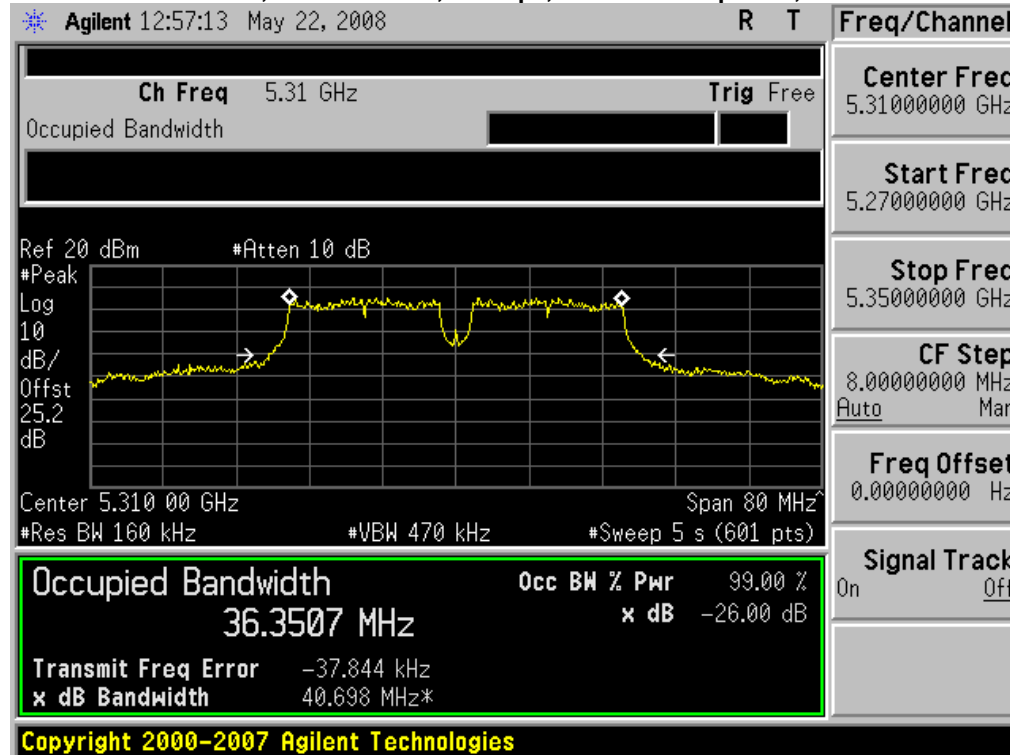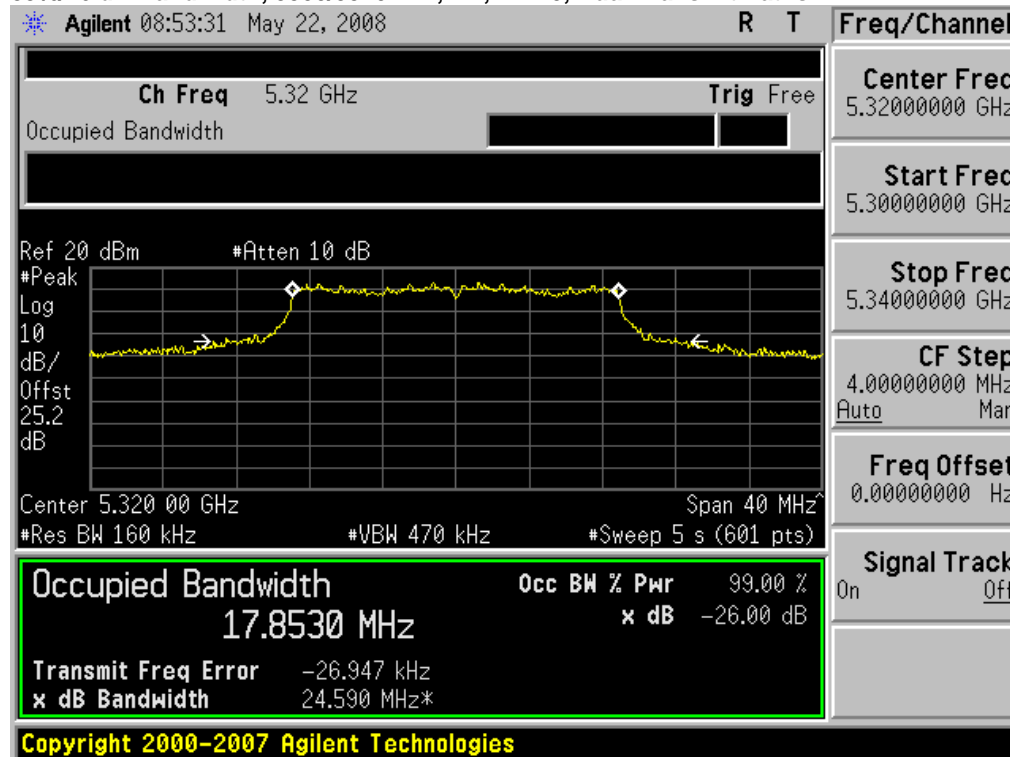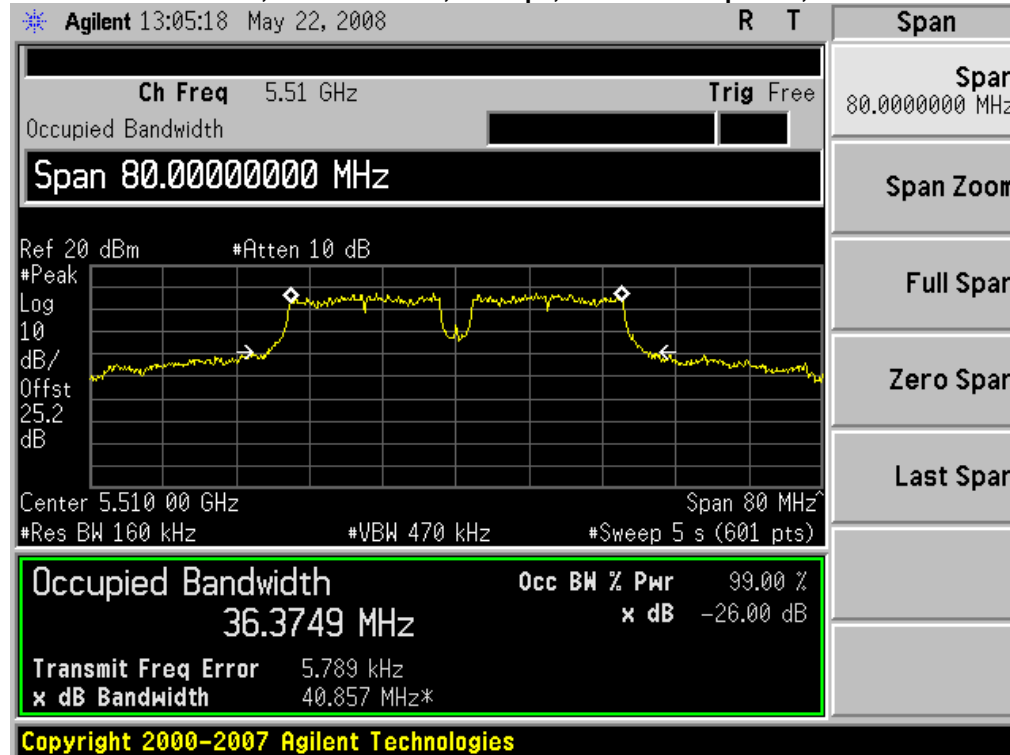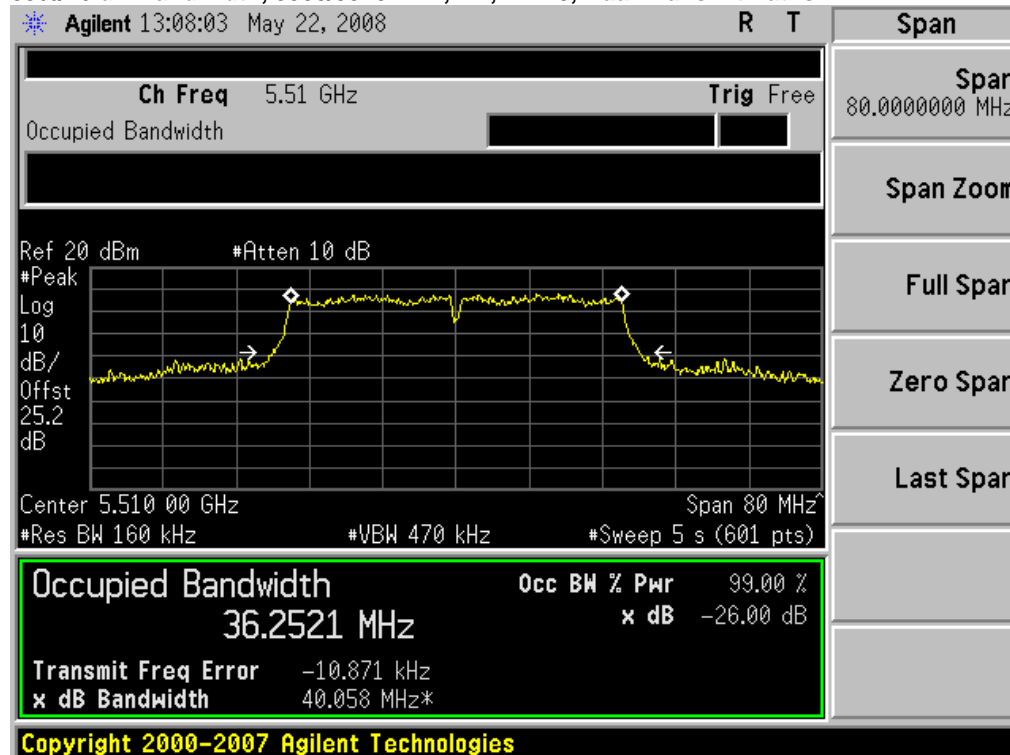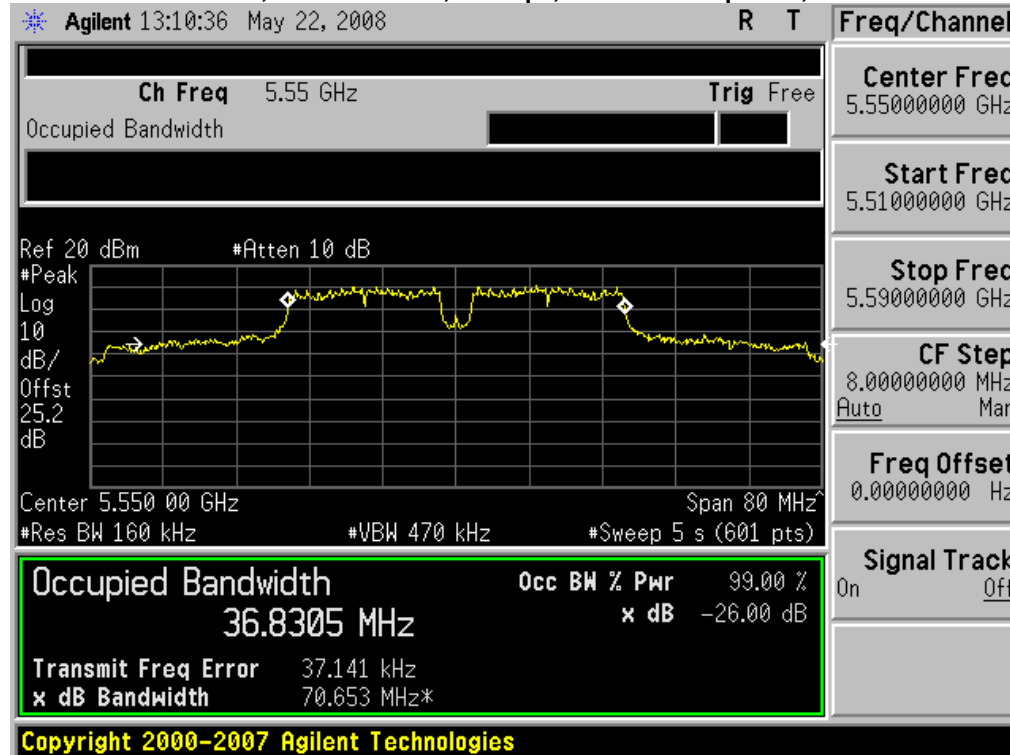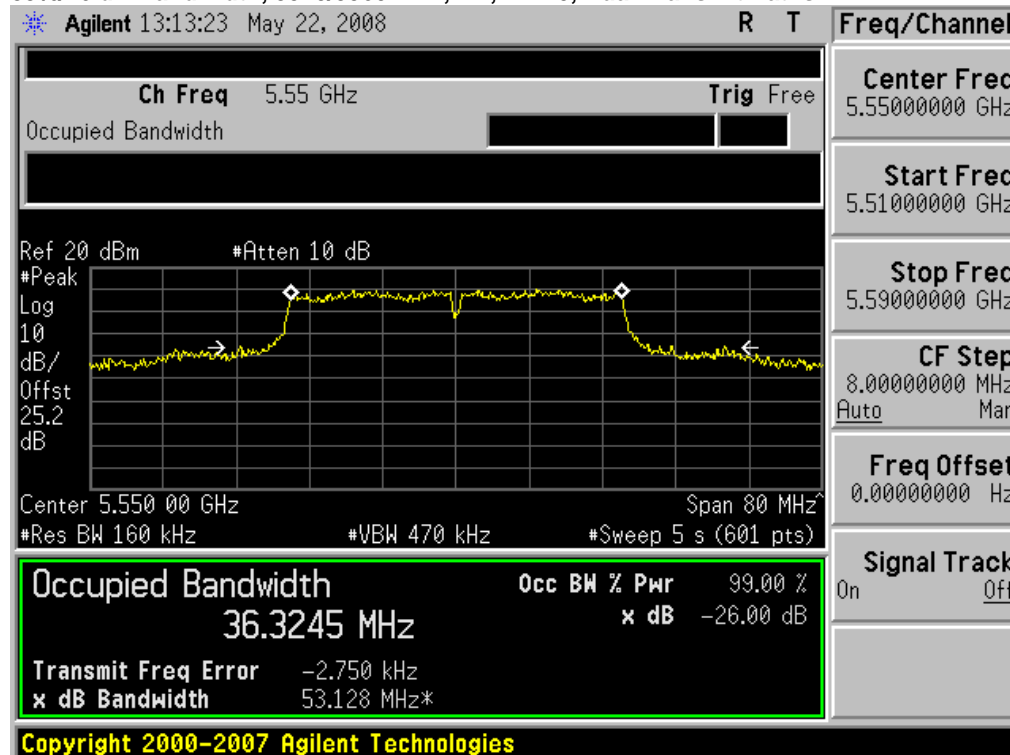**99%/26 dB Bandwidth, 5580 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**
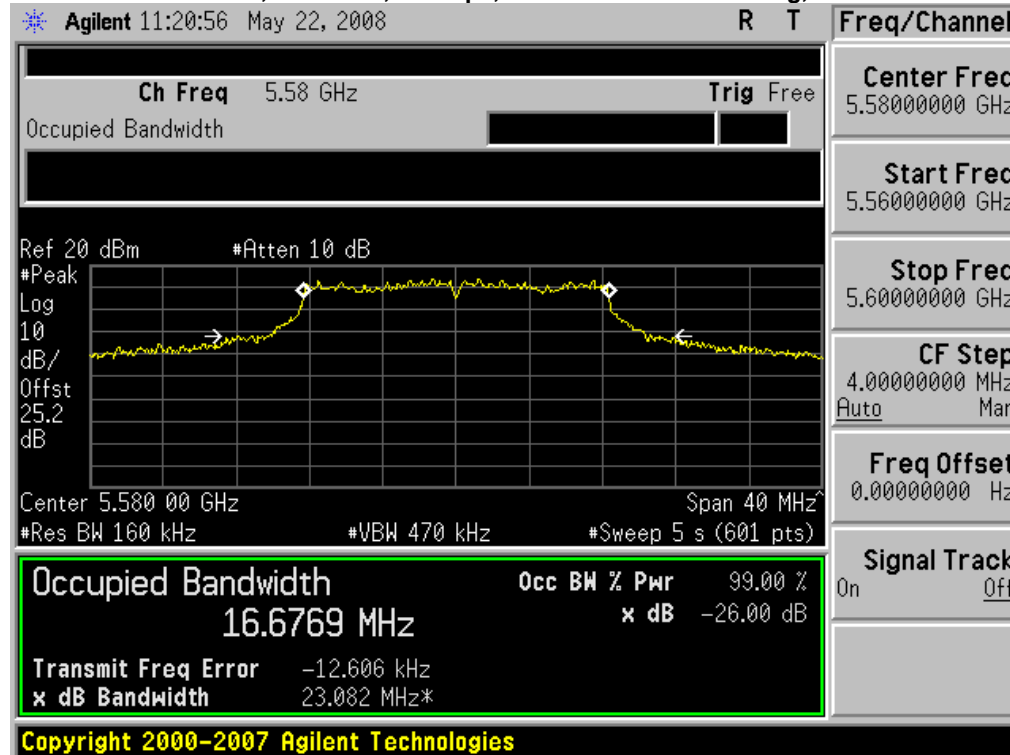
99%/26 dB Bandwidth, 5700 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths

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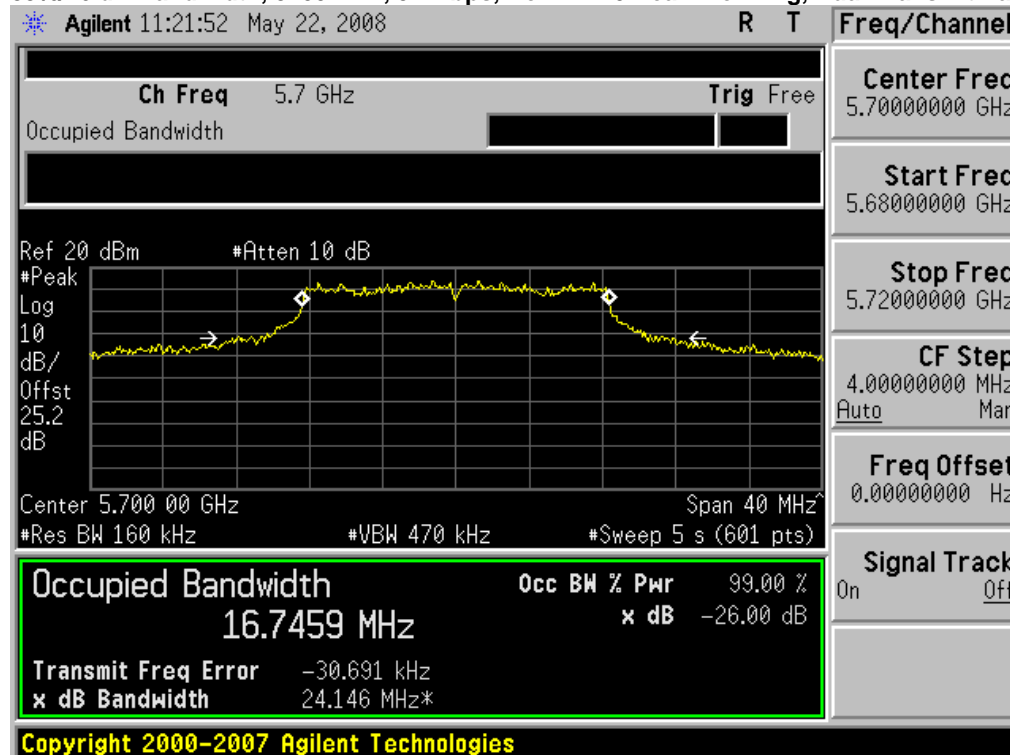
99%/26 dB Bandwidth, 5260/5280 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

99%/26 dB Bandwidth, 5260/5280 MHz, M7, HT-40, Dual Transmit Paths

**99%/26 dB Bandwidth, 5300/5320MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**

99%/26 dB Bandwidth, 5300/5320MHz, M7, HT-40, Dual Transmit Paths

99%/26 dB Bandwidth, 5500/5520 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

99%/26 dB Bandwidth, 5500/5520 MHz, M7, HT-40, Dual Transmit Paths

99%/26 dB Bandwidth, 5540/5560 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

99%/26 dB Bandwidth, 5540/5560 MHz, M7, HT-40, Dual Transmit Paths

99%/26 dB Bandwidth, 5660/5680 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths
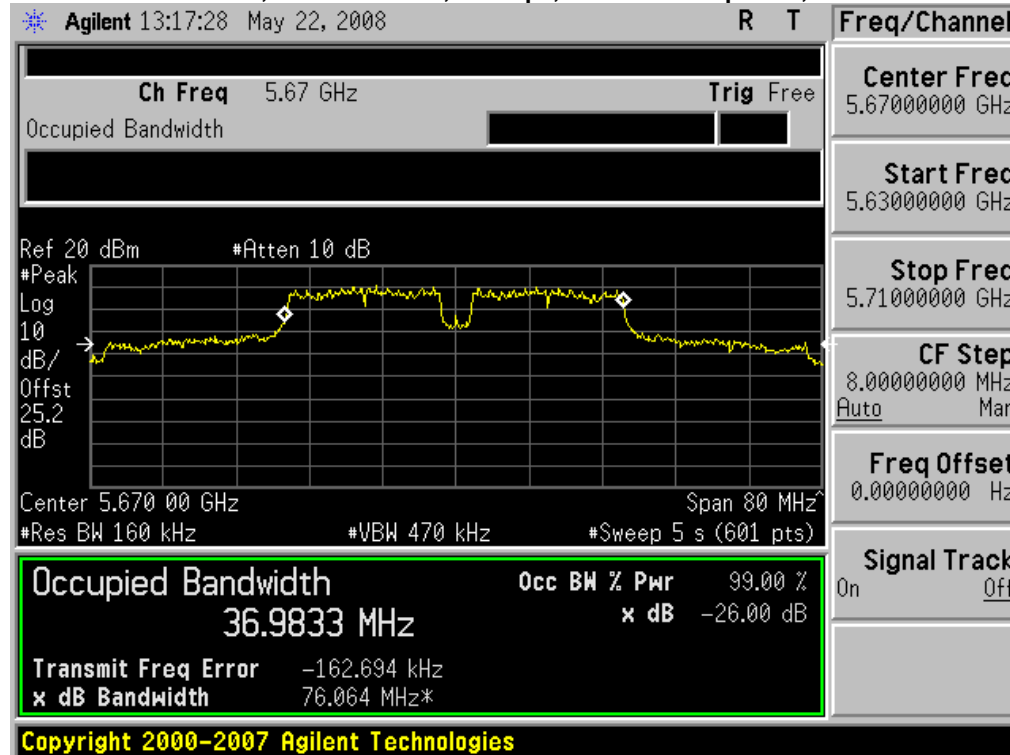
99%/26 dB Bandwidth, 5660/5680 MHz, M7, HT-40, Dual Transmit Paths
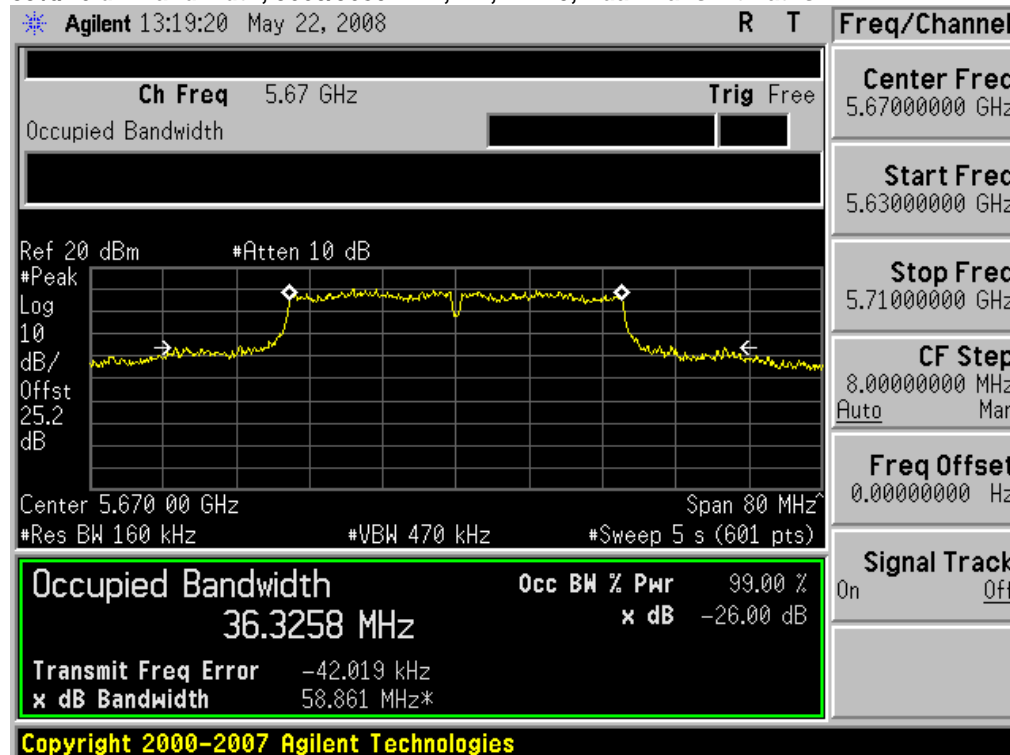
Peak Output Power

15.407: For the bands 5.25-5.35 and 5.47-5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. 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 smallest 26dB bandwidth for all channels is 20.4 MHz. The maximum conducted output power is calculated as 11dBm+10*log(20.4MHz) = 24dBm

The maximum supported antenna gain for all bands is 3dBi. In beamforming mode, the 3dBi behaves as 3dBi+10log(n) (n=2 radiating elements) = 6dBi.Therefore the maximum allowable output power requires no reduction in beam forming mode.

Power Spectral Density

15.407: For the bands 5.25-5.35 and 5.47-5.725 GHz, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum supported antenna gain in beamforming mode is 6dBi. Therefore the maximum allowable peak power spectral density requires no reduction in beamforming 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. Perform a Marker Peak Search function, and record this value as the Power Spectral Density.

Frequency (MHz)	Mode	Data Rate (Mbps)	Peak Power (dBm)	Limit (dBm)	Margin (dB)	PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
5260	Non HT-20 Beam Forming	54	**20.4**	24	3.6	**10.3**	11	0.7
5320	HT-20	M7	**18.6**	24	5.4	**8.1**	11	2.9
5320	Non HT-20 Beam Forming	54	**19.1**	24	4.9	**8.7**	11	2.3
5500	Non HT-20 Beam Forming	54	**20.8**	24	3.2	**10.9**	11	0.1
5580	Non HT-20 Beam Forming	54	**20.9**	24	3.1	**10.4**	11	0.6
5700	Non HT-20 Beam Forming	54	**20.8**	24	3.2	**10.6**	11	0.4
5260/5280	Non HT-40 Duplicate	54	**19.5**	24	4.5	**6.3**	11	4.7
5260/5280	HT-40	M7	**19.2**	24	4.8	**5.5**	11	5.5
5280/5320	Non HT-40 Duplicate	54	**16.0**	24	8.0	**2.8**	11	8.2
5280/5320	HT-40	M7	**16.9**	24	7.1	**3.3**	11	7.7
5500/5520	Non HT-40 Duplicate	54	**15.9**	24	8.1	**2.7**	11	8.3
5500/5520	HT-40	M7	**18.4**	24	5.6	**4.9**	11	6.1
5540/5560	Non HT-40 Duplicate	54	**20.6**	24	3.4	**7.1**	11	3.9
5540/5560	HT-40	M7	**20.1**	24	3.9	**6.5**	11	4.5
5660/5680	Non HT-40 Duplicate	54	**20.3**	24	3.7	**6.9**	11	4.1
5660/5680	HT-40	M7	**20.1**	24	3.9	**6.5**	11	4.5

Peak Power/PSD, 5260 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths
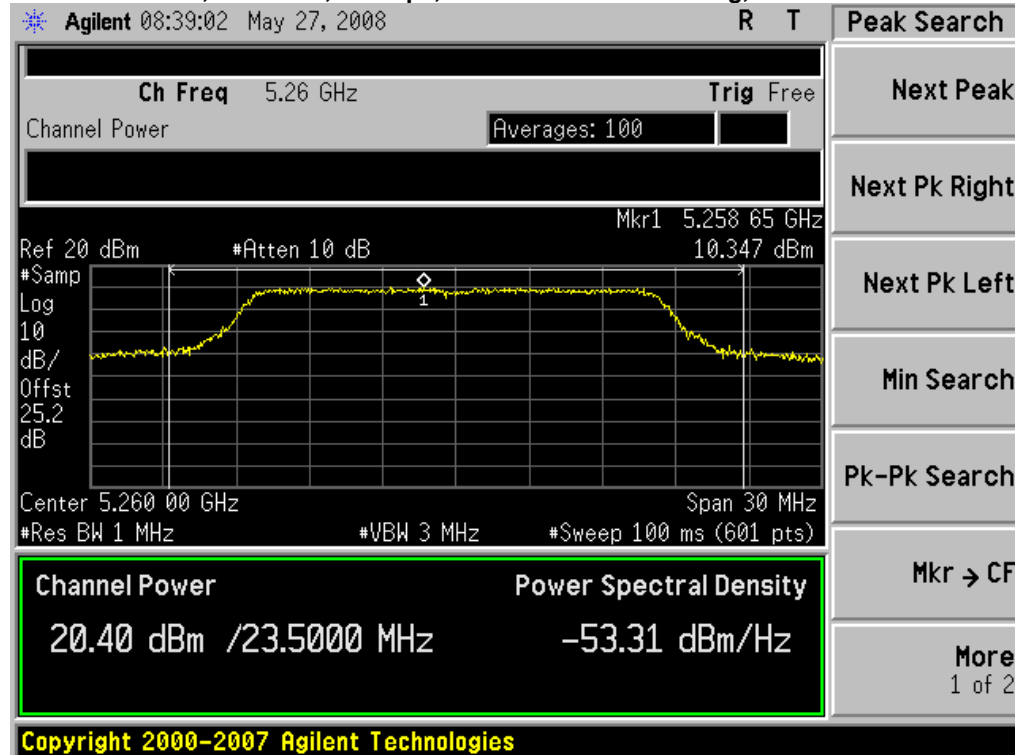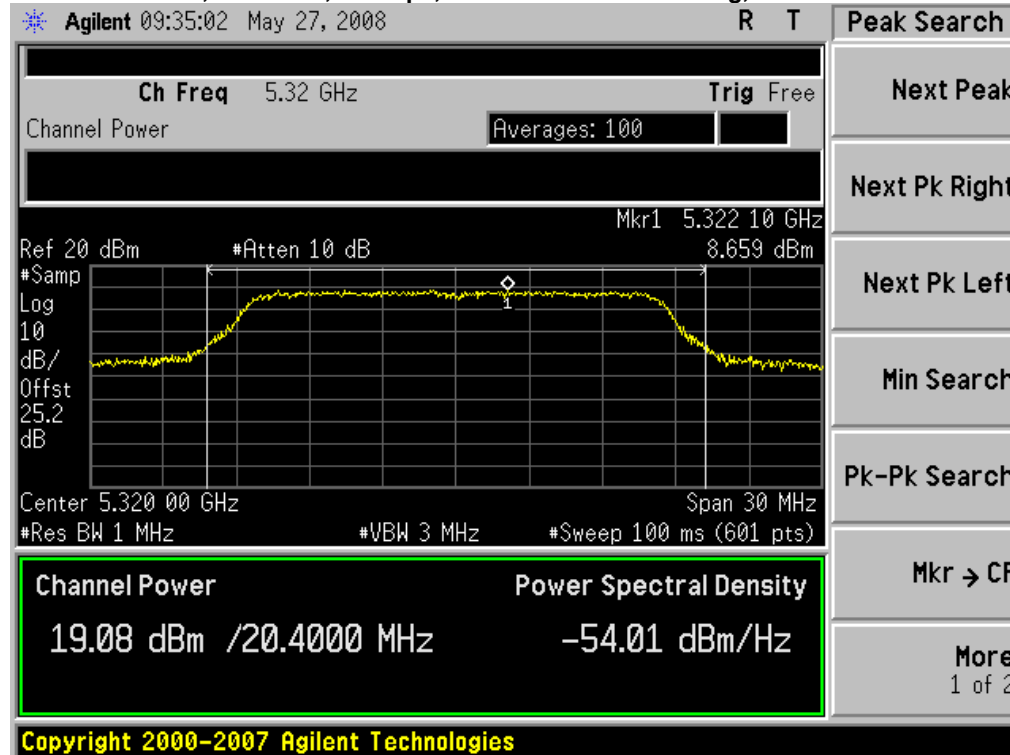

Peak Power/PSD, 5320 MHz, M7, HT-20, Dual Transmit Path
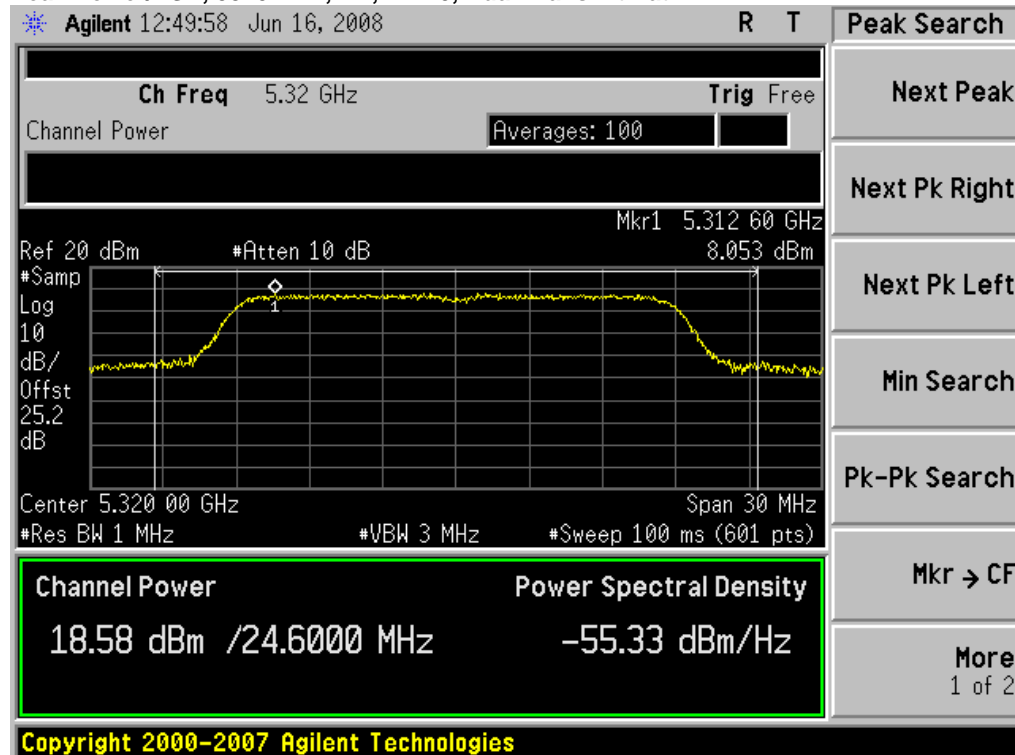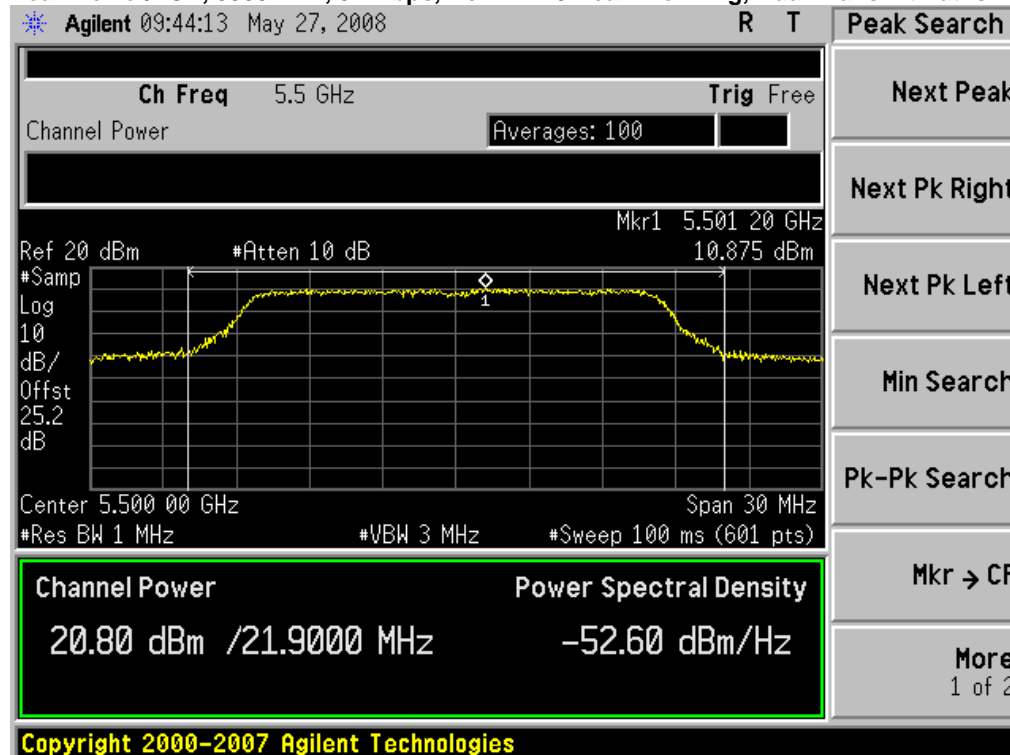
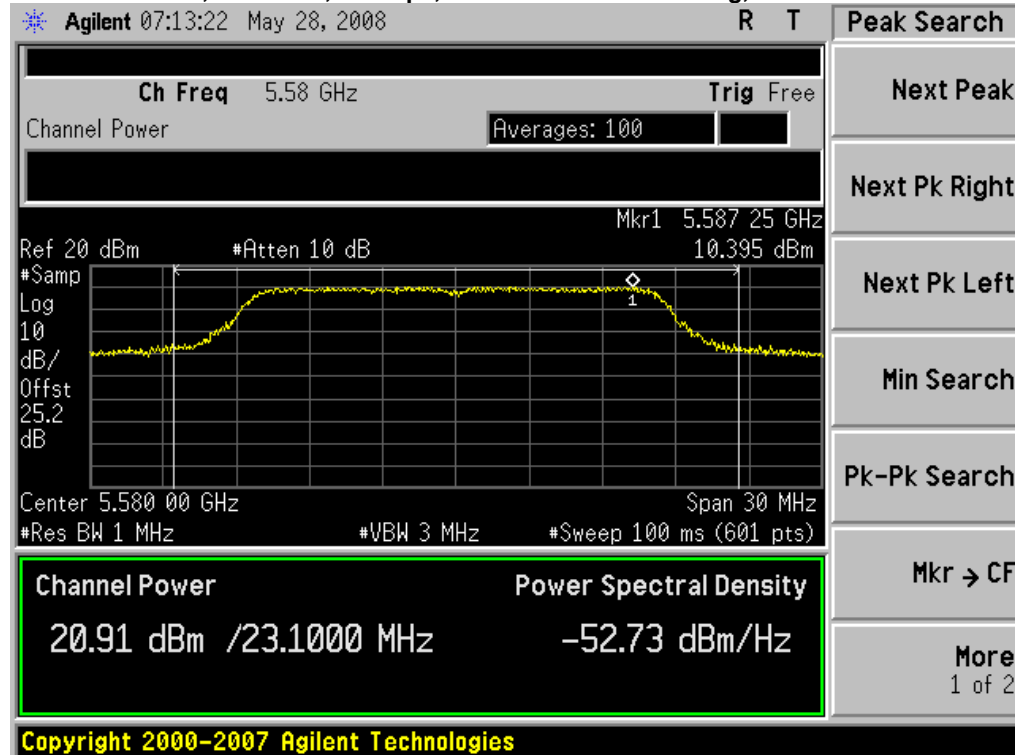**Peak Power/PSD, 5320 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

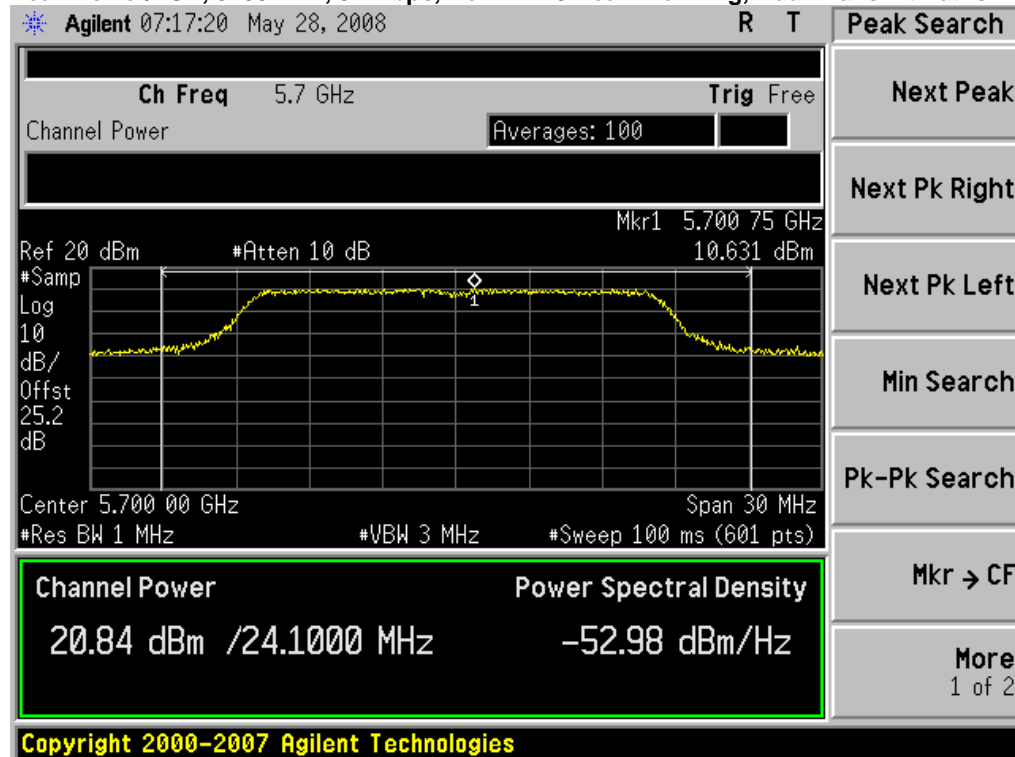**Peak Power/PSD, 5500 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

Peak Power/PSD, 5580 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths
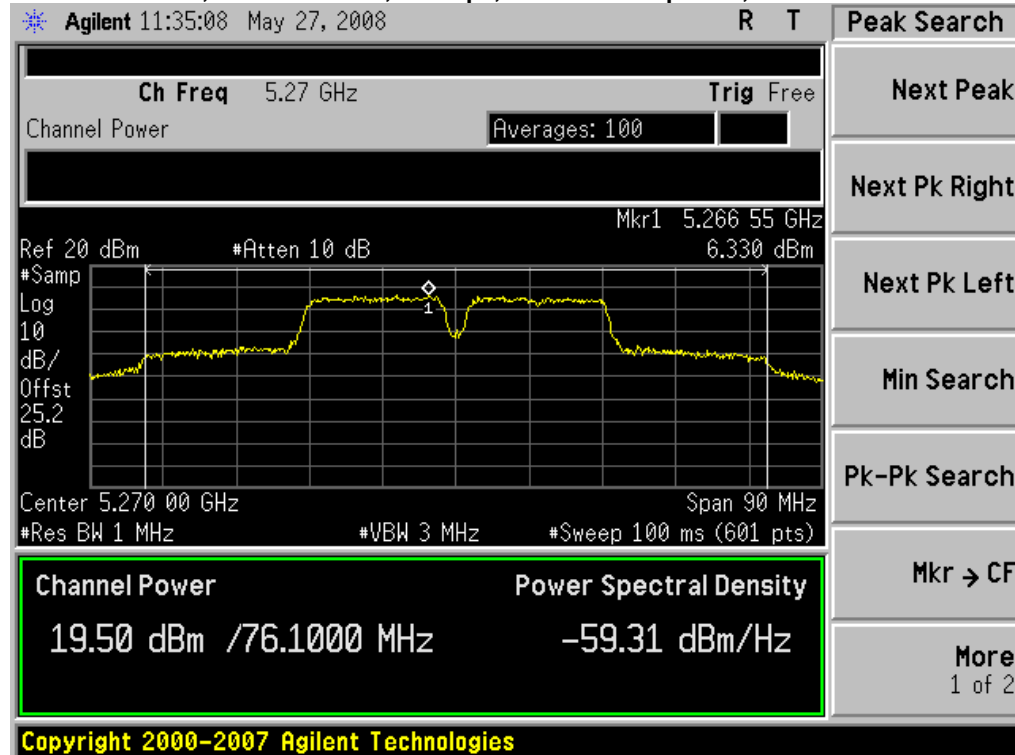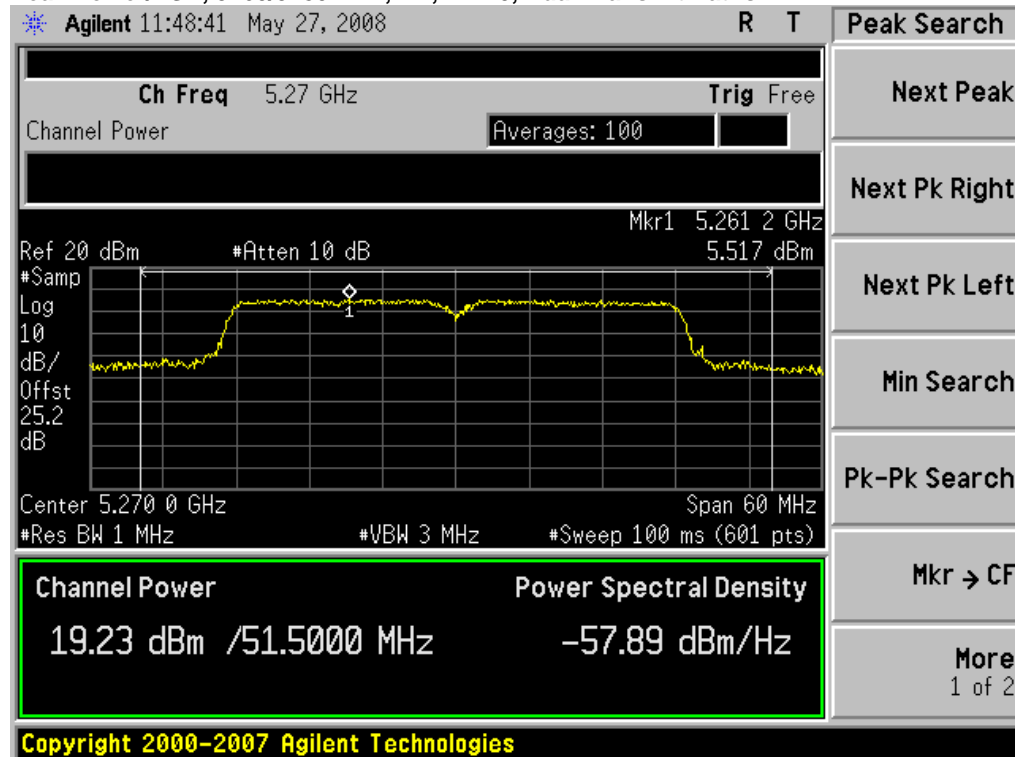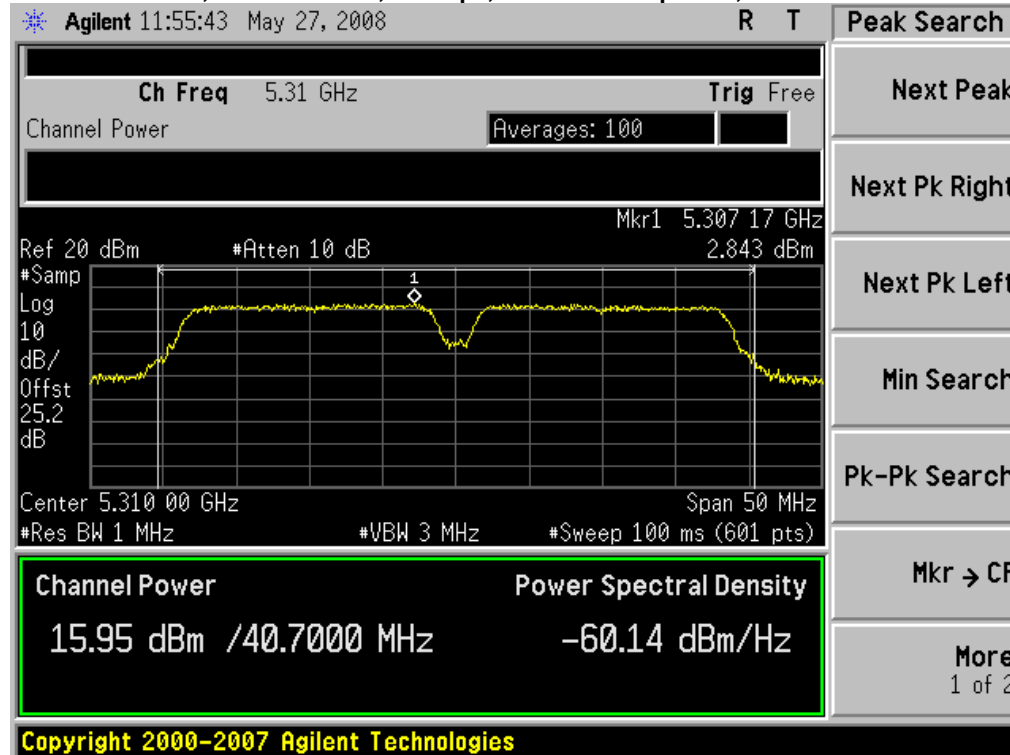

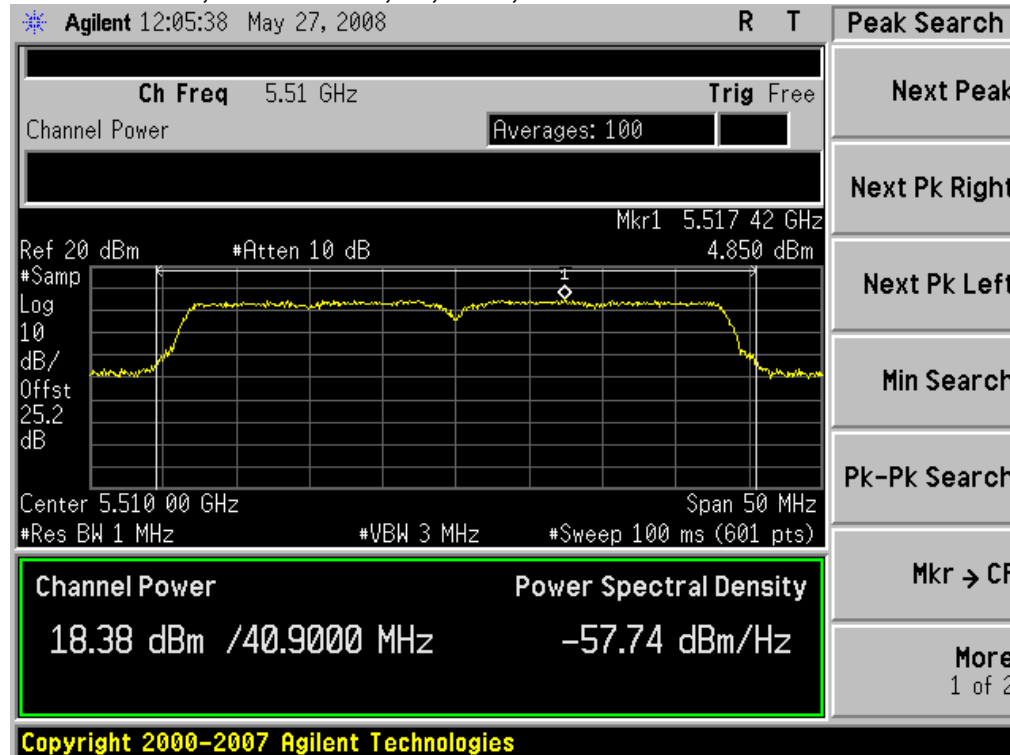**Peak Power/PSD, 5700 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**

Peak Power/PSD, 5260/5280 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

Peak Power/PSD, 5260/5280 MHz, M7, HT-40, Dual Transmit Paths

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Peak Power/PSD, 5300/5320MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

Peak Power/PSD, 5300/5320MHz, M7, HT-40, Dual Transmit Paths

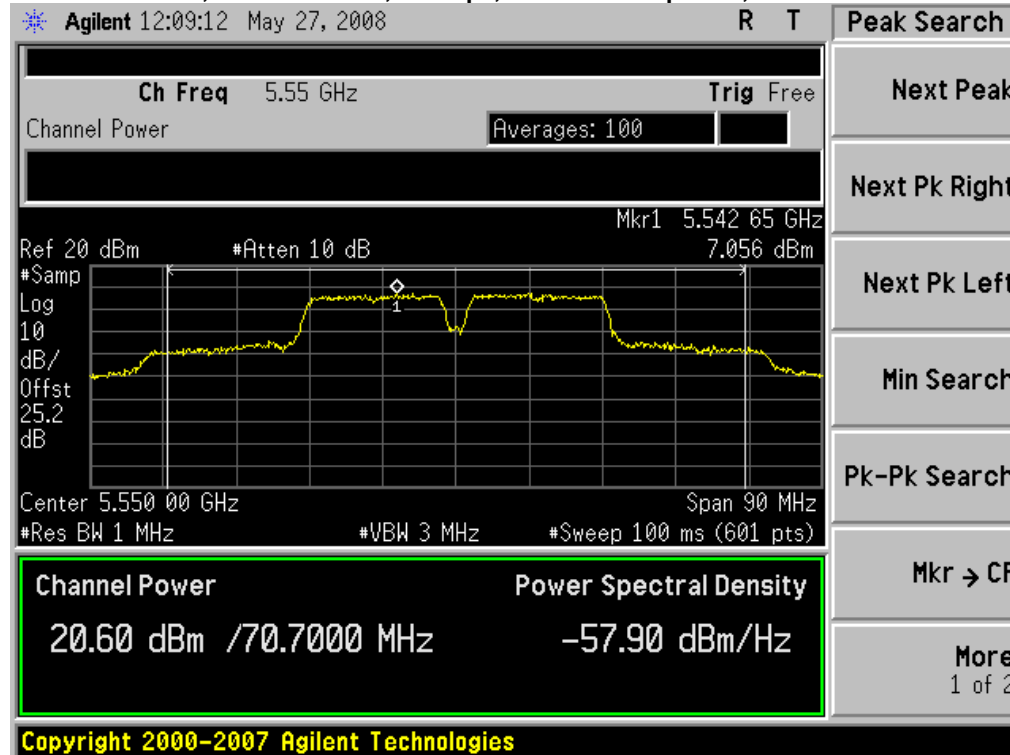**Peak Power/PSD, 5500/5520 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths**

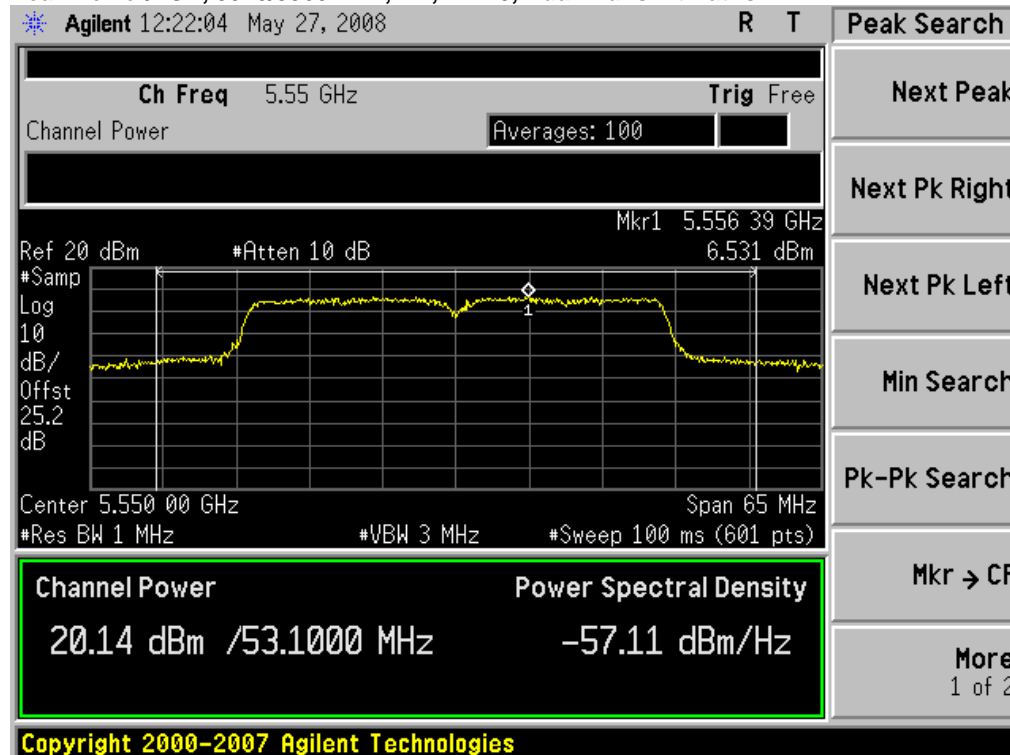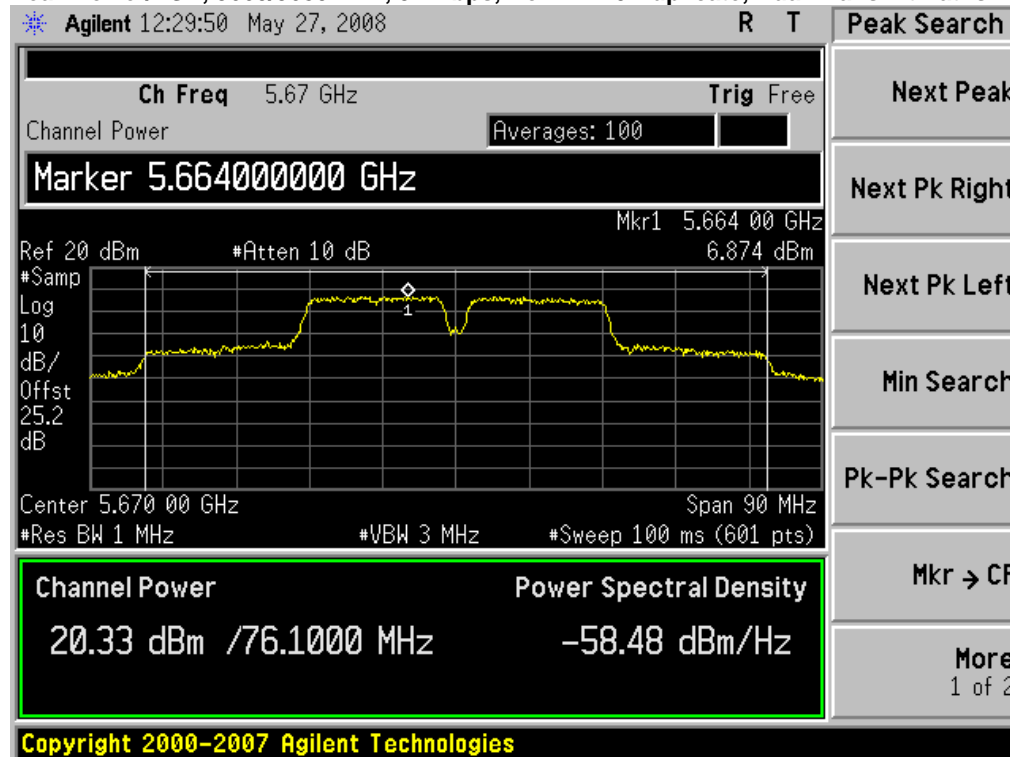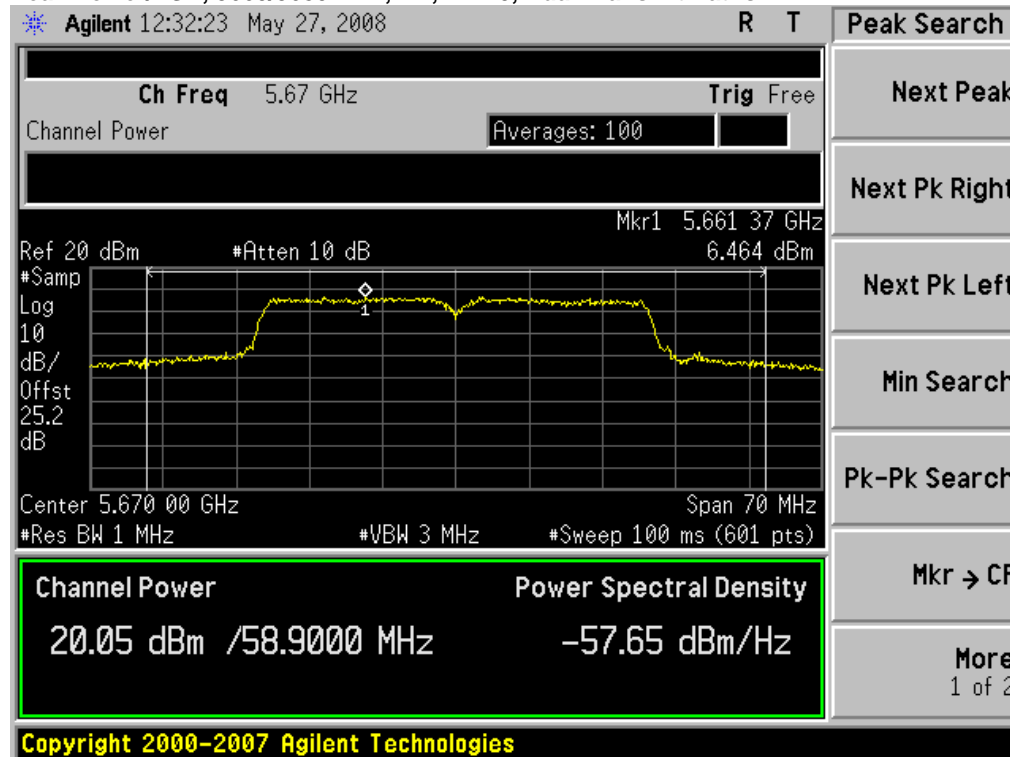**Peak Power/PSD, 5500/5520 MHz, M7, HT-40, Dual Transmit Paths**

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Peak Power/PSD, 5540/5560 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

✳ Agilent 12:09:12 May 27, 2008	R T	Peak Search

Ch Freq 5.55 GHz   **Trig** Free
Channel Power   Averages: 100

Next Peak

Next Pk Right

Mkr1 5.542 65 GHz
Ref 20 dBm   #Atten 10 dB   7.056 dBm
#Samp
Log
10
dB/
Offst
25.2
dB

Next Pk Left

Min Search

Pk-Pk Search

Center 5.550 00 GHz   Span 90 MHz
#Res BW 1 MHz   #VBW 3 MHz   #Sweep 100 ms (601 pts)

Mkr → CF

Channel Power   **Power Spectral Density**

20.60 dBm /70.7000 MHz   −57.90 dBm/Hz

More
1 of 2

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Peak Power/PSD, 5540/5560 MHz, M7, HT-40, Dual Transmit Paths

✳ Agilent 12:22:04 May 27, 2008	R T	Peak Search

Ch Freq 5.55 GHz   **Trig** Free
Channel Power   Averages: 100

Next Peak

Next Pk Right

Mkr1 5.556 39 GHz
Ref 20 dBm   #Atten 10 dB   6.531 dBm
#Samp
Log
10
dB/
Offst
25.2
dB

Next Pk Left

Min Search

Pk-Pk Search

Center 5.550 00 GHz   Span 65 MHz
#Res BW 1 MHz   #VBW 3 MHz   #Sweep 100 ms (601 pts)

Mkr → CF

Channel Power   **Power Spectral Density**

20.14 dBm /53.1000 MHz   −57.11 dBm/Hz

More
1 of 2

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Peak Power/PSD, 5660/5680 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

✳ **Agilent** 12:29:50 May 27, 2008	R T
	Peak Search
Ch Freq 5.67 GHz	**Trig** Free
	Next Peak
Channel Power	Averages: 100
Marker 5.664000000 GHz	**Next Pk Right**
	Mkr1 5.664 00 GHz
Ref 20 dBm #Atten 10 dB	6.874 dBm
#Samp Log 10 dB/ Offst 25.2 dB	**Next Pk Left**
	Min Search
	Pk-Pk Search
Center 5.670 00 GHz	Span 90 MHz
#Res BW 1 MHz #VBW 3 MHz #Sweep 100 ms (601 pts)	
Channel Power	Power Spectral Density
20.33 dBm /76.1000 MHz	−58.48 dBm/Hz
	Mkr → CF
	More 1 of 2
Copyright 2000−2007 Agilent Technologies	

Peak Power/PSD, 5660/5680 MHz, M7, HT-40, Dual Transmit Paths

✳ **Agilent** 12:32:23 May 27, 2008	R T
	Peak Search
Ch Freq 5.67 GHz	**Trig** Free
Channel Power	Averages: 100
	Next Peak
	Next Pk Right
	Mkr1 5.661 37 GHz
Ref 20 dBm #Atten 10 dB	6.464 dBm
#Samp Log 10 dB/ Offst 25.2 dB	**Next Pk Left**
	Min Search
	Pk-Pk Search
Center 5.670 00 GHz	Span 70 MHz
#Res BW 1 MHz #VBW 3 MHz #Sweep 100 ms (601 pts)	
Channel Power	Power Spectral Density
20.05 dBm /58.9000 MHz	−57.65 dBm/Hz
	Mkr → CF
	More 1 of 2
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Peak Excursion

15.407: The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be <= 13 dB for all frequencies across the emission bandwidth.

Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be <= 13 dB for all frequencies across the emission bandwidth.

 1st Trace: (Peak)

     Set Span to encompass the entire emission bandwidth of the signal.

     RBW = 1 MHz, VBW = 3 MHz

     Detector = Peak

     Sweep = Auto

     Trace 1 = Max-hold

     Ref Level Offset = correct for attenuator and cable loss

     Ref Level = 20dBm

     Atten = 10dBm

2nd Trace: (Average)

     Trace 2 = clear right

     Detector = Sample

     Avg/VBW type = Pwr(RMS)

     Average = 100

     Sweep = single

Set marker Deltas

     Trace 1 & Peak search

     Marker Delta

     Trace 2 & Peak search

Record the difference between the Peak and Average Markers

Frequency (MHz)	Mode	Data Rate (Mbps)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
5260	Non HT-20 Beam Forming	54	**10.3**	13	2.7
5320	HT-20	M7	**11.5**	13	1.5
5320	Non HT-20 Beam Forming	54	**11.2**	13	1.8
5500	Non HT-20 Beam Forming	54	**10.9**	13	2.1
5580	Non HT-20 Beam Forming	54	**10.9**	13	2.1
5700	Non HT-20 Beam Forming	54	**10.9**	13	2.1
5260/5280	Non HT-40 Duplicate	54	**10.6**	13	2.4
5260/5280	HT-40	M7	**10.0**	13	3.0
5280/5320	Non HT-40 Duplicate	54	**9.7**	13	3.3
5280/5320	HT-40	M7	**10.1**	13	2.9
5500/5520	Non HT-40 Duplicate	54	**10.5**	13	2.5
5500/5520	HT-40	M7	**10.4**	13	2.6
5540/5560	Non HT-40 Duplicate	54	**10.8**	13	2.2
5540/5560	HT-40	M7	**10.6**	13	2.4
5660/5680	Non HT-40 Duplicate	54	**10.5**	13	2.5
5660/5680	HT-40	M7	**10.5**	13	2.5

Peak Excursion, 5260 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths
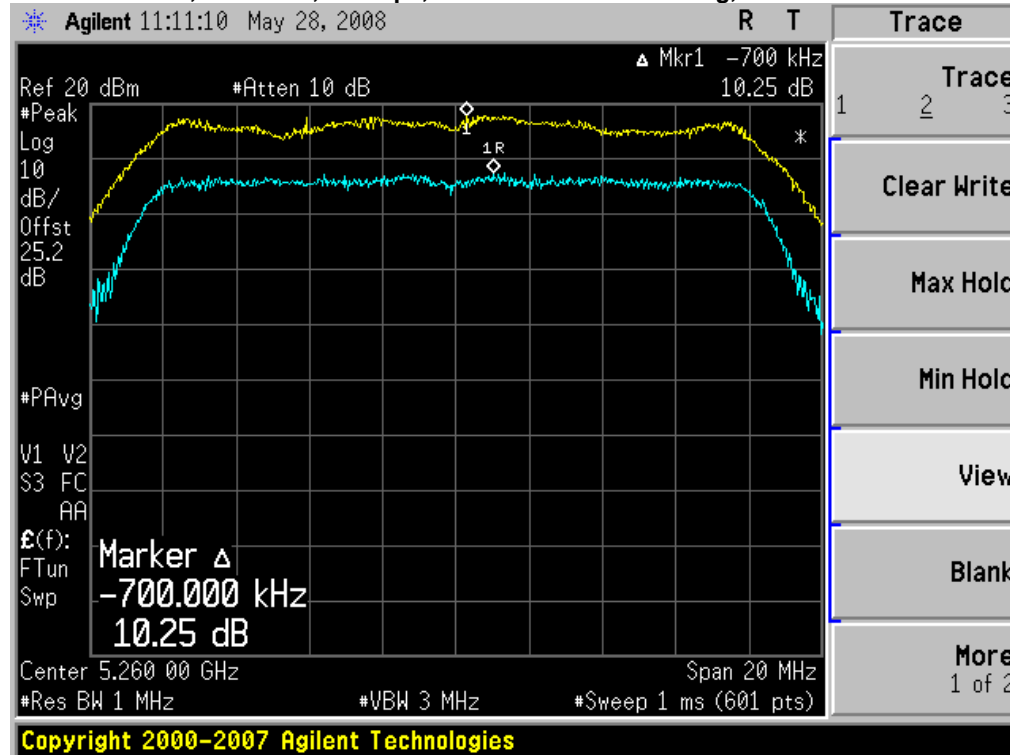
Peak Excursion, 5320 MHz, M7, HT-20, Dual Transmit Path
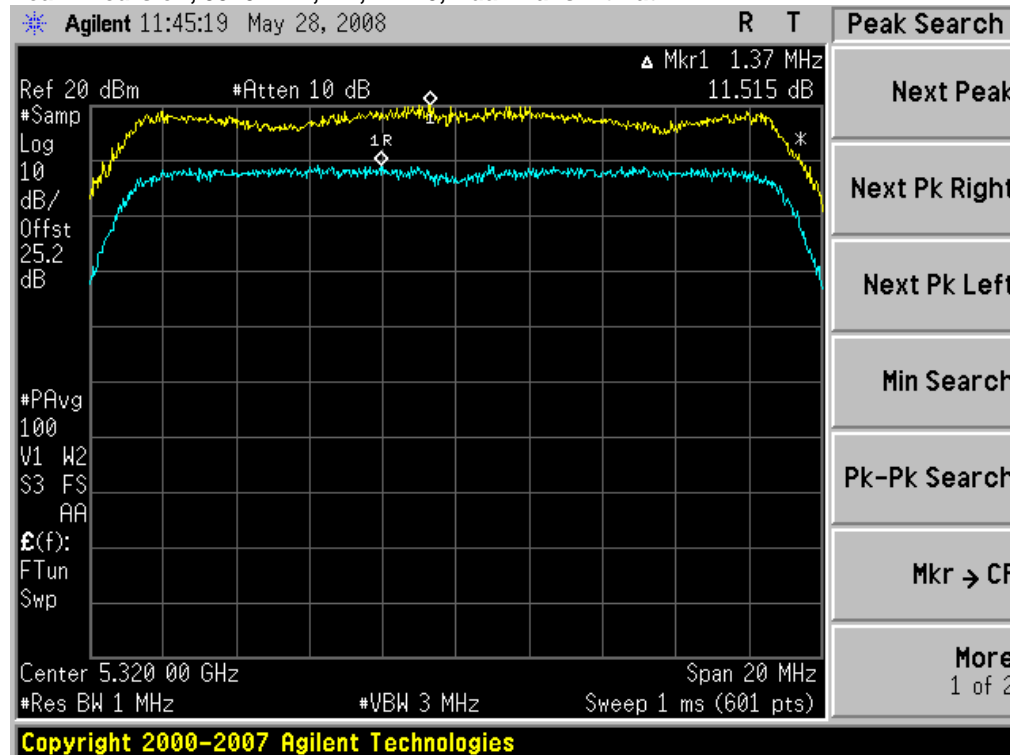
Peak Excursion, 5320 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths
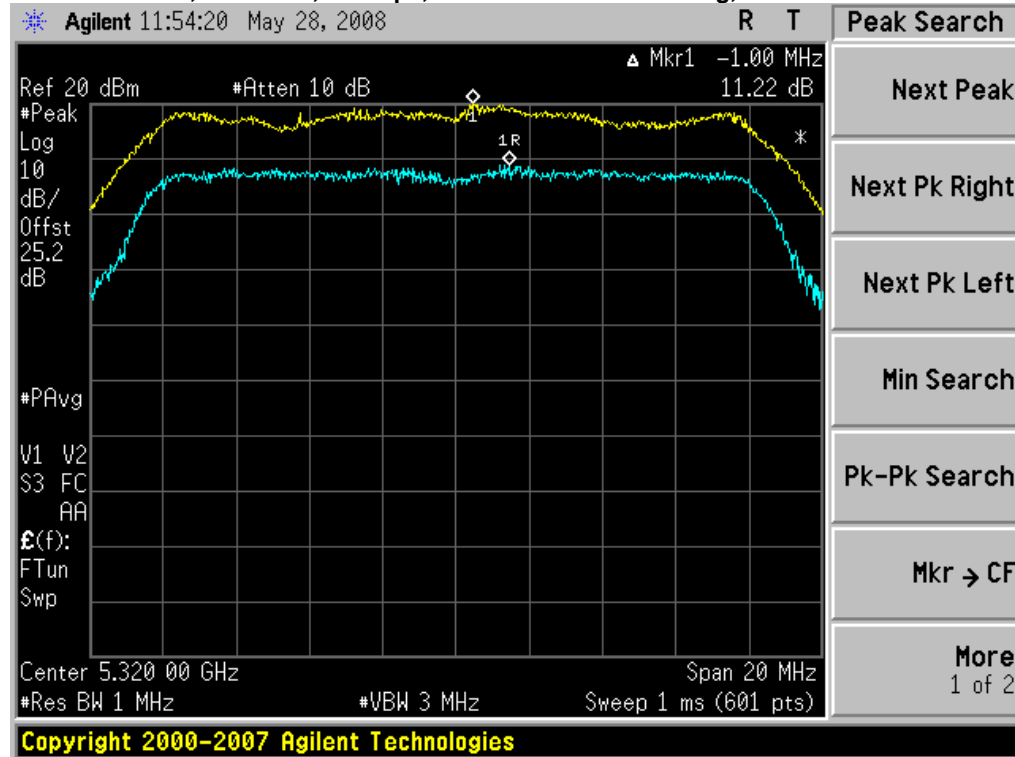
Peak Excursion, 5500 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths

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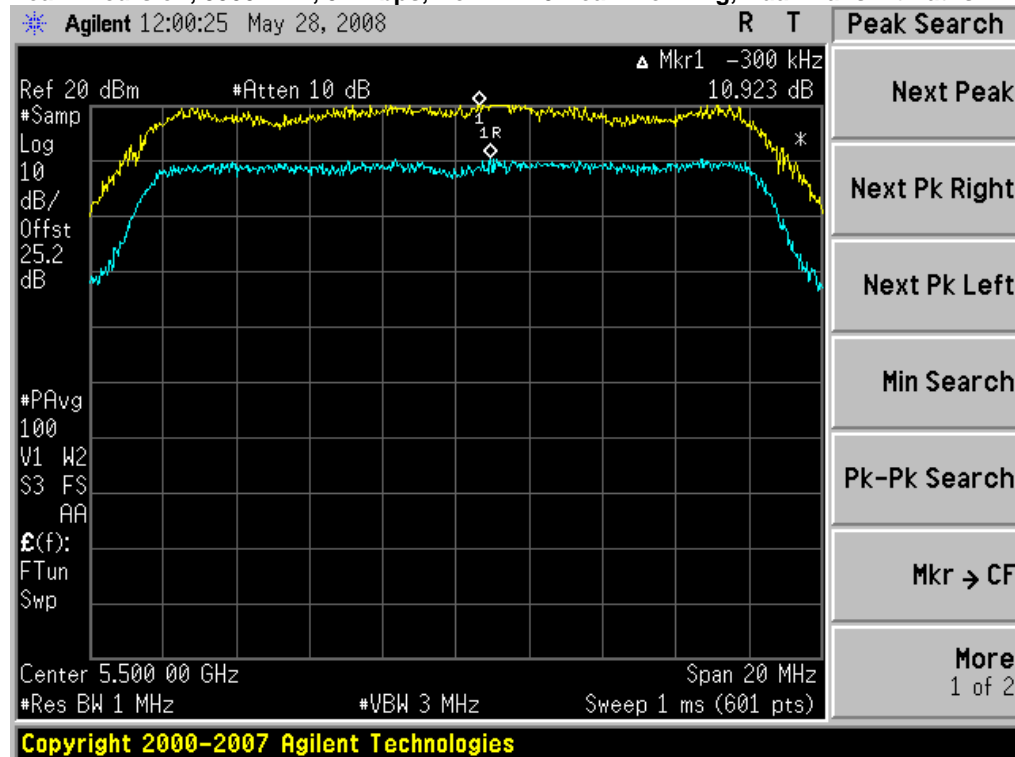
Peak Excursion, 5580 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths
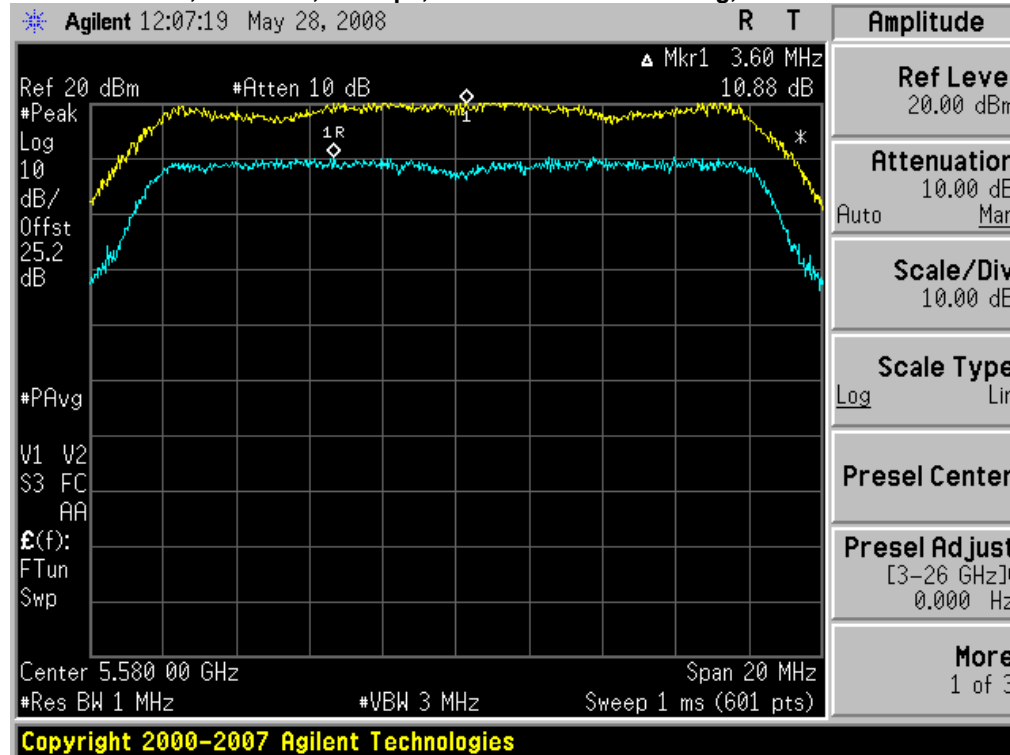
Peak Excursion, 5700 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths
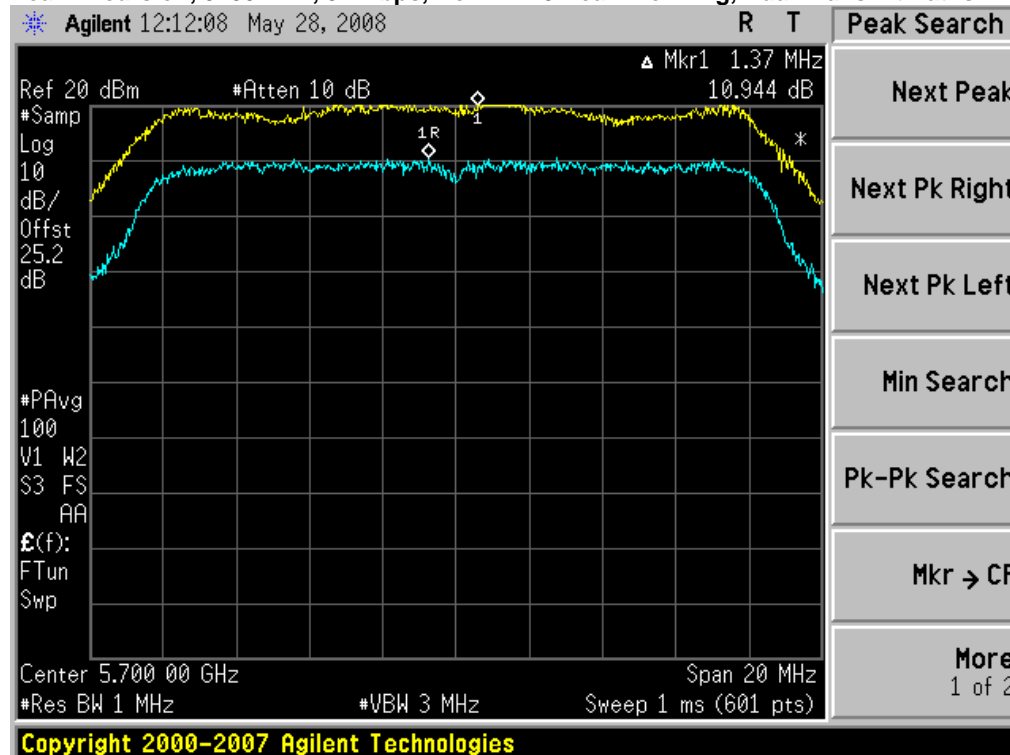
Peak Excursion, 5260/5280 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths
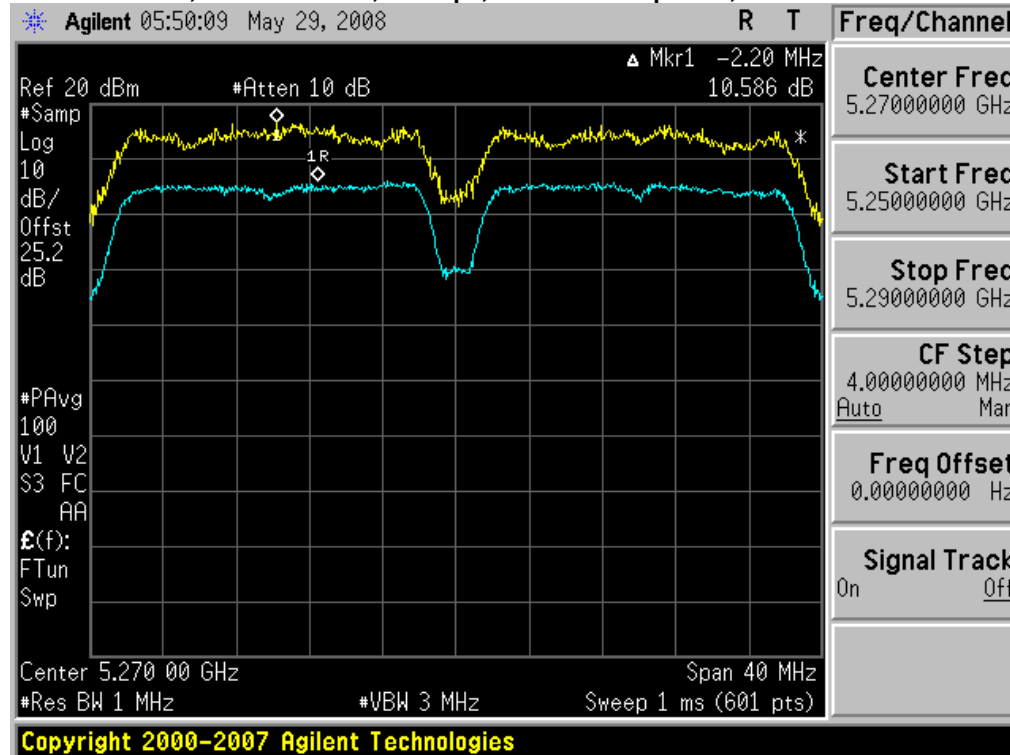
Peak Excursion, 5260/5280 MHz, M7, HT-40, Dual Transmit Paths
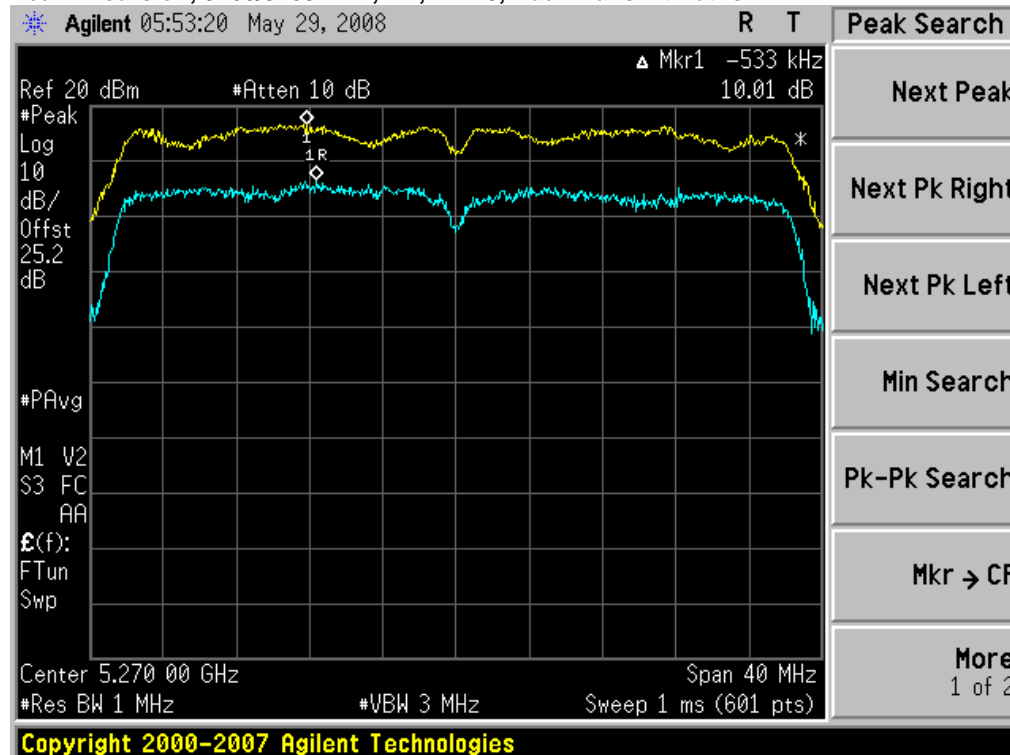
Peak Excursion, 5300/5320MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths
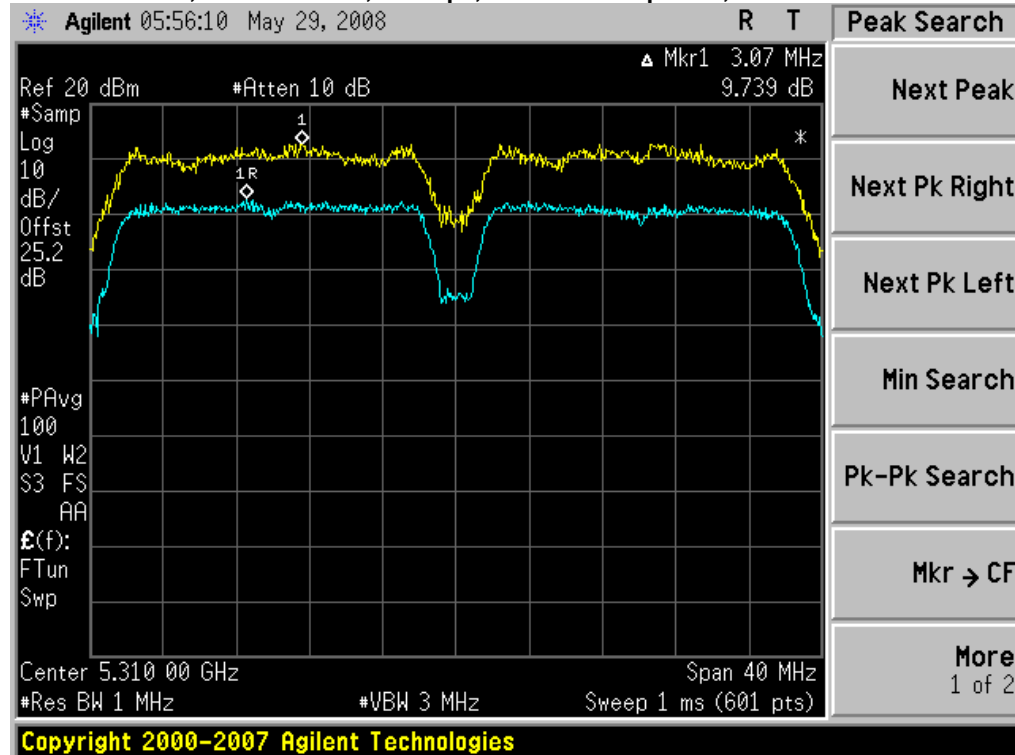
Peak Excursion, 5300/5320MHz, M7, HT-40, Dual Transmit Paths
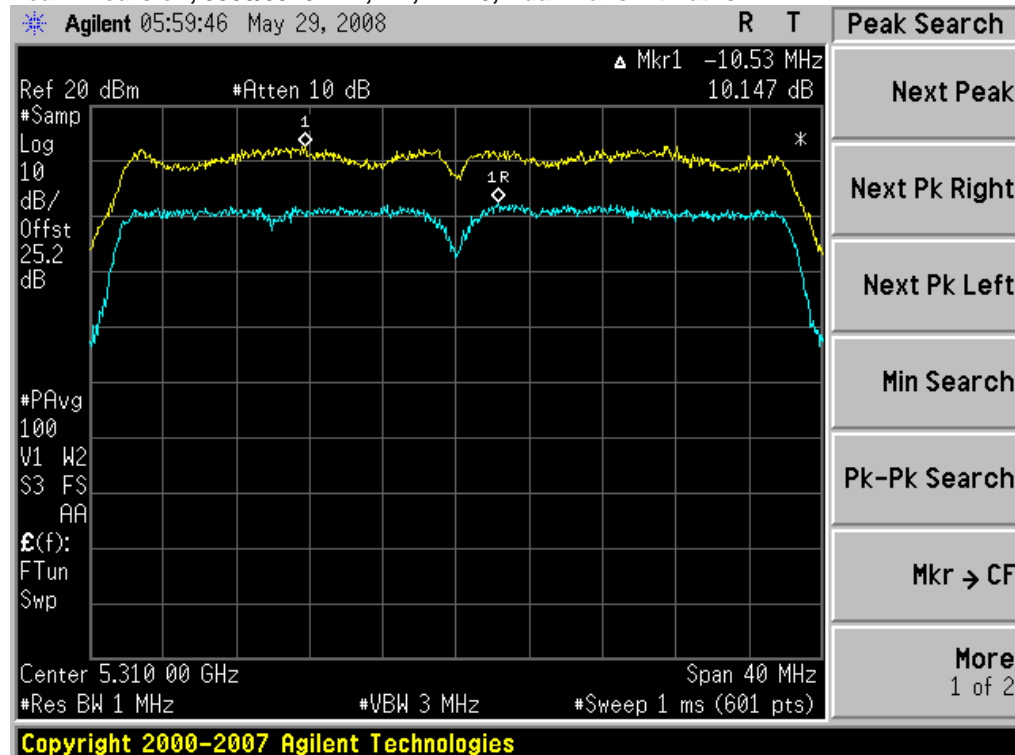
Peak Excursion, 5500/5520 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths
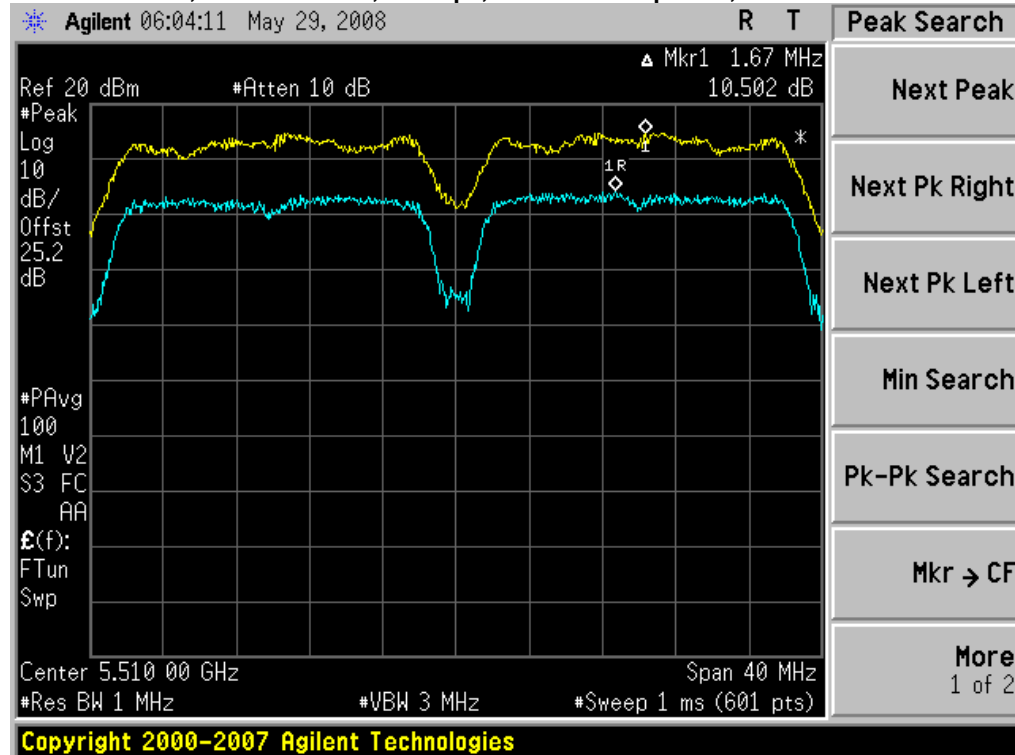
Peak Excursion, 5500/5520 MHz, M7, HT-40, Dual Transmit Paths

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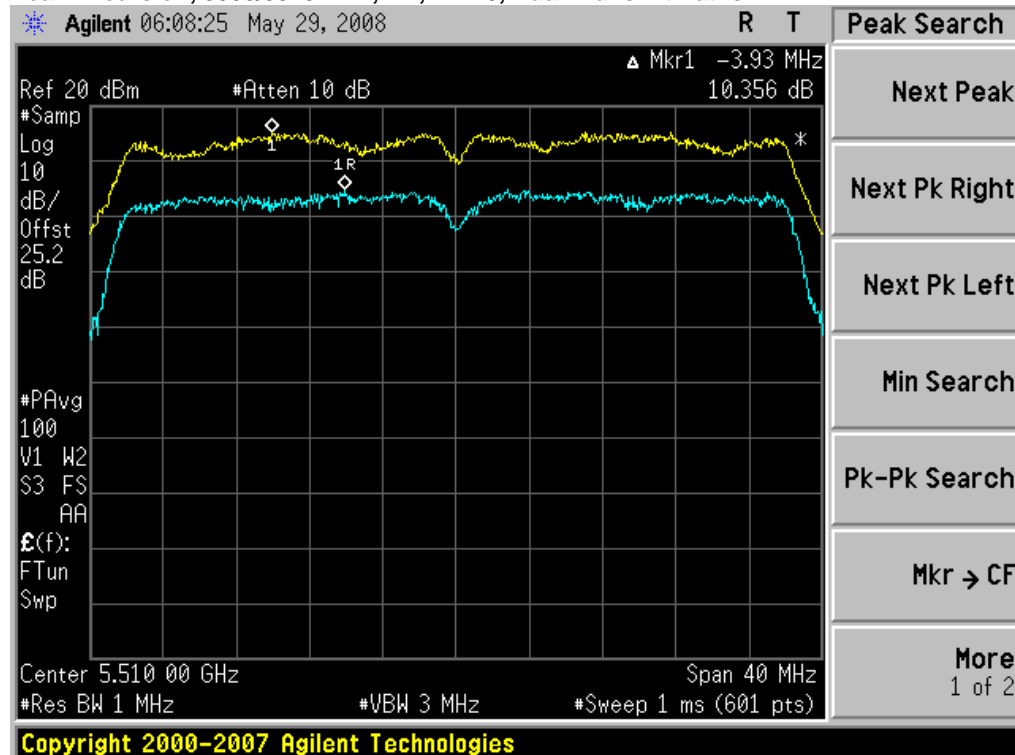
Peak Excursion, 5540/5560 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths
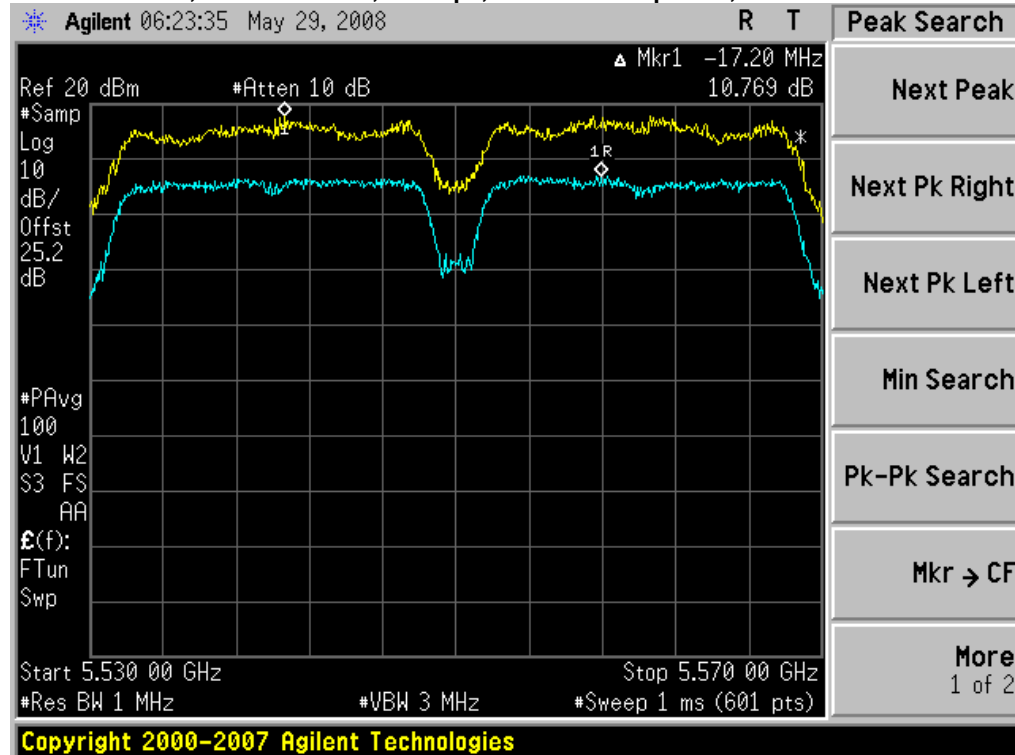
Peak Excursion, 5540/5560 MHz, M7, HT-40, Dual Transmit Paths
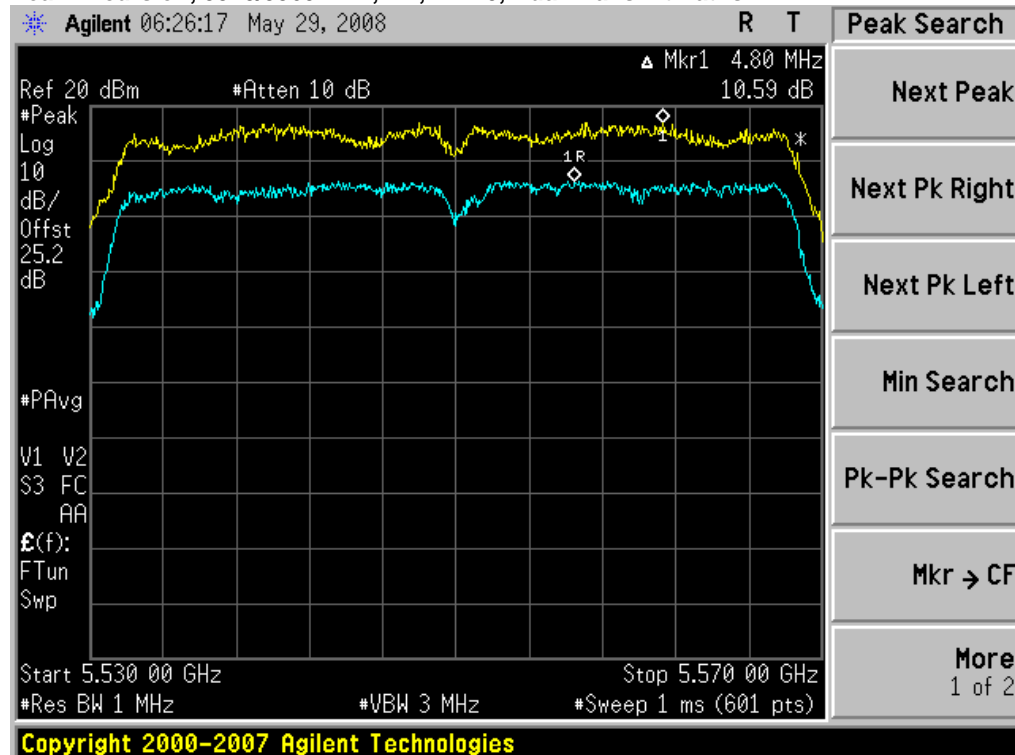
Peak Excursion, 5660/5680 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths
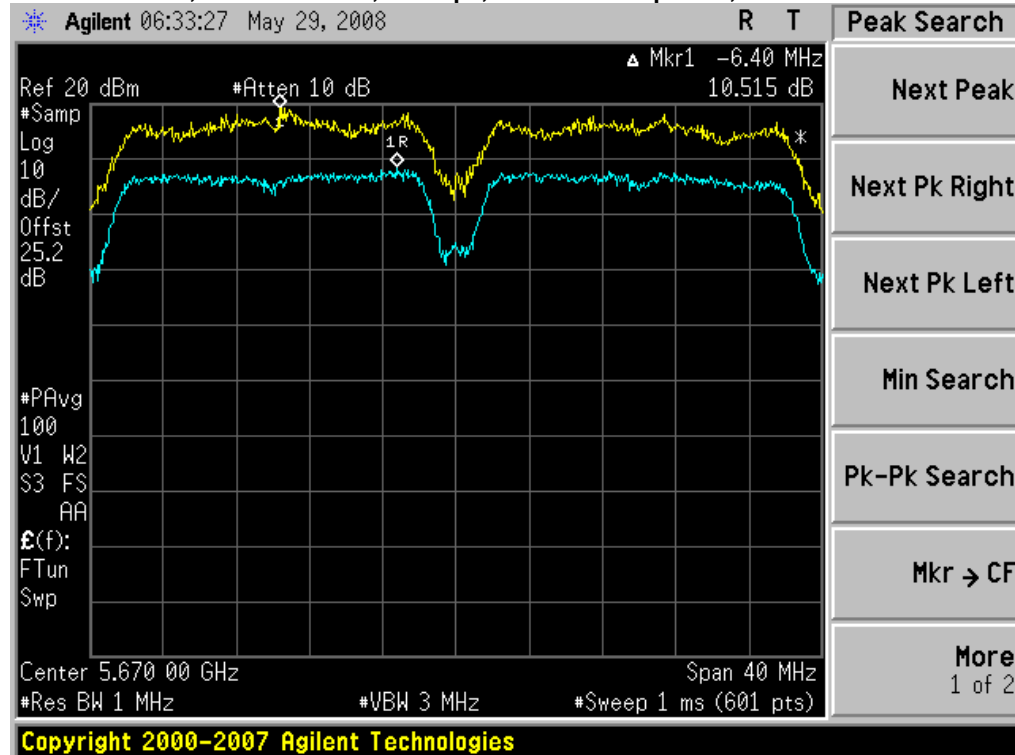
Peak Excursion, 5660/5680 MHz, M7, HT-40, Dual Transmit Paths
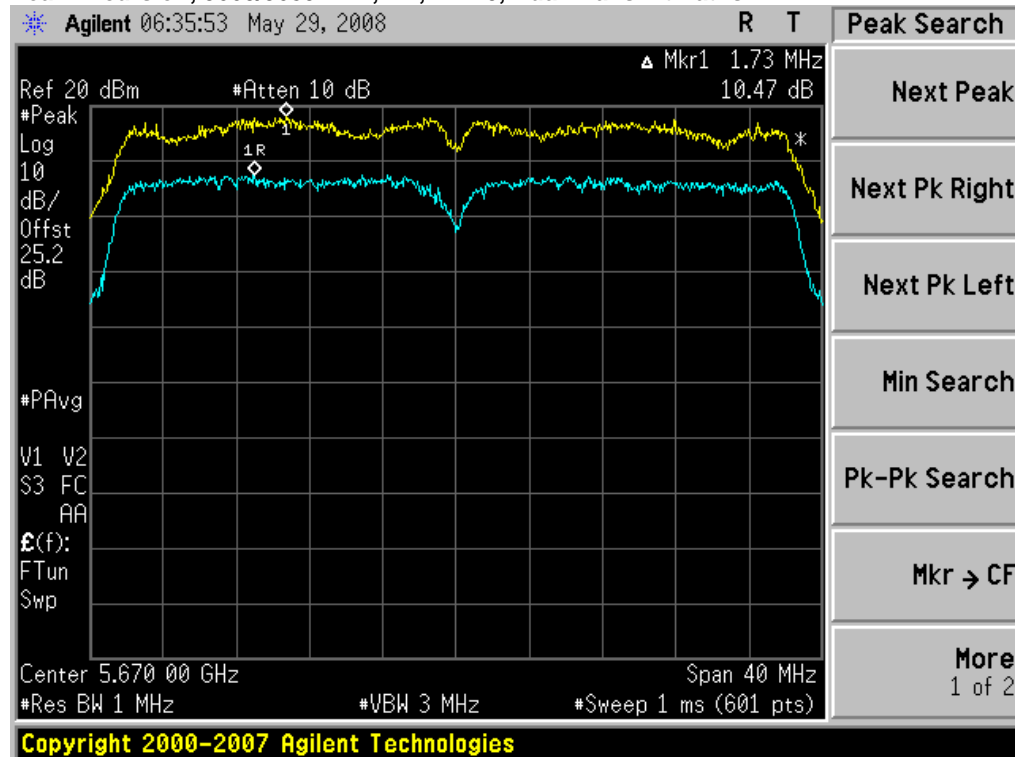
Conducted Spurious Emissions

15.407: For transmitters operating in the 5.25-5.35 and 5.47-5.725 GHz band: all emissions outside of the 5.25-5.35 and 5.47-5.725 GHz bands shall not exceed an EIRP of -27dBm/MHz.

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-40 GHz
Reference Level:	20 dBm
Attenuation:	10 dB
Sweep Time:	10 s
Resolution Bandwidth:	1 MHz
Video Bandwidth:	3 MHz
Detector:	Peak
Trace:	Single
Marker:	Peak

Record the marker waveform peak to spur difference

Frequency (MHz)	Mode	Data Rate (Mbps)	Conducted Spurs (dBm)	Limit (dBm)	Margin (dB)
5260	Non HT-20 Beam Forming	54	-37.8	-27	10.8
5320	HT-20	M7	-38.8	-27	11.8
5320	Non HT-20 Beam Forming	54	-36.5	-27	9.5
5500	Non HT-20 Beam Forming	54	-30.0	-27	3.0
5580	Non HT-20 Beam Forming	54	-27.3	-27	0.3
5700	Non HT-20 Beam Forming	54	-28.5	-27	1.5
5260/5280	Non HT-40 Duplicate	54	-36.2	-27	9.2
5260/5280	HT-40	M7	-35.5	-27	8.5
5280/5320	Non HT-40 Duplicate	54	-42.5	-27	15.5
5280/5320	HT-40	M7	-41.9	-27	14.9
5500/5520	Non HT-40 Duplicate	54	-34.8	-27	7.8
5500/5520	HT-40	M7	-37.1	-27	10.1
5540/5560	Non HT-40 Duplicate	54	-27.5	-27	0.5
5540/5560	HT-40	M7	-31.5	-27	4.5
5660/5680	Non HT-40 Duplicate	54	-27.6	-27	0.6
5660/5680	HT-40	M7	-31.1	-27	4.1

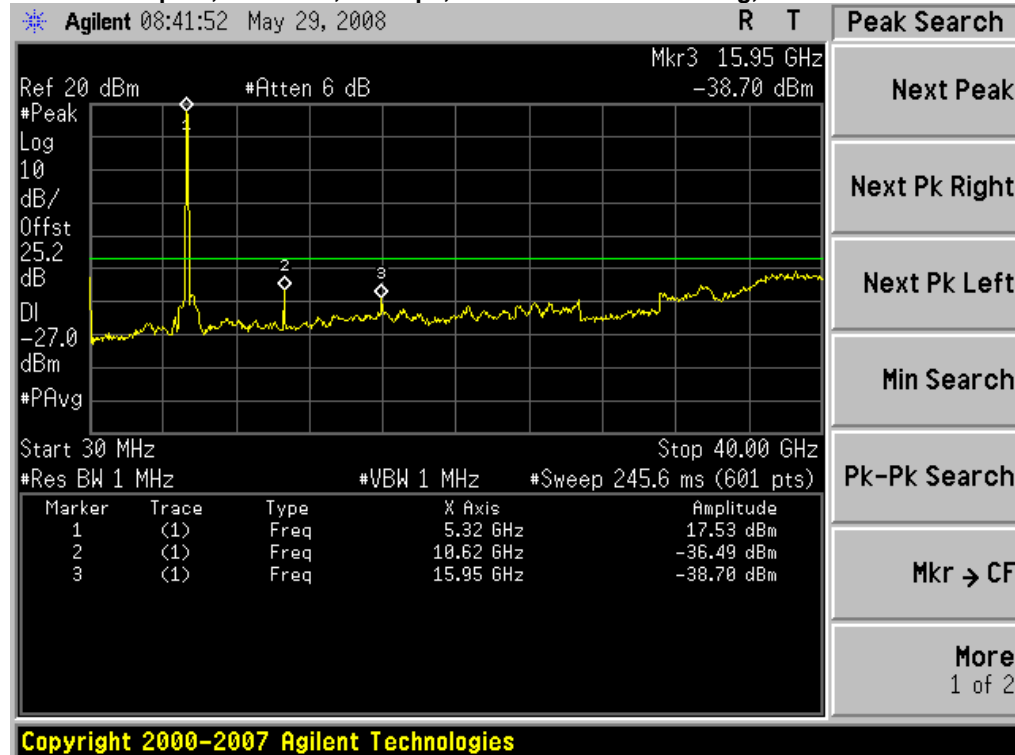**Conducted Spurs, 5260 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths**
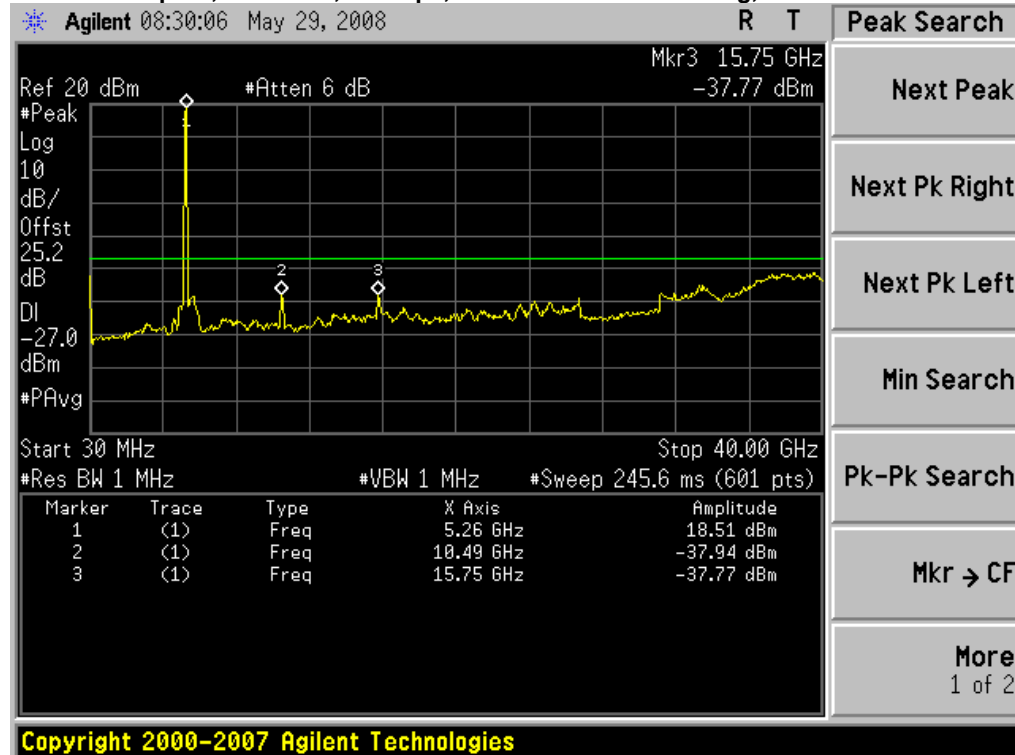
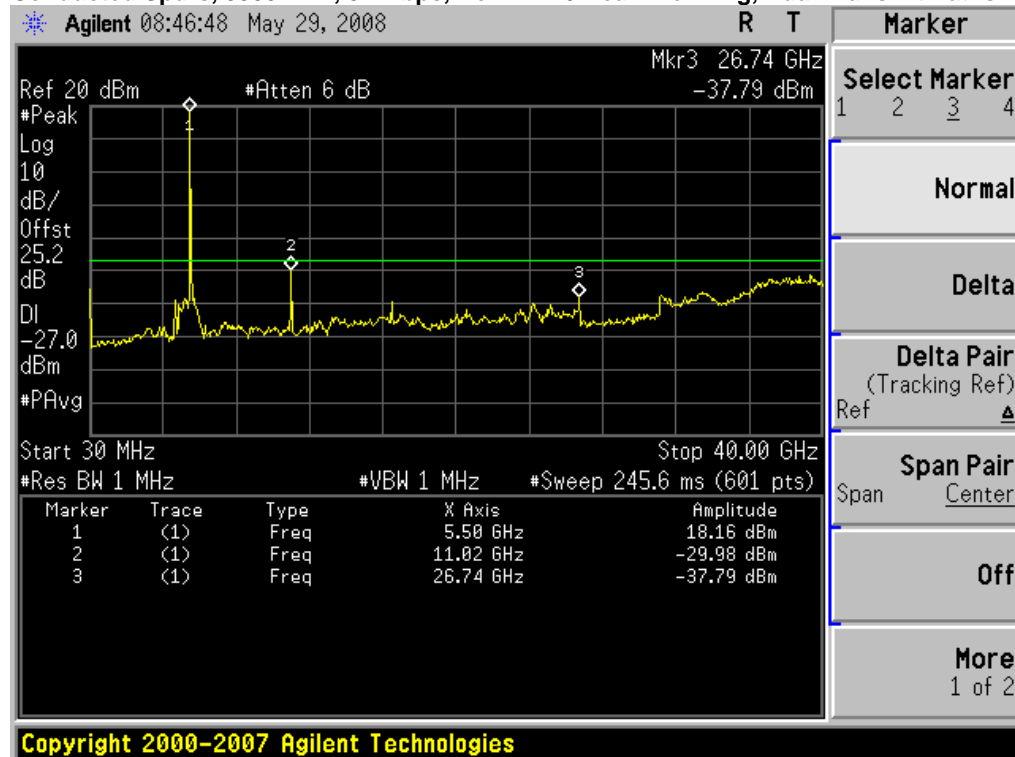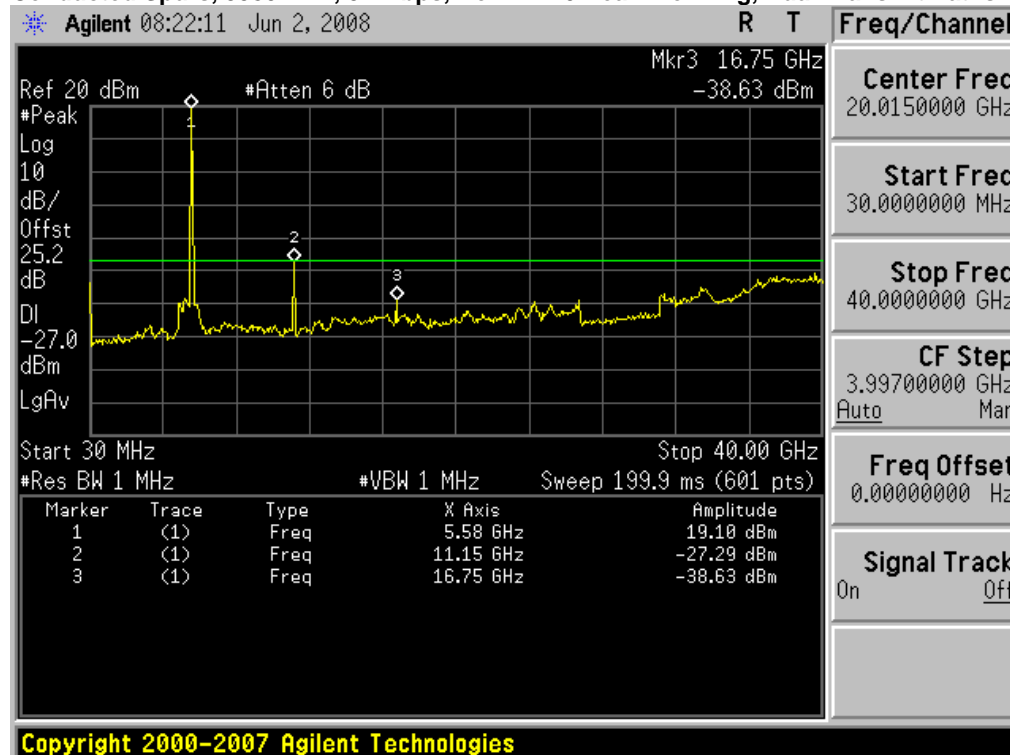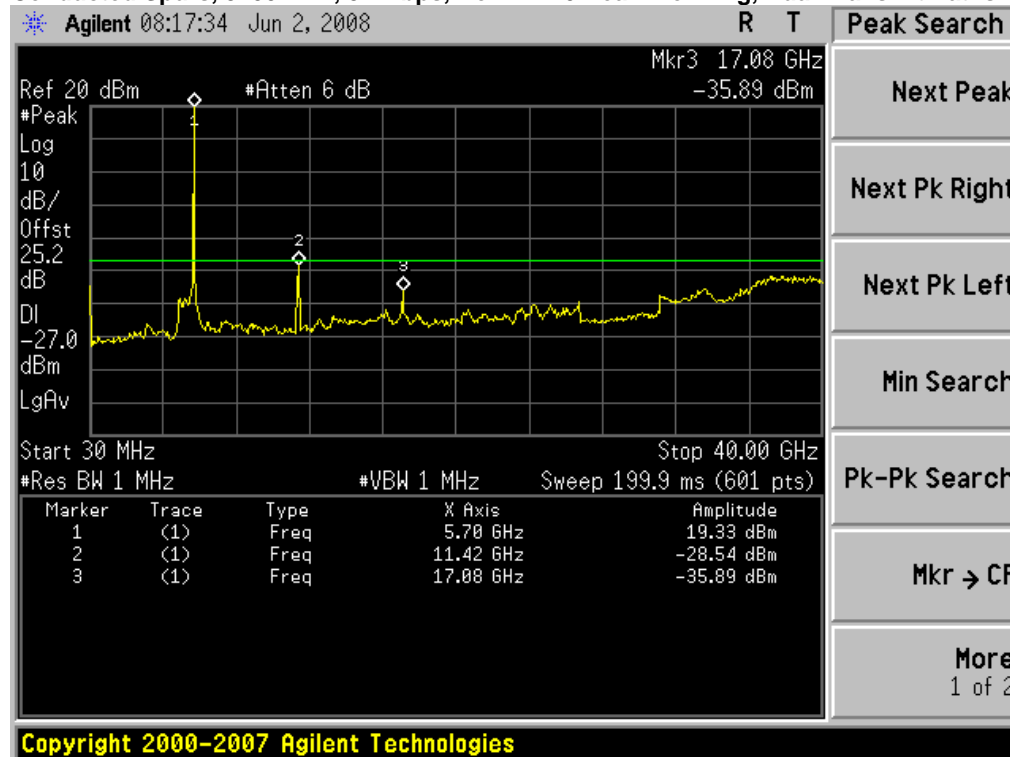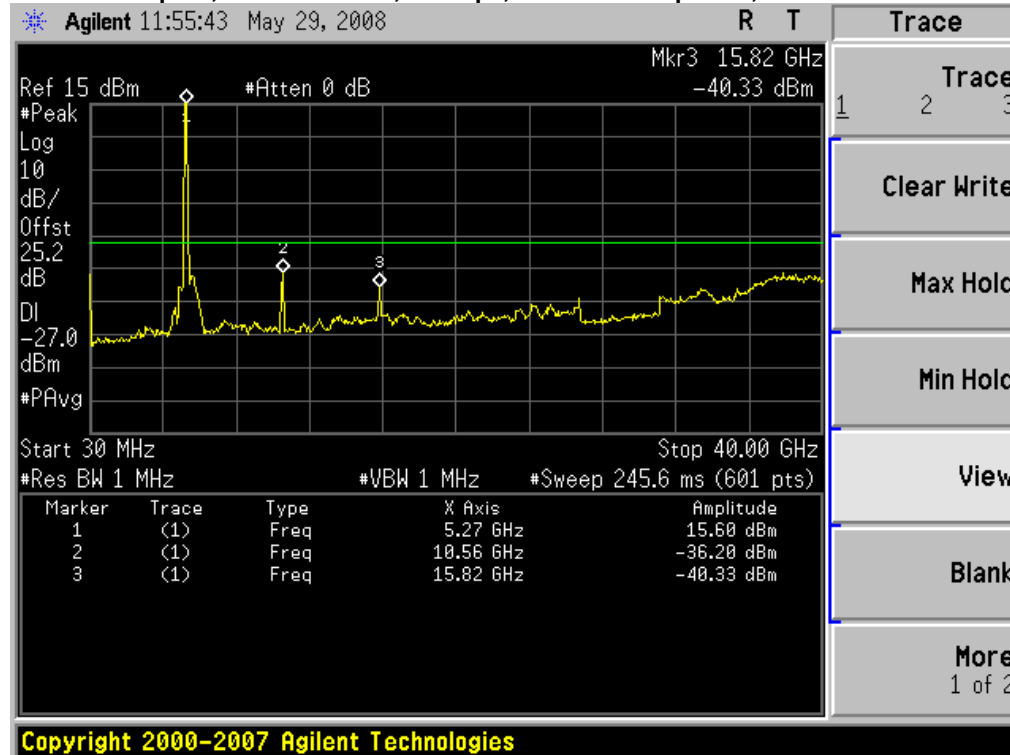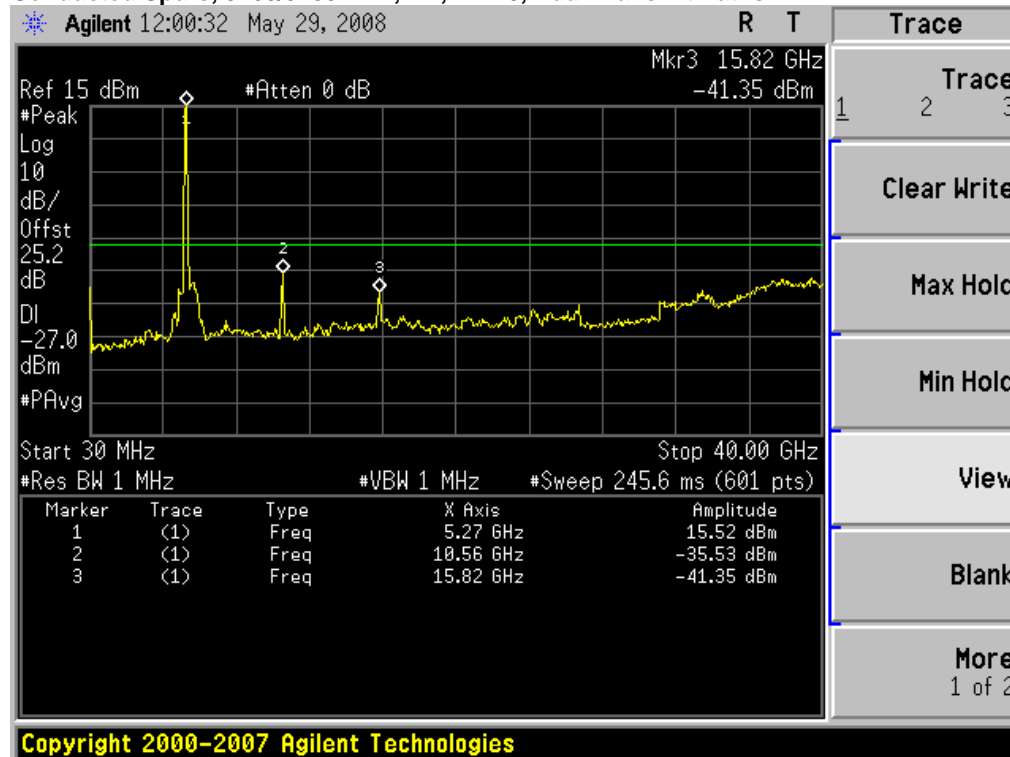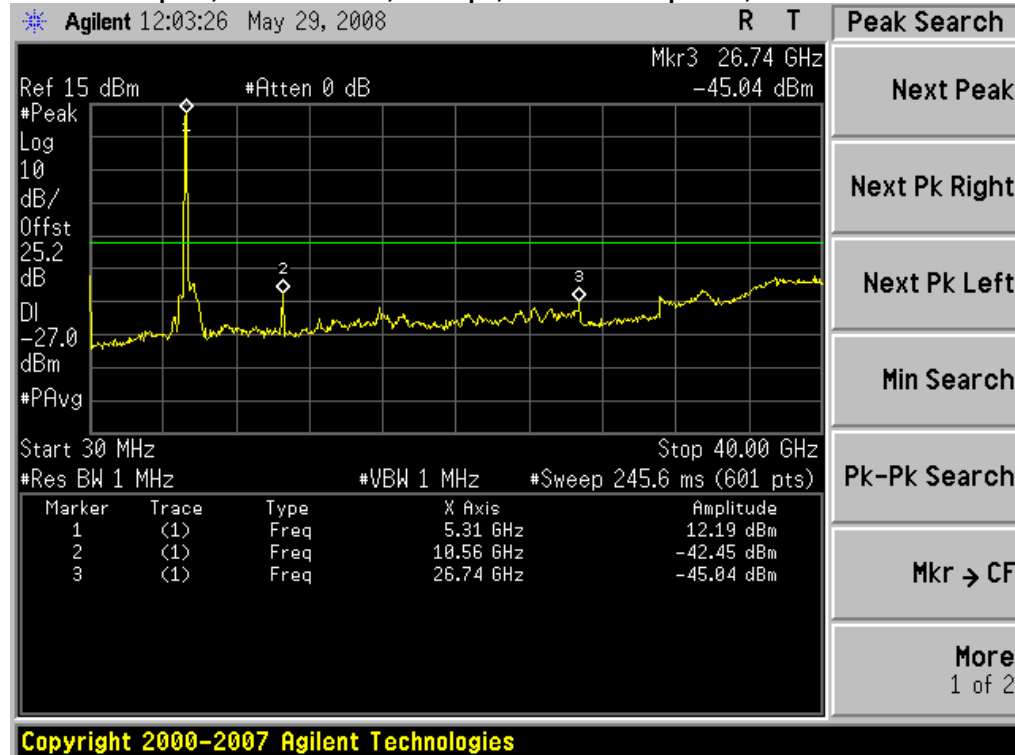
Conducted Spurs, 5320 MHz, M7, HT-20, Dual Transmit Path

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Cisco Systems, Inc. Company Confidential
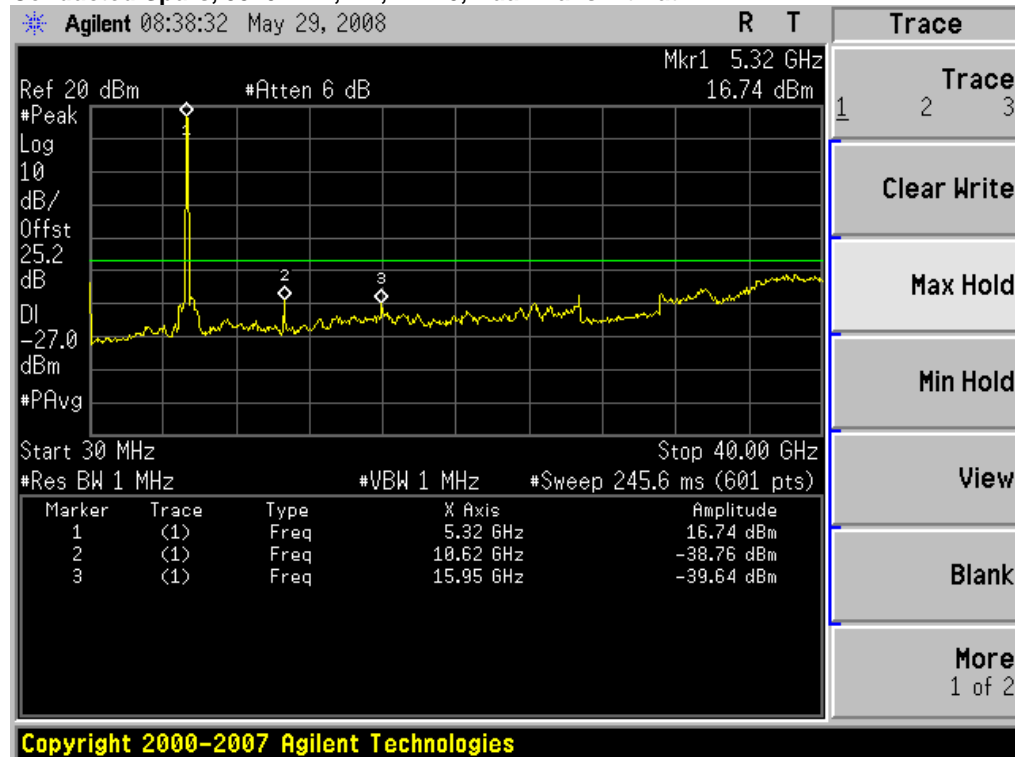
Conducted Spurs, 5320 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.32 GHz	17.53 dBm
2	(1)	Freq	10.62 GHz	-36.49 dBm
3	(1)	Freq	15.95 GHz	-38.70 dBm

Conducted Spurs, 5500 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.50 GHz	18.16 dBm
2	(1)	Freq	11.02 GHz	-29.98 dBm
3	(1)	Freq	26.74 GHz	-37.79 dBm

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Conducted Spurs, 5580 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.58 GHz	19.10 dBm
2	(1)	Freq	11.15 GHz	-27.29 dBm
3	(1)	Freq	16.75 GHz	-38.63 dBm

Conducted Spurs, 5700 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.70 GHz	19.33 dBm
2	(1)	Freq	11.42 GHz	-28.54 dBm
3	(1)	Freq	17.08 GHz	-35.89 dBm

Conducted Spurs, 5260/5280 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

Conducted Spurs, 5260/5280 MHz, M7, HT-40, Dual Transmit Paths

Conducted Spurs, 5300/5320MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

Conducted Spurs, 5300/5320MHz, M7, HT-40, Dual Transmit Paths
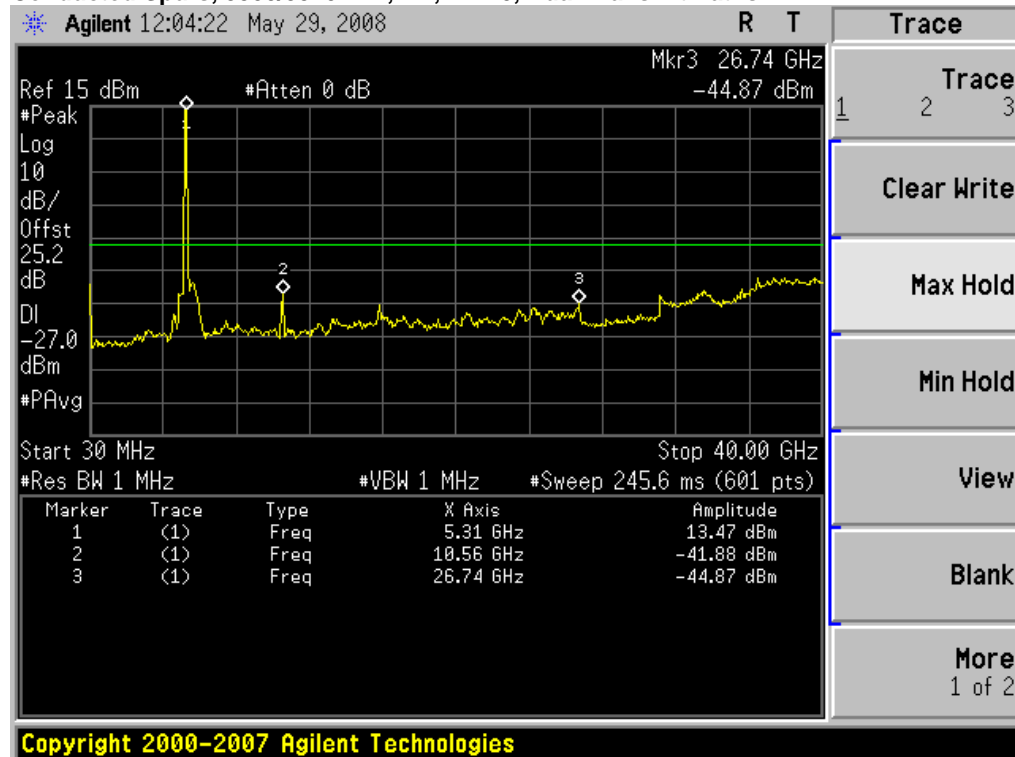
Conducted Spurs, 5500/5520 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths
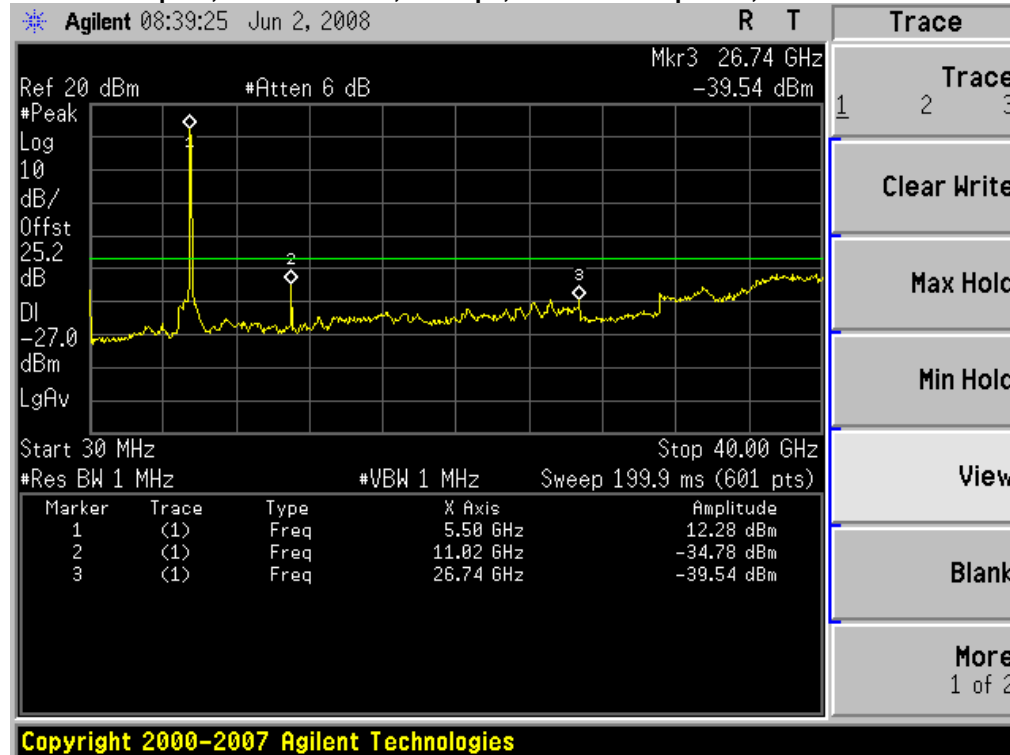
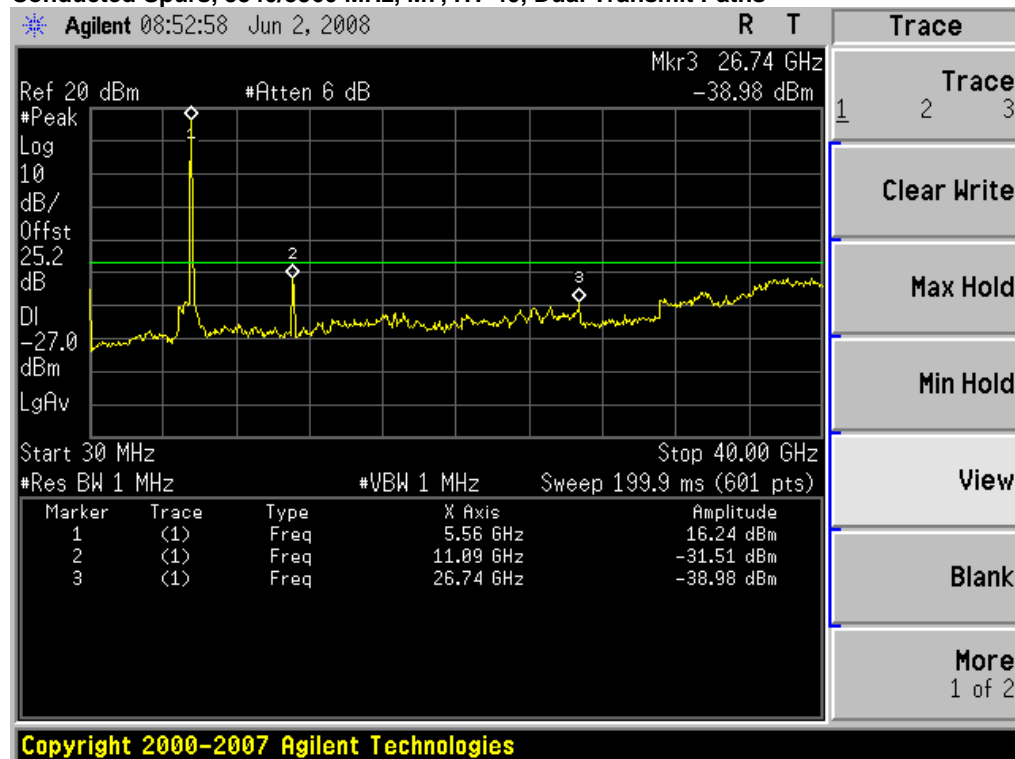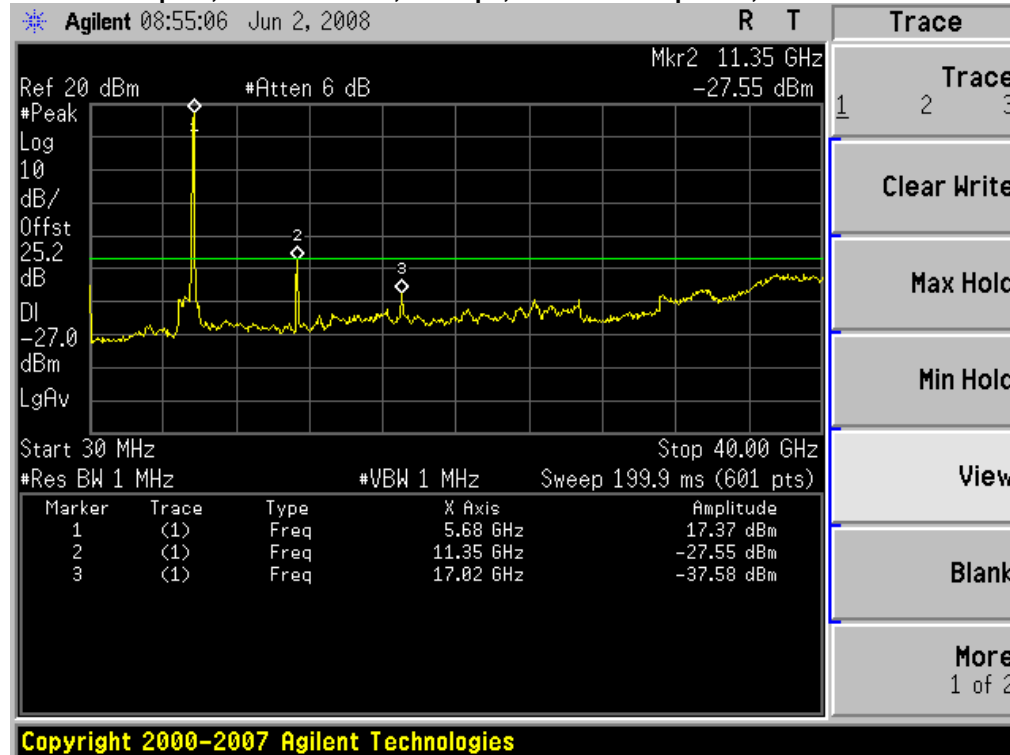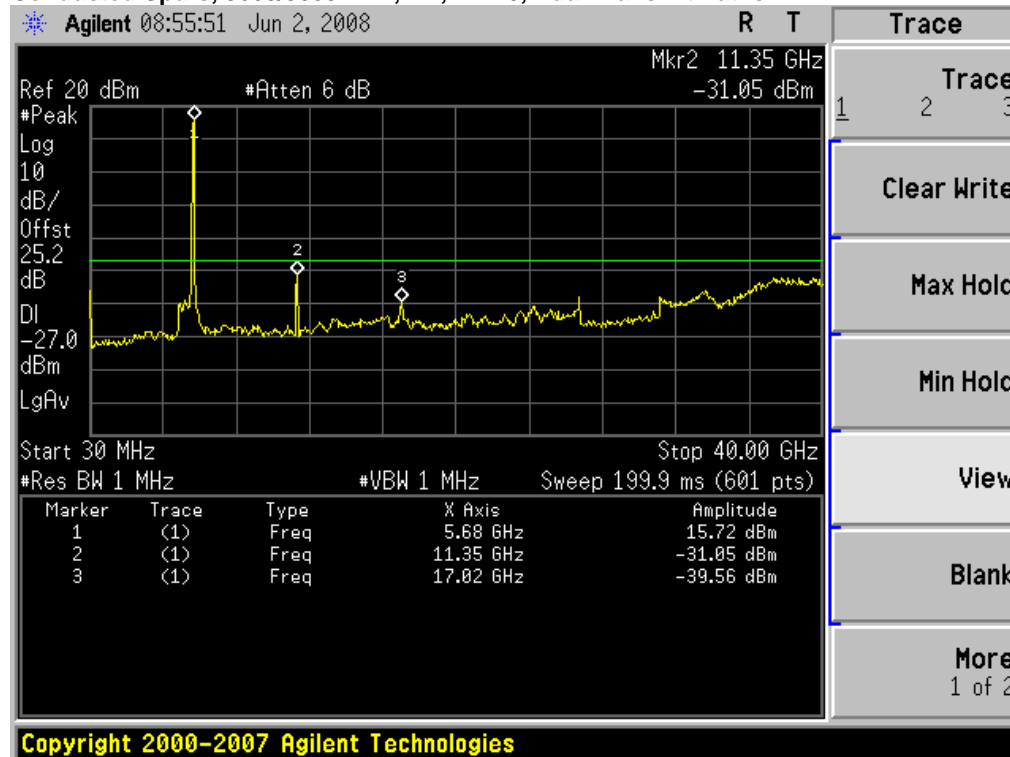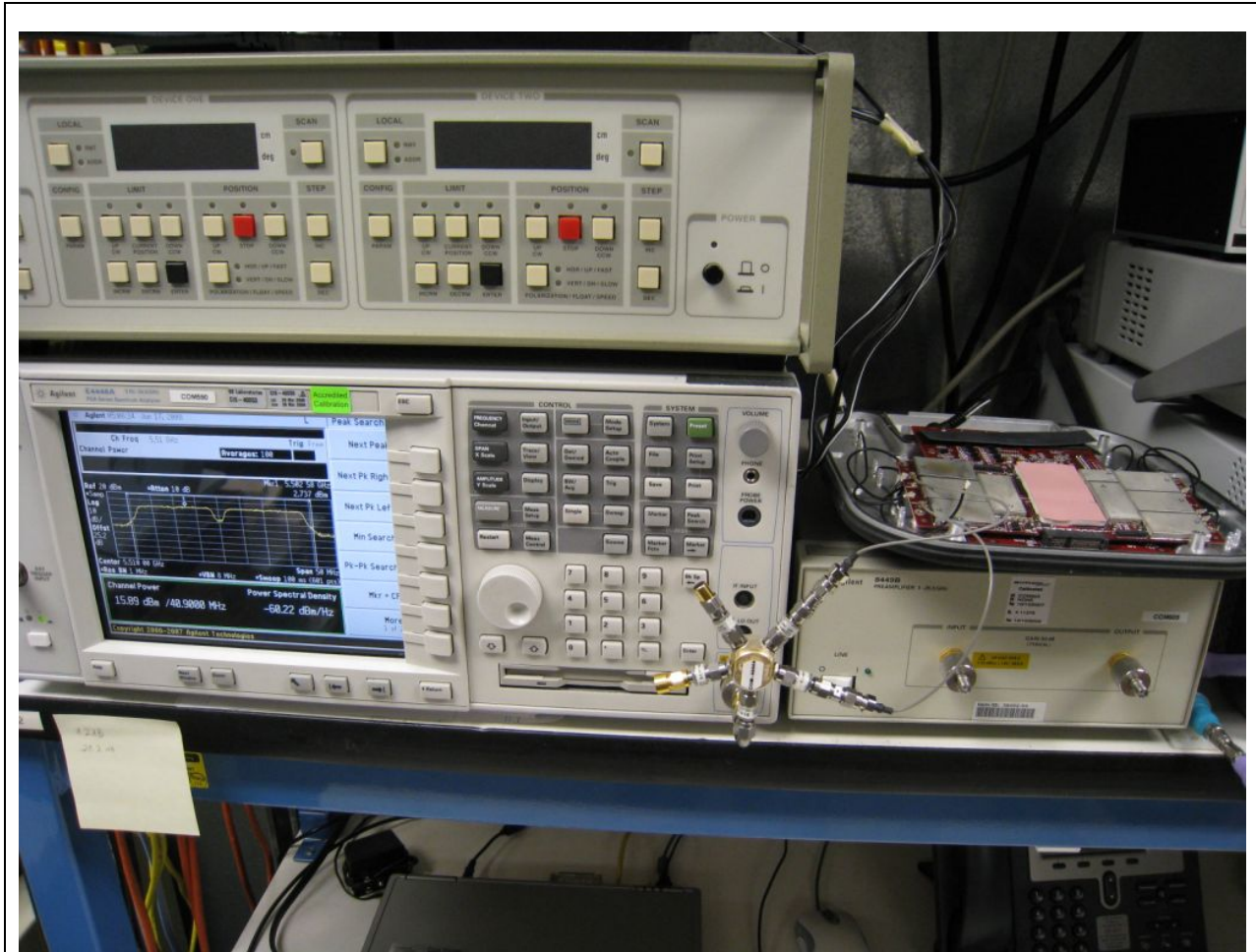**Conducted Spurs, 5500/5520 MHz, M7, HT-40, Dual Transmit Paths**

Conducted Spurs, 5540/5560 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.56 GHz	16.46 dBm
2	(1)	Freq	11.09 GHz	-27.47 dBm
3	(1)	Freq	26.74 GHz	-39.80 dBm

Conducted Spurs, 5540/5560 MHz, M7, HT-40, Dual Transmit Paths

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.56 GHz	16.24 dBm
2	(1)	Freq	11.09 GHz	-31.51 dBm
3	(1)	Freq	26.74 GHz	-38.98 dBm

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Conducted Spurs, 5660/5680 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths

Agilent 08:55:06 Jun 2, 2008				R T	Trace

Mkr2 11.35 GHz
−27.55 dBm
Ref 20 dBm   #Atten 6 dB
#Peak
Log
10
dB/
Offst
25.2
dB
DI
−27.0
dBm
LgAv

Start 30 MHz   Stop 40.00 GHz
#Res BW 1 MHz   #VBW 1 MHz   Sweep 199.9 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.68 GHz	17.37 dBm
2	(1)	Freq	11.35 GHz	−27.55 dBm
3	(1)	Freq	17.02 GHz	−37.58 dBm

Trace
1   2   3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

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Conducted Spurs, 5660/5680 MHz, M7, HT-40, Dual Transmit Paths

Agilent 08:55:51 Jun 2, 2008				R T	Trace

Mkr2 11.35 GHz
−31.05 dBm
Ref 20 dBm   #Atten 6 dB
#Peak
Log
10
dB/
Offst
25.2
dB
DI
−27.0
dBm
LgAv

Start 30 MHz   Stop 40.00 GHz
#Res BW 1 MHz   #VBW 1 MHz   Sweep 199.9 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	5.68 GHz	15.72 dBm
2	(1)	Freq	11.35 GHz	−31.05 dBm
3	(1)	Freq	17.02 GHz	−39.56 dBm

Trace
1   2   3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

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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)
5320	HT-20	M7	53.3	54	0.7
5320	Non HT-20 Beam Forming	54	53.1	54	0.9
5500	Non HT-20 Beam Forming	54	51.7	54	2.3
5700	Non HT-20 Beam Forming	54	53.4	68	14.6
5280/5320	Non HT-40 Duplicate	54	53.7	54	0.3
5280/5320	HT-40	M7	53.5	54	0.5
5500/5520	Non HT-40 Duplicate	54	52.7	54	1.3
5500/5520	HT-40	M7	53.5	54	0.5
5660/5680	Non HT-40 Duplicate	54	57.9	68	10.1
5660/5680	HT-40	M7	53.4	68	14.6

Radiated Bandedge, 5320 MHz, M7, HT-20, Dual Transmit Path, Average

Radiated Bandedge, 5320 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average

Radiated Bandedge, 5500 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average

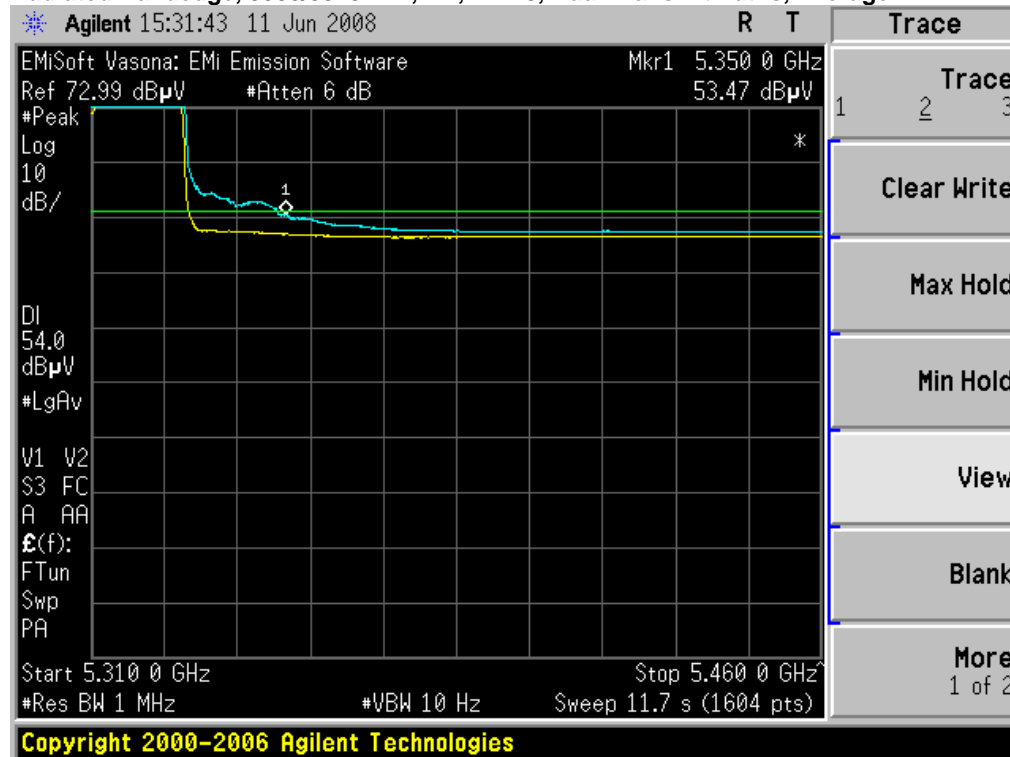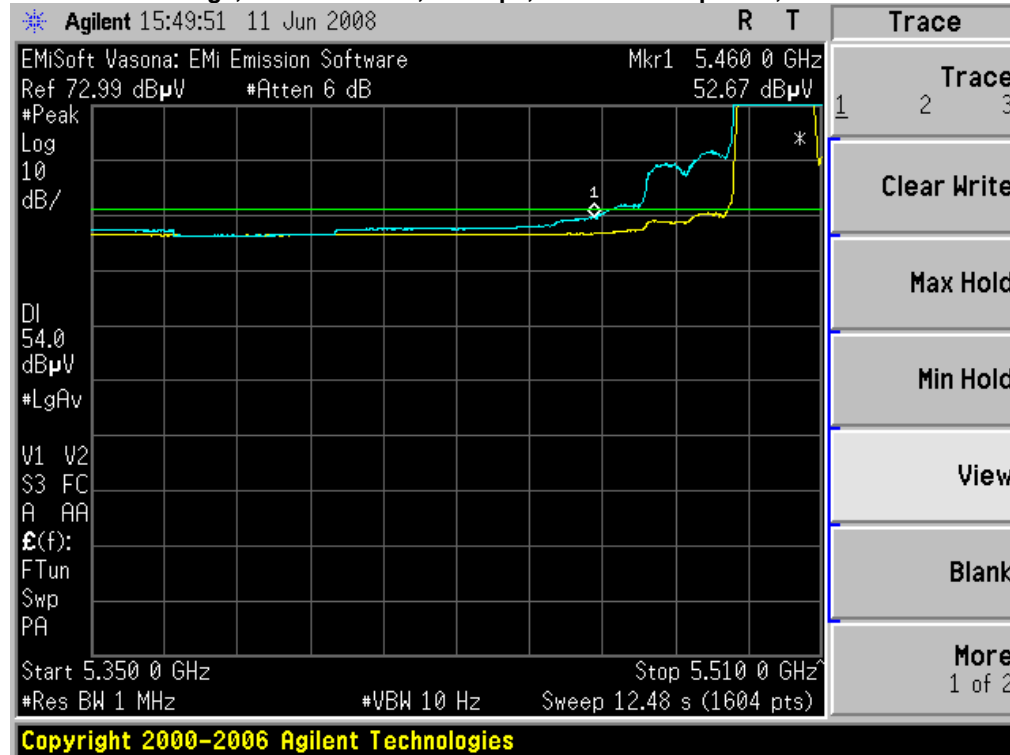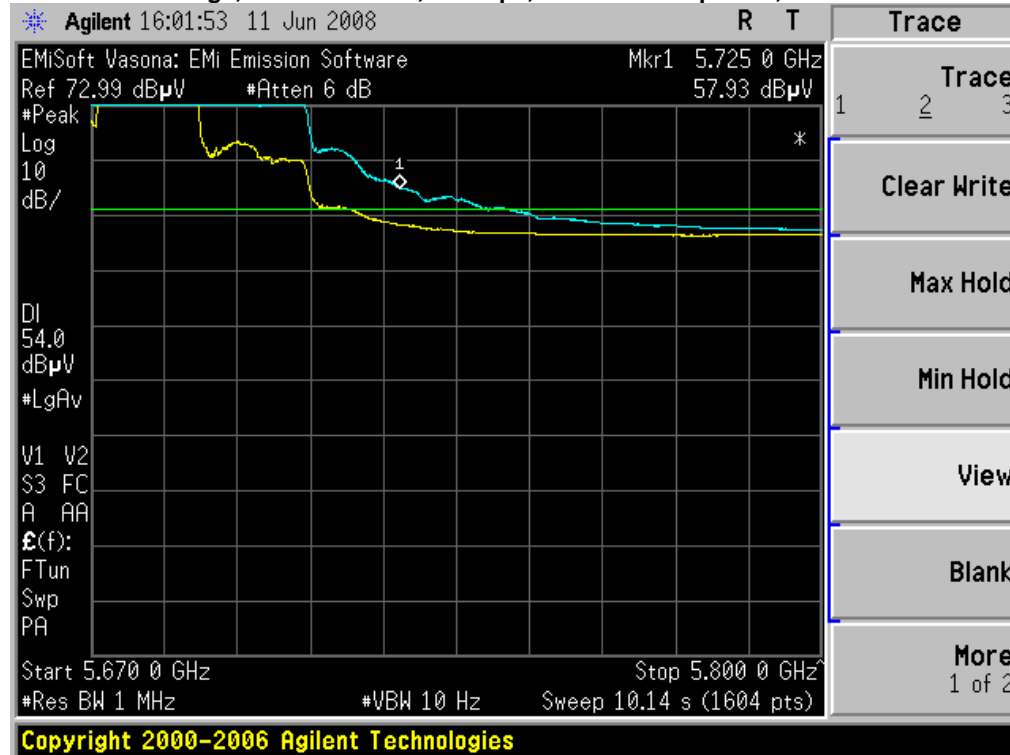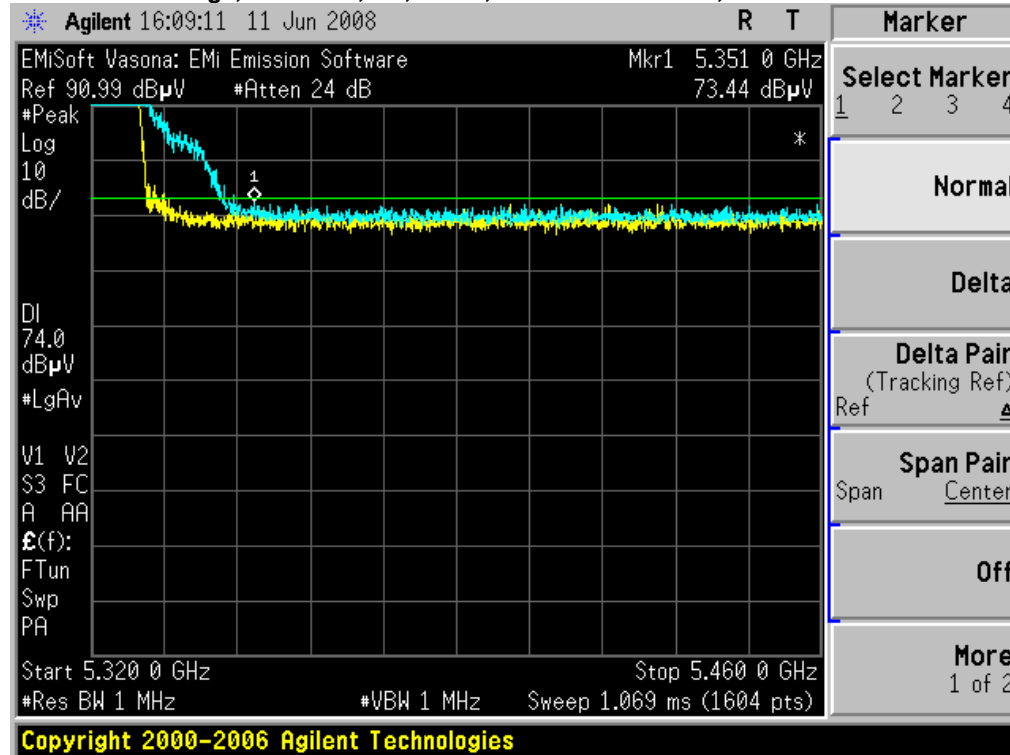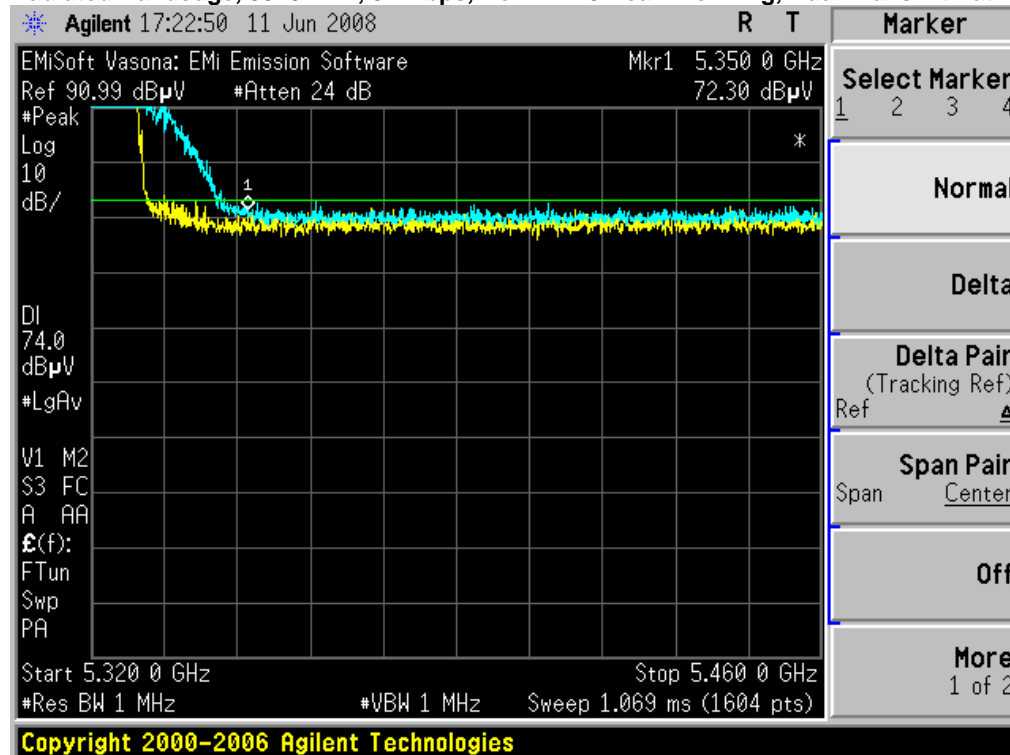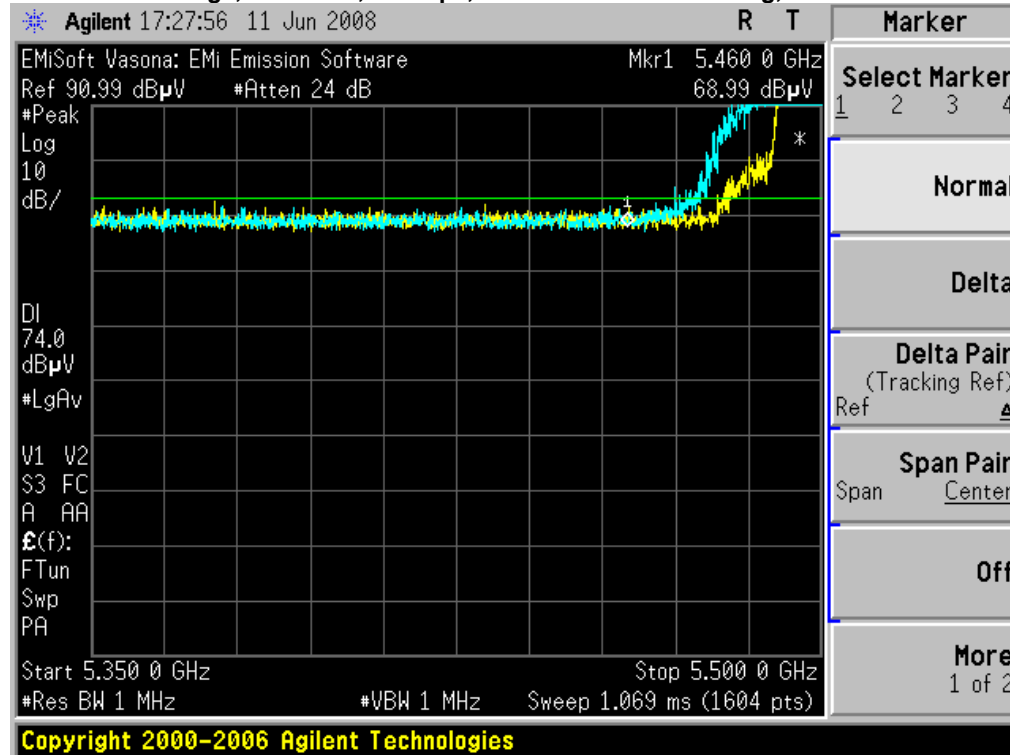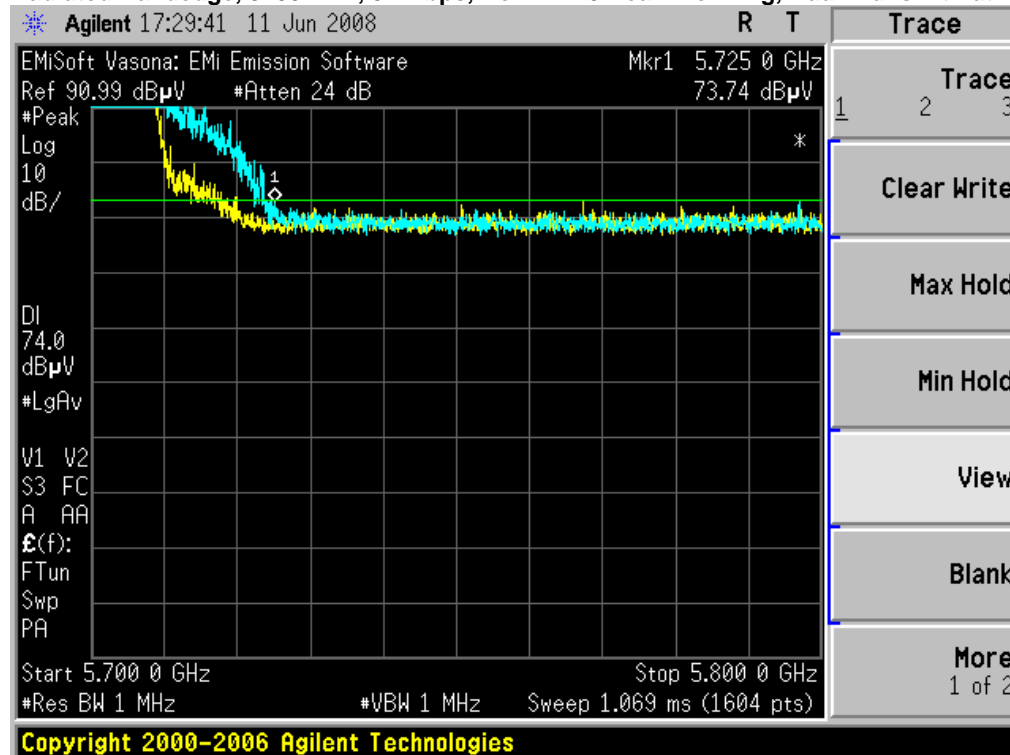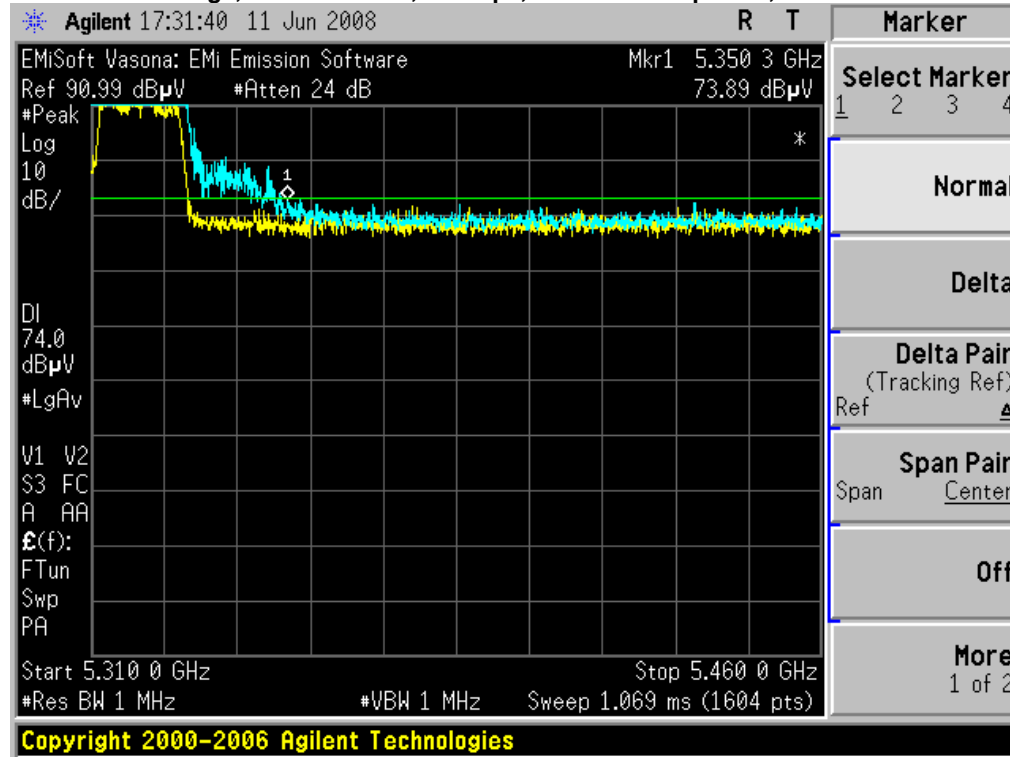**Radiated Bandedge, 5700 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average**
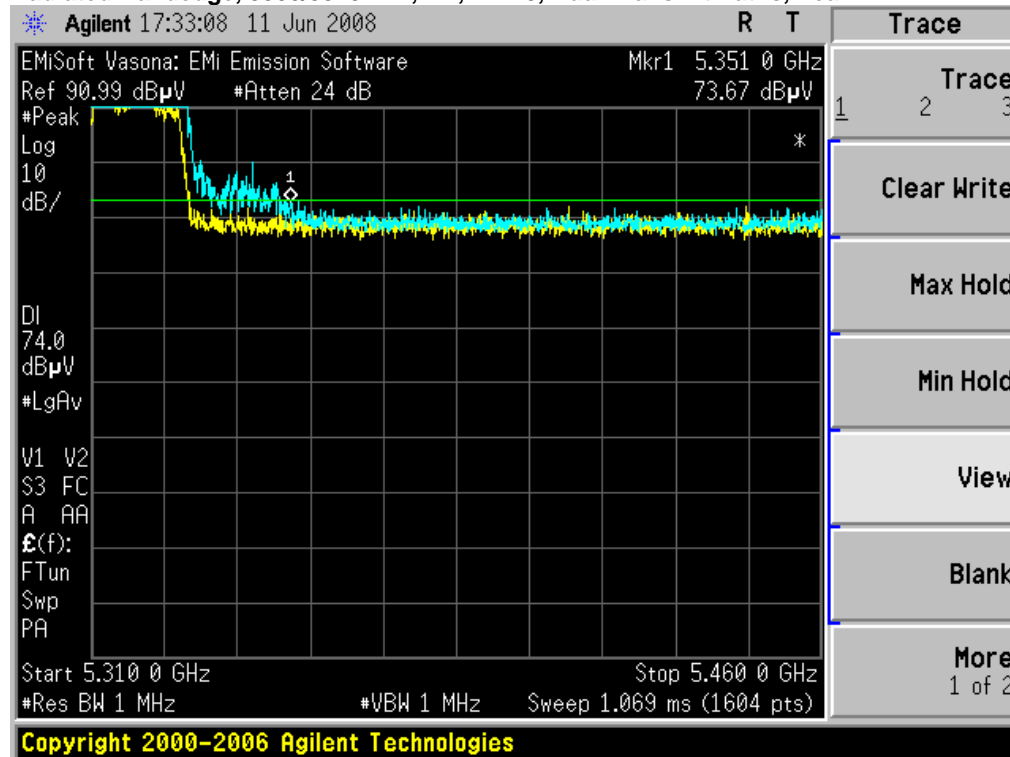

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Radiated Bandedge, 5300/5320MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average
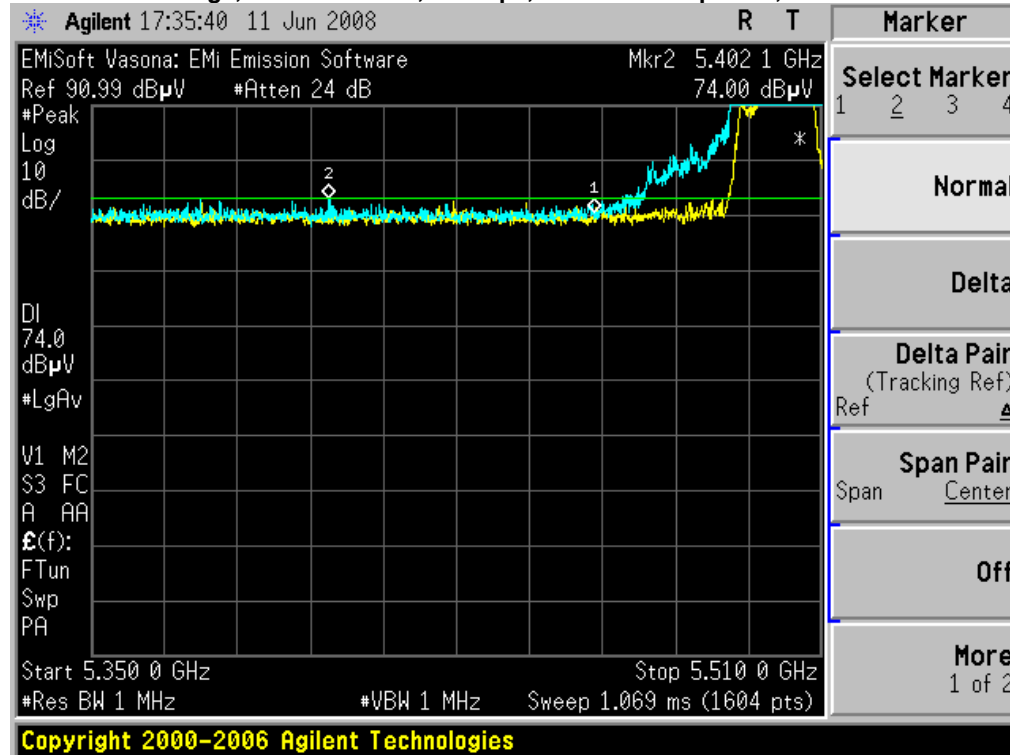

Radiated Bandedge, 5300/5320MHz, M7, HT-40, Dual Transmit Paths, Average

Radiated Bandedge, 5500/5520 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average

Radiated Bandedge, 5500/5520 MHz, M7, HT-40, Dual Transmit Paths, Average

Radiated Bandedge, 5660/5680 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average

Radiated Bandedge, 5660/5680 MHz, M7, HT-40, Dual Transmit Paths, Average

CISCO

Radiated Bandedge, 5320 MHz, M7, HT-20, Dual Transmit Path, Peak

Radiated Bandedge, 5320 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak

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CISCO

Radiated Bandedge, 5500 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak

Radiated Bandedge, 5700 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak

CISCO

Radiated Bandedge, 5300/5320MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak

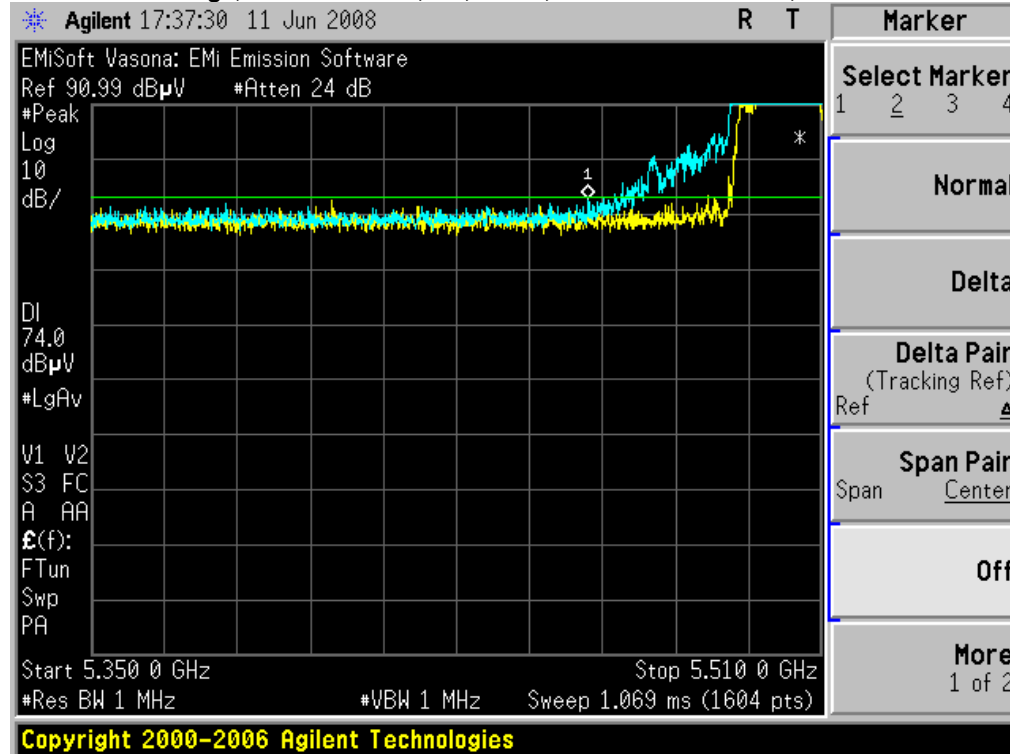**Radiated Bandedge, 5300/5320MHz, M7, HT-40, Dual Transmit Paths, Peak**

Radiated Bandedge, 5500/5520 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak
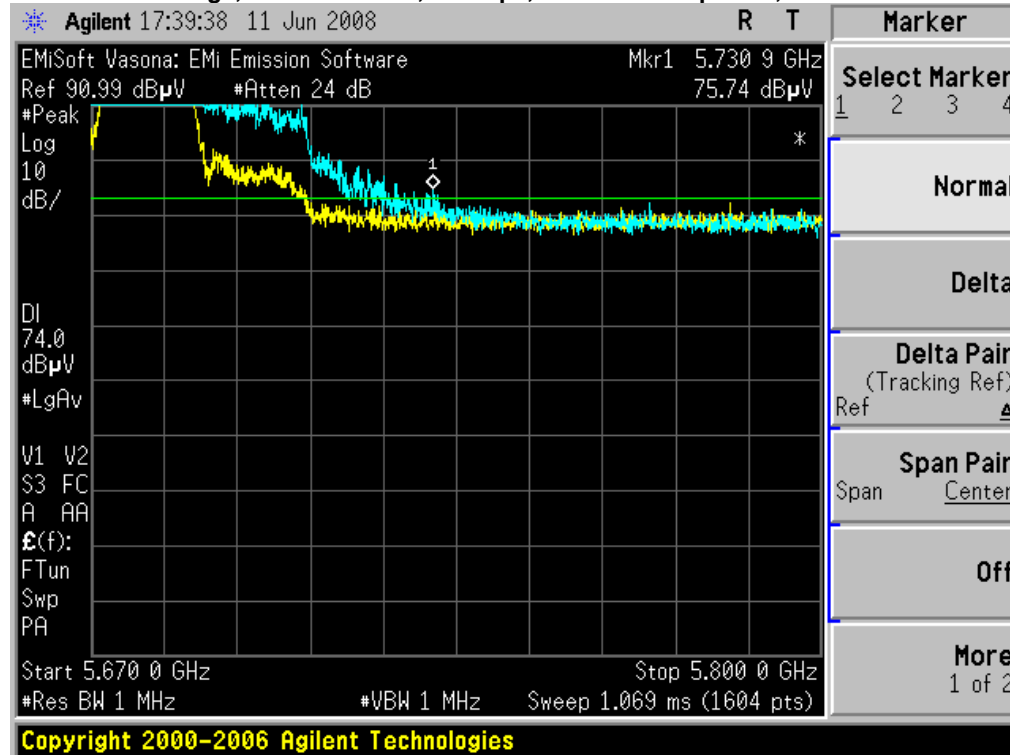

Radiated Bandedge, 5500/5520 MHz, M7, HT-40, Dual Transmit Paths, Peak
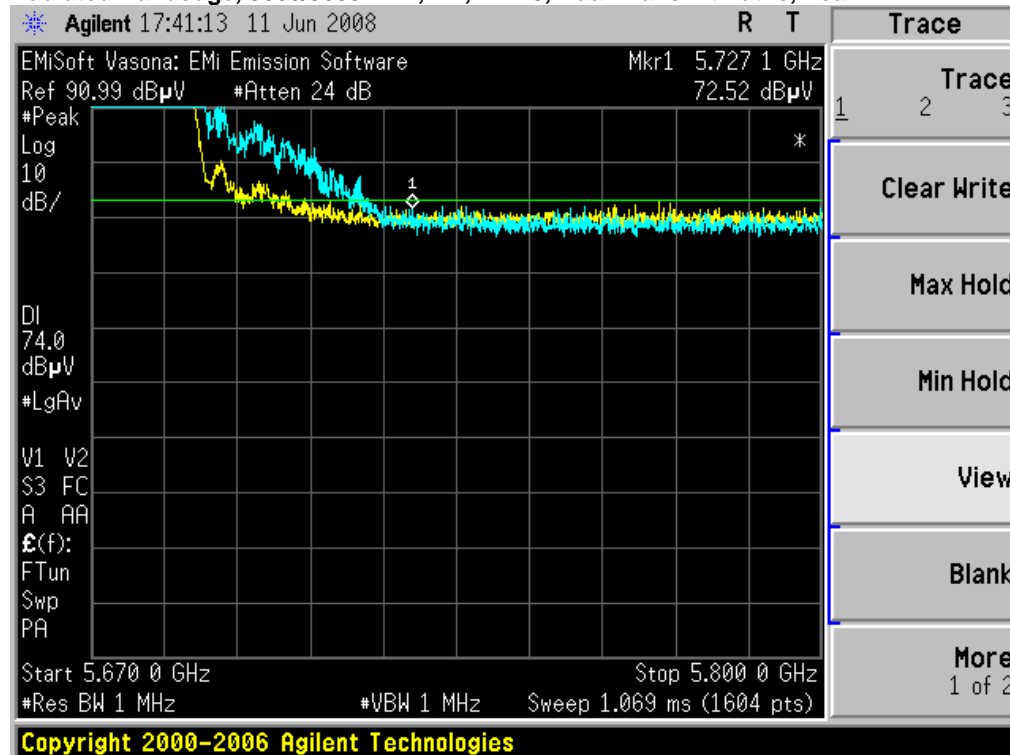
Radiated Bandedge, 5660/5680 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak

Radiated Bandedge, 5660/5680 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)
5260	Non HT-20 Beam Forming	54	44.5	54	9.5
5320	HT-20	M7	38.7	54	15.3
5320	Non HT-20 Beam Forming	54	39.2	54	14.8
5500	Non HT-20 Beam Forming	54	42.7	54	11.3
5580	Non HT-20 Beam Forming	54	46.1	54	7.9
5700	Non HT-20 Beam Forming	54	47.0	54	7.0
5260/5280	Non HT-40 Duplicate	54	45.6	54	8.4
5260/5280	HT-40	M7	39.7	54	14.3
5280/5320	Non HT-40 Duplicate	54	39.7	54	14.3
5280/5320	HT-40	M7	38.3	54	15.7
5500/5520	Non HT-40 Duplicate	54	43.6	54	10.4
5500/5520	HT-40	M7	40.5	54	13.5
5540/5560	Non HT-40 Duplicate	54	46.6	54	7.4
5540/5560	HT-40	M7	43.0	54	11.0
5660/5680	Non HT-40 Duplicate	54	45.5	54	8.5
5660/5680	HT-40	M7	43.4	54	10.6

Radiated Spurious, 5260 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average
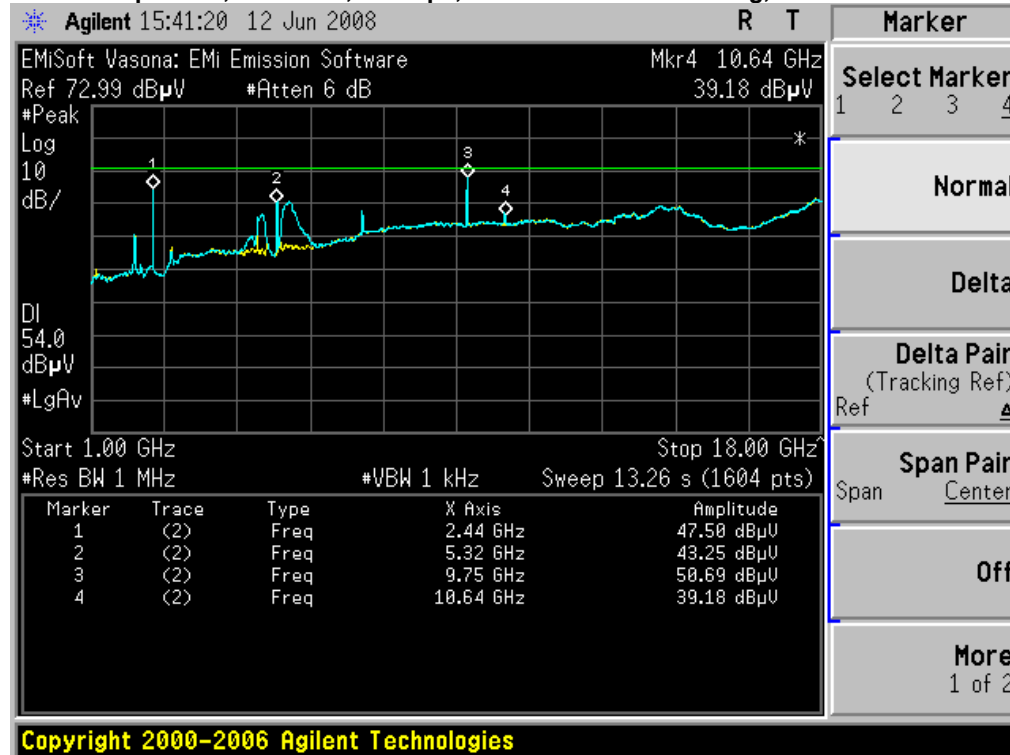

Radiated Spurious, 5320 MHz, M7, HT-20, Dual Transmit Path, Average
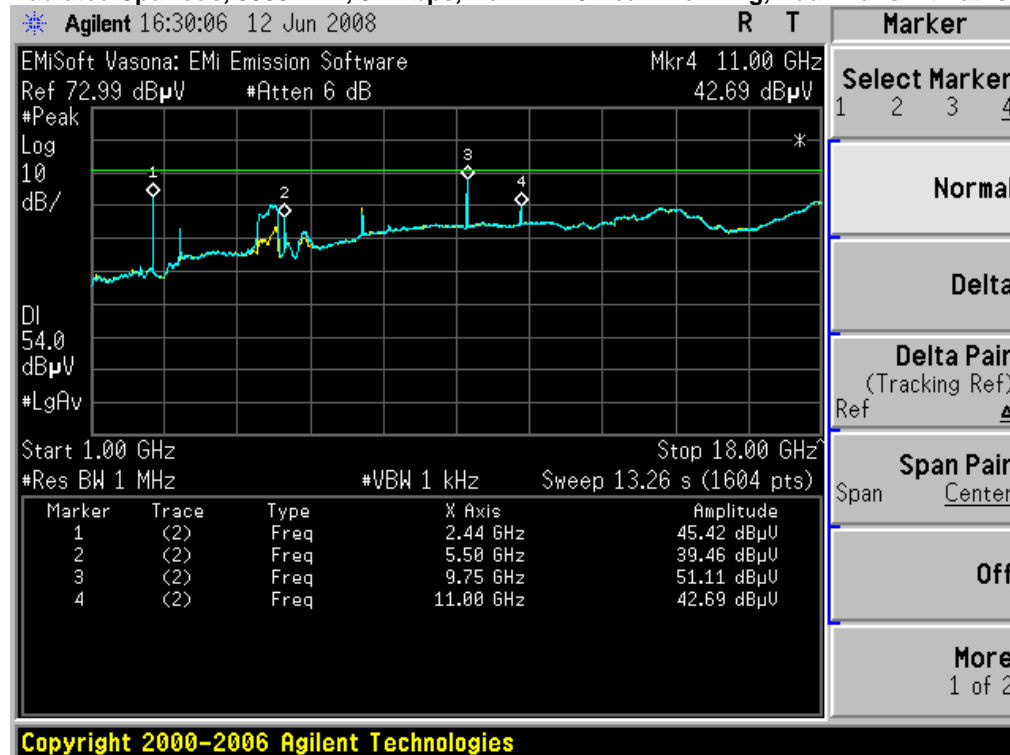
Radiated Spurious, 5320 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average
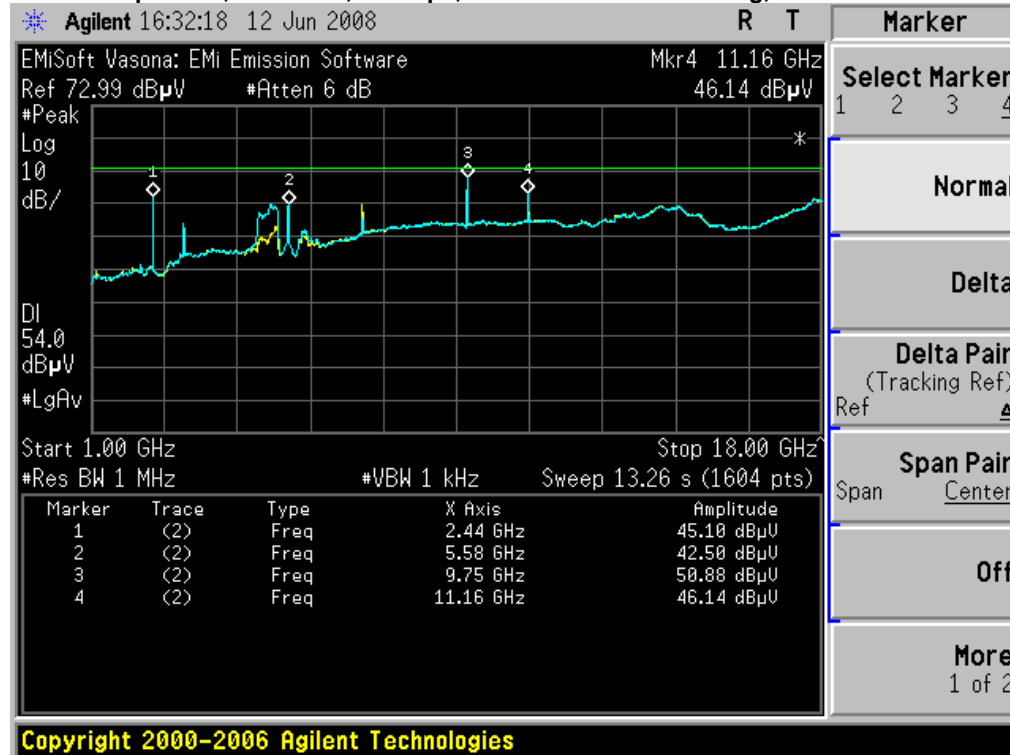

Radiated Spurious, 5500 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average
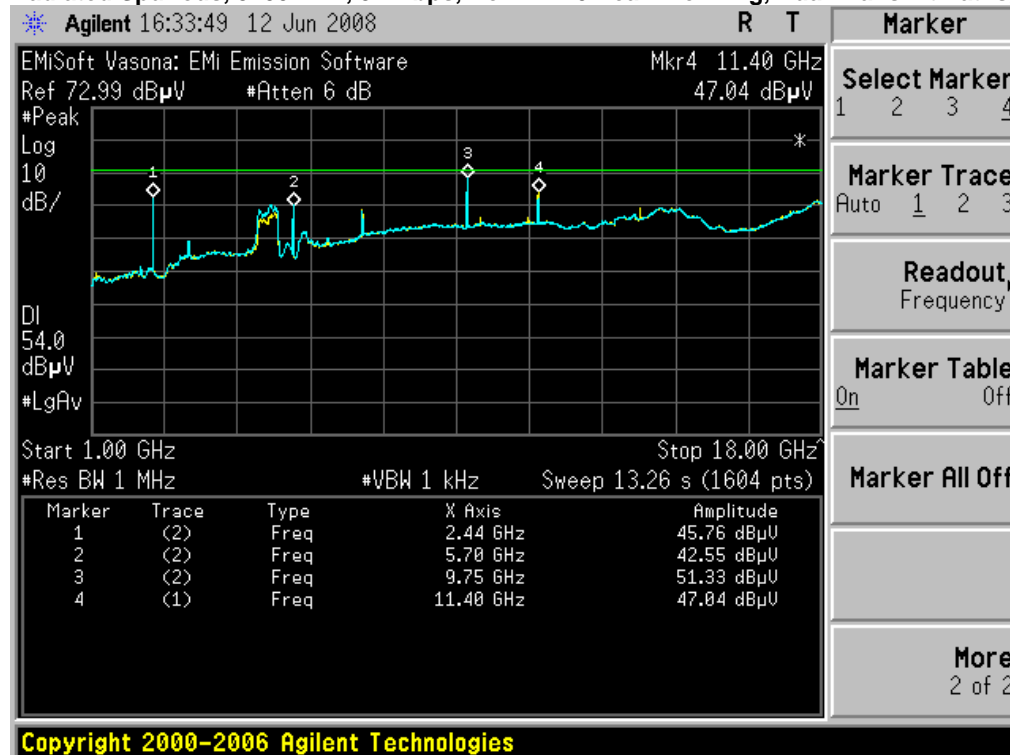
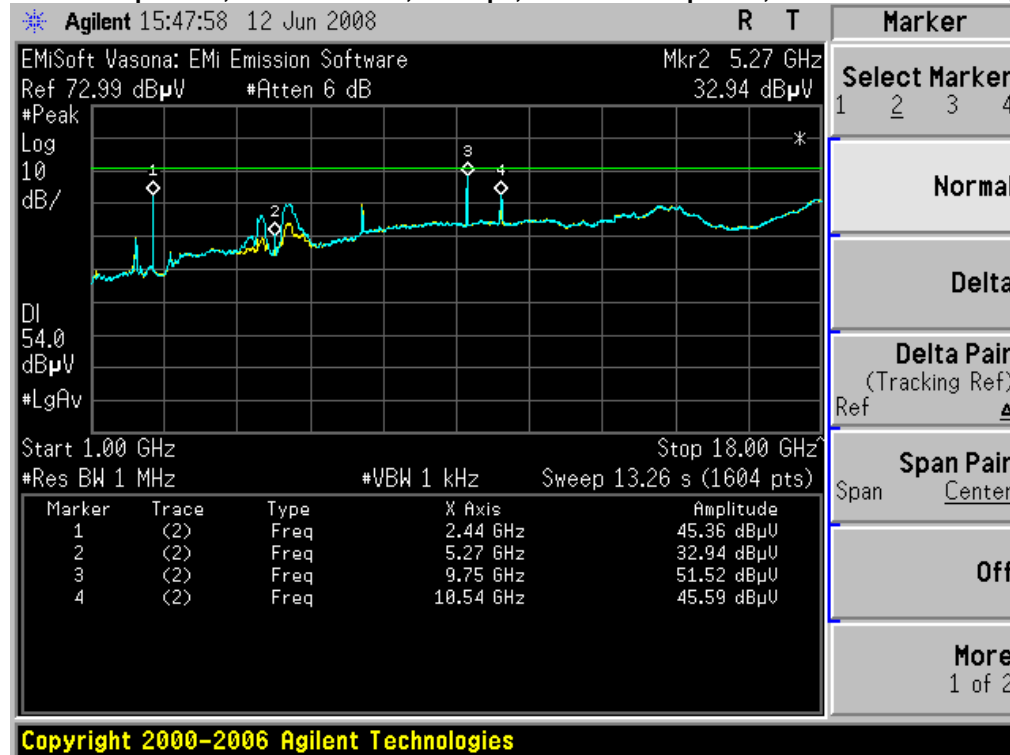**Radiated Spurious, 5580 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average**

Radiated Spurious, 5700 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Average
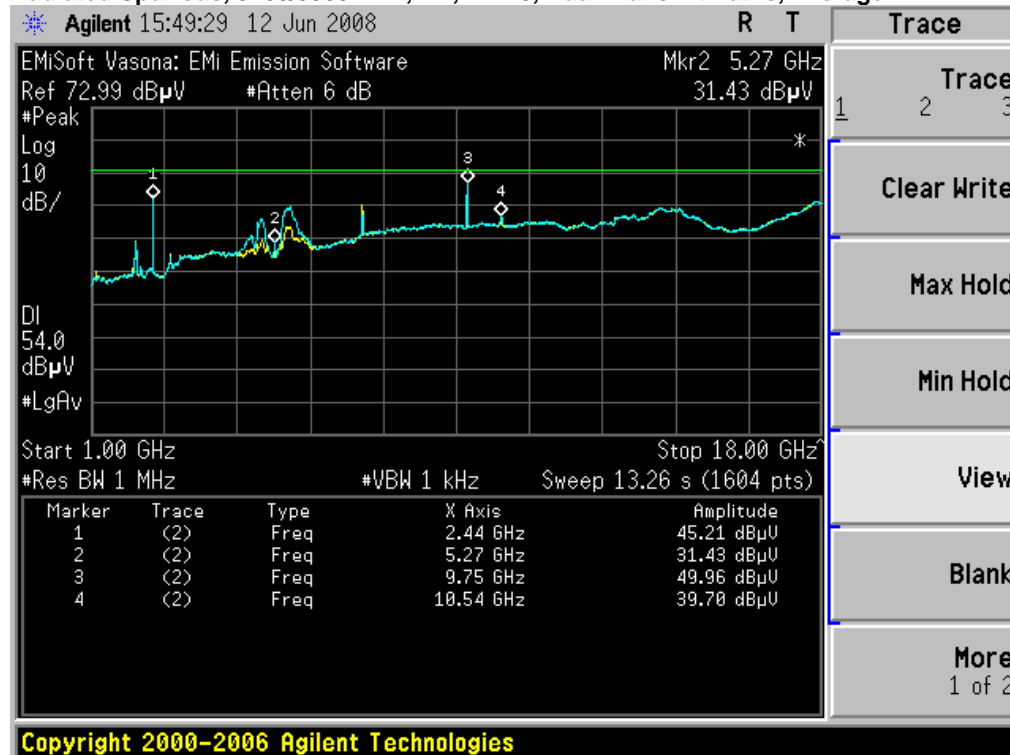
Radiated Spurious, 5260/5300 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average

Radiated Spurious, 5260/5300 MHz, M7, HT-40, Dual Transmit Paths, Average

Radiated Spurious, 5300/5320 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average
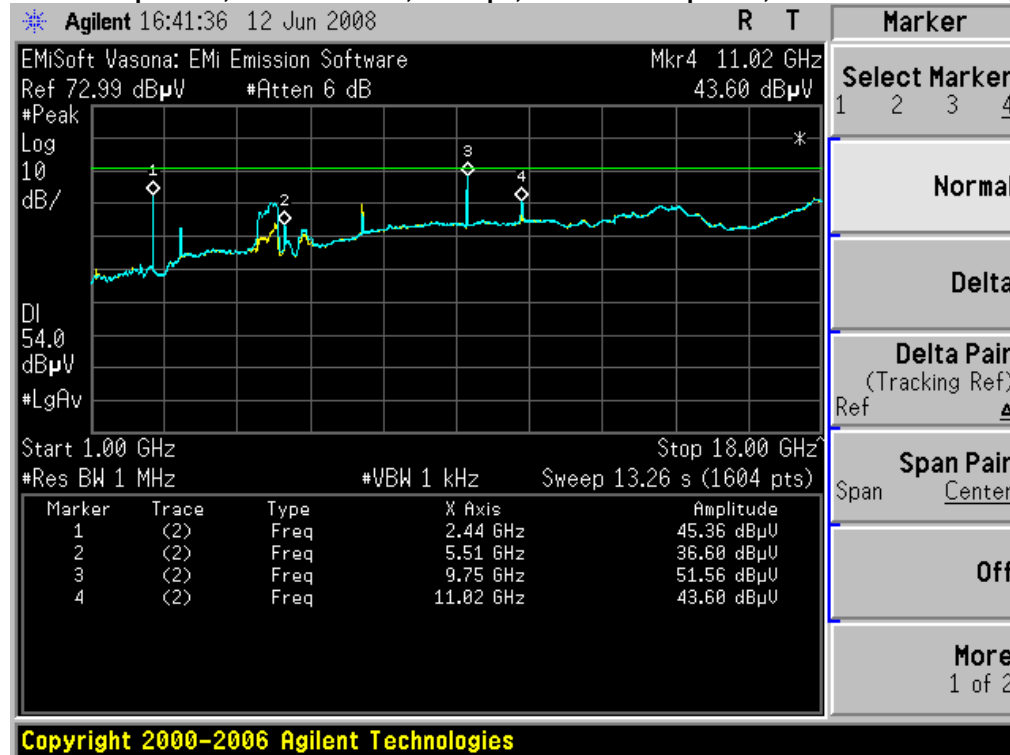

Radiated Spurious, 5300/5320 MHz, M7, HT-40, Dual Transmit Paths, Average

Radiated Spurious, 5500/5520 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average
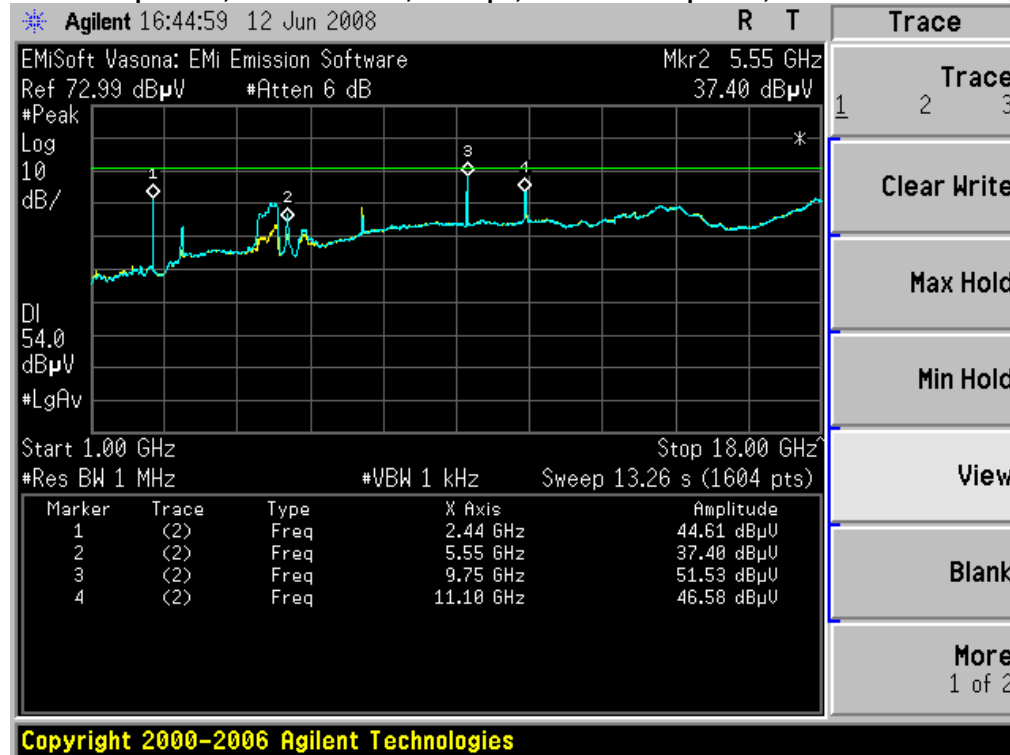

Radiated Spurious, 5500/5520 MHz, M7, HT-40, Dual Transmit Paths, Average
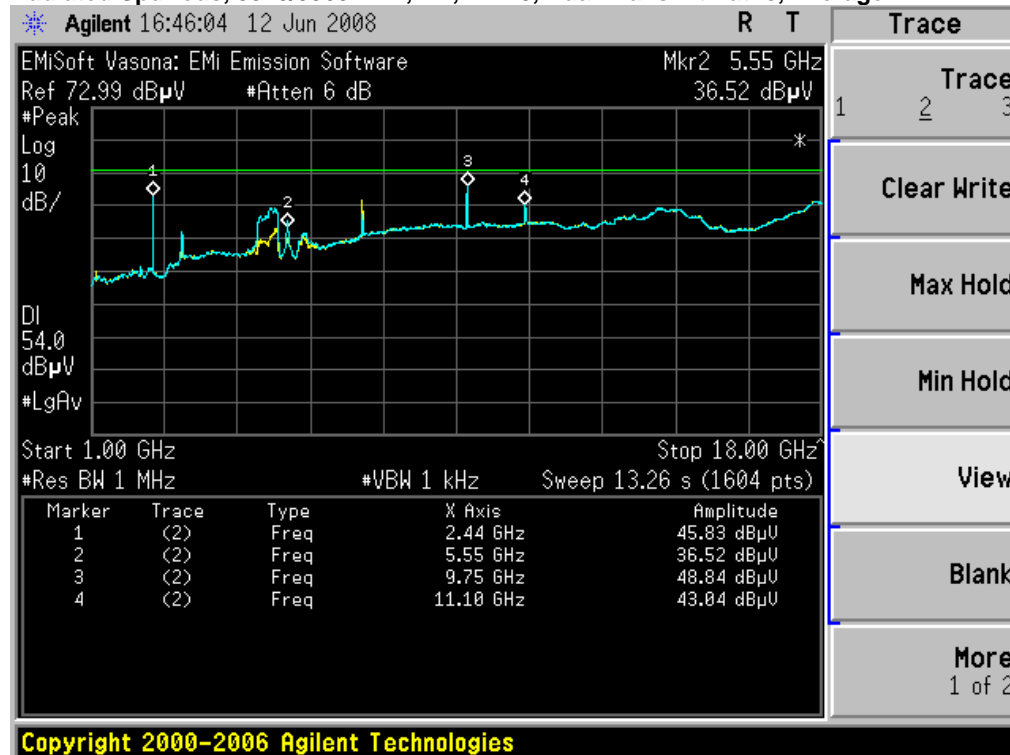
Radiated Spurious, 5540/5560 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average
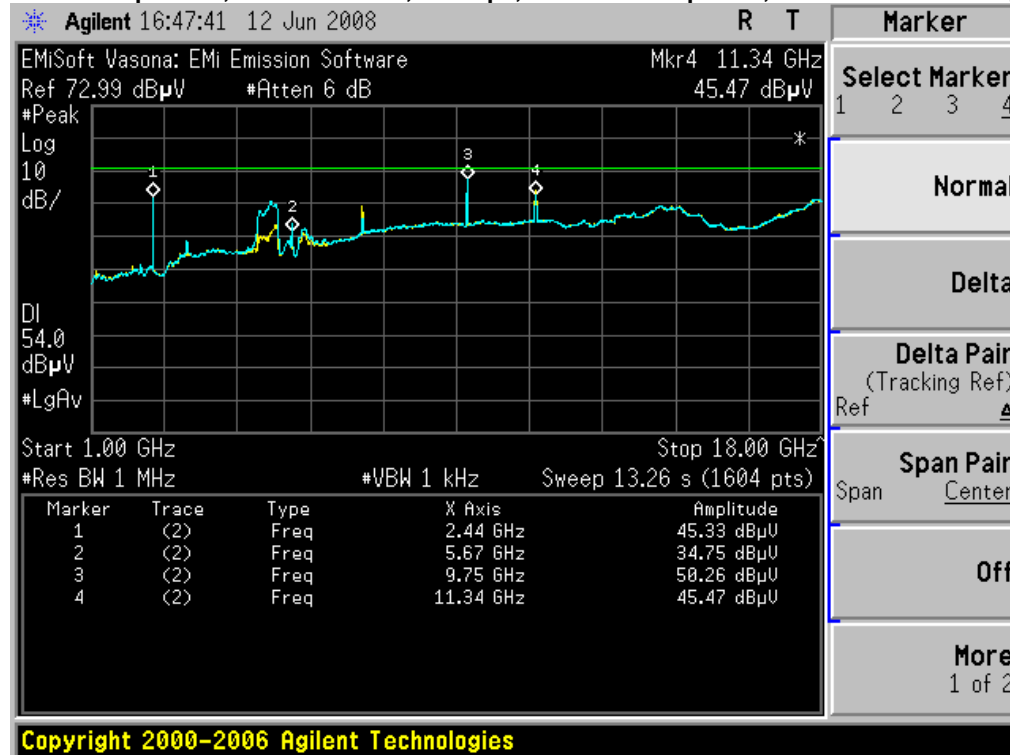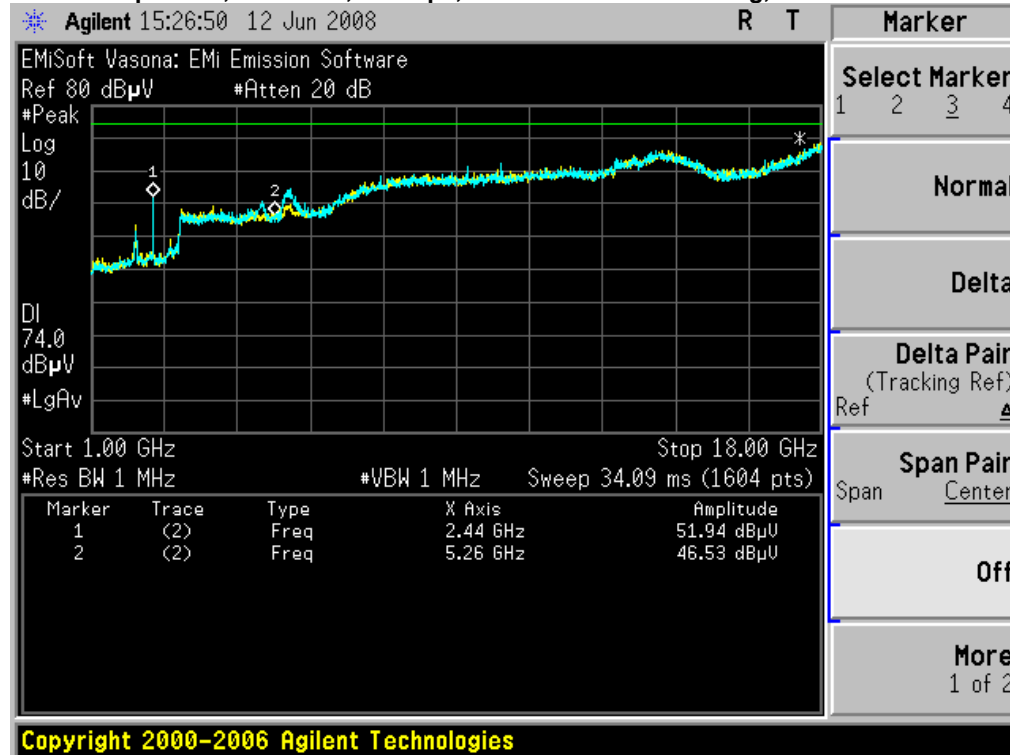

Radiated Spurious, 5540/5560 MHz, M7, HT-40, Dual Transmit Paths, Average

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Radiated Spurious, 5660/5680 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Average

Radiated Spurious, 5660/5680 MHz, M7, HT-40, Dual Transmit Paths, Average

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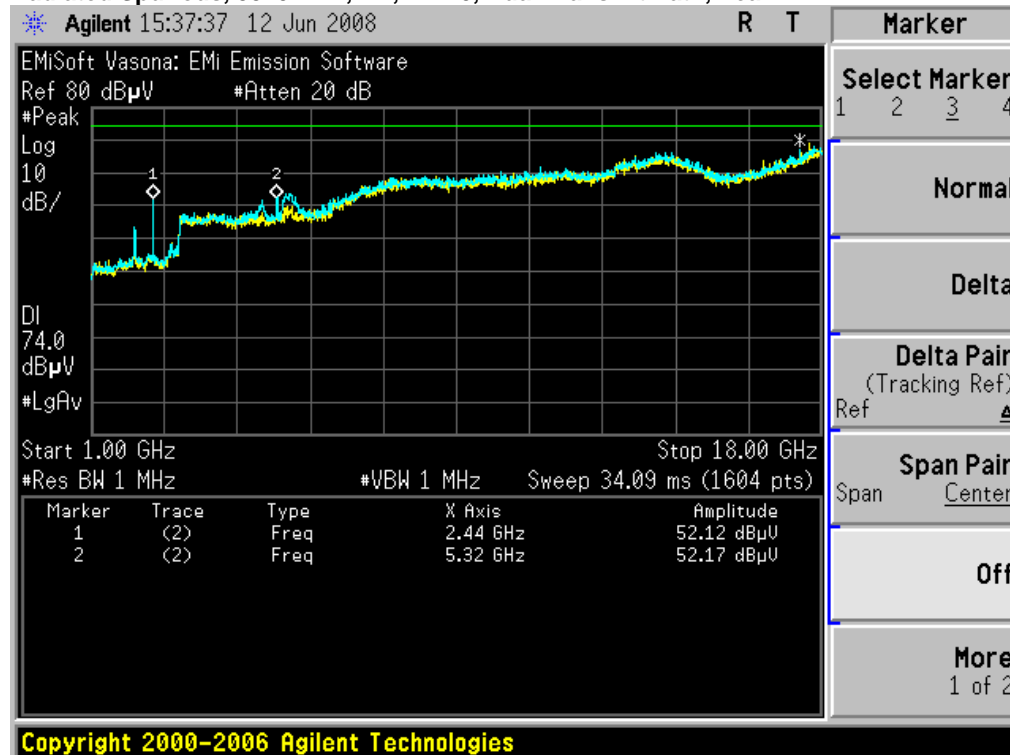Cisco Systems, Inc. Company Confidential

Radiated Spurious, 5260 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak

Radiated Spurious, 5320 MHz, M7, HT-20, Dual Transmit Path, Peak

Custom EMC Test Report No: **EDCS - 674054**

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Radiated Spurious, 5320 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak

Radiated Spurious, 5500 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak

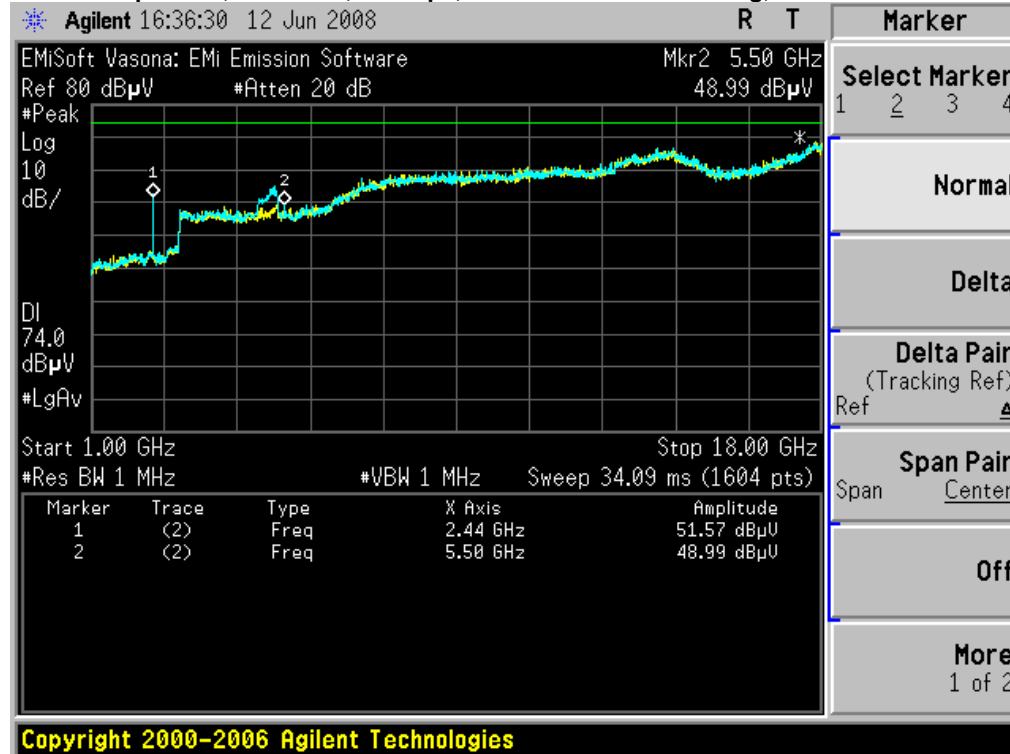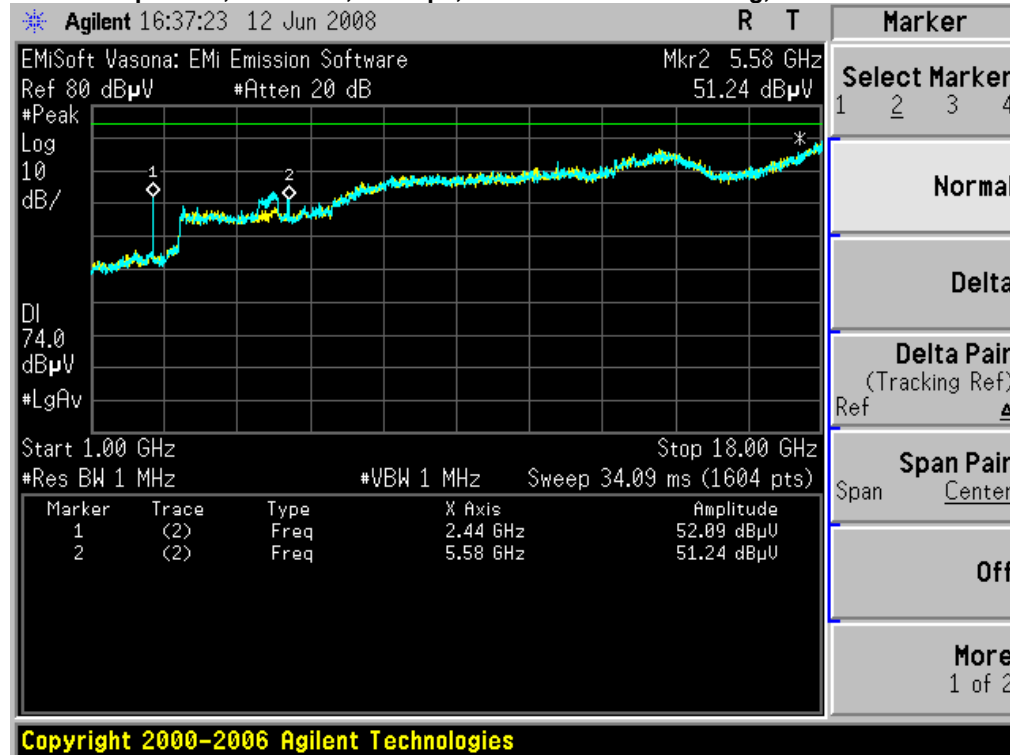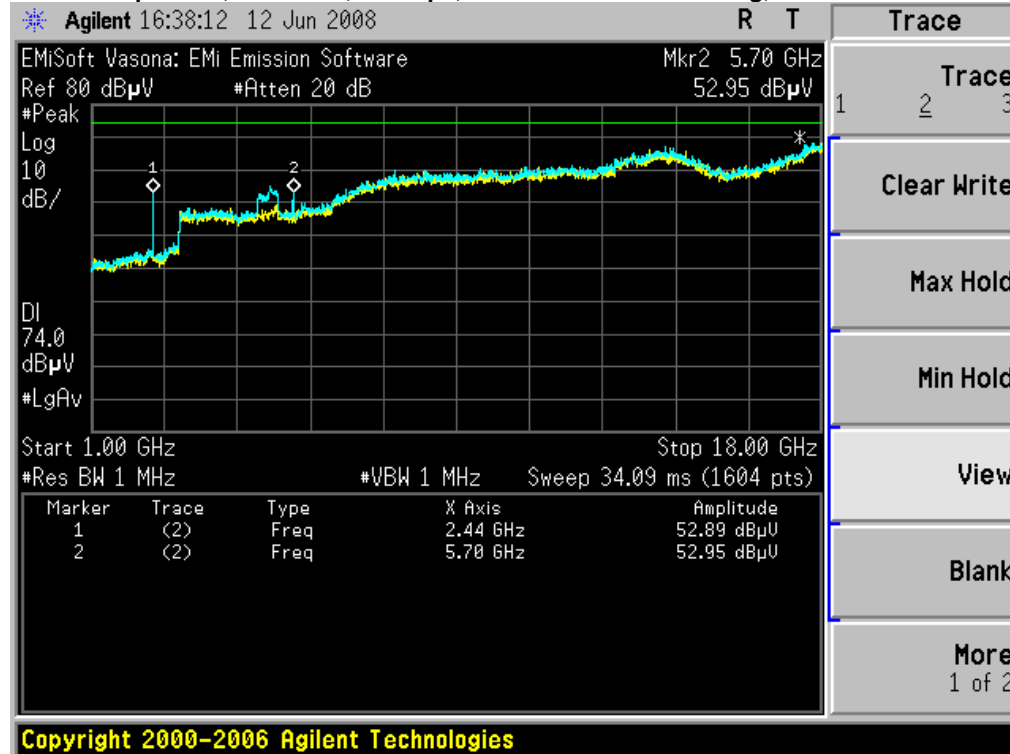**Radiated Spurious, 5580 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak**

Radiated Spurious, 5700 MHz, 54 Mbps, Non HT-20 Beam Forming, Dual Transmit Paths, Peak

Radiated Spurious, 5260/5300 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak

Radiated Spurious, 5260/5300 MHz, M7, HT-40, Dual Transmit Paths, Peak

Radiated Spurious, 5300/5320 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak

Radiated Spurious, 5300/5320 MHz, M7, HT-40, Dual Transmit Paths, Peak

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Radiated Spurious, 5500/5520 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak

Radiated Spurious, 5500/5520 MHz, M7, HT-40, Dual Transmit Paths, Peak
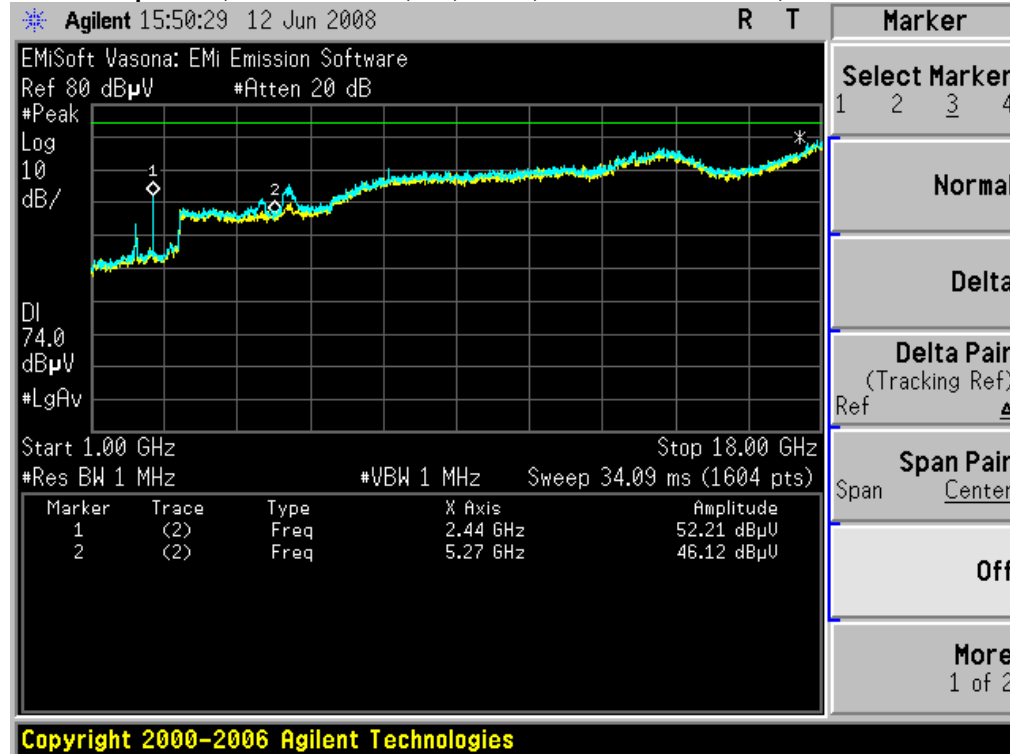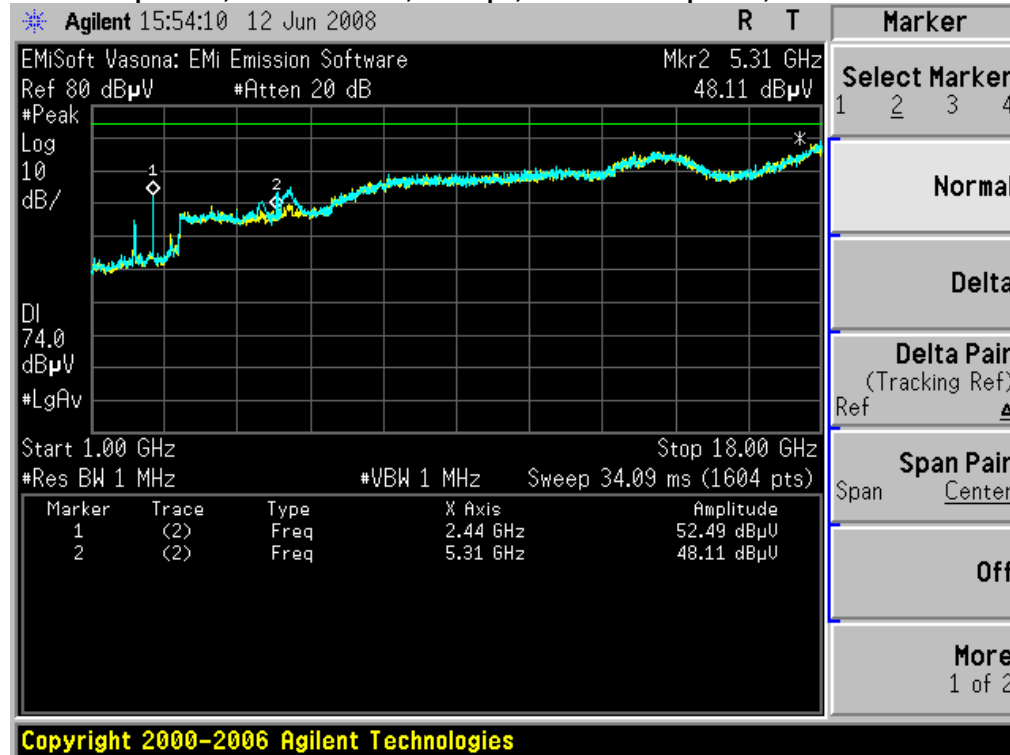
Radiated Spurious, 5540/5560 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak

Radiated Spurious, 5540/5560 MHz, M7, HT-40, Dual Transmit Paths, Peak

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Radiated Spurious, 5660/5680 MHz, 54 Mbps, Non HT-40 Duplicate, Dual Transmit Paths, Peak

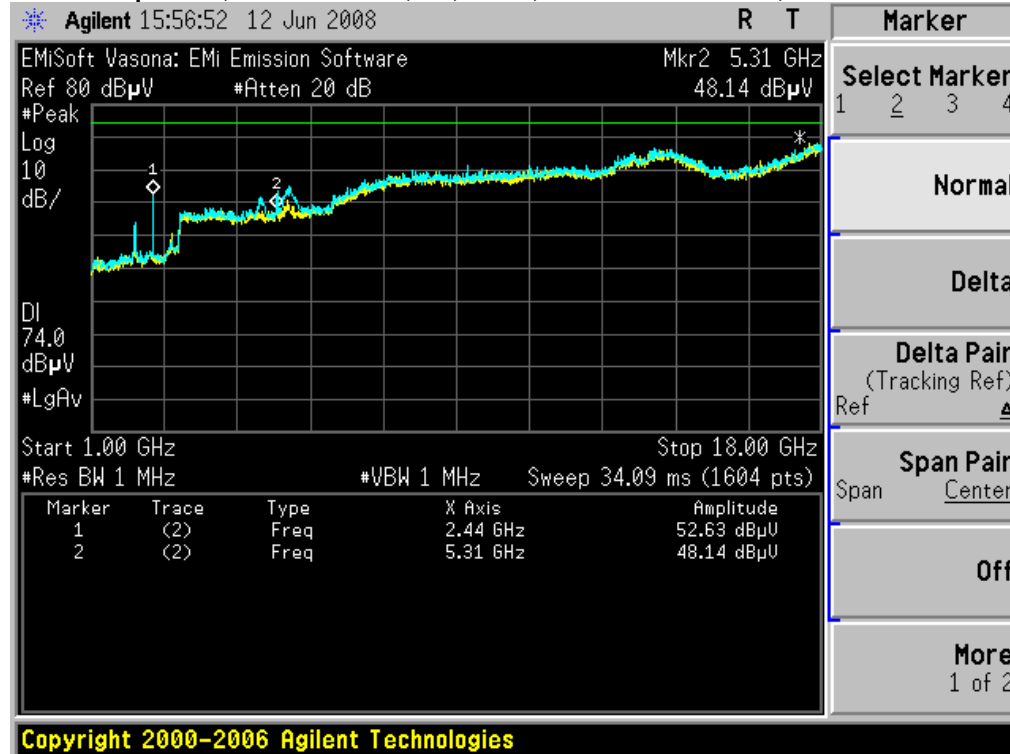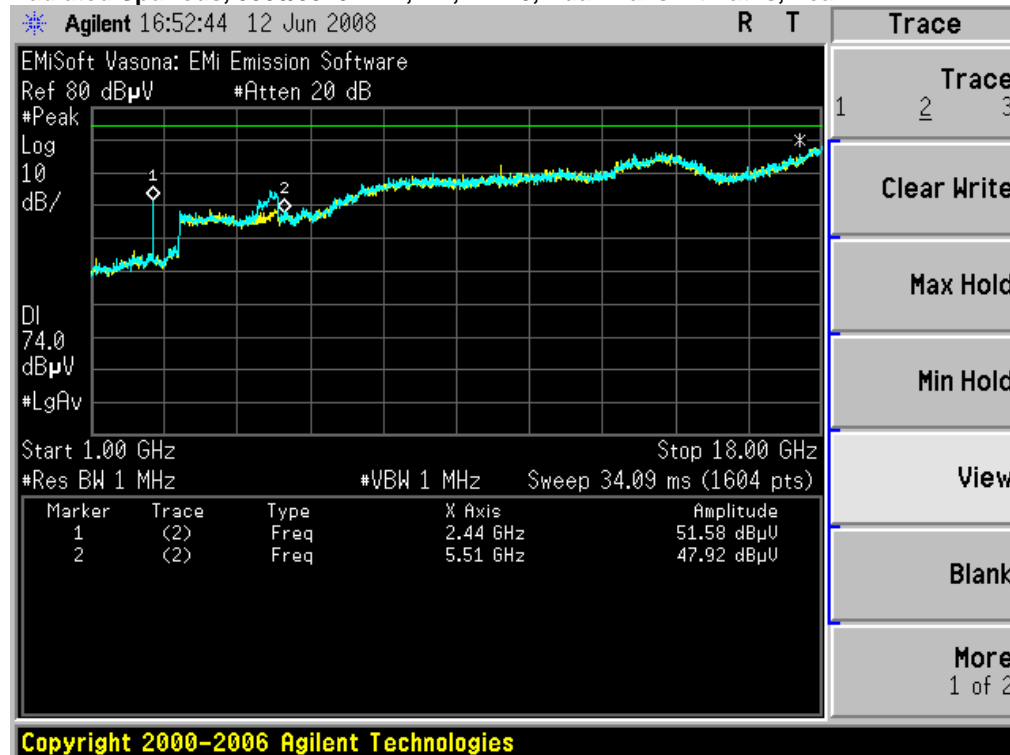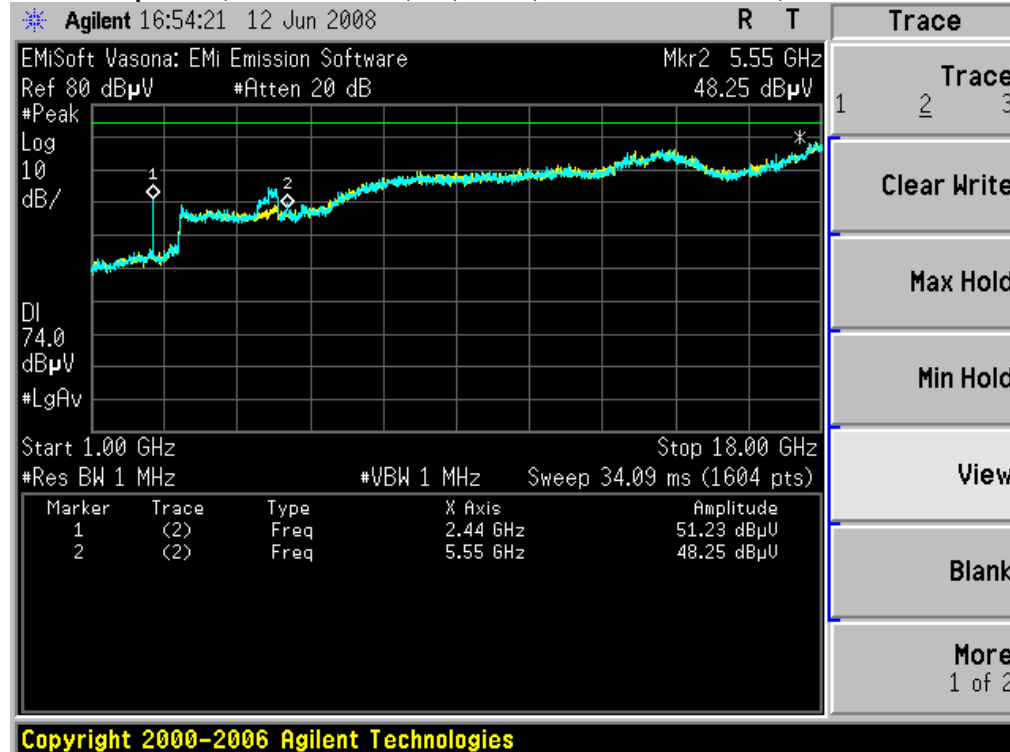**Radiated Spurious, 5660/5680 MHz, M7, HT-40, Dual Transmit Paths, Peak**

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Title: Radiated Test Setup

Conducted emissions

Power Line Conducted Emissions
Filename: Data not stored

Template: LISN A Cond Class B
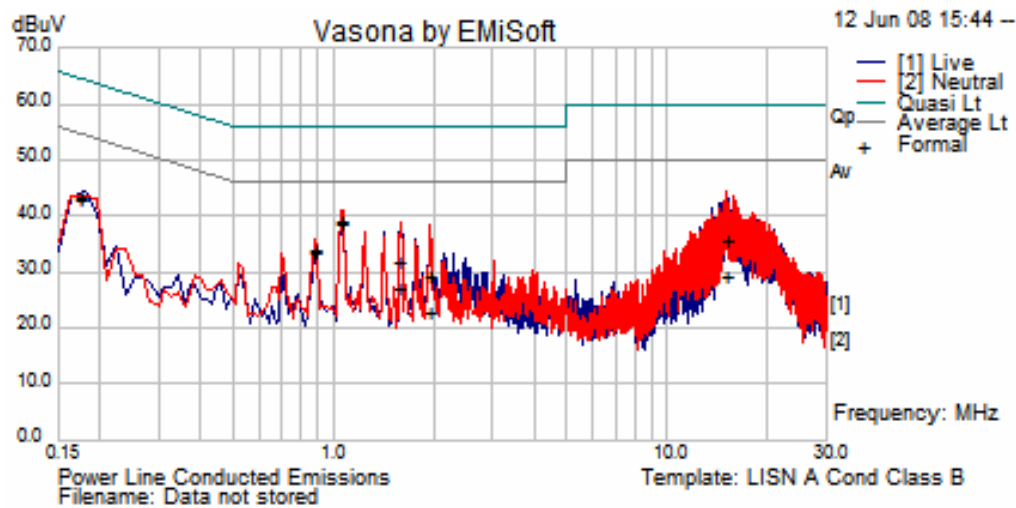
Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail
0.178	20.32	20.41	0.18	40.91	Average	Neutral	54.58	-13.66	Pass
0.178	20.69	20.41	0.18	41.28	Quasi Peak	Neutral	64.58	-23.29	Pass
0.889	11.71	19.96	0.08	31.75	Quasi Peak	Neutral	56	-24.25	Pass
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
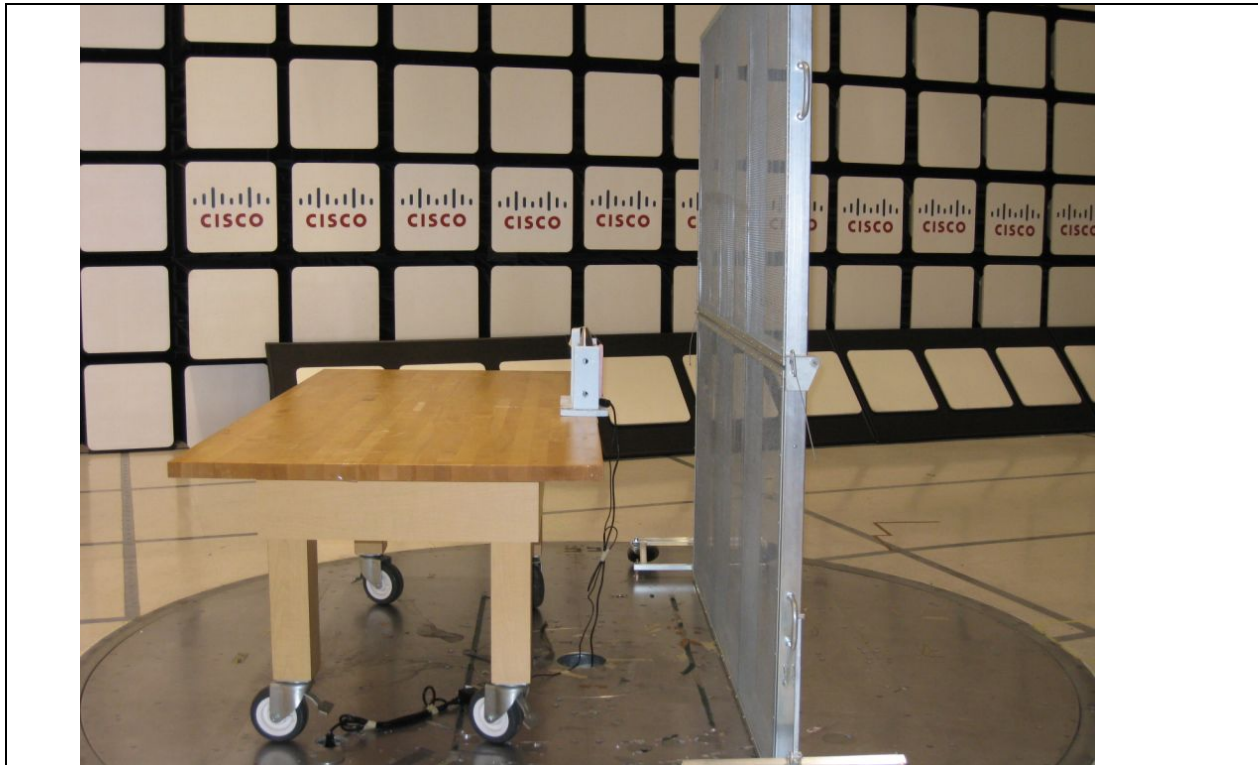
Title: Conducted Power Line Emissions

Radiated emissions

Radiated Emissions
Filename: Data not stored

Template: Rad Class B (3m) 30MHz-1GHz
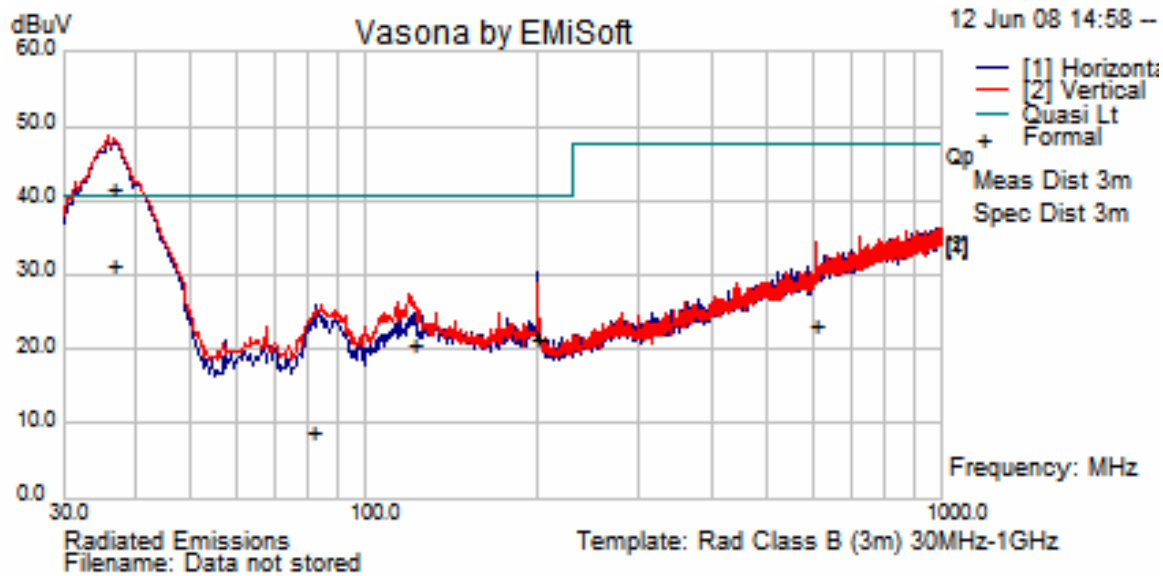
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail
36.913	13.4	0.4	15.7	29.43	Quasi Peak	H	220	282	40.5	-11.1	Pass
36.915	23.8	0.4	15.7	39.85	Quasi Peak	V	180	282	40.5	-0.7	Pass
82.382	-1.1	0.7	7.4	6.88	Quasi Peak	V	240	4	40.5	-33.6	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
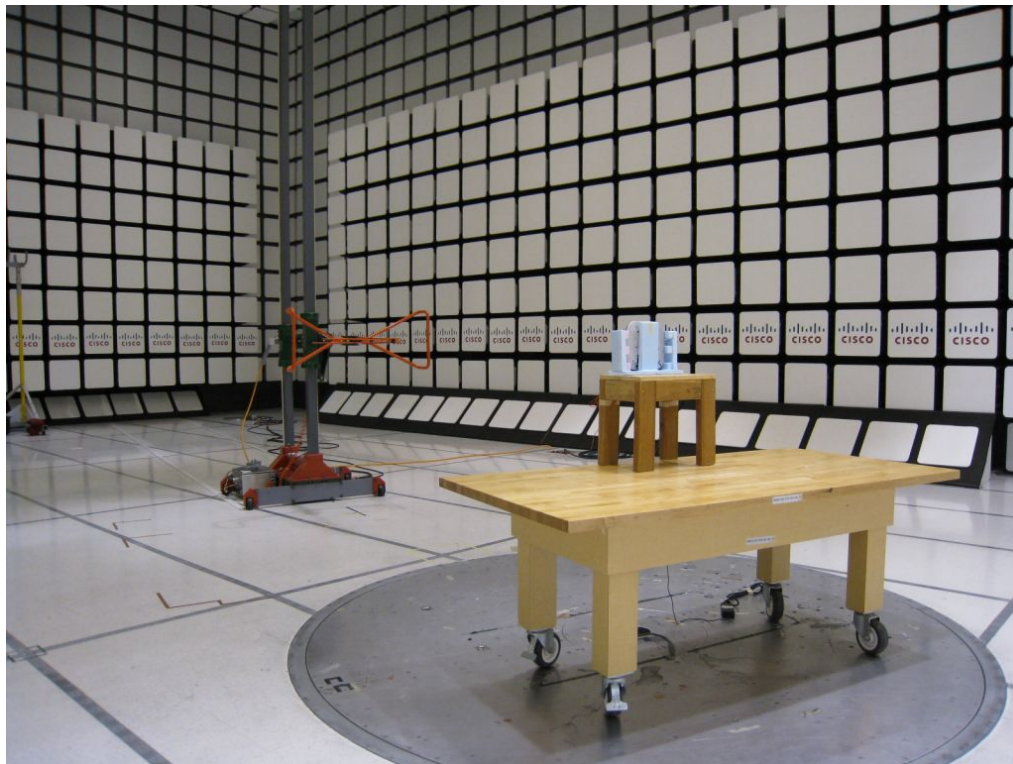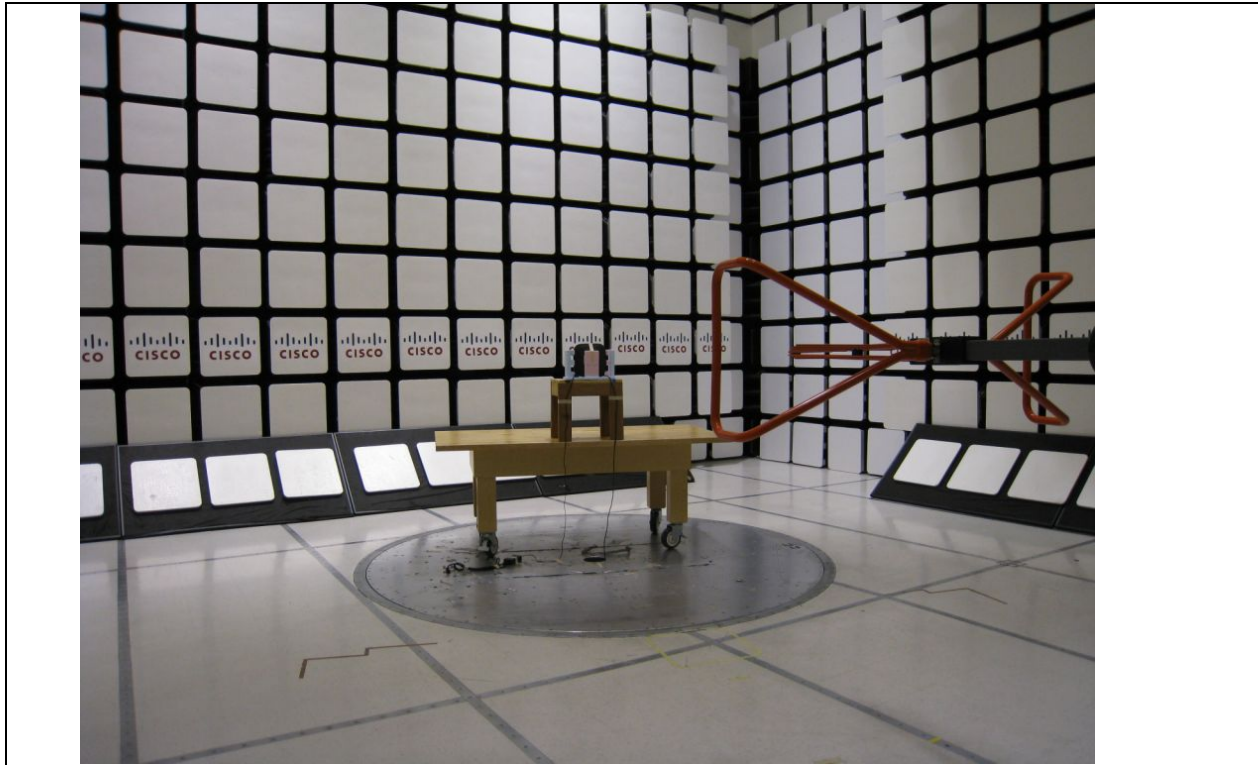
Title: Radiated Emissions 30M-1GHz

Maximum Permissible Exposure (MPE) Calculations

15.407: 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^2

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(mW)=P(W)/1000   d(cm)=100*d(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^2

Substituting the logarithmic form of power and gain using:

P(mW)=10^(P(dBm)/10)   G(numeric)=10^(G(dBi)/10)

yields

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

and

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

where

d=MPE distance in cm
P=Power in dBm
G=Antenna Gain in dBi
S=Power Density in mW/cm^2

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=1mW/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^2)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	Limit (cm)	Margin (cm)
5260	54	1	20.4	3	**4.17**	20	15.83
5320	54	1	19.1	3	**3.59**	20	16.41
5500	54	1	20.8	3	**4.37**	20	15.63
5580	54	1	20.9	3	**4.42**	20	15.58
5700	54	1	20.8	3	**4.37**	20	15.63

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^2)	Limit (mW/cm^2)	Margin (mW/cm^2)
5260	54	20	20.4	3	**0.04**	1	0.96
5320	54	20	19.1	3	**0.03**	1	0.97
5500	54	20	20.8	3	**0.05**	1	0.95
5580	54	20	20.9	3	**0.05**	1	0.95
5700	54	20	20.8	3	**0.05**	1	0.95

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 Heliax 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