



4.9 GHz Test Report

AIR-RM1520-49-A-K9

4.9 GHz Public Safety Band Radio Module for 1520 Series

FCC ID: LDK102067
IC ID: 2461B-102067

Against the following Specifications:
90.1215

Cisco Systems

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San Jose, CA 95134

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Approved By:

Title:



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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 90.1215	N/A
CFR47 Part 15: 2005 CFR47 Part 15: 2005 (CAN/CSA-CISPR 22-02)	

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

10-Dec-2007

2.3 Report Issue Date

Cisco uses an electronic system to issue, store and control the revision of test reports. This system is called the Engineering Document Control System (EDCS). The actual report issue date is embedded into the original file on EDCS. Any copies of this report, either electronic or paper, that are not on EDCS must be considered uncontrolled

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-RM1520-49-A -K9 4.9GHz Public Safety Band Radio Module for 1520 Series

2.6 EUT Description

The AIR-RM1520-49-A-K9 4.9GHz Public Safety Band Radio Module operates exclusively in the AIR-LAP1520 series access point, and may operate simultaneously with the AIR-RM1520-24-A-K9 (2.4GHz 802.11b/g Radio Module) and AIR-RM1520-58-A-K9 (5.8GHz 802.11a Radio Module).

The following antennas are supported by this product.

AIR-ANT5180V-N	4900-5850 MHz	8.0 dBi Omni-directional
AIR-ANT5114P-N	4900 -5850 MHz	14.0 dBi Patch
AIR-ANT5117S-N	4900 -5850 MHz	17.0 dBi 90-degree Sector

**Section 3: Sample Details**

Sample No.	Equipment Details	Part Number	Manufacturer	Hardware Rev.	Firmware Rev.	Software Rev.	Serial Number
S01	802.11a Radio Module	AIR-RM1520A-A-K9	Cisco Systems	NA	NA	NA	NA
S02	Mesh Access Point	AIR-LAP1522A G-A-K9	Cisco Systems	NA	NA	NA	NA
S03	8.0 dBi Omni Antenna	AIR-ANT5180 V-N	Cisco Systems	NA	NA	NA	NA
S05	17dBi Patch Antenna	AIR-ANT5117 S-N	Cisco Systems	NA	NA	NA	NA

**Appendix A: Emission Test Results**

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

Average Output Power

Average Power with up to 8, 14, and 17 dBi Antennas

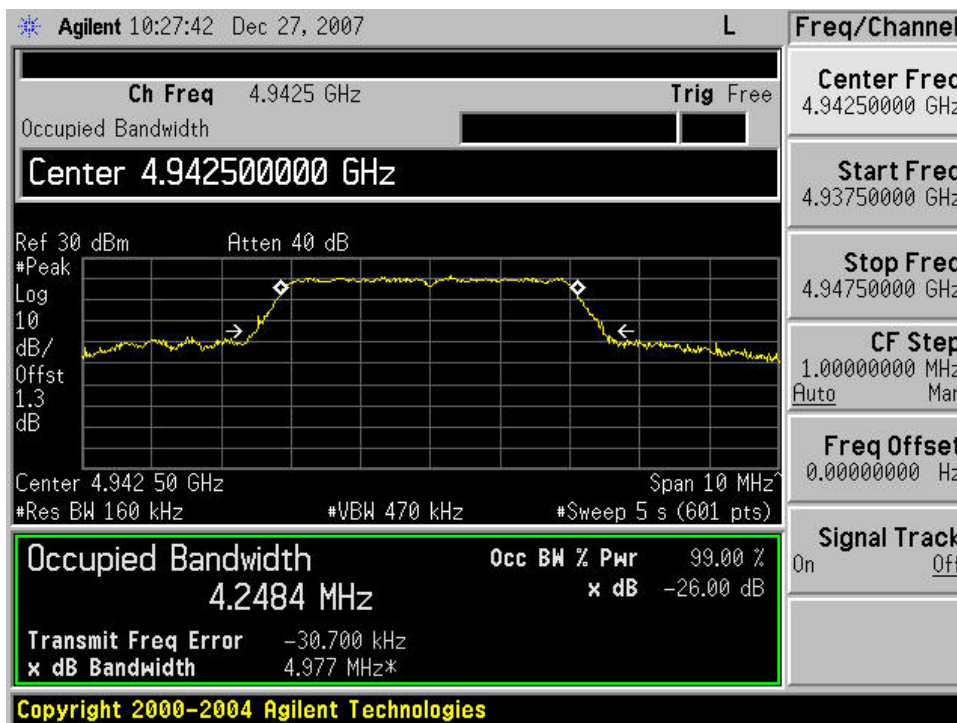
Frequency (MHz)	Signal Bandwidth (MHz)	Data Rate (Mbps)	Antenna Gain (dBi)	Target Power Level (dBm)	Actual Power Level (dBm)
4942.5	5	48	8,14,17	26	24.2
4967.5	5	48	8,14,17	26	24.3
4987.5	5	48	8,14,17	26	24.5
4945	10	48	8,14,17	26	24.4
4965	10	48	8,14,17	26	24.5
4985	10	48	8,14,17	26	24.5
4950	20	48	8,14,17	26	24.5
4965	20	48	8,14,17	26	24.5
4980	20	48	8,14,17	26	24.3



99% and 26dB Bandwidth

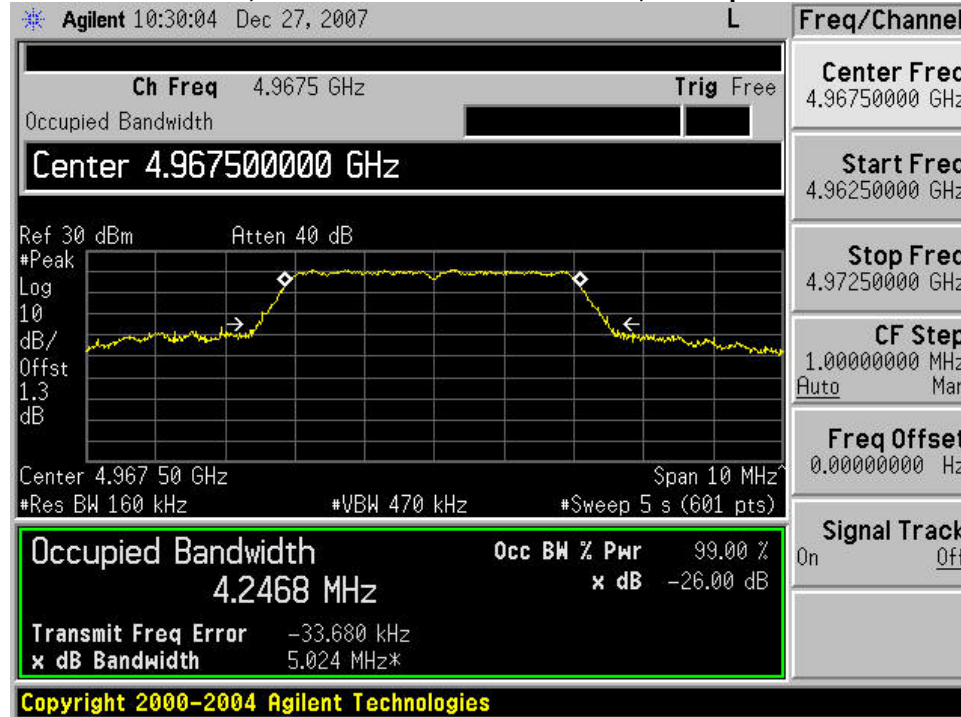
Frequency (MHz)	Signal Bandwidth (MHz)	Data Rate (Mbps)	26dB BW (MHz)	99% BW (MHz)
4942.5	5	48	4.9	4.2
4967.5	5	48	5.0	4.3
4987.5	5	48	5.0	4.2
4945	10	48	9.9	8.4
4965	10	48	9.9	8.3
4985	10	48	10.0	8.3
4950	20	48	19.4	16.4
4965	20	48	19.4	16.5
4980	20	48	19.2	16.4

26dB BANDWIDTH, 4942.5 MHz - 5MHz Bandwidth, 48 Mbps

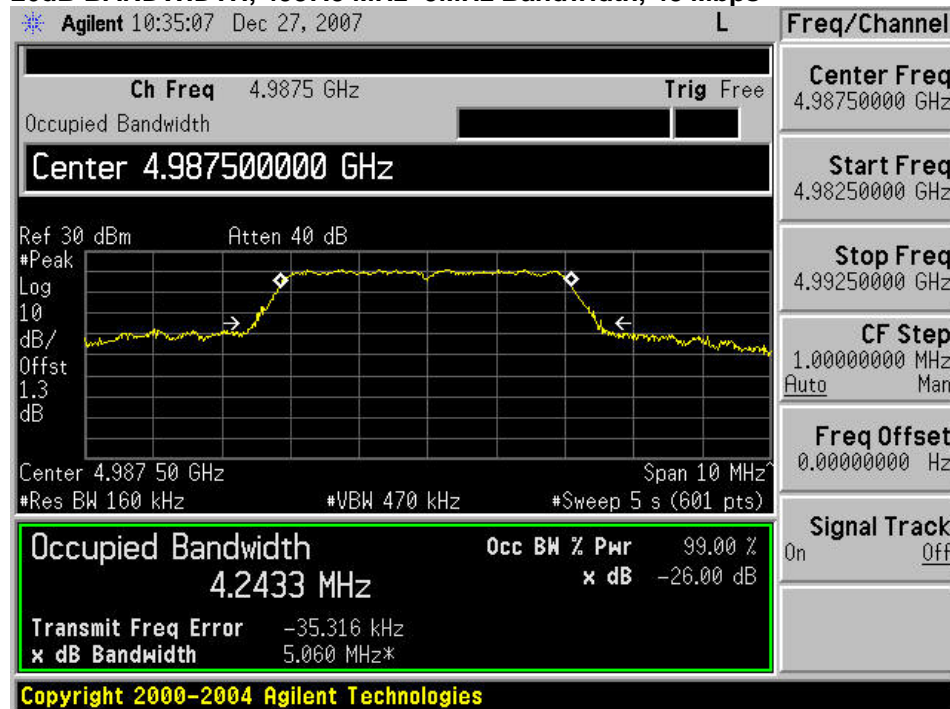




26dB BANDWIDTH, 4967.5 MHz -5MHz Bandwidth, 48 Mbps



26dB BANDWIDTH, 4987.5 MHz -5MHz Bandwidth, 48 Mbps





26dB BANDWIDTH, 4945MHz -10MHz Bandwidth, 48 Mbps

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Ch Freq 4.945 GHz Trig Free

Occupied Bandwidth

Span 20.00000000 MHz

Ref 30 dBm Atten 40 dB

#Peak Log 10 dB/Offst 1.3 dB

Center 4.945 00 GHz Span 20 MHz

#Res BW 160 kHz #VBW 470 kHz #Sweep 5 s (601 pts)

Occupied Bandwidth 8.3539 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB

Transmit Freq Error -31.470 kHz x dB Bandwidth 9.891 MHz*

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Span 20.00000000 MHz

Span Zoom

Full Span

Zero Span

Last Span

26dB BANDWIDTH, 4965MHz -10MHz Bandwidth, 48 Mbps

Agilent 10:43:49 Dec 27, 2007 L

Ch Freq 4.965 GHz Trig Free

Occupied Bandwidth

Center 4.965000000 GHz

Ref 30 dBm Atten 40 dB

#Peak Log 10 dB/Offst 1.3 dB

Center 4.965 00 GHz Span 20 MHz

#Res BW 160 kHz #VBW 470 kHz #Sweep 5 s (601 pts)

Occupied Bandwidth 8.3406 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB

Transmit Freq Error -29.476 kHz x dB Bandwidth 9.938 MHz*

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Freq/Channel

Center Freq 4.96500000 GHz

Start Freq 4.95500000 GHz

Stop Freq 4.97500000 GHz

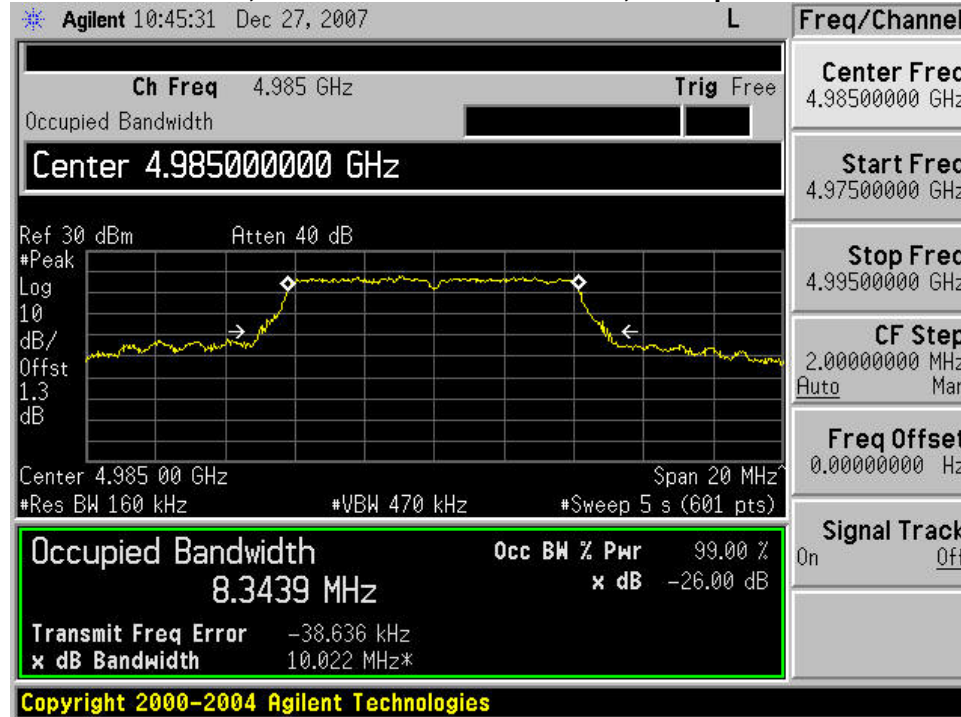
CF Step 2.00000000 MHz Auto Man

Freq Offset 0.00000000 Hz

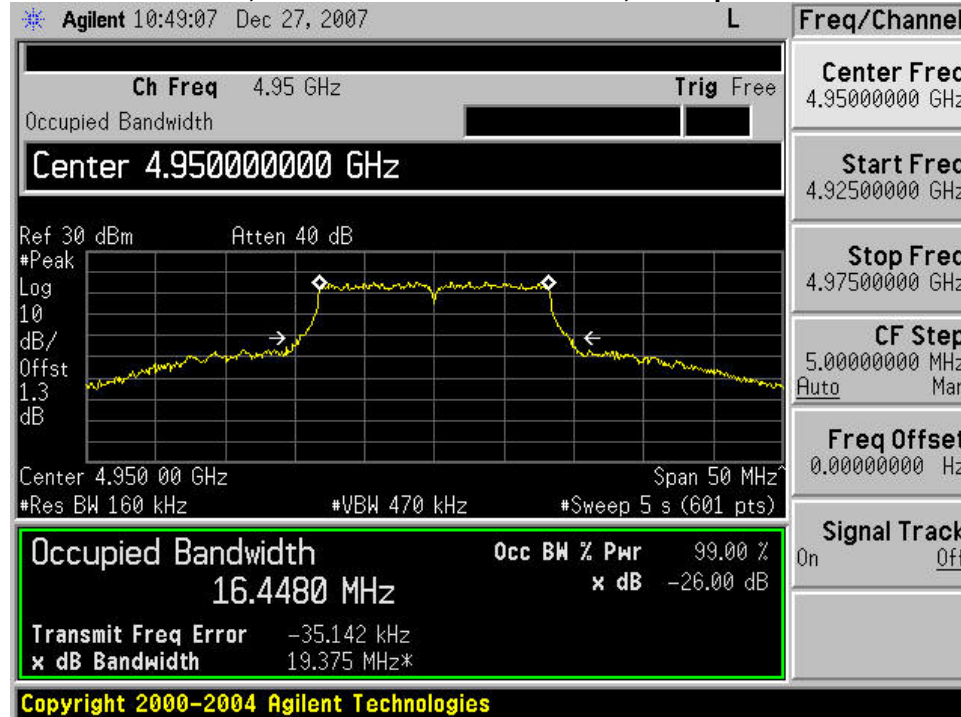
Signal Track On Off



26dB BANDWIDTH, 4985MHz -10MHz Bandwidth, 48 Mbps



26dB BANDWIDTH, 4950MHz -20MHz Bandwidth, 48 Mbps





26dB BANDWIDTH, 4965MHz -20MHz Bandwidth, 48 Mbps

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Ch Freq 4.965 GHz	Trig Free
Occupied Bandwidth	

Center Freq	4.96500000 GHz
Start Freq	4.94000000 GHz
Stop Freq	4.99000000 GHz
CF Step	5.00000000 MHz Auto Man
Freq Offset	0.00000000 Hz
Signal Track	On Off

Occupied Bandwidth	Occ BW % Pwr	99.00 %
16.4526 MHz	x dB	-26.00 dB
Transmit Freq Error	-34.020 kHz	
x dB Bandwidth	19.399 MHz*	

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26dB BANDWIDTH, 4980MHz -20MHz Bandwidth, 48 Mbps

Agilent 10:53:50 Dec 27, 2007 L

Ch Freq 4.98 GHz	Trig Free
Occupied Bandwidth	
Center 4.980000000 GHz	

Center Freq	4.98000000 GHz
Start Freq	4.95500000 GHz
Stop Freq	5.00500000 GHz
CF Step	5.00000000 MHz Auto Man
Freq Offset	0.00000000 Hz
Signal Track	On Off

Occupied Bandwidth	Occ BW % Pwr	99.00 %
16.4485 MHz	x dB	-26.00 dB
Transmit Freq Error	-38.363 kHz	
x dB Bandwidth	19.203 MHz*	

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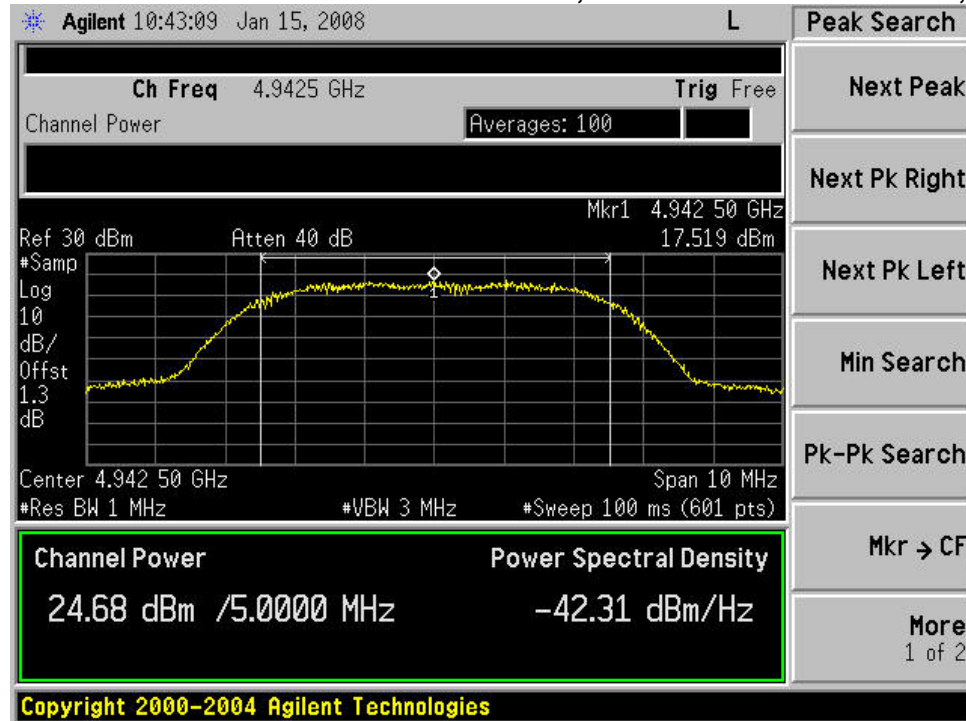
Peak Output Power/Power Spectral Density

90.1215: The transmitting power of stations operating in the 4940–4990 MHz band must not exceed 27dBm for a 5MHz channel, 30dBm for a 10MHz channel, and 33 dBm for a 20MHz channel in high power devices using antennas up to 9dBi gain. High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point or point-to-multipoint operation (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the transmitter power or spectral density. Corresponding reduction in the peak transmit power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

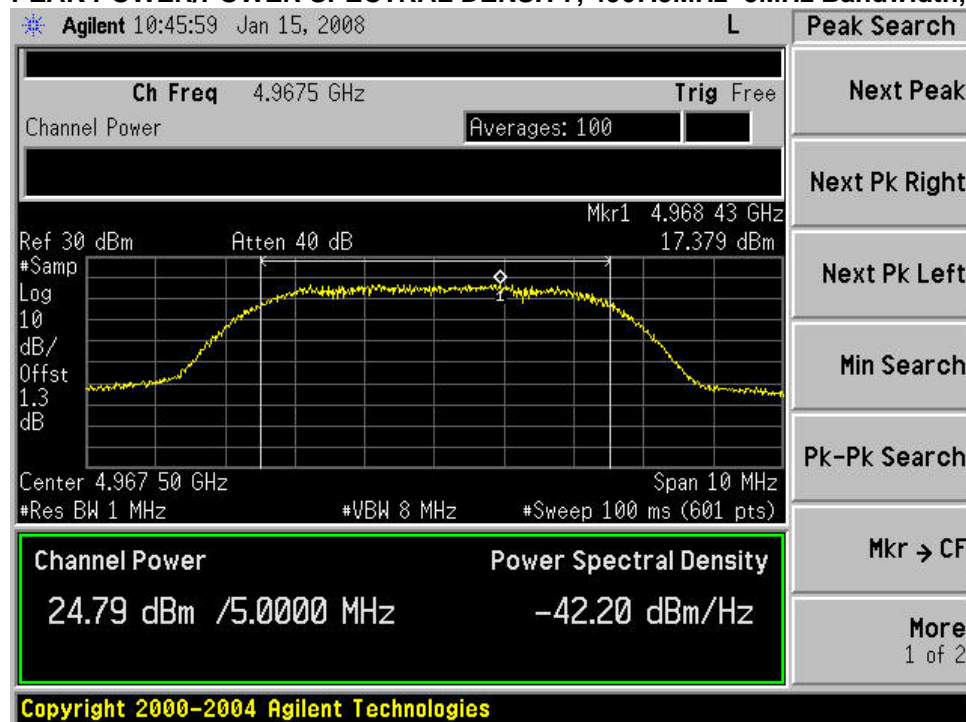
Frequency (MHz)	Signal Bandwidth (MHz)	Data Rate (Mbps)	Antenna Gain (dBi)	Peak Power (dBm)	Limit (dBm)	Margin (dB)	PSD (dBm/MHz)	Limit (dBm)	Margin (dB)
4942.5	5	48	8,14,17	24.7	27	2.3	17.5	21	3.5
4967.5	5	48	8,14,17	24.8	27	2.2	17.4	21	3.6
4987.5	5	48	8,14,17	24.7	27	2.3	17.3	21	3.7
4945	10	48	8,14,17	24.8	30	5.2	14.7	21	6.3
4965	10	48	8,14,17	24.9	30	5.1	13.8	21	7.2
4985	10	48	8,14,17	25.0	30	5.0	14.5	21	6.5
4950	20	48	8,14,17	24.8	33	8.2	11.8	21	9.2
4965	20	48	8,14,17	24.9	33	8.1	11.9	21	9.1
4980	20	48	8,14,17	25.0	33	8.0	11.7	21	9.3



PEAK POWER/POWER SPECTRAL DENSITY, 4942.5MHz- 5MHz Bandwidth, 48 Mbps, 26 dBm

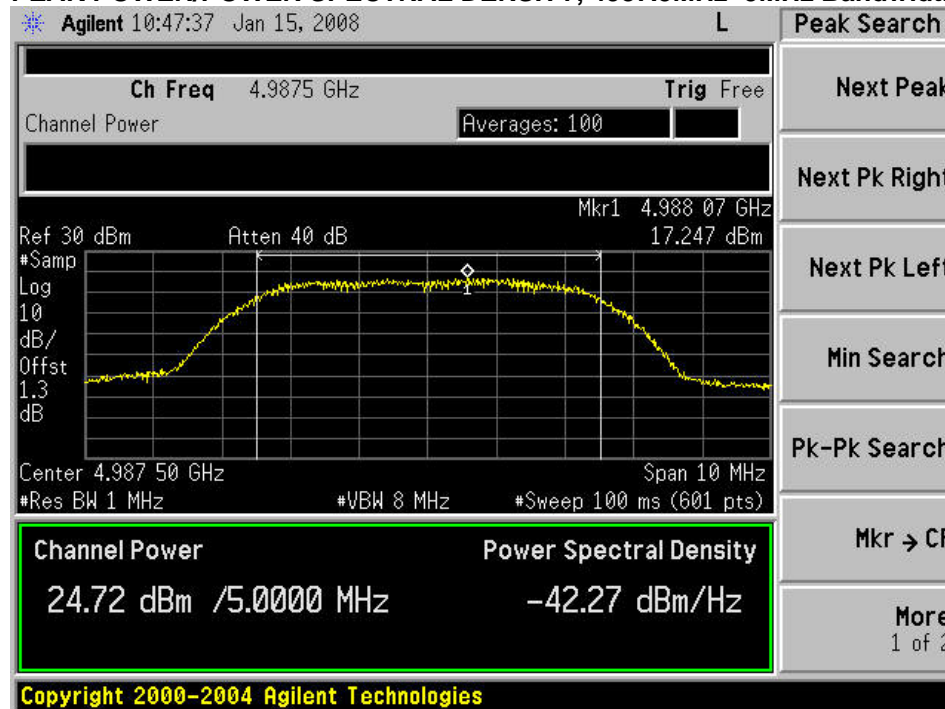


PEAK POWER/POWER SPECTRAL DENSITY, 4967.5MHz- 5MHz Bandwidth, 48 Mbps, 26 dBm

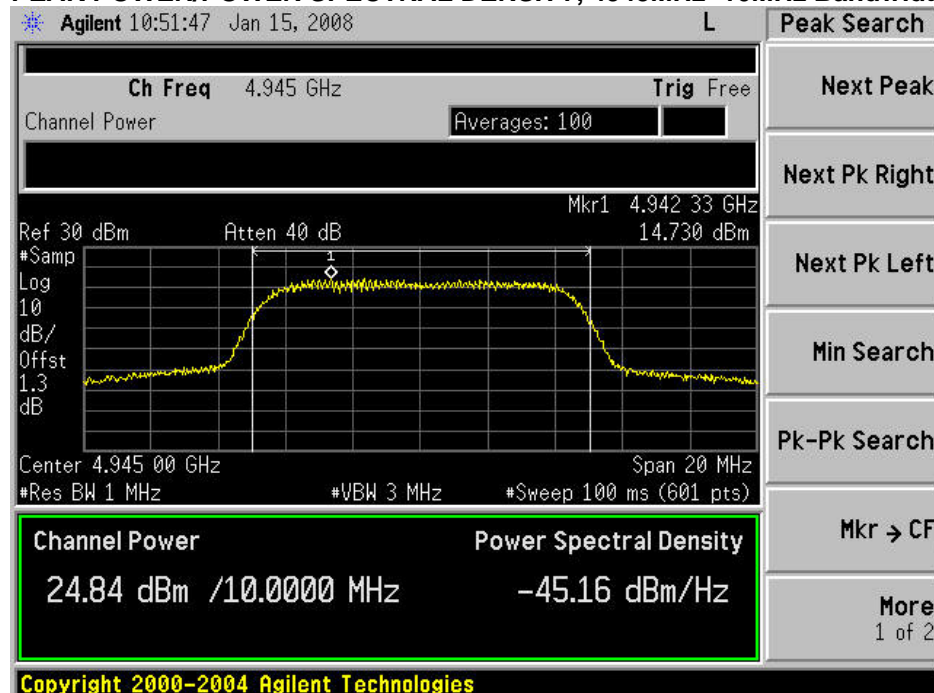




PEAK POWER/POWER SPECTRAL DENSITY, 4987.5MHz- 5MHz Bandwidth, 48 Mbps, 26 dBm

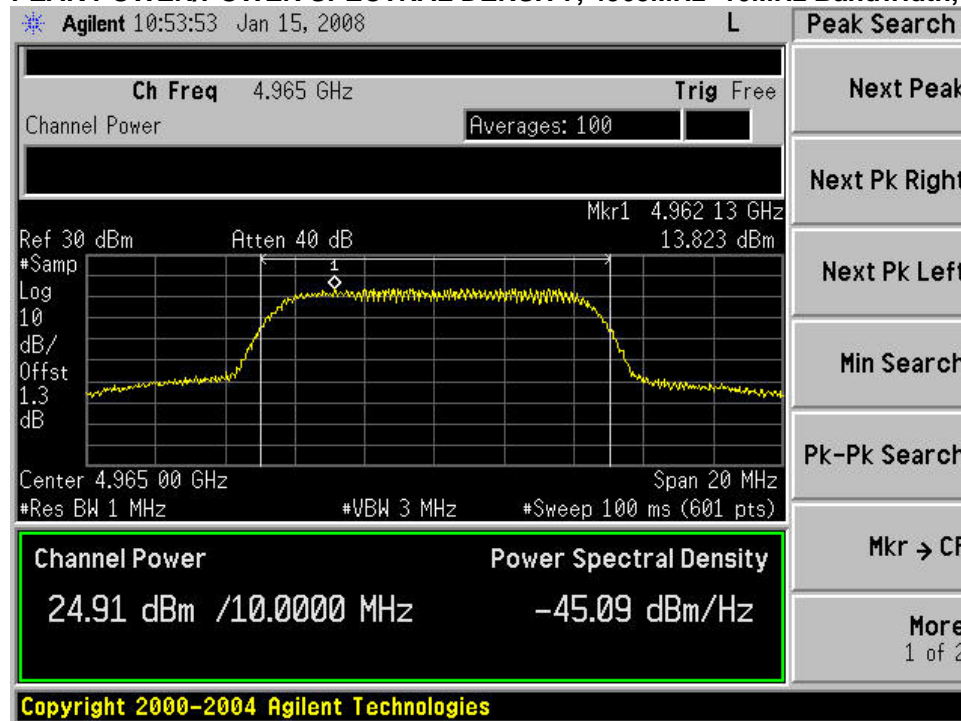


PEAK POWER/POWER SPECTRAL DENSITY, 4945MHz- 10MHz Bandwidth, 48 Mbps, 26 dBm

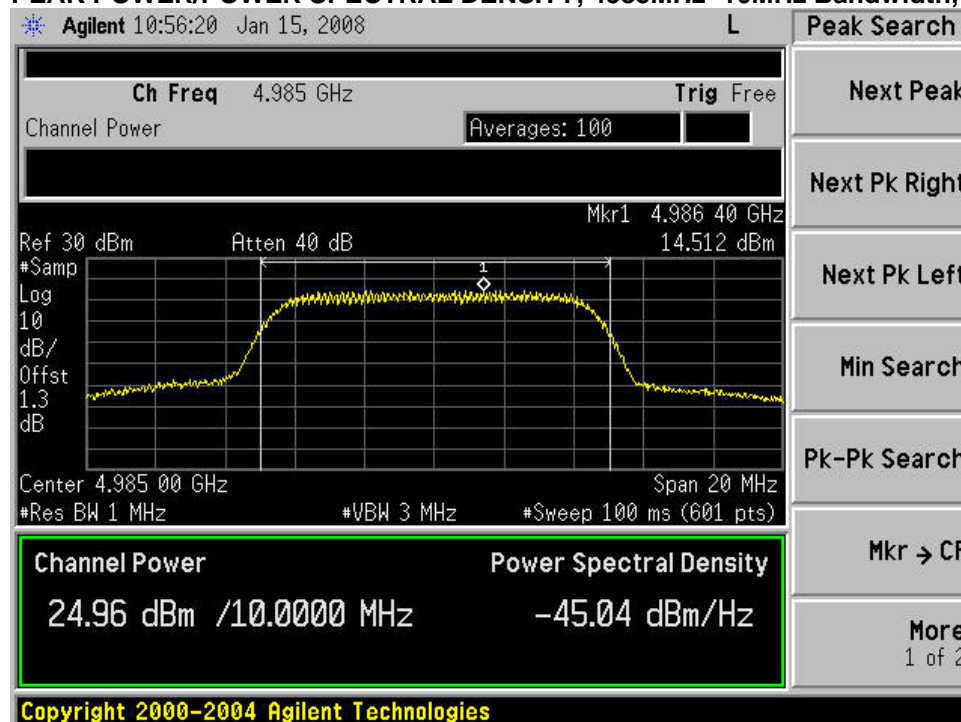




PEAK POWER/POWER SPECTRAL DENSITY, 4965MHz- 10MHz Bandwidth, 48 Mbps, 26 dBm

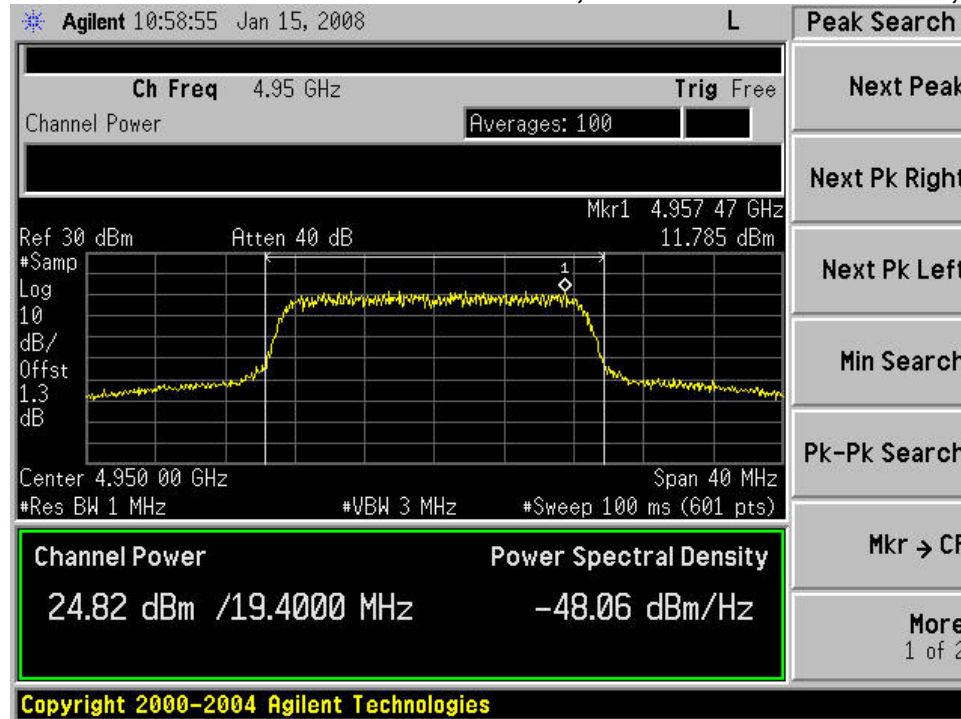


PEAK POWER/POWER SPECTRAL DENSITY, 4985MHz- 10MHz Bandwidth, 48 Mbps, 26 dBm

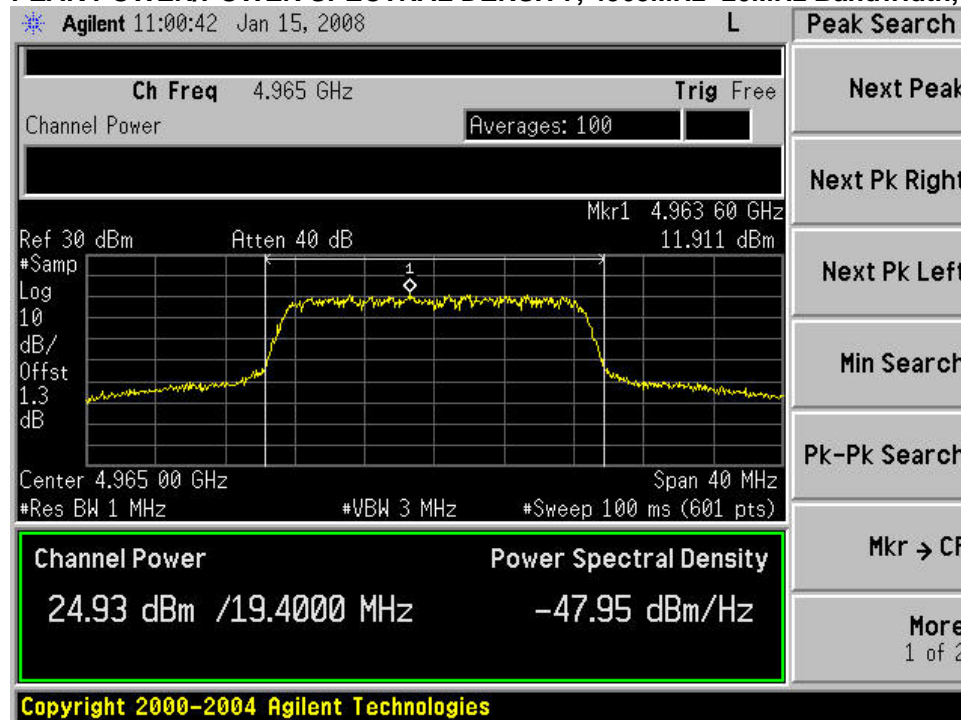




PEAK POWER/POWER SPECTRAL DENSITY, 4950MHz- 20MHz Bandwidth, 48 Mbps, 26 dBm

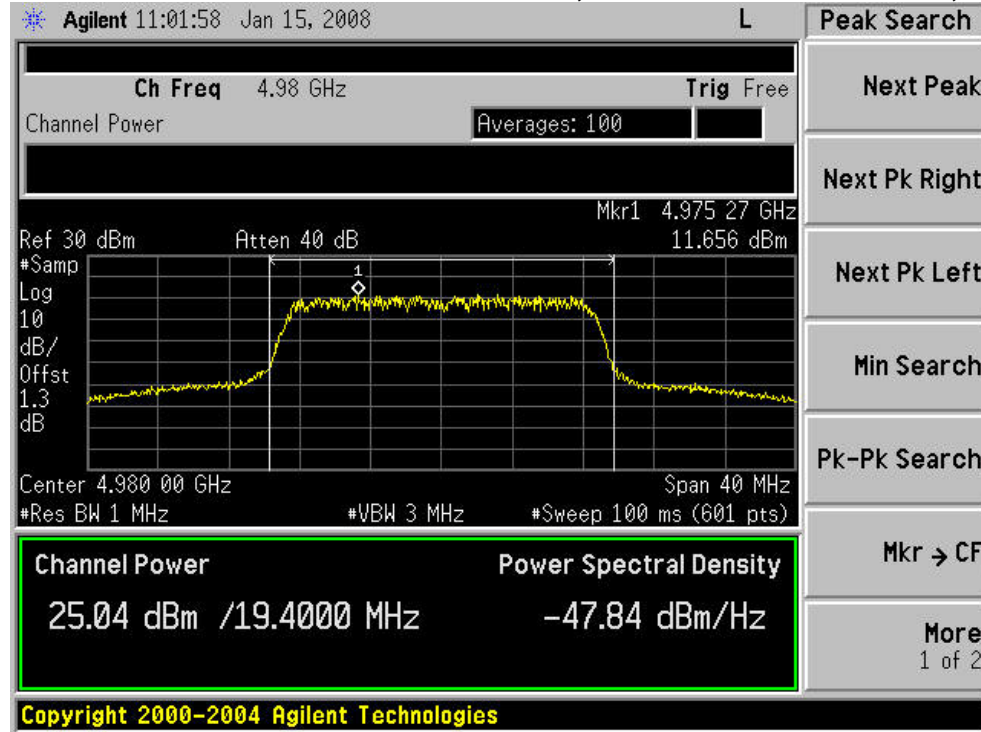


PEAK POWER/POWER SPECTRAL DENSITY, 4965MHz- 20MHz Bandwidth, 48 Mbps, 26 dBm





PEAK POWER/POWER SPECTRAL DENSITY, 4980MHz- 20MHz Bandwidth, 48 Mbps, 26 dBm





Frequency Stability

Frequency Stability over Temperature

The frequency stability shall be measured with variation of ambient temperature from -40[deg] to +55[deg] centigrade. (Frequency variation listed in parts per million)

Freq (Mhz)	-40C	-30C	-20C	-10C	+1C	+10C	+20C	+30C	+40C	+50C	+55C
4942.5	-3.66	2.33	5.64	5.73	4.31	2.34	-2.85	-1.74	-1.46	-3.03	-2.26
4987.5	-3.47	2.54	5.94	6.09	4.65	2.54	-2.62	-1.51	-1.19	-2.81	-2.06
4945	-3.23	2.78	6.15	6.24	4.77	2.73	-2.37	-1.26	-0.99	-2.68	-1.9
4985	-4.02	2.13	5.35	5.51	4.06	2.09	-3.05	-2.01	-1.8	-3.41	-2.67
4950	-3.69	2.44	5.79	5.74	4.64	2.63	-2.26	-1.13	-1.22	-2.8	-2.3
4980	-3.79	2.32	5.67	5.78	4.4	2.38	-2.77	-1.61	-1.5	-3.09	-2.42

Frequency Stability over Primary Supply Voltage (100-240 Vac)

The frequency stability shall be measured with variation of primary supply voltage from 85 to 115 percent of the nominal value. (Frequency variation listed in parts per million)

Freq (Mhz)	85 VAC	115 VAC	276 VAC
4942.5	0.23	2.29	2.08
4987.5	2.01	3.13	2.91
4945	2.24	3.35	3.15
4985	1.84	2.74	2.52
4950	2.36	3.21	3.03
4980	2.41	3.05	2.86



Conducted Spurious Emissions

90.210: For high power transmitters (greater than 20 dBm) operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0-45% of the authorized bandwidth (BW): 0 dB.

(2) On any frequency removed from the assigned frequency between 45-50% of the authorized bandwidth: $56.8 \log (\% \text{ of } (BW)/45)$ dB.

(3) On any frequency removed from the assigned frequency between 50-55% of the authorized bandwidth: $26 + 14.5 \log (\% \text{ of } BW/50)$ dB.

(4) On any frequency removed from the assigned frequency between 55-100% of the authorized bandwidth: $32 + 3.1 \log (\% \text{ of } (BW)/55)$ dB.

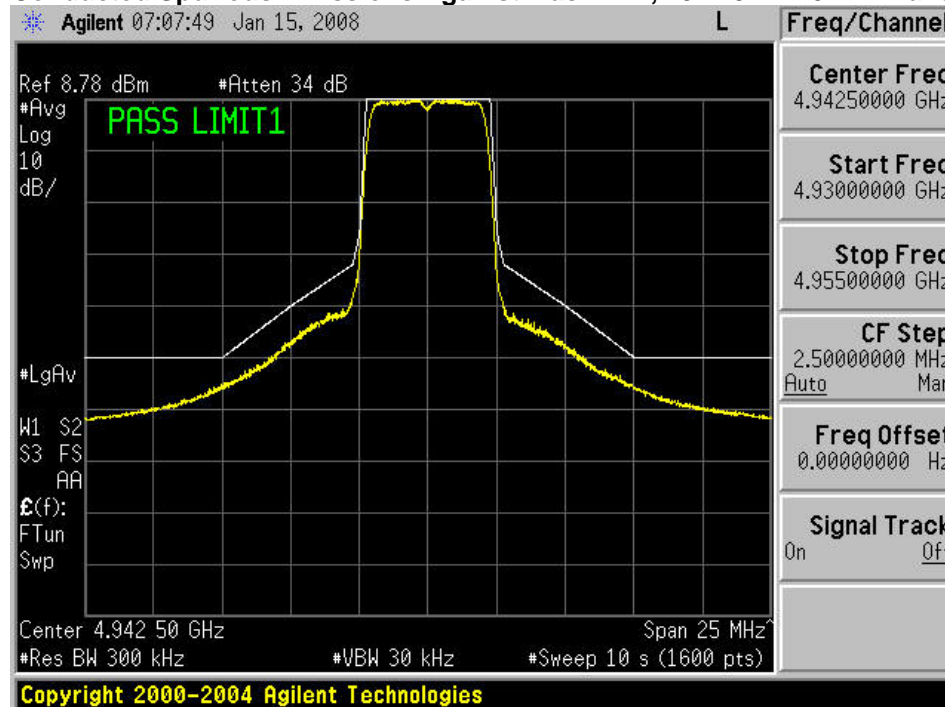
(5) On any frequency removed from the assigned frequency between 100-150% of the authorized bandwidth: $40 + 5.7 \log (\% \text{ of } (BW)/100)$ dB.

(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or $55 + 10 \log (P)$ dB, whichever is the lesser attenuation.

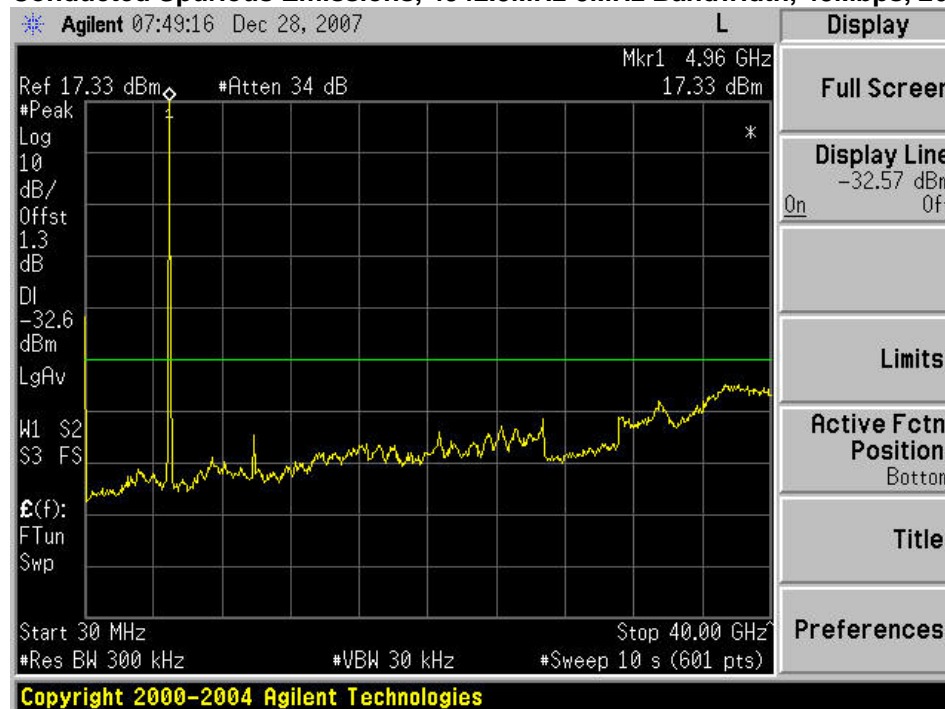
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.



Conducted Spurious Emissions Against Mask "M", 4942.5MHz-5MHz Bandwidth, 48Mbps, 26dBm

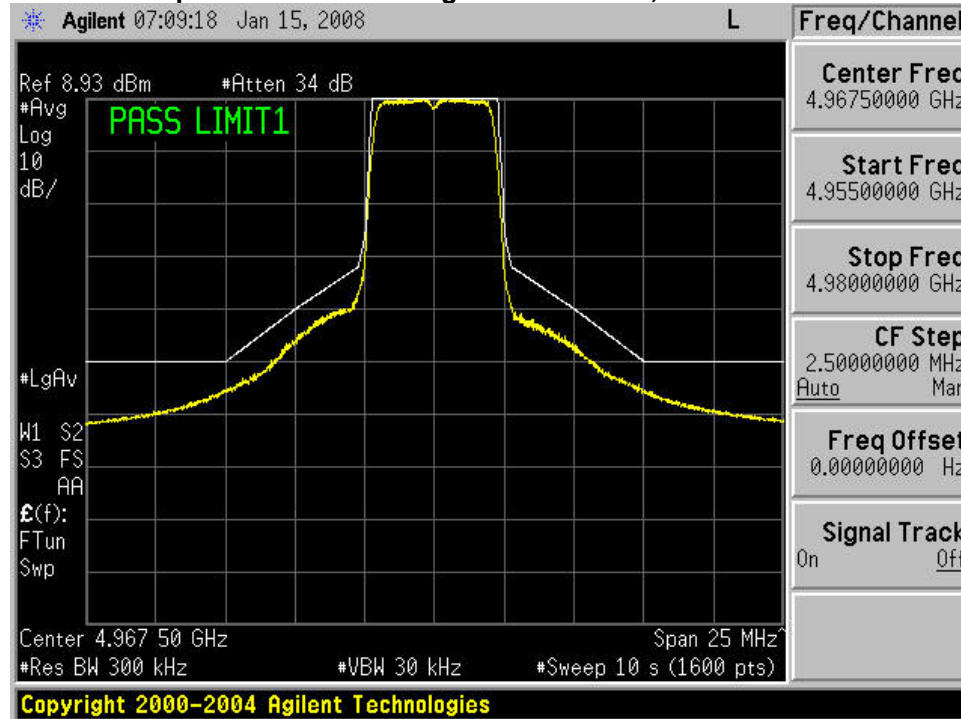


Conducted Spurious Emissions, 4942.5MHz-5MHz Bandwidth, 48Mbps, 26dBm

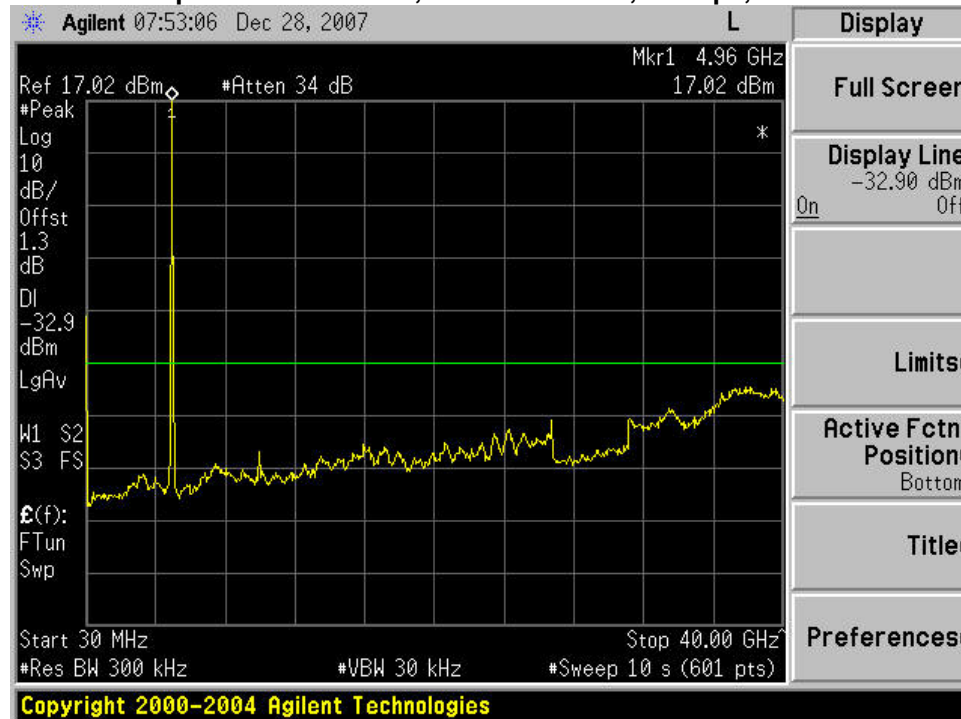




Conducted Spurious Emissions Against Mask "M", 4967.5MHz-5MHz Bandwidth, 48Mbps, 26dBm

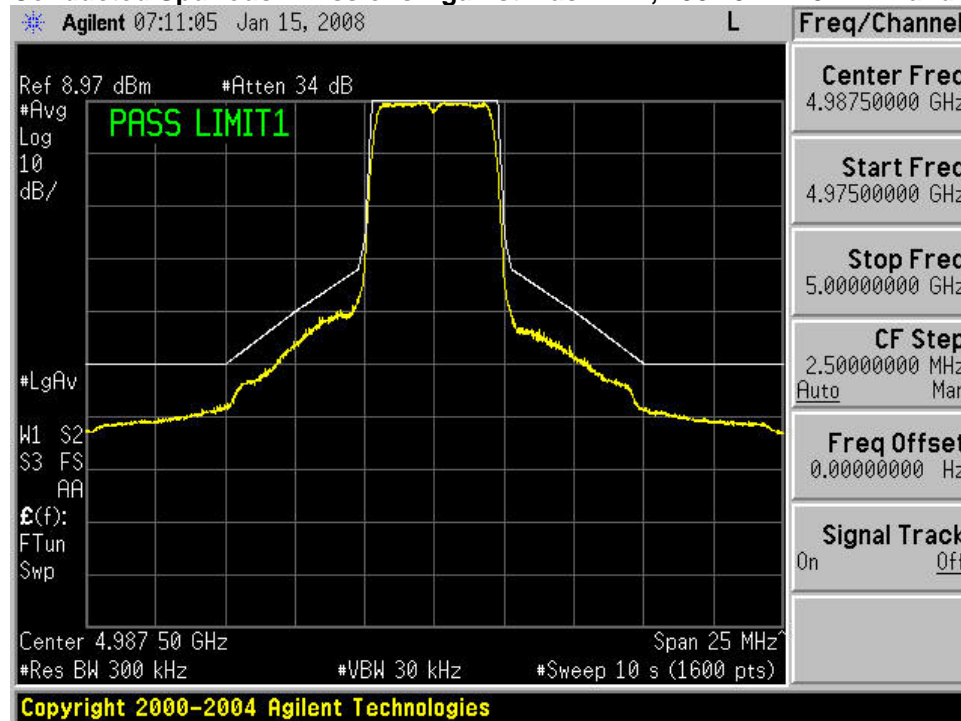


Conducted Spurious Emissions, 4967-5MHz MHz, 48Mbps, 26dBm





Conducted Spurious Emissions Against Mask "M", 4987.5MHz-5MHz Bandwidth, 48Mbps, 26dBm

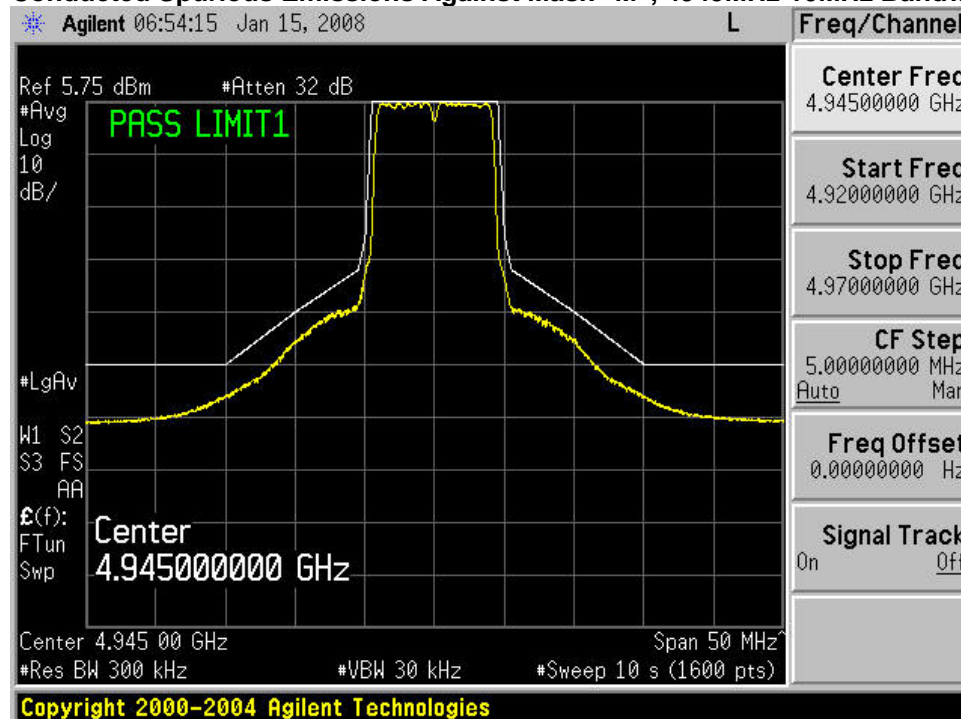


Conducted Spurious Emissions, 4987-5MHz MHz, 48Mbps, 26dBm

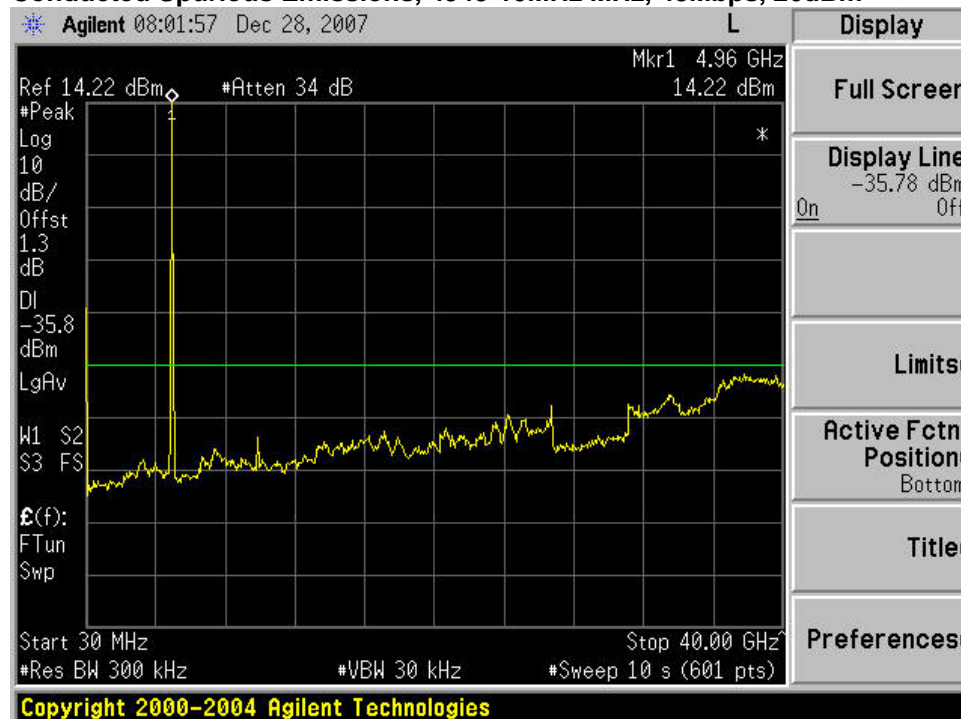




Conducted Spurious Emissions Against Mask "M", 4945MHz-10MHz Bandwidth, 48Mbps, 26dBm

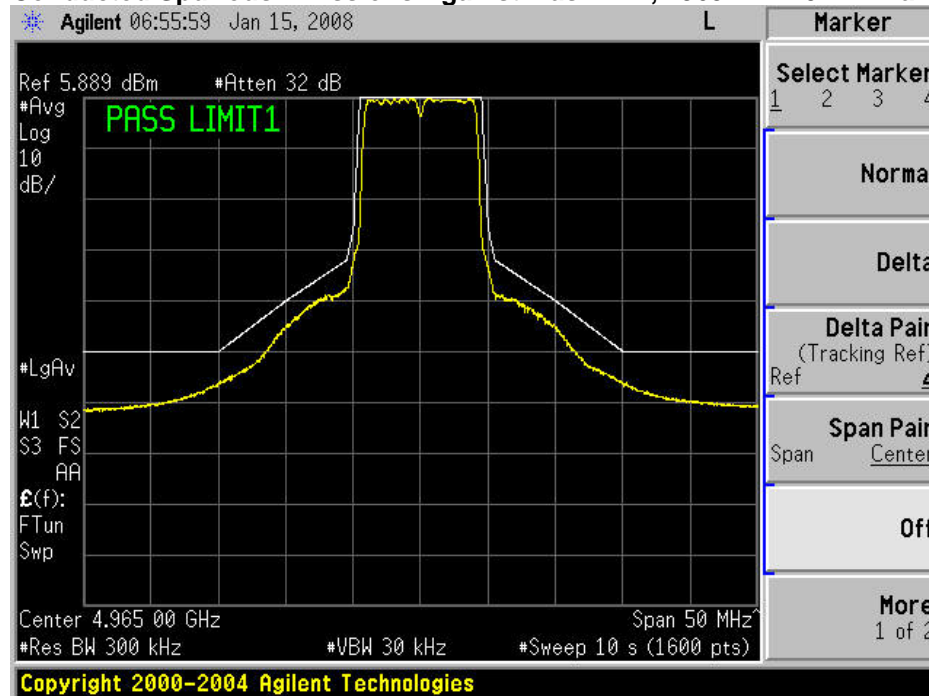


Conducted Spurious Emissions, 4945-10MHz MHz, 48Mbps, 26dBm

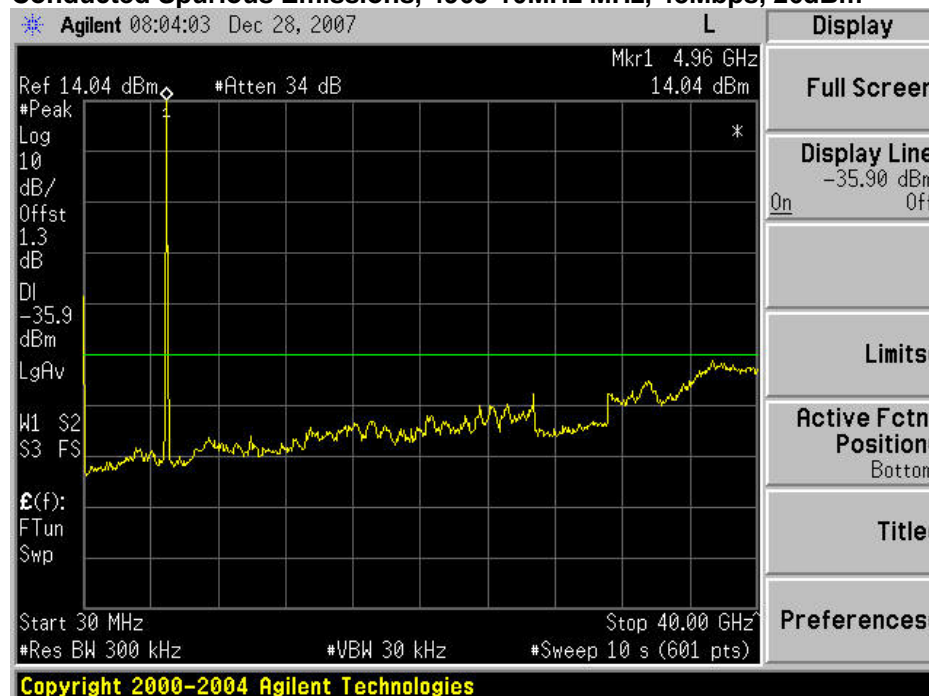




Conducted Spurious Emissions Against Mask "M", 4965MHz-10MHz Bandwidth, 48Mbps, 26dBm

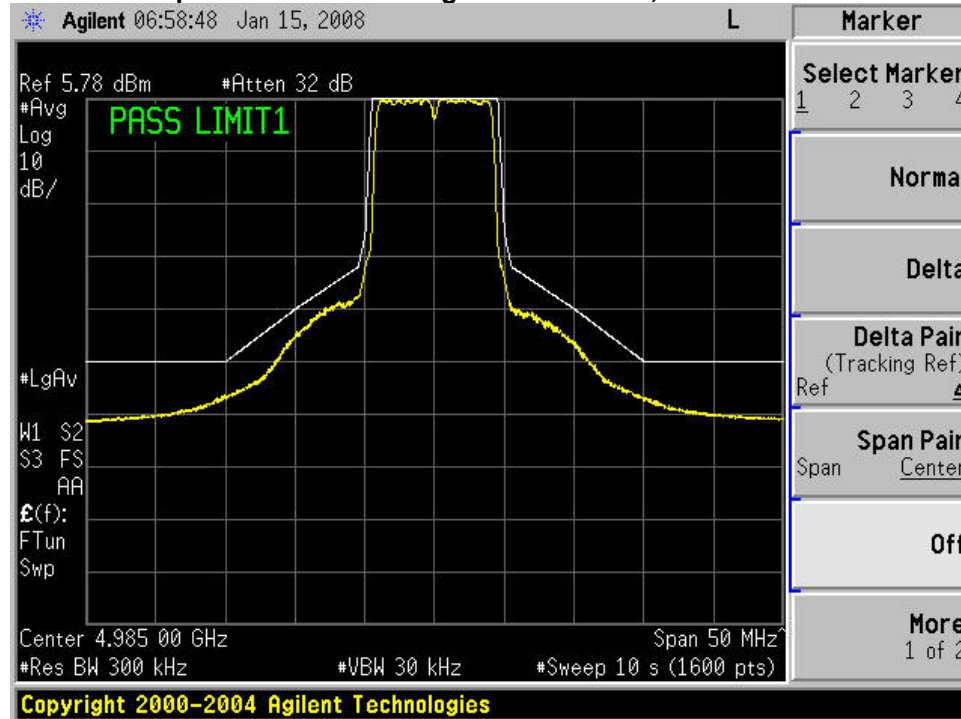


Conducted Spurious Emissions, 4965-10MHz MHz, 48Mbps, 26dBm

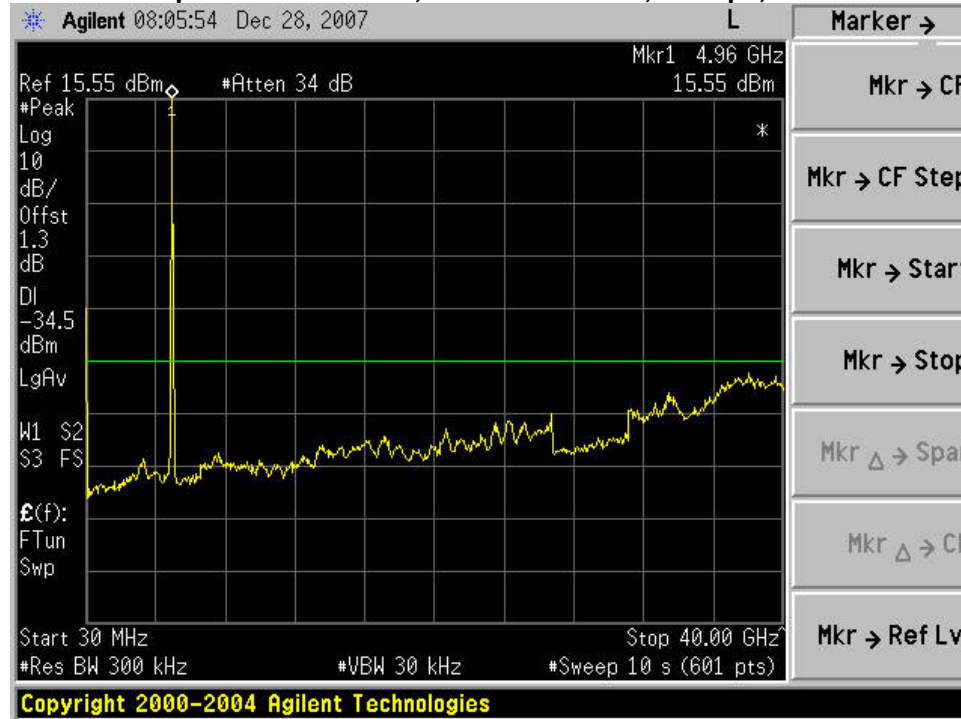




Conducted Spurious Emissions Against Mask "M", 4985MHz-10MHz Bandwidth, 48Mbps, 26dBm

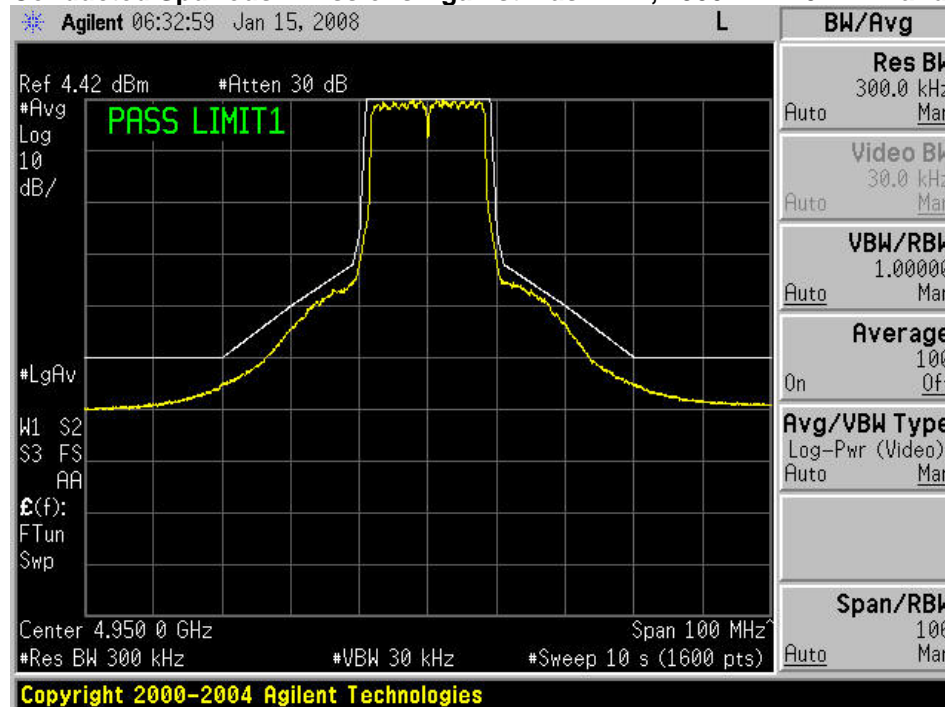


Conducted Spurious Emissions, 4985-10MHz MHz, 48Mbps, 26dBm

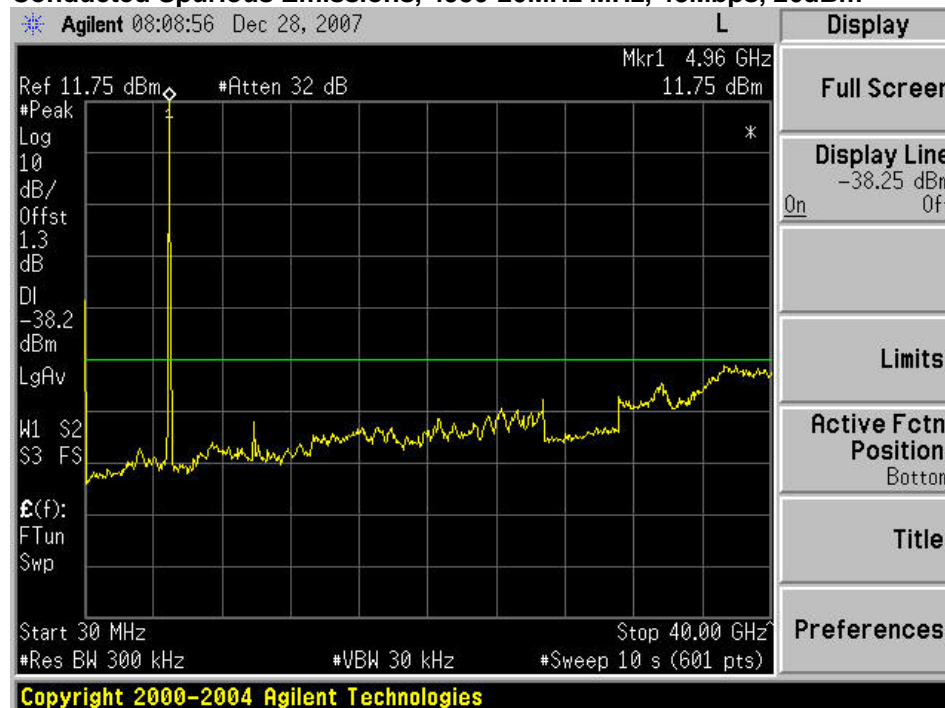




Conducted Spurious Emissions Against Mask "M", 4950MHz-20MHz Bandwidth, 48Mbps, 26dBm

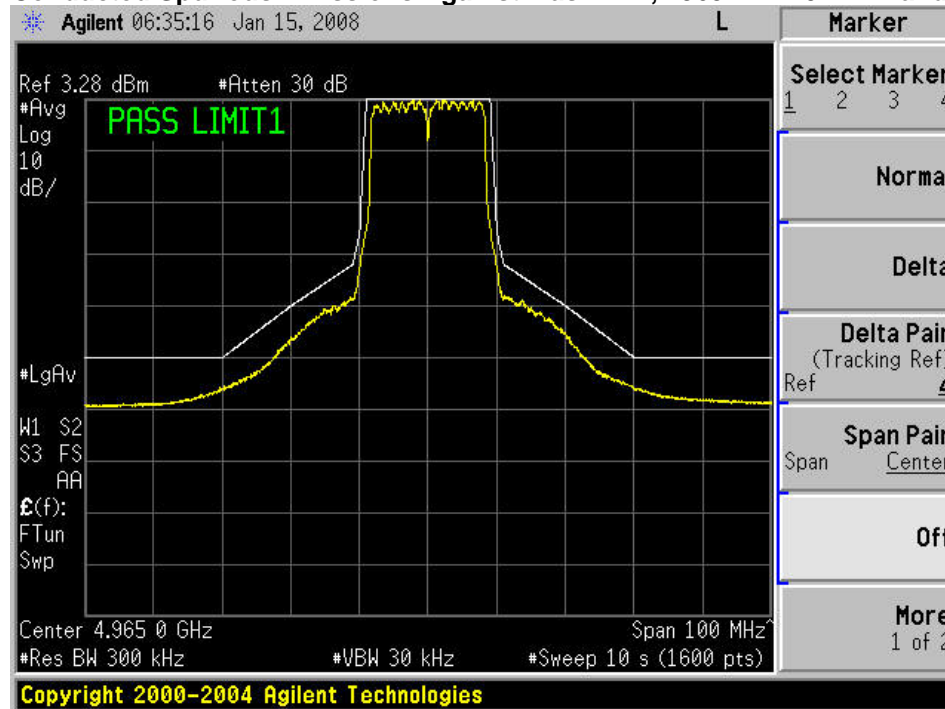


Conducted Spurious Emissions, 4950-20MHz MHz, 48Mbps, 26dBm

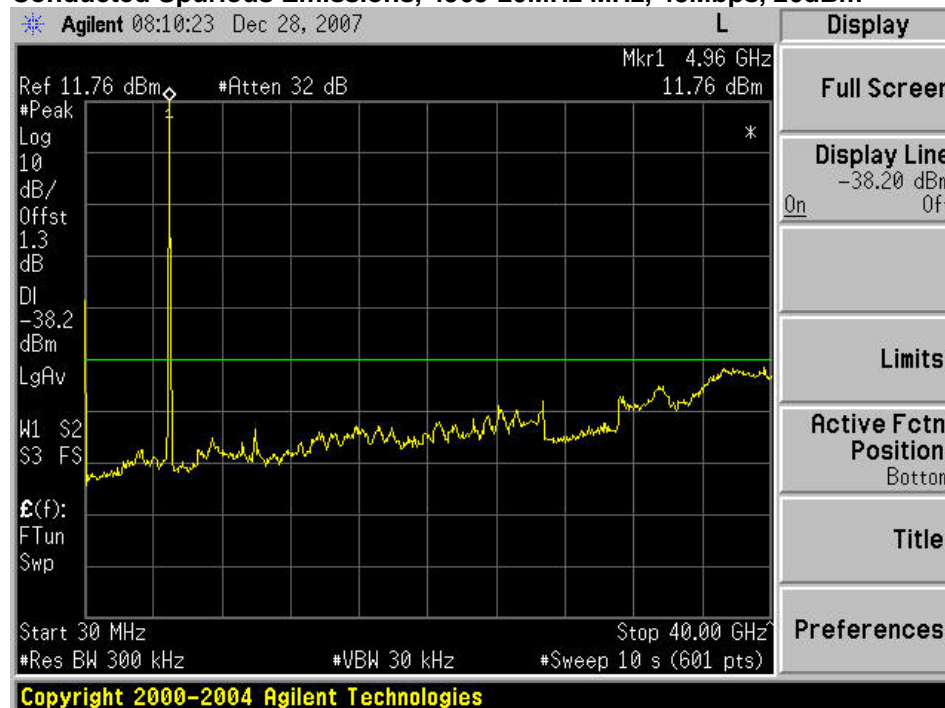




Conducted Spurious Emissions Against Mask "M", 4965MHz-20MHz Bandwidth, 48Mbps, 26dBm

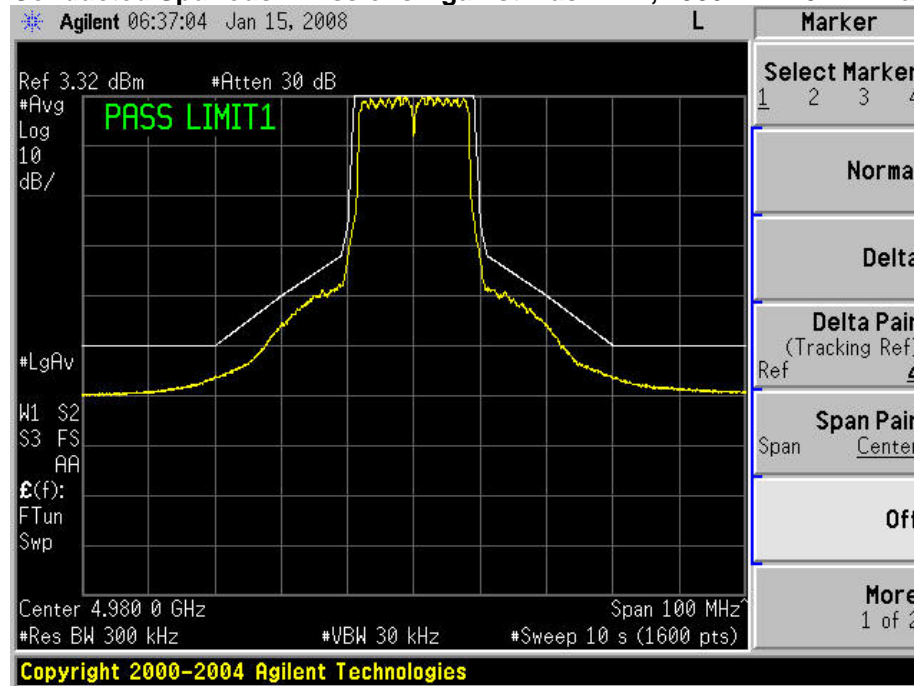


Conducted Spurious Emissions, 4965-20MHz MHz, 48Mbps, 26dBm

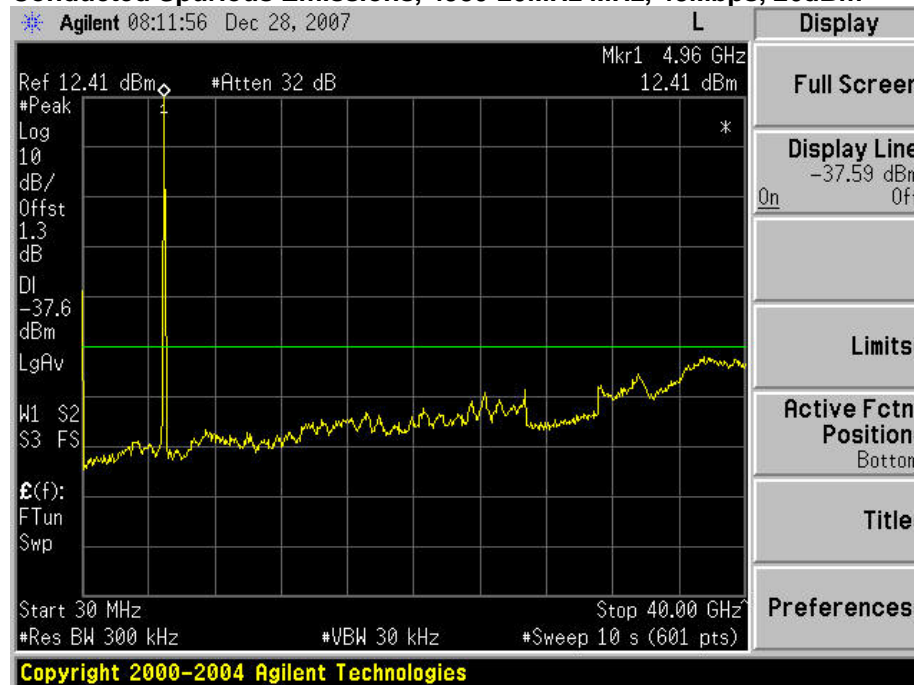




Conducted Spurious Emissions Against Mask "M", 4980MHz-20MHz Bandwidth, 48Mbps, 26dBm



Conducted Spurious Emissions, 4980-20MHz MHz, 48Mbps, 26dBm





CONDUCTED Rx SPURS

