JABIL Technology Services **Regulatory Laboratory**

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47 C.F.R. Part 90 FCC Rules
Certification Test Record
for a
Device Operating in the 4.9 GHz Public Safety Radio Band

Zhone Technologies
SkyZhone-1424 WiFi Access Point

Equipment:	**SKYZHONE-1424, Wi-Fi Access Point**
Client:	**Zhone Technologies**
Address:	**8545 126th Avenue North**
	Largo, FL 33773
	USA

Test Report Number: FCC90-ZHONE-09-11-07c
Date: September 19, 2007
Total Number of Pages: 50

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1 IDENTIFICATION SUMMARY

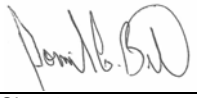
1.1 Test Report

Test Report Number: FCC90-ZHONE-09-11-07c
Test Report Date: September 19, 2007

Report written and approved by:

Date	Name	Signature
September 19, 2007	Peter J. Walsh, NCE	

Reviewed by:

Date	Name	Signature
September 19, 2007	Dominick Bitume	

1.2 Testing Laboratory

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1.3 Limits and Reservations

The test results in this report apply only to the particular Device Under Test (DUT) and component Implementations Under Test (IUTs) declared in this test report. The results and associated conclusions apply only to the DUT while operating in the configuration and modes described herein. This test report supersedes the revised test report number FCC90-09-11-07b. This report was re-issued to add the frequency stability data as declared by the radio manufacturer.

1.4 Client Information

Name:	Zhone Technologies
Street:	8545 126th Avenue North
City:	Largo
State:	Florida
Country:	USA
Phone:	(727) 530-2000
Contact Person:	Chuck Coston
Phone:	(727) 530-8326
Email:	ccoston@zhone.com

1.5 Dates

Date of commission:	November 1, 2006
Date of receipt of DUT:	September 11, 2007
Date of test completion:	September 14, 2007

1.6 Device Under Test (DUT)

Name:	SKYZHONE-1424, Wi-Fi Access Point
Version:	4 Port SHDSL STU-R with 4.9 GHz Public Safety Band Radio
Serial Number:	None (Engineering Prototype)
FCC ID Number:	PJZSZ1424
Industry Canada ID:	3691A-SZ1424
Modulation Type:	OFDM
Modulation Designation:	20M0D7W
Operating Band:	4940 – 4990 MHz
Rated Peak Transmit Power	1.4 watts
Frequency Stability:	± 20 ppm
Antenna Configuration:	2x2 MIMO
Antenna Gain:	5.3 dBi

2 GENERAL INFORMATION

2.1 Product Description

The SkyZhone Model 1424 access point is a line-powered carrier class outdoor Wi-Fi access point with 22 Mbps symmetric DSL backhaul to every unit. Using the 4.9 GHz Public Safety Radio Band, the SkyZhone supports a variety of applications including VoIP, internet access, mobile video, and enterprise VPNs optimized for deployments by licensed governmental agencies. SkyZhone allows for a more reliable, lower latency, higher speed and lower cost network than traditional mesh Wi-Fi solutions. The product includes two 5.3 dBi antennas, Comet Part Number SF-D49N W-SR. Antennas with lower gain may also be used. The antennas are configured in a 2X2 MIMO fashion with power split between the two antennas.

2.2 Interface Cable Details

Interface cables used in the system are as follows:

Qty	Length	Cable Description
1	30’	Shielded CAT5 4 twisted pairs SHDSL cable
1	30’	Shielded CAT5 4 twisted pairs Ethernet cable

2.3 Peripheral Devices

The following test support devices were used in the test set-up.

Qty	Description	Manufacturer/Model	Serial Number
1	PC	Gateway GP6-400	0014300762

2.4 Test Methodology

The test methods for determining compliance have been set out in 47 CFR Part 90.

2.5 Test Facility

The measurement facility used to collect the data is located at 8545 126th Avenue N., Largo FL 33773. This site is NVLAP Accredited (200125-0). The site has also been registered with Industry Canada, 2146A-1.

2.6 Deviations

No deviations were exercised during the course of the testing.

3 SYSTEM TEST CONFIGURATION

3.1 Justification

A test mode was used which allowed the radio to transmit at its maximum duty cycle and allowed the data rate, channel, and power level to be set. The tested power levels were the maximum levels that could be set in production units with the intention of providing sufficient margin to account for unit-to-unit variability. For conducted measurements at the antenna terminal the terminal under test was connected to the spectrum analyzer through a 600 cm cable and 10 dB pad. The other antenna port was connected to a 50 ohm load.

All measurements were performed with the DUT powered by a nominal line voltage of ±140 VDC applied between tip ring pairs of its SHDSL line interface.

3.2 Special Accessories

None

3.3 Equipment Modifications

No modifications were needed to achieve compliance.

Signature:		Date:	September 14, 2007
Typed/Printed Name:	Peter J. Walsh		
Position:	Regulatory Lab Manager		

If modifications were needed to achieve compliance, the client shall acknowledge these by signing below.

Signature:		Date:	
Typed/Printed Name:			
Position:			

4 BAND PLAN

Reference: 47 C.F.R. § 90.1213

The following channel center frequencies are permitted to be aggregated for channel bandwidths of 5, 10, 15 or 20 MHz. Channel numbers 1 through 5 and 15 through 18 are 1 MHz channels and channels numbers 6 through 14 are 5 MHz channels.

Center frequency (MHz)	***Channel Nos.***
4940.5	*1*
4941.5	*2*
4942.5	*3*
4943.5	*4*
4944.5	*5*
4947.5	*6*
4952.5	*7*
4957.5	*8*
4962.5	*9*
4967.5	*10*
4972.5	*11*
4977.5	*12*
4982.5	*13*
4985.5	*14*
4986.5	*15*
4987.5	*16*
4988.5	*17*
4989.5	*18*

"If channel aggregation is used, the tests would be performed with the transmitter tuned to the center frequency of the aggregated channels rather than frequencies listed in the table of 90.1213."[1]

The DUT may operate on two channels each with an aggregated bandwidth of 20 MHz. The first channel, hereafter called Channel A, has a center frequency of 4960.0 MHz aggregating channels 7 through 10. The second channel, hereafter called Channel B, has a center frequency of 4980.0 MHz aggregating channels 11 through 18. Section 8 in this test report shows the occupied bandwidth characteristics of the DUT. That test data shows the spectral placement centered on 4960.0 MHz and 4980.0 MHz.

[1] This guidance was given in a March 2006 presentation to the TCB by Steven Dayhoff of the FCC's Equipment Authorization Branch, "Licensed Devices - Recent Rule Interpretations."

5 PEAK TRANSMIT POWER DATA

Reference: 47 C.F.R. § 90.1215(a)

The transmitting power of stations operating in the 4940–4990 MHz band must not exceed the maximum limits in this section.

(a) The peak transmit power should not exceed:

Channel bandwidth (MHz)	Low power peak transmitter power (dBm)	High power peak transmitter power (dBm)
1	7	20
5	14	27
10	17	30
15	18.8	31.8
20	20	33

High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 21 dBm/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.

(b) Low power devices are also limited to a peak power spectral density of 8 dBm per one MHz. Low power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 8 dBm/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.

(c) The peak transmit power is measured as a conducted emission over any interval of continuous transmission calibrated in terms of an RMS-equivalent voltage. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement conforming to the definitions in this paragraph for the emission in question.

(d) The peak power spectral density is measured as conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of one MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

5.1 Test Procedure

The measurements are made using a direct connection between the DUT's antenna connection and the spectrum analyzer. The spectrum analyzer's resolution bandwidth (RBW) is set to 1 MHz, video bandwidth set to 3 MHz, peak detection and its span set to encompass the full bandwidth of the emission. The DUT is conditioned to transmit at its maximum duty cycle. The trace is set to max hold and allowed to run for 60 seconds. Markers are placed at the lower and upper 20 dB points relative to the peak level or alternatively at the upper and lower band frequencies of 4940 MHz and 4990 MHz. The spectrum analyzer's bandpower

function is used to integrate the total peak power. The peak power must be measured and summed on all active antennas.

Next, the DUT's Peak PSD is measured using a RBW of 1 MHz and a VBW or 1 MHz, peak detection with the analyzer's span set to encompass the full bandwidth of the emission. The DUT is conditioned to transmit at its maximum duty cycle. The trace is set to max hold and allowed to run for 60 seconds. The marker is then placed at the peak and the maximum power in a 1 MHz bandwidth, (Peak PSD) recorded. The peak PSD must be measured and summed on all active antennas.

5.2 Test Data

Compliance Verdict: PASS

The total peak power and peak PSD are measured on all active antennas and summed accordingly.

Table 5.2-1 below shows the measured peak power at the DUT's antenna terminals and calculated total power delivered to all antennas. Preliminary testing showed compliance for all data rates.

Table 5.2-1 – Total Power Summation

Antenna 0 Power (dBm)	Antenna 1 Power (dBm)	Total Power (watts)	Total Power (dBm)	Limit (dBm)	Margin (dB)	Data Rate (Mbps)	Channel
27.27	28.25	1.202	30.80	33	2.2	6	A
28.03	28.35	1.319	31.20	33	1.8	54	A
27.95	28.31	1.301	31.14	33	1.86	6	B
28.48	28.42	1.400	31.46	33	1.54	54	B

Table 5.2-2 below shows the peak PSD at the DUT's antenna terminals and calculated total power delivered to all antennas.

Table 5.2-2 – Total Peak Power in a 1 MHz RBW (PSD) Summation

Antenna 0 Power (dBm)	Antenna 1 Power (dBm)	Total Power (watts)	Total Power (dBm)	Limit (dBm)	Margin (dB)	Data Rate (Mbps)	Channel
15.84	17.21	0.091	19.59	21.0	1.41	6	A
17.09	17.18	0.103	20.15	21.0	0.85	54	A
16.41	17.38	0.098	19.93	21.0	1.07	6	B
17.02	17.44	0.106	20.25	21.0	0.75	54	B

Figure 5.2-1 below shows the DUT's highest the in-band spectral characteristics with the bandpower calculation performed by the spectrum analyzer. This figure shows the results for Antenna 0, operating at the highest data rate on Channel B.

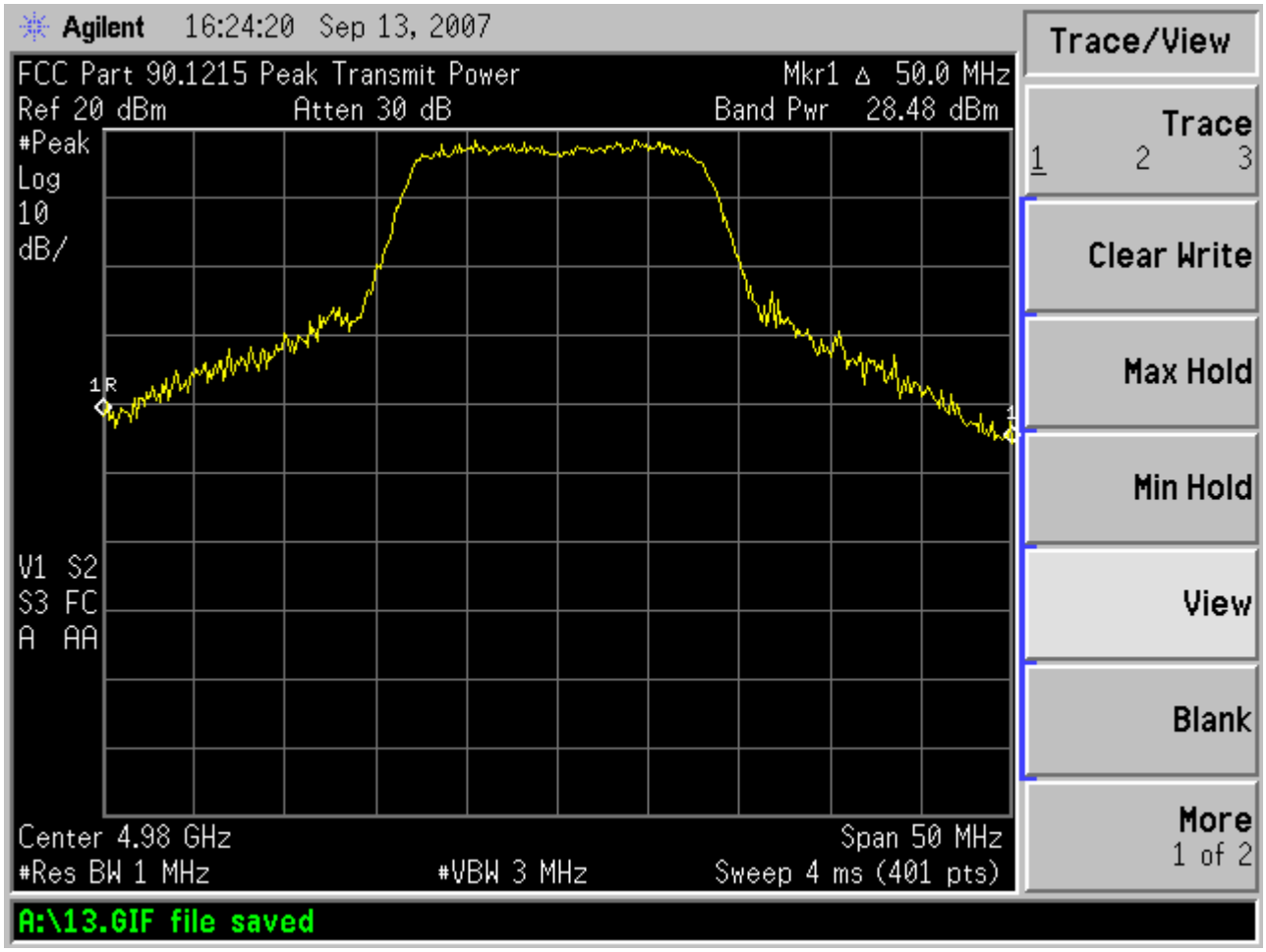


Figure 5.2-1 –Channel B Signal Power on Antenna 0

Figure 5.2-2 shows the DUT's highest measured PSD. This figure shows the worst-case results for Antenna 1, operating at the maximum data rate on Channel B. Note that the limit line was adjusted down by 3 dB because of the DUT's 2X2 MIMO antenna configuration.

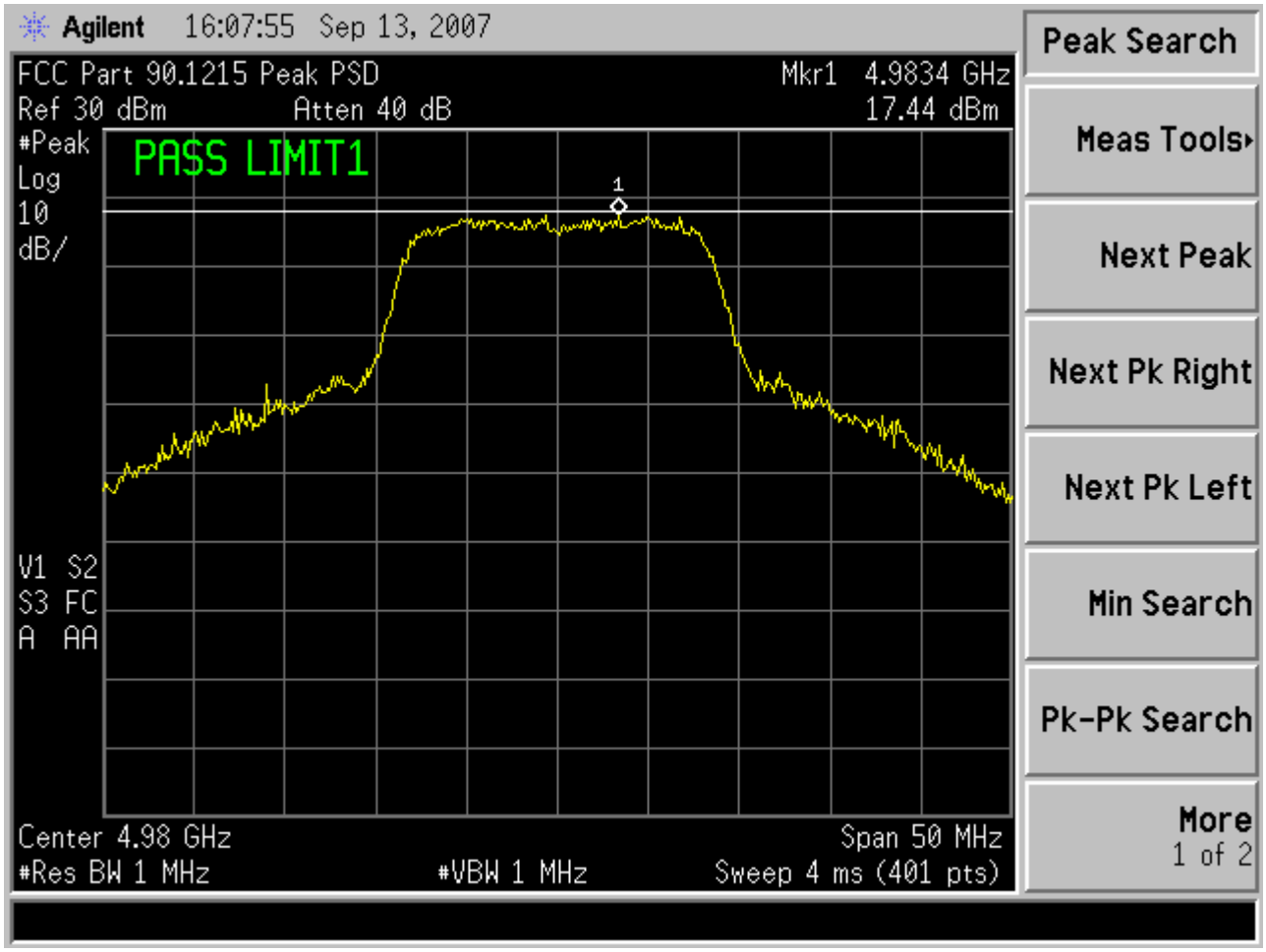


Figure 5.2-2 –Channel B Power in a 1 MHz RBW on Antenna 1

Test Personnel:

September 13, 2007	Peter J. Walsh, NCE	
Date	Name	Signature

5.3 Test Instrumentation Used, Peak Transmit Power Measurement

Description	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Agilent	E7405A	MY42000055
10 dB Attenuator Pad	Agilent	8491A 10 dB	90077
50 Ω 600 cm length coaxial cable	Hewlett Packard	HP 8120-466-1	-
50 ohm load	JFW	50T-054	-

Calibration and Traceability: All measuring and test equipment are calibrated every 12 months and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

5.4 Photographs of the Measurement Set-up

Photo 5.4-1 shows the setup for all measurements made on the DUT's antenna output.

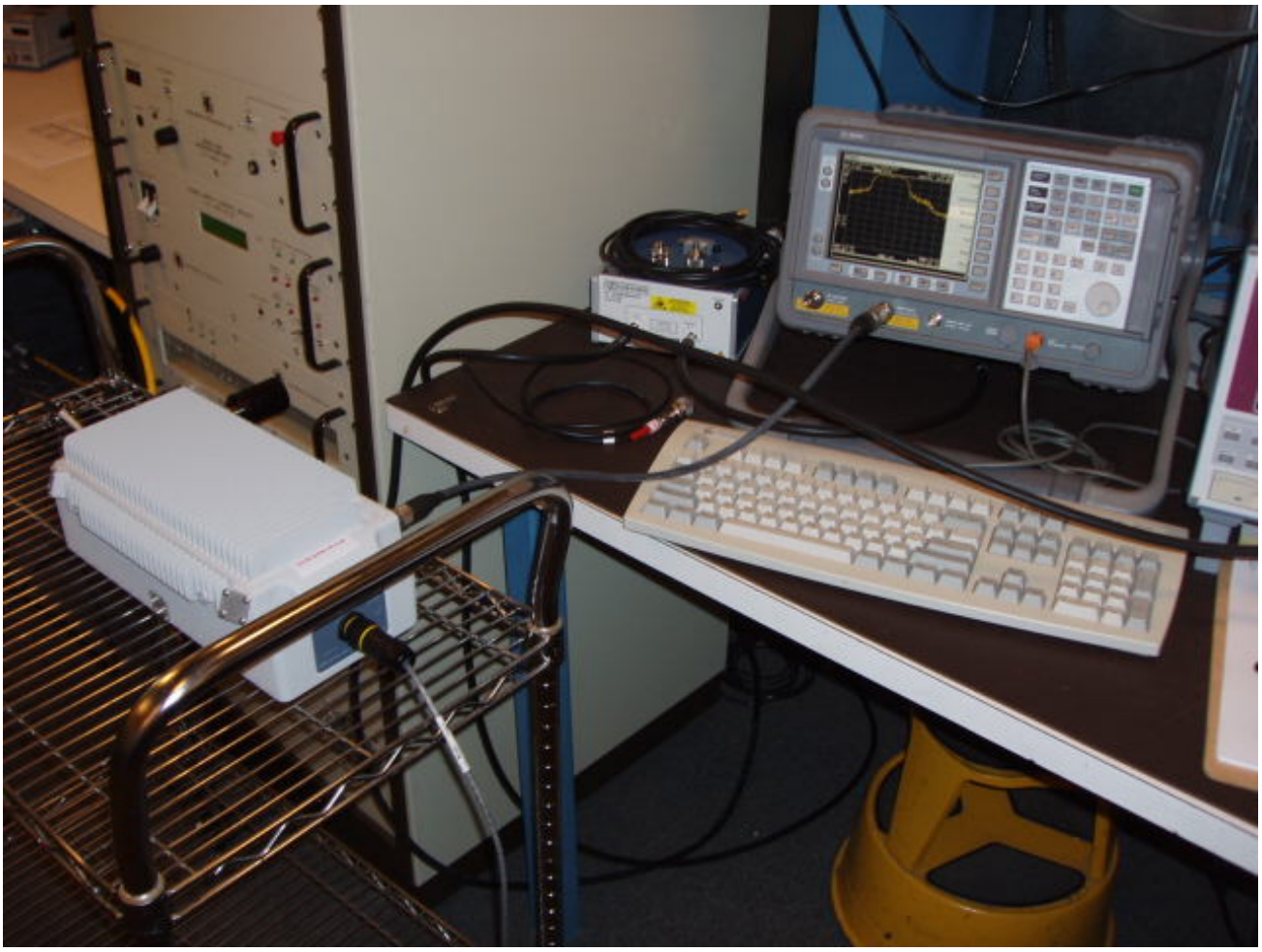


Photo 5.4-1

6 EMISSION MASK DATA

Reference: 47 C.F.R. § 90.210

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

Applicable Emission Masks

Frequency band (MHz)	***Mask for equipment with Audio low pass filter***	***Mask for equipment without audio low pass filter***
4940–4990 MHz	L or M	L or M.

(l) Emission Mask L. For low power transmitters (20 dBm or less) 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: 219 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 10 + 242 log (% of (BW)/50) dB.

(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 20 + 31 log (% of (BW)/55) dB attenuation.

(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 28 + 68 log (% of (BW)/100) dB attenuation.

(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 40 dB.[2]

(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.

(m) Emission Mask M. For high power transmitters (greater that 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: 568 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of BW/50) dB.

[2] Limit changed from 50 dB to 40 dB as detailed in a March 2006 presentation to the TCB by Steven Dayhoff of the FCC's Equipment Authorization Branch, "Licensed Devices - Recent Rule Interpretations."

(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB.

(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% 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.

Note to paragraph m: Low power devices may as an option, comply with paragraph (m).

6.1 Test Procedure

The measurements are made using a direct connection between the DUT's antenna connection and the spectrum analyzer.

First the reference level for the mask must be determined by measuring the DUT's average signal power. The is performed by setting the spectrum analyzer's resolution bandwidth (RBW) is set to 1 MHz, video bandwidth set to 30 kHz, peak detection and its span set to encompass the full bandwidth of the emission. The DUT is conditioned to transmit at its maximum duty cycle. The trace is set to max hold and allowed to run for 60 seconds. Markers are placed at the lower and upper 20 dB points relative to the peak level or alternatively at the upper and lower band frequencies of 4940 MHz and 4990 MHz. The amplitude limits of the mask are then offset such that the 0 dB reference level of the mask is set to the measured average power level.

The emission mask is then measured by setting the spectrum analyzer's resolution bandwidth (RBW) is set to 1 MHz, video bandwidth set to 30 kHz and its span set to encompass the full bandwidth of the emission. The DUT is conditioned to transmit at its maximum duty cycle. The DUT's spectrum is then compared to the mask limit in the operating band. The mask 50 dB point of the mask extends above and below the operating band. Measurements are performed to ensure that spurious emissions are attenuated by at least 50 dB.

6.2 Test Data

Compliance Verdict: PASS or FAIL

Table 6.2-1 shows the calculated emission mask limits. Figure 6.2-1 shows the DUT's normalized PSD, relative to the Emission Mask M, for Channel A. This shows the spectral response for frequencies within the operating band. Figure 6.2-2 shows the DUT's PSD for frequencies from 1 to 20 GHz. Figure 6.2-3 shows the DUT's PSD for frequencies from 30 to 1000 MHz.

Table 6.2-2 shows the calculated emission mask limits. Figure 6.2-4 shows the DUT's normalized PSD, relative to the Emission Mask M, for Channel A. This shows the spectral response for frequencies within the operating band. Figure 6.2-5 shows the DUT's PSD for frequencies from 1 to 20 GHz. Figure 6.2-6 shows the DUT's PSD for frequencies from 30 to 1000 MHz.

The measurements were made with the data rate set to its (worst-case) minimum value based upon results obtained during preliminary testing. The results were taken on Antenna 0. Preliminary results showed no appreciable difference between the measured results on Antenna 0 as compared to Antenna 1.

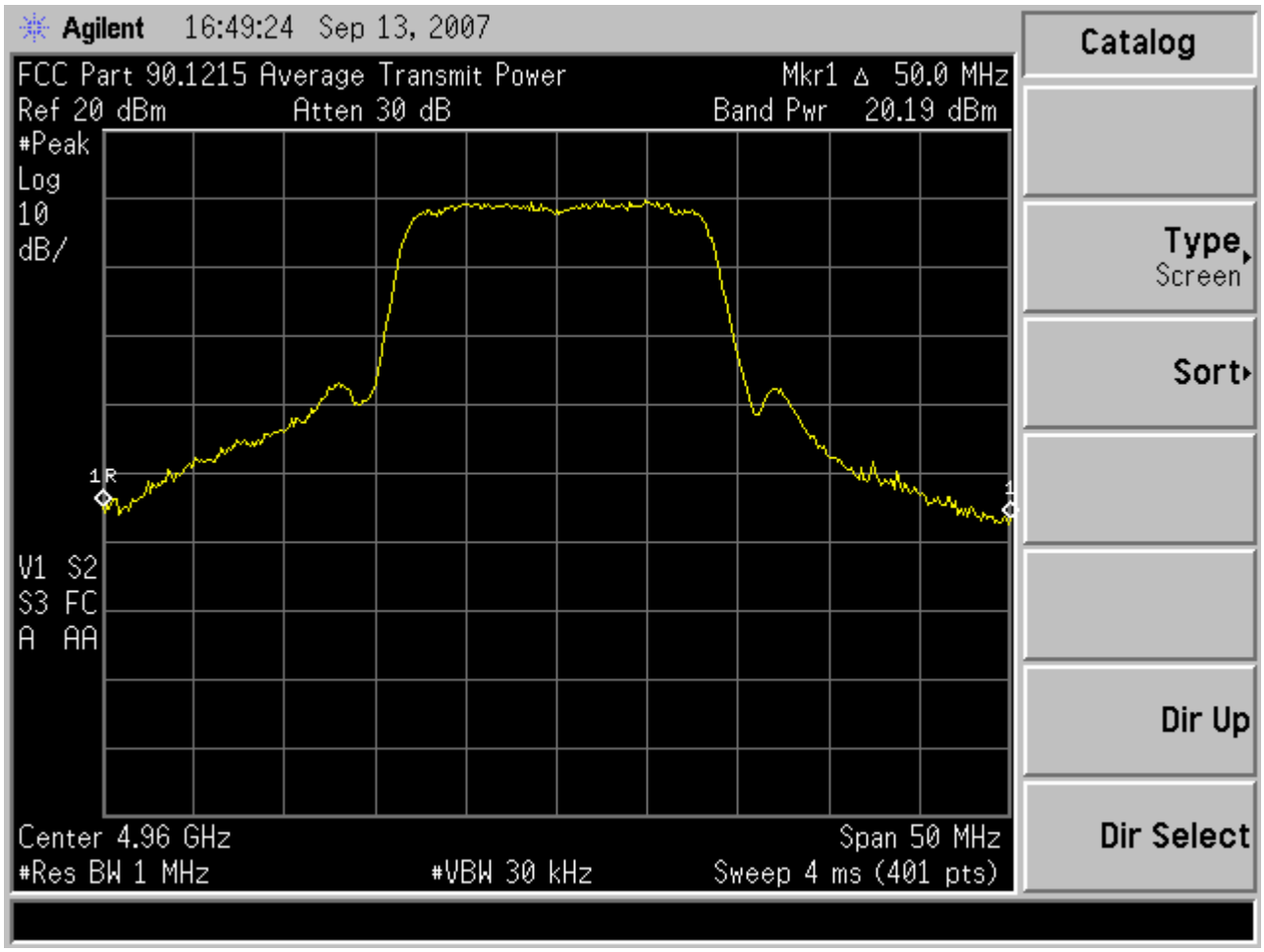


Figure 6.2-1 – Average Signal Power Channel A at 54 Mbps

Table 6.2-1 – Adjusted Emission Mask M Limits for Channel A

Frequency (MHz)	Normalized Amplitude (dB)	Adjusted Amplitude (dB)
4920	-50	-29.81
4930	-50	-29.81
4940	-40	-19.81
4949	-32	-11.81
4950	-26	-5.81
4951	0	20.19
4969	0	20.19
4970	-26	-5.81
4971	-32	-11.81
4980	-40	-19.81
4990	-50	-29.81
5000	-50	-29.81

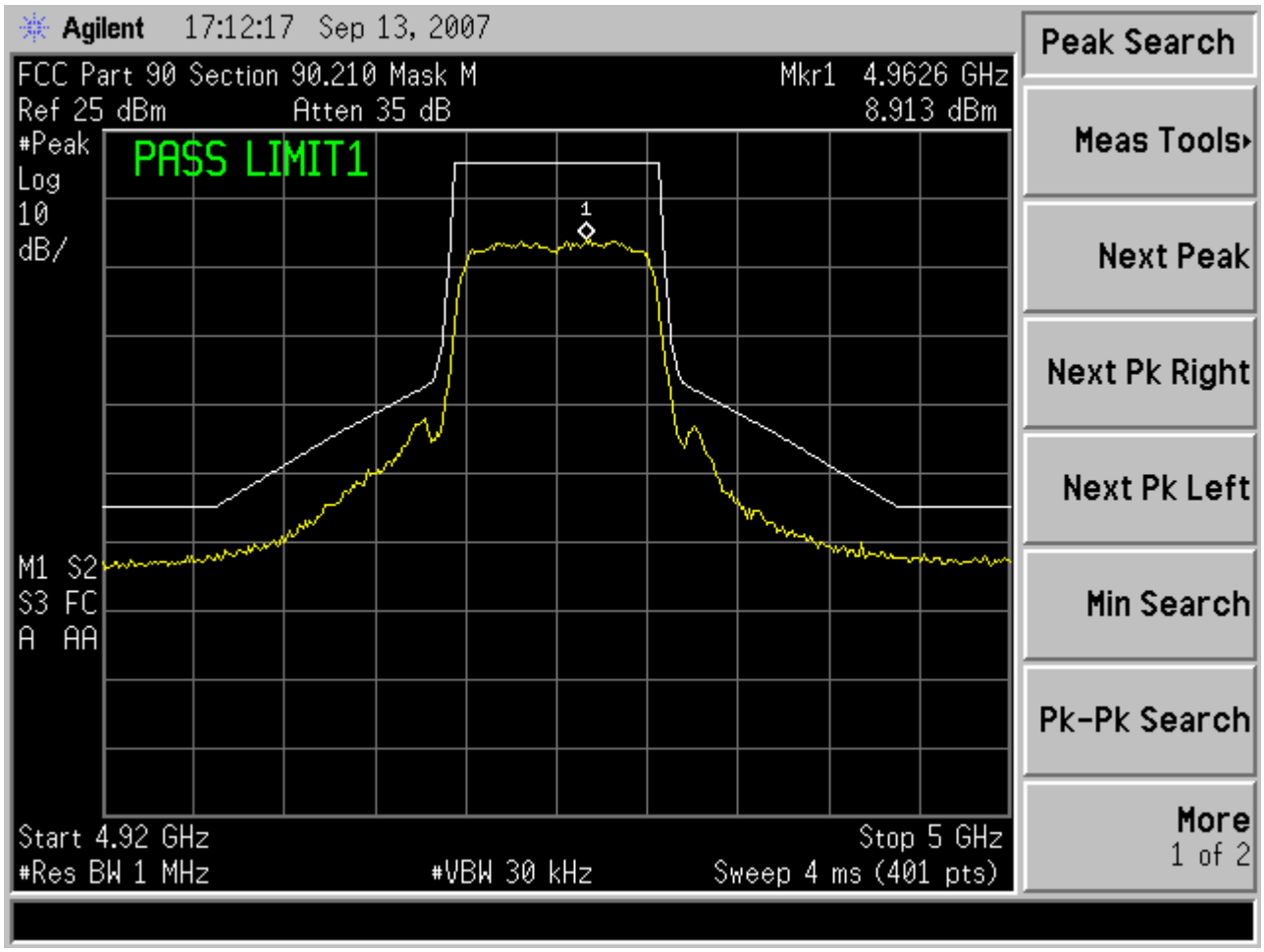


Figure 6.2-1 – Channel A PSD versus the Emission Mask M

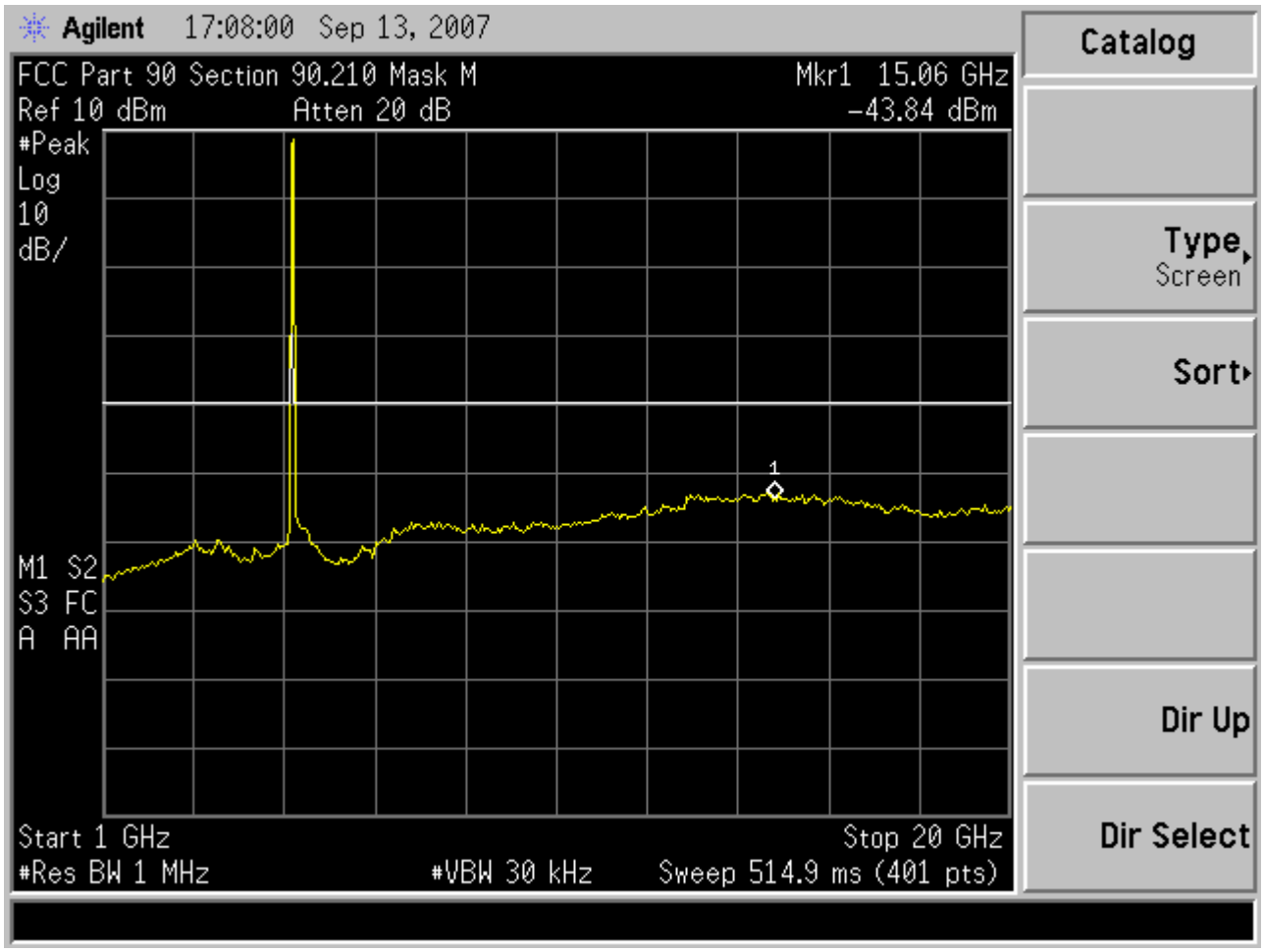


Figure 6.2-2 – Channel A PSD versus the Emission Mask M for Frequencies between 1 and 20 GHz

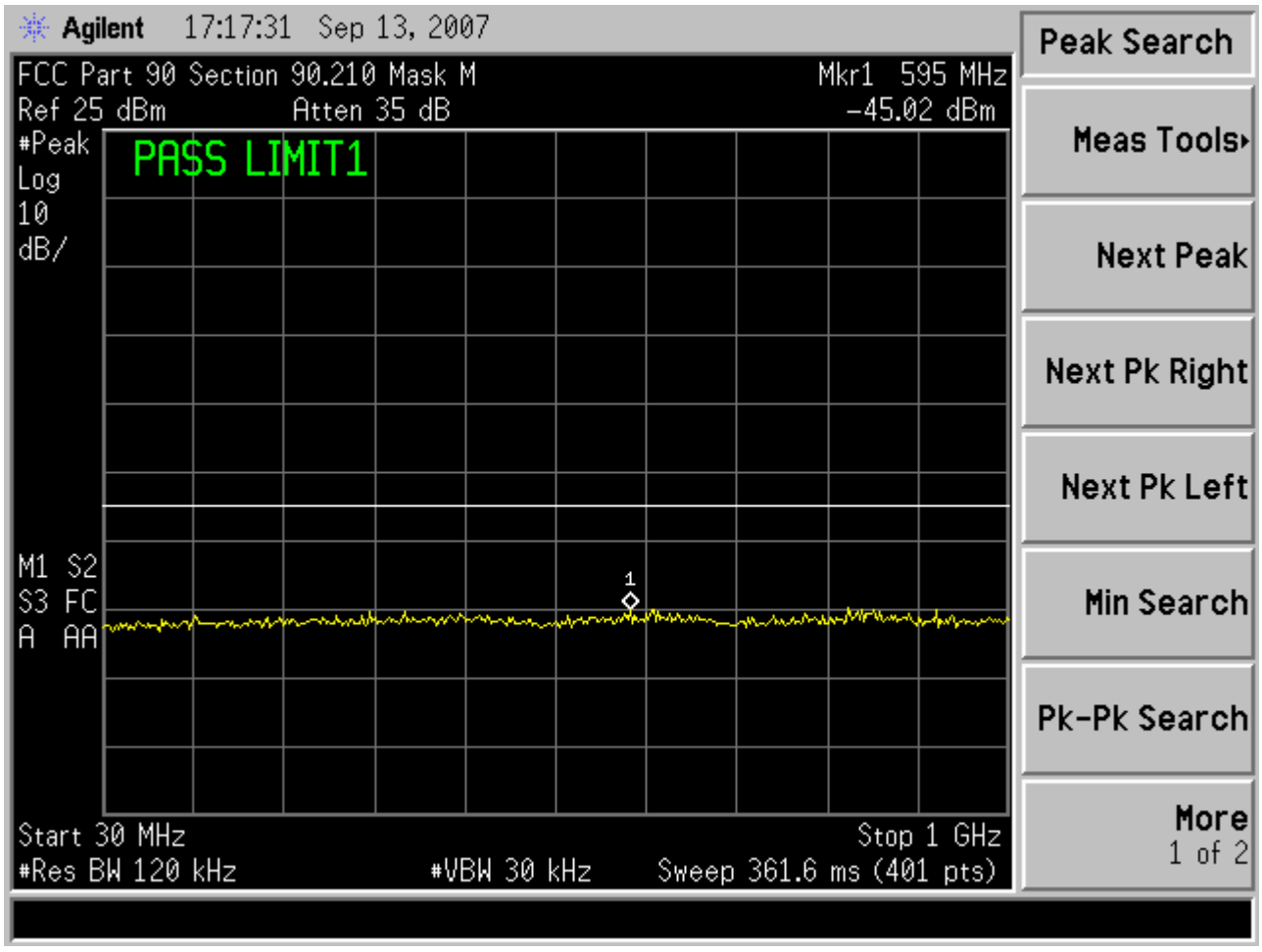


Figure 6.2-3 – Channel A PSD versus the Emission Mask M for Frequencies between 30 and 1000 MHz

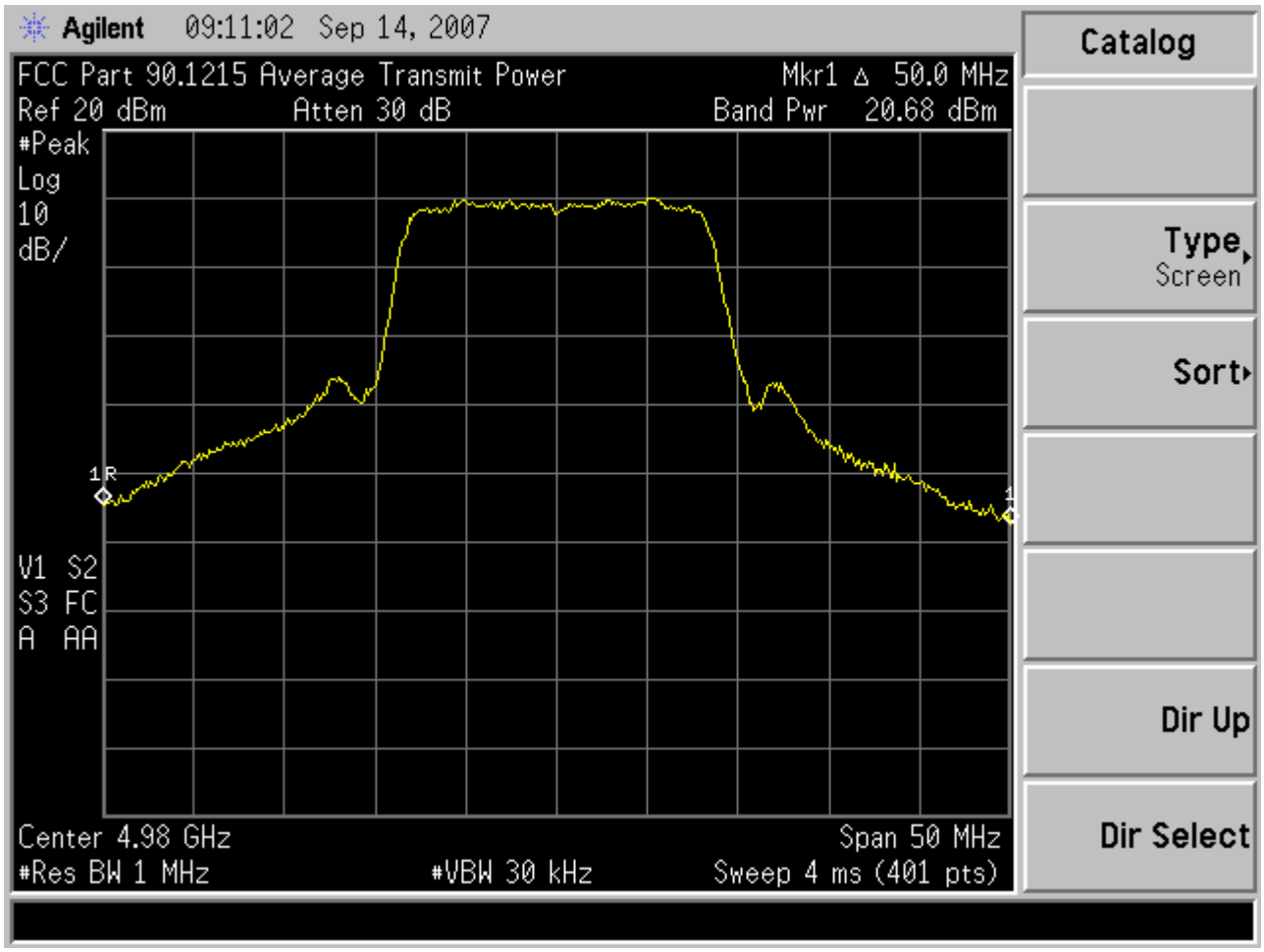


Figure 6.2-4 – Average Signal Power Channel B at 54 Mbps

Table 6.2-2 – Adjusted Emission Mask M Limits for Channel B

Frequency (MHz)	Normalized Amplitude (dB)	Adjusted Amplitude (dB)
4940	-50	-29.32
4950	-50	-29.32
4960	-40	-19.32
4969	-32	-11.32
4970	-26	-5.32
4971	0	20.68
4989	0	20.68
4990	-26	-5.32
4991	-32	-11.32
5000	-40	-19.32
5010	-50	-29.32
5020	-50	-29.32

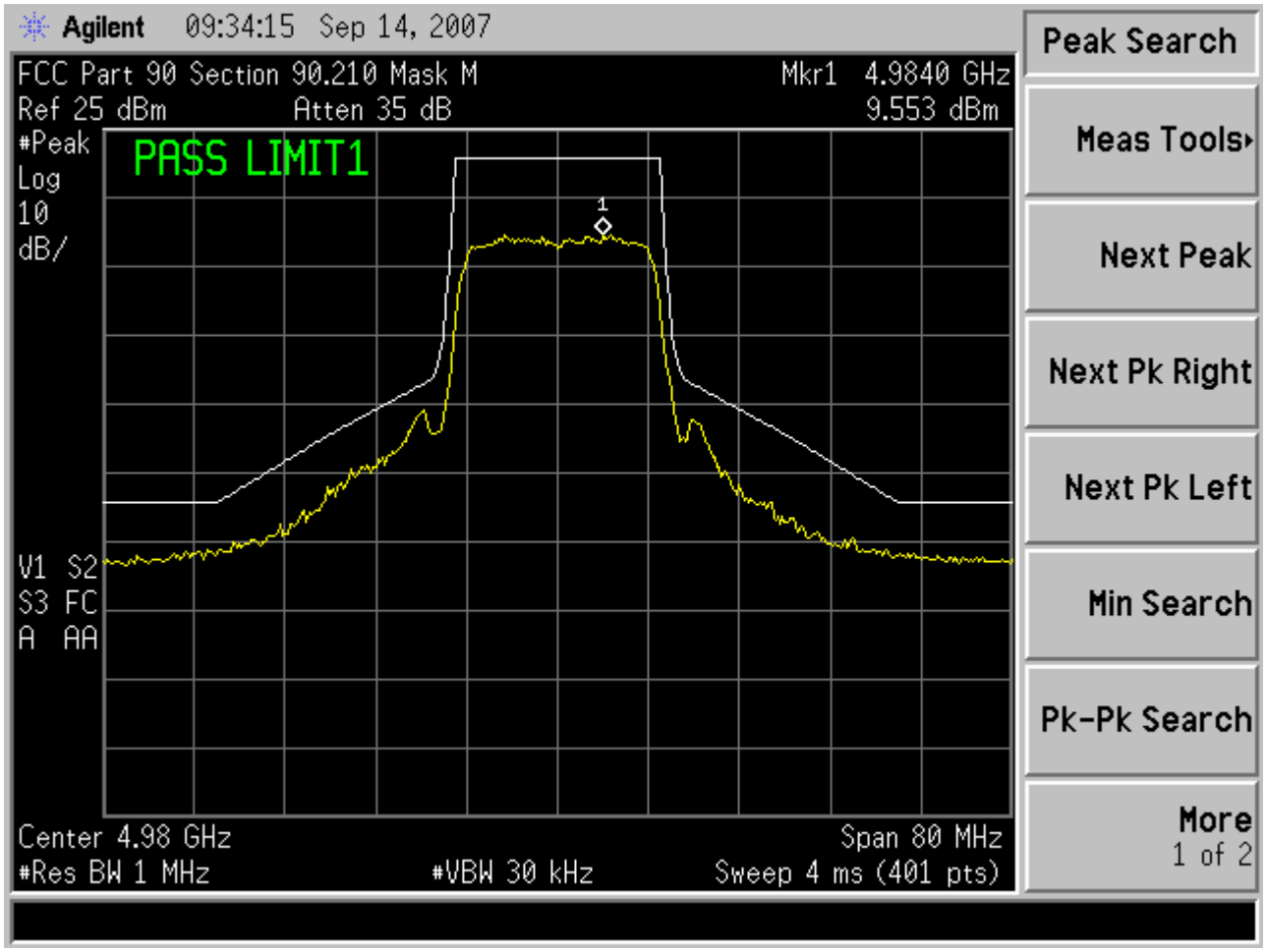


Figure 6.2-5 – Channel B PSD versus the Emission Mask M

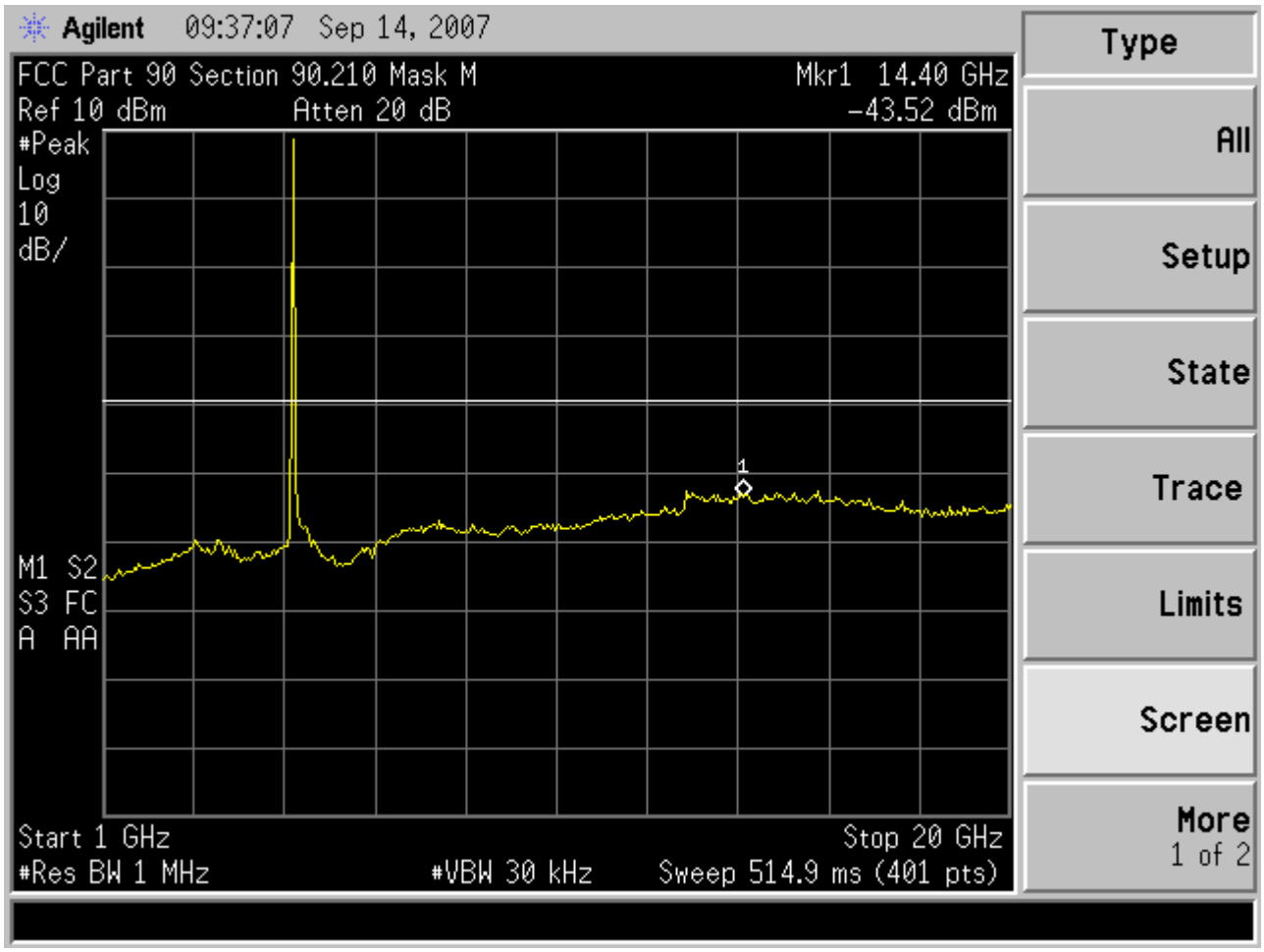


Figure 6.2-6 – Channel B PSD versus the Emission Mask M for Frequencies between 1 and 20 GHz

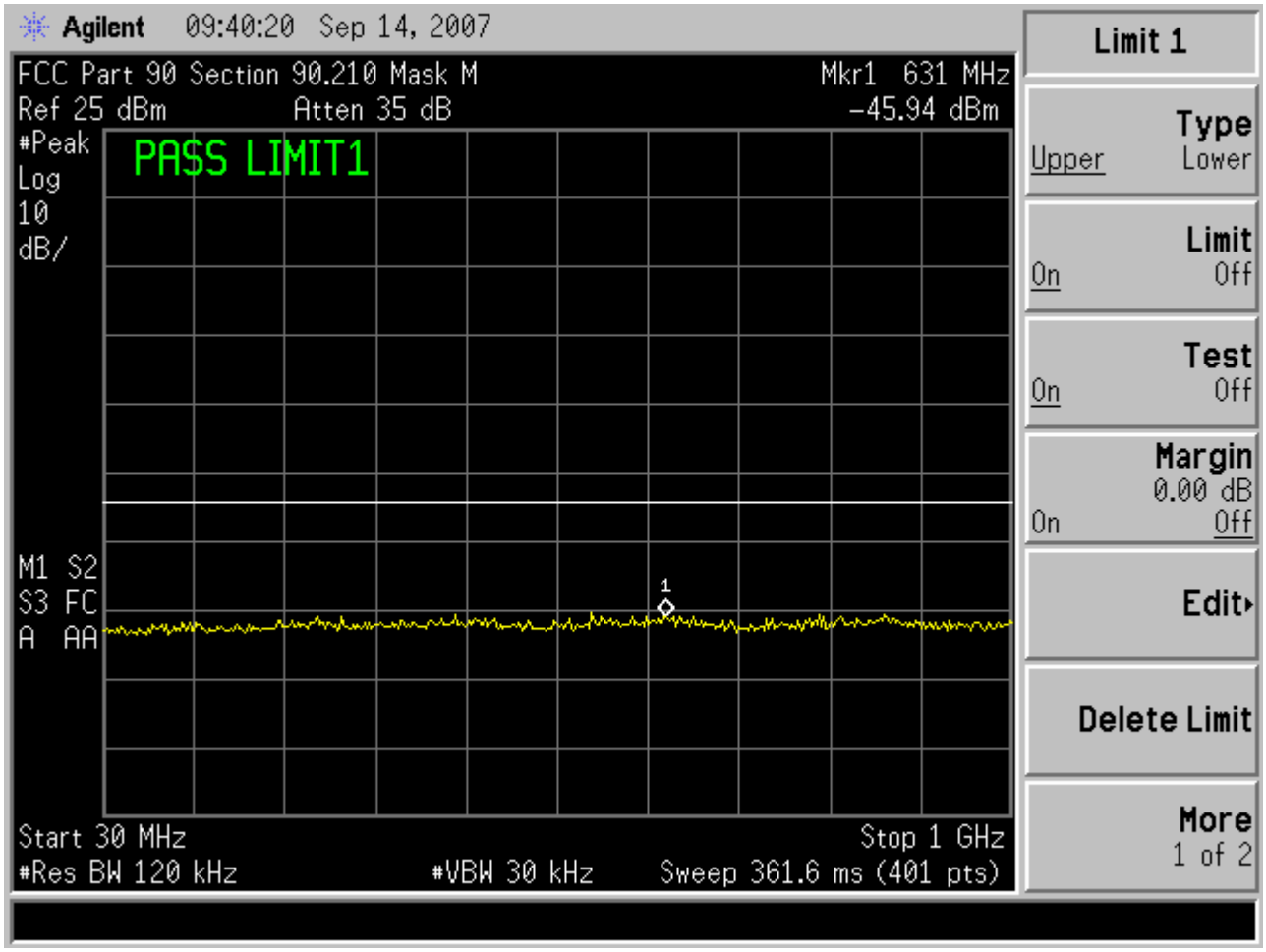


Figure 6.2-7 – Channel B PSD versus the Emission Mask M for Frequencies between 30 and 1000 MHz

Test Personnel:

September 14, 2007	Peter J. Walsh, NCE	
Date	Name	Signature

6.3 Test Instrumentation Used, Emission Mask Measurement

Description	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Agilent	E7405A	MY42000055
10 dB Attenuator Pad	Agilent	8491A 10 dB	90077
50 Ω 600 cm length coaxial cable	Hewlett Packard	HP 8120-466-1	-
50 ohm load	JFW	50T-054	-

Calibration and Traceability: All measuring and test equipment are calibrated every 12 months and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

7 FREQUENCY STABILITY

Reference: 47 C.F.R. § 90.213

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Minimum Frequency Stability

[Parts per million (ppm)]

Frequency range (MHz)	***Fixed and base stations***	***Mobile stations***	
		Over 2 watts output power	***2 watts or less output power***
Below 25	*[1,2,3]100*	*100*	*200*
25–50	*20*	*20*	*50*
72–76	*5*		*50*
150–174	*[5,11]5*	*[6]5*	*[4,6]50*
216–220	*1.0*		*1.0*
220–222[12]	*0.1*	*1.5*	*1.5*
421–512	*[7,11,14]2.5*	*[8]5*	*[8]5*
806–809	*[14]1.0*	*1.5*	*1.5*
809–824	*[14]1.5*	*2.5*	*2.5*
851–854	*1.0*	*1.5*	*1.5*
854–869	*1.5*	*2.5*	*2.5*
896–901	*[14]0.1*	*1.5*	*1.5*
902–928	*2.5*	*2.5*	*2.5*
902–928[13]	*2.5*	*2.5*	*2.5*
929–930	*1.5*		
935–940	*0.1*	*1.5*	*1.5*
1427–1435	*[9]300*	*300*	*300*
Above 2450[10]			

[1]Fixed and base stations with over 200 watts transmitter power must have a frequency stability of 50 ppm except for equipment used in the Public Safety Pool where the frequency stability is 100 ppm.

[2]For single sideband operations below 25 MHz, the carrier frequency must be maintained within 50 Hz of the authorized carrier frequency.

[3]Travelers information station transmitters operating from 530–1700 kHz and transmitters exceeding 200 watts peak envelope power used for disaster communications and long distance circuit operations pursuant to §§90.242 and 90.264 must maintain the carrier frequency to within 20 Hz of the authorized frequency.

[4]Stations operating in the 154.45 to 154.49 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of 5 ppm.

[5]In the 150–174 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

[6]In the 150–174 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth or designed to operate on a frequency specifically designated for itinerant use or designed for low-power operation of two watts or less, must have a frequency stability of 5.0 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 2.0 ppm.

[7]In the 421–512 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 1.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 0.5 ppm.

[8]In the 421–512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

[9]Fixed stations with output powers above 120 watts and necessary bandwidth less than 3 kHz must operate with a frequency stability of 100 ppm. Fixed stations with output powers less than 120 watts and using time-division multiplex, must operate with a frequency stability of 500 ppm.

[10]Except for DSRCS equipment in the 5850–5925 MHz band, frequency stability is to be specified in the station authorization. Frequency stability for DSRCS equipment in the 5850–5925 MHz band is specified in subpart M of this part.

[11]Paging transmitters operating on paging-only frequencies must operate with frequency stability of 5 ppm in the 150–174 MHz band and 2.5 ppm in the 421–512 MHz band.

[12]Mobile units may utilize synchronizing signals from associated base stations to achieve the specified carrier stability.

[13]Fixed non-multilateration transmitters with an authorized bandwidth that is more than 40 kHz from the band edge, intermittently operated hand-held readers, and mobile transponders are not subject to frequency tolerance restrictions.

[14]Control stations may operate with the frequency tolerance specified for associated mobile frequencies.

(b) For the purpose of determining the frequency stability limits, the power of a transmitter is considered to be the maximum rated output power as specified by the manufacturer.

7.1 Test Procedure

No procedure was specified because the test was not performed.

7.2 Test Data

Compliance Verdict: None

In accordance with the above, there are no frequency stability requirements. However, the stability must be specified in the station authorization. Because the DUT did not have the ability of transmitting at a single frequency, the declared stability is based upon the radio manufacturer's specification.

The frequency stability was ± 20 ppm.

8 OCCUPIED BANDWIDTH

Reference: 47 C.F.R. § 90.209 and § 90.1215

§ 90.209

(a) Each authorization issued to a station licensed under this part will show an emission designator representing the class of emission authorized. The designator will be prefixed by a specified necessary bandwidth. This number does not necessarily indicate the bandwidth occupied by the emission at any instant. In those cases where §2.202 of this chapter does not provide a formula for the computation of necessary bandwidth, the occupied bandwidth, as defined in part 2 of this chapter, may be used in lieu of the necessary bandwidth.

(b) The maximum authorized single channel bandwidth of emission corresponding to the type of emission specified in §90.207 is as follows:

(1) For A1A or A1B emissions, the maximum authorized bandwidth is 0.25 kHz. The maximum authorized bandwidth for type A3E emission is 8 kHz.

(2) For operations below 25 MHz utilizing J3E emission, the bandwidth occupied by the emission shall not exceed 3000 Hz. The assigned frequency will be specified in the authorization. The authorized carrier frequency will be 1400 Hz lower in frequency than the assigned frequency. Only upper sideband emission may be used. In the case of regularly available double sideband radiotelephone channels, an assigned frequency for J3E emissions is available either 1600 Hz below or 1400 Hz above the double sideband radiotelephone assigned frequency.

(3) For all other types of emissions, the maximum authorized bandwidth shall not be more than that normally authorized for voice operations.

(4) Where a frequency is assigned exclusively to a single licensee, more than a single emission may be used within the authorized bandwidth. In such cases, the frequency stability requirements of §90.213 must be met for each emission.

(5) Unless specified elsewhere, channel spacings and bandwidths that will be authorized in the following frequency bands are given in the following table.

Standard Channel Spacing/Bandwidth

Frequency band (MHz)	*Channel spacing (kHz)*	*Authorized bandwidth (kHz)*
Below 25[2]		
25–50	*20*	*20*
72–76	*20*	*20*
150–174	[1]*7.5*	[1,3]*20/11.25/6*
216–2205	*6.25*	*20/11.25/6*[5]
220–222	*5*	*4*
406–512[2]	[1]*6.25*	[13]*20/11.25/6*
806–809/851–854	*12.5*	*20*
809–824/854–869	*25*	*20*
896–901/935–940	*12.5*	*13.6*
902–928[4]		
929–930	*25*	*20*
1427–1432[5]	*12.5*	*12.5*
2450–2483.52[2]		
Above 2500[2]		

Note that for a device operating in the 4940 to 4990 MHz band, the occupied bandwidth is not restricted. Guidance in specified in § 90.1215 prescribes various nominal bandwidths.

§ 90.1215

The transmitting power of stations operating in the 4940–4990 MHz band must not exceed the maximum limits in this section.

(a) The peak transmit power should not exceed:

Channel bandwidth (MHz)	*Low power peak transmitter power (dBm)*	*High power peak transmitter power (dBm)*
1	*7*	*20*
5	*14*	*27*
10	*17*	*30*
15	*18.8*	*31.8*
20	*20*	*33*

8.1 Test Procedure

The measurements are made using a direct connection between the DUT's antenna connection and the spectrum analyzer. The spectrum analyzer's resolution bandwidth (RBW) is set to 300 kHz, video bandwidth set to 1 MHz, peak detection and its span set to encompass the full bandwidth of the emission. The DUT is conditioned to transmit at its maximum duty cycle. The trace is set to max hold and allowed to run for 60 seconds. A marker is placed on the maximum emission level and the spectrum analyzer's N dB function is used to measure the 26 dB bandwidth.

8.2 Test Data

Compliance Verdict: PASS

Table 8.2-1 below shows the measured occupied bandwidth. Preliminary testing showed that the data rate did not have an appreciable affect upon the occupied bandwidth. Figures 8.2-1 and 8.2-2 show the spectrum analyzer plots of these measurements.

Table 8.2-1 – 26 dB Occupied Bandwidth

Frequency (MHz)	Bandwidth (MHz)
4960	21.70
4980	21.07

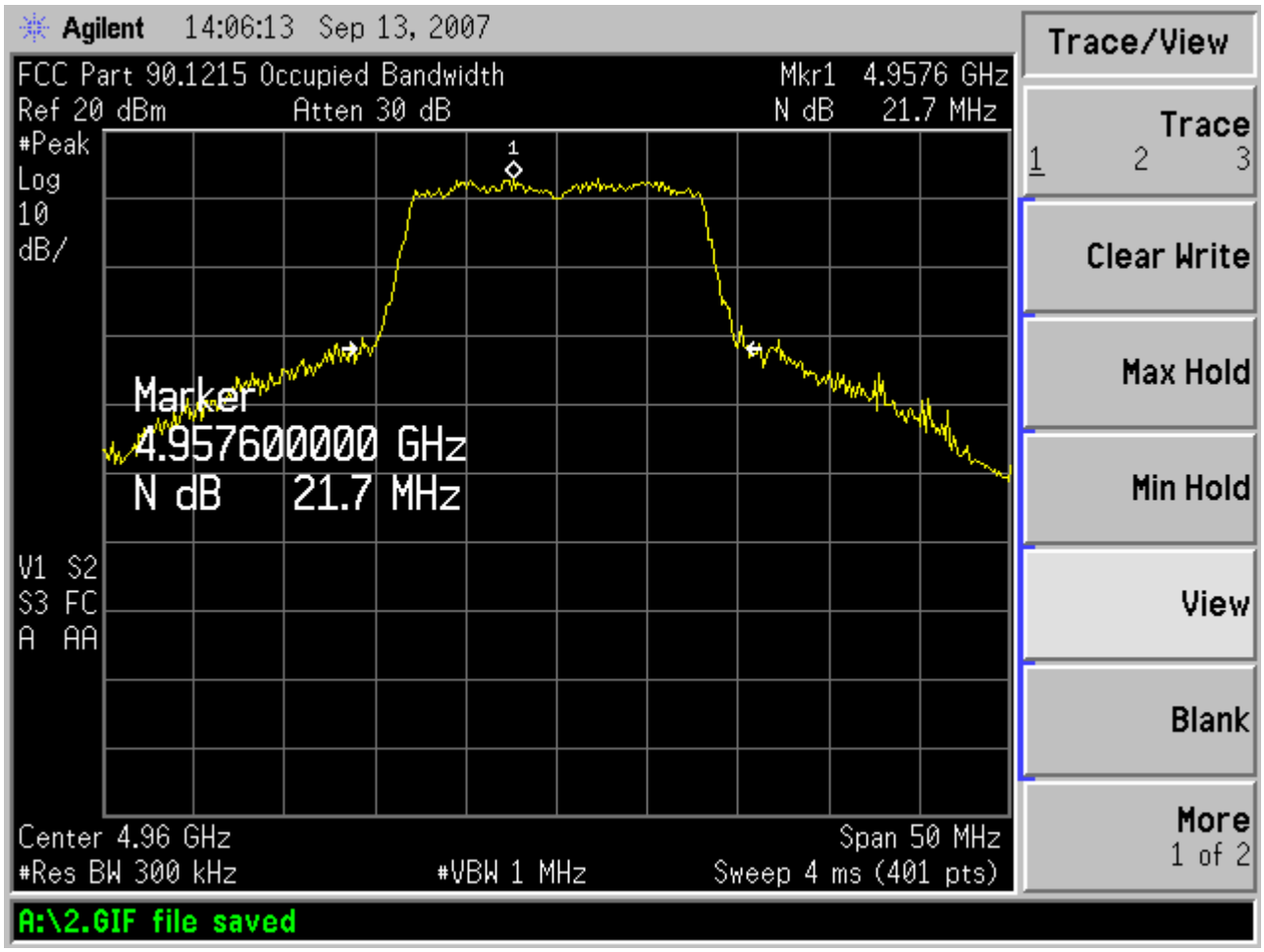


Figure 8.2-1 – 26 dB Occupied Bandwidth for Channel A

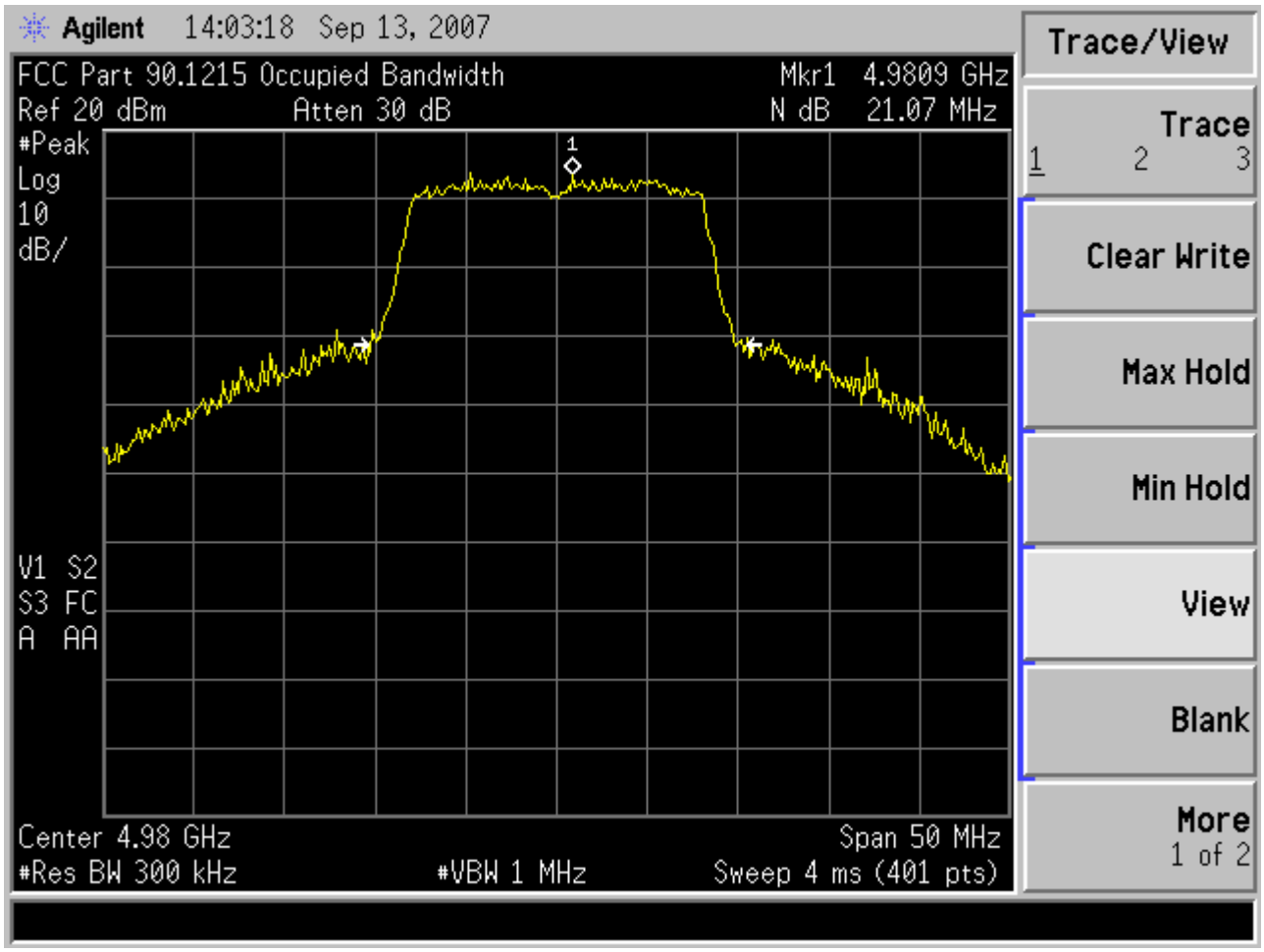


Figure 8.2-2 – 26 dB Occupied Bandwidth for Channel B

Test Personnel:

September 13, 2007	Peter J. Walsh, NCE	
Date	Name	Signature

8.3 Test Instrumentation Used, Emission Mask Measurement

Description	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Agilent	E7405A	MY42000055
10 dB Attenuator Pad	Agilent	8491A 10 dB	90077
50 ohm load	JFW	50T-054	-
50 Ω 600 cm length coaxial cable	Hewlett Packard	HP 8120-466-1	-

Calibration and Traceability: All measuring and test equipment are calibrated every 12 months and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

9 RADIATED SPURIOUS EMISSIONS

Reference: 47 C.F.R. § 90.210

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

Applicable Emission Masks

Frequency band (MHz)	***Mask for equipment with Audio low pass filter***	***Mask for equipment without audio low pass filter***
4940–4990 MHz	L or M	L or M.

(l) Emission Mask L. For low power transmitters (20 dBm or less) 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: 219 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 10 + 242 log (% of (BW)/50) dB.

(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 20 + 31 log (% of (BW)/55) dB attenuation.

(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 28 + 68 log (% of (BW)/100) dB attenuation.

(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 40 dB.[3]

(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.

(m) Emission Mask M. For high power transmitters (greater that 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: 568 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of BW/50) dB.

[3] Limit changed from 50 dB to 40 dB as detailed in a March 2006 presentation to the TCB by Steven Dayhoff of the FCC's Equipment Authorization Branch, "Licensed Devices - Recent Rule Interpretations."

(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB.

(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% 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.

Note to paragraph m: Low power devices may as an option, comply with paragraph (m).

Reference: 47 C.F.R. § 2.1053

§ 2.1053 Measurements required: Field strength of spurious radiation.

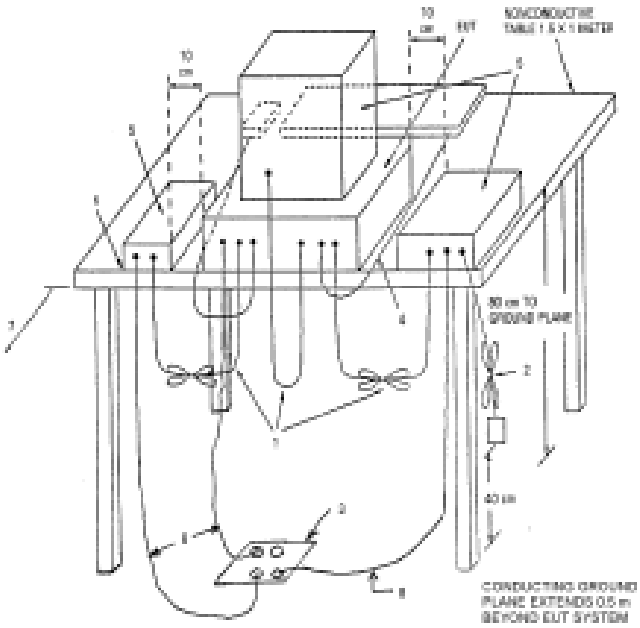
(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
(2) All equipment operating on frequencies higher than 25 MHz.
(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
(4) Other types of equipment as required, when deemed necessary by the Commission.

9.1 Test Procedure

The test was performed in accordance with ANSI C63.4-2003 § 8. The test setup was consistent with ANSI C63.4-2003 Figure 11a below. The test was performed in a semi-anechoic chamber.



LEGEND:

1) Interconnecting cables that hang closer than 40 cm to the groundplane shall be folded back and forth in the center, forming a bundle 30 to 40 cm long (see 6.1.4 and 11.2.4).

2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using the correct terminating impedance. The total length shall not exceed 1 m (see 6.1.4).

3) If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the groundplane with the receptacle flush with the groundplane (see 6.1.4).

4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use (see 6.2.1.3 and 11.2.4).

5) Non-EUT components of EUT system being tested (see also Figure 13).

6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop (see 6.2.1.1 and 6.2.1.2).

7) No vertical conducting plane used (see 5.2.2).

8) Power cords drape to the floor and are routed over to receptacle (see 6.1.4).

Figure 11a—Test arrangement for radiated emissions tabletop equipment

The following data lists the significant emission frequencies, amplitude levels (including cable correction and antenna factors), plus the limit. The frequency range investigated was 1 to 15 GHz based upon the conducted power measurements at the antenna port. First a scan was performed using the peak detector. Significant emissions were then measured using an Average detector. A separate test report documents compliance with Part 15, FCC Rules for the DUT's digital circuitry.

9.2 Test Data

Compliance Verdict: PASS

Aside from the Part 15 radiated emissions limit, a radiated emissions limit may be derived from 47 C.F.R. § 90.210. The following paragraphs describe how this limit was determined.

In accordance with 47 C.F.R. § 90.210, the DUT's out-of-band emissions must be attenuated by at least 50 dB relative to the fundamental. The conducted emissions mask test results showed compliance. An equivalent radiated emissions limit was calculated based upon the calculated field strength using the measured average signal power of the DUT using the formula below:

$$E = \sqrt{\frac{30xGxP}{R}}$$

Where: G = Power Gain of Antenna
P = Transmitter Power Output in Watts
R = Distance from Radiator at which field intensity is measured.

The total average power delivered to both antennas was 23.69 dBm or 0.234 watts.
The antenna gain was 5.3 dBi.
The distance from the DUT to the receiving antenna was 3 m.
The calculated field strength of the fundamental signal was 3.52 V/m or 130.9 dBµV/m.
The out-of-band field strength must be 50 dB down from the fundamental for a field strength limit of 80.9dBµV/m.

Figure 9.2-1 shows the maximum (peak hold) radiated emissions from 1 to 15 GHz in vertical and horizontal polarities at all turntable angles and an antenna height from 1 to 4 meters. This plot shows the fundamental emissions with the only other significant emissions being the second and third harmonics.[4] The field strength of these harmonics were maximized by rotating the turntable and changing antenna height until the maximum value was determined using peak detection. Figures 9.2-2 and 9.2-3 show the final results with an average detector, 30 Hz video bandwidth. These two levels were the only two within 20 dB of the limit. Table 9.2-1 shows the results in a tabular data format.

[4] These harmonics were due to measurement limitations of the spectrum analyzer caused by the high field strength of the fundamental. Recall that the conducted emissions measurements at the antenna port did not reveal these harmonics.

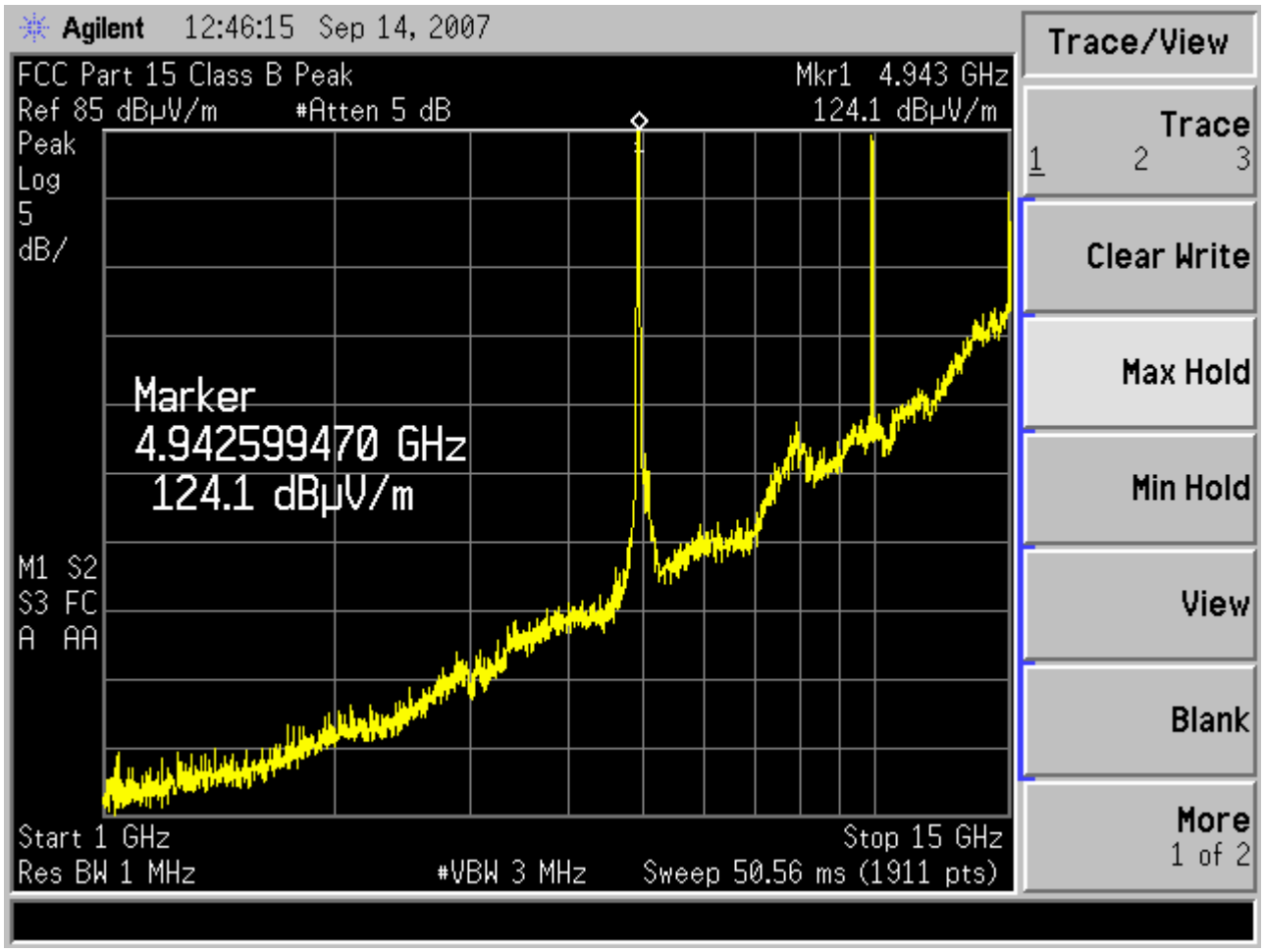


Figure 9.2-1 – Maximum Peak Radiated Emissions

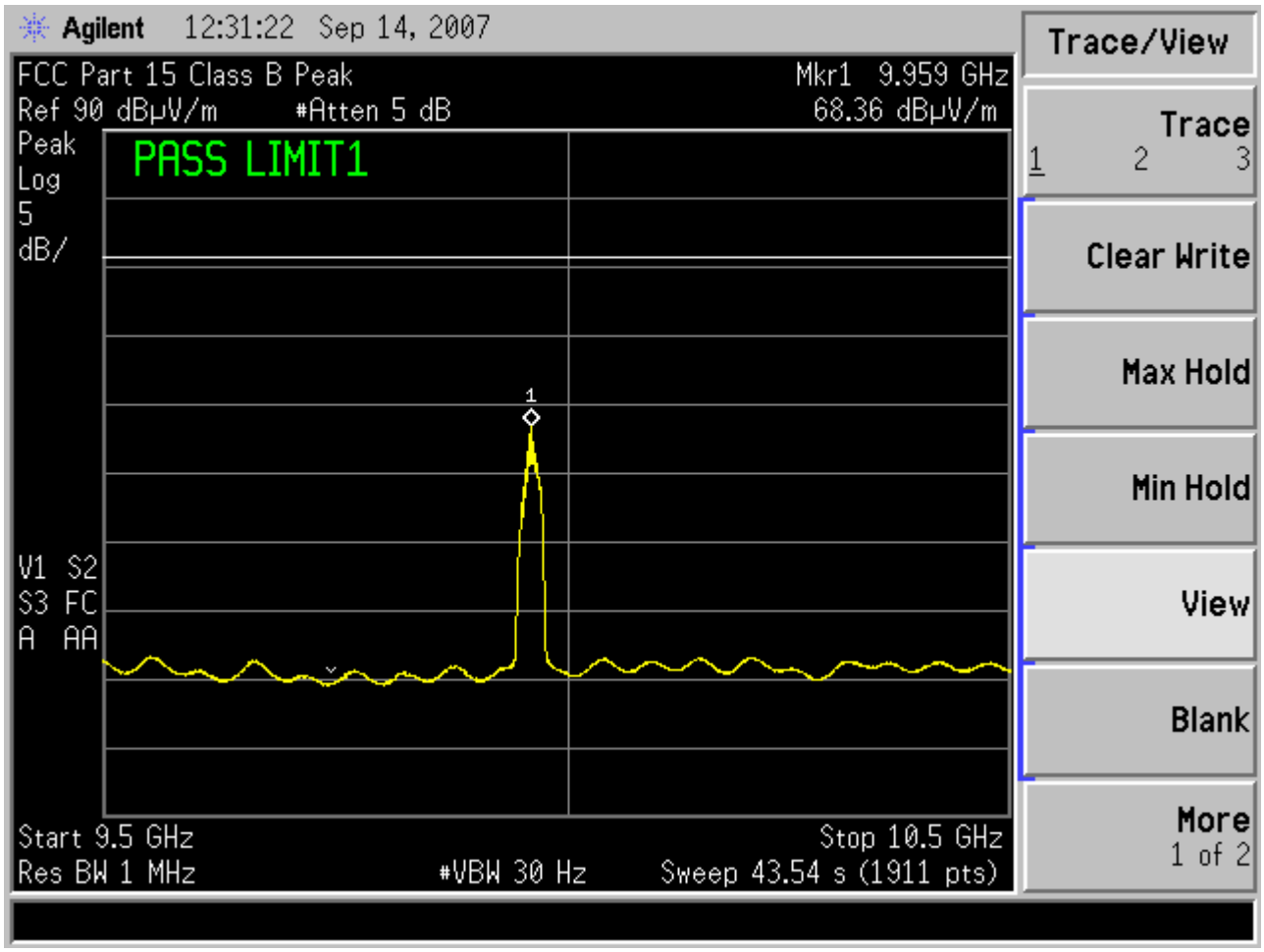


Figure 9.2-2 – Radiated Emissions for the Second Harmonic

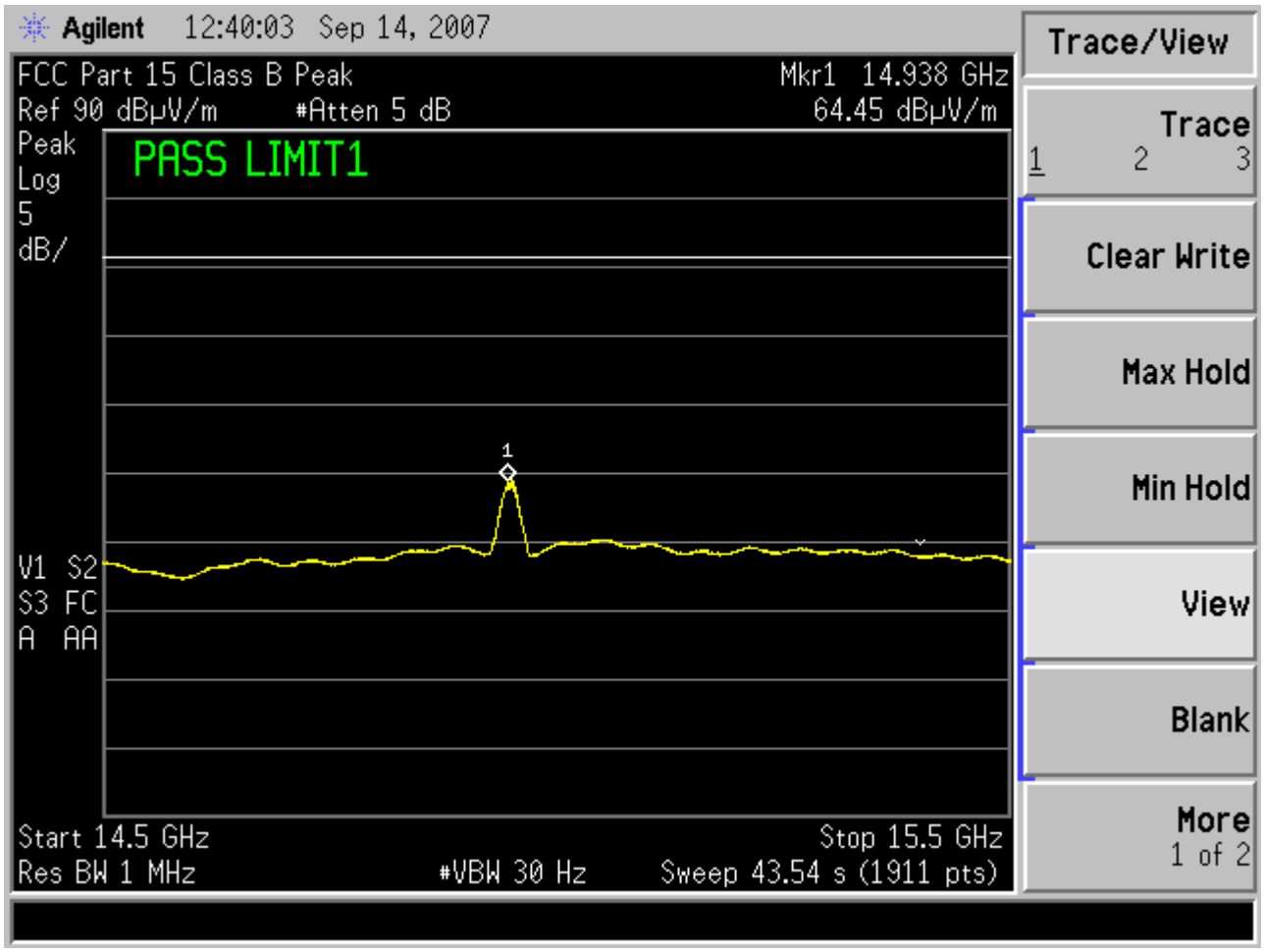


Figure 9.2-3 – Radiated Emissions for the Third Harmonic

Table 9.2-1 - Final Measurement (Average)

Frequency (MHz)	Average (dBµV/m)	Antenna height (cm)	Polarity	Turntable position (deg.)	CF* (dB)	AF# (dB)	Margin (dB)	Limit (dBµV/m)
9.959	68.4	100	Vertical	179	17.9	40.2	12.5	80.9
14.938	64.5	100	Vertical	179	12.5	42.8	16.4	80.9

* CF is the cable loss minus preamplifier gain.
# AF is the antenna correction factor.

Minimum Margin: **12.5 dBµV/m**

Measurement Uncertainty: +4.8 dB, -5.2 dB

Test Personnel:

Date	Name	Signature
September 14, 2007	Peter J. Walsh, NCE	

9.3 Test Instrumentation Used, Radiated Measurement

Type	Manufacturer/ Model No.	Serial Number
EMI Receiver	Rohde & Schwarz ESCS 30	825788/002
Spectrum Analyzer	Agilent E7405A	MY42000055
Preamplifier	Com-Power PA-122	181925
Antenna	Chase EMCCBL6112B	2579
Antenna	EMCO Horn Model 3115	9002-3393

Calibration and Traceability: All measuring and test equipment are calibrated every 12 months and are traceable to the National Institute for Standards and Technology (NIST) and Methods.

9.4 Field Strength Calculation

The field strength is calculated by adding the antenna correction factor and cable loss and subtracting the amplifier gain (if any) from the measured reading.

The Rohde & Schwarz Model ESCS30 receiver and Agilent E7405A spectrum analyzer have the capability of automatically performing the field strength calculations. The amplitude level displayed on the receiver or analyzer represents the total measured field strength. This level is directly compared to the appropriate FCC limit to determine the actual margin of the DUT.

9.5 Radiated Emissions Photographs

Photo 9.5-1 Front View of Radiated Emissions Test Set-up

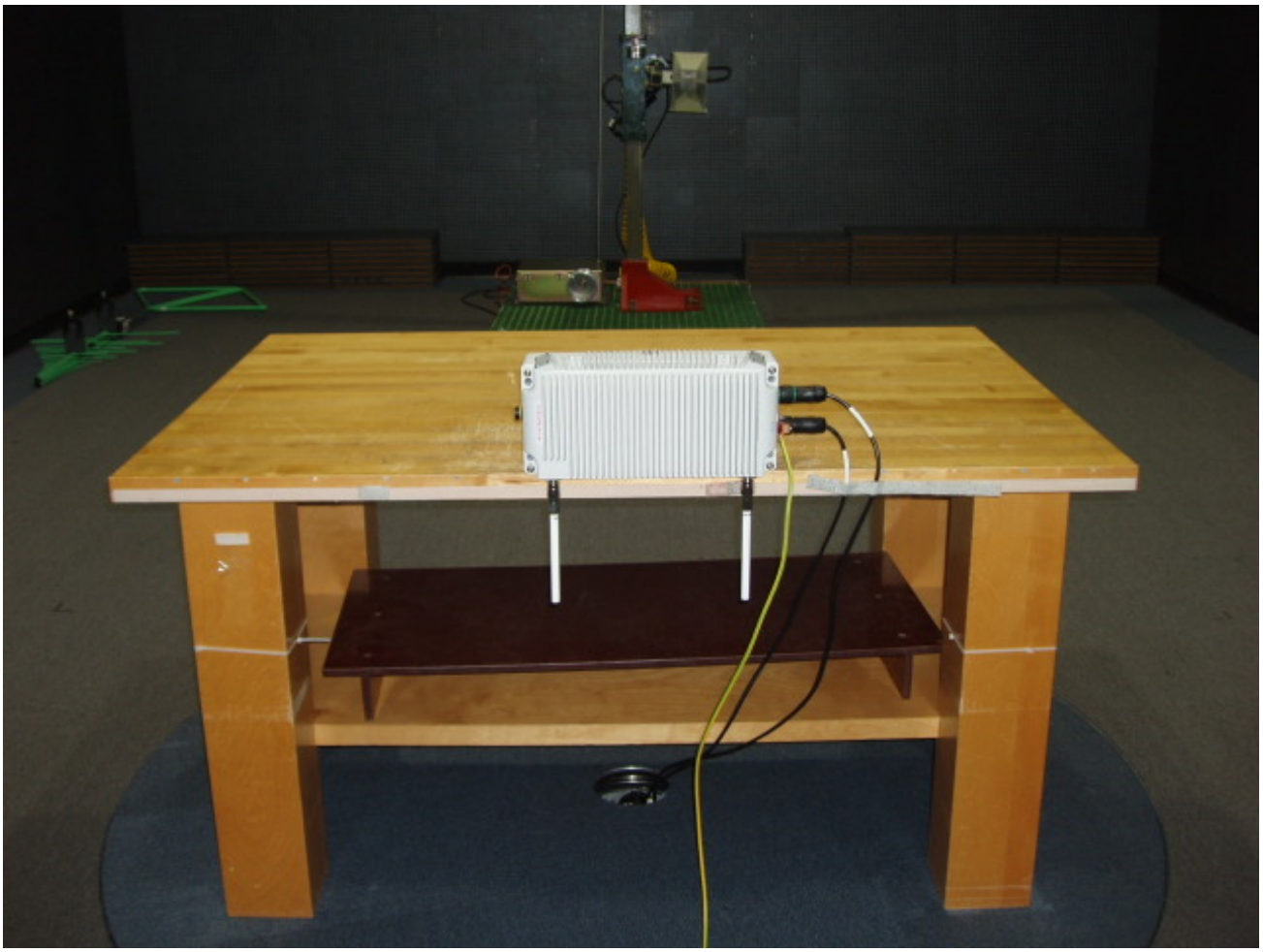


Photo 9.5-2 Rear View of Radiated Emissions Test Set-up

10 LABELING AND USER'S GUIDE REQUIREMENTS

10.1 FCC Label Statement

The FCC compliance label shall include the following information:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

The FCC ID number will be: PJZSZ1424.

The Industry Canada id number will be: 3691ASZ1424.

Figure 10.1-1 below shows the label drawing.

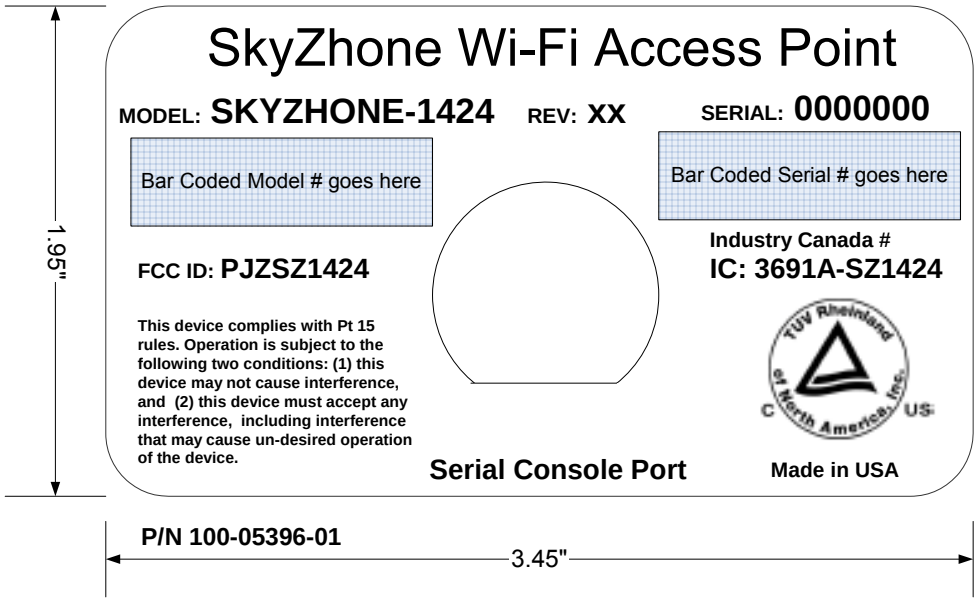


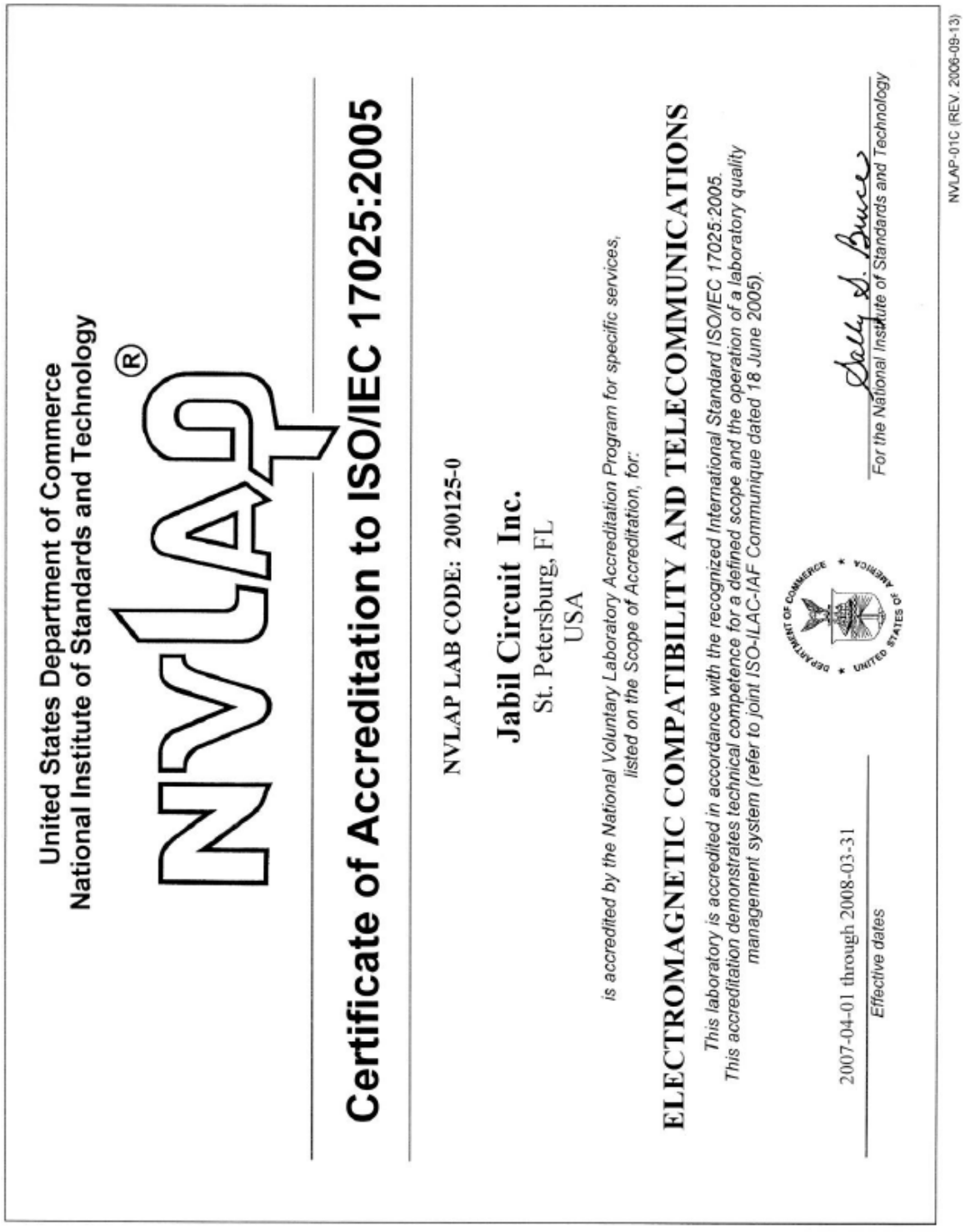
Figure 10.1-1 - Sample Label

10.2 Instruction Manual Statement

The instruction manual must contain the following statement:

Changes or modifications not expressly approved by the responsible party could void the user's authority to operate the equipment.

ANNEX A NVLAP CERTIFICATE of ACCREDITATION



United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200125-0

Jabil Circuit Inc.
St. Petersburg, FL
USA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated 18 June 2005).

2007-04-01 through 2008-03-31
Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2006-09-13)

ANNEX B NVLAP SCOPE of ACCREDITATION

NVLAP® National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Jabil Circuit Inc.
10800 Roosevelt Boulevard
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Mr. Peter Walsh, NCE
Phone: 727-803-5953 Fax:
E-Mail: peter_walsh@jabil.com
URL: http://www.jabil.com

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS **NVLAP LAB CODE 200125-0**

NVLAP Code	*Designation / Description*
Emissions Test Methods:	
12/CIS22	IEC/CISPR 22 (1997) & EN 55022 (1998) + A1(2000): Limits and methods of measurement of radio disturbance characteristics of information technology equipment
12/CIS22a	IEC/CISPR 22 (1993) and EN 55022 (1994): Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1 (1995) and Amendment 2 (1996)
12/CIS22b	CNS 13438 (1997): Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment
12/CIS22e1	IEC/CISPR 22, Edition 5 (2005) and EN 55022 (1998): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
12/CIS22e3	IEC/CISPR 22, Edition 5 (2005) + A1(2005): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
12/CIS22e4	EN 55022 (1998) + A1(2000) + A2(2003): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement

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ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 200125-0

NVLAP Code	*Designation / Description*
12/FCC15b	ANSI C63.4 (2003) with FCC Method 47 CFR Part 15, Subpart B: Unintentional Radiators
12/FCC15c3	KDB Pub. No. 200433 Millimeter Wave Test Procedures: with FCC Method - 47 CFR Part 15, Subpart C: Intentional Radiators
12/T51a	AS/NZS CISPR 22 (2004): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
12/VCCIb	Agreement of VCCI V-3 (2006.04): Agreement of Voluntary Control Council for Interference by Information Technology Equipment - Technical Requirements: V-3/2006.04

Radio Test Methods

12/BETS7a	Document AT-34-04-RT: Testing Procedures for Type Approval testing per BETS-7, Issue 1 (November 1, 1996)

Telecommunications Test Methods:

12/CS03a	Industry Canada CS-03, Issue 9, Amendment 1 (2005): Compliance Specification for Terminal Equipment, Terminal Systems, Network Protection Devices, Connection Arrangements and Hearing Aids Compatibility
12/T01	Terminal Equipment Network Protection Standards, FCC/ACTA Method - 47 CFR Part 68 - Analog and Digital
12/T01a	68.302 (Par. c,d,e,f) Environmental simulation; 68.304 Leakage current limit.; 68.306 Hazardous voltage limit.; 68.308 Signal power limit.; 68.310 Longitudinal balance limit.; 68.312 On-hook impedance limit.; 68.314 Billing protection
12/T01b	68.316 and 68.317 Hearing Aid Compatibility: technical standards
12/T01c	68.302 Environmental simulation (Par. a,b)
12/TIA968	ANSI/TIA-968-A (2003): Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network

2007-04-01 through 2008-03-31

Effective dates

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NVLAP® **National Voluntary Laboratory Accreditation Program**

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 200125-0

NVLAP Code	*Designation / Description*
12/TIA968a	ANSI/TIA-968-A-1 (2003): Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network - Addendum 1
12/TIA968b	ANSI/TIA-968-A-2 (2004): Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network - Addendum 2
12/TIA968c	ANSI/TIA-968-A-3 (2005): Telephone Terminal Equipment, Technical Requirements for Connection of Terminal Equipment to the Telephone Network - Addendum 3

2007-04-01 through 2008-03-31

Effective dates

Sally S. Bruce

For the National Institute of Standards and Technology

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ANNEX C DISCLOSURE STATEMENT

Jabil Circuit Inc. represents to the client that testing was done in accordance with standard procedures as applicable and that reported test results are accurate within generally accepted commercial ranges of accuracy. Jabil Circuit Inc. test reports only apply to the specific sample(s) tested. This report is the property of the client. This report shall not be reproduced except in full without the expressed written approval of Jabil Circuit, Inc.

TERMS and CONDITIONS

ARTICLE 1 *- Services, Jabil Circuit will:*

1.1 Act for Client in a professional manner, using the degree of care and skill ordinarily exercised by and consistent with the standards of the profession.

1.2 Provide only those services that lie within the technical and professional area of expertise and capability of the Lab.

1.3 Perform all technical services in accordance with accepted laboratory test principles and practices.

1.4 Use test equipment which has been calibrated within a period not exceeding the manufacturer's recommendation and which is traceable to the NIST.

1.6 Consider all reports to be the confidential property of the client, and distribute reports only to those persons designated by the client.

ARTICLE 2 *- Client's Responsibilities, The Client will:*

2.1 Provide all information necessary for proper performance of technical services.

2.2 Designate a person who is authorized to transmit instructions, receive information and test data reports, interpret and define Client's policies, and make decisions regarding technical services, as may be required at Clients expense.

2.3 Deliver without cost, representative samples of product for technical evaluation, together with any relevant data.

2.4 Furnish such labor and equipment necessary to handle sample product and to facilitate the technical evaluation.

2.5 The Client shall provide prior to the start of evaluation testing a signed Purchase Order for the amount agreed to by both parties.

ARTICLE 3 *- General Requirements.*

3.1 The only warranty made by Jabil Circuit, in connection with services performed thereunder is that it will use that degree of care and skill as stated in Article 1.1 and 1.3 above. No other warranty, expressed or implied, is made or intended for services provided thereunder.

3.2 Jabil Circuit shall supply technical services and prepare reports based solely on product samples submitted. The Client understands that application of the data to other devices is highly speculative and should be applied with extreme caution.

3.3 Jabil Circuit agrees to exercise ordinary care in receiving, preserving, and shipping any test sample to be tested, but assumes no responsibility for damages, either direct or consequential, which arise or are alleged to arise from loss, damage or destruction of the sample due to the act of examination, modification or testing, or technical analysis, or circumstances beyond our control.

3.4 The Client recognizes that generally accepted error variances apply and agrees to consider such error variances in its use of test data.

3.5 It is agreed between Jabil Circuit and Client that no distribution of any test reports, etc. shall be made to any third party without the prior written consent of both parties.

3.6 Test Reports may not be used by the Client to claim product endorsement by NVLAP or any agency of the U.S. Government.

ARTICLE 4 *- Payment.*

4.1 The Client agrees to pay for services and expenses as covered in the Purchase order or modified by Article 2.2. Jabil Circuit will present an invoice at the completion of work and will be paid within 30 days of receipt by Client unless the testing services are included with development services covered under a different agreement.