



CERTIFICATION TEST REPORT
FOR THE
WIRELESS CABLE MODEM TRANSCEIVER, 520001-2
FCC PART 21.101, 21.105, 21.106, & 21.904/21.107
COMPLIANCE

DATE OF ISSUE: APRIL 15, 1999

PREPARED FOR:

California Amplifier, Inc.
460 Calle San Pablo
Camarillo, CA 93012

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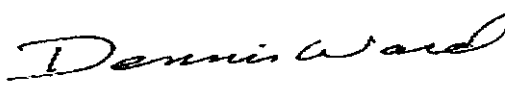
Date of test: February 3, 4, 1999 &
March 9, 1999

Report No: FC99-009

DOCUMENTATION CONTROL:


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DATE OF TEST: February 3 & 4, 1999 & March 9, 1999

PURPOSE OF TEST: To demonstrate the compliance of the Wireless Cable Modem Transceiver, 520001-2, with the requirements for FCC Part 21.101, 21.105, 21.106, & 21.904/21.107 devices.

MANUFACTURER: California Amplifier, Inc.
460 Calle San Pablo
Camarillo, CA 93012

REPRESENTATIVE: Kris Kelkar

TEST LOCATION: CKC Laboratories, Inc.
5473A Clouds Rest, Mariposa, CA 95338
110 North Olinda Place, Brea CA 92823

TEST PERSONNEL: Skip Doyle, Dustin Oaks, Eddie Wong & Monika Lopez

TEST METHOD: FCC Part 21.101, 21.105, 21.106, & 21.904/21.107

FREQUENCY RANGE TESTED: 14 MHz - 22 GHz

EQUIPMENT UNDER TEST: Wireless Cable Modem
Manuf: California Amplifier, Inc.
Model: 520001-2
Serial: 9060002945
FCC ID: (Pending)

The California Amplifier, Inc. Wireless Cable Modem Transceiver, 520001-2, was tested in accordance with FCC Part 21.101, 21.105, 21.106, & 21.904/21.107 devices. As received, the above equipment was found to be fully compliant with the limits of FCC Part 21.101, 21.105, 21.106, & 21.904/21.107 devices. The results in this report apply only to the items tested, as identified herein.

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Up/Down converter working in conjunction with a cable modem.

MEASUREMENT UNCERTAINTY

Associated with data in this report is a ± 4 dB measurement uncertainty.

EUT OPERATING FREQUENCY

The EUT was operating at 2150-2162 MHz.

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within $+15^{\circ}\text{C}$ and $+35^{\circ}\text{C}$.
The relative humidity was between 20% and 75%.

PERIPHERAL DEVICES

The EUT was tested with the following peripheral devices:

Mouse

Manuf: Compaq
Model: P/N:141189-401
Serial: N/A
FCC ID: DZL211029

Keyboard

Manuf: Compaq
Model: M/N
Serial: B23N0A39E874G
FCC ID: AQ6MTN4XZ15

PC

Manuf: Compaq
Model: Deskpro
Serial: 6647HVS3Q701
FCC ID: N/A

Monitor

Manuf: ViewSonic
Model: V641-1M
Serial: 2A71303961
FCC ID: GSS14002

Modem

Manuf: Hybrid Networks
Model: N231
Serial: 82AAP001759
FCC ID: N/A

2.1033(c)(4) – Type(s) of Emissions

The emission designator is M1D5M00.

2.1033(c)(5) – Frequency Range

Frequency Range tested from 2150-2162 MHz.

2.1033(c)(7) – Maximum Power Rating

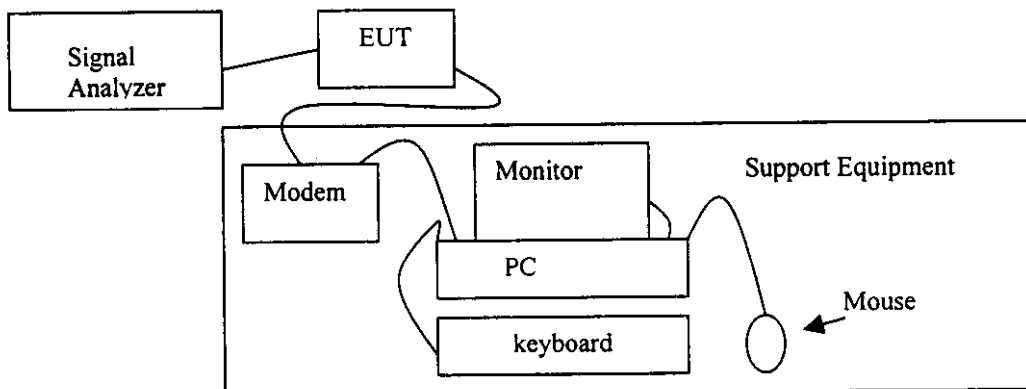
Maximum power rating as defined in the operating part(s) of the rules:

110 mW

2.1033(c)(14)/2.1046 - RF POWER OUTPUT

Test Conditions: The EUT was connected directly to the signal analyzer. The EUT is a Wireless Cable Modem operating at 2150-2162MHz. The EUT receives power from the modem via a RG58 cable. The power to the cable is provided through the power inserter. The EUT is continually sending packets via command from the PC. The EUT was operating on the Low Channel (2153MHz) and then again on the High Channel (2159MHz).

DIAGRAM OF TEST SETUP USED FOR TEST:



TEST EQUIPMENT USED:

1. Spectrum Analyzer, Hewlett Packard, Model No. 8566B, S/N 2209A01404. Calibration date: June 12, 1998. Calibration due date: June 12, 1999.

VIDEO BANDWIDTH AND RESOLUTION BANDWIDTH SETTINGS:

Frequency Range	Signal Analyzer VBW & RBW Setting
2152MHz - 2159MHz	1MHz

TEST DATA: (ERP or EIRP)

$$\begin{aligned} \text{Power Output} &= \text{InvLog}(\text{dBuV}-107/10) \\ &\quad \text{InvLog}(127.4\text{dBuV}-107/10) \\ &\quad \text{InvLog}(2.04) \\ \text{Power Output} &= \mathbf{109.6478196\text{mWatts}} \end{aligned}$$



Testing the Future

LABORATORIES, INC.

Spec Limit Per 21.107/21.904(b)

$$\begin{aligned} \text{EIRP Spec Limit} &= 33\text{dBW} + 10\text{Log}(360/\text{Beamwidth}) \\ &= 33\text{dBW} + 10\text{Log}(360/12.5) \\ &= 33\text{dBW} + 14.59 \end{aligned}$$

In accordance with 21.904(b) where $10\text{Log}(360/\text{beamwidth}) \leq 6$, since 14.59 is greater than 6 the following spec was used:

$$\begin{aligned} \text{EIRP Spec Limit} &= 33\text{dBW} + 6 \\ &= \mathbf{39\text{dBW or } 176\text{dBuV}} \end{aligned}$$

Measurement Data:

Sorted by Margin

Test Distance: None

#	Freq MHz	Rdng dB μ V	cable factor dB	dB	dB	DB	Dist dB	Corr dB μ V	Spec dB μ V	Margin dB	Polar
1	2152.730	123.5	+3.9				+0.0	127.4	176.0	-48.6	None
2	2158.840	123.2	+3.9				+0.0	127.1	176.0	-48.9	None

2.1033(c)(14)/2.1047(a)MODULATION CHARACTERISTICS – Audio Frequency Response

Not applicable to this unit.

2.1033(c)(14)/2.1047(b)MODULATION CHARACTERISTICS – Modulation Limiting Response

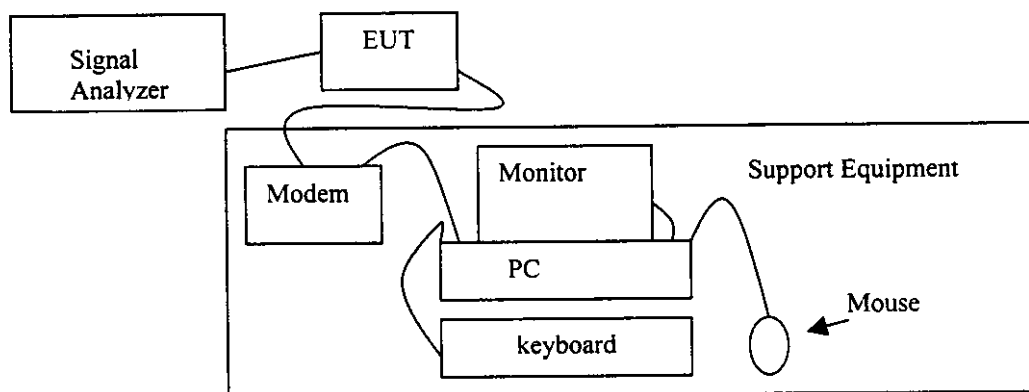
Not applicable to this unit.

2.1033(c)(14)/2.1049(i) - OCCUPIED BANDWIDTH

Test Conditions: The EUT was connected directly to the signal analyzer. Since the EUT only produced a modulated signal, plots showing the modulated signal were taken. The EUT is a Wireless Cable Modem operating at 2150-2162MHz. The EUT receives power from the modem via a RG58 cable. The power to the cable is provided through the power inserter. The EUT is continually sending packets via command from the PC. The EUT was operating on the Low Channel (2153MHz) and then again on the High Channel (2159MHz).

The emission designator is M1D5M00.

DIAGRAM OF TEST SETUP USED FOR TEST:

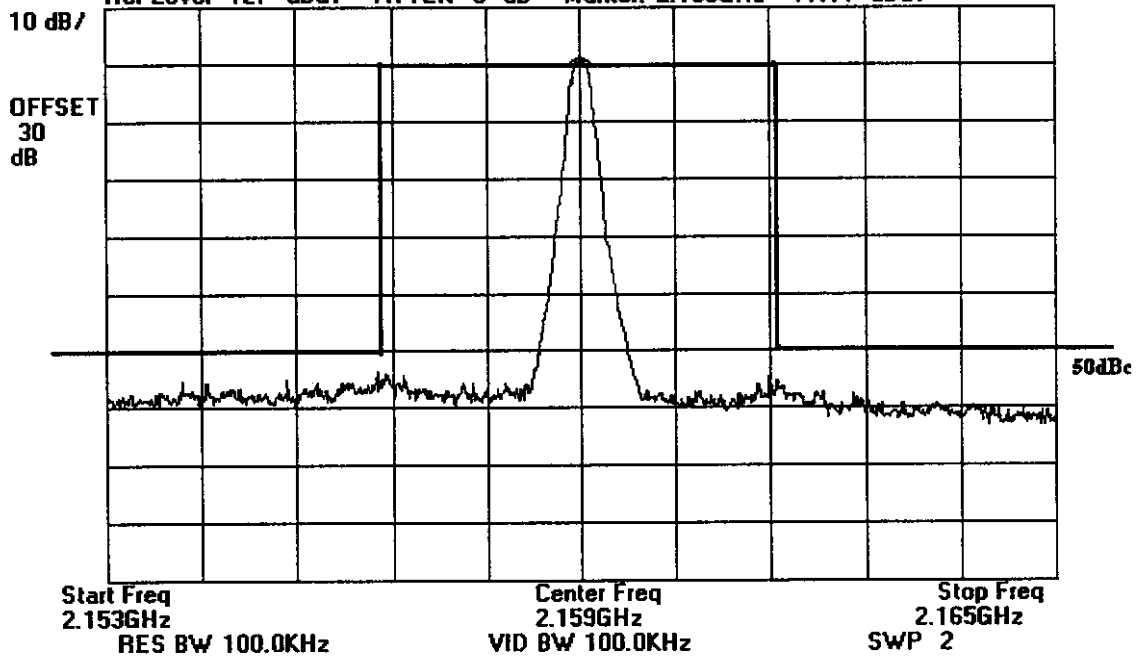


TEST EQUIPMENT USED:

1. Spectrum Analyzer, Hewlett Packard, Model No. 8566B, S/N 2209A01404.
Calibration date: June 12, 1998. Calibration due date: June 12, 1999.

FCC Part 2.1052(i)/21.106(a)(2) Emission Designator MID5M00

Title: California Amplifier 520001-2
 Ref Level 127 dBuV ATTN 0 dB Marker: 2.159GHz 117.4 dBuV



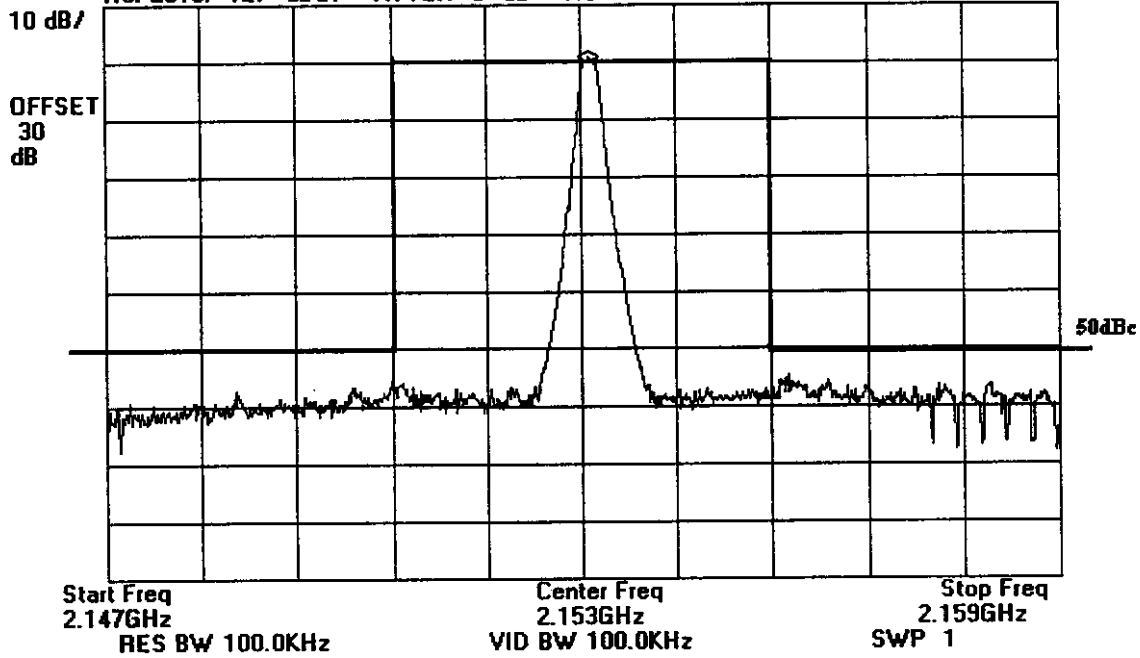
Test data: Low Channel 2.153GHz

FCC Part 2.1052(i)/21.106(a)(2)

Emission Designator M1D5M00

Title: California Amplifier 520001-2

Ref Level 127 dBuV ATTN 0 dB Marker: 2.153GHz 117.8 dBuV



2.1033(c)(14)/2.1051 - SPURIOUS EMISSIONS AT ANTENNA TERMINAL

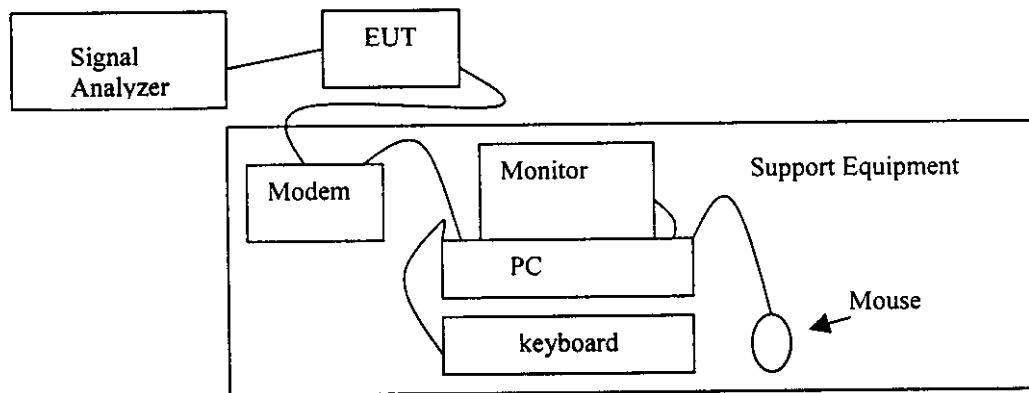
Test Conditions: The EUT was connected directly to the signal analyzer. The EUT is a Wireless Cable Modem operating at 2150-2162MHz. The EUT receives power from the modem via a RG58 cable. The power to the cable is provided through the power inserter. The EUT is continually sending packets via command from the PC. The EUT was operating on the Low Channel (2153MHz) and than again on the High Channel (2159MHz).

The emission designator is M1D5M00.

VIDEO BANDWIDTH AND RESOLUTION BANDWIDTH SETTINGS:

Frequency Range	Signal Analyzer VBW & RBW Setting
9kHz – 150kHz	3kHz
150kHz - 30MHz	100kHz
30MHz – 1MHz	1MHz
1GHz – 22GHz	1MHz

DIAGRAM OF TEST SETUP USED FOR TEST:



TEST EQUIPMENT USED:

1. Spectrum Analyzer, Hewlett Packard, Model No. 8566B, S/N 2209A01404. Calibration date: June 12, 1998. Calibration due date: June 12, 1999.
2. Spectrum Analyzer, Hewlett Packard, Model No. 8568A, S/N 2049A01287. Calibration date: October 14, 1998. Calibration due date: October 14, 1999.
3. Display, Hewlett Packard, Model No. 85680A, S/N 2106A02109. Calibration date: October 14, 1998. Calibration due date: October 14, 1999.

Specification: FCC Part 2.1051/FCC 21.106(a)(2)(i)(ii)
 Test Type: Antenna Terminal Emissions
 Equipment: Wireless Cable Modem

Test Conditions / Notes:

EUT is a Wireless Cable Modem operating at 2150-2162MHz. EUT receive power from modem via RG58 cable. Power to the cable is provided through the Power Inserter. EUT is continually sending packets via command from the PC. EUT is operating on Low Channel (2153MHz). FCC Part 21.106(a)(2)(i) A = 50dB, 21.106(a)(2)(ii) attenuation = 33dB, carrier power output = 127dBuV or 20dBm.

Measurement Data:			Sorted by Margin				Test Distance: None				
#	Freq MHz	Rdng dB μ V	cable dB	dB	dB	dB	Dist dB	Corr dB μ V	Spec dB μ V	Margin dB	Polar
1	2135.883	71.2	+3.9				+0.0	75.1	94.4	-19.3	None
2	6833.760	60.5	+8.6				+0.0	69.1	94.4	-25.3	None
3	6459.050	55.1	+7.7				+0.0	62.8	94.4	-31.6	None
4	1418.811	57.5	+3.1				+0.0	60.6	94.4	-33.8	None
5	15072.000	45.8	+13.5				+0.0	59.3	94.4	-35.1	None
6	17225.000	44.3	+14.5				+0.0	58.8	94.4	-35.6	None
7	6459.003	50.9	+7.7				+0.0	58.6	94.4	-35.8	None
8	10766.000	46.4	+11.0				+0.0	57.4	94.4	-37.0	None
9	1418.750	54.3	+3.1				+0.0	57.4	94.4	-37.0	None
10	12919.000	45.2	+12.1				+0.0	57.3	94.4	-37.1	None
11	2278.025	51.1	+4.0				+0.0	55.1	94.4	-39.3	None
12	8613.000	45.0	+9.3				+0.0	54.3	94.4	-40.1	None
13	117.068	50.5	+0.0				+0.0	50.5	94.4	-43.9	None
14	4555.860	43.2	+6.2				+0.0	49.4	94.4	-45.0	None
15	1891.831	45.1	+3.8				+0.0	48.9	94.4	-45.5	None
16	342.324	48.8	+0.0				+0.0	48.8	94.4	-45.6	None
17	1630.535	43.9	+3.4				+0.0	47.3	94.4	-47.1	None
18	4306.500	41.0	+5.8				+0.0	46.8	94.4	-47.6	None

Specification: FCC Part 2.1051/FCC 21.106(a)(2)(i)(ii)
 Test Type: Antenna Terminal Emissions
 Equipment: Wireless Cable Modem

Test Conditions / Notes:

EUT is a Wireless Cable Modem operating at 2150-2162MHz. EUT receive power from modem via RG58 cable. Power to the cable is provided through the Power Inserter. EUT is continually sending packets via command from the PC. EUT is operating on High Channel (2159MHz). FCC Part 21.106(a)(2)(i) A = 50dB; 21.106(a)(2)(ii) attenuation = 33dB, carrier output power = 127dBuV.

Measurement Data:

Sorted by Margin

Test Distance: None

#	Freq MHz	Rdng dB μ V	Barn				Dist dB	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar
			dB	dB	dB	dB					
1	2135.368	70.0	+3.9				+0.0	73.9	94.4	-20.5	None
2	6833.784	61.1	+8.6				+0.0	69.7	94.4	-24.7	None
3	348.130	65.4	+0.0				+0.0	65.4	94.4	-29.0	None
4	11389.940	51.7	+11.2				+0.0	62.9	94.4	-31.5	None
5	15113.600	46.8	+13.5				+0.0	60.3	94.4	-34.1	None
6	1393.220	56.7	+3.1				+0.0	59.8	94.4	-34.6	None
7	17272.600	44.7	+14.5				+0.0	59.2	94.4	-35.2	None
8	12954.600	44.9	+12.2				+0.0	57.1	94.4	-37.3	None
9	10795.600	45.8	+11.0				+0.0	56.8	94.4	-37.6	None
10	2277.980	52.6	+4.0				+0.0	56.6	94.4	-37.8	None
11	8636.600	46.0	+9.3				+0.0	55.3	94.4	-39.1	None
12	6473.600	46.8	+7.7				+0.0	54.5	94.4	-39.9	None
13	464.320	53.2	+0.0				+0.0	53.2	94.4	-41.2	None
14	2039.840	45.7	+3.9				+0.0	49.6	94.4	-44.8	None
15	522.460	48.5	+0.0				+0.0	48.5	94.4	-45.9	None
16	4314.600	39.5	+5.8				+0.0	45.3	94.4	-49.1	None

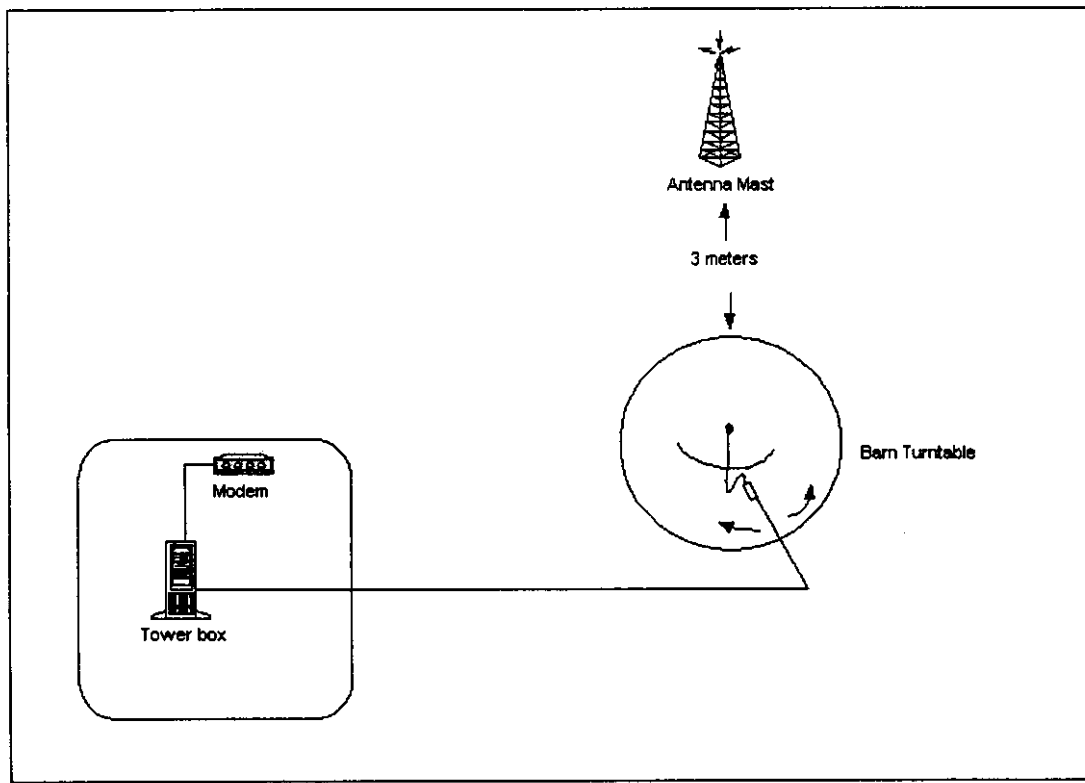
2.1033(c)(14)/2.1053 - FIELD STRENGTH OF SPURIOUS RADIATION

Test Conditions: All harmonics and subharmonics of the carrier frequency were investigated. Measurements were also made to detect any spurious emissions that were directly radiated from the EUT under normal conditions of installation and operation. All spurious emissions which were attenuated more than 20 dB below the permissible value were not reported. The information submitted includes the relative radiated power of each spurious and harmonic emissions with reference to the rated power output of the transmitter (assuming all emissions are radiated from half-wave dipole antennas).

VIDEO BANDWIDTH AND RESOLUTION BANDWIDTH SETTINGS:

Frequency Range	Signal Analyzer VBW & RBW Setting
9kHz – 150kHz	3kHz
150kHz - 30MHz	100kHz
30MHz – 1MHz	1MHz
1GHz – 22GHz	1MHz

DIAGRAM OF TEST SETUP USED FOR TEST:



TEST EQUIPMENT USED:

1. Spectrum Analyzer, Hewlett Packard, Model No. 8566B, S/N 2209A01404.
Calibration date: June 12, 1998. Calibration due date: June 12, 1999.
2. Preamp, Hewlett Packard, Model No. 8449B, S/N 3008A00301. Calibration date:
October 15, 1998. Calibration due date: October 15, 1999.
3. Biconical Antenna, A & H Systems, Model No. SAS-200/542, S/N 156. Calibration
date: June 9, 1998. Calibration due date: June 9, 1999.
4. Log Periodic Antenna, A & H Systems, Model No. SAS-200/512, S/N 154.
Calibration date: June 9, 1998. Calibration due date: June 9, 1999.
5. Horn Antenna, EMCO, Model No. 3115, S/N 4683. Calibration date: February 17,
1999. Calibration due date: February 17, 2000.

TEST CONDITIONS:

EUT is a Wireless Cable Modem operating at 2150-2162MHz. EUT receives power from modem via RG58 cable. Power to the cable is provided through the Power Inserter. EUT is continually sending packets via command from the PC. EUT is operating on Low Channel (2153MHz). Test was than redone in the same manner as stated above, except the EUT was operating at the High Channel (2159MHz).

FCC Part 2.1053/21.106(i) Measurements required: Field strength of spurious radiation

Low Channel – 2153MHz

Polarity	Freq(MHz)	Reading in dBuV/m	PreAmp Factor	Cable Factor	Horn Antenna	High Pass Filter
Horizontal	1418.822	54.10	0.00	6.4	25.2	0.0
Horizontal	2135.622	33.60	0.00	8.7	28.3	0.0
Vertical	2135.627	23.20	0.00	8.7	28.3	0.0
Vertical	10765.040	30.60	-33.20	25.2	36.8	0.0
Horizontal	10765.020	30.40	-33.20	25.2	36.8	0.0
Vertical	8612.009	28.80	-33.40	20.2	36.8	0.0

Corrected E (dBuV/M)	V/M	ERP (Watts) of spurious emissions	Spec Limit Watts	Pass or Fail
85.70	0.019275249	0.000067964	0.000109597	Pass
70.60	0.003388442	0.000002100	0.000109597	Pass
60.20	0.001023293	0.000000192	0.000109597	Pass
59.40	0.000933254	0.000000159	0.000109597	Pass
59.20	0.000912011	0.000000152	0.000109597	Pass
52.40	0.000416869	0.000000032	0.000109597	Pass

Notes: Frequency range investigated was from 14MHz to 22GHz. All spurious and harmonic emissions were investigated. All emissions detected that were less than 20dB below the permissible value were reported.

High Channel – 2159MHz

Polarity	Freq(MHz)	Reading in dBuV/m	PreAmp Factor	Cable Factor	Horn Antenna	High Pass Filter
Horizontal	2135.708	32.2	0.0	8.7	28.3	0.0
Vertical	2135.640	23.0	0.0	8.7	28.3	0.0
Horizontal	10795.000	29.9	-33.2	25.2	36.8	0.0
Vertical	10795.000	29.9	-33.2	25.2	36.8	0.0
Vertical	8636.000	29.4	-33.4	20.2	36.9	0.0

Corrected E (dBuV/M)	V/M	ERP (Watts) of Spurious Emission	Spec Limit Watts	Pass or Fail
69.2	0.002884032	0.000001522	0.000102300	Pass
60.0	0.001000000	0.000000183	0.000102300	Pass
58.7	0.000860994	0.000000136	0.000102300	Pass
58.7	0.000860994	0.000000136	0.000102300	Pass
53.1	0.000451856	0.000000037	0.000102300	Pass

Notes: Frequency range investigated was from 14MHz to 22GHz. All spurious and harmonic emissions were investigated. All emissions detected that were less than 20dB below the permissible value were reported.

CALCULATIONS

Note: The data taken is relative to the radiated power of each spurious emission with reference to the rated power output of the transmitter.

Channel 1 2153MHz - Output power measured at 3 meters = 117.4dBuV/m or 10.96mW.

$$10 \log (10.96\text{mW}/1\text{mW}) = 10.398\text{dBm}$$

$$10 \log (10.96\text{mW}/1\text{mW}) = 10.398\text{dBm}$$

$$\text{Inv Log } (-39.6 \text{ dBm}/10) = 0.000109597$$

Spec Limit = 0.000109597 Watts for Low Channel (2153MHz)

Channel 2 - 2159MHz - Output power measured at 3 meters = 117.1dBuV/m or 10.23mW

$$10 \log (10.23\text{mW}/1\text{mW}) = 10.09 \text{ dBm}$$

$$\text{Inv Log } (-39.990\text{dBm}/10) = 0.0001023\text{W}$$

Spec Limit = 0.0001023 Watts for High Channel (2159MHz)

Formulas Used:

$$\text{ERP} = (\text{Ed})^2/30(\text{G})$$

$$\text{E} = \text{V/m}$$

d= distance

G = Gain of Antenna (numerical gain of half wave dipole antenna 1.64 per Part 2.1053(a))

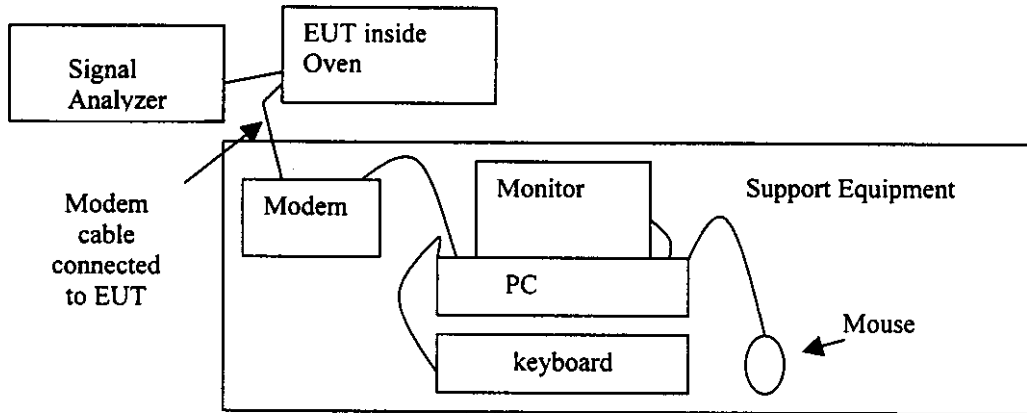
Conversion of dBuV/m to V/m

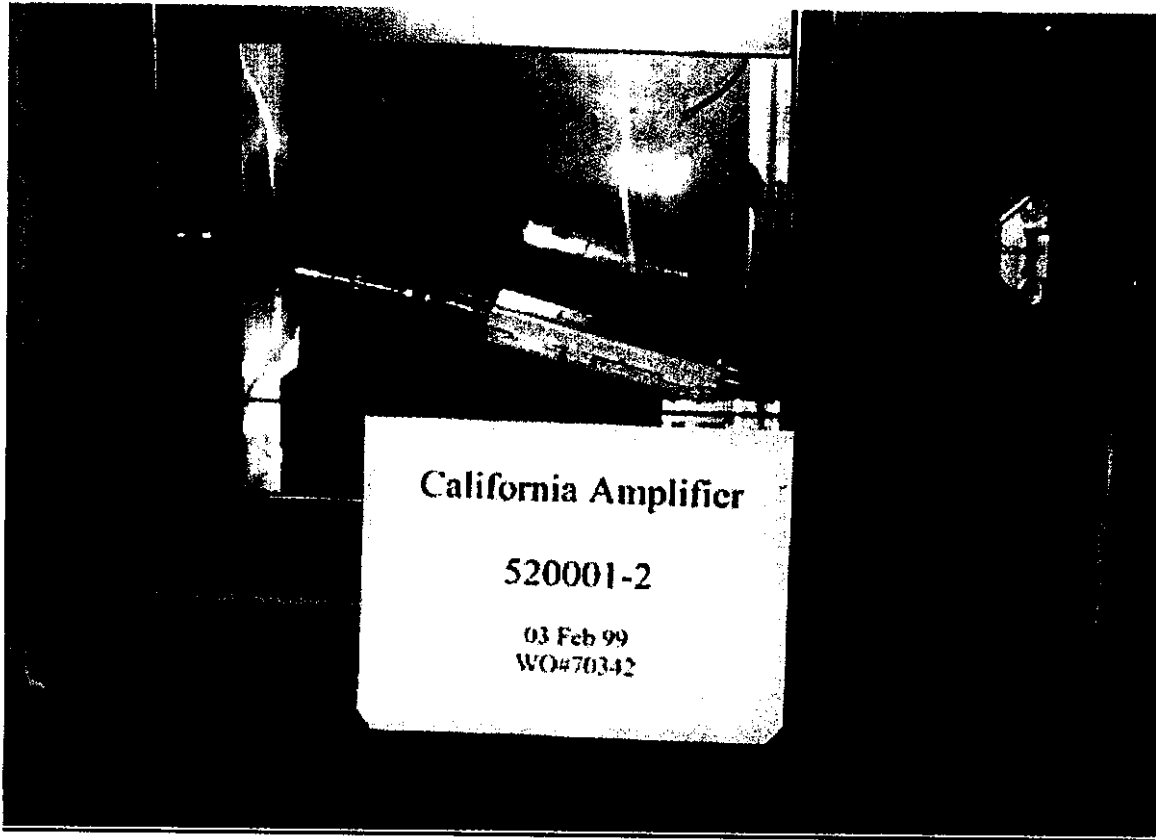
$$[\text{invlog}(\text{Reading in dBuV/m}/20)] \cdot 0.00001 = \text{V/m}$$

2.1033(c)(14)/2.1055/21.101 - FREQUENCY STABILITY

TEST CONDITIONS: The EUT was connected directly to the signal analyzer. The EUT is a Wireless Cable Modem operating at 2150-2162MHz. The EUT receives power from the modem via a RG58 cable. The power to the cable is provided through the power inserter. The EUT is continually sending packets via command from the PC.

DIAGRAM OF TEST SETUP USED FOR TEST:





TEST EQUIPMENT USED:

1. Spectrum Analyzer, Hewlett Packard, Model No. 8566B, S/N 2209A01404.
Calibration date: June 12, 1998. Calibration due date: June 12, 1999.
2. Temperature Chamber Thermotron Corp S-1.2 Mini Max 11899, Calibration date:
February 19, 1998. Calibration Due: February 19, 1999

VIDEO BANDWIDTH AND RESOLUTION BANDWIDTH SETTINGS:

Frequency Range	Signal Analyzer VBW & RBW Setting
2152MHz – 2159MHz	1MHz

LO 2278.000MHz, Counter is reading 6.834GHz which 3rd harmonic of LO, The Counter is reading this due to a higher amplitude than the LO. This will still work for measuring the LO stability of the device. Unable to check Low and High channels, EUT unable to produce unmodulated signal at those frequencies and the counter will not read the modulated signal

Temperature: -20°C		LIMIT (Hz) /Frequency Error
+V = 6.8340237GHz	2,278,007,900	7,900
V = 6.8340238GHz	2,278,007,933	7,933
-V = 6.8340238GHz	2,278,007,933	7,933
Temperature: -10°C		
f +V = 6.8340239GHz	2,278,007,967	7,967
V = 6.8340239GHz	2,278,007,967	7,967
-V = 6.8340239GHz	2,278,007,967	7,967
Temperature: -0°C		
f +V = 6.8340184GHz	2,278,006,133	6,133
V = 6.8340186GHz	2,278,006,200	6,200
-V = 6.8340184GHz	2,278,006,133	6,133
Temperature: +10°C		
f +V = 6.8340119GHz	2,278,003,967	3,967
V = 6.8340119GHz	2,278,003,967	3,967
-V = 6.8340118GHz	2,278,003,933	3,933
Temperature: +20°C		
f +V = 6.8340042GHz	2,278,001,400	1,400
V = 6.8340042GHz	2,278,001,400	1,400
-V = 6.8340042GHz	2,278,001,400	1,400
Temperature: +30°C		
f -V = 6.8339985GHz	2,277,999,500	500
V = 6.8339985GHz	2,277,999,500	500
-V = 6.8339985GHz	2,277,999,500	500
Temperature: +40°C		
f +V = 6.8339962GHz	2,277,998,733	1,267
V = 6.8339962GHz	2,277,998,733	1,267
-V = 6.8339962GHz	2,277,998,733	1,267
Temperature: +50°C		
f +V = 6.8339998GHz	2,277,999,933	67
V = 6.8339998GHz	2,277,999,933	67
-V = 6.8339998GHz	2,277,999,933	67