



**CFR TITLE 47 PART 15.205
CLASS II PERMISSIVE CHANGE TO APPLICATION
FCC ID# FUV-ISA-003-1**

EMI TEST REPORT

ON

**AMP INC.
WIRELESS ISA ADAPTER
XERTEX TECHNOLOGIES 9 DBI PATCH ANTENNA
AMP 13.5 DBI YAGI ANTENNA
CUSHCRAFT 3 DBD OMNIDIRECTIONAL ANTENNA
MOBILE MARK 9 DBI OMNIDIRECTIONAL ANTENNA**

PREPARED FOR

**AMP INC.
P.O BOX 3608
MS 258-27
HARRISBURG, PA 17105
TEL: (717) 986-3790
FAX: (717) 986-3965**

PREPARED BY

**ELECTRONIC COMPLIANCE LABORATORIES INC.
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TEST REPORT NUMBER: P711039

**DATE OF TEST: NOVEMBER 29 1997
IF THIS DOCUMENT IS REPRODUCED IT MUST BE
REPRODUCED IN ITS ENTIRETY**





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April 30, 1998

Federal Communications Commission
Equipment Authorization Division
7435 Oakland Mills Road
Columbia, MD 21046

Subject: Maximum Permissible Exposure calculations for **FCC ID: FUV-ISA-003-1**

The AMP Wireless ISA card can use four different antennas:

- Centurion 1.0 dBi Omnidirectional Antenna - Certified on original application
- Cushcraft 3.0 dBi Omnidirectional Antenna
- Xertex 9.0 dBi Patch Antenna
- Mobile Mark 9.0 dBi Omnidirectional Antenna
- Amp 13.5 dBi Yagi Antenna

No duty cycle is used in the following calculations.

For an Isotropic radiator the surface area of a sphere can be used to determine the area over which the transmitter energy is radiated.

$$\text{Surface area of a sphere} = 4 \cdot \pi \cdot \text{radius}^2$$

In the case where there is antenna gain, the worst case energy density is increased by the antenna gain. In this case, the exposure level can be calculated as follows:

$$\text{MPE distance} = \left(\frac{\text{output power} \cdot \text{duty cycle} \cdot 10^{(\text{antenna gain}/10)}}{4 \cdot \pi \cdot \text{Exposure Limit (mW/cm}^2)} \right)^{1/2}$$

Centurion 1.0 dBi	- MPE = (100 * 1.25/4*314*.6) ^{1/2}	= 4.1 cm = 1.6 in.
Cushcraft 3.0 dBi	- MPE = (100 * 1.99/4*314*.6) ^{1/2}	= 5.2 cm = 2.0 in.
Xertex 9.0 dBi	- MPE = (100 * 7.94/4*314*.6) ^{1/2}	= 10.3 cm = 4.0 in.
Mobile Mark 9.0 dBi	- MPE = (100 * 7.94/4*314*.6) ^{1/2}	= 10.3 cm = 4.0 in.
Amp 13.5 dBi	- MPE = (100 * 22.38/4*314*.6) ^{1/2}	= 17.2 cm = 6.8 in.

If you have any questions please do not hesitate to call me.

Sincerely,

Chris Byleckie
Technical Director



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Amp Incorporated
Wireless ISA Adapter
FCC ID: FUV-ISA-003-1

Antennas used with the wireless ISA card

Centurion	P/N CAF28777	1.0 dBi Omnidirectional Antenna
Cushcraft	P/N S2403BP	3.0 dBi Omnidirectional Antenna *
Cushcraft	P/N S2403BH	3.0 dBi Omnidirectional Antenna *
Mobile Mark	P/N OD9-2400	9.0 dBi Omnidirectional
Xertex	P/N 364015-2	9.0 dBi Patch Antenna
AMP	P/N 364016	13.5 dBi Yagi Antenna

* These antennas are identical except for the attachment method.

S2403BP is pole mounted

S2403BH is hinge mounted

Cushcraft 1.0 dBi Omnidirectional Antenna EIRP

EIRP = +20.0 dBm (peak power) +1.0 (antenna gain) = 21.0 dBm / 125 mW

Limit +36 dBm / 4 Watts

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1.0 Verification of Compliance

Purpose of Test: To validate compliance of four additional antennas for the
Wireless ISA Adapter:

Xertex Technologies 9 dBi Patch Antenna
AMP 13.5 dBi YAGI Antenna
Cushcraft 3 dBd Omnidirectional Antenna
Mobile Mark 9 dBi Omnidirectional Antenna

Description: Wireless ISA adapter Card

Part Number: 364003-1

Serial Number: N/A0020A60029BB

Applicant: Amp Inc.

Type of Test: CFR 47 Part 15, Section 15.205 and 15.247: Class II Permissive Change
Addendum to Application for FCC ID# FUV-ISA-003-1

Date of Test: November 29, 1997

Tested By: Chip Matheny

The above equipment was tested by Electronic Compliance Laboratories, Inc. and found to be in compliance with the requirements set forth in the FCC Rules and Regulations, Part 15, Subpart C and 15.247 and 15.205. The equipment, Test in the configuration described in this report, shows that the maximum emission levels emanating from this equipment are within the compliance requirements.

Chris Byleckie
Technical Director

Date: _____

2.0 General Information

Applicant: Amp Inc.
P.O Box 3608
MS 258-27
Harrisburg, PA 17105

Contact Person: Rex Kesser

Equipment Under Test: Wireless ISA Adapter

Part Number: **364003-1**

FCC ID No: **FUV-ISA-003-1**

Report Number: P711039

Date of Test: November 29, 1997

Manufacturer: Amp Inc.

Type of Test: FCC part 15, Subpart C, 15.205: Class II Permissive Change
Addendum to Application for FCC ID# FUV-ISA-003-1

Frequency Range: 2400 MHz to 2483.5 MHz

Operating Frequencies: 2402 MHz to 2480 MHz

Summary

Pass/Fail: Passed

15.205 Operation within the 2400 - 2483.5 MHz band:

The EUT met all the requirements for 15.205. See attached data and plots.
The EUT was placed on a 3 meter OATS.

3.0 Test Facility

Name: Electronic Compliance Laboratories

Location: 1249 Birchwood Drive
Sunnyvale, CA 94089

Site Filing: A site description is on file at the Federal Communications Commission
P.O. Box 429
Columbia, MD 21045

Types of Sites: Open Field Radiated and Indoor (Screen Room).
Line Conducted: All sites are constructed and calibrated to meet ANSI C63.4-1994 requirements.
Test facility is recognized by the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations.

NVLAP Code 20089 effective through: March 31, 1998

4.0 Test Equipment

The following list contains equipment used at EC Laboratories, Inc. for compliance testing. The equipment conforms to the American National Standard Specifications for Electromagnetic Interference and Field Strength Instrumentation from 10 kHz to 1000 MHz.

Description	Manufacturer	S/N	Model No.	Cal. Due Date
Pre-amp	HP	3008A00527	8449B	4/5/98
Spectrum Analyzer	HP	3137A01183	8563A	5/22/98
Plotter	HP	2644V00365	7470A	N/A
Horn Antenna	EM	6231	RGA-60	6/6/98

HP = Hewlett Packard
EM = Electro Metrics

The antenna used at the time the data was taken is indicated on each data page. The antenna height and polarization are also noted on the data pages.

The calibration of the measuring instruments, including any accessories that may effect such calibration, are checked frequently to assure their accuracy. Adjustments are made and correction factors applied in accordance with instructions contained in the manual for the measuring instrument.

5.0 Data Reporting Format

The measurement results are expressed in accordance with FCC Part-15, Subpart C: Class B limits, where applicable, are presented in tabular or graphical form.

6.0 Detector Functions

On any frequency or frequencies below or equal to 1000 MHz, the limits shown below are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths.

On any frequency or frequencies above 1000 MHz, the radiated limits shown below are based on the use of measuring equipment employing an average detector function.

EC Laboratories uses the Peak detection mode for normal testing and initial screening of the EUT. The Peak detection mode will produce a measurement value that is always greater than, or equal to, the quasi-peak or average detection mode. Whenever the measurement value is 6 dB below the applicable limit or greater, the appropriate detector function will be employed and recorded.

7.0 Frequency Range of Investigation

The spectrum was investigated up to the frequency specified in the following table according to the highest clock frequency generated in the device.

<u>Highest Frequency Used (Clock)</u>	<u>Upper Limit of Range Measured</u>
Below 1.705 MHz	30 MHz
1.705 to 108 MHz	1000 MHz
108 to 500 MHz	2000 MHz
500 to 1000 MHz	5000 MHz
Above 1000 MHz	5th Harmonic or 40 GHz (Whichever is Lower)

8.0 Summary of Measurements

Summary of Measurements for a Spread-Spectrum System, 2400 - 2483.5 MHz

CFR Title 47, Part 15.205

Manufacturer Amp Inc.
 P O Box 3608
 MS 258-27
 Harrisburg, PA 17105

Contact Rex Kesser

FCC ID FUV-ISA-003-1

Test Report Number: P711039

15.205 Restricted Bands - Emissions Within Restricted Bands

The EUT was placed on a wooden table resting on a turntable. The wooden table was approximately 1 meter above the ground plane of the 3 meter test site

The search antenna was located 1 meters from the EUT. With the EUT transmitting continuously, and with the spectrum analyzer in MAX HOLD mode, the turntable was rotated and the search antenna was raised and lowered in an attempt to maximize the received radiated emission level. Search antenna polarity was changed from vertical to horizontal and the test was repeated. Peak measurements were made using an RBW = VBW = 1MHz. Average Measurements were made with an RBW = 1MHz and a VBW = 10 Hz.

15.247(b) MAXIMUM PEAK OUTPUT POWER

Power = +20.0 dBm (peak reading)
Limit: +30 dBm / 1 W maximum power

Xertex 9 dBi Patch antenna.

EIRP = +20.0 (peak power) +9.0 (peak gain, dBi) = +29.0 dBm / 794 mW EIRP

Limit: +36 dBm / 4 W maximum EIRP

Cushcraft 3dBd Omnidirectional antenna.

EIRP = +20.0 (peak power) +3.0 (peak gain, dBi) = +23.0 dBm / 200 mW EIRP

Limit: +36 dBm / 4 W maximum EIRP

Amp 13.5 YAGI antenna

EIRP = +20.0 (peak power) +13.5 (peak gain, dBi) = +33.5dBm / 2.24 W EIRP

Limit: +36 dBm / 4 W maximum EIRP

Mobile Mark 9 dBi Omnidirectional Antenna

EIRP = +20.0 (peak power) +9.0 (peak gain, dBi) = +29.0 dBm / 794 mW EIRP

Limit: +36 dBm / 4 W maximum EIRP

APPENDIX A
Restricted Band Harmonics Plots/Data

FCC RADIATED DATA SHEET

EUT: ISA Card Adapter
 S/N:
 RULE PART: 15 205

DATE: Nov. 29,1997
 CUSTOMER NAME: AMP, Inc.
 WORK ORDER: 7112801
 FILE: 7112801a.xls

ANTENNA: Horn
 MODULATION TYPE: N/A
 TESTED BY: CHIP
 COMMENTS: Cushcraft S2403B
 5 dBi OMNI

OTHER CAL FACTORS: ATTN dB: 0
 DUTY dB: 0
 HP IL dB: 0
 DIST dB: 0

FREQ.	READING	Pk, QP,	A.F.	Cable loss	AMP	O.C.F.	TOTAL,	LIMIT	DELTA
MHz	dB(uV)	or Av	dB	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
Fund = 2402									
4804	47.5	Pk	32.8	7.0	35.0	0.0	52.3	74.0	-21.7
4804	36.8	Avg	32.8	7.0	35.0	0.0	41.6	54.0	-12.4
7206	50.5	Pk	36.0	10.6	35.0	0.0	62.1	74.0	-11.9
7206	38.3	Avg	36.0	10.6	35.0	0.0	49.9	54.0	-4.1
9608	50.5	Pk	38.3	13.0	35.0	0.0	66.8	74.0	-7.2
9608	32.7	Avg	38.3	13.0	35.0	0.0	49.0	54.0	-5.0
12010	47.7	Pk	39.3	13.6	35.0	0.0	65.5	74.0	-8.5
12010	26.5	Avg	39.3	13.6	35.0	0.0	44.4	54.0	-9.7
14412	49.7	Pk	40.8	14.5	35.0	0.0	70.0	74.0	-4.0
14412	22.0	Avg	41.8	14.5	35.0	0.0	43.3	54.0	-10.7
Fund = 2440									
4880	43.5	Pk	32.8	7.0	35.0	0.0	48.3	74.0	-25.7
4880	31.7	Avg	32.8	7.0	35.0	0.0	36.5	54.0	-17.5
7320	48.0	Pk	36.0	10.6	35.0	0.0	59.6	74.0	-14.4
7320	36.7	Avg	36.0	10.6	35.0	0.0	48.3	54.0	-5.7
9760	48.8	Pk	38.3	13.0	35.0	0.0	65.1	74.0	-8.9
9760	31.2	Avg	38.3	13.0	35.0	0.0	47.5	54.0	-6.5
12200	48.2	Pk	39.3	13.6	35.0	0.0	66.1	74.0	-8.0
12200	26.2	Avg	39.3	13.6	35.0	0.0	44.1	54.0	-10.0
14640	48.0	Pk	40.7	15.5	35.0	0.0	69.2	74.0	-4.8
14640	23.0	Avg	40.7	15.5	35.0	0.0	44.2	54.0	-9.8
Fund = 2480									
4960	46.0	Pk	32.8	7.0	35.0	0.0	50.8	74.0	-23.2
4960	40.5	Avg	32.8	7.0	35.0	0.0	45.3	54.0	-8.7
7440	50.5	Pk	36.0	10.6	35.0	0.0	62.1	74.0	-11.9
7440	37.0	Avg	36.0	10.6	35.0	0.0	48.6	54.0	-5.4
9920	49.5	Pk	38.3	13.0	35.0	0.0	65.8	74.0	-8.2
9920	29.8	Avg	38.3	13.0	35.0	0.0	46.1	54.0	-7.9
12400	42.0	Pk	39.3	13.6	35.0	0.0	59.9	74.0	-14.2
12400	30.7	Avg	39.3	13.6	35.0	0.0	48.6	54.0	-5.5
14880	44.7	Pk	40.7	15.5	35.0	0.0	65.9	74.0	-8.1
14880	22.9	Avg	40.7	15.5	35.0	0.0	44.1	54.0	-9.9

FCC RADIATED DATA SHEET

EUT:	ISA Card Adapter	DATE:	Nov. 29,1997
S/N:		CUSTOMER NAME:	AMP, inc.
RULE PAR	15 205	WORK ORDER:	7112801
		FILE:	7112801b.xls
ANTENNA:	Horn	OTHER CAL FACTORS: ATTN dB:	0
MODULATION TYPE:	N/A	DUTY dB:	0
TESTED B	CHIP	HP IL dB:	0
COMMENTS:	13 dBi YAGI Antenna	DIST dB:	0

FREQ.	READING	Pk, QP, or Av	A.F.	Cable loss	AMP	O.C.F.	TOTAL,	LIMIT	DELTA
MHz	dB(uV)		dB	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
Fund = 2402									
4804	47.0	Pk	32.8	7.0	35.0	0.0	51.8	74.0	-22.2
4804	39.0	Avg	32.8	7.0	35.0	0.0	43.8	54.0	-10.2
7206	53.6	Pk	36.0	10.6	35.0	0.0	65.2	74.0	-8.8
7206	38.2	Avg	36.0	10.6	35.0	0.0	49.8	54.0	-4.2
9608	51.6	Pk	38.3	13.0	35.0	0.0	67.9	74.0	-6.1
9608	34.6	Avg	38.3	13.0	35.0	0.0	50.9	54.0	-3.1
12010	48.3	Pk	39.3	13.6	35.0	0.0	66.2	74.0	-7.9
12010	26.3	Avg	39.3	13.6	35.0	0.0	44.2	54.0	-9.9
14412	44.7	Pk	40.8	14.5	35.0	0.0	65.0	74.0	-9.0
14412	23.4	Avg	41.8	14.5	35.0	0.0	44.7	54.0	-9.3
Fund = 2440									
4880	48.8	Pk	32.8	7.0	35.0	0.0	53.6	74.0	-20.4
4880	39.6	Avg	32.8	7.0	35.0	0.0	44.4	54.0	-9.6
7320	53.8	Pk	36.0	10.6	35.0	0.0	65.4	74.0	-8.6
7320	35.1	Avg	36.0	10.6	35.0	0.0	46.7	54.0	-7.3
9760	48.3	Pk	38.3	13.0	35.0	0.0	64.6	74.0	-9.4
9760	36.0	Avg	38.3	13.0	35.0	0.0	52.3	54.0	-1.7
12200	46.7	Pk	39.3	13.6	35.0	0.0	64.6	74.0	-9.5
12200	26.3	Avg	39.3	13.6	35.0	0.0	44.2	54.0	-9.9
14640	42.3	Pk	40.7	15.5	35.0	0.0	63.5	74.0	-10.5
14640	22.9	Avg	40.7	15.5	35.0	0.0	44.1	54.0	-9.9
Fund = 2480									
4960	44.8	Pk	32.8	7.0	35.0	0.0	49.6	74.0	-24.4
4960	37.0	Avg	32.8	7.0	35.0	0.0	41.8	54.0	-12.2
7440	47.7	Pk	36.0	10.6	35.0	0.0	59.3	74.0	-14.7
7440	37.8	Avg	36.0	10.6	35.0	0.0	49.4	54.0	-4.6
9920	48.2	Pk	38.3	13.0	35.0	0.0	64.5	74.0	-9.5
9920	29.7	Avg	38.3	13.0	35.0	0.0	46.0	54.0	-8.0
12400	46.3	Pk	39.3	13.6	35.0	0.0	64.2	74.0	-9.9
12400	26.0	Avg	39.3	13.6	35.0	0.0	43.9	54.0	-10.2
14880	42.3	Pk	40.7	15.5	35.0	0.0	63.5	74.0	-10.5
14880	22.9	Avg	40.7	15.5	35.0	0.0	44.1	54.0	-9.9

FCC RADIATED DATA SHEET

EUT:	ISA Card Adapter	DATE:	Nov. 29,1997
S/N:		CUSTOMER NAME:	AMP, Inc.
RULE PAR	15 205	WORK ORDER:	7112801
		FILE:	7112801c.xls
ANTENNA:	Horn	OTHER CAL FACTORS: ATTN dB:	0
MODULATION TYPE:	N/A	DUTY dB:	0
TESTED BY:	CHIP	HP IL dB:	0
COMMENT	Mobile Mark OD9-2400 9 dBi Omni	DIST dB:	0

FREQ.	READING	Pk, QP, or Av	A.F.	Cable loss	AMP	O.C.F.	TOTAL,	LIMIT	DELTA
MHz	dB(uV)		dB	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
Fund = 2402									
4804	45.6	Pk	32.8	7.0	35.0	0.0	50.4	74.0	-23.6
4804	35.5	Avg	32.8	7.0	35.0	0.0	40.3	54.0	-13.7
7206	52.0	Pk	36.0	10.6	35.0	0.0	63.6	74.0	-10.4
7206	40.2	Avg	36.0	10.6	35.0	0.0	51.8	54.0	-2.2
9608	49.0	Pk	38.3	13.0	35.0	0.0	65.3	74.0	-8.7
9608	34.6	Avg	38.3	13.0	35.0	0.0	50.9	54.0	-3.1
12010	49.3	Pk	39.3	13.6	35.0	0.0	67.2	74.0	-6.9
12010	26.5	Avg	39.3	13.6	35.0	0.0	44.4	54.0	-9.7
14412	44.3	Pk	40.8	14.5	35.0	0.0	64.6	74.0	-9.4
14412	23.3	Avg	41.8	14.5	35.0	0.0	44.6	54.0	-9.4
Fund = 2440									
4880	42.8	Pk	32.8	7.0	35.0	0.0	47.6	74.0	-26.4
4880	32.7	Avg	32.8	7.0	35.0	0.0	37.5	54.0	-16.5
7320	50.5	Pk	36.0	10.6	35.0	0.0	62.1	74.0	-11.9
7320	40.9	Avg	36.0	10.6	35.0	0.0	52.5	54.0	-1.5
9760	47.8	Pk	38.3	13.0	35.0	0.0	64.1	74.0	-9.9
9760	35.7	Avg	38.3	13.0	35.0	0.0	52.0	54.0	-2.0
12200	46.7	Pk	39.3	13.6	35.0	0.0	64.6	74.0	-9.5
12200	26.2	Avg	39.3	13.6	35.0	0.0	44.1	54.0	-10.0
14640	47.8	Pk	40.7	15.5	35.0	0.0	69.0	74.0	-5.0
14640	22.9	Avg	40.7	15.5	35.0	0.0	44.1	54.0	-9.9
Fund = 2480									
4960	45.3	Pk	32.8	7.0	35.0	0.0	50.1	74.0	-23.9
4960	36.2	Avg	32.8	7.0	35.0	0.0	41.0	54.0	-13.0
7440	51.2	Pk	36.0	10.6	35.0	0.0	62.8	74.0	-11.2
7440	39.8	Avg	36.0	10.6	35.0	0.0	51.4	54.0	-2.6
9920	47.3	Pk	38.3	13.0	35.0	0.0	63.6	74.0	-10.4
9920	27.7	Avg	38.3	13.0	35.0	0.0	44.0	54.0	-10.0
12400	46.0	Pk	39.3	13.6	35.0	0.0	63.9	74.0	-10.2
12400	26.0	Avg	39.3	13.6	35.0	0.0	43.9	54.0	-10.2
14880	49.3	Pk	40.7	15.5	35.0	0.0	70.5	74.0	-3.5
14880	23.4	Avg	40.7	15.5	35.0	0.0	44.6	54.0	-9.4

FCC RADIATED DATA SHEET

EUT: ISA Card Adapter
 S/N:
 RULE PART: 15 205
 ANTENNA: horn
 MODULATION TYPE: N/A
 TESTED BY: CHP
 COMMENTS: Kerex 245LD9W
 9 dBi Patch

DATE: Nov 29, 1997
 CUSTOMER NAME: AMP Inc
 WORK ORDER: 7112801
 FILE: 7112801d.xls

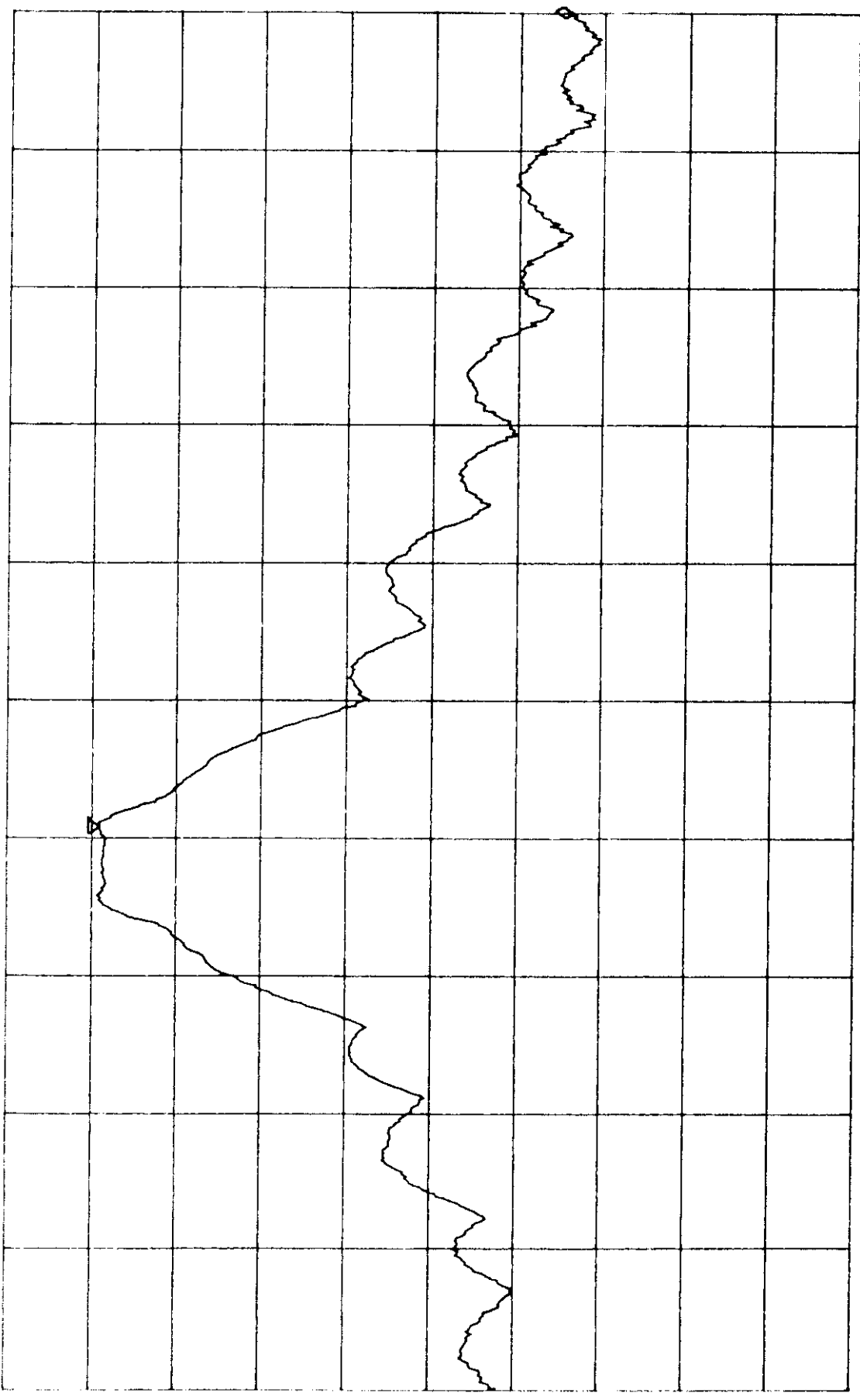
OTHER CAL FACTORS: ATTN dB: 0
 DUTY dB: 0
 HP IL dB: 0
 DIST dB: 0

FREQ.	READING	Pk, QP,	A.F.	Cable loss	AMP	O.C.F.	TOTAL,	LIMIT	DELTA
MHz	dB(uV)	or Av	dB	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
Fund = 2402									
4804	39.2	Pk	32.8	7.0	35.0	0.0	44.0	74.0	-30.0
4804	34.8	Avg	32.8	7.0	35.0	0.0	39.6	54.0	-14.4
7206	47.7	Pk	36.0	10.6	35.0	0.0	59.3	74.0	-14.7
7206	37.3	Avg	36.0	10.6	35.0	0.0	48.9	54.0	-5.1
9608	50.1	Pk	38.3	13.0	35.0	0.0	66.4	74.0	-7.6
9608	35.2	Avg	38.3	13.0	35.0	0.0	51.5	54.0	-2.5
12010	42.0	Pk	39.3	13.6	35.0	0.0	59.9	74.0	-14.2
12010	30.8	Avg	39.3	13.6	35.0	0.0	48.7	54.0	-5.4
14412	46.7	Pk	40.8	14.5	35.0	0.0	67.0	74.0	-7.0
14412	22.9	Avg	41.8	14.5	35.0	0.0	44.2	54.0	-9.8
Fund = 2440									
4880	42.5	Pk	32.8	7.0	35.0	0.0	47.3	74.0	-26.7
4880	31.8	Avg	32.8	7.0	35.0	0.0	36.6	54.0	-17.4
7320	52.3	Pk	36.0	10.6	35.0	0.0	63.9	74.0	-10.1
7320	38.8	Avg	36.0	10.6	35.0	0.0	50.4	54.0	-3.6
9760	47.8	Pk	38.3	13.0	35.0	0.0	64.1	74.0	-9.9
9760	35.6	Avg	38.3	13.0	35.0	0.0	51.9	54.0	-2.1
12200	46.3	Pk	39.3	13.6	35.0	0.0	64.2	74.0	-9.9
12200	26.0	Avg	39.3	13.6	35.0	0.0	43.9	54.0	-10.2
14640	48.5	Pk	40.7	15.5	35.0	0.0	69.7	74.0	-4.3
14640	23.0	Avg	40.7	15.5	35.0	0.0	44.2	54.0	-9.8
Fund = 2480									
4960	46.5	Pk	32.8	7.0	35.0	0.0	51.3	74.0	-22.7
4960	38.2	Avg	32.8	7.0	35.0	0.0	43.0	54.0	-11.0
7440	54.5	Pk	36.0	10.6	35.0	0.0	66.1	74.0	-7.9
7440	35.5	Avg	36.0	10.6	35.0	0.0	47.1	54.0	-6.9
9920	42.3	Pk	38.3	13.0	35.0	0.0	58.6	74.0	-15.4
9920	28.2	Avg	38.3	13.0	35.0	0.0	44.5	54.0	-9.5
12400	46.3	Pk	39.3	13.6	35.0	0.0	64.2	74.0	-9.9
12400	27.7	Avg	39.3	13.6	35.0	0.0	45.6	54.0	-8.5
14880	48.0	Pk	40.7	15.5	35.0	0.0	69.2	74.0	-4.8
14880	22.8	Avg	40.7	15.5	35.0	0.0	44.0	54.0	-10.0

ATTEN 40dB
RL 30.0dBm

ΔMKR -55.17dB
3.340MHz

10dB/



0

START 2.477855GHz STOP 2.483500GHz
*RBW 100kHz VBW 100kHz SWP 50ms

FCC RADIATED DATA SHEET										
EUT:	AMP	DATE:	4/16/98	CUSTOMER NAME:	AMP	WORK ORDER:	AMP	FILE:	AMP6.xls	
S/N:		OTHER CAL FACTORS:	ATTN dB: 0	DUTY dB:	4.3	HP IL dB:	0	DIST dB:	0	
RULE PART:	15.247	ANTENNA:	Horn	MODULATION TYPE:		TESTED BY:	Suresh	COMMENTS:		
FREQ.	READING	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB	
Fund = 2480										
2480	53.2	Pk	27.1	5.3	35.0	0.0	50.6	74.0	-23.4	3dBd Omni
2480	52.7	Avg	27.1	5.3	35.0	4.3	45.8	54.0	-8.3	3dBd Omni
2480	58.0	Pk	27.1	5.3	35.0	0.0	55.4	74.0	-18.6	9dBi Omni
2480	57.6	Avg	27.1	5.3	35.0	4.3	50.7	54.0	-3.3	9dBi Omni
2480	60.2	Pk	27.1	5.3	35.0	0.0	57.6	74.0	-16.4	9 dBi Patch
2480	59.9	Avg	27.1	5.3	35.0	4.3	53.0	54.0	-1.1	9 dBi Patch
2480	53.0	Pk	27.1	5.3	35.0	0.0	50.3	74.0	-23.7	13.5 dBi YAGI
2480	52.8	Avg	27.1	5.3	35.0	4.3	45.8	54.0	-8.2	13.5 dBi YAGI
2480	57.9	Pk	27.1	5.3	35.0	0.0	55.2	74.0	-18.8	1dBi Omni
2480	57.0	Avg	27.1	5.3	35.0	4.3	50.0	54.0	-4.0	1 dBi Omni

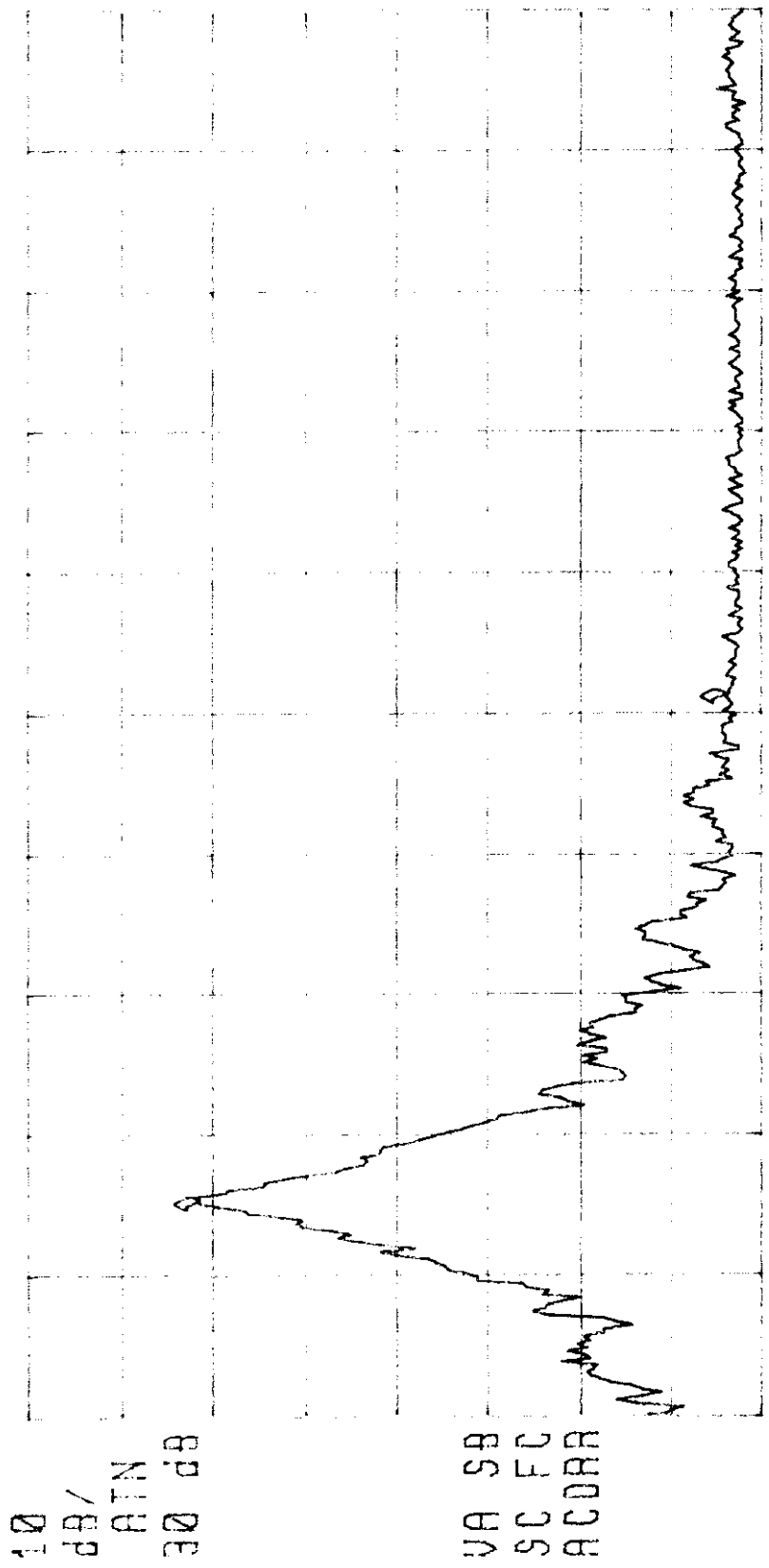
FCC RADIATED DATA SHEET										
EUT:	AMP	DATE:	4/16/98	CUSTOMER NAME:	AMP	WORK ORDER:	AMP	FILE:	AMP5.xls	
S/N:		OTHER CAL FACTORS:	ATTN dB: 0	DUTY dB:	0	HP IL dB:	0	DIST dB:	0	
RULE PART:	15.247	ANTENNA:	Horn	MODULATION TYPE:		TESTED BY:	Suresh	COMMENTS:	Peak and Average readings for the fundamental to be used in calculating restricted band performance	
FREQ.	READING	Pk, QP, or Av	A.F. dB	Cable loss dB	AMP dB	O.C.F. dB	TOTAL, dB(uV/m)	LIMIT dB(uV/m)	DELTA dB	
Fund = 2480										
2480	110.9	Pk	27.1	5.3	35.0	0.0	108.3	74.0	34.3	3dBd Omni
2480	110.4	Avg	27.1	5.3	35.0	0.0	107.7	54.0	53.7	3dBd Omni
2480	119.1	Pk	27.1	5.3	35.0	0.0	116.5	74.0	42.5	9dBi Omni
2480	118.6	Avg	27.1	5.3	35.0	0.0	116.0	54.0	62.0	9dBi Omni
2480	120.3	Pk	27.1	5.3	35.0	0.0	117.7	74.0	43.7	9 dBi Patch
2480	120.0	Avg	27.1	5.3	35.0	0.0	117.4	54.0	63.4	9 dBi Patch
2480	110.4	Pk	27.1	5.3	35.0	0.0	107.7	74.0	33.7	13.5 dBi YAGI
2480	110.2	Avg	27.1	5.3	35.0	0.0	107.6	54.0	53.6	13.5 dBi YAGI
2480	115.6	Pk	27.1	5.3	35.0	0.0	113.0	74.0	39.0	1dBi Omni
2480	114.7	Avg	27.1	5.3	35.0	0.0	112.0	54.0	58.0	1 dBi Omni

13:01:02 APR 16, 1998

16:09:17 JUN 29, 1994 16:36:52 JUN 29, 1994

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRA 3.62 MHz
-57.45 dB

LOG REF 127.0 dBμV



CENTER 2.48350 GHz

#IF BW 30 kHz

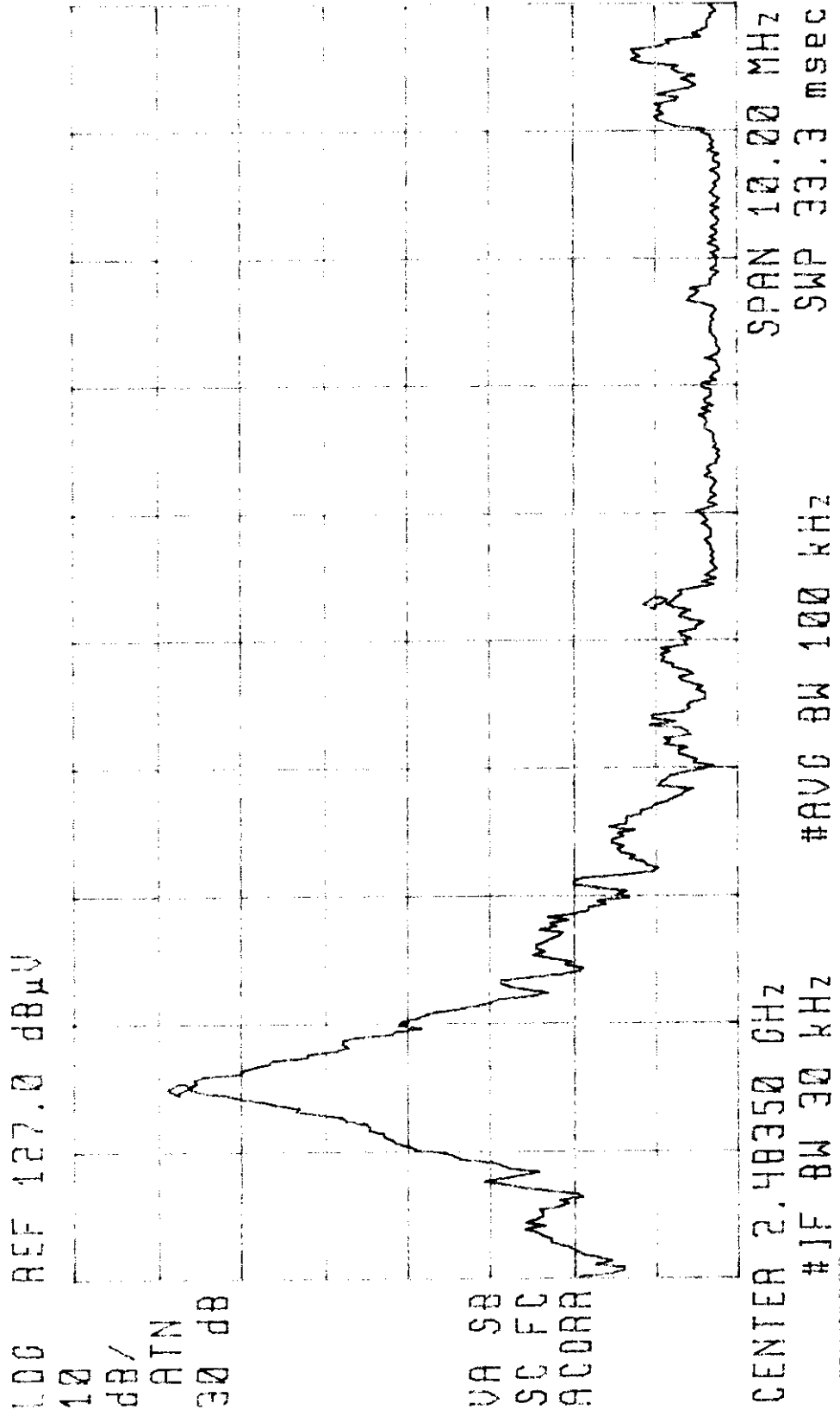
#AVG BW 100 kHz

SPAN 10.00 MHz

SWP 33.3 msec

12:32:23 APR 16, 1998
16:09:17 JUN 29, 1994 16:36:52 JUN 29, 1994

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRA Δ 3.80 MHz
-57.74 dB

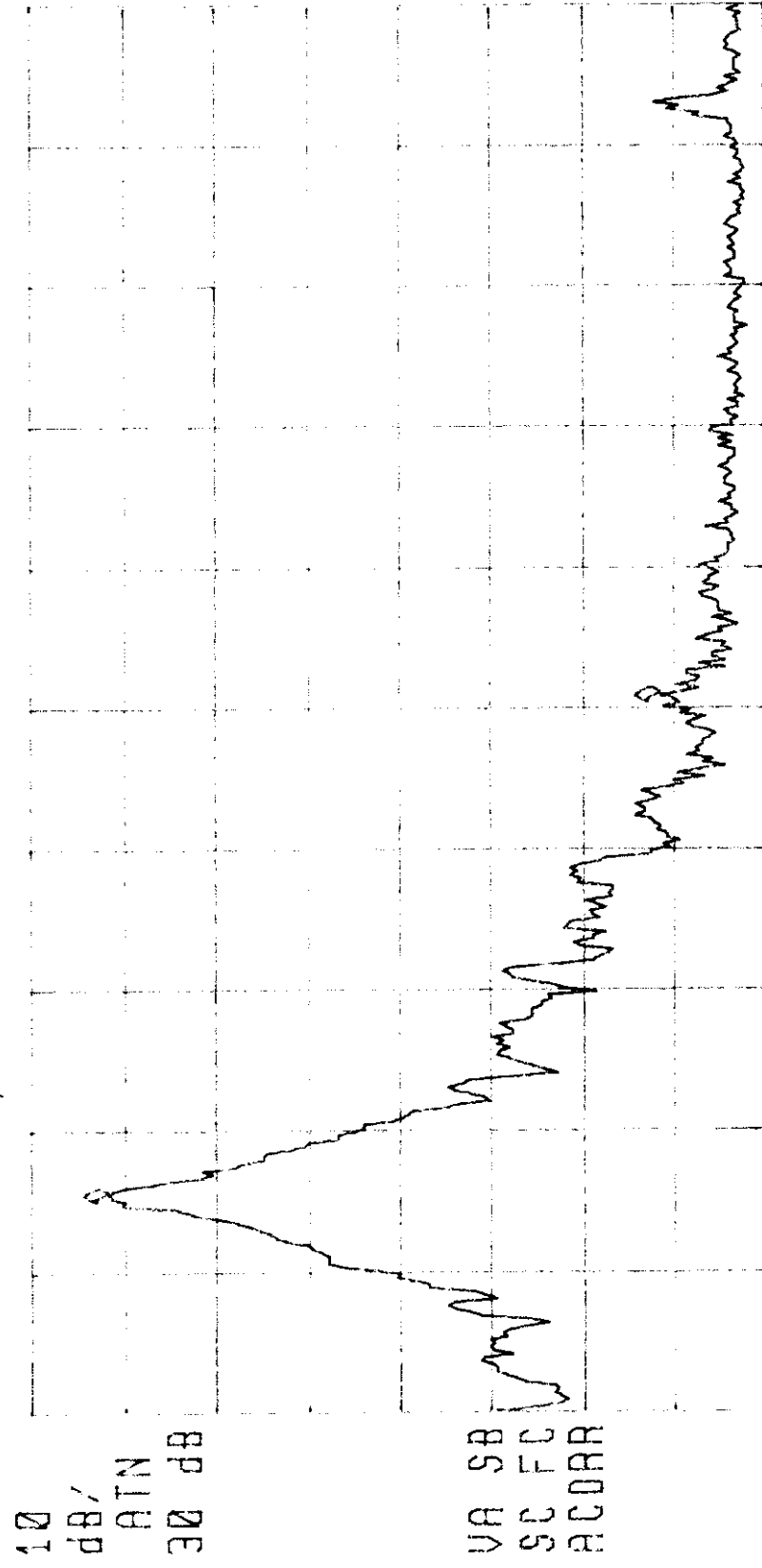


12:45:47 APR 16 1998

16:09:17 JUN 29 1994 16:36:52 JUN 29 1994

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRA 3.55 MHz
-60.09 dB

LOG REF 127.0 dBμV

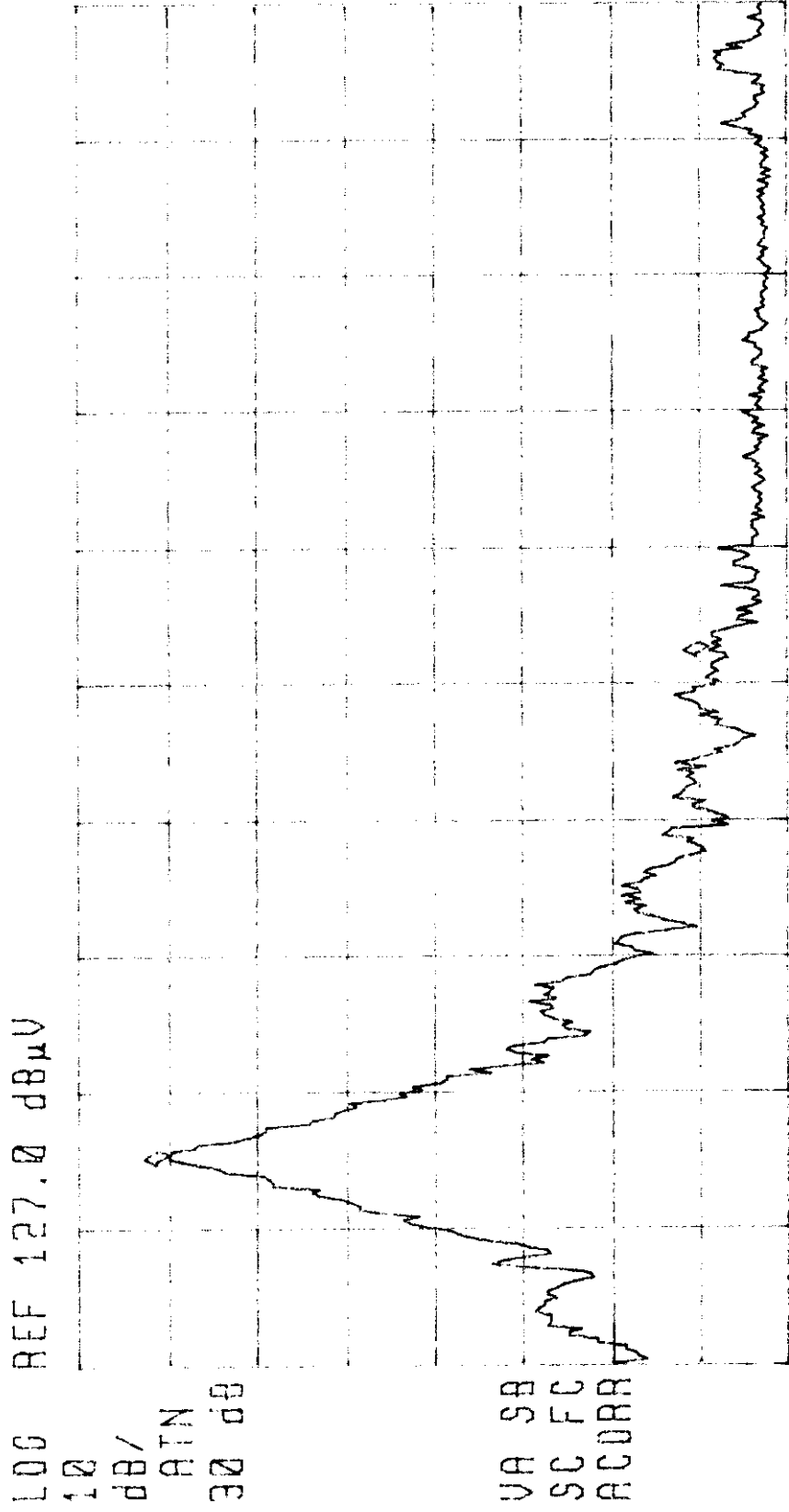


VA SB
SC FC
ACDAR

CENTER 2.48350 GHz
#JF BW 30 kHz
#AVG BW 100 kHz
SPAN 10.00 MHz
SWP 33.3 msec

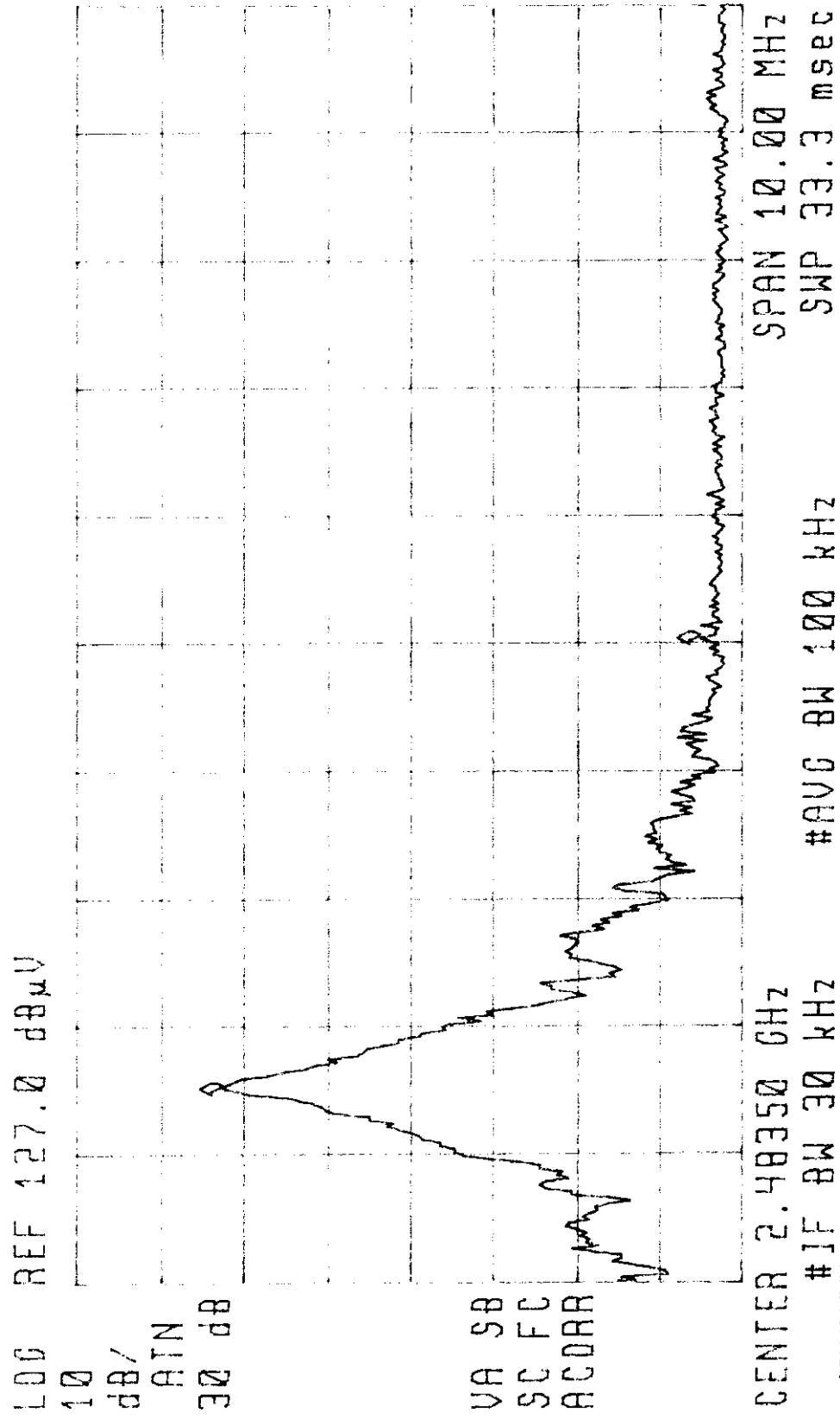
11:55:38 APR 16, 1998
16:09:17 JUN 29, 1994 16:36:52 JUN 29, 1994

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 3.73 MHz
-60.98 dB



[Q] 12:15:23 APR 16, 1998 10:00:00
16:09:17 JUN 29, 1994 16:36:52 JUN 29, 1994

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRA 3.53 MHz
-57.66 dB



APPENDIX B
Support Equipment

Equipment Type: Computer
Model Number: 0433-2D
Serial Number: C10004
FCC ID Number: ITUSC14PC35
Manufacturer: Syclone

Equipment Type: Monitor
Model Number: CA1511
FCC ID #: GBVCA-1511
Serial Number: A4KKU4931270
Manufacturer: Smile Int'l

Equipment Type: Keyboard
Model Number: SK-1100CW
Serial Number: C9709023311-14
FCC ID Number: G4UR26SK
Manufacturer: PC Concepts

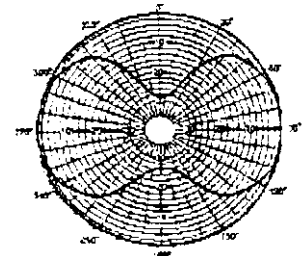
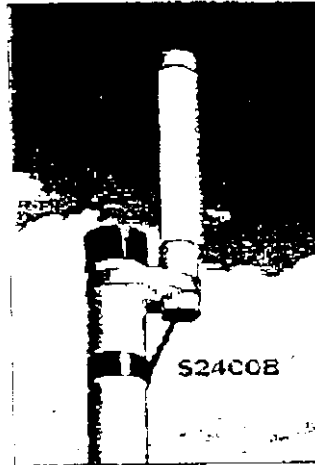
Equipment Type: Mouse
Model Number: Mouse 2000
Serial Number: 96020055
FCC ID Number: FSUGMZE0
Manufacturer: Genius

APPENDIX C
SET- UP PHOTOGRAPHS

APPENDIX D
ANTENNA AND CONNECTOR INFORMATION

3

Model	Spread Spectrum	SCADA
S3980BE	Yes	Yes
S8963BE	Yes	No
S2400BE	Yes	NA
S2403BE	Yes	NA



DATA OMNI SELECTOR CHART

Model	Freq. MHz	Gain dBi	Bandwidth 1.5:1 MHz	3dB bandwidth E-Plane*	Height In (cm)	Weight lb (kg)	W/Sur Area sq ft (m ²)	W/Survival mph (kph)	Power (Watts)	Enclosure Material	Mount Style	Mount Dia In (cm)
S8950B	396-390	3	64	75	17-1/2 (44.3)	0.36 (0.25)	0.063 (0.009)	125 (200)	150	Fiberglass	Tube and	2 (5.1)
S8950BE	396-390	3	64	75	9 (22.9)	0.36 (0.6)	0.122 (0.011)	125 (200)	150	Polycarbonate	Ceiling	N/A
S8963B	396-380	3	64	38	30-3/4 (78)	1.19 (0.53)	0.176 (0.018)	125 (200)	150	Fiberglass	Tube and	2 (5.1)
S8963BE	396-380	3	64	38	7 (43.2)	0.41 (0.18)	0.24 (0.02)	125 (200)	150	Polycarbonate	Ceiling	N/A
S8964B	396-380	4	64	30	42-1/8 (107)	1.56 (0.7)	0.24 (0.02)	125 (200)	150	Fiberglass	Tube end	2 (5.1)
S1403B	1410-1455	3	45	38	30 (76.2)	0.58 (0.26)	0.40 (0.04)	125 (200)	75	Polycarbonate	Tube end	2 (5.1)
S1406B	1410-1455	6	45	30	17-1/2 (44.5)	0.34 (0.15)	0.25 (0.023)	125 (200)	75	Polycarbonate	Tube end	2 (5.1)
S1904B	1850-1970	3	100	38	20-1/2 (52.1)	0.40 (0.17)	0.28 (0.024)	125 (200)	50	Polycarbonate	Tube end	2 (5.1)
S1906B	1850-1970	3	20	20	28-1/2 (67.3)	0.51 (0.23)	0.38 (0.025)	125 (200)	50	Polycarbonate	Tube end	2 (5.1)
S2400B	2400-2500	3	100	38	9 (22.9)	0.25 (0.11)	0.1 (0.01)	125 (200)	50	Polycarbonate	Tube and	2 (5.1)
S2400BE	2400-2500	3	100	38	3 (22.9)	0.29 (0.09)	0.122 (0.011)	125 (200)	50	Polycarbonate	Ceiling	N/A
S2403B	2400-2500	3	100	38	13-1/2 (34.3)	0.41 (0.18)	0.22 (0.02)	125 (200)	50	Polycarbonate	Tube and	2 (5.1)
S2403BE	2400-2500	3	100	38	9 (22.9)	0.31 (0.14)	0.122 (0.011)	125 (200)	50	Polycarbonate	Ceiling	2 (5.1)

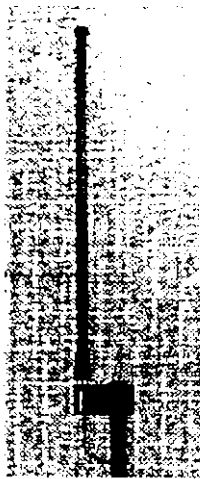
* Connector Specifications: /3 SMA - 1/2" nominal; Connector Type - N-female; Enclosure material - printed circuit

Cushcraft/Signal

→ Amp Part # 364014-1 Pole mount
364015-2 Hanging

Product Specifications

COMMUNICATIONS ANTENNAS



OD Series Antenna



OD Series with Reflector Option Kit

OD Series Omni Antenna

For WLAN, Video, PCS, and Data Systems

- 6 dBi, 9 dBi & 12 dBi antennas provide uniform omni coverage
- Unique design allows economical build out
- Mounting kit includes all hardware needed
- Reflector option provides directional beamshaping & increased performance

2

AMP PART # 364014-4

The OD Series Antennas are optimized for use in a wide variety of wireless systems. They are usable in point to point, multi-point and broadcast configurations. Typical uses include WLAN access points or bridge, PCS Micro-cell, and for video surveillance transmitters.

These antennas consist of a collinear array with elements stacked vertically. Unique phasing cancels out-of-phase current distribution, improving system performance. This design maintains an omni pattern in the horizontal plane. The OD Series are free space antennas and can be mounted anywhere, no ground plane is required.

An option for the OD series is a reflector kit that beam shapes the omni pattern into a directional cardoid shape. This can result in improved performance for gain, and isolation for reduced interference.

The low profile back radome (1.15" diameter) makes the OD Series durable and rugged. They can withstand the harshest environments of snow, wind, rain and ice. The feed assembly is made of precision machined aluminum components and is treated for weather protection. The OD Series comes with all the hardware needed to install

it to a mast. Customized hardware is also available for unique mounting needs. For ISM, special connectors and models with cable are available including reverse polarized. please consult factory

Model Numbers

Model	Freq.(MHz)	Gain	Applications
OD6-1800	1700-1900	6 dBi	GSM, Surveillance
OD9-1800	1700-1900	9 dBi	GSM, Surveillance
OD6-1900	1850-1990	6 dBi	PCS CDMA/TDMA
OD9-1900	1850-1990	9 dBi	PCS CDMA/TDMA
OD12-1900	1850-1990	12 dBi	PCS CDMA/TDMA
OD6-2400	2400-2500	6 dBi	WLAN, ISM, Video
OD9-2400	2400-2500	9 dBi	WLAN, ISM, Video
OD12-2400	2400-2500	12 dBi	WLAN, ISM, Video

Frequencies subject to bandwidth constraints; confirm desired frequencies at time of order. Special frequencies are also available, please consult factory for information.

Reflector Options

Reflector Options	Model
Add-on kit for 6 dBi models	ODR6-Kit
Add-on kit for 9 dBi models	ODR9-Kit
Add-on kit for 12 dBi models	ODR12-Kit

Specifications

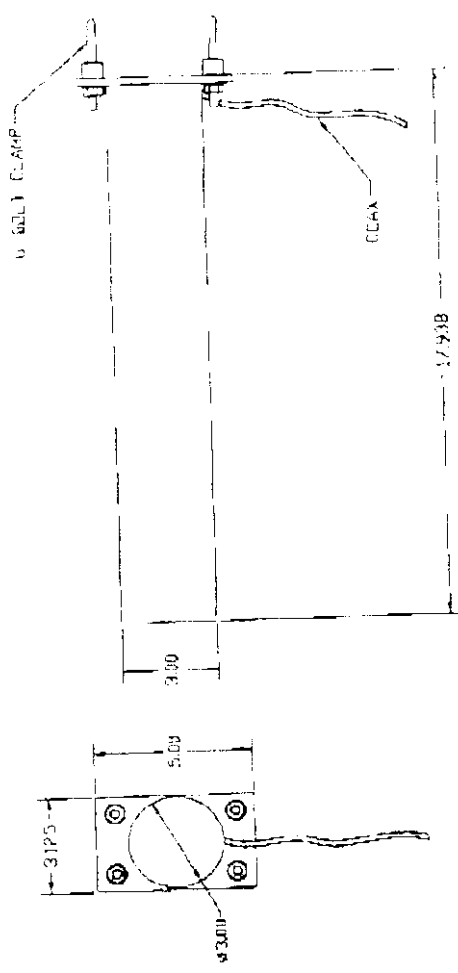
Frequency & Gain:	See above	Material:	ABS radome/aluminum feed
Bandwidth @2:1 SWR:	140+ MHz typical	Antenna Length:	- 6 dBi Models: 17 inches - 9 dBi Models: 25 inches - 12 dBi Models: 40 inches
Nominal Impedance:	50 ohms	Antenna Diameter:	1.15", main section
Max. Power (continuous):	100 watts	Antenna Weight:	2.0 lbs with clamp
Vertical Beamwidth (-3 dBi point):		Connector:	N female standard
5 dBi Models	32 degrees	Mounting Kit:	Mast mount kit included
9 dBi Models	17 degrees	Mounting Dimensions:	Use mast up to 2" OC
12 dBi Models	7 degrees	Accessory:	Reflector Option Kit
Wind Loading (flat plate equiv.):	30-40 sq. inches		
Rated Wind Velocity:	100+ mph		
Lightning Protection:	External suggested		

4

DATE	REV	BY	CHK
	1		

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PART NO	DESCRIPTION
364016-1	YAGI ANTENNA 135



SPECIFICATIONS:

ELECTRICAL:
 FREQUENCY RANGE 2400-2483 MHz
 LOSS THAN ENL. 1.5d
 NOMINAL VSWR 1.35 MAX (1.3 dB)
 NOMINAL GAIN GREATER THAN 20 dB
 FRONT-TO-BACK RATIO GREATER THAN 20 dB
 HALF-POWER BEAMWIDTH 10 DEGREES
 POLARIZATION VERTICAL

Mechanical:
 SIZE 18" LONG
 CLAMPS TO VERTICAL MAST UP TO 2-5/8" O.D.
 26'
 CABLE LENGTH RG-58 A7U TYPE 50 ohm, LOW LOSS, WHITE
 CABLE TYPE SPECIFY REVERSE INC (POLARIZED)
 CONNECTION OR REVERSE SMA (POLARIZED)

Amp PART # 364016-1

THIS DRAWING IS A CONTROLLED DOCUMENT.

DATE	TIME	BY	CHK
8/12/97	8/12/97		

AMP INCORPORATED
 10101 BROADWAY, PA 17115-3000

AMP YAGI ANTENNA

PART NO: 364016-1
 REV: 1
 DATE: 8/12/97

ISSUED BY: J. B. BROWN
 CHECKED BY: J. B. BROWN

TO QUOTE (PASS) UNQUOTE (SUFFIX)
 Q: 0 PLE 1 50 P
 0 PLE 1 50 P
 0 PLE 1 50 P
 0 PLE 1 50 P
 0 PLE 1 50 P
 0 PLE 1 50 P



9 dBi Patch
**2.4 GHz WLAN
Directional Antenna**

①

Electrical Specifications

Frequency:	2.4 to 2.5 GHz
Gain:	9 dBi
Typical Bandwidth (1.5:1 VSWR):	140 MHz
Polarization:	Linear (Vertical or Horizontal)
3dB Beamwidth (typical):	
E-Plane:	55 degrees
H-Plane:	60 degrees
Pattern:	Directional

Mechanical Specifications

Dimensions:	4.88 x 4.88 x 7/8 inches
Connector:	N-Female
Cable Length:	12 inches
Color:	Shell White
Environmental:	Indoor/Outdoor Use

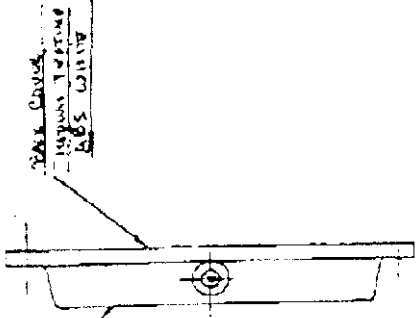
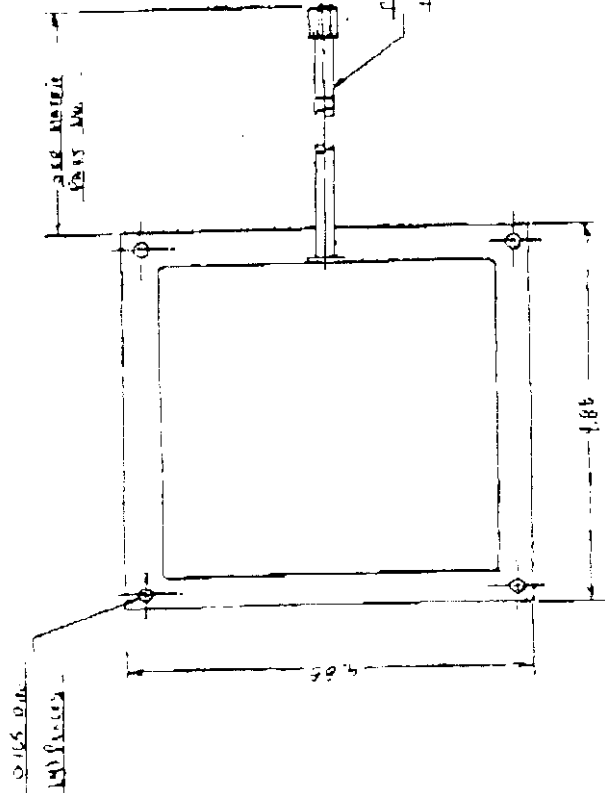
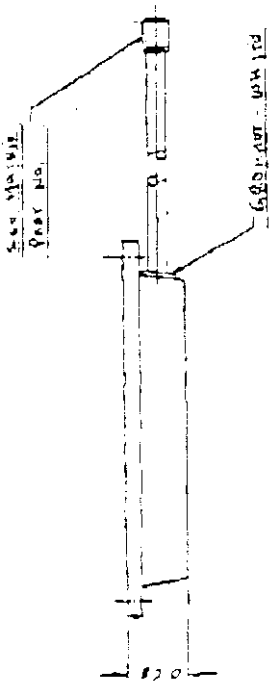
AMP PART # 364015-2
9 dBi Patch Antenna

1a

NOTE: INCLUDES

- 1. HOUSING: HOUSING
(4) VESSEL PAINTS (3) SCREWS
- 2. HOUSING: HOUSING
ANTENNA ENCLOSURE IN
CABLE WRAP CABLES
- 3. CABLE: LEADS TO ANTENNA
12. INCHES LONG

PART NO.	CABLE	CONNECTOR
2415LD9W-R T12	12.0 IN	HP-TNC PLUG
2431LD9W-R12	12.0 IN	IN JACK



NEXTEK TECHNOLOGIES INC.	
BOULDER COLORADO	
PART NAME	2415 LD9W-R12
PART NUMBER	See Material
MATERIAL	ABS 1000 Grade
SCALE	1:1
DATE	10/06/97
TOLERANCE	SEE 10/06/97
DESIGN	10/06/97

AMP PART # 364015-2
9 dBi Patch Antenna

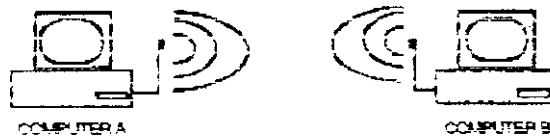
APPENDIX E
DUTY CYCLE INFORMATION

Duty Cycle Analysis for Proxim's RangeLAN2/PCMCIA:

The following section analyzes in detail the duty cycle performance experienced by a RangeLAN2/PCMCIA LAN adapter. It should be noted that all of Proxim's RangeLAN2 family of products use the same protocols and therefore show the same timing characteristics. The protocols are controlled by the firmware in the LAN adapter.

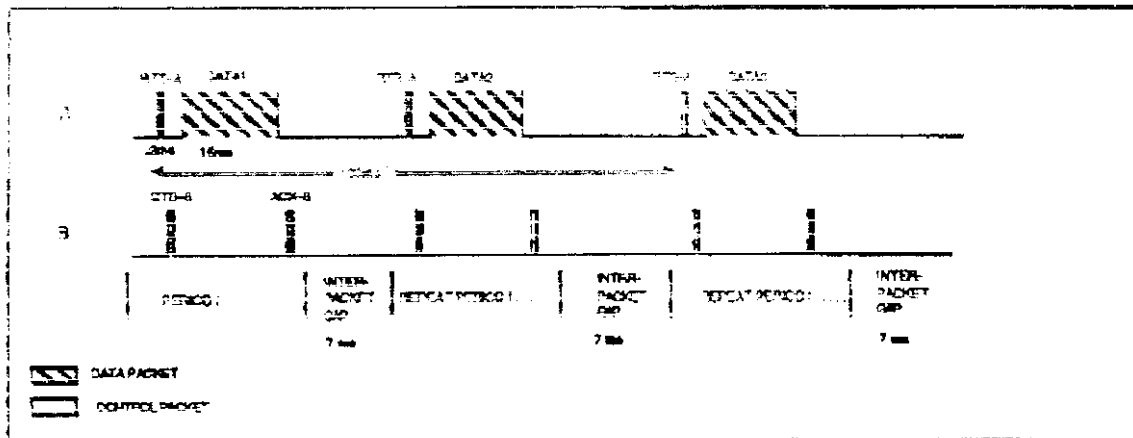
Worst case duty cycle timing for a given transmitter occurs when only two computers are actively communicating in a network. If more computers are present, each transmitter will have to back off as the additional computers gain access to the channel. Duty cycle for every transmitter in the network is thus reduced if more computers are present.

The topology we will therefore describe and the one of interest to the FCC is one with two computers ("A" and "B") communicating via Proxim's RangeLAN2/PCMCIA (as shown below).



Computer "A" duty cycle will be the highest when it is the one sending data. In this case Computer "B" will spend most of its time in receive mode, occasionally responding to "A" with some control information. "B" duty cycle will therefore be much lower than "A".

The timing diagram shown below depicts a worst case situation in which computer "A" is transferring a large file to computer "B".



During a file transfer from computer "A" and computer "B" the following events take place:

PERIOD 1

- 1) "A" sends a Request-To-Send (RTS) to computer "B" requesting permissions to send a packet.
- 2) If "B" receives the RTS message it will respond with a Clear-To-Send message to "A" indicating that "A" can proceed with the transmission of the packet.

- 3) Once "A" receives the CTS from "B" it then sends a packet of data of the file being transferred
- 4) If "B" receives the packet without errors it responds with a positive Acknowledgment (ACK). If errors are detected, "B" responds with a Negative Acknowledgment (NACK).

INTER-PACKET GAP (IPG)

The Inter Packet Gap is the amount of time that a station has to wait on the average to gain access to the media (the ether). Even if a station has data ready to be sent it will have to wait this period of time before entering a sent period. This number is typically 7 ms.

Each transmission follows a similar pattern: an IPG is followed by an RTS which is answered by a CTS which is followed by the data packet and is finally acknowledged with an ACK message.

Under worse case conditions the following applies: Control packets (RTS, CTS and ACK) are .64 ms long (64 bytes @ 800 kbs). Maximum length data packets are 15 ms long (1500 bytes @ 800 kbps). There is a .25 ms latency between the completion of a packet transmission from "A" and the beginning of a packet transmission from "B" (radio turn around time -TAT).

Since on a worst case scenario this cycle repeats itself, the duty cycle is given by the time a station is transmitting during each cycle and the total cycle time.

$$\begin{aligned} \text{Total Cycle Time} &= \text{IPG} + \text{RTS(A)} + \text{TAT} + \text{CTS(B)} + \text{TAT} + \text{DATA(A)} + \text{TAT} + \text{ACK(B)} = \\ &= 7 + .64 + .25 + .64 + .25 + 15 + .25 + .64 = 24.67 \end{aligned}$$

$$\begin{aligned} \text{Transmit Time} &= \text{RTS(A)} + \text{DATA(A)} = \\ &= .64 + 15 = 15.64 \end{aligned}$$

The resulting duty cycle is therefore $\approx 15.64/24.67 = 63\%$

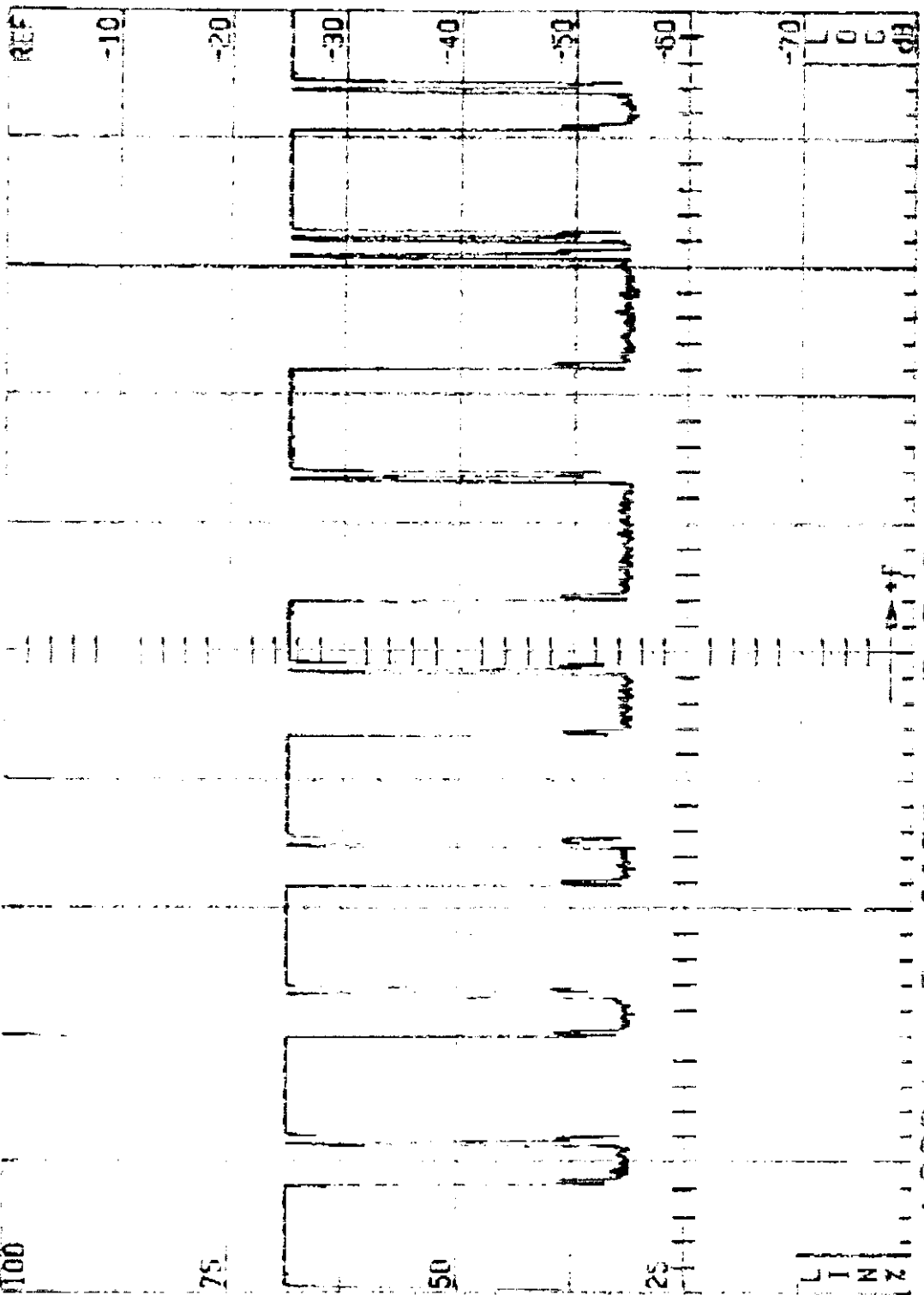
The plot shown attached was taken using a spectrum analyzer in zero span and with an antenna positioned near computer "A". Transmissions from "B" are not discernible on the photograph due to the fact that computer "B" was some distance from the spectrum analyzer and it's signal is therefore below the noise level. Only "A" transmissions are shown on the photograph.

REF LEVEL
0DBM

FREQUENCY
2.445 06GHZ

FREQ SPAN/DIV
20MS/

100
75
50
25



100B/ T 300B RF ATTENUATION RANGE 1.7-5.5 INT 1MHZ
VERTICAL DISPLAY RESOLUTION BANDWIDTH

DSS

(15)

$4\pi R^2 \quad (10^3)$

$R = \frac{6121}{4\pi}$

$R = 9.97 \times 10^2 \text{ m}$

$R = 27 \text{ cm} \quad (10^3) \text{ G}$

with calculations
correct
value of 214
distances
calculations
value of 314
value of 214

$\frac{2402 - 2483}{20, 37, 1}$