

**15.247 Certification
FCC ID: IMK-ILC56K**

EMI TEST REPORT

On

SYMPHONY CORDLESS MODEM

Prepared for

**Proxim Inc.
295 N. Bernardo Ave
Mountain View, CA 94043
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Prepared by

**Electronic Compliance Laboratories Inc.
1249 Birchwood Dr.
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**Test Report Number: A806014
Date of Test: June 24, 1998**

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in its entirety.**



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1.0 TEST FACILITY

Name: Electronic Compliance Laboratories

Location: 1249 Birchwood Dr.
Sunnyvale, CA 94089

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

NVLAP LAB CODE: 200089

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.

2.0 TEST EQUIPMENT

Description	Manufacturer	Model	SN
EMI Receiver	HP	8546A	3325A00137
Spectrum Analyzer	HP	8563A	3137A01183
Preamp	HP	8447F	3113A05849
Preamp	HP	8449B	3008A00527
LISN	EM	ANS-25/2	2532
Biconical Antenna	EM	EM 6912	414
Log Periodic Ant	EM	EM 6950	311
Double Ridge Horn	EM	EM 6961	6231
Filter BP 1.2-45 GHz	FSY	HM 1160-1155	001
Filter BP 4-10 GHz	FSY	HM 2950-1565	001
Filter HP 10-18 GHz	FSY	HP 8601-7SS	001

3.0 EUT

SYMPHONY CORDLESS MODEM

M/N: 4500

S/N: 81500021

FCC ID: IMK-ILC56K

With Proxim built in Dipole Antenna.

4.0 SUPPORT EQUIPMENT

	<u>Model No.</u>	<u>Serial No.</u>
PC Computer	486	95808514
Keyboard		
Monitor		

5.0 EQUIPMENT CONFIGURATION

All of the equipment and cables were placed in worst case positions to maximize emissions.

Interconnecting cables were of the type and length specified in the individual equipment requirements.

Grounding was in accordance with the manufacturer requirements and conditions for intended use.

6.0 SUMMARY OF TESTS

The SYMPHONY CORDLESS MODEM is a wireless LAN adapter with a low power frequency hopping spread spectrum (FHSS) radio system operating in the 2400-2483.5 MHz band. Tests were performed with one antenna. Test firmware resident in the Host PC was used to do the test.

6.1 15.247(a)(1) FREQUENCY HOPPING SYSTEMS

SYMPHONY CORDLESS MODEM uses 79 channels, each 1 MHz wide. The system hops over one of 15 pseudorandom sequences. On average, each channel is used equally. Please refer to "RangeLAN2 Frequency Hopping Theory of Operation" attached to this submission in the confidential section for more details.

6.1.1 15.247(a)(1)(ii) CHANNEL UTILIZATION

A spectrum analyzer plots labeled "CHANNEL UTILIZATION". The total number of channels is 79. The channels used have nominal center frequencies of 2402 through 2480 MHz. Three spectrum analyzer MAX HOLD plots labeled ""BANDWIDTH" show the 20 dB bandwidth of the hopping channel to be < 1 MHz (.910 / .885 / .840 MHz) at the low, mid, and high frequencies of 2.402/2.440/2.480 GHz. **Test Plots are shown in Appendix A.**

Zero span spectrum analyzer plot labeled "DWELL TIME" shows
Worst case transmission time in a given slot: 400 ms elapsed
time, <100 % duty
Maximum allowed: 400 msec.

Test Data in Appendix A.

6.1.2 **15.247(b) MAXIMUM PEAK OUTPUT POWER**

The three spectrum analyzer plots labeled " POWER OUT" show the maximum power of the hopping channel to be 19.17 dBm or 82.6 mW. The EUT was made to transmit uninterrupted random data on each of the low/mid/high channels. **Test Plots are shown in Appendix A.**

The output was taken from an N connector, through 1 foot of RG 142 cable, to Spectrum Analyzer set on Max Hold with no additional attenuation.

Power = 18.67 dBm (peak reading) +0.5dB cable loss = +19.17 dBm / 82 mW EIRP

Limit: +30 dBm / 1 W maximum power

Antenna

EIRP = +19.2 (peak power) +0 (peak gain, dBi) = + 19.2 dBm / 82.6 mW EIRP

Limit: +36 dBm / 4 W maximum EIRP

6.1.3 15.247(c) OUT OF BAND EMISSIONS

The spectrum analyzer plots titled "" OUT OF BAND - BAND EDGES" shows the output spectrum of the EUT while hopping one of the pseudorandom sequences and continuously transmitting packetized data. The analyzer was placed in MAX HOLD mode, and individual sweeps were recorded continually for 10 minutes with the same spectrum analyzer connection as was used for peak output power. The resultant plot shows that the EUT emissions remain inside the 2400 - 2483.5 MHz band when measured in ≥ 100 kHz bandwidth during operation.

The spectrum analyzer plots labeled "OUT OF BAND 30 MHz- 1.0 GHz", " OUT OF BAND 1.0 – 2.75 GHz ", and "OUT OF BAND 2.75 – 26.5 GHz" show that emissions measured in ≥ 100 kHz bandwidth are more than 20 dB below the highest level of the desired power outside of the 2400 - 2483.5 MHz band. **Test Plots are shown in Appendix A.**

6.1.4 15.203 ANTENNA REQUIREMENT

The antenna is an integral part of the unit, and is shown on the attached photos.

6.1.5 15.205 RESTRICTED BAND RADIATION LIMITS

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 moved in to 1 meter when necessary to improve the noise floor, and the appropriate range factor was applied. While the EUT was transmitting uninterrupted random data on each of the low/mid/high channels and with the spectrum analyzer on MAX HOLD, the turntable was rotated, and the search antenna raised and lowered in an attempt to maximize the received radiated emission level. **Test results are attached in Appendix B** in tabular form showing that no spurious signals were detected above the 74 dBuV/m peak/54dBuV/m average limits. Peak measurements were made with a RBW and VBW = 1Mhz. Average measurements were made with a RBW = 1 MHz and a VBW = 10 Hz.

6.1.6 15.207 AC LINE CONDUCTED EMISSIONS

The RF line conducted levels for emissions in the 0.45 - 30 MHz band must not exceed 250 μ V when measured with a LISN. Attached graphs and tabular data show that emissions are below the 250 μ V (48 dB μ V) maximum allowed level. **Test Data is in Appendix C.**

6.1.7 15.209 RADIATED EMISSIONS

The attached table shows that the Class B radiated limits from 30 - 1000 MHz are not exceeded by the EUT. The EUT was operating normally with a combination of transmission and reception and hopping one of the fifteen pseudorandom sequences during this test. The EUT was placed near one edge of 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 antennas were located at 3 meters. Measurements were made in accordance with ANSI C63.4-1994. **Test Data is in Appendix D.**

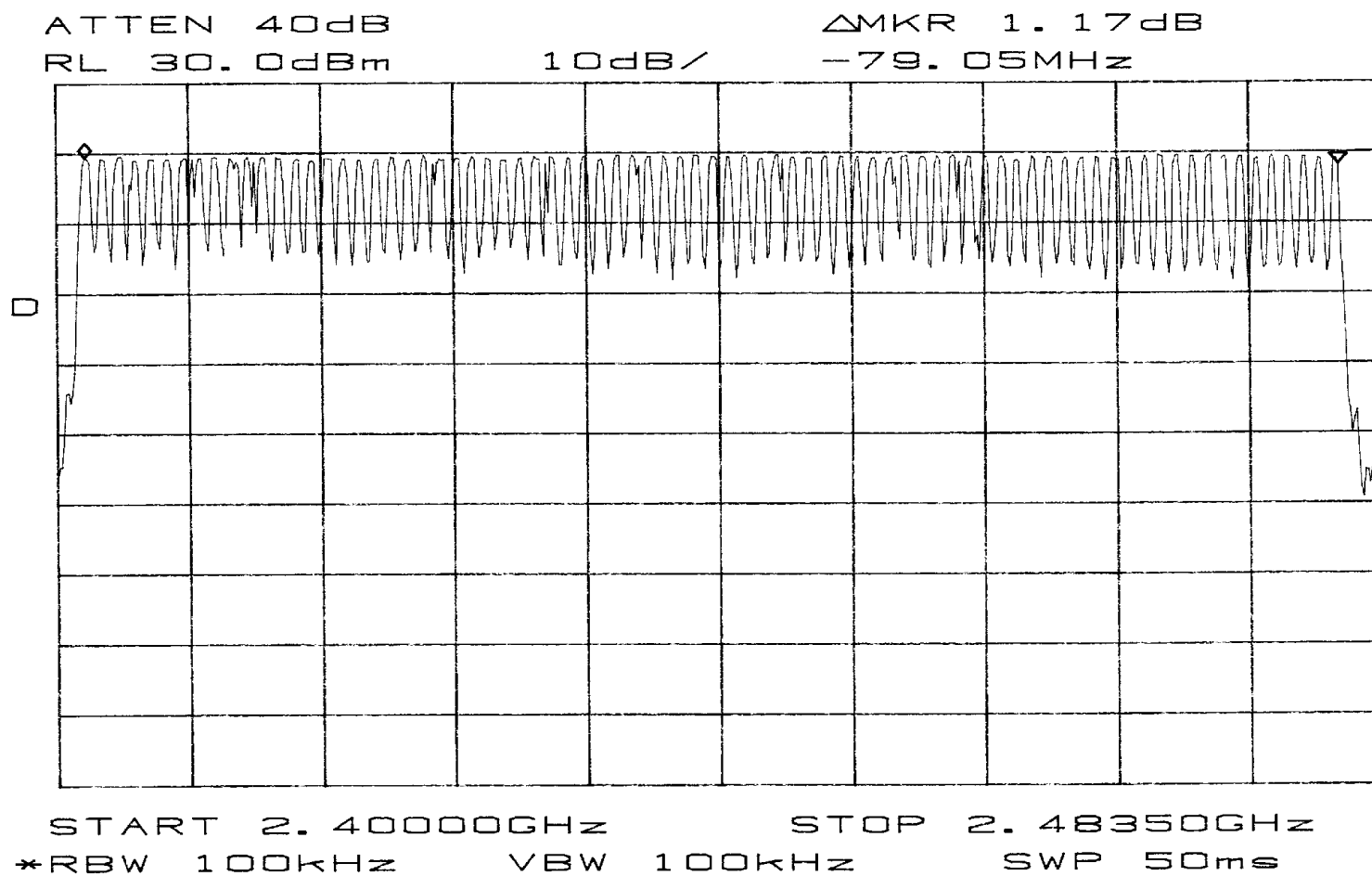
Electronic Compliance Laboratories

Chris Byleckie
Technical Director

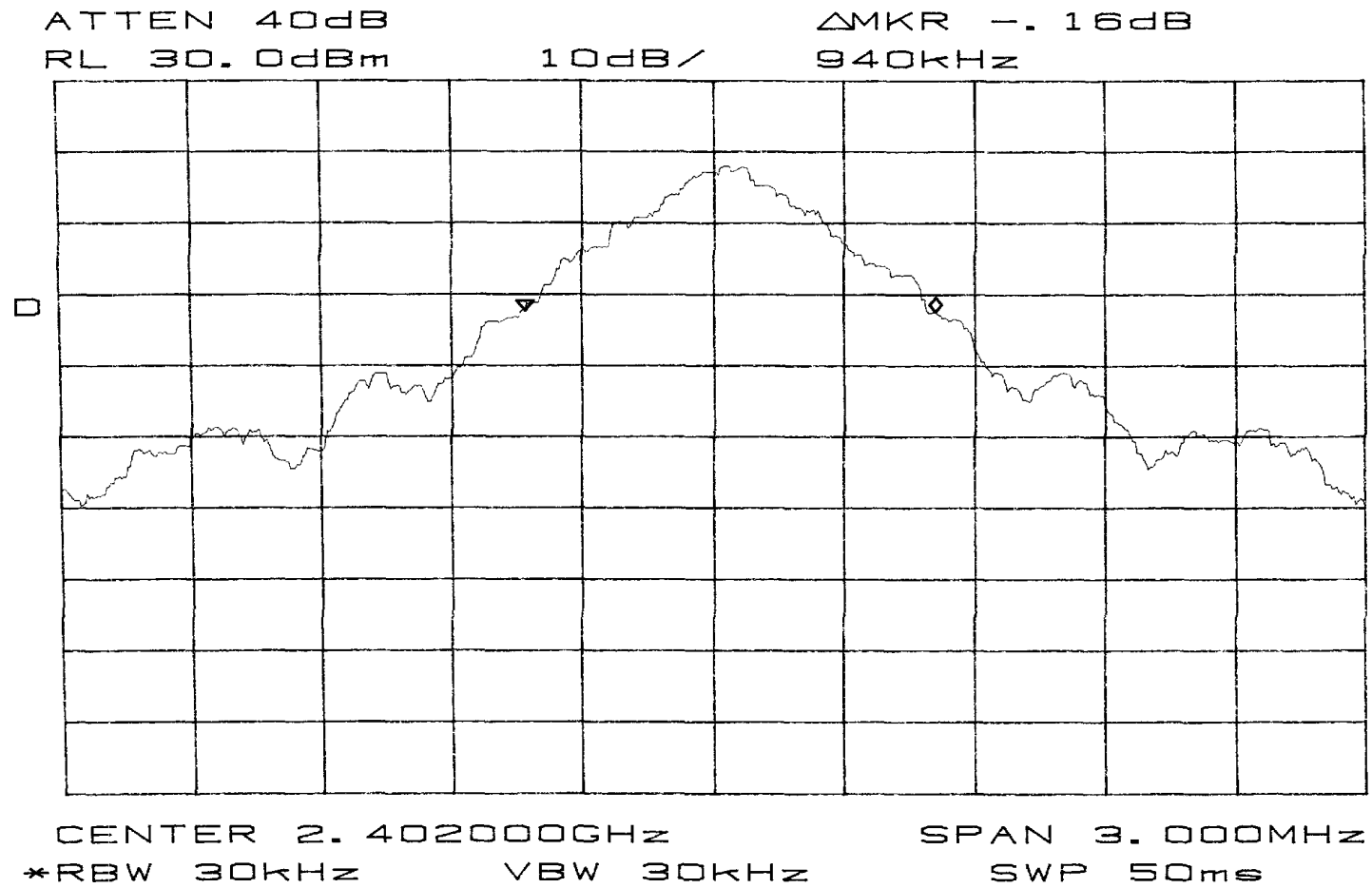
Date

APPENDIX A
SPREAD SPECTRUM PLOTS

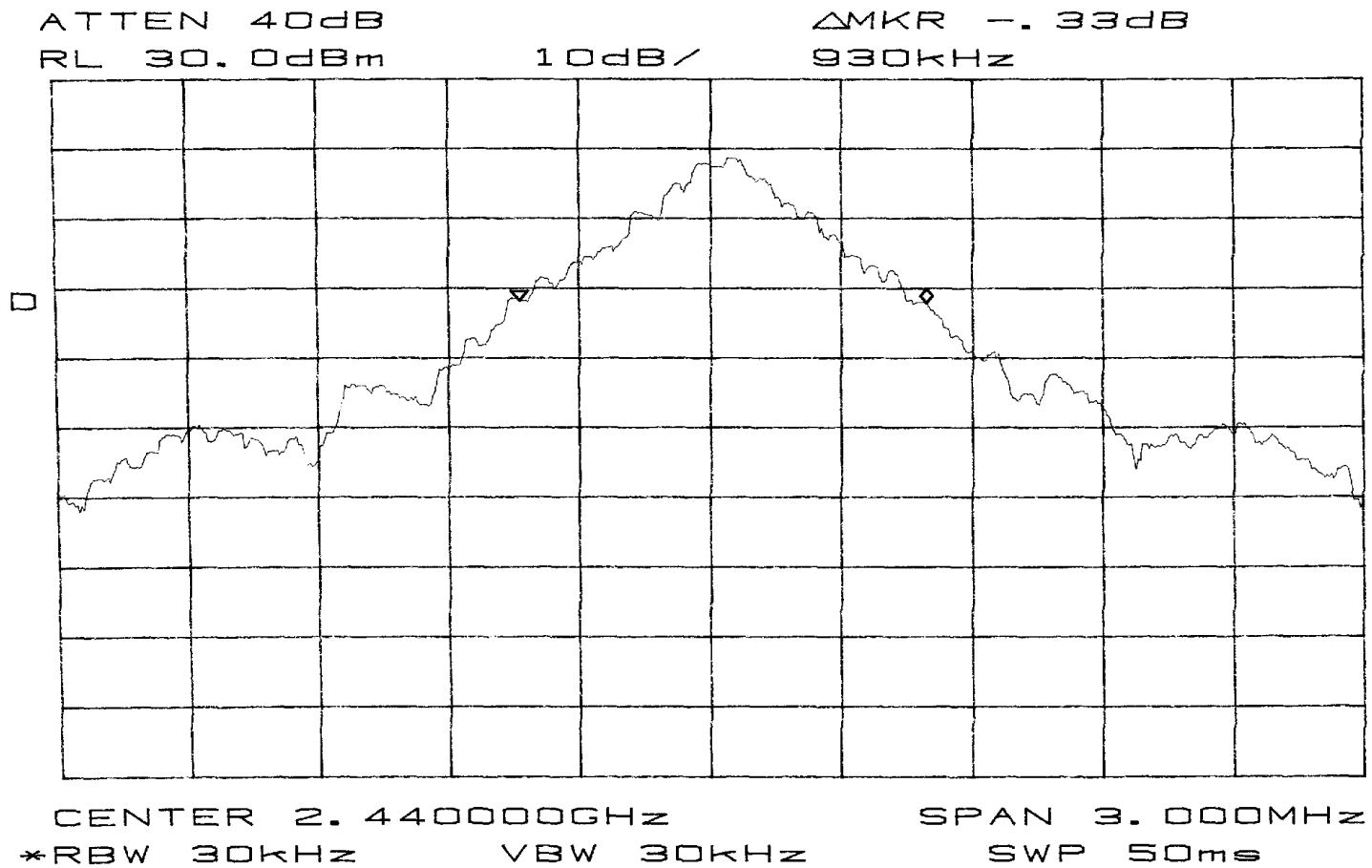
Channel Utilization



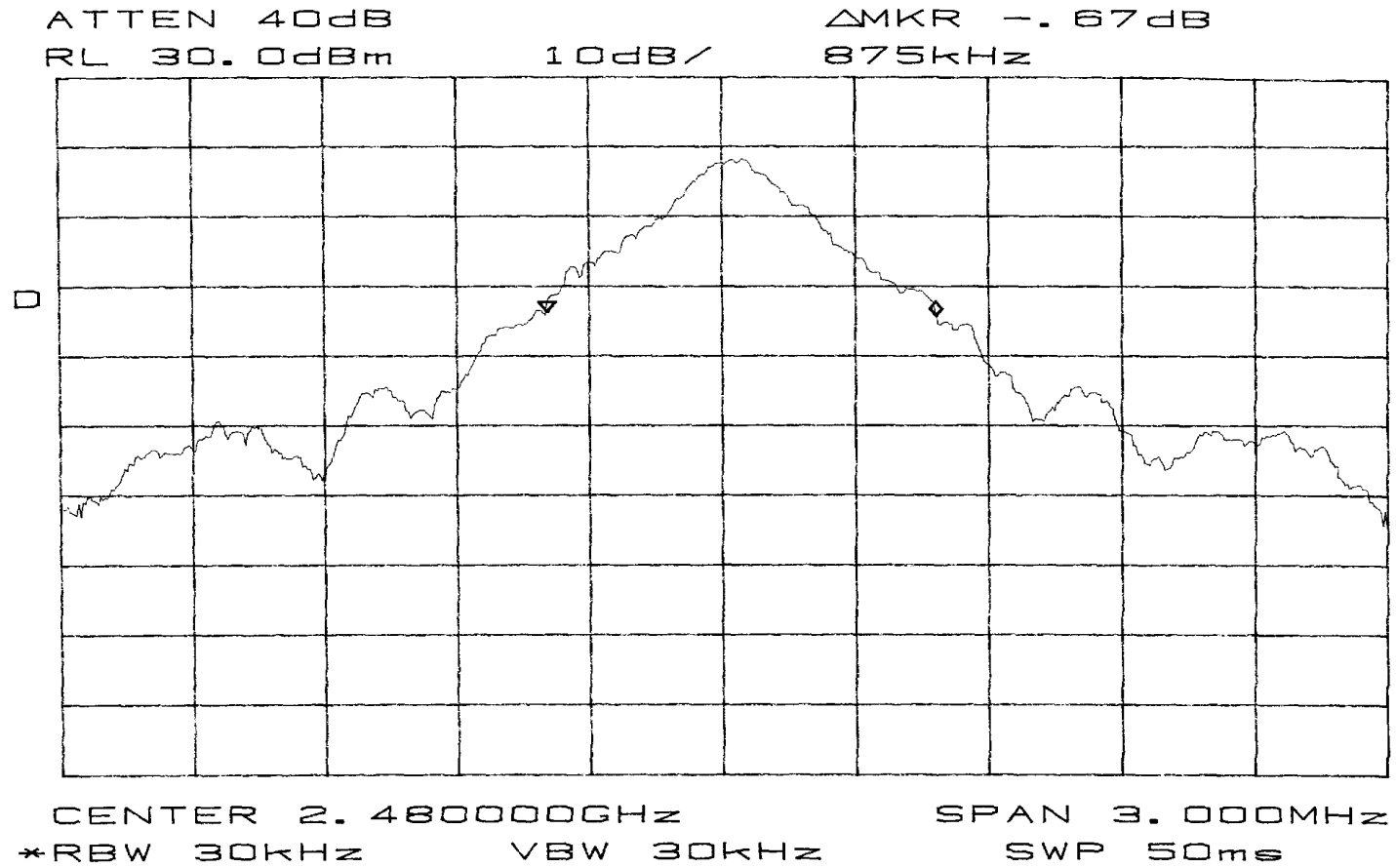
Bandwidth



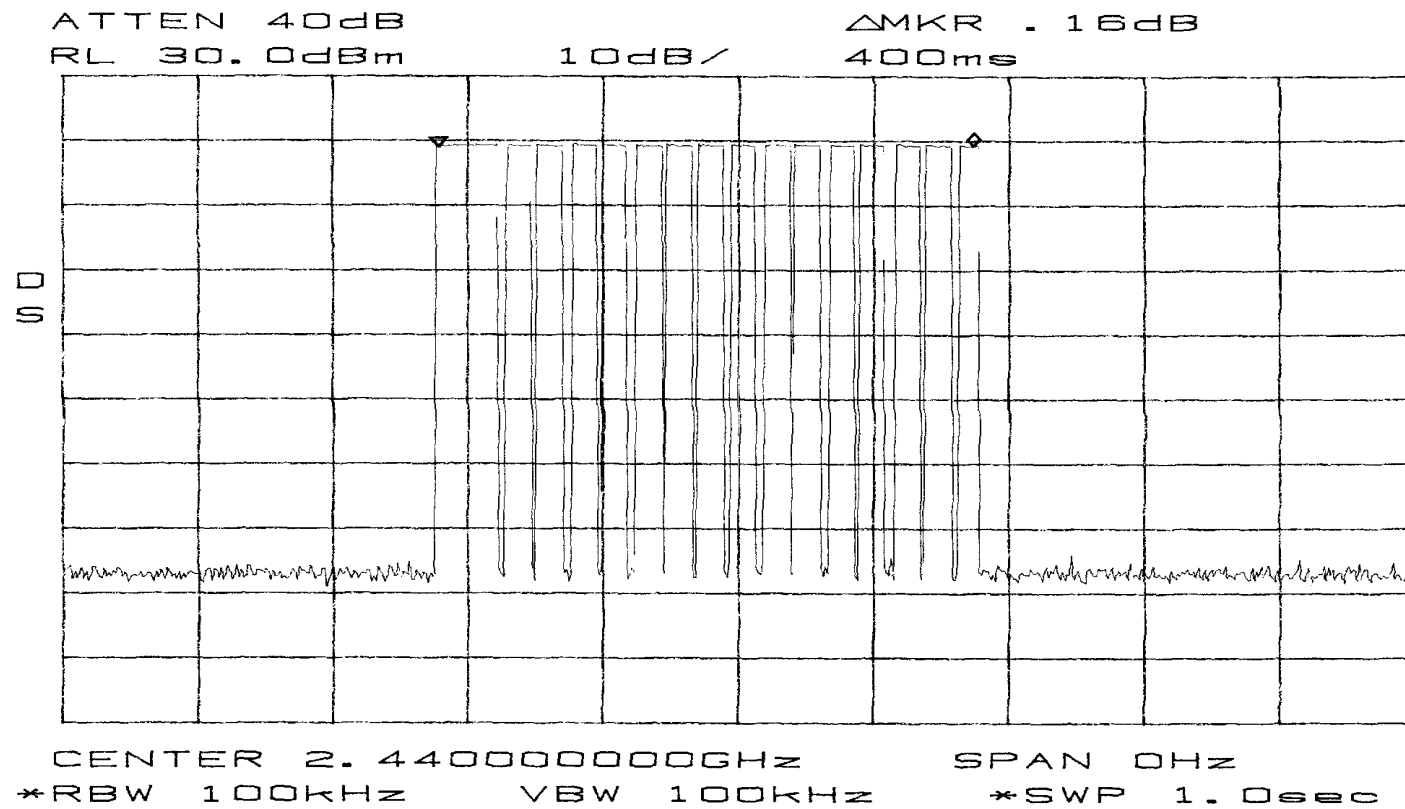
Bandwidth



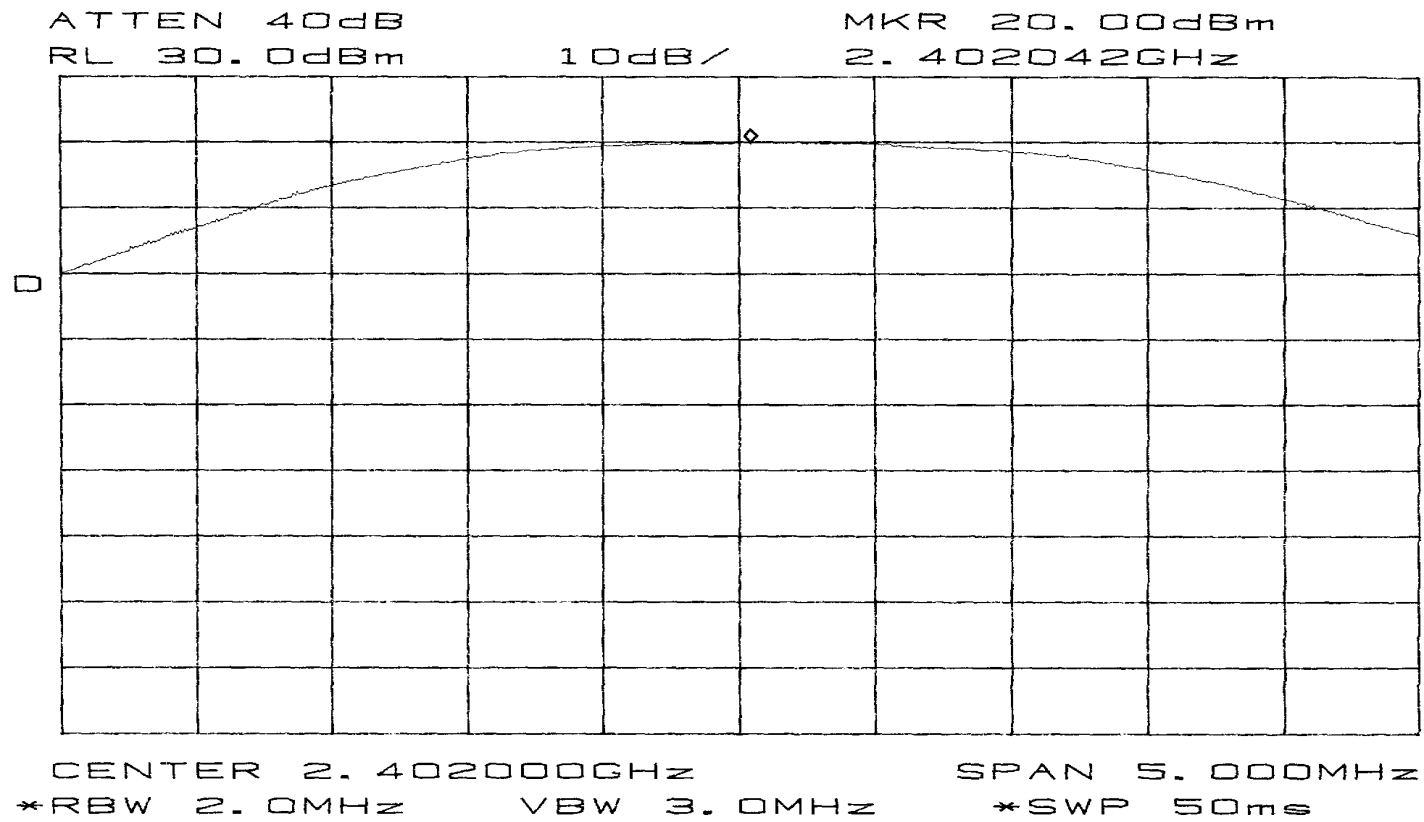
Bandwidth



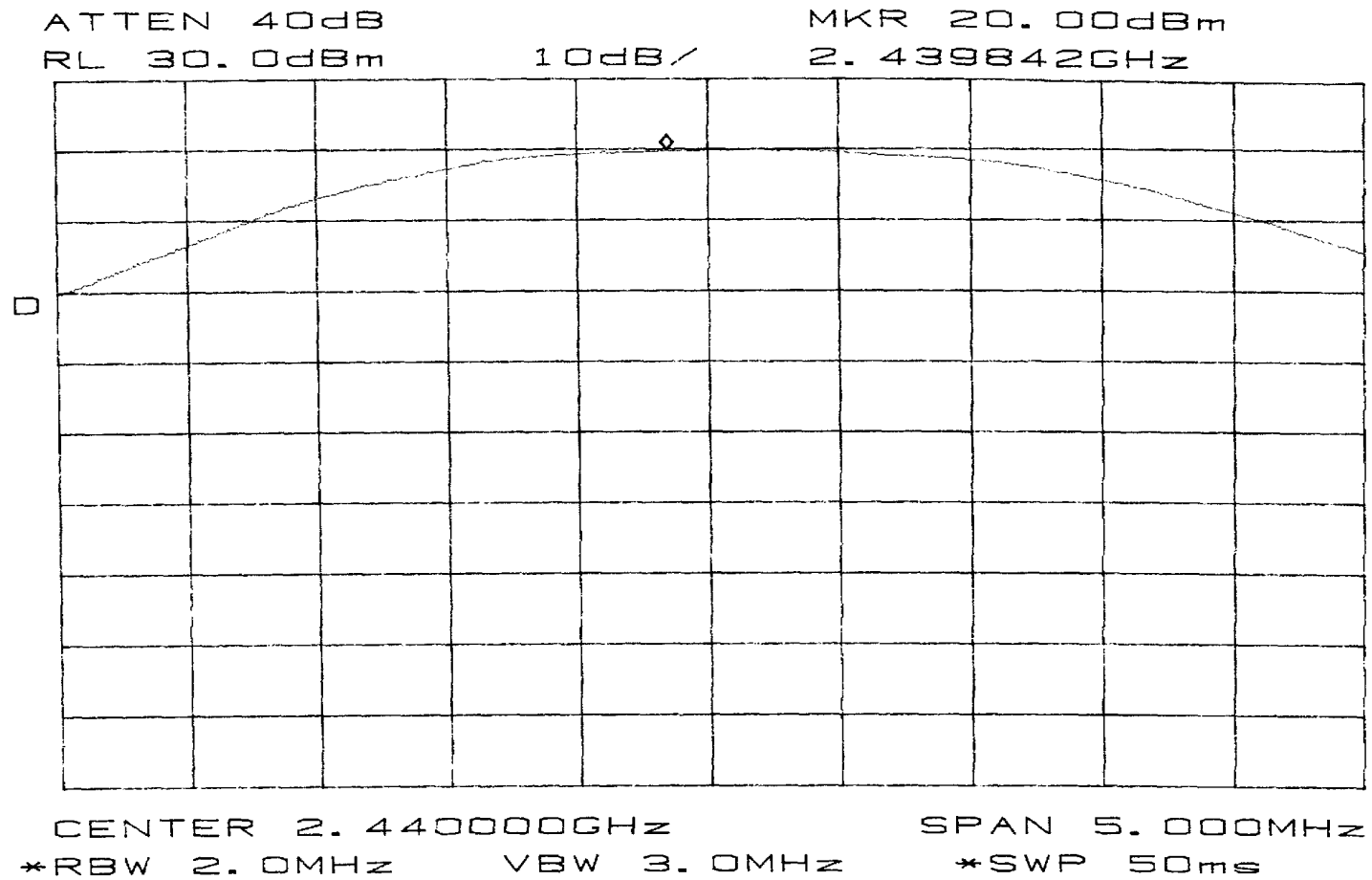
Dwell Time



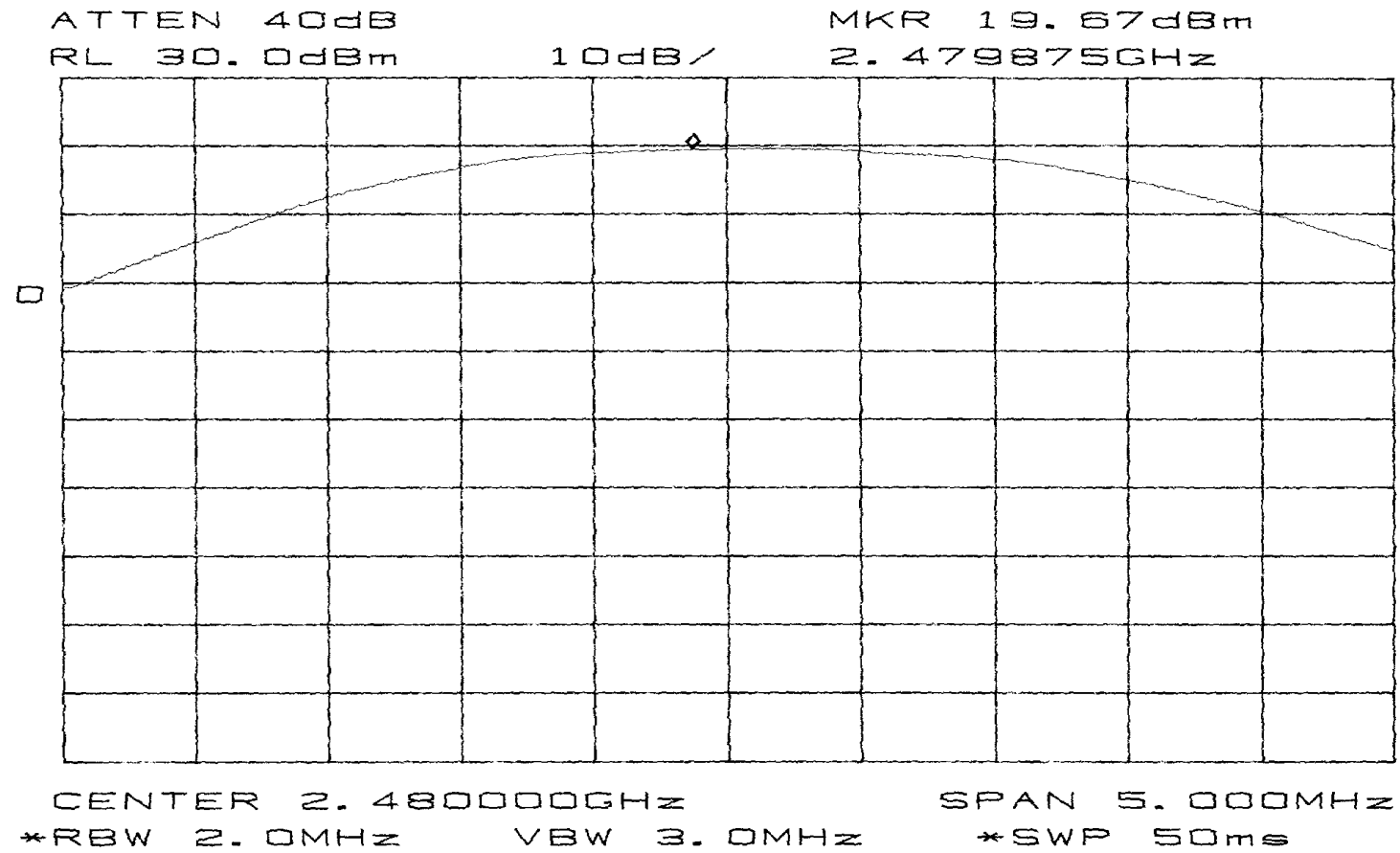
Power Out



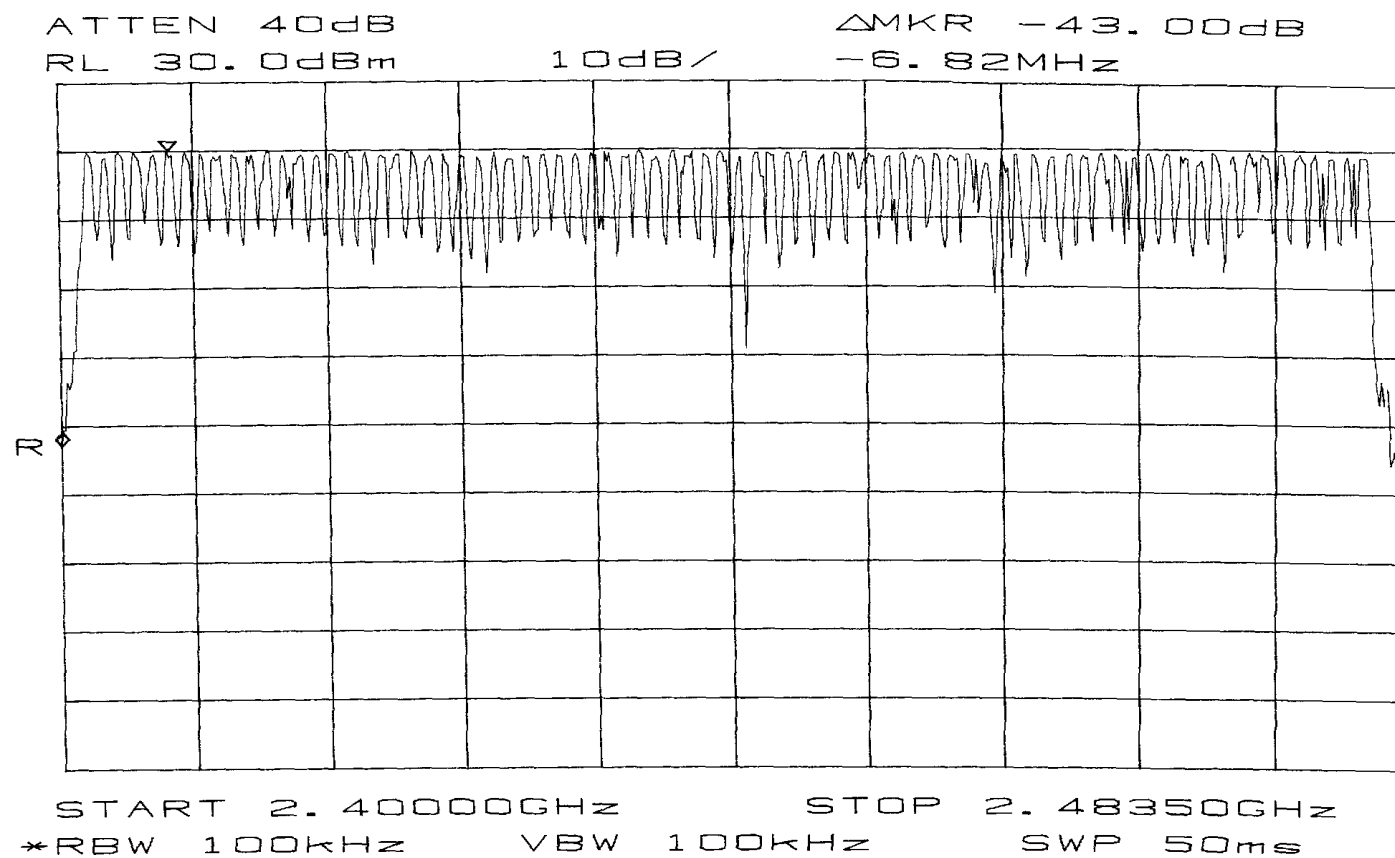
Power Out



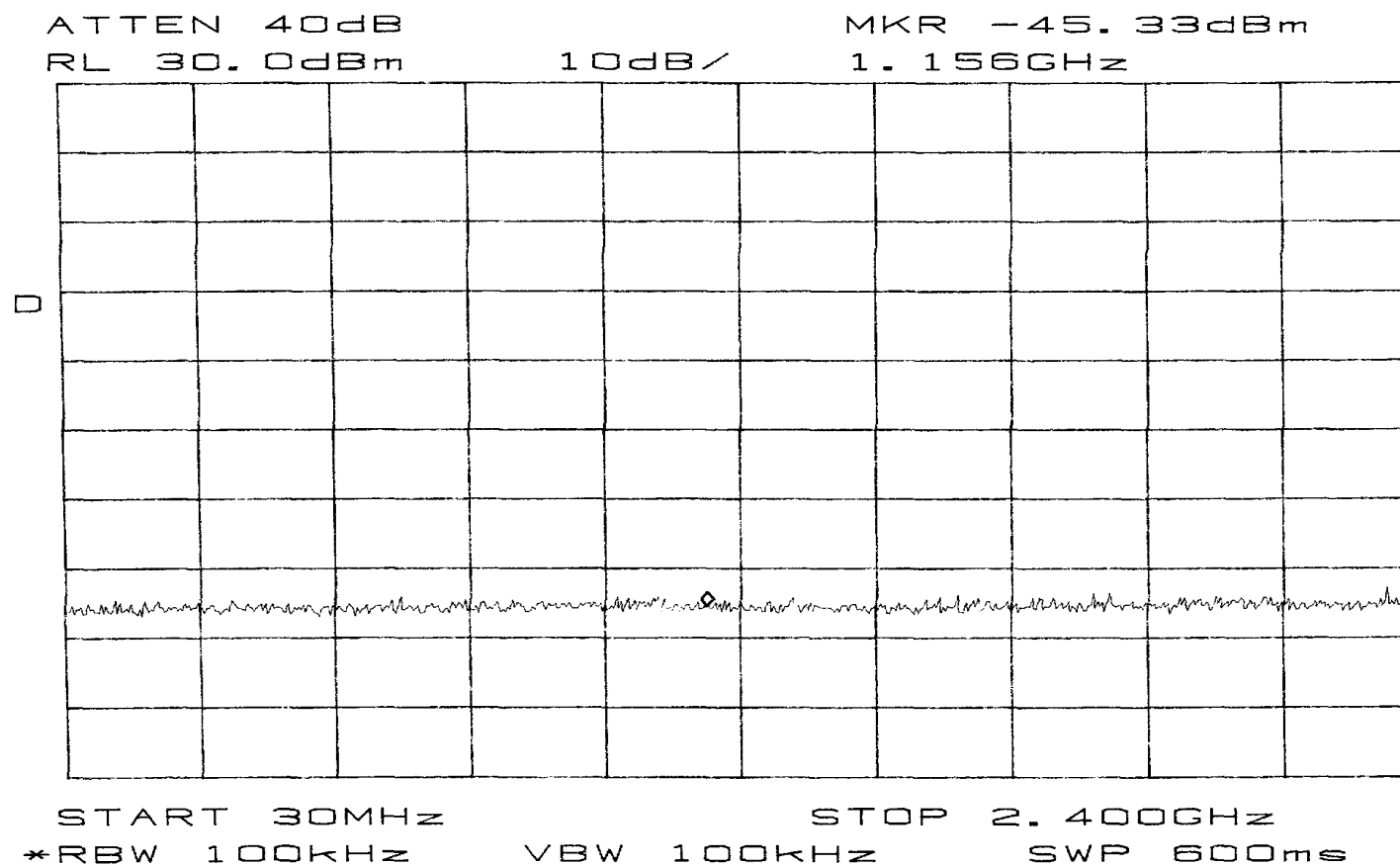
Power Out



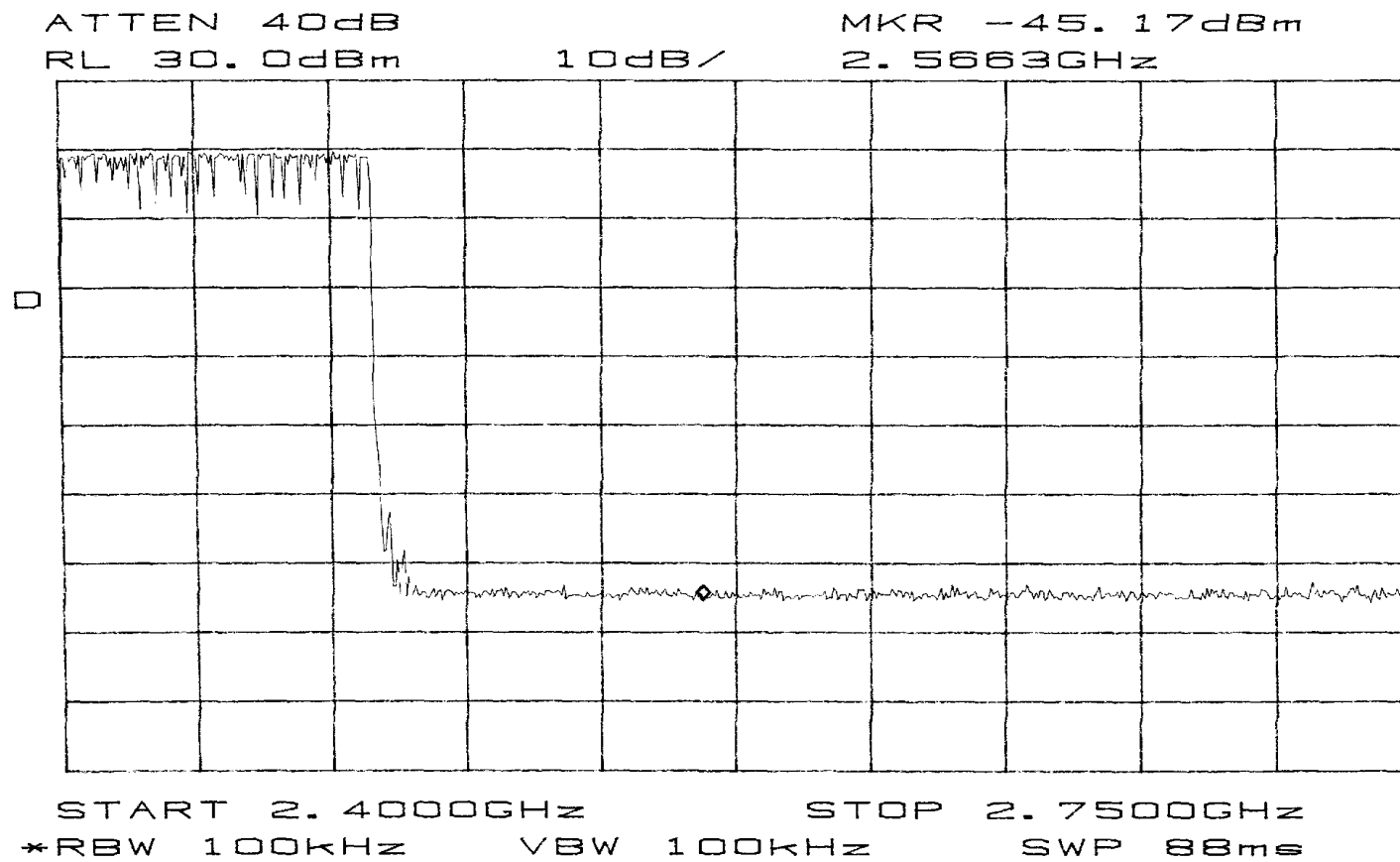
Out Of Band Emissions Band Edges



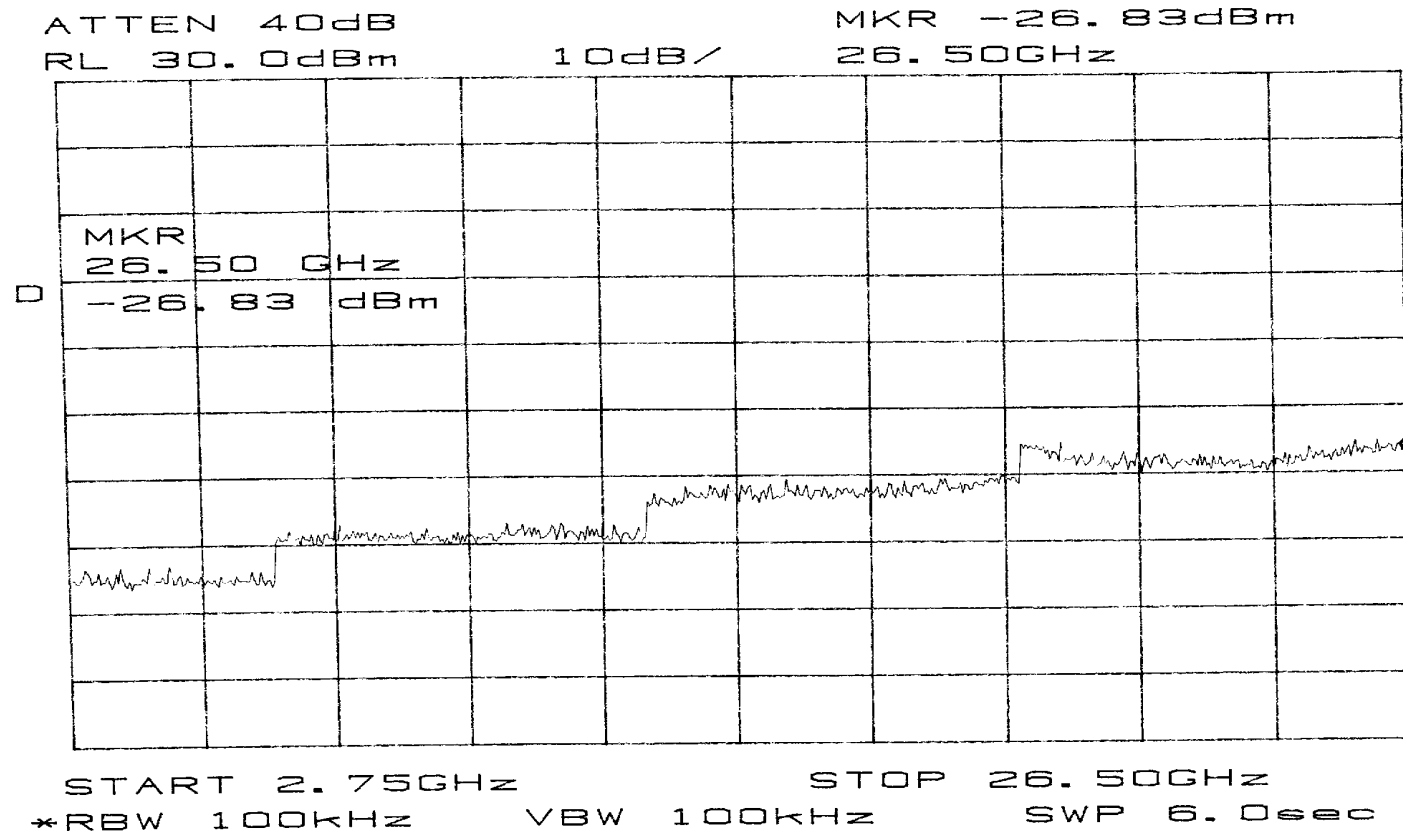
Out Of Band < 1 GHz



Out Of Band 1 - 2.75 GHz



Out of Band 2.75 – 26.5 GHz



APPENDIX B

ANTENNA DRAWINGS

NO ANTENNA DRAWINGS

APPENDIX C
RESTRICTED BAND DATA

FCC RADIATED DATA SHEET

EUT:	Wireless modem	DATE:	Jun 24 98
S/N:	Prototype	CUSTOMER NAME:	Proxim
RULE PART:	15.247	WORK ORDER:	8062401
		FILE:	8062401
ANTENNA:	Horn	OTHER CAL FACTORS:	ATTN dB: 0
MODULATION TYPE:			DUTY dB: 0
TESTED BY:	Shawn		HP IL dB: 0
COMMENTS:			DIST dB: 10

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	52.7	Pk	32.8	7.0	35.0	10.0	47.5	74.0	-26.5
4804	47.7	Avg	32.8	7.0	35.0	10.0	42.5	54.0	-11.5
9608	38.8	Pk	38.3	13.0	35.0	10.0	45.1	74.0	-28.9
9608	27.6	Avg	38.3	13.0	35.0	10.0	33.9	54.0	-20.1
12010	39.3	Pk	39.3	13.6	35.0	10.0	47.2	74.0	-26.9
12010	28.0	Avg	39.3	13.6	35.0	10.0	35.9	54.0	-18.2
Fund = 2440									
4880	48.2	Pk	32.8	7.0	35.0	10.0	43.0	74.0	-31.0
4880	41.8	Avg	32.8	7.0	35.0	10.0	36.6	54.0	-17.4
7320	50.2	Pk	36.0	10.6	35.0	10.0	51.8	74.0	-22.2
7320	34.0	Avg	36.0	10.6	35.0	10.0	35.6	54.0	-18.4
12200	39.3	Pk	39.3	13.6	35.0	10.0	47.2	74.0	-26.9
12200	27.8	Avg	39.3	13.6	35.0	10.0	35.7	54.0	-18.4
Fund = 2480									
4960	48.0	Pk	32.8	7.0	35.0	10.0	42.8	74.0	-31.2
4960	40.3	Avg	32.8	7.0	35.0	10.0	35.1	54.0	-18.9
7440	46.6	Pk	36.0	10.6	35.0	10.0	48.2	74.0	-25.8
7440	36.0	Avg	36.0	10.6	35.0	10.0	37.6	54.0	-16.4
12400	39.8	Pk	39.3	13.6	35.0	10.0	47.7	74.0	-26.4
12400	27.7	Avg	39.3	13.6	35.0	10.0	35.6	54.0	-18.5

APPENDIX D
15.207
CONDUCTED EMISSIONS

Electronic Compliance Laboratories, Inc.
1249 Birchwood Ave.
Sunnyvale, CA
Conducted Emissions
Frequency range: 450KHz-30MHz
Government Agency and Limit: FCC Class B

QP = Quasi-Peak Note: Ignore peak readings when Quasi-Peak reading exists
PK = Peak

Customer: proxim Operator: shawn
Date: 06-24-1998 Time: 09:45:07
Temperature Range: 70 Deg F Percent Humidity: 40
E.U.T.: Symphony Cordless Modem
Serial Number:
Support Devices:
Serial Number:
FCC ID:
Exercise Program:
Modifications: None
Report File Name: F:\TESTDATA\8062401.F

TEST FREQ	TEST dBuV	CLASS B LIMIT	VERSUS B LIMIT	CONDUCTOR	TYPE
=====	=====	=====	=====	=====	=====
0.541	41.8	48.0	-6.2	NEUTRAL	PK
0.837	35.4	48.0	-12.6	NEUTRAL	PK
1.770	19.5	48.0	-28.5	NEUTRAL	PK
4.647	14.2	48.0	-33.8	NEUTRAL	PK
9.940	14.7	48.0	-33.3	NEUTRAL	PK
17.310	19.2	48.0	-28.8	NEUTRAL	PK
21.440	21.1	48.0	-26.9	NEUTRAL	PK
28.630	15.1	48.0	-32.9	NEUTRAL	PK
10.130	17.7	48.0	-30.3	LINE	PK
17.310	17.6	48.0	-30.4	LINE	PK
21.440	18.5	48.0	-29.5	LINE	PK
28.600	14.0	48.0	-34.0	LINE	PK
0.484	43.2	48.0	-4.8	LINE	PK
0.916	35.6	48.0	-12.4	LINE	PK
2.532	17.9	48.0	-30.1	LINE	PK
4.659	13.5	48.0	-34.5	LINE	PK
0.484	39.0	48.0	-9.0	LINE	QP

(7) 09:53:33 JUN 24, 1998
8062401 ~~NEUTRAL~~ Line

SK

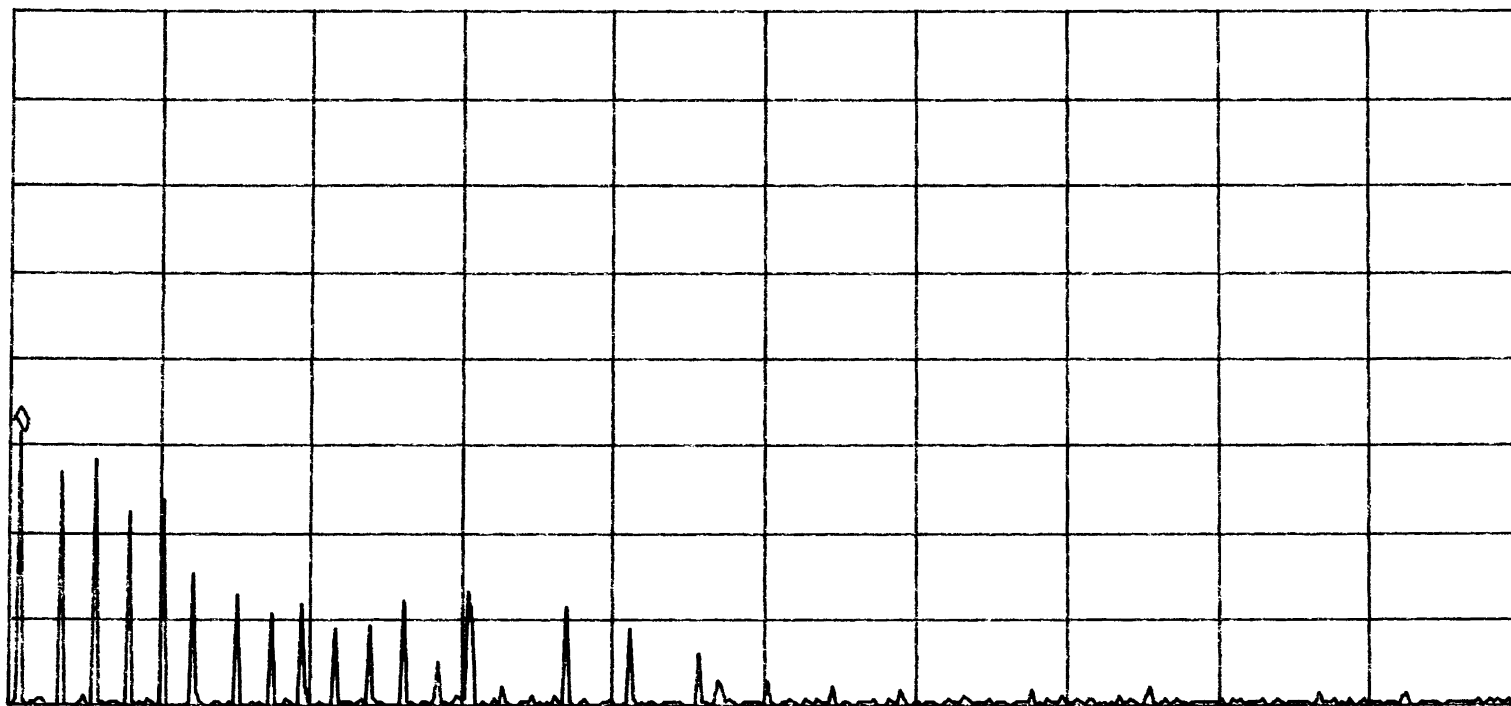
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 484 kHz
43.21 dB μ V

L00 REF 92.0 dB μ V

10
dB/
ATTN
10 dB

WA SB
SC FS
ACDAR

START 450 kHz STOP 5.000 MHz
IF BW 9.0 kHz AVG BW 30 kHz SWP 379 msec



09:47:41 JUN 24, 1998
0062401 ~~NEUTRAL~~ Line

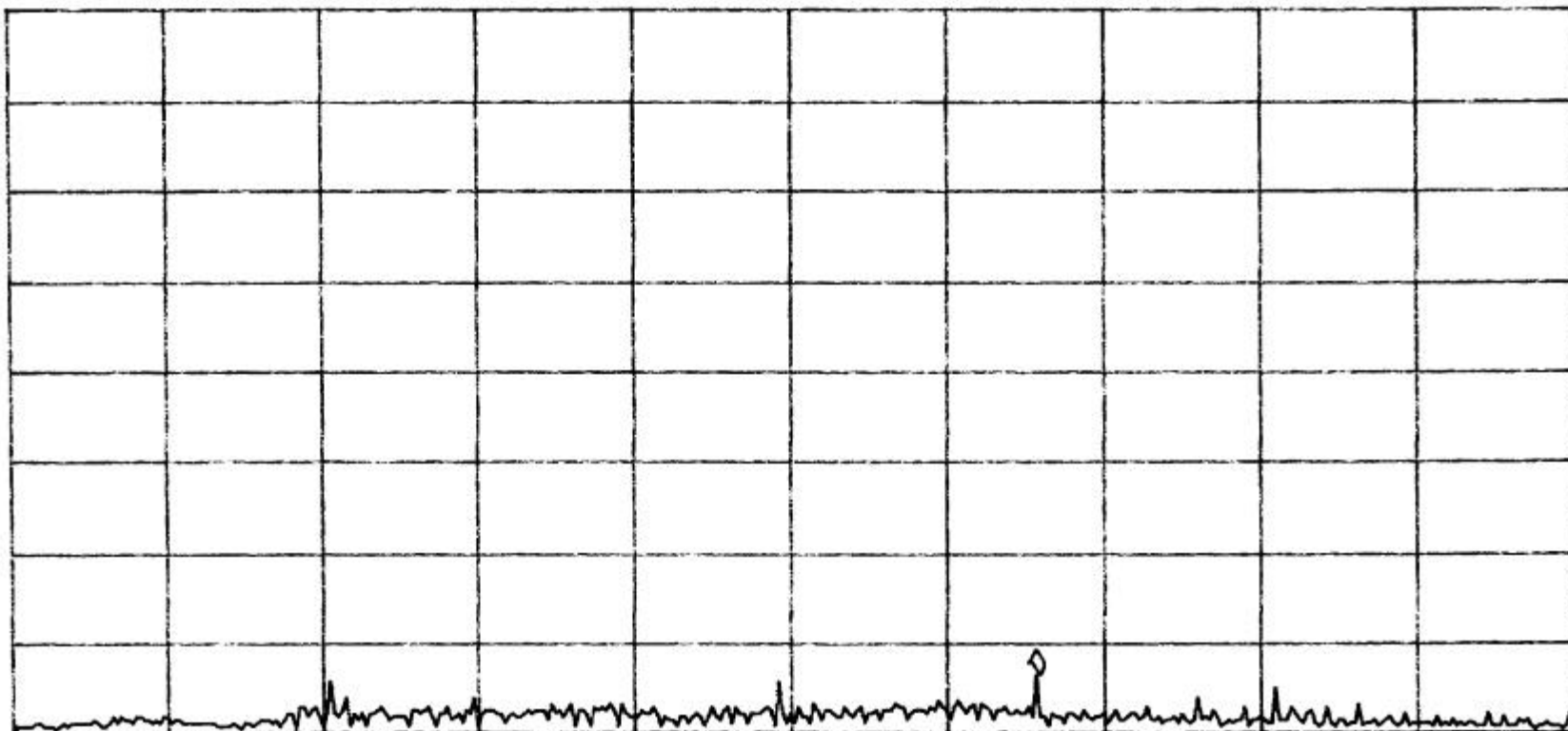
sk

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 21.44 MHz
18.52 dBμV

LDC REF 92.0 dBμV

10
dB/
ATN
10 dB

WA SB
SC FS
ACDRR



START 5.00 MHz

IF BW 9.0 kHz

AVG BW 30 kHz

STOP 30.00 MHz

SWP 2.00 sec

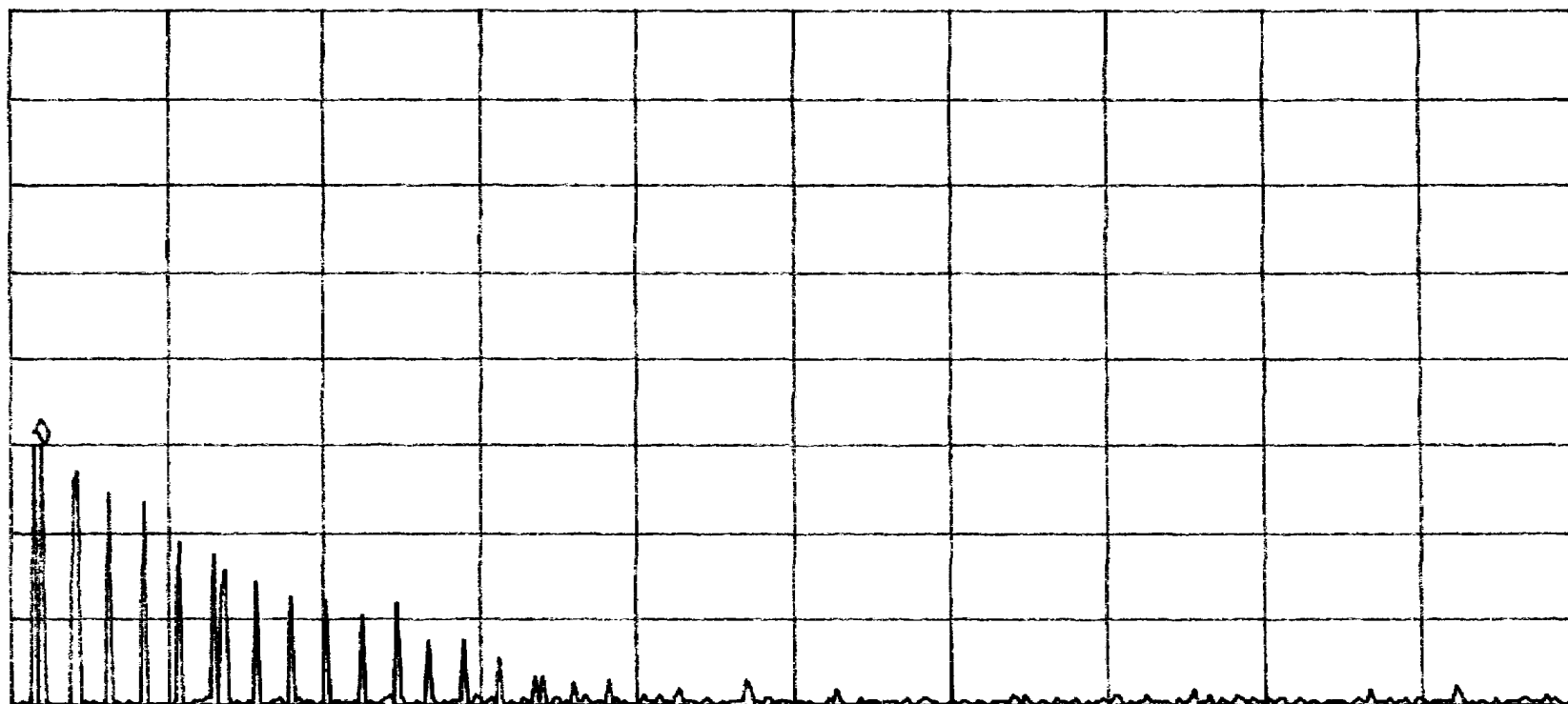
09:36:21 JUN 24, 1998
8062401 NEUTRAL

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 541 kHz
41.82 dB μ V

LDC REF 92.0 dB μ V

10
dB/
ATTN
10 dB

WA SB
SC FS
ACDRA



START 450 kHz

IF BW 9.0 kHz

AVG BW 30 kHz

STOP 5.000 MHz

SWP 379 msec

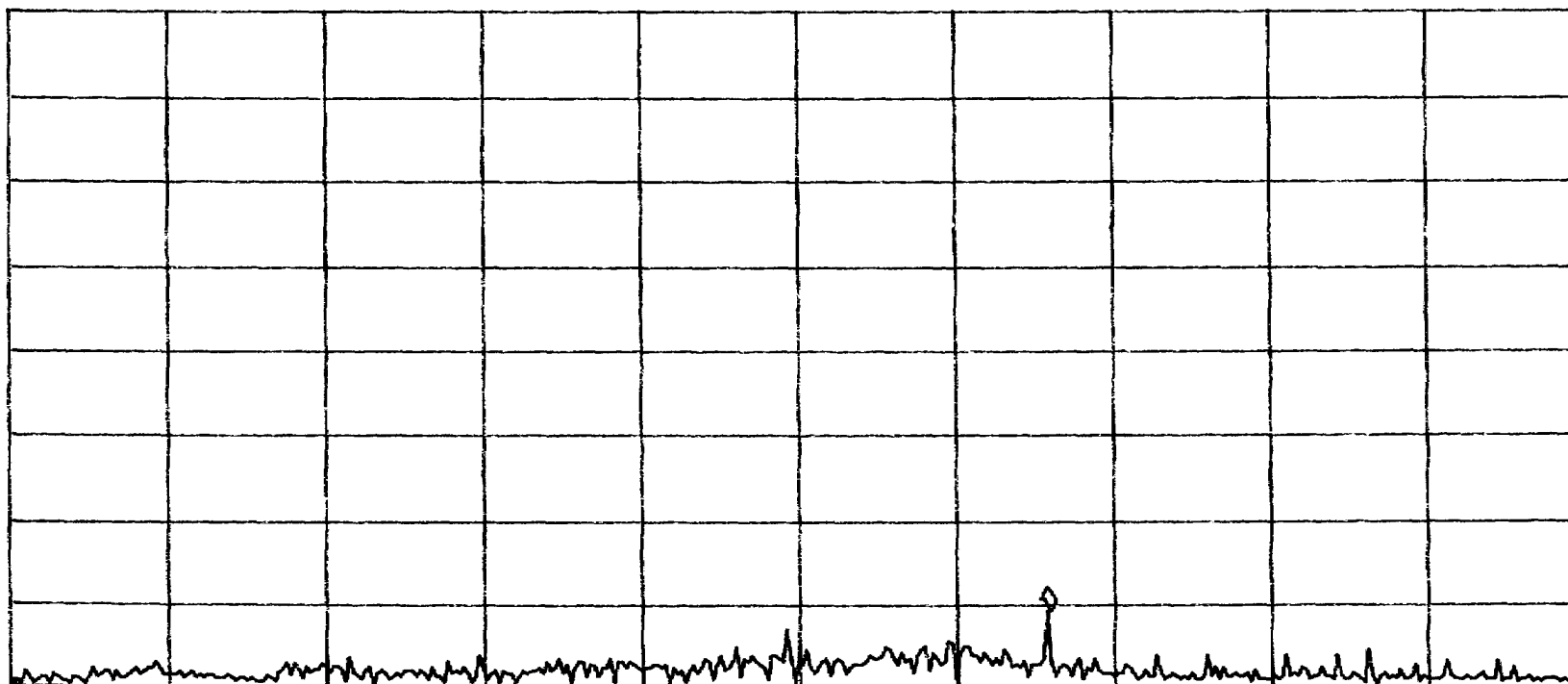
(75) 09:39:24 JUN 24, 1998
8062401 NEUTRAL

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKA 21.44 MHz
21.12 dB μ V

LDC REF 92.0 dB μ V

10
dB/
ATN
10 dB

WA SB
SC FS
ACDRA



START 5.00 MHz

IF BW 9.0 kHz

AVG BW 30 kHz

STOP 30.00 MHz

SWP 2.00 sec

APPENDIX E
15.209
RADIATED EMISSIONS

.....

Antenna Type: BICONICAL

32

APPENDIX F
SAMPLE LABEL

THIS DRAWING CONTAINS PROPRIETARY INFORMATION OF PROXIM AND MAY NOT BE REPRODUCED OR IN ANY MANNER BE REPRODUCED, DISCLOSED OR USED FOR MANUFACTURE OF ANY PART DESCRIBED HEREIN WITHOUT THE PRIOR WRITTEN PERMISSION OF PROXIM. AND IS NOT INTENDED FOR USE AS AN EXTERNAL DESIGN SPECIFICATION.				REVISION			
LTR	ECO	DATE	BY	APPR			
01	P141B	--	INITIAL RELEASE	BB			

TIMES NEW ROMAN FONT, BOLD, 7 pt.
TOP LINE ONLY

TIMES NEW ROMAN FONT, BOLD, 5 pt.
LINES 2 THROUGH 7

2.500
1.000

Symphony Cordless Modem
FCC ID: IMKILC/56K FCC Reg. No. IMKUSA-XXXXX-XX-X
Ringer Equivalence: 0.18 Regd. Conv. USDC-RJ11CC

Complies with FCC Rules Part 68 and with Part 15 of the FCC Rules
Operation is subject to the following two conditions:
(1) the device may not cause harmful interference, and (2) this device must accept
any interference received, including interference that may cause undesired operation.
Proxim Inc., Mountain View, CA 94043 Made in USA

PHYSICAL ADDRESS
00:20:A6:XX:XX:XX

PRODUCT SERIAL NUMBER
obppccoo-ywwxxxxx
zzzzzz-xxxx

NOTES: UNLESS OTHERWISE SPECIFIED

- 1 MATERIAL: .002" MATT SILVER MYLAR WITH ADHESIVE BACK.
- 2 ALL TEXT BLACK WITH SILVER BACKGROUND.
- 3 PHYSICAL ADDRESS NUMBER TO BE THE NODE ID NUMBER IDENTICAL TO OEM RADIO IN CORDLESS MODEM.
- 4 PRODUCT SERIAL NUMBER LABEL TEXT FORMAT:
"obppccoo" IS THE MARKETING PRODUCT NUMBER
a = BRANDED/OEM PRODUCT
b = FORM FACTOR
pp = PRODUCT VARIATION
cc = COUNTRY CODE
oo = OEM CODE
y = YEAR OF SHIPMENT
ww = WEEK OF SHIPMENT
xxxx = UNIQUE 5 DIGIT SERIAL NUMBER (1-99999),
RESETS TO 00001 EACH WEEK
zzzzzz = CUSTOMER SPECIFIED NUMBER
IF PROCEDURE 7335.0021 TABLE 1 CONTAINS A
CUSTOMER NUMBER FOR THE RESPECTIVE PRODUCT
MODEL NUMBER, PRINT THE CUSTOMER NUMBER ON
THE LABEL AS SHOWN, OTHERWISE LEAVE BLANK.

NOTES UNLESS SPECIFIED		DRAWN	BOB BEEDY	5-19-98	proxim	
TOLERANCES XX +/- ANGULAR XXX +/- .005 +/-		DESIGN	1			TITLE
FINISH		MATERIAL				LABEL, SYMPHONY CORDLESS MODEM
CHECKED AND APPROVED <i>chc</i>		SIZE		DWG NO.	REV.	
		B		2460.0740	01	
		SCALE		NONE	FILE NAME	24600740
				SHEET	1 OF 1	

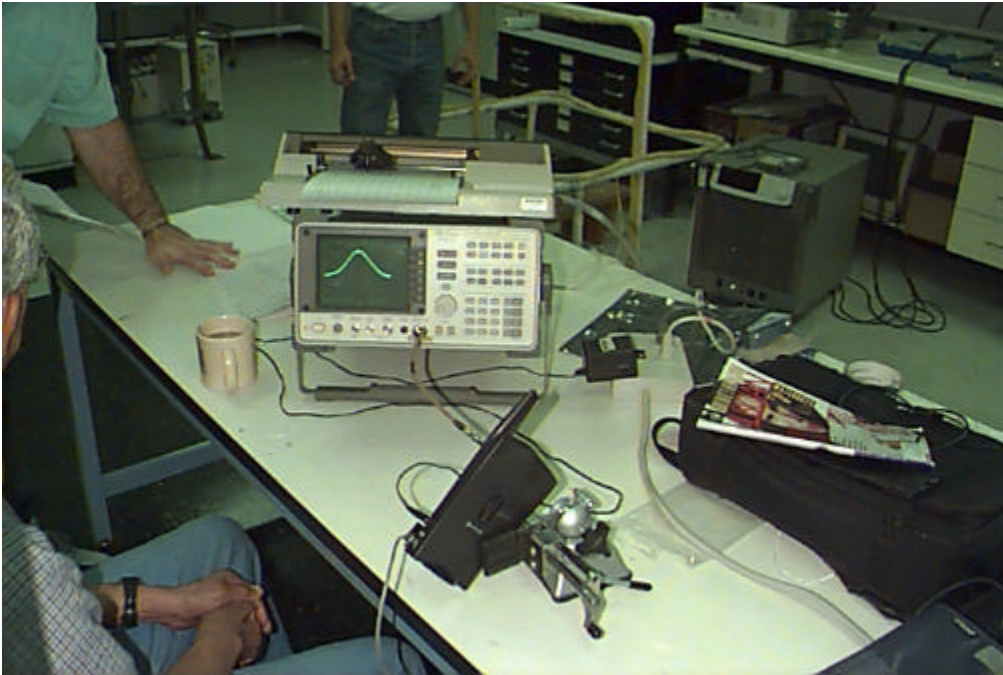
APPENDIX G
SET-UP PHOTOS



**FCC 15.207 Class B
Conducted Emissions**



**FCC 15.209 Class B
Radiated Emissions**



**FCC 15.247 RF Conducted Emissions
at Antenna Terminals**



FCC 15.205 Restricted Band

APPENDIX H
EUT PHOTOS

APPENDIX I
OWNERS MANUAL

Warranty Return Policy

If you have a problem with your RangeLAN2 product, please call Proxim Technical Support at 415/526-3640. Proxim Technical Support will assist with resolving any technical difficulties you may have with your Proxim product.

After calling Proxim Technical Support, if your product is found to be defective, you may return the product to Proxim after obtaining an RMA (Return Materials Authorization) number from Proxim Customer Service. The product must be returned in its original packaging. The RMA number should be clearly marked on the outside of the box. Proxim cannot be held responsible for any product returned without an RMA number, and no product will be accepted without an RMA number.

FCC WARNING

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ☐ Reorient or relocate the receiving antenna.
- ☐ Increase the separation between the equipment and the receiver.
- ☐ Connect the equipment into an outlet on a circuit different from that which the receiver is connected.
- ☐ Consult the dealer or an experienced radio/TV technician for help.

EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE

Statement of Compliance Information to User

This equipment has been tested and found to comply with the European Telecommunication Standard ETS 300.328. This standard covers Wideband Data Transmission Systems referred to in the CEPT recommendation T/R 10.01. This type of accepted equipment is designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

F. U.S. Specifications

The following technical specification is for reference purposes only. Actual product's performance and compliance with local telecommunications regulations may vary from country to country. Proxim, Inc. will only ship products that are type approved in the destination country.

Data Rate	1.6 Mbps
Media Access Protocol	CSMA/CA
Frequency Band	2.4-2.5 GHz Worldwide (Depends on country) (spread spectrum frequency hopping)
Output Power	100 mW
Operating Temperature	0 C to +40 C

APPENDIX J
CLIENT CONFIDENTIAL MATERIAL