

GENERAL INFORMATION

Part 2.948:

(a)(b) DESCRIPTION OF MEASUREMENT FACILITIES:
FILE: 31040/SIT

A description of the measurement facilities was filed with the Commission and was found to be in compliance with the requirements of Section 2.948, by letter dated March 3, 1997. All pertinent changes will be reported to the Commission by up-date prior to March 2000.

(b)(4): SUPPORTING STRUCTURES:

SKETCH - ATTACHED EXHIBITS

(b)(5)(6): TEST INSTRUMENTATION:

LIST - SEE EXHIBITS

2.925: IDENTIFICATION OF AN AUTHORIZED DEVICE:

DRAWING -- SEE EXHIBITS

LOCATION OF LABEL -- SEE PHOTOS

NAME AND ADDRESS OF APPLICANT:

Pinnacle Communications, Inc.
420 Fame Rd.
Dayton, Ohio 45449-2315

LIST OF GENERAL INFORMATION REQUIREDIN ACCORDANCE WITH FCC RULES AND REGULATIONS,
VOLUME II, PART 2 AND TO

15.247

Sub-part 2.1033(b)(1): NAME AND ADDRESS OF APPLICANT:Pinnacle Communications, Inc.
420 Fame Rd.
Dayton, Ohio 45449-2315VENDOR:

APPLICANT

(b)(2): FCC ID:

NSU EIPRTR

MODEL NO: PL2WEBK24

2.4 GHZ

ANTENNAS PARABOLIC AND OMNI

QUANTITY PRODUCTION PLANNED.(b)(4): TECHNICAL DESCRIPTION:

SEE ATTACHED EXHIBITS

TYPE OF EMISSION:

8M1X7D

FREQUENCY RANGE, MHz:

2412 to 2483

POWER RATING, Watts:

1

SWITCHABLE ____ ADJUSTABLE ____ N/A xMAXIMUM POWER RATING, Watts: 0.02SPREAD SPECTRUM METHOD= FREQUENCY HOPPING
DIRECT SEQUENCE
HYBRID_____
x
_____15.203: ANTENNA REQUIREMENTThe antenna is permanently attached to the E.U.T.
The antenna uses a unique coupling
The E.U.T. must be professionally installed
The antenna requirement does not applyx

Sub-part
2.1033(6):

TEST AND MEASUREMENT DATA

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2, Sub-part J, Sections 2.1031, 2.1033, 2.1035, 2.1041, 2.1043, 2.1045 and the following individual Parts:

- ___ 15.209 Radiated emission limits; general requirements
- ___ 15.211 Tunnel radio systems
- ___ 15.213 Cable locating equipment
- ___ 15.214 Cordless telephones
- ___ 15.217 Operation in the band 160-190 kHz
- ___ 15.219 Operation in the band 510-1705 kHz
- ___ 15.221 Operation in the band 525-1705 kHz (leaky coax)
- ___ 15.223 Operation in the band 1.705-10 MHz
- ___ 15.225 Operation in the band 13.553-13.567 MHz
- ___ 15.227 Operation in the band 26-27.28 MHz (remote control)
- ___ 15.229 Operation in the band 40.66-40.70 MHz
- ___ 15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz
- ___ 15.233 Operation within the bands 43.71-44.49, 46.60-46.98 MHz, 48.75-49.51 MHz and 49.66-50.0 MHz
- ___ 15.235 Operation within the band 49.82-49.90 MHz
- ___ 15.237 Operation in the bands 72.0-73.0 MHz, 74.6-74.8 MHz and 75.2-76.0 MHz (auditory assistance)
- ___ 15.239 Operation in the band 88-108 MHz
- ___ 15.241 Operation in the band 174-216 MHz (biomedical)
- ___ 15.243 Operation in the band 890-940 MHz (materials)
- ___ 15.245 Operation within the bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz, and 24075-24175 MHz (field disturbance sensors)
- x 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz (spread spectrum)
- ___ 15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz
- ___ 15.251 Operation within the bands 2.9-3.26 GHz, 3.267-3.332 GHz, 3.339-3.3458 GHz, and 3.358-3.6 GHz (vehicle identification systems)
- ___ 15.321 Specific requirements for asynchronous devices operating in the 1910-1920 MHz and 2390-2400 MHz bands (Unlicensed PCS)
- ___ 15.323 Specific requirements for isochronous devices operating in the 1920-1930 MHz sub-band (Unlicensed PCS)

PAGE NO. 6. NSU EIPRTR

NAME OF TEST: MAXIMUM PEAK OUTPUT POWER

PARAGRAPH: 15.247(b)

TEST CONDITIONS: S. T. & H.

SPEC. LIMIT: ≤ 1 Watt peak (0.25 if < 50 hopping channels)

TEST EQUIPMENT: ATTACHED

MEASUREMENT DATA

ANTENNA GAIN, dBi =

PEAK OUTPUT POWER, Watts =

WORST CASE
FOR ALL CHANNELS

TUNED, MHz	EMISSION, MHz	METER, dBuV	C.F., dB	$\mu\text{V/m}$ @ 3m	ERP, Watts
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RADIATED:

PARABOLIC:

2412.000	2413.38	50.2	35.6	19543	0.0001
2442.000	2443.75	58.2	35.7	49374	0.0004
2462.000	2463.38	54.2	35.8	31441	0.0002

OMNI:

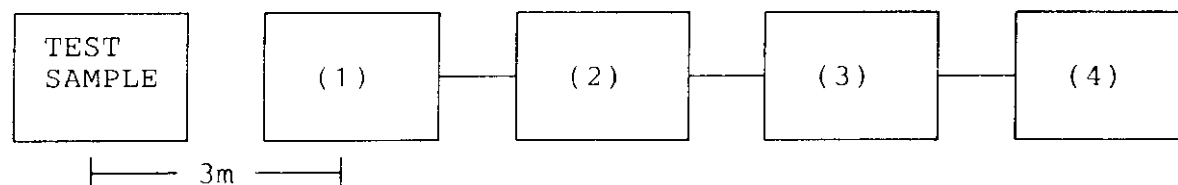
2412.000	2413.88	65.4	35.6	112202	0.0023
2442.000	2443.75	69.7	35.7	186853	0.0064
2462.000	2463.75	66.3	35.8	126765	0.0029

Sample Calculation:

$$P_{ERP} = (E_V \times R_M)^2 / 49.2 = (186853 \times 3)^2 / 49.2 = 0.0064 \text{ Watts}$$

SUPERVISED BY:

M. J. F. Eng.
MORTON FLOM, P. Eng.

TRANSMITTER RADIATED MEASUREMENTS(1) TRANSDUCER

EMCO 3115	<u>x</u>
APELCO 2001 LOG PERIODIC	<u>x</u>
_____	_____

(2) HIGH PASS FILTER

NARDA μ FAD (IN-BAND ONLY)	<u>x</u>
TRILITHIC (OUT-OF-BAND ONLY)	<u>x</u>
_____	_____

(3) PREAMP

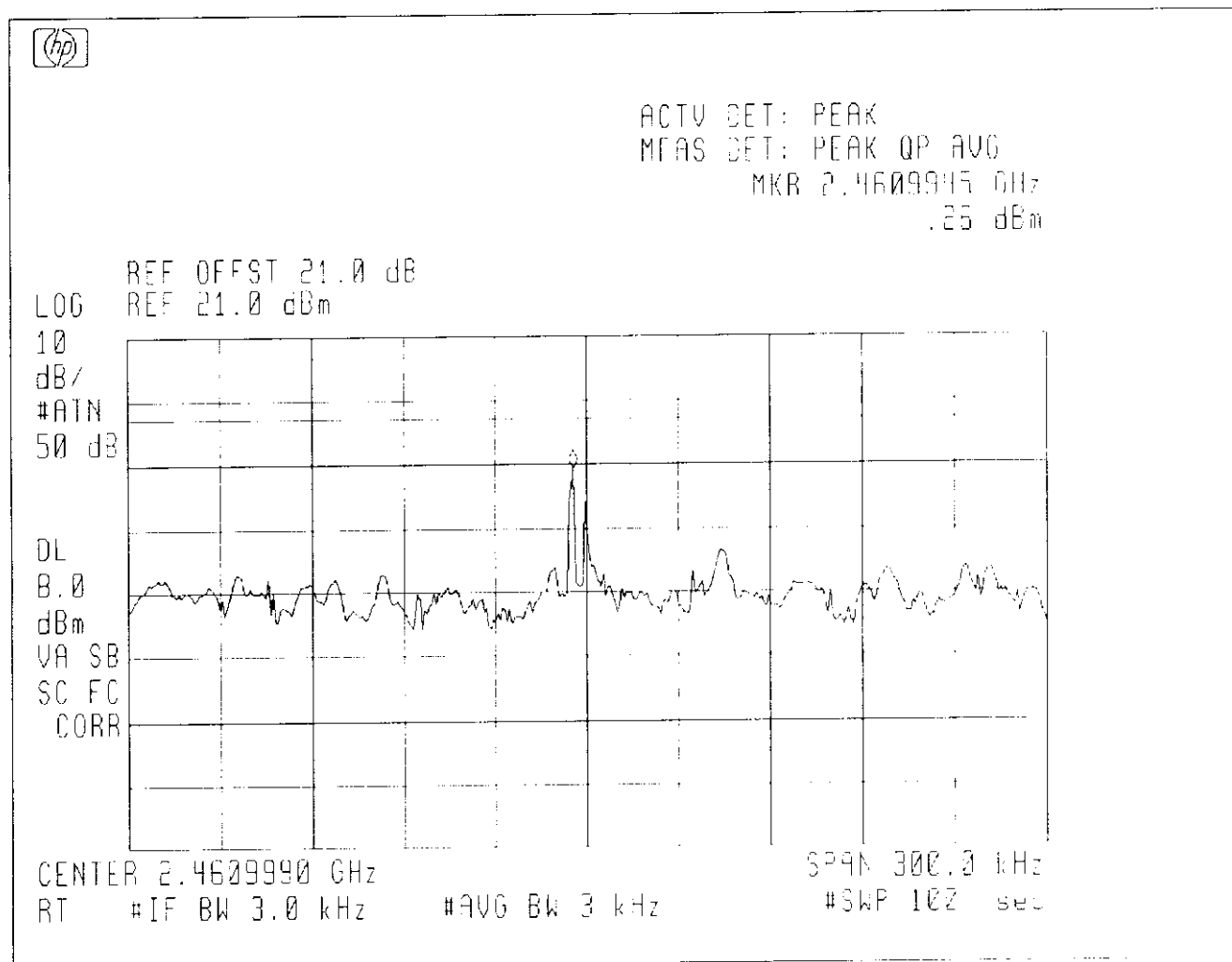
HP 8449 (+30 dB)	<u>x</u>
(OUT-OF-BAND ONLY)	
_____	_____

(4) SPECTRUM ANALYZER

HP 8566B	<u>x</u>
HP 8558B	_____
HP 8557A	_____
HP 8563E	<u>x</u>
_____	_____

PINNACLE, 2.4 GHZ WITH POWER AMP, ANTENNAS PARABO
1998-JUL-08, 16:16, WED

1998-JUL-08, 16:16, WED



PAGE NO. 8. NSU EIPRTR

NAME OF TEST: OUT OF BAND EMISSIONS

PARAGRAPH: 15.247(c), 15.209(a)

TEST CONDITIONS: STANDARD TEMPERATURE AND HUMIDITY

SPEC. LIMIT: SEE BELOW

TEST EQUIPMENT: AS PER PREVIOUS PAGE

SEARCH ANTENNAS: 10 kHz - 32 MHz: LOOP 94593-1
 32 MHz - 1 GHz: SINGER DM105, T₁T₂T₃
 1 GHz - 18 GHz: EMCO 3115

LIMIT

In any 100 kHz bandwidth outside these frequency bands, radio frequency power that is produced by the modulation products of the spreading sequence, information sequence, and the carrier frequency shall be either
 at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power

or

shall not exceed the general levels specified in 15.209(a), whichever results in the lesser attenuation. All other emissions outside these bands shall not exceed the general radiated emission limits specified in 15.209(a).

MEASUREMENT PROCEDURE:

At first, bench tests were performed to locate the emissions at the antenna terminals.

In the field, tests were conducted over the range shown. The test sample was set up on a wooden turntable above ground, and at a distance of three meters from the antenna connected to the spectrum analyzer.

In order to obtain the maximum response at each frequency, the turntable was rotated, and the search antenna was raised and lowered. The E.U.T. was also adjusted for maximum response.

The field strength was calculated from:

$$E \text{ } \mu\text{V/m @ 3 m} = \text{LOG}_{10}^{-1} \left(\frac{\text{dBm} + 107 + \text{A.F.} + \text{C.L.}}{20} \right)$$

The following results are worst case conditions. Tests were conducted in Horizontal & Vertical polarization modes.

MEASUREMENT RESULTS: ATTACHED

PAGE NO. 9.1.
 RADIATED EMISSIONS TX1
 1998-FEB-20, 13:51, FRI PARABOLIC

NSU EIPRTR

TUNED, MHz	EMISSION, MHz	PEAK /AVE	METER, dBuV	C.F., dB	$\mu\text{V/m}$ @ 3m
2412.000	2363.75	A	-2.4	35.4	44
2412.000	2364.00	P	-0.3	35.4	57
2412.000	2368.75	A	-2.3	35.4	45
2412.000	2370.25	P	1.3	35.4	68
2412.000	2373.75	A	-2.6	35.4	44
2412.000	2377.63	P	1.6	35.4	71
2412.000	2378.75	A	-2.5	35.4	44
2412.000	2383.50	P	3.3	35.5	87
2412.000	2383.75	A	-2.4	35.5	45
2412.000	2390.00	A	-2.4	35.5	45
2412.000	2390.00	P	0.4	35.5	63
2462.000	2483.50	A	-0.4	35.9	59
2462.000	2483.50	P	3.1	35.9	89
2462.000	2487.38	A	2.0	35.9	78
2462.000	2487.75	P	5.2	35.9	114
2462.000	2490.75	P	1.0	35.9	70
2462.000	2491.00	A	-1.5	35.9	52
2462.000	2496.00	A	-2.2	35.9	48
2462.000	2496.75	P	1.4	35.9	73
2462.000	2501.13	A	-2.4	36.0	48
2462.000	2501.88	P	1.7	36.0	77
2462.000	2505.75	P	1.7	36.0	76
2462.000	2506.13	A	-2.6	36.0	47
2462.000	2510.75	P	0.1	36.0	64
2462.000	2511.00	A	-2.6	36.0	47
2412.000	4824.00	P	7.5	43.3	347
2412.000	4824.00	A	-3.8	43.3	94
2442.000	4884.00	A	29.5	13.5	142
2442.000	4884.00	P	38.7	13.5	407
2462.000	4924.00	A	-2.4	43.7	116
2462.000	4924.00	P	7.7	43.7	371
2412.000	7236.00	P	37.8	19.2	712
2412.000	7236.00	A	29.0	19.2	258
2442.000	7326.00	P	38.3	19.5	778
2442.000	7326.00	A	29.7	19.5	287
2462.000	7386.00	P	38.3	19.1	746
2462.000	7386.00	A	30.2	19.1	292
2412.000	9648.00	A	30.0	22.9	443
2412.000	9648.00	P	40.8	22.9	1542
2442.000	9768.00	A	30.7	23.1	488
2442.000	9768.00	P	39.8	23.1	1400

PAGE 9.2.

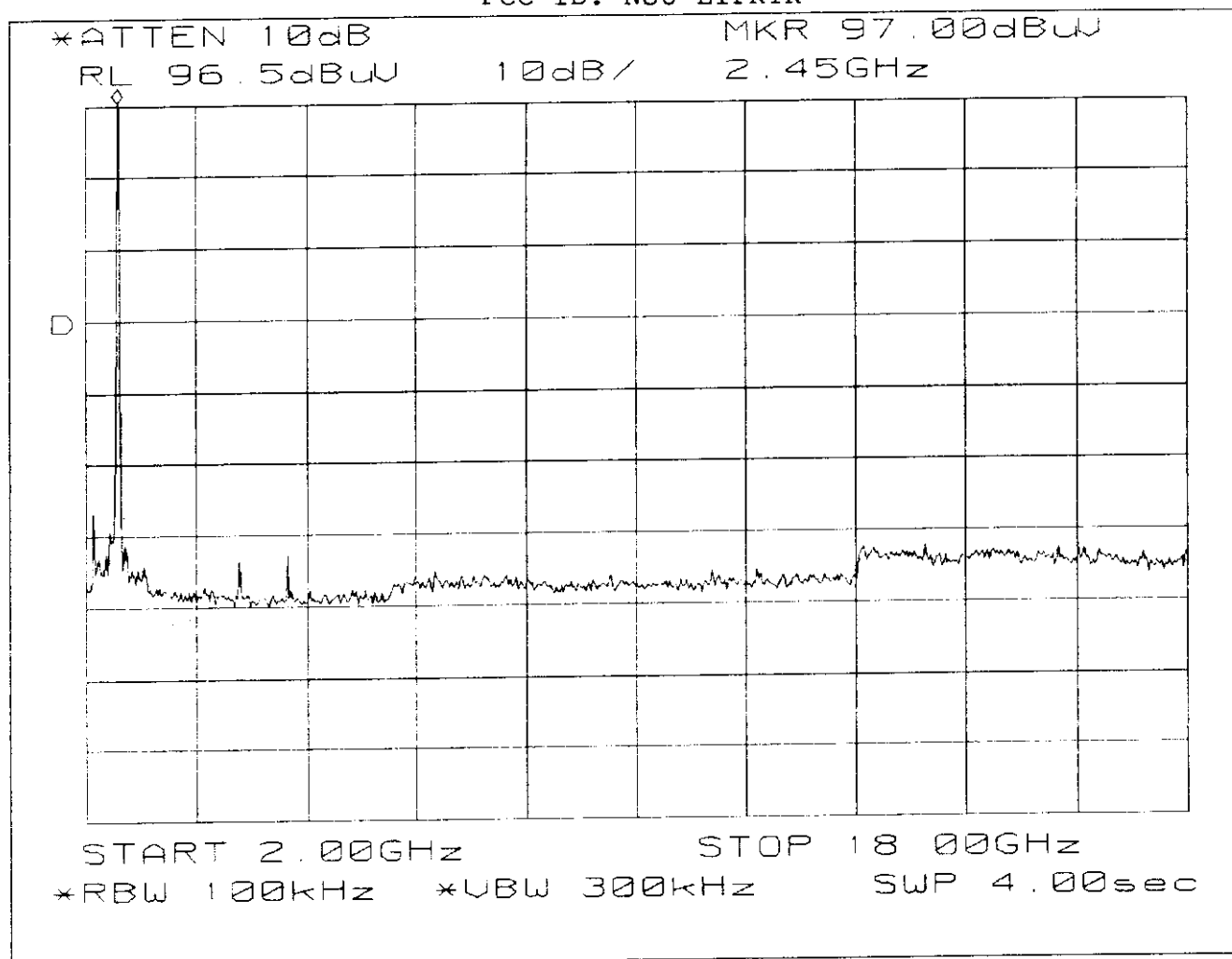
EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR

1998-FEB-20, 16:28, FRI

SPURIOUS EMISSIONS

FCC ID: NSU EIPRTR



LIMITS PER RULE 15.247(c): 20db below highest level

PARABOLIC ANTENNA: 2442 MHz:

HIGHEST LEVEL, fc

= 49,374 uV/M 2 3 M
= -13 dbm approx.

20db below

= -33 dbm
= 5,000 uV approx.

PAGE NO. 9.3.
 RADIATED EMISSIONS TX1
 1998-FEB-20, 09:22, FRI OMNI

NSU EIPRTR

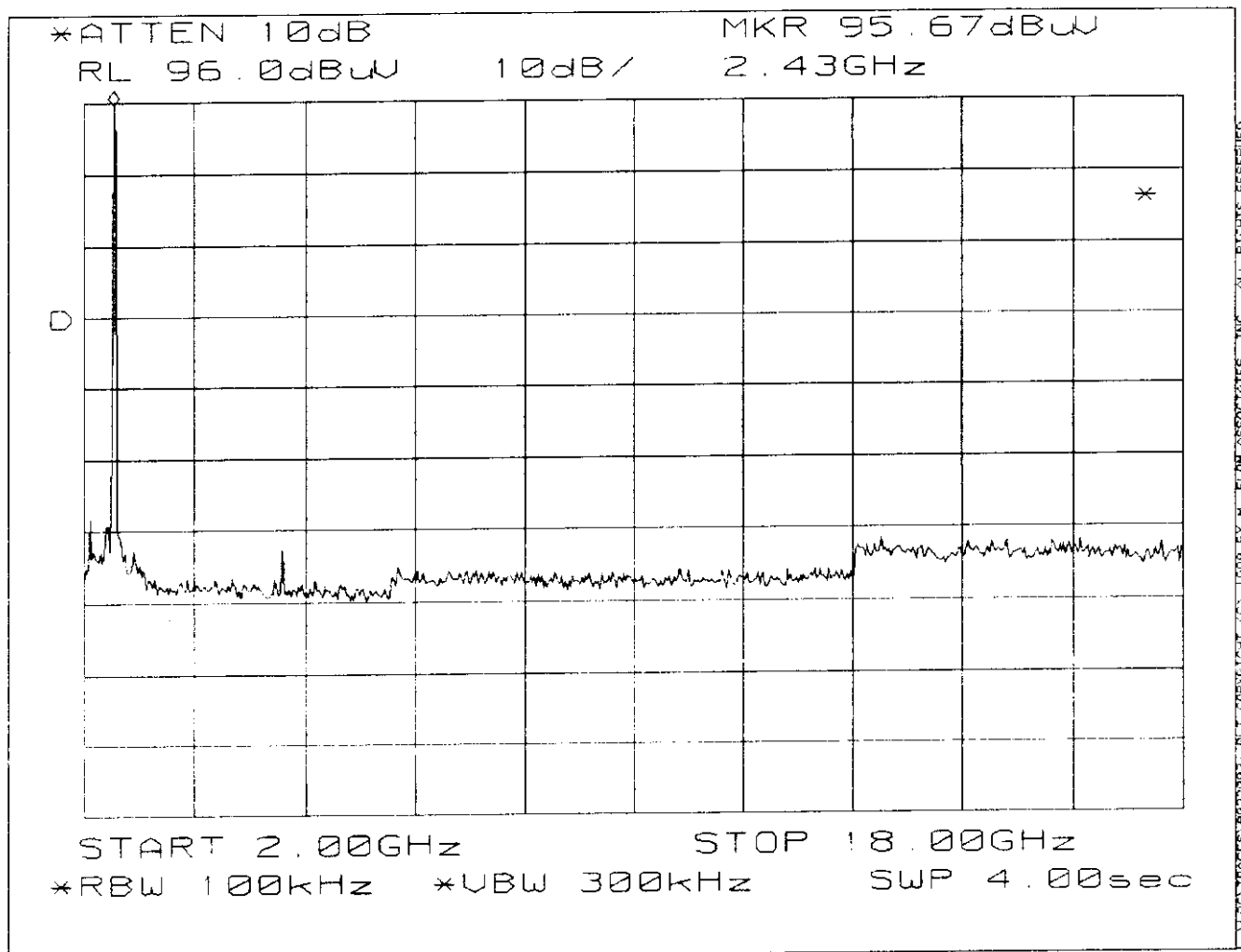
TUNED, MHz	EMISSION, MHz	PEAK /AVE	METER, dBuV	C.F., dB	$\mu\text{V/m}$ @ 3m
2412.000	2364.00	A	7.9	35.4	146
2412.000	2364.13	P	8.6	35.4	158
2412.000	2368.00	P	9.2	35.4	169
2412.000	2369.00	A	7.9	35.4	146
2412.000	2372.38	P	9.8	35.4	183
2412.000	2374.00	A	7.9	35.4	147
2412.000	2377.00	P	11.0	35.4	209
2412.000	2379.00	A	8.2	35.4	152
2412.000	2383.75	A	9.1	35.5	169
2412.000	2384.13	P	9.6	35.5	179
2412.000	2386.63	A	11.9	35.5	233
2412.000	2387.50	P	12.4	35.5	246
2412.000	2390.00	P	7.6	35.5	143
2412.000	2390.00	A	9.9	35.5	186
2462.000	2483.50	P	11.2	35.9	225
2462.000	2483.50	A	9.0	35.9	176
2462.000	2486.88	A	10.1	35.9	200
2462.000	2486.88	P	13.2	35.9	284
2462.000	2489.13	P	12.4	35.9	260
2462.000	2490.63	A	8.6	35.9	168
2462.000	2493.13	P	11.6	35.9	239
2462.000	2495.25	A	8.0	35.9	157
2462.000	2500.13	A	7.9	36.0	155
2462.000	2501.63	P	11.6	36.0	239
2462.000	2505.38	A	7.9	36.0	155
2462.000	2505.38	P	11.7	36.0	243
2462.000	2510.13	A	7.9	36.0	156
2462.000	2510.25	P	10.9	36.0	221
2412.000	4820.00	P	6.9	43.3	321
2412.000	4820.00	A	-2.8	43.3	106
2412.000	4824.00	A	32.2	13.3	187
2442.000	4884.00	P	42.7	12.9	600
2442.000	4884.00	P	1.9	42.9	173
2462.000	4924.00	A	4.6	43.7	258
2462.000	4924.00	A P	12.9	43.7	674
2412.000	7236.00	P	41.8	19.2	1128
2412.000	7236.00	A	32.7	19.2	393
2442.000	7326.00	A	32.8	19.0	388
2442.000	7326.00	P	41.7	19.0	1074
2462.000	7386.00	A	33.2	19.7	439
2462.000	7386.00	P	36.2	19.7	619

PAGE 9.4.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR
1998-FEB-20, 16:32, FRI

FCC ID: NSU EIPRTR



LIMITS: Rule 15.247(c): 20db below highest level

OMNI ANTENNA, 2442 MHz:

Highest level, Fc = 186,853 uV/M @ 3 m
= $-1\frac{1}{2}$ dbm approx.

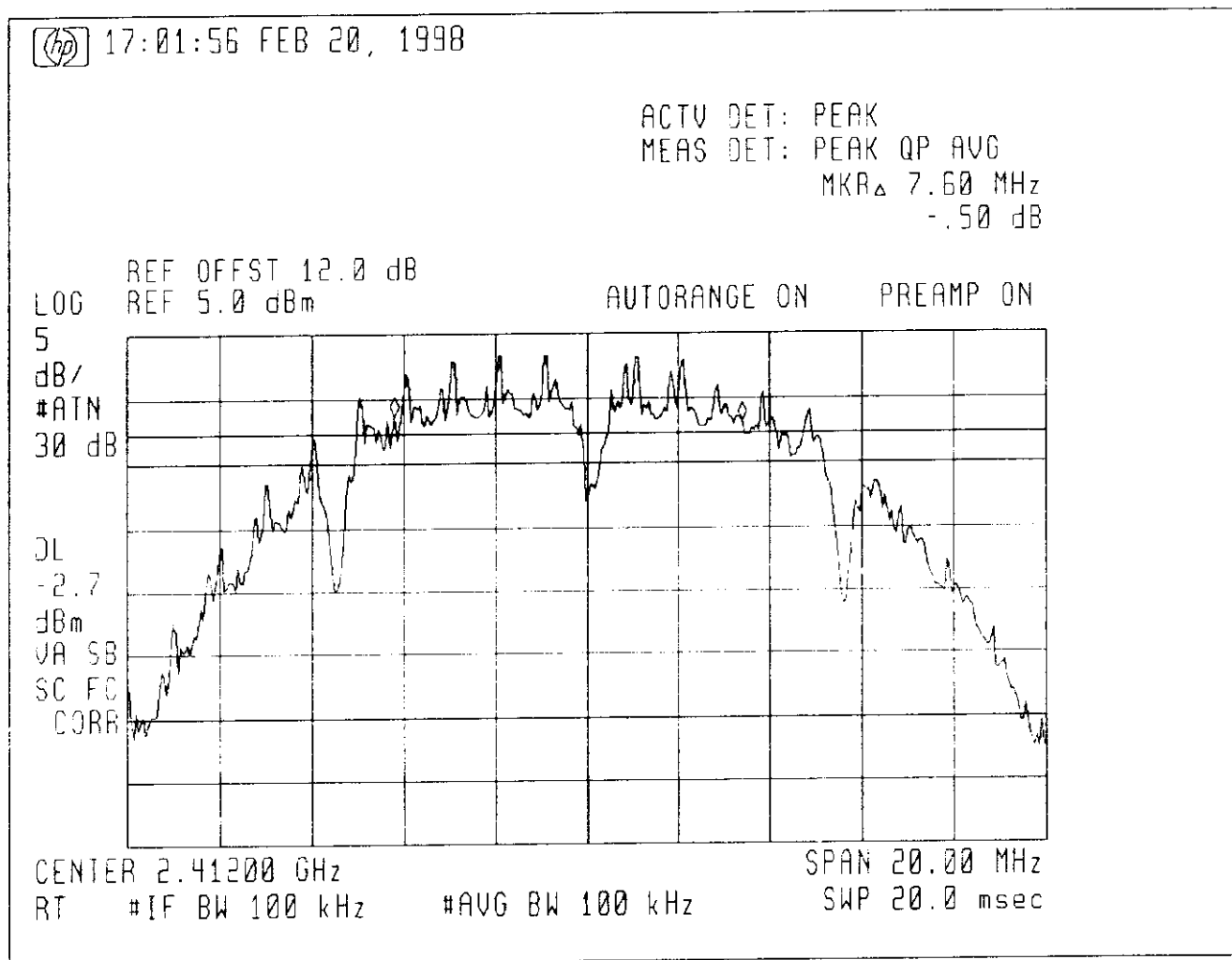
20db below = $-21\frac{1}{2}$ dbm
= 19,000 uV.M @ 3 m

PAGE 15.2.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR
1998-FEB-20, 16:59, FRI

6 dB BANDWIDTH



PAGE 15.3.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR

1998-FEB-20, 16:51, FRI

6 dB BANDWIDTH

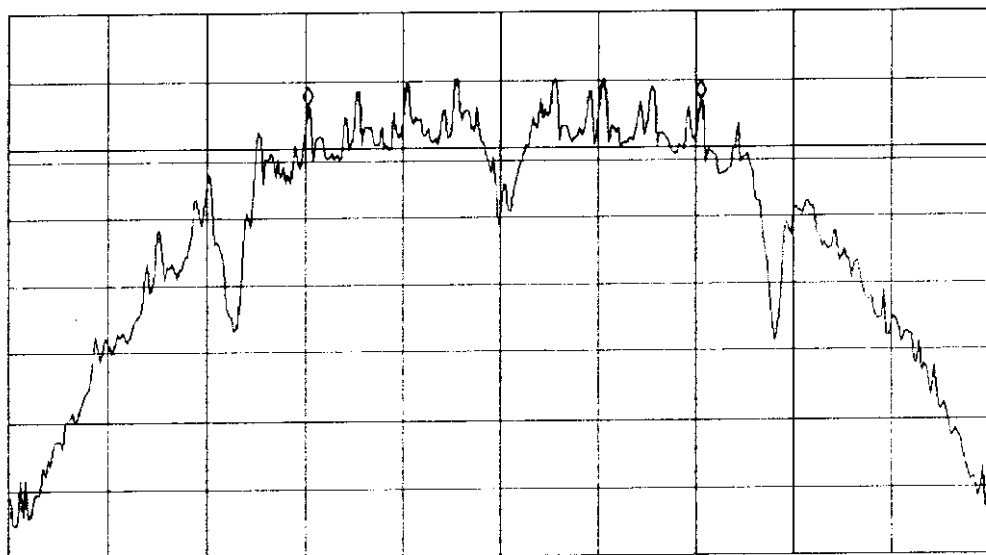
(hp) 16:53:02 FEB 20, 1998

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 8.05 MHz
.34 dB

LOG REF OFFST 12.0 dB
REF 5.0 dBm

AUTORANGE ON PREAMP ON

5
dB/
#ATN
30 dB
DL
6.2
dBm
VA SB
SC FC
CORR



CENTER 2.46200 GHz SPAN 20.00 MHz
RT #IF BW 100 kHz #AVG BW 100 kHz SWP 20.0 msec

PAGE NO.

16.

NSU EIPRTR

NAME OF TEST:

SPREAD SPECTRUM TECHNOLOGY
DIRECT SEQUENCE SYSTEMS

15.247(a)(2) Minimum 6 dB Bandwidth

RESULTS: Please see results for "Allowed Occupied Bandwidth."

15.247(d) Transmitted Power Density

LIMIT: The transmitted power density peak over any 1 second interval shall not be greater than 8 dBm in any 3 kHz bandwidth within these bands.

RESULTS: Please see attached plots.

15.247(e) Processing Gain

LIMIT: The processing gain shall ≥ 10 dB

RESULTS: See reference FCC ID IMR24HAT

Pseudorandom Sequence Description

RESULTS: See reference FCC ID IMR24HAT

Chip Rate

RESULTS: See reference FCC ID IMR24HAT

SUPERVISED BY:


MORTON FLOM, P. Eng.

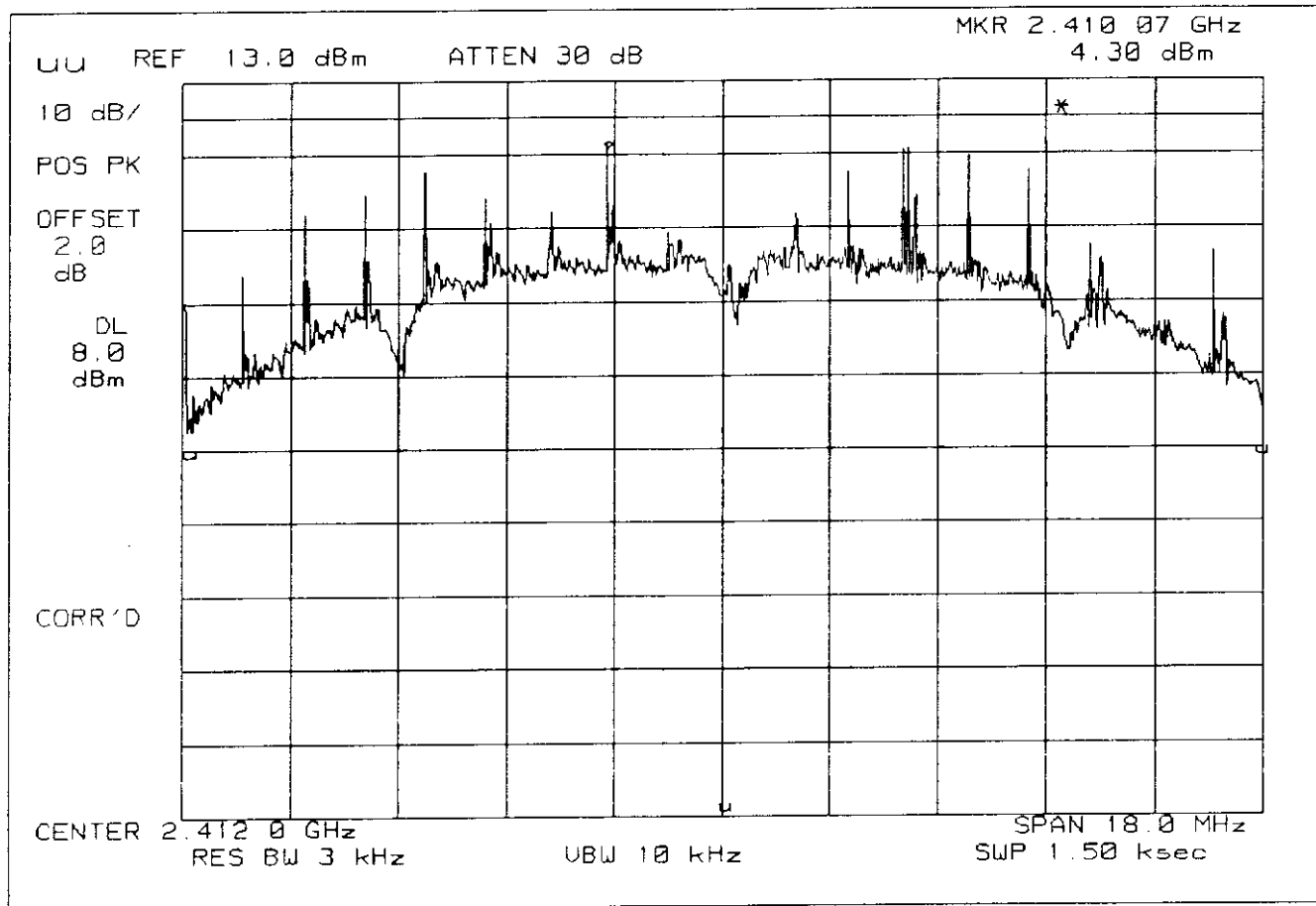
PAGE 17.1.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR

1998-FEB-21, 13:06, SAT

POWER DENSITY



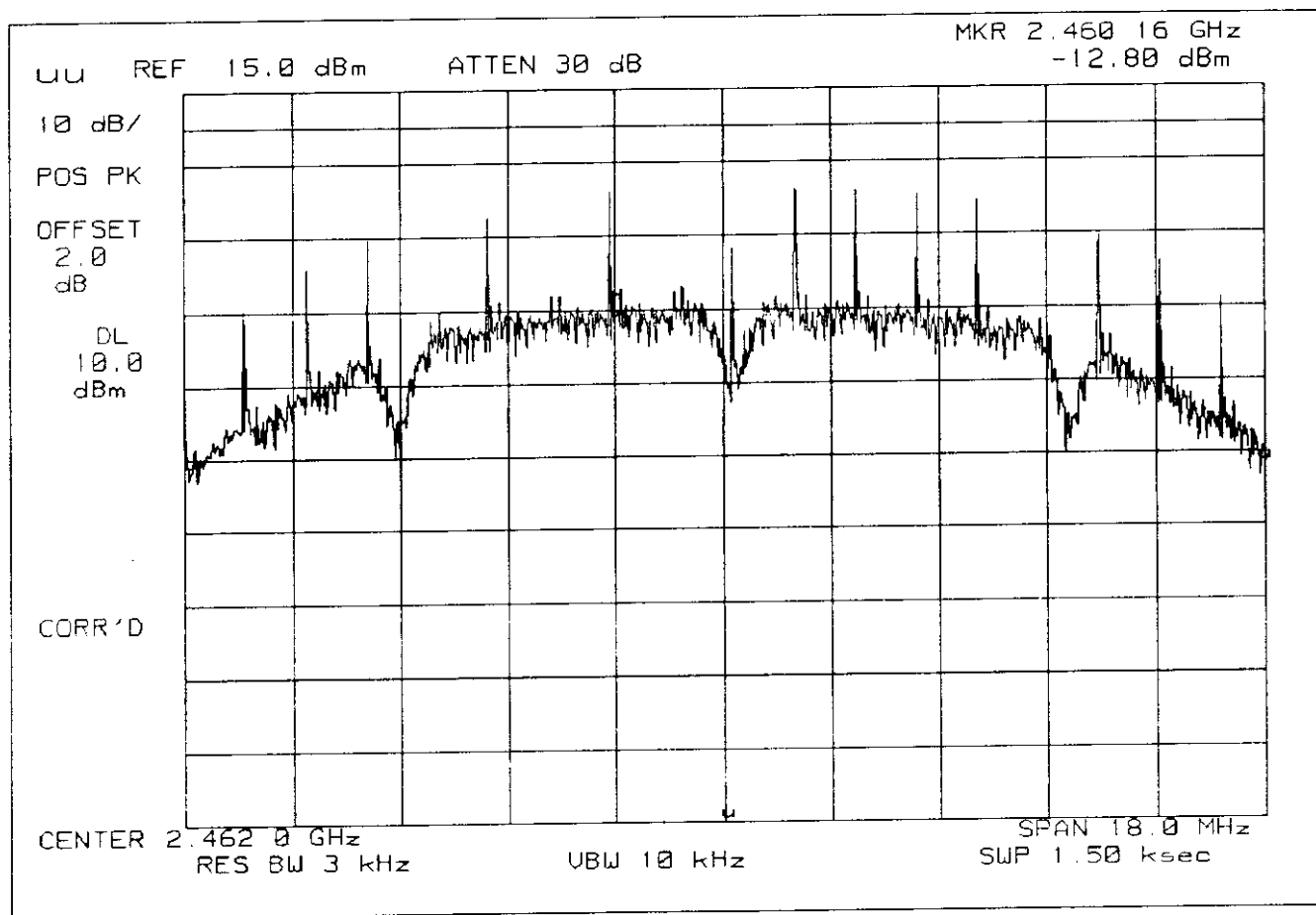
PAGE 17.2.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR

1998-FEB-21 14:26, SAT

POWER DENSITY



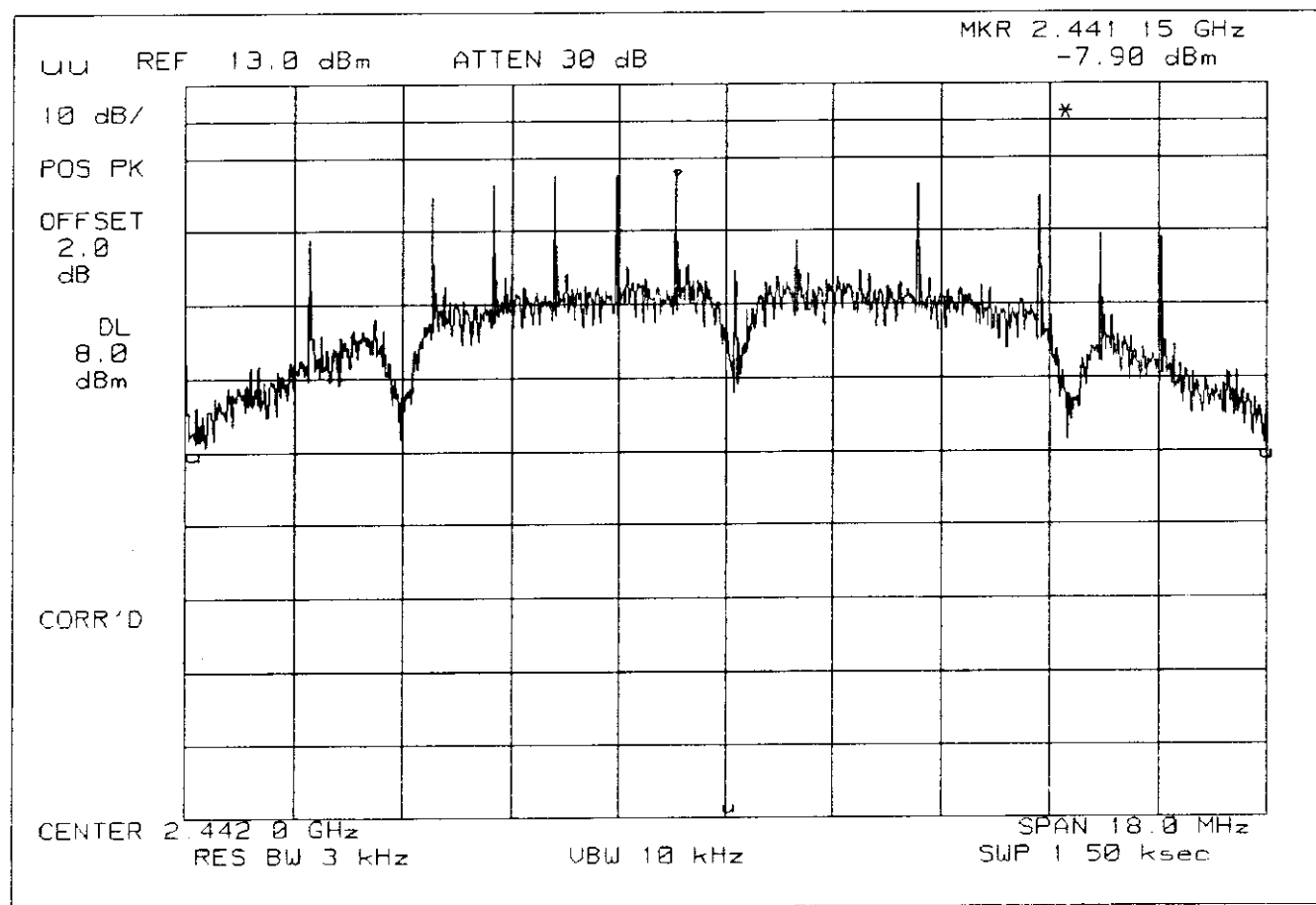
PAGE 17.3.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR

1998-FEB-21, 15:15, SAT

POWER DENSITY



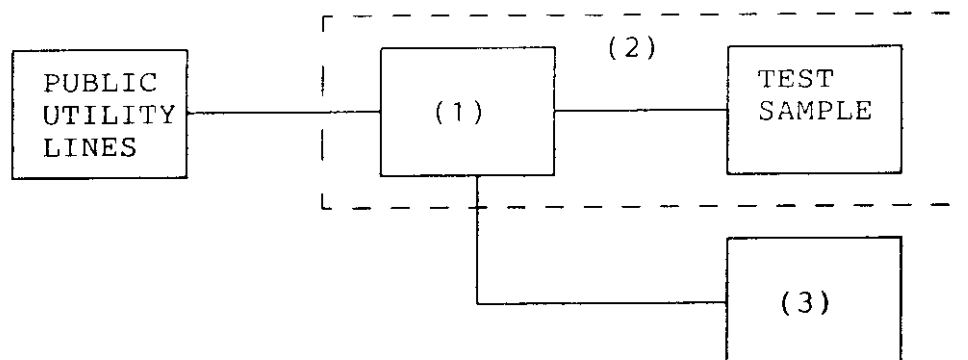
PAGE NO. 18. NSU EIPRTR
NAME OF TEST: AC POWER-LINE CONDUCTED INTERFERENCE
PARAGRAPH: 15.207
TEST CONDITIONS: S. T. & H.
SPEC. LIMIT: $\leq 250 \mu\text{V}$
TEST EQUIPMENT: AS PER ATTACHED PAGE AND
ANSI C63.4 (1992)

REFERENCE STANDARDS

1. American National Standard Specifications for Electromagnetic Interference and Field Strength Instrumentations 10 kHz to 10 GHz, ANSI C63.2 (1980).
2. American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage and Electronic Equipment in the range of 10 kHz to 1 GHz, ANSI C63.4 (1992).
3. Part 15 of FCC Rules and Regulations (47 CFR Part 15).

MEASUREMENT PROCEDURE

1. Table mounted or hand-held E.U.T.'s were placed on a non-conducting 1.0 x 1.5 m table at a height of 0.8 m above an earth-grounded conducting surface of 2.5 x 3.0 m.
2. Floor mounted E.U.T.'s were placed directly on insulating material covering the ground plane and arranged as specified in ANSI C63.4 (1992).
3. The test sample was connected to the Public Utility lines through a LISN Ailtech Model 94641-1 (50 μH).
4. A reference level of 250 μV was set on the Spectrum Analyzer. The spectrum searched was over the range of 450 kHz to 30 MHz.
5. All other emissions were 20 dB or more below limit.
6. MEASUREMENT RESULTS: ATTACHED

AC POWER-LINE CONDUCTED MEASUREMENTS(1) LINE IMPEDANCE STABILIZATION NETWORK

AILTECH 94641-1 (50 μ H)	<u>x</u>
EATON 94641-1 (50 μ H)	—
SINGER 91221-1 (5 μ H)	—
_____	—

(2) SCREEN ROOM

LINDGREN 22-2/2-0	<u>x</u>
_____	—

(3) SPECTRUM ANALYZER

HP 8566B	<u>x</u>
HP 8558B	—
HP 8557A	—
_____	—

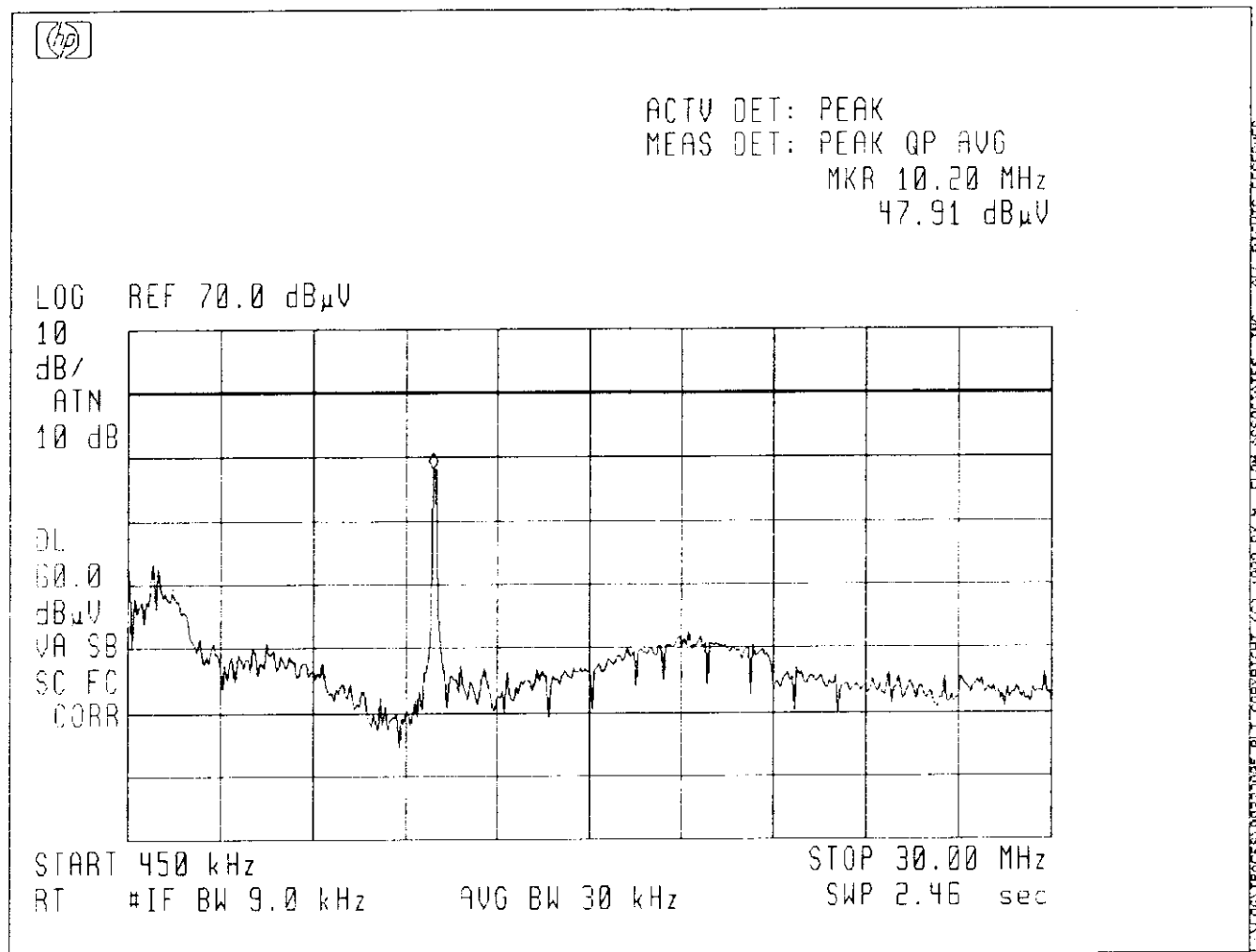
PAGE 20.1.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR

1998-FEB-23, 08:57, MON

REMARK: POWERLINE CONDUCTED, LINE SIDE, UNGROUNDED

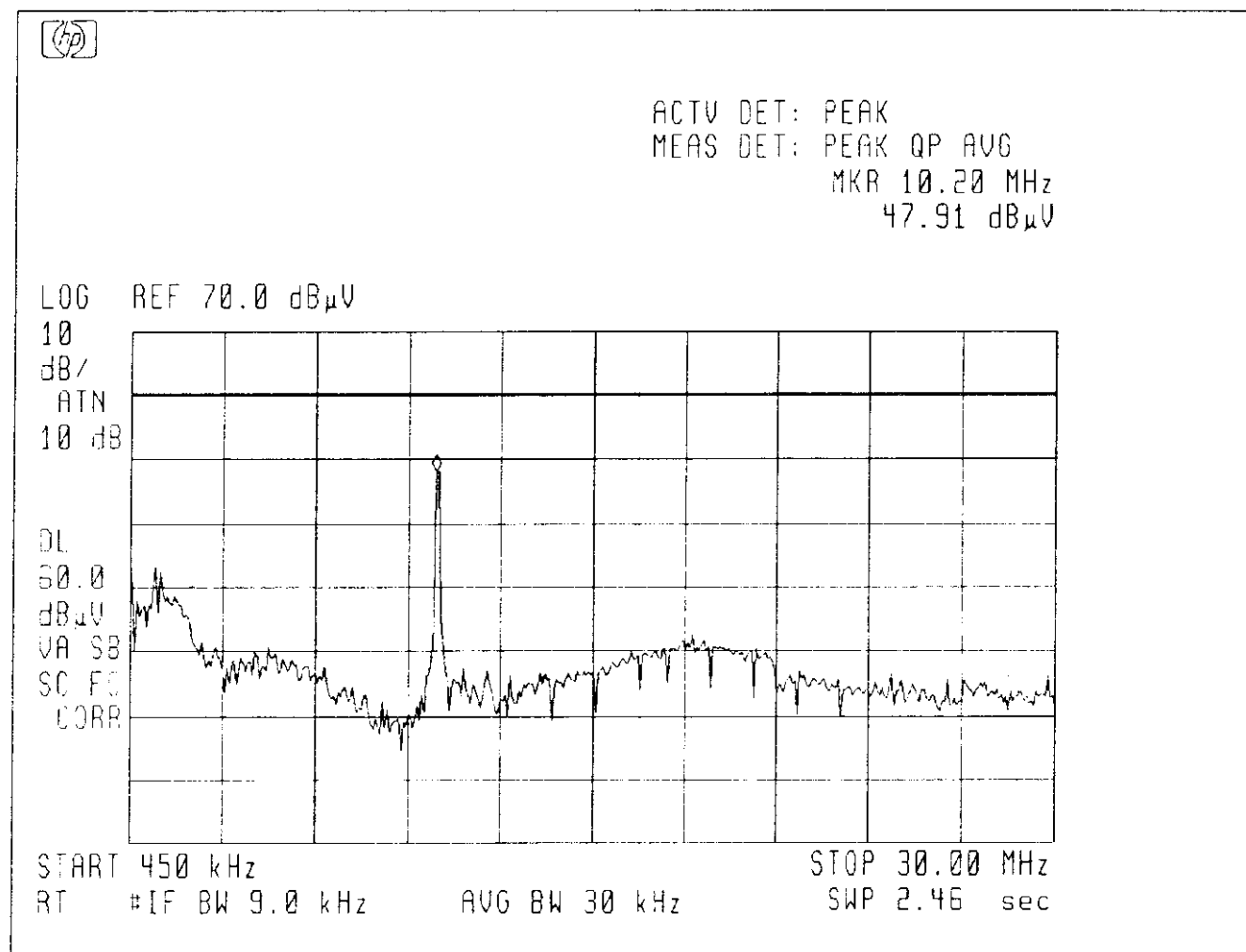


PAGE 20.2.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR
1998-FEB-23, 08:57, MON

REMARK: POWERLINE CONDUCTED, NEUTRAL SIDE, GROUNDED



PAGE NO.

21.

NSU EIPRTR

NAME OF TEST:

NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

PARAGRAPH:

47 CFR 2.202(g)

MODULATION = 8M1X7D

NECESSARY BANDWIDTH:

NECESSARY BANDWIDTH (B_N), MHz = 8.1

SUPERVISED BY:


MORTON FLOM, P. Eng.

PAGE NO. 22. NSU EIPRTR

NAME OF TEST: MAXIMUM PERMISSABLE EXPOSURE

PARAGRAPH: 47 CFR 1.1310

TEST CONDITIONS: S. T. & H.

SPEC. LIMIT: $\leq 1.6 \text{ mW/cm}^2$

GUIDE: IEEE C95.1-1991
IEEE Standard for Safety Levels with Respect to Human
Exposure to Radio Frequency Electromagnetic Field, 3 kHz to
300 GHz

Ref: Reference Data for Radio Engineers, Fifth Ed., p. 25-7

$$P = P_t / 4\pi R^2$$

where

P = Power Density (in W/m^2) at a distance R
 P_t = Power radiated by an isotropic radiator (Watts)
= (Transmitter Power) x (Duty Cycle) x (Antenna Gain)
R = Distance of measurement from source (meters)

ARRANG.	POWER Watts	DUTY CYCLE (FACTOR)	ANTENNA GAIN (FACTOR)	P_t W	P W/m^2	P mW/cm^2
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OMNI:

0.0064	1.0	1.0	0.0064	0.000057	0.00057
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PARABOLIC:

0.0004	1.0	1.0	0.0004	0.000004	0.00004
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M. J. F. Eng.
MORTON FLOM, P. Eng.

RADIATED MEASUREMENTS
FOR PART 15 TRANSMITTERS W/INTEGRAL ANTENNAS

RADIATED MEASUREMENTS

<u>RANGE OF MEASUREMENT</u>	<u>SPECIFICATION</u>	<u>RESOLUTION B/W</u>	<u>VIDEO B/A</u>
30 to 1000 MHz	CISPR	≥ 100 kHz	≥ 100 kHz
>1000 MHz	FCC, 15.37(b)	1 MHz	≥ 1 MHz
(if averaging)	FCC, 15.37(b)	1 MHz	10 Hz

MEASURING EQUIPMENT

a. ANTENNAS:

EMCO 3109	20 - 300 MHz
APREL AALP2001	200 - 1000 MHz
APREL AAB20200	20 - 200 MHz
APREL AAH118	1 - 18 GHz

b. INSTRUMENTS:

HP8566B	Spectrum Analyzer
HP85685A	Preselector, w/preamp below 2 GHz
HP85650A	Quasi Peak Adapter
HP8449	Preamp, above 2 GHz

All test instrumentation is calibrated every January and every July. In addition, all test instrumentation is calibrated daily, or as required by the manufacturer. A Calibration Agreement is maintained with Hewlett Packard.

OCCUPIED BANDWIDTH

Occupied bandwidth is measured as a radiated signal without attenuators and/or filter. RBW, VBW and scan settings as shown were set to produce a meaningful result in accordance with ANSI C63.4, Section 13.1.7.

Part 15.21, Information to User

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

THE APPLICANT HAS BEEN CAUTIONED AS TO THE FOLLOWING:

15.21 INFORMATION TO USER.

The users manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) SPECIAL ACCESSORIES.

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

§ 15.205 Restricted Bands of operation.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505 ¹	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

TESTIMONIAL
AND
STATEMENT OF CERTIFICATION

NSU EIPRTR

THIS IS TO CERTIFY:

1. THAT the application was prepared either by, or under the direct supervision of, the undersigned.
2. THAT the technical data supplied with the application was taken under my direction and supervision.
3. THAT the data was obtained on representative units, randomly selected.
4. THAT, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.

CERTIFYING ENGINEER:


MORTON FLOM, P. Eng.

STATEMENT OF QUALIFICATIONS

EDUCATION:

1. B. ENG. in ENGINEERING PHYSICS, 1949, McGill University, Montreal, Canada.
2. Post Graduate Studies, McGill University & Sir George Williams University, Montreal.

PROFESSIONAL AFFILIATIONS:

1. ARIZONA SOCIETY OF PROFESSIONAL ENGINEERS (NSPE), #026 031 821.
2. ORDER OF ENGINEERS (QUEBEC) 1949. #4534.
3. ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOPHYSICISTS & GEOLOGISTS OF ALBERTA #5916.
4. REGISTERED ENGINEERING CONSULTANT - GOVERNMENT OF CANADA, DEPARTMENT OF COMMUNICATIONS. Radio Equipment Approvals.
5. IEEE, Lifetime Member No. 0417204 (member since 1947).

EXPERIENCE:

1. Research/Development/Senior Project Engineer, R.C.A. LIMITED (4 years).
2. Owner/Chief Engineer of Electronics. Design/Manufacturing & Cable TV Companies (10 years).
3. CONSULTING ENGINEER (over 25 years).


MORTON FLOM, P. Eng.



ANTENNA ALIGNMENT PROCEDURES

Before attempting to align the Pinnacle LINK Wireless Bridge, all antenna connectors, cabling and ground connections must be installed properly. Once this has been confirmed, the antenna alignment procedure may be performed. First start by powering on the transmitting "host site" bridge unit. Then power on the receiving unit. Check the Pinnacle LINK Bridge display; it should show a "collision" light in the wireless column. This indicates that the Pinnacle LINK unit is not receiving signal from the transmitting unit, or "host site" bridge unit. If the red collision light is not on, then your antennas must be somewhat in line with each other, meaning the two units are communicating with each other.

Before you begin aligning antennas, it is recommended that you determine the azimuth or compass heading which would indicate the general direction of the receiving unit. This can be determined using a USGS topographical map or a hand held GPS receiver and a compass.

To align the antennas, you use the four signal strength lights located on the front of the Pinnacle LINK wireless bridge unit. The lights on the front show signal strength from low to excellent, reading left to right.

Moving the antenna in short increments either clockwise or counterclockwise, determine the greatest signal strength by referring to the signal strength lights located on the front of the bridge unit. By moving the antenna back and forth in either direction, it will become evident as to where the optimal signal strength is located. This procedure must be performed on both ends of the link to properly align the antennas. Once the antennas are aligned, the mounting brackets must be secured to prevent the antennas from moving.



PinnacleLINK 2/E
FCC ID: NSU EIPRTR
Theory of Operation

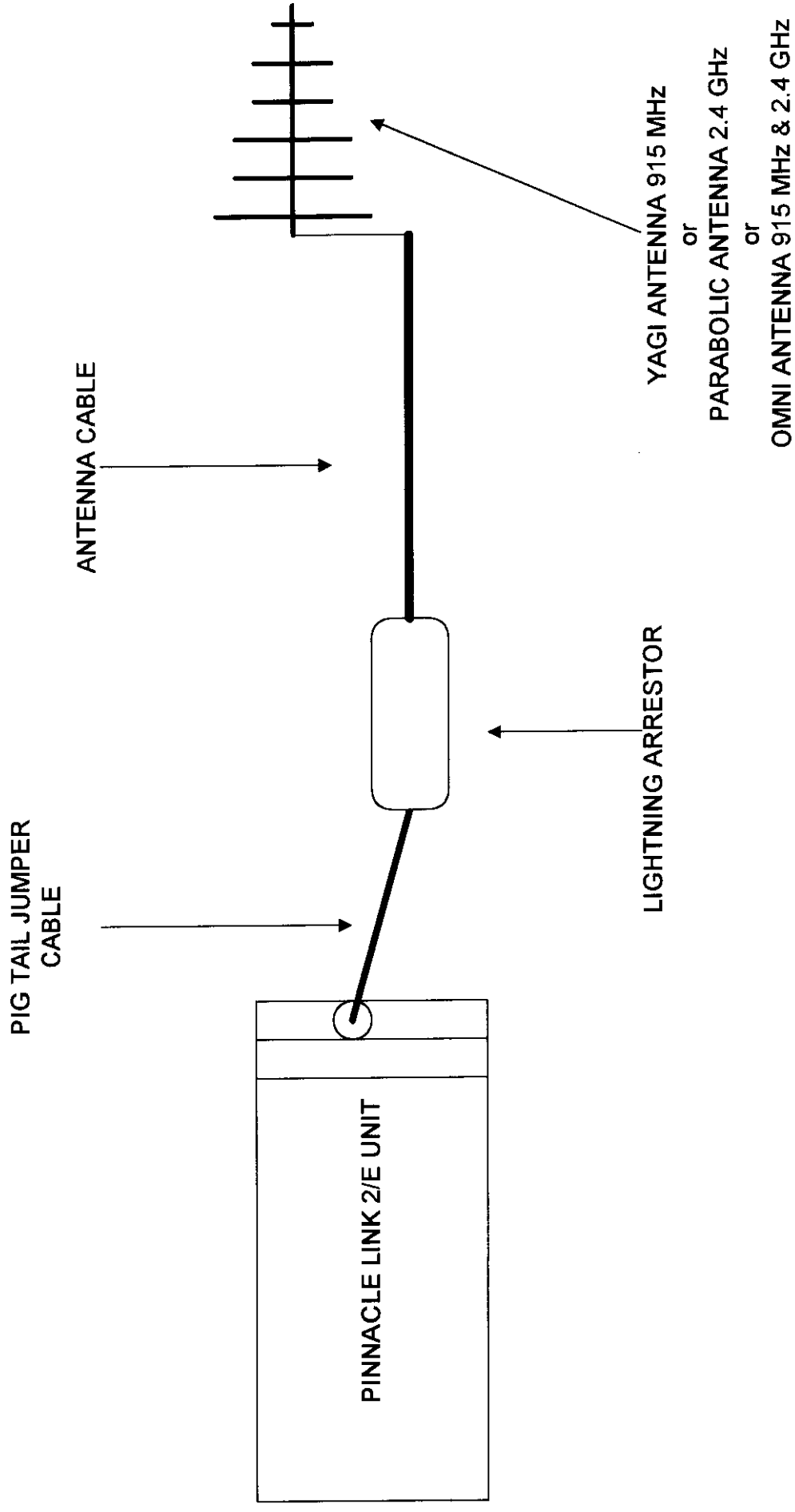
The **PinnacleLINK 2/E** is a wireless ethernet bridge or IP router which uses Spread Spectrum radio frequency technology to transmit data, as well as connect one or more remote ethernet LANs, at speeds of **2MBPS**.

The **PinnacleLINK 2/E** is built on a modular group of components. The units contain Industry standard parts such as an **ISA/PCI** Motherboard, an **SMC** ethernet card, and a **Lucent Technologies Wavelan** RF/ethernet card. The **MAC** layer bridge software can be configured to selectively forward or deny specified ethernet protocols. Each ethernet protocol can be passed, denied, or even stopped. This reduces, or in some cases, eliminates unwanted ethernet traffic traveling across the wireless link.

The "Brains" of the **PinnacleLINK 2/E** is a **Flash ROM** module that allows for any and all software upgrades to be uploaded from any workstation on the network, or from any workstation connected to the network via the internet. The **LAN LED** will blink whenever a packet is forwarded. It will also blink once per second, just after a re-boot and successful self test, and before any packets have been seen on the ethernet port. This light will also blink rapidly and brightly when the remote configuration protections have been overridden.

A basic interpretation of how the **PinnacleLINK 2/E** operates is as follows:

- (1) The **PinnacleLINK 2/E** is connected to a LAN via **CAT5**, **AUI** or **Coax** connection. Usually from a hub.
- (2) This connection will take the LAN's ethernet traffic and pass through a **10MB** auto-sensing, ethernet network card.
- (3) The signal is then sent to a **Lucent Technologies 2.4 Ghz** Spread Spectrum radio frequency card and is passed through an antenna cable to a **2.4 Ghz** Parabolic directional antenna.
- (4) Once the signal has passed through the wireless link, the same procedure operates in reverse.
- (5) The signal is passed from the **2.4 Ghz** Parabolic directional antenna then down the antenna cable to the **Lucent Technologies 2.4 Ghz** Spread Spectrum radio frequency card.
- (6) The signal then travels to the **10MB** auto-sensing ethernet network card.
- (7) The network signal now passes to the LAN via the **CAT5**, **AUI**, or **Coax** hub connection.



PINNACLE LINK 2/E BLOCK DIAGRAM

PAGE NO. 10. NSU EIPRTR
NAME OF TEST: RESTRICTED BANDS OF OPERATION
PARAGRAPH: 47 CFR 15.205
TEST CONDITIONS: S. T. & H.
SPEC. LIMIT:
TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

The EUT was set up on a three meter open field site according to the procedures on ANSI C63.4.

Sensitivity of system was measured:

Below 2 GHz:

HP 8566B/HP85685A

CISPR Bandwidths	= 8 dBμV
1 MHz RBW, 1 MHz VBW	= 12 dBμV
1 MHz RBW, 10 Hz VBW	= 3 dBμV

Above 2 GHz:

HP 8563E

1 MHz RBW, 1 MHz VBW	= 33 dBμV
1 MHz RBW, 10 Hz VBW	= 22 dBμV

Sensitivity of system with preamps (HP 8449A):

Below 2 GHz:

Preamps are not used in this range.

Above 2 GHz:

HP 8563E

Peak	= 3 dBμV
Average	= -8 dBμV

Cable loss:

915 MHz	= -0.8 dB
2450 MHz	= -3 dB

Note:

dB loss vs. frequency included in programmed software.

Reference Level Offset:

set @ 1 dB, accounts for cable and connector loss.

TEST RESULTS: No harmonic or spurious emissions were detected in the restricted bands in excess of the limits of 15.205. System measurement sensitivity was -130 dBm.

SUPERVISED BY:


MORTON FLOM, P. Eng.

PAGE NO.

11.

NSU EIPRTR

NAME OF TEST:

EMISSIONS AT BAND EDGES

PARAGRAPH:

TEST CONDITIONS:

S. T. & H.

SPEC. LIMIT:

TEST EQUIPMENT:

AS FOR "OUT OF BAND EMISSIONS"

PROCEDURE:

AS FOR "OUT OF BAND EMISSIONS"

MEASUREMENT RESULTS

ATTACHED

SUPERVISED BY:


MORTON FLOM, P. Eng.

PAGE 12.1.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR

1998-FEB-20, 14:57, FRI

PARABOLIC ANTENNA

FCC ID: NSU EIPRTR

(hp) 14:59:30 FEB 20, 1998

ACTV DET: PEAK

MEAS DET: PEAK QP AVG

MKR 2.46300 GHz

50.67 dBμV

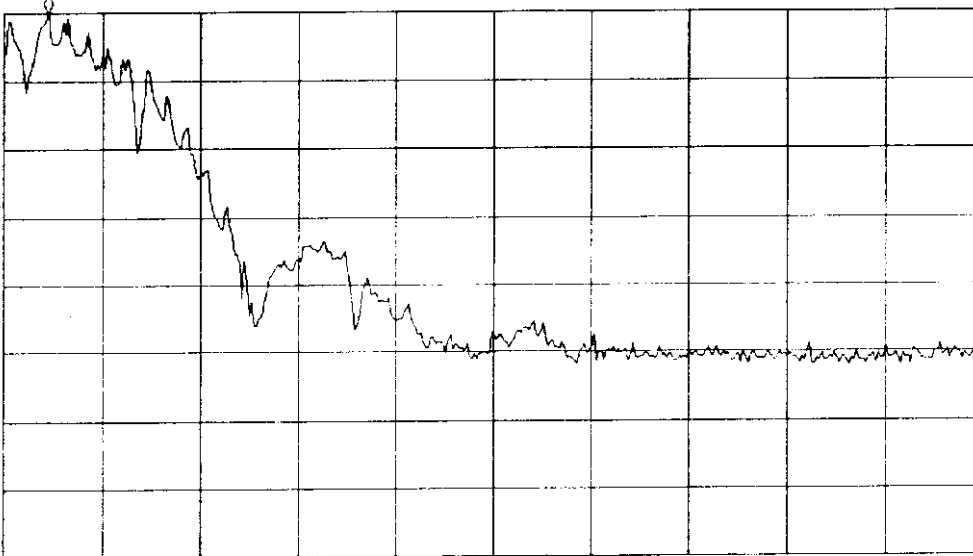
LOG REF 50.7 dBμV

AUTORANGE ON

PREAMP ON

10
dB/
#ATTN
0 dB

DL
30.7
dBμV
VA 3B
SC FC
CORR



CENTER 2.48575 GHz

SPAN 50.00 MHz

RT #IF BW 100 kHz

#AVG BW 100 kHz

SWP 20.0 msec

ALL RIGHTS RESERVED

PAGE 12.2.
EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR
1998-FEB-20, 14:03, FRI

PARABOLIC ANTENNA

FCC ID: NSU EIPRTR

(7p) 14:05:34 FEB 20, 1998

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.41138 GHz
40.94 dB μ V

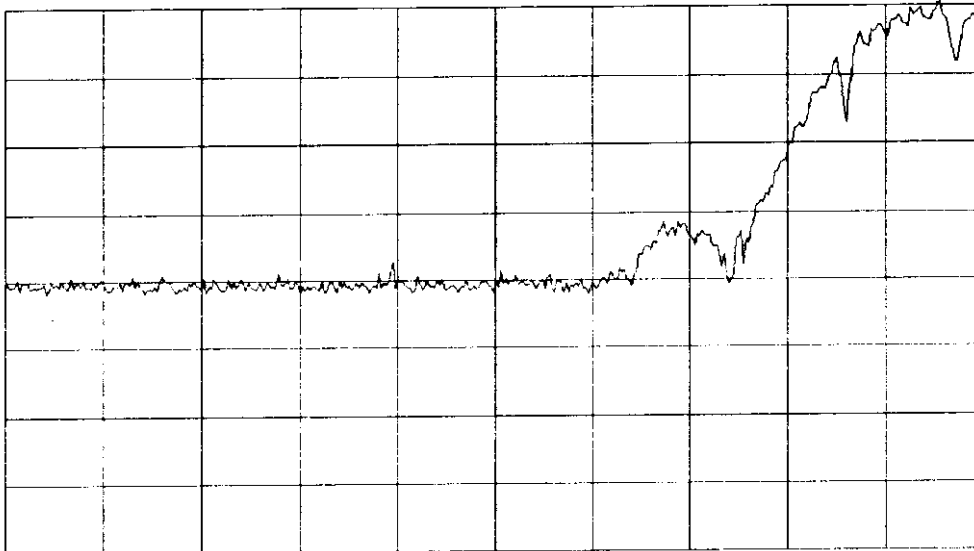
LOG REF 40.8 dB μ V

AUTORANGE ON

PREAMP ON

10
dB/
#ATN
0 dB

DL
20.8
dB μ V
VA S3
SC FC
CORR



CENTER 2.38875 GHz

SPAN 50.00 MHz

RT #IF BW 100 kHz

#AVG BW 100 kHz

SWP 20.0 msec

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PAGE 12.3.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR

1998-FEB-20, 14:08, FRI

OMNI ANTENNA

(h) 14:10:07 FEB 20, 1998

ACTV DET: PEAK

MEAS DET: PEAK QP AVG

MKR 2.41175 GHz

38.03 dB μ V

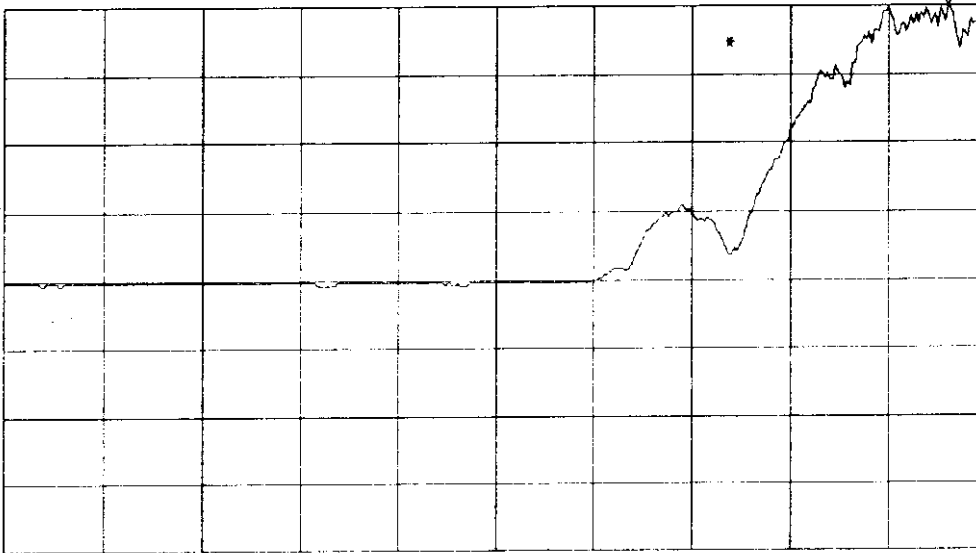
LOG REF 38.1 dB μ V

AUTORANGE ON

PREAMP ON

10
dB/
#ATTN
0 dB

OL
18.1
dB μ V
VA SB
SC FC
CORR



CENTER 2.38875 GHz

SPAN 50.00 MHz

RT #IF BW 1.0 MHz

#AVG BW 10 Hz

SWP 15.0 sec

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PAGE 12.4.

EMISSIONS

PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR

1998-FEB-20, 15:00, FRI

OMNI ANTENNA

(hp) 15:02:51 FEB 20, 1998

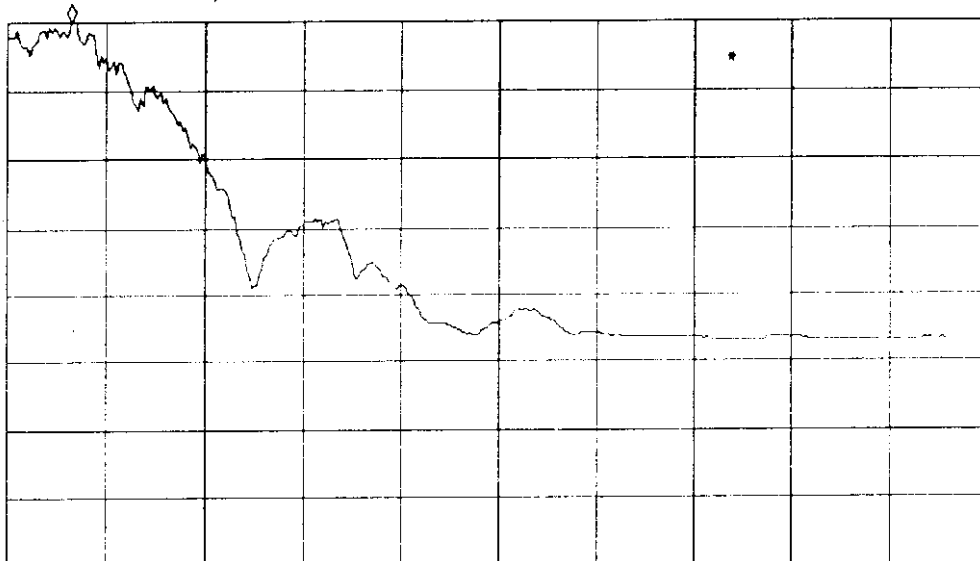
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.46425 GHz
44.24 dBμV

LOG REF 44.3 dBμV

AUTORANGE ON PREAMP ON

10
dB/
#ATN
0 dB

DL
24.3
dBμV
VA SB
SC FC
CORR



CENTER 2.48500 GHz

#IF BW 1.0 MHz

#AVG BW 10 Hz

SPAN 50.00 MHz

SWP 15.0 sec

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PAGE NO. 13. NSU EIPRTR
NAME OF TEST: ALLOWED OCCUPIED BANDWIDTH
PARAGRAPH: 47 CFR 15.247(a)(2)
TEST CONDITIONS: S. T. & H.
SPEC. LIMIT: SEE *
TEST EQUIPMENT: AS PER ATTACHED PAGE

*LIMITS

<u>RULE</u>	<u>TYPE</u>	<u>BANDS (MHz)</u>	<u>LIMIT (kHz)</u>
15.247(a)(1)(i)	F.H.	902-928	20 dB BW ≤ 500
15.247(a)(1)(ii)	F.H.	2400-2483.5, 5725-5850	20 dB BW ≤ 1000
15.247(a)(2)	D.S.	ALL	6 dB BW ≥ 500

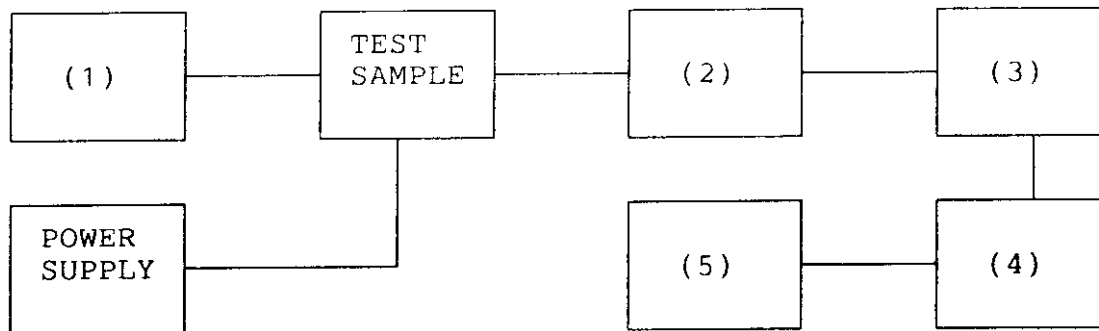
MEASUREMENT DATA

MEASURED BANDWIDTH, MHz = 8.1

RESULTS = ATTACHED

SUPERVISED BY:


MORTON FLOM, P. Eng.

TRANSMITTER CONDUCTED MEASUREMENTS(1) AUDIO OSCILLATOR/GENERATOR

HP 204D
 HP 8903A
 HP 3312A

(2) COAXIAL ATTENUATOR

NARDA 766-10
 SIERRA 661A-30
 BIRD 8329 (30 dB)

(3) FILTERS; NOTCH, HP, LP, BP

CIRQTEL FHT
 EAGLE TNF-1
 PHELPS DODGE PD-495-8

(4) SPECTRUM ANALYZER

HP 8566B
 HP 8558B
 HP 8557A

x

(5) SCOPE

HP 54502A
 HP 1741A
 HP 181T
 TEK 935

PAGE 15.1.

EMISSIONS

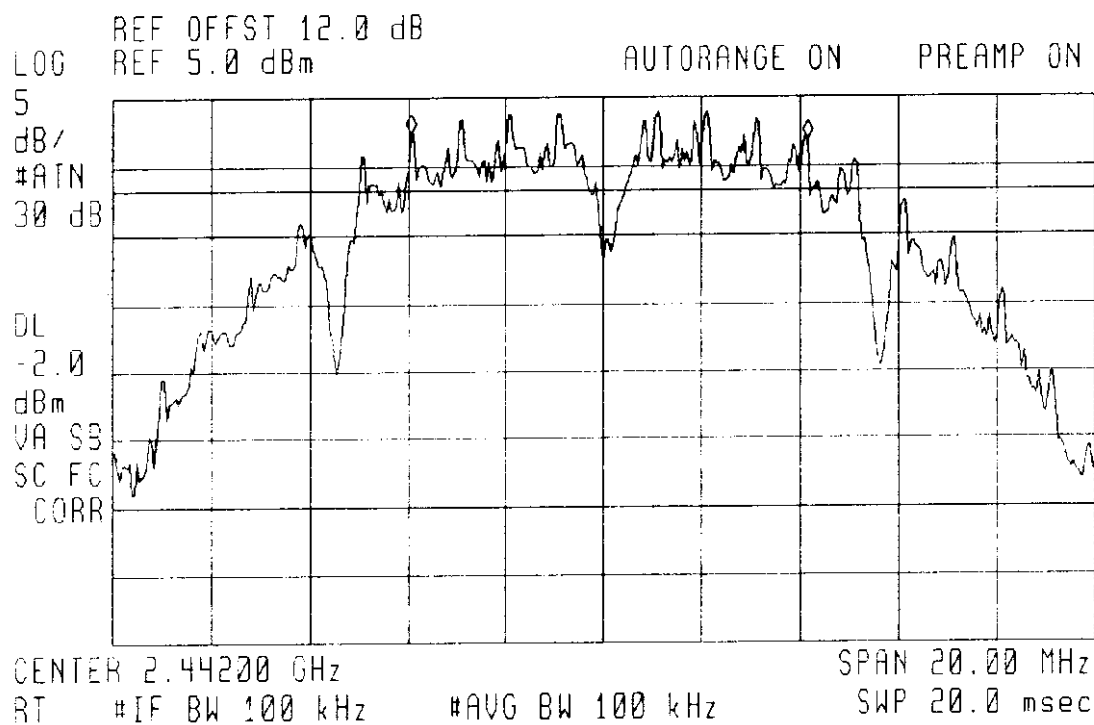
PINNACLE COMMUNICATION, INC., LUCENT DSW CARD 2.4GHZ NSU EIPRTR

1998-FEB-20, 16:55, FRI

6 dB BANDWIDTH

(hp) 16:57:56 FEB 20, 1998

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR Δ 8.10 MHz
- .55 dB



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