

PAGE NO.

3.

2.911:

TECHNICAL REPORT

NAME OF VENDOR:

Aironet Wireless Communications, Inc.
367 Ghent Rd., Suite 300
P.O. Box 5292
Fairlawn, OH 44334-0292

TRADE NAME:

Aironet

FCC ID:

LOZ102034

MODEL NO:

PC 4500

PHOTOGRAPHS:

SEE LIST OF EXHIBITS

15.31:

MEASUREMENT STANDARD & PROCEDURE:

IEEE STANDARD 187 WAS USED AS A GUIDE.
F.C.C. MEASUREMENT PROCEDURE MP-1
F.C.C. RULE PART 15(B) (NEW)
F.C.C. RULE 15.63 TRANSITION

 x

LIST OF GENERAL INFORMATION REQUIRED

IN ACCORDANCE WITH FCC RULES AND REGULATIONS,
VOLUME II, PART 2 AND TO

15.247, Confidentiality

Sub-part 2.1033

(b)(1): NAME AND ADDRESS OF APPLICANT:

Aironet Wireless Communications, Inc.
367 Ghent Rd., Suite 301
Fairlawn, OH 44334

VENDOR:

Aironet Wireless Communications, Inc.
367 Ghent Rd., Suite 300
P.O. Box 5292
Fairlawn, OH 44334-0292

(b)(2): FCC ID: LOZ102034

MODEL NO: PC 4500

QUANTITY PRODUCTION PLANNED.

(b)(4): TECHNICAL DESCRIPTION: SEE ATTACHED EXHIBITS

TYPE OF EMISSION: 10M2X7D

FREQUENCY RANGE, MHz: 2412 to 2483.5

POWER RATING, Watts: 0.25
SWITCHABLE ___ ADJUSTABLE ___ N/A x

MAXIMUM POWER RATING, Watts: 1

SPREAD SPECTRUM METHOD - FREQUENCY HOPPING ___
DIRECT SEQUENCE x
HYBRID ___

15.203: ANTENNA REQUIREMENT

The antenna is permanently attached to the E.U.T. x
The antenna uses a unique coupling ___
The E.U.T. must be professionally installed ___
The antenna requirement does not apply ___

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 11; 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.

LOZ102034

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 = As indicated below

PEAK OUTPUT POWER, Watts = As indicated below

TUNED, MHz	EMISSION, MHz	PEAK /AVE	METER, dBuV	C.F., dB	μV/m @ 3m	ERP WATTS
---------------	------------------	--------------	----------------	-------------	--------------	--------------

RADIATED:

12 dB OMNI

2412.000	2413.13	P	70.0	35.6	191205	0.011
2442.000	2441.25	P	68.0	35.7	152933	0.007
2462.000	2461.13	P	68.3	35.8	159772	0.008

13.5 dBi YAGI

2412.000	2411.88	P	77.6	35.6	457088	0.063
2442.000	2441.25	P	71.0	35.7	215030	0.014
2462.000	2462.88	P	70.2	35.8	200217	0.012

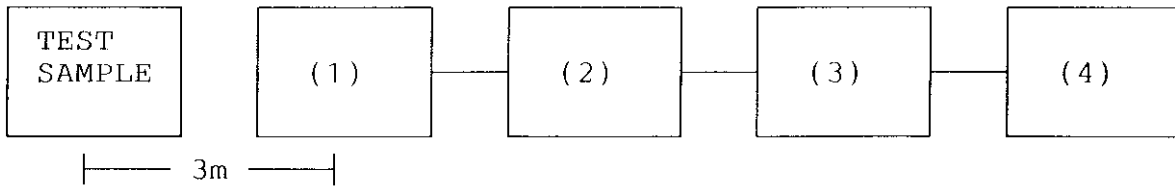
Sample Calculation:

$$P_{ERP} = (E_V \times R_M)^2 / 30 = (191205 \times 3)^2 / 30 = 0.011 \text{ Watts}$$

SUPERVISED BY:

Morton Flom P. 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 PAD (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>
_____	_____

PAGE NO.

8.

LOZ102034

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 TX4
1998-FEB-11, 14:13, WED 12 dBi OMNI

LOZ102034

TUNED, MHz	EMISSION, MHz	PEAK /AVE	METER, dBuV	C.F., dB	μ V/m @ 3m
2412.000	2363.25	A	1.7	35.4	71
2412.000	2364.00	P	1.9	35.4	73
2412.000	2367.13	A	2.9	35.4	82
2412.000	2368.88	P	6.7	35.4	127
2412.000	2371.25	A	4.5	35.4	100
2412.000	2374.13	A	5.2	35.4	107
2412.000	2374.13	P	8.0	35.4	148
2412.000	2378.63	A	6.5	35.4	125
2412.000	2379.13	P	9.0	35.4	166
2412.000	2383.25	A	7.5	35.5	141
2412.000	2388.13	P	21.6	35.5	711
2412.000	2388.13	A	8.9	35.5	166
2412.000	2389.13	P	9.7	35.5	182
2412.000	2389.38	P	19.7	35.5	575
2412.000	2390.00	A	9.8	35.5	184
2462.000	2483.50	A	14.2	35.9	318
2462.000	2483.50	P	15.6	35.9	374
2462.000	2484.00	A	14.4	35.9	327
2462.000	2487.50	P	16.4	35.9	412
2462.000	2488.13	A	13.3	35.9	287
2462.000	2492.88	P	15.7	35.9	380
2462.000	2493.38	A	11.9	35.9	247
2462.000	2498.50	A	11.7	35.9	240
2462.000	2500.13	P	14.5	36.0	332
2462.000	2501.50	A	11.3	36.0	231
2462.000	2503.38	P	13.5	36.0	297
2412.000	4824.00	P	36.0	12.7	271
2412.000	4824.00	A	26.8	12.7	94
2442.000	4884.00	A	27.0	12.9	99
2442.000	4884.00	P	37.0	12.9	313
2462.000	4924.00	P	36.2	13.1	290
2462.000	4924.00	A	27.7	13.1	109
2412.000	7236.00	A	27.2	18.7	196
2412.000	7236.00	P	36.7	18.7	586
2442.000	7326.00	P	36.2	19.0	570
2442.000	7326.00	A	27.3	19.0	206
2462.000	7386.00	A	28.7	19.1	245
2462.000	7386.00	P	40.8	19.1	995
2412.000	9648.00	P	35.7	22.4	797

PAGE NO. 9.2.
RADIATED EMISSIONS TX4
1998-FEB-11, 14:13, WED 12 dBi OMNI

LOZ102034

TUNED, MHz	EMISSION, MHz	PEAK /AVE	METER, dBuV	C.F., dB	μ V/m @ 3m
2412.000	9648.00	A	27.0	22.4	294
2442.000	9768.00	A	28.0	22.5	336
2442.000	9768.00	P	36.2	22.5	861
2462.000	9848.00	P	39.0	22.6	1208
2462.000	9848.00	A	29.5	22.6	405
2412.000	12060.00	A	27.2	24.4	378
2412.000	12060.00	P	38.0	24.4	1317
2442.000	12210.00	P	35.2	24.3	945
2442.000	12210.00	A	27.2	24.3	376
2462.000	12310.00	A	27.3	24.3	382
2462.000	12310.00	P	35.7	24.3	998

ABOVE 12,310 MHz, SYSTEM NOISE LEVEL OCCURED

PAGE NO. 9.3.
 RADIATED EMISSIONS TX1
 1998-FEB-11, 11:20, WED 13.5 dBi YAGI

LOZ102034

TUNED, MHz	EMISSION, MHz	PEAK /AVE	METER, dBuV	C.F., dB	μ V/m @ 3m
2412.000	2364.50	A	4.4	35.4	97
2412.000	2364.75	P	6.0	35.4	117
2412.000	2368.50	P	9.0	35.4	166
2412.000	2369.00	A	6.4	35.4	123
2412.000	2374.00	A	7.5	35.4	139
2412.000	2374.13	P	10.4	35.4	196
2412.000	2378.88	A	9.3	35.4	173
2412.000	2378.88	P	12.5	35.4	250
2412.000	2382.25	P	13.4	35.5	279
2412.000	2382.25	A	10.2	35.5	192
2412.000	2386.25	A	12.1	35.5	239
2412.000	2386.25	P	14.3	35.5	308
2412.000	2390.00	P	14.5	35.5	315
2412.000	2390.00	A	12.4	35.5	248
2412.000	2390.00	A	12.2	35.5	243
2462.000	2483.50	A	13.0	35.9	276
2462.000	2483.50	P	13.1	35.9	282
2462.000	2484.13	A	13.3	35.9	287
2462.000	2484.25	A	13.1	35.9	281
2462.000	2484.25	P	15.7	35.9	380
2462.000	2484.38	P	15.9	35.9	390
2462.000	2489.38	P	15.4	35.9	368
2462.000	2490.13	A	11.3	35.9	230
2462.000	2494.25	P	14.0	35.9	314
2462.000	2496.38	A	9.2	35.9	181
2462.000	2500.38	P	11.6	36.0	237
2462.000	2501.25	A	8.1	36.0	159
2462.000	2507.38	P	10.0	36.0	198
2462.000	2509.25	A	6.8	36.0	137
2412.000	4824.38	A	-3.7	42.7	89
2412.000	4824.38	P	5.6	42.7	259
2442.000	4884.12	A	-3.6	42.9	92
2442.000	4884.12	P	7.9	42.9	346
2462.000	4924.38	P	6.7	43.1	309
2462.000	4924.38	A	-3.1	43.1	100
2412.000	7236.00	A	27.2	18.7	196
2412.000	7236.00	P	35.5	18.7	512
2442.000	7326.00	A	27.2	19.0	202
2442.000	7326.00	P	37.3	19.0	652
2462.000	7386.00	A	28.7	19.1	245
2462.000	7386.00	P	36.0	19.1	571

PAGE NO. 9.4.
RADIATED EMISSIONS TX1
1998-FEB-11, 11:20, WED 13.5 dBi YAGI

LOZ102034

TUNED, MHz	EMISSION, MHz	PEAK /AVE	METER, dBuV	C.F., dB	μ V/m @ 3m
2412.000	9648.00	A	26.8	22.4	288
2412.000	9648.00	P	35.0	22.4	738
2442.000	9768.00	P	35.5	22.5	797
2442.000	9768.00	A	27.8	22.5	330
2462.000	9848.00	P	37.3	22.6	997
2462.000	9848.00	A	29.3	22.6	397
2412.000	12060.00	A	27.5	24.4	393
2412.000	12060.00	P	35.8	24.4	1026
2442.000	12210.00	A	27.3	24.3	383
2442.000	12210.00	P	36.2	24.3	1060
2462.000	12310.00	A	27.5	24.3	389
2462.000	12310.00	P	37.0	24.3	1163

ABOVE 12,310 MHz, SYSTEM NOISE LEVEL OCCURED

PAGE NO. 10. LOZ102034
 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.

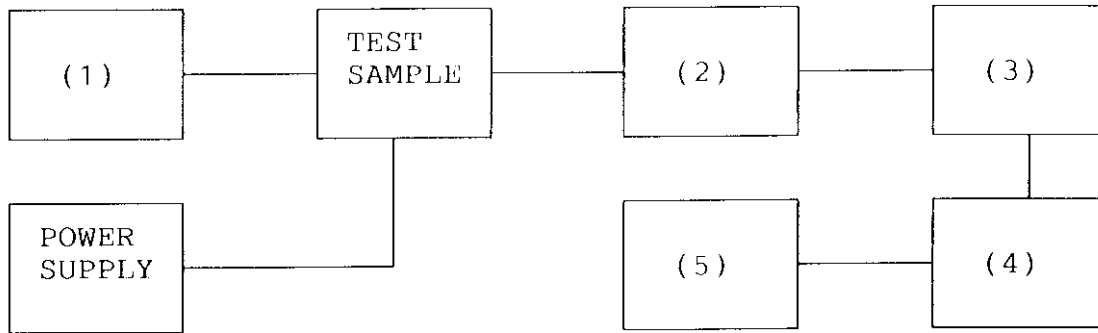
Reference Level Offset:
 set @ 1 dB, accounts for cable and connector loss.

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.

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

SUPERVISED BY:

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 x
- HP 8558B _____
- HP 8557A _____

(5) SCOPE

- HP 54502A _____
- HP 1741A _____
- HP 181T _____
- TEK 935 _____

EMISSIONS

AIRONET, PC 4500

1998-FEB-11, 13:52, WED

13.5 dBi YAGI ANTENNA

(hp) 13:58:32 FEB 11, 1998

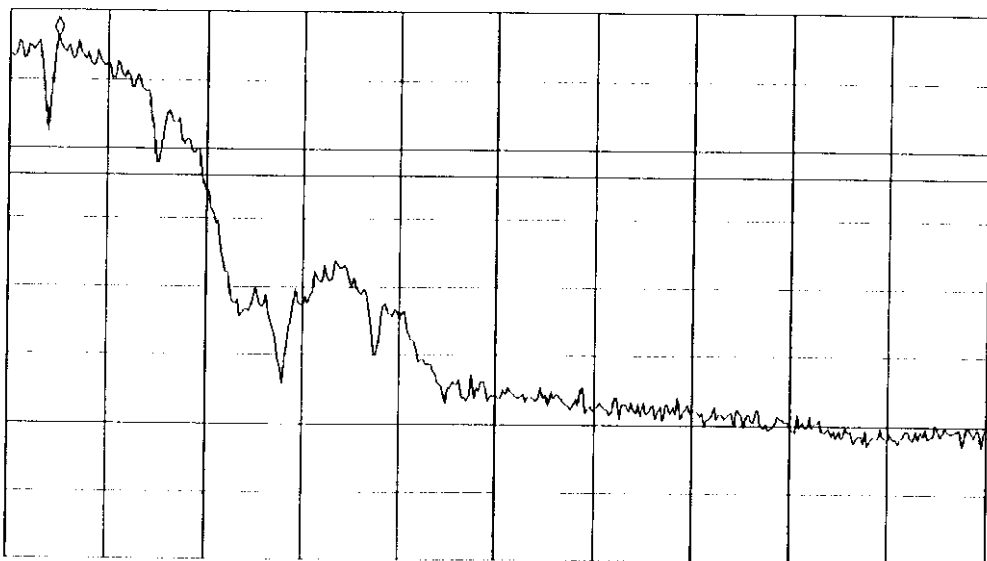
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.46250 GHz
66.16 dBμV

LOG REF 70.0 dBμV

PREAMP ON

10
dB/
#ATTN
0 dB

DL
46.1
dBμV
VA SB
SC FC
CORR



CENTER 2.48500 GHz

SPAN 50.00 MHz

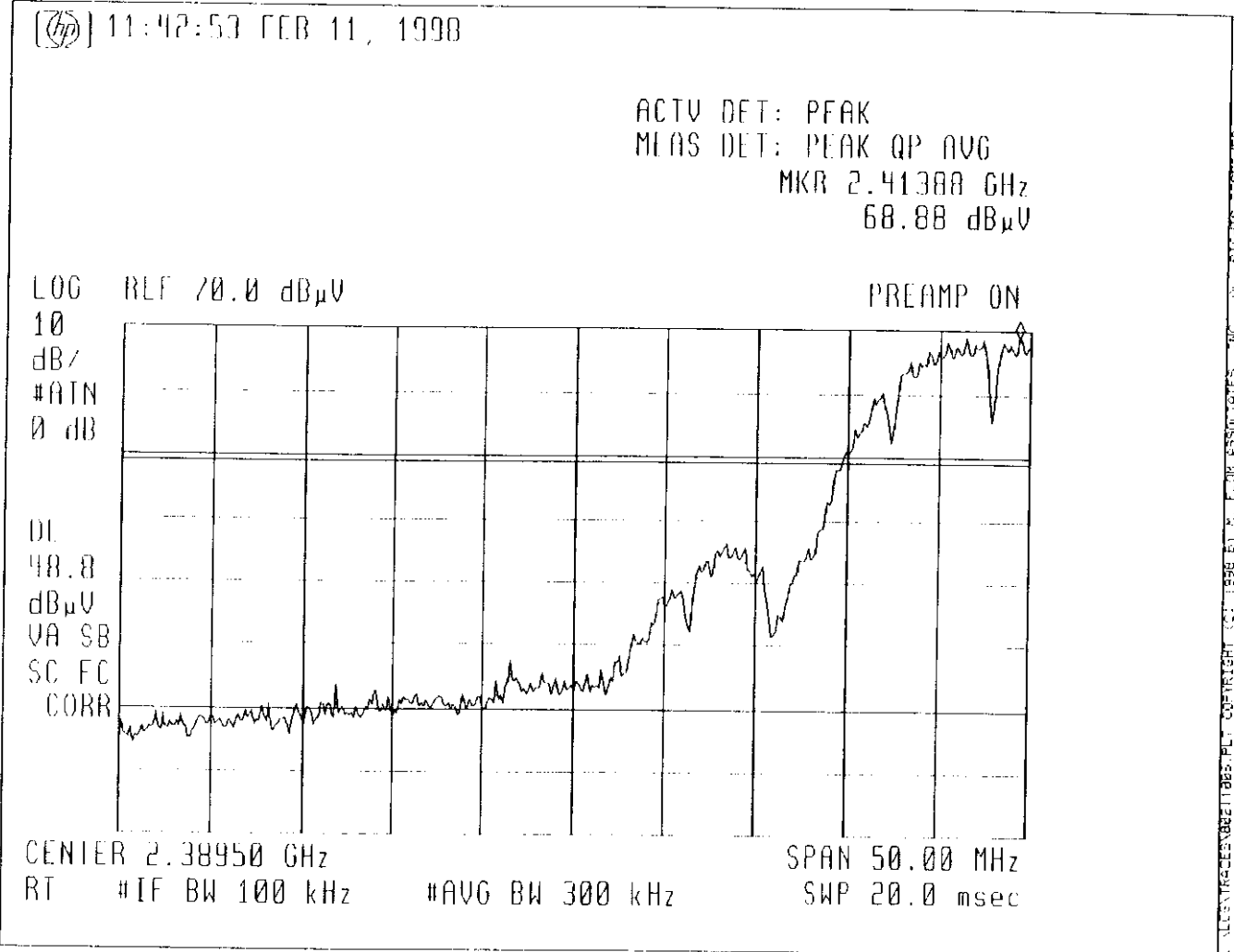
RT #IF BW 100 kHz

#AVG BW 300 kHz

SWP 20.0 msec

HP CALCULATED FROM THE PEAK COPYRIGHT © 1998 BY P. P. P. ASSOCIATES, INC. ALL RIGHTS RESERVED

13.5 dBi YAGI ANTENNA

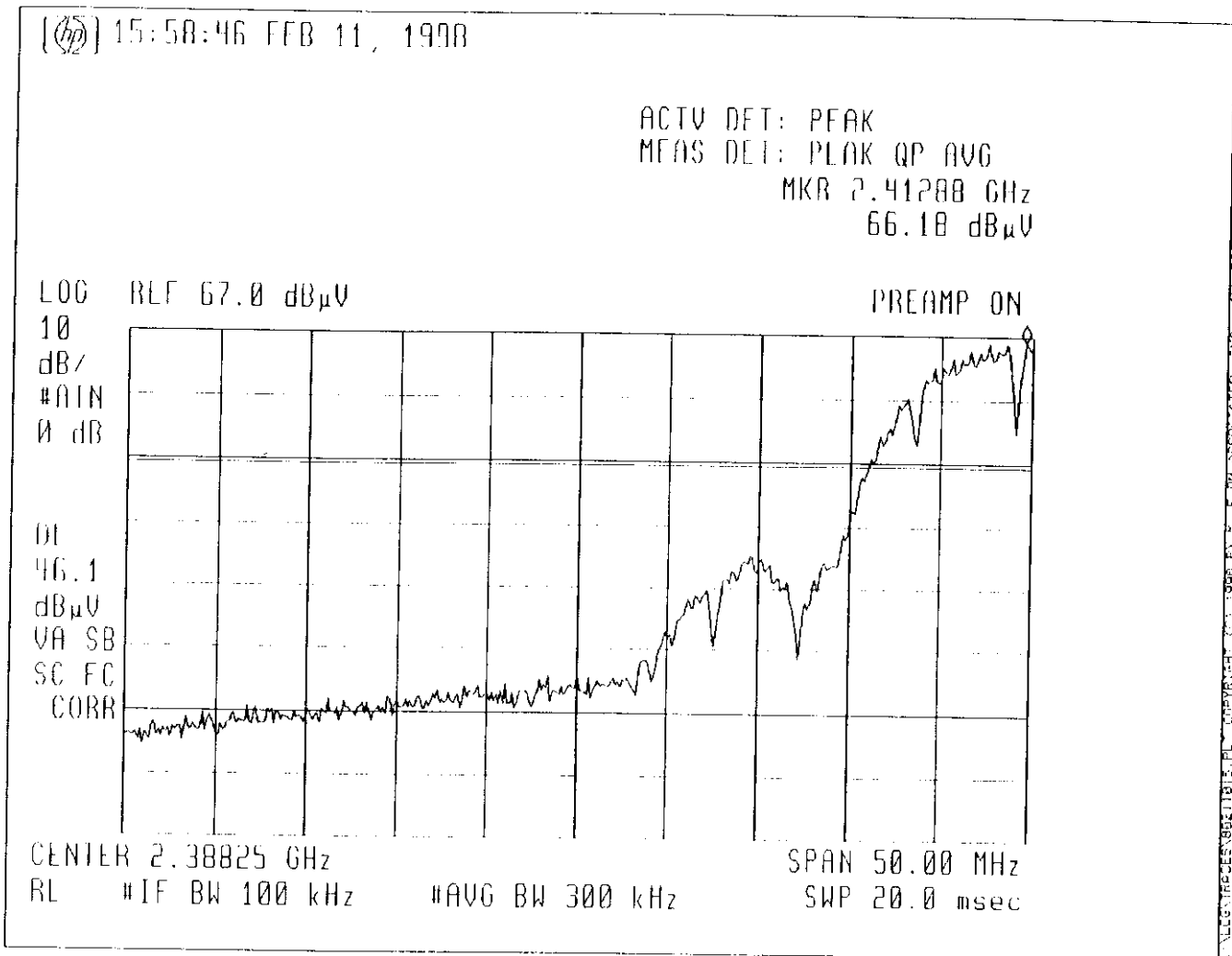


EMISSIONS

AIRONET, PC 4500

1998-FEB-11, 15:53, WED

12 dBi OMNI

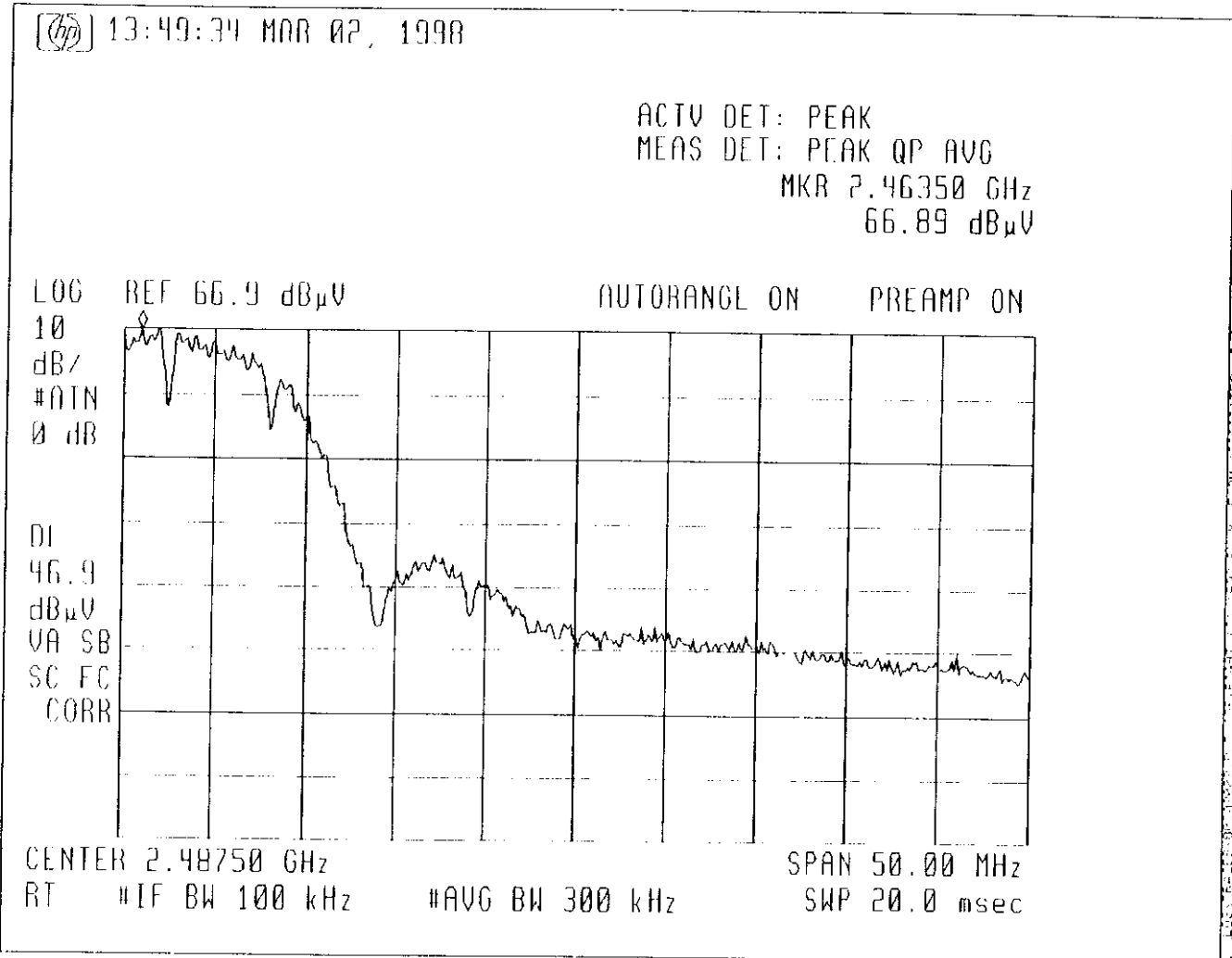


EMISSIONS

AIRONET, PC 4500

1998-MAR-02, 13:42, MON

12 dBi OMNI



NAME OF TEST: SPREAD SPFCTRUM TECHNOLOGY
FREQUENCY HOPPING SYSTEMS

15.247(a)(1) Channel Separation

LIMIT: 25 kHz minimum or 20 dB Bandwidth of the hopping channel, whichever is greater.
RESULTS: See attached plot

15.247(a)(1) Hopping Sequence Description

LIMIT: Hopping channels must be selected from a psuedorandom ordered list of of frequencies.
RESULTS: See applicant's statement

15.247(a)(1) Reuse Rate Description

LIMIT: Each frequency must be used equally on the average by each transmitter.
RESULTS: See applicant's statement

15.247(a)(1) System Receiver Compatibility and Correlation

LIMIT: Receiver bandwidths must match the hopping bandwidths of their corresponding transmitters & shall shift frequencies in synchronization with the transmitted signal.
RESULTS: The system was operated and found to stay in sync.

15.247(a)(1)(i)&(ii) Number of Hopping Frequencies

LIMIT: 902-928 MHz band: ≥ 50 (if Channel BW < 250 kHz)
902-928 MHz band: ≥ 25 (if Channel BW ≥ 250 kHz)
2400-2483.5, 5725-5850 MHz band: ≥ 75
RESULTS: See applicant's statement

15.247(a)(1)(i)&(ii) Maximum 20 dB Bandwidth

LIMIT: Channel bandwidth ≤ 500 kHz
RESULTS: Please see results for "Allowed Occupied Bandwidth."

15.247(a)(1)(i)&(ii) Average time of Occupancy

LIMIT: 902-928 MHz, ≤ 0.4 seconds in 20 second period.
2400-2483.5, 5725-5850 MHz ≤ 0.4 sec in 30 sec period.
RESULTS: See applicant's statement

SUPERVISED BY:


MORTON FLOM, P. Eng.

PAGE NO.

15.

I.OZ102034

NAME OF TEST:

NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

PARAGRAPH:

47 CFR 2.202(g)

MODULATION = 10M2X7D

NECESSARY BANDWIDTH:

NECESSARY BANDWIDTH (B_N), kHz = 10.2 (MEASURED)

SUPERVISED BY:


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

LOZ102034

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.

TEST INSTRUMENTATION LIST

All equipment calibrated
within last 90 days

ADAPTER

HP X281 (Coaxial waveguide); HP S281; HP 85659 (Quasi peak)

AMPLIFIER

Pre-amp. HP 10885A (2-1300 MHz); HP 8447D, HP 8447E, HP 8449A

ANTENNA See end

ATTENUATOR

Kay 432D; Power, Sierra 661A-30; Narda 76610; Narda 4779-3, -6, -10 dB

AUDIO OSCILLATOR

HP 204D; AIEC DTC-1; Motorola S-1333B; HP 3312A; HP 8903A

BATTERY

Sears Diehard, Stock #4341

CAMERA

Oscilloscope, Tektronix C5A; Polaroid Impulse AF; Kodak DC 50

CAPACITOR

Feed-Thru, 10 μ F, Solar 6512-106R; Solar 7525-1

CLOSE FIELD PROBE

HP 11940A, 11941A, HP 11945A

COMPUTER

HP 332; HP Vectra 486/25VL; Various PC Compatibles

CONVERTOR, Down

HP 117 10B

COUPLER

Narda 1080, Waveguide; HP S750E (Cross guide); Waveline 274/40; Solar 7415-3; Solar 7835-891 & -896

CURRENT PROBE

Solar 6741-1

DETECTOR

HP 8470B

DIGITAL MULTIMETER

HP 3476A w/H.F. Probe; Fluke 8030A-01; HP 3478A

DISTORTION ANALYZER

HP 334A; HP 8903A

ELECTRONIC COUNTER

HP 5383A; HP 5334B

FILTER

Cirqtel FHT/7-50-57/50-1A/1B (HP); Jerrold TLB-1; IHB-1, Piezo 5064; Eagle TNF I Series, Krohn-Hite 3202; Phelps-Dodge #PD-495-8; Newtone #PD6000 Line Protector; 870-890 MHz (Lab Design); 900 MHz (Lab Design); Solar High-Pass s/n 882029

FREQ. DEV. METER

HP 8901A

FREQ. DOUBLER

HP 11721A

FREQUENCY METER

HP 537A; HP 536A

GENERATOR

Solar 6550-1 (power sweep); HP 8640B, GAW 1012, HP 8656A (signal); Solar 8282-1 (spike)

HUMIDITY CHAMBER

Ember Co FW30; Bowser 0

LIMITER, R.F.

HP 11867A; HP 11693A; HP 10509A

LISN

Singer 91221-1; Ailtech 94641-1 (50 μ H)

LOAD, POWER

Telewave TLW-25; Bird 8329

MILLIAMETER

HP 428B

MIXER

HP 10514A; Mini-Circuits TAK-1H

OPEN FIELD SITE

As filed with FCC & IC and kept up-dated.

TURNTABLES:

Up to 2000# capacity

GROUND SCREEN:

Complies with docket 80-284

ANTENNA MAST:

Complies as above

OSCILLOSCOPE

HP 1741A; HP 181T; Tektronix T935; HP 54502A

PHANTOM

M.F.A. Labs Left and Right human head

PLOTTER

HP 7470; HP7475A

POWER METER

AF GR 1840A; HP 435A with 8481A & 8482H Power Sensors; HP 436A; HP 8901A

POWER SUPPLY

HP 6286A; Heathkit 1P 2711; 1P 5220; Honda EM400 (portable gas gen.); HP 6012

PRINTER

Brother HL-8; Brother HL-10V; HP DeskJet 640C

R. F. PRESELECTOR

HP 85685A

RADIATION METER

Narda 8717 w/8010 Amp, 8021B and 8760 probes

RESISTOR, PRECISION

Solar 7144-1.0, 7144-10.0; Solar 8525-1

SCALE

Weigh Tronix 36321-50

SCANNER

HP 9190A Scanjet

SCREEN ROOM

Lindgren 22-2/2-0

SIGNAL LEVEL METER

Jerrold 704B

SIGNAL SAMPLER

R. F. Bird 4273-030, 4275-030

SINAD/VOLTMETER

Helper Sinadder

SPECTRUM ANALYZER

HP 8558B, 8557; HP 8563E; HP 853A; HP 8566B/8568B

TEMPERATURE CHAMBER

Tenney, Jr

TEMPERATURE PROBE

Fluke 80T 150C

TERMINATION

Narda 320B Waveguide. Waveline #281

TEST SET

Semi Automatic; HP 8953A; HP 8954A Interface; Computer / Controller; P.S. Programmer; HP 59501A; RF Communications; HP 8920A

TRANSFORMERS

Audio Isolation: Solar 6220-1A; Impedance: HP 11694A; Isolation: Solar 7032-1; Matching: Solar 7033-1

TRANSMISSION & NOISE MEASURING SET

HP 3555B

VIBRATION CHAMBER

Unholtz-Dickie T 500; Unholtz-Dickie T 4000

VOLTMETER

HP 410C; HP 3478A

WATTMETER

Bird 43, Sierra 174A-2

ANTENNAS

30 - 50 Hz

Emco 7603 M-Field; Emco 7604 M-Field

20 - 200 MHz

Apriel Biconical Model AAB20200

20 - 300 MHz

Emco Biconical H-Field

25 - 1000 MHz

Singer DM-105A; EMCO 3121C

200 - 1000 MHz

Apriel Log Periodic, Model AALP 2001

10 kHz - 30 MHz

Emco 3107B, E-Field; Emco 3101B/1, Rod E-Field

10 kHz - 32 MHz

Singer 94593-1 (Loop)

150 kHz - 32 MHz

Singer 92197-1 (41")

150 kHz - 32 MHz

Singer 93049-1 (9')

1 - 10 GHz

Singer 90794-A Discone

1 - 18 GHz

Horn: Apriel Model AAH-118

18 - 40 GHz

Emco 3116, Horn

40 - 60 GHz

Horn: HP 11970U, HP 11971U, HP 11975A (Lo Drive Amplifier)

50 - 75 GHz

Mixer, HP 11970V, HP 11971V

75 - 110 GHz

Mixer, HP 11970W

Aironet Wireless Communications Inc

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FINE

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III. Maximum Permissible Exposure (MPE)

Ref: FCC Rules, 47 CFR 1.1310

(A) Limits for Occupational/Controlled Exposures

Frequency Range (MHz)	E Field Strength (V/m)	M Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500	---	---	f/300	6
1500-100,000	---	---	5	6

(B) Limits for General Population/Uncontrolled Exposure

0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
1500-100,000	---	---	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

The Uncontrolled Environment represents the most restrictive limits.

IV. Conclusions

In an uncontrolled environment, the maximum permissible exposure from a radio device operating at 2.4 GHz is 1.0 mW/cm² average over a 30 minute period.

In All operating modes, the EUT operates at a level below the required limit.

This analysis indicate a power density for the EUT within the referenced limits.

Since the analysis is favorable in the Uncontrolled Environment, it is unnecessary to analyze for the less restrictive conditions of Controlled Environments or Partial Body Exposure.