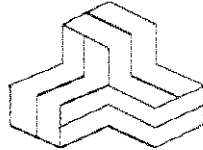


ENGINEERING TEST REPORT



ISP DIRECT INDOOR & OUTDOOR UNITS
MODEL NO.: 2401-01 (indoor) and 2401-02 (outdoor)

In Accordance With

FEDERAL COMMUNICATIONS COMMISSION (FCC)
PART 15, SUBPART C, SEC. 15.247
Direct Sequence Spread Spectrum Transmitters operating
in the frequency band 2408.625 - 2464.875 MHz

--- FCC CLASS II PERMISSIVE CHANGE ---

UltraTech's FILE NO.: IAW9-FTX

Tested for:

CLEARWIRE TECHNOLOGIES INC.

485 Cayuga Road P.O. Box 222
Buffalo, New York
USA, 14225-0222

Tested by:

UltraTech - Group of Labs

3000 Bristol Circle
Oakville, Ontario
Canada L6H 6G4

Report Prepared by: Dan Huynh

DATE: May 6, 1999

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
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1. EXHIBIT 1 - SUMMARY OF TEST RESULTS & GENERAL STATEMENT OF CERTIFICATION

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
15.247(a)(2)	Spectrum Bandwidth of a Direct Sequence Spread Spectrum System	Not required for this Class II Permissive Change
15.247(b) & 1.1310	Maximum Peak Power and RF Exposure Limits	Not required for this Class II Permissive Change
15.247(c)	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Not required for this Class II Permissive Change
15.247(c), 15.209 & 15.205	Transmitter Radiated Emissions	Yes
15.247(d)	Transmitted Power Density of a Direct Sequence Spread Spectrum System	Not required for this Class II Permissive Change
15.247(e)	Processing Gain of Direct Sequence Spread Spectrum System	Not required for this Class II Permissive Change
15.107, 15.109	AC Power Conducted Emissions & Radiated Emissions for Receiver and Digital Circuit Portions	Not required for this Class II Permissive Change

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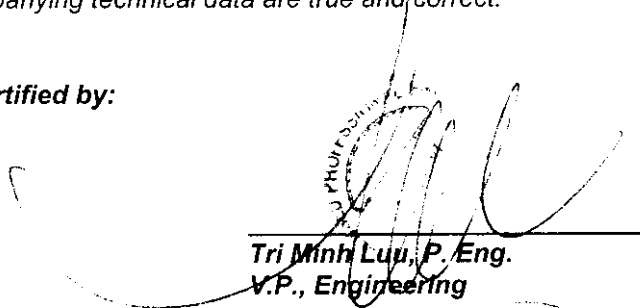
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TESTIMONIAL AND STATEMENT OF CERTIFICATION**THIS IS TO CERTIFY:**

- 1) *THAT the application was prepared either by, or under the direct supervision of the undersigned.*
- 2) *THAT the measurement data supplied with the application was taken under my direction and supervision.*
- 3) *THAT the data was obtained on a representative production unit.*
- 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.*

Certified by:

Tri Minh Luu, P. Eng.
V.P., Engineering

DATE: May 6, 1999**ULTRATECH GROUP OF LABS**

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2. EXHIBIT 2 - GENERAL INFORMATION

2.1. APPLICANT

CLEARWIRE TECHNOLOGIES INC.
485 Cayuga Road P.O. Box 222
Buffalo, New York
USA, 14225-0222

Applicant's Representative: Mr. Dave Chauncy, Director RF Engineering

2.2. MANUFACTURER

CLEARWIRE TECHNOLOGIES INC.
485 Cayuga Road P.O. Box 222
Buffalo, New York
USA, 14225-0222

2.3. DESCRIPTION OF EQUIPMENT UNDER TEST

PRODUCT NAME:	ISP Direct Indoor & Outdoor Units
MODEL NUMBER:	2401-01 (indoor) and 2401-02 (outdoor)
SERIAL NUMBER:	Pre-production
TYPE OF EQUIPMENT:	Direct Sequence Spread Spectrum Transmitters
OPERATING FREQ.:	2408.625 – 2464.875 MHz
POWER RATING:	190 mWatts
DUTY CYCLE:	63% maximum
OSC. FREQUENCY(IES):	35 MHz (Rx IF), 70 MHz(Rx LO), 915 MHz (Tx IF), Tx Lo. Osc. = 915 MHz (Tx Freq)
INPUT SUPPLY:	AC 120V 60Hz using alternative external switching power supply
ASSOCIATED DEVICES:	Huber Suhner 1X10 Patch Antenna and Andrews High Gain Omni Antenna
FCC ID:	NUX-ISP2401-2

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INDOOR UNIT:

- (1) LAN Port - RJ-45
- (2) Event In/Out (Sync) - BNC
- (3) Serial Port – DB9 (for factory uses only)
- (4) RF OUT - TNC. The RF OUT will not deliver any rf power if the indoor unit is not connected to the outdoor unit.

OUTDOOR UNIT:

- (1) RF-IN (TNC) (1) LAN Port - RJ-45
- (2) RF-OUT (TNC). Permanently attached to the antenna as one unique assembly. Heat shrink is used to secured the Outdoor Box's RF –OUT terminal to the Antenna, and the Outdoor Box is mounted on the antenna.

2.4. RELATED SUBMITTAL(S)/GRANT

Not applicable.

2.5. TEST METHODOLOGY

These tests were conducted on a sample of the equipment for the purpose of certification compliance with Code of Federal Regulations (CFR47-1991), Part 15, Subpart C, Para. 15.247, Direct Sequence Spread Spectrum Transmitters operating in the Frequency Band 2408.625 - 2464.875 MHz.

Radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4-1992 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz.

2.6. TEST FACILITY

Radiated Emissions were performed at the UltraTech's 3-10 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above site have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: September 20, 1998.

The above test site is also filed with Interference Technology International Ltd (ITI - An EC Directive on EMC).

2.7. UNITS OF MEASUREMENTS

Measurements of radiated emissions are reported in units of dB referenced to one microvolt per meter [dB(μV)/m] at the distance specified in the report, wherever it is applicable.

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3. EXHIBIT 3 - SYSTEM TEST CONFIGURATION

3.1. TEST SYSTEM DETAILS

The following peripherals, FCC identifiers and types interconnecting cables were used with the EUT for testing:

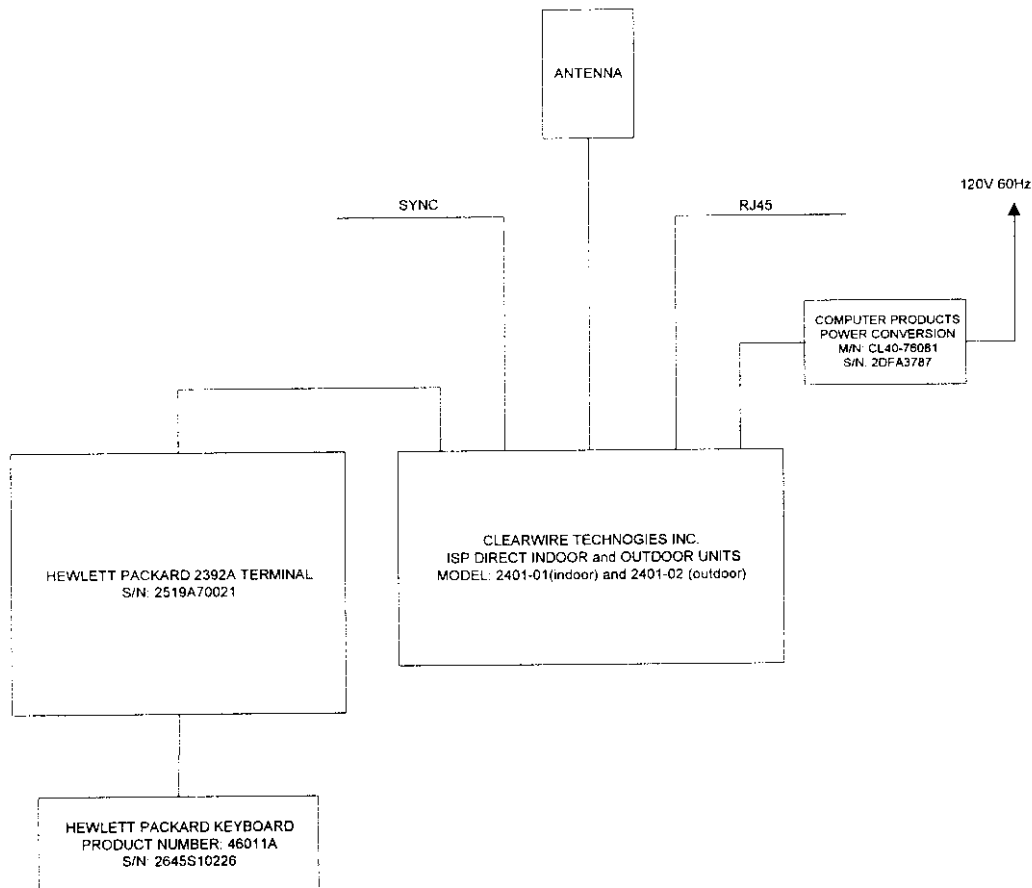
EUT: CLEARWIRE TECHNOLOGIES INC, ISP DIRECT INDOOR & OUTDOOR UNITS,
Model: 2401-01 (indoor) and 2401-02 (outdoor), S/N: Preproduction.
I/O Cable: All I/O cables were shielded except for the RJ-45 LAN cable
Power Supply Cable: Non-shielded AC cord and shielded DC out cable.

ASSOCIATED SHORTEST & MINIMUM LOSS RF CABLE: RG-223/U shielded cable, 0.25" flex, 30ft long minimum, 10.5 dB loss @ 2.45 GHz.

PERIPHERAL: Hewlett Packard 2392A Terminal, S/N: 2519A70021

PERIPHERAL: Hewlett Packard Keyboard, Product Number: 46011A, S/N: 2645S10226

3.2. BLOCK DIAGRAMS FOR CONDUCTED & RADIATED EMISSION MEASUREMENTS



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3.4. JUSTIFICATION

No deviation, in both configuration and operation manners, different from normal operation were required.

3.5. EUT OPERATING CONDITION

Software provided by CLEARWIRE TECHNOLOGIES INC. to set the EUT to transmit or receive at various channel frequencies.

3.6. SPECIAL ACCESSORIES

No special accessories were required.

3.7. EQUIPMENT MODIFICATIONS

Not required.

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4. EXHIBIT 4 - TEST DATA

4.1. TRANSMITTER RADIATED EMISSIONS @ 3 METERS, FCC CFR 47, PARA. 15.247(C), 15.209 & 15.205

PRODUCT NAME: ISP Direct Indoor & Outdoor Units,
Model No.: 2401-01 (indoor) and 2401-02 (outdoor)

FCC REQUIREMENTS:

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the 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), which lesser attenuation.

All other emissions inside restricted bands specified in @ 15.205(a) shall not exceed the general radiated emission limits specified in @ 15.209(a)

Remarks:

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- @ FCC CFR 47, Para. 15.237(c) - The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in @15.35 for limiting peak emissions apply.

FCC CFR 47, Part 15, Subpart C, Para. 15.205(a) - Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 - 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 - 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 - 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 - 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 - 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 - 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 - 156.9	2200 - 2300	9000 - 9200	

FCC CFR 47, Part 15, Subpart C, Para. 15.209(a)

-- Field Strength Limits within Restricted Frequency Bands --

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

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CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 23 °C
- Relative humidity: 43 %

POWER INPUT:

AC 120V 60Hz using alternative external switching power supply.

TEST EQUIPMENT:

- **Spectrum Analyzer**, Advantest, Model R3271, S/N: 15050203, 100 Hz to 32 GHz)
- **Microwave Amplifier**, HP, Model 83017A, Frequency Range 1 to 26.5 GHz, 34-38 dBdB gain nominal.
- **Active Loop Antenna**, Emco, Model 6507, SN 8906-1167, Frequency Range 1 KHz - 30 MHz, @ 50 Ohms
- **Log Periodic/Bow-Tie Antenna**, Emco, Model 3143, SN 1029, 20 - 1000 MHz, @ 50 ohms.
- **Horn Antenna**, Emco, Model 3115, SN 9701-5061, Frequency Range: 1 - 18 GHz, @ 50 Ohms.
- **Horn Antenna**, Emco, Model 3160-09, 18-26.5GHz
- **Horn Antenna**, Emco, Model 3160-09, 18-26.5GHz
- **Horn Antenna**, Emco, Model 3160-10, 26.5-40GHz
- **Mixer**, Tektronix, P/N 118-0098-00, 18-26.5GHz
- **Mixer**, Tektronix, P/N 119-0098-00, 26.5-40GHz

METHOD OF MEASUREMENTS:

Refer to ANSI 63.4-1992, Para. 8 for detailed radiated emissions measurement procedures.

Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.

For measurement below 1 GHz, set RBW = 100 KHz, VBW $\geq$ 100 KHz, SWEEP=AUTO.

For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz (Peak) & VBW = 10 Hz (Average), SWEEP=AUTO.

If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated

The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

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FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions

- (a) Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 1 GHz, an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.
- (b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:
- (1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
 - (2) All equipment operating on frequencies higher than 25 MHz
 - (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
 - (4) Other types of equipment as required, when deemed necessary by the Commission.

TEST RESULTS: Conforms.

TEST PERSONNEL: Hien Trinh, RFI/EMI Technician

DATE: April 29, 1999

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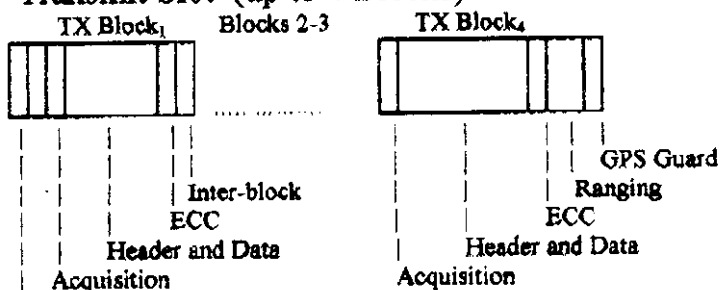


Calculated Duty Cycle

Slot Time 2:1 ratio

TX Slot 2083uS	TX Slot 2083uS	RX Slot 2083uS
4167uS		
6250uS		

Transmit Slot (up to 4 Blocks)



Setup Tuning

Setup			
Synth. Tuning	once per TX Slot	85uS	keyed
Acquisition	once per TX Block	64 chips	keyed
Header+Data+ECC			
range of 4 mile	once per TX Block	250 Bytes	keyed
range of 28 miles	once per TX Block	242 Bytes	keyed
Inter-block time	once per block (-1)	20uS	unkeyed
Ranging 28 miles	once per Slot	150uS	unkeyed
GPS Guard Time	once per Slot	20uS	unkeyed

Keyed time (for 4 blocks) = Total Slot Time - Inter-block*(blocks-1) - Range - GPS Guard

At 28 miles

$$\begin{aligned}
 \text{Keyed time (for 4 blocks)} &= 4167 - (20*(4-1)) - 150 - 20 \\
 &= 4167 - 230 \\
 &= 3937 \text{ uS and a Duty Cycle of } 62.992 \text{ OR } 63\%
 \end{aligned}$$

MEASUREMENT DATA**RADIATED EMISSIONS MEASUREMENTS @ 3 METERS****TEST CONFIGURATION**

- This lowest, middle and highest channels were established at its full rated output power. The emissions were investigated from the lowest frequency generated by the transmitter up to the 10th harmonic of the fundamental emissions in each case. the measured level of the carrier was recorded and compared to the level of the emissions as required in Parts 15.247(c) or 15.209(a) whichever was applicable.
- For measuring radiated emissions at frequencies below 1 GHz, the Spectrum Analyzer was set as 100 KHz RBW, VBW $\geq$ RBW, SWEEP TIME: AUTO, PEAK DETECTOR.
- For measuring radiated emissions at frequencies above 1 GHz, the Spectrum Analyzer was set as 1 MHz RBW, 1 MHz VBW, SWEEP TIME: AUTO for PEAK measurements and 1 MHz RBW, 10 Hz VBW, SWEEP TIME: AUTO for AVERAGE measurements.
- The following measurements were the worst cases when the radiating antenna was placed in both horizontal and vertical polarization.
- The following **AVERAGE** rf levels were obtained from either Peak or Average readings added by the duty cycle correction factor. **DUTY CYCLE FACTOR** = $20\text{LOG}_{10}(0.63) = -4.0 \text{ dB}$

ISP Direct Indoor & Outdoor Units with Huber Suhner 1x10 Patch Antenna

Channel #: 3 Frequency: 2408.63 MHz Full Rated Peak Power: 190mW Modulation: DQPSK, narrow, 11 chips/symbol Data Rate: 0.818 Mbps, 2 bits/symbol				Power Level in 1 MHz BW: 124.3dBμV/m Limit = 124.3 - 20dB = 104.3 dBμV/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dB μ V/m)	RF AVG LEVEL (dB μ V/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dB μ V/m)	LIMIT 15.247 (dB μ V/m)	MARGIN (dB)	PASS/ FAIL
1493.63	57.7	51.7	V	54.0	104.3	-2.3	*PASS
1493.63	54.6	48.3	H	54.0	104.3	-5.7	*PASS
2408.63	124.3	--	V	--	--	--	--
2408.63	106.6	--	H	--	--	--	--
2987.25	54.9	48.9	V	54.0	104.3	-55.4	PASS
2987.25	51.9	44.6	H	54.0	104.3	-59.7	PASS
4480.88	59.0	52.6	V	54.0	104.3	-51.7	PASS
4480.88	56.6	50.8	H	54.0	104.3	-53.5	PASS
5974.50	51.0	38.1	V	54.0	104.3	-66.2	PASS
5974.50	49.0	33.6	H	54.0	104.3	-70.7	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

* Emission within the restricted band specified in @ 15.205(a)

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INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 3, Tx Frequency: 2408.625 MHz, RF Power: 0.19 W

Modulation: DSSS, BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK

Antenna: 1 x 10 HUBER SUHNER

10: 09: 21 APR 28, 1999

16: 14: 40 NOV 05, 1998

Radiated Emissions Measurements @ 3 Meters

Polarization: | Horizontal | Vertical

MEAS DET: PEAK QP AVG

MKR 2.4090 GHZ

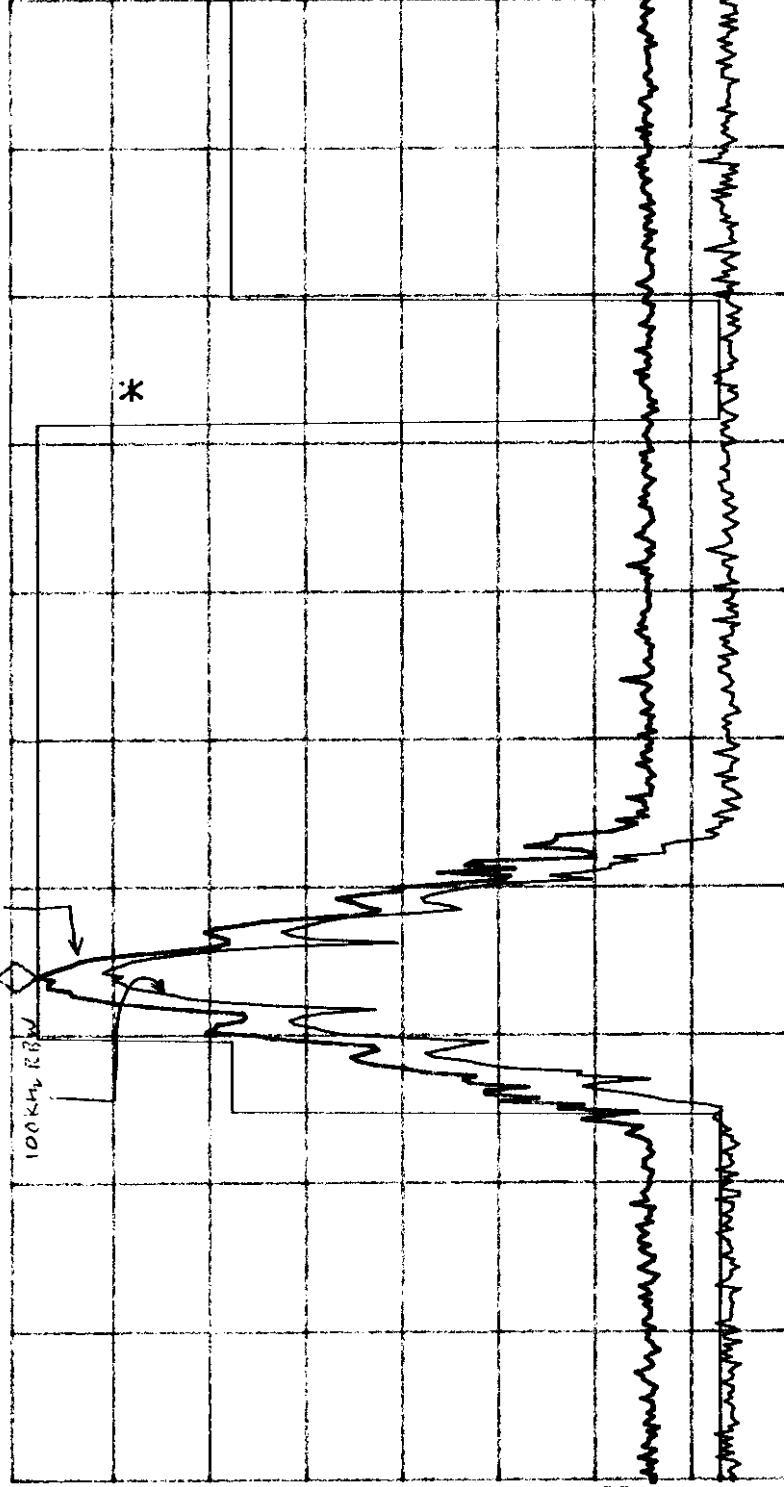
124.30 dBμV

No user
Menu

REF OFFST 20.0 dB

REF 127.0 dBμV

1 MHz RBW



CENTER 2.4410 GHZ

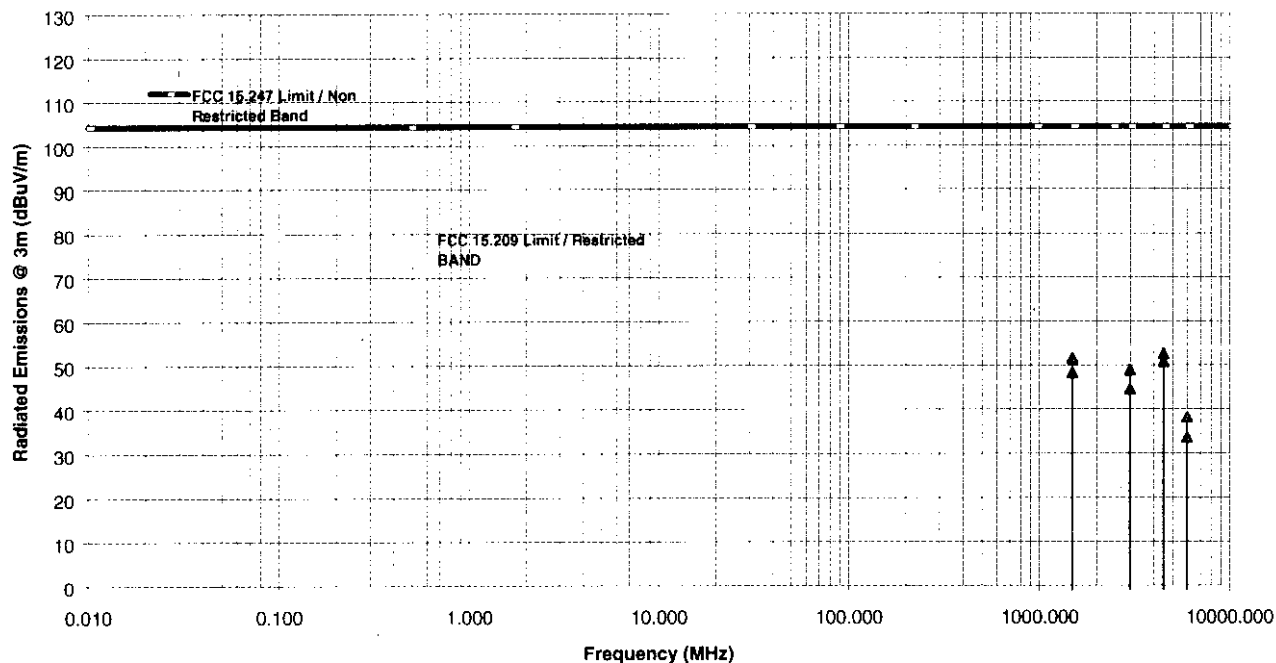
#IF BW 1.0 MHz

#AVG BW 1 MHz

SPAN 200.0 MHz

SWP 20.0 msec

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Clearwire ISP Direct Indoor and Outdoor Units, Model: 2401-02
Ch. #3, Center Freq.: 2408.63, Chip Rate: 4.5 MHz, Data Rate: 0.818 Mbps (Narrow)
(Huber Suhner 1x10 Patch Antenna, P/N: 1324-170001)

**ULTRATECH GROUP OF LABS**

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File #: IAW9-FTX

May 6, 1999

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INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)
Channel # 3, Tx Frequency: 2408.625 MHz, RF Power: 0.19 W
Modulation: DSSS, BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK
Antenna: 1 x 10 HUBER SUHNER

10: 25: 11 APR 28, 1999
16: 14: 40 NOV 05, 1998

Radiated Emissions Measurements @ 3 Meters

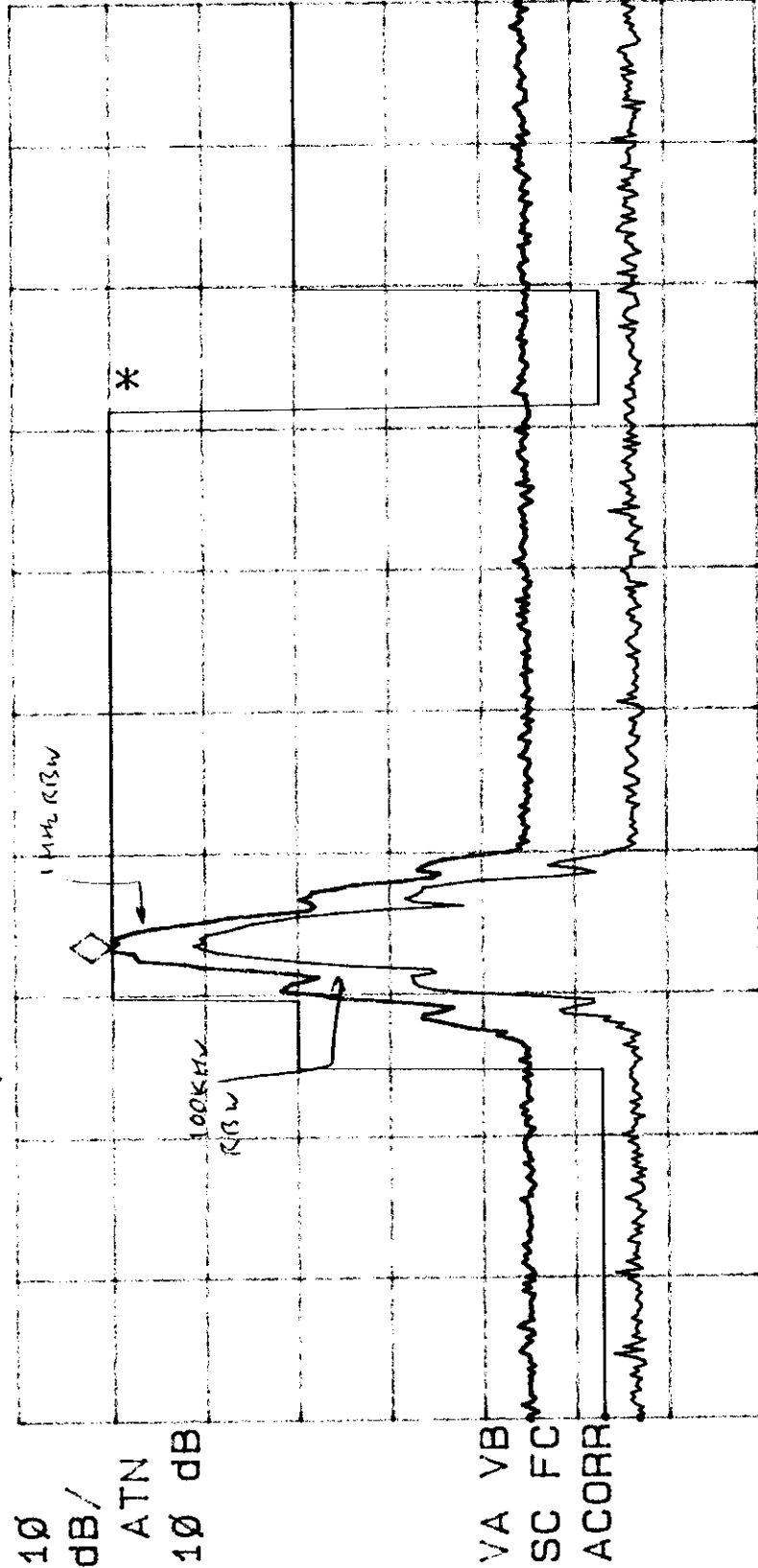
Polarization: [X] Horizontal [] Vertical
MEAS DEF: PEAK QP AVG

MKR 2.4080 GHZ
106.61 dBμV

No user
Menu

REF OFFST 20.0 dB
REF 117.0 dBμV

LOG 10 dB / ATN 10 dB



VA VB
SC FC
ACORR

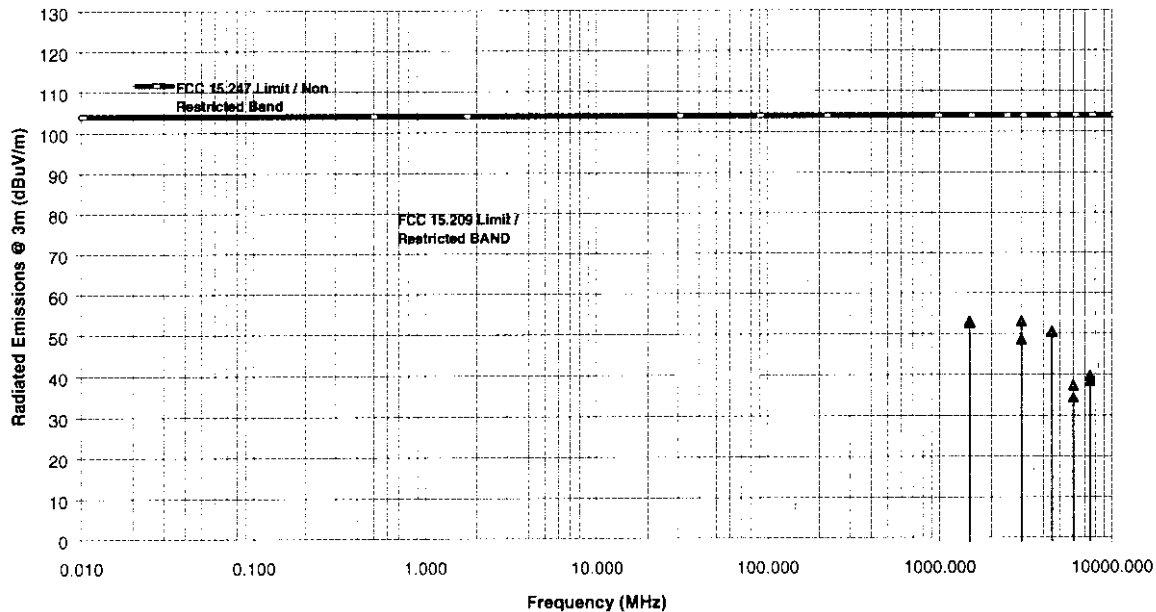
CENTER 2.4410 GHZ
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 200.0 MHz
SWP 20.0 msec

Channel #: 4 Frequency: 2411.44MHz Full Rated Peak Power: 190mW Modulation: DQPSK, medium, 11 chips/symbol Data Rate: 1.023 Mbps, 2 bits/symbol				Power Level in 1 MHz BW: 123.92dBμV/m Limit = 123.92 - 20dB = 103.9			
FREQUENCY (MHz)	RF PEAK LEVEL (dBμV/m)	RF AVG LEVEL (dBμV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBμV/m)	LIMIT 15.247 (dBμV/m)	MARGIN (dB)	PASS/ FAIL
1496.44	57.5	52.6	V	54.0	103.9	-1.4	*PASS
1496.44	57.5	53.1	H	54.0	103.9	-1.0	*PASS
2411.44	123.9	--	V	--	--	--	--
2411.44	106.2	--	H	--	--	--	--
2992.88	59.2	53.1	V	54.0	103.9	-50.9	PASS
2992.88	54.1	48.5	H	54.0	103.9	-55.4	PASS
4489.31	57.1	50.6	V	54.0	103.9	-53.3	PASS
4489.31	56.7	50.3	H	54.0	103.9	-53.6	PASS
5985.75	50.7	37.4	V	54.0	103.9	-66.6	PASS
5985.75	48.5	34.4	H	54.0	103.9	-69.5	PASS
7482.19	55.4	39.7	V	54.0	103.9	-14.3	*PASS
7482.19	51.9	38.4	H	54.0	103.9	-15.6	*PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

* Emission within the restricted band specified in @ 15.205(a)

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Clearwire ISP Direct Indoor and Outdoor Units
Ch. #4, Center Freq.: 2411.44, Chip Rate: 5.625 MHz, Data Rate: 1.02 Mbps (Medium)
(Huber Suhner 1x10 Patch Antenna, P/N: 1324-170001)



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INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 4, Tx Frequency: 2411.4375 MHz, RF Power: 0.19 W

Modulation: DSSS, BW: MEDIUM (5.625 Mc/s), 11 chips/symbol, 1.023 Mbps DQPSK

11: 16:03 APR 28, 1999

16: 14: 40 NOV 05, 1998

Antenna: 1 x 10 HUBER SHAWLER

Radiated Emissions Measurements @ 3 Meters

Polarization: | Horizontal | Vertical

MEAS DET: PEAK QP AVG

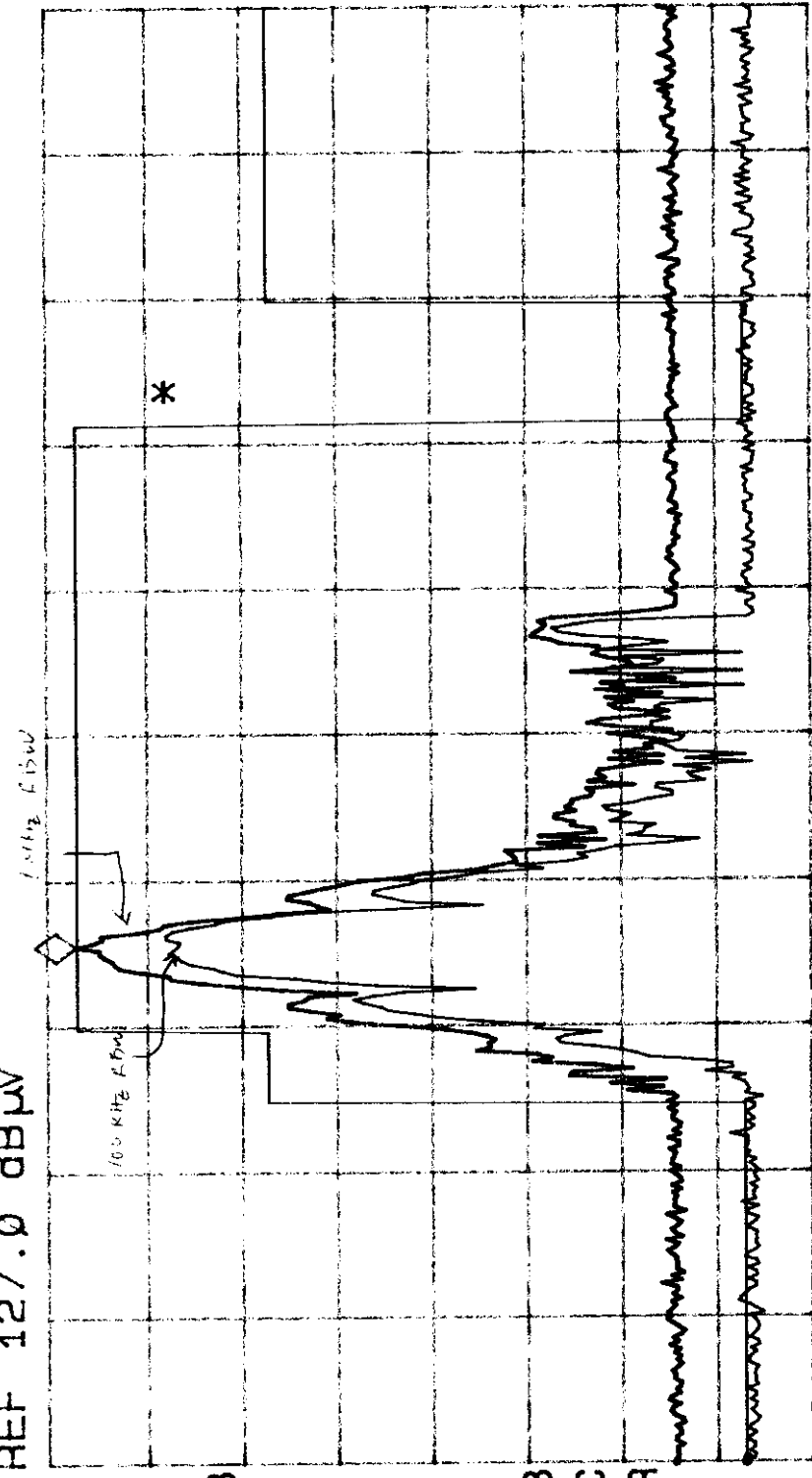
MKR 2.4120 GHZ

123.92 dBμV

No user
Menu

REF OFFST 20.0 dB
REF 127.0 dBμV

LOG 10 dB/ ATN 10 dB



CENTER 2.4410 GHZ SPAN 200.0 MHZ
#IF BW 1.0 MHZ #AVG BW 1 MHZ SWP 20.0 msec



INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)
Channel # 4, Tx Frequency: 2411.4375 MHz, RF Power: 0.19 W
Modulation: DSSS, BW: MEDIUM (5.625 Mc/s), 11 chips/symbol, 1.023 Mbps DQPSK
Antenna: 1 x 10 HUBER SUTHER

Date: April 22, 1999
Tested by: Hung Trinh

10: 46: 51 APR 28, 1999
16: 14: 40 NOV 05, 1998

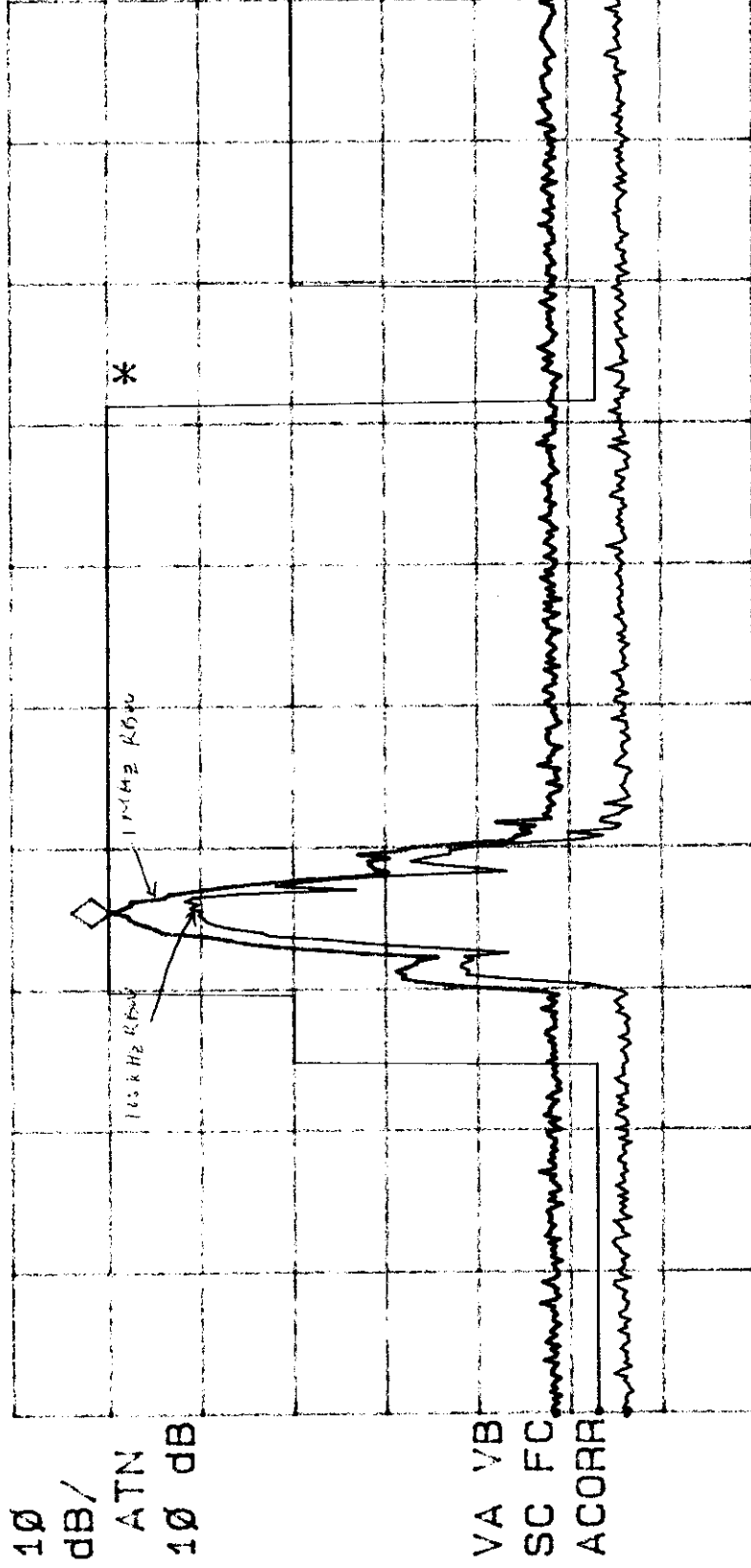
Radiated Emissions Measurements @ 3 Meters

Polarization: ☒ Horizontal ☐ Vertical
MEAS DET: PEAK QP AVG

No user
Menu

MKR 2.4120 GHz
106.22 dBμV

LOG REF OFFST 20.0 dB
10 REF 117.0 dBμV
dB/



CENTER 2.4410 GHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 200.0 MHz
SWP 20.0 msec

Channel #: 6 Frequency: 2419.88 MHz Full Rated Peak Power: 190mW Modulation: DQPSK, wide, 11 chips/symbol Data Rate: 2.045 Mbps, 2 bits/symbol				Power Level in 1 MHz BW: 119.8 dB μ V/m Limit = 119.8 - 20dB = 99.8 dB μ V/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
1504.88	57.2	52.9	V	54.0	99.8	-1.1	*PASS
1504.88	55.2	50.2	H	54.0	99.8	-3.8	*PASS
2419.88	119.8	--	V	--	--	--	--
2419.88	103.4	--	H	--	--	--	--
3009.75	51.5	44.2	V	54.0	99.8	-55.6	PASS
3009.75	50.3	41.7	H	54.0	99.8	-58.1	PASS
4514.63	58.0	51.3	V	54.0	99.8	-2.7	*PASS
4514.63	58.6	52.8	H	54.0	99.8	-1.2	*PASS
6019.50	51.2	38.9	V	54.0	99.8	-60.9	PASS
6019.50	51.3	39.0	H	54.0	99.8	-60.8	PASS
7524.38	56.7	41.1	V	54.0	99.8	-12.9	*PASS
7524.38	56.4	39.9	H	54.0	99.8	-14.1	*PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

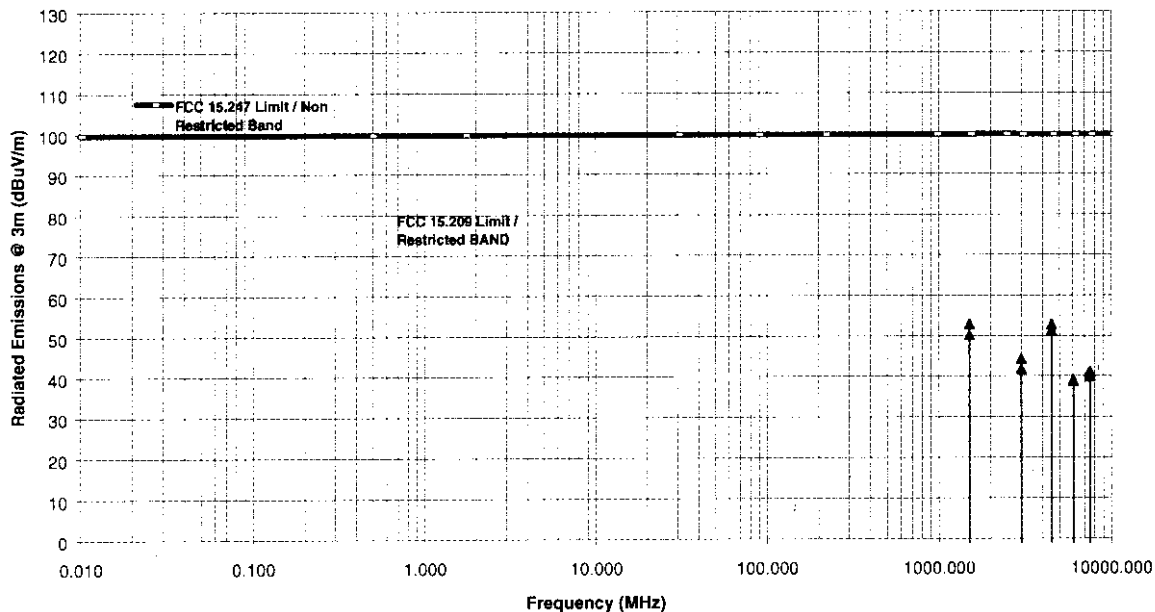
* Emission within the restricted band specified in @ 15.205(a)

Transmitter Radiated Emissions Measurements at 3 Meter OFTS

Clearwire ISP Direct Indoor and Outdoor Units

Ch. #6, Center Freq.: 2419.88, Chip Rate: 11.25 MHz, Data Rate: 2.045 Mbps (Wide)

(Huber Suhner 1x10 Patch Antenna, P/N: 1324-170001)



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File #: IAW9-FTX

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Engineering Labs Inc.

11: 27: 19 APR 28, 1999
16: 14: 40 NOV 05, 1998

INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 6, Tx Frequency: 2419.875 MHz, RF Power: 0.19 W

Modulation: DSSS, BW: WIDE (11.25 Mc/s), 11 chips/symbol, 2.045 Mbps DQPSK

Antenna: 1 X 10 SUBS SUMMER

Date: April 28, 1999
Tested by: Hung Trinh

Radiated Emissions Measurements @ 3 Meters

Polarization: [] Horizontal X Vertical

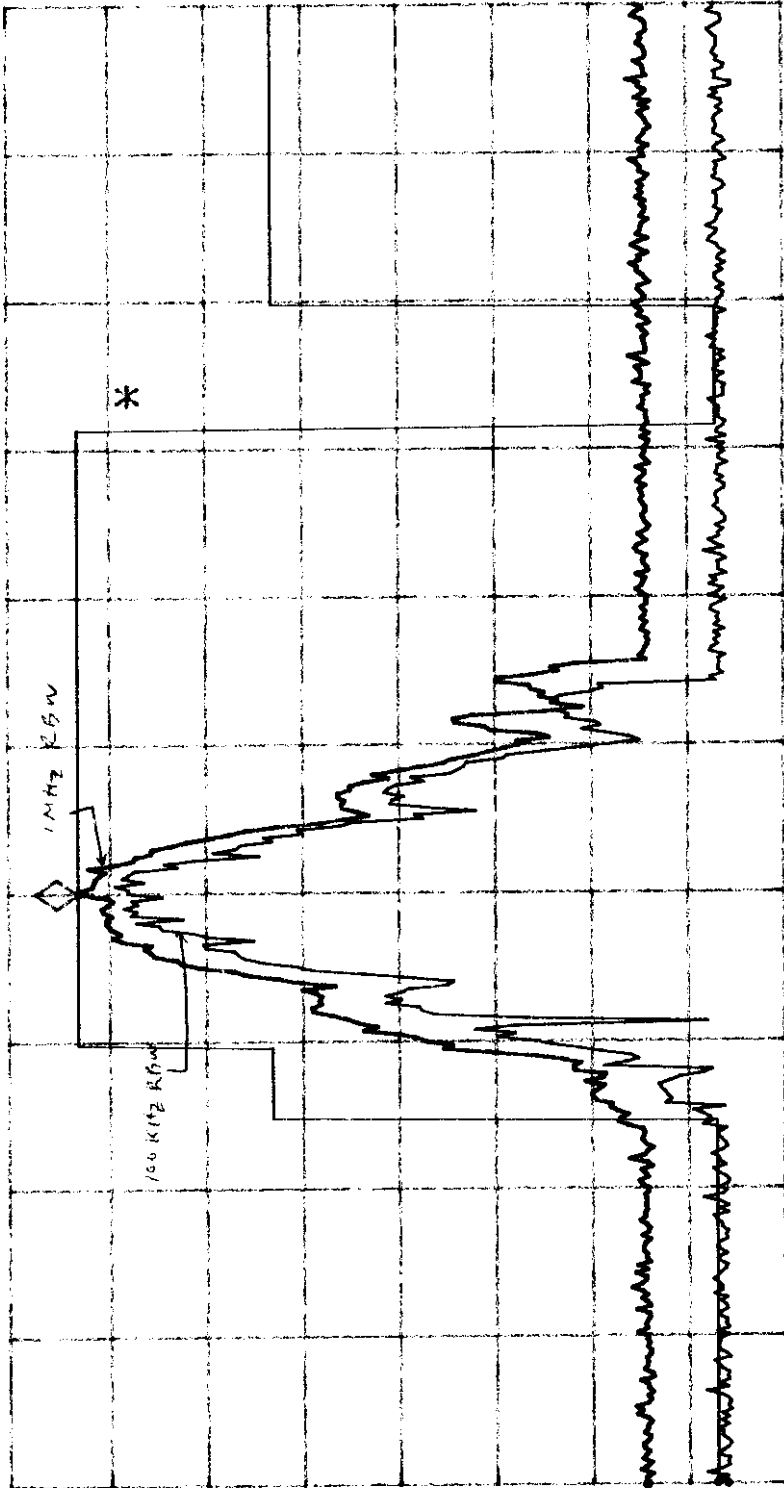
No user
Menu

MEAS DET: PEAK QP AVG

MKR 2.4210 GHZ
119.84 dBμV

LOG REF OFFST 20.0 dB
10 REF 127.0 dBμV
dB/

ATN
10 dB



VA VB
SC FC
ACORR

CENTER 2.4410 GHZ
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 200.0 MHz
SWP 20.0 msec



11: 27: 19 APR 28, 1998
16: 14: 40 NOV 05, 1998

INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 6, Tx Frequency: 2419.875 MHz, RF Power: 0.19 W

Modulation: DSSS, BW: WIDE (11.25 Mc/s), 11 chips/symbol, 2.045 Mbps DQPSK

Antenna: 1 x 10 dBS S.W. 11.25 MHz

Date: April 28, 1999
Tested by: Hung Trinh

Radiated Emissions Measurements @ 3 Meters

Polarization: | Horizontal | Vertical

MEAS DET: PEAK QP AVG

MKR 2.4210 GHz

119.84 dBμV

No user
Menu

REF OFFST 20.0 dB

REF 127.0 dBμV

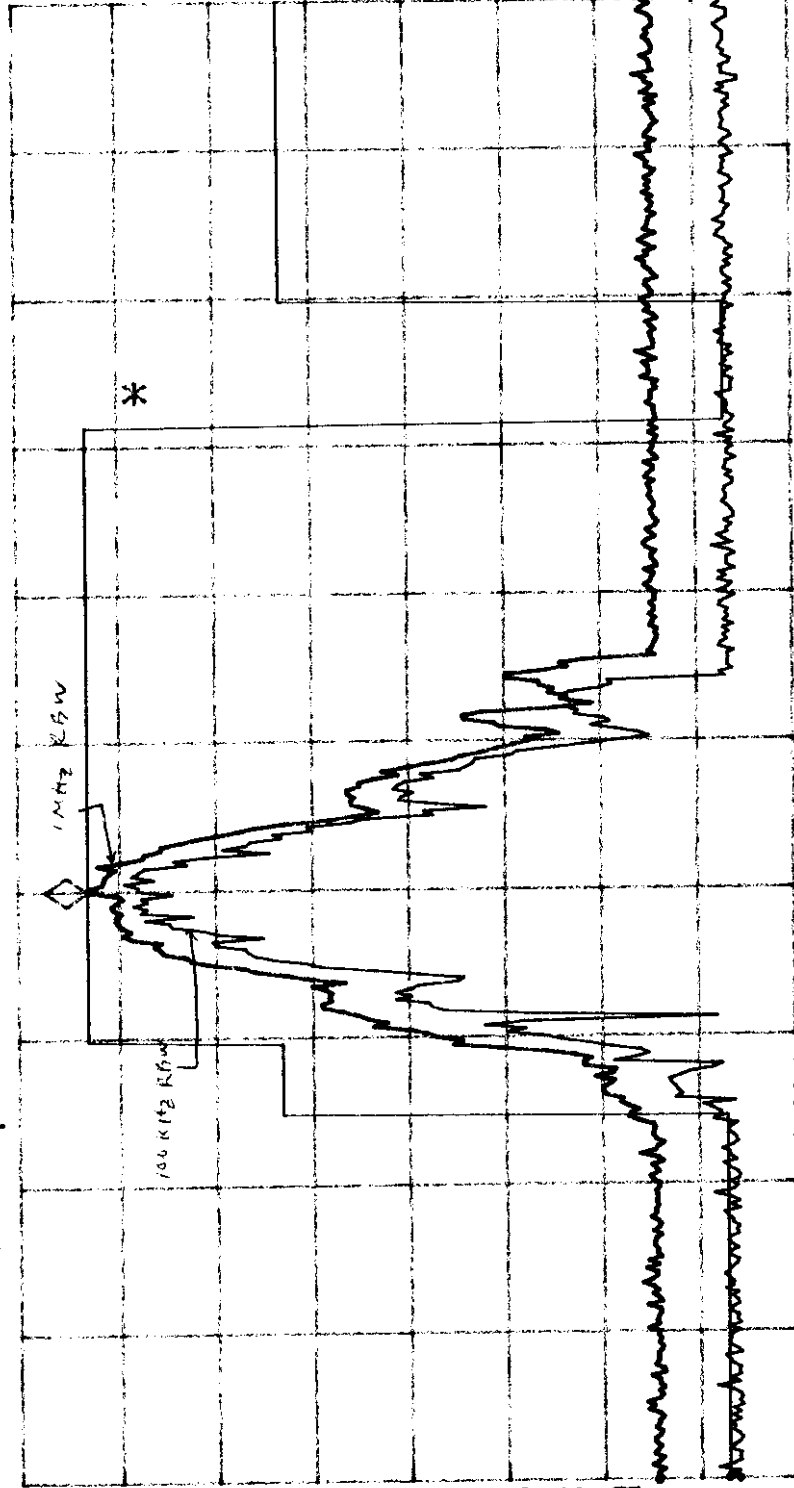
LOG

10

dB/

ATN

10 dB



CENTER 2.4210 GHz

#IF BW 1.0 MHz

#AVG BW 1 MHz

SPAN 200.0 MHz

SWP 20.0 msec



Engineering Labs Inc.

INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 6, Tx Frequency: 2419.875 MHz, RF Power: 0.19 W

Modulation: DSSS, BW: WIDE (11.25 Mc/s), 11 chips/symbol, 2.045 Mbps DQPSK

Antenna: 1 X 10 HUBER SUHNER

12: 45: 26 APR 28, 1998

16: 14: 40 NOV 05, 1998

Date: April 28, 1999
Tested by: Hung Trinh

Radiated Emissions Measurements @ 3 Meters

ACTV DET: PEAK

Polarization: KJ Horizontal

MEAS DET: PEAK QP AVG

No user
Menu

MKR 2.4200 GHz
103.38 dBμV

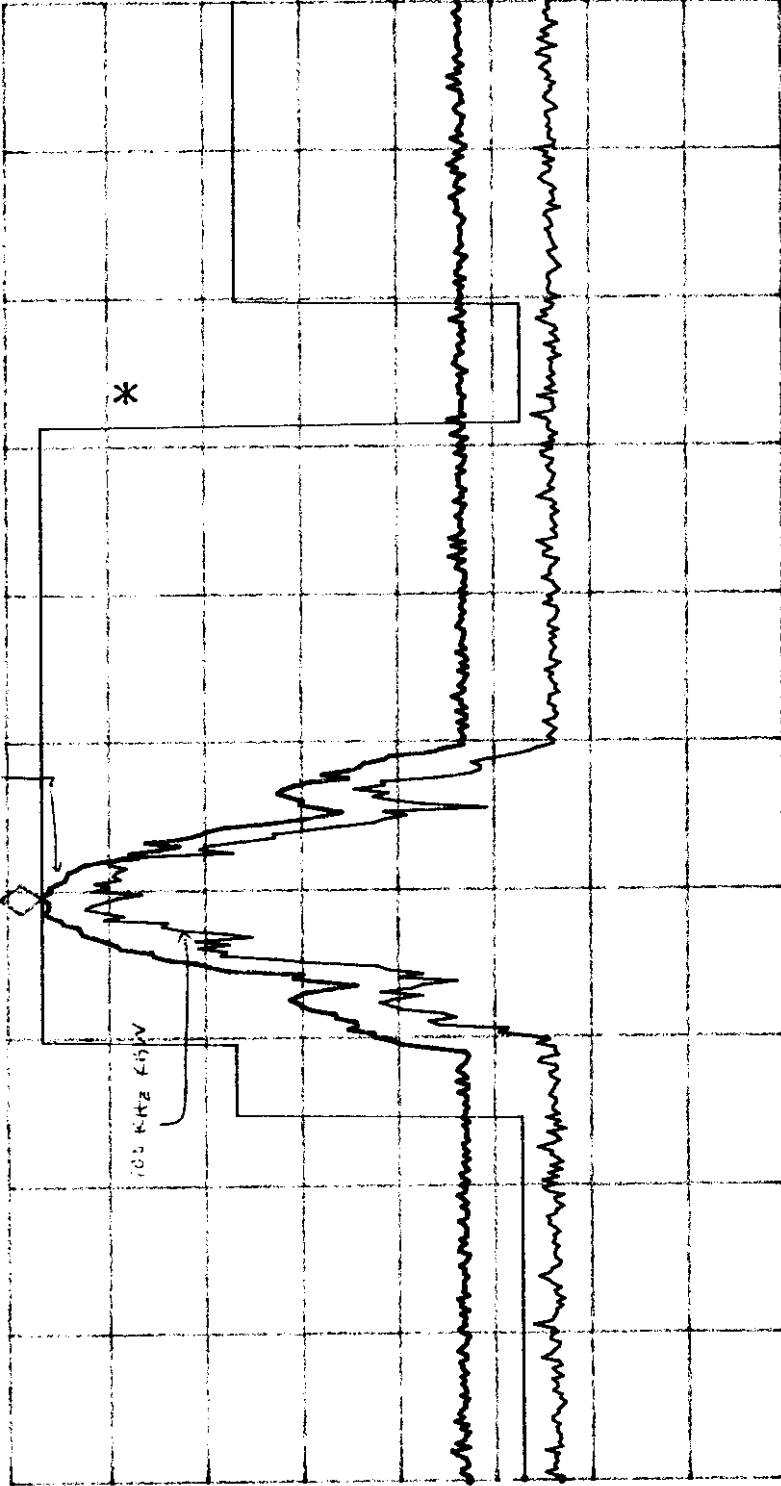
REF OFFST 20.0 dB
REF 107.0 dBμV

1 MHz BW

100 kHz 45 μV

*

LOG 10 dB/
ATN 10 dB



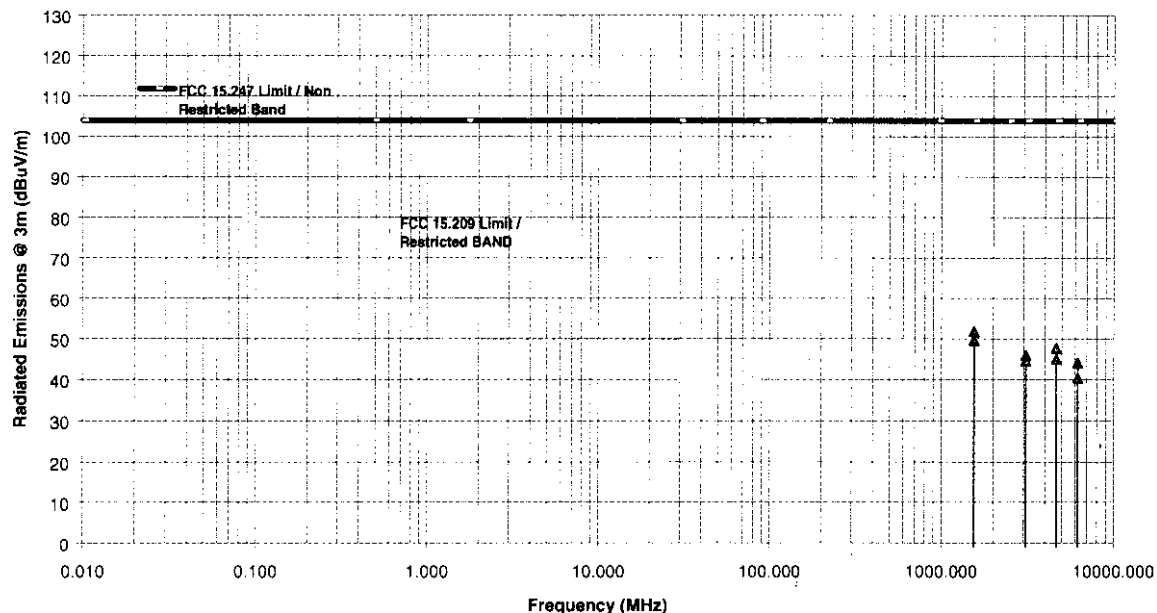
VA VB
SC FC
ACORR

CENTER 2.4410 GHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 200.0 MHz
SWP 20.0 msec

Channel #: 18 Frequency: 2464.88 MHz Full Rated Peak Power: 190mW Modulation:DQPSK, narrow, 11 chips/symbol Data Rate: 0.818 Mbps, 2 bits/symbol				Power Level in 1 MHz BW: 124.0 dBμV/m Limit = 124.0 - 20dB = 104.0 dBμV/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
1549.88	57.3	49.6	V	54.0	104.0	-4.4	*PASS
1549.88	57.7	51.7	H	54.0	104.0	-2.3	*PASS
2464.88	124.0	--	V	--	--	--	--
2464.88	103.4	--	H	--	--	--	--
3099.75	53.0	45.8	V	54.0	104.0	-58.2	PASS
3099.75	51.7	44.6	H	54.0	104.0	-59.4	PASS
4649.63	54.1	45.0	V	54.0	104.0	-9.0	*PASS
4649.63	55.1	47.7	H	54.0	104.0	-6.3	*PASS
6199.50	53.6	44.1	V	54.0	104.0	-59.9	PASS
6199.50	52.2	40.4	H	54.0	104.0	-63.6	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

* Emission within the restricted band specified in @ 15.205(a)

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Clearwire ISP Direct Indoor and Outdoor Units
Ch. #18, Center Freq.: 2464.88, Chip Rate: 4.5 MHz, Data Rate: 0.818 Mbps (Narrow)
(Huber Suhner 1x10 Patch Antenna, P/N: 1324-170001)



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Engineering Labs Inc.

13: 06: 42 APR 28, 1999

16: 14: 40 NOV 05, 1998

INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 18, Tx Frequency: 2464.875 MHz, RF Power: 0.19 W

Module: DSSS, BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK

Antenna: 1 x 10 METER SURVEY

Date: April 28, 1999
Tested by: Hung Trinh

Radiated Emissions Measurements @ 3 Meters

Polarization: [] Horizontal [X] Vertical

MEAS DET: PEAK QP AVG

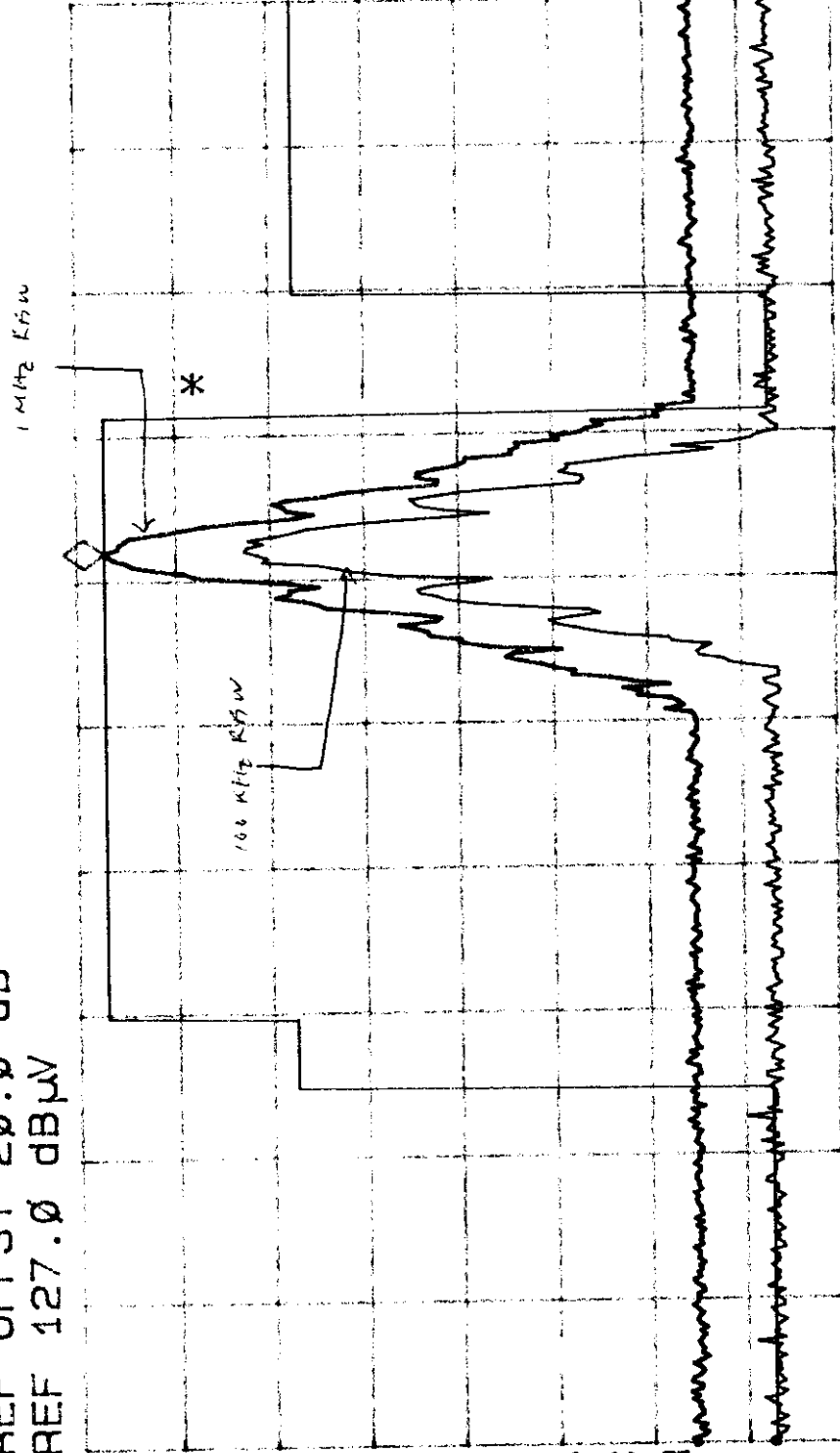
No user
Menu

MKR 2.4650 GHZ

123.99 dBμV

REF OFFST 20.0 dB
REF 127.0 dBμV

LOG
10
dB/
ATN
10 dB



VA VB
SC FC
ACORR

CENTER 2.4410 GHZ
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 200.0 MHz
SWP 20.0 msec



INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 18, Tx Frequency: 2464.875 MHz, RF Power: 0.19 W

Modulation: DSSS, BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK

Antenna: 1 X 10 HUBER SUBARIER

12: 52: 27 APR 28. 1998
16: 14: 40 NOV 05. 1998

Radiated Emissions Measurements @ 3 Meters

Polarization: ☒ Horizontal ☐ Vertical

MEAS DET: PEAK QP AVG

MKR 2.4650 GHZ

103.41 dBμV

No user
Menu

REF OFFST 20.0 dB

REF 107.0 dBμV

LOG

10

dB/

ATN

10 dB

1 MHz RES W

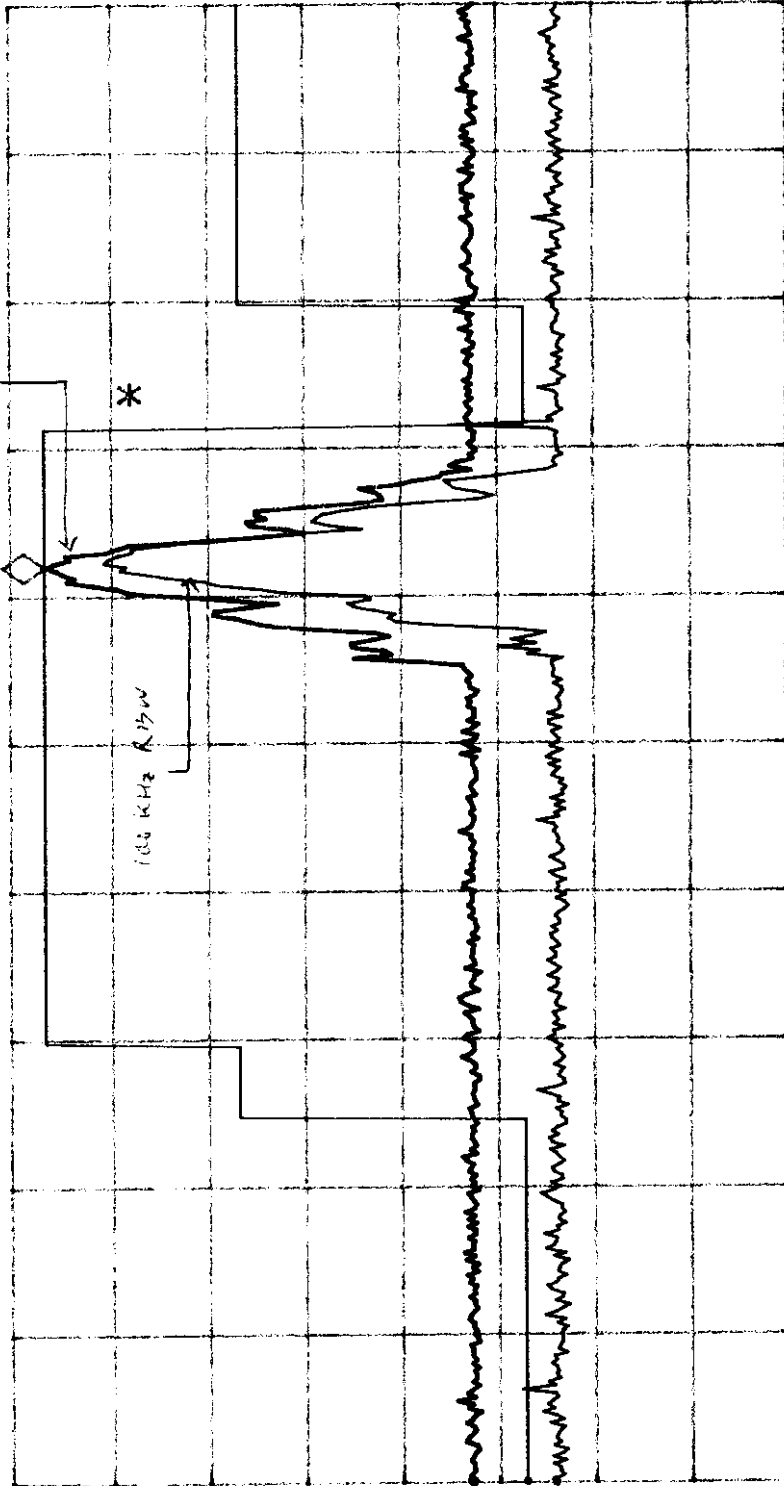
100 kHz RES W

*

VA VB

SC FC

ACORR



CENTER 2.4410 GHZ

#IF BW 1.0 MHz

#AVG BW 1 MHz

SPAN 200.0 MHz

SWP 20.0 msec

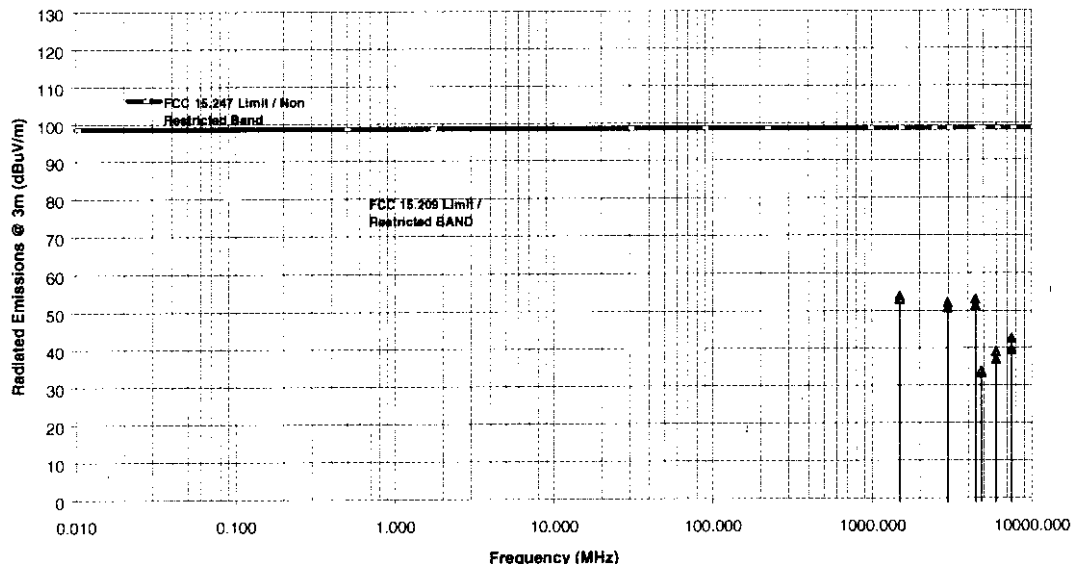
ISP Direct Indoor & Outdoor Units with Andrews High Gain Omni Antenna

Channel #: 3 Frequency: 2408.63 MHz Full Rated Peak Power: 190mW Modulation:DQPSK, narrow, 11 chips/symbol Data Rate: 0.818 Mbps, 2 bits/symbol				Power Level in 1 MHz BW: 118.7 dBμV/m Limit = 118.7 - 20dB = 98.7 dBμV/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dBμV/m)	RF AVG LEVEL (dBμV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBμV/m)	LIMIT 15.247 (dBμV/m)	MARGIN (dB)	PASS/ FAIL
1493.63	58.1	53.9	V	54.0	98.7	-0.1	*PASS
1493.63	57.1	53.0	H	54.0	98.7	-1.0	*PASS
2408.63	118.7	--	V	--	--	--	--
2408.63	100.4	--	H	--	--	--	--
2987.25	57.6	52.2	V	54.0	98.7	-46.5	PASS
2987.25	55.7	50.8	H	54.0	98.7	-47.9	PASS
4450.88	58.7	53.1	V	54.0	98.7	-45.6	PASS
4450.88	58.0	51.4	H	54.0	98.7	-47.3	PASS
4817.25	50.0	33.3	V	54.0	98.7	-20.7	*PASS
4817.25	51.2	33.8	H	54.0	98.7	-20.2	*PASS
5974.50	51.5	39.0	V	54.0	98.7	-59.7	PASS
5974.50	49.7	37.0	H	54.0	98.7	-61.7	PASS
7468.13	54.8	42.6	V	54.0	98.7	-11.4	*PASS
7468.13	55.4	39.6	H	54.0	98.7	-14.4	*PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

* Emission within the restricted band specified in @ 15.205(a)

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Clearwire ISP Direct Indoor and Outdoor Units
Ch. #3, Center Freq.: 2408.63, Chip Rate: 4.5 MHz, Data Rate: 0.818 Mbps (Narrow)
(Andrew Omni Antenna, P/N: RT1N0F-024V-013A)

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File #: IAW9-FTX

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INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)
Channel # 3, Tx Frequency: 2408.625 MHz, RF Power: 0.19 W
Modulation: DSSS, BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK

Antenna: ADDREW

16: 14: 40 NOV 05, 1998

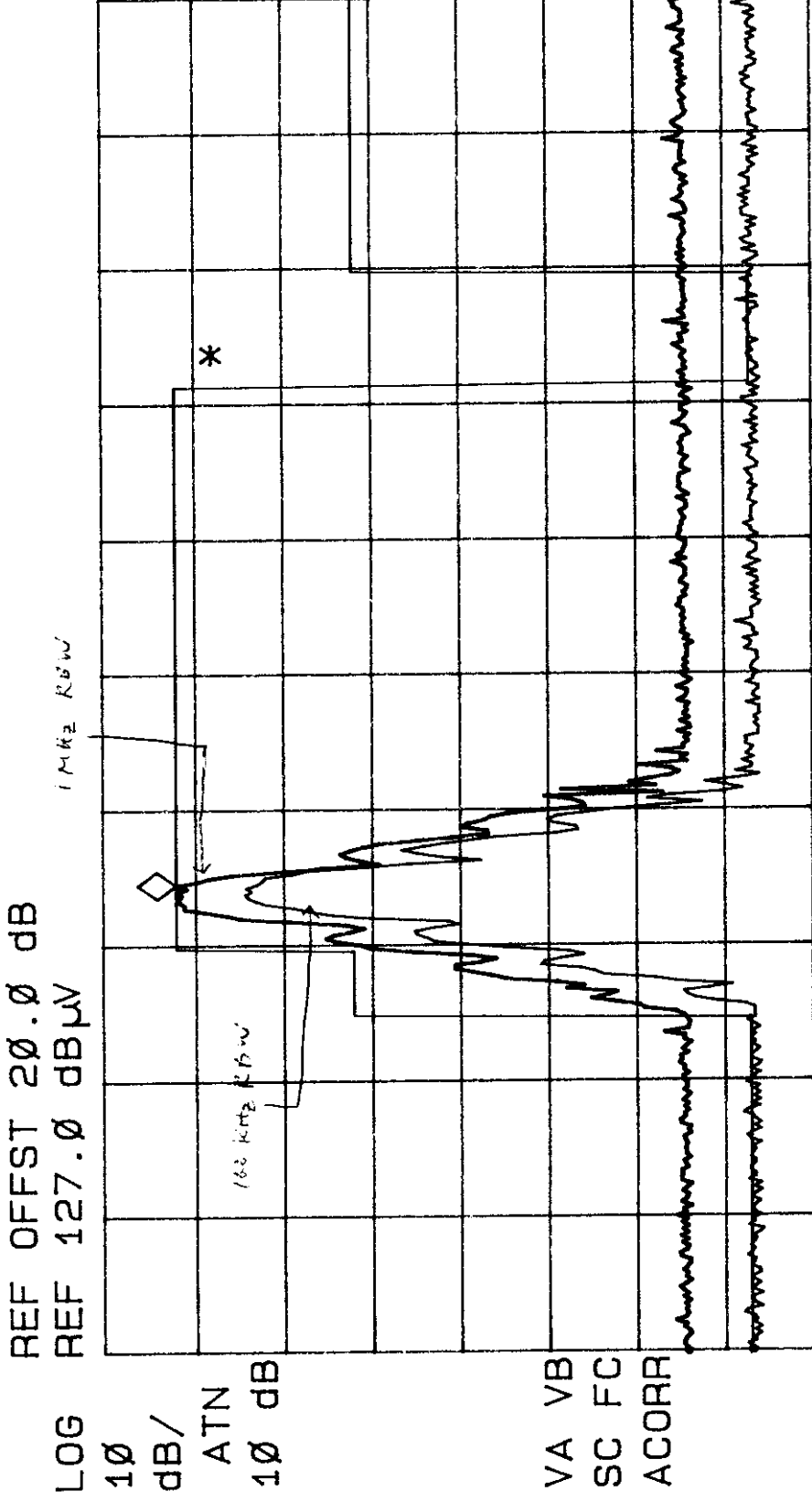
Radiated Emissions Measurements @ 3 Meters

Polarization: | Horizontal | x Vertical

MEAS DET: PEAK QP AVG

MKR 2.4100 GHz
118.70 dBμV

No user
Menu



CENTER 2.4410 GHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 200.0 MHz
SWP 20.0 msec



INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)
Channel # 3, Tx Frequency: 2408.625 MHz, RF Power: 0.19 W
Modulation: DSSS, BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK

Antenna: ANDREW
16: 14: 40 NOV 05, 1998

Radiated Emissions Measurements @ 3 Meters

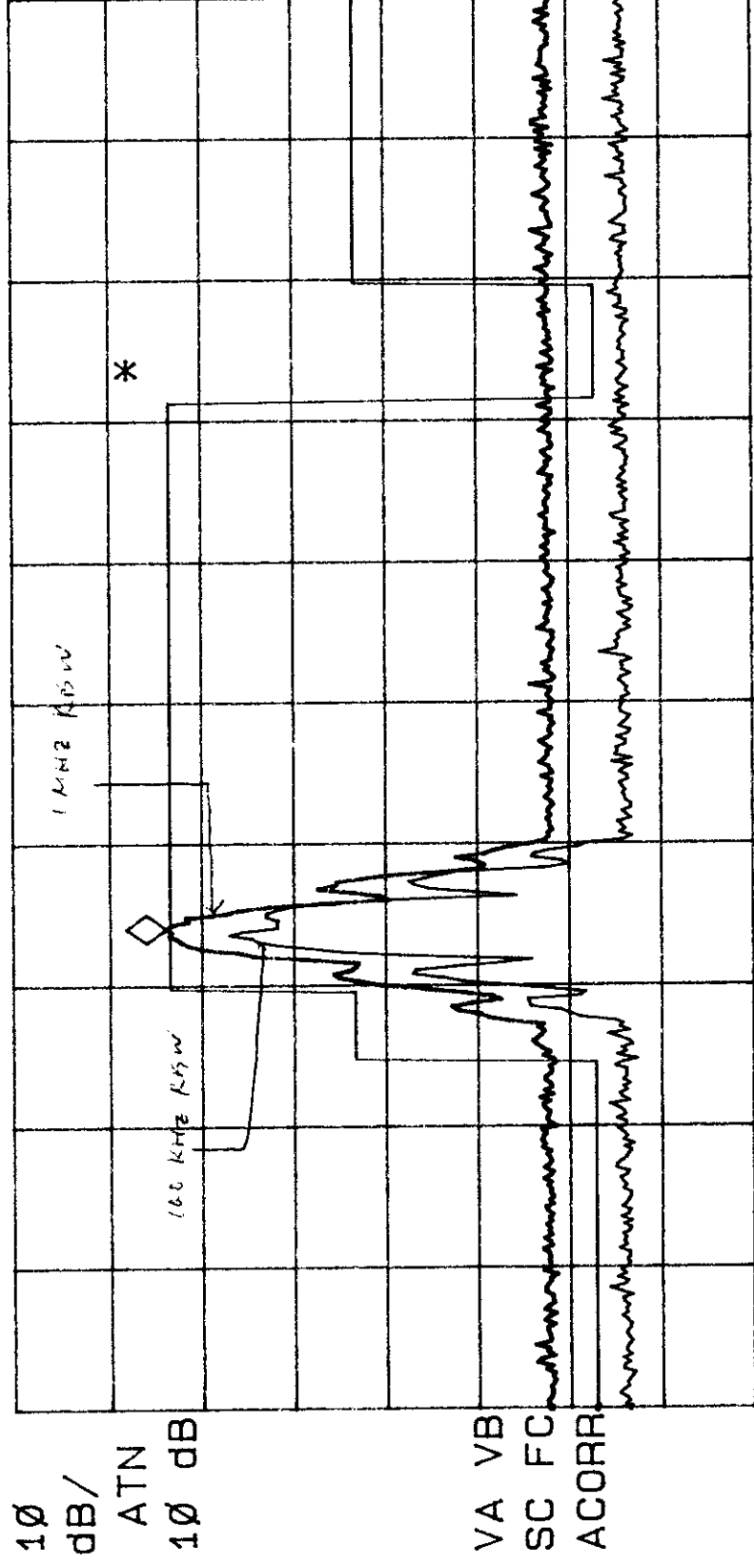
ACTV DET PEAK
Polarization: [X] Horizontal [] Vertical

MEAS DET: PEAK QP AVG

No user
Menu

MKR 2.4090 GHZ
100.42 dBμV

LOG 10 dB/ATN 10 dB
REF OFFST 20.0 dB
REF 117.0 dBμV



CENTER 2.4410 GHZ
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 200.0 MHz
SWP 20.0 msec



INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)
Channel # 3, Tx Frequency: 2408.625 MHz, RF Power: 0.19 W
Modulation: DSSS, BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK

Antenna: *ANDREW*

16: 14: 40 NOV 05, 1998

Radiated Emissions Measurements @ 3 Meters

Polarization: [X] Horizontal [] Vertical

MEAS DET: PEAK QP AVG

MKR 2.4090 GHz

100.42 dBμV

No user
Menu

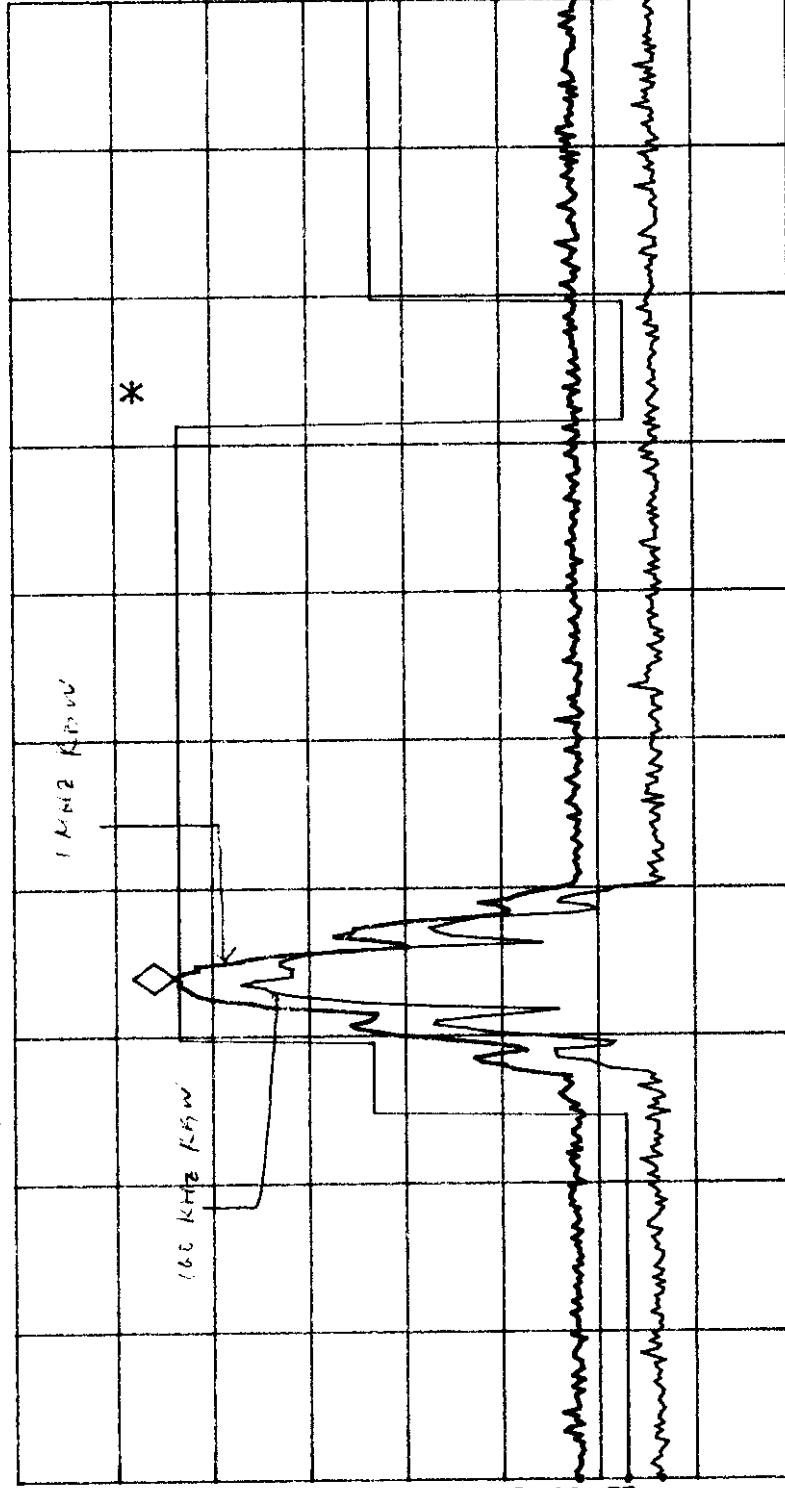
REF OFFST 20.0 dB

REF 117.0 dBμV

LOG
10
dB/

ATN

10 dB



VA VB
SC FC
ACORR

CENTER 2.4410 GHz

#IF BW 1.0 MHz

#AVG BW 1 MHz

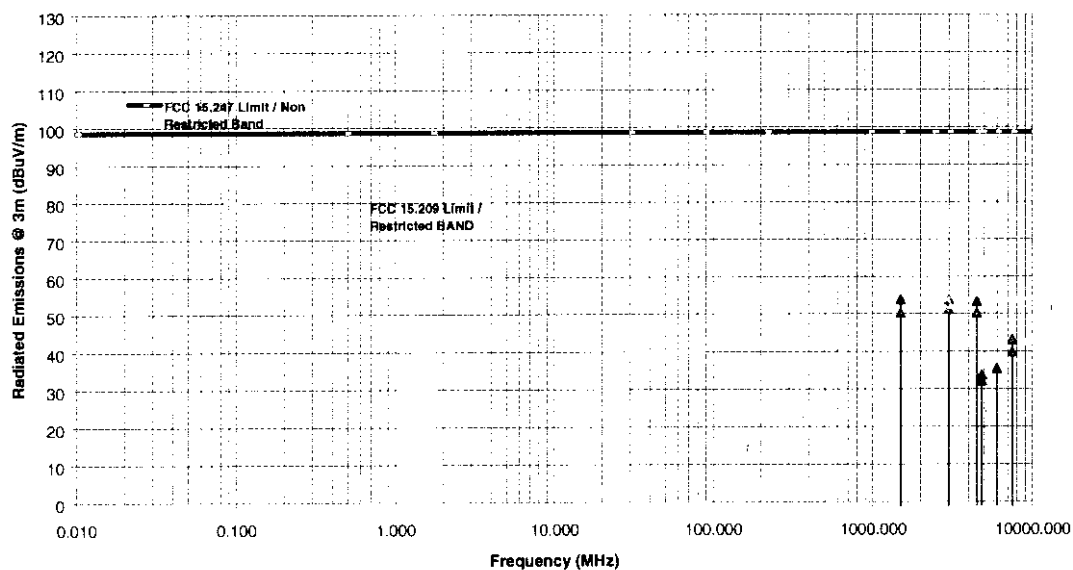
SPAN 200.0 MHz

SWP 20.0 msec

Channel #: 4 Frequency: 2411.44 MHz Full Rated Peak Power: 190mW Modulation: DQPSK, medium, 11 chips/symbol Data Rate: 1.023 Mbps, 2 bits/symbol				Power Level in 1 MHz BW: 118.7 dBμV/m Limit = 118.7 - 20dB = 98.7 dBμV/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dB μ V/m)	RF AVG LEVEL (dB μ V/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dB μ V/m)	LIMIT 15.247 (dB μ V/m)	MARGIN (dB)	PASS/ FAIL
1496.44	58.1	53.8	V	54.0	98.7	-0.3	*PASS
1496.44	55.1	50.2	H	54.0	98.7	-3.8	*PASS
2411.44	118.7	--	V	--	--	--	--
2411.44	101.7	--	H	--	--	--	--
2992.88	57.9	53.8	V	54.0	98.7	-44.9	PASS
2992.88	55.9	51.2	H	54.0	98.7	-47.5	PASS
4489.31	59.2	53.3	V	54.0	98.7	-45.4	PASS
4489.31	56.9	50.2	H	54.0	98.7	-48.5	PASS
4822.88	49.2	32.2	V	54.0	98.7	-21.8	*PASS
4822.88	53.4	33.7	H	54.0	98.7	-20.3	*PASS
5985.75	49.7	35.5	V	54.0	98.7	-63.2	PASS
5985.75	49.2	35.3	H	54.0	98.7	-63.5	PASS
7482.19	56.4	43.1	V	54.0	98.7	-10.9	*PASS
7482.19	56.3	39.9	H	54.0	98.7	-14.1	*PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

* Emission within the restricted band specified in @ 15.205(a)

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Clearwire ISP Direct Indoor and Outdoor Units
Ch. #4, Center Freq.: 2411.44, Chip Rate: 5.625 MHz, Data Rate: 1.023 Mbps (Medium)
(Andrew Omni Antenna, P/N: RT1N0F-024V-013A)



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File #: IAW9-FTX

May 6, 1999

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INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 4, Tx Frequency: 2411.4375 MHz, RF Power: 0.19 W

Modulation: DSSS, BW: MEDIUM (5.625 Mc/s), 11 chips/symbol, 1.023 Mbps DQPSK

Antenna: AUGREX
16: 14: 40 NOV 05, 1998

Radiated Emissions Measurements @ 3 Meters

ACTV DET: PEAK

Polarization: | Horizontal X Vertical

MEAS DET: PEAK QP AVG

MKR 2.4110 GHz
118.70 dBμV

No user
Menu

REF OFFST 20.0 dB

REF 127.0 dBμV

1 MHz RBW

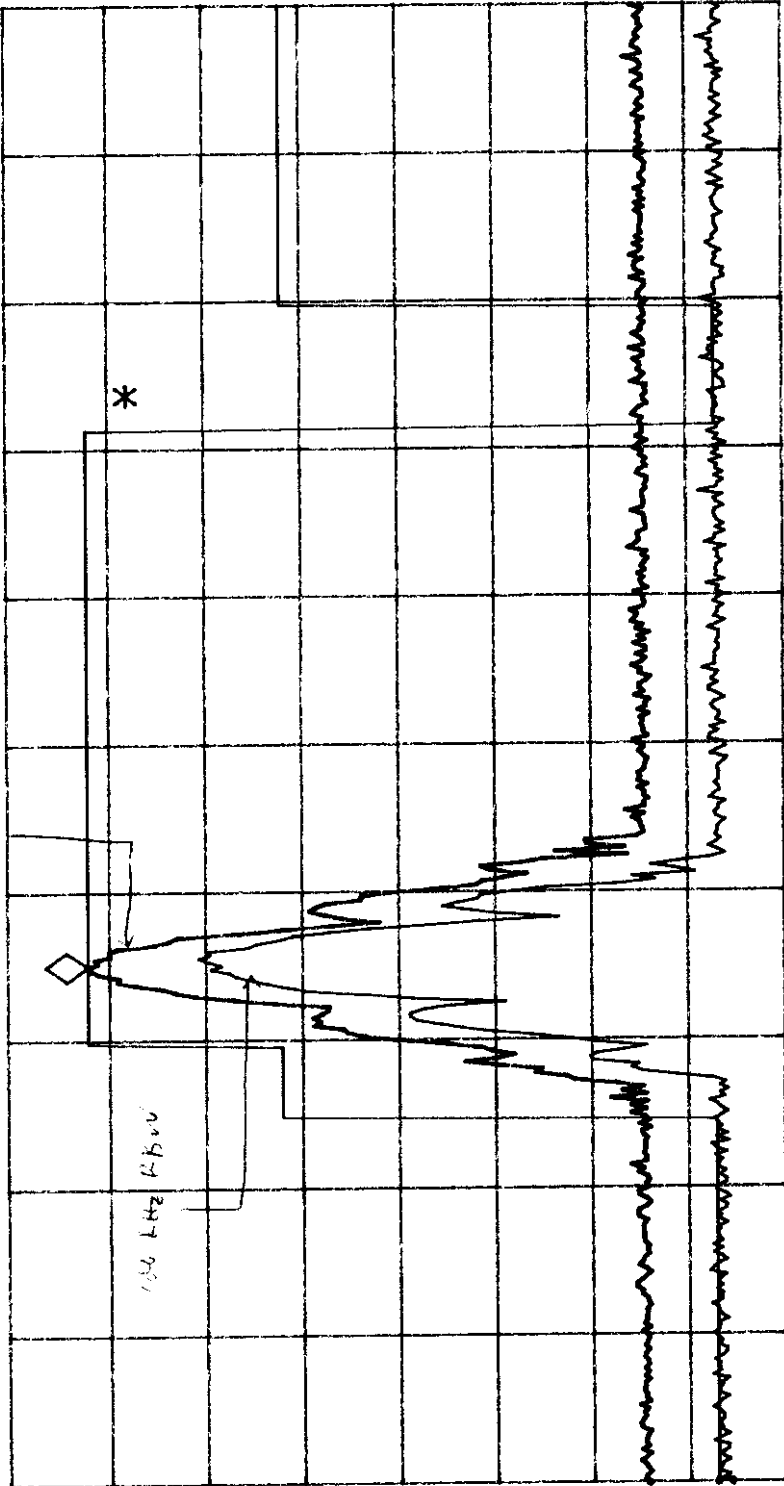
LOG

10

dB/

ATN

10 dB



VA VB

SC FC

ACORR

CENTER 2.4110 GHz

#IF BW 1.0 MHz

#AVG BW 1 MHz

SPAN 200.0 MHz

SWP 20.0 msec



INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 4, Tx Frequency: 2411.4375 MHz, RF Power: 0.19 W

Modulation: DSSS, BW: MEDIUM (5.625 Mc/s), 11 chips/symbol, 1.023 Mbps DQPSK

Antenna: ANDREW

16: 14: 40 NOV 05, 1998

Radiated Emissions Measurements @ 3 Meters

ACTV DET: PEAK
Polarization: [X] Horizontal | Vertical

MEAS DET: PEAK QP AVG

MKR 2.4125 GHz

101.71 dBμV

No user
Menu

REF OFFST 20.0 dB

REF 127.0 dBμV

LOG

10

dB/

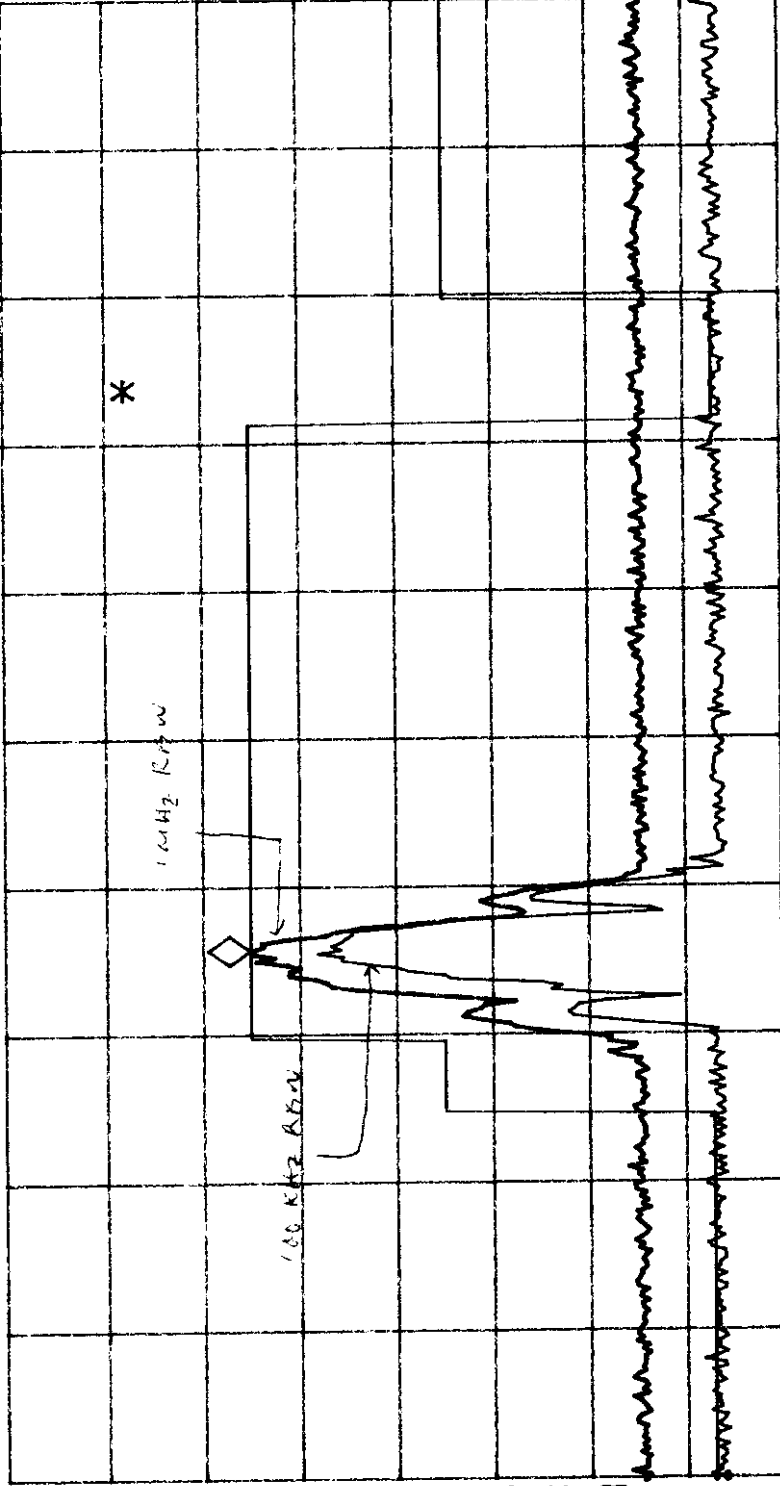
ATN

10 dB

VA VB

SC FC

ACORR



CENTER 2.410 GHz

#IF BW 1.0 MHz

#AVG BW 1 MHz

SPAN 200.0 MHz

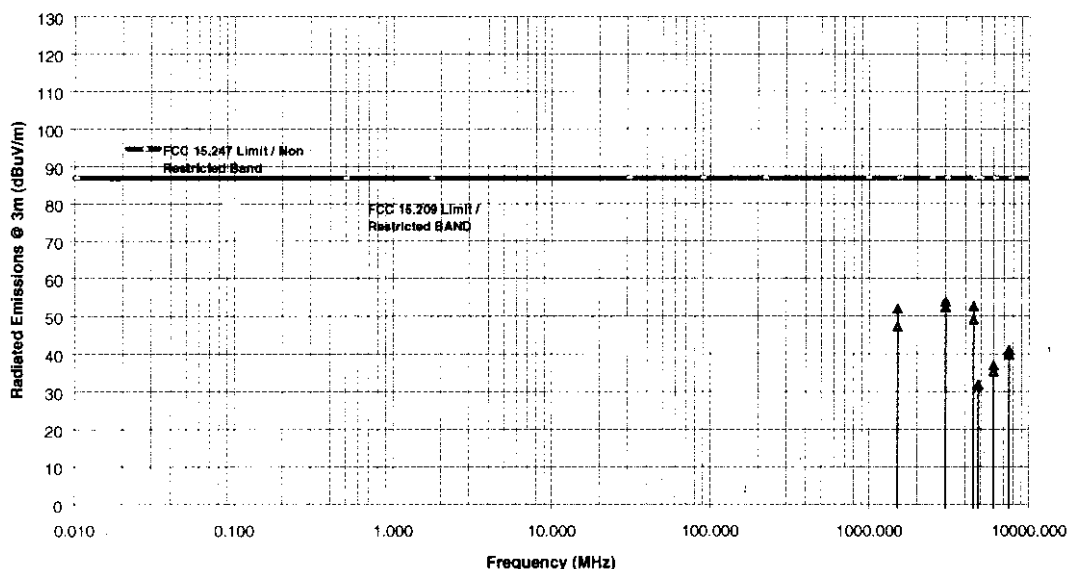
SWP 20.0 msec

Channel #: 6 Frequency: 2419.88 MHz Full Rated Peak Power: 190mW Modulation: DQPSK, wide, 11 chips/symbol Data Rate: 2.045 Mbps, 2 bits/symbol				Power Level in 1 MHz BW: 107.0 dB μ V/m Limit = 107.0 - 20dB = 87.0 dB μ V/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dB μ V/m)	RF AVG LEVEL (dB μ V/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dB μ V/m)	LIMIT 15.247 (dB μ V/m)	MARGIN (dB)	PASS/ FAIL
1504.88	56.2	51.9	V	54.0	87.0	-2.1	*PASS
1504.88	51.7	47.2	H	54.0	87.0	-6.8	*PASS
2419.88	107.0	--	V	--	--	--	--
2419.88	100.3	--	H	--	--	--	--
3009.75	58.7	53.8	V	54.0	87.0	-33.2	PASS
3009.75	57.2	52.4	H	54.0	87.0	-34.6	PASS
4514.63	55.7	49.1	V	54.0	87.0	-4.9	*PASS
4514.63	58.7	52.6	H	54.0	87.0	-1.4	*PASS
4839.75	51.3	31.8	H	54.0	87.0	-22.2	*PASS
6019.50	49.3	37.0	V	54.0	87.0	-62.8	PASS
6019.50	50.0	35.4	H	54.0	87.0	-64.4	PASS
7524.38	56.3	39.9	V	54.0	87.0	-14.1	*PASS
7524.38	56.7	41.0	H	54.0	87.0	-13.0	*PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

* Emission within the restricted band specified in @ 15.205(a)

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Clearwire ISP Direct Indoor and Outdoor Units
Ch. #6, Center Freq.: 2419.88, Chip Rate: 11.25 MHz, Data Rate: 2.045 Mbps (wide)
(Andrew Omni Antenna, P/N: RT1N0F-024V-013A)



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INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)
Channel # 6, Tx Frequency: 2419.875 MHz, RF Power: 0.19 W
Modulation: DSSS, BW: WIDE (11.25 Mc/s), 11 chips/symbol, 2.045 Mbps DQPSK

Antenna: ADDER

16: 14: 40 NOV 05, 1998

Radiated Emissions Measurements @ 3 Meters

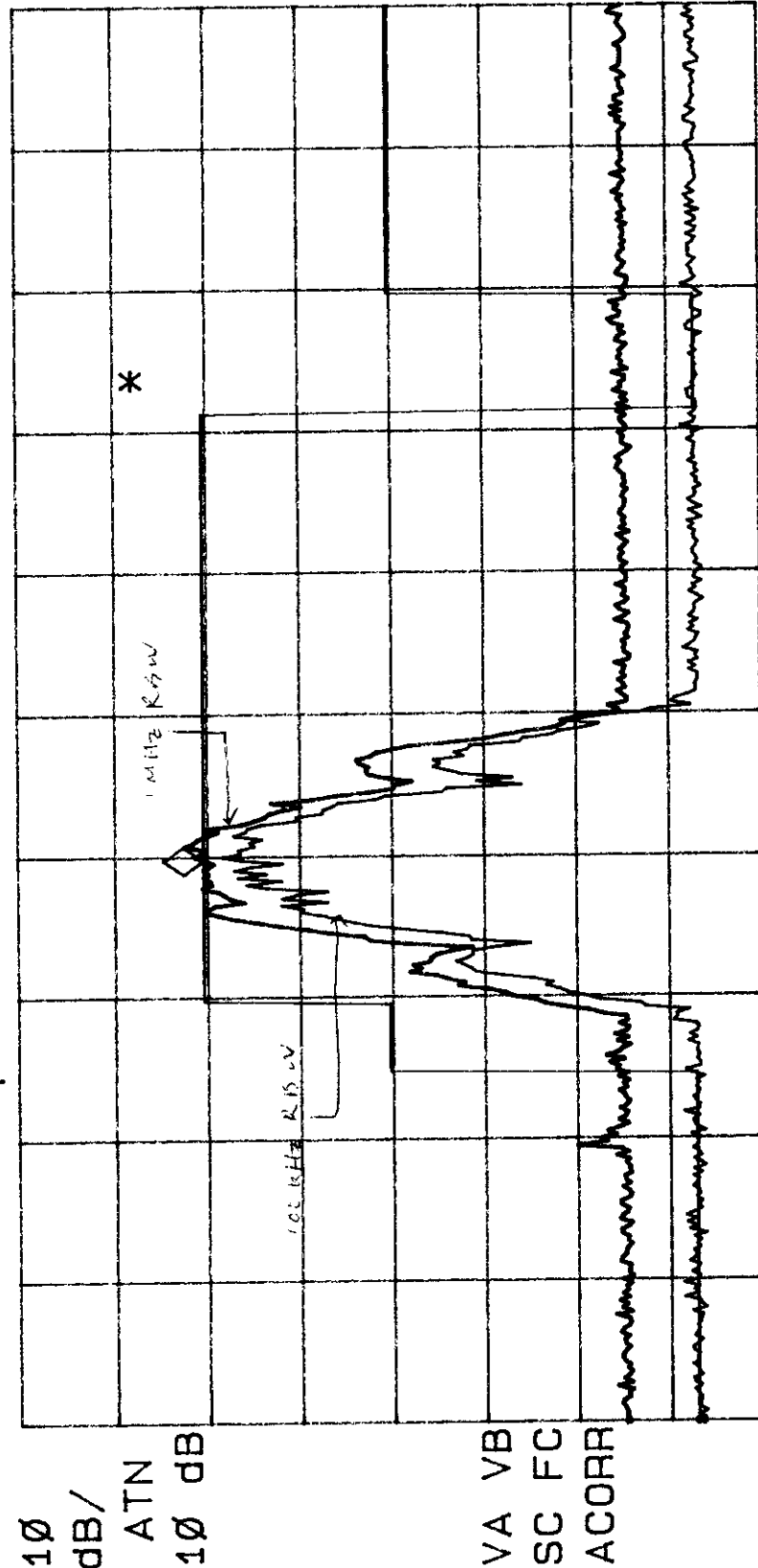
Polarization: | Horizontal | Vertical

MEAS DET: PEAK QP AVG

MKR 2.4205 GHz
106.97 dBμV

No user
Menu

LOG 10 dB/ ATN 10 dB
REF OFFST 20.0 dB
REF 127.0 dBμV



CENTER 2.4410 GHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 200.0 MHz
SWP 20.0 msec



hp

16: 14: 40 NOV 05, 1998

INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)
Channel # 6, Tx Frequency: 2419.875 MHz, RF Power: 0.19 W
Modulation: DSSS, BW: WIDE (11.25 Mc/s), 11 chips/symbol, 2.045 Mbps DQPSK
Antenna: *ANTENNA*

Date: April 30, 1999
Tested by: Hung Trinh

Radiated Emissions Measurements @ 3 Meters

ACQTY DET. PEAK
Polarization: [X] Horizontal | Vertical

MEAS DET: PEAK QP AVG

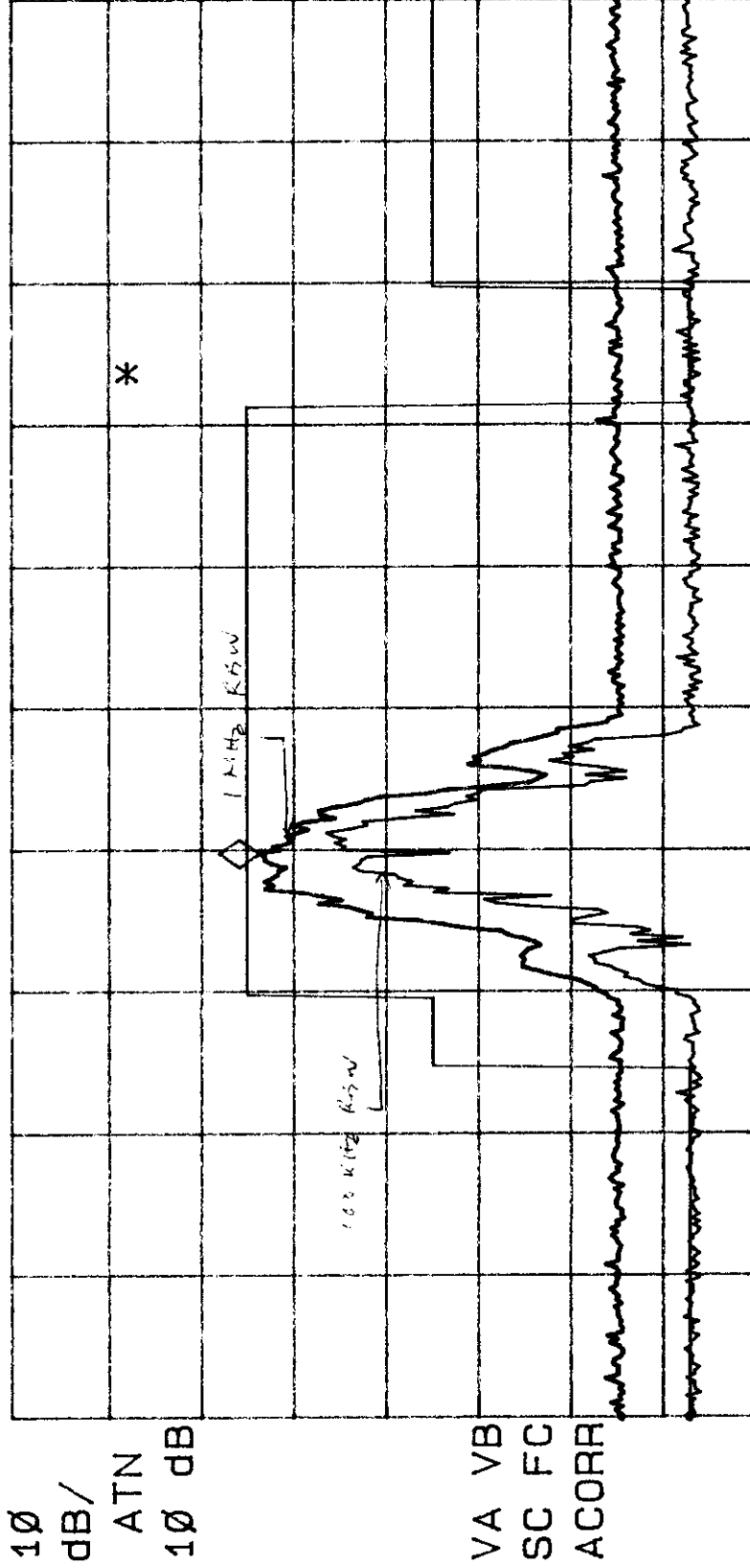
No user
Menu

MKR 2.4205 GHz

100.30 dBμV

REF OFFST 20.0 dB

LOG 10 dB/ ATN 10 dB



VA VB
SC FC
ACORR

CENTER 2.4410 GHz

#IF BW 1.0 MHz

#AVG BW 1 MHz

SPAN 200.0 MHz

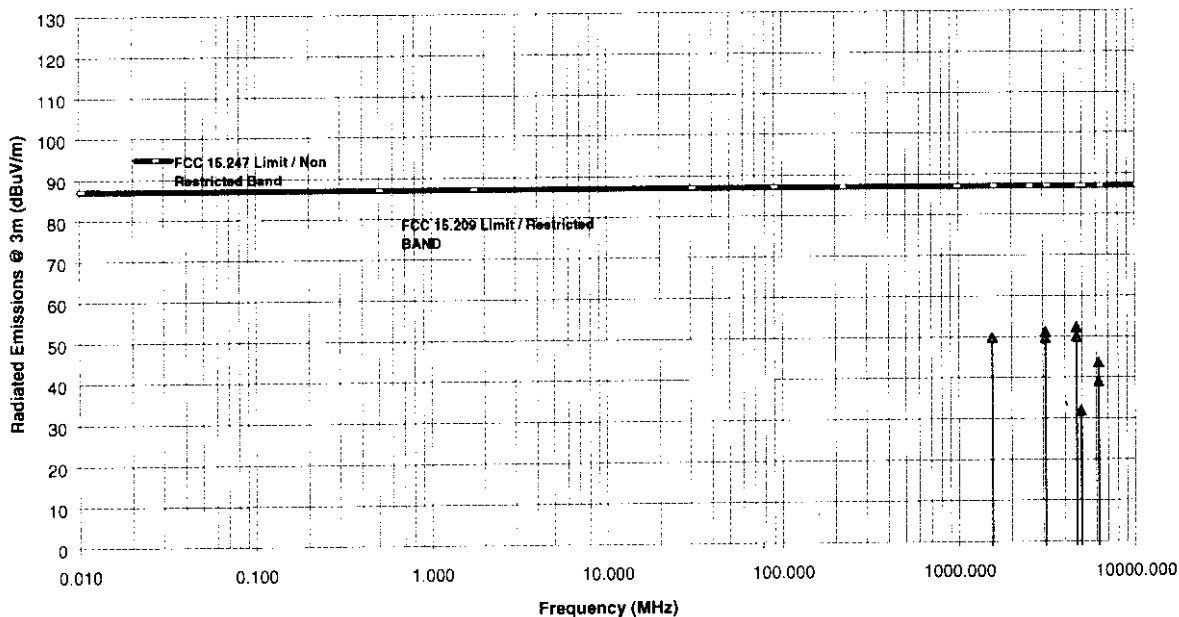
SWP 20.0 msec

Channel #: 18 Frequency: 2464.88 MHz Full Rated Peak Power: 190mW Modulation: DQPSK, narrow, 11 chips/symbol Data Rate: 0.818 Mbps, 2 bits/symbol				Power Level in 1 MHz BW: 107.1 dBμV/m Limit = 107.1 - 20dB = 87.1 dBμV/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dBμV/m)	RF AVG LEVEL (dBμV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBμV/m)	LIMIT 15.247 (dBμV/m)	MARGIN (dB)	PASS/ FAIL
1549.88	54.4	49.8	V	54.0	87.1	-4.3	*PASS
1549.88	53.9	49.8	H	54.0	87.1	-4.2	*PASS
2464.88	107.1	--	V	--	--	--	--
2464.88	100.8	--	H	--	--	--	--
3099.75	56.2	51.1	V	54.0	87.1	-36.0	PASS
3099.75	54.8	49.6	H	54.0	87.1	-37.5	PASS
4649.63	58.0	52.2	V	54.0	87.1	-1.8	*PASS
4649.63	56.6	50.0	H	54.0	87.1	-4.0	*PASS
4929.75	53.9	31.8	H	54.0	87.1	-22.2	*PASS
6199.50	52.7	43.6	V	54.0	87.1	-43.5	PASS
6199.50	52.2	38.9	H	54.0	87.1	-48.2	PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

* Emission within the restricted band specified in @ 15.205(a)

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Clearwire ISP Direct Indoor and Outdoor Units
Ch. #18, Center Freq.: 2464.88, Chip Rate: 4.5 MHz, Data Rate: 0.818 Mbps (narrow)
(Andrew Omni Antenna, P/N: RT1N0F-024V-013A)



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INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 18, Tx Frequency: 2464.875 MHz, RF Power: 0.19 W

Modulation: DSSS, BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK

Antenna: AVDREW
16: 14: 40 NOV 05, 1998

Radiated Emissions Measurements @ 3 Meters

ACTV DET: ☒ Vertical PEAK

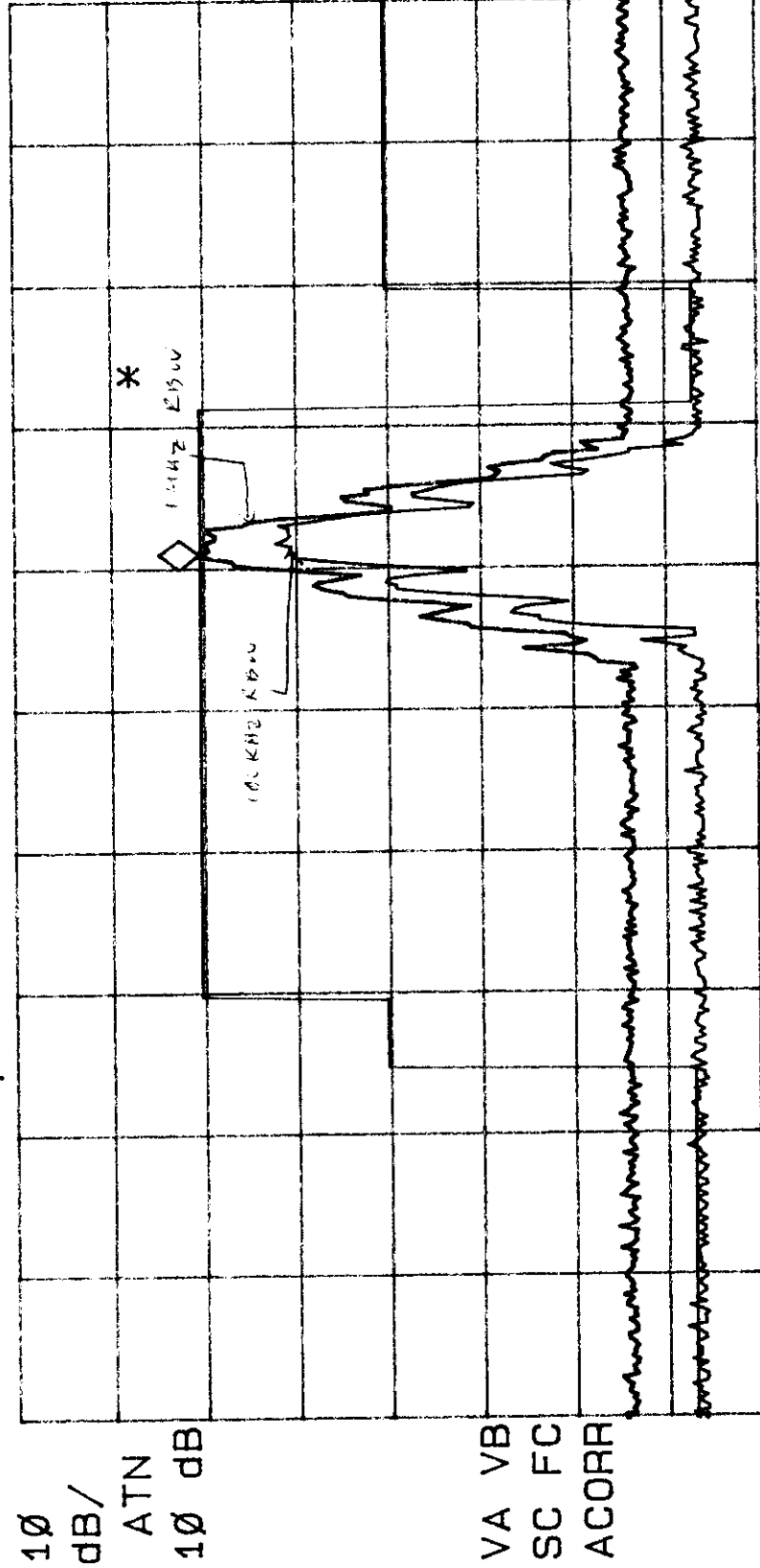
Polarization: [] Horizontal MEAS DET: PEAK QP AVG

MKR 2.4630 GHZ

107.05 dBμV

No user
Menu

LOG 10 dB/ ATN 10 dB
REF OFFST 20.0 dB
REF 127.0 dBμV



CENTER 2.4410 GHZ SPAN 200.0 MHz
#IF BW 1.0 MHz #AVG BW 1 MHz SWP 20.0 msec



INTERAIR WIRELESS

ISP DIRECT, MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

Channel # 18, Tx Frequency: 2464.875 MHz, RF Power: 0.19 W

Modulation: DSSS, BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK

Antenna: *AV22EN*

hp 16: 14: 40 NOV 05, 1998

Radiated Emissions Measurements @ 3 Meters

ACTV DEF: PEAK

MEAS DEF: MEAS

Polarization: ☒ Horizontal ☐ Vertical

PEAK QP AVG

100.83 dBμV

No user
Menu

MKR 2.4645 GHz

100.83 dBμV

REF OFFST 20.0 dB

REF 127.0 dBμV

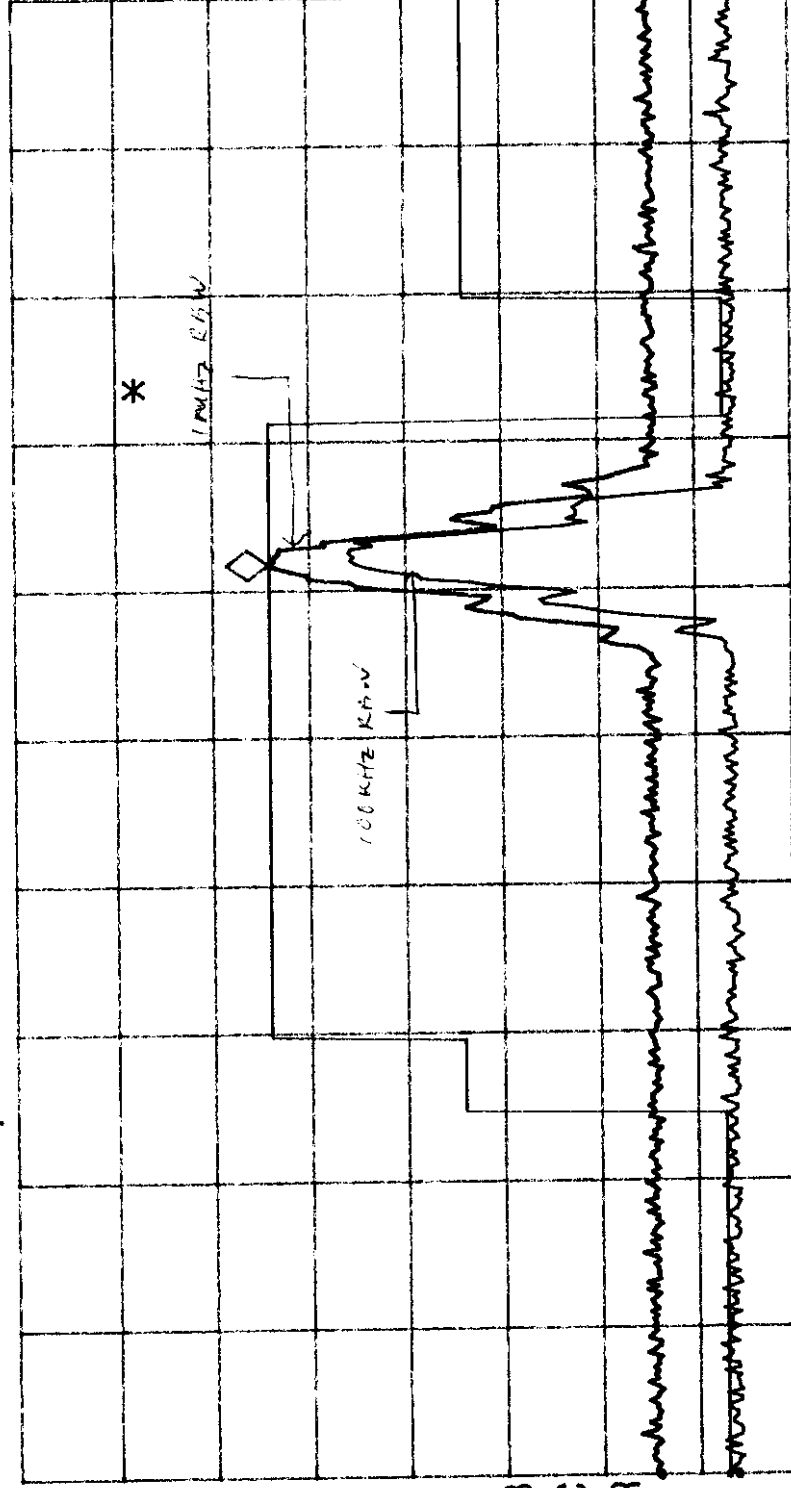
LOG

10

dB/

ATN

10 dB



VA VB

SC FC

ACORR

CENTER 2.4410 GHz

#IF BW 1.0 MHz

#AVG BW 1 MHz

SPAN 200.0 MHz

SWP 20.0 msec

5. EXHIBIT 5 - GENERAL TEST PROCEDURES

5.1. ELECTRICAL FIELD RADIATED EMISSIONS MEASUREMENTS - GENERAL TEST METHOD

- The radiated emission measurements were performed at the UltraTech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC.
- Radiated emissions measurements were made using the following test instruments:
 - 1) Calibrated EMCO active loop antenna in the frequency range from 10 KHz to 1 MHz
 - 2) Calibrated EMCO biconilog antenna in the frequency range from 30 MHz to 2000 MHz.
 - 3) Horn Antennas:
 - a) Horn Antenna, Emco, Model 3115, 1 – 18 GHz
 - b) Horn Antenna, Emco, Model 3160-09, 18-26.5GHz
 - c) Horn Antenna, Emco, Model 3160-10, 26.5-40GHz
 - d) Mixer, Tektronix, P/N 118-0098-00, 18-26.5GHz
 - e) Mixer, Tektronix, P/N 119-0098-00, 26.5-40GHz
 - 4) Calibrated Advantest spectrum analyzer and pre-selector/pre-amplifier. In general, the spectrum analyzer would be used as follows:
 - The rf electric field levels were measured with the spectrum analyzer set to PEAK detector (1 KHz RBW and 1 KHz VBW for frequency below 30 MHz, 100 KHz RBW and VBW $\geq$ RBW for Frequency below 1 GHz and 1 MHz RBW and 1 MHz VBW for frequency greater than 1 GHz).
 - If any rf emission was observed to be a broadband noise, the spectrum analyzer's CISPR QUASI-PEAK detector (120 KHz RBW and 1MHz VBW) was then set to measure the signal level.
 - If the signal being measured was narrowband and the ambient field was broadband, the bandwidth of the spectrum analyzer was reduced.
- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.
- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement (each variable within bounds specified elsewhere) were explored to produce the highest amplitude signal relative to the limit.

The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.

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- Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.
- Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.
- Step4: Move the antenna over its full allowed range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.
- Step5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.
- Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.
- Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

Calculation of Field Strength:

The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where	FS	=	Field Strength
	RA	=	Receiver/Analyzer Reading
	AF	=	Antenna Factor
	CF	=	Cable Attenuation Factor
	AG	=	Amplifier Gain

Example: If a receiver reading of 60.0 dBμV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:

$$\text{Field Level in dB}\mu\text{V/m} = 60 + 7.0 + 1.0 - 30 = 38.0 \text{ dB}\mu\text{V/m}.$$

$$\text{Field Level in } \mu\text{V/m} = 10^{(38/20)} = 79.43 \mu\text{V/m}.$$

Notes: The frequency and amplitude of at least six highest conducted emissions relative to the limit are recorded unless such emissions are more than 20 dB below the limit. If less than six emissions are within 20dB of the limit, the background or receiver noise level shall be reported at representative frequencies.

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6. EXHIBIT 6 - INFORMATION RELATED TO EQUIPMENT UNDER TESTS

6.1. FCC ID LABELING AND SKETCH OF FCC LABEL LOCATION

Please refer to the original application

6.2. PHOTOGRAPHS OF EQUIPMENT UNDER TEST

Please refer to the original application and the attached pictures for the additional antennas used.

6.3. SYSTEM BLOCK DIAGRAM(S)

Please refer to the original application

6.4. SCHEMATIC DIAGRAMS

Please refer to the original application

6.5. USER'S MANUAL WITH "FCC INFORMATION TO USER STATEMENTS"

Please refer to the original application

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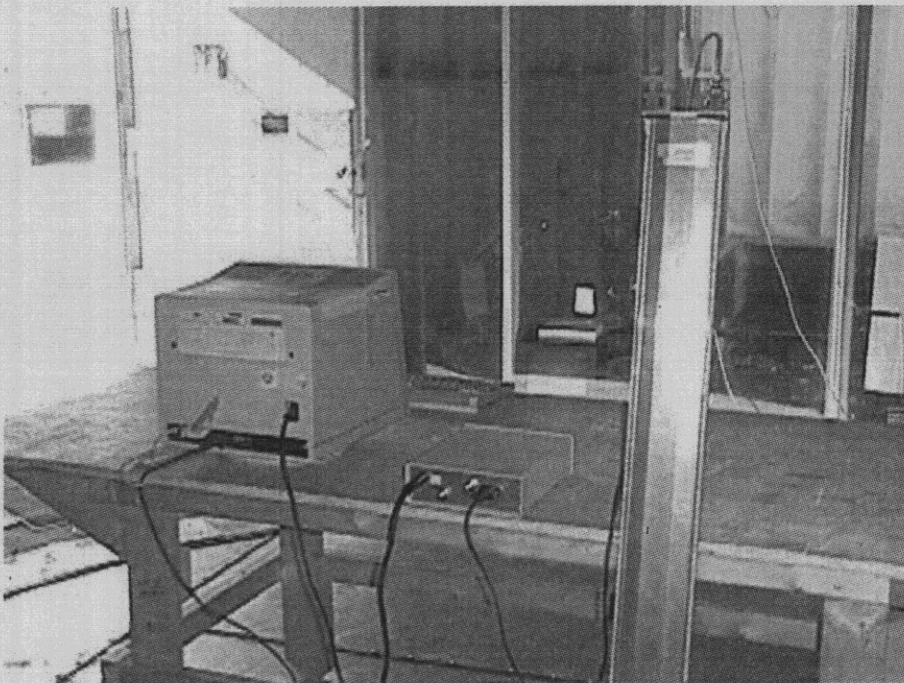
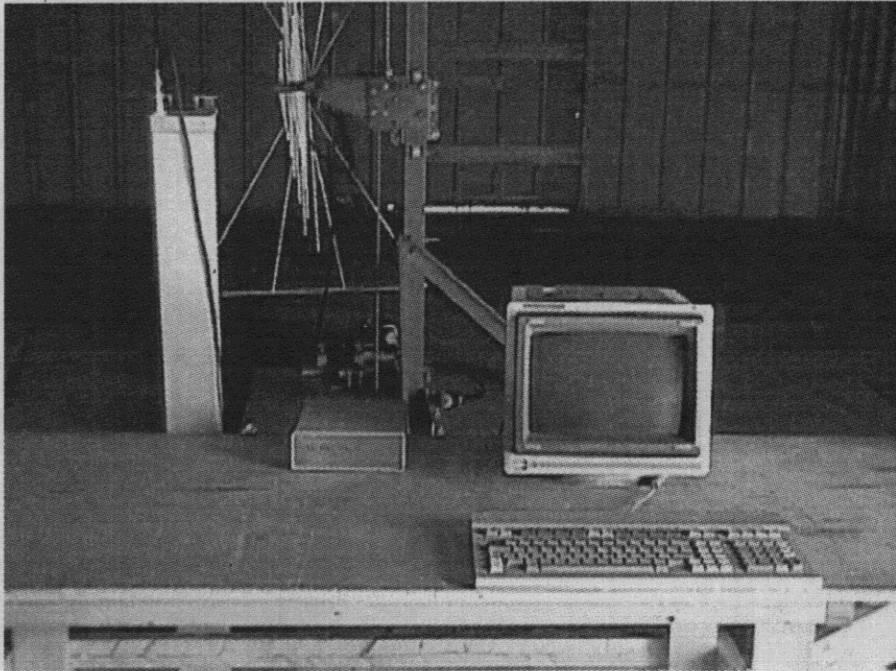
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3.3. PHOTOGRAPH FOR RF EMISSION MEASUREMENTS

3.3.1. TEST SETUP FOR RADIATED EMISSIONS MEASUREMENTS

Tests were performed at the Open Field test Site located in Oakville, Ontario, Canada

ISP Direct Indoor & Outdoor Units with Huber Suhner 1x10 Patch Antenna

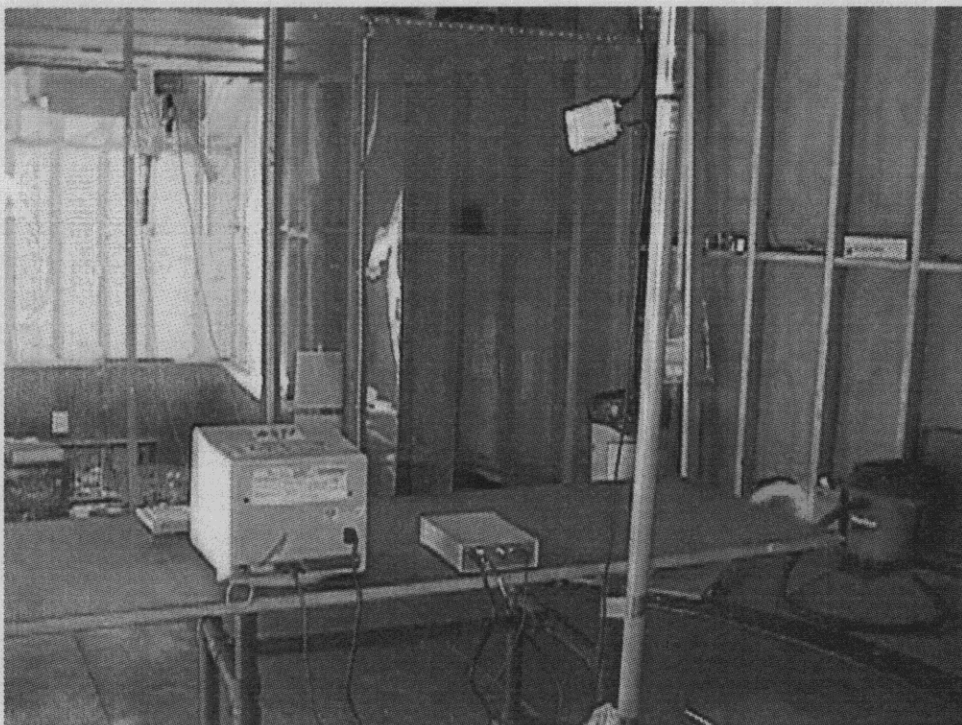
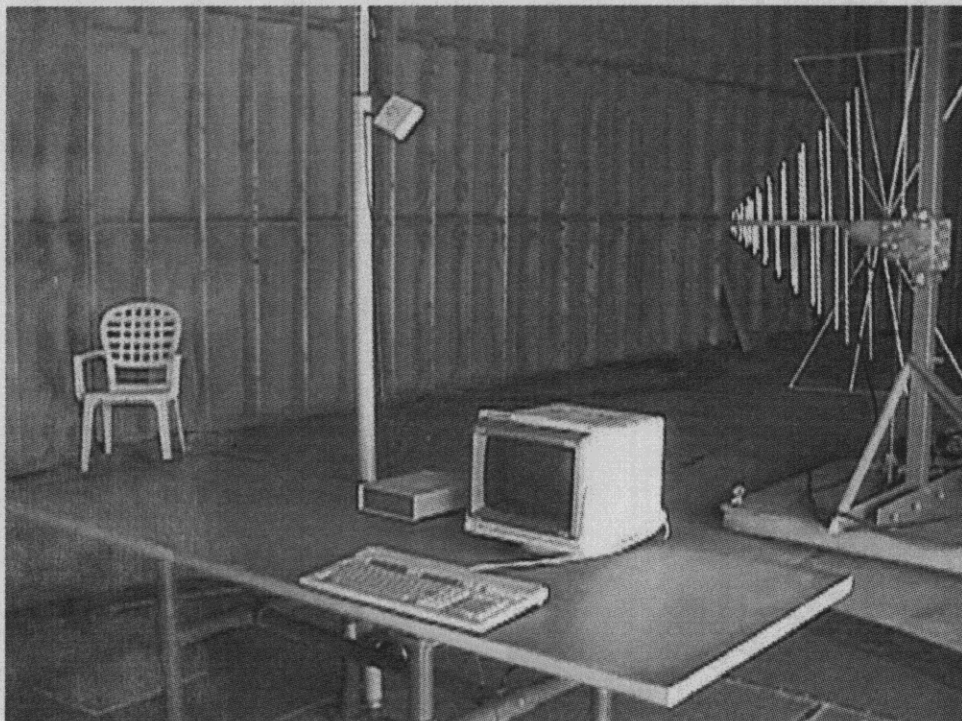


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ISP Direct Indoor & Outdoor Units with Andrews High Gain Omni Antenna**ULTRATECH GROUP OF LABS**

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May 6, 1999

- Assessed by ITI (UK) Competent Body, NVLAP (USA) Accreditation Body & ACA/AUSTEL (Australia)
- Recognized/Listed by FCC (USA), Industry Canada (Canada)
- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)